PLE Service Configuration

This chapter describes the Private Line Emulation (PLE) service and the configuration procedures.

Understanding Private Line Emulation

Private Line Emulation (PLE) is a pillar of the Routed Optical Networking solution. It enables service providers and enterprises to further collapse network layers, decreasing network complexity and increasing network efficiency. PLE enables private line services to be carried over the same MPLS or Segment Routing network for non-Ethernet type services such as SONET/SDH, OTN, and Fiber Channel. PLE also supports bit-transparent Ethernet services where required.

High revenue legacy private line services exist in the network infrastructure of most service providers, often carried over a dedicated inefficient TDM OTN layer. PLE enables service providers to carry SONET/SDH, OTN, Ethernet, and Fiber Channel over a circuit-style segment routed packet network while maintaining existing service SLAs. PLE utilizes Circuit Emulation (CEM) to transparently transfer PLE client frames over MPLS or SR networks without changing the characteristics of the original signal.

How PLE Works

Ethernet, OTN, Fiber Channel, or SONET/SDH PLE client traffic is carried on an EVPN-VPWS single homed service that is created between PLE endpoints. EVPN-VPWS signalling information is carried using BGP between the PLE circuit endpoints either through direct BGP sessions or through a BGP services route-reflector. The EVPN-VPWS pseudowire channel is set up between the endpoints when the CEM (Circuit Emulation) client interfaces are configured on each endpoint router and end-to-end transport connectivity using MPLS or Segment Routing transport is enabled.

CEM is a method through which client data can be transmitted over MPLS or Segment Routing networks in a bit-transparent manner, retaining the client L1 frame between sender and receiver. CEM over a Packet Switched Network (PSN) places the client bit streams into packet payload with appropriate pseudowire emulation headers.

The PLE initiator encapsulates the PLE client traffic and carries it over the EVPN-VPWS service running on MPLS or Segment Routing transport. The PLE terminator node extracts the bit streams from the EVPN-VPWS packets and places them onto the PLE client interface as defined by the client attribute and CEM profile.

Supported Payloads

The following payloads are supported through PLE:

Table 1: Supported Payloads

PLE Transport Type	Supported Payloads
Ethernet	1GE and 10GE
OTN	OTU2 and OTU2e
SONET	OC-48 and OC-192
SDH	STM-16 and STM64
Fiber Channel	FC1, FC2, FC4, FC8, FC16, and FC32

The combination of payloads is also supported.

Supported Hardware

PLE is supported on NC55-OIP-02 MPA (modular port adapter). This MPA is supported in the NC55A2-MOD-S and NC57C3-MOD-SYS routers. For more information, see Cisco NCS 5500 Modular Chassis

Circuit-Style Segment Routing

Segment Routing provides an architecture that caters to both IP-centric transport and connection-oriented transport. IP-centric transport uses the benefits of ECMP and automated protection from TI-LFA. Connection-oriented transport, which was historically delivered over circuit-switched SONET/SDH networks, requires the following:

- End-to-end bidirectional transport that provides congruent forward and reverse paths, predictable latency, and disjointness.
- Bandwidth commitment to ensure that there is no impact on the SLA due to network load from other services.
- Monitoring and maintenance of path integrity with end-to-end 50-msec path protection.
- Persistent end-to-end paths regardless of the state of the control plane.

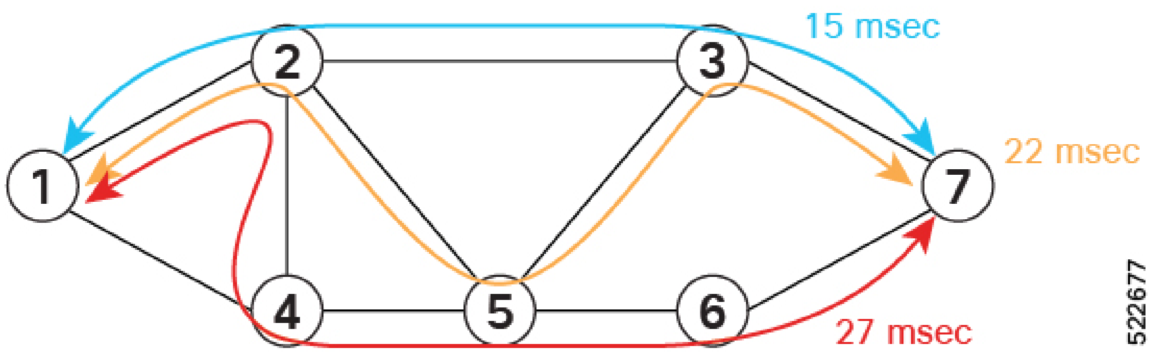
Introduction to Circuit-Style SR Policies

Circuit-Style SR policies have the following properties:

- Guaranteed Latency over Non-ECMP Paths
- Control-Plane Independent Persistency
- Co-Routed Bidirectional Path
- Liveness Monitoring with Path Protection Switching

Guaranteed Latency over Non-ECMP Paths

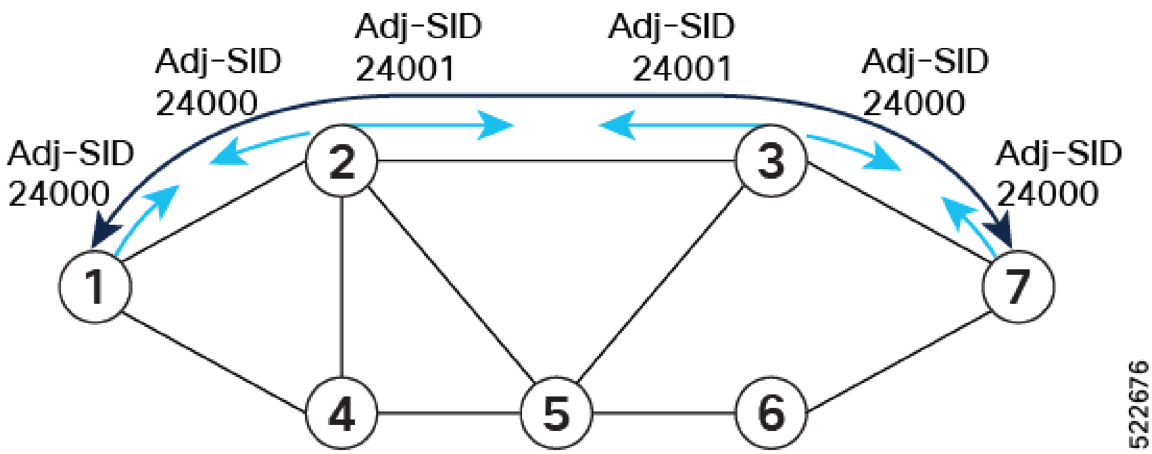
Consider the following network with three possible paths from node 1 to node 7. Of the three paths, the best end-to-end delay is provided by the blue path (1 -> 2 -> 3 -> 7). The chosen path is then encoded with adjacency SIDs corresponding to the traversed interfaces to avoid any ECMP, and therefore guarantee the latency over the path.



Control-Plane Independent Persistency

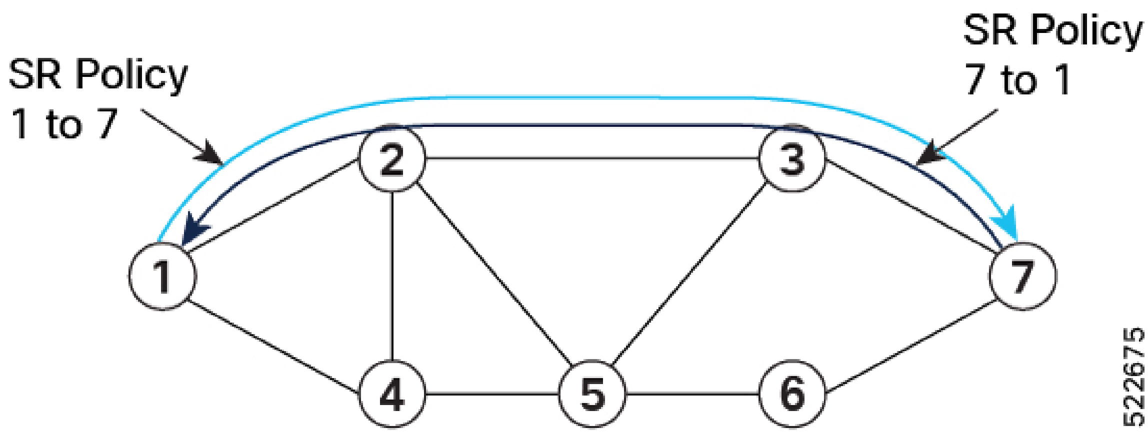
Adjacency SIDs can provide a persistent path independent from control-plane changes (such as IGP neighbor flaps), and network events (such as interface additions or interface flaps) and even the presence of IP on an interface. To achieve this, adjacency SIDs can be manually allocated to ensure persistent values, for example, after a node reload event. In addition, adjacency SIDs can be programmed as non-protected to avoid any local TI-LFA protection.

With the adjacency SIDs depicted in the following figure, the path from node 1 to node 7 is encoded with the segment list of {24000, 24001, 24000}. By manually allocating the same adjacency SID values for other direction, the path from node 7 to node 1 is encoded with the same segment list of {24000, 24001, 24000}.



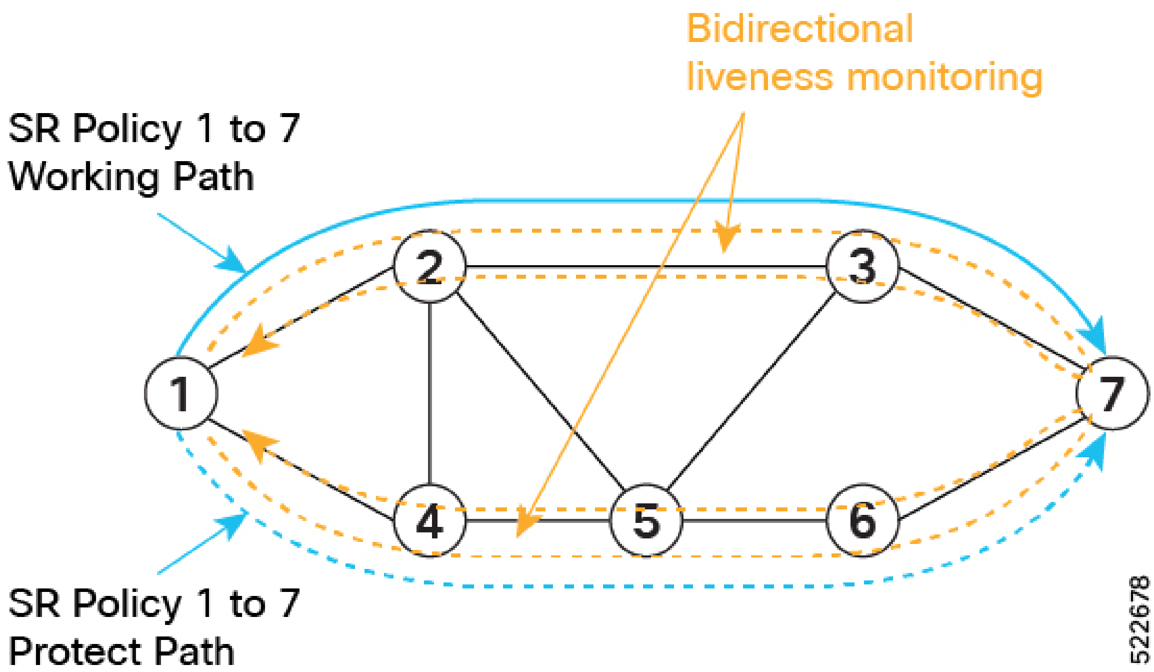
Co-Routed Bidirectional Path

Forward and return SR policies with congruent paths are routed along the same nodes.



Liveness Monitoring with Path Protection Switching

Bidirectional liveness monitoring on the working and protect paths ensures fast and consistent switchover, while a protect path is pre-programmed over disjoint facilities.



Usage Guidelines and Limitations

- Candidate path (CP) behavior:
  - The working path has the highest CP preference value.
  - The protect path has the second highest CP preference value.
  - The restore path has the lowest CP preference value and is configured as "backup ineligible."
  - Paths with the same role in both directions (working, protect, and restore) must have the same CP preference value.
- Bidirectional path behavior:
  - All paths must be configured as corouted.
  - All paths with the same role in both directions (working, protect, and restore) must have the same bidirectional association ID value.
  - The bidirectional association ID value must be globally unique.

Configure PLE over EVPN-VPWS

Configuring PLE over the EVPN-VPWS service procedure involves the following tasks:

1. Configure Optics Controller with Payloads, on page 6
2. Configure QoS Policy, on page 7
3. Configure CEM Interface for L2VPN Service, on page 7

4. Configure Performance Measurement, on page 8
5. Configure Segment Routing Adjacency SIDs, on page 8
6. Define Paths Between PLE Endpoints, on page 9
7. Configure Static Circuit-Style SR-TE Policies, on page 11
8. Configure PLE over EVPN-VPWS, on page 13

See the Private Line Emulation over EVPN-VPWS Single Homed section for pre-requisites and other details.

Configure Optics Controller with Payloads

Use this task to configure the Optics controller with different payloads.

Each port on the NC55-OIP-2 (PID of PLE Modular Port Adapter) can be independently configured for a specific PLE transport type. This configuration is done by configuring the **port-mode** command under the optics controller.

The **port-mode** command has several parameters. The first parameter sets the PLE transport type: Ethernet, OTN, SONET, SDH, or Fibre Channel. The **framing** parameter is required and must be set to **cem-packetize**, specifying this as a PLE CEM configuration. The **rate** parameter is used to configure the specific payload.

See the **Supported Payloads** section for information on all the payloads supported.

The following examples show how to configure the Optics controller for different payloads.

Ethernet:

Router(config)# **controller Optics0/0/3/1**

Router(config-Optics)# **port-mode Ethernet framing cem-packetize rate 10GE**

OTN:

Router(config)# **controller Optics0/0/3/2**

Router(config-Optics)# **port-mode otn framing cem-packetize rate otu2**

SONET/SDH:

Router(config)# **controller Optics0/0/3/3**

Router(config-Optics)# **port-mode sonet framing cem-packetize rate OC48**

Router(config)# **controller Optics0/0/3/4**

Router(config-Optics)# **port-mode sdh framing cem-packetize rate STM16**

Fiber Channel:

Router(config)# **controller Optics0/0/3/5**

Router(config-Optics)# **port-mode FC framing cem-packetize rate FC1**

Configure QoS Policy

Use this task to configure QoS policy to prioritize PLE traffic. This configuration is optional but is recommended so that higher priority PLE traffic is not dropped during network congestion.

Step 1 Router(config)# **policy-map ple-policy**

Defines the parent QoS policy to be applied to the CEM interface to prioritize the PLE traffic.

Step 2 Router(config-pmap)# **class class-default**

There is only one traffic flow type in a PLE service. Hence, the default class is used to match all the ingress packets on the PLE CEM interface.

Step 3 Router(config-pmap-c)# **set traffic-class 6**

Cisco NCS 5500 and NCS 5700 platforms use traffic class within the router to identify specific traffic flows and differentiate how they are treated on egress. In this example, traffic class 6 is set on ingress. The egress QoS policy matches traffic class 6 and sets appropriate queuing behavior. This value is used as an example; it must be set to the high priority EXP value used across the network. The egress QoS policy is outside the scope of this guide. For egress QoS policy, see *Modular QoS Configuration Guide for Cisco NCS 5500 Series Routers*.

Step 4 Router(config-pmap-c)# **set mpls experimental topmost 6**

Sets the topmost MPLS EXP (TC) value to 6. The value can be used at subsequent nodes in the path to classify PLE traffic and set appropriate queuing behavior. This value is used as an example; it must be set to the high priority EXP value used across the network.

Step 5 Router(config-pmap-c)# **end-policy-map**

Configure CEM Interface for L2VPN Service

Use this task to configure the CEM interface for the L2VPN EVPN-VPWS service.

Step 1 Router(config)# **interface CEM0/0/3/1**

Configures the appropriate CEM interface.

Step 2 Router(config-if)# **l2transport**

Enables the CEM interface to be used in a L2VPN EVPN-VPWS service.

Configure Performance Measurement

Use this task to configure the performance measurement to enable the liveness monitoring of the Segment Routing policy.

Step 1 Router(config)# **performance-measurement**

Enters the performance measurement configuration.

Step 2 Router(config-perf-meas)# **liveness-profile sr-policy name liveness-check**

Creates a SR Policy liveness profile.

Step 3 Router(config-perf-meas)# **liveness-detection**

Configures liveness detection parameters.

Step 4 Router(config-perf-meas)# **multiplier 3**

Configures the number of missed liveness probes to determine whether the SR Policy is down.

Step 5 Router(config-pm-ld-srpolicy)# **probe**

Enters the probe parameter configuration mode.

Step 6 Router(config-pm-ld-srpolicy-probe)# **measurement-mode loopback**

Sets the mode to loopback, where probe packets from the sender node are looped back to the sender node from the receiver node to test end-to-end liveness.

Step 7 Router(config-pm-ld-srpolicy-probe)# **tx-interval 30000**

Sets the interval of probe packets that are sent by the sender. The interval value is set in microseconds, and set to 30 seconds in this example.

Note Using a **tx-interval** value lower than 30 seconds requires hw-offload support. NCS-55A2-MOD supports this in R7.9.1.

Step 8 Router(config-pm-ld-srpolicy-probe)# **tos dscp 48**

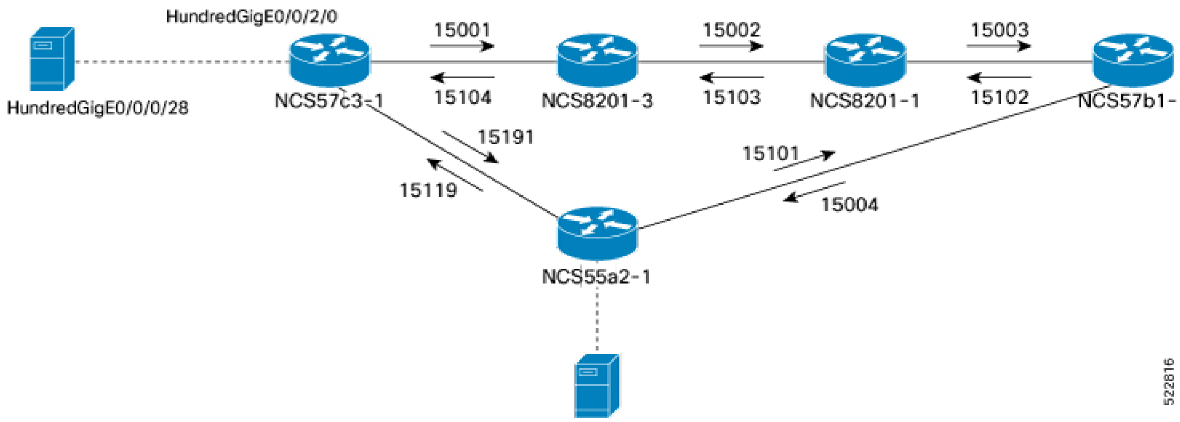
The *tos* parameter sets the Differentiated Services Code Point (DSCP) value on the probe packets to the specified DSCP. In this example it is 48, but must be set to the appropriate QoS value on the provider network to treat the liveness probe packets at high priority.

Configure Segment Routing Adjacency SIDs

Use this task to configure SR Adjacency SIDs between routers. Adjacency SIDs are unidirectional and are used to define the explicit path between endpoints. Adjacency SIDs must set on each interface participating in the SR policy path.

The following figure illustrates the SR adjacency SIDs configured between routers.

Figure 1: Segment Routing Adjacency SIDs



Step 1 Router(config)# **router isis core**

Enters IS-IS configuration mode for the appropriate instance. In this example, the instance is core.

Step 2 Router(config-isis)# **interface HundredGigE0/0/2/0**

Configures specific IS-IS interface.

Step 3 Router(config-isis-if)# **address-family ipv4 unicast**

Enters the IPv4 address family configuration if MPLS segment routing is used.

Step 4 Router(config-isis-if-af)# **adjacency-sid absolute 15001**

Configures a persistent SR adjacency SID on the interface. This value must be assigned from the Segment Routing Local Block (SRLB) of the router. The default SRLB range in IOS-XR is 15000–15999.

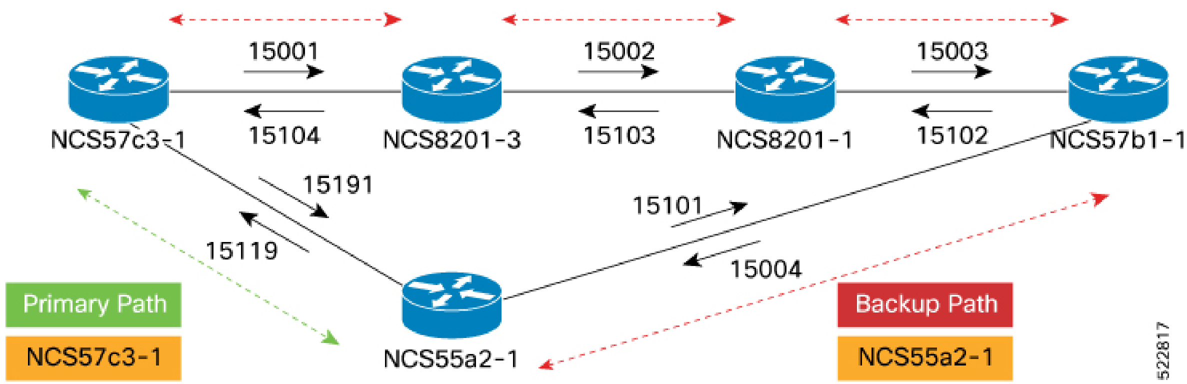
Configure other SR adjacency SIDs as appropriate.

Define Paths Between PLE Endpoints

Use this task to define end-to-end paths between PLE endpoints.

Note This task applies only for static circuit-style SR-TE policies.

Figure 2: Working and Reverse Path Definitions



Perform the following configurations on the NCS57C3-1 router to define the working forward path. In the illustration, the working forward path is a single hop between directly connected routers.

Step 1 Router(config)# **segment-routing**

Enters segment routing configuration.

Step 2 Router(config-sr)# **traffic-engineering**

Enters segment routing TE configuration.

Step 3 Router(config-sr-te)# **segment-list working-forward-path**

Creates segment list with name *working-forward-path*.

Step 4 Router(config-sr-te-sl)# **index 1 mpls label 15191**

Sets index 1 to the first hop interface adjacency SID.

Perform the following configurations on the NCS57C3-1 router to define the working reverse path. In the illustration, the working reverse path is a single hop between directly connected routers.

```
Router(config-sr-te)# segment-list working-reverse-path
Router(config-sr-te-sl)# index 1 mpls label 15119
```

Perform the following configurations on the NCS57C3-1 router to define the protect forward path. In the illustration, the protect forward path has four interface hops between the near-end and far-end router.

```
Router(config-sr-te)# segment-list protect-forward-path
Router(config-sr-te-sl)# index 1 mpls label 15001
Router(config-sr-te-sl)# index 2 mpls label 15002
Router(config-sr-te-sl)# index 3 mpls label 15003
Router(config-sr-te-sl)# index 4 mpls label 15004
```

Perform the following configurations on the NCS57C3-1 router to define the protect reverse path. In the illustration, the protect reverse path has four interface hops between the near-end and far-end router.

```
Router(config-sr-te)# segment-list protect-reversepath
Router(config-sr-te-sl)# index 1 mpls label 15101
Router(config-sr-te-sl)# index 2 mpls label 15102
```

```
Router(config-sr-te-sl)# index 3 mpls label 15103
Router(config-sr-te-sl)# index 4 mpls label 15104
```

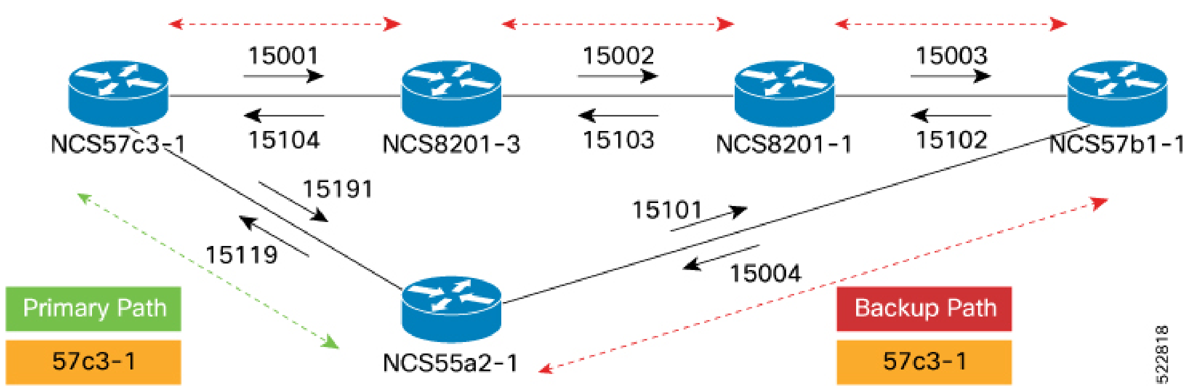
Perform the following configurations on the NCS55A2-1 router to define all the paths according to the illustration.

```
Router(config)# segment-routing
Router(config-sr)# traffic-eng
Router(config-sr-te)# segment-list working-forward-path
Router(config-sr-te-sl)# index 1 mpls label 15119
!
Router(config-sr-te)# segment-list working-reverse-path
Router(config-sr-te-sl)# index 1 mpls label 15191
!
Router(config-sr-te)# segment-list protect-forward-path
Router(config-sr-te-sl)# index 1 mpls label 15101
Router(config-sr-te-sl)# index 2 mpls label 15102
Router(config-sr-te-sl)# index 3 mpls label 15103
Router(config-sr-te-sl)# index 4 mpls label 15104
!
Router(config-sr-te)# segment-list protect-reversepath
Router(config-sr-te-sl)# index 1 mpls label 15001
Router(config-sr-te-sl)# index 2 mpls label 15002
Router(config-sr-te-sl)# index 3 mpls label 15003
Router(config-sr-te-sl)# index 4 mpls label 15004
```

Configure Static Circuit-Style SR-TE Policies

Use this task to configure static circuit-style SR-TE policies.

Figure 3: Segment Routing Traffic Engineering Policy



Perform the following configurations on the NCS57C3-1 router.

Before you begin

Static Circuit-Style SR-TE policies requires IOS XR 7.7.1 or later software.

Step 1 Router(config)# **segment-routing**

Enters segment routing configuration.

Step 2 Router(config-sr)# **traffic-engineering**

Enters segment routing TE configuration.

Step 3 Router(config-sr-te)# **policy to-55a2-1**

Creates a SR-TE policy with the name *to-55a2-1*.

Step 4 Router(config-sr-te-policy)# **color 1001 end-point ipv4 10.0.0.44**

Configures the SR-TE policy with the user-defined color and loopback address of the remote PLE far-end router.

Step 5 Router(config-sr-te-policy)# **path-protection**

Enables path protection on the SR-TE policy. When configured, the near-end router keeps the protect path in warm-standby state to quickly transition to it if the working path is down.

Step 6 Router(config-sr-te-policy)# **candidate-paths**

Configures the SR working and protect candidate paths.

Step 7 Router(config-sr-te-policy-path)# **preference 50**

Sets the user-defined preference on the protect path. Higher preference candidate paths are preferred over lower preference paths.

Note The protect path must always be set with lower preference value.

Step 8 Router(config-sr-te-policy-path-pref)# **explicit segment-list protect-forward-path**

Configures the candidate path to use an explicit segment list. The previously defined *protect-forward-path* explicit segment list is used.

Step 9 Router(config-sr-te-policy-path-pref)# **reverse-path segment-list protect-reverse-path**

Configures the reverse path to ensure that the SR-TE Policy uses a corouted bidirectional path. The previously defined *protect-reverse-path* explicit segment list is used.

Configure the higher priority working path similar to the protect path using the following commands:

```
Router(config-sr-te-policy-path)# preference 100
Router(config-sr-te-policy-path-pref)# explicit segment-list working-forward-path
Router(config-sr-te-policy-path-pref)# reverse-path segment-list working-reverse-path
```

Step 10 Router(config)# **performance-measurement**

Configures performance-measurement for the SR-TE policy.

Step 11 Router(config-perf-meas)# **liveness-detection**

Configures liveness detection parameters.

Step 12 Router(config-perf-meas)# **liveness-profile name liveness-check**

Configures a user-defined liveness policy to be used. In this case, the previously defined liveness profile *liveness-check* is used.

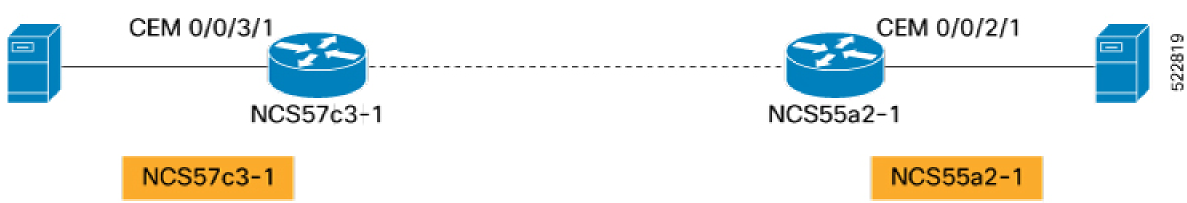
Perform the following configurations on the NCS55A2-1 router:

```
Router(config)# segment-routing
Router(config-sr)# traffic-eng
Router(config-sr-te)# policy to-57c3-1
Router(config-sr-te-policy)# color 1001 end-point ipv4 10.0.0.42
Router(config-sr-te-policy)# path-protection
Router(config-sr-te-policy)# candidate-paths
Router(config-sr-te-policy-path)# preference 50
Router(config-sr-te-policy-path-pref)# explicit segment-list protect-forward-path
Router(config-sr-te-policy-path-pref)# reverse-path segment-list protect-reverse-path
Router(config-sr-te-policy-path)# preference 100
Router(config-sr-te-policy-path-pref)# explicit segment-list working-forward-path
Router(config-sr-te-policy-path-pref)# reverse-path segment-list working-reverse-path
Router(config)# performance-measurement
Router(config-perf-meas)# liveness-detection
Router(config-perf-meas)# liveness-profile name liveness-check
```

Configure PLE over EVPN-VPWS

Use this task to configure PLE over EVPN-VPWS. The two core components are the Pseudowire class specifying the transport type and xconnect service to configure the EVPN-VPWS service parameters.

Figure 4: PLE EVPN-VPWS Service



Perform the following configurations on the NCS57C3-1 router.

Step 1 Router(config)# **l2vpn**

Enters l2vpn configuration.

Step 2 Router(config-l2vpn)# **pw-class circuit-style-srte**

Defines the Pseudowire class to be used with the PLE service. The same Pseudowire class can be used for multiple PLE services between the same far-end routers, or a unique class can be used for each service. The Pseudowire class defines the underlying transport for the service, in this case MPLS using a specific SR-TE policy. The **pw-class** command is followed by a user-defined name, in this example, *circuit-style-srte.*

Step 3 Router(config-l2vpn-pwc)# **encapsulation mpls**

Configures transport encapsulation.

Step 4 Router(config-l2vpn-pwc-mpls)# **preferred-path sr-te policy srte_c_1001_ep_10.0.0.42**

The preferred-path is the circuit-style policy. The preferred-path is used to configure an explicit MPLS path to be used for the l2vpn service. In this case, the preferred-path is set to the SR-TE policy created from the source node to the 10.0.0.42 endpoint node. The path is not the configured name of the policy; it is the computed name.

Step 5 Router(config-l2vpn)# **xconnect group ple**

Enters xconnect configuration mode. The **xconnect group** command is used to administratively group similar L2VPN services and can be set to any user-defined value.

Step 6 Router(config-l2vpn-xc)# **p2p ple-cs-1**

Creates point-to-point L2VPN service with user-defined name *ple-cs-1*.

Step 7 Router(config-l2vpn-xc-p2p)# **interface cem 0/0/2/1**

Specifes the client interface. This interface is the CEM interface type for PLE.

Step 8 Router(config-l2vpn-xc-p2p)# **neighbor evpn evi 100 target 4201 source 4401**

Configures EVPN-VPWS parameters. The user-defined *evi* value must be the same on each far-end router. The target must be the "source" value that is configured on the remote endpoint.

Step 9 Router(config-l2vpn-xc-p2p-pw)# **pw-class circuit-style-srte**

Attaches the previously defined Pseudowire class *circuit-style-te* to the L2VPN service.

Perform the following configurations on the NCS55a2-1 router.

```
Router(config)# l2vpn
Router(config-l2vpn)# pw-class circuit-style-srte
Router(config-l2vpn-pwc)# encapsulation mpls
Router(config-l2vpn-pwc-mpls)# preferred-path sr-te policy srte_c_1001_ep_10.0.0.44
Router(config-l2vpn)# xconnect group ple
Router(config-l2vpn-xc)# p2p ple-cs-1
Router(config-l2vpn-xc-p2p)# interface cem0/0/2/1
Router(config-l2vpn-xc-p2p)# neighbor evpn evi 100 target 4201 source 4401
Router(config-l2vpn-xc-p2p-pw)# pw-class circuit-style-srte
```

Verification

The following example shows the general CEM statistics.

```
RP/0/RP0/CPU0:ron-ncs57c3-1#show controllers CEM 0/0/3/1

Sat Sep 24 11:34:22.533 PDT
Interface : CEM0/0/3/1
Admin state : Up
Oper state : Up
Port bandwidth : 10312500 kbps
Dejitter buffer (cfg/oper/in-use) : 0/813/3432 usec
Payload size (cfg/oper) : 1280/1024 bytes
PDV (min/max/avg) : 980/2710/1845 usec
Dummy mode : last-frame
Dummy pattern : 0xaa
Idle pattern : 0xff
Signalling : No CAS
RTP : Enabled
Clock type : Differential
Detected Alarms : None
Statistics Info
---------------
```

```
Ingress packets : 517617426962, Ingress packets drop : 0
Egress packets : 517277124278, Egress packets drop : 0
Total error : 0
Missing packets : 0, Malformed packets : 0
Jitter buffer underrun : 0, Jitter buffer overrun : 0
Misorder drops : 0
Reordered packets : 0, Frames fragmented : 0
Error seconds : 0, Severely error seconds : 0
Unavailable seconds : 0, Failure counts : 0
Generated L bits : 0, Received L bits : 0
Generated R bits : 339885178, Received R bits : 17
Endpoint Info
-------------
Passthrough : No
```

The following example shows the PM statistics for 30 seconds.

```
RP/0/RP0/CPU0:ron-ncs57c3-1#show controllers CEM 0/0/3/1 pm current 30-sec cem

Sat Sep 24 11:37:02.374 PDT
CEM in the current interval [11:37:00 - 11:37:02 Sat Sep 24 2022]
CEM current bucket type : Valid
INGRESS-PKTS : 2521591 Threshold : 0 TCA(enable) : NO
EGRESS-PKTS : 2521595 Threshold : 0 TCA(enable) : NO
INGRESS-PKTS-DROPPED : 0 Threshold : 0 TCA(enable) : NO
EGRESS-PKTS-DROPPED : 0 Threshold : 0 TCA(enable) : NO
INPUT-ERRORS : 0 Threshold : 0 TCA(enable) : NO
OUTPUT-ERRORS : 0 Threshold : 0 TCA(enable) : NO
MISSING-PKTS : 0 Threshold : 0 TCA(enable) : NO
PKTS-REORDER : 0 Threshold : 0 TCA(enable) : NO
JTR-BFR-UNDERRUNS : 0 Threshold : 0 TCA(enable) : NO
JTR-BFR-OVERRUNS : 0 Threshold : 0 TCA(enable) : NO
MIS-ORDER-DROPPED : 0 Threshold : 0 TCA(enable) : NO
MALFORMED-PKT : 0 Threshold : 0 TCA(enable) : NO
ES : 0 Threshold : 0 TCA(enable) : NO
SES : 0 Threshold : 0 TCA(enable) : NO
UAS : 0 Threshold : 0 TCA(enable) : NO
FC : 0 Threshold : 0 TCA(enable) : NO
TX-LBITS : 0 Threshold : 0 TCA(enable) : NO
TX-RBITS : 0 Threshold : 0 TCA(enable) : NO
RX-LBITS : 0 Threshold : 0 TCA(enable) : NO
RX-RBITS : 0 Threshold : 0 TCA(enable) : NO
```

The following example shows the controller information for Ethernet 10GE.

```
RP/0/RP0/CPU0:ron-ncs57c3-1#show controllers TenGigECtrlr0/0/3/2

Sat Sep 24 11:43:23.164 PDT
Operational data for interface TenGigECtrlr0/0/3/2:
State:
Administrative state: enabled
Operational state: Up
LED state: Green On
PRBS:
Status: Locked
Mode: Source-sink
Pattern: User-defined
Direction: System
Error-inject: None
Framing: Unframed
User-pattern: 0xabcdef0123456789
Phy:
Media type: Not known
Autonegotiation disabled.
Operational values:
```

```
Speed: 10Gbps
Duplex: Full Duplex
Flowcontrol: None
Loopback: None (or external)
Inter-packet gap: standard (12)
BER monitoring:
Not supported
```

The following example shows the PM statistics for Ethernet controller.

```
RP/0/RP0/CPU0:ron-ncs57c3-1#show controllers TenGigECtrlr0/0/3/2 pm current 30-sec ether

Sat Sep 24 11:45:39.919 PDT
ETHER in the current interval [11:45:30 - 11:45:39 Sat Sep 24 2022]
ETHER current bucket type : Valid
RX-PKT : 4528985 Threshold : 0 TCA(enable) : NO
STAT-PKT : 9057971 Threshold : 0 TCA(enable) : NO
OCTET-STAT : 2318840576 Threshold : 0 TCA(enable) : NO
OVERSIZE-PKT : 0 Threshold : 0 TCA(enable) : NO
FCS-ERR : 0 Threshold : 0 TCA(enable) : NO
LONG-FRAME : 0 Threshold : 0 TCA(enable) : NO
JABBER-STATS : 0 Threshold : 0 TCA(enable) : NO
64-OCTET : 0 Threshold : 0 TCA(enable) : NO
65-127-OCTET : 0 Threshold : 0 TCA(enable) : N
128-255-OCTET : 0 Threshold : 0 TCA(enable) : NO
256-511-OCTET : 9057971 Threshold : 0 TCA(enable) : NO
512-1023-OCTET : 0 Threshold : 0 TCA(enable) : NO
1024-1518-OCTET : 0 Threshold : 0 TCA(enable) : NO
IN-UCAST : 0 Threshold : 0 TCA(enable) : NO
IN-MCAST : 0 Threshold : 0 TCA(enable) : NO
IN-BCAST : 0 Threshold : 0 TCA(enable) : NO
OUT-UCAST : 0 Threshold : 0 TCA(enable) : NO
OUT-BCAST : 0 Threshold : 0 TCA(enable) : NO
OUT-MCAST : 0 Threshold : 0 TCA(enable) : NO
TX-PKT : 4528986 Threshold : 0 TCA(enable) : NO
OUT-OCTET : 1159420416 Threshold : 0 TCA(enable) : NO
IFIN-ERRORS : 0 Threshold : 0 TCA(enable) : NO
IFIN-OCTETS : 0 Threshold : 0 TCA(enable) : NO
STAT-MULTICAST-PKT : 0 Threshold : 0 TCA(enable) : NO
STAT-BROADCAST-PKT : 0 Threshold : 0 TCA(enable) : NO
STAT-UNDERSIZED-PKT : 0 Threshold : 0 TCA(enable) : NO
IN_GOOD_BYTES : 1159420160 Threshold : 0 TCA(enable) : NO
IN_802_1Q_FRAMES : 0 Threshold : 0 TCA(enable) : NO
IN_GOOD_PKTS : 4528985 Threshold : 0 TCA(enable) : NO
IN_DROP_OTHER : 0 Threshold : 0 TCA(enable) : NO
OUT_GOOD_BYTES : 1159420416 Threshold : 0 TCA(enable) : No
OUT_802_1Q_FRAMES : 0 Threshold : 0 TCA(enable) : NO
OUT_GOOD_PKTS : 4528986 Threshold : 0 TCA(enable) : NO
IN_ERROR_FRAGMENTS : 0 Threshold : 0 TCA(enable) : NO
IN_PKT_64_OCTET : 0 Threshold : 0 TCA(enable) : NO
IN_PKTS_65_127_OCTETS : 0 Threshold : 0 TCA(enable) : NO
IN_PKTS_128_255_OCTETS : 0 Threshold : 0 TCA(enable) : NO
IN_PKTS_256_511_OCTETS : 4528985 Threshold : 0 TCA(enable) : NO
IN_PKTS_512_1023_OCTETS : 0 Threshold : 0 TCA(enable) : NO
IN_PKTS_1024_1518_OCTETS : 0 Threshold : 0 TCA(enable) : NO
OUT_PKT_64_OCTET : 0 Threshold : 0 TCA(enable) : NO
OUT_PKTS_65_127_OCTETS : 0 Threshold : 0 TCA(enable) : NO
OUT_PKTS_128_255_OCTETS : 0 Threshold : 0 TCA(enable) : NO
OUT_PKTS_256_511_OCTETS : 4528986 Threshold : 0 TCA(enable) : NO
OUT_PKTS_512_1023_OCTETS : 0 Threshold : 0 TCA(enable) : NO
OUT_PKTS_1024_1518_OCTETS : 0 Threshold : 0 TCA(enable) : NO
TX_UNDERSIZED_PKT : 0 Threshold : 0 TCA(enable) : NO
TX_OVERSIZED_PKT : 0 Threshold : 0 TCA(enable) : NO
TX_FRAGMENTS : 0 Threshold : 0 TCA(enable) : NO
TX_JABBER : 0 Threshold : 0 TCA(enable) : NO
```

```
TX_BAD_FCS : 0 Threshold : 0 TCA(enable) : NO

Last clearing of "show controllers ETHERNET" counters never
```

The following example shows the controller information for Fiber Channel 8G.

```
RP/0/RP0/CPU0:ron-ncs57c3-1#show controllers EightGigFibreChanCtrlr0/0/3/4

Sat Sep 24 11:53:09.820 PDT
Operational data for Fibre Channel controller EightGigFibreChanCtrlr0/0/3/4
State:
Admin State : Up
Operational state : Up
LED state : Green On
Secondary admin state : Normal
Laser Squelch : Disabled
Performance Monitoring is enabled
Operational values:
Speed : 8 Gbps
Loopback : None
BER monitoring:
Signal Degrade : 1e-0
Signal Fail : 1e-0
Hold-off Time : 0 ms
Forward Error Correction : Not Configured
```

The following example shows the PM statistics for Fiber Channel.

```
RP/0/RP0/CPU0:ron-ncs57c3-1#show controllers EightGigFibreChanCtrlr0/0/3/4 pm current 30-sec
 fc
Sat Sep 24 11:51:55.168 PDT
FC in the current interval [11:51:30 - 11:51:55 Sat Sep 24 2022]
FC current bucket type : Valid
IFIN-OCTETS : 16527749196 Threshold : 0 TCA(enable) : NO
RX-PKT : 196758919 Threshold : 0 TCA(enable) : NO
IFIN-ERRORS : 0 Threshold : 0 TCA(enable) : NO
RX-BAD-FCS : 0 Threshold : 0 TCA(enable) : NO
IFOUT-OCTETS : 0 Threshold : 0 TCA(enable) : NO
TX-PKT : 0 Threshold : 0 TCA(enable) : NO
TX-BAD-FCS : 0 Threshold : 0 TCA(enable) : NO
RX-FRAMES-TOO-LONG : 0 Threshold : 0 TCA(enable) : NO
RX-FRAMES-TRUNC : 0 Threshold : 0 TCA(enable) : NO
TX-FRAMES-TOO-LONG : 0 Threshold : 0 TCA(enable) : NO
TX-FRAMES-TRUNC : 0 Threshold : 0 TCA(enable) : NO
```