



# Configure Segment Routing Path Computation Element

---

The Segment Routing Path Computation Element (SR-PCE) provides stateful PCE functionality by extending the existing IOS-XR PCEP functionality with additional capabilities. SR-PCE is supported on the MPLS data plane and IPv4 control plane.



---

**Note** The Cisco IOS XRv 9000 is the recommended platform to act as the SR-PCE. Refer to the [Cisco IOS XRv 9000 Router Installation and Configuration Guide](#) for more information.

---

- [About SR-PCE, on page 1](#)
- [Configure SR-PCE, on page 2](#)

## About SR-PCE

The path computation element protocol (PCEP) describes a set of procedures by which a path computation client (PCC) can report and delegate control of head-end label switched paths (LSPs) sourced from the PCC to a PCE peer. The PCE can request the PCC to update and modify parameters of LSPs it controls. The stateful model also enables a PCC to allow the PCE to initiate computations allowing the PCE to perform network-wide orchestration.



---

**Note** For more information on PCE, PCC, and PCEP, refer to the [Path Computation Element](#) section in the *MPLS Configuration Guide for the Cisco CRS Router*.

---

SR-PCE learns topology information by way of IGP (OSPF or IS-IS) or through BGP Link-State (BGP-LS).

SR-PCE is capable of computing paths using the following methods:

- TE metric—SR-PCE uses the TE metric in its path calculations to optimize cumulative TE metric.
- IGP metric—SR-PCE uses the IGP metric in its path calculations to optimize reachability.
- LSP Disjointness—SR-PCE uses the path computation algorithms to compute a pair of disjoint LSPs. The disjoint paths can originate from the same head-end or different head-ends. Disjoint level refers to

the type of resources that should not be shared by the two computed paths. SR-PCE supports the following disjoint path computations:

- Link – Specifies that links are not shared on the computed paths.
- Node – Specifies that nodes are not shared on the computed paths.
- SRLG – Specifies that links with the same SRLG value are not shared on the computed paths.
- SRLG-node – Specifies that SRLG and nodes are not shared on the computed paths.

When the first request is received with a given disjoint-group ID, the first LSP is computed, encoding the shortest path from the first source to the first destination. When the second LSP request is received with the same disjoint-group ID, information received in both requests is used to compute two disjoint paths: one path from the first source to the first destination, and another path from the second source to the second destination. Both paths are computed at the same time.

## Configure SR-PCE

This task explains how to configure SR-PCE.

### Before you begin

The Cisco IOS XRv 9000 is the recommended platform to act as the SR-PCE.

### SUMMARY STEPS

1. **configure**
2. **pce**
3. **address ipv4** *address*
4. **state-sync ipv4** *address*
5. **tcp-buffer size** *size*
6. **password** {**clear** | **encrypted**} *password*
7. **segment-routing** {**strict-sid-only** | **te-latency**}
8. **timers**
9. **keepalive** *time*
10. **minimum-peer-keepalive** *time*
11. **reoptimization** *time*
12. **exit**

### DETAILED STEPS

|        | Command or Action   | Purpose                           |
|--------|---|-----------------------------------|
| Step 1 | <b>configure</b><br><b>Example:</b><br>RP/0/RP0/CPU0:router# <b>configure</b> | Enters global configuration mode. |

|               | Command or Action  | Purpose   |
|---------------|--|---|
| <b>Step 2</b> | <p><b>pce</b></p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config)# pce</pre>  | Enables PCE and enters PCE configuration mode.  |
| <b>Step 3</b> | <p><b>address ipv4 address</b></p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config-pce)# address ipv4 192.168.0.1</pre>                                  | Configures a PCE IPv4 address.  |
| <b>Step 4</b> | <p><b>state-sync ipv4 address</b></p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config-pce)# state-sync ipv4 192.168.0.3</pre>                            | Configures the remote peer for state synchronization.   |
| <b>Step 5</b> | <p><b>tcp-buffer size size</b></p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config-pce)# tcp-buffer size 1024000</pre>                                   | Configures the transmit and receive TCP buffer size for each PCEP session, in bytes. The default buffer size is 256000. The valid range is from 204800 to 1024000.  |
| <b>Step 6</b> | <p><b>password {clear   encrypted} password</b></p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config-pce)# password encrypted pwd1</pre>                  | Enables TCP MD5 authentication for all PCEP peers. Any TCP segment coming from the PCC that does not contain a MAC matching the configured password will be rejected. Specify if the password is encrypted or clear text. |
| <b>Step 7</b> | <p><b>segment-routing {strict-sid-only   te-latency}</b></p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config-pce)# segment-routing strict-sid-only</pre> | <p>Configures the segment routing algorithm to use strict SID or TE latency.</p> <p><b>Note</b> This setting is global and applies to all LSPs that request a path from this controller.</p>                              |
| <b>Step 8</b> | <p><b>timers</b></p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config-pce)# timers</pre>  | Enters timer configuration mode.  |
| <b>Step 9</b> | <p><b>keepalive time</b></p> <p><b>Example:</b></p>  | Configures the timer value for locally generated keep-alive messages. The default time is 30 seconds.   |

|                | Command or Action  | Purpose  |
|----------------|--|--|
|                | <pre>RP/0/RP0/CPU0:router(config-pce-timers)# <b>keepalive</b> 60</pre>  |  |
| <b>Step 10</b> | <b>minimum-peer-keepalive</b> <i>time</i><br><b>Example:</b><br><pre>RP/0/RP0/CPU0:router(config-pce-timers)# <b>minimum-peer-keepalive</b> 30</pre> | Configures the minimum acceptable keep-alive timer that the remote peer may propose in the PCEP OPEN message during session establishment. The default time is 20 seconds. |
| <b>Step 11</b> | <b>reoptimization</b> <i>time</i><br><b>Example:</b><br><pre>RP/0/RP0/CPU0:router(config-pce-timers)# <b>reoptimization</b> 600</pre>                | Configures the re-optimization timer. The default timer is 1800 seconds.   |
| <b>Step 12</b> | <b>exit</b><br><b>Example:</b><br><pre>RP/0/RP0/CPU0:router(config-pce-timers)# <b>exit</b></pre>  | Exits timer configuration mode and returns to PCE configuration mode.  |

## Configure the Disjoint Policy (Optional)

This task explains how to configure the SR-PCE to compute disjointness for a pair of LSPs signaled by PCCs that do not include the PCEP association group-ID object in their PCEP request. This can be beneficial for deployments where PCCs do not support this PCEP object or when the network operator prefers to manage the LSP disjoint configuration centrally.

### SUMMARY STEPS

1. **disjoint-path**
2. **group-id** *value* **type** {link | node | srlg | srlg-node} [**sub-id** *value*]
3. **strict**
4. **lsp** {1 | 2} **pcc ipv4** *address* **lsp-name** *lsp\_name* [**shortest-path**]

### DETAILED STEPS

|               | Command or Action  | Purpose                             |
|---------------|--|-------------------------------------|
| <b>Step 1</b> | <b>disjoint-path</b><br><b>Example:</b><br><pre>RP/0/RP0/CPU0:router(config-pce)# <b>disjoint-path</b></pre> | Enters disjoint configuration mode. |

|        | Command or Action  | Purpose  |
|--------|--|--|
| Step 2 | <p><b>group-id</b> <i>value</i> <b>type</b> {<b>link</b>   <b>node</b>   <b>srlg</b>   <b>srlg-node</b>} [<b>sub-id</b> <i>value</i>]</p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config-pce-disjoint)# group-id 1 type node sub-id 1</pre>   | <p>Configures the disjoint group ID and defines the preferred level of disjointness (the type of resources that should not be shared by the two paths):</p> <ul style="list-style-type: none"> <li>• <b>link</b>—Specifies that links are not shared on the computed paths.</li> <li>• <b>node</b>—Specifies that nodes are not shared on the computed paths.</li> <li>• <b>srlg</b>—Specifies that links with the same SRLG value are not shared on the computed paths.</li> <li>• <b>srlg-node</b>—Specifies that SRLG and nodes are not shared on the computed paths.</li> </ul> <p>If a pair of paths that meet the requested disjointness level cannot be found, then the paths will automatically fallback to a lower level:</p> <ul style="list-style-type: none"> <li>• If the requested disjointness level is SRLG or node, then link-disjoint paths will be computed.</li> <li>• If the requested disjointness level was link, or if the first fallback from SRLG or node disjointness failed, then the lists of segments encoding two shortest paths, without any disjointness constraint, will be computed.</li> </ul> |
| Step 3 | <p><b>strict</b></p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config-pce-disjoint)# strict</pre>   | <p>(Optional) Prevents the automatic fallback behavior of the preferred level of disjointness. If a pair of paths that meet the requested disjointness level cannot be found, the disjoint calculation terminates and no new path is provided. The existing path is not modified.</p>  |
| Step 4 | <p><b>lsp</b> {<b>1</b>   <b>2</b>} <b>pcc</b> <b>ipv4</b> <i>address</i> <b>lsp-name</b> <i>lsp_name</i> [<b>shortest-path</b>]</p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config-pce-disjoint)# lsp 1 pcc ipv4 192.168.0.1 lsp-name rtrA_t1 shortest-path RP/0/RP0/CPU0:router(config-pce-disjoint)# lsp 2 pcc ipv4 192.168.0.5 lsp-name rtrE_t2</pre> | <p>Adds LSPs to the disjoint group.</p> <p>The <b>shortest-path</b> keyword forces one of the disjoint paths to follow the shortest path from the source to the destination. This option can only be applied to the the first LSP specified.</p>   |

## Global Maximum-delay Constraint

This feature allows a PCE to compare the cumulative latency of a computed path against a global maximum-delay constraint value. If the latency of the computed path exceeds this global constraint, the path is not considered valid. This ensures that all latency-based paths computed by the PCE and signaled to the PCCs in the network do not exceed this maximum-delay constraint.

```

pce
  constraints
    bounds
      cumulative
      type
        latency <1-4294967295> Bound metric value in microseconds

```

### Configuration

To configure a PCE for specifying maximum cumulative latency metric, you must complete the following configurations:

```

RP/0/RSP0/CPU0:ios(config)# pce
RP/0/RSP0/CPU0:ios(config-pce)# constraints
RP/0/RSP0/CPU0:ios(config-pce-constr)# bounds
RP/0/RSP0/CPU0:ios(config-pce-constr-bounds)# cumulative
RP/0/RSP0/CPU0:ios(config-pce-constr-bounds-type)# type latency 1000000
RP/0/RSP0/CPU0:ios(config-pce-constr-bounds-type)#

```

### Verification

Verify using the **show** command:

```

RP/0/RSP0/CPU0:ios(config-pce-constr-bounds-type)# show
Wed Oct 12 22:18:22.962 UTC
pce
  constraints
    bounds
      cumulative
      type latency 1000000
    !
  !
!
!
!

```