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.

To install SR-PCE, you need to install an instance of Cisco IOS XRv 9000 Router. Refer to the Cisco IOS XRv 9000 Router Installation and Configuration Guide for more information.

**Note**

- 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.

For more information on PCE, PCC, and PCEP, refer to the Path Computation Element section in the MPLS Configuration Guide for Cisco ASR 9000 Series Routers.

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.

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**Configure SR-PCE**

This task explains how to configure SR-PCE.

**Before you begin**

Optionally install and configure an instance of Cisco IOS XRv 9000 Router.

**SUMMARY STEPS**

1. configure
2. pce
3. address ipv4 address
4. state-sync ipv4 address
5. tcp-buffer 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**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 configure</td>
<td></td>
</tr>
<tr>
<td>Step 2 pce</td>
<td>Enables PCE and enters PCE configuration mode.</td>
</tr>
</tbody>
</table>

Example:
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 3</strong> <code>address ipv4 address</code></td>
<td>Configures a PCE IPv4 address.</td>
</tr>
<tr>
<td>Example: <code>RP/0/RSP0/CPU0:router(config-pce)# address ipv4 192.168.0.1</code></td>
<td></td>
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<tr>
<td><strong>Step 4</strong> <code>state-sync ipv4 address</code></td>
<td>Configures the remote peer for state synchronization.</td>
</tr>
<tr>
<td>Example: <code>RP/0/RSP0/CPU0:router(config-pce)# state-sync ipv4 192.168.0.3</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> <code>tcp-buffer size</code></td>
<td>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.</td>
</tr>
<tr>
<td>Example: <code>RP/0/RSP0/CPU0:router(config-pce)# tcp-buffer 1024000</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> `password {clear</td>
<td>encrypted} password`</td>
</tr>
<tr>
<td>Example: <code>RP/0/RSP0/CPU0:router(config-pce)# password encrypted pwd1</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong> `segment-routing {strict-sid-only</td>
<td>te-latency}`</td>
</tr>
<tr>
<td>Example: <code>RP/0/RSP0/CPU0:router(config-pce)# segment-routing strict-sid-only</code></td>
<td><strong>Note</strong> This setting is global and applies to all LSPs that request a path from this controller.</td>
</tr>
<tr>
<td><strong>Step 8</strong> <code>timers</code></td>
<td>Enters timer configuration mode.</td>
</tr>
<tr>
<td>Example: <code>RP/0/RSP0/CPU0:router(config-pce)# timers</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 9</strong> <code>keepalive time</code></td>
<td>Configures the timer value for locally generated keep-alive messages. The default time is 30 seconds.</td>
</tr>
<tr>
<td>Example: <code>RP/0/RSP0/CPU0:router(config-pce-timers)# keepalive 60</code></td>
<td></td>
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</tbody>
</table>
### 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**

<table>
<thead>
<tr>
<th>Command or Action</th>
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</tr>
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<tbody>
<tr>
<td><strong>Step 1</strong> disjoint-path</td>
<td>Enters disjoint configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
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<td>...</td>
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<tr>
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<tbody>
<tr>
<td><strong>Step 2</strong> group-id value type {link</td>
<td>node</td>
</tr>
<tr>
<td>Example:</td>
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<td>...</td>
<td></td>
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</tbody>
</table>
**Purpose**

- **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.

If a pair of paths that meet the requested disjointness level cannot be found, then the paths will automatically fallback to a lower level:

- If the requested disjointness level is SRLG or node, then link-disjoint paths will be computed.
- 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.

### Step 3

**strict**

**Example:**

```
RP/0/RSP0/CPU0:router(config-pce-disjoint)# strict
```

(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.

### Step 4

```
lsp {1 | 2} pcc ipv4 address lsp-name lsp_name [shortest-path]
```

**Example:**

```
RP/0/RSP0/CPU0:router(config-pce-disjoint)# lsp 1 pcc ipv4 192.168.0.1 lsp-name rtrA_t1 shortest-path
RP/0/RSP0/CPU0:router(config-pce-disjoint)# lsp 2 pcc ipv4 192.168.0.5 lsp-name rtrE_t2
```

Adds LSPs to the disjoint group.

The **shortest-path** 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 first LSP specified.
Configure the Disjoint Policy (Optional)