Chapter 21

RSVP LSP Hierarchy Configuration Guidelines

This chapter provides an overview and describes how to configure the Resource Reservation Protocol (RSVP) label-switched path (LSP) hierarchy. The RSVP LSP hierarchy allows you to tunnel multiple RSVP LSPs over a single RSVP LSP.

The RSVP LSP hierarchy is described in the following sections:

RSVP LSP Hierarchy Standard

For more information on how the RSVP LSP hierarchy functions, see RFC 4206, *Label Switched Paths (LSP) Hierarchy with Generalized Multi-Protocol Label Switching (GMPLS) Traffic Engineering (TE)*.

RSVP LSP Hierarchy Terminology

The following terminology is used to describe functionality related to the RSVP LSP hierarchy:

- Forwarding adjacency LSP—An RSVP LSP used to tunnel other RSVP LSPs; forms the basis for a forwarding adjacency.
- Forwarding adjacency—A traffic engineering link created by a forwarding adjacency LSP. You can create a forwarding adjacency between two routers in a network by configuring a forwarding adjacency LSP. Forwarding adjacencies can only be statically configured. However, you can configure Open Shortest Path First (OSPF) to advertise the forwarding adjacency to other routers. When an RSVP LSP traverses a forwarding adjacency, existing Multiprotocol Label Switching (MPLS) features such as fast reroute continue to function.

RSVP LSP Hierarchy Overview

The following sections provide an overview of how the RSVP LSP hierarchy function:

RSVP LSP Hierarchy

Forwarding adjacencies are configured and managed as point-to-point traffic engineering links using statements configured at the [protocols link-management] hierarchy level. For the forwarding adjacency to function properly, you also need to make RSVP aware of the forwarding adjacency by configuring the corresponding peer interface at the [edit protocols rsvp] hierarchy level.

Although forwarding adjacency LSPs are configured and managed as traffic engineering links on the local router, it is not necessary to advertise these traffic engineering links to other routers in the network. However, if you want to automatically forward MPLS traffic over the forwarding adjacency or want other routers to compute paths over the forwarding adjacency, you must configure OSPF to advertise the forwarding adjacency to the other routers in the network and add the forwarding adjacency to the traffic engineering database (TED). OSPF is the only supported interior gateway protocol (IGP).

Advertising the Forwarding Adjacency with OSPF

Once a forwarding adjacency LSP and the corresponding traffic engineering link you have configured, you can configure OSPF to advertise the forwarding adjacency. Unlike regular traffic engineering links, OSPF hellos are not exchanged between the forwarding adjacency LSP endpoints and therefore no routing adjacency is created between the forwarding adjacency endpoints. If you issue a show ospf neighbor command on an ingress forwarding adjacency, the command displays the egress router of the forwarding adjacency LSP as a neighbor. However, no real OSPF adjacency is established (no OSPF hellos are exchanged) between the ingress and egress routers. For display purposes only, OSPF creates a pseudo neighbor corresponding to the peer.

You can configure forwarding adjacencies over existing MPLS networks. A forwarding adjacency LSP is signaled as a regular MPLS LSP without generalized MPLS (GMPLS) extensions. When the forwarding adjacency LSP is advertised as a traffic engineering link in OSPF, the corresponding traffic engineering link in OSPF is also advertised as a regular MPLS traffic engineering link without GMPLS extensions.

Configuring the RSVP LSP Hierarchy

The following sections describe how to configure the RSVP LSP hierarchy:

Configuring an RSVP LSP

To configure a standard RSVP LSP on the ingress router to be used as the forwarding adjacency LSP, see "Configuring an LSP" on page 71. This LSP requires no special configuration to function as a forwarding adjacency LSP.

Configuring a Forwarding Adjacency

A forwarding adjacency is a type of GMPLS traffic engineering link. It requires that you configure local and remote addresses to identify the link. A forwarding adjacency is associated with a specific peer router. You could configure multiple forwarding adjacencies to the same peer router.

To configure a forwarding adjacency, you need to configure the te-link statement at the [edit protocols link-management] hierarchy level:

```
[edit protocols link-management]
te-link te-link-name {
    label-switched-path label-switched-path-name;
    local-address ip-address;
    remote-address ip-address;
}
```

The following sections describe how to configure the te-link statement for a forwarding adjacency:

For more information on how to configure GMPLS traffic engineering links, see "Configuring LMP Traffic Engineering Links" on page 461.

NOTE: Do not configure the control channel for a forwarding adjacency peer router. Configuring a control channel causes the commit to fail.

Configuring the Local IP Address for the Forwarding Adjacency

To configure the local IP address for the forwarding adjacency, include the local-address statement:

```
local-address ip-address;
```

For a list of hierarchy levels at which you can include this statement, see the statement summary section for this statement.

Configuring the Remote IP Address for the Forwarding Adjacency

The address of the peer router is the node ID for the forwarding adjacency LSP egress node. You configure this node ID for the forwarding adjacency using the remote-address statement:

```
remote-address ip-address;
```

You can include this statement at the following hierarchy levels:

- [edit protocols link-management te-link *te-link-name*],
- [edit logical-routers *logical-router-name* protocols link-management te-link *te-link-name*]

Configuring the LSP for the Forwarding Adjacency

To configure a router to function as a forwarding adjacency, specify the LSP configured in "Configuring an RSVP LSP" on page 479 using the label-switched-path statement at the [edit protocols link-management te-link *te-link-name*] hierarchy level:

```
label-switched-path label-switched-path-name;
```

You can specify this statement at the following hierarchy levels:

- [edit logical-routers *logical-router-name* protocols link-management te-link *te-link-name*]
- [edit protocols link-management te-link *te-link-name*]

Configuring RSVP for a Forwarding Adjacency

For the forwarding adjacency to function properly, RSVP must be made aware of it. Do this by specifying the name of the peer interface corresponding to the link-management peer associated with the forwarding adjacency. Configuring the peer-interface statement at the [edit protocols rsvp] hierarchy level allows RSVP to use all of the traffic engineering links configured for that peer. You can also configure RSVP control-plane parameters such as the hello interval and refresh reduction.

To configure RSVP to recognize a forwarding adjacency, configure the peer-interface statement:

```
peer-interface peer-interface-name {
    disable;
    (aggregate | no-aggregate);
    authentication-key key;
    hello-interval seconds;
    (reliable | no-reliable);
}
```

You can specify this statement at the following hierarchy levels:

- [edit logical-routers *logical-router-name* protocols rsvp]
- [edit protocols rsvp]

For more information on how to configure the peer-interface statement, see "Configuring Peer Interfaces in RSVP and OSPF" on page 467.

Advertising a Forwarding Adjacency Using OSPF

You can allow other routers to dynamically signal paths over a forwarding adjacency LSP by configuring OSPF. This configuration is optional.

If you configure OSPF to advertise a forwarding adjacency LSP, the LSP is added to the traffic engineering database on each router in the traffic engineering domain. Because the forwarding adjacency LSP is unidirectional, the corresponding traffic engineering link (forwarding adjacency) is also unidirectional. The forwarding adjacency LSP appears as a standard traffic engineering database half-link to all routers in the traffic engineering domain.

CSPF performs a bidirectional link check to ensure that traffic can flow in both directions. CSPF checks for a reverse link, either the exact reverse forwarding adjacency or another reverse link. If there is no reverse link from the forwarding adjacency LSP egress router to the forwarding adjacency LSP ingress router, the CSPF check fails.

CSPF might find another parallel reverse link. However, the LSP cannot function properly over the forwarding adjacency unless you have explicitly configured a corresponding forwarding adjacency LSP to handle the traffic flowing in the opposite direction on the forwarding adjacency LSP egress router.

To advertise the traffic engineering properties of a forwarding adjacency to a specific peer router, include the peer-interface statement:

```
peer-interface peer-interface-name {
    authentication {...}
    dead-interval seconds;
    disable;
    hello-interval seconds;
    retransmit-interval seconds;
    transit-delay seconds;
}
```

You can configure this statement at the following hierarchy levels:

- [edit logical-routers *logical-router-name* protocols ospf area *area-name*]
- [edit protocols ospf area *area-name*]

For more information on how to configure the peer-interface statement, see "Configuring Peer Interfaces in RSVP and OSPF" on page 467.