

Chapter 3

Understanding CSPF Events

This chapter lists and describes Constrained Shortest Path First (CSPF) events that occur in the output of the `show mpls lsp extensive` command, including sample output of the label-switched path (LSP) event, an explanation of what the event means, the possible cause of the event, and any possible actions that you can take to remedy the situation. (See Table 7.)

Table 7: Checklist for Understanding CSPF Events

Understanding CSPF Events Tasks	Possible Action or Command
Displaying CSPF Events on page 40	<code>show mpls lsp extensive</code>
1. CSPF Failed: No Route Toward Event on page 41	<code>show ted database detail</code> Determine if there is a route to the destination. [<code>edit protocols mpls label-switched-path lsp-path-name</code>] <code>no-cspf</code>
2. CSPF: Link Down/Deleted Event on page 42	Investigate possible causes for the link failure.
3. CSPF: Computation Result Accepted Event on page 43	Not applicable.
4. CSPF: Computation Result Ignored Event on page 43	Not applicable.
5. CSPF: Could Not Determine Self Event on page 44	Take appropriate action: <ul style="list-style-type: none">■ Enable traffic engineering■ Configure the family <code>iso</code> statement or <code>address</code> statement■ Include interfaces at the [<code>edit interfaces</code>], [<code>edit protocols mpls</code>], or [<code>edit protocols isis</code>] hierarchy level
6. CSPF: Can't Find Non-Overlapping Path Event on page 45	Not applicable.
7. CSPF: Reroute Due to Re-Optimization Event on page 45	Not applicable.
8. Retry Limit Exceeded Event on page 46	<code>clear mpls lsp</code>
9. CSPF Failed: Empty Route Event on page 47	Enter the correct IP address at the [<code>edit protocols mpls label-switched-path lsp-path-name</code>] hierarchy level.

Displaying CSPF Events

Purpose The ingress router determines the physical path for each LSP by applying a CSPF algorithm to the information in the traffic engineering database (TED). CSPF is a shortest-path-first (SPF) algorithm that has been modified to take into account specific restrictions when calculating the shortest path across a network. Links that do not comply with the restrictions are removed from the tree and cannot be factored into the resulting SPF calculations. When compliant routes cannot be found, the output of the CSPF algorithm is a CSPF event or error message that can appear in the output of the `show mpls lsp extensive` command.

Action To display CSPF messages, enter the following JUNOS command-line interface (CLI) operational mode command from the ingress router:

```
user@host> show mpls lsp extensive
```

Sample Output

```
user@R1# run show mpls lsp extensive
Ingress LSP: 1 sessions

10.0.0.6
  From: 10.0.0.1, State: Dn, ActiveRoute: 0, LSPname: R1-to-R6
  ActivePath: (none)
  LoadBalance: Random
  Encoding type: Packet, Switching type: Packet, GPID: IPv4
  Primary                               State: Dn
    Will be enqueued for recomputation in 3 second(s).
    68 Jan  5 10:02:56 CSPF failed: no route toward 10.0.0.6[9 times]
    67 Jan  5 09:58:33 Deselected as active
    66 Jan  5 09:58:33 CSPF failed: no route toward 10.0.0.6
    65 Jan  5 09:58:33 Clear Call
    64 Jan  5 09:58:33 Session preempted
    63 Jan  5 09:58:33 Down
    62 Jan  5 09:58:32 CSPF failed: no route toward 10.0.0.6[2 times]
    61 Jan  5 09:57:55 10.1.36.2: Explicit Route: wrong delivery
    60 Jan  5 09:57:34 CSPF failed: no route toward 10.0.0.6[2 times]
    59 Jan  5 09:57:28 CSPF: link down/deleted
10.1.36.1(R3.00/10.0.0.3)->10.1.36.2(R6.00/10.0.0.6)
  58 Jan  5 09:54:37 Selected as active path
  57 Jan  5 09:54:37 Record Route: 10.1.13.2 10.1.36.2
  56 Jan  5 09:54:37 Up
  55 Jan  5 09:54:37 Originate Call
  54 Jan  5 09:54:37 CSPF: computation result accepted
[...Output truncated...]
```

What It Means The sample output from ingress router R1 shows extensive ingress LSP information, including LSP events that led to an LSP failure, with the most recent events at the top. The last line before the history log begins indicates the length of time the router waits before attempting to re-signal the LSP, three seconds in this instance.

LSP events in bold are described in this chapter. Descriptions include sample output of the LSP event, an explanation of what the event means, the possible cause of the event, and any possible actions that you can take.

For completeness, events not included in this example output are also described in this chapter to show LSP events that did not occur in the example network configuration, but might occur in your network. The output for these events includes the prompt `user@host` rather than the usual `user@R1` prompt.

CSPF Failed: No Route Toward Event

LSP Event CSPF failed: no route toward *ip-address*

Sample Output

```
user@R1> show mpls lsp extensive
[...Output truncated...]
Will be enqueued for recomputation in 3 second(s).
  68 Jan  5 10:02:56 CSPF failed: no route toward 10.0.0.6[9 times]
  67 Jan  5 09:58:33 Deselected as active
  66 Jan  5 09:58:33 CSPF failed: no route toward 10.0.0.6
[...Output truncated...]
```

What It Means This LSP event indicates that the CSPF calculation on the ingress router R1 failed to find a route to the destination, in this case the egress router.

Cause The CSPF calculation to the destination can fail for many reasons, and failures occur frequently. The failures include, but are not limited to:

- A downstream node not configured for the Resource Reservation Protocol (RSVP) or Multiprotocol Label Switching (MPLS).
- The family mpls statement not configured on routers along the LSP path.
- The loopback (lo0) interface not configured at the [edit protocols isis] hierarchy level on the ingress or egress routers
- A faulty Explicit Route Object (ERO) that causes a loop or contains a bad address.

This event always includes an address it cannot reach. The listed address may be the LSP egress address, an ERO address, or an intermediate address.

Action Determine if the node is listed in the traffic engineering database with the **show ted database detail** command. If necessary, compare the LSP constraints of all links that lead to the address to determine if there is a route to the destination.



NOTE: The CSPF algorithm prunes the database of links that do not comply with LSP constraints, then computes the shortest path from the remaining links.

A ping to an address that is unreachable by CSPF follows the interior gateway protocol (IGP) shortest path, not the CSPF constraints. Therefore, using the **ping** command to verify the connection does not provide information about why CSPF failed.

To verify whether the problem is a constraint issue, configure your LSP with the **no-cspf** statement at the [edit protocols mpls label-switched-path *lsp-path-name*] hierarchy level, then determine if the router signals the LSP successfully. If it does, the traffic engineering database contains links that do not comply with your constraints for the LSP.

The CSPF algorithm follows these steps to select a path:

1. Compute LSPs one at a time, beginning with the highest priority LSP (the one with the lowest setup priority value). Among LSPs of equal priority, CSPF starts with those that have the highest bandwidth requirement.
2. Prune the traffic engineering database of all links that are not full duplex and do not have sufficient reservable bandwidth.
3. If the LSP configuration includes the **include** statement, prune all links that do not share any included colors.
4. If the LSP configuration includes the **exclude** statement for the LSP, prune all links that contain excluded colors and do not contain a color.
5. Find the shortest path towards the LSP's egress router, taking into account explicit-path constraints. For example, if the path must pass through Router A, two separate SPF's are computed, one from the ingress router to Router A, the other from Router A to the egress router.
6. If several paths have equal cost, choose the path whose last-hop address is the same as the LSP's destination.
7. If several equal-cost paths remain, select the path with the fewest number of hops.
8. If several equal-cost paths remain, apply the CSPF load-balancing rule configured on the LSP (least-fill, most-fill, or random).

CSPF: Link Down/Deleted Event

LSP Event	CSPF: link down/deleted
Sample Output	<pre> user@R1> show mpls lsp extensive [...Output truncated...] 60 Jan 5 09:57:34 CSPF failed: no route toward 10.0.0.6[2 times] 59 Jan 5 09:57:28 CSPF: link down/deleted 10.1.36.1(R3.00/10.0.0.3)->10.1.36.2(R6.00/10.0.0.6) [...Output truncated...] </pre>
What It Means	This LSP event indicates that the traffic engineering database no longer includes this link.
Cause	The link probably failed.
Action	Investigate possible causes for the link failure. For more information on checking the physical layer, see the <i>JUNOS MPLS Network Operations Guide</i> .

CSPF: Computation Result Accepted Event

LSP Event	CSPF: computation result accepted
Sample Output	<pre>user@R1> show mpls lsp extensive [...Output truncated...] 57 Jan 5 09:54:37 Record Route: 10.1.13.2 10.1.36.2 56 Jan 5 09:54:37 Up 55 Jan 5 09:54:37 Originate Call 54 Jan 5 09:54:37 CSPF: computation result accepted [...Output truncated...]</pre>
What It Means	This LSP event indicates that CSPF pruned the traffic engineering database of noncompliant links and found a shortest path. CSPF generated an ERO, which was then passed to the RSVP.

CSPF: Computation Result Ignored Event

LSP Event	CSPF: computation result ignored
Sample Output	<pre>user@host> show mpls lsp extensive [...Output truncated...] 34 May 8 13:27:39 CSPF failed: no route toward 10.11.2.10 33 May 8 13:27:39 CSPF: link down/deleted 0.0.0.0(eagle.04/0.0.0.0)->0.0.0.0(papst.00/10.255.11.215) 32 May 8 13:27:12 CSPF: computation result ignored[16 times] 31 May 8 13:19:35 Record Route: 10.11.1.9(flag=9 Label=100064) 10.11.1.2(flag=9 Label=100048) 10.11.2.1(flag=1 Label=100048) [...Output truncated...]</pre>
What It Means	This LSP event indicates that during reoptimization, a CSPF path computation for a potential optimal path is performed. Various checks are carried out to evaluate whether the new path is better than the existing one. If the new path is not considered to be better, the CSPF computation results for the new path are ignored and the new path is not signaled.
Cause	<p>There can be various reasons for ignoring computation of a potential optimal path:</p> <ul style="list-style-type: none"> ■ The optimization is purely metric based, so switching to the new path could increase bandwidth congestion on links. ■ Switching to the new path could cause preemption. ■ The metric of the new path is higher than that of the existing path. ■ The metric is the same on the new and existing paths, but the number of hops in the new path is higher than on the existing path.

CSPF: Could Not Determine Self Event

LSP Event CSPF: could not determine self

Sample Output 1 user@host# **run show ted database extensive**
 TED database: 10 ISIS nodes
 9 INET nodes NodeID: HongKong.00(192.168.16.1)
Type: ---, Age: 148 secs, LinkIn: 1, LinkOut: 0

Sample Output 2 user@R1# **run show ted database detail**
 TED database: 6 ISIS nodes 6 INET nodes
 NodeID: R1.00(10.0.0.1)
Type: ---, Age: 654 secs, LinkIn: 3, LinkOut: 0
 NodeID: R2.00(10.0.0.2)
Type: Rtr, Age: 642 secs, LinkIn: 3, LinkOut: 4
 Protocol: IS-IS(2)

Sample Output 3 user@host> **show mpls lsp extensive**
 [...Output truncated...]
 192.168.32.1
From: 0.0.0.0, State: Dn, ActiveRoute: 0, LSPname: HK->AM
 ActivePath: (none)
 FastReroute desired
 LoadBalance: Random
 Encoding type: Packet, Switching type: Packet, GPID: IPv4
 Primary use-TOKYO State: Dn, No-decrement-ttl
 Will be enqueued for recomputation in 22 second(s).
 1 Sep 19 00:16:22 **CSPF: could not determine self**
 [...Output truncated...]

What It Means This LSP event indicates that the traffic engineering database cannot determine the address of the local router. Sample Outputs 1 and 2 show the entry in the traffic engineering database where the node entry **Type:** — does not indicate a type of router (Rtr) or pseudonode (Net) address. Since the node does not know what type it is, it cannot know its own address.

Cause This LSP event can be caused by several factors. Traffic engineering might not be configured for OSPF, the loopback (lo0) interface might not have the family ISO or an ISO address configured, or the loopback interface might not be included at the [edit interfaces] hierarchy level.

Note that in Sample Output 3, the source address of the LSP is 0.0.0.0 since the node does not know its own address. When the **From** address is 0.0.0.0, it can indicate that interfaces are not included at the [edit protocols mpls] or the [edit protocols isis] hierarchy level.

Action Take the corrective action appropriate to the situation: enable traffic engineering, configure the **family iso** statement or **address** statement, or include interfaces at the [edit interfaces], [edit protocols mpls], or [edit protocols isis] hierarchy level.

CSPF: Can't Find Non-Overlapping Path Event

LSP Event CSPF: Can't find non-overlapping path to *ip-address*

Sample Output

```
user@host> show mpls lsp extensive
[...Output truncated...]
Standby    test1          State: Dn
           Bandwidth: 80Mbps
           Will be enqueued for recomputation in 22 second(s).
           1 Apr 9 21:10:47 CSPF: Can't find non-overlapping path to 10.0.3.4[2 times]
           Created: Wed Apr 9 20:40:16 2003
           Total 1 displayed, Up 1, Down 0
[...Output truncated...]
```

What It Means This LSP event indicates that CSPF needed to compute an alternate path that did not intersect any other path.

Cause This error appears when running the adaptive feature to run shared explicit (SE)-style reservations, where no nonoverlapping paths are possible.

CSPF: Reroute Due to Re-Optimization Event

LSP Event CSPF: Reroute due to re-optimization

Sample Output

```
user@host> show mpls lsp extensive
[...Output truncated...]
9 Dec 11 17:32:35 Up
8 Dec 11 17:32:35 Clear Call
7 Dec 11 17:32:35 CSPF: computation result accepted
6 Dec 11 17:32:35 CSPF: Reroute due to re-optimization
5 Dec 11 17:28:29 CSPF: computation result ignored
4 Dec 11 17:24:23 Record Route: 10.35.38.2 S 192.168.135.29 S
10.35.39.1 S 10.35.40.2 S 10.35.41.1 S
3 Dec 11 17:24:23 Up
[...Output truncated...]
```

What It Means This LSP event indicates that CSPF found an optimal path for LSP traffic, and switched over to the new path.

Cause This is a periodic or one-time reoptimization event.

Retry Limit Exceeded Event

LSP Event Retry limit exceeded

```

Sample Output 1 user@R1> show mpls lsp extensive
[...Output truncated...]
10.0.0.6
  From: 10.0.0.1, State: Dn, ActiveRoute: 0, LSPname: R1-to-R6
  ActivePath: (none)
  LoadBalance: Random
  Encoding type: Packet, Switching type: Packet, GPID: IPv4
  Primary                               State: Dn
    RetryCount: 13
    RetryLimit: 1
    12 Jan 14 15:39:30 Clear Call
    11 Jan 14 15:39:30 Retry limit exceeded
    10 Jan 14 15:39:10 10.1.12.1: MPLS label allocation failure[11 times]
[...Output truncated...]

```

```

Sample Output 2 user@R1> show mpls lsp extensive
[...Output truncated...]
10.0.0.6
  From: 10.0.0.1, State: Dn, ActiveRoute: 0, LSPname: R1-to-R6
  ActivePath: (none)
  LoadBalance: Random
  Encoding type: Packet, Switching type: Packet, GPID: IPv4
  Primary          State: Dn
    14 Jan 14 15:44:07 10.1.12.1: MPLS label allocation failure[3 times]
    13 Jan 14 15:43:58 Originate Call
    12 Jan 14 15:39:30 Clear Call
    11 Jan 14 15:39:30 Retry limit exceeded
    10 Jan 14 15:39:10 10.1.12.1: MPLS label allocation failure[11 times]
[...Output truncated...]

```

What It Means This LSP event indicates that the number of CSPF path computations for a particular path exceeded a configured retry limit. After this point, the path is not recomputed or signaled, unless the user intervenes.

Cause The number of CSPF path computations for an LSP path exceeded the configured non-zero retry limit. Sample Output 1 shows that a configured retry limit of 1 was exceeded by the retry count of 13.

Action Enter the `clear mpls lsp` command to disconnect and restart the LSP. Sample Output 2 shows that events 13 and 14 were generated after the `clear mpls lsp` command was issued. This operation disconnects existing RSVP sessions on the ingress router, releases the routes and states associated with the LSPs, and starts a new LSP. Issuing this command might impact traffic travelling along the LSP, because of a time lag that can occur between the old path being torn down and the new path being set up.

CSPF Failed: Empty Route Event

LSP Event CSPF failed: empty route

Sample Output

```
user@R1> show mpls lsp extensive
[...Output truncated...]
From: 10.0.0.1, State: Dn, ActiveRoute: 0, LSPname: R1-to-R6
  ActivePath: (none)
  LoadBalance: Random
  Encoding type: Packet, Switching type: Packet, GPID: IPv4
  Primary                               State: Dn
    Will be enqueued for recomputation in 23 second(s).
    1 Jan 13 12:59:47 CSPF failed: empty route 10.0.0.1
  Created: Thu Jan 13 12:59:48 2005
Total 1 displayed, Up 0, Down 1
[...Output truncated...]
```

What It Means This LSP event indicates that the destination route for the LSP is incorrect.

Cause The IP address in the `to` statement at the `[edit protocols mpls label-switched-path lsp-path-name]` hierarchy level is incorrectly configured as the loopback (lo0) interface of this router itself, as indicated by the `From` address (10.0.0.1) which is identical to the empty route address (10.0.0.1).

Action Enter the correct IP address for the egress router at the `[edit protocols mpls label-switched-path lsp-path-name]` hierarchy level.

