

Chapter 4

Understanding Autobandwidth Events

Multiprotocol Label Switching (MPLS) autobandwidth automatically adjusts the bandwidth size of an MPLS traffic-engineered tunnel based on the actual traffic flowing through the tunnel. Autobandwidth success and failure is logged in the output of the `show mpls lsp extensive` command. For more information on autobandwidth, see the *JUNOS MPLS Applications Configuration Guide*.

This chapter lists and describes autobandwidth 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 specific actions that you can take to remedy the situation. (See Table 8.)

Table 8: Checklist for Understanding Autobandwidth Events

Understanding Autobandwidth Events Tasks	Possible Action or Command
Displaying Autobandwidth Events on page 50	<code>show mpls lsp extensive</code>
Manual Autobandwidth Adjustment on page 53	
1. Manual Autobandwidth Adjustment Failed Event on page 53	Take the corrective action appropriate to the situation: <ul style="list-style-type: none">■ Verify the MPLS and RSVP configurations on all available paths to the LSP endpoint.■ Check available bandwidth on alternate paths using the <code>show rsvp interface</code> command.
2. Manual Autobandwidth Adjustment Succeeded Event on page 54	Not applicable.
Automatic Autobandwidth Adjustment on page 56	
1. Automatic Autobandwidth Adjustment Failed Event on page 56	Take action appropriate to the situation: <ul style="list-style-type: none">■ Verify the MPLS and RSVP configurations on all available paths to the LSP endpoint.■ Check available bandwidth on alternate paths using the <code>show rsvp interface</code> command.
2. Automatic Autobandwidth Adjustment Succeeded Event on page 58	Not applicable.

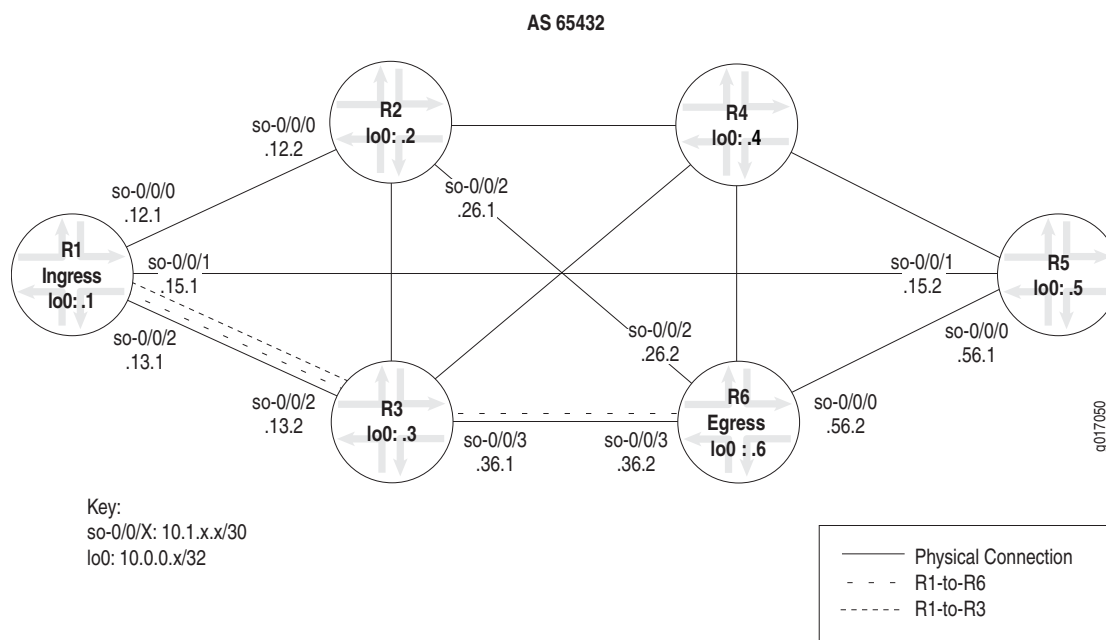
Displaying Autobandwidth Events

Purpose Automatic autobandwidth allocation allows an MPLS tunnel to automatically adjust its bandwidth allocation based on the volume of traffic flowing through the tunnel. Bandwidth allocation is adjusted according to a specified time interval when current maximum average bandwidth usage is compared with the allocated bandwidth for the LSP. If the bandwidth needs adjustment, a path with the new adjusted bandwidth is computed. The LSP's traffic is routed through the new path and the old path is removed.

Manual autobandwidth adjustment is used on the active LSP path when you do not wish to wait for the specified time interval to trigger an autobandwidth adjustment. The minimum specified time interval is 5 minutes (300 seconds) for MPLS LSP automatic bandwidth allocation adjustment. For more information on configuring autobandwidth, see the *JUNOS MPLS Applications Configuration Guide*.

Autobandwidth success and failure is logged in the output of the `show mpls lsp extensive` command. Figure 1 illustrates the example MPLS network used in this chapter to demonstrate autobandwidth LSP events.

Figure 1: MPLS Network Topology Configured with Autobandwidth



The MPLS network in Figure 1 illustrates a router-only network with SONET interfaces that consists of the following components:

- A full-mesh interior BGP (IBGP) topology, using AS 65432.
- MPLS is enabled on all routers.
- Autobandwidth is configured on ingress router R1.

- To produce the autobandwidth events, Resource Reservation Protocol (RSVP) is disabled on interfaces that could provide an alternate route for the LSP.
- A policy is configured on ingress router R1 that advertises new routes into the network.
- An LSP is established between routers R1 and R3, R1-to-R3.
- An LSP is established between router R1 and R6, R1-to-R6.

The network shown in Figure 1 is a BGP full-mesh network. Since route reflectors and confederations are not used to propagate BGP learned routes, each router must have a BGP session with every other router running BGP.

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

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

Sample Output 1

```
user@R1# run show mpls lsp extensive
Ingress LSP: 3 sessions

10.0.0.3
  From: 10.0.0.1, State: Up, ActiveRoute: 5, LSPname: R1-to-R3
  ActivePath: (primary)
  LoadBalance: Random
  Metric: 1
  Autobandwidth
  MinBW: 155Mbps MaxBW: 155Mbps
  AdjustTimer: 300 secs AdjustThreshold: 10%
  Max AvgBW util: 392bps, Bandwidth Adjustment in 101 second(s).
  Encoding type: Packet, Switching type: Packet, GPID: IPv4
  *Primary                               State: Up
    Bandwidth: 140Mbps
    Computed ERO (S [L] denotes strict [loose] hops): (CSPF metric: 10)
10.1.13.2 S
  Received RR0 (ProtectionFlag 1=Available 2=InUse 4=B/W 8=Node
10=SoftPreempt):
    10.1.13.2
13 Feb 17 21:23:51 Manual Autobw adjustment failed
12 Feb 17 21:23:51 CSPF failed: no route toward 10.0.0.3
11 Feb 17 21:16:06 Record Route: 10.1.13.2
10 Feb 17 21:16:06 Up
9 Feb 17 21:16:06 Manual Autobw adjustment succeeded
8 Feb 17 21:16:06 Originate make-before-break call
7 Feb 17 21:16:06 CSPF: computation result accepted
6 Feb 17 21:14:51 Selected as active path
5 Feb 17 21:14:51 Record Route: 10.1.13.2
4 Feb 17 21:14:51 Up
3 Feb 17 21:14:51 Originate Call
2 Feb 17 21:14:51 CSPF: computation result accepted
1 Feb 17 21:14:22 CSPF failed: no route toward 10.0.0.3[4 times]
[...Output truncated...]
```

Sample Output 2

```

user@R1> show configuration protocols mpls
statistics {
    file auto-bw.log;
    interval 5;
    auto-bandwidth;
}
label-switched-path R1-to-R6 {
    to 10.0.0.6;
    auto-bandwidth {
        adjust-interval 300;
        adjust-threshold 10;
        minimum-bandwidth 5m;
        maximum-bandwidth 80m;
    }
}
label-switched-path R1-to-R3 {
    to 10.0.0.3;
    auto-bandwidth {
        adjust-interval 300;
        adjust-threshold 10;
        minimum-bandwidth 155m;
        maximum-bandwidth 155m;
    }
}

```

What It Means Sample Output 1 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 autobandwidth 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 specific actions that you can take.

For completeness, autobandwidth events not included in this example output are also described in this chapter.

Sample Output 2 shows the configuration of autobandwidth on ingress router **R1**. LSP **R1-to-R3** is configured with 155 MB of bandwidth, and LSP **R1-to-R6** is configured with 5 MB of bandwidth. The autobandwidth failure events described in this chapter are created as follows:

- RSVP is disabled on all links except for the links used for the LSP.
- Traffic is sent along LSP **R1-to-R6**.
- The adjust interval for the LSP **R1-to-R3** expires, resulting in no valid usable paths, except for the existing path configured with 155 MB of bandwidth.

Manual Autobandwidth Adjustment

Purpose Manual autobandwidth adjustment is used on the active LSP path when you wish to trigger an autobandwidth adjustment before the next specified automatic bandwidth adjustment.



NOTE: Request for manual autobandwidth adjustment is a feature introduced in JUNOS software Release 7.0.

To manually trigger a bandwidth allocation adjustment, use the **request mpls lsp adjust-autobandwidth** command. You can trigger the command for all affected LSPs on the router, or you can specify a particular LSP. Once you execute the **request mpls lsp adjust-autobandwidth** command, the automatic bandwidth adjustment validation process is triggered. If all the criteria for adjustment are met, the LSP's active path bandwidth is adjusted to the set bandwidth value determined during the validation process.

For more information on configuring autobandwidth, see the *JUNOS MPLS Applications Configuration Guide*.

Autobandwidth success and failure is logged in the output of the **show mpls lsp extensive** command. The following manual autobandwidth adjustment events are included in this section:

- Manual Autobandwidth Adjustment Failed Event on page 53
- Manual Autobandwidth Adjustment Succeeded Event on page 54

Manual Autobandwidth Adjustment Failed Event

LSP Event Manual Autobw adjustment failed

Sample Output user@R1> **show mpls lsp extensive**
Ingress LSP: 3 sessions

```
10.0.0.3
  From: 10.0.0.1, State: Up, ActiveRoute: 5, LSPName: R1-to-R3
  ActivePath: (primary)
  LoadBalance: Random
  Metric: 1
  Autobandwidth
  MinBW: 155Mbps MaxBW: 155Mbps
  AdjustTimer: 300 secs AdjustThreshold: 10%
  Max AvgBW util: 392bps, Bandwidth Adjustment in 101 second(s).
  Encoding type: Packet, Switching type: Packet, GPID: IPv4
  *Primary                               State: Up
    Bandwidth: 140Mbps
    Computed ERO (S [L] denotes strict [loose] hops): (CSPF metric: 10)
  10.1.13.2 S
    Received RRO (ProtectionFlag 1=Available 2=InUse 4=B/W 8=Node
  10=SoftPreempt):
    10.1.13.2
    13 Feb 17 21:23:51 Manual Autobw adjustment failed
```

```

12 Feb 17 21:23:51 CSPF failed: no route toward 10.0.0.3
11 Feb 17 21:16:06 Record Route: 10.1.13.2
10 Feb 17 21:16:06 Up
[...Output truncated...]

```

What It Means This LSP event indicates that autobandwidth adjustment was triggered manually for the LSP using the `request mpls lsp adjust-autobandwidth name name` command. This adjustment failed, and the LSP continued on the existing path with its current bandwidth. Manual autobandwidth adjustment is a JUNOS Release 7.0 feature that enables you to issue the `request mpls lsp adjust-autobandwidth name name` command to manually adjust the bandwidth.

Cause This LSP event is caused by a Constrained Shortest Path First (CSPF) computation failure or a signaling failure on the new path. When you issue the `request mpls lsp adjust-autobandwidth name name` command, the current maximum average bandwidth usage is compared to the allocated bandwidth for the LSP. If the LSP needs more bandwidth, an attempt is made to set up a new path where bandwidth is equal to the current maximum average usage. If the attempt is successful, traffic on the LSP is routed through the new path and the old path is removed in a make-before-break fashion. If the attempt fails, the traffic on the LSP continues to use its current path.

Action Take the corrective action appropriate to the situation:

- Verify the MPLS and RSVP configurations on all available paths to the LSP endpoint. For more information on verifying the MPLS and RSVP configurations, see the *JUNOS MPLS Network Operations Guide*.
- Check available bandwidth on alternate paths using the `show rsvp interface` command. If not enough bandwidth is available on any available paths, adjust the minimum-bandwidth parameter for the LSP in order to establish or adjust the priority to allow the LSP to preempt another LSP of lesser priority. For an LSP to be preempted, its hold priority must be lower than the LSP you are trying to establish.

Manual Autobandwidth Adjustment Succeeded Event

LSP Event Manual Autobw adjustment succeeded

Sample Output

```

user@R1> show mpls lsp extensive
[...Output truncated...]
user@R1> request mpls lsp adjust-autobandwidth name R1-to-R6

user@R1> show mpls lsp extensive
Ingress LSP: 3 sessions

10.0.0.6
  From: 10.0.0.1, State: Up, ActiveRoute: 4, LSPname: R1-to-R6
  ActivePath: (primary)
  LoadBalance: Random
  Metric: 1
  Autobandwidth
  MinBW: 5Mbps MaxBW: 80Mbps
  AdjustTimer: 300 secs AdjustThreshold: 10%
  Max AvgBW util: 736bps, Bandwidth Adjustment in 65 second(s).
  Encoding type: Packet, Switching type: Packet, GPID: IPv4
  *Primary                               State: Up

```

```

Bandwidth: 5Mbps
Computed ERO (S [L] denotes strict [loose] hops): (CSPF metric: 20)
10.1.13.2 S 10.1.36.2 S
Received RRO (ProtectionFlag 1=Available 2=InUse 4=B/W 8=Node
10=SoftPreempt):
    10.1.13.2 10.1.36.2
11 Feb 17 21:16:22 Record Route: 10.1.13.2 10.1.36.2
10 Feb 17 21:16:22 Up
9 Feb 17 21:16:22 Manual Autobw adjustment succeeded
8 Feb 17 21:16:22 Originate make-before-break call
7 Feb 17 21:16:22 CSPF: computation result accepted
6 Feb 17 21:14:51 Selected as active path
5 Feb 17 21:14:51 Record Route: 10.1.13.2 10.1.36.2
4 Feb 17 21:14:51 Up
3 Feb 17 21:14:51 Originate Call
2 Feb 17 21:14:51 CSPF: computation result accepted
1 Feb 17 21:14:22 CSPF failed: no route toward 10.0.0.6[4 times]
[...Output truncated...]

```

What It Means This LSP event indicates that the autobandwidth adjustment is triggered manually for the LSP using the `request mpls lsp adjust-autobandwidth` command. A new path for the LSP with the adjust bandwidth is successfully computed and signaled, resulting in the LSP (and traffic) switching over to the new adjusted path

Cause When the CLI command to trigger the manual adjustment is issued, the autobandwidth adjustment validation runs. The current maximum average bandwidth usage is compared to the allocated bandwidth for the LSP. If the LSP needs more bandwidth, an attempt is made to set up a new path where bandwidth is equal to the current maximum average usage. If the attempt is successful, the LSP's traffic is routed through the new path and the old path is removed in a make-before-break fashion. If the attempt fails, the LSP continues to use its current path.

Action No action needed. Manual autobandwidth adjustment succeeded.

Automatic Autobandwidth Adjustment

Purpose Automatic autobandwidth allocation allows an MPLS tunnel to automatically adjust its bandwidth allocation based on the volume of traffic flowing through the tunnel. Bandwidth allocation is adjusted according to a specified time interval. At the end of the time interval specified at the `[edit protocols mpls label-switched-path auto-bandwidth]` hierarchy level, the current maximum average bandwidth usage is compared with the allocated bandwidth for the LSP. If the LSP needs more bandwidth, an attempt is made to set up a new path where bandwidth is equal to the current maximum average usage. If the attempt is successful, the LSP's traffic is routed through the new path and the old path is removed. If the attempt fails, the LSP continues to use its current path.

For more information on configuring autobandwidth, see the *JUNOS MPLS Applications Configuration Guide*.

Autobandwidth success and failure is logged in the output of the `show mpls lsp extensive` command. The following manual autobandwidth adjustment events are included in this section:

- Automatic Autobandwidth Adjustment Failed Event on page 56
- Automatic Autobandwidth Adjustment Succeeded Event on page 58

Automatic Autobandwidth Adjustment Failed Event

LSP Event Autobw adjustment failed

Sample Output 1

```

user@R1> show configuration protocols mpls
statistics {
    file auto-bw.log;
    interval 5;
    auto-bandwidth;
}
label-switched-path R1-to-R6 {
    to 10.0.0.6;
    auto-bandwidth {
        adjust-interval 300;
        adjust-threshold 10;
        minimum-bandwidth 5m;
        maximum-bandwidth 80m;
    }
}
label-switched-path R1-to-R3 {
    to 10.0.0.3;
    auto-bandwidth {
        adjust-interval 300;
        adjust-threshold 10;
        minimum-bandwidth 155m;
        maximum-bandwidth 155m;
    }
}

```


Sample Output user@R1> show mpls lsp extensive
 Ingress LSP: 3 sessions

```

10.0.0.3
  From: 10.0.0.1, State: Up, ActiveRoute: 5, LSPname: R1-to-R3
  ActivePath: (primary)
  LoadBalance: Random
  Metric: 1
  Autobandwidth
  MinBW: 155Mbps MaxBW: 155Mbps
  AdjustTimer: 300 secs AdjustThreshold: 10%
  Max AvgBW util: 192bps, Bandwidth Adjustment in 219 second(s).
  Encoding type: Packet, Switching type: Packet, GPID: IPv4
  *Primary State: Up
    Computed ERO (S [L] denotes strict [loose] hops): (CSPF metric: 10)
10.1.13.2 S
  Received RRO (ProtectionFlag 1=Available 2=InUse 4=B/W 8=Node
10=SoftPreempt):
    10.1.13.2
      7 Feb 17 15:41:12 Autobw adjustment failed
      6 Feb 17 15:41:12 CSPF failed: no route toward 10.0.0.3
      5 Feb 17 15:36:23 Selected as active path
      4 Feb 17 15:36:23 Record Route: 10.1.13.2
      3 Feb 17 15:36:23 Up
      2 Feb 17 15:36:23 Originate Call
      1 Feb 17 15:36:23 CSPF: computation result accepted
    Created: Thu Feb 17 15:36:23 2005
  [...Output truncated...]

```

What It Means This LSP event indicates that a periodic (timer-based) autobandwidth adjustment for the LSP is triggered at the end of the adjust interval. The adjustment fails, and the LSP stays up on the existing path with its current bandwidth.

Cause Adjustment failure may be due to a path CSPF computation failure with the adjust bandwidth or a signaling failure on the new path.

At the end of the time interval specified at the [edit protocols mpls label-switched-path auto-bandwidth] hierarchy level, the current maximum average bandwidth usage is compared to the allocated bandwidth for the LSP. If the LSP needs more bandwidth, an attempt is made to set up a new path where bandwidth is equal to the current maximum average usage. If the attempt is successful, the LSP's traffic is routed through the new path and the old path is removed. If the attempt fails, the LSP continues to use its current path.

Action Take action appropriate to the situation:

- Verify the MPLS and RSVP configuration on all available paths to the LSP endpoint.
- Check available bandwidth on alternate paths using the **show rsvp interface** command. If not enough bandwidth is available on any available paths, adjust the minimum-bandwidth parameter for the LSP in order to establish or adjust the priority to allow the LSP to preempt another LSP of lesser priority. For an LSP to be preempted, its hold priority must be lower than the LSP you are trying to establish.

Automatic Autobandwidth Adjustment Succeeded Event

LSP Event Autobw adjustment succeeded

Sample Output 1 user@R1> show configuration protocols mpls

```
statistics {
    file auto-bw.log;
    interval 5;
    auto-bandwidth;
}
label-switched-path R1-to-R6 {
    to 10.0.0.6;
    auto-bandwidth {
        adjust-interval 300;
        adjust-threshold 10;
        minimum-bandwidth 10m;
        maximum-bandwidth 80m;
    }
}
```

Sample Output 2 user@host> show mpls lsp extensive
[...Output truncated...]
Ingress LSP: 1 sessions

```
10.0.0.6
  From: 10.0.0.1, State: Up, ActiveRoute: 0, LSPname: R1-to-R6
  ActivePath: (primary)
  LoadBalance: Random
  Autobandwidth
  MinBW: 10Mbps MaxBW: 80Mbps
  AdjustTimer: 300 secs AdjustThreshold: 10%
  Max AvgBW util: 0bps, Bandwidth Adjustment in 282 second(s).
  Encoding type: Packet, Switching type: Packet, GPID: IPv4
  *Primary                               State: Up
    Bandwidth: 10Mbps
    Computed ERO (S [L] denotes strict [loose] hops): (CSPF metric: 20)
  10.1.13.2 S 10.1.36.2 S
    Received RRO (ProtectionFlag 1=Available 2=InUse 4=B/W 8=Node
  10=SoftPreempt):
      10.1.13.2 10.1.36.2
      9 Feb 17 14:41:12 Record Route: 10.1.13.2 10.1.36.2
      8 Feb 17 14:41:12 Up
      7 Feb 17 14:41:12 Autobw adjustment succeeded
      6 Feb 17 14:41:12 CSPF: computation result accepted
      5 Feb 17 14:36:29 Selected as active path
      4 Feb 17 14:36:29 Record Route: 10.1.13.2 10.1.36.2
      3 Feb 17 14:36:29 Up
      2 Feb 17 14:36:29 Originate Call
      1 Feb 17 14:36:29 CSPF: computation result accepted
    Created: Thu Feb 17 14:36:29 2005
  Total 1 displayed, Up 1, Down 0
  [...Output truncated...]
```

What It Means This LSP event indicates that a periodic (timer-based) autobandwidth adjustment for the LSP is triggered at the end of the adjust interval. A new path for the LSP, with the adjusted bandwidth, is successfully computed and signaled. The LSP (and traffic) switches over to the new adjusted path.

- Cause** At the end of the time interval specified at the [edit protocols mpls label-switched-path auto-bandwidth] hierarchy level, the current maximum average bandwidth usage is compared to the allocated bandwidth for the LSP. If the LSP needs more bandwidth, an attempt is made to set up a new path where bandwidth is equal to the current maximum average usage. If the attempt is successful, the LSP's traffic is routed through the new path and the old path is removed. If the attempt fails, the LSP continues to use its current path.
- Action** No action required. Automatic autobandwidth adjustment succeeded.

