



Cisco IOS Broadband High Availability Stateful Switchover

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The Cisco IOS Broadband High Availability Stateful Switchover feature provides the capability for dual Route Processor systems to support stateful switchover of Point-to-Point Protocol over X (PPPoX, where X designates a family of encapsulating communications protocols such as PPPoE, PPPoA, PPPoEoA, PPPoEoVLAN implementing PPP) sessions. Hence allows applications and features to maintain stateful state while system control and routing protocol execution is transferred between an active and a standby processor.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the [“Feature Information for Cisco IOS Broadband High Availability Stateful Switchover” section on page 20](#).

Use Cisco Feature Navigator to find information about platform support and Cisco IOS and Catalyst OS software image support. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

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Americas Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

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Prerequisites for Cisco IOS Broadband High Availability Stateful Switchover

- The Cisco IOS stateful switchover (SSO) and nonstop forwarding features (NSF) must be enabled. For more information on SSO, see the document [Stateful Switchover](#). For more information on NSF, see the document [Cisco Nonstop Forwarding](#).

Cisco 10000 Series Router

- The Cisco 10000 series router must be configured with redundant Performance Routing Engine (PRE) modules, that is, dual Route Processors.

Restrictions for Cisco IOS Broadband High Availability Stateful Switchover

The SSO is supported only on Cisco IOS High Availability (HA) network devices.

Information About Cisco IOS Broadband High Availability Stateful Switchover

To configure the Cisco IOS Broadband High Availability Stateful Switchover feature, you should understand the following concepts:

- [Feature Design of Cisco IOS Broadband High Availability Stateful Switchover, page 2](#)
- [Benefits of Cisco IOS Broadband High Availability Stateful Switchover, page 4](#)

Feature Design of Cisco IOS Broadband High Availability Stateful Switchover

Prior to the implementation of the Cisco IOS Broadband High Availability Stateful Switchover feature, unplanned control plane and dataplane failures resulted in service outages and network downtime for PPPoX sessions. Cisco High Availability features, including SSO, enable network protection by providing fast recovery from such failures. The Cisco IOS Broadband High Availability Stateful Switchover feature eliminates a source of outages by providing for stateful switchover to a standby processor while continuing to forward traffic. SSO protects from hardware or software faults on an active Route Processor by synchronizing protocol and state information for supported features with a standby Route Processor, helping to ensure no interruption of sessions or connections if a switchover occurs.

The SSO feature takes advantage of route-processor redundancy by establishing one of the Route Processors as the active processor, designating the other Route Processor as the standby processor, and then synchronizing critical state information between them. Following an initial (bulk) synchronization between the two processors, SSO dynamically maintains Route Processor state information between them. A switchover from the active to the standby processor occurs when the active Route Processor

fails, when it is removed from the networking device, or when it is manually taken down for maintenance. The standby Route Processor then takes control and becomes the active Route Processor, preserving the sessions and connections for the supported features. At this time, packet forwarding continues while route convergence is completed on the newly active Route Processor. A critical component of SSO and Cisco HA technology is the cluster control manager (CCM) that manages session recreation on the standby processor. The Cisco IOS Broadband High Availability Stateful Switchover feature allows you to configure subscriber redundancy policies that tune the synchronization process. For more information see the [“Configuring Subscriber Redundancy Policy for Broadband HA Stateful Switchover”](#) section on page 5.

The Cisco IOS Broadband High Availability Stateful Switchover feature works with the Cisco IOS NSF and SSO HA features, to maintain PPPoX sessions. NSF continues forwarding network traffic and application state information so that user session information is maintained after a switchover.

Supported Broadband Aggregation Protocols

The Cisco IOS Broadband High Availability Stateful Switchover feature set supports the broadband aggregation protocols described in the following sections:

- [SSO PPPoA, page 3](#)
- [SSO PPPoE, page 3](#)
- [SSO RA-MLPS VPN, page 3](#)

SSO PPPoA

The Cisco IOS Broadband High Availability Stateful Switchover feature delivers stateful switchover capability for PPP over ATM (PPPoA) sessions during Route Processor switchover.

SSO PPPoE

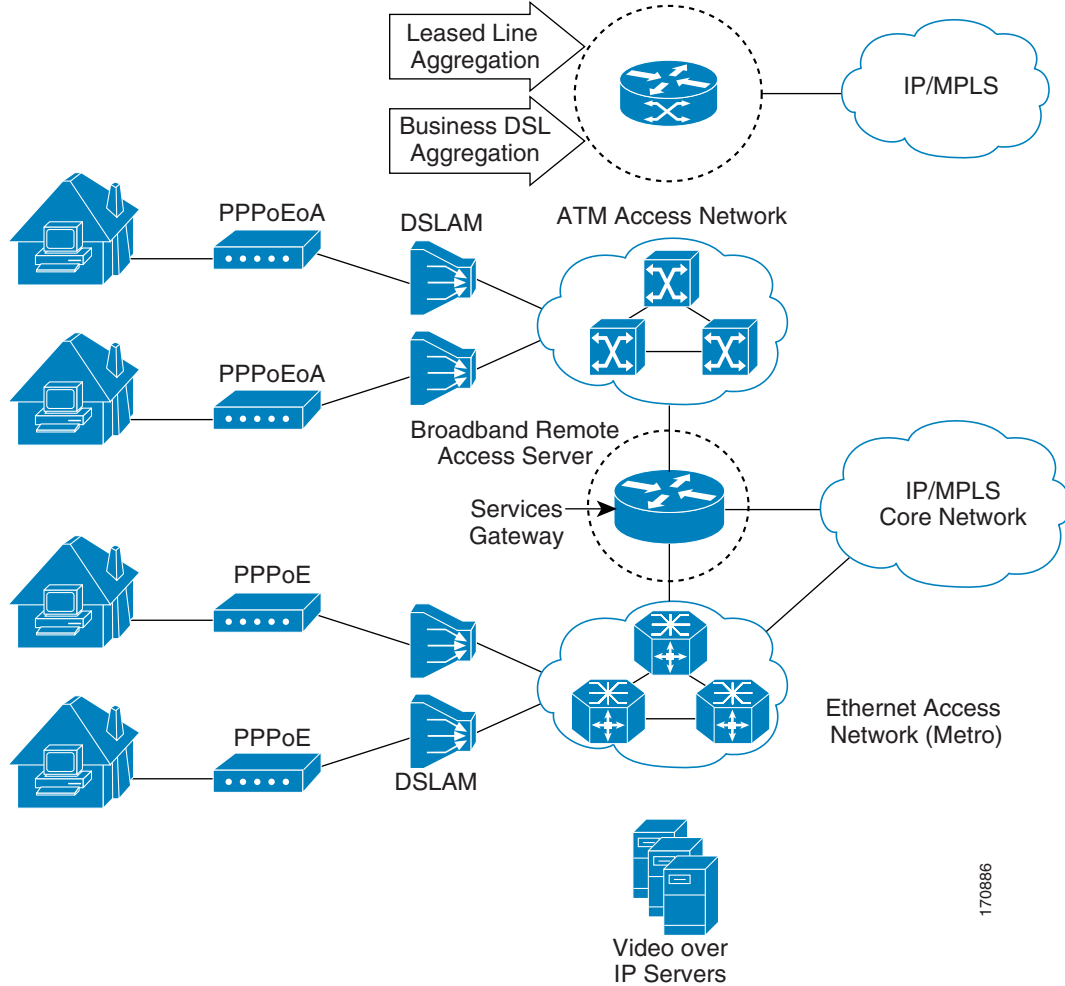
The Cisco IOS Broadband High Availability Stateful Switchover feature delivers stateful switchover capability for PPP over Ethernet (PPPoE) subscriber access sessions, including PPPoE, PPPoEoVLAN, and PPPoE802.1q-in-q sessions.

SSO RA-MLPS VPN

The Cisco IOS Broadband High Availability Stateful Switchover feature delivers stateful switchover capability for PPPoX terminated into remote access (RA)-MPLS VPN or PPPoX into MPLS VPN sessions during processor switchover.

[Figure 1](#) shows a typical broadband aggregation HA deployment with SSO functionality.

Figure 1 *Broadband Aggregation High Availability Deployment*



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Benefits of Cisco IOS Broadband High Availability Stateful Switchover

- Reduces operating costs associated with outages.
- Delivers higher service levels to subscribers.
- Improves network availability.
- Promotes continuous connectivity, lower packet loss, and consistent path flow through nodes providing specific network services.
- Mitigates service disruptions, reduces downtime costs, and increases operational efficiency.

How to Configure Cisco IOS Broadband High Availability Stateful Switchover

This section contains the following procedures:

- [Configuring Subscriber Redundancy Policy for Broadband HA Stateful Switchover, page 5](#) (required)
- [Verifying and Troubleshooting Subscriber Redundancy Policy for Broadband HA Stateful Switchover, page 6](#) (optional)

Configuring Subscriber Redundancy Policy for Broadband HA Stateful Switchover

This task configures subscriber redundancy policy for HA SSO capability for broadband subscriber sessions.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **subscriber redundancy [bulk limit cpu percentage delay seconds allow value] [dynamic limit cpu percentage delay seconds allow value] [delay time] [rate sessions time]**
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.

Command or Action	Purpose
<p>Step 3</p> <pre>subscriber redundancy [bulk limit cpu percentage delay seconds allow value] [dynamic limit cpu percentage delay seconds allow value] [<i>delay time</i>] [<i>rate sessions time</i>]</pre> <p>Example: Router(config)# subscriber redundancy bulk limit cpu 75 delay 20 allow 30</p>	<p>(Optional) Configures subscriber redundancy policy:</p> <ul style="list-style-type: none"> • bulk—Configures bulk synchronization redundancy policy. • limit <i>cpu percentage</i>—Specifies CPU busy threshold value as a percentage. Range is 0 to 100; default is 90. • delay <i>seconds</i>—Specifies delay in seconds before the CCM component synchronizes sessions after the CPU busy threshold is exceeded. • allow <i>value</i>—Specifies the minimum number of sessions to synchronize once the CPU busy threshold is exceeded and the specified delay is met. Range is 1 to 2 147 483 637; default is 25. • dynamic—Configures a dynamic synchronization redundancy policy. • delay <i>time</i>—Specifies a minimum amount of time in seconds that a session must be ready before dynamic synchronization occurs. Range is 1 to 33 550. • rate <i>sessions time</i>—Specifies number of sessions per time period for bulk and dynamic synchronization. <ul style="list-style-type: none"> – <i>sessions</i>—Range 1 to 32 000; default is 250. – <i>time</i>—Range in seconds is 1 to 33550; default is 1.
<p>Step 4</p> <pre>exit</pre> <p>Example: Router(config)# exit</p>	<p>Exits the current configuration mode.</p>

Verifying and Troubleshooting Subscriber Redundancy Policy for Broadband HA Stateful Switchover

To view the configuration, use the **show running-config** command. Sample output is located in the [“Configuration Examples for Cisco IOS Broadband High Availability Stateful Switchover”](#) section on page 13.

Step 1 and Step 2 are useful for troubleshooting the CCM synchronization component. Steps 3, 4, and 5 are useful for reviewing PPPoX session statistics. Step 6 through Step 8 are typically used by Cisco engineers for internal debugging purposes; you may be asked to provide command output to a Cisco Technical Assistance Center (TAC) engineer for assistance in troubleshooting.

SUMMARY STEPS

1. **show ccm clients**
2. **show ccm sessions**
3. **show ppp subscriber statistics**
4. **show pppatm statistics**

5. **show pppoe statistics**
6. **show ccm queues**
7. **show redundancy**
8. **show pppatm redundancy**
9. **debug pppatm redundancy**
10. **debug pppoe redundancy**

DETAILED STEPS

Step 1 **show ccm clients**

This command shows information on the CCM, the HA component that manages the capability to synchronize session launch on the standby processor of a redundant processor HA system. Use the **show ccm clients** command to display information on CCM clients. The following is sample output from the **show ccm clients** command from a Cisco 10000 Series router active processor:

```
Router# show ccm clients

CCM bundles sent since peer up:
  Sync Session           0
  Update Session         0
  Active Bulk Sync       0
  Session Down           0
  ISSU client msgs      0
  Unknown msgs           0
Client events sent since peer up:
  PPP                    0
  PPPoE                  0
  PPPoA                  0
  AAA                    0
  PPP SIP                 0
  LTERM                  0
  AC                      0
  Virtual Template       0
```

The following is sample output from the **show ccm clients** command from a Cisco 10000 series router standby processor:

```
Router# show ccm clients

CCM bundles rcvd since last boot:
  Sync Session           8
  Update Session         0
  Active Bulk Sync       1
  Session Down           8
  ISSU client msgs      59
  Unknown msgs           0
Client events extracted since last boot:
  PPP                    72
  PPPoE                  50
  PPPoA                  0
  AAA                    32
  PPP SIP                 0
  LTERM                  8
  AC                      0
```

The following is sample output from the `show ccm clients` command from a Cisco 7600 series router active processor:

```
Router# show ccm clients

CCM bundles sent since peer up:
  Sync Session          28059
  Update Session        0
  Active Bulk Sync End  1
  Session Down          8057
  ISSU client msgs     160
  Dynamic Session Sync  0
  Unknown msgs          0
Client events sent since peer up:
  PPP                   252351
  PPPoE                 168236
  AAA                   112236
  PPP SIP               0
  LTERM                 28059
  AC                    0
  SSS FM                28040
  IP SIP                60
  IP IF                 0
  DPM                   80
  COA                   0
  Auto SVC              0
```

The following is sample output from the `show ccm clients` command on a Cisco 7600 series router standby processor:

```
CCM bundles rcvd since last boot:
  Sync Session          28059
  Update Session        0
  Active Bulk Sync End  1
  Session Down          8057
  ISSU client msgs     160
  Dynamic Session Sync  0
  Unknown msgs          0
Client events extracted since last boot:
  PPP                   252351
  PPPoE                 168236
  AAA                   112174
  PPP SIP               0
  LTERM                 28045
  AC                    0
  SSS FM                28040
  IP SIP                18
  IP IF                 0
  DPM                   24
  COA                   0
  Auto Svc              0
```

Step 2 show ccm sessions

This command shows information on sessions managed by CCM. The following is sample output from the `show ccm sessions` command on the active processor:

```
Router# show ccm sessions

Global CCM state:                               CCM HA Active - Dynamic Sync
Global ISSU state:                             Compatible, Clients Cap 0x0
> Number of sessions in state Down:            0
> Number of sessions in state Not Ready:       0
```

```

> Number of sessions in state Ready:          0
> Number of sessions in state Dyn Sync:       0
>
> Timeout: Timer Type   Delay   Remaining Starts   CPU Limit CPU Last
> -----
>      Rate             00:00:01 -      2           -       -
>      Dynamic CPU     00:00:10 -      0           90       0

```

The following is sample output from the **show ccm sessions** command on the standby processor:

```
Router# show ccm sessions
```

```

Global CCM state:          CCM HA Standby - Collecting
Global ISSU state:        Compatible, Clients Cap 0xFFE

Current      Bulk Sent   Bulk Rcvd
-----
Number of sessions in state Down:          0           0           0
Number of sessions in state Not Ready:     0           0           0
Number of sessions in state Ready:         0           0           0
Number of sessions in state Dyn Sync:      0           0           0

Timeout: Timer Type   Delay   Remaining Starts   CPU Limit CPU Last
-----
      Rate             00:00:01 -      0           -       -
      Dynamic CPU     00:00:10 -      0           90       0
      Bulk Time Li   00:08:00 -      0           -       -
      RF Notif Ext  00:00:20 -      0           -       -

```

Step 3 show ppp subscriber statistics

This command is useful for displaying events and statistics for PPP subscribers. Use the **show ppp subscriber statistics** command to display a cumulative count of PPP subscriber events and statistics, and to display an incremental count since the **clear ppp subscriber statistics** command was last issued.

The following is sample output from the **show ppp subscriber statistics** command:

```
Router# show ppp subscriber statistics
```

```

PPP Subscriber Events      TOTAL      SINCE CLEARED
Encap                      32011     32011
DeEncap                    16002     16002
CstateUp                   173       173
CstateDown                 36        36
FastStart                  0         0
LocalTerm                  7         7
LocalTermVP                0         0
MoreKeys                   173       173
Forwarding                 0         0
Forwarded                  0         0
SSSDisc                    0         0
SSMDisc                    0         0
PPPDisc                    167       167
PPPBindResp                173       173
PPPREneg                   3         3
RestartTimeout             169       169
>
PPP Subscriber Statistics  TOTAL      SINCE CLEARED
IDB CSTATE UP              16008     16008
IDB CSTATE DOWN           40        40
APS UP                     0         0
APS UP IGNORE              0         0
APS DOWN                   0         0
READY FOR SYNC             10        10

```

Step 4 show pppatm statistics

This command is useful for obtaining statistics for PPPoA sessions. Use the **show pppatm statistics** command to display a total count of PPPoA events since the **clear pppatm statistics** command was last issued.

The following example displays PPPoA statistics:

```
Router# show pppatm statistics

4000 : Context Allocated events
3999 : SSS Request events
7998 : SSS Msg events
3999 : PPP Msg events
3998 : Up Pending events
3998 : Up Dequeued events
3998 : Processing Up events
3999 : Vaccess Up events
3999 : AAA unique id allocated events
3999 : No AAA method list set events
3999 : AAA gets nas port details events
3999 : AAA gets retrived attrs events
68202 : AAA gets dynamic attrs events
3999 : Access IE allocated events
```

Step 5 show pppoe statistics

This command is useful for obtaining statistics and events for PPPoE sessions. Use the **show pppoe statistics** command to display a cumulative count of PPPoE events and statistics, and to display an incremental count since the last time the **clear pppoe statistics** command was issued.

The following is sample output from the **show pppoe statistics** command:

```
Router# show pppoe statistics

PPPoE Events                TOTAL          SINCE CLEARED
-----
INVALID                      0              0
PRE-SERVICE FOUND           0              0
PRE-SERVICE NONE            0              0
SSS CONNECT LOCAL           16002          16002
SSS FORWARDING              0              0
SSS FORWARDED               0              0
SSS MORE KEYS               16002          16002
SSS DISCONNECT              0              0
CONFIG UPDATE               0              0
STATIC BIND RESPONSE        16002          16002
PPP FORWARDING              0              0
PPP FORWARDED               0              0
PPP DISCONNECT              0              0
PPP RENEGOTIATION           0              0
SSM PROVISIONED             16002          16002
SSM UPDATED                 16002          16002
SSM DISCONNECT              0              0
>
PPPoE Statistics            TOTAL          SINCE CLEARED
-----
SSS Request                  16002          16002
SSS Response Stale          0              0
SSS Disconnect              0              0
PPPoE Handles Allocated    16002          16002
PPPoE Handles Freed        0              0
Dynamic Bind Request        16002          16002
Static Bind Request         16002          16002
```

Step 6 show ccm queues

Use the **show ccm queues** command to display queue statistics for CCM sessions on active and standby processors. This command is generally used only by Cisco engineers for internal debugging of CCM processes.

The following is sample output from the **show ccm queues** command:

```
Router# show ccm queues

9 Event Queues
      size  max    kicks    starts  false  suspends  ticks(ms)
4 CCM      0    2      13      13     0       0         20

Event Names
      Events  Queued  MaxQueued  Suspends  usec/evt  max/evt
1  4 Sync Session      0      0      0      0      0      0
2  4 Sync Client      0      0      0      0      0      0
3  4 Update            0      0      0      0      0      0
4  4 Session Down     0      0      0      0      0      0
5  4 Bulk Sync Begi   0      0      0      0      0      0
6  4 Bulk Sync Cont   0      0      0      0      0      0
7  4 Bulk Sync End    1      0      1      0      53     53
8  4 Going Active     0      0      0      0      0      0
9  4 Going Standby    1      0      1      0     10     10
10 4 Standby Presen   0      0      0      0      0      0
11 4 Standby Gone     0      0      0      0      0      0
13 4 CP Message      18      0      2      0     156    573
14 4 Recr Session     0      0      0      0      0      0
15 4 Recr Update      0      0      0      0      0      0
16 4 Recr Sess Down   0      0      0      0      0      0
17 4 ISSU Session N   1      0      1      0     283    283
18 4 ISSU Peer Comm   0      0      0      0      0      0
```

Step 7 show redundancy

Use the **show redundancy** command to display current or historical status and related information on planned or logged handovers. The following is sample output from the **show redundancy clients** command from a Cisco 10000 Series router active processor:

```
Router# show redundancy clients

Active Location = slot A
  Current Software state = ACTIVE
  Uptime in current state = 2 hours, 4 minutes
  Image Version = Cisco IOS Software, 10000 Software (C10K3-P11-M),
Experimental Version 12.2(20090624:122305) [sinb-CSCTa34118-v122_33_SB5 102]
Copyright (c) 1986-2009 by Cisco Systems, Inc.
Compiled Thu 25-Jun-09 14:24 by sinb
  BOOT =
disk0:c10k3-p11-mz.fix,12;disk0:c10k3-p11-mz.mcp_dev_CSCsj73294,12;disk0:c10k3-p11-mz.122-
33.SB5,12;ftp:c10k3-p11-mz.122-33.SB2 10.48.160.30,12;
  CONFIG_FILE =
  BOOTLDR = bootflash:c10k3-eboot-mz.122-33.SB5
  Configuration register = 0x2102
```

Step 8 show pppatm redundancy

Use the **show pppatm redundancy** command to display PPPoA HA sessions summary:

```
Router# show pppatm redundancy

0 : Session recreate requests from CCM
0 : Session up events invoked
```

```

    the number of incoming call attempts seen by pppoa
0 : Sessions reaching PTA
    the number of sessions that reached a complete negotiation and were
successfully terminated
0 : Sessions closed by CCM
0 : Session down events invoked
    the number of sessions that were brought down
0 : Sessions queued for VC up notification so far
    the number of sessions that were pending completion
0 : Sessions queued for VC encap change notification so far
    the number of sessions in a message queue that required a virtual-circuit
encapsulation change
0 : VC activation notifications received from ATM
    the number of create on demand VC up notifications caused by the reception of
a FSOL for PPPoA
0 : VC encap change notifications received from ATM
    the number of sessions that required an encap (aal5xxx) change

```

Step 9 debug pppatm redundancy

Use the **debug pppatm redundancy** command to display CCM events and messages for PPPoA sessions on HA systems. This command is generally used only by Cisco engineers for internal debugging of CCM processes. The following is sample output from the **debug pppatm redundancy** command from a Cisco 10000 Series router standby processor:

```

Router# debug pppatm redundancy

*Dec 3 02:58:40.784: PPPATM HA: [14000001]: Received the first SHDB
*Dec 3 02:58:40.784: PPPATM HA: [14000001]: Base hwidb not created yet, queuing SHDB
*Dec 3 02:58:40.784: PPPATM HA: [14000001]:
Requesting base vaccess creation
>

```

Step 10 debug pppoe redundancy

Use the **debug pppoe redundancy** command to display CCM events and messages for PPPoE sessions on HA systems. This command is generally used only by Cisco engineers for internal debugging of CCM processes. The following is sample output for the **debug pppoe redundancy** command from a Cisco 10000 series router active processor:

```

Router# debug pppoe redundancy

Nov 22 17:21:11.327: PPPoE HA[0xBE000008] 9: Session ready to sync data
Nov 22 17:21:11.351: PPPoE HA[0xBE000008] 9: code = PADR, length = 58
Nov 22 17:21:11.351: PPPoE HA[0xBE000008] 9: code = SESSION ID, length = 2
Nov 22 17:21:11.351: PPPoE HA[0xBE000008] 9: code = SWITCH HDL, length = 4
Nov 22 17:21:11.351: PPPoE HA[0xBE000008] 9: code = SEGMENT HDL, length = 4
Nov 22 17:21:11.351: PPPoE HA[0xBE000008] 9: code = PHY SWIDB DESC, length = 20
Nov 22 17:21:11.351: PPPoE HA[0xBE000008] 9: code = VACCESS DESC, length = 28
Nov 22 17:21:11.351: PPPoE HA[0xBE000008] 9: Sync collection for ready events
Nov 22 17:21:11.351: PPPoE HA[0xBE000008] 9: code = PADR, length = 58
Nov 22 17:21:11.351: PPPoE HA[0xBE000008] 9: code = SESSION ID, length = 2
Nov 22 17:21:11.351: PPPoE HA[0xBE000008] 9: code = SWITCH HDL, length = 4
Nov 22 17:21:11.351: PPPoE HA[0xBE000008] 9: code = SEGMENT HDL, length = 4
Nov 22 17:21:11.351: PPPoE HA[0xBE000008] 9: code = PHY SWIDB DESC, length = 20
Nov 22 17:21:11.351: PPPoE HA[0xBE000008] 9: code = VACCESS DESC, length = 28

```

The following is sample output from the **debug pppoe redundancy** command from a Cisco 10000 series router standby processor:

```

Router# debug pppoe redundancy

Nov 22 17:21:11.448: PPPoE HA[0x82000008]: Recreating session: retrieving data
Nov 22 17:21:11.464: PPPoE HA[0x82000008] 9: Session ready to sync data

```

The following is a sample output from the **debug pppoe redundancy** command from a Cisco 7600 series router active processor:

```
Router# debug pppoe redundancy
```

```
Dec 17 15:14:37.060: PPPoE HA[0x131B01B1] 28039: Session ready to sync data
Dec 17 15:14:37.076: PPPoE HA[0x131B01B1] 28039: code = PADR, length = 48
Dec 17 15:14:37.076: PPPoE HA[0x131B01B1] 28039: code = SESSION ID, length = 2
Dec 17 15:14:37.076: PPPoE HA[0x131B01B1] 28039: code = SWITCH HDL, length = 4
Dec 17 15:14:37.076: PPPoE HA[0x131B01B1] 28039: code = SEGMENT HDL, length = 4
Dec 17 15:14:37.076: PPPoE HA[0x131B01B1] 28039: code = PHY SWIDB DESC, length = 20
Dec 17 15:14:37.076: PPPoE HA[0x131B01B1] 28039: code = VACCESS DESC, length = 28
Dec 17 15:14:37.076: PPPoE HA[0x131B01B1] 28039: Sync collection for ready events
Dec 17 15:14:37.076: PPPoE HA[0x131B01B1] 28039: code = PADR, length = 48
Dec 17 15:14:37.076: PPPoE HA[0x131B01B1] 28039: code = SESSION ID, length = 2
Dec 17 15:14:37.076: PPPoE HA[0x131B01B1] 28039: code = SWITCH HDL, length = 4
Dec 17 15:14:37.076: PPPoE HA[0x131B01B1] 28039: code = SEGMENT HDL, length = 4
Dec 17 15:14:37.076: PPPoE HA[0x131B01B1] 28039: code = PHY SWIDB DESC, length = 20
Dec 17 15:14:37.076: PPPoE HA[0x131B01B1] 28039: code = VACCESS DESC, length = 28
```

The following is sample output from the **debug pppoe redundancy** command from a Cisco 7600 series router standby processor:

```
Router# debug pppoe redundancy
```

```
Dec 17 15:14:37.180: STDBY: PPPoE HA[0xE41B019B]: Recreating session: retrieving data
Dec 17 15:14:37.204: STDBY: PPPoE HA[0xE41B019B] 28039: Session ready to sync data
```

Configuration Examples for Cisco IOS Broadband High Availability Stateful Switchover

This section provides the following configuration example:

- [PPPoX Terminated into an RA-MPLS Network with SSO: Example, page 13](#)

PPPoX Terminated into an RA-MPLS Network with SSO: Example

The following example shows how to configure the Cisco IOS Broadband High Availability Stateful Switchover feature in an RA-MPLS network:

```
Router# show running-config
```

```
hostname Router
!
boot-start-marker
boot system bootflash:c10k2-p11-mz.sur3_1003 boot-end-marker !
enable password cisco
!
aaa new-model
!
!
aaa authentication ppp default local
!
!
!
aaa session-id common
```

```

ppp hold-queue 80000
facility-alarm intake-temperature major 54 facility-alarm intake-temperature minor 45
facility-alarm intake-temperature critical 72 facility-alarm core-temperature major 58
facility-alarm core-temperature minor 50 facility-alarm core-temperature critical 85 !
!
card 1/0 4oc3atm-1
card 2/0 4oc3atm-1
card 3/0 4oc3atm-1
card 4/0 4oc3atm-1
card 5/0 8fastethernet-1
card 6/0 4oc3atm-1
card 7/0 4oc3atm-1
card 8/0 1gigethernet-hh-1
card 8/1 1gigethernet-hh-1
ip subnet-zero
no ip gratuitous-arps
no ip domain lookup
ip vrf vrf1
    rd 1:1
    route-target export 1:1
    route-target import 1:1
!
no ip dhcp use vrf connected
!
!
!
!
no subscriber policy recording rules

```

The following lines show the subscriber redundancy policy configuration:

```

subscriber redundancy dynamic limit cpu 90 delay 10 subscriber redundancy bulk limit cpu
90 delay 10 subscriber redundancy rate 4000 1 subscriber redundancy delay 10 no mpls
traffic-eng auto-bw timers frequency 0 mpls ldp graceful-restart mpls ldp router-id
Loopback100 no virtual-template snmp no issu config-sync policy bulk prc no issu
config-sync policy bulk bem !
redundancy
    mode sso
username cisco password 0 cisco
!
buffers small permanent 15000
buffers middle permanent 12000
buffers large permanent 1000
bba-group pppoe grp1
    virtual-template 1
!
bba-group pppoe grp2
    virtual-template 2
!
bba-group pppoe grp3
    virtual-template 3
!
bba-group pppoe grp4
    virtual-template 4
!
bba-group pppoe grp5
    virtual-template 5
!
bba-group pppoe grp7
    virtual-template 7
!
bba-group pppoe grp8
    virtual-template 8
!

```

```
bba-group pppoe grp6
  virtual-template 6
!
!
interface Loopback0
  ip vrf forwarding vrf1
  ip address 209.165.200.225 255.255.255.224
!
interface Loopback100
  ip address 209.165.200.226 255.255.255.224
!
interface FastEthernet0/0/0
  ip address 209.165.200.227 255.255.255.224
  speed 100
  full-duplex
!
interface ATM1/0/0
  no ip address
  load-interval 30
!
interface ATM1/0/0.1 multipoint
  range pvc 1/32 1/4031
  encapsulation aal5snap
  protocol pppoe group grp1
!
!
interface ATM1/0/0.2 multipoint
  range pvc 2/32 2/4031
  encapsulation aal5snap
  protocol pppoe group grp2
!
!
interface ATM1/0/1
  no ip address
!
interface ATM1/0/1.1 multipoint
  range pvc 3/32 3/4031
  encapsulation aal5snap
  protocol pppoe group grp3
!
!
interface ATM1/0/1.2 multipoint
  range pvc 4/32 4/4031
  encapsulation aal5snap
  protocol pppoe group grp4
!
!
interface ATM1/0/2
  no ip address
!
interface ATM1/0/2.1 multipoint
  range pvc 5/32 5/4031
  encapsulation aal5snap
  protocol pppoe group grp5
!
!
interface ATM1/0/2.2 multipoint
  range pvc 6/32 6/4031
  encapsulation aal5snap
  protocol pppoe group grp6
!
!
interface ATM1/0/3
  no ip address
```

```

!
interface ATM1/0/3.1 multipoint
  range pvc 7/32 7/4031
  encapsulation aal5snap
  protocol pppoe group grp7
!
!
interface ATM1/0/3.2 multipoint
  range pvc 8/32 8/4031
  encapsulation aal5snap
  protocol pppoe group grp8
!
!
!
interface ATM7/0/3
  no ip address
!
interface GigabitEthernet8/0/0
  mac-address 0011.0022.0033
  ip vrf forwarding vrf1
  ip address 209.165.200.228 255.255.255.224
  negotiation auto
!
interface GigabitEthernet8/1/0
  ip address 209.165.200.229 255.255.255.224
  negotiation auto
  mpls ip
!
interface Virtual-Template1
  ip vrf forwarding vrf1
  ip unnumbered Loopback0
  no logging event link-status
  peer default ip address pool pool1
  no snmp trap link-status
  keepalive 30
  ppp authentication pap
!
interface Virtual-Template2
  ip vrf forwarding vrf1
  ip unnumbered Loopback0
  no logging event link-status
  peer default ip address pool pool2
  no snmp trap link-status
  keepalive 30
  ppp authentication pap
!
interface Virtual-Template3
  ip vrf forwarding vrf1
  ip unnumbered Loopback0
  no logging event link-status
  peer default ip address pool pool3
  no snmp trap link-status
  keepalive 30
  ppp authentication pap
!
interface Virtual-Template4
  ip vrf forwarding vrf1
  ip unnumbered Loopback0
  no logging event link-status
  peer default ip address pool pool4
  no snmp trap link-status
  keepalive 30
  ppp authentication pap

```

```
!  
interface Virtual-Template5  
  ip vrf forwarding vrf1  
  ip unnumbered Loopback0  
  no logging event link-status  
  peer default ip address pool pool5  
  no snmp trap link-status  
  keepalive 30  
  ppp authentication pap  
!  
interface Virtual-Template6  
  ip vrf forwarding vrf1  
  ip unnumbered Loopback0  
  no logging event link-status  
  peer default ip address pool pool6  
  no snmp trap link-status  
  keepalive 30  
  ppp authentication pap  
!  
interface Virtual-Template7  
  ip vrf forwarding vrf1  
  ip unnumbered Loopback0  
  no logging event link-status  
  peer default ip address pool pool7  
  no snmp trap link-status  
  keepalive 30  
  ppp authentication pap  
!  
interface Virtual-Template8  
  ip vrf forwarding vrf1  
  ip unnumbered Loopback0  
  no logging event link-status  
  peer default ip address pool pool8  
  no snmp trap link-status  
  keepalive 30  
  ppp authentication pap  
!  
router ospf 1  
  log-adjacency-changes  
  nsf  
  network 10.1.1.0 0.0.0.255 area 0  
  network 224.0.0.0 0.0.0.255 area 0  
!  
router bgp 1  
  no synchronization  
  bgp log-neighbor-changes  
  bgp graceful-restart restart-time 120  
  bgp graceful-restart stalepath-time 360  
  bgp graceful-restart  
  neighbor 224.0.0.3 remote-as 1  
  neighbor 224.0.0.3 update-source Loopback100  
  no auto-summary  
  !  
  address-family vpnv4  
  neighbor 224.0.0.3 activate  
  neighbor 224.0.0.3 send-community extended  
  exit-address-family  
  !  
  address-family ipv4 vrf vrf1  
  redistribute connected  
  redistribute static  
  no auto-summary  
  no synchronization  
  exit-address-family
```

```

!
ip local pool pool2 192.0.2.0 192.0.2.255 ip local pool pool3 192.0.2.0 192.0.2.255 ip
local pool pool4 192.0.2.0 192.0.2.255 ip local pool pool5 192.0.2.0 192.0.2.255 ip local
pool pool6 192.0.2.0 192.0.2.255 ip local pool pool7 192.0.2.0 192.0.2.255 ip local pool
pool8 192.0.2.0 192.0.2.255 ip classless !
!
no ip http server
!
!
arp 192.0.2.0 0020.0001.0001 ARPA
arp vrf vrf1 192.0.2.0 0020.0001.0001 ARPA !
!
!
control-plane
!
!
line con 0
line aux 0
line vty 0 4
    password cisco
!
exception crashinfo file bootflash:crash.log !
end

```

Additional References

The following sections provide references related to the Cisco IOS Broadband High Availability Stateful Switchover feature.

Related Documents

Related Topic	Document Title
Information about Cisco 10000 series routers and broadband aggregation	Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide
Performing an In Service Software Upgrade (ISSU)	Cisco IOS In Service Software Upgrade Process
Information about the broadband ISSU feature	Cisco IOS Broadband High Availability In Service Software Upgrade
Information about stateful switchover	Stateful Switchover
Information about Cisco nonstop forwarding	Cisco Nonstop Forwarding

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/techsupport

Feature Information for Cisco IOS Broadband High Availability Stateful Switchover

Table 1 lists the release history for this feature.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS, Catalyst OS, and Cisco IOS XE software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.



Note

Table 1 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 1 Feature Information for the Cisco IOS Broadband High Availability Stateful Switchover Feature

Feature Name	Releases	Feature Information
Cisco IOS Broadband High Availability Stateful Switchover	12.2(31)SB2 12.2(33)SRC	The Cisco IOS Broadband High Availability Stateful Switchover feature provides the capability for dual Route Processor systems to support stateful switchover of PPPoX sessions, and allows applications and features to maintain the same state while system control and routing protocol execution is transferred between an active and a standby processor. In Cisco IOS Release 12.2(31)SB2, this feature was introduced. In Cisco IOS Release 12.2(33)SRC, support was added for the Cisco 7600 router.
SSO - PPPoA	12.2(33)SRE	The Cisco IOS Broadband High Availability Stateful Switchover feature delivers stateful switchover capability for PPP over ATM (PPPoA) sessions during Route Processor switchover. In Release 12.2(33)SRE, this feature was supported. The following commands were introduced or modified: subscriber redundancy, debug pppatm redundancy, debug pppoe redundancy, show pppoe redundancy, show pppatm statistics.
SSO PPPoE	12.2(33)SRE	The Cisco IOS Broadband High Availability Stateful Switchover feature delivers stateful switchover capability for PPP over Ethernet (PPPoE) subscriber access sessions, including PPPoE, PPPoEoVLAN, and PPPoE802.1q-in-q sessions. In Release 12.2(33)SRE, this feature was supported.

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