Cisco IOS Broadband High Availability Stateful Switchover

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The Cisco IOS Broadband High Availability (HA) Stateful Switchover (SSO) feature provides the capability for dual route processor systems to support stateful switchover of PPPoX sessions and allow applications and features to maintain state while system control and routing protocol execution is transferred between an active and a standby processor.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the "Feature Information for Cisco IOS Broadband High Availability Stateful Switchover" section on page 41.

Finding Support Information for Platforms and Cisco IOS and Catalyst OS Software Images

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

Prerequisites for Cisco IOS Broadband High Availability Stateful Switchover

- The Cisco 10000 Series router must be configured with redundant Performance Routing Engine (PRE) modules, that is, dual route processors.
- Cisco IOS Release 12.2(31)SB2 or a later release must be running.
- The Cisco IOS Stateful Switchover and Nonstop Forwarding features must be enabled. For more information on SSO, see the document "*Stateful Switchover*." For more information on NSF, see the document "*Cisco Nonstop Forwarding*."

Restrictions for Cisco IOS Broadband High Availability Stateful Switchover

Stateful switchover (SSO) is supported only on Cisco IOS 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 PPP over various media (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 other Cisco IOS HA features, *Cisco Nonstop Forwarding* and *Stateful Switchover* 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 following broadband aggregation protocols:

- 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 PPPoA sessions during route processor switchover.

SSO PPPoE

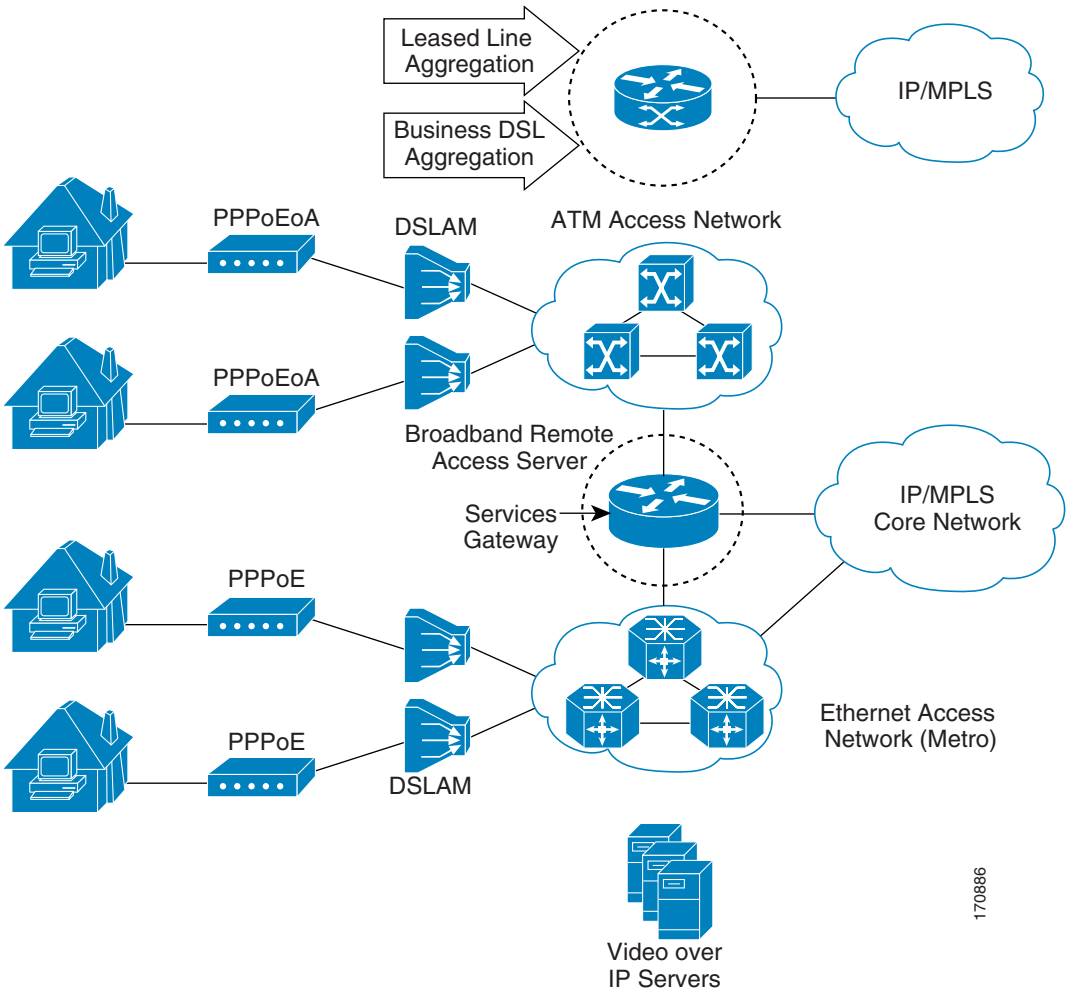
The Cisco IOS Broadband High Availability Stateful Switchover feature delivers stateful switchover capability for PPPoE subscriber access sessions, including PPPoE, PPPoEVLAN, PPPoE802.1q-in-q sessions.

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



Benefits of Cisco IOS Broadband High Availability Stateful Switchover

- Reduces operating costs associated with outages.
- Delivers higher service levels to subscribers.
- Improved 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

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.
Step 3	**subscriber redundancy [bulk limit cpu** *percentage* **delay** *seconds* **allow** *value*`][`**dynamic limit cpu** *percentage* **delay** *seconds* **allow** *value*`][`**delay** *time*`][`**rate** *sessions time*`]` **Example:** `Router(config)# subscriber redundancy bulk limit cpu 75 delay 20 allow 30`	(Optional) Configures subscriber redundancy policy: • **bulk**—Configures bulk synchronization redundancy policy. • **limit cpu** *percentage*—Specifies CPU busy threshold value as a percentage. Range 0 to 100, default 90. • **delay** *seconds*—Specifies delay in seconds before the CCM component synchronizes sessions after the CPU busy threshold is exceeded. • **allow** *value*—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 dynamic synchronization redundancy policy. • **delay** *time*—Specifies minimum amount of time in seconds that a session must be ready before dynamic synchronization occurs. Range is 1 to 33,550. • **rate** *sessions time*—Specifies number of sessions per time period for bulk and dynamic synchronization. – *sessions*—Range 1 to 32,000, default is 250. – *time*—Range in seconds is 1 to ?, default is 1.
Step 4	**exit** **Example:** `Router(config)# exit`	Exits the current configuration mode.

Verifying and Troubleshooting Subscriber Redundancy Policy for Broadband HA Stateful Switchover

To verify 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 11.

For troubleshooting the CCM synchronization component, Step 1 and Step 2 are useful. 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 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. **debug pppatm redundancy**
8. **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 bring up on the standby processor of a redundant processor, high availability (HA) system. Use the **show ccm clients** command to display information on CCM clients. The following is sample output for 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 for 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
```

Step 2 **show ccm sessions**

This command shows information on sessions managed by CCM.The following is sample output for 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 for 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 obtaining 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 for 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 for 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 for 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 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 for 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 8 **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 for 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
```

Configuration Examples for Cisco IOS Broadband High Availability Stateful Switchover

This section provides the following configuration examples:

- PPPoX Terminated into an RA-MPLS Network with SSO: Example, page 12

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 a 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 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 100.1.1.1 255.255.255.255
!
interface Loopback100
  ip address 223.0.0.1 255.255.255.255
!
interface FastEthernet0/0/0
  ip address 192.168.2.26 255.255.255.0
  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 20.1.1.2 255.255.255.0
  negotiation auto
!
interface GigabitEthernet8/1/0
  ip address 11.1.1.1 255.255.255.0
  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 11.1.1.0 0.0.0.255 area 0
  network 223.0.0.0 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 223.0.0.3 remote-as 1
  neighbor 223.0.0.3 update-source Loopback100
  no auto-summary
  !
  address-family vpnv4
  neighbor 223.0.0.3 activate
  neighbor 223.0.0.3 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 12.1.1.1 12.1.16.160 ip local pool pool3 13.1.1.1 13.1.16.160 ip local
pool pool4 14.1.1.1 14.1.16.160 ip local pool pool5 15.1.1.1 15.1.16.160 ip local pool
pool6 16.1.1.1 16.1.16.160 ip local pool pool7 17.1.1.1 17.1.16.160 ip local pool pool8
18.1.1.1 18.1.16.160 ip classless !
!
no ip http server
!
!
arp 20.1.1.1 0020.0001.0001 ARPA
arp vrf vrf1 20.1.1.1 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
Cisco IOS broadband commands	*Cisco IOS Broadband Access Aggregation and DSL Command Reference*
Cisco IOS HA commands	*Cisco IOS High Availability Command Reference*
Information about Cisco 10000 series routers and broadband aggregation	*Cisco 10000 Software Configuration Guide*
Performing an ISSU	*Cisco IOS In Service Software Upgrade Process*
Information about Stateful Switchover	*Stateful Switchover*
Information about Cisco Nonstop Forwarding	*Configuring 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
The Cisco Technical Support & Documentation website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, tools, and technical documentation. Registered Cisco.com users can log in from this page to access even more content.	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 and Catalyst OS 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	The Cisco IOS Broadband High Availability (HA) Stateful Switchover (SSO) feature provides the capability for dual route processor systems to support stateful switchover of PPPoX sessions, and allow applications and features to maintain state while system control and routing protocol execution is transferred between an active and a standby processor.