



Cisco IOS Broadband High Availability Stateful Switchover

First Published: December 4, 2006
Last Updated: December 2, 2010

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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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

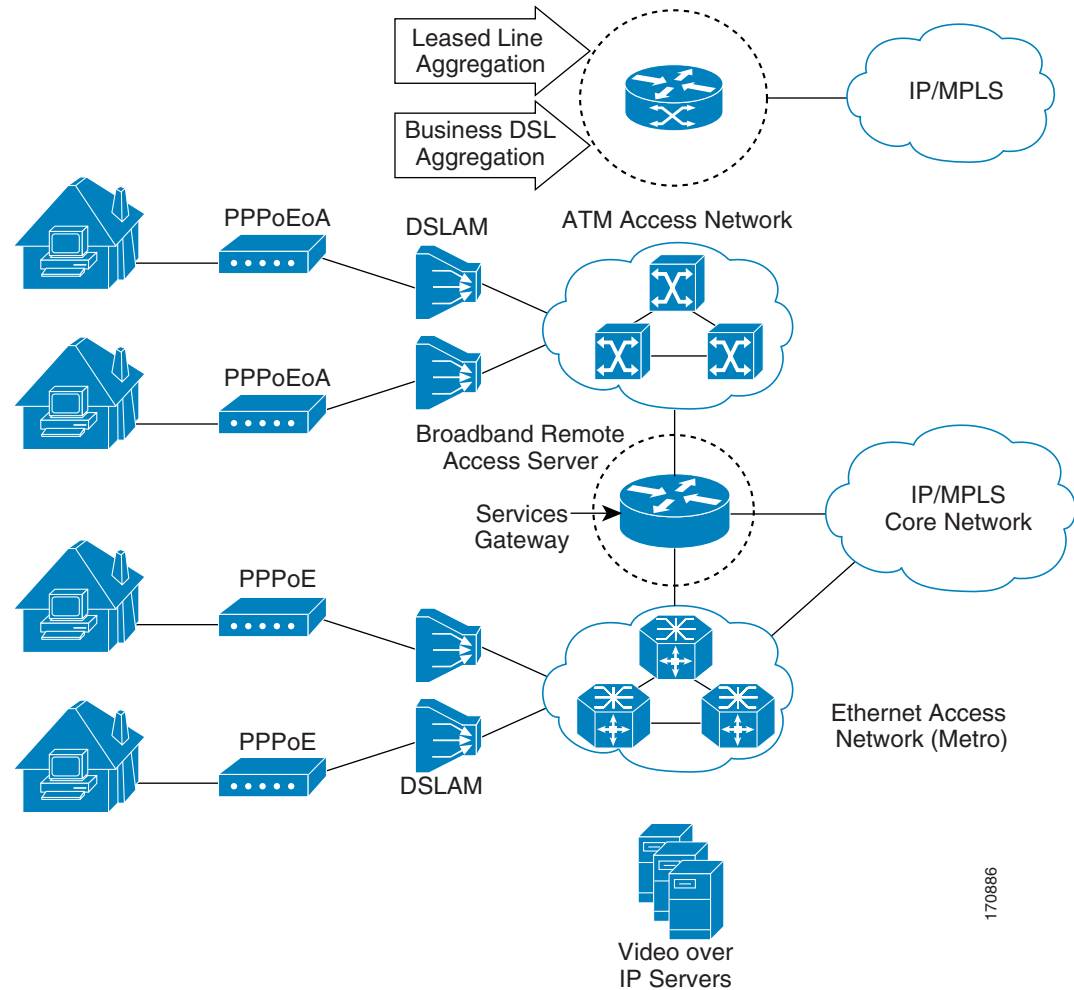
The Cisco IOS Broadband High Availability Stateful Switchover feature delivers stateful switchover capability for PPPoE subscriber access sessions, including PPPoE, PPPoEVLAN, PPPoE802.1q-in-q sessions.

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

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. <i>sessions</i>—Range 1 to 32,000, default is 250. <i>time</i>—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 vrfl
    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.

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