

Broadband High Availability Stateful Switchover

The Cisco IOS XE 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 PPP over Ethernet [PPPoE], PPP over ATM [PPPoA], PPPoEoA, PPPoEoVLAN implementing PPP) sessions, thus allowing applications and features to maintain a stateful state while system control and routing protocol execution is transferred between an active and a standby processor.

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Prerequisites for Broadband High Availability Stateful Switchover

The stateful switchover (SSO) and nonstop forwarding (NSF) features must be enabled. For more information about SSO, see the "Stateful Switchover" module. For more information about NSF, see the "Configuring Nonstop Forwarding" module.

Restrictions for Broadband High Availability Stateful Switchover

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

Information About Broadband High Availability Stateful Switchover

Feature Design of Broadband High Availability Stateful Switchover

Prior to the implementation of the Broadband High Availability Stateful Switchover feature, unplanned control plane and dataplane failures resulted in service outages and network downtime for PPPoX sessions. Cisco HA features, including SSO, enable network protection by providing fast recovery from such failures. The 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 (RP) by synchronizing protocol and state information for supported features with a standby RP, ensuring no interruption of sessions or connections if a switchover occurs.

The SSO feature takes advantage of RP redundancy by establishing one of the RPs as the active processor, designating the other RP as the standby processor, and then synchronizing critical state information between them. Following an initial (bulk) synchronization between the two processors, SSO dynamically maintains RP state information between them. A switchover from the active to the standby processor occurs when the active RP fails, when it is removed from the networking device, or when it is manually taken down for maintenance. The standby RP then takes control and becomes the active RP, preserving the sessions and connections for the supported features. At this time, packet forwarding continues while route convergence is completed on the newly active RP. A critical component of SSO and Cisco HA technology is the cluster control manager (CCM) that manages session re-creation on the standby processor. The 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, on page 4.

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

For information about High Availability and stateful switchover, see the "High Availability Overview" chapter in the Cisco ASR 1000 Series Aggregation Services Routers Software Configuration Guide .

Supported Broadband Aggregation Protocols

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

SSO PPPoA

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

SSO L2TP

The L2TP HA Session SSO/ISSU on a LAC/LNS feature provides a generic stateful switchover/In Service Software Upgrade (SSO/ISSU) mechanism for Layer 2 Tunneling Protocol (L2TP) on a Layer 2 Access

Concentrator (LAC) and a Layer 2 Network Server (LNS). This feature preserves all fully established PPP and L2TP sessions during an SSO switchover or an ISSU upgrade or downgrade.

SSO PPPoE

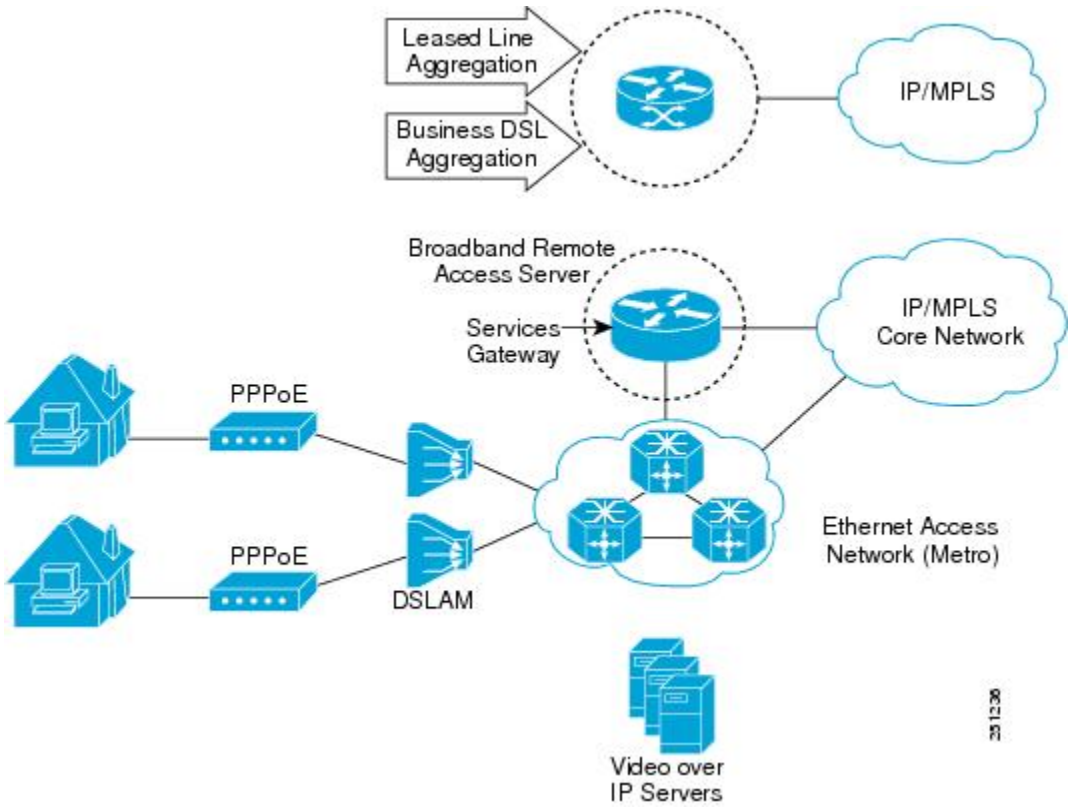
The Broadband High Availability Stateful Switchover feature delivers stateful switchover capability for PPP over Ethernet (PPPoE) subscriber access sessions, including PPPoE, PPPoEoVLAN, and PPPoEoQinQ.

SSO RA-MLPS VPN

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

The figure below shows a typical broadband aggregation HA deployment with SSO functionality.

Figure 1: Broadband Aggregation High Availability Deployment



Benefits of 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 Broadband High Availability Stateful Switchover

Configuring Subscriber Redundancy Policy for Broadband HA Stateful Switchover

Perform this task to configure subscriber redundancy policy for HA SSO capability for broadband subscriber sessions.

SUMMARY STEPS

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

DETAILED STEPS

Procedure

	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** *percent* **delay** *seconds* **[allow** *sessions* **]	time** *seconds* **}	dynamic limit cpu** *percent* **delay** *seconds* **[allow** *sessions* **]	delay** *seconds* **| rate** *sessions seconds* **}** **Example:**	(Optional) Configures subscriber redundancy policy. • **bulk** --Configures bulk synchronization redundancy policy. • **limit** --Specifies the limit for the synchronization.

	Command or Action	Purpose

	`Router(config)# subscriber redundancy bulk limit cpu 75 delay 20 allow 30`	• **cpu** *percent* --Specifies a CPU busy threshold value as a percentage. Range is from 0 to 100; default is 90.
		• **delay** *seconds* --Specifies the minimum amount of time, in seconds, that a session must be ready before bulk or dynamic synchronization occurs. Range is from 1 to 33550.
		• **allow** *sessions* --(Optional) Specifies the minimum number of sessions to synchronize once the CPU busy threshold is exceeded and the specified delay is met. Range is from 1 to 2147483637; default is 25.
		• **dynamic** --Configures a dynamic synchronization redundancy policy.
		• **rate** *sessions seconds* --Specifies the number of sessions per time period for bulk and dynamic synchronization.
		  • *sessions*--Range is from 1 to 32000; default is 250.
		  • *seconds*--Range in seconds is from 1 to 33550; default is 1.

Step 4	**exit** **Example:** `Router(config)# exit`	Exits global configuration mode and returns to privileged EXEC mode.

Verifying and Troubleshooting Subscriber Redundancy Policy for Broadband HA Stateful Switchover

To view the configuration, use the **show running-config** command. Sample output is available at Configuration Examples for Broadband High Availability Stateful Switchover, on page 11.

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 vpdn redundancy**
7. **show vpdn history failure**
8. **show pppatm redundancy**
9. **show pppoe redundancy**
10. **debug pppatm redundancy**

11. **debug pppoe redundancy**

DETAILED STEPS

Procedure

Step 1 **show ccm clients**

Example:

```
This command is useful for troubleshooting the CCM synchronization component. This command displays
 information about the CCM, which is the HA component that manages the capability to synchronize
session launch on the standby processor of a redundant processor HA system.
```

Active Route Processor

Example:

```
Router# show ccm clients
CCM bundles sent since peer up:
Sent Queued for flow control
Sync Session 16000 0
Update Session 0 0
Active Bulk Sync End 1 0
Session Down 0 0
ISSU client msgs 346 0
Dynamic Session Sync 0 0
Unknown msgs 0 0
Client events sent since peer up:
PPP 144000
PPPoE 96002
VPDN FSP 0
AAA 64000
PPP SIP 0
LTERM 16000
AC 0
L2TP CC 0
SSS FM 16000
VPDN LNS 0
```

Standby Route Processor

Example:

```
Router# show ccm clients

CCM bundles rcvd since last boot:
Sync Session 16000
Update Session 0
Active Bulk Sync End 1
Session Down 0
ISSU client msgs 173
Dynamic Session Sync 0
Unknown msgs 0
Client events extracted since last boot:
PPP 144000
PPPoE 96002
VPDN FSP 0
AAA 64000
```

```
PPP SIP 0
LTERM 16000
AC 0
L2TP CC 0
SSS FM 16000
VPDN LNS 0
```

Step 2 show ccm sessions

This command is useful for troubleshooting the CCM synchronization component. This command shows information about sessions managed by CCM.

Active Route Processor

Example:

```
Router# show ccm sessions
Global CCM state: CCM HA Active - Dynamic Sync
Global ISSU state: Compatible, Clients Cap 0x9EFFE
Current Bulk Sent Bulk Rcvd
----------- ----------- -----------
Number of sessions in state Down: 0 0 0
Number of sessions in state Not Ready: 0 0 9279
Number of sessions in state Ready: 0 0 6721
Number of sessions in state Dyn Sync: 16000 16000 0
Timeout: Timer Type Delay Remaining Starts CPU Limit CPU Last
------------ -------- --------- ----------- --------- --------
Rate 00:00:01 - 64 - -
Dynamic CPU 00:00:10 - 0 90 0
Bulk Time Li 00:08:00 - 1 - -
RF Notif Ext 00:00:01 - 475 - -
```

Standby Route Processor

Example:

```
Router# show ccm sessions

Global CCM state: CCM HA Standby - Collecting
Global ISSU state: Compatible, Clients Cap 0x9EFFE
Current Bulk Sent Bulk Rcvd
----------- ----------- -----------
Number of sessions in state Down: 0 0 0
Number of sessions in state Not Ready: 0 0 8384
Number of sessions in state Ready: 16000 0 7616
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 - 1 - -
RF Notif Ext 00:00:01 - 0 - -
```

Step 3 show ppp subscriber statistics

This command is useful for reviewing PPPoX session statistics. 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:

Example:

```
Router# show ppp subscriber statistics
PPP Subscriber Events          TOTAL         SINCE CLEARED
Encap                          5             5
DeEncap                        0             0
CstateUp                       7             7
CstateDown                     4             4
FastStart                      0             0
LocalTerm                      7             7
LocalTermVP                    0             0
MoreKeys                       7             7
Forwarding                     0             0
Forwarded                      0             0
SSSDisc                        0             0
SSMDisc                        0             0
PPPDisc                        0             0
PPPBindResp                    7             7
PPPReneg                       3             3
RestartTimeout                 5             5
PPP Subscriber Statistics      TOTAL         SINCE CLEARED
IDB CSTATE UP                  4             4
IDB CSTATE DOWN                8             8
APS UP                         0             0
APS UP IGNORE                  0             0
APS DOWN                       0             0
READY FOR SYNC                 8             8
```

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:

Example:

```
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 reviewing PPPoX session statistics. Use the **show pppoe statistics** command to display a cumulative count of PPPoE events and statistics, and to display an incremental count since the **clear pppoe statistics** command was last issued.

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

Example:

```
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               0             0
SSS FORWARDING                  0             0
SSS FORWARDED                   0             0
SSS MORE KEYS                   0             0
SSS DISCONNECT                  0             0
CONFIG UPDATE                   0             0
STATIC BIND RESPONSE            0             0
PPP FORWARDING                  0             0
PPP FORWARDED                   0             0
PPP DISCONNECT                  0             0
PPP RENEGOTIATION               0             0
SSM PROVISIONED                 0             0
SSM UPDATED                     0             0
SSM DISCONNECT                  0             0
PPPoE Statistics                TOTAL         SINCE CLEARED
------------------------------ ------------- -------------
SSS Request                     0             0
SSS Response Stale              0             0
SSS Disconnect                  0             0
PPPoE Handles Allocated         0             0
PPPoE Handles Freed             0             0
Dynamic Bind Request            0             0
Static Bind Request             0             0
```

Step 6 **show vpdn redundancy**

Use this command to verify the failure of any L2TP tunnels.

Example:

```
Router# show vpdn redundancy

L2TP HA support: Silent Failover
L2TP HA Status:
Checkpoint Messaging on: FALSE
Standby RP is up: TRUE
Recv'd Message Count: 0
L2TP Tunnels: 2/2/2/0 (total/HA-enabled/HA-est/resync)
L2TP Sessions: 10/10/10 (total/HA-enabled/HA-est)
L2TP Resynced Tunnels: 0/0 (success/fail)
```

Step 7 **show vpdn history failure**

Use this command to verify the failure of any VPDN groups.

Example:

```
Router# show vpdn history failure

% VPDN user failure table is empty
```

Step 8 **show pppatm redundancy**

Use the **show pppatm redundancy** command to display the PPPoA HA sessions summary. The following is sample output from the **show pppatm redundancy** command from a Cisco 10000 series router standby processor:

Example:

```
Router-stby# show pppatm redundancy
0 : Session recreate requests from CCM
0 : Session up events invoked
0 : Sessions reaching PTA
0 : Sessions closed by CCM
0 : Session down events invoked
0 : Queued sessions waiting for base hwidb creation
0 : Sessions queued for VC up notification so far
0 : Sessions queued for VC encap change notification so far
0 : VC activation notifications received from ATM
0 : VC encap change notifications received from ATM
0 : Total queued sessions waiting for VC notification(Encap change+VC Activation)
```

Step 9 **show pppoe redundancy**

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

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

Example:

```
Router-stby# show pppoe redundancy
12 Event Queues
size max kicks starts false suspends ticks(ms)
9 PPPoE CCM EV 0 1 2 3 1 0 20
Event Names
Events Queued MaxQueued Suspends usec/evt max/evt
1* 9 Recreate UP 2 0 1 0 1500 3000
2* 9 Recreate DOWN 0 0 0 0 0 0
3* 9 VC Wait UP 0 0 0 0 0 0
4* 9 VC Wait Encap 0 0 0 0 0 0
Sessions waiting for Base Vaccess: 0
Sessions waiting for ATM VC UP: 0
Sessions waiting for Auto VC Encap 0
```

Step 10 **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 active processor:

Example:

```
Router# debug pppatm redundancy
PPP over ATM redundancy debugging is on
```

Step 11 **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.

Example:

```
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
```

Configuration Examples for Broadband High Availability Stateful Switchover

Example Configuring Broadband High Availability Stateful Switchover

The following example shows how to configure the Broadband High Availability Stateful Switchover feature:

```
Router# configure terminal
Router(config)# subscriber redundancy bulk limit cpu 75 delay 20 allow 30
Router(config)# exit
```

The following is a sample configuration of PPPoX terminated into an RA-MPLS network with SSO. Commands that appear in the configuration task tables for this feature but that do not appear in the running configuration output are configured for their default settings.

```
Router# show running-config
hostname Router
!
boot-start-marker
boot system bootflash:packages.conf !
enable password cisco
!
aaa new-model
!
!
aaa authentication ppp default local
!
!
!
aaa session-id common
ppp hold-queue 80000
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
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
!
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 10.1.1.1 255.255.255.255
!
interface Loopback100
  ip address 192.168.0.1 255.255.255.255
!
interface FastEthernet0/0/0
  ip address 192.168.2.26 255.255.255.0
  speed 100
  full-duplex
!
interface GigabitEthernet1/0/0
no ip address
load-interval 30
!
interface GigabitEthernet1/0/0.1
encapsulation dot1Q 2
```

```
pppoe enable group grp1
!
!
interface GigabitEthernet1/0/0.2
encapsulation dot1Q 2
pppoe enable group grp2
!
!
interface GigabitEthernet1/0/1
no ip address
!
interface GigabitEthernet1/0/1.1
encapsulation dot1Q 2
pppoe enable group grp3
!
!
interface GigabitEthernet1/0/1.2
encapsulation dot1Q 2
pppoe enable group grp4
!
!
interface GigabitEthernet1/0/2
no ip address
!
interface GigabitEthernet1/0/2.1
encapsulation dot1Q 2
pppoe enable group grp5
!
!
interface GigabitEthernet1/0/2.2
encapsulation dot1Q 2
pppoe enable group grp6
!
!
interface GigabitEthernet1/0/3
no ip address
!
interface GigabitEthernet1/0/3.1
encapsulation dot1Q 2
pppoe enable group grp7
!
!
interface GigabitEthernet1/0/3.2
encapsulation dot1Q 2
pppoe enable group grp8
!
interface GigabitEthernet7/0/3
no ip address
!
interface GigabitEthernet8/0/0
  mac-address 0011.0022.0033
  ip vrf forwarding vrf1
  ip address 10.1.1.2 255.255.255.0
  negotiation auto
!
interface GigabitEthernet8/1/0
  ip address 10.1.1.1 255.255.255.0
  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 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 10.1.1.1 10.1.16.160
ip local pool pool3 10.13.1.1 10.13.16.160
ip local pool pool4 10.14.1.1 10.14.16.160
ip local pool pool5 10.15.1.1 10.15.16.160
ip local pool pool6 10.16.1.1 10.16.16.160
ip local pool pool7 10.17.1.1 10.17.16.160
ip local pool pool8 10.18.1.1 10.18.16.160
ip classless !
!
no ip http server
!
!
arp 10.20.1.1 0020.0001.0001 ARPA
arp vrf vrf1 10.20.1.1 0020.0001.0001 ARPA !
!
!
line con 0
line aux 0
line vty 0 4
  password cisco
!
exception crashinfo file bootflash:crash.log !
end
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS Broadband Access Aggregation and DSL commands	*Cisco IOS Broadband Access Aggregation and DSL Command Reference*
High Availability	"High Availability Overview" chapter in the Cisco ASR 1000 Series Aggregation Services Routers Software Configuration Guide
Performing an ISSU	The following chapters in the Cisco ASR 1000 Series Aggregation Services Routers Software Configuration Guide : • "Cisco IOS XE Software Package Compatibility for ISSU" • "In Service Software Upgrade (ISSU)"
Broadband ISSU	"Broadband High Availability In Service Software Upgrade" module
Stateful switchover	"Stateful Switchover" module
Configuring nonstop forwarding	"Configuring Nonstop Forwarding" module
Layer 2 Tunnel Protocol	Layer 2 Tunnel Protocol Technology Brief" module

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
None	To locate and download MIBs for selected platforms, Cisco software 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 Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Broadband High Availability Stateful Switchover

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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

Table 1: Feature Information for the Broadband High Availability Stateful Switchover Feature

Feature Name	Releases	Feature Information
SSO--PPPoA	Cisco IOS XE Release 3.3S	In Cisco IOS XE Release 3.3S, this feature was implemented on ASR 1000 Series Routers. The Broadband High Availability Stateful Switchover feature delivers stateful switchover capability for PPP over ATM (PPPoA) sessions during RP switchover. The following commands were introduced or modified: **subscriber redundancy**, **debug pppatm redundancy**, **debug pppoe redundancy**, **show pppoe redundancy**, **show pppatm statistics**.
SSO--PPPoE	Cisco IOS XE Release 2.1 Cisco IOS XE Release 2.5	In Cisco IOS XE Release 2.1, this feature was implemented on ASR 1000 Series Routers. This feature uses the SSO--PPPoE feature to provide 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. The following commands were introduced or modified: **clear ppp subscriber statistics**, **clear pppoe statistics**, **debug pppoe redundancy, show ccm clients, show ccm sessions, show ppp subscriber statistics, show pppoe statistic, subscriber redundancy**.