



# Cisco IOS Broadband High Availability In Service Software Upgrade

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**First Published:** December 4, 2006  
**Last Updated:** December 4, 2006

The Cisco IOS Broadband High Availability (HA) In Service Software Upgrade feature ensures continuous operations of broadband access protocols on dual Route Processor (RP) Cisco 10000 series platforms during software upgrades, downgrades, and service enhancements.

## 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 In Service Software Upgrade](#)” section on page 42.

## 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.

## Contents

- [Prerequisites for Cisco IOS Broadband High Availability In Service Software Upgrade](#), page 2
- [Restrictions for Cisco IOS Broadband High Availability In Service Software Upgrade](#), page 2
- [Information About Cisco IOS Broadband High Availability In Service Software Upgrade](#), page 2
- [How to Configure Cisco IOS Broadband High Availability In Service Software Upgrade](#), page 5
- [Configuration Examples for Cisco IOS Broadband High Availability In Service Software Upgrade](#), page 11
- [Additional References](#), page 17
- [Command Reference](#), page 18



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## Prerequisites for Cisco IOS Broadband High Availability In Service Software Upgrade

- 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 (SSO) and nonstop forwarding (NSF) 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 In Service Software Upgrade

- You cannot perform an In Service Software Upgrade (ISSU) across Cisco IOS release trains.
- You cannot perform an ISSU from a Cisco IOS software version that is not ISSU-capable to a Cisco IOS software version that does support this capability.

## Information About Cisco IOS Broadband High Availability In Service Software Upgrade

To configure the Cisco IOS Broadband High Availability In Service Software Upgrade feature, you should understand the following concepts:

- [Feature Design of Cisco IOS Broadband High Availability In Service Software Upgrade, page 2](#)
- [Benefits of Cisco IOS Broadband High Availability In Service Software Upgrade, page 4](#)

## Feature Design of Cisco IOS Broadband High Availability In Service Software Upgrade

Prior to the implementation of the Cisco IOS Broadband High Availability In Service Software Upgrade feature in Cisco IOS Release 12.2(31)SB2, software upgrades typically required planned outages that took the router or network out of service. The Cisco IOS Broadband High Availability In Service Software Upgrade feature enables the service provider to maximize network availability and eliminate planned outages by allowing you to upgrade the Cisco IOS image without taking the router or network out of service. ISSU is a procedure, based on Cisco HA architecture, whereby the Cisco IOS infrastructure accomplishes an upgrade while packet forwarding continues and broadband sessions are maintained. Cisco high availability (HA) architecture is based on redundant Route Processors and the NSF and SSO features, such that ports stay active and calls do not drop, eliminating network disruption during upgrades.

The ISSU feature allows deployment of new features, hardware, services, and maintenance fixes in a procedure that is seamless to end users. A critical component of ISSU and Cisco HA technology is the cluster control manager (CCM) that manages session re-creation and synchronization on the standby processor. The Cisco IOS Broadband High Availability In Service Software Upgrade feature allows you

to configure subscriber redundancy policies that tune the synchronization process. For more information see the “[Configuring Subscriber Redundancy Policy for Cisco IOS Broadband High Availability In Service Software Upgrade](#)” section on page 5.

The Cisco IOS Broadband High Availability In Service Software Upgrade feature handles upgrades and downgrades, and supports the following:

- Upgrades from one software feature release to another, as long as both versions support the ISSU feature, for example from Cisco IOS Release 12.2(28)SB to Cisco IOS Release 12.2(31)SB2.
- Upgrades from one software maintenance release to another, for example from Cisco IOS Release 12.2(28)SB1 to Cisco IOS Release 12.2(28)SB2

**Note**

Software upgrades and downgrades are supported only within the major Cisco IOS releases; crossing between the S and T or Mainline Cisco IOS releases, for example from Cisco IOS release 12.4(11)T and Cisco IOS release 12.2(31)SB, is not supported even if each release supports ISSU capability. For more information on Cisco IOS releases, see [Cisco IOS Reference Guide](#).

The Cisco IOS Broadband High Availability In Service Software Upgrade feature works with other Cisco IOS HA features, nonstop forwarding and stateful switchover, to maintain broadband sessions.

For more information on performing an ISSU, see the document [Cisco IOS In Service Software Upgrade Process](#).

## Supported Broadband Aggregation Protocols

The Cisco IOS Broadband High Availability In Service Software Upgrade feature supports the following broadband aggregation protocols:

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

### ISSU PPPoA

The Cisco IOS Broadband High Availability In Service Software Upgrade feature delivers ISSU capability for (PPPoA) sessions during supported software upgrades, downgrades and enhancements.

### ISSU PPPoE

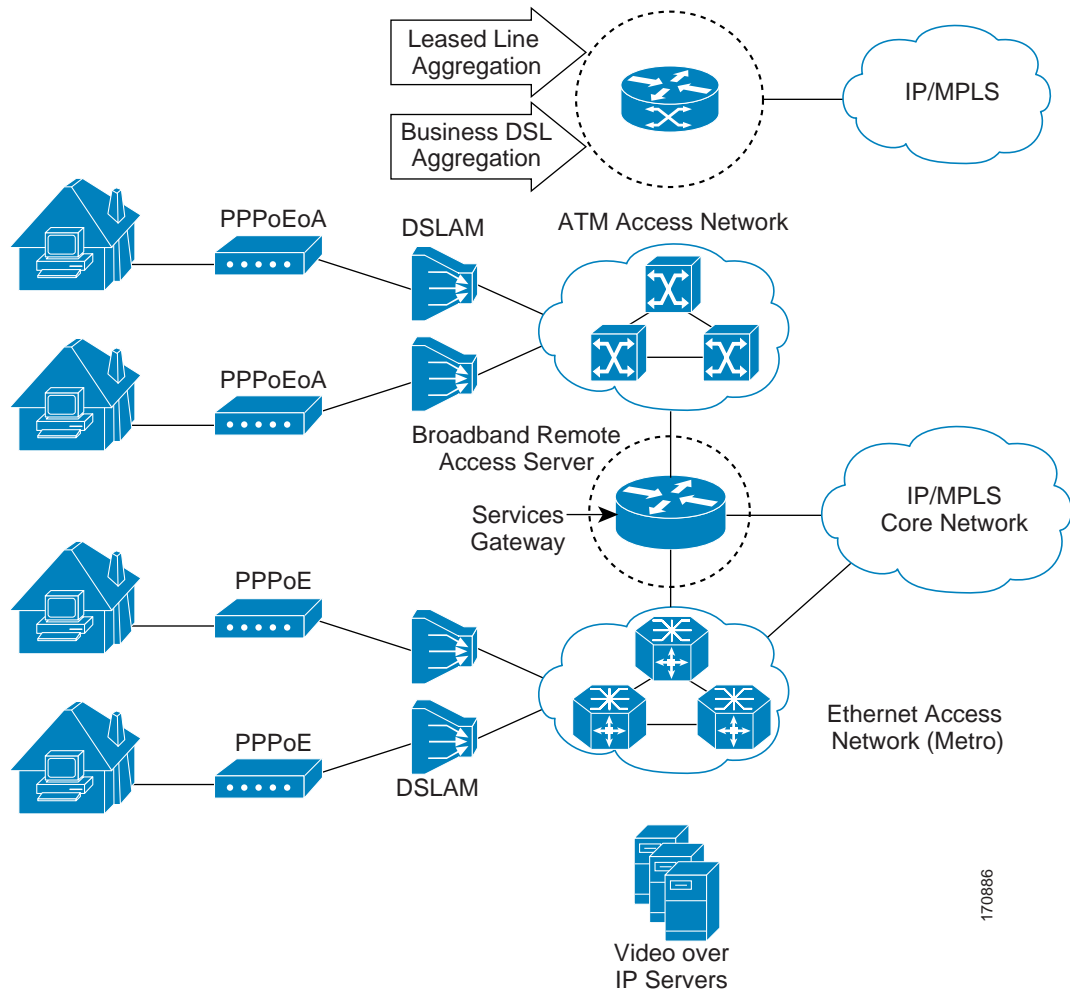
The Cisco IOS Broadband High Availability In Service Software Upgrade feature delivers ISSU capability for PPP over Ethernet (PPPoE) subscriber access sessions, including PPPoE, PPPoEVLAN, and PPPoE802.1q-in-q sessions, during supported software upgrades, downgrades and enhancements.

### ISSU RA-MLPS VPN

The Cisco IOS Broadband High Availability In Service Software Upgrade feature delivers ISSU capability for PPPoA and PPPoE (PPPoX) sessions terminated into remote access (RA)- Multiprotocol Label Switching (MPLS) virtual private networks (VPN) or PPPoX into MPLS VPN during supported software upgrades, downgrades and enhancements.

Figure 1 shows a typical broadband aggregation HA deployment with ISSU functionality.

Figure 1 *Broadband Aggregation High Availability Deployment*



## Benefits of Cisco IOS Broadband High Availability In Service Software Upgrade

- Eliminates network downtime for Cisco IOS software image upgrades.
- Eliminates resource scheduling challenges associated with planned outages and late night maintenance windows.
- Accelerates deployment of new services and applications and allows faster implementation of new features, hardware, and fixes.
- Reduces operating costs due to outages while delivering higher service levels.
- Provides additional options for adjusting maintenance windows.
- Minimizes the impact of upgrades to service and allows for faster upgrades, resulting in higher availability.

# How to Configure Cisco IOS Broadband High Availability In Service Software Upgrade

This section contains the following procedures:

- [Configuring Subscriber Redundancy Policy for Cisco IOS Broadband High Availability In Service Software Upgrade, page 5](#)
- [Verifying and Troubleshooting Subscriber Redundancy Policy for Broadband HA ISSU, page 6](#)

## Configuring Subscriber Redundancy Policy for Cisco IOS Broadband High Availability In Service Software Upgrade

The Cisco IOS Broadband High Availability In Service Software Upgrade feature is enabled by default. This task configures subscriber redundancy policy for HA ISSU capability, allowing you to manage synchronization between HA active and standby processors.

### Prerequisites

For more information on performing the ISSU process, see the document [Cisco IOS In Service Software Upgrade Process](#).

### 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	<pre>enable</pre> <p><b>Example:</b> Router&gt; enable </p>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
Step 2	<pre>configure terminal</pre> <p><b>Example:</b> Router# configure terminal </p>	<p>Enters global configuration mode.</p>
Step 3	<pre>subscriber redundancy [bulk limit cpu percentage delay seconds allow value] [dynamic limit cpu percentage delay seconds allow value] [delay time] [rate sessions time]</pre> <p><b>Example:</b> Router(config)# subscriber redundancy bulk limit cpu 75 delay 20 allow 30 </p>	<p>(Optional) Configures subscriber redundancy policy.</p> <ul style="list-style-type: none"> <li><b>bulk</b>—Configures bulk synchronization redundancy policy.</li> <li><b>limit cpu percentage</b>—Specifies CPU busy threshold value as a percentage. Range 0 to 100, default is 90.</li> <li><b>delay seconds</b>—Specifies delay in seconds before the CCM component synchronizes sessions after the CPU busy threshold is exceeded.</li> <li><b>allow value</b>—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 2147483637; default is 25.</li> <li><b>dynamic</b>—Configures dynamic synchronization redundancy policy.</li> <li><b>delay time</b>—Specifies minimum amount of time in seconds that a session must be ready before dynamic synchronization occurs. Range is 1 to 33550.</li> <li><b>rate sessions time</b>—Specifies number of sessions per time period for bulk and dynamic synchronization. <ul style="list-style-type: none"> <li><i>sessions</i>—Range is 1 to 32000; default is 250.</li> <li><i>time</i>—Range in seconds is 1 to 33550; default is 1.</li> </ul> </li> </ul>
Step 4	<pre>exit</pre> <p><b>Example:</b> Router(config)# exit </p>	<p>Exits the current configuration mode.</p>

## Verifying and Troubleshooting Subscriber Redundancy Policy for Broadband HA ISSU

To verify the subscriber redundancy policy configuration, use the **show running-config** command. Sample output is located in the “[Configuration Examples for Cisco IOS Broadband High Availability In Service Software Upgrade](#)” section on page 11.

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

## SUMMARY STEPS

1. **show ccm clients**
2. **show ccm sessions**
3. **show ppp subscriber statistics**
4. **show pppatm statistics**
5. **show pppoe statistics**
6. **show ccm queues**
7. **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 bringup 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 from the **show ccm clients** command from a Cisco 10000 series router active RP:

```
Router# show ccm clients

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

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

```
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 the CCM. The following is sample output from the **show ccm sessions** command on the active RP:

```

Router# show ccm sessions

Global CCM state:                CCM HA Active - Dynamic Sync
Global ISSU state:               Compatible, Clients Cap 0x0
> Number of sessions in state Down:      0
> Number of sessions in state Not Ready:  0
> Number of sessions in state Ready:     0
> Number of sessions in state Dyn Sync:  0
>
> Timeout: Timer Type   Delay   Remaining Starts   CPU Limit CPU Last
> -----
> Rate                  00:00:01 -      2       -       -
> Dynamic CPU           00:00:10 -      0       90      0

```

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

```

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 from the **show ppp subscriber statistics** command:

```

Router# show ppp subscriber statistics

PPP Subscriber Events          TOTAL          SINCE CLEARED
Encap                         32011          32011
DeEncap                       16002          16002
CstateUp                      173           173

```

```

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

```

#### Step 4 **show pppatm statistics**

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

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

```

Router# show pppatm statistics

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

```

#### Step 5 **show pppoe statistics**

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

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

```

Router# show pppoe statistics

PPPoE Events                TOTAL      SINCE CLEARED
-----
INVALID                      0         0
PRE-SERVICE FOUND           0         0
PRE-SERVICE NONE            0         0
SSS CONNECT LOCAL           16002     16002

```

```

SSS FORWARDING          0          0
SSS FORWARDED           0          0
SSS MORE KEYS          16002         16002
SSS DISCONNECT         0          0
CONFIG UPDATE          0          0
STATIC BIND RESPONSE   16002         16002
PPP FORWARDING        0          0
PPP FORWARDED         0          0
PPP DISCONNECT        0          0
PPP RENEGOTIATION     0          0
SSM PROVISIONED       16002         16002
SSM UPDATED           16002         16002
SSM DISCONNECT        0          0
>
PPPoE Statistics          TOTAL          SINCE CLEARED
-----
SSS Request             16002         16002
SSS Response Stale     0            0
SSS Disconnect         0            0
PPPoE Handles Allocated 16002         16002
PPPoE Handles Freed    0            0
Dynamic Bind Request   16002         16002
Static Bind Request    16002         16002

```

**Step 6 show ccm queues**

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

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

```

Router# show ccm queues

9 Event Queues

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

Event Names

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

```

**Step 7 debug pppatm redundancy**

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

```
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 from the **debug pppoe redundancy** command from a Cisco 10000 series router active RP:

```
Router# debug pppoe redundancy

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

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

```
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 In Service Software Upgrade

This section provides the following configuration examples:

- [PPPoX Terminated into an RA-MPLS Network with ISSU: Example, page 12](#)

## PPPoX Terminated into an RA-MPLS Network with ISSU: Example

The following example shows how to configure PPPoX session subscriber redundancy policy for the Cisco IOS Broadband High Availability In Service Software Upgrade 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 issu config-sync policy bulk prc 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 172.16.1.1 255.255.255.255
!
interface Loopback100
    ip address 172.31.0.1 255.255.255.255
!
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 !
!
!

!
!
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 In Service Software Upgrade feature.

### Related Documents

Related Topic	Document Title
Information about Cisco 10000 series routers and broadband aggregation	<i>Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide</i>
Performing an ISSU	<i>Cisco IOS In Service Software Upgrade Process</i>
Information about the broadband SSO feature	<i>Cisco IOS Broadband High Availability Stateful Switchover</i>
Information about SSO	<i>Stateful Switchover</i>
Information about NSF	<i>Cisco Nonstop Forwarding</i>

### 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: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

### 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.	<a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a>

## Command Reference

This section documents new commands only.

- [clear ppp subscriber statistics](#)
- [clear pppatm statistics](#)
- [clear pppoe statistics](#)
- [debug pppatm redundancy](#)
- [debug pppoe redundancy](#)
- [show ccm clients](#)
- [show ccm queues](#)
- [show ccm sessions](#)
- [show ppp subscriber statistics](#)
- [show pppatm statistics](#)
- [show pppoe statistics](#)
- [subscriber redundancy](#)

# clear ppp subscriber statistics

To clear PPP subscriber statistics and reset counters to zero, use the **clear ppp subscriber statistics** command in privileged EXEC mode.

## **clear ppp subscriber statistics**

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(31)SB2	This command was introduced.

**Usage Guidelines** Use the **clear ppp subscriber statistics** command to clear all PPP subscriber statistics and reset counters to zero.

**Examples** The following example clears all PPP subscriber statistics and resets counters to zero:

```
Router# clear ppp subscriber statistics
```

Related Commands	Command	Description
	<b>show ppp subscriber statistics</b>	Displays PPP statistics.

# clear pppatm statistics

To clear PPP over ATM statistics and reset counters to zero, use the **clear pppatm statistics** command in privileged EXEC mode.

## clear pppatm statistics

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(31)SB2	This command was introduced.

**Usage Guidelines** Use the **clear pppatm statistics** command to clear PPPoA statistics and reset counters to zero.

**Examples** The following example clears PPPoA statistics and reset counters to zero:

```
Router# clear pppatm subscriber statistics
```

Related Commands	Command	Description
	<b>show pppatm statistics</b>	Displays PPPoA statistics.

# clear pppoe statistics

To clear PPP over Ethernet (PPPoE) statistics and reset counters to zero, use the **clear pppoe statistics** command in privileged EXEC mode.

## **clear pppoe statistics**

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(31)SB2	This command was introduced.

**Usage Guidelines** Use the **clear pppoe statistics** command to clear all PPPoE statistic and reset counters to zero.

**Examples** The following example clears all PPPoE statistics and resets counters to zero:

```
Router# clear pppoe statistics
```

Related Commands	Command	Description
	<b>show pppoe statistics</b>	Displays PPPoE statistics.

## debug pppatm redundancy

To debug PPP over ATM (PPPoA) redundancy events on a high availability (HA) dual route processor system and display Cluster Control Manager (CCM) events and messages, use the **debug pppatm redundancy** command in privileged EXEC mode. To disable the display of debugging output, use the **no** form of this command.

**debug pppatm redundancy**

**no debug pppatm redundancy**

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(31)SB2	This command was introduced on the Cisco 10000 series routers.

**Usage Guidelines** The CCM provides the capability to facilitate and synchronize session bring up on the standby processor of a dual route processor HA system. Use the **debug pppatm redundancy** command to display CCM events and messages for PPPoA sessions on HA systems.



**Note**

The **debug pppatm redundancy** command does not display output on the active processor during normal synchronization, that is, the command displays output on the active processor only during an error condition.

This command is used only by Cisco engineers for internal debugging of CCM processes.

**Examples** The following is sample output for the **debug pppatm redundancy** command from a Cisco 10000 Series router standby processor. No field descriptions are provided because command output is used for Cisco internal debugging purposes only.

```
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
```

# debug pppoe redundancy

To debug PPP over Ethernet (PPPoE) redundancy events on a high availability (HA) dual route processor system and display Cluster Control Manager (CCM) events and messages, use the **debug pppoe redundancy** command in privileged EXEC mode. To disable the display of debugging output, use the **no** form of this command.

**debug pppoe redundancy**

**no debug pppoe redundancy**

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(31)SB2	This command was introduced.

**Usage Guidelines** The CCM provides the capability to facilitate and synchronize session bring up on the standby processor of a dual route processor HA system. Use the **debug pppoe redundancy** command to display CCM events and messages for PPPoE sessions. This command is used only by Cisco engineers for internal debugging of CCM processes.

**Examples** The following is sample output for the **debug pppoe redundancy** command from a Cisco 10000 Series router active processor. No field descriptions are provided because command output is used for Cisco internal debugging purposes only.

```
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
```

■ 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
```

# show ccm clients

To display information about cluster control manager (CCM) clients on high availability (HA), dual route processor systems use the **show ccm clients** command in privileged EXEC mode.

## show ccm clients

**Command Default** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(31)SB2	This command was introduced.

**Usage Guidelines** The CCM manages the capability to synchronize session bringup on the standby processor of a dual route processor HA system. Use the **show ccm clients** command to display information about CCM clients.

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

```
Router# show ccm clients

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

The following is sample output from the **show ccm clients** command on 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

```

[Table 5](#) describes the significant fields shown in the **display**. Any data not described in [Table 4](#) is used for Cisco internal debugging purposes.

**Table 1** *show ccm clients Field Descriptions*

Field	Description
CCM bundles sent since peer up	<p>Number of the following types of CCM bundles sent by the active processor since bringup on the standby processor :</p> <ul style="list-style-type: none"> <li>• Sync Session—Synchronization session bundles.</li> <li>• Update Session—Update session bundles.</li> <li>• Active Bulk Sync—Active processor bulk synchronization bundles.</li> <li>• Session Down—Session down bundles.</li> <li>• ISSU client msgs—In service software upgrade (ISSU) bundles.</li> <li>• Unknown msgs—Unknown message bundles.</li> </ul>
Client events sent since peer up	<p>Number of the following types of client events sent since bringup on the standby processor:</p> <ul style="list-style-type: none"> <li>• PPP—Point to point protocol (PPP) client events.</li> <li>• PPPoE—PPP over Ethernet client events.</li> <li>• PPPoA—PPP over ATM client events.</li> <li>• AAA—Authentication, authorization, and accounting (AAA) client events.</li> <li>• PPP SIP—PPP subscriber initiation process (SIP) events.</li> <li>• LTERM—Local termination client events.</li> <li>• AC—Attachment circuit events.</li> <li>• Virtual Template—Virtual template events.</li> </ul>

**Table 1** *show ccm clients Field Descriptions (continued)*

Field	Description
CCM bundles rcvd since last boot	<p>Number of the following types of CCM bundles received by the standby processor since bringup:</p> <ul style="list-style-type: none"> <li>• Sync Session—Synchronization session bundles.</li> <li>• Update Session—Update session bundles.</li> <li>• Active Bulk Sync—Active processor bulk synchronization bundles.</li> <li>• Session Down—Session down bundles.</li> <li>• ISSU client msgs—InISSU bundles.</li> <li>• Unknown msgs—Unknown message bundles.</li> </ul>
Client events extracted since last boot	<p>Number of the following client events extracted since bringup on the standby processor:</p> <ul style="list-style-type: none"> <li>• PPP—PPP client events.</li> <li>• PPPoE—PPPoE client events.</li> <li>• PPPoA—PPPoAclient events.</li> <li>• AAA—AAA client events.</li> <li>• PPP SIP—PPP SIP events.</li> <li>• LTERM—Local termination client events.</li> <li>• AC—Attachment circuit events.</li> </ul>

**Related Commands**

Command	Description
<b>show ccm queues</b>	Displays CCM queue statistics.
<b>show ccm sessions</b>	Displays CCM session information.

# show ccm queues

To display cluster control manager (CCM) queue statistics for high availability (HA) dual route processor systems, use the **show ccm queues** command in privileged EXEC mode.

## show ccm queues

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(31)SB2	This command was introduced.

**Usage Guidelines** The CCM manages the capability to synchronize session bringup on the standby processor of a redundant processor HA system. 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.

**Examples** The following is sample output from the **show ccm queues** command. No field descriptions are provided because command output is used for Cisco internal debugging purposes only.

```
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
```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>show ccm clients</b>	Displays CCM client information
<b>show ccm sessions</b>	Displays CCM session information

# show ccm sessions

To display information about cluster control manager (CCM) sessions on high availability (HA) dual route processor systems, use the **show ccm sessions** command in privileged EXEC mode.

## show ccm sessions

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(31)SB2	This command was introduced.

**Usage Guidelines** The CCM manages the capability to synchronize session bringup on the standby processor of a redundant processor HA system. Use the **show ccm sessions** command to display information on CCM sessions on active and standby processors, and also to display information on subscriber redundancy policies configured using the **subscriber redundancy** command.

**Examples** The following is sample output from the **show ccm sessions** command on the active processor of a Cisco 10000 series router:

```
Router# show ccm sessions

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

Timeout: Timer Type   Delay   Remaining Starts   CPU Limit CPU Last
-----
Rate                  00:00:01 -      2           -           -
Dynamic CPU           00:00:10 -      0           90          0
```

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

```
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      -      -

```

[Table 2](#) describes the significant fields shown in the display. Any data not described in [Table 2](#) is used for Cisco internal debugging purposes.

**Table 2** *show ccm sessions Field Descriptions*

Field	Description
Global CCM state	Displays the number and state of CCM sessions on the following processors: <ul style="list-style-type: none"> <li>• CCM HA Active- Dynamic Sync</li> <li>• CCM HA Standby - Collecting</li> </ul>
Global ISSU state	Compatible clients indicates that CCM compatible in service software upgrade (ISSU) clients — that is, ISSU-compatible Cisco IOS versions — are running on both processors.
Current	CCM sessions currently ready for synchronization.
Bulk Sent	CCM sessions sent during bulk synchronization.
Bulk Rcvd	CCM sessions received during bulk synchronization.
Number of sessions in state Down	Sessions in the down state.
Number of sessions in state Not Ready	Sessions in the not ready state.
Number of sessions in state Ready	Sessions in the ready state.
Number of sessions in state Dyn Sync	Sessions in the dynamic synchronization state.
Timeout	Displays statistics for the following timers: <ul style="list-style-type: none"> <li>• Rate—Monitors the number of sessions to be synchronized per configured time period.</li> <li>• Dynamic CPU—Monitors CPU limit, number of sessions, delay, and allowed calls configured for dynamic synchronization parameters.</li> <li>• Bulk Time Li—Monitors the time limit configured for bulk synchronization.</li> <li>• RF Notif Ext—Monitors redundancy facility(RF) active and standby state progressions and events.</li> </ul> Use the <b>subscriber redundancy</b> command to modify parameters that these timers monitor.
Delay	Timer delay in seconds for bulk and dynamic synchronization for subscriber sessions.
Remaining	Indicates remaining time in seconds before the timer expires.

**Table 2** *show ccm sessions Field Descriptions (continued)*

Field	Description
Starts	Indicates the number of times the timer started.
CPU Limit	CPU usage percentage, a configurable value; default 90 percent.
CPU Last	Indicates the last time in hours, minutes, and seconds that the CPU limit timer was running.

**Related Commands**

Command	Description
<b>show ccm clients</b>	Displays CCM client information.
<b>show ccm queues</b>	Displays CCM queue information.
<b>subscriber redundancy</b>	Configures subscriber session redundancy policies.

# show ppp subscriber statistics

To display PPP subscriber statistics, use the **show ppp subscriber statistics** command in privileged EXEC mode.

## show ppp subscriber statistics

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(31)SB2	This command was introduced.

**Usage Guidelines** 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.

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

```
Router# show ppp subscriber statistics

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

[Table 5](#) describes the significant fields shown in the displays. Any data not described in [Table 5](#) is used for internal debugging purposes.

**Table 3** *show ppp subscriber statistics Field Descriptions*

Field	Description
PPP Subscriber Events	PPP subscriber event counts.
Encap	Number of times PPP encapsulation occurred.
DeEncap	Number of times PPP deencapsulation occurred.
CstateUp	Number of times PPP interfaces are initialized.
CstateDown	Number of times PPP interfaces were shut down.
FastStart	Number of PPP sessions started by link control protocol (LCP) packets before the interface state was up.
LocalTerm	Number of locally terminated PPP sessions.
LocalTermVP	Number of locally terminated PPP sessions running on virtual profiles.
MoreKeys	Number of PPP sessions in the intermediate state — that is, processing service keys — before a session is forwarded or terminated locally.
Forwarding	Number of PPP sessions in forwarding state.
Forwarded	Number of PPP sessions that have been forwarded.
SSSDisc	Number of PPP sessions disconnected from the subscriber service switch after receiving disconnect notification.
SSMDisc	Number of PPP sessions disconnected from the dataplane after receiving disconnect notification.
PPP BindResp	Number of PPP responses where the interface has been bound to the session.
PPP Reneg	Number of PPP renegotiation events.
Restart Timeout	Occurrences of the restart timer beginning on PPP encapsulated interfaces in the down state.
PPP Subscriber Statistics	PPP subscriber statistic counts.
IDB CSTATE UP	Occurrences of the IDB making the transition to the up state.
IDB CSTATE DOWN	Occurrences of the IDB making the transition to the down state.
APS UP	Occurrences of PPP sessions receiving automatic protection switching (APS) selected events.
APS UP IGNORE	Occurrences of PPP sessions receiving APS selected events when the IDB state was down.
APS DOWN	Occurrences of PPP sessions receiving APS deselected events.
READY FOR SYNC	Number of PPP sessions ready for synchronization.

**Related Commands**

Command	Description
<b>clear ppp subscriber statistics</b>	Clears PPP subscriber statistics.

# show pppatm statistics

To display PPP over ATM (PPPoA) statistics, use the **show pppatm statistics** command in privileged EXEC mode.

## show pppatm statistics

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(31)SB2	This command was introduced.

**Usage Guidelines** Use the **show pppatm statistics** command to obtain statistics for PPPoA sessions. This command gives a total count of PPPoA events since the **clear pppatm statistics** command was last issued.

**Examples** 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
```

[Table 4](#) describes the significant fields shown in the displays. Any data not described in [Table 4](#) is used for internal debugging purposes.

**Table 4** *show pppatm statistics Field Descriptions*

Field	Description
Context allocated events	Number of PPPoA events for which a context has been allocated.
SSS request events	Subscriber service switch (SSS) requests.
SSS Msg events	SSS responses
PPP Msg events	PPP responses.

**Table 4** *show pppatm statistics Field Descriptions*

Field	Description
Up Pending events	ATM VC notification of events in queue.
Up dequeued events	ATM VC notification of events removed from queue.
Processing Up events	PPPoA events processed.
Vaccess Up events	Number of events for which the virtual access interface state changed to up.
AAA unique id allocated events	Number of events for which a unique AAA ID was allocated.
No AAA method list set events	Number of events for which no AAA accounting list was configured.
AAA get NAS port details events	Number of NAS port events.
AAA gets retrieved attrs events	Number of AAA retrieved attributes events for incoming and outgoing packets.
AAA gets dynamic attrs events	Number of AAA dynamic attributes events for start/stop packets.
Access IE allocated events	Number of IE (internal ID ) allocated events.

**Related Commands**

Command	Description
<b>clear pppatm statistics</b>	Clears PPP ATM statistics.

# show pppoe statistics

To display PPP over Ethernet (PPPoE) events and statistics, use the **show pppoe statistics** command in privileged EXEC mode.

## show pppoe statistics

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(31)SB2	This command was introduced.

**Usage Guidelines** 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.

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

```
Router# show pppoe statistics

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

```
show pppoe statistics
```

```
Static Bind Request          16002          16002
```

Table 5 describes the significant fields shown in the displays. Any data not described in Table 5 is used for internal debugging purposes.

SSS

**Table 5** *show pppoe statistics Field Descriptions*

Field	Description
INVALID	Errors in the segment handling state machine; this field typically displays a zero.
PRE-SERVICE FOUND	Number of occurrences of PPPoE service policy having been located and configuration data having been read from the external server to the bba-group profile.
PRE-SERVICE NONE	Number of failures of PPPoE service policy profile configuration read from the external server .
SSS CONNECT LOCAL	Subscriber service switch (SSS) connections that received local termination directives.
SSS FORWARDING	SSS connections that received forwarding notification.
SSS FORWARDED	SSS connections that received forwarded notification.
SSS MORE KEYS	PPPoE sessions that are in the intermediate state, processing service keys, before a session is forwarded or terminated locally.
SSS DISCONNECT	PPPoE sessions disconnected after receiving a disconnect notification from the subscriber service switch.
CONFIG UPDATE	PPPoE sessions receiving serving policy configuration updates.
STATIC BIND RESPONSE	Number of responses that the interface is bound to the PPP session.
PPP FORWARDING	Number of PPPoE sessions in the forwarding state.
PPP FORWARDED	Number of forwarded PPPoE sessions.
PPP DISCONNECT	PPPoE sessions disconnected after receiving a disconnect message from the state machine.
PPP RENEGOTIATION	PPPoE sessions renegotiated after receiving a renegotiation message from the state machine.
SSM PROVISIONED	Segment switching manager (SSM) response that the dataplane has been initialized.
SSM UPDATED	SSM response that the dataplane has been successfully updated.
SSM DISCONNECT	Dataplane disconnects from PPPoE sessions.
SSS Request	SSS requests to determine if a call is to be forwarded or locally terminated.
SSS Response Stale	SSS responses received for sessions that are already freed.
SSS Disconnect	SSS disconnect messages to PPPoE sessions.
PPPoE Handles Allocated	Handles assigned for PPPoE sessions.
PPPoE Handles Freed	Handles freed for PPPoE sessions.
Dynamic Bind Request	PPPoE requests to start PPP sessions.
Static Bind Request	PPPoE requests to bind interfaces to PPP sessions

---

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>clear pppoe statistics</b>	Clears PPPoE statistics.

---

# subscriber redundancy

To configure broadband subscriber session redundancy policy for synchronization between high availability (HA) active and standby processors, use the **subscriber redundancy** command in global configuration mode. To delete the policy, use the **no** form of this command.

**subscriber redundancy** [**bulk limit** *cpu percentage* **delay** *seconds* **allow** *value*] [**dynamic limit** *cpu percentage* **delay** *seconds* **allow** *value*] [**delay** *time*] [**rate** *sessions time*]

**no subscriber redundancy**

Syntax Description	
<b>bulk</b>	(Optional) Configures bulk synchronization redundancy policy.
<b>dynamic</b>	(Optional) Configures dynamic synchronization redundancy policy.
<b>limit</b> <i>cpu percent</i>	(Optional) Specifies CPU busy threshold value as a percentage. Range 0 to 100, default 90.
<b>delay</b> <i>seconds</i>	(Optional) Specifies delay in seconds before the CCM component synchronizes sessions after the CPU busy threshold is exceeded.
<b>allow</b> <i>value</i>	(Optional) 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.
<b>delay</b> <i>time</i>	(Optional) Specifies minimum amount of time in seconds that a session must be ready before dynamic synchronization occurs. Range is 1 to 33,550.
<b>rate</b> <i>sessions time</i>	(Optional) Specifies number of sessions per time period for bulk and dynamic synchronization . <ul style="list-style-type: none"> <li>• <i>sessions</i>—Range 1 to 32,000, default is 250.</li> <li>• <i>time</i>—Range in seconds is 1 to 33,550, default is 1.</li> </ul>

**Command Default** Subscriber redundancy policy applies default values.

**Command Modes** Global configuration

Command History	Release	Modification
	12.2(31)SB2	This command was introduced.

**Usage Guidelines** Cisco IOS HA functionality for broadband protocols and applications allows for stateful switchover (SSO) and in service software upgrade (ISSU) features that minimize planned and unplanned downtime and failures. HA uses the cluster control manager (CCM) to manage the capability to synchronize subscriber session bring up on the standby processor of a redundant processor system. Use the **subscriber redundancy bulk** command to create and modify redundancy policy used during bulk (startup) synchronization. Use the **subscriber redundancy dynamic** command to tune subscriber redundancy policies that throttle dynamic synchronization by monitoring CPU usage and sync rates. Use

the **subscriber redundancy delay** command to establish session duration minimums for synchronization and manage dynamic syncing of short duration calls. Use the **subscriber redundancy rate** command to throttle the number of sessions to be synchronized per period.

### Examples

The following example configures a 10 second delay when CPU usage exceeds 90 percent during bulk synchronization, after which 25 sessions will be synced before the CCM again checks CPU usage:

```
Router(config)# subscriber redundancy bulk limit cpu 90 delay 10 allow 25
```

The following example configures a minimum session duration of 15 seconds before dynamic synchronization to the standby processor:

```
Router(config)# subscriber redundancy dynamic 15
```

The following example configures 2000 sessions to be synchronized per second during bulk and dynamic synchronization:

```
Router(config)# subscriber redundancy rate 2000 1
```

### Related Commands

Command	Description
<b>show ccm sessions</b>	Displays CCM session information
<b>show ppp subscriber statistics</b>	Displays PPP subscriber statistics
<b>show pppatm statistics</b>	Displays PPPoA statistics
<b>show pppoe statistics</b>	Displays PPPoE statistics

# Feature Information for Cisco IOS Broadband High Availability In Service Software Upgrade

Table 6 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 6 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 6** Feature Information for Cisco IOS Broadband High Availability In Service Software Upgrade

Feature Name	Releases	Feature Information
Cisco IOS Broadband High Availability In Service Software Upgrade	12.2(31)SB2	The Cisco IOS Broadband High Availability (HA) In Service Software Upgrade (ISSU) feature provides the capability for the dual Route Processor (RP) Cisco 10000 series platforms to support continuous operations during software upgrades, downgrades and service enhancements.

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