



Cisco IOS Broadband High Availability In Service Software Upgrade

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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.

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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 [Configuring 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.

**Note**

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 [Performing a 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

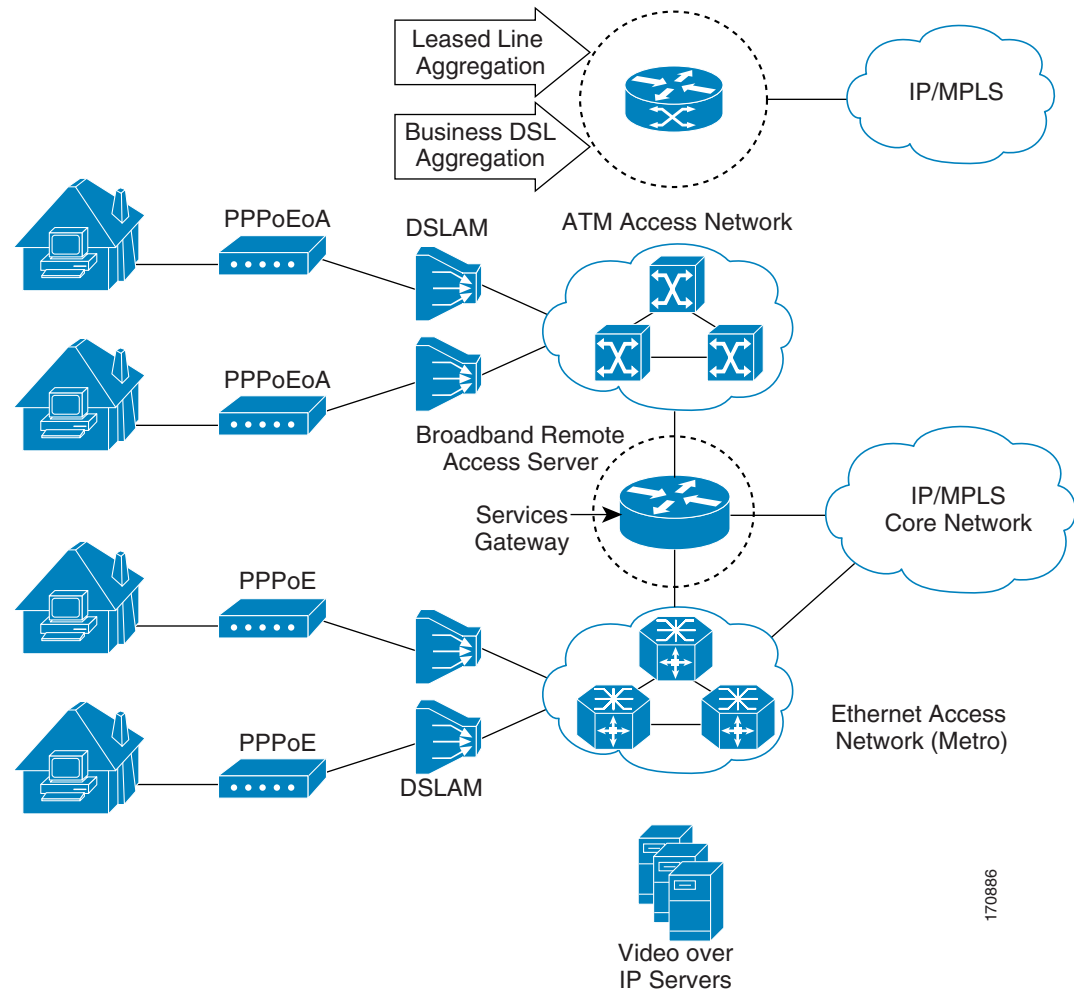
The Cisco IOS Broadband High Availability In Service Software Upgrade feature delivers ISSU capability for PPP over Ethernet (PPPoE) subscriber access sessions, including PPPoE, PPPoEVLAN, and PPPoE802.1q-in-q sessions, during supported software upgrades, downgrades and enhancements.

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*



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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.

SUMMARY STEPS

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

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	subscriber redundancy [bulk limit cpu percentage delay seconds allow value][dynamic limit cpu percentage delay seconds allow value][delay time][rate sessions time] Example: Router(config)# subscriber redundancy bulk limit cpu 75 delay 20 allow 30	(Optional) Configures subscriber redundancy policy. • bulk—Configures bulk synchronization redundancy policy. • limit cpu percentage—Specifies CPU busy threshold value as a percentage. Range 0 to 100, default is 90. • delay seconds—Specifies delay in seconds before the CCM component synchronizes sessions after the CPU busy threshold is exceeded. • allow value—Specifies the minimum number of sessions to synchronize once the CPU busy threshold is exceeded and the specified delay is met. Range is 1 to 2147483637; default is 25. • dynamic—Configures dynamic synchronization redundancy policy. • delay time—Specifies minimum amount of time in seconds that a session must be ready before dynamic synchronization occurs. Range is 1 to 33550. • rate sessions time—Specifies number of sessions per time period for bulk and dynamic synchronization. – <i>sessions</i>—Range is 1 to 32000; default is 250. – <i>time</i>—Range in seconds is 1 to 33550; default is 1.
Step 4	exit Example: Router(config)# exit	Exits the current configuration mode.

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	0
2 4 Sync Client	0	0	0	0	0	0	0
3 4 Update	0	0	0	0	0	0	0
4 4 Session Down	0	0	0	0	0	0	0
5 4 Bulk Sync Begi	0	0	0	0	0	0	0
6 4 Bulk Sync Cont	0	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	0
9 4 Going Standby	1	0	1	0	10	10	
10 4 Standby Presen	0	0	0	0	0	0	0
11 4 Standby Gone	0	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	0
15 4 Recr Update	0	0	0	0	0	0	0
16 4 Recr Sess Down	0	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		

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 11](#)

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 vrfl
    rd 1:1
    route-target export 1:1
    route-target import 1:1
!
no ip dhcp use vrf connected
!
!
!
!
no subscriber policy recording rules

```

The following lines show subscriber redundancy policy configuration:

```

subscriber redundancy dynamic limit cpu 90 delay 10 subscriber redundancy bulk limit cpu
90 delay 10 subscriber redundancy rate 4000 1 subscriber redundancy delay 10 no mpls
traffic-eng auto-bw timers frequency 0 mpls ldp graceful-restart mpls ldp router-id
Loopback100 no virtual-template snmp 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

Related Documents

Related Topic	Document Title
Information about Cisco 10000 series routers and broadband aggregation	Cisco 10000 Series Software Configuration Guide
Performing an ISSU	Performing a Cisco IOS In Service Software Upgrade Process
Information about the broadband SSO feature	Cisco IOS Broadband Access Aggregation and DSL Configuration Guide
Information about SSO	Configuring Stateful Switchover
Information about NSF	Configuring Nonstop Forwarding

Standards

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

MIBs

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

RFCs

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

Technical Assistance

Description	Link
The Cisco Technical Support & Documentation website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, tools, and technical documentation. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport

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

Table 1 lists the release history for this feature.

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

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



Note

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

Table 1 Feature Information for 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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