Line Card Redundancy

The line cards support high availability with redundancy schemes. Line card redundancy can help limit customer premises equipment (CPE) downtime by enabling robust automatic switchover and recovery in the event that there is a localized system failure.

Finding Feature Information

Your software release may not support all the features that are documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. The Feature Information Table at the end of this document provides information about the documented features and lists the releases in which each feature is supported.

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Hardware Compatibility Matrix for the Cisco cBR Series Routers

Note

The hardware components that are introduced in a given Cisco IOS-XE Release are supported in all subsequent releases unless otherwise specified.
Table 1: Hardware Compatibility Matrix for the Cisco cBR Series Routers

<table>
<thead>
<tr>
<th>Cisco CMTS Platform</th>
<th>Processor Engine</th>
<th>Interface Cards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco cBR-8 Converged Broadband Router</td>
<td><strong>Cisco IOS-XE Release 3.15.0S and Later Releases</strong>&lt;br&gt;Cisco cBR-8 Supervisor:&lt;br&gt;• PID—CBR-CCAP-SUP-160G&lt;br&gt;• PID—CBR-CCAP-SUP-60G&lt;sup&gt;1&lt;/sup&gt;&lt;br&gt;• PID—CBR-SUP-8X10G-PIC</td>
<td><strong>Cisco IOS-XE Release 3.15.0S and Later Releases</strong>&lt;br&gt;Cisco cBR-8 CCAP Line Cards:&lt;br&gt;• PID—CBR-LC-8D30-16U30&lt;br&gt;• PID—CBR-LC-8D31-16U30&lt;br&gt;• PID—CBR-RF-PIC&lt;br&gt;• PID—CBR-RF-PROT-PIC&lt;br&gt;Cisco cBR-8 Downstream PHY Modules:&lt;br&gt;• PID—CBR-D30-DS-MOD&lt;br&gt;• PID—CBR-D31-DS-MOD&lt;br&gt;Cisco cBR-8 Upstream PHY Modules:&lt;br&gt;• PID—CBR-D30-US-MOD</td>
</tr>
</tbody>
</table>

<sup>1</sup> Effective with Cisco IOS-XE Release 3.17.0S, CBR-CCAP-SUP-60G supports 8 cable line cards. The total traffic rate is limited to 60 Gbps. The total number of downstream service flows is limited to 72268, and downstream unicast low-latency flow does not count against the limits.

**Prerequisites for Line Card Redundancy**

• At least one RF Through PIC and its corresponding interface line card must be installed in the chassis to be configured as the primary card.

• An RF Protect PIC and its corresponding interface line card must be installed in the chassis to be configured as the secondary card.

**Restrictions for Line Card Redundancy**

• The line cards installed in slot 3 and 6 of the Cisco cBR-8 router cannot be configured as the secondary card.

• The RF Protect PIC can send RF signals only to the lower slots (with larger slot number). So, the slot number of the secondary card must be the smallest in the redundancy group.
We recommend that you install the RF Protect PIC in the uppermost slot (slot 0) of the chassis and configure it as the secondary card.

- The RF Through PIC can send RF signal only from upper slot to lower slot. So, do not install any RF blank PICs between the secondary card and primary cards.
- You cannot change any configuration on the primary or secondary card when the secondary card is active.
- You cannot remove the last primary card if there is a secondary card in the redundancy group. You must remove the secondary card and then remove the primary card.
- If the primary card is in the standby role, you must revert to the primary card before removing it from the redundancy group.

Information About Line Card Redundancy

Line card redundancy reduces the unplanned downtime. When you configure line card redundancy, a protect zone (redundancy group) is created on the router and the configurations on the primary cards are synchronized with the secondary card.

The following events can trigger a switchover from an active card to a standby card:
- Manual switchover using the `redundancy linecard-group switchover from slot slot` command.
- Line card reload using the `hw-module slot reload` command.
- Line card crash.
- Line card Online Insertion and Removal (OIR).

The secondary card reloads after the switchover. The router can be configured to automatically revert to the primary card when it becomes hot standby after an unplanned switchover triggered by the line card OIR or crash.

Following are the line card redundancy states:
- **Unavail**—The line card state is not available.
- **Init**—The line card did not boot up.
- **Active Cold**—The active card is downloading the configuration.
- **Active**—The active card is fully configured and working.
- **Stdby Cold**—The standby card configuration is synchronizing with the active card.
- **Stdby Warm**—(Only for the secondary card) The standby card is fully synchronized and ready for switchover. It is the stable state of a secondary standby card.
- **Stdby Hot**—The primary standby card is fully synchronized. It is the stable state of a primary standby card. The secondary standby card is chosen to switchover for a primary card, and will be active soon. It is a transient state when secondary card is becoming active.
N+1 Line Card Redundancy

The Cisco cBR-8 router supports N+1 redundancy scheme for line cards. A single RF Protect PIC can be configured as a secondary card for multiple RF Through PICs (primary cards). In this redundancy scheme, when the secondary card becomes the active card for a primary card, the redundancy scheme is changed to 1+1 redundancy.

The Cisco cBR-8 router supports a single protect zone or redundancy group (group 0).

How to Configure Line Card Redundancy

This section contains the following:

Configuring Line Card Manual Switchover

Before you begin

The line card must be in active role, and warm standby or hot standby state. Use the `show redundancy linecard all` command to verify the role and state of the card.

Restrictions

- You cannot perform a manual switchover when the standby Supervisor is booting up and not yet entered into SSO.
- You cannot auto revert the switchover triggered manually.

Procedure

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
|        | enable            | Enables privileged EXEC mode.  
| Example: |                   |  
|        |                   | • Enter your password if prompted. |
|        | redundancy linecard-group switchover from slot slot 9 | Manually switches over from the active line card. |

Configuring N+1 Line Card Redundancy

Procedure

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
|        | enable            | Enables privileged EXEC mode.  
<p>| Example: |                   |<br />
|        |                   | • Enter your password if prompted. |</p>
<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Step 2 configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3 redundancy</td>
<td>Enables redundancy and enters redundancy</td>
</tr>
<tr>
<td>Example:</td>
<td>configuration mode.</td>
</tr>
<tr>
<td>Router(config)# redundancy</td>
<td></td>
</tr>
<tr>
<td>Step 4 linecard-group group-id</td>
<td>Configures the redundancy group and enters</td>
</tr>
<tr>
<td>internal-switch</td>
<td>the line card redundancy configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config-red)# linecard-group 0 internal-switch</td>
<td></td>
</tr>
<tr>
<td>Step 5 description group-description</td>
<td>(Optional) Configures the redundancy group</td>
</tr>
<tr>
<td>Example:</td>
<td>description.</td>
</tr>
<tr>
<td>Router(config-red-lc)# description RedundancyGroup0</td>
<td></td>
</tr>
<tr>
<td>Step 6 class 1:N</td>
<td>Configures the N+1 redundancy class for the</td>
</tr>
<tr>
<td>Example:</td>
<td>redundancy group.</td>
</tr>
<tr>
<td>Router(config-red-lc)# class 1:N</td>
<td></td>
</tr>
<tr>
<td>Step 7 revertive seconds</td>
<td>(Optional) Configures the auto revert time</td>
</tr>
<tr>
<td>Example:</td>
<td>for the primary card, in seconds.</td>
</tr>
<tr>
<td>Router(config-red-lc)# revertive 60</td>
<td></td>
</tr>
<tr>
<td>Step 8 member slot slot primary</td>
<td>Adds the line card as a primary card in the</td>
</tr>
<tr>
<td>Example:</td>
<td>redundancy group.</td>
</tr>
<tr>
<td>Router(config-red-lc)# member slot 1 primary</td>
<td>Repeat this step for each primary card to be added in the redundancy group.</td>
</tr>
<tr>
<td>Step 9 member slot slot secondary</td>
<td>Adds the line card as a primary card in the</td>
</tr>
<tr>
<td>Example:</td>
<td>redundancy group.</td>
</tr>
<tr>
<td>Router(config-red-lc)# member slot 0 secondary</td>
<td></td>
</tr>
<tr>
<td>Step 10 end</td>
<td>Returns to privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config-red-lc)# end</td>
<td></td>
</tr>
</tbody>
</table>

Verifying the Line Card Redundancy Configuration

- `show redundancy linecard group all`—Displays the redundancy group information.
The following is a sample output of this command:

Router# show redundancy linecard group all

Group Identifier: 0
Revertive, Revert Timer: OFF (60000 sec)
Reserved Cardtype: 0xFFFFFFFF 4294967295
Group Redundancy Type: INTERNAL SWITCH
Group Redundancy Class: 1:N
Group Redundancy Configuration Type: LINECARD GROUP
Primary: Slot 6
Primary: Slot 7
Secondary: Slot 0

• show redundancy linecard all—Displays the role and state information for all line cards.

Following is a sample output of this command:

Router# show redundancy linecard all

<table>
<thead>
<tr>
<th>Slot</th>
<th>Subslot</th>
<th>Group</th>
<th>State</th>
<th>State</th>
<th>Slot</th>
<th>Subslot</th>
<th>Role</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Stdb Cold</td>
<td>0</td>
<td>-</td>
<td>Active Primary</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Stdb Warm</td>
<td>0</td>
<td>-</td>
<td>Active Primary</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Stdb Warm</td>
<td>0</td>
<td>-</td>
<td>Active Primary</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Stdb Cold</td>
<td>0</td>
<td>-</td>
<td>Active Primary</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Stdb Cold</td>
<td>0</td>
<td>-</td>
<td>Active Primary</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Stdb Cold</td>
<td>0</td>
<td>-</td>
<td>Active Primary</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Stdb Cold</td>
<td>0</td>
<td>-</td>
<td>Active Primary</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Multiple None</td>
<td>Standby Secondary</td>
<td></td>
</tr>
</tbody>
</table>

Note
The secondary card does not have a valid My State when it is in Standby role as it is the peer for N primary cards. The secondary card has N peer states. For example, it can be cold standby for some primary cards and warm standby for the other primary card.

Following is a sample output of the command when secondary card becomes active for a primary card, and the N+1 redundancy is changed to 1+1 redundancy:

Router# show redundancy linecard all

<table>
<thead>
<tr>
<th>Slot</th>
<th>Subslot</th>
<th>Group</th>
<th>State</th>
<th>State</th>
<th>Slot</th>
<th>Subslot</th>
<th>Role</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>-</td>
<td>0</td>
<td>Stdb Hot</td>
<td>Active</td>
<td>0</td>
<td>-</td>
<td>Standby Primary</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Unavail</td>
<td>0</td>
<td>-</td>
<td>Active Primary</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Unavail</td>
<td>0</td>
<td>-</td>
<td>Active Primary</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Unavail</td>
<td>0</td>
<td>-</td>
<td>Active Primary</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Unavail</td>
<td>0</td>
<td>-</td>
<td>Active Primary</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Unavail</td>
<td>0</td>
<td>-</td>
<td>Active Primary</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Unavail</td>
<td>0</td>
<td>-</td>
<td>Active Primary</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>-</td>
<td>0</td>
<td>Active</td>
<td>Stdb Hot</td>
<td>9</td>
<td>-</td>
<td>Active Secondary</td>
<td></td>
</tr>
</tbody>
</table>

• show redundancy linecard slot—Displays the redundancy information for the line card.

Following is a sample output of the command:
Line Card Redundancy

Router# show redundancy linecard slot 9

LC Redundancy Is Configured:
LC Group Number: 0
LC Slot: 9 (idx=9)
LC Peer Slot: 0
LC Card Type: 0x4076, 16502
LC Name: 9
LC Mode: Primary
LC Role: Active
LC My State: Active
LC Peer State: Stdby Warm

• show redundancy linecard history—Displays the state change history for all line cards.

Following is a sample output of the command:

Router# show redundancy linecard history

Jan 05 2012 12:24:27 20559 - st_mem(9): MY State Change, (Active Wait) -> (Active)
Jan 05 2012 12:24:27 20559 - st_mem(9): MY FSM execution, Active Wait:State Ntfy
Jan 05 2012 12:24:27 20559 - st_mem(9): MY State Change, (Active LC Cfg Dnld) -> (Active Wait)
Jan 05 2012 12:24:27 20559 - st_mem(9): MY FSM execution, Active LC Cfg Dnld:Init:Cfg Dnld Done
Jan 05 2012 12:24:27 20559 - st_mem(9): MY State Change, (Active Cold) -> (Active LC Cfg Dnld)
Jan 05 2012 12:23:09 12763 - st_mem(9): MY FSM execution, Active Cold:Init:Ccfg Dnld
Jan 05 2012 12:23:09 12760 - st_mem(9): MY State Change, (Init) -> (Active Cold)

• show lcha rfsw—Displays the internal RF switch PIC state information.

Following is a sample output of the command:

Router# show lcha rfsw

Slot 0 ----------------------------------------------
Type : Secondary PIC State: normal
Slot 1 ----------------------------------------------
Type : Primary PIC State: normal

• show lcha logging level—Displays the cable modem line card logs.

Following is a sample output of the command:

Router# show lcha logging level noise

11:02:03.313 CST Tue Nov 18 2014 [error] [slot=3] [txn=229] Peer-Up Message [tag=1011] to slot 3 complete [36144 ms]; status=nak response
11:02:03.313 CST Tue Nov 18 2014 [error] [slot=0] [txn=229] Slot 0 downloaded configuration for slot 3; result-peer-up notification failed
11:02:03.316 CST Tue Nov 18 2014 [noise] [slot=0] [txn=none] lcha_plfm_get_max_port_count_for_slot: slot 0 maximum port count is 1794
11:02:03.316 CST Tue Nov 18 2014 [noise] [slot=0] [txn=none] lcha_plfm_get_starting_port_index: slot 0 starting port count is 0
11:02:03.331 CST Tue Nov 18 2014 [note] [slot=0] [txn=none] Slot 0 is being reset
11:02:04.352 CST Tue Nov 18 2014 [note] [slot=0] [txn=none] slot 0 removed

Line Card Redundancy
• When the secondary card is active, you can use the slot number of either the primary or secondary card in the `show` commands.

Following is a sample output of the `show interfaces` command after the primary card in slot 8 switches over to secondary card in slot 0:

```
Router# show interfaces c0/0/0
Cable0/0/0 is up, line protocol is up
Hardware is CMTS MD interface, address is 0000.0000.031e (bia 0000.0000.031e)
MTU 1500 bytes, BW 26000 Kbit/sec, DLY 1000 usec,
  reliability 255/255, txload 1/255, rxload 1/255
Encapsulation MCNS, loopback not set
Keepalive set (10 sec)
ARP type: ARPA, ARP Timeout 04:00:00
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
  Conversations 0/0/256 (active/max active/max total)
  Reserved Conversations 0/0 (allocated/max allocated)
Available Bandwidth 19500 kilobits/sec
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 13000 bits/sec, 17 packets/sec
  0 packets input, 0 bytes, 0 no buffer
  Received 0 broadcasts (0 multicasts)
  0 runs, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
140520 packets output, 14052672 bytes, 0 underruns
  0 output errors, 0 collisions, 1 interface resets
  0 unknown protocol drops
  0 output buffer failures, 0 output buffers swapped out
```

```
Router# show interfaces c8/0/0
Cable0/0/0 is up, line protocol is up
Hardware is CMTS MD interface, address is 0000.0000.031e (bia 0000.0000.031e)
MTU 1500 bytes, BW 26000 Kbit/sec, DLY 1000 usec,
  reliability 255/255, txload 1/255, rxload 1/255
Encapsulation MCNS, loopback not set
Keepalive set (10 sec)
ARP type: ARPA, ARP Timeout 04:00:00
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
  Conversations 0/0/256 (active/max active/max total)
  Reserved Conversations 0/0 (allocated/max allocated)
Available Bandwidth 19500 kilobits/sec
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 14000 bits/sec, 18 packets/sec
  0 packets input, 0 bytes, 0 no buffer
  Received 0 broadcasts (0 multicasts)
  0 runs, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
140616 packets output, 14062272 bytes, 0 underruns
  0 output errors, 0 collisions, 1 interface resets
  0 unknown protocol drops
  0 output buffer failures, 0 output buffers swapped out
```
• When the secondary card is active, the `show running-config` command displays the output for the secondary card.

    Note

    The output of the `show running-config` command is empty for the primary card when the secondary card is active.

Following is a sample output of the `show running-config` command after the primary card in slot 8 switches over to secondary card in slot 0:

```
Router# show running-config | begin controller Upstream-Cable 0
controller Upstream-Cable 0/0/0
  us-channel 0 channel-width 1600000 1600000
  us-channel 0 docsis-mode atdma
  us-channel 0 minislot-size 4
  us-channel 0 modulation-profile 221
  no us-channel 0 shutdown
  us-channel 1 channel-width 1600000 1600000
  us-channel 1 docsis-mode atdma

Router# show running-config | begin controller Upstream-Cable 8
Router#
Router#
```

### Additional References

#### Related Documents

<table>
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<tr>
<th>Related Topic</th>
<th>Document Title</th>
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<tr>
<td>CMTS commands</td>
<td>Cisco CMTS Cable Command Reference</td>
</tr>
</tbody>
</table>

#### Technical Assistance

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<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Cisco Support website provides extensive online resources, including</td>
<td><a href="http://www.cisco.com/support">http://www.cisco.com/support</a></td>
</tr>
<tr>
<td>documentation and tools for troubleshooting and resolving technical issues</td>
<td></td>
</tr>
<tr>
<td>with Cisco products and technologies.</td>
<td></td>
</tr>
<tr>
<td>To receive security and technical information about your products, you can</td>
<td></td>
</tr>
<tr>
<td>subscribe to various services, such as the Product Alert Tool (accessed from</td>
<td></td>
</tr>
<tr>
<td>Field Notices), the Cisco Technical Services Newsletter, and Really Simple</td>
<td></td>
</tr>
<tr>
<td>Syndication (RSS) Feeds.</td>
<td></td>
</tr>
<tr>
<td>Access to most tools on the Cisco Support website requires a Cisco.com user</td>
<td></td>
</tr>
<tr>
<td>ID and password.</td>
<td></td>
</tr>
</tbody>
</table>
Feature Information for Line Card Redundancy

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

The following table lists the software release in which a given feature is introduced. Unless noted otherwise, subsequent releases of that software release train also support that feature.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>N+1 Line Card Redundancy</td>
<td>Cisco IOS-XE Release 3.16.0S</td>
<td>This feature was introduced on the Cisco cBR Series Converged Broadband Routers.</td>
</tr>
</tbody>
</table>