Virtual Interface Bundling

Virtual Interface Bundling allows supports combining multiple cable interfaces in a Cisco cBR series router into a single logical bundle, so as to conserve IP address space and simplify network management.

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.

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

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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

Cisco CMTS Platform	Processor Engine	Interface Cards
Cisco cBR-8 Converged Broadband Router	**Cisco IOS-XE Release 16.5.1 and Later Releases** Cisco cBR-8 Supervisor: • PID—CBR-SUP-250G • PID—CBR-CCAP-SUP-160G	**Cisco IOS-XE Release 16.5.1 and Later Releases** Cisco cBR-8 CCAP Line Cards: • PID—CBR-LC-8D30-16U30 • PID—CBR-LC-8D31-16U30 • PID—CBR-RF-PIC • PID—CBR-RF-PROT-PIC • PID—CBR-CCAP-LC-40G • PID—CBR-CCAP-LC-40G-R • PID—CBR-CCAP-LC-G2-R • PID—CBR-SUP-8X10G-PIC • PID—CBR-2X100G-PIC Digital PICs: • PID—CBR-DPIC-8X10G • PID—CBR-DPIC-2X100G Cisco cBR-8 Downstream PHY Module: • PID—CBR-D31-DS-MOD Cisco cBR-8 Upstream PHY Modules: • PID—CBR-D31-US-MOD

Note Do not use DPICs (8X10G and 2x100G) to forward IP traffic, as it may cause buffer exhaustion, leading to line card reload.

The only allowed traffic on a DPIC interface is DEPI, UEPI, and GCP traffic from the Cisco cBR-8 router to Remote PHY devices. Other traffic such as DHCP, SSH, and UTSC should flow via another router, since DPICs cannot be used for normal routing.

Information About Virtual Interface Bundling

This section contains the following:

Overview of Virtual Interface Bundling

Note All cable bundles are automatically converted and configured to virtual interface bundles. Any standalone cable interfaces must be manually configured to be in a virtual bundle to operate properly.

Virtual interface bundling supports the following:

- Virtual interface bundling uses *bundle interface* and *bundle members* instead of primary or secondary interfaces.

- A virtual bundle interface is virtually defined, as with IP loopback addresses.

- Virtual interface bundling supports bundle information in multiple **show** commands.

- The CISCO-DOCS-EXT-MIB is updated for cable helper-address and IPv6 DHCP relay configurations.

Virtual interface bundling prevents loss of connectivity on physical interfaces should there be a failure, problematic online insertion and removal (OIR) of one line card in the bundle, or erroneous removal of configuration on the primary interface.

Virtual interface bundling supports and governs the following Layer 3 settings for the bundle member interfaces:

- IP address

- IP helper-address

- source-verify and lease-timer functions

- cable dhcp-giaddr (The giaddr field is set to the IP address of the DHCP client.)

- Protocol Independent Multicast (PIM)

- Access control lists (ACLs)

- Sub-interfaces

- IPv6

- 1982 bytes layer 3 MTU.

Note In case customer wants to test 1982 bytes MTU by issuing a ping from CMTS to DOCSIS 3.1 modem, **cable mtu-override** command needs to be configured. After the test, please remove this configuration using **no cable mtu-override** command. By default, there is no cable mtu-override configured in bundle interface.

Note This virtual interface for the bundle should always remain on (enabled with **no shutdown**).

Guidelines for Virtual Interface Bundling

The following guidelines describe virtual interface bundling:

- Initial configuration of the first virtual bundle *member* automatically creates a virtual bundle interface.

- All cable bundles are automatically converted and configured to be in a virtual bundle after loading the software image.

- Standalone cable interfaces must be manually configured to be in a virtual bundle to operate properly.

- The virtual bundle interface accumulates the counters from members; counters on member links are not cleared when they are added to the bundle. If a bundle-only counter is desired, clear the bundle counter on the members before adding them to the bundle, or before loading the image.

- This feature supports a maximum of 40 virtual interface bundles, with the numeric range from 1 to 255.

- The virtual bundle interface remains configured unless specifically deleted, even if all members in the bundle are deleted.

- This feature supports subinterfaces on the virtual bundle interface.

- *Bundle-aware* configurations are supported on the virtual bundle interface.

- *Bundle-unaware* configurations are supported on each bundle member.

- While creating the virtual bundle interface, if the bundle interface existed in earlier Cisco IOS releases, then the earlier cable configurations re-appear after upgrade.

- When using sub-bundle, all layer 3 configurations must be configured on sub-bundle, instead of main bundle.

Virtual Interface Bundle-aware and Bundle-unaware Support

Virtual interface bundling uses two configurations: the virtual *bundle* itself, and the interfaces in that virtual bundle, known as *bundle members* . The virtual interface bundle and bundle members are either aware of the bundle, or unaware of the bundle, as follows.

- Bundle-aware features are maintained on the virtual *bundle* . These include:

    - IP Address
    - IP helper, cable helper
    - Dhcp-giaddr
    - Sub-interface
    - Source verify
    - Lease-query
    - Address Resolution Protocol (Cable ARP filtering, which also bundles cable interfaces, and Proxy ARP)
    - Cable match
    - Access Control Lists (ACLs)
    - Protocol Independent Multicast (PIM)
    - Cable Intercept

- Bundle-unaware features are maintained on the *bundle members* . These include:

- DS/US configurations
- HCCP redundancy
- Load balancing
- DMIC, tftp-enforce, shared-secret
- Spectrum management
- Admission control
- Intercept

Configuring Virtual Interface Bundling

To enable virtual interface bundling, and to reconfigure interface information on the Cisco CMTS as required, you first configure the virtual interface bundle, then add additional bundle members for the specified virtual bundle. Perform these steps on each interface, as needed for all virtual interface bundles.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface bundle** *n* **Example:** `Router(config-if)# interface bundle 1`	Adds the selected interface to the virtual bundle. If this is the first interface on which the virtual bundle is configured, this command enables the bundle on the specified interface. As many as 40 virtual interface bundles can be configured on the Cisco CMTS. Numeric identifiers may range from 1 to 255.
Step 4	**ip address** *address mask* **Example:** `Router(config-if)# ip address 7.7.7.7 255.255.255.0`	Use as needed after Cisco IOS upgrade. Configures the IP address for the specified interface and virtual bundle.
Step 5	**cable helper-address address** [**cable-modem** | **host** | **mta** | **ps** | **stb**] **Example:** `Router(config-if)# cable helper-address 10.10.10.13`	(Optional) Specifies the IPv4 DHCP server address.

	Command or Action	Purpose
Step 6	**cable dhcp-giaddr {primary	policy [host	stb	mta	ps	strict]}** **Example:** Router(config-if)# **cable dhcp-giaddr policy host**	Sets the DHCP GIADDR field for DHCP request packets.
Step 7	**cable source-verify dhcp** **Example:** Router(config-if)# **cable source-verify dhcp**	(Optional) Ensures that the Cisco CMTS allows network access only to those IP addresses that DCHP servers issued to devices on this cable interface. The Cisco CMTS examines the DHCP packets that pass through the cable interfaces to build a database of which IP addresses are valid on which interface. Drops traffic from all devices with unknown IP addresses, but the Cisco CMTS also sends a query to the DHCP servers for any information about the device. If a DHCP server informs the Cisco CMTS that the device has a valid IP address, the CMTS then allows the device on the network.
Step 8	**no cable arp** **Example:** Router(config-if)# **no cable arp**	(Optional) Blocks the static IPv4 CPE from coming online. Also blocks Address Resolution Protocol (ARP) process destined to devices on the cable network. **Note** Use this command, together with the **cable source-verify dhcp** command, to block certain types of scanning attacks that attempt to cause denial of service (DoS) on the Cisco CMTS.
Step 9	**exit** **Example:** Router(config-if)# **exit**	Exits the interface configuration mode and enters global configuration mode.
Step 10	**interface cable** *slot /subslot/port* **Example:** Router(config)# **interface cable 3/0/0**	Enters interface configuration mode for the selected interface, on which virtual interface bundling is to be enabled.
Step 11	**cable bundle** *n* **Example:** Router(config-if)# **cable bundle 1**	Configures a cable interface to belong to an interface bundle, where *n* is the bundle number.
Step 12	**no cable upstream** *n* **shut** **Example:** Router(config-if)# **no cable upstream 4 shut**	Use as needed after Cisco IOS upgrade. The cable interface must be enabled using the no shutdown command for the specified cable interface. *n* —Specifies the cable interface to enable for the virtual bundle.

	Command or Action	Purpose
Step 13	**end** **Example:** `Router(config-if)# end`	Returns to privileged EXEC mode.

What to do next

To remove a virtual bundle from the interface, use the **no interface bundle** command in interface configuration mode, where *n* specifies the bundle identifier:

no interface bundle *n*

If you remove a member from a bundle, the bundle remains on the interface (even if empty) until the bundle itself is specifically removed.

For more information on configuring IPv6 parameters for bundle interface, see *IPv6 on Cable* feature guide.

Verfiying the Virtual Interface Bundling Configuration

- **show ip interface brief**—Displays the summary of interfaces.

  Following is a sample output of this command:

  ```
  Router# show ip interface brief

  Interface            IP-Address      OK? Method Status                Protocol
  Cable3/0/0           Bundle1         YES unset  up                    up
  GigabitEthernet0     10.86.3.175     YES NVRAM  administratively down  down
  Bundle1              100.1.2.1       YES manual up                    up
  Bundle2              100.1.3.1       YES NVRAM  up                    up
  Dti4/1/0             unassigned      YES unset  administratively down  down
  Dti5/1/0             unassigned      YES unset  administratively down  down
  Dti4/1/1             unassigned      YES unset  administratively down  down
  Dti5/1/1             unassigned      YES unset  administratively down  down
  Loopback1            1.2.3.4         YES NVRAM  up                    up
  Tunnel0              unassigned      YES unset  up                    up
  ```

- **show running-config interface bundle** *n*—Displays the information about the specified bundle.

  Following is a sample output of this command:

  ```
  Router# show running-config interface Bundle 1

  Current configuration : 696 bytes
  !
  interface Bundle2
   ip address 100.1.3.1 255.255.255.0
   no cable nd
   cable arp filter request-send 3 2
   cable arp filter reply-accept 3 2
   no cable arp
   cable ipv6 source-verify dhcp
   cable source-verify dhcp
   cable dhcp-giaddr primary
   cable helper-address 10.10.0.53
   ipv6 address 2001:420:3800:910::1/64
  ```

```
 ipv6 enable
 ipv6 nd reachable-time 3600000
 ipv6 nd cache expire 65536
 ipv6 nd managed-config-flag
 ipv6 nd other-config-flag
 ipv6 nd ra interval msec 2000
 no ipv6 redirects
 ipv6 dhcp relay destination 2001:420:3800:800:250:56FF:FEB2:F11D
 ipv6 dhcp relay destination vrf vrfa 2001:420:3800:800:250:56FF:FEB2:F11D
 ipv6 dhcp relay source-interface Bundle2
 arp timeout 2147483
```

- **show ip interface brief | include bundle**—Displays the bundle interface information.

    Following is a sample output of this command:

    ```
    Router# show ip interface brief | include Bundle

    Bundle1 unassigned YES unset up up
    Bundle1.1 100.1.2.1 YES NVRAM up up
    Bundle2 100.1.3.1 YES NVRAM up up
    ```

- **show running-config interface bundle** *n.n*—Displays the subinterface information for the specified bundle.

    Following is a sample output of this command:

    ```
    Router# show running-config interface bundle 1.1

    Current configuration : 1415 bytes
    !
    interface Bundle1.1
    ip address 100.1.2.1 255.255.255.0
    ip pim sparse-mode
    ip rip send version 2
    ip rip receive version 2
    ip rip authentication mode md5
    ip rip authentication key-chain ubr-rip
    ip igmp static-group 239.1.4.1 source 115.255.0.100
    ip igmp static-group 239.1.3.1 source 115.255.0.100
    ip igmp static-group 239.1.2.1 source 115.255.0.100
    ip igmp static-group 232.1.4.1 source 115.255.0.100
    ip igmp static-group 232.1.3.1 source 115.255.0.100
    ip igmp static-group 232.1.2.1 source 115.255.0.100
    ip igmp static-group 232.1.1.1 source 115.255.0.100
    ip igmp static-group 230.1.4.1
    ip igmp static-group 230.1.3.1
    ip igmp static-group 230.1.2.1
    ip igmp static-group 224.1.4.1
    ip igmp static-group 224.1.3.1
    ip igmp static-group 224.1.2.1
    ip igmp static-group 224.1.1.1
    ip igmp version 3
    ip igmp query-interval 20
    no cable arp
    cable ipv6 source-verify dhcp
    cable source-verify dhcp
    cable dhcp-giaddr primary
    cable helper-address 10.10.0.53
    ipv6 address 2001:420:3800:909::1/64
    ipv6 enable
    ipv6 nd reachable-time 3600000
    ipv6 nd cache expire 65536
    ```

```
ipv6 nd prefix default no-advertise
ipv6 nd managed-config-flag
ipv6 nd other-config-flag
ipv6 nd ra interval msec 2000
no ipv6 redirects
ipv6 dhcp relay destination 2001:420:3800:800:250:56FF:FEB2:F11D link-address
2001:420:3800:909::1
ipv6 dhcp relay source-interface Bundle1
ipv6 rip CST enable
arp timeout 2147483
```

Additional References

Related Documents

Related Topic	Document Title
CMTS Command Reference	Cisco IOS CMTS Cable Command Reference Guide

Standards and RFCs

Standards	Title
SP-RFIv1.1-I09-020830	Data-over-Cable Service Interface Specifications Radio Frequency Interface Specification, version 1.1
SP-RFIv2.0-I03-021218	Data-over-Cable Service Interface Specifications Radio Frequency Interface Specification, version 2.0
SP-OSSIv2.0-I03-021218	Data-over-Cable Service Interface Specifications Operations Support System Interface Specification, version 2.0
SP-BPI+-I09-020830	Data-over-Cable Service Interface Specifications Baseline Privacy Plus Interface Specification, version 2.0

Technical Assistance

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

Feature Information for Virtual Interface Bundling

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 https://cfnng.cisco.com/ link. An account on the Cisco.com page is not required.

Note   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 2: Feature Information for Virtual Interface Bundling

Feature Name	Releases	Feature Information
Virtual interface bundling	Cisco IOS XE Fuji 16.7.1	This feature was integrated into Cisco IOS XE Fuji 16.7.1 on the Cisco cBR Series Converged Broadband Routers.