Cisco Dual DOCSIS Channel (DDC) on the Cisco uBR7246VXR Universal Broadband Router

October 2004

Cisco IOS Release 12.3(9a)BC

Cisco IOS Release 12.3(9a)BC introduces Cisco Dual DOCSIS Channel (DDC) on the Cisco uBR7246VXR universal broadband router and all Cisco uBR7200 series cable interface line cards. This document describes the configuration and operation of Cisco DDC on the Cisco uBR7246VXR router.

Feature History for Cisco Dual DOCSIS Channel (DDC) on the Cisco uBR7246VXR Universal Broadband Router

Release	Modification
12.3(9a)BC	This feature was introduced on the Cisco uBR7246VXR universal broadband router.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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Prerequisites for Cisco Dual DOCSIS Channel

The following prerequisites apply to Cisco DDC Redundancy with Cisco IOS Release 12.3(9a)BC:

- Cisco DDC Redundancy is currently supported the only on the Cisco uBR7246VXR router, and not the Cisco uBR10012 router.
- There are no SNMP extensions or additions required for Cisco DDC Redundancy.

Restrictions for Cisco Dual DOCSIS Channel

The following restrictions apply to Cisco DDC Redundancy with Cisco IOS Release 12.3(9a)BC:

- Cisco DDC *cannot* be used in conjunction with any other feature that makes use of subinterfaces on the Cisco uBR7246VXR CMTS (such as virtual private networks (VPNs)).
- Cisco DDC Redundancy is not supported with HCCP N+1 Redundancy.
- DOCSIS 1.0 cable modems do not support Cisco dynamic channel change (DCC), so they have to be moved via downstream frequency override (DFO). This adds approximately 30 seconds to the time that it takes to move a device from one CMTS to another (during a switchover event).
- If OUI or MAC exclusions are set incorrectly, the subscriber may have to reboot their CPE equipment because the cable modem receives a new address. In some cases, the cable modem might not come online at all, depending on configuration.
- Using non-matching Upstreams significantly degrades switchover performance. A cable modem on the Target US0 must move to Partner US0 (and so on) for optimal performance.

Information About Cisco Dual DOCSIS Channel

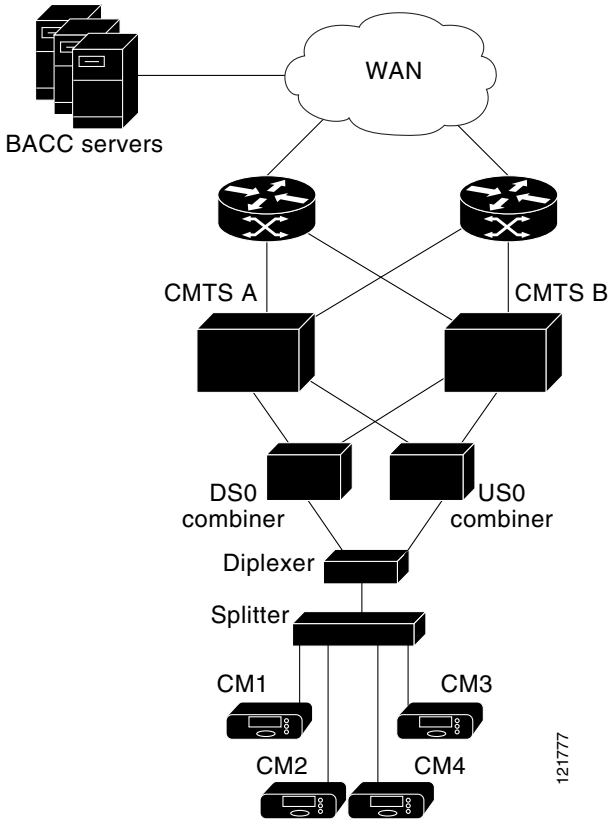
This section contains the following topics:

Introduction to Cisco DDC Redundancy

The Cisco DDC (Dual DOCSIS Channel) feature provides redundancy to cable voice and data customers by using two or three Cisco CMTS headends with connected RF upstreams and downstreams. Redundancy is provided by controlling on which Cisco CMTS the cable modems register, and by allowing movement of the cable modems between the Cisco CMTS systems. Cisco DDC provides redundancy during planned downtime, typically during software upgrades, with minimal configuration or control external to the Cisco CMTS.

Figure 1 illustrates one implementation of Cisco DDC redundancy using two Cisco CMTS headends (CMTS A and CMTSB). Cisco DDC Redundancy allows either CMTS headend to function as Target or Partner state for a given set of cable modems.

Figure 1 Cisco DDC Redundancy for DOCSIS 1.1 With Two Cisco uBR7246VXR Routers



In Figure 1, the downstreams and upstreams from each Cisco CMTS are combined onto one RF cable. This provides redundancy by enabling cable modem access to each Cisco CMTS at the same time. Straightforward management of cable modems is accomplished by controlling the downstream frequency for each cable modem. The following configuration examples describe the subinterface configuration for Cisco DDC redundancy that is illustrated in Figure 1.

Table 1 Cisco DDC Subinterface Configuration on the Cisco uBR7246VXR Routers for Figure 1

CMTS A Subinterface Configuration	CMTS B Subinterface Configuration
interface Cable5/0.1 description Group A subinterface ip address 11.1.1.1 255.255.255.0 ip address 12.1.1.1 255.255.255.0 secondary ip ospf cost 100 cable dhcp-giaddr policy cable helper-address 10.10.0.2 cable redundancy node 1 active end interface Cable5/0.2 description Group B subinterface ip address 11.1.2.1 255.255.255.0 ip address 12.1.2.1 255.255.255.0 secondary ip ospf cost 200 cable dhcp-giaddr policy cable helper-address 10.10.0.2 cable redundancy node 2 standby end	interface Cable5/0.1 description Group A subinterface ip address 11.1.1.1 255.255.255.0 ip address 12.1.1.1 255.255.255.0 secondary ip ospf cost 200 cable dhcp-giaddr policy cable helper-address 10.10.0.2 cable redundancy node 1 standby end interface Cable5/0.2 description Group B subinterface ip address 11.1.2.1 255.255.255.0 ip address 12.1.2.1 255.255.255.0 secondary ip ospf cost 100 cable dhcp-giaddr policy cable helper-address 10.10.0.2 cable redundancy node 2 active end

In this configuration, a group of cable modems are mapped to subinterface 5/0.1 and another group is mapped to subinterface 5/0.2. A hash filter creates the mapping based on the cable modems' MAC address.

- Cable modems belonging to group A will be registered on CMTS A because subinterface 5/0.1 is `active` on CMTS A (target) and in `standby` on CMTS B (partner).
- On the other hand, cable modems belonging to group B are registered on CMTS B because subinterface 5/0.2 is only `active` on CMTS B.

When CMTS A is due for planned maintenance, the subinterface 5/0.1 on CMTS B is activated (switchover to `active` state), and then the subinterface 5/0.1 on CMTS A switches over to `standby` state. At this point, Cisco DDC sends messages to the cable modems in group A to move to CMTS B by locking on to the downstream frequency of interface 5/0 on CMTS B. During this movement, the cable modems are prioritized according to their subscribed services and the type of active calls they are carrying. The high priority cable modems are moved over first to minimize their potential downtime.

After the cable modems are moved, the desired maintenance is performed. Once the maintenance is complete, the cable modems are moved back to their original states in a similar reversing procedure.

Hash Filters in Cisco DDC Redundancy

A hash filter is used to perform the following functions in Cisco DDC Redundancy:

- Deterministically associates each cable modem to a Cisco CMTS.
- Achieves balanced distribution of cable modems between Cisco routers that participate in the redundancy scheme.

The one hash filter type available is named **default**. The hash filter can be customized by specifying a hash filter mask, specific OUIs, or specific MAC addresses.

During initial ranging, a hash-algorithm on the cable modems' MAC address is used to generate a value X. The value X identifies a group which is associated with one of the subinterfaces. If the subinterface corresponding to the cable modem group is not `active` on this CMTS, then the cable modem is moved to the target CMTS using a *downstream frequency override*.

Note Downstream frequency override requires knowledge of the downstream frequencies for the redundant partners on each Cisco CMTS headend. See the "Additional References" section on page 22

Cable Modem Classification in Cisco DDC Redundancy

Once a Cisco DDC switchover event takes place in planned maintenance, the routing information for corresponding IP subnets is switched and the cable modems on the original CMTS are no longer reachable by any IP packets. Until the cable modems reach the `ONLINE` state on the target Cisco CMTS, they briefly lose their IP connections.

To minimize the downtime of the cable modems subscribed to the higher grade services, a DDC class value may be configured in the cable modem configuration file. Priority is given to the cable modems with high DDC class values during the switchover.

Cisco IOS 12.3(9a)BC introduces support for a new type-length value (TLV). This is added to the list of Cisco supported Vendor Specific TLVs to indicate the priority of a cable modem. You map a cable modem to a priority by including the desired priority TLV in the DOCSIS configuration file. Five priority values are available (the range is 0 - 4).

To include the DDC Priority in the DOCSIS configuration file, you must add the following elements for the cable modem:

- a Vendor specific TLV (type 43)
- the Cisco Vendor ID (subtype 8 = 0x0C)
- DDC Priority subtype 13 equal to the desired DDC Priority.

This is one illustration of the DOCSIS configuration file changes:

```
Type         Length        Value
13             1           DDC Priority
```

Below is an example of TLV 43, with subtype 8 (Cisco) and subtype 13 with a DDC priority of 4 in the plain text format of a DOCSIS configuration file:

```
43 (Vendor Specific Options)
S08 (Vendor ID)       = 00 00 0c
S013 (DDC Priority)       = 04
```

Call Priority in Cisco DDC Redundancy

During a Cisco DDC switchover event, Cisco IOS examines all the active service flows and marks cable modems with high priority flows. High priority flows are defined as UGS, UGS_AD, RTPS and NRPTS flows. For cable modems with the same DDC class (as described in the "Cable Modem Classification in Cisco DDC Redundancy" section on page 4), the cable modems marked as having active high priority flows are switched before those without high priority flows. Because service flows are created and deleted dynamically, this component of cable modem priority changes with time.

Active Emergency 911 Call Protection in Cisco DDC Redundancy

Active emergency 911 (E911) calls have utmost and highest priority and every effort should be made to prevent loss of service during a call, and to restore any lost service as quickly as possible.

Like the active UGS flows category, E911 calls are a dynamic indicator. At any time you can determine if there are active E911 calls by examining the cable modems. If a cable modem with an active E911 call is found, the request for Cisco DDC switchover is immediately halted and a message displays that notifies you about the existence of an active E911 call.

In this circumstance, you can attempt another Cisco DDC switchover event later, or force a switchover with an additional CLI command parameter.

Note Currently, SIP-based E911 calls transmit over Best Effort service flows, and cannot be detected as emergency calls.

Active Voice Call Protection in Cisco DDC Redundancy

Clearly it is preferable that voice calls do not experience significant interruptions. When a Cisco DDC switchover event is attempted, the number of voice calls is counted. If this number exceeds a threshold (that you can configure), a message is displayed and the Cisco DDC switchover event is aborted. In this circumstance, you can attempt another DDC switchover event later, or force a switchover with an additional **cable redundancy node {active | standby}** command with the **force** option.

Cable Interface Bundling in Cisco DDC Redundancy

When interface bundling is used to share IP subnets across multiple MAC domains and to help conserve IP addresses, IP configuration commands are used on the bundle master and distributed to the bundle slaves. Because Cisco DDC Redundancy deals with groups of cable modems and IP subnets, Cisco DDC commands are configured on the bundle master interfaces and distributed to the bundle slaves.

Note Cisco DDC commands pertaining to the physical interfaces, such as downstream frequency, are still configured on each individual interface.

Configuring Cisco DDC Redundancy on the Cisco uBR7246VXR Universal Broadband Router

Each Cisco CMTS that participates in the redundancy scheme must be configured with the total number of CMTS headends that have their RF channels connected together, and a unique identifier MYID. Subinterfaces must be configured on each interface or interface bundle master that participates in the DDC Redundancy scheme. Each subinterface is associated with a group of cable modems by the hash filter used on this interface or bundle. Finally, each subinterface is put in either *active* (target) or `standby` (partner) state.

Additional configuration requirements for Cisco DDC Redundancy described in this procedure include the following:

- The subinterfaces provide routing for the cable modems. On each Cisco CMTS interface, there must be at least as many subinterfaces configured as the number of cable modem groups.
- At least one hash filter has to be configured. A hash filter must be attached to each non-bundle-slave interface.
- On each interface, a target frequency must also be configured. This is the downstream frequency of the backup interface on another participating Cisco CMTS headends.

Perform the steps in this procedure to enable Cisco DDC Redundancy on each Cisco uBR7246VXR router in the redundancy scheme.

Note These steps must be performed on each router in the redundancy scheme.

Prerequisites

To complete this procedure, you must have the following information prepared for each router in the Cisco DDC Redundancy scheme.

Note Cisco recommends that you create a diagram of your desired redundancy scheme to include the information below. This will be useful for verification and troubleshooting of Cisco DDC Redundancy.

- Network router names (**show version**)
- IP addresses for each interface to be included in Cisco DDC (**show ip interface**)
- OUI values for each MAC interface
- Information about desired master and slave interfaces in cable interface bundling

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable redundancy myid** *node_id* **nodes** *nodes*
4. **cable redundancy hashfilter** *hash_id* {**type** *namestring* | **mac-mask** *mac-mask* | **mac-map** *mac-address* **node** *node_id* | **oui-map** *oui* **node** *node_id*}
5. **interface cable** *slot/port*
6. **cable redundancy hashfilter** *hash_id*
7. **cable redundancy node** *node_id* **frequency** *frequency*
8. **cable redundancy target** *node_id*
9. **cable redundancy threshold** *max-calls*
10. **interface cable** *slot.subinterface*
11. **cable redundancy node** *node_id* {**active** | **standby** [**force**]}
12. **Ctrl-Z**

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	**cable redundancy myid** *node_id* **nodes** *nodes* **Example:** `Router# cable redundancy myid 2 nodes 3`	Specifies the total number of Cisco CMTS systems participating in the DDC Redundancy scheme and the ID of this particular Cisco CMTS. **Note** This configuration must be present (identical except *node_id*) on all DDC nodes (routers) participating in the scheme. • *node_id*—A unique identifier for the Cisco CMTS currently being configured. The value must be 1 or greater (not to exceed the value used for *nodes*). This value must be unique on each CMTS that participates in the scheme. • *nodes*—Total number of Cisco CMTS routers participating in the DDC redundancy scheme (range 1 to 3). This value must be identical on all DDC nodes (routers).

Step 4	**cable redundancy hashfilter** *hash_id* {**type** *namestring* | **mac-mask** *mac-mask* | **mac-map** *mac-address* **node** *node_id* | **oui-map** *oui* **node** *node_id*}
	
	Example:
	`Router# cable redundancy hashfilter 1 type default`
	`Router# cable redundancy hashfilter 1 macmask FFFF.FF00.0000`
	`Router# cable redundancy hashfilter 1 macmap 0007.0e03.68ad node 2`
	`Router# cable redundancy hashfilter 1 ouimap 00070e node 1`
		Specifies the mapping of the CMTS MAC addresses and nodes on the local system, to be used by all DDC nodes (routers) participating in the scheme.
		
		The hash filter can be customized by specifying a hash filter mask, specific OUIs, or specific MAC addresses. The MAC address or OUI map is shared and hashed by all Cisco DDC nodes.
		
		Note This configuration must be present and identical on each CMTS router participating in the DDC redundancy scheme.
		
		• *hash_id*—Unique ID used to reference the hash filter.
		• *namestring*—Hash filter name. Only **default** is supported at this time.
		• *mac-mask*—Specifies the number of bits in the cable modem's MAC address to be used by the hashing algorithm.
		• *mac-map*—This value overrides the node a MAC address will use.
		• *oui*—Organizational Unique Identifier. Three octets assigned by the IEEE in a block of 48-bit LAN addresses.
		• *node_id*—This value overrides the node that all cable modems with the previous *oui* value will use.

Step 5	**interface cable** *slot/port* **Example:** `Router# interface cable 3/0`	Enters interface configuration mode for the specified slot and port. • *slot*—Slot in the router chassis • *port*—Port in the associated slot

	Command or Action	Purpose
Step 6	**cable redundancy hashfilter** *hash_id* **Example:** `Router(config-if)# cable redundancy hashfilter 1`	Enables hash filtering on the specified cable interface or bundle. If the command is executed on a bundle master, the hash filtering is enabled on all bundle members. • *hash_id*—The unique hash filter identifier. The *hash_id* value selects a hash filter previously defined in the global configuration mode. **Note** This command is not accepted on an interface that is configured as a bundle slave.
Step 7	**cable redundancy node** *node_id* **frequency** *frequency* **Example:** `Router(config-if)# cable redundancy node 1 frequency 435000000`	Defines downstream frequencies for each node participating in the scheme *other than the current Cisco CMTS*. This frequency is used to switch cable modems to the downstream frequency of the backup interface (on another Cisco CMTS) via DFO and DCC messages. • *node_id*—DDC node ID • *frequency*—Downstream frequency of the target interface **Note** This command must be present on each participating cable interface, regardless of its bundle status.
Step 8	**cable redundancy target** *node_id* **Example:** `Router(config-if)# cable redundancy target 1`	Defines the target node and therefore the downstream frequency to use in a DDC switchover event, as configured by the previous step. • *node_id*—target node ID (in relation to the current node) **Note** This command may be present on each participating cable interface, regardless of its bundle status. When this command is not present, the default target node is the next higher node in the scheme (the next higher *node_id* value in the scheme). For example, if there are three participating nodes, the default target nodes are as follows (respectively): • If the current node is 1, the target node is 2. • If the current node is 2, the target node is 3. • If the current node is 3, the target node is 1.
Step 9	**cable redundancy threshold** *max-calls* **Example:** `Router(config-if)# cable redundancy threshold 20`	Specifies the active voice call threshold. If the number of active voice calls exceeds this value, the DDC switchover does not take place, unless it is forced by using the **cable redundancy node** *node_id* **standby force** subinterface configuration command (Step 11). • *max-calls*—The threshold value for the number of active voice calls. **Note** If the command is configured on a bundle master, the threshold is used to compare with the total number of voice calls in the bundle. This command is not accepted on interfaces configured as bundle slaves. **Note** If this threshold is not configured, this check does not occur and the DDC switchover proceeds regardless of how many voice calls are active. This is subject to additional constraints described in the "Call Priority in Cisco DDC Redundancy" section on page 5.

	Command or Action	Purpose
Step 10	**interface cable** *slot.subinterface* **Example:** `Router(config-if)# interface cable 3.01`	Enters (sub)interface configuration mode for the specified slot and subinterface. • *slot*—Slot in the router chassis • *subinterface*—Subinterface in the corresponding slot

Step 11	**cable redundancy node** *node_id* {**active** | **standby** [**force**]}
	
	Example:
	`Router(config-subif)# cable redundancy node 2 active`
	`Router(config-subif)# cable redundancy node 1 standby`
	`Router(config-subif)# cable redundancy node 1 standby force`
		Specifies with which node ID this subinterface is associated, and in what state it is to be. The **force** keyword forces the subinterface into the **standby** state regardless of the number of voice calls or active E911 calls.
		• *node*—Node ID with which the subinterface is associated
		Note This is subject to additional constraints described in the "Active Voice Call Protection in Cisco DDC Redundancy" section on page 6.

Step 12	**Ctrl-Z** **Example:** `Router(config-if)# Ctrl^Z`	When you have completed the configuration, enter **^Z** (Control key with Z) to exit configuration mode and return to privileged EXEC.

Switchover Methods for Cisco DDC Redundancy

Cisco DDC Redundancy enables you to perform multiple types of switchover events according to your needs. These switchover methods are described with the following procedures:

- "Performing a Basic Switchover with Cisco DDC Redundancy" section on page 10
- "Performing a Revert-back Switchover with Cisco DDC Redundancy" section on page 13
- "Performing a Fast Switchover with Cisco DDC Redundancy" section on page 13
- "Performing a Route Reweighting Switchover with Cisco DDC Redundancy" section on page 14

Performing a Basic Switchover with Cisco DDC Redundancy

In this switchover procedure, there are two DDC nodes (routers), and cable 3/0 is the master on both. All cable modems from one system (CMTS B) are moved to another system (CMTS A).

Prerequisites

In this procedure, all downstreams are bundled on their respective systems.

- CMTS A is node 1 and has cable3/0.1 in `active` (target) state and cable 3/0.2 in `standby` (partner) state.
- CMTS B is node 2 and has cable3/0.2 in `active` (target) and cable 3/0.1 in `standby` (partner) state.

SUMMARY STEPS

1. **enable**
2. **show running interface cable** *interface/subinterface*

3. **show cable redundancy class**
4. **show cable modem redundancy**

Perform the following steps on CMTS A (node 1)

5. **config t**
6. **interface cable** *interface/subinterface*
7. **cable redundancy node** *node_id* **active**
8. **show ip route | include** *x.x.x.x*

Perform the following steps on CMTS B (node 2)

9. **config t**
10. **interface cable** *interface/subinterface*
11. **cable redundancy node** *node_id* **standby**

Perform the following step on both CMTS A (node 1) and CMTS B (node 2).

12. **copy running startup**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show running interface cable** *interface/subinterface* **Example:** `Router# show running interface cable 3/0.2`	Verify that on CMTS A (node 1), cable 3/0.2 is configured with a lower routing priority than on CMTS B cable 3/0.2. Use the **show running interface cable 3/0.2** command on both DDC nodes (CMTS routers) in privileged EXEC mode. Otherwise, both DDC nodes should have the same configuration.
Step 3	**show cable redundancy class** **Example:** `Router# show cable redundancy class`	Verify (if possible) that the highest priority cable modems are being put into the correct classes. Use the **show cable redundancy class** and **show cable modem redundancy** commands in privileged EXEC mode.
Step 4	**show cable modem redundancy** **Example:** `Router# show cable modem redundancy`	
Perform the following steps on CMTS A (node 1).		
Step 5	**configure terminal** **Example:** `Router# config t`	**Note** Read the remaining steps in this procedure completely before executing any of them. The following steps should be executed in rapid succession once you are ready. Enters global configuration mode On CMTS A (node 1).
Step 6	**interface cable** *interface/subinterface* **Example:** `Router(config)# int cable 3/0.2`	Enters subinterface configuration mode.
Step 7	**cable redundancy node** *node_id* **active** **Example:** `Router# cable redundancy node 2 active`	At this point, a two minute timer starts during which the CMTS runs in an optimized mode, allowing cable modems to register as fast as possible. After this period, the CMTS reverts to normal mode.
Step 8	**show ip route** | **include** *x.x.x.x* **Example:** `Router# show ip route 10.10.10.1`	(Optional) If you are certain that the routing updates will work correctly in a DDC switchover event, you can skip this step. On the WAN side router, execute the following command in Privileged EXEC mode: • *x.x.x.x* — IP subnet from cable 3/0.2 There should be two routes, with different weights. The route from CMTS B should be the preferred route. This step verifies that the routing updates are propagating correctly. When the interface on CMTS B goes to Standby state, the route via CMTS A is ready to take over.
Perform the following steps on CMTS B (node 2).		
Step 9	**configure terminal** **Example:** `Router# config t`	**Note** Read the remaining steps in this procedure completely before executing any of them. The following steps should be executed in rapid succession once you are ready. Enters global configuration mode On CMTS B (node 2).

	Command or Action	Purpose
Step 10	**interface cable** *interface/subinterface* **Example:** `Router(config)# int cable 3/0.2`	Enters subinterface configuration mode.
Step 11	**cable redundancy node** *node_id* **standby** **Example:** `Router# cable redundancy node 2 standby`	**Note** If there are too many active phone calls, or any E911 calls in session, the command is rejected. This can be overridden, if necessary, with the **force** option. Within 20 seconds, modems from CMTS B begin to arrive on CMTS A.
Perform the following step on both CMTS A (node 1) and CMTS B (node 2).		
Step 12	**copy running startup** **Example:** `Router# copy run start`	Execute the **copy running start** command in privileged EXEC mode so that when CMTS B is upgraded/rebooted, it does not cut IP connectivity for node 2 on CMTS A.

Performing a Revert-back Switchover with Cisco DDC Redundancy

There are two different approaches to the reverting process. The flow of commands is listed in this topic for both cases.

- One approach is to enable the **cable redundancy node standby** and **active** commands as quickly as possible. This involves the fewest configuration changes.
- The other approach is to reconfigure the relative route preferences so that the routes for cable 3/0.2 on CMTS B (DDC node 2) are less preferred than the routers on CMTS A (DDC node 1).

The reason for the two different approaches is that subinterface cable 3/0.2 on CMTS B has a higher routing preference than on CMTS A. As soon as the **cable redundancy node 2 active** command is executed on CMTS B, IP connectivity for the node 2 cable modems on CMTS A is lost. As long as the associated **cable redundancy node 2 standby** command is executed immediately on CMTS A, the impact is minimal.

However, this also requires that the **show cable redundancy calls** be executed on CMTS A *before* the switchover event is started. This verifies that no E911 calls are in progress, and that the total number of calls on cable 3/0.2 on CMTS A is lower than the threshold.

The method that changes the route preferences does not run the risk of accidental termination of E911 calls, and it does not add the additional time between the **cable redundancy node standby** and **active** commands to the total outage time for the cable modems. It does, however, increase the total number of configuration changes.

Performing a Fast Switchover with Cisco DDC Redundancy

Read the following instructions and understand them completely prior to their execution. The steps below should be executed in succession as quickly as possible.

1. Execute the **show cable redundancy calls** command in privileged EXEC mode on CMTS A (node 1).
2. Verify the following conditions are present:
   - There are no E911 calls.
   - The total calls are below the threshold.

Note If possible, wait until the total drops below the threshold or wait for the E911 calls to terminate (disappear from display). If it is not possible to wait, you will have to use the **cable redundancy node 2 standby force** command to start the switchover.

3. On CMTS B (node 2), execute the following commands in their respective modes:
   - **config t** (privileged EXEC)
   - **interface cable 3/0.2** (global configuration)
   - **cable redundancy node 2 active** (subinterface configuration)

Note At this point, IP connectivity is cut for all node 2 cable modems on CMTS A.

4. On CMTS A (node 1), execute the following commands in their respective modes:
   - **config t** (privileged EXEC)
   - **interface cable 3/0.2** (global configuration)
   - **cable redundancy node 2 standby** (subinterface configuration)

Note If there are too many active phone calls, or any E911 calls in session, the command will be rejected. This can be overridden, if necessary, with the **cable redundancy node 2 standby force** command.

   Within 20 seconds, modems will begin arriving on CMTS-B.

5. On both CMTS B (node 2) and CMTS A (node 1), execute the **copy running start** command in privileged EXEC mode.

Performing a Route Reweighting Switchover with Cisco DDC Redundancy

Read the following instructions and understand them completely prior to their execution.

1. After maintenance is complete on CMTS B (node 2), configure interface cable 3/0.2 on CMTS B (node 2) so that its routes are less preferred than the routes to CMTS A (node 1).
2. On CMTS B execute the following commands in their respective modes:
   - **config t** (privileged EXEC)
   - **interface cable 3/0.2** (global configuration)
   - **cable redundancy node 2 active** (subinterface configuration)
3. Use the **show ip route to** command in privileged EXEC mode on a WAN-side router to verify that the routes are being advertised properly.
4. On CMTS A, execute the following commands in their respective modes:
   - **config t** (privileged EXEC)
   - **interface cable 3/0.2** (global configuration)
   - **cable redundancy node 2 standby** (subinterface configuration)

Note If there are too many active phone calls, or any E911 calls in session, the command will be rejected. This can be overridden, if necessary, with the **cable redundancy node 2 standby force** command.

Within 20 seconds, modems begin to arrive on CMTS B.

5. Configure interface cable 3/0.2 on CMTS B (node 2) so that its routes have a higher preference than the routes on CMTS A (node 1). This results in the same weights that existed when the procedure was started.
6. On both CMTS B (node 2) and CMTS A (node 1), execute the **copy running start** command in privileged EXEC mode.

Configuration Examples for Cisco DDC Redundancy

Example of Two Cisco uBR7246VXR Routers Being Configured

This sample configuration is for a basic Cisco DDC Redundancy scheme. These are the primary features of this configuration are as follows:

- There are two nodes (Cisco CMTS routers), and both are using cable 3/0.
- Only one interface is configured for Cisco DDC on each CMTS router.
- CMTS A uses Downstream frequency 441000000 and has a 'node_id' of 1.
- CMTS B uses Downstream frequency 453000000 and a 'node_id' of 2.
- Both Cisco DDC nodes use hash filter 1.

This example assumes that there is a routing protocol running on the WAN interfaces to carry route updates about the cable interface states. The numeration for the steps below differs from the numeration described in the "Configuring Cisco DDC Redundancy on the Cisco uBR7246VXR Universal Broadband Router" section on page 6. However, the sequence of configuration modes and commands is essentially the same.

Note Because both Cisco CMTS routers are using the same physical wire, care must be used to not configure overlapping frequencies, especially on the upstreams.

Global Configuration

1. Configure **cable redundancy myid <1-3> nodes <1-3>** on each CMTS.
2. Configure **cable redundancy hashfilter 1 type default** on each CMTS.

Interface Configuration on cable 3/0

3. Configure **cable redundancy node 2 frequency 453000000** on CMTS A.
4. Configure **cable redundancy node 1 frequency 441000000** on CMTS B.
5. Configure **cable redundancy hashfilter 1** on both CMTS A and CMTS B.

Subinterface Configuration on cable 3/0.1

6. Configure the IP address and cable helper-address to be the same on CMTS A and CMTS B.
7. Configure OSPF (or another routing protocol) so that the interface on CMTS A is more preferred than the one running on CMTS B.
8. Configure **cable redundancy node 1 active** on CMTS A.
9. Configure **cable redundancy node 1 standby** on CMTS B.

Subinterface Configuration on cable 3/0.2

10. Configure the IP address and cable helper-address to be the same on CMTS A and CMTS B.
11. Configure OSPF (or another routing protocol) so that the interface on CMTS B is more preferred than the one running on CMTS A.
12. Configure **cable redundancy node 2 standby** on CMTS A.
13. Configure **cable redundancy node 2 active** on CMTS B.

Example of Two Configured Cisco uBR7246VXR Routers

The following example of the **show cable redundancy** command illustrates DDC redundancy with two Cisco uBR7246VXR routers. This example is from DDC Node ID 1 (one of two).

```
Router# show cable redundancy

Number of participating nodes: 2
DDC ID:                        1
Number of hash filters:        3
Int/Bundle      HashID  VoiceThreshold
Bundle 1        3       6
   *Cable3/0
    Cable3/1
    Cable4/0
    Cable4/1
    Cable5/0
    Cable5/1
    Cable6/0
    Cable6/1
* indicates bundle master

SubInterface    Node    Status  LineState
Cable3/0.1      1       active  up
Cable3/0.2      2       standby down
```

In this example, there are two Cisco routers participating in the DDC Redundancy configuration and the node_ID of the current router is 1. There are three configured hash filters. All the interfaces are part of a bundle interface with cable3/0 being the bundle master. Hash Filter 3 is associated with this bundle interface. The voice call threshold is set to 6.

This example also illustrates the association of the node_IDs to the subinterface, along with the current subinterface state.

Example of Hash Filter for Two Cisco uBR7246VXR Routers

The following example of the **show cable redundancy hashfilter** command illustrates the same DDC Redundancy scheme (two Cisco uBR7246VXR routers). This command displays the configured hash filter parameters. You can either list all hash filters (as shown) or list one hash filter, if specified with the optional *hash_id* value at the end of the command.

```
Router# show cable redundancy hashfilter

HashFilter 1
HashType        MacMask
default         ffff.ffff.ffff
MacAddr         OUI             Node
0000.39cc.b270                  1
0000.39cc.ba70                  2
0000.39cc.c070                  2

HashFilter 2
HashType        MacMask
default         0000.00ff.ffff
MacAddr OUI Node
    00.00.391
    00.08.0D1
    00.0C.E51
```

Example of DDC Cable Modem Classes for Two Configured Cisco uBR7246VXR Routers

The following example of the **show cable redundancy class** command displays the number of cable modems in each DDC class of the same DDC Redundancy scheme (two Cisco uBR7246VXR routers).

```
Router# show cable redundancy class

Number of modems in each DDC class:
InterfaceClass0Class1Class2Class3Class4
Cable3/0 32 00 0   0
Cable3/1 3200  0   0
Cable4/0320 0   0   0
Cable4/100  0   0   0
Cable5/0310 0   0   0
Cable5/1320 0   0   0
Cable6/000  0   0   0
Cable6/100  0   0   0
```

Example of Active Call Status in Cisco DDC Redundancy

The following example of the **show cable redundancy calls** command displays the number of active 911 (E911) calls, voice calls, and the number of cable modems with service flows for each subinterface. If the subinterface is configured on a bundle, the number of calls is the total for all the members in the bundle.

```
Router# show cable redundancy calls

SubInterface  911Calls   VoiceCalls  ModemCount  ServiceFlow
Cable3/0.1    0           0           159         159
Cable3/0.2    0           0           0           0
```

Example of Three Cisco uBR7246VXR Routers Configured for Cisco DDC

The following example illustrates one DDC Redundancy scheme with three Cisco uBR7246VXR chassis (CMTS A, CMTS B, CMTS C). CMTS C is the Standby router (node) in this configuration.

CMTS-A Configuration Example

```
cable redundancy myid 1 nodes 3
cable redundancy hashfilter 1 type hash-default

interface cable3/0
 cable bundle 1 master
 cable redundancy hash-filter 1
 cable redundancy node 2 frequency 550000000
 cable redundancy node 3 frequency 540000000

interface cable3/0.1
 ip address 1.1.1.1 255.255.255.0
 ip address 2.2.2.2 255.255.255.0 secondary
 cable redundancy node 1 active

interface cable3/0.2
 ip address 3.3.3.3 255.255.255.0
 ip address 4.4.4.4 255.255.255.0 secondary
 cable redundancy node 2 standby

interface cable3/0.3
 ip address 5.5.5.5 255.255.255.0
 ip address 6.6.6.6 255.255.255.0 secondary
 cable redundancy node 3 standby
```

CMTS-B Configuration Example

```
cable redundancy myid 2 nodes 3
cable redundancy hashfilter 1 type hash-default

interface cable3/0
 cable bundle 1 master
 cable redundancy hash-filter 1
 cable redundancy node 1 frequency 530000000
 cable redundancy node 3 frequency 540000000

interface cable3/0.1
 ip address 1.1.1.1 255.255.255.0
 ip address 2.2.2.2 255.255.255.0 secondary
 cable redundancy node 1 standby

interface cable3/0.2
 ip address 3.3.3.3 255.255.255.0
 ip address 4.4.4.4 255.255.255.0 secondary
 cable redundancy node 2 active

interface cable3/0.3
 ip address 5.5.5.5 255.255.255.0
 ip address 6.6.6.6 255.255.255.0 secondary
       cable redundancy node 3 standby
```

CMTS-C Configuration Example

```
cable redundancy myid 3 nodes 3
cable redundancy hashfilter 1 type hash-default

interface cable3/0
 cable bundle 1 master
 cable redundancy hash-filter 1
 cable redundancy node 1 frequency 530000000
 cable redundancy node 2 frequency 550000000

interface cable3/0.1
 ip address 1.1.1.1 255.255.255.0
 ip address 2.2.2.2 255.255.255.0 secondary
 cable redundancy node 1 standby

interface cable3/0.2
```

```
 ip address 3.3.3.3 255.255.255.0
 ip address 4.4.4.4 255.255.255.0 secondary
 cable redundancy node 2 standby

interface cable3/0.3
 ip address 5.5.5.5 255.255.255.0
 ip address 6.6.6.6 255.255.255.0 secondary
 cable redundancy node 3 active
```

What to Do Next

See the "Verifying Cisco DDC Redundancy" section on page 20.

Verifying Cisco DDC Redundancy

Prerequisites

Complete the "Configuring Cisco DDC Redundancy on the Cisco uBR7246VXR Universal Broadband Router" section on page 6 on each router in the Cisco DDC Redundancy scheme prior to verification.

SUMMARY STEPS

1. **enable**
2. **show run**
3. **copy run start**
4. **show run**
5. **reload**
6. **show cable redundancy**
7. **cable redundancy node** *node_id* {**active** | **standby**} [**force**]
8. **show cable redundancy**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show run** **Example:** `Router# show run`	Verifies that the DDC configuration changes have saved to the running configuration successfully.
Step 3	**copy run start** **Example:** `Router# copy run start`	Verifies that the DDC configuration changes have saved to the startup configuration successfully.
Step 4	**show run** **Example:** `Router# show run`	Verifies that the DDC configuration changes have reloaded to the running configuration successfully.
Step 5	**reload** **Example:** `Router# reload`	Verifies that all DDC configuration changes to the startup configuration have saved and reloaded successfully through a router restart.
Step 6	**show cable redundancy** **Example:** `Router# show cable redundancy`	Verifies that the DDC redundancy configurations on the multiple Cisco uBR7246VXR chassis are now active and valid.

	Command or Action	Purpose
Step 7	**cable redundancy node** *node_id* {**active** | **standby**} [**force**] **Example:** `Router# cable redundancy node 2 active force`	Forces a stateful subinterface switchover. This command can force a DDC switchover event from or to any node in the live DDC redundancy scheme. • *nodeid*—Specifies the DDC node on which to force the stateful switchover. • **active** | **standby** —Specifies the state to which the DDC node subinterfaces should switch.
Step 8	**show cable redundancy** **Example:** `Router# show cable redundancy`	Verifies that the DDC redundancy configurations on the multiple Cisco uBR7246VXR chassis are now enabled and functioning.

Additional References

The following sections provide references related to <<Feature>>.

Related Documents

Related Topic	Document Title
Cable Interface Features for the Cisco CMTS Relating to Cisco DDC Redundancy	• *Cable Interface Bundling for the Cisco CMTS* http://www.cisco.com/univercd/cc/td/doc/product/cable/cab_rout/cmtsfg/ufg_bund.htm • **"cable downstream override"** Command in the *Cisco Broadband Cable Command Reference Guide* http://www.cisco.com/univercd/cc/td/doc/product/cable/bbccmref/bbcmtscf.htm#wp1863310
Cisco IOS Software for Broadband Cable	• *Cisco Broadband Cable Command Reference Guide* http://www.cisco.com/univercd/cc/td/doc/product/cable/bbccmref/index.htm • *Release Notes for Cisco uBR7200 Series for Cisco IOS Release 12.3 BC* http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123relnt/ubr7200/123bcu72.htm
Cisco Broadband Cable Technical Support	• *Cisco Broadband Cable Technical Support* (Login required) http://www.cisco.com/cgi-bin/Support/browse/index.pl?i=Products&f=3534 • *Cisco Broadband Cable Frequently Asked Questions* http://www.cisco.com/en/US/tech/tk86/tk804/technologies_q_and_a_item09186a0080134f1d.shtml
Cisco uBR7246VXR Universal Broadband Router	• *Cisco uBR7200 Series Hardware Installation Guide* http://www.cisco.com/univercd/cc/td/doc/product/cable/cab_rout/cr72hig/index.htm • *Cisco uBR7200 Series Software Configuration Guide* http://www.cisco.com/univercd/cc/td/doc/product/cable/cab_rout/cr72scg/index.htm • *Upgrading to the Cisco uBR7246VXR Universal Broadband Router* http://www.cisco.com/univercd/cc/td/doc/product/cable/cab_rout/13536upg.htm

Standards

Standards	Title
DOCSIS	• *Cisco Cable DOCSIS 1.1 FAQs* http://www.cisco.com/en/US/tech/tk86/tk168/technologies_q_and_a_item09186a0080174789.shtml • CableLabs® *Cable Modem/DOCSIS Specifications* http://www.cablemodem.com/specifications/

MIBs

MIBs	MIBs Link
•	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

Technical Assistance

Description	Link
Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/public/support/tac/home.shtml

Command Reference for Cisco DDC Redundancy

This section describes configuration and **show** commands for Cisco DDC Redundancy on the Cisco uBR7246VXR router, as supported by Cisco IOS Release 12.3(9a)BC and later releases in this train.

cable redundancy hashfilter

To set the MAC address and DDC node mappings of the DDC redundancy scheme, use the c**able redundancy hashfilter** command in global configuration mode. This hash filter is to be shared by all DDC nodes (routers) in the redundancy scheme. To remove the hash filter from the Cisco CMTS router, use the **no** form of this command.

cable redundancy hashfilter *hash_id* {**type** *namestring* | **mac-mask** *mac-mask* | **mac-map** *mac-address* **node** *node_id* | **oui-map** *oui* **node** *node_id*}

no cable redundancy hashfilter

Syntax Description

hash_id	Unique ID for the shared hash filter. Multiple (differently named) hash filters are supported in the same Cisco DDC Redundancy scheme at the same time, though only one hash filter can be enabled at any one time. Supported range is 1 to 3.
namestring	Alphanumeric hash filter name, enabled with the **type** keyword. Only the namestring of **default** is supported at this time.
mac-mask	Specifies the number of bits in the cable modem's MAC address to be used by the hashing algorithm. Enabled with the **mac-mask** keyword.
mac-address	A manually configured MAC address for the DDC node (overrides any default MAC address configured on the router). Enabled with the **mac-map** keyword.
node_id	This value overrides the node that all cable modems with the shared `mac-address` value will use, and updates the MAC address mapping in the hash filter. Enabled with the **mac-map** *mac-address* **node** command syntax.
oui	This value overrides the node that all cable modems with the shared OUI value will use, and updates the OUI address mapping in the hash filter. Enabled with the **oui-map** keyword.
node_id	This value overrides the node that all cable modems with the shared `oui` value will use, and updates the MAC address mapping in the hash filter. Enabled with the **oui-map** *oui* **node** command syntax.

Defaults

- Cable redundancy hash filters are disabled (not configured) by default.
- Only the hash filter name of **default** is supported at this time.

Command Modes

Global configuration

Command History

Release	Modification
Release 12.3(9a)BC	This command was introduced on the Cisco uBR7246 universal broadband router.

Usage Guidelines

Note This configuration must be present and identical on each CMTS router participating in the DDC redundancy scheme.

This command is used in the early stages of configuring DDC Redundancy on all DDC nodes (routers) in the scheme. For additional information in context, refer to the "Configuring Cisco DDC Redundancy on the Cisco uBR7246VXR Universal Broadband Router" section on page 6.

Examples

The following example implements the **cable redundancy hashfilter** command in four sequential steps, completing the entire mapping information required for one DDC node in a redundancy scheme of two routers:

```
Router# cable redundancy hashfilter 1 type default
Router# cable redundancy hashfilter 1 macmask FFFF.FF00.0000
Router# cable redundancy hashfilter 1 macmap 0007.0e03.68ad node 2
Router# cable redundancy hashfilter 1 ouimap 00070e node 1
```

Related Commands

Command	Description
cable redundancy myid	Sets the total number of Cisco DDC nodes (routers) in the DDC Redundancy scheme, and sets the ID of the current DDC node.
cable redundancy node {active | standby}	Configures the DDC node (*node_id*) with active or standby state.
show cable redundancy	Displays the current DDC redundancy configurations and status.

cable redundancy myid

To set the total number of Cisco DDC nodes (routers) in the DDC Redundancy scheme, and to set the ID of the current DDC node, use the **cable redundancy myid** command in global configuration mode. To remove a DDC node ID from the router, use the **no** form of this command.

cable redundancy myid *node_id* **nodes** *nodes*

no cable redundancy myid *node_id*

Syntax Description

node_id	A unique identifier for the Cisco DDC node currently being configured. The value must be 1 or greater (not to exceed the value used for *nodes*). This value must be unique on each CMTS that participates in the scheme.
nodes	Total number of Cisco CMTS routers participating in the DDC redundancy scheme (range 1 to 3). This value must be identical on all DDC nodes (routers).

Defaults

DDC Redundancy is disabled and DDC nodes (routers) are not configured for DDC redundancy by default.

Command Modes

Global configuration

Command History

Release	Modification
Release 12.3(9a)BC	This command was introduced on the Cisco uBR7246 universal broadband router.

Usage Guidelines

This configuration must be present (identical except *node_id*) on all DDC nodes (routers) participating in the scheme.

This command is used in the early stages of configuring DDC Redundancy on all DDC nodes (routers) in the scheme. For additional information in context, refer to the "Configuring Cisco DDC Redundancy on the Cisco uBR7246VXR Universal Broadband Router" section on page 6.

Examples

The following example configures the DDC node (router) ID to be 2 in a scheme in which there are three DDC nodes total.

```
Router# cable redundancy myid 2 nodes 3
```

Related Commands

Command	Description
cable redundancy node {active | standby}	Configures the DDC node (*node_id*) with active or standby state.
show cable redundancy	Displays the current DDC redundancy configurations and status.

cable redundancy node {active | standby}

To set the DDC node (router) with which a subinterface is associated, and to set the state for that interface, use the **cable redundancy node** {**active** | **standby**} command in subinterface configuration mode. To remove this configuration from the router, use the **no** form of this command.

cable redundancy node *node_id* {**active** | **standby**} [**force**]

no cable redundancy node *node_id* {**active** | **standby**}

Syntax Description

node_id	DDC node (router) with which the subinterface is associated. The range is the number of DDC nodes in the scheme.
force	Optional keyword forces the subinterface into the **standby** state regardless of the number of active voice or E911 calls.

Defaults

DDC switchover events are disabled by default and must be manually initiated on a case-by-case basis.

Command Modes

Subinterface configuration

Command History

Release	Modification
Release 12.3(9a)BC	This command was introduced on the Cisco uBR7246 universal broadband router.

Usage Guidelines

This command can be used in the context of DDC configuration, testing or forced switchover events. Refer to earlier procedures in this document for additional information.

Note Use of this command is subject to additional constraints described in the "Active Voice Call Protection in Cisco DDC Redundancy" section on page 6.

Examples

The following command sequence sets the DDC node states in a scheme with two DDC nodes (routers), then forces a switchover event on DDC node 1 that puts it into `standby` state.

```
Router(config-subif)# cable redundancy node 2 active
Router(config-subif)# cable redundancy node 1 standby
Router(config-subif)# cable redundancy node 1 standby force
```

Related Commands

Command	Description
cable redundancy myid	Sets the total number of Cisco DDC nodes (routers) in the DDC Redundancy scheme, and sets the ID of the current DDC node.
show cable redundancy	Displays the current DDC redundancy configurations and status.

cable redundancy node frequency

To set the downstream frequencies for each node participating in the scheme other than the current DDC node (router), use the cable redundancy node frequency command in interface configuration mode. This frequency is used to switch cable modems to the downstream frequency of the backup interface (on another DDC node) via DFO and DCC messages. To remove this setting from the router, use the **no** form of this command.

cable redundancy node *node_id* **frequency** *frequency*

no cable redundancy node *node_id* **frequency**

Syntax Description

node_id	DDC target node ID for which the frequency is being set
frequency	Downstream frequency of the target interface

Defaults

Cable downstream frequency override is enabled by default.

Command Modes

Interface configuration mode

Command History

Release	Modification
Release 12.3(9a)BC	This command was introduced on the Cisco uBR7246 universal broadband router.

Usage Guidelines

This command must be present on each cable interface participating in the scheme, regardless of its bundle status.

Examples

The following example configures the downstream frequency of DDC node 1 to be 435000000.

```
Router(config-if)# cable redundancy node 1 frequency 435000000
```

Related Commands

Command	Description
cable redundancy myid	Sets the total number of Cisco DDC nodes (routers) in the DDC Redundancy scheme, and sets the ID of the current DDC node.
cable redundancy node {active | standby}	Configures the DDC node (*node_id*) with active or standby state.
cable redundancy target	Configures the DDC node (*node_id*) by setting the target DDC node (router) to use in a DDC switchover event.
cable redundancy threshold	Configures the DDC node (*node_id*) by setting the active voice call threshold on the current DDC node (router)
show cable redundancy	Displays the current DDC redundancy configurations and status.

cable redundancy target

To set the target DDC node (router) to use in a DDC switchover event, use the **cable redundancy target** command in interface configuration mode. To remove this configuration from the router, use the **no** form of this command.

cable redundancy target *node_id*

no cable redundancy target *node_id*

Syntax Description

node_id	Target node ID (in relation to the current DDC node)

Defaults

When this command is not present, the default target node is the next higher node in the scheme.

Command Modes

Interface configuration

Command History

Release	Modification
Release 12.3(9a)BC	This command was introduced on the Cisco uBR7246 universal broadband router.

Usage Guidelines

The downstream frequency that is used in a DDC switchover event is the frequency set on the respective target DDC node, as set with this command.

Note This command may be present on each participating cable interface, regardless of its bundle status.

When this command is not present, the default target node is the next higher node in the scheme (the next higher *node_id* value in the scheme). For example, if there are three participating nodes, the default target nodes are as follows (respectively):

- If the current node is 1, the target node is 2.
- If the current node is 2, the target node is 3.
- If the current node is 3, the target node is 1.

Examples

The following example configures the target node on the current router to be DDC node 1, often referred to as CMTS A in additional sections of this document.

```
Router(config-if)# cable redundancy target 1
```

Related Commands

Command	Description
cable redundancy myid	Sets the total number of Cisco DDC nodes (routers) in the DDC Redundancy scheme, and sets the ID of the current DDC node.
cable redundancy node {active | standby}	Configures the DDC node (*node_id*) with active or standby state.
cable redundancy node frequency	Configures the DDC scheme by setting the DS frequencies for each node in the scheme other than the current DDC node (router).
cable redundancy threshold	Configures the DDC node (*node_id*) by setting the active voice call threshold on the current DDC node (router).
show cable redundancy	Displays the current DDC redundancy configurations and status.

cable redundancy threshold

To set the active voice call threshold on the current DDC node (router), use the **cable redundancy threshold** command in interface configuration mode. If the number of active voice calls exceeds this value, a DDC switchover does not take place unless it is forced by using the **cable redundancy node** *node_id* **standby force** subinterface configuration command. To remove this configuration from the router, use the **no** form of this command.

cable redundancy threshold *max-calls*

no cable redundancy threshold

Syntax Description

max-calls	The threshold value for the number of active voice calls.

Defaults

The threshold for maximum calls is not set by default.

Command Modes

Interface configuration

Command History

Release	Modification
Release 12.3(9a)BC	This command was introduced on the Cisco uBR7246 universal broadband router.

Usage Guidelines

If the command is configured on a bundle master, the threshold is used to compare with the total number of voice calls in the bundle. This command is not accepted on interfaces configured as bundle slaves.

If this threshold is not configured, this check does not occur and the DDC switchover proceeds regardless of how many voice calls are active. This is subject to additional constraints described in the "Call Priority in Cisco DDC Redundancy" section on page 5.

Examples

The following example configures DDC redundancy not to take place if there are more than 20 active or E911 calls at the time a DDC switchover event is attempted or requested.

```
Router(config-if)# cable redundancy threshold 20
```

Related Commands

Command	Description
cable redundancy myid	Sets the total number of Cisco DDC nodes (routers) in the DDC Redundancy scheme, and sets the ID of the current DDC node.
cable redundancy node {active | standby}	Configures the DDC node (*node_id*) with active or standby state.
cable redundancy node frequency	Configures the DDC scheme by setting the DS frequencies for each node in the scheme other than the current DDC node (router).
cable redundancy target	Configures the DDC node (*node_id*) by setting the target DDC node (router) to use in a DDC switchover event.
show cable redundancy	Displays the current DDC redundancy configurations and status.

show cable redundancy

To display the DDC redundancy partners and their relative states, and additional information about DDC states on the Cisco CMTS, use the **show cable redundancy** command in privileged EXEC mode.

show cable redundancy {hashfilter | class | calls}

Syntax Description

hashfilter	Displays the hash filter(s) being used in the scheme.
class	Displays the displays the number of cable modems in each DDC class of the same scheme.
calls	Displays the number of active and E911 calls currently being supported on the relative DDC nodes.

Defaults

This command has no default behaviors or values.

Command Modes

Privileged EXEC

Command History

Release	Modification
Release 12.3(9a)BC	This command was introduced on the Cisco uBR7246 universal broadband router.

Examples

The following example of the **show cable redundancy hashfilter** command illustrates the same DDC Redundancy scheme (two Cisco uBR7246VXR routers). This command displays the configured hash filter parameters. You can either list all hash filters (as shown) or list one hash filter, if specified with the optional *hash_id* value at the end of the command.

```
Router# show cable redundancy hashfilter

HashFilter 1
HashType        MacMask
default         ffff.ffff.ffff
MacAddr         OUI             Node
0000.39cc.b270                  1
0000.39cc.ba70                  2
0000.39cc.c070                  2

HashFilter 2
HashType        MacMask
default         0000.00ff.ffff
MacAddr OUI Node
    00.00.391
    00.08.0D1
    00.0C.E51
```

The following example of the **show cable redundancy class** command displays the number of cable modems in each DDC class of the same scheme (two Cisco uBR7246VXR routers).

```
Router# show cable redundancy class

Number of modems in each DDC class:
InterfaceClass0Class1Class2Class3Class4
Cable3/0 32 00 0   0
Cable3/1 3200  0   0
Cable4/0320 0   0   0
Cable4/100  0   0   0
Cable5/0310 0   0   0
Cable5/1320 0   0   0
Cable6/000  0   0   0
Cable6/100  0   0   0
```

The following example of the **show cable redundancy calls** command displays the number of active 911 (E911) calls, voice calls, and the number of cable modems with service flows for each subinterface. If the subinterface is configured on a bundle, the number of calls is the total for all the members in the bundle.

```
Router# show cable redundancy calls

SubInterface  911Calls   VoiceCalls  ModemCount  ServiceFlow
Cable3/0.1    0          0           159         159
Cable3/0.2    0          0           0           0
```

Related Commands

Command	Description
cable redundancy hashfilter	Sets the MAC address and DDC node mappings of the DDC redundancy scheme
cable redundancy myid	Sets the total number of Cisco DDC nodes (routers) in the DDC Redundancy scheme, and sets the ID of the current DDC node.
cable redundancy node {active | standby}	Configures the DDC node (*node_id*) with active or standby state.
cable redundancy node frequency	Configures the DDC scheme by setting the DS frequencies for each node in the scheme other than the current DDC node (router).
cable redundancy target	Configures the DDC node (*node_id*) by setting the target DDC node (router) to use in a DDC switchover event.
cable redundancy threshold	Configures the DDC node (*node_id*) by setting the active voice call threshold on the current DDC node (router).

Glossary

DCC

Dynamic Channel Change, as described by the CableLabs® Data-Over-Cable Service Interface Specifications 1.1 & 2.0 RFI Acceptance Test Plan, CM-TP-RFI-ATP-I05-040618:

- http://www.cablemodem.com/downloads/specs/CM-TP-RFI_ATP-I05-040618.pdf

DDC

Dual-DOCSIS Channel. A high availability redundancy scheme with two or more Cisco uBR7246VXR routers. Redundancy is provided by controlling on which Cisco CMTS the cable modems register, and by allowing movement of the cable modems between the Cisco CMTS systems.

DFO

Downstream Frequency Override, as enabled by the **cable downstream frequency** command:

- http://www.cisco.com/univercd/cc/td/doc/product/cable/bbccmref/bbcmtscf.htm#wp1080840

DOCSIS

Data Over Cable Service Interface Specification, published by CableLabs®:

- http://www.cablemodem.com/specifications/

EMTA

Embedded Media Terminal Adapter. MTA integrated with a cable modem.

IUC

Interval Usage Code. A field in MAPs and UCDs to link burst profiles to grants.

MAP

Bandwidth Allocation MAP.

MIB

Management Information Base. A database of network management information that is used and maintained by a network management protocol, such as SNMP or CMIP. MIB objects are organized in a tree structure that includes public (standard) and private (proprietary) branches.

MTA

Multimedia terminal adapter. A CPE device that implements DCS or NCS signaling and provides an interface that allows customer equipment to access PacketCable services.

PCMM

PacketCable Multimedia.

SNMP

Simple Network Management Protocol. Network management protocol used almost exclusively in TCP/IP networks.

SNR

Signal to Noise Ratio. The ratio of Signal Power to Noise Power in the defined measurement bandwidth.

TLV

Type/Length/Value. A three-part object in the DOCSIS configuration file that governs part of cable modem provisioning on the Cisco CMTS. DOCSIS 1.1 TLVs include service flow encodings, classifier encodings, and support for PHS rules. The Cisco CMTS TLV parser features are used by different MAC message modules.

UCD

Upstream Channel Descriptor. The Cisco CMTS periodically broadcasts Upstream Channel Descriptor (UCD) messages to all cable modems. These messages define upstream channel characteristics including upstream frequencies, symbol rates and modulation schemes, FEC parameters, and other physical layer values.

Upstream

The direction of transmission from the subscriber to the head-end in a cable television network.