Dynamic Bandwidth Sharing on the Cisco CMTS Router

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The Cable Modem Termination System (CMTS) enables dynamic bandwidth sharing (DBS) on modular cable (MC), integrated cable (IC), and wideband (WB) cable interfaces.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

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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Prerequisites for Dynamic Bandwidth Sharing

Table below shows the hardware compatibility prerequisites for the Dynamic Bandwidth Sharing on the Cisco CMTS Router feature.

Table 1: Cable Hardware Compatibility Matrix for Dynamic Bandwidth Sharing

CMTS Platform	Processor Engine	Cable Interface Line Cards
Cisco uBR10012 Universal Broadband Router	Cisco IOS Release 12.3(23)BC1 and later releases • PRE2 Cisco IOS Release 12.2(33)SCB and later releases • PRE4 Cisco IOS Release 12.2(33)SCH and later releases • PRE5	Cisco IOS Release 12.2(33)SCB and later releases • Cisco uBR10-MC5X20S/U/H Cisco IOS Release 12.2(33)SCC and later releases • Cisco UBR-MC20X20V Cisco IOS Release 12.2(33)SCE and later releases • Cisco uBR-MC3GX60V[1]
Cisco uBR7225VXR Universal Broadband Router	Cisco IOS Release 12.2(33)SCD and later releases • NPE-G2	Cisco IOS Release 12.2(33)SCD and later releases • Cisco uBR-MC88V
Cisco uBR7246VXR Universal Broadband Routers	Cisco IOS Release 12.2(33)SCD and later releases • NPE-G2	Cisco IOS Release 12.2(33)SCD and later releases • Cisco uBR-MC88V

1   Cisco uBR-MC3GX60V cable interface line card is not compatible with PRE2.

Restrictions for Dynamic Bandwidth Sharing

• The bandwidth sharing state of a modular, integrated, or wideband cable interface can be changed only when the interface is administratively shutdown.

Information About Dynamic Bandwidth Sharing

The following sections provide information on DBS:

DBS for Modular, Integrated, and Wideband Cable Interfaces

Prior to DOCSIS 3.0 standards, cable service flows were associated with a single cable interface, which in turn corresponded to a physical downstream on a line card. Under DOCSIS 3.0 standards, cable service flows can be associated with more than one downstream channel.

DBS is the dynamic allocation of bandwidth for MC, IC, and WB cable interfaces sharing the same downstream channel. The bandwidth available to each MC, IC, WB cable, or narrowband channel is not a fixed value—it depends on the configuration and the traffic load on the MC, IC, or WB cable.

The available bandwidth for data traffic is calculated using the following formula: Actual Line Rate – (Bandwidth used by MAC Management Messages [MMM] + Bandwidth loss due to DOCSIS header)

The bandwidth required by MMM depends on the CMTS configuration. The maximum bandwidth reserved for MMM is 4 percent (if the MMM uses less than 4 percent of bandwidth, the remaining unused bandwidth is available for the data traffic).

DBS enables high burst rates with DOCSIS 2.0 cable modems as well as DOCSIS 3.0 cable modems. The DBS feature continues working across line card and performance routing engine (PRE) switchovers with no loss of functionality.

DBS Configuration

Dynamic bandwidth sharing and static bandwidth allocations are configured at the MC, IC, or WB cable interface level. By default, bandwidth for an MC, IC, or WB cable channel is statically allocated. When DBS is enabled on an interface, the static bandwidth percentage is converted to a committed information rate (CIR) value for the corresponding interface. The interface CIR value represents the guaranteed portion of the interface bandwidth and is used for admission control of the service flows with minimum reserved rate. When DBS is enabled, you can also specify the remaining ratio value of the excess bandwidth for the interface. If DBS is enabled and no bandwidth percentage is specified, no bandwidth is reserved for the MC, IC, or WB cable interface and the interface is effectively in protocol down state.

Dynamic bandwidth sharing does not preclude static bandwidth configuration. If a static portion of bandwidth is configured on any RF channel that one or more DBS-enabled channel utilizes, that portion is subtracted from the CIR value of the RF link. Therefore, such a portion is always reserved and is not available to dynamic MC, IC, or WB cable interfaces.

Note   Starting with Cisco IOS Release 12.2(33)SCE, the DBS mode is enabled by default, on the WB/MC/IC interfaces. To disable the DBS mode, configure the no cable dynamic-bw-sharing command.

How to Configure Dynamic Bandwidth Sharing

This section contains the following procedures:

Configuring DBS for a Modular Cable Interface

To configure DBS for an MC interface on the Cisco uBR10012 router, use the **cable dynamic-bw-sharing** command in interface configuration mode.

> ✎
>
> **Note** The interface must be administratively shutdown before DBS can be configured on the MC interface.

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.
Step 3	**interface modular-cable** *slot* /*subslot* /*port* :*nb-channel-number* **Example:** Router(config)# **interface modular-cable 1/0/0:1**	Configures a modular cable interface. • *slot* —Chassis slot number of the cable interface line card. Cisco uBR10012 router: The valid range for line card is from 5 to 8 and slots 1 and 3 can be used for SIPs. • *subslot* —(Cisco uBR10012 only) Secondary slot number of the cable interface line card. Valid subslots are 0 or 1. • *port* —Downstream port number. Cisco uBR10012 router: The valid range is from 0 to 4 (depending on the cable interface). • *nb-channel-number*—Narrowband channel number.
Step 4	**shutdown** **Example:** Router(config-if)# **shutdown**	Shuts down the interface selected in Step 3 prior to configuring dynamic bandwidth sharing.
Step 5	[**no**] **cable dynamic-bw-sharing** **Example:** Router(config-if)# **cable dynamic-bw-sharing**	Enables dynamic bandwidth sharing (DBS) on the modular cable interface. Use the **no** form of this command to enable static bandwidth sharing (SBS) on the interface.

	Command or Action	Purpose
		Note Starting with Cisco IOS Release 12.2(33)SCE, the DBS mode is enabled by default, on the WB, MC, and IC interfaces. To disable the DBS mode, configure the no cable dynamic-bw-sharing command.
Step 6	**no shutdown** **Example:** Router(config-if)# **no shutdown**	Enables the interface on which dynamic bandwidth sharing is configured.
Step 7	**cable rf-bandwidth-percent***percent-value* [**remaining ratio** *excess-value*] **Example:** Router(config-if)# **cable rf-bandwidth-percent 45 remaining ratio 22**	Enables either static or dynamic bandwidth sharing for modular cable interfaces. The default *percent-value* is 0. The *percent-value* range is 1–96. • If dynamic bandwidth sharing is enabled, the **remaining ratio** option is available. The bandwidth percentage is converted to a committed information rate (CIR) value for the corresponding interface. • The *excess value* - argument specifies the ratio of the excess bandwidth that can be allocated to the modular cable channel. The default *excess value* - is 1. The *excess value* - range is 1–100.

Configuring DBS for a Wideband Cable Interface

To configure DBS for a wideband cable interface, use the **cable dynamic-bw-sharing** command in interface configuration mode for WB cable.

Note The interface must be administratively shutdown before DBS can be configured on the wideband cable interface.

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	**interface wideband-cable** {*slot*/*port* | *slot*/*subslot*/*port* }:*wideband-channel* **Example:** Router(config)# **interface wideband-cable 1/0/0:0**	Configures a wideband cable interface. • *slot* —Chassis slot number of the cable interface line card. Cisco uBR7246VXR router: The valid range is from 3 to 6. Cisco uBR7225VXR router: The valid range is from 1 to 2. Cisco uBR10012 router: The valid range is from 5 to 8. • *subslot* —(Cisco uBR10012 only) Secondary slot number of the cable interface line card. Valid subslots are 0 or 1. • *port* —Downstream port number. Cisco uBR7246VXR and Cisco uBR7225VXR routers: The valid port value is 0 or 1. Cisco uBR10012 router: The valid range is from 0 to 4 (depending on the cable interface). • *wideband-channel*—Wideband channel number. Cisco uBR7246VXR and Cisco uBR7225VXR routers: The valid values are from 0 to 5. Cisco uBR10012 router: The valid range is from 0 to 11.
Step 4	**shutdown** **Example:** Router(config-if)# **shutdown**	Shuts down the interface selected in Step 3 prior to configuring dynamic bandwidth sharing.
Step 5	**cable dynamic-bw-sharing** **Example:** Router(config-if)# **cable dynamic-bw-sharing**	Enables dynamic bandwidth sharing (DBS) on the wideband cable interface. Use the **no** form of this command to enable static bandwidth sharing (SBS) on the interface. **Note** Starting with Cisco IOS Release 12.2(33)SCE, the DBS mode is enabled by default, on the WB, MC, and IC interfaces. To disable the DBS mode, configure the **no cable dynamic-bw-sharing** command.
Step 6	**no shutdown** **Example:** Router(config-if)# **no shutdown**	Enables the interface on which dynamic bandwidth sharing is configured.
Step 7	**cable rf-channel***rf-port* [**bandwidth-percent** *bw-percent*] [**remaining ratio***excess-value*] **Example:** Router(config-if)# **cable rf-channel**	Associates an RF channel on a Wideband SPA with a wideband channel and allocates bandwidth. The range for **bandwidth-percent** is 1−100. If **bandwidth-percent** is not used, the default bandwidth value is 100 percent. The **remaining-ratio** option is only available if DBS is enabled. The default *excess-value* is 1. The range for *excess-value* is 1−100.

Command or Action	Purpose
`10 bandwidth-percent 50` `remaining-ratio 5`	

Configuring DBS for an Integrated Cable Interface

To configure DBS for an integrated cable interface, use the **cable dynamic-bw-sharing** command in interface configuration mode.

Note The interface must be administratively shutdown before DBS can be configured on the integrated cable interface.

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.

Step 3	**interface integrated-cable** {*slot*/*port* | *slot*/*subslot*/*port* }:*rf-channel*
	
	Example:
	`Router(config)# interface`
	`integrated-cable 1/0/0:0`
		Enters the cable interface mode.
		
		• *slot* —Chassis slot number of the cable interface line card.
		Cisco uBR7246VXR router: The valid range is from 3 to 6.
		
		Cisco uBR7225VXR router: The valid range is from 1 to 2.
		
		Cisco uBR10012 router: The valid range is from 5 to 8.
		
		• *subslot*—(Cisco uBR10012 only) Secondary slot number of the cable interface line card. Valid subslots are 0 or 1.
		
		• *port*—Downstream port number.
		Cisco uBR7246VXR and Cisco uBR7225VXR routers: The valid port value is 0 or 1.
		
		Cisco uBR10012 router: The valid range is from 0 to 4 (depending on the cable interface).
		
		• *rf-channel*—RF channel number with a range of 0 to 3.

	Command or Action	Purpose
Step 4	**shutdown** **Example:** `Router(config-if)#  shutdown`	Shuts down the interface selected in Step 3 prior to configuring dynamic bandwidth sharing.

Step 5	**cable dynamic-bw-sharing**
	
	Example:
	
	`Router(config-if)# cable`
	`dynamic-bw-sharing`
		Enables dynamic bandwidth sharing on the wideband cable interface.
		
		Use the **no** form of this command to enable static bandwidth sharing (SBS) on the interface.
		
		Note Starting with Cisco IOS Release 12.2(33)SCE, the DBS mode is enabled by default, on the WB, MC, and IC interfaces. To disable the DBS mode, configure the no cable dynamic-bw-sharing command.

Step 6	**no shutdown** **Example:** `Router(config-if)# no shutdown`	Enables the interface where dynamic bandwidth sharing is configured.

Step 7	**cable rf-channel** *rf-port* [**bandwidth-percent** *bw-percent*] [**remaining ratio** *excess-value*]
	
	Example:
	
	`Router(config-if)# cable rf-channel`
	` 10 bandwidth-percent 50`
	`remaining-ratio 5`
		Enables either static or dynamic bandwidth percentage sharing for an IC interface in interface configuration mode.
		
		• *bw-percent*—Static bandwidth allocation of a downstream RF channel. The range is 1 to 100%. The default is 0.
		
		• **remaining ratio**—(Optional) Indicates the ratio of the remaining or excess bandwidth that can be allocated to the modular cable channel. This option is available only when dynamic bandwidth sharing is enabled. Run the **cable dynamic-bw-sharing** command to enable DBS.
		
		• *excess-value*—Value of excess bandwidth that can be allocated to the cable channel. The range is from 1 to 100. The default value is 1.

Verifying Configuration of DBS

To verify the configuration of the CMTS DBS, use the **show** commands described below.

Cisco uBR10012 Universal Broadband Router

To view the parallel express forwarding (PXF) queueing and link queue statistics, use the **show pxf cpu queue** command for either modular cable or wideband cable interfaces.

Modular cable interface

```
Router(config)# interface modular-cable 1/0/0:1
...
Router(config-if)# cable dynamic-bw-sharing
...
Router# show pxf cpu queue modular-cable 1/0/0:1
```

```
Link Queues :
QID   CIR(act/conf)        EIR          MIR        RF Chan.  Status
  420   19661/19661         1/1       65535/65535     0       Inactive
```

Wideband cable interface

```
Router(config)# interface wideband-cable 1/0/0:0
...
Router(config-if)# cable dynamic-bw-sharing
...
Router# show pxf cpu queue wideband-cable 1/0/0:0
Link Queues :
QID   CIR(act/conf)        EIR          MIR        RF Chan.  Status
  419   32768/32768         1/1       65535/65535     0       Inactive
  566   19661/19661         1/1       65535/65535     1       Inactive
```

Cisco uBR7200 Series Universal Broadband Router

To view the DBS configuration on the Cisco uBR7200 series universal broadband router, use show interface wideband-cable slot/port:wideband-channel dbs and show interface integrated-cable slot/port:rf-channel dbs commands as shown below:

Wideband cable interface

```
Router(config)# interface wideband-cable 5/1:0
...
Router(config-if)# cable dynamic-bw-sharing
...
Router# show
interface wideband-cable 5/1:0 dbs
        Dynamic Bandwidth Sharing is enabled
        bg_rf_channel_bitmap_local 70, active 0
        RF 4: tokens 32500, active 0, policer 3250 KB/s, max_tokens 32500
                deficit counter 0, quantum 10000
                ticks_limit: 62500, max_ticks:687500, policer(ticks): 212
                dbs_pct: 100, remain_bytes: 0, if range: 7-7
        RF 5: tokens 32500, active 0, policer 3250 KB/s, max_tokens 32500
                deficit counter 0, quantum 10000
                ticks_limit: 62500, max_ticks:687500, policer(ticks): 212
                dbs_pct: 100, remain_bytes: 0, if range: 7-7
        RF 6: tokens 32500, active 0, policer 3250 KB/s, max_tokens 32500
                deficit counter 0, quantum 10000
                ticks_limit: 62500, max_ticks:687500, policer(ticks): 212
                dbs_pct: 100, remain_bytes: 0, if range: 7-7
                dbs state: start:4, end:6
```

Integrated cable interface

```
Router(config)# interface integrated-cable 5/1:0
...
Router(config-if)# cable dynamic-bw-sharing
...
Router# show
interface integrated 5/1:0 dbs
        Dynamic Bandwidth Sharing is enabled
        active 0
        RF 4: tokens 32500, active 0, policer 3250 KB/s, max_tokens 32500
                deficit counter 0, quantum 0
                ticks_limit: 62500, max_ticks:687500, policer(ticks): 212
                dbs_pct: 100, remain_bytes: 0, if range: 7-7
```

Enabling DBS Debug

To enable specific DBS debug output, use the **debug cr10k-rp dbs-queue** command on the Cisco uBR10012 router and the debug cable dbs command on the Cisco uBR7200 series routers as shown in the following examples:

```
Router# debug cr10k-rp dbs-queue
CR10K RP debug dynamic BG link queue setup debugging is on
Router# debug cable dbs
DBS for cable 8x8 LC debugging is on
```

Note Routine use of the **debug cr10k-rp dbs-queue** and debug cable dbs commands is not recommended.

Configuration Examples for Dynamic Bandwidth Sharing

This section provides the following configuration examples:

Example: Configuring DBS on a Modular Cable Interface

In the following example, DBS is enabled on modular cable interface 1. Because DBS is enabled, the percent value is converted to a committed information rate (CIR) of 45, which means the modular cable channel is guaranteed 45 percent of the bandwidth. The ratio of excess bandwidth is assigned a value of 22, which means that if there is excess bandwidth available, a remaining ratio of 22 can be assigned to the MC channel.

Cisco uBR10012 Universal Broadband Routers

```
configure terminal
interface modular-cable 1/0/0:1
shutdown
cable dynamic-bw-sharing
no shutdown
cable rf-bandwidth-percent 45 remaining ratio 22
```

Example: Configuring DBS on a Wideband Cable Interface

In the following example, DBS is enabled on wideband channel 0. Because DBS is enabled, the percent value is converted to a CIR value of 50, which means the wideband cable channel is guaranteed 50 percent of the bandwidth. The *excess-value* is assigned a value of 5, which means that if there is excess bandwidth available, a remaining ratio of 5 can be assigned to the wideband channel.

Cisco uBR10012 Universal Broadband Routers

```
configure terminal
interface wideband-cable 1/0/0:0
shutdown
cable dynamic-bw-sharing
no shutdown
cable rf-channel 10 bandwidth-percent 50 remaining ratio 5
```

Cisco uBR7200 Series Universal Broadband Routers

```
configure terminal
interface wideband-cable 1/0:0
shutdown
cable dynamic-bw-sharing
no shutdown
cable rf-channel 10 bandwidth-percent 50 remaining ratio 5
```

Example: Configuring DBS on an Integrated Cable Interface

In the following example, DBS is enabled on integrated channel 0. Because DBS is enabled, the percent value is converted to a CIR value of 50, which means the integrated cable channel is guaranteed 50 percent of the bandwidth. The *excess-value* is assigned a value of 5, which means that if there is excess bandwidth available, a remaining ratio of 5 can be assigned to the integrated channel.

Cisco uBR10012 Universal Broadband Routers

```
configure terminal
interface integrated-cable 1/0/0:0
shutdown
cable dynamic-bw-sharing
no shutdown
cable rf-channel 10 bandwidth-percent 50 remaining ratio 5
```

Cisco uBR7200 Series Universal Broadband Routers

```
configure terminal
interface integrated-cable 1/0:0
shutdown
cable dynamic-bw-sharing
no shutdown
```
cable rf-channel 10 bandwidth-percent 50 remaining ratio 5

Where to Go Next

For further information on the commands required to configure, maintain, and troubleshoot Cisco uBR10012 universal broadband router or Cisco uBR7200 series universal broadband router and Cisco cable modems, see the *Cisco IOS CMTS Cable Command Reference* at:

http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html .

Additional References

The following sections provide references related to the dynamic bandwidth sharing (DBS) on the Cisco CMTS.

Related Documents

Related Topic	Document Title
Cisco IOS CMTS cable commands	See the *Cisco IOS CMTS Cable Command Reference* at: http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html

Standards

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

MIBs

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

RFCs

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

Technical Assistance

Description	Link
The Cisco 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/cisco/web/support/index.html

Feature Information for Dynamic Bandwidth Sharing

Table below lists the release history for this feature.

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

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Use Cisco Feature Navigator to find information about 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 http://tools.cisco.com/ITDIT/CFN/. An account on http://www.cisco.com/ is not required.

Note The below table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 2: Feature Information for Dynamic Bandwidth Sharing

Feature Name	Releases	Feature Information
CMTS Dynamic Bandwidth Sharing	12.3(23)BC1	The Cisco CMTS new feature enables dynamic bandwidth sharing on a modular cable or wideband cable interface. The following commands were introduced or modified by this feature: • **cable dynamic-bw-sharing** • **cable rf-bandwidth-percent** • **cable rf-channel** • **debug cr10k-rp dbs-queue** • **show pxf cable controller** • **show pxf cpu queue**
CMTS Dynamic Bandwidth Sharing	12.2(33)SCD	Support on the Cisco uBR7225VXR and Cisco uBR7246VXR routers was added. The following commands were introduced or modified: • **debug cable dbs** • **interface integrated-cable** • **interface wideband-cable** • **show interface integrated-cable** • **show interface wideband-cable**