



Advanced-Mode DOCSIS Set-Top Gateway 1.2 for the Cisco CMTS Routers

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Note

Cisco IOS Release 12.2(33)SCA integrates support for this feature on the Cisco CMTS routers. This feature is also supported in Cisco IOS Release 12.3BC, and this document contains information that references many legacy documents related to Cisco IOS 12.3BC. In general, any references to Cisco IOS Release 12.3BC also apply to Cisco IOS Release 12.2SC.

The Advanced-Mode DOCSIS Set-Top Gateway (A-DSG) Issue 1.2 introduces support for the latest DOCSIS Set-Top specification from CableLabs™, to include the following enhancements:

- *DOCSIS Set-top Gateway (DSG) Interface Specification*
- A-DSG 1.2 introduces support for the DOCS-DSG-IF MIB.

Cisco A-DSG 1.2 is certified by CableLabs™, and is a powerful tool in support of latest industry innovations. A-DSG 1.2 offers substantial support for enhanced DOCSIS implementation in the broadband cable environment. The set-top box (STB) dynamically learns the overall environment from the Cisco CMTS router, to include MAC address, traffic management rules, and classifiers.

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.

Contents

- [Prerequisites for Advanced-Mode DSG Issue 1.2, page 2](#)

- [Restrictions for Advanced-Mode DSG Issue 1.2, page 3](#)
- [Information About Advanced-Mode DSG Issue 1.2, page 4](#)
- [How to Configure Advanced-Mode DSG Issue 1.2, page 7](#)
- [How to Monitor and Debug the Advanced-mode DOCSIS Set-Top Gateway Feature, page 22](#)
- [Configuration Examples for Advanced-Mode DSG, page 32](#)
- [Additional References, page 35](#)
- [Feature Information for Advanced-Mode DSG 1.2 for the Cisco CMTS Routers, page 36](#)

Prerequisites for Advanced-Mode DSG Issue 1.2

Table below shows the hardware compatibility prerequisites for the A-DSG for the Cisco CMTS Routers feature.



Note The hardware components introduced in a given Cisco IOS Release are supported in all subsequent releases unless otherwise specified.

Table 1: A-DSG for the Cisco CMTS Routers Hardware Compatibility Matrix

CMTS Platform	Processor Engine	Cable Interface Cards
Cisco uBR10012 Universal Broadband Router	Cisco IOS Release 12.2(33)SCA and later	Cisco IOS Release 12.2(33)SCA and later
	• PRE2	• Cisco uBR10-MC5X20S/U/H
	Cisco IOS Release 12.2(33)SCB and later	Cisco IOS Release 12.2(33)SCC and later
	• PRE4	• Cisco UBR-MC20X20V
		Cisco IOS Release 12.2(33)SCE and later
		• Cisco uBR-MC3GX60V ¹
Cisco uBR7246VXR Universal Broadband Router	Cisco IOS Release 12.2(33)SCA and later	Cisco IOS Release 12.2(33)SCA and later
	• NPE-G1	• Cisco uBR-MC28U/X
	• NPE-G2	• Cisco uBR-MC16U/X
		Cisco IOS Release 12.2(33)SCD and later
		• Cisco uBR-MC88V ²

CMTS Platform	Processor Engine	Cable Interface Cards
Cisco uBR7225VXR Universal Broadband Router	<p>Cisco IOS Release 12.2(33)SCA and later</p> <ul style="list-style-type: none"> • NPE-G1 <p>Cisco IOS Release 12.2(33)SCD and later</p> <ul style="list-style-type: none"> • NPE-G2 	<p>Cisco IOS Release 12.2(33)SCA and later</p> <ul style="list-style-type: none"> • Cisco uBR-E-28U • Cisco uBR-E-16U • Cisco uBR-MC28U/X • Cisco uBR-MC16U/X <p>Cisco IOS Release 12.2(33)SCD and later</p> <ul style="list-style-type: none"> • Cisco uBR-MC88V³

¹ Cisco uBR3GX60V cable interface line card is compatible only with PRE4.

² You must use NPE-G2 with the Cisco uBR-MC88V cable interface line card.

³ You must use NPE-G2 with the Cisco uBR-MC88V cable interface line card.

Restrictions for Advanced-Mode DSG Issue 1.2

This section contains restrictions that are specific to A-DSG 1.2 on a Cisco CMTS router.

DSG Configuration File Transfer Operations

DSG 1.2 does not support the copying of a DSG configuration file from a TFTP server, file system, or bootflash to the running configuration.

Previously, with DSG 1.1, when copying the DSG configuration file from a file system or TFTP server to the running configuration, DSG rule error checking may disable a previously configured and valid DSG tunnel configuration. This issue has not been observed in DSG 1.1 when loading the DSG configuration file from the startup configuration, as during a reload.

Multicast Configuration Restrictions

As with earlier versions of DSG Issues 0.9 and 1.0, IP multicasting must be configured for correct operation of A-DSG 1.2. Specifically, IP multicast routing must be set in global configuration. Also, IP PIM must be configured on all bundle interfaces of cable interfaces that are to carry multicast traffic.

See the [Configuring the Default Multicast Quality of Service, on page 7](#) and the [Configuring IP Multicast Operations, on page 14](#) for additional Multicast information and global configurations supporting DSG.

NAT for DSG Unicast-only Mapping

A-DSG 1.2 supports multicast IP addressing. However, it also supports unicast IP destination addresses. On the Cisco uBR7246VXR router, DSG 1.2 support is provided with the configuration of Network Address Translation (NAT) on the router, to include these settings:

- WAN interface(s) are configured with the **ip nat outside** command.
- Cable interface(s) are configured with the **ip nat inside** command.
- For each mapping, additional configuration includes the source static multicast IP address and the unicast IP address.

The unicast IP address is the unicast destination IP address of the DSG packets arriving at the Cisco CMTS router. The multicast IP address is the new destination IP address that is configured to map to one or a set of DSG tunnels.

PIM and SSM for Multicast

When using Source Specific Multicast (SSM) operation in conjunction with A-DSG 1.2, the following system-wide configuration command must be specified:

- **ip pim ssm**

Refer to the [Configuring IP Multicast Operations](#), on page 14.

Subinterfaces

A-DSG 1.2 supports subinterfaces on the Cisco CMTS router starting from Cisco IOS Release 12.2(33)SCB4.



Note

Effective with Cisco IOS Release 12.2(33)SCH3, ensure that the DSG downstream configuration is disabled, before you remove a DSG tunnel group from a subinterface.

Information About Advanced-Mode DSG Issue 1.2

A-DSG 1.2 offers substantial upgrades over A-DSG 1.1 and earlier basic DSG on the Cisco CMTS router. A-DSG 1.2 offers these new or enhanced capabilities:

- A-DSG client and agent modes
- Advanced-mode MIBs supporting DSG 1.2, including the DOCS-DSG-IF-MIB
- Advanced-mode tunnels with increased security
- Cable interface bundling through virtual interface bundling
- Downstream Channel Descriptor
- IP multicast support

- Quality of Service (QoS)

DSG 1.2 Clients and Agents

A-DSG 1.2 supports the DSG client and agent functions outlined by the CableLabs™ *DOCSIS Set-top Gateway (DSG) Interface Specification*, CM-SP-DSG-I05-050812.

FQDN Support

Starting with Cisco IOS Release 12.2(33)SCG, you can specify either a fully-qualified domain name (FQDN) or IP address for A-DSG classifier multicast group and source addresses using the **cable dsg cfr** command in global configuration mode. We recommend that you use an FQDN to avoid modification of multicast group and source addresses when network changes are implemented.

This feature allows you to use a hostname (FQDN) in place of the source IP address using the **cable dsg cfr** command. For example, you have two A-DSG tunnel servers, in two locations, sending multicast traffic to the same multicast address. In this scenario, you can specify a hostname for the source IP address and let the DNS server determine which source is sending the multicast traffic.

If you configure an A-DSG classifier with a hostname, the Cisco CMTS router immediately verifies if the hostname can be resolved against an IP address using the local host cache. If not, the router does not enable the classifier until the hostname is resolved. If the hostname cannot be resolved locally, the router performs a DNS query to verify the DSG classifiers.

The FQDN format does not support static Internet Group Management Protocol (IGMP) join requests initiated on the Cisco CMTS router. The IGMP static group IP address created automatically under a bundle interface at the time of A-DSG configuration is not displayed in the **show running-config interface command output** in Cisco IOS Release 12.2(33)SCG and later. To display the A-DSG static groups configured under a bundle interface, use the **show cable dsg static-group bundle** command in privileged EXEC mode in Cisco IOS Release 12.2(33)SCG and later.

DSG Name Process and DNS Query

Every DNS record contains a time to live (TTL) value set by the server administrator, and this may vary from seconds to weeks. The DSG name process supersedes the TTL value criterion to update A-DSG classifiers on the Cisco CMTS router.

The DSG name process enables the Cisco CMTS router to query the DNS server for faster classifier updates. To enable the Cisco CMTS router to perform a DNS query for an A-DSG classifier verification, you must configure one or more DNS servers using the **ip name-server** command in global configuration mode. You can also specify the DNS query interval using the **cable dsg name-update-interval** command in global configuration mode.

During a Cisco IOS software reload or a route processor switchover, the router may fail to query the DNS server if the interfaces are down, and the router may not wait for the interval specified using the **cable dsg name-update-interval** command to perform a DNS query. In this case, for an unresolved hostname, the router automatically performs a DNS query based on a system-defined (15 seconds) interval to facilitate faster DSG classifier updates. You cannot change the system-defined interval.

A-DSG Forwarding on the Primary Channel

In Cisco IOS Release 12.2(33)SCF and earlier, DSG tunnels are configured globally and applied to all MAC domain interfaces. This automatically creates DSG tunnels for all primary capable interfaces associated with the MAC domain interfaces.

In Cisco IOS Releases earlier to 12.2(33)SCG, you cannot exclude A-DSG forwarding per primary capable interface. However, you can disable A-DSG forwarding for the entire MAC domain by using the no form of the cable dsg tg command.

Starting with Cisco IOS Release 12.2(33)SCG, you can disable A-DSG forwarding per primary capable interface using the **cable downstream dsg disable** command in interface configuration mode. Primary capable interfaces include modular, integrated cable interfaces, and Cisco uBR10-MC5X20 and Cisco uBR-MC28U cable interfaces.

For example, assume the cable interface 7/1/1 has A-DSG enabled and has four modular channels attached to it. However, you want A-DSG forwarding enabled only on two of these four modular channels. You can exclude the channels of your choice using the cable downstream dsg disable command. For details on how to disable modular channels, see the [Disabling A-DSG Forwarding on the Primary Channel, on page 21](#).



Note

If A-DSG downstream forwarding is disabled on a primary capable interface, the router does not create multicast service flows on the primary capable interface and stops sending Downstream Channel Descriptor (DCD) messages.

DOCSIS 3.0 DSG MDF Support

Support for DOCSIS 3.0 DSG Multicast DSID Forwarding (MDF) is introduced in Cisco IOS Release 12.2(33)SCG using DSG DA-to-DSID Association Entry type, length, value (TLV 13) in the MAC domain descriptor (MDD) message to communicate the association between a downstream service identifier (DSID) and a group MAC address used for DSG tunnel traffic. This is automatically supported on the Cisco CMTS router.

DOCSIS 2.0 hybrid CMs and DOCSIS 3.0 CMs use Dynamic Bonding Change (DBC) to get DSID information from the Cisco CMTS router, whereas DOCSIS 2.0 DSG hybrid embedded CMs and DOCSIS 3.0 DSG embedded CMs get DSID information from the Cisco CMTS router through MDD messages.

To disable MDF capability on all DSG embedded cable modems, including DOCSIS 3.0 DSG and DOCSIS 2.0 DSG hybrid modems, use the cable multicast mdf-disable command with the dsg keyword in global configuration mode.

Source Specific Multicast Mapping

Source Specific Multicast (SSM) is a datagram delivery model that best supports one-to-many applications, also known as broadcast applications. SSM is a core networking technology for the Cisco implementation of IP multicast solutions targeted for audio and video broadcast application environments.

The following two Cisco IOS components together support the implementation of SSM:

- Protocol Independent Multicast source-specific mode (PIM-SSM)

- Internet Group Management Protocol Version 3 (IGMPv3)

Starting with Cisco IOS Release 12.2(33)SCG, SSM mapping can be configured on Cisco CMTS routers.

For details on how to configure SSM mapping on a Cisco CMTS router, see the [Source Specific Multicast \(SSM\) Mapping](#) feature guide.

How to Configure Advanced-Mode DSG Issue 1.2

Advanced-mode DSG Issue 1.2 entails support for DSG tunnel configuration, to include global, WAN-side, and interface-level settings in support of Multicast.

Configuring the Default Multicast Quality of Service

According to DOCSIS 3.0, you must configure the default multicast quality of service (MQoS) when using the MQoS. This also applies to the DSG, which uses the MQoS by associating a service class name with the tunnel.

If the default MQoS is not configured, the DSG tunnel service class configuration is rejected. Similarly, if no DSG tunnel uses the MQoS, you are prompted to remove the default MQoS.

The CMTS selects the primary downstream channel to forward the multicast traffic when the default MQoS is configured and there is no matching MQoS group configuration. Otherwise, the wideband interface is used to forward the multicast traffic.

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal Example: Router(config)#	Enters global configuration mode.
Step 3	cable multicast group-qos default scn <i>service-class-name</i> aggregate Example: Router(config)# cable multicast group-qos default scn name1 aggregate	Configures a service class name for the QoS profile.

	Command or Action	Purpose
Step 4	end Example: Router(config)# end	Returns to privileged EXEC mode.

What to Do Next



Note If you configure or remove the default MQoS while the CMTS is sending multicast traffic, duplicate traffic is generated for approximately 3 minutes (or 3 times the query interval).

Configuring Global Tunnel Group Settings for Advanced-Mode DSG 1.2

This procedure configures global and interface-level commands on the Cisco CMTS router to enable DSG tunnel groups. A DSG tunnel group is used to bundle some DSG channels together and associate them to a MAC domain interface.

Global A-DSG 1.2 Tunnel Settings

This procedure sets and enables global configurations to support both A-DSG 1.2 clients and agents. Additional procedures provide additional settings for these clients and agents.

Before You Begin

Starting with the Cisco IOS Release 12.2(33)SCC1, when DOCSIS Set-top Gateway (DSG) is configured to have quality of service (QoS) for tunnel, ensure that the default multicast QoS (MQoS) is also configured. For more information, see [Configuring the Default Multicast Quality of Service, on page 7](#).



Note The DSG tunnel service class configuration is rejected, if default MQoS is not configured.

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.

	Command or Action	Purpose
Step 2	<p>configure terminal</p> <p>Example:</p> <pre>Router# configure terminal Router(config)#</pre>	Enters global configuration mode.
Step 3	<p>cable dsg tgroup-id [channel channel-id priority DSG-rule-priority] [enable disable]</p> <p>Example:</p> <pre>Router(config)# cable dsg tg 1 channel 1 priority 1 enable</pre>	Command allows the association of a group of tunnels to one or more downstream interfaces on the Cisco CMTS.
Step 4	<p>cabledsg tgroup-id [channel channel-id [ucid ID1]]</p> <p>Example:</p> <pre>Router(config)# cable dsg tg 1 channel 1 ucid 1</pre>	Sets the upstream channel or channels to which the DSG 1.2 tunnel applies.
Step 5	<p>cable dsg tg group-id [channel channel-id [vendor-param vendor-group-id]]</p> <p>Example:</p> <pre>Router(config)# cable dsg tg 1 channel 1 vendor-param 1</pre>	Sets the vendor-specific parameters for upstream DSG 1.2 channels.
Step 6	<p>cable dsg vendor-param group-id vendor vendor-index oui oui value value-in-TLV</p> <p>Example:</p> <pre>Router(config)# cable dsg vendor-param 1 vendor 1 oui ABCDEA value 0101AB</pre>	Configures vendor-specific parameters for A-DSG 1.2. To remove this configuration from the Cisco CMTS, use the no form of this command.
Step 7	<p>cable dsg chan-list list-index index entry-index freq freq</p> <p>Example:</p> <pre>Router(config)# cable dsg chan-list 1 index 1 freq 47000000</pre>	Configures the A-DSG 1.2 downstream channel list. The channel list is a list of DSG channels (downstream frequencies) that set-top boxes can search to find the DSG tunnel appropriate for their operation. To remove the A-DSG 1.2 channel list from the Cisco CMTS, use the no form of this command.
Step 8	<p>cable dsg timer inde [Tdsg1 Tdsg1] [Tdsg2 Tdsg2] [Tdsg3 Tdsg3] [Tdsg4 Tdsg4]</p> <p>Example:</p> <pre>Router(config)# cable dsg timer 1 Tdsg1 1 Tdsg2 2 Tdsg3 3 Tdsg4 4</pre>	Configures the A-DSG 1.2 timer entry to be associated to the downstream channel, and encoded into the Downstream Channel Descriptor (DCD) message. To remove the cable DSG timer from the Cisco CMTS, use the no form of this command.

	Command or Action	Purpose
Step 9	end Example: Router(config)# end	Returns to privileged EXEC mode.

What to Do Next

Troubleshooting Tips

Refer to **debug** and **show** commands in the [How to Monitor and Debug the Advanced-mode DOCSIS Set-Top Gateway Feature](#), on page 22.

Adding DSG Tunnel Group to a Subinterface

This procedure adds a DSG tunnel group to a subinterface using the `cable dsg tg group-id` command. After adding the DSG tunnel-group to a subinterface, appropriate IP Internet Group Management Protocol (IGMP) static joins are created and forwarding of DSG traffic begins, if the downstream DSG is configured.



Note This feature is not supported on Cisco IOS Release 12.2(33)SCC.

Before You Begin

Cisco IOS Release 12.2(33)SCB4 or Cisco IOS Release 12.2(33)SCC1 or future release versions must be installed previously on the Cisco CMTS.

The downstream DSG should exist to create IGMP static joins.



Restriction You can associate a DSG tunnel group to only one subinterface within the same bundle interface.

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.

	Command or Action	Purpose
Step 2	configureterminal Example: Router# configure terminal Router(config)#	Enters global configuration mode.
Step 3	interface bundle <i>bundle-subif-number</i> Example: Router(config)# interface bundle 11.2 Router(config-subif)#	Specifies the interface bundle and enters the subinterface configuration mode.
Step 4	cable dsg tg <i>group-id</i> Example: Router(config-subif)# cable dsg tg 1	Adds a DSG tunnel group to a subinterface.
Step 5	end Example: Router(config-subif)# end	Returns to privileged EXEC mode.

Configuring the DSG Client Settings for Advanced-Mode DSG 1.2

After the global configurations and DSG client configurations are set for DSG 1.2 on the Cisco CMTS, use the following procedure to continue DSG 1.2 client configurations.



Restriction The **in-dcd ignore** option is not supported by DSG-IF-MIBS specification.

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<p>cable dsg client-list <i>client-list-id</i> id-index <i>id</i> {application-id <i>app-id</i> ca-system-id <i>sys-id</i> mac-addr <i>mac-addr</i> broadcast [<i>broadcast-id</i>]}</p> <p>Example:</p> <pre>Router(config)# cable dsg client-list 1 id-index 1 mac-addr abcd.abcd.abcd</pre>	Sets the DSG client parameters. This command is changed from earlier Cisco IOS Releases, and for DSG 1.2, this command specifies the optional broadcast ID to client ID broadcast type and vendor specific parameter index.
Step 4	<p>cable dsg client-list <i>client-list-id</i> id-index <i>id</i> [vendor-param <i>vendor-group-id</i>]</p> <p>Example:</p> <pre>Router(config-if)# cable dsg client-list 1 id-index 1 vendor-param 1</pre>	Sets vendor-specific parameters for the DSG client.
Step 5	<p>cable dsg tunnel <i>tunnel id</i> mac_addr <i>mac addr</i> tg <i>tunnel-group</i> clients <i>client-list-id</i> [enable disable]</p> <p>Example:</p> <pre>Router(config)# cable dsg tunnel mac-addr abcd.abcd.abcd tg 1 clients 1 enable</pre>	<p>This command is changed to associate a tunnel group and client-list ID to a DSG tunnel. Also, an optional QoS service class name can be associated to the tunnel.</p> <p>Note To associate a cable service class with an A-DSG tunnel on a Cisco CMTS router, use the <code>cable dsg tunnel srv-class</code> command in global configuration mode.</p>
Step 6	<p>cable dsg cfr <i>cfr index</i> [dest-ip {<i>ipaddr</i> <i>hostname</i>}] [tunnel <i>tunnel-index</i>][dest-port <i>start end</i>][priority <i>priority</i>][src-ip {<i>ipaddr</i> <i>hostname</i>} [src-prefix-len <i>length</i>]] [enable disable] [in-dcd {yes no ignore}]</p> <p>Example:</p> <pre>Router(config)# cable dsg cfr 1 dest-ip 224.225.225.225 tunnel 1 dest-port 40 50 priority 2 src-ip ciscovideo.com src-prefix-len 24 enable</pre>	<p>Specifies the DSG classifier index, with optional support for the DCD parameter, indicating whether or not to include the classifier in the DCD message.</p> <p>Note The ignore option was added to the in-dcd keyword from Cisco IOS Release 12.2(33)SCD5 onwards. When you use the ignore option, the DSG classifier is not included in the DCD message.</p>
Step 7	<p>end</p> <p>Example:</p> <pre>Router(config)# end Router#</pre>	Returns to privileged EXEC mode.

What to Do Next

Troubleshooting Tips

Refer to **debug** and **show** commands in the [How to Monitor and Debug the Advanced-mode DOCSIS Set-Top Gateway Feature](#), on page 22.

Configuring Downstream DSG 1.2 Settings for Advanced-Mode DSG 1.2

When the global and client configurations are set for DSG 1.2 on the Cisco CMTS, use the following procedure to continue with DSG 1.2 downstream configurations.

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configureterminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface cable <i>{slot /port slot /subslot/port }</i> Example: Router (config) # interface cable 8/1/1	Enters interface configuration mode.
Step 4	cable downstream dsg tg <i>group-id</i> [channel <i>channel-id</i>] Example: Router (config-if) # cable downstream dsg tg 1 channel 1	Associates the DSG tunnel group to the downstream interface. To remove this setting, use the no form of this command.
Step 5	cable downstream dsg chan-list <i>list-index</i> Example: Router (config-if) # cable downstream dsg chan-list 2	Associates the A-DSG channel list entry to a downstream channel, to be included in the DCD message. To remove this setting, use the no form of this command.
Step 6	cable downstream dsg timer <i>timer-index</i> Example: Router (config-if) # cable downstream dsg timer 3	Associates the DSG timer entry to a downstream channel, to be included in the DCD message. To remove this setting, use the no form of this command.
Step 7	cable downstream dsg vendor-param <i>vsif-grp-id</i> Example: Router (config-if) # cable downstream dsg vendor-param 2	Associates A-DSG vendor parameters to a downstream to be included in the DCD message. To remove this configuration from the Cisco CMTS, use the no form of this command.

	Command or Action	Purpose
Step 8	cable downstream dsg [dcd-enable dcd-disable] Example: Router(config-if)# cable downstream dsg dcd-enable	Enables DCD messages to be sent on a downstream channel. This command is used when there are no enabled rules or tunnels for A-DSG currently on the Cisco CMTS. To disable DCD messages, use the disable form of this command.
Step 9	end Example: Router(config-if)# end	Returns to privileged EXEC mode.

Configuring IP Multicast Operations

This section describes how to configure the operation of IP multicast transmissions on the cable and WAN interfaces on the Cisco CMTS. You should perform this configuration on each cable interface being used for DSG traffic and for each WAN interface that is connected to a network controller or Conditional Access (CA) server that is forwarding IP multicast traffic.

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 2	ip multicast-routing Example: Router(config)# ip multicast-routing	Enables multicast routing on the router.
Step 3	ip pim ssm {default range{access-list word } } Example: Router(config)# ip pim ssm range 4	Defines the Source Specific Multicast (SSM) range of IP multicast addresses. To disable the SSM range, use the no form of this command. Note When an SSM range of IP multicast addresses is defined by the ip pim ssm command, no Multicast Source Discovery Protocol (MSDP) Source-Active (SA) messages will be accepted or originated in the SSM range.
Step 4	ip cef distributed Example: Router(config)# ip cef distributed	Enables Cisco Express Forwarding (CEF) on the route processor card. To disable CEF, use the no form of this command. For additional information about the ip cef command, refer to the following document on Cisco.com:

	Command or Action	Purpose
		<ul style="list-style-type: none"> • <i>Cisco IOS Switching Services Command Reference</i>, Release 12.3 http://www.cisco.com/en/US/docs/ios/12_3/switch/command/reference/swtch_r.html
Step 5	interface bundle <i>bundle-number</i> Example: Router(config)# interface bundle 10	Enters interface configuration mode for each interface bundle being used for DSG traffic.
Step 6	ip pim {dense-mode sparse-mode sparse-dense-mode} Example: Router(config-if)# ip pim dense-mode	Enables Protocol Independent Multicast (PIM) on the cable interface, which is required to use the DSG feature: Note You must configure this command on each interface that forwards multicast traffic.
Step 7	Repeat Step 5, on page 15 and Step 6, on page 15 for each cable interface that is being used for DSG traffic. Also repeat these steps on each WAN interface that is forwarding IP multicast traffic from the DSG network controllers and Conditional Access (CA) servers.	
Step 8	end Example: Router(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.

Enabling DNS Query and DSG Name Process

The DSG name process enables the Cisco CMTS router to query the DNS server for faster classifier updates.

Before You Begin

Ensure that the IP DNS-based hostname-to-address translation is configured on the Cisco CMTS router using the **ip domain-lookup** command in global configuration mode. This is configured by default, and the status is not displayed in the running configuration.

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 2	ip domain-name name Example: Router(config)# ip domain-name cisco.com	Sets the IP domain name that the Cisco IOS software uses to complete unqualified host names
Step 3	ip name-server server-address[multiple-server-addresses] Example: Router(config)# ip name-server 131.108.1.111	Sets the server IP address.
Step 4	cable dsg name-update-interval minutes Example: Router(config)# cable dsg name-update-interval 10	Sets the interval to check the DNS server for any FQDN classifier changes.
Step 5	end Example: Router(config)# end	Returns to privileged EXEC mode.

Configuring NAT to Support Unicast Messaging

This section describes how to configure a Cisco CMTS router for Network Address Translation (NAT) to enable the use of IP unicast addresses for DSG messaging. This allows the Cisco CMTS router to translate incoming IP unicast addresses into the appropriate IP multicast address for the DSG traffic.

For the Cisco uBR10012 router, A-DSG 1.2 can use an external router that is close to the Cisco CMTS to support unicast messaging. In this case, the nearby router must support NAT, and then send the address-translated multicast IP packets to the Cisco CMTS.


Tip

This procedure should be performed after the cable interface has already been configured for DSG operations, as described in the [Configuration Examples for Advanced-Mode DSG](#), on page 32.



Note The Cisco CMTS router supports NAT only when it is running an “IP Plus” (-i-) Cisco IOS software image. Refer to the release notes for your Cisco IOS release for complete image availability and requirements.

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 2	interface <i>wan-interface</i> Example: Router (config)# interface FastEthernet0/0	Enters interface configuration mode for the specified WAN interface.
Step 3	ip nat outside Example: Router (config-if)# ip nat outside	Configures the WAN interface as the “outside” (public) NAT interface.
Step 4	interface bundle <i>bundle-number</i> Example: Router (config-if)# interface bundle 10	Enters interface configuration mode for the specified interface bundle. Note This interface bundle should have previously been configured for DSG operations.
Step 5	ip address <i>ip-address mask secondary</i> Example: Router (config-if)# ip address 192.168.18.1 255.255.255.0 secondary	Configures the cable interface with an IP address and subnet that should match the unicast address being used for DSG traffic. This IP address and its subnet must not be used by any other cable interfaces, cable modems, or any other types of traffic in the cable network.
Step 6	ip nat inside Example: Router (config-if)# ip nat inside	Configures the cable interface as the “inside” (private) NAT interface.
Step 7	exit Example: Router (config-if)# exit	Exits interface configuration mode and returns to global configuration mode.

	Command or Action	Purpose
Step 8	<p>ip nat inside source static <i>ip-multicast-address</i> <i>cable-ip-address</i></p> <p>Example:</p> <pre>Router(config)# ip nat inside source static 224.3.2.1 192.168.18.2</pre>	Maps the unicast IP address assigned to the cable interface to the multicast address that should be used for the DSG traffic.
Step 9	Repeat Step 2, on page 17 and Step 8, on page 18 for each cable interface to be configured for DSG unicast traffic.	
Step 10	<p>end</p> <p>Example:</p> <pre>Router(config)# end</pre>	Exits global configuration mode and returns to privileged EXEC mode.

Configuring WAN Interfaces for Multicast Operations

In addition to basic WAN interface configuration on the Cisco CMTS, described in other documents, the following WAN interface commands should be configured on the Cisco CMTS to support IP multicast operations with A-DSG 1.2, as required.

- **ip pim**
- **ip pim ssm**
- **ip cef**

These commands are described in the [Configuring IP Multicast Operations, on page 14](#), and in the following documents on Cisco.com.

For additional information about the **ip pim** command, refer to the following document on Cisco.com:

- *Cisco IOS IP Command Reference, Volume 3 of 4 : Multicast*, Release 12.3

http://www.cisco.com/en/US/docs/ios/12_3/ipmulti/command/reference/iprnc_r.html

For additional information about the **ip pim ssm** command, refer to the following document on Cisco.com:

- *Cisco IOS IP Command Reference, Volume 3 of 4: Multicast*, Release 12.3 T

http://www.cisco.com/en/US/docs/ios/12_3t/ip_mcast/command/reference/ip3_i2gt.html

For additional information about the **ip cef** command, refer to the following document on Cisco.com:

- *Cisco IOS Switching Services Command Reference*, Release 12.3

http://www.cisco.com/en/US/docs/ios/12_3/switch/command/reference/swtch_r.html

Configuring a Standard IP Access List for Packet Filtering

This section describes how to configure a standard IP access list so that only authorized traffic is allowed on the cable interface.



Tip This procedure assumes a basic knowledge of how access lists use an IP address and bitmask to determine the range of IP addresses that are allowed access. For full details on configuring access lists, see the documents listed in the [Additional References](#), on page 35.

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 2	access-list access-list permit group-ip-address [mask] Example: Router(config)# access-list 90 permit 228.1.1.1	Creates an access list specifying that permits access to the specific multicast address that matches the specified <i>group-ip-address</i> and <i>mask</i> .
Step 3	access-list access-list deny group-ip-address [mask] Example: Router(config)# access-list 90 deny 224.0.0.0 15.255.255.255	Configures the access list that denies access to any multicast address that matches the specified <i>group-ip-address</i> and <i>mask</i> .
Step 4	access-list access-list deny any Example: Router(config)# access-list 90 deny any	Configures the access list so that it denies access to any IP addresses other than the ones previously configured.
Step 5	interface bundle bundle-number Example: Router(config)# interface bundle 10	Enters interface configuration mode for the specified interface bundle.
Step 6	ip access-group access-list Example: Router(config-if)# ip access-group 90	(Optional, but recommended) Configures the interface with the access list, so that packets are filtered by the list before being accepted on the interface.

	Command or Action	Purpose
		<p>Note Standard Access lists only allow one address to be specified in the earlier step. If you apply an outbound access-list with only the multicast address of the tunnel denied, then the DSG traffic is not allowed to pass.</p> <p>Note On the Cisco uBR10012 router, inbound access lists on the cable interface do not apply to multicast traffic, so they do not apply here. As a result, the Cisco uBR10012 requires that you use extended access lists that are blocked in the outbound direction for packets originating from the cable modem or CPE device on the network, and destined to the multicast group. The multicast group contains the classifiers associated with A-DSG 1.1 rules enabled on the interface.</p>
Step 7	<p>end</p> <p>Example:</p> <pre>Router(config-if)# end</pre>	Exits interface configuration mode and returns to Privileged EXEC mode.

Configuring a Standard IP Access List for Multicast Group Filtering

This section describes how to configure a standard IP access list so that non-DOCSIS devices, such as DSG set-top boxes, can access only the authorized multicast group addresses and DSG tunnels.



Tip

This procedure assumes a basic knowledge of how access lists use an IP address and bitmask to determine the range of IP addresses that are allowed access. For full details on configuring access lists, see the documents listed in the [Additional References](#), on page 35.

DETAILED STEPS

	Command or Action	Purpose
Step 1	<p>configure terminal</p> <p>Example:</p> <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 2	<p>access-list <i>access-list</i> permit <i>group-ip-address</i> [<i>mask</i>]</p> <p>Example:</p> <pre>Router(config)# access-list 90 permit 228.1.1.1</pre>	Creates an access list specifying that permits access to the specific multicast address that matches the specified <i>group-ip-address</i> and <i>mask</i> .

	Command or Action	Purpose
Step 3	access-list <i>access-list</i> deny <i>group-ip-address</i> [<i>mask</i>] Example: Router(config)# access-list 90 deny 224.0.0.0 15.255.255.255	Configures the access list that denies access to any multicast address that matches the specified <i>group-ip-address</i> and <i>mask</i> .
Step 4	access-list <i>access-list</i> deny any Example: Router(config)# access-list 90 deny any	Configures the access list so that it denies access to any IP addresses other than the ones previously configured.
Step 5	interface cable <i>interface</i> Example: Router(config)# interface cable 3/0	Enters interface configuration mode for the specified cable interface.
Step 6	ip igmp access-group <i>access-list</i> [<i>version</i>] Example: Router(config-if)# ip igmp access-group 90	(Optional, but recommended) Configures the interface to accept traffic only from the associated access list, so that only authorized devices are allowed to access the DSG tunnels.
Step 7	end Example: Router(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.

Disabling A-DSG Forwarding on the Primary Channel

You can disable A-DSG forwarding per primary capable interface.

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 2	interface modular-cable <i>slot /subslot/port</i> : <i>interface-number</i>	Specifies the modular cable interface and enters cable interface configuration mode. Variables for this command may vary depending on the Cisco CMTS router and the Cisco IOS

	Command or Action	Purpose
	Example: Router(config)# interface modular-cable 1/0/0:0	software release. For details, see the Cisco IOS CMTS Cable Command Reference .
Step 3	cable downstream dsg disable Example: Router(config-if)# cable downstream dsg disable	Disables A-DSG forwarding and DCD messages on the primary capable interface.
Step 4	end Example: Router(config-if)# end	Returns to privileged EXEC mode.

How to Monitor and Debug the Advanced-mode DOCSIS Set-Top Gateway Feature

This section describes the following commands that you can use to monitor and display information about the Advanced-mode DOCSIS Set-Top Gateway feature:

Displaying Global Configurations for Advanced-Mode DSG 1.2

The following commands display globally-configured or interface-level DSG settings, status, statistics, and multiple types of DSG 1.2 tunnel information.

show cable dsg cfr

To verify all DSG classifier details, such as the classifier state, source, and destination IP addresses, use the show cable dsg cfr command as shown in the following example:

```
Router# show cable dsg cfr
cfr id state resolved applied conflict dest-ip src-ip
-----
1000 en yes yes no 232.10.10.0 dsg-server-a
(40.0.0.30)
1010 en yes yes no 232.10.10.10 dsg-server-b
(40.0.0.40)
2000 en yes yes no 232.10.11.0 dsg-server-c
(40.0.0.50)
2010 en no no no 232.10.11.10 non-exist-hostnam
(---)
3000 en yes yes no 239.10.11.11 0.0.0.0
```

To verify details of a particular DSG classifier, use the **show cable dsg cfr** command as shown in the following example:

```
Router# show cable dsg cfr 1010
cfr id state resolved applied conflict dest-ip          src-ip
-----
1010  en   yes    yes    no     232.10.10.10    dsg-server-b
                                     (40.0.0.40)
```

To verify the detailed output for all DSG classifiers, use the **show cable dsg cfr** command as shown in the following example:

```
Router# show cable dsg cfr verbose
Cfr Id           : 1000
State            : enable
Resolved         : yes
Applied          : yes
Conflict         : no
Conflict Cfr Id  : --
Error Code       : 0 (DSG_CFR_ERR_NONE)
Tunnel Id        : 1000
Dest Hostname    : ----
Dest Hostname IP : ----
Dest IP          : 232.10.10.0
Src Hostname     : dsg-server-a
Src Hostname IP  : 40.0.0.30
Src IP           : 40.0.0.30
Src Prefix Length : 32
Dest Port Start  : 2000
Dest Port End    : 13821
Priority         : 1
In DCD           : yes
Forwarded        : 0
Received         : 0
Cfr Id           : 1010
State            : enable
Resolved         : yes
Applied          : yes
Conflict         : no
Conflict Cfr Id  : --
Error Code       : 0 (DSG_CFR_ERR_NONE)
Tunnel Id        : 1010
Dest Hostname    : ----
Dest Hostname IP : ----
Dest IP          : 232.10.10.10
Src Hostname     : dsg-server-b
Src Hostname IP  : 40.0.0.40
Src IP           : 40.0.0.40
Src Prefix Length : 32
Dest Port Start  : 2000
Dest Port End    : 13821
Priority         : 1
In DCD           : yes
Forwarded        : 0
Received         : 0
Cfr Id           : 2000
State            : enable
Resolved         : yes
Applied          : yes
Conflict         : no
Conflict Cfr Id  : --
Error Code       : 0 (DSG_CFR_ERR_NONE)
Tunnel Id        : 2000
Dest Hostname    : ----
Dest Hostname IP : ----
Dest IP          : 232.10.11.0
Src Hostname     : dsg-server-c
Src Hostname IP  : 40.0.0.50
Src IP           : 40.0.0.50
Src Prefix Length : 32
Dest Port Start  : 13822
```

```

Dest Port End      : 13822
Priority           : 1
In DCD            : yes
Forwarded         : 0
Received          : 0
Cfr Id            : 2010
State             : enable
Resolved          : no
Applied           : no
Conflict          : no
Conflict Cfr Id   : --
Error Code        : 0 (DSG_CFR_ERR_NONE)
Tunnel Id         : 2010
Dest Hostname     : ----
Dest Hostname IP  : ----
Dest IP           : 232.10.11.10
Src Hostname      : non-exist-hostname
Src Hostname IP   : ----
Src IP            : 0.0.0.0
Src Prefix Length : 32
Dest Port Start   : 2000
Dest Port End     : 13821
Priority           : 1
In DCD            : yes
Forwarded         : 0
Received          : 0
Cfr Id            : 3000
State             : enable
Resolved          : yes
Applied           : yes
Conflict          : no
Conflict Cfr Id   : --
Error Code        : 0 (DSG_CFR_ERR_NONE)
Tunnel Id         : 3000
Dest Hostname     : ----
Dest Hostname IP  : ----
Dest IP           : 239.10.11.11
Src Hostname      : ----
Src Hostname IP   : ----
Src IP            : 0.0.0.0
Src Prefix Length : 32
Dest Port Start   : 2000
Dest Port End     : 13821
Priority           : 1
In DCD            : yes
Forwarded         : 0
Received          : 0

```

To verify the detailed output for a single DSG classifier, use the **show cable dsg cfr** command as shown in the following example:

```

Router# show cable dsg cfr 1010 verbose
Cfr Id           : 1010
State            : enable
Resolved         : yes
Applied          : yes
Conflict         : no
Conflict Cfr Id  : --
Error Code       : 0 (DSG_CFR_ERR_NONE)
Tunnel Id        : 1010
Dest Hostname    : ----
Dest Hostname IP : ----
Dest IP          : 232.10.10.10
Src Hostname     : dsg-server-b
Src Hostname IP  : 40.0.0.40
Src IP           : 40.0.0.40
Src Prefix Length : 32
Dest Port Start  : 2000
Dest Port End    : 13821
Priority         : 1
In DCD           : yes

```



```
Forwarded           : 0
Received            : 0
```

show cable dsg host

To verify the mapping of the DSG hostnames and IP addresses on a Cisco CMTS router, use the **show cable dsg host** command as shown in the following example:

```
Router# show cable dsg host
Host          IP Address  Reference  Last Update Time
dsgserver1   232.1.1.10  2          21:41 08/01/2011
dsgserver2   234.3.2.1   1          21:41 08/01/2011
dsgserver3   ----        1          never
dsgserver4   ----        1          never
dsgserver5   ----        1          never
dsgserver6   235.5.5.5   1          21:41 08/01/2011
dsgserver7   235.0.0.2   1          21:41 08/01/2011
```

To verify the verbose output of the mapping of the DSG hostnames and IP addresses on a Cisco CMTS router, use the **show cable dsg host verbose** command as shown in the following example:

```
Router# show cable dsg host verbose
Host          IP Address  Reference  Last Update Time
dsgserver1   232.1.1.10  2          21:41 08/01/2011
  Cfrs:
    cable dsg cfr 2 dest-ip 232.1.1.125 tunnel 1 priority 0 src-ip a.b.c.d d...
    cable dsg cfr 3 dest-ip 232.1.1.125 tunnel 1 priority 10 src-ip a.b.c.d ...
dsgserver2   234.3.2.1   1          21:41 08/01/2011
  Cfrs:
    cable dsg cfr 4 dest-ip aaabbccc priority 0 src-ip cccddeee disable
dsgserver3   ----        1          never
  Cfrs:
    cable dsg cfr 4 dest-ip aaabbccc priority 0 src-ip cccddeee disable
dsgserver4   235.0.0.2   1          21:41 08/01/2011
  Cfrs:
    cable dsg cfr 24 dest-ip g2 priority 0 disable
dsgserver5   235.0.0.3   1          21:41 08/01/2011
  Cfrs:
    cable dsg cfr 30 dest-ip g3 tunnel 1 priority 0 disable
```

show cable dsg tunnel

To display tunnel MAC address, state, tunnel group id, classifiers associated to tunnel and its state, use the **show cable dsg tunnel** command in privileged EXEC mode. This command also displays the number of interfaces to which a tunnel is associated, the clients associated, and the QoS service class name for all the configured tunnels.

The following example illustrates this command:

```
Router# show cable dsg tunnel
      tunnel      TG      cfr      tunnel      rule      client service
id  state mac-addr  id  id  state I/F  id  state listId class
1   en  0100.5e01.0001  1   1   en  C5/0  1   en  1   DSG-Rate1
      6   en
      7   en
      8   en
2   en  0100.5e01.0002  1   2   en  C5/0  2   en  2
3   en  0100.5e01.0003  1   3   en  C5/0  3   en  3
4   en  0002.0002.0001  2   4   en  C5/0  4   en  1
      C5/1  1   en  1
5   en  0002.0002.0002  2   5   en  C5/0  5   en  2   DSG-Rate2
      C5/1  2   en  2
6   en  0002.0002.0003  2   9   en  C5/0  6   en  21
      C5/1  3   en  21
```

show cable dsg tunnel ID

To display information for a given DSG tunnel, use the **show cable dsg tunnel** command, specifying the tunnel for which to display information.

show cable dsg tunnel *tunnel-id* [**cfr** | **clients** | **interfaces** | **statistics** | **verbose**]

- **cfr**—Shows DSG tunnel classifiers.
- **clients**—Shows DSG tunnel clients.
- **interfaces**—Shows DSG tunnel interfaces.
- **statistics**—Shows DSG tunnel statistics.
- **verbose**—Shows DSG tunnel detail information.

The below example illustrates this command for DSG Tunnel 1:

```
Router# show cable dsg tunnel 1
      tunnel      TG      cfr      tunnel      rule      client      service
id  state mac-addr  id  id  state I/F  id  state listId  class
1   en  0100.5e01.0001 1   1   en  C5/0  1   en  1      DSG-Ratel
      6   en
      7   en
      8   en
```

The below example shows detailed information of all the classifiers associated to the specified tunnel.

```
Router# show cable dsg tunnel 1 cfr
tunnel cfr  cfr  cfr destination ip  source ip  srcPre d_port d_port
id  id  state pri address  address  length start end
1   1   en  0  230.1.0.1  0.0.0.0  32    0  65535
      6   en  0  231.1.1.6  0.0.0.0  32    0  65535
      7   en  0  231.1.1.7  0.0.0.0  32    0  65535
      8   en  0  231.1.1.8  0.0.0.0  32    0  65535
```

The below example illustrates detailed information about all the clients associated to the specified tunnel.

```
Router# show cable dsg tunnel 1 clients
tunnel client client client  client  vendor
id  listId id  id type  address  group
1   1      1   MAC Addr  0100.5e00.0001
      2   Application ID  0x0951
      3   Broadcast  Unspecified
      4   Broadcast  4
```

The below example illustrates all DSG interfaces and rules associated to the specified tunnel.

```
Router# show cable dsg tunnel 1 interfaces
tunnel downstream  rule
id  interface  id
4   Cable5/0  4
      Cable5/1  1
```

show cable dsg tunnel ID statistics

The below example illustrates packet statistics information about the specified tunnel.

```
Router# show cable dsg tunnel 1 statistics
tunnel cfr  cfr  destination ip  source ip  total  total
id  id  state address  address  forwarded  received
1   1   en  230.1.0.1  0.0.0.0  0  0
      6   en  231.1.1.6  0.0.0.0  0  0
```

```

      7      en      231.1.1.7      0.0.0.0      0      0
      8      en      231.1.1.8      0.0.0.0      0      0

```

The below example illustrates all detailed information about the specified tunnel.

```

Router# show cable dsg tunnel 1 verbose
Tunnel ID                               : 1
State                                    : enable
MAC Addr                                  : 0100.5e01.0001
TG Id                                     : 1
Cfr Id                                    : 1
State                                     : enable
Priority                                  : 0
Dest IP                                   : 230.1.0.1
Src IP                                    : 0.0.0.0
Src Prefix Length                         : 32
Dest Port Start                           : 0
Dest Port End                             : 65535
Forwarded                                 : 0
Received                                  : 0
Cfr Id                                    : 6
State                                     : enable
Priority                                  : 0
Dest IP                                   : 231.1.1.6
Src IP                                    : 0.0.0.0
Src Prefix Length                         : 32
Dest Port Start                           : 0
Dest Port End                             : 65535
Forwarded                                 : 0
Received                                  : 0
Cfr Id                                    : 7
State                                     : enable
Priority                                  : 0
Dest IP                                   : 231.1.1.7
Src IP                                    : 0.0.0.0
Src Prefix Length                         : 32
Dest Port Start                           : 0
Dest Port End                             : 65535
Forwarded                                 : 0
Received                                  : 0
Cfr Id                                    : 8
State                                     : enable
Priority                                  : 0
Dest IP                                   : 231.1.1.8
Src IP                                    : 0.0.0.0
Src Prefix Length                         : 32
Dest Port Start                           : 0
Dest Port End                             : 65535
Forwarded                                 : 0
Received                                  : 0
Client List Id                            : 1
Client Id                                  : 1
Client Id Type                             : MAC Addr          0100.5e00.0001
Client Id                                  : 2
Client Id Type                             : Application ID    0x0951
Client Id                                  : 3
Client Id Type                             : Broadcast         Unspecified
Client Id                                  : 4
Client Id Type                             : Broadcast         4
Interface                                  : Cable5/0
Rule Id                                    : 1

```

show cable dsg tg

The below example illustrates configured parameters for all DSG tunnel groups.

```

Router# show cable dsg tg
TG   Chan  Chan  Rule Vendor UCID
id   id    state I/F   pri  Param list
1    1      en   C5/0  16   1     1 2 3 4

```

```

1      2      en      0
2      1      en      C5/0  11    2
                C5/1
2      2      en      0

```



Note Beginning with Cisco IOS Release 12.2(33)SCG, the “TG state” field in the `show cable dsg tg` command output was replaced by “Chan state” to indicate that a channel belonging to a tunnel group is either enabled or disabled. It is possible that a tunnel group is enabled but a particular channel in that tunnel group is disabled.

The below example displays the same information as above for the specified tunnel group.

```

Router# show cable dsg tg 1 channel 1
TG      Chan  Chan      Rule Vendor UCID
id      id   state I/F    pri  Param list
1       1    en    C5/0   16   1      1 2 3 4

```

The below example illustrates detailed information for the specified tunnel group.

```

Router# show cable dsg tg 1 channel 1 verbose
TG: 1      Chan: 1      state: en pri: 16 Vendor: 1      UCID: 1 2 3 4
          rule        tunnel
          cfr
I/F      id state id state mac-addr      id state dest-ip      In-DCD listId
C5/0     1  en  1  en  0101.5e01.0001  1  en  230.1.0.1      yes    1
                                                6  en  231.1.1.6      no
                                                7  en  231.1.1.7      no
                                                8  en  231.1.1.8      no
          2  en  2  en  0101.5e01.0002  2  en  230.1.0.2      yes    2
          3  en  3  en  0101.5e01.0003  3  en  230.1.0.3      yes    3

```

The following is a sample output for the `show cable dsg tg` command that displays the ignore option, introduced in Cisco IOS Release 12.2(33)SCD5, under the ‘In DCD’ column.

```

Router# show cable dsg tg 1 channel 1 verbose
TG: 1      Chan: 1      state: en pri: 16 Vendor: 1      UCID: 1 2 3 4
          rule        tunnel
          cfr
I/F      id state id state mac-addr      id state dest-ip      In-DCD listId
-----
C7/0/0  1  en  1  en  0101.5e01.0001  1  en  230.1.0.1      ign    1
                                                6  en  231.1.1.6      no
                                                7  en  231.1.1.7      no
                                                8  en  231.1.1.8      no
          2  en  2  en  0101.5e01.0002  2  en  230.1.0.2      yes    2
          3  en  3  en  0101.5e01.0003  3  en  230.1.0.3      yes    3

```

show running-config interface

To display a tunnel group attached to a subinterface, use the `show running-config interface` command in privileged EXEC mode, as shown in the example below:

```

Router# show running-config interface bundle 11.2
!
interface Bundle11.2
 ip address 4.4.2.1 255.255.255.0
 no ip unreachable
 ip pim sparse-mode
 ip igmp static-group 230.1.1.30
 no cable ip-multicast-echo
 cable dsg tg 61
end

```

**Note**

The IGMP static group IP address created automatically at the time of DSG configuration is not displayed in the **show running-config interface command output** in Cisco IOS Release 12.2(33)SCG and later.

show cable dsg static-group bundle

To verify all DSG static groups configured under a bundle interface, use the **show cable dsg static-group bundle** command in privileged EXEC mode as shown in the following example:

```
Router# show cable dsg static-group bundle 2
Bundle Interface      Group      Source
Bundle2              228.0.0.1  0.0.0.0
Bundle2              228.0.0.1  1.2.3.4
Bundle2              232.1.1.1  2.3.4.5
```

Displaying Interface-level Configurations for Advanced-Mode DSG 1.2

The following **show** commands display interface-level configurations for A-DSG 1.2.

show cable dsg tunnel interfaces

To display all interfaces and DSG rules for the associated tunnel, use the **show cable dsg tunnel interfaces** command in privileged EXEC mode.

show cable dsg tunnel (tunnel-id) interfaces

The following example illustrates this command:

```
Router# show cable dsg tunnel 1 interfaces
tunnel downstream rule
id interface id
4 Cable5/0 4
Cable5/1 1
```

show interfaces cable dsg downstream

To display DSG downstream interface configuration information, to include the number of DSG tunnels, classifiers, clients, and vendor-specific parameters, use the **show interfaces cable dsg downstream** command in privileged EXEC mode.

show interfaces cable {slot/port | slot/subslot/port} dsg downstream

Keywords for this command include the following:

- **dcd**—Displays the DSG downstream DCD message.
- **tg**—Displays the DSG downstream tunnel group.
- **tunnel**—Displays the DSG downstream tunnel.

The following example illustrates this command supporting DSG 1.2:

```
Router# show interfaces c5/0 dsg downstream
```

chan list	chFreq index	chan freq	timer index	init timeout	oper timeout	twoWay timer	oneWay timer	num rule	num tunnel	num cfr	num client	num vsp
1	1	471	1	4	600	300	1800	6	6	3	4	2
	2	477										
	3	483										
	4	583										

show interfaces cable dsg downstream dcd

To display DCD statistics for the given downstream, use the **show interfaces cable dsg downstream dcd** command in privileged EXEC mode. This command only displays DCD Type/Length/Value information if the **debug cable dsg** command is previously enabled.

show interfaces cable {slot/port | slot/subslot/port} **dsg downstream dcd**

The following example illustrates DCD statistics information supporting DSG 1.2:

```
Router# show interfaces c5/0 dsg downstream dcd
dcd dcd num of dcd num of dcd num of dcd num of
state Tx sent fail change cnt fragment
en on 6502 0 28 1
Router# debug cable dsg
CMTS DSG debugging is on
Router#
Router# show interfaces c5/0 dsg downstream dcd
dcd dcd num of dcd num of dcd num of dcd num of
state Tx sent fail change cnt fragment
en on 6512 0 28 1
Router#
02:08:42: DCD TLV last sent:
32360101 01020110 03040102 03040412 02060100 5E000001 04020951 01000102
00040506 01005E01 00010602 00012B08 08030000 01010101 170F0202 00010501
00090605 04E60100 01322801 01020201 10030401 02030404 0403020A BC050601
005E0100 02060200 022B0808 03000001 01010117 0F020200 02050100 09060504
E6010002 32280101 03020110 03040102 03040404 04020123 05060100 5E010003
06020003 2B080803 00000101 0101170F 02020003 05010009 060504E6 01000332
38010104 02010B04 12020601 005E0000 01040209 51010001 02000405 06000200
0200012B 09080300 00010102 01022B09 08030000 02010201 02322A01 01050201
0B040403 020ABC05 06000200 0200022B 09080300 00010102 01022B09 08030000
02010201 02324601 01060201 0B042002 06002100 21000102 06002100 21000202
06002100 21000302 06002100 21000405 06000200 0200032B 09080300 00010102
01022B09 08030000 02010201 02332801 041C12E3 C001041C 6E714001 041CC9FE
C0010422 BFDFC002 02000403 02025804 02012C05 020708
```

show interfaces cable dsg downstream tg

To display DSG tunnel group parameters, and rule information applying to the tunnel group, to include tunnels and tunnel states, classifiers, and client information, use the **show interfaces cable dsg downstream tg** command in privileged EXEC mode. You can display information for a specific tunnel, if specified.

show interfaces cable {slot/port | slot/subslot/port} **dsg downstream tg** [channel *channel-id*]

The following example illustrates typical information displayed with this command in DSG 1.2:

```
Router# show interfaces c5/0 dsg downstream tg
TG: 1 Chan: 1 state: en pri: 16 Vendor: 1 UCID: 1 2 3 4
rule tunnel cfr client
I/F id state id state mac-addr id state dest-ip In-DCD listId
C5/0 1 en 1 en 0101.5e01.0001 1 en 230.1.0.1 yes 1
6 en 231.1.1.6 no
7 en 231.1.1.7 no
8 en 231.1.1.8 no
2 en 2 en 0101.5e01.0002 2 en 230.1.0.2 yes 2
3 en 3 en 0101.5e01.0003 3 en 230.1.0.3 yes 3
TG: 2 Chan: 1 state: en pri: 11 Vendor: 2 UCID:
```

I/F	rule		tunnel		cfr		client		
	id	state	id	state	mac-addr	id	state	dest-ip	In-DCD
C5/0	4	en 4	en	0002.0002.0001	4	en	230.2.2.1	no	1
	5	en 5	en	0002.0002.0002	5	en	230.2.2.2	no	2
	6	en 6	en	0002.0002.0003	9	en	231.1.1.9	no	21

The following examples displays the same type of information as above for the given tunnel group.

```
Router# show interfaces c5/0 dsg downstream tg 1 channel 1
TG: 1 Chan: 1 state: en pri: 16 Vendor: 1 UCID: 1 2 3 4
      rule tunnel cfr client
      id state id state mac-addr id state dest-ip In-DCD listId
C5/0 1 en 1 en 0101.5e01.0001 1 en 230.1.0.1 yes 1
      6 en 231.1.1.6 no
      7 en 231.1.1.7 no
      8 en 231.1.1.8 no
      2 en 2 en 0101.5e01.0002 2 en 230.1.0.2 yes 2
      3 en 3 en 0101.5e01.0003 3 en 230.1.0.3 yes 3
```

The following is a sample output for the **show interfaces cable dsg downstream tg** command that displays the ignore option, introduced in Cisco IOS Release 12.2(33)SCD5, under the 'In DCD' column.

```
Router# show interfaces cable 7/0/0 dsg downstream tg
TG: 1 Chan: 1 State: en Pri: 0 Vendor: UCID:
      rule tunnel cfr In clients
      id state id state mac-addr id state dest-ip DCD listId
-----
1 en 1 en 0100.5e01.0101 1 en 230.1.1.1 ign 1
```

show interfaces cable dsg downstream tunnel

To display DSG tunnel information associated with the downstream, use the **show interfaces cable dsg downstream tunnel** command in privileged EXEC mode.

show interfaces cable {slot/port | slot/subslot/port} dsg downstream tunnel tunnel-id

The following is a sample output for the **show interfaces cable dsg downstream tunnel** command that displays the interface information for the DSG downstream tunnel in DSG 1.2:

```
Router# show interfaces c5/0 dsg downstream tunnel
      tunnel TG cfr rule client service
id state mac-addr id id state id state listId class
1 en 0100.5e01.0001 1 1 en 1 en 1 DSG-Rate1
      6 en
      7 en
      8 en
2 en 0100.5e01.0002 1 2 en 2 en 2
3 en 0100.5e01.0003 1 3 en 3 en 3
4 en 0002.0002.0001 2 4 en 4 en 1
5 en 0002.0002.0002 2 5 en 5 en 2 DSG-Rate2
6 en 0002.0002.0003 2 9 en 6 en 21
```

The following is a sample output for the **show interfaces cable dsg downstream tunnel** command that displays information for the specified interface and tunnel:

```
Router# show interfaces c5/0 dsg downstream tunnel 1
      tunnel TG cfr rule client service
id state mac-addr id id state id state listId class
1 en 0100.5e01.0001 1 1 en 1 en 1 DSG-Rate1
      6 en
      7 en
      8 en
```

Debugging Advanced-Mode DSG

To enable debugging for A-DSG on a Cisco CMTS router, use the debug cable dsg command in privileged EXEC mode.

Configuration Examples for Advanced-Mode DSG

This configuration example illustrates a sample DSG network featuring these components:

- Two Cisco universal broadband routers
- IP Multicast for each DSG implementation
- Two DSG Clients for each Cisco CMTS
- Two DSG Servers (one for each Cisco CMTS)

Each Cisco CMTS is configured as follows, and the remainder of this topic describes example configurations that apply to this architecture.

CMTS Headend 1

- DSG Server #1—Connected to Cisco CMTS via IP Multicast, with DSG Server having IP Address 12.8.8.1
- Destination IP Address for the Cisco CMTS—228.9.9.1
- DSG Tunnel Address—0105.0005.0005
- Downstream #1 Supporting two DSG Clients:
 - DSG Client #1—ID 101.1.1
 - DSG Client #2—ID 102.2.2

CMTS Headend 2

- DSG Server #2—Connected to Cisco CMTS via IP Multicast, with DSG Server having IP Address 12.8.8.2
- Destination IP Address for the Cisco CMTS—228.9.9.2
- DSG Tunnel Address—0106.0006.0006
- Downstream #2 Supporting two DSG Clients:
 - DSG Client #1—ID 101.1.1
 - DSG Client #2—ID 102.2.2

Example of Two DSG Tunnels with MAC DA Substitution

In this configuration, and given the two Cisco CMTS Headends cited above, below are the two sets of DSG rules, with each set applying to each Cisco CMTS, in respective fashion.

These settings apply to DSG #1 and two downstreams:

- DSG Rule ID 1
- DSG Client ID 101.1.1
- DSG Tunnel Address 105.5.5

These settings apply to DSG Rule #2 and two downstreams:

- DSG Rule ID 1
- DSG Client ID 102.2.2
- DSG Tunnel Address 106.6.6

DSG Example with Regionalization Per Downstream

In this configuration, and given the two Cisco CMTS Headends cited earlier in this topic, below are two downstream rules that can be configured in this architecture, for example:

- Downstream Rule #1
 - DSG Rule ID #1
 - DSG Client ID—101.1.1
 - DSG Tunnel Address—105.5.5
- Downstream Rule #2
 - DSG Rule ID #2
 - DSG Client ID—102.2.2
 - DSG Tunnel Address—106.6.6

DSG Example with Regionalization Per Upstream

In this configuration, and given the two Cisco CMTS Headends cited earlier in this topic, below are two upstream rules that can be configured in this architecture, for example:

- Upstream Rule #1
 - DSG Rule ID #1
 - DSG Client ID—101.1.1
 - DSG UCID Range—0 to 2
 - DSG Tunnel Address—105.5.5
- Upstream Rule #2
 - DSG Rule ID #2

- DSG Client ID—102.2.2
- DSG UCID Range—3 to 5
- DSG Tunnel Address—106.6.6

Example of Two DSG Tunnels with Full Classifiers and MAC DA Substitution

In this configuration, and given the two Cisco CMTS Headends cited above, below are the two sets of DSG rules, with each set applying to each Cisco CMTS, in respective fashion.

These settings apply to DSG #1:

- DSG Rule ID 1
- Downstreams 1 and 2
- DSG Client ID 101.1.1
- DSG Tunnel Address 105.5.5
- DSG Classifier ID—10
- IP SA—12.8.8.1
- IP DA—228.9.9.1
- UDP DP—8000

These settings apply to DSG Rule #2:

- DSG Rule ID 2
- Downstreams 1 and 2
- DSG Client ID 102.2.2
- DSG Tunnel Address 106.6.6
- DSG Classifier ID—20
- IP SA—12.8.8.2
- IP DA—228.9.9.2
- UDP DP—8000

Example of One DSG Tunnel Supporting IP Multicast from Multiple DSG Servers

In this configuration, and given the two Cisco CMTS Headends cited earlier in this topic, below is an example of one DSG Tunnel with multiple DSG servers supporting IP Multicast:

- DSG Rule ID 1
- Downstreams 1 and 2
- DSG Client ID 101.1.1 and 102.2.2
- DSG Tunnel Address 105.5.5
- DSG Classifier ID—10

- IP SA—12.8.8.1
- IP DA—228.9.9.1
- UDP DP—8000
- DSG Classifier ID—20
 - IP SA—12.8.8.2
 - IP DA—228.9.9.2
 - UDP DP—8000

Example: Enabling DNS Query

The following example shows how to enable a DNS query on the Cisco CMTS router:

```
Router# configure terminal
Router(config)# ip domain-lookup
Router(config)# ip domain-name cisco.com
Router(config)# ip name-server 131.108.1.111
Router(config)# cable dsg name-update-interval 10
Router(config)# end
```

Example: Disabling A-DSG Forwarding on the Primary Channel

The following example shows how to disable A-DSG forwarding on a primary capable modular interface on the Cisco CMTS router:

```
Router# configure terminal
Router(config)# interface modular-cable 1/0/0:0
Router(config-if)# cable downstream dsg disable
Router(config-if)# end
```

Additional References

The following sections provide references related to A-DSG 1.2.

Related Documents

Related Topic	Document Title
Cisco CMTS Commands	<i>Cisco IOS CMTS Cable Command Reference</i> http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html
DOCSIS 3.0 Multicast Support on the CMTS Routers	DOCSIS 3.0 Multicast Support on the CMTS Routers http://www.cisco.com/en/US/docs/ios/cable/configuration/guide/ubr_d30_mcast_support.html

Standards

Standard	Title
CM-SP-DSG-I18-110623	DOCSIS Set-top Gateway (DSG) Interface Specification

MIBs

MIB	MIBs Link
DOCS-DSG-IF-MIB	<i>To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:</i> http://www.cisco.com/go/mibs

RFCs

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

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Advanced-Mode DSG 1.2 for the Cisco CMTS Routers

Table below lists the release history for this feature.

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://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

**Note**

Table below 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 DOCSIS Set-Top Gateway and A-DSG for the Cisco CMTS Routers

Feature Name	Releases	Feature Information
DOCSIS Set-Top Gateway for the Cisco CMTS Routers	12.2(15)BC2	This feature was introduced for the Cisco uBR7100 series and Cisco uBR7246VXR universal broadband routers.
DOCSIS Set-Top Gateway for the Cisco CMTS Routers	12.3(9a)BC	Support for the Cisco uBR10012 universal broadband router was added.
Advanced-mode DOCSIS Set-Top Gateway 1.1 for the Cisco CMTS Routers	Release 12.3(13)BC	This feature was introduced to support DOCSIS 1.1 on the Cisco uBR7200 Series and Cisco uBR10012 universal broadband routers.
Advanced-mode DOCSIS Set-Top Gateway 1.2 for the Cisco CMTS Routers	12.3(17a)BC2	This feature was introduced on the Cisco uBR7246VXR and Cisco uBR10012 universal broadband routers.
Advanced-mode DOCSIS Set-Top Gateway 1.2 for the Cisco CMTS Routers	12.2(33)SCA	This feature was integrated into Cisco IOS Release 12.2(33)SCA. Support for the Cisco uBR7225VXR universal broadband router was added.
Advanced-mode DOCSIS Set-Top Gateway 1.2 on a Subinterface for the Cisco CMTS Routers	12.2(33)SCB4	This feature was introduced on the Cisco uBR7246VXR and Cisco uBR10012 universal broadband routers.

Feature Name	Releases	Feature Information
Default Multicast QoS	12.2(33)SCC1	<p>This feature was modified to configure the service class name of the default multicast quality of service (MQoS) for the QoS profile.</p> <p>The following command was introduced or modified:</p> <ul style="list-style-type: none"> • <code>cable multicast group-qos default</code>
Advanced-mode DOCSIS Set-Top Gateway 1.2 on a Subinterface for the Cisco CMTS Routers	12.2(33)SCC1	This feature was integrated into Cisco IOS Release 12.2(33)SCC1.
Advanced-mode DOCSIS Set-Top Gateway 1.2 on a Subinterface for the Cisco CMTS Routers	12.2(33)SCD	Support was added for the Cisco uBR-MC88V line card.
Advanced-mode DOCSIS Set-Top Gateway 1.2 on a Subinterface for the Cisco CMTS Routers	12.2(33)SCD5	<p>This feature was modified to add the ignore option to the in-dcd keyword of the cable dsg cfr command to exclude DSG classifiers from the DCD message and enable the DSG rules regardless of the DSG tunnel MAC address.</p> <p>The following commands were introduced or modified:</p> <ul style="list-style-type: none"> • <code>cable dsg cfr</code> • <code>show cable dsg tg</code> • <code>show interfaces cable dsg downstream tg</code>

Feature Name	Releases	Feature Information
FQDN Support	12.2(33)SCG	<p>You can specify either an FQDN or IP address while configuring an A-DSG classifier on a Cisco CMTS router.</p> <p>The following commands were introduced or modified:</p> <ul style="list-style-type: none"> • cable dsg cfr • cable dsg tg default-priority • cable dsg tg priority • debug cable dsg • show cable dsg cfr • show cable dsg host
DNS Query and DSG Name Process	12.2(33)SCG	<p>One or more DNS servers must be configured to enable a Cisco CMTS router to perform a DNS query. The cable dsg name-update-interval command was introduced to support this feature.</p> <p>The following sections provide information about this feature:</p>
DOCSIS 3.0 DSG MDF Support	12.2(33)SCG	<p>DOCSIS 3.0 DSG MDF support is introduced using DSG DA-to-DSID Association Entry TLV in the MDD message. For details about this feature, see Information About Advanced-Mode DSG Issue 1.2, on page 4.</p>

Feature Name	Releases	Feature Information
A-DSG Forwarding on the Primary Channel	12.2(33)SCG	<p>This feature allows you to exclude a primary capable interface from A-DSG forwarding.</p> <p>The following sections provide information about this feature:</p> <p>The following commands were introduced or modified:</p> <ul style="list-style-type: none"> • cable downstream dsg disable • cable downstream dsg tg • show cable dsg static-group bundle • show interface cable dsg downstream