CHAPTER 11

Maximum CPE and Host Parameters for the Cisco CMTS

Revised: February 5, 2007, OL-1467-08

This document describes how to use the different methods to control subscriber access that are allowed by the Data-over-Cable Service Interface Specifications (DOCSIS) for use on cable networks.

Feature Specifications for the MAX CPE and Host Parameters

Feature History	
Release	**Modification**
Release 12.0(6)SC	The **cable max-hosts** and **cable modem max-hosts** commands were introduced for the Cisco uBR7200 series routers.
Release 12.0(10)SC	The **cable modem max-cpe** command was introduced for the Cisco uBR7200 series routers.
Release 12.1(2)EC1	Support for these features was added to the Cisco IOS Release 12.1 EC train for the Cisco uBR7200 series routers.
Release 12.1(5)EC	Support for these features was added for the Cisco uBR7100 series routers.
Release 12.2(4)BC1	Support for these features was added to the Cisco IOS Release 12.2 BC train for the Cisco uBR7100 series, Cisco uBR7200 series, and Cisco uBR10012 routers.
Supported Platforms	
Cisco uBR7100 series, Cisco uBR7200 series, and Cisco uBR10012 universal broadband routers.	

Finding Support Information for Platforms and Cisco IOS Software Images

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

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Information About the MAX CPE and Host Parameters

The DOCSIS specification includes a number of provisions to allow service providers to control the exact number of subscribers who can access the network through any particular cable modem:

- MAX CPE—This required parameter is configured in DOCSIS 1.0 configuration files (TLV 18) and controls how many different CPE devices can access the network during the current session. (This parameter is always enforced, and if it is not specified in the configuration file, it defaults to 1.)
- MAX CPE IP—This optional parameter is configured in DOCSIS 1.1 configuration files (TLV 35), or by adding a row to the docsSubMgtCpeControlTable table in the DOCSIS Subscriber Management MIB (DOCS-SUBMGT-MIB). It specifies the maximum number of simultaneous IP addresses that are permitted behind a cable modem at any one time. Both
- MAX Host—This optional parameter is configured on the Cisco CMTS, and specifies the maximum number of CPE devices (MAC addresses) that the CMTS will allow to have network access behind a particular cable modem. You can use one of three CLI commands to set the value of this parameter for a particular cable modem (**cable modem max-hosts**), for all cable modems on a particular cable interface (**cable max-hosts**), or for all cable modems on the Cisco CMTS (**cable modem max-cpe**).

Note In addition, the DOCSIS configuration file contains a Network Access parameter that specifies whether the CPE devices behind the cable modem can access the cable network. If this parameter is set to Disabled, no CPE devices behind a cable modem are able to access the network, regardless of the settings of the MAX CPE, MAX CPE IP, and MAX Host parameters.

Tip Also, the Cisco CMTS lists offline cable modems in its internal database for 24 hours. The CMTS does not reset the CPE counts for these offline cable modems until the 24 hour period expires and the cable modems come back online. If the cable modems come back online before the 24 hour period expires, the CMTS continues to use the existing CPE counts.

All of these methods are similar in purpose, but they are configured differently and have a different impact on cable modems and their CPE devices.

The cable modem enforces the MAX CPE and MAC CPE IP values, and the CMTS enforces the MAX Host value. Because CPE devices can come online and offline at any time, it is important to understand how these different parameters interact, and how the cable modem and CMTS enforce them.

Note The MAX CPE parameter provides Layer 2 control of CPE devices. The MAX CPE IP parameter provides Layer 3 control of CPE devices. The two methods are complimentary but not otherwise related.

MAX CPE

In DOCSIS 1.0 cable networks, the MAX CPE parameter is the primary means of controlling the number of CPE devices that can connect to the cable network using any particular cable modem. This parameter is configured in the DOCSIS configuration file (TLV 18) and controls how many different CPE devices can access the network during the current session. If not specified in the DOCSIS configuration file, it defaults to a value of 1.

Note In DOCSIS 1.1 cable networks, the CMTS ignores the MAX CPE parameter that is specified in the DOCSIS configuration file, and uses the MAX CPE IP parameter instead.

Each time a new CPE device attempts to connect to the cable network, the cable modem logs its hardware (MAC) address. If the cable modem has not reached its MAX CPE number of MAC addresses yet, the new CPE device is allowed to access the network. If the cable modem has reached its MAX CPE limit, it drops the traffic from any additional CPE devices.

By default, the cable modem learns new MAC addresses on a first-come, first-served basis. You can also preconfigure the allowable MAC addresses for CPE devices by entering those MAC addresses in the DOCSIS configuration file (TLV 14). These cable modem gives these preconfigured MAC addresses preference in connecting to the network.

The DOCSIS specification does not allow cable modems to age out MAC addresses, so a MAC address stays in the cable modem's log table until the cable modem is reset. You should therefore think of this parameter as specifying the maximum number of CPE devices that can connect during any particular session, instead of the maximum number of CPE devices that can simultaneously connect to the cable network.

For example, if you set MAX CPE to 2, a customer could use their cable modem to connect a maximum of two CPE devices (two MAC addresses) to the cable network. A customer could choose to connect two PCs simultaneously to their cable modem and use both to access the network.

However, if the customer then disconnected these PCs and connected two new PCs, the cable modem would not allow the new PCs to come online, because they would be the third and fourth MAC addresses that are connected to the cable modem. The customer would have to reset the cable modem before being able to use the new PCs.

Note The MAX CPE value, if present, must be a positive integer in DOCSIS 1.0 configuration files. This parameter can be zero in DOCSIS 1.1 configuration files, but if so, the cable modem uses a MAX CPE value of 1. If the MAX CPE parameter is not present in either type of DOCSIS configuration file, it defaults to 1.

MAX CPE IP

The MAX CPE IP parameter is applicable only in DOCSIS 1.1 cable networks. This parameter specifies whether the cable modem should perform IP address filtering on the CPE devices. If so, this attribute also specifies the maximum number of simultaneous IP addresses that are permitted behind the modem at any one time.

The MAX CPE IP parameter is configured in the DOCSIS configuration file (TLV 35), or by using SNMP commands to set the docsDevCpeIpMax attribute (in DOCS-CABLE-DEVICE-MIB) for the cable modem. By default, this parameter is not enabled and the Cisco CMTS does not actively manage CPE devices, unless you enable the use of the MAX CPE IP parameter by using the **cable submgmt default active** command.

Note In DOCSIS 1.1 networks, the CMTS ignores the MAX-CPE value (TLV 18) from the DOCSIS configuration file and uses the MAX CPE IP value instead.

If this feature is enabled, the cable modem learns the allowable IP addresses the first time that the CPE device sends an IP packet out into the network. IP addresses are added to the docsDevFilterCpeTable table. This address table is cleared automatically when the cable modem is reset or powered off, or you can manually clear the IP address table by setting the docsSubMgtCpeControlReset attribute in the appropriate table entry for this cable modem.

In DOCSIS 1.1 networks, the MAX CPE IP parameter can be configured as follows:

- If MAX CPE IP is set to –1, the cable modem does not filter any IP packets on the basis of their IP addresses, and CPE IP addresses are not added to the modem's CPE address table
- If MAX CPE IP is set to 0, the cable modem does not filter any IP packets on the basis of the IP addresses. However, the source IP addresses are still entered into the modem's CPE address table.
- If MAX CPE IP is set to a positive integer, it specifies the maximum number of IP addresses that can be entered into the modem's CPE address table. The modem compares the source IP address for packets it receives from CPE devices to the addresses in this table. If a match is found, the packet is processed; otherwise, the packet is dropped.

Tip In Cisco IOS Release 12.2(8)BC1, a similar address filtering mechanism exists on the CMTS. See the description of the docsSubMgtCpeControlMaxCpeIp attribute in the DOCS-SUBMGT-MIB MIB for details. The CMTS uses the MAX CPE IP value as part of its own filtering process, but the two filters operate independently on the cable modem and CMTS.

MAX Host

The MAX Host parameter is configured on the Cisco CMTS and specifies the maximum number of CPE devices (MAC addresses) that the CMTS will allow to have network access. You can control this parameter for individual cable modems, for all cable modems on a particular cable interface, or for all cable modems on the Cisco CMTS, depending on the CLI command being used:

- **cable modem max-hosts**—Configures MAX Host for a particular cable modem.
- **cable max-hosts**—Configures MAX Host for all cable modems on a particular cable interface.
- **cable modem max-cpe**—Configures MAX Host for all cable modems on the Cisco CMTS. You can use the **unlimited** keyword to specify that the Cisco CMTS should not enforce a MAX Host limit for cable modems.

When this is enabled, the Cisco CMTS learns a MAC address the first time that the CPE device accesses the cable network. After the Cisco CMTS has logged the maximum number of MAC addresses specified by a MAX Host parameter, it will drop all traffic from CPE devices that have any other MAC address.

Tip In DOCSIS 1.1 cable networks, when both the MAX CPE IP and MAX Host parameters are configured, the Cisco CMTS uses the lesser value to determine the maximum number of CPE devices that are allowed behind each cable modem.

Note The entire MAX Host address table is cleared whenever the Cisco CMTS is reset. You can also clear an entry for a particular CPE device using the **clear cable host** command.

Specifying MAX Host and MAX CPE Values

Typically, you would set the MAX Host parameter to a number that is greater than the value for the cable modem's MAX CPE or MAX CPE IP parameter. This would allow customers to switch between multiple computers, without requiring them to reboot their cable modem, and without requiring any action on the part of the service provider's network administrators.

For example, if you set MAX CPE or MAX CPE IP to a value of 2 for a cable modem, then you could set the MAX Host parameter to a value of 4. This would enable the cable modem to connect four different CPE devices to the cable network, but only two of them could be online simultaneously.

However, if you set the MAX Host parameter to a number smaller than the value of MAX CPE or MAX CPE IP in the DOCSIS configuration file, then the MAX CPE or MAX CPE IP value always takes precedence. For example, if the MAX CPE value is 2 and the MAX Host value is *1*, both the cable modem and CMTS allow up to two CPE devices to pass traffic for that cable modem.

Specifying an Unlimited Value for Max Host

The **cable modem max-cpe** command, which affects all cable modems on the CMTS, supports the **unlimited** keyword, which specifies that the CMTS should not enforce any limit on CPE devices. When you configure the CMTS with the unlimited **keyword**, this setting, you are allowing cable modems to support any number of CPE devices.

Do not use the **unlimited** option without also specifying the proper value for MAX CPE in the DOCSIS configuration file, so that each cable modem can control the maximum number of CPE devices it supports. In addition, to prevent users from requesting an unlimited number of IP address, be sure to configure the DHCP servers so that they control how many IP addresses are assigned to the CPE devices behind each cable modem.

Interoperation of the Maximum CPE Parameters

The different methods of CPE control can all be active simultaneously. They can interact with one another but do not conflict with one another. Table 11-1 lists each method and compares their characteristics.

Table 11-1 Comparison of the Different Max CPE and Max Host Control Mechanisms

Method	Configuration Method	Function	Can Be Changed By...
Methods that are configured on the cable modem:			
Network Access Control	DOCSIS Configuration File	Prevents all network access for CPE devices	Reset of cable modem
MAX CPE	DOCSIS Configuration File	Limits MAC addresses (Layer 2 control)	Reset of cable modem
MAX CPE IP	DOCSIS Configuration File SNMP Set Command	Limits IP addresses (Layer 3 control)	SNMP Set Command
Methods that are configured on the CMTS: [1]			
MAX CPE IP (the CMTS uses this value if MAX CPE IP is not specified in the DOCSIS configuration file)	DOCSIS Configuration File CLI Command SNMP Set Command	Limits IP addresses (Layer 3 control)	CLI Command SNMP Set Command
MAX Host Parameters			
MAX Host for one cable modem (**cable modem max-hosts**)	CLI Commands	Limits CPE devices for one particular cable modem	New CLI Command
MAX Host for a cable interface (**cable max-hosts**)		Limits CPE devices for all cable modems on a particular cable interface	
MAX Host for a CMTS (**cable modem max-cpe**)		Limits CPE devices for all cable modems on a Cisco CMTS	

1. In Cisco IOS Release 12.2(4)BC1 and later releases, the Cisco CMTS does not actively manage CPE devices unless this has been enabled using the **cable submgmt default active** command.

Table 11-1 lists the MAX CPE parameters in order of priority. For example, the Network Access Control and MAX CPE parameters interact as follows:

- If the Network Access Control field for a cable modem is set to Disabled, none of that modem's CPE devices will be able to access the network, regardless of how the other parameters are set.
- If Network Access Control is Enabled and MAX CPE is set to 1 for a cable modem, then a maximum of one CPE device will be able to access the network, no matter how the remaining parameters are configured.

Table 11-1 also lists the MAX Host parameters in order of more specific to less specific, where the more specific override the settings of the less specific. For example, if you use the **cable modem max-cpe** command to set the MAX Host value for all CMs to 2, you can still use the **cable modem max-hosts** command to give a particular CM a MAX Host value of 8.

In addition, the MAX CPE IP and MAX Host parameters interact as follows:

- When both the MAX CPE IP parameter and the MAX Host parameter for a specific cable modem are specified, the CMTS uses the value specified for MAX Host for that particular modem.
- When both the MAX CPE IP parameter and the MAX Host parameter for a cable interface are specified, the CMTS uses the larger value of the two.
- When both the MAX CPE IP parameter and the MAX Host parameter for the CMTS are specified, the CMTS uses the smaller value of the two.

Tip The Cisco CMTS keeps inactive cable modems listed in its internal database for 24 hours. The CMTS does not reset the CPE counts for these offline cable modems until the 24 hour period expires and the cable modems come back online. If the cable modems come back online before the 24 hours expires, the CMTS continues to use the existing CPE counts.

Possible Conflicts Between Parameters

The recommended procedure for disconnecting one PC from a cable modem and reconnecting a new one is the following:

1. The user first releases the IP address assigned to the PC. The user can do this either by using a utility such as winipcfg, or by shutting down the PC.
2. The user disconnects the old PC and reconnects the new PC to the cable modem.
3. The user reboots the cable modem so as to clear out its MAX CPE values.
4. After the cable modem has come online, the user boots the new PC so that it can obtain the correct IP address and come online.

This procedure will allow the MAX CPE value on the cable modem to stay synchronized with the MAX Host value on the CMTS. Problems can occur in the following situations:

- If the user does not release the IP address from the old PC before connecting a new one, the CMTS is not informed that the new PC is replacing the old one, and therefore counts both PCs when calculating the Host value. If the new value exceeds the MAX Host value, the CMTS does not allow the new PC to come online. The service provider will have to issue the **clear cable host** command to remove the old PC from the MAX Host table, so as to allow the new PC to come online.
- If the user does not reboot the cable modem after disconnecting the old PC, the cable modem retains the old PC's MAC address and continues to count it when calculating the CPE value. If the new value exceeds the MAX CPE value, the cable modem does not allow the new PC to come online. The user will have reboot the cable modem before the new PC can come online.
- If the user booted their PC before turning on the cable modem or before connecting the Ethernet cable to the cable modem. In this case, the operating system typically assigns a static private IP address (such as 169.254.232.199, which is the default Windows IP address). When the cable modem then boots or is connected to the PC, it logs the PC's private IP address as one of the allowable IP addresses. So, if MAX CPE IP is set to 1, the PC will not be allowed access to the Internet. You must reboot the cable modem to clear its IP address tables, and allow the PC to acquire an IP address from the DHCP server. (To avoid this problem, set the docsDevCpeIpMax attribute for the cable modem to –1 in the DOCSIS configuration file. CableLabs has proposed –1 as the new default, but this change has not yet been given final approval or been implemented in current software releases.)

To reduce service-impacting problems when users replace PCs without following the above guidelines, service providers can configure the MAX Host parameter for a value greater than the MAX CPE value. This allows users to replace a limited number PCs without releasing the IP address and still be able to come online. (Users should continue to reboot the cable modem, however, because that is the only way to clear their internal CPE counter.)

For example, if you configure MAX CPE for a cable modem at 2, and MAX Host at 4, the user can connect any two PCs to the cable modem at any one time. The user can then replace both PCs with new PCs, reboot the cable modem, and have both PCs come online.

The CMTS CPE table for this cable modem lists all four PCs, and the user can switch between them at will, as long as the user reboots the cable modem after each switch. The user, however, is not allowed to bring a fifth PC online until one of the previous PCs has been cleared from the CMTS, using the **clear cable host** command.

Note The cable modem always enforces the MAX CPE parameter, regardless of the setting of the other parameters.

Summary of CPE Address Control

In DOCSIS 1.1 cable networks, CPE address control is done as part of the following process, which also includes Layer 2 and Layer 3 filtering:

1. MAC address filtering—Packets are filtered on the basis of the MAC address for the CPE device. The filter is controlled by the MAX CPE parameter, as set in the DOCSIS configuration file.
2. Logical Link Control (LLC) filtering—Packets are filtered on the basis of the protocol for the packets. The filter is controlled by the docsDevFilterLLCTable table on the cable modem.
3. CPE IP address filtering—Packets are filtered on the basis of the IP address for the CPE device, as controlled by the MAX CPE IP value, as well as the docsDevCpeIpMax attribute and the docsDevFilterCpeTable table on the CMTS.
4. Access list filtering—Packets are filtered on the basis of access lists. IP filtering is controlled by the docsDevFilterIpTable table, and SNMP access filters are controlled by the docsDevNmAccessTable table.
5. MAX Host control—The CMTS allows access for CPE devices on the basis of the MAX Host parameters.

Tip This document does not describe the LLC and access list filtering. For more information about these filters, see the DOCS-CABLE-DEVICE-MIB MIB for more information on the SNMP attributes and tables that are listed above.

Benefits

- CMTS flexibility allows multiple service operator provisioners, service providers, and other users to synchronize between the CMTS and the cable modem the maximum number of permitted CPE devices that can be connected behind a cable modem.
- Changes can be made by using CLI commands or by using SNMP commands.

How to Configure the MAX CPE and Host Parameters

To reset the maximum number of permitted CPE devices recognized by the CMTS, use one of the following configuration commands. All procedures are optional, depending on the service provider's requirements.

Note The CMTS assigns the MAX Host value to a cable modem at the time that the cable modem registers with the CMTS. Changing any of the MAX Host commands affects only cable modems that register after the change.

Configuring the MAX CPE Parameter on the Cisco CMTS

To configure MAX CPE parameter, use the following procedure, beginning in user EXEC mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable modem max-cpe** [*number* | **unlimited**]
4. **cable submgmt default active**
5. **cable submgmt default max-cpe** *cpe-num*
6. **exit**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**enable**
	
	Example:
	`Router> enable`
	`Router#`
		Enables privileged EXEC mode. Enter your password if prompted.

Step 2	**configure terminal**
	
	Example:
	`Router# configure terminal`
	`Router(config)#`
		Enters global configuration mode.

	Command or Action	Purpose

Step 3	**cable modem max-cpe** [*number* | **unlimited**]
	
	Example:
	`Router(config)# cable modem max-cpe 8`
	`Router(config)#`
		Sets the value of the MAX CPE parameter on the Cisco CMTS for all cable interfaces.
		• number = Maximum number of CPE devices supported by cable modems. The valid range for *number* is 1 to 255, with a default of 0 (which indicates that the Cisco CMTS uses the MAX CPE value specified by each cable modem's DOCSIS configuration file).
		If *number* is larger than the MAX CPE value in the cable modem's DOCSIS configuration file or is set to **unlimited**, this command overrides the configuration file value. If *number* is smaller than the cpe-max value in the cable modem's DOCSIS configuration file, the value set in the configuration file takes precedence.
		• **unlimited** = Specifies that the CMTS does not enforce a limit on the number of CPE devices connected to a single cable modem. The cable modem is responsible for controlling the maximum number of CPEs, and the DHCP server is responsible for controlling the number of IP addresses assigned to the CPEs behind a single cable modem.
		Note If the value in the configuration file is zero and **no cable modem max-cpe** is configured, then no CPE device is able to obtain an IP address.

Step 4	**cable submgmt default active**
	
	Example:
	`Router(config)# cable submgmt default active`
	`Router(config)#`
		Specifies that the CMTS should actively manage CPE devices. The default is the **no** version of this command, so that the CMTS does not actively manage CPE devices.
		Note This command is required before the Cisco CMTS will manage CPE devices when running a Cisco IOS Release 12.2 BC software image.

Step 5	**cable submgmt default max-cpe** *cpe-num*
	
	Example:
	`Router(config)# cable submgmt default max-cpe 4`
	`Router(config)#`
		(Optional) Specifies the default value for the MAX-CPE parameter that the CMTS should use when the cable modem does not specify a MAX-CPE value in its DOCSIS configuration file. The range is 1 to 255, with a default of 16.

Step 6	**exit**
	
	Example:
	`Router(config)# exit`
	`Router#`
		Exits global configuration mode.

Note Use of the **cable modem max-cpe unlimited** command can open a security hole in the system by enabling denial of service attacks. It could allow a single user to obtain a large number of IP addresses, and thereby cause the entire network to go down after this single user has reserved all available IP addresses.

Configuring the MAX Hosts Parameter for a Cable Interface

To configure MAX Hosts parameter for all cable modems on a particular cable interface, use the following procedure, beginning in user EXEC mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface cable** *x/y*
4. **cable max-hosts** *number*
5. **exit**
6. **exit**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**enable**
	
	Example:
	`Router> enable`
	`Router#`
		Enables privileged EXEC mode. Enter your password if prompted.

Step 2	**configure terminal**
	
	Example:
	`Router# configure terminal`
	`Router(config)#`
		Enters global configuration mode.

Step 3	**interface cable** *x/y*
	
	Example:
	`Router(config)# interface cable 4/0`
	`Router(config-if)#`
		Enters cable interface configuration mode for the specified cable interface:

Step 4	**cable max-hosts** *number*
	
	Example:
	`Router(config-if)# cable max-hosts 10`
	`Router(config-if)#`
		Specifies the maximum number of hosts that each cable modem on this cable interface can support. The valid range is 0 to 255, with a default of 0 (which indicates that the Cisco CMTS uses the value specified in the cable modem's DOCSIS configuration file).

	Command or Action	Purpose

Step 5	**exit**
	
	Example:
	`Router(config-if)# exit`
	`Router(config)#`
		Exits interface configuration mode.

Step 6	**exit**
	
	Example:
	`Router(config)# exit`
	`Router#`
		Exits global configuration mode.

Configuring the MAX Hosts Parameter for a Particular Cable Modem

To configure MAX Hosts parameter for a particular cable modem, use the following procedure, beginning in user EXEC mode.

SUMMARY STEPS

1. **enable**
2. **cable modem** {*mac-addr* | *ip-addr*} **max-hosts** {*number* | **default**}

DETAILED STEPS

	Command or Action	Purpose

Step 1	**enable**
	
	Example:
	`Router> enable`
	`Router#`
		Enables privileged EXEC mode. Enter your password if prompted.

Step 2	**cable modem** {*mac-addr*	*ip-addr*} **max-hosts** {*number*	**default**}
			
			Example:
			`Router# cable modem 000C.0102.0304 max-hosts 8`
			`Router#`
				Specifies the maximum number of hosts allowed behind this particular cable modem:
				• *mac-addr* = Specifies the hardware (MAC) address for the particular cable modem.
				• *ip-addr* = Specifies the IP address for the particular cable modem.
				• *number* = Maximum number of CPE devices that this particular cable modem can support. The valid range is 0 to 255, with a default of 0 (which indicates that the Cisco CMTS uses the value specified in the cable modem's DOCSIS configuration file).
				• **default** = Sets the MAX Hosts parameter to 0.

Configuration Examples for the MAX CPE and Host Parameters

The following example shows how to allow the CMTS to recognize a maximum of four CPE devices attached to online cable modems for a CMTS:

```
cable modem max-cpe 4
```

The following example shows how to set the maximum CPE devices recognized by the CMTS for a cable interface to 15:

```
cable max-hosts 15
```

The following example shows how to allow the CMTS to recognize a maximum of 30 attached CPE devices for a specific cable modem of IP address 172.172.172.12:

```
cable modem 172.172.172.12 max-hosts 30
```

Sample Outputs

To display the current configuration and status of a cable interface, use the **show running-config** command in privileged EXEC mode. The following is sample output that shows that the CMTS permits up to five CPE devices to use the specified cable interface to pass traffic.

```
interface Cable3/0
 ip address 192.168.1.1 255.255.255.0 secondary
 ip address 10.1.1.1 255.255.255.0
 load-interval 30
 no keepalive
 cable max-hosts 5
 cable downstream annex B
 cable downstream modulation 256qam
 cable downstream interleave-depth 32
 cable downstream frequency 507000000
 cable upstream 0 frequency 27008000
 cable upstream 0 power-level 0
 cable upstream 0 minislot-size 32
 cable upstream 0 modulation-profile 2
 no cable upstream 0 shutdown
 cable upstream 1 frequency 29008000
 cable upstream 1 power-level 0
 cable upstream 1 channel-width 3200000
 cable upstream 1 minislot-size 4
 no cable upstream 1 shutdown
 cable dhcp-giaddr policy
 cable helper-address 172.17.110.131
end
```

You can also use the **more system:running-config** command to verify the maximum number of permitted CPE devices for a cable interface. Look for a notation, such as “cable max-host 4,” in the cable interface configuration information, as shown in the following sample output:

```
CMTS01# more system:running-config

Building configuration...
Current configuration:
!
interface Cable6/0
 ip address 1.1.1.1 255.255.255.0
 no keepalive
```

```
 cable max-hosts 4
 cable insertion-interval 2000
 cable downstream annex B
 cable downstream modulation 64qam
 cable downstream interleave-depth 32
 cable downstream symbol-rate 5056941
 cable upstream 0 frequency 15008000
 cable upstream 0 fec
 cable upstream 0 scrambler
 no cable upstream 0 shutdown
```

You can use the **show cable modem detail** command to list information on each CPE device permitted for a cable modem. The command displays the max cpe value as configured in the DOCSIS configuration file for the cable modem, and in parentheses the value of *n* configured in the **cable modem max-cpe** command, if different. See the following sample output where the CMTS is configured for max-cpe equal to four and then max-cpe equal to unlimited:

```
test-cmts# show cable modem detail

Interface         SID MAC address   Max CPE Concatenation Rx SNR
Cable4/0/U0 1      0001.9659.47bb    1      yes           37.37
Cable4/0/U0 2      0001.9659.47ab    1      yes           33.70
Cable4/0/U0 3      0001.9659.47bf    1      yes           30.67
Cable4/0/U0 4      0001.9659.3ef7    1      yes           28.84
Cable4/0/U0 5      0001.9659.47eb    1      yes           30.89

test-cmts# conf t

Enter configuration commands, one per line. End with CNTL/Z.
test-cmts(config)# cable modem max-cpe ?
<1-255> Number
unlimited Max CPE not enforced

test-cmts(config)# cable modem max-cpe 4
test-cmts(config)# end

test-cmts#
00:05:11: %SYS-5-CONFIG_I: Configured from console by console

test-cmts# show cable modem detail

Interface        SID MAC address   Max CPE Concatenation Rx SNR
Cable4/0/U0 1      0001.9659.47bb .1 (4)        yes       37.00
Cable4/0/U0 2      0001.9659.47ab .1 (4)        yes       33.54
Cable4/0/U0 3      0001.9659.47bf .1 (4)        yes       30.70
Cable4/0/U0 4      0001.9659.3ef7 .1 (4)        yes       29.00
Cable4/0/U0 5      0001.9659.47eb .1 (4)        yes       30.92

test-cmts# conf t

Enter configuration commands, one per line. End with CNTL/Z.

test-cmts(config)# cable modem max
test-cmts(config)# cable modem max-cpe ?

<1-255> Number
unlimited Max CPE not enforced

test-cmts(config)# cable modem max-cpe unli
test-cmts(config)# cable modem max-cpe unlimited
test-cmts(config)# ^Z

test-cmts#
```

```
00:06:06: %SYS-5-CONFIG_I: Configured from console by console
test-cmts# show cable modem detail
Interface      SID MAC address      Max CPE Concatenation Rx SNR
Cable4/0/U0 1      0001.9659.47bb   1 (ul)      yes          36.64
Cable4/0/U0 2      0001.9659.47ab   1 (ul)      yes          33.26
Cable4/0/U0 3      0001.9659.47bf   1 (ul)      yes          30.73
Cable4/0/U0 4      0001.9659.3ef7   1 (ul)      yes          29.15
Cable4/0/U0 5      0001.9659.47eb   1 (ul)      yes          30.95
```

Additional References

For additional information related to configuring the MAX CPE and Host parameters on the Cisco CMTS, refer to the following references:

Related Documents

Related Topic	Document Title
CMTS Command Reference	*Cisco Broadband Cable Command Reference Guide,* at the following URL: http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html
Cisco IOS Release 12.2 Command Reference	Cisco IOS Release 12.2 Configuration Guides and Command References, at the following URL: http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/products_installation_and_configuration_guides_list.html http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/prod_command_reference_list.html
Interaction of MAX CPE Parameters	*How MAX-CPE in DOCSIS File and CMTS Works*, at the following URL: http://www.cisco.com/en/US/tech/tk86/tk168/technologies_tech_note09186a00800a7609.shtml

Standards

Standards[1]	Title
SP-RFIv1.1-I08-020301	Data-Over-Cable Service Interface Specifications Radio Frequency Interface Specification, version 1.1 (http://www.cablelabs.com/cablemodem)

1. Not all supported standards are listed.

MIBs

MIBs[1]	MIBs Link
DOCS-CABLE-DEVICE-MIB DOCS-SUBMGT-MIB	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

1. Not all supported MIBs are listed.

Technical Assistance

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