



# Release Notes for the Cisco 678 ADSL Router

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**March 23, 2000**

These release notes discuss features, caveats, and open issues for the Cisco 678 asymmetric digital subscriber line (ADSL) router as of Release 2.3.0 of the Cisco Broadband Operating System (CBOS). This is the first supported release of the Cisco 678 ADSL router.

For more detailed information about the features in these release notes, refer to the “Related Documentation” section on page 13. Information about electronic documentation can be found in the “Obtaining Documentation” section on page 13.

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## Cisco Broadband Operating System (CBOS)

CBOS is the common operating system for Cisco customer premises equipment (CPE). This operating system is bundled with the Cisco 678 ADSL router, and can also be downloaded from Cisco Connection Online.



# Configuration Procedures

The Cisco 678 makes use of new capabilities that must be configured at the service provider's location. The service provider ensures that your service user information and network connections are valid and accurate. When service orders are processed and completed, the service provider alerts customers when an upgrade is available and orders a Cisco 678 to be delivered to them.

The Cisco 678 allows you to choose transmission protocols to match your network configuration by changing the router's configuration file. You will use the Trivial File Transfer Protocol (TFTP) to transfer files to and from a Cisco 678 router. This section describes procedures to configure the Cisco 678 for Discrete Multi-Tone (DMT), Carrierless Amplitude and Phase Modulation (CAP), or G.Lite protocols.



## Note

You will be notified by your DSL service provider when you need to use the following procedures to configure the Cisco 678 for a different transmission protocol. Changes to your Cisco 678 must be coordinated with your DSL service provider.

## Configuring the Cisco 678 for CAP

Follow these steps:

**Step 1** Verify the connection from the router to the location where the correct software image is stored. This location is provided by your service provider. Typically, you use the **ping** command for this step.

**Step 2** Enable TFTP by entering:

```
cbos#set tftp enabled
TFTP is enabled
```

**Step 3** Set the remote address for the TFTP host computer by entering:

```
cbos # set tftp remote ip address
```

This command tells the Cisco 678 to accept TFTP transfers from a specific IP address. An example remote IP address would be *192.168.35.4*. This address is an example only; do not use it to configure the router.



**Note** If you do not have the Cisco 678 address, consult your network administrator.

For more information about TFTP, see Chapter 3, "Configuration Procedures," of the *Cisco 678 ADSL Router Installation and Operation Guide*.

**Step 4** To start the file transfer from a PC, start a DOS session and enter the following command:

```
C:>tftp -i Cisco 678 IP address put image_filename
```

To start the file transfer from a UNIX machine, enter the following commands:

```
root@staten-</678>tftp
tftp> mode binary
tftp> put Cisco 678 IP address:image_filename
Sent 922294 bytes in 54.9 seconds
```

Where necessary, implement the following values:

- i** Sets the transfer mode to binary mode
- get** Downloads a file to a specified IP address
- put** Uploads a file onto that IP address

Substitute the filename for the software image update. Files use the naming format c678cap.x.x.x.x.bin, where x.x.x.x is the image version number.



**Caution**

Do not turn off the power to the router until after the file transfer is completed.

**Step 5**

Be sure to reboot the Cisco 678 to activate the new image. When you log back in to the Cisco 678 after the reboot, use the **show version** command to verify the version of the firmware that is active. Note the CAP firmware version.

## Sample Output of Configuration Session for CAP

```
cbos#set tftp enabled
TFTP is enabled

cbos#tftp -i 10.9.1.20 get c678cap.2.3.0.55.bin
Starting download...
  Downloading in progress..... done.
  Saving image.....done.
  Please reboot the CPE for the new downl
cbos#reboot
Hello!
C67x self-update code: Release 2.2.0
NOTE: Do not power off router until update is finished!

Decompressing router...
Erasing FLASH.....
Programming...
Decompressing monitor...
Erasing FLASH.....
Programming...
Finished. Rebooting...
Hello!
Expanding CBOS image...
CBOS v2.3.0.025 - Release Software

User Access Verification
Password:

cbos>enable
Password:
cbos#show version
Cisco Broadband Operating System
CBOS (tm) 025 - Release Software
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Dec 21 1999 20:37:27
CAP firmware version C.19
NVRAM image at 0x10356930
```

## Configuring the Cisco 678 for DMT

Follow these steps:

**Step 1** Verify the connection from the router to the location where the correct software image is stored. This location is provided by your service provider. Typically, you use the **ping** command for this step.

**Step 2** Enable TFTP by entering:

```
cbos#set tftp enabled
TFTP is enabled
```

**Step 3** Set the remote address for the TFTP host computer by entering:

```
cbos # tftp remote ip address
```

This command tells the Cisco 678 to accept TFTP transfers from a specific IP address. An example remote IP address would be *192.168.35.4*. This address is an example only; do not use it to configure the router.



**Note** If you do not have the Cisco 678 address, consult your network administrator.

For more information about TFTP, see Chapter 3, “Configuration Procedures,” of the *Cisco 678 ADSL Router Installation and Operation Guide*.

**Step 4** To start the file transfer from a PC, start a DOS session and enter the following command:

```
C:>tftp -i Cisco 678 IP address put image_filename
```

To start the file transfer from a UNIX machine, enter the following commands:

```
root@staten-</678>tftp
tftp> mode binary
tftp> put Cisco 678 IP address:image_filename
Sent 922294 bytes in 54.9 seconds
```

Where necessary, implement the following values:

**-i** Sets the transfer mode to binary mode

**get** Downloads a file to a specified IP address

**put** Uploads a file onto that IP address

Substitute the filename for the software image update. Files use the naming format *c678dmt.x.x.x.x.bin* where *x.x.x.x* is the image version number.



**Caution** Do not turn off the power to the router until after the file transfer is completed.

**Step 5** Be sure to reboot the Cisco 678 to activate the new image. When you log back in to the Cisco 678 after the reboot, use the **show version** command to verify the version of the firmware that is active. Note the DMT firmware version.

## Sample Output of Configuration Session for DMT

```

cbos#set tftp enabled
TFTP is enabled

cbos#tftp -i 10.9.1.20 get c678dmt.2.3.0.55.bin
Starting download...
    Downloading in progress..... done.
    Saving image.....done.
    Please reboot the CPE for the new downl
cbos#reboot
Hello!
C67x self-update code: Release 2.2.0
NOTE: Do not power off router until update is finished!

Decompressing router...
Erasing FLASH.....
Programming...
Decompressing monitor...
Erasing FLASH.....
Programming...
Finished. Rebooting...
Hello!
Expanding CBOS image...
CBOS v2.3.0.025 - Release Software

User Access Verification
Password:

cbos>enable
Password:

cbos#show version

Cisco Broadband Operating System
CBOS (tm) 025 - Release Software
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Dec 21 1999 20:37:27
DMT firmware version 210
NVRAM image at 0x10356930

```

## Configuring the Cisco 678 for G.Lite

Before the Cisco 678 can be configured for G.Lite, it must first be configured for DMT. The service provider must correctly configure the central office hardware with an application such as ViewRunner to accept a G.Lite service user.

Follow these steps:

- 
- Step 1** Ensure the service configuration for a service user shows the G.Lite Mode is enabled. Within ViewRunner, open the Subscriber Profiles window and check the G.Lite Mode check box. (See Figure 1.)

Figure 1 G.Lite Mode Enabled in the ViewRunner Subscriber Profiles Window



**Step 2** Configure the Cisco 678 for DMT.

**Step 3** Enter the following command:

```
cbos# set interface wan0 standard g.lite
```

**Step 4** Be sure to retrain the Cisco 678 to activate the new line code. When the Cisco 678 is retrained, use the **show interface wan0** command to verify the G.Lite standard is active. Note the FLEXI Standard is set to G.Lite.



**Note** Changes made to the running configuration must be written NVRAM for changes to be seen on reboot.

## Sample Output of Configuration Session for G.Lite

```

cbos#set interface wan0 standard
SET INTERFACE WANx STANDARD requires one of the following arguments
T1.413
G.lite (G992.2)

cbos#set interface wan0 standard g.lite
Note: Change will take effect on next retrain.

cbos#show interface wan0
wan0    ADSL Physical Port
        Line Trained
Actual Configuration:
  Overhead Framing:      3
  Trellis Coding:       Disabled
  Standard Compliance:  G.lite
  Downstream Data Rate: 1536 Kbps
  Upstream Data Rate:   512 Kbps
  Interleave S Downstream: 4
  Interleave D Downstream: 16
  Interleave R Downstream: 4
  Interleave S Upstream:  8
  Interleave D Upstream:  8
  Interleave R Upstream:  8
  Modem Microcode:      G96
  DSP version:          0
  Operating State:      Showtime/Data Mode
Configured:
  Echo Cancellation:    Disabled
  Overhead Framing:     3
  Coding Gain:          Auto
  TX Power Attenuation: 0dB
  Trellis Coding:       Enabled
  Bit Swapping:         Disabled
  Standard Compliance:  G.lite
  Remote Standard Compliance:T1.413
  Tx Start Bin:         0x6
  Tx End Bin:           0x1f
  Data Interface:       Utopia L1
Status:
  Local SNR Margin:     28.0dB
  Local Coding Gain:    1.5dB
  Local Transmit Power: 12.3dB
  Local Attenuation:    22.5dB
  Remote Attenuation:   21.5dB
Local Counters:
  Interleaved RS Corrected Bytes: 0
  Interleaved Symbols with CRC Errors: 0
  No Cell Delineation Interleaved: 0
  Out of Cell Delineation Interleaved: 0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames: 0
  Count of Loss of Signal Frames: 0
Remote Counters:
  Interleaved RS Corrected Bytes: 0
  Interleaved Symbols with CRC Errors: 0
  No Cell Delineation Interleaved: 0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames: 0
  Count of Loss of Signal Frames: 0

```

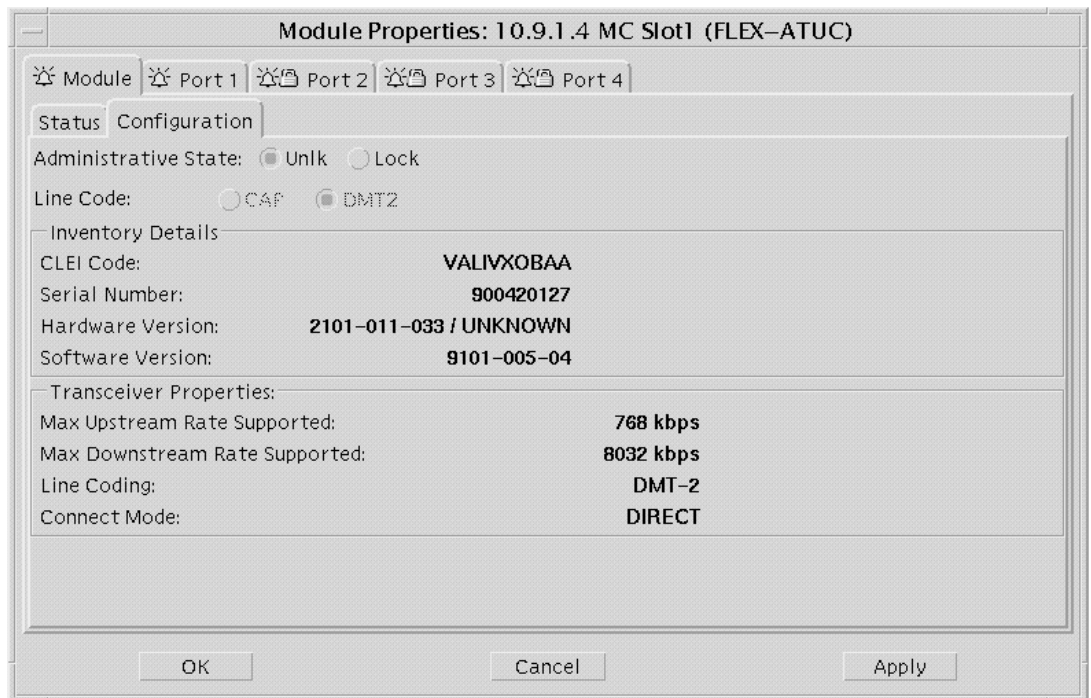
## Configuring the Cisco 678 for DMT2

Before the Cisco 678 can be configured for DMT2, it must first be configured for DMT. The service provider must correctly configure the central office hardware with an application such as ViewRunner to accept a DMT2 service user.

Follow these steps:

- Step 1** Ensure the service configuration for a service user shows the DMT2 Mode is enabled. (See Figure 2.)

*Figure 2 DMT2 Mode Enabled in the ViewRunner Subscriber Profiles Window*



- Step 2** Configure the Cisco 678 for DMT.

- Step 3** Enter the following command:

```
cbos# set interface wan0 standard t1.413
```

- Step 4** Be sure to retrain the Cisco 678 to activate the new line code. When the Cisco 678 is retrained, use the **show interface wan0** command to verify the DMT2 standard is active. Note the FLEXI Standard is set to DMT2.



**Note** Changes made to the running configuration must be written NVRAM for changes to be seen on reboot.



## Sample Output of Configuration Session for DMT2

```

cbos#set interface wan0 standard
SET INTERFACE WANx STANDARD requires one of the following arguments
T1.413
G-lite (G992.2)

cbos#set interface wan0 standard t1.413
Note: Change will take effect on next retrain.

cbos#show interface wan0
wan0   ADSL Physical Port
       Line Trained
Actual Configuration:
  Overhead Framing:      3
  Trellis Coding:       Disabled
  Standard Compliance:  T1.413
  Downstream Data Rate: 8032 Kbps
  Upstream Data Rate:   864 Kbps
  Interleave S Downstream: 1
  Interleave D Downstream: 64
  Interleave R Downstream: 2
  Interleave S Upstream:  4
  Interleave D Upstream:  8
  Interleave R Upstream: 16
  Modem Microcode:      G96
  DSP version:          0
  Operating State:      Showtime/Data Mode
Configured:
  Echo Cancellation:    Disabled
  Overhead Framing:     3
  Coding Gain:          Auto
  TX Power Attenuation: 0dB
  Trellis Coding:       Enabled
  Bit Swapping:         Disabled
  Standard Compliance:  Multimode
  Remote Standard Compliance:T1.413
  Tx Start Bin:         0x6
  Tx End Bin:           0x1f
  Data Interface:       Utopia L1
Status:
  Local SNR Margin:     3.5dB
  Local Coding Gain:    0.0dB
  Local Transmit Power: 12.5dB
  Local Attenuation:    28.5dB
  Remote Attenuation:   18.5dB
Local Counters:
  Interleaved RS Corrected Bytes: 0
  Interleaved Symbols with CRC Errors: 2
  No Cell Delineation Interleaved: 0
  Out of Cell Delineation Interleaved: 0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames: 0
  Count of Loss of Signal Frames: 0
Remote Counters:
  Interleaved RS Corrected Bytes: 0
  Interleaved Symbols with CRC Errors: 0
  No Cell Delineation Interleaved: 0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames: 0
  Count of Loss of Signal Frames: 0

```

# Known Issues for the Cisco 678 as of CBOS Release 2.3.0

Table 1 lists known issues for the Cisco 678 as of CBOS Release 2.3.0.

*Table 1 Known Issues for the Cisco 678 as of CBOS Release 2.3.0*

Bug Number	Description
CSCdp05750	<p><b>Symptoms:</b> Cannot pass traffic in overhead framing modes 0, 1 and 2</p> <p><b>Conditions:</b> Overhead framing modes are configurable, however in modes 0, 1 and 2, traffic cannot be passed.</p> <p><b>Workaround:</b> There is no workaround. This problem is due to a limitation with third-party hardware. There is currently no scheduled date from the vendor for resolution of the problem.</p>
CSCdp06125	<p><b>Symptoms:</b> Throughput performance is low for Cisco 678 vs. ADI DMT line card.</p> <p><b>Conditions:</b> This condition occurs when the Cisco 678 is trained against an ADI DMT line card.</p> <p><b>Workaround:</b> There is no workaround. This problem is due to a limitation with third-party hardware. There is currently no scheduled date from the vendor for resolution of the problem.</p>
CSCdp06890	<p><b>Symptoms:</b> Actual upstream rates for the Cisco 678 are much lower than that of the Cisco 677 vs. ADI DMT line card.</p> <p><b>Conditions:</b> This condition occurs when training Cisco 678 vs. ADI DMT line card.</p> <p><b>Workaround:</b> There is no workaround. This problem is due to a limitation with third-party hardware. There is currently no scheduled date from the vendor for resolution of the problem.</p>
CSCdp09999	<p><b>Symptoms:</b> When the Cisco 678 is trained against an ADI DMT line card, longer loops cause CRC, HEC and RS Corrected bytes to climb.</p> <p><b>Conditions:</b> This condition is seen when trained against an ADI DMT line card at loops ~13000' 26AWG or greater.</p> <p><b>Workaround:</b> There is no workaround. This problem is due to a limitation with third-party hardware. There is currently no scheduled date from the vendor for resolution of the problem.</p>

Table 1 Known Issues for the Cisco 678 as of CBOS Release 2.3.0

Bug Number	Description
CSCdp33321	<p><b>Symptoms:</b> File transfer performance rates may not meet performance expectations at high trained rates.</p> <p><b>Conditions:</b> Performance below expectations is most likely to manifest itself at high downstream trained rates, particularly above 4096 kbps. For example, at the maximum downstream trained rate, 7168, the file transfer rate for an FTP transfer will probably be no higher than 50-60% of the trained rate.</p> <p><b>Workaround:</b> There are options to improve performance, but note that each option may have drawbacks and may not be useful in all situations.</p> <p>1) Increase the TCP window size, particularly if using a Microsoft Windows 95/98 or NT client. Refer to Microsoft's web site at <a href="http://www.microsoft.com">www.microsoft.com</a> for information and caveats regarding modification of TCP window size. For Windows 95/98, search for "DefaultRcvWindow delay" (all words); for NT, search for "TcpWindowSize high delay" (all words).</p> <p>2) If TCP window size is increased, this may cause the CPE to show excessive CRC errors. Note that clients with a large default TCP window size such as certain Linux or UNIX clients may also see these CRC errors. If this occurs, utilize traffic shaping on the terminating router. Refer to Cisco IOS documentation for the terminating router for information on implementation of traffic shaping.</p>
CSCdp44187	<p><b>Symptoms:</b> G.Lite does not meet required train rate defined in ITU G.992</p> <p><b>Conditions:</b> When using ANSI 7 and 13, required train rates are not met.</p> <p><b>Workaround:</b> There is no workaround. This problem is due to a limitation with third-party hardware. There is currently no scheduled date from the vendor for resolution of the problem.</p>
CSCdp67298	<p><b>Symptoms:</b> Intermittently, certain trains result in RS Corrected Bytes, CRC and HEC counters to rise.</p> <p><b>Conditions:</b> The problems arise in at lengths between 0-1800 feet and 5500-6000 feet with trellis off and when trained greater than 7680kbps down.</p> <p><b>Workaround:</b></p> <p>1) Enabling trellis coding on the CO corrects this issue. The default setting for trellis is disabled in ViewRunner but is enabled on the Cisco 678.</p> <p>2) Lowering the provisioned rate for the subscriber to 7680/864 kbps or lower.</p>
CSCdp70810	<p><b>Symptoms:</b> On certain ANSI loops, the Cisco 678 takes a long time to train. The CPE will train, drop, and retrain a number of times till a solid train is achieved.</p> <p><b>Conditions:</b> This occurs with ANSI loops 7 and 13 on either the Flexi 4port CAP or 2port CAP line cards with either Cisco 675 or Cisco 678 CAP CPEs.</p> <p><b>Workaround:</b> There is no workaround.</p>
CSCdp87342	<p><b>Symptoms:</b> When running T1.413 Standard loops, the required rates cannot be met on all loops</p> <p><b>Conditions:</b> This occurs with Cisco 678 DMT vs. Flexi.</p> <p><b>Workaround:</b> There is no workaround. This problem is being investigated.</p>

# Documentation Updates

This section addresses errors in the *Cisco 678 ADSL Router Installation and Operation Guide* and information that was not available when the guide was printed.

- In “Frequently Asked Questions about the WAN LNK LED” on page 4-6

The following fields should be removed from the output of the **show interface wan0** command: Remote Transmit Power, Remote Vendor ID, Remote Vendor, Revision, Transmitted Cells, Received Cells, Transmitted Frames, and Received Frames. The output of the **show interface wan0** command should be:

```

cbos#show interface wan0
wan0  ADSL Physical Port
      Line Trained
Actual Configuration:
  Overhead Framing:          3
  Trellis Coding:           Disabled
  Standard Compliance:      T1.413
  Downstream Data Rate:     8032 Kbps
  Upstream Data Rate:       864 Kbps
  Interleave S Downstream:  1
  Interleave D Downstream:  64
  Interleave R Downstream:  2
  Interleave S Upstream:    4
  Interleave D Upstream:    8
  Interleave R Upstream:    16
  Modem Microcode:          G96
  DSP version:              0
  Operating State:          Showtime/Data Mode
Configured:
  Echo Cancellation:        Disabled
  Overhead Framing:          3
  Coding Gain:               Auto
  TX Power Attenuation:     0dB
  Trellis Coding:           Enabled
  Bit Swapping:             Disabled
  Standard Compliance:      Multimode
  Remote Standard Compliance:T1.413
  Tx Start Bin:             0x6
  Tx End Bin:               0x1f
  Data Interface:           Utopia L1
Status:
  Local SNR Margin:         3.5dB
  Local Coding Gain:         0.0dB
  Local Transmit Power:     12.5dB
  Local Attenuation:        28.5dB
  Remote Attenuation:       18.5dB
Local Counters:
  Interleaved RS Corrected Bytes: 0
  Interleaved Symbols with CRC Errors: 2
  No Cell Delineation Interleaved: 0
  Out of Cell Delineation Interleaved: 0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames: 0
  Count of Loss of Signal Frames: 0
Remote Counters:
  Interleaved RS Corrected Bytes: 0
  Interleaved Symbols with CRC Errors: 0
  No Cell Delineation Interleaved: 0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames: 0
  Count of Loss of Signal Frames: 0

```

- In “Cisco 678 Specifications” on page B-4

The following compliance statements should be added:

**ICES 003 Statement**

This Class [\*] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [\*] est conforme à la norme NMB-003 du Canada.

**VCCI Statement**

This is a Class B product based on the standard of the Voluntary Control Council for Interference from Information Technology Equipment (VCCI). If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction manual.

**警告**

VCCI準拠クラスB機器（日本）

この機器は、Information Technology EquipmentのVoluntary Control Council for Interference (VCCI)の規格に準拠したクラスB製品です。この機器をラジオやテレビ受信機の近くで使用した場合、混信が発生する恐れがあります。本機器の設置および使用に際しては、取扱説明書に従ってください。

## Related Documentation

Use these release notes in conjunction with the following documentation:

- *Cisco 678 ADSL Router Installation and Operation Guide* (Cisco document number 78-10172-01)
- *Quick Start for the Cisco 678 ADSL router* (Cisco document number 78-10174-01)
- *Regulatory Compliance and Safety Information for the Cisco 678 ADSL router* (Cisco document number 78-10175-01)

## Obtaining Documentation

### World Wide Web

You can access the most current Cisco documentation on the World Wide Web at <http://www.cisco.com>, <http://www-china.cisco.com>, or <http://www-europe.cisco.com>.

## Documentation CD-ROM

Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM is updated monthly. Therefore, it is probably more current than printed documentation. The CD-ROM package is available as a single unit or as an annual subscription.

## Ordering Documentation

Registered CCO users can order the Documentation CD-ROM and other Cisco Product documentation through our online Subscription Services at <http://www.cisco.com/cgi-bin/subcat/kaojump.cgi>.

Nonregistered CCO users can order documentation through a local account representative by calling Cisco's corporate headquarters (California, USA) at 408 526-4000 or, in North America, call 800 553-NETS (6387).

## Obtaining Technical Assistance

Cisco provides Cisco Connection Online (CCO) as a starting point for all technical assistance. Warranty or maintenance contract customers can use the Technical Assistance Center. All customers can submit technical feedback on Cisco documentation using the web, e-mail, a self-addressed stamped response card included in many printed docs, or by sending mail to Cisco.

## Cisco Connection Online

Cisco continues to revolutionize how business is done on the Internet. Cisco Connection Online is the foundation of a suite of interactive, networked services that provides immediate, open access to Cisco information and resources at anytime, from anywhere in the world. This highly integrated Internet application is a powerful, easy-to-use tool for doing business with Cisco.

CCO's broad range of features and services helps customers and partners to streamline business processes and improve productivity. Through CCO, you will find information about Cisco and our networking solutions, services, and programs. In addition, you can resolve technical issues with online support services, download and test software packages, and order Cisco learning materials and merchandise. Valuable online skill assessment, training, and certification programs are also available.

Customers and partners can self-register on CCO to obtain additional personalized information and services. Registered users may order products, check on the status of an order and view benefits specific to their relationships with Cisco.

You can access CCO in the following ways:

- WWW: [www.cisco.com](http://www.cisco.com)
- Telnet: [cco.cisco.com](telnet://cco.cisco.com)
- Modem using standard connection rates and the following terminal settings: VT100 emulation; 8 data bits; no parity; and 1 stop bit.
  - From North America, call 408 526-8070
  - From Europe, call 33 1 64 46 40 82

You can e-mail questions about using CCO to [cco-team@cisco.com](mailto:cco-team@cisco.com).

## Technical Assistance Center

The Cisco Technical Assistance Center (TAC) is available to warranty or maintenance contract customers who need technical assistance with a Cisco product that is under warranty or covered by a maintenance contract.

To display the TAC web site that includes links to technical support information and software upgrades and for requesting TAC support, use [www.cisco.com/techsupport](http://www.cisco.com/techsupport).

To contact by e-mail, use one of the following:

Language	E-mail Address
English	<a href="mailto:tac@cisco.com">tac@cisco.com</a>
Hanzi (Chinese)	<a href="mailto:chinese-tac@cisco.com">chinese-tac@cisco.com</a>
Kanji (Japanese)	<a href="mailto:japan-tac@cisco.com">japan-tac@cisco.com</a>
Hangul (Korean)	<a href="mailto:korea-tac@cisco.com">korea-tac@cisco.com</a>
Spanish	<a href="mailto:tac@cisco.com">tac@cisco.com</a>
Thai	<a href="mailto:thai-tac@cisco.com">thai-tac@cisco.com</a>

In North America, TAC can be reached at 800 553-2447 or 408 526-7209. For other telephone numbers and TAC e-mail addresses worldwide, consult the following web site:  
<http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml>.

## Documentation Feedback

If you are reading Cisco product documentation on the World Wide Web, you can submit technical comments electronically. Click **Feedback** in the toolbar and select **Documentation**. After you complete the form, click **Submit** to send it to Cisco.

You can e-mail your comments to [bug-doc@cisco.com](mailto:bug-doc@cisco.com).

To submit your comments by mail, for your convenience many documents contain a response card behind the front cover. Otherwise, you can mail your comments to the following address:

Cisco Systems, Inc.  
 Document Resource Connection  
 170 West Tasman Drive  
 San Jose, CA 95134-9883

We appreciate and value your comments.

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This document is to be used in conjunction with the documents listed in the “Related Documentation” section.

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