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# Release Notes for Cisco IOS Release 11.1(5)— CiscoPro CPA1000 Series Routers

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## October 14, 1996

These release notes identify the Cisco Internetwork Operating System (Cisco IOS) Release 11.1 feature sets for CiscoPro CPA1000 series routers. Product numbers for the supported feature sets are as follows:

- CPASW10-A-11.1= (IP Feature Pack for CPA1000)
- CPASW10-C-11.1= (IP/AppleTalk Feature Pack for CPA1000)
- CPASW10-D-11.1= (IP/IPX Feature Pack for CPA1000)

These release notes include tables that identify feature packs and tables that show the specific features comprising available feature sets for each supported CiscoPro router. These release notes also help you navigate the electronic documentation directly to the Cisco IOS Release 11.1 documentation for CiscoPro products. The CiscoPro Software Installer, delivered on the same CD-ROM as the Cisco IOS feature sets, is designed to work from a PC running Microsoft Windows 95. These release notes also describe how to install the router software feature sets using a PC running Microsoft Windows 3.1.

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**Note** Before running the CiscoPro Software Installer, read the section “Installation Tips,” page 4.

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These release notes contain the following sections:

- CiscoPro Feature Pack Descriptions, page 2
- Memory Requirements and Recommendations, page 3
- Installation Tips, page 4
- Installing the Router Software Feature Sets Using Microsoft Windows 3.1, page 12

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- Additional Release Note Information, page 19
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- Obtaining Service and Support, page 26
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**Note** Before running the router image loader confirm that the Configuration Register is set to 0x2; otherwise you will encounter an “unable to reload” message. If you encounter this message, you can run the **b flash** command to restore the configuration register.

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## CiscoPro Feature Pack Descriptions

This section describes the CiscoPro feature packs, listing the software feature sets comprising each set. You can use this information to identify your feature pack set in conjunction with the corresponding information provided in the tables in the section “Installation Tips,” page 4. Tables in that section identify which features that are supported for a feature set on a specific platform.

### Software Feature Packs

Table 1 identifies each feature pack as specified on the label of the CD containing the router software. It also lists the feature sets comprising the feature pack, giving the DOS and UNIX filenames of the images. The table provides a brief description of each feature set and the router platform on which the feature set runs.

**Table 1 CiscoPro Feature Pack Feature Set Image Filenames**

Feature Sets Included	DOS Filename	UNIX Filename	Description
<b>CPA1000 IP Feature Pack Release 11.1 (model number CPASW10-A-11.1=)</b>			
IP 1003/1004	JE11150N	cpa1003-y-mz.111-5	IP feature set for CPA1003 and CPA1004 routers
IP 1005 sync	KE11150N	cpa1005-xy-mz.111-5	IP feature set for CPA1005 routers
IP 1005 async	KA11150N	cpa1005-qy-mz.111-5	IP asynchronous feature set for CPA1005 routers
<b>CPA1000 IP/AppleTalk Feature Pack Release 11.1 (model number CPASW10-C-11.1=)</b>			
IP/AT 1003/1004	J11150N	cpa1003-by-mz.111-5	IP/AppleTalk feature set for CPA1003 and CPA1004 routers
IP/AT 1005	K11150N	cpa1005-by-mz.111-5	IP/AppleTalk feature set for CPA1005 routers
<b>CPA1000 IP/IPX Feature Pack Release 11.1 (model number CPASW10-D-11.1=)</b>			
IP/IPX 1003/1004	JN11150N	cpa1003-ny-mz.111-5	IP/IPX feature set for CPA1003 and CPA1004 routers
IP/IPX 1005 sync	KN11150N	cpa1005-ny-mz.111-5	IP/IPX synchronous feature set for CPA1005 routers
IP/IPX 1005 async	KU11150N	cpa1005-nqy-mz.111-5	IP/IPX asynchronous feature set for CPA1005 routers

## Memory Requirements and Recommendations

This section includes two tables: Table 2 identifies the memory required to run each feature set on a CiscoPro CPA1000 series router platform; Table 3 describes the memory delivered by default for a particular router series and the memory upgrades available for that series.

You can use Table 2 to identify the memory required for your configuration based on the image you run. You can then check this against Table 3 to determine how much memory is available on the router as the factory default and the upgrades that you can obtain to satisfy your requirements.

**Table 2 CiscoPro CPA1000 Series Feature Set Memory Requirements**

Feature Set	Description	Flash Memory Requirements	DRAM Memory Requirements
<b>CPA1000 IP Feature Pack Release 11.1</b>			
IP 1003/1004	IP feature set for CPA1003 and CPA1004 routers	2 MB (default)	4 MB (default)
IP 1005 sync	IP synchronous feature set for CPA1005 routers	2 MB (default)	4 MB (default)
IP 1005 async	IP asynchronous feature set for CPA1005 routers	2 MB (default)	4 MB (default)
<b>CPA1000 IP/AppleTalk Feature Pack Release 11.1</b>			
IP/AT 1003/1004	IP/AppleTalk feature set for CPA1003 and CPA1004 routers	2 MB (default)	4 MB (default)
IP/AT 1005	IP/AppleTalk feature set for CPA1005 routers	2 MB (default)	4 MB (default)
<b>CPA1000 IP/IPX Feature Pack Release 11.1</b>			
IP/IPX 1003/1004	IP/IPX feature set for CPA1003 and CPA1004 routers	2 MB (default)	4 MB (default)
IP/IPX 1005 sync	IP/IPX synchronous feature set for CPA1005 routers	2 MB (default)	4 MB (default)
IP/IPX 1005 async	IP/IPX asynchronous feature set for CPA1005 routers	2 MB (default)	4 MB (default)

Table 3 shows the amount of both Flash and main memory delivered by default on a CiscoPro CPA1000 series router. It also lists the available memory upgrades.

**Table 3 CiscoPro Access Default and Memory Upgrade Options**

Default	Upgrade Options
2 MB (Flash)	4-MB upgrade: CPA010-MEM4F=
4 MB (DRAM)	8-MB upgrade: CPA010-MEM8D=

## Installation Tips

This section describes several solutions to problems you might encounter when using the CiscoPro Software Installer. These solutions are additions to the installer’s online help.

- The CiscoPro Software Installer cannot communicate with a router that is operating in ROMMON (ROM Monitor) mode. To determine whether a router is operating in ROMMON mode, it is necessary to log in to the router via the console port by either telnet or terminal emulation software. (Configure the software settings to 9600 baud, no parity, 8 data bits, and 1 stop bit.)

After you log in, observe the user prompt displayed by the router. If the prompt appears as “rommon 1>” or “>,” the router is operating in ROMMON mode. If the prompt is “[router\_name](boot)>” or “[router\_name]>,” the unit is not operating in ROMMON mode.

To exit ROMMON mode and boot to a system image, enter the **b flash** command at the router prompt.

Next, check the Configuration Register value to confirm that ROMMON mode is no longer the default boot setting by entering the **show version** command. The last line of the output shows the Configuration Register value. Examine the last digit of the value, which represents the boot field. A value of 0 indicates that the router will reload to ROMMON on reboot.

However, the last digit should be greater than 0 for the CiscoPro Software Installer to communicate with the router. If you need to make this value greater than zero, enter the following commands while in enable (#) mode to change the value of the register to 0x2.

```
router#config t
router(config)#config 0x2
router(config)#exit
router#reload
```

The router should now reload to the system image.

- If you encounter a message stating “The router is unreachable,” you should check your network/communications connections, or the network/communications information you entered while running the CiscoPro Software Installer. The router might be operating in ROMMON mode. Refer to the previous bulleted item for instructions on how to identify whether the router is in ROMMON mode and how to exit ROMMON mode. Note that this message may indicate other types of problems as detailed in the online documentation.

## Cisco IOS Release 11.1 Feature Sets for CiscoPro Products

This section identifies specific features, within a category of features, supported on a particular router platform. Features marked with “Yes” are supported on the platform; features marked with “–” are not supported. You can use the information given in the tables provided in this section in conjunction with the information provided in the section “CiscoPro Feature Pack Descriptions,” page 2, to determine which features a particular feature set supports on a given platform.

**Table 4 Cisco IOS Release 11.1 Feature Sets for CiscoPro CPA1003 and CPA1004 Routers**

Feature	IP <sup>1</sup>	IP/IPX <sup>1</sup>	IP/AT <sup>1</sup>
<b>LAN Support</b>			
IP	Yes	Yes	Yes
GRE	Yes	Yes	Yes

<b>Feature</b>	<b>IP<sup>1</sup></b>	<b>IP/IPX<sup>1</sup></b>	<b>IP/AT<sup>1</sup></b>
IPX	–	Yes	–
AppleTalk Versions 1 and 2	–	–	Yes
DECnet IV	–	–	–
DECnet V	–	–	–
OSI CLNS	–	–	–
Banyan VINES	–	–	–
XNS	–	–	–
Apollo Domain	–	–	–
<b>Bridging</b>			
Transparent and translational	Yes	Yes	Yes
Concurrent routing and bridging	–	–	–
LAN extension, host	–	–	–
SRB	–	–	–
SRT	–	–	–
SR/TLB	–	–	–
Multiring	–	–	–
<b>Wide Area Support: Services</b>			
HDLC	Yes	Yes	Yes
PPP	Yes	Yes	Yes
Frame Relay	–	–	–
ISDN	Yes	Yes	Yes
X.25	–	–	–
LAP-B	–	–	–
SMDS	–	–	–
SW56	–	–	–
IPXWAN 2.0	–	–	–
ATM-DXI	–	–	–
<b>Wide Area Support: Optimization</b>			
Compression	Yes	Yes	Yes
Dial-on-demand	Yes	Yes	Yes
Bandwidth-on-demand	Yes	Yes	Yes
Dial backup	Yes	Yes	Yes
Custom queuing	Yes	Yes	Yes
Priority queuing	Yes	Yes	Yes
Weighted fair queuing	Yes	Yes	Yes
Snapshot routing	Yes	Yes	Yes
<b>IP: Host Services</b>			
Telnet	Yes	Yes	Yes
ARP	Yes	Yes	Yes

Feature	IP <sup>1</sup>	IP/IPX <sup>1</sup>	IP/AT <sup>1</sup>
FTP	Yes	Yes	Yes
NTP	-	-	-
<b>IP: Routing Protocols</b>			
RIP v1, v2	Yes	Yes	Yes
IGRP	Yes	Yes	Yes
Enhanced IGRP	Yes	Yes	Yes
OSPF	-	-	-
BGP	-	-	-
EGP	-	-	-
ES-IS	-	-	-
IS-IS	-	-	-
NHRP	-	-	-
PIM	-	-	-
IP multicast	-	-	-
Policy-based routing	-	-	-
HSRP	-	-	-
<b>Other Routing</b>			
IPX RIP	-	Yes	-
IPX NLSP	-	-	-
AT RTMP	-	-	Yes
AT AURP	-	-	-
AT SMRP	-	-	-
VINES SRTP	-	-	-
<b>IBM Support</b>			
SRB/RSRB	-	-	-
DLSw+	-	-	-
SNA and NetBios WAN optimization	-	-	-
SDLC	-	-	-
SDLLC	-	-	-
STUN	-	-	-
QLLC	-	-	-
Bisync	-	-	-
FR SNA support - RFC 1490	-	-	-
BAN for SNA FR support	-	-	-
TG/COS	-	-	-
DSPU	-	-	-
APPN	-	-	-
<b>Management</b>			
AutoInstall	-	-	-
CDP	Yes	Yes	Yes
SNMP	Yes	Yes	Yes
RMON: events & alarms	-	-	-
RMON: 9 groups	-	-	-

<b>Feature</b>	<b>IP<sup>1</sup></b>	<b>IP/IPX<sup>1</sup></b>	<b>IP/AT<sup>1</sup></b>
Auto modem config.	–	–	–
NetView native service point	–	–	–
<b>Security</b>			
Access lists	Yes	Yes	Yes
Access security	Yes	Yes	Yes
TACACS+	–	–	–
Radius	–	–	–
MD5 routing authentication	–	–	–
Lock and key	Yes	Yes	Yes
MAC security for hublets	–	–	–
Kerberized login	–	–	–
<b>Protocol Translation</b>			
Telnet	–	–	–
rlogin	–	–	–
LAT	–	–	–
TN3270	–	–	–
X.25	–	–	–
PPP	–	–	–
<b>Remote Node: Access Protocols</b>			
SLIP	—	—	—
CSLIP	—	—	—
PPP	—	—	—
CPPP	—	—	—
NetBEUI over PPP	–	–	–
IPXCP	–	–	–
NASI	–	–	–
ATCP	–	–	–
ARAP 1.0/2.0	–	–	–
<b>Remote Node: Access Services</b>			
DHCP	–	–	–
IP address pooling	–	–	–
Async master interfaces	–	–	–
MacIP	–	–	–
IPX on virtual async interfaces	–	–	–
ARAP on virtual async interfaces	–	–	–
LPD	–	–	–
Menus	–	–	–
CHAT scripts	–	–	–
<b>Terminal Services</b>			
Telnet	–	–	–
rlogin	–	–	–
X.25 PAD	–	–	–

Feature	IP <sup>1</sup>	IP/IPX <sup>1</sup>	IP/AT <sup>1</sup>
Mop	-	-	-
LAT	-	-	-
TN3270	-	-	-
XRemote	-	-	-
<b>Interface Support: LAN</b>			
Ethernet AUI	-	-	-
Ethernet 10BaseT	Yes	Yes	Yes
4/16-Mbps TRing	-	-	-
FDDI	-	-	-
<b>Interface Support: WAN</b>			
Sync. serial	-	-	-
Async. serial	-	-	-
ISDN BRI	Yes	Yes	Yes
Channelized T1/E1/ISDN PRI	-	-	-
G.703	-	-	-
ATM	-	-	-
HSSI	-	-	-

1. These images are identical to their Cisco Enterprise counterparts.

**Table 5 Cisco IOS Release 11.1 Feature Sets for CiscoPro CPA1005 Routers**

Feature	IP <sup>1</sup>	IP/IPX <sup>1</sup>	IP/AT <sup>1</sup>
<b>LAN Support</b>			
IP	Yes	Yes	Yes
GRE	Yes	Yes	Yes
IPX	-	Yes	-
AppleTalk Versions 1 and 2	-	-	Yes
DECnet IV	-	-	-
DECnet V	-	-	-
OSI CLNS	-	-	-
Banyan VINES	-	-	-
XNS	-	-	-
Apollo Domain	-	-	-
<b>Bridging</b>			
Transparent and translational	Yes	Yes	Yes
Concurrent routing and bridging	-	-	-
LAN extension host	-	-	-
SRB	-	-	-
SRT	-	-	-
SR/TLB	-	-	-
Multiring	-	-	-
<b>Wide Area Support: Services</b>			



<b>Feature</b>	<b>IP<sup>1</sup></b>	<b>IP/IPX<sup>1</sup></b>	<b>IP/AT<sup>1</sup></b>
HDLC	Yes	Yes	Yes
PPP	Yes	Yes	Yes
Frame Relay	Yes	Yes	Yes
ISDN	–	–	–
X.25	Yes	–	–
LAP-B	Yes	–	–
SMDS	Yes	Yes	Yes
SW56	Yes	Yes	Yes
IPXWAN 2.0	–	–	–
ATM-DXI	–	–	–
<b>Wide Area Support: Optimization</b>			
Compression	Yes	Yes	Yes
Dial-on-demand	Yes	Yes	Yes
Bandwidth-on-demand	Yes	Yes	Yes
Dial backup	Yes	Yes	Yes
Custom queuing	Yes	Yes	Yes
Priority queuing	Yes	Yes	Yes
Weighted fair queuing	Yes	Yes	Yes
Snapshot routing	–	–	–
<b>IP: Host Services</b>			
Telnet	Yes	Yes	Yes
ARP	Yes	Yes	Yes
FTP	Yes	Yes	Yes
NTP	–	–	–
<b>IP: Routing Protocols</b>			
RIP v1, v2	Yes	Yes	Yes
IGRP	Yes	Yes	Yes
Enhanced IGRP	Yes	Yes	Yes
OSPF	–	–	–
BGP	–	–	–
EGP	–	–	–
ES-IS	–	–	–
IS-IS	–	–	–
NHRP	–	–	–
PIM	–	–	–
IP multicast	–	–	–
Policy-based routing	–	–	–
HSRP	–	–	–

Feature	IP <sup>1</sup>	IP/IPX <sup>1</sup>	IP/AT <sup>1</sup>
<b>Other Routing</b>			
IPX RIP	–	Yes	–
IPX NLSP	–	–	–
AT RTMP	–	–	Yes
AT AURP	–	–	–
AT SMRP	–	–	–
VINES SRTP	–	–	–
<b>IBM Support</b>			
SRB/RSRB	–	–	–
DLSw+	–	–	–
SNA & NetBIOS WAN optimization	–	–	–
SDLC	–	–	–
SDLLC	–	–	–
STUN	–	–	–
QLLC	–	–	–
Bisync	–	–	–
FR SNA support - RFC 1490	–	–	–
BAN for SNA FR support	–	–	–
TG/COS	–	–	–
DSPU	–	–	–
APPN	–	–	–
<b>Management</b>			
AutoInstall	–	–	–
CDP	Yes	Yes	Yes
SNMP	Yes	Yes	Yes
RMON: events & alarms	–	–	–
RMON: 9 groups	–	–	–
Auto modem config.	–	–	–
NetView native service point	–	–	–
<b>Security</b>			
Access lists	Yes	Yes	Yes
Access security	Yes	Yes	Yes
TACACS+	–	–	–
RADIUS	–	–	–
MD5 routing authentication	–	–	–
Lock and key	Yes	Yes	Yes
MAC security for hublets	–	–	–
Kerberized login	–	–	–
<b>Protocol Translation</b>			
Telnet	–	–	–
rlogin	–	–	–
LAT	–	–	–
TN3270	–	–	–

Feature	IP <sup>1</sup>	IP/IPX <sup>1</sup>	IP/AT <sup>1</sup>
X.25	–	–	–
PPP	–	–	–
<b>Remote Node: Access Protocols</b>			
SLIP	–	–	–
CSLIP	–	–	–
PPP	–	–	–
CPPP	–	–	–
NetBEUI over PPP	–	–	–
IPXCP	–	–	–
NASI	–	–	–
ATCP	–	–	–
ARAP 1.0/2.0	–	–	–
<b>Remote Node: Access Services</b>			
DHCP	–	–	–
IP address pooling	–	–	–
Async master interfaces	–	–	–
MacIP	–	–	–
IPX on virtual async interfaces	–	–	–
ARAP on virtual async interfaces	–	–	–
LPD	–	–	–
Menus	–	–	–
CHAT scripts	–	–	–
<b>Terminal Services</b>			
Telnet	–	–	–
rlogin	–	–	–
X.25 PAD	–	–	–
Mop	–	–	–
LAT	–	–	–
TN3270	–	–	–
XRemote	–	–	–
<b>Interface Support: LAN</b>			
Ethernet AUI	–	–	–
Ethernet 10BaseT	Yes	Yes	Yes
4/16-Mbps TRing	–	–	–
FDDI	–	–	–
<b>Interface Support: WAN</b>			
Sync. serial	Yes	Yes	Yes
Async. serial	–	–	–
ISDN BRI	–	–	–
Channelized T1/E1/ISDN PRI	–	–	–
G.703	–	–	–
ATM	–	–	–
HSSI	–	–	–

1. These images are identical to their Cisco Enterprise counterparts.

## Installing the Router Software Feature Sets Using Microsoft Windows 3.1

In addition to the router software, the CD-ROM also contains the CiscoPro Software Installer, which you can use to download the software to the router. The CiscoPro Software Installer is designed to work with a PC running Microsoft Windows 95. The booklet included with the CD-ROM explains how to perform this simple process. However, you cannot use the CiscoPro Software Installer on a system running Microsoft Windows 3.1.

This section describes an alternative method you can use to install the router software from the CD-ROM onto the router using a PC running Microsoft Windows 3.1. The process requires that you first obtain a Trivial File Transfer Protocol (TFTP) application or a remote copy protocol (rcp) application, which you can use to set up your PC as a TFTP server or an rcp server. You can use either the **copy TFTP flash** or **copy rcp flash** command to download the router software images to the router from a system running Microsoft Windows 3.1.

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**Note** If you do not already have a TFTP or rcp application, you can choose from a number of TFTP applications or rcp applications available from independent software vendors. In addition, a number of TFTP programs are available as shareware from public sources on the World Wide Web.

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### Installation Process

This section provides steps that describe how to install the router software using a Microsoft Windows 3.1 PC with a TFTP application. To install the software using an rcp application, follow the same procedure and substitute rcp for TFTP in the instructions. You must also substitute the **copy rcp flash** command for the **copy TFTP flash** command in Step 6.

- Step 1** Install the TFTP application on the PC.
- Step 2** Launch the TFTP application on the PC. You commonly do this by double-clicking the application icon or its filename.
- Step 3** Set up the PC as a TFTP server using the TFTP application setup or configuration facility.  
The user interface of most TFTP applications includes a setup facility that allows you to specify the PC as a server. For example, from the TFTP menu of one application, you can select **Settings** to display a panel that includes a checkbox beside the word Server. To configure the local PC as a Server, you click in this checkbox.



**Warning** Make sure you set up your local PC as a TFTP server. If you overlook this step, you will not be able to perform the copy procedure. This reminder also applies if you are using rcp on your system instead of TFTP.

- Step 4** Establish a console session from your local PC (which is now configured as a TFTP server), to the Cisco router.

You can do this in either of two ways:

- Connect the PC's COM port to the router's console port.

This is the recommended method. If you use this method, when you reload the router to cause the image to take effect in Step 11, you will remain connected to the router. (Using Telnet, you will lose connection to the router at that point in the process.)

- Establish a Telnet session from the PC to the router.

- Step 5** Connect your PC's Ethernet port to the router's Ethernet port using the 10Base-T crossover cable provided.

---

**Note** Use straight-through cables if you are connecting by means of a 10Base-T hub.

---

- Step 6** At the router prompt, enter the following command to copy the new software image from the CD-ROM drive of the PC to the router:

```
# copy tftp flash
```

---

**Note** If you are using rcp, enter **copy rcp flash** instead.

---

- Step 7** When prompted, enter the IP address of your local Microsoft Windows 3.1-based PC as in the following example:

```
Address or name of remote host [255.255.255.255]? 131.108.1.1
```

This is the IP address of your local PC, not that of the router.

- Step 8** When prompted, enter the full path name of the image to be copied to the router as in the following example.

```
Source file name? d:\images\cisco.mz
```

- Step 9** In response to the prompt, enter the destination filename and press **Enter** to indicate that you want to copy the image.

This is the location and name of the image file on the router, not the full path name of the image on the CD-ROM attached to the PC.

```
Destination file name [d:\images\cisco.mz]?cisco.mz
```

During the transfer process, the software displays messages indicating that it has accessed the file you have specified and is loading it.

- Step 10** Enter **Yes** or **No** in response to the prompt asking if you want to erase the existing image copy resident in the router's Flash memory before copying the new one.

```
Erase flash device before writing? [confirm] yes
```

When copying to internal Flash memory, the system provides an option to erase existing internal Flash memory before writing onto it. The entire copying process takes several minutes and differs from network to network.

The exclamation point (!) indicates that the copy process is taking place. Each exclamation point (!) indicates that ten packets have been transferred successfully. A series of "V" characters indicates that a checksum verification of the image is occurring after the image is written to Flash memory.

- Step 11** Enter the **reload** command to reload the router:

```
# reload
```

## Command Reference Pages for TFTP and rcp

This section includes reference pages providing detailed information about the **copy rcp flash** and **copy tftp flash** commands. This information supplements the information provided in the steps described earlier in the section “Installing the Router Software Feature Sets Using Microsoft Windows 3.1,” page 12.

### copy rcp flash

To copy a file from a network server to the router or to another destination using rcp, use the **copy rcp flash** EXEC command.

#### copy rcp flash

#### Syntax Description

**flash** Specifies internal Flash memory as the destination of the copy operation.

#### Command Mode

EXEC

#### Usage Guidelines

The rcp protocol requires that a client send the remote username of an rcp request to the server. When you issue the **copy rcp flash** command, by default the Cisco IOS software sends the username associated with the current teletype (TTY), if that name is valid. For example, if the user is connected to the router through Telnet and the user was authenticated through the **username** command, then the software sends that username as the remote username.

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**Note** For Cisco, TTY lines are commonly used for access services. The concept of TTY originated with UNIX. For UNIX systems, each physical device is represented in the file system. Terminals are called TTY devices, which stands for *teletype*, the original UNIX terminal.

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If the TTY username is invalid, the software uses the host name as the both the remote and local usernames. To specify a different remote username to be sent to the rcp server, use the **ip rcmd remote-username** command. You can also specify the path of an existing directory along with the remote username.



**Caution** The remote username must be associated with an account on the destination server. If you do not use the **ip rcmd remote-username** command to specify the name of a remote user associated with an account on the server, then the remote username associated with the current TTY process must be associated with an account on the server. If there is no username for the current TTY process, then the host name must be associated with an account on the server. If the network administrator of the destination server did not establish accounts for the remote username used, this command will not execute successfully when a default remote username is used.

If you copy a system image from a personal computer used as a file server, the remote host computer must support the remote shell (rsh) protocol.

Use the **copy rcp flash** to copy a system image from a network server to the router's internal Flash memory using rcp. The Cisco IOS software prompts for the address of the rcp server and rcp filename. When you issue this command, the system provides an option to erase existing Flash memory before writing onto it. The entire copying process takes several minutes and differs from network to network.

Before booting from Flash memory, verify that the checksum of the image in internal Flash memory matches the checksum listed in the README file distributed with the system software image. The checksum of the image in Flash memory is displayed at the bottom of the screen when you issue the **copy rcp flash** command. The README file was copied to the rcp server automatically when you installed the system software image.



**Caution** If the checksum value does not match the value in the README file, do not reboot the router. Reissue the **copy rcp flash** command and compare the checksums again. If the checksum is repeatedly wrong, copy the original system software image back into Flash memory *before* you reboot the router from Flash memory. If you have a corrupted image in Flash memory and try to boot from Flash memory, the router starts the system image contained in ROM (assuming booting from a network server is not configured). If ROM does not contain a fully functional system image, the router cannot function and must be reconfigured through a direct console port connection.

## Examples

The following example shows how to use the **copy rcp flash** command. The interface might differ slightly on other systems. This example copies a system image named file1 from the netadmin1 directory on the remote server named *SERVER1.CISCO.COM* with an IP address of 131.108.101.101 to Flash memory. To ensure that enough Flash memory is available to accommodate the system image to be copied, the Cisco IOS software allows you to erase the contents of Flash memory first.

```
Router1# configure terminal

Router1(config)# rcmd remote-username netadmin1
Router(config)# Ctrl-Z
Router# copy rcp flash

System flash directory, partition 2:
File Length Name/status
  1  984   file1 [deleted]
  2  984   file1
[2096 bytes used, 8386512 available, 8388608 total]
Address or name of remote host [255.255.255.255]? 131.108.101.101
Source file name? file1
Destination file name [file1]?
Accessing file 'file1' on 131.108.101.101...
Loading dirt/ssangiah/file1 .from 131.108.101.101 (via Ethernet0): ! [OK]

Erase flash device before writing? [confirm]
Flash contains files. Are you sure you want to erase? [confirm]

Copy 'file1' from server
  as 'file1' into Flash WITH erase? [yes/no] yes
Erasing device... eeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeee ..erased
Loading file1 from 131.108.101.101 (via Ethernet0): !
[OK - 984/8388608 bytes]
```

```
Verifying checksum... OK (0x14B3)
Flash copy took 0:00:01 [hh:mm:ss]
```

The following example shows sample output resulting from copying a system image into a partition of Flash memory. The system prompts only if there are two or more read/write partitions or one read-only and one read/write partition and dual Flash memory bank support in boot ROMs. If the partition entered is not valid, the process terminates. You have the option to enter a partition number, a question mark (?) for a directory display of all partitions, or a question mark and a number (?*number*) for a directory display of a particular partition. The default is the first read/write partition.

```
Router# copy rcp flash

System flash partition information:
Partition  Size  Used  Free  Bank-Size  State  Copy-Mode
-----
1          4096K  2048K  2048K  2048K      Read Only  RXBOOT-FLH
2          4096K  2048K  2048K  2048K      Read/Write  Direct

[Type ?<no> for partition directory; ? for full directory; q to abort]
Which partition? [default = 2]
```

If the partition is read-only and has dual Flash memory bank support in boot ROMs, the session continues as follows:

```
**** NOTICE ****

Flash load helper v1.0
This process will accept the copy options and then terminate
the current system image to use the ROM based image for the copy.
Routing functionality will not be available during that time.
If you are logged in via telnet, this connection will terminate.
Users with console access can see the results of the copy operation.
----- ***** -----

Proceed? [confirm]
System flash directory, partition 1:
File Length Name/status
1 3459720 master/igs-bfpx.100-4.3
[3459784 bytes used, 734520 available, 4194304 total]
Address or name of remote host [255.255.255.255]? 131.108.1.1
Source file name? master/igs-bfpx-100.4.3
Destination file name [default = source name]?
```

The file will be copied into the partition given earlier by the user:

```
Loading master/igs-bfpx.100-4.3 from 131.108.1.111: !
Erase flash device before writing? [confirm]
Flash contains files. Are you sure? [confirm]
Copy 'master/igs-bfpx.100-4.3' from TFTP server
as 'master/igs-bfpx.100-4.3' into Flash WITH erase? [yes/no] yes
```

If the partition is read/write, the session continues as follows:

```
System flash directory, partition 2:
File Length Name/status
1 3459720 master/igs-bfpx.100-4.3
[3459784 bytes used, 734520 available, 4194304 total]
Address or name of remote host [255.255.255.255]? 131.108.1.1
Source file name? master/igs-bfpx.100-4.3
Destination file name [default = source name]?
```

The file will be copied into the partition given earlier by the user:

```
Accessing file 'master/igs-bfpx.100-4.3' on ABC.CISCO.COM...
Loading master/igs-bfpx.100-4.3 from 131.108.1.111: !
Erase flash device before writing? [confirm]
Flash contains files. Are you sure? [confirm]
```



```
Copy 'master/igs-bfpx.100-4.3' from TFTP server
as 'master/igs-bfpx.100-4.3' into Flash WITH erase? [yes/no] yes
```

### Related Commands

```
boot config
boot system flash
cd
copy flash rep
ip rcmd remote-username
verify flash
```

## copy tftp flash

To copy a file from a TFTP server to the router or to another destination, use the **copy tftp flash** EXEC command.

### copy tftp flash

### Syntax Description

**flash** Specifies internal Flash memory as the destination of the copy operation.

### Command Mode

EXEC

### Usage Guidelines

The system prompts for the address of the TFTP server and TFTP filename if you do not provide them at the command line. When copying to internal Flash memory, the system provides an option to erase existing internal Flash memory before writing onto it. The entire copying process takes several minutes and differs from network to network.

Before booting from Flash memory, verify that the checksum of the image in Flash memory matches the checksum listed in the README file distributed with the system software image. The checksum of the image in Flash memory is displayed at the bottom of the screen when you issue the **copy tftp flash** command. The README file was copied to the TFTP server automatically when you installed the system software image.



**Caution** If the checksum value is not correct according to the value in the README file, do not reboot the router. Issue the **copy tftp flash** command and compare the checksums again. If the checksum is repeatedly wrong, copy the original system software image back into Flash memory *before* you reboot the router from Flash memory. If you have a corrupted image in Flash memory and try to boot from Flash memory, the router starts the system image contained in ROM (assuming booting from a network server is not configured). If ROM does not contain a fully functional system image, the router cannot function and must be reconfigured through a direct console port connection.

### Examples

The following example shows sample output of copying a system image named file1 into Flash memory:

```
Router# copy tftp flash

System flash directory, partition 2:
File Length Name/status
  1  984   file1 [deleted]
  2  984   file1
[2096 bytes used, 8386512 available, 8388608 total]
Address or name of remote host [255.255.255.255]? 223.255.254.254
Source file name? file1
Destination file name [file1]?
Accessing file 'file1' on 223.255.254.254...
Loading dirt/ssangiah/file1 .from 223.255.254.254 (via Ethernet0): - [OK]

Erase flash device before writing? [confirm]
Flash contains files. Are you sure you want to erase? [confirm]

Copy 'file1' from server
  as 'file1' into Flash WITH erase? [yes/no] yes
Erasing device... eeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeee ...erased
Loading file1 from 223.255.254.254 (via Ethernet0): !!!!!...
[OK - 984/8388608 bytes]

Verifying checksum... OK (0x14B3)
Flash copy took 0:00:01 [hh:mm:ss]
```

The exclamation point (!) indicates that the copy process is taking place. Each exclamation point (!) indicates that ten packets have been transferred successfully. A series of “V” characters indicates that a checksum verification of the image is occurring after the image is written to Flash memory.

The following example shows sample output resulting from copying a system image into a partition of Flash memory. The system will prompt only if there are two or more read/write partitions or one read-only and one read/write partition and dual Flash bank support in boot ROMs. If the partition entered is not valid, the process terminates. You can enter a partition number, a question mark (?) for a directory display of all partitions, or a question mark and a number (?number) for directory display of a particular partition. The default is the first read/write partition.

```
Router# copy tftp flash

System flash partition information:
Partition Size Used Free Bank-Size State Copy-Mode
  1 4096K 2048K 2048K 2048K Read Only RXBOOT-FLH
  2 4096K 2048K 2048K 2048K Read/Write Direct

[Type ?<no> for partition directory; ? for full directory; q to abort]
Which partition? [default = 2]
```

If the partition is read-only and has dual Flash memory bank support in boot ROMs, the session continues as follows:

```
**** NOTICE ****

Flash load helper v1.0
This process will accept the copy options and then terminate
the current system image to use the ROM based image for the copy.
Routing functionality will not be available during that time.
If you are logged in via telnet, this connection will terminate.
Users with console access can see the results of the copy operation.
-----

Proceed? [confirm]
System flash directory, partition 1:
File Length Name/status
  1 3459720 master/igs-bfpx.100-4.3
```

```
[3459784 bytes used, 734520 available, 4194304 total]
Address or name of remote host [255.255.255.255]? 131.108.1.1
Source file name? master/igs-bfpx-100.4.3
Destination file name [default = source name]?
```

The file will be copied into the partition given earlier by the user:

```
Loading master/igs-bfpx.100-4.3 from 131.108.1.111: !
Erase flash device before writing? [confirm]
Flash contains files. Are you sure? [confirm]
Copy 'master/igs-bfpx.100-4.3' from TFTP server
as 'master/igs-bfpx.100-4.3' into Flash WITH erase? [yes/no] yes
```

If the partition is read/write, the session continues as follows:

```
System flash directory, partition 2:
File Length Name/status
  1 3459720 master/igs-bfpx.100-4.3
[3459784 bytes used, 734520 available, 4194304 total]
Address or name of remote host [255.255.255.255]? 131.108.1.1
Source file name? master/igs-bfpx.100-4.3
Destination file name [default = source name]?
```

The file will be copied into the partition given earlier by the user:

```
Accessing file 'master/igs-bfpx.100-4.3' on ABC.CISCO.COM...
Loading master/igs-bfpx.100-4.3 from 131.108.1.111: !
Erase flash device before writing? [confirm]
Flash contains files. Are you sure? [confirm]
Copy 'master/igs-bfpx.100-4.3' from TFTP server
as 'master/igs-bfpx.100-4.3' into Flash WITH erase? [yes/no] yes
```

## Related Commands

**copy flash tftp**  
**verify**  
**verify flash**

## Additional Release Note Information

For detailed information about this software release, see the Enterprise release notes located on the Cisco Connection Documentation, CiscoPro Solutions CD-ROM. Information that pertains to this feature pack includes the following:

- New features
- Important notes
- Caveats

## Using Cisco IOS Release 11.1 Electronic Documentation

This section provides general information about the Cisco IOS software documentation delivered on the Cisco Connection Documentation CD-ROM that is included with your feature packs. This section also tells you how to navigate through the electronic documentation hierarchy. It discusses the following topics:

- About the Cisco IOS Software Documentation, page 20
- Navigating the Electronic Documentation, page 20

### About the Cisco IOS Software Documentation

Cisco IOS online software documentation is organized into three main categories:

- Configuration guides and command references, which are organized into the following modules:
  - Configuration Fundamentals:
    - Configuration Guide
    - Command Reference
  - Access Services:
    - Configuration Guide
    - Command Reference
  - Wide-Area Networking:
    - Configuration Guide
    - Command Reference
  - Network Protocols, Part 1:
    - Configuration Guide
    - Command Reference
  - Network Protocols, Part 2:
    - Configuration Guide
    - Command Reference
  - Bridging and IBM Networking:
    - Configuration Guide
    - Command Reference
- Supporting documentation, such as a command summary, error messages, and an access connection guide
- Release notes

### Navigating the Electronic Documentation

This section explains how to navigate from the “Cisco Connection Documentation” home page to the “Cisco IOS Configuration Guides and Command References” page.

When you get to the “Cisco IOS Release 11.1” page (Step 4 that follows), you can access any of the Cisco IOS Release 11.1 documentation. Step 4 gives a brief description of the various documents you can access through the “Cisco IOS Release 11.1” page. Step 5 directs you to select the bulleted

item “Cisco IOS Configuration Guides and Command References” from the “Cisco IOS Release 11.1” page. You can select any of the bulleted items to navigate to other documents. This set of steps uses the “Cisco IOS Configuration Guides and Command References” link as an example to illustrate how to get to a specific document.

To navigate through the electronic documentation to the “Cisco IOS Configuration Guides and Command References” page, follow these steps:

**Step 1** Install the the Cisco Connection Documentation CD by following directions in the “Getting Started” booklet that shipped with the CD.

**Step 2** Launch Verity Mosaic by double-clicking the application’s icon.

---

**Note** Verity Mosaic is delivered with the documentation on the Cisco Connection Documentation CD-ROM and installed along with it.

---

**Step 3** Go to the Cisco Connection Documentation home page.

From this page, you can gain access to information about the documentation CD and how to use it (double-click on the second bulleted item, **Cisco Connection Documentation, CiscoPro Solutions**). Alternately, you can go directly to the Cisco IOS documentation by using the following steps.

**Step 4** From the “Cisco Connection Documentation” home page, double-click on **Cisco Internetworking Operating System (Cisco IOS)**.

This page shows a list of selectable bulleted items. Each item names a Cisco IOS release and represents a link to the entry point for the suite of documentation for that release.

**Step 5** Select **Cisco IOS Release 11.1**. Double-click on it to select it.

This brings you to the “Cisco IOS Release 11.1” page. This page shows a list of selectable bulleted items. Each item represents the entry point to a specific collection of documentation. Here is a brief description of the main documentation you can access through the “Cisco IOS Release 11.1” page. This list shows the document names in the order in which they appear on the “Cisco IOS Release 11.1” page, but it does not include all of them:

- Cisco IOS Configuration Guides and Command References

Each of the six modules consists of a configuration guide and command reference. The first chapter of each document of a set is called “About the Cisco IOS Software Documentation.” Each chapter includes a section called “Cisco IOS Software Documentation Organization,” which provides a documentation roadmap and describes the structure and content of the guides and references. You should read this chapter to familiarize yourself with the overall structure and organization of the documentation so you can more readily find information you need to set up, configure, and maintain the router to support your particular feature set.

Cisco IOS configuration guides describe system configuration and maintenance tasks and provide comprehensive configuration examples. The configuration guides do not include command syntax for every command, so you should use them in conjunction with the command references. The Cisco configuration guides give in-depth descriptions of configuration tasks.

Cisco IOS command references describe the commands necessary for configuring and maintaining your system. If you are new to CiscoPro software, you should use the Cisco command references in conjunction with the configuration guides to reference commands and detailed information pertaining to their use. If you are an experienced network administrator, you might want to use the Cisco command references as stand-alone manuals.

- Cisco IOS Supporting Documentation

This page gives you access to the following documentation:

*Cisco IOS Command Summary:* This document summarizes the commands in the six command reference publications. For each command, it provides complete syntax, the purpose of the command, and a description of each keyword and argument in the command syntax. Where possible, it also identifies the default values of keywords and arguments.

*System Error Messages:* This document describes system error messages reported by Cisco IOS software. It includes possible causes and recommended actions. The System Error Messages publication is intended for network administrators who are responsible for monitoring and maintaining internetworking equipment.

*Cisco Access Connection Guide:* This document explains how to use an access server or a router to connect to network hosts. It also describes how to manage and monitor network connections and how to change terminal parameters.

*Cisco Management Information Base (MIB) User Quick Reference:* This document describes the Cisco Systems private, or local, Management Information Base (MIB), which is provided with all Cisco software releases and with CiscoWorks router management software. A MIB file contains variables that can be set or read to provide information on network devices and interfaces. The Cisco MIB is a set of variables that are private extensions to the Internet standard MIB II.

*Debug Command Reference:* This document provides information about using debug commands to troubleshoot your internetwork. The *Debug Command Reference* is intended for network administrators who already know how to configure a router and are familiar with all relevant network equipment.

- Release Notes

**Step 6** From the “Cisco IOS Release 11.1” page, double-click the first bulleted item, **Cisco IOS Configuration Guides and Command References**, to select it.

This brings you to the “Cisco IOS Configuration Guides and Command References” page. This page shows a list of selectable bulleted items. Each item represents the entry point to one of the six modules.

**Step 7** To gain access to the Configuration Fundamentals documentation module, for example, select the first bulleted item, **Configuration Fundamentals**, on the “Cisco IOS Configuration Guides and Command References” page. Double-click on it to select it.

This brings up the “Configuration Fundamentals” reference page. This page shows two bulleted items: Configuration Fundamentals Configuration Guide and Configuration Fundamentals Command Reference.

**Step 8** To gain access to the *Configuration Fundamentals Configuration Guide*, for example, double-click the first bulleted item, **Configuration Fundamentals Configuration Guide**, on the “Configuration Fundamentals” page to select it.

This brings up the “Configuration Fundamentals Configuration Guide” page. This page lists the chapters comprising this guide.

**Step 9** To gain access to a chapter of the *Configuration Fundamentals Configuration Guide*—for example, the chapter entitled “Understanding the User Interface”—double-click the chapter title from the bulleted list of chapter titles comprising the *Configuration Fundamentals Configuration Guide* to select it.

This displays the table of contents for the chapter you selected. You can navigate through sections of the chapter from its table of contents.

---

**Note** Step 6, Step 7, and Step 8 give examples of how to navigate to the chapters of one module’s documentation. You can apply these steps to any of the six modules to use its chapters.

---

- Configuration Fundamentals
- Access Services
- Wide-Area Networking
- Network Protocols, Part 1
- Network Protocols, Part 2
- Bridging and IBM Networking

Each module consists of a configuration guide and command reference. The first chapter of each document of a set is called “About the Cisco IOS Software Documentation.” Each chapter includes a section called “Cisco IOS Software Documentation Organization,” which provides a documentation roadmap and describes the structure and content of the guides and references. You should read this chapter to familiarize yourself with the overall structure and organization of the documentation so you can more readily find information you need to set up, configure, and maintain the router to support your particular feature set.

To navigate through the electronic documentation to the “Cisco IOS Configuration Guides and Command References” page, follow these steps:

**Step 1** Launch Verity Mosaic by double-clicking the application’s icon.

**Step 2** Go to the Cisco Connection Documentation home page.

From this page, you can gain access to information about the Cisco IOS documentation and how to use it, as well as the Cisco IOS documentation itself. To read about the documentation, double-click on the first bulleted item, **About Cisco Connection Documentation**, in the list of topics. To go directly to the Cisco IOS documentation, continue to follow these steps.

---

**Note** Verity Mosaic is delivered with the documentation on the Cisco Connection Documentation CD-ROM and installed along with it.

---

**Step 3** From the Cisco Connection Documentation home page, select the first bracketed choice, **Cisco IOS**, in the group of topics under the second bulleted item called Cisco Product Documentation. Double-click on it to select it.

This brings you to the “Cisco IOS” page. This page shows a list of selectable bulleted items. Each item names a Cisco IOS release and represents a link to the entry point for the suite of documentation for that release.

- Step 4** From the “Cisco IOS” page, select the first bulleted item, **Cisco IOS Release 11.1**. Double-click on it to select it.

This brings you to the “Cisco IOS Release 11.1” page. This page shows a list of selectable bulleted items. Each item represents the entry point to a specific collection of documentation. You can read more about these documents in the chapter “About Cisco Connection documentation.” (You select **About Cisco Connection Documentation** from the documentation home page.) Here is a brief description of the main documentation you can access through the “Cisco IOS Release 11.1” page. This list shows the document names in the order in which they appear on the “Cisco IOS Release 11.1” page, but it does not include all of them:

- Release 11.1 Release Notes (this document)
- Cisco IOS Configuration Guides and Command References

Cisco IOS configuration guides describe system configuration and maintenance tasks and provide comprehensive configuration examples. The configuration guides do not include command syntax for every command, so you should use them in conjunction with the command references. The Cisco configuration guides give in-depth descriptions of configuration tasks.

Cisco IOS command references describe the commands necessary for configuring and maintaining your system. If you are new to CiscoPro software, you should use the Cisco command references in conjunction with the configuration guides to reference commands and detailed information pertaining to their use. If you are an experienced network administrator, you might want to use the Cisco command references as standalone manuals.

- Cisco IOS Supporting Documentation

This page gives you access to the following documentation:

*Cisco IOS Command Summary:* This document summarizes the commands in the six command reference publications. For each command, it provides complete syntax, the purpose of the command, and a description of each keyword and argument in the command syntax. Where possible, it also identifies the default values of keywords and arguments.

*System Error Messages:* This document describes system error messages reported by Cisco IOS software. It includes possible causes and recommended actions. The System Error Messages publication is intended for network administrators who are responsible for monitoring and maintaining internetworking equipment.

*Cisco Access Connection Guide:* This document explains how to use an access server or a router to connect to network hosts. It also describes how to manage and monitor network connections and how to change terminal parameters.

*Cisco Management Information Base (MIB) User Quick Reference:* This document describes the Cisco Systems private, or local, Management Information Base (MIB), which is provided with all Cisco software releases and with CiscoWorks router management software. A MIB file contains variables that can be set or read to provide information on network devices and interfaces. The Cisco MIB is a set of variables that are private extensions to the Internet standard MIB II.



*Debug Command Reference*: This document provides information about using debug commands to troubleshoot your internetwork. The *Debug Command Reference* is intended for network administrators who already know how to configure a router and are familiar with all relevant network equipment.

**Step 5** From the “Cisco IOS Release 11.1” page, double-click the second bulleted item, **Cisco IOS Configuration Guides and Command References**, to select it.

This brings you to the “Cisco IOS Configuration Guides and Command References” page. This page shows a list of selectable bulleted items. Each item represents the entry point to one of the six modules.

**Step 6** To gain access to the Configuration Fundamentals documentation module, for example, select the first bulleted item, **Configuration Fundamentals**, on the “Cisco IOS Configuration Guides and Command References” page. Double-click on it to select it.

This brings up the “Configuration Fundamentals” reference page. This page shows two bulleted items: Configuration Fundamentals Configuration Guide and Configuration Fundamentals Command Reference.

**Step 7** To gain access to the *Configuration Fundamentals Configuration Guide*, for example, double-click the first bulleted item, **Configuration Fundamentals Configuration Guide**, on the “Configuration Fundamentals” page to select it.

This brings up the “Configuration Fundamentals Configuration Guide” page. This page lists the chapters comprising this guide.

**Step 8** To gain access to a chapter of the *Configuration Fundamentals Configuration Guide*—for example, the chapter entitled “Understanding the User Interface”—double-click the chapter title from the bulleted list of chapter titles comprising the *Configuration Fundamentals Configuration Guide* to select it.

This displays the table of contents for the chapter you selected. You can navigate through sections of the chapter from its table of contents.

---

**Note** Step 6, Step 7, and Step 8 give examples of how to navigate to the chapters of one module’s documentation. You can apply these steps to any of the six modules to use its chapters.

---

### Obtaining Service and Support

For service and support for a product purchased from a reseller, contact the reseller. Resellers offer a wide variety of Cisco service and support programs, which are described in the section “Service and Support” in the information packet that shipped with your chassis.

---

**Note** If you purchased your product from a reseller, you can access Cisco Connection Online (CCO) as a guest. CCO is Cisco Systems’ primary, real-time support channel. Your reseller offers programs that include direct access to CCO’s services.

---

For service and support for a product purchased directly from Cisco, use CCO.

### Cisco Connection Online

CCO is Cisco Systems’ primary, real-time support channel. SMARTnet customers and partners can self-register on CCO to obtain additional content and services.

---

**Note** If you purchased your product from a reseller, you can access CCO as a guest. Your reseller offers programs that include direct access to CCO’s services.

---

Available 24 hours a day, 7 days a week, CCO provides a wealth of standard and value-added services to Cisco’s customers and business partners. CCO services include product information, software updates, release notes, technical tips, the Bug Navigator, configuration notes, brochures, descriptions of service offerings, and download access to public and authorized files.

CCO serves a wide variety of users through two interfaces that are updated and enhanced simultaneously—a character-based version and a multimedia version that resides on the World Wide Web (WWW). The character-based CCO supports Zmodem, Kermit, Xmodem, FTP, and Internet e-mail, and is excellent for quick access to information over lower bandwidths. The WWW version of CCO provides richly formatted documents with photographs, figures, graphics, and video, as well as hyperlinks to related information.

You can access CCO in the following ways:

- WWW: <http://www.cisco.com>.
- WWW: <http://www-europe.cisco.com>.
- WWW: <http://www-china.cisco.com>.
- Telnet: [cco.cisco.com](http://cco.cisco.com).
- Modem: From North America, 408 526-8070; from Europe, 33 1 64 46 40 82. Use the following terminal settings: VT100 emulation; databits: 8; parity: none; stop bits: 1; and baud rates up to 14.4 kbps.

For a copy of CCO's Frequently Asked Questions (FAQ), contact [cco-help@cisco.com](mailto:cco-help@cisco.com). For additional information, contact [cco-team@cisco.com](mailto:cco-team@cisco.com).

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**Note** If you need technical assistance with a Cisco product that is under warranty or covered by a Cisco maintenance contract, contact Cisco's Technical Assistance Center (TAC) at 800 553-2447, 408 526-7209, or [tac@cisco.com](mailto:tac@cisco.com).

---

Please use CCO to obtain general information about Cisco Systems, Cisco products, or upgrades. If CCO is not accessible, contact 800 553-6387, 408 526-7208, or [cs-rep@cisco.com](mailto:cs-rep@cisco.com).

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This document is to be used in conjunction with the Cisco IOS configuration guides and command reference publications.

AtmDirector, AutoConnect, AutoRoute, AXIS, BPX, Catalyst, CD-PAC, CiscoAdvantage, CiscoFusion, Cisco IOS, the Cisco IOS logo, *CiscoLink*, CiscoPro, the CiscoPro logo, CiscoRemote, the CiscoRemote logo, CiscoSecure, Cisco Systems, CiscoView, CiscoVision, CiscoWorks, ClickStart, ControlStream, EdgeConnect, EtherChannel, FairShare, FastCell, FastForward, FastManager, FastMate, FastPADImp, FastPADmicro, FastPADmp, FragmentFree, FrameClass, Fulcrum INS, IGX, Impact, Internet Junction, JumpStart, LAN<sup>2</sup>LAN Enterprise, LAN<sup>2</sup>LAN Remote Office, LightSwitch, NetBeyond, NetFlow, Newport Systems Solutions, *Packet*, PIX, Point and Click Internetworking, RouteStream, Secure/IP, SMARTnet, StrataSphere, StrataSphere BILLder, StrataSphere Connection Manager, StrataSphere Modeler, StrataSphere Optimizer, Stratm, StrataView Plus, StreamView, SwitchProbe, SwitchVision, SwitchWare, SynchroniCD, *The Cell*, The FastPacket Company, TokenSwitch, TrafficDirector, Virtual EtherSwitch, VirtualStream, VlanDirector, Web Clusters, WNIC, Workgroup Director, Workgroup Stack, and XCI are trademarks; Access by Cisco, Bringing the Power of Internetworking to Everyone, Enter the Net with MultiNet, and The Network Works. No Excuses, are service marks; and Cisco, the Cisco Systems logo, CollisionFree, Combinet, EtherSwitch, FastHub, FastLink, FastNIC, FastPacket, FastPAD, FastSwitch, ForeSight, Grand, Grand Junction, Grand Junction Networks, the Grand Junction Networks logo, HSSI, IGRP, IPX, Kalpana, the Kalpana logo, LightStream, MultiNet, MultiWare, OptiClass, Personal Ethernet, Phase/IP, RPS, StrataCom, TGV, the TGV logo, and UniverCD are registered trademarks of Cisco Systems, Inc. All other trademarks, service marks, registered trademarks, or registered service marks mentioned in this document are the property of their respective owners.

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