CISCO SYSTEMS

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Release Notes for Cisco IOS Release 11.2 Software Feature Packs—Cisco 4500 and 4700 Routers

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These release notes identify the Cisco IOS Release 11.2 feature packs for Cisco 4500 and 4700 routers (Cisco and CiscoPro models).

Product numbers for the supported feature packs are as follows:

- CD45-C-11.2= (Cisco 4500/4700 IP Feature Pack)

- CD45-CP-11.2= (Cisco 4500/4700 IP Plus Feature Pack)

- CD45-CW-11.2= (Cisco 4500/4700 IP Plus 40 Feature Pack)

- CD45-CY-11.2= (Cisco 4500/4700 IP Plus 56 Feature Pack)

- CD45-B-11.2= (Cisco 4500/4700 IP/IPX/AT/DEC Feature Pack)

- CD45-BP-11.2= (Cisco 4500/4700 IP/IPX/AT/DEC Plus Feature Pack)

- CD45-BW-11-2= (Cisco 4500/4700 IP/IPX/AT/DEC Plus 40 Feature Pack)

- CD45-BY-11.2= (Cisco 4500/4700 IP/IPX/AT/DEC Plus 56 Feature Pack)

- CD45-A-11.2= (Cisco 4500/4700 Enterprise Feature Pack)

- CD45-AP-11.2= (Cisco 4500/4700 Enterprise Plus Feature Pack)

- CD45-AW-11.2= (Cisco 4500/4700 Enterprise Plus 40 Feature Pack)

- CD45-AY-11.2= (Cisco 4500/4700 Enterprise Plus 56 Feature Pack)

Note   The feature packs listed here contain Cisco IOS Release 11.2(5)P software images and a selection of back rev images. The feature packs contain Router Software Loader (RSL) Version 5.0.

Note Before running RSL, read the section "Installation Tips," page 7.

Note If you are installing feature sets on a Cisco 4500 or 4700 router with no Ethernet, Fast Ethernet, or Token Ring interface, use the loading procedures described in the section "Installing the Router Software Without Using Windows 95," page 14.

These release notes contain the following sections:

What Is a Feature Pack?

The heart of a Cisco IOS software feature pack is a CD-ROM that contains software images and RSL, a Windows 95 application, which loads the images onto the router. Each Cisco IOS Release 11.2 feature pack CD contains feature sets and one bootstrap software image. For users without Windows 95, images can also be loaded with a Trivial File Transfer Protocol (TFTP) server application.

Each Cisco IOS Release 11.2 software feature pack box contains the following:

- CD-ROM with the following software:
  — Feature set software images
  — Bootstrap software image
  — RSL program (a Windows 95 application)
- Instruction booklet for using RSL
- Release notes (this document), which include instructions for using a TFTP server application on a system not running Windows 95
- Software license—for using Cisco software in object code form on a single router
- Cisco Documentation CD-ROM, which contains all Cisco IOS software documentation

Supported Platforms

RSL 5.0 supports both Cisco and CiscoPro versions of the Cisco 4500 and 4700 routers:

- CiscoPro CPA4500 and CPA4700

- Cisco 4500 and 4700

Loading Cisco IOS Release 11.2 Software on CiscoPro Routers

RSL contains an upgrade utility that permanently modifies a CiscoPro router so that it will accept the Cisco IOS Release 11.2 software images.

The utility changes the router's SysObjectID Simple Network Management Protocol (SNMP) MIB value (used for network management) from CiscoPro to that of a Cisco router. The software banner also changes so that it no longer identifies the router as a CiscoPro product.

Note After this upgrade, your router will no longer be recognized by CiscoVision. If you perform the permanent upgrade and currently use the CiscoVision network management application, CiscoWorks for Windows is a recommended replacement for network management purposes. You can upgrade your CiscoVision software to CiscoWorks Windows 2.1 by ordering one of the following: CPW-CVCW-U to upgrade CiscoVision to CiscoWorks Windows (managing up to 50 nodes), or CPW-CVCW-ENT-U to upgrade CiscoVision to CiscoWorks Windows (managing up to 500 nodes). To obtain general information about Cisco Systems, Cisco products, or upgrades, contact 800 553-6387, 408 526-7208, or cs-rep@cisco.com.

The upgrade utility must be located in the Images directory. If it is not, the upgrade utility will inform you that the image is not present. The Cisco 4500 and 4700 upgrade utility's filename is cpa45-upgrade-1.112-3.P.

Cisco Feature Pack Descriptions

This section describes the Cisco feature packs, listing the software feature sets comprising each pack. You can use this information to identify your feature pack set in conjunction with the corresponding information provided in the table in the section "Cisco IOS Release 11.2 Feature Sets," page 9. The table in that section identifies which features are supported for a feature set on a specific platform.

Note RSL 5.0, contained in every Cisco IOS Release 11.2 software feature pack, supports Ethernet, Fast Ethernet, and Token Ring interfaces.

Software Feature Packs

This section includes two tables: 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 UNIX and DOS 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 also identifies the memory required to run each feature set on your specific platform; Table 2 describes the memory delivered by default and the memory upgrades available.

You can use Table 1 to identify the memory required for your configuration based on the image you run. You can then check this against Table 2 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 1   Cisco Feature Pack Image Filenames and Memory Requirements

Image Description	Image Name (UNIX)	Image Name (DOS)	Flash Memory Required	Main Memory Required
Cisco 4500 and 4700 IP Feature Pack Release 11.2 (model number CD45-C-11.2=)				
Cisco 4500 IP feature set 11.2(5)	c4500-i-mz.112-5.P	80137005	4 MB	16 MB
Cisco 4500 IP feature set 11.2(3)	c4500-i-mz.112-3.P	80137003	4 MB	16 MB
Cisco 4500 IP feature set 11.1(8)	c4500-i-mz.111-8	YE11180N	4 MB	16 MB
Cisco 4500 IP feature set 11.0(13)	c4500-i-mz.110-13	80033713	4 MB	16 MB
Cisco 4500 bootstrap image 11.1(7)	c4500-boot-m.111-7	80082002	–	–
Cisco 4500 and 4700 IP Plus Feature Pack Release 11.2 (model number CD45-CP-11.2=)				
Cisco 4500 IP Plus feature set 11.2(5)	c4500-is-mz.112-5.P	80137105	4 MB	16 MB
Cisco 4500 IP Plus feature set 11.2(3)	c4500-is-mz.112-3.P	80137103	4 MB	16 MB
Cisco 4500 IP/IBM feature set 11.1(8)	c4500-ir-mz.111-8	YP11180N	4 MB	16 MB
Cisco 4500 IP/IBM feature set 11.0(13)	c4500-ir-mz.110-13	80033813	4 MB	16 MB
Cisco 4500 bootstrap image 11.1(7)	c4500-boot-m.111-7	80082002	–	–
Cisco 4500 and 4700 IP Plus 40 Feature Pack Release 11.2 (model number CD45-CW-11.2=)				
Cisco 4500 IP Plus 40 feature set 11.2(5)	c4500-is40-mz.112-5.P	80137205	4 MB	16 MB
Cisco 4500 IP Plus 40 feature set 11.2(3)	c4500-is40-mz.112-3.P	80137203	4 MB	16 MB
Cisco 4500 IP/IBM feature set 11.1(8)	c4500-ir-mz.111-8	YP11180N	4 MB	16 MB
Cisco 4500 IP/IBM feature set 11.0(13)	c4500-ir-mz.110-13	–	4 MB	16 MB
Cisco 4500 bootstrap image 11.1(7)	c4500-boot-m.111-7	80082002	–	–
Cisco 4500 and 4700 IP Plus 56 Feature Pack Release 11.2 (model number CD45-CY-11.2=)				
Cisco 4500 IP Plus 56 feature set 11.2(5)	c4500-is56-mz.112-5.P	80137305	4 MB	16 MB
Cisco 4500 IP Plus 56 feature set 11.2(3)	c4500-is56-mz.112-3.P	80137303	4 MB	16 MB
Cisco 4500 IP/IBM feature set 11.1(8)	c4500-ir-mz.111-8	YP11180N	4 MB	16 MB
Cisco 4500 IP/IBM feature set 11.0(13)	c4500-ir-mz.110-13	80033813	4 MB	16 MB
Cisco 4500 bootstrap image 11.1(7)	c4500-boot-m.111-7	80082002	–	–
Cisco 4500 and 4700 IP/IPX/AT/DEC Feature Pack Release 11.2 (model number CD45-B-11.2=)				
Cisco 4500 IP/ IPX/AT/DEC feature set 11.2(5)	c4500-d-mz.112-5.P	80136605	4 MB	16 MB
Cisco 4500 IP/ IPX/AT/DEC feature set 11.2(3)	c4500-d-mz.112-3.P	80136603	4 MB	16 MB
Cisco 4500 IP/ IPX/AppleTalk feature set 11.1(8)	c4500-d-mz.111-8	YD11180N	4 MB	16 MB

Table 1   Cisco Feature Pack Image Filenames and Memory Requirements (Continued)

Image Description	Image Name (UNIX)	Image Name (DOS)	Flash Memory Required	Main Memory Required
Cisco 4500 IP/ IPX/AppleTalk feature set 11.0(13)	c4500-d-mz.110-13	80033213	4 MB	16 MB
Cisco 4500 bootstrap image 11.1(7)	c4500-boot-m.111-7	80082002	–	–
Cisco 4500 and 4700 IP/IPX/AT/DEC Plus Feature Pack Release 11.2 (model number CD45-BP-11.2=)				
Cisco 4500 IP/ IPX/AT/DEC Plus feature set 11.2(5)	c4500-ds-mz.112-5.P	80136705	4 MB	16 MB
Cisco 4500 IP/ IPX/AT/DEC Plus feature set 11.2(3)	c4500-ds-mz.112-3.P	80136703	4 MB	16 MB
Cisco 4500 IP/ IPX/AT/IBM feature set 11.1(8)	c4500-dr-mz.111-8	YT11180N	4 MB	16 MB
Cisco 4500 IP/IPX/AT/IBM feature set 11.0(13)	c4500-dr-mz.110-13	80033413	4 MB	16 MB
Cisco 4500 bootstrap image 11.1(7)	c4500-boot-m.111-7	80082002	–	–
Cisco 4500 and 4700 IP/IPX/AT/DEC Plus 40 Feature Pack Release 11.2 (model number CD45-BW-11.2=)				
Cisco 4500 IP/IPX/AT/DEC Plus 40 feature set 11.2(5)	c4500-ds40-mz.112-5.P	80136805	4 MB	16 MB
Cisco 4500 IP/IPX/AT/DEC Plus 40 feature set 11.2(3)	c4500-ds40-mz.112-3.P	80136803	4 MB	16 MB
Cisco 4500 IP/ IPX/AT/IBM feature set 11.1(8)	c4500-dr-mz.111-8	–	4 MB	16 MB
Cisco 4500 IP/IPX/AT/IBM feature set 11.0(13)	c4500-dr-mz.110-13	80033413	4 MB	16 MB
Cisco 4500 bootstrap image 11.1(7)	c4500-boot-m.111-7	80082002	–	–
Cisco 4500 and 4700 IP/IPX/AT/DEC Plus 56 Feature Pack Release 11.2 (model number CD45-BY-11.2=)				
Cisco 4500 IP/IPX/AT/DEC Plus 56 feature set 11.2(5)	c4500-ds56-mz.112-5.P	80136905	4 MB	16 MB
Cisco 4500 IP/IPX/AT/DEC Plus 56 feature set 11.2(3)	c4500-ds56-mz.112-3.P	80136903	4 MB	16 MB
Cisco 4500 IP/ IPX/AT/IBM feature set 11.1(8)	c4500-dr-mz.111-8	YT11180N	4 MB	16 MB
Cisco 4500 IP/IPX/AT/IBM feature set 11.0(13)	c4500-dr-mz.110-13	80033413	4 MB	16 MB
Cisco 4500 bootstrap image 11.1(7)	c4500-boot-m.111-7	80082002	–	–
Cisco 4500 and 4700 Enterprise Feature Pack Release 11.2 (model number CD45-A-11.2=)				
Cisco 4500 Enterprise feature set 11.2(5)	c4500-j-mz.112-5.P	80137405	8 MB	16 MB
Cisco 4500 Enterprise feature set 11.2(3)	c4500-j-mz.112-3.P	80137403	8 MB	16 MB
Cisco 4500 Enterprise feature set 11.1(8)	c4500-j-mz.111-8	YJ11180N	8 MB	16 MB
Cisco 4500 Enterprise feature set 11.0(13)	c4500-j-mz.110-13	80033013	8 MB	16 MB
Cisco 4500 bootstrap image 11.1(7)	c4500-boot-m.111-7	80082002	–	–
Cisco 4500 and 4700 Enterprise Plus Feature Pack Release 11.2 (model number CD45-AP-11.2=)				
Cisco 4500 Enterprise Plus feature set 11.2(5)	c4500-js-mz.112-5.P	80137505	8 MB	16 MB
Cisco 4500 Enterprise Plus feature set 11.2(3)	c4500-js-mz.112-3.P	80137503	8 MB	16 MB
Cisco 4500 Enterprise feature set 11.1(8)	c4500-j-mz.111-8	YJ11180N	8 MB	16 MB
Cisco 4500 Enterprise feature set 11.0(13)	c4500-j-mz.110-13	80033013	8 MB	16 MB
Cisco 4500 bootstrap image 11.1(7)	c4500-boot-m.111-7	80082002	–	–
Cisco 4500 and 4700 Enterprise Plus 40 Feature Pack Release 11.2 (model number CD45-AW-11.2=)				
Cisco 4500 Enterprise Plus 40 feature set 11.2(5)	c4500-js40-mz.112-5.P	80137605	8 MB	16 MB
Cisco 4500 Enterprise Plus 40 feature set 11.2(3)	c4500-js40-mz.112-3.P	80137603	8 MB	16 MB
Cisco 4500 Enterprise feature set 11.1(8)	c4500-j-mz.111-8	YJ11180N	8 MB	16 MB
Cisco 4500 Enterprise feature set 11.0(13)	c4500-j-mz.110-13	80033013	8 MB	16 MB

Table 1   Cisco Feature Pack Image Filenames and Memory Requirements (Continued)

Image Description	Image Name (UNIX)	Image Name (DOS)	Flash Memory Required	Main Memory Required
Cisco 4500 bootstrap image 11.1(7)	c4500-boot-m.111-7	80082002	–	–
Cisco 4500 and 4700 Enterprise Plus 56 Feature Pack Release 11.2 (model number CD45-AY-11.2=)				
Cisco 4500 Enterprise Plus 56 feature set 11.2(5)	c4500-js56-mz.112-5.P	80137705	8 MB	16 MB
Cisco 4500 Enterprise Plus 56 feature set 11.2(3)	c4500-js56-mz.112-3.P	80137703	8 MB	16 MB
Cisco 4500 Enterprise feature set 11.1(8)	c4500-j-mz.111-8	YJ11180N	8 MB	16 MB
Cisco 4500 Enterprise feature set 11.0(13)	c4500-j-mz.110-13	80033013	8 MB	16 MB
Cisco 4500 bootstrap image 11.1(7)	c4500-boot-m.111-7	80082002	–	–

Table 2   Cisco 4500 and 4700 Default and Memory Upgrade Options

	Default	Upgrade Options
Cisco 4500 Router		
Flash	4 MB	8-MB upgrade: MEM8F= 16-MB upgrade: MEM16F=
Main	16 MB	16-MB upgrade: MEM16M= 32-MB upgrade: MEM32M=
Shared	8 MB	8-MB upgrade: MEM8S= 16-MB upgrade: MEM16S=
Cisco 4700 Router		
Flash	4 MB	8-MB upgrade: MEM8F= 16-MB upgrade: MEM16F=
Main	16 MB	16-MB upgrade: MEM16M= 32-MB upgrade: MEM32M= 64-MB upgrade: MEM64M=
Shared	8 MB	8-MB upgrade: MEM8S= 16-MB upgrade: MEM16S=

Memory Recommendations

Table 3 gives memory recommendations for routers based on the purpose for which you use the router. These recommendations are application-specific; they do not correspond to memory requirements given for images shown in Table 1. For example, if your router maintains routing data for more than 50 networks, we recommend 32 MB of main memory even though Table 1 indicates that the image itself requires 16 MB.

You can use the Cisco 4500 or 4700 router for one or more purposes. Refer to the memory recommendations Table 3 gives for single or combined applications. These uses of the router and their recommended memory sizes are not mutually exclusive. For example, if you connect directly to the Internet backbone, we recommend that you have 32 MB of main memory. If you also maintain more than 24 WAN virtual circuits on the same router, we recommend that you have 48 MB of RAM (the sum of recommended memory amounts supporting both applications).

For more comprehensive information on memory recommendations for Cisco routers, go to www.cisco.com, select **Products & Ordering**, then **Product Bulletins**. Under "Access Products," select product bulletin **#419**.

Table 3   Cisco 4500 and 4700 Memory Recommendations

Usage	Main	Shared	Flash
Running Cisco IOS Release 11.2 with 1-PRI, 4-BRI, or 8-BRI module	16 MB	–	–
Running IP, IPX, AppleTalk simultaneously	16 MB	–	–
Running Desktop or Enterprise feature set	16 MB	–	–
Connecting directly to Internet backbone	32 MB	–	–
Maintaining routing data for more than 50 networks	32 MB	–	–
Using 1-PRI or 8-BRI module	–	8 MB	–
Maintaining more than 24 WAN virtual circuits	–	16 MB	–
Using any two of 1-PRI, 4-BRI, or 8-BRI modules	–	16 MB	–
Storing multiple versions of Cisco IOS feature sets on the router	–	–	16 MB

Installation Tips

This section describes several solutions to problems you might encounter when using RSL. These solutions are additions to RSL's online help.

Recovering From a Connection Error

This installation tip provides a possible recovery solution in the event that you are unable to connect to your router. You can skip this section unless you are experiencing a connection error.

In some cases, you might receive the following error message while connecting to the target router:

```
"Failed to configure the router to enable the Cisco IOS software image and configuration
file upload and download operations. You may want to check the router to make sure that
the selected interface exists."
```

If you encounter this message, try increasing the Short Timeout value, which is set to 25 seconds, in the Options dialog box, especially if one of the following situations applies:

Note   Increasing the Short Timeout value may increase the time it takes for RSL to connect to the target router.

- You are connecting to a router that has a large configuration file.

- You are connecting to a Cisco AS5200. A Cisco AS5200 requires up to 45 seconds to write a configuration to nonvolatile random-access memory (NVRAM), due to the amount of interfaces that must be checked during this process. Increase the Short Timeout value to 60 seconds.

Restoring the Startup Configuration

In some cases, RSL is unable to restore the startup configuration. If this happens, take the following steps:

Step 1   Ensure that all cables are properly attached to both the router and the PC.

Step 2   Restart RSL and connect using the **Preconfigured router** option.

Step 3   When asked if you want to overwrite the existing startup configuration file, choose **NO**.

Step 4   When asked if you want to continue, choose **YES**.

Step 5   When connected, select **Download Router Configuration** in the Router Software Loader dialog box.

Step 6   Select the appropriate file, and click the radio button beside **Copy configuration to the router's nonvolatile memory**.

The router should now contain the startup configuration it had before the initial RSL connection. You can now exit RSL.

Note In the previous situation, the router's configuration register is not restored.

Note If you enter **Ctrl-Alt-Delete** to terminate RSL, the router's configuration and configuration register are not restored. However, in this case the configuration file is not deleted from the PC, so it can be restored using the previous steps.

Helpful Hints

The following information about RSL operations can help you with the installation process:

- If you have added any static entries to the PC's Address Resolution Protocol (ARP) table, one of them may be deleted by RSL. This entry will need to be manually re-entered into the PC's ARP table.

- If your router is configured with a **boot system flash** *filename* command, where *filename* is the name of the previous image residing in the first partition of Flash memory, this command must be manually changed to reflect the name of the image that was copied to the router's first Flash memory partition.

- If the router's running configuration at connection time is not the same as the router's startup configuration, the exact configuration will not be restored. Any changes that you have made since the last time a **copy running-config startup-config** or **write memory** command was entered will be lost.

- If you connect to a router with multiple Flash memory partitions, it will always copy the new image to the first partition and reload to the first partition. This will fail if there is not enough memory in the first partition.

- RSL will restore the router's running configuration, but some configuration commands will not be restored. However, the startup configuration will be correct. You can restore the exact running configuration by rebooting the router. Commands not restored to the running configuration include the following interface configuration commands: **no shutdown**, **no ringspeed**, and **media-type aui**.

Cisco IOS Release 11.2 Feature Sets

Table 4 shows specific features supported for Cisco IOS Release 11.2 on Cisco 4500 and 4700 routers.

The table uses these conventions to identify features:

- Yes: the feature is offered in the basic feature set

- – : the feature is not offered in the feature set

- Plus: the feature is offered only in the Plus feature sets, not in the basic feature set

- Encrypt: the addition of 40-bit (Plus 40) or 56-bit (Plus 56) data encryption feature sets

    Cisco IOS images with 40-bit Data Encryption Standard (DES) support can legally be distributed to any party eligible to receive Cisco IOS software. 40-bit DES is not a cryptographically strong solution and should not be used to protect sensitive data.

    Cisco IOS images with 56-bit DES are subject to International Traffic in Arms Regulations (ITAR) controls and have a limited distribution. Images to be installed outside the U.S. require an export license. Customer orders may be denied or subject to delay due to U.S. government regulations. Contact your sales representative or distributor for more information, or send e-mail to export@cisco.com.

Table 4   Cisco IOS Release 11.2 Feature Sets for Cisco 4500 and 4700 Routers

Features	IP Routing	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise
LAN Support			
Apollo Domain	–	–	Yes
AppleTalk 1 and 2[1]	–	Yes	Yes
Banyan VINES	–	–	Yes
Concurrent routing and bridging (CRB)	Yes	Yes	Yes
DECnet IV	–	Yes	Yes
DECnet V	–	–	Yes
GRE	Yes	Yes	Yes
Integrated routing and bridging (IRB)[2]	Yes	Yes	Yes
IP	Yes	Yes	Yes
LAN extension host	Yes	Yes	Yes
Multiring	Yes	Yes	Yes
Novell IPX[3]	–	Yes	Yes
OSI	–	–	Yes
Source-route bridging[4]	–	–	–
Transparent and translational bridging	Yes	Yes	Yes
XNS	–	–	Yes

Table 4   Cisco IOS Release 11.2 Feature Sets for Cisco 4500 and 4700 Routers (Continued)

Features	IP Routing	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise
WAN Services			
ATM LAN emulation: DECnet routing, XNS routing, and Banyan VINES support [5]	–	Plus	Plus
ATM LAN emulation: Hot Standby Router Protocol (HSRP) and Simple Server Redundancy Protocol (SSRP)	Plus	Plus	Plus
ATM: Rate queues for SVC per subinterface	Plus	Plus	Plus
ATM: UNI 3.1 signaling for ATM	Plus	Plus	Plus
Combinet Packet Protocol (CPP)	Yes	Yes	Yes
Dialer profiles	Yes	Yes	Yes
Frame Relay	Yes	Yes	Yes
Frame Relay SVC Support (DTE)	–	–	Yes
Frame Relay traffic shaping	Yes	Yes	Yes
Half bridge/half router for CPP and PPP	Yes	Yes	Yes
HDLC	Yes	Yes	Yes
IPXWAN 2.0	–	Yes	Yes
ISDN[6]	Yes	Yes	Yes
Multichassis Multilink PPP (MMP)	–	–	Yes
PPP[7]	Yes	Yes	Yes
SMDS	Yes	Yes	Yes
Switched 56	Yes	Yes	Yes
Virtual Private Dial-up Network (VPDN)	–	Yes	Yes
X.25[8]	Yes	Yes	Yes
WAN Optimization			
Bandwidth-on-demand	Yes	Yes	Yes
Custom and priority queuing	Yes	Yes	Yes
Dial backup	Yes	Yes	Yes
Dial-on-demand	Yes	Yes	Yes
Header[9], link and payload compression	Yes	Yes	Yes
Snapshot routing	Yes	Yes	Yes
Weighted fair queuing	Yes	Yes	Yes
IP Routing			
BGP	Yes	Yes	Yes
BGP4[10]	Yes	Yes	Yes
EGP	Yes	Yes	Yes
Enhanced IGRP	Yes	Yes	Yes
Enhanced IGRP Optimizations	Yes	Yes	Yes
ES-IS	–	–	Yes

Table 4   Cisco IOS Release 11.2 Feature Sets for Cisco 4500 and 4700 Routers (Continued)

Features	IP Routing	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise
IGRP	Yes	Yes	Yes
IS-IS	–	–	Yes
Named IP Access Control List	Yes	Yes	Yes
Network Address Translation (NAT)	Plus	Plus	Plus
NHRP	Yes	Yes	Yes
On Demand Routing (ODR)	Yes	Yes	Yes
OSPF	Yes	Yes	Yes
OSPF Not-So-Stubby-Areas (NSSA)	Yes	Yes	Yes
OSPF On Demand Circuit (RFC 1793)	Yes	Yes	Yes
PIM	Yes	Yes	Yes
Policy-based routing	Yes	Yes	Yes
RIP	Yes	Yes	Yes
RIP Version 2	Yes	Yes	Yes
Other Routing			
AURP	–	Yes	Yes
IPX RIP	–	Yes	Yes
NLSP	–	Yes	Yes
RTMP	–	Yes	Yes
SMRP	–	Yes	Yes
SRTP	–	–	Yes
Multimedia and Quality of Service			
Generic traffic shaping	Yes	Yes	Yes
Random Early Detection (RED)[11]	Yes	Yes	Yes
Resource Reservation Protocol (RSVP)[11]	Yes	Yes	Yes
Management			
AutoInstall	Yes	Yes	Yes
Automatic modem configuration	Yes	Yes	Yes
HTTP Server	Yes	Yes	Yes
RMON events and alarms[12]	Yes	Yes	Yes
RMON full (Cisco 3011 WAN module only)[13]	Plus	Plus	Plus
SNMP	Yes	Yes	Yes
Telnet	Yes	Yes	Yes
Security			
Access lists	Yes	Yes	Yes
Access security	Yes	Yes	Yes
Extended access lists	Yes	Yes	Yes

Table 4   Cisco IOS Release 11.2 Feature Sets for Cisco 4500 and 4700 Routers (Continued)

Features	IP Routing	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise
Kerberized login	–	–	Yes
Kerberos V client support	–	–	Yes
Lock and key	Yes	Yes	Yes
MAC security for hubs[14]	Yes	Yes	Yes
MD5 routing authentication	Yes	Yes	Yes
Network layer encryption (40-bit or export controlled 56-bit DES)	Encrypt	Encrypt	Encrypt
RADIUS	Yes	Yes	Yes
Router authentication	Encrypt	Encrypt	Encrypt
TACACS+[15]	Yes	Yes	Yes
IBM Support (Optional)			
BAN for SNA Frame Relay support	Plus	Plus	Yes
Bisync	Plus	Plus	Yes
Caching and filtering	Plus	Plus	Yes
DLSw+ [16]	Plus	Plus	Yes
Downstream PU (DSPU) concentration	Plus	Plus	Yes
Frame Relay SNA support (RFC 1490)	Plus	Plus	Yes
Native Client Interface Architecture (NCIA) Server	Plus	Plus	Yes
NetView Native Service Point	Plus	Plus	Yes
QLLC	Plus	Plus	Yes
Response Time Reporter (RTR)	Plus	Plus	Yes
SDLC integration	Plus	Plus	Yes
SDLC transport (STUN)	Plus	Plus	Yes
SDLC-to-LAN conversion (SDLLC)	Plus	Plus	Yes
SNA and NetBIOS WAN optimization via local acknowledgment	Plus	Plus	Yes
SRB/RSRB[17]	Plus	Plus	Yes
SRT	Plus	Plus	Yes
TG/COS	–	–	Yes
TN3270	–	–	Yes
Protocol Translation			
LAT	–	–	Yes
Rlogin	–	–	Yes
Remote Node[18]			
Asynchronous master interfaces	Yes	Yes	Yes
ATCP	–	Yes	Yes
CPPP	Yes	Yes	Yes
CSLIP	Yes	Yes	Yes

Table 4   Cisco IOS Release 11.2 Feature Sets for Cisco 4500 and 4700 Routers (Continued)

Features	IP Routing	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise
DHCP	Yes	Yes	Yes
IP pooling	Yes	Yes	Yes
IPX and ARAP on virtual async interfaces	–	–	Yes
IPXCP[9]	–	Yes	Yes
MacIP	–	Yes	Yes
NASI	–	Yes	Yes
NetBEUI over PPP	Yes	Yes	Yes
PPP	Yes	Yes	Yes
SLIP	Yes	Yes	Yes
Terminal Services[18]			
LAT[19]	–	–	Yes
Rlogin	Yes	Yes	Yes
Telnet	Yes	Yes	Yes
TN3270	–	–	Yes
X.25 PAD	Yes	Yes	Yes
Xremote	–	–	Yes

1. Includes AppleTalk load balancing.
2. IRB supports IP, IPX, and AppleTalk; it is supported for transparent bridging, but not for SRB; it is supported on all media-type interfaces except X.25 and ISDN bridged interfaces; IRB and concurrent routing and bridging (CRB) cannot operate at the same time.
3. The Novell IPX feature includes display SAP by name, IPX Access Control List violation logging, and plain-English IPX access lists.
4. Translational bridging is fast switched by default but can be disabled.
5. ATM LAN emulation for Banyan VINES is only supported in Enterprise. The Desktop feature set supports DECnet only.
6. ISDN support includes calling line identification (ANI), X.25 over the B channel, ISDN subaddressing, and applicable WAN optimization features.
7. PPP includes support for LAN protocols supported by the feature set, address negotiation, PAP and CHAP authentication, Multilink PPP, and PPP compression.
8. X.25 includes X.25 switching.
9. IPX header compression (RFC 1553) is available in the feature sets that support IPX.
10. BGP4 includes soft configuration, multipath support, and prefix filtering with inbound route maps.
11. RED and RSVP are supported in IP/IPX/IBM/APPN for the Cisco 4000, 4500, and 4700 only.
12. The RMON events and alarms groups are supported on all interfaces. Full RMON support is available with the Plus feature sets.
13. The Cisco 3011 WAN module is derived from the Cisco 2503 router.
14. This feature does not apply to the Cisco 3011 WAN module.
15. TACACS+ Single Connection and TACACS+ SENDAUTH enhancements are supported.
16. Cisco IOS Release 11.2 introduces several DLSw+ enhancements available in the Plus, Plus 40, and Plus 56 feature sets.
17. SRB/RSRB is fast switched. This enhancement is on by default but can be disabled.
18. Supported on access severs (with limited support on router auxiliary ports).
19. Use of LAT requires a terminal license (FR-L8-10.X= for an 8-user license or FR-L16-10.X= for a 16-user license).

Back Rev Feature Sets

For a list of features supported by the back rev feature sets, see the release notes available on the Documentation CD-ROM or the World Wide Web (www.cisco.com). See the section "About Cisco IOS Software Electronic Documentation," page 23. For example, to find a feature set list for Cisco IOS Release 11.1(8), locate the **Cisco IOS Software Configuration** database. Then select **Cisco IOS Release 11.1**, and then select **Release Notes for Cisco IOS Release 11.1**.

Installing the Bootstrap System Software Using RSL

You can use RSL to download bootstrap software images to the router's boot Flash memory. In the Router Software Loader dialog box, select the **Operations** menu, and then **Load Bootstrap Software**.

This operation is enabled when you connect RSL to the router and the boot Flash memory is detected on the router.

Note This operation is not enabled if you connect to a Cisco AS5200 that is operating in bootstrap mode.

To download a new bootstrap image, select the bootstrap image from the image list. Bootstrap images are in the Boot directory on the feature pack CD. Select the **Operations** menu, then **Load Bootstrap Software**. A progress bar will indicate the status of the download operation.

Note You cannot load a bootstrap image to system Flash memory or a Cisco IOS image to boot Flash memory with RSL.

Installing the Router Software Without Using Windows 95

This section describes an alternative method you can use to install the router software from the CD-ROM using a PC running Windows 3.1, a Macintosh, or a UNIX system. The process requires that you first obtain a TFTP application or a remote copy protocol (rcp) application, which you can use to set up your computer 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 feature sets to the router.

You can load router software with this alternative method in the following circumstances:

- You are not running Windows 95.

- Your router does not contain an Ethernet, Fast Ethernet, or Token Ring interface.

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.

Note The TFTP server included with RSL will run only on Windows 95.

Note For the Cisco 4500 and 4700 routers only, if you configure your router, such that the RJ-45 port of the Ethernet interface connects to the PC's Ethernet port, the connection will fail if the router's Ethernet port is not configured with the **media-type 10baseT** command.

Installation Process for Router Software Feature Sets

This section provides steps that describe how to install the router software feature sets using a Microsoft Windows 3.1 PC with a TFTP server application. You can also set up your Macintosh or UNIX workstation as a TFTP server and follow the same steps.

Note This is a two-part process. In the first part, which begins at Step 6, you will download the upgrade utility. In the second part, which begins at Step 15, you will download the Cisco IOS Release 11.2 images (referenced by the DOS names in Table 1) that you want on your particular router.

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 8.

Step 1 Install any TFTP application on the PC. (Not provided by Cisco.)

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.

The TFTP server also allows selection of a "root" directory. You must select the directory in which the Cisco IOS and upgrade files reside, for example **d:\cpswinst\images**.

Caution Be 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 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 20, 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, Fast Ethernet, or Token Ring port to the router's corresponding LAN port. Use the 10BaseT crossover cable provided if connecting to an Ethernet or Fast Ethernet port. You must use Category 5 cable for Fast Ethernet routers.

> **Note**   Use straight-through cables if you are connecting via a 10BaseT hub or a 100BaseT hub.

For systems without a LAN interface, make sure that the router and the PC have IP connectivity through the available interface (that is, the router and PC can ping each other with IP traffic).

In the following steps, you will upgrade your CiscoPro router to a Cisco Enterprise router. If you have a model CPA100x, CPA160x, CPA25xx or CPA4500 router and plan to install an 11.2 image on the router, you must perform Step 6 through Step 14. These steps upgrade your router to allow Enterprise images to run on it. For additional information, refer to the Note on page 3.

Step 6   From the console, enter the following configuration command:

```
# config terminal
```

Step 7   From the console, enter the following configuration command and then **Ctrl-Z** to exit configuration mode:

```
# config-reg 0x2102
# Ctrl-Z
```

Step 8   At the router prompt, enter the following command to copy the router upgrade utility 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 9   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 10   When prompted, enter the filename of the image to be copied to the router as in the following example:

```
Source file name? cpa45-upgrade-l.112-3.P
```

> **Note**   The upgrade image file on the Feature Pack CD has a long filename (cpa45-upgrade-l.112-3.P); note that it will be displayed in 8.3 format by DOS as cpa45-~1.P.

Step 11   In response to the prompt, enter the destination filename and press **Enter** to indicate that you want to copy the image.

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

```
Destination file name [cpa45-upgrade-1.112-3.p]? cpa45-upgrade-1.112-3.P
```

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

If the file is not found, check the following: filename; TFTP server is enabled; correct root directory is selected; IP connectivity between the router and TFTP server.

Step 12 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. Answer **yes** to the questions. 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. If you see three periods (...), the transfer failed. Check IP connectivity between the router and TFTP server using the **ping** command.

Step 13 Enter the **reload** command to reload the router:

```
# reload
```

After reload is complete, your CiscoPro router has been upgraded to a Cisco Enterprise router. Because the original Cisco IOS image, which resided in Flash memory, was erased during the upgrade process, the router should now be running in bootstrap mode.

Step 14 Redo Step 6 and Step 7.

Step 15 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:

(In the next series of steps, you download the Cisco IOS Release 11.2 images that you want installed on your router.)

```
(boot)# copy tftp flash
```

Step 16 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 17 When prompted, enter the filename of the Cisco IOS Release 11.2 image to be copied to the router as in the following example:

```
Source file name? 80137003.bin
```

This example specifies the IP feature set for Cisco 4500 and 4700 routers.

Step 18 In response to the prompt, enter the destination filename and press **Enter** to indicate that you want to copy the image.

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

```
Destination file name [80137003.bin]? c4500-i-mz
```

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

Step 19   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. Answer **yes** to the questions. 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 checksum verification of the image occurs after the image is written to Flash memory.

Step 20   Enter the **reload** command to reload the router:

```
(boot)# reload
```

You do *not* need to save the system configuration when prompted here. After reload is complete, the router should be running the required Cisco IOS image. Use the **show version** command to verify.

Installation Process for Bootstrap Software

This section provides steps that describe how to install the bootstrap software using a Microsoft Windows 3.1 PC and a TFTP server application. You can also set up your Macintosh or UNIX workstation as a TFTP server and follow the same steps.

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 bootflash** command for the **copy tftp bootflash** command.

Note   To download a bootstrap software image to a Cisco AS5200's boot Flash memory, the Cisco AS5200 cannot be currently running a bootstrap image.

Step 1   Install any TFTP server application on the PC. (Not provided by Cisco.)

Step 2   Launch the TFTP server 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 server application setup or configuration facility.

The user interface of most TFTP server 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, click in this checkbox.

The TFTP server also allows selection of a "root" directory. You must select the directory in which the Cisco IOS and upgrade files reside, for example **d:\cpswinst\images**.

Caution   Be 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 two ways:

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

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

Step 5   Connect your PC's Ethernet, Fast Ethernet, or Token Ring port to the router's corresponding LAN port. Use the 10BaseT crossover cable provided if connecting to an Ethernet or Fast Ethernet port. You must use Category 5 cable for Fast Ethernet routers.

Note   Use straight-through cables if you are connecting via a 10BaseT hub or a 100BaseT hub.

For systems without a LAN interface, make sure that the router and the PC have IP connectivity through the available interface (that is, the router and PC can ping each other with IP traffic).

Step 6   From the console, enter the **copy tftp bootflash** command.

Step 7   When prompted, enter the TFTP server's IP address.

Step 8   When prompted, enter the filename of the image to be copied to the router as in the following example:

```
Source file name? 80082002.bin
```

This example specifies the bootstrap image for Cisco 4500 and 4700 routers.

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 name you select for the image file on the router. You do not need to use the full pathname of the image on the CD-ROM attached to the PC. In this example, the UNIX filename is used:

```
Destination file name [80082002.bin]? c4500-boot-m.111-7
```

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

If the file is not found, check the following: filename; TFTP server is enabled; correct root directory is selected; IP connectivity between the router and TFTP server.

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 may provide 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. If you see three periods (...), the transfer failed. Check IP connectivity between the router and TFTP server using the **ping** command.

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 Without Using Windows 95," page 14.

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.

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.

If the TTY username is invalid, the software uses the host name as 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, and possibly the **ip rcmd remote-host** 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, and possibly the **ip rcmd remote-host** 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 on a Cisco 4500 router. 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)# ip 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... eeeeeeeeeeeeeeeeeeeeeeeeeeeeeeee ...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]
```

Related Commands

boot config
boot system flash
cd
copy flash rcp
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.

Example

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... eeeeeeeeeeeeeeeeeeeeeeeeeeeeeeee ...erased
Loading file1 from 223.255.254.254 (via Ethernet0): !!!!(etc.)
[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.

Related Commands

copy flash tftp
verify
verify flash

Note The release notes shipped with your router are designed as reference material. The feature pack release notes (this document) should be sufficient for installing your software.

About Cisco IOS Software Electronic Documentation

Cisco IOS software documentation is provided on the Documentation CD-ROM that is included with your feature pack. To locate the correct documentation, first determine the Cisco IOS release level of the image you loaded (see Table 1, the Description column).

You can either use the Documentation CD or go to www.cisco.com (select **Products & Ordering**, **Documentation**, **Cisco Product Documentation**, **Cisco IOS Software Configuration**, then select the level of release). Typical documentation consists of the following:

- Release notes—Contains information such as new features, important notes, and caveats.

- Feature guides—Describes new features available in specific Cisco IOS releases.

- Modules that comprise the configuration guides and command references. Figure 1 describes Cisco IOS Release 11.2 modules.

- *Cisco IOS Software Command Summary*—Summarizes the commands in the command reference publications. For each command, the summary provides complete syntax, the purpose of the command, and a description of each keyword and argument in the command syntax.

- *System Error Messages*—Describes system error messages reported by Cisco IOS software.

- *Cisco Management Information Base (MIB) User Quick Reference*—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*—Provides information about using debug commands to troubleshoot your network. 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.

- Caveats.

Figure 1   Cisco IOS Configuration Guides and Command References
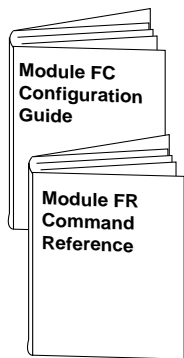
Module FC/FR:
**Configuration
Fundamentals**
• Access Server and
  Router Product
  Overview
• Cisco IOS Software
  Configuration Basics
• Images and
  Configuration Files
• Interface Configuration
• System Management
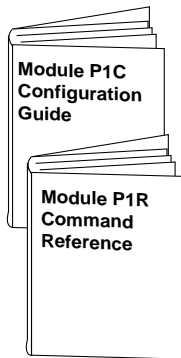
Module P1C/P1R:
**Network Protocols,
Part 1**
• IP Addressing
• IP Services
• IP Routing Protocols
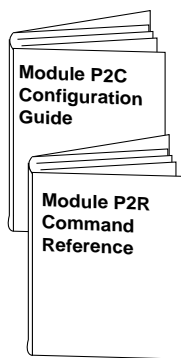
Module P2C/P2R:
**Network Protocols,
Part 2**
• AppleTalk
• Novell IPX
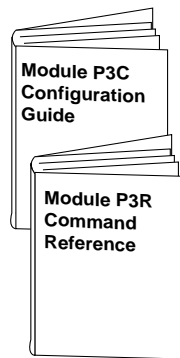
Module P3C/P3R:
**Network Protocols,
Part 3**
• Apollo Domain
• Banyan VINES
• DECnet
• ISO CLNS
• XNS
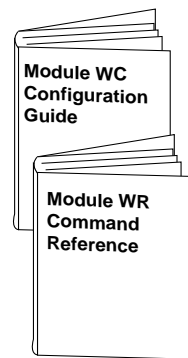
Module WC/WR:
**Wide-Area
Networking**
• ATM
• Frame Relay
• SMDS
• X.25 and LAPB
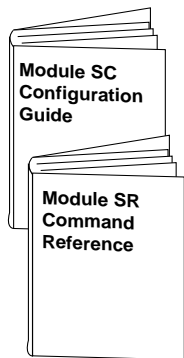
Module SC/SR:
Security
• Terminal Access Security
• Network Access Security
• Accounting and Billing
• Filtering Traffic
• Preventing Fraudulent
  Route Updates
• Network Data Encryption
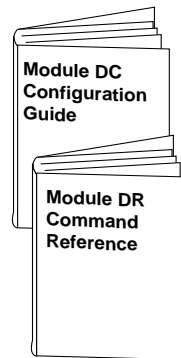
Module DC/DR:
Dial Solutions
• Dial Business
  Solutions and
  Examples
• Dial-In Port Setup
• DDR and Dial Backup
• Remote Node and
  Terminal Service
• Cost-Control and
  Large-Scale Dial
  Solutions
• VPDN
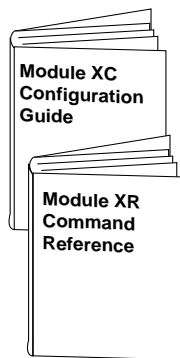
Module XC/XR:
**Cisco IOS Switching
Services**
• Switching Paths for IP
  Networks
  - Fast Switching
  - Autonomous Switching
  - NetFlow Switching
  - Optimum Switching
• Virtual LAN (VLAN)
  Switching and Routing
  - Inter-Switch Link Protocol
    Encapsulation
  - IEEE 802.10
    Encapsulation
  - LAN Emulation
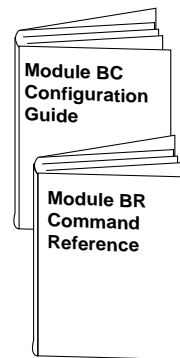
Module BC/BR:
**Bridging and IBM
Networking**
• Transparent Bridging
• Source-Route Bridging
• Remote Source-Route
  Bridging
• DLSw+
• STUN and BSTUN
• LLC2 and SDLC
• IBM Network Media Translation
• DSPU and SNA Service Point
• SNA Frame Relay Access Support
• APPN
• NCIA Client/Server Topologies
• IBM Channel Attach
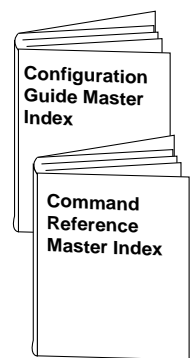
**Configuration
Guide Master
Index**

**Command
Reference
Master Index**

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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 Cisco 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 Connection Online

Cisco Connection Online (CCO) is Cisco Systems' primary, real-time support channel. Maintenance customers and partners can self-register on CCO to obtain additional information and 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, product documentation, software updates, release notes, technical tips, the Bug Navigator, configuration notes, brochures, descriptions of service offerings, and download access to public and authorized files.

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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
- 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 connection rates up to 28.8 kbps.

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

Note If you are a network administrator and need personal technical assistance with a Cisco product that is under warranty or covered by a maintenance contract, contact Cisco's Technical Assistance Center (TAC) at 800 553-2447, 408 526-7209, or tac@cisco.com. To obtain general information about Cisco Systems, Cisco products, or upgrades, contact 800 553-6387, 408 526-7208, or cs-rep@cisco.com.