Feature Support

Cisco IOS software is packaged in feature sets that consist of software images that support specific platforms. The feature sets available for a specific platform depend on which Cisco IOS software images are included in a release. Each feature set contains a specific set of Cisco IOS features.

Caution Cisco IOS images with strong encryption (including, but not limited to 168-bit (3DES) data encryption feature sets) are subject to U.S. government export controls and have limited distribution. Strong encryption images to be installed outside the United States are likely to require an export license. Customer orders may be denied or subject to delay because of U.S. government regulations. When applicable, the purchaser/user must obtain local import and use authorizations for all encryption strengths. Please contact your sales representative or distributor for more information, or send an e-mail to export@cisco.com.

The feature set tables have been removed from the Cisco IOS Release 12.2 release notes to improve the usability of the release notes documentation. The feature-to-image mapping that was provided by the feature set tables is available through Cisco Feature Navigator.

Cisco Feature Navigator is a web-based tool that enables you to determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image. You can search by feature or by feature set (software image). Under the release section, you can compare Cisco IOS software releases side by side to display both the features unique to each software release and the features that the releases have in common.

Cisco Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Cisco Feature Navigator home page at the following URL:

http://www.cisco.com/go/cfn

For frequently asked questions about Cisco Feature Navigator, see the FAQs at the following URL:

http://www.cisco.com/support/FeatureNav/FNFAQ.html

Determining Which Software Images (Feature Sets) Support a Specific Feature

To determine which software images (feature sets) in Cisco IOS Release 12.2 support a specific feature, go to the Cisco Feature Navigator home page, and perform the following steps.

Step 1 From the Cisco Feature Navigator home page, click **Search by feature**.

Step 2 To find a feature, use either "Search by full or partial feature name" or "Browse features in alphabetical order." Either a list of features that match the search criteria or a list of features that begin with the number or letter selected from the ordered list will be displayed in the Features available text box on the left side of the web page.

Step 3 Select a feature from the Features available text box, and click the **Add** button to add a feature to the Features selected text box on the right side of the web page.

Note To learn more about a feature in the list, click the Show Description(s) button below the Features available text box.

Repeat this step to add additional features. A maximum of 20 features can be chosen for a single search.

Step 4 Click **Continue** when you are finished selecting features.

Step 5 From the Major Release drop-down menu, choose **12.2**.

Step 6 From the Release drop-down menu, choose the appropriate maintenance release.

Step 7 From the Platform drop-down menu, select the appropriate hardware platform. The "Search Results" table will list all the software images (feature sets) that support the feature(s) that you selected.

Determining Which Features Are Supported in a Specific Software Image (Feature Set)

To determine which features are supported in a specific software image (feature set) in Cisco IOS Release 12.2, go to the Cisco Feature Navigator home page and perform the following steps.

Step 1 From the Cisco Feature Navigator home page, click **Compare Images**, and then **Search by Release**.

Step 2 In the "Find the features in a specific Cisco IOS release, using one of the following methods:" area, choose **12.2** from the Cisco IOS Major Release drop-down menu.

Step 3 Click **Continue**.

Step 4 From the Release drop-down menu, choose the appropriate maintenance release.

Step 5 From the Platform drop-down menu, choose the appropriate hardware platform.

Step 6 From the Feature Set drop-down menu, choose the appropriate feature set. The "Search Results" table will list all the features that are supported by the feature set (software image) that you selected.

Memory Recommendations

The memory recommendation tables have been removed from the Cisco IOS Release 12.2 release notes to improve the usability of the release notes documentation. The memory recommendations that were provided by these tables are available through Cisco Feature Navigator.

Cisco Feature Navigator is a web-based tool that enables you to determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image. You can search by feature or by feature set (software image). Under the release section, you can compare Cisco IOS software releases side by side to display both the features unique to each software release and the features that the releases have in common.

Cisco Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Cisco Feature Navigator home page at the following URL:

www.cisco.com/go/fn

For frequently asked questions about Cisco Feature Navigator, see the FAQs at the following URL:

http://tools.cisco.com/ITDIT/CFN/jsp/help.jsp

Determining Memory Recommendations for Software Images (Feature Sets)

To determine memory recommendations for software images (feature sets) in Cisco IOS Release 12.2, go to the Cisco Feature Navigator home page and perform the following steps.

Step 1 From the Cisco Feature Navigator home page, click **Search by Software/Image Name/Product Code/Platform**.

Step 2 To find the memory recommendations for the latest Cisco IOS release, click the release under the Cisco IOS Quick Pick Latest Release area. For other releases, go to Step 3.

a. Choose **All Platforms** from the Platform drop-down list

b. Choose **All Feature Sets** from the Feature Set drop-down list.

The Search Results table will list all the software images (feature sets) that support the release that you chose, plus the DRAM and flash memory recommendations for each image.

Step 3 If the release is not listed in the Cisco IOS Quick Pick Latest Release area, choose **IOS** from the Software drop-down list, and click **Continue**.

a. Choose a release from the Major Release drop-down list, and click **Continue** again.

b. Choose a specific release from the Release drop-down list.

c. Choose **All Platforms** from the Platform drop-down list

d. Choose **All Feature Sets** from the Feature Set drop-down list.

The Search Results table will list all the software images (feature sets) that support the release that you chose, plus the DRAM and flash memory recommendations for each image.

Platform-Specific Information

This section describes the platform-specific information for the Cisco platforms supported by Cisco IOS Release 12.2. Each section includes memory recommendations and supported features. Additional information is provided when applicable. This information is provided for the platforms described in the following sections:

Cisco Voice Gateway 200

This section contains the following sections with information that is specific to the Cisco Voice Gateway 200 (VG200):

Introduction

The Cisco VG200 is designed to provide easy integration between Voice over IP (VoIP) network resources, especially the Cisco IP Telephony solution and the public switched telephone system (PSTN). The current release of the Cisco VG200 gateways provides the following main features:

- 10/100BASE-T Ethernet connection for connecting to VoIP network resources.
- Support for one-slot or two-slot analog or digital voice network modules, usable with the Foreign Exchange Station (FXS), Foreign Exchange Office (FX0), and T1 voice interface cards (VICs).
- Support for the Media Gateway Control Protocol (MGCP) when used with the analog voice network module and Cisco CallManager Release 3.0 or other MGCP call agents.
- Support for the H.323 standard when used with the digital voice network module and H.323 end points.

Memory Recommendations

For memory recommendations for the Cisco Voice Gateway 200 in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Table 1 summarizes the modules and interfaces supported on the Cisco Voice Gateway 200.

Table 1 Supported Interfaces on the Cisco VG200

LAN Interfaces	1-port 10/100 Mbps Ethernet
LAN Network Modules	None
Serial Network Modules	None
Analog Voice/Fax Network Modules	NM1V One-Slot Voice/Fax Network Module
	NM2V Two-Slot Voice/Fax Network Module

Table 1 Supported Interfaces on the Cisco VG200 (Continued)

Analog Voice/Fax Interface Cards	VIC-1FXS One-Port Voice Interface Card—FXS
	VIC-2FXS Two-Port Voice Interface Card—FXS
	VIC-1FXO One-Port Voice Interface Card—FXO
	VIC-2FXO One-Port Voice Interface Card—FXO
Digital Voice/Fax Network Modules	NM-HDV-1T1-24 Single-Port 24-Channel T1 Voice/Fax Network Module
	NM-HDV-1T1-24E Single-Port 24-Enhanced Channel T1 Voice/Fax Network Module
	NM-HDV-2T1-48 Single-Port 48-Channel T1 Voice/Fax Network Module
Digital Voice/Fax Interface Cards	VIC-1MFT-T1 One-Port RJ-48 Multiflex Trunk—T1
	VIC-2MFT-T1 Two-Port RJ-48 Multiflex Trunk—T1
WAN Interface Cards	Not supported

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Additional Notes for the Cisco Voice Gateway 200

This section describes additional notes for the Cisco Voice Gateway 200 for Cisco IOS Release 12.2.

Handling Incoming Caller ID Digits on an E&M Port

When using an H.323 T1-CAS E&M port on the Cisco VG200, incoming caller ID digits may not be processed correctly by Cisco IP Interactive Voice Response (IVR) applications, such as Cisco IP Auto-Attendant.

Depending on the T1-CAS line provisioning, incoming dialed number information service (DNIS) digits received by the Cisco VG200 after its first wink to the Central Office (CO) are treated as user-entered digits and are sent to the remote endpoint as out-of-band dual tone multifrequency (DTMF) digits. If the remote endpoint is a Cisco IP IVR application, the out-of-band digits will be interpreted as a user entry and will change the application response. There are two ways to handle this situation:

- Request the T1 service provider to stop sending DNIS digits.
- Configure an IP phone with the same directory number as the incoming DNIS, and then modify the "forward all" selection for this phone so that it sends the incoming call to the desired destination.

Managing Input Gain for Cisco IP Voice Applications

When using the FXO ports on a Cisco VG200, set the input gain greater than 10 to achieve adequate audio quality for use with Cisco IP voice applications or the Cisco IP Phone 7960. Enter the following series of commands from the Cisco IOS command line to set the correct value for input gain:

```
vg200# configure terminal
vg200(config)# voice-port x/x/x input gain <value>
```

Permitted entries for <value> are from -6 to 14. Gain values higher than 12 may cause DTMF recognition difficulties.

Enabling DTMF Relay with MGCP

Make sure that you use the MGCP configuration command for enabling DTMF relay. If this command is not configured, DTMF tones will be not be regenerated correctly on the remote endpoint. The required command is as follows:

```
router(config)# mgcp dtmf-relay codec all mode out-of-band
```

For further information about configuring MGCP, refer to the *Software Configuration Guide for the Cisco VG200*.

Cisco 800 Series Routers

This section contains the following sections with information that is specific to the Cisco 800 series:

Memory Recommendations

For memory recommendations for the Cisco 800 series routers in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Cisco IOS Release 12.2 supports the Cisco 800 series routers:

- Cisco 801
- Cisco 802
- Cisco 803
- Cisco 804
- Cisco 805

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Table 2 lists the supported interfaces for the Cisco 800 series routers for Cisco IOS Release 12.2.

Table 2 Supported Interfaces for the Cisco 800 Series

Router	Ethernet Ports	ISDN Ports	Serial Ports	ADSL Ports	Telephone Ports	Console Ports
Cisco 801	One 10BASE-T (RJ-45)	ISDN BRI S/T (RJ-45)	—	—	—	RJ-45
Cisco 802	One 10BASE-T (RJ-45)	ISDN BRI U, integrated Network Termination 1 (NT-1) (RJ-45)	—	—	—	RJ-45
Cisco 803	Four-port 10BASE-T (RJ-45) hub	ISDN BRI S/T (RJ-45)	—	—	Two (RJ-11)	RJ-45

Table 2 Supported Interfaces for the Cisco 800 Series (Continued)

Router	Ethernet Ports	ISDN Ports	Serial Ports	ADSL Ports	Telephone Ports	Console Ports
Cisco 804	Four-port 10BASE-T (RJ-45) hub	ISDN BRI U, integrated NT-1 (RJ-45)	—	—	Two (RJ-11)	RJ-45
Cisco 805	One 10BASE-T (RJ-45)	—	One smart serial (RS-232, RS-449, RS-530, RS-530A, X.21 and V.35)	—	—	RJ-45

Cisco 801–804 Routers

The Cisco 801–804 routers provide the following key hardware features:

- Cisco 802 and Cisco 804 routers have an integrated NT-1, which eliminates the need for an external NT-1 in North America.
- Cisco 803 and Cisco 804 routers provide connection to analog telephones, fax machines, or modems, which are connected to telephone services through an ISDN line.
- Flash memory: Default is 8 MB, expandable to 12 MB. (4-MB Flash soldered to the motherboard.)

Note To add additional Flash memory to the Cisco 801–804, remove the existing Flash card and install a new one.

- Dynamic RAM: Default is 4 MB, expandable to 12 MB. (4-MB Dynamic RAM soldered to the motherboard.)
- ISDN B-channel LEDs are a different color from the other LEDs, which make them easy to distinguish.
- Color-coded ports and cable reduce the chance of cabling errors.
- Routers can be stacked or mounted on a wall.

Cisco 805 Router

The Cisco 805 router connects small professional offices over serial lines to corporate networks and to the Internet, and provides the following key features:

- One serial WAN interface that delivers up to 512 kbps for synchronous serial connections (Frame Relay, leased lines, and X.25) or up to 115 kbps for asynchronous dial-up.
- One Ethernet LAN interface.
- Flash memory: Default is 4 MB, expandable to 12 MB. (4-MB Flash soldered to the motherboard.)
- Dynamic RAM: Default is 8 MB, expandable to 16 MB. (8-MB Dynamic RAM soldered to the motherboard.)
- Color-coded ports and cable reduce the chance of cabling errors.
- Routers can be stacked.

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Additional Notes for the Cisco 800 Series

caller-id Command

When using the **caller-id** command, which appears under "dial-peer" in the configuration commands, the default setting is "off" for Japan and "on" for the U.S. This command was introduced in Cisco IOS Release 12.1(2)XF.

DHCP Client Support

To configure the router for Dynamic Host Configuration Protocol (DHCP) client support, perform the following steps:

Step 1 Configure the Bridge Group Virtual Interface (BVI) interface by entering the **ip address dhcp client-id ethernet 0** command.

Specifying the value **client-id ethernet0** causes the MAC address of the Ethernet interface to be used as the client ID when the DHCP request is sent. Otherwise, the MAC address of the BVI interface is used as the client ID.

Step 2 Configure Network Address Translation (NAT).

a. Configure the BVI interface by entering the **nat outside** command.

b. Configure the Ethernet interface by entering the **nat inside** command.

c. Create an access list under NAT by entering the **access-list 1 permit** *ip-address* command to match all Ethernet IP addresses.

d. Configure the source list under NAT by entering the command **ip nat inside source list 1 interface BVI 1 overload**.

The following is a sample configuration:

```
Current configuration:
!
version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname c827
!
!
ip subnet-zero
ip dhcp excluded-address 10.10.10.1
!
ip dhcp pool SERVER
 network 10.10.10.0 255.255.255.0
 default-router 10.10.10.1
 import all
!
!
!
bridge irb
```

```
!
!
!
!
interface Ethernet0
ip address 10.10.10.1 255.255.255.0
no ip directed-broadcast
ip nat inside
!
interface ATM0
no ip address
no ip directed-broadcast
no atm ilmi-keepalive
bundle-enable
hold-queue 208 in
!
interface ATM0.1 point-to-point
no ip directed-broadcast
pvc 1/100
 encapsulation aal5snap
!
bridge-group 1
!
interface ATM0.2 point-to-point
ip address 5.0.0.2 255.0.0.0
no ip directed-broadcast
pvc 1/101
 protocol ip 5.0.0.1 broadcast
 protocol ip 5.0.0.5 broadcast
 encapsulation aal5snap
!
!
interface BVI1
ip address dhcp client-id Ethernet0
no ip directed-broadcast
ip nat outside
!
ip nat inside source list 1 interface BVI1 overload
ip classless
ip route 0.0.0.0 0.0.0.0 BVI1
no ip http server
!
access-list 1 permit 10.10.10.0 0.0.0.255
bridge 1 protocol ieee
bridge 1 route ip
!
voice-port 1
timing hookflash-in 0
!
voice-port 2
timing hookflash-in 0
!
voice-port 3
timing hookflash-in 0
!
voice-port 4
timing hookflash-in 0
!
!
line con 0
exec-timeout 0 0
transport input none
stopbits 1
line vty 0 4
```

```
password lab
login
!
scheduler max-task-time 5000
end
```

Downloading Images

Delete files in the router Flash memory before attempting to download new images.

Caution Use the **delete** command, not the **erase command**, to free up space. Entering the **erase** command removes all files, including the configuration.

Flash Memory

Cisco 800 series routers use 4 MB of Flash memory for storing internal information such as the ROM monitor. Only the remainder of the Flash memory is available for storing Cisco IOS images and is displayed by using the **show flash** command. For example, if the router reports 8 MB of Flash, the actual amount of onboard Flash memory is 12 MB, even though only 8 MB are displayed and available for Cisco IOS image storage.

Multilink PPP and Interleaving

Multilink PPP fragments large data packets to allow small voice packets to be interleaved between them. However, apart from FIFO queuing, no other kind of output queuing mechanisms are currently supported with PPP over ATM. Consequently, when multilink PPP is configured on the Cisco 800 series routers, large packets are fragmented, but small voice packets are not interleaved between them.

NAT Support for H.323 Signaling

NAT does not support alerting H.225 messages; therefore, NAT communication cannot be established between router end points. NAT support for H.323 signaling is limited to the application NetMeeting.

PPP over AAL5SNAP Encapsulation Support

PPP over AAL5SNAP encapsulation is currently not supported, although the context sensitive help mentions that it can be configured.

Cisco 800 Series Router Clock—CSCdp09409

To run IP Security (IPSec) successfully, the Cisco 800 series router clock needs to be set accurately. Cisco 800 series router clocks are set and maintained using Simple Network Time Protocol (SNTP). For best results, set up a Network Time Protocol (NTP) server to periodically send time information messages to Cisco 800 series routers. See the SNTP configuration and command reference documentation for configuration instructions. If you do not have an NTP server, you must reset the Cisco 800 series router clock using the **clock set** command each time you restart the router.

Dial Peer Limitation

The **isdn answer1** and **isdn answer2** commands determine which called telephone numbers, for example, 555-1111 and 555-2222, a Cisco 800 series router can answer. Using these commands limits a router to using the two dial peers that contain the telephone numbers 555-1111 and 555-2222. (When not using these commands, a router can use up to six dial peers.)

A sample scenario in which the **isdn answer1** and **isdn answer2** commands are used is when a Cisco 801 or Cisco 803 router is connected with other ISDN devices to an ISDN S-bus.

Excessive ISDN Line Activation

The following protocols send updates that can cause an ISDN line to be activated excessively, thereby increasing your monthly ISDN line cost:

- IP
- User Datagram Protocol (UDP)
- Internetwork Packet Exchange (IPX)
- Cisco Discovery Protocol (CDP)
- Simple Network Time Protocol (SNTP)

For information on preventing this situation, refer to the *Cisco 800 Series Routers Software Configuration Guide*. This guide contains information on setting up extended access lists to prevent IP, UDP, IPX, and SNTP updates from activating the ISDN line. For CDP, make certain that you enter the **no cdp enable** command to disable CDP.

Hanging During Boot

If an illegal console configuration is issued to the router, the console will fail the POST test during boot and cause the router to hang. There is no way to recover a unit in this state except by pulling the soldered boot Flash and reburning the boot ROM.

This problem has been resolved in TinyROM version 1.0(3), a downloadable ROM upgrade available from Cisco.com. Please contact Cisco to upgrade to this version or later, and prevent this problem from occurring.

Phone Mate Answering Machine Model 9200

A Phone Mate answering machine model 9200 failed to recognize the ringing signal sent by AMD R79 ringing SLIC. This was confirmed by testing against Phone Mate model 3750 and newer model 9300.

B Channel Activation

When a call comes in, a B channel is activated. If the amount of traffic on the B channel exceeds a threshold, the other B channel is activated. If the amount of traffic falls below the threshold, one of the B channels is deactivated. The B channel that is initially activated when the call comes in is not necessarily B1, nor is the B channel that is deactivated when the traffic level lessens necessarily B2.

Cisco uBR924 Cable Access Router

This section contains the following sections with information that is specific to the Cisco uBR924 cable access router:

Introduction

The DOCSIS-based Cisco uBR924 cable access router gives residential or small office/home office (SOHO) subscribers high-speed Internet or intranet access. The Cisco uBR924 cable access router supports both data traffic and packet voice and fax traffic via a shared two-way cable system and IP backbone network. The Cisco uBR924 cable access router connects computers and other customer premises devices at a subscriber site to the service provider's cable, hybrid-fiber coaxial (HFC), and IP backbone network.

The Cisco uBR924 cable access router is based on Data-over-Cable Service Interface Specifications (DOCSIS) and interoperates with any bidirectional, DOCSIS-qualified cable modem termination system (CMTS). The Cisco uBR924 cable access router ships from the Cisco factory with a Cisco IOS software image stored in nonvolatile Flash memory that supports DOCSIS-compliant bridging data operations. The Cisco uBR924 cable access router functions as a cable modem at the subscriber site to convey data communications on the cable television system.

Based on the feature licenses your company purchased, other Cisco IOS images can be downloaded from Cisco.com. Special operating modes, based on your service offering and the practices in place for your network, can be supported for the Cisco uBR924 router, based on the available images in Cisco IOS Release 12.2. The Cisco uBR924 Cable Access Router can also function as an advanced router, providing WAN data connectivity in a variety of configurations.

Note All Cisco uBR924 Cable Access Router images support DOCSIS Baseline Privacy Interface (BPI) encryption. BPI is subject to export restrictions.

Cisco uBR924 Cable Access Router

The Cisco uBR924 Cable Access Router features a single F-connector interface to the cable system, four RJ-45 (10BASE-T Ethernet) hub ports, two RJ-11 Foreign Exchange Station (FXS) voice ports, one RJ-11 port for an optional backup analog telephone line connection, and one RJ-45 console port to connect to a laptop computer/console terminal for local Cisco IOS configuration. The Cisco uBR924 Cable Access Router supports voice and data Cisco IOS software images; available feature sets include Easy IP, Firewall Phase II (Cisco Secure Integrated Software), and IP Security (IPSec).

Memory Recommendations

For memory recommendations for the Cisco uBR924 cable access router in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Headend Interoperability

Cisco Cable Clock Card Support

When using Cisco IOS Release 12.1(1)T or greater, the Cisco uBR924 cable access router automatically supports the Cisco Cable Clock Card feature for voice traffic when the CMTS is a Cisco uBR7200 series universal broadband router with the Cisco Cable Clock Card feature.

DOCSIS Concatenation

If using DOCSIS concatenation with a 16-QAM (quadrature amplitude modulation) symbol rate, the CMTS must be configured for Unique Word 16 in the preamble for both short and long data burst profiles. On the Cisco uBR7200 series universal broadband routers, use the **cable modulation-profile** global configuration command and specify "uw16" for both the long and short modulation profiles.

DOCSIS 1.0+ Extensions

Cisco IOS Release 12.2 images support the Cisco DOCSIS 1.0+ Extensions, which include dynamic multi-SID assignment and concatenation. To use the dynamic multi-SID and concatenation features, both the Cisco uBR924 router and the CMTS router must support them. If you are using the Cisco uBR7200 series headend equipment as the CMTS router, Cisco IOS Release 12.0(7)XR, Release 12.1(1)T, or greater is required on both the Cisco uBR924 cable access router and the CMTS router to ensure that these features are activated.

To configure the Cisco uBR924 cable access router to support multiple classes of service, use either the Cisco Subscriber Registration Center (CSRC) tool or the configuration file editor of your choice. DOCSIS configuration files can contain multiple classes of service (CoS) to support voice. The first CoS is used for data (and voice if no other CoS is defined), and up to three additional classes of service can be defined to give higher priority for voice traffic.

IPSec Encryption Support

To use IPSec encryption, both the Cisco uBR924 cable access router and the destination endpoint must support IPSec encryption and be configured for the same encryption policy. The endpoint is typically an IPSec gateway such as a peer router, PIX Firewall, or other device that can be configured for IPSec. (The CMTS does not need to support IPSec encryption unless it is desired that the CMTS act as an IPSec gateway.)

Note The IPSec feature set encrypts traffic sent between endpoints, such as between two Cisco uBR924 cable access routers, to protect traffic sent across the Internet and other unprotected networks. The DOCSIS BPI feature encrypts traffic on the cable interface, between the Cisco uBR924 cable access router and the CMTS. To use BPI encryption, both the Cisco uBR924 cable access router and the CMTS must support and enable BPI encryption.

Voice Protocol Support

When using a voice-enabled Cisco IOS Release 12.1 image, the Cisco uBR924 cable access router can packetize and transport voice in compliance with the H.323 protocol. H.323v2 is integrated in Cisco gatekeeper/gateway products, such as the Cisco 2600 series and Cisco 3600 series, using Cisco IOS Release 12.0(5)T. The gatekeeper must be running Cisco IOS Release 12.0(5)T or greater to support registration of the full E.164 address for each Cisco uBR924 Cable Access Router voice port.

The Cisco uBR924 cable access router also supports the Simple Gateway Control Protocol (SGCP) when using voice-enabled Cisco IOS Release 12.1 images. SGCP is an alternative to the H.323 protocol that provides signaling and feature negotiation via a remote Call Agent. SGCP eliminates the need for a dial plan mapper. It also eliminates the need for static configuration on the router to map IP addresses to telephone numbers because this function is provided by the remote Call Agent.

Hardware Supported

The Cisco uBR924 cable access router contains the following interfaces:

- A single F-connector interface to the cable system.
- Four RJ-45 (10BASE-T Ethernet) hub ports to connect:
  - Up to 254 computers directly to the four Ethernet hub ports at the rear of the Cisco uBR924 router when operating in bridging mode. When operating in routing mode, all four Ethernet hub ports can be connected directly to four computers.

  Note For releases earlier than Cisco IOS Release 12.0(5)T—not 12.1(5)T but 12.0(5)T—, the four Ethernet hub ports support only a maximum of three computers when operating in bridging mode. (The maximum of three computers is for all four ports together—not three computers per port).

  - One of the four Ethernet hub ports at the rear of the Cisco uBR924 router can be connected to an Ethernet hub, which then connects additional computers or devices at the site when operating in routing or bridging mode.
- Two RJ-11 Foreign Exchange Station (FXS) ports connect telephones and fax devices to the cable system and IP backbone; the router ships from the Cisco factory with the voice ports enabled. The FXS ports on the Cisco uBR924 router can be connected to analog telephones or fax machines but cannot be used for PBX extensions.
- One RJ-11 port connects to a standard, analog telephone line (optional) to provide a backup plain old telephone service (POTS) connection to the Public Switched Telephone Network (PSTN). The backup port becomes operational if the Cisco uBR924 router loses power or its connection to the cable network.
- One RJ-45 console port (optional) to connect to a laptop computer or console terminal when locally configuring the Cisco uBR924 router; the router ships from the Cisco factory with the console port enabled.

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Limitations and Restrictions

Bridging Support

The Cisco uBR924 Cable Access Router interoperates with DOCSIS cable networks. Cisco IOS Release 12.1 T does not support bridging traffic across a non-DOCSIS cable network.

Detecting Carrier Sense Errors

The Cisco uBR924 cable access router cannot detect carrier sense errors on the four Ethernet ports that connect the router to the subscriber's local area network. This limitation is because the four Ethernet ports are provided by an internal hub that always provides a carrier sense signal to the Cisco IOS software, even if no Ethernet devices are connected to the external ports. In particular, this means that the dot3StatsCarrierSenseErrors attribute in ETHERLIKE-MIB (RFC 2665) will never indicate any drops in carrier of the Ethernet interface.

DOCSIS CLI Commands Are Removed

To comply with DOCSIS requirements that restrict access to commands that change DOCSIS parameters, Cisco IOS Release 12.1(2)T has removed a number of commands from the command line interface (CLI). These commands are now reserved exclusively for DOCSIS use.

IP Address Negotiation

The DOCSIS specifications require that a cable modem obtain its IP address at power-on or reset from a Dynamic Host Configuration Protocol (DHCP) server that is available through the cable interface. For this reason, the Cisco uBR924 cable access router defaults to a configuration that uses the **ip address docsis** command for the cable interface. It is not possible to override this setting by specifying a specific static IP address; to assign a static IP address to the Cisco uBR924 router, configure the DHCP server so that it assigns the desired IP address on the basis of the unit's MAC address. However, service providers should warn subscribers that changes in the topology of the cable network—because of traffic levels, growth, or changes to the cable plant and other hardware—might still require changing the subnets and IP addresses assigned to a particular cable modem.

Note The **ip address negotiated** and **ip address dhcp** commands cannot be used on the cable interface. Previous versions of Cisco IOS used these commands for the Cisco uBR924 router but Release 12.2 uses the **ip address docsis** command to avoid conflicts these other commands might have with DOCSIS operations.

Upgrading Software Images Using BPI

To enable BPI encryption, the Cisco uBR924 cable access router must use a Cisco IOS image that supports BPI encryption. If the router's current software image does not support BPI encryption (or if the current software image is corrupted), you must disable BPI encryption in the DOCSIS configuration file and reset the router before you will be able to download a new software image.

Using Access Lists with IPSec Images

Access lists 100 and 101 should never be manually configured on the Cisco uBR924 cable access router. Configuring these access lists with Cisco IOS Release 12.1 T images that support any form of IPSec encryption can crash the router. Use any access lists 102 through 199 instead.

Using Multiple PCs with the Cisco uBR924 Cable Access Router

The "MAX CPE" parameter in a Cisco uBR924 cable access router's DOCSIS configuration file determines how many PCs (or other customer premises equipment [CPE] devices) are supported by the Cisco uBR924 cable access router. The default value for the "MAX CPE" parameter is 1, which means only one PC can be connected to the Cisco uBR924 cable access router.

The DOCSIS 1.0 specification states that a CMTS cannot age out MAC addresses for CPE devices, so the first PC that is connected to the Cisco uBR924 cable access router is normally the only one that the CMTS recognizes as valid. If a subscriber replaces an existing PC or changes its network interface card (NIC) to one that has a different MAC address, the CMTS will refuse to let the PC come online because this would exceed the maximum number of CPE devices specified by the "MAX CPE" parameter. A similar result would occur if a user decided to move a PC from one Cisco uBR924 router to another.

To allow a subscriber to replace an existing PC or NIC, the following workarounds are possible:

- If using a Cisco uBR7200 series router as the CMTS, enter the **clear cable host** *MAC-address* command on the Cisco uBR7200 series router to remove the PC's MAC address from the router's internal address tables. The new PC will be rediscovered and associated with the correct Cisco uBR924 cable access router during the next DHCP lease cycle.
- Increase the value of the "MAX CPE" parameter in the Cisco uBR924 cable access router's DOCSIS configuration file so that it can accommodate the desired number of PCs. Reset the Cisco uBR924 cable access router to force it to load the new configuration file.

Using the Reset Switch

The reset switch on the back panel of the Cisco uBR924 cable access router is recessed to prevent accidental resets of the router. To depress the switch, use a blunt object, such as a pen or pencil point; do not use a sharp object, such as a knife or awl, because this could damage the switch and the router's circuitry.

Additional Notes for the Cisco uBR924 Cable Access Router

CPE Device Filtering

In Cisco IOS Release 12.1(2)T and above, the "docsDevCpeIpMax" attribute defaults to -1 instead of the previous default of 1. This attribute controls the maximum number of CPE devices that can pass traffic through the router from its Ethernet interface as follows:

- When "docsDevCpeIpMax" is set to -1, the Cisco uBR924 cable access router does not filter any IP packets on the basis of their IP addresses, and CPE IP addresses are not added to the "docsDevFilterCpeTable" table.
- When "docsDevCpeIpMax" is set to 0, the Cisco uBR924 cable access router does not filter IP packets on the basis of the IP addresses. However, the source IP addresses are still entered into the "docsDevFilterCpeTable" table.
- When "docsDevCpeIpMax" is set to a positive integer, it specifies the maximum number of IP addresses that can be entered into the "docsDevFilterCpeTable" table. The Cisco uBR924 cable access router compares the source IP address for packets it receives from CPE devices to the addresses in this table. If a match is found, the packet is processed; otherwise, the packet is dropped.

CPE IP address filtering is done as part of the following process:

1. MAC address filtering—Packets are filtered on the basis of the CPE device's MAC address. This is controlled by the value of the "MAX CPE" parameter, which is set in the DOCSIS configuration file.

2. Link Level Control (LLC) filtering—Packets are filtered on the basis of the packet's protocol. This is controlled by the "docsDevFilterLLCTable" table.
3. CPE IP address filtering—Packets are filtered on the basis of the CPE device's IP address, as controlled by the "docsDevCpeIpMax" attribute and the "docsDevFilterCpeTable" table.
4. Access list filtering—Packets are filtered on the basis of access lists. IP filtering is controlled by the "docsDevFilterIpTable" table, and SNMP access filters are controlled by the "docsDevNmAccessTable" table.

Refer to the DOCS-CABLE-DEVICE-MIB.my MIB for more information on the attributes and tables listed above.

Disabling the Finger Server

By default, the Cisco uBR900 series cable access router enables its onboard TCP/IP "finger" server to allow remote users to query the number and identities of any users who are logged in to the router. Unless your network operations center (NOC) requires this service, it should be disabled to prevent denial-of-service attacks that access the finger server's well-known port (TCP port 79). To disable the finger server, include the **no service finger** command in the Cisco IOS configuration file that the router downloads at initial power-on.

Supplemental and Corrected Text for the Online Feature Module

Troubleshooting Tips for the uBR924 cable access router, page 15, indicates:

> "Some CATV systems use alternative frequency plans such as the IRC (Incrementally Related Carrier) and HRC (Harmonically Related Carrier) plans. Most of the IRC channel slots overlap the EIA plan. The HRC plan is not supported by Cisco's cable access routers since so few cable plants are using this plan."

The correction should read:

> "For the Cisco uBR924 cable access router, both the IRC (Incrementally Related Carrier) and HRC (Harmonically Related Carrier) plans are supported. Most of the IRC channel slots overlap the EIA plan. For the Cisco uBR924 cable access router, both the IRC and HRC plans are supported.
>
> "The list of downstream search bands added for HRC have appropriate center frequencies and step values for an HRC channel plan. The expanded search band list may increase the amount of time required by the Cisco uBR924 cable access router to acquire the downstream signal on the HRC channel plan, which can add to the total time for complete registration of the modem the very first time it is added to the cable system."

Supported MIBs

The Cisco uBR924 cable access router supports the following categories of MIBs:

- Cable Device MIBs—These MIBs are for DOCSIS-compliant cable modems and CMTS to record statistics related to the configuration and status of the cable modem. These MIBs include support for the MIB attributes defined in RFC 2669.
- Cisco's Standard MIBs—These MIBs are common across most of Cisco's router platforms. If your network management applications are already configured to support other Cisco routers, such as the Cisco 2600 series or Cisco 7200 series, no further configuration is needed unless the version of Cisco IOS software being used has updated these MIBs.
- Cisco Voice MIBs—These MIBs are common across Cisco's router platforms that support Voice over IP (VoIP). These MIBs provide access to voice-related parameters and statistics, including the SGCP protocol.

- Radio Frequency Interface (RFI) MIBs—These MIBs are for DOCSIS-compliant radio frequency interfaces in cable modems and CMTS. These MIBs include support for the MIB attributes defined in RFC 2670.
- SNMP Standard MIBs—These are the MIBs required by any agent supporting SNMPv1 or SNMPv2 network management.
- Cable-specific MIBs—These MIBs provide information about the cable interface and related information on the Cisco uBR924 Cable Access Router. They include both DOCSIS-required MIBs and Cisco-specific enterprise MIBs. If your network management applications have not already been configured for the Cisco uBR924 Cable Access Router, these MIBs must be loaded.
- Deprecated MIBs—These MIBs were supported in earlier releases of Cisco IOS software but have been replaced by more standardized, scalable MIBs. Network management applications and scripts should convert to the replacement MIBs as soon as possible.

Cable Device MIBs

The Cisco uBR924 Cable Access Router supports the Cable Device MIB, which is defined by RFC 2669 and describes DOCSIS-compliant cable modems and CMTS. The Cable Device MIB records statistics related to the configuration and status of the cable modem. Statistics include an events log and device status. The following list details the components of the Cable Device MIB:

- **"docsDevBase"** group extends the MIB-II "system" group with objects needed for cable device system management.
- **"docsDevNmAccess"** group provides a minimum level of SNMP access security.
- **"docsDevSoftware"** group provides information for network downloadable software upgrades.
- **"docsDevServe"** group provides information about the progress of interaction with various provisioning servers.
- **"docsDevEven"** group provides information about the progress of reporting.
- **"docsDevFilter"** group configures filters at the link layer and IP layer for bridge data traffic.

The Cable Device MIB is very similar to the RFI MIB in that both allow access to statistics; they are different in that the Cable Device MIB reports statistics on the cable modem, while the RFI MIB reports statistics on the radio frequency transmissions over the cable television line.

Cisco Standard MIBs

The Cisco uBR924 Cable Access Router supports the Cisco Standard MIBs, which consist of the following components:

- CISCO-PRODUCT-MIB
- CISCO-SYSLOG-MIB
- CISCO-FLASH-MIB
- BRIDGE-MIB
- IF-MIB (RFC 2233)
- CiscoWorks/CiscoView support

Note The *Cisco Management Information Base (MIB) User Quick Reference* publication is no longer published. For the latest list of MIBs supported by Cisco, refer to the *Cisco Network Management Toolkit* on Cisco.com. From the Cisco.com home page, click the following:
Products and Services: **Cisco IOS Software**: **Cisco IOS Software Releases 12.2**: **Troubleshooting**: **Bug Toolkit**.

Cisco Voice MIBs

The Cisco uBR924 Cable Access Router supports the Cisco Voice MIBs, which consist of the following components:

- CISCO-VOICE-IF-MIB
- CISCO-VOICE-DIAL-CONTROL-MIB
- CISCO-VOICE-ANALOG-MIB
- CISCO-DIAL-CONTROL-MIB
- DIAL-CONTROL-MIB
- SGCP-MIB
- XGCP-MIB

Radio Frequency Interface MIBs

The Cisco uBR924 Cable Access Router supports the Radio Frequency Interface (RFI) MIB. The RFI MIB module is defined in RFC 2670 and describes DOCSIS-compliant radio frequency interfaces in cable modems and CMTS. On the cable modem, RFI MIB entries provide:

- Upstream and downstream channel characteristics
- Class-of-service attributes
- Physical signal quality of the downstream channels
- Attributes of cable access router MAC interface
- Status of several MAC layer counters

The RFI MIB includes tables that describe both the CMTS and the cable modem side of the cable interface. All cable modem tables are implemented.

With IPSec, data can be transmitted across a public network without fear of observation, modification, or spoofing. This enables applications such as VPNs, extranets, and remote user access.

IPSec services are similar to those provided by Cisco Encryption Technology, a proprietary Cisco security solution. However, IPSec provides a more robust security solution and is standards based.

SGCP and MGCP MIBs

The Cisco uBR924 Cable Access Router supports the Simple Gateway Control Protocol (SGCP) and Media Gateway Control Protocol (MGCP) through a single MIB (XGCP-MIB). This MIB supports configuration, performance, and fault management of the SGCP and MGCP interfaces.

The key attributes of this MIB are as follows:

- xgcplnBadVersions—Number of incoming messages delivered to the protocol entity and that are for an unsupported protocol version.
- xgcpRequestTimeOut—Timeout value used for retransmitting an unacknowledged message.

- xgcpRequestRetries—Number of retries for a request that exceeds timeout.
- xgcpAdminStatus—Desired state of the protocol entity.
- xgcpOperStatus—Current operational status of the protocol entity.
- xgcpUnRecognizedPackets—Number of unrecognized packets since reset.
- xgcpMsgStatTable—Table that contains SGCP statistics information since reset.
- xgcpMsgStatEntry—Row in the "xgcpMsgStatTable" that contains information about SGCP message statistics per IP address of the Media Gateway Controller (MGC).
- xgcpIPAddress—IP address of the MGC.
- xgcpSuccessMessages—Number of successful messages that communicate with the MGC on that IP address.
- xgcpFailMessages—Number of failed messages that communicate with the MGC on that IP address.
- xgcpUpDownNotification—Notification sent when the protocol status changes between up and down.

Note For complete details on the SGCP and MGCP MIB, refer to the XGCP-MIB.my file on the Cisco.com MIB website.

Cable-Specific MIBs

Table 3 shows the cable-specific MIBs that are supported on the Cisco uBR924 Cable Access Router. This table also provides a brief description of each MIB contents and the Cisco IOS software release in which the MIB was initially functional—earlier releases might have had unsupported prototype versions of the MIB; later releases might have added new attributes and functionality.

Note The names given in Table 3 are the filenames for the MIBs as they exist on Cisco's FTP site http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml. Most MIBs are available in both SNMPv1 and SNMPv2 versions; the SNMPv1 versions have *V1SMI* as part of their filenames. Also refer to the Cisco MIB home page at http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml.

Table 3 Supported MIBs for the Cisco uBR924 Cable Access Router

MIB Filename	Description	Release
SNMPv2-SMI.my SNMPv2-SMI-V1SMI.my	This module specifies the Structure of Management Information (SMI) for SNMPv2, as defined in RFC 1902.	12.0(4)XI
SNMPv2-TC.my SNMPv2-TC-V1SMI.my	This module defines the textual conventions as specified in pages 4 and 10–11 of RFC 854.	12.0(4)XI
CISCO-SMI.my CISCO-SMI-V1SMI.my	This module specifies the SMI for Cisco's enterprise MIBs.	12.0(4)XI
CISCO-TC.my CISCO-TC-V1SMI.my	This module defines the textual conventions used in Cisco's enterprise MIBs.	12.0(4)XI

Table 3 Supported MIBs for the Cisco uBR924 Cable Access Router (Continued)

MIB Filename	Description	Release
IF-MIB.my IF-MIB-V1SMI.my	This module describes generic objects for the Layer 3 network interface sublayers. This MIB is an updated version of MIB-II's *if* table and incorporates the extensions defined in RFC 2233.	12.0(4)XI RFC 2233 support: 12.1(2)T
CISCO-CABLE-SPECTRUM-MIB.my CISCO-CABLE-SPECTRUM-MIB-V1SMI.my	This module describes the spectrum management flap list attributes.	12.0(5)T1
DOCS-IF-MIB.my DOCS-IF-MIB-V1SMI.my	This module describes the DOCSIS-compliant Radio Frequency (RF) interfaces in cable modems and cable modem termination systems, as described in RFC 2670.	12.0(4)XI RFC 2670 support: 12.1(1)T
DOCS-BPI-MIB.my DOCS-BPI-MIB-V1SMI.my	This module describes the attributes for the DOCSIS-specified Baseline Privacy Interface (BPI) on cable modems and the CMTS.	12.0(5)T
CISCO-DOCS-EXT-MIB.my CISCO-DOCS-EXT-MIB-V1SMI.my	This module extends the DOCSIS standard RFI MIB (DOCS-IF-MIB) with Cisco-specific extensions, such as QoS attributes and connection status and other information regarding the cable modems and CPE devices supported by the CMTS. **Note** Cisco IOS releases prior to 12.0(5)T1 provide only partial support for the attributes in this MIB.	Partial support: 12.0(4)XI Full support: 12.0(5)T1
DOCS-CABLE-DEVICE-MIB.my DOCS-CABLE-DEVICE-MIB-V1SMI.my	This module was previously known as the CABLE-DEVICE-MIB and contains cable-related objects for DOCSIS-compliant cable modems, as specified in RFC 2669.	12.0(4)XI RFC 2669 support: 12.1(1)T

Note Because of interdependencies, the MIBs must be loaded in the order given in the table.

Deprecated MIBs

A number of Cisco-provided MIBs have been replaced with more scalable, standardized MIBs. These deprecated MIBs have filenames that start with "*OLD*", and they first appeared in Cisco IOS Release 10.2. The functionality of these MIBs has already been incorporated into replacement MIBs, but the old MIBs are still present to support existing Cisco IOS products or network management system (NMS) applications. However, because the deprecated MIBs will be removed from support in the future, you should update your network management applications and scripts to refer to the table names and attributes that are found in the replacement MIBs.

Table 4 shows the deprecated MIBs and their replacements. In most cases, SNMPv1 and SNMPv2 replacements are available, but some MIBs are available only in one version. A few of the deprecated MIBs do not have replacement MIBs; support for these MIBs will be discontinued in a future release of Cisco IOS software.

Table 4 Replacements for Deprecated MIBs

	Replacement MIBs	
Deprecated MIB	**SNMPv1 MIB**	**SNMPv2 MIB**
OLD-CISCO-APPLETALK-MIB	RFC1243-MIB	—
OLD-CISCO-CHASSIS-MIB	ENTITY-MIB-V1SMI	ENTITY-MIB
OLD-CISCO-CPU-MIB	—	CISCO-PROCESS-MIB
OLD-CISCO-DECNET-MIB	—	—
OLD-CISCO-ENV-MIB	CISCO-ENVMON-MIB-V1SMI	CISCO-ENVMON-MIB
OLD-CISCO-FLASH-MIB	CISCO-FLASH-MIB-V1SMI	CISCO-FLASH-MIB
OLD-CISCO-INTERFACES-MIB	IF-MIB-V1SMI CISCO-QUEUE-MIB-V1SMI	IF-MIB CISCO-QUEUE-MIB
OLD-CISCO-IP-MIB	—	—
OLD-CISCO-MEMORY-MIB	CISCO-MEMORY-POOL-MIB-V1SMI	CISCO-MEMORY-POOL-MIB
OLD-CISCO-NOVELL-MIB	NOVELL-IPX-MIB	—
OLD-CISCO-SYS-MIB	(Compilation of other OLD* MIBS)	
OLD-CISCO-SYSTEM-MIB	CISCO-CONFIG-COPY-MIB-V1SMI	CISCO-CONFIG-COPY-MIB
OLD-CISCO-TCP-MIB	CISCO-TCP-MIB-V1SMI	CISCO-TCP-MIB
OLD-CISCO-TS-MIB	—	—
OLD-CISCO-VINES-MIB	CISCO-VINES-MIB-V1SMI	CISCO-VINES-MIB
OLD-CISCO-XNS-MIB	—	—

Note Some of the MIBs listed in Table 4 represent feature sets that are not supported on the Cisco uBR924 Cable Access Router.

Troubleshooting uBR Cable Modems Not Coming Online

The tech note *Troubleshooting uBR Cable Modems Not Coming Online* is available on Cisco.com at the following location:

http://www-tac.cisco.com/Teams/esupport/Cable/troubleshooting_cm_online_from_ac.html

This tech note discusses the different states that cable modems go through before coming online and establishing IP connectivity. The tech note highlights the most commonly used Cisco IOS troubleshooting commands to verify what state the CM is in and the reasons that can cause the modem to arrive at that state. This is illustrated by debug and show commands at both the CMTS and the CM. The tech note also discusses some of steps that can be taken to arrive at the correct status, online.

Cisco 1400 Series Routers

This section contains the following sections with information that is specific to the Cisco 1400 series routers:

Memory Recommendations

For memory recommendations for the Cisco 1400 series routers in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Cisco IOS Release 12.2 supports the Cisco 1400 series routers:

- Cisco 1401
- Cisco 1417

Following are some of the key features of the Cisco 1400 series:

- ATM-25 port (Cisco 1401 router)—For connecting through a digital subscriber line (DSL) modem over an asymmetric digital subscriber line (ADSL) line to a central service provider.
- ADSL port (Cisco 1417 router)—For connecting directly over an ADSL line to a central service provider.
- Console port—For connecting a terminal or PC to configure and manage the router. Supports up to 9600 bps (up to 115.2 kbps for software download).
- Supports IP, Internetwork Packet Exchange (IPX), PPP over ATM, and firewall security.
- Supports ATM features such as ATM Adaption Layer 5, ATM permanent virtual connections (PVCs), and RFC 1483.
- Supports Simple Network Management Protocol (SNMP) for management over an SNMP network.
- Supports Cisco ATM MIB.

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Additional Notes for the Cisco 1400 Series Routers

Multipartition Flash Default

When using a multipartition Flash memory card, the various Flash partitions are referred to as “flash:1:”, “flash:2:”, and so on. If you specify only “flash” in a multipartition Flash, the parser assumes “flash:1:”. For example, if you enter the **show flash all** command the parser defaults to “show flash:1: all” and only the Flash information for the first partition displays. To see information for all Flash memory partitions, enter **show flash ?**. This will list all of the valid partitions. Then enter **show flash:xx: all** on each valid partition.

Traffic Shaping

On the ATM25 interface of the Cisco 1400 series there are two types of traffic shaping: hardware-based and software-based. Hardware-based traffic shaping is provided by the ATM SAR chip and is enabled on a per-PVC basis by one of the following Cisco IOS PVC configuration commands:

```
ubr     <peak-cell-rate>
ubr+    <peak-cell-rate> <minimum-guaranteed-cell-rate>
vbr-nrt <peak-cell-rate> <sustainable-cell-rate> <maximum-burst-size>
```

The SAR chip has “rate counters” that control the rate at which the current buffer up for segmentation is going to be transmitted. Ideally, the SAR chip could be programmed with values for all of the above command parameters. Unfortunately, it only has the rate counters, which specify a divisor of the basic line rate of 25 Mbps and which really sets the maximum transmission rate (peak-cell-rate) for the channel. Note that with the **ubr** and **ubr+** commands, the rate counter for the PVC is obtained from the <peak-cell-rate> parameter. With the **vbr-nrt** command, the rate counter is obtained from the <sustainable-cell-rate> parameter. While the <minimum-guaranteed-cell-rate> parameter in the **ubr+** command and the <peak-cell-rate> parameter in the **vbr-nrt** command can be specified by the user, they are ignored by the ATM25 driver.

Software-based traffic shaping is enabled on a per-interface basis via the **traffic-shape** interface configuration command. For performance reasons, and since for ATM interfaces you most likely want to do shaping on a per-PVC basis, the ATM driver does not support software-based traffic shaping while fast-switching. However, if fastswitching is disabled and the **traffic-shape** interface configuration command is enabled, software traffic shaping will occur. (See CSCdk28377 for more information.)

Cisco 1600 Series Routers

This section contains the following sections with information that is specific to the Cisco 1600 series routers:

Memory Recommendations

For memory recommendations for the Cisco 1600 series routers in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Cisco IOS Release 12.2 supports the Cisco 1600 series routers:

- Cisco 1601, Cisco 1601-R
- Cisco 1602, Cisco 1602-R
- Cisco 1603, Cisco 1603-R
- Cisco 1604, Cisco 1604-R
- Cisco 1605-R

Cisco 1600 series routers have two memory architectures: one run-from-Flash (RFF) and one run-from-RAM (RFR). Router model names with an R are RFR routers; all other models are RFF. In this document, model names without an R refer to both RFF and RFR models, except where otherwise noted.

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Table 5 lists the supported interfaces for the Cisco 1600 series routers for Cisco IOS Release 12.2.

Table 5 Supported Interfaces for the Cisco 1600 Series Routers

Interface, Network Module, or Data Rate	Platforms Supported
1 Ethernet port	Cisco 1601–1604
1 built-in WAN port	Cisco 1601–1604
1 WAN interface-card expansion slot	Cisco 1601–1604
1 built-in serial WAN port	Cisco 1601
1 onboard 56-kbps 4-wire DSU/CSU	Cisco 1602
1 ISDN BRI S/T port	Cisco 1603
ISDN BRI U interface with a built-in NT 1 device	Cisco 1604
2 Ethernet LAN interfaces	Cisco 1601-R–1605-R

Table 5 Supported Interfaces for the Cisco 1600 Series Routers (Continued)

Interface, Network Module, or Data Rate	Platforms Supported
1-port ISDN BRI with S/T interface	Cisco 1601, Cisco 1602, Cisco 1601-R–1605-R
1-port synchronous/ asynchronous serial	Cisco 1600 series
1-port ISDN BRI with integrated NT1 and with a U interface	Cisco 1601, Cisco 1602, Cisco 1601-R–1605-R
1-port ISDN Leased Line BRI S/T WAN interface	Cisco 1603, Cisco 1604
1-port 56/64-kbps DSU/CSU WAN interface	Cisco 1600 series
1-port T1/Fractional T1 DSU/CSU WAN interface	Cisco 1600 series

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Cisco 1700 Series Routers

This section contains the following sections with information that is specific to the Cisco 1700 series routers:

Memory Recommendations

For memory recommendations for the Cisco 1700 series routers in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Cisco IOS Release 12.2 supports the Cisco 1700 series routers:

- Cisco 1720—Runs data images only.
- Cisco 1750—Runs data and data-plus-voice images.

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Cisco 1720

The 1720 router provides Internet and intranet access and includes the following:

- Support for virtual private networking
- Modular architecture
- Network device integration

The Cisco 1720 router has the following hardware components:

- One autosensing 10/100 Fast Ethernet port, which operates in full- or half-duplex mode (with manual override available)
- Two WAN interface card slots
- One auxiliary (AUX) port (up to 115.2 kbps asynchronous serial)
- One console port
- RISC processor for high performance encryption
- One internal expansion slot for support of hardware-assisted services such as encryption (up to T1/E1) and compression
- DRAM memory: 16 MB default, expandable to 48 MB
- Flash memory: 4 MB default, expandable to 16 MB
- Desktop form factor

The Cisco 1720 router supports any combination of one or two of the following WAN interface cards, which are shared with the Cisco 1600, 2600, and 3600 series routers:

- WIC-1T: One port high speed serial (sync/async)
- WIC-2T: Two port high speed serial (sync/async)
- WIC-2A/S: Two port low speed serial (sync/async) (up to 128 kbps)
- WIC-1B-S/T: One port ISDN BRI S/T
- WIC-1B-U: One port ISDN BRI U
- WIC-1DSU-56K4: One port integrated 56/64-kbps 4-wire DSU/CSU
- WIC-1DSU-T1: One port integrated T1/Fractional T1 DSU/CSU

Cisco 1750

The voice-and-data capable Cisco 1750 router provides global Internet and company intranet access and includes the following:

- Voice-over-IP (VoIP) voice-and-data functionality; the router can carry voice traffic (for example, telephone calls and faxes) over an IP network.
- Support for virtual private networking.
- Modular architecture.
- Network device integration.

The Cisco 1750 router has the following hardware components:

- One autosensing 10/100 Fast Ethernet port, which operates in full- or half-duplex mode (with manual override available).
- One voice interface card slot—Supports a single voice interface card with two ports per card.
- Two WAN interface card slots for either WAN interface cards (WICs) or voice interface cards (VICs).
- Synchronous serial interfaces on serial WAN interface cards.
- Asynchronous serial interfaces on serial WAN interface cards.
- ISDN WAN interface cards—ISDN dialup and ISDN leased line (IDSL) at 144 kbps; encapsulation over ISDN leased line: Frame Relay and PPP.
- One auxiliary (AUX) port (up to 115.2 kbps asynchronous serial).
- One console port.
- One internal expansion slot—Supports hardware-assisted services such as encryption (up to T1/E1) and compression processor.
- RISC processor—Motorola MPC860T PowerQUICC at 48 MHz.
- One security slot that supports Kensington or similar lockdown equipment.
- DRAM memory: 16 MB default, expandable to 48 MB.
- Flash memory: 4 MB default, expandable to 16 MB.
- Desktop form factor.
- Australian FXO-M3.

The Cisco 1750 router also supports any combination of one or two of the following WAN interface cards, which are shared with the Cisco 1600, 1720, 2600, and 3600 routers:

- WIC-1T: One port high speed serial (sync/async) (T1/E1)
- WIC-2T: Two port high speed serial (sync/async) (T1/E1)
- WIC-2A/S: Two port low speed serial (sync/async) (up to 128 kbps)
- WIC-1B-S/T: One port ISDN BRI S/T
- WIC-1B-U: One port ISDN BRI U with integrated NT1
- WIC-1DSU-56K4: One port integrated 56/64-kbps 4-wire DSU/CSU
- WIC-1DSU-T1: One port integrated T1/Fractional T1 DSU/CSU

The Cisco 1750 router supports any combination of one or two of the following voice interface cards, which are shared with the Cisco 2600 and 3600 series routers:

- VIC-2FXS: Two port Foreign Exchange Station (FXS) voice/fax interface card for voice/fax network module
- VIC-2FXO: Two port Foreign Exchange Office (FXO) voice/fax interface card for voice/fax network module
- VIC-2FXO-EU: Two port FXO voice/fax interface card for Europe
- VIC-2E/M: Two port Ear & Mouth (E&M) voice/fax interface card for voice/fax network module

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Additional Notes for the Cisco 1700 Series Routers

Using the boot flash Command

Booting a Cisco 1700 series router with the **boot flash** or **boot system flash** commands results in unpredictable behavior. To work around this problem, be sure to enter a colon (:) following both commands (for example, **boot flash:** or **boot system flash:**).

Fan Operation in Cisco 1700 Series Routers

Be advised that the fans in the Cisco 1700 series routers stay off until thermally activated (45°C/115°F).

T.38 Fax Protocol Support on the Cisco 1750 Platform

The T.38 fax protocol is supported on the Cisco 1750 platform. The T.38 fax protocol can be enabled by configuring the **fax protocol t38** command in dial-peer configuration mode.

The T.38 fax protocol is supported in Cisco IOS Release 12.2(3) in all Cisco 1750 platform voice images. Refer to the following document for additional information:

http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121newft/121t/121t3/dt_t38fx.htm

Multipartition Flash Defaults

When using a multipartition flash card, the various flash partitions are referred to as “flash:1:”, “flash:2:”, etc. If you specify only “flash” in a multipartition flash, the parser assumes “flash:1:.” For example, if you enter **show flash all** the parser defaults to “show flash:1: all” and only the flash information for the first partition displays. To see information for all flash partitions, enter **show flash ?**. This will list all of the valid partitions. Then enter **show flash:xx: all** on each valid partition.

Cisco 2500 Series Routers

This section contains the following sections with information that is specific to the Cisco 2500 series routers:

Memory Recommendations

For memory recommendations for the Cisco 2500 series routers in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Cisco IOS Release 12.2 supports the Cisco 2500 series routers:

- Single LAN routers—Models 2502, 2503, 2504, 2520, 2521, 2522, and 2523
- Mission-specific, entry-level routers—Models 2501CF, 2502CF, 2503I, 2504I, 2520CF, 2520LF, 2521CF, 2521LF, 2522CF, 2522LF, 2523CF, and 2523LF
- Router/hub combinations—Models 2505, 2507, and 2516
- Access servers—Models 2509 to 2512
- Dual LAN routers—Models 2513, 2514, and 2515
- Modular routers—Models 2524 and 2525 (optional integrated DSU/CSU or NT-1)

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Table 6 lists the supported interfaces for the Cisco 2500 series routers for Cisco IOS Release 12.2.

Table 6 Supported Interfaces for the Cisco 2500 Series Routers

Interface, Network Module, or Data Rate	Product Description	Platforms Supported
LAN Interfaces	Ethernet (AUI)	Cisco 2501, 2503, 2509, 2511, 2513, 2514, 2520, 2522, and 2524 only
	Ethernet (10BASE-T)	Cisco 2505, 2507, 2516, and 2524 only
	4-Mbps Token Ring	Cisco 2502, 2504, 2513, 2515, 2521, 2523, and 2525 only
	16-Mbps Token Ring	Cisco 2502, 2504, 2513, 2515, 2521, 2523, and 2525 only
WAN Data Rates	48/56/64 kbps	Cisco 2500 series
	128 kbps	Cisco 2500 series
	1.544/2.048 Mbps	Cisco 2500 series

Table 6 Supported Interfaces for the Cisco 2500 Series Routers (Continued)

Interface, Network Module, or Data Rate	Product Description	Platforms Supported
WAN Interfaces	EIA/TIA-232	Cisco 2500 series
	EIA/TIA-449	Cisco 2500 series
	EIA-530	Cisco 2500 series
	X.21	Cisco 2500 series
	V.35	Cisco 2500 series
	Serial and synchronous	Cisco 2500 series
	Serial, synchronous, and asynchronous	Cisco 2520, 2521, 2522, and 2523 only
	ISDN BRI S/T	Cisco 2503, 2504, 2516, 2520, 2521, 2522, 2523, 2524, and 2525 only
	ISDN BRI U	Cisco 2524 and 2525 only

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Cisco 2600 Series Routers

This section contains the following sections with information that is specific to the Cisco 2600 series routers:

Introduction

With the Cisco 2600 series modular access router family, Cisco Systems extends enterprise-class and managed services customer premises equipment (CPE) versatility, integration, and power to branch offices. The widely deployed Cisco 2600 series modular access routers are designed to enable customers to easily adopt future technologies and scale to accommodate network expansion. The Cisco 2600 series shares modular interfaces with the Cisco 1600, Cisco 1700, and Cisco 3600 series, providing a solution to meet today's branch office needs for applications such as:

- Internet/intranet access with firewall security
- Multiservice voice/data integration
- Analog and digital dial access services
- Virtual Private Network (VPN) access
- Inter-VLAN routing
- Routing with bandwidth management

The Cisco 2600 series modular architecture provides the versatility needed to adapt to changes in network technology as new services and applications become available. Driven by a powerful RISC processor, the Cisco 2600 series supports the advanced Quality of Service (QoS), security, and network integration features required in today's evolving enterprise networks.

Memory Recommendations

For memory recommendations for the Cisco 2600 series routers in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Cisco IOS Release 12.2 supports the following Cisco 2600 series routers:

- Cisco 2610–Cisco 2613
- Cisco 2620 and 2621
- Cisco 2650 and 2651
- Cisco 2610XM and Cisco 2611XM
- Cisco 2620XM and Cisco 2621XM
- Cisco 2650XM and Cisco 2651XM

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Table 7 lists the supported interfaces on the Cisco 2600 series routers for Cisco IOS Release 12.2.

Table 7 Supported Interfaces on the Cisco 2600 Series Routers

Interface, Network Module, or Data Rate[1]		Platforms Supported
LAN Interfaces[2]	1- or 2-port Ethernet (10BASE-T)	All Cisco 2600 series platforms
	1-port Token Ring (RJ-45)	Cisco 2612, Cisco 2613
	1- or 2-port 10/100-Mbps Ethernet	Cisco 2620, Cisco 2621, Cisco 2620XM, Cisco 2621XM, Cisco 2650, Cisco 2651[3] Cisco 2650XM, Cisco 2651XM
LAN Network Modules	1-port Ethernet	All Cisco 2600 series platforms
	4-port Ethernet	All Cisco 2600 series platforms
	1-port ATM-25 RJ-45 interface	All Cisco 2600 series platforms
Serial Network Modules	16- or 32-port asynchronous/synchronous serial low speed (128 kbps max)	All Cisco 2600 series platforms
	4- or 8-port asynchronous/synchronous serial low speed (128 kbps max)	All Cisco 2600 series platforms
Multiport T1/E1 ATM Network Modules with Inverse Multiplexing over ATM (IMA)[4]	4-port T1 ATM network module with IMA (NM-4T1-IMA)	All Cisco 2600 series platforms
	4-port E1 ATM network module with IMA (NM-4E1-IMA)	All Cisco 2600 series platforms
	8-port T1 ATM network module with IMA (NM-8T1-IMA)	All Cisco 2600 series platforms
	8-port E1 ATM network module with IMA (NM-8E1-IMA)	All Cisco 2600 series platforms
ATM Network Modules[4]	1-port ATM T3 network module (NM-1A-T3)	All Cisco 2600 series platforms
	1-port ATM E3 network module (NM-1A-E3)	All Cisco 2600 series platforms

Table 7 Supported Interfaces on the Cisco 2600 Series Routers (Continued)

Interface, Network Module, or Data Rate[1]		Platforms Supported
Digital T1 Packet Voice Trunk Network Modules and Spare Components	1-port, 24-channel T1 voice/fax module supports 24 channels of medium-complexity codecs: G.729a/b, G.726, G.711 and fax or 12 channels of G.726, G.729, G.723.1, G.728, G.729a/b, G.711, and fax. Consists of one NM-HDV, two PVDM-12s, and one VWIC-1MFT-T1.[5] Part number: NM-HDV-1T1-24.	All Cisco 2600 series platforms
	1-port, enhanced 24-channel T1 voice/fax module, supports 24 channels of high- and medium-complexity codecs: G.729a/b, G.726, G.729, G.728, G.723.1, G.711, and fax. Consists of one NM-HDV, four PVDM-12s, and one VWIC-1MFT-T1.[4] Part number: NM-HDV-1T1-24E.	All Cisco 2600 series platforms
	2-port, 48-channel T1 voice/fax module supports add/drop multiplexing (drop and insert); 48 channels of medium-complexity codecs: G.729a/b, G.726, G.711, and fax; or 24 channels of G.726, G.729, G.723.1, G.728, G.729a/b, G.711, and fax. Consists of one NM-HDV, four PVDM-12, and one VWIC-2MFT-T1-DI.[4] Part number: NM-HDV-2T1-48.	All Cisco 2600 series platforms
	High-density voice/fax network module spare (NM-HDV)	Digital T1/E1 packet voice trunk network modules spare component
Digital T1 Packet Voice Trunk Network Modules and Spare Components (Continued)	12-channel packet voice DSP module upgrade spare (PVDM-12)	Digital T1/E1 packet voice trunk network modules spare component
	1-port RJ-48 multiflex trunk - T1 (VWIC-1MFT-T1)[4]	Digital T1/E1 packet voice trunk network modules spare component
	2-port RJ-48 multiflex trunk - T1 (VWIC-2MFT-T1)[4]	Digital T1/E1 packet voice trunk network modules spare component
	2-port RJ-48 multiflex trunk with drop and insert - T1 (VWIC-2MFT-T1-DI)[4]	Digital T1/E1 packet voice trunk network modules spare component
Digital E1 Packet Voice Network Modules	1-port 30 Channel E1 High-Density Voice Network Module (NM-HDV-1E1-30)	All Cisco 2600 series platforms
	1-port Enhanced 30 Channel E1 High-Density Voice Network Module (NM-HDV-1E130E)	All Cisco 2600 series platforms
	2-port 60 Channel High-Density Voice Network Module (NM-HDV-2E1-60)	All Cisco 2600 series platforms

Table 7 Supported Interfaces on the Cisco 2600 Series Routers (Continued)

Interface, Network Module, or Data Rate[1]		Platforms Supported
Dial, ISDN and Channelized Serial Network Modules	1- or 2-port channelized T1/ISDN PRI	All Cisco 2600 series platforms
	1- or 2-port channelized T1/ISDN PRI with CSU	All Cisco 2600 series platforms
	1- or 2-port channelized E1/ISDN PRI balanced	All Cisco 2600 series platforms
	1- or 2-port channelized E1/ISDN PRI unbalanced	All Cisco 2600 series platforms
	4-or 8-port ISDN BRI S/T interface	All Cisco 2600 series platforms
	4- or 8-port ISDN BRI U (NT1) interface	All Cisco 2600 series platforms
	8- or 16-port analog modems	All Cisco 2600 series platforms
T1/E1 Multiflex Voice/WAN Interface Cards[6]	1-port T1 multiflex trunk interface (VWIC-1MFT-T1)	All Cisco 2600 series platforms
	1-port E1 multiflex trunk interface (VWIC-1MFT-E1)	All Cisco 2600 series platforms
	2-port T1 multiflex trunk interface (VWIC-2MFT-T1)	All Cisco 2600 series platforms
	2-port E1 multiflex trunk interface (VWIC-2MFT-E1)	All Cisco 2600 series platforms
	2-port T1 multiflex trunk interface with Drop and Insert (VWIC-2MFT-T1-DI)	All Cisco 2600 series platforms
	2-port E1 multiflex trunk interface with Drop and Insert (VWIC-2MFT-E1-DI)	All Cisco 2600 series platforms
Voice/Fax Interface Cards	1- or 2- voice interface card slots	All Cisco 2600 series platforms
	1-slot high-density T1/E1 voice interface card slots[7]	All Cisco 2600 series platforms
	2-port FXS voice/fax interface card[8]	All Cisco 2600 series platforms with voice/fax network modules
	2-port E&M voice/fax interface card[3]	All Cisco 2600 series platforms with voice/fax network modules
	2-port FXO voice/fax interface card[3]	All Cisco 2600 series platforms voice/fax network modules
WAN Interface Cards	1-port ISDN BRI S/T interface (requires external NT1)	All Cisco 2600 series platforms
	1-port ISDN BRI (NT1) U	All Cisco 2600 series platforms
	1-port 56/64-kbps DSU/CSU	All Cisco 2600 series platforms
	1-port T1/Fractional T1 with DSU/CSU	All Cisco 2600 series platforms
	1-port high-speed serial (up to 2.048 Mbps)	All Cisco 2600 series platforms
	2-port dual high-speed serial (up to 2.048 Mbps; asynchronous/synchronous support)	All Cisco 2600 series platforms
	2-port asynchronous/synchronous (up to 128 kbps)	All Cisco 2600 series platforms
Advanced Integration Module	Data compression AIM (up to 8.192 Mbps)	All Cisco 2600 series platforms
	Hardware Encryption AIM	All Cisco 2600 series platforms

1. The voice/fax and ATM-25 network modules require Cisco IOS Plus feature sets.
2. The 1- or 2-port 10/100 Ethernet LAN interface for the Cisco 2620 and Cisco 2621 series routers is only available in Cisco IOS Release 12.0 XC and later.
3. Cisco 2650 and 2651 routers require Cisco IOS Release 12.1(3a)T1 or later.
4. Requires the Cisco IOS Plus feature sets.
5. See T1/E1 multiflex voice/WAN interface cards in this table.

6. T1 multiflex voice/WAN interface cards can be used in a chassis slot or installed in a digital T1 packet voice trunk module. E1 multiflex voice/WAN interface cards can be installed in a chassis slot.
7. Uses the VWIC-MFT T1/E1 interface cards.
8. Requires the NM-1V or NM-2V network module.

Other Firmware Code

The latest version of analog modem firmware for the Cisco 2600 series supports the internal analog modems (both NM-16AM and NM-8AM) in a wide range of countries, starting with Cisco IOS Release 11.3(5)T and later releases. The latest firmware (version 1.2.0) also supports dial-out and fax-out.

Additional information can be found on Cisco.com, beginning under the **Service & Support** heading:

Technical Documents: **Documentation Home Page**: **Access Servers and Access Routers**: **Modular Access Routers**: **Cisco 2600 Series Routers**: **Analog Modem Firmware**

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Cisco 3600 Series Routers

This section contains the following sections with information that is specific to the Cisco 3600 series routers:

Introduction

The Cisco 3600 series includes the Cisco 3620, Cisco 3640, Cisco 3640A, and Cisco 3660 routers. As modular solutions, the Cisco 3600 series routers enable corporations to increase dial-up density and take advantage of current and emerging WAN technologies and networking capabilities. The Cisco 3600 series routers are fully supported by Cisco IOS software, which includes dial-up connectivity, LAN-to-LAN routing, data and access security, WAN optimization, and multimedia features.

The Cisco 3640A router is identical to the Cisco 3640 router in terms of physical characteristics, interface support, performance and memory. The Cisco 3640A router will support the same Cisco IOS feature sets as the Cisco 3640 router, but requires a different minimum version of Cisco IOS software.

Memory Recommendations

For memory recommendations for the Cisco 3600 series routers in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Cisco IOS Release 12.2 supports the following routers in the Cisco 3600 series:

- Cisco 3620
- Cisco 3640 and Cisco 3640A
- Cisco 3660 (3661 and 3662)

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Table 8 lists the supported interfaces for the Cisco 3600 series routers for Cisco IOS Release 12.2.

Table 8 Supported Interfaces for the Cisco 3600 Series Routers

Interface, Network Module, or Data Rate		Platforms Supported
Dial Access Network Modules	16- and 32-port asynchronous (NM-16A and NM-32A)	All Cisco 3600 series platforms
	6- to 30-port integrated digital modems network modules (NM-6DM, NM-12-DM, NM-18DM, NM-24DM, NM-40DM)	All Cisco 3600 series platforms
	6 digital modem upgrade (MICA-6MOD)	All Cisco 3600 series platforms
	8- or 16-port integrated analog network modules (NM-8AM and NM16AM)	All Cisco 3600 series platforms

Table 8 Supported Interfaces for the Cisco 3600 Series Routers (Continued)

Interface, Network Module, or Data Rate		Platforms Supported
LAN Interfaces	1- and 4-port Ethernet (AUI and 10BASE-T, NM-1E and NM-4E)	All Cisco 3600 series platforms
	1-port Fast Ethernet (100BASE-TX and 100BASE-FX, NM-1FE-TX and NM-1FE-FX[1])	All Cisco 3600 series platforms
Mixed Media Network Modules	1-port 10/100BASE-TX with 1-port channelized/PRI/E1 balanced mode (NM-1FE1CE1B)	All Cisco 3600 series platforms
	1-port 10/100BASE-TX with 1-port channelized/PRI/E1 unbalanced mode (NM-1FE1CE1U)	All Cisco 3600 series platforms
	1-port 10/100BASE-TX with 1-port channelized/PRI/T1 (NM-1FE1CT1)	All Cisco 3600 series platforms
	1-port 10/100BASE-TX with 1-port channelized/PRI/T1 with CSU (NM-1FE1CT1-CSU)	All Cisco 3600 series platforms
	1-port 10/100BASE-TX with 2-port channelized/PRI/E1 balanced mode (NM-1FE2CE1B)	All Cisco 3600 series platforms
	1-port 10/100BASE-TX with 2-port channelized/PRI/E1 unbalanced mode (NM-1FE2CE1U)	All Cisco 3600 series platforms
	1-port 10/100BASE-TX with 2-port channelized/PRI/T1 (NM-1FE2CT1)	All Cisco 3600 series platforms
	1-port 10/100BASE-TX with 2-port channelized/PRI/T1 with CSU (NM-1FE2CT1-CSU)	All Cisco 3600 series platforms
	1 Ethernet and 2 WAN card slots (NM-1E2W)	All Cisco 3600 series platforms
	1 Ethernet, 1 Token Ring, and 2 WAN card slots (NM-1E1R2W)	All Cisco 3600 series platforms
	2 Ethernet and 2 WAN card slots (NM-2E2W)	All Cisco 3600 series platforms
	1-port fast Ethernet, 1-port Token Ring with 2 WAN card slots (NM-1FE1R2W[=])	All Cisco 3600 series platforms
	1-port Fast Ethernet with 2 WAN card slots (NM-1FE2W[=])	All Cisco 3600 series platforms
	2-port Fast Ethernet with 2 WAN card slots (NM-2FE2W[=])	All Cisco 3600 series platforms
	2 WAN card slots (NM-2W[=])	All Cisco 3600 series platforms
Multiport T1/E1 ATM Network Modules with Inverse Multiplexing over ATM (IMA)[2]	4-port T1 ATM network module with IMA (NM-4T1-IMA)	All Cisco 3600 series platforms
	4-port E1 ATM network module with IMA (NM-4E1-IMA)	All Cisco 3600 series platforms
	8-port T1 ATM network module with IMA (NM-8T1-IMA)	All Cisco 3600 series platforms
	8-port E1 ATM network module with IMA (NM-8E1-IMA)	All Cisco 3600 series platforms

Table 8 Supported Interfaces for the Cisco 3600 Series Routers (Continued)

Interface, Network Module, or Data Rate		Platforms Supported
Digital T1/E1 Packet Voice Trunk Network Modules and Spare Components	1-port, 24-channel T1 voice/fax module supports 24 channels of medium-complexity codecs: G.729a/b, G.726, G.711, and fax or 12 channels of G.726, G.729, G.723.1, G.728, G.729a/b, G.711, and fax. Consists of one NM-HDV, two PVDM-12s, and one VWIC-1MFT-T1.[3] Part number: NM-HDV-1T1-24.	All Cisco 3600 series platforms
	1-port, enhanced 24-channel T1 voice/fax module, supports 24 channels of high- and medium-complexity codecs: G.729a/b, G.726, G.729, G.728, G.723.1, G.711, and fax. Consists of one NM-HDV, four PVDM-12s, and one VWIC-1MFT-T1.[3] Part number: NM-HDV-1T1-24E.	All Cisco 3600 series platforms
	2-port, 48-channel T1 voice/fax module supports add/drop multiplexing (drop and insert); 48 channels of medium-complexity codecs: G.729a/b, G.726,G.711, and fax; or 24 channels of G.726, G.729, G.723.1, G.728, G.729a/b, G.711, and fax. Consists of one NM-HDV, four PVDM-12, and one VWIC-2MFT-T1-DI[3]. Part number: NM-HDV-2T1-48.	All Cisco 3600 series platforms
	1-port, 30-channel E1 voice/fax module, supports 30 channels of G.729a/b, G.726, G.711 and fax or 18 channels of G.726, G.729, G.723.1, G.728, G.729a/b, G.711, and fax. Consists of one NM-HDV, three PVDM-12s, and one VWIC-1MFT-E1[3]. (NM-HDV-1E1-30(=))	All Cisco 3600 series platforms
	1-port, enhanced 30-channel E1 voice/fax module supports 30 channels of G.729a/b, G.726, G.729, G.728, G.723.1, G.711, and fax. Consists of one NM-HDV, five PVDM-12s, and one VWIC-1MFT-E1[3]. (NM-HDV-1E1-30E(=)).	All Cisco 3600 series platforms
	2-port, 60-channel E1 voice/fax module supports add/drop multiplexing (drop and insert); 60 channels of G.729a/b, G.726, G.711, and fax or 30 channels of G.726, G.729, G.723.1, G.728, G.729a/b, G.711, and fax. Consists of one NM-HDV, five PVDM-12s, and one VWIC-2MFT-E1-D1[3]. (NM-HDV-2E1-60(=))	All Cisco 3600 series platforms
	High-density voice/fax network module spare (NM-HDV).	Digital T1 Packet Voice Trunk Network Modules spare component
	12-channel packet voice DSP module upgrade spare (PVDM-12=).	Digital T1 Packet Voice Trunk Network Modules spare component

Table 8 Supported Interfaces for the Cisco 3600 Series Routers (Continued)

Interface, Network Module, or Data Rate		Platforms Supported
Digital T1/E1 Packet Voice Trunk Network Modules and Spare Components (Continued)	1-port RJ-48 multiflex trunk—T1 (VWIC-1MFT-T1)[3]	Digital T1 Packet Voice Trunk Network Modules spare component
	2-port RJ-48 multiflex trunk—T1 (VWIC-2MFT-T1)[3]	Digital T1 Packet Voice Trunk Network Modules spare component
	2-port RJ-48 multiflex trunk with drop and insert—T1 (VWIC-2MFT-T1-DI(=))[3]	Digital T1 Packet Voice Trunk Network Modules spare component
T1/E1 Multiflex Voice/WAN Interface Cards	1-port T1 multiflex trunk interface (VWIC-1MFT-T1)	All Cisco 3600 series platforms
	1-port E1 multiflex trunk interface (VWIC-1MFT-E1)	All Cisco 3600 series platforms
	2-port T1 multiflex trunk interface (VWIC-2MFT-T1)	All Cisco 3600 series platforms
	2-port T1 multiflex trunk interface with drop and insert (VWIC-2MFT-T1-DI)[4]	All Cisco 3600 series platforms
	2-port E1 multiflex trunk interface with drop and insert (VWIC-2MFT-E1-DI)	All Cisco 3600 series platforms
Voice/Fax Interfaces and Network Modules[2]	1- and 2-port voice/fax network module (NM-1V and NM-2V)	All Cisco 3600 series platforms
	2-port E&M voice interface card (VIC-2E/M)	All Cisco 3600 series platforms with Voice/Fax network module
	2-port FXO voice interface card (VIC-2FXO, VIC-2FXO-M3, and VIC-2FXO-EU)	All Cisco 3600 series platforms with Voice/Fax network module
	2-port FXS voice interface card	All Cisco 3600 series platforms with Voice/Fax network module
	2-port BRI voice interface card (VIC-2BRI-S/T-TE)	Cisco 3620, 3640 and 3640A platforms with Voice/Fax network module
WAN Data Rates	48/56/64 kbps	All Cisco 3600 series platforms
	1.544/2.048 Mbps	All Cisco 3600 series platforms
	Up to 8 Mbps on 4-port serial network module	All Cisco 3600 series platforms
	52 Mbps max using HSSI network module	All Cisco 3600 series platforms
	Up to 100 Mbps on ATM OC3 network modules	All Cisco 3600 series platforms

Table 8 Supported Interfaces for the Cisco 3600 Series Routers (Continued)

Interface, Network Module, or Data Rate		Platforms Supported
Network Modules	1- and 2-port channelized T1 modules without CSUs (NM-1CT1 and NM-1CT1)	All Cisco 3600 series platforms
	1- and 2-port channelized T1 network modules with CSUs (NM-1CT1-CSU and NM-2CT1-CSU)	All Cisco 3600 series platforms
	1- and 2-port E1 network modules unbalanced mode (NM-1CE1U and NM-2CE1U)	All Cisco 3600 series platforms
	1- and 2-port E1 network modules balanced mode (NM-1CE1B and NM-2CE1B)	All Cisco 3600 series platforms
	1-port ATM-25 network modules (NM-1ATM-25)[2]	All Cisco 3600 series platforms
	1-port ATM T3 network module (NM-1A-T3)[2]	All Cisco 3600 series platforms
Network Modules (Continued)	1-port ATM E3 network module (NM-1A-E3)[2]	All Cisco 3600 series platforms
	1-port high-speed serial interface (HSSI) network module	All Cisco 3600 series platforms
	4- and 8-port BRI network module with NT1 (NM-4B-U and NM-8B-U)	All Cisco 3600 series platforms
	4- and 8-port BRI network module with S/T interface (NM-4B-S/T and NM-8B-S/T)	All Cisco 3600 series platforms
	4- and 8-port synchronous/asynchronous (NM-4A/S and NM-8A/S)	All Cisco 3600 series platforms
	16- and 32-port asynchronous (NM-16A and NM-32A)	All Cisco 3600 series platforms
	4-port serial (NM-4T)	All Cisco 3600 series platforms
	1-port ATM OC-3 network module with multimode fiber (NM-1A-OC3MM)	All Cisco 3600 series platforms
	1-port ATM OC-3 network module with single-mode intermediate reach fiber (NM-1A-OC3SMI)	All Cisco 3600 series platforms
	1-port ATM OC-3 network module with single-mode long reach fiber (NM-1A-OC3SML)	All Cisco 3600 series platforms
	1-port ATM OC-3 multimode network module and circuit emulation service (NM-1A-OC3MM-1V)[5]	All Cisco 3600 series platforms
	1-port ATM OC-3 single-mode, intermediate reach network module and circuit emulation service (NM-1A-OC3SMI-1V)[5]	All Cisco 3600 series platforms
	1-port ATM OC-3 single-mode, long reach network module and circuit emulation service (NM-1A-OC3SML-1V)[5]	All Cisco 3600 series platforms
Other Network Modules	Compression network module (NM-COMPR)	All Cisco 3600 series platforms
	4 E1 data compression Advanced Integration Module (AIM-COMPR4)	All Cisco 3600 series platforms
	Hardware Encryption Network Module	All Cisco 3620, 3640 and 3640A series platforms
	Hardware Encryption Advanced Integration Module (AIM)	All Cisco 3660 series platforms

Table 8 Supported Interfaces for the Cisco 3600 Series Routers (Continued)

Interface, Network Module, or Data Rate		Platforms Supported
WAN Interface Cards	1-port T1/Fractional T1/DSU/CSU WAN interface card (WIC-1DSU-T1)	All Cisco 3600 series platforms
	1-port T1/Fractional T1 56/64-kbps DSU/CSU WAN interface card (WIC-1DSU-56K4)	All Cisco 3600 series platforms
	1-port ISDN with NT1 WAN interface card (WIC-1B-U)	All Cisco 3600 series platforms
	1-port ISDN WAN interface card (WIC-1B-S/T)	All Cisco 3600 series platforms
	1-port serial WAN interface card (WIC-1T)	All Cisco 3600 series platforms
	2-port serial (WIC-2T[=])[6]	All Cisco 3600 series platforms
	2-port asynchronous/synchronous (WIC-2A/S[=])	All Cisco 3600 series platforms

1. The NM-1FE-FX network module name has changed to NM-1FE-FX-V2 in Cisco IOS Release 12.2(13).
2. Requires the Cisco IOS Plus feature sets.
3. See T1/E1 Multiflex Voice/WAN Interface Cards in this table.
4. For Cisco 3660 series, only supported in T1/E1 digital packet voice trunk network modules and new Fast Ethernet mixed media network modules: NM-1FE2W, NM-2FE2W, NM-1FE1R2W, NM-2W. For Cisco 3620 and 3640, supported in T1/E1 digital packet voice trunk network modules or in 1- or 2-port Ethernet and Fast Ethernet network modules (NM-1E2W, NM-2E2W, NM-1E1R2W, NM-1FE2W, NM-2FE2W, NM-1FE1R2W, NM-2W).
5. For the Cisco 3660 series only, online insertion and removal (OIR) is now supported in Cisco IOS Release 12.2.
6. Supported in Fast Ethernet mixed media network modules: NM-1FE2W, NM-2FE2W, NM-1FE1R2W, NM-2W.

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Cisco MC3810 Multiservice Access Concentrator

This section contains the following sections with information that is specific to the Cisco MC3810 multiservice access concentrator:

Introduction

The Cisco MC3810 multiservice access concentrator is fully supported by Cisco IOS software for multiprotocol routing, bridging, and Systems Network Architecture (SNA). As part of an enterprise backbone or as customer premises equipment (CPE) to serve provider-managed network services, the Cisco MC3810 reduces operating costs and complexity, and increases network throughput and performance.

The Cisco MC3810 provides a complete file system for software images, message files, and reports. The standard Flash memory size is 8 MB, and a 16-MB upgrade option is available. The 16-MB version can hold two code images simultaneously for fail-safe upgrades.

Management and configuration of the Cisco MC3810 should be familiar to the Cisco IOS user and compatible with existing management systems. As such, it provides a superset of the Cisco command-line interface (CLI). The Cisco MC3810 can be managed by standard Cisco management platforms and facilities such as CiscoView and the native remote log-in facilities provided by Telnet and rlogin. Three types of configuration interfaces are provided:

- Cisco CLI
- HTTP-based configuration server
- SNMP-based MIB

The HTTP-based interface allows configuration from any web browser such as Netscape Navigator or Microsoft Explorer. The Simple Network Management Protocol (SNMP) MIB allows management of the Cisco MC3810 from SNMP managers (for example, HP OpenView).

Memory Recommendations

For memory recommendations for the Cisco MC3810 in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Cisco IOS Release 12.2 supports the Cisco MC3810 multiservice access concentrator. The Cisco MC3810 base chassis is a semifixed configuration router that can be customized for a specific application at the factory or in the field by a qualified technician. The base chassis includes the following components:

- One fixed Ethernet LAN port
- A console port and an auxiliary port

- Two synchronous serial ports
- Five mounting areas for functional modules that support additional capabilities
- AC, DC, or redundant power supply option

Cisco MC3810 series concentrators are supplied in various standard hardware configurations. These are equipped with different sets of functional modules to provide specific functional capability. Many configurations are possible, but they are all variations of the basic categories described in Table 9. Supported hardware is shown in Table 10. The chassis opening for any mounting area that is not equipped with a functional module is closed off with a removable cover plate.

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Table 9 Cisco MC3810 Series Standard Hardware Categories

Category	Service Types Supported	Required Modules	Optional Modules
Base chassis	Base chassis services[1]	None	Optional modules can be added to create other chassis variations
Analog voice chassis	Base chassis services[1] plus compressed analog voice connections to telephone, fax, central office, analog PBX	AVM (analog voice module) with 1 to 6 APMs (analog personality modules) VCM3 or VCM6 or HCM2 or HCM6 (only one voice compression module)	MFT[2] to support a channelized T1 or E1 trunk MFT[2] and VDM[3] to support video codec dialing
Digital voice chassis	Base chassis services[1] plus compressed digital voice through digital PBX	DVM VCM3 or VCM6 or HCM2 or HCM6 (one or two voice compression modules)	MFT[2] to support a channelized T1 or E1 trunk MFT[2] and VDM[3] to support video codec dialing
BRI voice chassis	Base chassis services[1] plus compressed digital voice through PINX	BVM and MFT[1] VCM3 or VCM6 or HCM2 or HCM6 (only one voice compression module)	MFT[2] to support a channelized T1 or E1 trunk MFT[2] and VDM[3] to support video codec dialing
T1/E1 trunk chassis	Base chassis services[1] plus channelized T1 or E1	MFT[2]	DVM to support digital cross-connect voice (channel bank functionality/ drop-and-insert) through digital PBX or channel bank VDM[3] to support video codec dialing VCM3 and/or VCM6, or HCM2 and/or HCM6, to support voice compression

1. Base chassis services include administrative access, Ethernet, data transport, and video transport.
2. The MFT is available with or without BRI backup.

3. If a VDM is installed, an MFT is required to support ATM for the video dialing network connection.

Table 10 Hardware Supported on the Cisco MC3810 Multiservice Access Concentrator

Module or Other Hardware Option		Product Number
Voice Interface Modules	6-port AVM[1]	MC3810-AVM6=
	1-port E1 DVM, connects to PBX/channel bank/key system[2]	MC3810-DVM-E1=
	1-port T1 DVM, connects to PBX/channel bank/key system[2]	MC3810-DVM-T1=
	1-port unbalanced E1 DVM, connects to PBX/channel bank/key system[2]	MC3810-DVM-BNC=
	4-port BRI voice module[3]	MC3810-BVM4=
Video Dialing Module	Supports an RS-366 Automatic Calling Equipment (ACE) interface to the DTE port of the videoconferencing equipment[4]	MC3810-VDM=
Analog Personality Modules[5]	1-port E & M analog module	MC3810-APM-EM=
	1-port FXS analog module	MC3810-APM-FXS=
	1-port FXO analog module	MC3810-APM-FXO=
	1-port FXO analog module, approved for the U.K.	MC3810-FXO-UK=
	1-port FXO analog module, approved for Germany	MC3810-FXO-GER=
	1-port FXO analog module, approved for PR2[6] countries	MC3810-FXO-PR2=
	1-port FXO analog module, approved for PR3[7] countries	MC3810-FXO-PR3=
Voice Compression Modules[8]	2-DSP HCM, supports up to 8 channels of compressed voice	MC3810-HCM2=
	6-DSP HCM, supports up to 24 channels of compressed voice	MC3810-HCM6=
	3-DSP VCM, supports up to 6 channels[9] of compressed voice	MC3810-VCM3=
	6-DSP VCM, supports up to 12 channels[9] of compressed voice	MC3810-VCM6=
Multiflex Trunk Modules with Optional BRI	1-port MFT with RJ-48 channelized T1 interface	MC3810-MFT-T1=
	1-port MFT with RJ-48 channelized E1 interface	MC3810-MFT-E1=
	1-port MFT with unbalanced E1-BNC interface	MC3810-MFT-BNC=
	1-port MFT with RJ-48 channelized T1 and BRI S/T interfaces	MC3810-MFT-TBS=
	1-port MFT with unbalanced E1-BNC and BRI S/T interfaces	MC3810-MFT-EUS=

1. Requires one to six APMs and one voice compression module (VCM3 or VCM6).
2. Requires one or two voice compression modules (VCM6) for processed voice.
3. Requires one voice compression module (VCM3 or VCM6) and Cisco IOS Release 12.0(4)T or a later release.
4. Requires MFT for ATM connectivity and Cisco serial V.35 DCE cable (product order number 72-1721-01) that includes a Ringing Indicator (RI) conductor, and a Cisco RS-366 ACE cable (product order number 72-1722-01) to connect the VDM to the videoconferencing equipment RS-366 dial-up DTE port.
5. For use with analog voice modules; one AVM requires at least one APM and supports up to six APMs.
6. PR2 countries currently include Australia and New Zealand.
7. PR3 countries currently include Japan and Singapore.
8. VCMs and Cisco IOS Plus feature sets are required for voice processing (for example, switching, compression, echo cancellation, and silence suppression) but not for drop-and-insert applications.
9. Cisco MC3810 maximum voice channel support by compression algorithm: G.711 at 64 kbps = 6 channels; G.726 at 32 kbps = 12 channels; G.729 at 8 kbps = 12 channels; G.729a at 8 kbps = 24 channels.

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Additional Notes for the Cisco MC3810 Multiservice Access Concentrator

Using the Cisco MC3810 with QSIG or BRI

Serial port 1 is restricted to DCE operation when the following occurs:

- Q (point of the ISDN model) Signaling (QSIG) is enabled.
- BRI voice module (BVM) is installed and BRI is enabled.
- BRI S/T backup port is installed and enabled on the multiflex trunk module (MFT).

Using the Cisco MC3810 with the PSTN

This section includes important notes regarding use of the Cisco MC3810 with the Public Switched Telephone Network (PSTN).

- Connections to the PSTN

  Exercise care when connecting switched voice ports on the Cisco MC3810 directly to the PSTN because improper configurations can expose a corporate network to telephone fraud.

- Switched Access from the PSTN

  The Cisco MC3810 can connect a user from the PSTN directly to the corporate wide-area telephone network. You can configure the Cisco MC3810 as a phone switch that can switch a user to any location in that network, even to remote locations that are connected again to another PSTN. However, the Cisco MC3810 does not provide any mechanism to restrict users from calling after they are connected. Without proper network design, this condition could result in the unauthorized use of the corporate network for making calls at the corporation's expense. To prevent this from occurring, Cisco does not recommend connecting a switched voice interface on the Cisco MC3810 directly to the PSTN. Instead, it should be connected to a PBX that implements a security scheme that prevents unauthorized use.

- Nonswitched Calls

  The same opportunity for illicit use does not exist for nonswitched call types such as pass-through connections, although the possibility for fraud does exist at the direct contact point. Pass-through calls create a path to only a single location specified by the network administrator. For example, a pass-through connection might be used to pass a trunk from a PBX to the PSTN. In this case, the trunk on the PBX always passes straight through the Cisco MC3810 to the PSTN. As a result, the necessary security is provided by the PBX.

Cisco 4000 Series Routers

This section contains the following sections with information that is specific to the Cisco 4000 series routers:

Memory Recommendations

For memory recommendations for the Cisco 4000 series routers in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Table 11 lists the interfaces supported by the Cisco 4000 series routers.

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Table 11 Supported Interfaces for the Cisco 4000 Series Routers

Interface, Network Module, or Data Rate		Platforms Supported
LAN Interfaces	ATM Interface	Cisco 4500 and Cisco 4700
	Ethernet	Cisco 4500 and Cisco 4700
	Fast Ethernet	Cisco 4500 and Cisco 4700
	Token Ring	Cisco 4500 and Cisco 4700
	FDDI	Cisco 4500 and Cisco 4700
	Serial	Cisco 4500 and Cisco 4700
	HSSI	Cisco 4500 and Cisco 4700
	ISDN BRI	Cisco 4500 and Cisco 4700
	Channelized E1/T1 ISDN PRI	Cisco 4500 and Cisco 4700
	ATM OC-3c	Cisco 4500 and Cisco 4700
	ATM DS-3	Cisco 4500 and Cisco 4700
	ATM E3	Cisco 4500 and Cisco 4700
WAN Data Rates	48/56/64 kbps	Cisco 4500 and Cisco 4700
	1.544/2.048 Mbps	Cisco 4500 and Cisco 4700

Table 11 Supported Interfaces for the Cisco 4000 Series Routers (Continued)

Interface, Network Module, or Data Rate		Platforms Supported
WAN Interfaces and Network Modules	56K/64K DSU/CSU	Cisco 4500 and Cisco 4700
	Channelized E1	Cisco 4500 and Cisco 4700
	Channelized T1	Cisco 4500 and Cisco 4700
	E1-G.703/G.704	Cisco 4500 and Cisco 4700
	EIA/TIA-232	Cisco 4500 and Cisco 4700
	EIA/TIA-449	Cisco 4500 and Cisco 4700
	EIA/TIA-613 (HSSI)	Cisco 4500 and Cisco 4700
	EIA-530	Cisco 4500 and Cisco 4700
	ISDN BRI	Cisco 4500 and Cisco 4700
	ISDN PRI	Cisco 4500 and Cisco 4700
	MultiChannel Interface (Channelized E1/T1)	Cisco 4500 and Cisco 4700
	Serial	Cisco 4500 and Cisco 4700
	V.35	Cisco 4500 and Cisco 4700
	X.21	Cisco 4500 and Cisco 4700

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Cisco Catalyst 4500 Access Gateway Module

This section contains the following sections with information that is specific to the Cisco Catalyst 4500 access gateway module (AGM):

Note The Cisco Catalyst 4500 AGM can be deployed in both Cisco Catalyst 4500 series and Catalyst 4000 series chassis that are running either Catalyst OS or Cisco IOS software and is fully compatible with all supervisor engines. Multiple AGMs can be deployed in the chassis to support higher density requirements or provide a higher level of availability and resiliency. Refer to the following document for additional information:
http://www.cisco.com/en/US/partner/products/hw/modules/ps2797/products_data_sheet09186a00800924de.html

Introduction

The Cisco Catalyst 4500 access gateway module adds voice interfaces, WAN interfaces, and DSP farm services to the Cisco Catalyst 4500 family switch and enables it to become an integrated voice and data solution for branch and remote offices and small to medium businesses that support from 50 to 240 users. The module provides the following interfaces:

- A console port
- A management Ethernet port
- Two VIC/WIC slots
- One VIC slot
- One high-density analog slot
- Connection to the Catalyst 4500 backplane via Gigabit Ethernet

The Cisco Catalyst 4500 access gateway module supports H.323 for the telephony gateway functions and the Skinny Client Control Protocol (SCCP) for the DSP farm services. The module operates as a peer device in Voice over IP (VoIP) applications or as a slave device under the control of Cisco Call Manager in the Cisco AVVID IP Telephony environment.

Memory Recommendations

For memory recommendations for the Cisco Catalyst 4000 access gateway module in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Table 12 Minimum Memory Recommendations for the Cisco Catalyst 4500 Access Gateway Module

Image Name	Software Image	Recommended Flash Memory	Recommended DRAM Memory	Runs From
IOS IP/Firewall	c4gwy-io3s-mz[1]	32 MB, fixed	64 MB	RAM
IOS IP/Firewall/Voice	c4gwy-io3sx3-mz	32 MB	64 MB	RAM

1. The Cisco Catalyst 4500 access gateway module image c4gwy-io3s-mz is supported in Cisco IOS Release 12.2(6) through Cisco IOS Release 12.2(12).

Hardware Supported

Cisco IOS Release 12.2 supports the Catalyst 4500 Access Gateway module.

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Additional Notes for the Cisco Catalyst 4500 Access Gateway Module

Tighten Screws on VICs and WICs

You must tighten the screws on the voice interface cards (VICs) and WAN interface cards (WICs) mounted on the Access Gateway module. If the screws are not properly tightened, the VIC or WIC may malfunction.

TDM Clocking

The TDM clock reference on the Access Gateway module can be derived from one of seven sources. These are the free-running on-board clock and the two recovered clock sources from each VIC slot that contains an E1/T1 card.

The default reference is the on-board clock. The **frame-clock-select** command can be used to select one of the E1/T1 ports as the primary reference. This command can also be used to select up to three prioritized backups that can be used if the primary clock fails. Switchover to a backup source is nonrevertive; the system does not switch back to a higher priority clock if it recovers after a failure.

The command has the following syntax:

```
[no] frame-clock-select priority E1/T1 slot/port
```

The clock source with priority 1 is the primary reference, and the clock with priority 4 is the lowest priority backup.

The clock reference selection using the **frame-clock-select** command is independent of the clock selection between line or internal on an E1/T1 controller. Framing and cyclic redundancy check (CRC) errors because of clock slips may be observed on E1/T1 interfaces if the onboard clock is used as the reference.

Need to Support 56-Kbps Operation for Slot 3 WIC

The 8260 Rev1A device, which is being used in the Access Gateway module hardware, has a defect that can cause data corruption when configuring the MCC SI RAM for two entries (7 bits forming the 56-kbps channel and 1 bit being discarded).

As a workaround, three SI RAM entries would have to be used, but the Access Gateway module does not have enough room available. Therefore, only 64-kbps channels will be supported on the Access Gateway module.

If absolutely required, we could implement this feature in Access Gateway module slots 1 and 2 using the SCCs and limit it to two channels or super-channels per Access Gateway module slot. This requires more design work and will not be addressed unless really needed.

Customers that need 56-kbps should use the WIC-56K4 WIC.

Cisco Catalyst 5000 RSM/VIP2

This section contains the following sections with information that is specific to the Cisco Catalyst 5000 RSM/VIP2:

Note Only Cisco Catalyst 5000 RSM/VIP2s with hardware revision 6.0 and higher supporter Cisco IOS Release 12.2.

Memory Recommendations

For memory recommendations for the Cisco Catalyst 5000 RSM/VIP2 in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

The following switches are supported in Cisco IOS Release 12.2:

- Catalyst 5000
- Catalyst 5002
- Catalyst 5500

Feature Support

There are no new features for the Cisco Catalyst 5000 RSM/VIP2 for Cisco IOS Release 12.2.

Cisco AS5300 Universal Access Servers

This section contains the following sections with information that is specific to the Cisco AS5300 universal access servers:

Introduction

The Cisco AS5300 universal access server is a versatile data communications platform that performs the following two functions in a single modular chassis depending on the installed feature cards and Cisco IOS images:

- Remote Access Server
- Voice Gateway

The remote access server is intended for Internet service providers (ISPs), telecommunications carriers, and other service providers that offer managed Internet connections and medium to large sites that provide both digital and analog access to users on an enterprise network. By terminating both analog and digital calls on the same chassis simultaneously, the access server provides a clear, simple, and easy migration path from analog dial access services to digital dial access services.

The Cisco AS5300/Voice Gateway is a versatile data communications platform that provides the functions of an access server, router, and digital modem(s) in a single modular chassis. The Cisco AS5300 includes three feature card slots: one holds a T1/E1/PRI feature card and the other two support modem feature cards or voice digital signal processor (DSP) feature cards. When equipped with modem cards, the Cisco AS5300 serves as a remote access concentrator for dial-up (modem or ISDN) Internet access. When equipped with voice feature cards and Voice IOS, the Cisco AS5300/Voice Gateway serves as a voice (VoIP) gateway. By using one slot for modems and the other for voice DSPs, the Cisco AS5300 can serve in both capacities. Modem, voice, or fax calls are routed to the appropriate cards/resources via Dialed Number Identification Service (DNIS).

Note For the recommended VCWare version to use with this Cisco IOS release, refer to *Combined Version Release Notes and Compatibility Matrix for Cisco VCWare on Cisco AS5300 Universal Access Servers/Voice Gateway*s at the following location: http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/5300/sw_conf/vcw_rn/vcwrmtrx.htm.

Memory Recommendations

For memory recommendations for the Cisco AS5300 universal acess server in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Table 13 lists the supported interfaces for the Cisco AS5300 universal access server for Cisco IOS Release 12.2.

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Table 13 Supported Interfaces for the Cisco AS5300 Universal Access Server

Interface and Modem Cards	Product Description
Interface Cards	Ethernet RJ-45 (included with unit)
	Ethernet/Fast Ethernet (RJ-45) (included with unit)
	ISDN PRI
	E1-G.703/G.704
	Channelized T1 (4 ports) without serial support
	Channelized T1 (4 ports) with 4 serial ports
	Channelized T1 (8 ports) with 4 serial ports
	Channelized E1 (4 ports) without serial support
	Channelized E1 (4 ports) with 4 serial ports
	Channelized E1 (8 ports) with 4 serial ports
	HMM/48 channel
	HMM/54 channel
	HMM/60 channel
	DMM/48 channel
	DMM/96 channel
	DMM/108 channel
	DMM/120 channel
	48-channel, TI C549-based VoIP feature card (uses High Density AS53-VOXD DSP modules)
	60-channel, TI C549-based VoIP feature card (uses High Density AS53-VOXD DSP modules)
	24-channel, TI C542-based VoIP feature card (first generation, uses AS53-6VOX DSP modules)
	48-channel, TI C542-based VoIP feature card (first generation, uses AS53-6VOX DSP modules)
	MICA modems
	Microcom 56K modems

Microcode and Modem Code Software

Microcode software images are bundled with the system software image—with the exception of the Channel Interface Processor (CIP) microcode (all system software images). Bundling eliminates the need to store separate microcode images. When the router starts, the system software unpacks the microcode software bundle and loads the proper software on all the interface processor boards. Table 14 lists the current microcode versions for the Cisco AS5300 universal access server.

You could have received a later version of modem code than the one bundled with the Cisco IOS software. The modem code in Flash memory is mapped to the modems. Unless you fully understand how Cisco IOS software uses modem code, it is important to keep the factory configuration.

The modem code release notes are on Cisco.com:

On Cisco.com at:

Technical Documents: **All Product Documentation**: **Access Servers and Access Routers**: **Firmware and Portware Information**

Table 14 Current Modem Code Versions for the Cisco AS5300 Universal Access Server

Modem Module	Current Bundled Modem Code Version	Minimum Cisco IOS Release Required
Microcom modems	Microcom Version 5.1.20	12.0(5)T and later
MICA modems	MICA portware Version 2.7.1.0	12.0(5)T and later

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Additional Notes for the Cisco AS5300 Universal Access Server

Deferral of AS5300 Boot Image

The c5300-boot-mz image has been deferred in Cisco IOS Release 12.2(1) because of a severe defect. This defect has been assigned Cisco Caveat ID CSCdu10569. The software solution for this defect is the c5300-boot-mz image in Cisco IOS Release 12.0(4)T1.

In order to increase network availability, Cisco recommends that you upgrade affected Cisco IOS images with the suggested replacement software images. Cisco will discontinue manufacturing shipment of affected Cisco IOS images. Any pending order will be substituted by the replacement software images.

Caution Please be aware that failure to upgrade the affected Cisco IOS images may result in network downtime.

The terms and conditions that governed your rights and obligations and those of Cisco, with respect to the deferred images will apply to the replacement images.

Cisco AS5400 Universal Gateway

This section contains the following sections with information that is specific to the Cisco AS5400 universal gateway:

Introduction

The Cisco AS5400 universal gateway is a versatile data communications platform that provides high performance, high density, and hot swappability in only two rack units. The Cisco AS5400 is intended for large companies and service providers who require dense and scalable solutions to create new multiservice access networks, replace existing access server hardware, or expand and enhance their current access offering.

Memory Recommendations

For memory recommendations for the Cisco AS5400 universal gateway in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Table 15 details the supported interfaces and dial feature cards for the Cisco AS5400 universal gateway for Cisco IOS Release 12.2.

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Table 15 Supported Interfaces for the Cisco AS5400 Universal Gateway

Interfaces and Dial Feature Cards	Product Description
Dial Feature Cards	AS54-DFC-8CT1/CE1 (8PRI CT1/CE1)
	AS54-DFC-CT3
	AS54-DFC-108NP
LAN Interfaces	Fast Ethernet 10/100BASE-T (RJ-45)
WAN Interface Options	8PRI CT1/CE1 DFC
	CT3 DFC

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Cisco AS5800 Universal Access Servers

This section contains the following sections with information that is specific to the Cisco AS5800 universal access server:

Introduction

The Cisco AS5800 universal access server is a high-density, ISDN and modem WAN aggregation system that provides digital and analog call termination. It is intended to be used as a service provider dial point-of-presence (POP) or centralized enterprise dial gateway. The Cisco AS5800 consists of a dial shelf, a router shelf, and (optionally) a system controller:

- The Cisco DS5814 (dial shelf) has 14 slots and can support 1 or 2 dial shelf controller cards and up to 12 feature cards to provide full analog modem and ISDN coverage. The dial shelf supports up to 2047 simultaneous analog and/or digital calls. Analog calls are terminated by a feature card that is loaded with integrated modems. ISDN calls are terminated onboard the trunk card on High-Level Data Link Control (HDLC) controllers. The E1 trunk, CT3 trunk, and T1 trunk cards include CSUs and have either 12 E1 ports or 12 T1 ports that can operate as PRI interfaces or channelized interfaces in any combination. The CT3 trunk supports 28 T1s.

  Note T1 and E1 cards are not supported in the same box.

- The Cisco RS7206VXR (router shelf) contains a network processing engine, an I/O controller, and the egress interfaces, such as High-Speed Serial Interface (HSSI), Fast Ethernet (FE), FDDI, and ATM, and supports either 280W AC-input or 280W DC-input redundant power. The router shelf also may contain one or two dial shelf interconnect port adapters each with a single RJ-45 receptacle, which is used to connect the router shelf to the Cisco 5814 dial shelf. The interconnect port adapter connects directly to the dial shelf controller card on the dial shelf via a Cisco-proprietary cable, customized with jack screws to secure the connection. You must use this specially designed cable that ships with your interconnect port adapter.

The AC-input power shelf is an optional component of the Cisco AS5800 universal access server and is used to convert AC-input power into DC-output power for the DC-powered Cisco 5814 dial shelf. The AC-input power shelf contains two AC-input power supplies.

The AC-input to DC-output connection supplies -48V DC-output power to the dial shelf power entry modules (PEMs). The PEMs receive the -48V and transmit power to the filter module. Power flows through the filter module to the backplane where it is distributed to the dial shelf controller card(s) and feature cards.

The AC-input power shelf includes two 2,000 W, AC-input power supplies that plug into a common power backplane in the AC-input power shelf. A single AC-input power supply is capable of powering a fully configured Cisco 5814 dial shelf. The second power supply provides full redundancy.

Cisco AS5800 Voice Gateway

The Cisco AS5800/Voice Gateway enables highly scalable deployment of toll-quality voice and fax services over data networks. Enhanced with Cisco IOS software and Service Node (SN) capabilities, the Cisco AS5800 supports features such as prepaid and postpaid calling card, 800 call redirect, voice activated dialing, and voice and fax mail.

The Cisco AS5800 is specifically designed to meet the demands of large service providers such as Post, Telephone, and Telegraphs (PTTs), regional bell operating companies (RBOCs), inter-exchange carriers (IXCs), and large Internet telephony service providers (ITSPs). The physical architecture of the Cisco AS5800 product enhances reliability, availability, and serviceability. Critical features to dial POP administrators include minimizing downtime, service costs, and time to deployment.

The Cisco AS5800 supports up to 1344 voice ports in a single system, thus offering the highest concentration of Voice over IP (VoIP) Digital Signal Processors (DSPs) available in a single voice gateway. The Cisco AS5800 offers breakthrough voice quality, density, and scalability, while continuing to provide the rich set of access, VoIP, and Quality of Service (QoS) services that are part of Cisco IOS software.

Cisco AS5800 Voice Feature Card

The Cisco AS5800 Voice Feature card is a full featured voice processing card that supports 192 DSP-based voice ports. Voice processing capabilities include Voice Activity Detection (VAD), comfort noise generation, adaptive jitter buffering, programmable 16- and 32-msec echo cancellation, programmable frame size, and Dual Tone Multiple Frequency (DTMF) detection and generation. The Cisco AS5800 Voice Feature card offers industry-leading DSP density and a wide range of VoIP codecs, including G.711, G.729, G.729a, G.723.1, and Group III real-time fax support, on any port at any time.

For more information on the Cisco AS5800, refer to the *Cisco AS5800 Universal Access Server Operations, Administration, Maintenance, and Provisioning Guide*.

Memory Recommendations

For memory recommendations for the Cisco AS5800 universal access server in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Cisco IOS Release 12.2 supports the Cisco AS5800 universal access servers:

- Cisco DS5814
- Cisco RS7206
- Cisco RS7206 VXR

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Table 16 and Table 17, detail the supported interfaces, cards, options, NPE support, and port adapters.

Table 16 Supported Hardware for the Cisco AS5800 Universal Access Servers

Interfaces, Cards Options, and Support,	Description
Interfaces	12-port T1 or E1 termination card
	1-port channelized T3 (CT3) termination card
Modem Cards	72-port modem card (HMM)[1]
	144-port modem card (DMM)[2]
	324-port modem card (UPC)
Voice Feature Cards (VFCs)	96-port voice card (96VOX)
	192-port voice card (192VOX)
	192-port medium complexity voice card (192-MC-VOX)
	336-port medium complexity voice card (336-MC-VOX)
Optional AC-input Power Shelves	Two AC-input power supplies
NPE Support	With any Cisco AS5800 software image, the maximum hardware configuration with an NPE-200 router shelf (RS7206) is one CT3 or two T1/E1 trunk cards and five DMMs or 10 HMMs for a maximum of 28 T 1/24 E1 controllers and 720 modems. If a larger configuration is desired, a second NPE-200 router shelf can be configured in split-shelf mode, or a single NPE-300 (RS7206 VXR). The NPE call limitations for a Cisco AS5800/Voice Gateway are 672 voice calls per NPE-300. 1344 voice calls require two RS7206VXR router shelves configured in split-shelf mode. NPE-200 based router shelves, i.e. RS7206, do not support voice services.

1. 72-port modem card requires 32 MB DRAM.
2. 144-port modem card requires 64 MB DRAM.

Table 17 Supported Hardware for the Cisco AS5800 Universal Access Servers

Router Shelf	Port Adapter	Description
RS7206 Router Shelf	PA-100VG	Single-Port 100 VG Port Adapter
	PA-12E/2FE	Dual-Wide Ethernet-Switch Port Adapter
	PA-1C-E	1-Port ESCON Channel Port Adapter
	PA-2CE1/PRI-120	2-Port Channelized E1/PRI Port Adapter, 120 ohm
	PA-2CE1/PRI-75	2-Port Channelized E1/PRI Port Adapter, 75 ohm
	PA-2CT1/PRI	2-Port Channelized T1/PRI Port Adapter
	PA-2E3	2-Port E3 Serial Port Adapter with E3 DSU
	PA-2FEISL-FX	2-Port Fast Ethernet/ISL 100BASE-TX Port Adapter
	PA-2FEISL-TX	2-Port Fast Ethernet/ISL 100BASE-FX Port Adapter
	PA-2H	Port Adapter, 2-Port HSSI
	PA-4B-U	4-Port BRI Port Adapter, U Interface
	PA-4E	Port Adapter, 4-Port Ethernet, 10BT
	PA-4R	Port Adapter, 4-Port Token Ring (Older Hermon Based)
	PA-4R-DTR	Port Adapter, 4-Port Token Ring (Hawkeye Based)
	PA-4R-FDX	Port Adapter, 4 Port Token Ring 4/16Mbps, Full Duplex
	PA-4T+	Port Adapter, 4-Port Serial, 5IN1
	PA-5EFL	Port Adapter, 5-Port Ethernet, 10FL
	PA-8B-S/T	8-Port BRI Port Adapter, S/T Interface
	PA-8E	Port Adapter, 8-Port Ethernet, 10BT
	PA-8T-232	Port Adapter, 8-Port Serial, 232
	PA-8T-V35	Port Adapter, 8-Port Serial, V.35
	PA-8T-X21	Port Adapter, 8-Port Serial, X.21
	PA-A1-OC3MM	1-Port ATM OC3 Multi-Mode Port Adapter
	PA-A1-OC3SM	1-Port ATM OC3 Single Mode Intermediate Reach Port Adapter
	PA-A2-4E1XC-E3ATM	CES Port Adapter E3/E1 120 ohms
	PA-A2-4E1XC-OC3SM	CES OC3 Port Adapter 4E1 Ports 120 ohms
	PA-A2-4T1C-OC3SM	ATM CES Port Adapter, 4T1 CES Ports and 1 OC3 ATM SM Port
	PA-A2-4T1C-T3ATM	ATM CES Port Adapter, 4T1 CES Ports and 1 T3 ATM Port
	PA-A3-E3	1-Port ATM Enhanced E3 Port Adapter
	PA-A3-OC3MM	1-Port ATM Enhanced OC3c/STM1 Multi-Mode
	PA-A3-OC3SMI	1-Port ATM Enhanced OC3c/STM1 Single Mode
	PA-A3-OC3SML	1-Port ATM Enhanced OC3c/STM1 Single Mode
	PA-A3-T3	1-Port ATM Enhanced DS3 Port Adapter
	PA-CT3/4T1	Channelized DS3 Port Adapter with 4 T1
	PA-E3	1-Port E3 Serial Port Adapter with E3 DSU
	PA-F/FD-MM	Port Adapter, 1-Port FDDI Full Duplex Multi-Mode

Table 17 Supported Hardware for the Cisco AS5800 Universal Access Servers (Continued)

Router Shelf	Port Adapter	Description
RS7206 Router Shelf (continued)	PA-F/FD-SM	Port Adapter, 1-Port FDDI Full Duplex Single-Mode
	PA-FE-FX	Port Adapter, 1-Port FE, 100FX
	PA-FE-TX	Port Adapter, 1-Port FE, 100TX
	PA-F-MM	Port Adapter, 1-Port FDDI Multi-Mode
	PA-F-SM	Port Adapter, 1-Port FDDI Single Mode
	PA-H	Port Adapter, 1-Port HSSI
	PA-POS-OC3MM	1-Port Packet/SONET OC3c/STM1 Multi-Mode Port Adapter
	PA-POS-OC3SMI	1-Port Packet/SONET OC3c/STM1 Single Mode (IR) Port Adapter
	PA-POS-OC3SML	1-Port Packet/SONET OC3c/STM1 Single Mode (LR) Port Adapter
	PA-T3	1-Port T3 Serial Port Adapter with T3 DSUs
	PA-T3+	1-Port T3 Serial Port Adapter Enhanced
	SA-COMP/1	Service Adapter, Compression (64 VCs Stac)
	SA-COMP/4	Service Adapter, Compression (256 VCs Stac)
RS7206VXR Router Shelf	PA-100VG	Single Port 100VG Port Adapter
	PA-12E/2FE	Dual-Wide Ethernet-Switch Port Adapter
	PA-1C-E	1-Port ESCON Channel Port Adapter
	PA-2E3	2-Port E3 Serial Port Adapter with E3 DSU
	PA-2FEISL-FX	2-Port Fast Ethernet/ISL 100BASE-TX Port Adapter
	PA-2FEISL-TX	2-Port Fast Ethernet/ISL 100BASE-FX Port Adapter
	PA-2H	Port Adapter, 2-Port HSSI
	PA-4B-U	4-Port BRI Port Adapter, U Interface
	PA-4E	Port Adapter, 4-Port Ethernet, 10BT
	PA-4R-DTR	Port Adapter, 4-Port Token Ring (Hawkeye Based)
	PA-4T+	Port Adapter, 4-Port Serial, 5in1
	PA-5EFL	Port Adapter, 5-Port Ethernet, 10FL
	PA-8B-S/T	8-Port BRI Port Adapter, S/T Interface
	PA-8E	Port Adapter, 8-Port Ethernet, 10BT
	PA-8T-232	Port Adapter, 8-Port Serial, 232
	PA-8T-V35	Port Adapter, 8-Port Serial, V.35
	PA-8T-X21	Port Adapter, 8-Port Serial, X.21
	PA-A1-OC3MM	1-Port ATM OC3 Multi-Mode Port Adapter
	PA-A1-OC3SM	1-Port ATM OC3 Single Mode Intermediate Reach Port Adapter
	PA-A2-4E1XC-E3ATM	CES Port Adapter E3/E1 120 ohms
	PA-A2-4E1XC-OC3SM	CES OC3 Port Adapter 4E1 Ports 120 ohms
	PA-A2-4T1C-OC3SM	ATM CES Port Adapter, 4T1 CES Ports and 1 OC3 ATM SM Port
	PA-A2-4T1C-T3ATM	ATM CES Port Adapter, 4T1 CES Ports and 1 T3 ATM Port

Table 17 Supported Hardware for the Cisco AS5800 Universal Access Servers (Continued)

Router Shelf	Port Adapter	Description
RS7206VXR Router Shelf (continued)	PA-A3-E3	1-Port ATM Enhanced E3 Port Adapter
	PA-A3-OC3MM	1-Port ATM Enhanced OC3c/STM1 Multi-Mode
	PA-A3-OC3SMI	1-Port ATM Enhanced OC3c/STM1 Single Mode
	PA-A3-OC3SML	1-Port ATM Enhanced OC3c/STM1 Single Mode
	PA-A3-T3	1-Port ATM Enhanced DS3 Port Adapter
	PA-E3	1-Port E3 Serial Port Adapter with E3 DSU
	PA-FE-FX	Port Adapter, 1-Port FE, 100FX
	PA-FE-TX	Port Adapter, 1-Port FE, 100TX
	PA-GE	One-Port Gigabit Ethernet PA for 7200VXR
	PA-H	Port Adapter, 1-Port HSSI
	PA-MC-8E1/120	8-Port Multichannel E1 Port Adapter
	PA-POS-OC3MM	1-Port Packet/SONET OC3c/STM1 Multi-Mode Port Adapter
	PA-POS-OC3SMI	1-Port Packet/SONET OC3c/STM1 Single Mode (IR) Port Adapter
	PA-POS-OC3SML	1-Port Packet/SONET OC3c/STM1 Single Mode (LR) Port Adapter
	PA-T3	1-Port T3 Serial Port Adapter with T3 DSUs
	PA-T3+	1-Port T3 Serial Port Adapter Enhanced

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Additional Notes for the Cisco AS5800

The following MIBs are supported on the Cisco AS5800:

- CISCO-C8500-REDUNDANCY-MIB
- CISCO-ENVMON-MIB.my
- CISCO-QUEUE-MIB.my
- CISCO-CALL-HISTORY-MIB.my
- CISCO-MEMORY-POOL-MIB.my
- CISCO-RF-MIB
- CISCO-DIAL-CONTROL-MIB
- CISCO-MODEM-MGMT-MIB
- CISCO-SMI.my
- CISCO-DSP-MGMT-MIB
- CISCO-PING-MIB
- CISCO-TC
- CISCO-ENTITY-FRU-CONTROL-MIB

- CISCO-POP-MGMT-MIB
- OLD-CISCO-CPU-MIB
- OLD-CISCO-IP-MIB
- RFC-1212.mib
- RFC-1215.mib
- RFC1155-SMI.mib
- RFC1213-MIB.mib
- RFC1354-MIB.mib
- RFC1406-MIB
- RFC1407-MIB
- DIAL-CONTROL-MIB
- ENTITY-MIB
- IF-MIB.mib
- ATM-MIB
- CALL-TRACKER-MIB
- CISCO TOKEN RING MIB
- CISCO-ATM2-MIB
- CISCO-ATM-IF-PHYS-MIB
- CISCO-ATM-SIG-DIAG-MIB
- CISCO-BULK-FILE-MIB
- CISCO-ENTITY-MIB
- CISCO-FRAME-RELAY-MIB
- CISCO-ISDN-MIB
- CISCO-SYSLOG-MIB
- CISCO-VPDN-MGMT-MIB
- EXPRESSION-MIB
- FDDI-SMT73-MIB
- FSIP-MIB
- OLD-CISCO-CHASSIS-MIB
- OLD-CISCO-MEMORY-MIB
- PROCESS-MIB
- RFC1398-MIB
- RTT Mon MIB
- SONET-MIB
- EVENT-MIB
- AAA-SESSION-MIB
- AAA-SERVER-MIB
- CISCO-CIRCUIT-INTERFACE-MIB

Cisco 7000 Family Routers

This section contains the following sections with information that is specific to the Cisco 7000 family router:

Memory Recommendations

For memory recommendations for the Cisco 7000 family routers in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Cisco IOS Release 12.2 supports the Cisco 7000 family:

- Cisco 7000 series routers (Cisco 7000 and Cisco 7010) upgraded with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI)
- Cisco 7100 series routers (Cisco 7120 and Cisco 7140)
- Cisco 7200 series routers (Cisco 7202, Cisco 7204, and Cisco 7206)
- Cisco 7500 series routers (Cisco 7505, Cisco 7507, Cisco 7513, and Cisco 7576)

Note The VIP2-10, VIP2-15, and VIP2-20 must be upgraded to VIP2-40s to support Cisco IOS Release 12.2. The appropriate upgrade kits are available through Cisco.

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Additional Notes for the Cisco 7000 Family Routers

MBS Not Configurable on Cisco 7200 Series Routers

When PCR (Peak Cell Rate) and SCR (Sustainable Cell Rate) are the same on a Cisco 7200 series router, the Maximum Burst Size (MBS) is irrelevant. Therefore, MBS is not configurable.

Cisco uBR7200 Series Universal Broadband Routers

This section contains the following sections with information that is specific to the uBR7200 series universal broadband routers:

Introduction

The Cisco uBR7200 Series universal broadband routers—the Cisco uBR7223, the Cisco uBR7246, and the Cisco uBR7246 VXR—are based on the Data Over Cable Service Interface Specification (DOCSIS) standards. Each is designed to be installed at a service provider's headend facility.

Cisco uBR7200 Series universal broadband routers allow two-way transmission of digital data and Voice over IP (VoIP) traffic over a hybrid-fiber coaxial (HFC) network. These routers function as the cable modem termination system (CMTS) for subscriber-end devices such as Cisco uBR904 and Cisco uBR924 Cable Access Routers, and other DOCSIS-compliant cable modems (CMs) and set top boxes (STBs).

For cable plants not fully upgraded to support two-way cable transmission, the routers support DOCSIS-compliant telco return, where the cable modem's return path to the CMTS is via a dial-up telephone line connection instead of an upstream channel over the coaxial cable. The telco-return delivery mechanism enables cable operators to accelerate deployment of high-speed data services before the cable systems are upgraded to two-way plants.

The introduction of the WT2700 Wireless Technology Suite also allows the Cisco uBR7223, the Cisco uBR7246, and the Cisco uBR7246 VXR Universal Broadband Routers to become a two-way high-speed point-to-point broadband fixed wireless system that provides a fixed, dedicated wireless link from one headend site to another. This link delivers full-duplex data in unlicensed U-NII band (5.725 to 5.825 GHz). The WT2700 Wireless Technology Suite includes the point-to-point wireless modem card, which is installed in the Cisco uBR7200 series chassis, and the power feed panel, which is an external component.

The Cisco uBR7200 series routers support IP routing with a wide variety of protocols and combinations of Ethernet, Fast Ethernet, Gigabit Ethernet, serial, High-Speed Serial Interface (HSSI), Packet over SONET (POS) OC-3 and OC-12c, and ATM media.

Cisco IOS Release 12.2 supports cable & fixed wireless system configurations using the Cisco uBR7246 VXR, Cisco uBR7246, and Cisco uBR7223.

Cisco uBR7246 VXR Universal Broadband Router

The Cisco uBR7246 VXR offers an industry-proven CMTS and carrier-class router in a scalable platform with a high-performance network processing engine to support data, voice, and video services for medium to large network installations.

The Cisco uBR7246 VXR provides the following major hardware features:

- High-performance network processing engine
- I/O controller
- Up to two network interface port adapters
- Up to four cable and/or wireless modem cards
- Up to two removable power supplies that provide load-sharing and redundancy capabilities
- Two Personal Computer Memory Card International Association (PCMCIA) slots that allow for software upgrades through the use of Flash memory cards

Note The Cisco uBR7246 VXR chassis does not support the MC11-FPGA cable modem card.

Cisco uBR7246 Universal Broadband Router

The Cisco uBR7246 offers an industry-proven CMTS and carrier-class router in a scalable platform to support data, voice, and video services for medium to large network installations.

The Cisco uBR7246 provides the following major hardware features:

- Network processing engine
- I/O controller
- Up to two network interface port adapters
- Up to four cable and/or wireless modem cards
- Up to two removable power supplies that provide load-sharing and redundancy capabilities
- Two PCMCIA slots that allow for software upgrades through the use of Flash memory cards

Cisco uBR7223 Universal Broadband Router

The Cisco uBR7223 is a cost-effective, scalable interface between subscriber cable modems and the backbone data network, and is designed specifically for small to medium network installations.

The Cisco uBR7223 provides the following major hardware features:

- Network processing engine
- I/O controller
- One network interface port adapter
- Up to two cable and/or wireless modem cards
- One removable power supply (The Cisco uBR7223 does not feature load-sharing and redundant power supply capability like the Cisco uBR7246 VXR and Cisco uBR7246.)
- Two PCMCIA slots that allow for software upgrades through the use of Flash memory cards

Universal Broadband Router Overview

Table 18 provides a quick overview of the major hardware features of the three universal broadband routers.

Table 18 Cisco uBR7200 Series Universal Broadband Routers Overview

Hardware Supported	Cisco uBR7246 VXR	Cisco uBR7246	Cisco uBR7223
Network Processing Engine	One of the following: NPE-225 NPE-300	One of the following: NPE-150 NPE-200 NPE-225	One of the following: NPE-150 NPE-200 NPE-225
I/O Controller	1	1	1
Network Interface Port Adapters	Up to 2	Up to 2	1
Cable and/or Wireless Modem Cards	Up to 4	Up to 4	Up to 2
Removable Power Supplies	Up to 2	Up to 2	1
PCMCIA Slots	2	2	2

Note Earlier release notes stated that the NPE-175 was also supported on the Cisco uBR7200 series routers. Because the NPE-175 has reached its end of life and was never made orderable on the Cisco uBR7200 series routers, it has been removed from the table.

Memory Recommendations

For memory recommendations for the Cisco uBR7200 series universal broadband routers in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

System Interoperability

This section clarifies the operation of certain features in the Cisco uBR7200 Series Universal Broadband Routers:

- DOCSIS 1.0 Baseline Privacy

  DOCSIS Baseline Privacy Interface (BPI) gives subscribers data privacy across the RF network, encrypting traffic flows between the CMTS and the CM. BPI ensures that a CM, uniquely identified by its MAC address, can obtain keying material for services that only it is authorized to access.

  To enable BPI, choose software at both the CMTS and the CM that support the mode of operation. For the Cisco uBR7200 series software, choose an image with "k1" in its file name or BPI in the feature set description.

  The CM must also support BPI. CMs must have factory-installed RSA private/public key pairs to support internal algorithms to generate key pairs prior to first BPI establishment. BPI must be enabled via the DOCSIS configuration file.

  Note RSA stands for Rivest, Shamir, and Adelman, inventors of a public-key cryptographic system.

- CM Interoperability

The Cisco uBR7200 series interoperates with the following cable modems:

- DOCSIS-based two-way CMs that support basic Internet access, VoIP, or VPN.
- Telco-return CMs—To support telco return, use a Cisco uBR7200 series software image that contains "t" in its filename. The telco-return CM must be DOCSIS-based or compliant, and must be configured to support telco return.

Note Some third-party telco-return CMs cannot receive traffic over the same downstream channel as CMs operating on a two-way data system. In these instances, segment your cable plant to allow more than one downstream channel.

- EuroDOCSIS CMs or set top boxes (STBs) with integrated EuroDOCSIS CMs using Cisco MC16E Cable Modem Cards and Cisco IOS Release 12.1(1a)T1 or higher. EuroDOCSIS operation support includes 8-MHz Phase Alternating Line (PAL) or Systeme Electronique Couleur Avec Memoire (SECAM) channel plans.

- DOCSIS 1.0 Extensions

  The Cisco uBR7200 series supports DOCSIS 1.0 quality of service (QoS) extensions that include:

  - Multi-SID support, allowing the definition of multiple Service IDs (SIDs) on the upstream: Voice traffic can be designated on a higher QoS committed information rate (CIR) secondary SID, while data traffic can be forwarded on a best-effort basis on a primary SID. Secondary SIDs are higher QoS CIR-type classes that have a nonzero minimum reserved rate (CIR-type service). These SIDs receive preferential treatment at the CMTS for grants over any tiered best-effort type data SID of that upstream. Reliable operation with voice requires multiple SIDs—at least two per CM to separate voice from data. In DOCSIS 1.0, SIDs are set up statically. When supporting DOCSIS 1.0 extensions, SIDs can be set up statically or dynamically. Both the CMTS and CM must support this capability.
  - CM-initiated dynamic MAC messages: Dynamic Service Addition (DSA) and Dynamic Service Deletion (DSD). These messages allow dynamic SIDs to be created and deleted at run-time on a per-VoIP call basis.
  - Unsolicited grant service (constant bit-rate scheduling) on the upstream: This helps provide a higher-quality channel for upstream VoIP packets from an Integrated Telephony Cable Modem (ITCM) such as the Cisco uBR924 Cable Access Router.
  - Ability to provide separate downstream rates for any given ITCM, based on the IP-precedence value in the packet: This helps separate voice signaling and data traffic that goes to the same ITCM to address rate shaping purposes.
  - Concatenation—To increase the per-CM upstream throughput in certain releases of software, Cisco uBR7200 series software supports a concatenated burst of multiple MAC frames from a CM that supports concatenation.

Note All DOCSIS 1.0 extensions are activated only when a CM or Cisco uBR924 that supports these extensions solicits services via dynamic MAC messages or the feature set. If the CMs in your network are pure DOCSIS 1.0-based, they will receive regular DOCSIS 1.0 treatment from the CMTS.

- Clock Synchronization

  The Cisco uBR7200 series supports clock hardware and software to enable high-quality delivery of IP telephony services through synchronized data transmissions. To support the clock feature set, a Cisco uBR7246 VXR chassis must be used. The Cisco uBR7246 VXR must contain a clock card

and an MC16S or MC16E Cable Modem Card. Only the MC16S and the MC16E Cable Modem Cards support the external clock reference from the clock card to distribute that signal to CMs or set top boxes (STBs) attached to the specific network segments. The chassis must be running Cisco IOS Release 12.1(1a)T1 or higher.

Each cable modem must also supports VoIP applications and the clock reference feature set to enable synchronized timing. The Cisco uBR924 Cable Access Router, running Cisco IOS Release 12.0(7)T or later, supports the clock reference feature set automatically.

Hardware Supported

Cisco IOS Release 12.2 supports the following Cisco uBR7200 Series Universal Broadband Routers:

- Cisco uBR7223
- Cisco uBR7246
- Cisco uBR7246 VXR

For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Network Processing Engines

The Cisco uBR7223 and the Cisco uBR7246 support the following Network Processing Engines (NPEs) in Cisco IOS Release 12.2:

- NPE-150
- NPE-200
- NPE-225

The Cisco uBR7246 VXR supports the following NPEs in Cisco IOS Release 12.2:

- NPE-225
- NPE-300

Note The NPE-300 is not supported on the Cisco uBR7223 and the Cisco uBR7246. The NPE-150 and NPE-200 are not supported on the Cisco uBR7246 VXR.

Cable Modem Cards

Cisco IOS Release 12.2 supports the following cable modem cards, all of which provide connection to the HFC network:

- MC11C cable modem cards (which replace the original MC11-FPGA cable modem cards that are also supported for existing installations) offer the following ports:
  - One upstream port
  - One downstream port
- MC12C cable modem cards (which replace the original MC12 cable modem cards) offer the following ports:
  - Two upstream ports
  - One downstream port

- MC14C cable modem cards (which replace the original MC14 cable modem cards) offer the following ports;
  - Four upstream ports
  - One downstream port
- MC16C cable modem cards (which replace the MC16B cable modem cards that are also supported for existing installations) offer the following ports:
  - Six upstream ports
  - One downstream port
- MC16E cable modem cards provide connection to an HFC network using the proposed EuroDOCSIS (Annex A) standard and offer the following ports:
  - Six upstream ports
  - One downstream port
- MC16S spectrum management cable modem cards offer the following ports:
  - Six upstream ports, with dedicated hardware support for enhanced hardware-based spectrum management
  - One downstream port

Table 19 provides a quick overview of the cable modem cards that are supported in Cisco IOS Release 12.2.

Table 19 Cisco uBR7200 Series Universal Broadband Routers Cable Modem Cards

Cable Modem Card	Upstream Ports	Downstream Ports	Additional Features
MC11C	1	1	—
MC12C	2	1	—
MC14C	4	1	—
MC16C	6	1	—
MC16E	6	1	EuroDOCSIS (Annex A) Support
MC16S	6	1	Enhanced software- and hardware-based Spectrum Management Support

Port Adapter Cards

Table 20 lists and describes the port adapters supported by Cisco uBR7200 series routers in Cisco IOS Release 12.2.

Note Not all Cisco uBR7200 series routers support all port adapters. Some port adapters must be at certain revision levels to be used in the Cisco uBR7246 VXR router.

Note Not all port adapters are supported with the point-to-point wireless modem card. The HSSI, 10BASE-T Ethernet, 100BASE-T Ethernet, serial Frame Relay, ATM, and POS interfaces are fully supported. The Gigabit Ethernet port adapter was not supported with the point-to-point wireless modem card at the time the Cisco IOS Release 12.2 software was released.

Table 20 Cisco uBR7200 Series Universal Broadband Routers Port Adapter Releases

Product Number	Cisco uBR7223	Cisco uBR7246	Cisco uBR7246 VXR
Ethernet			
PA-4E—4-port Ethernet 10BASE-T port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1[1]
PA-8E—8-port Ethernet 10BASE-T port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1[2]
PA-FE-TX—1-port 100BASE-TX Fast Ethernet port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1
PA-FE-FX—1-port 100BASE-FX Fast Ethernet port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1
PA-2FEISL-TX—2-port 100BASE-TX Fast Ethernet port adapter with Inter-Switch Link (ISL) support	12.0(5)T1, 12.1(1a)T1	12.0(5)T1, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1
PA-2FEISL-FX—2-port 100BASE-FX Fast Ethernet port adapter with Inter-Switch Link (ISL) support	12.0(5)T1, 12.1(1a)T1	12.0(5)T1, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1
PA-12E/2FE—12-port 10BASE-T and 2-port 10/100BASE-TX port adapter	—	12.0(5)T1, 12.1(1a)T1	—
Gigabit Ethernet			
PA-GE—1-port, full-duplex, IEEE 802.3z-compliant Gigabit Ethernet (GE) port adapter[3]	—	—	12.0(7)T, 12.1(1a)T1
Serial			
PA-4T+—4-port synchronous serial port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.1(1a)T1
PA-8T-232—8-port EIA/TIA-232 synchronous serial port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	—
PA-8T-V35—8-port V.35 synchronous serial port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	—
PA-8T-X21—8-port X.21 synchronous serial port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	—
PA-4E1G-75—4-port unbalanced (75-ohm) E1-G.703/G.704 synchronous serial port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.1(3)T
PA-4E1G-120—4-port balanced (120-ohm) E1-G.703/G.704 synchronous serial port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.1(3)T
PA-E3—1-port high-speed serial E3 interface port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.1(3)T
PA-T3—1-port T3 serial interface port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.1(3)T
PA-2E3—2-port high-speed serial E3 interface port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.1(3)T
PA-2T3—2-port T3 serial interface port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.1(3)T
PA-MC-E3—1-port multi-channel E3, medium-speed serial interface port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	—
PA-MC-T3—1-port T3 (channelized into 28 independent T1 data lines) port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	—

Table 20 Cisco uBR7200 Series Universal Broadband Routers Port Adapter Releases (Continued)

Product Number	Cisco uBR7223	Cisco uBR7246	Cisco uBR7246 VXR
PA-MC-4T1—4-port multichannel DS1 ISDN Primary Rate Interface (PRI) single-wide port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	—
PA-MC-8E1/120—8-port multichannel E1 ISDN Primary Rate Interface (PRI) single-wide port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	—
PA-MC-8T1—8-port multichannel DS1 ISDN Primary Rate Interface (PRI) single-wide port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	—
HSSI			
PA-H—1-port HSSI port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1[4]
PA-2H—2-port HSSI port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1[5]
ATM			
PA-A1-OC3SMI—1-port ATM OC-3c/STM-1 single-mode intermediate reach port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	—
PA-A1-OC3MM—1-port ATM OC-3c/STM-1 multimode port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	—
PA-A2-4E1XC-OC3SM—5-port ATM CES[6] (4 E1 120-ohm CBR[7] ports and 1 OC-3 ATM single-mode port) port adapter	—	12.0(1)T, 12.1(1a)T1	—
PA-A2-4E1XC-E3ATM—5-port ATM CES[6] (4 E1 120-ohm CBR[7] ports and 1 E3 ATM port) port adapter	—	12.0(1)T, 12.1(1a)T1	—
PA-A2-4T1C-OC3SM—5-port ATM CES[6] (4 T1 CBR[7] ports and 1 OC-3 ATM single-mode port) port adapter	—	12.0(1)T, 12.1(1a)T1	—
PA-A2-4T1C-T3ATM—5-port ATM CES[6] (4 T1 CBR[7] ports and 1 T3 ATM port) port adapter	—	12.0(1)T, 12.1(1a)T1	—
PA-A3-E3—1-port E3 ATM, PCI-based port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	—
PA-A3-T3—1-port T3 ATM, PCI-based port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	—
PA-A3-OC3MM—1-port OC-3c ATM, PCI-based multimode port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1
PA-A3-OC3SMI—1-port OC-3c ATM, PCI-based single-mode intermediate reach port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1
PA-A3-OC3SML—1-port OC-3c ATM, PCI-based single-mode long reach port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1) T, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1
Packet-Over-SONET (POS)			
PA-POS-OC3SML—1-port POS OC-3 single-mode, long reach port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1

Table 20 Cisco uBR7200 Series Universal Broadband Routers Port Adapter Releases (Continued)

Product Number	Cisco uBR7223	Cisco uBR7246	Cisco uBR7246 VXR
PA-POS-OC3SMI—1-port OC3 single-mode, intermediate reach port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1
PA-POS-OC3MM—1-port POS OC3 multimode port adapter	12.0(5)T1, 12.1(1a)T1	12.0(1)T, 12.1(1a)T1	12.0(7)T, 12.1(1a)T1
Dynamic Packet Transport (DPT)			
PA-SRP-OC12SMX—2-port SRP[8] OC12 single-mode, extended reach port adapter	Not applicable	12.1(1a)T1	12.1(1a)T1

1. To use a PA-4E 4-port Ethernet 10BASE-T port adapter in a Cisco uBR7246 VXR, be sure you have the minimum required hardware revision (version 1.14, part number 800-02070-04) or a more recent version of the port adapter.
2. To use a PA-8E 8-port Ethernet 10BASE-T port adapter in a Cisco uBR7246 VXR, be sure you have the minimum required hardware revision (version 1.14, part number 800-02069-04) or a more recent version of the port adapter.
3. The Gigabit Ethernet port adapter must be combined with the appropriate optical fiber cable and a Gigabit Interface Converter (GBIC).
4. To use a PA-H 1-port HSSI port adapter in a Cisco uBR7246 VXR, be sure you have the minimum required hardware revision (version 1.17, part number 800-02747-06) or a more recent version of the port adapter.
5. To use a PA-2H 2-port HSSI port adapter in a Cisco uBR7246 VXR, be sure you have the minimum required hardware revision (version 1.3, part number 800-03306-02) or a more recent version of the port adapter.
6. CES = circuit emulation services
7. CBR = constant bit rate
8. SRP = spatial reuse protocol

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Limitations and Restrictions

Cisco IOS Release 12.1(5)T for the Cisco uBR7200 Series Universal Broadband Routers contains the following limitations and restrictions. Unless otherwise indicated, these limitations and restrictions apply to all previous software releases as well.

Wireless Modem Card Support for Port Adapters

Not all port adapters are supported with the point-to-point wireless modem card. The HSSI, 10BASE-T Ethernet, 100BASE-T Ethernet, serial Frame Relay, ATM, and POS interfaces are fully supported. The Gigabit Ethernet port adapter was not supported with the point-to-point wireless modem card at the time the Cisco IOS Release 12.2 software was released.

Wireless System Power Feed Panel

The cable that supplies -48VDC to the wireless system's power feed panel should not exceed 3 meters in length.

Supported MIBS

The Cisco uBR7200 Series Universal Broadband Routers support the following categories of MIBs:

- SNMP standard MIBs—These are the MIBs that are required by any agent that supports SNMPv1 or SNMPv2 network management.

- Cisco's platform and network-layer enterprise MIBs—Common across most of Cisco's router platforms. If your network management applications are already configured to support other Cisco routers, such as the 2600 series or 7200 series, no further configuration is needed unless the version of Cisco IOS software being used has updated these MIBs.
- Cable-specific and wireless-specific MIBs—Provide information about the cable and wireless interfaces and related information on the uBR7200 series routers. They include both DOCSIS-specific MIBs and Cisco-specific enterprise MIBs. If your network management applications have not already been configured for the uBR7200 series routers, these MIBs must be loaded.
- Deprecated MIBs—Supported in earlier releases of Cisco IOS software but have been replaced by more standardized, scalable MIBs. Network Management applications and scripts should convert to the replacement MIBs as soon as possible.

The cable-specific and wireless-specific MIBs are described in the following sections. For information on the SNMP standard MIBs and Cisco's platform and network-layer enterprise MIBs, see Cisco's MIB web site at http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml.

Cable-Specific and Wireless-Specific MIBs

Table 21 shows the cable-specific and wireless-specific MIBs that are supported on the Cisco uBR7200 Series Universal Broadband Routers. The table also provides a brief description of each MIB contents and the Cisco IOS software release in which the MIB was initially functional—earlier releases might have had unsupported prototype versions of the MIB; later releases might have added new attributes and functionality. Because of interdependencies, the MIBs must be loaded in the order given in the table.

Note The names given in Table 21 are the filenames for the MIBs as they exist on Cisco's FTP site http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml. Most MIBs are available in both SNMPv1 and SNMPv2 versions; the SNMPv1 versions have *V1SMI* as part of their filenames.

Table 21 Cable-Specific and Wireless-Specific MIBs Supported on Cisco uBR7200 Series Universal Broadband Routers

MIB Filename	Description	Release
SNMPv2-SMI.my SNMPv2-SMI-V1SMI.my	This module specifies the Structure of Management Information (SMI) for SNMPv2, as defined in RFC 1902.	11.3 T
SNMPv2-TC.my SNMPv2-TC-V1SMI.my	This module defines the textual conventions as specified in RFC 1903.	11.3 T
SNMPv2-MIB.my SNMPv2-MIB-V1SMI.my	The management protocol, SNMPv2, provides for the exchange of messages that convey management information between the agents and the management stations, as defined in RFC 1907.	11.3 T
CISCO-SMI.my CISCO-SMI-V1SMI.my	This module specifies the SMI for Cisco's enterprise MIBs.	11.3 T
CISCO-TC.my CISCO-TC-V1SMI.my	This module defines the textual conventions used in Cisco's enterprise MIBs.	11.3 T
IF-MIB.my IF-MIB-V1SMI.my	This module describes generic objects for the Layer 3 network interface sublayers. This MIB is an updated version of MIB-II's *if* table and incorporates the extensions defined in RFC 2233.	11.3 T 12.1(2)T
DOCS-IF-MIB.my DOCS-IF-MIB-V1SMI.my	This module describes the DOCSIS-compliant Radio Frequency (RF) interfaces in cable modems and cable modem termination systems, as defined in RFC 2670.	12.1(1a)T1
DOCS-BPI-MIB.my	This module—available in an SNMPv2 version only—describes the attributes for the DOCSIS-specified Baseline Privacy Interface (BPI) on cable modems and the CMTS.	11.3(11)NA 12.0(7)XR
CISCO-DOCS-EXT-MIB.my CISCO-DOCS-EXT-MIB-V1SMI.my	This module extends the DOCSIS standard RFI MIB (DOCS-IF-MIB) with Cisco-specific extensions, such as QoS attributes and connection status and other information regarding the cable modems and CPE devices supported by the CMTS.	11.3(9)NA 12.0(5)T1
CISCO-DOCS-REMOTE-QUERY-MIB.my (also referred to as SNMP Cable Modem Remote Query)	This module facilitates SNMP polling of remote CMs on a CMTS.	12.1(2)T
CISCO-CIRCUIT-INTERFACE-MIB.my	This module adds support for a new Cisco enterprise MIB, used to assist in SNMP monitoring of circuit-based interfaces.	12.1(3)T
CISCO-MSDP-MIB.my	This module enables users to manage Multicast Source Discovery Protocol operations using SNMP.	12.1(5)T

Table 21 Cable-Specific and Wireless-Specific MIBs Supported on Cisco uBR7200 Series Universal Broadband Routers (Continued)

MIB Filename	Description	Release
CISCO-NTP-MIB.my	This module enables users to remotely monitor an NTP server using SNMP.	12.1(5)T
EXPRESSION-MIB.my	This module adds support of the Delta, Wildcarding, Delta Wildcarding, and Aggregation features in the Distributed Management Expression MIB (EXPRESSION-MIB).	12.1(3)T
CISCO-CABLE-SPECTRUM-MIB.my CISCO-CABLE-SPECTRUM-MIB-V1SMI.my	This module describes the spectrum management flap list attributes.	12.0(5)T1
CISCO-WIRELESS-TC-MIB.my CISCO-WIRELESS-TC-MIB-V1SMI.my	This module contains the textual conventions for the other wireless modem card MIB modules.	12.0(7)XR
CISCO-WIRELESS-EXP-MIB.my CISCO-WIRELESS-EXP-MIB-V1SMI.my	This module is the Cisco Wireless Radio Experimental MIB for the Cisco wireless modem card and related subsystem.	12.0(7)XR
CISCO-WIRELESS-IF-MIB.my CISCO-WIRELESS-IF-MIB-V1SMI.my	This module is the MIB module for the Cisco Wireless Radio Point-to-Point interface specification.	12.0(7)XR
CISCO-WIRELESS-P2P-BPI-MIB.my CISCO-WIRELESS-P2P-BPI-MIB-V1SMI.my	This module is the MIB module for the Baseline Privacy Interface (BPI) as implemented on the wireless modem card. This is a variation of the DOCSIS BPI MIB that has been customized for the point-to-point wireless modem subsystem.	12.0(7)XR

Cisco ICS 7750

This section contains the following sections with information that is specific to the Cisco ICS 7750:

Memory Recommendations

For memory recommendations for the Cisco ICS7750 in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

Cisco IOS Release 12.2 supports the Cisco ICS 7750.

Cisco MGX 8850 Route Processor Module

This section contains the following sections with information that is specific to the Cisco MGX 8850 Route Processor Module (RPM):

Memory Recommendations

For memory recommendations for the Cisco MGX 8850 RPM in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Cisco 15104 Optical Networking System

This section contains the following sections with information that is specific to the Cisco 15104 Optical Networking System:

Memory Recommendations

For memory recommendations for the Cisco 15104 Optical Networking System in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.

Cisco Signaling Link Terminal

This section contains the following sections with information that is specific to the Cisco Signaling Link Terminal:

Introduction

The Cisco Signaling Link Terminal (SLT) enables service providers to reliably transport SS7 protocols across an IP network. The Cisco SLT uses the Cisco IOS SS7 Signaling Link Terminal feature set, providing reliable interoperability with the Cisco Media Gateway Controller. The Cisco SLT is responsible for terminating the Message Transfer Part (MTP) 1 and MTP 2 layers of the SS7 protocol stack. Using Cisco's Reliable User Datagram Protocol (RUDP), the Cisco SLT backhauls, or transports, upper-layer SS7 protocols across an IP network to the Cisco Media Gateway Controller (Cisco VSC3000 or Cisco SC2200).

In combination with this application-specific version of the Cisco IOS software, the Cisco SLT hardware component leverages the widely deployed Cisco 2600 series multiservice access router. The Cisco 2600 series, driven by a powerful RISC processor, provides the high performance required in complex networking infrastructures.

Note When used as a Cisco Signaling Link Terminal device integrated into a Cisco Media Gateway Controller, the Cisco 2611 has SS7 functionality only; all standard Cisco 2611 software features are disabled when running the Cisco SLT image. In that case, only the *Cisco Signaling Link Terminal* document and the Cisco Media Gateway Controller documentation are relevant.

When used for Signaling Link Terminal applications, the modular Cisco 2611 dual-Ethernet port router can be configured with dual serial and the multiflex interface cards. The E1 multiflex interface cards offer integrated DSUs and the T1 multiflex interface cards offer integrated CSU/DSUs. For additional flexibility, the multiflex interface cards can also be ordered with a dual-port drop-and-insert capability. All of these interface cards are Field Replaceable Units (FRUs).

The Cisco SLT supports only the SS7 MTP 2 serial protocol. Therefore, the serial interfaces cannot be configured for other protocols such as HDLC, PPP, X.25, LAPB, and Frame Relay.

The Cisco SLT functions as a component of several solutions that are currently under development. Participants in lab trials can obtain solution documentation from their Cisco representative.

Memory Recommendations

For memory recommendations for the Cisco Signaling Link Terminal in Cisco IOS Release 12.2, refer to the "Memory Recommendations" section on page 9.

Hardware Supported

The Cisco SLT feature in Cisco IOS Release 12.2 supports the Cisco 2611 series routers exclusively. The Cisco SLT feature is not supported with any other Cisco 2600 series chassis. For detailed descriptions of the new hardware features, see the "New and Changed Information" section on page 93.

Table 22 lists the supported interfaces for the Cisco SLT solution data rate.

Table 22 Supported Interfaces for the Cisco SLT Solution Data Rate

Interface, Network Module, or Data Rate[1]		Other Platforms Supporting These Modules
LAN Interfaces	2-port Ethernet (10BASE-T)[2]	Cisco 2611
E1/T1 Multiflex Voice/WAN Interface Cards	1-port T1 multiflex trunk interface (VWIC-1MFT-T1)	All Cisco 2600 series platforms
	1-port E1 multiflex trunk interface (VWIC-1MFT-E1)	All Cisco 2600 series platforms
	2-port T1 multiflex trunk interface (VWIC-2MFT-T1)	All Cisco 2600 series platforms
	2-port E1 multiflex trunk interface (VWIC-2MFT-E1)	All Cisco 2600 series platforms
	2-port T1 multiflex trunk interface with drop-and-insert (VWIC-2MFT-T1-DI)	All Cisco 2600 series platforms
	2-port E1 multiflex trunk interface with drop-and-insert (VWIC-2MFT-E1-DI)	All Cisco 2600 series platforms
WAN Interface Cards	1-port high-speed serial (up to 2.048 Mbps)	All Cisco 2600 series platforms
	2-port Dual high-speed serial (up to 2.048 Mbps; asynchronous/ synchronous support)	All Cisco 2600 series platforms

1. See E1/T1 Multiflex Voice/WAN Interface Cards in this table.
2. The Cisco SLT does not support SS7/IP over both ethernet ports.

Feature Support

For feature support in Cisco IOS Release 12.2, refer to the "Feature Support" section on page 7.