Doc. No. 78-3997-06

Release Notes for Cisco IOS Release 11.2 P

June 30, 1997

These release notes describe the features and caveats for Cisco IOS Release 11.2 P, up to and including Release 11.2(7)P. Specific routers and access servers are affected by this software release. For detailed software configuration information on the new access server and router features and Cisco IOS commands supported by Release 11.2 P, refer to the *Feature Guide for Cisco IOS Release 11.2 P.*

This release note will no longer be updated with maintenance release information. As of Release 11.2(8)P, release notes are product specific. That is, there are separate release notes for each product line rather than one release note that covers all products. Refer to the particular product's release note for information about the release. For example, for information about Cisco 2500 series, refer to the *Release Notes for the Cisco 2500 Series for Cisco IOS Release 11.2*.

Prior to Cisco IOS Release 11.2, maintenance releases of major Cisco IOS software releases were used to deliver additional new features. Beginning with Cisco IOS Release 11.2, Cisco Systems provides as many as three software release "trains" based on a single version of Cisco IOS software. Maintenance releases of the Major train software deliver fixes to software defects only, thus providing the most stable software for your network, for the features you need.

In addition to the Major train, there are up to two Early Deployment (ED) trains. One ED train—Release 11.2 P—delivers both fixes to software defects and support for new Cisco platforms. The other ED train—Release 11.2 F—delivers fixes to software defects, new platform support, and new cross-platform functionality.

These release notes do not describe features that are available in Release 11.2 or Release 11.2 F. For information about features in Release 11.2, refer to the *Release Notes for Cisco IOS Release 11.2*. For information about features in Release 11.2 F, refer to the *Release Notes for Cisco IOS Release 11.2 F.*

Use these release notes in conjunction with the *Release Notes for Cisco IOS Release 11.2*. The software caveats that apply to Release 11.2 also apply to Release 11.2 P.

Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA

These release notes discuss the following topics:

Documentation

Refer to the *Feature Guide for Cisco IOS Release 11.2 P* for new or changed Cisco IOS software documentation specific to new access server and router features described in these release notes. In this feature guide, new features are documented in their own sections, which include configuration tasks and also new and changed command reference pages. This feature guide supplements the Cisco IOS Release 11.2 configuration guide and command reference publications and provides feature documentation for all 11.2 P releases up to and including 11.2(7)P.

Note Because the new features introduced in Release 11.2(6)P do not require additional software configuration information or feature chapters, a configuration section for Release 11.2(6)P does not exist in the feature guide.

These release notes do not describe features that are available in Release 11.2 or Release 11.2 F. For information about features in Release 11.2, refer to the *Release Notes for Cisco IOS Release 11.2*. For information about features in Release 11.2 F, refer to the *Release Notes for Cisco IOS Release 11.2 F*.

All the documents mentioned are available as printed manuals or electronic documents.

The most up-to-date Cisco IOS documentation can be found on the latest Documentation CD-ROM and on the Web. These electronic documents contain updates and modifications made after the paper documents were printed.

For electronic documentation of Cisco IOS Release 11.2 router and access server software features, available on the Documentation CD-ROM, refer to the Cisco IOS Release 11.2 configuration guides and command references, which are located in the Cisco IOS Release 11.2 database.

You can also access Cisco technical documentation on the Web at http://www.cisco.com.

Platform Support for Release 11.2 P

Cisco IOS Release 11.2 P supports the following platforms:

- Cisco 1600 series routers (Cisco 1601, Cisco 1602, Cisco 1603, and Cisco 1604)
- Cisco AS2509-RJ and Cisco AS2511-RJ access servers
- Cisco 2500 Fixed FRAD series (Cisco 2501FRAD-FX, Cisco 2501LANFRAD-FX, and Cisco 2502LANFRAD-FX)
- Cisco 3011 WAN module (a router card that is installed in the Catalyst 3200 switch)
- Cisco 3600 series routers (Cisco 3640 and Cisco 3620)
- Cisco 3800 Series (for information on the Cisco 3800, refer to the *Cisco 3800 Series Product Release Notes*)
- Cisco 4000 series routers (Cisco 4500, Cisco 4500-M, Cisco 4700, and Cisco 4700-M)
- Cisco AS5200 universal access server
- Cisco 7000 series (RSP7000 and RSP7000CI only)
- Cisco 7200 series (Cisco 7206 and Cisco 7204)
- Cisco 7500 series (Cisco 7505, Cisco 7507, and Cisco 7513)

Table 1 and Table 2 summarize the LAN interfaces supported on each platform.

Table 3 and Table 4 summarize the WAN data rates and interfaces supported on each platform.

"Yes" means that a particular data rate or interface is supported. "No" means that it is not.

Table 1 LAN Interfaces Supported on Low-End to Mid-Range Routers, Access Servers, and Router Cards

Interface	Cisco 1600 Series	Cisco AS2509-RJ and Cisco AS2511-RJ	Cisco 2500 Fixed FRAD Series	Cisco 3600 Series	Cisco 4000 Series	Cisco 3011 WAN Module[1]	Internet Router Cards[2]
Ethernet (AUI)	Yes	Yes	Yes[3]	Yes	Yes	No	No
Ethernet (10BaseT)	Yes	No	No	Yes	Yes	Yes[4]	Yes[5]
Ethernet (10BaseFL)	No	No	No	No	No	Yes[4]	Yes[5]
Fast Ethernet (100BaseTX)	No	No	No	Yes	Yes	Yes[4]	Yes[5]
Fast Ethernet (100BaseFX)[6]	No	No	No	Yes	Yes	Yes[4]	No
4-Mbps Token Ring	No	No	Yes[7]	Yes	Yes	No	No
16-Mbps Token Ring	No	No	Yes[7]	Yes	Yes	No	No

Table 1 LAN Interfaces Supported on Low-End to Mid-Range Routers, Access Servers, and Router Cards

Interface	Cisco 1600 Series	Cisco AS2509-RJ and Cisco AS2511-RJ	Cisco 2500 Fixed FRAD Series	Cisco 3600 Series	Cisco 4000 Series	Cisco 3011 WAN Module[1]	Internet Router Cards[2]
FDDI full duplex	No	No	No	No	Yes	No	No
FDDI DAS	No	No	No	No	Yes	No	No
FDDI SAS	No	No	No	No	Yes	No	No
FDDI multimode	No	No	No	No	Yes (DAS/ SAS)	No	No
FDDI single-mode	No	No	No	No	Yes	No	No
ATM Interface	No	No	No	No	Yes	Yes[8]	No
100VG Any LAN	No	No	No	No	No	Yes[8]	Yes[5]
Packet OC-3 Interface	No	No	No	No	Yes	No	No

1. This module is supported in the Catalyst 3200 switch.
2. These router cards are inserted into supported 10BaseT hubs.
3. Only the Cisco 2501FRAD-FX router has an AUI port.
4. These Ethernet interfaces are provided on the Catalyst 3200 switch, which is the device that the Cisco 3011 WAN module slides into. The Cisco 3011 WAN module does not provide Ethernet interfaces as a standalone router card.
5. Internet router cards do not directly provide 10BaseT or 100VG interfaces. These interfaces exist on supported hub devices.
6. This feature requires an external MII transceiver.
7. Only the Cisco 2502LANFRAD-FX router has support for 4- and 16-Mbps Token Ring.
8. This interface is provided by the Catalyst 3200 switch not by the Cisco 3011 WAN module.

Table 2 LAN Interfaces Supported on High-End Access Servers and Routers

Interface	Cisco AS5200	Cisco 7000 Series[1]	Cisco 7200 Series	Cisco 7500 Series
Ethernet (AUI)	Yes	Yes	Yes	Yes
Ethernet (10BaseT)	No	Yes	Yes	Yes
Ethernet (10BaseFL)	No	Yes	Yes	Yes
Fast Ethernet (100BaseTX)	No	Yes	Yes	Yes
Fast Ethernet (100BaseFX)	No	Yes	Yes	Yes
4-Mbps Token Ring	Yes	Yes	Yes	Yes
16-Mbps Token Ring	Yes	Yes	Yes	Yes
Full-duplex Token Ring	No	Yes	Yes	Yes
FDDI DAS	No	Yes	Yes	Yes
FDDI SAS	No	Yes	No	Yes
FDDI full duplex	No	Yes	Yes	Yes
FDDI multimode	No	Yes	Yes	Yes
FDDI single-mode	No	Yes	Yes	Yes
ATM Interface	No	Yes	Yes	Yes

Table 2 LAN Interfaces Supported on High-End Access Servers and Routers (Continued)

Interface	Cisco AS5200	Cisco 7000 Series[1]	Cisco 7200 Series	Cisco 7500 Series
Channel Interface	No	Yes	No	Yes
Second-Generation Channel Interface [2]	No	Yes	No	Yes
Parallel Channel Adapter (Bus and Tag)	No	Yes	No	Yes
ESCON Channel Adapter (ECA)	No	Yes	No	Yes
Versatile Interface	No	Yes	No	Yes
Second-Generation Versatile Interface [2]	No	Yes	No	Yes
100 VG Any LAN	No	Yes	Yes	Yes
Packet OC-3 Interface[2]	No	Yes	No	Yes
Synchronous Serial	Yes	Yes	Yes	Yes

1. Only Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and the 7000 Series Chassis Interface (RSP7000CI) are supported.
2. These interfaces require the RSP7000 and RSP7000CI.

Table 3 WAN Data Rates and Interfaces Supported on Low-End to Mid-Range Routers, Access Servers, and Router Cards

	Cisco 1600 Series	Cisco AS2095-RJ and Cisco AS2511-RJ	Cisco 2500 Fixed FRAD Series	Cisco 3600 Series	Cisco 4000 Series	Cisco 3011 WAN Modules	Internet Router Cards
Data Rate							
48/56/64 kbps	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.544/2.048 Mbps	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interface							
EIA/TIA-232	Yes	Yes	Yes	Yes	Yes	Yes	Yes
X.21	Yes	Yes	Yes	Yes	Yes	Yes	Yes
V.35	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EIA/TIA-449	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EIA-530	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Serial, synchronous and asynchronous	Yes	Yes	Yes	Yes	Yes[1]	Yes	Yes
4-wire 56K DSU/CSU	Yes[2]	No	No	Yes	No	No	No
ISDN BRI S/T ISDN BRI U	Yes	Yes	No	Yes	Yes	Yes	Yes
ISDN PRI	No	No	No	Yes	Yes	No	No
Channelized T1 (with and without CSU)	No	No	No	Yes	Yes	No	No
Channelized E1 (balanced and unbalanced)	No	No	No	Yes	Yes	No	No
HSSI	No	No	No	No	Yes	No	No

Table 3 WAN Data Rates and Interfaces Supported on Low-End to Mid-Range Routers, Access Servers, and Router Cards (Continued)

	Cisco 1600 Series	Cisco AS2095-RJ and Cisco AS2511-RJ	Cisco 2500 Fixed FRAD Series	Cisco 3600 Series	Cisco 4000 Series	Cisco 3011 WAN Modules	Internet Router Cards
EIA/TIA-613 (HSSI)	No	No	No	No	Yes	No	No
E1-G.703/G.704	No	No	No	No	Yes	No	No

1. High-speed synchronous serial ports and low-speed serial ports are provided for the Cisco 4000 series routers.
2. This interface is supported on the Cisco 1602 router only.

Table 4 WAN Data Rates and Interfaces Supported on High-End Access Servers and Routers

	Cisco AS5200	Cisco 7000 Series[1]	Cisco 7200 Series	Cisco 7500 Series
Data Rate				
48/56/64 kbps	Yes	Yes	Yes	Yes
1.544/2.048 Mbps	Yes	Yes	Yes	Yes
34/45/52 Mbps	Yes	Yes	Yes	Yes
Interface				
EIA/TIA-232	Yes	Yes	Yes	Yes
X.21	Yes	Yes	Yes	Yes
V.35	Yes	Yes	Yes	Yes
EIA/TIA-449	Yes	Yes	Yes	Yes
EIA-530	Yes	Yes	Yes	Yes
EIA/TIA-613 (HSSI)	No	Yes	No	Yes
ISDN BRI	No	No	Yes	No
ISDN PRI	Yes	Yes	Yes	Yes
HSSI	No	Yes	Yes	Yes
MultiChannel Interface (Channelized E1/T1)	Yes	Yes	No	Yes
Channelized T3	No	Yes	No	Yes
E1-G.703/G.704	Yes	Yes	No	Yes

1. Only Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and the 7000 Series Chassis Interface (RSP7000CI) are supported.

New Features in Release 11.2(7)P

The following new features are supported by Cisco IOS Release 11.2(7)P.

Cisco 3800

Cisco 3800 is a scalable access solution that combines switched voice, multiprotocol data and routing in one powerful access device. By integrating switching and routing technology onto a single card the Cisco 3800 significantly reduces communications costs. Switched voice, multiprotocol data, and routed traffic can be combined over Frame Relay, leased line, or T1/E1 ATM access lines for delivery over public Frame Relay or ATM services, or on Cisco's StrataCom IGX or BPX ATM backbone switches.

For more information on the Cisco 3800, refer to the *Cisco 3800 Series Product Release Notes* (documentation part number 78-4205-04).

Catalyst 5000 Route Switch Module (RSM)

The Catalyst 5000 RSM is a RSP2 class router blade for the Catalyst 5000 family of switches. The RSM provides high-performance, multilayer switching and routing services between switched Virtual LANs (VLANs) and emulated LANs (ELANs). Initial protocol support includes IP, IPX, appletalk, and DECnet.

For more information on the Catalyst 5000 RSM refer to the Cisco 5000 Series Switch Route Switch Module Installation and Configuration Note (documentation part number 78-4058-01).

16-Port and 32-Port Asynchronous Network Modules for Cisco 3600 Series Routers

Cisco 3600 series routers now support 16- and 32-port network modules for asynchronous connections. These devices are high density modules that support speeds up to 134.4 kbps. Depending on which module you install in the router, you can have up to 16 or 32 modem connections to each module at any given time. The Cisco 3640 can support up to 96 dialin ports.

56K 12-Port Modem Modules for the Cisco AS5200 Access Server

The Cisco AS5200 universal access server now supports digital modem cards, which are software upgradeable to 56K modems (K56flex) with modem firmware 3.1.x and beyond.

Digital modems are used for making high-speed connections across digital networks. Ultimately, this means that files transmitted up to 56 kbps arrive at the desktop at nearly twice the speed of standard V.34 (28.8-kbps) connections. The wait for information is reduced by nearly 50 percent.

56K modems are ideal for serious Internet users who want to quickly dial in to corporate LANs or download web pages containing sound, video, graphics, and other large files over digital networks using standard telephone lines.

Note Even with these new digital modem cards, modem firmware earlier than version 3.1.x will transmit only at 33.6 kbps. You must be running modem firmware 3.1.x or greater to truly experience K56flex support.

Compression Network Module for Cisco 3600 Series Routers

Cisco 3600 series routers now support a compression port module that provides high-performance, hardware-based data compression using simultaneous Stacker compression algorithms. Independent full-duplex compression and decompression capabilities are used on point-to-point (PPP) encapsulated packets.

A router's central processing unit is generally reserved for tasks such as creating and maintaining routing tables, not performing compression duties. When a hardware compression port module is used in a router, all compression activity is offloaded from the router's central processing unit. This kind of hardware configuration is needed for routers that require B-channel compression for multiple WAN connections, such as two ISDN PRI interfaces carrying 46 B channels. Signaling over the D channel is not compressed. One compression port module supports up to 128 WAN interfaces.

PA-8B-ST and PA-4B-U Basic Rate Interface Port Adapters

Basic Rate Interface (BRI) Integrated Services Digital Network (ISDN) port adapters (PA-8B-ST and PA-4B-U) are available on Cisco 7200 series routers.

The PA-8B-ST port adapter provides up to eight S/T-type BRI interfaces used to connect to an ISDN wide-area network through an external network terminator 1 (NT1) device. The PA-4B-U provides up to four BRI interfaces used to connect to an ISDN wide-area network through its internal NT1 device. Each PA-8B-ST and PA-4B-U interface consists of two bearer (B) channels that can transmit and receive data at the rate of 64-kbps, full-duplex, and one data (D) channel that can transmit and receive data at the rate of 16-kbps, full-duplex. The interfaces use an RJ-45 receptacle and standard straight-through twisted pair cable.

The B channels are used for transmitting user data. The D channel is used for call setup control and network connection teardown, and provides the communication from the router to the ISDN switch. The B and D channels are presented to the system as serial interfaces that support High-Level Data Link Control (HDLC) and Point-to-Point Protocol (PPP) encapsulation. The PA-8B-ST and PA-4B-U port adapters also support dial-on-demand routing (DDR).

Half-Duplex and Bisync for Synchronous Serial Port Adapters on Cisco 7200 Series Routers

The synchronous serial port adapters (PA-8T-V35, PA-8T-X21, PA-8T-232, and PA-4T+) on Cisco 7200 series routers support half-duplex and binary synchronous communications (Bisync). Bisync is a character-oriented data link layer protocol for half-duplex applications. In half-duplex mode, data is sent one direction at a time. Direction is controlled by handshaking the RTS and CTS control lines.

Particle-Based Transparent Bridging on Cisco 7200 Series Routers

Particle-based transparent bridging (TRB) adds scatter-gather capability to transparent bridging by default to improve performance on Cisco 7200 series routers.

Particles represent a communications data packet as a collection of noncontiguous buffers. The traditional Cisco IOS packet has a packet type control structure and a single, contiguous data buffer. A particle packet has the same packet-type control structure, but also maintains a queue of particle-type structures, each of which manages its own block.

This scatter-gather architecture provides the following advantages:

- Allows drivers to use memory more efficiently (especially when using media that has a large maximum transmission unit [MTU]). For example, Token Ring buffers could be 512 bytes rather than 16 KB.
- Allows concurrent use of the same region of memory. For example, on IP multicast a single packet is received and sent out on multiple interfaces simultaneously.
- Allows insertion or deletion of memory at any location in a packet (not just at the beginning or end).

Fast-Switched Fragmented IP Packets on Cisco 7200 Series Routers

Fragmented IP packets are now fast switched rather than process switched by default to improve performance on Cisco 7200 series routers.

Fast-Switched SMRP Packets on Cisco 7200 Series Routers

Simple Multicast Routing Protocol (SMRP) packets are now fast switched rather than process switched by default to improve performance on Cisco 7200 series router.

Turbo Flooding of UDP Datagrams on Cisco 7200 Series Routers

Turbo flooding is now supported on Cisco 7200 series routers. Turbo flooding speeds up flooding of User Datagram Protocol (UDP) datagrams using the spanning-tree algorithm. This feature is useful for quickly downloading periodic updates from a server to multiple clients in an environment where updates are frequent and speed and latency are primary considerations.

Next-Generation Route Switch Processor (RSP4) on Cisco 7500 Series Routers

The next-generation Route Switch Processor (RSP4) provides improved performance on Cisco 7500 series routers. The RSP4 uses a 200-MHz R5000 processor with twice the primary cache and a 512-KB secondary cache to greatly improve performance. The biggest increases in performance are in process-level switching and other process-level tasks (for example, route calculations) where the RSP4 is between two and four times faster than an RSP2. Fast-switching performance is also improved. The RSP4 supports the high system availability (HSA) feature and can be used in combination with an RSP2 or another RSP4.

Packet OC-3 Interface Processor

The Packet OC-3 Interface Processor (POSIP) is available on Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI) and on Cisco 7500 series routers.

The POSIP is a fixed-configuration interface processor that uses second-generation Versatile Interface Processor (VIP2) technology. The POSIP provides a single 155.520-Mbps, OC-3 physical layer interface for packet-based traffic. This OC-3 interface is fully compatible with SONET and Synchronous Digital Hierarchy (SDH) network facilities and is compliant with RFC 1619, “PPP over SONET/SDH,” and RFC 1662, “PPP in HDLC-like Framing.” The Packet-Over-SONET specification is primarily concerned with the use of the PPP encapsulation over SONET/SDH links.

Channelized T3 Interface Processor Feature Enhancements

You can now perform the following new tasks on the Channelized T3 Interface Processor (CT3IP) available on Cisco 7500 series routers, and on Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI):

- Configure Maintenance Data Link (MDL) messages
- Enable performance monitoring via Facility Data Link (FDL) per ANSI T1.403
- Generate bit error rate testing (BERT) test patterns
- Enable remote FDL loopbacks
- Support SNMP MIB per RFC 1406 and RFC 1407

100VG-AnyLAN Port Adapter

The 100VG-AnyLAN port adapter (PA-100VG) is available on Cisco 7200 series routers, Cisco 7500 series routers, and on Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI).

The PA-100VG provides a single interface compatible with and specified by IEEE 802.12 to support 100 Mbps over Category 3 or Category 5 unshielded twisted-pair (UTP) cable with RJ-45 terminators. The PA-100VG supports 802.3 Ethernet packets and can be monitored with the IEEE 802.12 Interface MIB.

PA-4R-FDX Token Ring Full-Duplex Port Adapter

The Token Ring full-duplex port adapter (PA-4R-FDX) is available on Cisco 7500 series routers, Cisco 7200 series routers, and Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI).

The PA-4R-FDX provides up to four IBM Token Ring or IEEE 802.5 Token Ring interfaces that can be set for 4- or 16-Mbps half-duplex or full-duplex operation and early token release. The default for all interfaces is half-duplex 4-Mbps operation with early token release disabled. The PA-4R-FDX connects over Type 1 lobe or Type 3 lobe cables and provides a DB-9 (PC-type) receptacle.

PA-A1-OC3MM and PA-A1-OC3SM ATM Port Adapters

Asynchronous Transfer Mode (ATM) port adapters (PA-A1-OC3MM and PA-A1-OC3SM) are available on Cisco 7200 series routers, on the second-generation Versatile Interface Processor (VIP2) in Cisco 7500 series routers, and in Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI).

The ATM port adapter provides a single SONET/SDH OC-3 full-duplex interface (either multimode or single-mode intermediate reach) and supports data rates of up to 155 Mbps bidirectionally. The ATM port adapter connects to a SONET/SDH multimode or SONET/STC-3C single-mode optical fiber cable (STS-3C or STM-1 physical layer) to connect the router to an external DSU (an ATM network). The ATM port adapter supports the following features:

- Segmentation and reassembly (SAR) of up to 512 buffers simultaneously, where each buffer represents a packet
- Up to 256 transmit buffers for simultaneous fragmentation
- Up to 2,048 SAR virtual circuits (VCs)

- ATM adaptation layer (AAL) 5
- Operation, Administration, and Maintenance (OAM) cells

PA-2CE1/PRI-75, PA-2CE1/PRI-120, and PA-2CT1/PRI Channelized E1 and T1 Port Adapters

Channelized E1 and T1 Primary Rate Interface (PRI) Integrated Services Digital Network (ISDN) port adapters (PA-2CE1/PRI-75, PA-2CE1/PRI-120, and PA-2CT1/PRI) are available on Cisco 7200 series routers, Cisco 7500 series routers, and on Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI).

The PA-2CE1/PRI-120 (balanced 120 ohm) and PA-2E1/PRI-75 (unbalanced 75 ohm) provide up to two channelized E1 interfaces to connect to channel service units (CSUs), and can transmit and receive data bidirectionally at the E1 rate of 2.048 Mbps. The PA-2CT1/PRI provides up to two channelized T1 interfaces to connect to CSUs, and can transmit and receive data bidirectionally at the T1 rate of 1.544 Mbps. The interfaces use a 15-pin, D-shell receptacle. The PA-2CE1/PRI-75 and PA-2E1/PRI-120 use G.703 serial interface cables, and the PA-2CT1/PRI uses standard serial cables (null-modem and straight-through).

Data Encryption Service Adapter

The data encryption service adapter (ESA) is available on Cisco 7200 series routers, on the second-generation Versatile Interface Processors (VIP2-40 specifically) in Cisco 7500 series routers, and on the VIP2-40 in Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI). (ESAs require VIP2 model VIP2-40.)

The ESA provides encryption processing to offload some of the encryption processing from the router's main processor and to improve performance. Encryption and authentication are provided by a software service called a *crypto engine*. The ESA provides the encryption mechanisms required to perform data encryption using a 40-bit or 56-bit Data Encryption Standard (DES) configured through the crypto engine. The ESA uses Public Key (PK) technology based on the concept of the Protected Entity (PE) and employs the DES and the Digital Signature Standard (DSS) to ensure secure data and information can be transferred between similarly equipped hosts on your network.

For detailed information on encryption, refer to the "Configuring Network Data Encryption with Router Authentication" chapter in the *Security Configuration Guide*.

Clock Rate Command Enhancements

The **clock rate** interface command has been enhanced for the synchronous serial port adapters (PA-8T-V35, PA-8T-X21, PA-8T-232, and PA-4T+) on Cisco 7200 series routers, on second-generation Versatile Interface Processors (VIP2s) in Cisco 7500 series routers, and on Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI). For these port adapters, a nonstandard clock rate can be used. The clock rate you enter is rounded (if needed) to the nearest value that your hardware can support.

New Features in Release 11.2(6)P

The following new features are supported by Cisco IOS Release 11.2(6)P. Because each of these features do not require new or modified software configuration information, no additional feature chapters for Release 11.2(6)P are included in the *Feature Guide for Cisco IOS Release 11.2 P.*

Cisco 2500 Fixed FRAD Series

Cisco Systems is introducing three new models in the Cisco 2500 series that are preconfigured as Frame Relay access devices (FRADs). The devices include the Cisco 2501FRAD-FX, Cisco 2501LANFRAD-FX, and Cisco 2502LANFRAD-FX. These new "Fixed FRADs" complement the existing Cisco 2500 serial and LAN FRAD models and offer a new entry point for cost-effective Frame Relay applications. The Fixed FRADs are ideal for branch office and remote office connectivity of legacy/ System Network Architecture (SNA) devices or cost-effective Frame Relay access.

Mission-specific routers are entry-level routers that are based on standard Cisco 2500 series hardware. However, mission-specific routers contain less memory than standard models and run reduced software images designed for CFRAD, LAN FRAD, and ISDN applications. The Cisco 2500 series fixed FRAD platforms are a variation of the Mission-specific CFRAD and LAN FRAD platforms. However, they are not upgradeable to routers like the mission-specific FRAD models.

The Cisco Fixed FRADs have been modified so that they will not execute non-FRAD Cisco IOS software images. This includes the images designed for other Cisco 2500 series systems. The Fixed FRAD routers cannot be upgraded to run feature sets that typically run on Cisco 2500 series routers.

The Fixed FRAD series includes three fixed-configuration hardware models with the following features:

- Cisco 2501FRAD-FX—Two high-speed synchronous serial and one low-speed asynchronous serial interface
- Cisco 2501LANFRAD-FX—One Ethernet, two high-speed synchronous serial, and one low-speed asynchronous serial interface
- Cisco 2502LANFRAD-FX—One Token Ring, two high-speed synchronous serial, and one low-speed asynchronous serial interface

Generated SysObjectID's

The Generated SysObjectID's feature generates a unique sysObjectID for each Cisco 2500 series router and its derived partner product. For example, the sysObjectID values for a Cisco 2511, a partner's 2511, and another partner's 2511 will each be different. The sysObjectID SNMP MIB object is used to identify the device to be managed and make application-specific decisions. In some network management programs, this object determines which graphical element or name to display for a device.

Fast Ethernet for the Cisco 3600 Series Routers

The Fast Ethernet network module provides a single interface that supports 100BaseT and 10BaseT connectivity. There is one RJ-45 10/100 port on the Fast Ethernet network module. This port enables autonegotiation of the peers' capabilities and configure itself to support the highest possible data rate.

New Features in Release 11.2(5)P

The following hardware platforms are supported by Cisco IOS Release 11.2(5)P.

Cisco 1600 Series Routers

The Cisco 1600 series of access routers deliver the next-generation set of features and benefits for small-office Internet and intranet access: WAN flexibility, end-to-end security, end-to-end quality of service, ease of use, deployment, and management. Cisco 1600 series routers connect small offices with Ethernet LANs to the public Internet and to a company's internal intranet or corporate LAN through several WAN connections such as ISDN, asynchronous serial, and synchronous serial. Cisco 1600 series routers include the following models: the Cisco 1601, Cisco 1602, Cisco 1603, and Cisco 1604.

All Cisco 1600 series models include one Ethernet port, one built-in WAN port, and one WAN interface card expansion slot for additional connectivity and flexibility. The Cisco 1601 includes a built-in serial WAN port; the Cisco 1602 has an onboard 56-kbps four-wire channel service unit/data service unit (CSU/DSU); the Cisco 1603 has an ISDN BRI S/T port; and the Cisco 1604 includes an ISDN BRI U interface with a built-in NT1 device.

The following are WAN interface cards supported by the Cisco 1600 series routers:

- 1-port serial
- 1-port ISDN BRI with S/T interface
- 1-port ISDN BRI with NT1 and U interface

Cisco AS2509-RJ and Cisco AS2511-RJ Access Servers

The Cisco AS2509-RJ and Cisco AS2511-RJ access servers connect asynchronous serial devices to LANs and WANs. The access servers combine the functions of a terminal server, protocol translator, and a router, and perform both synchronous and asynchronous routing of supported protocols.

These access servers provide the following interfaces and ports:

- 8 (Cisco AS2509-RJ) or 16 (Cisco AS2511-RJ) asynchronous serial ports for connection to modems, terminals, or other asynchronous devices
- One Ethernet attachment unit interface (AUI) port for connection to a LAN
- One synchronous serial port for connection to a WAN
- One EIA/TIA-232 console port for connection to a console terminal
- One EIA/TIA-232 auxiliary port for connection to a terminal or modem

Cisco 3600 Series Routers

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

The Cisco 3640 has four network module slots; the Cisco 3620 has two slots. Each network module slot accepts a variety of network module interface cards, including LAN and WAN mixed media cards supporting Ethernet, Token Ring, and a variety of WAN technologies. These cards provide the

foundation of LAN and WAN connectivity on a single modular network module. Additional applications are supported with a series of network module cards offering asynchronous and synchronous serial, ISDN PRI, and ISDN BRI interfaces.

Table 5 lists the WAN interface cards supported by the Cisco 3600 series routers.

Table 5 Supported WAN Interface Cards and Network Modules

Combination WAN/LAN Interface Cards
1 Ethernet and 2 WAN interface card
2 Ethernet and 2 WAN interface card
1 Ethernet, 1 Token Ring, and 2 WAN interface card
Standard WAN Interface Cards[1]
1-port serial WAN interface card
1-port ISDN BRI WAN interface card
1-port ISDN BRI with NT1 WAN interface card
1-port ISDN BRI with NT1 and U interface card slots
1-port 4-wire 56-kbps DSU/CSU WAN interface card
Channelized T1 and E1 ISDN PRI Network Modules
1-port channelized T1/ISDN PRI network module
1-port channelized T1/ISDN PRI with CSU network module
2-port channelized T1/ISDN PRI network module
2-port channelized T1/ISDN PRI with CSU network module
1-port channelized E1/ISDN PRI balanced network module
1-port channelized E1/ISDN PRI unbalanced network module
2-port channelized E1/ISDN PRI balanced network module
2-port channelized E1/ISDN PRI unbalanced network module
Blank network module panel
ISDN BRI Network Modules
4-port ISDN BRI network module with an S/T interface[2]
4-port ISDN BRI with NT1 network module[2]
8-port ISDN BRI network module with an S/T interface
8-port ISDN BRI with NT1 network module
Asynchronous/Synchronous Network Modules
4-port asynchronous/synchronous serial network module[2]
8-port asynchronous/synchronous serial network module
16- and 32-port asynchronous network module

Table 5 Supported WAN Interface Cards and Network Modules (Continued)

Additional Network Module
1-port Ethernet network module
4-port Ethernet network module
1-port Fast Ethernet network module
4-port Serial network module
Compression network module

1. These interface cards are compatible with Cisco 1600 series routers.
2. The 4-port module is not upgradeable to the 8-port module.

Channelized E1 Signaling for the Cisco AS5200

The Cisco AS5200 universal access server now supports channel-associated signaling for channelized E1 lines, which are commonly deployed in networks in Latin America, Asia, and Europe.

After this feature is configured on a single E1 controller, up to 30 remote users can simultaneously dial in to the Cisco AS5200 through networks running the R2 protocol. Typically, all 30 channels of an channelized E1 line are used for analog calls. However, a signal converter is still needed to perform conversions between R2 signaling and ear and mouth signaling (also known as E&M). Because the Cisco AS5200 has two physical E1 ports on its dual E1 PRI board, up to 60 simultaneous connections can be made through the dual E1 PRI board.

High-Speed Serial Interface Network Processor Module for Cisco 4000 Series Routers

A High-Speed Serial Interface (HSSI) network processor module (NPM) is a high-speed and high-bandwidth serial interface device that is inserted into a vacant chassis slot on Cisco 4000 series routers. The HSSI NPM supports full-duplex and data rates up to 52 Mbps.

There are many network applications for the HSSI NPM. For example, medium-sized Internet service providers can use this module to connect to an Internet backbone provider via a T3 or E3 line. It can also be used for campus-to-campus high-speed serial connections.

SA-Comp/1 and SA-Comp/4 Data Compression Service Adapters

The SA-Comp/1 and SA-Comp/4 data compression service adapters (CSAs) are available on Cisco 7200 series routers, on second-generation Versatile Interface Processors (VIP2s) in Cisco 7500 series routers, and on Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI). (CSAs require VIP2 model VIP2-40.)

These service adapters provide high-performance, hardware-based data compression capabilities via simultaneous Stacker compression data compression algorithms with independent full-duplex compression and decompression capabilities on Point-to-Point Protocol (PPP) encapsulated packets.

Channelized T3 Interface Processor

The Channelized T3 Interface Processor (CT3IP) is available on Cisco 7500 series routers and Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI).

The CT3IP is a fixed-configuration interface processor based on the second-generation Versatile Interface Processor (VIP2). The CT3IP has four T1 connections via DB-15 connectors and one DS3 connection via BNC connectors. Each DS3 interface can provide up to 28 T1 channels (a single T3 group). Each channel is presented to the system as a serial interface that can be configured individually. The CT3IP can transmit and receive data bidirectionally at the T1 rate of 1.536 Mbps. The four T1 connections use 100-ohm twisted-pair serial cables to external channel service units (CSUs) or to a MultiChannel Interface Processor (MIP) on the same router or on another router. For wide-area networking, the CT3IP can function as a concentrator for a remote site.

FDDI Full-Duplex Single-Mode and Multimode Port Adapters

Fiber Distributed Data Interface (FDDI) full-duplex single-mode and multimode port adapters (PA-F/FD-SM and PA-F/FD-MM) are available on Cisco 7200 series routers, on second-generation Versatile Interface Processors (VIP2s) in Cisco 7500 series routers, and on Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI).

These port adapters provide an interface for both single-mode and multimode fiber-optic cable. Two physical ports are available with either single-mode SC-type or multimode MIC receptacles. Each port adapter's FDDI connection allows a maximum aggregate bandwidth of 200 Mbps per the FDDI standard.

High-Speed Serial Interface Port Adapters

The High-Speed Serial Interface (HSSI) port adapters (PA-H and PA-2H) are available on Cisco 7200 series routers, on second-generation Versatile Interface Processors (VIP2s) in Cisco 7500 series routers, and on Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI).

The PA-H provides one high-speed synchronous serial interface, and the PA-2H provides two high-speed synchronous serial interfaces.

Synchronous Serial Port Adapters

The synchronous serial port adapters (PA-8T-V35, PA-8T-X21, PA-8T-232, and PA-4T+) are available on Cisco 7200 series routers, on second-generation Versatile Interface Processors (VIP2s) in Cisco 7500 series routers, and on Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI).

The PA-8T-V35, PA-8T-X21, PA-8T-232 port adapters provide up to eight synchronous serial interfaces, and the PA-4T+ provides up to four synchronous serial interfaces. Each port on the PA-4T+ supports any of the available interface types: Electronics Industries Association/Telecommunications Industries Association (EIA/TIA)-232, EIA/TIA-449, V.35, X.21, and EIA-530.

RSP Fragmented IP Packets Optimum or Flow Switched

To improve performance, fragmented IP packets are now optimum or flow switched (depending which switching method is enabled) rather than being process switched on Cisco 7500 series routers and on Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI).

Selective Packet Discard (SPD)

When in severe overload conditions, routers that cannot keep up with the incoming packet stream must drop packets. If no intelligence is applied to choosing which ones to discard, this will impact the stability of routing protocols. This feature applies some simple choices to selectively discard packets likely to be unimportant for routing and interface stability. SPD is enabled by default; there are no commands or configuration tasks required.

New Features in Release 11.2(4)P

The following software features have been added to Release 11.2(4)P.

Internet Router Cards for 10BaseT Hubs

An Internet router card is a low-end router module, which has functionality similar to the Cisco 2503, that is inserted into a 10BaseT hub and provides the following interfaces and ports:

- One ISDN BRI port (RJ-45)
- Two synchronous serial ports for WAN connections
- One 10BaseT or 100VG port for LAN connections, which is integrated into the card's backplane
- One EIA/TIA-232 console port for connection to a console terminal
- One EIA/TIA-232 auxiliary port for connection to a terminal or modem

2T16S Network Processor Module (Asynchronous and Synchronous)

This network processor module for the Cisco 4500 and Cisco 4700 routers now provides asynchronous interfaces on its 16 low-speed serial interfaces (supports speeds up to 115 kbps). Asynchronous terminal services and async dial-up connections using external modems for PPP, SLIP, and ARAP are now supported. In Cisco IOS Release 11.2(3)P, the 2T16S network processor module only supported synchronous serial connections. Each Cisco 4500 and Cisco 4700 router supports up to two installed modules. This processor module does not support x.21/mix/rs530A.

New Features in Release 11.2(3)P

The following software features have been added to Release 11.2(3)P.

2T16S Network Processor Module (synchronous)

The 2T16S network processor module provides high-density serial interfaces for the Cisco 4500 and Cisco 4700 routers. This module has two high-speed interfaces that support full duplex T1 and E1 rates (up to 2 MB per second) and 16 low-speed interfaces. The 16 lower speed ports can be individually configured as synchronous ports at speeds up to 128 kbps. Synchronous protocols

include IBM's BSC, SDLC, and HDLC. Each Cisco 4500 series and Cisco 4700 series router can run up to two of these new modules simultaneously. This processor module does not support x.21/mix/rs530A.

New Features in Release 11.2(2)P

The following software features have been added to Release 11.2(2)P.

Robbed Bit Signaling for the Cisco AS5200

New types of signaling provided for a channelized T1 include ground start and loop start support. This new signaling is set using the **cas-group** controller configuration command.

Dual E1 PRI for the Cisco AS5200

This new E1 PRI card has two E1 controllers, which provide physical termination for two E1 PRI lines. Unlike most controller E1 configurations, the Cisco AS5200's E1 PRI controllers require a clock source, which is set with the **clock source** command.

Fast Ethernet Network Interface Module for the Cisco 4000 series

This new module is supported on the Cisco 4500, Cisco 4500-M, Cisco 4700, and Cisco 4700-M routers. It provides a single full-duplex, 100-Mbps Ethernet interface that conforms with the IEEE 802.3u Fast Ethernet specification.

The recommended rxboot for this module is 11.1(7). You can download this free image from the Web. (See the section "Cisco Connection Online" at the end of this document.)

Cisco 3011 WAN Module

This module is a router card that is installed in the Catalyst 3200 switch. In addition to two synchronous serial interfaces and an auxiliary interface, this card provides a BRI interface for ISDN WAN connectivity.

Access the Cisco 3011 WAN module's console port through the Catalyst 3200's console port. From the switch's console, press **Ctrl-R** to toggle between the switch's console configuration mode and the router's console configuration mode. To resynchronize the baud rate of the internal console, press **Ctrl-B**.

Cisco IOS Feature Sets

This section lists Cisco IOS software feature sets available in Cisco IOS Release 11.2 P. These features are available in specific features sets on specific platforms.

For a complete list of Release 11.2 features that apply to platforms not mentioned in this release note, refer to the *Release Notes for Cisco IOS Release 11.2*.

Release 11.2 P supports the same feature sets as Release 11.2, but it also has new software features to accompany new platform support (such as dual E1 PRI for the Cisco AS5200, robbed bit signaling for the Cisco AS5200, and Fast Ethernet for the Cisco 4000 series).

Table 6 through Table 17 use these feature set matrix symbols to identify features:

Feature Set Matrix Symbol	Description
Ð	This feature is offered in the basic feature set.
—	This feature is not offered in the feature set.
Plus	This feature is offered in the Plus feature set, not in the basic feature set.
Encrypt	This feature is offered in the encryption feature sets, which consist of 40-bit (Plus 40) or 56-bit (Plus 56) data encryption feature sets.

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

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

Table 6 and Table 7 list the standard feature sets supported in Release 11.2 P.

Table 6 Feature Set Matrix for Low-End to Mid-Range Routers, Access Servers, and Router Cards

Standard Feature Sets	Cisco 1600 Series	Cisco AS2509-RJ and Cisco AS2511-RJ	Cisco 2500 Fixed FRAD Series	Cisco 3600 Series	Cisco 4000 Series	Cisco 3011 WAN Modules	Internet Router Cards[1]
IP	Ð, Plus, Encrypt	Ð	—	Ð, Plus, Encrypt	Ð, Plus, Encrypt	Ð, Plus, Encrypt	Ð
IP/IPX	Ð, Plus, Encrypt	—	—	—	—	—	—
IP/AppleTalk	Ð, Plus, Encrypt	—	—	—	—	—	—
IP/IPX/AppleTalk	Ð, Plus, Encrypt	—	—	—	—	—	—
Desktop (IP/IPX/AppleTalk/DEC)	—	—	—	Ð, Plus, Encrypt	Ð, Plus, Encrypt	Ð, Plus, Encrypt	Ð and Plus[2]

Table 6 Feature Set Matrix for Low-End to Mid-Range Routers, Access Servers, and Router Cards (Continued)

Standard Feature Sets	Cisco 1600 Series	Cisco AS2509-RJ and Cisco AS2511-RJ	Cisco 2500 Fixed FRAD Series	Cisco 3600 Series	Cisco 4000 Series	Cisco 3011 WAN Modules	Internet Router Cards[1]
Enterprise	—	—	—	Đ, Plus, Encrypt	Đ, Plus, Encrypt	Đ, Plus, Encrypt	—
Enterprise and APPN	—	—	—	Đ, Plus, Encrypt	Đ, Plus, Encrypt	Đ, Plus, Encrypt	—
IP/IPX/IBM and APPN	—	—	—	Đ[3]	Đ	Đ	—
Special Applications							
Remote Access Server	—	Đ	—	—	—	Đ	—
CFRAD	—	—	Đ	—	—	—	—
LANFRAD	—	—	Đ	—	—	—	—
OSPF LANFRAD	—	—	Đ	—	—	—	—

1. These router cards are used on supported 10BaseT hubs.
2. The Plus feature set is Desktop and IBM (IP/IPX/AppleTalk/DEC/IBM).
3. IP/IPX/IBM/APPN has no additional options. It offers a low-end APPN solution for the Cisco 3600 series routers.

Table 7 Feature Set Matrix for High-End Access Servers and Routers

Standard Feature Sets	Cisco AS5200	Cisco 7200 Series[1]	Cisco 7500 Series[1,2]
IP	Đ and Plus	Đ and Encrypt	Đ and Encrypt
Desktop (IP/IPX/AppleTalk/DEC)	Đ and Plus	—	—
Desktop/IBM		Đ and Encrypt	Đ and Encrypt
Desktop/IBM and APPN		Đ	Đ
Enterprise	Đ and Plus	Đ and Encrypt	Đ and Encrypt
Enterprise and APPN	—	Đ and Encrypt	Đ and Encrypt
Network Layer 3 Switching Set	—	Đ	—

1. Basic images for Cisco 7000 series (with RSP7000), 7200 series, and 7500 series routers include additional functionality not found in the basic feature sets offered on the other hardware platforms.
2. These feature sets also include support for Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and the 7000 Series Chassis Interface (RSP7000CI).

Feature Set Tables

The Cisco IOS software is available in different feature sets depending upon the platform. Table 8 lists the feature sets for the Cisco 1600 series. Table 9 lists the feature sets for the Cisco AS2509-RJ and Cisco AS2511-RJ. Table 10 lists the feature sets for the Cisco 2500 Fixed FRAD series. Table 11 lists the feature sets for the Cisco 3600 series. Table 12 lists the feature sets for the Cisco 4000 series. Table 13 lists the feature sets for the Cisco AS5200. Table 14 lists the feature sets for the Cisco 3011 WAN module. Table 15 lists the feature sets for Internet router cards installed in 10BaseT hubs. Table 16 lists the feature sets for Cisco 7000 (with RSP7000) and Cisco 7500 series routers. Table 17 lists the feature sets for Cisco 7200 series routers. Table 18 lists optional feature set licenses for the Cisco 7000 series (with RSP7000), Cisco 7200 series, and Cisco 7500 series.

Table 8 Cisco 1600 Series Feature Sets

	Feature Sets			
Feature Set	**IP Routing**	**IP/IPX Routing**	**IP/AppleTalk Routing**	**IP/IPX/AppleTalk Routing**
LAN Support				
AppleTalk 1 and 2[1]	—	—	Đ	Đ
Integrated routing and bridging (IRB)[2]	Đ	Đ	Đ	Đ
IP	Đ	Đ	Đ	Đ
Novell IPX[3]	—	Đ	—	Đ
Transparent bridging	Đ	Đ	Đ	Đ
WAN Services				
Asynchronous	Đ	Đ	Đ	Đ
Frame Relay	Đ	Đ	Đ	Đ
Frame Relay SVC support (DTE)	Plus	Plus	Plus	Plus
Frame Relay traffic shaping[4]	—	—	—	—
HDLC	Đ	Đ	Đ	Đ
ISDN [5]	Đ	Đ	Đ	Đ
PPP[6]	Đ	Đ	Đ	Đ
SMDS	Đ	Đ	Đ	Đ
Switched 56	Đ	Đ	Đ	Đ
X.25	Đ	Đ	Đ	Đ
SLIP asynchronous only	Đ	Đ	Đ	Đ
WAN Optimization				
Bandwidth-on-demand[7]	Đ	Đ	Đ	Đ
Custom and priority queuing	Đ	Đ	Đ	Đ
Dial backup	Đ	Đ	Đ	Đ
Dial-on-demand	Đ	Đ	Đ	Đ
Header, link, and payload compression	Đ	Đ	Đ	Đ
Header and link compression	Đ	Đ	Đ	Đ
Snapshot routing	Đ	Đ	Đ	Đ
Weighted fair queuing	Đ	Đ	Đ	Đ
IPX and SPX spoofing	—	Đ	—	Đ

Table 8 Cisco 1600 Series Feature Sets (Continued)

	Feature Sets			
Feature Set	**IP Routing**	**IP/IPX Routing**	**IP/AppleTalk Routing**	**IP/IPX/AppleTalk Routing**
IP Routing				
AppleTalk SMRP Multicast	—	—	Đ	Đ
Enhanced IGRP	Đ	Đ	Đ	Đ
IGRP	Đ	Đ	Đ	Đ
IP Multicast (PIM)	Đ	Đ	Đ	Đ
Network Address Translation (NAT)	Plus	Plus	Plus	Plus
On Demand Routing (ODR)	Đ	Đ	Đ	Đ
OSPF	Plus	Plus	Plus	Plus
OSPF On Demand Circuit (RFC 1793)	Plus	Plus	Plus	Plus
PIM	Plus	Plus	Plus	Plus
RIP	Đ	Đ	Đ	Đ
RIP Version 2	Đ	Đ	Đ	Đ
Other Routing				
IPX RIP	—	Đ	—	Đ
RTMP	—	—	Đ	Đ
NLSP	—	Plus	—	Plus
Multimedia and Quality of Service				
Generic traffic shaping	Plus	Plus	Plus	Plus
Random Early Detection (RED)	Plus	Plus	Plus	Plus
Resource Reservation Protocol (RSVP)	Plus	Plus	Plus	Plus
Management				
SNMP	Đ	Đ	Đ	Đ
Telnet	Đ	Đ	Đ	Đ
Console port	Đ	Đ	Đ	Đ
Access lists	Đ	Đ	Đ	Đ
Access security	Đ	Đ	Đ	Đ
Extended access lists	Đ	Đ	Đ	Đ
GRE tunneling	Đ	Đ	Đ	Đ
Lock and key	Đ	Đ	Đ	Đ

Table 8 Cisco 1600 Series Feature Sets (Continued)

Feature Set	Feature Sets			
	IP Routing	IP/IPX Routing	IP/AppleTalk Routing	IP/IPX/AppleTalk Routing
Network layer encryption, 40-bit (Plus 40) and 56-bit (Plus 56)	Encrypt	Encrypt	Encrypt	Encrypt
Access lists	Đ	Đ	Đ	Đ

1. AppleTalk load balancing is available in Cisco IOS Release 11.2.
2. IRB supports IP, IPX, and AppleTalk; it is supported for transparent bridging, but not for SRB; it is supported on all media-type interfaces except X.25 and ISDN bridged interfaces; and IRB and concurrent routing and bridging (CRB) cannot operate at the same time.
3. In Cisco IOS Release 11.2, the Novell IPX feature includes Display SAP by Name, IPX Access Control List violation logging, and plain-English IPX access lists.
4. Frame Relay traffic shaping will be available in a future 11.2 P release.
5. ISDN support includes calling line identification (CLI/ANI), ISDN subaddressing, and applicable WAN optimization features.
6. PPP includes support for LAN protocols supported by the feature set, address negotiation, PAP and CHAP authentication, and PPP compression. Multilink PPP is included with Cisco IOS Release 11.0(4) and later releases.
7. Bandwidth-on-demand means two B-channel calls to the same destination.

Table 9 Cisco AS2509-RJ and Cisco AS2511-RJ Feature Sets

Features	Feature Sets	
	IP Routing	Remote Access Server
LAN Support		
AppleTalk 1 and 2[1]	—	Đ
Concurrent routing and bridging (CRB)	Đ	—
DECnet IV	—	—
GRE	—	Đ
Integrated routing and bridging (IRB)[2]	Đ	Đ
IP	Đ	Đ
Multiring	Đ	Đ
Novell IPX	—	Đ
Source-route bridging	Đ	—
Transparent bridging	—	Đ
Transparent and translational bridging[3]	—	Đ
WAN Services		
Combinet Packet Protocol (CPP)	Đ	Đ
Dialer profiles	Đ	Đ
Frame Relay	—	Đ
Frame Relay traffic shaping	—	Đ
Half bridge/half router for CPP and PPP	—	Đ
HDLC	—	Đ
IPXWAN 2.0	Đ	Đ

Table 9 Cisco AS2509-RJ and Cisco AS2511-RJ Feature Sets (Continued)

	Feature Sets	
Features	**IP Routing**	**Remote Access Server**
ISDN[4]	Đ	—
Multichassis Multilink PPP (MMP)	Đ	Đ
PPP[5]	Đ	Đ
SMDS	Đ	—
Switched 56	—	Đ
Virtual Private Dial-up Network (VPDN)	Đ	Đ
X.25[6]	Đ	Đ
WAN Optimization		
Bandwidth-on-demand[7]	—	Đ
Custom and priority queuing	Đ	Đ
Dial backup	—	Đ
Dial-on-demand	Đ	Đ
Header[8], link and payload compression[9]	Đ	Đ
Header[9] and link compression	Đ	—
Snapshot routing	—	Đ
Weighted fair queuing	Đ	Đ
IP Routing		
BGP	Đ	—
BGP4[10]	Đ	—
EGP	Đ	—
Enhanced IGRP	Đ	Đ
Enhanced IGRP Optimizations	Đ	Đ
IGRP	Đ	Đ
NHRP	Đ	—
On Demand Routing (ODR)	—	Đ
OSPF	Đ	—
OSPF Not-So-Stubby-Areas (NSSA)	Đ	—
OSPF On Demand Circuit (RFC 1793)	Đ	—
PIM	Đ	Đ
Policy-based routing	Đ	Đ
RIP	—	Đ
RIP Version 2	Đ	Đ
Other Routing		
AURP	Đ	Đ
IPX RIP	Đ	Đ
NLSP	Đ	—

Table 9 Cisco AS2509-RJ and Cisco AS2511-RJ Feature Sets (Continued)

Features	Feature Sets	
	IP Routing	Remote Access Server
RTMP	Đ	Đ
Multimedia and Quality of Service		
Generic traffic shaping	Đ	Đ
Random Early Detection (RED)	Đ	Đ
Resource Reservation Protocol (RSVP)	Đ	Đ
Management		
AutoInstall	Đ	Đ
Automatic modem configuration	Đ	Đ
HTTP Server	—	Đ
RMON events and alarms[11]	—	Đ
SNMP	—	Đ
Telnet	—	Đ
Security		
Access lists	—	Đ
Access security	—	Đ
Extended access lists	—	Đ
Kerberos V client support	Đ	Đ
Lock and Key	Đ	Đ
MAC security for hubs	Đ	—
MD5 routing authentication	—	Đ
RADIUS	Đ	Đ
TACACS+[12]	Đ	Đ
IBM Support (Optional)		
BAN for SNA Frame Relay support	Đ	—
Bisync	Đ	—
Caching and filtering	Đ	—
DLSw+[13]	Đ	—
Frame Relay SNA support (RFC 1490)	Đ	—
Native Client Interface Architecture (NICA) Server	Đ	—
NetView Native Service Point	Đ	—
Polled async (ADT, ADPLEX)	Đ	—
QLLC	—	—
DLSw (RFC 1795)	—	—
RSRB	Đ	—
SDLC integration	Đ	—

Table 9 Cisco AS2509-RJ and Cisco AS2511-RJ Feature Sets (Continued)

	Feature Sets	
Features	**IP Routing**	**Remote Access Server**
SDLC transport (STUN)	Đ	—
SDLC-to-LAN conversion (SDLLC)	Đ	—
SNA and NetBIOS WAN optimization via local acknowledgment	Đ	—
SRB/RSRB[14]	Đ	—
SRT	Đ	—
Protocol Translation		
LAT	—	Đ
PPP	Đ	Đ
Rlogin	Đ	Đ
Telnet	Đ	Đ
TN3270	Đ	Đ
X.25	Đ	Đ
Remote Node[15]		
ARAP 1.0/2.0	Đ	Đ
Asynchronous master interfaces	Đ	Đ
ATCP	Đ	Đ
CPPP	Đ	Đ
CSLIP	Đ	Đ
DHCP		Đ
IP pooling	Đ	Đ
IPX and ARAP on virtual async interfaces	Đ	Đ
IPXCP[16]	Đ	Đ
MacIP	Đ	Đ
PPP	—	Đ
SLIP	—	Đ
Terminal Services[15]		
LAT[17]	—	Đ
Rlogin	—	Đ
Telnet	Đ	Đ
TN3270	—	Đ

Table 9 Cisco AS2509-RJ and Cisco AS2511-RJ Feature Sets (Continued)

	Feature Sets	
Features	**IP Routing**	**Remote Access Server**
X.25 PAD	—	Đ
Xremote	Đ	Đ

1. Includes AppleTalk load balancing.
2. IRB supports IP, IPX, and AppleTalk; it is supported for transparent bridging, but not for SRB; it is supported on all media-type interfaces except X.25 and ISDN bridged interfaces; and IRB and concurrent routing and bridging (CRB) cannot operate at the same time.
3. Translational bridging is fast switched, but this can be disabled.
4. ISDN support includes calling line identification (ANI), X.25 over the B channel, ISDN subaddressing, and applicable WAN optimization features.
5. PPP includes support for LAN protocols supported by the feature set, address negotiation, PAP and CHAP authentication, PPP compression, and Multilink PPP.
6. X.25 includes X.25 switching.
7. Bandwidth-on-demand means two B-channel calls to the same destination.
8. IPX header compression (RFC 1553) is available in the feature sets that support IPX.
9. X.25 and Frame Relay payload compression.
10. BGP4 includes soft configuration, multipath support, and prefix filtering with inbound route maps.
11. RMON events and alarms are supported on all interfaces.
12. TACACS+ Single Connection and TACACS+ SENDAUTH enhancements are supported.
13. Cisco IOS Release 11.2 introduces several DLSw+ enhancements available in the Plus, Plus 40, and Plus 56 feature sets.
14. SRB/RSRB is fast switched. This enhancement is on by default, but can be disabled.
15. Remote node and terminal services supported on access servers (with limited support on router auxiliary ports).
16. IPX header compression (RFC 1553) is available in the feature sets that support IPX.
17. Use of LAT requires terminal license (FR-L8-10.X= or FR-L16-10.X=).

Table 10 Cisco 2500 Fixed FRAD Series

	Feature Sets		
Features	**CFRAD**	**LAN FRAD**	**OSPF LAN FRAD[1]**
Platforms Supported			
Cisco 2501FRAD-FX	Đ	—	—
Cisco 2501LANFRAD-FX and Cisco 2502LANFRAD-FX	—	Đ	Đ
LAN Support			
AppleTalk 1 and 2[2]	—	—	—
Concurrent routing and bridging (CRB)	—	—	—
DECnet IV	—	—	—
GRE	—	Đ	Đ
Integrated routing and bridging (IRB)[3]	Đ	Đ	Đ
IP	Đ	Đ	Đ
Multiring	—	Đ	Đ
Novell IPX[4]	—	Đ	Đ

Table 10 Cisco 2500 Fixed FRAD Series (Continued)

	Feature Sets		
Features	**CFRAD**	**LAN FRAD**	**OSPF LAN FRAD[1]**
Source-route bridging	Đ	Đ	Đ
Transparent bridging	Đ	Đ	Đ
Transparent and translational bridging[5]	Đ	Đ	Đ
WAN Services			
Combinet Packet Protocol (CPP)	Đ	Đ	Đ
Dialer profiles	Đ	Đ	Đ
Frame Relay	Đ	Đ	Đ
Frame Relay traffic shaping	Đ	Đ	Đ
Half bridge/half router for CPP and PPP	Đ	Đ	Đ
HDLC	—	—	—
IPXWAN 2.0	—	Đ	Đ
ISDN[6]	—	—	—
Multichassis Multilink PPP (MMP)	—	—	—
PPP[7]	Đ	Đ	Đ
SMDS	—	—	—
Switched 56	—	—	—
Virtual Private Dial-up Network (VPDN)	—	—	—
X.25[8]	—	—	—
WAN Optimization			
Bandwidth-on-demand[9]	—	—	—
Custom and priority queuing	Đ	Đ	Đ
Dial backup	—	—	—
Dial-on-demand	—	—	—
Header[10], link and payload compression[11]	Đ	Đ	Đ
Header[9] and link compression	—	—	—
Snapshot routing	—	—	—
Weighted fair queuing	Đ	Đ	Đ
IP Routing			
BGP	—	—	—
BGP4[12]	Đ	—	—
EGP	—	—	—
Enhanced IGRP	Đ	Đ	Đ[13]
Enhanced IGRP Optimizations	Đ	Đ	Đ[13]
IGRP	Đ	Đ	Đ
NHRP	—	—	—
On Demand Routing (ODR)	Đ	Đ	Đ

Table 10 Cisco 2500 Fixed FRAD Series (Continued)

	Feature Sets		
Features	**CFRAD**	**LAN FRAD**	**OSPF LAN FRAD[1]**
OSPF	Đ	—	Đ
OSPF Not-So-Stubby-Areas (NSSA)	Đ	—	Đ
OSPF On Demand Circuit (RFC 1793)	Đ	—	Đ
PIM	—	—	—
Policy-based routing	—	—	—
RIP	Đ	Đ	Đ
RIP Version 2	Đ	Đ	Đ
Other Routing			
AURP	—	—	—
IPX RIP	—	Đ	Đ
NLSP	—	—	—
RTMP	—	—	—
Multimedia and Quality of Service			
Generic traffic shaping	Đ	Đ	Đ
Random Early Detection (RED)	Đ	Đ	Đ
Resource Reservation Protocol (RSVP)	Đ	Đ	Đ
Management			
AutoInstall	Đ	Đ	Đ
Automatic modem configuration	—	—	—
HTTP Server	Đ	Đ	Đ
RMON events and alarms[14]	Đ	Đ	Đ
SNMP	Đ	Đ	Đ
Telnet	Đ	Đ	Đ
Security			
Access lists	Đ	Đ	Đ
Access security	Đ	Đ	Đ
Extended access lists	Đ	Đ	Đ
Kerberos V client support	Đ	Đ	Đ
Lock and Key	Đ	Đ	Đ
MAC security for hubs[15]	—	—	—
MD5 routing authentication	Đ	Đ	Đ
RADIUS	—	—	—
TACACS+[16]	Đ	Đ	Đ
IBM Support			
BAN for SNA Frame Relay support	Đ	Đ	Đ
Bisync	Đ	Đ	Đ

Table 10 Cisco 2500 Fixed FRAD Series (Continued)

	Feature Sets		
Features	**CFRAD**	**LAN FRAD**	**OSPF LAN FRAD[1]**
Caching and filtering	Đ	Đ	Đ
DLSw+[17]	Đ	Đ	Đ
Frame Relay SNA support (RFC 1490)	Đ	Đ	Đ
Native Client Interface Architecture (NICA) Server	—	—	—
NetView Native Service Point	Đ	Đ	Đ
Polled async (ADT, ADPLEX)	Đ	Đ	Đ
QLLC	Đ	Đ	Đ
DLSw (RFC 1795)	Đ	Đ	Đ
RSRB	Đ	—	—
SDLC integration	Đ	Đ	Đ
SDLC transport (STUN)	Đ	Đ	Đ
SDLC-to-LAN conversion (SDLLC)	Đ	Đ	Đ
SNA and NetBIOS WAN optimization via local acknowledgment	Đ	Đ	Đ
SRB/RSRB[18]	—	Đ	Đ
SRT	—	Đ	Đ
Protocol Translation			
LAT	—	—	—
PPP	—	—	—
Rlogin	—	—	—
Telnet	—	—	—
TN3270	—	—	—
X.25	—	—	—
Remote Node[19]			
ARAP 1.0/2.0[20]	—	—	—
Asynchronous master interfaces	—	—	—
ATCP	—	—	—
CPPP	—	—	—
CSLIP	—	—	—
DHCP	—	—	—
IP pooling	—	—	—
IPX and ARAP on virtual async interfaces	—	—	—
IPXCP[21]	—	—	—
MacIP	—	—	—
PPP	—	—	—
SLIP	—	—	—

Table 10 Cisco 2500 Fixed FRAD Series (Continued)

	Feature Sets		
Features	**CFRAD**	**LAN FRAD**	**OSPF LAN FRAD[1]**
Terminal Services[15]			
LAT[22]	—	—	—
Rlogin	—	—	—
Telnet	—	—	—
TN3270	—	—	—
X.25 PAD	—	—	—
Xremote	—	—	—

1. The OSPF LANFRAD for the Cisco 2500 Fixed FRAD series routers is available in Release 11.2(6)P and later. This feature set is not available in Release 11.2 F.
2. Includes AppleTalk load balancing.
3. IRB supports IP, IPX, and AppleTalk; it is supported for transparent bridging, but not for SRB; it is supported on all media-type interfaces except X.25 and ISDN bridged interfaces; and IRB and concurrent routing and bridging (CRB) cannot operate at the same time.
4. The Novell IPX feature includes display SAP by name, IPX Access Control List violation logging, and plain-English IPX access lists.
5. Translational bridging is fast switched, but this can be disabled.
6. ISDN support includes calling line identification (ANI), X.25 over the B channel, ISDN subaddressing, and applicable WAN optimization features.
7. PPP includes support for LAN protocols supported by the feature set, address negotiation, PAP and CHAP authentication, PPP compression, and Multilink PPP.
8. X.25 includes X.25 switching.
9. Bandwidth-on-demand means two B channels calls to the same destination.
10. IPX header compression (RFC 1553) is available in the feature sets that support IPX.
11. X.25 and Frame Relay payload compression.
12. BGP4 includes soft configuration, multipath support, and prefix filtering with inbound route maps.
13. Enhanced IGRP in the OSPF LANFRAD feature set is only available in Release 11.2(4). Cisco does not support this functionality in any releases of the OSPF LANFRAD feature set, and this feature is subject to removal without notice.
14. RMON events and alarms are supported on all interfaces.
15. Applicable to the following Cisco 2500 series Ethernet hub models: Cisco 2505, Cisco 2507, Cisco 2516, and Cisco 2518.
16. TACACS+ Single Connection and TACACS+ SENDAUTH enhancements are supported.
17. Cisco IOS Release 11.2 introduces several DLSw+ enhancements available in the Plus, Plus 40, and Plus 56 feature sets.
18. SRB/RSRB is fast switched. This enhancement is on by default, but can be disabled.
19. Remote node and terminal services supported on access servers (with limited support on router auxiliary ports).
20. The Cisco 4000 series products do not support ARAP 1.0/2.0.
21. IPX header compression (RFC 1553) is available in the feature sets that support IPX.
22. Use of LAT requires terminal license (FR-L8-10.X= or FR-L16-10.X=).

Table 11 Cisco 3600 Series Feature Sets

	Feature Sets			
Features	**IP Routing**	**IP/IPX/IBM/APPN[1]**	**Desktop (IP/IPX/AppleTalk/DEC)**	**Enterprise**
LAN Support				
Apollo Domain	—	—	—	Đ
AppleTalk 1 and 2	—	—	Đ	Đ
Banyan VINES	—	—	—	Đ
Concurrent routing and bridging	Đ	Đ	Đ	Đ
DECnet IV	—	—	Đ	Đ
DECnet V	—	—	—	Đ
GRE	Đ	Đ	Đ	Đ
Integrated routing and bridging (RB)	Đ	Đ	Đ	Đ
IP	Đ	Đ	Đ	Đ
LAN extension host	Đ	Đ	Đ	Đ
Multiring	Đ	Đ	Đ	Đ
Novell IPX	—	Đ	Đ	Đ
OSI	—	—	—	Đ
Source-route bridging	—	—	—	—
Transparent and translational bridging	Đ	Đ	Đ	Đ
XNS	—	—	—	Đ
WAN Services				
Combinet packet protocol	Đ	Đ	Đ	Đ
Dialer profiles	Đ	Đ	Đ	Đ
Frame Relay	Đ	Đ	Đ	Đ
Frame Relay SVC support (DTE)	—	—	—	Đ
Frame Relay traffic shaping[2]	—	—	—	—
Half bridge/half router for CPP and PPP	Đ	Đ	Đ	Đ
Multichassis Multilink PPP (MMP)	Plus	—	Plus	Plus
Virtual Private Dial-up Network (VPDN)	—	—	Đ	Đ
HDLC	Đ	Đ	Đ	Đ
IPXWAN 2.0	—	Đ	Đ	Đ
ISDN[3]	Đ	Đ	Đ	Đ
PPP[4]	Đ	Đ	Đ	Đ
SMDS	Đ	Đ	Đ	Đ
Switched 56	Đ	Đ	Đ	Đ
X.25[5]	Đ	Đ	Đ	Đ

Table 11 Cisco 3600 Series Feature Sets (Continued)

	Feature Sets			
Features	**IP Routing**	**IP/IPX/IBM/APPN[1]**	**Desktop (IP/IPX/AppleTalk/DEC)**	**Enterprise**
WAN Optimization				
Bandwidth-on-demand	Đ	Đ	Đ	Đ
Custom and priority queuing	Đ	Đ	Đ	Đ
Dial backup	Đ	Đ	Đ	Đ
Dial-on-demand	Đ	Đ	Đ	Đ
Header[6], link and payload compression[7]	Đ	Đ	Đ	Đ
Snapshot routing	Đ	Đ	Đ	Đ
Weighted fair queuing	Đ	Đ	Đ	Đ
IP Routing				
BGP	Đ	Đ	Đ	Đ
BGP4	Đ	Đ	Đ	Đ
EGP	Đ	Đ	Đ	Đ
Enhanced IGRP	Đ	Đ	Đ	Đ
Enhanced IGRP optimizations	Đ	Đ	Đ	Đ
ES-IS	—	—	—	Đ
IGRP	Đ	Đ	Đ	Đ
IS-IS	—	—	—	Đ
Named IP access control list	Đ	Đ	Đ	Đ
Network Address Translation (NAT)	Plus	—	Plus	Plus
NHRP	Đ	Đ	Đ	Đ
OSPF	Đ	Đ	Đ	Đ
OSPF Not-So-Stubby-Areas (NSSA)	Đ	Đ	Đ	Đ
OSPF On Demand Circuit (RFC 1793)	Đ	Đ	Đ	Đ
PIM	Đ	Đ	Đ	Đ
Policy-based routing	Đ	Đ	Đ	Đ
RIP	Đ	Đ	Đ	Đ
RIP Version 2	Đ	Đ	Đ	Đ
Other Routing				
AURP	—	—	Đ	Đ
IPX RIP	—	Đ	Đ	Đ
NLSP	—	Đ	Đ	Đ
RTMP	—	—	Đ	Đ
SMRP	—	—	Đ	Đ
SRTP	—	—	—	Đ

Table 11 Cisco 3600 Series Feature Sets (Continued)

Features	Feature Sets			
	IP Routing	IP/IPX/IBM/APPN[1]	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise
Multimedia and Quality of Service				
Generic traffic shaping	Đ	Đ	Đ	Đ
Random Early Detection (RED)	Đ	Đ	Đ	Đ
Resource Reservation Protocol (RSVP)	Đ	Đ	Đ	Đ
Management				
AutoInstall	Đ	Đ	Đ	Đ
Automatic modem configuration[8]	Đ	Đ	Đ	Đ
HTTP server	Đ	Đ	Đ	Đ
RMON events and alarms[9]	Đ	Đ	Đ	Đ
SNMP	Đ	Đ	Đ	Đ
Telnet	Đ	Đ	Đ	Đ
Security				
Access lists	Đ	Đ	Đ	Đ
Access security	Đ	Đ	Đ	Đ
Extended access lists	Đ	Đ	Đ	Đ
Kerberized login	—	—	—	Đ
Kerberos V client support	—	—	—	Đ
Lock and key	—	—	—	Đ
MAC security for hubs	Đ	Đ	Đ	Đ
MD5 routing authentication	Đ	Đ	Đ	Đ
Network layer encryption (40-bit or export controlled 56-bit DES)	Encrypt	—	Encrypt	Encrypt
RADIUS	Đ	Đ	Đ	Đ
Router authentication	Encrypt	—	Encrypt	Encrypt
TACACS+	Đ	Đ	Đ	Đ
IBM Support (Optional)[10]				
APPN	—	Đ	—	Đ
BAN for SNA Frame Relay support	Plus	Đ	Đ	Đ
Bisync[11]	Plus	Đ	Đ	Đ
Caching and filtering	Plus	Đ	Đ	Đ
DLSw+	Plus	Đ	Đ	Đ
Downstream PU concentration (DSPU)	Plus	Đ	—	Đ
Frame Relay SNA Support (RFC 1490)	Plus	Đ	Đ	Đ
NetView Native Service Point	Plus	Đ	Đ	Đ
QLLC[11]	Plus	Đ	Đ	Đ
SDLC integration	Plus	Đ	Đ	Đ

Table 11 Cisco 3600 Series Feature Sets (Continued)

	Feature Sets			
Features	**IP Routing**	**IP/IPX/IBM/APPN[1]**	**Desktop (IP/IPX/AppleTalk/DEC)**	**Enterprise**
SDLC transport (STUN)	Plus	Đ	Đ	Đ
SDLC-to-LAN conversion (SDLLC)	Plus	Đ	Đ	Đ
SNA and NetBIOS WAN optimization via local acknowledgment	Plus	Đ	Đ	Đ
SRB/RSRB	Plus	Đ	Đ	Đ
SRT	Plus	Đ	Đ	Đ
TG/COS	—	—	—	Đ
Protocol Translation				
LAT	—	—	—	Đ
Rlogin	—	—	—	Đ
Remote Node				
ARAP 1.0/2.0[12]	—	—	Đ	Đ
Asynchronous master interfaces	Đ	Đ	Đ	Đ
ATCP	—	—	Đ	Đ
CPPP	Đ	Đ	Đ	Đ
CSLIP	Đ	Đ	Đ	Đ
DHCP	Đ	Đ	Đ	Đ
IP pooling	Đ	Đ	Đ	Đ
IPX and ARAP on virtual asynch interfaces	—	—	—	Đ
IPXCP	—	Đ	Đ	Đ
MacIP	—	—	Đ	Đ
NASI[13]	—	Đ	Đ	Đ
NetBEUI over PPP	Đ	Đ	Đ	Đ
PPP	Đ	Đ	Đ	Đ
SLIP	Đ	Đ	Đ	Đ
Terminal Services				
LAT[14]	—	—	—	Đ
Rlogin	Đ	Đ	Đ	Đ
Telnet	Đ	Đ	Đ	Đ
TN3270	—	—	—	Đ

Table 11 Cisco 3600 Series Feature Sets (Continued)

Features	Feature Sets			
	IP Routing	IP/IPX/IBM/APPN[1]	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise
X.25 PAD	Đ	Đ	Đ	Đ
Xremote	—	—	—	Đ

1. IP/IPX/IBM/APPN has no additional options. It offers a low-end APPN solution for the Cisco 3600 series routers.
2. Frame Relay traffic shaping will be available in a future 11.2 P release.
3. ISDN support includes calling line identification (ANI), X.25 over the B channel, ISDN subaddressing, and applicable WAN optimization features.
4. PPP includes support for LAN protocols supported by the feature set, address negotiation, PAP and CHAP authentication, and PPP compression. Multilink PPP is available in Cisco IOS Release 11.0(4) and later releases.
5. Includes X.25 switching.
6. IPX header compression (RFC 1553) is available in the feature sets that support IPX in Cisco IOS Release 11.1(1) and later releases.
7. X.25 and Frame Relay payload compression are supported in Cisco IOS Release 11.0(4) and later releases.
8. Automatic modem configuration is available for all features sets in Cisco IOS Release 11.1(2) and later. For the Enterprise feature set, automatic modem configuration is available in Cisco IOS Release 11.1(1) and later.
9. The RMON events and alarms groups are supported on all interfaces in Cisco IOS Release 11.1 and later releases. Enhanced RMON feature sets are also available.
10. "Optional" means a separate Cisco IOS feature set with the IBM base option: IP/IBM base, IP/IPX/IBM/APPN base, Desktop/IBM base, or Enterprise/IBM base.
11. QLLC and Bisync are available in IP/IBM in Cisco IOS Release 11.0(3) and later releases, and in IP/IPX/IBM and Desktop/IBM base in Cisco IOS Release 11.0(2) and later releases.
12. ARAP will be supported in a future 11.2 P release, not in Release 11.2(4)XA.
13. NASI is supported in Cisco IOS Release 11.1(2) and later releases.
14. Use of LAT requires terminal license (FR-L8-10.X= for an 8-user license or FR-L16-10.X= for a 16-user license).

Table 12 Cisco 4500 Series and Cisco 4700 Series Feature Sets

Features	Feature Sets			
	IP Routing	IP/IPX/IBM/APPN[1]	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise[2]
LAN Support				
Apollo Domain	—	—	—	Đ
AppleTalk 1 and 2[3]	—	—	Đ	Đ
Banyan VINES	—	—	—	Đ
Concurrent routing and bridging (CRB)	Đ	Đ	Đ	Đ
DECnet IV	—	—	Đ	Đ
DECnet V	—	—	—	Đ
GRE	Đ	Đ	Đ	Đ
Integrated routing and bridging (IRB)[4]	Đ	Đ	Đ	Đ
IP	Đ	Đ	Đ	Đ
LAN extension host	Đ	Đ	Đ	Đ
Multiring	Đ	Đ	Đ	Đ
Novell IPX[5]	—	Đ	Đ	Đ
OSI	—	—	—	Đ
Source-route bridging[6]	—	—	—	—

Table 12 Cisco 4500 Series and Cisco 4700 Series Feature Sets (Continued)

	Feature Sets			
Features	**IP Routing**	**IP/IPX/IBM/APPN[1]**	**Desktop (IP/IPX/AppleTalk/DEC)**	**Enterprise[2]**
Transparent and translational bridging	Đ	Đ	Đ	Đ
XNS	—	—	—	Đ
WAN Services				
ATM LAN emulation: DECnet routing, XNS routing, and Banyan VINES support[7] (Cisco 4500, and Cisco 4700 only)	—	—	Plus	Plus
ATM LAN emulation: Hot Standby Router Protocol (HSRP) and Simple Server Redundancy Protocol (SSRP) (Cisco 4500, and Cisco 4700 only)	Plus	—	Plus	Plus
ATM: Rate queues for SVC per subinterface (Cisco 4500, and Cisco 4700 only)	Plus	—	Plus	Plus
ATM: UNI 3.1 signaling for ATM (Cisco 4500 and Cisco 4700 only)	Plus	—	Plus	Plus
Combinet Packet Protocol (CPP)	Đ	Đ	Đ	Đ
Dialer profiles	Đ	Đ	Đ	Đ
Frame Relay	Đ	Đ	Đ	Đ
Frame Relay SVC Support (DTE)	—	—	—	Đ
Frame Relay traffic shaping	Đ	Đ	Đ	Đ
Half bridge/half router for CPP and PPP	Đ	Đ	Đ	Đ
HDLC	Đ	Đ	Đ	Đ
IPXWAN 2.0	—	Đ	Đ	Đ
ISDN[8]	Đ	Đ	Đ	Đ
Multichassis Multilink PPP (MMP)	—	—	—	Đ
PPP[9]	Đ	Đ	Đ	Đ
SMDS	Đ	Đ	Đ	Đ
Switched 56	Đ	Đ	Đ	Đ
Virtual Private Dial-up Network (VPDN)	—	—	Đ	Đ
X.25[10]	Đ	Đ	Đ	Đ
WAN Optimization				
Bandwidth-on-demand	Đ	Đ	Đ	Đ
Custom and priority queuing	Đ	Đ	Đ	Đ
Dial backup	Đ	Đ	Đ	Đ
Dial-on-demand	Đ	Đ	Đ	Đ
Header[11], link and payload compression	Đ	Đ	Đ	Đ

Table 12 Cisco 4500 Series and Cisco 4700 Series Feature Sets (Continued)

Features	Feature Sets			
	IP Routing	IP/IPX/IBM/APPN[1]	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise[2]
Snapshot routing	Đ	Đ	Đ	Đ
Weighted fair queuing	Đ	Đ	Đ	Đ
IP Routing				
BGP	Đ	Đ	Đ	Đ
BGP4[12]	Đ	Đ	Đ	Đ
EGP	Đ	Đ	Đ	Đ
Enhanced IGRP	Đ	Đ	Đ	Đ
Enhanced IGRP Optimizations	Đ	Đ	Đ	Đ
ES-IS	—	—	—	Đ
IGRP	Đ	Đ	Đ	Đ
IS-IS	—	—	—	Đ
Named IP Access Control List	Đ	Đ	Đ	Đ
Network Address Translation (NAT)	Plus	—	Plus	Plus
NHRP	Đ	Đ	Đ	Đ
On Demand Routing (ODR)	Đ	Đ	Đ	Đ
OSPF	Đ	Đ	Đ	Đ
OSPF Not-So-Stubby-Areas (NSSA)	Đ	Đ	Đ	Đ
OSPF On Demand Circuit (RFC 1793)	Đ	Đ	Đ	Đ
PIM	Đ	Đ	Đ	Đ
Policy-based routing	Đ	Đ	Đ	Đ
RIP	Đ	Đ	Đ	Đ
RIP Version 2	Đ	Đ	Đ	Đ
Other Routing				
AURP	—	—	Đ	Đ
IPX RIP	—	Đ	Đ	Đ
NLSP	—	Đ	Đ	Đ
RTMP	—	—	Đ	Đ
SMRP	—	—	Đ	Đ
SRTP	—	—	—	Đ
Multimedia and Quality of Service				
Generic traffic shaping	Đ	Đ	Đ	Đ
Random Early Detection (RED)[13]	Đ	Đ	Đ	Đ
Resource Reservation Protocol (RSVP)[13]	Đ	Đ	Đ	Đ
Management				
AutoInstall	Đ	Đ	Đ	Đ
Automatic modem configuration	Đ	Đ	Đ	Đ

Table 12 Cisco 4500 Series and Cisco 4700 Series Feature Sets (Continued)

	Feature Sets			
Features	**IP Routing**	**IP/IPX/IBM/APPN[1]**	**Desktop (IP/IPX/AppleTalk/DEC)**	**Enterprise[2]**
HTTP Server	Đ	Đ	Đ	Đ
RMON events and alarms[14]	Đ	Đ	Đ	Đ
SNMP	Đ	Đ	Đ	Đ
Telnet	Đ	Đ	Đ	Đ
Security				
Access lists	Đ	Đ	Đ	Đ
Access security	Đ	Đ	Đ	Đ
Extended access lists	Đ	Đ	Đ	Đ
Kerberized login	—	—	—	Đ
Kerberos V client support	—	—	—	Đ
Lock and key	Đ	Đ	Đ	Đ
MAC security for hubs	Đ	Đ	Đ	Đ
MD5 routing authentication	Đ	Đ	Đ	Đ
Network layer encryption (40-bit or export controlled 56-bit DES)[15]	Encrypt	—	Encrypt	Encrypt
RADIUS	Đ	Đ	Đ	Đ
Router authentication	Encrypt	—	Encrypt	Encrypt
TACACS+[16]	Đ	Đ	Đ	Đ
IBM Support (Optional)				
APPN (optional)[2]	—	Đ	—	Đ
BAN for SNA Frame Relay support	Plus	Đ	Plus	Đ
Bisync	Plus	Đ	Plus	Đ
Caching and filtering	Plus	Đ	Plus	Đ
DLSw+ [17]	Plus	Đ	Plus	Đ
Downstream PU (DSPU) concentration	Plus	Đ	Plus	Đ
Frame Relay SNA support (RFC 1490)	Plus	Đ	Plus	Đ
Native Client Interface Architecture (NCIA) Server	Plus	Đ	Plus	Đ
NetView Native Service Point	Plus	Đ	Plus	Đ
QLLC	Plus	Đ	Plus	Đ
Response Time Reporter (RTR)	Plus	Đ	Plus	Đ
SDLC integration	Plus	Đ	Plus	Đ
SDLC transport (STUN)	Plus	Đ	Plus	Đ
SDLC-to-LAN conversion (SDLLC)	Plus	Đ	Plus	Đ
SNA and NetBIOS WAN optimization via local acknowledgment	Plus	Đ	Plus	Đ
SRB/RSRB[18]	Plus	Đ	Plus	Đ

Table 12 Cisco 4500 Series and Cisco 4700 Series Feature Sets (Continued)

	Feature Sets			
Features	**IP Routing**	**IP/IPX/IBM/APPN[1]**	**Desktop (IP/IPX/AppleTalk/DEC)**	**Enterprise[2]**
SRT	Plus	Đ	Plus	Đ
TG/COS	—	—	—	Đ
TN3270	—	—	—	Đ
Protocol Translation				
LAT	—	—	—	Đ
Rlogin	—	—	—	Đ
Remote Node[19]				
ARAP 1.0/2.0[20]	—	—	Đ	Đ
Asynchronous master interfaces	Đ	Đ	Đ	Đ
ATCP	—	—	Đ	Đ
CPPP	Đ	Đ	Đ	Đ
CSLIP	Đ	Đ	Đ	Đ
DHCP	Đ	Đ	Đ	Đ
IP pooling	Đ	Đ	Đ	Đ
IPX and ARAP on virtual async interfaces	—	—	—	Đ
IPXCP[11]	—	Đ	Đ	Đ
MacIP	—	—	Đ	Đ
NASI	—	Đ	Đ	Đ
NetBEUI over PPP	Đ	Đ	Đ	Đ
PPP	Đ	Đ	Đ	Đ
SLIP	Đ	Đ	Đ	Đ
Terminal Services[19]				
LAT[21]	—	—	—	Đ
Rlogin	Đ	Đ	Đ	Đ
Telnet	Đ	Đ	Đ	Đ
TN3270	—	—	—	Đ

Table 12 Cisco 4500 Series and Cisco 4700 Series Feature Sets (Continued)

	Feature Sets			
Features	**IP Routing**	**IP/IPX/IBM/APPN[1]**	**Desktop (IP/IPX/AppleTalk/DEC)**	**Enterprise[2]**
X.25 PAD	Đ	Đ	Đ	Đ
Xremote	—	—	—	Đ

1. This feature set has no additional options. It offers a low-end APPN solution for this set of hardware platforms.
2. Enterprise is available with APPN in a separate feature set. APPN includes APPN Central Registration (CRR) and APPN over DLSw+.
3. Includes AppleTalk load balancing.
4. IRB supports IP, IPX, and AppleTalk; it is supported for transparent bridging, but not for SRB; it is supported on all media-type interfaces except X.25 and ISDN bridged interfaces; IRB and concurrent routing and bridging (CRB) cannot operate at the same time.
5. The Novell IPX feature includes display SAP by name, IPX Access Control List violation logging, and plain-English IPX access lists.
6. Translational bridging is fast switched by default but can be disabled.
7. ATM LAN emulation for Banyan VINES is only supported in Enterprise. The Desktop feature set supports DECnet only.
8. ISDN support includes calling line identification (ANI), X.25 over the B channel, ISDN subaddressing, and applicable WAN optimization features.
9. PPP includes support for LAN protocols supported by the feature set, address negotiation, PAP and CHAP authentication, Multilink PPP, and PPP compression.
10. X.25 includes X.25 switching.
11. IPX header compression (RFC 1553) is available in the feature sets that support IPX.
12. BGP4 includes soft configuration, multipath support, and prefix filtering with inbound route maps.
13. RED and RSVP are supported in IP/IPX/IBM/APPN for the Cisco 4500 and Cisco 4700 only.
14. The RMON events and alarms groups are supported on all interfaces. Full RMON support is available with the Plus feature sets.
15. For more details, see the description of the new data encryption options in the see the beginning of the section “Cisco IOS Feature Sets.”
16. TACACS+ Single Connection and TACACS+ SENDAUTH enhancements are supported.
17. Cisco IOS Release 11.2 introduces several DLSw+ enhancements available in the Plus, Plus 40, and Plus 56 feature sets.
18. SRB/RSRB is fast switched. This enhancement is on by default but can be disabled.
19. Supported on access severs (with limited support on router auxiliary ports).
20. The Cisco 4500 and Cisco 4700 routers do not support ARAP 1.0/2.0.
21. Use of LAT requires a terminal license (FR-L8-10.X= for an 8-user license or FR-L16-10.X= for a 16-user license).

Table 13 Cisco AS5200 Access Server Software Feature Sets

	Feature Set		
Features	**IP Routing**	**Desktop (IP/IPX/AppleTalk/DEC)**	**Enterprise[1]**
LAN Support			
Apollo Domain	—	—	Đ
AppleTalk 1 and 2[2]	—	Đ	Đ
Banyan VINES	—	—	Đ
Concurrent routing and bridging (CRB)	Đ	Đ	Đ
DECnet IV	—	Đ	Đ
DECnet V	—	—	Đ
GRE	Đ	Đ	Đ
Integrated routing and bridging (IRB)[3]	Đ	Đ	Đ
IP	Đ	Đ	Đ
LAN extension host	Đ	Đ	Đ
Multiring	Đ	Đ	Đ

Table 13 Cisco AS5200 Access Server Software Feature Sets (Continued)

Features	Feature Set		
	IP Routing	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise[1]
Novell IPX[4]	—	Đ	Đ
OSI	—	—	Đ
Source-route bridging (SRB)	—	—	Đ
Transparent and translational bridging	Đ	Đ	Đ
XNS	—	—	Đ
WAN Services			
ATM LAN emulation: Rate queues for SVC per subinterface	—	—	Đ
Combinet Packet Protocol (CPP)	Đ	Đ	Đ
Dialer profiles	Đ	Đ	Đ
Frame Relay	Đ	Đ	Đ
Frame Relay SVC Support (DTE)	—	—	Đ
Frame Relay traffic shaping	Đ	Đ	Đ
Half bridge/half router for CPP and PPP	Đ	Đ	Đ
HDLC	Đ	Đ	Đ
IPXWAN 2.0	—	Đ	Đ
ISDN[5]	Đ	Đ	Đ
Multichassis Multilink PPP (MMP)	—	—	Đ
PPP[6]	Đ	Đ	Đ
SMDS	Đ	Đ	Đ
Switched 56	Đ	Đ	Đ
Virtual Private Dial-up Network (VPDN)	—	Đ	Đ
X.25[7]	Đ	Đ	Đ
WAN Optimization			
Bandwidth-on-demand	Đ	Đ	Đ
Custom and priority queuing	Đ	Đ	Đ
Dial backup	Đ	Đ	Đ
Dial-on-demand	Đ	Đ	Đ
Header[8], link and payload compression[9]	Đ	Đ	Đ
Snapshot routing	Đ	Đ	Đ
Weighted fair queuing	Đ	Đ	Đ
IP Routing			
BGP	Đ	Đ	Đ
BGP4[10]	Đ	Đ	Đ
EGP	Đ	Đ	Đ
Enhanced IGRP	Đ	Đ	Đ

Table 13 Cisco AS5200 Access Server Software Feature Sets (Continued)

Features	Feature Set		
	IP Routing	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise[1]
Enhanced IGRP Optimizations	Đ	Đ	Đ
ES-IS	—	—	Đ
IGRP	Đ	Đ	Đ
IS-IS	—	—	Đ
Named IP Access Control List	Đ	Đ	Đ
Network Address Translation (NAT)	Plus	Plus	Plus
NHRP	Đ	Đ	Đ
On Demand Routing (ODR)	Đ	Đ	Đ
OSPF	Đ	Đ	Đ
OSPF Not-So-Stubby-Areas (NSSA)	Đ	Đ	Đ
OSPF On Demand Circuit (RFC 1793)	Đ	Đ	Đ
PIM	Đ	Đ	Đ
Policy-based routing	Đ	Đ	Đ
RIP	Đ	Đ	Đ
RIP Version 2	Đ	Đ	Đ
Other Routing			
AURP	—	Đ	Đ
IPX RIP	—	Đ	Đ
NLSP	—	Đ	Đ
RTMP	—	Đ	Đ
SMRP	—	Đ	Đ
SRTP	—	—	Đ
Multimedia and Quality of Service			
Generic traffic shaping	Đ	Đ	Đ
Random Early Detection (RED)	Đ	Đ	Đ
Resource Reservation Protocol (RSVP)	Đ	Đ	Đ
Management			
AutoInstall	Đ	Đ	Đ
Automatic modem configuration	Đ	Đ	Đ
HTTP Server	Đ	Đ	Đ
Modem Management	Plus	Plus	Plus
RMON events and alarms[11]	Đ	Đ	Đ
RMON full	Plus	Plus	Plus
SNMP	Đ	Đ	Đ
Telnet	Đ	Đ	Đ

Table 13 Cisco AS5200 Access Server Software Feature Sets (Continued)

Features	Feature Set		
	IP Routing	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise[1]
Security			
Access lists	Đ	Đ	Đ
Access security	Đ	Đ	Đ
Extended access lists	Đ	Đ	Đ
Kerberized login	—	—	Đ
Kerberos V client support	—	—	Đ
Lock and key	Đ	Đ	Đ
MAC security for hubs	Đ	Đ	Đ
MD5 routing authentication	Đ	Đ	Đ
RADIUS	Đ	Đ	Đ
TACACS+[12]	Đ	Đ	Đ
IBM Support (Optional)			
APPN (optional)[2]	—	—	—
BAN for SNA Frame Relay support	Plus	Plus	Đ
Bisync	Plus	Plus	Đ
Caching and filtering	Plus	Plus	Đ
DLSw+ [13]	Plus	Plus	Đ
Downstream PU concentration (DSPU)	Plus	Plus	Đ
Frame Relay SNA support (RFC 1490)	Plus	Plus	Đ
Native Client Interface Architecture (NCIA) Server	Plus	Plus	Đ
NetView Native Service Point	Plus	Plus	Đ
QLLC	Plus	Plus	Đ
Response Time Reporter (RTR)	Plus	Plus	Đ
SDLC integration	Plus	Plus	Đ
DLSw (RFC 1795)	Plus	Plus	Đ
SDLC transport (STUN)	Plus	Plus	Đ
SDLC-to-LAN conversion (SDLLC)	Plus	Plus	Đ
SNA and NetBIOS WAN optimization via local acknowledgment	Plus	Plus	Đ
SRB/RSRB[14]	Plus	Plus	Đ
SRT	Plus	Plus	Đ
TG/COS	—	—	Đ
TN3270	—	—	Đ
Protocol Translation			
LAT	—	—	Đ
Rlogin	—	—	Đ

Table 13 Cisco AS5200 Access Server Software Feature Sets (Continued)

Features	Feature Set		
	IP Routing	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise[1]
Remote Node[15]			
ARAP 1.0/2.0	—	Đ	Đ
Asynchronous master interfaces	Đ	Đ	Đ
ATCP	—	Đ	Đ
CPPP	Đ	Đ	Đ
CSLIP	Đ	Đ	Đ
DHCP	Đ	Đ	Đ
IP pooling	Đ	Đ	Đ
IPX and ARAP on virtual async interfaces	—	—	Đ
IPXCP	—	Đ	Đ
MacIP	—	Đ	Đ
NASI	—	—	—
NetBEUI over PPP	—	—	—
SLIP	Đ	Đ	Đ
Terminal Services[15]			
LAT[16]	—	—	Đ
Rlogin	Đ	Đ	Đ
Telnet	Đ	Đ	Đ
TN3270	—	—	Đ
X.25 PAD	Đ	Đ	Đ
Xremote	—	—	Đ

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

Table 14 Cisco 3011 WAN Module Feature Sets

	Feature Sets			
Features	**IP Routing**	**IP/IPX/IBM/APPN[1]**	**Desktop (IP/IPX/AppleTalk/DEC)**	**Enterprise[2]**
LAN Support				
Apollo Domain	—	—	—	Đ
AppleTalk 1 and 2[3]	—	—	Đ	Đ
Banyan VINES	—	—	—	Đ
Concurrent routing and bridging (CRB)	Đ	Đ	Đ	Đ
DECnet IV	—	—	Đ	Đ
DECnet V	—	—	—	Đ
GRE	Đ	Đ	Đ	Đ
Integrated routing and bridging (IRB)[4]	Đ	Đ	Đ	Đ
IP	Đ	Đ	Đ	Đ
LAN extension host	Đ	Đ	Đ	Đ
Multiring	Đ	Đ	Đ	Đ
Novell IPX[5]	—	Đ	Đ	Đ
OSI	—	—	—	Đ
Source-route bridging[6]	—	—	—	—
Transparent and translational bridging	Đ	Đ	Đ	Đ
XNS	—	—	—	Đ
WAN Services				
Combinet Packet Protocol (CPP)	Đ	Đ	Đ	Đ
Dialer profiles	Đ	Đ	Đ	Đ
Frame Relay	Đ	Đ	Đ	Đ
Frame Relay SVC Support (DTE)	—	—	—	Đ
Frame Relay traffic shaping	Đ	Đ	Đ	Đ
Half bridge/half router for CPP and PPP	Đ	Đ	Đ	Đ
HDLC	Đ	Đ	Đ	Đ
IPXWAN 2.0	—	Đ	Đ	Đ
ISDN[7]	Đ	Đ	Đ	Đ
Multichassis Multilink PPP (MMP)	—	—	—	Đ
PPP[8]	Đ	Đ	Đ	Đ
SMDS	Đ	Đ	Đ	Đ
Switched 56	Đ	Đ	Đ	Đ
Virtual Private Dial-up Network (VPDN)	—	—	Đ	Đ
X.25[9]	Đ	Đ	Đ	Đ

Table 14 Cisco 3011 WAN Module Feature Sets (Continued)

Features	Feature Sets			
	IP Routing	IP/IPX/IBM/APPN[1]	Desktop (IP/IPX/AppleTalk/DEC)	Enterprise[2]
WAN Optimization				
Bandwidth-on-demand	Đ	Đ	Đ	Đ
Custom and priority queuing	Đ	Đ	Đ	Đ
Dial backup	Đ	Đ	Đ	Đ
Dial-on-demand	Đ	Đ	Đ	Đ
Header[10], link and payload compression	Đ	Đ	Đ	Đ
Snapshot routing	Đ	Đ	Đ	Đ
Weighted fair queuing	Đ	Đ	Đ	Đ
IP Routing				
BGP	Đ	Đ	Đ	Đ
BGP4[11]	Đ	Đ	Đ	Đ
EGP	Đ	Đ	Đ	Đ
Enhanced IGRP	Đ	Đ	Đ	Đ
Enhanced IGRP Optimizations	Đ	Đ	Đ	Đ
ES-IS	—	—	—	Đ
IGRP	Đ	Đ	Đ	Đ
IS-IS	—	—	—	Đ
Named IP Access Control List	Đ	Đ	Đ	Đ
Network Address Translation (NAT)	Plus	—	Plus	Plus
NHRP	Đ	Đ	Đ	Đ
On Demand Routing (ODR)	Đ	Đ	Đ	Đ
OSPF	Đ	Đ	Đ	Đ
OSPF Not-So-Stubby-Areas (NSSA)	Đ	Đ	Đ	Đ
OSPF On Demand Circuit (RFC 1793)	Đ	Đ	Đ	Đ
PIM	Đ	Đ	Đ	Đ
Policy-based routing	Đ	Đ	Đ	Đ
RIP	Đ	Đ	Đ	Đ
RIP Version 2	Đ	Đ	Đ	Đ
Other Routing				
AURP	—	—	Đ	Đ
IPX RIP	—	Đ	Đ	Đ
NLSP	—	Đ	Đ	Đ
RTMP	—	—	Đ	Đ
SMRP	—	—	Đ	Đ
SRTP	—	—	—	Đ

Table 14 Cisco 3011 WAN Module Feature Sets (Continued)

	Feature Sets			
Features	**IP Routing**	**IP/IPX/IBM/APPN[1]**	**Desktop (IP/IPX/AppleTalk/DEC)**	**Enterprise[2]**
Multimedia and Quality of Service				
Generic traffic shaping	Đ	Đ	Đ	Đ
Random Early Detection (RED)	Đ	Đ	Đ	Đ
Resource Reservation Protocol (RSVP)[13]	Đ	Đ	Đ	Đ
Management				
AutoInstall	Đ	Đ	Đ	Đ
Automatic modem configuration	Đ	Đ	Đ	Đ
HTTP Server	Đ	Đ	Đ	Đ
RMON events and alarms[12]	Đ	Đ	Đ	Đ
RMON full (Cisco 3011 WAN module only)[13]	Plus	Plus	Plus	Plus
SNMP	Đ	Đ	Đ	Đ
Telnet	Đ	Đ	Đ	Đ
Security				
Access lists	Đ	Đ	Đ	Đ
Access security	Đ	Đ	Đ	Đ
Extended access lists	Đ	Đ	Đ	Đ
Kerberized login	—	—	—	Đ
Kerberos V client support	—	—	—	Đ
Lock and key	Đ	Đ	Đ	Đ
MAC security for hubs[14]	Đ	Đ	Đ	Đ
MD5 routing authentication	Đ	Đ	Đ	Đ
Network layer encryption (40-bit or export controlled 56-bit DES)[15]	Encrypt	—	Encrypt	Encrypt
RADIUS	Đ	Đ	Đ	Đ
Router authentication	Encrypt	—	Encrypt	Encrypt
TACACS+[16]	Đ	Đ	Đ	Đ
IBM Support (Optional)				
APPN (optional)[2]	—	Đ	—	Đ
BAN for SNA Frame Relay support	—	Đ	—	Đ
Bisync	—	Đ	—	Đ
Caching and filtering	—	Đ	—	Đ
DLSw+ [17]	—	Đ	—	Đ
Downstream PU (DSPU) concentration	—	Đ	—	Đ
Frame Relay SNA support (RFC 1490)	—	Đ	—	Đ
Native Client Interface Architecture (NCIA) Server	—	Đ	—	Đ

Table 14 Cisco 3011 WAN Module Feature Sets (Continued)

	Feature Sets			
Features	**IP Routing**	**IP/IPX/IBM/APPN[1]**	**Desktop (IP/IPX/AppleTalk/DEC)**	**Enterprise[2]**
NetView Native Service Point	—	Đ	—	Đ
QLLC	—	Đ	—	Đ
Response Time Reporter (RTR)	—	Đ	—	Đ
SDLC integration	—	Đ	—	Đ
SDLC transport (STUN)	—	Đ	—	Đ
SDLC-to-LAN conversion (SDLLC)	—	Đ	—	Đ
SNA and NetBIOS WAN optimization via local acknowledgment	—	Đ	—	Đ
SRB/RSRB[18]	—	Đ	—	Đ
SRT	—	Đ	—	Đ
TG/COS	—	—	—	Đ
TN3270	—	—	—	Đ
Protocol Translation				
LAT	—	—	—	Đ
Rlogin	—	—	—	Đ
Remote Node[19]				
ARAP 1.0/2.0	—	—	Đ	Đ
Asynchronous master interfaces	Đ	Đ	Đ	Đ
ATCP	—	—	Đ	Đ
CPPP	Đ	Đ	Đ	Đ
CSLIP	Đ	Đ	Đ	Đ
DHCP	Đ	Đ	Đ	Đ
IP pooling	Đ	Đ	Đ	Đ
IPX and ARAP on virtual async interfaces	—	—	—	Đ
IPXCP[11]	—	Đ	Đ	Đ
MacIP	—	—	Đ	Đ
NASI	—	Đ	Đ	Đ
NetBEUI over PPP	Đ	Đ	Đ	Đ
PPP	Đ	Đ	Đ	Đ
SLIP	Đ	Đ	Đ	Đ
Terminal Services				
LAT[20]	—	—	—	Đ
Rlogin	Đ	Đ	Đ	Đ
Telnet	Đ	Đ	Đ	Đ
TN3270	—	—	—	Đ

Table 14 Cisco 3011 WAN Module Feature Sets (Continued)

	Feature Sets			
Features	**IP Routing**	**IP/IPX/IBM/APPN[1]**	**Desktop (IP/IPX/AppleTalk/DEC)**	**Enterprise[2]**
X.25 PAD	Đ	Đ	Đ	Đ
Xremote	—	—	—	Đ

1. This feature set has no additional options. It offers a low-end APPN solution for this set of hardware platforms.
2. Enterprise is available with APPN in a separate feature set. APPN includes APPN Central Registration (CRR) and APPN over DLSw+.
3. Includes AppleTalk load balancing.
4. IRB supports IP, IPX, and AppleTalk; it is supported for transparent bridging, but not for SRB; it is supported on all media-type interfaces except X.25 and ISDN bridged interfaces; IRB and concurrent routing and bridging (CRB) cannot operate at the same time.
5. The Novell IPX feature includes display SAP by name, IPX Access Control List violation logging, and plain-English IPX access lists.
6. Translational bridging is fast switched by default but can be disabled.
7. ISDN support includes calling line identification (ANI), X.25 over the B channel, ISDN subaddressing, and applicable WAN optimization features.
8. PPP includes support for LAN protocols supported by the feature set, address negotiation, PAP and CHAP authentication, Multilink PPP, and PPP compression.
9. X.25 includes X.25 switching.
10. IPX header compression (RFC 1553) is available in the feature sets that support IPX.
11. BGP4 includes soft configuration, multipath support, and prefix filtering with inbound route maps.
12. The RMON events and alarms groups are supported on all interfaces. Full RMON support is available with the Plus feature sets.
13. The Cisco 3011 WAN module is derived from the Cisco 2503 router.
14. This feature does not apply to the Cisco 3011 WAN module.
15. For more details, see the description of the new data encryption options in the see the beginning of the section “Cisco IOS Feature Sets.”
16. TACACS+ Single Connection and TACACS+ SENDAUTH enhancements are supported.
17. Cisco IOS Release 11.2 introduces several DLSw+ enhancements available in the Plus, Plus 40, and Plus 56 feature sets.
18. SRB/RSRB is fast switched. This enhancement is on by default but can be disabled.
19. Supported on access severs (with limited support on router auxiliary ports).
20. Use of LAT requires a terminal license (FR-L8-10.X= for an 8-user license or FR-L16-10.X= for a 16-user license).

Table 15 Internet Router Cards Installed in 10BaseT Hubs Feature Sets

	Feature Sets		
Features	**IP Routing**	**Desktop (IP/IPX/AppleTalk/DEC)**	**Desktop with IBM (IP/IPX/AppleTalk/DEC/IBM)**
LAN Support			
Apollo Domain	—	—	—
AppleTalk 1 and 2[1]	—	Đ	Đ
Banyan VINES	—	—	—
Concurrent routing and bridging (CRB)	Đ	Đ	Đ
DECnet IV	—	Đ	Đ
DECnet V	—	—	—
GRE	Đ	Đ	Đ
Integrated routing and bridging (IRB)[2]	Đ	Đ	Đ
IP	Đ	Đ	Đ
LAN extension host	Đ	Đ	Đ
Multiring	Đ	Đ	Đ
Novell IPX[3]	—	Đ	Đ

Table 15 Internet Router Cards Installed in 10BaseT Hubs Feature Sets (Continued)

Features	Feature Sets		
	IP Routing	Desktop (IP/IPX/AppleTalk/DEC)	Desktop with IBM (IP/IPX/AppleTalk/DEC/IBM)
OSI	—	—	—
Source-route bridging[4]	—	—	—
Transparent and translational bridging	Đ	Đ	Đ
XNS	—	—	—
WAN Services			
Combinet Packet Protocol (CPP)	Đ	Đ	Đ
Dialer profiles	Đ	Đ	Đ
Frame Relay	Đ	Đ	Đ
Frame Relay SVC Support (DTE)	—	—	—
Frame Relay traffic shaping	Đ	Đ	Đ
Half bridge/half router for CPP and PPP	Đ	Đ	Đ
HDLC	Đ	Đ	Đ
IPXWAN 2.0	—	Đ	Đ
ISDN[5]	Đ	Đ	Đ
Multichassis Multilink PPP (MMP)	—	—	—
PPP[6]	Đ	Đ	Đ
SMDS	Đ	Đ	Đ
Switched 56	Đ	Đ	Đ
Virtual Private Dialup Network (VPDN)	—	Đ	Đ
X.25[7]	Đ	Đ	Đ
WAN Optimization			
Bandwidth-on-demand	Đ	Đ	Đ
Custom and priority queuing	Đ	Đ	Đ
Dial backup	Đ	Đ	Đ
Dial-on-demand	Đ	Đ	Đ
Header[8], link and payload compression	Đ	Đ	Đ
Snapshot routing	Đ	Đ	Đ
Weighted fair queuing	Đ	Đ	Đ
IP Routing			
BGP	Đ	Đ	Đ
BGP4[9]	Đ	Đ	Đ
EGP	Đ	Đ	Đ
Enhanced IGRP	Đ	Đ	Đ
Enhanced IGRP Optimizations	Đ	Đ	Đ
ES-IS	—	—	—
IGRP	Đ	Đ	Đ

Table 15 Internet Router Cards Installed in 10BaseT Hubs Feature Sets (Continued)

Features	Feature Sets		
	IP Routing	Desktop (IP/IPX/AppleTalk/DEC)	Desktop with IBM (IP/IPX/AppleTalk/DEC/IBM)
IS-IS	—	—	—
Named IP Access Control List	Đ	Đ	Đ
Network Address Translation (NAT)	—	—	—
NHRP	Đ	Đ	Đ
On Demand Routing (ODR)	Đ	Đ	Đ
OSPF	Đ	Đ	Đ
OSPF Not-So-Stubby-Areas (NSSA)	Đ	Đ	Đ
OSPF On Demand Circuit (RFC 1793)	Đ	Đ	Đ
PIM	Đ	Đ	Đ
Policy-based routing	Đ	Đ	Đ
RIP	Đ	Đ	Đ
RIP Version 2	Đ	Đ	Đ
Other Routing			
AURP	—	Đ	Đ
IPX RIP	—	Đ	Đ
NLSP	—	Đ	Đ
RTMP	—	Đ	Đ
SMRP	—	Đ	Đ
SRTP	—	—	—
Multimedia and Quality of Service			
Generic traffic shaping	Đ	Đ	Đ
Resource Reservation Protocol (RSVP)	Đ	Đ	Đ
Management			
AutoInstall	Đ	Đ	Đ
Automatic modem configuration	Đ	Đ	Đ
HTTP Server	Đ	Đ	Đ
RMON events and alarms[10]	Đ	Đ	Đ
SNMP	Đ	Đ	Đ
Telnet	Đ	Đ	Đ
Security			
Access lists	Đ	Đ	Đ
Access security	Đ	Đ	Đ
Extended access lists	Đ	Đ	Đ
Kerberized login	—	—	—
Kerberos V client support	—	—	—
Lock and key	Đ	Đ	Đ

Table 15 Internet Router Cards Installed in 10BaseT Hubs Feature Sets (Continued)

Features	Feature Sets		
	IP Routing	Desktop (IP/IPX/AppleTalk/DEC)	Desktop with IBM (IP/IPX/AppleTalk/DEC/IBM)
MAC security for hubs	Đ	Đ	Đ
MD5 routing authentication	Đ	Đ	Đ
RADIUS	Đ	Đ	Đ
TACACS+[11]	Đ	Đ	Đ
IBM Support (Optional)			
APPN (optional)[2]	—	—	—
BAN for SNA Frame Relay support	—	—	Plus
Bisync	—	—	Plus
Caching and filtering	—	—	Plus
DLSw+ [12]	—	—	Plus
Downstream PU (DSPU) concentration	—	—	Plus
Frame Relay SNA support (RFC 1490)	—	—	Plus
Native Client Interface Architecture (NCIA) Server	—	—	Plus
NetView Native Service Point	—	—	Plus
QLLC	—	—	Plus
Response Time Reporter (RTR)	—	—	Plus
SDLC integration	—	—	Plus
SDLC transport (STUN)	—	—	Plus
SDLC-to-LAN conversion (SDLLC)	—	—	Plus
SNA and NetBIOS WAN optimization via local acknowledgment	—	—	Plus
SRB/RSRB[13]	—	—	Plus
SRT	—	—	Plus
TG/COS	—	—	—
TN3270	—	—	—
Protocol Translation			
LAT	—	—	—
Rlogin	—	—	—
Remote Node[14]			
ARAP 1.0/2.0	—	Đ	Đ
Asynchronous master interfaces	Đ	Đ	Đ
ATCP	—	Đ	Đ
CPPP	Đ	Đ	Đ
CSLIP	Đ	Đ	Đ
DHCP	Đ	Đ	Đ

Table 15 Internet Router Cards Installed in 10BaseT Hubs Feature Sets (Continued)

Features	Feature Sets		
	IP Routing	Desktop (IP/IPX/AppleTalk/DEC)	Desktop with IBM (IP/IPX/AppleTalk/DEC/IBM)
IP pooling	Đ	Đ	Đ
IPX and ARAP on virtual async interfaces	—	—	—
IPXCP	—	Đ	Đ
MacIP	—	Đ	Đ
NASI	—	Đ	Đ
NetBEUI over PPP	Đ	Đ	Đ
PPP	Đ	Đ	Đ
SLIP	Đ	Đ	Đ
Terminal Services[19]			
LAT[15]	—	—	—
Rlogin	Đ	Đ	Đ
Telnet	Đ	Đ	Đ
TN3270	—	—	—
X.25 PAD	Đ	Đ	Đ
Xremote	—	—	—

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

Table 16 Cisco 7000 Series (with RSP7000) and Cisco 7500 Series Software Feature Sets

	Feature Sets		
Features	**IP Routing**	**Desktop/IBM[1]**	**Enterprise[1]**
LAN Support			
Apollo Domain	—	—	Đ
AppleTalk 1 and 2[2]	—	Đ	Đ
Banyan VINES	—	—	Đ
Concurrent routing and bridging (CRB)[3]	Đ	Đ	Đ
DECnet IV	—	Đ	Đ
DECnet V	—	—	Đ
GRE	Đ	Đ	Đ
Integrated routing and bridging (IRB)[4]	Đ	Đ	Đ
IP	Đ	Đ	Đ
LAN extension host	Đ	Đ	Đ
Multiring	Đ	Đ	Đ
Novell IPX[5]	—	Đ	Đ
OSI	—	—	Đ
Transparent and translational bridging	Đ	Đ	Đ
VLANs (ISL and IEEE 802.10)	Đ	Đ	Đ
XNS	—	—	Đ
WAN Services			
ATM LAN emulation: DECnet routing, XNS routing, and Banyan VINES support	Đ	Đ	Đ
ATM LAN emulation: Hot Standby Router Protocol (HSRP) and Simple Server Redundancy Protocol (SSRP)	Đ	Đ	Đ
ATM: Rate queues for SVC per subinterface	Đ	Đ	Đ
ATM: UNI 3.1 signaling for ATM	Đ	Đ	Đ
Combinet Packet Protocol (CPP)	Đ	Đ	Đ
Dialer profiles	Đ	Đ	Đ
Half bridge/half router for CPP and PPP	Đ	Đ	Đ
HDLC	Đ	Đ	Đ
IPXWAN 2.0	—	Đ	Đ
ISDN[6]	Đ	Đ	Đ
Multichassis Multilink PPP (MMP)	—	—	Đ
PPP[7]	Đ	Đ	Đ
Virtual Private Dial-up Network (VPDN)	—	Đ	Đ

Table 16 Cisco 7000 Series (with RSP7000) and Cisco 7500 Series Software Feature Sets

	Feature Sets		
Features	**IP Routing**	**Desktop/IBM[1]**	**Enterprise[1]**
WAN Optimization			
Bandwidth-on-demand	Đ	Đ	Đ
Custom and priority queuing[8]	Đ	Đ	Đ
Dial backup	Đ	Đ	Đ
Dial-on-demand	Đ	Đ	Đ
Header[9], link and payload compression[10]	Đ	Đ	Đ
Named IP Access Control List	Đ	Đ	Đ
NetFlow Switching (NFS)[11]	Đ	Đ	Đ
Snapshot routing	Đ	Đ	Đ
Weighted fair queuing[8]	Đ	Đ	Đ
IP Routing			
Enhanced IGRP	Đ	Đ	Đ
Enhanced IGRP Optimizations	Đ	Đ	Đ
ES-IS	—	—	Đ
IGRP	Đ	Đ	Đ
IS-IS	—	—	Đ
Named IP Access Control List[12]	Đ	Đ	Đ
NHRP	Đ	Đ	Đ
Network Address Translation (NAT)	Đ	Đ	Đ
On Demand Routing (ODR)	Đ	Đ	Đ
OSPF	Đ	Đ	Đ
OSPF Not-So-Stubby-Areas (NSSA)	Đ	Đ	Đ
OSPF On Demand Circuit (RFC 1793)	Đ	Đ	Đ
PIM	Đ	Đ	Đ
Policy-based routing	Đ	Đ	Đ
RIP	Đ	Đ	Đ
RIP Version 2	Đ	Đ	Đ
Other Routing			
AURP	—	Đ	Đ
IPX RIP	—	Đ	Đ
NLSP	—	Đ	Đ
RTMP	—	Đ	Đ
SMRP	—	Đ	Đ
SRTP	—	—	Đ

Table 16 Cisco 7000 Series (with RSP7000) and Cisco 7500 Series Software Feature Sets

	Feature Sets		
Features	**IP Routing**	**Desktop/IBM[1]**	**Enterprise[1]**
Multimedia and Quality of Service			
Generic traffic shaping	Đ	Đ	Đ
Random Early Detection (RED)	Đ	Đ	Đ
Resource Reservation Protocol (RSVP)	Đ	Đ	Đ
Management			
AutoInstall	Đ	Đ	Đ
Automatic modem configuration	Đ	Đ	Đ
HTTP Server	Đ	Đ	Đ
RMON events and alarms	Đ	Đ	Đ
SNMP	Đ	Đ	Đ
Telnet	Đ	Đ	Đ
Security			
Access lists	Đ	Đ	Đ
Access security	Đ	Đ	Đ
Extended access lists	Đ	Đ	Đ
Kerberized login	—	—	Đ
Kerberos V client support	—	—	Đ
Lock and Key	Đ	Đ	Đ
MD5 routing authentication	Đ	Đ	Đ
Network layer encryption (40-bit or export controlled 56-bit DES)[13]	Encrypt	Encrypt	Encrypt
RADIUS	Đ	Đ	Đ
Router authentication	Encrypt	Encrypt	Encrypt
TACACS+[14]	Đ	Đ	Đ
IBM Support			
APPN (optional)[1]	—	Đ	Đ
BAN for SNA Frame Relay support	—	Đ	Đ
Caching and filtering	—	Đ	Đ
DLSW+[15, 16]	—	Đ	Đ
Downstream PU concentration (DSPU)	—	Đ	Đ
Frame Relay SNA support (RFC 1490)	—	Đ	Đ
Native Client Interface Architecture (NCIA) Server	—	Đ	Đ
NetView Native Service Point	—	Đ	Đ
QLLC	—	Đ	Đ
Response Time Reporter (RTR)	—	Đ	Đ
SDLC integration	—	Đ	Đ

Table 16 Cisco 7000 Series (with RSP7000) and Cisco 7500 Series Software Feature Sets

	Feature Sets		
Features	**IP Routing**	**Desktop/IBM[1]**	**Enterprise[1]**
SDLC transport (STUN)	—	Đ	Đ
SDLC-to-LAN conversion (SDLLC)	—	Đ	Đ
SNA and NetBIOS WAN optimization via local acknowledgment	—	Đ	Đ
SRB/RSRB[17]	—	Đ	Đ
SRT	—	Đ	Đ
TG/COS	—	—	Đ
TN3270 Server (CIP only)	—	Đ	Đ
VIP and HSA			
VIP and HSA[18]	Đ	Đ	Đ
VIP2[19]	Đ	Đ	Đ

1. Desktop/IBM and Enterprise are available with APPN in a separate feature set. In Cisco IOS Release 11.2, APPN includes APPN Central Registration (CRR) and APPN over DLSw+.
2. Includes AppleTalk load balancing.
3. Concurrent routing and bridging feature only applies to transparent bridging, not source-route bridging (SRB).
4. IRB supports IP, IPX, and AppleTalk; it is supported for transparent bridging, but not for SRB; it is supported on all media-type interfaces except X.25 and ISDN bridged interfaces; and IRB and concurrent routing and bridging (CRB) cannot operate at the same time.
5. The Novell IPX feature includes display SAP by name, IPX Access Control List violation logging, and plain-English IPX access lists.
6. ISDN support includes calling line identification (ANI), X.25 over the B channel, ISDN subaddressing, and applicable WAN optimization features. Asynchronous ISDN Access (V.120) is only supported in the Enterprise feature set.
7. PPP includes support for LAN protocols supported by the feature set, address negotiation, PAP and CHAP authentication, and PPP compression.
8. Custom priority and queuing is not currently supported on SMIP or MIP cards.
9. IPX header compression (RFC 1553) is available in the feature sets that support IPX.
10. X.25 and Frame Relay payload compression.
11. NFS supports IP over all interfaces with optimal performance on Ethernet, FDDI, and HDLC.
12. Named IP Access Control List can only be used by packet and route filters, it is not backward-compatible with earlier Cisco IOS releases, and is not supported with Distributed Fast Switching.
13. For more details on the new data encryption options, see the beginning of the section “Cisco IOS Feature Sets.”
14. TACACS+ Single Connection and TACACS+ SENDAUTH enhancements are supported.
15. DLSw+ over TCP/IP is supported.
16. Cisco IOS Release 11.2 introduces several DLSw+ enhancements.
17. SRB/RSRB is fast switched. This enhancement is on by default, but can be disabled.
18. HSA support requires Cisco IOS Release 11.1(2) or later releases.
19. VIP2 support requires Cisco IOS Release 11.1(5) or later releases.

Table 17 Cisco 7200 Series Software Feature Sets

Features	Feature Sets			
	Network Layer 3 Switching	IP Routing	Desktop/IBM[1]	Enterprise[1]
LAN Support				
Apollo Domain	—	—	—	Đ
AppleTalk 1 and 2[2]	—	—	Đ	Đ
Banyan VINES	—	—	—	Đ
Concurrent routing and bridging (CRB)[3]	Đ	Đ	Đ	Đ
DECnet IV	—	—	Đ	Đ
DECnet V	—	—	—	Đ
GRE	—	Đ	Đ	Đ
Integrated routing and bridging (IRB)[4]	—	—	—	—
IP	Đ	Đ	Đ	Đ
LAN extension host	Đ	Đ	Đ	Đ
Multiring	Đ	Đ	Đ	Đ
Novell IPX[5]	Đ	—	Đ	Đ
OSI	—	—	—	Đ
Transparent and translational bridging	Đ	Đ	Đ	Đ
VLANs (ISL and IEEE 802.10)	Đ	Đ	Đ	Đ
XNS	—	—	—	Đ
WAN Services				
Combinet Packet Protocol (CPP)	Đ	Đ	Đ	Đ
Dialer profiles	Đ	Đ	Đ	Đ
Half bridge/half router for CPP and PPP	Đ	Đ	Đ	Đ
HDLC	Đ	Đ	Đ	Đ
IPXWAN 2.0	Đ	—	Đ	Đ
ISDN[6]	—	Đ	Đ	Đ
Multichassis Multilink PPP (MMP)	—	—	—	Đ
PPP[7]	—	Đ	Đ	Đ
Virtual Private Dial-up Network (VPDN)	—	—	Đ	Đ
WAN Optimization				
Bandwidth-on-demand	—	Đ	Đ	Đ
Custom and priority queuing	—	Đ	Đ	Đ
Dial backup	—	Đ	Đ	Đ
Dial-on-demand	—	Đ	Đ	Đ
Header[8], link and payload compression[9]	—	Đ	Đ	Đ
NetFlow Switching (NFS)[10]	—	Đ	Đ	Đ

Table 17 Cisco 7200 Series Software Feature Sets (Continued)

Features	Feature Sets			
	Network Layer 3 Switching	IP Routing	Desktop/IBM[1]	Enterprise[1]
Snapshot routing	Đ	Đ	Đ	Đ
Weighted fair queuing	—	Đ	Đ	Đ
IP Routing				
Enhanced IGRP	Đ	Đ	Đ	Đ
Enhanced IGRP Optimizations	Đ	Đ	Đ	Đ
ES-IS	—	—	—	Đ
IGRP	Đ	Đ	Đ	Đ
IS-IS	—	—	—	Đ
Named IP Access Control List[11]	—	Đ	Đ	Đ
Network Address Translation (NAT)	Đ	Đ	Đ	Đ
NHRP	Đ	Đ	Đ	Đ
On Demand Routing (ODR)	Đ	Đ	Đ	Đ
OSPF	Đ	Đ	Đ	Đ
OSPF Not-So-Stubby-Areas (NSSA)	Đ	Đ	Đ	Đ
OSPF On Demand Circuit (RFC 1793)	Đ	Đ	Đ	Đ
PIM	Đ	Đ	Đ	Đ
Policy-based routing	Đ	Đ	Đ	Đ
RIP	Đ	Đ	Đ	Đ
RIP Version 2	Đ	Đ	Đ	Đ
Other Routing				
AURP	—	—	Đ	Đ
IPX RIP	Đ	—	Đ	Đ
NLSP	Đ	—	Đ	Đ
RTMP	Đ	Đ	Đ	Đ
SMRP	—	—	Đ	Đ
SRTP	—	—	—	Đ
Multimedia and Quality of Service				
Generic traffic shaping	Đ	Đ	Đ	Đ
Random Early Detection (RED)	Đ	Đ	Đ	Đ
Resource Reservation Protocol (RSVP)	Đ	Đ	Đ	Đ
Management				
AutoInstall	Đ	Đ	Đ	Đ
HTTP Server	Đ	Đ	Đ	Đ
RMON events and alarms	Đ	Đ	Đ	Đ

Table 17 Cisco 7200 Series Software Feature Sets (Continued)

Features	Feature Sets			
	Network Layer 3 Switching	IP Routing	Desktop/IBM[1]	Enterprise[1]
SNMP	Đ	Đ	Đ	Đ
Telnet	Đ	Đ	Đ	Đ
Security				
Access lists	Đ	Đ	Đ	Đ
Access security	Đ	Đ	Đ	Đ
Extended access lists	Đ	Đ	Đ	Đ
Kerberized login	—	—	—	Đ
Kerberos V client support	—	—	—	Đ
Lock and key	Đ	Đ	Đ	Đ
MD5 routing authentication	Đ	Đ	Đ	Đ
Network layer encryption (40-bit or export controlled 56-bit DES)[12]	Encrypt	Encrypt	Encrypt	Encrypt
RADIUS	Đ	Đ	Đ	Đ
Router authentication	Encrypt	Encrypt	Encrypt	Encrypt
TACACS+[13]	Đ	Đ	Đ	Đ
IBM Support				
APPN (optional)[1]	—	—	Đ	Đ
BAN for SNA Frame Relay support	—	—	Đ	—
Caching and filtering	—	—	Đ	Đ
DLSw+[14, 15]	—	—	Đ	Đ
Downstream PU concentration (DSPU)	—	—	Đ	Đ
Frame Relay SNA support (RFC 1490)	—	—	Đ	Đ
Native Client Interface Architecture (NCIA) Server	—	—	Đ	Đ
NetView Native Service Point	—	—	Đ	Đ
Response Time Reporter (RTR)	—	—	Đ	Đ
QLLC	—	—	Đ	Đ
SDLC integration	—	—	Đ	Đ
SDLC transport (STUN)	—	—	Đ	Đ
SDLC-to-LAN conversion (SDLLC)	—	—	Đ	Đ
SNA and NetBIOS WAN optimization via local acknowledgment	—	—	Đ	Đ
SRB/RSRB[16]	Đ	—	Đ	Đ

Table 17 Cisco 7200 Series Software Feature Sets (Continued)

Features	Feature Sets			
	Network Layer 3 Switching	IP Routing	Desktop/IBM[1]	Enterprise[1]
SRT	Ð	—	Ð	Ð
TG/COS	—	—	—	Ð

1. Desktop/IBM and Enterprise are available with APPN in a separate feature set. Use the product numbers that specify APPN. APPN includes APPN Central Registration (CRR) and APPN over DLSw+.
2. Includes AppleTalk load balancing.
3. Concurrent routing and bridging feature only applies to transparent bridging, not source-route bridging (SRB).
4. Releases 11.2(1) through 11.2(3) do not support IRB. In a later maintenance release: IRB supports IP, IPX, and AppleTalk; it is supported for transparent bridging, but not for SRB; it is supported on all media-type interfaces except X.25 and ISDN bridged interfaces; and IRB and concurrent routing and bridging (CRB) cannot operate at the same time.
5. The Novell IPX feature includes display SAP by name, IPX Access Control List violation logging, and plain-English IPX access lists.
6. ISDN support includes calling line identification (ANI), X.25 over the B channel, ISDN subaddressing, and applicable WAN optimization features. Asynchronous ISDN Access (V.120) is only supported in the Enterprise feature set.
7. PPP includes support for LAN protocols supported by the feature set, address negotiation, PAP and CHAP authentication, and PPP compression.
8. IPX header compression (RFC 1553) is available in the feature sets that support IPX.
9. X.25 and Frame Relay payload compression.
10. NFS supports IP over all interfaces with optimal performance on Ethernet, FDDI, and HDLC.
11. This feature can only be used by packet and route filters, it is not backward-compatible with earlier Cisco IOS releases, and is not supported with Distributed Fast Switching.
12. For more details on the new data encryption options, see the beginning of the section “Cisco IOS Feature Sets.”
13. TACACS+ Single Connection and TACACS+ SENDAUTH enhancements are supported.
14. DLSw+ over TCP/IP is supported.
15. Cisco IOS Release 11.2 introduces several DLSw+ enhancements.
16. SRB/RSRB is fast switched. This enhancement is on by default, but can be disabled.

Table 18 Optional Feature Set Licenses for Cisco 7000 Series (with RSP7000), Cisco 7200 Series, and Cisco 7500 Series

WAN Packet Protocols
ATM DXI
Frame Relay
Frame Relay switching
Frame Relay SVC support (DTE)
Frame Relay traffic shaping
SMDS over ATM
X.25
X.25 switching
Interdomain Routing
BGP
BGP4[1]
EGP for Internet scale routing
VIP/VIP2 support[2]
Included automatically with VIP order

Table 18 Optional Feature Set Licenses for Cisco 7000 Series (with RSP7000), Cisco 7200 Series, and Cisco 7500 Series (Continued)

CIP Support[2, 3]
SNA support
TCP/IP offload
NetFlow Switching[4]
NetFlow Switching software

1. BGP4 includes soft configuration, multipath support, and prefix filtering with inbound route maps.
2. Cisco 7000 series (with RSP7000) and 7500 series only.
3. CIP orders must include one or both of the licenses.
4. Cisco 7200 series only.

Upgrading to a New Software Release

If you are upgrading to Cisco IOS Release 11.2 P from an earlier Cisco IOS software release, you should save your current configuration file before configuring your access server with the Cisco IOS Release 11.2 P software in the event that an unrecoverable error occurs during download or configuration.

Memory Requirements

Table 19 through Table 27 describe the memory requirements for each platform's feature set supported by Cisco IOS Release 11.2 P.

Table 19 Cisco 1600 Series—Memory Requirements

Feature Set	Required Flash Memory	Required DRAM Memory	Release 11.2 P Runs From[1]
IP	4 MB Flash	2 MB DRAM	Flash
IP Plus	6 MB Flash	4 MB DRAM	Flash
IP Plus 40	6 MB Flash	4 MB DRAM	Flash
IP Plus 56	6 MB Flash	4 MB DRAM	Flash
IP/IPX	4 MB Flash	2 MB DRAM	Flash
IP/IPX Plus	6 MB Flash	4 MB DRAM	Flash
IP/IPX Plus 40	6 MB Flash	4 MB DRAM	Flash
IP/IPX Plus 56	6 MB Flash	4 MB DRAM	Flash
IP/AT	4 MB Flash	2 MB DRAM	Flash
IP/AT Plus	6 MB Flash	4 MB DRAM	Flash
IP/AT Plus 40	6 MB Flash	4 MB DRAM	Flash
IP/AT Plus 56	6 MB Flash	4 MB DRAM	Flash
IP/IPX/AT	6 MB Flash	4 MB DRAM	Flash
IP/IPX/AT Plus	6 MB Flash	4 MB DRAM	Flash

Table 19 Cisco 1600 Series—Memory Requirements (Continued)

Feature Set	Required Flash Memory	Required DRAM Memory	Release 11.2 P Runs From[1]
IP/IPX/AT Plus 40	6 MB Flash	4 MB DRAM	Flash
IP/IPX/AT Plus 56	6 MB Flash	4 MB DRAM	Flash

1. When a system is running from Flash memory, you cannot update the system while it is running. You must use the Flash load helper.

Table 20 Cisco AS2509-RJ and Cisco AS2511-RJ—Memory Requirements

Feature Set	Required Flash Memory	Required DRAM Memory	Release 11.2 P Runs From[1]
IP	8 MB Flash	4 MB DRAM	Flash
Remote Access Server	8 MB Flash	4 MB DRAM	Flash

1. When a system is running from Flash memory, you cannot update the system while it is running. You must use the Flash load helper.

Table 21 Cisco 2500 Fixed FRAD Series—Memory Requirements

Feature Set	Required Flash Memory	Required DRAM Memory	Release 11.2 P Runs From[1]
CFRAD	4 MB Flash	4 MB DRAM	Flash
LAN FRAD	4 MB Flash	4 MB DRAM	Flash
OSPF LAN FRAD	4 MB Flash	4 MB DRAM	Flash

1. When a system is running from Flash memory, you cannot update the system while it is running. You must use the Flash load helper.

Table 22 Cisco 3600 Series—Memory Requirements

Feature Set	Required Flash Memory	Required DRAM Memory	Release 11.2 P Runs From
Cisco 3620			
IP	4 MB Flash	16 MB DRAM	RAM
IP Plus	4 MB Flash	16 MB DRAM	RAM
IP Plus 40	4 MB Flash	16 MB DRAM	RAM
IP Plus 56	4 MB Flash	16 MB DRAM	RAM
Desktop (IP/IPX/AppleTalk/DEC)	4 MB Flash	24 MB DRAM	RAM
Desktop Plus	4 MB Flash	24 MB DRAM	RAM
Desktop Plus 40	4 MB Flash	24 MB DRAM	RAM
Desktop Plus 56	4 MB Flash	24 MB DRAM	RAM
Enterprise	8 MB Flash	24 MB DRAM	RAM

Table 22 Cisco 3600 Series—Memory Requirements (Continued)

Feature Set	Required Flash Memory	Required DRAM Memory	Release 11.2 P Runs From
Enterprise Plus	8 MB Flash	24 MB DRAM	RAM
Enterprise Plus 40	8 MB Flash	24 MB DRAM	RAM
Enterprise Plus 56	8 MB Flash	24 MB DRAM	RAM
Enterprise and APPN Plus	8 MB Flash	32 MB DRAM	RAM
Enterprise and APPN Plus 40	8 MB Flash	32 MB DRAM	RAM
Enterprise and APPN Plus 56	8 MB Flash	32 MB DRAM	RAM
IP/IPX/IBM/APPN	8 MB Flash	32 MB DRAM	RAM
Cisco 3640			
IP	4 MB Flash	16 MB DRAM	RAM
IP Plus	4 MB Flash	16 MB DRAM	RAM
IP Plus 40	4 MB Flash	16 MB DRAM	RAM
IP Plus 56	4 MB Flash	16 MB DRAM	RAM
Desktop (IP/IPX/AppleTalk/DEC)	4 MB Flash	24 MB DRAM	RAM
Desktop Plus	4 MB Flash	24 MB DRAM	RAM
Desktop Plus 40	4 MB Flash	24 MB DRAM	RAM
Desktop Plus 56	4 MB Flash	24 MB DRAM	RAM
Enterprise	8 MB Flash	24 MB DRAM	RAM
Enterprise Plus	8 MB Flash	24 MB DRAM	RAM
Enterprise Plus 40	8 MB Flash	24 MB DRAM	RAM
Enterprise Plus 56	8 MB Flash	24 MB DRAM	RAM
Enterprise and APPN Plus	8 MB Flash	32 MB DRAM	RAM
Enterprise and APPN Plus 40	8 MB Flash	32 MB DRAM	RAM
Enterprise and APPN Plus 56	8 MB Flash	32 MB DRAM	RAM
IP/IPX/IBM/APPN	8 MB Flash	32 MB DRAM	RAM

Table 23 Cisco 4500 Series and Cisco 4700 Series—Memory Requirements

Router	Required Flash Memory	Required DRAM Memory		Release 11.2 P Runs From
Cisco 4500/4500-M[1]		**Cisco 4500**	**Cisco 4500-M**	
IP	4 MB Flash	32 MB DRAM	16 MB DRAM[2]	RAM
IP Plus[3]	4 MB Flash	32 MB DRAM	16 MB DRAM	RAM
IP Plus 40	4 MB Flash	32 MB DRAM	16 MB DRAM	RAM
IP Plus 56	4 MB Flash	32 MB DRAM	16 MB DRAM	RAM
IP/IPX/AT/DEC	4 MB Flash	32 MB DRAM	16 MB DRAM	RAM
IP/IPX/AT/DEC Plus	4 MB Flash	32 MB DRAM	16 MB DRAM	RAM
IP/IPX/AT/DEC Plus 40	4 MB Flash	32 MB DRAM	16 MB DRAM	RAM
IP/IPX/AT/DEC Plus 56	4 MB Flash	32 MB DRAM	16 MB DRAM	RAM
IP/IPX/IBM/APPN	8 MB Flash	32 MB DRAM	32 MB DRAM	RAM
Enterprise	8 MB Flash	32 MB DRAM	16 MB DRAM	RAM
Enterprise Plus	8 MB Flash	32 MB DRAM	16 MB DRAM	RAM
Enterprise Plus 40	8 MB Flash	32 MB DRAM	16 MB DRAM	RAM
Enterprise Plus 56	8 MB Flash	32 MB DRAM	16 MB DRAM	RAM
Enterprise/APPN Plus	8 MB Flash	32 MB DRAM	32 MB DRAM	RAM
Enterprise/APPN Plus 40	8 MB Flash	32 MB DRAM	32 MB DRAM	RAM
Enterprise/APPN Plus 56	8 MB Flash	32 MB DRAM	32 MB DRAM	RAM
Cisco 4700/4700-M[1]				
IP	4 MB Flash	16 MB DRAM		RAM
IP Plus	4 MB Flash	16 MB DRAM		RAM
IP Plus 40	4 MB Flash	16 MB DRAM		RAM
IP Plus 56	4 MB Flash	16 MB DRAM		RAM
IP//IPX/AT/DEC	4 MB Flash	16 MB DRAM		RAM
IP//IPX/AT/DEC Plus	4 MB Flash	16 MB DRAM		RAM
IP//IPX/AT/DEC Plus 40	4 MB Flash	16 MB DRAM		RAM
IP//IPX/AT/DEC Plus 56	4 MB Flash	16 MB DRAM		RAM
IP/IPX/IBM/APPN	8 MB Flash	32 MB DRAM		RAM
Enterprise	8 MB Flash	16 MB DRAM		RAM
Enterprise Plus	8 MB Flash	16 MB DRAM		RAM
Enterprise Plus 40	8 MB Flash	16 MB DRAM		RAM
Enterprise Plus 56	8 MB Flash	16 MB DRAM		RAM
Enterprise/APPN Plus	8 MB Flash	32 MB DRAM		RAM
Enterprise/APPN Plus 40	8 MB Flash	32 MB DRAM		RAM
Enterprise/APPN Plus 56	8 MB Flash	32 MB DRAM		RAM

1. Memory requirements for each 2T16S network processor module are as follows: 275 K (0.275 MB) for main memory and 0.63 MB for shared memory.
2. The Cisco 4500 requires 16 MB of DRAM when two NP-CT1 or two NP-CE1 network processor modules are installed.
3. Plus for the Cisco 4500,/4500-M and Cisco 4700/4700-M includes NAT, ISL, LANE, and IBM (if IBM is not already included).

Table 24 Cisco 3011 WAN Module—Memory Requirements

	Required Flash Memory	Required DRAM Memory	Release 11.2 P Runs From[1]
IP	8 MB Flash	4 MB DRAM	Flash
IP Plus	8 MB Flash	4 MB DRAM	Flash
IP Plus 40	8 MB Flash	4 MB DRAM	Flash
IP Plus 56	8 MB Flash	4 MB DRAM	Flash
IP/IPX/IBM/APPN	8 MB Flash	8 MB DRAM	Flash
IP/IPX/AT/DEC	8 MB Flash	4 MB DRAM	Flash
IP/IPX/AT/DEC Plus	8 MB Flash	4 MB DRAM	Flash
IP/IPX/AT/DEC Plus 40	8 MB Flash	4 MB DRAM	Flash
IP/IPX/AT/DEC Plus 56	8 MB Flash	4 MB DRAM	Flash
Enterprise	8 MB Flash	8 MB DRAM	Flash
Enterprise Plus	8 MB Flash	8 MB DRAM	Flash
Enterprise Plus 40	8 MB Flash	8 MB DRAM	Flash
Enterprise Plus 56	8 MB Flash	8 MB DRAM	Flash
Enterprise/APPN Plus	16 MB Flash	8 MB DRAM	Flash
Enterprise/APPN Plus 40	16 MB Flash	8 MB DRAM	Flash
Enterprise/APPN Plus 56	16 MB Flash	8 MB DRAM	Flash

1. When a system is running from Flash memory, you cannot update the system while it is running. You must use the Flash load helper.

Table 25 Internet Router Cards for 10BaseT Hubs—Memory Requirements

Feature Set	Required Flash Memory	Required DRAM Memory	Release 11.2 P Runs From[1]
IP	8 MB Flash	4 MB DRAM	Flash
IP/IPX/AT/DEC	8 MB Flash	4 MB DRAM	Flash
IP/IPX/AT/DEC/IBM	8 MB Flash	4 MB DRAM	Flash

1. When a system is running from Flash memory, you cannot update the system while it is running. You must use the Flash load helper.

Table 26 Cisco AS5200—Memory Requirements

Feature Set	Required Flash Memory	Required DRAM Memory	Release 11.2 P Runs From[1]
IP	8 MB Flash	8 MB DRAM	Flash
IP Plus[2]	8 MB Flash	8 MB DRAM	Flash
Desktop	8 MB Flash	8 MB DRAM	Flash
Desktop Plus	8 MB Flash	8 MB DRAM	Flash
Enterprise	8 MB Flash	8 MB DRAM	Flash
Enterprise Plus	8 MB Flash	8 MB DRAM	Flash

1. When a system is running from Flash memory, you cannot update the system while it is running. You must use the Flash load helper.
2. Plus for the Cisco AS5200 includes protocol translation, V.120, RMON, Managed Modems, and IBM (if IBM is not already included).

Table 27 Cisco 7000 Series (RSP7000 and RSP7000CI), Cisco 7200 Series, and Cisco 7500 Series—Memory Requirements

Router	Required Flash Memory[1]	Required DRAM Memory	Release 11.2 P Runs From
Cisco 7200 Series			
IP	4 MB Flash	32 MB DRAM	RAM
IP 40	4 MB Flash	32 MB DRAM	RAM
IP 56	4 MB Flash	32 MB DRAM	RAM
Desktop/IBM	4 MB Flash	32 MB DRAM	RAM
Desktop/IBM 40	4 MB Flash	32 MB DRAM	RAM
Desktop/IBM 56	4 MB Flash	32 MB DRAM	RAM
Desktop/IBM/APPN	8 MB Flash	32 MB DRAM	RAM
Enterprise	8 MB Flash	32 MB DRAM	RAM
Enterprise 40	8 MB Flash	32 MB DRAM	RAM
Enterprise 56	8 MB Flash	32 MB DRAM	RAM
Enterprise/APPN	8 MB Flash	32 MB DRAM	RAM
Enterprise/APPN 40	8 MB Flash	32 MB DRAM	RAM
Enterprise/APPN 56	8 MB Flash	32 MB DRAM	RAM
Network Layer 3 Switching	8 MB Flash	32 MB DRAM	RAM
Cisco 7500 Series and Cisco 7000 Series with RSP7000[2]			
IP	8 MB Flash	32 MB DRAM	RAM
IP 40	8 MB Flash	32 MB DRAM	RAM
IP 56	8 MB Flash	32 MB DRAM	RAM
Desktop/IBM	8 MB Flash	32 MB DRAM	RAM
Desktop/IBM/APPN	8 MB Flash	32 MB DRAM	RAM

Table 27 Cisco 7000 Series (RSP7000 and RSP7000CI), Cisco 7200 Series, and Cisco 7500 Series—Memory Requirements (Continued)

Router	Required Flash Memory[1]	Required DRAM Memory	Release 11.2 P Runs From
Desktop/IBM 40	8 MB Flash	32 MB DRAM	RAM
Desktop/IBM 56	8 MB Flash	32 MB DRAM	RAM
Enterprise	8 MB Flash	32 MB DRAM	RAM
Enterprise 40	8 MB Flash	32 MB DRAM	RAM
Enterprise 56	8 MB Flash	32 MB DRAM	RAM
Enterprise/APPN	8 MB Flash	32 MB DRAM	RAM
Enterprise/APPN 40	8 MB Flash	32 MB DRAM	RAM
Enterprise/APPN 56	8 MB Flash	32 MB DRAM	RAM

1. The Cisco 7200 series is shipped with an 8-, 16-, or 20-MB Flash memory card. The Cisco 7500 series and Cisco 7000 series with RSP7000 is shipped with a 16- or 20-MB Flash memory card.
2. All feature sets for the Cisco 7500 series and Cisco 7000 series with RSP7000 include VIP support.

Important Notes

This section contains important information about the Cisco IOS Release 11.2 P software. The following information describes the changes in release number for Release 11.2 P:

- Release 11.2(6)P2 is an early deployment release of software to support new features in Cisco 7000 series routers with the RSP7000, Cisco 7500 series routers, and Cisco 7200 series routers.

  Release 11.2(6)P2 is the same as Release 11.2(6)P except the following defects have been resolved in Release 11.2(6)P2: CSCdj060068, CSCdj10028, CSCdj19231, and CSCdi67315.

  Release 11.2(6)P and Release 11.2(6)P1 software images for the Cisco 7000 series with RSP7000, Cisco 7500 series, and Cisco 7200 series routers was not released.

Release 11.2(7)P Caveats

This section describes possibly unexpected behavior by Cisco IOS Release 11.2(7)P. Unless otherwise noted, these caveats apply to all 11.2 P releases up to and including Release 11.2(7)P.

Catalyst 5000 Route Switch Module (RSM)

- Sustained IPX traffic load consisting of 64 byte packets causes the Catalyst 5000 RSM to stop receiving packets. Symptoms include the RSM not routing any traffic, as well as a user being unable to reach the RSM via session or telnet. Workarounds are to reset the RSM or issue the **test rsp stall** command from the RSM console. [CSCdj21750]

Access Server

- When using the ground start option for channelized T1 signaling, the Cisco AS5200 universal access server may not reliably indicate which channels are busied out. This occurs when the unit has run out of available modems. [CSCdj00011]
- Under conditions where there is a very high rate of channelized T1/E1 signalling transitions, the AS5200 may crash with a bus error at PC 0, address 0. This may occur when the AS5200 is connected to a noisy line. [CSCdj19651]

EXEC and Configuration Parser

- **autohangup** does not work if the you use rlogin. Instead of being disconnected at the end of the rlogin session, you will be presented back with the prompt (or the menu if you are using one).

  A workaround is to use the **telnet** command in the menu, specifying the rlogin port value (513), which will cause rlogin to be invoked (for example, **menu test command 1 telnet myhost 513**). [CSCdj16600]

BM Connectivity

- On Cisco 2500 series routers, RSRB fails using FST encapsulation on PPP or HDLC. The workaround is to use TCP encapsulation when bridging over ISDN links. [CSCdi48888]

Interfaces and Bridging

- On the MultiChannel Interface Processor (MIP), when controller T1 X/X is configured for a PRI test on a Cisco 7000 series router instead of the serial X/X:23 interface getting configured, the other X/X:23 interface gets configured. After this point, any attempt to configure the interface crashes the router. This problem does not occur on the Cisco 7500 series router. [CSCdj20356]

TN3270

- International (8 bit) characters will not echo when using TN3270. [CSCdj22231]

Wide-Area Networking

When running NHRP with IP/IPX/AT map-lists on an RSP4, user may see the router continuously reboot and display the following message on the console [CSCdj22122]:

```
%ALIGN-1-FATAL: Corrupted program counter pc=0x0, ra=0x603CCF3C, sp=0x6110DFD0
Unexpected exception, CPU signal 10, PC = 0x0
```

Release 11.2(6)P Caveats/11.2(7)P Modifications

This section describes possibly unexpected behavior by Release 11.2(6)P. Unless otherwise noted, these caveats apply to all 11.2 P releases up to and including 11.2(6)P. For additional caveats applicable to Release 11.2(6)P, see the caveats sections for newer 11.2 P releases. The caveats for newer releases precede this section.

All the caveats listed in this section are resolved in Release 11.2(7)P.

Basic System Services

- Symptom—Under extremely heavy CPU interrupt states, a router with FSIP, CT3, or any serial interface might experience the following "output stuck" error message:

  ```
  %RSP-3-RESTART: interface Serial12/0/0:28, output stuck %RSP-3-RESTART: interface
  Serial12/0/0:6, output stuck %RSP-3-RESTART: interface Serial12/0/0:12, output
  stuck %RSP-3-RESTART: interface Serial12/0/0:2, output stuck
  ```

  This is a result of a internal timer utility that can incorrectly return a false value under extreme interrupt situations, which causes the transmit-buffers backing-store mechanism to falsely declare serial interface "output stuck."

  Conditions—The symptom occurs on Cisco 7000 family routers using the CT3, 4/8 port FSIP cards, or any serial interface under Cisco IOS Release 11.1(10)CA, 11.1(11), and 11.2. It is only observed under oversubscribed traffic load conditions.

  Workaround—Configure the interface to FIFO queueing using the **no fair-queue** command.

  The command **transmit-buffers backing-store** is ON by default when an interface is configured for weighted fair-queueing. If the interface command **no fair-queue** is used, which changes the queueing strategy to FIFO, the transmit-buffers backing-store is OFF by default. [CSCdj12815]

- A problem has been found in RSP code in Cisco IOS Release 11.2 P images. A failure condition can occur when backing-store or fair queuing are enabled. The conditions that could cause one of the above behaviors to occur are expected to be extremely rare.

  For those customers running Release 11.2 P, we highly recommend upgrading all RSP-based systems to Cisco IOS Release 11.2(6)P or later. For those systems that cannot upgrade, this problem can be avoided by disabling both backing-store and fair queuing. See the instructions for this at the end of this message.

  When packet load on RSP-equipped systems causes datagrams to be forwarded from SRAM to DRAM (a function of backing-store) 32 bytes of data may be randomly written into DRAM. This could result in several anomalous system behaviors including software-induced system crashes, dropped datagrams, and other anomalous errors.

  SOLUTION:

  FOR CUSTOMERS WITH CISCO IOS RELEASE 11.2 P

  Option 1: We highly recommends the installation of Release 11.2(6)P or later for 11.2(x)P images.

  This problem was fixed as bug CSCdi71609 in images 10.3 through 11.2. Unfortunately it was reintroduced as a result of merged code in Release 11.2 P only.

  Option 2: Following are options to work around this bug.

  Disable backing-store and fair queuing on each interface with the following IOS commands:

  no transmit-buffers backing-store
  no fair-queue

Also disable udp-turbo flooding if the image is Release 11.0 or later. The Cisco IOS command to disable UDP turbo flooding is **no ip forward-protocol turbo-flood**, which is OFF by default in all releases.

However, it is important to look at the current configuration. An image configured before backing-store defaulted to OFF may have it ON for router interfaces. [CSCdj19231]

- This bug causes the connection setup to fail. If the user turn on **crypto debug** they will see a message *cannot allocate blk*. This problem happens after a connection has been renegotiate or reestablish about 50+ times. [CSCdj20354]

Interfaces and Bridging

- The Cisco 1602 requires the user to enter the command **service-module 56k network-type dds** even though **dds** is the default. This also causes auto-install to fail. [CSCdj04135]
- An encap change on a POS interface can result in a PCI Time out VIP reload. This is due to the POS interface accessing on board registers before the onboard PLX chips are programmed. [CSCdj08510]
- The POS interface specific configuration commands **pos specify-s1s0** and **pos specify-c2** do not work correctly. [CSCdj09646]
- When there is another port adapter (for example, another FDDI FDX port adapter) in addition to the FDDI FDX port adapter in the same VIP2, the port adapter could (1) take a long time or forever to go into FDX operation, (2) after it goes into FDX operation, fall out of FDX mode for no good reason, or (3) see a lot of claims at the interface.

  The workaround is to have the FDDI FDX port adapter only in one VIP2 and leave the other bay empty. [CSCdj11249]
- On a Cisco 7206 running Cisco IOS Release 11.1.10.4 CA1 when **ipx route-cache** is enabled on an interface, clients are unable to connect to Novell servers through the router. When **ipx route-cach** is disabled, they are able to connect. [CSCdj11354]
- The **full-duplex** command for the FDDI FDX port adapter is not recognized. The workaround is to use the old **fddi full-duplex** command instead. [CSCdj11501]
- In Cisco IOS Release 11.1(8)CA images and later, when transparent bridging is configured on a Cisco 7200 series router, a system reload can happen under heavy loads. The error message issued by the router indicates a bus error due to an illegal access to a low address. [CSCdj14850]
- Selecting line (recovered) clocking on the CT3's T1 #23 does not work. There is no known workaround, other then to not do it (that is, always use internal clocking on T1 #23). Depending on what equipment is at the remote end, this workaround might cause the remote end to slip.

  This is fixed in CT3 firmware version 2.2.0. To determine your current CT3 firmware version, use the **show cont t3** EXEC command:

  CT3 H/W Version: 5, CT3 ROM Version: 1.2, CT3 F/W Version: 2.2.0 ^^^^^

  You must have version 2.2.0 or greater to use line clocking on T1 #23. Other T1s are not affected. [CSCdj18588]

TCP/IP Host-Mode Services

- No more than one data-line switching (DLSw) peer comes active in a Cisco 3640 router running Cisco IOS Release 11.1(10). It is possible to configure the second peer, but this one will never be in a CONNECT state. [CSCdj09782]
- User Datagram Protocol (UDP) turbo flooding is now supported on the Cisco 3600 series. [CSCdj16381]

Release 11.2(5)P Caveats/11.2(6)P Modifications

This section describes possibly unexpected behavior by Release 11.2(5)P. Unless otherwise noted, these caveats apply to all 11.2 P releases up to and including 11.2(5)P. For additional caveats applicable to Release 11.2(5)P, see the caveats sections for newer 11.2 P releases. The caveats for newer releases precede this section.

All the caveats listed in this section are resolved in release 11.2(6)P.

Access Server

- You lose the capability to configure CE1 as PRI/ISDN after configuring and deconfiguring the **cas-group** command. Note that **pri-group** and **cas-group** are mutually exclusive (that is, both commands cannot exist at the same time). Therefore, when one of them is configured, the other is disabled until the first command is deconfigured. [CSCdj00744]

Interfaces and Bridging

- A Cisco 4000 series Fast Ethernet network processor module (NPM) does not respond to its virtual MAC addresses. This makes Hot Standby Router Protocol (HSRP) fail. [CSCdi80641]
- When integrated routing and bridging (IRB) is configured on a Cisco 4500 router in order to route AppleTalk across an Inter-Switch Link (ISL) trunk, the input queue may fill up and stop receiving traffic. There is no workaround. [CSCdj01341]

IP Routing Protocols

- On a Cisco 7500 RSP system, access list processing does not work with optimum switching. Packets that should be dropped are forwarded, and packets that should be forwarded are switched via the slower fast switching. The workaround is not to use optimum switching if access lists are defined. [CSCdj04279]

Novell IPX, XNS, and Apollo Domain

- IPX packets are getting corrupted with MIP and CT3 hardware with fast switching. The workaround is to disable **ipx fastswitching** on these interfaces. [CSCdj06068]

Wide-Area Networking

- The ISDN leased-line does not come up after reload on Cisco 3600 series platforms. [CSCdj03228]

- In the presence of traffic on the ATM side (LANE configuration), if you reset the ATM module, then wait for the module to come on line and for the first spanning tree ports (forwarding mode) to show up under the ATM port, then reset the ATM module, it fails to come on line and displays the following error message:

  ```
  CDL-3W-1 (debug-eng) reset 4 Resetting module 4... CDL-3W-1 (debug-eng) Syndiags failed
  on Module Number 4 CDL-3W-1 (debug-eng) Wed Apr 2 1997, 16:37:48 Module 4 failed to come
  online.
  ```

  At this point, the only workaround is to remove and install the ATM module.

  The traffic pattern that caused this had to be "incrementing Destination Address" generated by an Ethernet sniffer.

  This has been seen with NMP 2.1(705), ATM 3.2(3), and 3.2(2). This will be fixed in ATM 3.2(4). [CSCdj07474]

- Customer has a fully redundant network with SSRP, HSRP running on two routers, Dual Phy on all Catalyst 5000. We can verify that when the active LightStream 1010 is shut, the connection over the other LightStream 1010 is taking place and LANE gets back up shortly. However CAM entries still point to old VC that doesn't exist anymore. A clear cam is required to re-establish connectivity. [CSCdj08341]

Release 11.2(4)P Caveats/11.2(5)P Modifications

This section describes possibly unexpected behavior by Release 11.2(4)P. Unless otherwise noted, these caveats apply to all 11.2 P releases up to and including 11.2(4)P. For additional caveats applicable to Release 11.2(4)P, see the caveats sections for newer 11.2 P releases. The caveats for newer releases precede this section.

All the caveats listed in this section are resolved in Release 11.2(5)P.

EXEC and Configuration Parser

- When you change the encapsulation on an interface from one that supports weighted fair queueing to one that does not and you make the change from the console or aux port, there may be a memory loss of 8 KB each time you change the encapsulation. You can identify this problem by examining the output of the **show memory allocating-process** command, which shows that the number of memory blocks allocated by the exec increases each time you change the encapsulation. If you do not change the encapsulation on an interface often, this problem should not have a significant impact on system performance. [CSCdi89723]

Release 11.2(3)P Caveats/11.2(4)P Modifications

This section describes possibly unexpected behavior by Release 11.2(3)P. Unless otherwise noted, these caveats apply to all 11.2 P releases up to and including 11.2(3)P. For additional caveats applicable to Release 11.2(3)P, see the caveats sections for newer 11.2 P releases. The caveats for newer releases precede this section.

All the caveats listed in this section are resolved in Release 11.2(4)P.

Interfaces and Bridging

- When pinging over synchronous DDR with HDLC Stacker compression, the router will unexpectedly reset. [CSCdi79832]

Release 11.2(1)P Caveats/11.2(3)P Modifications

This section describes possibly unexpected behavior by Release 11.2(1)P. Unless otherwise noted, these caveats apply to all 11.2 P releases up to and including 11.2(1)P. For additional caveats applicable to Release 11.2(1)P, see the caveats sections for newer 11.2 P releases. The caveats for newer releases precede this section.

All the caveats listed in this section are resolved in Release 11.2(3)P.

IBM Connectivity

- A hang of APPN's APPC stack (used to send locates and TDUs) can occur in rare situations when an outbound locate or TDU is in the process of being transmitted on a CP-CP session at the exact time that session is terminated (due to link failure or other reason). The APPC component does not handle this situation properly, and after the condition occurs, APPC and all locates and TDU processing becomes stuck. [CSCdi73085]

Cisco Connection Online

Cisco Connection Online (CCO) is Cisco Systems' primary, real-time support channel. Maintenance customers and partners can self-register on CCO to obtain additional information and services.

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

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

You can access CCO in the following ways:

- WWW: http://www.cisco.com
- WWW: http://www-europe.cisco.com
- WWW: http://www-china.cisco.com
- Telnet: cco.cisco.com
- Modem: From North America, 408 526-8070; from Europe, 33 1 64 46 40 82. Use the following terminal settings: VT100 emulation; databits: 8; parity: none; stop bits: 1; and connection rates up to 28.8 kbps.

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

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

Documentation CD-ROM

Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM, a member of the Cisco Connection Family, is updated monthly. Therefore, it might be more up to date than printed documentation. To order additional copies of the Documentation CD-ROM, contact your local sales representative or call customer service. The CD-ROM package is available as a single package or as an annual subscription. You can also access Cisco documentation on the World Wide Web at http://www.cisco.com, http://www-china.cisco.com, or http://www-europe.cisco.com.

This document is to be used in conjunction with the *Release Notes for Cisco IOS Release 11.2* and *Feature Guide for Cisco IOS Release 11.2 P.*

975R