Doc. No. 78-4694-16

Release Notes for Cisco IOS Release 11.2 BC

These release notes describe the features for IBM network software in Cisco IOS Release 11.2 BC, up to and including the final Release 11.2(23)BC1. The Cisco IOS Release 11.2 BC offers features from Cisco IOS Release 11.2 plus Channel Interface Processor (CIP)-related features. This release contains the stability that is required for deploying this software in a production environment. Use Release 11.2 BC for Cisco 7000 series routers installed with Route Switch Processor (RSP) and Cisco 7500 series routers.

Note The software caveats that apply to Release 11.2 also apply to Release 11.2 BC. For information on software caveats, microcode revision history, and RSP revision history, refer to the *Release Notes for Cisco IOS Release 11.2* (Part Number 78-3648-xx). For information on CIP, refer to the *Channel Interface Processor Microcode Release Notes and Upgrade Instructions* (part number 78-4715-xx).

Introduction

These release notes discuss the following topics:

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Cisco Systems, Inc.
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San Jose, CA 95134-1706
USA

Documentation

Table 1 lists the related documentation for Cisco IOS Release 11.2 BC.

Note The most current Cisco IOS documentation can be found on the latest Documentation CD-ROM and on the World Wide Web at http://www.cisco.com. These electronic documents contain updates and modifications made after the paper documents were printed.

Table 1 Cisco IOS Documentation Set

Books	Chapter Topics
• *Configuration Fundamentals Configuration Guide* • *Configuration Fundamentals Command Reference*	Access Server and Router Product Overview User Interface System Images and Configuration Files Using ClickStart, AutoInstall, and Setup Interfaces System Management
• *Security Configuration Guide* • *Security Command Reference*	Network Access Security Terminal Access Security Accounting and Billing Traffic Filters Controlling Router Access Network Data Encryption with Router Authentication
• *Access Services Configuration Guide* • *Access Services Command Reference*	Terminal Lines and Modem Support Network Connections AppleTalk Remote Access SLIP and PPP XRemote LAT Telnet TN3270 Protocol Translation Configuring Modem Support and Chat Scripts X.3 PAD Regular Expressions

Table 1 Cisco IOS Documentation Set (Continued)

Books	Chapter Topics
• *Wide-Area Networking Configuration Guide* • *Wide-Area Networking Command Reference*	ATM Dial-on-Demand Routing (DDR) Frame Relay ISDN LANE PPP for Wide-Area Networking SMDS X.25 and LAPB
• *Network Protocols Configuration Guide, Part 1* • *Network Protocols Command Reference, Part 1*	IP IP Routing
• *Network Protocols Configuration Guide, Part 2* • *Network Protocols Command Reference, Part 2*	AppleTalk Novell IPX
• *Network Protocols Configuration Guide, Part 3* • *Network Protocols Command Reference, Part 3*	Apollo Domain Banyan VINES DECnet ISO CLNS XNS
• *Bridging and IBM Networking Configuration Guide* • *Bridging and IBM Networking Command Reference*	Transparent Bridging Source-Route Bridging Remote Source-Route Bridging DLSw+ STUN and BSTUN LLC2 and SDLC IBM Network Media Translation DSPU and SNA Service Point Support SNA Frame Relay Access Support APPN NCIA Client/Server Topologies IBM Channel Attach
• *Cisco IOS Software Command Summary* • *Access Services Quick Configuration Guide* • *System Error Messages* • *Debug Command Reference* • *Cisco Management Information Base (MIB) User Quick Reference*	

These documents are available as printed manuals or electronic documents.

For electronic documentation of Release 11.2 BC 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, located in the Cisco IOS Release 11.2 database.

Platform Support for Release 11.2 BC

Cisco IOS Release 11.2 BC supports the Cisco 7000 series routers with RSP and 7500 series routers. Table 2 summarizes the LAN and WAN interfaces and data rates supported on the Cisco 7000 and 7500 series routers.

Table 2 Supported Interfaces and Data Rates for Cisco 7000 and 7500 Series Routers

LAN Interfaces	WAN Interfaces	Data Rates
Ethernet (AUI)	EIA/TIA-232	48/56/64 kbps
Ethernet (10BaseT)	X.21	1.544/2.048 Mbps
Ethernet (10BaseFL)	V.35	34/45/52 Mbps
Fast Ethernet (100BaseTX)	EIA/TIA-449	
Fast Ethernet (100BaseFX)	EIA-530	
4-Mbps Token Ring	EIA/TIA-613 (HSSI)	
16-Mbps Token Ring	ISDN PRI[1]	
FDDI DAS	E1-G.703/G.704	
FDDI SAS		
FDDI multimode		
FDDI single-mode		
ATM Interface		
Channel Interface		
Second-Generation Channel Interface [2]		
Parallel Channel Adapter (Bus and Tag)		
ESCON Channel Adapter (ECA)		
Versatile Interface		
Second-Generation Versatile Interface [2]		
MultiChannel Interface (Channelized E1/T1)		
Packet-Over-SONET OC-3 Interface[2]		
Synchronous Serial		

1. ISDN BRI is not supported in the Cisco 7000 and 7500 series routers.
2. In the Cisco 7000 series routers (Cisco 7000 and Cisco 7010), these interfaces require Cisco 7000 with RP/SP or RP/SSP, or the Cisco 7000 Series Route Switch Processor (RSP7000) and the Cisco 7000 series Chassis Interface (RSP7000CI).

Cisco IOS Software Packaging

The Cisco IOS Release 11.2 BC is available in two basic feature sets for the Cisco 7000 series routers with RSPs and Cisco 7500 series routers:

- Enterprise—Basic
- Enterprise and APPN—Basic

Feature Set Tables

Table 3 describes the basic feature sets in the Cisco IOS Release 11.2 BC software.

Table 3 Basic Feature Sets in Cisco 7000 and 7500 Series Routers

Feature	Feature Set in Enterprise and Enterprise and APPN[1]
LAN Support	Apollo Domain
	AppleTalk 1 and 2[2]
	Banyan VINES
	Concurrent routing and bridging (CRB)[3]
	DECnet IV
	DECnet V
	GRE
	Integrated routing and bridging (IRB)[4]
	IP
	LAN extension host
	Multiring
	Novell IPX[5]
	OSI
	Transparent and translational bridging
	VLANs (ISL[6] and IEEE 802.10)
	XNS
	XNS
WAN Services	ATM LAN emulation: DECnet routing, XNS routing, and Banyan VINES support
	ATM LAN emulation: Hot Standby Router Protocol (HSRP) and Simple Server Redundancy Protocol
	ATM: Rate queues for SVC per subinterface
	ATM: UNI 3.1 signaling for ATM
	Combinet Packet Protocol (CPP)
	Dialer profiles
	Half bridge/half router for CPP and PPP
	HDLC
	IPXWAN 2.0

Table 3 Basic Feature Sets in Cisco 7000 and 7500 Series Routers (Continued)

Feature	Feature Set in Enterprise and Enterprise and APPN[1]
	ISDN[7]
	Multichassis Multilink PPP (MMP)
	NetBEUI over PPP
	PPP[8]
	Virtual Private Dial-up Network (VPDN)
WAN Optimization	Bandwidth-on-demand
	Custom and priority queuing[9]
	Dial backup
	Dial-on-demand
	Header[10], link and payload compression[11]
	Named IP Access Control List
	NetFlow Switching [12]
	Snapshot routing
	Weighted fair queuing
IP Routing	Enhanced IGRP
	Enhanced IGRP Optimizations
	ES-IS
	IGRP
	IS-IS
	Named IP Access Control List[13]
	NHRP
	Network Address Translation (NAT)[14]
	On-Demand Routing
	OSPF
	OSPF Not-So-Stubby-Areas
	OSPF On Demand Circuit (RFC 1793)
	Protocol Independent Multicast (PIM)
	Policy-based routing
	RIP
	RIP Version 2
Other Routing	AURP
	IPX RIP
	NLSP
	RTMP
	SMRP
	SRTP
Multimedia and Quality of Service	Generic traffic shaping

Table 3 Basic Feature Sets in Cisco 7000 and 7500 Series Routers (Continued)

Feature	Feature Set in Enterprise and Enterprise and APPN[1]
	Random Early Detection (RED)
	Resource Reservation Protocol (RSVP)
Management	AutoInstall
	Automatic modem configuration
	HTTP Server
	RMON events and alarms
	SNMP
	Telnet
Security	Access lists
	Access security
	Extended access lists
	Kerberized login
	Kerberos V client support
	Lock and Key
	MD5 routing authentication
	RADIUS
	TACACS+[15]
IBM Support	APPN (optional)
	BAN for SNA Frame Relay support
	Caching and filtering
	DLSW+[16, 17]
	Downstream PU concentration (DSPU)
	Frame Relay SNA support (RFC 1490)
	Native Client Interface Architecture (NCIA) Server
	NetView Native Service Point
	QLLC
	Response Time Reporter (RTR)
	SDLC integration
	SDLC transport (STUN)
	SDLC-to-LAN conversion (SDLLC)
	SNA and NetBIOS WAN optimization via local acknowledgment
	SRB/RSRB[18]
	SRT
	TG/COS
	TN3270 Server (CIP only)
VIP and HSA	VIP and HSA[19]
	VIP[20]

1. In the Enterprise and APPN feature set in Cisco IOS Release 11.2, APPN includes APPN Central Registration (CRR) and APPN over DLSWw+.
2. Includes AppleTalk load balancing.
3. Concurrent routing and bridging feature only applies to transparent bridging, not source-route bridging (SRB).
4. IRB is not supported on the Cisco 7000 series. On the Cisco 7500 series, IRB supports IP, IPX, and AppleTalk. It is supported for transparent bridging, but not for SRB. IRB 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. Note that the only IPX encapsulation supported in ISL is 802.3.
7. 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.
8. PPP includes support for LAN protocols supported by the feature set, address negotiation, PAP and CHAP authentication, and PPP compression.
9. Custom priority and queuing is not currently supported on SMIP or MIP cards.
10. IPX header compression (RFC 1553) is available in the feature sets that support IPX.
11. X.25 and Frame Relay payload compression.
12. NetFlow Switching is supported on the Cisco 7500 series and Cisco 7000 series with a Route Switch Processor (RSP) only. NetFlow Switching supports IP over all interfaces with optimal performance on Ethernet, FDDI, and HDLC.
13. 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.
14. On the Cisco 7000, NAT is supported with the RSP option only.
15. TACACS+ Single Connection and TACACS+SENDAUTH enhancements are supported.
16. DLSw+ over TCP/IP is supported.
17. Cisco IOS Release 11.2 BC introduces several DLSw+ enhancements. See the section "IBM Functionality in Both Release 11.2 and Release 11.2 BC" for more details.
18. SRB/RSRB is fast switched. This enhancement is on by default, but can be disabled.
19. HSA support is available on the Cisco 7500 series only.
20. VIP2 requires the RSP7000 for the Cisco 7000 series.

Table 4 describes optional feature sets for Cisco 7000 and Cisco 7500 series routers.

Table 4 Optional Feature Sets for Cisco 7000 and 7500 Series Routers

Optional Feature Set Licenses	Specific Features
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

Table 4 Optional Feature Sets for Cisco 7000 and 7500 Series Routers (Continued)

Optional Feature Set Licenses	Specific Features
VIP/VIP2 support	Included automatically with VIP order
CIP Support[2]	SNA support
	TN3270 servers
NetFlow Switching	NetFlow Switching software

1. BGP4 includes soft configuration, multipath support, and prefix filtering with inbound route maps.
2. CIP orders must include one or more of the licenses.

Software Images and Memory Requirements for Release 11.2 BC

Beginning with Cisco IOS Release 10.3, some software image sizes exceed 4 MB and, when compressed, exceed 2 MB. Also, some systems now require more than 1 MB of main system memory for data structure tables.

Table 5 lists image names in Release 11.1 that have been replaced by new sets in Release 11.2 BC. If you normally use an image from Release 11.1 or earlier that is not available in Release 11.2 BC, use the equivalent image shown in Table 5. New images contain as many features as earlier ones and include features that are specific to Release 11.2 BC.

For Cisco routers to take advantage of the Release 11.2 BC features, you must upgrade the code or main system memory as listed in Table 6. Some platforms have specific chip or architecture requirements that affect what can be upgraded and in what increments.

Table 5 Image Name Mapping from Release 11.1 to Release 11.2 BC for Cisco 7000 and Cisco 7500 Series Routers

Image Name in Release 11.1 or Earlier	Image Name in Release 11.2 BC
rsp-aj-mz	rsp-ajsv-mz
rsp-j-mz	rsp-jsv-mz
rsp-ajv-mz	rsp-ajsv-mz
rsp-jv-mz	rsp-jsv-mz

Table 6 provides memory requirements for feature sets in Release 11.2 BC.

Table 6 Release 11.2 BC Memory Requirements

Router	Minimum Required Code Memory	Required Main Memory		Release 11.2 BC Runs From
Cisco 7000 Series with RSP and 7500 Series[1]		**Cisco 7513 only**	**All Others**	
Enterprise Set	16/20 MB Flash memory card	32 MB RAM	32 MB RAM	RAM
Enterprise/APPN Set	16/20 MB Flash memory card	32 MB RAM	32 MB RAM	RAM

1. All feature sets for the Cisco7000 and Cisco 7500 Series include VIP support.

Microcode Software

Table 7 and Table 8 list the current microcode versions for the Cisco 7000 and Cisco 7500 series. These microcode software images are bundled with the system software image—with the exception of the CIP microcode (all system software images) and Versatile Interface Processor (VIP) microcode (certain system software images). Bundling eliminates the need to store separate microcode images. When the router starts, the system software unpacks the microcode software bundle and loads the proper software on all the interface processor boards. VIP and VIP2 microcode is bundled in all Cisco 7500 series feature sets listed in Table 7.

Note For the Cisco 7000 series, all boards must use the Level 10 or greater microcode that is bundled (except CIP) with the system image.

Table 7 Bundled Microcode Versions, by Release, for the Cisco 7000 Series

	Processor or Module[1]										
Cisco IOS Release	**AIP**	**EIP**	**FEIP**	**FIP**	**FSIP**	**HIP**	**MIP**	**SP**	**SSP**	**TRIP**	**VIP[2]**
Minimum Version Required	10.15	10.1	10.4	10.2	10.18	10.2	12.0	11.15	11.15	10.3	22.20
11.2(1)	10.15	10.1	10.4	10.2	10.18	10.2	12.0	11.15	11.15	10.3	22.20
11.2(2)	10.15	10.1	10.4	10.2	10.18	10.2	12.0	11.15	11.15	10.3	22.20
11.2(3)	10.17	10.1	10.4	10.2	10.18	10.2	12.2	11.15	11.15	10.4	22.20
11.2(4)	10.17	10.1	10.4	10.2	10.19	10.2	12.2	11.15	11.15	10.4	22.20
11.2(5)	10.18	10.1	10.5	10.2	10.19	10.2	12.2	11.15	11.15	10.4	22.20
11.2(6)	10.19	10.1	10.6	10.2	10.19	10.2	12.2	11.15	11.15	10.4	22.20
11.2(7)	10.20	10.1	10.6	10.2	10.19	10.2	12.2	11.15	11.15	10.4	22.20
11.2(8)	10.20	10.1	10.6	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(9)	10.20	10.1	10.7	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(10)	10.22	10.1	10.7	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(11)	10.22	10.1	10.7	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(12a)	10.23	10.1	10.7	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(13)	10.23	10.1	10.7	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(14)	10.23	10.1	10.7	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(15)	10.25	10.1	10.7	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(16)	10.25	10.1	10.7	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(17)	10.25	10.2	10.7	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(18)	10.25	10.2	10.9	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(19)	10.25	10.2	10.9	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(20)	10.25	10.2	10.10	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(21)	10.25	10.2	10.10	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20

Table 7 Bundled Microcode Versions, by Release, for the Cisco 7000 Series (Continued)

	Processor or Module[1]										
Cisco IOS Release	**AIP**	**EIP**	**FEIP**	**FIP**	**FSIP**	**HIP**	**MIP**	**SP**	**SSP**	**TRIP**	**VIP[3]**
11.2(22)	10.25	10.2	10.10	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20
11.2(23)	10.25	10.2	10.10	10.2	10.19	10.3	12.2	11.15	11.15	10.4	22.20

1. AIP (ATM Interface Processor), EIP (Ethernet Interface Processor), FEIP (Fast Ethernet Interface Processor), FIP (FDDI Interface Processor), FSIP (Fast Serial Interface Processor), HIP (HSSI Interface Processor), MIP (MultiChannel Interface Processor), SP (Switch Processor), SSP (Silicon Switch Processor), TRIP (Token Ring Interface Processor), VIP (Versatile Interface Processor).
2. VIP microcode resides within the Cisco IOS software; it is not bundled in.
3. VIP microcode resides within the Cisco IOS software; it is not bundled in.

Table 8 Bundled RSP Microcode Versions, by Release, for the Cisco 7500 Series

	Processor or Module[1]												
Cisco IOS Release	**AIP**	**EIP**	**FEIP**	**FIP**	**FSIP**	**HIP**	**MIP**	**POSIP**	**RSP2[2]**	**TRIP**	**VIP[2]**	**VIP2[2]**	**VIP2C[2,3]**
Minimum Version Required	20.8	20.2	20.3	20.1	20.4	20.0	22.0	20.0	20.0	20.0	22.20	22.20	22.20
11.2(1)	20.8	20.2	20.3	20.1	20.4	20.0	22.0	20.0	20.0	20.0	22.20	22.20	—
11.2(2)	20.8	20.2	20.3	20.1	20.4	20.0	22.0	20.0	20.0	20.0	22.20	22.20	22.20
11.2(3)	20.10	20.2	20.3	20.1	20.4	20.0	22.2	20.0	20.0	20.1	22.20	22.20	22.20
11.2(4)	20.10	20.2	20.3	20.1	20.6	20.0	22.2	20.0	20.0	20.1	22.20	22.20	22.20
11.2(5)	20.12	20.3	20.4	20.1	20.6	20.0	22.2	20.0	20.0	20.1	22.20	22.20	22.20
11.2(6)	20.12	20.3	20.5	20.1	20.6	20.0	22.2	20.0	20.0	20.1	22.20	22.20	22.20
11.2(7)	20.13	20.3	20.5	20.1	20.6	20.0	22.2	20.0	20.0	20.1	22.20	22.20	22.20
11.2(8)	20.13	20.3	20.5	20.1	20.8	20.1	22.2	20.0	20.0	20.1	22.20	22.20	22.20
11.2(9)	20.13	20.3	20.6	20.1	20.8	20.1	22.2	20.0	20.0	20.1	22.20	22.20	22.20
11.2(10)	20.15	20.3	20.6	20.1	20.8	20.1	22.2	20.0	20.0	20.1	22.20	22.20	22.20
11.2(11)	20.15	20.3	20.6	20.1	20.8	20.1	22.2	20.0	20.0	20.1	22.20	22.20	22.20
11.2(12a)	20.16	20.3	20.6	20.1	20.8	20.1	22.2	20.0	20.0	20.1	22.20	22.20	22.20
11.2(13)	20.16	20.3	20.6	20.1	20.9	20.1	22.2	20.0	20.0	20.1	22.20	22.20	22.20
11.2(14)	20.16	20.3	20.6	20.1	20.9	20.1	22.2	20.0	20.0	20.1	22.20	22.20	22.20
11.2(15)	20.18	20.3	20.6	20.4	20.9	20.2	22.2	20.0	20.0	20.2	22.20	22.20	22.20
11.2(16)	20.18	20.3	20.6	20.4	20.9	20.2	22.2	20.0	20.0	20.2	22.20	22.20	22.20
11.2(17)	20.18	20.3	20.6	20.4	20.9	20.2	22.2	20.0	20.0	20.2	22.20	22.20	22.20
11.2(18)	20.18	20.6	20.8	20.4	20.9	20.2	22.2	20.0	n/a	20.2	22.20	22.20	22.20
11.2(19)	20.18	20.6	20.8	20.4	20.9	20.2	22.2	20.0	n/a	20.2	22.20	22.20	22.20
11.2(20)	20.18	20.6	20.8	20.4	20.9	20.2	22.2	20.0	n/a	20.2	22.20	22.20	22.20
11.2(21)	20.18	20.6	20.8	20.4	20.9	20.2	22.2	20.0	n/a	20.2	22.20	22.20	22.20

Table 8 Bundled RSP Microcode Versions, by Release, for the Cisco 7500 Series (Continued)

	Processor or Module[1]												
Cisco IOS Release	**AIP**	**EIP**	**FEIP**	**FIP**	**FSIP**	**HIP**	**MIP**	**POSIP**	**RSP2[2]**	**TRIP**	**VIP[2]**	**VIP2[2]**	**VIP2C[2,3]**
11.2(22)	20.18	20.6	20.8	20.4	20.9	20.2	22.2	20.0	n/a	20.2	22.20	22.20	22.20
11.2(23)	20.18	20.6	20.8	20.4	20.9	20.2	22.2	20.0	n/a	20.2	22.20	22.20	22.20

1. AIP (ATM Interface Processor), EIP (Ethernet Interface Processor), FEIP (Fast Ethernet Interface Processor), FIP (FDDI Interface Processor), FSIP (Fast Serial Interface Processor), HIP (HSSI Interface Processor), MIP (MultiChannel Interface Processor), POSIP (Packet over SONET OC-3 Interface Processor), RSP2 (Route Switch Processor), TRIP (Token Ring Interface Processor), VIP (Versatile Interface Processor), VIP2 (Second-Generation Versatile Interface Processor),VIP2C (Second-Generation Versatile Interface Processor—Encrypted).
2. RSP2, VIP, VIP2, and VIP2C microcode reside within the Cisco IOS software; they are not bundled in.
3. VIP2C was introduced in Release 11.2(2).

CIP Microcode

Beginning with Cisco IOS Release 11.1, the CIP microcode is no longer bundled with the Cisco IOS software image. You must have Flash memory installed on the Route Processor (RP) card and 8 MB RAM installed on your CIP card to use the IBM channel attach features in Cisco IOS Release 11.1 and later. See the “Important Notes” section for more information about CIP microcode.

Features in Release 11.2 and Release 11.2 BC

This section describes IBM network software features and support in Release 11.2 and Release 11.2 BC. Some features are available in both Release 11.2 and Release 11.2 BC; other features are available only in 11.2 BC.

- IBM Functionality in Both Release 11.2 and Release 11.2 BC
- IBM Functionality in Release 11.2 BC Only

For information on all new features in Release 11.2 and Release 11.2 BC, refer to the *Release Notes for Cisco IOS Release 11.2*.

IBM Functionality in Both Release 11.2 and Release 11.2 BC

This section describes IBM network software features available in both Cisco IOS Release 11.2 and Release 11.2 BC.

Features

The following new IBM software features were first available in Cisco IOS Release 11.2 and Release 11.2 BC:

- Native Client Interface Architecture (NCIA) Server—NCIA server, introduced by Cisco Systems for access to IBM SNA applications over routed internetworks, has been enhanced to be more flexible and scalable. The NCIA Client, implemented in the client workstation, encapsulates the full SNA stack inside TCP/IP packets. These packets are sent to the NCIA Server implemented in Cisco IOS software. The NCIA Server de-encapsulates the TCP/IP packet and sends the LLC data to the host processor via RSRB or DLSw+.

The NCIA Server supports SNA and NetBIOS sessions over a variety of LAN and WAN connections, including dialup connections. The NCIA architecture supports clients with full SNA stacks. This support provides all advanced SNA capabilities, unlike some split-stack solutions.

NCIA Server enhancements provide:

— Simplified client configuration—It is no longer necessary to predefine ring numbers, and the NCIA Server supports optional dynamic assignment of MAC addresses. There is no Logical Link Control, type 2 (LLC2) at the client. The client is configured as an end station, not a router peer.

— Scalability—The limit is based on the number of LLC connections in the central site router rather than RSRB peer connections.

Note that each client is a full SNA PU with one or more LUs. As such, each device requires one LLC connection at the central site router. The Cisco 4700 currently supports 3000 to 4000 LLC connections.

- TN3270 Server—The TN3270 Server is a new feature of the CIP in the Cisco 7000 family of routers. The TN3270 Server allows TN3270 and TN3270E clients access to IBM and IBM-compatible mainframes without the limitations of existing alternatives. It offloads 100 percent of the TCP/IP and TN3270 cycles from the mainframe, and offers a robust, scalable, and dynamic implementation that meets the stringent requirements of the data center.

  The TN3270 Server on the CIP supports up to 8000 concurrent sessions on a CIP and up to 16,000 concurrent sessions on a CIP2 card. The TN3270 Server offers the following advanced capabilities:

  — Load balancing and redundancy—Provides effective utilization of CIP resources and more consistent response times.

  — End-to-end session visibility—Provides enhanced management of resources.

  — SNA session switching—SNA Session Switch enables cross-domain traffic to bypass the owning VTAM.

  — TN3270E support—In combination with a TN3270E client, provides advanced SNA management and SNA functionality, including printer support.

  — Dynamic definition of dependent LUs—Provides simplified configuration and network definition at the router and in VTAM.

  — Dynamic allocation of LUs—Removes the need to pool LU resources while supporting multiple SNA model types.

  TN3270 Server requires 32 MB of CIP DRAM to support up to 4000 sessions, 64 MB to support 8000 sessions, and 128 MB to support 16,000 sessions. TN3270 Server can run concurrently with any of the other CIP applications (IP Datagram, TCP/IP Offload, or CSNA), but operation of any of these features will affect the total number of sessions supported because of contention for CIP processor cycles.

- Fast Switched Source-Route Translational Bridging (SR/TLB)—With Cisco IOS software Release 11.2 and Release 11.2(8) BC, SR/TLB is fast switched. No queuing is done and resource utilization is low. This enhancement is on by default, but can be disabled. It is supported across all router platforms.

  Fast Switched SR/TLB improves performance on all platforms by a factor of at least 2. It is ideal for IBM environments (for example, where low-cost Ethernet adapters are being installed on campus, but Token Ring connectivity to a FEP is still required) and for campus environments with a mix of Token Ring and Ethernet LANs and switches that rely on the Cisco IOS software for translational bridging.

- Response Time Reporter (RTR)—RTR feature allows you to monitor network performance, network resources, and applications by measuring response times and availability. RTR statistics can be used to perform troubleshooting, problem notifications and pre-problem analysis. RTR offers enhanced functionality over a similar IBM product, NetView Performance Monitor.

  RTR enables the following functions to be performed:

  — Troubleshoot problems by checking the time delays between devices (such as a router and an MVS host) and the time delays on the path from the source device to the destination device at the protocol level.

  — Send SNMP traps and or SNA Alerts/Resolutions when one of the following has occurred: a user-configured threshold is exceeded, a connection is lost and reestablished, or a timeout occurs and clears. Thresholds can also be used to trigger additional collection of time-delay statistics.

  — Perform preproblem analysis by scheduling the RTR and collecting the results as history and accumulated statistics. The statistics can be used to model and predict future network topologies.

  The RTR feature is currently available only with feature sets that include IBM support. A CiscoWorks Blue network management application will be available to support the RTR feature. Both the CiscoWorks Blue network management application and the router use the Cisco Round Trip Time Monitor (RTTMON) MIB. This MIB is available in both Release 11.2 and Release 11.2 BC.

APPN Enhancements

The following features have been added to Cisco's APPN software:

- APPN Central Resource Registration—APPN Central Resource Registration support allows a Cisco IOS software-based router acting as a network node (NN) to register the resources of end nodes (ENs) to the Central Directory Service (CDS) on Advanced Communication Facility/Virtual Telecommunication Access Method (ACF/VTAM). A Cisco IOS software NN will now register resource names with a VTAN CDS as soon as it establishes connectivity with it. Prior to this enhancement, the router acting as a NN could not register EN resources. ACF/VTAM could, however, query the router to find these resources.

  The CDS reduces broadcast traffic in the network. Without an active CDS on ACF/VTAM, the NN must send a broadcast message to the network to locate nonlocal resources required for a session. With an active CDS, the NN sends a single request directly to the CDS for the location of the resource. A network broadcast is used only if the resource has not registered with the CDS.

  ACF/VTAM must be configured as a CDS. The Cisco IOS software NN learns of the capability when network topology is exchanged. To most effectively use the CDS, ENs should register the resources with the NN. Depending on the EN implementation, registration may occur automatically, may require configuration on the EN, or may not be a function of the EN.

- APPN DLUR MIB—The existing APPN MIB does not contain information about Dependent Logical Units (DLUs) accessing the APPN network through the DLU Requester (DLUR) function in the Cisco IOS software NN. A standard MIB for DLUR has been defined by the APPN Implementers Workshop (AIW), the standards body for APPN, and is implemented in Release 11.2 of the Cisco IOS software.

  With the APPN DLUR MIB, users have access to information collected about the DLUR function in the Cisco IOS software NN and the DLUs attached to it for more complete network management information.

Data Link Switching+ (DLSw+) Features and Enhancements

The following features have been added to Cisco's DLSw+ software. These features had previously been available with Remote Source-Route Bridging (RSRB). To provide these features for DLSw+, the Cisco IOS software uses a component known as Virtual Data Link Control (VDLC) that allows one software component to use another software component as a data link.

- LAN Network Manager (LNM) over DLSw+—LNM over DLSw+ allows DLSw+ to be used in Token Ring networks that are managed via IBM's LNM software.

  With this feature, LNM can be used to manage Token Ring LANs, Control Access Units, and Token Ring attached devices over a DLSw+ network. All management functions continue to operate as they would in an RSRB network or source-route bridged network.

- Native Service Point (NSP) over DLSw+—NSP over DLSw+ allows Cisco's NSP feature to be used in conjunction with DLSw+ in the same router.

  With this feature, NSP can be configured in remote routers, and DLSw+ can provide the path for the remote service point PU to communicate with NetView. This allows full management visibility of resources from a NetView 390 console, while concurrently offering the value-added features of DLSw+ in an SNA network.

- Down Stream Physical Unit (DSPU) over DLSw+—DSPU over DLSw+ allows Cisco's DSPU feature to operate in conjunction with DLSw+ in the same router. DLSw+ can be used either upstream (toward the mainframe) or downstream (away from the mainframe) of DSPU.

  DSPU concentration consolidates the appearance of up to 255 PUs into a single PU appearance to VTAM, minimizing memory and cycles in central site resources (VTAM, NCP, and routers) and speeding network startup. Used in conjunction with DLSw+, network availability and scalability can be maximized.

- APPN over DLSw+—APPN over DLSw+ allows Cisco's APPN feature to be used in conjunction with DLSw+ in the same router.

  With this feature, DLSw+ can be used as a low-cost way to access an APPN backbone or APPN in the data center. In addition, DLSw+ can be used as a transport for APPN, providing nondisruptive recovery from failures and high-speed intermediate routing. In this case, the DLSw+ network appears as a connection network to the APPN NNs.

- SRB over FDDI to DLSw+—This feature allows access to DLSw+ over source-route bridged FDDI LANs. In the past, the supported local DLCs were only Token Ring, Ethernet, or SDLC. With this extension, Token Ring-attached devices can access a DLSw+ router using source-route bridging over an FDDI backbone. At the remote site, the device can be attached over Token Ring, Ethernet, SDLC, or FDDI. This is useful either in environments with Token Ring switches that use FDDI as a campus backbone or in environments with Cisco 7000 and Cisco 7500 series routers providing SRB over an FDDI backbone.

This feature allows SRB over FDDI to provide the highest speed access between campus resources, while concurrently allowing DLSw+ for access to remote resources.

Currently, SRB over FDDI is supported by the Cisco 7000 and Cisco 7500 series platforms only.

IBM Functionality in Release 11.2 BC Only

This section describes IBM network software features available only in Release 11.2 BC. These features are not available in Release 11.2. The following TN3270 server enhancements are described:

The following enhanced CLAW and offload support is described:

LU Address Mapping (Nailing)

LU address mapping allows a client IP address to be mapped, or "nailed," to one or more LU local addresses on one or more PUs by means of router configuration commands. You can control the relationship between the TN3270 client and the LU.

Using this feature, clients from traditional TN3270 (non-TN3270E) devices can connect to specific LUs, which overcomes a limitation of TN3270 devices that cannot specify a "CONNECT LU." LU nailing is also useful for TN3270E clients, because you can perform the configuration at the router, providing central control, rather than at the client.

Note Extensive use of the LU Address Mapping feature can result in large configurations. Refer to "Handling Large Configurations" for information on how to manage large configurations.

LU Model Matching

The LU selection algorithm attempts to match a client to a previously used LU that has the same terminal model type as the terminal model type requested by the client for this connection. If a match is found, that LU is used. If a match is not found, an LU which has not been used (since the PU was last activated) is the next choice. If all LUs have been used, an LU which is not currently in use is chosen. In this last case, it is necessary to impose a delay of three seconds during the connection process. This is to avoid a window in VTAM which can result in a Host application binding the terminal as the wrong model.

Where a client is "nailed" to use one of a limited set of LUs, the same selection logic is applied to choosing an LU from that set.

In the following example, LUs BAGE1004 and BAGE1005, which were connected, are now disconnected:

```
lu    name   client-ip:tcp       nail state    model   frames in out    idle for
1   BAGE1001 192.195.80.40:3822   Y   P-BIND   327904E  4       4       0:22:35
2   BAGE1002 192.195.80.40:3867   Y   ACT/SESS 327904E  8       7       0:21:20
3   BAGE1003 192.195.80.40:3981   Y   ACT/SESS 327803E  13      14      0:10:13
4   BAGE1004 192.195.80.40:3991   Y   ACT/NA   327803E  8       9       0:0:7
5   BAGE1005 192.195.80.40:3997   Y   ACT/NA   327805   8       9       0:7:8
```

If the client at IP address 192.195.80.40 requests a terminal model of type IBM-3278-5, LU BAGE1005 will be selected over BAGE1004:

```
lu    name   client-ip:tcp       nail state    model   frames in out    idle for
1   BAGE1001 192.195.80.40:3822   Y   P-BIND   327904E  4       4       0:23:29
2   BAGE1002 192.195.80.40:3867   Y   ACT/SESS 327904E  8       7       0:22:14
3   BAGE1003 192.195.80.40:3981   Y   ACT/SESS 327803E  13      14      0:11:7
4   BAGE1004 192.195.80.40:3991   Y   ACT/NA   327803E  8       9       0:1:1
5   BAGE1005 192.195.80.40:4052   Y   ACT/SESS 327805   13      14      0:0:16
```

Limiting LU Sessions

You can limit the number of LU sessions that can be established from a client IP address. This feature can control how many LU sessions a client IP address uses. For example, if a service bureau has 8,000 clients and each client IP address is limited to four LU sessions, you will never need more than 32,000 concurrent LU definitions even when the service is running at 100 percent capacity.

1646 Printer Support

Cisco provides full RFC 1646 printer support in the TN3270 server. There are no configuration tasks or other options required in the CIP to take advantage of this support. Prior versions of the TN3270 server feature provided RFC 1647 support.

Function Management Header (FMH) Support

FMH support is provided in the context of providing printer support for the Kanji character set. There are no configuration tasks or other options required in the CIP to take advantage of this support.

When a client does not support FMH and the host sends an FMH, the client will report a bad data stream or print random data. Prior to TN3270 server support of FMH, when a host sent an FMH the session would be unbound.

With suitable host and client software, you can now print double-byte character set characters over an LU type 1 session.

Unformatted System Services Table (USSTAB) Conversion

The TN3270 server now translates the host SNA character string (SCS) to 3270DS. In the initial release of TN3270 server, you were required to set up the host to provide VTAM's USSTAB messages as either SCS or 3270 data stream (DS) data, depending on the needs of the client. That requirement no longer exists.

A real 3274 can run in SNA or non-SNA mode. In non-SNA mode, the terminals expect all data in 3270DS. In SNA mode, the terminals expect the LU-LU session to use 3270DS, but the system services control point (SSCP)-to-LU session from the host are expected to use SCS data.

The TN3270 architecture is modeled on non-SNA 3270, whereas the CIP TN3270 Server resembles the SNA 3270 to the host. TN3270E is modeled on SNA 3270, so different clients require different datastreams.

With the USSTAB conversion feature, the SCS data is converted automatically for clients that always require 3270DS data. There are no configuration tasks or other options required in the CIP to take advantage of this support.

IP Type of Service and Precedence Setting

The TN3270 server supports IP type of service (TOS) precedence setting. TOS is used in router networks to make routing decisions for the generated IP packets. The TN3270 server generates packets that comply to IP TOS/precedence values. (Refer to RFC 1349 for a description of IP TOS/precedence.)

The Cisco implementation of IP precedence allows values of 0 to 7 while TOS allows values from 0 to 15. You must choose appropriate values for TN3270 screens and printers consistent with your organization's policy.

At the protocol level, IP precedence allows a router network to discriminate between different types of traffic by giving different priorities to them. IP TOS allows router networks to discriminate between different types of traffic by giving different routing characteristics to them. Precedence and TOS values complement one another and provide flexibility in managing your network traffic.

In TN3270 server, two types of TN3270 clients connect: interactive screens or printers. Screens are interactive while printers need bulk data transfer. IP TOS/precedence allows you to discriminate between those two types of sessions and assign different precedence values to the interactive connection and the bulk data connection.

IP TOS/precedence values can be specified either at the TN3270 server command level or on the individual PU command level. Values can be specified on both levels, in which case siftdown will be used to determine value on individual PU. Siftdown is used when you configure values in TN3270 server configuration mode that apply to all entities in the server, yet you still can configure individual PUs at the PU configuration mode to alternative values. PU values not specifically changed use the values configured at the TN3270 server configuration mode. This flexibility provides a powerful, yet efficient, way to manage the values.

LU Pooling and Response Time MIB

The LU Pooling and Response Time MIB feature provides the following enhancements to the TN3270 server feature on the Cisco 7500 series router:

- LU pooling—Allows configuration of LU pools, which are groups of LUs that can contain logical clusters to establish relationships between screen and printer LUs. This configuration allows logically related clients to connect to LUs that have the same logical relationship with the host.
- LU nailing—Extends LU nailing capability to support association of LU pools with a particular client IP address.
- ASSOCIATE request support—Extends use of the ASSOCIATE request, which allows clients to connect to a printer LU that is attached to a terminal LU pool or a single terminal LU. This extension enables clients to acquire a terminal LU and its associated printer without desktop configuration to specific LUs.
- Response-time statistics—Enables capture of response-time statistics for individual sessions and clients or for groups of sessions and clients.

- LU deletion—Sends a REPLY-PSID poweroff request to VTAM to delete an LU when a client disconnects from the TN3270 server.
- LU termination—Prevents VTAM security problems with applications such as IBM's CICS by supporting use of the TERMSELF RU upon session termination.

IP Host Backup

The IP Host Backup feature permits the mainframe operating system to be moved from one mainframe to another without requiring a change to the router configuration at the time of the move.

Note IP Host Backup does not provide single-system image or automatic failover to a waiting backup application. Host operator action on the mainframe is required in these instances.

Multiple mainframes can be connected to a single CIP by means of an ESCON director. Often, these mainframes run using the Multiple Image Facility (MIF), which permits the physical machine to be divided into multiple logical partitions (LPARs). By defining an unused partition on another mainframe, a user can move the operating system from a failed mainframe or mainframe partition to the unused partition. By having multiple paths to each device, the move is accomplished without changing the mainframe software. This function also permits moving an IP stack between multiple operating system images.

On the CIP, each IP connection is treated as a physical device. The CIP does not support multiple paths to a single IP connection (or device). Prior to IP Host Backup, the router configuration had to be changed each time the mainframe operating system was moved from one mainframe or LPAR to another.

CLAW Packing

The Cisco IOS implements the CLAW channel protocol to transport data between the mainframe and the Cisco CIP in TCP/IP environments. The CLAW Packing feature is an enhancement to the CLAW support which enables the transport of multiple IP packets in a single channel operation and significantly increases throughput performance between a mainframe and a Cisco CIP. CLAW Packing is supported on the Cisco 7500 series.

Currently, IBM's TCPIP stack does not support the CLAW Packing feature. However, the original implementation of the CLAW IP datagram support will continue to work with IBM's stack, even concurrently with the CLAW Packing feature.

Important Notes

This section describes warnings and cautions about using the IBM network software features in Cisco IOS Release 11.2 and Cisco IOS Release 11.2 BC software. The following topics are discussed:

- Upgrading to a New Software Release, page 20
- CIP Microcode, page 12
- Netbooting from VIP, page 21
- Source-Route Bridging (SRB) over FDDI, page 21

Upgrading to a New Software Release

If you are upgrading to Cisco IOS Release 11.2 or Release 11.2 BC from an earlier Cisco IOS software release, you should save your current configuration file before installing the Release 11.2 or Release 11.2 BC software on your router.

CIP Microcode

CIP microcode is now available as a separate image, unbundled from the Cisco IOS image. CIP microcode (for the CIP or Second-Generation CIP [CIP2] card) resides only in router Flash memory as multiple files. The router loads a "kernel" to the CIP (based on hardware revision), and the CIP selectively loads and relocates the software it requires from the router's Flash memory. The CIP image is available on preloaded Flash memory cards, on a floppy disk, or via FTP from Cisco. Every version of Cisco IOS Release 11.2 has a corresponding version of CIP microcode. Refer to the *Channel Interface Processor (CIP) Microcode Release Note and Microcode Upgrade Requirements* publication (Document Number 78-4715-xx) for information about the recommended pairs of Cisco IOS Release 11.2 and CIP microcode.

Consider the following before using Cisco IOS Release 11.2, Release 11.2 BC, and CIP microcode:

- If you have a router with Release 11.2 and a Release 11.2 CIP image on a Flash memory card, no action is required. The CIP microcode will load automatically upon booting the router.
- If you have an existing router with Release 11.2 in Flash memory or ROM and a Release 11.1 Flash memory card or earlier, either:
  - Replace the Flash memory card with a Release 11.2 pre-loaded Flash memory card, or
  - Boot the router with Release 11.2 software (CIP load will fail), then copy the Release 11.2 CIP image to the Flash memory card, and reboot the router.

When the CIP image is copied to an existing Flash memory card, the existing **flash copy** commands are used, just as before. If a CIP image other than the default for the release is being used, then the **microcode cip flash** configuration command must be issued.

The **show microcode** command has been expanded to display the default CIP image name for the Cisco IOS release.

Note The router must already be running Cisco IOS Release 11.2 before performing a copy of the CIP image to Flash memory because the CIP image must be "exploded" from the single image file on the TFTP server to multiple files in Flash memory. This capability was first available in Release 11.1.

There are two ways to determine what is loaded on each CIP:

- The CIP MIB has been enhanced to show the segments loaded on each CIP and their version and compilation information.
- The **show controller cbus** command has been expanded to include segments loaded and their version and compilation information.

Multiple CIP cards of different hardware revisions can run in the same router.

Netbooting from VIP

To netboot from Ethernet or Fast Ethernet ports on a VIP card, the system must contain version 11.1 boot ROMs. If the system contains version 11.0 boot ROMs, you can work around this requirement by using the **boot bootldr** *device***:***filename* global configuration command to load a bootstrap image from Flash memory.

Source-Route Bridging (SRB) over FDDI

This feature supports forwarding of source-route bridged traffic between Token Ring and FDDI interfaces on the Cisco 7000, Cisco 7010, and Cisco 7500 series routers. Previously, the only way to transport SNA and NetBIOS over FDDI was with remote source-route bridging (RSRB), which is either fast switched (direct or Fast-Sequence Transport (FST) encapsulation) or process-switched (TCP encapsulation). With SRB over FDDI, traffic can be autonomously switched, greatly improving performance for SRB traffic that uses FDDI as a backbone. This feature eliminates the need for RSRB peer definitions to connect Token Ring networks over the FDDI backbone.

Note SRB over FDDI does not support RSRB traffic forwarded to RSRB peers. Routers that have connections to local Token Ring networks as well as RSRB connections to remote networks cannot use this feature. The workaround is to move the RSRB connections to routers that are not connected to the FDDI backbone.

Using AIP Cards

Cisco 7000 series ATM Interface Processor (AIP) cards that support E3, DS3, or Transport Asynchronous Transmitter/Receiver Interface (TAXI) connections and that were shipped after February 22, 1995, require Cisco IOS Release 10.0(9), 10.2(5), 10.3(1), or later.

Using LAN Emulation (LANE)

Note the following information regarding the LAN Emulation (LANE) feature in Cisco IOS Release 11.2 and Release 11.2 BC:

- LANE is available for use with Cisco 7000 and 7500 series routers connected to either an LS100 or LS1010 switch. LANE requires at least version 3.1(2) of the LS100 software, which requires a CPU upgrade if you are currently running software prior to version 2.5.
- The LS2020 cannot be used for LANE because it does not support UNI 3.0 and point-to-multipoint SVCs.
- Routing of IP, IPX, AppleTalk, DECnet, VINES, and XNS is supported.
- HSRP is supported.
- LANE does not support CLNS or LANE over PVCs.
- AppleTalk Phase 1 cannot be routed to AppleTalk Phase 2 via LANE.

Caveats

Caveats describe unexpected behavior or defects in Cisco IOS software releases. The software caveats that apply to Cisco IOS Release 11.2 also apply to Cisco IOS Release 11.2 BC. Additional CIP-related caveats also apply.

- CSCdw65903

  An error can occur with management protocol processing. Please use the following URL for further information:

  http://www.cisco.com/cgi-bin/bugtool/onebug.pl?bugid=CSCdw65903

Refer to the following documents to find caveat information for Cisco IOS Release 11.2 BC:

- For information on caveats in Cisco IOS Release 11.2, see the Important Notes and the Caveats sections in the *Release Notes for Cisco IOS Release 11.2* document (Part number 78-3648-xx).
- For information on caveats in the CIP microcode, see the *Channel Interface Processor Microcode Release Notes and Upgrade Instructions* (Part number 78-4715-xx).

Note If you have an account with CCO, you can use Bug Navigator II to find caveats of any severity for any release. From the CCO home page, log in and click on this path: **Service&Support: Online Technical Support: Software Bug Toolkit**. You can also find Bug Navigator II at http://www.cisco.com/support/bugtools.

Handling Large Configurations

The largest size nonvolatile random-access memory (NVRAM) planned for the Cisco 7000 and 7500 series routers is 128 KB. The maximum number of nailing commands that can be stored in a 128 KB NVRAM is approximately 4000. However, large configurations may map as many as 10,000 IP addresses to LUs.

To maintain a configuration file that exceeds 128 KB there are two alternatives. The configuration file can be stored compressed in NVRAM. Or, the configuration file can be stored in Flash memory that is either internal Flash or on a PCMCIA card.

NVRAM Configuration File Compression

The **service compress-config** global command specifies that the configuration file is to be stored compressed in NVRAM. Once the configuration file has been compressed, the router functions normally. A **show startup-config** EXEC command expands the configuration before displaying it. When the system is booted, it recognizes that the configuration file is compressed and will expand it and proceed normally.

This example compresses a 129 KB configuration file to 11 KB:

```
router# copy running-config startup-config
Building configuration...
Compressing configuration from 129648 bytes to 11077 bytes
[OK]
```

The size of the configuration must not exceed three times the NVRAM size. For a 128 KB size NVRAM, the largest expanded configuration file size is 384 KB.

Note This compression facility is only available with Cisco IOS Software Release 10 boot ROMs or later.

If the boot ROMs do not recognize a compressed configuration, the following message is displayed:

```
Boot ROMs do not support NVRAM compression Config NOT written to NVRAM
```

Store Configuration File in Flash

Store the startup configuration file in Flash memory by entering the **boot config slot0:router-config** global command. This command sets the environment variable CONFIG_FILE to load the startup configuration (router-config) from Flash memory, which is PCMCIA slot0 in this case. The buffer that holds the configuration file is usually the size of NVRAM. Larger configurations need larger buffers. To adjust the buffer size, use the **boot buffersize** *bytes* global command.

Note that you must do a **copy startup-config slot0:router-config** command prior to the **boot config slot0:router-config** to create the Flash configuration file. After you have created the Flash configuration file, update the Flash again.

For example, the following commands store the configuration file in Flash memory:

```
copy startup-config slot0:router-config
conf t
  boot buffersize <bytes>
  boot config slot0:router-config
copy running-config startup-config
```

Care must be taken when editing or changing a large configuration. Flash memory space is used every time a **copy running-config startup-config** is issued. Because file management for Flash memory, such as optimizing free space, is not done automatically you must pay close attention to available Flash memory. Cisco recommends that you use a large-capacity Flash card of at least 20 MB.

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 current 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.

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

This document is to be used in conjunction with the *Release Notes for Cisco IOS Release 11.2* publication.