



Cisco 7401ASR Installation and Configuration Guide

Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
<http://www.cisco.com>
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100

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Preface

This preface describes who should read the *Cisco 7401ASR Installation and Configuration Guide*, how it is organized, and its document conventions.

The following sections are in this preface:

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Audience

To use this publication, you should be familiar not only with Cisco router hardware and cabling but also with electronic circuitry and wiring practices. You should also have experience as an electronic or electromechanical technician.

This installation guide explains the initial hardware installation and basic configuration procedures for the Cisco 7401ASR router. It contains procedures for unpacking and installing the router hardware, creating a basic software configuration file, and starting up the router. After completing the installation and basic configuration procedures covered in this guide, you will then use the appropriate companion publications to more completely configure your system.

Organization

The major sections of this guide are as follows:

Chapter	Title	Description
1	Overview and Parts Installation	This chapter provides a hardware overview as well as preparation and installation instructions for a Gigabit Interface Converter (GBIC), CompactFlash Disk, and port adapter or service adapter.
2	Rack-Mounting, Tabletop Installation, and Cabling	This chapter provides preparation and installation instructions for installing the chassis in a rack and for attaching cables.
3	Starting and Configuring	This chapter provides a functional overview of the system, as well as startup and configuration instructions.
4	Configuring the VPN Acceleration Module	This chapter provides configuration instructions for the VPN Acceleration Module (VAM).
5	Troubleshooting	This chapter provides basic system startup troubleshooting information.
A	Specifications	This appendix provides system specifications as well as port and cabling pinouts and specifications.
B	PXF Information	This appendix contains information about enabling PXF features, and PXF show commands.
C	Using the CompactFlash Disk	This appendix contains information about using the CompactFlash Disk.
D	Configuration Register Information	This appendix contains configuration register information.

Document Conventions

Command descriptions use the following conventions:

boldface font	Commands and keywords are in boldface .
<i>italic font</i>	Arguments for which you supply values are in <i>italics</i> .
[]	Elements in square brackets are optional.
{ x y z }	Alternative keywords are grouped in braces and separated by vertical bars.
[x y z]	Optional alternative keywords are grouped in brackets and separated by vertical bars.
string	A nonquoted set of characters. Do not use quotation marks around the string, or the string will include the quotation marks.

Screen examples use the following conventions:

screen font	Terminal sessions and information the system displays are in <code>screen font</code> .
boldface screen font	Information you must enter is in boldface screen font .
<i>italic screen font</i>	Arguments for which you supply values are in <i>italic screen font</i> .

^	The symbol ^ represents the key labeled Control —for example, the key combination ^D in a screen display means hold down the Control key while you press the D key.
< >	Nonprinting characters, such as passwords, are in angle brackets.
[]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

Notes, cautionary statements, and safety warnings use these conventions:

**Note**

Means *reader take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

**Caution**

Means *reader be careful*. You are capable of doing something that might result in equipment damage or loss of data.

Warning Definition



Warning

IMPORTANT SAFETY INSTRUCTIONS

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the translated safety warnings that accompanied this device.

Note: SAVE THESE INSTRUCTIONS

Note: This documentation is to be used in conjunction with the specific product installation guide that shipped with the product. Please refer to the Installation Guide, Configuration Guide, or other enclosed additional documentation for further details.

Waarschuwing

BELANGRIJKE VEILIGHEIDSINSTRUCTIES

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Voor een vertaling van de waarschuwingen die in deze publicatie verschijnen, dient u de vertaalde veiligheidswaarschuwingen te raadplegen die bij dit apparaat worden geleverd.

Opmerking BEWAAR DEZE INSTRUCTIES.

Opmerking Deze documentatie dient gebruikt te worden in combinatie met de installatiehandleiding voor het specifieke product die bij het product wordt geleverd. Raadpleeg de installatiehandleiding, configuratiehandleiding of andere verdere ingesloten documentatie voor meer informatie.

Varoitus

TÄRKEITÄ TURVALLISUUTEEN LIITTYVIÄ OHJEITA

Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä asiakirjassa esitettyjen varoitusten käännökset löydät laitteen mukana toimitetuista ohjeista.

Huomautus SÄILYTÄ NÄMÄ OHJEET

Huomautus Tämä asiakirja on tarkoitettu käytettäväksi yhdessä tuotteen mukana tulleen asennusoppaan kanssa. Katso lisätietoja asennusoppaasta, kokoonpano-oppaasta ja muista mukana toimitetuista asiakirjoista.

Attention IMPORTANTES INFORMATIONS DE SÉCURITÉ

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez les consignes de sécurité traduites qui accompagnent cet appareil.

Remarque CONSERVEZ CES INFORMATIONS

Remarque Cette documentation doit être utilisée avec le guide spécifique d'installation du produit qui accompagne ce dernier. Veuillez vous reporter au Guide d'installation, au Guide de configuration, ou à toute autre documentation jointe pour de plus amples renseignements.

Warnung WICHTIGE SICHERHEITSANWEISUNGEN

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewusst. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise sind im Lieferumfang des Geräts enthalten.

Hinweis BEWAHREN SIE DIESE SICHERHEITSANWEISUNGEN AUF

Hinweis Dieses Handbuch ist zum Gebrauch in Verbindung mit dem Installationshandbuch für Ihr Gerät bestimmt, das dem Gerät beiliegt. Entnehmen Sie bitte alle weiteren Informationen dem Handbuch (Installations- oder Konfigurationshandbuch o. Ä.) für Ihr spezifisches Gerät.

Figyelem! FONTOS BIZTONSÁGI ELŐÍRÁSOK

Ez a figyelmeztető jel veszélyre utal. Sérülésveszélyt rejtő helyzetben van. Mielőtt bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplő figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található.

Megjegyzés ŐRIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Megjegyzés Ezt a dokumentációt a készülékhez mellékelt üzembe helyezési útmutatóval együtt kell használni. További tudnivalók a mellékelt Üzembe helyezési útmutatóban (Installation Guide), Konfigurációs útmutatóban (Configuration Guide) vagy más dokumentumban találhatók.

Avvertenza IMPORTANTI ISTRUZIONI SULLA SICUREZZA

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Per le traduzioni delle avvertenze riportate in questo documento, vedere le avvertenze di sicurezza che accompagnano questo dispositivo.

Nota CONSERVARE QUESTE ISTRUZIONI

Nota La presente documentazione va usata congiuntamente alla guida di installazione specifica spedita con il prodotto. Per maggiori informazioni, consultare la Guida all'installazione, la Guida alla configurazione o altra documentazione acclusa.

Advarsel VIKTIGE SIKKERHETSINSTRUKSJONER

Dette varselssymbolet betyr fare. Du befinner deg i en situasjon som kan forårsake personskade. Før du utfører arbeid med utstyret, bør du være oppmerksom på farene som er forbundet med elektriske kretssystemer, og du bør være kjent med vanlig praksis for å unngå ulykker. For å se oversettelser av advarslene i denne publikasjonen, se de oversatte sikkerhetsvarslene som følger med denne enheten.

Merk TA VARE PÅ DISSE INSTRUKSJONENE

Merk Denne dokumentasjonen skal brukes i forbindelse med den spesifikke installasjonsveiledningen som fulgte med produktet. Vennligst se installasjonsveiledningen, konfigureringsveiledningen eller annen vedlagt tilleggsdokumentasjon for detaljer.

Aviso INSTRUÇÕES IMPORTANTES DE SEGURANÇA

Este símbolo de aviso significa perigo. O utilizador encontra-se numa situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha em atenção os perigos envolvidos no manuseamento de circuitos eléctricos e familiarize-se com as práticas habituais de prevenção de acidentes. Para ver traduções dos avisos incluídos nesta publicação, consulte os avisos de segurança traduzidos que acompanham este dispositivo.

Nota GUARDE ESTAS INSTRUÇÕES

Nota Esta documentação destina-se a ser utilizada em conjunto com o manual de instalação incluído com o produto específico. Consulte o manual de instalação, o manual de configuração ou outra documentação adicional inclusa, para obter mais informações.

¡Advertencia! INSTRUCCIONES IMPORTANTES DE SEGURIDAD

Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Vea las traducciones de las advertencias que acompañan a este dispositivo.

Nota GUARDE ESTAS INSTRUCCIONES

Nota Esta documentación está pensada para ser utilizada con la guía de instalación del producto que lo acompaña. Si necesita más detalles, consulte la Guía de instalación, la Guía de configuración o cualquier documentación adicional adjunta.

Varning! VIKTIGA SÄKERHETSANVISNINGAR

Denna varningssignal signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanliga förfaranden för att förebygga olyckor. Se översättningarna av de varningsmeddelanden som finns i denna publikation, och se de översatta säkerhetsvarningarna som medföljer denna anordning.

OBS! SPARA DESSA ANVISNINGAR

OBS! Denna dokumentation ska användas i samband med den specifika produktinstallationshandbok som medföljde produkten. Se installationshandboken, konfigurationshandboken eller annan bifogad ytterligare dokumentation för närmare detaljer.

Предупреждение **ВАЖНЫЕ СВЕДЕНИЯ ПО БЕЗОПАСНОСТИ**

Этот символ предупреждает о наличии опасности. При неправильных действиях возможно получение травм. Перед началом работы с любым оборудованием необходимо ознакомиться с ситуациями, в которых возможно поражение электротоком, и со стандартными действиями для предотвращения несчастных случаев. Переведенный текст предупреждений содержится в соответствующем документе, поставляемом вместе с устройством.

Примечание **СОХРАНЯЙТЕ ЭТУ ИНСТРУКЦИЮ**

Примечание Эта инструкция должна использоваться вместе с руководством по установке конкретного изделия, входящим в комплект поставки. Дополнительные сведения см. в руководстве по установке, руководстве по настройке и другой документации, поставляемой с изделием.

警告 **有关安全的重要说明**

这个警告符号指有危险。您所处的环境可能使身体受伤。操作设备前必须意识到电流的危险性，务必熟悉操作标准，以防发生事故。如果需要了解本说明中出现的警告符号的译文，请参阅本装置所附之安全警告译文。

注意 保存这些说明

注意 本文件应与本产品附带的具体安装说明一并阅读。如欲了解详情，请参阅《安装说明》、《配置说明》或所附的其他文件。

警告 **安全上の重要な注意事項**

「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止対策に留意してください。このマニュアルに記載されている警告の各国語版は、装置に付属の「Translated Safety Warnings」を参照してください。

注 これらの注意事項を保管しておいてください。

注 この資料は、製品に付属のインストレーション ガイドと併用してください。詳細は、インストレーション ガイド、コンフィギュレーション ガイド、または添付されているその他のマニュアルを参照してください。

Terms and Acronyms

To fully understand the content of this user guide, you should be familiar with the following terms and acronyms:

- Cache—Memory with fast access and small capacity used to temporarily store recently accessed data; found either incorporated into the processor or near it.
- DCE—data communications equipment
- DMA—direct memory access
- DTE—data terminal equipment
- EPROM—erasable programmable read-only memory
- EEPROM—electrically erasable programmable read-only memory

- GB—gigabit
- GBIC—Gigabit Interface Converter
- Gbps—gigabits per second
- Instruction and data cache—Instructions to the processor and data on which the instructions work.
- Integrated cache—Cache that is built into the processor; sometimes referred to as internal cache. Cache memory that is physically located outside the processor is not integrated, and is sometimes referred to as external cache.
- MB—megabyte
- Mbps—megabits per second
- NVRAM—nonvolatile random-access memory
- OIR—online insertion and removal
- PCI—Peripheral Component Interconnect
- Primary, secondary, tertiary cache—Hierarchical cache memory storage based on the proximity of the cache to the core of the processor. Primary cache is closest to the processor core and has the fastest access. Secondary cache has slower access than primary cache, but faster access than tertiary cache.
- PXF—Parallel eXpress Forwarding: A secondary processor used to accelerate Cisco IOS services
- RFI—radio frequency interference
- RISC—reduced instruction set computing
- SDRAM—synchronous dynamic random-access memory
- SNMP—Simple Network Management Protocol
- TFTP—Trivial File Transfer Protocol
- Unified cache—Instruction cache and data cache are combined. For example, a processor may have primary cache with separate instruction and data cache memory, but unified secondary cache.
- VAM—VPN acceleration module
- VPN—Virtual Private Network

Related Documentation

Your Cisco 7401ASR router and the Cisco IOS software running on it contain extensive features and functionality, which are documented in the following resources:

- Cisco Documentation CD-ROM package (See the “[Obtaining Documentation](#)” section on [page xvii](#).)
- Cisco.com (See the “[Cisco.com](#)” section on [page xvii](#).)
- *Cisco 7401ASR Router Documentation Master Index* provides a list of related documents and links at: <http://www.cisco.com/univercd/cc/td/doc/product/core/7401/ol3514.htm>
- *Cisco 7401ASR Router Port Adapter Documentation Master Index* provides a list of related documents and links at: <http://www.cisco.com/univercd/cc/td/doc/product/core/7401/ol3533.htm>
- *Cisco 7401ASR Router Troubleshooting Master Index* provides links to TAC Tech Notes, troubleshooting documentation, and troubleshooting tools and utilities at: <http://www.cisco.com/univercd/cc/td/doc/product/core/7401/ol3517.htm>
- [Cisco IOS software](#) documentation contains Cisco IOS software configuration information and support. See the modular configuration and modular command reference publications in the set that corresponds to the software release installed on your Cisco hardware.
- *Cisco IOS Enterprise VPN Configuration Guide* at: <http://www.cisco.com/univercd/cc/td/doc/product/core/7100/swcg/index.htm>
- *Cisco IOS Security Configuration Guide* at: http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122cgcr/fsecur_c/index.htm

Obtaining Documentation

Cisco documentation and additional literature are available on Cisco.com. Cisco also provides several ways to obtain technical assistance and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

Cisco.com

You can access the most current Cisco documentation at this URL:

<http://www.cisco.com/univercd/home/home.htm>

You can access the Cisco website at this URL:

<http://www.cisco.com>

You can access international Cisco websites at this URL:

http://www.cisco.com/public/countries_languages.shtml

Ordering Documentation

You can find instructions for ordering documentation at this URL:

http://www.cisco.com/univercd/cc/td/doc/es_inpek/pdi.htm

You can order Cisco documentation in these ways:

- Registered Cisco.com users (Cisco direct customers) can order Cisco product documentation from the Ordering tool:

<http://www.cisco.com/en/US/partner/ordering/index.shtml>

- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco Systems Corporate Headquarters (California, USA) at 408 526-7208 or, elsewhere in North America, by calling 1 800 553-NETS (6387).

Documentation Feedback

You can send comments about technical documentation to bug-doc@cisco.com.

You can submit comments by using the response card (if present) behind the front cover of your document or by writing to the following address:

Cisco Systems
Attn: Customer Document Ordering
170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

For all customers, partners, resellers, and distributors who hold valid Cisco service contracts, Cisco Technical Support provides 24-hour-a-day, award-winning technical assistance. The Cisco Technical Support Website on Cisco.com features extensive online support resources. In addition, Cisco Technical Assistance Center (TAC) engineers provide telephone support. If you do not hold a valid Cisco service contract, contact your reseller.

Cisco Technical Support Website

The Cisco Technical Support Website provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The website is available 24 hours a day, 365 days a year, at this URL:

<http://www.cisco.com/techsupport>

Access to all tools on the Cisco Technical Support Website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register at this URL:

<http://tools.cisco.com/RPF/register/register.do>



Note

Use the Cisco Product Identification (CPI) tool to locate your product serial number before submitting a web or phone request for service. You can access the CPI tool from the Cisco Technical Support Website by clicking the **Tools & Resources** link under Documentation & Tools. Choose **Cisco Product Identification Tool** from the Alphabetical Index drop-down list, or click the **Cisco Product Identification Tool** link under Alerts & RMAs. The CPI tool offers three search options: by product ID

or model name; by tree view; or for certain products, by copying and pasting **show** command output. Search results show an illustration of your product with the serial number label location highlighted. Locate the serial number label on your product and record the information before placing a service call.

Submitting a Service Request

Using the online TAC Service Request Tool is the fastest way to open S3 and S4 service requests. (S3 and S4 service requests are those in which your network is minimally impaired or for which you require product information.) After you describe your situation, the TAC Service Request Tool provides recommended solutions. If your issue is not resolved using the recommended resources, your service request is assigned to a Cisco TAC engineer. The TAC Service Request Tool is located at this URL:

<http://www.cisco.com/techsupport/servicerequest>

For S1 or S2 service requests or if you do not have Internet access, contact the Cisco TAC by telephone. (S1 or S2 service requests are those in which your production network is down or severely degraded.) Cisco TAC engineers are assigned immediately to S1 and S2 service requests to help keep your business operations running smoothly.

To open a service request by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411 (Australia: 1 800 805 227)

EMEA: +32 2 704 55 55

USA: 1 800 553-2447

For a complete list of Cisco TAC contacts, go to this URL:

<http://www.cisco.com/techsupport/contacts>

Definitions of Service Request Severity

To ensure that all service requests are reported in a standard format, Cisco has established severity definitions.

Severity 1 (S1)—Your network is “down,” or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Severity 2 (S2)—Operation of an existing network is severely degraded, or significant aspects of your business operation are negatively affected by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.

Severity 3 (S3)—Operational performance of your network is impaired, but most business operations remain functional. You and Cisco will commit resources during normal business hours to restore service to satisfactory levels.

Severity 4 (S4)—You require information or assistance with Cisco product capabilities, installation, or configuration. There is little or no effect on your business operations.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- Cisco Marketplace provides a variety of Cisco books, reference guides, and logo merchandise. Visit Cisco Marketplace, the company store, at this URL:

<http://www.cisco.com/go/marketplace/>

- The Cisco *Product Catalog* describes the networking products offered by Cisco Systems, as well as ordering and customer support services. Access the Cisco Product Catalog at this URL:

<http://cisco.com/univercd/cc/td/doc/pcat/>

- *Cisco Press* publishes a wide range of general networking, training and certification titles. Both new and experienced users will benefit from these publications. For current Cisco Press titles and other information, go to Cisco Press at this URL:

<http://www.ciscopress.com>

- *Packet* magazine is the Cisco Systems technical user magazine for maximizing Internet and networking investments. Each quarter, Packet delivers coverage of the latest industry trends, technology breakthroughs, and Cisco products and solutions, as well as network deployment and troubleshooting tips, configuration examples, customer case studies, certification and training information, and links to scores of in-depth online resources. You can access Packet magazine at this URL:

<http://www.cisco.com/packet>

- *iQ Magazine* is the quarterly publication from Cisco Systems designed to help growing companies learn how they can use technology to increase revenue, streamline their business, and expand services. The publication identifies the challenges facing these companies and the technologies to help solve them, using real-world case studies and business strategies to help readers make sound technology investment decisions. You can access iQ Magazine at this URL:

<http://www.cisco.com/go/iqmagazine>

- *Internet Protocol Journal* is a quarterly journal published by Cisco Systems for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the Internet Protocol Journal at this URL:

<http://www.cisco.com/ipj>

- World-class networking training is available from Cisco. You can view current offerings at this URL:

<http://www.cisco.com/en/US/learning/index.html>



Overview and Parts Installation

The Cisco 7401ASR router provides application-specific features for broadband subscriber aggregation and network application services with high processing performance.

This chapter provides a quick hardware overview and options installation instructions for the Cisco 7401ASR router. For functional information see [Chapter 3, “Starting and Configuring,”](#) the “[Functional Overview](#)” section on [page 3-1](#). For system specifications and port and cabling specifications, see [Appendix A, “Specifications.”](#)

The following sections describe router hardware and options installation:

- [Hardware Overview, page 1-1](#)
- [Checking the Shipping Container Contents, page 1-5](#)
- [Installation Checklist, page 1-6](#)
- [Installing the CompactFlash Disk, GBIC, and Port Adapter, page 1-7](#)
- [Replacing the SDRAM DIMM, page 1-11](#)



Warning

Before you install, operate, or service the system, read the *Site Preparation and Safety Guide*. This guide contains important safety information you should know before working with the system.

Hardware Overview

The Cisco 7401ASR router supports the following features:

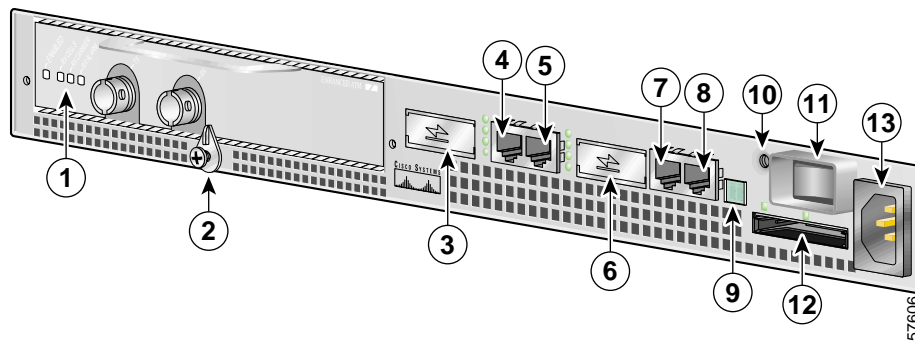
- Online insertion and removal (OIR)—Allows you to add, replace, or remove port adapters without interrupting the system.
- Environmental monitoring and reporting functions—Allow you to maintain normal system operation by resolving adverse environmental conditions prior to loss of operation.
- Downloadable software—Allows you to load new images into Flash memory remotely, without having to physically access the router, for fast, reliable upgrades.
- Small form-factor—One rack-unit (RU) high with stacking capability: 1.72 in. x 17.3 in. x 11.80 in. (4.37 cm x 43.9 cm x 30 cm). The weight is approximately 10.5 lbs (4.76 kg).
- Front-to-back airflow—Allows you to mount the router from either front or back into two post or 19-inch racks and 21–23-inch four-post racks.

The following sections provide illustrations and a brief overview of the Cisco 7401ASR router:

- [Front View, page 1-2](#)
- [LEDs, page 1-3](#)
- [Rear View, page 1-4](#)
- [System Board, page 1-4](#)
- [System Management Functions, page 1-5](#)

Front View

Figure 1-1 Cisco 7401ASR Router—Front View



1	Port adapter slot (with installed port adapter)	8	Console port
2	Port adapter latch	9	Alarm port
3	GBIC port 0	10	Ground for ESD wrist strap banana jack
4	FE port 0	11	Power switch
5	FE port 1	12	CompactFlash Disk slot
6	GBIC port 1	13	Power connector
7	Auxiliary port		

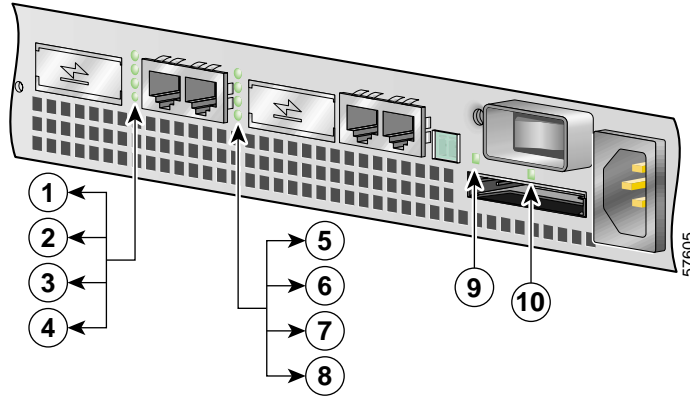
The Cisco 7401ASR router supports:

- Two native Ethernet interfaces—Each interface has two physical ports, a Gigabit Ethernet (1000-Mbps) port that uses a Gigabit Interface Converter (GBIC) and a Fast Ethernet/Ethernet (10/100-Mbps) port with an RJ-45 connector. Any two of the four ports are available at any one time.
- Both 25-MHz and 50-MHz port adapter operation.
- A 64- or 128-MB CompactFlash Disk.
- A single power supply that is available in four options: AC, single –24V DC, single –48V DC, and dual –48V DC.

LEDs

LED information is in [Figure 1-2](#) and the table below [Figure 1-2](#).

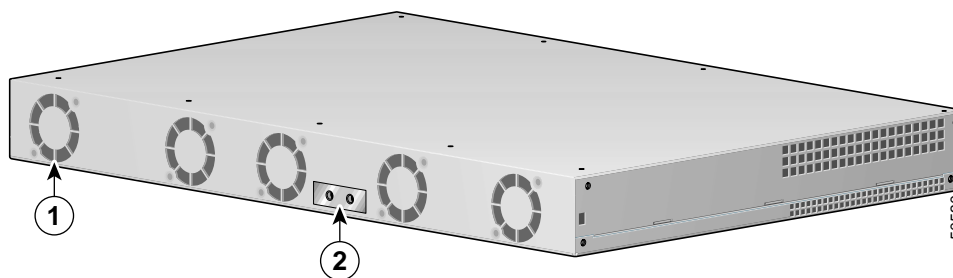
Figure 1-2 LEDs on the Cisco 7401ASR Router



No.	LED Label	LED	Color	In the Power Up state, the LED is	LED flashes when there is traffic
1	GBIC 0 ENABLE	GBIC 0 ENABLE	Green	On	No, remains constantly on
2	LINK	GBIC LINK 0	Green	—	Yes
3	FE 0 LINK	FE 0 LINK	Green	—	Yes
4	100 Mbps	FE 0	Green	On	No, remains constantly on
5	GBIC 1 ENABLE	GBIC 1 ENABLE	Green	—	No, remains constantly on
6	LINK	GBIC LINK 1	Green	On	Yes
7	FE 1 LINK	FE 1 LINK	Green	—	Yes
8	100 Mbps	FE 1	Green	On	No, remains constantly on
9	STATUS	System Status	Green	On	No, remains constantly on
10	COMPACT FLASH	CompactFlash Disk	Green	On, if the CompactFlash Disk is inserted and functioning	No, remains constantly on if the CompactFlash Disk is inserted and functioning

Rear View

Figure 1-3 Cisco 7401ASR Router—Rear View



1	Fan vent	2	Grounding connector
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The rear of the Cisco 7401ASR router has five fan airflow vents and the chassis grounding connector that provides a chassis ground connection for ESD equipment or a two-hole grounding lug. (See [Figure 1-3](#).)

Five internal fans draw cooling air into the chassis and across internal components to maintain an acceptable operating temperature. (See [Figure 1-3](#).) The five fans are located at the rear of the chassis.

System Board

Internally, the system board contains the following components:

- SDRAM memory that is available in three options: 128, 256, or 512 MB DIMM
- Processors
 - Reduced instruction set computing (RISC) RM7000 microprocessor that operates at an internal clock speed of 375 MHz. The RM7000 processor maintains and executes the system management functions for the Cisco 7401ASR router. The processor also performs some memory and environmental monitoring functions.
 - The Parallel eXpress Forwarding (PXF) processor enables parallel IP multipacket processing functions, working with the Route Processor to provide accelerated packet switching, as well as accelerated IP Layer 3 feature processing.
- System controller

The system controller provides hardware logic to interconnect the processors, SDRAM, and the PCI buses. The Cisco 7401ASR router has one system controller that provides processor access to the two PCI buses. The system controller also allows the port adapter access to SDRAM.
- Cache memory

The processor has three levels of cache: primary and secondary cache that are internal to the microprocessor with secondary unified cache for data and instruction, and tertiary, 2-MB external cache.
- Two environmental sensors for monitoring the internal temperature of the chassis
- Boot ROM for storing sufficient code for booting the Cisco IOS software

System Management Functions

The Cisco 7401ASR processor performs the following system management functions:

- Sending and receiving routing protocol updates
- Managing tables, caches, and buffers
- Monitoring interface and environmental status
- Providing Simple Network Management Protocol (SNMP) management through the console and Telnet interface
- Accounting for and switching of data traffic
- Booting and reloading images
- Managing the port adapter (including recognition and initialization during online insertion and removal)



Note

For a chassis footprint, additional dimensions, and clearance requirements for the Cisco 7401ASR router, see the [“Preparing to Install the Cisco 7401ASR Router”](#) section on page 2-1 in Chapter 2, [“Rack-Mounting, Tabletop Installation, and Cabling.”](#)

The Cisco 7401ASR router supports multiprotocol, multimedia routing and bridging with a wide variety of protocols and port adapters.

Checking the Shipping Container Contents

Use the [Cisco 7401ASR Components List](#) to check the contents of the Cisco 7401ASR router shipping container. Do not discard the shipping container. You need the container if you move or ship the Cisco 7401ASR router in the future.

Table 1-1 Cisco 7401ASR Components List

Component	Description	Received
Chassis	Cisco 7401ASR chassis configured with an AC or DC power supply, a port adapter filler plate, and a CompactFlash Disk	
Accessories:	The following accessories might arrive in separate shipping containers:	
<ul style="list-style-type: none"> • Rack-mount and cable-management kit • Power cables • Documentation 	<p>Two rack-mount brackets, one cable-management bracket, four 12-24 x 0.5-in. screws to secure the rack-mount brackets to the chassis, four 8-18 x .37-in. screws to secure the rack-mount brackets to a 19-inch rack, four 8 x .375-in. screws to secure the rack-mount brackets to a 21–23-inch rack, and one M4 x 20-mm screw to attach the cable-management bracket to the rack-mount bracket</p> <p>An AC power cable, if an AC power supply was ordered</p> <p>If ordered, router hardware and software documentation set and the Cisco Documentation CD-ROM package¹</p>	
Optional Equipment	Examples: Network interface cables, transceivers, special connectors	

1. Titles and quantities of documents will vary. You must order the type and quantity of documentation sets when you order the hardware.

**Note**

We no longer ship the entire router documentation set automatically with each system. You must specifically order the documentation as part of the sales order. If you ordered documentation and did not receive it, we will ship the documents to you within 24 hours. To order documents, contact a customer service representative.

Installation Checklist

This section assumes you will be installing the CompactFlash Disk, Gigabit Interface Converter (GBIC), and port adapter or service adapter before powering on the router, or before installing it in a rack and powering it on. For complete site requirement information, see [Chapter 2, “Rack-Mounting, Tabletop Installation, and Cabling,”](#) the “[Site Requirement Guidelines](#)” section on page 2-4.

To assist you with your installation and to provide a historical record of what was done by whom, photocopy the Cisco 7401ASR Router Installation Checklist, [Table 1-2 on page 1-6](#). Indicate when each procedure or verification is completed. When the checklist is completed, place it in your site log along with the other records for your new router.

Table 1-2 Cisco 7401ASR Router Installation Checklist

Task	Verified By	Date
Date router received		
Router and all accessories unpacked		
Types and numbers of interfaces verified		
Safety recommendations and guidelines reviewed		
Installation Checklist copied		
Site log established and background information entered		
Site power voltages verified		
Site environmental specifications verified		
Required passwords, IP addresses, device names, and so on, available		
Required tools available		
Network connection equipment available		
Router mounted in rack (optional)		
Cable-management bracket installed (optional but recommended)		
AC power cable(s) connected to AC source(s) and router		
DC power cable(s) connected to DC source(s) and router		
Network interface cables and devices connected		
ASCII terminal attached to console port		
Console port set for 9600 baud, 8 data bits, no parity, and 2 stop bits (9600 8N2)		
System power turned on		
System boot complete (STATUS LED is on)		

Table 1-2 Cisco 7401ASR Router Installation Checklist

Task	Verified By	Date
I/O ports and port adapter are operational (see Figure 1-2 on page 1-3 for specific LED information)		
Correct hardware configuration displayed after system banner appears		

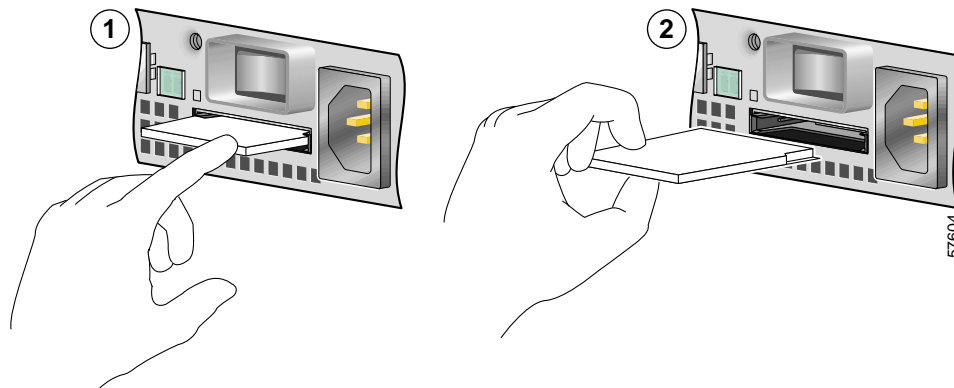
Installing the CompactFlash Disk, GBIC, and Port Adapter

You may have ordered a CompactFlash Disk, Gigabit Interface Converter (GBIC), and one of a variety of port adapters or service adapter with your Cisco 7401ASR router. You must install the CompactFlash Disk, GBIC, and port adapter service adapter. Use the installation instructions in the following sections to install or remove one of these optional parts:

- [Installing and Removing the CompactFlash Disk, page 1-7](#)
- [Installing and Removing the Gigabit Interface Converter, page 1-8](#)
- [Installing and Removing a Port Adapter or Service Adapter, page 1-10](#)

Installing and Removing the CompactFlash Disk

Figure 1-4 Installing and Removing the CompactFlash Disk



1	CompactFlash Disk insertion	2	CompactFlash Disk removal
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Insert the CompactFlash Disk in the CompactFlash Disk slot (1) with the label with the vendor name and memory size facing up. It protrudes when completely seated. To remove the CompactFlash Disk, grasp it and pull it from the slot (2).

The CompactFlash Disk is keyed to prevent it being inserted incorrectly.



Note

Only the CompactFlash Disk is supported in a Cisco 7401ASR router.

Information about CompactFlashDisks:

- The larger the CompactFlash Disk size, the longer the system boot time.
- The CompactFlash Disk supports online insertion and removal (OIR).
- Use the CompactFlash Disk to store your configuration files and Cisco IOS software image.

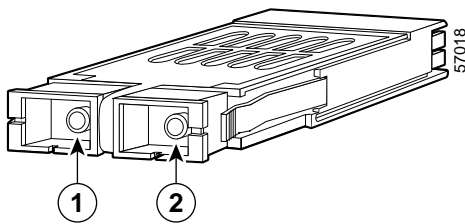
For complete information about using a CompactFlash Disk, see [Appendix C, “Using the CompactFlash Disk.”](#)

For further installation procedures including rack-mounting or general workbench installation, see [Chapter 2, “Rack-Mounting, Tabletop Installation, and Cabling.”](#)

Installing and Removing the Gigabit Interface Converter

For ease of installation, insert the Gigabit Ethernet Gigabit Interface Converter (GBIC) in the router while it is powered down and before placing it in a rack. For complete GBIC installation instructions, see the [“Attaching the GBIC Interface Cables”](#) section on page 2-17 and see the [“Gigabit Ethernet GBIC Configurations and Port and Cabling Specifications”](#) section on page A-4.

Figure 1-5 Gigabit Interface Converter—GBIC



1	Receive	2	Transmit
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The Gigabit Ethernet Gigabit Interface Converter (GBIC) port is a 1000-Mbps optical interface in the form of an SC-type duplex port that supports IEEE 802.3z interfaces compliant with the 1000BASEX standard. Gigabit Interface Converter models WS-5484 or GBIC-SX, WS-G5486 or GBIC-LX/LH, and WS-G5487 or GBIC-ZX are supported in the Cisco 7401ASR router.



Note

The GBIC must be installed before you connect the cables to it.

- You can install and remove GBICs with power on to the system.
- Disconnect all cables before removing or installing a GBIC. We strongly recommend that you do *not* install or remove the GBIC with optical fiber cables attached to it.
- GBICs are keyed to prevent incorrect insertion.



Warning

Because invisible laser radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to laser radiation and do not stare into open apertures.



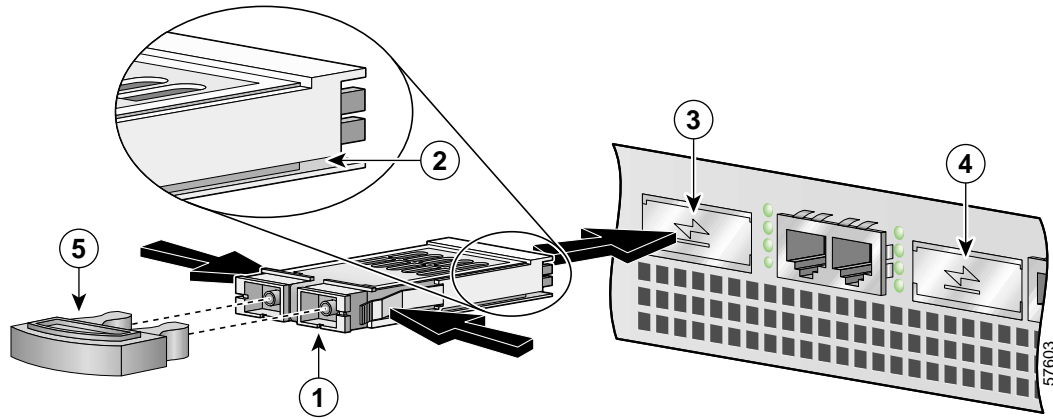
Warning

Class 1 laser product.



Warning Class 1 LED product.

Figure 1-6 Inserting a GBIC into the Cisco 7401ASR Gigabit Ethernet Slot 0



1	Gigabit Interface Converter (GBIC)	4	GBIC port 1
2	Alignment groove	5	Plug
3	GBIC port 0		

Use the following procedure to install a GBIC:

- Step 1** Attach an ESD-preventive wrist strap between you and an unpainted chassis surface.
- Step 2** Locate the label on the GBIC and turn the GBIC so the label is on top and the alignment groove is down.



Note The GBIC is keyed so that it cannot be inserted incorrectly.

- Step 3** Insert the GBIC into GBIC slot 0 or 1. The tabs on either side of the GBIC snap into place when you have completely and properly inserted the GBIC.
- Step 4** Repeat Step 2 and Step 3 if you are inserting a second GBIC.



Note Do not remove the plug from the GBIC optical bores until you are ready to install the network interface optical fiber cable. Save the plug for future use.

This completes the GBIC installation procedure.

Installing and Removing a Port Adapter or Service Adapter

The information in this section also applies to service adapters. For information about configuring a port adapter, see the port adapter documentation at:

<http://www.cisco.com/univercd/cc/td/doc/product/core/7200vx/portadpt/index.htm>.



Warning

When performing the following procedures, wear a grounding wrist strap to avoid ESD damage to the card. Some platforms have an ESD connector for attaching the wrist strap. Do not directly touch the midplane or backplane with your hand or any metal tool, or you could shock yourself.

Before removing any port adapter, gracefully shut down the interface so that there is no traffic running through the port adapter when it is removed. Removing a port adapter when traffic is flowing through the ports can cause system disruption.

The Cisco 7401ASR router supports OIR of the port adapter. However, if you choose to power off the router to remove or install a port adapter, turn the power switch to the off position and then remove the power cable. After you have replaced the port adapter or inserted a filler panel, replace the power cable and then turn the power switch to the on position.



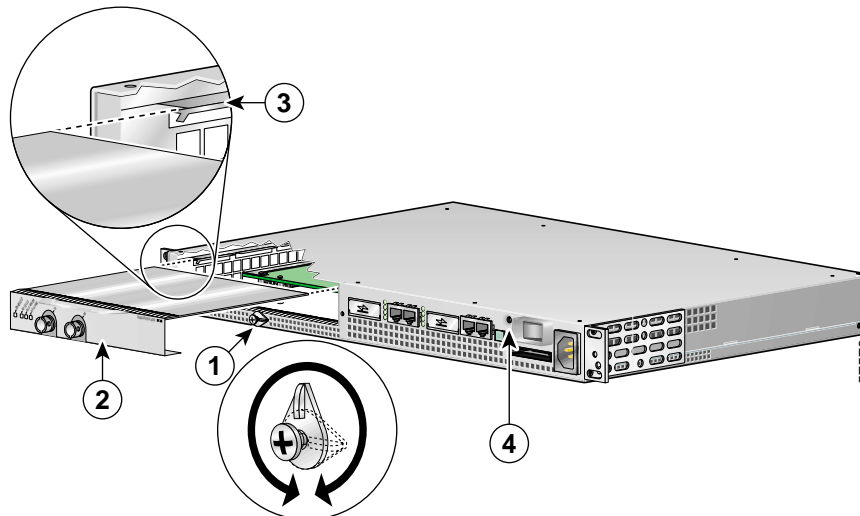
Note

After powering off the router, wait at least 30 seconds before powering it on again.

Follow these steps for inserting and securing a port adapter:

- Step 1** Attach an ESD wrist strap between you and an unpainted chassis surface. For wrist straps with a banana jack, insert the banana jack in its grounding hole located on the front of the chassis, near the STATUS LED and power switch.

Figure 1-7 Installing a Port Adapter or Service Adapter



1	Port adapter latch	3	Port adapter slot guide
2	Port adapter	4	Ground for ESD wrist strap banana jack

- Step 2** Using a Phillips screwdriver, loosen the screw of the port adapter latch, and rotate the port adapter latch until it clears the faceplate of the port adapter. The latch can rotate 360°.
- Step 3** Pull the port adapter about halfway out of the port adapter slot. (If you remove a port adapter filler plate, keep the blank port adapter for use in the router if you should ever remove the port adapter. The port adapter slot must always be filled.)
- Step 4** With the port adapter halfway out of the slot, disconnect all cables from the port adapter. After disconnecting the cables, pull the port adapter from the chassis slot.
- Step 5** Locate the port adapter slot guides inside the Cisco 7401ASR router. They are near the top, and are recessed about one-half inch.

**Caution**

The port adapter must slide into the slot guides under the chassis lid. Do not allow the port adapter components to come in contact with the system board or the port adapter could be damaged.

**Note**

If it is easier to attach the port adapter cables with the port adapter inserted halfway, attach the cables before seating the port adapter and securing the port adapter latch.

- Step 6** Locate the port adapter slot guides. Carefully slide the port adapter into the port adapter slot and seat it. When installed, the port adapter input/output panel should be flush with the face of the router.
- Step 7** Rotate the port adapter latch to the upright locked position and use a Phillips screwdriver to tighten the latch screw. Loosen the latch screw, if needed, to be able to rotate the latch over the port adapter. Then tighten the latch screw.

This completes the port adapter installation procedure.

**Caution**

To ensure the proper flow of cooling air across the internal components, make sure a port adapter filler panel is installed in the unoccupied port adapter slot.

For further installation procedures, see [Chapter 2, “Rack-Mounting, Tabletop Installation, and Cabling.”](#)

Replacing the SDRAM DIMM

The information in this section provides instructions for replacing the SDRAM DIMM and is included for future use. The memory configuration you ordered is installed in the Cisco 7401ASR router.

**Warning**

Only trained and qualified personnel should be allowed to install, replace, or service this equipment.

**Warning**

Before working on a chassis or working near power supplies, unplug the power cord on AC units; disconnect the power at the circuit breaker on DC units.

**Warning**

When performing the following procedures, wear a grounding wrist strap to avoid ESD damage to the card. Some platforms have an ESD connector for attaching the wrist strap. Do not directly touch the system board with your hand or any metal tool, or you could shock yourself.

To replace or upgrade the SDRAM DIMM, follow these instructions:

Removing the Cover

The Cisco 7401ASR router cover fits tightly on the chassis. Follow these instructions to remove the cover:

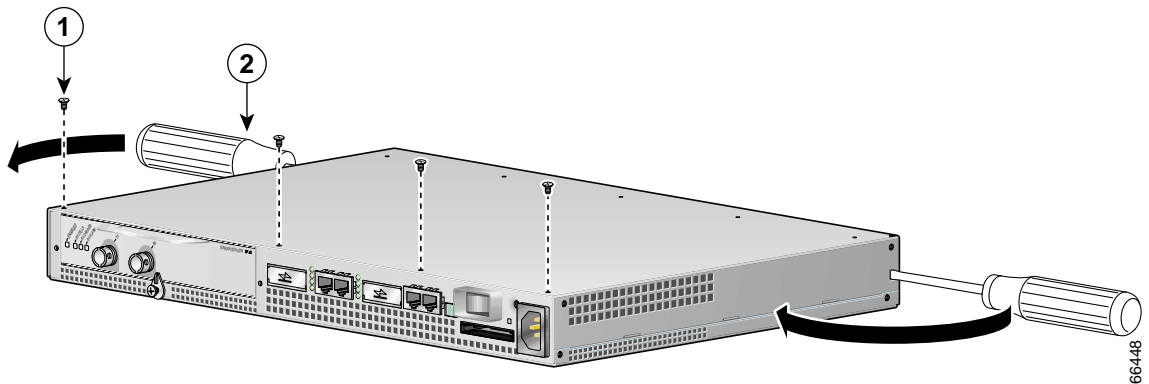
Step 1 Power off the router by turning the power switch to the off position.



Note After powering off the router, wait at least 30 seconds before powering it on again.

Step 2 Remove any cables from the Cisco 7401ASR router, including the power cables. For AC power supplies, unplug the AC power cord from the power outlet. For DC power supplies, to ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

Figure 1-8 Removing the Screws and Releasing the Cover



1	Cover screws	2	Cover removal slot and flatblade screwdriver
---	--------------	---	--

Step 3 Remove the Cisco 7401ASR router from the rack, if it is rack-mounted.

Step 4 Remove the four screws holding the cover to the chassis.

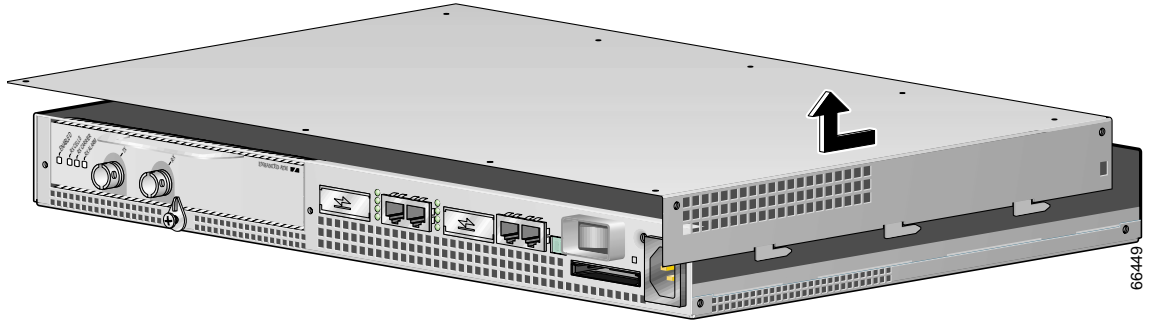


Note If needed, use a Phillips recess flat-head screw, M3.5 x 6-mm long, type B thread, steel with black zinc coating, as a replacement.

Step 5 Insert a flat-blade screwdriver in each of the side cover removal slots.

Step 6 Push the screwdriver blade against the cover latches to release the cover, as shown in [Figure 1-8](#). The cover moves forward about one-quarter inch.

Figure 1-9 Removing the Cover

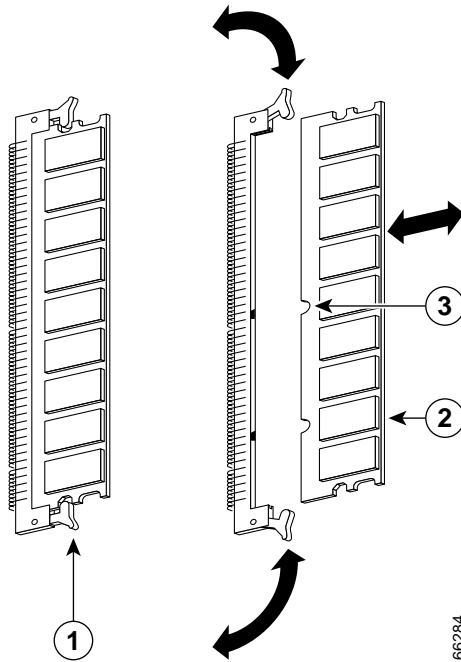


Step 7 Slide the cover forward about one-half inch and then lift it from the chassis.

Removing and Installing the SDRAM DIMM

Follow these instructions to remove and replace the SDRAM DIMM:

Figure 1-10 Removing and Replacing the DIMM



1	Spring latch on DIMM socket	3	Notch
2	DIMM		

Step 1 Attach an ESD-preventative wrist strap between you and an unpainted router surface.

Step 2 Locate the DIMM.

- Step 3** Press both spring latches outward to release the DIMM. See [Figure 1-10](#).
- Step 4** Gently pull the DIMM free from the DIMM socket, taking care not to touch the pins that insert into the socket. Place the DIMM in an anti-static bag.



Caution Forcing the DIMM into the socket can damage the DIMM. Use the notches on the DIMM to align the DIMM with the DIMM socket before inserting it.

- Step 5** Locate the notches and align the DIMM with the DIMM socket.
- Step 6** Gently insert the new DIMM, taking care not to damage the pins on the edge of the DIMM.
- Step 7** Press the spring latches to lock the DIMM in place.
-

Replacing the Cover

-
- Step 1** Replace the cover; lower it onto the chassis and push the cover toward the rear of the chassis to lock it in place.
- Step 2** Replace and tighten the four cover screws.
-

Replace the Cisco 7401ASR router in the rack. See [Chapter 2, “Rack-Mounting, Tabletop Installation, and Cabling”](#) for instructions.

For memory specifications and configurations, see Appendix A, “Specifications” the “[Memory Specifications and Configurations](#)” section on page A-3.



Rack-Mounting, Tabletop Installation, and Cabling

This chapter explains how to install a Cisco 7401ASR router in a rack in a general tabletop or workbench installation, how to attach cables, and how to power on the router.

This chapter contains the following sections:

- [Preparing to Install the Cisco 7401ASR Router, page 2-1](#)
- [Installing the Router, page 2-5](#)
- [Attaching a Chassis Ground Connection, page 2-11](#)
- [Connecting Port Adapter Cables, page 2-13](#)
- [Connecting I/O Cables, page 2-14](#)
- [Attaching the Alarm Port Cable, page 2-22](#)
- [Using the Cable-Management Bracket, page 2-22](#)
- [Connecting Power, page 2-23](#)

The Cisco 7401ASR router operates as either a tabletop or a rack-mounted unit. A rack-mount kit is standard equipment included with the Cisco 7401ASR router when it is shipped from the factory. The kit provides the hardware needed to mount the router in a standard 19-inch equipment rack or a two post rack or a 21–23-inch equipment rack.

If you are not rack-mounting your Cisco 7401ASR router, place it on a sturdy tabletop or platform.

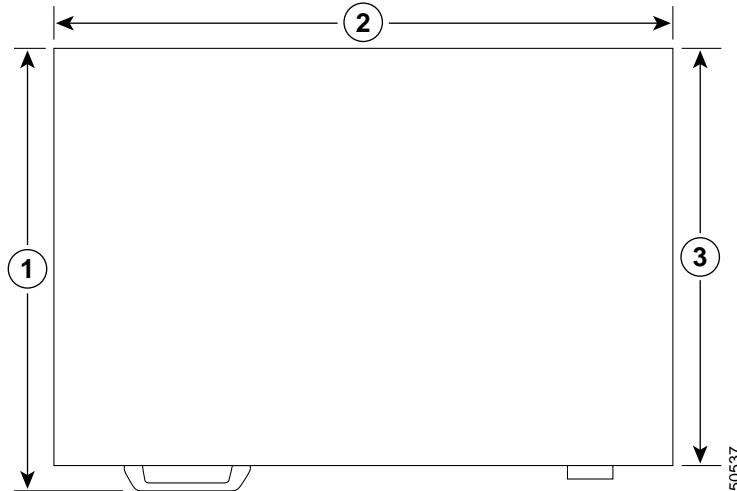
Preparing to Install the Cisco 7401ASR Router

Before installing your Cisco 7401ASR router, you should consider the power and cabling requirements that must be in place at your installation site, the equipment you need to install the router, and the environmental conditions your installation site must meet to maintain normal operation. This section guides you through the process of preparing for your router installation and the installation in a rack.

This section contains the following topics:

- [Tools and Parts Required, page 2-2](#)
- [Electrical Equipment Guidelines, page 2-3](#)
- [Preventing Electrostatic Discharge Damage, page 2-4](#)
- [Site Requirement Guidelines, page 2-4](#)

Figure 2-1 Dimensions of Cisco 7401ASR Router



1	12.875 in. (32.7cm)	3	11.8 in. (30 cm)
2	17.3 in. (43.9 cm)		

Table 2-1 provides dimensions and weight information.

Table 2-1 Cisco 7401ASR Dimensions and Weight

Cisco 7401ASR	
Dimensions (H x W x D)	1.72 in. x 17.3 in. x 11.80 in. (4.37 cm x 43.9 cm x 30 cm)
Weight	Chassis fully configured with a port adapter ~ 10.5 lb (4.76 kg)

Tools and Parts Required

Your Cisco 7401ASR chassis is fully assembled at the factory; no assembly is required. However, you need the following tools and equipment to install the chassis and the rack-mount and cable-management kit:

- Number 2 Phillips screwdriver
- A 3/16-inch flat-blade screwdriver
- Tape measure (optional)
- Level (optional)

The rack-mount and cable-management kit includes the following parts:

- Two rack-mount brackets for mounting the chassis in the rack
- One cable-management bracket
- Four 12-24 x 0.5-in. screws to secure the rack-mount brackets to the chassis
- Four 8-18 x .37-in. screws to secure the rack-mount brackets to a 19-inch rack
- Four 8 x .375-in. screws to secure the rack-mount brackets to a 21–23-inch rack
- One M4 x 20-mm screw to attach the cable-management bracket to the rack-mount bracket

- Grounding lug and wires:
 - A grounding lug with two number-10 screw holes with a 0.63-inch (16.002-mm) spacing between them
 - A wire receptacle large enough to accept a 6-AWG multistrand, copper wire
 - Two Phillips machine screws with locking washers—M5 (metric), 0.031-inch (.08-mm) pitch, 0.315-inch (8-mm) length
 - A crimping tool to fit the grounding lug wire receptacle
 - One grounding wire—6-AWG, 0.162-inch (4.115-mm) diameter, with approximately 0.108-inch (2.743-mm) insulation, for a total wire diameter of approximately 0.27 inches (6.858 mm). The wire length depends on your router location and site environment.

In addition, you might need the following external equipment:

- Data service unit (DSU) to connect each serial port to an external network
- T1 channel service unit/data service unit (CSU/DSU) that converts the High-Level Data Link Control (HDLC) synchronous serial data stream into a T1 data stream with the correct framing and ones density to connect a serial port to a T1 network. (Some telephone systems require a minimum number of 1 bits per time unit in a data stream, called *ones density*.) Several T1 CSU/DSU devices are available as additional equipment, and most provide a V.35, EIA/TIA-449, or EIA-530 electrical interface.
- Ethernet transceiver
- Token Ring multistation access unit (MSAU)
- ESD-preventative wrist strap
- Power cord
- Appropriate cables to connect the router to the console and auxiliary ports

Electrical Equipment Guidelines

The port adapter is designed to be removed and replaced while the system is operating without presenting an electrical hazard or damage to the system.

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedures requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a chassis.
- Do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard or makes the equipment unsafe.
- Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

Safety Guidelines

Following are safety guidelines that you should follow when working with any equipment that connects to electrical power, or which might be sensitive to electrostatic discharge (ESD) damage.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which occurs when electronic cards or components are improperly handled, can result in complete or intermittent system failures. Each port adapter consists of a printed circuit board that is fixed in a metal carrier. Electromagnetic interference (EMI) shielding, connectors, and a handle are integral components of the carrier. Although the carrier helps protect the boards, use an antistatic strap whenever handling the port adapter. Handle the carriers by the handle and the carrier edges only; never touch the boards or connector pins.

Electrostatic Discharge Prevention

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures.

Use the following guidelines for preventing ESD damage:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact; connect the equipment end of the strap to an unfinished chassis surface.
- Avoid contact between the printed circuit boards and clothing. The wrist strap only protects components from ESD voltages on the body; ESD voltages on clothing can still cause damage.



Caution

For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megaohms (Mohms).

Site Requirement Guidelines

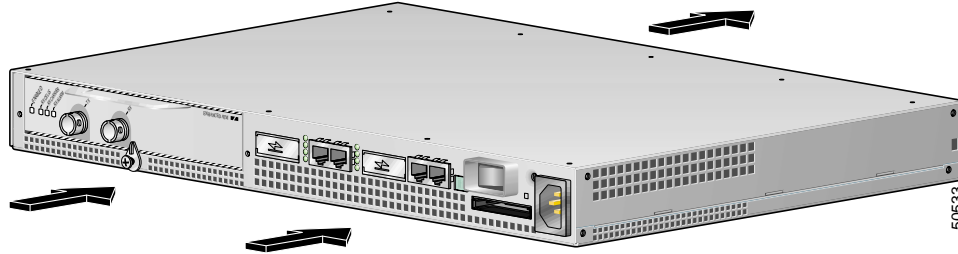


Warning

Before you install, operate, or service the system, read the *Site Preparation and Safety Guide*. This guide contains important safety information you should know before working with the system.

The environmental monitoring functionality in the Cisco 7401ASR router protects the system and components from potential damage from overvoltage and overtemperature conditions. To ensure normal operation and avoid unnecessary maintenance, plan your site configuration and prepare your site *before* installation. After installation, make sure the site maintains an ambient temperature of 32°F through 104°F (0°C through 40°C), and keep the area around the chassis as free from dust as is practical.

Planning a proper location for the Cisco 7401ASR router and the layout of your equipment rack or wiring closet is essential for successful system operation. Equipment placed too close together or inadequately ventilated can cause system overtemperature conditions. In addition, chassis panels made inaccessible by poor equipment placement can make system maintenance difficult. Following are precautions that can help avoid problems during installation and ongoing operation.

Figure 2-2 Airflow Through the Chassis

When you plan the location and layout of your equipment rack or wiring closet, you need to consider how air flows through your router. The Cisco 7401ASR router draws cooling air in through the intake vents on the front of the chassis and moves the air across the internal components and out the exhaust vents on the rear of the chassis. [Figure 2-2](#) shows airflow through the router.

Temperature sensors on the system board monitor the internal air temperature and send warning messages when the internal air temperature approaches a specified threshold. If the internal temperature exceeds the specified threshold, the system environmental monitor shuts down all internal power to prevent equipment damage from excessive heat. (See the [“Environmental Monitoring and Reporting Functions”](#) section on [page 3-4](#) for temperature threshold information.)

Installing the Router

This section explains how to install a Cisco 7401ASR router in a general tabletop or workbench installation and in a rack, and how to attach I/O, port adapter, and power cables. This section contains the following topics:

- [General Tabletop or Workbench Installation, page 2-5](#)
- [Rack-Mounting a Cisco 7401ASR Router, page 2-6](#)
- [Attaching the Chassis Rack-Mount and Cable-Management Brackets, page 2-7](#)
- [Installing the Chassis in the Rack, page 2-9](#)

General Tabletop or Workbench Installation

The router should already be in the area where you will install it, and your installation location should already be determined. If not, see the [“Preparing to Install the Cisco 7401ASR Router”](#) section on [page 2-1](#), the [“Site Requirement Guidelines”](#) section on [page 2-4](#), and the [“Site Preparation and Safety”](#) section of the *Cisco 7401ASR Regulatory Compliance and Safety Information* document.

When installing a Cisco 7401ASR router on a workbench or tabletop, ensure that the surface is clean and in a safe location and that you have considered the following:

- The router requires at least 3 inches (7.62 cm) of clearance at the inlet and exhaust vents (the front and rear of the router).
- The router should be installed off the floor. (Dust that accumulates on the floor is drawn into the interior of the router by the cooling fans. Excessive dust inside the router can cause overtemperature conditions and component failures.)
- There must be approximately 19 inches (48.3 cm) of clearance at the front and rear of the router for installing and replacing router parts—such as the port adapter, GBIC, or CompactFlash Disk—or accessing network cables or equipment.

- A port adapter filler panel is installed if a port adapter or service adapter is not in place.
- The router will receive adequate ventilation (it is not being installed in an enclosed cabinet where ventilation is inadequate).
- If you plan to install the cable-management bracket, unpack and have handy the cable-management bracket and one M4 x 20-mm screw.
- An adequate chassis ground (earth) connection exists for your router chassis.



Note We strongly recommend that you provide a chassis ground connection. See the [“Attaching a Chassis Ground Connection”](#) section on page 2-11 for instructions.

Following are the steps for installing a Cisco 7401ASR router on a workbench or tabletop:

-
- Step 1** Remove any debris and dust from the tabletop or workbench, as well as the surrounding area. Also make sure your path between the router and its new location is unobstructed.
 - Step 2** On the chassis, ensure that the port adapter latch is in the locked position.
 - Step 3** Lift the chassis by placing your hands around the chassis sides and lifting the chassis from underneath. To prevent injury, avoid sudden twists or moves.
 - Step 4** Place the router on the tabletop or workbench.
 - Step 5** Ensure that there is at least 3 inches (7.62 cm) of clearance at the inlet and exhaust vents of the router and no exhaust air from other equipment will be drawn into the chassis. Also, ensure that there is approximately 19 inches (48.3 cm) of clearance at the front and rear of the chassis.
-

This completes the general tabletop or workbench installation.

Rack-Mounting a Cisco 7401ASR Router

The chassis mounts to two rack posts with brackets that attach to either the front or the rear sides of the chassis. The inside width between the two posts or mounting strips (left and right) must be at least 17.3 inches (43.9 cm).

Some equipment racks provide a power strip along the length of one of the mounting strips. [Figure 2-7](#) shows a typical four-post equipment rack with a power strip along one of the back posts. If your rack has this feature, consider the position of the strip when planning fastener points to ensure that you will be able to pull the port adapter, a GBIC, or CompactFlash Disk straight out of their respective slots.

The inlet and exhaust ports for cooling air are located on the front and rear of the chassis, respectively, so multiple routers can be stacked in a rack with little or no vertical clearance.

Before beginning the installation, determine the type of rack you are using and whether or not you want the chassis front- or rear-mounted.



Note If you are rear-mounting the chassis and want to use the cable-management bracket, you must purchase a second rack-mount kit. You need another rack-mount bracket to attach to the front of the chassis. After it is attached to the chassis, install the cable-management bracket to the rack-mount bracket.

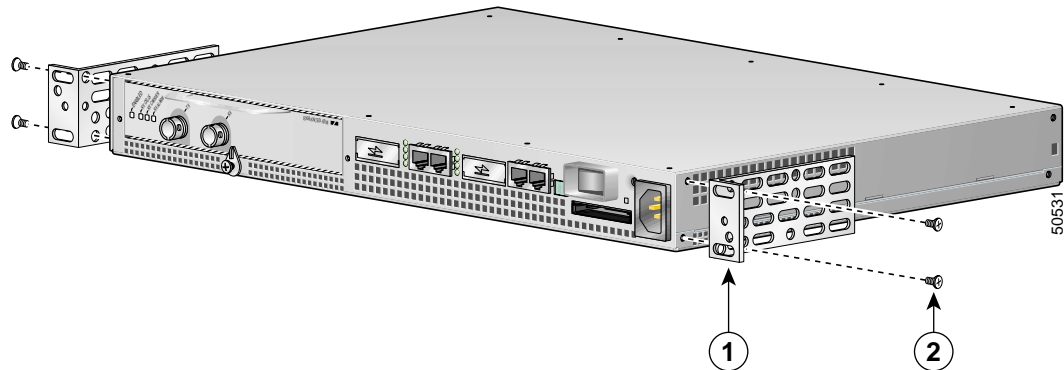
Attaching the Chassis Rack-Mount and Cable-Management Brackets

This section explains how to install the rack-mount and cable-management brackets at the front and the rear of a Cisco 7401ASR router. Before installing the chassis in the rack, you must install a rack-mount bracket on each side of the front or rear of the chassis.

The parts and tools required for installing the rack-mount brackets and cable-management bracket are listed in the “[Tools and Parts Required](#)” section on page 2-2.

Installing Rack-Mount Brackets on the Front of the Chassis

Figure 2-3 Attaching the Rack-Mount Brackets to the Front of the Chassis



1	Rack-mount bracket	2	4 screws, 8-18 x .37 in., for use with a 19-inch rack 4 screws, 8 x .375 in., for use with a 21–23-inch rack
---	--------------------	---	---

Determine whether you want the chassis to be flush-mounted or recessed. [Figure 2-3](#) shows the brackets being attached for a front rack-mount. Depending on the bracket holes you use, the router will protrude or be recessed in the rack.

To install the rack-mount and cable-management brackets on a Cisco 7401ASR router for a front rack-mount configuration, complete the following steps:

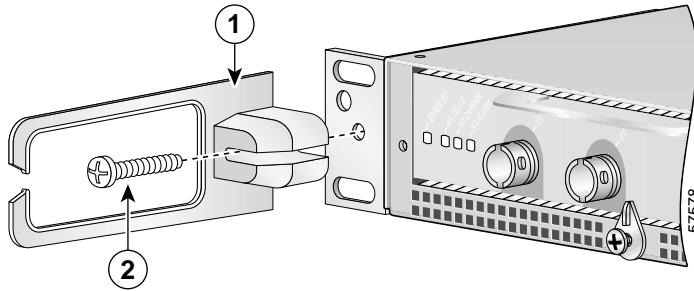
-
- Step 1** Locate the threaded holes in the front sides of the chassis.
 - Step 2** Align the rack-mount bracket (1) to the side of the router. Depending on which set of rack-mount bracket holes you choose to use to attach the rack-mount bracket to the router, the chassis will either be recessed in the rack or protrude from the rack.
 - Step 3** Insert and tighten two screws (2).
 - Step 4** Repeat Step 1 through Step 3 on the other side of the router.
-

This completes the steps for attaching the rack-mount brackets to the Cisco 7401ASR router.

To install the cable-management bracket, go to “[Attaching the Cable-Management Bracket](#)” section on page 2-8. If you are not installing the cable-management bracket, go to the “[Installing the Chassis in the Rack](#)” section on page 2-9.

Attaching the Cable-Management Bracket

Figure 2-4 Installing the Cable-Management Bracket



1	Cable-management bracket	2	M4 x 20-mm screw
---	--------------------------	---	------------------

- Step 1** Align the cable-management bracket to the rack-mount bracket on the left side of the Cisco 7401ASR router.
- Step 2** Using a Phillips screwdriver and the M4 x 20-mm screw, thread and tighten the screw to the cable-management bracket.

This completes the procedure for installing the cable-management bracket on a Cisco 7401ASR router for a front rack-mount configuration. Go to the [“Installing the Chassis in the Rack”](#) section on page 2-9.

Installing Rack-Mount Brackets on the Rear of the Chassis

Figure 2-5 Attaching the Rack-Mount Brackets to the Rear of the Chassis



1	Rack-mount bracket	2	4 screws, 8-18 x .37 in., for use with a 19-inch rack 4 screws, 8 x .375 in., for use with a 21–23-inch rack
---	--------------------	---	---

To install the rack-mount and cable-management brackets on a Cisco 7401ASR router for a rear rack-mount configuration, complete the following steps:

- Step 1** Locate the threaded holes in the rear sides of the chassis.

- Step 2** Align the rack-mount bracket to the side of the router. Depending on which set of holes on the rack-mount bracket that you use, the router will either be recessed in the rack or protrude from the rack.
- Step 3** Insert and tighten the screws.
- Step 4** Repeat Step 1 through Step 3 on the other side of the router.
-

**Note**

To use the cable-management bracket with the Cisco 7401ASR router rear-mounted, you must purchase a second rack-mount kit, attach a rack-mount bracket to the left front of the chassis, and attach the cable-management bracket to it. See the [“Attaching the Cable-Management Bracket” section on page 2-8](#) for cable-management bracket installation instructions.

This completes the procedure for installing the rack-mount on a Cisco 7401ASR router for a rear rack-mount configuration. Go to the [“Installing the Chassis in the Rack” section on page 2-9](#).

Installing the Chassis in the Rack

**Caution**

To prevent injury, review the safety precautions in this chapter before installing the router in a rack.

After installing the brackets on the chassis, you mount the router by securing the rack-mount brackets to two posts or mounting strips in the rack using the four screws provided. Because the brackets support the weight of the entire chassis, be sure to use all four screws to fasten the two rack-mount brackets to the rack posts. [Figure 2-6 on page 2-10](#) and [Figure 2-7 on page 2-11](#) show typical installations in two-post and four-post equipment racks.

We recommend that you allow at least 1 or 2 inches (2.54 or 5.08 cm) of vertical clearance between the router and any equipment directly above and below it.

To install the chassis in the rack, complete the following steps:

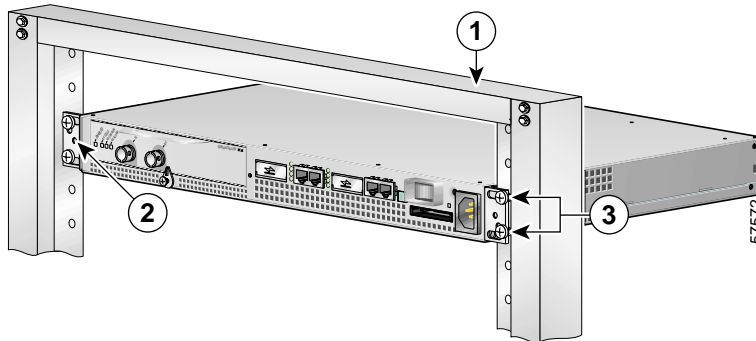
- Step 1** On the chassis, ensure that the port adapter latch is in the locked position and tightened, and that the CompactFlash Disk and any GBICs are installed.
- Step 2** Make sure that your path to the rack is unobstructed. If the rack is on wheels, ensure that the brakes are engaged or that the rack is otherwise stabilized.
- Step 3** Position the chassis so that the front end is closest to you. Lift the chassis and move it to the rack. To prevent injury, avoid sudden twists or moves.
- Step 4** Slide the chassis into the rack, pushing it back until the brackets (installed at the front or rear of the chassis) meet the mounting strips or posts on both sides of the equipment rack.
-

For two-post rack installation, go to the [“Two-Post Rack Installation” section on page 2-10](#).

For four-post rack installation, go to the [“Four-Post Rack Installation” section on page 2-11](#).

Two-Post Rack Installation

Figure 2-6 Installing the Cisco 7401ASR Router in a Two-Post Rack



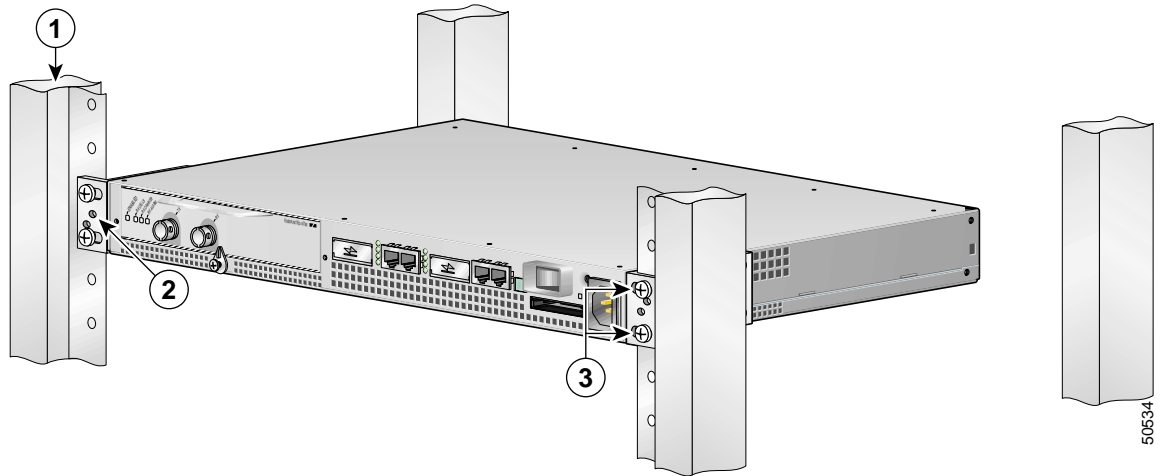
1	Two-post or four-post rack	3	Four 12-24 x 0.5-inch screws
2	Screw hole for the cable-management bracket		

-
- Step 1** Make sure that the port adapter latch is in the locked position and the screw is tightened.
- Step 2** Make sure the rack brakes are locked or the rack is stabilized.
- Step 3** Position the router so the front is closest to you and lift it carefully into the rack. To prevent injury, avoid any sudden twists or moves.
- Step 4** Slide the chassis into the rack, pushing it back until the brackets meet the mounting strips or posts on both sides of the rack.
- Step 5** Keeping the brackets flush against the posts or mounting strips, align the holes in the brackets with the holes on the rack or mounting strip.
- Step 6** For each bracket, insert and tighten two 12-24 x 0.5-inch screws to the rack.
-

This completes the procedure for installing the chassis in the rack. Proceed to the [“Attaching a Chassis Ground Connection”](#) section on page 2-11 to continue the installation.

Four-Post Rack Installation

Figure 2-7 Installing the Cisco 7401ASR Router in a Four-Post Rack



1	Four-post rack	3	Four 12-24 x 0.5-inch screws
2	Screw hole for the cable-management bracket		

-
- Step 1** Make sure that the port adapter latch is in the locked position and the screw is tightened.
- Step 2** Make sure the rack brakes are locked or the rack is stabilized.
- Step 3** Position the router so the front is closest to you and lift it carefully into the rack. To prevent injury, avoid any sudden twists or moves.
- Step 4** Slide the chassis into the rack, pushing it back until the brackets meet the mounting strips or posts on both sides of the rack.
- Step 5** Keeping the brackets flush against the posts or mounting strips, align the holes in the brackets with the holes on the rack or mounting strip.
- Step 6** For each bracket, insert and tighten two 12-24 x 0.5-inch screws to the rack.
-

This completes the procedure for installing the chassis in the rack. Proceed to the [“Attaching a Chassis Ground Connection”](#) section on page 2-11 to continue the installation.

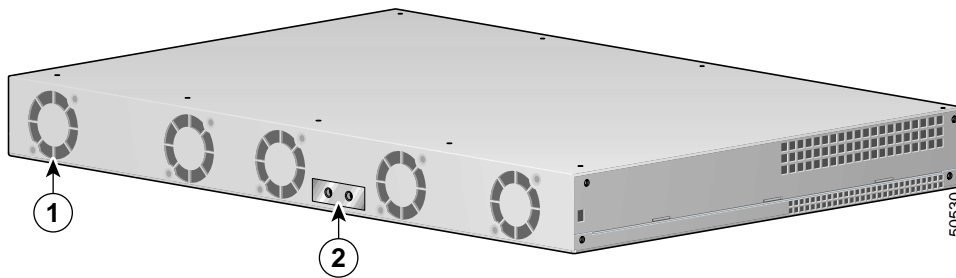
Attaching a Chassis Ground Connection

Before you connect power or turn on power to your router, we strongly recommend that you provide an adequate chassis ground (earth) connection for the router chassis. Chassis grounding connectors are provided on each Cisco 7401ASR router chassis. (See [Figure 2-8](#) on page 2-12.)

To ensure the chassis grounding connection that you provide is adequate, you will need the following parts and tools:

- One grounding lug—Must have two number-10 screw holes that have a 0.63-inch (16.002-mm) spacing between them, and a wire receptacle large enough to accept a 6-AWG multistrand, copper wire. This grounding lug is not available from Cisco Systems; electrical-connector vendors provide this type of grounding lug.
- Two Phillips machine screws with locking washers—M5 (metric), 0.031-inch (0.8-mm) pitch, 0.315-inch (8-mm) length. These screws are not available from Cisco Systems; they are available from a commercial hardware vendor.
- One grounding wire—6-AWG, 0.162-inch (4.115-mm) diameter, with approximately 0.108-inch (2.743-mm) insulation, for a total wire diameter of approximately 0.27 inches (6.858 mm). The wire length is dependent on your router location and site environment. This wire is not available from Cisco Systems; it is available from a commercial cable vendor.
- Number 2 Phillips screwdriver
- Crimping tool large enough to accommodate the diameter of the wire receptacle on your grounding lug
- Wire stripper

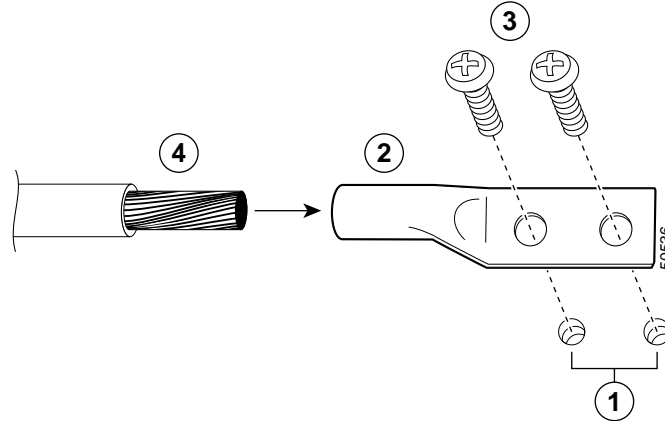
Figure 2-8 Locating the Chassis Grounding Connector



1	Fan vents	2	Ground connector
---	-----------	---	------------------

Use the following procedure to attach the grounding lug to the chassis grounding connector on your router chassis:

-
- Step 1** Locate the chassis grounding connector on your router chassis.

Figure 2-9 Attaching a Grounding Lug to the Chassis Grounding Connector

1	Chassis grounding connector	3	Screws
2	Grounding lug	4	Wire

- Step 2** Use the wire stripper to strip one end of the 6-AWG wire approximately 0.75 inches (19.05 mm).
- Step 3** Insert the 6-AWG wire into the wire receptacle on the grounding lug.
- Step 4** Use the crimping tool to carefully crimp the wire receptacle around the wire; this step is required to ensure a proper mechanical connection.
- Step 5** Insert the two screws through the holes in the grounding lug. (See [Figure 2-9](#).)
- Step 6** Use the Number 2 Phillips screwdriver to carefully tighten the screws until the grounding lug is held firmly to the chassis. Do not overtighten the screws.
- Step 7** Connect the opposite end of the grounding wire to the appropriate grounding point at your site to ensure an adequate chassis ground.

This completes the procedure for attaching a chassis ground connection. Go to the following cabling sections for information on attaching cables.

Connecting Port Adapter Cables

The instructions for connecting the cables for the port adapter installed in the Cisco 7401ASR router are contained in the respective configuration note for each port adapter. For example, if you are connecting the optical fiber cables for the PA-POS-OC3 port adapter, refer to the configuration note *PA-POS-OC3 Packet OC3 Port Adapter Installation and Configuration* at http://www.cisco.com/univercd/cc/td/doc/product/core/7206/port_adp/sonet_pa/paposoc3/index.htm. Port adapter documents are also available on the Documentation CD-ROM.



Note

There are no cable connections to the VPN Acceleration Module (.).

Connecting I/O Cables

This section contains connection equipment information for the Fast Ethernet/Ethernet, Gigabit Ethernet, console, and auxiliary ports.

Connecting Console and Auxiliary Port Cables

The Cisco 7401ASR router has a DCE-mode console port for connecting a console terminal, and a DTE-mode auxiliary port for connecting a modem or other DCE device (such as a CSU/DSU or other router) to your router.



Note

Both the console and the auxiliary ports are asynchronous serial ports; any devices connected to these ports must be capable of asynchronous transmission. (Asynchronous is the most common type of serial device; for example, most modems are asynchronous devices.)

The Cisco 7401ASR router uses RJ-45 ports for both the auxiliary and console ports.

Before connecting a terminal to the console port, configure the terminal to match the router console port as follows: 9600 baud, 8 data bits, no parity, 2 stop bits (9600 8N2). After you establish normal router operation, you can disconnect the terminal.

Table 2-2 Pinouts for the RJ-45-to-DB-25 Adapters

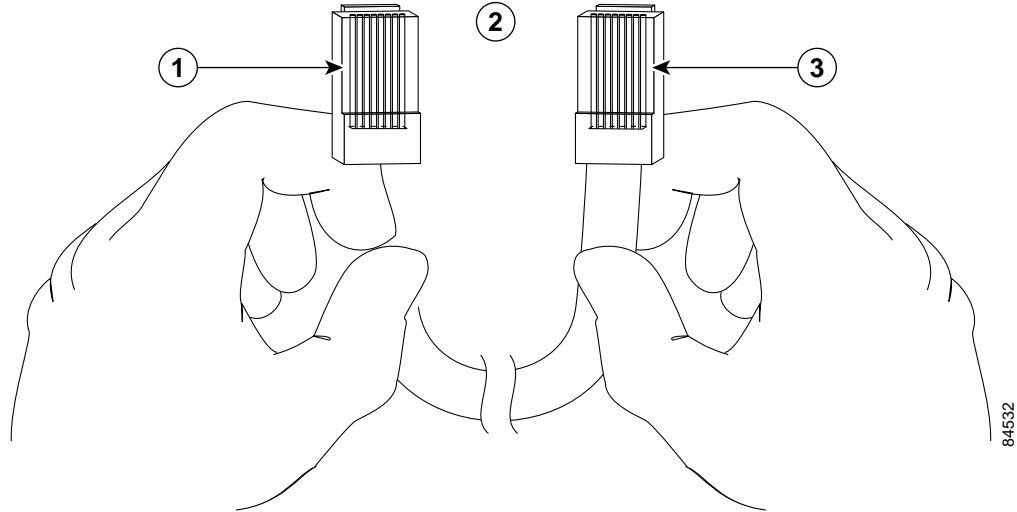
Adapter	DTE M/F Pins ¹	DCE M/F Pins	MMOD Pins ²
1	4	5	5
2	20	6	8
3	2	3	3
4	7	7	7
5	7	7	7
6	3	2	2
7	6	20	20
8	5	4	4

1. The female data terminal equipment (FDTE) adapter that is available from Cisco is labeled "Terminal".
2. The MMOD adapter that is available from Cisco is labeled "Modem".

Refer to [Table 2-2](#) for a list of the pins used on the RJ-45-to-DB-25 adapters, used with an RJ-45 cable, to connect terminals and modems to the Cisco 7200 series routers. The cable you use may be a roll-over cable or a straight cable.

A roll-over cable can be detected by comparing the two modular ends of the cable. Holding the cables in your hand, side-by-side, with the tab at the back, the wire connected to the pin on the outside of the left plug should be the same color as the pin on the outside of the right plug. If your cable was purchased from Cisco, pin 1 will be white on one connector, and pin 8 will be white on the other (a roll-over cable reverses pins 1 and 8, 2 and 7, 3 and 6, and 4 and 5). (See [Figure 2-10](#).)

Figure 2-10 Identifying a Roll-Over Cable



1	Pin 1	3	Pin 8
2	Pin 1 and pin 8 should be the same color		

The Cisco 7200 series routers ships with a rolled cable. Connection to a terminal or a modem will require an RJ-45-to-DB-25 adapter, and possibly a DB-25-to-DB9 adapter. Refer to [Table 2-3](#) for the cable and adapter configurations that can be used to connect terminals and modems to the Cisco 7200 series routers.

Table 2-3 Asynchronous Device Cabling Options

Access Server Port	RJ-45 Cable Type	DB-25 Adapter	End Device
Console or auxiliary	Rolled	FDTE ¹	Terminal
Console or auxiliary	Straight	FDCE	Terminal
Auxiliary or console	Rolled	MMOD ²	Modem

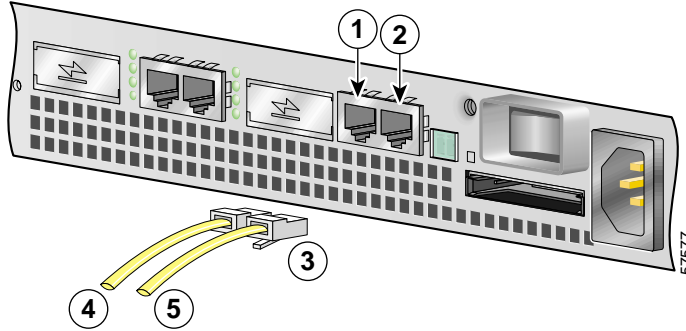
1. The FDTE RJ-45-to-DB-25 adapter is labeled “Terminal”.

2. The MMOD RJ-45-to-DB-25 adapter is labeled “Modem”.

Both ports are configured as asynchronous serial ports. [Figure 2-11](#) shows the RJ-45 console and auxiliary port connections.

For console and auxiliary port pinouts for the RJ-45 connector, see [Appendix A, “Specifications,”](#) the `uckers3cat`.

Figure 2-11 Console and Auxiliary Port RJ-45 Connectors



1	Auxiliary port	4	Cable to modem or DCE
2	Console port	5	Cable to console terminal or DTE
3	RJ-45 connector		

Connecting Native Gigabit Ethernet and Fast Ethernet/Ethernet Cables



Note

See [Chapter 3, “Starting and Configuring,”](#) the [“Configuring the Native Gigabit Ethernet and Fast Ethernet/Ethernet Interfaces”](#) section on page 3-15, for information on configuring and troubleshooting the Gigabit Ethernet and Fast Ethernet/Ethernet interfaces.

The Cisco 7401ASR router has two Ethernet interfaces and four physical Ethernet ports, two RJ-45 (10/100 Mbps) ports and two Gigabit Ethernet (1000 Mbps) ports. Only two of the four ports can be in use at any one time.

There are two PCI buses. One Gigabit Ethernet (1000) port and one Fast Ethernet RJ-45 (10/100) port are on the PCI bus 1. The port adapter slot, one Gigabit Ethernet (1000) port, and one Fast Ethernet RJ-45 (10/100) port are on PCI bus 0.

Attaching the Fast Ethernet/Ethernet 10/100 Cables

The RJ-45 ports support IEEE 802.3 (Ethernet) and IEEE 802.3u (Fast Ethernet) interfaces compliant with 10BASET and 100BASETX specifications.

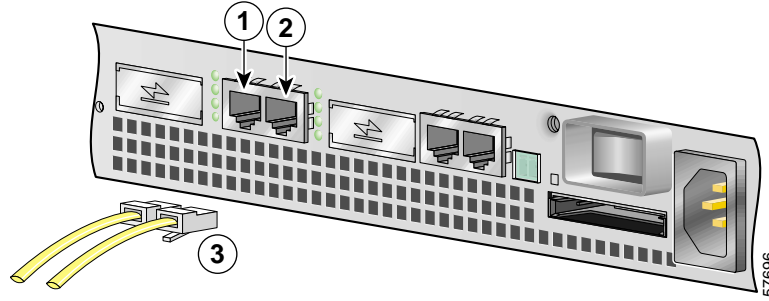
The RJ-45 port supports standard straight-through and crossover Category 5 unshielded twisted-pair (UTP) cables with RJ-45 connectors. Cisco Systems does not supply Category 5 UTP cables; these cables are available commercially.

See [Appendix A, “Specifications,”](#) for Fast Ethernet RJ-45 port specifications.

Intra-Building Lightning Protection

Shielded cables, which are grounded at both ends are required to be used on the 10/100 Ethernet port in order to be in compliance with requirement R4-11 in GR-1089-Core for a Central Office environment. This is not a requirement for customer premise installations.

Figure 2-12 Attaching the Fast Ethernet/Ethernet Cables



1	Fast Ethernet/Ethernet port 0 (RJ-45 connector)	3	Fast Ethernet cables
2	Fast Ethernet/Ethernet port 1 (RJ-45 connector)		

Attach either one or two Fast Ethernet/Ethernet 10/100 cables to the Fast Ethernet/Ethernet port 0 or port 1.



Warning

To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables.

Attaching the GBIC Interface Cables

The GBIC ports support IEEE 8092.3z (optical Gigabit Ethernet) interfaces compliant with 1000BASESX and 1000BASELX specifications.

After you install the GBIC in the Gigabit Ethernet port, you must attach the cables to the GBIC. The instructions that follow apply to all supported platforms.

See [Appendix A, “Specifications,”](#) for more information on GBIC cabling and cabling specifications.



Note

Optical fiber cables are commercially available; they are not available from Cisco Systems.

Attaching Multimode and Single-Mode Optical Fiber Cables

If you ordered a Gigabit Interface Converter (GBIC) with your Cisco 7401ASR router, it is one of three types listed in [Table 2-4](#):

Table 2-4 GBIC Products, Description, and Operating Distance

Product Number	GBIC	Description	Operating Distance
GBIC-SX= or WS-G5484=	Short wavelength (1000BASESX)	Contains a Class 1 laser of 850 nm for 1000BASESX (short wavelength) applications.	Operates on standard multimode fiber-optic link spans of up to 1804 ft (550 m).
GBIC-LX/LH= or WS-G5486=	Long wavelength/ long haul (1000BASELX/LH)	Contains a Class 1 laser of 1300 nm for 1000BASELX/LH (long wavelength) applications.	Operates on single-mode and multimode fiber-optic link spans of up to 6.2 miles (10 km).
GBIC-ZX= or WS-G5487=	Extended distance (1000BASEZX)	Contains a Class 1 laser of 1550 nm for 1000BASEZX (extended wavelength) applications.	Operates on ordinary single-mode fiber-optic link spans of up to 43.5 miles (70 km). Link spans of up to 62.1 miles (100 km) are possible using premium single-mode fiber or dispersion-shifted single-mode fiber.

For cabling specifications, including specific cable maximum distances, see [Appendix A, “Specifications.”](#)

**Caution**

If you plan to use a GBIC-LX/LH or WS-G5486 at distances greater than 984.25 feet (300 meters) over 50/125-micron or 62.5/125-micron multimode fiber, you must use the mode-conditioning patch cord to prevent data transmission problems. (See the [“Attaching the Mode-Conditioning Patch Cord”](#) section on page 2-21.)

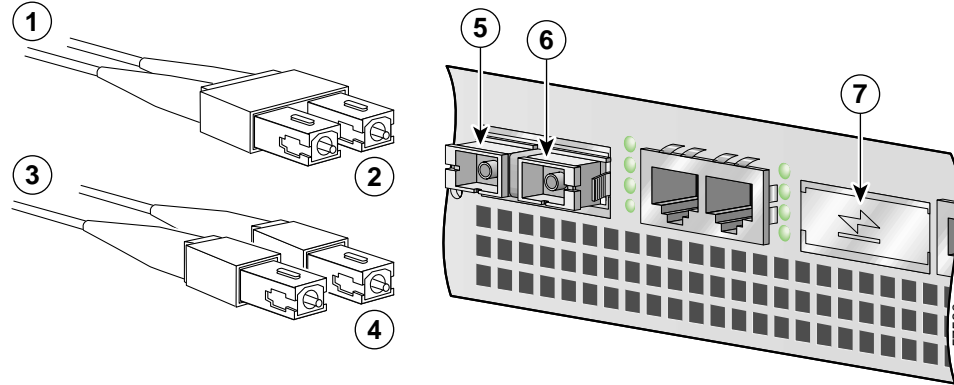
**Warning**

Class 1 laser product.

**Warning**

Class 1 LED product.

Figure 2-13 GBIC Port Connections



1	To external 1000BASEX network	5	TX (GE port 0)
2	1 duplex connector (TX and RX)	6	RX (GE port 0)
3	To external 1000BASEX network	7	GE port 1
4	2 simplex connectors		

Step 1 Remove the plug from the GBIC so that you can insert the cables. Keep the plug for use should you ever disconnect the optical fiber cables.



Warning

Because invisible laser radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to laser radiation and do not stare into open apertures.

Step 2 Attach the appropriate optical fiber cable directly to the SC-type receptacle on the GBIC. You can use either simplex or duplex connectors for most devices. (Figure 2-13 shows a GBIC installed in GE port 0.)

- For simplex connectors, two cables are required, one cable for transmit (TX) and a second cable for receive (RX).
- For duplex connectors, only one cable that has both TX and RX connectors is required.

A mode-conditioning patch cord can be used with the GBIC-LX/LH or WS-G5486 to allow reliable laser transmission between the single-mode laser source on the GBIC and a multimode optical fiber cable. See the “Attaching the Mode-Conditioning Patch Cord” section on page 2-21 for installation instructions.

Mode-Conditioning Patch Cord Description

A mode-conditioning patch cord can be used with the GBIC-LX/LH or WS-G5486 to allow reliable laser transmission between the single-mode laser source on the GBIC and a multimode optical fiber cable.

When an unconditioned laser source designed for operation on single-mode optical fiber is directly coupled to a multimode optical fiber cable, an effect known as *differential mode delay* (DMD) might result in a degradation of the modal bandwidth of the optical fiber cable.

This degradation results in a decrease in the link span (the distance between a transmitter and a receiver) that can be supported reliably. The effect of DMD can be overcome by conditioning the launch characteristics of a laser source. A practical means of performing this conditioning is to use a device called a mode-conditioning patch cord.

A mode-conditioning patch cord is an optical fiber cable assembly that consists of a pair of optical fibers terminated with connector hardware. Specifically, the mode-conditioning patch cord is composed of a single-mode optical fiber permanently coupled off-center (see Offset in [Figure 2-14](#)) to a graded-index multimode optical fiber. [Figure 2-14](#) shows a diagram of the mode-conditioning patch cord assembly.

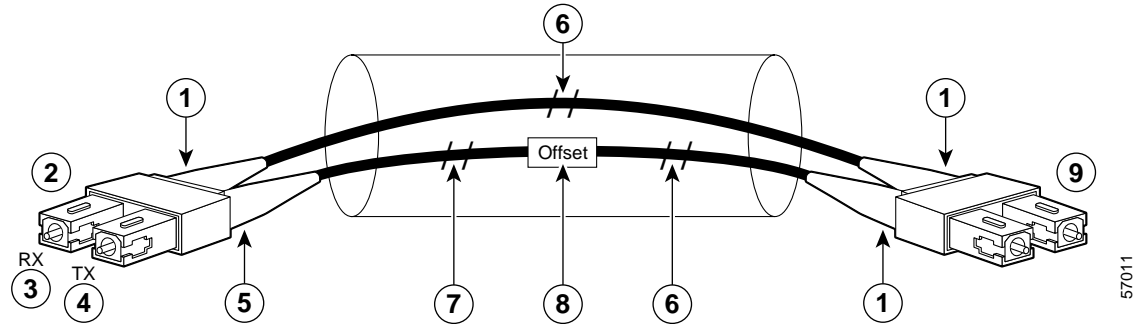
A mode-conditioning patch cord assembly is composed of duplex optical fibers, including a single-mode-to-multimode offset launch fiber connected to the transmitter, and a second conventional graded-index multimode optical fiber connected to the receiver. The use of a plug-to-plug patch cord maximizes the power budget of multimode 1000BASELX and 1000BASELH links.

**Note**

The mode-conditioning patch cord is required to comply with IEEE standards. The IEEE found that link distances could not be met with certain types of fiber-optic cable cores. The solution is to launch light from the laser at a precise offset from the center, which is accomplished by using the mode-conditioning patch cord. At the output of the patch cord, the GBIC is compliant with the IEEE 802.3z standard for 1000BASELX.

Attaching the Mode-Conditioning Patch Cord

Figure 2-14 GBIC Mode-Conditioning Patch Cord



1	Beige color identifier	6	Multimode bar
2	To GE interface	7	Single-mode bar
3	RX	8	Offset
4	TX	9	To cable plant
5	Blue color identifier		

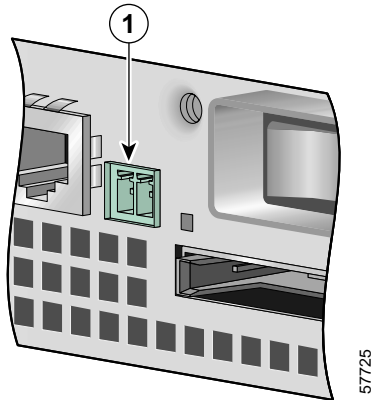
To use the mode-conditioning patch cord, follow these steps:

-
- Step 1** Attach the patch cord to the SC-type receptacle on the GBIC. (See [Figure 2-13](#).)
- Step 2** Attach the network ends of your patch cord to the appropriate 1000BASEX equipment in your building cable plant.
- Ensure that you connect the TX and RX ports on one end of the patch cord to the RX and TX ports (respectively) on the other end. Connect TX to RX and RX to TX.
-

This completes the procedures for connecting the I/O cables.

Attaching the Alarm Port Cable

Figure 2-15 Connecting the Alarm Port Cable



1	Alarm port		
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If you have an alarm system, attach the alarm cable to the Cisco 7401ASR router alarm port. The alarm port cable is not provided by Cisco Systems. Insert the cable connector into the alarm port. The cable connector cannot be incorrectly inserted into the alarm port.

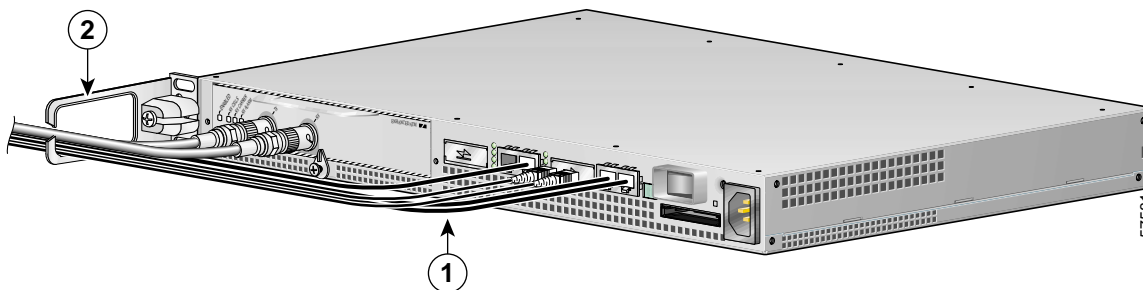
The alarm port is used to monitor fatal or severe errors that cause Cisco IOS to crash. The alarm port is connected to a normally closed solid state relay. Cisco IOS writes to a hardware port and the relay contact opens. If the system enters into a ROMmon or watchdog reset state, the relay contacts close. The closing contacts alert the alarm annunciator or monitor that a Cisco IOS crash has occurred.

If interfaces fail or other non-fatal errors occur, the alarm port does not respond. Continue to use SNMP to manage these types of errors.

For alarm port specifications, see [Appendix A, “Specifications,”](#) the “Alarm Port” section on page A-9.

Using the Cable-Management Bracket

Figure 2-16 Securing Interface Cables through the Cable-Management Bracket



1	Input/output cables	2	Cable-management bracket
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Secure port adapter interface cables and input/output cables by placing them through the cable-management bracket.

Proceed to the “[Connecting Power](#)” section on page 2-23 to complete the installation.

Connecting Power

This section provides the procedures for connecting AC-input and DC-input power to your Cisco 7401ASR router.



Warning

This unit might have more than one power cord. To reduce the risk of electric shock, disconnect the two power supply cords before servicing the unit.

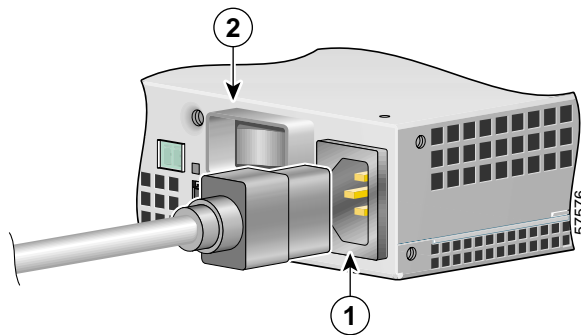


Warning

The AC power supply has double pole/neutral fusing.

Connecting AC-Input Power

Figure 2-17 Connecting AC-Input Power



1	AC power connector	2	Power switch
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Connect an AC-input power supply as follows:

- Step 1** At the front of the router, check that the power switch is in the off (O) position.
- Step 2** Plug the power cable into the AC connector on the router.
- Step 3** Plug the AC power supply cable into the AC power source.



Note

After powering off the router, wait at least 30 seconds before powering it on again.

This completes the procedure for connecting AC-input power. Your installation is complete. Proceed to [Chapter 3, “Starting and Configuring,”](#) to start the router and to perform a basic configuration.

Connecting DC-Input Power



Note

The color coding of the DC-input power supply leads depends on the color coding of the DC power source at your site. Make certain the lead color coding you choose for the DC-input power supply matches lead color coding used at the DC power source.



Warning

When you install the unit, the ground connection must always be made first and disconnected last.



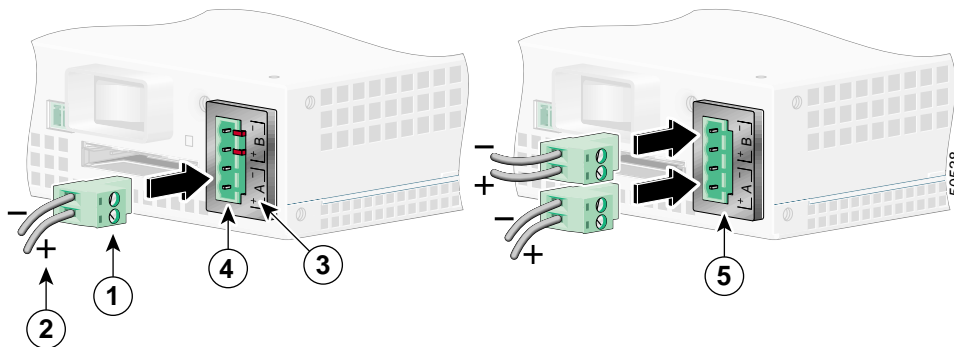
Warning

Before completing any of the following steps, and to prevent short-circuit or shock hazards, ensure that power is removed from the DC circuit. To ensure that all power is OFF, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the OFF position, and tape the switch handle of the circuit breaker in the OFF position.

Connect a DC-input power supply as follows:

- Step 1** At the front of the router, check that the power switch is in the off (O) position.
- Step 2** Ensure that no current is flowing through the DC power supply leads. To ensure that all power is OFF, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the OFF position, and tape the switch handle of the circuit breaker in the OFF position.
- Step 3** Using a wire stripper, strip approximately 0.55 inch (14 mm) from the –V and +V leads.

Figure 2-18 Attaching the Leads to the DC Plug and the DC Plug to the DC Connector



1	DC plug	4	Single DC power connector
2	Lead	5	Dual DC power connector
3	+ and – embossed on connector		

- Step 4** Insert the –V and +V leads into the DC plug that ships with the Cisco 7401ASR router. The plug allows you to unplug the DC wires from the power supply without having to unscrew the leads.
 - a. Orient the plug (1) to the connector (4) as shown in [Figure 2-18](#). The plug inserts only one way. Notice the symbols, + A –, embossed on the connector (3). Use the symbols and the orientation of the plug to guide you when inserting the leads into the plug.

- b. Insert the +V lead (2) into the plug as shown in [Figure 2-18](#), and tighten the screw to hold the lead to the plug.
- c. Insert the –V into the plug as shown in [Figure 2-18](#), and tighten the screw to hold the lead to the plug.

Step 5 If you have a dual DC power supply, repeat Step 4 for the second plug.

Step 6 Insert the DC plug into the DC power connector on the chassis. If you have a dual DC power supply, insert the second DC plug into the DC power connector.

Step 7 Switch the circuit breaker to the on position.



Note After powering off the router, wait at least 30 seconds before powering it on again.

This completes the procedure for connecting DC-input power. Your installation is complete. Proceed to [Chapter 3, “Starting and Configuring,”](#) to start the router and to perform a basic configuration.



Starting and Configuring

This chapter describes how to start the system and perform a basic configuration for your Cisco 7401ASR router. The chapter contains the following sections:

- [Functional Overview, page 3-1](#)
- [Checking Conditions Prior to System Startup, page 3-9](#)
- [Starting the System and Observing Initial Conditions, page 3-9](#)
- [Configuring a Cisco 7401ASR Router, page 3-10](#)
- [Performing Other Configuration Tasks, page 3-21](#)
- [Replacing or Recovering a Lost Password, page 3-22](#)
- [Viewing Your System Configuration, page 3-25](#)
- [Performing Complex Configurations, page 3-27](#)

This chapter guides you through a basic router configuration, which is sufficient for you to access your network. Complex configuration procedures are beyond the scope of this publication and can be found in the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.

To configure a Cisco 7401ASR router from a console, you need to connect a terminal to the router console port.

Functional Overview

This section provides a functional overview of the Cisco 7401ASR router. It describes the numbering and addressing scheme of the port adapter for the router, the environmental monitoring and reporting functions, and online insertion and removal (OIR). These descriptions help you become familiar with the capabilities of the Cisco 7401ASR router.

Chassis Slot and Logical Interface Numbering

In the Cisco 7401ASR router, the *port-adapter-slot-number* is the chassis slot in which a port adapter is installed, whereas the *logical-interface-number* is the physical location of the interface port on a port adapter.

The port adapter slot in the Cisco 7401ASR router is numbered slot 1. Port adapter slot 0 is always reserved for logical slots 10 |100|1000 on the system board.

The Media Access Control (MAC) or hardware address is a standardized data link layer address that is required for certain network interface types. These addresses are not used by other devices in the network; they are specific and unique to each port. The Cisco 7401ASR router uses a specific method to assign and control the MAC addresses of its port adapters. For a description of the MAC address, see the “MAC Address” section on page 3-3.

You can identify port adapter slots by using software commands. To display information about all port adapter slots, use the **show interfaces** command. To display information about a specific port adapter slot, use the **show interfaces** command with the port adapter type and slot number in the format **show interfaces port-adapter-type slot-number/port-number**. If you abbreviate the command (**sh int**) and do not specify port adapter type and slot number (or arguments), the system interprets the command as **show interfaces** and displays the status of all port adapters and ports.

The following example shows how the **show interfaces** command, used without arguments, displays status information (including the physical port adapter number) for each port adapter in a Cisco 7401ASR router.

In the following example, most of the status information for each interface is omitted.

```
Router# show interfaces
GigabitEthernet0/0 is up, line protocol is down
  Hardware is i82543 (Livengood), address is 0000.0000.0000 (bia 0000.0000.0000)
  Internet address is 1.1.1.2
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
    reliability 255/255, txload 1/255, rxload 1/255

  (display text omitted)

GigabitEthernet0/1 is administratively down, line protocol is down
  Hardware is i82543 (Livengood), address is 0000.0000.0000 (bia 0000.0000.0000)
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
    reliability 255/255, txload 1/255, rxload 1/255

  (display text omitted)

Serial1/0:0 is down, line protocol is down
  Hardware is Multichannel T1
  MTU 1500 bytes, BW 1536 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255

  (display text omitted)

alarm present
  Timeslot(s) Used:1-24, subrate:64Kb/s, transmit delay is 0 flags
```

You can also use arguments such as the interface type (Ethernet, Token Ring, ATM, and so forth) and the port address (*slot-number/port-number*) to display information about a specific interface only.

The following example shows the display for the first port on the Gigabit Ethernet port adapter in the port adapter slot (1):

```
Router# show interface g1/0
GigabitEthernet1/0 is up, line protocol is down
  Hardware is i82543 (Livengood), address is 0000.0000.0000 (bia 0000.0000.0000)
  Internet address is 1.1.1.2
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex mode, link type is autonegotiation, media type is SX
  output flow-control is off, input flow-control is off
  ARP type:ARPA, ARP Timeout 04:00:00
```

For complete descriptions and instructions of the commands used to configure your Cisco 7401ASR router, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications, which are available online, on the Documentation CD-ROM, and in print.

MAC Address

All LAN interfaces (ports) require unique MAC addresses, also known as *hardware addresses*. Typically, the MAC address of an interface is stored on a memory component that resides directly on the interface circuitry; however, the OIR feature requires a different method. (For a description of OIR, see the “[Online Insertion and Removal](#)” section on page 3-3.)

Using OIR you can remove a port adapter and replace it with another identically configured one. If the new port adapter matches the port adapter you removed, the system immediately brings it online. In order to enable OIR, an address allocator with unique MAC addresses is stored in an EEPROM on the system board. Each address is reserved for a specific port and slot in the router regardless of whether a port adapter resides in that slot. The MAC address for the port adapter slot in the Cisco 7401ASR is slot 0. You can remove a port adapter and insert it into another router without causing the MAC addresses to move around the network or be assigned to multiple devices.

Note that if the MAC addresses were stored on each port adapter, OIR would not function because you could never replace one port adapter with an identical one; the MAC addresses would always be different. Also, each time a port adapter was replaced, other devices on the network would have to update their data structures with the new address. If the other devices did not update quickly enough, the same MAC address could appear in more than one device at the same time.



Note

Storing the MAC addresses for every slot in one central location means the addresses stay with the memory device on which they are stored.

Online Insertion and Removal

All port adapters and service adapters in the Cisco 7401ASR routers support online insertion and removal (OIR). This function allows you to install and replace port adapters and service adapters while the router is operating; you do not need to notify the software or shut down the system power. This provides a method that is seamless to end users on the network, maintains all routing information, and preserves sessions.

The following is a functional description of OIR for background information only; for specific procedures for installing and replacing a port adapter or service adapter in a Cisco 7401ASR router, refer to the configuration note that ships with each port adapter or service adapter.

Each port or service adapter has a bus connector that connects it to the router. The connector has a set of tiered pins in three lengths that send specific signals to the system as they make contact with the port adapter or service adapter. The system assesses the signals it receives and the order in which it receives them to determine if a port adapter or service adapter is being removed or inserted into the system. From these signals, the system determines whether to reinitialize a new interface or shut down a removed interface.

For example, when you insert a port adapter or service adapter, the longest pins make contact with the port adapter or service adapter first, and the shortest pins make contact last. The system recognizes the signals and the sequence in which it receives them.

When you remove or insert a port adapter or service adapter in a Cisco 7401ASR router, the pins send signals to notify the system, which then performs as follows:

1. Rapidly scans the system for configuration changes.
2. Initializes all newly inserted port adapter or service adapter, noting any removed interfaces and placing them in the administratively shutdown state.
3. Brings all previously configured interfaces on the port adapter back to the state they were in when they were removed. Any newly inserted interface is put in the administratively shutdown state, as if it was present (but not configured) at boot time. If a similar port adapter type is reinserted into a slot, its ports are configured and brought online up to the port count of the original port adapter. (A service adapter has no configurable ports.)

Environmental Monitoring and Reporting Functions

Environmental monitoring and reporting functions allow you to maintain normal system operation by identifying and resolving adverse conditions prior to loss of operation. The environmental monitoring functions constantly monitor the internal chassis air temperature and DC supply voltages and currents. If conditions reach shutdown thresholds, the system shuts down to avoid equipment damage from excessive heat. The reporting functions periodically log the values of measured parameters so that you can retrieve them for analysis later, and the reporting functions display warnings on the console if any of the monitored parameters exceed defined thresholds.

Environmental Monitoring

The environmental monitoring functions use two sensors, Sensor 1 near the processor, and Sensor 2, near the power supply. If the air temperature exceeds a defined threshold, the system controller displays warning messages on the console terminal, and if the temperature exceeds the shutdown threshold, the system controller shuts down the system. The system stores the present parameter measurements for both temperature and DC voltage in NVRAM so you can retrieve them later as a report of the last shutdown parameters.

If an internal power supply temperature or voltage reaches a critical level, the power supply shuts down without any interaction with the system processor.

The environmental monitoring functions use the following levels of status conditions to monitor the system:

- Normal—All monitored parameters are within normal tolerances.
- Warning—The system has exceeded a specified threshold. The system continues to operate, but operator action is recommended to bring the system back to a normal state.
- Critical—An out-of-tolerance temperature or voltage condition exists. The system continues to operate; however, the system is approaching shutdown. Immediate operator action is required.
- Shutdown—The processor has detected a temperature condition that could result in physical damage to system components and has disabled DC power to all internal components. This condition requires immediate operator action. All DC power remains disabled until you toggle the power switch. Before any shutdown, the system logs the status of monitored parameters in NVRAM so you can retrieve it later to help determine the cause of the problem.
- Power supply shutdown—The power supply detected an internal out-of-tolerance overvoltage, overcurrent, or temperature condition and shut itself down. All DC power remains disabled until you toggle the power switch.

Table 3-1 lists the typical temperature thresholds for the Cisco 7401ASR router, and Table 3-2 lists the DC power thresholds for the normal, warning, and critical (power supply-monitored) levels.

Table 3-1 Typical Processor-Monitored Temperature Thresholds

Parameter	High Warning	High Critical	Shutdown
Sensor 1 (near processor)	122°F (50°C)	140°F (60°C)	149°F (65°C)
Sensor 2 (near power supply)	107°F (42°C)	125°F (52°C)	134°F (57°C)



Note

Table 3-2 shows output from the **show environment table** command.

Table 3-2 Typical Power Supply-Monitored DC-Voltage Thresholds

Parameter	Low Critical	Low Warning	High Warning	High Critical
+1.8V (PXF)	+1.61	+1.66	+1.93	+1.98
+1.8V (CPU)	+1.61	+1.66	+1.93	+1.97
+2.50V	+2.24	+2.31	+2.68	+2.75
+3.30V	+2.96	+3.04	+3.54	+3.62
+5.0V	+4.50	+4.62	+5.36	+5.50
+5.20V	+4.68	+4.80	+5.58	+5.72
+12.25V	+11.03	+11.32	+13.16	+13.49
-12.00V	-10.82	-11.10	-12.91	-13.20

Reporting Functions

The Cisco 7401ASR router displays warning messages on the console if chassis interface-monitored parameters exceed a desired threshold. You can also retrieve and display environmental status reports with the **show environment**, **show environment all**, **show environment last**, and **show environment table** commands. Parameters are measured and reporting functions are updated every 60 seconds. A brief description of each of these commands follows.



Caution

To prevent overheating the chassis, ensure that your system is drawing cool inlet air. Overtemperature conditions can occur if the system is drawing in the exhaust air of other equipment. Ensure adequate clearance around the sides of the chassis so that cooling air can flow through the chassis interior unimpeded and exhaust air exits the chassis and is not drawn into the inlet vent of another device.

The **show environment** command displays reports of the current environmental system status. The report displays parameters that are out of the normal values. No parameters are displayed if the system status is normal. The example that follows shows the display for a system in which all monitored parameters are within normal range:

```
Router# show environment
```

```
All measured values are normal
```

If the environmental status is *not* normal, the system reports the worst-case status level. Following is a sample overvoltage warning:

```
Router# show environment

Warning:+3.45 V measured at +3.27 V
```

The **show environment last** command retrieves and displays the NVRAM log, which shows the reason for the last system shutdown (if the shutdown was related to voltage or temperature) and the environmental status at that time. Air temperature is measured and displayed, and the DC voltage supplied by the power supply is also displayed.

Following is sample output of the **show environment last** command:

```
Router# show environment last
chassis inlet      previously measured at 30C/86F
chassis outlet 1   previously measured at 28C/82F
chassis outlet 2   previously measured at -1C/31F
chassis outlet 3   previously measured at -1C/31F
+3.45 V            previously measured at +3.27
+5.15 V            previously measured at +5.01
+12.15 V           previously measured at +12.34
-11.95 V           previously measured at -12.41
last shutdown reason - power supply shutdown
```

The **show environment table** command displays the temperature and voltage thresholds for each temperature sensor and for each monitored status level. These thresholds are related to those listed in [Table 3-1](#) and [Table 3-2](#). The display also lists the shutdown threshold for the system.

Following is sample output of the **show environment table** command for a Cisco 7401ASR router:

```
Router# show environment table

Sample Point      LowCritical      LowWarning      HighWarning      HighCritical
chassis inlet      40C/104F         50C/122F
chassis outlet 1   43C/109F         53C/127F
chassis outlet 2   75C/167F         75C/167F
chassis outlet 3   50C/122F         60C/140F
+3.45 V            +3.26            +3.34            +3.55            +3.63
+5.15 V            +4.86            +4.99            +5.31            +5.43
+12.15 V           +11.39           +11.67           +12.62           +12.91
-11.95 V           -9.52            -10.73           -13.16           -14.38
System shutdown for chassis outlet 1 58C/136F
System shutdown for chassis outlet 3 65C/149F
```



Note Temperature ranges and values are subject to change.

The **show environment all** command displays an extended report that includes temperature readings and voltage readings. The **show environment all** command also displays a report showing which power supply slots are occupied and which are empty.

Following is sample output of the **show environment all** command.

With AC power supply installed:

```
Router# show environment all

Power Supplies:
Power supply 1 is Internal AC Power Supply. Unit is on.
Power supply 2 is unmeasured.
```

```

Temperature readings:
  chassis inlet    measured at 29C/84F
  chassis outlet  measured at 26C/78F

```

```

Voltage readings:
+1.8 V (PXF)    measured at +1.79 V
+1.8 V (CPU)    measured at +1.77 V
+2.50 V         measured at +2.47 V
+3.30 V         measured at +3.28 V
+5.00 V         measured at +4.98 V
+5.20 V         measured at +5.18 V
+12.25 V        measured at +12.21 V
-12.00 V        measured at -12.15 V

```

```

Fans:
  Fan 1 is believed to be working
  Fan 2 is believed to be working
  Fan 3 is believed to be working
  Fan 4 is believed to be working
  Fan 5 is believed to be working

```

With a single 24V DC power supply installed:

```
Router# show environment all
```

```

Power Supplies:
  Power supply 1 is Internal 24VDC Power Supply. Unit is on.
  Power supply 2 is unmeasured.

```

```

Temperature readings:
  chassis inlet    measured at 35C/95F
  chassis outlet  measured at 29C/84F

```

```

Voltage readings:
+1.8 V (PXF)    measured at +1.79 V
+1.8 V (CPU)    measured at +1.77 V
+2.50 V         measured at +2.47 V
+3.30 V         measured at +3.28 V
+5.00 V         measured at +4.98 V
+5.20 V         measured at +5.18 V
+12.25 V        measured at +12.36 V
-12.00 V        measured at -12.15 V

```

```

Fans:
  Fan 1 is believed to be working
  Fan 2 is believed to be working
  Fan 3 is believed to be working
  Fan 4 is believed to be working
  Fan 5 is believed to be working

```

With a single 48V DC power supply installed:

```
Router# show environment all
```

```

Power Supplies:
  Power supply 1 is Internal 48VDC Power Supply. Unit is on.
  Power supply 2 is empty.

```

```

Temperature readings:
  chassis inlet    measured at 34C/93F
  chassis outlet  measured at 28C/82F

```

```

Voltage readings:
+1.8 V (PXF)    measured at +1.79 V
+1.8 V (CPU)    measured at +1.77 V

```

```

+2.50 V      measured at +2.47 V
+3.30 V      measured at +3.28 V
+5.00 V      measured at +4.98 V
+5.20 V      measured at +5.18 V
+12.25 V     measured at +12.36 V
-12.00 V     measured at -12.15 V

```

Fans:

```

Fan 1 is believed to be working
Fan 2 is believed to be working
Fan 3 is believed to be working
Fan 4 is believed to be working
Fan 5 is believed to be working

```

With dual 48V DC power supplies installed:

```
Router# show environment all
```

Power Supplies:

```

Power supply 1 is Redundant 48VDC Power Supply. Unit is on.
Power supply 2 is empty.

```

Temperature readings:

```

chassis inlet   measured at 34C/93F
chassis outlet  measured at 28C/82F

```

Voltage readings:

```

+1.8 V (PXF)   measured at +1.79 V
+1.8 V (CPU)   measured at +1.77 V
+2.50 V        measured at +2.47 V
+3.30 V        measured at +3.28 V
+5.00 V        measured at +4.98 V
+5.20 V        measured at +5.18 V
+12.25 V       measured at +12.26 V
-12.00 V       measured at -12.15 V

```

Fans:

```

Fan 1 is believed to be working
Fan 2 is believed to be working
Fan 3 is believed to be working
Fan 4 is believed to be working
Fan 5 is believed to be working

```

Fan Failures

When the system power is on, all five fans should be operational. The system continues to operate if a fan fails. When a fan fails, the system displays the following message:

```
router: 00:03:46:%ENVM-3-BLOWER:Fan 2 may have failed
```

If the air temperature exceeds a defined threshold, the system controller displays warning messages on the console terminal, and if the temperature exceeds the shutdown threshold, the system controller shuts down the system.

If the system does shut down because the temperature exceeded the shutdown threshold, the system displays the following message on the console screen and in the environment display when the system restarts:

Queued messages:

```
%ENVM-1-SHUTDOWN: Environmental Monitor initiated shutdown
```

For complete descriptions and instructions for the environmental monitor commands, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications, which are available online, on the Documentation CD-ROM, and in print.

Checking Conditions Prior to System Startup

Check the following conditions before you start your router:

- The port adapter is inserted in its slot and the port adapter latch is in the locked position.
- The network interface cable is connected to the port adapter.
- A CompactFlash Disk is installed.
- The console terminal is turned on.

You are now ready to start your router. Proceed to the section “[Starting the System and Observing Initial Conditions.](#)”

Starting the System and Observing Initial Conditions

After installing your Cisco 7401ASR router and connecting cables, start the router as follows:

-
- Step 1** At the front of the router, place the power switch on the power supply in the on (I) position.
- Step 2** Listen for the fans; you should immediately hear them operating.
- Step 3** During the boot process, observe the system LEDs. The LEDs on the port adapter go on and off in irregular sequence. They may go on, go out, and go on again for a short time. On the router, the green STATUS LED comes on and stays on.
- Step 4** Observe the initialization process. When the system boot is complete (a few seconds), the processor begins to initialize the port adapter and the I/O subsystem. During this initialization, the LEDs on the port adapter probably will flash on and off.

The enabled LED on the port adapter goes on when initialization is completed, and the console screen displays a script and system banner similar to the following:

```
Cisco Internetwork Operating System Software
IOS (tm) 7400 Software (C7400-JS-M), Version 12.2(V99.1)Copyright (c) 1986-2001 by cisco
Systems, Inc.
Compiled Sat 19-May-01 11:31 by
Image text-base:0x60008960, data-base:0x617CA000
```

- Step 5** When you start up the router for the first time, the system automatically enters the setup facility, which determines which port adapter is installed and prompts you for configuration information. On the console terminal, after the system displays the system banner and hardware configuration, you will see the following System Configuration Dialog prompt:

```
--- System Configuration Dialog ---
```

```
At any point you may enter a questions mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '['].
```

```
continue with configuration dialog? [yes]:
```

You have the option of proceeding with the setup facility to configure the interfaces, or exiting from setup and using configuration commands to configure global (system-wide) and interface-specific parameters. You do not have to configure the interfaces immediately; however, you cannot enable the interfaces or connect them to any networks until you have configured them.

Many of the port adapter LEDs do not go on until you have configured the interfaces. To verify correct operation of each interface, complete the first-time startup procedures and configuration, and then refer to the configuration note for the port adapter for LED descriptions and to check the status of the interfaces.

If the system does not complete each of the steps in the startup procedure, proceed to [Chapter 5, “Troubleshooting,”](#) for troubleshooting recommendations and procedures.

Configuring a Cisco 7401ASR Router

You can configure your Cisco 7401ASR router using one of the procedures described in the following sections:

- [Performing a Basic Configuration Using AutoInstall, page 3-11](#)
- [Performing a Basic Configuration Using the Setup Facility, page 3-11](#)
- [Performing a Basic Configuration Using Global Configuration Mode, page 3-20](#)

Follow the procedure that best fits the needs of your network configuration.



Note

You need to acquire the correct network addresses from your system administrator or consult your network plan to determine correct addresses before you can complete the router configuration.

Before continuing the configuration process, check the current state of the router by entering the **show version** command. The **show version** command displays the release of Cisco IOS software that is available on the router. Sample output of the **show version** command appears in the [“Viewing Your System Configuration”](#) section on page 3-25.

Performing a Basic Configuration Using AutoInstall

The AutoInstall process is designed to configure the Cisco 7401ASR router automatically after connection to your WAN. For AutoInstall to work properly, a TCP/IP host on your network must be preconfigured to provide the required configuration files. The TCP/IP host may exist anywhere on the network as long as the following two conditions are maintained:

1. The host must be on the remote side of the router synchronous serial connection to the WAN.
2. User Datagram Protocol (UDP) broadcasts to and from the router and the TCP/IP host are enabled.

This functionality is coordinated by your system administrator at the site where the TCP/IP host is located. You should not use AutoInstall unless the required files are available on the TCP/IP host. Refer to the publications *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* for information about how AutoInstall works.

Complete the following steps to prepare your Cisco 7401ASR router for the AutoInstall process:

-
- Step 1** Attach the appropriate synchronous serial cable to synchronous serial interface 0 on the router.
- Step 2** Turn the power switch on the power supply to the on (I) position. (This action turns on AC power to the router.)



Note After powering off the router, wait at least 30 seconds before powering it on again.

The router loads the operating system image from Flash memory. If the remote end of the WAN connection is connected and properly configured, the AutoInstall process begins.

Once the AutoInstall process is completed, use the **copy running-config startup-config** command to write the configuration data to the router's nonvolatile random-access memory (NVRAM). Perform the following step to complete this task.

- Step 3** At the # prompt, enter the following command:
- ```
Hostname# copy running-config startup-config
```



---

**Note** Completing Step 3 saves the configuration settings that the AutoInstall process created to NVRAM. If you fail to do this, your configuration will be lost the next time you reload the router.

---

## Performing a Basic Configuration Using the Setup Facility

If you do not plan to use AutoInstall, do not connect the router's serial (WAN) cable to the channel service unit/data service unit (CSU/DSU). If the WAN cable is not connected, the router boots from Flash memory and goes automatically into the setup facility.



---

**Note** You can run the setup facility any time you are at the enable prompt (#) by entering the **setup** command.

---

If the serial (WAN) cable is connected to the CSU/DSU and the router does not have a configuration stored in NVRAM, the router attempts to run AutoInstall at startup. The router may take several minutes to determine that AutoInstall is not set up to a remote TCP/IP host. Once the router determines that AutoInstall is not configured, it defaults to the setup facility.

## Configuring Global Parameters

When you first start the setup program, you must configure the global parameters. These parameters are used for controlling system-wide settings. Complete the following steps to enter the global parameters:

**Step 1** Connect a console terminal to the console port, and then boot the router.

The system boots from Flash memory. The following information appears after about 30 seconds. When you see this information, you have successfully booted your router:

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cisco Systems, Inc.  
170 West Tasman Drive  
San Jose, California 95134-1706

Cisco Internetwork Operating System Software  
IOS (tm) 7400 Software (C7400-JS-M) Version 12.2  
Copyright (c) 1986-2001 by cisco Systems, Inc.  
Compiled Fri 19-May-01 13:12 by Biff  
Image text-base:0x60008960, data-base:0x617CA000

cisco 7401ASR (NSE) processor (revision A) with 245760K/16384K bytes of memory.  
Processor board ID 4294967295  
R7000 CPU at 375Mhz, Implementation 39, Rev 3.3, 256KB L2, 2000KB L3 Cache  
1 slot ASR midplane, Version 2.0

Last reset from power-on  
Bridging software.  
X.25 software, Version 3.0.0.  
SuperLAT software (copyright 1990 by Meridian Technology Corp).  
TN3270 Emulation software.  
PXF processor tmc has been reset.  
8 Ethernet/IEEE 802.3 interface(s)  
2 Gigabit Ethernet/IEEE 802.3 interface(s)  
509K bytes of non-volatile configuration memory.

64256K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).  
8192K bytes of Flash internal SIMM (Sector size 256K).

Press RETURN to get started!

The first two sections of the configuration script (the banner and the installed hardware) appear only at initial system startup. On subsequent uses of the setup facility, the script begins with a System Configuration Dialog as shown in the following example.



```
--- System Configuration Dialog ---
```

```
At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '['].
```

- Step 2** When asked if you want to enter the initial configuration dialog and see the current interface summary, enter **yes** or press **Return**:

```
Would you like to enter the initial configuration dialog? [yes]:
```

```
First, would you like to see the current interface summary? [yes]:
```

In the following example, the summary shows a Cisco 7401ASR router at first-time startup; that is, nothing is configured.

```
Any interface listed with OK? value "NO" does not have a valid configuration
```

| Interface       | IP-Address | OK? | Method | Status | Protocol |
|-----------------|------------|-----|--------|--------|----------|
| ATM1/0          | unassigned | NO  | unset  | down   | down     |
| FastEthernet2/0 | unassigned | NO  | unset  | down   | down     |

- Step 3** Choose which protocols to support on your interfaces. For Internet Protocol (IP)-only installations, you can accept the default values for most of the questions. A typical configuration using IP, IPX, and AppleTalk follows and continues through [Step 8](#):

```
Configuring global parameters:
```

```
Enter host name [Router]:
```

- Step 4** Enter enable secret, enable, and virtual terminal passwords:

```
The enable secret password is a one-way cryptographic secret
password used instead of the enable password when it exists.
```

```
Enter enable secret: barney
```

```
The enable password is used when there is no enable secret
password and when using older software and some boot images.
```

```
Enter enable password: betty
```

```
Enter virtual terminal password: fred
```

- Step 5** The Simple Network Management Protocol (SNMP) is the most widely supported open standard for network management. It provides a means to access and set configuration and run-time parameters of routers and communication servers. SNMP defines a set of functions that can be used to monitor and control network elements.

Enter **yes** or press **Return** to accept SNMP management; enter **no** to refuse it:

```
Configure SNMP Network Management? [yes]:
Community string [public]:
```

- Step 6** For the following queries, do not enable VINES, LAT, DECnet, CLNS, bridging, XNS, or Apollo:

```
Configure Vines? [no]:
Configure LAT? [no]:
Configure DECnet? [no]:
Configure CLNS? [no]:
Configure bridging? [no]:
Configure XNS? [no]:
Configure Apollo? [no]:
```

**Step 7** For the following queries, enable routing on AppleTalk and IPX:

```
Configure AppleTalk? [no]: yes
 Multizone networks? [no]: yes
```

```
Configure IPX? [no]: yes
```

**Step 8** In most cases you use IP routing. If you are using IP routing, you must also select an interior routing protocol. You can specify only one of two interior routing protocols to operate on your system using the setup facility: Interior Gateway Routing Protocol (IGRP) or Routing Information Protocol (RIP).

To configure IP routing, enter **yes** (the default) or press **Return**, and then select an interior routing protocol:

```
Configure IP? [yes]:
Configure IGRP routing? [yes]:
Your IGRP autonomous system number [1]: 15
```

The following sample display includes a continuous listing of all configuration parameters selected in [Step 3](#) through [Step 8](#). Only IP, IPX, and AppleTalk are the selected protocols for this example.

Configuring global parameters:

```
Enter host name [Router]: router
```

The enable secret is a one-way cryptographic secret used instead of the enable password when it exists.

```
Enter enable secret: barney
```

The enable password is used when there is no enable secret and when using older software and some boot images.

```
Enter enable password: betty
Enter virtual terminal password: fred
Configure SNMP Network Management? [yes]:
 Community string [public]:
Configure Vines? [no]:
Configure LAT? [no]:
Configure AppleTalk? [no]: yes
 Multizone networks? [no]: yes
Configure DECnet? [no]:
Configure IP? [yes]:
Configure IGRP routing? [yes]:
Your IGRP autonomous system number [1]: 15
Configure RIP routing? [no]:
Configure CLNS? [no]: n
Configure bridging? [no]:
Configure IPX? [no]: yes
Configure XNS? [no]:
Configure Apollo? [no]:
```

**Step 9** Save your settings to NVRAM. (See the [“Saving the Running Configuration to NVRAM”](#) section on [page 3-21](#).) If you do not save the configuration settings you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you load the router.

---

## Configuring the Native Gigabit Ethernet and Fast Ethernet/Ethernet Interfaces

The Cisco 7401ASR router reports both the Fast Ethernet/Ethernet and the Gigabit Ethernet ports as GE 0/0 and GE 0/1. Before configuring either port type, you must first use the **media-type** interface command to select the media type, either Gigabit Ethernet (**gbic**) or Fast Ethernet/Ethernet (**rj45**).

### Changing the Media Type

- Step 1** To be able to use a particular media port, use Cisco IOS to select the media type. This is done by using the **media-type** interface command:

```
media-type { gbic | rj45 }
```

Example:

```
interface GigabitEthernet 0/0
 media-type rj45
end
```

- Step 2** After changing the media type, configure the speed and duplex to appropriately match the new interface characteristics. Changing the speed and duplex of a Cisco 7401ASR router Gigabit Ethernet interface is done using the **speed** and **duplex** interface commands.



**Note** These commands are only applicable when using the RJ-45 media.

```
speed { 10 | 100 | 1000 | auto }
```

```
duplex { full | half | auto }
```

The following speed/duplex settings are supported:

| Media Type | Speed          | Duplex           |
|------------|----------------|------------------|
| RJ45       | 10, 100, auto  | full, half, auto |
| GBIC       | ignored (1000) | ignored (full)   |

(By default on this interface)

When using the GBIC media, there is also the additional **negotiation auto** command that is used to enable the IEEE 801.1z Gigabit Ethernet (1000 Mbps) autonegotiation protocol.

- Step 3** To turn this autonegotiation feature off (it is on by default), issue the interface command **no negotiation auto**. This is useful for connecting to other Gigabit Ethernet equipment that does not support 802.1z autonegotiation.



**Note** The **negotiation auto** feature is not supported when using the media type **rj-45** and will be ignored if implementation is attempted.

If you change from the **gbic** to **rj-45** media, you must set **speed** and **duplex** after you have executed the **media-type** command to ensure the interface will operate in the correct mode.

The media type GBIC mode will always default to 1000-Mbps, full-duplex operation as this is the only configuration that is supported in this mode. Any **speed** or **duplex** commands are ignored while using this media type, even if it is present in the configuration (for example, in the **show running-config** output).

## Debugging

Cisco IOS provides two commands to provide information on your interfaces: **show interface GigabitEthernet 0/X** (where X is either 0 or 1) and **show controllers GigabitEthernet 0/X** (where X is either 0 or 1).

The output of the **show interface** command is useful for determining the current operating mode of the interface (speed/duplex/media-type) and the current interface statistics.

The output of the **show controller** command displays more information specific to the Cisco 7401ASR router Gigabit Ethernet interface. For example, it shows the detected link status, speed, and duplex, and also determines the current status of autonegotiation and the link partners' abilities (if it is an autonegotiation-capable interface).

The **show controller** command also displays the current operating state of the driver and the Ethernet controller hardware. The **show controller** command is a very powerful debugging aid, especially for Cisco engineers should you need help in debugging a problem. If you have any problems with your Gigabit Ethernet interfaces, you will need to provide this information to Cisco for analysis.

## Resetting the Interface

Should you have a problem with your interface and you want to try and reset it, use the command:

**clear interface GigabitEthernet 0/X** (where X is either 0 or 1)

## Clearing Counters

Interface counters may be cleared (reset) by using the command:

**clear counters GigabitEthernet 0/X** (where X is either 0 or 1)



Note

---

Using this command will not reset the interface.

---

## Configuring Port Adapter Interfaces

Following are the steps for configuring interfaces to allow communication over a LAN or WAN. To configure the interface parameters, you need your interface network addresses and subnet mask information. Consult with your network administrator for this information.



Note

---

See [Chapter 4, "Configuring the VPN Acceleration Module,"](#) for instructions on configuring VAM.

---

## Configuring ATM Interfaces

In the following example, an ATM interface in slot 1 is configured for an ATM LAN using IP. Follow these steps to configure an ATM interface:

---

**Step 1** Using your own addresses and mask at the setup prompts, respond to the prompts as follows:

Configuring interface parameters:

Configuring interface ATM1/0:

Is this interface in use? [yes]:

Configure IP on this interface? [yes]:

IP address for this interface: 1.1.1.10

```
Number of bits in subnet field [0]:
Class C network is 1.1.1.0, 0 subnet bits; mask is /24
```

- Step 2** Determine if you are going to enable IPX on this interface; if you are, enter the unique IPX network number:
- ```
Configure IPX on this interface? [no]: yes
IPX network number [2]:
```
- Step 3** If you are using AppleTalk on the interface, enter **yes**. Enter **yes** to configure for extended AppleTalk networks, and then enter the cable range number. Enter the zone name and any other additional zones that are associated with your local zone:
- ```
Configure AppleTalk on this interface? [no]: yes
Extended AppleTalk network? [no]: yes
AppleTalk starting cable range [0]:
```
- Step 4** Save your settings to NVRAM. (See the “[Saving the Running Configuration to NVRAM](#)” section on [page 3-21](#).) If you do not save the configuration settings you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you load the router.

**Note**

If additional ATM interfaces are available in your system, you are prompted for their configurations as well.

## Configuring Fast Ethernet Interfaces

In the following example, a Fast Ethernet interface in slot 1 is configured for a Fast Ethernet LAN using IP. Follow these steps to configure Fast Ethernet interfaces:

- Step 1** Using your own addresses and mask at the setup prompts, respond to the prompts as follows:
- ```
Configuring interface parameters:

Configuring interface FastEthernet1/0:
Is this interface in use? [yes]:
Use the 100 Base-TX (RJ-45) connector? [yes]:
Operate in full-duplex mode? [no]:
Configure IP on this interface? [yes]:
IP address for this interface: 1.1.1.20
Number of bits in subnet field [0]:
Class C network is 1.1.1.0, 0 subnet bits; mask is /24
```
- Step 2** Determine if you are going to enable IPX on this interface; if you are, enter the unique IPX network number:
- ```
Configure IPX on this interface? [no]: yes
IPX network number [2]:
```
- Step 3** If you are using AppleTalk on the interface, enter **yes**. Enter **yes** to configure for extended AppleTalk networks, and then enter the cable range number. Enter the zone name and any other additional zones that are associated with your local zone:
- ```
Configure AppleTalk on this interface? [no]: yes
Extended AppleTalk network? [no]: yes
AppleTalk starting cable range [0]:
```

- Step 4** Save your settings to NVRAM. (See the [“Saving the Running Configuration to NVRAM”](#) section on page 3-21.) If you do not save the configuration settings you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you load the router.



Note If additional Fast Ethernet interfaces are available in your system, you are prompted for their configurations as well.

Configuring Synchronous Serial Interfaces

Synchronous serial interfaces are configured to allow connection to WANs through a CSU/DSU. In the following example, a synchronous serial interface in slot 1 is configured for a WAN connection using IP. Follow these steps to configure synchronous serial interfaces:

- Step 1** Using your own addresses and mask at the setup prompts, respond to the prompts as follows:

Configuring interface parameters:

```
Configuring interface serial 1/0:
Is this interface in use? [yes]:
Configure IP on this interface? [yes]:
IP address for this interface: 1.1.1.30
Number of bits in subnet field [0]:
Class A network is 1.1.1.0, 0 subnet bits; mask is /24
```

- Step 2** Determine if you are going to enable IPX on this interface; if you are, enter the unique IPX network number:

```
Configure IPX on this interface? [no]: yes
IPX network number [2]:
```

- Step 3** If you are using AppleTalk on the interface, enter **yes**. Enter **yes** to configure for extended AppleTalk networks, and then enter the cable range number. Enter the zone name and any other additional zones that are associated with your local zone:

```
Configure AppleTalk on this interface? [no]: yes
Extended AppleTalk network? [no]: yes
AppleTalk starting cable range [0]:
```

- Step 4** Save your settings to NVRAM. (See the [“Saving the Running Configuration to NVRAM”](#) section on page 3-21.) If you do not save the configuration settings you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you load the router.



Note If additional synchronous serial interfaces are available in your system, you are prompted for their configurations as well.

The following sample display includes a continuous listing of all interface configuration parameters selected for ATM, Fast Ethernet, and synchronous serial interfaces.

Configuring interface parameters:

Configuring interface ATM1/0:

```
Is this interface in use? [yes]:
Configure IP on this interface? [yes]:
  IP address for this interface: 1.1.1.10
  Number of bits in subnet field [0]: 0
  Class C network is 1.1.1.0, 0 subnet bits; mask is /24
Configure IPX on this interface? [yes]:
  IPX network number [2]:
Configure AppleTalk on this interface? [no]: yes
  Extended AppleTalk network? [no]: yes
  AppleTalk starting cable range [0]:
```

Configuring interface FastEthernet1/0:

```
Is this interface in use? [yes]:
Use the 100 Base-TX (RJ-45) connector? [yes]:
Operate in full-duplex mode? [no]:
Configure IP on this interface? [yes]:
  IP address for this interface: 1.1.1.20
  Number of bits in subnet field [0]:
  Class C network is 1.1.1.0, 0 subnet bits; mask is /24
Configure IPX on this interface? [yes]:
  IPX network number [2]:
Configure AppleTalk on this interface? [no]: yes
  Extended AppleTalk network? [no]: yes
  AppleTalk starting cable range [0]:
```

Configuring interface Serial1/0:

```
Is this interface in use? [no]: yes
Configure IP on this interface? [no]: yes
Configure IP unnumbered on this interface? [no]:
  IP address for this interface: 1.1.1.30
  Number of bits in subnet field [0]:
  Class A network is 1.0.0.0, 0 subnet bits; mask is 255.0.0.0
Configure IPX on this interface? [no]: yes
  IPX network number [2]:
Configure AppleTalk on this interface? [no]: yes
  Extended AppleTalk network? [no]:
  AppleTalk network number [1]:
```

The following configuration command script was created:

```
hostname Router
enable secret 5 $1$u8z3$PMYY8em./8sszhzk78p/Y0
enable password betty
line vty 0 4
password fred
snmp-server community public
!
ip routing
no vines routing
ipx routing
appletalk routing
no apollo routing
no decnet routing
no xns routing
no clns routing
no bridge 1
! Turn off IPX to prevent network conflicts.
interface ATM1/0
```

```

ip address 1.1.1.10 255.0.0.1
appletalk cable-range 0-0 0.0
appletalk discovery
!

interface FastEthernet1/0
media-type 100BaseX
half-duplex
ip address 1.1.1.20 255.0.0.2
appletalk cable-range 0-0 0.0
appletalk discovery
!
interface serial3/0
ip address 1.1.1.30 255.0.0.3
ip route-cache cbus
no keepalive
!
!
router igrp 15
network 1.0.0.0
!
end

```

```

Use this configuration? [yes/no]: yes
Building configuration...
Use the enabled mode 'configure' command to modify this configuration.

Press RETURN to get started!

```

Your router is now minimally configured and ready to use. You can use the **setup** command if you want to modify the parameters after the initial configuration. To perform more complex configurations, use the **configure** command.

For information on additional interface configuration and specific system configurations, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.

Performing a Basic Configuration Using Global Configuration Mode

You can configure a Cisco 7401ASR router manually if you prefer not to use the setup facility or AutoInstall. Complete the following steps to configure the router manually:

-
- Step 1** Connect a console terminal to the console port.
- Step 2** When asked if you want to enter the initial dialog, answer **no** to go into the normal operating mode of the router:
- ```
Would you like to enter the initial dialog? [yes]: no
```
- Step 3** After a few seconds the user EXEC prompt (`Router>`) is displayed. Type **enable** to enter enable mode (configuration changes can only be made in enable mode):
- ```
Router> enable
```
- The prompt changes to the privileged EXEC prompt:
- ```
Router#
```



- Step 4** Enter the **config terminal** command at the enable prompt to enter configuration mode from the terminal:

```
Router# config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```

At the `Router(config)#` prompt, enter the **interface** *type slot/port* command to enter the interface configuration mode:

```
Router(config)# interface serial slot/port
Router(config-int)#
```

In either configuration mode, you can now enter any changes to the configuration. Press **Ctrl-Z** (hold down the **Control** key while you press **Z**) or enter **end** to exit configuration mode and return to the EXEC command interpreter.

- Step 5** Save your settings to NVRAM. (See the “[Saving the Running Configuration to NVRAM](#)” section on [page 3-21](#).) If you do not save the configuration settings you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you load the router.

---

Your router is now minimally configured and will boot with the configuration you have entered. To see a list of the configuration commands available to you, enter **?** at the prompt while in configuration mode.

## Saving the Running Configuration to NVRAM

To store the configuration or changes to your startup configuration in NVRAM, enter the **copy running-config startup-config** command at the `Router#` prompt:

```
Router# copy running-config startup-config
```

Using this command saves the configuration settings that you created in the router using configuration mode and the setup facility. If you fail to do this, your configuration will be lost the next time you reload the router.

## Checking the Running Configuration Settings

To check the value of the settings you have entered, enter the **show running-config** command at the `Router#` prompt:

```
Router# show running-config
```

To review changes you make to the configuration, use the EXEC mode **show startup-config** command to display the information stored in NVRAM.

## Performing Other Configuration Tasks

To make advanced configuration changes after you establish the basic startup configuration for your router, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware. These publications contain additional information on using the **configure** command.

The configuration publications also provide information about the following tasks:

- Understanding and working with the user interface on your router
- Booting and rebooting the router
- Setting the configuration register—see the *Cisco IOS Configuration Fundamentals Configuration Guide*
- Loading configuration files or system images using remote copy protocol (rcp) or Trivial File Transfer Protocol (TFTP)
- Reloading the operating system

## Replacing or Recovering a Lost Password

This section describes how to recover a lost enable or console login password, and how to replace a lost enable secret password on your Cisco 7401ASR router.

**Note**

---

It is possible to recover the enable or console login password. The enable secret password is encrypted, however, and must be replaced with a new enable secret password.

---

### Overview of the Password Recovery Procedure

Following is an overview of the steps in the password recovery procedure:

- 
- Step 1** If you can log in to the router, enter the **show version** command to determine the existing configuration register value.
- Step 2** Press the **Break** key to get to the bootstrap program prompt (ROM monitor). You might need to reload the system image by power cycling the router.
- Step 3** Change the configuration register so the following functions are enabled:
- a. Break
  - b. Ignore startup configuration
  - c. Boot from Flash memory

**Note**

---

The key to recovering a lost password is to set the configuration register bit 6 (0x0040) so that the startup configuration (usually in NVRAM) is ignored. This allows you to log in without using a password and to display the startup configuration passwords.

---

- Step 4** Power cycle the router by turning power off and then back on.

**Note**

---

After powering off the router, wait at least 30 seconds before powering it on again.

---

- Step 5** Log in to the router and enter the privileged EXEC mode.
- Step 6** Enter the **show startup-config** command to display the passwords.

- Step 7** Recover or replace the displayed passwords.
- Step 8** Change the configuration register back to its original setting.



**Note** To recover a lost password if the Break function is disabled on the router, you must have physical access to the router.

## Details of the Password Recovery Procedure

Complete the following steps to recover or replace a lost enable, enable secret, or console login password:

- Step 1** Attach an ASCII terminal to the console port on your router.
- Step 2** Configure the terminal to operate at 9600 baud, 8 data bits, no parity, and 2 stop bits (9600 8N2).
- Step 3** If you can log in to the router as a nonprivileged user, enter the **show version** command to display the existing configuration register value. Note the value for use later and proceed to Step 6. If you cannot log in to the router at all, go to the next step.
- Step 4** Press the **Break** key or send a Break from the console terminal. If Break is enabled, the router enters the ROM monitor, indicated by the ROM monitor prompt (`rommon1>`). Proceed to Step 6. If Break is disabled, power cycle the router (turn the router off or unplug the power cord, and then restore power). Then proceed to Step 5.
- Step 5** Within 60 seconds of restoring the power to the router, press the **Break** key or send a Break. This action causes the router to enter the ROM monitor and display the ROM monitor prompt (`rommon1>`).
- Step 6** Set the configuration register using the configuration register utility; enter the **confreg** command at the ROM monitor prompt as follows:
- ```
rommon1> confreg
```
- Step 7** Answer **yes** to the enable “ignore system config info?” question, and note the current configuration register settings.
- Step 8** Initialize the router by entering the **reset** command as follows:
- ```
rommon2> reset
```
- The router initializes, the configuration register is set to 0x142, and the router boots the system image from Flash memory and enters the System Configuration Dialog prompt as follows:
- ```
--- System Configuration Dialog ---
```
- Step 9** Enter **no** in response to the System Configuration Dialog prompts until the following message is displayed:
- ```
Press RETURN to get started!
```
- Step 10** Press **Return**. The user EXEC prompt is displayed as follows:
- ```
Router>
```
- Step 11** Enter the **enable** command to enter privileged EXEC mode. Then enter the **show startup-config** command to display the passwords in the configuration file as follows:

```
Router# show startup-config
```

- Step 12** Scan the configuration file display looking for the passwords (the enable passwords are usually near the beginning of the file, and the console login or user EXEC password is near the end). The passwords displayed look something like this:

```
enable secret 5 $1$ORPP$s9syZt4uKn3SnpuLDrhuei
enable password 23skiddoo
.
.
line con 0
password onramp
```

The enable secret password is encrypted and cannot be recovered; it must be replaced. The enable and console login passwords may be encrypted or clear text. Proceed to the next step to replace an enable secret, console login, or enable password. If there is no enable secret password, note the enable and console login passwords, if they are not encrypted, and proceed to [Step 17](#).

**Caution**

Do not execute the next step unless you have determined you must change or replace the enable, enable secret, or console login passwords. Failure to follow the steps as shown might cause you to erase your router configuration

- Step 13** Enter the **configure memory** command to load the startup configuration file into running memory. This action allows you to modify or replace passwords in the configuration.

```
Router# configure memory
```

- Step 14** Enter the privileged EXEC command **configure terminal** to enter configuration mode:

```
Hostname# configure terminal
```

- Step 15** Change all three passwords using the following commands:

```
Hostname(config)# enable secret newpassword1
Hostname(config)# enable password newpassword2
Hostname(config)# line con 0
Hostname(config-line)# password newpassword3
```

Change only the passwords necessary for your configuration. You can remove individual passwords by using the **no** form of the above commands. For example, entering the **no enable secret** command removes the enable secret password.

- Step 16** You must configure all interfaces to be *not* administratively shut down as follows:

```
Hostname(config)# interface fastethernet 0/0
Hostname(config-int)# no shutdown
```

Enter the equivalent commands for all interfaces that were originally configured. If you omit this step, all interfaces are administratively shut down and unavailable when the router is restarted.

- Step 17** Use the **config-register** command to set the configuration register to the original value noted in Step 3 or Step 8, or to the factory default value 0x2102 as follows:

```
Hostname(config)# config-register 0x2102
```

- Step 18** Press **Ctrl-Z** (hold down the **Control** key while you press **Z**) or enter **end** to exit configuration mode and return to the EXEC command interpreter.

**Caution**

Do not execute the next step unless you have changed or replaced a password. If you skipped [Step 13](#) through [Step 16](#), skip to [Step 20](#). Failure to observe this caution causes you to erase your router configuration file.

- Step 19** Enter the **copy running-config startup-config** command to save the new configuration to NVRAM.
- Step 20** Enter the **reload** command to reboot the router.
- Step 21** Log in to the router with the new or recovered passwords.

This completes the steps for recovering or replacing a lost enable, enable secret, or console login password.

Viewing Your System Configuration

You can use the **show version**, **show hardware**, and the **show diag** commands to view information specific to the hardware configuration of your Cisco 7401ASR router.

Use the **show version** (or **show hardware**) command to display the system hardware, processor and the number of interfaces installed, the software version, the names and sources of configuration files, and the boot images.

The following sample output of the **show version** command shows a Cisco 7401ASR running Cisco IOS Release 12.2(1)DD:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7400 Software (C7400-JS-M), Version 12.2(V99.1)
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Sat 19-May-01 11:31 by
Image text-base:0x60008960, data-base:0x617CA000

ROM:System Bootstrap, Version 12.2(1r)DD1, RELEASE SOFTWARE (fc1)
BOOTFLASH:7400 Software (C7400-KBOOT-M),
12.2(20010427:125)

router uptime is 17 hours, 2 minutes
System returned to ROM by reload at 01:09:49 UTC Sat Jan 1 2000
System image file is "tftp://000.000.000.000//tftpboot/biff/122_1_DX/c7400-
mz.V122_1_DX.5.19.01"

cisco 7401ASR (NSE) processor (revision A) with 245760K/16384K bytes of memory
Processor board ID 4294967295
R7000 CPU at 375Mhz, Implementation 39, Rev 3.3, 256KB L2, 2000KB L3 Cache
1 slot ASR midplane, Version 2.0

Last reset from power-on
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
PXF processor tmc is running.
8 Ethernet/IEEE 802.3 interface(s)
2 Gigabit Ethernet/IEEE 802.3 interface(s)
509K bytes of non-volatile configuration memory.
```

64256K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
 8192K bytes of Flash internal SIMM (Sector size 256K).
 Configuration register is 0x100

Use the **show diag** command to determine what type of Fast Ethernet/Ethernet port is active or what type of port adapter is installed in your Cisco 7401ASR router. You can also use the **show diag slot** command to display information about the port adapter slot.

The following example shows the **show diag** command output from a Cisco 7401ASR router. Note that slot 0 is reserved for the native Gigabit Ethernet and Fast Ethernet/Ethernet ports:

**Note**

Both native Gigabit Ethernet and Fast Ethernet/Ethernet ports are reported as Gigabit Ethernet ports. To select either Gigabit Ethernet or Fast Ethernet/Ethernet ports, use the **media-type** command. See the [“Configuring the Native Gigabit Ethernet and Fast Ethernet/Ethernet Interfaces”](#) section on page 3-15.

```
Router# show diag
pxf:tmc type TMC ASIC revision 3
ucode:filename 'system:pxf/ucode0' revision 1.1
state: is running, number of starts 1
uptime:2d04h
Memory Configuration:
  Bank Name                               Total      Reserved  In-use     Free
  tmc internal memory column 0           16 Kb      6656 bytes 0 bytes    9728 bytes
  tmc column 0 memory bank 0             32 Mb      26 Mb      0 bytes    5703 Kb
  tmc internal memory column 1           16 Kb      512 bytes  0 bytes    15 Kb
  tmc column 1 memory bank 0             32 Mb      480 Kb     352 Kb     31 Mb
  tmc internal memory column 2           16 Kb      1536 bytes 512 bytes  14 Kb
  tmc column 2 memory bank 0             32 Mb      23 Kb      32 Kb     31 Mb
  tmc internal memory column 3           16 Kb      10 Kb      0 bytes    5632 bytes
  tmc column 3 memory bank 0             32 Mb      471 Kb     0 bytes    31 Mb
Slot 0:
  C7401 GigabitEthernet I/O Controller Port adapter, 2 ports
  Port adapter is analyzed
  Port adapter insertion time 2d04h ago
  EEPROM contents at hardware discovery:
  Hardware Revision      :0.0
  EEPROM format version 4
  EEPROM contents (hex):
  0x00:04 FF 40 02 80 41 00 00 FF FF FF FF FF FF FF FF
  0x10:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
  0x20:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
  0x30:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
  0x40:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
  0x50:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
  0x60:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
  0x70:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
Slot 1:
  Channelized T1 (CSU) Port adapter, 8 ports
  Port adapter is analyzed
  Port adapter insertion time 00:29:09 ago
  EEPROM contents at hardware discovery:
  Hardware revision 1.0          Board revision A0
  Serial number 21713084        Part number 73-2488-07
  Test history 0x0              RMA number 00-00-00
  EEPROM format version 1
  EEPROM contents (hex):
  0x20:01 72 01 00 01 4B 50 BC 49 09 B8 07 00 00 00 00
  0x30:50 00 00 00 00 09 23 00 FF FF FF FF FF FF FF FF
```

For specific information on the **show version**, **show diag**, and other software commands, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.

Performing Complex Configurations

After you have installed your Cisco 7401ASR router hardware, checked all external connections, turned on the system power, allowed the system to boot up, and minimally configured the system, you might need to perform more complex configurations, which are beyond the scope of this publication.

For information on configuring VPN on the VPN Acceleration Module, see [Chapter 4, “Configuring the VPN Acceleration Module.”](#) For other specific information on system and interface configuration, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.



Configuring the VPN Acceleration Module

This chapter contains the information and procedures needed to configure the VPN Acceleration Module (VAM) in Cisco 7401ASR routers. This chapter contains the following sections:

- [Overview, page 4-1](#)
- [Configuration Tasks, page 4-1](#)

Overview

The VAM provides encryption services for Cisco 7401ASR routers. You must configure IPSec on the router for the VAM to provide encryption services.



Note

There are no interfaces to configure on the VAM.

This chapter contains basic configuration information for enabling encryption and IPSec tunneling services. Refer to the [Cisco Enterprise VPN Configuration Guide](#), the [VPN Acceleration Module Installation and Configuration Guide](#), the “IP Security and Encryption” part of the [Security Configuration Guide](#) and the [Security Command Reference](#) for detailed configuration information on IPSec, IKE, and CA.

Configuration Tasks

If the ENABLE LED is on on power up, the VAM is fully functional and does not require any configuration commands. However, for the VAM to provide encryption services, you must complete the steps in the following sections:

- [Configuring IKE, page 4-2](#) (required)
- [Configuring IPSec, page 4-3](#) (required)



Note

You can configure a static crypto map, create a dynamic crypto map, or add a dynamic crypto map into a static crypto map. Refer to Chapter 3, “[Site-to-Site and Extranet VPN Business Scenarios](#),” of the online publication [Cisco IOS Enterprise VPN Configuration Guide](#).

Optionally, you can configure Certification Authority (CA) interoperability (refer to the “[Configuring Certification Authority Interoperability](#)” chapter in the [Security Configuration Guide](#)).

Using the EXEC Command Interpreter

You modify the configuration of your router through the software command interpreter called the *EXEC* (also called enable mode). You must enter the privileged level of the EXEC command interpreter with the **enable** command before you can use the **configure** command to configure a new interface or change the existing configuration of an interface. The system prompts you for a password if one has been set.

The system prompt for the privileged level ends with a pound sign (#) instead of an angle bracket (>). At the console terminal, use the following procedure to enter the privileged level:

-
- Step 1** At the user-level EXEC prompt, enter the **enable** command. The EXEC prompts you for a privileged-level password as follows:
- ```
Router> enable

Password:
```
- Step 2** Enter the password (the password is case sensitive). For security purposes, the password is not displayed. When you enter the correct password, the system displays the privileged-level system prompt (#):
- ```
Router#
```
-

This completes the procedure for entering the privileged level of the EXEC command interpreter.

Configuring IKE

If you do not specify a value for a parameter, the default value is assigned. For information on default values, refer to the “IP Security and Encryption” chapter of the *Security Command Reference* publication.

To configure a policy, use the following commands, starting in global configuration mode:

	Command	Purpose
Step 1	crypto isakmp policy <i>priority</i>	Identifies the policy to create, and enters config-isakmp command mode.
Step 2	encryption {des 3des}	Specifies the encryption algorithm.
Step 3	group {1 2}	Specifies the Diffie-Hellman group identifier.

For detailed information on creating IKE policies, refer to the “Configuring Internet Key Exchange Security Protocol” chapter in the *Security Configuration Guide* publication.

Configuring IPsec

After you have completed IKE configuration, configure IPsec at each participating IPsec peer. This section contains basic steps to configure IPsec and includes the tasks discussed in the following sections:

- [Creating Crypto Access Lists, page 4-3](#)
- [Defining Transform Sets, page 4-4](#)
- [Creating Crypto Map Entries, page 4-5](#)
- [Verifying the Configuration, page 4-6](#)

For detailed information on configuring IPsec, refer to the “[Configuring IPsec Network Security](#)” chapter in the *Security Configuration Guide* publication.

Creating Crypto Access Lists

Crypto access lists define which IP traffic will be protected by encryption.



Note

IKE uses UDP port 500. The IPsec Encapsulation Security Protocol (ESP) and Authentication Header (AH) protocols use protocol numbers 50 and 51. Ensure that your interface access lists are configured so that protocol numbers 50, 51, and UDP port 500 traffic are not blocked at interfaces used by IPsec. In some cases you might need to add a statement to your access lists to explicitly permit this traffic.

To create crypto access lists, use the following commands in global configuration mode:

Step	Command	Purpose
Step 1	access-list <i>access-list-number</i> { deny permit } <i>protocol source source-wildcard destination destination-wildcard</i> [log] or ip access-list extended <i>name</i>	Specifies conditions to determine which IP packets are protected. ¹ (Enable or disable encryption for traffic that matches these conditions.) We recommend that you configure “mirror image” crypto access lists for use by IPsec and that you avoid using the any keyword.
Step 2	Add permit and deny statements as appropriate.	Adds permit or deny statements to access lists.
Step 3	end	Exits the configuration command mode.

1. You specify conditions using an IP access list designated by either a number or a name. The **access-list** command designates a numbered extended access list; the **ip access-list extended** command designates a named access list.

For detailed information on configuring access lists, refer to the “[Configuring IPsec Network Security](#)” chapter in the *Security Configuration Guide* publication.

Defining Transform Sets

A transform set is a combination of security protocols and algorithms. During the IPSec security association negotiation, peers agree to use a specific transform set to protect a particular data flow.

To define a transform set, use the following commands, starting in global configuration mode:

	Command	Purpose
Step 1	crypto ipsec transform-set <i>transform-set-name transform1</i> [<i>transform2</i> [<i>transform3</i>]]	Defines a transform set and enters crypto transform configuration mode. Note Complex rules define which entries you can use for the transform arguments. These rules are explained in the command description for the crypto ipsec transform-set command, and Table 4-1 provides a list of allowed transform combinations.
Step 2	mode [tunnel transport]	Changes the mode associated with the transform set. The mode setting is applicable only to traffic whose source and destination addresses are the IPSec peer addresses; it is ignored for all other traffic. (All other traffic is in tunnel mode only.)
Step 3	end	Exits the crypto transform configuration mode to enabled mode.
Step 4	clear crypto sa or clear crypto sa peer { <i>ip-address</i> <i>peer-name</i> } or clear crypto sa map <i>map-name</i> or clear crypto sa spi <i>destination-address</i> <i>protocol spi</i>	Clears existing IPSec security associations so that any changes to a transform set take effect on subsequently established security associations (SAs). (Manually established SAs are reestablished immediately.) Using the clear crypto sa command without parameters clears out the full SA database, which clears out active security sessions. You may also specify the peer , map , or entry keywords to clear out only a subset of the SA database.

[Table 4-1](#) shows allowed transform combinations.

Table 4-1 Allowed Transform Combinations

AH Transform ¹		ESP Encryption Transform ¹		ESP Authentication Transform ²	
Transform	Description	Transform	Description	Transform	Description
ah-md5-hmac	AH with MD5 (HMAC variant) authentication algorithm	esp-3des	ESP with 168-bit Triple DES encryption algorithm	esp-md5-hmac	ESP with MD5 (HMAC variant) authentication algorithm

Table 4-1 Allowed Transform Combinations (continued)

AH Transform ¹		ESP Encryption Transform ¹		ESP Authentication Transform ²	
ah-sha-hmac	AH with SHA (HMAC variant) authentication algorithm	esp-des	ESP with 56-bit DES encryption algorithm	esp-sha-hmac	ESP with SHA (HMAC variant) authentication algorithm
		esp-null	ESP transform without cipher		

1. Pick one transform option.
2. Pick one transform option, but only if you selected **esp-null** or ESP encrypting transform.

Creating Crypto Map Entries

To create crypto map entries that use IKE to establish the security associations, use the following commands, starting in global configuration mode:

	Command	Purpose
Step 1	crypto map <i>map-name seq-num ipsec-isakmp</i>	Creates the crypto map and enters crypto map configuration mode.
Step 2	match address <i>access-list-id</i>	Specifies an extended access list. This access list determines which traffic is protected by IPsec and which is not.
Step 3	set peer { <i>hostname ip-address</i> }	Specifies a remote IPsec peer. This is the peer to which IPsec-protected traffic can be forwarded. Repeat for multiple remote peers.
Step 4	set transform-set <i>transform-set-name1 [transform-set-name2...transform-set-name6]</i>	Specifies which transform sets are allowed for this crypto map entry. Lists multiple transform sets in order of priority (highest priority first).
Step 5	end	Exits crypto map configuration mode.
Step 6	Repeat these steps to create additional crypto map entries as required.	

Verifying the Configuration

Some configuration changes take effect only after subsequent security associations are negotiated. For the new settings to take effect immediately, clear the existing security associations.

To clear (and reinitialize) IPSec security associations, use one of the commands in [Table 4-2](#) in global configuration mode:

Table 4-2 Commands to Clear IPSec Security Associations

Command	Purpose
clear crypto sa or clear crypto sa peer {ip-address peer-name} or clear crypto sa map map-name or clear crypto sa spi destination-address protocol spi	Clear IPSec security associations (SAs). Using the clear crypto sa command without parameters clears out the full SA database, which clears out active security sessions. You may also specify the peer , map , or spi keywords to clear out only a subset of the SA database.

The following steps provide information on verifying your configurations:

- Step 1** Enter the **show crypto ipsec transform-set** command to view your transform set configuration:

```
Router# show crypto ipsec transform-set
Transform set combined-des-md5: {esp-des esp-md5-hmac}
  will negotiate = {Tunnel,},
Transform set t1: {esp-des esp-md5-hmac}
  will negotiate = {Tunnel,},
Transform set t100: {ah-sha-hmac}
  will negotiate = {Transport,},
Transform set t2: {ah-sha-hmac}
  will negotiate = {Tunnel,},
  {esp-des}
  will negotiate = {Tunnel,},
```

- Step 2** Enter the **show crypto map [interface interface | tag map-name]** command to view your crypto map configuration:

```
Router# show crypto map
Crypto Map: "router-alice" idb: Ethernet0 local address: 172.21.114.123
Crypto Map "router-alice" 10 ipsec-isakmp
  Peer = 172.21.114.67
  Extended IP access list 141
    access-list 141 permit ip
      source: addr = 172.21.114.123/0.0.0.0
      dest:   addr = 172.21.114.67/0.0.0.0
  Current peer: 172.21.114.67
  Security-association lifetime: 4608000 kilobytes/120 seconds
  PFS (Y/N): N
  Transform sets={t1,}
```

- Step 3** Enter the **show crypto ipsec sa [map map-name | address | identity | detail | interface]** command to view information about IPSec security associations.

```
Router# show crypto ipsec sa
interface: Ethernet0
  Crypto map tag: router-alice, local addr. 172.21.114.123
  local ident (addr/mask/prot/port): (172.21.114.123/255.255.255.255/0/0)
```

```

remote ident (addr/mask/prot/port): (172.21.114.67/255.255.255.255/0/0)
current_peer: 172.21.114.67
  PERMIT, flags={origin_is_acl,}
#pkts encaps: 10, #pkts encrypt: 10, #pkts digest 10
#pkts decaps: 10, #pkts decrypt: 10, #pkts verify 10
#send errors 10, #recv errors 0
local crypto endpt.: 172.21.114.123, remote crypto endpt.: 172.21.114.67
path mtu 1500, media mtu 1500
current outbound spi: 20890A6F
inbound esp sas:
  spi: 0x257A1039(628756537)
    transform: esp-des esp-md5-hmac,
    in use settings ={Tunnel,}
    slot: 0, conn id: 26, crypto map: router-alice
    sa timing: remaining key lifetime (k/sec): (4607999/90)
    IV size: 8 bytes
    replay detection support: Y
inbound ah sas:
outbound esp sas:
  spi: 0x20890A6F(545852015)
    transform: esp-des esp-md5-hmac,
    in use settings ={Tunnel,}
    slot: 0, conn id: 27, crypto map: router-alice
    sa timing: remaining key lifetime (k/sec): (4607999/90)
    IV size: 8 bytes
    replay detection support: Y
outbound ah sas:
interface: Tunnel0
Crypto map tag: router-alice, local addr. 172.21.114.123
local ident (addr/mask/prot/port): (172.21.114.123/255.255.255.255/0/0)
remote ident (addr/mask/prot/port): (172.21.114.67/255.255.255.255/0/0)
current_peer: 172.21.114.67
  PERMIT, flags={origin_is_acl,}
#pkts encaps: 10, #pkts encrypt: 10, #pkts digest 10
#pkts decaps: 10, #pkts decrypt: 10, #pkts verify 10
#send errors 10, #recv errors 0
local crypto endpt.: 172.21.114.123, remote crypto endpt.: 172.21.114.67
path mtu 1500, media mtu 1500
current outbound spi: 20890A6F
inbound esp sas:
  spi: 0x257A1039(628756537)
    transform: esp-des esp-md5-hmac,
    in use settings ={Tunnel,}
    slot: 0, conn id: 26, crypto map: router-alice
    sa timing: remaining key lifetime (k/sec): (4607999/90)
    IV size: 8 bytes
    replay detection support: Y
inbound ah sas:
outbound esp sas:
  spi: 0x20890A6F(545852015)
    OL-5419-01 B0transform: esp-des esp-md5-hmac,
    in use settings ={Tunnel,}
    slot: 0, conn id: 27, crypto map: router-alice
    sa timing: remaining key lifetime (k/sec): (4607999/90)
    IV size: 8 bytes
    replay detection support: Y
outbound ah sas:

```

For a detailed description of the information displayed by the **show** commands, refer to the “[IP Security and Encryption](#)” chapter of the *Security Command Reference* publication. For more information on the VAM, see the *VPN Acceleration Module Installation and Configuration Guide*.



Troubleshooting

Your Cisco 7401ASR router went through extensive testing before leaving the factory. However, if you encounter problems starting the router, use the information in this chapter to help isolate the cause of the problems. This chapter contains the following sections:

- [Troubleshooting Overview, page 5-1](#)
- [Problem Solving Using a Subsystems Approach, page 5-2](#)
- [Upgrading the Boot Helper \(Boot Loader\) Image, page 5-7](#)
- [PXF Troubleshooting Information, page 5-8](#)

The procedures in this chapter assume that you are troubleshooting the initial system startup, and that your router is in the original factory configuration. If you have removed or replaced components or changed any default settings, the recommendations in this chapter might not apply. Make sure to review the safety warnings listed in the publication *Cisco 7401ASR Regulatory Compliance and Safety Information* that accompanied your Cisco 7401ASR router before using the troubleshooting procedures in this chapter.

Troubleshooting Overview

This section describes the troubleshooting methods used in this chapter and describes how the Cisco 7401ASR router is divided into subsystems for more efficient problem solving. If you are unable to easily solve the problem, contact a customer service representative for assistance and further instructions. Provide the representative with the following information:

- Date you received the router
- Chassis serial number
- Type of software and release number
- Brief description of the problem you are having
- Brief explanation of the steps you have taken to isolate and resolve the problem
- Maintenance agreement or warranty information

The following table shows the general troubleshooting strategy described in this appendix. Refer to this table, as necessary, to follow the steps to isolate problems to a specific subsystem; resolve the problem if possible.

	Action	Yes	No
Step 1	Turn power on. Go to Step 2.	—	—
Step 2	Green STATUS LED on?	Go to Step 4.	Troubleshoot power system, and go to Step 3.
Step 3	Green STATUS LED on?	Go to Step 4.	Obtain technical assistance.
Step 4	Fans operating?	Go to Step 6.	Troubleshoot cooling subsystem, and go to Step 5.
Step 5	Fans operating?	Go to Step 6.	Obtain technical assistance.
Step 6	GBIC ENABLE LEDs and FE (100 Mbps) LEDs on?	Go to Step 8.	Check all cable connections and restart system. Check that the GBIC is fully seated. Go to Step 7.
Step 7	GBIC ENABLE LEDs and FE (100 Mbps) LEDs on?	Go to Step 8.	Obtain technical assistance
Step 8	Port adapter ENABLE LEDs on?	Go to Step 10.	Reseat port adapters and restart system. Go to Step 9.
Step 9	Port adapter ENABLE LEDs on?	Go to Step 10.	Obtain technical assistance.
Step 10	System startup successful.	—	—

In addition to following the subsystems approach to troubleshooting, Cisco Registered Direct users can access troubleshooting tools at http://www.cisco.com/kobayashi/support/tac/tools_az.shtml.

Problem Solving Using a Subsystems Approach

The key to solving problems with the system is isolating the problem to a specific subsystem. The first step in solving startup problems is to compare what the system *is doing* to what it *should be doing*. Because a startup problem is usually caused by a single component, it is more efficient to first isolate the problem to a subsystem rather than troubleshoot each component in the system. For these troubleshooting procedures, consider the following subsystems:

- Power subsystem—This subsystem comprises the power supply, the external power cable, and the system board.
- Cooling subsystem—The fans should be operating whenever system power is on. Contact your customer service representative if you determine a fan is not functioning properly.
- Processor subsystem—This subsystem includes the processing and input/output functions, the port adapter or service adapter, and system memory and management functions. The ENABLE LED on the port adapter indicates if the port adapter is initialized. A port adapter that is partially installed can cause the system to pause indefinitely and reload.

The following sections help you isolate a problem to one of these subsystems and direct you to the appropriate troubleshooting section.

Identifying Startup Problems

Startup problems are commonly due to the source power or to a port adapter or service adapter that is dislodged from the system board. Although an over temperature condition is unlikely at initial startup, the environmental monitoring functions are included in this chapter because they also monitor internal voltages.

When you start up the router for the first time, you should observe the startup sequence described in the [“Starting the System and Observing Initial Conditions” section on page 3-9 in Chapter 3, “Starting and Configuring.”](#) This section contains a more detailed description of the normal startup sequence and describes the steps to take if the system does *not* perform that sequence as expected.

LEDs indicate all system states in the startup sequence. By checking the state of the LEDs, you can determine when and where the system failed in the startup sequence. Use the following descriptions to isolate the problem to a subsystem, and then proceed to the appropriate sections to try to resolve the problem.

When you start up the system by turning on the power supply switch, the following should occur:

- You should immediately hear the fans operating. If not, proceed to the [“Troubleshooting the Cooling Subsystem” section on page 5-5](#). If you determine that the power supply is functioning normally and that a fan is faulty, contact a customer service representative. If a fan does not function properly at initial startup, there are no installation adjustments that you should make.
- The STATUS LED should come on. As the system boots to ROM monitor state, the STATUS LED is amber. The STATUS LED turns green when the system boots to the Cisco IOS state. If the system does not boot properly, call your local service representative.
- The native GBIC ENABLE and 100 Mbps LEDs should come on as follows:
 - The 100 Mbps LED comes on and indicates that a Fast Ethernet port (0 or 1) is initialized and enabled for operation by the system. This LED comes on during a successful router boot and remains on during normal operation of the router. If this LED remains off when you start the router, it is probably a problem with the Fast Ethernet port. Consult the table on page 5-2.
 - The GBIC ENABLE LED comes on and indicates that a GBIC port (0 or 1) is initialized and enabled for operation by the system. This LED comes on during a successful router boot and remains on during normal operation of the router.

If this LED remains off when you start the router, it is probably a problem with the Gigabit Ethernet port. Consult the table on page 5-2.
 - The GBIC LINK LED comes on only when a router Gigabit Ethernet port (0 or 1) is receiving a carrier signal from the network. This LED remains off during normal operation of the router unless there is an incoming carrier signal, and does not indicate startup problems.
 - The FE LINK LED comes on only when a router Fast Ethernet port (0 or 1) is receiving a carrier signal from the network. This LED remains off during normal operation of the router unless there is an incoming carrier signal, and does not indicate startup problems.
- The ENABLED LED on the port adapter or service adapter comes on when the processor completes its initialization of the adapter for operation. The ENABLED LED indicates that the adapter is receiving power and has been recognized by the processor; it does not indicate the state of the individual interfaces on the adapters. If an ENABLED LED fails to come on, proceed to the [“Upgrading the Boot Helper \(Boot Loader\) Image” section on page 5-7](#).
- When all LEDs come on to indicate that the system has booted successfully, the initial system banner should be displayed on the console screen. If it is not displayed, see [Appendix A, “Specifications,”](#) the [“Console and Auxiliary Port Signals and Pinouts” section on page A-8](#) to verify that the terminal is set correctly and that it is properly connected to the console port.

Troubleshooting the Power Subsystem

Check the following to help isolate a problem with the power subsystem:


Note

If the system powers off, wait at least one minute before manually rebooting the system, or it will pause indefinitely.

Table 5-1 Troubleshooting the Power Subsystem

Symptom	Possible Cause	Possible Solution
System begins power on, amber STATUS LED comes on.	System has failed to boot Cisco IOS, turning the STATUS LED green.	Power off, and reboot the system. Check to be sure you are using the correct Cisco IOS release. If Cisco IOS does not boot, and the green STATUS LED is not displayed, contact a service representative.
System does not power on.	AC power cable not fully seated at system or at the wall outlet (power source).	Turn the router power switch to the off position and reseal the AC power cable at the system or at the wall outlet (power source).
	DC power cable not turned on at the panel board of the circuit breaker.	Turn the router power switch to the off position and locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the on position.
	Power source is faulty.	Turn the switch off, connect the power cable to another power source, if available, and turn the router power switch back on.
	Faulty power cable.	Turn the switch to the off position, remove the cable and replace it.
	Faulty power supply.	If the system still fails to come up when the power supply is connected to a different power source with a new power cable, the power supply is probably faulty. Contact a service representative.
System powers off, no STATUS LED, and no operating fans.	Power supply failure.	Contact a service representative.

Troubleshooting the Cooling Subsystem

Check the following to help isolate a problem with the cooling subsystem:

Table 5-2 Troubleshooting the Cooling Subsystem

Symptom	Possible Cause	Possible Solution
System displays the following message: Router: 00:03:46:%ENVM-3-BLOWER:Fan 2 may have failed	One or more fans are not operating.	Contact a service representative.
System shuts down, some fans may or may not continue to rotate, and this error message is displayed: Queued messages: %ENVM-1-SHUTDOWN: Environmental Monitor initiated shutdown This error message indicates that the system has detected an overtemperature condition or out-of-tolerance power condition inside the chassis.	<ul style="list-style-type: none"> One or more fans are not operating. The fans are operating too slowly. The power supply is not operating. <p>To determine if the fans are operating, listen for them. In noisy environments, place your hand on the rear of the chassis to feel if air is being forced out the vents.</p>	Contact a service representative.
	Heated exhaust air from other equipment is entering the router's inlet vents.	Move other equipment or the router to ensure proper airflow.
System shuts down and this error message is displayed: Queued messages: %ENVM-1-SHUTDOWN: Environmental Monitor initiated shutdown This error message indicates that the system has detected an overtemperature condition or out-of-tolerance power condition inside the chassis. Note The system fans may continue to operate although the system shuts down.	The error message could indicate a faulty component or temperature sensor. Before the system shuts down, use the show environment or show environment table command to display the internal chassis environment. See Chapter 3, "Starting and Configuring," the "Reporting Functions" section on page 3-5 for descriptions of the show environment and show environment table commands.	Contact a service representative.
	If an environmental shutdown results from an out-of-tolerance power condition, the system shuts down.	If the system still fails to come up when the power supply is connected to a different power source with a new power cable, the power supply is probably faulty. Contact a service representative.

Troubleshooting the I/O Subsystem

The procedures in this section assume that you have not made changes to your configuration file.

If the Cisco 7401ASR router I/O LEDs do not go on as expected (see the [“Identifying Startup Problems” section on page 5-3](#)), check the following items to help isolate the problem:

Table 5-3 *Troubleshooting the I/O Subsystem*

Symptom	Possible Cause	Possible Solution
LEDs remain off when the system power switch is turned on.	Power supply or cooling subsystem is faulty.	If the LEDs stay off, first see the “Troubleshooting the Power Subsystem” section on page 5-4 and the “Troubleshooting the Cooling Subsystem” section on page 5-5 to ensure that both the fans and the power supply are functioning properly.
Power supply and fans appear operational, but none of the I/O LEDs are on.	The improperly connected port adapter has indefinitely paused the system.	Reseat the port adapter, tighten the screw of the port adapter latch, and then restart the system.
The prior configuration—native Gigabit Ethernet or the Fast Ethernet/Ethernet—LEDs remain on after configuring the ports to change the configuration from one Ethernet type to the other.	The media-type command was not used when changing the configuration of these ports.	See Chapter 3, “Starting and Configuring,” the “Configuring the Native Gigabit Ethernet and Fast Ethernet/Ethernet Interfaces” section on page 3-15 .

Troubleshooting the Processor Subsystem

The processor subsystem comprises the system board and the port adapter. A port adapter that is partially connected to the system board sends incomplete signals to the processor, which faults the PCI bus and causes the system to pause indefinitely. Therefore, first ensure that the system software has initialized successfully and then check to see if the port adapter is fully connected.

Troubleshooting the Port Adapter or Service Adapter

Check the following to help isolate a problem with the port adapter or service adapter:

Table 5-4 *Troubleshooting the Port Adapter or Service Adapter*

Symptom	Possible Cause	Possible Solution
Port adapter or service adapter ENABLE LED is off.	The port adapter or service adapter might have pulled away from the system board.	Reseat the adapter in its slot (you do not have to turn off the system power when removing or replacing port adapter and service adapters). After the system reinitializes the interfaces, the ENABLE LED on the port adapter or service adapter should go on. If the ENABLE LED remains off, the system detected a processor hardware failure. (This LED should be on in normal operation.) Contact a service representative for instructions.

Upgrading the Boot Helper (Boot Loader) Image

The boot helper (boot loader) image resides in Flash memory and contains a subset of the Cisco IOS software. This image is used to boot your router from the network or to load Cisco IOS images onto the router. This image is also used if the system cannot find a valid system image.

Your boot helper (boot loader) image should correspond to the Cisco IOS release that is running on your router.



Note

The Cisco 7401ASR router requires the c7400-kboot-mz boot helper image.

To upgrade your boot helper (boot loader) image, obtain the most current boot helper image through Cisco.com and copy the new boot helper image to Flash memory on your router. For information on how to access Cisco.com, see the “Cisco.com” section in the Preface. Follow the Software Center link under Service and Support. You need to get a login code from a Cisco representative to retrieve files from the Software Center.

To obtain a boot helper (boot loader) image from Cisco.com and upgrade your bootflash, do the following:

Step 1 Download the boot helper (boot loader) image from Cisco.com to a Trivial File Transfer Protocol (TFTP) server.

Step 2 Reformat the Flash memory on your router as follows:

```
router# format bootflash:
Format operation may take a while. Continue? [confirm]
Format operation will destroy all data in "bootflash:". Continue? [confirm]
Formatting sector ...
Format of bootflash:complete
```



Note Reformatting Flash memory erases the current Flash memory contents.

Step 3 Copy the boot helper image from the TFTP server to Flash memory as follows:

```
router# copy tftp bootflash:
Address or name of remote host []? biff
Source filename []? c7200-boot-mz.120-5.S
Destination filename [c7200-boot-mz.120-5.S]?
Accessing tftp://biff/c7200-boot-mz.120-5.S...
Loading c7200-boot-mz.120-5.S from 192.168.254.254 (via
Ethernet4/0):!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 3132516/6264832 bytes]

3132516 bytes copied in 28.488 secs (111875 bytes/sec)
```

This completes the procedure for upgrading your boot helper (boot loader) image. For more detailed instructions on loading and maintaining system images and microcode, including boot helper images, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide*, which is available on Cisco.com.

PXF Troubleshooting Information



Note

The VPN Acceleration Module (VAM) is not compatible with the PXF processor.

Cisco IOS Statistics Not Supported by PXF

Some standard Cisco IOS statistics are not supported in the PXF path, including:

- Subinterface counters
- ATM VC counters
- Class-match statistics on classes with neither policing nor class-based weighted fair queuing (CBWFQ)

Features Not Supported by PXF

Features that are not supported by PXF are punted to the Route Processor (RP), which can cause high RP CPU usage.

High PXF CPU Usage

Enter the **show pxf accounting summary** command to display information about PXF CPU usage:

```
Router# show pxf accounting summary
.
.
.
10 second averages: PXF complex busy: 1% PXF read pipeline full: 0%
```

The PXF has 16 processors, only one of which is in use at a time when there is a low traffic rate. Even though only one of the processors is working, all of the PXF processors are slightly slowed. At higher traffic rates, many of the PXF processors are working at the same time, but there is no additional slow down.

High Route Processor CPU Usage

High RP CPU usage may result from punting of packets from the PXF processors to the RP. Enter the **show pxf accounting summary** command to view the number and cause of punts.

```
Router# show pxf accounting summary

Pkts          Dropped   RP Processed   Ignored
              Total           0             48360           0

PXF Statistic:
Packets RP -> PXF:
  switch ip:           0
  switch raw:        30048360
  qos fastsend:       0
  qos enqueue:        1938
Total:                30050298

Packets PXF -> RP:
  qos pkts:            1938
  fast pkts:          30000000
  drops:total         0
  punts:total         48360
    " not IP          :      40572
    " CEF no adjacency :      7788
Total:                30050298
```



```

Packets ignored:          0 | ring space:
  shadow ring full:      0 |   shadow ring:      16384
  in ring full:         0 |   inring:          968
  PXF inactive:         0 |
tx credits:              16230330 | delayed credits:      0
holdq enqueues:         0 | requeue drops:       0
interrupts:             40538 | interrupt misses:    1947
interrupt packets:     53326 |
pending read bytes:    0 |

```

Interface	Pkts In	Chars In	Pkts Out	Chars Out	Punted	Dropped
Fa0/0	0	0	30000000	1740000000	970	0
Et1/0	0	0	0	0	21309	0
Et1/1	0	0	0	0	0	0
Et1/2	0	0	0	0	0	0
Et1/3	0	0	0	0	0	0
Se2/0	0	0	0	0	963	0
Se2/1	0	0	0	0	0	0
Se2/2	0	0	0	0	0	0
Se2/3	0	0	0	0	0	0
Fa3/0	0	0	0	0	963	0
PO4/0	30000000	1440000000	0	0	963	0
AT5/0	0	0	0	0	23192	0
Vi1	0	0	0	0	0	0
Vt1	0	0	0	0	0	0
Vi2	0	0	0	0	0	0
Vt2	0	0	0	0	0	0

**Note**

CPU usage becomes more efficient as packet load increases. For example, if you are running at 60% CPU with only 33% of customer load on the system, this does not mean that you need 180% CPU for 100% of customers. Part of the original 60% CPU usage is overhead usage, which does not increase as packet load increases.

Ignored Packets

Packet ignores on an interface may result from high CPU usage. Enter the **show interfaces** command to display any input ignores:

```

Router# show interfaces ethernet 0/0
  Ethernet0/0 is up, line protocol is up
  ...
  21 input errors, 0 CRC, 0 frame, 0 overrun, 21 ignored

```

Packets are ignored if there is no available CPU to accept the new packet. This can happen if the router is overloaded with traffic, but can also happen if the interface is faulty. If ignores are present on all interfaces, then the router is probably overloaded with traffic, or does not have sufficient free buffers in the pool that match the maximum transmission unit (MTU) on interfaces. In the latter case, an increment of the ignored counter is followed by an increment of the no buffer counter:

```

Router# show interfaces serial 0/0
  ...
  1567 packets input, 0 bytes, 22 no buffer
  22 input errors, 0 CRC, 0 frame, 0 overrun, 22 ignored, 0 abort

```

No Buffers

If there are too many buffers configured for the output hold queue on an interface, this can use memory and result in dropped input packets. Enter the **show running-config** command and the **show interfaces** command to display the status of the incoming packet interfaces.

Priority and Policing Configured in the Class Policy

PXF does not support a configured priority and policing in the same class of a policy.

PXF Punts

If a feature that is supported in the PXF path appears not to be working, it could be the result of PXF failing to punt packets when it should. If you have only particular interfaces running the feature, you can configure a feature that PXF does not support on that interface to force PXF to punt packets.

QoS Fast-send and QoS Enqueue

PXF is responsible for managing the outbound traffic queues on an interface on which output QoS queueing is configured. All traffic destined for this interface must be processed by PXF, including both keepalive packets that originate in the router, known as QoS Fast-send packets, and packets that are switched in IOS, known as QoS Enqueue packets. If there is excessive traffic on the QoS Enqueue or on the QoS Fast-send path, QoS functionality can be disrupted. Use the **show pxf accounting summary** command to display the QoS Fast-send and QoS Enqueue packets:

```
Router# show pxf accounting summary
.
.
.
qos fastsend:          8
qos enqueue:          5
```

WFQ Queues

When there is an increase in ignored packets and in the no buffer count, it is possible that the output weighted fair queueing (WFQ) queues are too long. To specify the number of dynamic queues to be reserved for use by the class-default class as part of the default class policy, use the **fair-queue** policy-map class configuration command; for example:

```
Router# fair-queue

policy-map policy9
  class class-default
    fair-queue 16
    queue-limit 20
```



Specifications

This appendix provides system and component specifications for the Cisco 7401ASR router.

The following topics are found in this appendix:

- [System Specifications, page A-1](#)
- [Software Requirements, page A-2](#)
- [Processor Specifications, page A-3](#)
- [Memory Specifications and Configurations, page A-3](#)
- [Gigabit Ethernet GBIC Configurations and Port and Cabling Specifications, page A-4](#)
- [Fast Ethernet/Ethernet RJ-45 Port Pinouts, page A-6](#)
- [Console and Auxiliary Port Signals and Pinouts, page A-8](#)
- [Alarm Port, page A-9](#)
- [Lithium Battery Caution, page A-9](#)

System Specifications

Table A-1 Cisco 7401ASR System Specifications

Description	Specification
System	Two primary PCI buses with an aggregate bandwidth of 600 Mbps ¹
Dimensions (H x W x D)	1.72 in. x 17.3 in. x 11.80 in. (4.37 cm x 43.9 cm x 30 cm)
Weight	Chassis fully configured with a port adapter ~ 10.5 lb (4.76 kg)
Heat dissipation	50W (170 BTU ²) typical, 75W (255 BTU) maximum
Power dissipation	75W maximum configuration
AC Power Supply Information	
AC-input power	75W maximum (single supply configuration)
AC-input voltage rating	100–240 VAC ³ wide input with power factor correction
AC-input current rating	Rated for 2A Not to exceed 1.0A ⁴ maximum at 100 VAC and .05A maximum at 240 VAC
AC-input frequency rating	50–60 Hz ⁵

Table A-1 Cisco 7401ASR System Specifications (continued)

Description	Specification
AC-input cable	18 AWG ⁶ three-wire cable, with a three-lead IEC-320 receptacle on the power supply end, and a country-dependent plug on the power source end
DC Power Supply Information	
DC-input power	75W maximum configuration
24V DC-input voltage ratings	+24 VDC nominal. Maximum range +20 to +36 VDC
24V DC-input current ratings	Rated for 5A. 3.0A at +24 VDC, 3.75A at +20 VDC (50VA/28 VDC = 1.8A typical draw)
24V DC-input cable	18 AWG recommended minimum, with at least 2 conductors rated for at least 140°F (60°C)
48V Single and Dual DC Power Supply Information	
48V DC-input voltage rating	–48 VDC ⁷ nominal in North America, –60 VDC nominal in some areas of the European Community. Maximum range is –40.5 to 72 VDC (75 VDC for 5 mA).
48V DC-input current rating	Rated for 3A. Not to exceed 1.6A max. at –48 VDC. Not to exceed 2.0A max. at –40.5 VDC (50VA/–54 VDC = 1.0A typical draw)
48V DC-input cable	18 AWG stranded recommended minimum, rated for at least 140°F (60°C)
Temperature	32 to 104°F (0 to 40°C) operating; –4 to 149°F (–20 to 65°C) nonoperating
Humidity	10% to 90% noncondensing

1. Mbps = megabits per second
2. BTU = British thermal units
3. VAC = volts alternating current
4. A = amperes
5. Hz = hertz
6. AWG = American Wire Gauge
7. VDC = volts direct current

Software Requirements

The minimum software requirements for the Cisco 7401ASR router are:

- Cisco IOS Release 12.2 DX
- Cisco IOS Release 12.2(1)DD
- Cisco IOS Release 12.2(4)B
- Cisco IOS Release 12.2(9)YE
- To check the minimum software requirements of Cisco IOS software with the hardware installed on your router, Cisco maintains the [Software Advisor](#) tool on Cisco.com. This tool does not verify whether modules within a system are compatible, but it does provide the minimum IOS requirements for individual hardware modules or components.



Note

Access to this tool is limited to users with Cisco.com login accounts.

Processor Specifications

Table A-2 Processor Specifications

Memory Type	Size	Quantity	Description
SDRAM	128 MB, 256 MB, 512 MB	1	128-MB, 256-MB, or 512-MB DIMM
Boot ROM	512 KB	1	OTP ¹ ROM for the ROM monitor program
Primary cache	16 KB (instruction), 16 KB (data)	—	RM7000 processor, internal cache
Secondary cache	256 KB	—	RM7000 processor; internal, unified cache
Tertiary cache	2 MB (fixed)	—	RM7000 processor, external cache ²

1. OTP = one time programmable
2. Located on the processor engine board

Memory Specifications and Configurations

Table A-3 Memory Specifications

Type	Quantity	Size	Memory Description
Flash memory	1	8 MB	Contains the default boot helper (boot loader) image
CompactFlash Disk	1	64 MB or 128 MB	Contains the default Cisco IOS image
NVRAM	1	512 KB	Nonvolatile EPROM for the system configuration file

Table A-4 Memory Configurations

Total SDRAM	Quantity	Product Number
128 MB	1 128-MB DIMM	MEM-7400ASR-128MB=
256 MB	1 256-MB DIMM	MEM-7400ASR-256MB=
512 MB	1 512- MB DIMM	MEM-7400ASR-512MB=

Table A-5 CompactFlash Disk Configuration

Memory Size	Product Number
64 MB	MEM-COMP-FLD64M=
128 MB	MEM-COMP-FLD128M=

Gigabit Ethernet GBIC Configurations and Port and Cabling Specifications

The Gigabit Interface Converter (GBIC) port is a 1000-Mbps optical interface in the form of an SC-type duplex port that supports IEEE 802.3z interfaces compliant with the 1000BASEX standard.



Note

The GBIC is a separately orderable part and does not ship installed in your Cisco 7401ASR router. You must install the GBIC before you connect the cables to it.



Note

Optical fiber cables are commercially available; they are not available from Cisco Systems.

Table A-6 GBIC Transmit Power, Receive Power, and Power Budget

GBIC	Transmit Power		Receive Power		Power Budget
	Minimum	Maximum	Minimum	Maximum	
GBIC-SX= or WS-G5484=	-9.5 dBm ¹	-4 dBm ¹	-17 dBm	0 dBm	7.5 dBm ²
GBIC-LX/LH= or WS-G5486=	-9.5 dBm ³ -11.5 dBm ⁴	-3 dBm ⁵	-20 dBm	-3 dBm	7.5 dBm ⁶ and 8.0 dBm ⁷
GBIC-ZX= or WS-G5487=	0 dBm	5.2 dBm	-24 dBm	-3 dBm	-24 dBm

1. For fiber types 50/125 μm , NA = 0.20 fiber and 62.5/125 μm , NA = 0.275 fiber.
2. For fiber types 50 μm MMF and 62.5 μm MMF.
3. For fiber types 9/125 μm SMF.
4. For fiber types 62.5/125 μm MMF and 50/125 μm MMF.
5. For fiber types 9/125 μm SMF, 62.5/125 μm MMF, and 50/125 μm MMF.
6. For fiber types 50 μm MMF and 62.5 μm MMF.
7. For fiber type 10 μm SMF.

GBIC Cabling and Connection Equipment

[Table A-7](#) provides cabling specifications for the GBICs that you install in Gigabit Ethernet ports. Note that all GBIC ports have SC-type connectors. Also, the minimum cable distance for the WS-G5484= or GBIC-SX and GBIC-LX/LH or WS-G5486 (multimode fiber [MMF] and single-mode fiber [SMF]) is 6.5 feet (2 m), and the minimum link distance for the GBIC-ZX or WS-G5487 is 6.2 miles (10 km) with an 8-dB attenuator installed at each end of the link. Without attenuators, the minimum link distance for the GBIC-ZX or WS-G5487 is 24.9 miles (40 km).

Table A-7 GBIC Port Cabling Specifications

GBIC	Wave-length (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
GBIC-SX or WS-G5484	850	MMF ¹	62.5	160	722 ft (220 m)
			62.5	200	902 ft (275 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)
GBIC-LX/LH or WS-G5486	1300	MMF ² and SMF	62.5	500	1804 ft (550 m)
			50.0	400	1804 ft (550 m)
			50.0	500	1804 ft (550 m)
			9/10	—	6.2 miles (10 km)
GBIC-ZX ^{3,4} or WS-G5487 Extended distance (1000BASEZX) ⁵	1550	SMF	9/10	—	43.5 miles (70 km)
		SMF ⁶	8	—	62.1 miles (100 km)

- Multimode fiber (MMF) only.
- A mode-conditioning patch cord is required.
When using the GBIC-LX/LH or WS-G5486 with 62.5-micron diameter MMF, you must install a mode-conditioning patch cord between the GBIC and the MMF cable on both the transmit and the receive ends of the link when link distances are greater than 984 ft (300 m).
We do not recommend using the GBIC-LX/LH or WS-G5486 and MMF with no patch cord for very short link distances (tens of meters). The result could be an elevated bit error rate (BER).
- You can have a maximum of 12 1000BASEZX GBICs per system to comply with EN55022 Class B regulations and 24 1000BASEZX GBICs per system to comply with FCC Class A regulations.
- The minimum link distance for the GBIC-ZX or WS-G5487 is 6.2 miles (10 km) with an 8-dB attenuator installed at each end of the link. Without attenuators, the minimum link distance for the GBIC-ZX or WS-G5487 is 24.9 miles (40 km).
- Contains a Class 1 laser of 1550 nm for 1000BASEZX (extended wavelength) applications.
- Dispersion-shifted single-mode optical fiber cable.

A mode-conditioning patch cord can be used with the GBIC-LX/LH or WS-G5486 to allow reliable laser transmission between the single-mode laser source on the GBIC and a multimode optical fiber cable.

GBIC-SX or WS-G5484

The GBIC-SX or WS-G5484 operates on standard multimode fiber-optic link spans of up to 1804 feet (550 m).

GBIC-LX/LH or WS-G5486

The GBIC-LX/LH or WS-G5486 1000BASELX/LH (long wavelength/long haul) GBIC interfaces fully comply with the IEEE 802.3z 1000BASELX standard. However, their higher optical quality allows them to reach 10 km over single-mode fiber (SMF) versus the 3.1 miles (5 km) specified in the standard.

GBIC-ZX or WS-G5487

The 1000BASEZX (extended wavelength) GBIC operates on ordinary single-mode fiber-optic link spans of up to 43.5 miles (70 km). Link spans of up to 62.1 miles (100 km) are possible using premium single-mode fiber or dispersion-shifted single-mode fiber (premium single-mode fiber has a lower attenuation per unit length than ordinary single-mode fiber; dispersion-shifted single-mode fiber has both lower attenuation and less dispersion).

The 1000BASEZX GBIC must be coupled to single-mode fiber-optic cable, which is the type of cable typically used in long-haul telecommunications applications. The 1000BASE-ZX GBIC will not operate correctly when coupled to multimode fiber, and it is not intended to be used in environments where multimode fiber is frequently used (for example, building backbones, horizontal cabling).

The 1000BASEZX GBIC is intended to be used as a Physical Medium Dependent (PMD) component for Gigabit Ethernet interfaces found on various switch and router products. It operates at a signaling rate of 1250 Mbaud, transmitting and receiving 8B/10B encoded data.

When shorter lengths of single-mode fiber are used, it may be necessary to insert an in-line optical attenuator in the link to avoid overloading the receiver.

- Insert a 10-dB in-line optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASEZX GBIC at each end of the link whenever the fiber-optic cable span is less than 15.5 miles (25 km).
- Insert a 5-dB in-line optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASEZX GBIC at each end of the link whenever the fiber-optic cable span is equal to or greater than 15.5 miles (25 km) but less than 31 miles (50 km).



Note

Fiber-optic cables are commercially available; they are not available from Cisco Systems.

Fast Ethernet/Ethernet RJ-45 Port Pinouts

The Cisco 7401ASR router has RJ-45 ports for the two Fast Ethernet/Ethernet connections. The RJ-45 ports support IEEE 802.3 (Ethernet) and IEEE 802.3u (Fast Ethernet) interfaces compliant with 10BASET and 100BASETX specifications.

The RJ-45 ports support standard straight-through and crossover Category 5 UTP cables with RJ-45 connectors. Cisco Systems does not supply Category 5 UTP cables; these cables are available commercially.

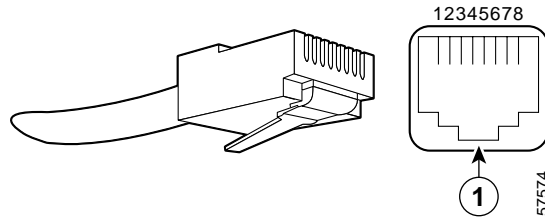


Warning

To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables.

Figure A-1 shows an RJ-45 port and connector. Table A-8 lists the pinouts and signals for the RJ-45 port.

Figure A-1 RJ-45 Port and Connector



1	RJ-45 connector		
---	-----------------	--	--

Table A-8 RJ-45 Receptacle Pinouts

Pin ¹	Description
1	TxD+ ²
2	TxD-
3	RxD+ ³
6	RxD-

1. Any pin not referenced is not connected.
2. TxD = Transmit Data
3. RxD = Receive Data

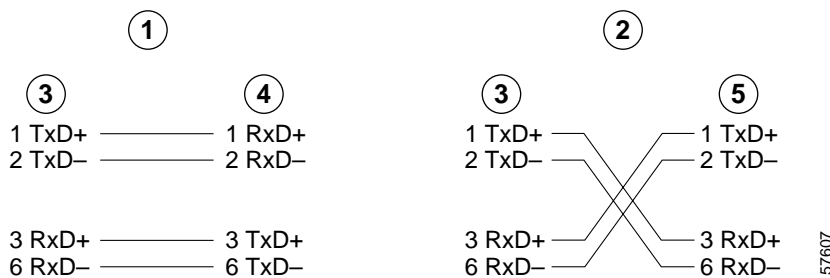


Note

With reference to the RJ-45 pinouts in [Table A-8](#), proper common-mode line terminations should be used for the unused Category 5 UTP cable pairs 4/5 and 7/8. Common-mode termination reduces electromagnetic interference (EMI).

Use the pinouts shown in [Figure A-2](#) for straight-through and crossover twisted-pair cable connections for your RJ-45 interface cabling requirements.

Figure A-2 Fast Ethernet/Ethernet Pinouts—Straight-Through or Crossover Cable



1	Straight-through cable pinout, Ethernet port to a hub or repeater	4	Hub
2	Crossover cable pinout, Ethernet port to a DTE	5	DTE
3	Ethernet port		

To determine whether a UTP cable is a crossover cable or a straight-through cable, hold the two RJ-45 connectors next to each other so you can see the colored wires inside the ends.

Examine the sequence of colored wires to determine the type of cable, as follows:

- Straight-through—The colored wires are in the same sequence at both ends of the cable.
- Crossover—The first (far left) colored wire at one end of the cable is the third colored wire at the other end of the cable.

Console and Auxiliary Port Signals and Pinouts

The Cisco 7401ASR router does not support Data Carrier Detect (DCD). [Table A-9](#) lists the RJ-45 console port signals.

Table A-9 Console Port Signals

Pin	Signal	Direction	Description
1	CTS	Out	Clear To Send (tracks RTS)
2	DSR	Out	Data Set Ready (always on)
3	RXD	Out	Receive Data
4	GND	—	Signal Ground
	—	—	Not connected
6	TXD	In	Transmit Data
7	DTR	In	Data Terminal Ready
8	RTS	In	Ready To Send

[Table A-10](#) lists the RJ-45 auxiliary port signals.

Table A-10 Auxiliary Port Signals

Pin	Signal	Direction	Description
1	RTS	Out	Ready To Send
2	DTR	Out	Data Terminal Ready
3	TXD	Out	Transmit Data
4	RING ¹	In	Ring Indication
5	GND	—	Signal Ground
6	RXD	In	Receive Data
7 ²	DSR/DCD (RLSD)	In	Data Set Ready / Data Carrier Detect (Receive Line Signal Detect)
8	CTS	In	Clear To Send (tracks RTS)

1. RING is not supported on Cisco-supplied adapters. To use this pin, you must create a customized cable.
2. Pin 7 can be used as a DCD input for connection to a modem. The RJ-45-to-DB-25F adapter maps DCD to this pin when used with a straight-through cable.

Alarm Port

The dry relay alarm port operates up to 50V AC/DC maximum and up to 80 mA maximum. Total power dissipation should not exceed 300 milliwatts. The normally closed position will have from 15 to 30 ohms resistance. The open position will be greater than 1 megohm. The Alarm condition is the closed position. This port is a switch so that the cable connector can be inserted in either orientation.

Lithium Battery Caution

This caution is required although the Cisco 7401ASR router has no internal field replaceable units.



Caution Danger of explosion if battery is incorrectly replaced.

Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturers instructions.

ADVARSEL!	Lithiumbatteri - Eksplosionsfare ved fejlagtig håndtering. Udskiftning må kun ske med batteri af samme fabrikat og type. Levér det brugte batteri tilbage tilleverandøren.
VAROITUS	Paristo voi räjähtää, jos se on virheellisesti asennettu. Vaihda paristo ainoastaan valmistajan suosittelemaan tyyppiin. Hävitä käytetty paristo valmistajan ohjeiden mukaisesti.
ADVARSEL	Eksplosjonsfare ved feilaktig skifte av batteri. Benytt samme batteritype eller en tilsvarende type anbefalt av apparatfabrikanten. Brukte batterier kasseres i henhold til fabrikantens instruksjoner.
WARNING	Eksplosionsfara vid felaktigt batteribyte. Använd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren. Kassera använt batteri enligt fabrikantens instruktion.



PXF Information

The PXF processor is turned on by default. If it is ever disabled, you must enable it to take advantage of IP packet switching and feature acceleration.



Note

The VPN Acceleration Module (VAM) is not compatible with the PXF processor.



Note

Before enabling the PXF processor, you must have IP routing and IP CEF switching turned on.

To manually disable or enable the PXF processor, use the global commands:

```
hostname (config)# [no] ip pxf
```

The following features are supported by the PXF processor and are enabled using standard IOS procedures:

- CEF—Cisco Express Forwarding
- NetFlow
- NAT—Network Address Translation
- WFQ—weighted fair queuing
- WRED—weighted random early detection
- ACL—access control list
- CBWRED—class-based weighted random early detection
- CBWFQ—class-based weighted fair queueing
- CAR—committed access rate

See the [“Related Documentation”](#) section on page xvii to find documents about enabling these features.

Using show Commands

Use the global **show version** or **show c7400** commands to obtain information about the hardware and software installed on your router. Examples of each follow.

Using the show version Command

Use the **show version** command to display the configuration of the system hardware and the software version.

The following example of the **show version** command provides information about a Cisco 7401ASR router:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7400 Software (C7400-JS-M), Version 12.2
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Sat 19-May-01 11:31 by
Image text-base:0x60008960, data-base:0x617CA000

ROM:System Bootstrap, Version 12.2(1r)DD1, RELEASE SOFTWARE (fc1)
BOOTFLASH:7400 Software (C7400-KBOOT-M),
12.2(20010427:125)

router uptime is 17 hours, 2 minutes
System returned to ROM by reload at 01:09:49 UTC Sat Jan 1 2000
System image file is "tftp://000.000.000.000//tftpboot/biff/122_1_DX/c7400-
mz.V122_1_DX.5.19.01"

cisco 7401ASR (NSE) processor (revision A) with 245760K/16384K bytes of memory
Processor board ID 4294967295
R7000 CPU at 375Mhz, Implementation 39, Rev 3.3, 256KB L2, 2000KB L3 Cache
1 slot ASR midplane, Version 2.0

Last reset from power-on
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
PXF processor tmc is running.
8 Ethernet/IEEE 802.3 interface(s)
2 Gigabit Ethernet/IEEE 802.3 interface(s)
509K bytes of non-volatile configuration memory.

64256K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x100
```

Using the show c7400 Command

Use the **show c7400** command to obtain information about the router.

```
Router# show c7400
Network IO Interrupt Throttling:
  throttle count=0, timer count=0
  active=0, configured=1
  netint usec=4000, netint mask usec=200
Midplane EEPROM:
  Hardware revision 2.0          Board revision UNKNOWN
  Serial number 0000000000 Part number 00-0000-00
  Test history 0xFF             RMA number 000-000-000
  MAC Pool Size 64             MAC Addr Base 0000.000.0000
  Chassis Model 0x1
  EEPROM format version 1
  EEPROM contents (hex):
    0x00:01 01 02 00 FF FF FF FF 49 16 41 02 00 04 C1 28
    0x10:54 40 00 40 FF FF FF FF FF FF FF FF FF FF FF FF
    0x20:62 20 00 00 63 2F 55 7C 00 00 00 00 60 63 B2 D0
    0x30:00 00 00 00 62 6D 0C 50 00 00 00 00 00 00 00 00

C7401ASR CPU EEPROM:
  Hardware Revision      :1.0
  PCB Serial Number     :CAB0516HKEC
  Part Number           :73-5697-02
  Board Revision        :02
  RMA Test History      :00
  RMA Number            :0-0-0-0
  RMA History           :00
  Deviation Number      :0-0
  Product Number        :CISCO7401
  Top Assy. Part Number :800-09092-02
  EEPROM format version 4
  EEPROM contents (hex):
    0x00:04 FF 40 02 7E 41 01 00 C1 8B 43 41 42 30 35 31
    0x10:36 48 4B 45 43 82 49 16 41 02 42 30 32 03 00 81
    0x20:00 00 00 00 04 00 80 00 00 00 00 CB 94 43 49 53
    0x30:43 4F 37 34 30 31 20 20 20 20 20 20 20 20 20 20
    0x40:20 C0 46 03 20 00 23 84 02 FF FF FF FF FF FF FF
    0x50:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
    0x60:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
    0x70:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

Using the show pxf Commands

Following are five specific **show pxf** commands and several subcommands. Included in this section are examples for each command.

- show pxf accounting ?
- show pxf accounting summary
- show pxf accounting *interface*
- show pxf crash
- show pxf info

- show pxf interface
- show pxf feature ?

Sample output for these commands follows.

Using the show pxf accounting ? Command and Subcommands

The following is an example of the **show pxf accounting ?** command with sample output:

```
Router# show pxf accounting ?

ATM          ATM interface
Ethernet     IEEE 802.3
FastEthernet FastEthernet IEEE 802.3
Hssi         High Speed Serial Interface
Null         Null interface
POS          Packet over Sonet
Serial       Serial
summary     PXF summary statistics
```

The following is an example of the **show pxf accounting summary** command with sample output:

```
Router# show pxf accounting summary

Pkts      Dropped  RP Processed      Ignored
Total          0          90          0
>
>PXF complex busy      : 8%
>PXF input pipeline full: 0%
>

>PXF Statistic:
>Packets RP -> PXF:
>  switch ip:          0
>  switch raw:         90
>  qos fastsend:       0
>  qos enqueue:        0
>Total:                90
>
>Packets PXF -> RP:
>  qos pkts:           0
>  fast pkts:          0
>  drops:total         0
>  punts:total         90
>  "  not IP           :      89
>  "  CEF receive      :      1
>Total:                90
>
>Packets ignored:      0 | ring space:
>  shadow ring full:   0 |   shadow ring: 16382
>  in ring full:      0 |   inring:      995
>  PXF inactive:      0
>
>tx credits:           0 | delayed credits:  0
>holdq enqueues:      0 | requeue drops:   0
>interrupts:          90 | pending read bytes: 0
>L2TP tunnel read:    0 | session stats:   0
>
Interface Pkts In  Chars In  Pkts Out  Chars Out  Punted  Dropped
Et0/0      0      0      0      0      0      93      0
Gi0/0      0      0      0      0      0      0      0
Fa1/0      0      0      0      0      0      0      0
```



```

Fa4/0      0          0          0          0          0          0
Vt1       0          0          0          0          0          0
Lo0       0          0          0          0          0          0

```

The following is an example of the **show pxf accounting interface** command with sample output:

```
Router# show pxf accounting POS4/0
```

```

Interface      Pkts In   Chars In   Pkts Out   Chars Out   Punted
POS4/0         19        1064        0           0           44

```

Using the show pxf crash Command

The following is an example of the **show pxf crash** command with sample output:

```
Router#show pxf crash
```

```

EX_Type = 0x80000000
EX_ID(b0~3,16~17) = 0x00400
CPU_EX_ID(b0~15) = 0x0004
IHB_EX_Type(b0~5) = 0x00
XRAM0(b0~13) = 0x00000
XRAM1(b0~13) = 0x00000
XRAM2(b0~13) = 0x00000
XRAM3(b0~13) = 0x00000
Pipeline:7FDEFD pdone[3210]:1F 17 17 1D

ICM0(b4~13) = 0x00000 ICM1(b4~13) = 0x00000
ICM2(b4~13) = 0x00010 ICM3(b4~13) = 0x00000
LOCK0(b0~4) = 0x00000 LOCK1(b0~4) = 0x00000
LOCK2(b0~4) = 0x00000 LOCK3(b0~4) = 0x00000
CPU0/2: SW EX Type=0x00000000 LBUS EX Type=0x00000081 HW EX
Type=0x00000400

CPU:row=0x0 column=0x2 cpu=0x2
PC:0000098E LR:0000087F CR:002C4C00
r0:00000000 r1:8001CEA0 r2:80784390 r3:00000000
r4:00005400 r5:80D3BA04 r6:80A7CA00 r7:00000004
r8:00000000 r9:00000008 r10:80092324 r11:800A6200
r12:00000033 r13:00000008 r14:00000000 r15:00000000
misr1a:00000000 misr1bhi:00000000 misr1blo:00000000 misr2hi:00000000
misr2lo:00000000 reserve:00000000 reserve:00000000 reserve:00000000
sisr1a:01000040 sisr1b:00000000 irhi:4402200F irlo:00000000
cAll:C20DE822 DCD1:00020400 DCD2:00000002 CNTL:00000000
TBuf intr 0:1111111F
TBuf intr 1:020FFFF0
TBuf intr 2:00003C80
TBuf intr 3:80000000
TBuf intr 4:00000400
Xram return:00000000
Icram return hi:80024E00
Icram return lo:800A4E00
TBuf addr 0:005E6800 TBuf sblock1 0:8078A374 TBuf sblock0 0:804FD600
TBuf addr 1:005E6800 TBuf sblock1 1:8078A374 TBuf sblock0 1:804FD600
TBuf addr 2:005E6800 TBuf sblock1 2:8078A374 TBuf sblock0 2:804FD600
TBuf addr 3:005E6800 TBuf sblock1 3:8078A374 TBuf sblock0 3:804FD600
TBuf addr 4:005E6800 TBuf sblock1 4:8078A374 TBuf sblock0 4:804FD600
TBuf addr 5:005E6800 TBuf sblock1 5:8078A374 TBuf sblock0 5:804FD600
TBuf addr 6:005E6800 TBuf sblock1 6:8078A374 TBuf sblock0 6:804FD600
TBuf addr 7:005E6800 TBuf sblock1 7:8078A374 TBuf sblock0 7:804FD600

```

Using the show pxf info Command

The following is an example of the **show pxf info** command with sample output:

```
Router# show pxf info
pxf:tmc type TMC ASIC Pass1 (no ECC) revision 3
ucode:filename 'system:pxf/ucode0' revision 1.1
state: is running, number of starts 1
uptime:15:24:18
Memory Configuration:
  Bank Name                               Total    Reserved  In-use    Free
  tmc internal memory column 0           16 Kb    10 Kb     0 bytes  6144
bytes
  tmc column 0 memory bank 0              32 Mb    26 Mb     16 Kb    5554 Kb
  tmc internal memory column 1            16 Kb    512 bytes  0 bytes   15 Kb
  tmc column 1 memory bank 0              32 Mb    669 Kb    2015 Kb   29 Mb
  tmc internal memory column 2            16 Kb    6656 bytes 0 bytes   9728
bytes
  tmc column 2 memory bank 0              32 Mb    441 Kb    800 Kb    30 Mb
  tmc internal memory column 3            16 Kb    15 Kb     0 bytes   512
bytes
  tmc column 3 memory bank 0              32 Mb    2092 Kb   128 Kb    29 Mb
```

Using the show pxf interface Command

The **show pxf interface** command provides a summary of the interfaces in the router and which PXF features or capabilities are enabled on these interfaces. The following is an example of the **show pxf interface** command:

```
Router# show pxf interface
  Intf  I/f #  Attributes
Fa0/0   3      Raw, Encap, QoS(Cr 0, Thrsh 2, Max 101)
Et1/0   4      Raw, Encap
Et1/1   5      Raw, Encap, QoS(Cr 0, Thrsh 2, Max 13)
Et1/2   6      Raw, Encap
Et1/3   7      Raw, Encap
Se2/0   8      Raw, Encap, QoS(Cr 0, Thrsh 2, Max 5)
Se2/1   9      Raw, Encap, QoS(Cr 0, Thrsh 2, Max 5)
Se2/2  10     Raw, Encap, QoS(Cr 0, Thrsh 2, Max 5)
Se2/3  11     Raw, Encap, QoS(Cr 0, Thrsh 2, Max 5)
Fa3/0   12     Raw, Encap
PO4/0   13     Raw, Encap
AT5/0   14     Raw, Encap
```

Using the show pxf feature ? Command and Subcommands

The following is an example of the feature-specific **show pxf feature ?** command with sample output:

```
Router# show pxf feature ?
  cef  PXF CEF info
  nat  PXF NAT info
```

- **show pxf feature cef ?**

```
Router# show pxf feature cef ?
entry
Shadow 16-4-4-8 PXF Mtrie:
  41 leaves, 1968 leaf bytes, 15 nodes, 267000 node bytes
  5 invalidations
  46 prefix updates
  refcounts: 66746 leaf, 66720 node
```

Prefix/Length	Refcount	Parent
0.0.0.0/0	62282	
0.0.0.0/32	3	0.0.0.0/0
171.69.12.128/27	34	0.0.0.0/0
171.69.12.128/32	3	171.69.12.128/27
171.69.12.129/32	3	171.69.12.128/27
171.69.12.130/32	3	171.69.12.128/27
171.69.12.131/32	3	171.69.12.128/27
171.69.12.132/32	3	171.69.12.128/27
171.69.12.138/32	3	171.69.12.128/27
171.69.12.139/32	3	171.69.12.128/27
171.69.12.140/32	3	171.69.12.128/27
171.69.12.141/32	3	171.69.12.128/27
171.69.12.142/32	3	171.69.12.128/27
171.69.12.143/32	3	171.69.12.128/27
171.69.12.145/32	3	171.69.12.128/27
171.69.12.146/32	3	171.69.12.128/27
171.69.12.147/32	3	171.69.12.128/27

(display text omitted)

- **show pxf feature nat ?**

```
Router# show pxf feature nat ?
entry toaster nat entry
stat toaster nat processing info
tcp toaster nat tcp logging info
```

- Router# **show pxf feature nat entry**

```
Router# show pxf feature nat entry
--- 171.69.12.175      192.168.0.129      ---
--- 171.69.12.161      192.168.0.7        ---
--- 171.69.12.162      192.168.0.2        ---
--- 171.69.12.163      192.168.0.3        ---
--- 171.69.12.164      192.168.0.4        ---
--- 171.69.12.165      192.168.0.13       ---
--- 171.69.12.166      192.168.0.5        ---
```

- Router# **show pxf feature nat stat**

```
Router# show pxf feature nat stat
NAT translation processing information
total nat entries = 0x1000, entries (used, free) = (0x7, 0xFF9)
untranslated flows:0x7022D
translated flows:0x1030
icmp extendable flows:0x0
noop alloc miss:0x0
entry alloc miss:0x0
entry delete miss:0x0
```




Using the CompactFlash Disk

This appendix describes installation prerequisites you should observe before you can use the CompactFlash Disk in your system, and includes the following sections:

- [Hardware and Software Requirements, page C-1](#)
- [Tools and Parts Required, page C-1](#)
- [“Product Description” section on page C-2](#)
- [Compatibility Requirements, page C-3](#)
- [Boot Environment Variables, page C-4](#)
- [Sample Upgrade Process, page C-5](#)
- [Product Description, page C-2](#)
- [Working with a CompactFlash Disk, page C-5](#)

Hardware and Software Requirements

The Cisco 7401ASR uses only CompactFlash Disks of the following configurations:

- 64 MB, Product ID: MEM-COMP-FLD64M=
- 128 MB, Product ID: MEM-COMP-FLD128M=

The minimum Cisco IOS releases for the Cisco 7401ASR CompactFlash Disks are the following: Cisco IOS Release 12.2 DX, Cisco IOS Release 12.2(1)DD, Cisco IOS Release 12.2(4)B, and Cisco IOS Release 12.2(9) YE.

Tools and Parts Required

You need some or all of the following tools and parts to install a CompactFlash Disk:

- Antistatic wrist strap
- Access to a Trivial File Transfer Protocol (TFTP) server
- One of the following CompactFlash Disk kits:
 - 64 MB, Product ID: MEM-COMP-FLD64M=
 - 128 MB, Product ID: MEM-COMP-FLD128M=

Product Description

CompactFlash Disks are designed with Flash technology, a nonvolatile storage solution that does not require a battery to retain data indefinitely. CompactFlash Disks provide complete PCMCIA-ATA functionality and compatibility as defined by the CompactFlash Association in their CF+ and CompactFlash Specification, revision 1.4.

The CompactFlash Disk is more flexible than linear Flash memory because the CompactFlash Disk has controller circuitry that allows it to emulate a hard disk and automatically maps out bad blocks and performs automatic block erasure. Further, the CompactFlash Disk provides the capability to allocate noncontiguous sectors, which eliminates the need for the **squeeze** command (previously required with linear Flash memory cards).

The CompactFlash Disk provides increased Flash-based memory space—64 MB to 128 MB—for storage of system configuration files, Cisco IOS software images, and other types of system-related files. [Table C-1](#) provides memory information for the CompactFlash Disk.

Table C-1 CompactFlash Disk Memory Options

Memory Size	Product Number
64 MB	MEM-COMP-FLD64M=
128 MB	MEM-COMP-FLD128M=



Note

The CompactFlash Disk is only supported on systems with the Cisco IOS File System feature, and the Cisco IOS File System feature is supported in Cisco IOS Release 12.0(1) or later releases of 12.0. In general, CompactFlash Disk functionality requires Cisco IOS Release 12.0(2) or a later release of 12.0.

The Cisco IOS File System feature provides a single interface to all file systems your system uses:

- Flash memory file systems—CompactFlash Disks and onboard Flash memory
- Network file systems—File Transfer Protocol (FTP), Remote Copy Protocol (rcp), and TFTP
- Any other endpoint for reading or writing data—NVRAM, the running configuration, ROM, raw system memory, system bundled microcode, Xmodem, Flash load helper log, modems, and BRI MUX interfaces



Note

A complete discussion of the Cisco IOS File System feature is beyond the scope of this publication. For information about this feature, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications for Cisco IOS Release 12.x. These publications are available on Cisco.com. (For information on how to access Cisco.com, see the [“Cisco.com”](#) section on page xvii.)

Compatibility Requirements

This section discusses CompactFlash Disk compatibility and use between supported systems.

In order to boot a Cisco IOS software image from the CompactFlash Disk, when the system is executing from the ROM monitor software image, your ROM monitor software image and your boot image must be from one of the minimum Cisco IOS releases listed in the “[Hardware and Software Requirements](#)” section on page C-1. Use the **show version** or **show hardware** commands to verify that your system is running these software images.

The **format** command places a processor-specific file system on the CompactFlash Disk so that the ROM monitor software can read the CompactFlash disk media. If you plan to use the **boot** or **dir** commands at the ROM monitor prompt (`r0mmon>`), you might need to reformat your CompactFlash Disk *if* it was not already formatted on a like system processor.

For simple file storage and retrieval functions, CompactFlash Disks can be interchanged between any Cisco 7401ASR router.



Note

The CompactFlash Disk in the Cisco 7401ASR router is supported on the `c7400-kboot-mz` image.

System Memory and Software Image Functions and Interactions

The read-only memory (ROM) monitor image on your system performs important functions, such as running a brief set of system diagnostics, and initializing the hardware. This image gains control at reset or power on, or after a nonrecoverable event (such as a bus error). The ROM monitor software image has a rudimentary user interface that is recognizable by way of the ROM monitor prompt (`r0mmon>`). The ROM monitor software image has console drivers and trap handlers for parity and bus errors; however, the ROM monitor does not have any network interface code and it *cannot* boot an image over the network.



Note

The ROM monitor is *only* able to load an image from boot flash memory or a CompactFlash Disk.

By default, and as a result of a reset or power on, the ROM monitor loads the boot image from boot flash memory. If the ROM monitor cannot find a bootable image in boot flash memory, it searches the CompactFlash Disk for the first bootable image. Normally, this would be the `c7400-kboot-mz` image.

The boot image, when loaded, looks in the boot environment variables—stored in nonvolatile random-access memory (NVRAM)—to determine the location of the Cisco IOS software image and the configuration to use. If boot environment variables are not defined, the system will boot the first image found on the CompactFlash Disk.

The operation of the boot environment variables is described in the “[Boot Environment Variables](#)” section, which follows.

Boot Environment Variables

The contents of the boot environment variables, which are stored in the configuration file in NVRAM, determine the actions your system takes on bootup. To see the current settings of these variables, use the **show bootvar** command as follows:

```
Router> show bootvar
BOOT variable =
CONFIG_FILE variable =
Current CONFIG_FILE variable =
BOOTLDR variable does not exist
Configuration register is 0x100
```

Following are explanations for each of these boot environment variables:

- **BOOT variable**—Points to the Cisco IOS software image that you want to boot; you set it in configuration mode. The default software image is the **CISCOxxx** image (where *xxx* is a filename assigned by the system, if you do not enter a specific filename). The system then looks for the first image on the CompactFlash Disk in slot 0.

Enter configuration mode and specify a filename and CompactFlash Disk slot from which to boot using the **configure terminal** and **boot system** commands as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CTRL-Z.
System(config)# boot system flash disk0:rsp-p-mz.12-0
```

The result of this configuration file entry is that the **BOOT** variable is **disk0: c7400-js-m...bin**

CONFIG_FILE (configuration file) variable—Determines where the configuration is read from on bootup; you set it in configuration mode as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CTRL-Z.
System(config)# boot config disk0:configfile
```

The result of this configuration file entry is that the **CONFIG_FILE** variable is **disk0:configfile**.

- **BOOTLDR** (boot loader) variable—Determines which image is used as the boot helper (boot image); you set it in configuration mode as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CTRL-Z.
System(config)# boot bootldr bootflash:c7401-boot-mz
```

The result of this configuration file entry is that the **BOOTLDR** variable is **bootflash:c7401-boot-mz**.

- **Configuration register** variable—Instructs the system where to look for a bootable Cisco IOS software image; you set it as a hexadecimal value in configuration mode as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CTRL-Z.
System(config)# config-register 0x102
```

The result of this configuration file entry is that the configuration register is set to hexadecimal **0x102**. Please see Chapter 3, “Starting and Configuring,” page 3-9, for more information about the configuration register.

Sample Upgrade Process

This section applies to users who want to use CompactFlash Disks for simple file storage.

-
- Step 1** Format your onboard Flash memory—called boot flash memory. (See the **format** command description in the “[Software Command Overview](#)” section on page C-6.)
 - Step 2** Upgrade your onboard Flash memory by copying the Cisco IOS Release 12.x boot image (the c7400-kboot-mz) into onboard Flash memory. (See the “[Software Command Overview](#)” section on page C-6.)
 - Step 3** Copy the Cisco IOS Release 12.x software image from onboard Flash memory to the CompactFlash Disk.
 - Step 4** Change the boot variables in your configuration file to point to the new Cisco IOS image in your CompactFlash Disk. (See the preceding section, “[Boot Environment Variables](#),” and the “[Making a CompactFlash Disk-Based Software Image the Bootable Software Image](#)” section on page C-13.)
 - Step 5** Reboot your system to load the Cisco IOS Release 12.x software image from the CompactFlash Disk.
 - Step 6** Insert a new CompactFlash Disk. (See “[Installing and Removing the CompactFlash Disk](#)” section on page 1-7.)
 - Step 7** With your system running Cisco IOS release 12.x, format the blank CompactFlash Disk. (See the **format** command description in [Table C-2](#) on page C-6, and the “[Using the format Command](#)” section on page C-9.)
-

You should now be able to store configuration files and Cisco IOS software images on your CompactFlash Disk.

Working with a CompactFlash Disk

This section provides basic instructions for working with a CompactFlash Disk in your system. Detailed descriptions of more complex CompactFlash Disk options and the Cisco IOS File System feature are beyond the scope of this publication and can be found in the following Cisco IOS Release 12.x publications:

- *Cisco IOS Configuration Fundamentals Configuration Guide*, in the chapter “File Management”
- *Cisco IOS Configuration Fundamentals Command Reference*, in the chapter “File Management Commands”

**Note**

These and all publications are available online on Cisco.com. For information on how to access Cisco.com, see the “[Cisco.com](#)” section on page xvii.

This section includes the following subsections:

- [Software Command Overview](#), page C-6
- [Using Software Commands](#), page C-7
- [Enabling Booting from a CompactFlash Disk](#), page C-12
- [Making a CompactFlash Disk-Based Software Image the Bootable Software Image](#), page C-13

Software Command Overview

This section lists some of the basic software commands you can use with the CompactFlash Disk. Examples of these commands are included in the sections that follow.

The CompactFlash Disk and other memory devices and locations in your system are defined as *file systems*, which are locations where you can store, use, or retrieve files and software images. (See the brief discussion about the Cisco IOS File System feature in the “[Product Description](#)” section on [page C-2](#).)

A CompactFlash Disk in the Cisco 7301 is referred to as *slot0*.

The following partial output of the **show file systems** command shows a sample system with a CompactFlash Disk—called *slot0*:—installed in slot 0:

```
System# show file systems
File Systems:

      Size(b)      Free(b)      Type  Flags  Prefixes

(Additional displayed text omitted from this example.)

      48755200     48747008     flash   rw    slot0:
```

[Table C-2](#) lists the software commands that you can use with the CompactFlash Disk.



Note

You can use other arguments with some of the commands listed in [Table C-2](#); however, in [Table C-2](#) and throughout this document, command arguments are limited to those that apply to the CompactFlash Disk and related file systems.

For a discussion of additional command arguments, refer to the *Cisco IOS Configuration Fundamentals Command Reference* document, in the chapter “File Management Commands.”

Table C-2 CompactFlash Disk-Related Software Commands for the Cisco 7401ASR

Command and Arguments	Purpose
<code>cd [disk0: directory-name]</code>	Changes current directory. Allows you to move between directories on a CompactFlash Disk, where <i>directory-name</i> is the directory to which you want to move.
<code>copy [disk0:]source-filename [tftp:]destination-filename</code>	Copies from one file to another. Allows you to make a copy of a file (<i>source-filename</i>) located on a source file system (disk0:) and place it with either the same filename or a different filename (<i>destination-filename</i>) on a destination file system. Along with disk0: , the source and destination file system arguments include, but are not limited to: <ul style="list-style-type: none"> • bootflash: (onboard Flash memory) • nvr: (onboard nonvolatile random-access memory) • running-config (the running system configuration file) • startup-config (the startup system configuration file) • tftp: (a TFTP server to which you have access)

Table C-2 CompactFlash Disk-Related Software Commands for the Cisco 7401ASR (continued)

Command and Arguments	Purpose
<code>delete [disk0:]filename</code>	Deletes a file. Allows you to delete any file you designate, where <i>filename</i> designates the name of the file.
<code>dir [/all disk0:]</code>	Lists files on a file system. Allows you to list the contents of the CompactFlash Disk in slot 0. The /all argument lists all files on all file systems in your system.
<code>format [flash: bootflash: disk0:]</code>	Formats a file system. Allows you to format a linear Flash memory card (flash:), onboard Flash memory (bootflash:), or a new CompactFlash Disk (disk0:). This command also allows you to reformat a linear Flash memory card or CompactFlash Disk that was formatted on another type of system. Note This command destroys all data currently in Flash memory; therefore, we strongly recommend that you use the format command with caution to prevent irretrievable loss of data.
<code>mkdir [disk0:]directory-name</code>	Creates a new directory. Allows you to create directories on a CompactFlash Disk, where <i>directory-name</i> is the name you assign to this directory.
<code>pwd</code>	Displays current working directory. Allows you to display the name of the CompactFlash Disk directory in which you are currently working.
<code>rename [disk0:]filename [disk0:]filename</code>	Renames a file. Allows you to rename a file that is located on one CompactFlash Disk and assign to that file another (or the same) file system path and filename. The first group of arguments defines the source (current) file system path and filename, and the second set of arguments defines the destination file system path and filename.
<code>rmdir [disk0:]directory-name</code>	Removes an existing directory. Allows you to remove a directory that currently exists on a CompactFlash Disk, where <i>directory-name</i> is the name of the directory you want to remove.
<code>show [disk0:]</code>	Lists information about CompactFlash Disk format and geometry.

Using Software Commands

This section provides examples of some of the basic software commands you can use with the CompactFlash Disk. See [Table C-2](#) for optional arguments you can use with some of the following commands:

- [Using the cd Command, page C-8](#)
- [Using the show Command, page C-8](#)
- [Using the pwd Command, page C-9](#)
- [Using the dir Command, page C-9](#)
- [Using the format Command, page C-9](#)

- [Using the mkdir Command, page C-10](#)
- [Using the rmdir Command, page C-11](#)
- [Using the delete Command, page C-11](#)

Using the cd Command

Use the **cd** command by defining a specific path name. Then to verify your working directory, use the **pwd** command:

```
System# cd disk0:
System# pwd
disk0:/
```

You can also move up (or back) one level in the Flash Disk directory hierarchy using the **cd ..** command, and then verify your working directory with the **pwd** command:

```
System# pwd
disk0:daily_dir/
System# cd ..
System# pwd
disk0:/
System#
```

Using the show Command

To display information about CompactFlash Disk format and geometry, use the **show [disk0: | disk2:]** command:

```
System# show disk0:fileSYS
***** ATA Flash Card Geometry/Format Info *****

ATA CARD GEOMETRY
  Number of Heads:           16
  Number of Cylinders        840
  Sectors per Cylinder       32
  Sector Size                 512
  Total Sectors               430080

ATA CARD FORMAT
  Number of FAT Sectors       105
  Sectors Per Cluster         16
  Number of Clusters          26822
  Number of Data Sectors      429536
  Base Root Sector            338
  Base FAT Sector              128
  Base Data Sector             370

Router#
```

In this example:

- Number of Heads is the number of heads on the CompactFlash Disk.
- Number of Cylinders is the number of cylinders on the CompactFlash Disk.
- Sectors per Cylinder is the number of sectors in each cylinder.
- Sector Size is the number of bytes in each sector.
- Total Sectors is the total number of sectors on the CompactFlash Disk.

- Number of FAT Sectors is the number of sectors used to track allocation of clusters to files.
- Sectors Per Cluster is the number of sectors contained in each cluster. (Files grow by a minimum of one cluster.)
- Number of Clusters is the total number of clusters available for use by files.
- Number of Data Sectors is the number of sectors available for files.
- Base Root Sector is the logical address of the first sector of the root directory.
- Base FAT Sector is the first sector in the File Allocation Table (FAT).
- Base Data Sector is the first sector available for use by files.

Using the pwd Command

You can verify your working directory by using the **pwd** command:

```
System# pwd
disk1:daily_dir/
System# cd ..
System# pwd
disk1:/
System#
```

Using the dir Command

To list the directory structure and contents of the CompactFlash Disk from which you are currently working, use the **dir** command with no arguments:

```
System# dir
Directory of disk0:/

  1 drw-          0   Jul 25 1998 10:23:11  daily_dir
  2 drw-          0   Jul 25 1998 10:28:37  access_lists

64755200 bytes total (64742912 bytes free)
System#
```

Note that the size of the CompactFlash Disk is shown in the output of the **dir** command. (A 64-MB CompactFlash Disk is shown in this example.) You can also view the contents of other directories and file systems using specific optional arguments with the **dir** command. (See [Table C-1](#).)

Using the format Command

To format a new CompactFlash Disk, use the **format [disk0:]** command.



Note

You must format a new CompactFlash Disk before you can use it. If you plan to use a CompactFlash Disk that was formatted and used on another type of system, see the [“Compatibility Requirements” section on page C-3](#) to determine if you need to reformat the CompactFlash Disk first.



Caution

The formatting procedure erases all information on the CompactFlash Disk. To prevent the loss of important data that might be stored on a CompactFlash Disk, proceed carefully. If you want to save data that is currently on your CompactFlash Disk, copy the data to a TFTP server or to another CompactFlash

Disk on another router *before* you format the new CompactFlash Disk. A CompactFlash Disk that was shipped as part of a configured system contains a CompactFlash Disk-compatible Cisco IOS software image; therefore, you do not need to format it to use it in the system in which it was shipped.

**Note**

If you order a spare CompactFlash Disk, it is shipped blank; therefore, you must format it before you can use it.

Use the following procedure to format a new CompactFlash Disk using the **format** command. (The procedure assumes you have already booted your system.)

Step 1 Insert the CompactFlash Disk into slot 0 using the procedures in the [“Installing and Removing the CompactFlash Disk”](#) section on page 1-7.

Step 2 Use the **format disk0:** command to format the CompactFlash Disk in slot 0 as follows:

```
Router# format disk0
Format operation may take a while. Continue? [confirm]
Format operation will destroy all data in "disk0". Continue? [confirm]

Format: Drive communication & 1st Sector Write OK
Writing Monlib
sectors.....
.....
.....
Monlib write complete

Format: All system sectors written. OK...

Format: Total sectors in formatted partition: 125152
format: Total bytes in formatted partition: 64077824
Format: Operation completed successfully.

Format of disk0: complete
```

**Note**

A 64-MB CompactFlash Disk was formatted in this example.

The new CompactFlash Disk is now formatted and ready to use in the system on which you formatted it. (For specific formatting and compatibility requirements, see the [“Compatibility Requirements”](#) section on page C-3.)

Using the mkdir Command

To create a directory on the CompactFlash Disk, use the **mkdir** command. The following example shows how to create a directory called *daily_dir* on the CompactFlash Disk in slot 0, and then verify that it was created:

```
System# mkdir disk0:daily_dir
Created dir disk0:daily_dir
System# dir
Directory of disk0:/

 1  drw-          0  Jul 25 1998 10:15:43  daily_dir
```

```
48755200 bytes total (48751104 bytes free)
System#
```

**Note**

If you create a directory and place a file in it that you plan to access or use later on, be sure to define the entire directory path to the file as you enter the appropriate software commands.

For example, if you placed the file *itsa.file* into the directory *daily_dir* on the CompactFlash Disk in slot 0, you must designate the entire directory path as follows: *disk0:daily_dir/itsa.file*. Otherwise, the system might not be able to locate this file.

Using the rmdir Command

To remove a directory from the CompactFlash Disk, use the **rmdir** command. The following example shows how to remove the directory *daily_dir* from the CompactFlash Disk in slot 0, and then verify that it was removed:

```
System# rmdir disk0:daily_dir
Delete disk0:daily_dir? [confirm] y
Removed dir disk0:daily_dir
System# dir
Directory of disk0:/

   No files in directory.

48755200 bytes total (48751104 bytes free)
System#
```

Using the delete Command

To delete a file from a CompactFlash Disk, use the **delete** command. Use the **dir** command to find the file you want to delete, and then use the **delete** command to delete it.

The following example shows how to find a file (called *fun1*) on the CompactFlash Disk, delete the file, and then verify that it is deleted:

Step 1 Find the file you want to delete:

```
System# dir
Directory of disk0:/

  1  drw-          0   May 10 1998 09:54:53 fun1

48755200 bytes total (48742912 bytes free)
```

Step 2 Delete the file *fun1*:

```
System# delete disk0:fun1
```

Step 3 Verify that the file *fun1* is deleted:

```
System# dir
Directory of disk0:/

   No files in directory.

48755200 bytes total (48742912 bytes free)
System#
```

Enabling Booting from a CompactFlash Disk

This section explains how to enable booting from a CompactFlash Disk.

To enable booting from a CompactFlash Disk, set configuration register bits 3, 2, 1, and 0 to a value between 2 and 15 in conjunction with the **boot system [disk0:]filename** configuration command. This section includes only descriptions of **boot** commands specific to the CompactFlash Disk. (You can use either the **slotn:** argument or the **diskn:** argument for **boot** commands.)

Following are definitions of the various CompactFlash Disk-related **boot** commands:

- **boot system flash disk0:** or **boot system slot0:**—Boots the first file in the CompactFlash Disk in slot 0.
- **boot system flash disk0:herfile** or **boot system slot0:herfile**—Boots the file named *herfile* from the CompactFlash Disk in slot 0.

As you enter **boot** commands, pay attention to how you use the Spacebar, which influences the way your system interprets the commands. Also, ensure that you define the entire path to a file as you enter the **boot** commands; otherwise, the system might not be able to find the file.

For example, notice the difference in the following correct and incorrect commands:

```
System(config)# boot system flash disk0:myfile
```

Based on the preceding correct command, the system boots the file specified (*myfile*).

```
System(config)# boot system flash disk0: myfile
```

Based on the preceding incorrect command, the system finds the *filename* field blank because there is a space after **disk0:**. In this case, the system ignores the filename argument and boots the first file on the CompactFlash Disk, which might not be the file called *myfile*.

Use the following procedure to enable booting the file *myfile* from a CompactFlash Disk:

Step 1 Enter configuration mode and specify an image filename in the CompactFlash Disk slot from which to boot by using the **configure terminal** command, as follows:

```
System# configure terminal
Enter configuration commands, one per line. End with CTRL-Z.
System(config)# boot system flash disk0:myfile
```

Step 2 Enable the **boot system flash disk0:myfile** command using the **config-register** command with the hexadecimal value shown in the following example:

```
System(config)# config-reg 0x2102
```

This command, with the hexadecimal value 0x2102, results in the following:

- Enables the system to boot the default boot ROM software if the CompactFlash Disk-based image fails to boot—hexadecimal value 0x2000
- Disables Break—hexadecimal value 0x0100
- Enables the image *myfile* as the default boot image—hexadecimal value 0x0002

Step 3 Press **Ctrl-Z** to exit configuration mode:

```
System(config)#  
Ctrl-Z  
System#
```

Step 4 Save the new configuration to NVRAM by using the **copy system:running-config nvram:startup-config** command as follows:

```
System# copy system:running-config nvram:startup-config
```

Making a CompactFlash Disk-Based Software Image the Bootable Software Image

This section explains how to make a CompactFlash Disk-based Cisco IOS software image a bootable image.

After you copy a software image to the CompactFlash Disk, use the following series of commands to make the image bootable (the file named *new.image* in this example). The software image in this example is located on the CompactFlash Disk in slot 0. Note that the **config-register** command is also a part of this command sequence because you must set the configuration register to 0x2102 to enable loading an image from the CompactFlash Disk.

```
System# config terminal  
System(config)# no boot system  
System(config)# boot system flash disk0:new.image  
System(config)# config-register 0x2102  
Ctrl-Z  
System# copy system:running-config nvram:startup-config  
System# reload
```

When the system reloads, it boots the image *new.image* from the CompactFlash Disk in slot 0.



Configuration Register Information

The following information is found in this appendix:

- [Configuration Bit Meanings, page D-1](#)
- [Displaying the Configuration Register While Running Cisco IOS, page D-5](#)
- [Displaying the Configuration Register While Running ROM Monitor, page D-5](#)
- [Setting the Configuration Register While Running Cisco IOS, page D-6](#)
- [Setting the Configuration Register While Running ROM Monitor, page D-6](#)

Configuration Bit Meanings

Use the processor configuration register information contained in this appendix to do the following:

- Set and display the configuration register value
- Force the system into the bootstrap program
- Select a boot source and default boot filename
- Enable or disable the Break function
- Control broadcast addresses
- Set the console terminal baud rate
- Load operating software from ROM
- Enable booting from a Trivial File Transfer Protocol (TFTP) server

[Table D-1](#) lists the meaning of each of the configuration memory bits. Following the table is a more in-depth description of each setting.

Table D-1 Configuration Register Bit Settings

Bit No.	Hex	Meaning
00–03	0x0000–0x000F	Boot field
06	0x0040	Causes the system software to ignore nonvolatile random-access memory (NVRAM) contents
07	0x0080	OEM (original equipment manufacturer) bit enabled
08	0x0100	Break disabled
10	0x0400	IP broadcast with all zeros

Table D-1 Configuration Register Bit Settings (continued)

Bit No.	Hex	Meaning
11–12	0x800–0x1000	Console line speed
13	0x2000	Boots default ROM software if initial boot fails
14	0x4000	IP broadcasts do not have network numbers
15	0x8000	Enables diagnostic messages and ignores NVRAM contents

Bits 0–3

The lowest four bits of the processor configuration register (bits 3, 2, 1, and 0) form the boot field. [Table D-2](#) provides information about the bits settings.

Table D-2 Bits 0–3 Settings

Boot Field	Meaning
0	Stays at the system bootstrap prompt (ROM monitor) on a reload or power cycle
1	Boots the boot helper image as a system image
2	Full boot process, which loads the Cisco IOS image into Flash memory
2-F	Specifies a default filename for booting over the network from a TFTP server

The boot field specifies a number in binary. If you set the boot field value to 0, you must have a console port access to boot the operating system manually. Boot the operating system by entering the **b** command at the bootstrap prompt as follows:

```
> b [tftp] flash filename
```

Definitions of the various command options follow:

- b**—Boots the default system software from ROM
- b flash**—Boots the first file in Flash memory
- b filename [host]**—Boots over the network using TFTP
- b flash filename**—Boots the file (*filename*) from Flash memory

If you set the boot field value to a value of 2 through F, and there is a valid system boot command stored in the configuration file, the router boots the system software as directed by that value. (See [Table D-3](#).) If you set the boot field to any other bit pattern, the router uses the resulting number to form a default boot filename for netbooting.

If there are no **boot** commands in the configuration file, the router attempts to boot the first file in system Flash memory. If no file is found in system Flash memory, the router attempts to netboot a default file with a name derived from the value of the boot field (for example, cisco2-7400). If the netboot attempt fails, the boot helper image in boot flash memory will boot up.

If **boot** commands are in the configuration file, the router software processes each **boot** command in sequence until the process is successful or the end of the list is reached. If the end of the list is reached without a file being successfully booted, the router will retry the **netboot** commands up to six times if bit 13 of the configuration register is set, otherwise it will load the operating system software available

in ROMmon. If bit 13 is not set, the router will continue to netboot images indefinitely. The default setting for bit 13 is 0. If bit 13 is set, the system boots the boot helper image found in boot flash memory without any retries.

The server creates a default filename as part of the automatic configuration processes. To form the boot filename, the server starts with Cisco and links the octal equivalent of the boot field number, a dash, and the image name. [Table D-3](#) lists the default boot filenames or actions.



Note

A **boot system configuration** command in the router configuration in NVRAM overrides the default netboot filename.

Table D-3 Default Boot Filenames

Action/File Name	Bit 3	Bit 2	Bit 1	Bit 0
Bootstrap mode	0	0	0	0
ROM software	0	0	0	1
Flash software	0	0	1	0
cisco3-<image-name1>	0	0	1	1
cisco4-<image-name2>	0	1	0	0
cisco5-<image-name3>	0	1	0	1
cisco6-<image-name4>	0	1	1	0
cisco7-<image-name5>	0	1	1	1
cisco10-<image-name6>	1	0	0	0
cisco11-<image-name7>	1	0	0	1
cisco12-<image-name8>	1	0	1	0
cisco13-<image-name9>	1	0	1	1
cisco14-<image-name10>	1	1	0	0
cisco15-<image-name11>	1	1	0	1
cisco16-<image-name12>	1	1	1	0
cisco17-<image-name13>	1	1	1	1

Bit 6

Bit 6 causes the system software to ignore nonvolatile random-access memory (NVRAM) contents.

Bit 7

Bit 7 enables the OEM bit. It disables the bootstrap messages at startup.

Bit 8

Bit 8 controls the console Break key. Setting bit 8 (the factory default) causes the processor to ignore the console Break key. Clearing bit 8 causes the processor to interpret Break as a command to force the system into the bootstrap monitor, halting normal operation. A Break can be sent in the first sixty seconds while the system reboots, regardless of the configuration settings.

Bit 10 and Bit 14

Bit 10 controls the host portion of the Internet IP broadcast address. Setting bit 10 causes the processor to use all zeros; clearing bit 10 (the factory default) causes the processor to use all ones. Bit 10 interacts with bit 14, which controls the network and subnet portions of the IP broadcast address. [Table D-4](#) shows the combined effect of bit 10 and bit 14.

Table D-4 Bit 10 and Bit 14 Settings

Bit 14	Bit 10	IP Address (<net> <host>)
Off	Off	<ones><ones>
Off	On	<zeros><zeros>
On	On	<net><zeros>
On	Off	<net><ones>

Bit 11 and Bit 12

Bit 11 and Bit 12 in the configuration register determine the baud rate of the console terminal. [Table D-5](#) shows the bit settings for the four available baud rates. (The factory set default baud rate is 9600.)

Table D-5 Bit 11 and Bit 12 Settings

Baud	Bit 12	Bit 11
9600	0	0
4800	0	1
2400	1	1
1200	1	0

Bit 13

Bit 13 determines the server response to a bootload failure. If **boot** commands are in the configuration file, the router software processes each **boot** command in sequence until the process is successful or the end of the list is reached. If the end of the list is reached without a file being successfully booted, the router will retry the **netboot** commands up to six times if bit 13 of the configuration register is set, otherwise it will load the operating system software available in ROMmon. If bit 13 is not set, the router will continue to netboot images indefinitely. The default setting for bit 13 is 0. If bit 13 is set, the system boots the boot helper image found in boot flash memory without any retries.

Bit 15

Bit 15 enables diagnostic messages and ignores NVRAM contents.

Displaying the Configuration Register While Running Cisco IOS

The configuration register can be viewed by using the **show version** or **show hardware** command.

The following is sample output of the **show version** command from a Cisco 7401ASR router.

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7400 Software (C7400-JS-M), Version 12.2(V99.1)
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Sat 19-May-01 11:31 by
Image text-base:0x60008960, data-base:0x617CA000

ROM:System Bootstrap, Version 12.2(1r)DD1, RELEASE SOFTWARE (fc1)
BOOTFLASH:7400 Software (C7400-KBOOT-M),
12.2(20010427:125)

router uptime is 17 hours, 2 minutes
System returned to ROM by reload at 01:09:49 UTC Sat Jan 1 2000
System image file is "tftp://000.000.000.000//tftpboot/biff/122_1_DX/c7400-
mz.V122_1_DX.5.19.01"

cisco 7401ASR (NSE) processor (revision A) with 245760K/16384K bytes of memory
Processor board ID 4294967295
R7000 CPU at 375Mhz, Implementation 39, Rev 3.3, 256KB L2, 2000KB L3 Cache
1 slot ASR midplane, Version 2.0

Last reset from power-on
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
PXF processor tmc is running.
8 Ethernet/IEEE 802.3 interface(s)
2 Gigabit Ethernet/IEEE 802.3 interface(s)
509K bytes of non-volatile configuration memory.

64256K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x100
```

Displaying the Configuration Register While Running ROM Monitor

If the bootstrap prompt ">", the **o** command displays the virtual configuration register currently in effect. It includes a description of the bits. See the following sample output:

```
>o
Configuration register + 02x100 at last boot
Bit#           Configuration register option settings:
15             Diagnostic mode disabled
```

```

14      IP broadcasts do not have network numbers
13      Boot default ROM software if network boot fails
12-11   Console speed is 9600 baud
10      IP broadcasts with ones
09      Do not use secondary bootstrap
08      Break disabled
07      OEM disabled
06      Ignore configuration disabled
05      Fast boot disabled
04      Fan boot disabled
03-00   Boot to ROM monitor

```

If the prompt is “rommon1”, the **confreg** command displays the virtual configuration register currently in effect. It includes a description of the bits. See the following sample output:

```

rommon 1 > confreg

Configuration Summary
enabled are:
load rom after netboot fails
console baud: 9600
boot: the ROM Monitor

Do you wish to change the configuration? y/n [n]

```

Setting the Configuration Register While Running Cisco IOS

The configuration register can be set in the configuration mode with the **config-register 0x<value>** command. See the following sample output:

```

Router# config t
Enter configuration commands, one per line. End with CNTRL/Z.
Router(config)#config-register 0x2142
Router(config)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

```

Setting the Configuration Register While Running ROM Monitor

If the prompt is “>”, the **or0x<value>** command sets the configuration register. See the following sample output:

```

>o/r 0x2102
>

```

If the prompt is “rommon1”, the **confreg** command sets the configuration register. It prompts the user about each bit. See the following sample output:

```

rommon 1 > confreg

Confiruation Summary
enabled are:
load rom after netboot fails
console baud: 9600
boot: the ROM Monitor

do you wish to change the configuration y/n [n]: y
enable "diagnostic mode"? y/n [n]: n

```



```
enable "use net in IP bcast address"? y/n [n]: n
disable "use rom after netboot fails"? y/n [n]: n
enable "use all zero broadcast"? y/n [n]: n
enable "break/abort has effect"? y/n [n]: n
enable "ignore system config info"? y/n [n]: n
change console baud rate? y/n [n]: n
change the boot characteristics? y/n [n]:y
enter to boot:
0 = ROM Monitor
1 = the boot helper image
2 - 15 = boot system
[0]: 2

Configuration Summary:
enabled are:
load rom after netboot fails
console baud: 9600
boot: image sepcified by the boot system commands or default to: cisco2-c7400

do you wish to change the configuration? y/n [n] n

You must reset or power cycle for new config to take effect
rommon 2 >
```




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