Cisco 7301 Installation and Configuration Guide

Product Number: Cisco 7301

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The following information is for FCC compliance of Class A devices: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to correct the interference at their own expense.

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You can determine whether your equipment is causing interference by turning it off. If the interference stops, it was probably caused by the Cisco equipment or one of its peripheral devices. If the equipment causes interference to radio or television reception, try to correct the interference by using one or more of the following measures:

• Turn the television or radio antenna until the interference stops.

• Move the equipment to one side or the other of the television or radio.

• Move the equipment farther away from the television or radio.

• Plug the equipment into an outlet that is on a different circuit from the television or radio. (That is, make certain the equipment and the television or radio are on circuits controlled by different circuit breakers or fuses.)

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CONTENTS

Preface

This preface discusses the objectives, audience, organization, and conventions of this publication. The following sections are in this chapter:

Document Version History

The version history of this document is provided below beginning with version OL-5418-06.

Version	Date	Notes
OL-5418-07	August 11, 2005	Adding more second cpu **show** commands and output Adding statement numbers to warnings and adding the console port cable kit product number.

Document Objectives

This publication describes the installation and configuration of the Cisco 7301 router, replacement or upgrading of field replaceable units (FRUs), and troubleshooting of the Cisco 7301 hardware. The purpose of this guide is to enable the safe and efficient installation of the Cisco 7301 router.

Audience

This publication is primarily designed for the person responsible for installing, maintaining, and troubleshooting the Cisco 7301 router. The users of this guide should be familiar with electronic circuitry and wiring practices and have experience as electronic or electromechanical technicians. Users of this guide should also have experience in installing high-end networking equipment. Certain procedures described in this guide require a certified electrician.

For configuration applications, refer to the Cisco IOS configuration guides and command references and to the documents listed in the "Related Documentation" section on page x at the end of this preface.

Document Organization

The major sections of this installation and configuration guide are as follows:

Chapter /Appendix Number and Title	Description
Chapter 1, "Cisco 7301 Overview"	This chapter provides a hardware overview as well as installation instructions for a small form factor (SPF) Gigabit Interface Converter (GBIC) module.
Chapter 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.
Chapter 3, "Starting and Configuring the Router"	This chapter provides a functional overview of the system as well as startup and configuration instructions.
Chapter 4, "Installing and Removing Field-Replaceable Units"	This chapter provides instructions for removing and replacing power supplies, SODIMMs, fans, CompactFlash disks, and port adapters.
Chapter 5, "Troubleshooting Initial Startup Problems"	This chapter provides basic system startup troubleshooting information.
Appendix A, "Specifications"	This appendix provides system specifications as well as port and cabling pinouts and specifications.
Appendix B, "Using the CompactFlash Disk"	This appendix provides instructions for using the CompactFlash Disk.
Appendix C, "Configuration Register Information"	This appendix provides configuration register information.

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. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

SAVE THESE INSTRUCTIONS

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. Gebruik het nummer van de verklaring onderaan de waarschuwing als u een vertaling van de waarschuwing die bij het apparaat wordt geleverd, wilt raadplegen.

BEWAAR DEZE INSTRUCTIES

Varoitus **TÄRKEITÄ TURVALLISUUSOHJEITA**

Tämä varoitusmerkki merkitsee vaaraa. Tilanne voi aiheuttaa ruumiillisia vammoja. Ennen kuin käsittelet laitteistoa, huomioi sähköpiirien käsittelemiseen liittyvät riskit ja tutustu onnettomuuksien yleisiin ehkäisytapoihin. Turvallisuusvaroitusten käännökset löytyvät laitteen mukana toimitettujen käännettyjen turvallisuusvaroitusten joukosta varoitusten lopussa näkyvien lausuntonumeroiden avulla.

SÄILYTÄ NÄMÄ OHJEET

Attention **IMPORTANTES INFORMATIONS DE SÉCURITÉ**

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant entraîner des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers liés aux circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions des avertissements figurant dans les consignes de sécurité traduites qui accompagnent cet appareil, référez-vous au numéro de l'instruction situé à la fin de chaque avertissement.

CONSERVEZ CES INFORMATIONS

Warnung **WICHTIGE SICHERHEITSHINWEISE**

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu Verletzungen führen kann. Machen Sie sich vor der Arbeit mit Geräten mit den Gefahren elektrischer Schaltungen und den üblichen Verfahren zur Vorbeugung vor Unfällen vertraut. Suchen Sie mit der am Ende jeder Warnung angegebenen Anweisungsnummer nach der jeweiligen Übersetzung in den übersetzten Sicherheitshinweisen, die zusammen mit diesem Gerät ausgeliefert wurden.

BEWAHREN SIE DIESE HINWEISE GUT AUF.

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. Utilizzare il numero di istruzione presente alla fine di ciascuna avvertenza per individuare le traduzioni delle avvertenze riportate in questo documento.

CONSERVARE QUESTE ISTRUZIONI

Advarsel **VIKTIGE SIKKERHETSINSTRUKSJONER**

Dette advarselssymbolet betyr fare. Du er i en situasjon som kan føre til skade på person. Før du begynner å arbeide med noe av utstyret, må du være oppmerksom på farene forbundet med elektriske kretser, og kjenne til standardprosedyrer for å forhindre ulykker. Bruk nummeret i slutten av hver advarsel for å finne oversettelsen i de oversatte sikkerhetsadvarslene som fulgte med denne enheten.

TA VARE PÅ DISSE INSTRUKSJONENE

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você está em uma situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha conhecimento dos perigos envolvidos no manuseio de circuitos elétricos e familiarize-se com as práticas habituais de prevenção de acidentes. Utilize o número da instrução fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham este dispositivo.

GUARDE ESTAS INSTRUÇÕES

¡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. Al final de cada advertencia encontrará el número que le ayudará a encontrar el texto traducido en el apartado de traducciones que acompaña a este dispositivo.

GUARDE ESTAS INSTRUCCIONES

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. Använd det nummer som finns i slutet av varje varning för att hitta dess översättning i de översatta säkerhetsvarningar som medföljer denna anordning.

SPARA DESSA ANVISNINGAR

FONTOS BIZTONSÁGI ELOÍRÁSOK

Ez a figyelmezeto jel veszélyre utal. Sérülésveszélyt rejto helyzetben van. Mielott bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplo figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található; a fordítás az egyes figyelmeztetések végén látható szám alapján keresheto meg.

ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Предупреждение **ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

Этот символ предупреждения обозначает опасность. То есть имеет место ситуация, в которой следует опасаться телесных повреждений. Перед эксплуатацией оборудования выясните, каким опасностям может подвергаться пользователь при использовании электрических цепей, и ознакомьтесь с правилами техники безопасности для предотвращения возможных несчастных случаев. Воспользуйтесь номером заявления, приведенным в конце каждого предупреждения, чтобы найти его переведенный вариант в переводе предупреждений по безопасности, прилагаемом к данному устройству.

СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ

警告 重要的安全性说明

此警告符号代表危险。您正处于可能受到严重伤害的工作环境中。在您使用设备开始工作之前，必须充分意识到触电的危险，并熟练掌握防止事故发生的标准工作程序。请根据每项警告结尾提供的声明号码来找到此设备的安全性警告说明的翻译文本。

请保存这些安全性说明

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、一般的な事故防止策に留意してください。警告の各国語版は、各注意事項の番号を基に、装置に付属の「Translated Safety Warnings」を参照してください。

これらの注意事項を保管しておいてください。

주의 중요 안전 지침

이 경고 기호는 위험을 나타냅니다. 작업자가 신체 부상을 일으킬 수 있는 위험한 환경에 있습니다. 장비에 작업을 수행하기 전에 전기 회로와 관련된 위험을 숙지하고 표준 작업 관례를 숙지하여 사고를 방지하십시오. 각 경고의 마지막 부분에 있는 경고문 번호를 참조하여 이 장치와 함께 제공되는 번역된 안전 경고문에서 해당 번역문을 찾으십시오.

이 지시 사항을 보관하십시오.

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você se encontra em uma situação em que há risco de lesões corporais. Antes de trabalhar com qualquer equipamento, esteja ciente dos riscos que envolvem os circuitos elétricos e familiarize-se com as práticas padrão de prevenção de acidentes. Use o número da declaração fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham o dispositivo.

GUARDE ESTAS INSTRUÇÕES

Advarsel **VIGTIGE SIKKERHEDSANVISNINGER**

Dette advarselssymbol betyder fare. Du befinder dig i en situation med risiko for legemesbeskadigelse. Før du begynder arbejde på udstyr, skal du være opmærksom på de involverede risici, der er ved elektriske kredsløb, og du skal sætte dig ind i standardprocedurer til undgåelse af ulykker. Brug erklæringsnummeret efter hver advarsel for at finde oversættelsen i de oversatte advarsler, der fulgte med denne enhed.

GEM DISSE ANVISNINGER

تحذير **إرشادات الأمان الهامة**

يوضح رمز التحذير هذا وجود خطر. وهذا يعني أنك متواجد في مكان قد ينتج عنه التعرض لإصابات. قبل بدء العمل، احذر مخاطر التعرض للصدمات الكهربائية وكن على علم بالإجراءات القياسية للحيلولة دون وقوع أي حوادث. استخدم رقم البيان الموجود في أخر كل تحذير لتحديد مكان ترجمته داخل تحذيرات الأمان المترجمة التي تأتي مع الجهاز.
قم بحفظ هذه الإرشادات

Upozorenje **VAŽNE SIGURNOSNE NAPOMENE**

Ovaj simbol upozorenja predstavlja opasnost. Nalazite se u situaciji koja može prouzročiti tjelesne ozljede. Prije rada s bilo kojim uređajem, morate razumjeti opasnosti vezane uz električne sklopove, te biti upoznati sa standardnim načinima izbjegavanja nesreća. U prevedenim sigurnosnim upozorenjima, priloženima uz uređaj, možete prema broju koji se nalazi uz pojedino upozorenje pronaći i njegov prijevod.

SAČUVAJTE OVE UPUTE

Upozornění

DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY

Tento upozorňující symbol označuje nebezpečí. Jste v situaci, která by mohla způsobit nebezpečí úrazu. Před prací na jakémkoliv vybavení si uvědomte nebezpečí související s elektrickými obvody a seznamte se se standardními opatřeními pro předcházení úrazům. Podle čísla na konci každého upozornění vyhledejte jeho překlad v přeložených bezpečnostních upozorněních, která jsou přiložena k zařízení.

USCHOVEJTE TYTO POKYNY

Προειδοποίηση

ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

Αυτό το προειδοποιητικό σύμβολο σημαίνει κίνδυνο. Βρίσκεστε σε κατάσταση που μπορεί να προκαλέσει τραυματισμό. Πριν εργαστείτε σε οποιοδήποτε εξοπλισμό, να έχετε υπόψη σας τους κινδύνους που σχετίζονται με τα ηλεκτρικά κυκλώματα και να έχετε εξοικειωθεί με τις συνήθεις πρακτικές για την αποφυγή ατυχημάτων. Χρησιμοποιήστε τον αριθμό δήλωσης που παρέχεται στο τέλος κάθε προειδοποίησης, για να εντοπίσετε τη μετάφρασή της στις μεταφρασμένες προειδοποιήσεις ασφαλείας που συνοδεύουν τη συσκευή.

ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ

אזהרה

הוראות בטיחות חשובות

סימן אזהרה זה מסמל סכנה. אתה נמצא במצב העלול לגרום לפציעה. לפני שתעבוד עם ציוד כלשהו, עליך להיות מודע לסכנות הכרוכות במעגלים חשמליים ולהכיר את הנהלים המקובלים למניעת תאונות. השתמש במספר ההוראה המסופק בסופה של כל אזהרה כד לאתר את התרגום באזהרות הבטיחות המתורגמות שמצורפות להתקן.

שמור הוראות אלה

Opomena

ВАЖНИ БЕЗБЕДНОСНИ НАПАТСТВИЈА
Симболот за предупредување значи опасност. Се наоѓате во ситуација што може да предизвика телесни повреди. Пред да работите со опремата, бидете свесни за ризикот што постои кај електричните кола и треба да ги познавате стандардните постапки за спречување на несреќни случаи. Искористете го бројот на изјавата што се наоѓа на крајот на секое предупредување за да го најдете неговиот период во преведените безбедносни предупредувања што се испорачани со уредот.
ЧУВАЈТЕ ГИ ОВИЕ НАПАТСТВИЈА

Ostrzeżenie

WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA

Ten symbol ostrzeżenia oznacza niebezpieczeństwo. Zachodzi sytuacja, która może powodować obrażenia ciała. Przed przystąpieniem do prac przy urządzeniach należy zapoznać się z zagrożeniami związanymi z układami elektrycznymi oraz ze standardowymi środkami zapobiegania wypadkom. Na końcu każdego ostrzeżenia podano numer, na podstawie którego można odszukać tłumaczenie tego ostrzeżenia w dołączonym do urządzenia dokumencie z tłumaczeniami ostrzeżeń.

NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ

Upozornenie

DÔLEŽITÉ BEZPEČNOSTNÉ POKYNY

Tento varovný symbol označuje nebezpečenstvo. Nachádzate sa v situácii s nebezpečenstvom úrazu. Pred prácou na akomkoľvek vybavení si uvedomte nebezpečenstvo súvisiace s elektrickými obvodmi a oboznámte sa so štandardnými opatreniami na predchádzanie úrazom. Podľa čísla na konci každého upozornenia vyhľadajte jeho preklad v preložených bezpečnostných upozorneniach, ktoré sú priložené k zariadeniu.

USCHOVAJTE SI TENTO NÁVOD

Warning

Ultimate disposal of this product should be handled according to all national laws and regulations. To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information* document that accompanied the equipment.

Related Documentation

Your Cisco 7301 router and the Cisco IOS software running on it contain extensive features and functionality, which are documented in the following resources:

- Cisco Documentation DVD package (See the "Obtaining Documentation and Submitting a Service Request" section on page xi.)
- Cisco.com (See the "Obtaining Documentation and Submitting a Service Request" section on page xi.)
- 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.
- All documentation related to the Cisco 7301 router, is listed in the online *Cisco 7301 Router Documentation Roadmap*. Information in this master index includes troubleshooting tools and documentation, regulatory compliance and safety information, and installation and replacement information.

  Some of the Cisco 7301 documentation that is listed on the *Cisco 7301 Router Documentation Roadmap* includes:

  - The *Cisco 7301 Installation and Configuration Guide* contains complete installation and startup configuration information.
  - The *Cisco 7301Router Quick Start Guide* contains installation and configuration information and is online. It contains quick reference information about chassis or parts installation.
  - The *Cisco 7301 Troubleshooting* document contains information to help you troubleshoot problems with the Cisco 7301 router.
  - *Cisco 7301 Router Troubleshooting and Configuration Notes*
  - *Regulatory Compliance and Safety Information for the Cisco 7301 Router* This document provides international agency compliance, safety, and statutory information for wide-area network (WAN) interfaces for the Cisco 7301 router. It also contains information previously found in the *Site Preparation and Safety Guide*.
  - Port adapter and service adapter documentation. See the documentation guide that ships with the port adapter or service adapter for the customer order number.

- 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.

  To access Software Advisor, click **Log In** at Cisco.com and go to Support, Tools and Resources.

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

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

Subscribe to the *What's New in Cisco Product Documentation* as a Really Simple Syndication (RSS) feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.

CHAPTER 1

Cisco 7301 Overview

The Cisco 7301 router provides application-specific features for broadband subscriber aggregation and network application services with high processing performance.

This chapter provides a quick hardware and features overview and options installation instructions for the Cisco 7301 router. For functional information see Chapter 3, "Starting and Configuring the Router," the "Functional Overview" section on page 3-1. For system specifications and port and cabling specifications, see Appendix A, "Specifications."

This chapter includes the following sections:

Warning **This warning 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 the standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the *CRegulatory Compliance and Safety Information for the Cisco 7301 Router* publication that accompanied this device**. Statement 1071

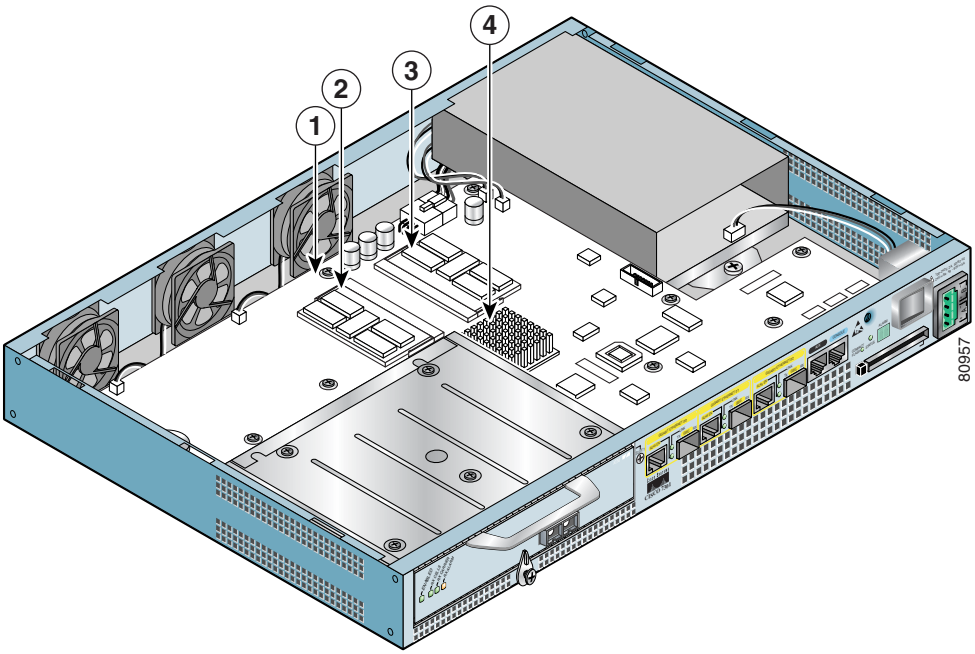
Warning **Before you install, operate, or service the system, read the "Preparing to Install the Cisco 7301 Router" section on page 2-1 and the *Regulatory Compliance and Safety Information for the Cisco 7301 Router* publication. These documents provide important safety information you should know before working with the system.** Statement 200

Cisco 7301 Features

Each Cisco 7301 router consists of the following features:

- Small form-factor—One rack-unit (RU) high with stacking capability:
  1.73 in. x 17.3 in. x 13.87 in. (4.39 cm x 43.9 cm x 35.23 cm). The weight is approximately 10.5 lbs (4.76 kg).
- Three native Gigabit Ethernet interfaces—six ports:
  - Three optical fiber Gigabit Ethernet (1000 Mbps) ports that use a small form factor pluggable (SFP) Gigabit Interface Converter (GBIC) modules with LC connectors
  - Three Gigabit Ethernet (10/100/1000 Mbps) ports with RJ-45 connectors (any three ports are available at any one time)
- Both 25-MHz and 50-MHz port adapter operation
- A 64- or 128-MB CompactFlash Disk
- SFP GBIC modules: Three Gigabit Ethernet SX, LH, ZX module options, 1000BASE-T SFP (copper) module, and several coarse wavelength-division multiplexing CWDM SFP modules
- Power supplies:
  - Single or dual AC power supplies
  - Single 24V DC power supply
  - Dual 48V DC power supply
- BCM 1250 integrated dual processors that operates at an internal clock speed of 700 MHz
- 512-KB Boot ROM
- 32-MB Boot Flash
- Three SDRAM memory options: 256 MB, 512 MB, and 1 GB
- Auxiliary port
- Console port
- Online insertion and removal (OIR)—Allows you to add, replace, or remove port adapters with minimal interruption of 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
- Front-to-back airflow—Allows you to mount the router from either front or back into 19-inch two-post racks and 21–23-inch four-post racks

Figure 1-1 Cisco 7301 Router—Interior View



1	Temperature sensor 2 (U5)	**3**	SODIMM 2 (J2)
2	SODIMM 1 (J1)	**4**	BCM 1250 Processor (U31)

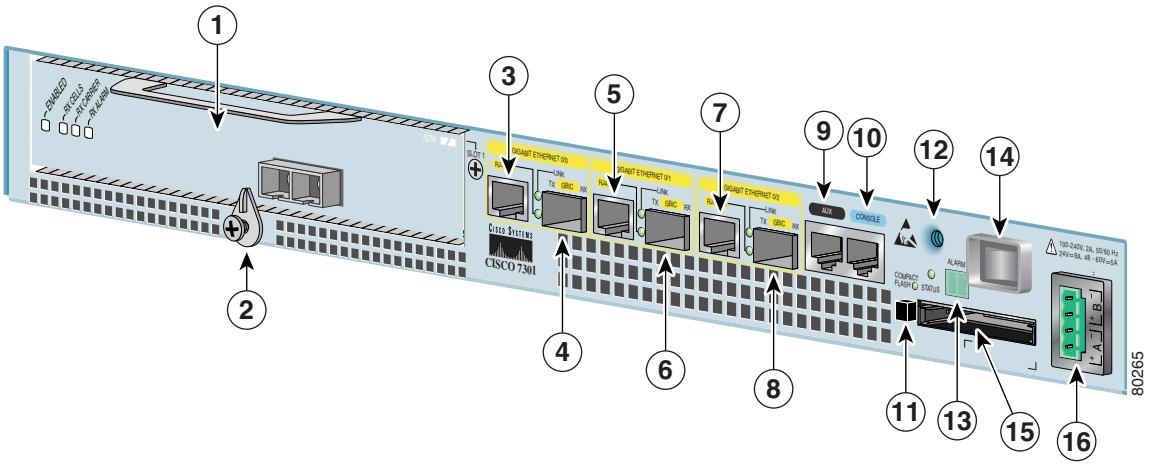
Temperature sensor 1 (U62) is on the underneath side of the board.

Cisco 7301 Hardware Overview

This section provides you with an overview of the hardware including LEDs, front and rear views, and interior part identification.

Front View

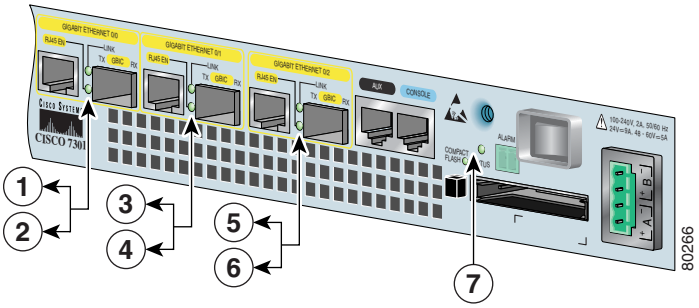
Figure 1-2 Cisco 7301 Router—Front View



1	Port adapter slot (with installed port adapter)	**9**	Auxiliary port
2	Port adapter latch	**10**	Console port
3	Gigabit Ethernet 0/0—RJ-45 port	**11**	CompactFlash Disk ejector button
4	Gigabit Ethernet 0/0—SFP GBIC port	**12**	Ground for ESD wrist strap with banana jack
5	Gigabit Ethernet 0/1—RJ-45 port	**13**	Alarm port
6	Gigabit Ethernet 0/1—SFP GBIC port	**14**	Power switch
7	Gigabit Ethernet 0/2—RJ-45 port	**15**	CompactFlash Disk slot
8	Gigabit Ethernet 0/2—SFP GBIC port	**16**	Power connector

LEDs

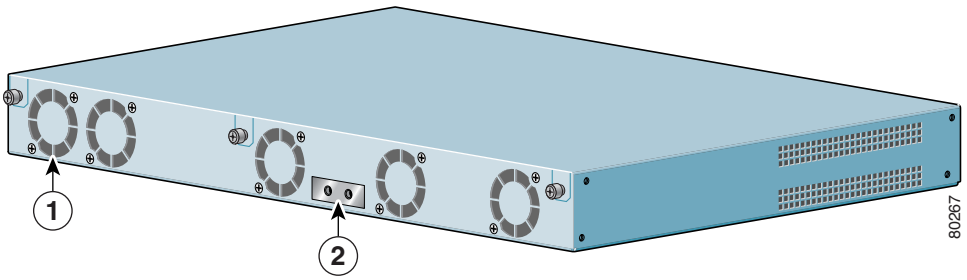
Figure 1-3 Cisco 7301 Router—LEDs



No.	LED Label	LED	Color	Status	LED flashes when there is traffic
1	LINK (0/0)	LINK (0/0)	Green	—	Yes
2	RJ-45 EN (0/0)	RJ-45 enable (0/0)	Green	In the Power Up state, the LED is on	No, remains constantly on
3	LINK (0/1)	LINK (0/1)	Green	—	Yes
4	RJ-45 EN (0/1)	RJ-45 enable (0/1)	Green	In the Power Up state, the LED is on	No, remains constantly on
5	LINK (0/2)	LINK (0/2)	Green	—	Yes
6	RJ-45 EN (0/2)	RJ-45 enable (0/2)	Green	In the Power Up state, the LED is on	No, remains constantly on
7	STATUS	System status	Amber while the system boots Green when the system is operational	— In the Power Up state, the LED is on	— No, remains constantly on

Rear View

Figure 1-4 Cisco 7301—Rear View



1	Fan	**2**	Grounding connector

Five internal fans draw cooling air into the chassis and across internal components to maintain an acceptable operating temperature. (See Figure 1-4.) The five fans are located at the rear of the chassis as is the chassis grounding connector that provide a chassis ground connection for ESD equipment or a two-hole grounding lug.

System Board

Internally, the system board contains the following components:

- Two SODIMM DDR-SDRAM memory modules that are available in three options: 128 MB, 256 MB, and 512 MB
- BCM 1250 processor system
- BCM 1250 integrated dual processor that operates at an internal clock speed of 700 MHz. The BCM 1250 processor maintains and executes the system management functions for the Cisco 7301 router. The processor also performs some memory and environmental monitoring functions.
  - The BCM 1250 serves as the system controller. It interconnects the processor with the double data rate synchronous dynamic random-access memory (DDR-SDRAM) controller, lightning data transport (LDT) bus, and the three direct-interface Gigabit Ethernet interfaces, and the port adapter PCI bus, which allows the port adapter access to DDR-SDRAM.
- Cache memory

  The processor system has two levels of cache: primary and secondary cache that are internal to the microprocessor with secondary unified cache for data and instruction.
- Three Gigabit Ethernet interfaces: (six ports: three SFP GBIC [optical] and three RJ-45s [copper]). Any three ports are available at the same time and are linked directly to the BCM 1250 system.
- A CompactFlash Disk for storing the default Cisco IOS software image.
- Auxiliary port with full data terminal equipment (DTE) functionality.
- Boot ROM for storing sufficient code for booting the Cisco IOS software.
- Flash memory for storing the boot helper (boot loader) image.

- NVRAM for storing the system configuration and environmental monitoring logs. NVRAM uses lithium batteries to maintain its contents when disconnected from power.
- Two environmental sensors for monitoring the internal temperature of the chassis.

System Management Functions

The Cisco 7301 processor system 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)

The Cisco 7301 router supports multiprotocol, multimedia routing and bridging with a wide variety of protocols and port adapters.

Checking the Shipping Container Contents

Use the Cisco 7301 components list to check the contents of the Cisco 7301 router shipping container. Do not discard the shipping container. You need the container if you move or ship the Cisco 7301 router in the future.

Table 1-1 Cisco 7301 Components List

Component	Description	Received
Chassis	Cisco 7301 chassis configured with a single or dual AC or DC power supply and port adapter filler plate.	
Accessories: • Rack-mount and cable-management kit • AC power cable-retention clip • Power cables • Documentation	The following accessories might arrive in separate shipping containers: 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 If a single AC power supply is ordered, an AC power cable-retention clip ships An AC power cable, if an AC power supply was ordered If ordered, router hardware and software documentation and the Cisco Documentation CD-ROM package[1]	
Optional Equipment	Examples: Port adapter, SFP GBIC modules , network interface cables, transceivers, special connectors and so on	

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.

Cisco 7301 Router Installation Checklist

To assist you with your installation and to provide a historical record of what was done by whom, photocopy the Cisco 7301 Router Installation Checklist, Table 1-2 on page 1-9. 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.

Information on replacing internal field-replaceable units (FRUs) is found in Chapter 4, “Installing and Removing Field-Replaceable Units.”

Table 1-2 Cisco 7301 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; cable-retention clip secured		
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 1 stop bits (9600 8N1)		
System power turned on		
System boot complete (STATUS LED is on)		
I/O ports and port adapter are operational (see Figure 1-3 for specific LED information)		
Correct hardware configuration displayed after system banner appears		

About the SFP GBIC Module

You may have ordered a SFP (small form-factor pluggable) Gigabit Interface Converter (GBIC) module with your Cisco 7301 router. You must install the SFP GBIC module. It is shipped separately to prevent damage during shipment. After reading this section, use the installation instructions in the "Installing the SFP GBIC Module" section on page 1-11 the to install the SFP GBIC modules.

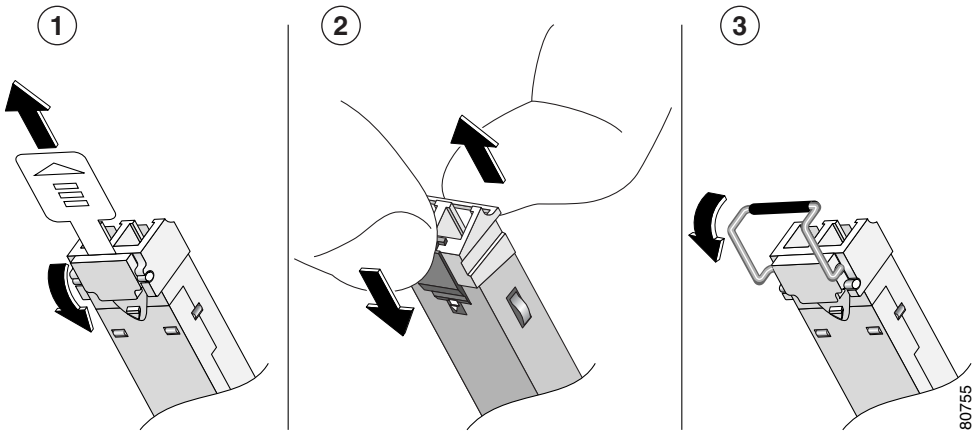
For ease of installation, insert the SFP GBICmodule in the router while it is powered down and before placing it in a rack.

The SFP GBIC port is a 1000-Mbps optical interface in the form of an LC-type duplex port that supports IEEE 802.3z interfaces compliant with the 1000BASEX standard. Gigabit Ethernet SFP GBIC models GLC-SX-MM, GLC-LH-SM, and GLC-ZX-SM are supported in the Cisco 7301 router, as well as the Cisco 1000BASE-T SFP. In addition, a variety of Coarse Wave Division Multiplexing (CWDM) SFPs are supportedon the Cisco 7301. The cabling information is the same for all optical SFPs.

Also see "SFP GBIC Module Configurations" section on page A-4, the *Gigabit Interface Converter (GBIC) and Small Form-Factor Pluggable(SFP) GBIC Installation Inforamtion and Specifications*, and the *Coarse Wavelength-Division Multiplexing SFP Compatability Matrix*.

For optical connection cleaning information, see the *Inspection and Cleaning Procedures for Fiber-Optic Connections* document.

Figure 1-5 Types of SFP GBIC Module Latches



1	Sliding latch	**3**	Swing latch
2	Swing and slide latch		

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

- The SPF GBIC module has three types of latches, which are also the removal mechanism. See Figure 1-5. There is no correlation of the type of latch to the model (such as SX or LH) or technology type (such as Gigabit Ethernet) of SFP modules. Always read the label on the SFP GBIC module to determine the technology type, and model.
- You can install and remove Gigabit Ethernet SFP GBIC modules with power on to the system.
- Disconnect all cables before removing or installing a Gigabit Ethernet SFP module. We strongly recommend that you do *not* install or remove the SFP GBIC with optical fiber cables attached to it.
- SFP GBIC modules are keyed to prevent incorrect insertion.

Warning **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

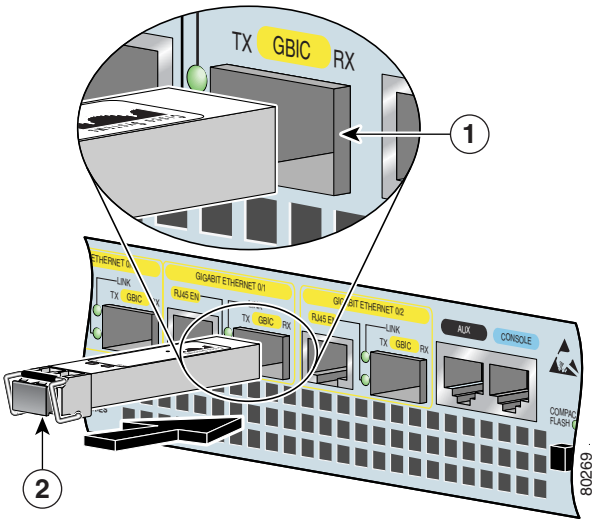
Warning **Class 1 laser product.** Statement 1008

Warning **Class 1 LED product.** Statement 1027

Warning **During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.** Statement 94

Installing the SFP GBIC Module

Figure 1-6 Inserting a SFP GBIC Module into the Cisco 7301 Gigabit Ethernet Port 0/1



1	SFP GBIC port 0/1	**2**	SFP GBIC module

Use the following procedure to install a SFP GBICmodule:

Step 1 Attach an ESD-preventive wrist strap between you and an unpainted chassis surface.

Step 2 Locate the label on the SFP GBIC module and turn the SFP GBIC module so the label is on top and the alignment groove is down.

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

Step 3 Insert the SFP GBIC module into SFP GBIC port 0/1, 0/2, or 0/3. The SFP GBIC module snaps into place when you have completely and properly inserted it.

Step 4 Repeat Step 2 if you are inserting a second or third SFP GBIC module.

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

This completes the SFP GBIC module installation procedure.

For information on removing and installing other options, see Chapter 4, "Installing and Removing Field-Replaceable Units."

For rack-mounting and cabling procedures, see Chapter 2, "Rack-Mounting, Tabletop Installation, and Cabling."

CHAPTER 2

Rack-Mounting, Tabletop Installation, and Cabling

This chapter explains how to install a Cisco 7301 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:

The Cisco 7301 router operates as either a tabletop or a rack-mounted unit. A rack-mount kit is standard equipment included with the Cisco 7301 router when it is shipped from the factory. The kit provides the hardware needed to mount the router in a standard four-post 19-inch equipment rack or a two-post rack or a 21–23-inch equipment rack.

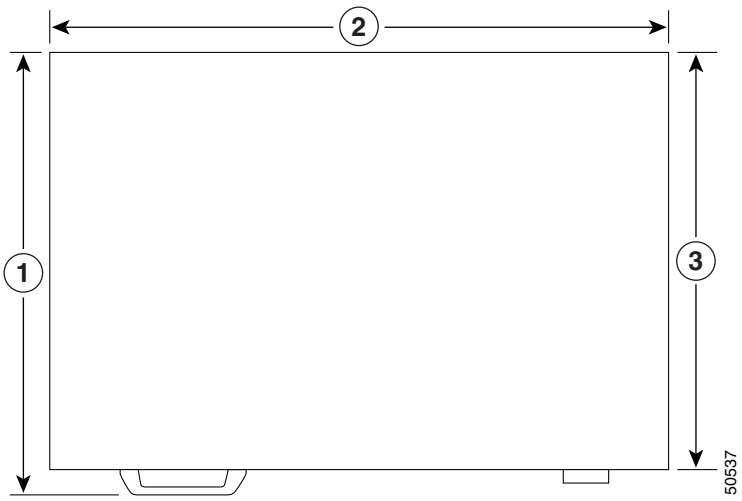
If you are not rack-mounting your Cisco 7301 router, place it on a sturdy tabletop or platform.

Preparing to Install the Cisco 7301 Router

Before installing your Cisco 7301 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:

Figure 2-1 Dimensions of Cisco 7301 Router



1	13.87 in.	**3**	12.3 in.
2	17.3 in.		

Table 2-1 provides dimensions and weight information.

Table 2-1 Cisco 7301 Router Dimensions and Weight

Cisco 7301	
Dimensions	1.73 in. x 17.3 in. x 13.87 in. (4.39 cm x 43.9 cm x 35.23 cm)
Weight	Chassis fully configured with a port adapter ~ 10.5 lb (4.76 kg)

Tools and Parts Required

Your Cisco 7301 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)
- 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.

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
- One AC power cable-retention clip (if you ordered a single AC power supply)
- 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

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.

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.

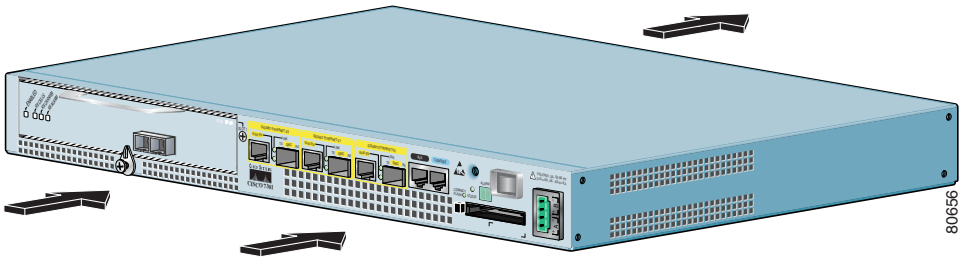
Site Requirement Guidelines

Warning **Before you install, operate, or service the system, read the "Site Preparation and Safety Information" section of the *Cisco 7301 Series Internet Routers Regulatory Compliance and Safety Information* document. This section contains important safety information you should know before working with the system.** Statement 200

The environmental monitoring functionality in the Cisco 7301 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 7301 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 7301 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 3-5 for temperature threshold information.)

Installing the Router

This section explains how to install a Cisco 7301 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:

- Attaching the Chassis Rack-Mount and Cable-Management Brackets, page 2-6
- 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 7301 Router" section on page 2-1, and the "Site Requirement Guidelines" section on page 2-4.

When installing a Cisco 7301 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 back sides 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, SFP GBIC module, or CompactFlash Disk—or accessing network cables or equipment.
- A blank port adapter 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.

Warning **This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a fuse or circuit breaker no larger than 120 VAC, 15A U.S. (240 VAC, 10A international) is used on the phase conductors (all current-carrying conductors).** Statement 13

Following are the steps for installing a Cisco 7301 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 7301 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, SFP GBIC module, 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.

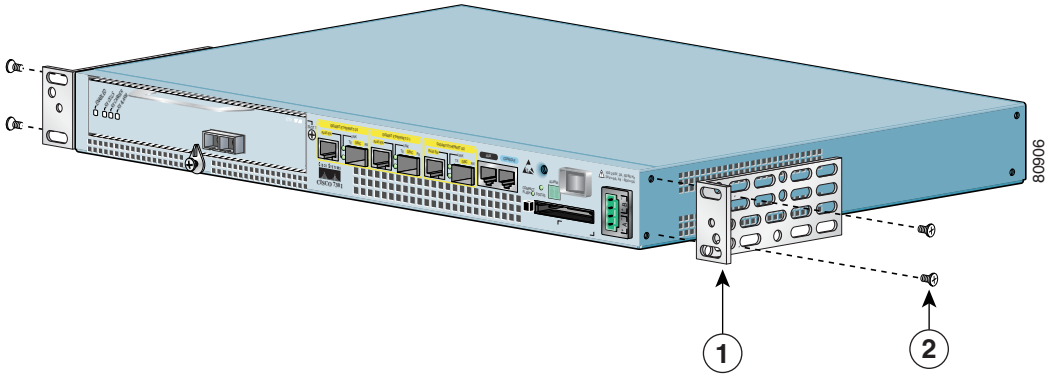
Attaching the Chassis Rack-Mount and Cable-Management Brackets

This section explains how to install the rack-mount and cable-management brackets at the front and the rear of a Cisco 7301 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 7301 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 the two screws.

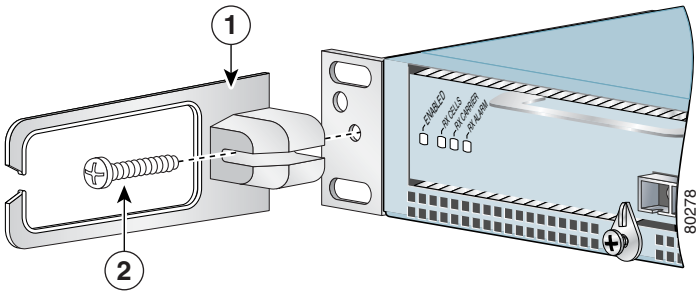
Step 4 Repeat Step 1through Step 3 on the other side of the router.

This completes the steps for attaching the rack-mount brackets to the Cisco 7301 router.

To install the cable-management bracket, go to the "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

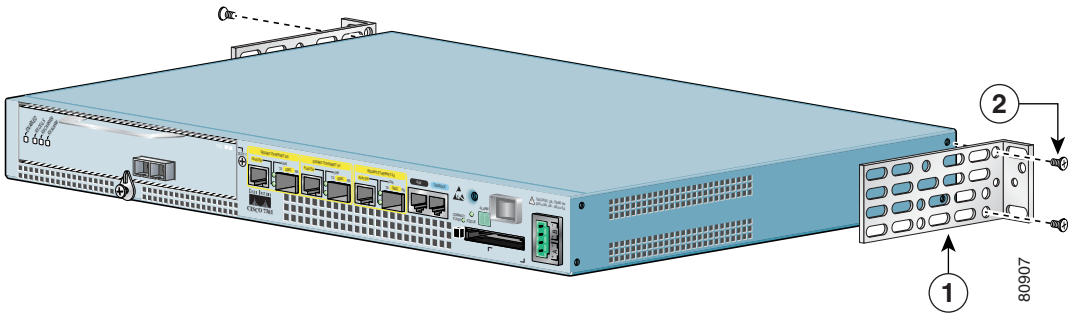
Step 1 Align the cable-management bracket to the rack-mount bracket on the left side of the Cisco 7301 router.

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 7301 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 7301 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 two 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 7301 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 and cable-management brackets on a Cisco 7301 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 SFP GBIC modules 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.

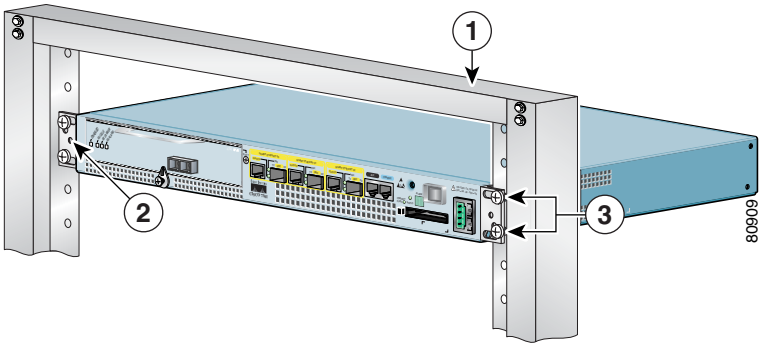
For two-post rack installation, go to the "Two-Post Rack Installation" section on page 2-10.

For four-post rack installation, go to the "Four-Post Rack Installation" section on page 2-11.

Two-Post Rack Installation

Note Inner clearance (the width between the inner sides of the two posts or rails) must be at least 17.3 inches (43.9 cm). The height of the chassis is 1.73 inches (4.39 cm). Airflow through the chassis is from front to back.

Figure 2-6 Installing the Cisco 7301 Router in a Two-Post Rack



1	Two-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.

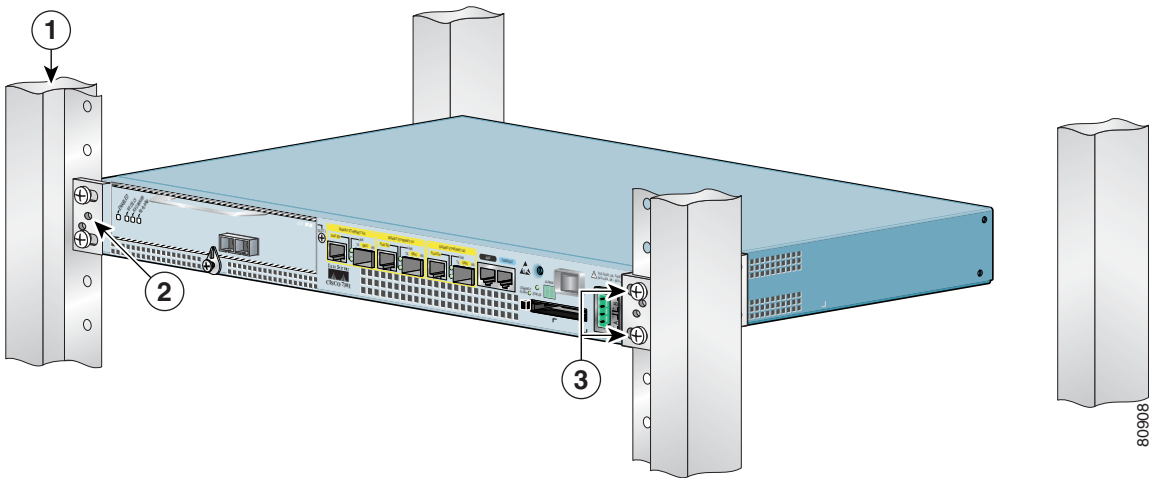
Step 6 For each bracket, insert and tighten two 12-24 x 0.5-inch screws to the rack.

This completes the procedure for installing the chassis in the rack. Proceed to the "Attaching a Chassis Ground Connection" section on page 2-12 to continue the installation.

Four-Post Rack Installation

Note Inner clearance (the width between the inner sides of the two posts or rails) must be at least 17.3 inches (43.9 cm). The height of the chassis is 1.73 inches (4.39 cm). Airflow through the chassis is from front to back.

Figure 2-7 Installing the Cisco 7301 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 2-12 to continue the installation.

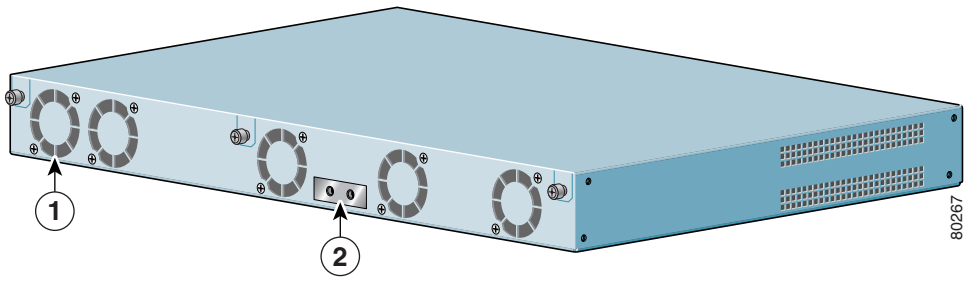
Attaching a Chassis Ground Connection

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 ground connectors are provided on each Cisco 7301 router chassis. (See Figure 2-8 on page 2-12.)

To ensure the chassis ground 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

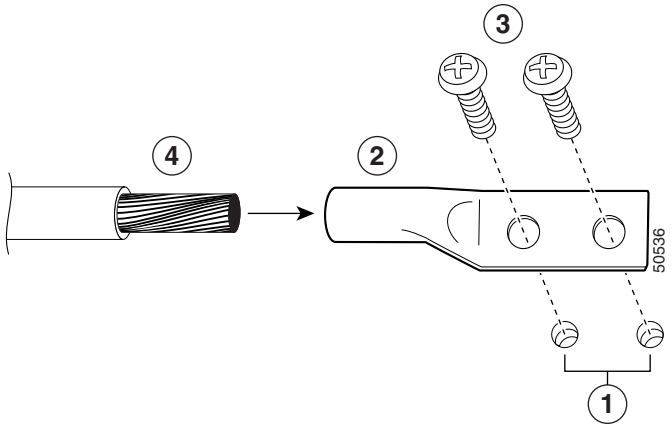
Figure 2-8 Locating the Chassis Ground Connector



1	Fan vents	**2**	Chassis ground connector

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

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



1	Chassis ground connector	**3**	Screws
2	Grounding lug	**4**	Wire

Note The grounding lug and Phillips scres are not available from Cisco Systems. Get the grounding lug from an electrical-connector vendor and the screws from a hardware vendor. See "Tools and Parts Required" section on page 2-2.

Step 1 Use the wire stripper to strip one end of the 6-AWG wire approximately 0.75 inches (19.05 mm).

Step 2 Insert the 6-AWG wire (4) into the wire receptacle on the grounding lug.

Step 3 Use the crimping tool to carefully crimp the wire receptacle around the wire; this step is required to ensure a proper mechanical connection.

Step 4 Locate the chassis ground connector (1) on the rear of your router chassis.

Step 5 Insert the two screws (3) through the holes in the grounding lug (2).

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 7301 router are contained in the respective configuration notes 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 OC-3 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.

Connecting I/O Cables

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

Warning **The ports labeled "Ethernet," "10BaseT," "Token Ring," "Console," and "AUX" are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.** Statement 22

Connecting Console and Auxiliary Port Cables

Note The console cable kit product number is ACS-2500ASYN.

The Cisco 7301 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 7301 router uses RJ-45 ports for both the auxiliary port and console port.

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, 1 stop bits (9600 8N1). After you establish normal router operation, you can disconnect the terminal.

For console and auxiliary port pinouts for the RJ-45 connector, see Appendix A, "Cisco 7301 Router Specifications."

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

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

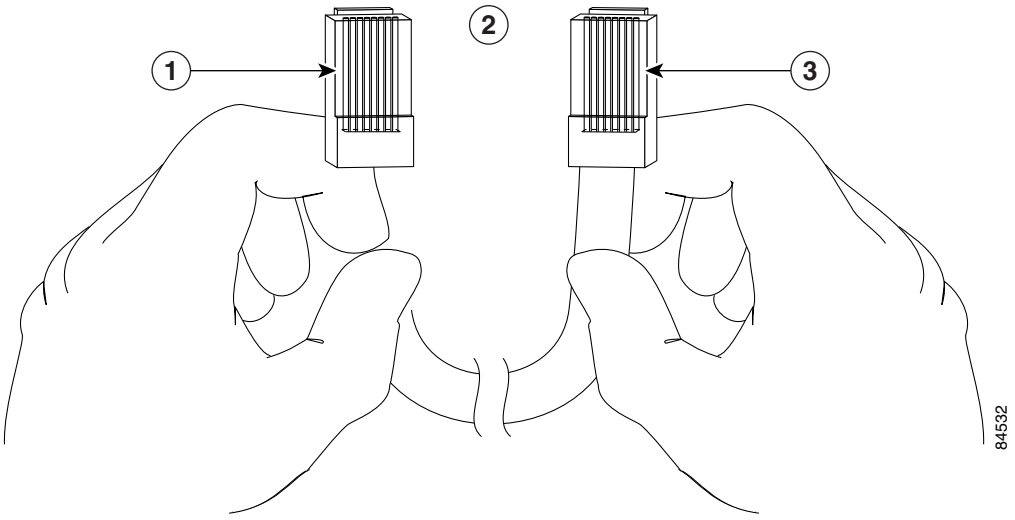
Adapter	DTE M/F Pins[1]	DCE M/F Pins	MMOD Pins[2]
4	7	7	7
5	7	7	7
6	3	2	2
7	6	20	20
8	5	4	4

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 7301 router. 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 7301 router 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 7301 router.

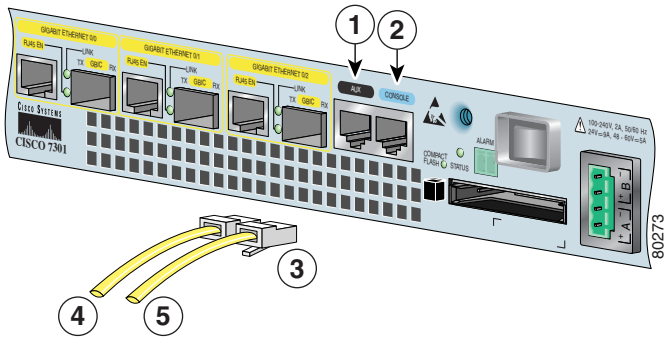
Table 2-3 Asynchronous Device Cabling Options

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.

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 Cables

Note See Chapter 3, “Starting and Configuring the Router,” the “Configuring the Native Gigabit Ethernet Interfaces” section on page 3-14, for information on configuring and troubleshooting the Gigabit Ethernet interfaces.

The Cisco 7301 router has three native Gigabit Ethernet interfaces and six physical Gigabit Ethernet ports, three RJ-45 ports (copper) and three SFP GBIC ports (optical). Only three of the six ports can be in use at any one time. The three Gigabit Ethernet interfaces are directly connected to the BCM 1250 processor.

Attaching the Gigabit Ethernet Cables

The RJ-45 ports support IEEE 802.u (Fast Ethernet) and 802.3ab (Gigabit Ethernet) twisted-pair interfaces compliant with 1000BASETX and 1000BASET specifications.

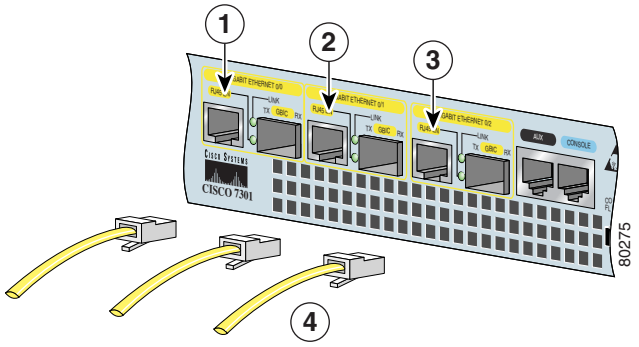
The RJ-45 port supports standard straight-through and crossover Category 5 unshielded twisted-pair (UTP) cables with RJ-45 connectors. Cisco Systems does not supply Category 5 UTP cables; these cables are available commercially.

See Appendix A, "Specifications," for Gigabit Ethernet RJ-45 port specifications.

Intra-Building Lightning Protection

Shielded cables, which are grounded at both ends, are required to be used on the 10/100/1000 Ethernet (RJ-45) 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 RJ-45 Port Gigabit Ethernet Cables



1	Gigabit Ethernet port 0/0 (RJ-45 connector)	**3**	Gigabit Ethernet port 0/2 (RJ-45 connector)
2	Gigabit Ethernet port 0/1 (RJ-45 connector)	**4**	Gigabit Ethernet cables with RJ-45 connectors

Attach one, two, or three Gigabit Ethernet 10/100/1000 cables to Gigabit Ethernet RJ-45 port 0/0, port 0/1, or port 0/2.

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.** Statement 76

Attaching the SFP GBIC Interface Cables

Note We recommend cleaning the fiber optical cables before connecting them to the fiber optic ports. For optical-fiber cleaning information, see the *Inspection and Cleaning Procedures for Fiber-Optic Connections* document.

The SFP GBIC module ports support IEEE 802.3z (optical Gigabit Ethernet) interfaces compliant with 1000BASESX and 1000BASELX specifications.

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

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 Ethernet SFP GBIC module with your Cisco 7301 router, it is one of three types listed in Table 2-4:

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

Product Number	GBIC	Description	Operating Distance
GLC-SX-MM=	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 1804.5 ft. (550 m).
GLC-LH-SM=	Long wavelength/ long haul (1000BASELX/LH)	Contains a Class 1 laser of 1300 nm for 1000BASELX/LH (long wavelength) applications.	Operates on single-mode fiber-optic link spans of up to 6.21 miles (10 km) or multimode spans up to 1804.5 ft. (550 m) with mode- conditioning cable.
GLC-ZX-SM=	Extended distance (1000BASEZX)	Contains a Class 1 laster 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 cabling information, see the online *Gigabit Interface Converter (GBIC) and Small Form-Factor Pluggable (SFP) GBIC Installation Information and Specifications*.

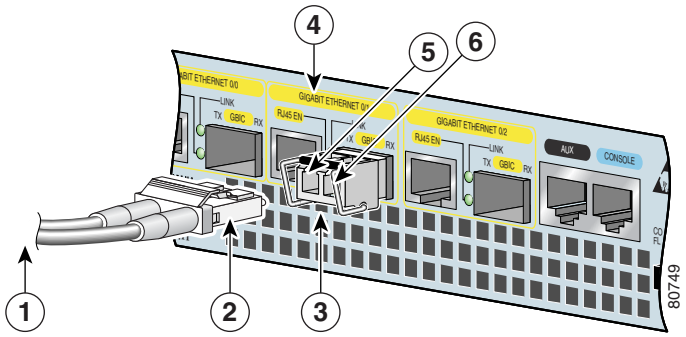
For product numbers of SFPs supported on the Cisco 7301, see Appendix A, "SFP GBIC Module Configurations."

Caution If you plan to use a GLC-LH-SM 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 2-19.

Warning **Class 1 laser product.** Statement 1008

Warning **Class 1 LED product.** Statement 1027

Figure 2-13 SFP GBIC Port Connections



1	To external 1000BASEX network	**4**	Gigabit Ethernet SFP GBIC port 0/1
2	Duplex connector (TX and RX)	**5**	TX (SFP GBIC port 0/1)
3	SFP GBIC module	**6**	RX (SFP GBIC port 0/1)

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

Warning **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

Step 2 Attach the appropriate optical fiber cable directly to the SFP GBIC module. You can use either simplex or duplex connectors for most devices. (Figure 2-13 shows a SFP GBIC module with a duplex connector being installed in SFP GBIC slot 0/1.)

- 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 GLC-LH-SM to allow reliable laser transmission between the single-mode laser source on the SFP GBIC module and a multimode optical fiber cable. For installation instructions, see the "Attaching the Mode-Conditioning Patch Cord" section on page 2-19.

Attaching the Mode-Conditioning Patch Cord

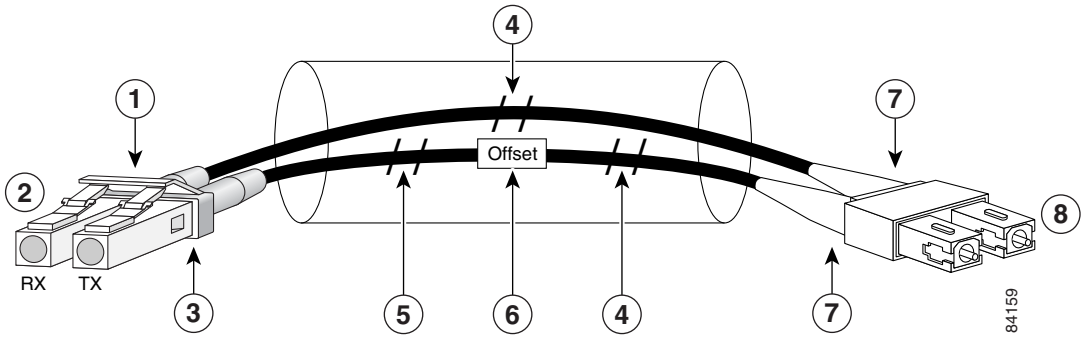
A mode-conditioning patch cord can be used with the GLC-LH-SM to allow reliable laser transmission between the single-mode laser source on the SFP GBIC and a multimode optical fiber cable.

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.

Figure 2-14 SFP Mode-Conditioning Patch Cord



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

Note Figure 2-14 shows one type of mode-conditioning patch cord.

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

Step 1 Attach a patch cord to the SFP GBIC module. (See Figure 2-13.)

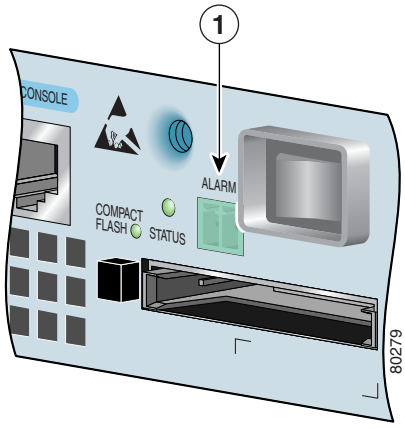
Step 2 Attach the network ends of your patch cord to the appropriate 1000BASEX equipment in your building cable plant.

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		

If you have an alarm system, attach the alarm cable to the Cisco 7301 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.

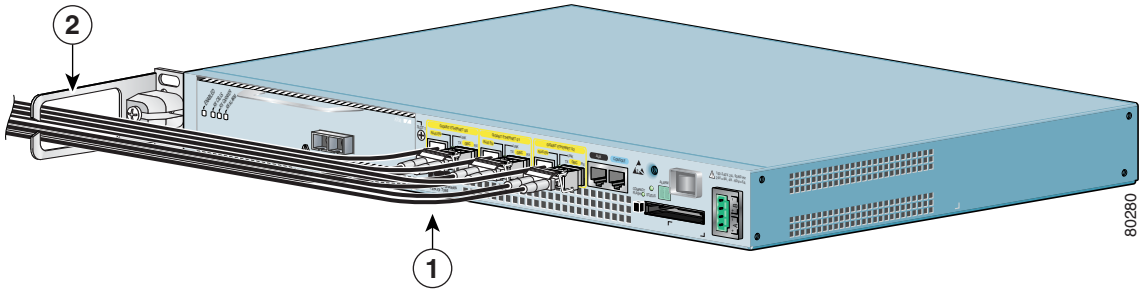
The alarm port is used to monitor fatal or severe errors that cause Cisco IOS to crash. The alarm port is connected to a normally closed solid state relay. Cisco IOS writes to a hardware port and the relay contact opens. If the system enters into a ROMmon or watchdog reset state, the relay contacts close.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

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 2-22 to complete the installation.

Connecting Power

This section provides the procedures for connecting AC-input and DC-input power to your Cisco 7301 router.

Warning **This unit might have more than one power supply connection. All connections must be removed to de-energize the unit.** Statement 1028

Warning **This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a fuse or circuit breaker no larger than 120 VAC, 15A U.S. (240 VAC, 10A international) is used on the phase conductors (all current-carrying conductors).** Statement 13

Connecting AC-Input Power

Figure 2-17 Dual-AC Power Supply Cables

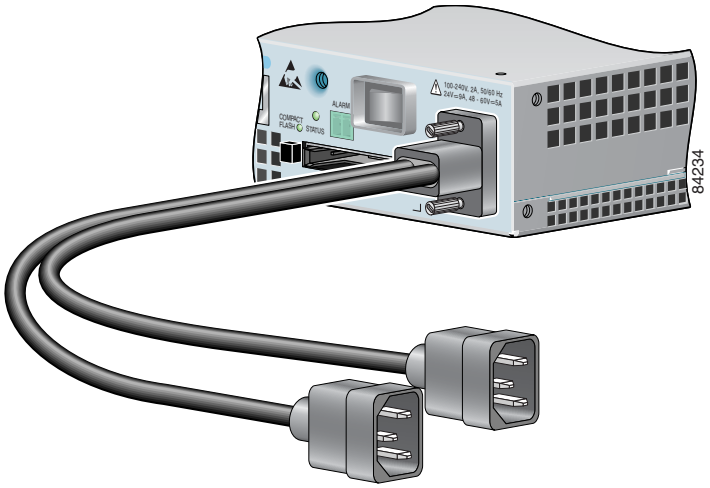
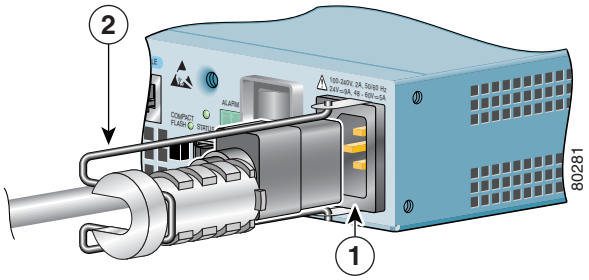


Figure 2-18 Connecting AC-Input Power



1	AC power receptacle	**2**	Adjustable AC power cable-retention clip

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 single power cable into the AC connector on the router, or if you have a dual-AC power supply, plug an AC power cable into each AC connector. The dual AC power supply cables are attached with screws to the chassis.

Step 3 If you have a single AC power supply, insert the cable-retention clip wire into the clip bracket holes. Then slide the plastic portion into the clip, adjusting it to the desired length. See Figure 2-18.

Step 4 Place the AC power cable in the adjustable cable-retention clip. The plastic part that grips the cable can be removed from the supporting wire and repositioned for better support of the cable.

Step 5 Plug the AC power supply cable into the AC power source. Repeat this step if you have a dual-AC power supply.

Note After powering off the router, wait a minimum of 30 seconds before powering it on again.

Note If required, use Sinewave Output UPS (uninterruptable power supply), not Ferro-resonant type UPS.

This completes the procedure for connecting AC-input power. Your installation is complete. Proceed to Chapter 3, "Starting and Configuring the Router," 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.** Statement 1046

Warning **Before connecting or disconnecting ground or power wires to the chassis, 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.** Statement 140

Warning **This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a Listed and Certified fuse or circuit breaker no larger than 60 VDC, 15 A is used on all currently-carrying conductors.** Statement 96

Caution The DC return connection to this system is to remain isolated from the system frame and chassis (DC-I).

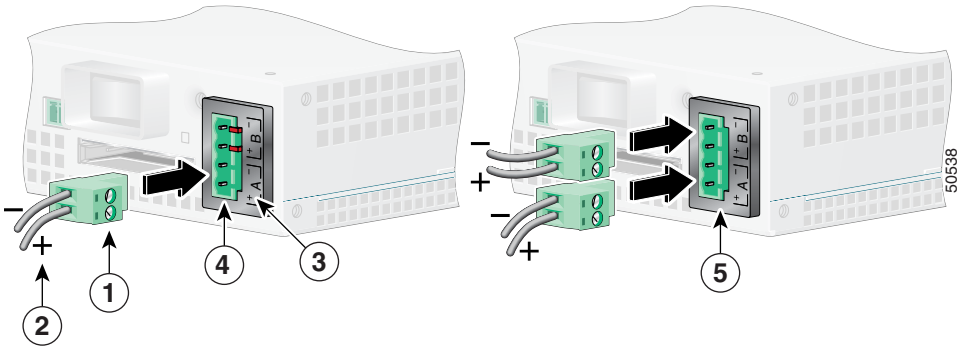
Connect a DC-input power supply as follows:

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 2-19 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 7301 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 2-19. 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 2-19, and tighten the screw to hold the lead to the plug.

c. Insert the –V lead into the plug as shown in Figure 2-19, 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.

Step 8 Press the power switch to turn on the router.

For information on Cisco 7301 product specifications and power supply, refer to *Cisco 7301 Router Data Sheet* at the following URL:

https://www.cisco.com/en/US/prod/collateral/routers/ps352/ps4972/product_data_sheet09186a008014611a.html

Note After powering off the router, wait a minimum of 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 the Router," to start the router and to perform a basic configuration.

CHAPTER 3

Starting and Configuring the Router

This chapter describes how to start the system and perform a basic configuration for your Cisco 7301 router. The chapter contains the following sections:

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 7301 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 7301 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 7301 router.

Chassis Slot and Logical Interface Numbering

In the Cisco 7301 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 7301 router is numbered slot 1. Port adapter slot 0 is always reserved for logical ports 10/100/1000.

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 7301 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 the port adapter in a Cisco 7301 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 up
  Hardware is BCM1250 Internal MAC, address is 0005.dd2c.7c1b (bia 0005.dd2c.7c1b)
  Internet address is 10.1.3.153/16
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Half-duplex, 100Mb/s, media type is RJ45
  output flow-control is off, input flow-control is off
  ARP type:ARPA, ARP Timeout 04:00:00
  Last input 00:00:01, output 00:00:07, output hang never
  Last clearing of "show interface" counters 19:00:50
  Input queue:0/75/63658/0 (size/max/drops/flushes); Total output drops:0

(display text omitted)

GigabitEthernet0/1 is up, line protocol is up
  Hardware is BCM1250 Internal MAC, address is 0005.dd2c.7c1a (bia 0005.dd2c.7c1a)
  Internet address is 192.18.1.1/24
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 5/255, rxload 6/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 1000Mb/s, 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
  Last input 18:56:46, output 00:00:09, output hang never
  Last clearing of "show interface" counters 19:00:52
  Input queue:0/75/16176489/0 (size/max/drops/flushes); Total output drops:0

(display text omitted)

GigabitEthernet0/2 is up, line protocol is up
```

```
  Hardware is BCM1250 Internal MAC, address is 0005.dd2c.7c19 (bia 0005.dd2c.7c19)
  Internet address is 1.1.1.1/24
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 5/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 1000Mb/s, 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
  Last input 00:04:42, output 00:00:01, output hang never
  Last clearing of "show interface" counters 19:00:54
  Input queue:0/75/22087/0 (size/max/drops/flushes); Total output drops:0

(display text omitted)
```

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:

```
Router# show interfaces g0/0
GigabitEthernet0/0 is up, line protocol is up
  Hardware is BCM1250 Internal MAC, address is 0005.dd2c.7c1b (bia 0005.dd2c.7c1b)
  Internet address is 10.1.3.153/16
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Half-duplex, 100Mb/s, media type is RJ45
  output flow-control is off, input flow-control is off
  ARP type:ARPA, ARP Timeout 04:00:00
  Last input 00:00:00, output 00:00:01, output hang never
  Last clearing of "show interface" counters 19:04:04
  Input queue:0/75/63658/0 (size/max/drops/flushes); Total output drops:0

(display text omitted)
```

For complete descriptions and instructions of the commands used to configure your Cisco 7301 router, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications at the following URL:

http://www.cisco.com/en/US/products/sw/iosswrel/tsd_products_support_category_home.html

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 3-4.)

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 7301 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 7301 routers support online insertion and removal (OIR). However, it is wise to shut down the interface before removing a port adapter that has active traffic moving through it. Removing a port adapter while traffic is flowing through the ports can cause system disruption. Once the port adapter is inserted, the ports can be brought back up.

Note As you disengage the port adapter from the router or switch, online insertion and removal (OIR) administratively shuts down all active interfaces in the port adapter.

OIR 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, although you should not run traffic through the port adapter you are removing while it is being removed. OIR is 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 7301 router, refer to the online configuration note for each port adapter or service adapter.

Each port adapter 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 7301 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 adapters or service adapters, 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 (U62) on the underneath front edge of the system board, and Sensor 2 (U5), near the fans. 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 7301 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 (U62, beneath the front edge of the system board under the port adapter slot)	113°F (45°C)	122°F (50°C)	131°F (55°C)
Sensor 2 (U5, near the fans, top of system board)	122°F (50°C)	131°F (55°C)	140°F (60°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
+3.30V	+2.96	+3.12	+3.46	+3.62
+2.50V	+2.24	+2.37	+2.62	+2.75
+12.25V	+11.03	+11.65	+12.87	+13.49
+5.00V	+4.50	+4.74	+5.24	+5.50
–12.00V	–10.82	–11.39	–12.58	–13.20
+5.20V	+4.68	+4.94	+5.46	+5.72
+1.50V	+1.34	+1.41	+1.58	+1.65
+1.20V	+1.07	+1.15	+1.26	+1.32
+1.25V	+1.12	+1.18	+1.30	+1.37

Reporting Functions

The Cisco 7301 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 7301 router:

```
Router# show environment table

Sample Point      LowCritical    LowWarning     HighWarning    HighCritical
Thermal Sensor 1                                45C/113F       50C/122F
Thermal Sensor 2                                50C/122F       55C/131F
+3.30 V           +2.96          +3.12          +3.46          +3.62
+2.50 V           +2.24          +2.37          +2.62          +2.75
+12.25 V          +11.03         +11.65         +12.87         +13.49
+5.00 V           +4.50          +4.74          +5.24          +5.50
-12.00            -10.82         -11.39         -12.58         -13.20
+5.20 V           +4.68          +4.94          +5.46          +5.72
+1.50 V           +1.34          +1.41          +1.58          +1.65
+1.20 V           +1.07          +1.15          +1.26          +1.32
+1.25 V           +1.12          +1.18          +1.30          +1.37
System shutdown for Thermal Sensor 1 is 55C/131F
System shutdown for Thermal Sensor 2 is 60C/140F
```

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# sh environment all
Power Supplies:
        Power Supply is Internal AC Power Supply. Unit is on.

Temperature readings:
        Thermal Sensor 1 measured at 28C/82F
        Thermal Sensor 2 measured at 33C/91F

Voltage readings:
        +3.30 V       measured at +3.27 V
        +2.50 V       measured at +2.46 V
        +12.25 V      measured at +12.17 V
        +5.00 V       measured at +4.94 V
        -12.00 V      measured at -12.01 V
        +5.20 V       measured at +5.20 V
        +1.50 V       measured at +1.48 V
```

```
        +1.20 V       measured at +1.20 V
        +1.25 V       measured at +1.23 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

Envm stats saved 0 time(s) since reload
```

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.

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 7301 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 (|) 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) 7301 Software (C7301-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 Initial Startup Problems" for troubleshooting recommendations and procedures.

Configuring a Cisco 7301 Router

Before configuring the router, determine whether or not you want to use a management tool such as Cisco Security Device Manager.

Cisco Security Device Manager (SDM), version 1.1, is an optional Java-based device-management tool that allows you to configure LAN interfaces, routing, Network Address Translation (NAT), firewalls, Virtual Private Networks (VPNs), and other features without knowledge of the Cisco command-line interface (CLI). You can configure features such as Access Control Lists (ACLs), routing protocols, and other options using the advanced mode SDM.

Note You will need to use CLI commands to configure several features that SDM does not support. SDM does not support the following features: WAN configuration, Gigabit Ethernet (GE) interfaces, AA client, EZ VPN server, QoS, SSHv2, DHCP server configuration options, and usability enhancements.

SDM is preinstalled on your router's flash disk or compactflash disk when it is ordered as part of a VPN bundle or as part of a 7xxx VPN bundle. If your router did not ship with SDM preinstalled, you can download a free copy from the Software Center at Cisco.com at http://ww.cisco.com/kobayashi/sw-center/index.shtm. Because SDM uses a GUI, it requires that you access it from a PC using a supported web browser. Go to the *Cisco Router and Security Device Manager (SDM) User Guide for the Cisco 7200 VXR and Cisco 7301 Routers* documentation for more information.

You can configure your Cisco 7301 router using one of the procedures described in the following sections:

- Performing a Basic Configuration Using AutoInstall, page 3-10
- 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 3-34.

Performing a Basic Configuration Using AutoInstall

The AutoInstall process is designed to configure the Cisco 7301 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 *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications for information about how AutoInstall works.

Complete the following steps to prepare your Cisco 7301 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 (|) position. (This action turns on AC power to the router.)

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:

```
Restricted Rights Legend
```

```
Use, duplication, or disclosure by the Government is
subject to restrictions as set forth in subparagraph
(c) of the Commercial Computer Software - Restricted
Rights clause at FAR sec. 52.227-19 and subparagraph
(c) (1) (ii) of the Rights in Technical Data and Computer
Software clause at DFARS sec. 252.227-7013.

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

Cisco Internetwork Operating System Software
IOS (tm) 7301 Software (C7301-JS-M), Experimental Version 12.2(20030103:230909) [biff 100]
Copyright (c) 1986-2003 by cisco Systems, Inc.
Compiled Fri 03-Jan-03 16:03 by biff
Image text-base:0x600088F4, data-base:0x617F6000

cisco 7301 (NPE-G1) processor (revision A) with 245760K/16384K bytes of memory.
Processor board ID 0
SB-1 CPU at 650Mhz, Implementation 1, Rev 0.2, 512KB L2 Cache
1 slot 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.
3 Gigabit Ethernet/IEEE 802.3 interface(s)
509K bytes of non-volatile configuration memory.

125440K bytes of ATA PCMCIA card at slot 2 (Sector size 512 bytes).
32768K 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 7301 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 3-27.) If you do not save the configuration settings that you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you reload the router.

Configuring the Native Gigabit Ethernet Interfaces

The Cisco 7301 router reports the Gigabit Ethernet RJ-45 and SFP GBIC ports as GigabitEthernet 0/0, GigabitEthernet 0/1, and GigabitEthernet0/2. Before configuring any of the three interfaces, you must first use the **media-type** interface command to select the media type, either **gbic** or **rj45**.

Changing the Media Type

To be able to use a particular media type, 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
```

Configuring the Interface Transmission and Speed Modes

Step 1 After changing the media type, configure the speed and duplex transmission modes to appropriately match the new interface characteristics. Changing the speed and duplex of a Cisco 7301 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, 1000, auto	full, half, auto
GBIC(1)	1000, auto(2)	full, half, auto

a. If you are using the **no negotion auto** command, the speed and duplex should be set to a value other than **auto** for correct operation.

b. The only available speed in this mode is 1000 Mbps; there is no difference whether **1000** or **auto** is selected.

When using the SFP GBIC media, there is also the additional **negotiation auto** command that is used to enable the IEEE 802.1z Gigabit Ethernet (1000 Mbps) autonegotiation protocol.

Step 2 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 IEEE 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.

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 mode, even if present in the configuration (for an example, see output from **show running-config**).

Debugging

Cisco IOS provides two commands to provide information on your interfaces: **show interface GigabitEthernet 0/X** (where X is 0, 1, or 2) and **show controllers GigabitEthernet 0/X** (where X is 0, 1, or 2).

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 7301 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 0, 1, or 2)

Clearing Counters

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

clear counters GigabitEthernet 0/X (where X is 0, 1, or 2)

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 Only one port adapter can be installed in the Cisco 7301 at one time. Following are three examples of three different interfaces that might be used.

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 3-27.) If you do not save the configuration settings that you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you reload 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 3-27.) If you do not save the configuration settings that you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you reload 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 3-27.) If you do not save the configuration settings that you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you reload the router.

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

The following example display lists the ATM configuration 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]:


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
!
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 7301 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, or if you are enabling the second processor, see "Enabling the Second Processor" section on page 3-20. (See the "Saving the Running Configuration to NVRAM" section on page 3-27.) If you do not save the configuration settings that you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you reload 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.

Enabling the Second Processor

The Cisco 7301 includes a dual-CPU-core BCM 1250. All Cisco IOS images for the Cisco 7301 platform use CPU-core 0. CPU-core 1 allows acceleration of specific feature sets via separately purchased special software. As of Cisco IOS Release 12.3(14)YM, multi-processor forwarding (MPF) accelerates the following broadband features: L2TP Access Concentrator (LAC), L2TP Network Server (LNS), and PPP Terminated Aggregation (PTA). Port adapters are not supported in the multi-processor forwarding (MPF) path on processor 1.

Only the following port adapters are supported in the punt path (Processor 0, processing Cisco IOS) on Cisco IOS Release 12.3(14)YM and later releases of Cisco IOS Release 12.3YM:

- PA-A3-OC3 (SMI/SML/MM)
- PA-A3-T3
- PA-A3-E3
- PA-A6-OC3 (SMI/SML/MM)
- PA-A6-T3
- PA-A6-E3
- PA-FE-TX
- PA-2FE-TX
- PA-2FE-FX

You may have purchased the enabling software when you purchased a new chassis or you may have purchased the software as an upgrade.

If you are purchasing the software as an upgrade, you must:

- Upgrade the ROMmon if you do not have the minimum ROMmon version.
  - The minimum ROMmon version is 12.3-4r.T2.
  - The recommended ROMmon version is 12.3-4r.T4 or higher.
- Install the enabling software.

Instructions for upgrading ROMmon are in the "Upgrading ROMmon on the Cisco 7301" section on page 3-27.

The software releases associated with enabling the second processor are listed in Table 3-3.

Table 3-3 Cisco IOS Release Information

Features	Cisco IOS Release
Broadband L2TP Access Concentrator (LAC)	Cisco IOS Release 12.3(7)XI
Broadband L2TP Access Concentrator (LAC), L2TP Network Server (LNS) and PPP Terminated Aggregation (PTA)	Cisco IOS Release 12.3(14)YM

Also see the *Multi-Processor Forwarding (MPF) for Broadband LAC* document for minimum memory requirements and configuration information.

Note Before enabling the second processor, you must have IP routing turned on.

Processor 1 is enabled by default after you install the enabling software. To have all packets forwarded by processor 0, use the **no ip mpf** command. To enable processor 1, use the **ip mpf** command.

```
hostname: (config)# [no] ip mpf
```

Save the running configuration to NVRAM. See the "Saving the Running Configuration to NVRAM" section on page 3-27. If you do not save the configuration settings that you created in the router using configuration mode and the setup facility, your configuration will be lost the next time you reload the router.

Error Messages

The following error messages are displayed if a feature is configured that is not supported in the MPF path:

```
Router# %MPF-4-IGNOREDFEATURES: Interface Gi0/3: Input "PBR" configurations are not MPF
supported and are IGNORED. %SYS-5-CONFIG_I: Configured from console by console

Router# (config-if)# %MPF-4-IGNOREDFEATURES: Interface Gi0/3: Input "PBR" configurations
are not MPF supported and are IGNORED.
%MPF-4-IGNOREDFEATURES: Interface Gi0/3: Output "NetFlow" configurations
are not MPF supported and are IGNORED.
```

Using show Commands to Check the Installation

There are a variety of **show** commands associated with the **mpf** command. They are listed below along with sample output. Use these commands to verify the MPF installation.

Using the show interface stats Command

Use the **show interface stats** command for information about the interface.

```
Router# show interface stats

GigabitEthernet0/1
          Switching path     Pkts In   Chars In   Pkts Out  Chars Out
               Processor       33090    6424353      86353    8645650
             Route cache           2        116          0          0
  Multi-Processor Fwding        1004     158632       5004     790632  <==
                   Total       34096    6583101      91357    9436282
```

Using the show ip interface Command

Use the **show ip interface** command to get information about the specific interface port.

```
Router# show ip interface g0/3
GigabitEthernet0/3 is up, line protocol is up
Internet address is 155.1.1.1/16
Broadcast address is 255.255.255.255
Address determined by setup command
MTU is 1500 bytes
Helper address is not set
Directed broadcast forwarding is disabled
Outgoing access list is not set
```

```
Inbound access list is not set
Proxy ARP is enabled
Local Proxy ARP is disabled
Security level is default
Split horizon is enabled
ICMP redirects are always sent
ICMP unreachables are always sent
ICMP mask replies are never sent
IP fast switching is enabled
IP fast switching on the same interface is disabled
IP Flow switching is disabled
IP CEF switching is enabled
IP Feature Fast switching turbo vector
IP VPN Flow CEF switching turbo vector
IP multicast fast switching is enabled
IP multicast distributed fast switching is disabled
IP route-cache flags are Fast, CEF
Router Discovery is disabled
IP output packet accounting is disabled
IP access violation accounting is disabled
TCP/IP header compression is disabled
RTP/IP header compression is disabled
Policy routing is enabled, using route map PBR
Network address translation is disabled
BGP Policy Mapping is disabled
IP Multi-Processor Forwarding is enabled
IP Input features, "PBR",
are not supported by MPF and are IGNORED
IP Output features, "NetFlow",
are not supported by MPF and are IGNORED
```

Using the show mpf cpu Command

Use the **show mpf cpu** command to display the average second CPU utilization in the last five seconds, one minute, and five minutes.

```
hostname: show mpf cpu
CPU utilization for five seconds: 33%; one minute: 25%; five minutes: 30%
```

Using the show mpf cpu history Command

Use the **show mpf cpu history** command to graph output of the second CPU utilization for the last 60 seconds, 60 minutes, and 72 hours.

```
Router# show mpf cpu history
slns 12:12:40 AM Saturday Nov 18 2000 UTC
333333333333333333333333333333333333333333333333333333333333
333333333333333333333333333333333333333333333333333333333333
100
90
80
70
60
50
40
30 ***************************
20 ***************************
10 ***************************
0....5....1....1....2....2....3....3....4....4....5....5....
```

```
          0    5    0   5    0    5   0    5    0    5
               CPU% per second (last 60 seconds)
333333333333333333333333333333333333333333333333333333333333
333333333333333333333333333333333333333333333333333333333333
100
90
80
70
60
50
40
30 ##################
20 ##################
10 ##################
0....5....1....1....2....2....3....3....4....4....5....5....
          0    5   0    5    0    5   0    5    0    5
                   CPU% per minute (last 60 minutes)
                   * = maximum CPU% # = average CPU%
1
60
80
100 *
90 *
80 *
70 **
60 **
50 **
40 ##
30 ##
20 ##
10 ##
0....5....1....1....2....2....3....3....4....4....5....5....6....6....7.
          0        5    0    5    0    5    0    5    0    5    0    5    0
                   CPU% per hour (last 72 hours)
                   * = maximum CPU% # = average CPU%
```

Using the show mpf interface Command

Using the **show mpf interface** command without arguments shows the interface information for all Gigabit Ethernet interfaces and subinterfaces. This command is supported only for physical interfaces. There is no support for virtual access interface.

```
Router# show mpf interface
Name        Index   State   Counter    Count
Gi0/1       0       up      RX packets   1004
                            RX bytes   158632
                            TX packets   5004
                            TX bytes   790632
                            RX punts    32961
                            TX punts    85972
Gi0/1       1       up
Gi0/1.100   100     up      RX packets    1004
                            RX bytes    158632
                            TX packets    5004
                            TX bytes    790632
                            RX punts        25
Gi0/1.101   101     up
Gi0/1.102   102     up
Gi0/1.105   105     up
Gi0/1.106   106     up
Gi0/1.107   107     up
```

```
Gi0/1.200   200     up
Gi0/1.201   201     up      RX punts       29
Gi0/1.202   202     up
Gi0/1.206   206     up
Gi0/1.2002  602     up      RX punts    26114
Gi0/1.2004  604     up
```

Using the show mpf interface GigabitEthernet 0/1 Command

The following example displays the interface information for GigabitEthernet 1/0, subinterface number 100. However, all GigabitEthernet interface and subinterface information are displayed because MPF does not recognize the subinterface number, unless it is a VLAN number.

```
Router# show mpf interface Gigabit Ethernet 0/1.100
Name          Index   State     Counter              Count
Gi0/1         0       up        RX packets           1004
                                RX bytes             158632
                                TX packets           5004
                                TX bytes             790632
                                RX punts             32996
                                TX punts             86062
Gi0/1         1       up
Gi0/1.100     100     up        RX packets           1004
                                RX bytes             158632
                                TX packets           5004
                                TX bytes             790632
                                RX punts             25
Gi0/1.101     101     up
Gi0/1.102     102     up
Gi0/1.105     105     up
Gi0/1.106     106     up
Gi0/1.107     107     up
Gi0/1.200     200     up
Gi0/1.201     201     up       RX punts             29
Gi0/1.202     202     up
Gi0/1.206     206     up
Gi0/1.2002    602     up       RX punts             26142
Gi0/1.2004    604     up
```

Using the show mpf interface GigabitEthernet 01/100 Command

The following example displays the interface information for VLAN number 100 on GigabitEthernet 0/1 interface, including up state, receiving packet count, receiving bytes count, transmitting packet count, transmitting bytes count, and receiving punts count.

```
Router# show mpf interface GigabitEthernet 0/1 100
Name    Index      State      Counter    Packets        Bytes
Gi0/1.100 100         up      RX total       963        151050
                              RX punt          5           475
                              TX total       956        150449

IP Multi-Processor Forwarding is enabled
```

Using the show mpf ip exact-route Command

Use the **show ip mpf exact-route** command to show which routing decision is made for a given IP address pair.

```
hostname: show mpf ip exact-route [vrf vrf_name] src-ip-addr dst-ip-addr

1.1.1.1 -> 192.168.255.255 :Gi2/0/0 (next hop 10.1.255.10)
```

Using the show mpf punt Command

Use the **show mpf punt** command to display the per-box punt reason and punt packet counts.

```
Router# show mpf punt
       slns#show mpf punt
       Type           Message                        Count
       l2tp           unknown session errors             7
       l2tp           L2TP control                       6
       ipv4/verify    adjacency punt                     1
       ethernet       unknown ethernet type            542
       ppp            punts due to unknown protocol    333
       arp            ARP request                        6
```

Using the show version Command

Following is output from the **show version** command with the second processor enabled. Note that the **show version** output provides "SB-1 CPU" when processor 1 is enabled.

```
Router# show version
Cisco IOS Software, 7301 Software (C7301-I12S-M), Experimental Version
12.3(20040524:050554) [REL-v123_7_xi_throttle.ios-weekly 114]
Copyright (c) 1986-2004 by Cisco Systems, Inc.
Compiled Mon 24-May-04 06:26

ROM:System Bootstrap, Version 12.3(4r)T2, RELEASE SOFTWARE (fc1)
BOOTLDR:Cisco IOS Software, 7301 Software (C7301-BOOT-M), Experimental Version
12.3(20040514:051116) [biff-v123_7_xi_throttle-ios-nightly-task 117]

lac7301_256M uptime is 1 hour, 50 minutes
System returned to ROM by reload at 18:05:37 UTC Wed Mar 22 2000
System image file is
"tftp://223.255.254.253//auto/tftpboot-users/biff/c7301-i12s-mz.v123_7_xi_throttle"

Cisco 7301 (NPE) processor (revision C) with 229376K/32768K bytes of memory.
Processor board ID 74806813
SB-1 CPU at 700MHz, Implementation 1, Rev 0.2, 512KB L2 Cache
1 slot midplane, Version 3.0

Last reset from watchdog nmi
CPU 1 Multi-Processor Forwarding, Fri May 21 14:21:57 2004 [rtang 119]
1 FastEthernet interface
3 Gigabit Ethernet interfaces
509K bytes of NVRAM.

62976K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
32768K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0
```

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
- Loading configuration files or system images using remote copy protocol (rcp) or Trivial File Transfer Protocol (TFTP)
- Reloading the operating system

Upgrading ROMmon on the Cisco 7301

Upgrading the rewriteable ROM monitor (ROMmon) allows you to download a new ROMmon image instead of having to replace hardware (Cisco 7301) to get a new image.

There are two ROMmon images: the ReadOnly image that ships with your system (and is always available if you have Cisco 7301 hardware EPROM Version 1.4 and software C7301:Rommon version is 12.3(4r)T2 or later), and the upgradable ROMmon image that is downloaded from a specified TFTP file location. You can choose to configure the system to point to the upgradable ROMmon image. At bootup, the system starts with the ReadOnly image and then, if configured, jumps to the upgradeable ROMmon image. If the upgradeable ROMmon image fails to boot, the router will mark this ROMmon image as invalid and reverts to the ReadOnly ROMmon image.

The first time a new ROMmon image is executed, you must allow the system to boot ROMmon before doing any additional resets or power cycling. If the ROMmon-executing process is interrupted, the system interprets this as a bootup failure of the new ROMmon image. The router reverts to the ReadOnly image.

Note The ROMmon upgradeable image is marked as invalid if it fails to boot. Do not reset the router when it is doing an initial bootup.

Using the show rom-monitor Command and showmon Commands

Use the **show rom-monitor** command if you are in Cisco IOS, or the **showmon** command if you are in ROMmon, to determine which ROMmon images are available. See the following examples for information shown in the output of the **show rom-monitor** or **showmon** commands:

- If you are in Cisco IOS, use the **show rom-monitor** command:

```
Router> show rom-monitor
ReadOnly ROMMON version:

System Bootstrap, Version 12.2(20031011:151758)
Copyright (c) 1994-2003 by cisco Systems, Inc.

Upgrade ROMMON version:

System Bootstrap, Version 12.2(20031011:151758)
Copyright (c) 1994-2003 by cisco Systems, Inc.

Currently running ROMMON from Upgrade region
ROMMON from Upgrade region is selected for next boot
```

- If you are in ROMmon, use the **showmon** command:

```
rommon 1 > rommon CLI showmon

ReadOnly ROMMON version is:
System Bootstrap, Version 12.2(20031011:151758) [biff]
Copyright (c) 1994-2003 by cisco Systems, Inc.

Upgrade ROMMON version is:
System Bootstrap, Version 12.2(20031011:151758) [biff]
Copyright (c) 1994-2003 by cisco Systems, Inc.

Upgrade ROMMON currently running
Upgrade ROMMON is selected for next boot
rommon 2 >
```

Using the upgrade rom-monitor Command

Use the **upgrade rom-monitor file** *file_id* command to program the ROMmon.

See the following example of the **upgrade rom-monitor** command:

```
Router# upgrade rom-monitor file tftp://00.0.00.0/biff/C7301_c7301-is-mz
Loading pgettner/C7200_NPEG1_RMFUR.srec from 00.0.00.0 (via GigabitEthernet0/1):
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 392348 bytes]
```

```
This command will reload the router. Continue? [yes/no]:yes
ROMMON image upgrade in progress.
Erasing boot flash eeeeeeeeeeeeeeeee
Programming boot flash ppppp
Now Reloading via hard watchdog timeout

Unexpected exception, CP
System Bootstrap, Version 12.2(20031011:151758) [biff]
Copyright (c) 1994-2003 by cisco Systems, Inc.

 Running new upgrade for first time

System Bootstrap, Version 12.2(20031011:151758) [biff]
Copyright (c) 1994-2003 by cisco Systems, Inc.

ROM:Rebooted by watchdog hard reset
C7301 platform with 1048576 Kbytes of main memory


Upgrade ROMMON initialized
rommon 1 >
```

Note It is advisable to load a known good Cisco IOS image after a ROMmon upgrade.

Changing Preferences to Choose the Other ROMmon Image

To use the other ROMmon image, use one of the following commands to make the change depending on whether you are in Cisco IOS or in ROMmon:

- In Cisco IOS, use the **upgrade rom-monitor preference** command to change to the other ROMmon image:

  upgrade rom-monitor preference [readonly | upgrade]

  Example:

  ```
  Router: upgrade rom-monitor preference readonly
  You are about to mark ReadOnly region of ROMMON for the highest boot preference.
  Proceed? [confirm]
  Done! Router must be reloaded for this to take effect.
  ```

- In ROMmon, use the ROMmon CLI **rommon-pref** command to change to the other ROMmon image:

  rommon-pref [readonly|upgrade]

  Example:

  ```
  rommon 2 > rommon-pref readonly
  ```

Troubleshooting the Upgrade

This section contains sample error messages that appear if an upgrade fails, or if an upgrade is successful but the upgrade image is corrupted.

ROMmon Upgrade Error Messages

One if these error message appears when the upgrade has failed or if the upgrade image is corrupted:

- ROMmon image is not compatible with ReadOnly image:

```
Router: upgrade rom-monitor file tftp://00.0.00.0/biff/c7301-is-mz
Loading biff/C7200_NPEG1_RMFUR.srec from 00.0.00.0 (via GigabitEthernet0/1):
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 392348 bytes]

ROMMON upgrade aborted; new ROMMON image version is not compatible with ReadOnly
```

- ROMmon upgrade image is too big:

```
Router: upgrade rom-monitor file tftp://00.0.00.0/biff/c7301-is-mz
Loading biff/C7200_NPEG1_RMFUR.srec from 00.0.00.0 (via GigabitEthernet0/1):
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 392348 bytes]

ROMMON upgrade aborted; new ROMMON is too big
```

- Hardware does not support ROMmon upgrade:

```
Router: upgrade rom-monitor file tftp://00.0.00.0/biff/c7301-is-mz
Loading biff/C7200_NPEG1_RMFUR.srec from 00.0.00.0 (via GigabitEthernet0/1):
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 392348 bytes]

ROMMON upgrade aborted; Current ROMMON does not support upgrade capability
```

- Upgrade command with incorrect file type:

```
NPEG1-10# upgrade rom-monitor file tftp://00.0.00.0/biff/c7301-is-mz
from 00.0.00.0 (via GigabitEthernet0/1):!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 524288 bytes]

%Error:not srec file
NPEG1-10#
```

- A boot of a corrupted upgrade image:

```
System Bootstrap, Version 12.2(20031011:151758) [pgettner-npeg1-fur 135], DEVELOPMENT
SOFTWARE
Copyright (c) 1994-2003 by cisco Systems, Inc.

 Upgrade ROMMON corrupted.
 Falling to ReadOnly ROMMON

ROM:Rebooted by watchdog hard reset
C7301 platform with 1048576 Kbytes of main memory

Readonly ROMMON initialized
rommon 1 >
```

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 7301 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.

Note When powering off the router, wait 30 seconds before powering it on again.

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

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 1 stop bit (9600 8N1).

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 after waiting 30 seconds). 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 gigabitethernet 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 7301 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 is Cisco 7301 sample output of the **show version** command:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 7301 Software (C7301-JS-M), Experimental Version 12.2(20020904:004736) [biff 107]
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Mon 09-Sep-02 18:02 by biff
Image text-base:0x600088F8, data-base:0x61A94000

ROM:System Bootstrap, Version 12.2(20020730:200705) [biff-TAZ2_QA_RELEASE_16B 101],
DEVELOPMENT SOFTWARE
BOOTLDR:7301 Software (C7301-BOOT-M), Experimental Version 12.2(20020813:014224)
[biff-TAZ2_QA_RELEASE_17B 101]

7301p2b uptime is 0 minutes
System returned to ROM by reload at 00:01:51 UTC Sat Jan 1 2000
System image file is "tftp://10.1.8.11/tazii/images/c7301-js-mz"

cisco 7301 (NPE-G1) processor (revision A) with 491520K/32768K bytes of memory.
Processor board ID 0
BCM1250 CPU at 700Mhz, Implementation 1, Rev 0.2, 512KB L2 Cache
1 slot 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.
3 Gigabit Ethernet/IEEE 802.3 interface(s)
509K bytes of non-volatile configuration memory.

62976K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
32768K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x102
```

Use the **show diag** command to determine what type of Gigabit Ethernet port is active or what type of port adapter is installed in your Cisco 7301 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 7301 router. Note that slot 0 is reserved for the native Gigabit Ethernet ports:

Note Both native SFP GBIC and RJ-45 Gigabit Ethernet ports are reported as Gigabit Ethernet ports. To select either optical Gigabit Ethernet or copper Gigabit Ethernet ports, use the **media-type** command. See the "Configuring the Native Gigabit Ethernet Interfaces" section on page 3-14.

Note Input/output data for the console port, auxiliary port, Gigabit Ethernet ports, and CompactFlash Disk are listed in the output of the **show c7301** command, rather than in the output of the **show diag** command. Use the **show diag** command for port adapter information.

```
Router# show diag

Slot 1:
        POS Single Width, Multi Mode Port adapter, 1 port
        Port adapter is analyzed
        Port adapter insertion time 01:38:29 ago
        EEPROM contents at hardware discovery:
        Hardware revision 2.2           Board revision A0
        Serial number     28672741      Part number    73-3192-06
        FRU Part Number: PA-POS-OC3MM=

        Test history      0x0           RMA number     00-00-00
        EEPROM format version 1
        EEPROM contents (hex):
          0x20:01 96 02 02 01 B5 82 E5 49 0C 78 06 00 00 00 00
          0x30:50 00 00 00 02 08 19 00 00 00 FF FF FF FF FF FF
```

For specific information on the **show version**, **show hardware**, **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 7301 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 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.

CHAPTER 4

Installing and Removing Field-Replaceable Units

This chapter guides you through installing additional equipment or replacing the SODIMMs in the Cisco 7301 router. Before you remove or replace any equipment, be sure to read the "Electrical Equipment Guidelines" section on page 2-3, the "Preventing Electrostatic Discharge Damage" section on page 2-3 and the "Site Requirement Guidelines" section on page 2-4.

This chapter includes the following sections:

Warning **Only trained and qualified personnel should be allowed t install, replace, or service this equipment.** Statement 1030

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**. Statement 12

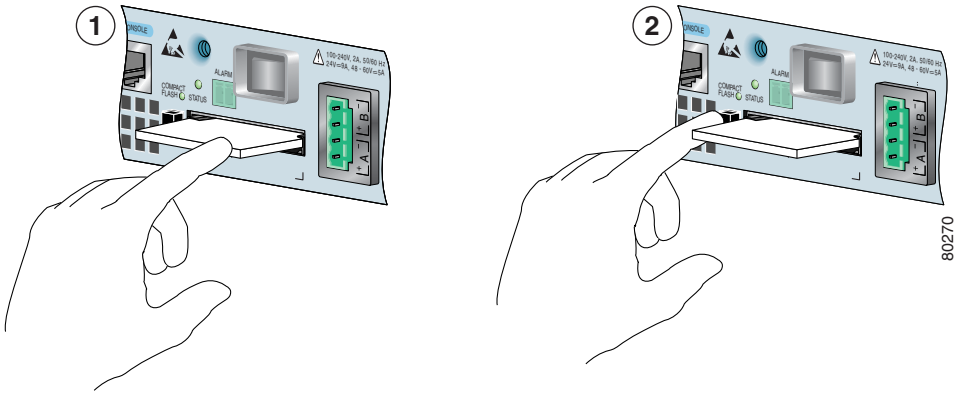
Warning **During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.** Statement 94

Warning **Before opening the chassis, disconnect the telephone-network cables to avoid contact with telephone-network voltages.** Statement 2

Warning **Do not work on the system or disconnect cables during periods of lightning activity.** Statement 1001

Installing and Removing the CompactFlash Disk

Figure 4-1 Installing and Removing the CompactFlash Disk



1	CompactFlash Disk insertion	**2**	CompactFlash Disk ejector button and removal

Step 1 To remove the CompactFlash Disk, push the ejector button to the left of the CompactFlash Disk slot.

Step 2 After the CompactFlash Disk is ejected, remove it from the CompactFlash Disk slot.

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

Step 3 With the vendor name and memory size facing up and the arrow pointing toward the router, gently insert the CompactFlash Disk in the CompactFlash Disk slot. If the CompactFlash Disk does not completely insert into the slot, remove it and turn it over, and reinsert it; it was probably upside down. The CompactFlash Disk protrudes a bit from the chassis when it is completely inserted.

This completes the CompactFlash Disk installation and removal procedure.

About CompactFlash Disks

- 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.

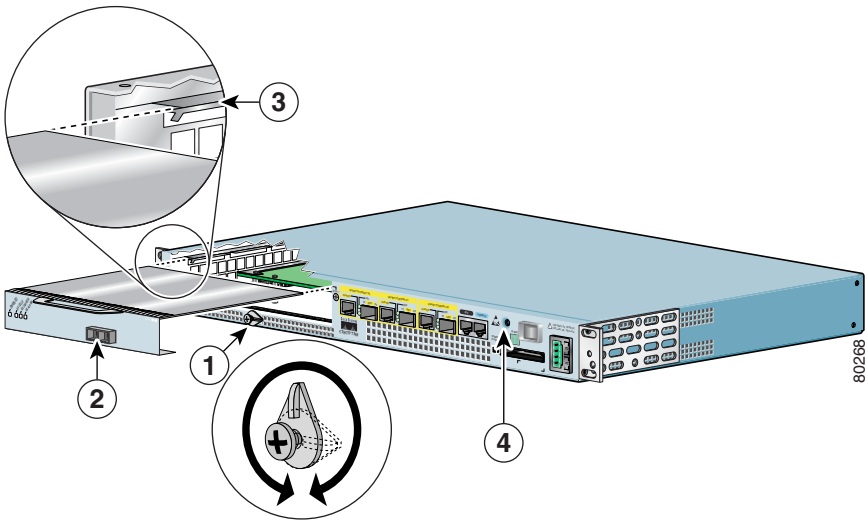
For complete information about using a CompactFlash Disk, see Appendix B, "Using the CompactFlash Disk."

For further installation procedures including rack-mounting or general workbench installation, see Chapter 2, "Rack-Mounting, Tabletop Installation, and Cabling," and Chapter 3, "Starting and Configuring the Router."

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 *Cisco 7301 Internet Router Port Adapter Documentation Roadmap.*

Figure 4-2 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

Warning **During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.** Statement 94

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 while traffic is flowing through the ports can cause system disruption.

The Cisco 7301 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 (see Figure 4-2) located on the front of the chassis, near the STATUS LED and power switch.

Step 2 Remove the port adaper from the chassis slot. Use a Phillips screwdriver to turn the screw holding the port adapter latch. The screw should be loose enough to allow the latch to rotate to an unlocked position (1). The latch can rotate 360°.

Step 3 Grasp the handle and pull the port adapter (2) or blank port adapter from the router.

Step 4 Disconnect all cables from the port adapter.

Step 5 Locate the port adapter slot guides inside the Cisco 7301 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.

Step 6 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.

Step 8 Reconnect any cables, including the port adapter and power cables, and place the cables through any cable-management bracket or power cable-retention clip.

Step 9 Power on the router by turning the power switch to the on position.

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 plate is installed in the unoccupied port adapter slot.

Powering Off the Router and Removing the Cover

Warning **This unit might have more than one power supply connection. All connections must be removed to de-energize the unit.** Statement 1028

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

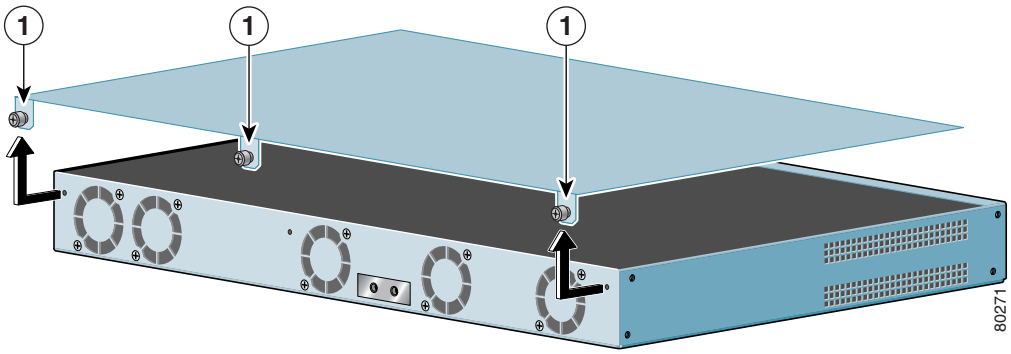
Note After powering off the router, wait a minimum of 30 seconds before powering it on again.

Step 2 Remove any cables from the Cisco 7301 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, tape the switch handle of the circuit breaker in the off position, and remove the DC connector.

Step 3 Remove the grounding cable.

Step 4 Remove the Cisco 7301 router from the rack, if it is rack-mounted.

Figure 4-3 Removing the Cover



1	Captive installation screws		

Step 5 Turn the Cisco 7301 so that the back is facing you.

Step 6 Using a Phillips screwdriver, loosen the three captive installation screws holding the cover to the chassis.

Step 7 Pull the cover toward you, away from the front of the router, and lift off the cover.

Proceed to the following sections for replacement instructions:

- Removing and Installing the SODIMMs, page 4-5
- Replacing the Cover and Powering On the Router, page 4-7

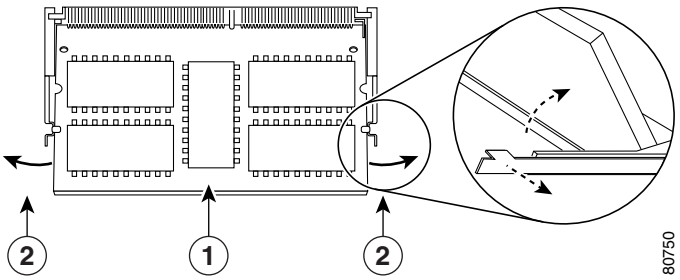
Removing and Installing the SODIMMs

This information in this section provides instructions for replacing a DDR-SDRAM SODIMM and is included for future use. The memory configuration you ordered is installed in the Cisco 7301 router.

Warning **During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.** Statement 94

To replace or upgrade the DDR-SDRAM SODIMM, follow these instructions:

Figure 4-4 Removing and Replacing the SODIMM



1	SODIMM	**2**	SODIMM spring latches

Note Both SODIMMs must be of the same size and type.

Note Use only memory purchased form Cisco Systems.

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

Step 2 Locate the SODIMMs.

Step 3 Press both spring latches outward to release the SODIMM. See Figure 4-4.

Step 4 Gently pull the SODIMM free from the SODIMM socket, taking care not to touch the pins that insert into the socket. Place the SODIMM in an anti-static bag.

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

Step 5 Locate the notches and align the SODIMM with the socket before inserting it.

Step 6 Gently insert the new SODIMM at a 30° angle, taking care not to damage the pins on the edge of the SODIMM.

Step 7 Press down on the SODIMM until the spring latches lock the SODIMM in place.

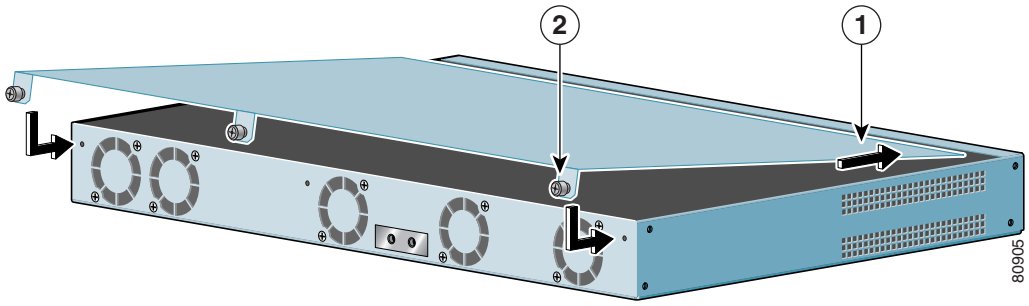
Step 8 Repeat Step 1 through Step 7 if you are also replacing the second SODIMM.

For memory specifications and configurations, see Appendix A, "Specifications."

Replacing the Cover and Powering On the Router

The Cisco 7301 router cover fits tightly on the chassis. Follow these instructions to replace the cover:

Figure 4-5 Inserting the Screws and Replacing the Cover



1	Inserting the lid under the router lip	**2**	Captive installation screws

Step 1 Holding the cover by the edge with the captive installation screws, tilt the cover and insert the front edge tabs into their slots under the lip on the top of the router.

Step 2 Lower the cover, align the captive installation screws with the chassis screw holes, and insert and tighten the three screws with a Phillips screwdriver.

Step 3 Return the router to its installation site, and attach the grounding cable, and input/output and power cables.

Step 4 Power on the router by turning the power switch to the on position.

CHAPTER 5

Troubleshooting Initial Startup Problems

Your Cisco 7301 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:

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 *Regulatory Compliance and Safety Information for the Cisco 7301 Internet Router* publication that accompanied your Cisco 7301 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 7301 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 chapter. 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	RJ-45 EN LEDs on?	Go to Step 8.	Check all cable connections and restart system. Check that the SFP GBIC module is fully seated. Go to Step 7.
Step 7	RJ-45 EN LEDs on?	Go to Step 8.	Obtain technical assistance
Step 8	Port adapter EN LEDs on?	Go to Step 10.	Reseat port adapters and restart system. Go to Step 9.
Step 9	Port adapter EN LEDs on?	Go to Step 10.	Obtain technical assistance.
Step 10	System startup successful.	—	—

Online Troubleshooting Resources

In addition to following the subsystems approach to troubleshooting, a variety of online troubleshooting resources are available.

- The *Cisco 7301 Router Troubleshooting Module* contains information to help you troubleshoot problems with the Cisco 7301 router. It is online at http://www.cisco.com/univercd/cc/td/doc/product/core/7301/trouble/index.htm.
- *Cisco 7301 Router Troubleshooting and Configuration Notes* is online at http://www.cisco.com/univercd/cc/td/doc/product/core/7301/trouble/7301note.htm.
- Cisco.com registered users can access various troubleshooting tools such as Software Advisor, Cisco IOS Error Message Decoder Tool, and Output Interpreter Tool from the Troubleshooting Tools menu after logging in at http://www.cisco.com/.
- *Inspection and Cleaning Procedures for Fiber-Optic Connections* provides information about cleaning fiber optic connections.
- *Compressed Air Cleaning Issues for Fiber-Optic Connections provides information about cleaning fiber optic connections.*

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 overtemperature 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 the Router." 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 RJ-45 EN LED comes on and indicates that a RJ-45 port (0/0, 0/1, or 0/2) 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 RJ-45 port. Consult Step 6 in the troubleshooting table on page 5-2.

- The native LINK LED comes on only when a router Gigabit Ethernet SFP GBIC port (0/0, 0/1, or 0/2) 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. An 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 5-8.
- 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" 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.	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 reseat 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.
	AC internal power cables are not fully seated; from the power supply to the system board, from the power supply to the power switch, and the power supply to the power connector	Turn the router power switch to the off position and unplug the router power cable. Open the cover and check the power supply cable connections. Reseat the cables if necessary. Replace the cover, plug in the power cable, and power on the router.

Table 5-1 Troubleshooting the Power Subsystem (continued)

Symptom	Possible Cause	Possible Solution
System does not power on.	DC internal power cables are not fully seated; from the power supply to the system board, from the power supply to the power switch, and the power supply to the power connector	Turn the router power switch to the off position and unplug the router power cable. Open the cover and check the power supply cable connections. Reseat the cables if necessary. Replace the cover, plug in the power cable, and power on the router.
	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.
System does not power on. *(continued)*	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.	Replace fan 2. 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.
	• One or more fans are not operating.
	• The fans are operating too slowly.
	• The power supply is not operating.
	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.
		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 Router," the "Reporting Functions" section on page 3-6 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 7301 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—LEDs remain on after configuring the ports to change the configuration from one media 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 Router," the "Configuring the Native Gigabit Ethernet Interfaces" section on page 3-14.

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 hang. 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 ENABLED 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 and service adapters). After the system reinitializes the interfaces, the ENABLED LED on the port or service adapter should go on. If the ENABLED 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 7301 router requires the c7301-boot-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. Access Cisco.com on the web and if you are a registered Cisco.com user, click **Login** at the top right of the page. If you are not a registered Cisco.com user, you can register by clicking **Register** at the top right side of the Cisco.com page. After you have logged in, click **Technical Support**. Follow the Software Center link under Service and Support. You need to get a login password 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 []? 10.7.0.99
Source filename []? c7301-boot-mz.122-4.BW
Destination filename [c7301-boot-mz.122-4.BW]?
Loading c7301-boot-mz.122-4.BW from 10.7.0.99 (via GigabitEthernet0/3):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

[OK - 5137928/10275840 bytes]

5137928 bytes copied in 45.420 secs (114176 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.

Cleaning the Fiber-Optic Connections

For information about cleaning fiber-optic cable connectors and receptacles, see the *Inspection and Cleaning Procedures for Fiber-Optic Connections* document, and the *Compressed Air Cleaning Issues for Fiber-Optic Connections* document. It provides detailed illustrations and photos of procedures and equipment required to properly clean fiber-optic connections.

APPENDIX A

Specifications

This appendix provides router specifications and cable assemblies and pinouts for the cables shipped with the Cisco 7301 router.

For additional information on how the cables are physically connected to the devices, see, Chapter 1, "Cisco 7301 Overview," and Chapter 2, "Rack-Mounting, Tabletop Installation, and Cabling."

This appendix includes the following cable assembly and pinout information:

Cisco 7301 Router Specifications

The specifications for the Cisco 7301 router are listed in Table A-1.

Table A-1 Cisco 7301 Router Specifications

Description	Specification
Dimensions (H x W x D)	1.73 in. x 17.3 in. x 13.87 in. (4.39 cm x 43.9 cm x 35.23 cm)
Weight	Chassis fully configured with a port adapter ~ 10.5 lb (4.76 kg)
Heat dissipation	50W (170 BTU) typical, 75W (255 BTU[1]) maximum
Power dissipation	75W maximum configuration
Single and Dual AC Power Supply Information	
AC-input power	75W maximum (single supply configuration)
AC-input voltage rating	100–240 VAC[2]wide input with power factor correction
AC-input current rating	Rated for 2A Not to exceed 1.0A[3] maximum at 100 VAC and .05A maximum at 240 VAC

Table A-1 Cisco 7301 Router Specifications (continued)

Description	Specification
AC-input frequency rating	50–60 Hz[4]
AC-input cable	18 AWG[5] 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
24V DC Power Supply Information	
DC-input power	75W maximum configuration
DC-input voltage ratings	+24 VDC[6] nominal. Maximum range +18 to +36 VDC
DC-input current ratings	Rated for 6A. Not to exceed 3A at +24 VDC (50A at 34 VDC = 2.1A typical draw)
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	
DC-input voltage rating	–48 VDC nominal in North America, –60 VDC nominal in some areas of the European Community. Maximum range is –40.5 to 72 VDC.
DC-input current rating	Rated for 3A. Not to exceed 1.6A at –48 VDC (50A at 48 VDC = 1.1A typical draw)
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. BTU = British thermal units
2. VAC = volts alternating current
3. A = amperes
4. Hz = hertz
5. AWG = American Wire Gauge
6. VDC = volts direct current

Note If required, use Sinewave Output UPS (uninterruptable power supply), not Ferro-resonant type UPS.

Software Requirements

The minimum software requirement for the Cisco 7301 router is Cisco IOS Release 12.2(11)YZ and Release 12.2(13)B.

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.

To access Software Advisor, click **Log In** at Cisco.com and go to Technical Support. You can also access the tool by pointing your browser directly to http://www.cisco.com/en/US/customer/products/sw/secursw/ps2136/products_software_advisor_tool_launch.html.

Choose a product family or enter a specific product number to search for the minimum supported software release needed for your hardware.

Processor and Memory Specifications

Table A-2 Processor and Memory Specifications

Memory Type	Size	Quantity	Description
SDRAM	128 MB	2	2 SDRAM SODIMMs for a total of 256 MB
	256 MB	2	2 SDRAM SODIMMs for a total of 512 MB
	512 MB	2	2 SDRAM SODIMMs for a total of 1 GB
Boot ROM	512 KB	1	FLASH PROM for the ROM monitor program
Primary cache	32 KB (16 KB instruction, 16 KB data)	—	BCM 1250 processor, internal cache
Secondary cache	512 KB	—	BCM 1250 processor, internal cache
Flash memory	32 MB	1	Contains the default boot helper (boot loader) image
NVRAM	512 KB	1	Battery-backed SRAM for the system configuration file

Table A-3 CompactFlash Disk Configurations

Quantity	Size	Description	Product ID
1	64 MB	Contains the default Cisco IOS image	MEM-7301-FLD64M=
1	128 MB		MEM-7301-FLD128M=

Table A-4 SODIMM Configurations

Total SDRAM	Quantity	Product ID
256 MB	2 128-MB SODIMMs	MEM-7301-256MB=
512 MB	2 256-MB SODIMMs	MEM-7301-512-MB=
1 GB	2 512-MB SODIMMs	MEM-7301-1GB=

SFP GBIC Module Configurations

Table A-5 SFP GBIC Module Configurations

Product ID	Type
GLC-SX-MM=	Short wavelength (1000BASESX)
GLC-LH-SM=	Long wavelength/long haul (1000BASELX)
GLC-ZX-SM=	Extended distance wavelength (1000BASEZX)

See Table A-6 for a list of the CWDN SFPs supported on the Cisco 7301 router.

Table A-6 CWDM SFP Configurations

CWDM Product Number	Color
CWDM-SFP-1470=	Gray
CWDM-SFP-1490=	Violet
CWDM-SFP-1510=	Blue
CWDM-SFP-1530=	Green
CWDM-SFP-1550=	Yellow
CWDM-SFP-1570=	Orange
CWDM-SFP-1590=	Red
CWDM-SFP-1610=	Brown

For specification and cabling information, see the following documentation:

- *Gigabit Interface Converter (GBIC) and Small Form-Factor Pluggable (SFP) GBIC Installation Information and Specifications*
- *Cisco Small Form-Factor Pluggable Gigabit Interface Converter Data Sheet.*
- *Cisco 1000BASE-T SFP Data Sheet*.

- *Cisco CWDM GBIC/SFP Solution Data Sheet.*
- *Cisco Coarse Wavelength-Divsion Multiplexing SFP Compatability Matrix*.

Gigabit Ethernet RJ-45 Port Pinouts

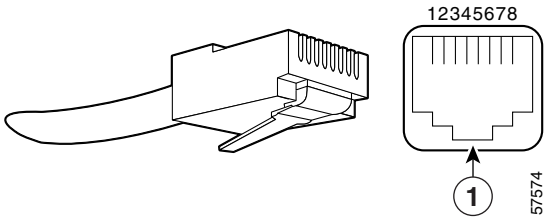
The Cisco 7301 router has RJ-45 ports for the three 10/100/1000 Gigabit Ethernet/Fast Ethernet/Ethernet connections. The RJ-45 ports support IEEE 802.3ab (Gigabit Ethernet) and IEEE 802.3u (Fast Ethernet) interfaces compliant with 10BASET, 100BASETX, and 1000BASET specifications.

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.** Statement 76

Figure A-1 shows an RJ-45 port and connector. Table A-7 lists the pinouts and signals for the RJ-45 port.

Figure A-1 RJ-45 Port and Connector



1	RJ-45 connector		

Table A-7 RJ-45 Receptacle Pinouts

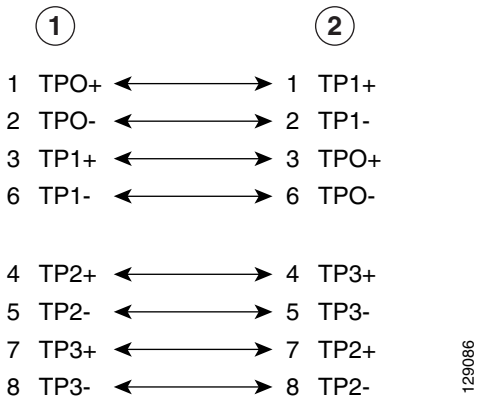
Pin	FE Signal	GE Signal
1	TX DATA+[1]	Tx A+
2	TX DATA–	Tx A–
3	RX DATA+[2]	Rx B+
4	N/C	Tx C+
5	N/C	Tx C–
6	RX DATA–	Rx B–
7	N/C	Rx D+
8	N/C	Rx D–

1. TX DATA = Transmit Data
2. RX DATA = Receive Data

Note With reference to the RJ-45 pinouts in Table A-7, 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).

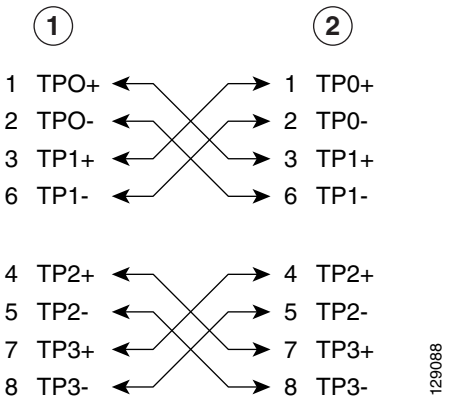
Depending on your RJ-45 interface cabling requirements, use the pinouts shown in Figure A-2 and Figure A-3 for Gigabit Ethernet straight-through and crossover twisted-pair cable connections. Use Figure A-4 for Ethernet/Fast Ethernet straight-through and crossover twisted-pair cable connections.

Figure A-2 Four Twisted-Pair Straight-Through Cable Schematics for 10/100/1000 and 1000BASE-T GBIC Module Ports



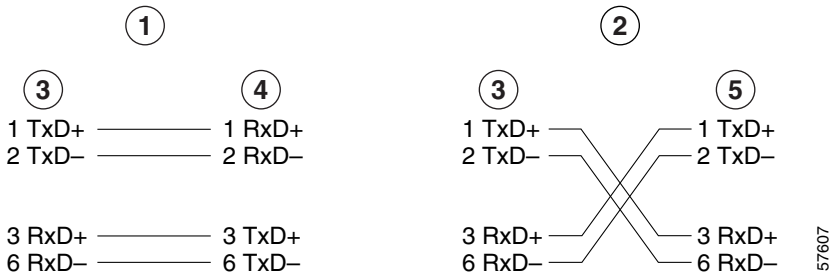
1	Router	**2**	Hub

Figure A-3 Four Twisted-Pair Crossover Cable Schematics for 10/100/1000 and 1000BASE-T GBIC Module Ports



1	Router	**2**	Hub

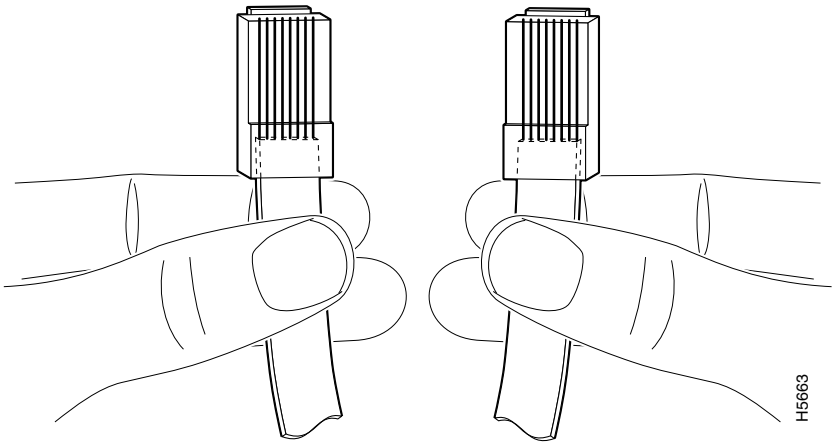
Figure A-4 Ethernet, Fast Ethernet Pinouts—Straight-Through or Crossover Cable



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, as shown in Figure A-5.

Figure A-5 Identifying a Crossover or Straight-Through Cable



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.

You can identify a rollover cable 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 connector (pin 1) should be the same color as the pin on the outside of the right connector (pin 8).

Table A-8 provides information about asynchronous device cabling options.

Table A-8 Asynchronous Device Cabling Options

Cable	Adapter	End Device
Crossover	RJ-45-to-DB-25M	Terminal or DTE
Crossover	RJ-45-to-DB-9M	Terminal or DTE
Straight-through	RJ-45-to-DB-25F	Modem or DCE

Console Port and Auxiliary Port Signals and Pinouts

Note The console cable kit product number is ACS-2500ASYN.

The Cisco 7301 router does not support Data Carrier Detect (DCD).

Table A-9 Console Port Signals

Pin	Signal	Direction	Description
1	CTS	Out	Clear to Send (tied to pin 8)
2	DSR	Out	Data Set Ready
3	RXD	Out	Receive Data
4	GND	—	Signal Ground
5	GND	—	Signal Ground
6	TXD	In	Transmit Data
7	DTR	In	Data Terminal Ready
8	RTS	In	Ready to Send (tied to pin 1)

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

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 mikaisesti.

ADVARSEL Eksplosjonsfare ved feilaktig skifte av batteri. Benytt samme batteritype eller en tilsvarende type anbefait av apparatfabrikanten. Brukte batterier kasseres i henhold til fabrikantens instruksjoner.

VARNING Eksplosionsfara vid felaktigt batteribyte. Använd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren. Kassera använt batteri enligt fabrikantens instruktion.

APPENDIX B

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:

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 B-1 provides memory information for the CompactFlash Disk.

Table B-1 CompactFlash Disk Memory Options

Memory Size	Product Number
64 MB	MEM-7301-FLD64M=
128 MB	MEM-7301-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 *Configuration Fundamentals Configuration Guide* and *Configuration Fundamentals Command Reference* publications for Cisco IOS Release 12.*x*. These publications are available on the Documentation DVD and through Cisco.com. (For information on how to access Cisco.com, see the "Obtaining Documentation and Submitting a Service Request" section on page xi.)

Hardware and Software Requirements

The Cisco 7301 uses only CompactFlash Disks of the following configurations:

- 64 MB, Product ID: MEM-7301-FLD64M=
- 128 MB, Product ID: MEM-7301-FLD128M=

The minimum Cisco IOS release for the Cisco 7301 CompactFlash Disks is Cisco IOS Release 12.2(11)YZ.

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-7301-FLD64M=
  - 128 MB, Product ID: MEM-7301-FLD128M=

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 B-2. 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 (`rommon>`), 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 7301 router.

Note The CompactFlash Disk in the Cisco 7301 router is supported on the c7301-boot-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 (`rommon>`). 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 c7301-boot-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 CISCO*xxx* 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: c7301-js-mz.122...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:c7301-boot-mz
  ```

  The result of this configuration file entry is that the BOOTLDR variable is bootflash:c7301-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 the Router,” the “Starting the System and Observing Initial Conditions” section on page 3-9 for 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 B-6.)

Step 2 Upgrade your onboard Flash memory by copying the Cisco IOS Release 12.*x* boot image (the c7301-boot-mz) into onboard Flash memory. (See the "Software Command Overview" section on page B-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 B-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 4-2.)

Step 7 With your system running Cisco IOS Release 12.*x*, format the blank CompactFlash Disk. (See the **format** command description in Table B-2 on page B-6, and the "Using the format Command" section on page B-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:

- *Configuration Fundamentals Configuration Guide*, in the chapter "File Management"
- *Configuration Fundamentals Command Reference*, in the chapter "File Management Commands"

Note These and all publications are available online, on the Documentation CD-ROM, and on Cisco.com. For information on how to access Cisco.com, see the "Obtaining Documentation and Submitting a Service Request" section on page xi.

This section includes the following subsections:

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 "Working with a CompactFlash Disk" section on page B-5.)

A CompactFlash Disk in the Cisco 7301 is referred to as *disk0.*

The following partial output of the **show file systems** command shows a sample system with a CompactFlash Disk—called *disk0:*—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   disk0:
```

Table B-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 B-2; however, in Table B-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 *Configuration Fundamentals Command Reference* document, in the chapter "File Management Commands."

Table B-2 CompactFlash Disk-Related Software Commands for the Cisco 7301

Command and Arguments	Purpose
cd [**disk0:** | *directory-name*]	Changes current directory. Allows you to move between directories on a CompactFlash Disk, where *directory-name* is the directory to which you want to move.
copy [**disk0:** |]*source-filename* [**tfpt:**]*destination-filename*	Copies from one file to another. Allows you to make a copy of a file (*source-filename*) located on a source file system (**disk0:**) and place it with either the same filename or a different filename (*destination-filename*) on a destination file system. Along with **disk0:**), the source and destination file system arguments include, but are not limited to: • **bootflash:** (onboard Flash memory) • **nvram:** (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 B-2 CompactFlash Disk-Related Software Commands for the Cisco 7301 (continued)

Command and Arguments	Purpose
delete [**disk0:**]*filename*	Deletes a file. Allows you to delete any file you designate, where *filename* designates the name of the file.
dir [**/all** | **disk0:**]	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.
format [**flash:** | **bootflash:** | **disk0:**]	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.
mkdir [**disk0:**]*directory-name*	Creates a new directory. Allows you to create directories on a CompactFlash Disk, where *directory-name* is the name you assign to this directory.
pwd	Displays current working directory. Allows you to display the name of the CompactFlash Disk directory in which you are currently working.
rename [**disk0:**]*filename* [**disk0:**]*filename*	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.
rmdir [**disk0:**]*directory-name*	Removes an existing directory. Allows you to remove a directory that currently exists on a CompactFlash Disk, where *directory-name* is the name of the directory you want to remove.
show [**disk0:**]	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 B-2 for optional arguments you can use with some of the following commands:

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 CompactFlash 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:]** 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.

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 B-2 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 4-2.

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 B-2.)

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)#
Crtl-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.

APPENDIX C

Configuration Register Information

The following information is found in this appendix:

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 C-1 lists the meaning of each of the configuration memory bits. Following the table is a more in-depth description of each setting.

Table C-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 C-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 C-2 provides information about the bits settings.

Table C-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 C-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, cisco2-7301). 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 C-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 C-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. B it 10 interacts with bit 14, which controls the network and subnet portions of the IP broadcast address. Table C-4 shows the combined effect of bit 10 and bit 14.

Table C-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 C-5 shows the bit settings for the four available baud rates. (The factory set default baud rate is 9600.)

Table C-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 7301 router.

```
Cisco Internetwork Operating System Software
IOS (tm) 7301 Software (C7301-JS-M), Experimental Version 12.2(20020904:004736) [biff 107]
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Mon 09-Sep-02 18:02 by biff
Image text-base:0x600088F8, data-base:0x61A94000

ROM:System Bootstrap, Version 12.2(20020730:200705) [biff-TAZ2_QA_RELEASE_16B 101],
DEVELOPMENT SOFTWARE
BOOTLDR:7301 Software (C7301-BOOT-M), Experimental Version 12.2(20020813:014224)
[biff-TAZ2_QA_RELEASE_17B 101]

7301p2b uptime is 0 minutes
System returned to ROM by reload at 00:01:51 UTC Sat Jan 1 2000
System image file is "tftp://10.1.8.11/tazii/images/c7301-js-mz"

cisco 7301 (NPE-G1) processor (revision A) with 491520K/32768K bytes of memory.
Processor board ID 0
BCM1250 CPU at 700Mhz, Implementation 1, Rev 0.2, 512KB L2 Cache
1 slot 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.
3 Gigabit Ethernet/IEEE 802.3 interface(s)
509K bytes of non-volatile configuration memory.

62976K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
32768K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x102
```

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

Confiuration 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-c7301

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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