CISCO SYSTEMS

Cisco 1760 Modular Access Router Hardware Installation Guide

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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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The Cisco implementation of TCP header compression is an adaptation of a program developed by the University of California, Berkeley (UCB) as part of UCB's public domain version of the UNIX operating system.

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CONTENTS

Preface

This section discusses the intended audience, scope, and organization of the *Cisco 1760 Router Hardware Installation Guide* and defines the conventions used to convey instructions and information.

Audience and Scope

This guide is for users who have some experience installing and maintaining networking hardware. We assume that Cisco 1760 router users are familiar with the terminology and concepts of local Ethernet and wide-area networking.

This guide describes the functional and physical features of the Cisco 1760 router and provides installation procedures, troubleshooting information, technical specifications, and cable and connector guidelines and specifications.

Organization

This guide is organized as follows:

- Chapter 1, "Cisco 1760 Router Overview," describes the router features, LEDs, and connectors.
- Chapter 2, "Installation," describes how to install the router by connecting cables and power, and tells how to install WAN interface cards (WICs) and voice interface cards (VICs).

- Chapter 3, "Troubleshooting," describes some problems that you might have with the router and how to solve these problems.
- Appendix A, "Technical Specifications," lists the physical characteristics, environmental requirements, and power specifications for the router.
- Appendix B, "Cabling Specifications," describes the cables and cabling guidelines for the router.
- Appendix C, "Installing and Upgrading Memory and Packet Voice Data Modules," describes how to install or upgrade memory or data modules in your router.
- Appendix D, "Installing the Virtual Private Network Module," describes how to install the Virtual Private Network (VPN) module in the router.
- Appendix E, "Installing the Echo Canceler Expansion Modules on Cisco Interface Cards," provides information about the echo canceler expansion modules that are available for use on the 1-port RJ-48 T1/E1 multiflex trunk (VWIC2-1MFT-T1/E1), and on the 2-port RJ-48 T1/E1 multiflex trunk (VWIC2-2MFT-T1/E1) interface cards.

Related Documentation

The following publications provide related information on this product:

- *Quick Start Guide for Installing Your Cisco 1760 Modular Access Router,* which came with your router, explains how to install voice hardware and how to configure the router for a Voice-over-IP (VoIP) network.
- *Cisco 1700 Router Software Configuration Guide* describes some common network scenarios and how to use the Cisco IOS command-line interface (CLI) to configure the router in these scenarios.
- *Cisco 1751 Router Software Configuration Guide* provides instructions on how to use Cisco IOS software to configure voice interfaces and virtual LANs (VLANs). The configuration information in this document also applies to the Cisco 1760 router.
- *Cisco 1- and 2-port T1/E1 Multiflex Voice/WAN Interface Cards for the Cisco 1751 and 1760 Routers* provides information about the Cisco 1-port and the Cisco 2-port multiflex trunk interface cards.

- *Cisco WAN Interface Cards Hardware Installation Guide* describes how to install and configure the WICs and VICs that are supported by the Cisco 1760 router.
- Cisco IOS command reference and configuration guides provide complete information about all Cisco IOS CLI commands and how to use them, as well as information on designing and configuring LANs and WANs.

Conventions

This guide uses the following conventions for information and instructions.

Notes, Cautions, and Warnings

Notes, cautions, and warnings use the following conventions and symbols:

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

Caution This caution symbol means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Warning Definition

Warning **IMPORTANT SAFETY INSTRUCTIONS**

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. 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

Figyelem **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。

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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

Commands

Table 1 describes the syntax used with the commands in this document.

Table 1 Command Syntax Guide

Convention	Description
boldface	Commands and keywords.
italic	Command input that is supplied by you.
[ ]	Keywords or arguments that appear within square brackets are optional.
{**x** | **x** | **x**}	A choice of keywords (represented by **x**) appears in braces separated by vertical bars. You must select one.
^ or Ctrl	Represent the key labeled *Control*. For example, when you read ^*D* or *Ctrl-D*, you should hold down the Control key while you press the D key.
`screen font`	Examples of information displayed on the screen.
`boldface screen font`	Examples of information that you must enter.
< >	Nonprinting characters, such as passwords, appear in angled brackets.
[ ]	Default responses to system prompts appear in square brackets.

Obtaining Documentation

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

Cisco.com

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

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

You can access the Cisco website at this URL:

http://www.cisco.com

You can access international Cisco websites at this URL:

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

Documentation DVD

Cisco documentation and additional literature are available in a Documentation DVD package, which may have shipped with your product. The Documentation DVD is updated regularly and may be more current than printed documentation. The Documentation DVD package is available as a single unit.

Registered Cisco.com users (Cisco direct customers) can order a Cisco Documentation DVD (product number DOC-DOCDVD=) from the Ordering tool or Cisco Marketplace.

Cisco Ordering tool:

http://www.cisco.com/en/US/partner/ordering/

Cisco Marketplace:

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

Ordering Documentation

You can find instructions for ordering documentation at this URL:

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

You can order Cisco documentation in these ways:

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

  http://www.cisco.com/en/US/partner/ordering/

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

We appreciate your comments.

Cisco Product Security Overview

Cisco provides a free online Security Vulnerability Policy portal at this URL:

http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html

From this site, you can perform these tasks:

- Report security vulnerabilities in Cisco products.
- Obtain assistance with security incidents that involve Cisco products.
- Register to receive security information from Cisco.

A current list of security advisories and notices for Cisco products is available at this URL:

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

If you prefer to see advisories and notices as they are updated in real time, you can access a Product Security Incident Response Team Really Simple Syndication (PSIRT RSS) feed from this URL:

http://www.cisco.com/en/US/products/products_psirt_rss_feed.html

Reporting Security Problems in Cisco Products

Cisco is committed to delivering secure products. We test our products internally before we release them, and we strive to correct all vulnerabilities quickly. If you think that you might have identified a vulnerability in a Cisco product, contact PSIRT:

- Emergencies—security-alert@cisco.com
- Nonemergencies—psirt@cisco.com

Tip We encourage you to use Pretty Good Privacy (PGP) or a compatible product to encrypt any sensitive information that you send to Cisco. PSIRT can work from encrypted information that is compatible with PGP versions 2.*x* through 8.*x*.

Never use a revoked or an expired encryption key. The correct public key to use in your correspondence with PSIRT is the one that has the most recent creation date in this public key server list:

http://pgp.mit.edu:11371/pks/lookup?search=psirt%40cisco.com&op=index&exact=on

In an emergency, you can also reach PSIRT by telephone:

- 1 877 228-7302
- 1 408 525-6532

Obtaining Technical Assistance

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

Cisco Technical Support Website

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

http://www.cisco.com/techsupport

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

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

Note Use the Cisco Product Identification (CPI) tool to locate your product serial number before submitting a web or phone request for service. You can access the CPI tool from the Cisco Technical Support Website by clicking the **Tools & Resources** link under Documentation & Tools. Choose **Cisco Product Identification Tool** from the Alphabetical Index drop-down list, or click the **Cisco Product Identification Tool** link under Alerts & RMAs. The CPI tool offers three search options: by product ID or model name; by tree view; or for certain products, by copying and pasting **show** command output. Search results show an illustration of your product with the serial number label location highlighted. Locate the serial number label on your product and record the information before placing a service call.

Submitting a Service Request

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

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

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

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

Asia-Pacific: +61 2 8446 7411 (Australia: 1 800 805 227)
EMEA: +32 2 704 55 55
USA: 1 800 553-2447

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

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

Definitions of Service Request Severity

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

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

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

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

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

Obtaining Additional Publications and Information

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

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

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

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

  http://www.ciscopress.com

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

  http://www.cisco.com/packet

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

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

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

  http://www.cisco.com/ipj

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

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

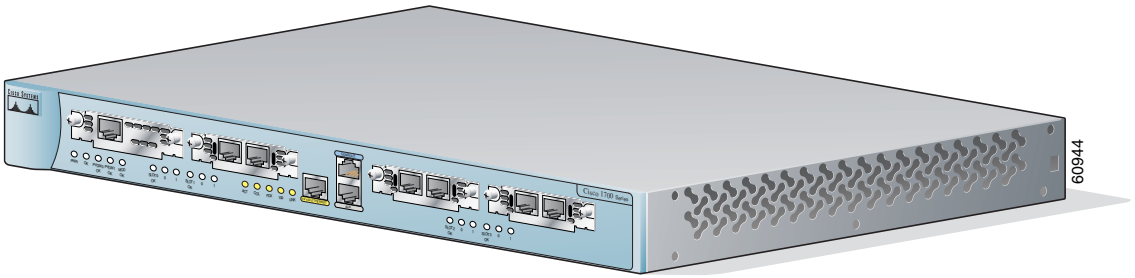
Cisco 1760 Router Overview

This chapter introduces the Cisco 1760 router, also referred to in this guide as *the router*, and covers the following topics:

- Key Features
- Ports and LEDs
- Router Memory
- Unpacking the Router
- Additional Required Equipment

Figure 1-1 shows the Cisco 1760 router.

Figure 1-1 Cisco 1760 Router



Key Features

The Cisco 1760 router is a voice-and-data-capable router that provides Voice-over-IP (VoIP) functionality and can carry voice traffic (for example, telephone calls and faxes) over an IP network. Using one or two WAN interface card (WIC) connections, the router links small-to-medium-size Ethernet and Fast Ethernet LANs in remote offices to central offices.

The Cisco 1760 router is available in two models. The Cisco 1760 runs data and data-plus-voice images, providing digital and analog voice support. The Cisco 1760-V includes all the features needed for immediate integration of data and voice services with support for multiple voice channels.

Table 1-1 lists the key features of the router.

Table 1-1 Key Features

Feature	Description
One Fast Ethernet (10/100BASE-TX) port	• Operates in full- or half-duplex mode (with software override support). • Supports autosensing for 10- or 100-Mbps operation (with software override support).
Cisco interface cards	• Supports two slots (slots 0 and 1) for either WICs or voice interface cards (VICs). • Supports two slots (slots 2 and 3) for VICs only. • Supports the following WICs: 1T, 2T, 2A/S, 1B-S/T, 1B-U, 1DSU-56K4, 1DSU-T1, 1ADSL, and 1ENET. • Supports the following VICs: 2FXS, 2FXO, 2E&M, 2FXO-EU, 2FXO-M1, 2FXO-M2, 2FXO-M3, 2DID, and 2BRI-NT/TE. • Changes in WAN interface configuration can be made as your network requirements change.
Console port	Supports router configuration and management from a connected terminal or PC. Supports up to 115.2 kbps.
Auxiliary port	Supports modem connection to the router, which can be configured and managed from a remote location. Supports up to 115.2 kbps.
SNMP support	Supports Simple Network Management Protocol (SNMP) to manage the router over a network.

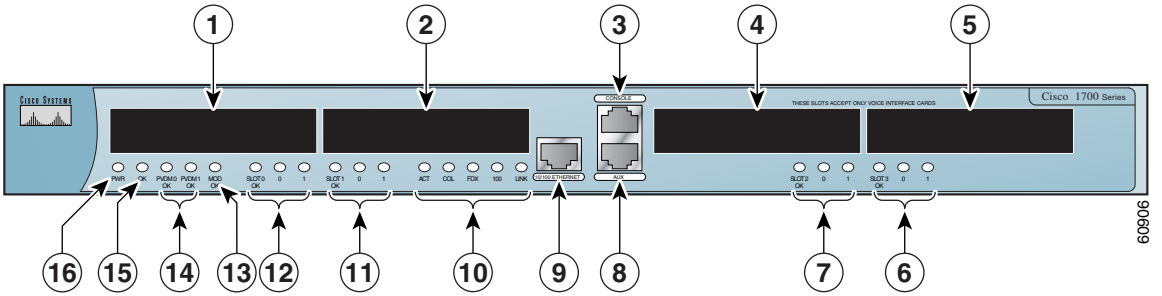
Table 1-1 Key Features (continued)

Feature	Description
VoIP and VoFR support	Supports VoIP and Voice-over-Frame Relay (VoFR) connections.
AutoInstall support	Supports AutoInstall for downloading configuration files to the router over a WAN connection.

Ports and LEDs

This section describes the router ports and LEDs, all on the front panel, which are shown in Figure 1-2 and described in the sections immediately following.

Figure 1-2 Ports and LEDs



1	Interface Card Slot 0 (WIC/VIC)	**9**	Ethernet Port
2	Interface Card Slot 1 (WIC/VIC)	**10**	Ethernet LEDs
3	Console Port	**11**	Interface Card Slot 1 LEDs
4	Interface Card Slot 2 (VIC only)	**12**	Interface Card Slot 0 LEDs
5	Interface Card Slot 3 (VIC only)	**13**	MOD OK LED
6	Interface Card Slot 3 LEDs	**14**	PVDM 0/1 OK LEDs
7	Interface Card Slot 2 LEDs	**15**	Router OK LED
8	Auxiliary Port	**16**	Power LED

Ports

The ports of the 1760 router are described in Table 1-2.

Table 1-2 Port Connectors

Connector/Slot	Label/Color	Description
Ethernet port	10/100 ETHERNET (yellow)	Router connection to the local Ethernet network. This port autosenses the speed (10 or 100 Mbps) and duplex mode (full or half) of the device to which it is connected and then operates at the same speed and in the same duplex mode.
Auxiliary port	AUX (black)	Modem connection for remote configuration using Cisco IOS software.
Console port	CONSOLE (light blue)	Terminal or PC connection for local configuration using Cisco IOS software.
WIC/VIC slot	SLOT 0	Supports either a Cisco WIC or a Cisco VIC. For detailed information, refer to the *Cisco WAN Interface Cards Hardware Installation Guide*.
WIC/VIC slot	SLOT 1	Supports either a Cisco WIC or a Cisco VIC. For detailed information, refer to the *Cisco WAN Interface Cards Hardware Installation Guide*.
VIC slot	SLOT 2	Supports a Cisco VIC. For detailed information, refer to the *Cisco WAN Interface Cards Hardware Installation Guide*.
VIC slot	SLOT 3	Supports a Cisco VIC. For detailed information, refer to the *Cisco WAN Interface Cards Hardware Installation Guide*.

System LEDs

The system LEDs, described in Table 1-3, confirm the presence of power to the router, basic router functionality, and the presence of packet voice data modules (PVDMs) and Virtual Private Network (VPN) modules.

Table 1-3 System LEDs

LED Label	Color	Description
PWR	Green	On when DC power is being supplied to the router.
OK	Green	On when the router has successfully booted up and the software is functional. This LED blinks during the power-on self-test (POST). See Table 3-1 in the "Troubleshooting" chapter for how to use this LED in router diagnostics.
PVDM 0 OK	Green	On when a packet voice data module (PVDM) is correctly inserted in PVDM card slot 0.
PVDM 1 OK	Green	On when a packet voice data module (PVDM) is correctly inserted in PVDM card slot 1.
MOD OK	Green	On when a VPN module is present.

Ethernet LEDs

The Ethernet LEDs show network activity and status on the Ethernet port. These LEDs are described in Table 1-4.

Table 1-4 Ethernet LEDs

LED Label	Color	Description
ACT	Green	Blinks when there is network activity on the Ethernet port.
COL	Yellow	Blinks when there are packet collisions on the local Ethernet network.
FDX	Green	On—Ethernet port is operating in full-duplex mode. Off—Ethernet port is operating in half-duplex mode.

Table 1-4 Ethernet LEDs (continued)

LED Label	Color	Description
100	Green	On—Ethernet port is operating at 100 Mbps. Off—Ethernet port is operating at 10 Mbps.
LINK	Green	On when the Ethernet link is up.

WIC/VIC LEDs

The WIC/VIC LEDs show network activity and status on the WIC and VIC ports. These LEDs are described in Table 1-5.

Table 1-5 WIC/VIC LEDs

LED	Color	Cards Supported	LED Meaning
SLOT 0 OK	Green		On when either a WIC or a VIC is correctly inserted in the card slot.
0	Green	ISDN	On when the first ISDN B channel is connected.
		Serial and CSU/DSU	Blinks when data is being sent to or received from port 0 in slot 0. For the VIC-2BRI-ST-NT/TE, blinks when data is being sent to or received from any of the B channels.
		2-port serial	
		VIC-2E&M	
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-ST-NT/TE	
		VIC-2DID	
		WIC-1ADSL	
		WIC-1ENET	

Table 1-5 WIC/VIC LEDs (continued)

LED	Color	Cards Supported	LED Meaning
1	-	Serial and CSU/DSU	Off.
	Green	ISDN	On when the second ISDN B channel is connected.
		2-port serial	Blinks when data is being sent to or received from port 1 in slot 0.
		VIC-2E&M	
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-NT/TE	
		VIC-2DID	
SLOT 1 OK	Green		On when either a WIC or a VIC is correctly inserted in the card slot.
0	Green	ISDN	On when the first ISDN B channel is connected.
		Serial and CSU/DSU	Blinks when data is being sent to or received from port 0 in slot 1.
		2-port serial	
		VIC-2E&M	
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-NT/TE	
		VIC-2DID	
		WIC-1ADSL	
		WIC-1ENET	

Table 1-5 WIC/VIC LEDs (continued)

LED	Color	Cards Supported	LED Meaning
1	-	Serial and CSU/DSU	Off.
	Green	ISDN	On when the second ISDN B channel is connected.
		2-port serial	Blinks when data is being sent to or received from port 1 in slot 1.
		VIC-2E&M	
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-NT/TE	
		VIC-2DID	
SLOT 2 OK	Green		On when a VIC is correctly inserted in the card slot.
0	Green	VIC-2E&M	Blinks when data is being sent to or received from port 0 in slot 2.
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-NT/TE	
		VIC-2DID	
1	Green	VIC-2E&M	Blinks when data is being sent to or received from port 1 in slot 2.
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-NT/TE	
		VIC-2DID	

Table 1-5 WIC/VIC LEDs (continued)

LED	Color	Cards Supported	LED Meaning
SLOT 3 OK	Green		On when a VIC is correctly inserted in the card slot.
0	Green	VIC-2E&M	Blinks when data is being sent to or received from port 0 in slot 3.
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-NT/TE	
		VIC-2DID	
1	Green	VIC-2E&M	Blinks when data is being sent to or received from port 1 in slot 3.
		VIC-2FXO	
		VIC-2FXS	
		VIC-2BRI-NT/TE	
		VIC-2DID	

Router Memory

This section describes the types of memory stored in the router and tells how to find out how much of each type the router has.

For instructions on how to upgrade memory in the router, See Appendix C, "Installing and Upgrading Memory and Packet Voice Data Modules," in this guide.

Types of Memory

The router has the following types of memory:

- Dynamic RAM (DRAM)—This is the main storage memory for the router. DRAM is also called working storage and contains the dynamic configuration information. The router stores a working copy of Cisco IOS software, dynamic configuration information, and routing table information in DRAM.
- Nonvolatile RAM (NVRAM)—This type of memory contains the startup configuration.

- Flash memory—This special kind of erasable, programmable memory contains a copy of the Cisco IOS software. The Flash memory structure can store multiple copies of the Cisco IOS software. You can load a new level of the operating system in every router in your network; then, when it is convenient, you can upgrade the whole network to the new level.

Amounts of Memory

The Cisco 1760 is shipped with 64 MB of DRAM and 32 MB of Flash memory on board.

The Cisco 1760-V is shipped with 96 MB of DRAM (64 MB on board and 32 MB in a DIMM socket) and 32 MB of Flash memory (32 MB on board and one empty SIMM socket).

Use the **show version** command to view the amount of DRAM, NVRAM, and Flash memory stored in your router. The following example shows the output of the **show version** command.

```
Router> show version

Cisco Internetwork Operating System Software
IOS (tm) C1700 Software (C1700-SV3Y-M), Version 12.2(2)XK, EARLY
DEPLOYMENT
RELEASE SOFTWARE (fc1)
TAC Support: http://www.cisco.com/tac
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Fri 13-Oct-01 15:26 by ealyon
Image text-base: 0x800080FC, data-base: 0x80D117A8

ROM: System Bootstrap, Version 12.2(2)XK, RELEASE SOFTWARE (fc1)
ROM: C1700 Software (C1700-SV3Y-M), Version 12.2(4)XL, EARLY
DEPLOYMENT
RELEASE SOFTWARE (fc1)

Router uptime is 2 days, 1 minute
System returned to ROM by reload
Running default software

cisco 1760 (MPC860) processor (revision 0x00) with 62260K/3276K bytes
of memory.
Processor board ID 0000 (1314672220), with hardware revision 0000
MPC860 processor: part number 5, mask 2
Bridging software.
X.25 software, Version 3.0.0.
```

```
Basic Rate ISDN software, Version 1.1.
1 FastEthernet/IEEE 802.3 interface(s)
2 Serial(sync/async) network interface(s)
2 ISDN Basic Rate interface(s)
4 Voice FXS interface(s)
4 Voice NT or TE BRI interface(s)
32K bytes of non-volatile configuration memory.
8192K bytes of processor board System flash partition 1 (Read/Write)
8192K bytes of processor board System flash partition 2 (Read/Write)


Configuration register is 0x0
```

Unpacking the Router

Table 1-6 lists the items that come with your router. All these items are in the accessory kit that is inside the box that your router came in.

Table 1-6 Router Box Contents

• Power cord (black)
• Console cable, RJ-45 to DB-9 (light blue)
• Rack-mounting brackets
• DB-25 to DB-9 adapter
• Cable guide
• Product documentation

Additional Required Equipment

Depending on your local network and on which Cisco WICs and VICs you install in your router, you might need other items listed in Table 1-7 to complete the router installation.

Table 1-7 Additional Required Equipment

Equipment	When You Use It
Ethernet hub	A hub connects pieces of network equipment (including the router) to create a network. You can use a 10-, 100-, or 10/100-Mbps hub with the router.
Ethernet switch	A switch connects pieces of network equipment (including the router) to create a network. You can use a 10-, 100-, or 10/100-Mbps switch with the router.
Phillips screwdriver	Although the WICs and VICs use thumbscrews, you might need a Phillips screwdriver to loosen the WIC or VIC covers.
Cisco WIC	To make a WAN connection, the router must have a supported WIC installed. The router supports up to two cards. You can either order the cards when you order the router, and they will be installed for you, or you can order the cards separately, after you receive the router, and install them yourself.
Cisco VIC	To make a voice connection, the router must have a supported VIC installed. The router supports up to three cards. You can either order the cards when ordering the router, and they will be installed for you, or you can order the cards separately, after receiving the router, and install them yourself. You must install digital signal processors (DSPs) to use VICs in the router.
Straight-through RJ-45-to-RJ-45 cable	This cable connects the router to the Ethernet LAN and the WICs to various WAN services, including ISDN, T1/FT1, and 56-kbps services. You will need one cable for each of these connections.
Standard RJ-11 telephone cable	This cable connects the VIC to a telephone, fax machine, or a telephone wall-jack. You will need one cable for each of these connections.
Standard RJ-48 telephone cable	This cable connects the VIC to a PBX trunk line. You will need one cable for each of these connections.

Table 1-7 Additional Required Equipment (continued)

Equipment	When You Use It
Serial cable	This cable connects a serial card to serial services. You must order this cable from Cisco. For detailed information about serial cable types, refer to the *Cisco WAN Interface Cards Hardware Installation Guide* that comes with every card.
NT1	Some ISDN service providers require a Network Termination 1 (NT1) device to connect an ISDN S/T port to the ISDN line.
Asynchronous modem	To configure the router from a remote location, connect a modem to the AUX port on the router.

Installation

This chapter provides the installation procedures for the router. The chapter includes the following sections:

Before Installing the Router

The router is shipped ready for rack mounting. Before making the power and network connections, mount the router in a rack, as described in the next section.

Be sure to read the safety information in the *Regulatory Compliance and Safety Information for Cisco 1700 Routers* document that came with your router.

Warning **Read the installation instructions before you connect the system to its power source.**

Warning **This equipment needs to be grounded. Use a green and yellow 14 AWG ground wire to connect the host to earth ground during normal use.**

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

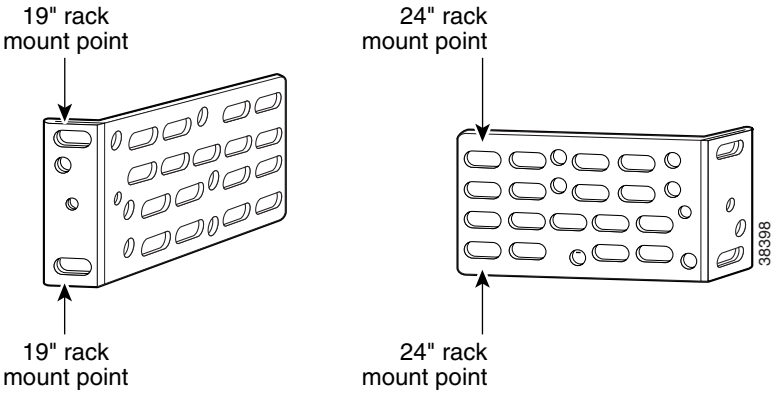
Mounting the Router in a Rack

Warning **To prevent bodily injury when mounting or servicing this unit in a rack, you must take special precautions to ensure that the system remains stable. The following guidelines are provided to ensure your safety:**

- This unit should be mounted at the bottom of the rack if it is the only unit in the rack.
- When mounting this unit in a partially filled rack, load the rack from the bottom to the top, with the heaviest component at the bottom of the rack.
- If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the unit in the rack.

The rack-mounting brackets supplied with the router can be attached to a 19- or 24-inch rack. Figure 2-1 shows the bracket mounting points that attach to the rack.

Figure 2-1 Bracket Mounting Points



To install the router in a 19-inch or a 24-inch standard rack, follow the instructions described in these procedures:

- Attaching Brackets to the Router
- Attaching Brackets to the Rack

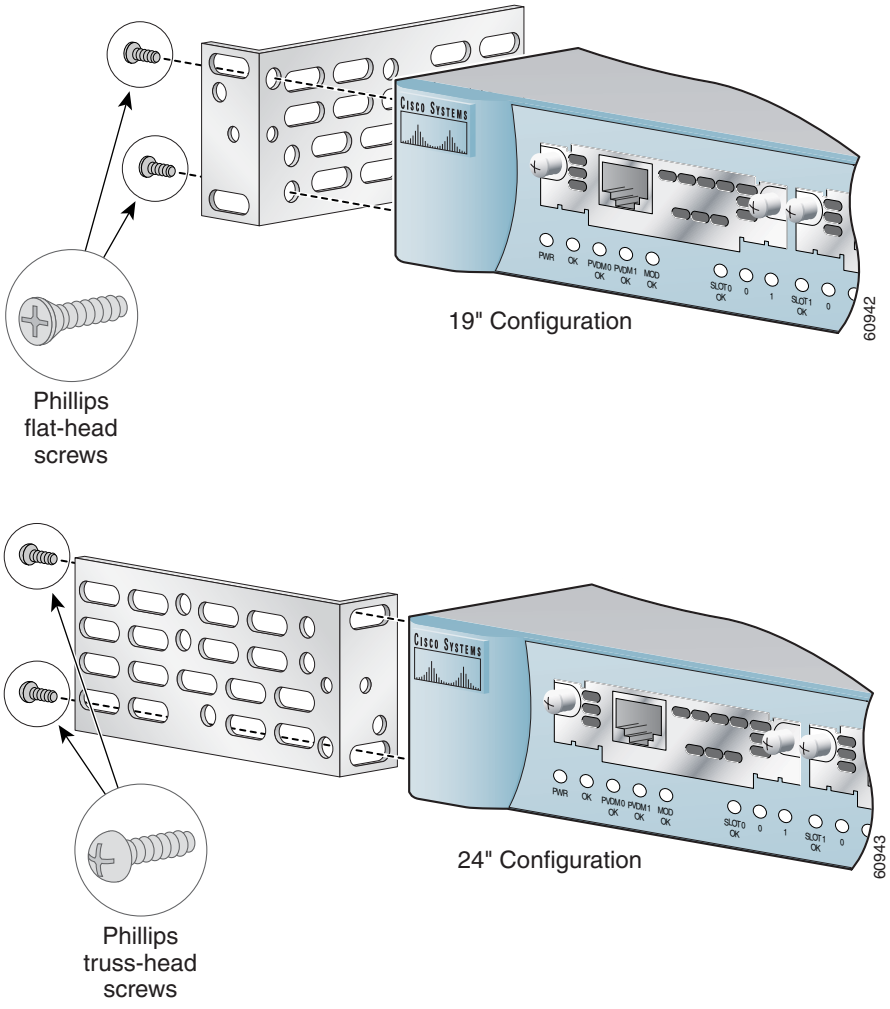
Attaching Brackets to the Router

The bracket orientation and the screws you use depend on whether a 19-inch rack or a 24-inch rack will be used. Use two of the supplied screws to attach each bracket, according to the following guidelines:

- For a 19-inch rack, use the supplied number-8 Phillips flat-head screws to attach the long side of the bracket to the router.
- For a 24-inch rack, use the supplied number-8 Phillips truss-head screws to attach the short side of the bracket to the router.

Figure 2-2 shows how to attach the brackets to the two sides of the router with the front panel forward.

Figure 2-2 Attaching Brackets for 19- and 24-Inch Racks

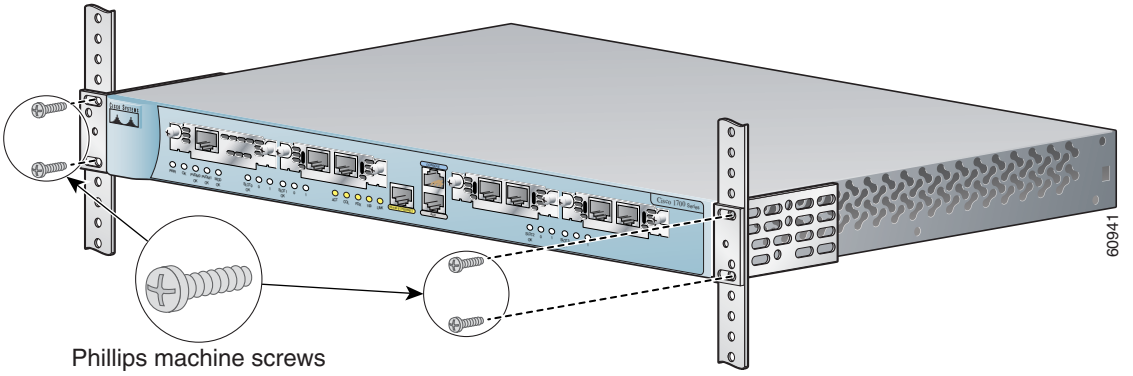


Attaching Brackets to the Rack

After you attach the brackets to the router, use the four supplied number-12 Phillips machine screws to securely attach the brackets to the rack, as shown in Figure 2-3.

Caution Make sure that the fans on the side of the chassis are not blocked.

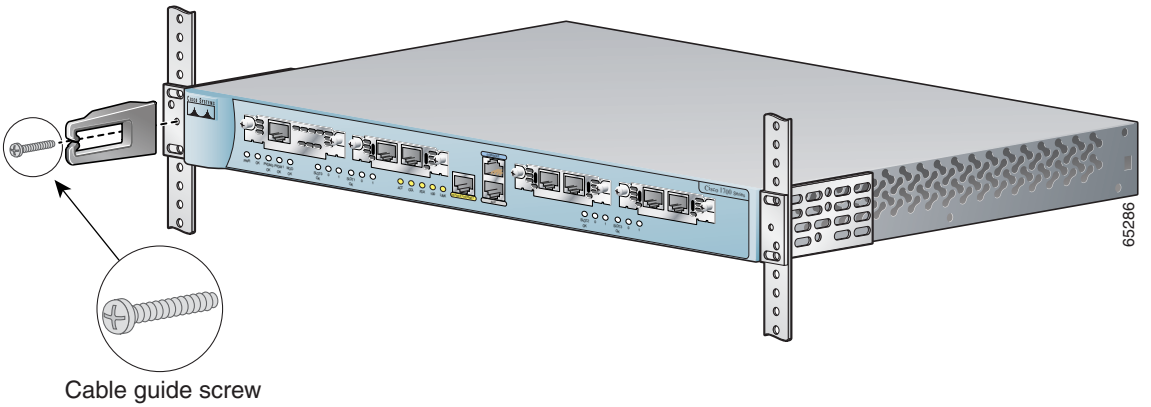
Figure 2-3 Attaching Brackets to the Rack



Attaching the Optional Cable Guide

Cisco recommends attaching the cable guide to prevent the cables from obscuring the front panel of the router and the other devices installed in the rack. If the router is in a 19-inch or 24-inch rack, use the supplied black screw, as shown in Figure 2-4, to attach the cable guide to the left or right bracket.

Figure 2-4 Attaching the Cable Guide to the Router



Connecting the Router to Your Local Network

The router is connected to your local Ethernet network through the yellow 10/100 Ethernet port. You must provide the following items for this connection:

- A straight-through, RJ-45-to-RJ-45 Ethernet cable
- A 10/100-Mbps Ethernet hub or switch

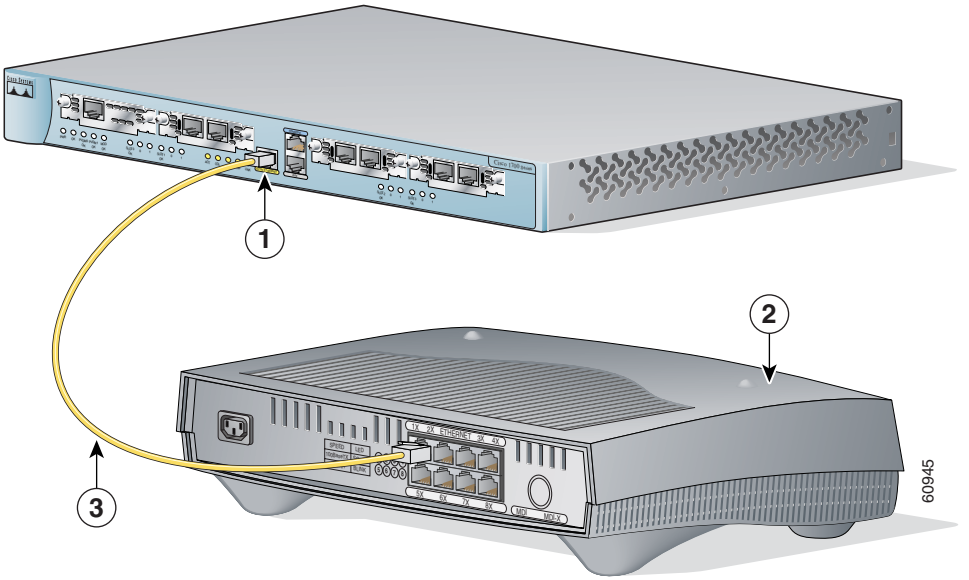
Warning **The ports labeled *10/100-Mbps Ethernet port* and *Console port* are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuits to the telephone network voltage (TNV) circuits. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information for Cisco 1700 Routers* document that came with the router.)**

Caution Always connect the Ethernet cable to the yellow ports on the router. Do not connect the cable to an ISDN S/T or U port on a WIC or to an NT1 that is connected to a WIC. Accidentally connecting the cable to the wrong port can damage your router.

Follow these steps to connect the router to your local network:

Step 1 Connect one end of the cable to the yellow Ethernet port (labeled *10/100-Mbps Ethernet port*). (See Figure 2-5.)

Figure 2-5 Connecting the Router to the Local Network



1	10/100 Ethernet port	**3**	Straight-through Ethernet cable
2	Ethernet hub or switch		

Step 2 Connect the other end of the cable to a network port on the hub or switch.

Installing WICs and VICs

The router has four card slots that hold Cisco WICs and VICs. Either one or two WICs may be installed, with the remaining slots holding VICs, as desired. If no WICs are present in the slots, up to four VICs may be installed. Each WIC has one or two WAN ports and each VIC has one or more voice ports. This section describes the procedure for installing a WIC or a VIC in the router.

Note For details on specific WICs and VICs, on connecting a WIC to the WAN line or VIC to the telephone and fax line, and on configuring the interface with Cisco IOS software, refer to the *Cisco WAN Interface Cards Hardware Installation Guide* that came with the cards.

Safety Information

This section lists safety warnings that you should be aware of before installing WICs or VICs in the router. To see translated versions of these warnings, refer to the *Regulatory Compliance and Safety Information for the Cisco 1700 Routers* document that came with the router.

Warning **Before working on a system that has an on/off switch, turn off the power and unplug the power cord.**

Warning **Only trained and qualified personnel should be allowed to install or replace this equipment.**

Warning **Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.**

Warning **Before opening the chassis, disconnect the telephone-network cables (from the card) to avoid contact with the telephone-network voltages.**

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

Caution Do not connect a WAN, telephone, or fax cable to the card until you have completed the installation procedure.

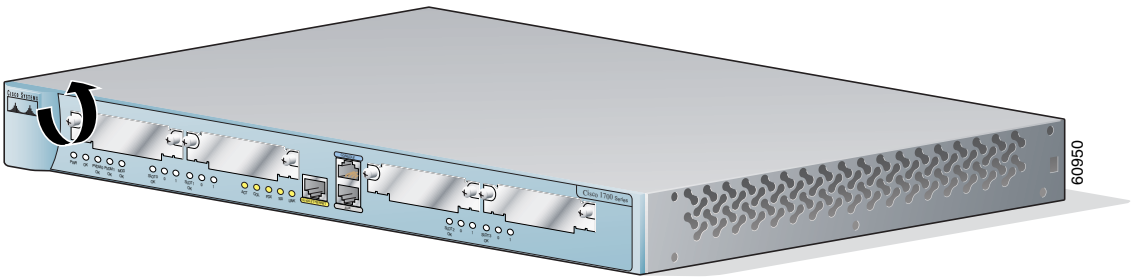
Follow these steps to remove or insert a card in the router:

Step 1 Make sure that the router is turned off and is disconnected from power.

Caution Power must be disconnected from the system before installing or removing WICs or VICs to avoid damaging them. When WICs or VICs are pushed into or pulled out of a router that is powered up, there is a very good chance that they could be damaged electrically and will no longer function.

Step 2 Loosen the thumbscrews on the WIC or VIC slot cover, as shown in Figure 2-6.

Figure 2-6 Removing a WIC or VIC Slot Cover

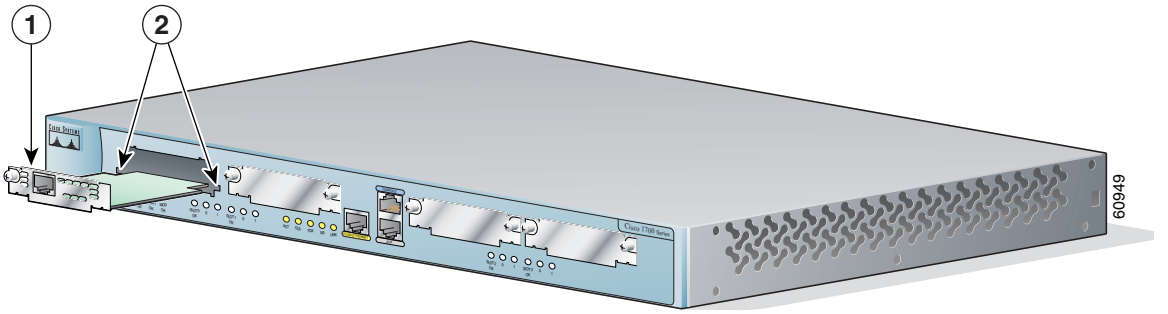


You should be able to loosen the screws using your fingers; however, if the screws are very tight, you might need to use a Phillips screwdriver.

Step 3 Remove the metal plate that covers the card slot.

Step 4 Hold the card by the edges on either side of the card front panel, and line up the card edges with the guides inside the card slot, as shown in Figure 2-7.

Figure 2-7 Inserting a WIC or VIC in the Router



1	Interface Card	**2**	Guides

Step 5 Insert the card in the slot, and gently push it into the router until the front panel of the card is flush with the router.

Note Slots 2 and 3 accept VICs only. These slots have a small metal tab on the right side that interferes with a similar tab on WICs, preventing WICs from being inserted by mistake.

Step 6 Tighten the screws.

Connecting Power to the Router

Read the following warnings before connecting the power to the router.

Warning **The power supply is designed to work with TN power systems.**

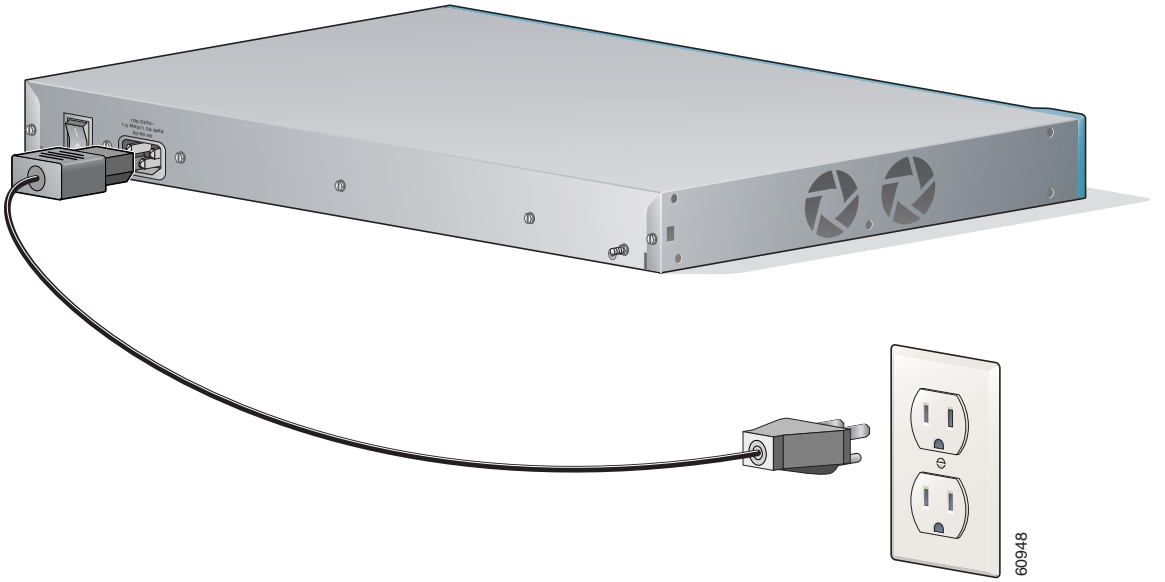
Warning **This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a fuse or circuit breaker no larger than 120VAC, 15AU.S. (240VAC, 16A international) is used on the phase conductors (all current-carrying conductors).**

Warning **This equipment needs to be grounded. Use a green and yellow 14 AWG ground wire to connect the host to earth ground during normal use.**

Follow these steps to connect power to the router and to turn the router on:

Step 1 Connect the separate power cord to the power socket on the rear panel. (See Figure 2-8.)

Figure 2-8 Connecting Power



Step 2 Connect the other end of the separate power cord to a power outlet.

Step 3 Turn the power switch on (|).

Step 4 Confirm that the router has power by checking that the PWR LED is on.

Verifying the Installation

You can verify that you have correctly installed the router by checking the following LEDs:

- PWR—On when power is being supplied to the router.
- OK—On when the router software is loaded and functional. Blinking means that the router is performing a power-on self-test (POST).
- ETH ACT—Blinking when there is network traffic on the local Ethernet LAN.

- SLOT 0 and SLOT 1 OK—On when a WIC or VIC is correctly installed in the slot.
- SLOT 2 and SLOT 3 OK—On when a VIC is correctly installed in the slot.
- SLOT 0, SLOT 1, SLOT 2, and SLOT 3—Activity on ports 0 and 1 of each of these slots varies, depending on the type of WIC or VIC installed. See Table 1-5 in Chapter 1, "Cisco 1760 Router Overview," for detailed information on activity at different ports.
- LINK—On when the router is correctly connected to the local Ethernet LAN through the 10/100-Mbps Ethernet port.

Optional Installation Steps

This section describes the following installation steps that you might or might not use, depending on your site and how you are configuring the router:

- Connecting a PC
- Connecting a Modem

Connecting a PC

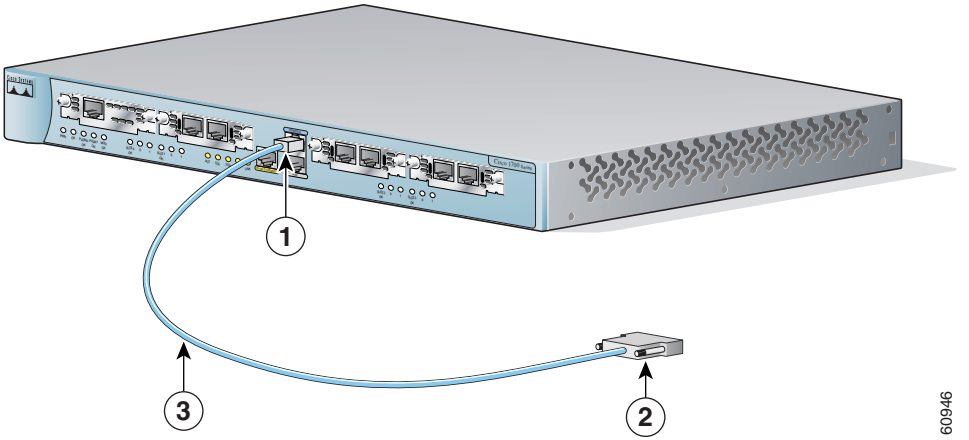
If you want to configure the router through the Cisco IOS command-line interface (CLI), you must connect the router console port to a terminal or PC. The cable required for this connection is included with the router.

The PC must have some type of terminal emulation software installed. The software should be configured with the following parameters: 9600 baud, 8 data bits, no parity, 1 stop bit, and no flow control. Refer to the *Cisco 1700 Router Software Configuration Guide* for detailed information about configuring the router using Cisco IOS software.

Follow these steps to connect the router to a terminal or PC:

Step 1 Connect the end of the light blue console cable with the RJ-45 connector to the blue console port on the router, as shown in Figure 2-9.

Figure 2-9 Connecting the Console Cable to the Router



1	Blue console port	**3**	Light blue console cable
2	To PC or terminal		

Step 2 Connect the end of the cable with the DB-9 connector to the terminal or PC. If your terminal or PC has a console port that does not fit a DB-9 connector, you must provide a correct adapter for that port.

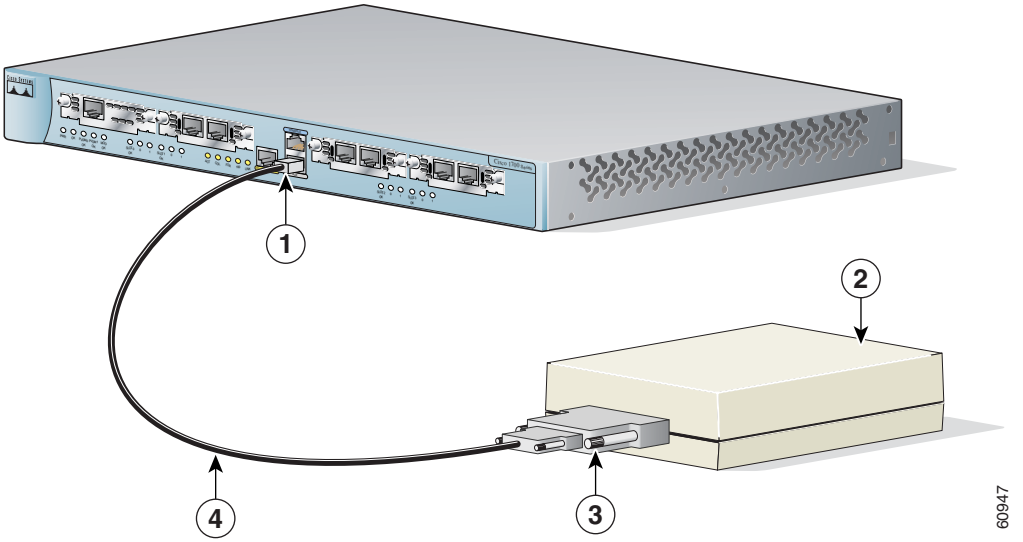
Connecting a Modem

When a modem is connected to the auxiliary port, a remote user can dial into the router and configure it. You can use the light blue console cable that came in the accessory kit. If you are using the light blue cable with the console port, you can use any crossover RJ-45-to-RJ-45 cable, along with an RJ-45-to-DB-25 adapter that you must provide.

Follow these steps to connect a modem to the router:

Step 1 Connect the RJ-45 end of the console cable to the black AUX port on the router. (See Figure 2-10.)

Figure 2-10 Connecting a Modem to the Router



1	Aux port (RJ-45)	**3**	DB-9-to-DB-25 adapter
2	Modem	**4**	Console cable

Step 2 Connect the DB-9-to-DB-25 adapter to the DB-9 end of the console cable.

Step 3 Connect the DB-25 end of the adapter to the modem.

Troubleshooting

Use the information in this chapter to help isolate problems with the router or to rule out the router as the source of the problem.

This chapter contains the following sections:

Contacting Your Cisco Reseller

If you cannot locate the source of a problem, contact your local reseller for advice. Before you call, you should have the following information ready:

- Chassis type and serial number
- Maintenance agreement or warranty information
- Cisco IOS release installed on your router
- Date you received the router
- Brief description of the problem
- Brief description of the steps you have taken to isolate the problem
- Output from the **show tech-support** EXEC command

Recovering a Lost Password

This section describes how to recover a lost enable password and how to enter a new enable secret password.

Password recovery consists of the following major processes:

- Determining the Configuration Register Value

  With this process, you determine the configuration of the router, so that you may restore the configuration after the password is recovered.

- Resetting the Router

  With this process, you reconfigure the router to its intial startup configuration. You then display the enable password, if one is used.

- Resetting the Password

  If you are using an enable secret password, you enter a new password with this process. You then restore the router to its prior configuration.

- Resetting the Configuration Register Value

  If you are using an enable password, you use this process to restore the router to its prior configuration.

Note See the "Hot Tips" section on Cisco.com for additional information on replacing enable secret passwords.

Determining the Configuration Register Value

Follow these steps to determine the configuration register value:

Step 1 Connect an ASCII terminal or a PC running a terminal-emulation program to the console port on the router. See the "Connecting a PC" section in Chapter 2, "Installation."

Step 2 Configure the terminal to operate at 9600 baud, 8 data bits, no parity, 1 stop bit and no flow control.

Step 3 Reboot the router by pressing the power switch to the off (0) position and then to the on (|) position.

Step 4 At the user EXEC prompt (`Router>`), enter the **show version** command to display the existing configuration register value (shown at the end of this example output):

```
Router> show version

Cisco Internetwork Operating System Software
IOS (tm) C1700 Software (C1700-SV3Y-M), Version 12.2(2)XK, EARLY
DEPLOYMENT
RELEASE SOFTWARE (fc1)
TAC Support: http://www.cisco.com/tac
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Fri 13-Oct-01 15:26 by ealyon
Image text-base: 0x800080FC, data-base: 0x80D117A8

ROM: System Bootstrap, Version 12.2(2)XK, RELEASE SOFTWARE (fc1)
ROM: C1700 Software (C1700-SV3Y-M), Version 12.2(4)XL, EARLY
DEPLOYMENT
RELEASE SOFTWARE (fc1)

Router uptime is 2 days, 1 minute
System returned to ROM by reload
Running default software

cisco 1760 (MPC860) processor (revision 0x00) with 62260K/3276K bytes
of memory.
Processor board ID 0000 (1314672220), with hardware revision 0000
MPC860 processor: part number 5, mask 2
Bridging software.
X.25 software, Version 3.0.0.
Basic Rate ISDN software, Version 1.1.
1 FastEthernet/IEEE 802.3 interface(s)
2 Serial(sync/async) network interface(s)
2 ISDN Basic Rate interface(s)
4 Voice FXS interface(s)
4 Voice NT or TE BRI interface(s)
32K bytes of non-volatile configuration memory.
8192K bytes of processor board System flash partition 1 (Read/Write)
8192K bytes of processor board System flash partition 2 (Read/Write)

Configuration register is 0x0
```

Step 5 Record the setting of the configuration register. It is usually 0x0.

Step 6 Record the break setting, as given by bit 8 of the configuration register.

- Break enabled—Bit 8 is set to 0.
- Break disabled (default setting)—Bit 8 is set to 1.

Resetting the Router

Follow these steps to reset the router:

Step 1 Do one of the following:

- If break is enabled, go to Step 2.
- If break is disabled, turn the router off, wait 5 seconds, and turn it on again. Within 60 seconds, press the **Break** key. The terminal displays the ROM monitor prompt. Go to Step 3.

Note Some terminal keyboards have a key labeled Break. If your keyboard does not have a Break key, refer to the documentation that came with the terminal for instructions on how to send a break. To send a break in Windows HyperTerminal, enter Ctrl-Break.

Step 2 Send a break. The terminal displays the following prompt:

```
rommon 2>
```

Step 3 Enter **confreg 0x142** to reset the configuration register:

```
rommon 2> confreg 0x142
```

Step 4 Initialize the router by entering the **reset** command:

```
rommon 2> reset
```

The router resets, and the configuration register is set to 0x142. The router boots the system image in Flash memory and displays the following:

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

Step 5 Enter **no** in response to the prompts until the following message is displayed:

```
Press RETURN to get started!
```

Step 6 Press **Return**. The following prompt appears:

```
Router>
```

Step 7 Enter the **enable** command to enter privileged EXEC mode. Configuration changes can be made only in this mode.

```
Router> enable
```

The prompt changes to the privileged EXEC prompt:

```
Router#
```

Step 8 Enter the **show startup-config** command to display an enable password in the configuration file:

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

If you are using an enable password, it will appear in the startup configuration. Write down the password and keep the record secure.

If you are using a secret enable password, there will be no enable password in the startup configuration.

Step 9 Enter the **copy startup-config running-config** command to return to your startup configuration:

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

If you are recovering an enable password, skip the next section, "Resetting the Password," and complete the password recovery process by performing the steps in the "Resetting the Configuration Register Value" section.

If you are resetting an enable secret password, you will not see it displayed in the **show startup-config** command output. Complete the password recovery process by performing the steps in the "Resetting the Password" section, which follows.

Resetting the Password

Follow these steps to reset an enable secret password and restore the configuration of the router:

Step 1 Enter the **configure terminal** command to enter configuration mode:

```
Router# configure terminal
```

Step 2 Enter the **enable secret** command to reset the enable secret password in the router:

```
Router(config)# enable secret <gobbledegook>
```

Step 3 Enter the **config-register** command and the original configuration register value that you recorded in Step 5 in the "Determining the Configuration Register Value" section on page 3-2.

Step 4 Press **Ctrl-Z** to exit configuration mode.

```
Router(config)# Ctrl-Z
```

Step 5 Save your configuration changes:

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

Step 6 Reboot the router, and enter the enable secret password.

Resetting the Configuration Register Value

Follow these steps to restore the configuration of the router after you have recovered an enable password:

Step 1 Enter the **configure terminal** command to enter configuration mode:

```
Router# configure terminal
```

Step 2 Enter the **config-register** command and the original configuration register value that you recorded in Step 5 in the "Determining the Configuration Register Value" section on page 3-2.

Step 3 Press **Ctrl-Z** to exit configuration mode:

```
Router(config)# Ctrl-Z
```

Step 4 Reboot the router, and enter the recovered enable password.

Problem-Solving

The key to problem-solving is to isolate the problem to a specific subsystem by comparing what the router is doing to what it should be doing.

When problem-solving, consider the following subsystems of the router:

- WICs and VICs—Observe the LEDs on the cards and the LEDs on the router front panel to help identify a failure. For more information on WICs and VICs, refer to the *Cisco WAN Interface Cards Hardware Installation Guide* that comes with each card.
- Cables—Check all the external cables that connect the router to the network.
- Power system—Check the external power source, power cable, router power supply, and circuit breaker. Check for inadequate ventilation or air circulation that might cause overheating.
- ISDN configuration—Consider ISDN-specific hardware and software configurations (ISDN BRI WICs only).

OK LED Diagnostics

Use the OK LED to help determine any problems with the router. When the router first boots up, it performs a power-on self-test (POST). If the router detects a problem during the POST, the OK LED blinks in a different pattern (described in Table 3-1), depending on the problem. A pattern is a specific number of blinks that is repeated until the router is turned off. If the router experiences any of these problems, contact your Cisco reseller.

Table 3-1 Blinking Patterns of the OK LED

Number of Blinks	Meaning
2	The 860P dual-port RAM (DPRAM) failed.
3	The parameter RAM area of the 860P DPRAM failed.
4	The 860P system protection control register has a write failure.
5	The router cannot detect the dynamic RAM (DRAM).
6	The user programmable machine has a write failure.
9	The router DRAM failed.

Troubleshooting WICs and VICs

Use the **show diag** command to help determine problems with a card.

```
Router# show diag

      Slot 0:
        C1760 1FE VE 4SLOT DV Mainboard Port adapter, 9 ports
        Port adapter is analyzed
        Port adapter insertion time unknown
        EEPROM contents at hardware discovery:
        Hardware Revision        : 0.0
        PCB Serial Number        :
        Part Number              : 00-0000-00
        Fab Version              : 04
        EEPROM format version 4
        EEPROM contents (hex):
          0x00: 04 FF 40 03 16 41 00 00 C1 8B 00 00 00 30 30 30
          0x10: 30 00 00 00 00 82 00 00 00 00 02 04 FF FF FF FF
          0x20: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x30: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x40: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x50: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x60: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x70: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF

        Packet Voice DSP Module Slot 0:
        Hardware Revision        : 2.2
        Part Number              : 73-3815-01
        Board Revision           : A0
```

```
  Deviation Number         : 0-0
  Fab Version              : 02
  PCB Serial Number        : ICP0339007X
  RMA Test History         : 00
  RMA Number               : 0-0-0-0
  RMA History              : 00
  Processor type           : 02
  Number of DSP's          : 2
  Type of DSP              : TMS320C549
  EEPROM format version 4
  EEPROM contents (hex):
  0x00:   04 FF 40 01 5B 41 02 02 82 49 0E E7 01 42 41 30
  0x10:   80 00 00 00 00 02 02 C1 8B 49 43 50 30 33 33 39
  0x20:   30 30 37 58 03 00 81 00 00 00 00 04 00 09 02 FF

  Packet Voice DSP Module Slot 1:
  Hardware Revision        : 2.2
  Part Number              : 73-3741-01
  Board Revision           : A0
  Deviation Number         : 0-0
  Fab Version              : 02
  PCB Serial Number        : ICP0326001Y
  RMA Test History         : 00
  RMA Number               : 0-0-0-0
  RMA History              : 00
  Processor type           : 02
  Number of DSP's          : 1
  Type of DSP              : TMS320C549
  EEPROM format version 4
  EEPROM contents (hex):
  0x00:   04 FF 40 01 5A 41 02 02 82 49 0E 9D 01 42 41 30
  0x10:   80 00 00 00 00 02 02 C1 8B 49 43 50 30 33 32 36
  0x20:   30 30 31 59 03 00 81 00 00 00 00 04 00 09 02 FF

WIC/VIC Slot 0:
  Serial 2T (12in1)
  Hardware revision 1.0   Board revision B0
  Serial number     0017662984    Part number    800-03181-01
  Test history      0x00          RMA number     00-00-00
  Connector type    PCI
  EEPROM format version 1
  EEPROM contents (hex):
  0x20:   01 12 01 00 01 0D 84 08 50 0C 6D 01 00 00 00 00
  0x30:   58 00 00 00 00 01 03 00 FF FF FF FF FF FF FF FF

  WIC/VIC Slot 1:
  Dual FXS Voice Interface Card
  Hardware revision 1.1   Board revision F0
```

```
Serial number     0014501612    Part number    800-02493-01
Test history      0x00          RMA number     00-00-00
Connector type    WAN Module
EEPROM format version 1
EEPROM contents (hex):
0x20:   01 0E 01 01 00 DD 46 EC 50 09 BD 01 00 00 00 00
0x30:   78 00 00 00 99 05 26 01 FF FF FF FF FF FF FF FF

VIC Slot 2:
Dual FXS Voice Interface Card
Hardware revision 1.1   Board revision B0
Serial number     0019621176    Part number    800-02493-02
Test history      0x00          RMA number     00-00-00
Connector type    WAN Module
EEPROM format version 1
EEPROM contents (hex):
0x20:   01 0E 01 01 01 2B 65 38 50 09 BD 02 00 00 00 00
0x30:   58 00 00 00 00 05 15 01 FF FF FF FF FF FF FF FF

 VIC Slot 3:
Dual NT or TE BRI Voice Interface Card
Hardware revision 1.0   Board revision B0
Serial number     0022850526    Part number    800-07272-01
Test history      0x00          RMA number     00-00-00
Connector type    PCI
EEPROM format version 1
EEPROM contents (hex):
0x20:   01 32 01 00 01 5C AB DE 50 1C 68 01 00 00 00 00
0x30:   58 00 00 00 00 10 27 00 FF FF FF FF FF FF FF FF
```

The **show diag** command displays similar information for each port available on the router.

Table 3-2 lists problems that could occur with the WICs and VICs and describes possible solutions.

Table 3-2 Troubleshooting WICs and VICs

Symptom	Possible Solutions
Router does not recognize the card.	• Confirm that the Cisco IOS release installed in the router supports the WIC or VIC. • Make sure that you have a Cisco IOS feature set that supports voice. The *Cisco WAN Interface Cards Hardware Installation Guide* lists the software requirements for each card. • Make sure that the card is correctly installed in the router. See the "Installing WICs and VICs" section in Chapter 2, "Installation."
Router recognizes the cards, but the card ports do not initialize.	• Make sure that the card is correctly installed in the router. Refer to the "Installing WICs and VICs" section in the "Installation" chapter. • Check the external cable connections to make sure they are secure.
Router does not boot properly, or router reboots continuously or intermittently.	Make sure that the WIC or VIC is correctly installed in the router. See the "Installing WICs and VICs" section in Chapter 2, "Installation."
Router boots, but the console screen is frozen.	• Make sure that the console cable is securely connected to the router and to the PC or terminal. • Verify that the parameters for your terminal are set to the following: – 9600 baud – 8 data bits – no parity – 1 stop bit – no flow control
Router does not boot or reset after the WIC or VIC is inserted.	There might be an electrical short. Turn off the router immediately.

Table 3-2 Troubleshooting WICs and VICs (continued)

Symptom	Possible Solutions
Router powers on and boots only when a particular WIC or VIC is removed from the router.	• There may be a problem with the WIC or VIC. Consult your Cisco reseller. • Confirm that the Cisco IOS release installed in the router supports the WIC or VIC. The *Cisco WAN Interface Cards Hardware Installation Guide* lists the software requirements for each card.
Router powers on and boots only when a particular cable is disconnected.	There might be a problem with the WIC or VIC cables. Consult your Cisco reseller for warranty information.

Troubleshooting the Power System

Table 3-3 lists symptoms of and possible solutions to power problems.

Table 3-3 Troubleshooting the Power System

Symptom	Possible Solutions
Router shuts down after being on for a short time.	• The router may be overheating. Make sure that nothing is blocking the fan vents on the side of the router. • Make sure that the area in which the router is installed meets the environmental site requirements given in Appendix A of this guide and in the "Site Requirements" section in the *Regulatory Compliance and Safety Information for Cisco 1700 Routers* document that came with your router. • If the PWR LED is not on, the power supply has failed.
The router attempts to boot, but all LEDs remain off.	The power supply has failed. Return the router to your Cisco reseller.

Table 3-3 Troubleshooting the Power System (continued)

Symptom	Possible Solutions
The router is on, but the PWR LED is off.	The PWR LED is broken. Return the router to your Cisco reseller.
The PWR LED is on, the OK LED is off, and the router does not pass console or EIA data.	The router may be malfunctioning. Contact your Cisco reseller.

Troubleshooting ISDN

Because ISDN uses many variables and supports many different configurations, it can sometimes cause problems for the router.

Two commands are useful when troubleshooting ISDN:

- For routers with an ISDN S/T WIC, enter the **clear interface** command to terminate any active ISDN calls and to reset the ISDN BRI interface. Do this for each ISDN port installed in the router:

```
Router# clear interface bri0/0
Router# clear interface bri1/0
```

- For routers with an ISDN U WIC, use the **clear controller** command to terminate any active ISDN calls, to reset the ISDN BRI interface, and to reset the ISDN line between the router and the central office switch. Do this for each ISDN port installed in the router:

```
Router# clear controller bri0
Router# clear controller bri1
```

Table 3-4 lists troubleshooting methods for ISDN-specific problems that might occur.

Table 3-4 Troubleshooting ISDN

WIC	Symptom	Check the Following	Possible Solutions
ISDN S/T	Router is on, but the OK LED on the card is off.	Is the OK LED on?	If no, the router/WIC might be malfunctioning. Contact your Cisco reseller.
		Are all ISDN cables properly connected?	If yes, the ISDN line might be malfunctioning. Check with your ISDN service provider.
		Is the NT1 LED on?	If no, the NT1 might be malfunctioning.
ISDN U	Router is on, but the NT1 LED on the card is off.	Is the OK LED on?	If no, the router/WIC might be malfunctioning. Contact your Cisco reseller.
		Are all ISDN cables properly connected?	If yes, the ISDN line might be malfunctioning. Check with your ISDN service provider.

Table 3-4 Troubleshooting ISDN (continued)

WIC	Symptom	Check the Following	Possible Solutions
ISDN S/T or ISDN U	Card cannot make a connection to the remote router.	Use **show isdn status** command to check the following: Does the current ISDN switch type match actual switch type being used?	Use the **isdn switch-type** command to configure correct switch type.
		Is Layer 1 status deactivated?	• Verify that all ISDN cabling is connected properly. • Use the **show controller bri0** command to check for the message *CO RUNNING LOOPBACK TESTS* or *CO TESTING*. If you receive either message, contact your ISP.
		If Layer 1 status is active, does Layer 3 status say "2 Active Layer 3 calls"?	Router might have called itself. Check destination phone number configured with the **dialer map** command or the **dialer string** command.
		If Layer 1 status is active, does Layer 3 status say "No Active Layer 3 call(s)"?	Make sure that the destination phone number matches the remote router phone number. Make sure that the route to the destination matches the remote router network address.
		If Layer 1 status is active, does Layer 3 status say "1 Active Layer 3 call"?	Check the router protocol configurations.

Fan Behavior

The fans in the Cisco 1760 router are always on. They are not thermostatically controlled, but they are normally operational.

Technical Specifications

Table A-1 lists hardware and operating specifications for the Cisco 1760 router.

Table A-1 Router Specifications

Description	Specification
Console port	RJ-45.
Auxiliary port	RJ-45.
Ethernet port	RJ-45.
Dimensions	
H x W x D	1.7 x 17.5 x 12.8 in. (4.32 x 44.45 x 32.51 cm).
Weight	
Weight (no WICs, VICs, PVDMs, VPN, SIMM, or DRAM module)	8.2 lb (3.7 kg).
Weight, fully populated	9.4 lb (4.3 kg).
Power Supply	
On-board	Supplies regulated +5V, +12V, and –12V. DC-DC regulators supply +3.3V and +2.5V from +5V. Linear regulator supplies –5V from –12V.
Power Consumption	Up to 50W when fully populated.

Table A-1 Router Specifications (continued)

Description	Specification
Operating Specifications	
Operating temperature	32 to 104°F (0 to 40°C).
Storage temperature	–40 to 149°F (–40 to 65°C).
Operating humidity	10% to 85%, noncondensing.

Cabling Specifications

This appendix describes cables and cabling guidelines for the router and contains the following sections:

Note For detailed information about cables used with Cisco WICs and VICs, refer to the *Cisco WAN Interface Cards Hardware Installation Guide* that comes with each of the cards.

Ethernet Cables

This section describes the Ethernet cables that you use to connect the router to your local Ethernet network. A 10/100BASE-TX router, such as the Cisco 1760 router, requires Category 5 twisted-pair cable. Table B-1 describes the pinouts for an RJ-45-to-RJ-45 Ethernet cable.

Table B-1 Straight-Through Ethernet Cable (RJ-45-to-RJ-45) Pinouts

RJ-45 Pin[1]	Signal	Direction	RJ-45 Pin
1	TX+	—>	1
2	TX–	—>	2
3	RX+	<—	3
6	RX–	<—	6

1. Pins 4, 5, 7, and 8 are not used for signaling but for reducing radiated cable emissions.

Ethernet Network Cabling Guidelines

Table B-2 describes guidelines for creating Ethernet networks. Numbers might vary, depending on the manufacturer of the network equipment.

Table B-2 Ethernet Cabling Guidelines

Specification	10BASE-T	100BASE-TX
Maximum segment length	100 meters	100 meters
Maximum number of segments per network	5	• With Class I repeaters: 1 • With Class II repeaters: 2
Maximum hop count[1]	4	• With Class I repeaters: none • With Class II repeaters: 1
Maximum number of nodes per segment	1024	1024
Cable type required	Category 3, 4, or 5	Category 5

1. Hop count = routing metric used to measure the distance between a source and a destination.

Console Cable and Adapter

A console cable is provided with your router. Use this cable to connect the router to a PC or terminal. A DB-9-to-DB-25 adapter is also provided for connecting the router to a modem, using the console cable.

Table B-3 describes the wiring for the console port and the console cable. This table also includes pinouts for the DB-9-to-DB-25 adapter.

Table B-3 Console Cable and Adapter Pinouts

Console (DTE)	Console Port	Console Cable	Adapter	Terminal (DTE)
Signal	**RJ-45 Pin**	**DB-9 Pin**	**DB-25 Pin**	**Signal**
RTS	1	8	5	CTS
DTR	2	6	6	DSR
TXD	3	2	3	RXD
GND	4	5	7	GND
GND	5	5	7	GND
RXD	6	3	2	TXD
DSR	7	4	20	DTR
CTS	8	7	4	RTS

VIC Cables and Pinouts

This section describes the VIC cables and pinouts for foreign exchange station (FXS), foreign exchange office (FXO), and recEive and transMit (or ear and mouth) (E&M) connectors. Use the following cables to connect the VICs to the network:

- Standard RJ-11 modular telephone cable to connect FXS VIC ports (gray) to a telephone or fax machine.
- Standard RJ-11 modular telephone cable to connect FXO VIC ports (pink) to the PSTN or to a PBX that does not support E&M signaling.

- Standard RJ-48S connector and cable to connect E&M VIC ports (brown) to a PBX line. The cable wiring depends on the PBX type and connection. For details, refer to the *Cisco WAN Interface Cards Hardware Installation Guide*.

Figure B-1 shows how to connect the VICs to the network.

Figure B-1 Connecting VICs to the Network

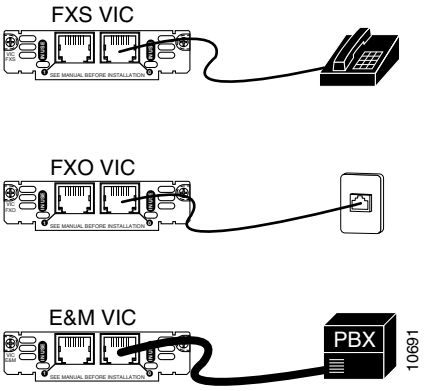


Table B-4 lists the pinouts for FXS and FXO VIC connectors.

Note Pins that are not used should not be connected.

Table B-4 Pinouts for FXS and FXO Connectors

Pin	Signal
1	–
2	–
3	Ring
4	Tip
5	–
6	–

The E&M VIC pinout depends on the PBX type and connection. Table B-5 lists the pinouts for the E&M connector.

Note Pins that are not used should not be connected.

Table B-5 E&M Pinouts

Pin	Signal	Description
1	SB	–48V signaling battery
2	M-lead	Signaling input
3	R	Ring, audio input
4	R or R1	Ring, audio input/output, or output
5	T or T1	Tip, audio input/output, or output
6	T	Tip, audio input
7	E-lead	Signaling output
8	SG	Signaling ground return

Cables and Pinouts for 2-Port ISDN BRI Card

Use the straight-through RJ-45 cable to connect the 2-port ISDN BRI card to an ISDN network through a telephone wall outlet or other device.

Note When an interface configured as network termination (NT) is connecting to a terminal equipment (TE) device, the cable must have the transmit and receive pins swapped (crossover cable). (See Table B-6.)

Table B-6 Interface Pin Numbers and Functions

ISDN BRI NT/TE	NT Interface (straight-through cable)	TE Interface (crossover cable)
Pin 3/T+	Pin 3/R+	Pin 3/T+
Pin 4/R+	Pin 4/T+	Pin 4/R+
Pin 5/R–	Pin 5/T–	Pin 5/R–
Pin 6/T–	Pin 6/R–	Pin 6/T–

Installing and Upgrading Memory and Packet Voice Data Modules

This chapter describes how to install or upgrade memory or data modules in your router and contains the following sections:

Safety Information

This section contains safety information that you should read before installing or upgrading memory in the router.

Warning **Before working on a system that has an on/off switch, turn off the power and unplug the power cord.**

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

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

Warning **Do not touch the power supply when the power cord is connected. For systems with a power switch, line voltages are present within the power supply even when the power switch is off and the power cord is connected. For systems without a power switch, line voltages are present within the power supply when the power cord is connected.**

Warning **Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.**

Warning **Only trained and qualified personnel should be allowed to install or replace this equipment.**

Warning **Hazardous network voltages are present in WAN ports regardless of whether power to the router is OFF or ON. To avoid electric shock, use caution when working near WAN ports. When detaching cables, detach the end away from the router first.**

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

Opening the Chassis

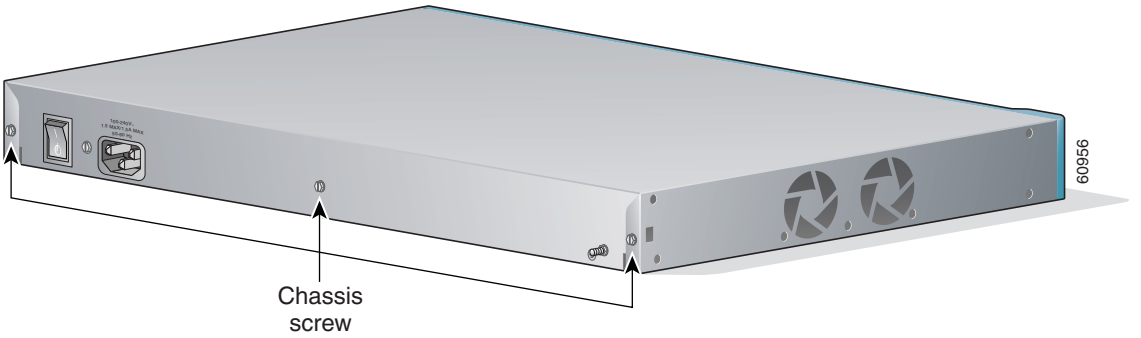
Follow these steps to open the chassis:

Step 1 Make sure that the router is turned off and is disconnected from the power supply.

Step 2 Use a flat-head screwdriver to remove the screws that hold the top and bottom of the chassis together, as shown in Figure C-1.

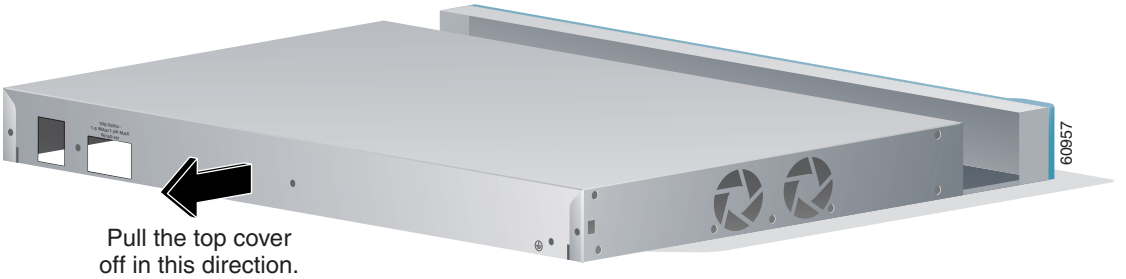
Note Some Cisco 1760 routers have five chassis screws in the rear assembly, but most models have three screws in the rear assembly.

Figure C-1 Removing the Cisco 1760 Chassis Screws



Step 3 Gently slide the top cover of the router toward you, as shown in Figure C-2.

Figure C-2 Removing the Top Cover of the Router

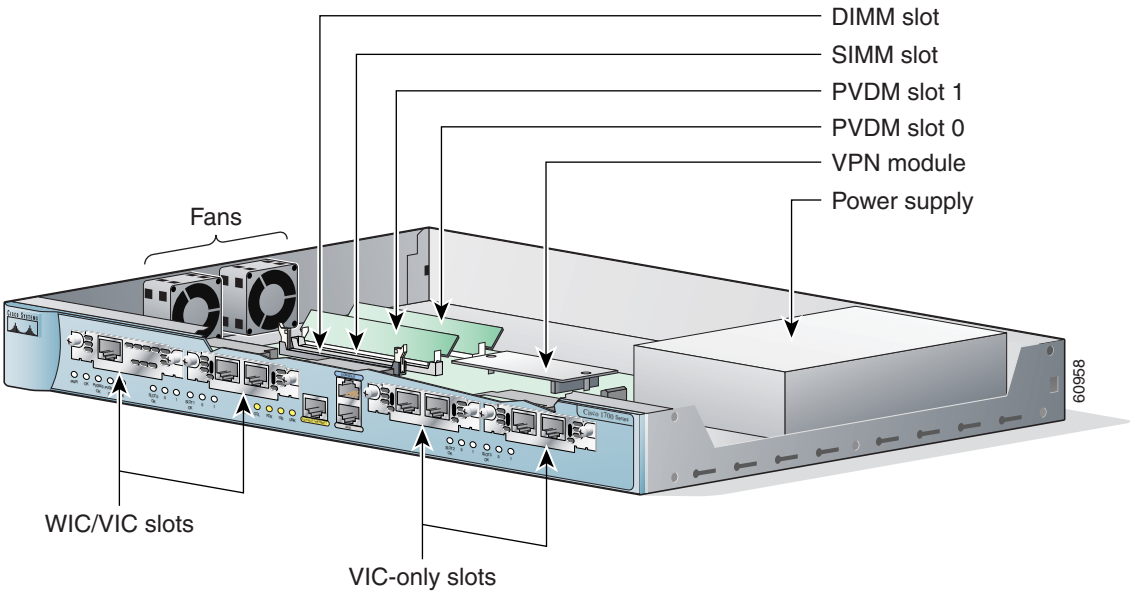


Step 4 Place the router bottom on an antistatic mat, and begin installing modules.

Locating Modules

Figure C-3 shows where to install a dual in-line DRAM memory module (DIMM), a single inline Flash memory module (SIMM) and packet voice data modules (PVDMs) on the motherboard.

Figure C-3 Cisco 1760 Motherboard—Module Locations



Installing a DIMM

You can install a DIMM to increase the amount of dynamic RAM (DRAM) in the router. DIMMs are available in the following sizes:

- 16 MB

- 32 MB
- 64 MB

Use the **show version** command to see the router memory size. This command is described in the "Amounts of Memory" section of the "Cisco 1760 Router Overview" chapter.

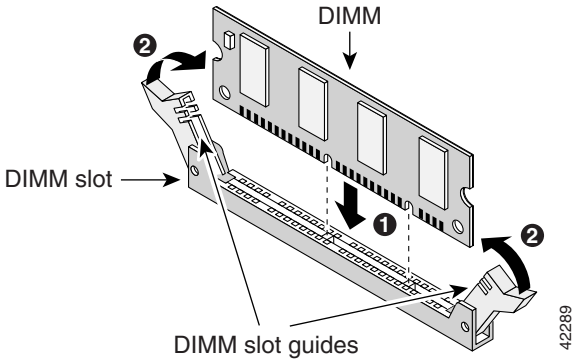
Follow these steps to install a DIMM on the router motherboard:

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

Step 1 Locate the DIMM slot on the motherboard. See Figure C-3 on page C-4.

Step 2 Remove any existing DIMM by pulling the DIMM slot guides (shown in Figure C-4) away from the DIMM and down toward the motherboard.

Figure C-4 Installing a DIMM



Step 3 Insert the DIMM into the DIMM slot, making sure that the notches on the edge of the DIMM are inserted over the bars inside the DIMM slot.

Caution Handle DIMMs by the card edges only. DIMMs are ESD-sensitive components and can be damaged by mishandling.

Step 4 Press the DIMM firmly into the slot until the slot guides on each side of the slot move up and over the end of the DIMM. If the guides do not move up over the edge of the DIMM, move them with your hands.

Installing a SIMM

You can install one SIMM to increase the amount of Flash memory in the router. The SIMM used to upgrade Flash memory is 16 MB in size.

Follow these steps to install a SIMM on the router motherboard.

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

Step 1 Locate the SIMM slot on the motherboard. See Figure C-3 on page C-4.

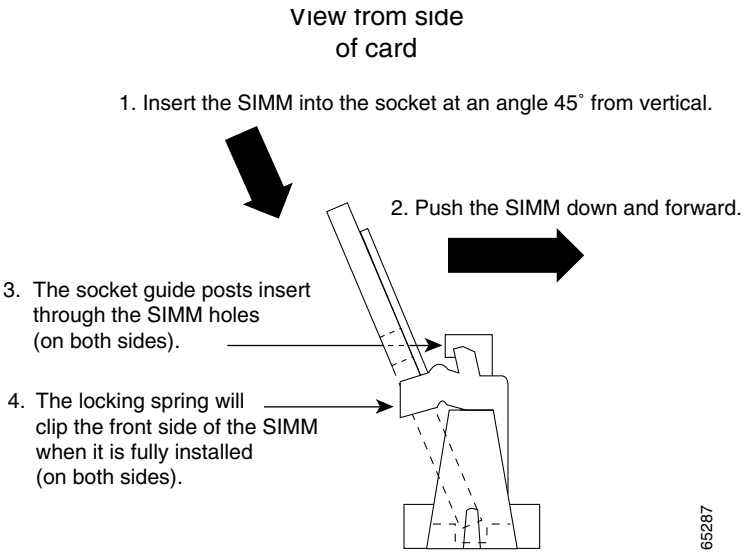
Step 2 Remove any existing SIMM by pulling the locking spring clips on both sides outward and tilting the SIMM free of the clips.

Step 3 Face the front panel of the router. Hold the SIMM with the component side toward you.

Caution Handle SIMMs by the card edges only. SIMMs are ESD-sensitive components and can be damaged by mishandling.

Step 4 Position the SIMM so that the indexing slot in the connector (bottom edge) of the SIMM is lined up with the indexing tab inside the SIMM slot. Tilt the SIMM 45 degrees toward the rear of the router, and insert it into the slot (see Figure C-5). Rock it into its vertical position, using the minimum force necessary. When the SIMM is properly seated, the connector springs will click into place.

Figure C-5 Installing a SIMM



Installing a PVDM

You can install up to two PVDMs to support enhanced versions of digital signal processors (DSPs).

There are five types of PVDMs:

- PVDM-256K-4—Supports one DSP
- PVDM-256K-8—Supports up to two DSPs
- PVDM-256K-12—Supports up to three DSPs
- PVDM-256K-16—Supports up the four DSPs
- PVDM-256K-20—Supports up to five DSPs

Each DSP supports two analog voice ports or one ISDN BRI port. Each analog VIC used with the Cisco 1760 router has two voice ports and requires a single DSP. The 2-port ISDN Voice-BRI requires two DSPs. Table C-1 shows the possible combinations of PVDMs and voice ports for the Cisco 1760 router.

Table C-1 PVDM and VIC Combinations

PVDM	Number of DSPs	Supported VIC Combinations
PVDM-256K-4	1	1 analog VIC
PVDM-256K-8	2	Up to 2 analog VICs or 1 voice-BRI VIC
PVDM-256K-12	3	Up to 3 analog VICs or 1 analog VIC and 1 voice-BRI VIC
PVDM-256K-16	4	Up to 4 analog VICs or Up to 2 voice-BRI VICs or Up to 2 analog VICs and 1 voice-BRI VIC
PVDM-256K-20	5	Up to 4 analog VICs or Up to 2 voice-BRI VICs or Up to 3 analog VICs and 1 voice-BRI VIC or 1 analog VIC and up to 2 voice-BRI VICs

The Cisco 1760 router has two PVDM slots. Any of the PVDMs can occupy either slot. The total number of DSPs provided by one or two PVDMs installed in those slots must be greater than or equal to the number of DSPs required by the number and type of VICs installed, as described in Table C-1.

For example, if you have one PVDM (a single DSP), and you want to increase the number of DSPs to 3, you can either add a PVDM-256K-8 in the second slot or replace the PVDM-256K-4 with a PVDM-256K-12.

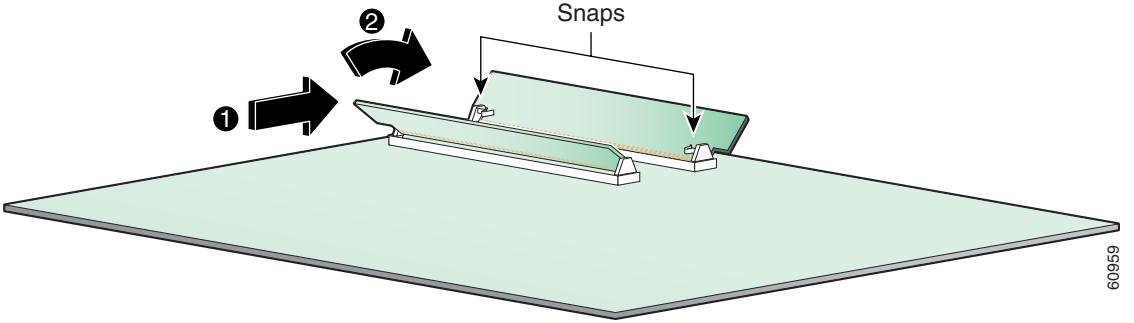
Follow these steps to install a PVDM on the router motherboard.

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

Step 1 Locate the PVDM slots on the motherboard. (See Figure C-3.)

Step 2 Remove any existing PVDM modules by pulling the PVDM snaps away from the module. (See Figure C-6.)

Figure C-6 Installing a PVDM



Step 3 If only one module is to be installed, install it into PVDM slot 0.

Step 4 Face the front panel of the router. Insert the module vertically into the PVDM slot. Orient the module so that the indexing slot in the connector (bottom edge) of the module is lined up with the indexing tab inside the PVDM slot, and so that all electrical connections are made.

Caution Handle PVDMs by the edges only. PVDMs are ESD-sensitive components and can be damaged by mishandling.

Step 5 Holding the module firmly in the slot, rotate it toward the rear of the router, until you hear a clicking sound and the module is firmly seated in the slot. Make sure that the snaps on both ends of the PVDM are engaged.

Closing the Chassis

After installing memory or data modules on the motherboard, close the chassis by following these steps:

Step 1 Slide the top cover of the router back on the bottom of the chassis by pushing it in the opposite direction from that shown in Figure C-2, "Removing the Top Cover of the Router," on page C-3.

Step 2 Replace the screws that you removed when you opened the chassis. (See Figure C-1, "Removing the Cisco 1760 Chassis Screws," on page C-3.)

Installing the Virtual Private Network Module

This chapter describes how to install the Virtual Private Network (VPN) module in your Cisco 1760 router.

Before You Begin

This section describes important safety information and the tools required to install the VPN module. Read this section before installing the VPN module in a Cisco 1760 router.

VPN Module Parts

These parts are needed for installation and are included with the VPN module:

- Two metal standoffs
- Four screws

Safety Warnings

Warning **Before working on a system that has an on/off switch, turn OFF the power and unplug the power cord.**

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

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

Warning **Do not touch the power supply when the power cord is connected. For systems with a power switch, line voltages are present within the power supply even when the power switch is off and the power cord is connected. For systems without a power switch, line voltages are present within the power supply when the power cord is connected.**

Warning **Read the installation instructions before you connect the system to its power source.**

Warning **Ultimate disposal of this product should be handled according to all national laws and regulations.**

Warning **Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.**

Warning **Only trained and qualified personnel should be allowed to install or replace this equipment.**

Warning **Hazardous network voltages are present in WAN ports regardless of whether power to the router is OFF or ON. To avoid electric shock, use caution when working near WAN ports. When detaching cables, detach the end away from the router first.**

Preventing Electrostatic Discharge Damage

Before installing a VPN module, read the electrostatic discharge (ESD) instructions in this section. ESD is a discharge of stored static electricity that can damage equipment and impair electrical circuitry. It occurs when electronic components are improperly handled and can result in complete or intermittent failures.

The following are guidelines for preventing ESD damage:

- Before opening the chassis, turn the router power switch to off (O).
- Disconnect the power cable to the router.
- Always use an ESD-preventive wrist or ankle strap, and ensure that it makes good skin contact.
- Avoid contact between equipment and clothing. The wrist or ankle strap protects the equipment only from ESD voltages on the body; ESD voltages on clothing can still cause damage.
- Handle printed circuit cards by the edges only. Avoid touching the components, traces, or any connector pins.
- Place a removed card component on an antistatic surface or in a static shielding bag.
- Do not remove the wrist or ankle strap until after you complete the installation.

Caution To avoid damaging the equipment, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohms (Mohms).

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

Installing the VPN Module in a Cisco 1760 Router

This section describes how to install the VPN module in a Cisco 1760 router. It contains these sections:

Opening the Cisco 1760 Chassis

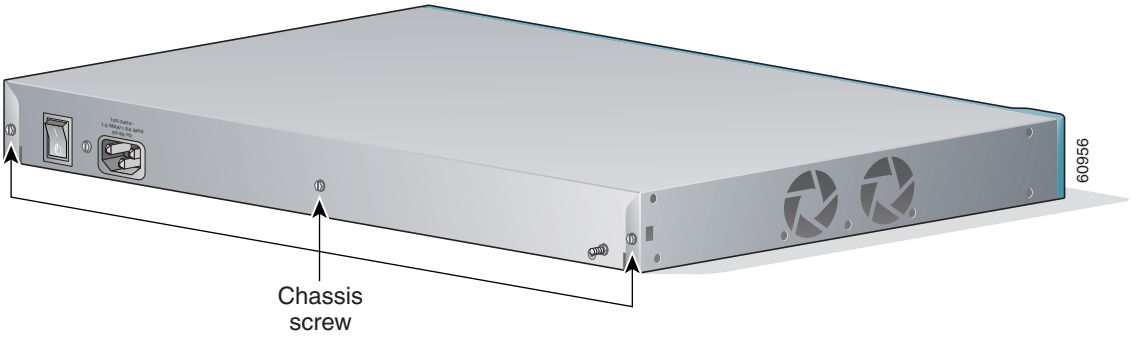
Follow these steps to open the chassis:

Step 1 Make sure that the router is turned off and is disconnected from the power supply.

Step 2 Use a flat-head screwdriver to remove the screws that hold the top and bottom of the chassis together, as shown in Figure D-1.

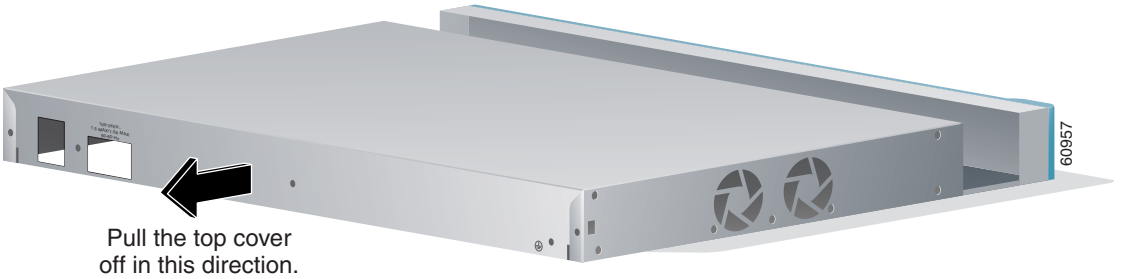
Note Some Cisco 1760 routers have five chassis screws in the rear assembly, but most models have three screws in the rear assembly.

Figure D-1 Removing the Cisco 1760 Chassis Screws



Step 3 Gently slide the top cover of the router toward you, as shown in Figure D-2.

Figure D-2 Removing the Top Cover of the Router



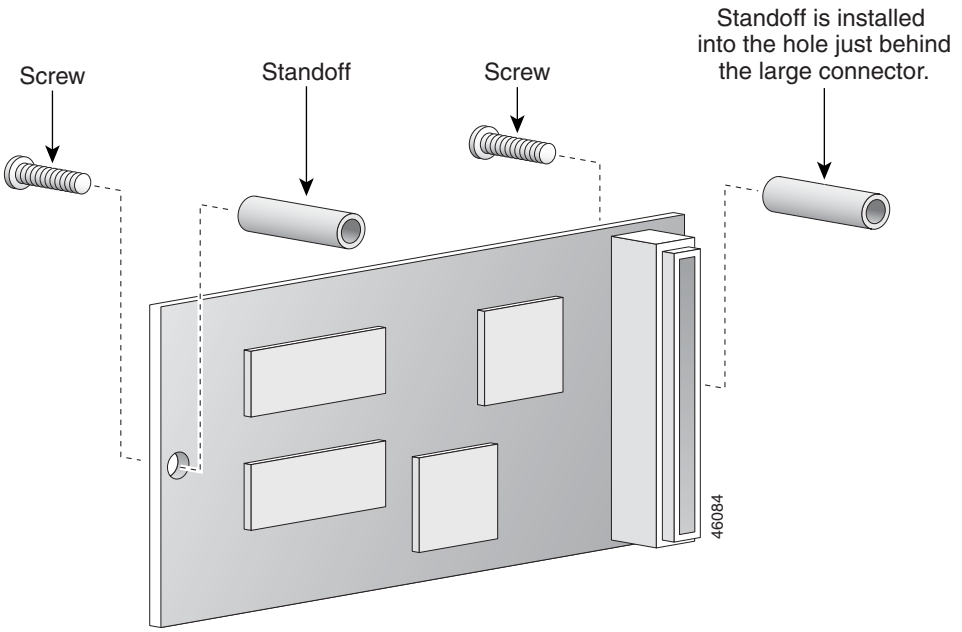
Step 4 Place the router bottom on an antistatic mat, and begin installing the VPN module.

Installing the VPN Module

Follow the steps in this section to install the VPN module.

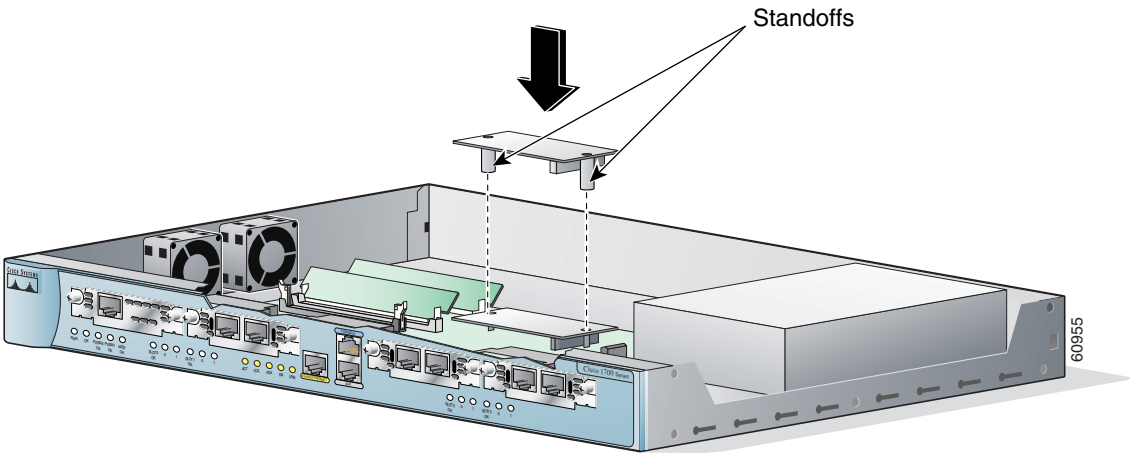
Step 1 Install the two standoffs on the module, as shown in Figure D-3.

Figure D-3 Installing the Standoffs on the VPN Module



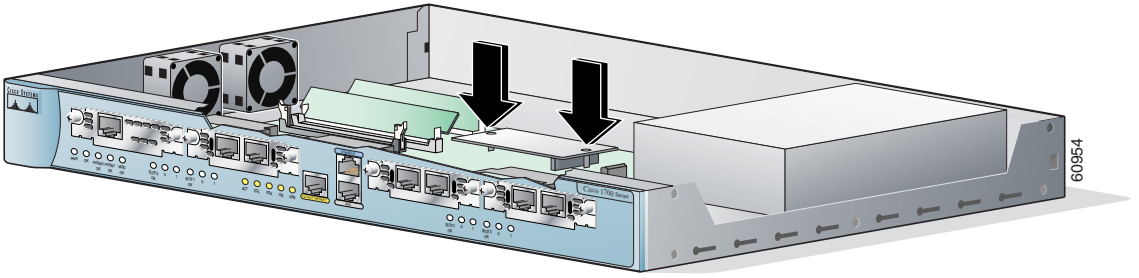
Step 2 Locate the VPN module socket, and insert the VPN module, as shown in Figure D-4.

Figure D-4 VPN Module Location



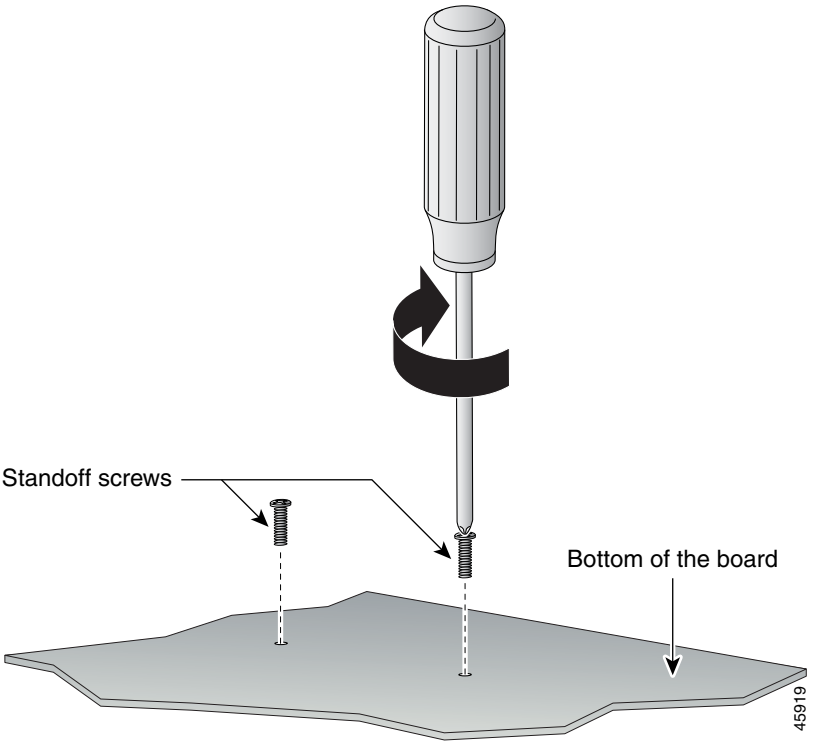
Step 3 Pushing down as indicated in Figure D-5, plug the VPN module into the socket.

Figure D-5 Seating the VPN Module



Step 4 Turn the chassis over, and attach the standoffs to it by using the screws provided, as shown in Figure D-6.

Figure D-6 Securing the Standoff to the Router Motherboard



Closing the Cisco 1760 Chassis

After installing the VPN module on the motherboard, close the chassis by following these steps:

Step 1 Slide the top cover of the router back on the bottom of the chassis by pushing it in the opposite direction from that shown in Figure D-2, "Removing the Top Cover of the Router," on page D-5.

Step 2 Replace the screws that you removed when you opened the chassis. (See Figure D-1, "Removing the Cisco 1760 Chassis Screws," on page D-5.)

Installing the Echo Canceler Expansion Modules on Cisco Interface Cards

This chapter provides information about the hardware-based echo canceler expansion modules that are available on the enhanced multiflex trunk interface cards on the Cisco 1760 router.

Multiflex Trunk Interface Cards

The following multiflex trunk interface cards on the Cisco 1760 support hardware-based echo cancellation features through an optional echo canceler expansion module installed on the main board of the interface card:

- 1-Port RJ-48 Multiflex Trunk T1/E1—VWIC2-1MFT-T1/E1, with voice-only support
- 2-Port RJ-48 Multiflex Trunk T1/E1—VWIC2-2MFT-T1/E1, with voice-only support

Note For additional information about the Cisco 1- and 2-port T1/E1 multiflex trunk interface cards, refer to the *Cisco 1- and 2-port T1/E1 Multiflex Voice/WAN Interface Cards for the Cisco 1751 and 1760 Routers.*

Echo

Echo occurs when the speech energy being generated and transmitted down the signal path is coupled into the receive path from the far end. This causes a speaker to hear the sound of his or her own voice, delayed by the total echo path delay time.

In a traditional voice network, voice can reflect back, but it usually goes unnoticed because the delay is so low. In a Voice over IP (VoIP) network, echo is more noticeable because packetization and compression contribute to delay.

Echo cancellation technology is a functional component of a voice gateway that is used to reduce the effects of echo. An echo canceler monitors a caller's speech. If that caller's speech echoes, the echo canceler generates and transmits a signal that is sent back to the caller to cancel out the echo. The amount of time that it takes the echo canceler to locate the echo and to generate its opposite signal is called *convergence time* (typically, a few seconds). During convergence, the caller hears echo, which should gradually decrease in amplitude to zero when convergence is complete.

For additional information about echo and echo cancellation, refer to *Echo Analysis for Voice over IP*.

Echo Canceler Expansion Modules

The echo canceler expansion modules are user-installable, plug-in modules. The expansion modules provide a hardware-based echo cancellation feature that simultaneously offloads the work of the DSPs on the Signal Processing Mini-Module (SPMM) on the motherboard. By offloading this processing, hardware-based echo cancellation results in more robust echo cancellation.

The echo canceler expansion modules enable high performance hardware-based echo cancellation for up to 64 voice calls.

The following echo canceler expansion modules are available for voice-only support on the 1-port RJ-48 multiflex trunk T1/E1 (VWIC2-1MFT-T1/E1) and on the 2-port RJ-48 multiflex trunk T1/E1(VWIC2-2MFT-T1/E1) interface cards on the Cisco 1760 router.

- 32-channel echo canceler expansion module for multiflex trunk (EC-MFT-32)
- 64-channel echo canceler expansion module for multiflex trunk (EC-MFT-64)

Installing and Configuring the Echo Canceler Expansion Modules

For information about installing the echo canceler expansion modules on the 1-port RJ-48 T1/E1 multiflex trunk and on the 2-port RJ-48 T1/E1 multiflex trunk interface cards, refer to the *Installing Echo Canceler Expansion Modules on Cisco Interface Cards.*

For detailed information about configuring 1- and 2-port multiflex trunk interface cards with echo cancellation, refer to *T1/E1 Multiflex Voice/WAN Interface Cards with Echo Cancellation Module.*

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