Cisco 2900 and 3900 Series Hardware Installation Guide

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CONTENTS

Preface

This preface describes the objectives, audience, organization and conventions of this guide, and the references that accompany this document set. The following sections are provided:

Objectives

This guide explains how to install, connect, and perform initial configuration for the Cisco 2900 series and Cisco 3900 series Integrated Services Routers (ISRs). Some information may not apply to your specific router model.

Note For warranty, service, and support information, see the "Cisco Warranty Terms" section in the *Readme First for the Cisco 1900 Series, 2900 Series, and 3900 Series Integrated Services Routers* document that was shipped with your router.

Audience

This guide is intended for Cisco equipment providers and service persons who are technically knowledgeable and familiar with Cisco routers and Cisco IOS software and features. They would understand how to install, configure, and maintain the router, and they should be familiar with electronic circuitry and wiring practices, and have experience as an electronic or electromechanical technician. This guide identifies certain procedures that should be performed only by trained and qualified personnel.

Organization

This guide includes the following chapters:

Chapter	Title	Description
1	Overview of the Routers	Describes the router chassis views, information for locating the serial number, PID[1], and UDI[2]. Also includes general hardware features, slot, port, and interface information; and LED indicators.
2	Preparing for Router Installation	Describes site requirements and the equipment needed to install the router.
3	Installing and Connecting the Router	Describes how to install and connect the router to LAN, WAN, and Voice networks.
4	Configuring the Router	Describes how to power up the router and perform the initial configuration.
5	Installing and Upgrading Internal Modules and FRUs	Describes how to install and upgrade internal modules and field replaceable units[3] on the router.
6	Getting Software Licenses for the Router	Describes how to purchase a PAK and activate software licenses on the router.
7	Online Insertion Removal and Hot-Swapping	Describes how to remove and replace data and voice modules using the online insertion and removal[4] procedure.

1. PID = Product ID
2. UID = Universal Device Identifier
3. FRU = Field Replaceable Unit
4. OIR = Online Insertion and Removal

Conventions

This document uses the following conventions:

Convention	Indication
bold font	Commands and keywords and user-entered text appear in **bold** font.
italic font	Document titles, new or emphasized terms, and arguments for which you supply values are in *italic* font.
[ ]	Elements in square brackets are optional.
{x	y	z }	Required alternative keywords are grouped in braces and separated by vertical bars.
[x	y	z]	Optional alternative keywords are grouped in brackets and separated by vertical bars.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.
courier font	Terminal sessions and information the system displays appear in courier font.
< >	Nonprinting characters such as passwords are in angle brackets.
[ ]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

Note Means *reader take note*.

Tip Means *the following information will help you solve a problem*.

Caution Means *reader be careful*. In this situation, you might perform an action that could result in equipment damage or loss of data.

Timesaver Means *the described action saves time*. You can save time by performing the action described in the paragraph.

Warning **IMPORTANT SAFETY INSTRUCTIONS**

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

SAVE THESE INSTRUCTIONS

Waarschuwing **BELANGRIJKE VEILIGHEIDSINSTRUCTIES**

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Gebruik het nummer van de verklaring onderaan de waarschuwing als u een vertaling van de waarschuwing die bij het apparaat wordt geleverd, wilt raadplegen.

BEWAAR DEZE INSTRUCTIES

Varoitus **TÄRKEITÄ TURVALLISUUSOHJEITA**

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

SÄILYTÄ NÄMÄ OHJEET

Attention **IMPORTANTES INFORMATIONS DE SÉCURITÉ**

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

CONSERVEZ CES INFORMATIONS

Warnung **WICHTIGE SICHERHEITSHINWEISE**

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

BEWAHREN SIE DIESE HINWEISE GUT AUF.

Avvertenza   **IMPORTANTI ISTRUZIONI SULLA SICUREZZA**

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Utilizzare il numero di istruzione presente alla fine di ciascuna avvertenza per individuare le traduzioni delle avvertenze riportate in questo documento.

CONSERVARE QUESTE ISTRUZIONI

Advarsel   **VIKTIGE SIKKERHETSINSTRUKSJONER**

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

TA VARE PÅ DISSE INSTRUKSJONENE

Aviso   **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

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

GUARDE ESTAS INSTRUÇÕES

¡Advertencia!   **INSTRUCCIONES IMPORTANTES DE SEGURIDAD**

Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Al final de cada advertencia encontrará el número que le ayudará a encontrar el texto traducido en el apartado de traducciones que acompaña a este dispositivo.

GUARDE ESTAS INSTRUCCIONES

Varning!   **VIKTIGA SÄKERHETSANVISNINGAR**

Denna varningssignal signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanliga förfaranden för att förebygga olyckor. Använd det nummer som finns i slutet av varje varning för att hitta dess översättning i de översatta säkerhetsvarningar som medföljer denna anordning.

SPARA DESSA ANVISNINGAR

FONTOS BIZTONSÁGI ELOÍRÁSOK

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

ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Предупреждение   **ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

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

СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ

警告   重要的安全性说明

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

请保存这些安全性说明

警告   安全上の重要な注意事項

「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止策に留意してください。警告の各国語版は、各注意事項の番号を基に、装置に付属の「Translated Safety Warnings」を参照してください。

これらの注意事項を保管しておいてください。

주의   중요 안전 지침

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

이 지시 사항을 보관하십시오.

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

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

GUARDE ESTAS INSTRUÇÕES

Advarsel **VIGTIGE SIKKERHEDSANVISNINGER**

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

GEM DISSE ANVISNINGER

تحذير إرشادات الأمان الهامة

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

Upozorenje **VAŽNE SIGURNOSNE NAPOMENE**

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

SAČUVAJTE OVE UPUTE

Upozornění **DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY**

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

USCHOVEJTE TYTO POKYNY

Προειδοποίηση ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

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

ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ

אזהרה

הוראות בטיחות חשובות

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

שמור הוראות אלה

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

Ostrzeżenie **WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA**

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

NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ

Upozornenie **DÔLEŽITÉ BEZPEČNOSTNÉ POKYNY**

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

USCHOVAJTE SI TENTO NÁVOD

Warning   **When installing the product, please use the provided or designated connection cables/power cables/AC adaptors. Using any other cables/adaptors could cause a malfunction or a fire. Electrical Appliance and Material Safety Law prohibits the use of UL-certified cables (that have the "UL" shown on the code) for any other electrical devices than products designated by CISCO. The use of cables that are certified by Electrical Appliance and Material Safety Law (that have "PSE" shown on the code) is not limited to CISCO-designated products. Statement 371.**

Warning   **There is the danger of explosion if the battery is replaced incorrectly. Replace the battery only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.** Statement 1015

Warning   **Do not use this product near water; for example, near a bath tub, wash bowl, kitchen sink or laundry tub, in a wet basement, or near a swimming pool.** Statement 1035

Warning   **Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.** Statement 1036

Warning   **Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.** Statement 1037

Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning. Statement 1038

Related Documentation

In addition to *Cisco 2900 series and 3900 series Hardware Installation Guide* (this document), the following references are included in this documentation set.

Table 1 *Additional References*

Type of Document	Links
Hardware	• *Cisco Modular Access Router Cable Specifications* • *Installing, Replacing, and Upgrading Components in Cisco Modular Access Routers and Integrated Services Routers* • *Overview of Cisco Network Modules for Cisco Access Routers* • *Cisco Interface Cards for Cisco Access Routers* • *Installing Cisco Network Modules in Cisco Access Routers* • *Installing Cisco Interface Cards in Cisco Access Routers*
Regulatory Compliance	• *Declarations of Conformity and Regulatory Information for Cisco Access Products with 802.11a/b/g and 802.11b/g Radios* • *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Routers* • *Regulatory Compliance and Safety Information for Cisco 3900 Series Integrated Services Routers*
Software Activation	• *Software Activation for Cisco Integrated Services Routers* • *Cisco IOS Software Activation Configuration Guide*
Configuration	• *Cisco CP Express User's Guide*
Cisco Internet Operating System Software	• New Features in Cisco 15.0(1)M **Note** Cisco IOS software release 15.0(1)M is the next IOS release following the Cisco IOS 12.4(24)T release.
Wireless	• *Cisco IOS Command Reference for Cisco Aironet Access Points and Bridges, versions 12.4(10b) JA and 12.3(8) JEC* • *Wireless LAN Controllers* • *Unified Wireless LAN Access Points*
Voice	• *Cisco IOS Voice Port Configuration Guide* • *SCCP Controlled Analog (FXS) Ports with Supplementary Features in Cisco IOS Gateways*

Searching for Cisco Documents

To search an HTML document using a web browser, press **Ctrl-F** (Windows) or **Cmd-F** (Apple). In most browsers, the option to search whole words only, invoke case sensitivity, or search forward and backward is also available.

To search a PDF document in Adobe Reader, use the basic Find toolbar (**Ctrl-F**) or the Full Reader Search window (**Shift-Ctrl-F**). Use the Find toolbar to find words or phrases within a specific document. Use the Full Reader Search window to search multiple PDF files simultaneously and to change case sensitivity and other options. The Adobe Reader online help has more information about how to search PDF documents.

Obtaining Documentation and Submitting a Service Request

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

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

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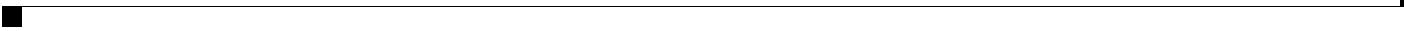
Overview of the Routers

Cisco Integrated Services Routers Generation 2 (ISR G2) offer data functionality through Gigabit Ethernet ports and security functionality with a virtual private network (VPN) accelerator on the motherboard. Additional security features are available with add-on hardware and software.

Cisco 2900 series and Cisco 3900 series routers also provide voice IP telephony with digital signal processor (DSP) capability; and voice gateway, DSP farm, IP-to-IP gateway, Cisco Unified Communications Manager Express (CUCME) via Cisco IOS. Cisco Unity Express (CUE) is provided through the use of add-on hardware.

This series of ISRs have new slots that support next generation Enhanced High-Speed WAN Interface Cards (EHWICs), Internal Services Modules (ISMs), Packet Voice Data Modules (PVDM3s), Service Modules (SMs), and Services Performance Engines (SPEs).

Access to the Cisco Multi-Gigabit Fabric (MGF) facilitates connection between switch ports on the ISR without utilizing all of the external ports. A logical GE interface on the ISR connects external and internal modules through the MGF for improved LAN and WAN switching.

Table 1-1   ISR G2 Models

Series	Routers
Cisco 2900	• 2901 • 2911 • 2911-T • 2921 • 2951
Cisco 3900	• 3925 • 3925E • 3945 • 3945E

The following sections are provided in this chapter:

Chassis Views

This section contains views of the front and back panels of the Cisco 2900 series and Cisco 3900 series routers, showing locations of the power and signal interfaces, module slots, status indicators, and chassis identification labels.

Note   Routers support the following slot types: Service Modules (SMs), Enhanced High-Speed Interface Card (EHWICs), high-speed WAN interface cards (HWICs), voice WAN interface cards (VWICs), WAN interface cards (WICs), Internal Services Modules (ISMs), and packet voice DSP modules (PVDM3s). However, some router models do not support all of these media types. See the router model descriptions for more information.

Cisco 2900 Series ISRs

Cisco 3900 Series ISRs

Cisco 2901 Chassis

Figure 1-1   *Front Panel of the Cisco 2901 Router*
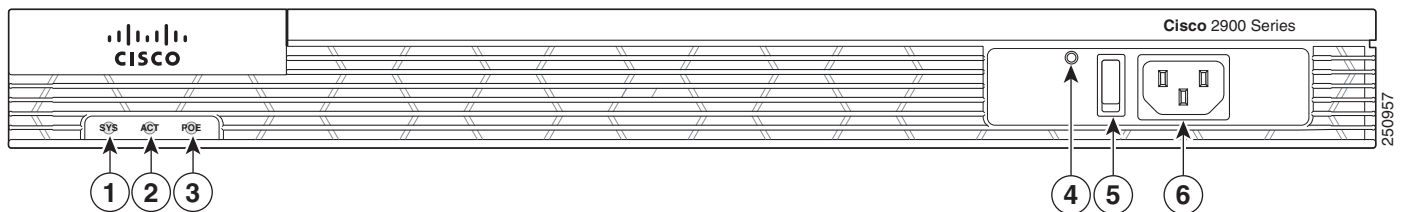
1	SYS[1]	2	ACT[2]
3	POE[3]	4	AC OK[4] (only on AC PS, not AC-POE PS)
5	On/off switch	6	AC power connector

1. System

2. Activity

3. POE = power over Ethernet.

4. LED goes off if the AC power fails or is disconnected. It does not go on and off with the power switch.

Figure 1-2   ***Back Panel Slots and Connectors of the Cisco 2901 Router***
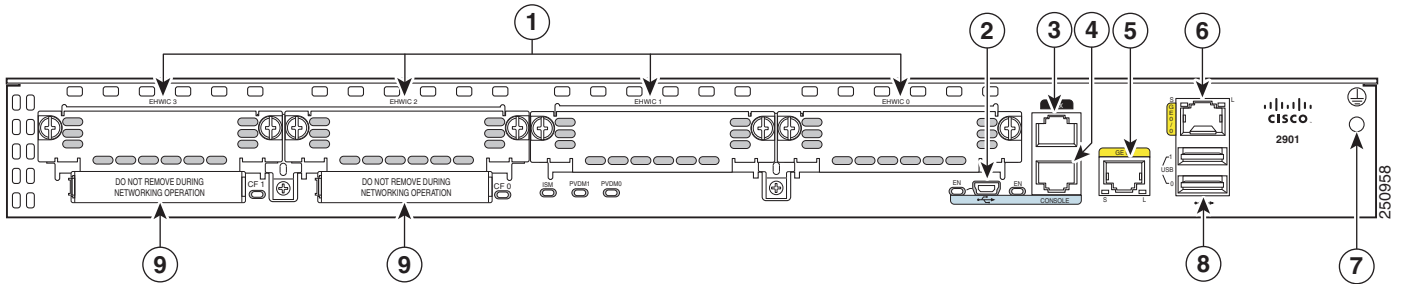
1	EHWIC slots [1] 0, 1, 2, and 3 (0, Far right)	2	USB[2] serial port
3	Aux port	4	RJ-45 serial console port
5	10/100/1000 Ethernet ports (GE0/1)	6	10/100/1000 Ethernet port (GE0/0)
7	Ground	8	USB0 and USB1 (1, Top)
9	CompactFlash[3] 0 and 1		

1. DW-EHWICs can fit into slot 0 and 1, and into slot 2 and 3. EHWIC slots support HWIC, VIC, and WIC.

2. USB = Universal serial bus

3. Only Advanced Capability CompactFlash (CF) purchased from Cisco operates in Cisco 2900 series and Cisco 3900 series ISRs. Legacy CF can impact and severely degrade performance in these routers. See the "Memory" section on page 1-22. When legacy CF is inserted, the following error message appears:

```
WARNING: Unsupported compact flash detected. Use of this card during normal operation
can impact and severely degrade performance of the system. Please use supported
compact flash cards only.
```

Figure 1-3   Back Panel LEDs of Cisco 2901 Router
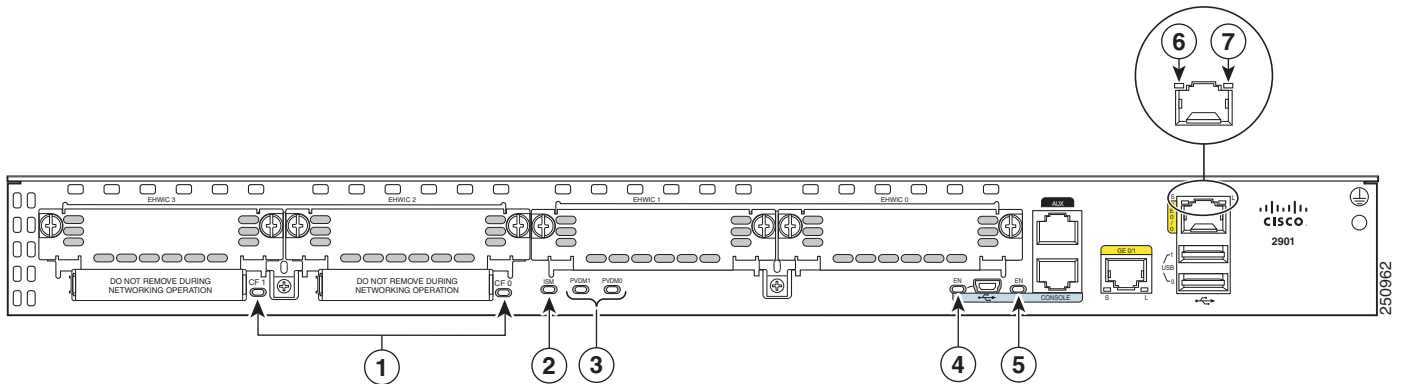
1	CompactFlash 0 and 1 (0, Right)	2	ISM[1]
3	PVDM3 0 and 1 (0, Right)	4	EN (Enable USB console)
5	EN (Enable RJ-45 console)	6	S (Speed)
7	L (Link)		

1. ISM = Internal Services Module

Cisco 2911 Chassis

Figure 1-4   Front Panel of the Cisco 2911 Router
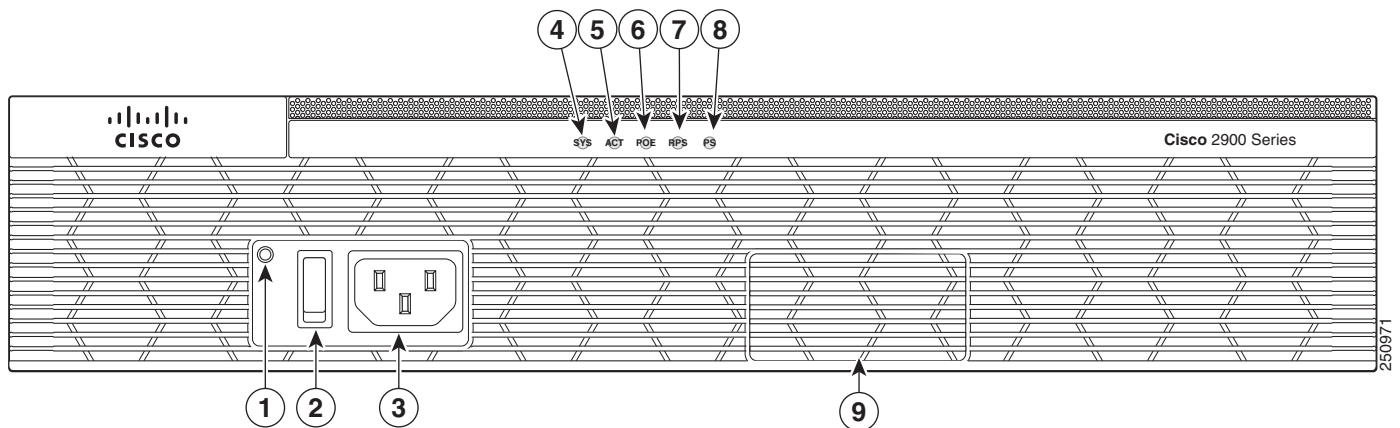
1	AC OK[1]	2	On/off switch
3	AC power connector	4	SYS
5	ACT	6	POE
7	RPS[2]	8	PS[3]
9	Optional RPS adapter (blank panel shown)		

1. LED goes off if the AC power fails or is disconnected. It does not go on and off with the power switch

2. RPS = Redundant Power Supply

3. PS = power supply

Figure 1-5   ***Back Panel of the Cisco 2911 Router***
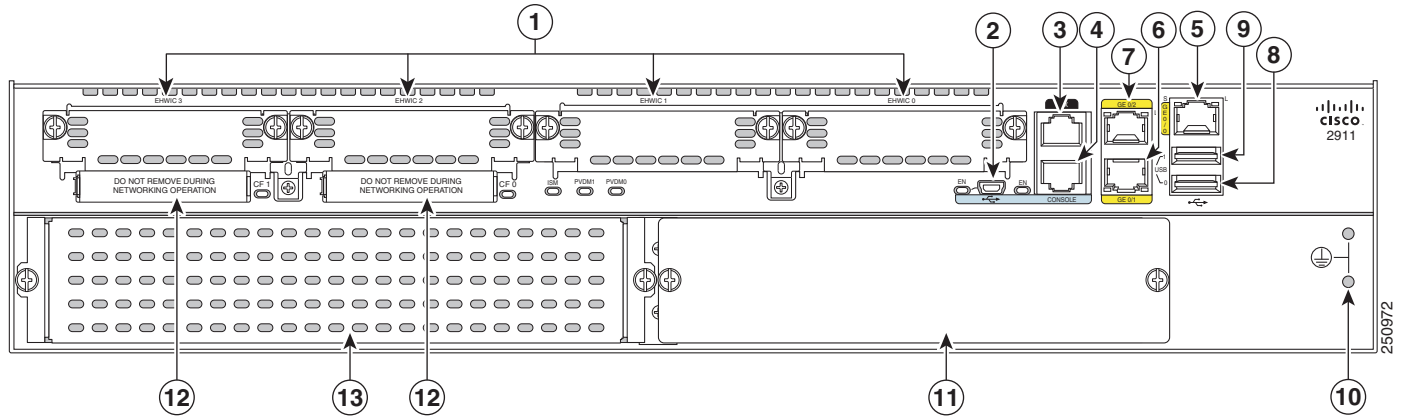
1	EHWIC slots[1] 0, 1, 2, and 3 (0, Far right)	2	USB serial port
3	AUX	4	RJ-45 serial console port
5	10/100/1000 Ethernet port (GE0/0)	6	10/100/1000 Ethernet port (GE0/1)
7	10/100/1000 Ethernet port (GE0/2)	8	USB 0
9	USB 1	10	Ground
11	AC, DC, AC-POE, or DC-POE Power Module	12	CompactFlash[2] 0 and 1 (0, Right)
13	Service module[3] slot 1		

1. Double-wide EHWICs can fit into slot 0 and 1, and into slot 2 and 3. EHWIC slots support HWIC, VIC, and WIC.

2. Only Advanced Capability CompactFlash (CF) purchased from Cisco operates in Cisco 2900 series and Cisco 3900 series ISRs. Legacy CF can impact and several degrade performance in these routers. See the "Memory" section on page 1-22. When legacy CF is inserted, the following error message appears:

   ```
   WARNING: Unsupported compact flash detected. Use of this card during normal operation can impact and
   severely degrade performance of the system. Please use supported compact flash cards only.
   ```

3. Service module slots support legacy network modules when inserted with an adapter. See the router product page at Cisco.com for a list of supported modules.

Figure 1-6   *Back Panel LEDs of the Cisco 2911 Router*
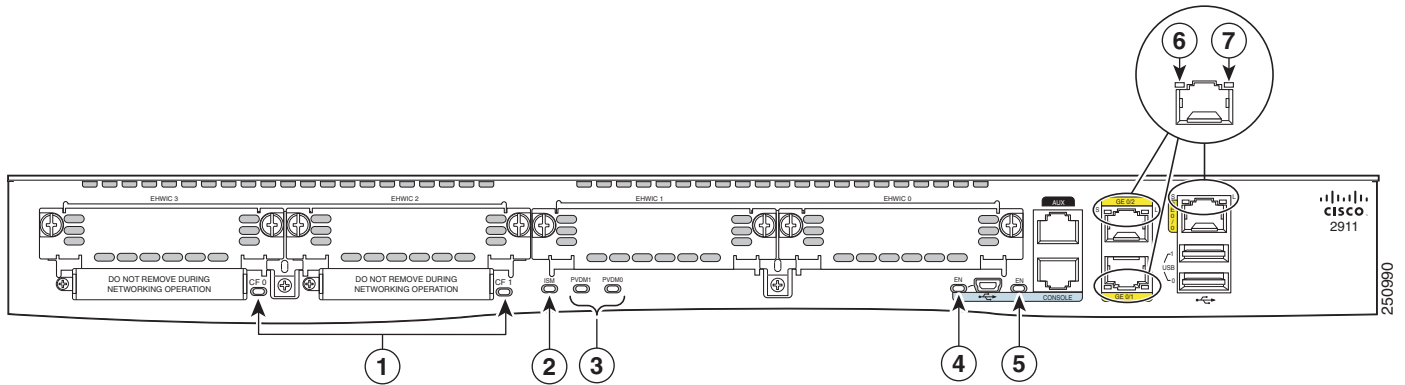
1	CompactFlash 0 and 1 (0, Far right)	**2**	ISM[1]
3	PVDM3 PVDM 0, 1, (0, Far right LED)	**4**	EN (Enable USB console)
5	EN (Enable RJ-45 console)	**6**	S (Speed)
7	L (Link)		

1. Integrated Service Module (ISM)

Cisco 2921 and Cisco 2951 Chassis

Figure 1-7   *Front Panel of the Cisco 2921 and 2951 Routers*
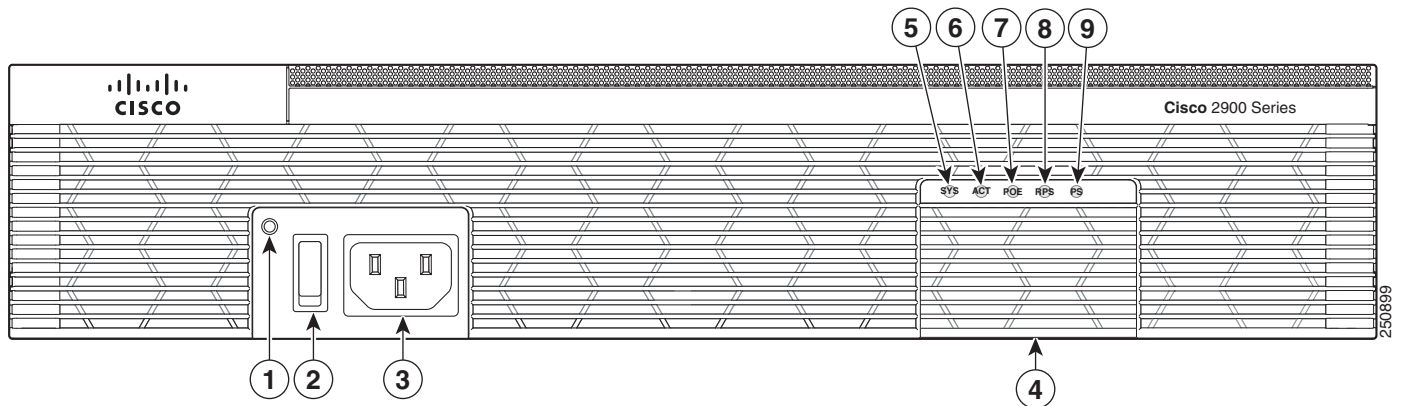
1	AC OK[1]	**2**	Power On/off switch
3	AC power connector	**4**	Optional RPS adapter (Blank panel shown)

5	SYS	**6**	ACT
7	POE	**8**	RPS
9	PS[2]		

1. LED goes off if the AC power fails or is disconnected. It does not go on and off with the power switch.

2. Power supply (PS)

Figure 1-8   Back Panel Slots and Connectors on the Cisco 2921 and 2951 Routers
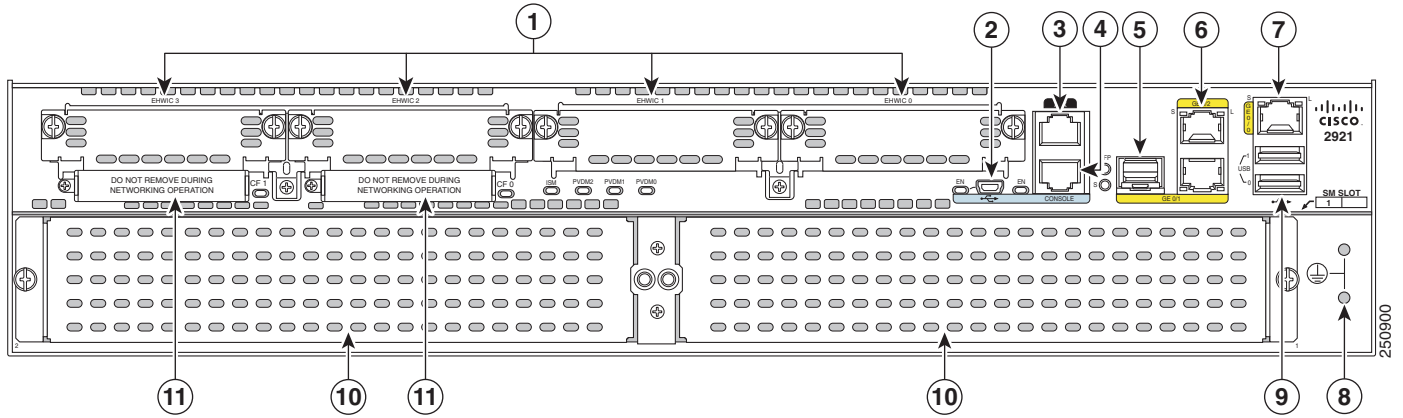
1	EHWIC slots[1] 0,1,2, and 3 (0, Far right)	**2**	USB serial console port
3	AUX port	**4**	RJ-45 serial console port
5	SFP	**6**	10/100/1000 Ethernet ports (GE 0/1 and GE 0/2 (GE 0/2, Top)
7	10/100/1000 Ethernet port GE 0/0	**8**	Ground
9	USB0 and USB1 (1, Top)	**10**	Service module slots[2] SM1 and SM2 (1, Right on 2951), (1, left on 2921)
11	CompactFlash[3] 0 and 1 (0, Right)		

1. Double-wide EHWICs can fit into slot 0 and 1, and into slot 2 and 3. EHWIC slots support HWIC, VIC, and WIC.

2. Service module slots support legacy network modules when inserted with an adapter. See the router product page at Cisco.com for a list of supported modules. Cisco 2921 supports only one service module in the left slot.

3. Only Advanced Capability CF purchased from Cisco operates in Cisco 2900 series and Cisco 3900 series ISRs. Legacy CF will not operate in these routers. When legacy CF is inserted, the following error message appears:

```
WARNING: Unsupported compact flash detected. Use of this card during normal operation can impact and
severely degrade performance of the system. Please use supported compact flash cards only.
```

Figure 1-9   *Back Panel LEDS of the Cisco 2921 and 2951 Routers*
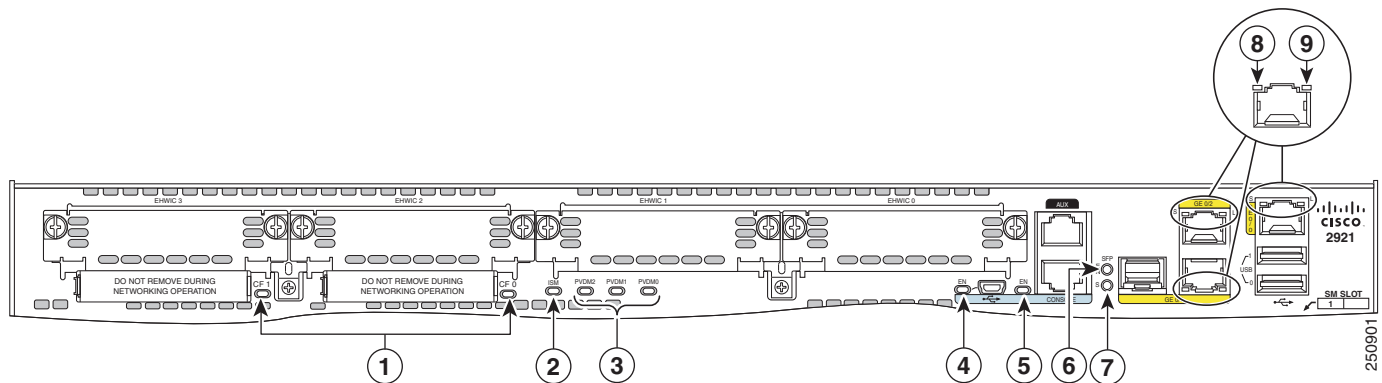
1	CompactFlash 0 and 1 (0, Right)	2	ISM[1]
3	PVDM3 0,1, and 2 (0, Right)	4	EN (Enable USB console)
5	EN (Enable RJ-45 console)	6	SFP[2] EN
7	SFP S	8	S (Speed)
9	L (Link)		

1. ISM = Internal Services Module

2. SFP = small-form-factor pluggable

Cisco 3900 Series Chassis

Cisco 3900 series ISRs are shipped with Services Performance Engines (SPEs) pre-installed in the router. See the "Services Performance Engine" section on page 1-21 for models and support information.

Table 1-2   *Services Performance Engines*

Router	Services Performance Engine
Cisco 3925	Services Performance Engine 100
Cisco 3945	Services Performance Engine 150
Cisco 3925E	Services Performance Engine 200
Cisco 3945E	Services Performance Engine 250

Figure 1-10 shows the Cisco 3925 and Cisco 3945 front panels.

Cisco 3925 and Cisco 3945 (SPE 100 and SPE 150)

- Back panel slots and connectors— Figure 1-11
- Back panel LEDs— Figure 1-12

Cisco 3925E and Cisco 3945E (SPE 200 or SPE 250)

- Back panel slots and connectors— Figure 1-13
- Back panel LEDs— Figure 1-14

Figure 1-10   *Front Panel of the Cisco 3900 Series ISRs*
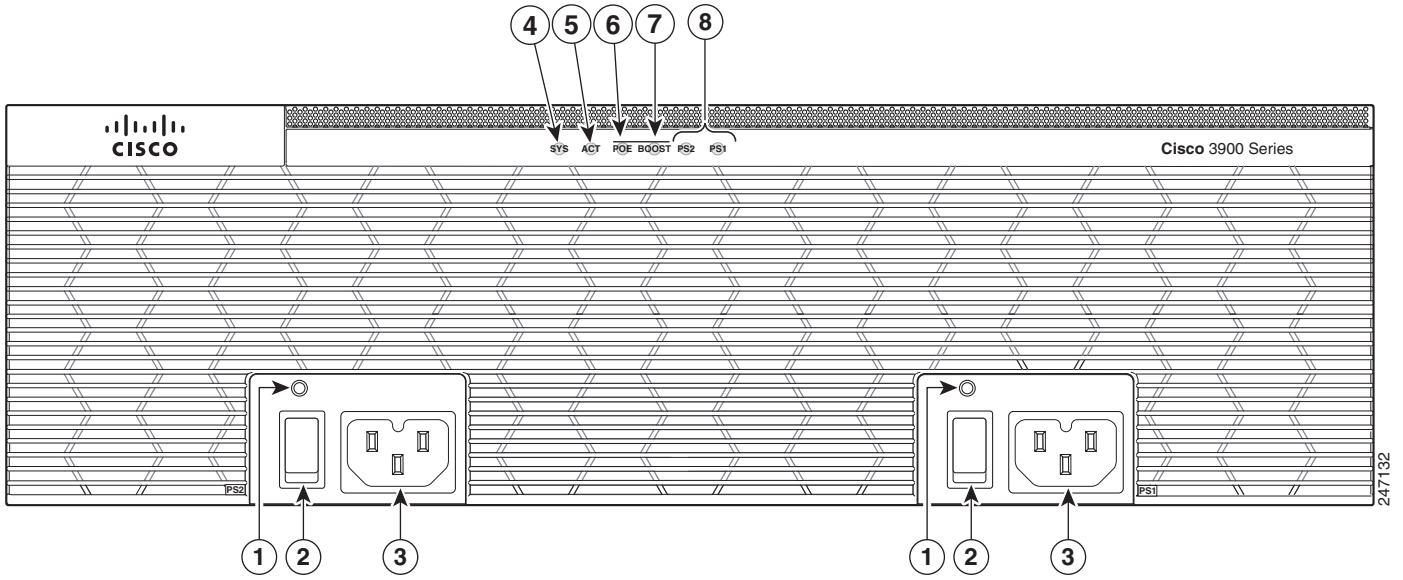
1	AC OK[1]	**2**	On/off switch
3	Power connector	**4**	SYS status LED
5	ACT status LED	**6**	POE
7	Boost	**8**	PS1 (Right), PS2 (Left)

1. LED goes off if the AC power fails or is disconnected. It does not go on and off with the power switch.

Figure 1-11   *Back Panel Slots and Connectors for Cisco 3925 and 3945 (SPE 100 and SPE 150)*

1	EHWIC slots[1] 0, 1, 2 and 3 (0, Far right)	2	USB serial console port
3	AUX port	4	RJ-45 serial console port
5	SFP1 and SFP2 (2, Top)	6	10/100/1000 Ethernet ports GE 0/1 and GE 0/2 (GE 0/2,Top)
7	10/100/1000 Ethernet port GE0/0	8	USB0 and USB1 (1, Top)
9	Ground	10	Cisco 3945 Service module slots[2], 1 (Lower right), 2 (Lower left), 3 (Top right), and 4 (Top left)
			Cisco 3925 Service module slots[3], 1 (Lower left)[4], 2 (Top left)
11	CompactFlash[5] 0 and 1 (0, Far right)		

1. Double-wide EHWICs can fit into slot 0 and 1, and into slot 2 and 3. EHWIC slots support HWIC, VIC, and WIC.

2. Service module slots support legacy network modules when inserted with an adapter. See the router product page at Cisco.com for a list of supported modules. See Table 1-5 for more router slot and module configurations.

3. Service module slots support legacy network modules when inserted with an adapter. See the router product page at Cisco.com for a list of supported modules. Double wide service modules install in the top slots. See Table 1-5 for more router slot and module configurations.

4. One single-wide in slot 1 (lower left). Lower right panel cannot be removed. See Table 1-5 for more router slot and module configurations.

5. Only Advanced Capability CompactFlash (CF) purchased from Cisco operates in Cisco 2900 series and Cisco 3900 series ISRs. Legacy CF can impact and severely degrade performance in these routers. See the "Memory" section on page 1-22. When legacy CF is inserted, the following error message appears:

```
WARNING: Unsupported compact flash detected. Use of this card during normal operation can impact and
severely degrade performance of the system. Please use supported compact flash cards only.
```

Figure 1-12   ***Back Panel LEDS on Services Performance Engine 100 and SPE 150***
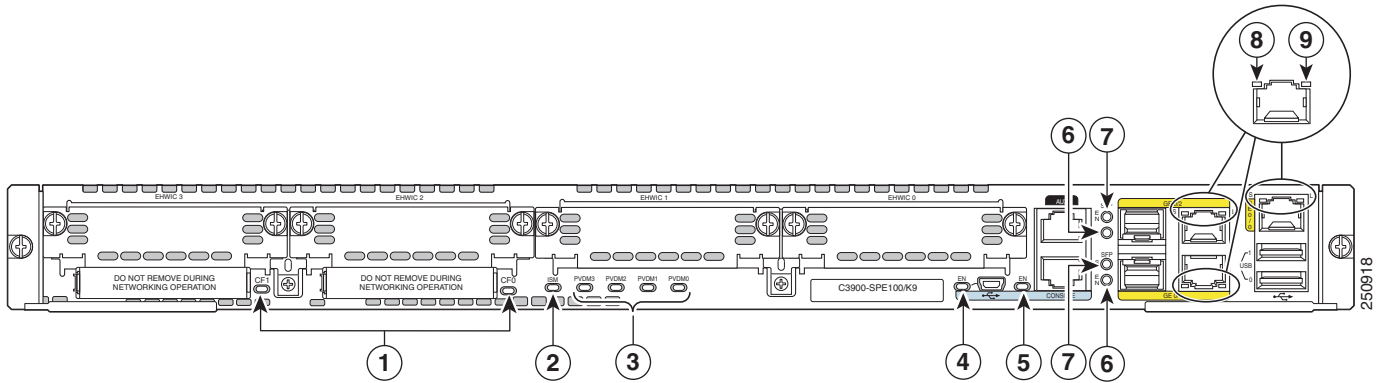
1	CompactFlash 0 and 1 (0, Far right)	**2**	ISM[1]
3	PVDM3 0,1, 2, and 3 (0, Far right LED)	**4**	EN (Enable USB console)
5	EN (Enable RJ-45 console)	**6**	SFP S
7	SFP EN	**8**	S (Speed)
9	L (Link)		

1. ISM = Internal Services Module

Figure 1-13   ***Back Panel Slots/Connectors for Cisco 3925E and 3945E (SPE 200 or SPE 250)***
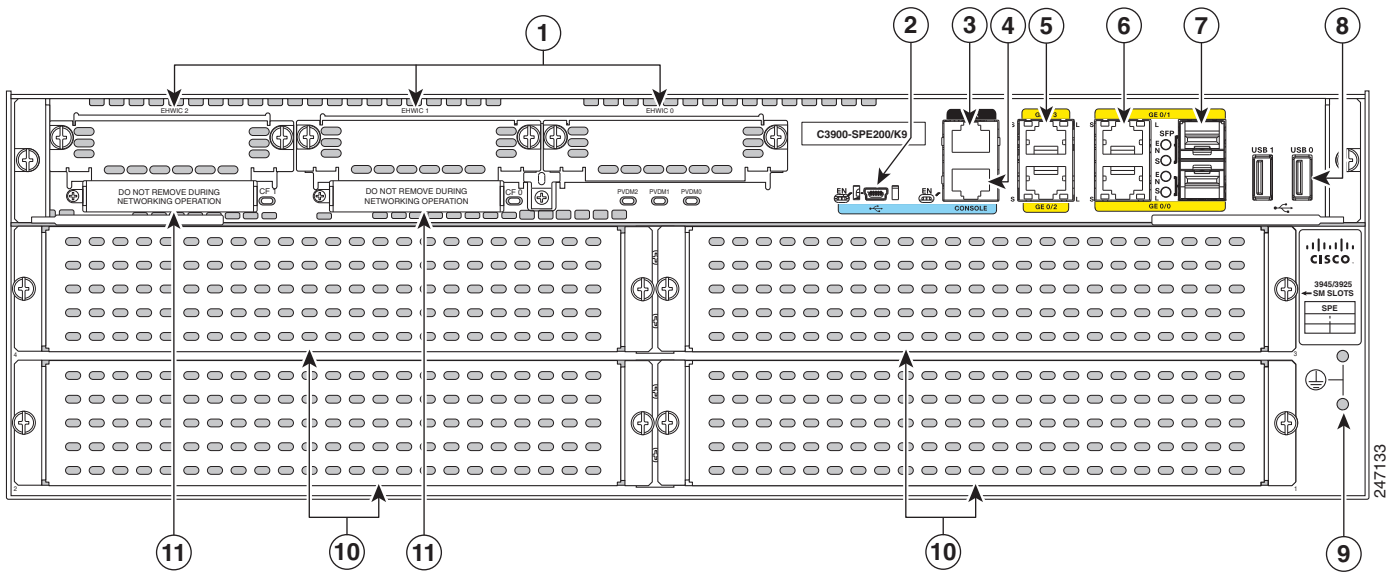
1	EHWIC slots[1] 0,1, and 2 (0, Far right)	**2**	USB serial console port
3	AUX port	**4**	RJ-45 serial console port
5	10/100/1000 Ethernet ports (GE 0/3, Top; GE 0/2, Bottom)	**6**	10/100/1000 Ethernet ports (GE 0/1, Top; GE 0/0, Bottom)

7	SFP 1 and SFP 2 (1, Top)	8	USB 0 and USB 1 (1, Left)
9	Ground	10	Cisco 3945 Service module slots[2], 1 (Lower right), 2 (Lower left), 3 (Top right), and 4 (Top left)
			Cisco 3925 Service module slots[3], 1 (Lower left)[4], 2 (Top left)
11	CompactFlash[5] 1 and 0 (0, Far right)		

1. Slot 0 supports WIC/VIC, HWIC, and EHWIC.
   Slot 1 supports WIC/VIC, HWIC, EHWIC, DWHIC, and EDHWIC.
   Slot 2 supports WIC/VIC, HWIC, and EHWIC.

2. Service module slots support legacy network modules when inserted with an adapter. See the router product page at Cisco.com for a list of supported modules. See Table 1-5 for router slot and module configurations.

3. Service module slots support legacy network modules when inserted with an adapter. See the router product page at Cisco.com for a list of supported modules. See Table 1-5 for router slot and module configurations.

4. One single-wide in slot 1 (lower left). Lower right panel cannot be removed. See Table 1-5 for more router slot and module configurations.

5. Only Advanced Capability CF purchased from Cisco operates in Cisco 2900 series and Cisco 3900 series ISRs. Legacy CF will not operate in these routers. When legacy CF is inserted, the following error message appears:

   ```
   WARNING: Unsupported compact flash detected. Use of this card during normal operation can impact and
   severely degrade performance of the system. Please use supported compact flash cards only.
   ```

Figure 1-14   ***Back Panel LEDS on Services Performance Engine 200 and 250***
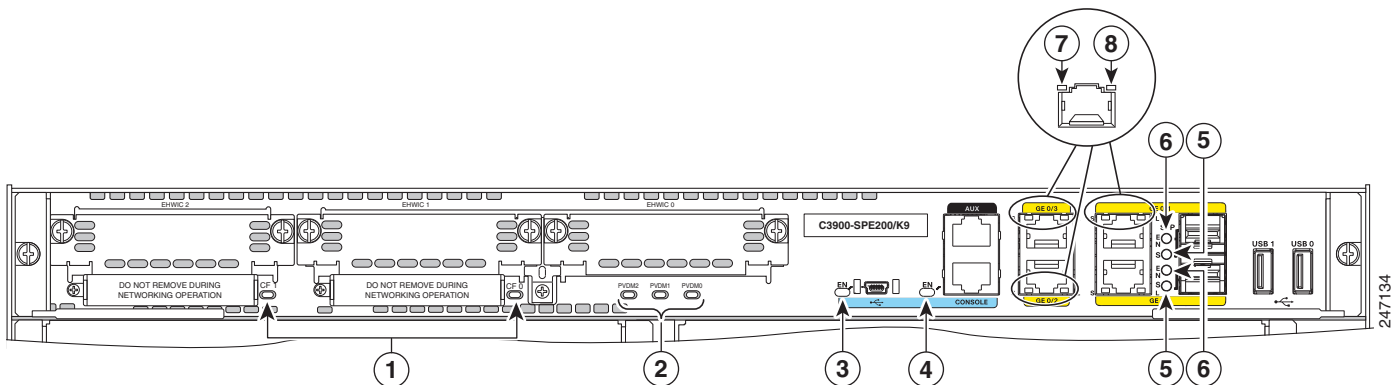
1	CompactFlash 0 and 1 (0, Far right)	2	PVDM3 0,1, and 2 (0, Far right LED)
3	EN (Enable USB console)	4	EN (Enable RJ-45 console)
5	SFP S	6	SFP EN
7	S (Speed)	8	L (Link)

Locating the Serial Number, PID, VID and CLEI

Software License

To obtain a software license, you need a product authorization key (PAK) and the unique device identifier (UDI) of the device where the license will be installed.

The serial number (SN), product ID (PID), version ID (VID), and Common Language Equipment Identifier (CLEI) are printed on a label on the back of the router or on a label tray located on the router chassis or motherboard. The UDI can be viewed using the **show license udi** command in privileged Exec

mode in Cisco Internet Operating System (IOS) software. For additional information on the UDI or how to obtain a PAK, see the *Cisco Software Activation on Integrated Services Routers* document at Cisco.com.

The UDI has two main components:

- Product ID (PID)
- Serial number (SN)

Refer to these sections to locate labels on Cisco 2900 series and 3900 series ISRG2 routers:

Cisco 2900 Series

Cisco 3900 Series

Labels on Cisco 2901

Figure 1-15 shows the location of the labels on the Cisco 2901 router.

Figure 1-15   Labels Location on the Cisco 2901 Router
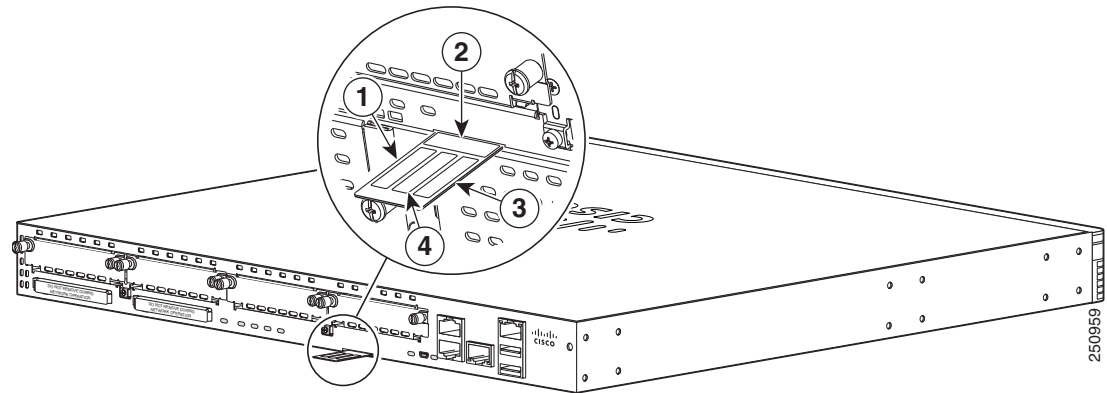
Label	Description
1	Product ID
2	Serial Number
3	Product ID/Version ID
4	Common Language Equipment Identifier

Labels on Cisco 2911

Figure 1-16 shows the location of the labels on the Cisco 2911 router.

Figure 1-16   Labels Location on the Cisco 2911 Router
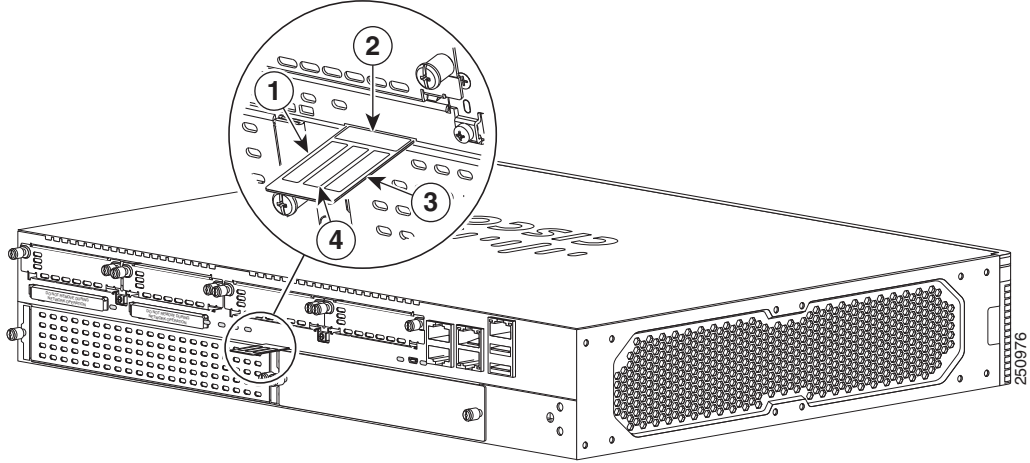
Label	Description
1	Product ID
2	Serial Number
3	PID/VID
4	CLEI

Labels on Cisco 2921 and Cisco 2951

Figure 1-17 shows the location of the labels on the Cisco 2921 and Cisco 2951 routers.

Figure 1-17   *Label Location on the Cisco 2921 and Cisco 2951 Routers*
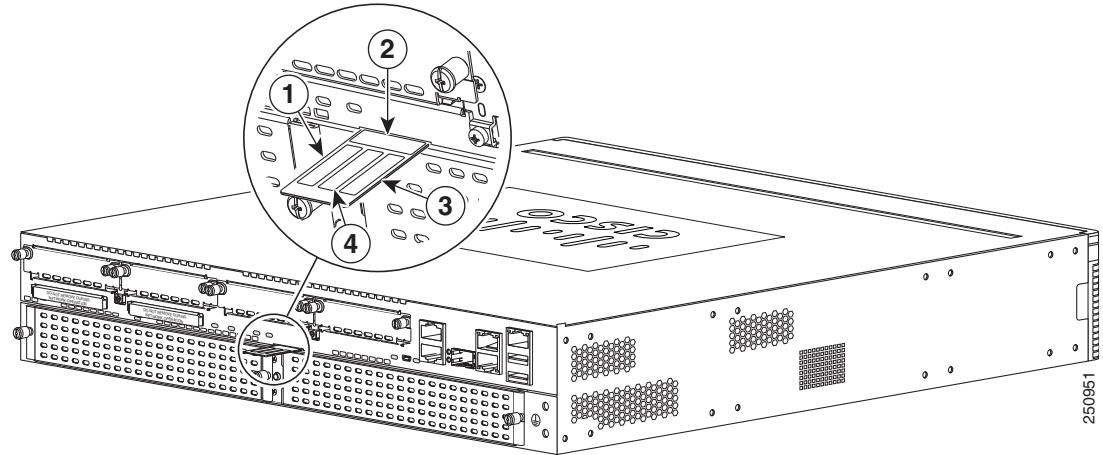
Label	Description
1	Product ID
2	Serial Number
3	PID/VID
4	CLEI

Labels on Cisco 3925 and Cisco 3945

Figure 1-18 shows the two locations where labels are located on Cisco 3900 ISRs. There are labels on the router chassis and on the Services Performance Engine (SPE).

Note   Use the serial number on the SPE label to obtain a PAK.

Figure 1-18   Labels Location(s) on Cisco 3900 ISRs
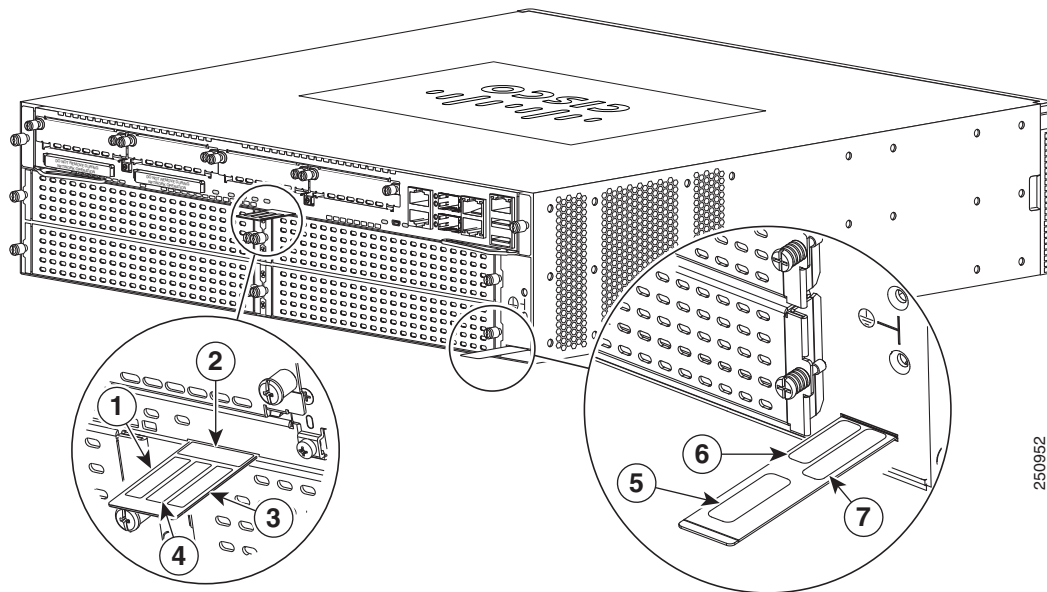
Table 1-3   Labels on Cisco 3900 Routers and SPE

Label	Description
1	SPE PID
2	SPE Serial Number
3	SPE PID/VID
4	SPE CLEI
5	Chassis CLEI
6	Chassis Serial Number
7	Chassis PID/VID

For Additional Help Locating Labels on the Router

Use the Cisco Product Identification (CPI) tool to find labels on the router. It provides detailed illustrations and descriptions of where the labels are located on Cisco products. It includes the following features:

- A search option that allows browsing for models by using a tree-structured product hierarchy
- A search field on the final results page that makes it easier to look up multiple products
- End-of-sale products clearly identified in results lists

The tool streamlines the process of locating serial number labels and identifying products. Serial number information expedites the entitlement process and is important for access to support services.

The Cisco Product Identification tool can be accessed at the following URL:

http://tools.cisco.com/Support/CPI/index.do

Hardware Features

This section describes the hardware features in Cisco 2900 series and Cisco 3900 series routers.

- Built-in Interface Ports, page 1-17
- Removable and Interchangeable Modules and Cards, page 1-18
- Packet Voice Data Modules, page 1-22
- Power Supplies, page 1-24
- Module and Router Power Consumption, page 1-25
- Fans, Ventilation, and Airflow, page 1-26
- Real-Time Clock, page 1-28
- Secure Key, page 1-28
- Cryptographic Accelerator, page 1-28

Built-in Interface Ports

Table 1-4 summarizes the interface ports built into the router chassis.

Table 1-4   ***Summary of Cisco 2900 series and Cisco 3900 series Built-In Interfaces***

Router Model	Data Ports			Management Ports		
	10/100/1000 GE RJ-45	10/100/1000 SFP	USB Type A	Console Serial, RJ-45	Console Serial, Mini-USB (Type B)	Auxiliary, RJ-45
Cisco 2901	2	—	2	1	1	1
Cisco 2911	3	—	2	1	1	1
Cisco 2921	3	1	2	1	1	1
Cisco 2951	3	1	2	1	1	1
Cisco 3925 with SPE 100	3[1]	2	2	1	1	1
Cisco 3945 with SPE 150	3[2]	2	2	1	1	1
Cisco 3925E with SPE 200	4[3]	2	2	1	1	1
Cisco 3945E with SPE 250	4[4]	2	2	1	1	1

1. One RJ-45 with 2 GE SFPs, or 3 RJ-45 GEs
2. One RJ-45 with 2 GE SFPs, or 3 RJ-45 GEs
3. Four RJ-45 or three RJ-45 with one GE-SFP, or two RJ-45 with two GE SFP
4. Four RJ-45 or three RJ-45 with one GE-SFP, or two RJ-45 with two GE SFP

Gigabit Ethernet Ports

There are two different types of Gigabit Ethernet (GE) ports available on Cisco 2900 series and Cisco 3900 series ISRs.

GE Ports

The GE RJ-45 copper interface ports support 10BASE-T, 100BASE-TX, and 1000BASE-T.

SFP Ports

The small-form-factor pluggable (SFP) ports support 1000BASE-LX/LH, 1000BASE-SX, 1000BASE-ZX, and Coarse Wavelength-Division Multiplexing (CWDM-8) modules, as well as 100Mbs SFP modules.

The SFP port shares the same physical port as an RJ-45 GE port. Table 1-4 on page 1-17 shows the models that support SFP installation. The SFP port supports auto-media-detection, auto-failover and remote fault indication (RFI), as described in the IEEE 802.3ah specification.

Use the **media-type** {**rj45**{**auto-failover**}} | {**sfp**{**auto-failover**}} command to enable the auto-media-detection and auto-failover features. Use the *Command Lookup Tool* for details about this command.

The SFP port can be configured for the following behaviors:

- Always use the RJ-45 port.
- Always use the SFP port.
- Always use the RJ-45 port but fail over to the SFP port if the RJ-45 port fails. This is the default configuration.
- Always use the SFP port but fail over to the RJ-45 port if the SFP port fails.

USB Serial Console Port

The Mini-USB type B serial port has been enabled to perform management tasks on the router. To use this port, you must install a Windows USB device driver before establishing physical connectivity between a personal computer and the router. See the "Installing the Cisco Microsoft Windows USB Device Driver" section on page 3-35 for driver installation instructions.

Removable and Interchangeable Modules and Cards

Table 1-5 on page 1-20 summarizes the type of removable modules and cards that can be installed in the router to provide specific capabilities. Services Performance Engines (SPEs), Service Modules (SMs), and Enhanced High-Speed WAN Interface Cards (EHWICs) fit into external slots and can be removed or replaced without opening the chassis.

Internal Services Modules (ISMs), expansion DRAM memory modules and next-generation Packet Voice Data Modules (PVDM3s) plug into internal connectors inside the chassis. These modules can be removed and installed only by opening the chassis on the Cisco 3900 series, or sliding the motherboard out of the Cisco 3900 series.

External Slots

- Services Performance Engine, page 1-21
- Service Modules, page 1-21
- Enhanced High-Speed WAN Interface Cards, page 1-21

Internal Slots

- Integrated Service Modules, page 1-22
- Packet Voice Data Modules, page 1-22
- Memory, page 1-22

Because of physical differences with the new slots, legacy network modules and legacy Service Modules require an adapter for installation.

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

Warning   **This equipment must be installed and maintained by service personnel as defined by AS/NZS 3260. Incorrectly connecting this equipment to a general-purpose outlet could be hazardous. The telecommunications lines must be disconnected 1) before unplugging the main power connector or 2) while the housing is open, or both.** Statement 1043

See the *Overview of Cisco Network Modules and Service Modules for Cisco Access Routers* document for general information and single- and double-wide slot numbering.

See the *Installing Cisco Network Modules in Cisco Access Routers* document for instructions that describe how to install SMs, legacy network modules, and legacy Service Modules in the router.

See the *Overview of Cisco Interface Cards for Cisco Access Routers* for general interface card information.

See the *Installing Cisco Interface Cards in Cisco Access Routers* document, for instructions that describe how to install EHWICs and legacy interface cards in the router.

Note   See the router product page at Cisco.com for a list of supported network modules and interface cards for Cisco 2900 series and Cisco 3900 series ISRs.

Table 1-5 shows the number of internal and external slots on Cisco 2900 series and Cisco 3900 series ISRs. It also shows the number of EHWICs and SMs that are supported in the router slots at any time. Table 1-8 on page 1-23 shows memory specifications by router.

Table 1-5   Cisco 2900 series and Cisco 3900 series Slots and Module Configurations

	Modules and Cards			Internal Modules	
Router	SPE	SM[1]	EHWIC[2]	ISM[3]	PVDM3[4]
2901	—	—	4 single-wide (EHWIC) or 2 double-wide (DW-EHWIC)	1	2
2911	—	1 single-wide	4 single-wide (EHWIC) or 2 double-wide (DW-EHWIC)	1	2
2921	—	1 single-wide or 1 double-wide	4 single-wide (EHWIC) or 2 double-wide (DW-EHWIC)	1	3
2951	—	2 single-wide or 1 double-wide	4 single-wide (EHWIC) or 2 double-wide (DW-EHWIC)	1	3
3925	Services Performance Engine 100	2 single-wide or 1 single-wide + 1 double-wide	4 single-wide (EHWIC) or 2 double-wide (DW-EHWIC)	1	4
3945	Services Performance Engine 150	4 single-wide or 1 double-wide + 2 single-wide	4 single-wide (EHWIC) or 2 double-wide (DW-EHWIC)	1	4
3925E	Services Performance Engine 200	2 single-wide or 1 single-wide + 1 double-wide	3 single-wide (EHWIC) or 1 double-wide + 1 single-wide	0	3
3945E	Services Performance Engine 250	4 single-wide or 1 double-wide + 2 single-wide	3 single-wide (EHWIC) or 1 double-wide + 1 single-wide	0	3

1. Service Module slots support the installation of legacy network modules and extended voice modules (EVMs) with an appropriate adapter. See the *Hardware Installation Guide* for the router.

2. EHWIC slots support HWICs, WICs and VICs.

3. AIMs are not supported.

4. PVDM3 slots support the installation of PVDM2 modules with an appropriate adapter. PVDM2s can not be intermixed with PVDM3s. See the *Hardware Installation Guide* for router.

Services Performance Engine

Services Performance Engines (SPEs) are modular motherboards for Cisco 3900 series ISRs. The SPE includes PVDM3 slots and system memory slots, and the ISM slot. The Services Performance Engine provides a modular approach to system upgrades. Slide out the SPE from the router to replace internal modules, or to upgrade the SPE for improved router performance.

See the "Removing and Replacing the Services Performance Engine" procedure on page 5-6 for installation information.

Table 1-6 lists four SPE models that are supported on Cisco 3900 series routers. SPEs illustrations are shown in the "Chassis Views" section on page 1-2. SPEs come pre-installed in 3900 series routers, or they are purchased separately and installed in a 3900 series router. See the support table for more information.

Table 1-6   Services Performance Engine Support

Services Performance Engines	Cisco 3925	Cisco 3945
SPE 100	supported	—
SPE 150	—	supported
SPE 200	supported	—
SPE 250	—	supported

Note   The SPE 200 and the SPE 250 include a cryptographic accelerator for improved security performance. See the "Cryptographic Accelerator" section on page 1-28 for more information.

Service Modules

Service Modules (SM) are the largest modules on Cisco 2900 series and Cisco 3900 series ISRs. With the largest form-factor and power capacity, these modules deliver high-performance service applications. SMs are physically larger than legacy network modules, as a result, network modules require an adapter for installation. See the *Installing Cisco Network Modules in Cisco Access Routers* guide for installation instructions,
http://www.cisco.com/en/US/docs/routers/access/interfaces/nm/hardware/installation/guide/InstNetM.html.

Enhanced High-Speed WAN Interface Cards

Enhanced High-Speed WAN Interface Card (EHWICs) are the latest generation of interface cards. EHWICs are installed in the EHWIC slot on the router. Legacy interface cards, such as WAN interface cards (WICs), voice interface cards (VICs), high-speed WAN interface cards (HWICs), double-width high-speed WAN interface cards (DHWICs), and (EHWICs) are supported in the EHWIC slot on the router.

Services Performance Engine 200 and Services Performance Engine 250 support the following legacy interface cards in the EHWIC slots. (See Table 1-7.)

Table 1-7   EHWIC Support for SPE 200 and SPE 250

Slot 0	Slot 1	Slot 2
WIC/VIC and HWIC	WIC/VIC, HWIC, EHWIC, DHWIC, and EDHWIC	WIC/VIC and HWIC

Integrated Service Modules

Internal Services Modules (ISM) supersede advanced integration modules (AIM) on Cisco 2900 series and Cisco 3900 series ISRs. The ISM is larger in size than the AIM. Due to these physical differences, the AIM does not fit into the ISM slot and is no longer supported on Cisco 2900 series and Cisco 3900 series ISRs.

Packet Voice Data Modules

The Packet Voice Data Modules (PVDM3s) are the latest generation of PVDMs. First-generation PVDM-I cards are not supported in the PVDM3 slots. Due to physical differences, PVDM2s require an adapter for installation in the PVDM3 slot. See the "Installing and Removing PVDM2s" section on page 5-23 for installation instructions.

Note PVDM2 cards cannot be mixed with PVDM3s.

Memory

Cisco 2900 series and Cisco 3900 series routers contain the following types of memory:

- DRAM—Stores the running configuration and routing tables and is used for packet buffering by the network interfaces. Cisco IOS software executes from DRAM memory. Supported module types are Unregistered Dual In-Line Memory Module (UDIMM) and very low profile registered DIMM (VLP RDIMM).

  Note UDIMMs and VLP RDIMMs are not interchangeable.

- Boot/NVRAM—256K of internal non-volatile memory. Stores the bootstrap program (ROM monitor), the configuration register, and the startup configuration.

- Flash memory—External flash memory. Stores the operating system software image. Each model supports 2 external CompactFlash 4-GB memory cards provide a maximum 8-GB of CompactFlash.

  Note You must use Cisco-qualified CompactFlash cards supporting True IDE PIO Mode 6 and True IDE Multiword DMA Mode 4 as defined in CompactFlash Specification Revision 4.1 of the CompactFlash Association. Use of any other cards during normal network operation can affect system performance.

Table 1-8 summarizes the memory options for Cisco 2900 series and Cisco 3900 series routers. Default memory represents the minimum usable RAM. You can install additional RAM up to the maximum amount.

Expansion memory modules are UDIMMs or VLP RDIMMs with error correction code (ECC). All onboard RAM uses ECC.

> **Note**   The current IOS supports only 2 GB of DRAM, although; the hardware supports more. Future IOS versions may support more than 2 GB of DRAM.

Table 1-8   Router Memory Specifications

Router Platform	DRAM
Cisco 2901	Expansion Type—UDIMM with ECC. UDIMM sizes—512 MB, 1 GB, 2 GB. UDIMM expansion slots—1. Fixed onboard ECC memory—512 MB. Maximum memory—2 GB.
Cisco 2911	Expansion Type—UDIMM with ECC. UDIMM sizes—512 MB, 1 GB, 2GB. UDIMM expansion slots—1. Fixed onboard ECC memory—512 MB. Maximum memory—2 GB.
Cisco 2921	Expansion Type—UDIMM with ECC. UDIMM sizes—512 MB, 1 GB, 2 GB. UDIMM expansion slots—1. Fixed onboard ECC memory—512 MB. Maximum memory—2 GB.
Cisco 2951	Expansion Type—VLP RDIMM with ECC. VLP RDIMM sizes—512 MB, 1 GB, 2 GB. VLP RDIMM slots—2. Default VLP RDIMM memory module — One 512 MB module (slot 0) Maximum memory—2 GB.
Cisco 3925	Type—VLP RDIMM with ECC VLP RDIMM sizes—512 MB and 1 GB. VLP RDIMM expansion slots—2; both must be the same density. Default VLP RDIMM memory modules—Two 512-MB modules for a maximum of 1 GB. Maximum memory—2.0 GB; 1.0 GB in each slot.

Table 1-8   Router Memory Specifications (continued)

Router Platform	DRAM
Cisco 3945	Type—VLP RDIMM with ECC
	VLP RDIMM sizes—512 MB and 1 GB.
	VLP RDIMM expansion slots—2; both must be the same density.
	Default VLP RDIMM memory modules—Two 512-MB modules for a maximum of 1 GB.
	Maximum memory—2.0 GB; 1.0 GB in each slot.
Cisco 3925E	Type—VLP RDIMMwith ECC.
	VLP RDIMM sizes—512 MB, 1GB.
	VLP RDIMM expansion slots—2, both must be the same density.
	Default ECC memory modules—Two 512-MB modules for 1 GB.
	Maximum memory—2.0 GB; 1.0 GB in each slot.
Cisco 3945E	Type—VLP RDIMMwith ECC.
	VLP RDIMM sizes—512 MB, 1GB.
	VLP RDIMM expansion slots—2, both must be the same density.
	Default ECC memory modules—Two 512-MB modules for 1 GB.
	Maximum memory—2.0 GB; 1.0 GB in each slot.

Power Supplies

Cisco 2900 series and Cisco 3900 series ISRs support a variety of power supply configurations. All power supplies are field replaceable and externally accessible with the exception of the Cisco 2901 ISR. The Cisco 2901 ISR has an internal power supply, which requires removing the cover for replacement.

If configured with dual power supplies or an Redundant power supplies (RPS), the power supplies are hot swappable. RPSs require an RPS adapter. There are two versions of the RPS adapter, one for the Cisco 2911 and one for the Cisco 2921 and 2951. Both use the Cisco Redundant Power System 2300.

Configurations include AC and DC (with and without IP), Dual DC, internal POE, and POE boost.

- Table 1-9 summarizes the power options.
- Table 1-10 shows POE power rates.

Table 1-9   ***Cisco 2900 Series and Cisco 3900 Series Field Replaceable Unit Power Options***

Router Model	AC	AC + POE	DC	Hot Swap[1]	Internal RPS[2]	External RPS[3]	Dual DC[4]	Internal POE	Internal POE Boost	External POE Boost[5]	Internal DC + POE
2901	X	X	—	—	—		—	X	—	—	—
2911	X	X	X	X	—	X	—	X	—	X	X
2921	X	X	X	X	—	X	—	X	—	X	—
2951	X	X	X	X	—	X	—	X	—	X	—
3925	X	X	X	X	X	—	—	X	X	—	—
3925E	X	X	X	X	X	—	—	X	X	—	—
3945	X	X	X	X	X	—	—	X	X	—	—
3945E	X	X	X	X	X	—	—	X	X	—	—

1. Must have RPS or POE boost installed.
2. Internal RPS means that and additional power supply can be added to the PS2 slot.
3. Uses external Cisco Redundant Power System 2300 with an adapter inserted in the chassis.
4. Dual DC means two separate DC inputs to the same power supply.
5. Uses Cisco Redundant Power System 2300 as 100% power boost. Internal power supply does not supply any boost. In this configuration there is no POE redundancy.

Table 1-10   ***Cisco 2900 series and Cisco 3900 series POE Power Ratings***

Power Supply	Router Model							
	2901	2911	2921	2951	3925	3925E	3945	3945E
Internal POE	130 W	200 W	280 W	370 W	520 W	520 W	520 W	520 W
Internal POE Boost	—	—	—	—	1040 W	1040 W	1040 W	1040 W
Internal DC+POE	—	160 W	—	—	—	—	—	—
External POE Boost	—	750 W	750 W	750 W	—	—	—	—

Module and Router Power Consumption

Cisco 2900 series and Cisco 3900 series ISRs have energy efficiency features that reduce power consumption. Some of the energy efficiency features are controlled by the hardware, whereas other energy efficiency features are controlled by the software.

Hardware Features

- High-efficiency AC power supplies.

Software Features

- See the *Configuring Power Efficiency Management* module in the *Cisco 3900 Series, 2900 Series, and 1900 Series Integrated Services Routers Software Configuration Guide* at Cisco.com. Learn how to configure and manage power going to modules and peripherals.

Fans, Ventilation, and Airflow

The Cisco 2911 and Cisco 3900 series ISRs have optional fan filters that are easy to replace. The filters may be used to meet Network Equipment Building Systems (NEBS) requirements, or to operate in dusty environments. When a filter becomes dirty, discard it and replace it with a new one. See the "Replacing a Fan Tray or Air Filter" section on page 5-44.

Fan speeds are controlled by the fan speed controller circuitry. To minimize noise, the fans operate at one of several predetermined speeds and are dependent on the input ambient air temperature.

- Figure 1-19 shows Cisco 2901 airflow.
- Figure 1-20 shows Cisco 2911 airflow.
- Figure 1-21 shows Cisco 2921 and 2951 airflow.
- Figure 1-22 shows the Cisco 3900 series standard (non NEBS) airflow configuration. For NEBS, the airflow is reversed.
- Figure 1-23 shows the Cisco 3900 series standard NEBS airflow configuration.

Figure 1-19   Cisco 2901 Router Airflow
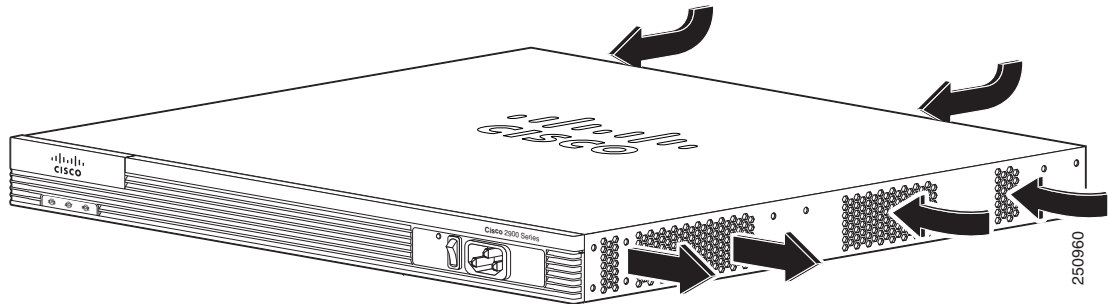
Figure 1-20   Cisco 2911 Router Airflow
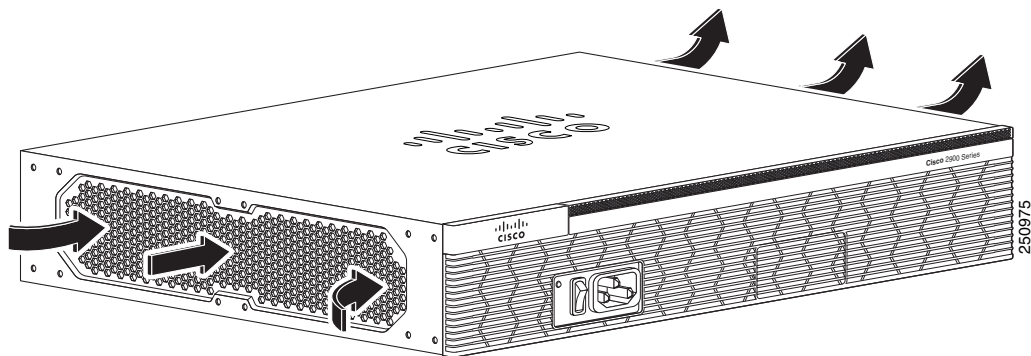
Figure 1-21   Cisco 2921 and Cisco 2951 Router Airflow
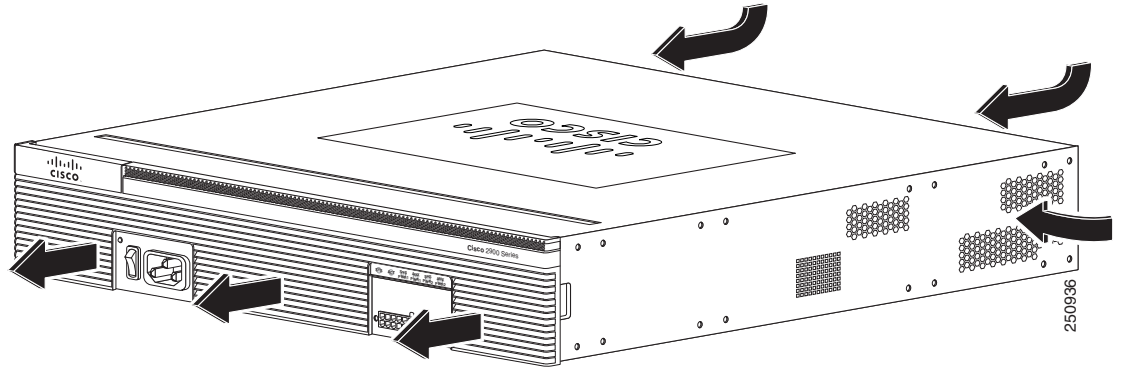
Figure 1-22   Cisco 3900 Series (Non NEBS) Router Airflow
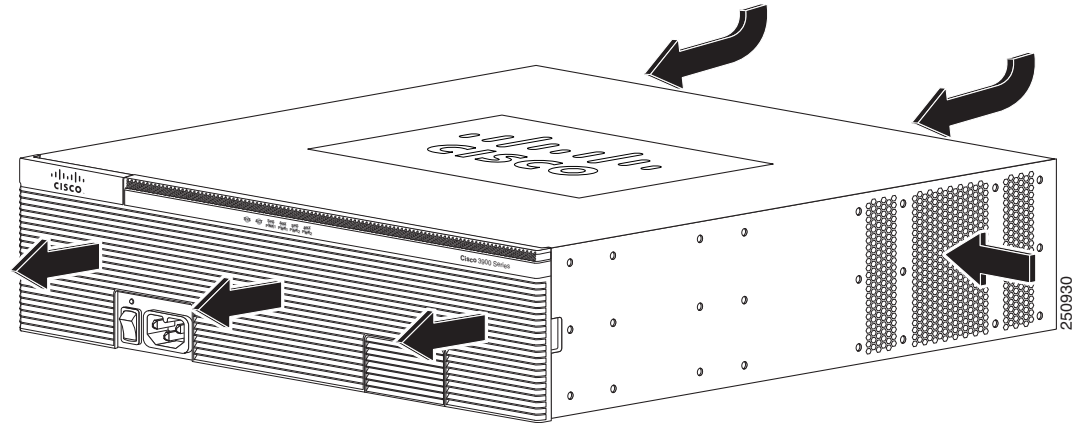
Figure 1-23   Cisco 3900 Series NEBS Router Airflow
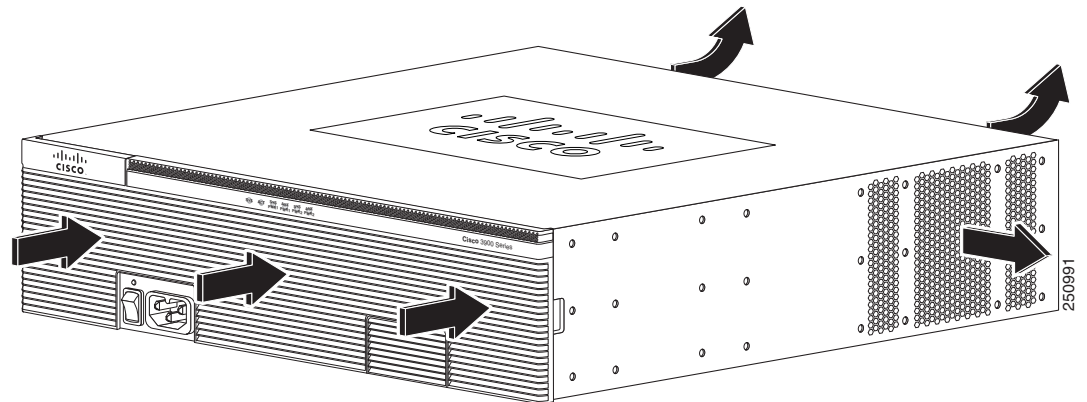
Real-Time Clock

Upon system power up, the internal real-time clock with battery backup provides the system software with the time of day. This allows the system to verify the validity of the certification authority (CA) certificate. The Cisco 2900 and Cisco 3900 series routers have a lithium battery. This battery lasts for the life time of the router under the operating environmental conditions specified for the router and is not field-replaceable.

Note   If the lithium battery in a Cisco 2900 or Cisco 3900 series ISR should fail, the router must be returned to Cisco for repair.

Although the battery is not intended to be field-replaceable, the following warning must be heeded:

Warning   **There is the danger of explosion if the battery is replaced incorrectly. Replace the battery only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.** Statement 1015

Secure Key

A hardware secure key storage unit is provided on the Cisco 3925 and Cisco 3945 routers to safely store passwords and credentials. The secure key storage unit is a self-contained tamper-resistant computer key-store that acts as a black box for credential storage by accepting credentials and never returning them.

Cryptographic Accelerator

Cisco 3925E and Cisco 3945E ISRs ship with a Services Performance Engine that includes an onboard cryptographic accelerator. It shares security processing for SSLVPN and IPSec. By default, acceleration of SSL is disabled so IPSec performance is maximized.

If you want to set up the router as an SSLVPN gateway, enable the SSLVPN feature with the **crypto engine accelerator bandwidth-allocation ssl fair** command. To learn more about the cryptographic accelerator, see the *Configuring the Security Features* module in the *Cisco 3900 series, 2900 series, and 1900 series Integrated Services Routers Software Configuration Guide* at Cisco.com.

Slot, Port, and Interface Information

Table 1-11 and Table 1-12 show slot, port, and interface numbering ranges.

On the Cisco 2901 router, the numbering format for slots and ports is defined as follows: **interface type** *0/slot/port*. "0" indicates slots that are built into the chassis of a router. On the Cisco 2901 router, all slots begin with "0," because all slots are built into the chassis. On the Cisco 2911, 2921, 2951, and Cisco 3900 series routers, some slots are built into the chassis and some are external.

Slots that are part of a network module or an extension voice module have numbers that begin with "1" or "2," respectively. See the module documentation for more information.

Table 1-11   Slot, Port, and Interfaces

Slots, Ports, Interface	2901[1]	2911 & 2921	2951 & 3925 & 3945	3925E & 3945E
GE	Gi0/0,Gi0/1	Gi0/0,Gi0/1,GI0/2	Gi0/0,Gi0/1,GI0/2	Gi0/0,Gi0/1,GI0/2, GI0/3
USB	*usbflash0, usbflash1* *usbtoken0, usbtoken1*	*usbflash0, usbflash1* *usbtoken0, usbtoken1*	*usbflash0, usbflash1* *usbtoken0, usbtoken1*	*usbflash0, usbflash1* *usbtoken0, usbtoken1*
Logical ISM-GE interface via PCIe	*interface ISM 0/0*	*service-module-name*-Gi 0/0	*service-module-name*-Gi 0/0	—
Logical ISM-GE interface via MGF	*interface ISM 0/1*	*service-module-name*-Gi 0/1	*service-module-name*-Gi 0/1	—
HWIC and VWIC interface	*interface*0/0/*port* *interface*0/1/*port* *interface*0/2/*port* *interface*0/3/*port*	*interface*0/0/*port* *interface*0/1/*port* *interface*0/2/*port* *interface*0/3/*port*	*interface*0/0/*port* *interface*0/1/*port* *interface*0/2/*port* *interface*0/3/*port*	*interface*0/0/*port* *interface*0/1/*port* *interface*0/2/*port*
Double-Wide HWIC interface	*interface*0/1/*port* *interface*0/3/*port*	*interface*0/1/*port* *interface*0/3/*port*	*interface*0/1/*port* *interface*0/3/*port*	*interface*0/1/*port*
SM interface	not supported	*interface*1/*port*	*interface*1-2/*port*[2] *interface*1-4/*port*[3]	*interface*1-2/*port* *interface*1-4/*port*
Double-Wide SM interface	not supported	*interface*1/*port*[4]	*interface*2/*port*[5] *interface*4/*port*[6]	*interface*2/*port* *interface*4/*port*
HWIC on SM interfaces VWIC on SM interfaces	not supported	*interface*1*wic-slot/port*	*interface*1-2/*wic-slot/port*[7] *interface*1-4/*wic-slot/port*[8]	*interface*1-2/*wic-slot/port* *interface*1-4/*wic-slot/port*

1. On the Cisco 2901 router, the numbering format for configuring an asynchronous interface is 0/slot/port. To configure the line associated with an asynchronous interface, use the interface number to specify the async line. For example, line 0/1/0 specifies the line associated with interface serial 0/1/0 on a WIC-2A/S in slot 1. Similarly, line 0/2/1 specifies the line associated with interface async 0/2/1 on a WIC-2AM in slot 2.

2. Applies only to Cisco 2951, Cisco 3925, and Cisco 3925E routers.

3. Applies only to Cisco 3945 and Cisco 3945E routers.

4. Applies only to Cisco 2921 router.

5. Applies only to Cisco 2951, Cisco 3925, and Cisco 3925E routers.

6. Applies only to Cisco 3945 and Cisco 3945E routers.

7. Applies only to Cisco 2951, Cisco 3925, and Cisco 3925E routers.

8. Applies only to Cisco 3945 and 3945E routers.

Table 1-12   Interface Numbering on Cisco 2911, 2921, 2951 ISRs and Cisco 3900 ISRs

Port Location	IOS Command Line Interface	Examples[1,2]
Interface card (DW-EHWIC, EHWIC,HWIC, HWIC-D, WIC, VWIC, VIC) plugged directly into an EHWIC slot	*Interface-type* **0** / *interface-card-slot*[3] / *port*	interface serial 0/x/y interface async 0/x/y line 0/x/y[4] interface fa 0/x/y voice-port 0/x/y
Interface card (WIC, VWIC, VIC) plugged into a service or network module	*Interface-type* **1**[5] / *interface-card-slot* / *port*	controller t1 1/x/y voice-port 1/x/y interface serial 1/x/y interface async 1/x/y line 1/x/y[4]
Built into a service or network module (NME, NME-X, NMD, NME-XD)	*Interface-type* **1**[5] / *port*	interface gi 1/x interface serial 1/x interface async 1/x line 1/x[4]
FXS or FXO port in an extension voice module (EVM)	*Interface-type* **2** / **0** / *port* FXS/DID port numbers 0 to 7 are built into the EVM. FXS/FXO port numbers 8 to 15 are in expansion module 0. FXS/FXO port numbers 16 to 23 are in expansion module 1.	voice-port 2/0/x
Voice port in a BRI expansion module (internal slot) in an extension voice module (EVM)	*Interface-type* **2** / **0** / *port* Port numbers are 8 to 11 in expansion module 0. Port numbers are 16 to 19 in expansion module 1.	voice-port 2/0/x
BRI interface in a BRI expansion module (internal slot) in an extension voice module	*Interface-type* **2** / *port* Port numbers are 0 to 3 if one expansion module is installed. Port numbers are 0 to 7 if two expansion modules are installed.	interface bri 2/x

1. Interface abbreviations: fa = Fast Ethernet; gi = Gigabit Ethernet; USB = universal serial bus; BRI = ISDN basic rate interface.
2. The interfaces listed are examples only; other possible interface types are not listed.
3. Only interface card slot numbers 1 and 3 are used for double-width (HWIC-D).
4. Specify the line number in the Cisco IOS command-line interface (CLI) by using the interface number for the associated asynchronous serial interface.
5. The network module slot number is 1 for all Cisco 2900 series routers.

Note   On the Cisco 2911, 2921, 2951 routers and Cisco 3900 series routers the interface numbering scheme is the same for asynchronous interfaces as for other types of interfaces. To configure the line associated with an async interface, use the interface number to specify the async line. For example, line 0/3/0 specifies the line associated with interface serial 0/3/0 on an WIC-2A/S in slot 3. Similarly, line 1/22 specifies the line associated with interface async 1/22 on an NM-32A in network module slot 1.

LED Indicators

Table 1-13 summarizes the LED indicators that are located on the router bezel or chassis, but not on the removable modules or interface cards.

For descriptions of LEDs in removable modules and interface cards, see the applicable documentation for those products.

For LED troubleshooting information, including possible trouble causes and corrective actions, see Table 1-13.

Table 1-13   Cisco 2900 and 3900 Series Routers LED Indicators

LED	Color	Description	Cisco 2900 Routers	Cisco 3900 Routers
POE	Green	IP phone power is on.	Front bezel	Front bezel
	Amber	IP phone power is not on.		
POE Boost	Green	IP Phone power is supplied by POE Boost power supply.	—	—
	Off	External POE Boost power supply is not on.	—	—
PS/PS1	Green	System is running.	Front bezel	Front bezel
	Amber	System is not running.		
PS2	Green	System is running.	Front bezel	Front bezel
	Amber	System is not running.		
AC OK[1]	Green	AC power connected.	Front bezel, not available on 2901	Front bezel
	Off	No AC power connected		
RPS	Green	System is running on external RPS power supply.	Front bezel, not available on 2901	—
SYS	Solid green	Solid green indicates normal operation.	Front bezel	Front bezel
	Blinking green	System is booting or is in ROM monitor mode.		
	Amber	System error.		
	Off	Power is off or system board is faulty.		
ACT	Solid or blinking green	Solid or blinking indicates packet activity between the forwarding and routing engine and any I/O port.	Front bezel	Front bezel
	Off	No packet transfers are occurring.		
RJ-45 CON	Green	Serial console is active.	Back panel	Back panel
USB CON	Green	USB console is active.	Back panel	Back panel

Table 1-13   *Cisco 2900 and 3900 Series Routers LED Indicators (continued)*

LED	Color	Description	Cisco 2900 Routers	Cisco 3900 Routers
GE: Link	Green	Solid green indicates the Ethernet port has a link partner.	Back panel	Back panel
SFP S	Blinking green	Blinking frequency indicates port speed. See the definition for the S LED.	Back panel	Back panel
SFP EN	Off	Not present.	Back panel	Back panel
	Green	Present and enabled.		
	Amber	Present with failure.		
CF0/CF1	Green	Flash memory is being accessed; do not eject the CompactFlash memory card.	Back panel	Back panel
	Amber	CompactFlash error.	Back panel	Back panel
	Off	Flash memory is not being accessed; okay to eject the CompactFlash memory card.	Back panel	Back panel
S (Speed)	1 blink + pause	FE or GE port operating at 10 Mb/s.	Back panel	Back panel
	2 blink + pause	FE or GE port operating at 100 Mb/s.		
	3 blink + pause	GE port operating at 1000 Mb/s.		
L (Link)	Green	FE or GE link is established.	Back panel	Back panel
	Off	No FE or GE link is established.		
PVDM 0,1,2, and 3	Green	PVDM is initialized.	Back panel	Back panel
	Amber	PVDM is detected but not initialized.	Back panel	Back panel
	Off	No PVDM installed.	Back panel	Back panel
ISM	Green	Initialized.		
	Amber	Initialized with error.		
	Off	Not installed.		

1.   LED goes off if the AC power fails or is disconnected. It does not go on and off with the switch.

Specifications

The following tables provide ISR specifications.

- Cisco 2901—Table 1-14
- Cisco 2911—Table 1-15
- Cisco 2921—Table 1-16
- Cisco 2951—Table 1-17
- Cisco 3900 series—Table 1-18

Table 1-14   Cisco 2901 Router Specifications

Description	Specification
Physical	
Dimensions (H x W x D)	1.75 x 17.25 x 17.3 in. (44.5 x 438.2 x 439.4 mm), 1 RU height
Weight - with AC PS (without modules)	13.4 lbs (6.08 kg)
Weight - with AC-POE PS (without modules)	14.3 lbs (6.49 kg)
Weight - fully configured	16.0 lb (7.26 kg)
Power	
AC input	
• Voltage	100 to 240 VAC, autoranging
• Frequency	47 to 63 Hz
• Current	1.5 A to 0.3 A (configuration dependent)
• Current with AC-POE	3.4 A to 0.3 A (configuration dependent)
• Surge current	30 A maximum at 115 VAC 60Hz, 60 A maximum at 230 VAC 50 Hz
Power consumption	
• AC power supply	55 W to 145 W, 188 to 495 BTU/hr (configuration dependent)
• AC-POE power supply	60 W to 330 W, 205 to 1126 BTU/hr (configuration dependent)
Ports	
Console	One RJ-45 connector and one mini USB Type B, USB 2.0 compliant
Auxiliary ports	RJ-45 connector
USB ports	Two USB Type A, USB 2.0 compliant, 2.5 W (500 mA) max.[1]
10/100/1000 Gigabit Ethernet	Two RJ-45 connectors (GE0/0, GE0/1), auto-MDIX[2]
Environmental	
Operating humidity	10 to 85% RH
Operating humidity (short-term per NEBS)	NA
Operating temperature - up to 5906 ft (1800 m) elevation	32 to 104°F (0 to 40°C)

Table 1-14   Cisco 2901 Router Specifications (continued)

Description	Specification
Operating temperature - up to 9843 ft (3000 m) elevation	32 to 77°F (0 to 25°C)
Operating altitude maximum	10,000 ft (3000 m)
Transportation and Storage Environment	
Nonoperating temperature	–40 to 158°F (–40 to 70°C)
Nonoperating humidity	5 to 95% RH
Nonoperating altitude	15,000 ft (4570 m)
Acoustic	
Sound Pressure (Typ/Max)	41/53
Sound Power (Typ/Max)	49/61 dBA
Regulatory	
Safety compliance	IEC 60950-1, Safety of information technology equipment
	EN 60950-1, Safety of information technology equipment
	UL 60950-1, Standard for safety for information technology equipment [US]
	CAN/CSA C22.2 No. 60950-1, Safety of information technology equipment including electrical business equipment [Canada]
	AS/NZS 60950.1 2003
	IEC60950, 3rd edition [PRC]
	IEC60950, 2nd Edition [Mexico]
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Router* document.

Table 1-14   Cisco 2901 Router Specifications (continued)

Description	Specification
Immunity compliance	CISPR24 ITE-Immunity characteristics, Limits and methods of measurement
	EN 55024 ITE-Immunity characteristics, Limits and methods of measurement
	EN50082-1 Electromagnetic compatibility - Generic immunity standard - Part 1
	EN300-386 Electromagnetic compatibility for TNE
	SD/EMI
	EN61000-6-1
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Routers* document.
EMC compliance	EN 55022, class A
	CISPR22, class A
	CFR47, Part 15, Subpart B, class A
	EN300386, Class A
	AS/NZS CISPR22, Class A
	VCCI, Class A
	SD/EMI, Class A
	Harmonic Current Emission EN61000-3-2 for EUT Power requirements <16A EN61000-3-12 for EUT Power requirements >16A
	Voltage Fluctuation and Flicker EN61000-3-3 for EUT Power requirements <16 EN61000-3-11 for EUT Power requirements >16A
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Router* document.

1. 480 Mb/s individually, bandwidth is shared when both are used.

2. Auto-MDIX = auto media-dependent interface cross over.

Table 1-15   Cisco 2911 (including 2911-T) Router Specifications

Description	Specification
Dimensions (H x W x D)	3.5 x 17.25 x 12.0 in. (88.9 x 438.2 x 304.8mm), 2 RU height
Weight - with AC power supply (without modules)	18.0 lbs (8.2 kg)
Weight - with AC-POE power supply (without modules)	19.0 lbs (8.6 kg)

Table 1-15   Cisco 2911 (including 2911-T) Router Specifications (continued)

Description	Specification
Weight - with DC-POE power supply (without modules)	18.8 lbs (8.5 kg)
With DC power supply (without modules)	Not Available
Weight - fully configured	21 lb (9.5 kg)
Power	
AC input	
• Voltage	100 to 240 VAC, autoranging
• Frequency	47 to 63 Hz
• Current	2.3 A to 0.35 A (configuration dependent)
• Current with AC-POE	3.5 A to 0.4 A (configuration dependent)
• Surge current	30 A maximum at 115 VAC 60 Hz, 60 A maximum at 230 VAC 50 Hz
DC input (for DC-POE power supply)	
• Voltage	-40 to -60 VDC
• Current	9 A to 1 A (configuration dependent)
Power Consumption	
• AC power supply	65 W to 220 W, 221 to 751 BTU/hr (configuration dependent)
• AC-POE power supply	70 W to 330 W, 239 to 1126 BTU/hr (configuration dependent)
• DC-POE power supply	60 W to 320 W (configuration dependent)
Ports	
Console port	One RJ-45 connector and one mini USB Type B, USB 2.0 compliant
Auxiliary port	RJ-45 connector
USB ports	Two USB Type A, USB 2.0 compliant, 2.5 W (500 mA) max.[1]
10/100/1000 Gigabit Ethernet	Three RJ-45 connectors (GE0/0, GE0/1, GE0/2), auto-MDIX[2]
Environmental	
Operating humidity	5 to 85% RH
Operating humidity (short-term per NEBS)	5% to 90%, but not to exceed 0.024 kg water/kg of dry air
Operating temperature up to 5906 ft (1800 m) elevation	Cisco 2911 model: 32 to 104°F (0 to 40°C) Cisco 2911-T model: 32 to 140°F (0 to 60°C)
Operating temperature up to 5906 ft (1800 m) elevation, with filter	Cisco 2911 model: 32 to 104°F (0 to 40°C) Cisco 2911-T model: 32 to 122°F (0 to 50°C)
Operating temperature up to 9843 ft (3000 m) elevation, with or without filter	32 to 104°F (0 to 40°C)

Table 1-15   Cisco 2911 (including 2911-T) Router Specifications (continued)

Description	Specification
Operating temperature up to 13,123 ft (4000 m) elevation	32 to 86°F (0 to 30°C)
Temperature - (Short-term per NEBS/1800m max altitude)	23°F to 122°F (-5°C to 50°C)
Operating altitude maximum	13,123 ft (4000 m)
Transportation and Storage	
Non-operating temperature	-40 to 176°F (-40 to 80°C)
Non-operating humidity	5 to 95% RH
Non-operating altitude	15,000 ft (4570 m)
Acoustic	
Acoustic: Sound Pressure (Typical/Maximum)	51.8/62.9 dBA
Acoustic: Sound Power (Typical/Maximum)	58.5/70.3 dBA
Regulatory	
Safety compliance	IEC 60950-1, Safety of information technology equipment
	EN 60950-1, Safety of information technology equipment
	UL 60950-1, Standard for safety for information technology equipment [US]
	CAN/CSA C22.2 No. 60950-1, Safety of information technology equipment including electrical business equipment [Canada]
	AS/NZS 60950.1 2003
	IEC60950, 3rd edition [PRC]
	IEC60950, 2nd Edition [Mexico]
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Router* document.

Table 1-15   Cisco 2911 (including 2911-T) Router Specifications (continued)

Description	Specification
Immunity compliance	CISPR24 ITE-Immunity characteristics, Limits and methods of measurement
	EN 55024 ITE-Immunity characteristics, Limits and methods of measurement
	EN 50082-1 Electromagnetic compatibility - Generic immunity standard - Part 1
	EN 300-386 Electromagnetic compatibility for TNE
	SD/EMI
	EN 61000-6-1
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Router* document.
EMC compliance	EN 55022, class A
	CISPR22, class A
	CFR47, Part 15, Subpart B, class A
	EN300386, Class A
	AS/NZS CISPR22, Class A
	VCCI, Class A
	SD/EMI, Class A
	Harmonic Current Emission EN61000-3-2 for EUT Power requirements <16A EN61000-3-12 for EUT Power requirements >16A
	Voltage Fluctuation and Flicker EN61000-3-3 for EUT Power requirements <16 EN61000-3-11 for EUT Power requirements >16A
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Router* document.

1. 480 Mb/s individually, bandwidth is shared when both are used.

2. Auto-MDIX = auto media-dependent interface crossover

Table 1-16   Cisco 2921 Router Specifications

Description	Specification
Physical	
Dimensions (H x W x D)	3.5 x 17.25 x 18.5 in. (88.9 x 438.2 x 469.9 mm), 2 RU height
Weight with AC PS (w/o modules)	29.0 lbs (13.15 kg)
Weight with AC-POE PS (w/o modules)	30.0 lbs (13.6 kg)

Table 1-16   Cisco 2921 Router Specifications (continued)

Description	Specification
With DC PS (w/o modules)	NA
Weight (fully configured)	34 lb, 14.42 kg
Power	
AC input power	
• Input voltage	100 to 240 VAC, autoranging
• Frequency	47 to 63 Hz
• Input current	0.4 A to 3.3 A (configuration dependent)
• Input current with AC-POE	0.4 A to 7.6 A (configuration dependent)
• Surge current	60 A peak and less than 12 Arms per half cycle
Power consumption	75 W to 320 W, 256 to 1092 BTU/hr (configuration dependent)
• With AC-POE	80W to 750 W, 273 to 753 BTU/hr (configuration dependent)
Ports	
Console ports	One RJ-45 connector and one mini USB Type B, USB 2.0 compliant
Auxiliary port	RJ-45 connector
USB ports	Two USB Type A, USB 2.0 compliant, 2.5 W (500 mA) max.[1]
10/100/1000 Gigabit Ethernet	Three RJ-45 connectors (GE0/0, GE0/1, GE0/2), auto-MDIX
SFP	One RJ-45 connector supports an SFP module. When an SFP module is installed, the adjacent RJ-45 GE connector is disabled.
Environmental	
Operating humidity	10 to 85% RH
Operating temperature up to 5906 ft (1800 m) elevation	32 to 104°F (0 to 40°C)
Operating temperature up to 9843 ft (3000 m) elevation	32 to 104°F (0 to 40°C)
Operating altitude	9842 ft (3000 m) maximum
Transportation and Storage	
Nonoperating temperature	-40 to 158°F (-40 to 70°C)
Nonoperating humidity	5 to 95% RH
Nonoperating altitude	15,000 ft (4570 m)
Acoustic	
Acoustic: Sound Pressure (Typical/Maximum)	54.4 to 67.4 dBA
Acoustic: Sound Power (Typical/Maximum)	62.6 to 74.5 dBA

Table 1-16   Cisco 2921 Router Specifications (continued)

Description	Specification
Regulatory	
Safety compliance	IEC 60950-1, Safety of information technology equipment
	EN 60950-1, Safety of information technology equipment
	UL 60950-1, Standard for safety for information technology equipment [US]
	CAN/CSA C22.2 No. 60950-1, Safety of information technology equipment including electrical business equipment [Canada]
	AS/NZS 60950.1 2003
	IEC60950, 3rd edition [PRC]
	IEC60950, 2nd Edition [Mexico]
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Router* document.

Table 1-16   Cisco 2921 Router Specifications (continued)

Description	Specification
Immunity compliance	CISPR24 ITE-Immunity characteristics, Limits and methods of measurement
	EN 55024 ITE-Immunity characteristics, Limits and methods of measurement
	EN 50082-1 Electromagnetic compatibility - Generic immunity standard - Part 1
	EN 300-386 Electromagnetic compatibility for TNE
	SD/EMI
	EN 61000-6-1
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Routers* document.
EMC compliance	EN 55022, class A
	CISPR22, class A
	CFR47, Part 15, Subpart B, class A
	EN 300386, Class A
	AS/NZS CISPR22, Class A
	VCCI, Class A
	SD/EMI, Class A
	Harmonic Current Emission EN 61000-3-2 for EUT Power requirements <16A EN 61000-3-12 for EUT Power requirements >16A
	Voltage Fluctuation and Flicker EN 61000-3-3 for EUT Power requirements <16 EN 61000-3-11 for EUT Power requirements >16A
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Router* document.

1. 480 Mb/s individually, bandwidth is shared when both are used.

Table 1-17   Cisco 2951 Router Specifications

Description	Specification
Physical	
Dimensions (H x W x D)	3.5 x 17.25 x 18.5 in. (88.9 x 438.2 x 469.9 mm), 2 RU height
Weight with AC power supply (without modules)	29.0 lbs (13.15 kg)
Weight with AC-POE power supply (without modules)	30.0 lbs (13.6 kg)

Table 1-17   Cisco 2951 Router Specifications (continued)

Description	Specification
With DC power supply (without modules)	NA
Weight (fully configured)	34 lb (14.42 kg)
Power	
AC input power	
• Input voltage	100 to 240 VAC, autoranging
• Frequency	47 to 63 Hz
• Input current	0.4 to 3.3 A (configuration dependent)
• Input current with AC-POE	0.4 to 7.6 A (configuration dependent)
• Surge current	60 A peak and less than 12 Arms per half cycle
Power consumption	75 to 320 W, 256 to 1092 BTU/hr (configuration dependent)
• With AC-POE	80 to 750 W, 273 to 753 BTU/hr (configuration dependent)
Ports	
Console port	One RJ-45 connector and one mini USB Type B, USB 2.0 compliant
Auxiliary port	RJ-45 connector
USB ports	Two USB Type A, USB 2.0 compliant, 2.5 W (500 mA) max.[1]
10/100/1000 Gigabit Ethernet	Three RJ-45 connectors (GE0/0, GE0/1, GE0/2), auto-MDIX
SFP	One RJ-45 connectors supports an SFP module. When an SFP module is installed the adjacent RJ-45 GE connector is disabled. See Table 1-4 for a list of supported modules.
Environmental	
Operating humidity	5 to 85% RH
Operating humidity (short-term per NEBS)	5 to 90%, but not to exceed 0.024 kg water/kg of dry air
Operating temperature - up to 5906 ft (1800 m) elevation	32 to 104°F (0 to 40°C)
Operating temperature - up to 9843 ft (3000 m) elevation	32 to 104°F (0 to 40°C)
Operating temperature - up to 13,123 ft (4000 m) elevation	32 to 86 °F (0 - 30 °C)
Temperature - Short-term per NEBS/1800m max altitude	23 to 122°F (-5°C to 50°C)
Operating altitude maximum	13,123 ft (4000 m)
Transportation and Storage	
Nonoperating temperature	-40 to 158°F (-40 to 70°C)
Nonoperating humidity	5 to 95% RH
Nonoperating altitude	15,000 ft (4570 m)

Table 1-17   Cisco 2951 Router Specifications (continued)

Description	Specification
Acoustic	
Acoustic: Sound Pressure (Typical/Maximum)	54.4 to 67.4 dBA
Acoustic: Sound Power (Typical/Maximum)	62.6 to 74.5 dBA
Regulatory	
Safety compliance	IEC 60950-1, Safety of information technology equipment
	EN 60950-1, Safety of information technology equipment
	UL 60950-1, Standard for safety for information technology equipment [US]
	CAN/CSA C22.2 No. 60950-1, Safety of information technology equipment including electrical business equipment [Canada]
	AS/NZS 60950.1 2003
	IEC60950, 3rd edition [PRC]
	IEC60950, 2nd Edition [Mexico]
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Router* document

Table 1-17   Cisco 2951 Router Specifications (continued)

Description	Specification
Immunity compliance	CISPR24 ITE-Immunity characteristics, Limits and methods of measurement
	EN 55024 ITE-Immunity characteristics, Limits and methods of measurement
	EN 50082-1 Electromagnetic compatibility - Generic immunity standard - Part 1
	EN 300-386 Electromagnetic compatibility for TNE
	SD/EMI
	EN 61000-6-1
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Router* document
EMC compliance	EN 55022, class A
	CISPR22, class A
	CFR47, Part 15, Subpart B, class A
	EN 300386, Class A
	AS/NZS CISPR22, Class A
	VCCI, Class A
	SD/EMI, Class A
	Harmonic Current Emission EN 61000-3-2 for EUT Power requirements <16A EN 61000-3-12 for EUT Power requirements >16A
	Voltage Fluctuation and Flicker EN 61000-3-3 for EUT Power requirements <16 EN 61000-3-11 for EUT Power requirements >16A
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Router* document.

1. 480 Mb/s individually, bandwidth is shared when both are used.

Table 1-18   Cisco 3900 Series Router Specifications

Description	Specification
Physical	
Dimensions (H x W x D)	5.25 x 17.25 x 18.75 in. (133.4 x 438.2 x 476.2 mm), 3 RU height
Weight with AC PS (w/o modules)	39.0 lbs (17.69 kg)
Weight with AC-POE PS (w/o modules)	40.0 lbs (18.14 kg)
With DC PS (w/o modules)	Not available (NA)

Table 1-18   Cisco 3900 Series Router Specifications (continued)

Description	Specification
Weight (fully configured)	60 lb (27.21 kg)
Power	
AC input power (Cisco 3945)	
• Input voltage	100 to 240 VAC, autoranging
• Frequency	47 to 63 Hz
• Input current	0.4 to 3.5 A (configuration dependent)
• Input current with AC-POE	0.4 to 7.0 A (configuration dependent)
• Surge current	30 A maximum at 115 VAC 60 Hz, 60 A maximum at 230 VAC 50 Hz
Power consumption (Cisco 3945)	85 to 400 W, 600 to 1370 BTU/hr (configuration dependent)
• With AC-POE	85 to 800 W, 600 to 2740 BTU/hr (configuration dependent)
Ports	
Console port	One RJ-45 connector and one mini USB Type B, USB 2.0 compliant
Auxiliary port	RJ-45 connector
USB ports	Two USB Type A, USB 2.0 compliant, 2.5 W (500 mA) max.[1]
10/100/1000 Gigabit Ethernet	Three or Four RJ-45 connectors (GE0/0, GE0/1, GE0/2, GE0/3), auto-MDIX[2]. **Note** Cisco 3925E and Cisco 3945E routers have four RJ-45 connectors that support Gigabit Ethernet networks.
SFP	Two RJ-45 connectors support SFP modules. When an SFP module is installed the adjacent RJ-45 GE connector is disabled. See Table 5-3 for a list of supported modules.
Environmental	
Operating humidity	5 to 85% RH
Operating humidity (short-term per NEBS)	5% to 90%, but not to exceed 0.024 kg water/kg of dry air
Operating temperature up to 5906 ft (1800 m) elevation	32 to 104°F (0 to 40°C)
Operating temperature up to 9843 ft (3000 m) elevation	32 to 104°F (0 to 40°C)
Operating temperature up to 13,123 ft (4000 m) elevation	32 to 86 °F (0 - 30 °C)
Temperature - Short-term per NEBS/1800m max altitude	23 to 122°F (-5°C to 50°C)
Operating altitude maximum	13,123 ft (4000 m)
Transportation and Storage	
Nonoperating temperature	-40 to 158°F (-40 to 70°C)
Nonoperating humidity	5 to 95% RH

Table 1-18   *Cisco 3900 Series Router Specifications (continued)*

Description	Specification
Nonoperating altitude	15,000 ft (4570 m)
Acoustic	
Acoustic: Sound Pressure (Typical/Maximum)	57.6 to 77.6 dBA
Acoustic: Sound Power (Typical/Maximum)	67.8 to 84.7 dBA
Environmental	
Operating humidity	5 to 85% RH
Operating humidity (short-term per NEBS)	5 to 90%, but not to exceed 0.024 kg water/kg of dry air
Operating temperature up to 5906 ft (1800 m) elevation	32 to 104°F (0 to 40°C)
Safety compliance	IEC 60950-1, Safety of information technology equipment
	EN 60950-1, Safety of information technology equipment
	UL 60950-1, Standard for safety for information technology equipment [US]
	CAN/CSA C22.2 No. 60950-1, Safety of information technology equipment including electrical business equipment [Canada]
	AS/NZS 60950.1 2003
	IEC60950, 3rd edition [PRC]
	IEC60950, 2nd Edition [Mexico]
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 3900 Series Integrated Services Routers* document.

Table 1-18   Cisco 3900 Series Router Specifications (continued)

Description	Specification
Immunity compliance	CISPR24 ITE-Immunity characteristics, Limits and methods of measurement
	EN 55024 ITE-Immunity characteristics, Limits and methods of measurement
	EN 50082-1 Electromagnetic compatibility - Generic immunity standard - Part 1
	EN 300-386 Electromagnetic compatibility for TNE
	SD/EMI
	EN 61000-6-1
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 3900 Series Integrated Services Routers* document.
EMC compliance	EN 55022, class A
	CISPR22, class A
	CFR47, Part 15, Subpart B, class A
	EN300386, Class A
	AS/NZS CISPR22, Class A
	VCCI, Class A
	SD/EMI, Class A
	Harmonic Current Emission EN 61000-3-2 for EUT Power requirements <16A EN 61000-3-12 for EUT Power requirements >16A
	Voltage Fluctuation and Flicker EN 61000-3-3 for EUT Power requirements <16 EN 61000-3-11 for EUT Power requirements >16A
	For detailed compliance information, see the *Regulatory Compliance and Safety Information for Cisco 3900 Series Integrated Services Routers* document.

1. 480 Mb/s individually, bandwidth is shared when both are used.

2. Auto-MDIX = auto media-dependent interface crossover

Periodic Inspection and Cleaning

Periodic inspection and cleaning of the external surface of the router is recommended to minimize the negative impact of environmental dust or debris. The frequency of inspection and cleaning is dependent upon the severity of the environmental conditions, but a minimum of every six months is recommended. Cleaning involves vacuuming of router air intake and exhaust vents and replacement of air filters. See the "Fans, Ventilation, and Airflow" section on page 1-26 and the "Replacing a Fan Tray or Air Filter" section on page 5-44.

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Caution   Sites with ambient temperatures consistently above 25°C or 77°F and with potentially high levels of dust or debris may require periodic preventative maintenance cleaning.

Preparing for Router Installation

This document provides preinstallation information, such as recommendations and requirements that should be before installing your router. See the following sections to prepare for installation:

To see translated warnings that appear in this publication, see the *Cisco 2900 and 3900 Series Integrated Services Routers Regulatory Compliance and Safety Information* document.

Warnings

Warning Statements

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

Warning **This equipment must be installed and maintained by service personnel as defined by AS/NZS 3260. Incorrectly connecting this equipment to a general-purpose outlet could be hazardous. The telecommunications lines must be disconnected 1) before unplugging the main power connector or 2) while the housing is open, or both.** Statement 1043

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

Warning   **Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.** Statement 1029

Warning   **Hazardous network voltages are present in WAN ports regardless of whether power to the unit is OFF or ON. To avoid electric shock, use caution when working near WAN ports. When detaching cables, detach the end away from the unit first.** Statement 1026

Warning   **This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.** Statement 1024

Warning   **Before opening the unit, disconnect the telephone-network cables to avoid contact with telephone-network voltages.** Statement 1041

Warning   **Do not use this product near water; for example, near a bath tub, wash bowl, kitchen sink or laundry tub, in a wet basement, or near a swimming pool.** Statement 1035

Warning   **Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.** Statement 1036

Warning   **Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.** Statement 1037

Warning   **Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.** Statement 1038

Warning   **To report a gas leak, do not use a telephone in the vicinity of the leak.** Statement 1039

Warning   **his unit is intended for installation in restricted access areas. A restricted access area can be accessed only through the use of a special tool, lock and key, or other means of security.** Statement 1017

Protection from Airborne Pollutants

Cisco ISR platforms are designed for and intended to be deployed/installed in environmentally controlled spaces that maintain ambient conditions meeting the environmental parameters defined in the documentation for the equipment. Sites that subject the equipment to direct exposure to airborne pollutants from sources such as automotive and other vehicular traffic, industrial sites, or other sources that generate pollutants, are not supported. Such exposure may include corrosive materials that can lead to early failure of the equipment.

Safety Recommendations

Follow these guidelines to ensure general safety:

- Keep the chassis area clear and dust-free during and after installation.
- If you remove the chassis cover, put it in a safe place.
- Keep tools and chassis components away from walk areas.
- Do not wear loose clothing that could get caught in the chassis. Fasten your tie or scarf and roll up your sleeves.
- Wear safety glasses when working under conditions that might be hazardous to your eyes.
- Do not perform any action that creates a hazard to people or makes the equipment unsafe.

Safety with Electricity

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

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

Warning   **Read the installation instructions before connecting the system to the power source.** Statement 1004

Warning   **Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.** Statement 1029

Warning   **The covers are an integral part of the safety design of the product. Do not operate the unit without the covers installed.** Statement 1077

Follow these guidelines when working on equipment powered by electricity:

- Locate the emergency power-off switch in the room in which you are working. If an electrical accident occurs, you can quickly turn off the power.
- Disconnect all power before doing the following:
  - Installing or removing a chassis
  - Working near power supplies
- Look carefully for possible hazards in your work area, such as moist floors, ungrounded power extension cables, frayed power cords, and missing safety grounds.
- Do not work alone if hazardous conditions exist.
- Never assume that power is disconnected from a circuit. Always check.
- Never open the enclosure of the internal power supply.
- If an electrical accident occurs, proceed as follows:
  - Use caution; do not become a victim yourself.
  - Turn off power to the device.
  - If possible, send another person to get medical aid. Otherwise, assess the condition of the victim and then call for help.
  - Determine if the person needs rescue breathing or external cardiac compressions; then take appropriate action.

In addition, use the following guidelines when working with any equipment that is disconnected from a power source but still connected to telephone wiring or other network cabling:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for it.
- Never touch uninsulated telephone wires or terminals unless the telephone line is disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) can damage equipment and impair electrical circuitry. It can occur if electronic printed circuit cards are improperly handled and can cause complete or intermittent failures. Always follow ESD prevention procedures when removing and replacing modules:

- Ensure that the router chassis is electrically connected to ground.
- Wear an ESD-preventive wrist strap, ensuring that it makes good skin contact. Connect the clip to an unpainted surface of the chassis frame to channel unwanted ESD voltages safely to ground. To guard against ESD damage and shocks, the wrist strap and cord must operate effectively.
- If no wrist strap is available, ground yourself by touching a metal part of the chassis.

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Caution   For the safety of your equipment, periodically check the resistance value of the antistatic strap. It should be between 1 and 10 megohms (Mohm).

General Site Requirements

This section describes the requirements your site must meet for safe installation and operation of your router. Ensure that the site is properly prepared before beginning installation. If you are experiencing shutdowns or unusually high errors with your existing equipment, this section can also help you isolate the cause of failures and prevent future problems.

Rack Requirements

Some Cisco routers include brackets for use with a 19-inch rack or, if specified in your order, optional larger brackets for use with a 23-inch rack.

The following information can help you plan your equipment rack configuration:

- Allow clearance around the rack for maintenance.
- Allow at least one rack unit of vertical space between routers.
- Enclosed racks must have adequate ventilation. Ensure that the rack is not congested, because each router generates heat. An enclosed rack should have louvered sides and a fan to provide cooling air. Heat generated by equipment near the bottom of the rack can be drawn upward into the intake ports of the equipment above it.
- When mounting a chassis in an open rack, ensure that the rack frame does not block the intake or exhaust ports. If the chassis is installed on slides, check the position of the chassis when it is seated in the rack.

Router Environmental Requirements

Cisco 2900 series routers can be placed on a desktop or installed in a rack. The Cisco 2901 router can also be wall mounted. The location of your router and the layout of your equipment rack or wiring room are extremely important considerations for proper operation. Equipment placed too close together, inadequate ventilation, and inaccessible panels can cause malfunctions and shutdowns, and can make maintenance difficult. Plan for access to both front and rear panels of the router.

When planning your site layout and equipment locations, refer to the "General Site Requirements" section on page 2-5, section. If you are currently experiencing shutdowns or an unusually high number of errors with your existing equipment, these precautions and recommendations may help you isolate the cause of failure and prevent future problems.

- Ensure that the room where your router operates has adequate air circulation. Electrical equipment generates heat. Without adequate air circulation, ambient air temperature may not cool equipment to acceptable operating temperatures.
- Always follow ESD-prevention procedures described in the "Preventing Electrostatic Discharge Damage" section on page 2-4 to avoid damage to equipment. Damage from static discharge can cause immediate or intermittent equipment failure.
- Ensure that the chassis cover and module rear panels are secure. All empty network module slots, interface card slots, and power supply bays must have filler panels installed. The chassis is designed to allow cooling air to flow within it, through specially designed cooling slots. A chassis with uncovered openings permits air leaks, which may interrupt and reduce the flow of air across internal components.

- Baffles can help to isolate exhaust air from intake air, which also helps to draw cooling air through the chassis. The best placement of the baffles depends on the airflow patterns in the rack, which can be found by experimenting with different configurations.
- When equipment installed in a rack (particularly in an enclosed rack) fails, try operating the equipment by itself, if possible. Power off other equipment in the rack (and in adjacent racks) to allow the router under test a maximum of cooling air and clean power.

Power Guidelines and Requirements

Check the power at your site to ensure that you are receiving "clean" power (free of spikes and noise). Install a power conditioner if necessary.

The AC power supply includes the following features:

- Autoselects either 110 V or 220 V operation.
- All units include a 6-foot (1.8-meter) electrical power cord. (A label near the power inlet indicates the correct voltage, frequency [AC-powered systems only], current draw, and power dissipation for the unit.)

For the power requirements for the Cisco 2900 and 3900 series routers, see the specifications table for each router model, which can be found at the following link:

http://www.cisco.com/en/US/docs/routers/access/2900/hardware/installation/guide/Overview.html#wp1207121

Network Cabling Specifications

The following sections describe the cables needed to install your Cisco 2900 and 3900 series ISR in the following sections:

- Console and Auxiliary Port Considerations, page 2-7
- Preparing for Network Connections, page 2-10

Console and Auxiliary Port Considerations

The router includes an asynchronous serial console port and an auxiliary port. The console and auxiliary ports provide access to the router either locally using a console terminal connected to the console port, or remotely using a modem connected to the auxiliary port. This section discusses important cabling information to consider before connecting the router to a console terminal or modem.

The main difference between the console and auxiliary ports is that the auxiliary port supports hardware flow control and the console port does not. Flow control paces the transmission of data between a sending device and a receiving device. Flow control ensures that the receiving device can absorb the data sent to it before the sending device sends more. When the buffers on the receiving device are full, a message is sent to the sending device to suspend transmission until the data in the buffers has been processed. Because the auxiliary port supports flow control, it is ideally suited for use with the high-speed transmissions of a modem. Console terminals send data at speeds slower than modems do; therefore, the console port is ideally suited for use with console terminals.

Console Port Connections

The router has both EIA/TIA-232 asynchronous (RJ-45) and USB 5-pin mini Type B, 2.0 compliant serial console ports. The console ports do not have any hardware flow control. Shielded USB cables with properly terminated shields are recommended.

EIA/TIA-232

Depending on the cable and the adapter used, this port appears as a DTE or DCE device at the end of the cable. Only one port can be used at the same time.

The default parameters for the console port are 9600 baud, 8 data bits, 1 stop bit, and no parity. The console port does not support hardware flow control. For detailed information about installing a console terminal, see the "Connecting to a Console Terminal or Modem" section on page 3-30.

For cable and port pinouts, see the *Cisco Modular Access Router Cable Specifications* document located at Cisco.com.

USB Serial Console

The USB serial console port connects directly to the USB connector of a PC using a USB Type A to 5-pin mini USB Type-B cable. The USB Console supports full speed (12Mb/s) operation. The console port does not support hardware flow control.

> **Note**   Always use shielded USB cables with a properly terminated shield.

The default parameters for the console port are 9600 baud, 8 data bits, no parity, and 1 stop bit. The console port does not support mode control. For detailed information about installing a console terminal, see the "Connecting to a Console Terminal or Modem" section on page 3-30.

For operation with Microsoft Windows, the Cisco Windows USB Console Driver must be installed on any PC connected to the console port. If the driver is not installed, prompts guide you through a simple installation process. For detailed information about installing the Cisco Windows USB Console Driver see "Installing the Cisco Microsoft Windows USB Device Driver" section on page 3-35.

The Cisco Windows USB Console Driver allows plugging and unplugging the USB cable from the console port without affecting Windows HyperTerminal operations. No special drivers are needed for Mac OS X or Linux.

Only one console port can be active at a time. When a cable is plugged into the USB console port, the RJ-45 port becomes inactive. Conversely, when the USB cable is removed from the USB port, the RJ-45 port becomes active.

Baud rates for the USB console port are 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 bps.

> **Note**   4-pin mini USB Type-B connectors are easily confused with 5-pin mini USB Type-B connectors. Only the 5-pin mini USB Type-B is supported.

USB Console OS Compatibility

- Windows 2000, Window XP 32 bit, Windows Vista 32 bit
- Mac OS X version 10.5.4
- Redhat / Fedora Core 10 with kernel 2.6.27.5-117
- Ubuntu 8.10 with kernel 2.6.27-11
- Debian 5.0 with kernel 2.6
- Suse 11.1 with kernel 2.6.27.7-9

Auxiliary Port Connections

The router has an EIA/TIA-232 asynchronous serial auxiliary port (RJ-45) that supports flow control. Depending on the cable and the adapter used, this port appears as a DTE or DCE device at the end of the cable.

For connection to a modem, your router is provided with an RJ-45-to-DB-25 adapter cable. (A DB-9-to-DB-25 adapter is also included with the Cisco 2901 router.)

For detailed information about connecting devices to the auxiliary port, see the "Connecting to a Console Terminal or Modem" section on page 3-30.

For cable and port pinouts, see the *Cisco Modular Access Router Cable Specifications* document at Cisco.com.

Preparing for Network Connections

When setting up your router, consider distance limitations and potential electromagnetic interference (EMI) as defined by the applicable local and international regulations.

Network connection considerations are provided for several types of network interfaces and are described in the following sections:

- Ethernet Connections, page 2-10
- Serial Connections, page 2-10
- ISDN BRI Connections, page 2-12
- CSU/DSU Connections, page 2-13

See the following online document for more information about network connections and interfaces:

- *Cisco Modular Access Router Cable Specifications*

⚠️

Warning   **To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors.** Statement 1021

Ethernet Connections

The IEEE has established Ethernet as standard IEEE 802.3. Cisco 2900 series routers support the following Ethernet implementations:

- 1000BASE-T—1000 Mb/s full-duplex transmission over a Category 5 or better unshielded twisted-pair (UTP) cable. Supports the Ethernet maximum length of 328 feet (100 meters).
- 100BASE-T—100 Mb/s full-duplex transmission over a Category 5 or better unshielded twisted-pair (UTP) cable. Supports the Ethernet maximum length of 328 feet (100 meters).
- 10BASE-T—10 Mb/s full-duplex transmission over a Category 5 or better unshielded twisted-pair (UTP) cable. Supports the Ethernet maximum length of 328 feet (100 meters).

See the *Cisco Modular Access Router Cable Specifications* document at Cisco.com for information about Ethernet cables, connectors, and pinouts.

Serial Connections

Serial connections are provided by WAN interface cards and network modules. Before you connect a device to a serial port, you need to know the following:

- Type of device, data terminal equipment (DTE), or data communications equipment (DCE), you are connecting to the synchronous serial interface
- Type of connector, male or female, required to connect to the device
- Signaling standard required by the device

Configuring Serial Connections

The serial ports on the asynchronous/synchronous serial network modules and the serial WAN interface card use DB-60 connectors. Serial ports can be configured as DTE or DCE, depending on the serial cable used.

Serial DTE or DCE Devices

A device that communicates over a synchronous serial interface is either a DTE or DCE device. A DCE device provides a clock signal that paces the communications between the device and the router. A DTE device does not provide a clock signal. DTE devices usually connect to DCE devices. The documentation that accompanied the device should indicate whether it is a DTE or DCE device. (Some devices have a jumper to select either DTE or DCE mode.) Table 2-1 lists typical DTE and DCE devices.

Table 2-1   Typical DTE and DCE Devices

Device Type	Gender	Typical Devices
DTE	Male[1]	Terminal
		PC
DCE	Female[2]	Modem
		CSU/DSU
		Multiplexer

1. If pins protrude from the base of the connector, the connector is male.
2. If the connector has holes to accept pins, the connector is female.

Signaling Standards Supported

The synchronous serial ports available for the router support the following signaling standards: they are EIA/TIA-232, EIA/TIA-449, V.35, X.21, and EIA-530. You can order a Cisco DB-60 shielded serial transition cable that has the appropriate connector for the standard you specify. The documentation for the device you want to connect should indicate the standard used for that device. The router end of the shielded serial transition cable has a DB-60 connector, which connects to the DB-60 port on a serial WAN interface card. The other end of the serial transition cable is available with a connector appropriate for the standard you specify.

The synchronous serial port can be configured as DTE or DCE, depending on the attached cable (except EIA-530, which is DTE only).

All serial ports configured as DTE require external clocking from a CSU/DSU or other DCE device.

Although manufacturing your own serial cables is not recommended (because of the small size of the pins on the DB-60 serial connector), cable pinouts are provided in the *Cisco Modular Access Router Cable Specifications* document.

Distance Limitations

Serial signals can travel a limited distance at any given bit rate; generally, the slower the data rate, the greater the distance. All serial signals are subject to distance limits, beyond which a signal significantly degrades or is completely lost.

Note   Only the serial WAN interface card supports bit rates above 128 Kbps.

Table 2-2 lists the recommended maximum speeds and distances for each serial interface type; however, you might get good results at speeds and distances greater than those listed, if you understand the electrical problems that might arise and can compensate for them. For instance, the recommended maximum rate for V.35 is 2 Mb/s, but 4 Mb/s is commonly used.

Table 2-2   Serial Signal Transmission Speeds and Distances

Rate (bps)	Distance for EIA/TIA-232		Distance for EIA/TIA-449, X.21, V.35, and EIA-530		Distance for USB	
	Feet	Meters	Feet	Meters	Feet	Meters
2400	200	60	4100	1250	16.4	5
4800	100	30	2050	625	16.4	5
9600	50	15	1025	312	16.4	5
19200	25	7.6	513	156	16.4	5
38400	12	3.7	256	78	16.4	5
56000	8.6	2.6	102	31	16.4	5
1544000 (T1)	—	—	50	15	16.4	5

Balanced drivers allow EIA/TIA-449 signals to travel greater distances than EIA/TIA-232 signals. The recommended distance limits for EIA/TIA-449 shown in Table 2-2 are also valid for V.35, X.21, and EIA-530. Typically, EIA/TIA-449 and EIA-530 can support 2-Mb/s rates, and V.35 can support 4-Mb/s rates.

Asynchronous/Synchronous Serial Module Baud Rates

The following baud-rate limitations apply to the slow-speed serial interfaces found in the asynchronous/synchronous serial modules:

- Asynchronous interface—Maximum baud rate is 115.2 kbps.
- Synchronous interface—Maximum baud rate is 128-kbps full duplex.

ISDN BRI Connections

BRI WAN interface cards provide ISDN BRI connections. The BRI modules and BRI WAN interface cards are available with either an S/T interface that requires an external Network Terminator 1 (NT1), or a U interface that has a built-in NT1.

You can install the BRI modules in any available slot in the chassis.

⚠️

Warning   **Hazardous network voltages are present in WAN ports regardless of whether power to the unit is OFF or ON. To avoid electric shock, use caution when working near WAN ports. When detaching cables, detach the end away from the unit first.** Statement 1026

Use a BRI cable (not included) to connect the BRI WAN interface card directly to an ISDN. Table 2-3 lists the specifications for ISDN BRI cables. Also, see the *Cisco Modular Access Router Cable Specifications* document at Cisco.com for pinouts.

Table 2-3 **ISDN BRI Cable Specifications**

Specification	High-Capacitance Cable	Low-Capacitance Cable
Resistance (at 96 kHz)	160 ohms/km	160 ohms/km
Capacitance (at 1 kHz)	120 nF[1]/km	30 nF/km
Impedance (at 96 kHz)	75 ohms	150 ohms
Wire diameter	0.024 in. (0.6 mm)	0.024 in. (0.6 mm)
Distance limitation	32.8 ft (10 m)	32.8 ft (10 m)

1. nF = nano Farad

CSU/DSU Connections

CSU/DSU WAN interface cards (WICs) are available to provide switched-56-kbps connections or full or fractionalized T1 connections.

For more information on CSU/DSU WICs, see the online documents at Cisco.com.

Required Tools and Equipment for Installation and Maintenance

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

Warning   **This equipment must be installed and maintained by service personnel as defined by AS/NZS 3260. Incorrectly connecting this equipment to a general-purpose outlet could be hazardous. The telecommunications lines must be disconnected 1) before unplugging the main power connector or 2) while the housing is open, or both.** Statement 1043

You need the following tools and equipment to install and upgrade the router and its components:

- ESD-preventive cord and wrist strap
- Number 2 Phillips screwdriver
- Torx T-15 screwdriver
- Phillips screwdrivers: small, 3/16-in. (4 to 5 mm) and medium, 1/4-in. (6 to 7 mm)
  - To install or remove modules
  - To remove the cover, if you are upgrading memory or other components
- Screws that fit your rack
- Wire crimper
- Wire for connecting the chassis to an earth ground:
  - AWG 6 (13 mm^2) wire for NEBS-compliant chassis grounding
  - AWG 14 (2 mm^2) or larger wire for NEC-compliant chassis grounding
  - AWG 18 (1 mm^2) or larger wire for EN/IEC 60950-compliant chassis grounding

- For NEC-compliant grounding, an appropriate user-supplied ring terminal, with an inner diameter of 1/4 in. (5 to 7 mm)

In addition, depending on the type of modules you plan to use, you might need the following equipment to connect a port to an external network:

- Cables for connection to the WAN and LAN ports (dependent on configuration)

✎

Note   For more information on cable specifications, see the *Cisco Modular Access Router Cable Specifications* document at Cisco.com.

- Ethernet hub or PC with a network interface card for connection to an Ethernet (LAN) port.
- Console terminal (an ASCII terminal or a PC running HyperTerminal or similar terminal emulation software) configured for 9600 baud, 8 data bits, 1 stop bit, no flow control, and no parity.
- Modem for connection to the auxiliary port for remote administrative access (optional).
- Data service unit (DSU) or channel service unit/data service unit (CSU/DSU) as appropriate for serial interfaces.
- External CSU for any CT1/PRI modules without a built-in CSU.
- NT1 device for ISDN BRI S/T interfaces (if not supplied by your service provider).

Installation Checklist

The sample installation checklist lists items and procedures for installing a new router. Make a copy of this checklist and mark the entries when completed. Include a copy of the checklist for each router in your site log (described in the next section, "Creating a Site Log").

Installation checklist for site_____

Router name_____

Task	Verified by	Date
Installation checklist copied		
Background information placed in Site Log		
Site power voltages verified		
Installation site power check completed		
Required tools available		
Additional equipment available		
Router received		
Router quick start guide received		
Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Routers or *Regulatory Compliance and Safety Information for Cisco 3900 Series Integrated Services Routers* document received		
Product registration card received		
Cisco.com contact information label received		
Chassis components verified		
Initial electrical connections established		
ASCII terminal (for local configuration) or modem (for remote configuration) available		
Signal distance limits verified		
Startup sequence steps completed		
Initial operation verified		
Software image verified		

Creating a Site Log

The Site Log provides a record of all actions related to the router. Keep it in an accessible place near the chassis where anyone who performs tasks has access to it. Use the installation checklist to verify steps in the installation and maintenance of the router. Site Log entries might include the following information:

- Installation progress—Make a copy of the installation checklist and insert it into the site log. Make entries as each procedure is completed.

- Upgrade and maintenance procedures—Use the site log as a record of ongoing router maintenance and expansion history. A site log might include the following events:

    - Installation of network modules

    - Removal or replacement of network modules and other upgrades

    - Configuration changes

    - Maintenance schedules and requirements

    - Maintenance procedures performed

    - Intermittent problems

    - Comments and notes

Inspect all items for shipping damage. If anything appears to be damaged or if you encounter problems installing or configuring your router, contact customer service. Warranty, service, and support information is in the quick start guide that shipped with your router, or in the Preface of this guide. See the "Obtaining Documentation and Submitting a Service Request" section on page -xvii.

CHAPTER 3

Installing and Connecting the Router

This document describes how to install and connect Cisco 2900 series and Cisco 3900 series integrated services routers (ISRs) to LAN, WAN, and Voice networks. The following sections provide technical details.

Installation Requirements and Warnings

Warning To see translations of the warnings that appear in this publication, see the *Regulatory Compliance and Safety Information for Cisco 2900 Series Integrated Services Routers* or the *Regulatory Compliance and Safety Information for Cisco 3900 Series Integrated Services Routers* document. **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.** Statement 1030

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

Warning   **Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.** Statement 1029

Warning   **Hazardous network voltages are present in WAN ports regardless of whether power to the unit is OFF or ON. To avoid electric shock, use caution when working near WAN ports. When detaching cables, detach the end away from the unit first.** Statement 1026

Warning   **This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.** Statement 1024

Warning   **Before opening the unit, disconnect the telephone-network cables to avoid contact with telephone-network voltages.** Statement 1041

Warning   **Do not use this product near water; for example, near a bath tub, wash bowl, kitchen sink or laundry tub, in a wet basement, or near a swimming pool.** Statement 1035

Warning   **Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.** Statement 1036

Warning   **Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.** Statement 1037

Warning   **Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.** Statement 1038

Warning   **To report a gas leak, do not use a telephone in the vicinity of the leak.** Statement 1039

Warning   **This unit is intended for installation in restricted access areas. A restricted access area can be accessed only through the use of a special tool, lock and key, or other means of security.** Statement 1017

⚠

Warning   **Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.** Statement 1029

⚠

Warning   **The covers are an integral part of the safety design of the product. Do not operate the unit without the covers installed.** Statement 1077

What you Need to Know

CLI Console Access

Use the new USB console port on the router to access the Cisco Internet Operating System (IOS) CLI on the router and perform configuration tasks. A terminal emulation program, such as Microsoft Windows HyperTerminal, is required to establish communication between the router and a PC. See the "Connecting to a Console Terminal or Modem" section on page 3-30 for instructions.

✎

Note   A Microsoft Windows USB driver must be installed before you establish physical connectivity between the router and the PC.

Slot and Port Numbers

Cisco 2900 series and 3900 series ISRs have built in ports and new slots. The new slots accommodate new modules and interface cards; Enhanced High-Speed WAN Interface Cards (EHWICs), Internal Services Modules (ISMs), Packet Voice Data Modules (PVDM3), and Service Modules (SMs). See the "Slot, Port, and Interface Information" section on page 1-28 for slot and port numbering.

Software Licenses

To use the following features on Cisco Integrated Services Routers, you must purchase a software package.

- Gatekeeper
- IPS (subscription)
- SSL_VPN (counted)
- SNA Switching

See the "Getting Software Licenses for the Router" section on page 6-1 for more information.

Before you Begin

Before installing and connecting a Cisco Integrated Services Router, read the safety warnings and gather the following tools and equipment.

- ESD-preventive cord and wrist strap
- Number 2 Phillips screwdriver
- Flat-blade screwdrivers: small, 3/16-in. (4 to 5 mm) and medium, 1/4-in. (6 to 7 mm)
    - To install or remove modules
    - To remove the cover, if you are upgrading memory or other components
- Screws that fit your rack
- Wire crimper
- Wire for connecting the chassis to an earth ground:
    - AWG 6 (13 mm^2) wire for NEBS-compliant chassis grounding
    - AWG 14 (2 mm^2) or larger wire for NEC-compliant chassis grounding
    - AWG 18 (1 mm^2) or larger wire for EN/IEC 60950-compliant chassis grounding
- For NEC-compliant grounding, an appropriate user-supplied ring terminal, with an inner diameter of 1/4 in. (5 to 7 mm)

In addition, depending on the type of modules you plan to use, you might need the following equipment to connect a port to an external network:

- Cables for connection to the WAN and LAN ports (dependent on configuration)

    Note   For more information on cable specifications, see the *Cisco Modular Access Router Cable Specifications* document on Cisco.com.

- Ethernet hub or PC with a network interface card for connection to an Ethernet (LAN) port.
- Console terminal (an ASCII terminal or a PC running HyperTerminal or similar terminal emulation software) configured for 9600 baud, 8 data bits, 1 stop bit, no flow control, and no parity.
- Modem for connection to the auxiliary port for remote administrative access (optional).
- Data service unit (DSU) or channel service unit/data service unit (CSU/DSU) as appropriate for serial interfaces.
- External CSU for any CT1/PRI modules without a built-in CSU.
- NT1 device for ISDN BRI S/T interfaces (if not supplied by your service provider).

Unpacking the Router

Do not unpack the router until you are ready to install it. If the final installation site will not be ready for some time, keep the chassis in its shipping container to prevent accidental damage. When you are ready to install the router, proceed with unpacking it.

The router, accessory kit, publications, and any optional equipment you ordered may be shipped in more than one container. When you unpack the containers, check the packing list to ensure that you received all of the items on the list.

Installing the Router

If you need to install service modules, interface cards, and FRUs, you can install them either before or after you install the router. Ideally, you install modules and interface cards when you have the best access to the back panel of the router. Internal modules and FRUs, such as internal services modules (ISMs) or packet voice data modules (PVDMs), and fan trays should be installed before rack-mounting. See the "Installing and Upgrading Internal Modules and FRUs" section on page 5-1.

There are three methods of installing the router:

- Rack-Mounting the Chassis, page 3-5
- Setting the Chassis on a Desktop, page 3-12
- Mounting a Cisco 2901 or 2911 Router on a Wall, page 3-13

⚠ **Warning**   **Before working on a system that has an on/off switch, turn OFF the power and unplug the power cord.** Statement 1

⚠ **Caution**   To prevent damage to the chassis, never attempt to lift or tilt the chassis by holding it by the plastic panel on the front. Always hold the chassis by the sides of the metal body.

Rack-Mounting the Chassis

Cisco 2900 series and 3900 series routers can be installed in 19-inch (48.26-cm) EIA and 23-inch (58.42-cm) Southwestern Bell Corporation (SBC) racks. The Cisco 3900 series routers can also be mounted in a 600-mm ETSI rack. Use the standard brackets shipped with the router for mounting the chassis in a 19-inch EIA rack; you can order optional larger brackets for mounting the chassis in a 19-inch SBC rack.

You can mount the router in the following ways:

- Center-front mounting—Brackets attached in the center front of the chassis with only the front panel facing forward.
- Center-back mounting—Brackets attached in the center back of the chassis with only the back panel facing forward.
- Front mounting—Brackets attached at the front of the chassis with the front panel facing forward.
- Back mounting—Brackets attached at the back of the chassis with the back panel facing forward.

Attaching Rack-Mount Brackets to Cisco 2901 Routers

For the Cisco 2900 series routers use four of the supplied number-8 Phillips flat-head screws to attach the long side of each bracket to the router. For the Cisco 3900 series routers use four of the supplied number-6 Phillips flat-head screws to attach the long side of each bracket to the router.

Figure shows how to attach the brackets to the sides of the router with the front panel forward.
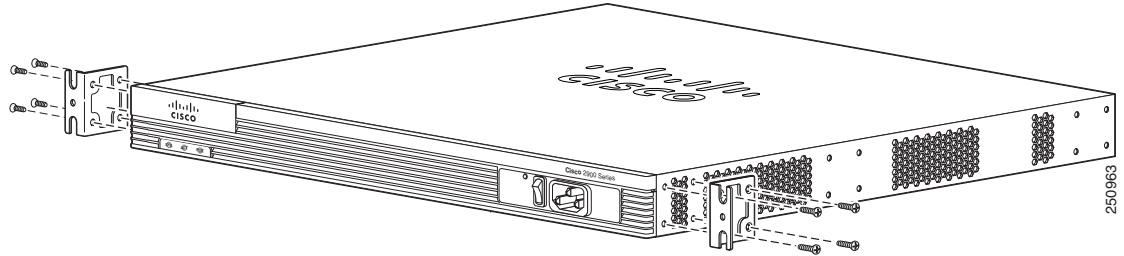
Figure 3-1   Bracket Installation for Front Mounting

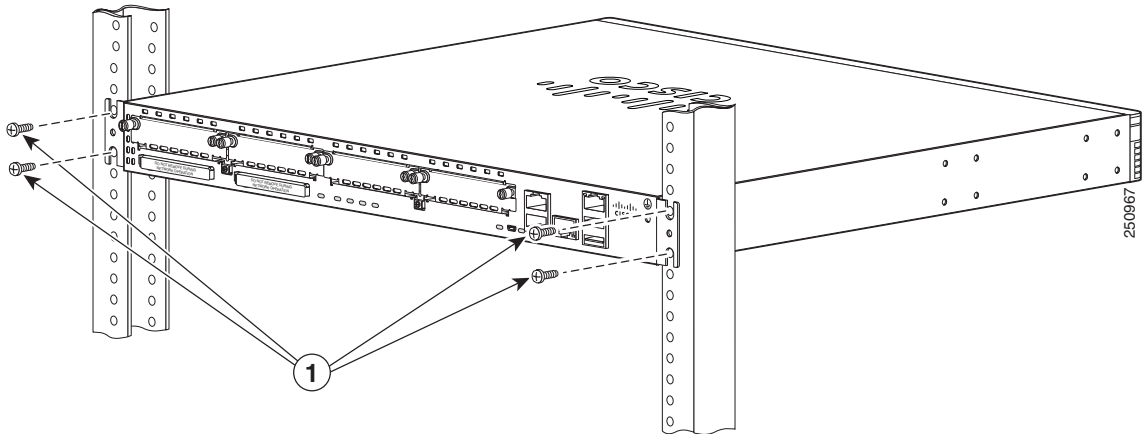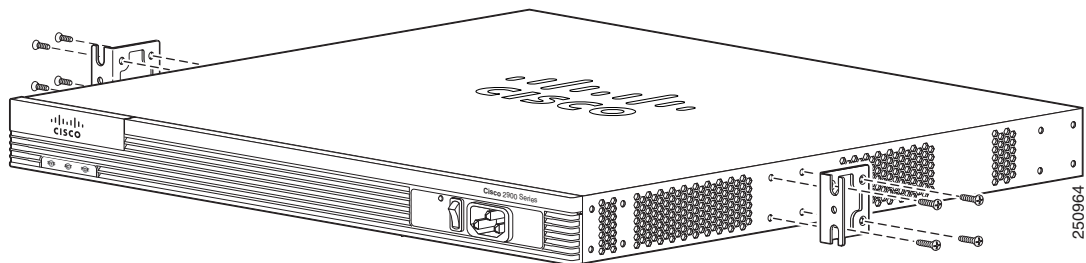Figure 3-2 shows how to attach the brackets to the sides of the router with the back panel forward.

Figure 3-2   Bracket Installation for Back Mounting

Figure 3-3 shows how to attach the brackets to the sides of the router with center mounting.

Figure 3-3   Bracket Installation for Center Mounting

Attaching Rack-Mount Brackets to Cisco 2911, Cisco 2921, and Cisco 2951 Routers

Attach the mounting brackets to the router chassis as shown in Figure 3-4 through Figure 3-7, using the screws provided.

⚠️

Caution   Do not over torque the screws. The recommended torque is 15 to 18 inch-lb (1.7 to 2.0 N-m).

Attach the second bracket to the opposite side of the chassis. Use a number-2 Phillips screwdriver to install the number-8 bracket screws.

⚠

Caution   Your chassis installation must allow unrestricted airflow for chassis cooling.
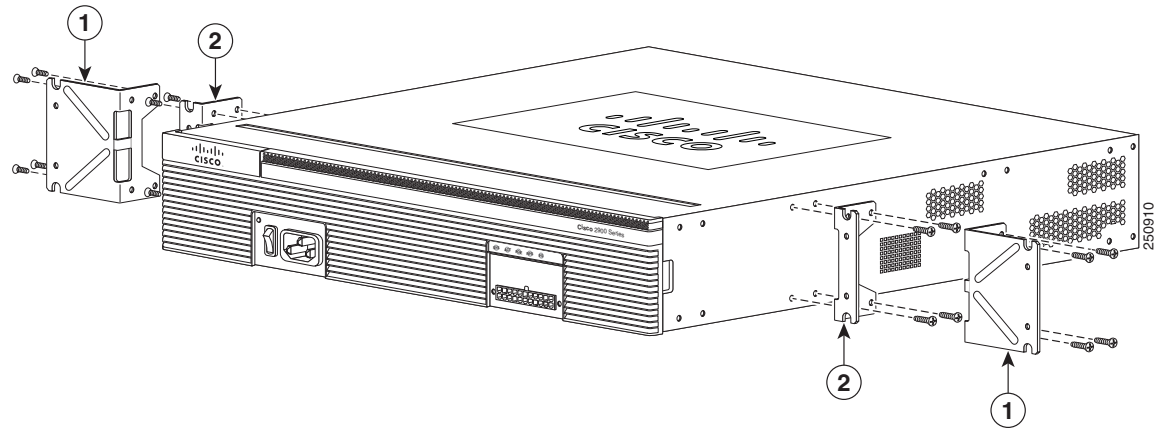
Figure 3-4   Bracket Installation for Front Mounting
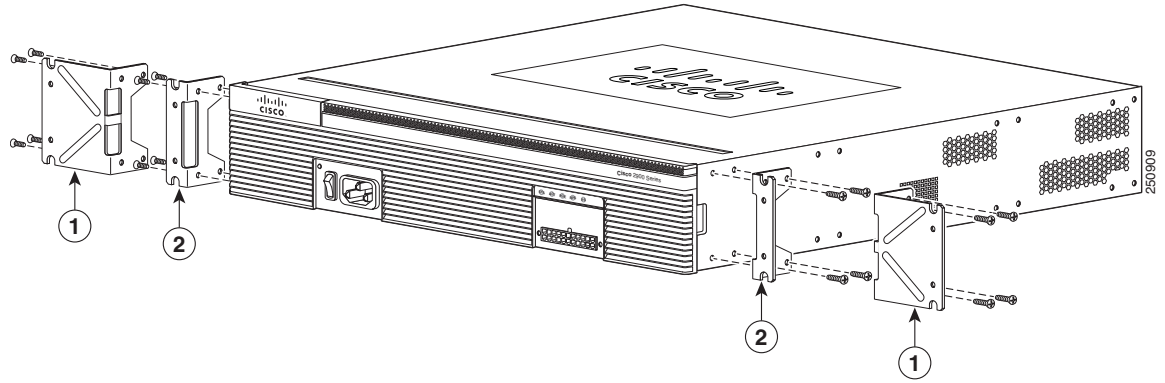
1	23-inch SBC[1] brackets	**2**	19-inch EIA brackets

1. Southwestern Bell Corporation (SBC)

Figure 3-5   Bracket Installation for Center-Front Mounting

1	23-inch SBC brackets	**2**	19-inch EIA brackets

Figure 3-6   Bracket Installation for Back Mounting

1	23-inch SBC brackets	**2**	19-inch EIA brackets

Figure 3-7   Bracket Installation for Center-Back Mounting

1	23-inch SBC brackets	**2**	19-inch EIA brackets

Attaching Rack-Mount Brackets to Cisco 3900 Series Routers

Attach the mounting brackets to the router chassis as shown in Figure 3-8 through Figure 3-11, using the screws provided.

⚠️
Caution   Do not over torque the screws. The recommended torque is 8 to 10 inch-lb (0.9 to 1.12 N-m).

Attach the second bracket to the opposite side of the chassis. Use a number-2 Phillips screwdriver to install the number-6 bracket screws.

⚠️
Caution   Your chassis installation must allow unrestricted airflow for chassis cooling.
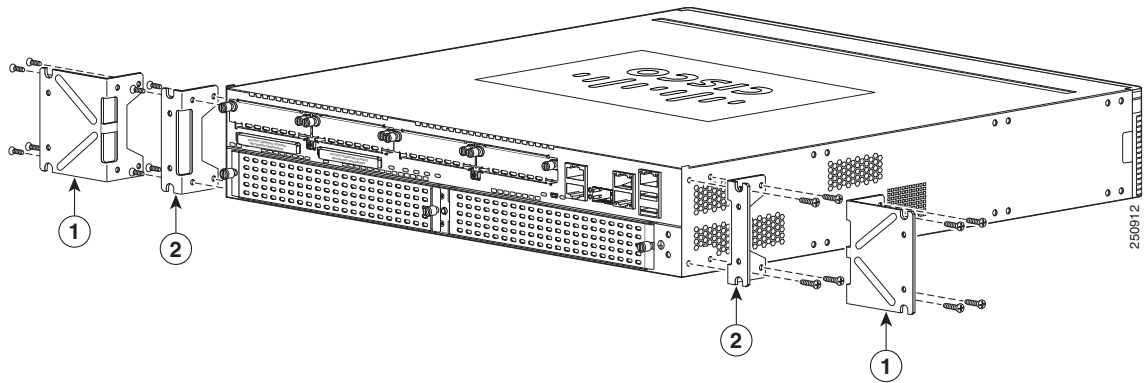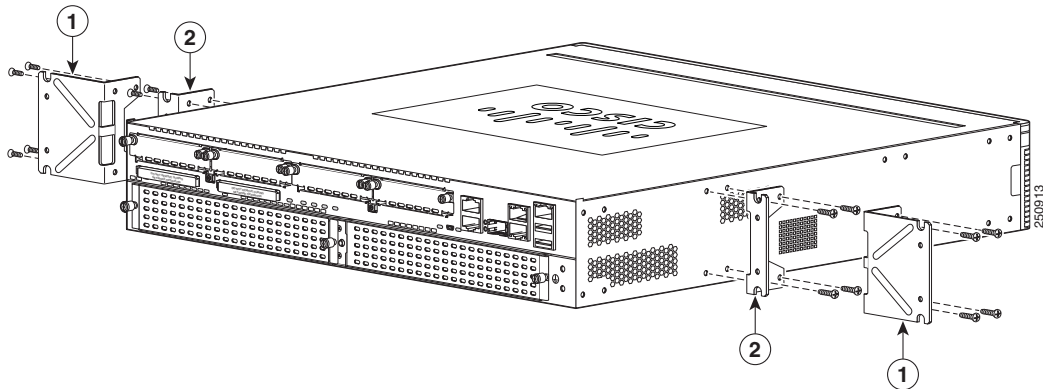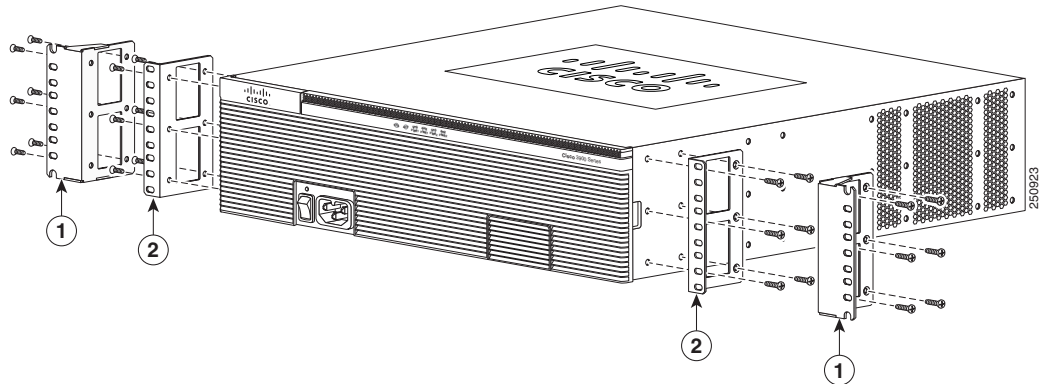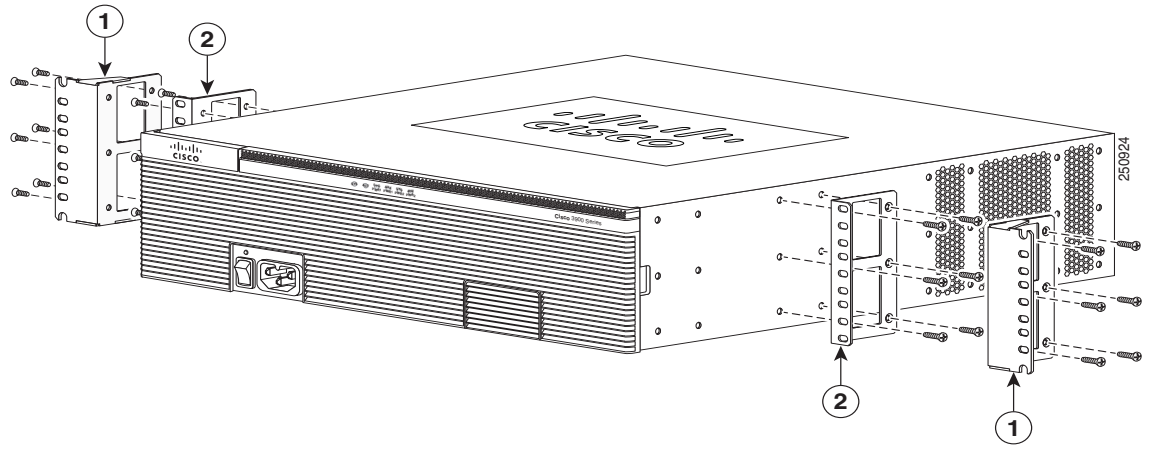
Figure 3-8   Bracket Installation for Front Mounting

1	23-inch EIA brackets	**2**	19-inch EIA brackets

Figure 3-9   Bracket Installation for Center-Front Mounting

1	23-inch EIA brackets	**2**	19-inch EIA brackets

Figure 3-10   Bracket Installation for Rear Mounting

| 1 | 23-inch EIA brackets | 2 | 19-inch EIA brackets |
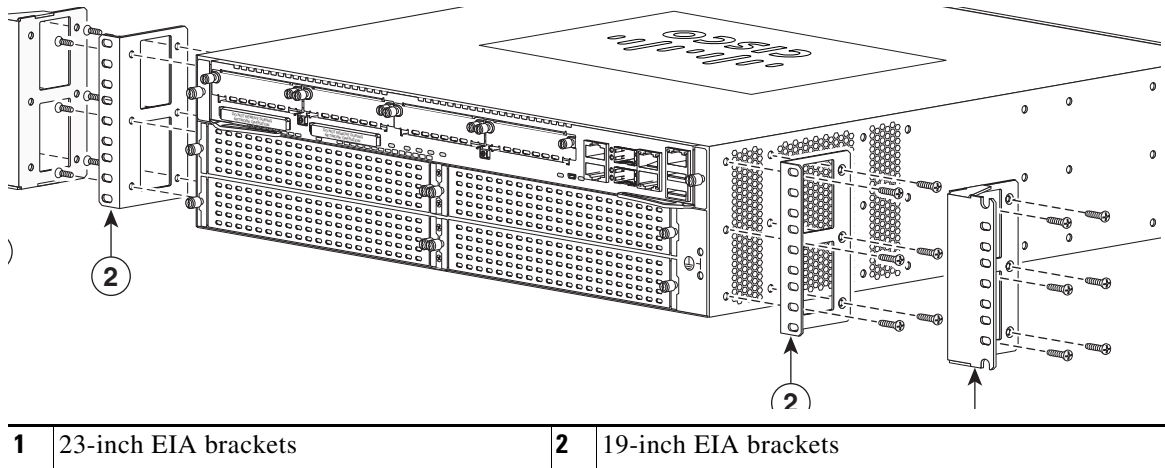
Figure 3-11   Bracket Installation for Center-Rear Mounting

| 1 | 23-inch EIA brackets | 2 | 19-inch EIA brackets |
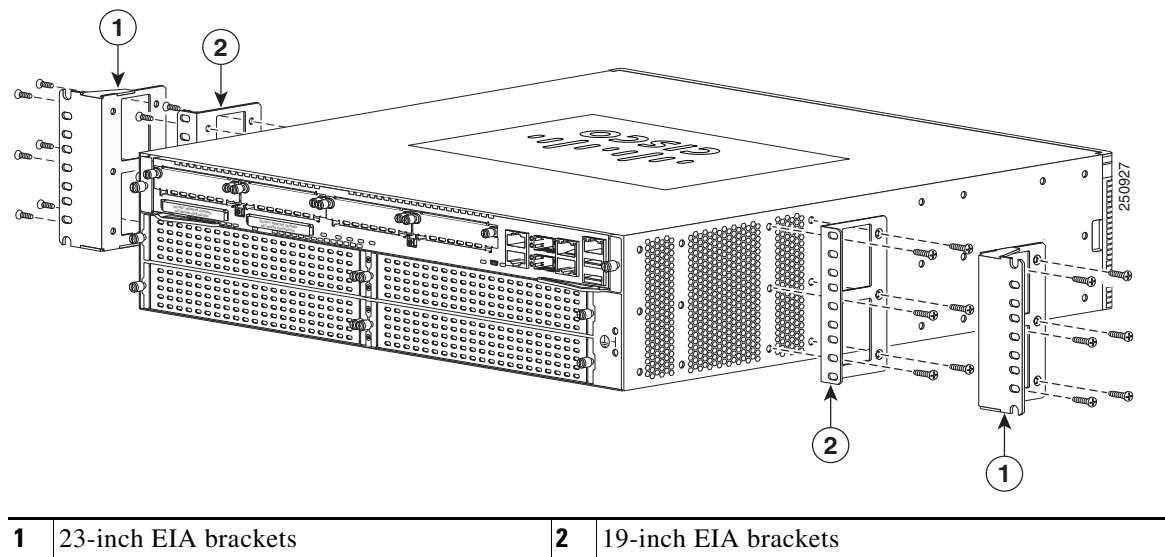
Mounting the Router in a Rack

After you attach the rack-mount brackets to the router chassis, use the screws provided with the rack to install the chassis in the rack. (See Figure 3-12.)

Tip   For 23-inch SBC brackets start the lower pair of screws first, and rest the brackets on the lower screws while you insert the upper pair of screws.

Tip   The screw slots in the brackets are spaced to line up with every *second* pair of screw holes in the rack. When the correct screw holes are used, the small threaded holes in the brackets line up with unused screw holes in the rack. If the small holes do not line up with the rack holes, you must raise or lower the brackets to the next rack hole.

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.** Statement 1006

Warning   **To prevent personal injury or damage to the chassis, never attempt to lift or tilt the chassis using the handles on modules (such as power supplies, fans, or cards); these types of handles are not designed to support the weight of the unit.** Statement 1032

Caution   Be sure to leave space above and below each router in a rack to allow for cooling air circulation.

Figure 3-12 shows a typical installation in a rack.

Figure 3-12   Mounting the Chassis in a Rack (Typical)
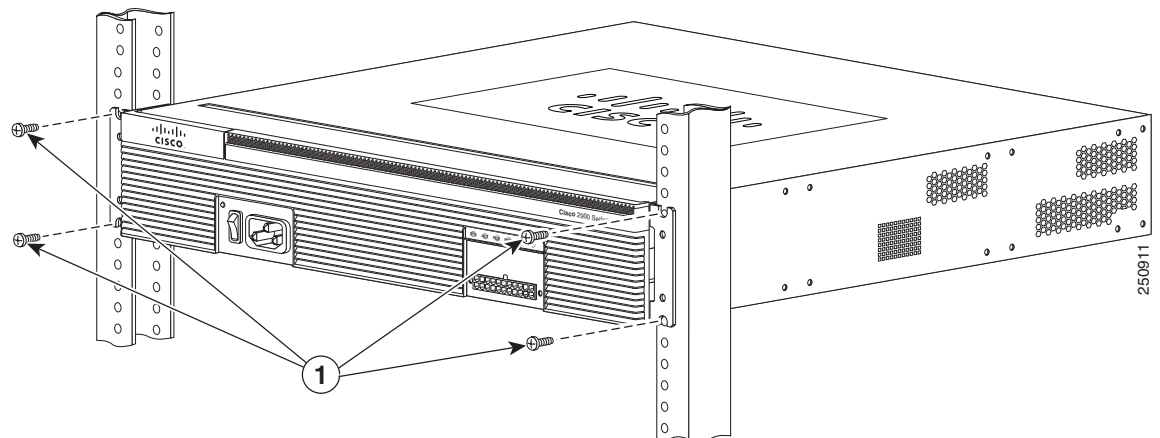
1	Mounting screws (4)		

Figure 3-13 shows an installation with a chassis rear-forward.

Figure 3-13   Mounting the Chassis in a Rack, Rear Forward
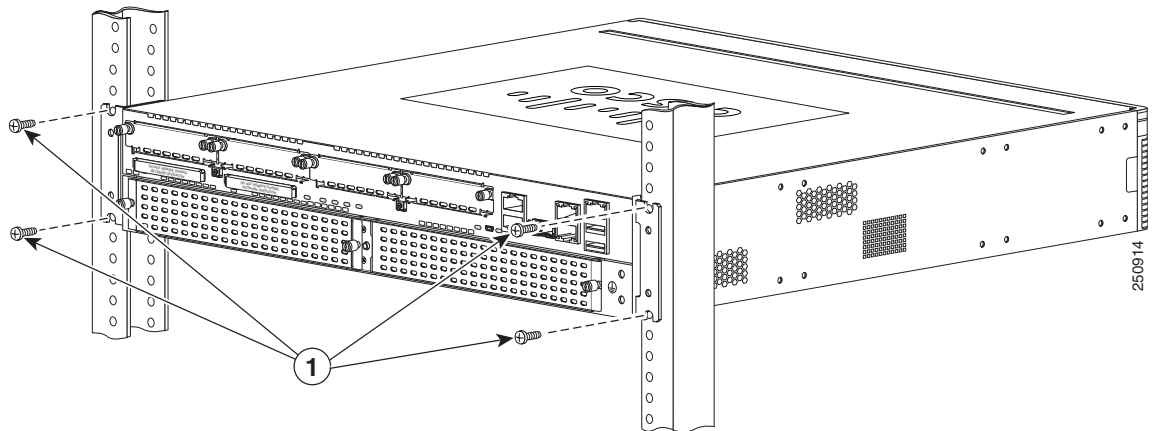
1	Mounting screws (4)		

Grounding the Chassis

After the router is installed, you must connect the chassis to a reliable earth ground. For the chassis ground connection procedures, see the "Chassis Grounding" section on page 3-15.

Setting the Chassis on a Desktop

You can place Cisco 2901, Cisco 2911, and Cisco 3900 series routers on a desktop or shelf.

Note   Models 2921 and above are not recommended for desktop mounting.

To install a Cisco 2901 or 2911 router on a desktop, first install the four rubber feet that are supplied in the accessory kit. They provide anti-skid protection and space for air circulation. Peel the rubber feet from the adhesive strip, and stick them onto the "+" marked on the bottom of the chassis.

Warning   **To prevent personal injury or damage to the chassis, never attempt to lift or tilt the chassis using the handles on modules (such as power supplies, fans, or cards); these types of handles are not designed to support the weight of the unit.** Statement 1032

Caution   Do not place anything on top of the router that weighs more than 10 pounds (4.5 kg), and do not stack routers on a desktop. Excessive distributed weight of more than 10 pounds, or pound point load of 10 pounds on top could damage the chassis.

Caution   Your chassis installation must allow unrestricted airflow for chassis cooling. For placing the router on a desktop, keep at least 1 inch (2.54 cm) of clear space beside the cooling inlet and exhaust vents.

After the router is installed, you must connect the chassis to a reliable earth ground. For the chassis ground connection procedures, see the "Chassis Grounding" section on page 3-15.

Mounting a Cisco 2901 or 2911 Router on a Wall

This section explains how to mount Cisco 2901 and Cisco 2911 routers on a wall or other vertical surface. We do not recommend mounting a Cisco 2921, 2951, or Cisco 3900 series router on a wall.

The following warning applies to Cisco 2901 and 2911 routers:

Warning   **This unit is intended to be mounted on a wall. Please read the wall mounting instructions carefully before beginning installation. Failure to use the correct hardware or to follow the correct procedures could result in a hazardous situation to people and damage to the system.** Statement 248

Tip   When choosing a wall-mounting location, consider cable limitations and wall structure.

Note   The Cisco 2901 and Cisco 2911 routers use brackets designed for the 19-inch EIA rack-mounting, the part number 700-16559-01 is stamped on the bracket (shown in Figure 3-15).

Attaching Brackets to the Router for Wall Mounting

Attach the standard brackets to the chassis using the four screws provided for each bracket.

Attaching the Router to a Wall

Attach the router to the wall using the brackets previously attached. Use attachment hardware that you provide as follows:

- For attaching to a wall stud, each bracket requires two number-10 wood screws (round- or pan-head) with number-10 washers, or two number-10 washer-head screws. The screws must be long enough to penetrate at least 1.5 inches (38.1 mm) into the supporting wood or metal wall stud.

- For hollow-wall mounting, each bracket requires two wall anchors with washers. Wall anchors and washers must be size number 10.

- Route the cables so that they do not put a strain on the connectors or mounting hardware.

- The NEBS air baffle (Cisco 2911) should not be used when wall-mounting the router.

Caution   This unit is intended to be mounted on a wall. Please read the wall mounting instructions carefully before beginning installation. Failure to use the correct hardware or to follow the correct procedures could result in a hazardous situation to people and damage to the system.

Caution   The router must be mounted with the power connections oriented downward. Failure to do so could present a fire hazard.

Figure 3-14 and Figure 3-15 show typical wall-mounted installations.

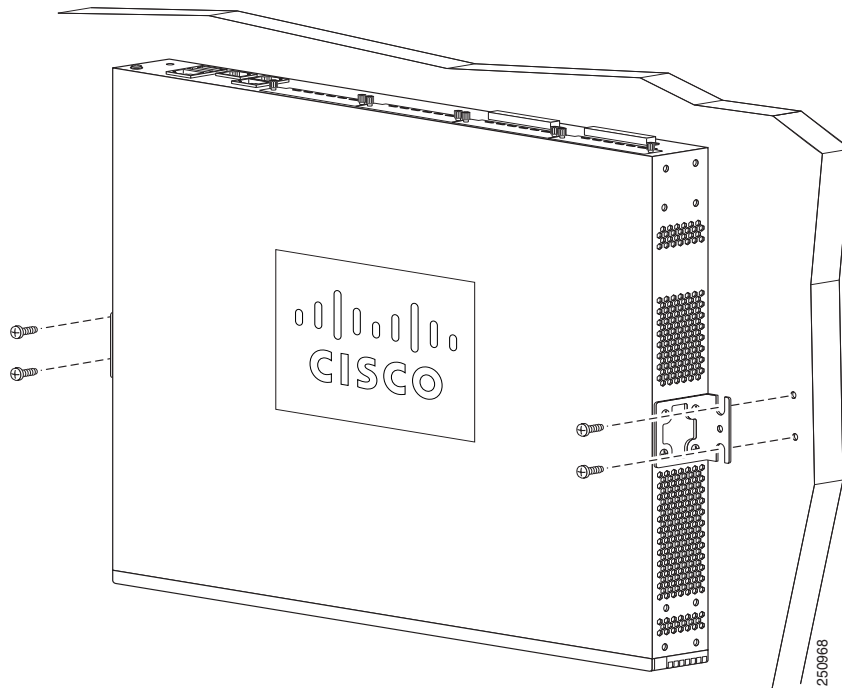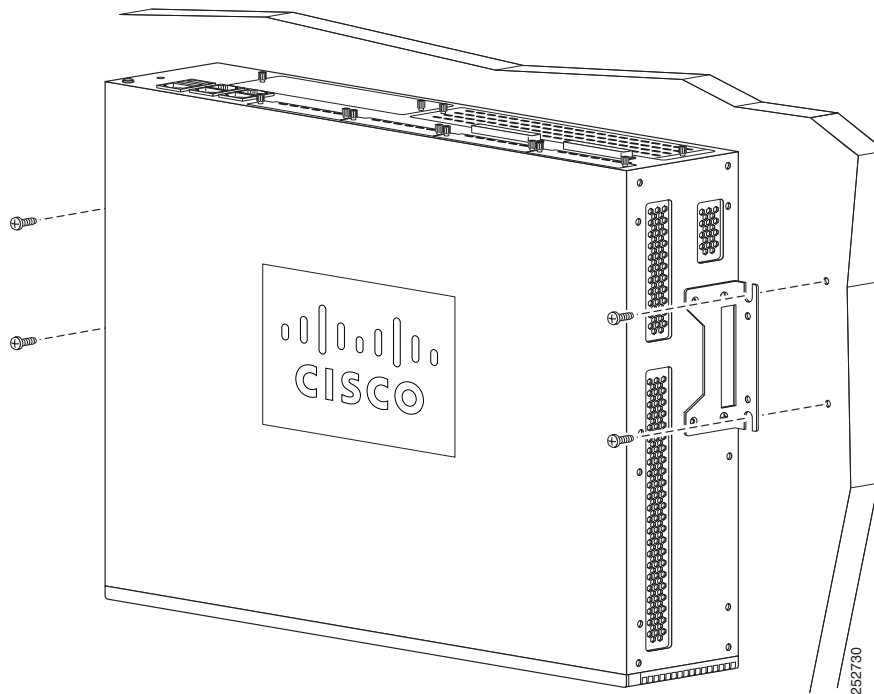*Figure 3-14   Mounting the 2901 Chassis on the Wall*

Figure 3-15   Mounting the 2911 Chassis on the Wall

After the router is installed, you must connect the chassis to a reliable earth ground. For the chassis ground connection procedures, see the "Chassis Grounding" section on page 3-15.

Chassis Grounding

Warning   **This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.** Statement 1024

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

You must connect the chassis to a reliable earth ground; the ground wire must be installed in accordance with local electrical safety standards.

- For NEBS-compliant grounding, use size 6 AWG (13 mm^2) copper wire and the ground lug provided in the accessory kit.

  Note   NEBS-compliant grounding is not supported on the Cisco 2901 router.

  Note   This equipment is suitable for installation in Network Telecommunications Facilities and locations where the NEC applies. The equipment is suitable for installation as part of the Common Bonding Network (CBN).

- For NEC-compliant grounding, use size 14 AWG (2 mm^2) or larger copper wire and an appropriate user-supplied ring terminal with an inner diameter of 1/4 in. (5–7 mm).

- For EN/IEC 60950-compliant grounding, use size 18 AWG (1 mm^2) or larger copper wire and an appropriate user-supplied ring terminal.

To install the ground connection for a Cisco 2900 or Cisco 3900 series router, perform the following steps:

Step 1   Strip one end of the ground wire to the length required for the ground lug or terminal.

- For the NEBS ground lug—approximately 0.75 inch (20 mm)
- For user-provided ring terminal—as required

Step 2   Crimp the ground wire to the ground lug or ring terminal, using a crimp tool of the appropriate size.

Step 3   Attach the ground lug or ring terminal to the chassis as shown in Figure 3-16, Figure 3-17, Figure 3-18, Figure 3-18, or Figure 3-19. For a ground lug, use the two screws with captive locking washers provided. For a ring terminal, use one of the screws provided. Tighten the screws to a torque of 8 to 10 in-lb (0.9 to 1.1 N-m).

Figure 3-16   *Chassis Ground Connection Using Ring Terminal on Cisco 2901 Chassis*
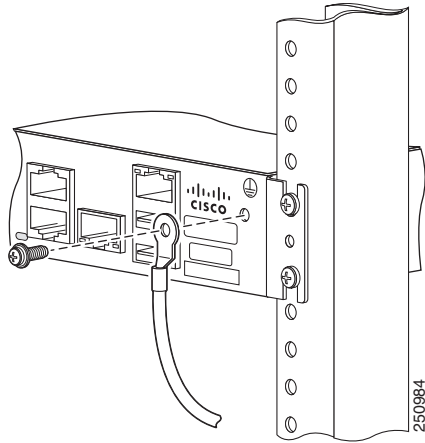

Figure 3-17   *NEBS-Compliant Chassis Ground Connection on Cisco 2911 Chassis*
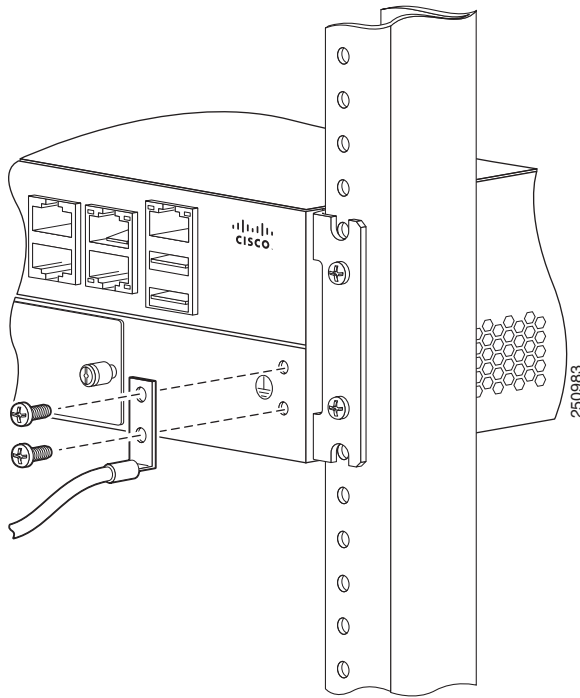
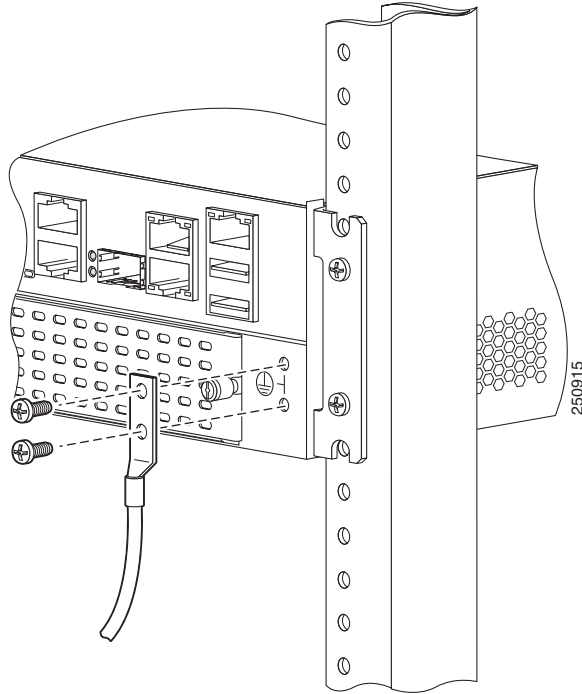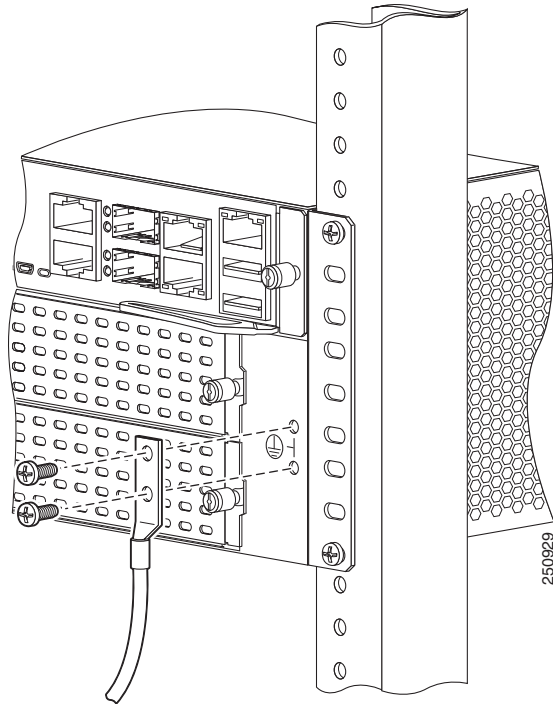*Figure 3-18*   *NEBS-Compliant Chassis Ground Connection on Cisco 2921 or Cisco 2951 Chassis*

Figure 3-19   *Chassis Ground Connection on Cisco 3900 Series Chassis*

Step 4   Connect the other end of the ground wire to a known reliable earth ground point at your site.

Connecting Power

This section explains how to connect AC or DC power to Cisco 2900 series routers. It covers the following topics:

Warning **Read the installation instructions before connecting the system to the power source.** Statement 1004

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

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

Note The installation must comply with all required electrical codes applicable at the installation site.

Connecting to AC Power

If your router uses AC power, connect it to a 15 A, 120 VAC (10 A, 240 VAC) circuit with overcurrent protection. If backup power is required, see the "Connecting to Backup Power" section on page 3-30.

Note The input voltage tolerance limits for AC power are 90 and 264 VAC.

Note This product requires surge protection to be provided as part of the building installation. To comply with the Telcordia GR-1089 NEBS standard for electromagnetic compatibility and safety, an external surge protective device (SPD) is required at the AC power service equipment.

Warning **AC connected units must have a permanent ground connection in addition to the power cable ground wire. NEBS-compliant grounding satisfies this requirement.** Statement 284

Warning **This product requires short-circuit (overcurrent) protection, to be provided as part of the building installation. Install only in accordance with national and local wiring regulations.** Statement 1045

Warning   **This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that the protective device is rated not greater than:**
15A, 120VAC (16A, 240VAC). Statement 1005

Connecting to DC Power

If your router has a DC-input power supply, follow the directions in this section for proper wiring. A router with a DC-input power supply has a terminal block for the DC power connections. If backup power is required, see the "Connecting to Backup Power" section.

- DC Wiring Requirements for Cisco 2911, 2921, and 2951 Routers, page 3-19
- Wiring Procedure for DC Input on Cisco 2911, 2921, and 2951 Routers, page 3-20
- Approved Scenarios and Scenarios Not Approved for Dual DC Power Supply Configuration on Cisco 2911, 2921, and 2951 Routers, page 3-23
- DC Wiring Requirements for Cisco 3900 Series Routers, page 3-24

Caution   DC return is isolated from the frame. (NEBS DC-I)

Warning   **This product requires short-circuit (overcurrent) protection, to be provided as part of the building installation. Install only in accordance with national and local wiring regulations.** Statement 1045

Warning   **This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that the protective device is rated not greater than:**
60 VDC, 20 A.
Statement 1005

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

Warning   **Use copper conductors only.** Statement 1025

DC Wiring Requirements for Cisco 2911, 2921, and 2951 Routers

A Cisco 2911, Cisco 2921, or Cisco 2951 router with a DC-input power supply requires copper wire and crimp-type terminals for the power connections. Table 3-1 and Table 3-2 summarize the wiring requirements.

You can connect a single DC power source to either the A input or the B input. If there are dual power sources, connect one source to the A input and one source to the B input; both sources must be the same polarity and voltage.

Table 3-1   DC Wiring Requirements for Cisco 2911 Routers

DC Power Input	DC Input Wire Size	Safety Ground Wire Size	Wire Terminal (Lug)	Overcurrent Protection
24-36 VDC, 11 A, positive or negative, single source or dual sources	AWG 14 (2.0 mm^2)	AWG 14 (2.0 mm^2), minimum	Amp/Tyco No. 32957	20 A maximum
36-60 VDC, 4 A, positive or negative, single source or dual sources				

Table 3-2   DC Wiring Requirements for Cisco 2921 and 2951 Routers

DC Power Input	DC Input Wire Size	Safety Ground Wire Size	Wire Terminal (Lug)	Overcurrent Protection
24-36 VDC, 17 A, positive or negative, single source or dual sources	AWG 14 (2.0 mm^2)	AWG 14 (2.0 mm^2), minimum	Amp/Tyco No. 32957	20 A maximum
36-60 VDC, 7 A, positive or negative, single source or dual sources				

Wiring Procedure for DC Input on Cisco 2911, 2921, and 2951 Routers

To connect a router to a DC power source, perform the following steps:

Step 1   Remove power from the DC circuit. To ensure that power is removed from the DC circuit, locate the circuit breaker for the DC circuit, switch the circuit breaker to the OFF position.

Warning   Follow proper Lockout /Tagout Procedures as defined by your company in accordance with local and national laws (e.g. Title 29 CFR Part 1910.147).

Warning   Before performing any of the following procedures, ensure that power is removed from the DC circuit. Statement 1003

Warning   Use copper conductors only. Statement 1025

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

Tip   Tip Secure all power cabling when installing this unit to avoid disturbing field-wiring connections.

Warning   **When stranded wiring is required, use approved wiring terminations, such as closed-loop or spade-type with upturned lugs. These terminations should be the appropriate size for the wires and should clamp both the insulation and conductor.** Statement 1002

Step 2   Strip the wires to the appropriate length for the terminals. The strip length is 5/64 to 1/8 inch (2 to 4 mm) for Amp/Tyco No. 32957 terminals.

Step 3   Crimp the terminals to the power input and safety ground wires.

Step 4   Remove the plastic covers from the terminal block. Save the covers for reinstallation after you finish wiring.

Step 5   Connect the wires to the terminal block, starting with the safety ground wire. Connect each wire to the appropriate terminal as shown in Figure 1. Tighten the terminal screws to 8.0 ± 0.5 in-lb (0.9 ± 0.05 N-m).

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

Warning   **The illustration shows the DC power supply terminal block. Wire the DC power supply as illustrated. The proper wiring sequence is ground to ground, positive to positive, and negative to negative. The ground wire should always be connected first and disconnected last.** Statement 239

Warning   **An exposed wire lead from a DC-input power source can conduct harmful levels of electricity. Be sure that no exposed portion of the DC-input power source wire extends from the terminal block plug.** Statement 122
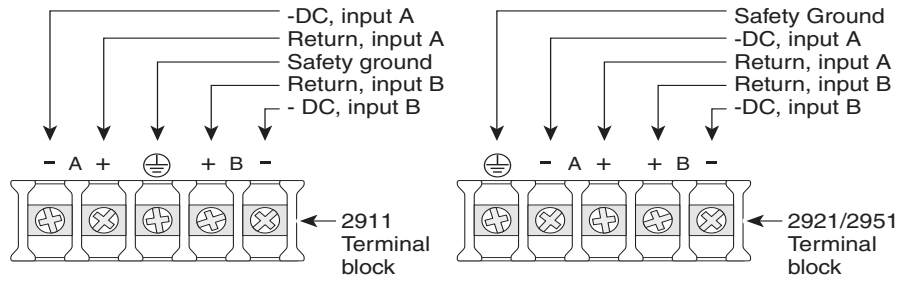
Caution   Dual sources with opposite-polarity grounding damage equipment.

Caution   Caution Do not overtorque the terminal block contact screws. Recommended torque is 5.0 ± 0.5 in-lb (0.56 ± 0.06 N-m) for 2911 series routers, and 9 ± 1.0 in-lb (1.02 ± 0.11 N-m)

Figure 3-20   *DC Power Connections for Cisco 2911, 2921, and 2951 Routers*

Step 6   Install the plastic covers over the terminals. (See Figure 3-21 or Figure 3-22.)

⚠️

Warning   **The safety cover is an integral part of the product. Do not operate the unit without the safety cover installed. Operating the unit without the cover in place will invalidate the safety approvals and pose a risk of fire and electrical hazards.** Statement 117

Step 7   Organize and secure the wires using cable ties as shown in Figure 2 or Figure 3. Make sure that the wires do not project above or below the front panel of the router.

Step 8   Turn on power to the DC circuit. Be sure to remove tape used to secure the circuit-breaker switch in the OFF position.

Figure 3-21   *Wire Routing and Attachment for Cisco 2911 Routers*
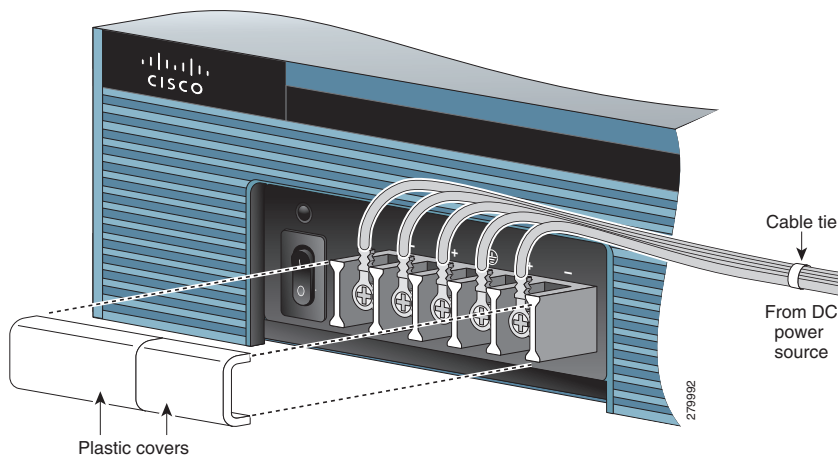
Figure 3-22   Wire Routing and Attachment for Cisco 2921 and Cisco 2951 Routers
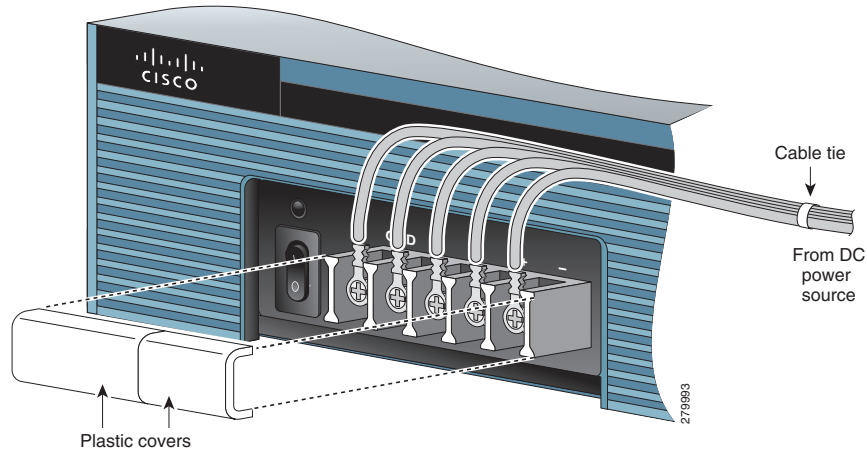
Approved Scenarios and Scenarios Not Approved for Dual DC Power Supply Configuration on Cisco 2911, 2921, and 2951 Routers

You can connect a single DC power source to either the A input or the B input. If there are dual power sources, connect one source to the A input and one source to the B input. Both sources must be the same polarity (with respect to ground) and voltage (within 0.25 volts). Do not connect –DC grounded and +DC grounded dual sources to Cisco 2911, Cisco 2921, and Cisco 2951 routers.

⚠

Caution   Dual sources with opposite-polarity grounding damage equipment.

In Figure 3-23, either the positive source terminal or the negative source terminal is tied to ground.

Figure 3-23   Connecting to One Source Only—Source A or Source B

In Figure 3-24, source A and source B share common negative terminal connections.

Figure 3-24   *Connecting Source A and Source B with Common Negative Terminals*

DC Wiring Requirements for Cisco 3900 Series Routers

If your router has a DC-input power supply, follow the directions in this section for proper wiring. If backup power is required, see the "Connecting to Backup Power" section.
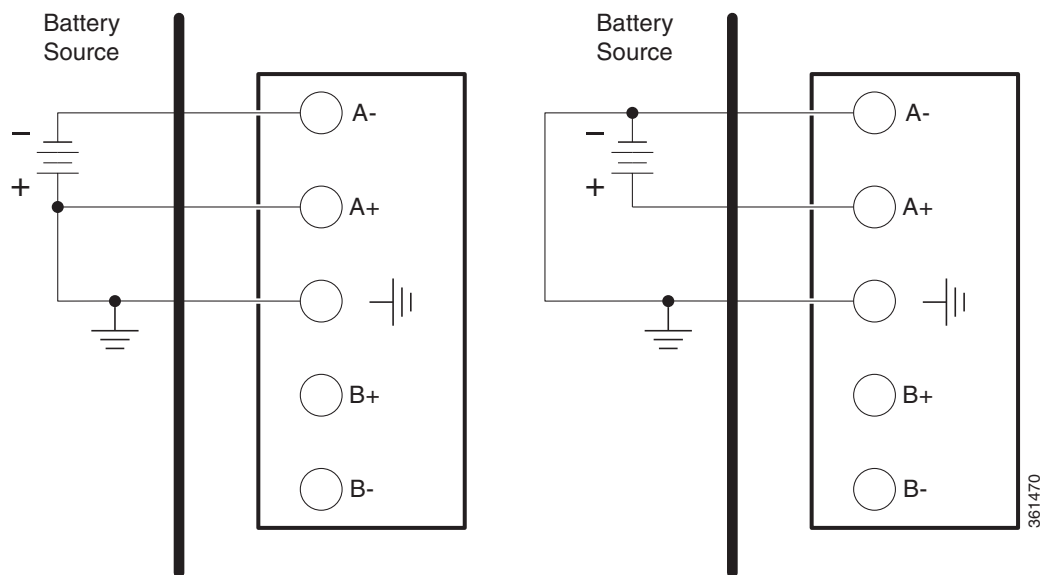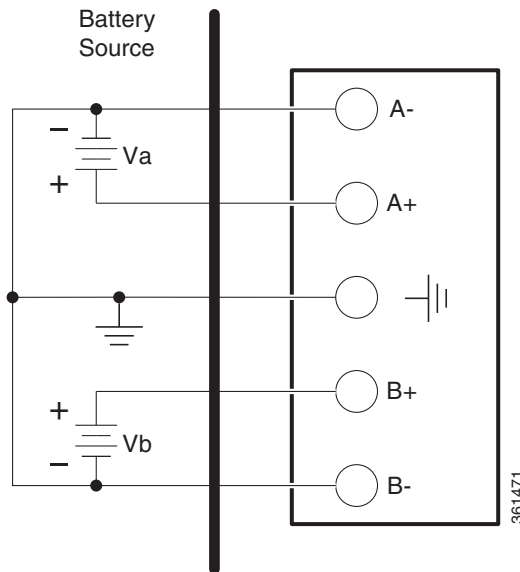
Warning	**Use copper conductors only.** Statement 1025

Warning	**This product requires short-circuit (overcurrent) protection, to be provided as part of the building installation. Install only in accordance with national and local wiring regulations.** Statement 1045

The following warning applies to the Cisco 3925 and Cisco 3925-NOVPN routers only:

Warning	**This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that the protective device is rated not greater than:** **60 VDC, 20 A.** Statement 1005

The following warning applies to the Cisco 3945 and Cisco 3945-NOVPN routers only:

Warning	**This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that the protective device is rated not greater than:** **60 VDC, 30 A.** Statement 1005

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

Table 3-3 summarizes DC wiring requirements for all Cisco 3925 and Cisco 3945 routers.

✎ **Note**   For Cisco 3945 and Cisco 3945-NOVPN routers, the safety ground wire connection must be at the same potential as the 0 V (return) connection.

Table 3-3   DC Wiring Requirements for Cisco 3900

DC Power Input	DC Input Wire Size	Safety Ground Wire Size	Wire Terminal (Lug)	Overcurrent Protection
24-36 VDC, 12 A, positive or negative, single source or dual sources	AWG 10	AWG 10 minimum	Panduit No. LCAS8-10F-L	30 A maximum
36-60 VDC, 8 A, positive or negative, single or dual source				

Cisco 3900 Series Router Wiring Procedure for DC Input

To connect the router to a DC power source, follow these steps:

Step 1 Remove power from the DC circuit. To ensure that power is removed from the DC circuit, locate the circuit breaker for the DC circuit, switch the circuit breaker to the OFF position.

> **Warning** **Follow proper Lockout /Tagout Procedures as defined by your company in accordance with local and national laws (e.g. Title 29 CFR Part 1910.147).**

> **Warning** **Before performing any of the following procedures, ensure that power is removed from the DC circuit.** Statement 1003

> **Tip** Secure all power cabling when installing this unit to avoid disturbing field-wiring connections.

> **Warning** **When stranded wiring is required, use approved wiring terminations, such as closed-loop or spade-type with upturned lugs. These terminations should be the appropriate size for the wires and should clamp both the insulation and conductor.** Statement 1002

Step 2 Strip the wires to the appropriate length for the terminals. The length is 3/16 to 1/4 inch (5 to 6 mm) for Panduit No. LCAS8-10F-L terminals.

Step 3 Crimp the terminals onto the DC power input and safety ground wires.

Step 4 Remove the plastic covers from the terminal block. Save the covers for reinstallation after you finish wiring.

Step 5 Connect the wires to the terminal block, starting with the safety ground wire. Connect each wire to the appropriate terminal as shown in Figure 3-25.

> **Warning** **The illustration shows the DC power supply terminal block. Wire the DC power supply as illustrated. The proper wiring sequence is ground to ground, positive to positive, and negative to negative. The ground wire should always be connected first and disconnected last.** Statement 239

> **Warning** **An exposed wire lead from a DC-input power source can conduct harmful levels of electricity. Be sure that no exposed portion of the DC-input power source wire extends from the terminal block plug.** Statement 122

> **Caution** Do not overtorque the terminal block screws. The recommended torque is 18.0 – 20.0 in-lb (2.03 – 2.26 N-m).

Figure 3-25   DC Power Connections for Cisco 3925 and 3925-NOVPN Routers
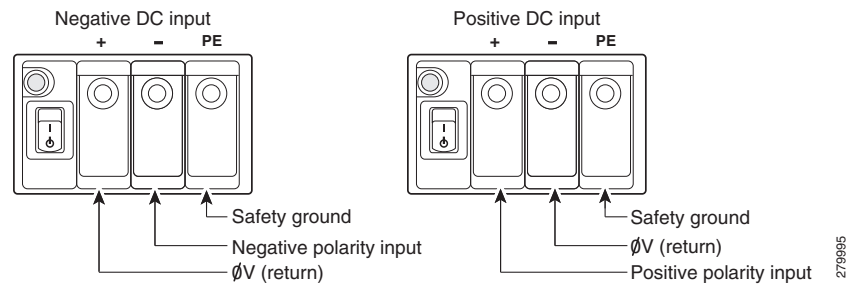
Figure 3-26   DC Power Connections for the Cisco 3945 and 3945-NOVPN Routers
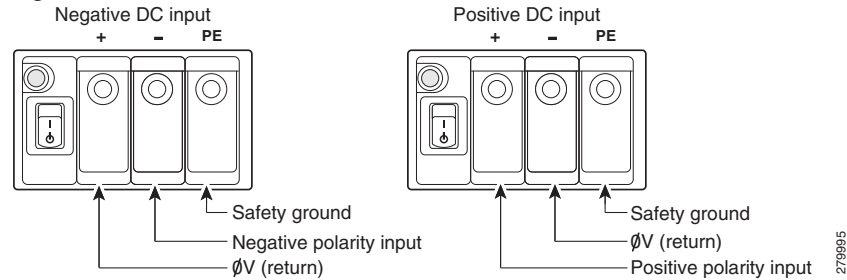
Step 6   Install the plastic cover over the terminals. (See Figure 3-27.)

Warning   **The safety cover is an integral part of the product. Do not operate the unit without the safety cover installed. Operating the unit without the cover in place will invalidate the safety approvals and pose a risk of fire and electrical hazards.** Statement 117

Step 7   Organize and bundle the wires using cable ties as shown in Figure 3-27 or Figure 3-28.

Step 8   If you are installing a second DC power supply, repeat Step 1 through Step 7 for the second supply (input B).

Step 9   Turn on power to the DC circuit. Be sure to remove tape used to secure the circuit-breaker switch in the OFF position.

Figure 3-27   DC Wire Routing andAttachment for Cisco 3925 and 3925-NOVPN Router

Plastic covers

Cable tie
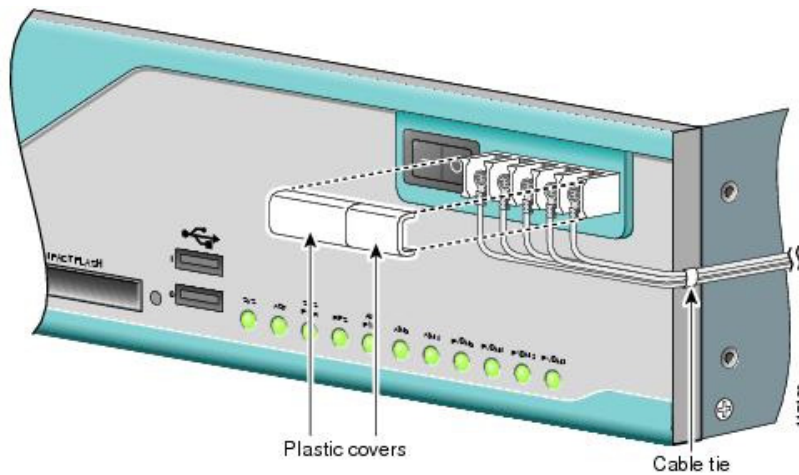
Figure 3-28   DC Wire Routing and Attachment for Cisco 3945 and 3945-NOVPN Router
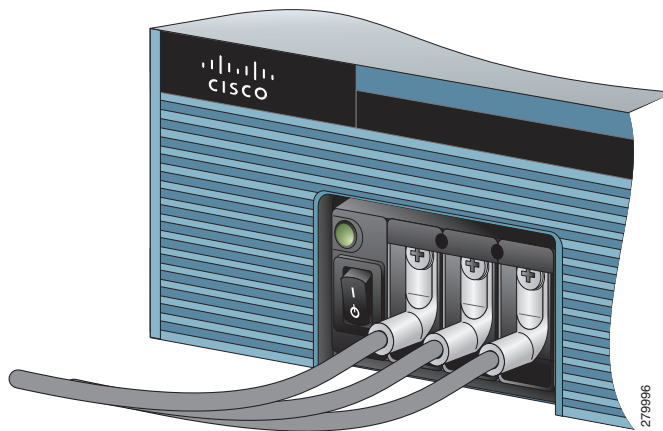
Dual DC Power Supply Configuration in Cisco 3925 and Cisco 3925-NOVPN Routers

You can connect a single DC power source to either the A input or the B input. If there are dual power sources, connect one source to the A input and one source to the B input. Both sources must have the same polarity (with respect to ground) and voltage (within 0.25 V). Do not connect -DC-grounded and +DC-grounded dual sources to Cisco 3925 and Cisco 3925-NOVPN routers.

⚠

Caution   Dual sources with opposite-polarity grounding damage equipment.

In Figure 3-29, either the positive source terminal or the negative source terminal is tied to ground.

Figure 3-29   Connecting to One Source Only—Source A or Source B
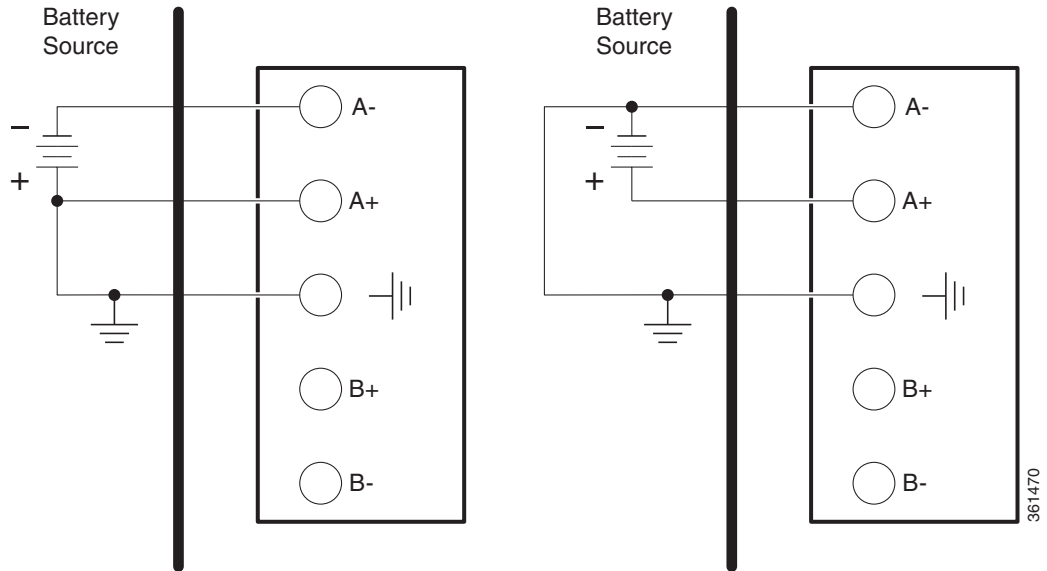
In Figure 3-30, source A and source B share common negative terminal connections.

Figure 3-30   Connecting Source A and Source B with Common Negative Terminals

Connecting to Backup Power

The redundant power supply (RPS) for the Cisco 2911, Cisco 2921, and Cisco 2951 router is an external Cisco RPS 2300. To connect the RPS, the router must be fitted with an RPS adapter. See the "Installing and Removing a Redundant Power Supply Adapter" section on page 5-41 before connecting to a backup power source.

If your router uses the Cisco Redundant Power System (RPS), see the *Cisco Redundant Power System 2300 Hardware Installation Guide* for instructions about the power connections. You can access this document at:
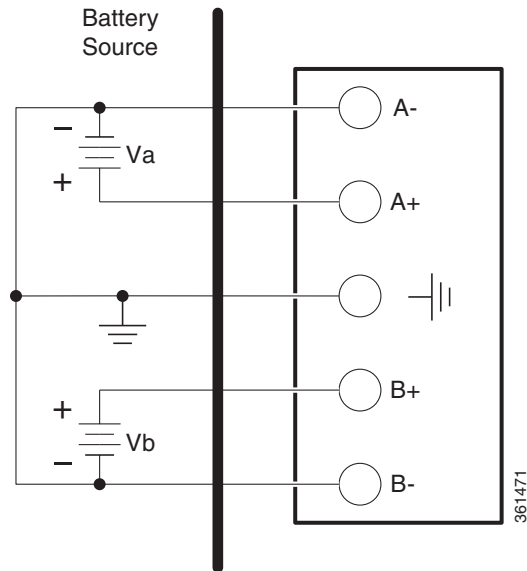
http://www.cisco.com/en/US/docs/switches/power_supplies/rps2300/hardware/installation/guide/2300 hig.html

Caution   Before connecting the RPS to the router, make sure that either the RPS is in standby mode or the RPS AC power is disconnected. Connecting the RPS to AC power automatically places the RPS in active mode.

Note   The Cisco 2901 router does not support an RPS.

Connecting to a Console Terminal or Modem

The router has asynchronous serial ports and auxiliary ports. These ports provide administrative access to the router either locally (with a console terminal or a PC) or remotely (with a modem).To configure the router through the Cisco IOS CLI, you must establish a connection between the router console port and either a terminal or a PC.

Use the following cables and adapters to establish a local or remote connection.

Table 3-4   Local and Remote Connections

Port Type	Cable	Section
Serial (RJ-45)	EIA RJ-45	Connecting to the Serial Port with Microsoft Windows
Serial (USB)	USB 5-pin mini USB Type-B-to-USB Type-A	
Auxiliary (Modem)	DB-9-to-DB-25	Connecting to the Auxiliary Port

Connecting to the Serial Port with Microsoft Windows

Note   Install the USB device driver before establishing a physical connection between the router and the PC using the USB Console cable plugged into the USB serial port, otherwise the connection will fail. See the "Installing the Cisco Microsoft Windows USB Device Driver" section on page 3-35.

Step 1   Connect the end of the console cable with the RJ-45 connector to the light blue console port on the router.

or

Connect a USB 5-pin mini USB Type-B to the USB console port as shown in Figure 3-31, Figure 3-32 or Figure 3-33. If you are using the USB serial port for the first time on a Windows-based PC, install the USB driver now according to the instructions in the following sections.

- "Installing the Cisco Microsoft Windows XP USB Driver" section on page 3-35
- "Installing the Cisco Microsoft Windows 2000 USB Driver" section on page 3-36
- "Installing the Cisco Microsoft Windows Vista USB Driver" section on page 3-36

✎

Note   You cannot use the USB port and the EIA port concurrently. See "Connecting to the Auxiliary Port" section on page 3-38. When the USB port is used it takes priority over the RJ-45 EIA port.

Step 2   Connect the end of the cable with the DB-9 connector (or USB Type-A) to the terminal or PC. If your terminal or PC has a console port that does not accommodate a DB-9 connector, you must provide an appropriate adapter for that port.

Step 3   To communicate with the router, start a terminal emulator application, such as Microsoft Windows HyperTerminal. This software should be configured with the following parameters:

- 9600 baud
- 8 data bits
- no parity
- 1 stop bit
- no flow control

Figure 3-31   *Connecting the USB Console Cable to the Cisco 2901 Router*
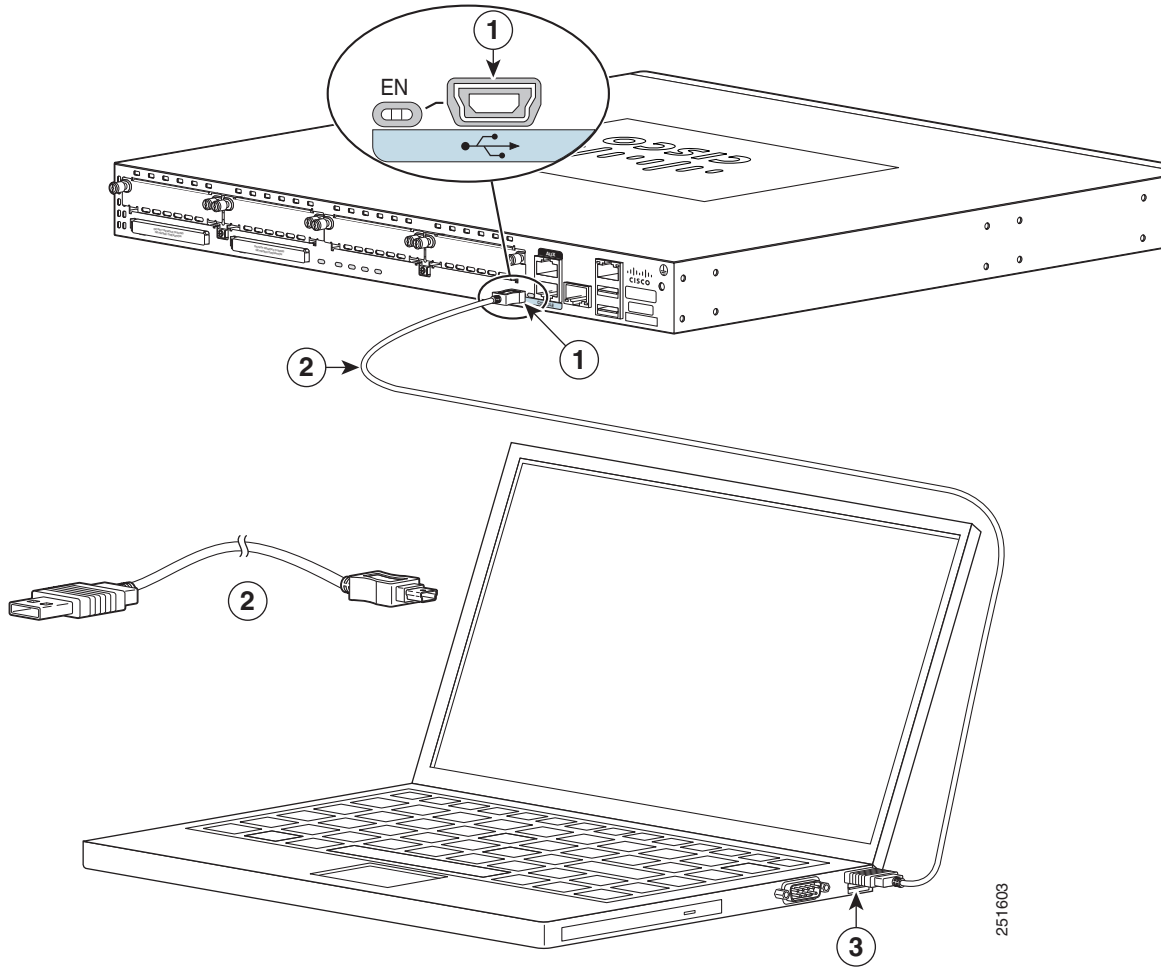
1	USB 5-pin mini USB Type-B console port	2	USB 5-pin mini USB Type-B to USB Type-A console cable
3	USB Type-A		

Figure 3-33   Connecting the USB Console Cable to the Cisco 2921, 2951, 3925 and 3945 Routers
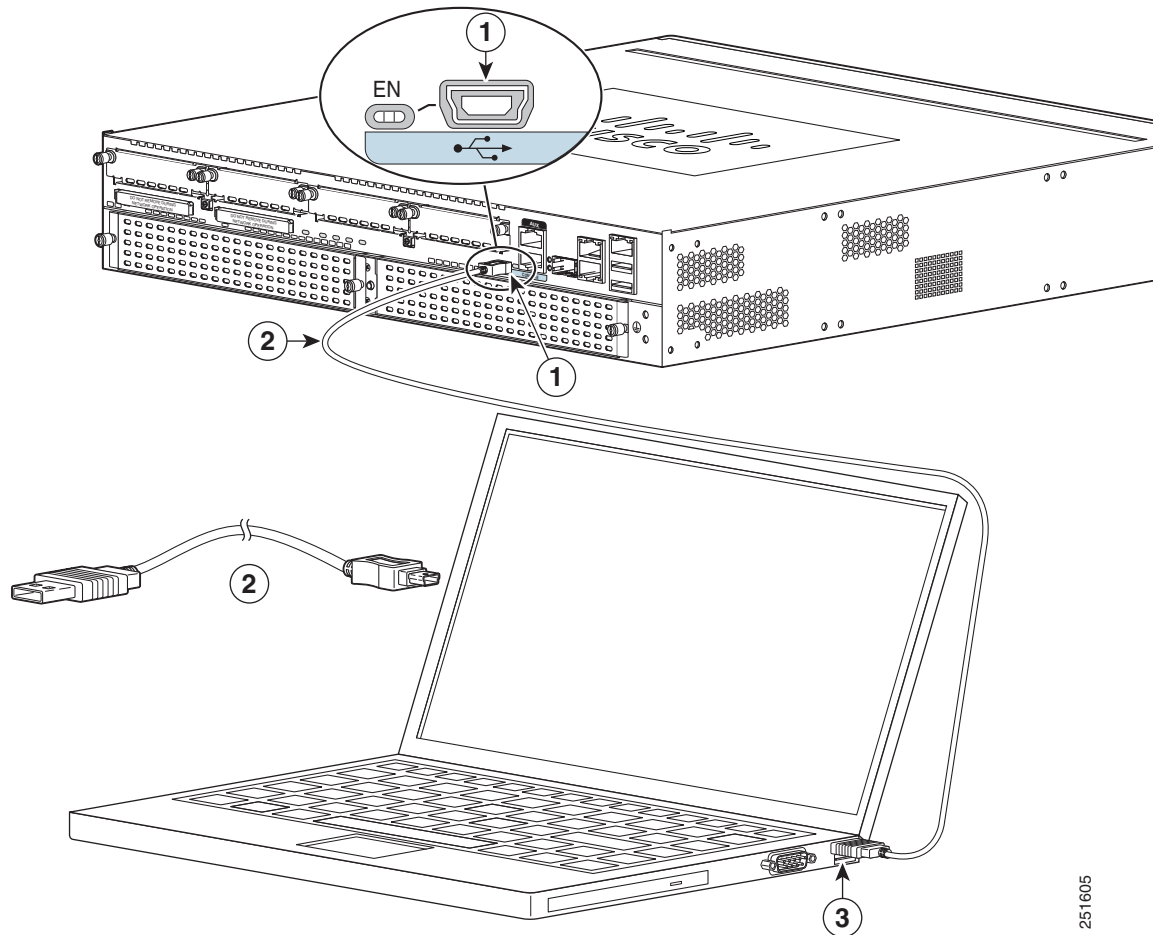
1	USB 5-pin mini USB Type-B console port	2	USB 5-pin mini USB Type-B to USB Type-A console cable
3	USB Type-A		

Connecting to the Console Port with Mac OS X

This procedure describes how to connect a Mac OS X system USB port to the console using the built in OS X Terminal utility.

Step 1   Use the Finder to go to **Applications** > **Utilities** > **Terminal**.

Step 2   Connect the OS X USB port to the router.

Step 3   Enter the following commands to find the OS X USB port number

```
macbook:user$ cd /dev
macbook:user$ ls -ltr /dev/*usb*
crw-rw-rw-  1 root    wheel        9,  66 Apr  1 16:46 tty.usbmodem1a21
DT-macbook:dev user$
```

Step 4   Connect to the USB port with the following command followed by the router USB port speed

```
macbook:user$ screen /dev/tty.usbmodem1a21 9600
```

To disconnect the OS X USB console from the Terminal window

Enter **Ctrl-a** followed by **Ctrl-**

Connecting to the Console Port with Linux

This procedure shows how to connect a Linux system USB port to the console using the built in Linux Terminal utility.

Step 1   Open the Linux Terminal window.

Step 2   Connect the Linux USB port to the router.

Step 3   Enter the following commands to find the Linux USB port number

```
root@usb-suse# cd /dev
root@usb-suse /dev# ls -ltr *ACM*
crw-r--r--   1 root     root     188,   0 Jan 14 18:02 ttyACM0
root@usb-suse /dev#
```

Step 4   Connect to the USB port with the following command followed by the router USB port speed

```
root@usb-suse /dev# screen /dev/ttyACM0 9600
```

To disconnect the Linux USB console from the Terminal window

Enter **Ctrl-a** followed by **:** then **quit**

Installing the Cisco Microsoft Windows USB Device Driver

A USB device driver must be installed the first time a Microsoft Windows-based PC is connected to the USB serial port on the router.

This section contains the following topics:

- "Installing the Cisco Microsoft Windows XP USB Driver"
- "Installing the Cisco Microsoft Windows 2000 USB Driver"
- "Installing the Cisco Microsoft Windows Vista USB Driver"

Installing the Cisco Microsoft Windows XP USB Driver

This procedure shows how to install the Microsoft Windows XP USB driver. Download the driver for your router model from the Tools and Resources Download Software site, USB Console Software category:

www.cisco.com/cisco/pub/software/portal/select.html?mdfid=268437899&?i=rp

Step 1   Unzip the file Cisco_usbconsole_driver_X_X.zip (where X is a revision number).

Step 2   If using 32-bit Windows XP double-click the file setup.exe from the Windows_32 folder, or if using 64-bit Windows XP double-click the file setup(x64).exe from the Windows_64 folder.

Step 3   The Cisco Virtual Com InstallShield Wizard begins. Click **Next**.

Step 4   The Ready to Install the Program window appears, Click **Install**.

Step 5   The InstallShield Wizard Completed window appears. Click **Finish.**

Step 6   Connect the USB cable to the PC and router USB console ports. See Table 3-1. The EN LED for the USB console port turns green, and within a few moments the Found New Hardware Wizard appears. Following the instructions to complete the installation of the driver.

Step 7   The USB console is ready for use.

Installing the Cisco Microsoft Windows 2000 USB Driver

This procedure shows how to install the Microsoft Windows 2000 USB driver.

Step 1   Obtain the file Cisco_usbconsole_driver.zip from the Cisco.com web site and unzip it.

Step 2   Double-click the file setup.exe.

Step 3   The Cisco Virtual Com InstallShield Wizard begins. Click **Next**.

Step 4   The Ready to Install the Program window appears, Click **Install**.

Step 5   The InstallShield Wizard Completed window appears. Click **Finish.**

Step 6   Connect the USB cable to the PC and router USB console ports. See Table 3-1. The EN LED for the USB console port turns green, and within a few moments a series of Found New Hardware Wizard windows appear. Following the instructions to complete the installation of the driver.

Step 7   The USB console is ready for use.

Installing the Cisco Microsoft Windows Vista USB Driver

This procedure shows how to install the Microsoft Windows Vista USB driver.

Step 1   Obtain the file Cisco_usbconsole_driver.zip from the Cisco.com web site and unzip it.

Step 2   If using 32-bit Windows Vista double-click the file setup.exe from the Windows_32 folder, or if using 64-bit Windows Vista double-click the file setup(x64).exe from the Windows_64 folder.

Step 3   The Cisco Virtual Com InstallShield Wizard begins. Click **Next**.

Step 4   The Ready to Install the Program window appears, Click **Install**.

Note   If a User Account Control warning appears, click "Allow - I trust this program..." to proceed.

Step 5   The InstallShield Wizard Completed window appears. Click **Finish.**

Step 6   Connect the USB cable to the PC and router USB console ports. See Table 3-1. The EN LED for the USB console port turns green, and within a few moments a pop up window stating "Installing device driver software" appears. Following the instructions to complete the installation of the driver.

Step 7   The USB console is ready for use.

Uninstalling the Cisco Microsoft Windows USB Driver

This section provides instructions for how to uninstall the Cisco Microsoft Windows USB device driver.

- "Uninstalling the Cisco Microsoft Windows XP and 2000 USB Driver"
- "Uninstalling the Cisco Microsoft Windows Vista USB Driver"

Uninstalling the Cisco Microsoft Windows XP and 2000 USB Driver

This procedure shows you how to uninstall both the Microsoft Windows XP and 2000 USB driver. The driver can be removed using the Windows Add Remove Programs utility or the setup.exe program.

Using the Add Remove Programs utility

Note   Disconnect the router console terminal before uninstalling the driver.

Step 1   Click **Start** > **Control Panel** > **Add or Remove** Programs.

Step 2   Scroll to Cisco Virtual Com and click **Remove**.

Step 3   When the Program Maintenance window appears, select the **Remove** radio button. Click **Next**.

Using the Setup.exe program

Note   Disconnect the router console terminal before uninstalling the driver.

Step 1   Run the setup.exe for Windows 32-bit or setup(x64).exe for Windows-64bit. Click **Next**.

Step 2   The InstallShield Wizard for Cisco Virtual Com appears. Click **Next**.

Step 3   When the Program Maintenance window appears, select the **Remove** radio button. Click **Next**.

Step 4   When the Remove the Program window appears, click **Remove**.

Step 5   When the InstallShield Wizard Completed window appears click **Finish**.

Uninstalling the Cisco Microsoft Windows Vista USB Driver

This procedure shows you how to uninstall the Microsoft Windows Vista USB driver.

Note   Disconnect the router console terminal before uninstalling the driver.

Step 1   Run the setup.exe for Windows 32-bit or setup(x64).exe for Windows-64bit. Click **Next**.

Step 2   The InstallShield Wizard for Cisco Virtual Com appears. Click **Next**.

Step 3   When the Program Maintenance window appears, select the **Remove** radio button. Click **Next**.

Step 4   When the Remove the Program window appears, click **Remove**.

Note   If a User Account Control warning appears, click "Allow - I trust this program..." to proceed.

Step 5   When the InstallShield Wizard Completed window appears click **Finish**.

Connecting to the Auxiliary Port

When a modem is connected to the auxiliary port, a remote user can dial in to the router and configure it. Use the light blue console cable and the DB-9-to-DB-25 connector adapter that came in the router accessory kit.

To connect a modem to the router, follow these steps:

Step 1   Connect the RJ-45 end of the adapter cable to the black AUX port on the router. (See Figure 3-34, Figure 3-35, or Figure 3-36.)

Figure 3-34   Connecting a Modem to the Cisco 2901 Router
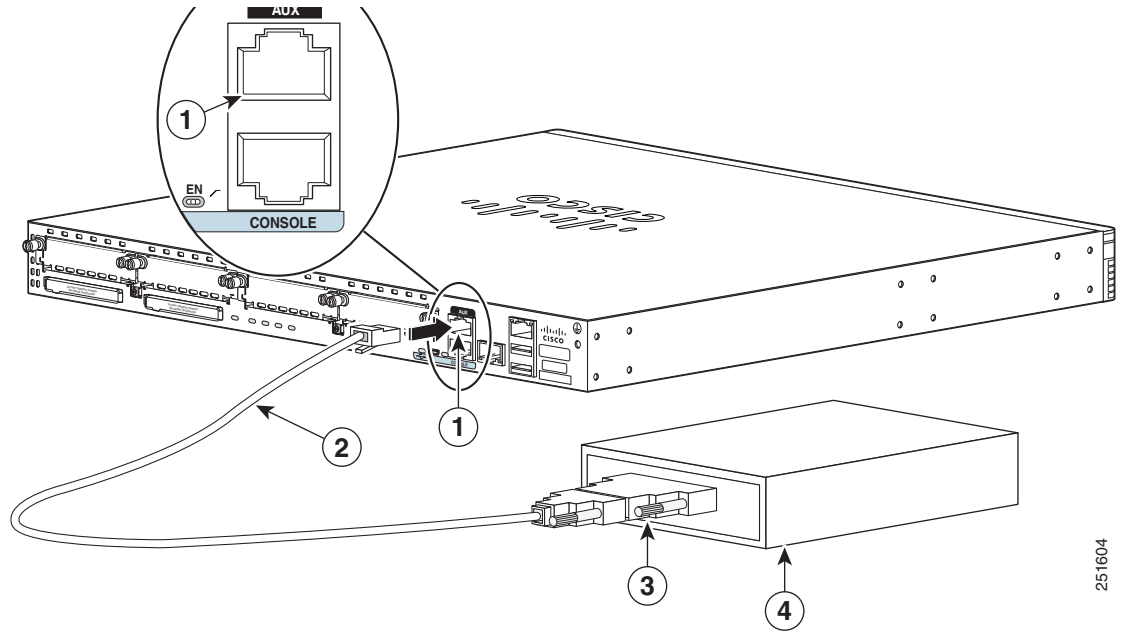
1	RJ-45 AUX port	3	RJ-45 to DB-9
2	DB-9 to DB-25 adapter	4	Modem

Figure 3-35   *Connecting a Modem to the Cisco 2921 Router*
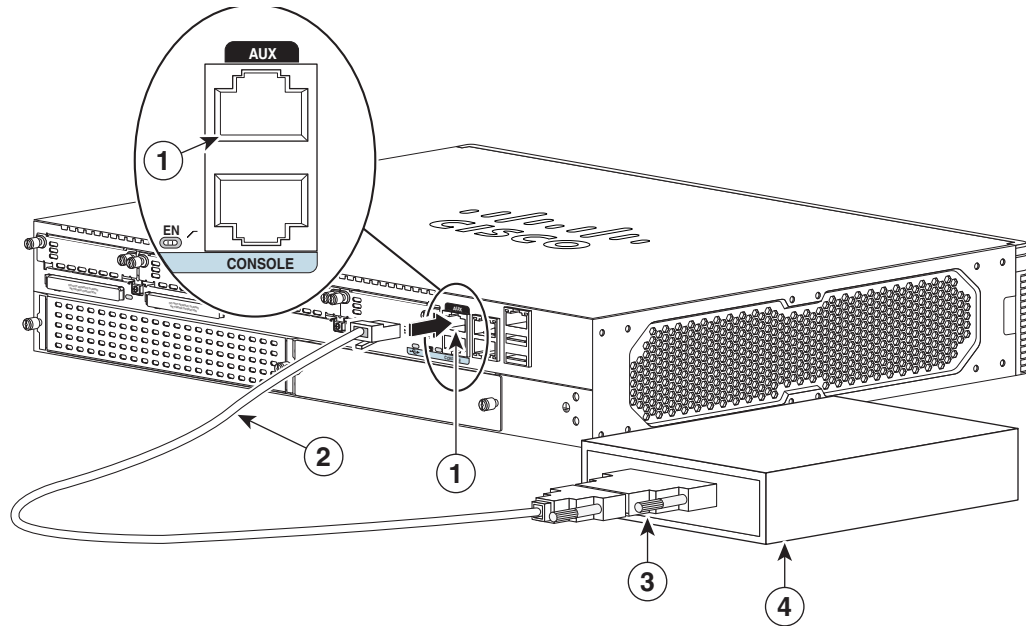
1	RJ-45 AUX port	3	RJ-45 to DB-9
2	DB-9 to DB-25 adapter	4	Modem

Figure 3-36   *Connecting a Modem to the Cisco 2921, 2925, 3925, and 3945 Routers*
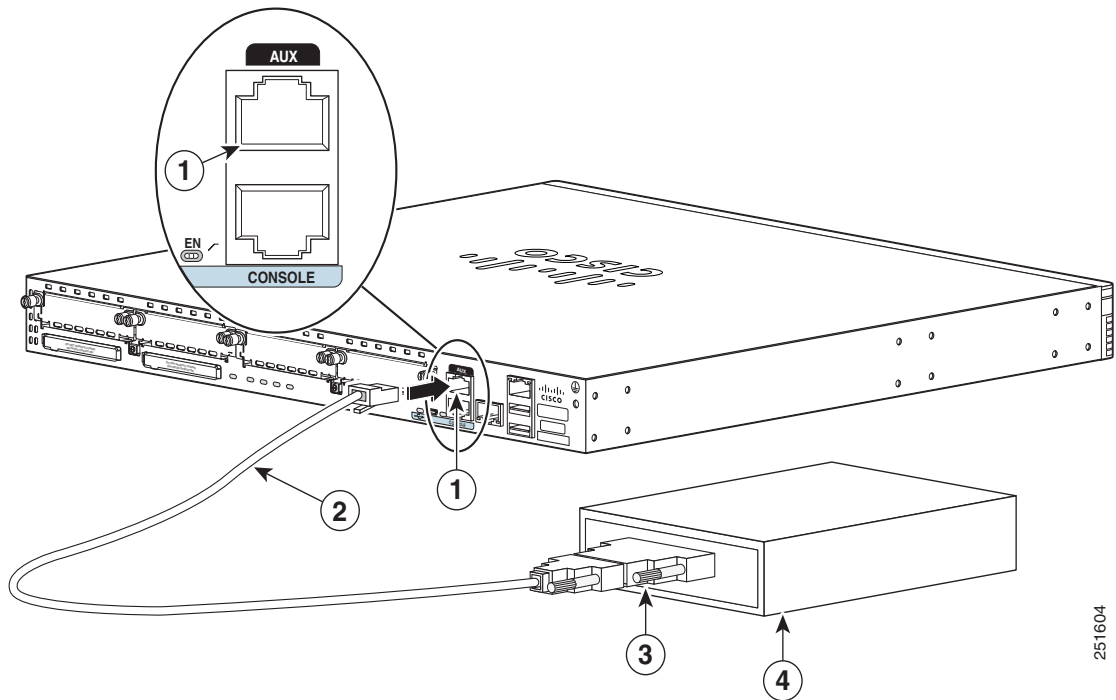
1	RJ-45 AUX port	3	RJ-45 to DB-9
2	DB-9 to DB-25 adapter	4	Modem

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

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

Step 4   Make sure that your modem and the router auxiliary port are configured for the same transmission speed (up to 115200 bps is supported) and for mode control with data carrier detect (DCD) and data terminal ready (DTR) operations.

Connecting WAN, LAN, and Voice Interfaces

This section describes how to connect WAN, LAN, and voice interface cables. It covers the following topics:

- Ports and Cabling, page 3-43
- Connection Procedures and Precautions, page 3-44

✎
Note   One or two Ethernet cables are typically provided with the router. Additional cables and transceivers can be ordered from Cisco. For ordering information, contact customer service. For cable pinouts, see the *Cisco Modular Access Router Cable Specifications* document.

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

⚠
Warning   **To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables.** Statement 1021

⚠
Warning   **Hazardous network voltages are present in WAN ports regardless of whether power to the unit is OFF or ON. To avoid electric shock, use caution when working near WAN ports. When detaching cables, detach the end away from the unit first.** Statement 1026

⚠
Caution   To comply with the Telcordia GR-1089 NEBS standard for electromagnetic compatibility and safety, connect Gigabit Ethernet ports using RJ-45 connectors for shielded twisted pair cable only to intra-building or unexposed wiring or cable. The intrabuilding cable must be shielded and the shield must be grounded at both ends. The intra-building port(s) of the equipment or subassembly must not be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

⚠
Warning   **Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.** Statement 1036

Warning   **Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.** Statement 1037

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

Ports and Cabling

Table 3-5 summarizes typical WAN, LAN, and voice connections for Cisco 2900 and Cisco 3900 series routers. The connections summarized here are also described in detail in the document on Cisco.com *Cisco Modular Access Router Cable Specifications*

Table 3-5   WAN, LAN, and Voice Connections

Port or Connection	Port Type, Color[1]	Connection:	Cable
Ethernet	RJ-45, yellow	Ethernet hub or Ethernet switch	Category 5 or higher Ethernet
T1/E1 WAN xCE1T1-PRI	RJ-48C/CA81A RJ-48S, tan	T1 or E1 network External T1 CSU or other T1 equipment	RJ-48 T1/E1 RJ-48S to RJ-48S TE RJ-48S to RJ-48S NT RJ-48S to RJ-48S T1 RJ-48S to bare RJ-48S to BNC RJ-48S to twinaxial cable RJ-48S to DB-15 RJ-48S to DB-15 null
T3/DS3/E3 WAN	BNC connector	T3 network, CSU/DSU, or other T3/DS3 equipment	75-ohm coaxial cable
Cisco serial	60-pin D-sub, blue	CSU/DSU and serial network or equipment	Cisco serial transition cable that matches the signaling protocol (EIA/TIA-232, EIA/TIA-449, V.35, X.21, or EIA-530) and the serial port operating mode (DTE or DCE).[2]
Cisco Smart serial	Cisco Smart compact connector, blue	CSU/DSU and serial network or equipment	
ADSL	RJ-11C/CA11A, lavender	Network demarcation device for service provider DSL interface	RJ-11 straight-through
SHDSL	RJ-11C/CA11A, lavender, RJ-14	Network demarcation device for service provider DSL interface	RJ-11 straight-through for 2-wire RJ-14 straight-through for 4-wire
T1/E1 digital voice	RJ-48C/CA81A, tan	Digital PBX, ISDN network, CSU/DSU	RJ-48 T1/E1
Analog voice FXS	RJ-11, gray	Telephone, fax	RJ-11; RJ21 if using NM-HDA, straight-through
Analog voice FXO	RJ-11, pink	Central office, analog PBX	
Analog voice E&M	RJ-45, brown	Analog PBX	RJ-45
BRI S/T WAN (external NT1)	RJ-45/CB-1D, orange	NT1 device or private integrated network exchange (PINX)	RJ-45 straight-through
BRI U WAN (built-in NT1)	RJ-49C/CA-A11, red	ISDN network	RJ-48 straight-through
56/64-kbps DSU/CSU	8-pin modular, blue	RJ-48S interface in subrate device or network	RJ-48 straight-through
T1/FT1 DSU/CSU	8-pin modular, blue	RJ-48C interface	RJ-48 straight-through
Gigabit Ethernet SFP, optical	LC, color according to optical wavelength	1000BASE-SX, -LX, -LH, -ZX, -CWDM	Optical fiber as specified on applicable data sheet
Gigabit Ethernet SFP, copper	RJ-45	1000BASE-T	Category 5, 5e, 6 UTP

1. Cable color codes are specific to Cisco cables.

2. See the *Cisco Modular Access Router Cable Specifications* document for information about choosing these cables.

Connection Procedures and Precautions

- Connect each WAN, LAN, and voice cable to the appropriate connector on the chassis or on a network module or interface card.

- Position the cables carefully, so that they do not put strain on the connectors.

- Organize cables in bundles so that cables do not intertwine.

- Inspect the cables to make sure that the routing and bend radius is satisfactory. Reposition cables, if necessary.

- Install cable ties in accordance with site requirements.

For cable pinouts, see *Cisco Modular Access Router Cable Specifications*.

CHAPTER 4

Configuring the Router

This document describes how to power up the router and perform the initial configuration in the following sections:

Powering up the Router

> **Warning** **Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.** Statement 1029

This section covers the following topics:

Checklist for Power Up

Check the following items before powering up the router:

- Chassis is securely mounted and grounded.
- Power and interface cables are connected.
- The external CompactFlash memory card is properly seated into its slot. For installation instructions, see "Removing and Installing CompactFlash Memory Cards" procedure on page 5-58.

- PC with terminal emulation program (HyperTerminal or equivalent) is connected to the console port and configured for 9600 baud, 8 data bits, 1 stop bit, no parity, and flow control is set to "none."

- Suitable PC COM port is selected in the terminal emulation program.

- Passwords for access control are selected.

- IP addresses for the Ethernet and serial interfaces have been determined.

Power Up Procedure

To power up your Cisco router, follow this procedure to verify the router has performed the initialization and self-test. When the procedure is finished, the router is ready to configure.

If you encounter problems while powering on the router, see the router's Troubleshooting page on Cisco.com.

For information about the ROM monitor and the bootstrap program, see *Using the ROM Monitor* in the router's software configuration guide. For information about the configuration register, see *Changing the Configuration Register Settings* in the router's software configuration guide.

Note   To view the boot sequence, you must establish console connection to the Cisco router *before* it powers up.

Step 1   Make sure that your PC is powered up and connected as described in the "Checklist for Power Up" section on page 4-1.

Step 2   Move the power switch to the ON position.

- The SYS LED on the front of the chassis begins blinking green.

- The fans begin operating.

- Startup messages appear in your Console window. When the startup messages finish, the SYS LED appears solid green.

Caution   *Do not press any keys on the keyboard until the messages stop and the SYS LED is solid green*. Any keys pressed during this time are interpreted as the first command typed when the messages stop, which might cause the router to power off and start over. It takes a few minutes for the messages to stop.

Note   Depending on your installation, some LEDs at the rear of the chassis and on installed modules might also illuminate.

If you encounter a problem during the power up process, see the *Troubleshooting* documentation on the Cisco.com product page.

Step 3   Use any of the following tools to perform the initial configuration.

- Cisco Configuration Professional Express, page 4-3

Note   Cisco recommends using Cisco Configuration Professional Express to perform the initial configuration on the router because it provides a web-based graphical-user interface. See Cisco Configuration Professional Express, page 4-3.

- Cisco Setup Command Facility, page 4-3
- Cisco Command Line Interface, page 4-3

Cisco Setup Command Facility

Cisco Setup Command Facility lets you configure the initial router settings through a configuration dialog. If you see the following messages, the router has booted and is ready for initial configuration using the setup command facility.

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

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

Would you like to enter the initial configuration dialog? [yes/no]:
```

See the "Performing the Initial Configuration on the Router" section on page 4-4 for additional information.

Note   If the system configuration dialog message does not appear, a default configuration file was installed on the router prior to shipping. See the "Using Cisco Configuration Professional Express" section on page 4-8 to configure the router.

Cisco Configuration Professional Express

Use the Cisco Configuration Professional Express web-based application to configure the initial router settings. See the *Cisco Configuration Professional Express User Guide* document on Cisco.com for detailed instructions,
http://www.cisco.com/en/US/docs/net_mgmt/cisco_configuration_professional_express/version1_1/online_help/CCPE11.pdf

Cisco Command Line Interface

Cisco Command Line Interface (CLI) lets you configure the initial router settings manually. If you see the following messages, the router has booted and is ready for initial configuration using the CLI. For how to use the CLI to configure the router, see the "Using Cisco IOS CLI—Manual Configuration" section on page 4-8.

Note   If the `rommon 1>` prompt appears, your system has booted in ROM monitor mode. For information on the ROM monitor, see *Using the ROM Monitor* in the router's software configuration guide.

Verifying the Front Panel LED Indications

The front-panel indicator LEDs described in Table 1-13 provide power, activity, and status information useful during power up.

Performing the Initial Configuration on the Router

Use the following tools to perform the initial configuration on the router:

- Using Cisco Setup Command Facility
- Using Cisco Configuration Professional Express
- Using Cisco IOS CLI—Manual Configuration

Using Cisco Setup Command Facility

The setup command facility prompts you to enter the information that is needed to configure a router quickly. The facility steps you through a initial configuration, including LAN and WAN interfaces. For more general information about the setup command facility, see the following document:

Cisco IOS Configuration Fundamentals Configuration Guide, Release 12.4, Part 2: Cisco IOS User Interfaces:Using AutoInstall and Setup: http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/12_4/cf_12_4_book.html

This section explains how to configure a hostname for the router, set passwords, and configure an interface for communication with the management network.

Note The messages that are displayed will vary based on your router model, the installed interface modules, and the software image. The following example and the user entries (in **bold**) are shown as examples only.

Note If you make a mistake while using the setup command facility, you can exit and run the setup command facility again. Press **Ctrl-C**, and enter the **setup** command in privileged EXEC mode (`Router#`).

Step 1 Enter the setup command facility by using one of the following methods:

- From the Cisco IOS CLI, enter the **setup** command in privileged EXEC mode:

```
Router> enable
Password: <password>
Router# setup

        --- System Configuration Dialog ---
Continue with configuration dialog? [yes/no]:
```

You are now in the Setup Configuration Utility.

The prompts in the setup command facility vary; depending on your router model, on the installed interface modules, and on the software image. The following steps and the user entries (in bold) are shown as examples only.

> **Note** If you make a mistake while using the setup command facility, you can exit and run the setup command facility again. Press Ctrl-C, and enter the setup command at the privileged EXEC mode prompt (Router#). For more information on using the setup command facility, see *The Setup Command* chapter in *Cisco IOS Configuration Fundamentals Command Reference*, Release 12.2T,
> http://www.cisco.com/en/US/docs/ios/12_2t/fun/command/reference/122tfr.html

Step 2   To proceed using the setup command facility, enter **yes**.

```
Continue with configuration dialog? [yes/no]:

At any point you may enter a question mark '?' for help.

Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.
```

Step 3   Basic management setup configures only enough connectivity

```
Would you like to enter basic management setup? [yes/no]: yes
```

Step 4   Enter a hostname for the router (this example uses myrouter):

```
Configuring global parameters:
Enter host name [Router]: myrouter
```

Step 5   Enter an enable secret password. This password is encrypted (for more security) and cannot be seen when viewing the configuration.

```
The enable secret is a password used to protect access to
privileged EXEC and configuration modes. This password, after
entered, becomes encrypted in the configuration.
Enter enable secret: cisco
```

Step 6   Enter an enable password that is different from the enable secret password. This password is *not* encrypted (and is less secure) and can be seen when viewing the configuration.

```
The enable password is used when you do not specify an
enable secret password, with some older software versions, and
some boot images.
Enter enable password: cisco123
```

Step 7   Enter the virtual terminal password, which prevents unauthenticated access to the router through ports other than the console port:

```
The virtual terminal password is used to protect
access to the router over a network interface.
Enter virtual terminal password: cisco
```

Step 8   Respond to the following prompts as appropriate for your network:

```
Configure SNMP Network Management? [no]: yes
    Community string [public]:
```

A summary of the available interfaces is displayed.

> **Note** The interface summary includes interface numbering, which is dependent on the router model and the installed modules and interface cards.

```
Current interface summary

Interface                IP-Address     OK? Method Status               Protocol
GigabitEthernet0/0       unassigned     YES NVRAM  administratively down down
GigabitEthernet0/1       10.10.10.12    YES DHCP   up                   up
GigabitEthernet0/2       unassigned     YES NVRAM  administratively down down
SSLVPN-VIF0              unassigned     NO  unset  up

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

Step 9   Select one of the available interfaces for connecting the router to the management network:

```
Enter interface name used to connect to the
management network from the above interface summary: gigabitethernet0/1
```

Step 10   Respond to the following prompts as appropriate for your network:

```
Configuring interface GigabitEthernet0/1:
  Configure IP on this interface? [yes]: yes
    IP address for this interface [10.10.10.12]:
    Subnet mask for this interface [255.0.0.0] : 255.255.255.0
    Class A network is 10.0.0.0, 24 subnet bits; mask is /24
```

The following configuration command script was created:

```
hostname myrouter
enable secret 5 $1$t/Dj$yAeGKviLLZNOBX0b9eifO0 enable password cisco123 line vty 0 4
password cisco snmp-server community public !
no ip routing

!
interface GigabitEthernet0/0
shutdown
no ip address
!
interface GigabitEthernet0/1
no shutdown
ip address 10.10.10.12 255.255.255.0
!
interface GigabitEthernet0/2
shutdown
no ip address
!
end
```

Step 11   Respond to the following prompts. Select [2] to save the initial configuration:

```
[0] Go to the IOS command prompt without saving this config.
[1] Return back to the setup without saving this config.
[2] Save this configuration to nvram and exit.

Enter your selection [2]: 2
Building configuration...
Use the enabled mode 'configure' command to modify this configuration.

Press RETURN to get started! RETURN
```

The user prompt is displayed:

```
myrouter>
```

Completing the Configuration

When using the Cisco Setup, and after you have provided all the information requested by the facility, the final configuration appears. To complete your router configuration, follow these steps:

Step 1   The facility prompts you to save the configuration.

- If you answer no, the configuration information you entered is *not* saved, and you return to the router enable prompt (Router#). Enter **setup** to return to the System Configuration Dialog.

- If you answer yes, the configuration is saved, and you are returned to the user EXEC prompt (Router>).

```
Use this configuration? {yes/no} : yes
Building configuration...
Use the enabled mode 'configure' command to modify this configuration.


Press RETURN to get started!

%LINK-3-UPDOWN: Interface Ethernet0/0, changed state to up
%LINK-3-UPDOWN: Interface Ethernet0/1, changed state to up
%LINK-3-UPDOWN: Interface Serial0/0/0, changed state to up
%LINK-3-UPDOWN: Interface Serial0/0/1, changed state to down
%LINK-3-UPDOWN: Interface Serial0/2, changed state to down
%LINK-3-UPDOWN: Interface Serial1/0, changed state to up
%LINK-3-UPDOWN: Interface Serial1/1, changed state to down
%LINK-3-UPDOWN: Interface Serial1/2, changed state to down

<Additional messages omitted.>
```

Step 2   When the messages stop appearing on your screen, press **Return** to get the Router> prompt.

> ✎
>
> **Note**   If you see the next message, it means that no other routers were found on the network attached to the port.

```
%AT-6-ONLYROUTER: Ethernet0/0: AppleTalk port enabled; no neighbors found
```

Step 3   The Router> prompt indicates that you are now at the command-line interface (CLI) and you have just completed a initial router configuration. Nevertheless, this is *not* a complete configuration. At this point, you have two choices:

- Run the setup command facility again, and create another configuration.

  ```
  Router> enable
  Password: password
  Router# setup
  ```

- Modify the existing configuration or configure additional features by using the CLI:

  ```
  Router> enable
  Password: password
  Router# configure terminal
  Router(config)#
  ```

Using Cisco Configuration Professional Express

Use Cisco Configuration Professional Express web-based application to configure the initial router settings. See the *Cisco Configuration Professional Express User Guide* document on Cisco.com for detailed instructions,
http://www.cisco.com/en/US/docs/net_mgmt/cisco_configuration_professional_express/version1_1/online_help/CCPE11.pdf

For help with interface and port numbering, see the "Slot, Port, and Interface Information" section on page 1-28.

Using Cisco IOS CLI—Manual Configuration

This section shows you how to access the command-line interface (CLI) to perform the initial configuration on the router.

If the system configuration dialog message does not appear, a default configuration file was installed on the router prior to shipping. See the "Using Cisco Configuration Professional Express" section on page 4-8 to configure the router.

For help with interface and port numbering, see the "Slot, Port, and Interface Information" section on page 1-28.

Step 1 Enter the following answer when the system message appears on the router.

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

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

Would you like to enter the initial configuration dialog? [yes/no]: no
```

Step 2 Press **Return** to terminate autoinstall and continue with manual configuration:

```
Would you like to terminate autoinstall? [yes] Return
```

Several messages are displayed, ending with a line similar to the following:

```
...
Copyright (c) 1986-2004 by cisco Systems, Inc.
Compiled <date> <time> by <person>
```

Step 3 Press **Return** to bring up the Router> prompt.

```
...
flashfs[4]: Initialization complete.
Router>
```

Step 4 Type **enable** to enter privileged EXEC mode:

```
Router> enable
Router#
```

- Configuring the Router Hostname, page 4-9 (Optional)
- Configuring the Enable and Enable Secret Passwords, page 4-10 (Required)
- Configuring the Console Idle Privileged EXEC Timeout, page 4-11 (Optional)
- Configuring Gigabit Ethernet Interfaces, page 4-13 (Required)

Configuring the Router Hostname

The hostname is used in CLI prompts and default configuration filenames. If you do not configure the router hostname, the router uses the factory-assigned default hostname "Router."

Do not expect capitalization and lower casing to be preserved in the hostname. Uppercase and lowercase characters are treated as identical by many Internet software applications. It may seem appropriate to capitalize a name as you would ordinarily do, but conventions dictate that computer names appear in all lowercase characters. For more information, see the RFC 1178, *Choosing a Name for Your Computer*.

The name must also follow the rules for Advanced Research Projects Agency Network (ARPANET) hostnames. They must start with a letter, end with a letter or digit, and have as interior characters only letters, digits, and hyphens. Names must be 63 characters or fewer. For more information, see the RFC 1035, *Domain Names—Implementation and Specification*.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **hostname** *name*
4. Verify that the router prompt displays your new hostname.
5. **end**

DETAILED STEPS

	Command or Action	Purpose

Step 1	`enable`
	
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		
		- Enter your password if prompted.

Step 2	`configure terminal`
	
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	`hostname` *name* **Example:** `Router(config)# hostname myrouter`	Specifies or modifies the hostname for the network server.

	Command or Action	Purpose
Step 4	Verify that the router prompt displays your new hostname. **Example:** `myrouter(config)#`	—
Step 5	**end** **Example:** `myrouter# end`	(Optional) Returns to privileged EXEC mode.

Configuring the Enable and Enable Secret Passwords

To provide an additional layer of security, particularly for passwords that cross the network or are stored on a TFTP server, you can use either the **enable password** command or **enable secret** command. Both commands accomplish the same thing—they allow you to establish an encrypted password that users must enter to access privileged EXEC (enable) mode.

We recommend that you use the **enable secret** command because it uses an improved encryption algorithm. Use the **enable password** command only if you boot an older image of the Cisco IOS software or if you boot older boot ROMs that do not recognize the **enable secret** command.

For more information, see the "Configuring Passwords and Privileges" chapter in the *Cisco IOS Security Configuration Guide*. Also see the *Cisco IOS Password Encryption Facts* tech note and the *Improving Security on Cisco Routers* tech note.

Restrictions

If you configure the **enable secret** command, it takes precedence over the **enable password** command; the two commands cannot be in effect simultaneously.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **enable password** *password*
4. **enable secret** *password*
5. **end**
6. **enable**
7. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**enable password** *password* **Example:** Router(config)# enable password pswd2	(Optional) Sets a local password to control access to various privilege levels. • We recommend that you perform this step only if you boot an older image of the Cisco IOS software or if you boot older boot ROMs that do not recognize the **enable secret** command.
Step 4	**enable secret** *password* **Example:** Router(config)# enable secret *greentree*	Specifies an additional layer of security over the **enable password** command. • Do not use the same password that you entered in Step 3.
Step 5	**end** **Example:** Router(config)# end	Returns to privileged EXEC mode.
Step 6	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Verify that your new enable or enable secret password works.
Step 7	**end** **Example:** Router(config)# end	(Optional) Returns to privileged EXEC mode.

Configuring the Console Idle Privileged EXEC Timeout

This section describes how to configure the console line's idle privileged EXEC timeout. By default, the privileged EXEC command interpreter waits 10 minutes to detect user input before timing out.

When you configure the console line, you can also set communication parameters, specify autobaud connections, and configure terminal operating parameters for the terminal that you are using. For more information on configuring the console line, see the *Cisco IOS Configuration Fundamentals and Network Management Configuration Guide*. In particular, see the "Configuring Operating Characteristics for Terminals" and "Troubleshooting and Fault Management" chapters.

SUMMARY STEPS

1. **enable**

2. **configure terminal**

3. **line console 0**

4. **exec-timeout** *minutes* [*seconds*]

5. **end**

6. **show running-config**

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**line console 0** **Example:** Router(config)# line console 0	Configures the console line and starts the line configuration command collection mode.
Step 4	**exec-timeout** *minutes* [*seconds*] **Example:** Router(config-line)# exec-timeout 0 0	Sets the idle privileged EXEC timeout, which is the interval that the privileged EXEC command interpreter waits until user input is detected. • The example shows how to specify no timeout. Setting the exec-timeout value to 0 will cause the router to never log out once logged in. This could have security implications if you leave the console without manually logging out using the disable command.
Step 5	**end** **Example:** Router(config)# end	Returns to privileged EXEC mode.
Step 6	**show running-config** **Example:** Router(config)# show running-config	Displays the running configuration file. • Verify that you properly configured the idle privileged EXEC timeout.

Examples

The following example shows how to set the console idle privileged EXEC timeout to 2 minutes 30 seconds:

```
line console
 exec-timeout 2 30
```

The following example shows how to set the console idle privileged EXEC timeout to 10 seconds:

```
line console
 exec-timeout 0 10
```

Configuring Gigabit Ethernet Interfaces

This sections shows how to assign an IP address and interface description to an Ethernet interface on your router.

For comprehensive configuration information on Gigabit Ethernet interfaces, see the "Configuring LAN Interfaces" chapter of the *Cisco IOS Interface and Hardware Component Configuration Guide*, http://www.cisco.com/en/US/docs/ios/12_2/interface/configuration/guide/icflanin.html

For information on interface numbering, see the software configuration guide for your router.

SUMMARY STEPS

1. **enable**

2. **show ip interface brief**

3. **configure terminal**

4. **interface** {**fastethernet** | **gigabitethernet**} **0/***port*

5. **description** *string*

6. **ip address** *ip-address mask*

7. **no shutdown**

8. **end**

9. **show ip interface brief**

DETAILED STEPS

	Command or Action	Purpose

Step 1	`enable`
	
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		
		• Enter your password if prompted.

Step 2	`show ip interface brief`
	
	Example:
	`Router# show ip interface brief`
		Displays a brief status of the interfaces that are configured for IP.
		
		• Learn which type of Ethernet interface is on your router.

Step 3	`configure terminal`
	
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

	Command or Action	Purpose
Step 4	**interface** {**fastethernet** | **gigabitethernet**} **0/***port* **Example:** Router(config)# interface gigabitethernet 0/0	Specifies the Ethernet interface and enters interface configuration mode. **Note** For information on interface numbering, see the software configuration guide.
Step 5	**description** *string* **Example:** Router(config-if)# description GE int to 2nd floor south wing	(Optional) Adds a description to an interface configuration. • The description helps you remember what is attached to this interface. The description can be useful for troubleshooting.
Step 6	**ip address** *ip-address mask* **Example:** Router(config-if)# ip address 172.16.74.3 255.255.255.0	Sets a primary IP address for an interface.
Step 7	**no shutdown** **Example:** Router(config-if)# no shutdown	Enables an interface.
Step 8	**end** **Example:** Router(config)# end	Returns to privileged EXEC mode.
Step 9	**show ip interface brief** **Example:** Router# show ip interface brief	Displays a brief status of the interfaces that are configured for IP. • Verify that the Ethernet interfaces are up and configured correctly.

Examples

Configuring the GigabitEthernet Interface: Example

```
!
interface GigabitEthernet0/0
 description GE int to HR group
 ip address 172.16.3.3 255.255.255.0
 duplex auto
 speed auto
 no shutdown
!
```

Sample Output for the show ip interface brief Command

```
Router# show ip interface brief

Interface               IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0        172.16.3.3     YES NVRAM  up                        up
GigabitEthernet0/1        unassigned     YES NVRAM  administratively down down
Router#
```

Specifying a Default Route or Gateway of Last Resort

This section describes how to specify a default route with IP routing enabled. For alternative methods of specifying a default route, see the *Configuring a Gateway of Last Resort Using IP Commands* tech note.

The Cisco IOS software uses the gateway (router) of last resort if it does not have a better route for a packet and if the destination is not a connected network. This section describes how to select a network as a default route (a candidate route for computing the gateway of last resort). The way in which routing protocols propagate the default route information varies for each protocol.

Configuring IP Routing and IP Protocols

For comprehensive configuration information about IP routing and IP routing protocols, see the *Cisco IOS IP Routing Protocols Configuration Guide, Release 12.4T* on Cisco.com at the following URL, http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/12_4t/irp_12_4t_book.html.

IP Routing

You can configure integrated routing and bridging (IRB) so the router can route and bridge simultaneously. The router will act as an IP host on the network whether routing is enabled or not. To read more about IRB see the following URL on Cisco.com, http://www.cisco.com/en/US/tech/tk389/tk815/tk855/tsd_technology_support_sub-protocol_home.html

IP routing is automatically enabled in the Cisco IOS software. When IP routing is configured, the system will use a configured or learned route to forward packets, including a configured default route.

Note This task section does not apply when IP routing is disabled. To specify a default route when IP routing is disabled, refer to the *Configuring a Gateway of Last Resort Using IP Commands* tech note on Cisco.com.

Default Routes

A router might not be able to determine the routes to all other networks. To provide complete routing capability, the common practice is to use some routers as smart routers and give the remaining routers default routes to the smart router. (Smart routers have routing table information for the entire internetwork.) These default routes can be passed along dynamically, or can be configured into the individual routers.

Most dynamic interior routing protocols include a mechanism for causing a smart router to generate dynamic default information that is then passed along to other routers.

Default Network

If a router has an interface that is directly connected to the specified default network, the dynamic routing protocols running on the router will generate or source a default route. In the case of RIP, the router will advertise the pseudonetwork 0.0.0.0. In the case of IGRP, the network itself is advertised and flagged as an exterior route.

A router that is generating the default for a network also may need a default of its own. One way a router can generate its own default is to specify a static route to the network 0.0.0.0 through the appropriate device.

Gateway of Last Resort

When default information is being passed along through a dynamic routing protocol, no further configuration is required. The system periodically scans its routing table to choose the optimal default network as its default route. In the case of RIP, there is only one choice, network 0.0.0.0. In the case of IGRP, there might be several networks that can be candidates for the system default. The Cisco IOS software uses both administrative distance and metric information to determine the default route (gateway of last resort). The selected default route appears in the gateway of last resort display of the **show ip route** EXEC command.

If dynamic default information is not being passed to the software, candidates for the default route are specified with the **ip default-network** global configuration command. In this usage, the **ip default-network** command takes an unconnected network as an argument. If this network appears in the routing table from any source (dynamic or static), it is flagged as a candidate default route and is a possible choice as the default route.

If the router has no interface on the default network, but does have a route to it, it considers this network as a candidate default path. The route candidates are examined and the best one is chosen, based on administrative distance and metric. The gateway to the best default path becomes the gateway of last resort.

SUMMARY STEPS

1. **enable**

2. **configure terminal**

3. **ip routing**

4. **ip route** *dest-prefix mask next-hop-ip-address* [*admin-distance*] [**permanent**]

5. **ip default-network** *network-number*
   or
   ip route *dest-prefix mask next-hop-ip-address*

6. **end**

7. **show ip route**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip routing** **Example:** `Router(config)# ip routing`	Enables IP routing.

	Command or Action	Purpose
Step 4	**ip route** *dest-prefix mask next-hop-ip-address* [*admin-distance*] [**permanent**] **Example:** Router(config)# ip route 192.168.24.0 255.255.255.0 172.28.99.2	Establishes a static route.
Step 5	**ip default-network** *network-number* or **ip route** *dest-prefix mask next-hop-ip-address* **Example:** Router(config)# ip default-network 192.168.24.0 **Example:** Router(config)# ip route 0.0.0.0 0.0.0.0 172.28.99.1	Selects a network as a candidate route for computing the gateway of last resort. Creates a static route to network 0.0.0.0 0.0.0.0 for computing the gateway of last resort.
Step 6	**end** **Example:** Router(config)# end	Returns to privileged EXEC mode.
Step 7	**show ip route** **Example:** Router# show ip route	Displays the current routing table information. • Verify that the gateway of last resort is set.

Examples

Specifying a Default Route: Example

```
!
ip routing
!
ip route 192.168.24.0 255.255.255.0 172.28.99.2
!
ip default-network 192.168.24.0
!
```

Sample Output for the show ip route Command

```
Router# show ip route

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
Gateway of last resort is 172.28.99.2 to network 192.168.24.0

     172.24.0.0 255.255.255.0 is subnetted, 1 subnets
C       172.24.192.0 is directly connected, FastEthernet0
S       172.24.0.0 255.255.0.0 [1/0] via 172.28.99.0
S*    192.168.24.0 [1/0] via 172.28.99.2
     172.16.0.0 255.255.255.0 is subnetted, 1 subnets
C       172.16.99.0 is directly connected, FastEthernet1
Router#
```

Configuring Virtual Terminal Lines for Remote Console Access

Virtual terminal (vty) lines are used to allow remote access to the router. This section shows you how to configure the virtual terminal lines with a password, so that only authorized users can remotely access the router.

The router has five virtual terminal lines by default. However, you can create additional virtual terminal lines as described in the Cisco IOS Terminal Services Configuration Guide, Release 12.4. See the *Configuring Terminal Operating Characteristics for Dial-In Sessions* section.

Line passwords and password encryption is described in the Cisco IOS Security Configuration Guide, Release 12.4. See the Security with Passwords, Privilege Levels, and Login Usernames for CLI Sessions on Networking Devices section. If you want to secure the vty lines with an access list, see the Access Control Lists: Overview and Guidelines. Also see the *Cisco IOS Password Encryption Facts* tech note.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **line vty** *line-number* [*ending-line-number*]
4. **password** *password*
5. **login**
6. **end**
7. **show running-config**
8. From another network device, attempt to open a Telnet session to the router.

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**line vty** *line-number* [*ending-line-number*] **Example:** Router(config)# line vty 0 4	Starts the line configuration command collection mode for the virtual terminal lines (vty) for remote console access. • Make sure that you configure all vty lines on your router. Note To verify the number of vty lines on your router, use the **line vty ?** command.

	Command or Action	Purpose
Step 4	**password** *password* **Example:** Router(config-line)# password *guessagain*	Specifies a password on a line.
Step 5	**login** **Example:** Router(config-line)# login	Enables password checking at login.
Step 6	**end** **Example:** Router(config-line)# end	Returns to privileged EXEC mode.
Step 7	**show running-config** **Example:** Router# show running-config	Displays the running configuration file. • Verify that you properly configured the virtual terminal lines for remote access.
Step 8	From another network device, attempt to open a Telnet session to the router. **Example:** Router# 172.16.74.3 Password:	Verifies that you can remotely access the router and that the virtual terminal line password is correctly configured.

Examples

The following example shows how to configure virtual terminal lines with a password:

```
!
line vty 0 4
 password guessagain
 login
!
```

What to Do Next

After you configure the vty lines, follow these steps:

- (Optional) To encrypt the virtual terminal line password, see the "Configuring Passwords and Privileges" chapter in the *Cisco IOS Security Configuration Guide*. Also see the *Cisco IOS Password Encryption Facts* tech note.

- (Optional) To secure the VTY lines with an access list, see the "Part 3: Traffic Filtering and Firewalls" in the *Cisco IOS Security Configuration Guide*.

Configuring the Auxiliary Line

This section describes how to enter line configuration mode for the auxiliary line. How you configure the auxiliary line depends on your particular implementation of the auxiliary (AUX) port. See the following documents for information on configuring the auxiliary line:

Configuring a Modem on the AUX Port for EXEC Dialin Connectivity, tech note

http://www.cisco.com/en/US/tech/tk801/tk36/technologies_tech_note09186a0080094bbc.shtml

Configuring Dialout Using a Modem on the AUX Port, sample configuration

http://www.cisco.com/en/US/tech/tk801/tk36/technologies_configuration_example09186a0080094579
.shtml

Configuring AUX-to-AUX Port Async Backup with Dialer Watch, sample configuration

http://www.cisco.com/en/US/tech/tk801/tk36/technologies_configuration_example09186a0080093d2b.
shtml

Modem-Router Connection Guide, tech note

http://www.cisco.com/en/US/tech/tk801/tk36/technologies_tech_note09186a008009428b.shtml

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **line aux 0**
4. See the tech notes and sample configurations to configure the line for your particular implementation of the AUX port.

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**line aux 0** **Example:** `Router(config)# line aux 0`	Starts the line configuration command collection mode for the auxiliary line.
Step 4	See the tech notes and sample configurations to configure the line for your particular implementation of the AUX port.	—

Verifying Network Connectivity

This section describes how to verify network connectivity for your router.

Prerequisites

- Complete all previous configuration tasks in this document.
- The router must be connected to a properly configured network host.

SUMMARY STEPS

1. **enable**
2. **ping** [*ip-address* | *hostname*]
3. **telnet** {*ip-address* | *hostname*}

DETAILED STEPS

	Command or Action	Purpose

Step 1	`enable`
	
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		
		- Enter your password if prompted.

Step 2	`ping [ip-address	hostname]`  **Example:** `Router# ping 172.16.74.5`	Diagnoses initial network connectivity. - To verify connectivity, ping the next hop router or connected host for each configured interface to.
Step 3	`telnet {ip-address	hostname}`  **Example:** `Router# telnet 10.20.30.40`	Logs in to a host that supports Telnet. - If you want to test the vty line password, perform this step from a different network device, and use your router's IP address.

Examples

The following display shows sample output for the ping command when you ping the IP address 192.168.7.27:

```
Router# ping

Protocol [ip]:
Target IP address: 192.168.7.27
Repeat count [5]:
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.7.27, timeout is 2 seconds:
!!!!!
Success rate is 100 percent, round-trip min/avg/max = 1/2/4 ms
```

The following display shows sample output for the ping command when you ping the IP hostname donald:

```
Router# ping donald

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.7.27, timeout is 2 seconds:
!!!!!
Success rate is 100 percent, round-trip min/avg/max = 1/3/4 ms
```

Saving Your Router Configuration

This section describes how to avoid losing your configuration at the next system reload or power cycle by saving the running configuration to the startup configuration in NVRAM. The NVRAM provides 256KB of storage on the router.

SUMMARY STEPS

1. **enable**
2. **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**copy running-config startup-config** **Example:** Router# copy running-config startup-config	Saves the running configuration to the startup configuration.

Saving Backup Copies of Configuration and System Image

To aid file recovery and minimize downtime in case of file corruption, we recommend that you save backup copies of the startup configuration file and the Cisco IOS software system image file on a server.

SUMMARY STEPS

1. **enable**

2. **copy nvram:startup-config** {**ftp:** | **rcp:** | **tftp:**}

3. **show {flash0|flash1}:**

4. **copy {flash0|flash1}:** {**ftp:** | **rcp:** | **tftp:**}

DETAILED STEPS

	Command or Action	Purpose

Step 1	`enable`
	
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		
		• Enter your password if prompted.

Step 2	`copy nvram:startup-config {ftp: | rcp: | tftp:}`
	
	Example:
	`Router# copy nvram:startup-config ftp:`
		Copies the startup configuration file to a server.
		
		• The configuration file copy can serve as a backup copy.
		• Enter the destination URL when prompted.

Step 3	`show {flash0|flash1}:`
	
	Example:
	`Router# show {flash0|flash1}:`
		Displays the layout and contents of a flash memory file system.
		
		• Learn the name of the system image file.

Step 4	`copy {flash0|flash1}: {ftp: | rcp: | tftp:}`
	
	Example:
	`Router# copy {flash0|flash1}: ftp:`
		Copies a file from flash memory to a server.
		
		• Copy the system image file to a server to serve as a backup copy.
		• Enter the filename and destination URL when prompted.

Examples

Copying the Startup Configuration to a TFTP Server: Example

The following example shows the startup configuration being copied to a TFTP server:

```
Router# copy nvram:startup-config tftp:

Remote host[]? 172.16.101.101

Name of configuration file to write [rtr2-confg]? <cr>
Write file rtr2-confg on host 172.16.101.101?[confirm] <cr>
![OK]
```

Copying from Flash Memory to a TFTP Server: Example

The following example shows the use of the **show {flash0|flash1}:** command in privileged EXEC to learn the name of the system image file and the use of the **copy {flash0|flash1}: tftp:** privileged EXEC command to copy the system image (c3900-2is-mz) to a TFTP server. The router uses the default username and password.

```
Router# show {flash0|flash1}:

System flash directory:
File Length Name/status
1 4137888 c3900-c2is-mz
[4137952 bytes used, 12639264 available, 16777216 total]
16384K bytes of processor board System flash (Read/Write)\

Router# copy {flash0|flash1}: tftp:

IP address of remote host [255.255.255.255]? 172.16.13.110
filename to write on tftp host? c3900-c2is-mz
writing c3900-c2is-mz !!!!...
successful ftp write.
```

Note   To avoid losing work you have completed, be sure to save your configuration occasionally as you proceed. Use the **copy running-config startup-config** command to save the configuration to NVRAM.

Verifying the Initial Configuration

Enter the following commands in the Cisco IOS to verify the initial configuration on the router:

- **show version**—Displays the system hardware version; the installed software version; the names and sources of configuration files; the boot images; and the amount of installed DRAM, NVRAM, and flash memory.
- **show diag**—Lists and displays diagnostic information about the installed controllers, interface processors, and port adapters.
- **show interfaces**— Shows interfaces are operating correctly and that the interfaces and line protocol are in the correct state—up or down
- **show ip interface brief**— Displays a summary status of the interfaces configured for IP protocol.
- **show configuration**— Verify that you have configured the correct hostname and password.

When you have completed and verified the initial configuration, the specific features and functions are ready to be configured. See the Cisco 1900 Series, 2900 Series, and 3900 Series Software Configuration Guide.

Note   If you need help with the interface and port numbering, see the "Slot, Port, and Interface Information" section on page 1-28.

Installing and Upgrading Internal Modules and FRUs

This document describes how to install and upgrade internal modules and field replaceable units (FRUs) in Cisco 2900 and Cisco 3900 series integrated services routers (ISRs). The install and upgrade information is contained the following sections:

Internal Modules

- Accessing Internal Modules, page 5-4
- Locating Internal Modules, page 5-7
- Installing and Removing DRAM DIMMs, page 5-13
- Installing and Removing ISMs, page 5-16
- Installing and Removing PVDM3, page 5-20
- Installing and Removing PVDM2s, page 5-23
- Replacing Power Supplies and Redundant Power Supplies, page 5-28
- Installing a FIPS Louver, page 5-50

FRUs

- Replacing a Fan Tray or Air Filter, page 5-44
- 2911 Front to Back Air Flow Converter, page 5-51
- Removing and Installing CompactFlash Memory Cards, page 5-58
- Installing SFP Modules, page 5-61

⚠️ **Caution** Read the Safety Warnings section and disconnect the power supply before you perform any module replacement.

See the "Accessing Internal Modules" section on page 5-4 for instructions on how to install and replace internal components.

Safety Warnings

Warning **Read the installation instructions before connecting the system to the power source.** Statement 1004

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

Warning **This equipment must be installed and maintained by service personnel as defined by AS/NZS 3260. Incorrectly connecting this equipment to a general-purpose outlet could be hazardous. The telecommunications lines must be disconnected 1) before unplugging the main power connector or 2) while the housing is open, or both.** Statement 1043

Warning **Before working on a system that has an on/off switch, turn OFF the power and unplug the power cord.** Statement 1

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

Warning **This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.** Statement 1024

Warning **Hazardous network voltages are present in WAN ports regardless of whether power to the unit is OFF or ON. To avoid electric shock, use caution when working near WAN ports. When detaching cables, detach the end away from the unit first.** Statement 1026

Warning **Before opening the unit, disconnect the telephone-network cables to avoid contact with telephone-network voltages.** Statement 1041

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.** Statement 43

Warning **Do not use this product near water; for example, near a bath tub, wash bowl, kitchen sink or laundry tub, in a wet basement, or near a swimming pool.** Statement 1035

Warning   **Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.** Statement 1036

Warning   **Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.** Statement 1037

Warning   **Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.** Statement 1038

Warning   **To report a gas leak, do not use a telephone in the vicinity of the leak.** Statement 1039

Warning   **There is the danger of explosion if the battery is replaced incorrectly. Replace the battery only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.** Statement 1015

Warning   **Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.** Statement 1029

Warning   **No user-serviceable parts inside. Do not open.** Statement 1073

Warning   **For connections outside the building where the equipment is installed, the following ports must be connected through an approved network termination unit with integral circuit protection.**

T1 SFP Statement 1044

Accessing Internal Modules

See the following sections for instructions about accessing the internal modules on the router.

- Cisco 2900 series routers— Removing and Replacing the Chassis Cover, page 5-4
- Cisco 3900 series routers— Removing and Replacing the Services Performance Engine, page 5-6

Removing and Replacing the Chassis Cover

Cisco 2900 series routers have a removable cover. Cisco 3900 routers do not have a removable cover. All serviceable components and assemblies are easily removed on the Cisco 3900 series ISR by simply sliding them out of the chassis.

Warning   **Before opening the unit, disconnect the telephone-network cables to avoid contact with telephone-network voltages.** Statement 1041

Note   Use a number-2 Phillips screwdriver to perform the following tasks.

Removing the Cover

To remove the cover, perform the following steps.

Step 1   Read the "Safety Warnings" section on page 5-2 and disconnect the power supply before you perform any module replacement.

Step 2   Confirm the router is turned off and disconnected from the power supply or power supplies. If a redundant power is used, disconnect from the redundant power supply.

Step 3   Place the chassis on a flat surface.

Step 4   Remove the three cover screws at the back of the router cover. See Figure 5-1.

Step 5   Lift the cover from the back edge to a 45-degree angle.

Step 6   Pull the cover toward you to disengage the slots along the front (bezel) edge of the chassis. See Figure 5-1.

Replacing the Cover

To replace the cover, perform the following steps.

Step 1   Read the Safety Warnings, page 5-2 and disconnect the power supply before you perform any module replacement.

Step 2   Confirm the router is turned off and disconnected from the power supply or power supplies. If a redundant power is used disconnect from the redundant power supply.

Step 3   Place the chassis on a flat surface.

Step 4   Hold the cover at a 45-degree angle and insert the cover tabs into the slots along the front (bezel) edge of the chassis. See Figure 5-1.

Step 5   Center the cover over the chassis and lower it onto the chassis.

Step 6   Install the three cover screws.

Figure 5-1   Installing Cover on Cisco 2900 Series Routers
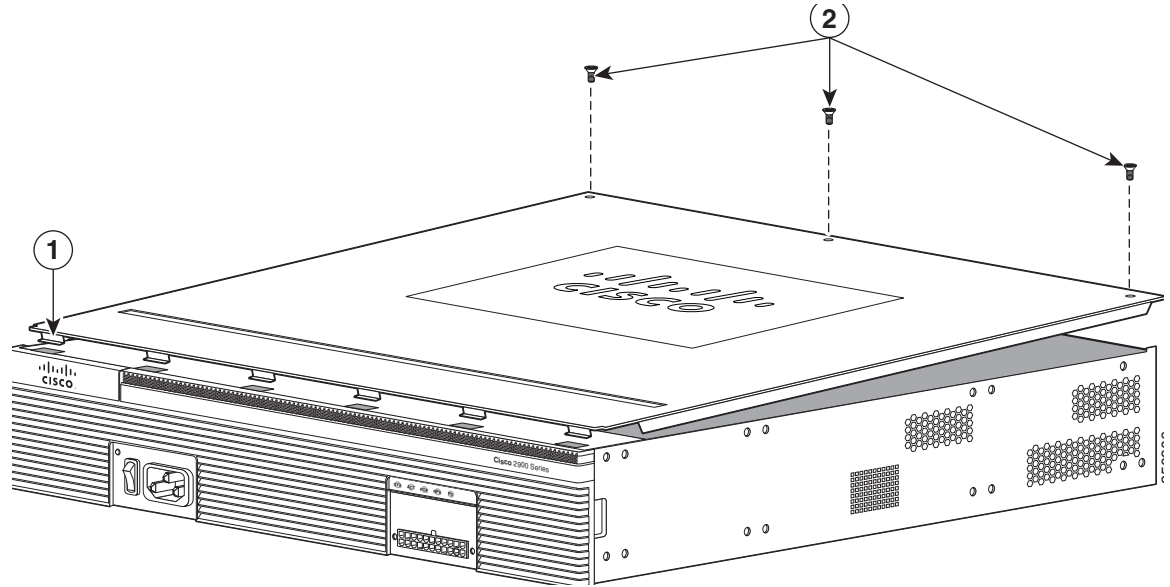
1	Cover tabs	**2**	Cover screws (3)

Removing and Replacing the Services Performance Engine

Modular motherboards, also known as Services Performance Engines (SPEs), are field replaceable units (FRUs) for Cisco 3900 series ISRs. Install and replace SPEs in the Cisco 3900 series routers without removing the chassis from the rack. After the SPE is removed, you can access internal modules for replacement or upgrade.

> **Note** Use a number-2 Phillips screwdriver for this task.

Step 1 Read the "Safety Warnings" section on page 5-2 and disconnect the power supply before you perform any module replacement.

Step 2 Loosen the two captive thumbscrews on each side of the SPE. See Figure 5-2.

Step 3 Rotate the ejector levers outward on each side of the SPE and carefully slide it straight out of the router. Place it on an antistatic surface.

> **Caution** The SPE is an ESD-sensitive component. To avoid damage, read and observe all ESD precautions noted in the "Safety Warnings" section on page 5-2.

Figure 5-2   Removing the Services Performance Engine from a Cisco 3925 and 3945 Router

| 1 | Captive thumbscrews | 2 | Ejector levers |
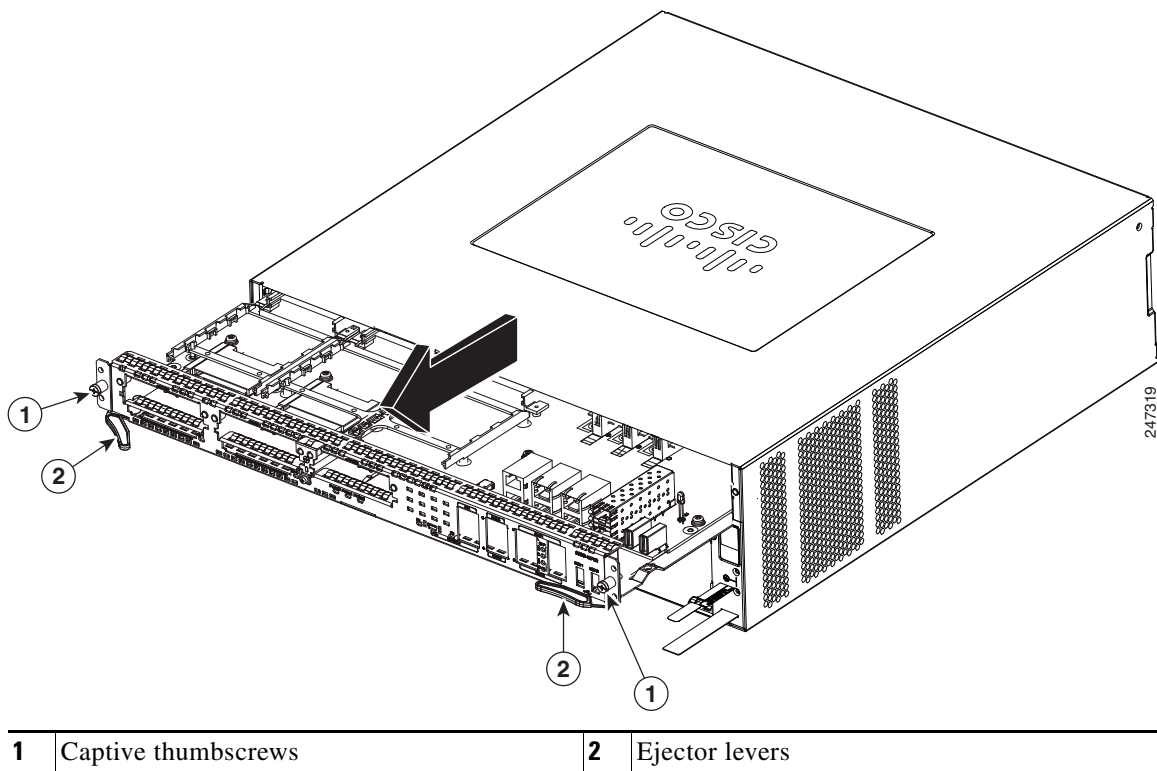
Step 4   Install or replace DRAM DIMMs, ISMs, or PVDMs. See the "Locating Internal Modules" section on page 5-7 to locate the slots on the router.

or

Install or replace the Services Performance Engine. Check that the ejector levers on the replacement SPE are fully open outward. Carefully slide the SPE into the router tray until the connector is engaged, and then close the ejector levers to fully seat the SPE.

Step 5   Tighten the two captive retention screws on each side of the motherboard.

Locating Internal Modules

The following illustrations show the locations of internal modules on the router motherboard. Internal modules include DIMMs, Internal Services Modules (ISMs), next-generation Packet Voice Data Modules (PVDM3s), and power supply on Cisco 2900 series ISR.

- Cisco 2901—Figure 5-3
- Cisco 2911—Figure 5-4
- Cisco 2921 and Cisco 2951—Figure 5-5
- Cisco 3925 and Cisco 3945—Figure 5-6
- Cisco 3925E and Cisco 3945E—Figure 5-7

Figure 5-3 *Module Locations in Cisco 2901 Router*
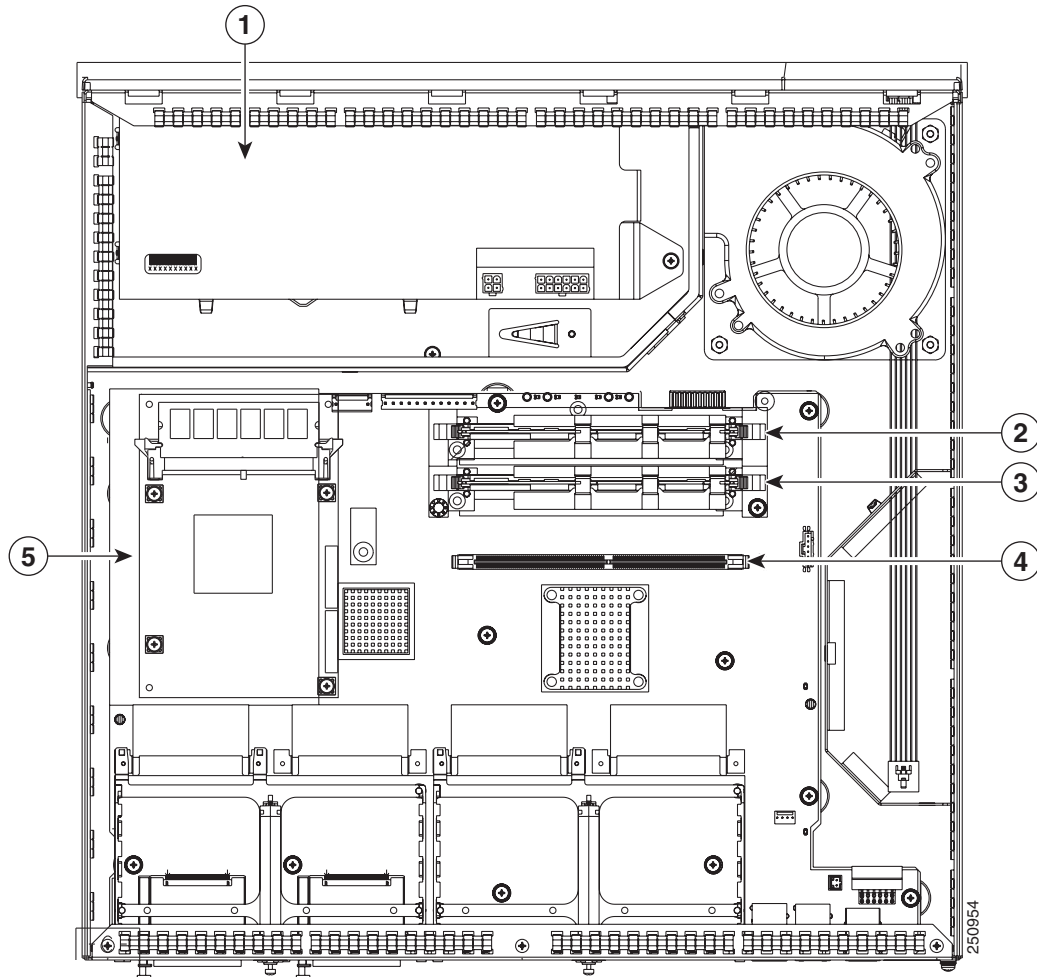
1	Power supply (Cisco 2901 router shown)	2	PVDM3 1
3	PVDM3 0	4	DIMM socket
5	ISM		

Figure 5-4   Module Locations in Cisco 2911 Router
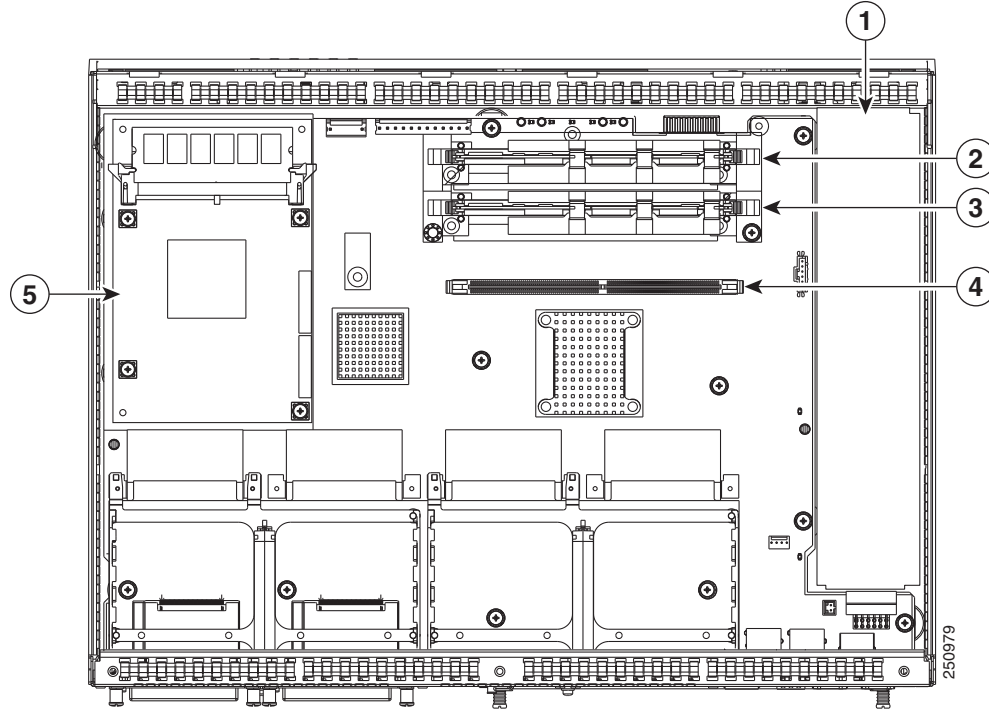
1	Removable fan tray	**2**	PVDM3 1
3	PVDM3 0	**4**	DIMM socket
5	ISM		

Figure 5-5   Module Locations in Cisco 2921 and Cisco 2951 Router
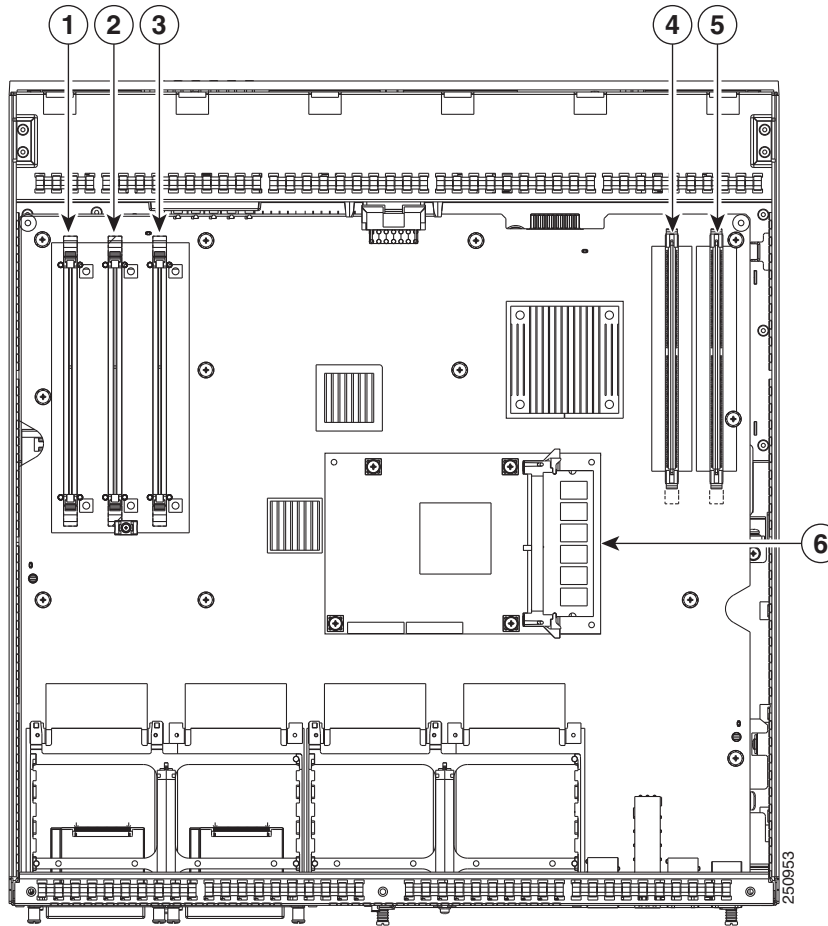
1	PVDM3 0	**2**	PVDM3 1
3	PVDM3 2	**4**	DIMM 0 socket (Cisco 2921 has only 1 (one) DIMM0 socket)
5	DIMM 1 (2951 only)	**6**	ISM

Figure 5-6   Module Locations in Cisco 3925 and Cisco 3945 Router
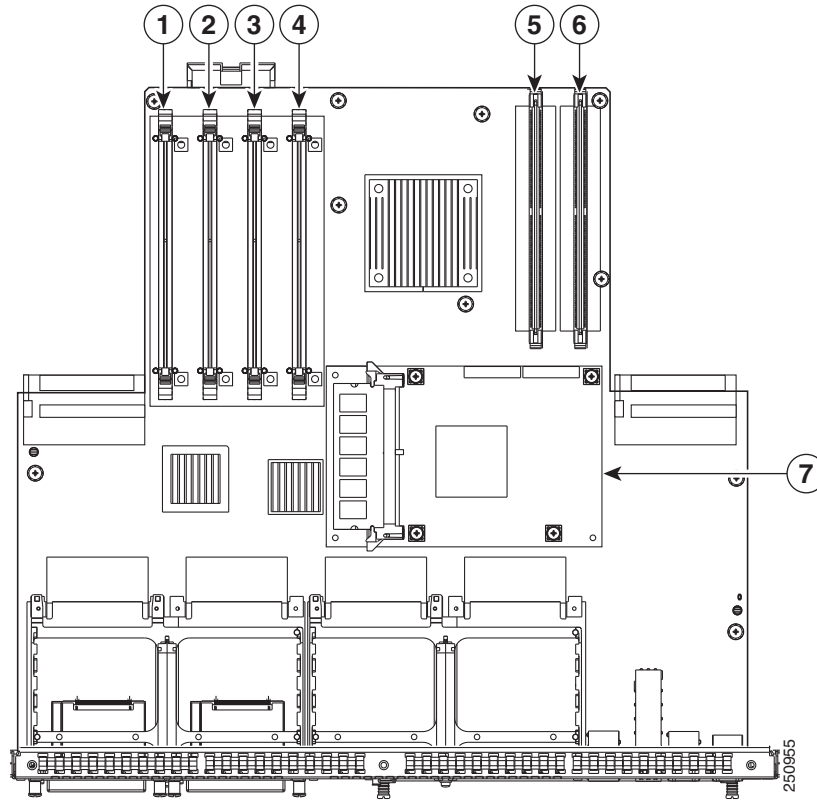
1	PVDM3 0	**2**	PVDM3 1
3	PVDM3 2	**4**	PVDM3 3
5	DIMM 0 socket	**6**	DIMM 1 socket
7	ISM		

Figure 5-7   Module Locations on Cisco 3925E and 3945E
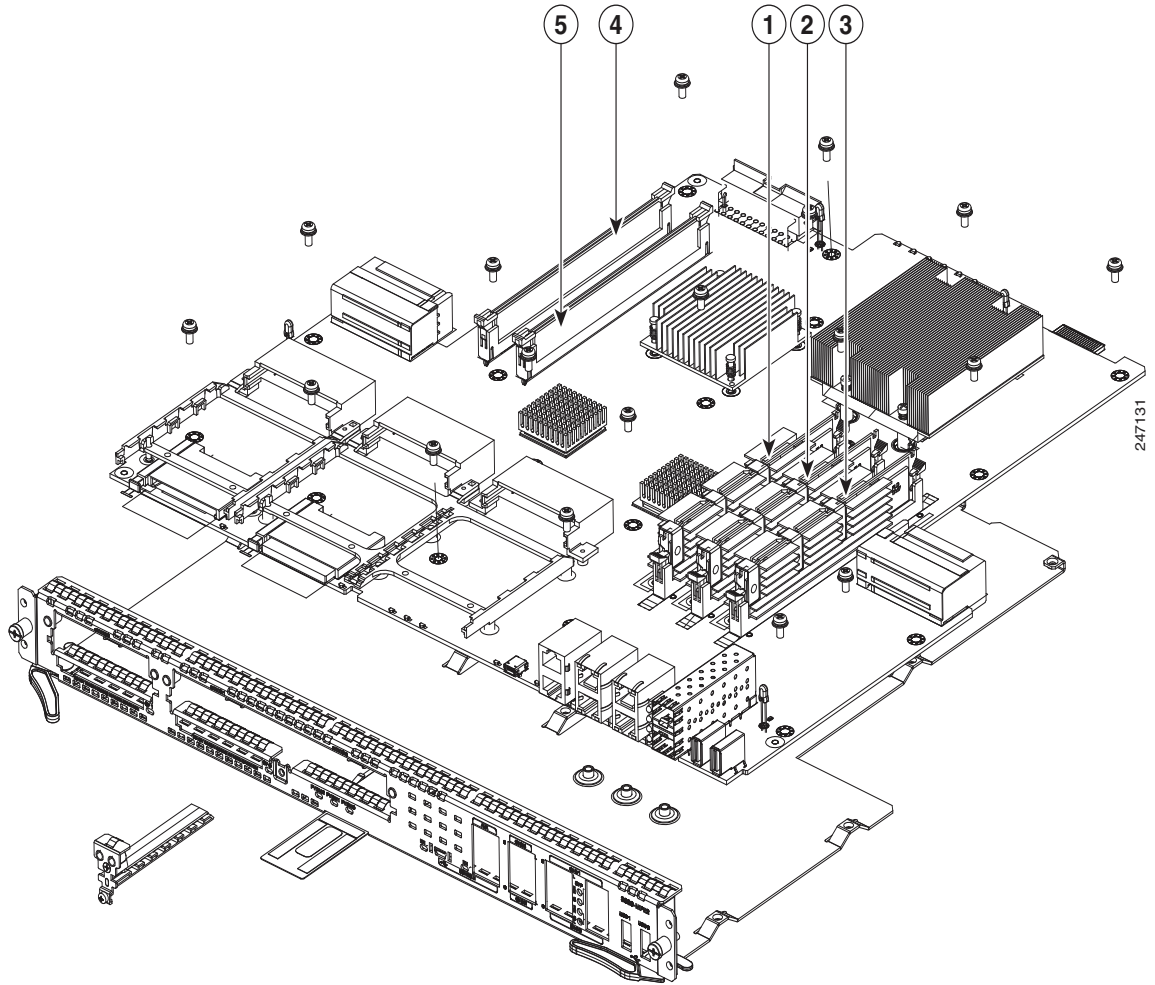
1	PVDM-3 0	**2**	PVDM-3 1
3	PVDM-3 2	**4**	DIMM 0 socket
5	DIMM 1 socket		

Installing and Removing DRAM DIMMs

Remove the chassis cover or remove the SPE as described in the "Accessing Internal Modules" section on page 5-4.

> ⚠ **Caution**   Always wear an ESD-preventive wrist strap and ensure that it makes good contact with your skin when you remove or install DIMMs. Connect the equipment end of the wrist strap to the metal part of the chassis.

> ⚠ **Caution**   Handle DRAM DIMMs by the edges only. DIMMs are ESD-sensitive components and can be damaged by mishandling.

Locating and Orienting DRAM DIMM

Cisco 2901, 2911, and 2921 routers have a single DRAM DIMM socket on the system board. Cisco 2951 and Cisco 3900 series have two DRAM DIMM sockets on the system board that are identified as DIMM 0 and DIMM 1. See the "Locating Internal Modules" section on page 5-7 to find DIMM connectors on the router.

DRAM DIMMs have a polarization notch on the mating edge to prevent incorrect insertion. Figure 5-8 shows the polarization notch on a DRAM DIMM.

> ⚠ **Caution**   DIMMs and PVDM3s plug into similarly sized sockets. Only the polarization notch differs. Look for the polarization notch shown in Figure 5-8 before inserting a DRAM DIMM in the socket.

Figure 5-8   DRAM DIMM Showing Polarization Notch
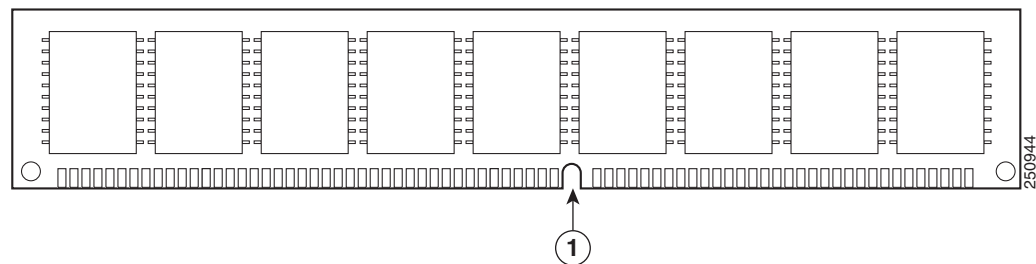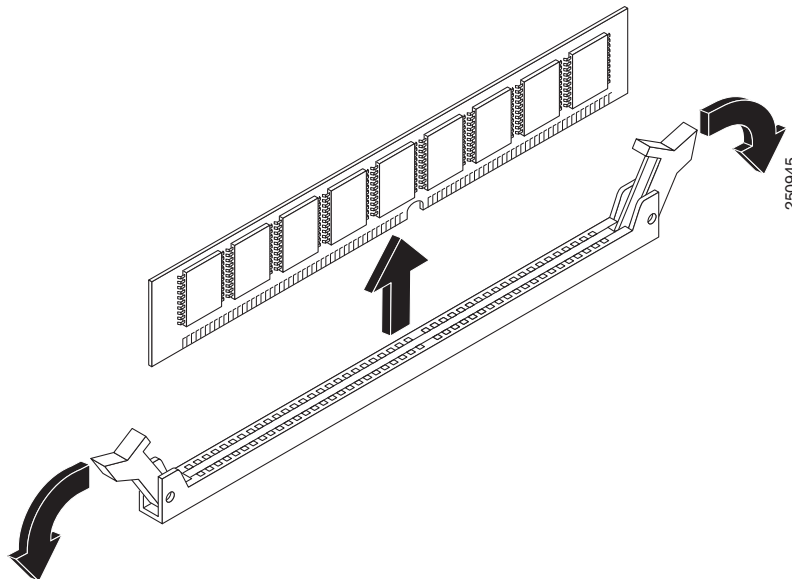

1	Polarization notch		

Removing a DRAM DIMM

Follow these steps to remove a DRAM DIMM:

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Remove the chassis cover. For Cisco 2900 series ISRs, see the "Removing and Replacing the Chassis Cover" section on page 5-4. For Cisco 3900 series ISRs, see the "Removing and Replacing the Services Performance Engine" section on page 5-6.

Step 3   Locate the DRAM DIMM module. See the "Locating Internal Modules" section on page 5-7 to find the DRAM DIMM sockets on the router.

Step 4   Pull the latches away from the DRAM DIMM at both ends to lift the DIMM slightly. Pull the DIMM out of the socket as shown in Figure 5-9.

Figure 5-9   Removing a DRAM DIMM

Step 5   Place the DIMM in an antistatic bag to protect it from ESD damage.

Step 6   Replace the chassis cover. For Cisco 2900 series ISRs, see the "Removing and Replacing the Chassis Cover" section on page 5-4. For Cisco 3900 series ISRs, see the "Removing and Replacing the Services Performance Engine" section on page 5-6.

Installing a DRAM DIMM

Note   Unregistered DIMMS (UDIMMs) and very low profile (VLP) RDIMMs are not interchangeable.

Follow these steps to install a DRAM DIMM:

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Remove the chassis cover. For Cisco 2900 series ISRs, see the "Removing and Replacing the Chassis Cover" section on page 5-4. For Cisco 3900 series ISRs, see the "Removing and Replacing the Services Performance Engine" section on page 5-6.

Step 3   Locate the DRAM DIMM module. See the "Locating Internal Modules" section on page 5-7 to find the DRAM DIMM sockets on the router.

Step 4   Make sure that both latches on the DIMM connector are in the open position.

Step 5   Orient the DIMM so that the polarization notch lines up with the polarization key on the connector. See Figure 5-10.

Caution   DIMMs and PVDM3s plug into similarly sized sockets. Only the polarization notch differs. Look for the polarization notch shown in Figure 5-10 before inserting a DRAM DIMM in the socket.

Figure 5-10   *DRAM DIMM Showing Polarization Notch*
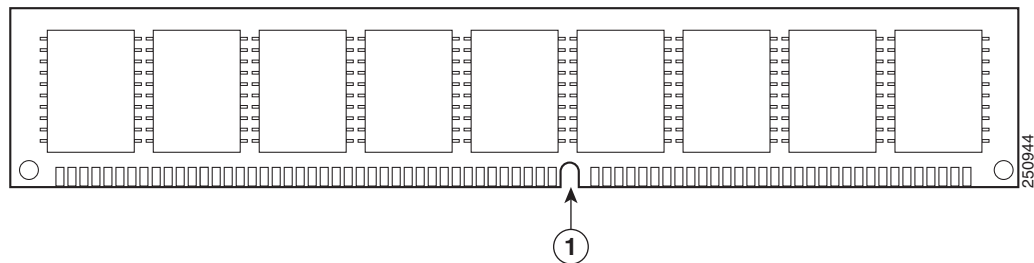
Step 6   Insert the DIMM into the connector.

Step 7   Carefully and firmly press the DRAM DIMM into the connector until the latches close onto the DIMM. Make sure that both latches rotate to the closed position against the DIMM. See Figure 5-11.

Figure 5-11   *Installing a DRAM DIMM*
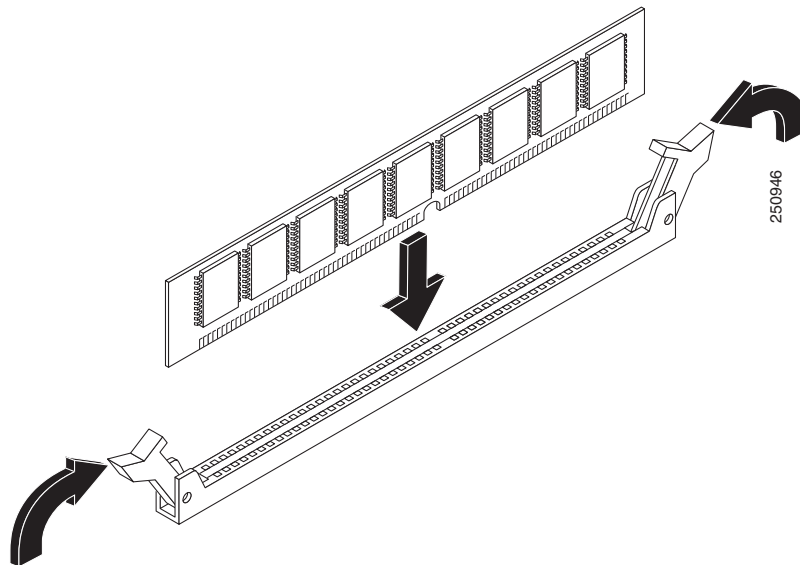
Step 8   Replace the chassis cover. For Cisco 2900 series ISRs, see the "Removing and Replacing the Chassis Cover" section on page 5-4. For Cisco 3900 series ISRs, see the "Removing and Replacing the Services Performance Engine" section on page 5-6.

Installing and Removing ISMs

A Integrated Service Modules (ISMs) plug into the ISM slot on the motherboard. ISMs are sold as a spare part, and they have a label that identifies the ISM type. See the following sections for ISM installation tasks:

- Software Requirement for ISMs, page 5-17
- Locating an ISM, page 5-17
- Removing an ISM, page 5-17
- Installing an ISM, page 5-18
- Verifying ISM Installation, page 5-20

⚠

Caution   Always wear an ESD-preventive wrist strap and ensure that it makes good contact with your skin when you remove or install an ISM. Connect the equipment end of the wrist strap to the metal part of the chassis.

⚠

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

Software Requirement for ISMs

Cisco IOS software of a specified release or later release is required for using an ISM.

To determine the version of Cisco IOS software that is running on your router, log in to the router and enter the **show version** command:

```
Router> show version

Cisco Internetwork Operating System Software
2900 Software (C2900-ADVENTERPRISEK9-M), Version 12.3(8.2)T, INTERIM SOFTWARE
```

Locating an ISM

See the "Locating Internal Modules" section on page 5-7 to locate the ISM slot on the Services Performance Engine (SPE).

Removing an ISM

Use the following procedure to remove an ISM:

Step 1 Read the "Safety Warnings" section on page 5-2 and disconnect the power supply before you perform any module replacement.

Step 2 Access the ISM slot. For Cisco 2900 series, see the "Removing and Replacing the Chassis Cover" section on page 5-4. For Cisco 3900 series, see the "Removing and Replacing the Services Performance Engine" section on page 5-6.

Step 3 Locate the ISM to be removed. See the "Locating Internal Modules" section on page 5-7.

Step 4 Remove the four screws from the ISM. See Figure 5-12.

Figure 5-12   *Removing Screws from the ISM*
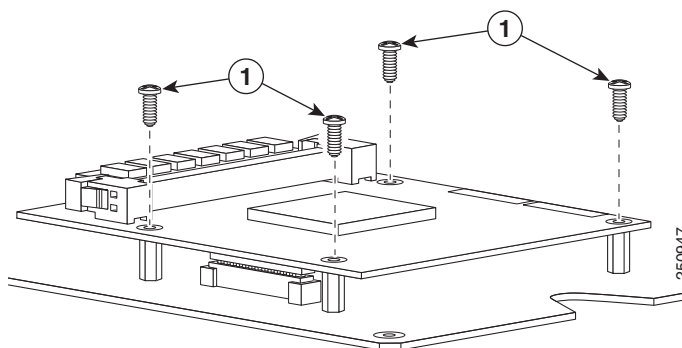
1	ISM screws (4)		

Step 5 Lift the ISM off of the connector and the plastic standoff. Keep the ISM parallel with the motherboard to prevent damage to the slot and standoff.

**Step 6** Place the ISM in an antistatic bag to protect it from ESD damage.

Step 7 Replace the chassis cover. For Cisco 2900 series, see the "Removing and Replacing the Chassis Cover" section on page 5-4. For Cisco 3900 series, see the "Removing and Replacing the Services Performance Engine" section on page 5-6.

Installing an ISM

To install an ISM, use a number 2 Phillips screwdriver or flat-blade screw drive, and a 1/4-inch nut driver or wrench. Cisco 2900 and Cisco 3900 series routers have one ISM connector on the system board.

Step 1 Read the "Safety Warnings" section on page 5-2 and disconnect the power supply before you perform any module replacement.

Step 2 Access the ISM slot. For Cisco 2900 series, see the "Removing and Replacing the Chassis Cover" section on page 5-4. For Cisco 3900 series, see the "Removing and Replacing the Services Performance Engine" section on page 5-6.

Step 3 Locate the four standoffs from the accessory kit. See Figure 5-13.

Figure 5-13   Standoffs
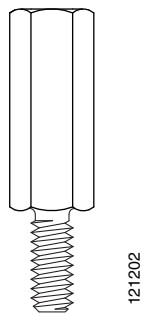
Step 4 Install the four standoffs into the system board in the attachment locations, as shown in Figure 5-14. Use a 1/4-inch nut driver to tighten the standoffs. The locations for ISM standoffs have white plastic grommets surrounding the mounting hole location.

Figure 5-14   Connecting the ISM to the Cisco 2900 and 3900 Series System Board
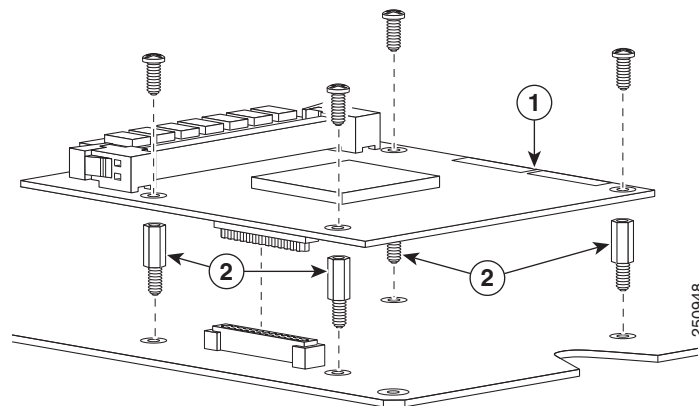
1	ISM	**2**	Standoffs (4)

⚠

Caution   Make sure that the standoffs are straight when installed. Tighten them gently but firmly. The shoulder must be seated tightly against the system board.

Step 5   Insert the connector on the ISM and attach it to the system board. See Figure 5-15.

✎

Note   Be sure to press firmly on the ISM until the board seats onto the connector.

Step 6   Insert the screws from the accessory kit through the ISM into the standoffs. See Figure 5-13. Carefully tighten the screws with a Phillips screwdriver (torque 6 to 8 in-lb or 0.7 to 1.1 Nm.).

Step 7   Check that the ISM is installed correctly on the system board. See Figure 5-15.

Figure 5-15   Correctly Installed ISM
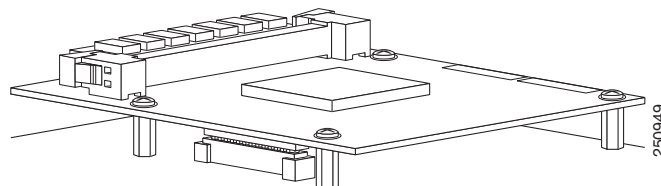
Step 8   Cisco 2900, See the "Accessing Internal Modules" section on page 5-4.

or

Cisco 3900, See the "Removing and Replacing the Services Performance Engine" section on page 5-6.

Verifying ISM Installation

Use the **show diag** command to verify that the ISM has been installed correctly. In the following example, one ISM is recognized by the system.

```
Router# show diag


ISM Slot 0:
        Internal-Service-Module
        Internal-Service-Module is analyzed
        Internal-Service-Module insertion time 13:25:34 ago
        EEPROM contents at hardware discovery:
        Hardware Revision       : 1.0
        Part Number             : 73-11709-01
        Board Revision          : 01
        Deviation Number        : 0-0
        Fab Version             : 01
        PCB Serial Number       : FHH1228P02T
        RMA Number              : 0-0-0-0
        RMA History             : 00
        RMA Test History        : 00
        Top Assy. Part Number   : 800-30779-01
        Product (FRU) Number    : ISM-SRE-200-K9
        Version Identifier      : V01
        CLEI Code               : CLEITBDXXX
        EEPROM format version 4
        EEPROM contents (hex):
          0x00: 04 FF 40 06 31 41 01 00 82 49 2D BD 01 42 30 31
          0x10: 80 00 00 00 00 02 01 C1 8B 46 48 48 31 32 32 38
          0x20: 50 30 32 54 81 00 00 00 00 04 00 03 00 D9 03 40
          0x30: C1 CB C0 46 03 20 00 78 3B 01 CB 8E 49 53 4D 2D
          0x40: 53 52 45 2D 32 30 30 2D 4B 39 89 56 30 31 00 C6
          0x50: 8A 43 4C 45 49 54 42 44 58 58 58 FF FF FF FF FF
          0x60: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x70: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF

Slot 1:
        N2G SM Test Card 1GE Port adapter, 1 port
        Port adapter is analyzed
        Port adapter insertion time 13:26:22 ago
        EEPROM contents at hardware discovery:
```

Installing and Removing PVDM3

The Cisco 2900 and 3900 series ISRs support next generation Packet Voice Data Modules (PVDM3) for enhanced digital signal processors (DSPs). Each router holds a different number of PVDM3s on the motherboard. See Table 5-1 for details.

Table 5-1   PVDM3 Support

Router	Motherboard	Number of Supported PVDM3
Cisco 2921, 2951	Default	2
Cisco 2921, 2951	Default	3
Cisco 3925	Services Performance Engine 100	4
Cisco 3945	Services Performance Engine 150	4

Table 5-1   PVDM3 Support (continued)

Router	Motherboard	Number of Supported PVDM3
Cisco 3925E	Services Performance Engine 200	3
Cisco 3945E	Services Performance Engine 250	3

PVDMs must be used in an homogeneous fashion. In other words, do not mix PVDM2s with PVDM3s in the same router.

PVDM slot numbering is defined in the "Locating Internal Modules" section on page 5-7. When using only one PVDM, ensure the module is installed in slot0.

PVDM2s must be installed in a PVDM II adapter for use in the PVDM3 slot on Cisco 2900 series and Cisco 3900 series ISRs. See the "Installing and Removing PVDM2s" section on page 5-23.

⚠️
Caution   When you remove or install PVDMs, always wear an ESD-preventive wrist strap, and ensure that it makes good contact with your skin. Connect the equipment end of the wrist strap to the metal part of the chassis.

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

PVDM3 Location and Orientation

The PVDM3 connectors are located on the motherboard and are identified as PVDM3 0 through 3. See the "Locating Internal Modules" section on page 5-7 for locations.

PVDM3s have a polarization notch on the mating edge to prevent incorrect insertion.

⚠️
Caution   PVDM3s and DIMMs plug into similarly sized connectors. Only the polarization notch differs. Be sure that you are inserting the PVDM3 into the PVDM3 connector. See Figure 5-10 for an example of the DIMM polarization notch.

Removing a PVDM3

To remove a PVDM3 from the motherboard, follow these steps:

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Locate the PVDM3 on the motherboard. See the "Locating Internal Modules" section on page 5-7.

Step 3   Pull the PVDM3 retaining clips away from the PVDM3 at both ends, and then lift the PVDM3 straight up from the connector. See Figure 5-16.

Figure 5-16   *Removing a PVDM3*
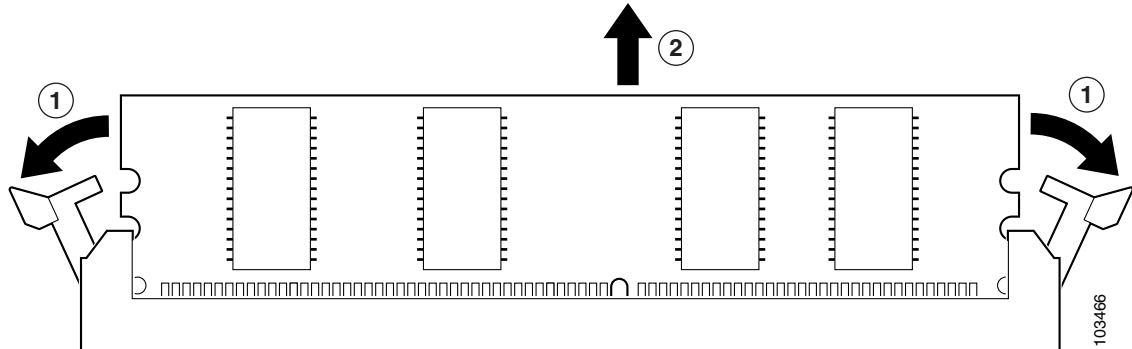
| 1 | Pull away the retaining clips | 2 | Pull out the PVDM3 |

Step 4   Place the PVDM3 in an antistatic bag to protect it from ESD damage.


Installing a PVDM3

To install a PVDM3, follow these steps.

Note   Fill PVDM3s slots sequentially, starting with connector 0.

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Locate the PVDM3 connector on the system board. See the "Locating Internal Modules" section on page 5-7 for the PVDM3 locations.

Step 3   Orient the PVDM3 so that the polarization notch lines up with the polarization key on the connector. See Figure 5-17.

Figure 5-17   Installing a PVDM3
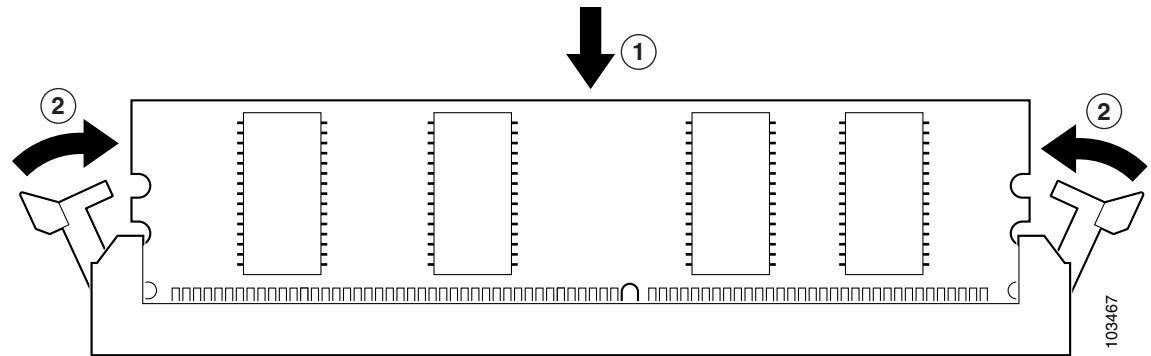
| 1 | Insert PVDM3 into connector | 2 | Snap retaining clips into place |

Step 4   Insert the PVDM3 firmly into the connector until seated.

Step 5   Replace the chassis cover. For Cisco 2900 series ISRs replace the cover. See the "Removing and Replacing the Chassis Cover" section on page 5-4. For Cisco 3900 series ISRs replace the SPE. See the "Removing and Replacing the Services Performance Engine" section on page 5-6.

Installing and Removing PVDM2s

A PVDM adapter must be used to insert a PVDM2 into the PVDM3 slot. The PVDM adapter is a small circuit board with connectors and clips that securely mount the PVDM2 into the PVDM3 slot. The clips are on the side of the adapter and require physical manipulation to secure the module in place. The following video clip shows how to install and remove a PVDM2 from the adapter.

http://cisco.com/en/US/docs/routers/access/2900/videos/PVDM/PVDM_Adapter.swf

- PVDM Adapter—Figure 5-18 on page 5-24
- Clips and Guide Post—Figure 5-19 on page 5-25
- Clips Open—Figure 5-20 on page 5-26
- Clips Closed—Figure 5-21 on page 5-26

Figure 5-18   *PVDM Adapter Components*
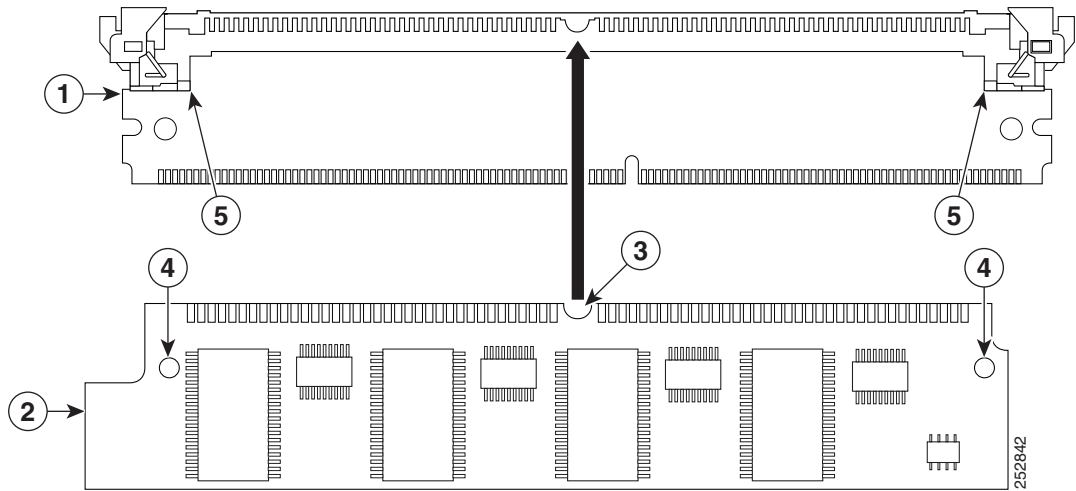
1	PVDM adapter	2	PVDM2
3	Orientation notch	4	Guide post holes
5	Guide posts		

To install a PVDM2 into the PVDM3 slot, perform the following steps:

Step 1 Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2 Ensure that *both* retainer clips are open (the UP position). (See Figure 5-19, Figure 5-20, and Figure 5-21.)

Figure 5-19 shows the retainer clip, connector clip, and guide post locations on the adapter.

Figure 5-19   *Adapter Retainer Clip, Connector Clips, and Guide Posts*
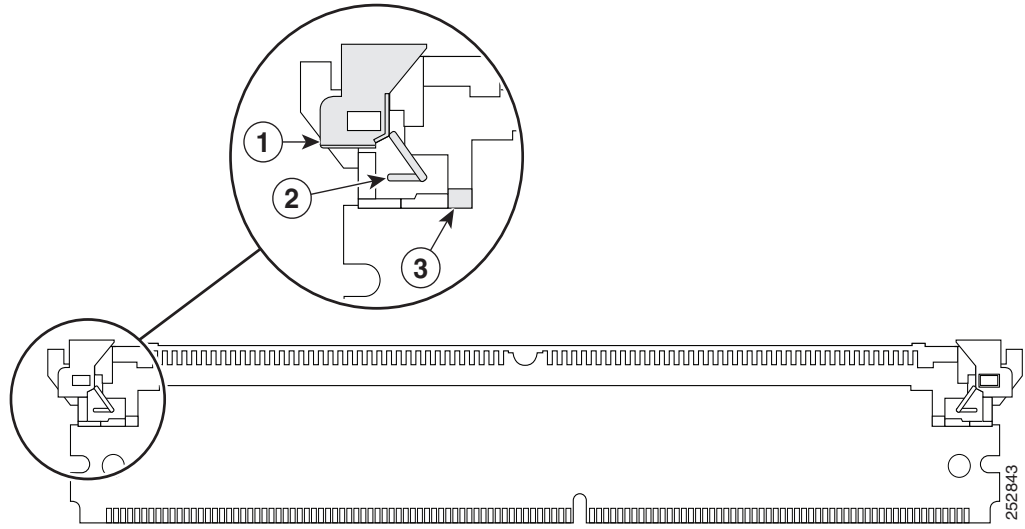
1	Retainer clip	**2**	Connector clip
3	Guide post		

Figure 5-20 shows a retainer clip open.

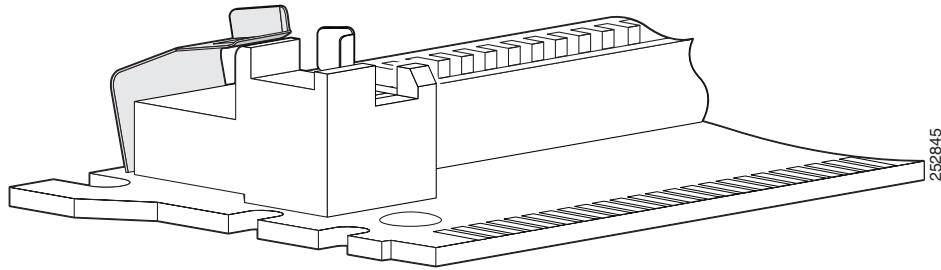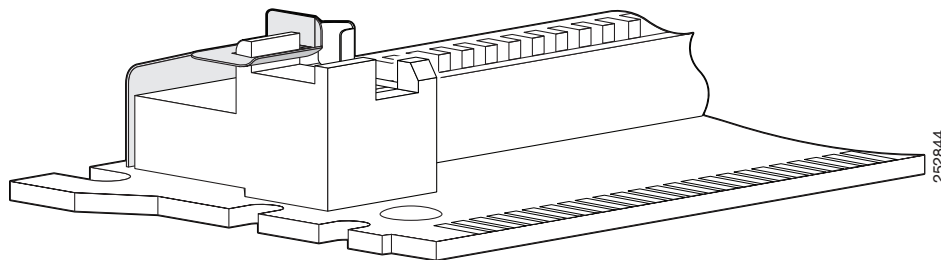*Figure 5-20   Retainer Clip Open (Up Position)*

Figure 5-21 show a retainer clip closed (DOWN).

*Figure 5-21   Retainer Clip Closed (Down Position)*

Step 3   Insert the PVDM2 at a 45-degree angle to the adapter while aligning the key notch. Ensure that the entire connector seats into the adapter across its entire length, and push the PVDM2 firmly into the adapter.

Figure 5-22   Installing the PVDM2 into the PVDM Adapter
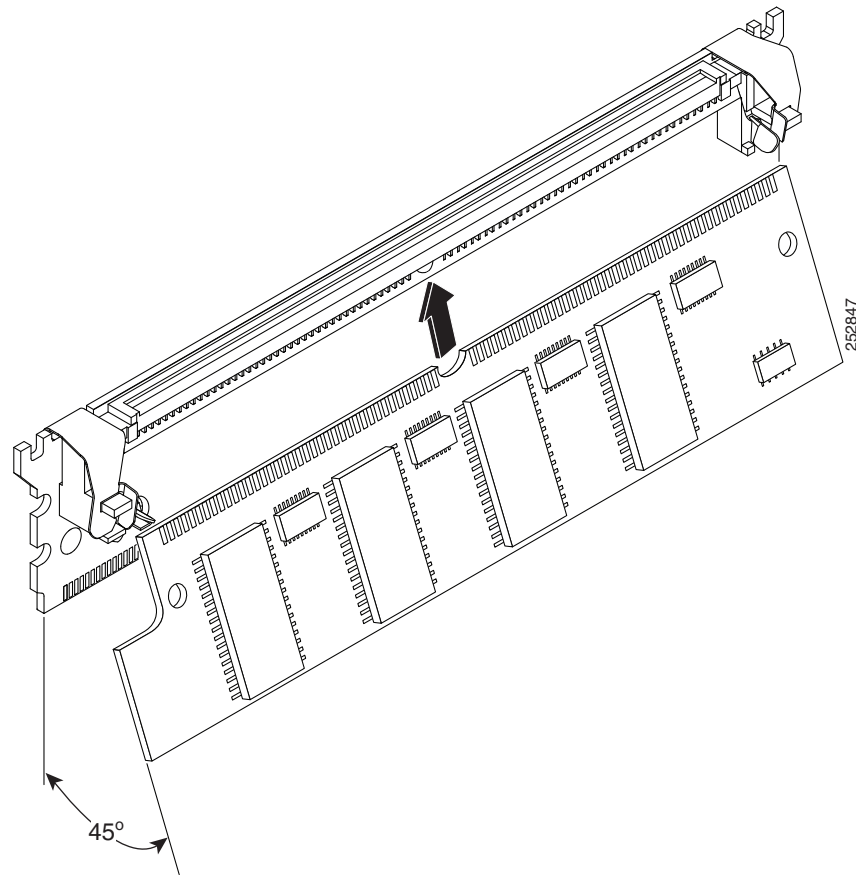
Step 4   Push the PVDM onto the guide posts. The guide posts should protrude through the guide holes. The connector clips seat themselves on top of the PVDM2, holding the PVDM2 in the adapter.

Step 5   Push both retainer clips over their respective catches. The retainer clips prevent the connector clips from releasing the PVDM2. Figure 5-23 shows the PVDM2 properly installed in the adapter.

Figure 5-23   Proper Installation of PVDM2 in the Adapter
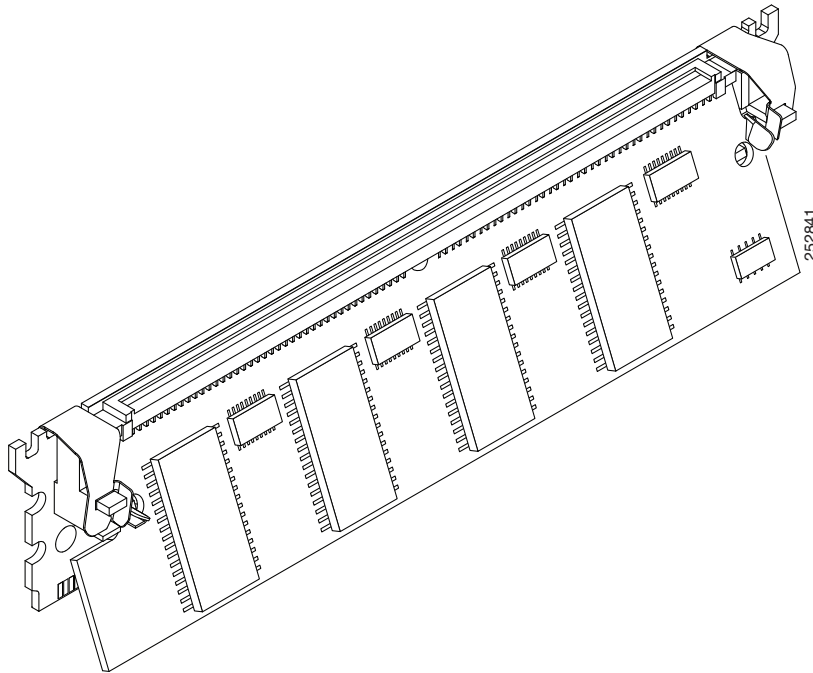
Replacing Power Supplies and Redundant Power Supplies

Except for the Cisco 2901 router, all Cisco 2900 series routers have replaceable power supply modules and external redundant power supplies (RPS). The Cisco 3900 series routers cannot use an external RPS, and instead use one or two (optional) internal power supplies. All of the internal power supplies for the 2900 series and the 3900 series are modular and do not have internal cabling. These modular power supplies can be removed or installed using only a screwdriver.

- Replacing the Cisco 2901 Router Power Supply, page 5-29

- Replacing the Cisco 2911 Router Power Supply, page 5-31

- Installing and Removing the Cisco 2911 Router Optional DC Power Supply, page 5-32

- Installing the Cisco 2911 Router Power Supply Blank, page 5-33

- Replacing the Cisco 2911 Router Redundant Power Supply, page 5-35

- Replacing the Cisco 2921, Cisco 2951, or Cisco 3900 Series Power Supply, page 5-35

    - Inserting POE supply in an Ethernet Switch Network Module, page 5-38

- Installing and Removing the Cisco 2921, Cisco 2951, or Cisco 3900 Series Optional DC Power Supply, page 5-39

- Installing and Removing a Redundant Power Supply Adapter, page 5-41

Note   Replace power supplies with the types shown in Table 1-9.

# Replacing the Cisco 2901 Router Power Supply

Warning   **Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.** Statement 1029

To replace the power supply in a Cisco 2901 router, perform the following steps. See Figure 5-3 for the locations of connectors and other components within the Cisco 2901 router.

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Disconnect the router from the external AC power supply.

Step 3   Remove the cover from the chassis. See the "Removing and Replacing the Chassis Cover" section on page 5-4.

Step 4   Disconnect the power supply cable from the main power supply connector. See Figure 5-24.

Figure 5-24   Cisco 2901 Power Supply Components
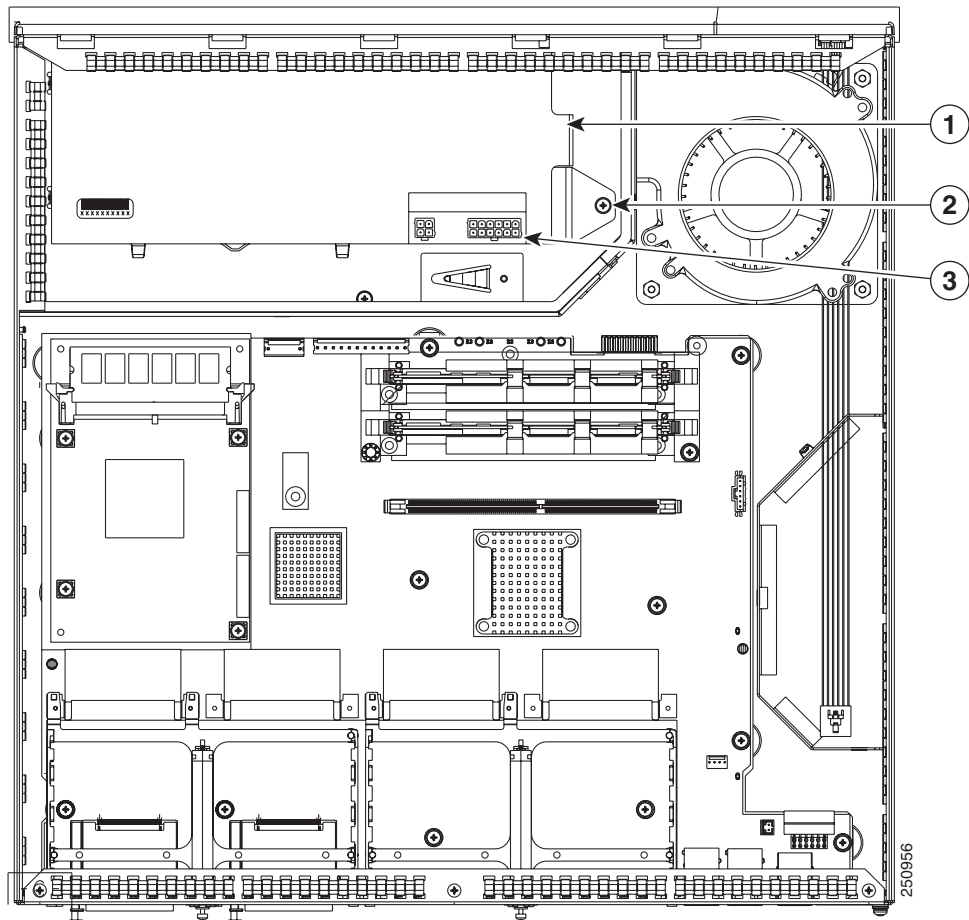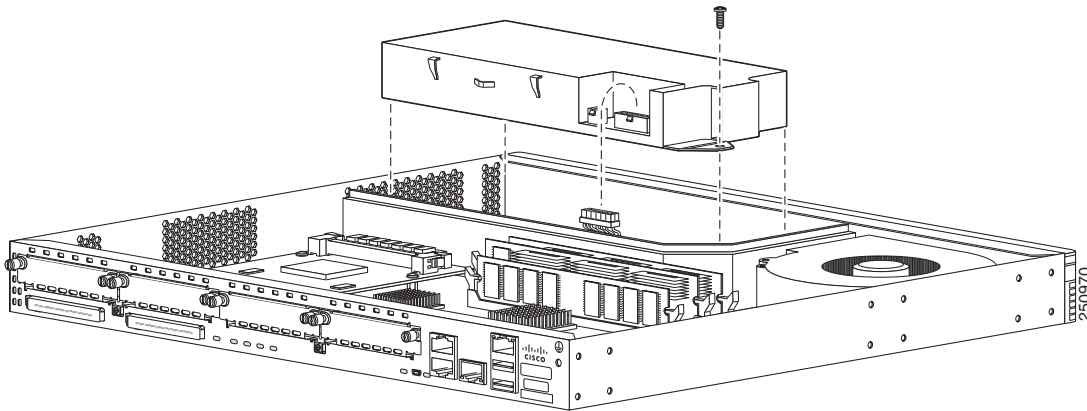

1	Power supply	2	Power supply fastening screw
3	Power cable connector		

Step 5   Remove the screw that fastens the main power supply to the chassis.

Step 6   Lift the main power supply out of the chassis. See Figure 5-25.

Figure 5-25   *Lifting the 2901 Power Supply In or Out*

Step 7   Insert the replacement power supply into the chassis. See Figure 5-25. Insert the screws that fasten the power supply to the chassis. See Figure 5-24.

Step 8   Connect the power supply cable to the power supply connector. Replace the chassis cover and connect power to the router.

Replacing the Cisco 2911 Router Power Supply

Several power supply options are available for the Cisco 2911 router. See Table 1-9. All of the power supply options have the same modular form factor for easy removal and replacement.

Perform the following steps to replace the 2911 power supply:

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Figure 5-26   *Cisco 2911 Power Supply Components*

.
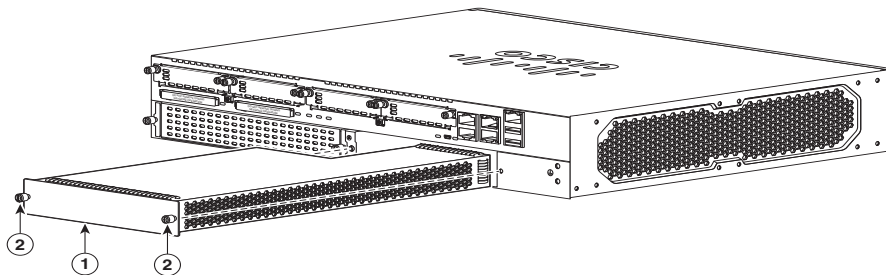
1	Power supply	**2**	Power supply fastening screws (2)

Step 2 Loosen the two captive screws on the power supply module. See Figure 5-26.

Step 3 Slide the power supply module out of the chassis.

Step 4 Insert the replacement power supply module and tighten the captive screws.

Step 5 If you are not immediately replacing the power supply, install the blank cover over the empty supply slot. See the "Installing the Cisco 2911 Router Power Supply Blank" section on page 5-33.

Warning **Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.** Statement 1029

Installing and Removing the Cisco 2911 Router Optional DC Power Supply

Several power supply options are available for the Cisco 2911 router. See Table 1-9. All of the power supply options have the same modular form factor for easy removal and replacement.

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

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

Installing the 2911 DC Power Supply

Perform the following steps to install the 2911 DC or DC+POE power supply:

Step 1 Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module removal or installation.

Step 2 Remove the AC power supply module from the system by loosening the two captive screws using a number 1 Phillips head screwdriver (See Figure 5-26) and pulling the power supply out slowly from the I/O side (See Figure 5-27) of the chassis.

Step 3 Slide the power supply module out of the chassis.

Step 4 Insert the replacement DC power supply module and tighten the captive screws. Torque to 8 to10 in-lbf (0.9 to 1.1 N-m).

Removing the 2911 DC Power Supply

Perform the following steps to remove the 2911 DC power supply:

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module removal or installation.

Step 2   Remove the power supply module from the system by loosening the two captive screws using a number 1 Phillips head screwdriver (See Figure 5-26) and pulling the power supply out slowly from the I/O side (See Figure 5-27) of the chassis.

Step 3   Slide the power supply module out of the chassis.

Step 4   If you are not immediately replacing the power supply, install the blank cover over the empty supply slot. See the "Installing the Cisco 2911 Router Power Supply Blank" section on page 5-33.

## Installing the Cisco 2911 Router Power Supply Blank

For safety reasons, the power supply blank cap and panel must be installed immediately if the power supply is removed from the system and the system stays or will be energized before the power supply is replaced.

✎
Note   This procedure applies to customers who will maintain or supply power to the system with the RPS module.

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   If the power supply is present, make sure it is turned off and the power cord is detached.

Step 3   Remove it from the system by loosening the two captive screws using a number 1 Phillips head screwdriver and pulling the power supply out slowly from the I/O side of the chassis. See Figure 5-27.

Figure 5-27　　*2911 Power Supply Blank I/O Side Installation*
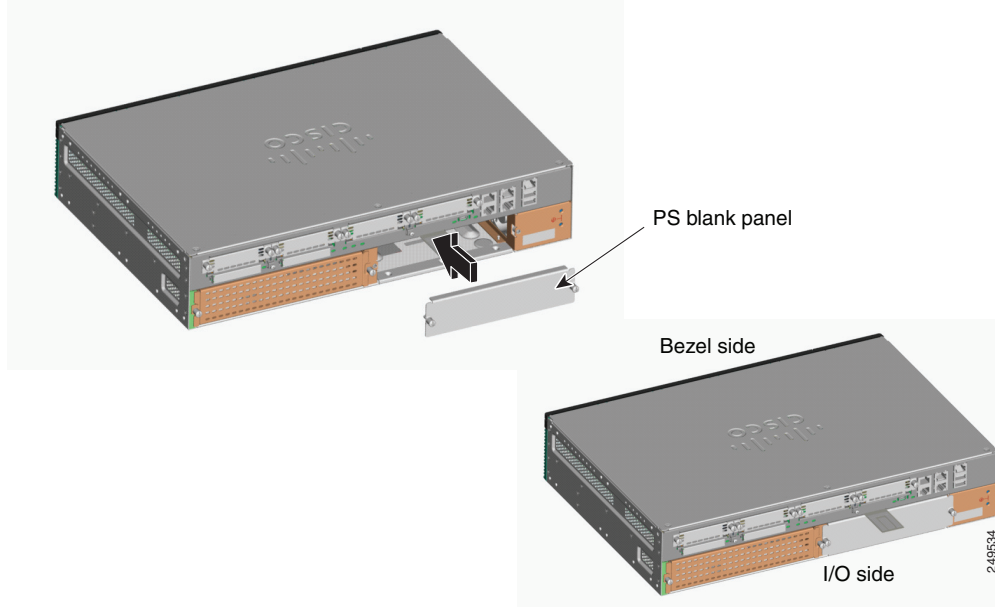
Step 4　Remove the bezel assembly from the bezel side of the router by pulling the bezel away from the face of the router. See Figure 5-28

*Figure 5-28*　　*2911 Power Supply Blank Bezel Side Installation*
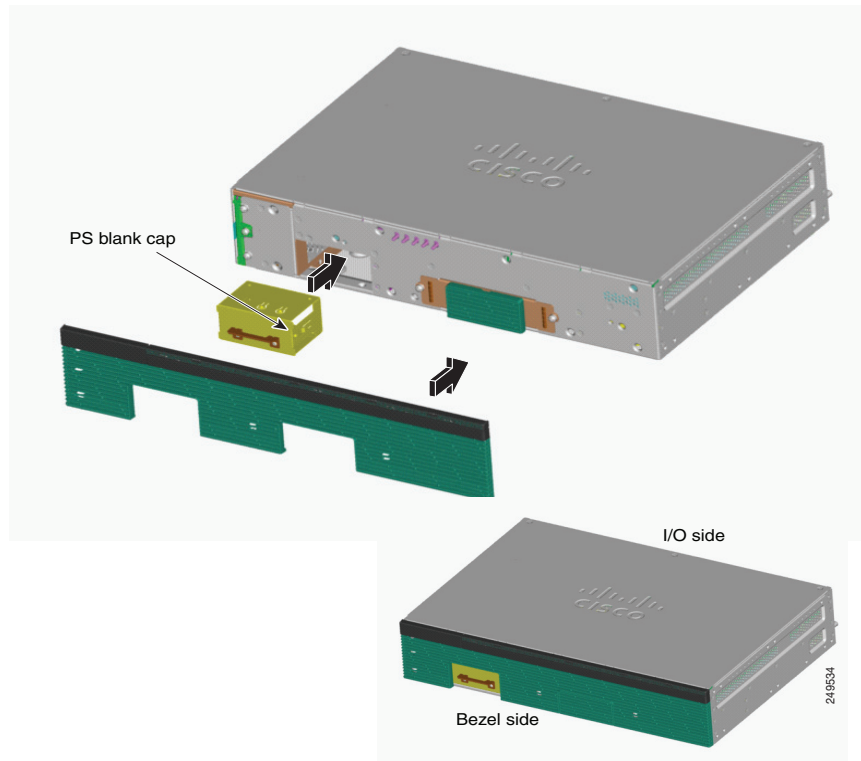
Step 5   Install the power switch blank cap by slowly pushing it into the power supply opening on the bezel side of the chassis. Make sure that the "THIS SIDE UP" label is on top when installing the blank cap. You will feel it snap into place when it is fully seated. See Figure 5-28

Step 6   Replace the bezel assembly by lining up the holes in chassis with the connectors on the bezel. Slowly push the bezel assembly into place until it is fully seated.

Step 7   Install the power supply blank panel into the power supply opening on the I/O side of the chassis by pushing it into place, as shown in Figure 5-27. Make sure that the flange with the marking "THIS SIDE UP" is facing up.

Step 8   Tighten the two captive screws with a number 1 Phillips head screw driver after the power supply blank panel is fully seated.

Replacing the Cisco 2911 Router Redundant Power Supply

The redundant power supply (RPS) for the Cisco 2911 router is an external RPS. The external RPS attaches to a connector on the front of the router. For an RPS to be attached, the Cisco 2911 must be fitted with an RPS adapter. See Figure 5-29. See the "Installing and Removing a Redundant Power Supply Adapter" section on page 5-41.

.

Figure 5-29   *Cisco 2911 Redundant Power Supply Adapter*
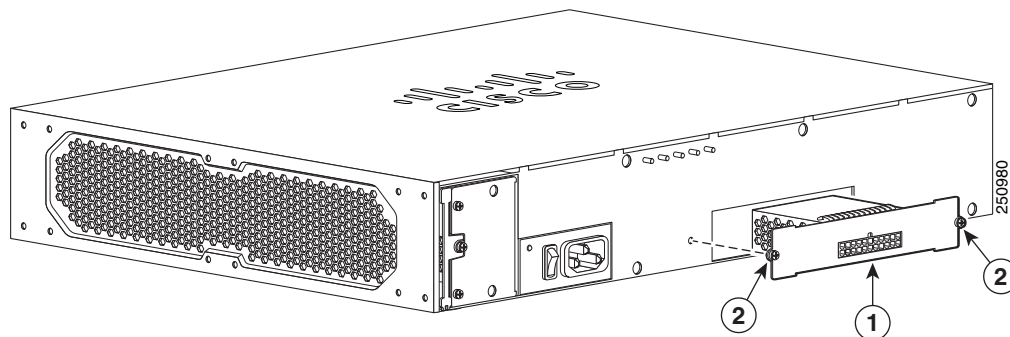
1	RPS Adapter	**2**	RPS fastening screws (2)

Replacing the Cisco 2921, Cisco 2951, or Cisco 3900 Series Power Supply

Warning   **Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.** Statement 1029

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

Several power supply options are available for the Cisco 2921, 2951, and 3900 series routers. See Table 1-9. All of the power supply and RPS options have a similar modular form factor, with no cabling, for easy removal and replacement. If an RPS is attached, the power supply may be hot-swapped.

Note   The 3900 series routers do not use an external RPS, and instead use an optional secondary internal power supply.

Note   Read this entire procedure and have all of your tools and the replacement power supply ready before performing a hot-swap. The hot-swap procedure requires removal of the cooling fans. You have only a few minutes to replace the fans before the router powers off, because the router has reached the upper temperature limits.

Replacing the Power Supply on the Cisco 2921 and Cisco 2951 Routers

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Remove the fan tray and bezel assembly by pulling the fan tray and bezel assembly straight out. See Figure 5-30.

Step 3   Loosen the two captive screws on the power supply module. See Figure 5-30.

Step 4   Pull on the two captive power supply fastening screws to leverage the power supply from its connector, and then slide the power supply module out of the chassis.

Step 5   Insert the replacement power supply module, and tighten the captive screws.

Step 6   Reinstall the fan tray and bezel assemblies.

Figure 5-30   *Cisco 2921 and 2951 Power Supply Components*
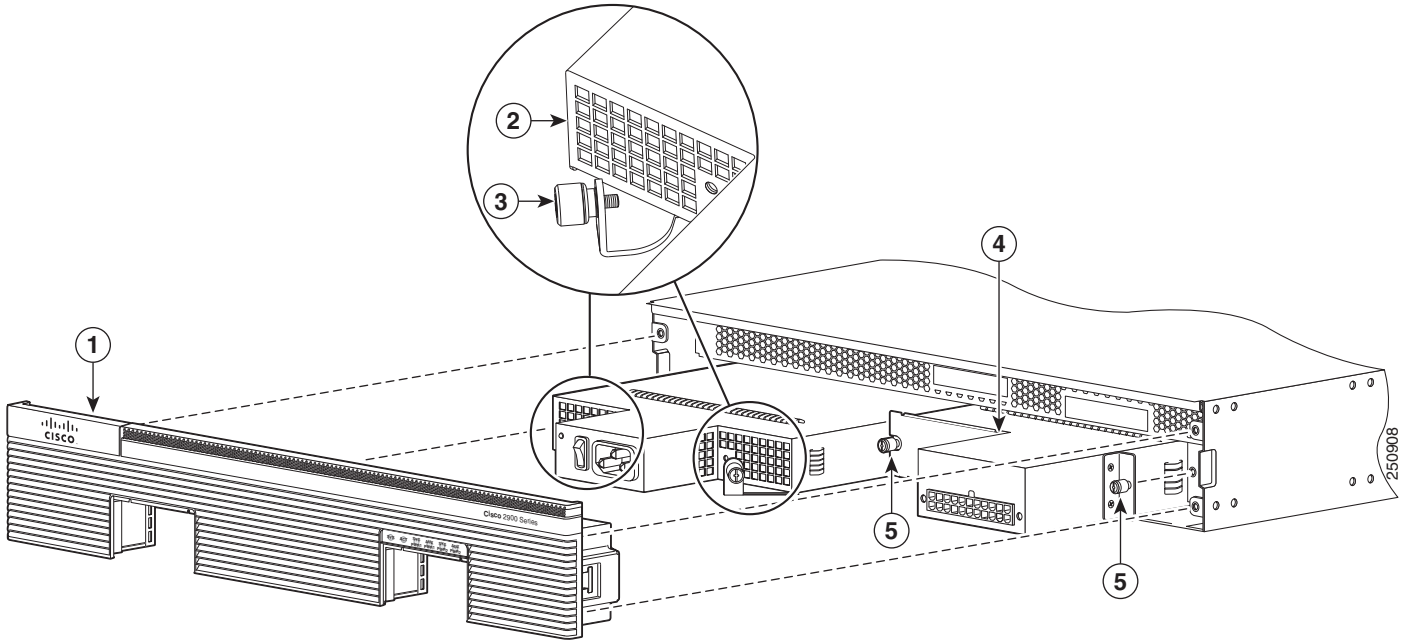
1	Fan tray and bezel assembly	**2**	Power supply
3	Power supply fastening screws (2)	**4**	(Optional) RPS adapter
5	RPS or secondary power supply fastening screws (2)		

Replacing the Power Supply on the Cisco 3900 Series Routers

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Remove the bezel.

Step 3   Loosen the four captive screws on each corner of the fan tray and pull out the fan tray. See Figure 5-31.

Step 4   Loosen the two captive screws on the power supply module. See Figure 5-31.

Step 5   Pull on the two captive power supply fastening screws to leverage the power supply from its connector, and then slide the power supply module out of the chassis.

Step 6   Insert the replacement power supply module, and tighten the captive screws.

Step 7   Reinstall the fan tray and bezel.

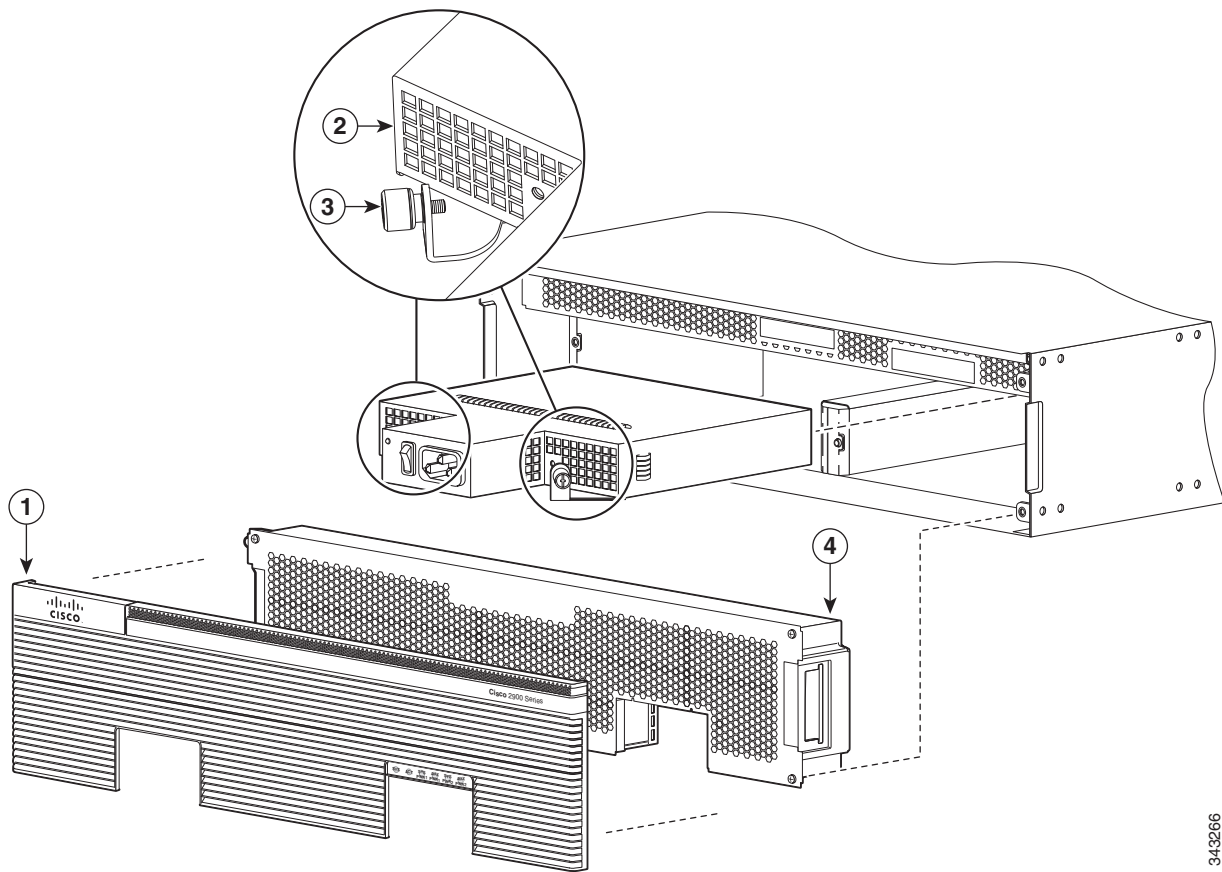*Figure 5-31*   *Cisco 3900 Series Power Supply Components*

1	Bezel	**2**	Power supply
3	Power supply fastening screws (2)	**4**	Fan tray

Inserting POE supply in an Ethernet Switch Network Module

The POE power supply for Ethernet Switch Network Modules supports online insertion feature. The POE power supply does not support online removal.

The following messages are expected behavior when you try to reload or insert a POE supply in a router with Ethernet Switch Network Module:

```
Aug 10 18:29:40.331: %ILPM_FAULT-5-ILPM_NOTICE: Notice: Inline power supply is being
started.
*Aug 10 18:29:40.331: %ILPM_FAULT-5-ILPM_WARNING: Warning: Ethernet Switch Network Modules
with PoE Support need to be reloaded to function properly.
*Aug 10 18:29:40.691: %SYS-5-RESTART: System restarted -- Cisco IOS Software, C2900
Software (C2900-UNIVERSALK9-M), Version 15.0(1)M2, RELEASE SOFTWARE (fc2)
```

This Warning message is not an indication of any ERROR in the system but a WARNING upon system reload or POE power supply restoration.

Upon POE power supply insetion, inline power supply restores automatically in the router. After the insertion, reset is needed for the switch modules in the router for the POE supply to work properly.

If there are two POE supplies, the power supplies can operate in a boost mode or redundant mode. In a boost mode, the total power supplied is a sum of the two power supplies capacity. In a redundant mode, if one of the POE supply fails, the other POE will supply power.

Installing and Removing the Cisco 2921, Cisco 2951, or Cisco 3900 Series Optional DC Power Supply

⚠

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

⚠

Warning   **Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.** Statement 1029

⚠

Warning   **This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.** Statement 1024

⚠

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

Several power supply options are available for the Cisco 2921, 2951, and 3900 series routers. See Table 1-9. All of the power supply and RPS options have a similar modular form factor, with no cabling, for easy removal and replacement. If an RPS is attached, the power supply may be hot-swapped.

✎

Note   The 3900 series routers do not use an external RPS, and instead use an optional secondary internal power supply.

✎

Note   Read this entire procedure and have all of your tools and the replacement power supply ready before performing a hot-swap. The hot-swap procedure requires removal of the cooling fans. You have only a few minutes to replace the fans before the router powers off, because the router has reached the upper temperature limits.

Installing the Cisco 2921, Cisco 2951, or Cisco 3900 Series Optional DC Power Supply

Perform the following steps to install the Cisco 2921, Cisco 2951, or Cisco 3900 Series Optional DC Power Supply:

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Remove the fan tray and bezel assembly:

- For the Cisco 3900 series routers, pull straight out on the bezel to remove the bezel along with the optional air filter from the fan tray assembly.

- For the 2900 series routers, remove the bezel assembly, then loosen the four captive screws on each corner of the fan tray assembly and pull out the fan tray assembly. See Figure 5-30.

Step 3   Loosen the two captive screws on the AC power supply module. See Figure 5-30.

Step 4   Pull on the two captive AC power supply fastening screws to leverage the AC power supply from its connector, and then slide the power supply module out of the chassis.

Step 5   Insert the DC power supply module, and tighten the captive screws.

Step 6   Reinstall the fan tray and bezel assemblies.

Removing the Cisco 2921, Cisco 2951, or Cisco 3900 Series Optional DC Power Supply

Perform the following steps to remove the Cisco 2921, Cisco 2951, or Cisco 3900 Series Optional DC Power Supply:

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Remove the fan tray and bezel assembly:

- For the Cisco 3900 series routers, pull straight out on the bezel to remove the bezel along with the optional air filter from the fan tray assembly.

- For the 2900 series routers, remove the bezel assembly, then loosen the four captive screws on each corner of the fan tray assembly and pull out the fan tray assembly. See Figure 5-30.

Step 3   Loosen the two captive screws on the DC power supply module. See Figure 5-30.

Step 4   Pull on the two captive DC power supply fastening screws to leverage the AC power supply from its connector, and then slide the power supply module out of the chassis.

Step 5   Reinstall the fan tray and bezel assemblies.

Installing and Removing a Redundant Power Supply Adapter

The redundant power supply (RPS) for the Cisco 2911, 2921, or 2951 router is an external Cisco RPS 2300. To connect the RPS, the router must be fitted with an RPS adapter. A blank panel must be removed before installing the RPS adapter. The external RPS attaches to a connector on the front of the adapter. See Figure 5-32.

Note   After connecting to the RPS2300, Cisco 2900 series routers require a reboot.

Tip   For information specific to the RPS 2300, see the Cisco Redundant Power Supply System Hardware Installation Guide at:

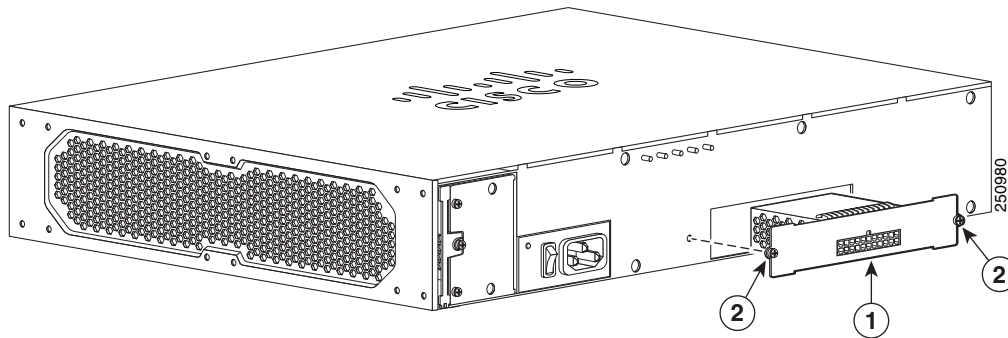http://www.cisco.com/en/US/docs/switches/power_supplies/rps2300/hardware/installation/guide/2300 hig.html

Depending upon RPS configuration, more than one router can be backed up.

Caution   Failure to follow the RPS Installation or Removal procedures can cause damage to the router, RPS adapter, RPS cable, or RPS.

Figure 5-32   Cisco 2911 Redundant Power Supply Adapter

| **1** | RPS Adapter | **2** | RPS fastening screws (2) |

Table 5-2 shows RPS 2300 backup capabilities when coupled with Cisco 2900 series ISRs.

Table 5-2   RPS 2300 Backup Capabilities

Power Mode	Quantity and Type of RPS 2300 FRU			
	Quantity 1 C3K-PWR-750WAC	Quantity 2 C3K-PWR-750WAC	Quantity 1 C3K-PWR-1150WAC	Quantity 2 C3K-PWR-1150WAC
2911 in RPS	1	2	1	2
2921, 2951 in RPS	0	1	0	1

Table 5-2 **RPS 2300 Backup Capabilities (continued)**

Power Mode	Quantity and Type of RPS 2300 FRU			
	Quantity 1 C3K-PWR-750WAC	Quantity 2 C3K-PWR-750WAC	Quantity 1 C3K-PWR-1150WAC	Quantity 2 C3K-PWR-1150WAC
2911 in POE Boost	0	1	1	2
2921, 2951 in POE Boost	0	1	0	1

Installing an RPS Adapter

To install an RPS adapter, perform the following steps:

⚠️
Caution   The RPS adapter must be in the router chassis before connecting to the RPS.

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Ensure AC or DC power is disconnected from the router power supply.

Step 3   If connected, place the RPS 2300 into standby mode. Consult the *Cisco Redundant Power System 2300 Hardware Installation Guide* for operating the RPS 2300.

Step 4   If an RPS Adapter had never been installed, a blank panel is in its place. Remove the RPS Adapter blank panel.

Step 5   Insert the RPS adapter into the router (Figure 5-29 or Figure 5-30) and tighten the screws.

Step 6   Connect the RPS 2300 cable into the RPS adapter connector.

Step 7   Connect the other end of the RPS 2300 cable to the RPS 2300.

Step 8   Power up the router.

Step 9   Place the RPS into Active mode.

Removing an RPS Adapter

To remove an RPS adapter, perform the following steps:

Step 1   Read the Safety Warnings section and disconnect the power supply before you perform any module replacement.

Step 2   If connected, place the RPS 2300 into standby mode. Consult the *Cisco Redundant Power System 2300 Hardware Installation Guide* for operating the RPS 2300.

Step 3   Power off and disconnect the AC or DC power from the router power supply.

Step 4   Remove the RPS cable from the RPS 2300.

Step 5   Remove the other end of the RPS 2300 cable from the RPS adapter.

Step 6   Remove the RPS adapter.

Step 7   Install the RPS blank panel.

Cisco 2911, 2921, and 2951 Power and RPS Error Messages

There are many RPS error messages unique to the Cisco 2911, 2921, and 2951 routers. The messages appear on the router console terminal. Table 5-3 lists the messages and their meanings.

Table 5-3   Cisco 2911, 2921, and 2951 Power and RPS Error Messages

Message	Condition
An unsupported RPS is connected or cable is not inserted properly	During reload, IOS cannot read the RPS2300 PID, or the RPS2300 PID does not match. The RPS2300 PID is read over the I2C link between the Router and the RPS2300. The error could also indicate there is a cable connectivity problem.
Power supplies inserted in RPS are incompatible	RPS 2300 FRUs are different. FRUs can be either 1150W or 750W. The RPS does not support differing FRUs. See Table 1-9.
RPS has a critical fault	During reload, the RPS2300 has an over-current, over-temperature, or under-voltage condition.
RPS is not ready for configuration	RPS2300 is busy handling control or configuration commands from the connected LUs[1], and the router is trying to send command to the RPS2300.
RPS is not available for backup	RPS2300 is backing up other LUs and it cannot backup the current router.
One critical RPS fault has occurred or RPS power supply is not good	During runtime, the RPS2300 encountered an over-current, over-temperature, or under-voltage condition, or the power supplies is faulty.
RPS is disconnected or powered off	RPS2300 is disconnected or powered off.
An unsupported RPS is connected.	During reload or runtime, an unsupported RPS2300 is connected to the router.
RPS OIR insertion is not supported. Reload the router for power redundancy.	During runtime, the supported RPS2300 is connected to the router.
Chassis power is not good in PSU 1	During runtime, the power input source was removed from the internal power supply.
Input source is removed from PSU 1	During runtime, the power input source was removed from the internal power supply.
PSU's PoE power is not good in slot 1	During runtime, the PoE power from the internal power supply failed.
PSU is removed in slot 1	Internal power supply is removed.

1. LU=Load Unit.

Replacing a Fan Tray or Air Filter

The Cisco 2900 series and 3900 series routers have hot-swappable fan trays and air filters that are field replaceable units (FRUs). The fan tray includes all of the router fans in one assembly. If a fan fails, replace the tray using a flat-blade or Phillips screwdriver.

Note We recommended replacing fan filters every six months, or when dirty, whichever comes first.

Before Hot-Swapping a Fan Tray

Before hot-swapping a fan tray, read the safety precautions below.

- Read the entire procedure and have the required tools available.
- Do not attempt the hot-swap in ambient air temperature above 90°F (32°C).
- Do not attempt the hot-swap at an altitude above 6000 feet (1829 meters).
- When the router is being operated, it is recommended to change the fans within the following times to ensure the router does not overheat:
  - Cisco 2911 within 2 minutes
  - Cisco 2921 or 2951 within 2 minutes
  - Cisco 3900 series within 1.5 minutes

Cisco 2911
- Replacing the Cisco 2911 Fan Tray, page 5-44
- Replacing the Cisco 2911 Air Filter, page 5-45

Cisco 2921 and Cisco 2951
- Replacing the Cisco 2921 or 2951 Fan Tray, page 5-46

Cisco 2900 and Cisco 3900 Series
- Replacing the Cisco 3900 Series Fan Tray, page 5-47
- Replacing the Cisco 3900 Series Air Filter, page 5-48

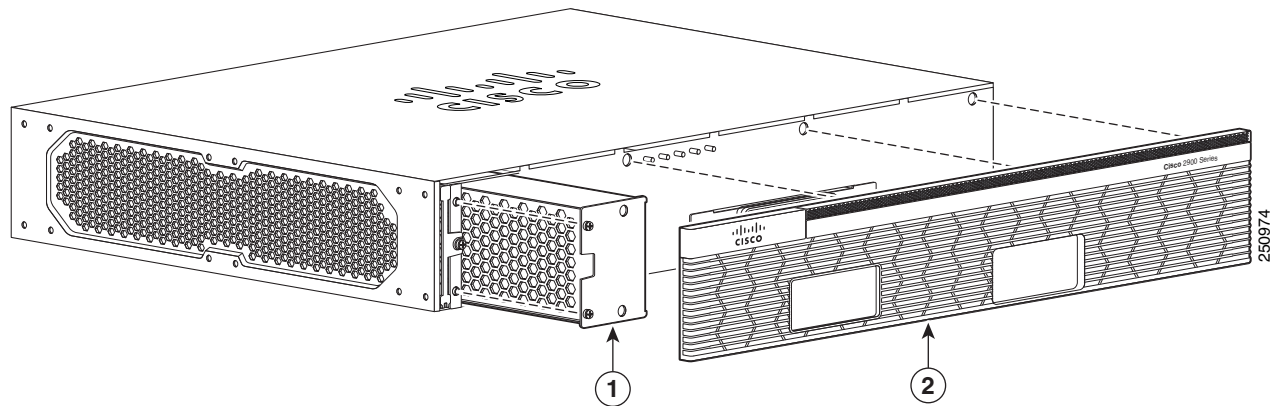## Replacing the Cisco 2911 Fan Tray

To hot-swap a fan tray, complete the following steps:

Note If hot-swapping the fan tray, it is recommended to complete the operation within 2 minutes to ensure the router remains within operating temperature.

Step 1 Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2 Unsnap the bezel by pulling it straight out from the chassis. See Figure 5-33.

Figure 5-33 **Cisco 2911 Fan Tray Replacement**

| **1**	Fan tray captive screws (2)	**2**	Bezel

Step 3   Loosen the two captive screws on the fan tray.

Step 4   Pull the fan tray out.

Step 5   Insert the replacement fan tray and tighten the two captive screws.

Step 6   Snap the bezel back in place.

Replacing the Cisco 2911 Air Filter

To replace the air filter, complete the following steps:

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Unsnap the bezel by pulling it straight out from the chassis. See Figure 5-34.

Figure 5-34   *Cisco 2911 Filter Replacement*
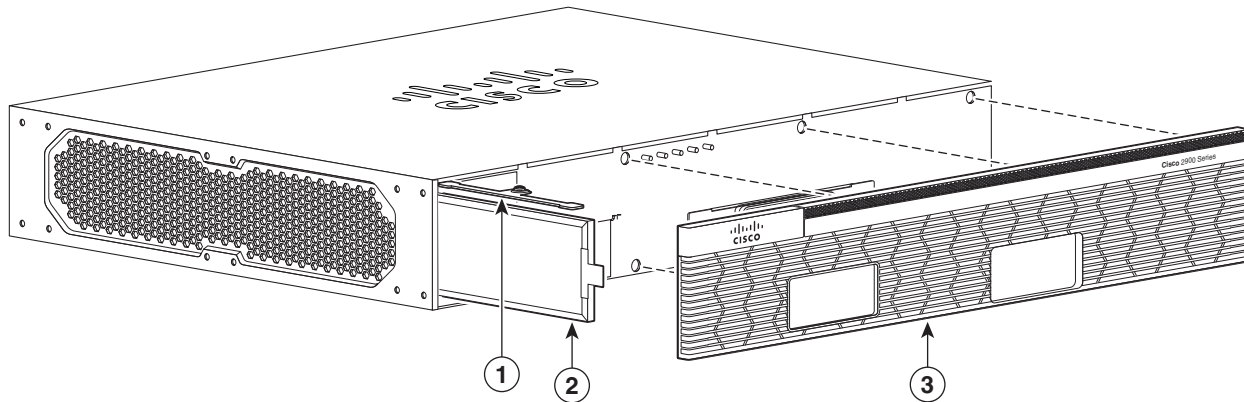
1	Filter	**2**	Filter cover
3	Bezel		

Step 3   Remove the screw from the air filter cover and remove the filter.

Step 4   Install the replacement air filter, the air filter cover, and the bezel

.

Replacing the Cisco 2921 or 2951 Fan Tray

To replace the fan tray, complete the following steps:

Note   If hot-swapping the fan tray, it is recommended to complete the operation within two minutes to ensure the router remains within operating temperature. See Figure 5-35.

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Pry open the fan tray screw covers on the four captive fan tray screws.

Step 3   Completely loosen the four captive fan tray screws.

Step 4   Pull the fan tray out.

Step 5   Insert the replacement fan tray and tighten the four captive screws.

Step 6   Snap the screw covers in place.

Figure 5-35   Cisco 2921 and 2951 Fan Tray Replacement
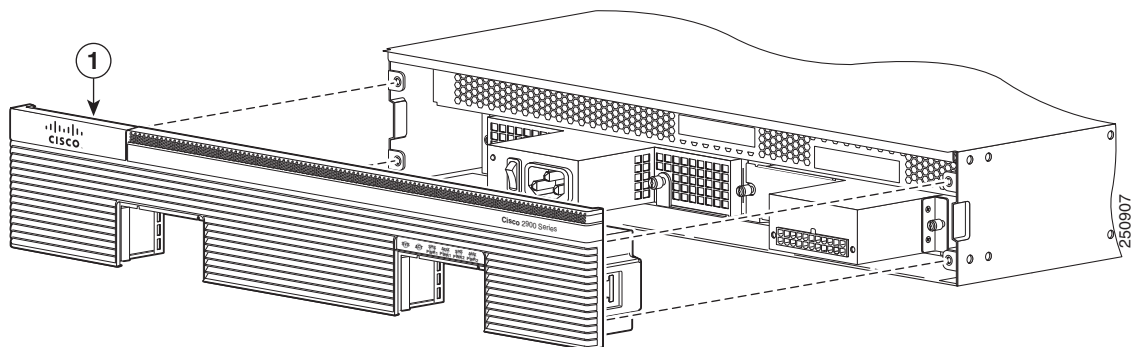
1	Fan tray and bezel assembly		

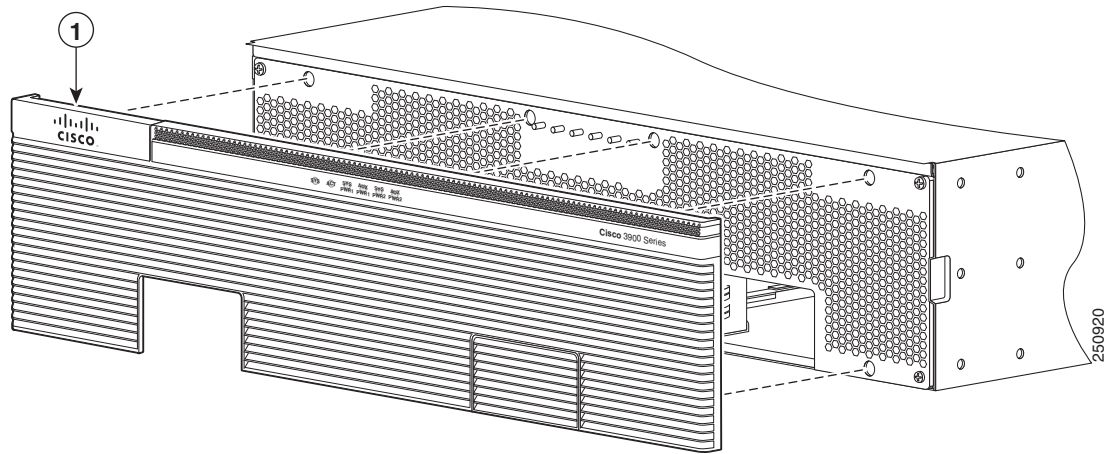# Replacing the Cisco 3900 Series Fan Tray

To hot-swap the Cisco 3900 series router fan tray, perform the following steps:

Note   If hot-swapping the fan tray, it is recommended to complete the operation within 1.5-minutes to ensure the router remains within operating temperature.

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Unsnap the bezel by pulling it straight out from the chassis. Initially, the bezel fits very tightly. See Figure 5-36.
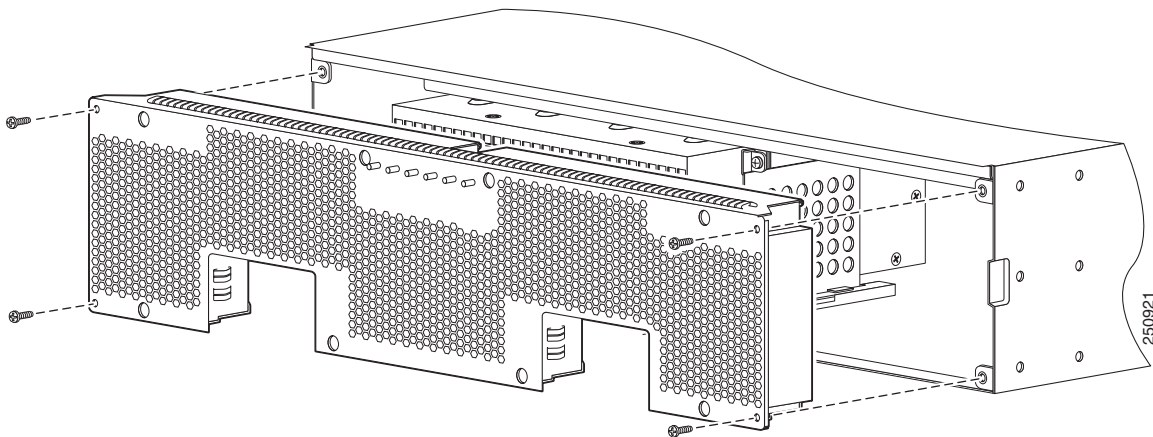
Figure 5-36   *Removing the Cisco 3900 Series Router Bezel*

1	Bezel		

Step 3   Loosen the four captive screws on the fan tray.

Step 4   Pull out the fan tray.

Step 5   Insert the replacement fan tray, and tighten the four captive screws as shown in Figure 5-37.

Figure 5-37   *Cisco 3900 Series Fan Tray Replacement*
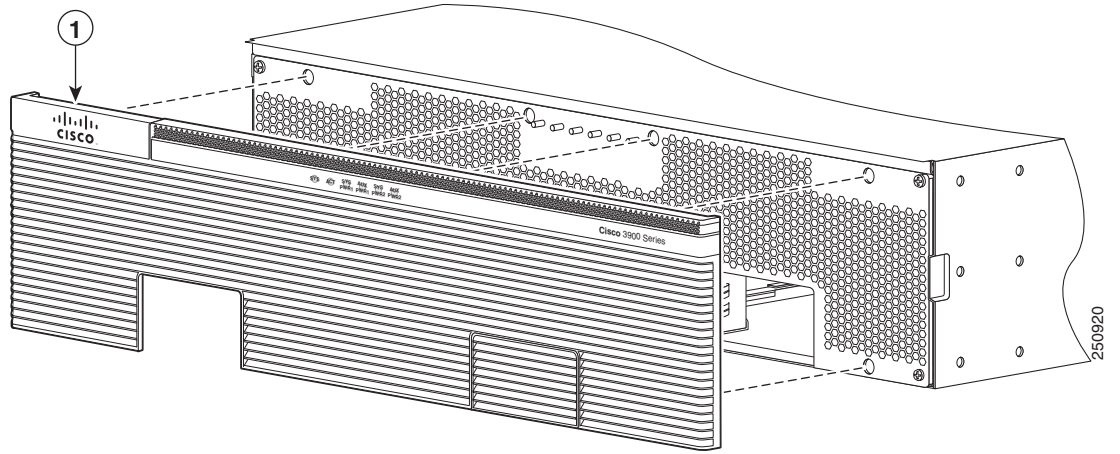

Step 6   Snap the bezel in place.

Replacing the Cisco 3900 Series Air Filter

Perform the following steps to replace the air filter:

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

**Step 2**   Unsnap the bezel by pulling it straight out from the chassis. See Figure 5-38.

Figure 5-38   *Removing the Cisco 3900 Series Router Bezel*

1	Bezel		

Step 3   Locate the filter, recessed inside the bezel.

Step 4   Remove the filter and insert the replacement filter inside the bezel.

Step 5   Snap the bezel back in place. See Figure 5-39.

*Figure 5-39*   *Replacing the Cisco 3900 Series Air Filters*
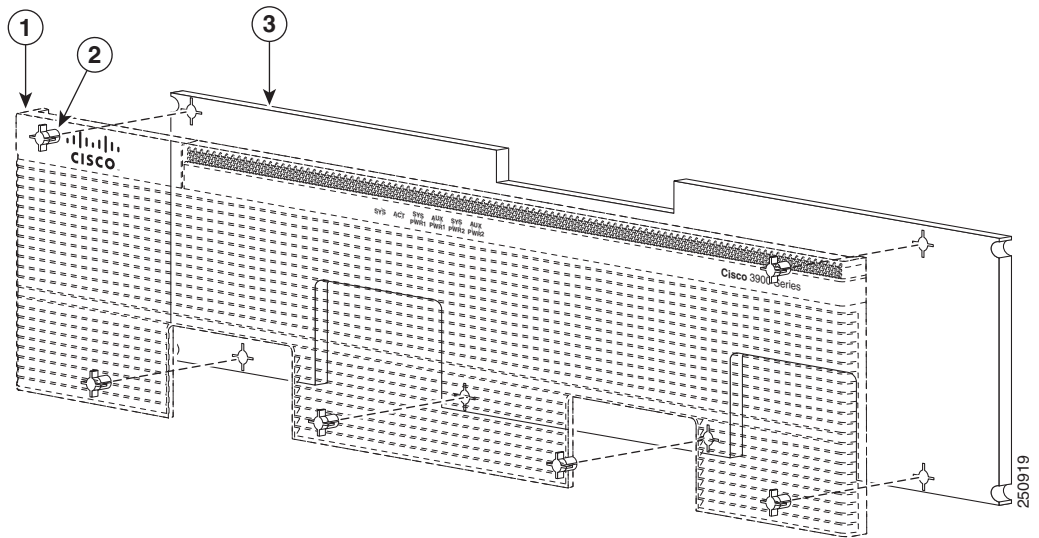
1	Bezel	2	Snaps (stationary)
3	Air filter		

Installing a FIPS Louver

A Federal Information Processing Standards (FIPS) louver can be installed to make a Cisco 2911 system compliant with FIPS 140-2. Complete the following steps to install the louver.

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Remove the screws to gain access to the side of the router as shown in Figure 5-40.

Step 3   Insert the four 8-32 screws through the FIPS louver plate, then position the FIPS spacers over the screws. See Figure 5-40.
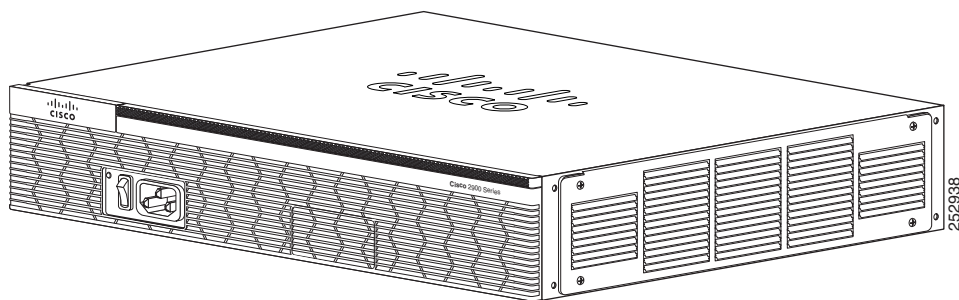
Figure 5-40   FIPS Louver Components and Installation)
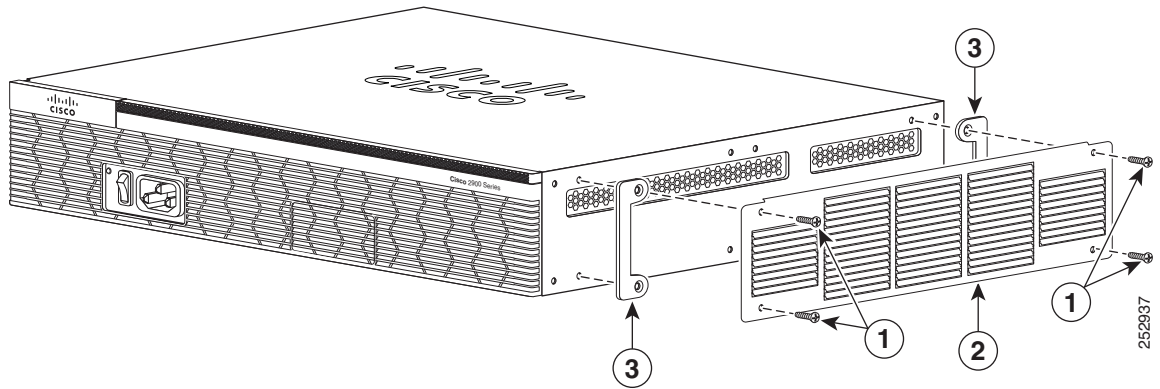
1	Screws	**2**	FIPS louver
3	FIPS louver spacer		

Step 4   Tighten the screws to secure the louver and spacers onto the router.

*Figure 5-41   Properly Installed FIPS Louver*

2911 Front to Back Air Flow Converter

The 2911 Air Converter forces the routers to take in (intake) air from the front (bezel) (Figure 5-42) and allow it to go out through (exhaust) the back (business) (Figure 5-43). Installation of the 2911 Front to Back Air Converter still allows the router to run over its full temperature operating range. The pieces of the 2911 Air Converter are symmetric, and hence, if required, instead of the default 2911 side to opposite side venting direction, they can be reversed to facilitate back-to-front air flow. The 2911 with 2911 Front to Back Air Converter installed adds width to the router and requires it to be installed only in a EIA 23-inch rack. Based on the requirement, the rack mount brackets can be positioned on the front, centre, Inside, or outside.

> **Note**   The installation of the 2911 Air Converter requires only two rack-mount brackets.

Figure 5-42   Front View of the Cisco 2911 Router with the 2911 Air Converter
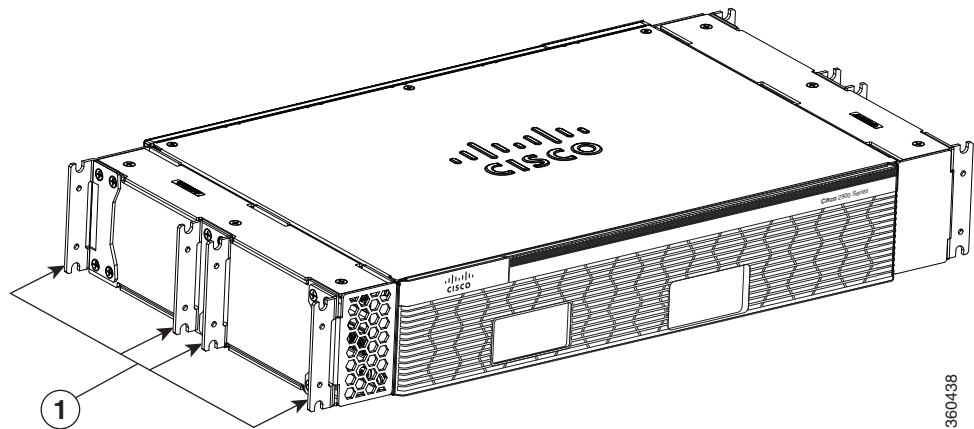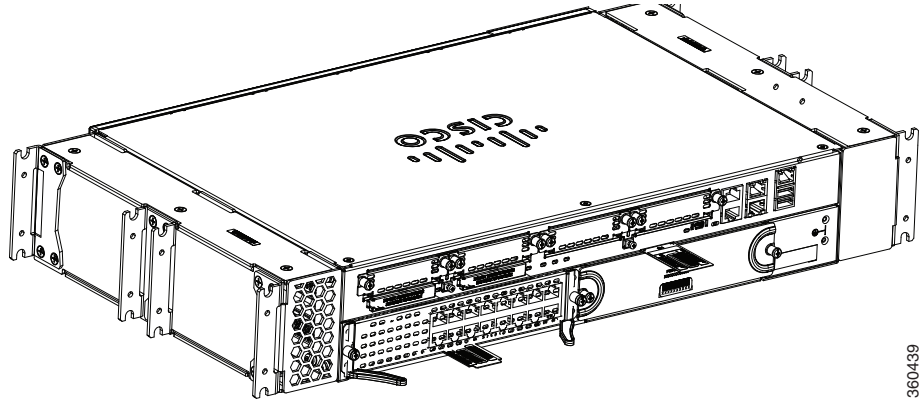

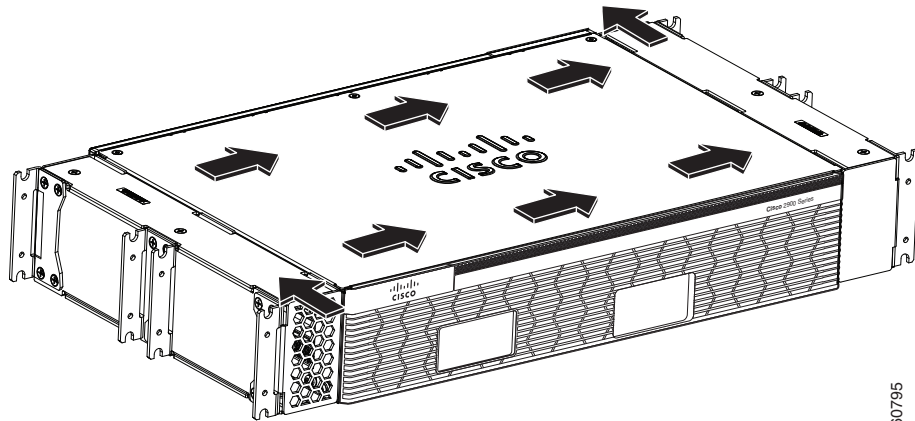| **1**	Rack mount brackets		

> **Note**   The 2911 router view shows the rack mount brackets installed at all possible locations. You can choose one of these four positions to install rack mount brackets.

Figure 5-43   Back View of the Cisco 2911 Router with the 2911 Air Converter

Figure 5-44   Front View of the Cisco 2911 Router Showing Forced Front-to-Back Air Flow Scheme

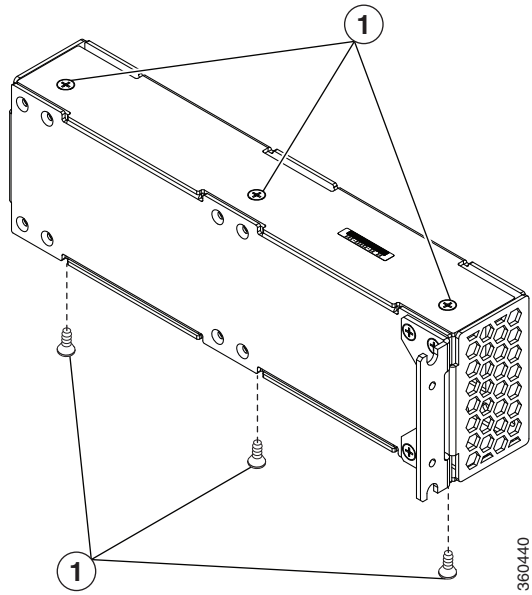

Follow these steps to install the 2911 Air Converter:

Step 1   Remove the screws (three on top and three at the bottom) of the 2911 Air Converter. See Figure 5-45.

Note   Set aside these six screws for joining the inner and outer piece in Step 4.

Figure 5-45   *The 2911 Air Converter*

1	8-32 x 0.25 inch (0.63 cm) long countersunk Screws (48-0965-01)		

Step 2   Slide apart the inner and outer pieces. See Figure 5-46.

Figure 5-46   Inner and Outer Pieces of the 2911 Air Converter
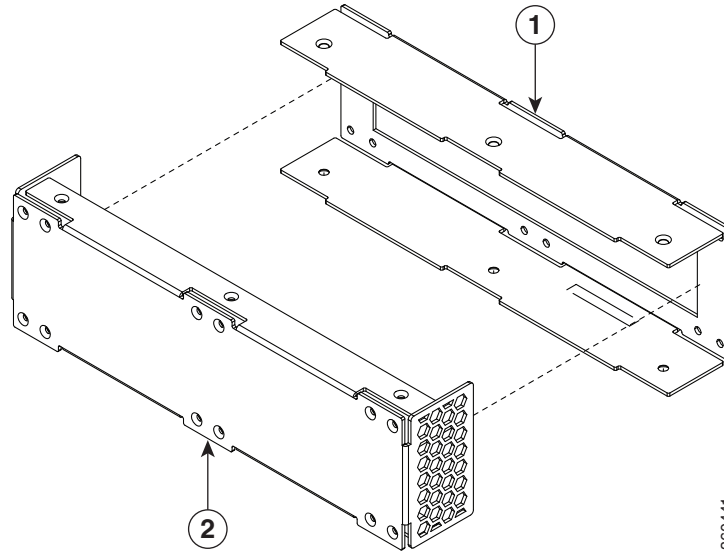
1	Inner piece	**2**	Outer piece

Step 3   Assemble the inner piece of the 2911 Air Converter on the chassis using the twelve pan head screws. See Figure 5-47.

✎

Note   Tigthen all the pan head screws to a minimum torque of 15 in-lb.

Figure 5-47   *Assesmbling the Inner Piece of the 2911 Air Converter to the Chassis*
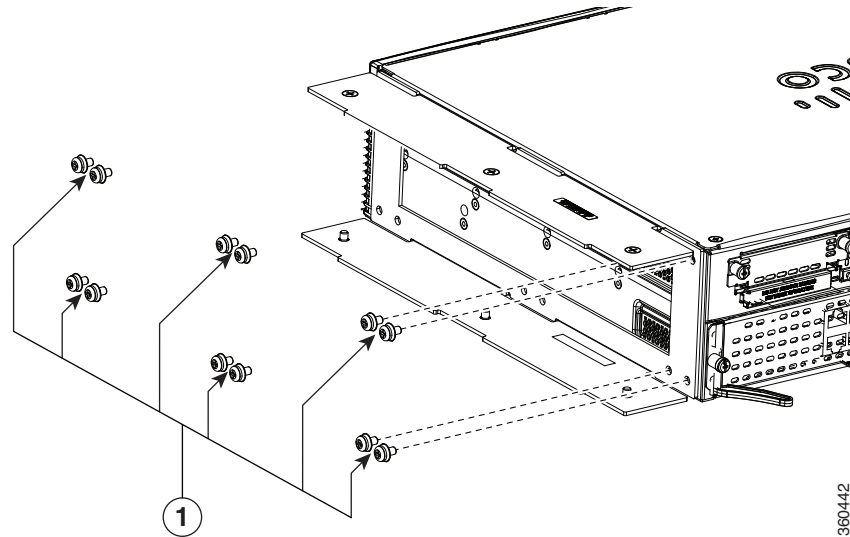
1	8-32 x 0.31 inch (0.79 cm) long pan head screws (48-1970-01)		

Step 4   Slide the outer piece along with the rack-mount brackets attached, into the inner piece. See "Attaching Rack-Mount Brackets to Cisco 2911, Cisco 2921, and Cisco 2951 Routers" section on page 3-6 for details on attaching rack-mount brackets. Insert and tighten the flat head screws (three on top and three at the bottom). See Figure 5-48.

Figure 5-48   *Inserting the Outer Piece to the Chassis*
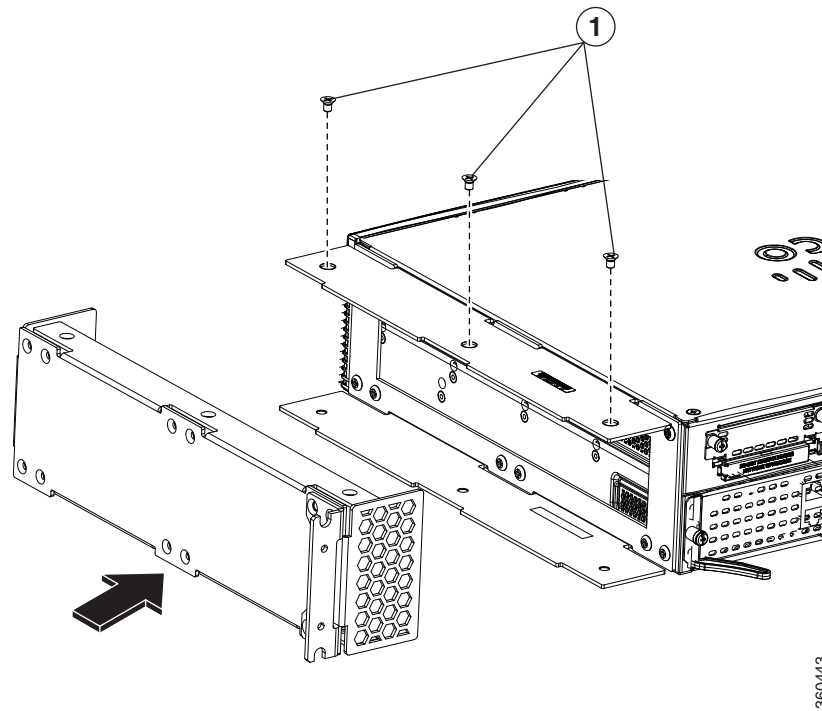
1	Flat head screws (48-0965-01)		

Step 5   Repeat the same steps and assemble the 2911 Air Converter on the other side of the router. The rack mount brackets can stay in the position, as shown, or can be moved to any of the positions shown. See Figure 5-49.

> **Note**   The hexagonal vent patterns on each Air Converter assembly should be oriented in different directions when installed on opposite sides of the router, to facilitate front-to-back or back-to-front air movement.

> **Note**   Once both 2911 air converters are attached to the opposite sides of the router and all screws used to attach the converter pieces are tightened to at least 15 in-lb, user can then install the 2911 with air converter into an EIA 23" rack. See the "Mounting the Router in a Rack" section on page 3-10" for details on how to install router in a rack.

Figure 5-49   The Cisco 2911 Router After the installation of the 2911 Air Converter
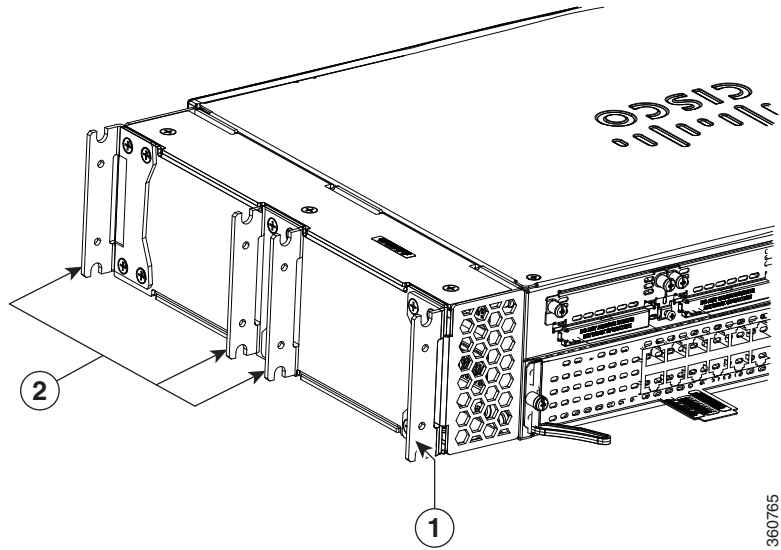
1	Rack mount bracket	**2**	Other possible positions for rack mount bracket

Removing and Installing CompactFlash Memory Cards

This section describes installing and replacing CompactFlash (CF) memory cards in Cisco 2900 and 3900 series integrated services routers. It contains the following sections:

- Preventing Electrostatic Discharge Damage, page 5-58
- Removing a CompactFlash Memory Card, page 5-58
- Installing a CompactFlash Memory Card, page 5-60

Preventing Electrostatic Discharge Damage

CF memory cards are sensitive to electrostatic discharge (ESD) damage, which can occur when electronic cards or components are handled improperly. ESD results in complete or intermittent failures.

To prevent ESD damage, follow these guidelines:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to an unfinished chassis surface.
- Place CF memory cards on an antistatic surface or in a static shielding bag. If the card will be returned to the factory, immediately place it in a static shielding bag.
- Avoid contact between the card and clothing. The wrist strap protects the card from ESD voltages on the body only; ESD voltages on clothing can still cause damage.
- Do not remove the wrist strap until the installation is complete.

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

Removing a CompactFlash Memory Card

To remove a CF memory card from the chassis, perform the following steps: See Figure 5-52.

⚠
Caution   Do not remove a CF memory card from the chassis while it is being accessed. The CF LED blinks to indicate when flash memory is being accessed. Removing the CF memory card from the router while flash memory is being accessed can cause data corruption and erratic operation.

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Remove the CF cover by placing a flat-blade screwdriver in the slot and pushing sideways against the tensioner to release the cover door. (See Figure 5-50 and Figure 5-51.)

Figure 5-50   Inserting Screwdriver Into the CompactFlash Cover
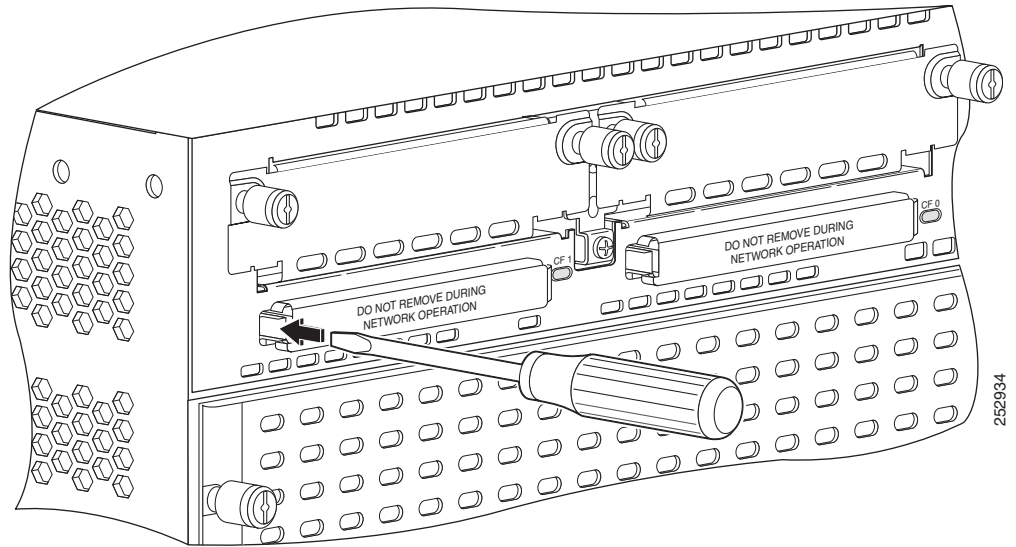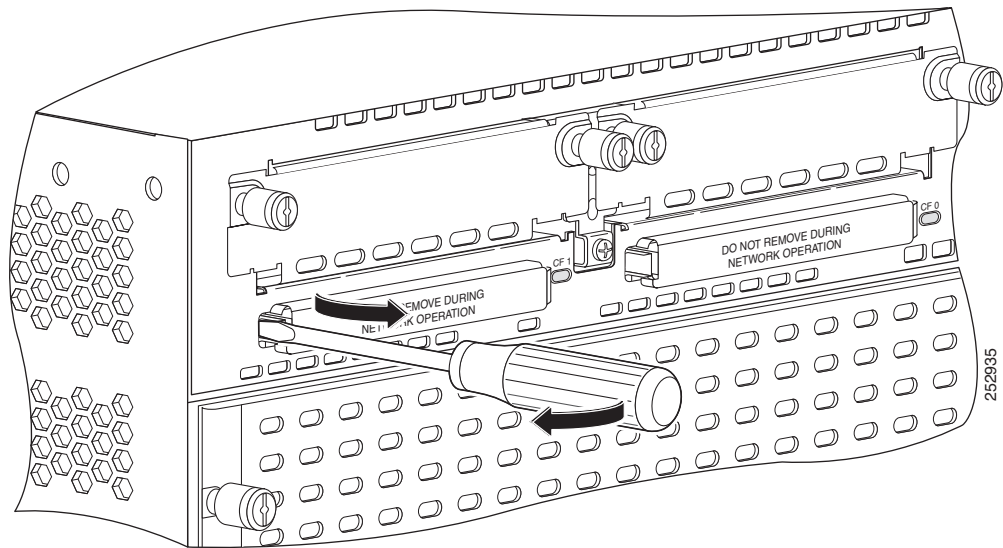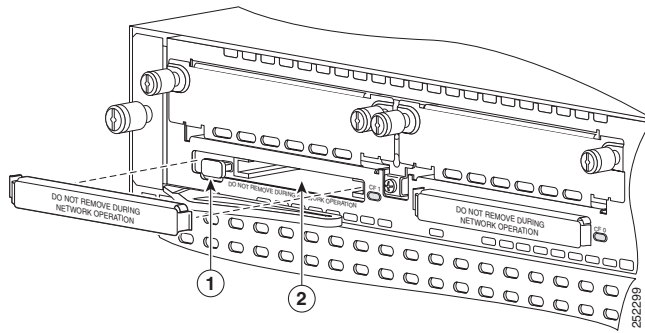

Figure 5-51   Removing the CompactFlash Cover

Step 3   Press the ejector button next to the CompactFlash memory card. The ejector button moves outward so that it projects from the panel.

Figure 5-52   CompactFlash Memory Card Slot in Cisco 2900 Series Routers

Step 4   Press the ejector button again. See Figure 5-52. This ejects the CompactFlash memory card partially out of its slot.

Step 5   Pull the CF memory card out of its slot.

Step 6   Push the ejector button in until the button is flush with the bezel.

⚠️

Caution   To prevent damage to the ejector mechanism, the ejector button must remain pressed all the way in (flush against the bezel) when not being used to eject a CompactFlash memory card.

Installing a CompactFlash Memory Card

To install a CompactFlash memory card, perform the following steps (see Figure 5-52):

Step 1   Read the "Safety Warnings" section on page 5-2 and disconnect the power supply before you perform any module replacement.

Step 2   Make sure that the ejector button is fully seated until it is flush with the bezel.

✏️

Note   If the ejector button is projecting out from the panel, push it in until it is flush with the bezel.

Step 3   Insert the CompactFlash memory card into the slot until it is fully seated. The ejector button remains flush with the panel.

✏️

Note   If the ejector button is projecting from the panel after you insert the CompactFlash memory card, remove the CompactFlash memory card, press the ejector button until it clicks, and reinsert the CompactFlash memory card.

⚠️

Caution   To prevent damage to the ejector mechanism, the ejector button must remain fully seated when not being used to eject a CompactFlash memory card.

Step 4   Replace the CompactFlash cover by inserting the cover lip into the chassis and pushing the cover to snap it back into place.

Installing SFP Modules

This section describes how to install optional small-form-factor pluggable (SFP) modules in Cisco 2900 and Cisco 3900 series integrated services routers to provide optical Gigabit Ethernet connectivity.

The SFP module installs into a slot on the router rear panel. When selected in Cisco IOS software, it is assigned port **gigabitethernet 0/0**. The default is the built-in RJ-45 1000Base-T connector, which is enabled on this port.

Only SFP modules certified by Cisco are supported on Cisco 2900 series and Cisco 3900 series routers. Table 5-4 lists supported SFPs on Cisco 2900 and 3900 ISRs.

See *Cisco Transceiver Modules Compatibility Information* for compatibility issues.

Table 5-4   SFPs Supported on Cisco 2900 and 3900 Series Routers

Cisco Model Number	SFP Transceiver	Fiber Diameter (micrometer)	Wavelength (nm)	Mode	Maximum Distance
GLC-SX-MM=	1000Base-SX	50	850	Multi	550 m
GLC-LH-SM=	1000Base-LX/LH	9/125	1310	Single	10 km
GLC-ZX-SM=	1000Base-ZX	9/125	1550	Single	100 km
CWDM-SFP-1470=	1000Base-CWDM	50	1470	Single	100 km
CWDM-SFP-1490=			1490		
CWDM-SFP-1510=			1510		
CWDM-SFP-1530=			1530		
CWDM-SFP-1550=			1550		
CWDM-SFP-1570=			1570		
CWDM-SFP-1590=			1590		
CWDM-SFP-1610=			1610		
DWDM-SFP-3033	1000BASE-DWDM	—	1530.33	—	—
DWDM-SFP-3112	1000BASE-DWDM	—	1531.12	—	—
DWDM-SFP-3190	1000BASE-DWDM	—	1531.90	—	—
DWDM-SFP-3268	1000BASE-DWDM	—	1532.68	—	—
DWDM-SFP-3425	1000BASE-DWDM	—	1534.25	—	—
DWDM-SFP-3504	1000BASE-DWDM	—	1535.04	—	—
DWDM-SFP-3582	1000BASE-DWDM	—	1535.82	—	—
DWDM-SFP-3661	1000BASE-DWDM	—	1536.61	—	—
DWDM-SFP-3819	1000BASE-DWDM	—	1538.19	—	—
DWDM-SFP-3898	1000BASE-DWDM	—	1539.77	—	—
DWDM-SFP-3977	1000BASE-DWDM	—	1539.98	—	—
DWDM-SFP-4056	1000BASE-DWDM	—	1540.56	—	—

Table 5-4   *SFPs Supported on Cisco 2900 and 3900 Series Routers (continued)*

Cisco Model Number	SFP Transceiver	Fiber Diameter (micrometer)	Wavelength (nm)	Mode	Maximum Distance
DWDM-SFP-4214	1000BASE-DWDM	—	1542.14	—	—
DWDM-SFP-4294	1000BASE-DWDM	—	1542.94	—	—
DWDM-SFP-4373	1000BASE-DWDM	—	1543.73	—	—
DWDM-SFP-4453	1000BASE-DWDM	—	1544.53	—	—
DWDM-SFP-4612	1000BASE-DWDM	—	1546.12	—	—
DWDM-SFP-4692	1000BASE-DWDM	—	1546.92	—	—
DWDM-SFP-4772	1000BASE-DWDM	—	1547.72	—	—
DWDM-SFP-4851	1000BASE-DWDM	—	1548.51	—	—
DWDM-SFP-5012	1000BASE-DWDM	—	1550.12	—	—
DWDM-SFP-5092	1000BASE-DWDM	—	1550.92	—	—
DWDM-SFP-5172	1000BASE-DWDM	—	1551.72	—	—
DWDM-SFP-5252	1000BASE-DWDM	—	1552.52	—	—
DWDM-SFP-5413	1000BASE-DWDM	—	1554.13	—	—
DWDM-SFP-5494	1000BASE-DWDM	—	1554.94	—	—
DWDM-SFP-5575	1000BASE-DWDM	—	1555.75	—	—
DWDM-SFP-5655	1000BASE-DWDM	—	1556.55	—	—
DWDM-SFP-5817	1000BASE-DWDM	—	1558.17	—	—
DWDM-SFP-5898	1000BASE-DWDM	—	1558.98	—	—
DWDM-SFP-5979	1000BASE-DWDM	—	1559.79	—	—
DWDM-SFP-6061	1000BASE-DWDM	—	1560.61	—	—
GLC-BX-D			1490 TX	—	—
			1310 RX	—	—
GLC-BX-U			1310 TX	—	—
			1490 RX	—	—
GLC-FE-100FX	—	—	1310	Multi	2 km
GLC-FE-100LX	—	—	1310	Single	10 km
GLC-FE-100EX	100BASE-FX	—	1310	Single	40 km
GLC-FE-100ZX	100BASE-ZX	—	1550	Single	80 km
GLC-FE-100BX-U			1310 TX	Single	10 km
			1550 RX		
GLC-FE-100BX-D			1550 TX	Single	10 km
			1310 RX		
GLC-GE-100FX	—	—	1310	Multi	2 km

Tip   Use the **show controller** command at the Cisco IOS prompt to determine whether you are using an SFP certified by Cisco.

Laser Safety Guidelines

Optical SFPs use a small laser to generate the fiber-optic signal. Keep the optical transmit and receive ports covered whenever a cable is not connected to the port.

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

Warning   **Ultimate disposal of this product should be handled according to all national laws and regulations.** Statement 1040
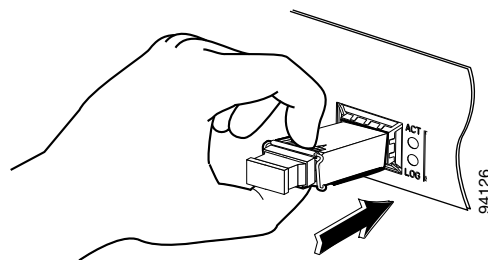
Follow these steps to install an SFP module in a Cisco 2900 or 3900 series router:

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Slide the SFP into the router connector until it locks into position (see Figure 5-53).

Tip   If the SFP uses a bale-clasp latch (see Figure 5-53), the handle should be on top of the SFP module.

Figure 5-53   Installing an SFP Module

Caution   Do not remove the optical port plugs from the SFP until you are ready to connect cabling.

Step 3   Connect the network cable to the SFP module.

Removing SFP Modules

Follow these steps to remove an SFP from a Cisco 2900 series or Cisco 3900 series router:

Step 1   Read the "Safety Warnings" section on page 5-2 section and disconnect the power supply before you perform any module replacement.

Step 2   Disconnect all cables from the SFP.

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

Caution   The latching mechanism used on many SFPs locks the SFP into place when cables are connected. Do not pull on the cabling in an attempt to remove the SFP.
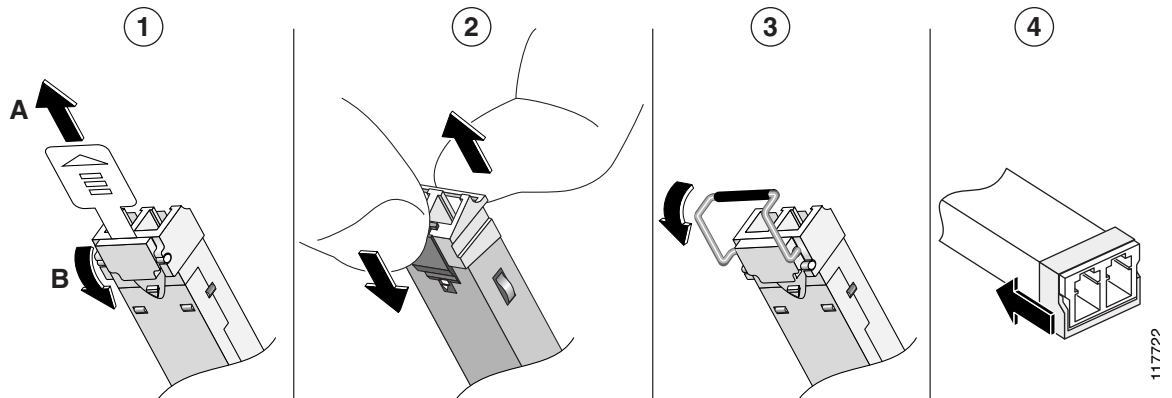
Step 3   Disconnect the SFP latch. See Figure 5-54.

Note   SFP modules use various latch designs to secure the module in the SFP port. Latch designs are not linked to SFP model or technology type. For information on the SFP technology type and model, see the label on the side of the SFP.

Figure 5-54   Disconnecting SFP Latch Mechanisms

| **1** | Sliding latch | **3** | Bale-clasp latch |
| **2** | Swing and slide latch | **4** | Plastic collar latch |

Tip   Use a pen, screwdriver, or other small straight tool to gently release a bale-clasp handle if you cannot reach it with your fingers.

Step 4   Grasp the SFP on both sides and remove it from the router.

CHAPTER **6**

Getting Software Licenses for the Router

The Integrated Services Router Generation 2 (ISR G2) platforms offer a new Universal Cisco Internet Operating System (IOS) software image. The Universal image and its licensing provisions provide greater flexibility to deploy new features while also improving visibility and management of existing licenses on routers in the network.

When you order a new ISR G2, it is shipped with the software image and the corresponding permanent licenses for the packages and features that you specified, preinstalled. The software does not need to be activated or registered prior to use.

Use the Cisco management application such as Cisco License Manager (CLM), or use the Cisco IOS **show license command** to determine the licenses activated on your system. CLM is a free software application available at http://www.cisco.com/go/clm.

The router comes with an evaluation license, also known as a temporary license, for most packages and features supported on the router. To try a new software package or feature, activate the evaluation license for that package or feature.

Activating a New Software Package or Feature

Complete the following steps to permanently activate a software package or feature on the router:

Step 1 Purchase the software package or feature you want to install. You receive a product activation key (PAK) with your purchase.

Step 2 If you do not have a Cisco.com username and password, register for an account at the following URL:

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

Step 3 Get the license file using one of the following options:

Note You must have the serial number (SN) and product ID (PID) of the router where the license should be installed. See Figure 1-13 for the location of the SN and PID.

- **Cisco License Manager (CLM)**— CLM is a free software application available at:

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

- **Cisco License Registration Portal**— Cisco license registration portal is a web-based portal for getting and registering individual software licenses, available at:

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

- **Cisco License Call Home**— Use the Cisco License Call Home interface on the router to directly interact with the Cisco Product License Registration portal.

Step 4   Install the license file using one of the following options:

- **Cisco License Manager (CLM)**— CLM is a free software application available at http://www.cisco.com/go/clm.

- **Cisco License Call Home**— Use the Cisco License Call Home interface on the router to directly interact with the Cisco Product License Registration portal.

- **Cisco IOS CLI** - Use the Cisco IOS command line interface to install and manage licenses.

- **Simple Network Management Protocol (SNMP)**— Use SNMP to install and manage software licenses.

Figure 1   *Steps for Software Activation*
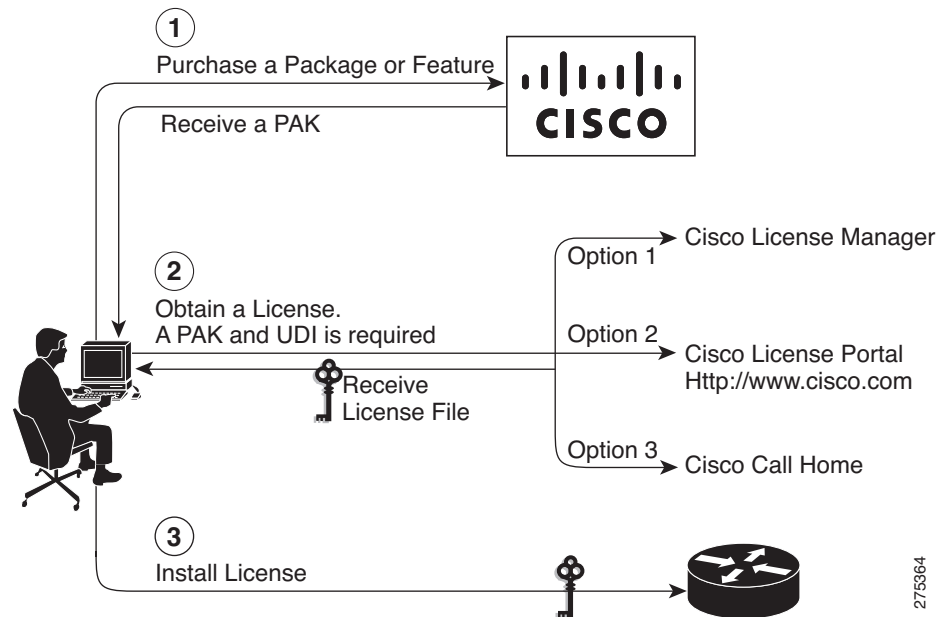
RMA License Transfer

To transfer a software license from a failed device to a new device, go to the Cisco licensing portal at:

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

Note You need the SN and PID of the defective device and the RMA router, to initiate an RMA replacement license.

Additional Information

See the *Software Activation on Cisco Integrated Services Routers and Cisco Integrated Service Routers Generation 2* document at Cisco.com for detailed information about software activation on Cisco ISR G2 platforms.

Online Insertion Removal and Hot-Swapping

Online insertion and removal (OIR) enables you to replace faulty modules without affecting system operation, which is similar to hot-swapping. OIR commands are issued before removing a module and after installing a module. When performing OIR, an identical module must be used to replace the original one. If performing OIR on multiple modules within a router, perform the operation on one module at a time.

Requirement

The module must be in energywise full-power mode for OIR commands to be issued. If the module is in energywise power-saving or shutdown mode, OIR commands can not be issued, and the module should not be removed.

Note   OIR is only supported on the Cisco 3925, 3925E, 3945, and 3945E ISRs.

The difference between hot-swapping and OIR is that OIR requires performing IOS commands before and after the OIR. Hot-swapping is strictly a hardware function and requires no commands. Not all router components or modules use OIR, or can be hot swapped.

The following items use OIR in the Cisco 3925, 3925E, 3945, and 3945E ISRs:

- Service Modules
- Network modules

Note   Network modules must be inserted into a network module adapter. The network module adapter and network module must always remain together. They function as one unit.

- External CompactFlash memory
- SFPs
- USB devices

The following items can be hot swapped:

- Fan tray
- Power supply only when the router is backed up with an RPS

OIR Procedures

The following procedures describe using the OIR process to remove and replace data and voice modules.

Removing a Module

From a console terminal issue the **hw-module sm {slot} oir-stop** command**.** The service module adapter LED blinks then turns off, and the console displays a prompt signaling the module can be removed. See the following output:

```
Router# hw-module sm 4 oir-stop
*Nov 11 22:40:53.299: %ATMOC3POM-6-SFP_OUT: Interface ATM4/0 SFP has been removed.
*Nov 11 22:40:54.299: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM4/0, changed
state to down
SM Hardware slot 4 can be removed
```

Removing a Voice Module

> **Note**   All voice ports, controllers, transcoding, conferencing, and MTP dspfarm profiles should be shut down before removing a voice module.

From a console terminal issue the **hw-module sm {slot} oir-stop** command**.** The service module adapter LED blinks then turns off, and the console displays a prompt signaling the module can be removed. See the following output:

```
Router# hw-module sm 4 oir-stop
*Nov 11 22:40:53.299: %ATMOC3POM-6-SFP_OUT: Interface ATM4/0 SFP has been removed.
*Nov 11 22:40:54.299: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM4/0, changed
state to down
SM Hardware slot 4 can be removed
```

Inserting a Data or Voice Module

This step is only required if the **oir-stop** command was issued and the module was not physically removed from the slot. If the module was physically removed, this command is not needed.

From a console terminal issue the **hw-module sm {slot} oir-start** command**.** The console displays a output showing the module changing states. See the following output:

```
Router# hw-module sm 2 oir-start
Router#
*Nov 11 21:06:17.546: %ATMOC3POM-6-SFP_IN: Interface ATM2/0 OC3 MM SFP has been inserted.
Router#
*Nov 11 21:06:19.442: %LINK-3-UPDOWN: Interface ATM2/0, changed state to up
*Nov 11 21:06:20.442: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM2/0, changed
state to up
```

Hot-Swapping Procedures

The following items can be hot-swapped:

- Fan trays

- Power supplies only when the router is backed up with an RPS

See the "Replacing a Fan Tray or Air Filter" section on page 5-44 and the "Replacing Power Supplies and Redundant Power Supplies" section on page 5-28.