

Hardware Installation Guide for the Cisco 4451-X Integrated Services Router

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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, page ix
- Audience, page ix
- Organization, page x
- Conventions, page xi
- Related Documentation, page xvii
- Searching for Cisco Documents, page xviii
- Obtaining Documentation and Submitting a Service Request, page xviii

Objectives

This guide explains how to install, connect, and perform initial configurations for the Cisco 4451-X Integrated Services Router (ISR).

Note For warranty, service, and support information, see the "Cisco Warranty Terms" section in the *Pointer Card for the Cisco 4451-X Integrated Services Router* 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 Cisco 4451-X Integrated Services Router	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	Initial Configuration	Describes how to power up the router and perform the initial configuration.
5	ROM Monitor Overview and Basic Procedures	Provides an overview of ROM Monitor concepts and operations.
6	Installing and Upgrading Internal Modules and FRUs	Describes how to install and upgrade internal modules and field replaceable units[3] on the router.
7	Online Insertion and Removal (OIR) and Hot-Swapping	Describes how to remove and replace data and modules using the online insertion and removal[4] procedure.

1. PID = Product ID
2. UDI = 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

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이 지시 사항을 보관하십시오.

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

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

GUARDE ESTAS INSTRUÇÕES

Advarsel **VIGTIGE SIKKERHEDSANVISNINGER**

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

GEM DISSE ANVISNINGER

تحذير **إرشادات الأمان الهامة**

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

Upozorenje **VAŽNE SIGURNOSNE NAPOMENE**

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

SAČUVAJTE OVE UPUTE

Upozornění **DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY**

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

USCHOVEJTE TYTO POKYNY

Προειδοποίηση

ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

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

ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ

אזהרה

הוראות בטיחות חשובות

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

מור 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

Related Documentation

For a list of all related release and supported module documentation, see the *Documentation Roadmap for the Cisco 4451-X Integrated Services Routers* at the following URL:
http://www.cisco.com/en/US/docs/routers/access/4400/roadmap/isr4400roadmap.html

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 *What's New in Cisco Product Documentation* at: http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html.

Subscribe to *What's New in Cisco Product Documentation*, which lists all new and revised Cisco technical documentation, as an RSS feed and deliver content directly to your desktop using a reader application. The RSS feeds are a free service



Overview of the Cisco 4451-X Integrated Services Router

About the Cisco ISR 4451-X

The Cisco 4451-X Integrated Services Router (ISR) is a modular router with LAN and WAN connectivity and supports several interface modules, including Cisco Service Modules (SMs), or Enhanced Service Modules (SM-X), and Network Interface Modules (NIMs). The router has slots that support the interface modules and modular Solid State Drives (SSDs).

The Cisco ISR 4451-Xs target the following applications:

- Enterprise applications—Intended as the mid-size aggregation and gateway router typically residing in a regional or large branch office:
  - WAN aggregation at Cisco Enterprise core
  - Internet gateway
  - Branch or regional office aggregation
  - Remote access aggregation
- Service provider applications—Intended for high-end Enterprise Branch environments.:
  - High-end customer premises equipment (CPE) for business-quality Internet access
  - Service provider leased line aggregation
  - Provider edge (PE) and high-end customer edge (CE) for Layer 2 VPN or Layer 3 VPN services
  - Broadband aggregation—PPPoE/PPPoA aggregation and Service Selection Gateway (SSG)
  - Low-end Ethernet aggregation

The Cisco ISR 4451-Xs provide the following capabilities:

- Two single-wide SM slots that may be combined into one double wide SM slot.
- Three single-wide NIM slots that may combined into one double wide (NIM1 and NIM2) and one single wide NIM slot (NIM3). The slots can also support a modular or optional SSD.
- NIM3 slot also functions as a special hard drive carrier slot.
- 1 10/100/1000 RJ-45 Ethernet port for system managements (labeled "GE 0" with “MGMT” on the left of the connector)
- 2 USB 2 Type A host ports
- 1 USB mini-TypeB Console (placed next to the RJ45 Console port)

- 1 RJ45 Console
- 1 RJ45 AUX port with full modem control signals
- 4 10/100/1000 RJ-45 Ethernet ports (labeled GE 0/0/0, 0/0/1, 0/0/2, and 0/0/3)
- 4 100/1000 SFP Ethernet ports (labeled SFP 0/0/0, 0/0/1, 0/0/2, and 0/0/3)
- LEDs for Ethernet and console status
- LEDs for SATA hard disk drive activity and status (available on certain models)
- Two DDR3 240 pin Control Plane DIMM slots which can be replaced
- One DDR3 240 pin Data Plane DIMM slot which can be replaced
- One compact flash slot, which is serviceable when the fan tray is removed
- One 30W PoE daughter card for two of the front Gigabit Ethernet ports which can be replaced (labeled GE 0/0/0 and 0/0/1)
- One Next Generation Voice Module (NGVM) providing IP Voice and video capability
- Environment monitoring
- Field replaceable fan tray
- Dual redundant power supply units (PSUs) and PoE PSU.

This chapter contains the following sections:

- Safety Warnings, page 1-2
- Chassis Views, page 1-3
- Locating the Serial Number, PID, VID and CLEI, page 1-7
- Hardware Features, page 1-9
- About Slots and Interfaces, page 1-17
- Specifications, page 1-20
- Periodic Inspection and Cleaning, page 1-23

Safety Warnings



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



Warning **Ultimate disposal of this product should be handled according to all national laws and regulations.**
Statement 1040

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

Safety Warnings for Finland, Norway and Sweden

Warning statement 1017 applies to the countries of Finland, Norway, and Sweden.

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

Chassis Views

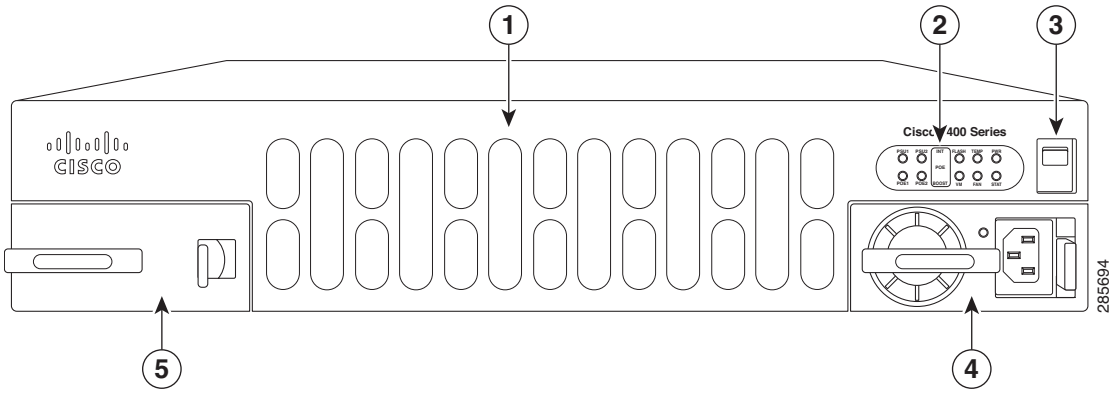
This section contains views of the front and back panels of the Cisco ISR 4451-Xs, showing locations of the power and signal interfaces, module slots, status indicators, and chassis identification labels.

Note The Cisco ISR 4451-Xs support the following slot types:
- Network Interface Modules (NIMs)
- Service modules (SMs, like SM-X-1T3/E3)
- Next generation voice modules (NGVMs)
- the E-Series Server Modules
- Solid State Drives (SSDs).

Cisco ISR 4451-X Chassis

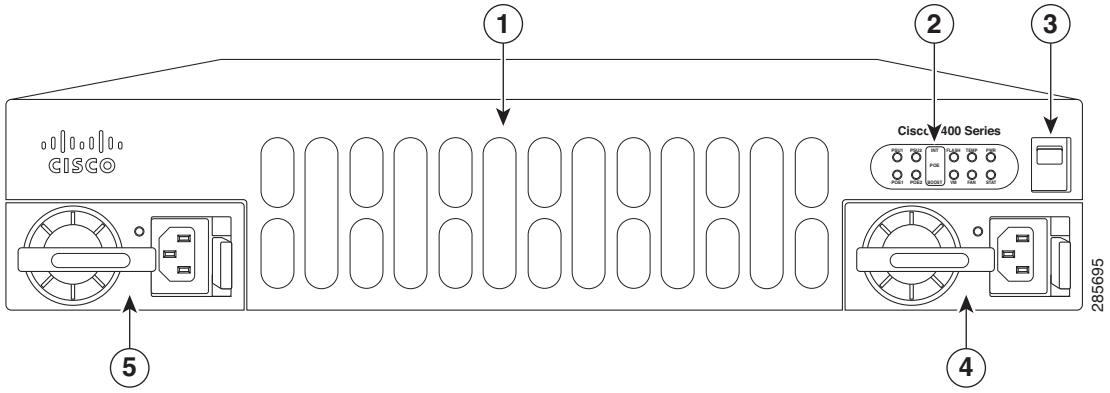
Figure 1-1 on page 1-4— Bezel view with one PSU
Figure 1-2 on page 1-5— Bezel view with two PSUs
Figure 1-3 on page 1-5— Back panel slots and ports
Figure 1-4 on page 1-6—Bezel side LEDs

Figure 1-1 Bezel View of the Cisco ISR 4451-X with one Power Supply Unit



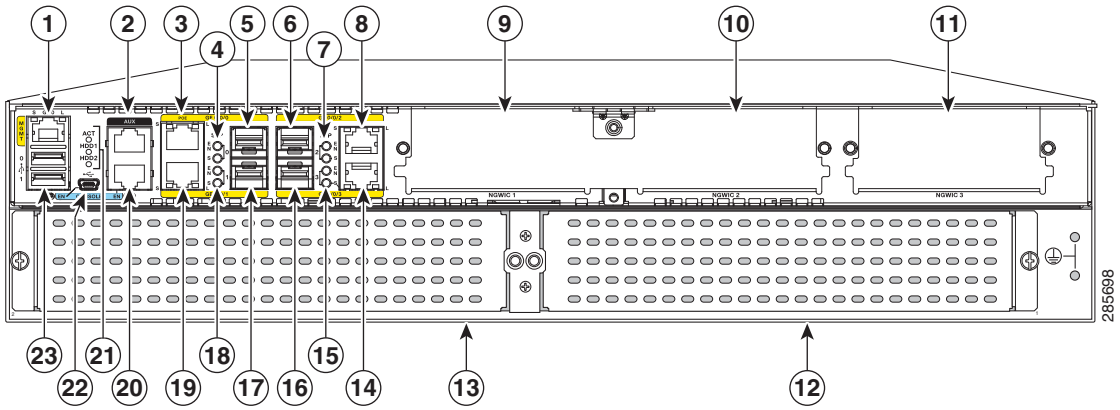
1	Router fan tray	**2**	LEDs
3	Router power On/Off switch	**4**	Power supply unit (PSU)
5	Optional power supply unit		

Figure 1-2 Bezel side of the Cisco ISR 4451-X with two PSUs



1	Router fan tray	**2**	LEDs
3	Router power On/Off switch	**4**	AC power supply unit (P1)
5	AC power supply unit (P0)		

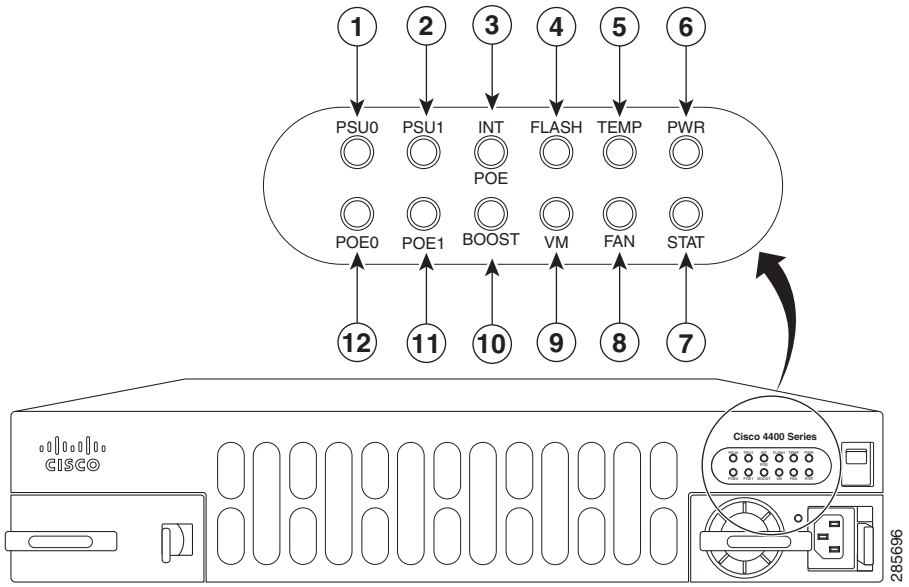
Figure 1-3 Back Panel (I/O Side) Slots and Connectors on the Cisco ISR 4451-X



1	GE 0 management port	**2**	Auxiliary port
3	RJ45 Gigabit Ethernet port (GE 0/0/0)	**4**	LEDs for the GE 0/0/0 interface (See Table 1-1 for detailed LED information)
5	SFP Gigabit Ethernet port (GE 0/0/0)	**6**	SFP Gigabit Ethernet port (GE 0/0/2)
7	LEDs for the GE 0/0/2 interface	**8**	RJ45 Gigabit Ethernet port (GE 0/0/2)
9	NIM slot 1	**10**	NIM slot 2
11	NIM slot 3 (Optional Modular SSD Slot)	**12**	Enhanced Service Module (SM-X) 2
13	Enhanced Service Module (SM-X) 1	**14**	RJ45 Gigabit Ethernet port GE 0/0/3
15	LEDs for the GE 0/0/3 interface	**16**	SFP Gigabit Ethernet GE 0/0/3

17	SFP Gigabit Ethernet GE 0/0/1	**18**	LEDs for the GE 0/0/1 interface
19	RJ45 Gigabit Ethernet port GE 0/0/1	**20**	Serial Console Port
21	Console port USB 0 and USB 1		

Figure 1-4 Bezel Side LEDS of the Single PSU Cisco ISR 4451-X Model

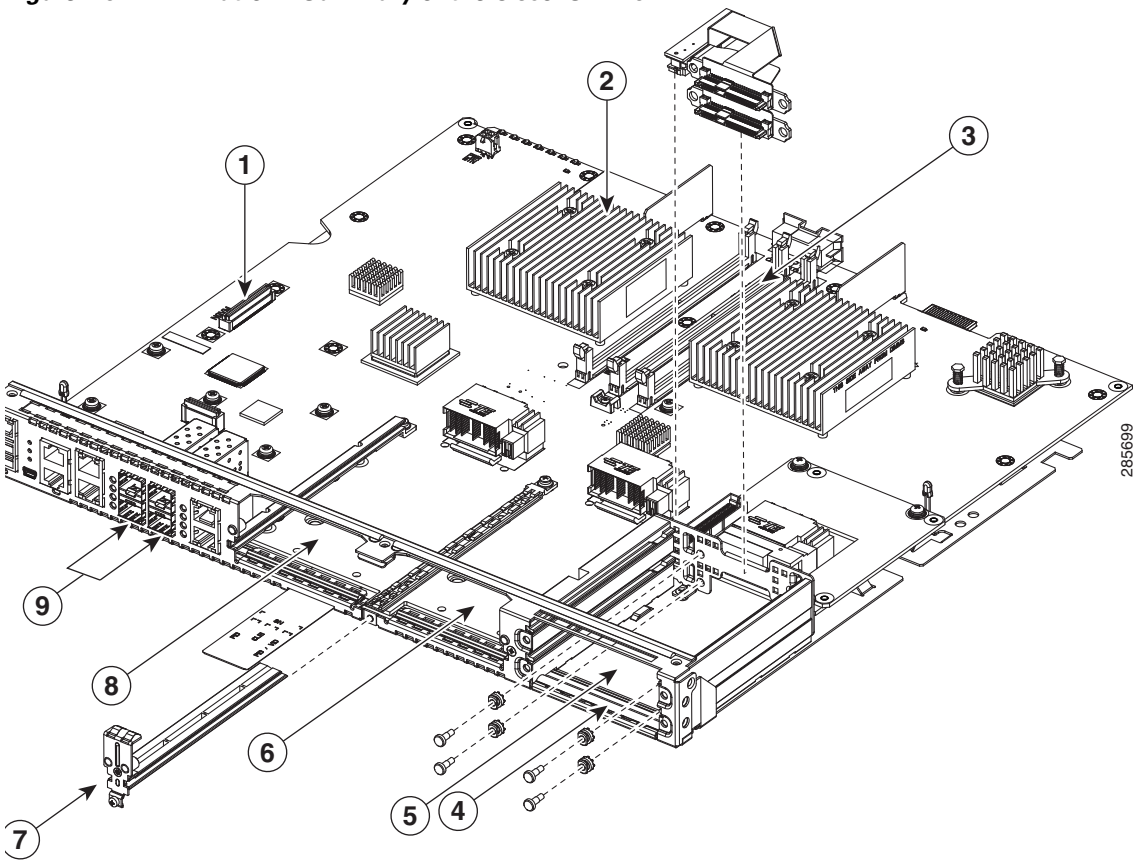


1	PSU0: Power supply unit 1	**2**	PSU1: Power supply unit 2
3	INT POE: Internal PoE daughter card status	**4**	FLASH: Compact flash status
5	TEMP: Temperature status	**6**	PWR: Power
7	STAT: System status	**8**	FAN: Fan status
9	NGVM: Next generation voice module status	**10**	POE BOOST: Power over Ethernet boost mode
11	POE 1: Power over Ethernet 2 status	**12**	POE 0: Power over Ethernet 1 status

Platform Summary

Figure 1-5 shows an internal view of the Cisco ISR 4451-X with all the parts and module location.

Figure 1-5 Platform Summary of the Cisco ISR 4451-X



1. NGVM slot	**2.** CPU
3. DIMM	**4.** Modular HDD Slot (Factory-configured)
5. Modular HDD slot (Factory-configured)	**6.** NIM 2 (single-wide)
7. NIM slot divider	**8.** NIM 1 (single-wide)

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 on Cisco.com.

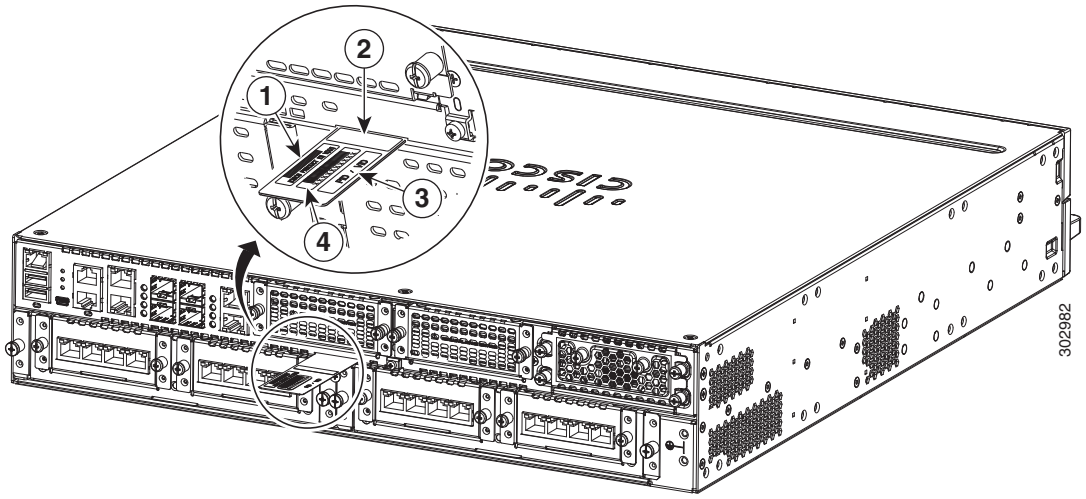
The UDI has two main components:

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

Labels on Cisco ISR 4451-X

Figure 1-6 shows the location of the labels on the Cisco ISR 4451-Xs.

Figure 1-6 Label Location on the Cisco ISR 4451-X



Label	Description
1	Product ID
2	Serial Number
3	PID/VID
4	CLEI

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

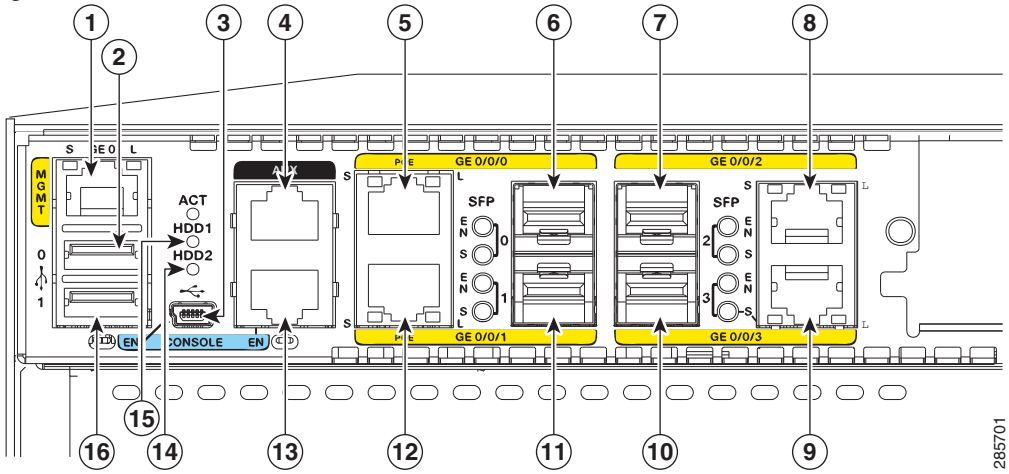
Hardware Features

This section describes the hardware features in the Cisco ISR 4451-X.

- Built-in Interface Ports, page 1-9
- LED Indicators, page 1-11
- Removable and Interchangeable Modules and Cards, page 1-13
- Fans, Ventilation, and Airflow, page 1-17
- About Slots and Interfaces, page 1-17

Built-in Interface Ports

Figure 1-7 Ports on the Cisco ISR 4451-X



1	Gigabit Ethernet management port	**2**	USB port 0
3	USB console	**4**	Auxiliary port
5	Gigabit Ethernet port 0	**6**	Small-form-factor pluggable (SFP) 0
7	SFP 2	**8**	Gigabit Ethernet port 2
9	Gigabit Ethernet port 3	**10**	SFP 3
11	SFP 1	**12**	Gigabit Ethernet port 1
13	Serial Console port	**14**	HDD LEDs
15	HDD LEDs	**16**	USB port 1

The Cisco ISR 4451-Xs have four 10/100/1000 front panel ports and SFPs and one 10/100/1000 management port.

Front Panel Ethernet Ports

There are 4 front panel Ethernet ports. Each port independently supports dual-media types, RJ45 copper or SFPs.

Dual Mode GE/SFP Ports

There are Dual Mode ports available on the Cisco ISR 4451-X that can function as GE or SFP ports.

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, but are not restricted to 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 with the same number. It can only be used for one or the other function at one time. 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 can be used as an alternative to the RJ45 console port. For Windows operating systems older than Windows 7, you must install a Windows USB device driver before using the USB console port.

Front Panel PoE+ Ports

Two of the four front panel ethernet ports are PoE+ (802.3at) compliant ports. These are ports GE 0/0/0 and GE 0/0/1.

System PoE power supplies do not provide power to the front panel ports.

Note The PoE card is always required to provide PoE power to these ports, regardless of what other power supplies are present in the system. An internal PoE module needs to be ordered separately for this functionality.

Internal PoE card

The internal PoE daughter card provides a total of 30.8 Watts of power across the 2 ports.

LED Indicators

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

Note For module LEDs, please refer to the respective module installation guides for each module.

Table 1-1 LED Indicators on the Cisco ISR 4451-X

LED	Represents	Color	Description	Location
STAT	System Status	Solid green	Normal System Operation.	Bezel side
		Blinking amber	BIOS/Rommon is in the process of booting.	
		Amber	BIOS/Rommon has completed booting and system at Rommon prompt or booting platform software.	
		Off	System is not out of reset or BIOS image not loadable.	
TEMP	Temperature Status	Solid green	All temperature sensors in the system are within acceptable range.	Bezel side
		Amber	One or more temperature sensors in the system are outside the acceptable range.	
		Off	Temperature is not being monitored.	
FAN	Fan Status	Green	All fans are operating.	Bezel side
		Amber	One fan has stopped working.	
		Blinking Amber	Two or more fans have stopped working, or the fan tray has been removed.	
		Off	Fans are not being monitored.	
L (left)	Ethernet ports 0 and 1 Link	Green	Ethernet cable present and link established with other side or PoE power is enabled for this port.	I/O side
		Amber	Yellow: PoE power for this connector is faulty and link is down. (Only for Ethernet port 0 and 1.)	
		Off	No link.	
S (left)	Speed of Ethernet ports 0 and 1	Green Blinking	Blink frequency indicates port speed: 1 blink - 10Mbps link speed 2 blinks - 100Mbps link speed 3 blinks - 1000Mbps link speed	I/O side
		Off	No link or a non-Ethernet 802.3af/t capable device plugged in and powered over the PoE.	

Table 1-1 LED Indicators on the Cisco ISR 4451-X (continued)

LED	Represents	Color	Description	Location
L (right)	Ethernet ports 2 and 3 and Management Ethernet Link	Green	Ethernet cable present and link established with other side.	I/O side
		Off	No link.	
S (right)	Ethernet ports 2, and 3 and Management Ethernet Speed	Green	Blinking: blink frequency indicates port speed: 1 blink - 10Mbps link speed 2 blinks - 100Mbps link speed 3 blinks - 1000Mbps link speed	I/O side
		Off	No link	
SFP EN	Port 0, 1, 2, and 3 Enable	Green	Indicates SFP module detected and recognized.	I/O side
		Amber	Initialized with error.	
		Off	Not present.	
SFP S	Status of Ports 0, 1, 2, and 3	Green	tbd	I/O side
		Amber		
		Off	Not present.	
SER CON (right)	Serial Console Active	Green	Indicates that the active console port is RJ-45. **Note** When this LED is on, the USB CON LED will be off.	I/O side
USB CON (left)	USB Console Active	Green	Green indicates that the active console port is USB. **Note** When this LED is on, the SER CON LED will be off.	I/O side
NGVM	NGVM Slot Status	Green	NGVM present and enabled.	Bezel side
		Amber	Initialized with error.	
		Off	Not present.	
FLASH	Compact Flash Status	Green	Present and inactive.	Bezel side
		Blinking Green	Compact flash present and currently being accessed. **Note** Do not remove the Compact Flash when this LED is blinking.	
		Off	Not present.	
PSU	Power Supply Unit (P0 and P1) Status	Green	PSU on and providing power.	Bezel side
		Amber	PSU is on but with errors or in a failure condition.	
		Off	Power supply turned off.	

Table 1-1 LED Indicators on the Cisco ISR 4451-X (continued)

LED	Represents	Color	Description	Location
POE PSU (not supported in Cisco IOS XE 3.8)	Power Over Ethernet Power Supply Unit 1 and 2 Status	Green	PSU is on and providing power.	Bezel side
		Amber	PSU is on but with errors or in a failure condition.	
		Off	PSU is off.	
POE Boost (not supported in Cisco IOS XE 3.8)	Power Over Ethernet Boost Mode	Green	Two PoE Power Supplies are installed and operating in boost mode.	Bezel side
		Off	This can mean one of the following: • No PoE PSU installed • One PoE PSU installed • Two PoE PSUs installed and operating in redundant mode.	
INT POE	Internal POE Daughter Card Status	Green	PSU installed and providing power	Bezel side
		Amber	PSU installed but in a failure condition.	
		Off	PSU is off.	
PWR	System Power	Green	System power is on and functioning correctly.	Bezel side
		Green blinking	System power is in the process of shutting down.	
		Amber	System power is up, but low level initialization failed.	
		Amber blinking:	System power is up, but the system failed to come out of reset.	
		Off	System power is off.	
AC OK	AC power status	Green	AC power is on.	On each power supply unit
		Off	AC power is off.	

Removable and Interchangeable Modules and Cards

Table 1-2 on page 1-15 summarizes the type of removable modules and cards that can be installed in the router to provide specific capabilities. Service Modules (SMs), Network Interface Modules (NIMs) and E-Series Server Modules, fit into external slots and can be removed or replaced without opening the chassis.

External Slots

- Network Interface Modules, page 1-15
- Cisco UCS E-Series Server Modules, page 1-15
- Solid State Drives, page 1-15

Internal Slots

- Next Generation Voice Modules, page 1-16
- Memory, page 1-16
- Compact Flash, page 1-15

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 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 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 ISR 4451-Xs.

Table 1-2 shows the number of internal and external slots on Cisco ISR 4451-Xs. It also shows the number of EHWICs and SMs that are supported in the router slots at any time.

Note Table 1-2 is valid for Cisco IOS XE release 3.9.

T
Table 1-2 Cisco ISR 4451-X Slots and Module Configurations

	Modules and Cards			
Router	**Solid State Drive (SSD)**	**Service Module (SM-X)**	**Network Interface Module (NIM)**	**E-Series Module (UCS)**
Cisco ISR 4451-X	1 single-wide	2 single-wide or 1 double-wide	3 single-wide or 1 double-wide + 1 single-wide	2 single-wide or 1 double-wide

Network Interface Modules

To install the Cisco SM-X-1T3/E3 service modules on the router chassis, see the *Installing Cisco Network Modules in Cisco Access Routers* guide for installation instructions at the following URL: http://www.cisco.com/en/US/docs/routers/access/interfaces/nm/hardware/installation/guide/InstNetM.html.

Cisco UCS E-Series Server Modules

The Cisco UCS E-Series Servers (E-Series Servers) are the next generation of Cisco UCS Express servers. E-Series Servers are a family of size, weight, and power efficient blade servers that are housed within the Generation 2 Cisco Integrated Services Routers (ISR G2) and the Cisco 4451-X Integrated Services Router. These servers provide a general purpose compute platform for branch-office applications deployed either as bare-metal on operating systems, such as Microsoft Windows or Linux; or as virtual machines on hypervisors, such as VMware vSphere Hypervisor™, Microsoft Hyper-V, or Citrix XenServer.

Compact Flash

The Cisco ISR 4451-Xs use a USB to Compact Flash.

Note Do not run the router without a Compact Flash card installed. Cisco IOS-XE will not come up without a compact flash card in the router.

Solid State Drives

The NIM slot 3 in the Cisco ISR 4451-X supports a field-replaceable solid state drive module with a dual-SSD SATA slot.

The SSD slot is always powered up. The SSDs are hot-swappable as part of normal operation. See the "Overview of the SSD Carrier Card NIM (NIM-SSD), page 6-6" section for more information.

Next Generation Voice Modules

The Next Generation Voice Modules (NGVMs) add additional voice capabilities to the Cisco ISR 4451-Xs. The NGVM is installed inside the chassis of the router. See the "Installing the PVDM4 on the Motherboard of the Cisco 4451-X ISR" section on page 6-26 for installation instructions.

Memory

Cisco ISR 4451-X routers contain the following types of memory:

- Control and data plane DIMMs—Stores the running configuration and routing tables and is used for packet buffering by the network interfaces. Cisco IOS XE software executes from memory. Supported module types are Dual In-Line Memory Modules (DIMMs).

Note The DIMMs are interchangeable although the same sizes are not supported in all locations. The single data plane DIMM must have a 2GB DIMM which is exactly like one of the two DIMMs used for the control plane with 4GB default memory. The control plane uses two DIMMs and they must be exactly the same type and density.

- Boot/NVRAM—Stores the bootstrap program (ROM monitor), the configuration register, and the startup configuration.
- Flash memory—Internal bootflash memory. Stores the operating system software image. Each model supports 1 internal Compact Flash 8GB, 15GB or 32 GB memory card. The compact flash is located behind the fan tray on the router chassis.

Note You must use Cisco-qualified CompactFlash cards. Use of any other cards during normal network operation can affect system performance.

Power Supplies

Cisco ISR 4451-Xs support a variety of power supply configurations. All power supplies are field-replaceable and externally accessible.

If configured with dual power supplies or a PoE adaptor, the power supplies are hot-swappable. There is an option for a second power supply unit.

Configurations include AC, internal PoE, and PoE boost. Table 1-3 summarizes the power options.

Table 1-3 Cisco ISR 4451-X Field Replaceable Unit Power Options

Router Model	AC	Hot Swap[1]	Additional AC Power	Internal PoE	Internal PoE Boost
Cisco ISR 4451 -X	X	X		X	X

1. Must have PoE boost installed.

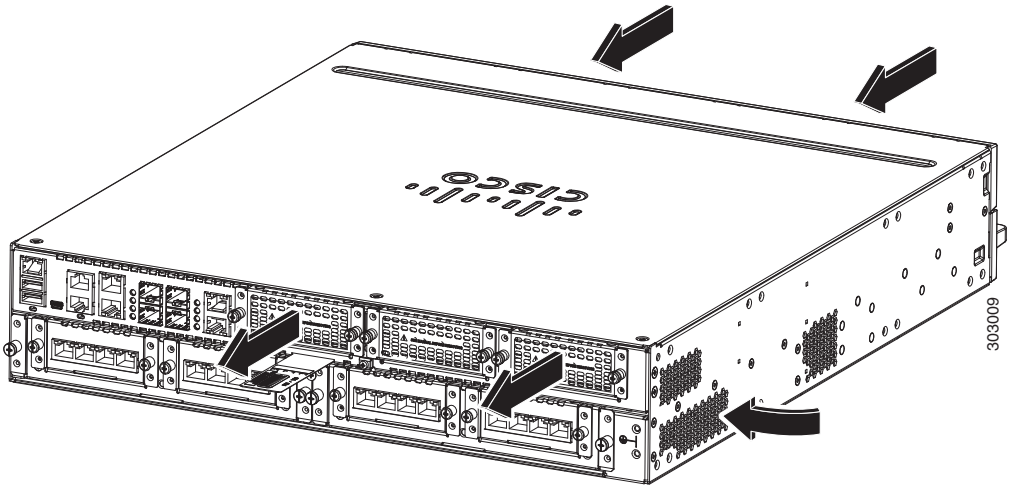
Fans, Ventilation, and Airflow

Chassis Ventilation

An internal fan tray consisting of 4 fans provides chassis cooling. An onboard temperature sensor controls the fan speed. The fans are always on when the router is powered on. Under most conditions, the fans operate at the slowest speed to conserve power and reduce fan noise. The fans operate at the higher speeds when necessary under conditions of higher ambient temperature. To replace a fan tray, see the "Replacing a Fan Tray" section on page 6-33.

- Figure 1-8 shows the Cisco ISR 4451-X airflow.

Figure 1-8 Cisco ISR 4451-X Airflow)



About Slots and Interfaces

This section covers the following topics:

- About Slot, Subslot (Bay), and Port Numbering, page 1-17
- Slot Numbering, page 1-19
- Subslot/Bay Numbering, page 1-19
- Gigabit Ethernet Management, page 1-20
- About Fixed Interfaces, page 1-20

About Slot, Subslot (Bay), and Port Numbering

The Cisco ISR 4451-X supports two types of interface modules: Enhanced Service Modules (SMs) and Network Modules (NIMs).

- In most cases, the router designates its interfaces using a 3-tuple notation that lists the slot, bay, and port. The 3-tuple value is zero based. An example of a 3-tuple is 0/1/2. This refers to slot 0, the second bay in slot 0 (the first bay is 0 so the second bay is 1), and the third port in bay 1. See Table 1-4 for more examples.

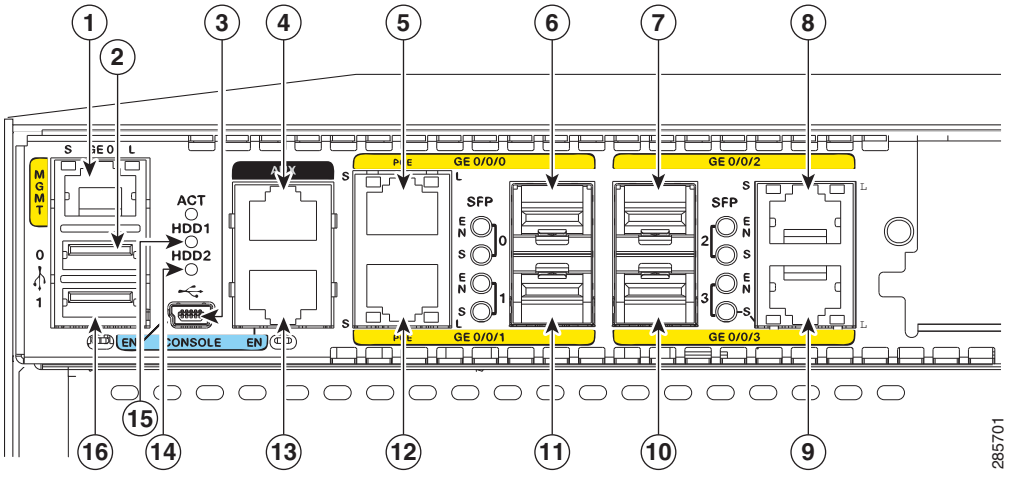
Table 1-4 Slot, Subslot (Bay) and Port Numbering

3-Tuple Example	Slot	Bay	Port
0/1/2	0	2nd	3rd
0/0/1	0	1st	2nd
1/1/1	1	2nd	2nd

- Slots and bays are numbered from the left to the right, and from the top to the bottom.
- NIMs are designated by the number of the first slot that they occupy. A NIM occupies two slots, but its designation is only the left-most slot number (double-wide cards only).
- The auxiliary (AUX) serial port and console (CON) serial port do not have slot, bay, or port numbers.
- The GE management port is named GE 0. It does not have a slot, bay, or port number.
- The two USB ports are named USB0 and USB1. They do not have slot, bay or port numbers.

Figure 1-9 shows the ports and slots on the Cisco ISR 4451-Xs.

Figure 1-9 Ports and Slots on the Cisco ISR 4451-Xs



1	Gigabit Ethernet management port	**2**	USB port 0
3	USB console	**4**	Auxiliary port
5	Gigabit Ethernet port 0	**6**	Small-form-factor pluggable (SFP) 0
7	SFP 2	**8**	Gigabit Ethernet port 2

9	Gigabit Ethernet port 3	**10**	SFP 3
11	SFP 1	**12**	Console port
13	Gigabit Ethernet port 1	**14**	HDD 2 LED
15	HDD 1 LED	**16**	USB port 1

Slot Numbering

Slots are numbered 0, 1 and 2.

- About Slot 0
- About Slot 1 and 2
- Additional Slots

About Slot 0

The following are the main features of Slot 0:

- Slot 0 is the motherboard and not removable. It is reserved for integrated ports and NIMs.
- The front panel GE ports (or native interface ports) always reside in slot 0 and bay 0. There are four ports, and they are called Gigabitethernet 0/0/0, Gigabitethernet 0/0/1, Gigabitethernet 0/0/2, and Gigabitethernet 0/0/3.
- NGVMs do not have an external slot number. Therefore, the nomenclature for NGVMs always has 0 in the first tuple. For example, the 3-tuple for an NGVM might be 0/4/x.

About Slot 1 and 2

Slot 1 and slot 2 are NIM slots. All enhanced SM slots start with 1.

Additional Slots

The Cisco ISR 4451-Xs have the following additional slots:

- P0: Field upgradable power supply slot 0
- P1: Field upgradable/replaceable power supply slot 1.
- INT-POE: Internal PoE card slot.

Subslot/Bay Numbering

- Integrated devices, also known as integrated ports or FPGEs, and integrated NIMs reside in a fixed section of bay 0.
- Main board NIMs bays start at bay 1, since the integrated devices and integrated NIMs take up bay 0.
- The bay numbers for NGVMs start with the next bay number after the last NIM bay number.
- The two modular SATA slots share the same bay as the third NIM slot.

Gigabit Ethernet Management

The Cisco ISR 4451-X provides a Gigabit Ethernet Management port, called GE0. This port is the only 1-tuple port on the system. See the *<chapter on Ethernet Management in SW Configuration Guide>* for additional information about the Gigabit Ethernet Management port.

About Fixed Interfaces

The router supports fixed interfaces on the motherboard and on service modules. The system treats the onboard interfaces as if they lived on a virtual NIM plugged into bay 0. In this case, the front panel GigabitEthernet ports are considered slot 0 bay 0 (0/0/x). The onboard ports on the service module are slot 1 bay 0 (1/0/x).

Specifications

The following tables provide Cisco ISR 4451-X specifications.

- Cisco ISR 4451-X—Table 1-5

Table 1-5 Cisco ISR 4451-X Router Specifications

Description	Specification
Physical	
Dimensions (H x W x D)	3.5 x 17.25 x 18.7 in. (88.9 x 438.2 x 474.9 mm), 2 RU height
Weight with AC PS (w/o modules)	28.5 lbs (12.92 kg)
Weight with dual AC-PoE PS (w/o modules)	30.0 lbs (13.6 kg)
Weight with dual AC + PoE adaptor (w/o modules)	38.0-40.0 lbs (17.23-18.14 kg)
Power	
AC input power	
• Input voltage	100 to 240 VAC, autoranging
• Frequency	47 to 63 Hz
• Input current	5.3 A
• Input current with PoE Power Adaptor	7.4 A
• 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

Table 1-5 Cisco ISR 4451-X Router Specifications (continued)

Description	Specification
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	Once an SFP module is installed the adjacent RJ-45 GE connector is disabled. See xxxx for a list of supported modules.
Environmental	
Operating humidity	5 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 temperature - up to 10,000 ft (3000 m) elevation	32 to 86 °F (0 - 30 °C)
Operating altitude maximum	10,000 ft (3000 m); China: ≥ 2000 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)
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 GB 4943[PRC] IEC60950, 2nd Edition [Mexico] For detailed compliance information, see the *Regulatory Compliance and Safety Information for the Cisco 4451-X Integrated Services Router* document

Table 1-5 Cisco ISR 4451-X 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 the Cisco 4451-X 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 the Cisco 4451-X Integrated Services Router* document.

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

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. See the "Fans, Ventilation, and Airflow" section on page 1-17.

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:

- Safety Recommendations, page 2-5
- General Site Requirements, page 2-7
- Rack Requirements, page 2-9
- Router Environmental Requirements, page 2-10
- Network Cabling Specifications, page 2-11
- Installation Checklist, page 2-16
- Creating a Site Log, page 2-17

To see translated warnings that appear in this publication, see the *Regulatory Compliance and Safety Information for the Cisco 4451-X Integrated Services Routers* document.

Standard Warning Statements

This section describes the warning definition and then lists core safety warnings grouped by topic.

Warning **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.**

Note: SAVE THESE INSTRUCTIONS
Statement 1071

General Safety Warnings

Warning **Read the installation instructions before you connect the system to its power source.** Statement 1004



Warning **Ultimate disposal of this product should be handled according to all national laws and regulations.** Statement 1040



Warning **Installation of the equipment must comply with local and national electrical codes.** Statement 1074



Warning **To comply with the Class A emissions requirements shielded twisted pair T1/E1 cables must be used for SPA-8-Port Channelized T1/E1 SPA (SPA-8XCHT1/E1) on the Cisco ISR 4451-Xs.** EN55022/CISPR22 Statement



Warning **To comply with Class A emissions requirements- shielded management Ethernet, CON, and AUX cables on the Cisco ISR 4451-Xs must be used.**



Warning **Power cable and AC adapter - When installing the product, please use the provided or designated connection cables/power cables/AC adaptors. Using any other cables or adapters could cause a malfunction or a fire. Electrical Appliance and Material Safety Law prohibits the use of 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 **Only trained and qualified personnel should be allowed to install or replace this equipment** Statement 1030



Warning **This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that the protective device is rated not greater than: AC power supplies for the Cisco ISR 4451-X.** Statement 1005



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



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 **The plug-socket combination must be accessible at all times, because it serves as the main disconnecting device.** Statement 1019



Warning **Hazardous voltage or energy may be present on the DC power terminals. Always replace cover when terminals are not in service. Be sure uninsulated conductors are not accessible when cover is in place.** Statement 1075



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



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 voltage or energy is present on the backplane when the system is operating. Use caution when servicing.** Statement 1034



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



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



Warning **Laser radiation is present when the system is open.** Statement 1009



Warning **Do not stare into the laser beam.** Statement 1010



Warning **Class I(CDRH) and Class 1M (IEC) laser products.** Statement 1055



Warning **Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard.** Statement 1056



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 touch or bridge the metal contacts on the battery. Unintentional discharge of the batteries can cause serious burns.** Statement 341



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



Warning **To prevent the system from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature of: 40 degrees C.** Statement 1047



Warning **This equipment must be externally grounded using a customer-supplied ground wire before power is applied. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.** Statement 366



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 **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 **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 **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 **No user-serviceable parts inside. Do not open.** Statement 1073

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

Safety Recommendations

Follow these guidelines to ensure general safety:

- Review the safety warnings listed in *Regulatory Compliance and Safety Information for the Cisco 4451-X Integrated Services Routers* that comes with your Cisco ISR 4451-X, before installing, configuring, or maintaining the router.
- Never attempt to lift an object that might be too heavy for you to lift by yourself.
- 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 **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.
- Remove power cables from all installed power supplies before opening the chassis.

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.

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.

General Precautions

Observe the following general precautions when using and working with your Cisco ISR 4451-X.

- Keep your system components away from radiators and heat sources and do not block cooling vents.
- Do not spill food or liquids on your system components and never operate the product in a wet environment.
- Do not push any objects into the openings of your system components. Doing so can cause fire or electric shock by shorting out interior components.
- Position system cables and power supply cables carefully. Route system cables and the power supply cable and plug so that they cannot be stepped on or tripped over. Be sure that nothing else rests on your system component cables or power cable.
- Do not modify power cables or plugs. Consult a licensed electrician or your power company for site modifications. Always follow your local and national wiring rules.
- If you turn off your system, wait at least 30 seconds before turning it on again to avoid system component damage.

Site Selection Guidelines

The Cisco ISR 4451-Xs require specific environmental operating conditions. Temperature, humidity, altitude, and vibration can affect the performance and reliability of the router. The following sections provide specific information to help you plan for the proper operating environment.

The Cisco ISR 4451-Xs are designed to meet the industry EMC, safety, and environmental standards described in the *Regulatory, Safety, and Compliance Information for Cisco 4451-X Integrated Services Routers* document.

Site Environmental Requirements

Environmental monitoring in the Cisco ISR 4451-X protects the system and components from damage caused by excessive voltage and temperature conditions. To ensure normal operation and avoid unnecessary maintenance, plan and prepare your site configuration *before* installation. After installation, make sure the site maintains the environmental characteristics as shown in Table 2-1.

Table 2-1 Cisco ISR 4451-X Environmental Tolerances

Environmental Characteristic	Minimum	Maximum
Steady State Operating	0 degree C	50 degree C (50 degrees C at 10,000 feet)
Storage	–20 degrees C	+70 degrees C
Humidity operating (noncondensing)	10%	90%
Humidity nonoperating (noncondensing)	5%	95%
Altitude operating: over allowable temperature range (0 to 50 degrees C)	–500 feet	10,000 feet
Altitude, nonoperating: over allowable temperature range	–1000 feet	50,000 feet
Thermal shock non-operating with change over time of 3 minute	–25 degrees C	+70 degrees C
Thermal Shock - Operating at 2.5 degree C per minute	0 degrees C	+50 degrees C

Physical Characteristics

Be familiar with the physical characteristics of the Cisco ISR 4451-X to assist you in placing the system in the proper location.

Table 2-2 shows the weight and dimensions of the Cisco ISR 4451-X.

Table 2-2 Physical Characteristics of **Cisco ISR 4451-X*s***

Characteristics	Cisco ISR 4451-Xs
Height	3.5 in. (8.89 cm.)—2RU rack-mount
Width	17.25 in. (43.815 cm.)—19-inch rack-mount
Depth	18.7 in. (47.498 cm.) (including card handles, cable-management brackets, power supply handles)
Weight	38-40 lbs (17.23-18.14 kg)

The following list describes additional Cisco ISR 4451-X chassis characteristics:

- Chassis height meets EIA-310 rack spacing 2RU (3.5 inches/88.90 mm.), universal rack-mount
- Chassis width meets EIA-310 19-inch (17.25 inches/438.15 mm) wide with rack brackets
- Cable-management brackets at each Cisco ISR 4451-X locations can hold 16 ports of STP/UTP RJ 45 cables
- Cable-management brackets allow a bend radius of 1.5 inches for cables
- Adjustable rack-mount brackets allow for a front to rear rail variance distance of 15.50/394mm to 19.00/482.6mm

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 ISR 4451-Xs can be placed on a desktop or installed in a rack. 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 2-7, 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 2-7 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.)

Table 2-3 lists power requirements for the Cisco ISR 4451-Xs.

Table 2-3 Power Requirements for Cisco ISR 4451-Xs

Router	Power Source	Input Power	Input Voltage Tolerance Limits
Cisco ISR 4451-X	AC	100 — 240 VAC, 3.0 A, 50 — 60 Hz	90 — 264 VAC
Cisco ISR 4451-X with PoE	AC	100 — 240 VAC, 8.0 A, 50 — 60 Hz	90 — 264 VAC

Network Cabling Specifications

The following sections describe the cables needed to install your Cisco ISR 4451-X in the following sections:

- Console and Auxiliary Port Considerations, page 2-12
- Preparing for Network Connections, page 2-14

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 3-14.

For cable and port pinouts, see the *Cisco Modular Access Router Cable Specifications* document located on 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. For detailed information about installing a console terminal, see the "Connecting to a Console Terminal or Modem" section on page 3-14.

For operation with a Microsoft Windows OS version older than Windows 7, 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 3-16.

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 must use an RJ-45-to-DB-25 adapter cable. This cable is orderable separately along with a DB-9-to-DB-25 adapter.

For detailed information about connecting devices to the auxiliary port, see the "Connecting to a Console Terminal or Modem" section on page 3-14.

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:

- Ethernet Connections, page 2-14

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 ISR 4451-Xs 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.

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
- 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.

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 the Cisco 4451-X 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 -xviii.



Installing and Connecting the Router

This document describes how to install and connect the Cisco 4451-X Integrated Services Routers (ISRs) to LAN, WAN, and Voice networks. The following sections provide technical details.

- Installing the Router, page 3-4
- Chassis Grounding, page 3-11
- Connecting Power, page 3-12
- Connecting to a Console Terminal or Modem, page 3-14
- Installing the Cisco Microsoft Windows USB Device Driver, page 3-16
- Uninstalling the Cisco Microsoft Windows USB Driver, page 3-18
- Connecting to the Auxiliary Port, page 3-19
- Connecting WAN, LAN, and Voice Interfaces, page 3-20

Warning To see translations of the warnings that appear in this publication, see the *Regulatory Compliance and Safety Information for the Cisco 4451-X 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 USB console port on the router to access the Cisco Internet Operating System (IOS-XE) command line interface (CLI) on the router and perform configuration tasks. A terminal emulation program is required to establish communication between the router and a PC. See the "Connecting to a Console Terminal or Modem" section on page 3-14 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 ISR 4451-Xs have built in ports and new slots. The new slots accommodate new modules and interface cards; NIMs, NGVMs, and the Cisco E-Series Server Modules. See the "About Slots and Interfaces" section on page 1-17 for slot and port numbering.

Software Licenses

To use all the features on the Cisco ISR 4451-X, you must purchase a software package.

See the "Licensing" section of the *Software Configuration Guide for the Cisco 4451-X Integrated Services Routers* 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.

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 modules and FRUs, you can install them either before or after you install the router. Ideally, you install modules when you have the best access to the back panel of the router. Internal modules and FRUs, such as NIMs or next generation Voice modules (NGVMs), Compact Flash Cards, and fan trays should be installed before rack-mounting.

There are two methods of installing the router:

- Rack-Mounting the Chassis, page 3-5
- Setting the Chassis on a Desktop, page 3-10

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

Warning **If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the unit in the rack.** Statement 1006

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 **To prevent the system from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature of: 40 degrees C.** Statement 1047

Cisco ISR 4451-Xs can be installed in 19-inch (48.26-cm) EIA and 23-inch (58.42-cm) Southwestern Bell Corporation (SBC) racks. The Cisco ISR 4451-Xs 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 23-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

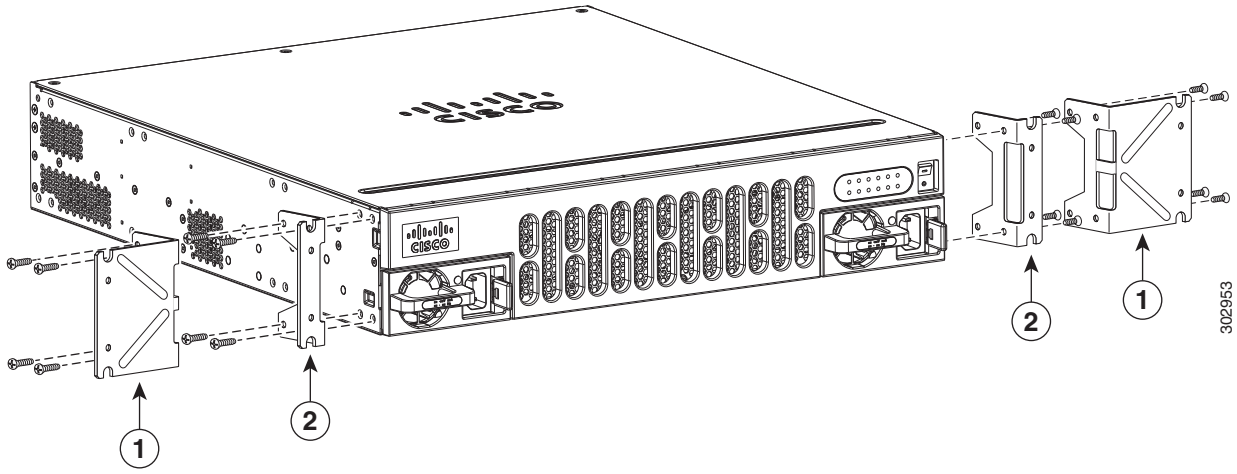
Attach the mounting brackets to the router chassis as shown in Figure 3-1 through Figure 3-4, using the screws provided.

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.

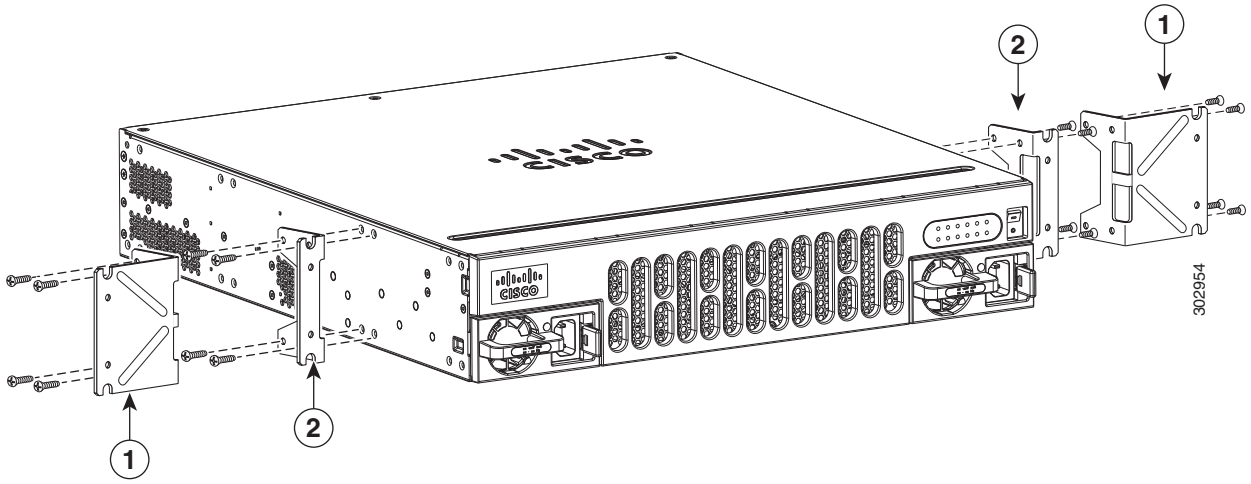
Figure 3-1 Bracket Installation for Front Mounting



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

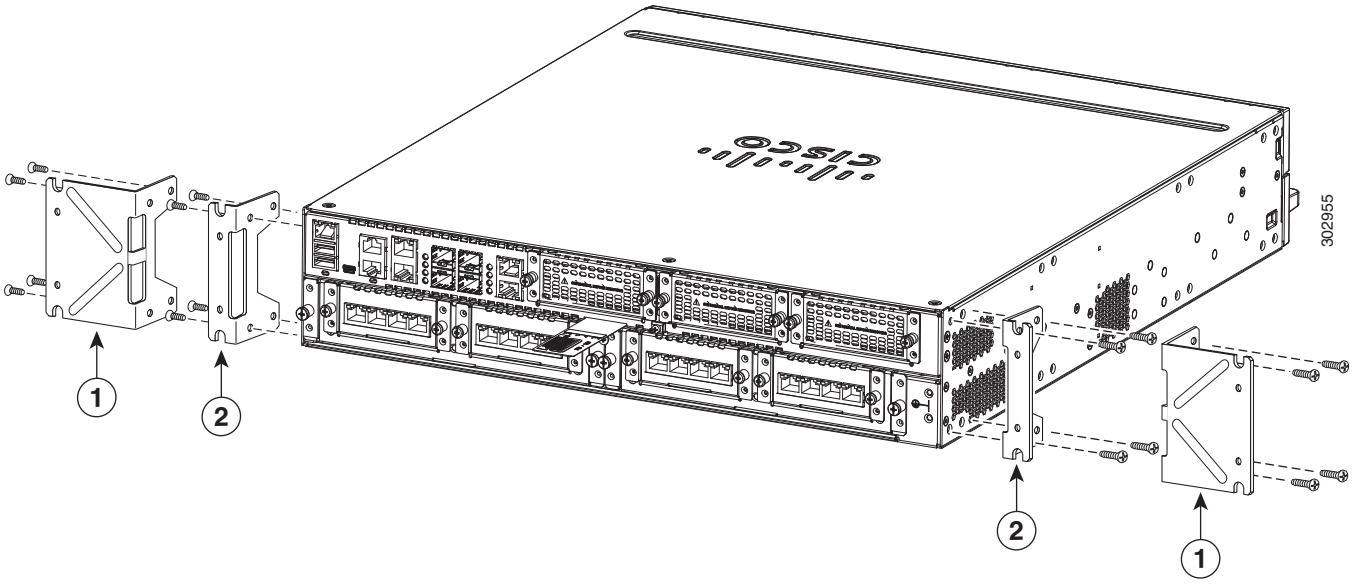
1. Southwestern Bell Corporation (SBC)

Figure 3-2 Bracket Installation for Center-Front Mounting



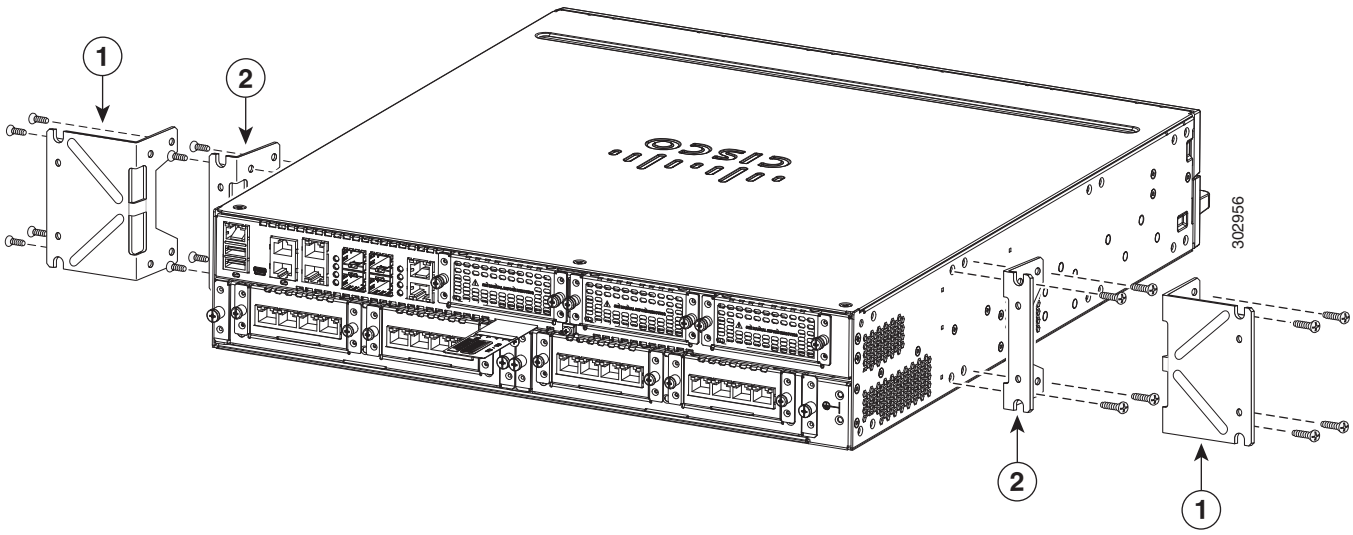
1	23-inch SBC brackets	**2**	19-inch EIA brackets

Figure 3-3 Bracket Installation for Back Mounting



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

Figure 3-4 Bracket Installation for Center-Back Mounting



1	23-inch SBC 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 3-5.)