Product Overview

The heart of the Cisco 12404 Internet Router is the consolidated switch fabric (CSF) card circuity, which provides synchronized interconnections for the line cards and the route processor (RP). The CSF card also contains alarm functions to alert you to conditions in the router through LEDs.

This Cisco 12404 Internet router overview is presented in the following sections.

Introduction

The 12404 series routers described in this guide are:

- The original Cisco 12404 Internet router.
- The enhanced Cisco 12404 Internet router.
  The enhanced router includes a new backplane to allow the BITS feature. The PRP-2 and enhanced CSF card are required for complete BITS functionality. This chassis also contains several cosmetic changes including a new front door.

Note Most illustrations are shown without the new front door for clarity.

Unless otherwise noted, all information in this publication applies to original and enhanced series routers.

Product Description

The Cisco 12404 Internet router scales the Internet and enterprise backbones to speeds of OC-3/STM-1 (155 Mbps), OC-12/STM-4 (622 Mbps), OC-48/STM-16 (2.4 Gbps), and OC-192/STM (10 Gbps).

The Cisco 12404 Internet router has one fabric alarm, RP, and line card cage.

The RP and line card cage has four user-configurable slots that support a combination of three line cards and one RP or two RPs and two line cards. Network interfaces reside on the line cards that provide connection between the router's CSF and the external networks.

The bottom slot labelled FABRIC ALARM in the RP and line card cage is a dedicated slot for the card containing the switch fabric, alarm, and clock scheduler functions.

Features

The Cisco 12404 Internet router has the following features (Table 1-1).

Table 1-1 Cisco 12404 Internet Router Key Features

Feature	Description
Line cards	Four (4) hot-swappable card slots. Up to three OC-192 line cards, two if redundant RPs are installed.
Consolidated switch fabric card	Switch fabric, alarm, and clock schedule functions are located on one board. The CSF card has a switching capacity of 40 Gbps.
Route processor	A redundant RP can go in any line card slot.
AC power entry module (PEM)	A 1-piece unit; customized and hot-swappable.
DC power entry module (PEM) and DC power distribution unit (PDU)	Two pieces that can be removed as one unit or in separate pieces. **Note** When operating the router, both power module bays must have DC PEMs and DC PDUs installed to ensure EMI compliance.
Line cards, RP, and fabric card	Removable from the front of the chassis.
Power systems, fan tray, and filter	Removable from the rear of the chassis.
AC source or DC source power connections	Located at the rear of the chassis on the AC PEM or the DC PDU.
Network Equipment Building Systems	The Cisco 12404 Internet router is designed to comply with the Network Equipment Building System (NEBS) Criteria Level 3 requirements defined in SR-3580 for flammability, structural, and electronics compliance.

Table 1-1 Cisco 12404 Internet Router Key Features (continued)

Feature	Description
Electromagnetic Compatibility and Electrostatic Discharge Compliant	The router is designed to comply with Electromagnetic Compatibility (EMC) Emissions, Immunity, and Electrostatic Discharge (ESD) for both the product and packaging.
Bonding and Grounding	The router complies with bonding and grounding for safety, circuit protection, noise currents, reliability, and operations compliance standards.
Environmental Monitoring	The router monitors operating temperature and humidity, handling temperature, and humidity (exception - heat dissipation).
Shock and Vibration	The router is shock and vibration tested for operating ranges, handling, and earthquake standards to NEBS (Zone 4 per GR-63-Core) in earthquake environment and criteria, office vibration and criteria, transportation vibration and criteria, and packaged equipment shock criteria.
Alarm and Illumination	The Cisco 12404 Internet router has alarm and illumination for operating ranges.
Fiber Cable Management	The router is designed with support for high density fiber Fast Ethernet (FE) ports. Current 1.275-inch pitch line cards fit in the line card cage with the addition of a front panel adapter cover. The line card adapter cover is included with the 1.275-inch line card.

Table 1-1 Cisco 12404 Internet Router Key Features (continued)

Feature	Description
Other	The router • Uses existing RP cards • Has a side-to-side exhaust cooling system air handling module • Supports up to 8 chassis in a single standard 7 ft. (2.15 m) rack
Cosmetics	The enhanced Cisco 12404 has a frosted glass door that can be configured to open either from the left or right side.

Physical and Functional Overview

The Cisco 12404 Internet router has a 5-slot card cage which holds:

- One RP, second RP option
- Up to three line cards, two with redundant RPs
- CSF card

The card cage is integrated into a rigid metal frame.

The router uses line cards that are compatible with other Internet routers. Separate line card documentation is provided with each line card ordered as a FRU.

See Chapter 5 and separate configuration notes for instructions to remove and replace FRUs. For information on ordering FRUs, contact a customer service representative. See the section titled Obtaining Technical Assistance, page xix.

Components

Cisco 12404 Internet router field replaceable units are comprised of the following items.

- 2 AC PEMs
- 2 DC PEMs
- 2 DC PDUs
- 1 air filter
- 1 combined clock scheduler, alarm and switch fabric card
- 1 fan tray assembly
- 1 chassis cable management bracket

Route Processors

The RP is used as the main system processor for the Cisco 12404 Internet router. Slot number 0 (zero) is the recommended slot for the first RP card.

The RP communicates with the line cards either through the CSF or the through the maintenance bus (MBus). The CSF connection is the main data path for routing table distribution as well as for packets that are sent between the line cards and the RP.

The MBus connection allows the RP to download a system bootstrap image, collect or load diagnostic information, and perform general internal system maintenance operations. The RP can be installed in any of the five slots in the card cage in the Cisco 12404 router, but slot number 0 (zero) is the recommended slot for the first RP.

Two types of RPs are available for the Cisco 12404 router:

- Gigabit Route Processor (GRP)
- Performance Route Processor (PRP)

When not explicitly specified, this document uses the term route processor (RP) to indicate either the GRP or the PRP.

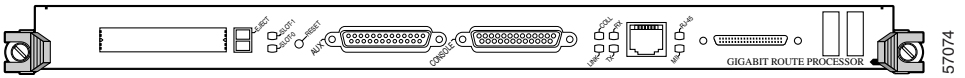
Note If you install a second, redundant RP, it must be of the same type as the primary RP.

For information on the Performance Route Processor, see the "Performance Route Processor" section on page 1-13.

Gigabit Route Processor

The GRP front view is shown in Figure 1-1.

Figure 1-1 Gigabit Route Processor—Front View



GRP Memory

The Cisco IOS software images that run the Cisco 12404 router reside in Flash memory, which is located on the GRP in the form of a single inline memory module (SIMM), and on the PCMCIA cards, called Flash memory cards, that insert in the two PCMCIA slots on the front of the GRP. Storing the Cisco IOS images in Flash memory enables you to download and boot from upgraded Cisco IOS images remotely, or from software images resident in GRP Flash memory.

Note The Cisco 12000 series routers no longer ship with GRP or GRP-B processors as these items are now End of Sale (EOS). Refer to the the Cisco 12000 End of Life (EOL) web page for additional information.

GRP memory components are presented in the following sections.

- EDO DRAM—Extended Data Output, Dynamic Random Access Memory
- DIMM—Dual Inline Memory Module
- SRAM—Static Random Access Memory
- NVRAM—Non-Volatile Random Access Memory
- Flash Memory:
  - SIMM—Single In-line Memory Module
  - ROM—Read Only Memory
  - PCMCIA—Personal Computer Memory Card International Association cards or Flash memory cards.

The Cisco 12404 router supports system software downloads for most Cisco IOS software upgrades, which enables you to remotely download, store, and boot from a new Cisco IOS image.

EDO DRAM

The EDO DRAM on the GRP stores routing tables, protocols, and network accounting applications. It also runs the Cisco IOS software. The default GRP DRAM configuration is 64 megabytes (MB) of EDO DRAM, which you can increase up to 256 MB maximum, through DRAM upgrades. Cisco IOS software runs from within GRP DRAM.

DIMM

The Dual In-line Memory Module (DIMM) with 168 pins, is a small circuit board that holds memory chips and doubles the number of circuit paths to and from a module by using independent pins on each side of the edge connector. You can install DIMM memory modules one at a time.

SRAM

The principle function of SRAM is to act as a staging area for routing table update information to and from the line cards. SRAM also provides secondary CPU cache memory. The standard GRP configuration is 512 KB. SRAM cannot be upgraded or configured.

NVRAM

Non-Volatile Random Access Memory (NVRAM) cannot be upgraded or configured. The system configuration, software configuration register settings, and environmental monitoring logs are contained in the 512-KB NVRAM, which is backed up with built-in lithium batteries that retain the contents for a minimum of five years.

Caution Before you replace the RP in the system, back up the running configuration to a Trivial File Transfer Protocol (TFTP) file server or an installed Flash memory card so you can retrieve it later.

Flash Memory or SIMM

A single inline memory module (SIMM) is a Flash memory card that allows you to remotely load and store multiple Cisco IOS software and microcode images. You can download a new image over the network or from a local server and then add the new image to Flash memory or replace the existing files. You can then boot the routers either manually or automatically from any of the stored images. Flash memory also functions as a trivial file transfer protocol (TFTP) server to allow other servers to boot remotely from stored images or to copy them into their own Flash memory.

Read Only Memory

Read-only memory (ROM), computer memory on which data has been prerecorded. Once data has been written onto a ROM chip, it cannot be removed and can only be read.

Unlike main memory (RAM), ROM retains its contents even when the computer is turned off. ROM is referred to as being nonvolatile, whereas RAM is volatile.

The GRP provides two dedicated PCMCIA card slots. Either slot can support a Flash memory card or an input/output (I/O) device, as long as the device requires only +5 VDC. The GRP supports Type 1 and Type 2 devices. Each PCMCIA slot has an ejector button for ejecting the card from its slot.

GRP LEDs

The light emitting diodes (LEDs) located on the GRP show the status of the GRP, system error messages, or when reprogrammed, the GRP LEDs show the user-defined status/error messages.

The two types of system status LEDs used on the GRP are:

- 2 PCMCIA LEDs go on when the slot is accessed.
- 4 RJ-45 Ethernet port activity LEDs (labeled LINK, COLL, TX and RX)—these LEDs are used in conjunction with the RJ-45 Ethernet connector. When on, the 4 RJ-45 LEDs indicate:
  - Link activity (LINK)
  - Collision detection (COLL)
  - Data transmission (TX)
  - Data reception (RX)

Note These LEDs are disabled when the media-independent interface (MII) Ethernet port is in use.

- 2 Ethernet port selection LEDs (labeled MII and RJ-45)—these LEDs are used in conjunction with both the RJ-45 and MII Ethernet ports. When on, they identify your selection of either the RJ-45 Ethernet port or the MII Ethernet port.

Alphanumeric displays are organized as two rows of 4 characters each. The content of the display is controlled by the MBus module software. The alphanumeric displays provide information about the system status during the boot process, where the alphanumeric LED displays are controlled directly by the MBus.

After the boot process, the LEDs are controlled by Cisco IOS software through the MBus, and messages are designated by Cisco IOS software.

Asynchronous Serial Ports

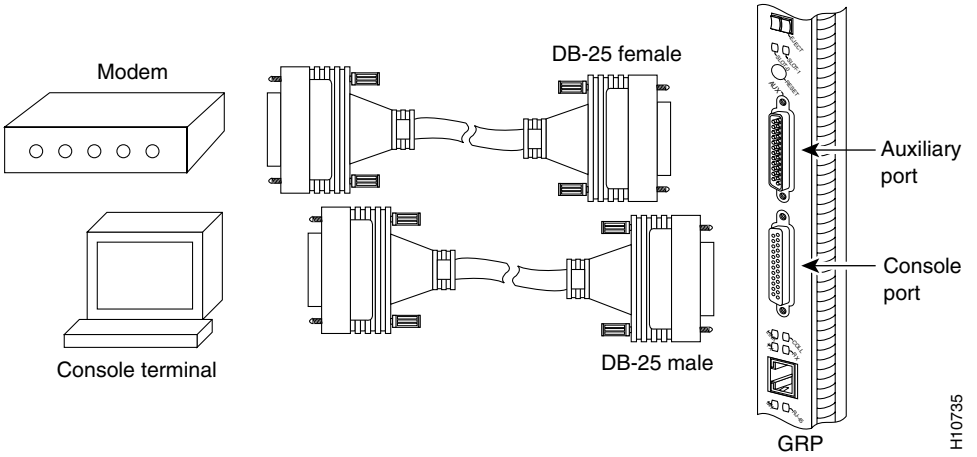
The two asynchronous serial ports on the GRP allow you to connect external devices to monitor and manage the system. The ports are a console port and an auxiliary port.

The console port is an Electronics Industries Association/Telecommunications Industry Association (EIA/TIA)-232 receptacle (RS-232 female) that provides a data circuit-terminating equipment (DCE) interface for connecting a console terminal.

Note EIA/TIA-232 was known as recommended standard RS-232 before its acceptance as a standard by the EIA/TIA.

The auxiliary port is a EIA/TIA-232 plug (male) that provides a data terminal equipment (DTE) interface. The auxiliary port supports flow control and can be used to connect a modem, a channel service unit (CSU), or other optional equipment for Telnet management (Figure 1-2).

Figure 1-2 GRP Console and Auxiliary Port Connections

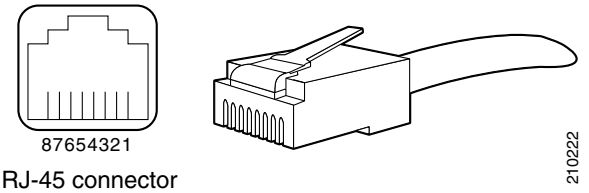


Ethernet Port

The GRP has one Ethernet port which uses one of the following two port connection types:

- RJ-45 port—Is an 8-pin MDI RJ-45 port for either IEEE 802.3 10BASE-T (10 Mbps) or IEEE 802.3u 100BASE-TX (100 Mbps) Ethernet connections (Figure 1-3).

Figure 1-3 GRP RJ-45 Connector



- MII receptacle—Is a 40-pin media independent interface (MII) port that provides additional flexibility in Ethernet connections (Figure 1-4). The pinout of this standard 40-pin port is defined by the IEEE 802.3u standard in Appendix A of this guide (Figure 1-5).

Figure 1-4 GRP MII Ethernet Receptacle

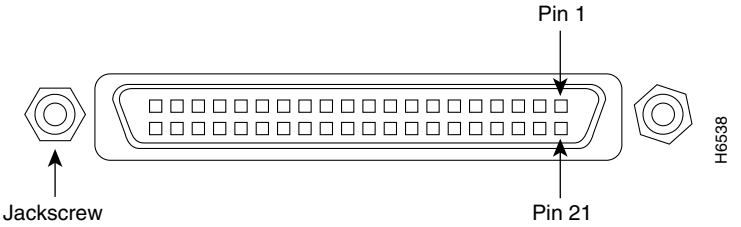
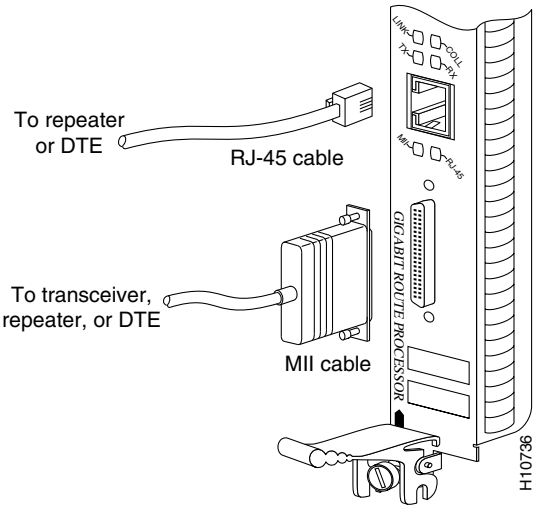


Figure 1-5 RJ-45 Port and MII Receptacles on the GRP



Performance Route Processor

Two types of RPs are available for the Cisco 12404 router:

- Gigabit Route Processor (part number GRP or GRP-B)
- Performance Route Processor (part number PRP-1 or PRP-2)

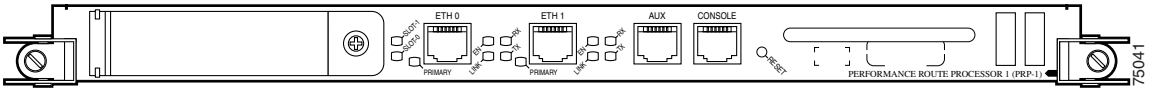
When not explicitly specified, this document uses the term route processor (RP) to indicate either the GRP or the PRP.

Note If you install a second, redundant RP, it must be of the same type as the primary RP.

For information on the Gigabit Route Processor, see the "Gigabit Route Processor" section on page 1-7.

The PRP front view is shown in Figure 1-6.

Figure 1-6 Performance Route Processor—Front View



PRP Memory

The Cisco IOS software images that run the Cisco 12404 router reside in Flash memory, which is located on the PRP in the form of a single in-line memory module (SIMM), and on the PCMCIA cards, called Flash memory cards that insert in the two PCMCIA slots on the front of the PRP. Storing the Cisco IOS images in Flash memory enables you to download and boot from upgraded Cisco IOS images remotely or from software images resident in PRP Flash memory.

Note The Cisco 12404 router is shipped with 20 MB of Flash memory as the default configuration.

PRP memory components are presented in the following sections.

- SDRAM—Synchronous Dynamic Random Access Memory
- DIMM—Dual In-line Memory Module
- SRAM—Static Random Access Memory
- NVRAM—Non-Volatile Random Access Memory
- Flash Memory:
  - SIMM—Single Inline Memory Module
  - ROM—Read Only Memory
  - PCMCIA—Personal Computer Memory Card International Association cards or Flash memory cards.

The router supports system software downloads for most Cisco IOS software upgrades, which enables you to remotely download, store, and boot from a new Cisco IOS image.

SDRAM

The SDRAM on the PRP stores routing tables, protocols, and network accounting applications. It also runs the Cisco IOS software. The default PRP SDRAM configuration is 512 megabytes (MB) of SDRAM, which you can increase up to 1 GB maximum, through DIMM upgrades. You cannot mix memory sizes. If two DIMMs are installed, they must be the same memory size.

Caution We recommends that you use only Cisco approved memory. To prevent memory problems, SDRAM DIMMs must be +3.3VDC, PC133-compliant devices. Do not attempt to install other devices in the DIMM sockets.

DIMM

The Dual In-line Memory Module (DIMM) with 168 pins is a small circuit board that holds memory chips and doubles the number of circuit paths to and from a module by using independent pins on each side of the edge connector. You can install DIMM memory modules one at a time.

SRAM

The principle function of SRAM is to act as a staging area for routing table update information to and from the line cards. SRAM also provides secondary CPU cache memory. The standard PRP configuration is 2 MB. SRAM cannot be upgraded or configured.

NVRAM

Non-Volatile Random Access Memory (NVRAM) cannot be upgraded or configured. The system configuration, software configuration register settings, and environmental monitoring logs are contained in the 2 MB NVRAM, which is backed up with built-in lithium batteries that retain the contents for a minimum of five years.

Caution Before you replace the RP in the system, back up the running configuration to a Trivial File Transfer Protocol (TFTP) file server or an installed Flash memory card so you can retrieve it later.

Flash Memory or SIMM

A single online memory module (SIMM) is a Flash memory card that allows you to remotely load and store multiple Cisco IOS software and microcode images. You can download a new image over the network or from a local server and then add the new image to Flash memory or replace the existing files. You can then boot the routers either manually or automatically from any of the stored images. Flash memory also functions as a trivial file transfer protocol (TFTP) server to allow other servers to boot remotely from stored images or to copy them into their own Flash memory.

Read-Only Memory

Read-only memory (ROM), computer memory on which data has been prerecorded. Once data has been written onto a ROM chip, it cannot be removed and can only be read.

Unlike main memory (RAM), ROM retains its contents even when the computer is turned off. ROM is referred to as being nonvolatile, whereas RAM is volatile.

The PRP provides two dedicated PCMCIA card slots. Either slot can support a Flash memory card or an input/output (I/O) device, as long as the device requires only +5 VDC. The PRP supports Type 1 and Type 2 devices. Each PCMCIA slot has an ejector button for ejecting the card from its slot.

PRP LEDs

The light emitting diodes (LEDs) located on the PRP show the status of the PRP, system error messages, or when reprogrammed, the PRP LEDs show the user-defined status/error messages. The two types of system status LEDs used on the PRP are:

- 2 PCMCIA LEDs go on when the slot is accessed.
- 4 RJ-45 Ethernet port activity LEDs (labeled LINK, EN, TX and RX) these LEDs are used in conjunction with the RJ-45 Ethernet connector. When on, the 4 RJ-45 LEDs indicate:
  - Link activity (LINK)
  - Port enabled (EN)
  - Data transmission (TX)
  - Data reception (RX)

- 2 Ethernet port selection LEDs (labeled PRIMARY), when lit these LEDs identify which of the two Ethernet connections is selected. Because both ports are supported on the PRP, the LED on port ETH0 is always on. The ETH1 LED goes on when it is selected.

Alphanumeric displays are organized as two rows of four characters each. The content of the display is controlled by the MBus module software. The alphanumeric displays provide information about the system status during the boot process where the alphanumeric LED displays are controlled directly by the MBus.

After the boot process, the LEDs are controlled by the Cisco IOS software through the MBus and display messages are designated by the Cisco IOS software.

The display LEDs indicate the following:

- Status of the PRP
- System error messages
- User-defined status and error messages

Note A complete, descriptive list of all system and error messages is located in the *Cisco IOS System Error Messages* publications.

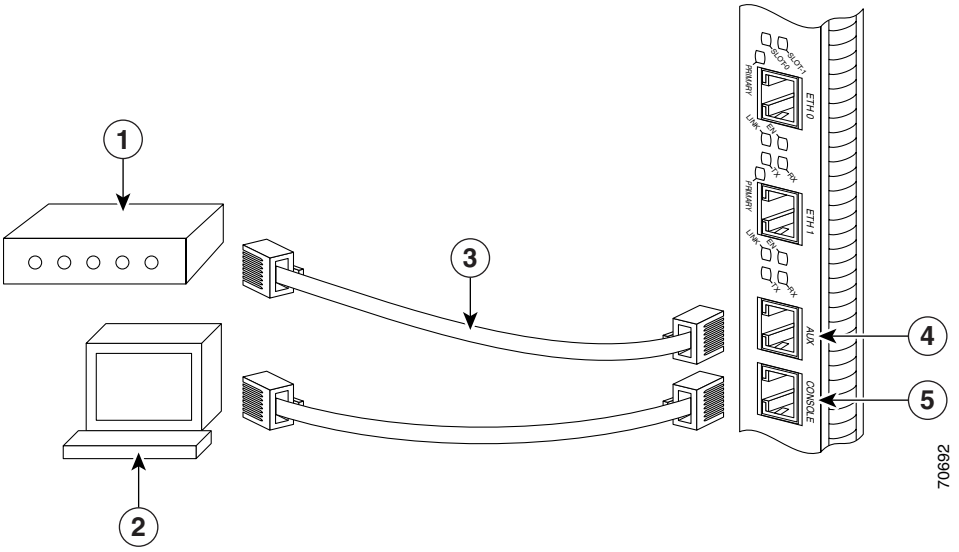
Asynchronous Serial Ports

The PRP has two asynchronous serial ports: the console and auxiliary ports. These allow you to connect external serial devices to monitor and manage the system. Both ports use RJ-45 receptacles.

The console port provides a data circuit-terminating equipment (DCE) interface for connecting a console terminal. The auxiliary port provides a data terminal equipment (DTE) interface and supports flow control. It is often used to connect a modem, a channel service unit (CSU), or other optional equipment for Telnet management.

Figure 1-7 shows the PRP console and auxiliary port connections.

Figure 1-7 PRP Console and Auxiliary Port Connections



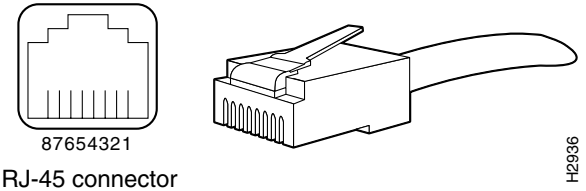
1	Modem	**4**	Auxiliary port
2	Console terminal	**5**	Console port
3	RJ-45 Ethernet cables		

Ethernet Port

The PRP is configured with 2 Ethernet ports, both using an 8-pin RJ-45 receptacle for either IEEE 802.3 10BASE-T (10 Mbps) or IEEE 802.3u 100BASE-TX (100 Mbps) connections (Figure 1-8).

Note The transmission speed of the Ethernet ports is autosensing by default and is user configurable.

Figure 1-8 PRP RJ-45 Connector

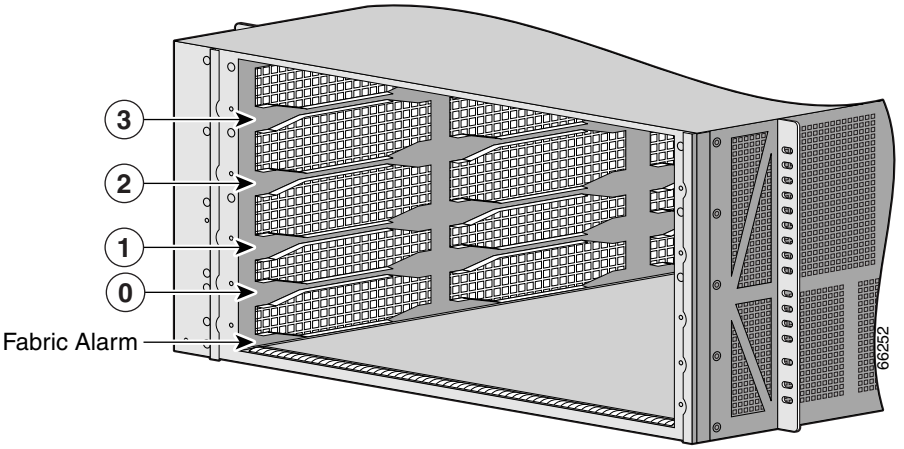


RJ-45 connector

Line Cards

The Cisco 12404 Internet router is shipped with up to three installed line cards and one RP that provide a variety of network media types. Line card slots and RPs shipped from the factory are based on your order. Line cards can be installed in any slot 0 (zero) through 3 in the card cage. Slot zero (0) the second slot from the bottom of the card cage, is the default RP slot (Figure 1-9).

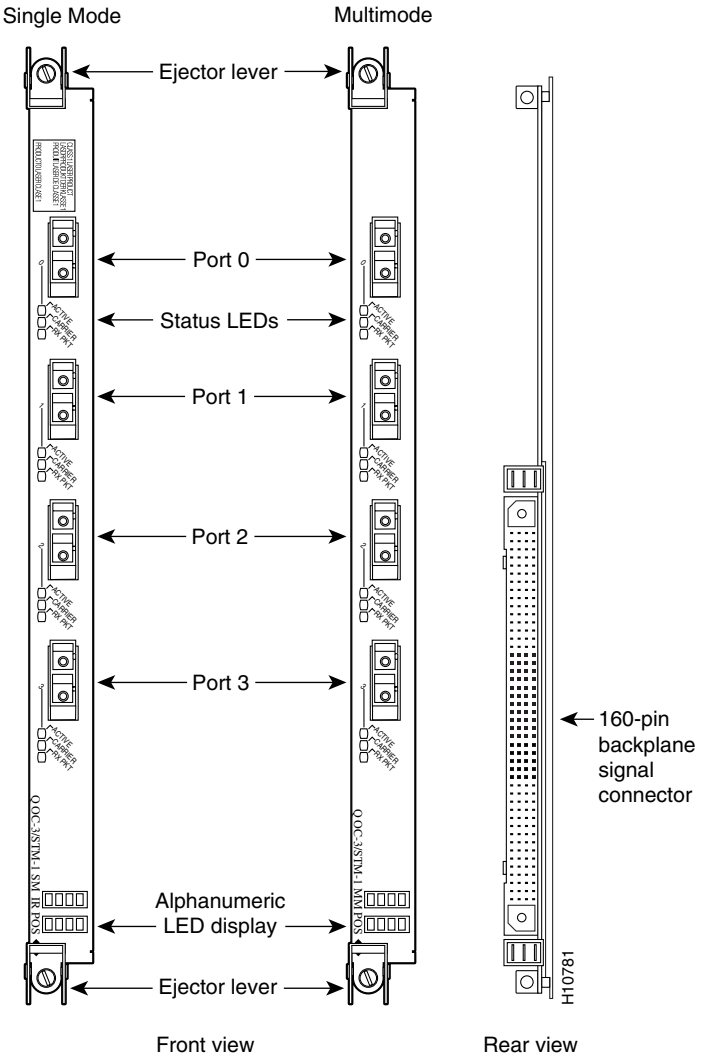
Figure 1-9 RP Slot Location



The line cards interface to each other, and to the RP through the CSF card. Line cards installed in the Cisco 12404 router are hot swappable) and can be replaced while the router is On.

For detailed instructions on removing, replacing, and configuring the line cards supported by the Cisco 12404 Internet router, see the configuration note shipped with each line card when ordered as an FRU (Figure 1-10).

Figure 1-10 Sample Line Cards



Consolidated Switch Fabric Card

The Cisco 12404 router CSF card contains the following functionality:

- Alarm functionality
- Clock and scheduler functionality
- Fabric functionality

Alarm Functionality

The Cisco 12404 router CSF card alarm functionality provides visual alarm notification of a fault condition. The alarm card function indicates the following condition.

- Alarm status
- CSF MBus
- Alarm MBus status
- Fan fault monitoring
- AC or DC power source status
- DC PEM status
  - The 5V MBus power supply has been integrated onto the CSF permitting the use of generic PEMs in the chassis. The Cisco 12404 Internet router can monitor for the PEM for these conditions:
- The operational status
- Output voltage
- Output current.
- Alarm Output Function
  - The alarm output function is controlled by the software on the RP. When a signal is received from the RP the alarm MBus module on the CSF card will activate specific LEDs to signal a condition that is either critical, major, or minor.

- LEDs
  - LEDs alert you to a condition in the router. The determination of a critical, major, or minor alarm condition is designed into Cisco IOS software running on your RP. Type the **show** commands **sh gsr table** and **sh env all** to view the table of limits and current readings for the LEDs.
- CSF MBus Status
  - Drivers are provided for MBus OK and FAIL indication.
- The 5V MBus power supply
  - Consists of a 100 W DC-DC converter.
- Alarm Status
  - The Alarm output function consists of a group of LEDs and their associated drivers connected to an output port on the alarm MBus module. As directed by the software on the RP, the alarm MBus module on the CSF card activates specific LEDs. The software which drives these LEDs divides them into three levels, Critical, Major, and Minor. The classification of a critical, major, or minor alarm is determined by Cisco IOS software running on the RP. Each of the three LEDs is a dual LED (for failure redundancy).
  - The OK/FAIL pair of LEDs indicate the status of the alarm MBus:

    Green indicates that the alarm MBus module is operating properly.

    Amber FAIL indicates that the alarm MBus has detected an error in itself or with the MBus module.

Power Source Monitoring

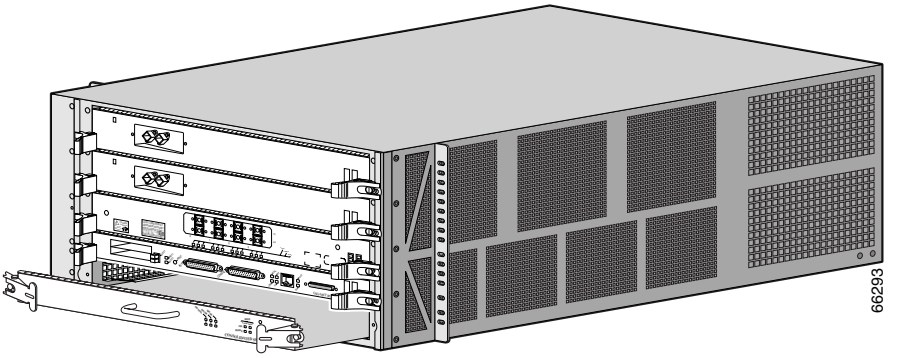
The alarm MBus monitors the power supply and signals when there is a condition outside the normal range of operation.

- Power source voltage is not being provided to a component
- A fault exist in the power source or PEM
- A voltage monitor signal is outside the allowable range
- The current monitor signal is outside the allowable range

Fabric Functionality

The consolidated switch fabric (CSF) circuity provides synchronized speed interconnections for the line cards and the RP (Figure 1-11). The CSF circuitry is contained on 1 card and consists of a clock scheduler and switch fabric functionality. The CSF card is housed in the bottom slot labeled Fabric Alarm in the router chassis. The switching capacity is 40 Gbps full duplex.

Figure 1-11 Consolidated Switch Fabric Card Slot



Clock and Scheduler Functionality

The fabric card generates and distributes system-wide clock and cell time synchronization signaling. System clock generation is delivered to the system through the backplane and local clock functions are derived from the system clock.

- System Clock—The system clock synchronizes data transfers between line cards or between the RP and a line card through the CSF. The system clock signal is sent to all line cards and the RP.
- Scheduler—The scheduler handles requests from the line cards for access to the CSF. When the scheduler receives a request from a line card for CSF access, the scheduler determines when to allow the line card access to the CSF.
- CSF—Switch fabric circuitry carries the user traffic between line cards or between the RP and the line cards.

Power Entry Modules

The Cisco 12404 router chassis supports two 1100 W hot swappable PEMs. Each unit is capable of delivering up to 1100 W at –54.5 VDC. The Cisco 12404 Internet router PEMs are hot swappable and the router must be populated with 2 PEMs to meet EMI standards.

Caution Do not mix PEM types in the Cisco 12404 Internet router. In multiple PEM system configurations, all PEMs must be of the same type; either all AC PEM, or all DC PDUs and PEMs.

A hardwired DC power source, power cable is required from the site DC power source to the DC PDU on the chassis. The DC power cable leads are 6 American Wiring Gauge (AWG) high strand count wire.

For detailed handling and replacement instructions for Cisco 12404 router PEMs, see Appendix A or the appropriate configuration note that accompanies each AC PEM or DC PEM and PDU shipped from the factory as an FRU.

AC Power Entry Module

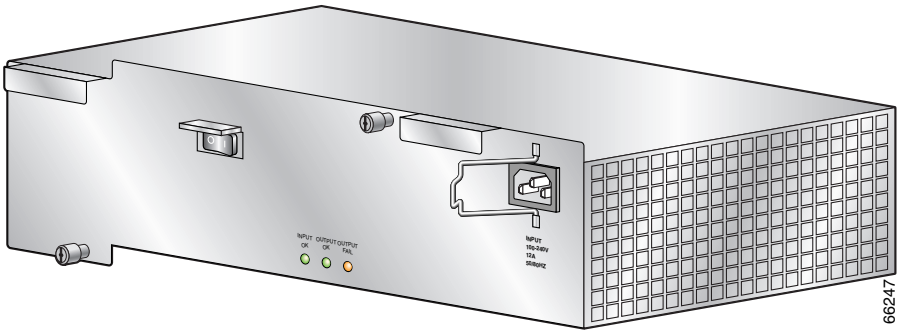
The AC PEM is a modular unit which measures:

6.60 inches (16.76 cm) deep by 14.30 inches (36.32 cm) wide by 3.50 inches (8.89 cm) high

Weight: 11.0 lbs (5.0 kg)

The Cisco 12404 router is configured to the customer specifications from the factory (Figure 1-12). If AC PEM is requested, two AC PEM are shipped. Each AC PEM should be connected to a separate AC power source.

Figure 1-12 AC Power Entry Module



An AC PEM is equipped as follows:

- A power switch to turn the PEM On and Off
- A power factor corrector (PFC)—Allows the PEM to accept AC power source voltage from an AC power source nominally operating between 100 to 120 VAC, 15-Amp service in North America; and a range of 185 to 264 VAC, 10-Amp service, in an international environment
- Requires a dedicated 15A service North America (10A International)
- Handles—Provided for ease in removing and replacing the PEM
- Captive screws—Secure the PEM in the bay
- A 14 ft. (4.3 m) AC power cord—Connects the AC PEM to the AC power source

Note We recommend you install an uninterruptable power source (UPS) as a safeguard against power loss.

Power Distribution

The backplane distributes power through the Cisco 12404 router and to all cards in the card cage. The PEM converts AC power source into –48 VDC. When directed by the RP or by MBus software, the MBus module turns on the DC-DC converter; the –48 VDC is converted into +2.5 VDC, +3.3 VDC and +5 VDC for all internal voltages required by the cards.

Power for the fan tray assembly is supplied directly from the backplane. An internal fan tray assembly controller card converts –48 VDC into DC voltage that powers the fans.

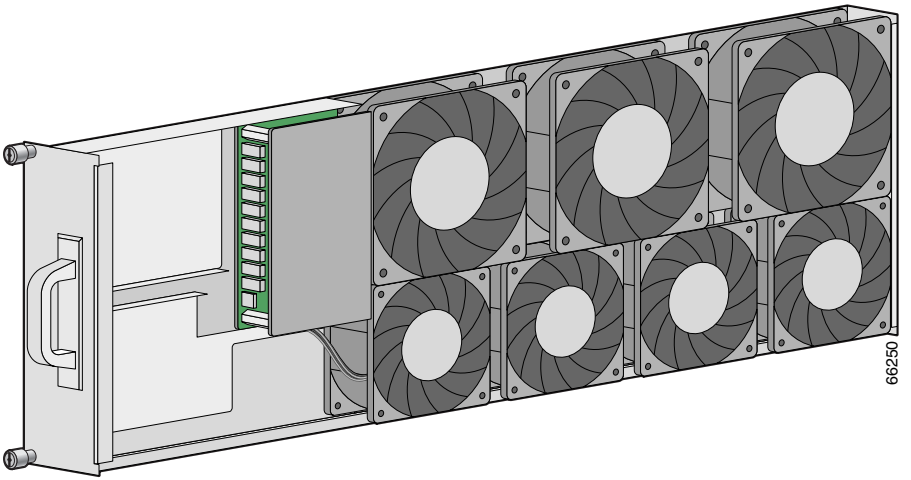
Fan Tray

The Cisco 12404 router is equipped with 1 fan tray located at the side of the chassis. The fan tray assembly maintains acceptable operating temperatures for the internal components by drawing cooling air across the card cage.

The fan assembly is a sheet metal enclosure containing 7 fans and 2 fan controller cards (Figure 1-13).

Warning **Exhaust from other equipment vented directly into the Cisco 12404 router air inlet can cause an over-heat condition. Install the router so that it is protected from a direct flow of hot air from other equipment.**

Figure 1-13 Fan Tray Assembly



The fan tray assembly draws room air in through the air filter, across the card cage and out through exhaust vents located on the side of the chassis. See Figure 1-14.

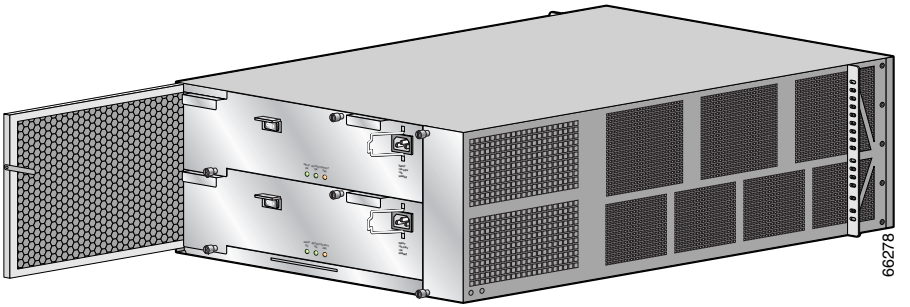
Note Warm air exits at the side of the chassis. Allow sufficient air flow by maintaining 6 inches (15.24 CM) of clearance at both the inlet and exhaust openings on the chassis.

A fan tray assembly controller card monitors the operation of the 7 fans.

Air Filter

The Cisco 12404 router chassis is equipped with a serviceable air filter. Facing the rear of the chassis, the air filter is located on the left side (Figure 1-14).

Figure 1-14 Cisco 12404 Internet Router Air Filter Location



Caution When operating the Cisco 12404 Internet router, we recommend that you install a clean air filter.

Inspect and clean the air filter one time per month (more often in dusty environments). A copy of the air filter replacement instructions is shipped with the air filters when ordered as a FRU. For information on ordering FRUs, contact a customer service representative. See the section titled, "Obtaining Technical Assistance" section on page -xix.

Cable-Management System

The Cisco 12404 Internet router is set up with two types of cable-management systems:

- Line card cable-management bracket (Figure 1-15)—Attached to each line card and routes the line card cables to the chassis cable management bracket. These brackets keep the cables free of sharp bends and out of the way.
- Chassis cable-management bracket (Figure 1-16)—Attached to the chassis and routes the line card cables away from the chassis.

Cable-management systems:

- Organize the interface cables on the line cards, RP, and clock and scheduler cards as they enter and exit the system.
- Consists of two parts, a card cable-management bracket and a chassis cable-management bracket.

Caution Excessive bending in an interface cable can cause performance degradation.

Figure 1-15 RP and Line Card Cable-Management Bracket

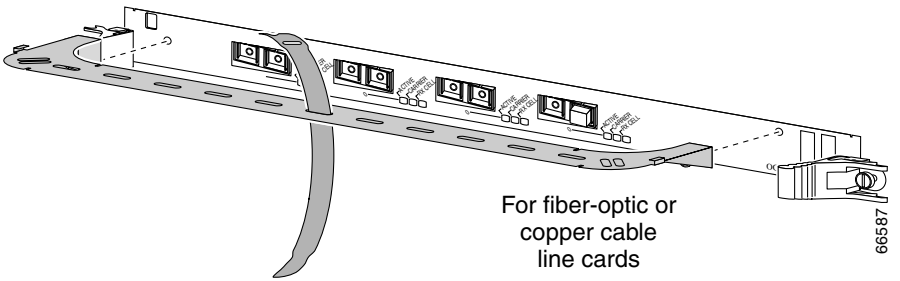
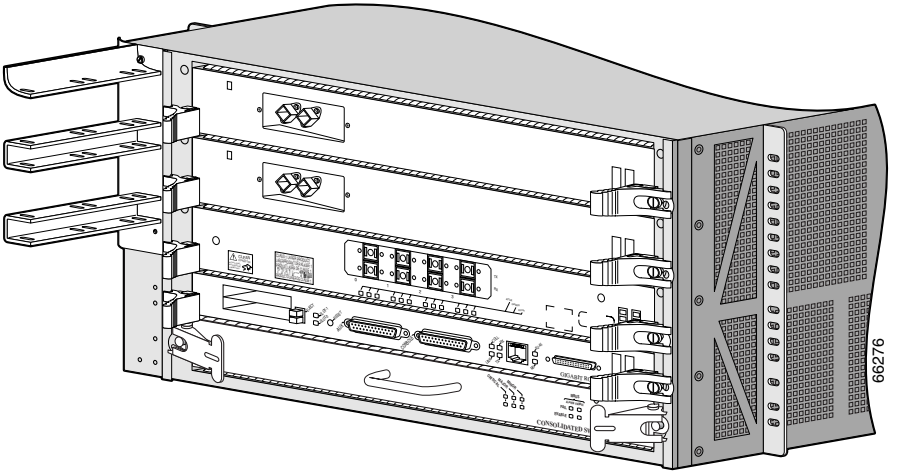


Figure 1-16 Chassis Cable Management Bracket



Maintenance Bus

The Cisco 12404 Internet router maintenance bus and MBus modules manage all of the maintenance functions of the system.

The MBus consists of two separate busses (providing MBus redundancy). Each MBus is linked to all of the following.

- Line cards
- Route Processor
- CSF card

The MBus module located on each component, communicates over the MBus and is powered by +5 VDC directly from the fabric card. The MBus performs the functions of power-on/off control for each component, component (device) discovery, code download, diagnostics, and environmental monitoring and alarms.

Power-On/Off Control

Each MBus module directly controls the DC–to–DC converters on the component it is mounted on based on commands the component receives from its on-board EPROM and from the RP. Each MBus module is tied directly to +5 VDC from the consolidated fabric card.

When power is applied to the Cisco 12404 router, all MBus modules immediately power on. The MBus modules on the RP and CSF card immediately turn on the DC–to–DC converter, powering up the respective card. The line card MBus module waits to power on the line card until it receives a command from the RP.

Component Discovery

The RP can determine the system configuration using the MBus. A message is sent from the RP over the MBus requesting all installed devices to identify themselves. The response back provides component type, line card slot number, and CSF card slot number.

Code Download

A portion of the line card operating software can be downloaded from the RP to the line card over the MBus. Because the MBus is relatively slow compared to the CSF, only enough code is downloaded to the line card for it to access the CSF and complete the download process.

Diagnostics

The diagnostic software image is downloaded from the RP to the line card during the test sequence.

Environmental Monitoring and Alarms

The MBus module on each component monitors that component's environment as follows.

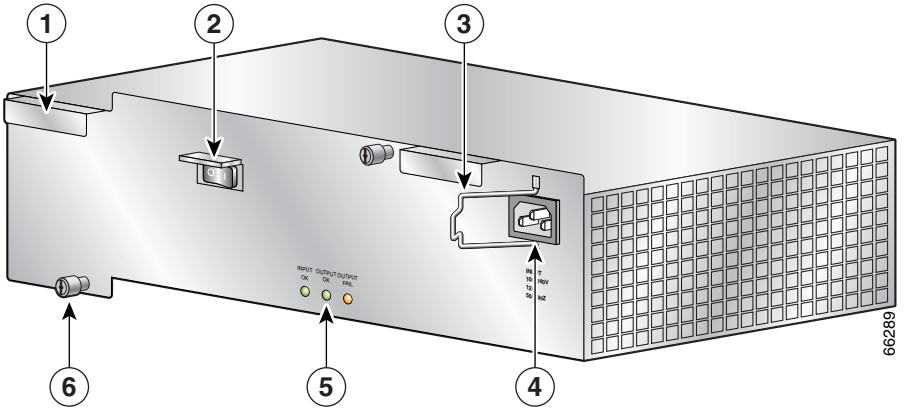
- Line cards and the RP are monitored for temperature by two temperature sensors mounted on each card. The MBus module makes voltage monitoring through software; for example the +2.5 VDC, +3.3 VDC, and +5 VDC DC–to–DC converters.
- The CSF card is monitored for temperature by two temperature sensors mounted on the card. The MBus module performs voltage monitoring through software (for example, the +2.5 VDC and +3.3 VDC).
- Voltage monitoring the for +5 VDC, for example; is made by the alarm MBus module on the CSF card.
- Environmental monitoring includes voltage and current monitoring, temperature monitoring, and sensing for fan power and RPM.

Power Distribution Unit

A chassis can be reconfigured from an AC power source to a DC power source, and vice versa. A Cisco 12404 Internet router can be either AC powered or DC powered (Figure 1-17 and Figure 1-18).

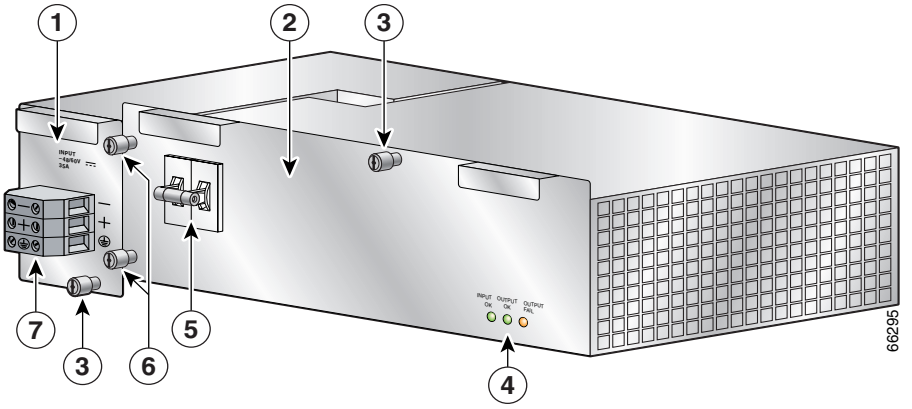
The router does not accept two different types of PEMs at the same time. Conversion can be performed in the field. The conversion procedure requires the system be powered down and involves replacement of the appropriate PEMs. The AC– to DC– and vice versa, power conversion process is explained in Chapter 5 of this document.

Figure 1-17 AC PEM



1	AC PEM handle	**4**	Power cord receptacle
2	On/Off switch	**5**	LEDs
3	Bail Latch	**6**	Captive screws

Figure 1-18 DC PEM and PDU Assembly



1	DC PDU	**5**	On/Off switch
2	DC PEM	**6**	PDU captive screws
3	PEM captive screws	**7**	Terminal Block
4	LEDs		