Overview

This chapter provides physical and functional overviews of Cisco 7100 series VPN routers and contains the following sections that describe router hardware, major components, and functions of hardware-related features:

Product Description

Cisco 7100 series VPN routers support Virtual Private Networks (VPNs) and provide an integrated solution for security, quality of service (QoS), and service-level validation with emphasis on network technologies such as encryption and tunneling using IP Security (IPSec), Layer 2 Tunneling Protocol (L2TP), Generic Routing Encapsulation (GRE), and Layer 2 Forwarding (L2F) tunneling to ensure private transactions over public data networks. Cisco 7100 series VPN routers are designed for the enterprise WAN edge market and customer premises equipment (CPE) for the service provider as shown in Figure 1-1.

Note   For more information on VPN software features, refer to the *Cisco 7100 Series VPN Configuration Guide* available online and on the Documentation CD.

Figure 1-1   Cisco 7100 Series Routers in a Virtual Private Network
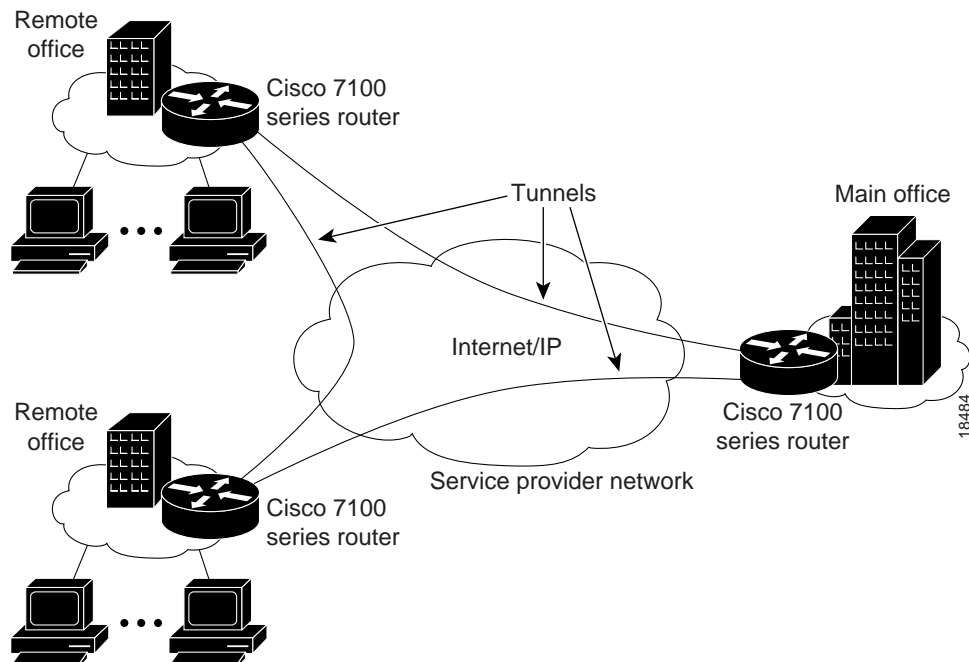
Cisco 7100 series VPN routers include the following:

  • Cisco 7120 series—Provides one fixed WAN port, two fixed 10BaseT/100BaseTX Fast Ethernet
    ports, one modular port adapter slot, and one service module slot.

  • Cisco 7140 series—Provides two fixed WAN ports, two fixed 10BaseT/100BaseTX Fast Ethernet
    LAN ports, one modular port adapter slot, and one service module slot.

The Cisco 7120 series is available in six models, and the Cisco 7140 series is available in five models.
The models are defined by the WAN interface.

Figure 1-2 shows the front of a Cisco 7100 series VPN router. The front of the router is the same on both
Cisco 7120 series and Cisco 7140 series routers. The specific model number is located on the back of
each unit.

Figure 1-2   Cisco 7100 Series—Front View
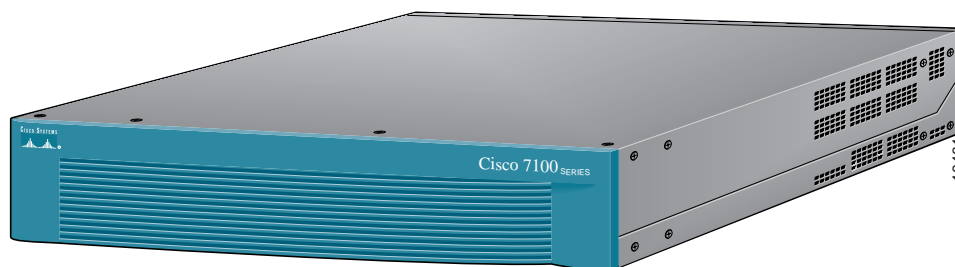
Cisco 7100 series VPN routers support the following features:

  • Online insertion and removal (OIR)—Allows you to add, replace, or remove a modular port adapter
    without interrupting the system.

  • Environmental monitoring and reporting functions—Allow you to maintain normal system
    operation by resolving adverse environmental conditions prior to loss of operation.

- Downloadable software—Allows you to load new images into Flash memory remotely, without having to physically access the router, for fast, reliable upgrades.
- Network management—Allows you to remotely manage the router. Cisco 7100 series VPN routers support CiscoWorks and CiscoView network management software.
  - CiscoWorks—Lets you monitor complex internetworks that use Cisco routing devices and helps you plan, troubleshoot, and analyze your network. CiscoWorks uses the Simple Network Management Protocol (SNMP) to monitor and control any SNMP device on the network.
  - CiscoView—A graphical SNMP-based device management tool that provides powerful real-time views of your networked Cisco devices. These views deliver a continuously updated physical picture of device configuration and performance conditions, with simultaneous views available for multiple device sessions. CiscoView runs from a centralized network management site from which you can review, reconfigure, and monitor essential device data from a simple GUI (that displays information such as dynamic status reports, performance statistics, and network inquiries) without having to physically check connections for each device, module, or port at every different or remote location.
- Integrated Service Module (ISM)—Provides Layer 3 encryption that supports IPSec encryption of IP datagrams.

Figure 1-3 shows a Cisco 7120 series router from the back and Figure 1-4 shows a Cisco 7140 series router. All interface connections and LEDs are located at the back of the router.

The Cisco 7100 series VPN routers have the following components:

- One fixed WAN port on the Cisco 7120 series—T1, T3, E3, or ATM (T3, E3, or OC-3c/STM1 single-mode intermediate reach).
- Two fixed WAN ports on the Cisco 7140 series—T3, E3, or ATM (T3, E3 OC-3c/STM1 multimode).
- Two fixed LAN ports—10BaseT/100BaseTX autosensing Ethernet/Fast Ethernet (full and half duplex) equipped with an RJ-45 receptacle.
- One modular port adapter slot—Supports one single-width port adapter.
- One service module slot—ISM provides encryption services.
- A Million Instructions Per Second (MIPS) Reduced Instruction Set Computing (RISC) network processor that supports VPN services at 50 Mbps in Cisco 7120 series routers and 90 Mbps in Cisco 7140 series routers.
- One console port—Equipped with an RJ-45 receptacle.
- One auxiliary port—Equipped with an RJ-45 receptacle.
- 280W AC-input power—Cisco 7120 series routers are equipped with one power supply and Cisco 7140 series routers are equipped with two power supplies for power load-sharing and redundancy.
- Two PC Card slots—Flash Disk or Flash memory cards contain the default Cisco IOS software image.
- LEDs—System ready, power, slot 0, slot 1, and LEDs for the fixed LAN and WAN ports.
- Up to 256 MB of synchronous dynamic random-access memory (SDRAM) system memory with 64 MB of fixed SDRAM packet memory—Three dual in-line memory modules (DIMMs) on the network processor board.

Figure 1-3   Cisco 7120 Series—Back View
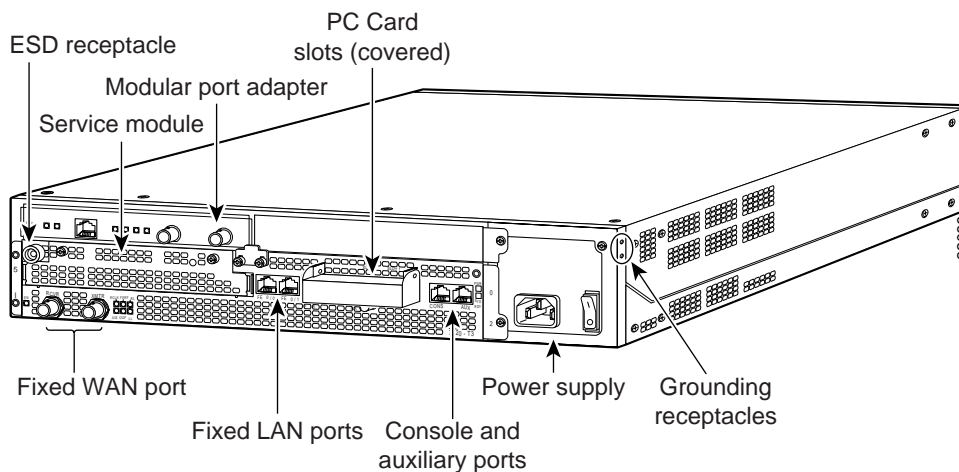
Figure 1-4   Cisco 7140 Series—Back View
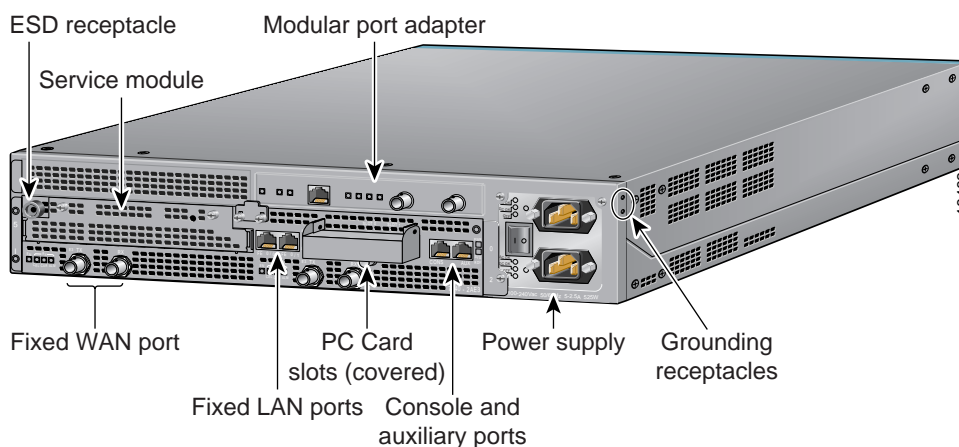
Cisco 7120 series routers have one power supply with one AC-input power receptacle; Cisco 7140 series routers have two power supplies with two AC-input power receptacles for power load-sharing and redundancy. A modular power cable connects each AC-input power supply to the site AC power source. The router's main power switch is located next to the AC-input power receptacles.

Cisco 7140 series routers will operate with power connected to either of the two power supplies. The second AC-input power supply simply enables power load-sharing and redundancy. There is no primary or secondary power supply for Cisco 7140 series routers.

We recommend powering the router from a 15A receptacle at the power source.

On the side of each chassis are two chassis ground receptacles that provide a chassis ground connection for a two-hole grounding lug. On the back of the chassis, there is a receptacle for electrostatic discharge (ESD) equipment. (See Figure 1-3 and Figure 1-4.)

Four internal fans draw cooling air into the chassis (back to front) and across internal components to maintain an acceptable operating temperature. There are four environmental sensors for monitoring the cooling air as it leaves the chassis. For more information on environmental monitoring, see the "Environmental Monitoring and Reporting Functions" section on page 1-39.

⚠

Caution   To ensure the proper flow of cooling air across the internal components, make sure a blank port adapter is installed in an unoccupied port adapter slot. The product number for a blank port adapter is MAS-7100-PABLANK=.

The modular port adapter slides into the chassis slot and connects directly to the router; there are no internal cables to connect.

The port adapter, service module, fixed WAN interfaces, and fixed LAN interfaces connect to two Peripheral Component Interconnect (PCI) buses on the router's backplane that provide a path to packet I/O memory and the system processor. For more information, see the "Peripheral Component Interconnect Buses" section on page 1-33.

Cisco 7100 series VPN routers can be installed on a tabletop or in an equipment rack. Rubber feet for tabletop installation are included in the accessory kit that shipped with your router. A rack-mount and cable-management kit is also standard equipment when Cisco 7100 series VPN routers are shipped from the factory. The kit provides the hardware needed to mount the router in a standard 19- or 23-inch, four-post or telco-type equipment rack. The kit also provides the hardware necessary to manage the interface cables attached to the router. The product number for the rack-mount kit is ACS-7100-RMK=. Instructions for setting the router on a tabletop, installing the router in an equipment rack, and attaching the cable-management bracket are the same for all Cisco 7100 series VPN models and are explained in Chapter 3, "Installing a Cisco 7100 VPN Series Router."

Cisco 7120 Series Overview

Cisco 7120 series routers include the following models:

- Cisco 7120-4T1—Provides four channel-independent, synchronous serial ports that support full-duplex operation at T1 (1.544-Mbps) and E1 (2.048-Mbps) speeds.

- Cisco 7120-T3—Provides one high-speed, synchronous serial port that supports full-duplex operation at T3 (45-Mbps) speeds.

- Cisco 7120-E3—Provides one high-speed, synchronous serial port that supports full-duplex operation at E3 (34-Mbps) speeds.

- Cisco 7120-AT3—Provides one high-speed, ATM port that supports full-duplex operation at T3 (45-Mbps) speeds.

- Cisco 7120-AE3—Provides one high-speed, ATM port that supports full-duplex operation at E3 (34-Mbps) speeds.

- Cisco 7120-SMI3—Provides one ATM port that supports full-duplex operation at OC-3c/STM1 single-mode intermediate reach (155-Mbps) speeds.
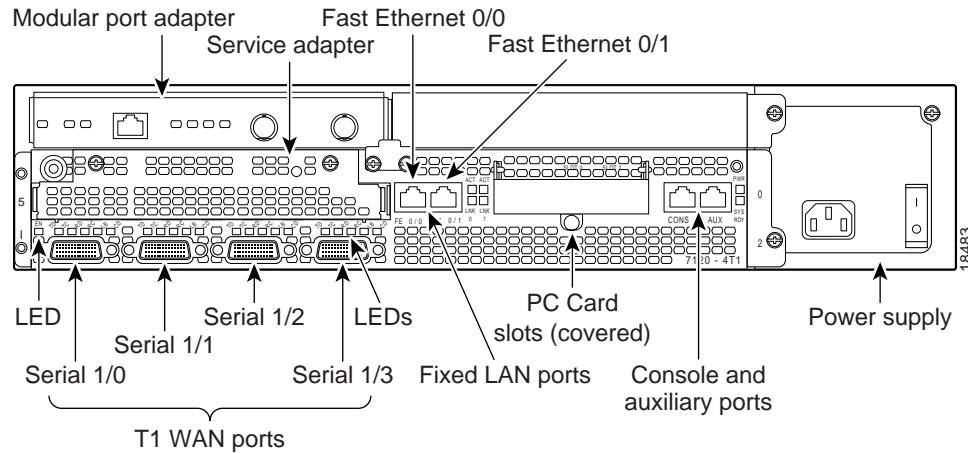
Cisco 7120-4T1

The Cisco 7120-4T1 provides four channel-independent, synchronous serial ports that support full-duplex operation at T1 (1.544-Mbps) and E1 (2.048-Mbps) speeds. The Cisco 7120-4T1 provides the following features:

- EIA/TIA-232, EIA/TIA-449, V.35, X.21, and EIA-530 interface types

- External (data terminal equipment [DTE] mode) or internal (data communications equipment [DCE] mode) timing signals (except for EIA-530, which only supports external)

- Loopbacks (except for X.21 DTE)
- ATM-DXI, Frame Relay, High-Level Data Link Control (HDLC), Point-to-Point Protocol (PPP), and Switched Multimegabit Data Service (SMDS) encapsulation
- RFC 1406 (except for the Frac table)

Figure 1-5 shows the back of the Cisco 7120-4T1. Access to the interfaces is located at the back of the router.

Figure 1-5   Cisco 7120-4T1—Back View

The Cisco 7120-4T1 WAN ports have one enabled (EN) LED and five status LEDs (each of the four ports has a set of status LEDs). After system initialization, the enabled LED goes on to indicate that all ports have been enabled for operation. If the initialization fails for any reason, the enabled LED will not go on. The LEDs are shown in Figure 1-6 and described in Table 1-1.
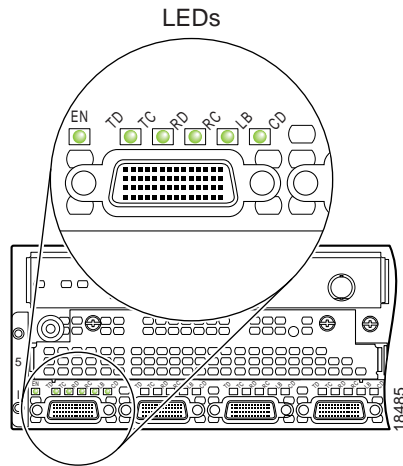
Figure 1-6   Cisco 7120-4T1 WAN Port LEDs

Table 1-1   Cisco 7120-4T1 LEd Descriptions

LED Label	Color	State	Function
EN	Green	On	Indicates ports are ready.
TD	Green	On	DTE—Transmit data out. DCE—Transmit data in.
TC	Green	On	DTE—Transmit clock in. DCE—Transmit clock in (TxCE).
RD	Green	On	DTE—Receive data in. DCE—Receive data out.
RC	Green	On	DTE—Receive clock in. DCE—Receive clock out.
LB/CD	Green	On	Indicates DTR[1], DSR[2], RTS[3], CTS[4], or DCD[5] is active.
	Green	Flashing	Indicates RTS, CTS, or DCD is sending and receiving data in half-duplex mode.
	Yellow	On	Indicates local loop or internal loop active.

1. DTR = Data Terminal Ready.
2. DSR = Data Set Ready.
3. RTS = Request To Send.
4. CTS = Clear To Send.
5. DCD = Data Carrier Detect.

Cisco 7120-T3

The Cisco 7120-T3 provides one high-speed, synchronous serial port that supports full-duplex operation at T3 (45-Mbps) speeds. The Cisco 7120-T3 provides the following features:

• Integrated DSU functionality

• 16- and 32-bit CRCs

• B3ZS line coding

• Scrambling and bandwidth reduction

• Loopbacks

• ATM-DXI, Frame Relay, HDLC, SMDS, and PPP serial encapsulation

• RFC 1213 and RFC 1407

Figure 1-7 shows the back of the Cisco 7120-T3. Access to the interfaces is located at the back of the router.

Figure 1-7   Cisco 7120-T3—Back View
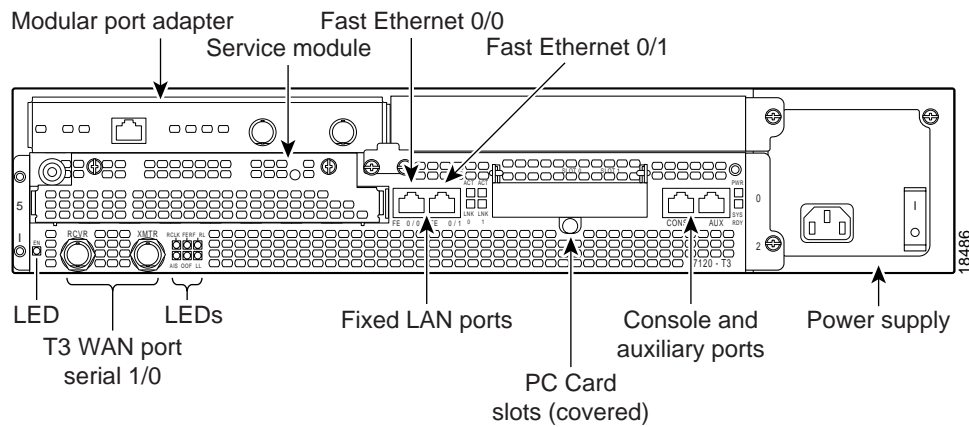
The Cisco 7120-T3 WAN port has one enabled LED and six uplink port status LEDs. After system initialization, the enabled LED goes on to indicate that the port has been enabled for operation. If the initialization fails for any reason, the enabled LED will not go on. The LEDs are shown in Figure 1-8 and described in Table 1-2.

Figure 1-8   Cisco 7120-T3 WAN Port LEDs

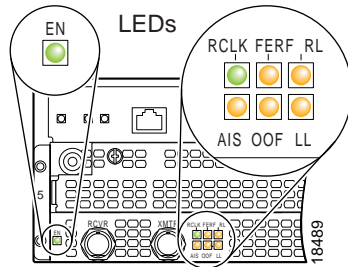
Table 1-2   Cisco 720-T3 LED Descriptions

LED Label	Color	State	Function
EN	Green	On	Indicates the port is ready.
RCLK	Green	On	Indicates a receive clock has been detected.
FERF	Yellow	On	Indicates the framer detected far-end receive failure.
RL	Yellow	On	Indicates the port is in remote loopback mode.
AIS	Yellow	On	Indicates the framer detected an alarm indication signal.
OOF	Yellow	On	Indicates the framer detected out of frame.
LL	Yellow	On	Indicates the port is in local loopback mode.

Cisco 7120-E3

The Cisco 7120-E3 provides one high-speed, synchronous serial port that supports full-duplex operation at E3 (34-Mbps) speeds. The Cisco 7120-E3 provides the following features:

- Integrated data service unit (DSU) functionality
- 16- and 32-bit cyclic redundancy checks (CRCs)
- HDB3 line coding
- Scrambling and bandwidth reduction
- G.751 framing or bypass framing
- National service bits
- Loopbacks
- ATM-DXI, Frame Relay, HDLC, SMDS, and PPP serial encapsulation
- RFC 1213 and RFC 1407

Figure 1-9 shows the back of the Cisco 7120-E3. Access to the interfaces is located at the back of the router.

Figure 1-9   Cisco 7120-E3—Back View
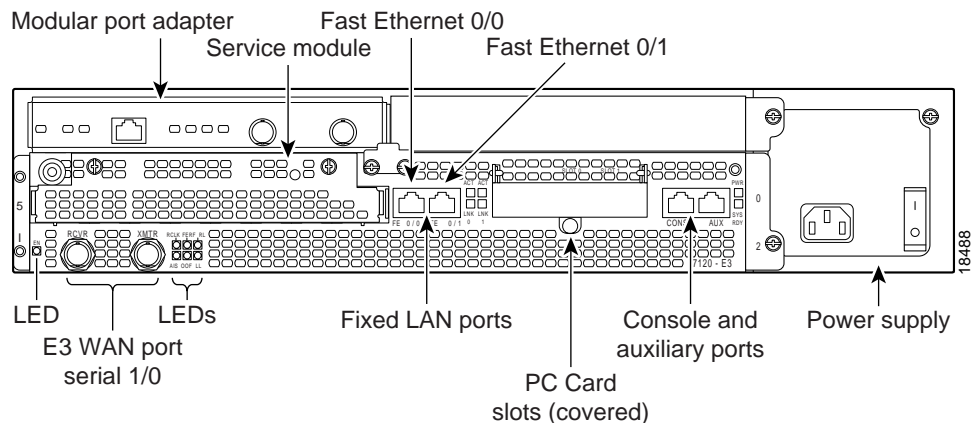
The Cisco 7120-E3 WAN port has one enabled LED and six uplink port status LEDs. After system initialization, the enabled LED goes on to indicate that the port has been enabled for operation. If the initialization fails for any reason, the enabled LED will not go on. The LEDs are shown in Figure 1-10 and described in Table 1-3.

Figure 1-10   Cisco 7120-E3 WAN Port LEDs
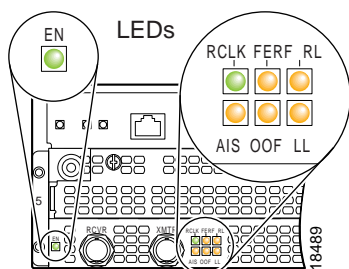
Table 1-3   Cisco 7120-E3 LED Descriptions

| LED Label	Color	State	Function
EN	Green	On	Indicates the port is ready.
RCLK	Green	On	Indicates a receive clock has been detected.
FERF	Yellow	On	Indicates the framer detected far-end receive failure.
RL	Yellow	On	Indicates the port is in remote loopback mode.
AIS	Yellow	On	Indicates the framer detected an alarm indication signal.
OOF	Yellow	On	Indicates the framer detected out of frame.
LL	Yellow	On	Indicates the port is in local loopback mode.

Cisco 7120-AT3, Cisco 7120-AE3, and Cisco 7120-SMI3

The Cisco 7120-AT3 provides one high-speed, ATM port that supports full-duplex operation at T3 (45-Mbps) speeds. The Cisco 7120-AE3 provides one high-speed, ATM port that supports full-duplex operation at E3 (34-Mbps) speeds. The Cisco 7120-SMI3 provides one ATM port that supports full-duplex operation at OC-3c/STM1 single-mode intermediate reach (155-Mbps) speeds.

These models provide the following features:

- Up to 4096 total virtual circuits (open VCs)
- Up to 1024 simultaneous segmentations and reassemblies (SARs)
- ATM adaptation layer 5 (AAL5) for data traffic
- Traffic shaping on a per-VC basis
- IP-to-ATM class of service (CoS)
- Non-real time variable bit rate (nrt-VBR), unspecified bit rate (UBR), and available bit rate (ABR) quality of service (QoS)
- Operation, Administration, and Maintenance alarm indication signal (OAM AIS) cells
- LAN emulation (LANE)
- User-Network Interface (UNI) signaling
- Integrated Local Management Interface (ILMI)
- Loopbacks
- RFC 1483 and RFC 1577

Figure 1-11 shows the back of the Cisco 7120-AT3. Access to the interfaces is located at the back of the router.
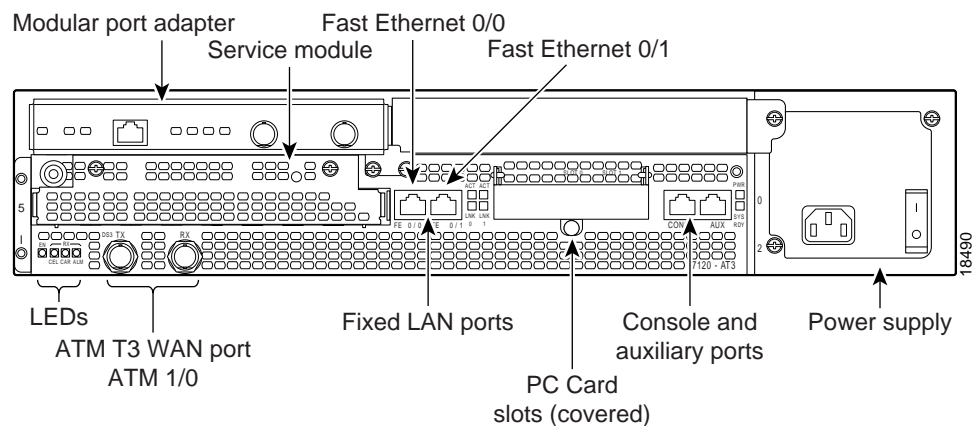
Figure 1-11   Cisco 7120-AT3—Back View

Figure 1-12 shows the back of the Cisco 7120-AE3. Access to the interfaces is located at the back of the router.
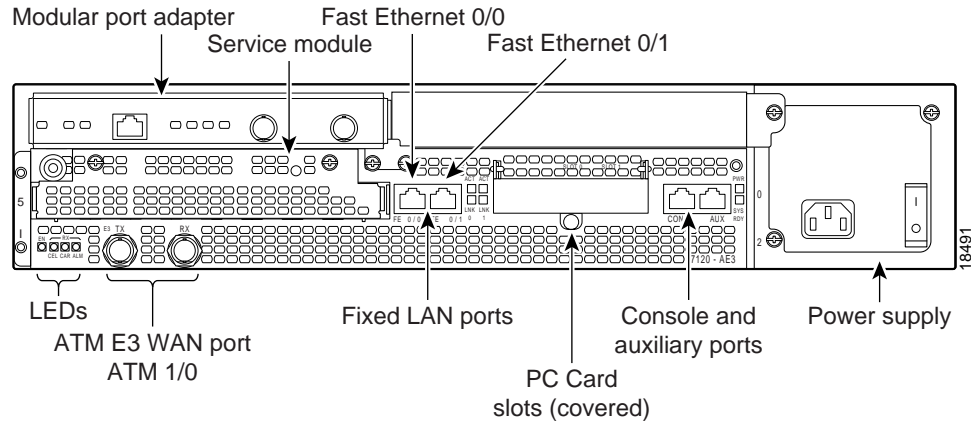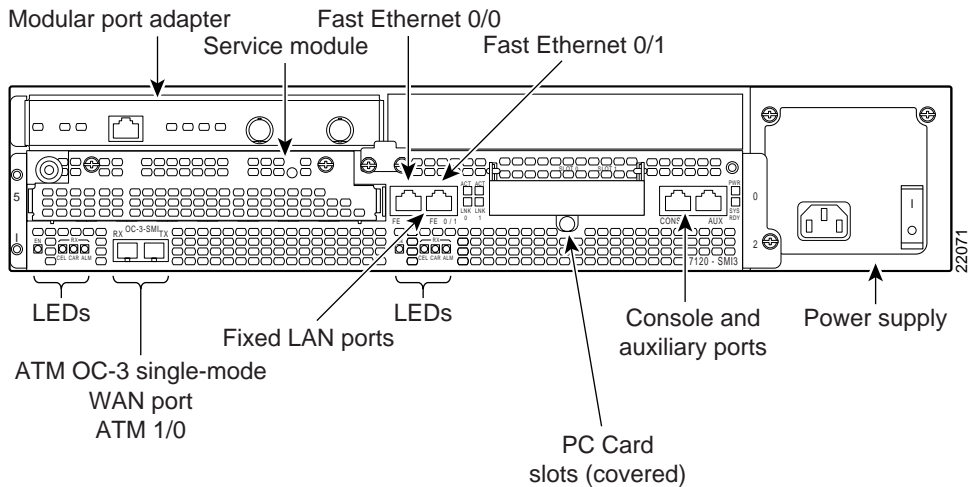
Figure 1-12   Cisco 7120-AE3—Back View

Figure 1-13 shows the back of the Cisco 7120-SMI3. Access to the interfaces is located at the back of the router.

Figure 1-13   Cisco 7120-SMI3—Back View

The Cisco 7120-AT3, Cisco 7120-AE3, and Cisco 7120-SMI3 WAN ports have one enabled LED and three status LEDs. The LEDs are in the same location and labeled the same on each model. After system initialization, the enabled LED goes on to indicate that the port has been enabled for operation. If the initialization fails for any reason, the enabled LED will not go on. The LEDs are shown in Figure 1-14 and described in Table 1-4.

Figure 1-14   Cisco 7120-AT3 WAN Port LEDs
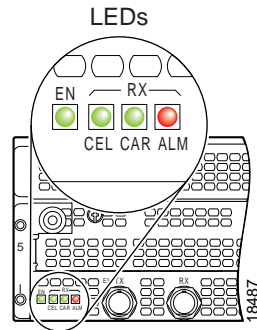
Table 1-4   Cisco 7120-AT3, Cisco 7120-AE3, and Cisco 7120-SMI3 LED Descriptions

LED Label	Color	State	Function
EN	Green	On	Indicates the port is ready.
RX CEL	Green	On	Indicates the port has received an ATM cell.
RX CAR	Green	On	Indicates the port has detected a carrier on the receiver cable. For a fiber-optic interface, this means that light is detected, and a valid frame is detected.
RX ALM	Red	On	Indicates the router detected an alarm condition.

Cisco 7140 Series Overview

Cisco 7140 series routers consist of the following models:

- Cisco 7140-2T3—Provides two high-speed, synchronous serial ports that support full-duplex operation at T3 (45-Mbps) speeds.

- Cisco 7140-2E3— Provides two high-speed, synchronous serial ports that support full-duplex operation at E3 (34-Mbps) speeds.

- Cisco 7140-2AT3—Provides two high-speed, ATM ports that support full-duplex operation at T3 (45-Mbps) speeds.

- Cisco 7140-2AE3—Provides two high-speed, ATM ports that support full-duplex operation at E3 (34-Mbps) speeds.

- Cisco 7140-2MM3—Provides two ATM ports that support full-duplex operation at OC-3c/STM1 multimode (155-Mbps) speeds.

- Cisco 7140-8T—Provides eight high-speed, synchronous serial ports that support full-duplex operation at T1 (1.544-Mbps) and E1 (2.048-Mbps) speeds.

- Cisco 7140-2FE—Provides two fixed LAN ports—10BaseT/100BaseTX autosensing Ethernet/Fast Ethernet (full and half duplex) equipped with an RJ-45 receptacle.

Cisco 7140-2T3

The Cisco 7140-2T3 provides two high-speed, synchronous serial ports that support full-duplex operation at T3 (45-Mbps) speeds. The Cisco 7140-2T3 provides the following features:

- Integrated DSU functionality
- 16- and 32-bit CRCs
- B3ZS line coding
- Scrambling and bandwidth reduction
- Loopbacks
- ATM-DXI, Frame Relay, HDLC, SMDS, and PPP serial encapsulation
- RFC 1213 and RFC 1407

Figure 1-15 shows the back of the Cisco 7140-2T3. Access to the interfaces is located at the back of the router.

Figure 1-15   Cisco 7140-2T3—Back View
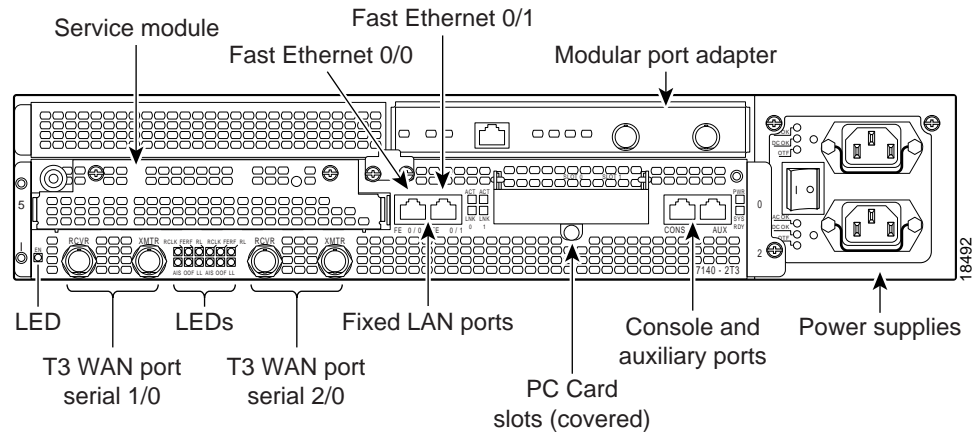
The Cisco 7140-2T3 WAN ports have one enabled (EN) LED and six uplink port status LEDs (each port has a set of status LEDs). After system initialization, the enabled LED goes on to indicate that the ports have been enabled for operation. If the initialization fails for any reason, the enabled LED will not go on. The LEDs are shown in Figure 1-16 and described in Table 1-5.

Figure 1-16   Cisco 7140-2T3 WAN Port LEDs

Table 1-5   Cisco 7140-2T3 LED Descriptions

| LED Label	Color	State	Function
EN	Green	On	Indicates the port is ready.
RCLK	Green	On	Indicates a receive clock has been detected.
FERF	Yellow	On	Indicates the framer detected far-end receive failure.
RL	Yellow	On	Indicates the port is in remote loopback mode.
AIS	Yellow	On	Indicates the framer detected an alarm indication signal.
OOF	Yellow	On	Indicates the framer detected out of frame.
LL	Yellow	On	Indicates the port is in local loopback mode.

Cisco 7140-2E3

The Cisco 7140-2E3 provides two high-speed, synchronous serial ports that support full-duplex operation at E3 (34-Mbps) speeds. The Cisco 7140-2E3 provides the following features:

- Integrated DSU functionality
- 16- and 32-bit CRCs
- HDB3 line coding
- Scrambling and bandwidth reduction
- G.751 framing or bypass framing
- National service bits
- Loopbacks
- ATM-DXI, Frame Relay, HDLC, SMDS, and PPP serial encapsulation
- RFC 1213 and RFC 1407

Figure 1-17 shows the back of the Cisco 7140-2E3. Access to the interfaces is located at the back of the router.

Figure 1-17   Cisco 7140-2E3—Back View
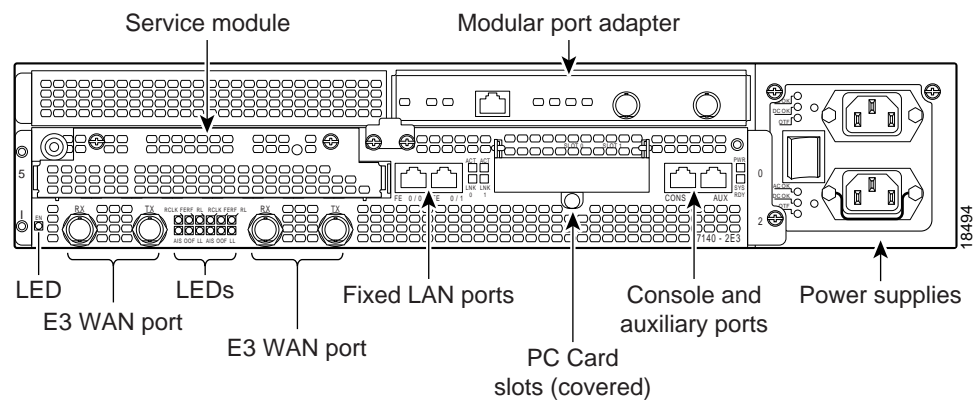
The Cisco 7140-2E3 WAN ports have one enabled (EN) LED and six uplink port status LEDs (each port has a set of status LEDs). After system initialization, the enabled LED goes on to indicate that the ports have been enabled for operation. If the initialization fails for any reason, the enabled LED will not go on. The LEDs are shown in Figure 1-18 and described in Table 1-6.

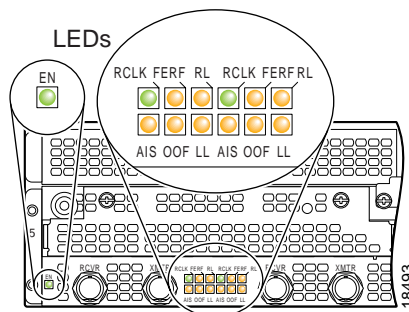*Figure 1-18   Cisco 7140-2E3 WAN Port LEDs*
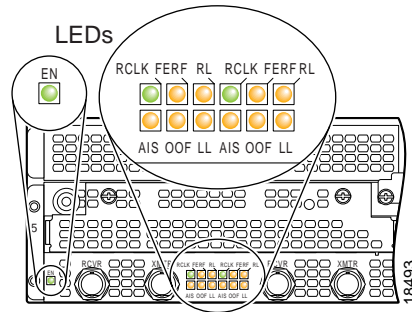
Table 1-6   Cisco 7140-2E3 LED Descriptions

LED Label	Color	State	Function
EN	Green	On	Indicates the port is ready.
RCLK	Green	On	Indicates a receive clock has been detected.
FERF	Yellow	On	Indicates the framer detected far-end receive failure.
RL	Yellow	On	Indicates the port is in remote loopback mode.
AIS	Yellow	On	Indicates the framer detected an alarm indication signal.
OOF	Yellow	On	Indicates the framer detected out of frame.
LL	Yellow	On	Indicates the port is in local loopback mode.

Cisco 7140-2AT3, Cisco 7140-2AE3, and Cisco 7140-2MM3

The Cisco 7140-2AT3 provides two high-speed, ATM ports that support full-duplex operation at T3 (45-Mbps) speeds. The Cisco 7140-2AE3 provides two high-speed, ATM ports that support full-duplex operation at E3 (34-Mbps) speeds. The Cisco 7140-2MM3 provides two ATM ports that support full-duplex operation at OC-3c/STM1 multimode (155-Mbps) speeds.

These models provides the following features:

- Up to 4096 total virtual circuits (open VCs)
- Up to 1024 simultaneous SARs
- ATM adaptation layer 5 (AAL5) for data traffic
- Traffic shaping on a per-VC basis
- IP-to-ATM CoS
- Non-real time variable bit rate (nrt-VBR), unspecified bit rate (UBR), and available bit rate (ABR) quality of service (QoS)
- Operation, Administration, and Maintenance alarm indication signal (OAM AIS) cells
- LAN emulation (LANE)

- User-Network Interface (UNI) signaling

- Integrated Local Management Interface (ILMI)

- Loopbacks

- RFC 1483 and RFC 1577

Figure 1-19 shows the back of the Cisco 7140-2AT3. Access to the interfaces is located at the back of the router.

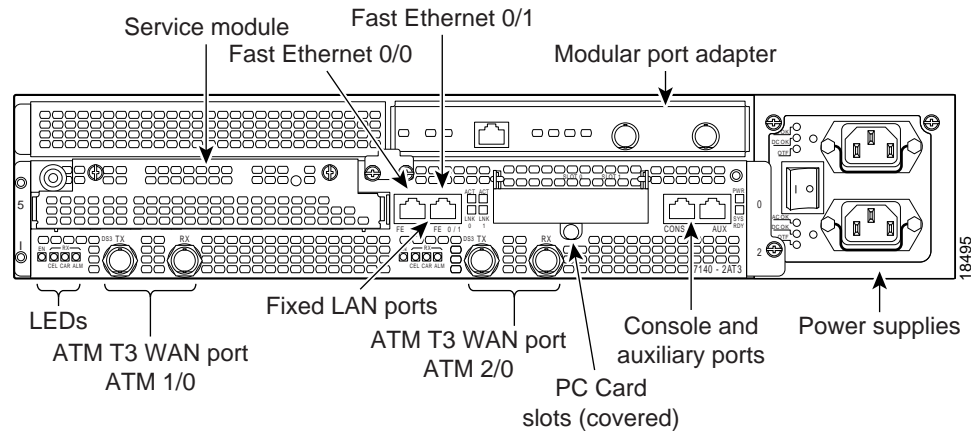*Figure 1-19   Cisco 7140-2AT3—Back View*

Figure 1-20 shows the back of the Cisco 7140-2AE3. Access to the interfaces is located at the back of the router.

Figure 1-20   Cisco 7140-2AE3—Back View

Figure 1-21 shows the back of the Cisco 7140-2MM3. Access to the interfaces is located at the back of the router.

Figure 1-21   Cisco 7140-2MM3—Back View
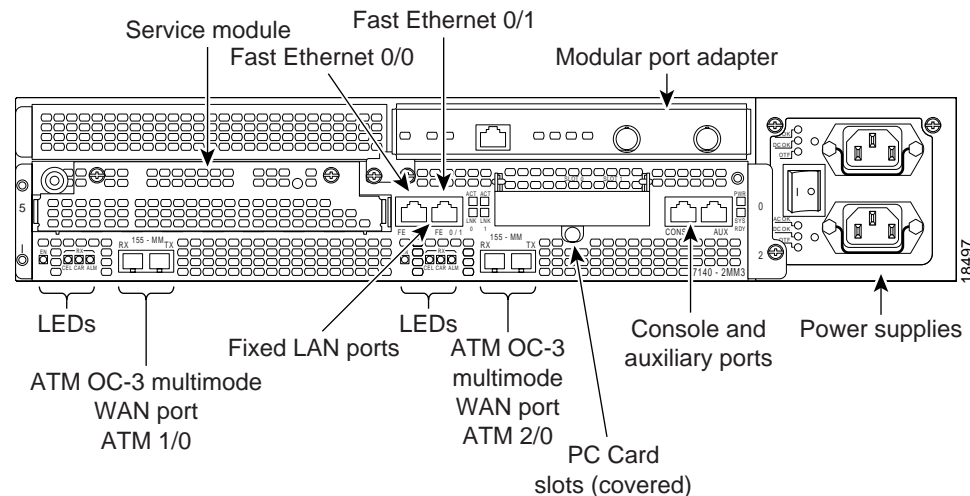
The Cisco 7140-2AT3, Cisco 7140-2AE3, and Cisco 7140-2MM3 WAN ports have one enabled (EN) LED and three status LEDs (each port has a set of status LEDs). The LEDs are in the same location and labeled the same on each model. After system initialization, the enabled LED goes on to indicate that the ports have been enabled for operation. If the initialization fails for any reason, the enabled LED will not go on. The LEDs are shown in Figure 1-22 and described in Table 1-7.

Figure 1-22   Cisco 7140-2AT3 WAN Port LEDs
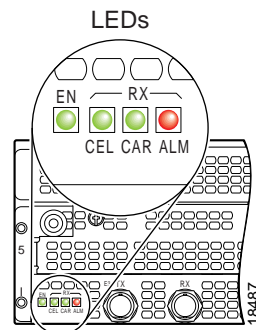
Table 1-7   Cisco 7140-2AT3, Cisco 7140-2AE3, and Cisco 7140-2MM3 LED Descriptions

LED Label	Color	State	Function
EN	Green	On	Indicates the port is ready.
RX CEL	Green	On	Indicates the port has received an ATM cell.
RX CAR	Green	On	Indicates the port has detected a carrier on the receiver cable. For a fiber-optic interface, this means that light is detected, and a valid frame is detected.
RX ALM	Red	On	Indicates the router detected an alarm condition.

Cisco 7140-8T

The Cisco 7140-8T provides eight high-speed, synchronous serial ports that support full-duplex operation at T1 (1.544-Mbps) and E1 (2.048-Mbps) speeds. The Cisco 7140-8T provides the following features:

- EIA/TIA-232, EIA/TIA-449, V.35, X.21, and EIA-530 interface types

- External (data terminal equipment [DTE] mode) or internal (data communications equipment [DCE] mode) timing signals (except for EIA-530, which only supports external)

- Loopbacks (except for X.21 DTE)

- ATM-DXI, Frame Relay, High-Level Data Link Control (HDLC), Point-to-Point Protocol (PPP), and Switched Multimegabit Data Service (SMDS) encapsulation
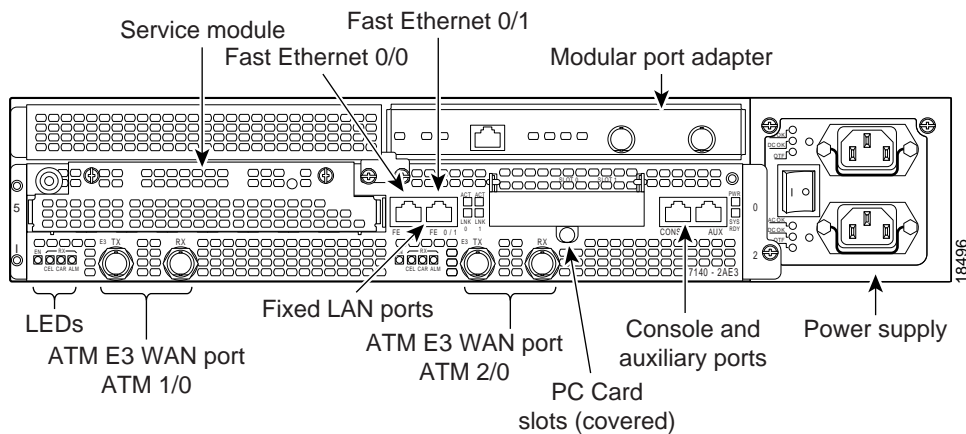
- RFC 1406 (except for the Frac table)

Figure 1-23 shows the back of the Cisco 7140-8T. Access to the interfaces is located at the back of the router.

Figure 1-23   Cisco 7140-8T—Back View
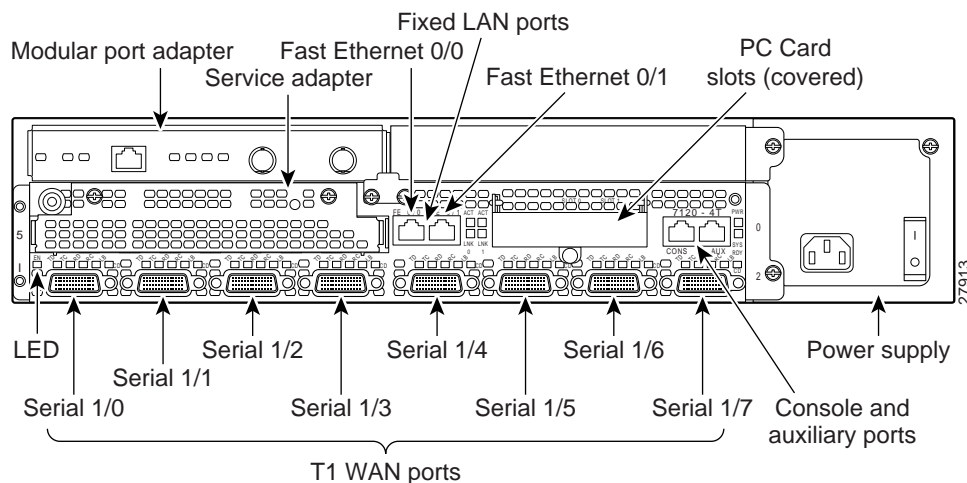
The Cisco 7140-8T WAN ports have one enabled (EN) LED and five status LEDs (each of the eight ports has a set of status LEDs). After system initialization, the enabled LED goes on to indicate that all ports have been enabled for operation. If the initialization fails for any reason, the enabled LED will not go on. The LEDs are shown in Figure 1-24 and described in Table 1-8.

Figure 1-24   Cisco 7140-8T WAN Port LEDs
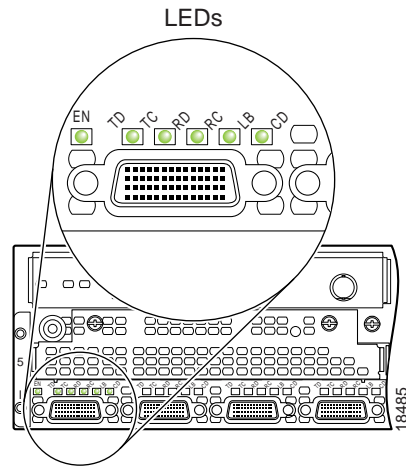
Table 1-8   Cisco 7140-8T LED Descriptions

LED Label	Color	State	Function
EN	Green	On	Indicates ports are ready.
TD	Green	On	DTE—Transmit data out. DCE—Transmit data in.
TC	Green	On	DTE—Transmit clock in. DCE—Transmit clock in (TxCE).
RD	Green	On	DTE—Receive data in. DCE—Receive data out.
RC	Green	On	DTE—Receive clock in. DCE—Receive clock out.
Loopback/	Green	On	Indicates DTR[1], DSR[2], RTS[3], CTS[4], or DCD[5] is active.
Carrier Detect	Green	Flushing	Indicates RTS, CTS, or DCD is sending and receiving data in half-duplex mode.
	Yellow	On	Indicates local loop or internal loop active.

1. DTR = Data Terminal Ready.

2. DSR = Data Set Ready.

3. RTS = Request To Send.

4. CTS = Clear To Send.

5. DCD = Data Carrier Detect.

Cisco 7140-2FE

The Cisco 7140-2FE provides two fixed LAN ports—10BaseT/100BaseTX autosensing Ethernet/Fast Ethernet (full and half duplex) equipped with an RJ-45 receptacle.

Figure 1-25   Cisco 7140-2FE—Back View
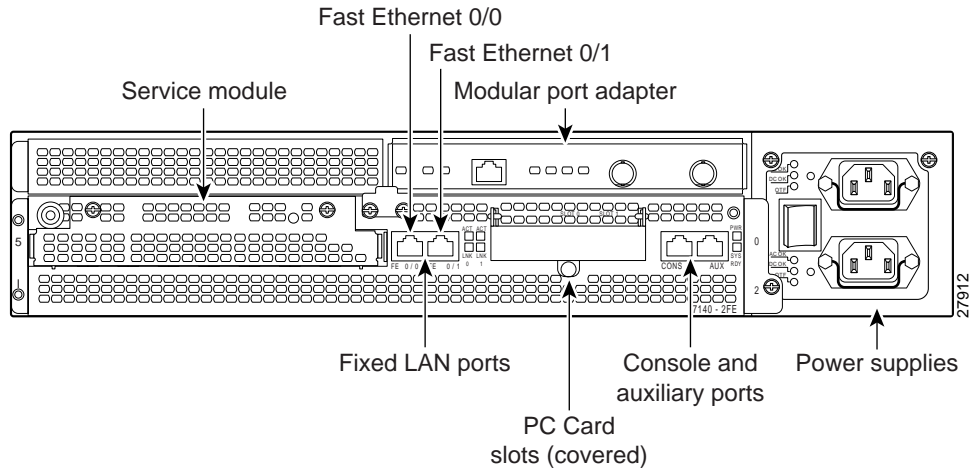
Field-Replaceable Units

Cisco 7100 series VPN routers have the following field-replaceable units (FRUs):

- Port Adapters, page 1-23
- Integrated Service Module (ISM)/Integrated Service Adapter (ISA), page 1-23
- VPN Acceleration Module (VAM), page 1-26
- Flash Disks, page 1-27
- SDRAM Memory, page 1-28
- Rack-Mount and Cable-Management Kit, page 1-29

Note   Replacement instructions for the rack-mount and cable-management kit, SDRAM memory, and Flash memory PC Cards are contained in the *Installing Field-Replaceable Units in Cisco 7100 Series VPN Routers* document.

Replacement instructions for removing and replacing other FRUs are contained in separate documents found online, and on the Documentation CD-ROM.

Port Adapters

The port adapters installed in Cisco 7100 series VPN routers are of the same type as those installed in the Cisco 72xx family routers. For information on supported port adapters, refer to the *Cisco Product Catalog* or contact your local sales representative. The port adapters provide network interfaces to connect the router to external networks.

For a complete list of port adapters available to the Cisco 7100 series VPN routers, see the *Cisco 7100 Series VPN Router Documentation*—DOC-7814391= http://www.cisco.com/en/US/products/hw/vpndevc/ps333/products_product_index09186a00800fa142. html

All port adapters available for the Cisco 7100 series connect directly to the router and are locked into position by a locking tab with two screws (see Figure 1-26). To remove or replace a port adapter, you must loosen the screws (using a number 2 Phillips screwdriver) and slide the tab down. To lock the port adapter in place, slide the tab up and tighten the screws.

Note   Detailed port adapter installation information is contained in the installation note for the port adapter. For example, if you plan to replace a four-port Ethernet port adapter in your Cisco 7100 series VPN router, refer to the *PA-4E Ethernet 10BaseT Port Adapter Installation and Configuration* note. The document is available online and on the Documentation CD-ROM.

Figure 1-26   Port Adapter Locking Tabs—Cisco 7120 Series
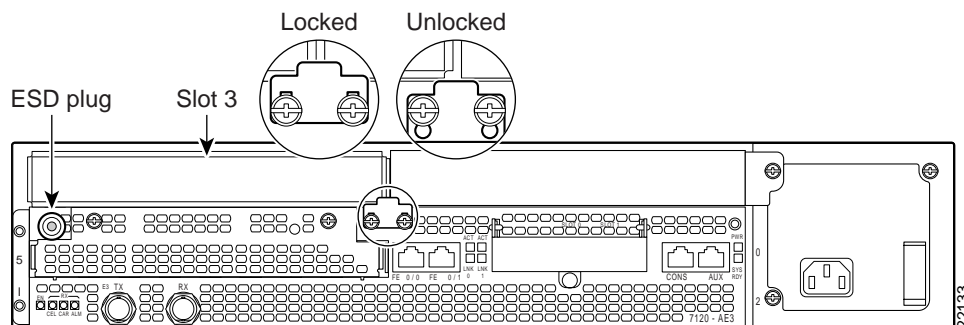
Caution   To ensure adequate airflow across the router port adapters, a port adapter or a blank port adapter must be installed in each port adapter slot. The product number for the blank port adapter is MAS-7100-PABLANK=.

Integrated Service Module (ISM)/Integrated Service Adapter (ISA)

The ISM/ISA is a Layer 3 encryption module that supports IP Security Protocol (IPSec) encryption of IP datagrams. In addition to enabling the secure use of public switched networks and the Internet through encryption, the ISM/ISA supports all encryption features supported by the Cisco IOS software. The hardware-based services provided by the ISM/ISA improve the overall performance of Cisco 7100 series routers by off-loading data encryption processing from the main system processor.

For more information on ISM or ISA features and for installation and configuration information, refer to the *Integrated Service Adapter and Integrated Service Module Installation and Configuration* online. This document is also available on the Documentation CD-ROM.

✎

Note   The Cisco 7100 series VPN routers do not support an ISM and an ISA in the same chassis.

The boot LED remains lit when the ISA/ISM is configured for MPPE, and it starts to pulsate after booting when the ISA/ISM is configured for IPSec. The ISA/ISM functions normally whether the boot LED is pulsating or is solid. See the *Integrated Service Adapter and Integrated Service Module Installation and Configuration* for more information on configuring the ISA/ISM.

⚠

Caution   To ensure compliance with U.S. export laws and regulations, and to prevent problems later on, refer to the "Compliance with U.S. Export Laws and Regulations Regarding Encryption" section in the *Regulatory Compliance and Safety Information for the Cisco 7100 Series VPN Routers* document for specific and important information.

ISM

The Integrated Service Module (ISM) is a service module that resides in slot 5 in Cisco 7100 series VPN routers. The ISM has three LEDs, as shown in Figure 1-27. Table 1-9 lists the colors and functions of the LEDs.

Figure 1-27   ISM LEDs

✎
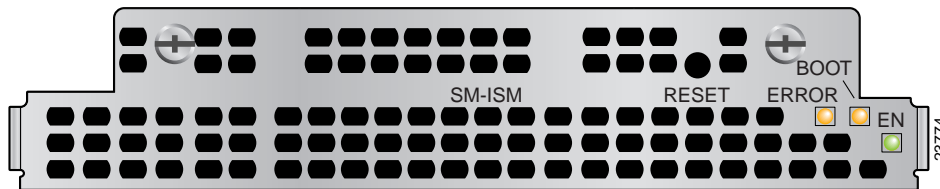
Note   The physical orientation of the ISM LEDs is reversed from that of the ISA (see Figure 1-27).

Table 1-9   ISM LEDs

LED Label	Color	State	Function
EN	Green	On	Indicates the ISM is powered up and enabled for operation.
BOOT	Amber	Pulses[1]	Indicates the ISM is operating.
		On	Indicates the ISM is booting or a packet is being encrypted or decrypted.
ERROR	Amber	On	Indicates an encryption error has occurred. This LED is normally off.

1. After successfully booting, the boot LED pulses in a "heartbeat" pattern to indicate that the ISM is operating. As crypto traffic increases, the nominal level of this LED increases in proportion to the traffic level.

The following conditions must all be met before the enabled LED goes on:

• The ISM is correctly connected to the backplane and receiving power.

•   The system bus recognizes the ISM.

If either of these conditions is not met, or if the router initialization fails for other reasons, the enabled LED does not go on.

⚠

Caution   To ensure adequate airflow across the router components, an ISM or a blank service module must be installed in slot 5. The product number for the blank service module is SM-BLANK=.

ISA

The Integrated Service Adapter (ISA) is a service adapter that resides in slot 3 in Cisco 7120 series routers, and slot 4 in the Cisco 7140 series routers. The ISA has three LEDs, as shown in Figure 1-28. Table 1-10 lists the colors and functions of the ISA LEDs.

Figure 1-28   ISA Front Panel LEDs (SA-ISA shown)
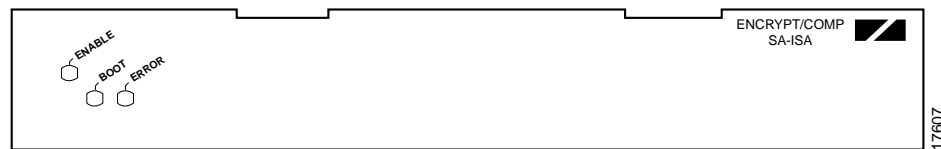
Table 1-10   ISA LEDs

LED Label	Color	State	Function
ENABLE	Green	On	Indicates the ISA is powered up and enabled for operation.
BOOT	Amber	Pulses[1]	Indicates the ISA is operating.
		On	Indicates the ISA is booting or a packet is being encrypted or decrypted.
ERROR	Amber	On	Indicates an encryption error has occurred. This LED is normally off.

1. After successfully booting, the boot LED pulses in a "heartbeat" pattern to indicate that the ISA is operating. As crypto traffic increases, the nominal level of this LED increases in proportion to the traffic level.

The following conditions must all be met before the enabled LED goes on:

•   The ISA is correctly connected to the backplane and receiving power.

•   The system bus recognizes the ISA.

If either of these conditions is not met, or if the router initialization fails, the enabled LED does not go on.

VPN Acceleration Module (VAM)

The VPN Acceleration Module (VAM) is a single-width acceleration module. The VAM supports LAN/WAN media and full Layer 3 routing services. VAMs provide hardware-assisted tunneling and encryption services for virtual private network (VPN) remote access, site-to-site intranet and extranet applications, including security, quality of service (QoS), firewall and intrusion detection, and service-level validation and management. The VAM off-loads IPSec processing from the main processor to permit resources on the processor engines for other tasks. The VAM provides hardware-accelerated support for multiple encryption functions.

The VAM is available as a service adapter (SA-VAM), and as a service module (SM-VAM).

SA-VAM

The SA-VAM resides in slot 3 in the Cisco 7120 series routers, and slot 4 in the Cisco 7140 series routers. The SA-VAM has three LEDs, as shown in Figure 1-29. Table 1-11 lists the colors and functions of the SA-VAM LEDs.

Figure 1-29   SA-VAM LEDs

Table 1-11   SA-VAM LEDs

LED Label	Color	State	Function
ENABLE	Green	On	Indicates the VAM is powered up and enabled for operation.
BOOT	Amber	Pulses[1]	Indicates the VAM is operating.
		On	Indicates the VAM is booting or a packet is being encrypted or decrypted.
ERROR	Amber	On	Indicates an encryption error has occurred. This LED is normally off.

1. After successfully booting, the boot LED pulses in a "heartbeat" pattern to indicate that the VAM is operating. As crypto traffic increases, the nominal level of this LED increases in proportion to the traffic level.

The following conditions must be met before the enabled LED goes on:

- The SA-VAM is correctly connected to the backplane and receiving power.
- The system bus recognizes the SA-VAM.

If either of these conditions is not met, or if the router initialization fails, the enabled LED does not go on.

SM-VAM

The SM-VAM resides in slot 5 in the Cisco 7100 series VPN routers. The SM-VAM has three LEDs, as shown in Figure 1-30. Table 1-12 lists the colors and functions of the LEDs.
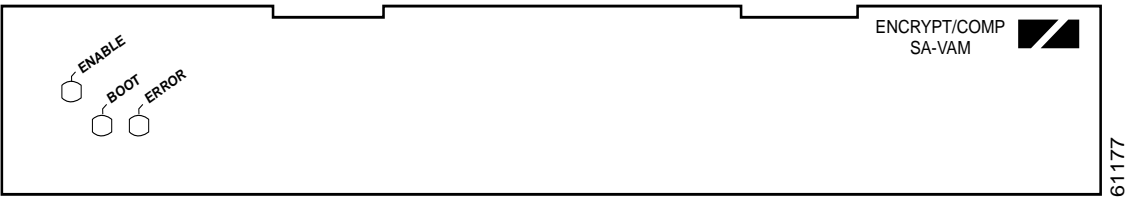
Figure 1-30   SM-VAM LEDs
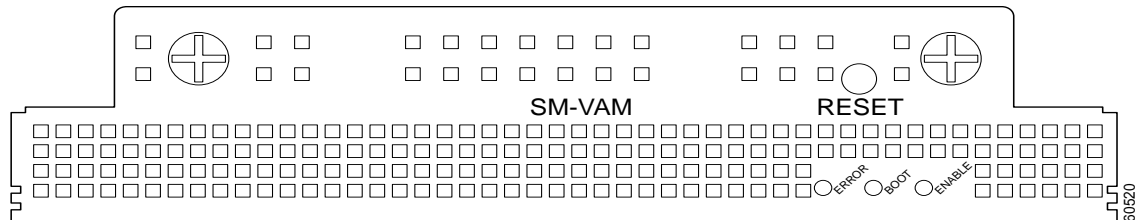
Table 1-12   SM-VAM LEDs

LED Label	Color	State	Function
ERROR	Amber	On	Indicates an encryption error has occurred. This LED is normally off.
BOOT	Amber	Pulses[1]	Indicates the SM-VAM is operating.
		On	Indicates the SM-VAM is booting or a packet is being encrypted or decrypted.
ENABLE	Green	On	Indicates the SM-VAM is powered up and enabled for operation.

1. After successfully booting, the boot LED pulses in a "heartbeat" pattern to indicate that the VAM is operating. As crypto traffic increases, the nominal level of this LED increases in proportion to the traffic level.

The following conditions must be met before the enabled LED goes on:

- The SM-VAM is correctly connected to the backplane and receiving power.
- The system bus recognizes the SM-VAM.

If either of these conditions is not met, or if the router initialization fails for other reasons, the enabled LED does not go on.

Flash Disks

A Flash Disk is the default memory device that ships with your Cisco 7100 series VPN router.

Cisco 7100 series VPN routers support up to two installed Flash Disks that contain the default Cisco IOS software image. Flash Disks can be installed in slot 0 and slot 1 of the PC Card slots located at the back of the router. Slot 0 is the top slot and slot 1 is the bottom slot.

The PC Card must be installed with the back label facing up. The PC Card is keyed and cannot be seated the wrong way. The ejector button will not pop out if the card is not completely inserted.

To ensure proper electromagnetic compatibility (EMC), the PC Card slot has a cover that is secured with a captive screw. To install or remove a Flash Disk from slot 0 or slot 1, you must loosen the captive screw.

Note   To avoid potential problems when you install spare Flash Disks in the router, we recommend that you reformat all Flash Disks on a Cisco 7100 series VPN router that is running the Cisco IOS release recommended for your router during your regularly scheduled service times. The Flash Disk requires the designation **disk0** or **disk1** to format it.

See the *Using the Flash Disk* document for additional information on the Flash Disk.This document is also available on cisco.com and on the Documentation CD-ROM.

Table 1-13 lists the Flash Disk memory options and their product numbers.

Table 1-13   Flash Disk Memory Options

Memory Size	Product Number[1]
48 MB	MEM-7100-FLD48M
128 MB	MEM-7100-FLD128M

1.   These products are also available as Flash Disk upgrades. To order an upgrade, add an equal sign (=) after the product number, for example, MEM-7100-FLD48M=.

Note   Flash memory cards that are used in Cisco 7200 series and Cisco 7500 series routers are also supported on Cisco 7100 series routers. For information on the Flash memory card, refer to the *Installing Field-Replaceable Units in Cisco 7100 Series VPN Routers* document, available on cisco.com and on the Documentation CD-ROM.

SDRAM Memory

Warning   **Only trained and qualified personnel should be allowed to install, replace, or service this equipment. This equipment contains an energy hazard. Disconnect the system before servicing.**

SDRAM memory consists of three DIMMs on the network processor card that contain the packet and system memory. By default, each chassis comes with 64 MB of fixed packet memory and 64 MB of upgradable system memory. You can have up to 256 MB of SDRAM system memory. (For more information on the network processor, see the "Network Processor Card" section on page 1-34.)

Note   For information on how to replace the SDRAM memory, refer to the *Installing Field-Replaceable Units in Cisco 7100 Series VPN Routers* available online and on the Documentation CD.

Table 1-14 lists the SDRAM product numbers.

Table 1-14   SDRAM DIMM Configurations

Total SDRAM	Memory Configuration	Product Number
64 MB[1]	1 64-MB DIMM in slot DIMM 1	MEM-7120/40-64S(=)
	1 64-MB DIMM in slot DIMM 0[2]	MEM-7120/40-64P
128 MB[3]	1 128-MB DIMM in slot DIMM 1	MEM-7120/40-128S=
192 MB	1 128-MB DIMM in slot DIMM 1 and 1 64-MB DIMM in slot DIMM 2	MEM-7120/40-192P=
256 MB	2 128-MB DIMMs; 1 in each slot (DIMM 1 and DIMM 2)	MEM-7120/40-256P=

1. This is the default memory configuration for all Cisco 7100 series routers.
2. Slot DIMM 0 is used exclusively for packet memory and is fixed at 64 MB.
3. This memory product will be available in the future.

Note The amount of memory installed in slot DIMM 1 must be greater than or equal to the amount of memory installed in slot DIMM 2, and slot DIMM 2 can be zero.

Slot DIMM 0 is used exclusively for packet memory and is fixed at 64 MB in the factory.

Rack-Mount and Cable-Management Kit

The rack-mount and cable-management kit for Cisco 7100 series routers consists of rack-mount brackets and a cable-management bracket that are designed for mounting your router in 19- or 23-inch, four-post or telco-type equipment racks. The kit is shipped with each Cisco 7100 series router and is also available as a single FRU. The product number for the rack-mount and cable-management kit is ACS-7100-RMK=.

Note Rubber feet for tabletop installation are included in the accessory kit that shipped with your router. (See the "Setting the Chassis on a Tabletop" section on page 3-1.)

For detailed instructions about how to install the rack-mount and cable-management brackets on your Cisco 7100 series router, see the "Rack-Mounting the Chassis" section on page 3-2 and the "Connecting to the Network" section on page 3-7.

Note Information on how to install the rack-mount and cable-management brackets is in the *Installing Field-Replaceable Units in Cisco 7100 Series VPN Routers* document available online and on the Documentation CD.

Functional Overview

The following sections provide a functional overview of Cisco 7100 series VPN routers to help you become familiar with the capabilities of the router:

- Chassis Slot and Logical Interface Numbering, page 1-30
- Online Insertion and Removal, page 1-33
- Peripheral Component Interconnect Buses, page 1-33
- Network Processor Card, page 1-34
- System LEDs and Reset Button, page 1-38
- Environmental Monitoring and Reporting Functions, page 1-39

Chassis Slot and Logical Interface Numbering

In Cisco 7100 series VPN routers, the s*lot number* is the location in the chassis where the interface resides and the *port number* is the physical port associated with that slot. Cisco 7100 series router slots are numbered 0 through 5. Interfaces in the Cisco IOS software are identified by a type, slot number, and port number. The number of physical ports depends on the type of modular port adapter or fixed interface. For example, in a Cisco 7120-4T1, serial 1/0 indicates port 0 on the fixed serial interface in slot 1. (See Figure 1-5.)

Slots in the Cisco 7120 series are numbered as follows and are shown in Figure 1-31:

- Slot 0—Fixed LAN (Ethernet) interface
- Slot 1—Fixed WAN (serial) interface
- Slot 2—Not used
- Slot 3—Modular port adapter
- Slot 4—Not used
- Slot 5—Integrated Service Module

Figure 1-31   Port Adapter Slot Numbering—Cisco 7120 Series
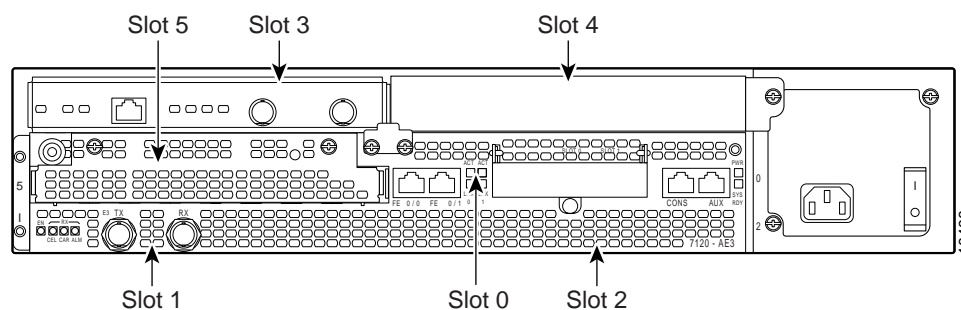
Slots in the Cisco 7140 series are numbered as follows and are shown in Figure 1-32:

- Slot 0—Fixed LAN (Ethernet) interface
- Slot 1—Fixed WAN (serial) interface
- Slot 2—Fixed WAN (serial) interface

- Slot 3—Not used
- Slot 4—Modular port adapter
- Slot 5—Integrated Service Module

Figure 1-32   Port Adapter Slot Numbering—Cisco 7140 Series

Interface Information in the Software

You can identify interfaces by using software commands. To display information about all interfaces, use the **show interfaces** command. To display information about a specific interface, use the **show interfaces** command with the interface type, slot number, and port number in the format **show interfaces** *type slot*/*port*.

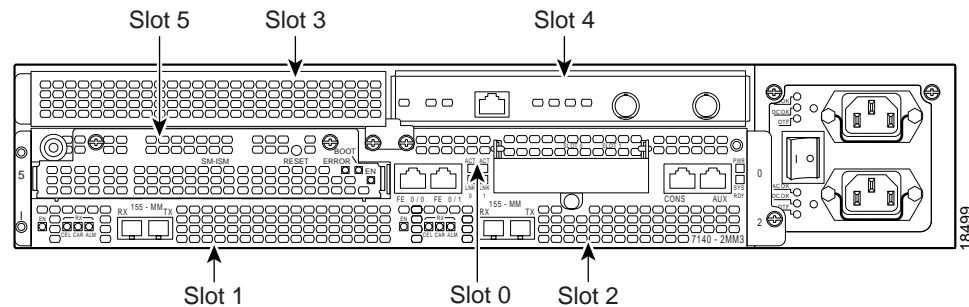The following example shows how the **show interfaces** command, used without arguments, displays status information (including the slot and port number) for each interface in a Cisco 7100 series VPN router. In the following example, most of the status information for each interface is omitted:

```
Router# show interfaces
FastEthernet0/0 is up, line protocol is up
  Hardware is DEC21140A, address is 0050.73ff.6300 (bia 0050.73ff.6300)
  Internet address is 10.0.0.0/1
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,
    (display text omitted)

FastEthernet0/1 is administratively down, line protocol is down
  Hardware is DEC21140A, address is 0050.73ff.6301 (bia 0050.73ff.6301)
  Internet address is 10.0.0.0/2
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
    (display text omitted)

Serial1/0 is administratively down, line protocol is down
  Hardware is M2T-T3 pa
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
    (display text omitted)

Serial1/1 is administratively down, line protocol is down
  Hardware is M2T-T3 pa
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
    (display text omitted)

FastEthernet4/0 is administratively down, line protocol is down
  Hardware is DEC21140, address is 0050.73ff.6370 (bia 0050.73ff.6370)
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
    (display text omitted)
```

```
You can also use arguments such as the interface type (Ethernet, Token Ring, ATM, and so
forth) and the slot/port number to display information about a specific interface only.
The following example shows the display for the fixed LAN (Fast Ethernet interface) port 0
in slot 0:
Router# show interfaces fastethernet 0/0
FastEthernet0/0 is up, line protocol is up
  Hardware is DEC21140A, address is 0050.73ff.6300 (bia 0050.73ff.6300)
  Internet address is 10.0.0.0/1
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,
     reliablility 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Half-duplex, 10Mb/s, 100BaseTX/FX
  ARP type:ARPA, ARP Timeout 04:00:00
  Last input 00:00:04, output 00:00:03, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy:fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 2000 bits/sec, 1 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     134 packets input, 41451 bytes
     Received 134 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 0 multicast
     0 input packets with dribble condition detected
     26 packets output, 5281 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
```

For information on the other commands used to configure the router, refer to the Cisco IOS configuration guides and command references, which are available on the Documentation CD-ROM or in print.

MAC Addresses

The *Media Access Control (MAC)* or *hardware* address is a standardized data-link layer address that is required for certain network interface types. These addresses are not used by other devices in the network; they are specific and unique to each port. The router uses a specific method to assign and control the MAC addresses of its port adapters.

All LAN interfaces (ports) require unique MAC addresses. Typically, the MAC address of an interface is stored on a memory component that resides directly on the interface circuitry; however, the online insertion and removal (OIR) feature requires a different method. (For a description of OIR, see "Online Insertion and Removal" section on page 1-33.)

The OIR feature allows you to remove a port adapter and replace it with another identically configured one. If the new port adapter matches the port adapter you removed, the system immediately brings it on line. To allow OIR, an address allocator with unique MAC addresses is stored in an EEPROM on the router. Each address is reserved for a specific port and slot in the router regardless of whether a port adapter resides in that slot. The MAC addresses are assigned to slot 3 in Cisco 7120 series routers and slot 4 in Cisco 7140 series routers. This address scheme allows you to remove a port adapter and insert the port adapter into other routers without causing the MAC addresses to move around the network or be assigned to multiple devices.

If the MAC addresses were stored on each port adapter, OIR would not function because you could never replace one port adapter with an identical one; the MAC addresses would always be different. Also, each time a port adapter was replaced, other devices on the network would have to update their data structures with the new address and, if they did not do so quickly enough, could cause the same MAC address to appear in more than one device at the same time.

> **Note**   Storing the MAC addresses for every slot in one central location means the addresses stay with the memory device on which they are stored.

Online Insertion and Removal

The modular port adapter installed in Cisco 7100 series VPN routers supports OIR. This function allows you to install and replace a port adapter while the router is operating; you do not need to notify the software or shut down the system power. This provides a method that is seamless to end users on the network, maintains all routing information, and preserves sessions.

The following is a functional description of OIR for background information only; for specific procedures for installing and replacing a port adapter in a Cisco 7100 series VPN router, see the configuration note that ships with each port adapter.

Each port adapter has a bus connector that connects it to the router. Each connector has a set of tiered pins in three lengths that send specific signals to the system as they make contact with the port adapter. The system assesses the signals it receives and the order in which it receives them to determine if a port adapter is being removed or inserted into the router. From these signals, the system determines whether to reinitialize a new interface or shut down a removed interface. For example, when you insert a port adapter, the longest pins make contact with the port adapter first, and the shortest pins make contact last. The system recognizes the signals and the sequence in which it receives them.

When you remove or insert a port adapter in a Cisco 7100 series VPN router, the port adapter pins send signals to notify the system, which then performs as follows:

1. Rapidly scans the system for configuration changes.

2. Initializes all newly inserted port adapters, noting any removed interfaces and placing them in the administratively shutdown state.

3. Brings all previously configured interfaces on the port adapter back to the state they were in when they were removed. Any newly inserted interfaces are put in the administratively shutdown state, as if they were present (but not configured) at boot time. If a similar port adapter type is reinserted into a slot, its ports are configured and brought on line up to the port count of the original port adapter.

Peripheral Component Interconnect Buses

All interfaces connect to two Peripheral Component Interconnect (PCI) buses on the router that provide a path to packet I/O memory and the network processor. Interfaces in slots 1, 3, and 5 use PCI bus 0 and interfaces in slots 0, 2, and 4 use PCI bus 1. For port adapters that are installed in the modular port adapter slots (slot 3 or slot 4), use the guidelines described in Appendix A, "Modular Port Adapter Configuration Guidelines," to ensure sufficient bandwidth.

The maximum recommended bandwidth points on each PCI bus is 600 points. For best performance we recommend that you avoid using port adapters that exceed the total available bandwidth for your router.

Network Processor Card

The network processor card resides inside the chassis and is shown in Figure 1-33. The network processor card provides the following features:

- Senses OIR of the port adapters
- Bridges the PCI buses from the interfaces to packet memory
- Arbitrates traffic across the PCI buses
- Generates the clock signals for the interfaces on each PCI bus

The network processor card also performs the following system management functions:

- Sending and receiving routing protocol updates
- Managing tables, caches, and buffers
- Monitoring interface and environmental status
- Providing Simple Network Management Protocol (SNMP) management and the console or Telnet interface
- Accounting and switching of data traffic
- Booting and reloading images
- Managing port adapters (recognition and initialization during OIR)

Note Instructions for removing and replacing memory components on the network processor card, such as the SDRAM DIMMs, are contained in the *Installing Field-Replaceable Units in Cisco 7100 Series VPN Routers* document available online and on the Documentation CD.

Figure 1-33   Network Processor Card
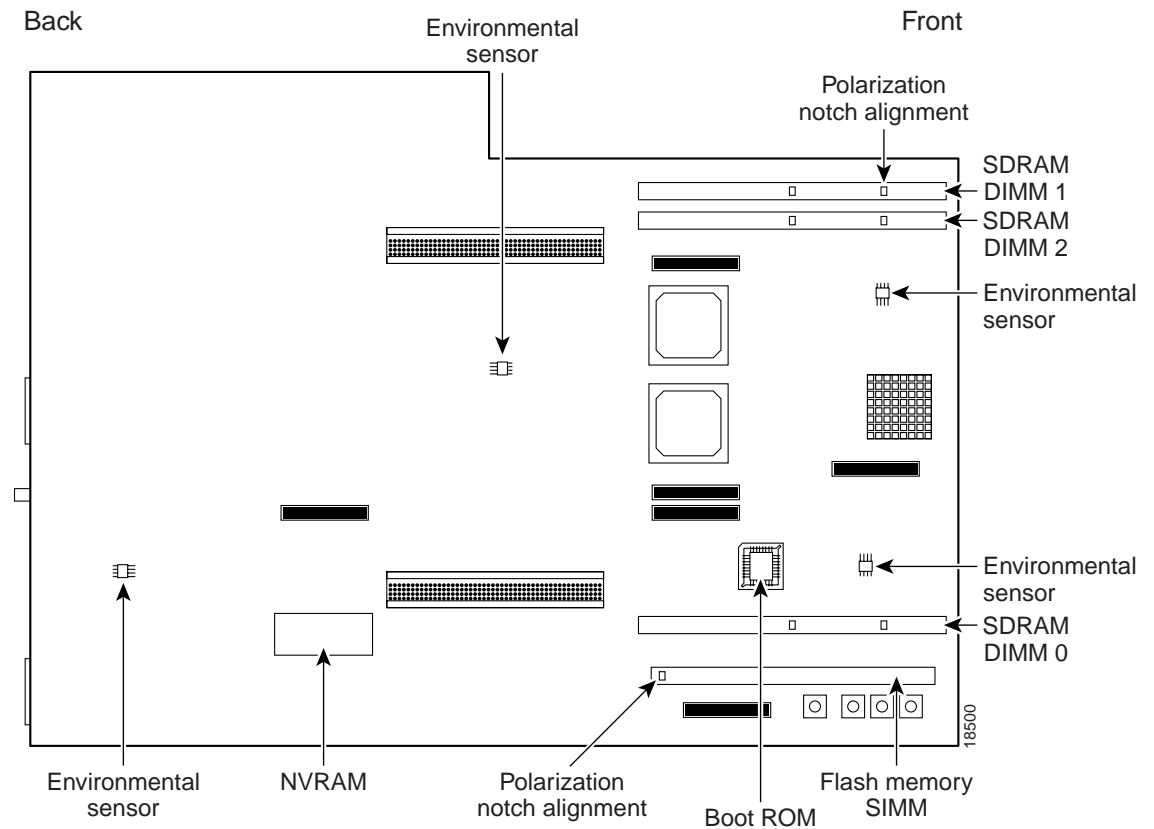
The network processor card consists of the following components:

- Reduced Instruction Set Computing (RISC) microprocessor

- Two system controllers—Provide processor access to two separate banks of SDRAM and that permit devices on both PCI buses to access either SDRAM bank. This means that devices on different PCI buses can access different SDRAM banks simultaneously.

- Upgradable memory modules—SDRAM system memory is up to 256 MB. (SDRAM packet memory is fixed at 64 MB.) SDRAM memory stores packets received or sent from network interfaces, routing tables, and network accounting applications. There are two independent SDRAM memory arrays that allow concurrent access by interfaces and the processor.

Note   The network processor card contains two SDRAM slots for user-configurable system and packet memory, DIMM 1 and DIMM 2. The amount of memory installed in slot DIMM 1 must be greater than or equal to the amount of memory installed in slot DIMM 2, and slot DIMM 2 can be zero.

Slot DIMM 0 is used exclusively for packet memory and is fixed at 64 MB in the factory.

- Cache memory
  - Cisco 7120 series routers have two levels of cache: a primary cache that is internal to the microprocessor and a secondary, 2-MB (fixed) external cache that provides additional high-speed storage for data and instructions.

- – Cisco 7140 series routers have three levels of cache: a primary and a secondary cache that are internal to the microprocessor and a tertiary, 2-MB (fixed) external cache that provides additional high-speed storage for data and instructions.
- Four environmental sensors—Monitor the cooling air as it leaves the chassis.
- Boot ROM—Stores sufficient code for booting the Cisco IOS software.
- Flash memory single in-line memory module (SIMM)—Stores the boot image used to boot the router.
- NVRAM—Stores the system configuration and environmental monitoring logs (the NVRAM uses lithium batteries to maintain its contents when disconnected from power).
- Console port—Provides access for a local terminal and is equipped with an RJ-45 receptacle.
- Auxiliary port—Provides access for a modem for remote access and is equipped with an RJ-45 receptacle.
- Two fixed LAN ports—Provide 10BaseT/100BaseTX autosensing Ethernet/Fast Ethernet (full and half duplex) and are equipped with an RJ-45 receptacle.
- Two PC Card slots—Contain Flash Disks or Flash memory cards that provide the default Cisco IOS software image.

Table 1-15 describes the memory types on the network processor card.

Table 1-15   Network Processor Memory Components

Memory Type	Size	Quantity	Description	Location
SDRAM memory	64 to 128 MB	2 configurable[1] SDRAM slots	64–128-MB DIMMs (based on maximum SDRAM required)	DIMM 1 = U13 DIMM 2 = U14
Boot ROM	512 KB	1	OTP[2] ROM for the ROM monitor program	Socket U21

Table 1-15   Network Processor Memory Components (continued)

Memory Type	Size	Quantity	Description	Location
Primary cache				
Cisco 7120	32 KB (instruction), 32 KB (data)	–	Processor's primary internal cache	Internal to processor
Cisco 7140	16 KB (instruction), 16 KB (data)	–	Processor's primary internal cache	Internal to processor
Secondary cache[3]	256 KB	–	Processor's secondary unified instruction and data cache	Internal to Cisco 7140 processors only
External cache	2 MB (fixed)	–	Secondary external cache for Cisco 7120 series processors Tertiary external cache for Cisco 7140 series processors	–
Flash memory SIMM	8 MB	1	Contains the default boot helper image	Flash SIMM socket P2
Flash Disk	48 MB and 128 MB	Up to 2	Contains the default Cisco IOS image	PC Card slot 0 and slot 1
NVRAM	128 KB	1	Nonvolatile EPROM for the system configuration file	U69

1. Slot DIMM 0 (U16) is used exclusively for packet memory and is not user-configurable.

2. OTP = one-time programmable.

3. Cisco 7120 series routers do not have a secondary internal cache.

To identify the processor and software version installed in your Cisco 7100 series VPN router, use the **show version** command. The following example using a Cisco 7120 series router shows sample output from the **show version** command:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) EGR Software (c7100-P-M), Released Version 12.0(4)XE
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Mon 07-Jun-99 17:49 by biff
Image text-base:0x600088F8, data-base:0x60A54000

ROM:System Bootstrap, Version 12.0(4)XE, RELEASED SOFTWARE
BOOTFLASH:EGR Software (c7100-BOOT-M), Released Version 12.0(4)XE

Router uptime is 19 minutes
System restarted by reload
System image file is "c7100-p-mz"

cisco 7120-T3 (EGR) processor with 61440K/69632K bytes of memory.
R527x CPU at 225Mhz, Implementation 40, Rev 10.0, 2048KB L2 Cache
Last reset from power-on
X.25 software, Version 3.0.0.
```

```
3 FastEthernet/IEEE 802.3 interface(s)
1 Serial network interface(s)
125K bytes of non-volatile configuration memory.

4096K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x2000
```

System LEDs and Reset Button

Cisco 7100 series VPN routers provide LEDs to indicate the status of the router and a CPU reset button that allows you to reset the entire system. The LEDs are shown in Figure 1-34 and described in Table 1-16.

Caution   To prevent system errors and problems, use the CPU reset button only at the direction of your service representative.

Figure 1-34   Cisco 7100 Series System LEDs
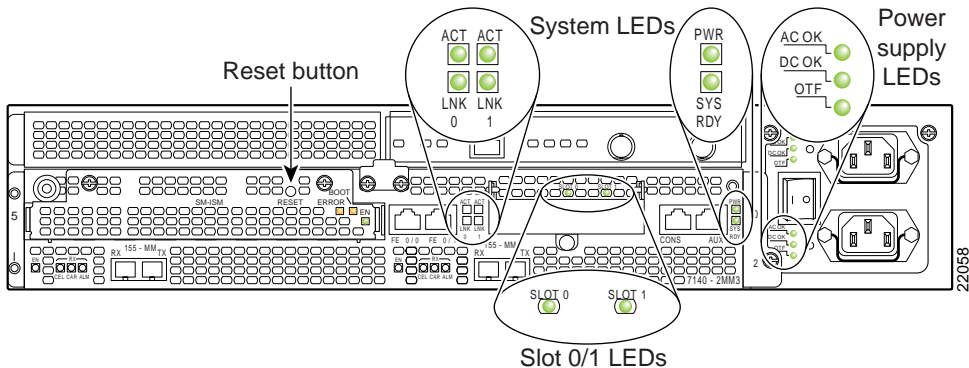
Note   The Cisco 7100 series system LEDs are identical for all models except that Cisco 7120 series routers have no power supply LEDs, while Cisco 7140 series routers have two identical banks of three LEDs that correspond to each AC-input receptacle.

Table 1-16   Cisco 7100 Series System LED Descriptions

LED Label	Color	State	Function
ACT 0 ACT 1	Green	On	Indicates 10BaseT/100BaseTX Ethernet ports are transmitting or receiving packets (activity).
LNK 0 LNK 1	Green	On	Indicates 10BaseT/100BaseTX Ethernet ports have established a valid link with the network. This LED remains off during normal operation of the router, unless there is an incoming carrier signal.
SLOT 0 SLOT 1	Green	On	Indicates which PC Card slot is in use when either slot is being accessed by the system. These LEDs remain off during normal operation of the router.

Table 1-16   Cisco 7100 Series System LED Descriptions (continued)

LED Label	Color	State	Function
PWR	Green	On	Indicates that the power supply is delivering AC-input power to the router.
SYS RDY	Green	On	Indicates the system is operational.
AC OK	Green	On	Indicates that AC input is within normal range.
DC OK	Green	On	Indicates that DC output is within normal range.
OTF	Green	On	Indicates that internal temperatures are normal.
	Amber	On	Indicates a power supply fan failure.

Environmental Monitoring and Reporting Functions

Environmental monitoring and reporting functions are controlled by the network processor and allow you to maintain normal system operation by identifying and resolving adverse conditions that might disrupt operation.

The environmental monitoring functions constantly monitor the internal chassis air temperature and power supply voltages and currents. The power supply monitors its own voltage and temperature and shuts itself down if it detects a critical condition within the power supply. The reporting functions periodically log the values of measured parameters so that you can retrieve them for analysis later, and the reporting functions display warnings on the console if any of the monitored parameters exceed defined thresholds.

The front and back of the chassis must remain unobstructed to ensure adequate airflow and prevent overheating inside the chassis; we recommend at least 3 inches (7.6 cm) of clearance. Temperature sensors in the router monitor the internal air temperature and send warning messages when the internal air temperature exceeds the specified threshold.

Environmental Monitoring

The environmental monitoring functions use four sensors to monitor the temperature of the cooling air as it moves through the chassis.

If the air temperature exceeds a defined threshold, the router displays warning messages on the console terminal. The system stores the present parameter measurements for both temperature and power voltage in NVRAM so you can retrieve them later.

In addition, the power supply monitors the internal power supply temperature and voltages. A power supply is either within tolerance (normal) or out of tolerance (critical). If the internal power supply temperature or voltage reaches a critical level, the power supply shuts down without any interaction with the system processor.

The environmental monitoring functions use the following levels of status conditions to monitor the system:

- Normal—All monitored parameters are within normal tolerances.
- Warning—The system has exceeded a specified threshold. The system continues to operate, but operator action is recommended to bring the system back to a normal state.
- Critical—An out-of-tolerance temperature or voltage condition exists. The system continues to operate; however, immediate operator action is required.

✎

Note   For more information on troubleshooting an overtemperature condition in your router, see the "Troubleshooting the Cooling Subsystem" section on page 5-6.

Table 1-17 lists the typical temperature thresholds for each network processor type, and Table 1-18 lists the power thresholds for the normal, warning, and critical (power supply-monitored) levels.

Table 1-17   Typical Processor-Monitored Temperature Thresholds

Parameter	High Warning	High Critical
Core	120°F (49°C)	129°F (54°C)
Chassis inlet	109°F (43°C)	118°F (48°C)
Chassis outlet 1	114°F (46°C)	123°F (51°C)
Chassis outlet 2	116°F (47°C)	125°F (52°C)

✎

Note   If the system reports temperatures in the critical range, you must manually shut down the router. The processor cannot shut down the router automatically.

Table 1-18   Typical Power Supply-Monitored Voltage Thresholds

Parameter	Low Critical	Low Warning	High Warning	High Critical
+2.5V	+2.35V	+2.39V	+2.69V	+2.72V
+3.3V	+3.11V	+3.19V	+3.39V	+3.47V
+5.15V	+4.88	+5.00	+5.23	+5.39
+12.3V	+11.53	+11.77	+12.76	+13.05
+12.3V	+11.53	+11.77	+12.76	+13.05
−12.5V	−10.20V	−11.24V	−13.71V	−14.33V

Displaying Environmental Status Reports

Cisco 7100 series VPN routers display warning messages on the console if chassis interface-monitored parameters exceed a desired threshold. You can also retrieve and display environmental status reports with the **show environment**, **show environment all**, **show environment last**, and **show environment table** commands. Parameters are measured and reporting functions are updated every 60 seconds. A brief description of each of these commands follows.

⚠

Caution   To prevent overheating the chassis, ensure that your system is drawing cool inlet air. Overtemperature conditions can occur if the system is drawing in the exhaust air of other equipment. Ensure adequate clearance around the sides of the chassis so that cooling air can flow through the chassis interior unimpeded and exhaust air exits the chassis and is not drawn into the inlet vent of other device.

The **show environment** command displays the current environmental status of the system. The report displays parameters that are out of the normal values. No parameters are displayed if the system status is normal. The example that follows shows the display for a system in which all monitored parameters are within normal range:

```
Router# show environment
All measured values are normal
```

If the environmental status is *not* normal, the system reports the worst-case status level. Following is a sample overvoltage warning:

```
Router# show environment
Warning: +3.3 V measured at +3.41 V
```

The **show environment last** command retrieves and displays the NVRAM log, which provides a record of environmental status readings. Air temperature is measured and displayed, and the voltage supplied by the power supply is also displayed.

Following is sample output of the **show environment last** command:

```
Router# show environment last
  chassis corepreviously measured at 34C/93F
  chassis inletpreviously measured at 28C/82F
  chassis outlet 1previously measured at 31C/87F
  chassis outlet 2previously measured at 33C/91F
  +2.5 Vpreviously measured at +2.59
  +3.3 Vpreviously measured at +3.32
  +5.15 Vpreviously measured at +5.13
  +12.3 Vpreviously measured at +12.99
  +12.3 Vpreviously measured at +12.33
  -12.5 Vpreviously measured at -12.43
```

The **show environment table** command displays the temperature and voltage thresholds for each temperature sensor and for each monitored status level, which are related to those thresholds listed in .

Following is sample output of the **show environment table** command:

```
Router# show environment table
Sample Point      LowCritical      LowWarning       HighWarning      HighCritical
chassis core                                        49C/120F         54C/129F
chassis inlet                                       43C/109F         48C/118F
chassis outlet 1                                    46C/114F         51C/123F
chassis outlet 2                                    47C/116F         52C/125F
+2.5 V            +2.35            +2.39            +2.69            +2.72
+3.3 V            +3.11            +3.19            +3.39            +3.47
+5.15 V           +4.88            +5.00            +5.23            +5.39
+12.3 V           +11.53           +11.77           +12.76           +13.05
+12.3 V           +11.53           +11.77           +12.76           +13.05
-12.5 V           -10.20           -11.24           -13.71           -14.33
```

Note   Temperature ranges and values are subject to change.

The **show environment all** command displays an extended report that includes temperature readings and voltage readings.

Following is sample output of the **show environment all** command:

```
Router# show environment all
```

```
Power Supply:
        Power supply is standard power supply. Unit is on.

Temperature readings:
        chassis core     measured at 33C/91F
        chassis inlet    measured at 27C/80F
        chassis outlet 1 measured at 30C/86F
        chassis outlet 2 measured at 32C/89F

Voltage readings:
        +2.5 V  measured at +2.59 V
        +3.3 V  measured at +3.32 V
        +5.15 V measured at +5.13 V
        +12.3 V measured at +12.29 V
        +12.3 V measured at +12.33 V
        -12.5 V measured at -12.43 V

Envm stats saved 2 time(s) since reload
```

Fan Failures

When the system power is on, all four fans should be operational. The system continues to operate if a fan fails; however, if the air temperature exceeds a defined threshold, the router displays warning messages on the console terminal. (See the "Troubleshooting the Cooling Subsystem" section on page 5-6.)

For complete descriptions and instructions of the environmental monitor commands, refer to the *Configuration Fundamentals Configuration Guide* and *Configuration Fundamentals Command Reference* publications, available online and on the Documentation CD.