Product Overview

This chapter provides an overview of the Cisco 6260 Digital Subscriber Line (DSL) Access Multiplexer (DSLAM) and its related components, collectively known as the Cisco 6260 system. This chapter contains the following sections:

1.1 Introduction to the Cisco 6260 System

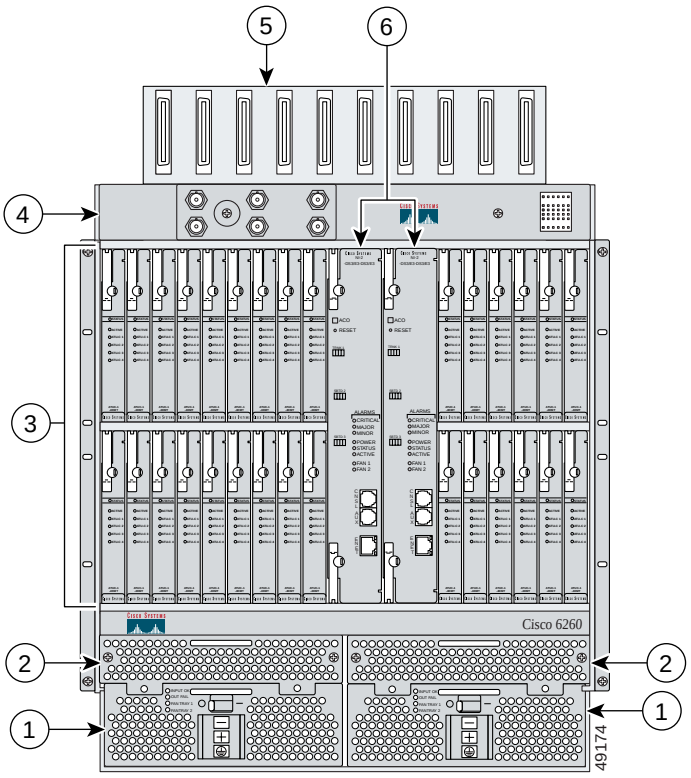
The Cisco 6260 system is part of the Cisco DSL product family that provides end-to-end service by carrying voice or data traffic, or both, between a subscriber's home or office, a telephone central office (CO), and various networks beyond. The Cisco 6260 system sends and receives subscriber data (often Internet service) over existing copper telephone lines, concentrating all traffic onto a single high-speed trunk for transport to the Internet or a corporate intranet. Before traveling over telephone lines to the DSLAM at the CO, data is modulated by *x*DSL customer premises equipment (CPE) devices, which are connected to PCs or routers at the subscriber site.

The Cisco 6260 system may include the following components:

- Cisco 6260 chassis—A carrier class DSLAM.
  - *x*DSL Transmission Unit—central office (*x*TU-C) line cards and second generation network interface (NI-2) card(s)
  - Input/output module
  - Power entry modules (PEMs)
  - Fan trays

  Figure 1-1 shows the location of the Cisco 6260 chassis components.

Figure 1-1 Cisco 6260 Chassis Components



1	PEMs	**4**	I/O module
2	Fan trays	**5**	Subscriber champ connectors
3	*x*TU-C line cards (slots 1 to 9, 12 to 17, 18 to 26, and 27 to 32)	**6**	NI-2 card(s)

- POTS splitters (optional). The POTS splitter is a passive device that supports simultaneous voice (basic telephone service) and data services.

Note POTS splitters are available from Cisco Ecosystem partners. Please verify the compatibility with your Cisco representative.

For POTS splitter information, refer to the vendor documentation.

- Management software—Provisions and manages the Cisco 6260 system.
  - Cisco IOS—A command-line interface (CLI) that is available for network element provisioning.
  - Cisco DSL Manager (CDM)—An element management system designed to configure and manage the 6xxx series of Cisco IOS software-based DSLAMs through a graphical-user interface (GUI). CDM provides the following areas of network management: fault, configuration, performance, and security. CDM runs within the Cisco Element Manager Framework (EMF); both are installed on Sun workstations.

Cisco EMF is based on an object model in which network elements or modules represent the managed entity. Each object is defined by a class and specific attributes. An object can represent a network element or a more abstract entity such as a link relationship, a network, or a container such as a site, shelf, or region.

Note See the "Hardware Specifications" section on page A-1 for minimum software and network management release requirements per Cisco 6260 chassis component.

1.1.1 Features

The Cisco 6260 system includes the following features:

- Supports ADSL, SDSL, and SHDSL.
- ANSI T1.413 Discrete Multitone (DMT), G.DMT, G.lite, and single-pair, high-speed DSL (G.SHDSL) modem support.
- E3, E1, and OC-3c network transmission connections.
- Small footprint that terminates up to 240 ADSL, 120 SDSL, or 240 G.SHDSL subscriber connections and multiplexes them onto a network trunk.
- European Telecommunication Standards Institute (ETSI) compliant, 19-inch (48.26 cm) chassis.
- Completely front-accessible chassis for cabling and maintenance, eliminating the need for access to the back of the unit.
- Chassis has 30 line card slots, redundant power entry modules (PEMs), and two-speed, software-controlled cooling fans.
- Manageable through IOS or CDM.
- Supports subtending of as many as twelve Cisco 6260 chassis for a maximum of 3120 subscribers.
- Building integrated timing supply (BITS) clock input.
- Facility alarm input.
- Supports the entire range of virtual channel identifier (VCI)/virtual path identifier (VPI) connections, and connections are not limited by memory.
- ATM Forum User-Network Interface (UNI) Version 3.1 compliant.
- Nonblocking ATM switching architecture.
- Allows up to four ATM classes of service simultaneously.

1.1.2 Configurations

This guide provides information about the following configurations:

- Cisco 6260 system with a POTS splitter
- Cisco 6260 system without a POTS splitter
- Inverse multiplexing over ATM (IMA)
- Subtended network

1.1.2.1 Cisco 6260 System with a POTS Splitter Configuration

The Cisco 6260 system with a POTS splitter configuration supports up to 240 data subscribers. To increase subscribership, you can add chassis to your system.

This configuration can include the following hardware components:

- Cisco 6260 chassis
  - Quad-port DMT ATU-C line cards (4xDMTs)
  - Quad-port DMT ATU-C over ISDN line cards (4xDMTs over ISDN)
  - Quad-port flexi ATU-C line cards (4xflexis)
  - Octal-port DMT ATU-C line cards (8xDMTs)
  - Octal-port DMT ATU-C over ISDN line cards (8xDMTs over ISDN)
  - DS3/2DS3, DS3+T1/E1 IMA, or OC-3c/OC-3c NI-2 card
  - E3, E1, or OC-3c I/O module
  - PEM(s)
  - Fan Trays
- Third-party POTS splitter

1.1.2.2 Cisco 6260 System Without a POTS Splitter Configuration

The Cisco 6260 system without a POTS splitter configuration supports up to 240 data subscribers. To increase subscribership, you can add chassis to your system.

This configuration can include the following hardware components:

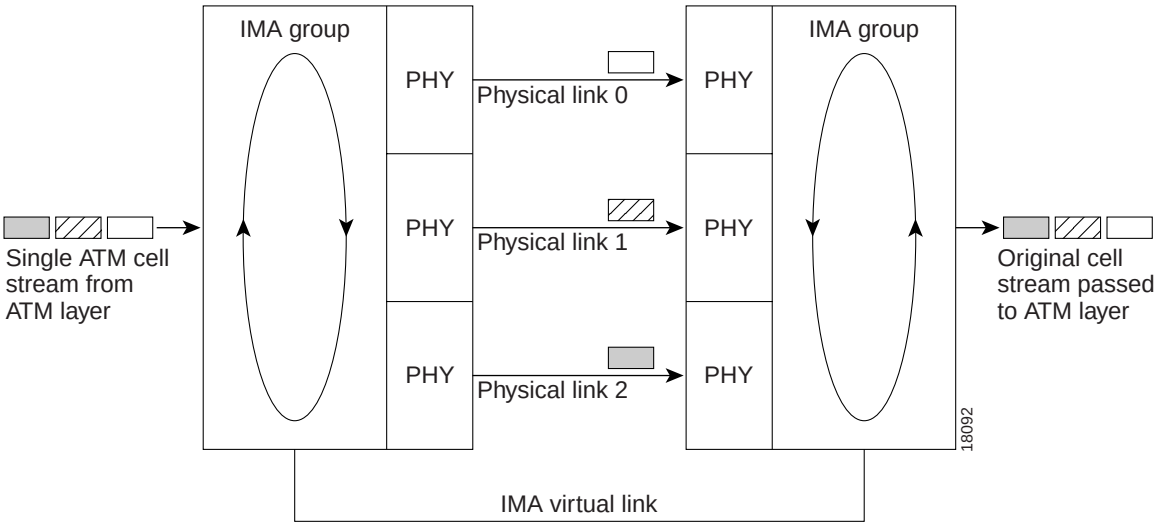
- Cisco 6260 chassis
  - Quad-port DMT ATU-C line cards (4xDMTs)
  - Quad-port DMT ATU-C over ISDN line cards (4xDMTs over ISDN)
  - Quad-port flexi ATU-C line cards (4xflexis)
  - Quad-port STU-C line cards (4xSDSLs)
  - Octal-port DMT ATU-C line cards (8xDMTs)
  - Octal-Port G.SHDSL SHTU-C line cards (8xG.SHDSL)
  - DS3/2DS3, DS3+T1/E1 IMA, or OC-3c/OC-3c NI-2 card
  - E3, E1, or OC-3c I/O module
  - PEM(s)
  - Fan Trays

1.1.2.3 IMA Configuration

The DS3+T1/E1 IMA NI-2 card uses inverse multiplexing over ATM (IMA) technology to aggregate multiple low-speed links into one larger virtual network trunk or IMA group. An inverse multiplexer appears to your ATM switch router as one logical pipe. IMA provides you with modular bandwidth to access the ATM network between T1/E1 and DS3/E3 rates. The Cisco 6260 system allows you to combine up to eight E1 lines to form an IMA group.

IMA breaks up the ATM cell stream, distributes the cells over the multiple physical links of an IMA group, and recombines the cells into a single stream at the other end of the connection. The ATM cells are distributed in a round-robin fashion over the physical links of the IMA group, recombined at the receiving IMA group, and passed in their original form to the ATM layer (see Figure 1-2). Using the multiple links of an IMA group increases the logical link bandwidth to approximately the sum of the individual link rates. The physical links should be nominally the same length to avoid excessive intragroup delay. We recommend that all of the links in an IMA group be bundled together between the source and the destination.

Figure 1-2 Inverse Multiplexing and Recombining of ATM Cells Through IMA Groups



E1 I/O modules have eight ports. You can use the eight ports on the E1 I/O modules as independent ATM links or in the IMA mode. The following bullets are examples of possible IMA groups, independent ATM links, and mixed modes. In examples of IMA groups, two links are assumed per group.

- Four IMA groups with any combination of eight links
- Three IMA groups and up to two independent ATM links
- Two IMA groups and up to four independent ATM links
- One IMA group and up to six independent ATM links
- No IMA group and up to eight independent ATM links

The E1 (1.544 Mbps) IMA port adapters provide network trunk or subtend connectivity and are used for intercampus or wide-area links. The E1 IMA port adapters support unshielded twisted-pair (UTP) connectors. The order of assignment of links to an IMA group is not restricted.

The IMA group interfaces use a naming convention different from those used by the other interfaces in the system. IMA group interfaces are named with the convention *atm<slot>/ima<group>*, where *<slot>* is the slot number for the DS3+T1/E1 IMA NI-2 card and *<group>* is the IMA group number from 0 to 3. Table 1-1 lists the interface naming conventions.

Table 1-1 IMA Group Interface Names

Interface	Name
DS3 link	atm0/1
T1/E1 link 0	atm0/2
T1/E1 link 1	atm0/3
T1/E1 link 2	atm0/4
T1/E1 link 3	atm0/5
T1/E1 link 4	atm0/6
T1/E1 link 5	atm0/7
T1/E1 link 6	atm0/8
T1/E1 link 7	atm0/9
IMA group 0	atm0/ima0
IMA group 1	atm0/ima1
IMA group 2	atm0/ima2
IMA group 3	atm0/ima3

1.1.2.4 Subtended Network Configuration

The term *subtending* refers to the host chassis, and *subtended* refers to the downstream chassis in a subtended network.

Note For information on enabling redundancy in subtended network configurations, see the "Redundancy in Subtended Configurations" section on page 1-41.

A subtended network configuration

- Services and aggregates the data from one or more Cisco 6260 chassis into a subtending host chassis to take advantage of the data network interface on the subtending host chassis.
- Reduces the number of ATM edge-switch ports required to terminate the chassis.
- Supports a Cisco 6260 system with a POTS splitter and a Cisco 6260 system without a POTS splitter configuration.

A subtended network configuration supports the following features:

- Four arbitration priorities, one for each quality of service (QoS) level. The supported QoS service levels are
  - Constant bit rate (CBR) for rate-limited services that require guaranteed bandwidth and bounded delay
  - Variable bit rate real time (VBR-rt) for delay-sensitive voice and video services
  - Variable bit rate nonreal time (VBR-nrt) for high-priority data services
  - Unspecified bit rate (UBR) for low-priority data services
- Explicit forward congestion indication (EFCI) marking for available bit rate (ABR) service support.
- Guaranteed frame rate (GFR).

- Tree or daisy chain topology configurations for E3 subtended Cisco 6260 chassis.
- Star topology configurations for E1 or IMA group subtended Cisco 6260 chassis.
- Daisy chain configurations for OC-3c subtended Cisco 6260 chassis.
- Fair access to the trunk port for each subtended chassis.
- A network trunk port that operates as fast as any subtended link.

The NI-2 card provides one of following types of subtended network connections:

- An E3 ATM interface
- A high-speed OC-3c optical ATM interface that supports single-mode fiber (SMF) intermediate range
- A high-speed OC-3c optical ATM interface that supports multimode fiber (MMF) short range
- Up to eight E1 interfaces when you are using the DS3+T1/E1 IMA NI-2 card in conjunction with the E1 I/O module.
- Up to four IMA interfaces when you are using the DS3+T1/E1 IMA NI-2 card in conjunction with the E1 I/O module.

The following sections detail the different types of subtending network connections.

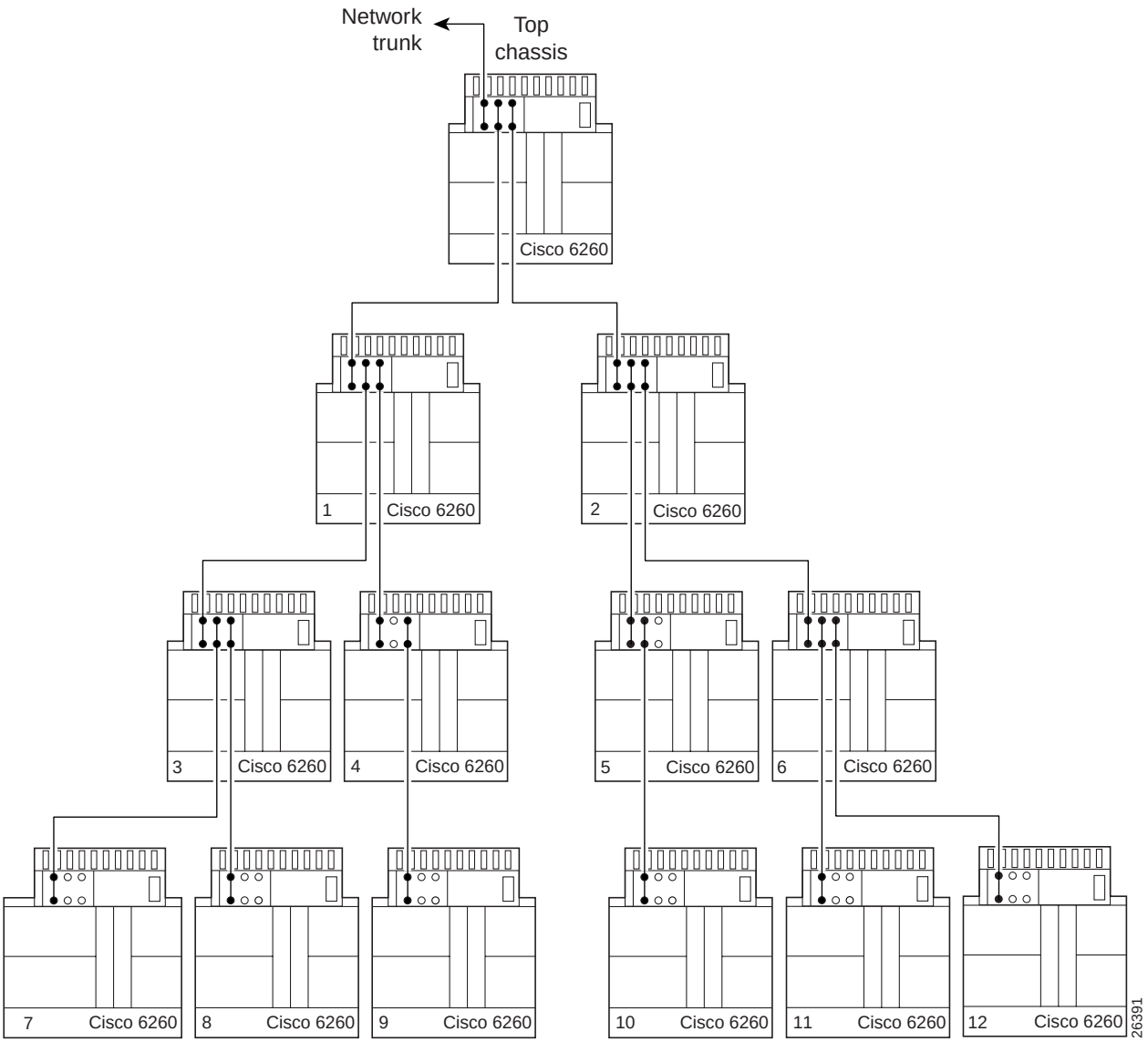
1.1.2.4.1 Subtended Network Configuration with DS3/2DS3 NI-2 Cards

In a subtended network configuration using DS3/2DS3 NI-2 cards, you can subtend a Cisco 6260 chassis to four tiers, with up to 12 chassis, all connecting through one subtending host chassis to the ATM backbone.

When the DS3/2DS3 NI-2 card is installed in the Cisco 6260 chassis, it adopts E3 functionality.

Figure 1-3 shows E3-configured Cisco 6260 systems subtended in a combined subtending tree topology with daisy chain. The subtending host chassis at the top of the subtending tree connects directly to the ATM switch. The middle two Cisco 6260 chassis in the lowest level are daisy chained. You make network interface connections at the I/O module that is installed on the front of the Cisco 6260 chassis.

Figure 1-3 Subtended Network Configuration with DS3/2DS3 NI-2 Cards



For each chassis in a subtended network configuration to have fair access to the shared network trunk, the chassis must have a unique ID number. The subtending host chassis places this ID number in the GFC field of the ATM header of each cell; this ID number is then used to forward cells up the tree to the network trunk.

Note You can subtend Cisco 6260 chassis with DS3/2DS3 NI-2 cards in a continuous daisy chain. However, a daisy-chained subtending scheme is not optimal for data throughput for Cisco 6260 chassis that use DS3/2DS3 NI-2 cards.

Cisco IOS software does not manage the primary Cisco 6260 chassis and all subtended Cisco 6260 chassis as a single large Cisco 6260 system. Each Cisco 6260 chassis supports an independent Cisco IOS processor and MIBs.

1.1.2.4.2 Subtended Network Configuration with DS3+T1/E1 IMA NI-2 Cards

In a subtended network configuration using DS3+T1/E1 IMA NI-2 cards, you can subtend Cisco 6260 systems in a star topology. The eight E1 links can be used as network trunk or subtend interfaces or can be combined into trunk or subtend IMA groups in the following two ways:

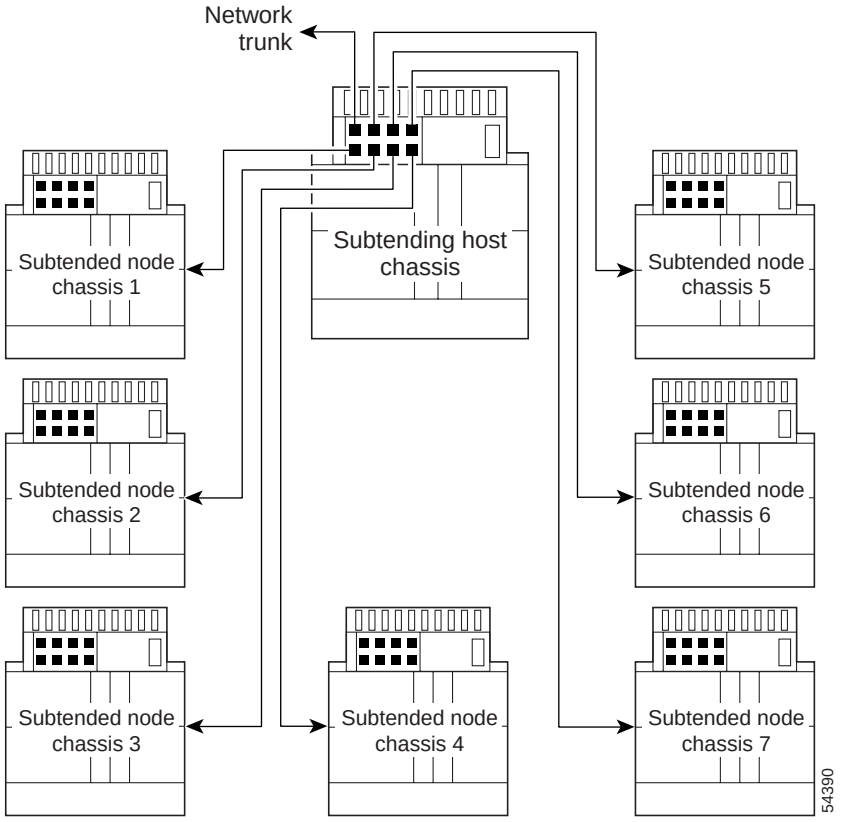
- E1 IMA group or E1 User-Network Interface (UNI) as the network trunk with seven subtended node chassis

Note If you are using an E1 trunk to the network, the trunk connection originates at one of the RJ-48 receptacle connectors on the E1 I/O module. Therefore, you can have only seven subtended node chassis.

- Up to seven individual E1 interfaces or up to four IMA groups, or a combination of the two

Figure 1-4 shows an example of a subtended network with a star topology. The subtending host chassis in the middle of the star topology connects directly to the ATM switch.

Figure 1-4 Subtended Network Configuration Using DS3+T1/E1 IMA NI-2 Cards



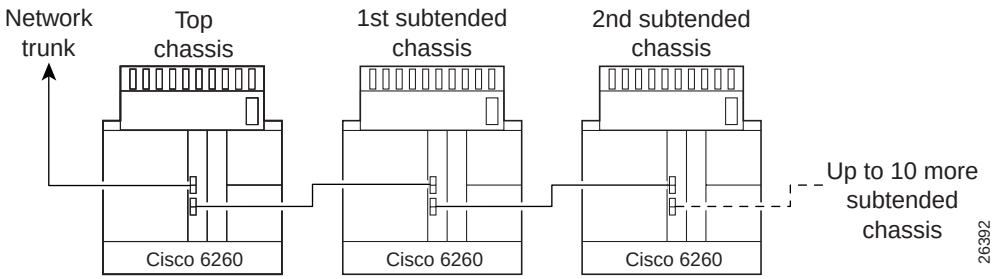
Note Consult with your network architect or Cisco customer service representative for examples of other subtending topology configurations.

1.1.2.4.3 Subtended Network Configuration with OC-3c/OC-3c NI-2 Cards

In a subtended network configuration using OC-3c/OC-3c NI-2 cards (SMF or MMF), you can subtend up to 12 OC-3c configured chassis in a daisy chain, all connecting through one subtending host chassis to the ATM backbone (see Figure 1-5).

Note The Cisco 6260 chassis can also serve as the subtending host chassis to, or as a subtended node chassis from, the Cisco 6100, Cisco 6130, Cisco 6015, or Cisco 6160 chassis.

Figure 1-5 Daisy Chain Topology for OC-3c Interfaces



1.2 Cisco 6260 System Overview

The Cisco 6260 system consists of circuitry and connections that reside within a chassis, an enclosure that allows modular insertion and removal of various field-replaceable units (FRUs). The Cisco 6260 system includes

- A card compartment with 32 slots: 30 slots for *x*TU-C line cards and two slots for NI-2 cards
- A set of connectors that serve subscriber lines with or without POTS splitters
- An I/O module
- Compartments for two PEMs, two fan trays, and air filters.

See Figure 1-1 for the location of the system components in the Cisco 6260 chassis.

Note For hardware specifications for the Cisco 6260 chassis, see the "Cisco 6260 Chassis" section on page A-2.

1.2.1 Cisco 6260 Card Compartment

The Cisco 6260 chassis contains a 32-slot card compartment holds NI-2 cards and *x*TU-C line cards. Table 1-2 describes each card slot assignment for the Cisco 6260 chassis.

Table 1-2 Cisco 6260 Card Slot Assignments

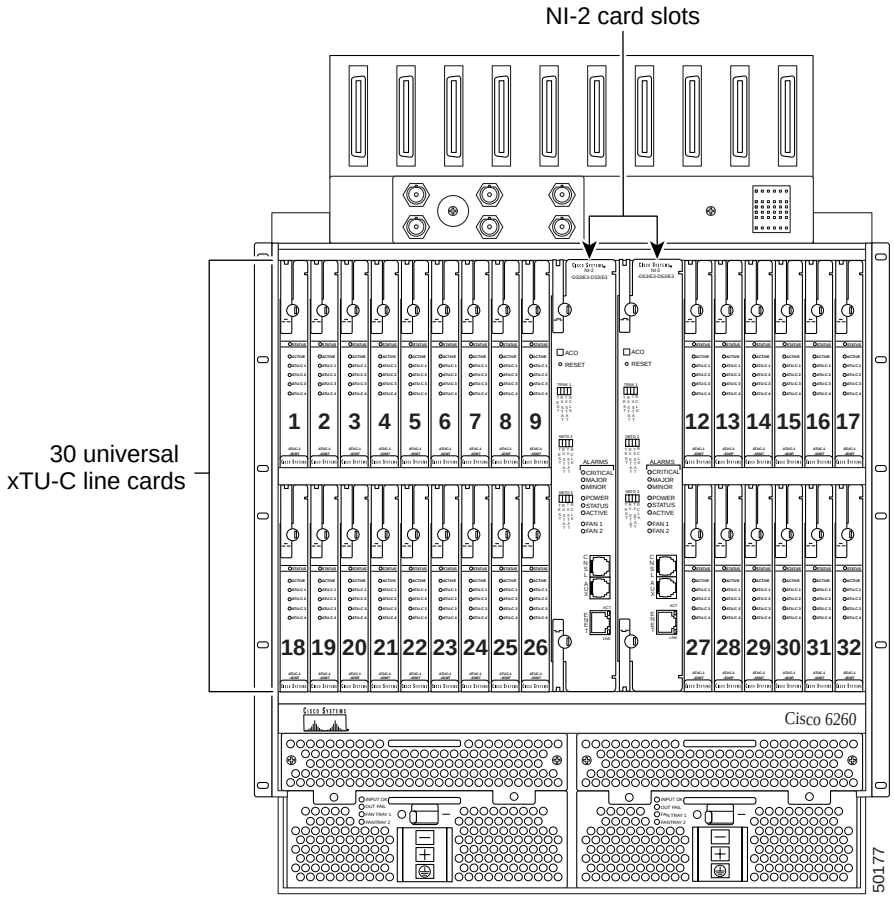
Card Slot	Card Assignment
1 to 9	4xDMT, 4xDMT over ISDN, 4xflexi, 4xSDSL[1], 8xDMT, 8xDMT over ISDN[2], or 8xG.SHDSL[1]
10	NI-2 card
11	Secondary (redundant) NI-2 card
12 to 32	4xDMT, 4xDMT over ISDN, 4xflexi, 4xSDSL, 8xDMT, 8xDMT over ISDN, or 8xG.SHDSL

1. 4xSDSLs and G.SHDSLs can be used only in a Cisco 6260 system without a POTS splitter configuration.
2. 8xDMT over ISDN can be used only in a Cisco 6260 system with a POTS splitter configuration.

Note You can purchase blank faceplates for empty Cisco 6260 card slots.

Figure 1-6 identifies the Cisco 6260 card slots. Each slot on a chassis is numbered along the top of the chassis. In this guide, the slot numbers are shown on the cards for easy reference and readability. These slots are referred to in subsequent sections of this chapter and elsewhere in this guide.

Figure 1-6 Cisco 6260 Card Slots

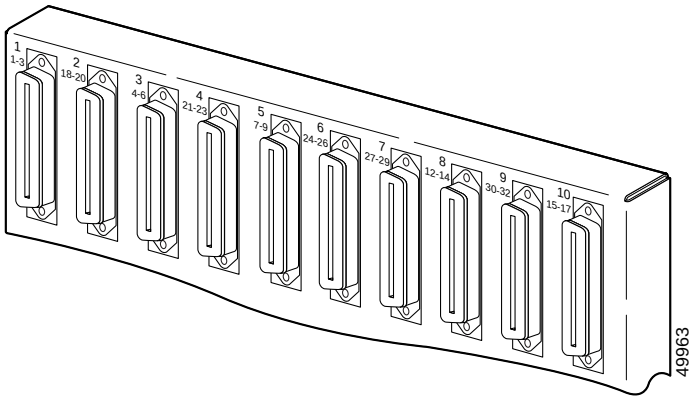


Note Slot 10 is the primary NI-2 card slot, and Slot 11 is the secondary NI-2 card slot. A secondary NI-2 card, when installed in Slot 11, provides cold redundancy.

1.2.2 Cisco 6260 Connectors

Ten female RJ-21 (Champ) subscriber connectors are located at the top of the chassis, facing forward. These 50-pin sockets provide the DSL subscriber connections. Each subscriber connector serves three line card slots. Figure 1-7 depicts the Cisco 6260 subscriber connectors.

Figure 1-7 Cisco 6260 Champ Connectors



The Cisco 6260 subscriber connectors are numbered 1 to 10. See the "Port Mapping Table" section on page B-1 for information about how subscriber connectors correspond to line card slots and ports.

See Figure 1-1 for the location of the subscriber connectors on the Cisco 6260 chassis.

1.2.3 Cisco 6260 Cards

This section contains the following information:

Some line cards can be intermixed within the Cisco 6260 chassis. See the "Line Card Intermixing" section on page 1-27 for intermixing guidelines.

1.2.3.1 Quad-Port DMT ATU-C Line Card Overview

The quad-port DMT ATU-C line card (4xDMT)

- Supports four ADSL modem connections
- Converts ADSL modulation from the line into digital data streams to and from the NI-2 card
- Negotiates the line rate with the CPE when it trains and bases the rate on line quality and distance

If provisioned, the 4xDMT rate adapts to the maximum bit rate negotiable on the line. The maximum bit rate settings are provisioned in the management software.

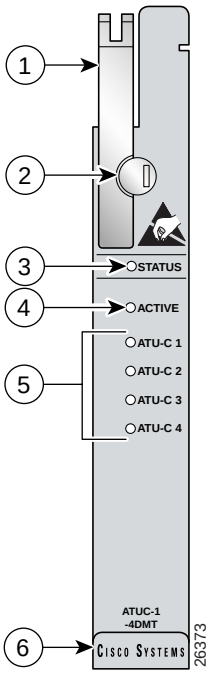
The chassis can include up to 30 4xDMTs for a total of 120 ADSL modem connections.

Note For hardware specifications for the 4xDMT line card, see the "Quad-Port DMT ATU-C Line Card" section on page A-3.

1.2.3.1.1 Faceplate Features

Figure 1-8 shows a close-up of the 4xDMT faceplate.

Figure 1-8 4xDMT Faceplate



1	Ejector lever	**4**	ACTIVE LED
2	Locking tab	**5**	Modem port status LEDs
3	STATUS LED	**6**	Extraction tab

Table 1-3 describes the 4xDMT LED indicator functions.

Table 1-3 4xDMT LED Indicators

LED	State	Function
STATUS	Green slow blinking	The self-test is in progress.
	Green fast blinking	The image download is in progress.
	Green solid	The status is OK.
	Red	The self-test or line card has failed.
	Off	The ATU-C line card has had a power failure.

Table 1-3 4xDMT LED Indicators (continued)

LED	State	Function
ACTIVE	Green solid	The line card is activated.
	Off	The line card is not in service.
ATUC-1	Green solid	Modem 1 is trained.
	Green blinking	Training is in progress for modem 1.
	Off	Modem 1 is idle.
ATUC-2	Green solid	Modem 2 is trained.
	Green blinking	Training is in progress for modem 2.
	Off	Modem 2 is idle.
ATUC-3	Green solid	Modem 3 is trained.
	Green blinking	Training is in progress for modem 3.
	Off	Modem 3 is idle.
ATUC-4	Green solid	Modem 4 is trained.
	Green blinking	Training is in progress for modem 4.
	Off	Modem 4 is idle.

1.2.3.2 Quad-Port DMT ATU-C over ISDN Line Card Overview

The quad-port DMT ATU-C over ISDN line card (4xDMT over ISDN)

- Supports four ADSL modem connections
- Converts ADSL modulation from the line into digital data streams to and from the NI-2 card
- Negotiates the line rate with the CPE when it trains and bases the rate on line quality and distance
- Contains filters that reject the ISDN spectrum (or signal) during operation
- Separates DMT signals from, or combines them with, ISDN signals, if the CPE includes ISDN telephone service (in a configuration with a connected POTS splitter)

If provisioned, the 4xDMT over ISDN rate adapts to the maximum bit rate negotiable on the line. The maximum bit rate settings are provisioned in the management software.

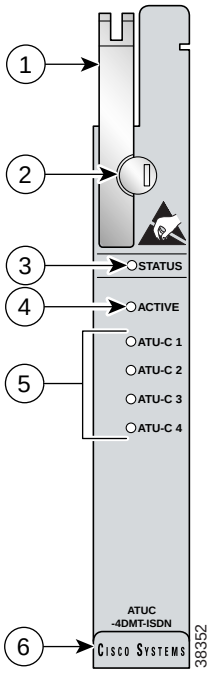
The chassis can include up to 30 4xDMT over ISDN line cards, for a total of 120 ADSL modem connections.

Note For hardware specifications for the 4xDMT over ISDN line card, see the "Quad-Port DMT over ISDN Line Card" section on page A-4.

1.2.3.2.1 Faceplate Features

Figure 1-9 shows a close-up of the 4xDMT over ISDN faceplate.

Figure 1-9 4xDMT over ISDN Faceplate



1	Ejector lever	**4**	ACTIVE LED
2	Locking tab	**5**	Modem port status LEDs
3	STATUS LED	**6**	Extraction tab

Table 1-3 describes the 4xDMT over ISDN LED indicator functions.

Table 1-4 4xDMT over ISDN LED Indicators

LED	State	Function
STATUS	Green slow blinking	The self-test is in progress.
	Green fast blinking	The image download is in progress.
	Green solid	The status is OK.
	Red	The self-test or line card has failed.
	Off	The ATU-C line card has had a power failure.
ACTIVE	Green solid	The line card is activated.
	Off	The line card is not in service.

Table 1-4 4xDMT over ISDN LED Indicators (continued)

LED	State	Function
ATUC-1	Green solid	Modem 1 is trained.
	Green blinking	Training is in progress for modem 1.
	Off	Modem 1 is idle.
ATUC-2	Green solid	Modem 2 is trained.
	Green blinking	Training is in progress for modem 2.
	Off	Modem 2 is idle.
ATUC-3	Green solid	Modem 3 is trained.
	Green blinking	Training is in progress for modem 3.
	Off	Modem 3 is idle.
ATUC-4	Green solid	Modem 4 is trained.
	Green blinking	Training is in progress for modem 4.
	Off	Modem 4 is idle.

1.2.3.3 Quad-Port Flexi ATU-C Line Card Overview

The quad-port flexi ATU-C line card (4xflexi)

- Supports DMT line encoding
- Supports four ADSL modem connections
- Converts ADSL modulation from the line into digital data streams to and from the NI-2 card
- Negotiates the line rate with the CPE when it trains and bases the rate on line quality and distance

If provisioned, the 4xflexi rate adapts to the maximum bit rate negotiable on the line. The maximum bit rate settings are provisioned in the management software.

The Cisco 6260 chassis can include up to 30 4xflexi line cards for a total of 120 ADSL modem connections.

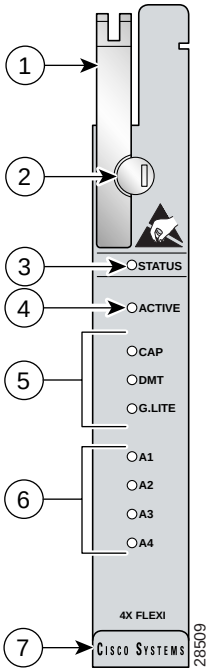
The edge connector key, located on the rear of the 4xflexi, connects the 4xflexi to the backplane of the chassis. Two edge connector keys are available for the 4xflexi: one has six notches, and one has seven notches. Only the seven-notched edge connector key can be installed in the Cisco 6260.

Note For hardware specifications for the 4xflexi, see the "Quad-Port Flexi ATU-C Line Card" section on page A-4.

1.2.3.3.1 Faceplate Features

Figure 1-10 shows a close-up of the 4xflexi faceplate.

Figure 1-10 4xflexi Faceplate



1	Ejector lever	**5**	Line card mode LEDs
2	Locking tab	**6**	Modem port status LEDs
3	STATUS LED	**7**	Extraction tab
4	ACTIVE LED		

Table 1-5 describes the 4xflexi LED indicator functions.

Table 1-5 4xflexi LED Indicators

LED	State	Function
STATUS	Green slow blinking	The self-test is in progress.
	Green fast blinking	The image download is in progress.
	Green solid	The status is OK.
	Red	The self-test or line card has failed.
	Off	The ATU-C line card has had a power failure.
ACTIVE	Green solid	The line card is activated.
	Off	The line card is not in service.

Table 1-5 4xflexi LED Indicators (continued)

LED	State	Function
CAP	Green solid	The line card is in CAP mode. **Note** CAP mode is not available on the 4xflexi in a Cisco 6260.
	Off	The line card is not in CAP mode.
DMT	Green solid	The line card is in DMT mode.
	Off	The line card is not in DMT mode.
G.LITE	Green solid	The line card is in G.lite mode. **Note** G.lite mode is not available on the 4xflexi in a Cisco 6260.
	Off	The line card is not in G.lite mode.
A1	Green solid	Modem 1 is trained.
	Green blinking	Training is in progress for modem 1.
	Off	Modem 1 is idle.
A2	Green solid	Modem 2 is trained.
	Green blinking	Training is in progress for modem 2.
	Off	Modem 2 is idle.
A3	Green solid	Modem 3 is trained.
	Green blinking	Training is in progress for modem 3.
	Off	Modem 3 is idle.
A4	Green solid	Modem 4 is trained.
	Green blinking	Training is in progress for modem 4.
	Off	Modem 4 is idle.

1.2.3.4 Quad-Port STU-C Line Card Overview

The quad-port STU-C line card (4xSDSL)

- Supports 2B1Q line encoding
- Is designed for use in a Cisco 6260 system without a POTS splitter configuration
- Supports four SDSL modem connections
- Converts SDSL modulation from the line into digital data streams to and from the NI-2 card

The negotiated bit rate is the lower of the following rates:

- The provisioned bit rate set for the 4xSDSL in the management software
- The assigned bit rate at the CPE

The chassis can include up to 30 4xSDSLs for a total of 120 SDSL modem connections.

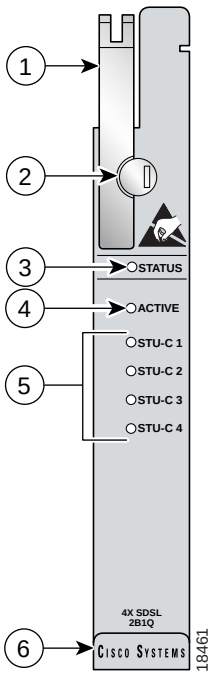
Note For hardware specifications for the 4xSDSL line card, see the "Quad-Port STU-C Line Card" section on page A-5.

The edge connector key, located on the rear of the 4xSDSL, connects the 4xSDSL to the backplane of the chassis. Two edge connector keys are available for the 4xSDSL: one has six notches, and one has seven notches. Only the seven-notched edge connector key can be installed in the Cisco 6260.

1.2.3.4.1 Faceplate Features

Figure 1-11 shows a close-up of the 4xSDSL faceplate.

Figure 1-11 4xSDSL Faceplate



1	Ejector lever	**4**	ACTIVE LED
2	Locking tab	**5**	Modem port status LEDs
3	STATUS LED	**6**	Extraction tab

Table 1-6 describes the 4xSDSL LED indicator functions.

Table 1-6 4xSDSL LED Indicators

LED	State	Function
STATUS	Green slow blinking	The self-test is in progress.
	Green fast blinking	The image download is in progress.
	Green solid	The status is OK.
	Red	The self-test or line card has failed.
	Off	The ATU-C line card has had a power failure.
ACTIVE	Green solid	The line card is activated.
	Off	The line card is not in service.

Table 1-6 4xSDSL LED Indicators (continued)

LED	State	Function
STU-C 1	Green solid	Modem 1 is trained.
	Green blinking	Training is in progress for modem 1.
	Off	Modem 1 is idle.
STU-C 2	Green solid	Modem 2 is trained.
	Green blinking	Training is in progress for modem 2.
	Off	Modem 2 is idle.
STU-C 3	Green solid	Modem 3 is trained.
	Green blinking	Training is in progress for modem 3.
	Off	Modem 3 is idle.
STU-C 4	Green solid	Modem 4 is trained.
	Green blinking	Training is in progress for modem 4.
	Off	Modem 4 is idle.

1.2.3.5 Octal-Port DMT ATU-C Line Card Overview

The octal-port DMT ATU-C line card (8xDMT)

- Supports eight ADSL modem connections
- Converts ADSL modulation from the line into digital data streams to and from the NI-2 card
- Negotiates the line rate with the CPE when it trains and bases the rate on line quality and distance

If provisioned, the 8xDMT rate adapts to the maximum bit rate negotiable on the line. The maximum bit rate settings are provisioned in the management software.

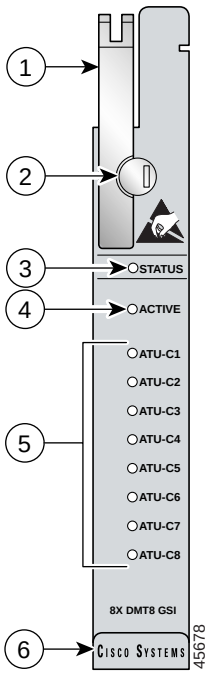
The chassis can include up to 30 8xDMTs for a total of 240 ADSL modem connections.

Note For hardware specifications for the 8xDMT line card, see the "Octal-Port DMT ATU-C Line Card" section on page A-6.

1.2.3.5.1 Faceplate Features

Figure 1-12 shows a close-up of the 8xDMT faceplate.

Figure 1-12 8xDMT Faceplate



1	Ejector lever	**4**	ACTIVE LED
2	Locking tab	**5**	Modem port status LEDs
3	STATUS LED	**6**	Extraction tab

Table 1-7 describes LEDs on the 8xDMT.

Table 1-7 8xDMT LED Indicators

LED	State	Function
STATUS	Green slow blinking Green solid Red Off	No errors, but no connection established. The image download is in progress. NI-2 communication established. The self-test or line card has failed. The ATU-C line card has had a power failure.
ACTIVE	Green solid Off	The line card is activated. The line card is not in service.
ATU-C 1	Green solid Green blinking Off	Modem 1 is trained. Training is in progress for modem 1. Modem 1 is idle.

Table 1-7 8xDMT LED Indicators (continued)

LED	State	Function
ATU-C 2	Green solid Green blinking Off	Modem 2 is trained. Training is in progress for modem 2. Modem 2 is idle.
ATU-C 3	Green solid Green blinking Off	Modem 3 is trained. Training is in progress for modem 3. Modem 3 is idle.
ATU-C 4	Green solid Green blinking Off	Modem 4 is trained. Training is in progress for modem 4. Modem 4 is idle.
ATU-C 5	Green solid Green blinking Off	Modem 5 is trained. Training is in progress for modem 5. Modem 5 is idle.
ATU-C 6	Green solid Green blinking Off	Modem 6 is trained. Training is in progress for modem 6. Modem 6 is idle.
ATU-C 7	Green solid Green blinking Off	Modem 7 is trained. Training is in progress for modem 7. Modem 7 is idle.
ATU-C 8	Green solid Green blinking Off	Modem 8 is trained. Training is in progress for modem 8. Modem 8 is idle.

1.2.3.6 Octal-Port DMT ATU-C Over ISDN Line Card Overview

The octal-port DMT ATU-C over ISDN line card (8xDMT over ISDN)

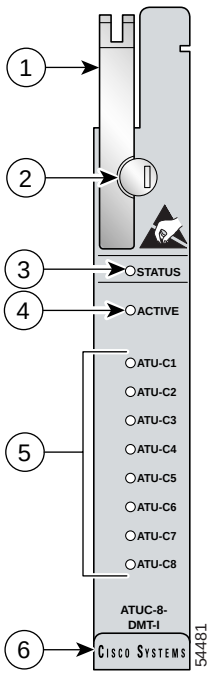
- Supports eight ADSL modem connections
- Converts ADSL modulation from the line into digital data streams to and from the NI-2 card
- Negotiates the line rate with the CPE when it trains and bases the rate on line quality and distance

Note For hardware specifications for the 8xDMT over ISDN line card, see the "Octal-Port DMT ATU-C Over ISDN Line Card" section on page A-7.

1.2.3.6.1 Faceplate Features

Figure 1-13 shows a close-up of the 8xDMT over ISDN faceplate.

Figure 1-13 8xDMT Over ISDN Faceplate



1	Ejector lever	**4**	ACTIVE LED
2	Locking tab	**5**	Modem port status LEDs
3	STATUS LED	**6**	Extraction tab

Table 1-7 describes LEDs on the 8xDMT over ISDN.

Table 1-8 8xDMT over ISDN LED Indicators

LED	State	Function
STATUS	Green slow blinking Green solid Red Off	No errors, but no connection established. The image download is in progress. NI-2 communication established. The self-test or line card has failed. The ATU-C line card has had a power failure.
ACTIVE	Green solid Off	The line card is activated. The line card is not in service.
ATU-C 1	Green solid Green blinking Off	Modem 1 is trained. Training is in progress for modem 1. Modem 1 is idle.

Table 1-8 8xDMT over ISDN LED Indicators (continued)

LED	State	Function
ATU-C 2	Green solid Green blinking Off	Modem 2 is trained. Training is in progress for modem 2. Modem 2 is idle.
ATU-C 3	Green solid Green blinking Off	Modem 3 is trained. Training is in progress for modem 3. Modem 3 is idle.
ATU-C 4	Green solid Green blinking Off	Modem 4 is trained. Training is in progress for modem 4. Modem 4 is idle.
ATU-C 5	Green solid Green blinking Off	Modem 5 is trained. Training is in progress for modem 5. Modem 5 is idle.
ATU-C 6	Green solid Green blinking Off	Modem 6 is trained. Training is in progress for modem 6. Modem 6 is idle.
ATU-C 7	Green solid Green blinking Off	Modem 7 is trained. Training is in progress for modem 7. Modem 7 is idle.
ATU-C 8	Green solid Green blinking Off	Modem 8 is trained. Training is in progress for modem 8. Modem 8 is idle.

1.2.3.7 Octal-Port G.SHDSL SHTU-C Line Card Overview

The octal-port G.SHDSL SHTU-C line card (8xG.SHDSL)

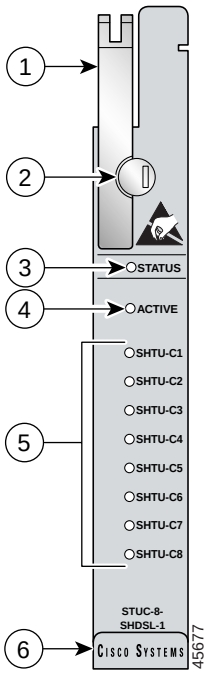
- Supports eight SHDSL modem connections
- Supports trellis coded pulse amplitude modulation (TC-PAM) line encoding
- Converts G.SHDSL modulation from the line into digital data streams to and from the NI-2 card
- Supports fixed and adaptive rate modes
- Has deployment guidelines when used in the Cisco 6260 system; see the "Guidelines for Intermixing 8xG.SHDSLs—Cisco IOS Release 12.2(7)DA and Later" section on page 1-28.

Note For hardware specifications for the 8xG.SHDSL line card, see the "Octal-Port G.SHDSL SHTU-C Line Card" section on page A-7.

1.2.3.7.1 Faceplate Features

Figure 1-14 shows a close-up of the 8xG.SHDSL faceplate.

Figure 1-14 8xG.SHDSL Faceplate



1	Ejector lever	**4**	ACTIVE LED
2	Locking tab	**5**	Modem port status LEDs
3	STATUS LED	**6**	Extraction tab

Table 1-9 describes the 8xG.SHDSL LED indicator functions.

Table 1-9 8xG.SHDSL LED Indicators

LED Label	State	Function
STATUS	Green slow blinking Green fast blinking Green solid Red Off	No errors, but no connection established. The image download is in progress. NI-2 communication established. The self-test or line card has failed. The line card has a power failure.
ACTIVE	Green solid Off	The line card is activated. The line card is not in service.
SHTU-C1	Green solid Green blinking Off	Modem 1 is trained. Training is in progress for modem 1. Modem 1 is idle.

Table 1-9 8xG.SHDSL LED Indicators (continued)

LED Label	State	Function
SHTU-C2	Green solid Green blinking Off	Modem 2 is trained. Training is in progress for modem 2. Modem 2 is idle.
SHTU-C3	Green solid Green blinking Off	Modem 3 is trained. Training is in progress for modem 3. Modem 3 is idle.
SHTU-C4	Green solid Green blinking Off	Modem 4 is trained. Training is in progress for modem 4. Modem 4 is idle.
SHTU-C5	Green solid Green blinking Off	Modem 5 is trained. Training is in progress for modem 5. Modem 5 is idle.
SHTU-C6	Green solid Green blinking Off	Modem 6 is trained. Training is in progress for modem 6. Modem 6 is idle.
SHTU-C7	Green solid Green blinking Off	Modem 7 is trained. Training is in progress for modem 7. Modem 7 is idle.
SHTU-C8	Green solid Green blinking Off	Modem 8 is trained. Training is in progress for modem 8. Modem 8 is idle.

1.2.3.8 Line Card Intermixing

Note Figure 1-6 shows the Cisco 6260 chassis slot numbers.

The Cisco 6260 chassis supports line card intermixing. This section uses the terms *halves* and *quadrants*. The Cisco 6260 chassis consists of two halves:

- Slots 1 to 9 and slots 18 to 26 (left half of the chassis)
- Slots 12 to 17 and slots 27 to 32 (right half of the chassis)

The Cisco 6260 chassis consists of four quadrants:

- Slots 1 to 9 (top left quadrant)
- Slots 12 to 17 (top right quadrant)
- Slots 18 to 26 (bottom left quadrant)
- Slots 27 to 32 (bottom right quadrant)

The following sections describe the line card intermixing guidelines for the Cisco 6260.

1.2.3.8.1 Guidelines for Intermixing *x*DSL Line Cards

Mixing line cards of different modulation types in the same quadrant of any Cisco DSLAM is prohibited. Different modulation types are allowed in the same half of a chassis with the exceptions of slots 18 and 34 in the Cisco 6160 beginning with Cisco IOS release 12.2(7)DA. Mixing line cards of the same modulation type (for example, 4xFlexiDMT and 8xDMT line cards) in a quadrant is allowed.

1.2.3.8.2 Guidelines for Intermixing 8xG.SHDSLs—Cisco IOS Release 12.1(7)DA2, 12.2(1b)DA, and 12.2(5)DA

The Cisco 6260 chassis can be fully populated with 8xG.SHDSLs while retaining QoS, as long as the upstream bandwidth is provisioned at a maximum of 5 Mbps for even ports and a maximum of 5 Mbps for odd ports per line card. Once an 8xG.SHDSL is installed in a chassis quadrant, no ADSL line cards can be installed in that same quadrant.

1.2.3.8.3 Guidelines for Intermixing 8xG.SHDSLs—Cisco IOS Release 12.2(7)DA and Later

The Cisco 6260 system supports up to 16 8xG.SHDSLs installed per chassis while retaining QoS. Once an 8xG.SHDSL is installed in a quadrant, no ADSL line cards can be installed in that same quadrant.

Figure 1-15 illustrates the optimal deployment of 8xG.SHDSLs in the Cisco 6260 chassis with quadrant intermixing of ADSL line cards in the Cisco 6260 chassis. For example:

- If 4 8xG.SHDSLs are installed in the left side of the chassis, only 21 ADSL line cards can be installed in the remaining chassis quadrants.

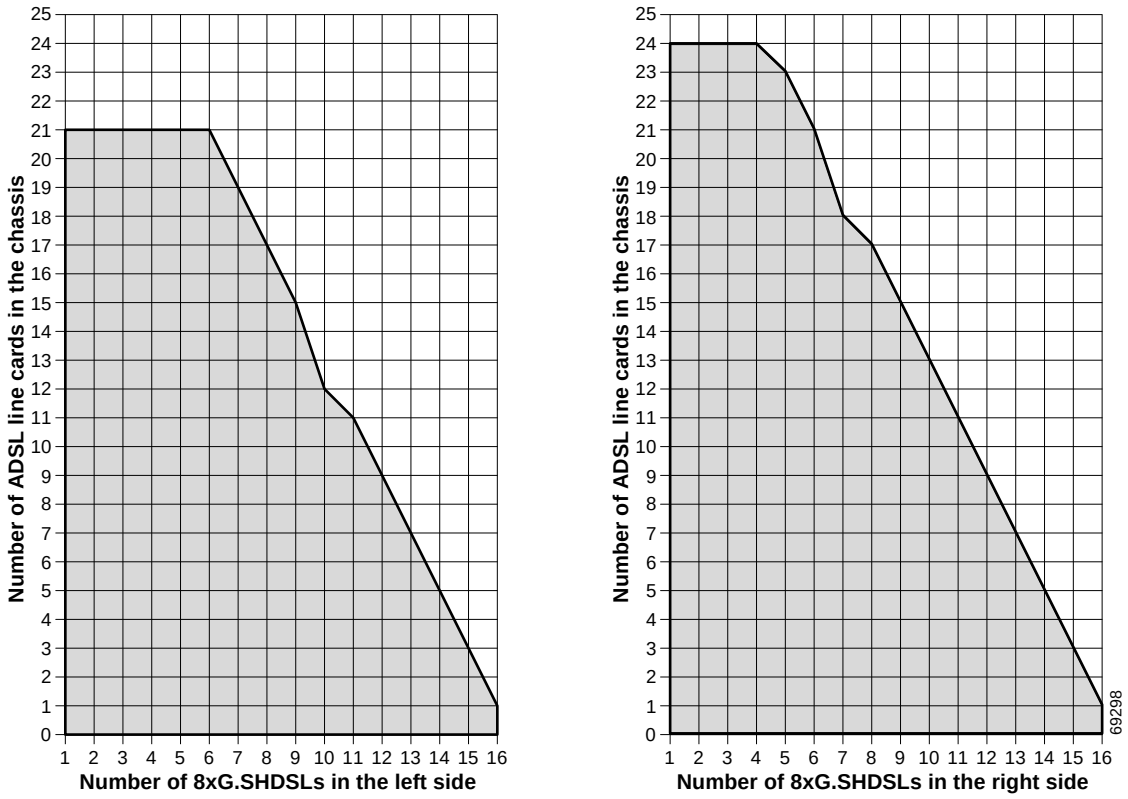
  Note No ADSL line cards can be installed in the same quadrant as the 8xG.SHDSLs.

- If 4 8xG.SHDSLs are installed in the right side of the chassis, only 24 ADSL line cards can be installed in the remaining chassis quadrants.

  Note No ADSL line cards can be installed in the same quadrant as the 8xG.SHDSLs.

Caution Random cell loss may occur if the guidelines for 8xG.SHDSL deployment in a system are exceeded.

Figure 1-15 8xG.SHDSL Deployment in the Cisco 6260 System.



1.2.3.8.4 Guidelines for Intermixing 8xG.SHDSLs—Cisco IOS Release 12.2(12)DA and Later for NI2-155SM-155SM2 or NI2-155MM-155MM2 Only

This section describes intermixing in Cisco IOS Release 12.2(12)DA and later for NI2-155SM-155SM2 or NI2-155MM-155MM2 only. All other NI2s, including NI2-155SM-155SM and NI2-155MM-155MM, follow guidelines as described in the "Guidelines for Intermixing 8xG.SHDSLs—Cisco IOS Release 12.2(7)DA and Later" section on page 1-28.

The Cisco 6015, Cisco 6160, and Cisco 6260 can be fully populated with 8xG.SHDSLs while retaining QoS.

- In the Cisco 6160 and Cisco 6260, once an 8xG.SHDSL is installed in a chassis quadrant, no other type of line card can be installed in that same quadrant.
- In the Cisco 6015, intermixing is limited to chassis halves.

Note In order to provision 18.5 Mbps per line card in a chassis fully populated with 8xG.SHDSLs, an OC-3c/OC-3c single-mode fiber (SMF) or multi-mode fiber (MMF) NI-2 card (NI2-155SM-155SM2 and NI2-155MM-155MM2) must be installed in the chassis.

1.2.3.9 DS3/2DS3 NI-2 Card Overview

The DS3/2DS3 NI-2 card

- Provides the network E3 network trunk interface through BNC connectors located on the E3 I/O module.

Note The Cisco 6260 system does not support the DS3 interface. When the DS3/2DS3 NI-2 card and the E3 I/O module are installed in the Cisco 6260 chassis, the system adopts E3 functionality.

- Connects to the *x*TU-C line cards through point-to-point serial data buses on the backplane
- Contains the ATM switch fabric
- Provides CO facility alarm relay contact interfaces and an alarm cut-off (ACO) button
- Provides visual and audible operating status alerts
- Is manageable through Cisco IOS software or through CDM
- Provides Cisco IOS-based ATM QoS
- Controls timing and redundancy

Note The BITS interface is connected through the E3 I/O module located on the front of the Cisco 6260.

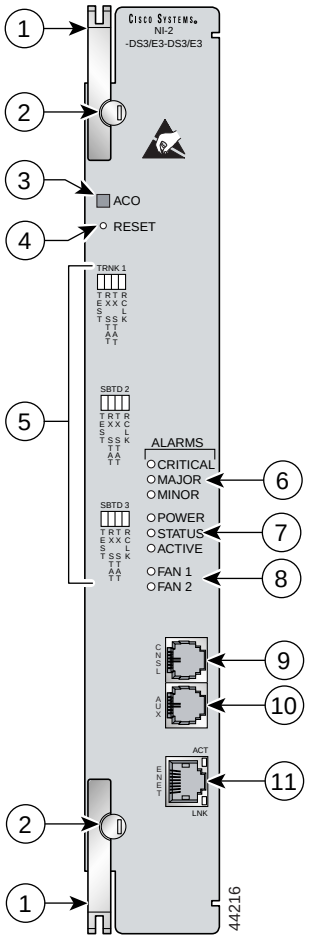
- Supports the aggregation of up to 12 subtended node chassis that are configured for E3 operation in a tree topology.
- Provides two E3 subtend interfaces through BNC connectors located on the I/O module.

Note For hardware specifications for the DS3/2DS3 NI-2 card, see the "DS3/2DS3 NI-2 Card" section on page A-8.

1.2.3.9.1 Faceplate Features

Figure 1-16 shows a close-up of the DS3/2DS3 NI-2 card faceplate.

Figure 1-16 DS3/2DS3 NI-2 Card Faceplate



1	Ejector lever	**7**	Card status LED group
2	Locking tab	**8**	Fan alarm LED group
3	ACO button	**9**	CNSL—An RJ-45 receptacle that provides a serial connection to a system console.
4	Maintenance RESET port	**10**	AUX—An RJ-45 receptacle that provides connection to an auxiliary device (such as a modem) used to remotely configure the system.
5	Interface status LED groups: TRNK[1] 1, SBTD[2] 2, and SBTD 3, which show the status of the network trunk and subtend connections on the I/O module.	**11**	ENET—An RJ-45 10BaseT receptacle that complies with Ethernet standards and that provides connection to a system Ethernet.
6	System alarm LED group		

1. TRNK = trunk
2. SBTD = subtend

Table 1-10 describes the LED group indicators and their functions.

Table 1-10 DS3/2DS3 NI-2 Card LED Group Indicators

LED Group	LED	State	Function
Interface status LED (**5** in Figure 1-16)	TEST	Amber solid	Cisco IOS detects that an obtrusive test (loopback) is active on this interface.
		Off	Cisco IOS does not detect obtrusive test activity.
	RX[1] STAT	Amber solid	The receiver detects a physical layer problem.
		Off	The receiver does not detect a physical layer problem.
	TX[2] STAT	Amber solid	The transmitter detects a physical layer problem.
		Off	The transmitter does not detect a physical layer problem.
	RCLK[3]	Green solid	Hardware detects an incoming clock signal.
		Off	Hardware does not detect an incoming clock signal.
System alarm (**6** in Figure 1-16)	CRITICAL	Red	A critical alarm is active.
	MAJOR	Red	A major alarm is active.
	MINOR	Amber	A minor alarm is active.
Card status (**7** in Figure 1-16)	POWER	Green	The NI-2 card has power.
	STATUS	Green	The operational status of the NI-2 card. • On—There are no internal faults or problems. • Off—The NI-2 card has not booted properly, or a problem is preventing normal operation.
	ACTIVE	Green	The NI-2 card is operating as the active NI-2 card in the chassis.
Fan alarm (**8** in Figure 1-16)	FAN 1	Red	The fan module or fan tray is not operational and is in alarm mode.
	FAN 2	Off	The fan tray is off.
ENET interface LED (**11** in Figure 1-16)	ACT	Green solid or blinking	The Ethernet interface is active.
		Off	The Ethernet interface is inactive.
	LNK	Green solid	The Ethernet link is connected and enabled.

1. RX = receive
2. TX = transmit
3. RCLK = receive clock

1.2.3.10 DS3+T1/E1 IMA NI-2 Card Overview

The DS3+T1/E1 IMA NI-2 card

- Provides the following network trunk and subtend interfaces:

- E1
- E1 IMA group

Note Network trunk and subtend connectors for the DS3+T1/E1 IMA NI-2 cards are located on the E1 I/O module on the front of the Cisco 6260 chassis.

- Connects to the *x*TU-C line cards through point-to-point serial data buses on the backplane
- Contains the ATM switch fabric
- Provides CO facility alarm relay contact interfaces and an ACO button
- Provides visual and audible operating status alerts
- Is manageable through Cisco IOS software or CDM
- Provides Cisco IOS-based ATM QoS
- Controls timing through an internal clock or BITS interface, or from an ATM interface (E1)

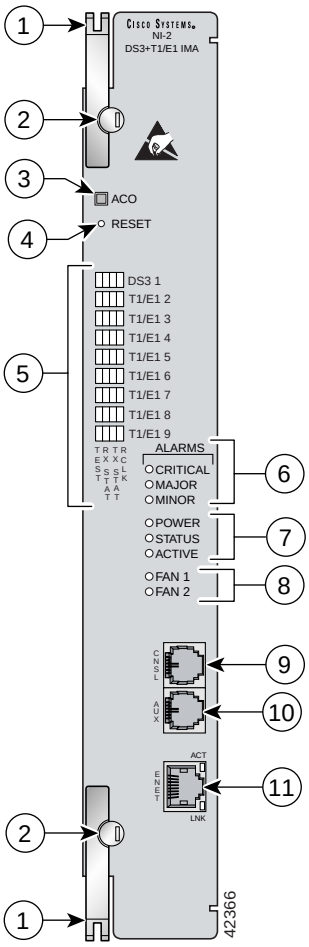
Note The BITS interface is connected through the I/O module located on the front of the Cisco 6260.

- Supports the aggregation of up to seven subtended node chassis that are configured for E1 or E1 IMA group operation in a daisy-chain, tree, or star topology
- Provides E1 subtend interfaces through RJ-48c connectors located on the E1 I/O module.

1.2.3.10.1 Faceplate Features

Figure 1-17 shows a close-up of the DS3+T1/E1 IMA NI-2 card faceplate.

Figure 1-17 DS3+T1/E1 IMA NI-2 Card Faceplate



1	Ejector lever	**7**	Card status LED group
2	Locking tab	**8**	Fan alarm LED group
3	ACO button	**9**	CNSL—An RJ-45 receptacle that provides a serial connection to a system console.
4	Maintenance RESET port	**10**	AUX—An RJ-45 receptacle that provides connection to an auxiliary device (such as a modem) used to remotely configure the system.
5	Interface status LED groups: DS3 1, T1/E1 2, T1/E1 3, T1/E1 4, T1/E1 5, T1/E1 6, T1/E1 7, T1/E1 8, and T1/E1 9, which show the status of the network trunk and subtend connections on the I/O module	**11**	ENET—An RJ-45 10BaseT receptacle that complies with Ethernet standards and that provides connection to a system Ethernet.
6	System alarm LED group		

Table 1-11 describes the LED group indicators and their functions.

Table 1-11 DS3+T1/E1 IMA NI-2 Card LED Group Indicators

LED Group	LED	State	Function
Interface status LED (**5** in Figure 1-17)	TEST	Amber solid	Cisco IOS detects that an obtrusive test (loopback) is active on this interface.
		Off	Cisco IOS does not detect obtrusive test activity.
	RX STAT	Amber solid	The receiver detects a physical layer problem.
		Off	The receiver does not detect a physical layer problem.
	TX STAT	Amber solid	The transmitter detects a physical layer problem.
		Off	The transmitter does not detect a physical layer problem.
	RCLK	Green solid	Hardware detects an incoming clock signal.
		Off	Hardware does not detect an incoming clock signal.
System alarm (**6** in Figure 1-17)	CRITICAL	Red	A critical alarm is active.
	MAJOR	Red	A major alarm is active.
	MINOR	Amber	A minor alarm is active.
Card status (**7** in Figure 1-17)	POWER	Green	The NI-2 card has power.
	STATUS	Green	The operational status of the NI-2 card. • On—There are no internal faults or problems. • Off—The NI-2 card has not booted properly, or a problem is preventing normal operation.
	ACTIVE	Green	The NI-2 card is operating as the active NI-2 card in the chassis.
Fan alarm (**8** in Figure 1-17)	FAN 1	Red	The fan module or fan tray is not operational and is in alarm mode.
	FAN 2	Red	The fan module or fan tray is not operational and is in alarm mode.
ENET interface LED (**11** in Figure 1-17)	ACT	Green solid or blinking	The Ethernet interface is active.
		Off	The Ethernet interface is inactive.
	LNK	Green solid	The Ethernet link is connected and enabled.

1.2.3.11 OC-3c/OC-3c NI-2 Card Overview

The OC-3c/OC-3c NI-2 card

- Provides the network OC-3c network trunk interface through optical connectors located on the NI-2 card faceplate. The following two versions of the OC-3c/OC-3c NI-2 card are available to support the network trunk interface:
  - SMF intermediate range
  - MMF short range
- Connects to the *x*TU-C line cards through point-to-point serial data buses on the backplane

- Contains the ATM switch fabric
- Provides CO facility alarm relay contact interfaces and an ACO button
- Provides visual and audible operating status alerts
- Is manageable through Cisco IOS software or CDM
- Provides Cisco IOS-based ATM QoS
- Controls timing and redundancy

Note The BITS interface is connected through the OC-3c I/O module located on the front of the Cisco 6260 chassis.

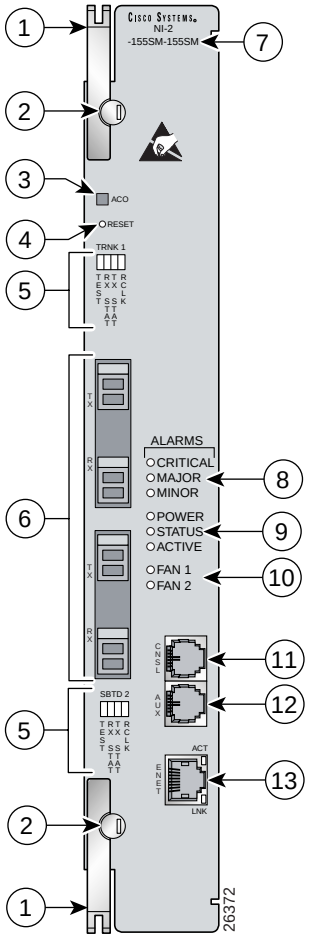
- Supports the aggregation of up to 12 subtended node chassis configured for OC-3c operation in a daisy chain configuration.
- Provides an OC-3c subtend interface through optical connectors located on the NI-2 card faceplate.

Note For hardware specifications for the OC-3c/OC-3c NI-2 card, see the "OC-3c/OC-3c NI-2 Card" section on page A-10.

1.2.3.11.1 Faceplate Features

Figure 1-18 shows a close-up of the OC-3c/OC-3c NI-2 card faceplate.

Figure 1-18 OC-3c/OC-3c NI-2 Card Faceplate



1	Ejector lever	**8**	System alarm LED group
2	Locking tab	**9**	Card status LED group
3	ACO button	**10**	Fan alarm LED group
4	Maintenance RESET port	**11**	CNSL—An RJ-45 receptacle that provides a serial connection to a system console.

5	Interface status LED groups: TRNK 1 and SBTD 2, which show the status of the network trunk and subtend connections.	**12**	AUX—An RJ-45 receptacle that provides connection to an auxiliary device (such as a modem) used to remotely configure the system.
6	Two optical interface connector pairs: TRNK 1 and SBTD 2 • TRNK 1—for network trunk interface TX and RX data optical cables. On a subtended node chassis, these TX and RX cables connect to SBTD 2 on the subtending host chassis. • SBTD 2—for subtended node chassis TX and RX data optical cables.	**13**	ENET—An RJ-45 10BaseT receptacle that complies with Ethernet standards and that provides connection to a system Ethernet.
7	Model number		

Table 1-12 describes the LED group indicators and their functions.

Table 1-12 OC-3c/OC-3c NI-2 Card LED Group Indicators

LED Group	LED	State	Function
Interface status LED (**5** in Figure 1-18)	TEST	Amber solid	Cisco IOS detects that an obtrusive test (loopback) is active on this interface.
		Off	Cisco IOS does not detect obtrusive test activity.
	RX STAT	Amber solid	The receiver detects a physical layer problem.
		Off	The receiver does not detect a physical layer problem.
	TX STAT	Amber solid	The transmitter detects a physical layer problem.
		Off	The transmitter does not detect a physical layer problem.
	RCLK	Green solid	Hardware detects an incoming clock signal.
		Off	Hardware does not detect an incoming clock signal.
System alarm (**7** in Figure 1-18)	CRITICAL	Red	A critical alarm is active.
	MAJOR	Red	A major alarm is active.
	MINOR	Amber	A minor alarm is active.
Card status (**8** in Figure 1-18)	POWER	Green	The NI-2 card has power.
	STATUS	Green	The operational status of the NI-2 card. • On—There are no internal faults or problems. • Off—The NI-2 card has not booted properly, or a problem is preventing normal operation.
	ACTIVE	Green	The NI-2 card is operating as the active NI-2 card in the chassis.

Table 1-12 OC-3c/OC-3c NI-2 Card LED Group Indicators (continued)

LED Group	LED	State	Function
Fan alarm (**9** in Figure 1-18)	FAN 1	Red	The fan module or fan tray is not operational and is in alarm mode.
	FAN 2	Red	The fan module or fan tray is not operational and is in alarm mode.
ENET interface LED (**12** in Figure 1-18)	ACT	Green solid or blinking	The Ethernet interface is active.
		Off	The Ethernet interface is inactive.
	LNK	Green solid	The Ethernet link is connected and enabled.

1.2.3.12 Network Clocking Overview

The NI-2 card receives its network timing signal from any one of the following sources:

- A BITS clock. When a BITS clock is the network timing signal source, the Cisco 6260 chassis receives a clock signal through designated pins on the I/O module and distributes the signal through the Cisco 6260 backplane.
- An internal clock.
- E3 or OC-3c network trunk interface. An NI-2 card synchronizes with the network timing source and provides a clock reference signal to line cards in the Cisco 6260 chassis and to subtended node chassis.

  The active NI-2 card supplies a redundant pair of clock signals to all cards in the chassis. This same clock reference can be propagated to subtended systems via the trunk and subtended interface ports. This is done by configuring the subtending port of the root system to source the network-derived clock. The trunk port of the subtended system is configured as the network clock source for that chassis. This chain continues down the subtended tree.

1.2.3.13 Redundancy Overview

Redundancy is available for the Cisco 6260 system. The following forms of redundancy are available:

- NI-2 card cold redundancy, which allows a standby NI-2 card to take over system operations in the event of a complete failure of the active NI-2 card.
- Automatic protection switching (APS) link redundancy, which is available on OC-3c/OC-3c NI-2 card network trunk and subtend interfaces.

Note Line card redundancy is not currently supported in the Cisco 6260 system.

1.2.3.13.1 NI-2 Card Redundancy

NI-2 card redundancy requires that two NI-2 cards be installed in the chassis. The primary card is installed in slot 10 of the chassis, and the secondary card is installed in slot 11. Either the primary or the secondary NI-2 card can serve as the active NI-2 card. The interface types must be the same for both the primary and secondary NI-2 cards. The following NI-2 cards support cold redundancy in the Cisco 6260 chassis:

- DS3/2DS3
- DS3+T1/E1 IMA
- OC-3c/OC-3c (SMF and MMF)

During steady-state operations, one NI-2 card functions as the active unit, and the other functions as the standby unit. The active NI-2 card displays a green ACTIVE LED. In an active state, the NI-2 card

- Has full Ethernet, auxiliary port, and console access
- Communicates with line cards
- Has full access to the environmental monitoring subsystem
- Has access to the optical interfaces on the standby NI-2 card
- Allows remote access to the file system of the standby NI-2 card

The standby NI-2 card plays a minimal role during steady-state operations. In a standby state, the NI-2 card

- Receives configuration changes from the active NI-2 card (when the cards are configured for synchronization)
- Has no Ethernet, auxiliary port, or console access
- Does not communicate with line cards
- Has no access to the environmental monitoring subsystem
- Generates only APS alarms, which are reported via the active card

For management purposes, the primary and secondary NI-2 cards appear as one element. The cards share one IP address.

Note For information on NI-2 card cold redundancy switchover conditions, refer to the *Upgrading DSLAMs for NI-2 Card and APS Link Redundancy* document.

1.2.3.13.2 APS Link Redundancy

APS link redundancy provides recovery from a cut fiber or the failure of an OC-3c optical TX or optical RX interface on an NI-2 card. APS link redundancy is available on OC-3c/OC-3c NI-2 card network trunk and subtend interfaces.

APS link redundancy is nonrevertive. After a switchover from the primary to the secondary fiber occurs, the active NI-2 card switches back to the primary fiber only if it is manually forced through a command-line interface (CLI) or if a failure condition occurs on the secondary fiber. However, if a failure condition occurs on the secondary fiber while the primary fiber is still in a failed state, a switch back to the primary fiber does not occur.

Note The OC-3c ports on the standby NI-2 card are available for APS link redundancy only if the standby NI-2 card is working and in a STANDBY-READY state.

For more information on APS link redundancy, refer to the *Upgrading DSLAMs for NI-2 Card and APS Link Redundancy* document.

1.2.3.14 Redundancy in Subtended Configurations

NI-2 card redundancy is supported in an E3 subtend tree or daisy-chain or in an OC-3c subtend daisy-chain if both the subtending host chassis and the subtended node chassis have primary and secondary NI-2 cards installed. An NI-2 card failure on a node in a subtend tree or daisy-chain temporarily interrupts traffic to all subtended node chassis.

NI-2 card redundancy is not supported in DS3+T1/E1 IMA subtended configurations.

APS link redundancy is supported in subtending configurations only if all of the following conditions exist:

1. The subtending host chassis is configured for OC-3c/OC-3c operation;
2. The subtending host chassis has a secondary NI-2 card installed; and
3. The subtended node chassis have primary and secondary OC-3c/OC-3c NI-2 cards installed.

1.2.4 Cisco 6260 I/O Modules

This section contains the following information:

A Cisco 6260 chassis must have an I/O module installed. The I/O module is delivered installed near the top of the Cisco 6260 chassis, just below the subscriber connectors. Figure 1-1 shows the location of the I/O module on the Cisco 6260 chassis.

1.2.4.1 E3 I/O Module Overview

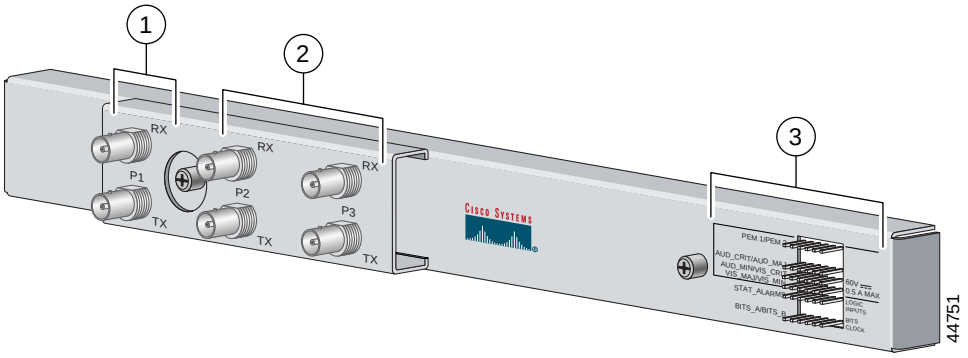
The E3 I/O module provides the Cisco 6260 chassis with a network trunk interface connector and connectors to subtend other DSLAMs to the chassis. The E3 I/O module also provides the alarm pinouts and BITs clock input circuits for the Cisco 6260 system.

The E3 I/O module works with the DS3/2DS3 NI-2 card in the Cisco 6260 chassis.

Note The Cisco 6260 does not support the DS3 interface. When the DS3/2DS3 NI-2 card is installed in the Cisco 6260 chassis with an E3 I/O module, the NI-2 card adopts E3 functionality.

Figure 1-19 shows a close-up of the E3 I/O module.

Figure 1-19 E3 I/O Module



1	E3 75-ohm coaxial BNC connectors. The P1 RX and TX connectors serve as the network trunk interface.	**3**	Six rows of six wire-wrap pins that support CO alarm relay interfaces and BITS clock input circuits.
2	E3 75-ohm coaxial BNC connectors. The P2 and P3 RX and TX connectors serve as subtend connectors to additional chassis.		

Note For hardware specifications for the E3 I/O module, see the "I/O Module" section on page A-11.

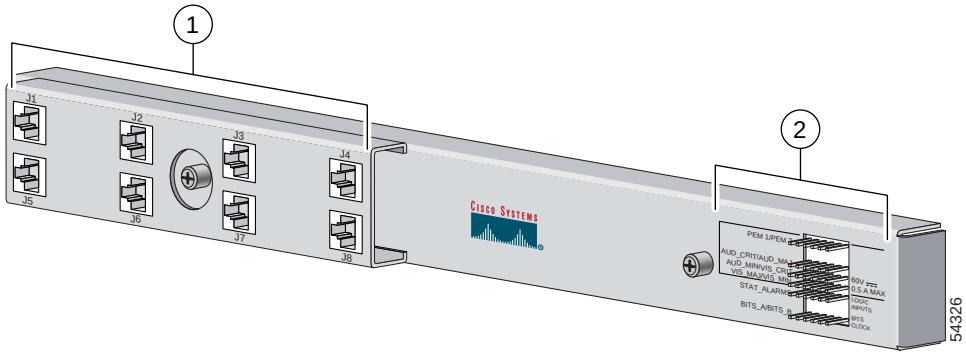
1.2.4.2 E1 I/O Module Overview

The E1 I/O module provides eight E1 interfaces that can be allocated as either individual E1 network trunk or subtend interfaces, or as IMA group trunk or subtend interfaces. The E1 I/O module also provides the alarm pinouts and BITS clock input circuits for the Cisco 6260 system.

The E1 I/O module works with the DS3+T1/E1 IMA NI-2 card in the Cisco 6260 chassis.

Figure 1-20 shows a close-up of the E1 I/O module.

Figure 1-20 E3 I/O Module



1	Four sets of two verically-paired E1 120-ohm RJ-48c connectors that can be used as a network trunk connection, an individual E1 subtend link, a connection to an IMA subtending group, or a connection to an IMA group trunk interface.	2	Six rows of six wire-wrap pins that support CO alarm relay interfaces and BITS clock input circuits.

Note For hardware specifications for the E1 I/O module, see the "I/O Module" section on page A-11.

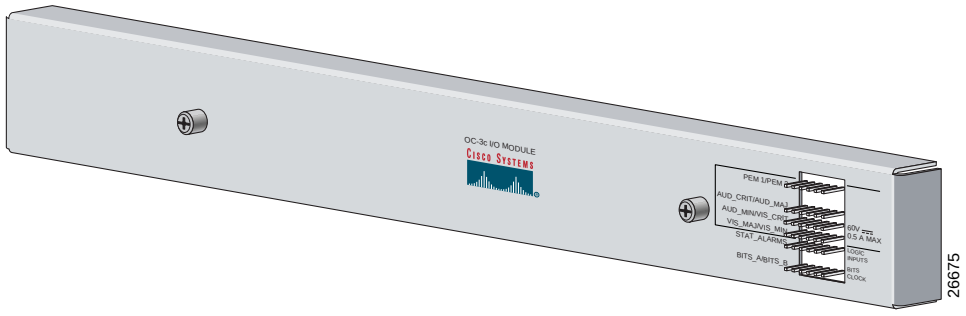
1.2.4.3 OC-3c I/O Module Overview

No network trunk or subtending port connectors are needed on the OC-3c I/O module. These connectors are present on the OC-3c/OC-3c NI-2 card faceplate.

The OC-3c I/O module works with the OC-3c/OC-3c NI-2 card in the Cisco 6260 chassis.

Figure 1-21 shows a close-up of the OC-3c I/O module, including the wire-wrap pins located on the right side of the I/O module faceplate that support CO alarm relay interfaces and BITS clock input circuits.

Figure 1-21 OC-3c I/O Module



Note For hardware specifications for the OC-3c I/O module, see the "I/O Module" section on page A-11.

1.2.4.4 I/O Module Wire-Wrap Pins

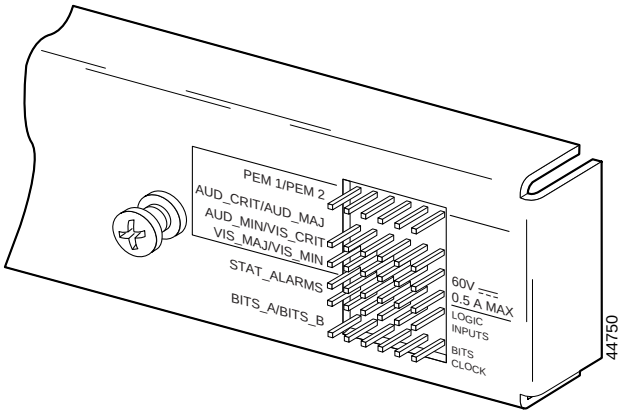
Located on the right side of each I/O module faceplate are 36 wire-wrap pins that support

- Central office alarm relay interfaces (visual and audible critical, major, and minor)
- BITS clock input circuits
- Wire-wrap and socket-type connections

Both the alarm relay and the BITS clock connections are optional. If you connect the alarm relays, they transmit critical, major, and minor alarms to a separate, external alarm device. The alarm device uses a bell, light, or some other signal to alert service personnel to the change in system status. If you connect the BITS interface, the Cisco 6260 can receive a clock signal from an E1 line.

Figure 1-22 shows a close-up of the wire-wrap pins.

Figure 1-22 I/O Module Wire-Wrap Pins Close-Up



These pins support the following items:

- Visual critical alarm
- Visual major alarm
- Visual minor alarm
- Audible critical alarm
- Audible major alarm
- Audible minor alarm
- Power module alarms
- Remote alarm cut off
- Reserved (several pins are reserved for future specification)

Each of the wire-wrap pins is connected to the NI-2 cards in the Cisco 6260 chassis; however, only one NI-2 card manages the alarms. The ACO switch on the NI-2 card faceplate shuts off the audible alarms generated by the Cisco 6260 system software.

One of the alarm relay functions provided by the wire-wrap connector is an ACO circuit that you can wire to your external alarm device. To use this feature, connect the alarm device so that it can close the contact between pin 5 and pin 6 in row 5.

The connector also provides contacts for the following features, all of which can be used separately:

- Audible alarms—Wire pins whose signals begin with AUD
- Visible alarms—Wire pins whose signals begin with VIS
- Power alarms—Wire pins whose signals begin with PEM
- BITS clock—Wire pins whose signals begin with RX_BITS

Note There is one set of contacts for audible alarms and one set for visual alarms. You can use either or both sets of contacts.

You can wire the alarm relay contacts as normally open (NO) or normally closed (NC). (One exception is the ACO circuit, which can be wired as NO only.) Use common (CO) pins for both the NO and NC wiring methods.

Table 1-13 Pin Assignments for the Cisco 6260 I/O Module

Wiring Method	Pins to Use
Normally open	Pin 2 in rows 1, 2, 3, 4 (NO) Pin 5 in rows 1, 2, 3, 4, 5 (NO) Pin 1 in rows 1, 2, 3, 4 (CO) Pin 4 in rows 1, 2, 3, 4 (CO) Pin 6 in row 5 (GND[1])
Normally closed	Pin 3 in rows 1, 2, 3, 4 (NC) Pin 6 in rows 1, 2, 3, 4 (NC) Pin 1 in rows 1, 2, 3, 4 (CO) Pin 4 in rows 1, 2, 3, 4 (CO

1. GND = ground

Note For more information on how the wire-wrap pins map to the alarms, see the "Port Mapping Table" section on page B-1.

1.2.5 PEM

The Cisco 6260 system is equipped with one or two –48/–60V direct current (DC) PEMs, which distribute DC power within the chassis. The Cisco 6260 requires only one active PEM to operate; if two PEMs are installed, the second PEM serves as a hot backup to the first.

Each PEM should be connected to a single DC power source. DC power (–48V) enters the chassis through the terminal blocks on the front of each PEM. For full power redundancy, two PEMs must be installed in the chassis, and the two PEMs must be connected to two separate DC power sources.

In a system with two PEMs installed, you can remove and replace each individual PEM while the system continues to operate. (A system with a single PEM must be powered down before the PEM is removed.)

In addition, you can replace a PEM in a chassis with a single PEM installed without shutting down system power by first removing the blank faceplate from the second slot, installing a replacement PEM in the second slot, and then removing the first PEM. The blank faceplate can then be installed in the empty first PEM slot.

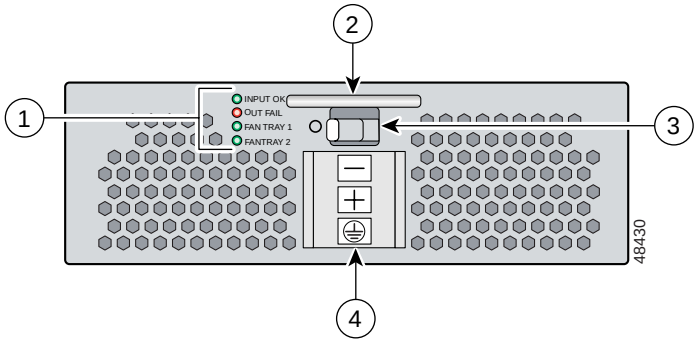
Note The PEMs reside at the bottom of the chassis, and they are installed and accessed from the front (see Figure 1-1 for the location of the PEM in the Cisco 6260 chassis). Each PEM is held in place by the overhanging lip of the fan tray above it. You must remove the fan tray before you can remove the PEM.

To turn off a Cisco 6260 that has two PEMs, you must flip the circuit breakers on *both* PEMs to the OFF (0) position.

The Cisco 6260 can be ordered with only one PEM installed, and with a blank faceplate installed in place of a second PEM.

Figure 1-23 shows a close-up of the PEM faceplate.

Figure 1-23 PEM Faceplate



1	PEM and fan tray status LEDs	**3**	Two-position circuit breaker—the positions are Off (0) and On (1)
2	Extraction handle	**4**	Negative (-), positive (+), and ground DC power terminal blocks

Note For hardware specifications for the PEM, see the "PEM" section on page A-11.

Table 1-14 describes the PEM LED indicators and their functions.

Table 1-14 PEM LEDs

LED	State	Function
Input OK	Green	–48V power is available to the chassis.
Out Fail	Red	The PEM is not distributing power to the chassis.
Fan Tray 1	Green	The fans in this tray are operating normally.
	Red	One or more fans in this tray have failed.
Fan Tray 2	Green	The fans in this tray are operating normally.
	Red	One or more fans in this tray have failed.

1.2.6 Fan Tray

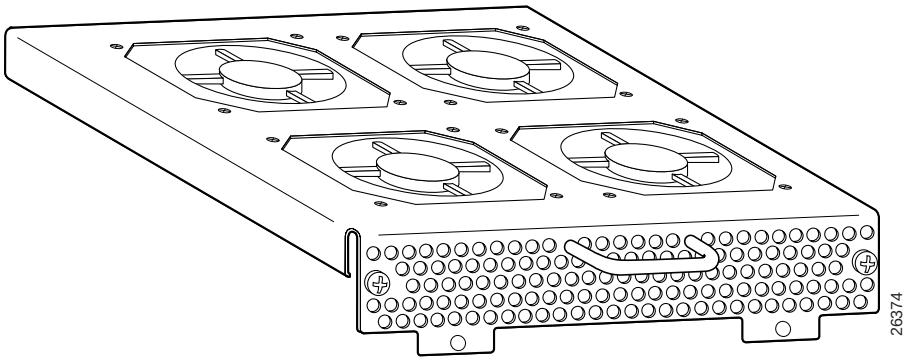
Two fan trays are installed in the Cisco 6260 chassis below the line cards. Each tray houses four fans. The compartments for the two fan trays are located side by side near the bottom of the chassis, just above the PEMs (see Figure 1-1 for the location of the fan trays in the Cisco 6260 chassis). As you face the chassis, fan tray 1 is on the left; and fan tray 2 is on the right.

A narrow bezel fits across the chassis to hold the air filters and fan trays in place.

Note The Cisco 6260 system requires that a fan tray be installed when the system is in operation.

Figure 1-24 shows a close-up view of the fan tray.

Figure 1-24 Cisco 6260 Fan Tray



The fans have two speeds. By default, they run at low speed. The system turns up the fan speed when

- It senses high temperatures within the chassis.
- One or more fans fail.
- The other fan tray is removed.

The fan speed returns to normal (low speed) when

- Temperatures within the chassis fall to acceptable levels.
- A missing fan tray is reinstalled in the chassis.

Caution The fans in both fan trays must run continuously. The system might suffer thermal damage if the fans in either tray stop for more than 5 minutes.

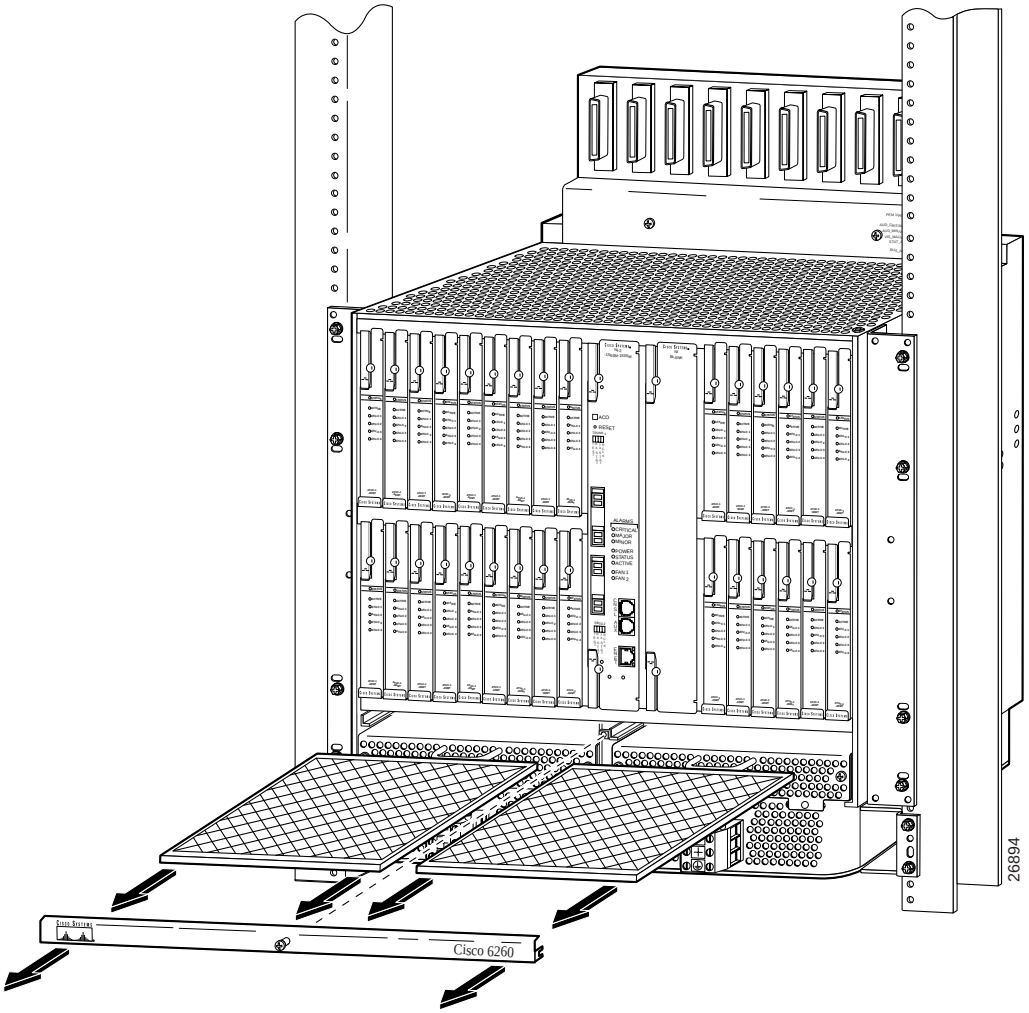
An air filter is located above each fan tray. The air filters must be removed and cleaned periodically. See the "Replacing or Cleaning the Air Filter" section on page 6-2 for instructions on cleaning the air filters.

Note For hardware specifications for the fan tray, see the "Fan Tray" section on page A-12.

1.2.7 Air Filters

Two air filters are located at the bottom of the Cisco 6260 chassis. The air filters must be removed and cleaned periodically. See Chapter 6, "Upgrading and Maintaining the Cisco 6260 System," for complete instructions on cleaning and replacing the air filter. Figure 1-25 shows the location of the air filters and the protective bezel that covers them.

Figure 1-25 Air Filters



1.2.8 ESD Jack

An electrostatic discharge (ESD) jack is located on the top of the chassis at the right front corner. Before removing any components from the chassis or installing any components, ground yourself by using the ESD jack.

1.2.9 Third-Party POTS Splitter

For information about the third-party POTS splitter, refer to the vendor documentation.

1.3 Management Software

You can provision and manage the Cisco 6260 system through the following management software:

- Cisco IOS—A command-line interface (CLI) that is available for network element provisioning.
- Cisco DSL Manager (CDM)—An element management system designed to configure and manage the 6xxx series of Cisco IOS software-based DSLAMs through a graphical-user interface (GUI). CDM provides the following areas of network management: fault, configuration, performance, and security. CDM runs within the Cisco Element Manager Framework (EMF); both are installed on Sun workstations.

  Cisco EMF is based on an object model in which network elements or modules represent the managed entity. Each object is defined by a class and specific attributes. An object can represent a network element or a more abstract entity such as a link relationship, a network, or a container such as a site, shelf, or region.

Note If your network contains multiple SUN workstations, you must dedicate one workstation as the server and use all additional workstations as clients. The server should be the repository and distributor of database information from which the clients request information. The client workstations allow multiple users to monitor the managed network.

1.3.1 Management Software-Generated Alarms

The Cisco 6260 includes CO alarm LED indicators and relays that indicate system status. You can wire CO facility alarm relay contacts for either normally open or normally closed operations. The supported alarms that are generated by the management software are:

- CRITICAL—A critical condition is indicated when the CRITICAL LED in the NI-2 card faceplate lights.
  - When a critical alarm occurs, the critical visual and audible alarm relays are activated.
  - A critical alarm affects many or all subscribers that are connected to the node. (For example, failure of the NI-2 card or the network trunk connection can cause a critical alarm.)
  - Critical alarms clear after you fix the condition that triggered the alarm.
  - Audible alarms are turned off when you press the ACO button on the NI-2 card faceplate or clear the alarm in the Cisco IOS software.
- MAJOR—A major alarm condition is indicated when the MAJOR LED in the NI-2 card faceplate lights.
  - When a major alarm occurs, the major visual and audible alarm relays are also activated.
  - Many of the subscribers that are connected to the node are affected.
  - Major alarms clear after you fix the condition that triggered the alarm.

  - Audible alarms are turned off when you press the ACO button on the NI-2 card faceplate or clear the alarm in the Cisco IOS software.

- MINOR—A minor alarm condition is indicated when the MINOR LED in the NI-2 card faceplate lights.
  - When a minor alarm occurs, the minor visual and audible alarm relays are also activated.
  - A small number of subscribers that are connected to the node are affected.
  - Minor alarms clear after you fix the condition that triggered the alarm.
  - Audible alarms are turned off when you press the ACO button on the NI-2 card faceplate or clear the alarm in the Cisco IOS software.

Visual and audible alarm relay contacts can be wired from the Cisco 6260 to CO alarm devices (remote lights or bells, for example) located anywhere within the facility.

The visual and audible alarm relays are located on the I/O module, but the NI-2 card hardware operates them.

For more information about alarms that are generated in the management software, see Chapter 5, “Troubleshooting.”