Hardware Description

This chapter provides an overview of the Cisco 6200 advanced digital subscriber line access multiplexer (DSLAM) and describes the system's hardware components. The chapter is arranged as follows:

Warning For translations of the safety warnings in this chapter, see Appendix C, "Translated Safety Warnings."

1.1 Cisco DSL Product Family

The Cisco 6200 is part of a family of digital subscriber line (DSL) products that provide end-to-end service, carrying data between the subscriber's home or office, the telephone central office (CO), and the networks beyond. The Cisco 6000 family includes the following members:

- The Cisco 6200 DSLAM is a CO-grade multiplexer that supports up to 80 asymmetric digital subscriber line (ADSL) ports. The Cisco 6200 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 the enterprise intranet.
- ADSL customer premises equipment (CPE) devices, which reside at the subscriber site connected to PCs or routers, modulate data so that it can travel over telephone lines to the Cisco 6200 DSLAM at the CO. CPE devices in the Cisco DSL product family include the Cisco 675 and the Cisco 605.
- The Cisco 6200 Manager is an SNMP-based element management application that provides configuration, monitoring, and management support. The Cisco 6200 Manager offers a graphical user interface and runs under Windows NT 4.0 and higher. A separate console interface to the Cisco 6200 DSLAM provides command line access to all management services.
- ADSL plain old telephone service (POTS) splitters, or voice filters, located both at the subscriber premises and at the CO, support simultaneous voice and data transmission. (If a subscriber is using a telephone line for data only, the POTS splitter connection is not required.)

The Cisco DSL family also includes a Frame Relay IDSL multiplexer, a service selection gateway, the Cisco 605 card, the Cisco 6100 DSLAM, and an ATM switch to aggregate Cisco 6200 traffic.

1.2 Cisco 6200 Chassis

This section describes the chassis that houses the Cisco 6200 DSLAM.

The Cisco 6200 consists of circuitry and connections that reside within a shelf or chassis that allows modular insertion and removal of the various field-replaceable units (FRUs). The chassis consists of a module compartment, a fan compartment, a power module compartment, a backplane, and I/O cabling. Figure 1-1 shows the front of the chassis; Figure 1-2 shows the back.

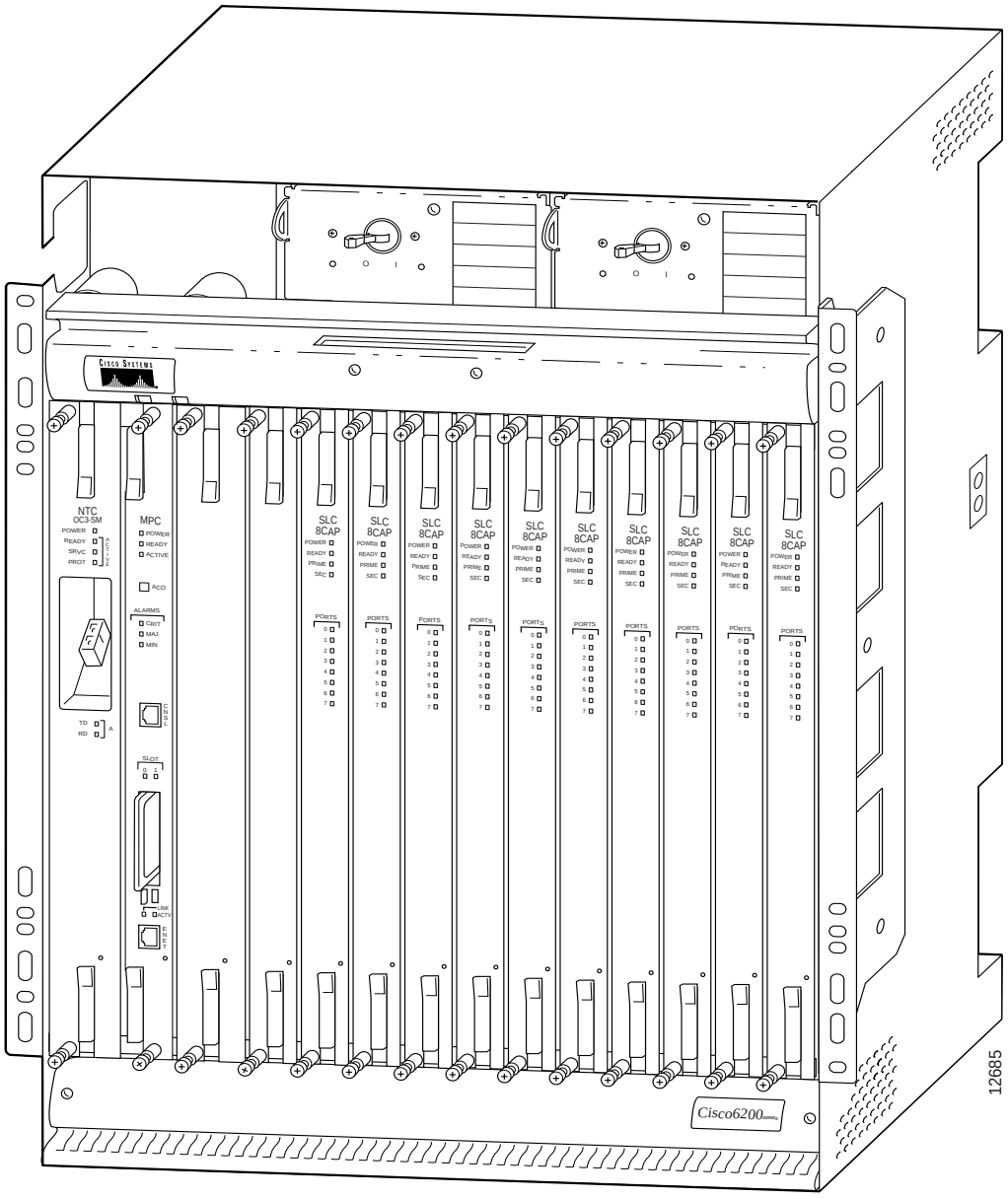
1.2.1 Module Compartment

The module compartment holds all circuitry that relates to Cisco 6200 operation. The module compartment includes 14 slots that hold the modules (cards):

- Slot 1: Holds the network trunk card (NTC).
- Slot 2: Holds the management processor card (MPC).
- Slots 3 and 4: Unoccupied in this release of the system.
- Slots 5 to 14: Hold up to ten subscriber line cards (SLCs).

All Cisco 6200 cards can be installed and removed while the rest of the system continues to operate. (However, the system cannot pass data if the NTC is removed.) The NTC, MPC, and SLCs are described later in this chapter.

Figure 1-1 Cisco 6200 Chassis, Front View

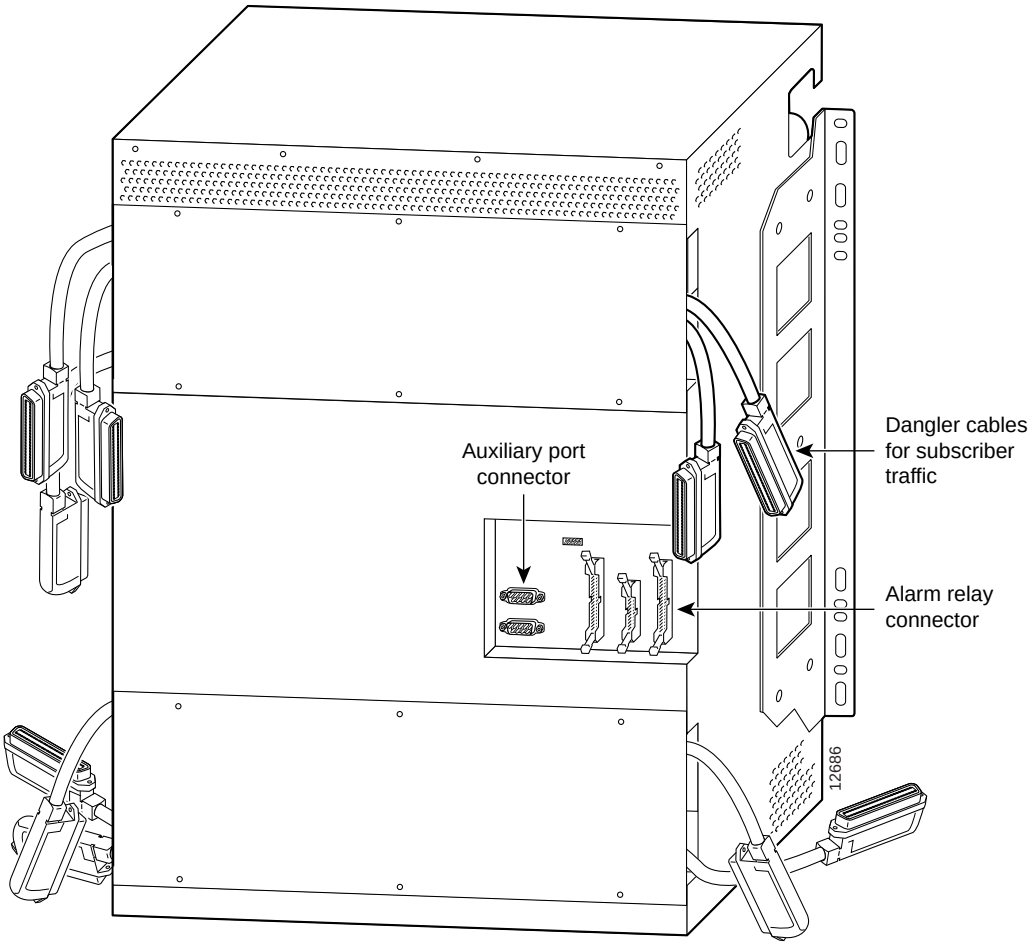


1.2.2 Backplane

Located behind the module compartment, the backplane provides the following services:

- Interconnects the MPC, NTC, and SLCs
- Connects the SLCs with the subscribers (local loops) or the POTS splitter
- Distributes power, clocking, and other common signals to all the modules

Figure 1-2 Cisco 6200 Chassis, Rear View



Primary (A) and Secondary (B) H-Buses

The backplane's primary and secondary H-buses (horizontal buses) link the MPC, NTC, and SLCs. In this release, the primary bus carries all traffic. The buses operate at 160 Mbps total throughput.

Each H-bus has two parts:

- A downstream component broadcasts all cells received from the NTC interface to each SLC. (Logic on the SLC filters and directs cells destined for each port.)
- An upstream component provides a contention mechanism for cells received from subscriber ports to be funneled into the upstream NTC path.

Ethernet Management Bus

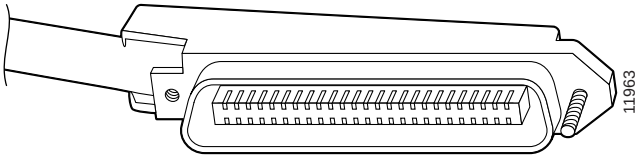
A 10Base2-type Ethernet bus in the backplane carries internal management traffic between the cards.

Connections to POTS Splitters or Telephone Lines

On the inner surface of the backplane, the upper and lower SLC connectors connect the SLC in the corresponding slot (5 to 14) with unshielded twisted pair (UTP) lines. These lines connect to an external POTS splitter, and from there to subscribers over telephone lines. (If a subscriber is using a telephone line for data only, the POTS splitter is not required.)

Ten factory-installed dangler cables provide DSL subscriber connections. Each dangler cable ends with a 50-pin female Champ Telco connector (Figure 1-3), and each carries eight pairs to a single SLC module. For a pinout list and an illustration showing the connectors on the rear panel, see Appendix A, “Pin Assignments.”

Figure 1-3 Telco Champ Connector



Alarm Relay Connection

Backplane connector J39, accessible from the rear of the chassis, is the alarm relay connector. The alarm relays provide relay contact closures. The alarm relays transmit critical, major, and minor alarms to a separate, external alarm device within the CO. The alarm device uses a bell, light, or other signal to alert CO support personnel of the change in status. (The alarm relay transmits audible and visual alarms on separate circuits.) Alarms transmitted through J39 are also communicated by all of the following methods:

- Alarm LEDs (labeled Critical, Major, and Minor) on the MPC. (Some alarms also affect the TD and RD LEDs on the NTC.)
- Event messages on the console.
- Component status display of the Cisco 6200 Manager.

To turn off an audible alarm, do one of the following:

- Press the alarm cut-off (ACO) button on the MPC
- Click the ACO button in the Cisco 6200 Manager component status display
- Use the **alarmcutoff** command (at the console or via Telnet)
- Use a switch or command on your external alarm device

Cutting off an alarm has no effect on the alarm status of the system or on the indication of visual alarms. To clear an alarm, you must correct the condition that caused it. To get information about the source of an alarm, do one of the following:

- Use the Cisco 6200 Manager. (See the *User Guide for the Cisco 6200 Manager* for instructions.)
- Use the command **show dsl alarms**. (See Chapter 7, “Troubleshooting,” for more information on this command.)

For a pinout list and additional information on connecting alarm relays, see Appendix A, “Pin Assignments.”

Auxiliary Port

J40, a 9-pin female connector on the Cisco 6200 backplane, is an EIA/TIA-232 (RS-232) serial port connecting to the management processor card (MPC). J40 is an auxiliary craft port that can be used to connect devices such as terminals, modems, or laptop computers to the Cisco 6200. It is accessible from the rear of the chassis. For a pinout list, see Appendix A, “Pin Assignments.”

Power Terminals

J17, J18, J19, and J20, located at the upper right corner of the rear panel, are screw terminals for –48 VDC power input and return:

- J17 is the –48V terminal for power circuit A.
- J19 is the +48V (return) terminal for power circuit A.
- J18 is the –48V terminal for power circuit B.
- J20 is the +48V (return) terminal for power circuit B.

Power circuit A is connected to the power entry module (PEM) on the left (as you face the front of the chassis); power circuit B is connected to the PEM on the right.

Unused Connectors

The Cisco 6200 backplane contains several connectors and a jumper that are not used in the current release. See Appendix A, “Pin Assignments,” for a list of the unused items.

1.2.3 Fan Tray

The fan tray, located at the bottom of the chassis, houses eight fans that maintain proper temperatures inside the chassis, plus an air filter. The filter should be removed and cleaned periodically. Refer to Chapter 6, “Preventive Maintenance,” for complete information on cleaning the air filter.

Caution The Cisco 6200 cooling fans must run continuously. The system may suffer thermal damage if the fans stop for more than 10 minutes. (At ambient temperatures above 104 F(40 C),thermal damage may occur sooner.)

1.2.4 Power Entry Modules (PEMs)

One or two PEMs distribute DC power to the chassis. The Cisco 6200 needs only one active PEM to operate; if two PEMs are installed, the second PEM’s power source serves as a hot backup to the first PEM’s power source.

Each PEM is connected to a single DC power source. For power redundancy, two PEMs must be installed, and two separate DC power sources must be connected to the chassis. If one power source is connected, only one PEM is required. There is no benefit to connecting two power sources to a chassis with one PEM, or to installing two PEMs in a chassis with one power source.

The PEMs reside at the top of the Cisco 6200 chassis, and they are installed and accessed from the front. DC power (–48V) enters the chassis through screw terminals on the rear panel of the chassis. The PEMs receive power through the backplane and internal cabling.

The power bay on the left is wired to power circuit A; the bay on the right is wired to power circuit B. (The circuits are identified at the power terminals on the backplane.)

The following fixtures are present on the front panel of each PEM:

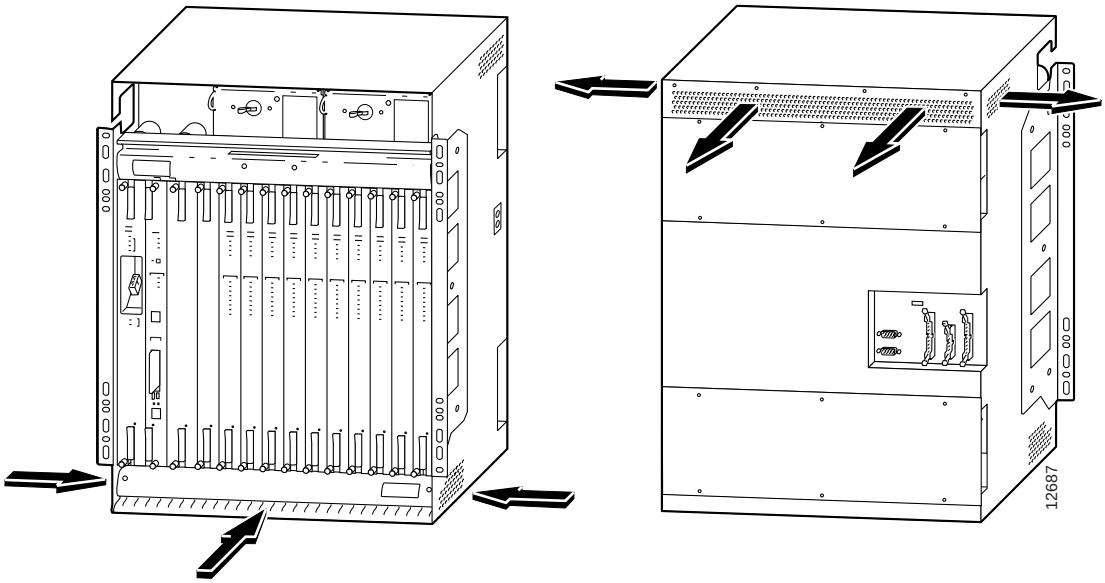
- A green LED that comes on to indicate that –48 VDC power is available to the chassis
- A circuit breaker

Note To turn off a Cisco 6200 that has two PEMs, you must flip the circuit breakers on *both* PEMs to OFF (0).

1.2.5 Cooling Vents

The cooling vents are located on the sides, front, and back of the Cisco 6200 chassis, as shown in Figure 1-4. Air flows in at the bottom of the chassis, and flows out at the top. Do not obstruct the intake and exhaust vents in any way.

Figure 1-4 Air Flow Through Intake and Exhaust Vents



1.2.6 DSLAM Specifications

Table 1-1 lists the specifications of the Cisco 6200 DSLAM. Table 1-2 lists standards and certifications for the Cisco 6200 DSLAM.

Warning To prevent a Cisco 6200 system from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature of 131˚F (55˚C).

Table 1-1 Cisco 6200 DSLAM Specifications

Specification	Description
Components	14-slot card compartment
	Backplane
	Fan compartment
	Power module compartment
Power input	Dual inputs, each –48 VDC Tested voltages: –48V and –57V Tolerance limits: –42V to –57V Maximum input current: 23A
Power consumption, fully loaded[1]	With SLC 8CAPs: 820W
	With SLC 8DMTs: 892W
Dimensions	Height: 23.6 in. (60.0 cm)
	Width: 17.5 in. (44.4 cm) (mounting brackets not included)
	Depth: 11.8 in. (30.0 cm)
Weight with no cards[2]	48 lb (21.7 kg)
Weight fully loaded[1]	82.5 lb (37.4 kg)
Operating temperatures	Short term: 23 to 131 F (–5 to 55 C)[3]
	Long term: 32 to 104 F (0 to 40 C)
Storage temperature	–40 to 158 F (–40 to 70 C)
Operating humidity	15% to 90% noncondensing
Storage humidity	10% to 95% noncondensing

1 A fully loaded chassis has 1 fan tray, 2 PEMs, 1 MPC, 1 NTC, 10 SLCs, covers, and dangler cables.
2 A chassis with no cards has 1 fan tray, 2 power entry modules, covers, and dangler cables.
3 The chassis can operate safely at short term operating temperatures only if all of the fans are working properly. If a fan fails in a chassis that is experiencing an ambient temperature above 104 F (40 C), thermal damage may occur.

Table 1-2 Standards and Certifications

Category	Description
NEBS	Bellcore SR-3580 to Level 3 (GR-63, GR-1089)
EMI	FCC Part 68 and part 15 Class A CSA Class A EN55022 Class A AS/NRZ 3548 Class A VCCI Class 1
Safety	UL 1950 EN60950 CSA C22.2 No. 950 AUSTEL TS001 AS/NZS 3260
Immunity	EN61000-4-2/IEC-1000-4-2 EN61000-4-3/IEC-1000-4-3 EN61000-4-4/IEC-1000-4-4 EN61000-4-5/IEC-1000-4-5 EN61000-4-6/IEC-1000-4-6 EN61000-4-11/IEC-1000-4-11

1.3 Network Trunk Cards (NTCs)

This section describes the OC-3c and STM-1 network trunk cards (NTCs). The NTC module resides in slot 1 of the Cisco 6200 chassis.

1.3.1 What is the NTC OC-3?

The NTC is a service interface module that concentrates the data traffic from all Cisco 6200 subscriber ports and connects the node to a single trunk line from the service-providing ATM network. This full-duplex channel unit carries data both downstream (to the subscriber) and upstream (from the subscriber).

In Release 1, the trunk is a full-duplex OC-3c fiber optic channel. One OC-3c channel terminates at a single NTC.

The OC3 NTC is available in both single-mode and multimode versions. Multimode fiber is LED-driven and is designed for distances up to 2 kilometers (1.2 miles). Longer distances (up to 15 kilometers or 9.2 miles) require laser-driven single-mode fiber.

In the downstream direction, the OC3 NTC accepts ATM cells at the OC-3c rate (155.52 Mbps) and adapts these cells to the Cisco 6200 internal bus.

The OC3 NTC also transmits upstream data back to the service provider via ATM on the OC-3c physical layer.

The Cisco 6200 uses a fixed mapping of permanent virtual channels (PVCs) between trunk and subscriber ports. This means that no configuration of these circuits is required. Thirty-one PVCs link each subscriber port to the trunk port on the NTC. These subscriber traffic PVCs are assigned virtual channel identifiers (VCIs) 33 through 63. VCIs 0 through 31 are reserved for control traffic. All of these VCs use virtual path identifier (VPI) 0. See the chapter “Command Reference” for instructions on using the command **show dsl vcmap** to display the VCIs assigned to a particular slot or port.

The OC3 NTC collects ATM cell counts, which are accessible through the 6200 Management Information Base (MIB). These cell count include:

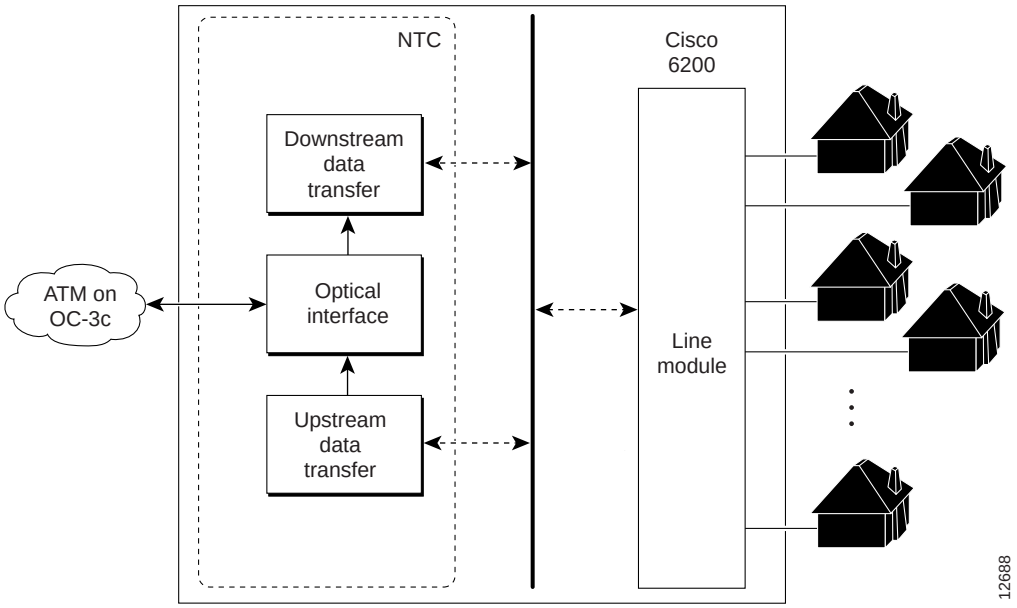
- Number of nonidle cells transmitted upstream
- Number of nonidle downstream cells received with good or correctable header checksums
- Number of downstream cells received with uncorrectable header checksums

The OC3 NTC provides bidirectional adaptation between serial ATM cells within the OC-3c fiber and the 16-bit-parallel format on the backplane’s 160-Mbps H-bus. Three basic circuits perform this adaptation process:

- Optical interface
- Upstream data transfer
- Downstream data transfer

Figure 1-5 shows how the three circuits interact.

Figure 1-5 NTC OC-3 Application



The optical interface performs the optical-to-electrical and electrical-to-optical conversions. Its other tasks include clock recovery, overhead processing, cell delineation, and diagnostic information retrieval.

The upstream data transfer unit receives data via a 16-bit parallel input from the internal bus on the node's backplane. ATM cells are received from an SLC channel only after that channel has won access to the upstream data bus from the other contending line channels. The upstream data transfer unit monitors the contention bus to direct inbound data to the optical interface.

The downstream data transfer unit inserts data onto the bus. This circuit inserts idle cells when a full data cell is not yet ready for transmission.

1.3.2 NTC OC-3: Physical Description

The NTC resides in slot 1 (the left-most slot as you face the front of the chassis). Each OC-3 NTC faceplate is marked NTC OC3-SM (single-mode) or NTC OC3-MM (multimode). The faceplate (see Figure 1-6) includes the fixtures discussed in the following paragraphs.

OC-3c Trunk Port

The dual SC connectors (one for transmitting, one for receiving) for the Cisco 6200 network trunk port are recessed into the OC-3 NTC faceplate to prevent the cables from protruding too far outside the faceplate.

Warning Class 1 laser product.

Warning Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.

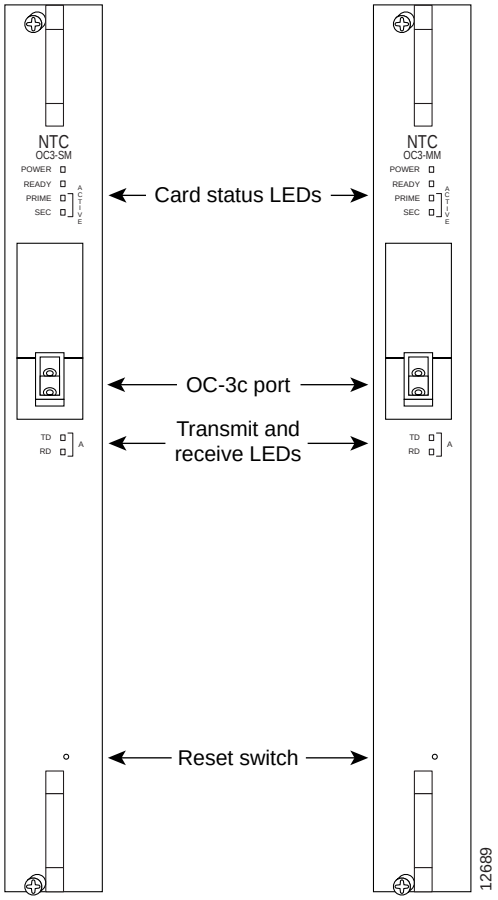
The fiber optic communication channels in the single-mode OC-3c card (NTC OC3-SM) operate with laser energy, which can be harmful, especially to the eyes. During normal operation this energy is confined to the cable and presents no danger. To avoid injury when you are connecting or disconnecting optical channels, observe these precautions:

- Always disconnect the card from the backplane before connecting or disconnecting optical cables.
- Always keep the protective cap on the optic connector when the connector is not in use.
- Never look into an optical cable or connector.

Reset Switch

The reset switch is recessed behind the faceplate to avoid accidental disturbance. It is not for customer use.

Figure 1-6 NTC OC-3 Faceplates



LED Indicators

Table 1-3 describes the LEDs on the faceplate of the OC-3 NTC.

Table 1-3 LEDs on the NTC OC-3

LED	Color	Condition Indicated
POWER	Green	The module is receiving power.
READY	Green	The NTC is experiencing no problems.
	Yellow	The NTC failed its power-on self test; it has a hardware problem. Refer to Chapter 7, “Troubleshooting.”
	Off	The NTC is either initializing or in test mode.
PRIME	Green	This NTC is active and is using the primary bus.
SEC	Green	This NTC is active and is using the secondary bus. (Redundant systems only.)
TD	Green	None of the fault conditions that cause the LED to turn yellow or turn off have been reported.
	Yellow	The LRFI fault condition has been reported on the transmit side.
	Red	The PRFI fault condition has been reported on the transmit side.
RD	Green	None of the fault conditions that cause the LED to turn yellow or turn off have been reported.
	Yellow	One or more of the following fault conditions have been reported on the receive side: LOS, LOF, LOP, EQF, LOCD, LAIS.
	Red	One or more of the following fault conditions have been reported on the receive side: PAIS, LOST, Signal Label Mismatch. It is not possible to determine with a high degree of certainty the operational state of the link when one of these conditions is present.

1.3.3 NTC OC-3 Specifications

Table 1-4 lists the physical and electrical specifications of the NTC.

Table 1-4 NTC OC-3 Specifications

Specification	Description
External interface	One SONET STS-3c (155 Mbps). Single-mode (intermediate reach) and multimode OC-3c versions available
Connector type	SC
Fiber types	• Single mode (up to 15 km) • Multimode (up to 2 km)
Average transmitted power	• Single mode: –11.5 dBm • Multimode: –17 dBm
Average received power	• Single mode: –28 to –8 dBm • Multimode: –30 to –14 dBm
Transmission distances	• Single mode: up to 15 km (9.2 miles) • Multimode: up to 2 km (1.2 miles)
Wavelength (both modes)	1310 nm
Level 2 protocol	ATM
Timing	Loop timed
Internal interface	16-bit parallel bus at 10 Mbps (160 Mbps total throughput)
Internal hardware	• Motorola MC68360 • 0.5M of PROM • 4M of RAM • Odetics SONET interface
Dimensions (width x height x depth)	1.5 x 15.75 x 9.75 in (3.8 x 40.0 x 24.8 cm)
Weight	2 lb (0.9 kg)
Power consumption	26W

1.3.4 What is the NTC STM-1?

The NTC STM-1 is a service interface module that concentrates the data traffic from all Cisco 6200 subscriber ports and connects the node to a single trunk line from the service-providing ATM network. This full-duplex channel unit carries data both downstream (to the subscriber) and upstream (from the subscriber).

The trunk is a full-duplex STM-1 fiber optic channel. One STM-1 channel terminates at a single NTC.

The NTC STM-1 is available in both single-mode and multimode versions. Multimode fiber is LED-driven and is designed for distances up to 2 kilometers (1.2 miles). Longer distances (up to 15 kilometers or 9.2 miles) require laser-driven single-mode fiber.

In the downstream direction, the NTC STM-1 accepts ATM cells at the SDH rate (155.52 Mbps) and adapts these cells to the Cisco 6200 internal bus.

The NTC STM-1 also transmits upstream data back to the service provider via ATM on the STM-1 physical layer.

The Cisco 6200 uses a fixed mapping of permanent virtual channels (PVCs) between trunk and subscriber ports. This means that no configuration of these circuits is required. Thirty-one PVCs link each subscriber port to the trunk port on the NTC. These subscriber traffic PVCs are assigned virtual channel identifiers (VCIs) 33 through 63. VCIs 0 through 31 are reserved for control traffic. All of these VCs use virtual path identifier (VPI) 0. See the *Cisco 6200 User Guide* for instructions on using the command **show dsl vcmap** to display the VCIs assigned to a particular slot or port.

The NTC STM-1 collects ATM cell counts, which are accessible through the 6200 Management Information Base (MIB). These cell count include:

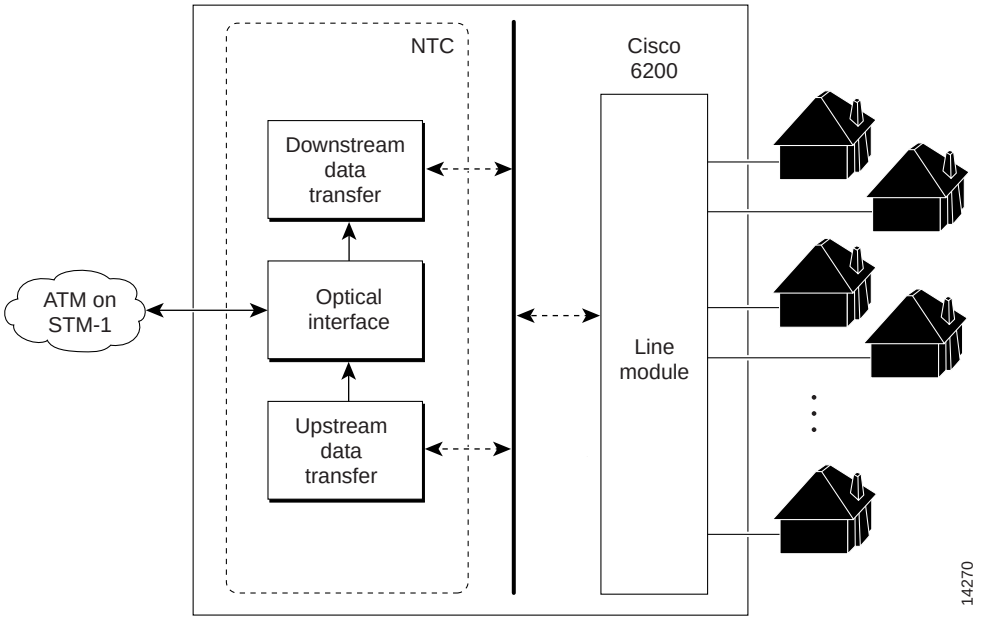
- Number of nonidle cells transmitted upstream
- Number of nonidle downstream cells received with good or correctable header checksums
- Number of downstream cells received with uncorrectable header checksums

The NTC STM-1 provides bidirectional adaptation between serial ATM cells within the STM-1 fiber and the 16-bit-parallel format on the backplane's 160-Mbps H-bus. Three basic circuits perform this adaptation process:

- Optical interface
- Upstream data transfer
- Downstream data transfer

Figure 1-7 shows how the three circuits interact.

Figure 1-7 NTC STM-1 Application



The optical interface performs the optical-to-electrical and electrical-to-optical conversions. Its other tasks include clock recovery, cell delineation, and diagnostic information retrieval.

The upstream data transfer unit receives data via a 16-bit parallel input from the internal bus on the node's backplane. ATM cells are received from a subscriber line card (SLC) channel only after that channel has won access to the upstream data bus from the other contending line channels. The upstream data transfer unit monitors the contention bus to direct inbound data to the optical interface.

The downstream data transfer unit inserts data onto the bus. This circuit inserts idle cells when a full data cell is not yet ready for transmission.

1.3.5 NTC STM-1: Physical Description

The NTC resides in slot 1 (the left-most slot as you face the front of the chassis). Each NTC STM-1 faceplate is marked NTC STM1-SM (single-mode) or NTC STM1-MM (multimode). The faceplates (see Figure 1-8) include the fixtures discussed in the following paragraphs.

Trunk Port

The dual SC connectors (one for transmitting, one for receiving) for the Cisco 6200 network trunk port are recessed into the NTC faceplate to prevent the cables from protruding too far outside the faceplate.

Warning Class 1 laser product.

Warning Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.

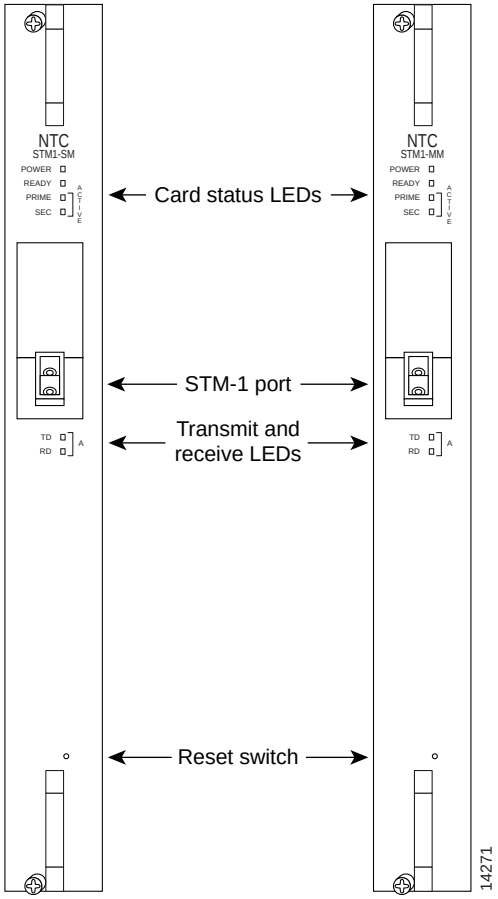
The fiber optic communication channels in the single-mode trunk card (NTC STM1-SM) operate with laser energy, which can be harmful, especially to the eyes. During normal operation this energy is confined to the cable and presents no danger. To avoid injury when you are connecting or disconnecting optical channels, observe these precautions:

- Always disconnect the card from the backplane before connecting or disconnecting optical cables.
- Always keep the protective cap on the optic connector when the connector is not in use.
- Never look into an optical cable or connector.

Reset Switch

The reset switch is recessed behind the faceplate to avoid accidental disturbance. It is not for customer use.

Figure 1-8 NTC STM-1 Faceplates



LED Indicators

Table 1-5 describes the LEDs on the faceplate of the NTC STM-1.

Table 1-5 LEDs on the NTC STM-1

LED	Color	Condition Indicated
POWER	Green	The module is receiving power.
READY	Green	The NTC is experiencing no problems.
	Yellow	The NTC failed its power-on self test; it has a hardware problem. Refer to the *Cisco 6200 User Guide* for troubleshooting instructions.
	Off	The NTC is either initializing or in test mode.
PRIME	Green	This NTC is active and is using the primary bus.
SEC	Green	This NTC is active and is using the secondary bus. (Redundant systems only.)
TD	Green	None of the fault conditions that cause the LED to turn yellow or turn off have been reported.
	Yellow	The LRFI fault condition has been reported on the transmit side.
RD	Green	None of the fault conditions that cause the LED to turn yellow or turn off have been reported.
	Yellow	One or more of the following fault conditions have been reported on the receive side: LOS, LOF, LOP, EQF, LOCD, LAIS.

1.3.6 NTC STM-1 Specifications

Table 1-6 lists the physical and electrical specifications of the NTC STM-1.

Table 1-6 NTC STM-1 Specifications

Specification	Description
External interface	One SDH STM-1 (155 Mbps). Single-mode (intermediate reach) and multimode STM-1 versions available
Connector type	SC
Fiber types	• Single mode (up to 15 km) • Multimode (up to 2 km)
Average transmitted power	• Single mode: –11.5 dBm • Multimode: –17 dBm
Average received power	• Single mode: –28 to –8 dBm • Multimode: –30 to –14 dBm
Transmission distances	• Single mode: up to 15 km (9.2 miles) • Multimode: up to 2 km (1.2 miles)
Wavelength (both modes)	1310 nm
Level 2 protocol	ATM
Timing	Loop timed
Internal interface	16-bit parallel bus at 10 Mbps (160 Mbps total throughput)
Internal hardware	• Motorola MC68360 • 0.5M of PROM • 4M of RAM • Odetics SDH interface
Dimensions (width x height x depth)	1.5 x 15.75 x 9.75 in (3.8 x 40.0 x 24.8 cm)
Weight	2 lb (0.9 kg)
Power consumption	26W

1.4 Management Processor Card (MPC)

The Cisco 6200 is controlled and managed by the MPC.

1.4.1 Functional Description

The MPC performs management and storage tasks for the Cisco 6200 DSLAM. The MPC provides

- The Cisco IOS command line interface (CLI) for configuration and monitoring
- An SNMP agent for communicating between the Cisco 6200 and the PC running the Cisco 6200 Manager software
- Alarm contacts and environmental monitoring of key system resources
- Line card configuration and fault polling
- Nonvolatile storage of configuration information
- Two PCMCIA Flash slots for storage of software images and configuration data

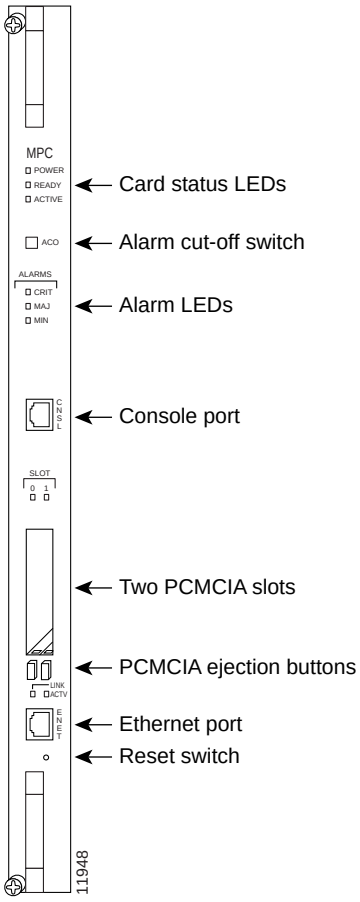
The MPC runs a version of Cisco IOS software that is designed for DSL multiplexing.

At startup, the MPC loads program software and configuration data from NVRAM, from a server on the network, or from a Flash card in one of its PCMCIA slots. The MPC then provides boot images to the line cards. After initializing the system, the MPC provides monitoring and control services, including the CLI (available at the console and via Telnet); SNMP communication with the Cisco 6200 Manager; and critical, major, and minor alarm signals.

1.4.2 Physical Description

The MPC resides in slot 2. The MPC faceplate (see Figure 1-9) includes the fixtures discussed in the following paragraphs.

Figure 1-9 MPC Faceplate



ACO Switch

The alarm cut-off (ACO) switch is a pushbutton located near the top of the MPC. Press the switch to turn off an audible alarm. (For more information on alarms, see the "Alarm Relay Connection" section on page 1-5.)

Console Port

The console port on the MPC is a serial EIA/TIA-232 port with an RJ-45 connector. See Appendix A, “Pin Assignments,” for pinouts.

PCMCIA Slots and Ejection Buttons

The MPC provides two slots for PCMCIA Flash memory cards. PCMCIA cards store system software and node configuration information. An ejection button is located beneath each PCMCIA slot; push the button to remove the card.

Ethernet Port

The Ethernet port on the MPC is a 10BaseT port with an RJ-45 connector. It is used to connect the Cisco 6200 to its management station. See Appendix A, “Pin Assignments,” for pinouts.

Reset Switch

The reset switch, which initializes the MPC, is recessed behind the faceplate to avoid accidental disturbance.

LED Indicators

All LEDs on the MPC are described in Table 1-7.

Table 1-7 MPC LEDs

LED	Color	Condition Indicated
POWER	Green	The MPC is receiving power.
READY	Green	The MPC is experiencing no problems.
	Yellow	The MPC failed its power-on self test—it has a hardware problem. Refer to Chapter 7, “Troubleshooting.”
	Off	The MPC is either initializing or in test mode.
ACTIVE	Green	This MPC is active.
CRITICAL	Red	The system is experiencing a critical alarm. A critical alarm affects many or all of the subscribers connected to the node. (Failure of the NTC or the trunk can cause a critical alarm.) Use the Cisco 6200 Manager or the command line interface to identify the problem.
MAJOR	Red	The system is experiencing a major alarm. A major alarm affects several subscribers. (A total SLC failure, which affects all of the subscribers connected to that card, causes a major alarm.) Use the Cisco 6200 Manager or the command line interface to identify the problem.
MINOR	Yellow	The system is experiencing a minor alarm. A minor alarm affects a small number of subscribers. (A partial SLC failure causes a minor alarm.) Use the Cisco 6200 Manager or the command line interface to identify the problem.
Slot 0	Green	PCMCIA card slot 0 is being accessed by system software.
Slot 1	Green	PCMCIA card slot 1 is being accessed by system software.
ACT	Green	The Ethernet port is receiving or transmitting data (active).
LNK	Green	A 10BaseT link is present on the Ethernet port.

1.4.3 MPC Specifications

Table 1-8 lists the physical and electrical specifications of the MPC.

Table 1-8 MPC Specifications

Specification	Description
External Interfaces	• EIA/TIA-232 console port • 10BaseT Ethernet management port
Internal Hardware	• MIPS RV4640 processor • Galileo GT64011 memory management unit • 16 MB of DRAM • 8MB of Flash memory (to store boot image) • 2 PCMCIA Flash card slots
Dimensions (width x height x depth)	1.5 x 15.75 x 9.75 in (3.8 x 40.0 x 24.8 cm)
Weight	2.5 lb (1.13 kg)
Power consumption	36.5W

1.5 Subscriber Line Card (SLC)

This section describes the CAP and DMT versions of the subscriber line card (SLC). A Cisco 6200 chassis can hold up to 10 SLC modules.

Note All the SLCs in a Cisco 6200 chassis should be of the same type. The mixture of CAP and DMT cards in a single chassis is not supported.

1.5.1 What is the SLC 8CAP?

The CAP version of the SLC (labeled SLC 8CAP) is a hot-swappable line module that provides data communication between the Cisco 6200 node and up to eight subscribers. Modems on the CAP SLC use the carrierless amplitude modulation/phase modulation (CAP) method, a common line code method for asymmetric digital subscriber line (ADSL) transmissions. As an ADSL device, the CAP SLC transmits high-speed data through an external plain old telephone service (POTS) splitter to subscribers over existing, telephone-grade segments of copper wire. Figure 1-10 illustrates SLC operation.

The CAP SLC transports data at speeds up to 7 Mbps downstream (from the service provider to the subscriber) and receives up to 1 Mbps upstream (from the subscriber to the service provider). The SLC supports upstream and downstream passband channels for subscriber data. Baseband POTS is unused by the SLC; data is added to this channel by the external POTS splitter.

How the SLC Handles Traffic

In the downstream direction, the SLC receives ATM cells from the Cisco 6200 backplane bus. The cell filter discards cells whose virtual path/virtual channel IDs (VPI/VCIs) do not pertain to this subscriber's channel. (Each port has a fixed set of 31 VCIs, which are permanently assigned to VCIs on the NTC.) The traffic controller buffers cells. Then the CAP transceiver transmits the outbound cells. The SLC sends the cells out to an external POTS splitter, which inserts baseband POTS traffic (if any such traffic is provided) before sending the downstream ADSL and POTS signals across standard unshielded twisted pair copper wire to the subscriber.

In the upstream direction, the SLC receives ADSL signals from a POTS splitter and demodulates the CAP-modulated signal. Then the SLC channel contends with the other SLC channels for the upstream data bus. Two priority levels are available. For the first Cisco 6200 release, only UBR service is available. The SLC will ensure fair access among all cells of the same priority.

The SLC separates the upstream and downstream data channels:

- The upstream data channel occupies a band between 30 kHz and 200 kHz.
- The downstream data channel takes the band between 240 kHz and 1.5 MHz.

At the subscriber site, the DSL customer premises equipment (the Cisco 675, for example) demodulates the downstream signal and sends the data to the subscriber's PC.

Transmission Rates and Modem Training

Two options are available with respect to transmission rates:

- You can set the subscriber ports to rate-adapt (train) automatically to the highest attainable line speed.
- You can set transmission speeds. Upstream and downstream speeds can be set separately.

In the downstream direction, 11 rates are available ranging from 640 kbps to 7.168 Mbps. In the upstream direction, 9 rates are available, ranging from 91 kbps to 1.088 Mbps.

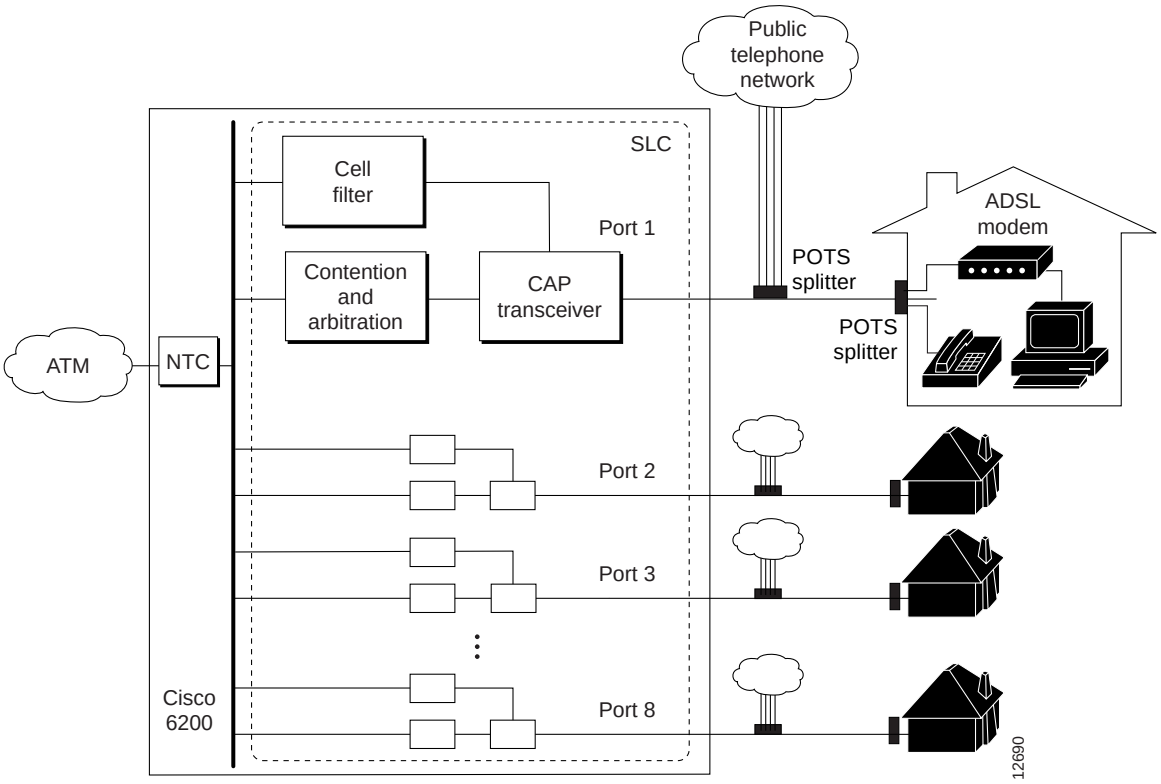
The modems on the CAP SLC train in sequence, first downstream, then upstream. Each modem first acquires the line. Then it tests the signal quality on the line by measuring the signal-to-noise ratio (SNR). It adds a preset margin, 6 dbm, to the SNR, and compares the resulting value to a table. If the value is acceptable, the modem trains at the configured rate. If not, the modem repeats the process, using the next lower transmission rate. The modem keeps trying to train indefinitely until it is successful.

Statistics

The SLC gathers signal quality statistics for network management purposes. It sends this information to the management system via the master SNMP agent. The SLC reports each of the following statistics to the management system for both upstream and downstream traffic:

- Number of nonidle cells transmitted downstream
- Number of nonidle upstream cells received with valid header checksum
- Number of upstream cells received with invalid header checksum
- Number of errored seconds (this is the number of seconds in which at least one header checksum error or loss of cell delineation is observed), both upstream and downstream

Figure 1-10 SLC 8CAP Operation



1.5.2 SLC 8CAP: Physical Description

Up to 10 SLCs can be installed in a Cisco 6200 cabinet. The cabinet slots assigned to the SLCs are slot 5 through slot 14.

The CAP SLC's faceplate is labeled SCL 8CAP. The faceplate (Figure 1-11) includes the fixtures discussed in the following paragraphs.

Reset Switch

The reset switch is recessed behind the faceplate to avoid accidental activation. It is not for customer use.

LED Indicators

Table 1-9 describes the LEDs on the faceplate of the SLC.

Figure 1-11 SLC 8CAP Faceplate

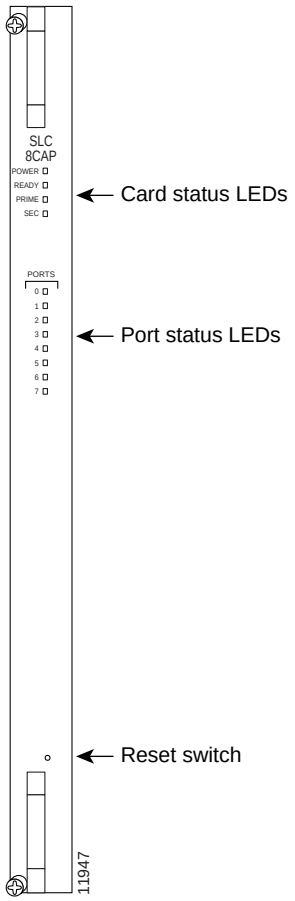


Table 1-9 SLC 8CAP LEDs

LED	Color	Condition Indicated
POWER	Green	The SLC is receiving power.
READY	Green	The SLC is experiencing no problems.
	Yellow	At least one port on the SLC is in line test mode.
	Off	The SLC is not communicating with the MPC. This is the case when • The SLC is initializing. • The SLC has a hardware problem. If the READY LED is off for an extended period when the POWER LED is on, see the *Cisco 6200 User Guide* for instructions on troubleshooting the SLC.
PRIME	Green	The SLC is using the primary (A) bus to move information across the backplane.
SEC	Green	The SLC is using the secondary (B) bus to move information across the backplane. (Redundant systems only.)
Ports 0 to 7	Green	The following conditions exist: • The port is receiving the upstream heartbeat message regularly. • The heartbeat message indicates the CAP PIM has HEC alignment in the downstream direction. • The SLC has HEC alignment in the upstream direction. • The modems on both sides have negotiated the loop rates. The port LEDs remain lit (green) in the presence of occasional minor alarms.
	Flashing green	The loop is rate-adapting (training).
	Off	One of the following conditions exists: • The port is experiencing an intrusive line quality test. • The port is experiencing an intrusive CAP hardware test. • The port is disabled or is not configured.

1.5.3 SLC 8CAP Specifications

Table 1-10 lists the physical and electrical specifications of the CAP SLC (SLC 8CAP).

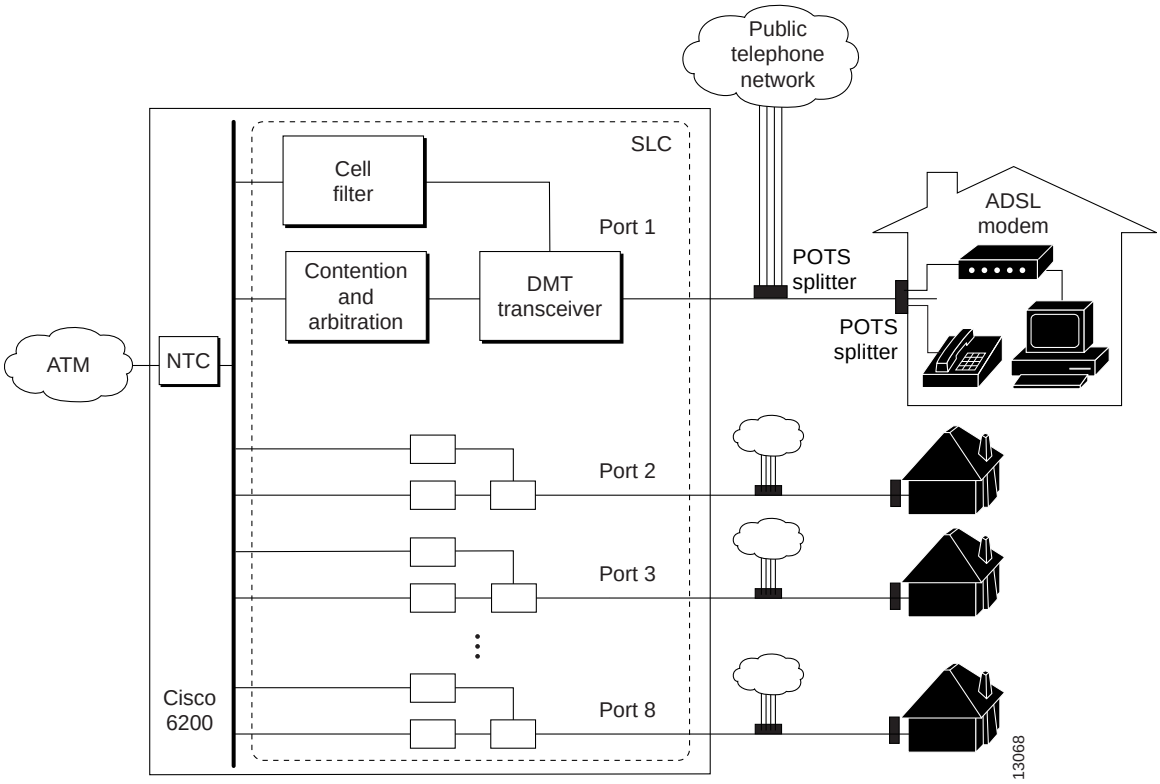
Table 1-10 SLC 8CAP Specifications

Specification	Description
Subscriber ports	8 per card
Transmission speeds	Downstream: up to 7 Mbps Upstream: up to 1 Mbps
Loop hardware media	Unshielded twisted pair copper wire
Loop modulation method	ADSL with CAP line code
Layer 2 format	ATM (service and subscriber side, end-to-end)
ATM virtual circuits supported	Up to 31 per subscriber, numbered 33 through 63 (VPI 0)
Data channel frequencies	• Upstream: 30 to 200 kHz • Downstream: 240 kHz to 1.5 MHz
Internal hardware	• Motorola MC68360 • 1 Mbyte Flash memory • 512 kbyte Flash boot memory • Globespan CAP chip set • Cisco ATM framer
Dimensions (width x height x depth)	1.17 x 15.75 x 9.75 in (3.0 x 40.0 x 24.8 cm)
Weight	3 lb (1.36 kg)
Power consumption	72W

1.5.4 What is the SLC 8DMT?

The eight-port DMT version of the SLC (SLC 8DMT) is a hot-swappable line module that provides data communication between the Cisco 6200 node and up to eight subscribers. Modems on the SLC 8DMT use discrete multitone (DMT) modulation, a common method for encoding asymmetric digital subscriber line (ADSL) transmissions. The SLC 8DMT transmits high-speed data through an external POTS splitter to subscribers over existing, telephone-grade segments of copper wire. Figure 1-12 illustrates SLC operation.

Figure 1-12 SLC 8DMT Operation



The SLC 8DMT transports data at speeds up to 8 Mbps downstream (from the service provider to the subscriber) and receives at speeds up to 800 kbps upstream (from the subscriber to the service provider). The SLC supports upstream and downstream passband channels for subscriber data. Baseband plain old telephone service (POTS) is unused by the SLC; voice and data are added by the external POTS splitter.

How the SLC 8DMT Handles Traffic

In the downstream direction, the SLC receives ATM cells from the Cisco 6200 backplane bus. The cell filter discards cells whose virtual path/virtual channel IDs (VPI/VCIs) do not pertain to a particular subscriber's channel. (Each port has a fixed set of 31 VCIs, numbered 33 to 63, which are permanently assigned to VCIs on the NTC.) The cell filter buffers cells, and the DMT transceiver transmits the outbound cells. The SLC sends the cells out to an external POTS splitter, which inserts baseband POTS traffic (if any such traffic is provided) before sending the downstream ADSL and POTS signals across standard unshielded twisted pair copper wire to the subscriber.

In the upstream direction, the SLC receives ADSL signals from a POTS splitter and demodulates the DMT-modulated signal. Then the SLC channel contends with the other SLC channels for the upstream data bus. Two priority levels are available. For the first Cisco 6200 release, only UBR service is available. The SLC will ensure fair access among all cells of the same priority.

The SLC separates the upstream and downstream data channels:

- The upstream data channel occupies a band between 25.875 kHz and 138 kHz.
- The downstream data channel takes the band between 138 kHz and 1.104 MHz.

At the subscriber site, the DSL customer premises equipment (CPE)—the Cisco 676, for example—demodulates the downstream signal and sends the data to the subscriber's PC.

Transmission Rates and Modem Training

Two modes are available for setting transmission rates:

- Rate-adaptive mode: You can set the subscriber ports to adapt (train) automatically to the highest line speed attainable for the configured signal-to-noise ratio (SNR) margin for each direction.
- Explicit rate mode: You can set SNR margins and transmission speeds explicitly. Upstream and downstream speeds can be set separately.

You can mix rate-adaptive and explicit modes on the same circuit, using one mode for upstream traffic and the other for downstream traffic.

Rates available for downstream traffic range from 32 kbps to 8.032 Mbps, in increments of 32 kb (32 kbps, 64 kbps, 96 kbps, 128 kbps, and so on). Rates available for upstream traffic start at 32 kbps and increase in 32-kb increments to a maximum upstream rate of 864 kbps.

The modems on the SLC 8DMT train simultaneously in the upstream and downstream directions. Each modem first tries to train at the configured rate at a specified SNR margin. If the first attempt fails in either direction but a CPE is detected, the modem tries to train at the highest rate possible (up to the configured rate). The modem keeps trying to train until it is successful.

Statistics

The SLC 8DMT gathers signal quality statistics for network management purposes and sends this information to the management system via SNMP. The SLC reports each of the following statistics to the management system for both upstream and downstream traffic:

- Near and far end uncorrected blocks
- Near and far end corrected blocks
- Near and far end loss of signal (LOS) counter
- Near end loss of frame (LOF) counter
- Remote failure indication (RFI, or far end LOF)
- Near and far end errored seconds
- Near and far end attenuation
- Near and far end SNR margin
- Upstream and downstream actual rates
- Number of nonidle cells transmitted downstream
- Number of nonidle upstream cells received with valid header checksum

- Number of upstream cells received with invalid header checksum
- Number of errored seconds (this is the number of seconds in which at least one DMT-layer CRC error, loss of signal, or severely errored frame is observed), both upstream and downstream

In addition, the SLC 8DMT reports the following fault indications:

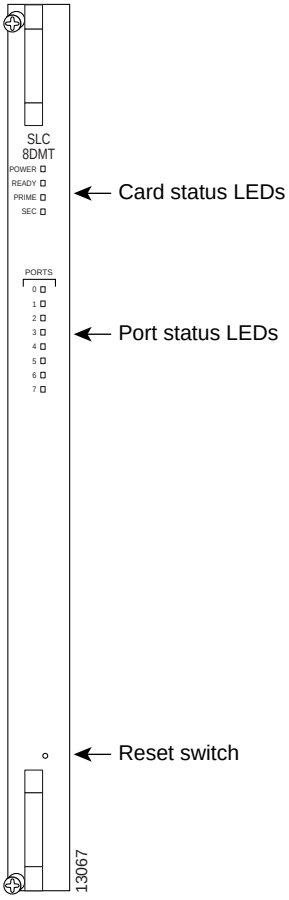
- Far end LPR
- Near end LOS
- Near end LOF
- Near end loss of cell delineation (LOCD)

1.5.5 SLC 8DMT: Physical Description

Up to ten SLCs can be installed in a Cisco 6200 cabinet. The slots assigned to the SLCs are slot 5 through slot 14.

The card's faceplate is labeled SLC 8DMT. The faceplate (Figure 1-13) includes a reset switch and LED indicators.

Figure 1-13 SLC 8DMT Faceplate



Reset Switch

The reset switch is recessed behind the faceplate to avoid accidental activation. It is not for customer use.

LED Indicators

Table 1-11 describes the LEDs on the faceplate of the SLC.

Table 1-11 SLC 8DMT LEDs

LED	Color	Condition Indicated
POWER	Green	The SLC is receiving power.
READY	Green	The SLC is experiencing no problems.
	Yellow	At least one port on the SLC is in line test mode.
	Off	The SLC is not communicating with the MPC. This is the case when • The SLC is initializing. • The SLC has a hardware problem. If the READY LED is off for an extended period when the POWER LED is on, see the *Cisco 6200 User Guide* for instructions on troubleshooting the SLC.
PRIME	Green	The SLC is using the primary (A) bus to move information across the backplane.
SEC	Green	The SLC is using the secondary (B) bus to move information across the backplane. (Redundant systems only.)
Ports 0 to 7	Green	The following conditions exist: • The port is receiving good signal levels (no loss of signal, or LOS) from the CPE. • The port has frame alignment with the far end CPE (no loss of frame (LOF) or severely errored frames (SEC)). • The SLC has HEC alignment in the upstream direction. • The modems on both sides have negotiated the loop rates. The port LEDs remain lit (green) in the presence of occasional minor alarms.
	Flashing green	The port is enabled and is trying to communicate with the remote CPE. (That is, the port is training or preparing to train.)
	Off	One of the following conditions exists: • The port is experiencing an intrusive DMT hardware test. • The port is disabled or is not configured.

1.5.6 SLC 8DMT Specifications

Table 1-12 lists the physical and electrical specifications of the SLC 8DMT.

Table 1-12 SLC 8DMT Specifications

Specification	Description
Subscriber ports	8 per card
Transmission speeds	Downstream: up to 8.032 Mbps Upstream: up to 864 kbps
Loop hardware media	Unshielded twisted pair copper wire
Loop modulation method	ADSL with DMT line code
Layer 2 format	ATM (service and subscriber side, end-to-end)
ATM virtual circuits supported	Up to 31 per subscriber, numbered 33 through 63 (VPI 0)
Data channel frequencies	• Upstream: 25.875 to 138 kHz • Downstream: 138 kHz to 1.104 MHz
Internal hardware	• Motorola MC68360 • 1 Mbyte Flash memory • 512 kbyte Flash boot memory • ADI DMT chip set • Cisco ATM framer
Dimensions (width x height x depth)	1.17 x 15.75 x 9.75 in (3.0 x 40.0 x 24.8 cm)
Weight	3 lb (1.36 kg)
Power consumption	79.2 W