SGI® Altix™ 350 System User's Guide

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Record of Revision

Version	Description
001	January 2004
	First release
002	January 2005
	Scale systems to 32-processors; color changes, add router modules

Contents

007-4660-002

Figures

Tables

About This Guide

This guide provides an overview of the Altix 350 system components, and it describes how to set up and operate this system.

The Altix 350 system is either a standalone base compute module, or a base compute module that is rackmounted and connected to one or more of the following optional modules:

- A CPU expansion compute module provides one or two additional 64-bit Intel processors and up to 24 GB of memory. No PCI or disk options are available in this module. See Chapter 4, "CPU Expansion Module," for information about this module.

- A CPU, memory and PCI/PCI-X expansion (CMPX) module provides one or two optional processors, up to 24 GB of memory, and four PCI and PCI-X card slots. See Chapter 5, "CMPX Module," for information about this module.

- Systems using eight to sixteen modules are interconnected using one or two router modules. The router module or "R-brick" is an eight-port 2U high module that functions as a high-speed switch to route network packets between Altix 350 modules within a system.

- The SGI TP900 storage module provides additional storage to the system. An overview of this storage module is provided in "Storage Expansion" on page 93. For detailed information about this module, see *SGI Total Performance 900 Storage System User's Guide* (007-4428-00*x*).

This guide is written for owners, system administrators, and users of the Altix 350 system. It is written with the assumption that the reader has a general knowledge of computers and computer operations.

Important Information

Your SGI system support engineer (SSE) should perform the addition or replacement of parts, cabling, and service of your Altix 350 system, with the exception of the following tasks that you may perform yourself:

• Installing your system in a rack.

• Cabling the system modules to each other.

• Connecting a system console to your server system.

• Using your system console to enter commands and perform system functions such as powering on and powering off.

• Using the On/Off, reset, and non-maskable interrupt (NMI) switches on the front panel of your system.

• Installing and removing PCI and PCI-X cards.

Caution: Exception: Because the installation and removal of a base I/O PCI card, which installs in the lowermost slot, is more complicated and can cause damage to your system if not performed properly, it can only be installed and removed by a trained SGI system support engineer.

• Installing and removing disk drives.

• Installing and removing power supplies.

• Installing and removing DIMMs.

• Installing and removing the L1 controller display.

Chapter Descriptions

The following topics are covered in this guide:

- Chapter 1, "Installation and Operation," provides instructions for rack mounting, cabling, and operating the Altix 350 system.

- Chapter 2, "System Overview," provides a general overview of the Altix 350 system and its topology. This chapter also includes a quick description of the various components and modules that can be part of an Altix 350 system.

- Chapter 3, "Base Compute Module,"describes the base compute module and provides details about its internal and external components.

- Chapter 4, "CPU Expansion Module,"describes the CPU expansion compute module and provides details about its internal and external components.

- Chapter 5, "CMPX Module," describes the CMPX module and provides details about its internal and external components.

- Chapter 6, "Optional Router," provides a description of the optional router module used with larger systems (generally 16 to 32 processors). The chapter provides information on all connectors and front and rear external components.

- Chapter 7, "Installing and Removing Customer-replaceable Units," describes how to install and remove the following customer-replaceable units (CRUs):

  - PCI and PCI-X cards

  - Disk drives

  - Power supplies

  - Memory (DIMMs)

  - L1 system controller display

- Chapter 8, "Troubleshooting," describes how to troubleshoot your system by using the L1 controller and your system LEDs.

- Appendix A, "Technical Specifications," contains environmental and physical specifications for the Altix 350 system, as well as pin assignments for non-proprietary connectors for the various modules that can be part of an Altix 350.

- Appendix B, "Regulatory Specifications and Safety Information," contains regulatory specifications and safety information related to the Altix 350 system.

An index completes this guide.

Related Publications

This section lists various information sources and explains how to access them. The following SGI publications relate to the Altix 350 system:

- *SGI Altix 350 User's Guide* (this manual) (hard copy shipped with the system and available online) (007-4660-00*x*). Use this guide to become acquainted with your system and to learn how to operate and monitor the system. In addition, this guide contains information on installing the system in a 19-inch rack, cabling the system, and replacing PCI and PCI-X cards, disk drives, power supplies, DIMMs, and an L1 display.

Warning: **To ensure your safety and protect your system, do not add or replace any components that this guide does not designate as customer replaceable. Contact your SGI system support engineer (SSE) to install any hardware components that are not designated as customer replaceable in this guide.**

- *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) (available online). This guide describes the L1 and L2 controller functions, commands, and error messages that you may need to operate and maintain your system.

- *SGI Total Performance 900 Storage System User's Guide* (007-4428-00*x*) (optional). This guide describes the SGI TP900 storage module, which provides additional storage for the Altix 350 system.

- *SGIconsole Hardware Connectivity Guide* (007-4340-00*x*) (optional). This guide describes how to connect an SGIconsole to SGI server systems. You can use an optional SGIconsole to manage and monitor your system.

You can obtain SGI documentation, release notes, or man pages in the following ways:

- See the SGI Technical Publications Library at http://docs.sgi.com. Various formats are available. This library contains the most recent and most comprehensive set of online books, release notes, man pages, and other information.

- SGI ProPack for Linux documentation, and all other documentation included in the RPMs on the distribution CDs can be found on the CD titled "SGI ProPack v*X.X* for Linux - Documentation CD." To access the information on the documentation CD, open the index.html file with a web browser. Because this online file can be updated later in the release cycle than this document, you should check it for the latest information.

- The release notes, which contain the latest information about software and documentation in this release, are on the SGI ProPack for Linux Documentation CD in the root directory, in a file named `README.TXT`.

Note: There are no command line **`grelnotes`** or **`relnotes`** available on an SGI Linux system. The **InfoSearch** tool is not available with Linux.

Conventions

The following conventions are used throughout this document:

Convention	Meaning
`Command`	This fixed-space font denotes literal items such as commands, files, routines, path names, signals, messages, and programming language structures.
variable	The italic typeface denotes variable entries and words or concepts being defined. Italic typeface is also used for book titles.
`user input`	This fixed-space font denotes literal items that the user enters in interactive sessions. Output is shown in nonbold, fixed-space font.
[ ]	Brackets enclose optional portions of a command or directive line.
...	Ellipses indicate that a preceding element can be repeated.
`man page(`*x*`)`	Man page section identifiers appear in parentheses after man page names.
GUI element	This font denotes the names of graphical user interface (GUI) elements such as windows, screens, dialog boxes, menus, toolbars, icons, buttons, boxes, fields, and lists.

Product Support

SGI provides a comprehensive product support and maintenance program for its products, as follows:

- If you are in North America, contact the Technical Assistance Center at 1 (800) 800 4SGI or contact your authorized service provider.

- If you are outside North America, contact the SGI subsidiary or authorized distributor in your country.

Reader Comments

If you have comments about the technical accuracy, content, or organization of this document, contact SGI. Be sure to include the title and document number of the manual with your comments. (Online, the document number is located in the front matter of the manual. In printed manuals, the document number is located at the bottom of each page.)

You can contact SGI in any of the following ways:

- Send e-mail to the following address:

    techpubs@sgi.com

- Use the Feedback option on the Technical Publications Library website:

    http://docs.sgi.com

- Contact your customer service representative and ask that an incident be filed in the SGI incident tracking system.

- Send mail to the following address:

    Technical Publications
    SGI
    1500 Crittenden Lane, M/S 535
    Mountain View, California 94043

SGI values your comments and will respond to them promptly.

Installation and Operation

This chapter describes how to install and operate your Altix 350 system. Specifically, the following topics are covered:

System Installation Overview

In this chapter, different installation instructions are provided for different types of system installations. Follow the instructions for your type of installation, as follows:

Note: It is assumed that you will be connecting a system console to your system in each installation case.

- If you have ordered a server system that is already rackmounted, which means that the modules that compose your system are also already cabled together, follow the instructions in these sections:
    - "Safety Precautions" on page 3
    - "Installing a Rack" on page 6
    - "Cabling the System Modules to a Power Source" on page 48
    - "Connecting the System Console" on page 52
- If you have ordered system modules and an empty rack or racks with the intention of rackmounting and cabling your own server system, follow the instructions in these sections:
    - "Safety Precautions" on page 3
    - "Installing a Rack" on page 6
    - "Unpacking and Inspecting Modules" on page 24
    - "Installing the Modules in a Rack" on page 26
    - "Cabling the System Modules" on page 45
    - "Cabling the System Modules to a Power Source" on page 48
    - "Connecting the System Console" on page 52

- If you have ordered either a single- or dual-module system that you intend to install on a table top, follow the instructions in these sections:

  - "Safety Precautions" on page 3

  - "Unpacking and Inspecting Modules" on page 24

  - "Cabling the System Modules" on page 45

  - "Cabling the System Modules to a Power Source" on page 48

  - "Connecting the System Console" on page 52

- If you have your own rack, and have ordered system modules with the intention of rackmounting and cabling your own system, follow the instructions in these sections:

  - "Safety Precautions" on page 3

  - "Unpacking and Inspecting Modules" on page 24

  - "Installing the Modules in a Rack" on page 26

  - "Cabling the System Modules" on page 45

  - "Cabling the System Modules to a Power Source" on page 48

  - "Connecting the System Console" on page 52

Safety Precautions

Before you install an Altix 350 system, you should familiarize yourself with the safety precautions discussed in the following subsections:

- "Hazard Statements" on page 4

- "ESD Precautions" on page 4

- "Safety Measures" on page 5

Hazard Statements

During the installation of your Altix 350 system, be alert for hazard advisory statements with icons, which signify the following:

- **Caution** indicates a potentially hazardous situation that, if not avoided, can result in minor or moderate injury. A caution statement also alerts you to unsafe practices that can result in equipment damage and/or data corruption. A caution message is accompanied by an icon as shown in the following example:

  Caution:

- **Warning** indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury. A warning message is accompanied by icon as shown in the following example:

  Warning:

- **Danger** indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. A danger message is accompanied by the same icon as a warning.

ESD Precautions

Observe electrostatic discharge (ESD) precautions during the entire installation process to eliminate possible ESD damage to the equipment. Wear an SGI-approved wrist strap when you handle an ESD-sensitive device. Connect the wrist strap cord directly to earth ground.

  Caution: Observe all ESD precautions. Failure to do so can result in damage to the equipment.

Safety Measures

Observe the following safety measures when you install the system:

- Use caution when you remove the system from the shipping crate. Failure to handle the system carefully can result in personal injury or property damage.

Caution: Ensure that the shipping crate is positioned close to its destination before you unpack the crate.

Warning: **Employ a minimum of two people to lift a module, to move the module(s) from one location to another, and to install the module(s) in a rack. Otherwise, someone could be seriously injured.**

- Do not move the system while it is connected to power.

Warning: **Keep fingers and conductive tools away from high-voltage areas. Failure to follow these precautions will result in serious injury or death. The high-voltage areas of the system are indicated with high-voltage warning labels.**

- Ensure that a qualified electrician has properly installed the power receptacles.
- Set all circuit breakers to the OFF (**O**) position before you plug in the system power cord.

Warning: **Use the following guidelines to prevent the rack from toppling over. Otherwise, people could be seriously injured and/or equipment could be damaged.**

- Follow these guidelines to prevent the rack from toppling over:
    - Make sure that only one module is extended out of the rack at one time.
    - Install all equipment in the lowest available position in the rack.
    - Ensure that the tip tray is bolted to the front of the rack.

Installing a Rack

This section describes how to install a rack that already has your system modules rackmounted and cabled together. The following information is provided:

Preinstallation Activities

Perform the following preinstallation activities:

Note: You can perform the preinstallation activities days or weeks before you receive your system.

Site Plan Verification

Ensure that all site requirements are met before your system arrives. If you have questions about the site requirements or you would like to order full-size floor templates

for your site, contact a site planning representative by e-mail (site@sgi.com) or by telephone (+1 715 726 2820).

Tools Required

Table 1-1 lists the tools that you need to complete the installation.

Table 1-1   Installation Tools

Tool	Part Number	Purpose
13-mm wrench	7260744	Adjust the leveling pads.
13-mm socket (3/8-in. drive)	7260726	Remove bracket bolts from tall rack shipping crate.
19-mm socket (3/8-in. drive)	9470618	Remove bolts from short rack shipping crate.
Extension, 6-in. (3/8-in. drive)	7260655	Used with ratchet and sockets.
Ratchet, reversible (3/8-in. drive)	7260755	Used with extension and sockets.
Level, 9-in.	9470556	Level the rack.

Power Receptacle Verification

Ensure that a qualified technician installs the correct power receptacles. Your Altix 350 system uses one or two single-phase power receptacles. For North American sites, the single-phase receptacle is a 30-amp, 200- to 240-volt receptacle that has two phase sockets and one ground socket. For international sites, the single-phase receptacle is a 32-amp, 200-volt receptacle that has one phase socket, one neutral socket, and one ground socket. Note that the ground pin is slightly longer than the other two pins on the North American plug.

For North American sites, follow these steps to ensure that a single-phase power receptacle is properly wired:

1. Set the voltmeter to a high AC voltage range.

2. Check the voltage between socket X and socket Y (see Figure 1-1). The meter should read between 200 and 240 VAC.

3. Check the voltage between socket X and the ground socket. The meter should read approximately 120 VAC.

4. Check the voltage between socket Y and the ground socket. The meter should read approximately 120 VAC.

5. Check the voltage between the ground socket and an earth-ground location. The meter should read 0 VAC.

6. Change the voltmeter to a low-resistance setting.

7. Measure between the ground socket and an appropriate earth-ground location and ensure that resistance is less than 1 ohm.

8. Repeat steps 1 through 7 for any additional single-phase power receptacles.

Caution: If a voltage reading is incorrect, or if the resistance measured in step 7 is more than 1 ohm, contact a site-approved electrician. Do not proceed with the installation.
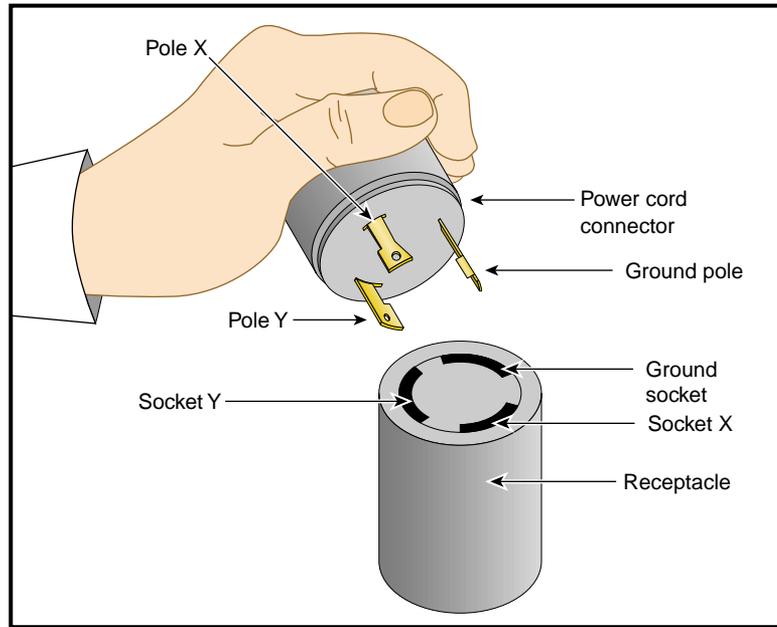
Figure 1-1   30-amp Single-phase Power Receptacle for North American Sites

For international sites, follow these steps to ensure that a single-phase power receptacle is properly wired:

1. Set the voltmeter to a high AC voltage range.

2. Check the voltage between socket 1 and socket 2 (see Figure 1-2). The meter should read between 200 and 240 VAC.

3. Check the voltage between socket 1 (line) and the ground socket. The meter should read between 200 and 240 VAC.

   Note: The ground pin is slightly larger in diameter than the other two pins.

4. Check the voltage between socket 2 (neutral) and the ground socket. The meter should read approximately 0 VAC.

5. Check the voltage between the ground socket and an earth-ground location. The meter should read 0 VAC.

6. Change the voltmeter to a low-resistance setting.

7. Measure between the ground socket and an appropriate earth-ground location and ensure that resistance is less than 1 ohm.

8. Repeat steps 1 through 7 for any additional single-phase power receptacles.

Caution: If a voltage reading is incorrect, or if the resistance measured in step 7 is more than 1 ohm, contact a site-approved electrician. Do not proceed with the installation.
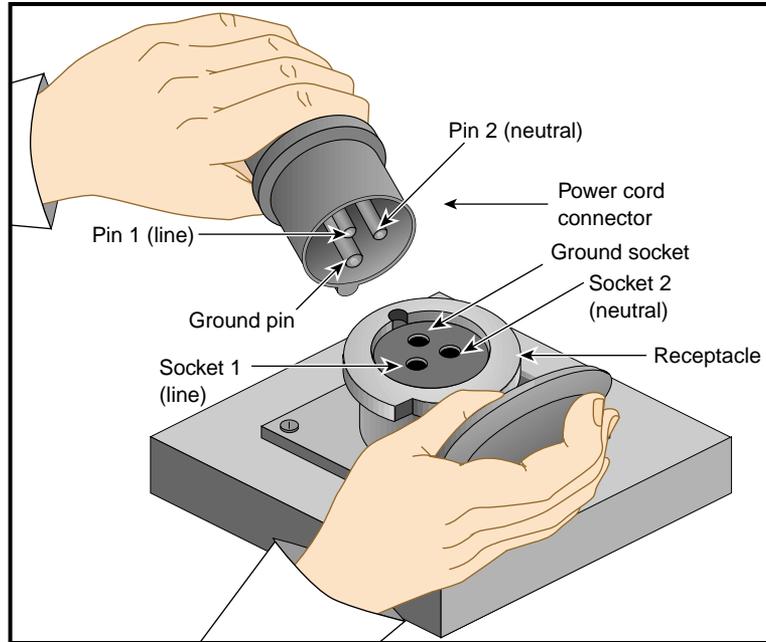
Figure 1-2   32-amp Single-phase Power Plug for International Sites

Unloading and Moving System Equipment

Your Altix 350 system arrives at the site in cardboard shipping crates.

For a short rack system, the documentation carton and the accessories carton are packed with the system. The documentation carton contains the system manuals as well as warranty and licensing information. The accessories carton contains the I/O, peripheral, and system cables, and any additional connectors or tools that are required for a specific configuration. The PC, workstation, or terminal is shipped in a separate carton.

For a tall rack system, the system documentation; accessories; and PC, workstation, or terminal arrive in separate cartons.

This section describes how to unload and transport the system to its designated location, as follows:

- "Unloading the Equipment from the Truck" on page 12
- "Inspecting the Shipping Crate" on page 14
- "Transporting the Shipping Crate" on page 15

Unloading the Equipment from the Truck

If your loading dock is the same height as the transportation vehicle, use a pallet jack to unload the system from the transportation vehicle. The pallet jack should have 48-in. tines or forks. Follow any instructions that are printed on the packing crates.

If the loading dock is not the same height as the vehicle, you must provide a forklift or another approved method to unload the system. You can use a platform or ramp to obtain the desired level as long as the ramp incline does not exceed a ratio of one unit vertical to six units horizontal. For more information on site requirements, contact site planning by e-mail (site@sgi.com) or by telephone (+1 715 726 2820).

Warning: **Use two or more people to prevent computer equipment from rolling off the transportation vehicle. Failure to do so could result in serious damage to the computer equipment.**

If your site does not have a loading dock, arrange for a forklift to unload the system from the transportation vehicle. Ensure that two or three people are available to help unload the equipment. Move all crates slowly and carefully.

Figure 1-3 shows the lift openings and dimensions of a tall rack shipping crate. This figure also shows where to position the pallet jack.
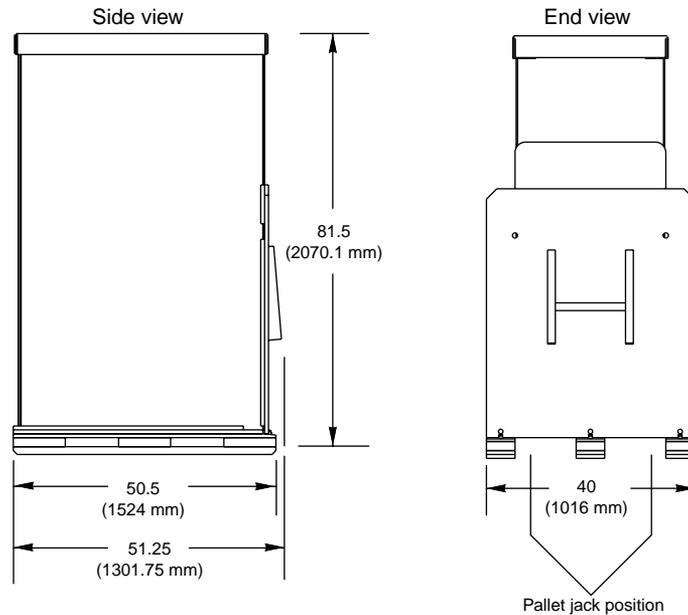
Figure 1-3   Dimensions of Tall Rack Shipping Crate

Figure 1-4 shows the lift openings and dimensions of a short rack shipping crate. This figure also shows where to position the pallet jack.

Side view   End view

48.75
(1238 mm)

42.75
(1068 mm)

29.25
(743 mm)

Pallet jack position
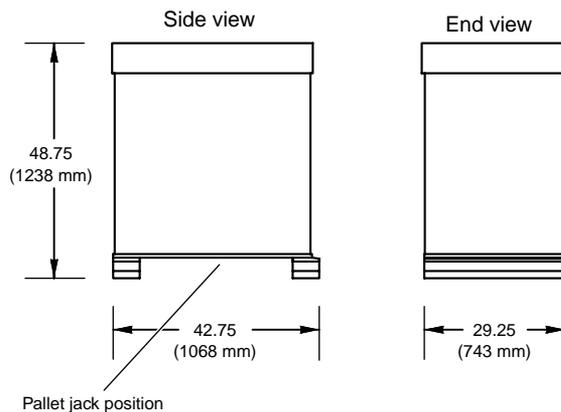
Figure 1-4   Dimensions of Short Rack Shipping Crate

Inspecting the Shipping Crate

After the system is unloaded from the truck, follow these steps before you unpack it:

1. Ensure that the crates and cartons arrive unopened.

2. Inspect the shipping crate for signs of external damage such as dents, holes, crushed corners, and water marks.

3. Ensure that the tilt watch has not been tripped.

4. If the crate is damaged, file a damage claim with the carrier immediately. In addition, notify your local Customer Support Center (CSC) for any missing, incorrect, or damaged items. For CSC contact information, see http://www.sgi.com/support/supportcenters.html.

Transporting the Shipping Crate

Use a pallet jack with forks that are 48 in. (122 cm) long or longer to transport the shipping crate to the designated location. See Figure 1-3 and Figure 1-4 for the crate dimensions and location to position the pallet jack. For system weight and dimensions, contact site planning by e-mail (site@sgi.com) or by telephone (+1 715 726 2820).

If the crate does not fit through all access doors, you may need to partially disassemble the crate.

Caution: If the system shipping or storage environment is significantly colder than the environment in which it will be installed [40 °F (22 °C) or greater disparity], leave the rack in its shipping crate for at least 24 hours at room temperature before you start the installation. This acclimation prevents damage to the equipment that could result from thermal shock and condensation.

Removing a Short Rack from the Shipping Crate

Warning: Be careful when you unpack and move the short rack system. Ensure that the rack remains on a level surface and that the rack weight remains evenly distributed across the four casters. If you must lift the casters over an obstacle, such as a door threshold, use proper lifting techniques and employ a minimum of two people.

Caution: Do not subject the rack to any unnecessary shocks or vibration while you unpack and install the system.

See Figure 1-5 as you follow these steps; the numbered illustrations correspond to the numbered steps.

1. Ensure that the temperature of the rack is acclimated to the environment in which you are installing it.
2. Remove the crate cover.
3. Lift the ramp out of the crate and set it aside.
4. Remove the documentation carton, accessories carton, and cardboard packing material.
5. Lift the sidewalls of the crate up and over the system.
6. Remove the four bolts that secure the rack to the crate. You must reach underneath the crate and feel for the bolts.
7. Align the holes in the edge of the ramp with the pegs in the base of the crate. Ensure that the ramp is secure.
8. Remove the gate pins from the left and right ends of the gate. Then remove the gate.
9. Pull the rack down the ramp.

Warning: The maximum weight of the short rack is 488 lb (221 kg). Use caution when you roll the rack down the ramp.
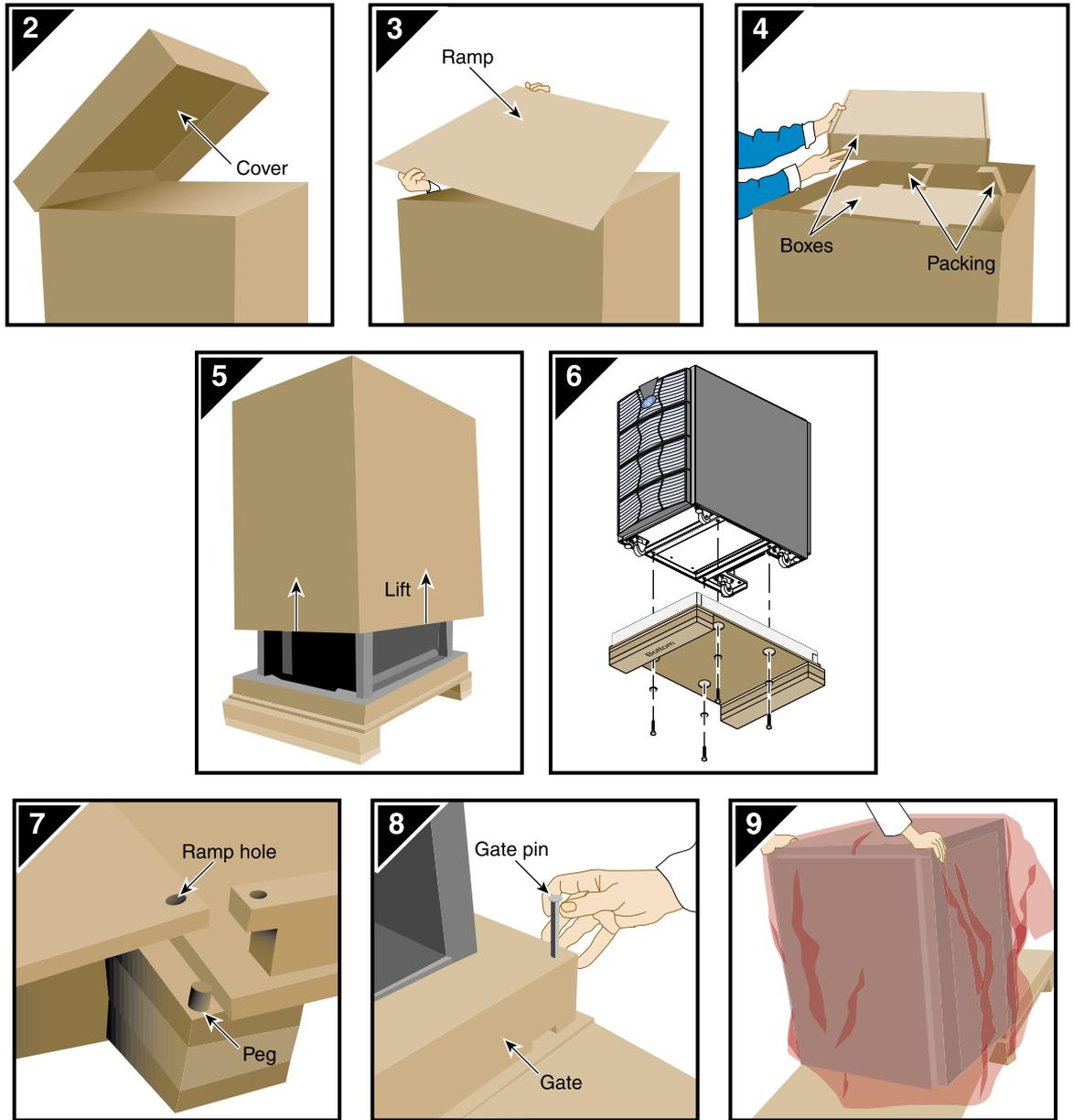
Figure 1-5   Removing a Short Rack from the Shipping Crate

Removing a Tall Rack from the Shipping Crate

Warning: In its maximum configuration, a tall rack system weighs approximately 1,366 lb (620 kg). Use caution when you unpack and move this rack. Ensure that the rack remains on a level surface and that the rack weight remains evenly distributed across the four casters.

To unpack a tall rack, you will need the following tools:

- Extension, 6-inch, 3/8-in. drive
- 13-mm standard 3/8-in. drive socket
- Ratchet, reversible, 3/8-in. drive

See Figure 1-6 as you follow these steps; the numbered illustrations correspond to the numbered steps.

1. Ensure that the temperature of the rack is acclimated to the environment in which you are installing it and that the system crate is in a stable, upright position.

2. Remove the bands that secure the crate.

   Note: Brace the wooden ramp as you remove the horizontal band that surrounds the crate and the wooden ramp. The ramp moves freely after you remove this band.

3. Place the ramp so that the three holes in the edge of the ramp align with the pegs in the base of the pallet deck.

4. Remove the cardboard cover, the two cardboard sidewalls, and the foam cushion.

5. Remove the bolts that secure the rack to the pallet deck, as follows:
   a. Remove the top four bolts from the rear mounting bracket; do not remove the bottom bolts.
   b. Remove the four bolts that secure the front mounting bracket and tip tray to the bottom of the pallet deck. Set the tip tray aside.
   c. Remove the top four bolts from the front mounting bracket. Set the mounting bracket aside.

6. Use two people to roll the rack out of the crate and down the ramp.

Warning: Use extreme caution when you roll the tall rack down the ramp. Personal injury and system damage could result if the rack becomes unbalanced or gains too much momentum when it rolls down the ramp.

7. Bolt the tip tray to the front of the rack before you move the rack to its designated location. This tray prevents the rack from tipping while you move the rack.
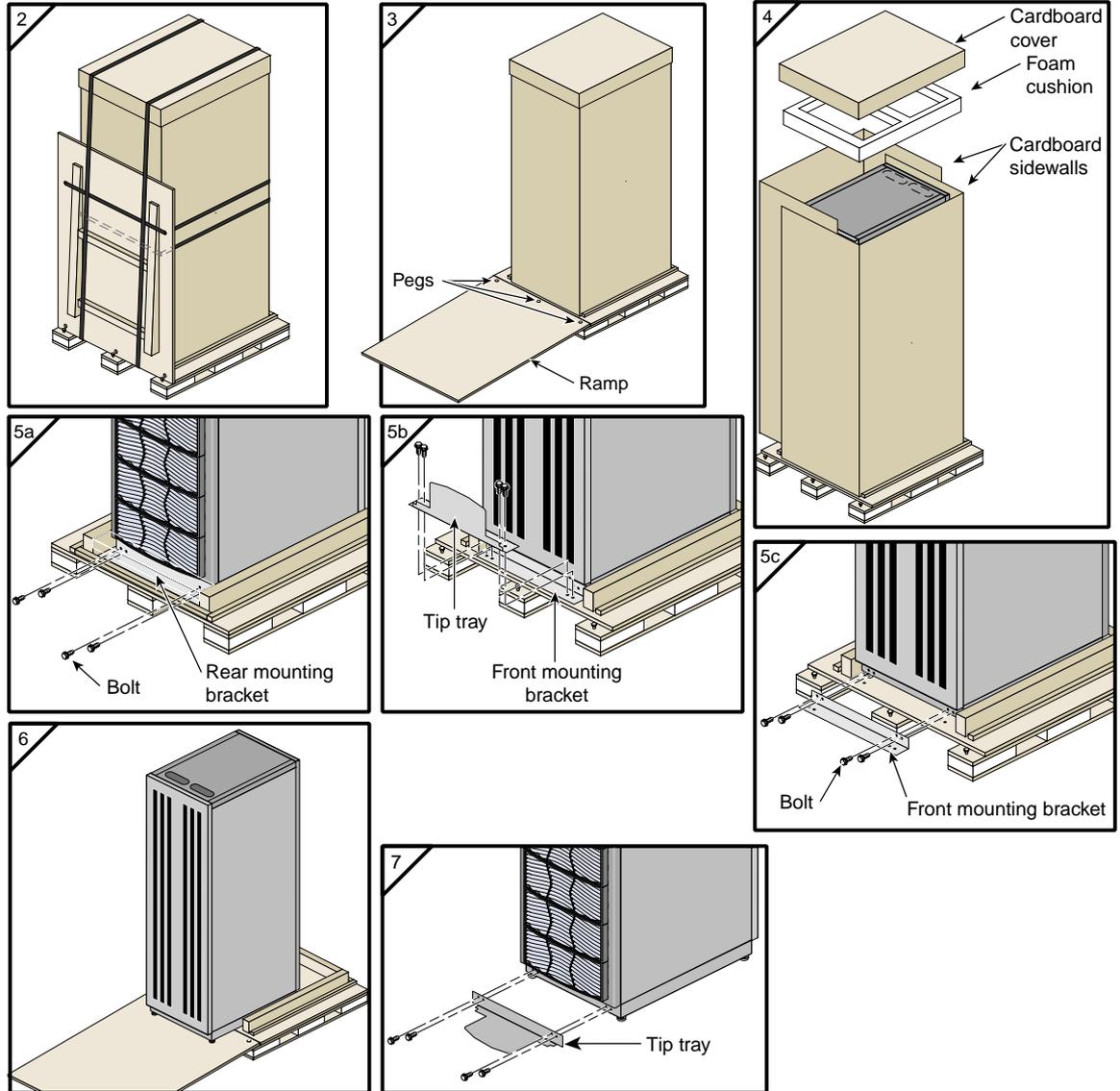
Figure 1-6   Removing a Tall Rack from the Shipping Crate

Positioning and Leveling a Single-rack System

⚠️ **Caution:** To avoid ESD damage to the electronic components, be sure to position the rack before you remove the ESD bag that covers the rack assembly.

To position and level a single-rack system, follow these steps:

1. Grasp the rear of the rack and roll the rack to its designated location.

2. Remove the ESD bag.

3. If you are installing a tall rack, adjust the leveling bolts, as shown in Figure 1-7, until the rack is level.
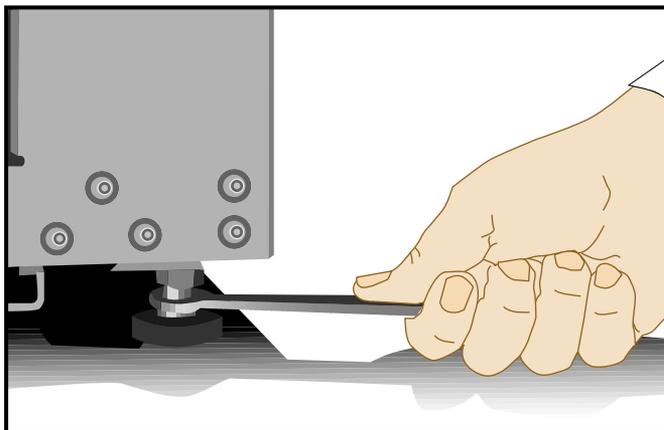
Figure 1-7 Leveling Bolts

4. Ensure that the circuit breaker on the power distribution unit is in the OFF (**O**) position. Then connect the power cord to a grounded power outlet. Plugging in the power cord grounds the rack.

5. Secure the rack with seismic tie-downs if you are installing the system in an earthquake zone.

    Note: Tall and short racks have four threaded holes that are located at the bottom of the rack (see Figure 1-8). Use these holes to secure the seismic tie-downs. SGI does not supply the seismic tie-downs.

Top view of short rack
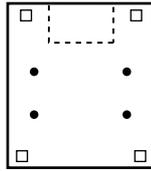
Top view of tall rack
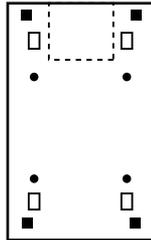
- Seismic tie-down attachment points
- Casters
- Leveling pads

Figure 1-8   Seismic Tie-down Attachment Points

Positioning and Leveling Multiple Racks

⚠ **Caution:** To avoid ESD damage to the electronic components, be sure to position the racks before you remove the ESD bags that cover the rack assemblies.

To position and level multiple racks, follow these steps:

1. Grasp the rear of each rack and roll the rack to its designated location.

2. Remove the ESD bags.

3. Adjust the leveling bolts of rack 001, as shown in Figure 1-9, until the rack is level.
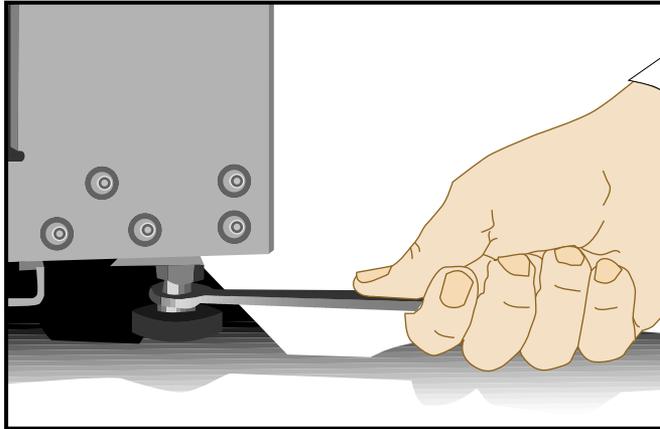
Figure 1-9   Leveling Bolts

4. Using the leveling bolts of rack 002, adjust rack 002 so that the joining holes of rack 002 align with the joining holes of rack 001. See Figure 1-10.

5. Using the provided straps, screws, and washers, bolt the racks together in the four designated locations shown in Figure 1-10.

6. If your system has additional racks, repeat steps 4 and 5 until all of the racks are bolted together.

7. Ensure that the circuit breakers on the power distribution units are in the OFF (**O**) position. Then connect the power cords to grounded power outlets. Plugging in the power cords grounds the racks.

8. Secure the racks with seismic tie-downs if you are installing the system in an earthquake zone.

Note: Tall racks have four threaded holes that are located at the bottom of the rack (see Figure 1-8 on page 21). Use these holes to secure the seismic tie-downs. SGI does not supply the seismic tie-downs.

Location 3

Joining holes of
location 4

Location 2

Location 1

Strap
Washer
Screw
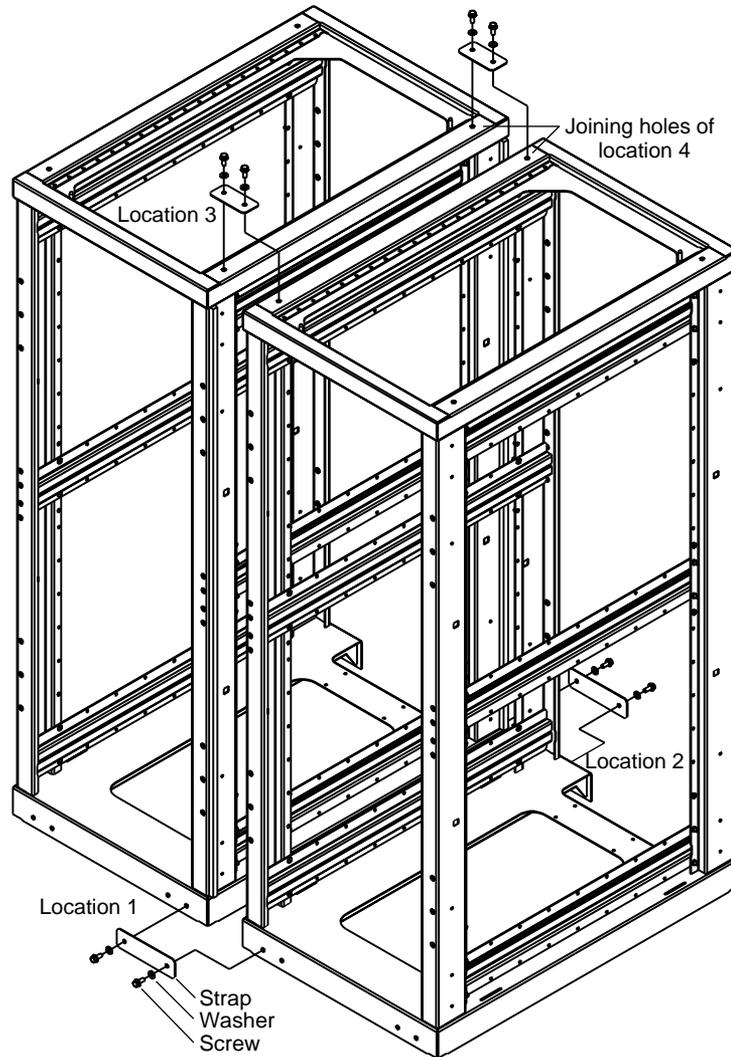
Figure 1-10   Joining Locations

Unpacking and Inspecting Modules

This section describes how to unpack and inspect individual modules. Follow these instructions if you plan to install individual modules in a rack or on a table top.

Before unpacking your modules, inspect the packaging container for evidence of mishandling during transit. If the packaging container is damaged, photograph it for reference. After you remove the contents, keep the damaged container and the packing materials.

Remove the module or modules from the packaging container and ensure that all accessories are included. Inspect the module(s) and accessories for damage. If the contents appear damaged, file a damage claim with the carrier immediately. In addition, notify your local Customer Support Center (CSC) for any missing, incorrect, or damaged items. For CSC contact information, see http://www.sgi.com/support/supportcenters.html.

Setting the Server System on a Table Top

If your system is a single module system (the base compute module) or a dual-module system (a base compute module cabled to a CMPX module, for example), and you choose to operate it on a table top, you need to install five self-adhesive feet that are supplied with the module(s). To install the feet, follow these steps:

1. Place the module upside down on a flat, stable surface.

2. Peel off the protective film from the feet and place them on the five circular marks, as shown in Figure 1-11.

3. If you have a dual-module system, repeat steps 1 and 2 to put feet on the second module. (If you have a dual-module system, it is recommended that you place the base compute module on the bottom, and that you place the other module on top.)

Note: If you mount the system in a rack at a later date, you will need to remove the feet.
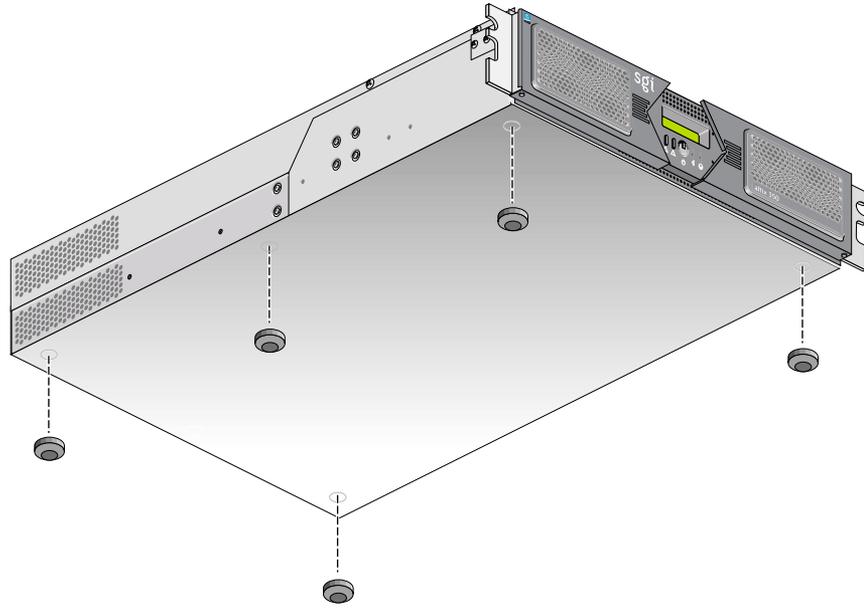
Figure 1-11   Location of Table-mounting Feet

Installing the Modules in a Rack

This section describes how to install the modules that compose an Altix 350 system in a rack with either a slide-rail assembly or with a shelf-rail assembly (also known as a fixed-rail assembly). The module type determines which rail assembly you should use. For example, the base compute module, the CPU expansion compute module, and the CMPX module are rackmounted with shelf rails or optional slide rails. The SGI TP900 storage system is always rackmounted with shelf rails.

This section also describes how to remove the modules from a rack.

This rackmounting information is found in the following sections:

- "Rackmounting Modules with Optional Slide Rails" on page 26
- "Removing a Module on Slide Rails from a Rack" on page 39
- "Rackmounting Modules with Shelf Rails" on page 42
- "Removing a Module on Shelf Rails from a Rack" on page 44

Rackmounting Modules with Optional Slide Rails

This section describes how to rackmount modules with optional slide-rail assemblies. You can use the instructions to rackmount base compute modules, CPU expansion compute modules, and CMPX modules. This section includes the following topics:

- "Determining Space Requirements" on page 27
- "Checking the Slide-rail Hardware" on page 28
- "Preparing the Optional Slide-rail Assemblies" on page 28
- "Attaching Optional Chassis Rails to the Module" on page 31
- "Determining Where to Attach the Slide Rails in the Rack" on page 32
- "Attaching the Slide Rail to the Rack" on page 33
- "Installing Clip Nuts in Rack Rails" on page 36
- "Installing the Module in the Rack" on page 37
- "Adjusting the Position of the Rackmounted Module" on page 38

Determining Space Requirements

Table 1-2 specifies the space requirements when rackmounting either a base compute module, a CPU expansion compute module, or an CMPX module in a 19-inch rack.

Table 1-2   Module Space Requirements

Height	3.44 inches (8.74 cm)
Width	17.06 inches (43.33 cm)
Depth	27 inches (68.58 cm) (with bezel)
Weight	50 lb (22.7 kg) maximum configuration[a]
Required front clearance for module	8.25 in. (20.96 cm)
Required rear clearance for module	10 in. (25.40 cm)
Required side clearance for module	6 in. (15.24 cm) (right side) No clearance requirement for left side.
Required front clearance for rack	36 in. (91 cm)
Required rear clearance for rack	36 in. (91 cm)

a. Weight will vary depending on whether the system has one or two power supplies, on the amount of DIMMs installed, and on whether you have one or two disk drives in your system.

Checking the Slide-rail Hardware

Table 1-3 lists the hardware that you will use to mount the module in a 19-inch rack.

Table 1-3   Rackmounting Hardware

Hardware Type	Qty	Usage
Slide rail assembly (includes chassis rail)	2	Allows the module to slide in and out of rack. (The left and right slides are identical.)
2-in. rear mounting bracket	2	Mounts the slide rails to the rear rack rails. (The left and right brackets are identical.)
10-24 x 1/4-in. Phillips screw	10	Secures the chassis rails to the module.
10-32 x 1/2-in. Phillips screw Shoulder washer Barnut	8 8 4	Secures the slide rails to the rack rails.
10-32 x 1/2-in. Phillips screw Barnut	4 2	Secures the slide rails to their mounting brackets.
10-32 clip nut	2	Provides a threaded hole for fastening the module front panel to the rack rails.
10-32 x 1/2-in. Phillips screw	2	Fastens the module front panel to the clip nut.

Preparing the Optional Slide-rail Assemblies

The slide-rail assembly consists of a chassis rail and a slide rail. You need to remove the chassis rail from the slide rail so that you can install a mounting bracket to the slide rail and attach the chassis rail to the module. To remove the chassis rail from the slide rail, follow these steps:

1. Remove the two slide-rail assemblies and the rear mounting brackets from the shipping container.

2. Extend each slide-rail assembly until the safety latch snaps into place.

3. Press the safety latch and remove the chassis rail from the slide rail, as shown in Figure 1-12.

Safety latch

Slide rail

Safety latch
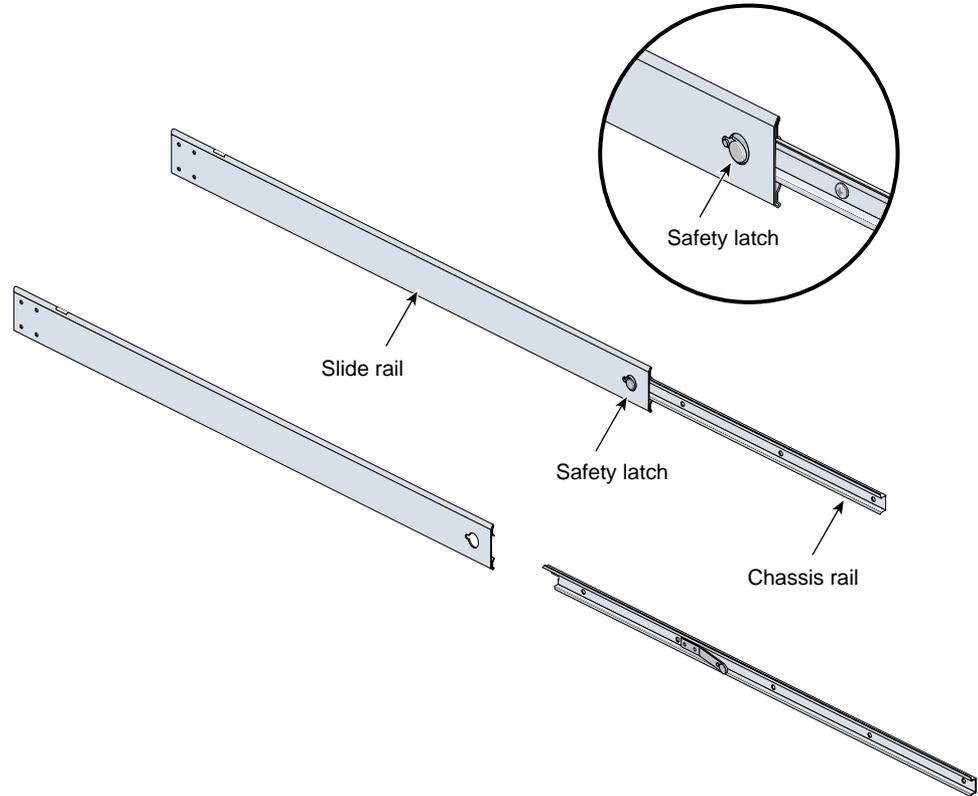
Chassis rail

Figure 1-12   Removing the Chassis Rail from the Slide Rail

4. Place one of the mounting brackets on the back of the slide rail, as shown in Figure 1-13. Adjust the position of the mounting bracket on the slide rail according to the depth of the rack.
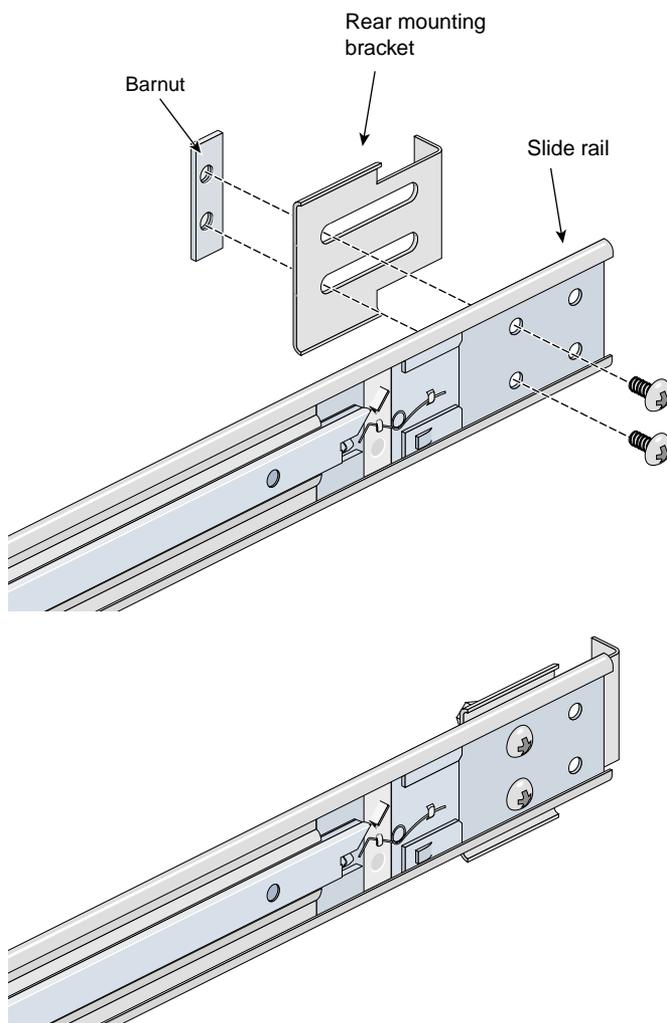
Figure 1-13   Attaching the Rear Mounting Bracket to the Slide Rail

5. Place a barnut next to the mounting bracket.

6. Secure the mounting bracket to the slide rail by inserting two 10-32 x 1/2-in. screws through the assembly and into the barnut, as shown in Figure 1-13.

7. Repeat steps 4 and 5 to attach a mounting bracket to the other slide rail.

Attaching Optional Chassis Rails to the Module

To attach the chassis rails to the module, follow these steps:

1. Place the module on a flat, stable surface.

2. Using four 10-24 x 1/4-in. screws, attach one of the chassis rails to the right side of the module chassis. Ensure that the rail is installed in the correct direction (see Figure 1-14).

⚠ **Caution:** Use only the 1/4-in. (0.64 cm) length screws. Longer screws damage internal components in the module.

3. Using five 10-24 x 1/4-in. screws, attach the second rail to the left side of the module chassis. Again, ensure that the rail is installed in the correct direction.
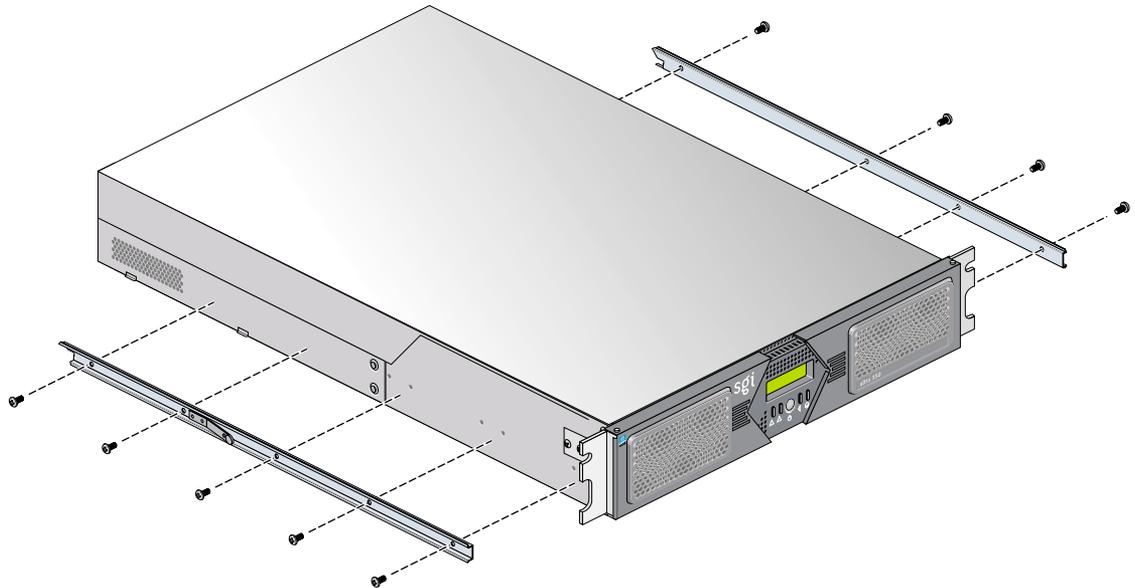
Figure 1-14   Attaching Chassis Rails to the Module Chassis

Determining Where to Attach the Slide Rails in the Rack

The base compute module, CPU expansion compute module, and CMPX module each require two units (2U) of space within the rack (one unit is equivalent to 1.75 inches [44.5 cm]). To determine where you should install the slide rails in the rack, you must count mounting holes. Each U contains three mounting holes; therefore, in the 2U of space that the module occupies, there are six mounting holes. The bottom hole of the 2U space is hole 1. The top mounting hole in the 2U space is hole 6. See Figure 1-15.

Note: A module in the rack is identified by the lowest U number that it occupies. For example, in Figure 1-15 the module resides in U5 (the fifth unit within the rack).
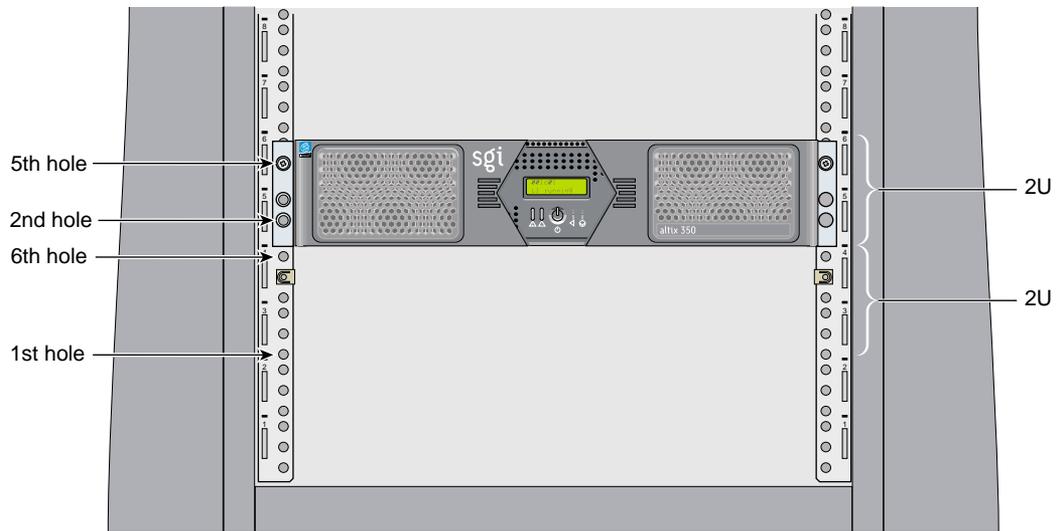
Figure 1-15   Mounting Hole Pattern of Rack Vertical Rails

To determine how many mounting holes you must count, use the following formula: **3 x (the lowest U number that the module will occupy) - 2**. For example, when you want to install the module in locations U9 and U10, count 25 mounting holes (3 x 9 - 2) starting from the bottom of the rack. The 25th hole is the first mounting hole of U9.

Attaching the Slide Rail to the Rack

To attach the slide rail to the rack, follow these steps:

Tip: The slide rails must be level in the rack. To ensure that you install the slide rails correctly, carefully count the mounting holes on all of the rack rails (two front rails and two rear rails).

---

1. Locate eight 10-32 x 1/2-in. Phillips screws, eight shoulder washers, and four barnuts.

2. Place one of the barnuts inside the rack and align it with the second and third holes of the selected 2U of space (see Figure 1-16).

   Note: The holes in the barnuts are not centered. The barnuts need to be placed in such a way that the holes are closest to the inside edge of the rack rails. See Figure 1-16.

   ---

3. Insert two screws with shoulder washers through the rack rail to hold the barnut in place. The screws should not be tightened at this point.

4. Repeat steps 2 and 3 to install the remaining three barnuts on the other three rack rails (front and rear of rack).
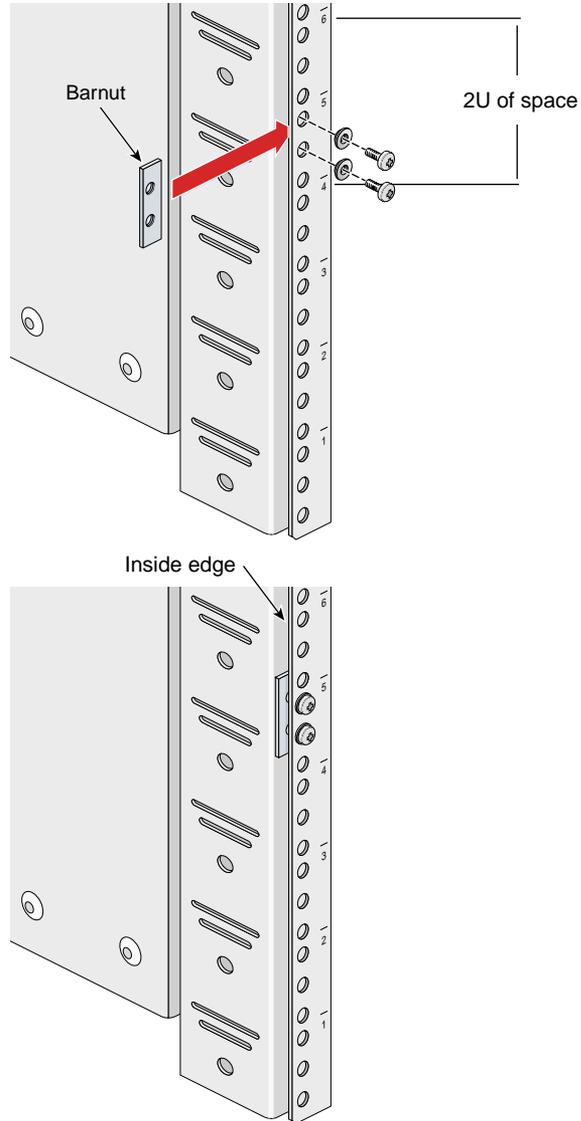
Figure 1-16   Placing the Barnuts on the Rack Rails

5. Insert the front and rear brackets of one of the slide rails between the rack rails and the barnuts, as shown in Figure 1-17.

6. Tighten the screws on the front- and rear-end of the rails. Do not tighten firmly at this point, because all screws will be firmly tightened once the module is installed in the rack.

7. Repeat steps 5 and 6 to attach the second slide rail to the other side of the rack.

Tighten screws

Barnut

Rack rail

Slide rail assembly
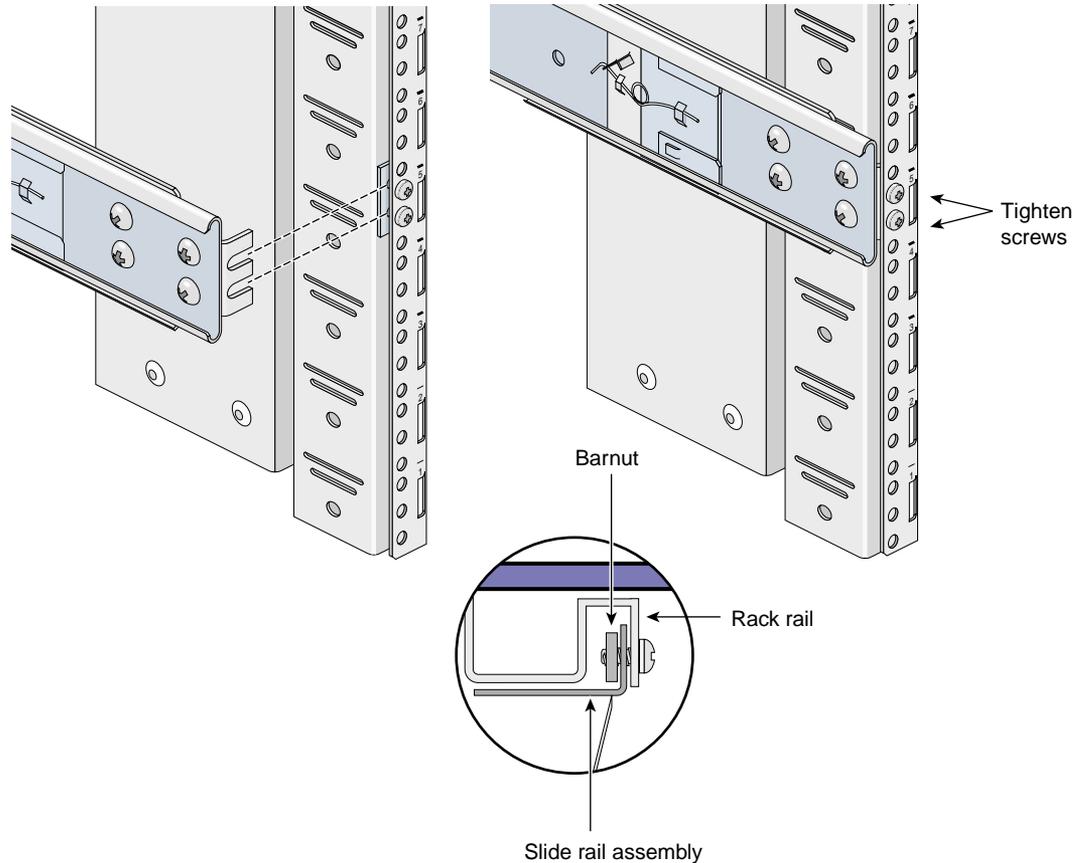
Figure 1-17   Attaching the Slide Rail to the Rack

Installing Clip Nuts in Rack Rails

Clip nuts secure the modules to the rack. To install the clip nuts, slide the clip nuts over the fifth hole of the selected 2U of space on each of the front rails. See Figure 1-18 for details.
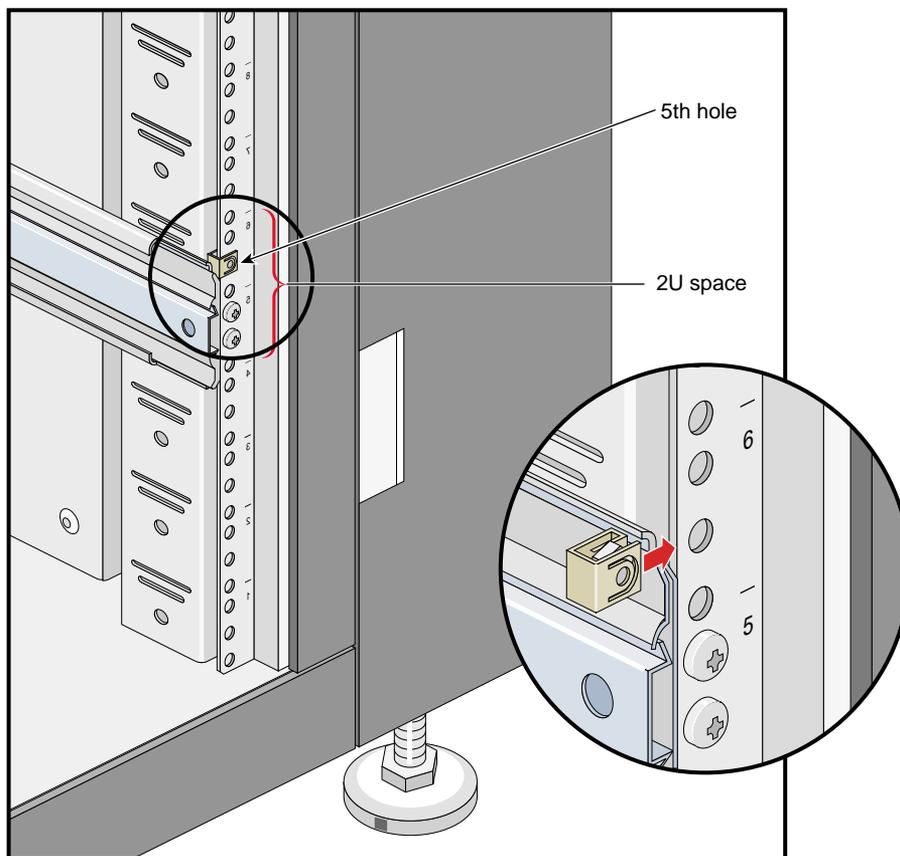
Figure 1-18   Installing Clip Nuts in Rack Rails

Installing the Module in the Rack

To install the module in the rack, follow these steps:

Note: Step 2 requires two people.

1. Fully extend the left and right slide rails from the rack until they lock into place.

2. With one person holding each side of the module, align the chassis rails of the module with the slide rails of the rack.

3. Slide the chassis rails into the slide rails until the chassis rails are stopped by the safety latches.

4. Press the safety latches on both sides of the module to fully seat the chassis rails into the slide rails (see Figure 1-19).

5. Firmly tighten all screws (the eight screws that secure the slide rails to the rack rails).
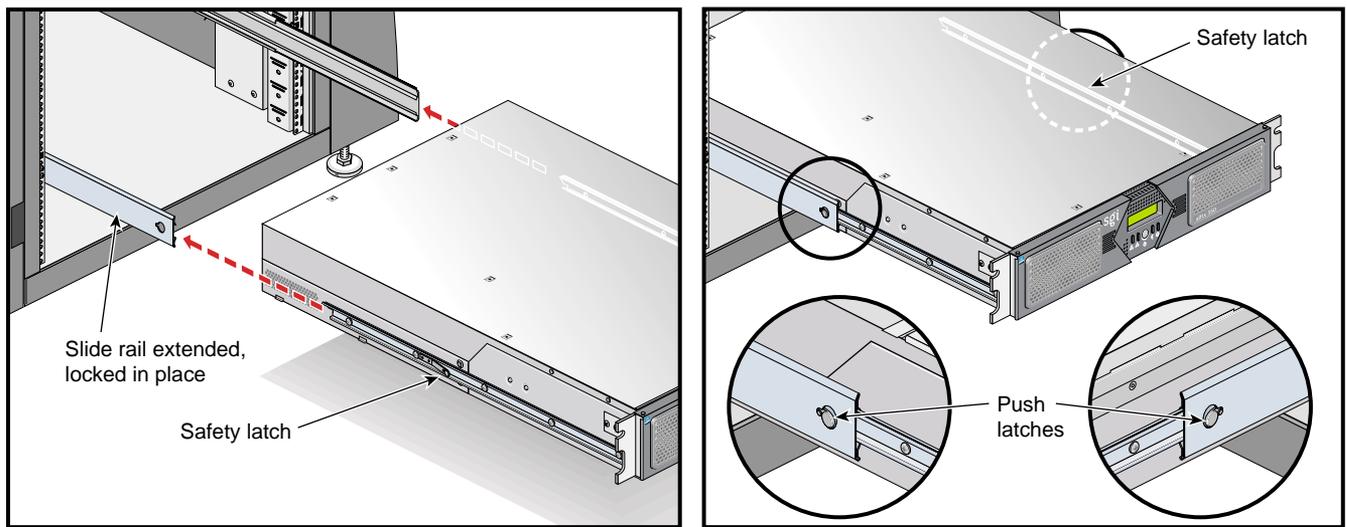
Figure 1-19   Pressing the Safety Latches

6. Secure the module to the rack by inserting a 10-32 x 1/2-in. Phillips screw in the top hole of each chassis ear (see Figure 1-20).

10-32 x 1/2-inch screws
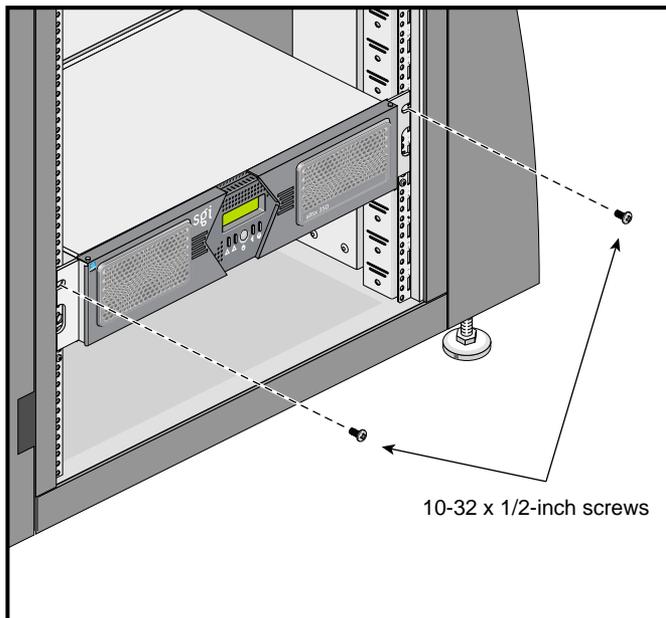
Figure 1-20   Securing the Module to the Rack

Adjusting the Position of the Rackmounted Module

Once the module is installed in the rack, you can adjust the position of the module in the rack (upward and sideways). To adjust the position of the module, loosen the front mounting screws, adjust the module to the desired position, and then tighten the mounting screws.

⚠ **Caution:** Do not lift the module by its bezel; it is not designed to handle the weight of the module. Instead, use the chassis ears to move the module (see Figure 1-20).

Removing a Module on Slide Rails from a Rack

To remove the module that is on slide rails on a rack, follow these steps:

1. Power off the module. For instructions on how to power off the module, see "Powering the System On and Off" on page 54.

2. Disconnect all of the cables at the rear of the module.

Warning: **Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.**

3. Remove the two screws that secure the module to the front rails of the rack.

4. Carefully pull the module from the rack until it is stopped by the safety latches.

5. With one person holding each side, release the safety latches on both sides of the module and pull the module out of the slide rail (see Figure 1-21).

6. Place the module on a flat, stable surface.
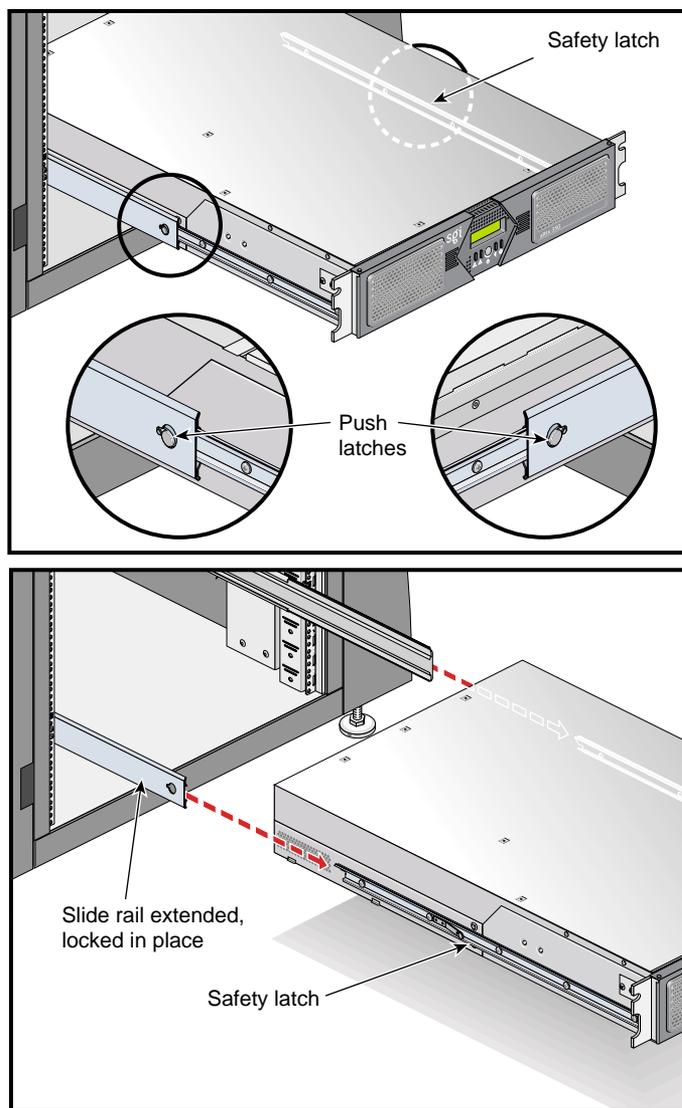
Figure 1-21   Releasing the Safety Latches

7. To slide the slide rails back into the rack, push down on the slide latches as shown in Figure 1-22.

Note: Before you can reinstall a module into the rack, fully extend the slide rails from the rack until they lock into place.
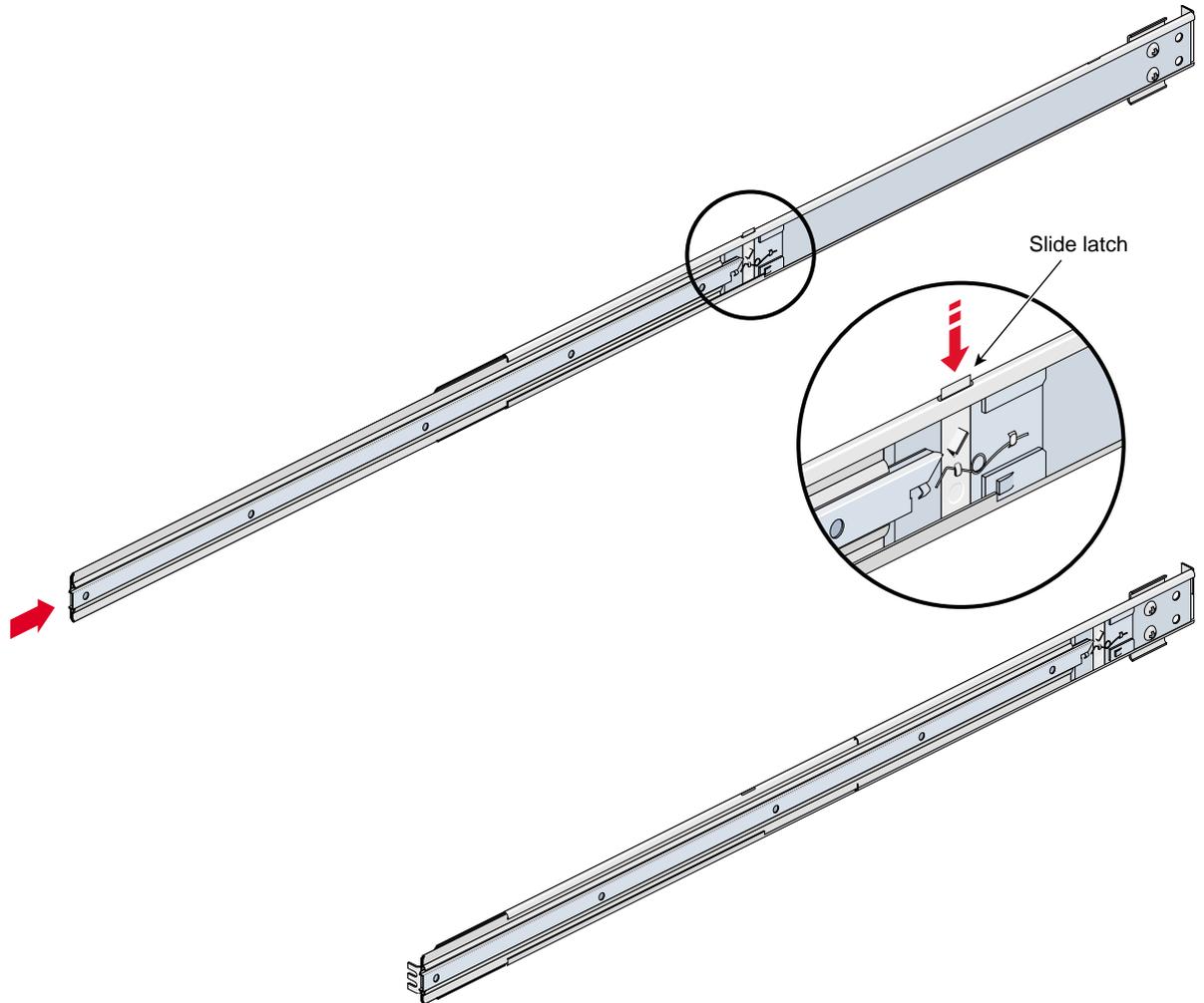
Slide latch

Figure 1-22   Releasing the Slide Latches

Rackmounting Modules with Shelf Rails

This section describes how to rackmount a module using shelf rails. The shelf rails, which are shipped with the module, support the module within the rack. To attach the shelf rails to the rack, follow these steps:

1. Locate the slot location in the rack in which you will install the module.

2. In the slot location from step 1, position the left shelf rail at a 90-degree angle to the front and rear rack rails (see Figure 1-23).

3. Insert the top-front bracket tab into one of the narrow slots in the front rack rail.

4. Insert the top-rear bracket tab into the narrow slot in the rear rack rail.

Note: Verify that the tabs are the same height to ensure that the module is level in the rack.

5. Lower the bottom of the shelf rail until its two lower tabs engage with the wide slots in the front and rear rack rails.

6. Install the two push-in fasteners that secure the shelf rail to the front and rear rack rails.

7. Place the EMI gasket bracket on the rear rack rail. Then install the two screws that secure the bracket and the shelf to the rear rack rail.

8. Repeat steps 2 through 7 for the right shelf rail.
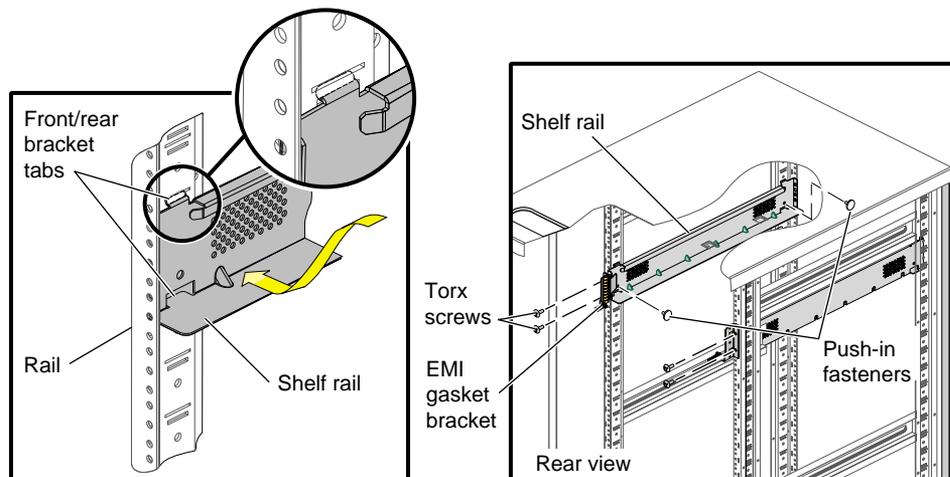
Figure 1-23   Installing the Shelf Rails in the Rack

9. Set the rear edge of the module on the shelf rails. Then slide the module into the rack until the module ears are snug against the rack rails. See Figure 1-24.

10. Fasten the module to the front rails of the rack with the screws and clip nuts provided. See Figure 1-24.

11. Fasten the module to the rear rails of the rack with the screws and clip nuts provided.

10-32 x 1/2-inch screws
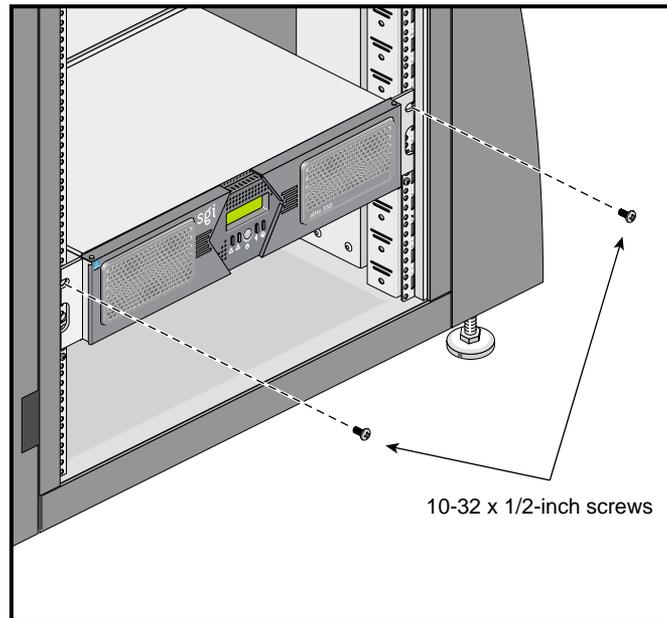
Figure 1-24   Securing the Module to the Rack

Removing a Module on Shelf Rails from a Rack

To remove the module that is on shelf rails in a rack, follow these steps:

1. Power off the module. For instructions on how to power off the module, see "Powering the System On and Off" on page 54.

2. Disconnect all of the cables at the rear of the module.

Warning: **Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.**

3. Remove the two screws and clip nuts that secure the module to the front rails of the rack.

4. Remove the two screws and clip nuts that secure the module to the rear rails of the rack.

Caution: For added safety, always use two people while removing or replacing a module from the rack.

5. Carefully and slowly slide out the module by holding and pulling on one of the module ears with one hand, while placing the other hand securely under the module so that it supports the weight of the module as it clears the rack.

6. Place the module on a flat, stable surface.

Cabling the System Modules

Some configurations of an Altix 350 system will consist of either two or more modules. This section describes how to cable together these multiple modules.

Note: If your system is made up of a single module, you can skip this section and proceed to "Cabling the System Modules to a Power Source" on page 48 for instructions to connect your system to power.

The base compute module, CPU expansion compute module, or CMPX module connect via the module's NUMAlink connectors. Figure 1-25 shows an example cabling of a base compute module to a CMPX module.
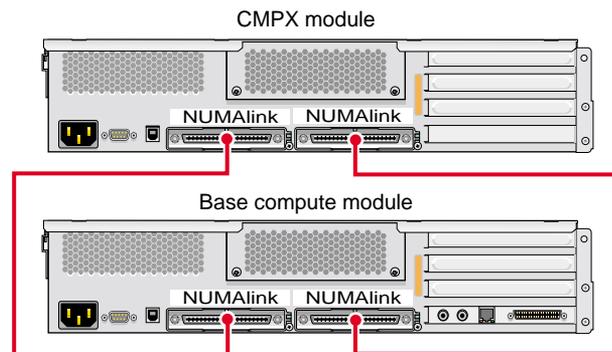
Figure 1-25   Cabling a Base Compute Module to a CMPX Module

Note: Before you connect two Altix 350 compute modules to each other, you must assign unique system ID numbers to the compute modules, as follows:

1. Designate one of the compute modules as the master server and the other compute module as the slave.

2. Connect a console to the slave compute module (see "Connecting the System Console" on page 52), and power on the compute module (see "Powering the System On and Off" on page 54).

3. Use the `brick slot` <*slotnumber*> L1 command to set the slave system ID number to a higher number than the master system ID number. For example, if the master compute module's L1 prompt indicates that its ID number is `01` (`001c01-L1>`), then the slave system ID number should be 02 or higher (`001c02-L1>`).

    ```
    001c01-L1>brick slot 02
    brick slot set to 02.
    ```

    See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for more information on L1 commands.

To connect two Altix 350 compute modules to each other with a NUMAlink cable, follow these steps:

1. Power off both compute modules (see "Powering the System On and Off" on page 54).

2. Connect the NUMAlink cable to the NUMAlink connectors on both compute modules.

3. Connect a system console to the master compute module, as described in "Connecting the System Console" on page 52.

4. Power on both compute modules as described in "Powering the System On and Off" on page 54.

The console output should indicate that the processors and memory on both compute modules have been discovered. If the slave compute module has not been discovered, use the `reset` L1 command to perform a reset of the system.

Note: For module-to-module communication to work correctly, the network mode on the module must be set to 422 (when connecting a PC [system console] to a serial port). Use the `network` L1 command to set the network mode. (See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for more information on L1 commands.)

Figure 1-26 shows the cabling of the system modules to the following components:

- System console (for example the SGIconsole), which you can use to monitor and manage your system. (The LAN2 port of the SGIconsole connects to the L2 controller's Ethernet port with an RJ-45 twisted-pair cable.)

- L2 controller. (Using an RJ-45 twisted-pair cable, the L2 controller's L1 port connects to the L1 port of a base compute module, CPU expansion compute module, or CMPX module.)

- TP900 storage module. (Using a SCSI cable, the SCSI port on the base compute module connects to the TP900 module's SCSI port.) Note that the type of connection shown in this example is only available in systems using IO9 base I/O cards. For systems using the IO10 base I/O card, an optional SCSI PCI card is required.
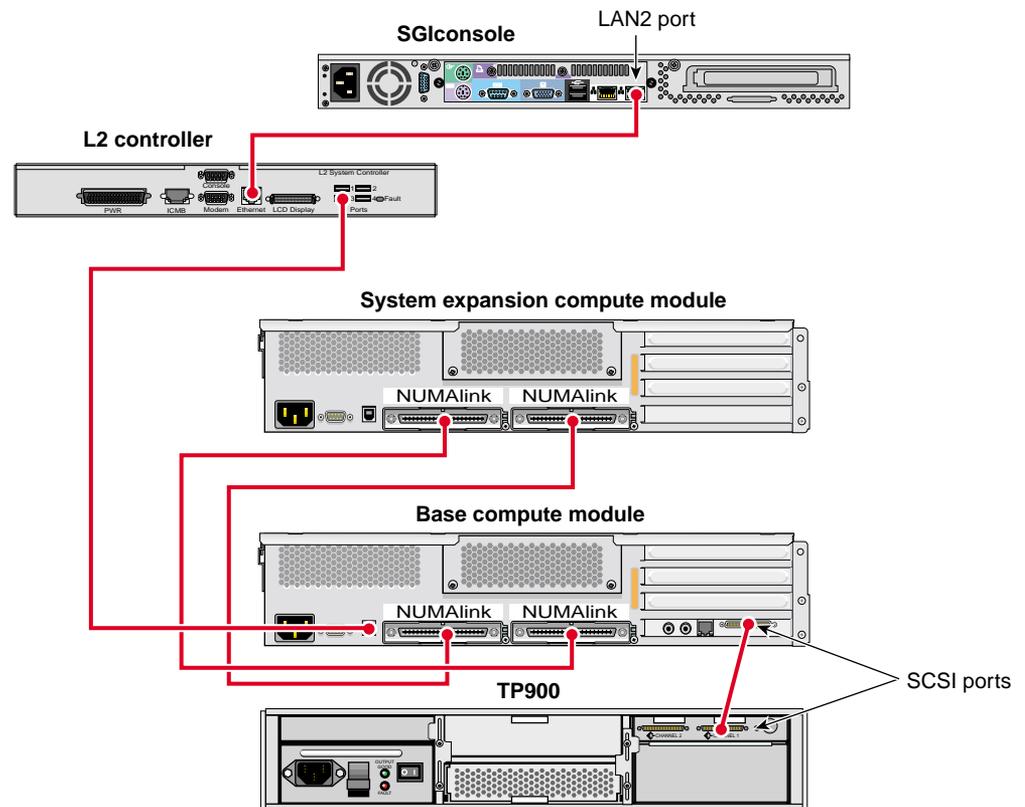
Figure 1-26   Cabling Multiple Modules Example

Optional Router System Cabling

If you have a larger (greater than 16 processor) Altix 350, your system will use one or two optional router modules. The router-based systems use a completely different cabling scheme than those that are connected in a ring topology.

Figure 2-3 on page 70 and Figure 2-4 on page 71 illustrate the cabling of an optional router system using block diagrams. The section "Optional Router System Cabling" on page 48 details the cable connection points used in an optional router system.

The router module or R-brick is an eight-port 2U high module that functions as a high-speed switch to route network packets between Altix 350 modules within a system. Chapter 6, "Optional Router" describes this module in detail.

Cabling the System Modules to a Power Source

This section describes how to make the following connections to a power source:

- "Connecting a System Module to a Power Source (No Rack)" on page 48
- "Connecting System Modules to a Rack Power Source" on page 50

Connecting a System Module to a Power Source (No Rack)

If you are operating your system on a table top, connect the system modules to a wall power receptacle. See Figure 1-27 for the location of the module's power connector.
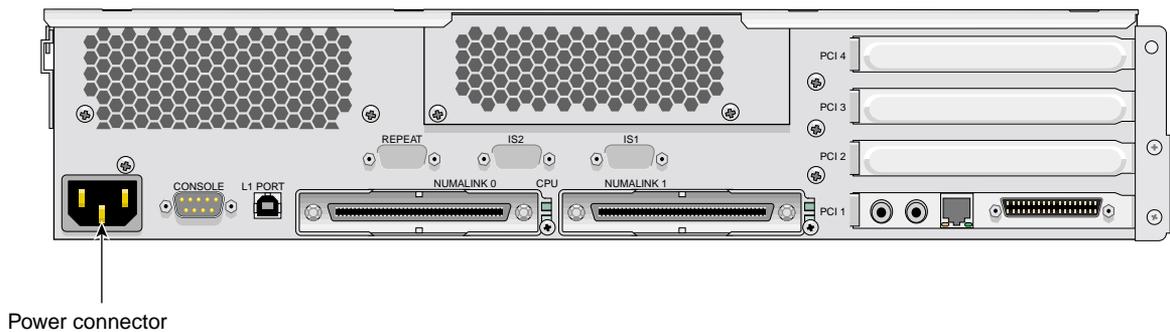
Power connector

Figure 1-27   Power Connector on the Rear of the Base Compute Module

Figure 1-28 shows the connecting of a dual-module server system (a CMPX module and a base compute module), located on either a tabletop or desktop, to a power source.
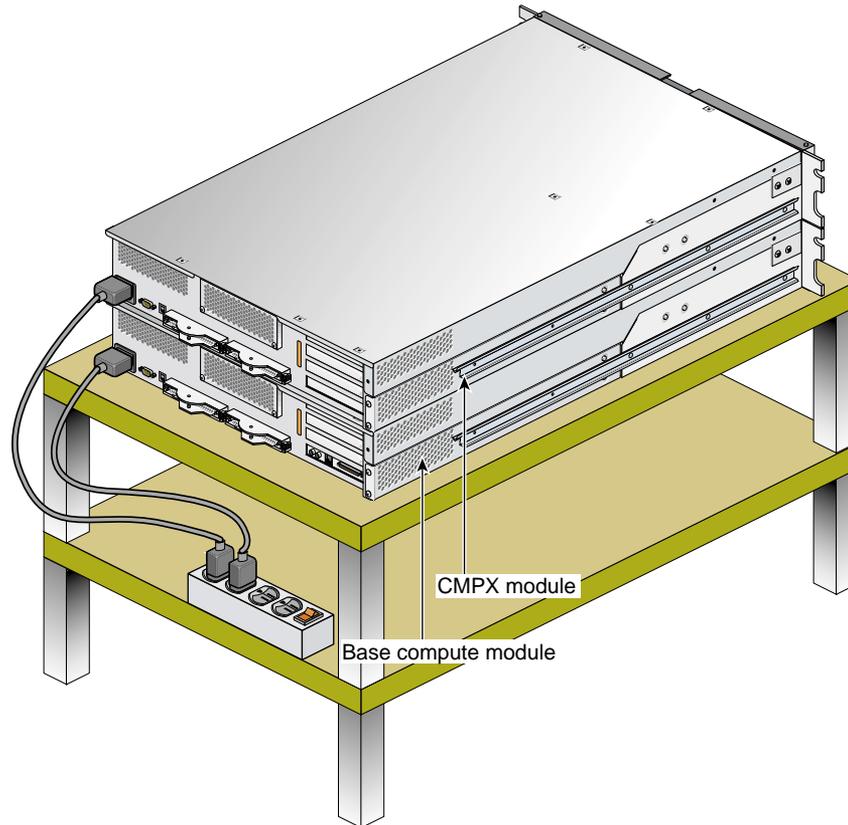
Figure 1-28   Connecting a Dual-module System to a Power Source

Connecting System Modules to a Rack Power Source

This section describes how to cable the system modules that reside in a rack to a power source. Figure 1-29 shows an example of a system that consists the following components:

- Optional L2 controller
- CPU expansion compute module
- Base compute module
- Optional TP900 storage module
- Power distribution unit (PDU)/Power adapter
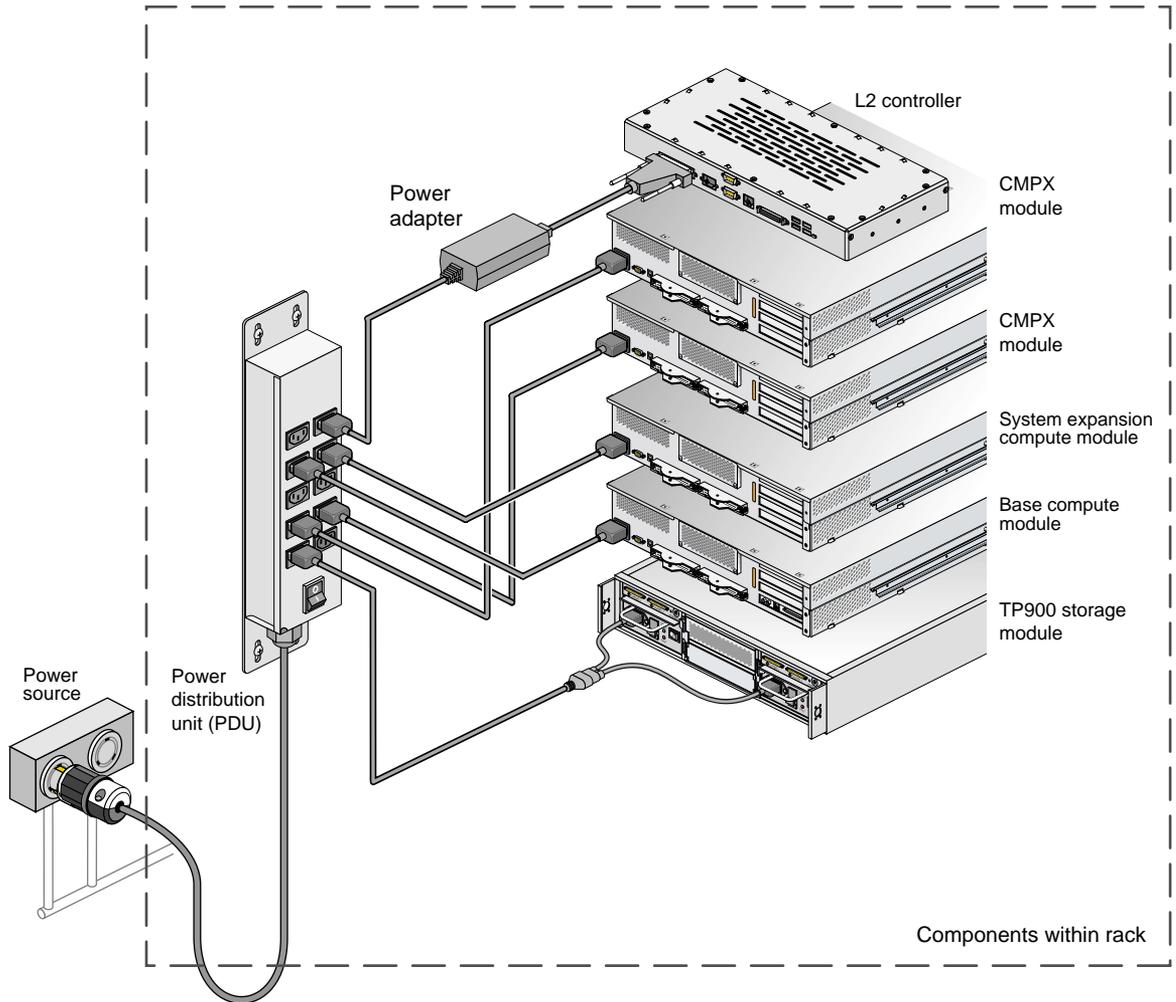
Figure 1-29   Connecting Multiple Modules to a Power Source

Connecting the System Console

This section explains how to attach and establish a connection between a system console and an Altix 350 system. The system console enables you to perform the following activities:

- Start a Linux or IRIX console session to set up networking and other configuration parameters.

- Monitor your system by reading the status and error message information that the L1 controller generates.

- Enter L1 controller commands to monitor or change particular system functions. You can, for example, monitor the speed of fans for a particular module. See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for descriptions of the L1 controller commands that you can use.

- Power on or power off your system.

The system console can be a server that runs the SGIconsole remote multiserver management software or a laptop/personal computer (PC). SGIconsole provides a central server control environment that has the following features:

- Support for SGI clusters, partitioned systems, and large single-system-image servers.

- Expandable to support additional systems.

- Rackmountable, space-efficient platform.

- Software applications and tools for installation and configuration, for console functionality, and for monitoring and managing system-level performance.

- Web-based user interface.

For information on connecting a system console that runs SGIconsole software to your system, see the *SGIconsole Hardware Connectivity Guide* (007-4340-00*x*).

To attach a PC to your server system, connect a null modem serial cable between the PC and the CONSOLE port of the base compute module of your system (see Figure 1-30). To establish a connection between your system and the system console (PC), follow these steps:

1. Ensure that the L1 controller of the base compute module is powered on. When the base compute module is connected to a power source, the L1 controller should be powered on.

    Note: When powered on, the L1 controller displays `L1 running`. If it does not display `L1 running`, check the connection between the base compute module and the power source. In addition, ensure that the circuit breaker of the power source is on.

2. Power on the system console.

3. Ensure that the system console has the following network settings:

    *   Baud 38400

    *   No parity

    *   8 data bits

    *   1 stop bit

    *   Hardware flow control on (RTS/CTS)

4. Type `cu -l ttyd2` for an IRIX based console, or `cu -l ttys0 -S38400` for a Linux based console, and then press **Enter** to display the L1 prompt. If the console uses another operating system, start a terminal emulation program as instructed in the console's user documentation.
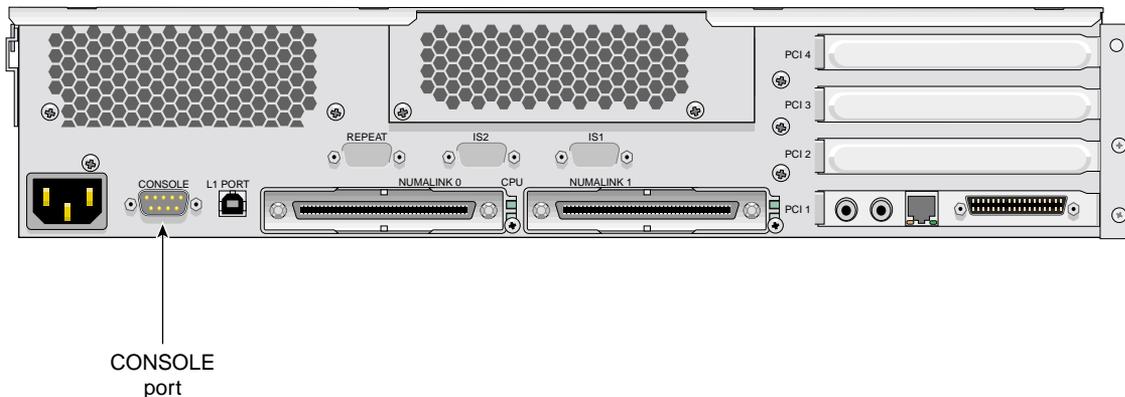
Figure 1-30   Location of the Console Port

Operating Your System

This section describes how to operate your Altix 350 system, as follows:

- "Powering the System On and Off" on page 54

- "Operating the System Modules via Front Panel Controls" on page 61

- "Operating the L1 Controller" on page 62

Powering the System On and Off

This section describes how to power on and power off your system (or an individual module) at a system console, or manually, as follows:

- "Preparing to Power On" on page 55

- "Powering Off at the System Console" on page 59

- "Powering On Manually or With L1 Console" on page 57

- "Powering Off at the System Console" on page 59

- "Powering Off Manually" on page 60

Preparing to Power On

To prepare to power on your system, follow these steps:

1. Confirm that all the cable connections between the modules and between the modules and other system items are connected securely. If necessary, see "Cabling the System Modules" on page 45 for information.

2. Confirm that all the power cables are plugged in securely to a power source. If necessary, see "Cabling the System Modules to a Power Source" on page 48 for information.

Powering On With Optional System Console and L2 Controller

To power on and boot your system using the system console, follow these steps:

Note: You must manually power on the TP900 storage module by placing the power switch(es) in the ON (**I**) position. You must turn this module on before starting the operating system.

1. If not yet done so, connect a system console to the server system as described in "Connecting the System Console" on page 52.

2. If the monitors and other peripherals are equipped with voltage select switches, verify that they are set for the appropriate AC voltage and plug them in. Note that they are normally plugged into sources outside the rack system.

3. Turn on the circuit breaker switch of the PDU as shown in Figure 1-31.

Power distribution unit (PDU)

Wall power source

Circuit breaker switch
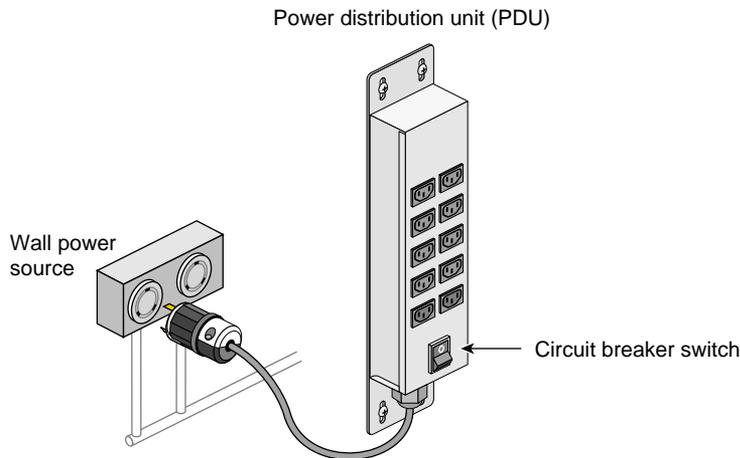
Figure 1-31   PDU Circuit Breaker

4. Verify that all of the L1 controllers display "L1 running." If any L1 controllers are not running, contact your SGI system support engineer (SSE).

5. At the system console, access the L2 controller by entering the following command:

    ```
    $> /stand/sysco/bin/l2term
    ```

6. From the L2 prompt, display the system configuration by entering the following command:

    ```
    L2> cfg
    ```

    This command lists the modules that the L2 controller detects in the system and their system controller addresses. If a module that you want to power on does not appear in the list, it will not power on. Ensure that the module's L1 controller is running and that the module is cabled properly.

7. From the L2 prompt (L2>), power on an individual module by entering the following command. (If you want to power on the entire system, proceed to Step 8.)

    ```
    L2> r <rack#> s <slot#> pwr u
    ```

    For example, to power on a module in rack 1, slot 18, enter the following command:

    ```
    L2> r 1 s 18 pwr u
    ```

    The slot number is the unit number of the module within the rack.

If you want to power on several selected modules of a rack at the same time, you must enter the rack number followed by the slot numbers of the modules that you want to power on. For example, to power on the modules in slots 18, 20, and 22, enter the following command:

```
L2> r 1 s 18,20,22 pwr u
```

8. If you want to power on the entire system, enter the following command:

    ```
    L2> pwr u
    ```

    (The default setting for the pwr u command is all racks and slots.)

9. When the L2 prompt appears, you will not see the output that is produced during the power-on procedure unless you redirect the keyboard input from the L2 controller to the normal console by typing control d.

    ```
    L2> ctrl d
    ```

Powering On Manually or With L1 Console

If your system does not have a a local system console, you can manually power on and off the server by using the power button(s). To power on your system or an individual module manually, follow these steps:

1. If the monitors and other peripherals are equipped with voltage select switches, verify that they are set for the appropriate AC voltage and plug them in. Note that they are normally plugged into power sources outside the rack system.

2. Turn on the circuit breaker switch of the PDU as shown in Figure 1-31 on page 56.

3. Press the power buttons on each of the modules that you want to power on in the following order:

    a. For the TP900 storage module, press the rear-panel power button to ON (**I**).

    b. For the CMPX module, the base compute module, and the CPU expansion compute module, press the power button with the LED on the front panel of each module (see Figure 1-32).

To boot the system from the L1 interface you must have a console connected to the system via the console port. Use the following commands depending on your system type:

1. For a system that contains one server, enter the following command at the L1 prompt to power on the server:
   001c01-L1> power up

2. For a system with multiple modules, enter the following command at the L1 prompt:
   001c01-L1> * power up

Power button
with LED
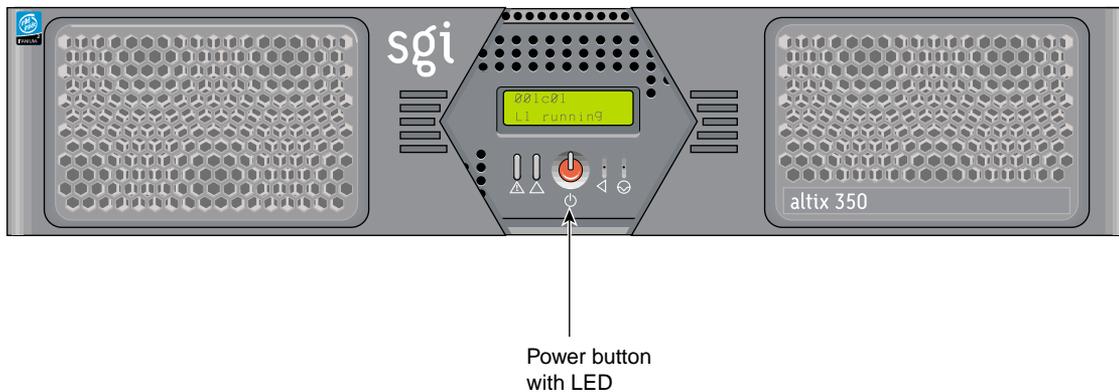
Figure 1-32   Location of the Power Button

Powering Off at the System Console

To power off your system using the system console, follow these steps:

> ⚠ **Caution:** If you power off the system before you halt the operating system, you can lose data.

1. Shut down the operating system by entering the following command:

   `# init 0`

2. To access the L2 prompt, direct the keyboard input to the L2 controller by entering **Ctrl+T**.

   `$> ctrl t`

3. From the L2 prompt (L2>), power off an individual module by entering the following command. (If you want to power off the entire system, proceed to Step 4.)

   `L2> r <rack#> s <slot#> pwr d`

   For example, to power off the module in rack 1, slot 18, enter the following command:

   `L2> r 1 s 18 pwr d`

   The slot number is the unit number of the module within the rack.

   If you want to power off several selected modules from the rack at the same time, enter the rack number followed by the slot numbers of the modules that you want to power off. For example, to power off the modules in slots 18, 20, and 22, enter the following command:

   `L2> r 1 s 18,20,22 pwr d`

4. If you want to power off all of the modules within the rack, enter the following command:

   `L2> pwr d`

   (The default setting for the `pwr d` command is all racks and slots.)

   "Powered Down" appears on the L1 display when the module is powered off. The L1 controller is still powered on.

5. To power down an L1 controller, unplug the module from the PDU.

Powering Off Manually

To power off your system manually, follow these steps:

⚠️ **Caution:** If you power off the system before you halt the operating system, you can lose data.

1. Shut down the operating system by entering the following command:

    ```
    # init 0
    ```

2. Press the power buttons or power switches on each of the modules that you want to power off. You may power off the modules in any order:

    *   To power off the TP900 storage module, press the power button on its rear panel to the OFF (**O**) position.

    *   To power off the base compute module, the system expansion compute module, and the CMPX module, press the power button with the LED on the front panel of each module (see Figure 1-32 on page 58).

Operating the System Modules via Front Panel Controls

The front panel of the base compute module, the CPU expansion compute module, and the CMPX module provides the following control features, as shown in Figure 1-33:

- **Status LEDs.** The front panel has the following LEDs:

  - Power button LED. This LED illuminates green when the internal components are on.

  - Service-required LED. This LED illuminates yellow to indicate that an item is not functioning properly (for example, a fan is off), but the module is still operating.

  - Failure LED. This LED illuminates red to indicate that a failure has occurred and the module is down.

- **Power button.** Press this button to power on the module. Alternatively, you can power on the module at the system console.

- **Reset button.** Actuate this button to reset the internal processors and ASICs. The reset will cause a memory loss. (To perform a reset without losing memory, see the NMI button information that follows.)

- **NMI button**. Actuate the NMI (non-maskable interrupt) button to reset the internal processor(s) and ASICs, and write register data and memory to the /var/adm/crash file.

Use a paperclip or other small object to access the "pin-hole" actuator for this button.
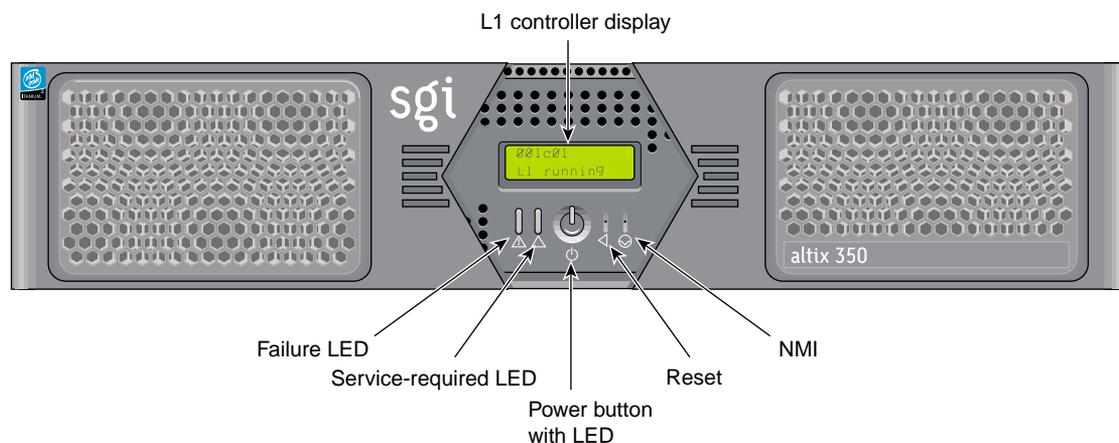
Figure 1-33   Front Panel Functions

Note: If your system includes a TP900 storage module, see the *SGI Total Performance 900 Storage System User's Guide* (007-4428-00*x*) for operating instructions.

Operating the L1 Controller

The L1 controller operates in one of the two following modes:

- **L1 mode**. The L1 prompt (`001c01-L1>`) is visible and all input is directed to the L1 command processor.

- **Console mode from L1**. Output from the system is visible and all input is directed to the system.

The L1 controller is ready to accept commands when you see a prompt of the following form:

```
001c01-L1>
```

See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for a detailed list of L1 commands.

To enter console mode, press **Ctrl+D** at the L1 prompt, as follows:

```
001c01-L1> Ctrl+D
entering console mode 001c01 console, <CTRL-T> to escape to L1
.
<system output appears here>
.
```

To return to L1 mode, press **Ctrl+T**, as follows:

```
Ctrl+T
escaping to L1 system controller
001c01-L1>
```

At this point, you can enter any L1 command. When the command completes execution, the L1 returns to console mode:

```
re-entering console mode 001c01 console, <CTRL-T> to escape to L1
```

To permanently engage the L1 mode, press **Ctrl+T** and then enter the **l1** command, as follows:

```
Ctrl+T
escaping to L1 system controller
001c01-L1> l1
L1 command processor engaged, <CTRL-D> for console mode.
001c01-L1>
```

System Overview

This chapter provides an overview of the physical and architectural aspects of your Altix 350 system. System configurations and components are described and illustrated. This chapter includes the following sections:

- "Physical Features" on page 66
- "Functional Architecture" on page 68
- "System Configurations" on page 73
- "System Components" on page 88

Physical Features

The Altix 350 system is the latest advancement in the SGI NUMAflex approach to mid-range modular computing. It is designed to deliver maximum sustained performance in a compact system footprint. Independent scaling of computational power, I/O bandwidth, and in-rack storage lets you configure a system to meet your unique computational needs. The small footprint and highly modular design of the Altix 350 system makes it ideal for computational throughput, media streaming, or complex data management.

The Altix 350 system can be expanded from a standalone single-module system with 2GB of memory and 4 PCI/PCI-X slots to a high-performance system that contains 32 processors, one or two routers, up to 192 GB of memory, and 64 PCI/PCI-X slots. For most configurations, the Altix 350 system is housed in one 17U rack or one 39U rack as shown in Figure 2-1; however, for small system configurations, the Altix 350 system can be placed on a table top.

Systems that are housed in 17U racks have a maximum weight of approximately 610 lb (277 kg). The maximum weight of systems that are housed in 39U racks is approximately 1,366 lb (620 kg). The racks have casters that enable you to remove the system from the shipping container and roll it to its placement at your site.

See Chapter 1, "Installation and Operation," for more information about installing your system. Check with your SGI service representative for additional physical planning documentation that may be available.

For more information about the technical specifications of your system, see Appendix A, "Technical Specifications," in this manual.
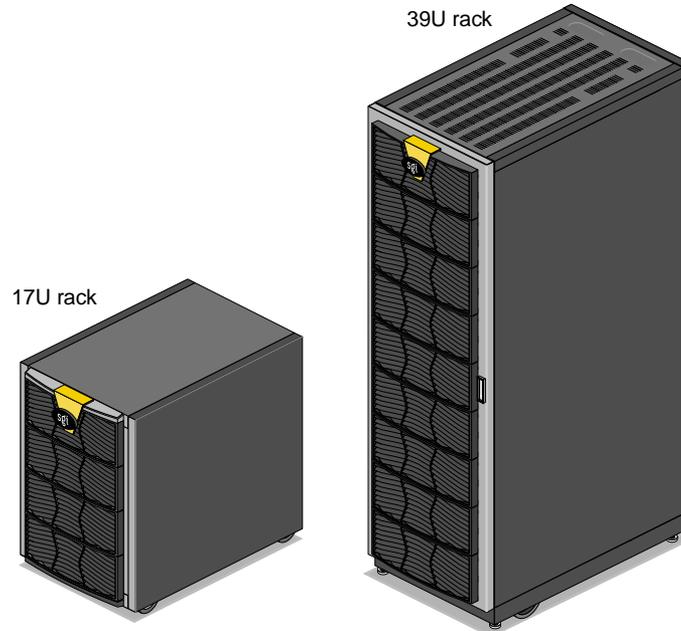
Figure 2-1   Example of SGI Altix 350 Rack Systems

Functional Architecture

The Altix 350 system is based on the SGI NUMAflex architecture, which is a shared-memory system architecture that is the basis of SGI HPC servers and supercomputers. The NUMAflex architecture is specifically engineered to provide technical professionals with superior performance and scalability in a design that is easy to deploy, program, and manage. It has the following features:

Shared access of processors, memory, and I/O. The Super Hub (SHub) ASICs and the NUMAlink-4 interconnect functions of the NUMAflex architecture enable applications to share processors, memory, and I/O devices.

- Each SHub ASIC in the system acts as a memory controller between processors and memory for both local and remote memory references.

- The NUMAlink interconnect channels information between all the modules in the system to create a single contiguous memory in the system of up to 384 GB and enables every processor in a system direct access to every I/O slot in the system.

Together, the SHub ASICs and the NUMAlink interconnect enable efficient access to processors, local and remote memory, and I/O devices without the bottlenecks associated with switches, backplanes, and other commodity interconnect technologies.

System scalability. The NUMAflex architecture incorporates a low-latency, high-bandwidth interconnect that is designed to maintain performance as you scale system computing, I/O, and storage functions. For example, the computing dimension in some system configurations can range from 1 to 32 processors in a single system image (SSI).

Efficient resource management. The NUMAflex architecture is designed to run complex models and, because the entire memory space is shared, large models can fit into memory with no programming restrictions. Rather than waiting for all of the processors to complete their assigned tasks, the system dynamically reallocates memory, resulting in faster time to solution.

The Altix 350 system can be configured using a ring topology, as described in Figure 2-2. In a ring topology, the components that make up the system are connected in a closed-loop fashion; the components have a direct connection with two neighboring components and indirect connection with the other components in the loop. For example, component 1 in Figure 2-2 can communicate with component 2 and 8 directly; however, to communicate with component 4, the message passes through components 2 and 3. Note that the diagram is for explanatory purposes and does not represent any actual configuration. For more detailed information about this type of configuration, see the section "System Configurations" on page 73.
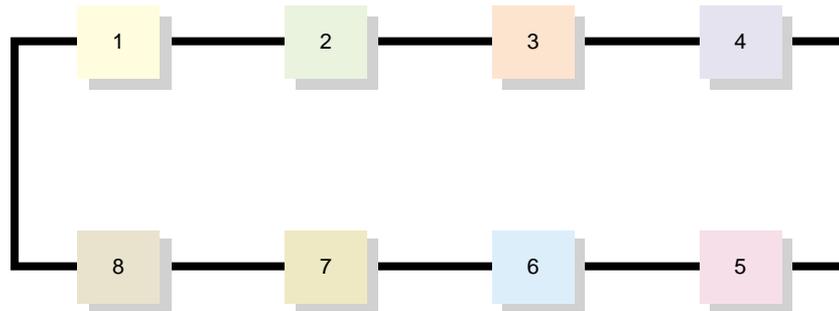
Figure 2-2   Ring Topology Block Diagram Example

The Altix 350 system can be optionally configured using one or two NUMAlink-4 routers. This is also referred to as single-plane or dual-plane router configuration. Using routers, eight to sixteen modules can be interconnected for a system with up to 32 processors in a single system image.

In a single-plane router configuration a single NUMAlink-4 connection is made to the port 0 connector on the back of (up to) eight Altix 350 modules. Additional modules (9 thru 16) are connected to the open NUMAlink-4 port (port 1) on the modules already connected to the router. See Figure 2-3 on page 70 for an example diagram of single-plane router connection.

In a dual-plane configuration a NUMAlink-4 connection is made to the NUMAlink ports (port 1) on the back of two modules in the configured system. These connections are made from port A on the back of each of two NUMAlink-4 routers. The two Altix 350 modules are then joined together by routing a NUMAlink cable between the two open ports (port 0). This creates a dual-communication pathway between the modules, the routers and other modules in the configuration. See Figure 2-4 on page 71 for an example diagram of a dual-plane router system.
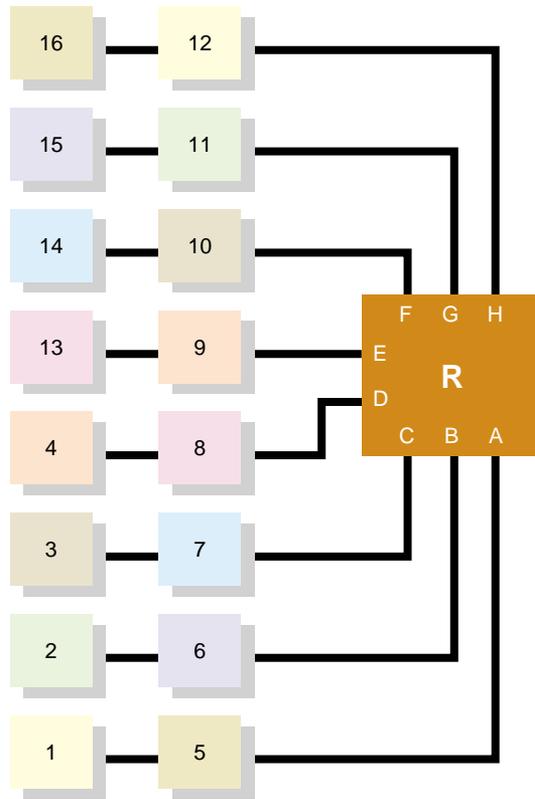
Figure 2-3   Single-Plane Router Configuration Block Diagram
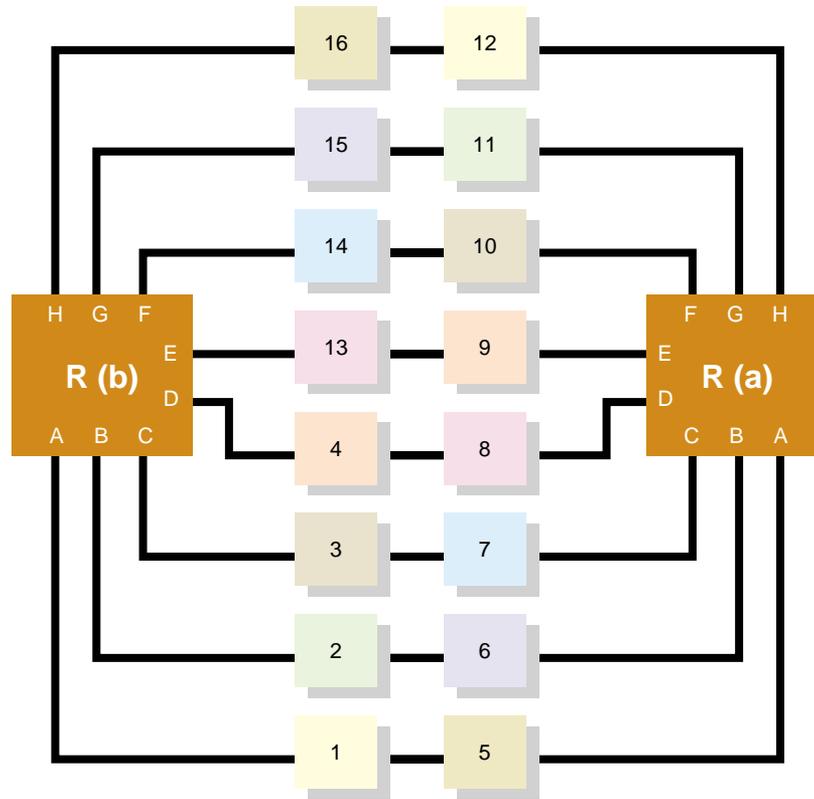
Figure 2-4   Dual-Plane Router Configuration Block Diagram

Main System Components

The components shown in Figure 2-2 are 2U modules that can be configured as one system using the following devices:

- **Base compute module.** All Altix 350 systems contain at least one base compute module that contains the following components:

  – One or two Intel Itanium 2 processors; each processor has integrated L1, L2, and L3 caches

  – Up to 24 GB of local memory

  – Four PCI/PCI-X slots

  – One base I/O PCI card that comes factory-installed in the lowermost PCI/PCI-X slot

    Note: Each system or partition requires one base I/O PCI card. This card provides the base I/O functionality for the system. Additional I/O cards are required if you want additional hard disk drives and/or DVD-ROM drives in additional modules. These cards must reside in additional base compute modules (one card per module).

    The system base I/O card has a real time interrupt input port and output port, an Ethernet port, and a either a serial port or SCSI connector (the IO10 has serial, the IO9 has SCSI.). The base I/O card is also needed to support a base module's system disk drive(s), optional DVD-ROM, and a console serial port.

    Note: The RT interrupt input and RT interrupt output functionality of either base I/O PCI card is not supported under SGI Linux + ProPack.

  – One SHub ASIC (the crossbar between the processors, local memory, the network interface, and the I/O interface).

    For more information about the base compute module, see Chapter 3, "Base Compute Module,".

- **CPU Expansion module.** The only difference between the base compute module and the CPU expansion module is that the CPU expansion module does not contain any usable PCI/PCI-X slots or disk drives. For more information about the CPU expansion module, see Chapter 4, "CPU Expansion Module,".

- **CMPX module.** The only difference between the base compute module and the CMPX module is that the CMPX module does not contain a base I/O PCI card or disk drives. For more information about the CMPX module, see Chapter 5, "CMPX Module,".

When the system consists of a base compute module only, the maximum number of processors is 2 and the maximum amount of memory is 24 GB. To increase the number of processors and/or memory in the system, the base compute module can connect to additional CPU expansion and/or CMPX modules.

System Configurations

Table 2-1 lists the minimum and maximum ranges of the configurable items for the Altix 350 system.

Table 2-1   Altix 350 Configuration Ranges

	Configuration Minimum	Configuration Maximum
Compute modules	1	16
Processors	1	32
Peak performance of processors: 1.5 GHz 1.6 GHz	 ~ 6.0 GFLOPS ~6.4 GFLOPS	Peak performance will vary over time based on new technology available; check with your SGI sales or service representative.
Memory capacity	2 GB	384 GB
Internal disk storage	One or two disks	16 to 32 disk drives
Internal PCI/PCI-X slots[a]	4	64
External storage devices	None	Customer-configurable
Compute rack	None	2
L2 controller	None	1

a. Each base compute module has four internal PCI/PCI-X slots; however, one slot is required for the base IO PCI card. Therefore, the number of available slots in the base compute module is reduced by one.

Ring Topology Configurations

As described in "Functional Architecture" on page 68 some Altix 350 systems use a type of network configuration that is referred to as a ring topology. As the name implies, the network connection between the base compute modules, CPU expansion modules, and the CMPX modules forms a ring. A message is passed around the ring until it reaches its destination.

The data flow of this ring topology flows in both directions, enabling the modules to have direct connection to two other modules and providing an alternative path when a connection fails between two modules.

The bisection bandwidth of the ring depends on the number of modules on the ring; the bisection bandwidth is greatest when there are only two modules on the ring. See Table 2-2.

Table 2-2   Bisection Bandwidth of Ring Topology

Module Count	Bisection Bandwidth
2	3.2 GB/s per processor
3	2.13 GB/s per processor
4	1.6 GB/s per processor
5	1.28 GB/s per processor
6	1.06 GB/s per processor
7	914 MB/s per processor
8	800 MB/s per processor

Figure 2-5 through Figure 2-11 provide some examples of the ring topology.
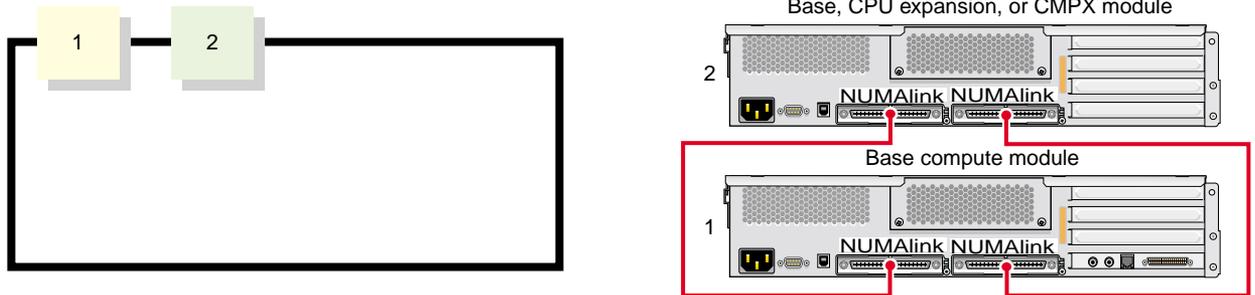
Figure 2-5   Two Module Ring Topology
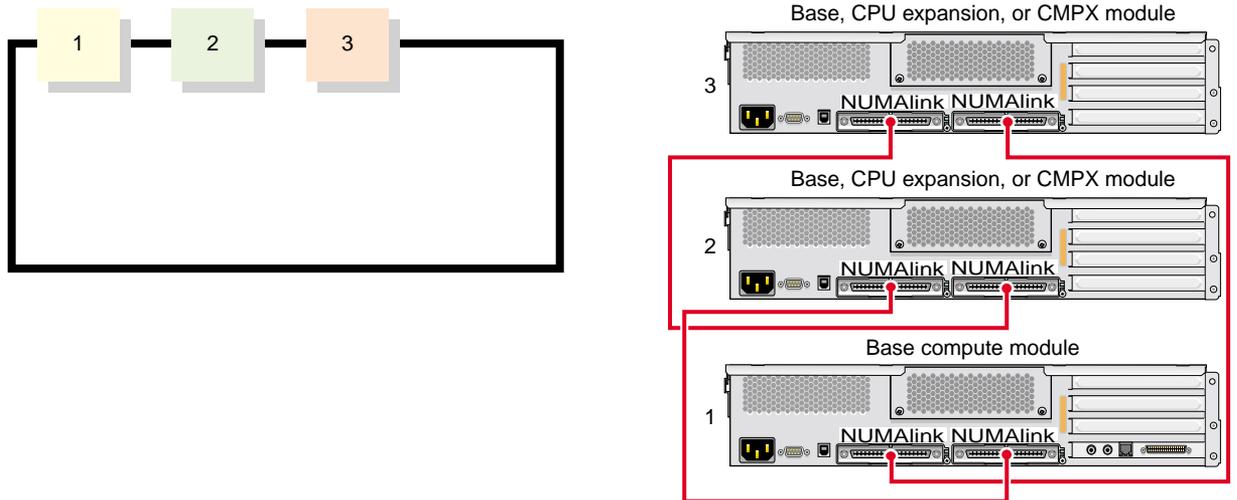
Figure 2-6   Three Module Ring Topology
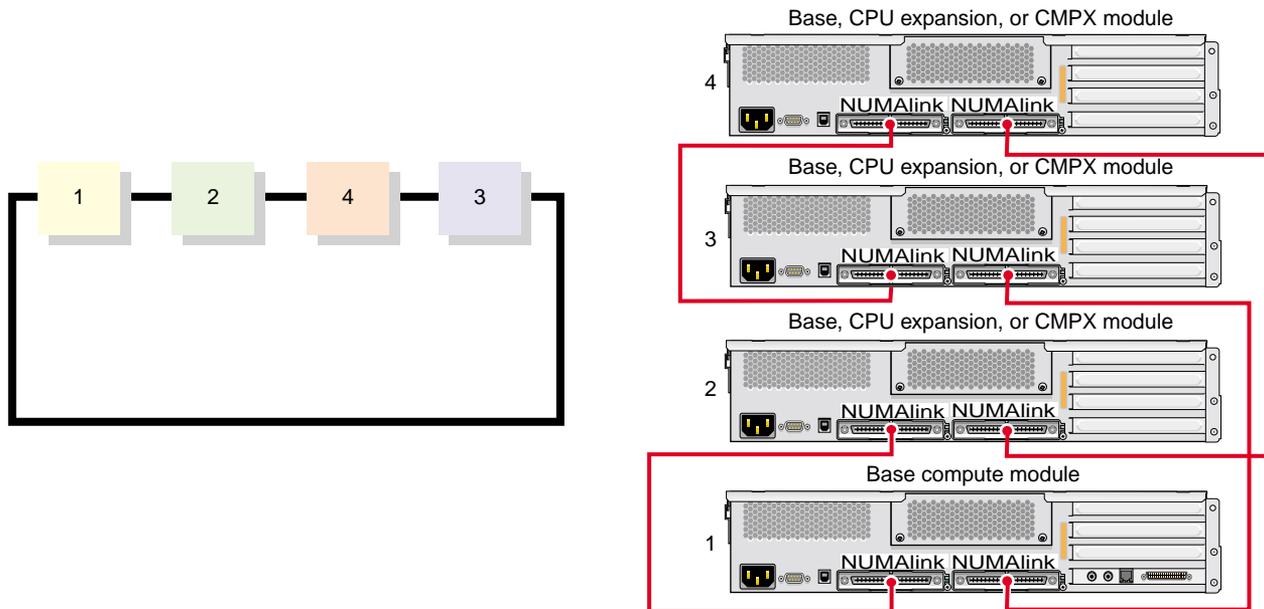
Figure 2-7   Four Module Ring Topology
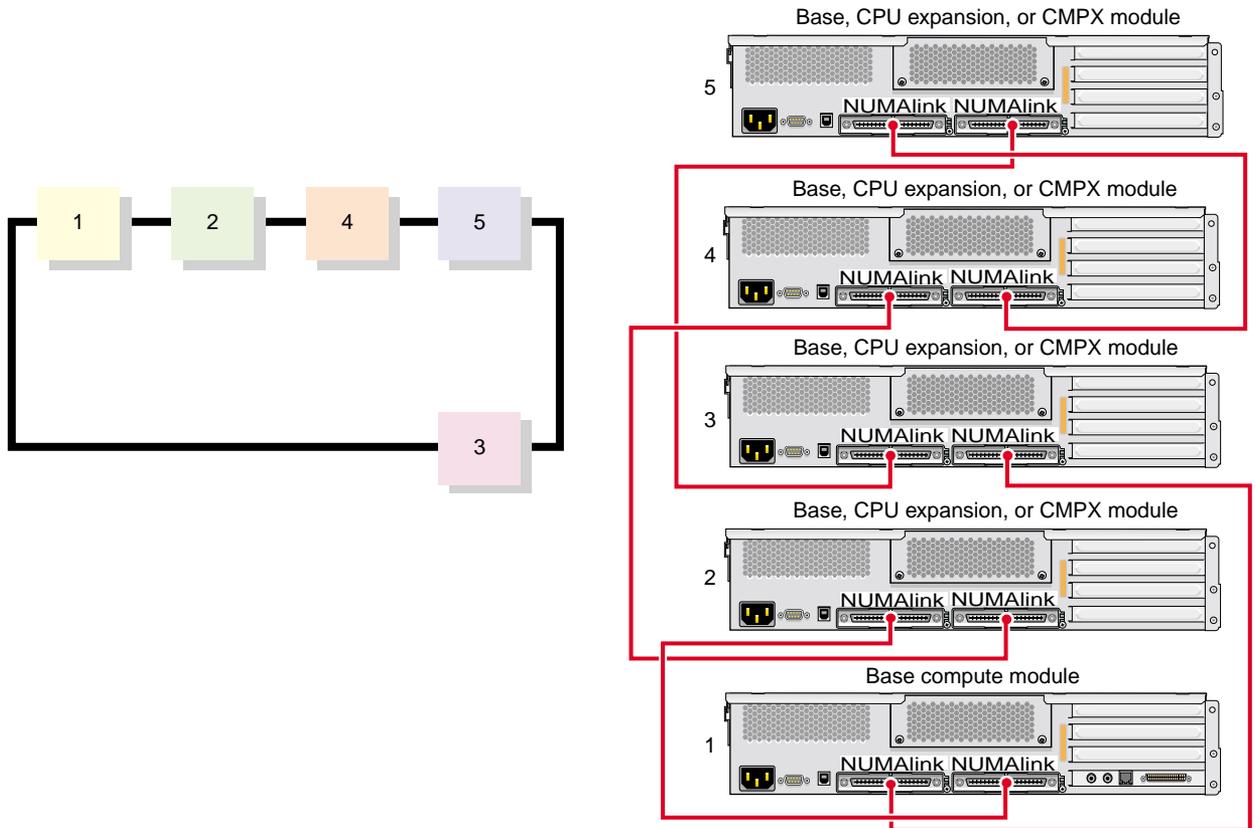
Figure 2-8   Five Module Ring Topology
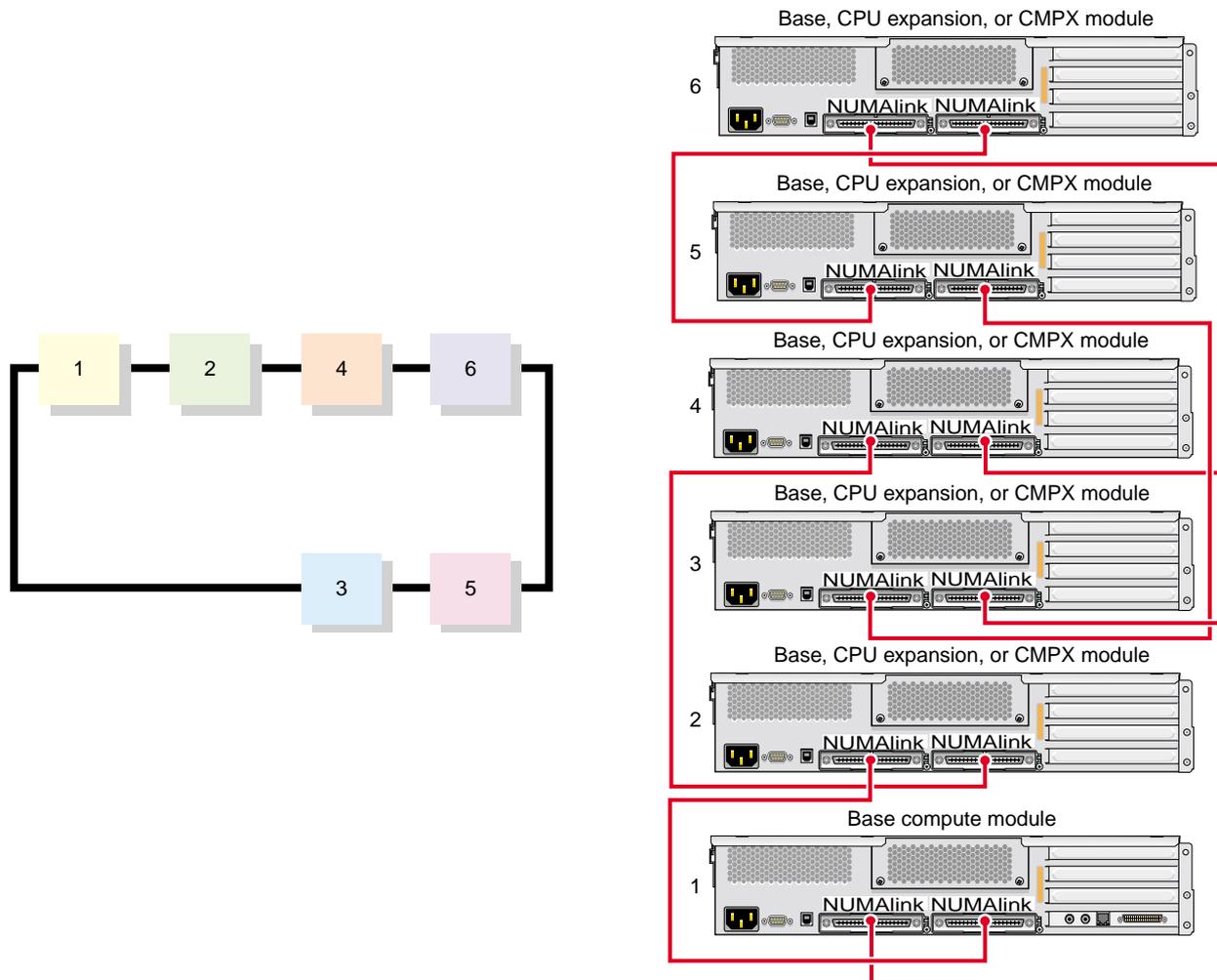
Figure 2-9   Six Module Ring Topology

Figure 2-10   Seven Module Ring Topology
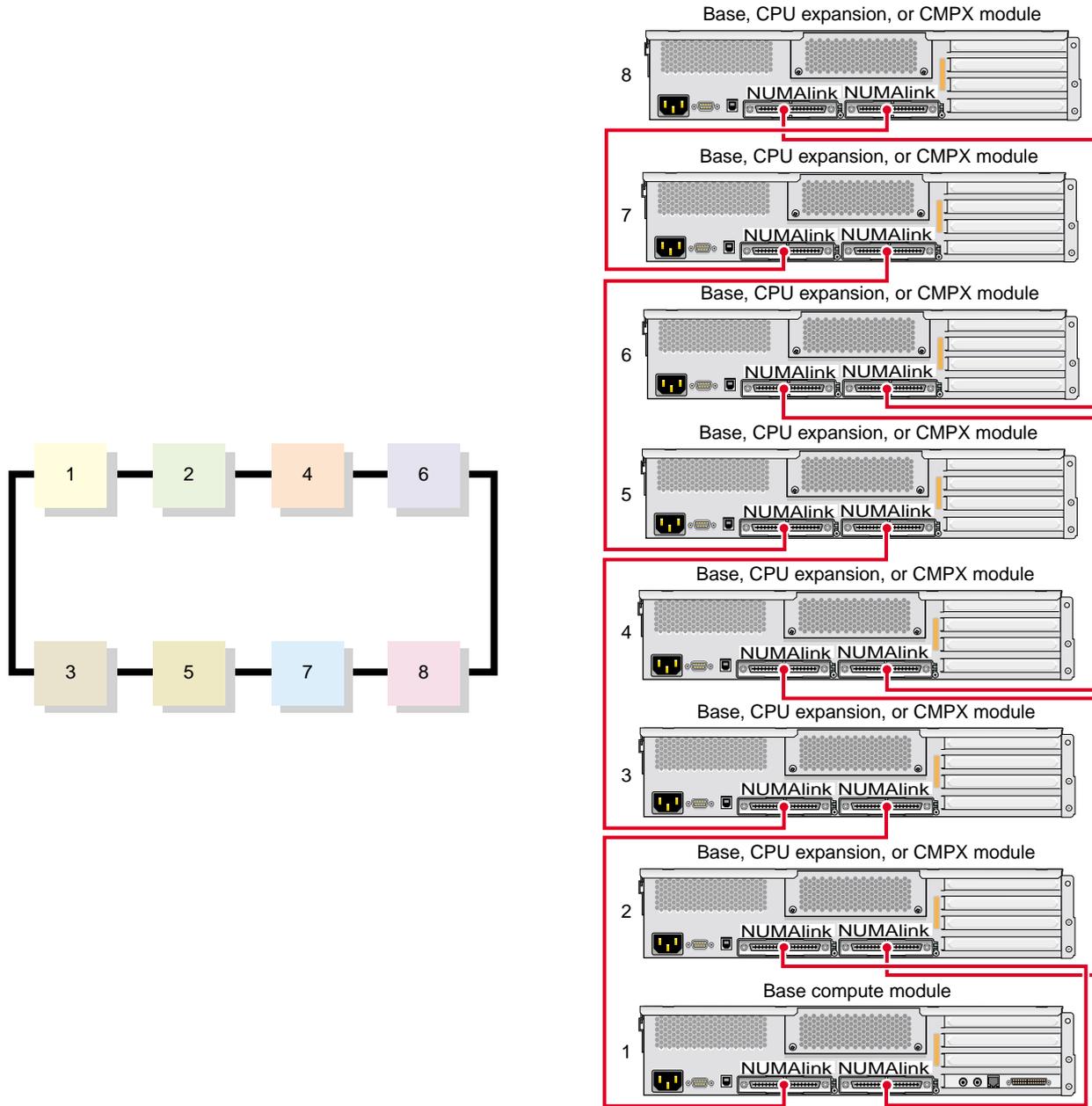
Figure 2-11   Eight Module Ring Topology

Optional Router Configurations

Altix 350 systems with eight or more modules can optionally be connected using one (single-plane) or two (dual-plane) router modules.

The router module or R-brick is an eight-port 2U high module that functions as a high-speed switch to route network packets between Altix 350 modules within a system. This creates a NUMAlink interconnect fabric (as opposed to a ring topology which is normally used in smaller system configurations). The ring topology interconnect method is described in the previous section ("Ring Topology Configurations" on page 74). For more information on router module features, see Chapter 6, "Optional Router,".

Figure 2-3 on page 70 and Figure 2-4 on page 71 show the single and dual router configuration concepts from a block diagram perspective.

Table 2-3 describes the cable connections made in a single-router configuration with a maximum of 16 modules. An example of a single-plane (single router) system interconnect topology is shown in Figure 2-12 on page 83.

Table 2-3   Single Plane Router Cable Connection Descriptions

1st NUMAlink Connection point	2nd NUMAlink Connection point	Description
From Router connector (**A**)	To (**A**) module 5 NUMAlink 1	First NUMAlink-4 cable connection (**A** to **A**)
From Router connector (**B**)	To (**B**) module 6 NUMAlink 1	Second NUMAlink-4 cable connection (**B** to **B**)
From Router connector (**C**)	To (**C**) module 7 NUMAlink 1	Third NUMAlink-4 cable connection (**C** to **C**)
From Router connector (**D**)	To (**D**) module 8 NUMAlink 1	Fourth NUMAlink-4 cable connection (**D** to **D**)
From Router connector (**E**)	To (**E**) module 9 NUMAlink 1	Fifth NUMAlink-4 cable connection (**E** to **E**)
From Router connector (**F**)	To (**F**) module 10 NUMAlink 1	Sixth NUMAlink-4 cable connection (**F** to **F**)
From Router connector (**G**)	To (**G**) module 11 NUMAlink 1	Seventh NUMAlink-4 cable connection (**G** to **G**)

Table 2-3   Single Plane Router Cable Connection Descriptions **(continued)**

1st NUMAlink Connection point	2nd NUMAlink Connection point	Description
From Router connector (**H**)	To (**H**) module 12 NUMAlink 1	Eighth NUMAlink-4 cable connection (**H** to **H**)
From module 9 NUMAlink 0 (**I**)	To module 13 NUMAlink 0 (**I**)	Ninth NUMAlink-4 cable connection (**I** to **I**)
From module 10 NUMAlink 0 (**J**)	To module 14 NUMAlink 0 (**J**)	Tenth NUMAlink-4 cable connection (**J** to **J**)
From module 11 NUMAlink 0 (**K**)	To module 15 NUMAlink 0 (**K**)	Eleventh NUMAlink-4 cable connection (**K** to **K**)
From module 12 NUMAlink 0 (**L**)	To module 16 NUMAlink 0 (**L**)	Twelfth NUMAlink-4 cable connection (**L** to **L**)
From module 1 NUMAlink 0 (**M**)	To module 5 NUMAlink 0 (**M**)	Thirteenth NUMAlink-4 cable connection (**M** to **M**)
From module 2 NUMAlink 0 (**N**)	To module 6 NUMAlink 0 (**N**)	Fourteenth NUMAlink-4 cable connection (**N** to **N**)
From module 3 NUMAlink 0 (**O**)	To module 7 NUMAlink 0 (**O**)	Fifteenth NUMAlink-4 cable connection (**O** to **O**)
From module 4 NUMAlink 0 (**P**)	To module 8 NUMAlink 0 (**P**)	Sixteenth NUMAlink-4 cable connection (**P** to **P**)
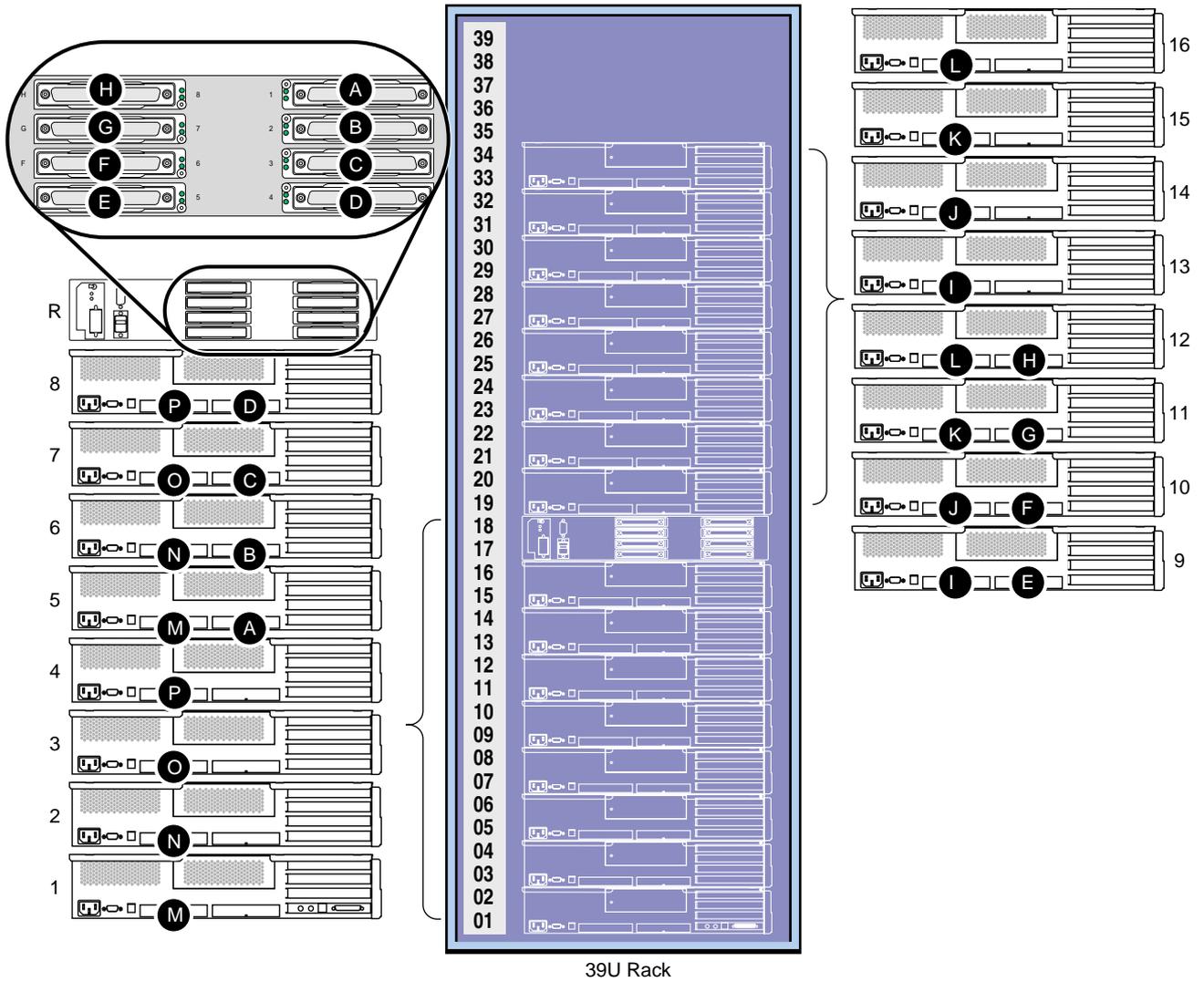
Figure 2-12 Single Router Cable Connect Point Topology Example

In a dual-plane (two router) system every module is connected directly to one of the two routers. Each module is then interconnected to another module to create a high-speed NUMAlink fabric interconnection. Table 2-4 lists the cable interconnects as they relate to a 32 processor (16 module) maximum configuration system. An example of a dual-plane (two router) system interconnect topology is shown in Figure 2-13 on page 85.

Table 2-4   Dual Plane Cable Interconnect Points

1st NUMAlink cable	2nd NUMAlink cable	3rd NUMAlink cable
From 1st router port 1(**A**) To module 5 port 1 (**A**)	From module 5 port 0 (**M**) To module 1 port 0 (**M**)	From module 1 port 1 (**A1**) To 2nd router port 1 (**A1**)
From 1st router port 2 (**B**) To module 6 port 1 (**B**)	From module 6 port 0 (**N**) To module 2 port 0 (**N**)	From module 2 port 1 (**B1**) To 2nd router port 2 (**B1**)
From 1st router port 3 (**C**) To module 7 port 1 (**C**)	From module 7 port 0 (**O**) To module 3 port 0 (**O**)	From module 3 port 1 (**C1**) To 2nd router port 3 (**C1**)
From 1st router port 4 (**D**) To module 8 port 1 (**D**)	From module 8 port 0 (**P**) To module 4 port 0 (**P**)	From module 4 port 1 (**D1**) To 2nd router port 4 (**D1**)
From 1st router port 5 (**E**) To module 9 port 1 (**E**)	From module 9 port 0 (**I**) To module 13 port 0 (**I**)	From module 13 port 1 (**E1**) To 2nd router port 5(**E1**)
From 1st router port 6 (**F**) To module 10 port 1 (**F**)	From module 10 port 0 (**J**) To module 14 port 0 (**J**)	From module 14 port 1 (**F1**) To 2nd router port 6 (**F1**)
From 1st router port 7 (**G**) To module 11 port 1 (**G**)	From module 11 port 0 (**K**) To module 15 port 0 (**K**)	From module 15 port 1 (**G1**) To 2nd router port 7 (**G1**)
From 1st router port 8 (**H**) To module 12 port 1 (**H**)	From module 12 port 0 (**L**) To module 16 port 0 (**L**)	From module 16 port 1 (**H1**) To 2nd router port 8 (**H1**)
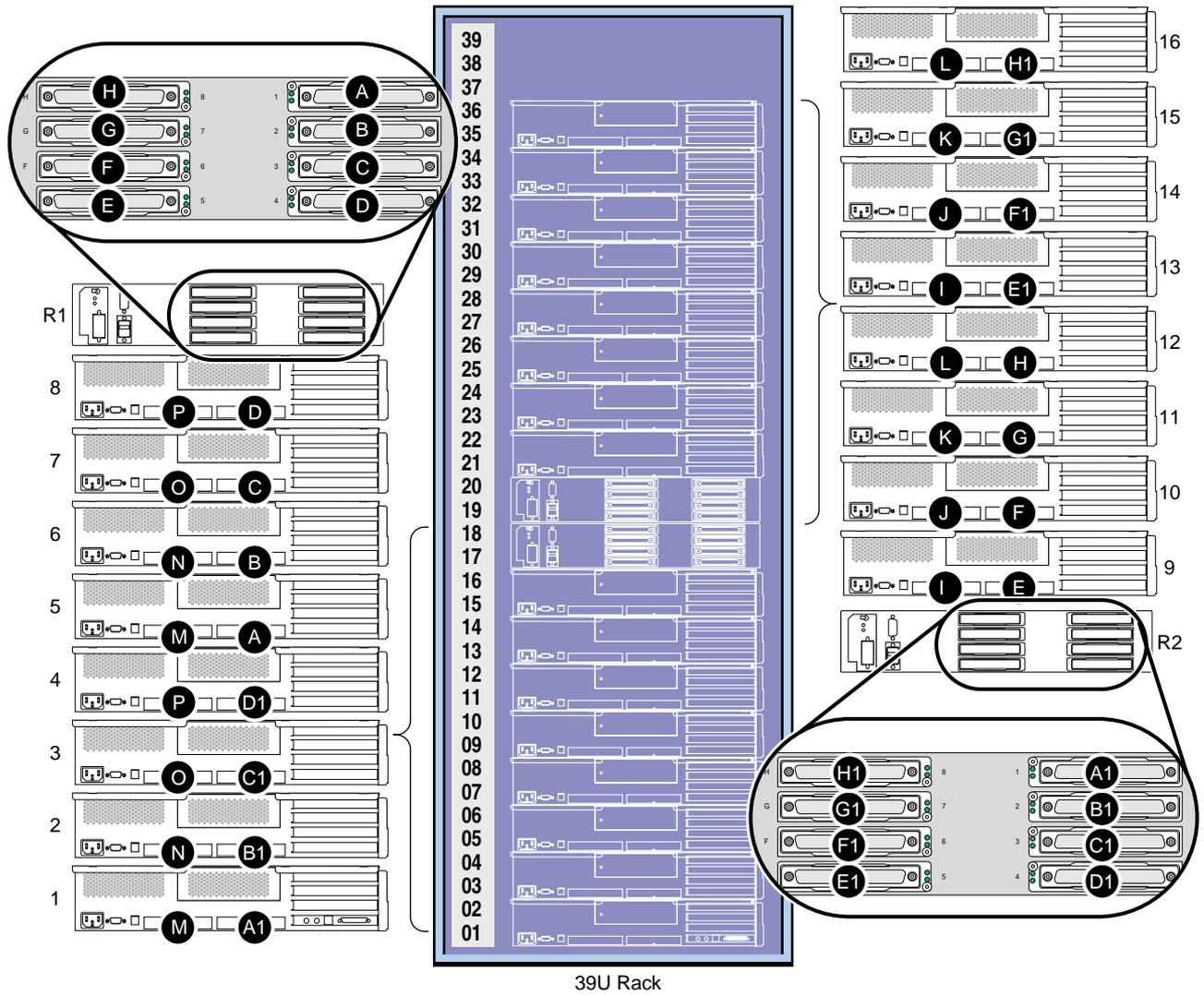
Figure 2-13   Two Router Cable Connect Topology Example

Use of Ethernet Switch With Dual Routers

In order to be able to efficiently monitor and direct all the L1 controllers in a dual-router Altix 350 system, an optional Ethernet switch is available. This switch allows connection of a laptop or workstation using SGI's optional L3 controller software.

The connection is made by way of an Ethernet to USB adapter that plugs into the rear of each of the router modules. The adapters plug into the router's USB connections and then each adapter is connected to the Ethernet switch mounted at the top of the rack.

The switch connects to a public or local area Ethernet. You can then connect a system console with optional L3 controller software to that Ethernet to monitor and control the dual-plane Altix 350 system remotely.

For information on using the controller software, see the *SGI L1 and L2 Controller Software User's Guide* (P/N 007-3938-xxx). This guide describes how to use the L1 and L2 controller commands at your system console to monitor and manage your SGI system.

Figure 2-14 on page 87 shows an example diagram of a system with two routers connected to an Ethernet switch.
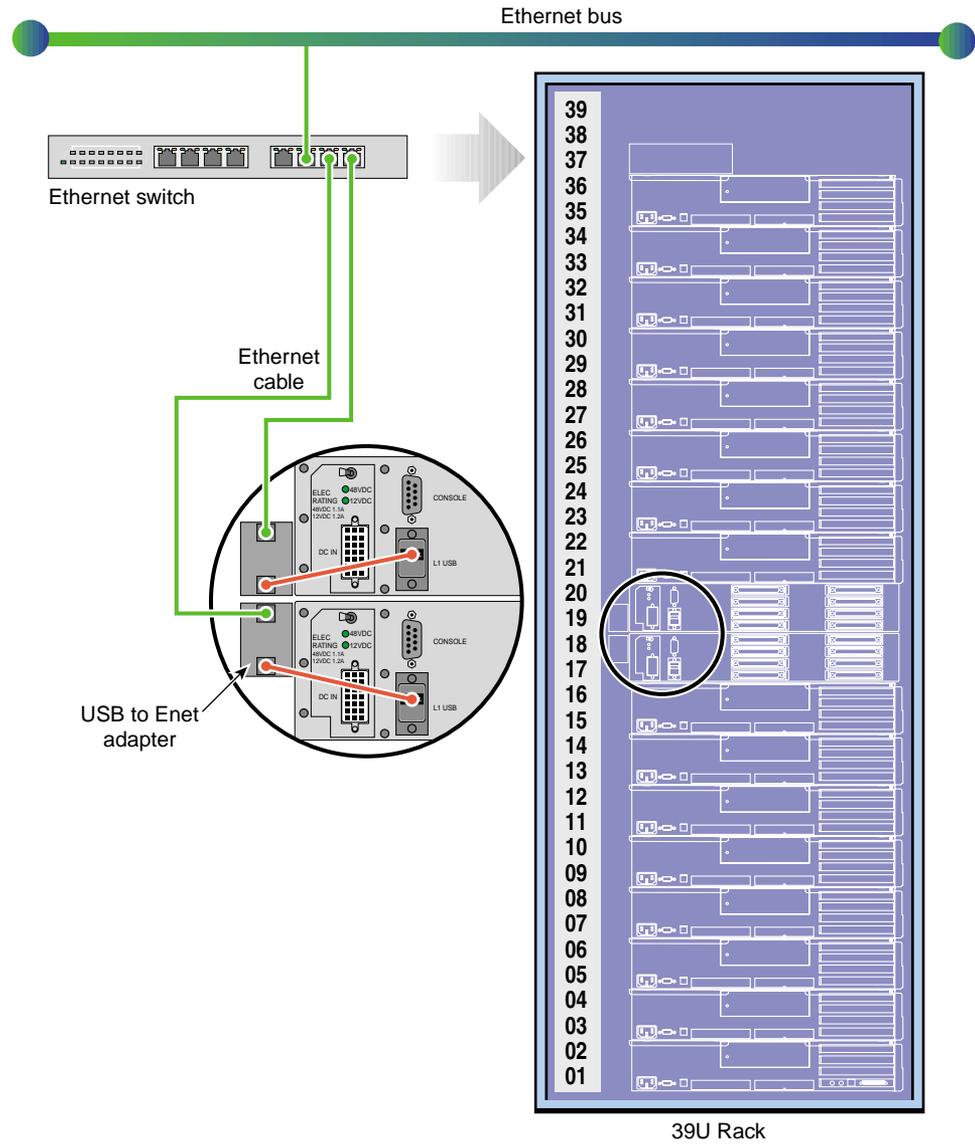
Figure 2-14   Dual-Plane System with Ethernet Switch Connection Example

System Components

This section briefly describes the major system components of an Altix 350 system, in the following subsections:

- "Base Compute Module" on page 88
- "CPU Expansion Module" on page 90
- "CMPX Module" on page 91
- "Storage Expansion" on page 93
- "L2 Controller" on page 97
- "Power Components" on page 98
- "Rack" on page 100

Base Compute Module

The base compute module is a 2U AC-powered device that consists of the following:

- One or two Intel Itanium 2 processors; each processor has integrated L1, L2, and L3 caches
- Up to 24 GB of memory.
- One to four PCI/PCI-X cards.

  Note: At least one base compute module comes factory-installed with a base I/O card in the bottom PCI/PCI-X slot.

- One or two sled-mounted disk drives (at least one disk drive is required in the system).
- DVD-ROM (optional).

The system disk drives and the DVD-ROM require a base I/O card to function.

Each base compute module also contains an L1 controller that provides the following services:

- Controls and sequences power.

- Controls and monitors the environment.

- Initiates a reset.

- Stores identification and configuration information.

Figure 2-15 shows the front and rear views of a base compute module. See Chapter 3, "Base Compute Module," for more information about this module.

Front view
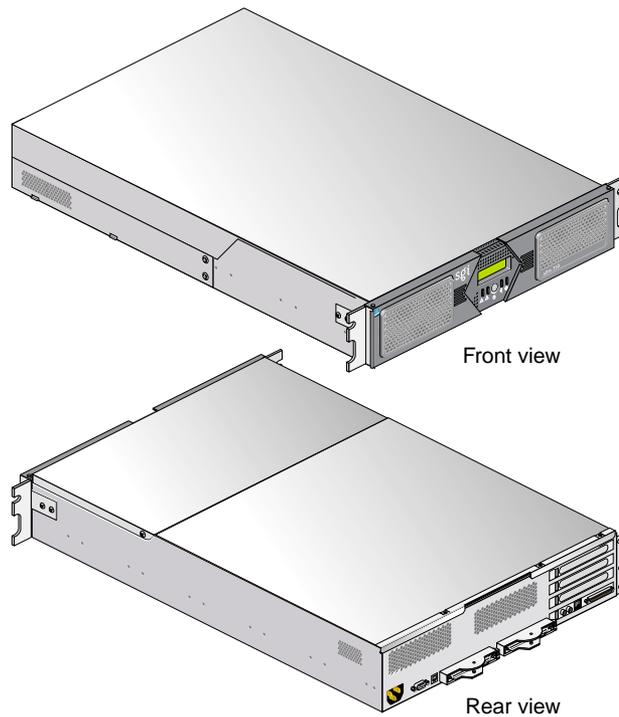
Rear view

Figure 2-15   Front and Rear Views of Base Compute Module

CPU Expansion Module

The CPU expansion module is a 2U AC-powered device that consists of the following:

- One or two Intel Itanium 2 processors; each has integrated L1, L2, and L3 caches

- Up to 24 GB of memory.

- One L1 controller that provides the following services:

    – Controls and sequences power.

    – Controls and monitors the environment.

    – Initiates a reset.

    – Stores identification and configuration information.

Figure 2-16 shows the front and rear views of a CPU expansion module.

Front view
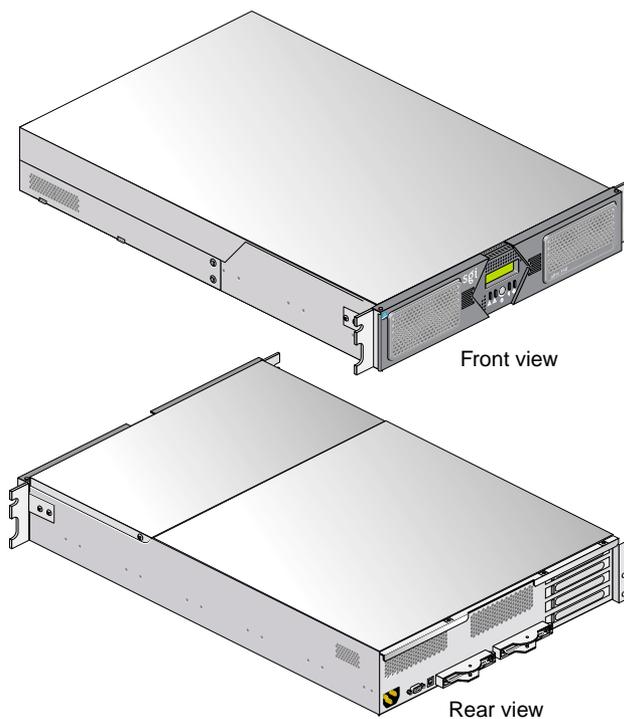
Rear view

Figure 2-16   Front and Rear Views of CPU Expansion Module

CMPX Module

The CMPX module is a 2U AC-powered module that offers the following options:

- Zero, one or two optional processors

- Up to 24 GB of optional memory

- Four PCI/PCI-X slots (see Figure 2-17)

- One L1 controller that provides the following services:

    - Controls and sequences power.

    - Controls and monitors the environment.

    - Initiates a reset.

    - Stores identification and configuration information.

See Chapter 5, "CMPX Module," for more information about the CMPX module.

Front view
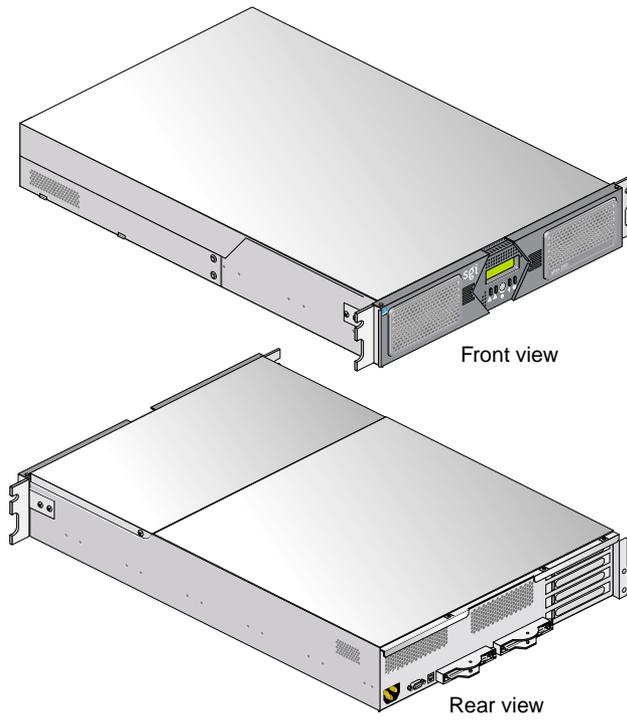
Rear view

Figure 2-17   CMPX Module Front and Rear Views

Storage Expansion

Each base compute module contains a base I/O card and two disk-drive bays. You can add additional storage to the system as follows:

- For a SCSI (small computer system interface) JBOD (just a bunch of disks) solution, SGI offers the TP900 storage module, that can be added to base compute modules or CMPX expansion modules (with optional IO9 or other optional SCSI PCI cards).

- For a Fibre Channel solution that supports both JBOD and RAID configurations, SGI offers the 2Gb SGI TP9100 storage system.

- For Fibre Channel RAID solutions, SGI offers the SGI TP9400 storage system and the SGI TP9500 or TP9500S storage system family. Check with your SGI sales or service representative for additional RAID storage systems available.

- The server system also supports a number of tape devices; check with your SGI sales or support representative for available options.

The various storage devices are discussed in the subsections that follow.

SGI TP900 Storage Module

The TP900 storage module, shown in Figure 2-18, is a 2U-high 8-drive storage system that provides compact, high-capacity, high-availability JBOD storage. The enclosure backplane connects the 8 drives on one SCSI bus. As an option, the storage module can also be configured on two SCSI buses (2 strings of 4 drives).

This storage module has the following features:

- It mounts in a standard 19-inch rack; it is available in factory-installed configurations.

- It uses SCSI Parallel Interface 3 (SPI-3) capable Low Profile (1-inch high) 3.5-inch disk drives.

- Its drive carriers accept SGI-qualified 10,000- or 15,000-RPM SCSI disk drives.

For more information about the TP900 storage module, see *SGI Total Performance 900 Storage System User's Guide* (007-4428-00*x*).

Front view

Rear view
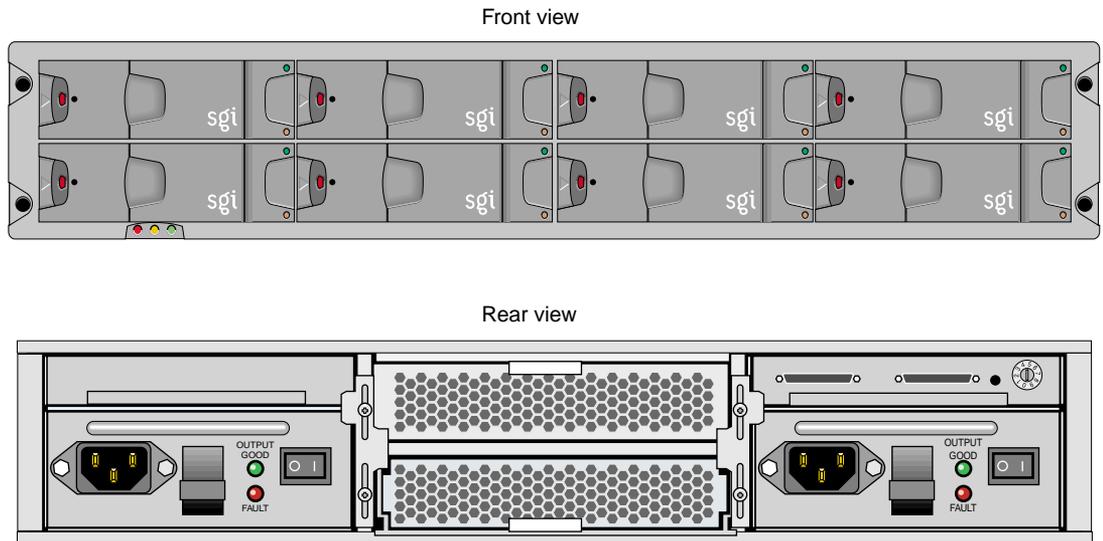
Figure 2-18   SGI TP900 Storage Module

2Gb SGI TP9100 Storage System

The 2Gb SGI TP9100, shown in Figure 2-19, is an affordable, entry-level RAID storage array that is easily expandable and comes in either a deskside tower or a rackmounted configuration. You can start with a basic JBOD configuration and later add RAID controllers, or you can start with a RAID configuration.

The 2Gb SGI TP9100 storage system connects to base compute and/or CMPX modules via a Fibre Channel PCI card. For more information about the SGI TP9100 storage system, see *SGI Total Performance 9100 (2 Gb TP9100) Storage System User's Guide* (007-4522-00*x*).

Rackmounted configuration

Deskside tower configuration
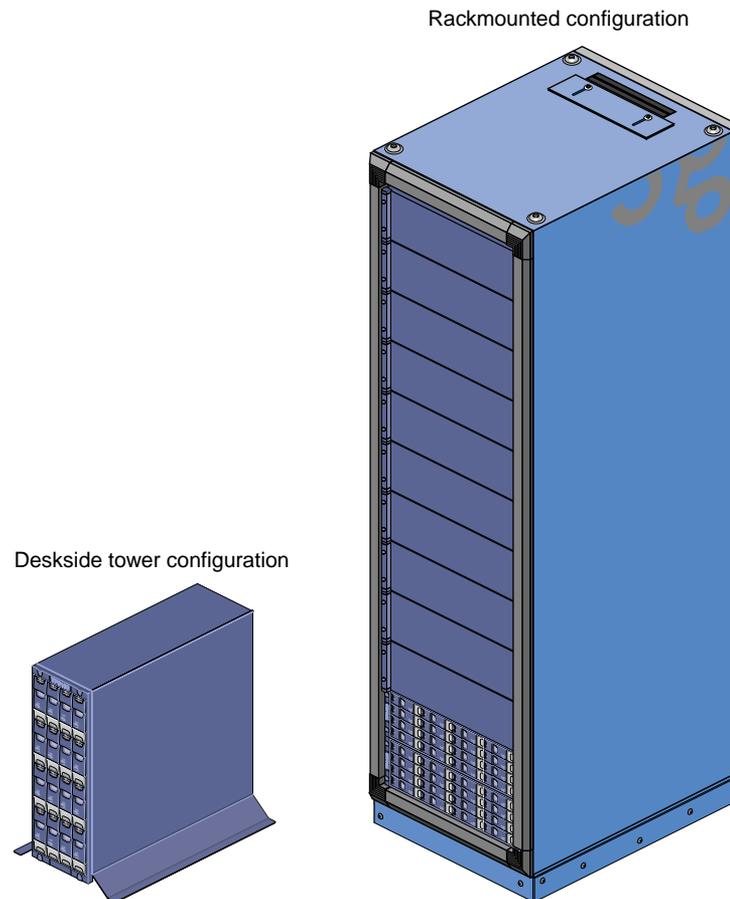
Figure 2-19   2Gb SGI TP9100 Storage System

SGI TP9400 and SGI TP9500 Storage Systems

The SGI TP9400, shown in Figure 2-20, and the SGI TP9500 and TP9500S are highly scalable RAID storage subsystems. These storage systems have vast storage capacities and can grow to whatever size you require without disruption to normal processing activities. This continuous availability enables all active components to be configured redundantly and installed "hot" as customer-replaceable or expansion units.

The TP9400 and TP9500 family of storage systems connect to base compute modules and/or CMPX modules via Fibre Channel PCI cards.

For more information about the TP9400 and TP9500 family of storage systems, see the *SGI InfiniteStorage TP9400 and SGI InfiniteStorage TP9500 and TP9500S RAID User's Guide* (007-4304-00*x*).
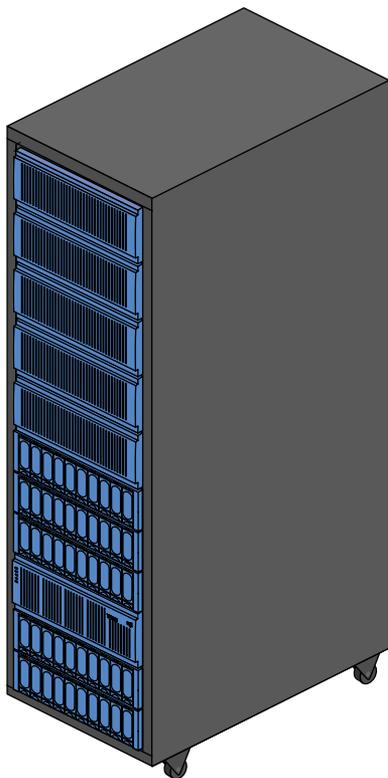
Figure 2-20   SGI TP9400 Storage System

Optional Tape Devices

The Altix 350 system supports optional or third-party tape drives. For current tape solutions for your server visit:

http://sales.corp.sgi.com/products/storage/tape.html

or check with your SGI sales or service representative.

L2 Controller

The L2 controller (see Figure 2-21), which is an optional component, is a rack-level controller that performs the following functions:

- Controls resource sharing.

- Controls L1 controllers.

- Maintains system configuration and topology information.

- Enables remote maintenance.

- Routes data between upstream and downstream devices, as follows:

  - Upstream devices (for example, the system console) provide control for the system, initiate commands for the downstream devices, and act on the messages that they receive from downstream devices.

  - Downstream devices (for example, L1 controllers) perform the actions specified by the L2 controller commands, send responses to the L2 controller that indicate the status of the commands, and send error messages to the L2 controller.

All components within a rack that have an L1 controller can connect to the L2 controller (see Figure 2-21). For example, base compute, CPU expansion, and CMPX, modules can connect to the L2 controller directly.
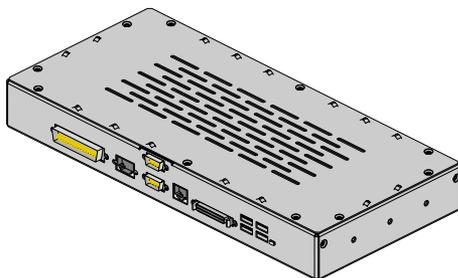
Figure 2-21   Optional L2 Controller Unit

Power Components

The Altix 350 system can consist of the following power components:

- **One or two power distribution units (PDUs)** (see Figure 2-22). The second PDU is added to the system when more than 10 AC power receptacles are needed within the rack.

  The PDU inputs AC voltage from an external power receptacle and it can output AC voltage to the base compute modules, CPU expansion modules, CMPX modules and TP900 storage modules.

Figure 2-22 shows the power connections for a sample Altix 350 system.
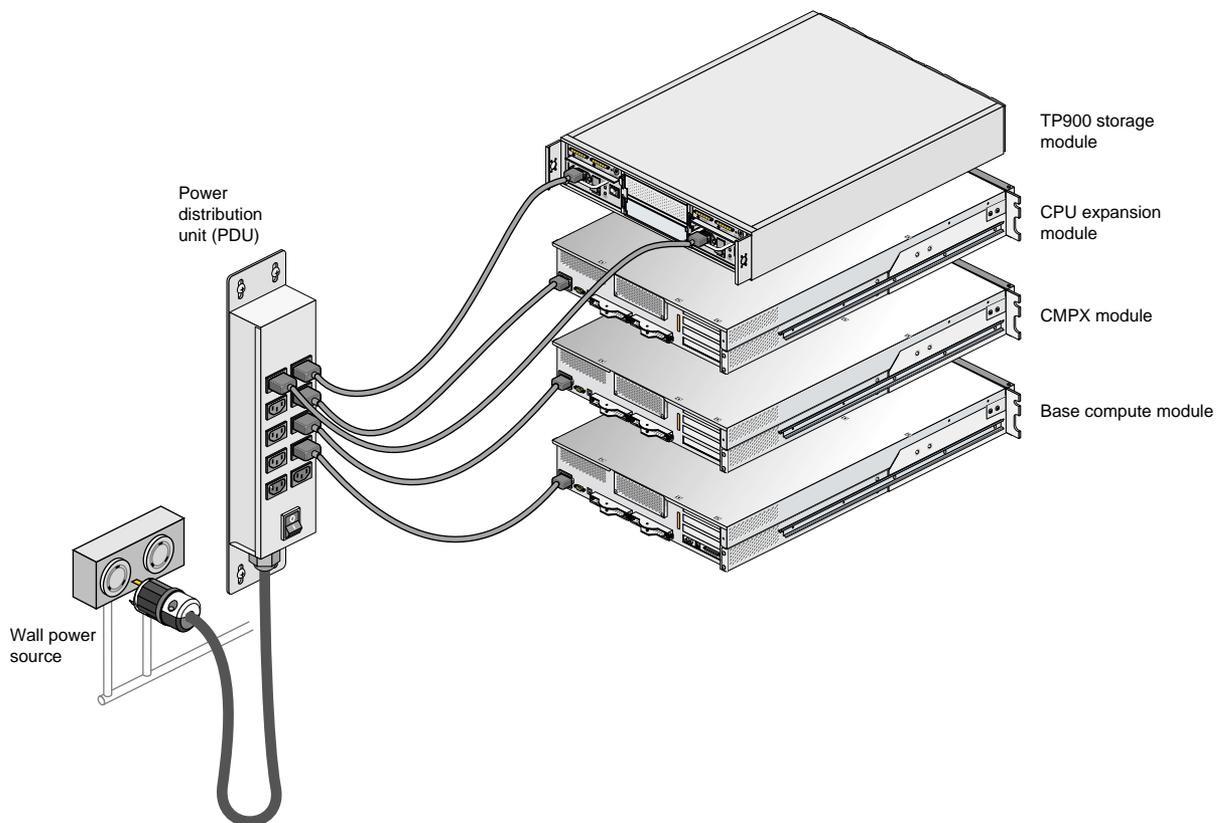
Figure 2-22   Power Connection Example for Altix 350 System

Rack

The Altix 350 system supports two rack types: a short rack and a tall rack. The racks are measured in standard units (U); one U is equal to 1.75 in. (4.45 cm). The short rack is a 17U rack and the tall rack is a 39U rack (see Figure 2-23).

The components within the rack are identified by the lowest U number that they occupy. For example, the top CMPX module shown in Figure 2-23 is identified as U7 in the short rack and U15 in the tall rack.
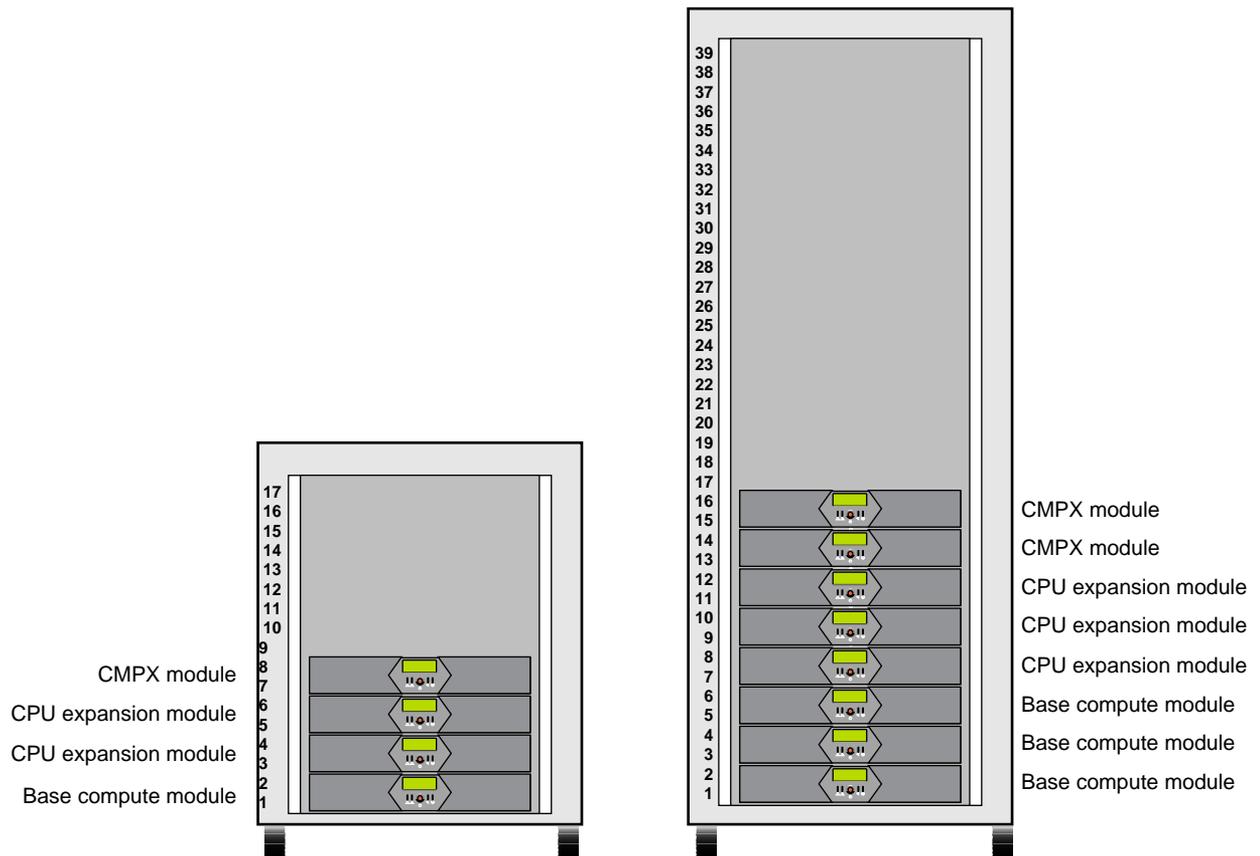
Figure 2-23   Unit Numbering Within Racks

Both rack types are industry-standard 19-inch racks, and they support two types of mounting rails (optional slide rails and shelf rails) that hold the modules within the rack. For example, the base compute, CPU expansion, and CMPX modules can use shelf rails or optional slide-mounting rails (see Figure 2-24). The TP900 storage modules always use shelf rails, which are two parallel L-shaped mounting rails within the rack (see Figure 2-25).
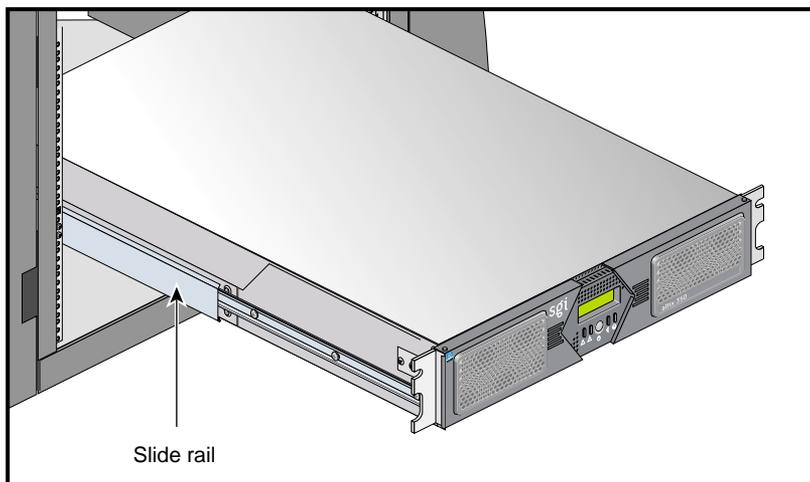
Slide rail

Figure 2-24　　Optional Slide Rails

Shelf rails

19 in.
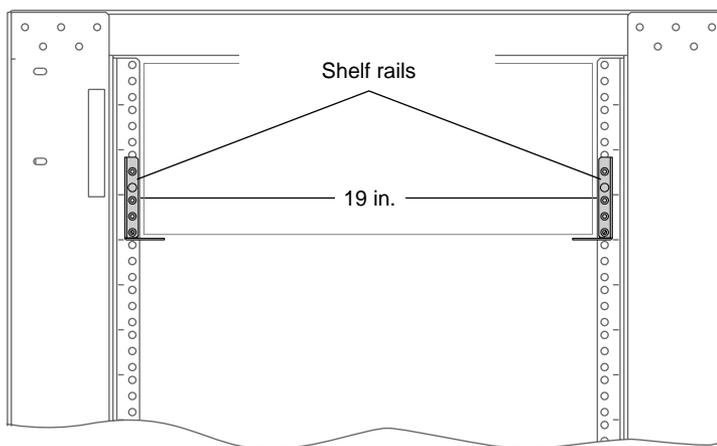
Figure 2-25　　Shelf Rails

Both rack types, as shown in Figure 2-26, have front and rear doors that have keylocks to prevent unauthorized access of the system. The racks also have cable entry/exit areas at the bottom of the racks. The 39U racks have cable management hardware in the rear.

Both rack types are mounted on four casters, two of which are swivel casters. The casters enable the rack to be rolled out of a shipping crate and to its placement at your site.

The base of the racks have seismic tie-down attachment points. The base of the tall rack also has leveling pads.
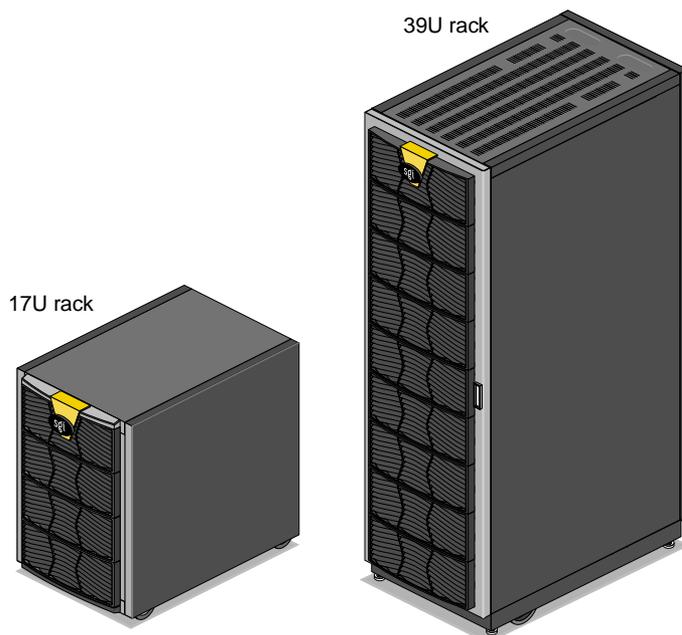
Figure 2-26   Front Views of Short and Tall Racks

Base Compute Module

This chapter describes the function and physical components of the base compute module. It also describes the possible configurations and the technical specifications for this module. Specifically, this chapter includes the following information.

- "System Features" on page 104
- "External Components" on page 116
- "Module Configuration" on page 120
- "Technical Specifications" on page 121

System Features

The 2U base compute module can serve as a standalone Altix 350 system, or it can be cabled to other optional modules to create an Altix 350 system with more functionality. A base compute module consists of 1 or 2 Intel Itanium 2 processors, and up to 24 GB of local memory available on 4, 8, or 12 dual inline memory modules (DIMMs), and 4 PCI/PCI-X slots.

Your system can contain from 1 to 16 base compute modules. One of the base compute modules provides the base I/O functionality for the system; it is the module where the operating system resides. (Every system must have at least one base compute module that has I/O functionality.) This module has a factory-installed disk drive(s) and a base I/O card.

The base compute module includes the following features:

- L1 controller that manages and monitors functions of the base compute module such as temperature. The module includes an L1 controller display, which displays system processes and error messages.

- Optional internal read-only slim-line DVD-ROM drive, and one or two hard disk drives. These components require a base I/O PCI card.

- One or two power supplies. The second power supply, which is optional, is redundant to assure that your base compute module always has power.

- Two NUMAlink-4 ports that can connect your base compute module to a CPU expansion module, and/or a CMPX module.

- Four PCI/PCI-X card slots on two busses. These 64-bit slots can contain 33-MHz and 66-MHz PCI cards, or 66-MHZ, 100-MHz, or 133-MHz PCI-X cards.

- One L1 console port (console and diagnostic port) that enables you to connect a system console to the L1 controller of the base compute module.

- Type B USB (universal serial bus) L1 port that connects the L1 controller of the base compute module to an optional L2 controller.

The base compute module can connect the following optional modules:

- Other base compute modules to add processors, memory, and PCI/PCI-X slots.

- CPU expansion modules to add processors and memory to your system. See Chapter 4, "CPU Expansion Module," for more information about this module.

- CMPX modules to add processors, memory, and PCI/PCI-X card slots to your system. See Chapter 5, "CMPX Module," for more information about this module.

- Router modules or "R-bricks" can be used in larger (8-16 module) systems to provide a NUMAlink-4 interconnect fabric. See Chapter 6, "Optional Router,"for additional information on this module.

- The SGI TP900 storage module to provide additional storage for the system. See *SGI Total Performance 900 Storage System User's Guide* (007-4428-00*x*) for information about this module.

Note: The Altix 350 system also supports other storage systems. See "Storage Expansion" on page 93 for information.

Figure 3-1 shows front panel and side views of the base compute module.
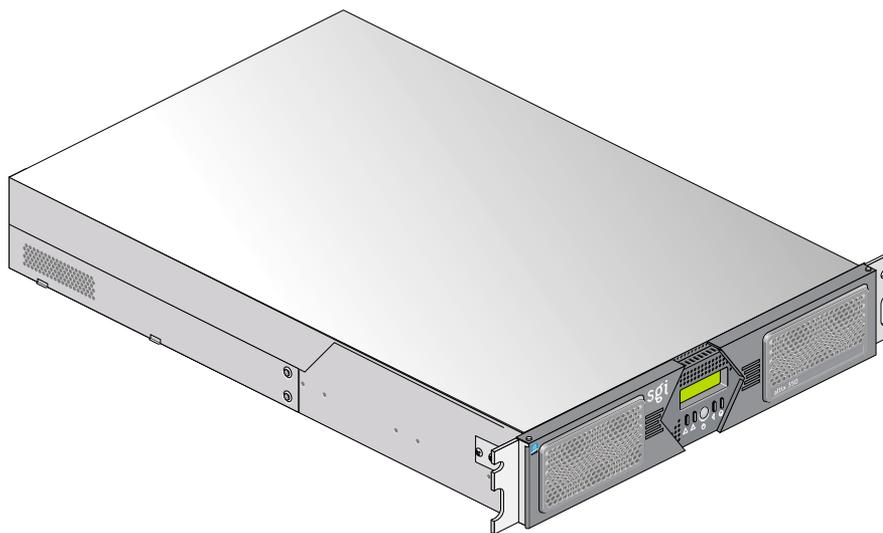
Figure 3-1   Front and Side Views of a Base Compute Module

The compute module architecture includes the following components, which are shown in Figure 3-2 on page 107 and discussed in the following subsections:

- "IP57 Node Board" on page 108

- "Connecting the IO10 Multi-port Serial Cable" on page 113

- "PCI Riser Card" on page 115

- "DVD-ROM" on page 115

- "Internal System Disk Drives" on page 115

- "Power Supplies" on page 115
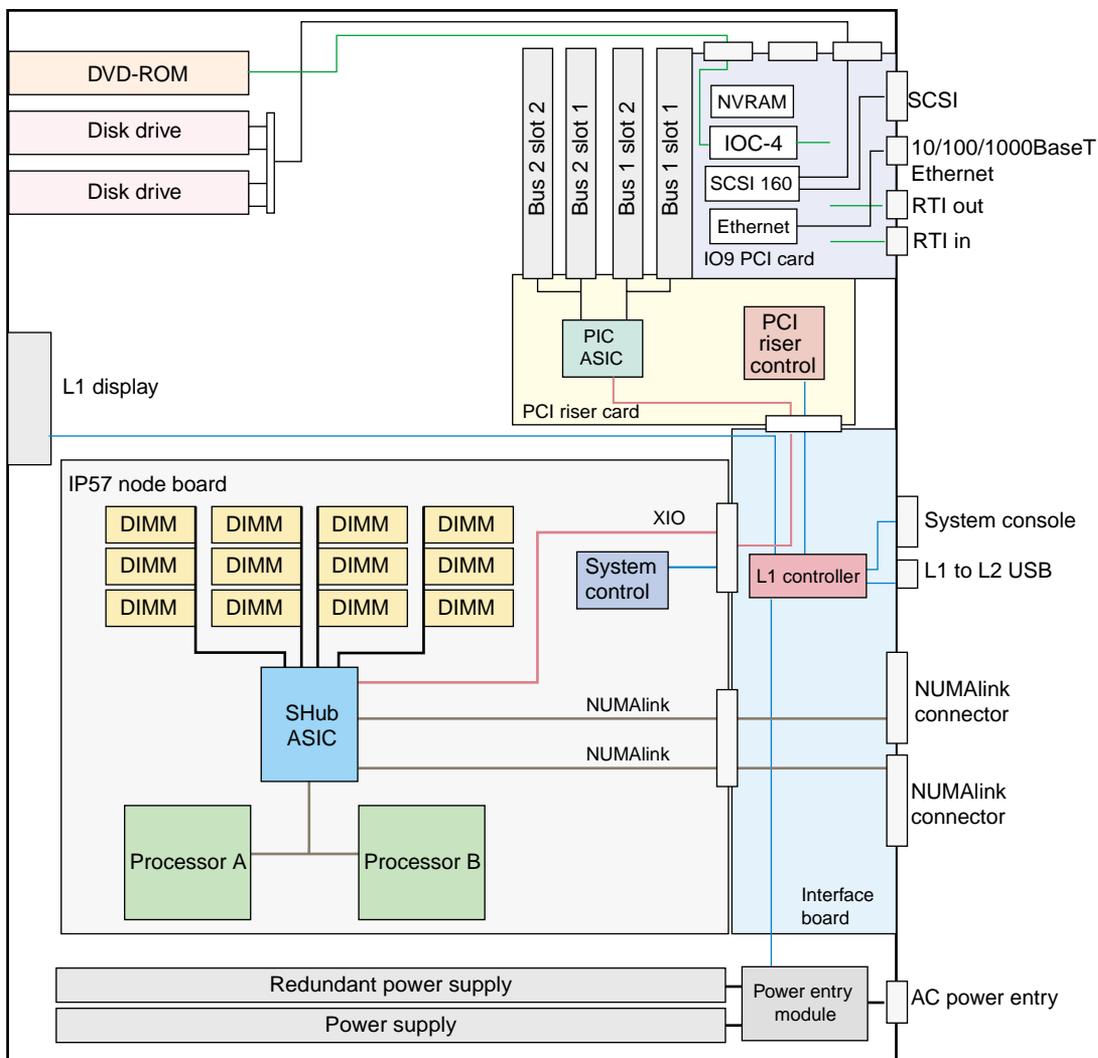
Figure 3-2　　Functional Logic Diagram of Base Compute Module With IO9

IP57 Node Board

The IP57 node board consists of the following components, which are discussed in the subsections that follow.

- One or two Intel Itanium 2 processors (labeled CPU in Figure 3-3). Each processor has integrated L1, L2, and L3 caches.

- Twelve dual inline memory module (DIMM) slots that provide up to 24 GB of memory. See "Local Memory (DIMMs)" on page 110, for more information about DIMMs.

- SHub ASIC that enables communication between the processors, memory, and I/O devices.

- Serial ID EEPROM that contains component information.

- Two voltage regulators convert incoming voltages to voltages required by components.
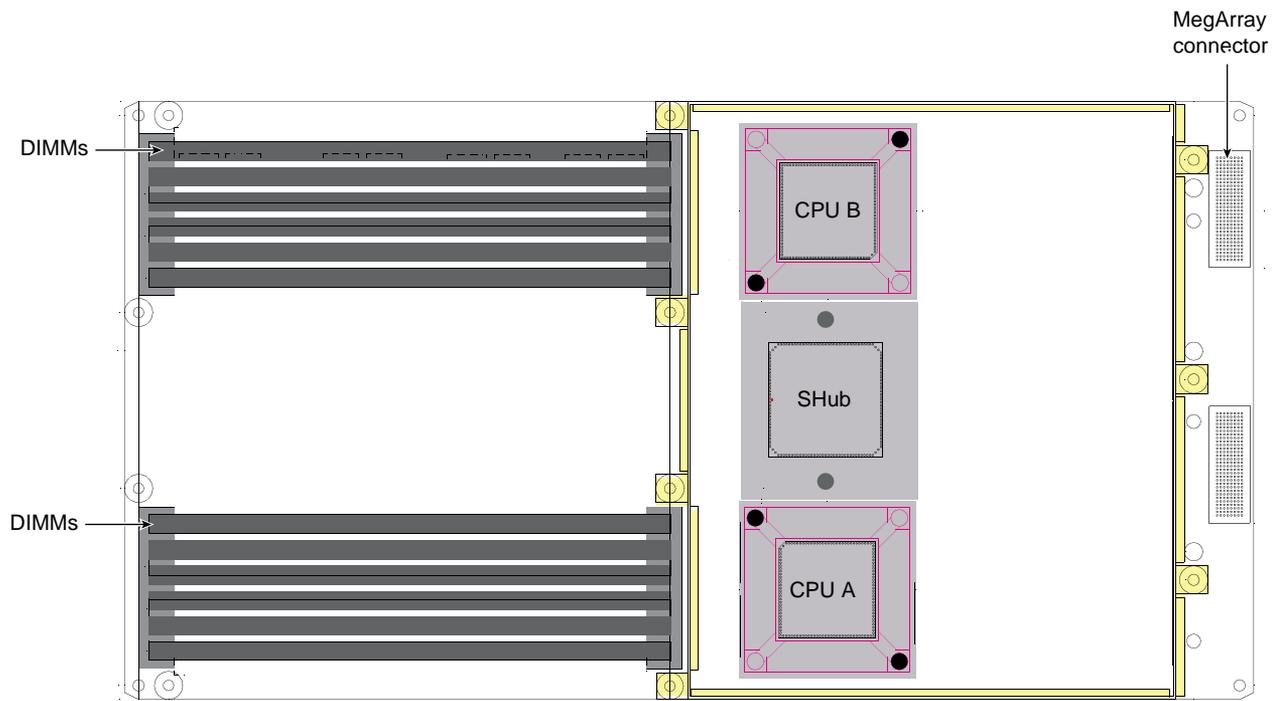
Figure 3-3   IP57 Node Board

Processors (CPUs)

The Intel Itanium 2 processors, which are socketed components (not soldered), employ Explicitly Parallel Instruction Computing (EPIC) architecture. This architecture provides fast online transaction processing, the capability to execute multiple instructions simultaneously, and fast calculations and data analysis. The processors operate at core clock rates from 1.5 GHz and up. Each processor has the following integrated (on-chip) caches:

- Two 32-KB L1 caches: one cache is for data and the other cache is for instructions

- One 256-KB L2 cache

- One L3 cache; the size of the L3 cache depends on the version of the processor selected (see Table 3-1)

Table 3-1   L3 Cache Size Examples

Processor Speed	L3 Minimum Cache Size
1.5 GHz	4 MB
1.6 GHz	6 MB
1.6 GHz	9 MB

Note that additional processor speeds and cache sizes may become available. Check with your SGI sales or service representative for the latest information.

The IP57 node boards use SECDED ECC to protect data when transferred to and from secondary cache, main memory, and directory memory.

The IP57 node boards use parity to protect data when transferred between a processor and primary cache, and to protect system commands sent between the Bedrock ASIC and a processor.

Local Memory (DIMMs)

Each module's node board has up to 24 GB of local memory, which includes main memory and directory memory for cache coherence. Local memory can consist of 4, 8, or 12 dual-inline memory modules (DIMMs) that contain double data rate synchronous dynamic random-access memory (DDR SDRAM). See Figure 3-4.

You can increase or decrease the size of memory by adding or removing the four DIMMs that compose a group. The four DIMMs that compose a group must be the same size; however, each group can be a different memory size.
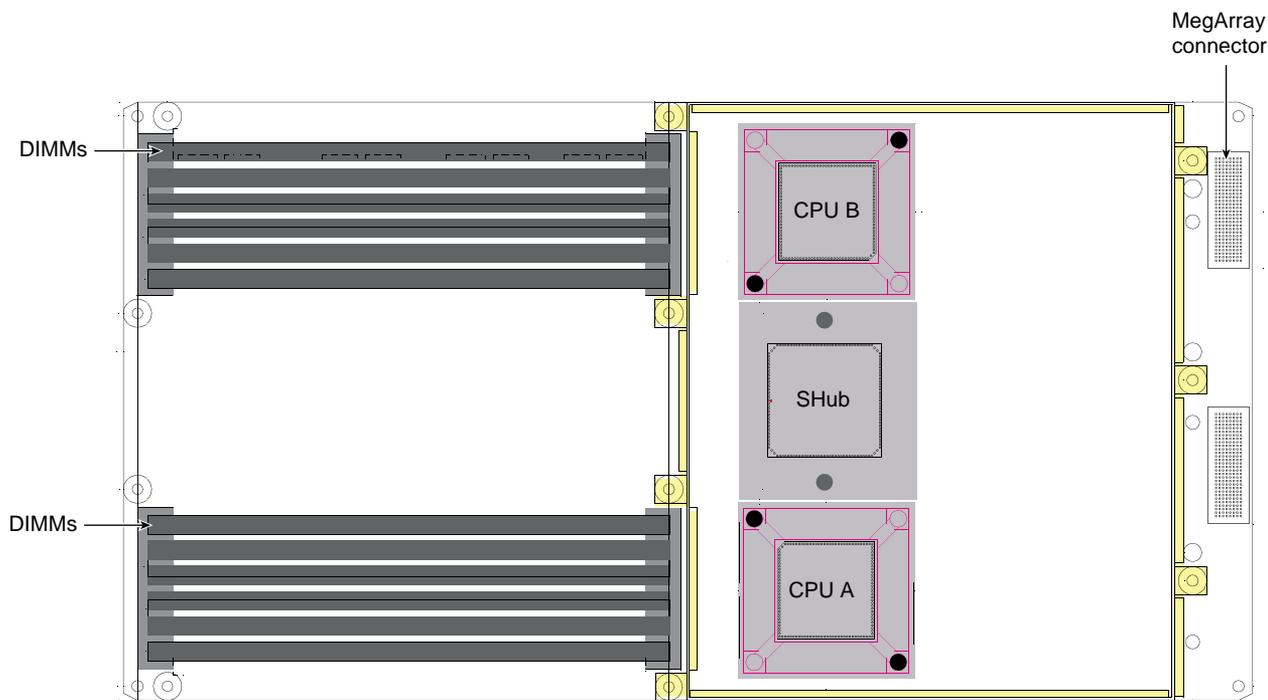
Figure 3-4   Local Memory Layout

Note: Group 0 DIMMs must always be present in the base server module.

The four DIMMs that compose a group must all be the same size (memory capacity), however each group of four DIMMs may be a different total size. The DIMM group locations are shown in Figure 3-5.
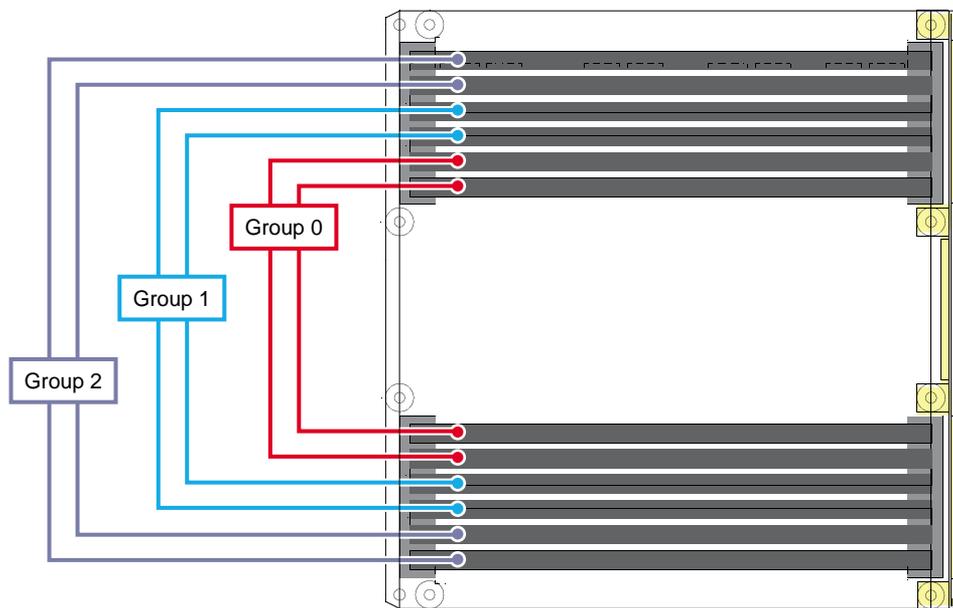
Figure 3-5   DIMM Group Locations on the Processor Board

SHub ASIC

The Super Hub (SHub) ASIC enables communication among the processors, memory, network, and I/O devices. It controls all activity within the node board (for example, error correction and cache coherency). The SHub ASIC also supports page migration.

The SHub ASIC consists of the following:

- One central crossbar (XN) provides connectivity between the SHub ASIC interfaces.

- One processor interface (PI) communicates directly with one or two processors.

- One memory/directory interface (MD) controls all memory access.

- Two network interfaces (NI) interfaces between the crossbar unit and NUMAlinks.

- One I/O interface (II) allows I/O devices to read and write memory (direct memory access [DMA] operations) and allows the processors within the system to control the I/O devices (PIO operations).

- One local block (LB) services processor I/O (PIO) requests local to the SHub ASIC.

Base I/O Options

The Altix 350 is available with either the standard IO10 base I/O card or the optional IO9 card. Note the following guidelines for use of the base I/O cards:

- Altix 350 base compute modules using the IO10 PCI card do **not** support SCSI internal hard drives. Likewise, optional IO9 cards do **not** support SATA drives.

- Each system must have either an IO9 or IO10 as its base I/O.

- Only one IO9 or IO10 base I/O card can be used in each system module and it must be installed in PCI slot 1.

- You must use the optional multi-port serial adapter cable to convert the 36-pin MDR connector on the IO10 to four 9-pin serial ports.

- The RTO and RTI functionality is not supported under SGI Linux + ProPack.

Caution: Only trained service personnel should install or remove a base I/O card (IO9 or IO10). Otherwise, your system could be damaged.

Standard IO10 PCI Card

The standard base I/O card on Altix 350 systems is known as the IO10. The card is a full-size PCI expansion board that provides basic system I/O capabilities via the PCI bus. It connects to your system's internal serial ATA hard drive(s) and DVD-ROM drive and provides optional external serial ports. The IO10 is installed in the lower PCI slot of your system.

Connecting the IO10 Multi-port Serial Cable

A multi-port serial cable that converts the serial output on the IO10 board into four DB-9 serial cables is required to use serial connections with a base compute module containing an IO10. Figure 3-6 shows an example connection.

Note: Leave the multi-port serial adapter cable unplugged if you are not using it.
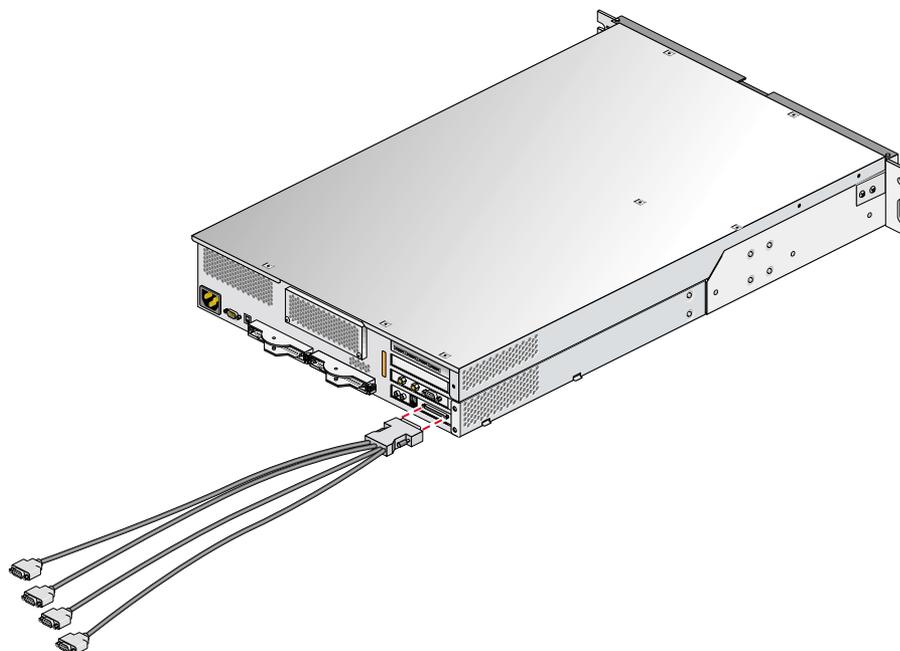
Figure 3-6   Multi-port Adapter Serial Cable Connection to IO10

Optional IO9 PCI Card

If you do not wish to use the IO10 base I/O card in your system, an optional IO9 PCI card is required for base I/O functionality. Each system must contain at least one base I/O PCI card for base I/O functionality within the system. This PCI card must reside in bus 1, slot 1 (the bottom slot) of the lowest base compute module in the system. The IO9 PCI card has the following connectors:

- External VHDCI 68-pin SCSI connector

- 10/100/1000BaseT Ethernet connector

- Real-time interrupt output (RTO) and real-time interrupt input (RTI) connectors

Note: The RT interrupt input and RT interrupt output functionality of the IO9 PCI card is not supported under SGI Linux + ProPack.

The optional IO9 card also contains an IOC-4 ASIC that supports the following features:

- One IDE channel for the DVD-ROM

- NVRAM and time-of-day clock

Additional Internal Components

The Altix 350 system will have some or all of the internal components listed in the following subsections, depending on the type of module and options you order.

PCI Interface Board

The interface board contains the following components:

- L1 controller logic

- Power supply interface

- NUMAlink connectors

- Voltage regulators

- Connectors to the IP57 node board and the PCI riser card

PCI Riser Card

The PCI riser card provides the following:

- PIC ASIC

- Connectors that connect the PCI riser card to the interface board

- Nonstandard PCI/PCI-X connector that connects to the system's base I/O card

- Four PCI/PCI-X card slots (64 bit, 3.3 V) using speeds up to 133 MHz

DVD-ROM

A base compute module can contain an optional slim-line DVD-ROM that has CD-ROM capabilities. It is located at the front left side of the module (above the disk drives).

Note: The DVD-ROM requires the presence of a base I/O PCI card.

Internal System Disk Drives

A base compute module that contains a base I/O PCI card supports one or two sled-mounted disk drives. The standard IO10 base I/O card supports one or two Serial Advanced Technology Attachment (SATA) system disk drives. When the module contains an optional IO9 card, the disk drives are Ultra3 SCSI disk drives that have a peak data transfer speed of up to 160 MB/s between the disks and system memory. The disk drives are located at the front left side of the module (below the DVD-ROM). The master drive is the bottom drive.

Power Supplies

The base compute module can contain one or two power supplies; the second power supply is optional and is required only when you want redundant power. The power supply can input 110/220 VAC and output 500 W (12 VDC, 5 VDC, and -12 VDC).

When the module contains two power supplies, both power supplies are hot-swappable. They are located at the front right side of the module. The primary power supply is the left supply, and the redundant power supply is the right supply.

External Components

This section describes the external components of a base compute module, which are located in the front and rear panels.

Front Panel

This section describes the front-panel controls and indicators of a base compute module, as shown in Figure 3-7.

- **L1 controller display.** A liquid crystal display (LCD) displays status and error messages that the L1 controller generates.

  Note: See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for more information on the L1 controller.

- **Power button with LED**. Press this button to power on the internal components. Alternatively, you can power on the internal components at a system console. The LED illuminates green when the internal components are on.

- **Reset button**. Press this button to reset the internal processors and ASICs. The reset will cause a memory loss.

- **NMI button**. Press the NMI (non-maskable interrupt) button to reset the internal processors and ASICs, and to write register data and memory to the /var/adm/crash file.

- **Service-required LED**. This LED illuminates yellow to indicate that an item has failed or is not operating properly, but the base compute module is still operating.

- **Failure LED**. This LED illuminates red to indicate that a failure has occurred and that the base compute module is not operating.
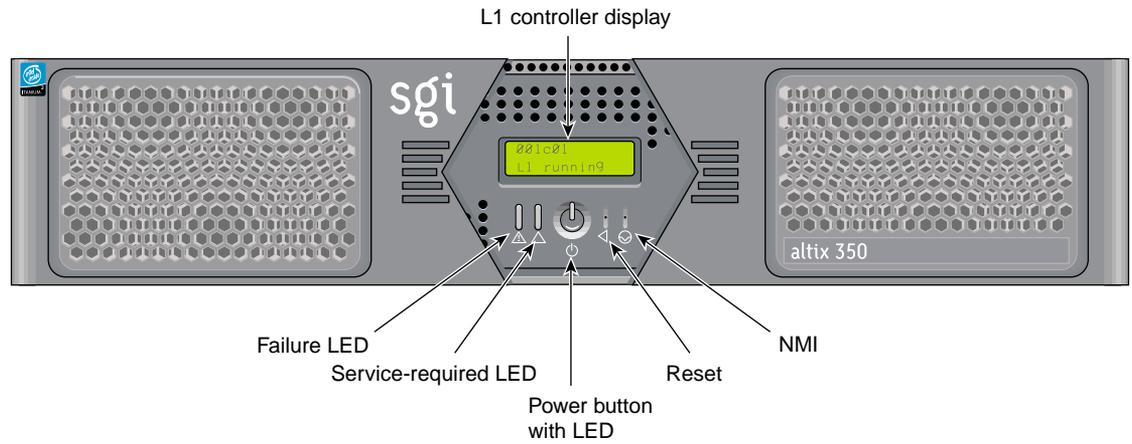
Figure 3-7   Front-panel Items

Rear Panel

This section describes the rear panel connectors, PCI/PCI-X slots, and LEDs of the base compute module, as shown in Figure 3-8.

- **Power connector.** This connector connects the base compute module to an AC power outlet.

- **Console port.** This DB-9 serial port (console and diagnostic port) enables you to connect a system console to the L1 controller of the base compute module.

- **L1 port (USB type B).** This universal serial bus (USB) type B connector connects the base compute module's L1 controller to an L2 controller.

- **Two NUMAlink connectors.** These NUMAlink connectors can connect the base compute module to other base compute modules, CPU expansion modules, and/or CMPX modules. This connection is made with a NUMAlink cable at 3.2 GB/s in each direction.

- **NUMAlink LEDs.** Each NUMAlink connector has two LEDs. These LEDs are located to the right of the NUMAlink connector. One LED lights yellow to indicate that the base compute module and the module to which it is connected are powered on. The other LED lights green when the link between the base compute module and the module to which it is connected is established.

- **PCI/PCI-X slots.** These slots are labeled from bottom to top **PCI 1**, **PCI 2**, **PCI 3**, and **PCI 4**. Two of these slots are on one bus, and two slots are on another. These 64-bit slots can contain 33-MHz and 66-MHz PCI cards, and 66-MHz and 100-MHz PCI-X cards. (For an updated list of supported cards, see SGI Supportfolio at http://support.sgi.com.) The bottom slot contains an I/O PCI card.

Note: If you run PCI and PCI-X cards on the same bus at the same time, the PCI-X card runs in PCI mode. And if you run cards of different speeds on the same bus, the highest-speed card runs at the speed of the slower card. For example, if a 100-MHz card resides in one slot of a bus, and a 33-MHz card resides in the second slot of the same bus, both cards will run at 33 MHz.

The factory-installed base I/O PCI card provides the following connectors:

> **Note: Real-time interrupt input and output.** The RT interrupt input and RT interrupt output functionality of the base I/O PCI card is not supported under SGI Linux + ProPack.

- **Ethernet port (10/100/1000** Mbits)**.** This autonegotiating 10BaseT/100BaseT/1000BaseT twisted-pair Ethernet port connects the base compute module to an Ethernet network.

- **Multi-port Serial Adapter Connector (IO10 Only).**
  - This 36-pin MDR external port enables you to connect up to four serial 9-pin DIN cables to the base I/O.

- **SCSI connector (Optional IO9 Only).**
  - IO9 card: This 68-pin VHDCI external SCSI port enables you to connect to one SCSI device.

    For an updated list of supported SCSI devices, see the SGI Supportfolio at http://support.sgi.com.
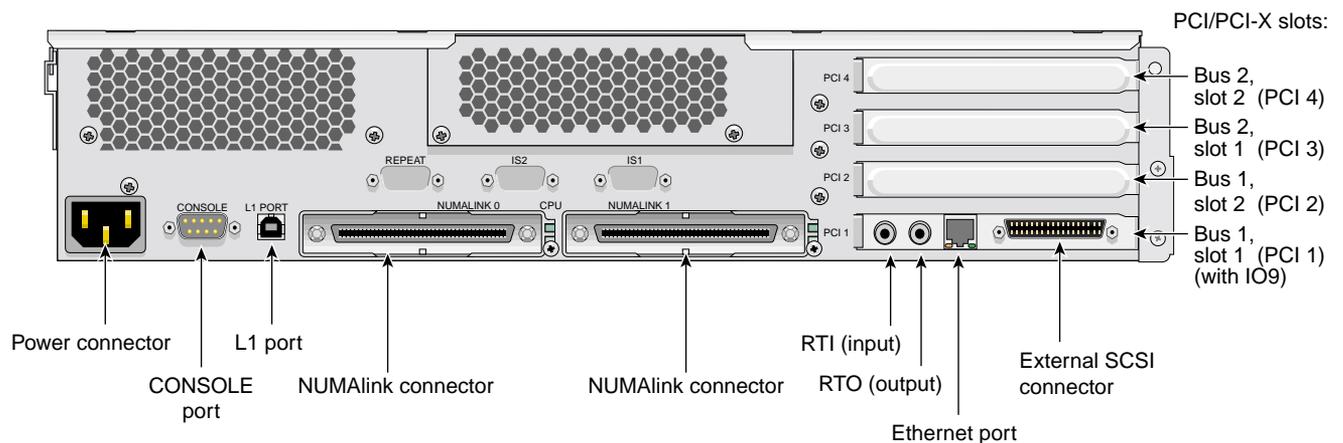
Figure 3-8   Rear-panel Items (Optional IO9 Shown)

Module Configuration

The base compute module contains the following configurable components:

- Processors
- PCI and PCI-X cards
- Disk drives
- Memory (DIMMs)

Warning: **Only trained SGI system support engineers (SSEs) can install and remove the processors, and base I/O PCI card.**

As a customer, you can add or remove PCI and PCI-X cards, disk drives, and memory. See Chapter 7, "Installing and Removing Customer-replaceable Units," for information about installing and removing these items.

Warning: **To prevent personal injury or damage to your system, only trained SGI system support engineers (SSEs) can service or configure internal components of the base compute module that are not specifically listed as serviceable and configurable by customers.**

The base compute module can be configured with the following optional modules to expand its function:

- The CPU expansion module, which is interconnected to the base compute module via a NUMAlink cable, adds processors and memory. See Chapter 4, "CPU Expansion Module," for more information about this module.

- The CMPX module which is interconnected to the base compute module via a NUMAlink cable, adds optional processors, memory and four PCI/PCI-X slots. See Chapter 5, "CMPX Module," for more information about this module.

- The TP900 storage module provides additional storage to the system. See *SGI Total Performance 900 Storage System User's Guide*, 007-4428-00*x*, for information about this module.

> **Note:** The Altix 350 system also supports other storage modules. See "Storage Expansion" on page 93 for information.

Technical Specifications

Table 3-2 lists the bandwidth characteristics of the base compute module.

Table 3-2   Bandwidth Characteristics of the Base Compute Module

Characteristic	Peak Bandwidth	Sustainable Bandwidth
NUMAlink-4 channel	6.4 GB/s full duplex 3.2 GB/s each direction	~2.8 GB/s each direction
Main memory	Up to 10.8 GB/s	Up to 10.8 GB/s
Front side bus (FSB)	6.4 GB/s	~6.4 GB/s

Table 3-3 summarizes the general features of a base compute module that contains an IO9 PCI card.

Table 3-3   General Features of the Base Compute Module

Feature	Description
Intel Itanium 2 processor	1 or 2
Memory	Up to 24 GB
Expansion slot	1 PCI, 2 PCI-X
Console port	1
NUMAlink-4 port	2 (3.2 GB/s each direction)
L1 port (USB, type B)	1
RT interrupt input port	1 (not functional)
RT interrupt output port	1 (not functional)
Ethernet port	One 10BaseT/100BaseT/1000BaseT

Table 3-3   General Features of the Base Compute Module **(continued)**

Feature	Description
SATA internal port	Serial ATA drive port (with IO10 base I/O card)
Multi-port Serial Adapter Connector	One external 36-pin MDR (with IO10 base I/O card)
SCSI port (internal)	1 Ultra3 SCSI, 160 MB/s (optional with IO9 base I/O)
SCSI port (external)	1 Ultra3 SCSI (VHDCI) (optional with IO9 base I/O)
3.5-in. drive bay	2

Table 3-4 lists the specifications for the base compute module.

Table 3-4   Base Compute Module Specifications

Characteristic	Specification
Height	3.44 in. (8.74 cm)
Width	17.06 in. (43.33 cm)
Depth	27 in. (68.58 cm) (with bezel)
Weight	50 lb (22.7 kg) maximum configuration[a]
Noise	6 Bels sound power, up to 30 ºC
Heat dissipation	1576 Btu/hr maximum
Input power	120 - 240 VAC

a. Weight will vary depending on whether the base compute module has one or two power supplies, on the number of DIMMs installed, and on the number of disk drives installed.

CPU Expansion Module

This chapter describes the function and physical components of the CPU expansion module. It also describes the possible configurations and the technical specifications for this module. Specifically, this chapter includes the following information.

System Features

The 2U CPU expansion module is an optional module that consists of 1 or 2 Intel Itanium 2 processors and up to 24 GB of local memory available on 4, 8, or 12 dual inline memory modules (DIMMs). Your system may contain from 0 to 15 CPU expansion modules.

The CPU expansion module includes the following features:

- L1 controller that manages and monitors functions of the CPU expansion module such as temperature. The module includes an L1 controller display, which displays system processes and error messages.

- One or two power supplies. The second power supply, which is optional, is redundant to assure that your CPU expansion module always has power.

- Two NUMAlink ports that can connect your CPU expansion module to base modules, other CPU expansion modules, optional router modules, and/or CMPX modules.

- One L1 console port (console and diagnostic port) that enables you to connect a system console to the L1 controller of the CPU expansion module.

- Type B USB (universal serial bus) L1 port that connects the L1 controller of the CPU expansion module to an L2 controller.

Figure 4-1 shows front panel and side views of the CPU expansion module.
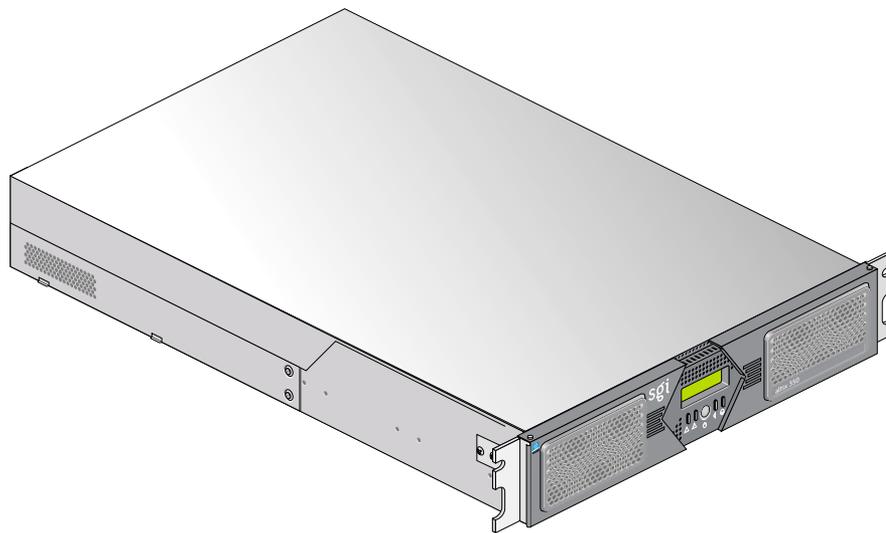
Figure 4-1   Front and Side Views of a CPU Expansion Module

The CPU expansion module architecture includes the following components, which are shown in Figure 4-2 and discussed in the following subsections:

- "IP57 Node Board" on page 127
- "Interface Board" on page 130
- "Power Supplies" on page 131
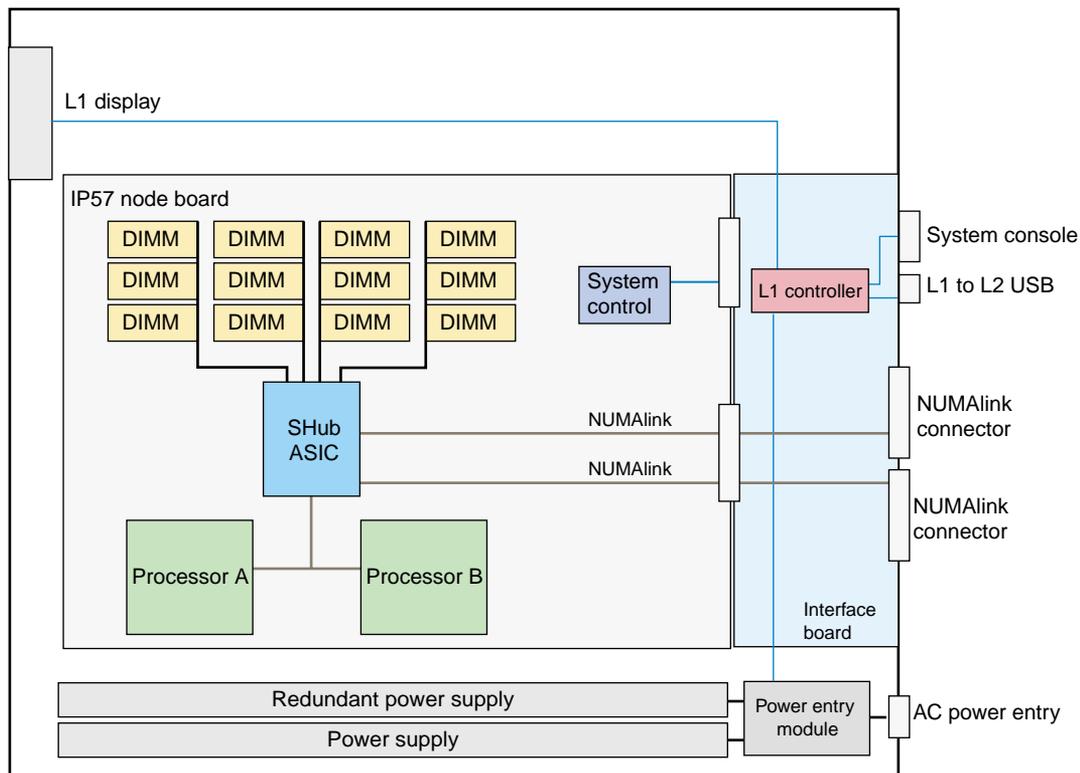
Figure 4-2   Functional Block Diagram of CPU Expansion Module

IP57 Node Board

The IP57 node board consists of the following components, which are discussed in the subsections that follow.

- One or two Intel Itanium 2 processors (labeled CPU in Figure 4-3). Each processor has integrated L1, L2, and L3 caches.

- Twelve dual inline memory module (DIMM) slots that provide up to 24 GB of memory. See "Local Memory (DIMMs)" on page 129, for more information about DIMMs.

- SHub ASIC that enables communication between the processors, memory, and I/O devices.

- Serial ID EEPROM that contains component information.

- Two voltage regulators that convert incoming voltages to voltages required by components.
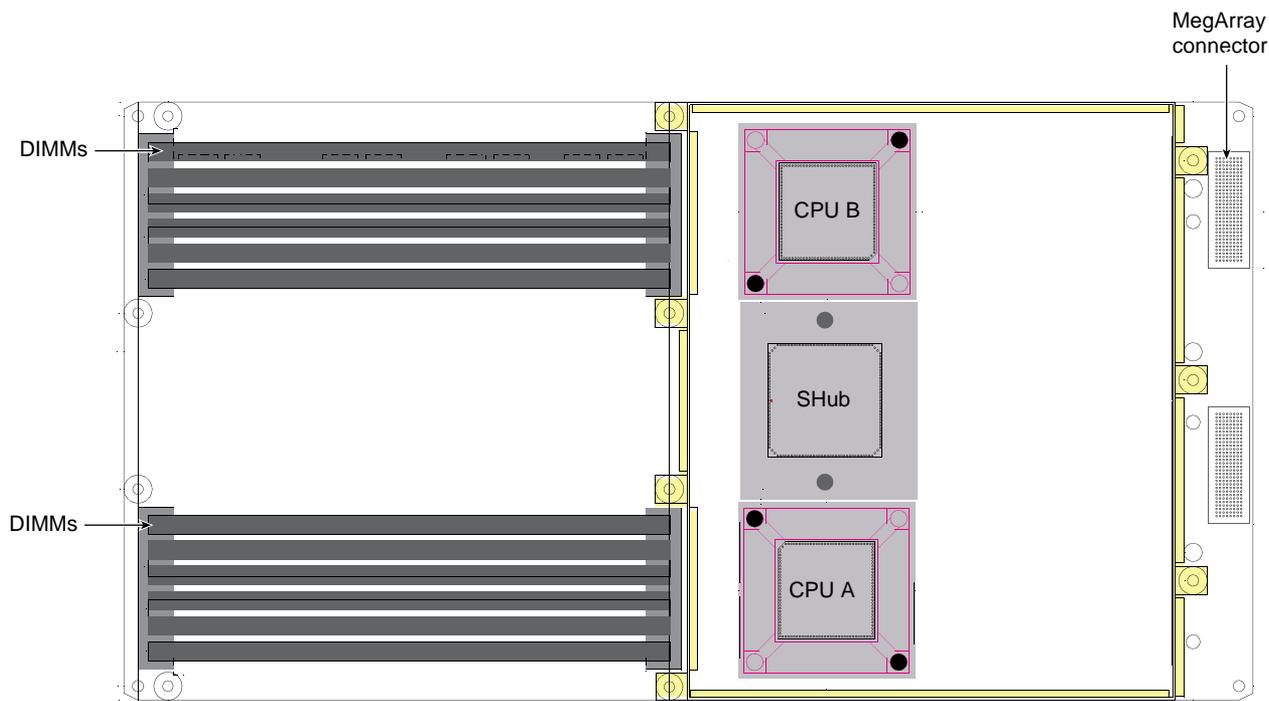
Figure 4-3   IP57 Node Board

Processors (CPUs)

The Intel Itanium 2 processors, which are socketed components (not soldered), employ Explicitly Parallel Instruction Computing (EPIC) architecture. This architecture provides fast online transaction processing, the capability to execute multiple instructions simultaneously, and fast calculations and data analysis. The processors operate at core clock rates from 1.5 GHz and up. Each processor has the following integrated (on-chip) caches:

- Two 32-KB L1 caches: one cache is for data and the other cache is for instructions

- One 256-KB L2 cache

- One L3 cache; the size of the L3 cache depends on the processor option you order (see Table 3-1 on page 109).

Different L3 cache sizes and processor speeds may become available with new release options, see your SGI sales or service representative for the latest information.

The IP57 node boards use SECDED ECC to protect data when transferred to and from secondary cache, main memory, and directory memory.

The IP57 node boards use parity to protect data when transferred between a processor and primary cache, and to protect system commands sent between ASICs and a processor.

Local Memory (DIMMs)

Each IP57 node board has up to 24 GB of local memory, which includes main memory and directory memory for cache coherence. Local memory can consist of 4, 8, or 12 dual-inline memory modules (DIMMs) that contain double data rate synchronous dynamic random-access memory (DDR SDRAM).

You can increase or decrease the size of memory by adding or removing the four DIMMs that compose a group. The four DIMMs that compose a group must be the same size; however, each group can be a different memory size.
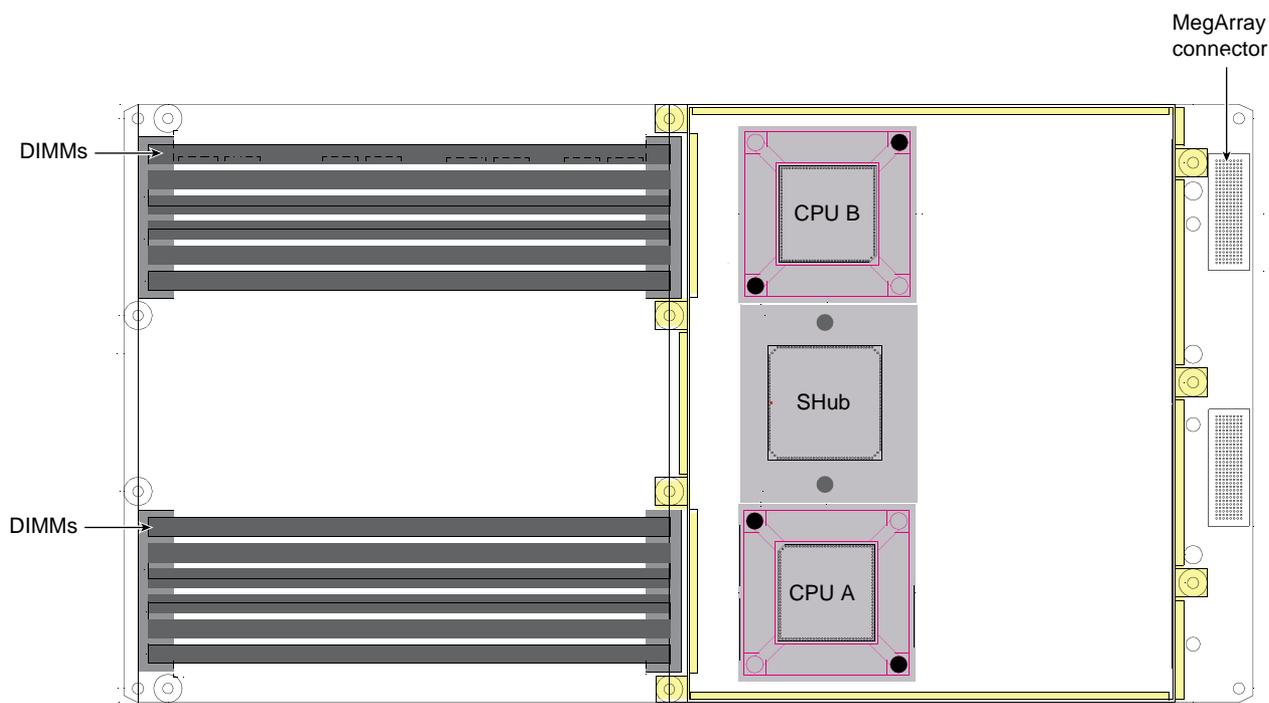
Figure 4-4   Local Memory Layout

SHub ASIC

The Super Hub (SHub) ASIC enables communication among the processors, memory, network, and I/O devices. It controls all activity within the node board (for example, error correction and cache coherency). The SHub ASIC also supports page migration.

The SHub ASIC consists of the following:

- One central crossbar (XN) provides connectivity between the SHub ASIC interfaces.
- One processor interface (PI) communicates directly with one or two processors.
- One memory/directory interface (MD) controls all memory access.
- Two network interfaces (NI) interface between the crossbar unit and the NUMAlink interconnect.
- One I/O interface (II) allows I/O devices to read and write memory (direct memory access [DMA] operations) and allows the processors within the system to control the I/O devices (PIO operations).
- One local block (LB) services processor I/O (PIO) requests that are local to the SHub ASIC.

Interface Board

The interface board contains the following components:

- L1 controller logic
- Power supply interface
- NUMAlink connectors
- Voltage regulators
- Connectors to the IP57 node board and the PCI riser card

Power Supplies

The CPU expansion module can contain one or two power supplies; the second power supply is optional and is required only when you want redundant power. The power supply can input 110/220 VAC and output 500 W (12 VDC, 5 VDC, and -12 VDC).

When the module contains two power supplies, both power supplies are hot-swappable. They are located at the front right side of the module. The primary power supply is the left supply, and the redundant power supply is the right supply.

External Components

This section describes the external components of a CPU expansion module, which are located in the front and rear panels.

Front Panel

This section describes the front-panel controls and indicators of a CPU expansion module, as shown in Figure 4-5.

- **L1 controller display.** A liquid crystal display (LCD) displays status and error messages that the L1 controller generates.

  Note: See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for more information on the L1 controller.

- **Power button with LED**. Press this button to power on the internal components. Alternatively, you can power on the internal components at a system console. The LED illuminates green when the internal components are on.

- **Reset button**. Press this button to reset the internal processors and ASICs. The reset will cause a memory loss. Use a paperclip or other small object to access the "pin-hole" acuator for this button.

- **NMI button**. Press the NMI (non-maskable interrupt) button to reset the internal processors and ASICs, and to write register data and memory to the /var/adm/crash file. Use a paperclip or other small object to access the "pin-hole" acuator for this button.

- **Service-required LED**. This LED illuminates yellow to indicate that an item has failed or is not operating properly, but the CPU expansion module is still operating.

- **Failure LED**. This LED illuminates red to indicate that a failure has occurred and that the CPU expansion module is not operating.
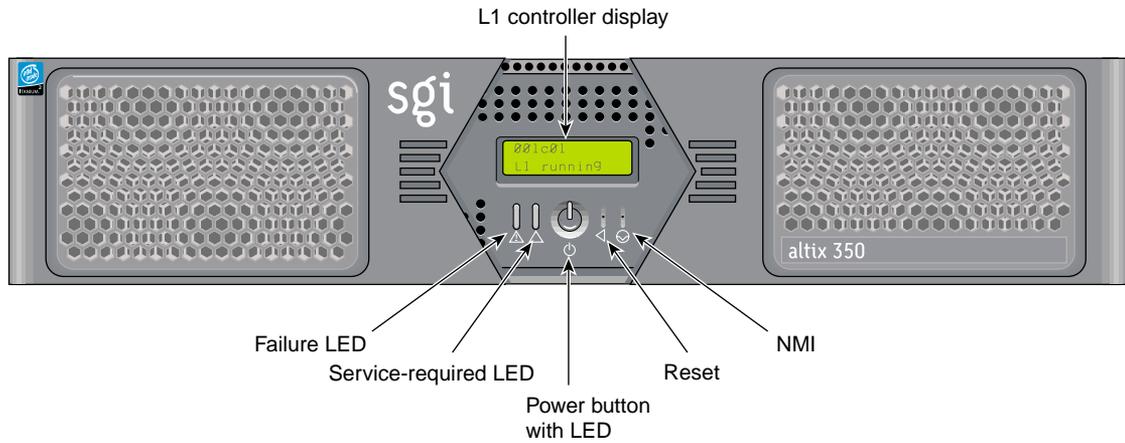
Figure 4-5   Front-panel Items

Rear Panel

This section describes the rear panel connectors and LEDs of the CPU expansion module, as shown in Figure 4-6.

- **Power connector.** This connector connects the CPU expansion module to an AC power outlet.

- **Console port.** This DB-9 serial port (console and diagnostic port) enables you to connect a system console to the L1 controller of the CPU expansion module.

- **L1 port (USB type B).** This universal serial bus (USB) type B connector connects the CPU expansion module's L1 controller to an L2 controller.

- **Two NUMAlink connectors.** These NUMAlink connectors can connect the CPU expansion module to other CPU expansion modules, base compute modules, and/or MPX modules. This connection is made with a NUMAlink cable at 3.2 GB/s in each direction.

- **NUMAlink LEDs.** Each NUMAlink connector has two LEDs. These LEDs are located to the right of the NUMAlink connector. One LED lights yellow to indicate that the CPU expansion module and the module to which it is connected are powered on. The other LED lights green when the link between the CPU expansion module and the module to which it is connected is established.
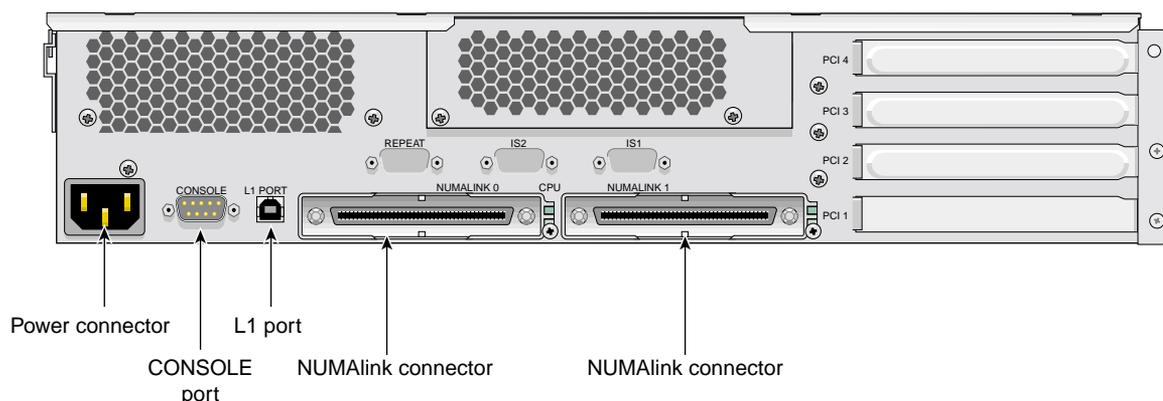
Figure 4-6   Rear-panel Items

Module Configuration

The CPU expansion module contains the following configurable components:

- Processors
- Memory (DIMMs)

Warning: **Only trained SGI system support engineers (SSEs) can install and remove the processors.**

As a customer, you can add or remove memory. See Chapter 7, "Installing and Removing Customer-replaceable Units," for information about installing and removing memory DIMMs.

Warning: **To prevent personal injury or damage to your system, only trained SGI system support engineers (SSEs) can service or configure internal components of the CPU expansion module that are not specifically listed as serviceable and configurable by customers.**

Technical Specifications

Table 4-1 lists the bandwidth characteristics of the CPU expansion module.

Table 4-1   Bandwidth Characteristics of the CPU Expansion Module

Characteristic	Peak Bandwidth	Sustainable Bandwidth
NUMAlink channel	6.4 GB/s full duplex 3.2 GB/s each direction	~2.8 GB/s each direction
Main memory	Up to 10.8 GB/s	Up to 10.8 GB/s
Front Side Bus (FSB)	6.4 GB/s	~6.4 GB/s

Table 4-2 summarizes the general features of a CPU expansion module.

Table 4-2   General Features of the CPU Expansion Module

Feature	Description
Intel Itanium 2 processor	1 or 2
Memory	Up to 24 GB
Console port	1
NUMAlink-4 port	2 (3.2 GB/s each direction)
L1 port (USB, type B)	1

Table 4-3 lists the specifications for the CPU expansion module.

Table 4-3   CPU Expansion Module Specifications

Characteristic	Specification
Height	3.44 in. (8.74 cm)
Width	17.06 in. (43.33 cm)
Depth	27 in. (68.58 cm) (with bezel)
Weight	50 lb (22.7 kg) maximum configuration[a]
Noise	6 Bels sound power, up to 30 ºC
Heat dissipation	1398 Btu/hr maximum
Input power	120 - 240 VAC

a. Weight will vary depending on whether the CPU expansion module has one or two processors, one or two power supplies and on the number of DIMMs installed.

CMPX Module

This chapter describes the function and physical components of the 2U CMPX module, which can add optional processors, local memory (DIMMs) and four PCI/PCI-X card slots to your system. Specifically, this chapter includes the following information:

- "System Features" on page 137
- "External Components" on page 141
- "System Configurations" on page 144
- "Technical Specifications" on page 148

System Features

The CMPX module includes the following features:

- One or two optional 64-bit Intel processors.
- The L1 controller manages and monitors the functions of the CMPX module, such as system temperature. The system includes an L1 controller display system that processes error messages.
- The module can have one or two power supplies. The second power supply is redundant to assure that your CMPX module will always have power.
- The L1 port connector connects the module to an L2 controller.
- The NUMAlink ports connect the CMPX module to base compute modules, CPU expansion modules and/or other CMPX modules.
- The console port is an RS-232 DB-9 serial connector used to connect a system console, which is used monitor and manage your system.
- Four 64-bit PCI and PCI-X card slots on two busses can contain 33-MHz and 66-MHz PCI cards, and 66-MHz, 100-MHz, or 133-MHz PCI-X cards.

Figure 5-1 shows a front panel and side view of the CMPX module.
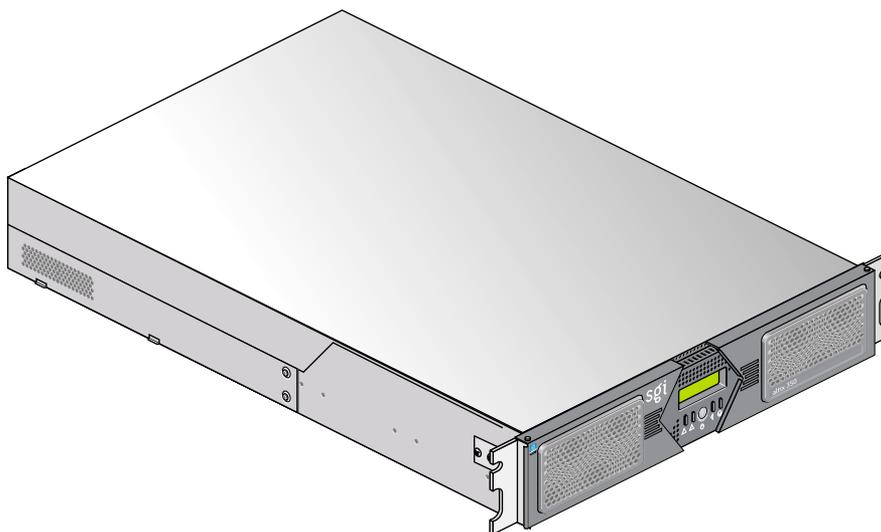
Figure 5-1   Front and Side Views of CMPX Module

The CMPX module architecture includes the components discussed in the following subsections

- "IP57 Node Board" on page 138

- "Interface Board" on page 140

- "PCI Riser Card" on page 140

- "Power Supplies" on page 141

IP57 Node Board

The IP57 node board consists of the following components:

- Twelve dual-inline memory module (DIMM) slots enable installation of DIMMs to provide up to 24 GB of memory.

- The SHub ASIC enables communication between memory and I/O devices.

- The serial ID EEPROM contains component information.

- Two voltage regulators convert input voltages to those required by components.

Local Memory (DIMMs)

Each module optionally has up to 24 GB of local memory, which includes main memory and directory memory for cache coherence.

Local memory is provided by DIMMs, which contain double data rate synchronous dynamic random-access memory (DDR SDRAM chips), installed in groups of 4, 8, or 12 DIMMs.

All the DIMMs must be present in a group for proper functionality. See Figure 5-2 for group locations in the memory slots.

Note: The four DIMMs that compose a group must be the same size; however, each group may differ in total memory size (capacity).
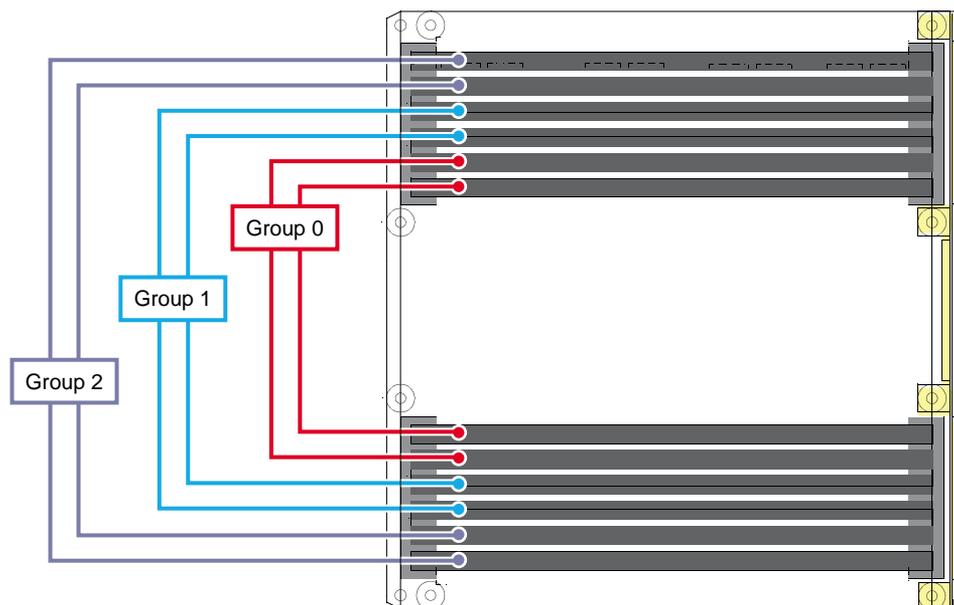
Figure 5-2 Local Memory Layout

SHub ASIC

The SHub ASIC enables communication among the processors, memory, network, and I/O devices. It controls all activity within the node board (for example, error correction and cache coherency). The SHub ASIC also supports page migration.

The SHub ASIC consists of the following:

- One central crossbar (XN) provides connectivity between the SHub ASIC interfaces.
- One processor interface (PI) communicates directly with one or two processors.
- One memory/directory interface (MD) controls all memory access.
- Two network interfaces (NI) interface between the crossbar unit and the NUMAlink interconnect.
- One I/O interface (II) allows I/O devices to read and write memory (direct memory access [DMA] operations) and allows the processors within the system to control the I/O devices (PIO operations).
- One local block (LB) services processor I/O (PIO) requests local to the SHub ASIC.

Interface Board

The interface board contains the following components:

- L1 controller logic.
- Power supply interface.
- NUMAlink connectors.
- Switching regulators.
- Connectors to the IP57 node board and the PCI riser card.

PCI Riser Card

The PCI riser card provides the following:

- PIC ASIC.
- Connectors that connect the PCI riser card to the interface board.
- Four PCI/PCI-X card slots (64 bit, 3.3 V).

Power Supplies

The CMPX module can contain one or two power supplies; the second power supply is optional and is required only when you want redundant power. The power supply can input 110/220 VAC and output 500 W (12 VDC, 5 VDC, and -12 VDC).

Both power supplies are hot-swappable. They are located at the front right side of the module. The primary power supply is the left supply and the redundant power supply is the right supply.

External Components

This section describes the external components of the CMPX module, which are located in the front and rear panels.

Front Panel Items

This section describes the front panel controls and indicators of the CMPX module, as shown in Figure 5-3.
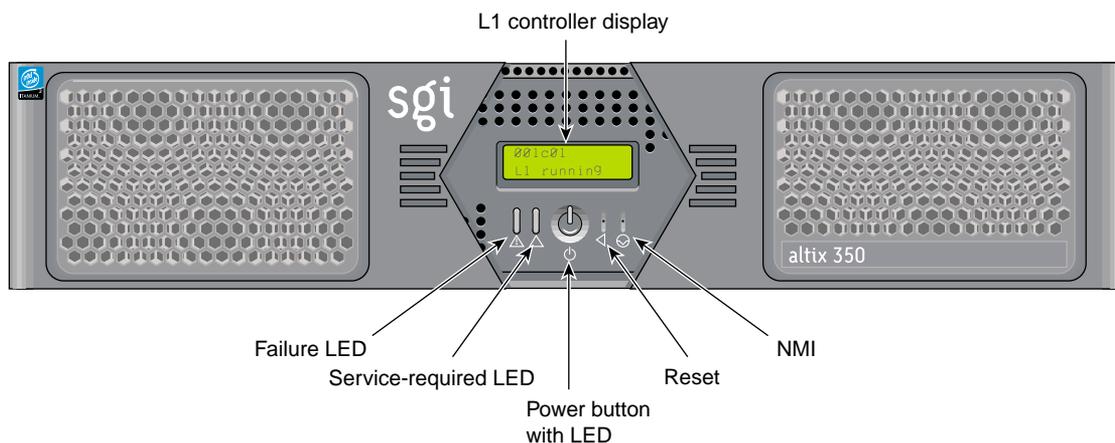
Figure 5-3   Front Panel Items

The front panel of the CMPX module has the following items:

- **L1 controller display.** A liquid crystal display (LCD) displays status and error messages that the L1 controller generates.

  Note: See the *SGI L1 and L2 Controller Software User's Guide* (007-3938-00*x*) for more information on the L1 controller.

- **Power button with LED**. Press this button to power on the internal components. Alternatively, you can power on the internal components at a system console. The LED illuminates green when the internal components are on.

- **Reset button**. Press this button to reset the internal processors and ASICs. The reset will cause a memory loss. (To perform a reset without losing memory, see the NMI button information that follows.)

- **NMI button**. Press the NMI (non-maskable interrupt) button to reset the internal processors and ASICs without losing memory. Register data and memory are stored in a /var/adm/crash file.

- **Service-required LED**. This LED illuminates yellow to indicate that an item has failed or is not operating properly, but the CMPX module is still operating.

- **Failure LED**. This LED illuminates red to indicate that a failure has occurred and that the CMPX module is down.

Rear Panel Items

This section describes the rear panel connectors, PCI/PCI-X slots, and LEDs of the CMPX module, as shown in Figure 5-4.
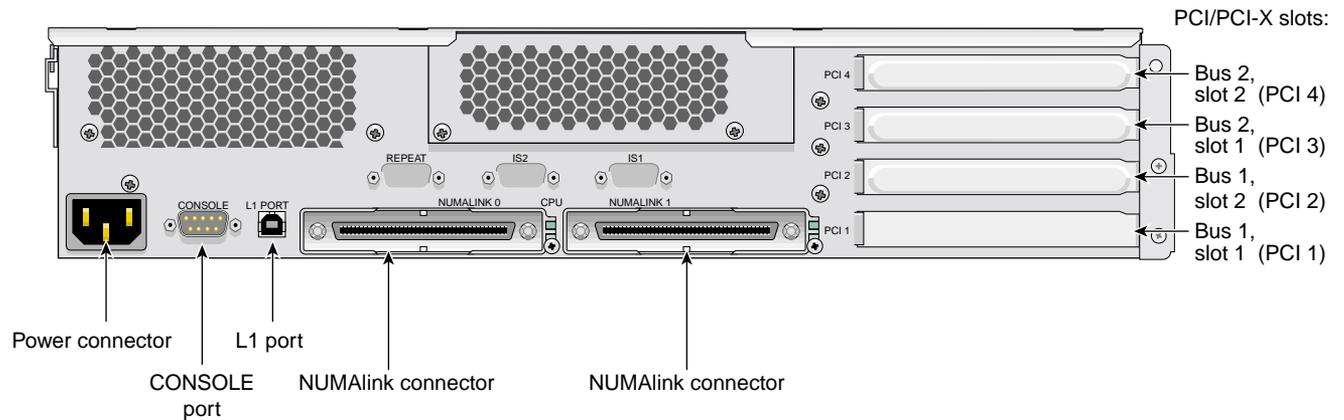
Figure 5-4   Rear Panel Items

The rear panel of the CMPX module has the following items:

- **Power connector.** This connector connects the CMPX module to an AC power outlet.

- **Console port.** This DB-9 serial port (console and diagnostic port) enables you to connect a system console to the L1 controller on the CMPX module.

- **L1 port (USB type B).** This Universal Serial Bus (USB) type B connector connects the CMPX module's L1 controller to an optional L2 controller.

- **Two NUMAlink-4 connectors.** The NUMAlink connectors attach the CMPX module to one of the following modules: base compute module, expansion compute module, or NUMAlink-4 module (router). This connection is made with a NUMAlink cable at 3.2 GB/s in each direction.

  - **NUMAlink LED.** The NUMAlink connector has two LEDs. These LEDs are located to the right of the NUMAlink connector. One LED lights yellow to indicate that the CMPX module and the module to which it is connected are powered on. The other LED lights green when the link between the CMPX module and the module to which it is connected is established.

- **PCI/PCI-X slots (bus 1, slot 1; bus 1, slot 2; bus 2, slot 1; bus 2, slot 2).** These slots are labeled from bottom to top **PCI 1**, **PCI 2**, **PCI 3**, and **PCI 4**. Two of these slots are on one bus, and two slots are on another. These 64-bit slots can contain 33-MHz and 66-MHz PCI cards, or 66-MHz, 100-MHz, or 133-MHz PCI-X cards. (For an updated list of supported cards, see SGI Supportfolio at http://support.sgi.com.)

Note: If you run PCI and PCI-X cards on the same bus at the same time, the PCI-X card will run on PCI mode. And if you run cards of different speeds on the same bus, the highest speed card will run at the speed of the slower card. For example, if a card is running at 100 MHz in one slot of a bus, and a card is running at 33 MHz in the second slot of the same bus, both cards will run at 33 MHz.

System Configurations

This section lists the internal CMPX module configuration options such as the number of DIMMs that can be installed in the CMPX module to increase its local memory.

This section also lists external CMPX module configuration options that can enhance the performance of the server system. For example, the server system configuration can include a CMPX module together with a base compute module, and a 2U SGI TP900 storage system to expand storage.

Internal Configurations

PCI and PCI-X cards and memory (DIMMs) are the configurable internal components of the CMPX module.

As a customer, you can configure PCI and PCI-X cards and memory. See Chapter 7, "Installing and Removing Customer-replaceable Units," for information about installing and removing these items to reconfigure your CMPX module.

Warning: **To prevent personal injury or damage to your system, only trained SGI system support engineers (SSEs) can service or configure internal components of the CMPX module that are not specifically listed as serviceable and configurable by customers.**

External Configurations

The CMPX module can be configured together with the following items to expand the function of your server system:

- Every system must include a base compute module. The base compute module can have 1 or 2 processors, up to 24 GB of local memory, an optional DVD-ROM, one or (optionally) two system disk drives, and two PCI/PCI-X and one PCI slots. The fourth slot includes a base I/O card that adds various connectors to your system.

- The system expansion compute module, which is interconnected to the base compute module via a NUMAlink-4 cable, adds processors and memory.

- The TP900 storage module provides additional storage to the system. See *SGI Total Performance 900 Storage System User's Guide* (007-4428-00*x*), for information about this module. The server system supports other storage modules. For information, see "Storage Expansion" on page 93.

- The optional NUMAlink-4 router module connects eight to 16 Altix 350 modules and allows for maximum expansion of the system.

The server system can be configured with a CMPX module in many different ways to satisfy your computing needs. This section shows two sample configurations.

Figure 5-5 shows a server system on a table top that includes the following items:

- A CMPX module adds optional processors, additional local memory and four PCI/PCI-X card slots to your system.

- A 2U base compute module has 1 or 2 processors, up to 24 GB of local memory, and two PCI/PCI-X and one PCI card slots. (Because the fourth lowermost slot comes with a factory-installed 66-MHz base I/O card, the slot directly above it, which is on the same bus as the slot in which the I/O card is installed, can only accommodate a PCI card that runs at a speed of 66 MHz or slower.)
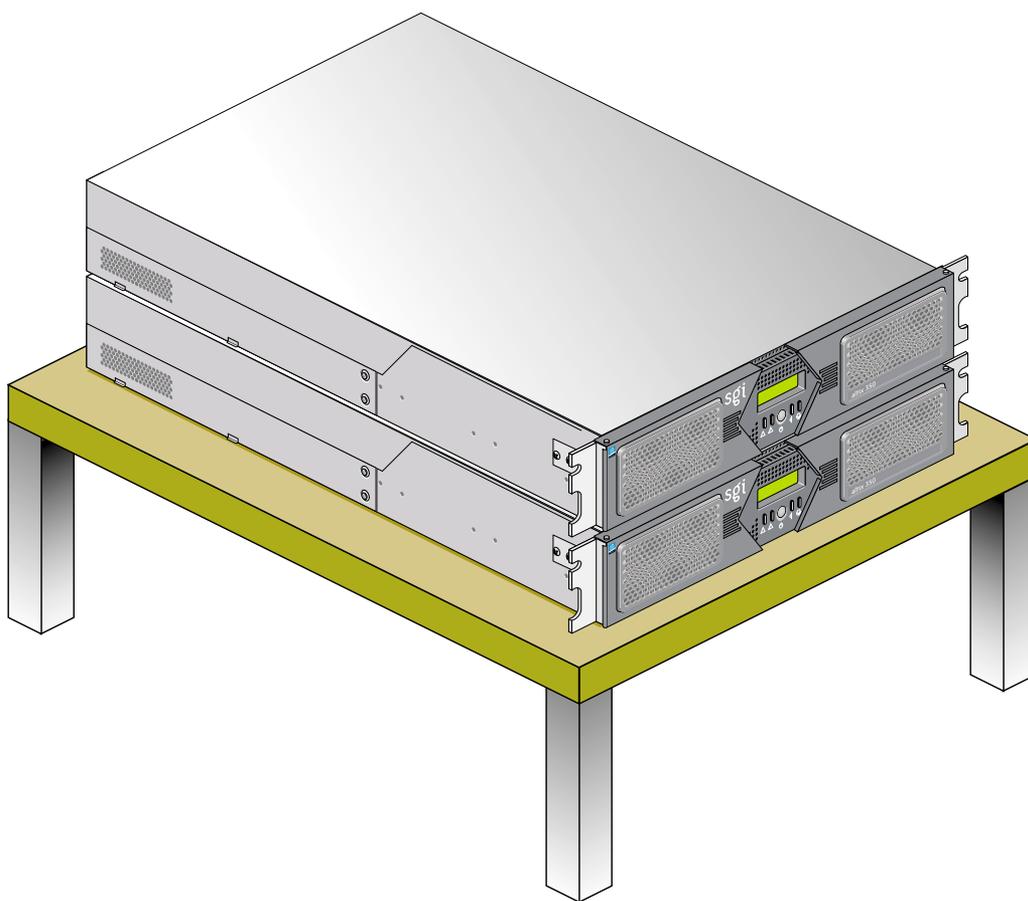
Figure 5-5   System with One CMPX Module and One Base Compute Module

Figure 5-6 shows a server system rackmounted in a 17U rack that includes the following items (from top to bottom in the rack):

- Each CMPX module adds optional processors, additional local memory and four PCI/PCI-X card slots.

- A system expansion compute module adds processors, and local memory.

- A 2U base compute module adds 1 or 2 processors, local memory, and two PCI/PCI-X and one PCI card slots. (Because the fourth lowermost slot comes with a factory-installed 66-MHz base I/O card, the slot right above it, which is on the same bus as the slot in which the Base I/O PCI card is installed, can only accommodate a PCI card that runs at a speed of 66 MHz or slower.) Any faster card installed in this slot will run at the reduced 66 MHz speed.
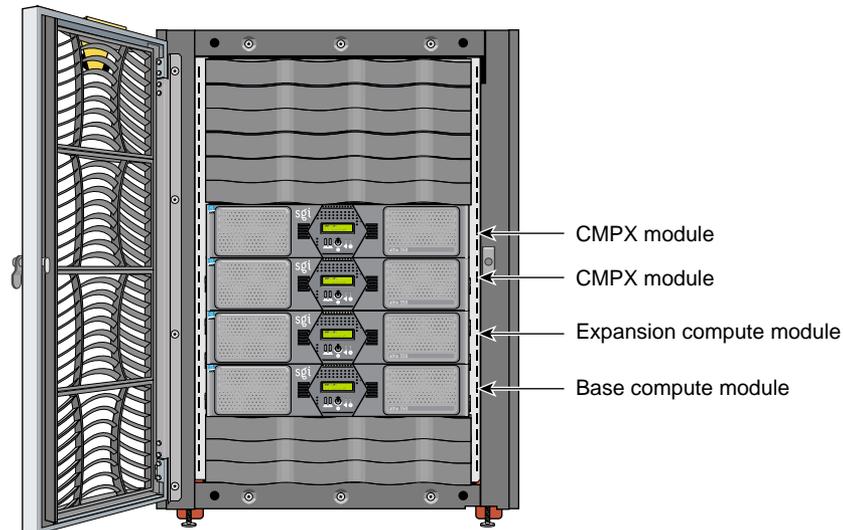
Figure 5-6   System with CMPX Modules, Expansion Compute Module, and a Base Compute Module

Technical Specifications

Table 5-1 lists the bandwidth characteristics of the CMPX module.

Table 5-1   Bandwidth Characteristics of the CMPX Module

Characteristic	Peak Bandwidth	Sustainable Bandwidth
NUMAlink channel	6.4 GB/s full duplex 3.2 GB/s each direction	~2.8 GB/s each direction
Main memory	Up to 10.8 GB/s	Up to 10.8 GB/s
Front Side Bus (FSB)	6.4 GB/s	~6.4 GB/s

Table 5-2 lists the specifications for the CMPX module.

Table 5-2   CMPX Module Specifications

Characteristic	Specification
Height	3.44 in. (8.74 cm)
Width	17.06 in. (43.33 cm)
Depth	27 in. (68.58 cm) (with bezel)
Weight	50 lb (22.7 kg) maximum configuration[a]
Heat Dissipation	1467 BTUs
Input power	120 - 240 VAC

a. Weight will vary depending on whether the module has zero, one, or two optional processors, one or two power supplies, and on the number of DIMMs installed.

Optional Router

This chapter describes the function and physical components of the optional router module (also known as an R-brick) in the following sections:

- "Overview" on page 149
- "External Components" on page 152
- "Router Module Technical Specifications" on page 154

Overview

The router module or R-brick is an eight-port 2U high module that functions as a high-speed switch to route network packets between Altix 350 modules within a system. This creates a NUMAlink-4 interconnect fabric (as opposed to a ring topology which is normally used in smaller system configurations). The optional router is generally only used when there are eight or more modules interconnected as a single system image (16 to 32 processors). Figure 6-1 shows a front view of the router.

Figure 2-3 on page 70 and Figure 2-4 on page 71 illustrate the cabling of an optional router system using block diagrams. The section "Optional Router Configurations" in Chapter 2 details the cable connection points used in an optional router system.

The key component within the module is the router chip, an SGI custom-designed ASIC. The router chip is an eight-port crossbar that connects any input-link channel to any of the seven possible output-link channels (ports).
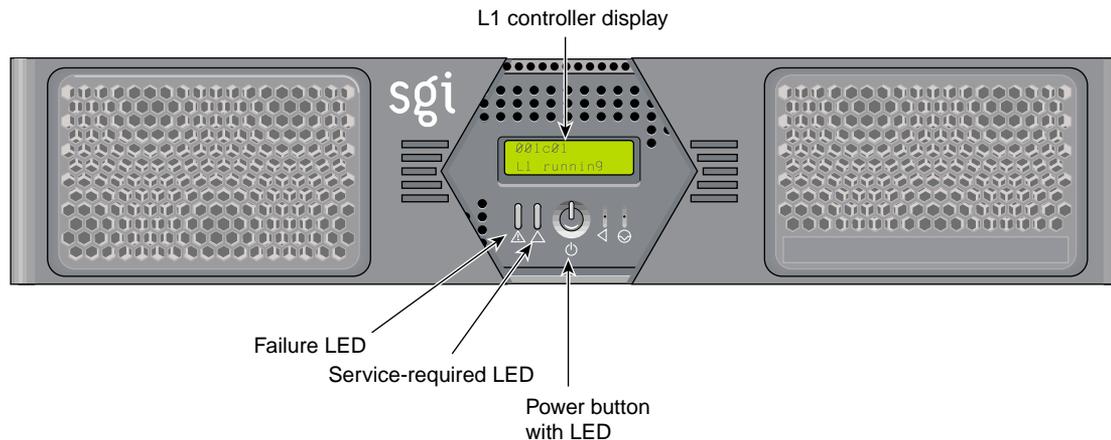
Figure 6-1   Front View of the R-Brick

The router has the following features:

- Eight NUMAlink-4 channels

- One USB port for system controller support

- One L1 controller and LCD display

- One 9-pin console connector

- Two hot-pluggable cooling fans (not customer replaceable)

Figure 6-2 shows a block diagram of the router.
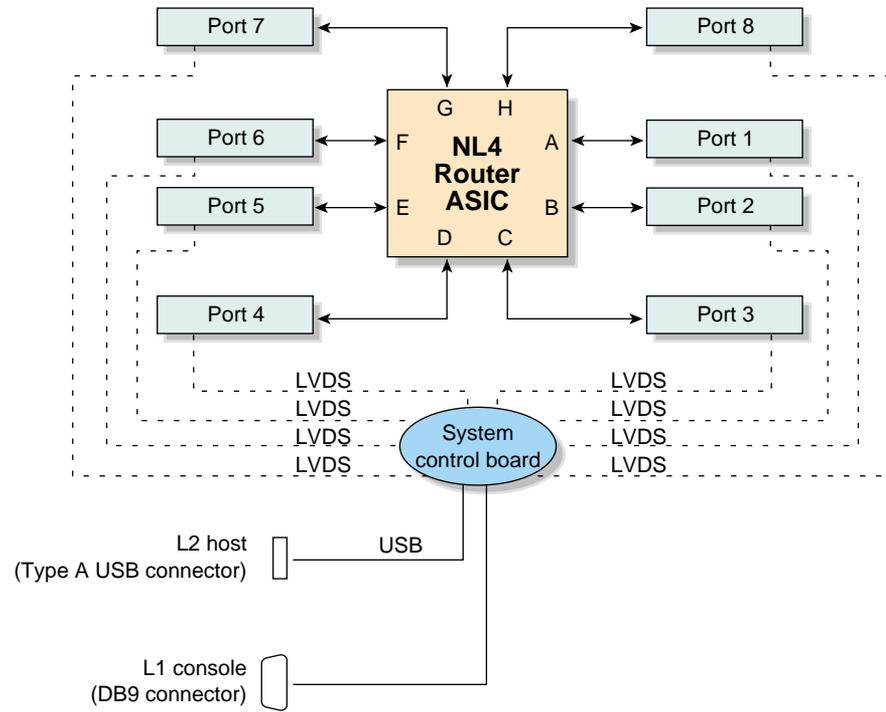
Figure 6-2   Router Functional Block Diagram

External Components

This section describes the external components that are located on the front and rear panels of the router.

Front Panel Components

The router contains the following front panel items (as shown in Figure 6-1 on page 150):

- **L1 display.** The L1 display is a 55.7 mm X 32 mm backlit liquid crystal display (LCD) that displays system messages. It displays two lines with a maximum of 12 characters on each line.

- **On/Off switch with LED.** Press this button to turn on the router internal components. You can also turn on the router internal components at a system console.

- **Three LEDs:**
  - On/Off switch LED. This LED illuminates green when the router internal components are on and turns off when they are off.

  - Service required LED. This LED illuminates orange to indicate that an item is broken or not operating properly (for example, a fan is off), but the router is still operating.

  - Failure LED. This LED illuminates red to indicate that a system failure has occurred and the router is down.

- **Fans.** Two hot-pluggable fans provide N+1 redundant cooling.

Rear Panel Components

The router has the following rear panel items (see Figure 6-3):

- **PWR (power) connector.** This connects the router to the power outlet, (120 or 220V autosensing).

- **Links Altix 350 to NUMAlink connectors** (A through H or 1 through 8). These link connectors connect the router to the Altix 350 compute or option modules to form an interconnect fabric.

- **L1 port connector.** This connects the internal USB hub of the router to an optional console/controller. The internal USB hub can receive the USB signals from the controller via this port and distribute these signals to the L1 of the router.

- **Console connector.** This serial port provides optional connection to a terminal for system control purposes.
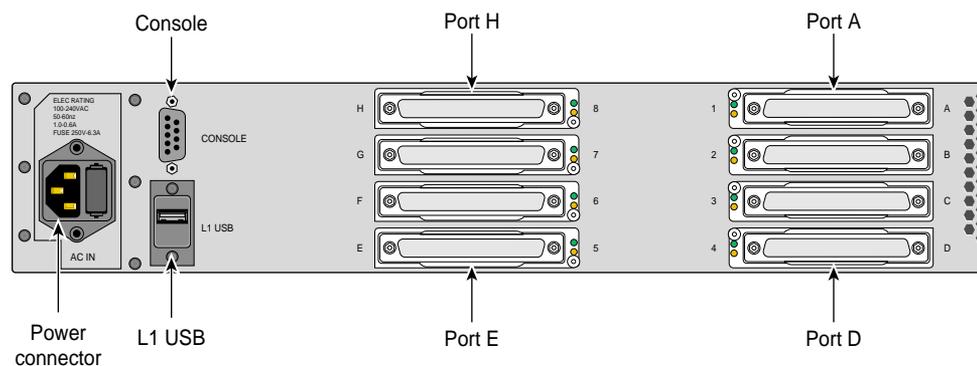
Figure 6-3   Rear View of Router

- **Link connector LEDs.** Each NUMAlink connector has two LEDs, as follows:

  - The yellow LED illuminates to indicate that both the router and the brick to which it is connected are powered on.

  - The green LED illuminates when a link has been established between the router and the brick to which it is connected.

Router Module Technical Specifications

Table 6-1 lists the technical specifications of the router.

Table 6-1   Router Technical Specifications

Characteristic	Specification
Height	3.3 in. (83.82 mm)
Width	17.38 in. (441.45 mm)
Depth	27.5 in. (698.50 mm)
Weight	20 lb (9.1 kg)
Heat dissipation	205 Btu/hr maximum
Input power	(~ 60 W)

Table 6-2 lists the specifications of the router ports.

Table 6-2   Router Port Specifications

Port	Quantity	Peak Transfer Rate
link	8	3.2 GB/s each direction
L1	1	12 Mbits/s

Installing and Removing Customer-replaceable Units

This chapter provides safety instructions to follow when using and maintaining your system. It also describes how to install and remove module customer-replaceable units (CRUs). This information is covered in the following sections:

- "Safety Instructions" on page 155
- "PCI and PCI-X Cards" on page 158
- "Disk Drives" on page 177
- "Power Supplies" on page 182
- "Memory DIMM Group Placement and Guidelines" on page 187
- "L1 Controller Display" on page 195

Safety Instructions

Before you perform any type of maintenance to your system, read the following safety instructions:

- Follow all warnings and instructions marked on the product and noted in this and other documentation included with the product.
- Unplug this product from the wall outlet before you clean it. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
- Do not use this product near water.
- Do not place this product or components of this product on an unstable cart, stand, or table. The product may fall, causing serious damage to the product.

- Slots and openings on the cabinet and components are provided for ventilation, reliable operation, and protection from overheating of the product. These slots and openings must not be blocked or covered. This product should never be placed near or over a radiator or heat register, or in a built-in installation unless proper ventilation is provided.

- This product should be operated with the type of power indicated on the marking label. If you are not sure of the type of power available, consult your dealer or local power company.

- Do not allow anything to rest on the power cord. Do not locate this product where people will walk on the cord.

- Do not use extension cords with your SGI system.

- Never push objects of any kind into this product through cabinet slots because they may touch dangerous voltage points or short out parts that could result in a fire or electric shock.

- Never spill liquid of any kind on the product.

- Do not attempt to service this product yourself except as noted in this guide. Opening or removing covers of internal components may expose you to dangerous voltage points or other risks. Refer all servicing to qualified service personnel.

- Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:

  - If the power cord or plug is damaged or frayed.

  - If the product has been exposed to rain, water, or other type of liquid.

  - If the product does not operate normally when the operating instructions are followed.

    Note: Adjust only those controls that are covered by the operating instructions, because improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to normal condition.

  - If the product has been dropped or if the cabinet has been damaged.

  - If the product exhibits a distinct change in performance, which indicates a need for service.

- Only qualified service personnel should replace the soldered lithium battery (or batteries) in the SGI Altix 350 server system. Please see the "Lithium Battery Statement" in Appendix B for more information.

- Use only the proper type of power supply cord set (provided with the system) for this unit.

Accessing the System's Internal Components

Most of the procedures in this chapter require the removal of the top cover to access the internal component(s) you are removing or replacing. Use the following steps and illustrations to open and close the cover:

1. To remove the module's top cover and access the internal system components, remove the ten Phillips screws as shown in Figure 7-1.

2. Lift the hinged cover into the fully open position.
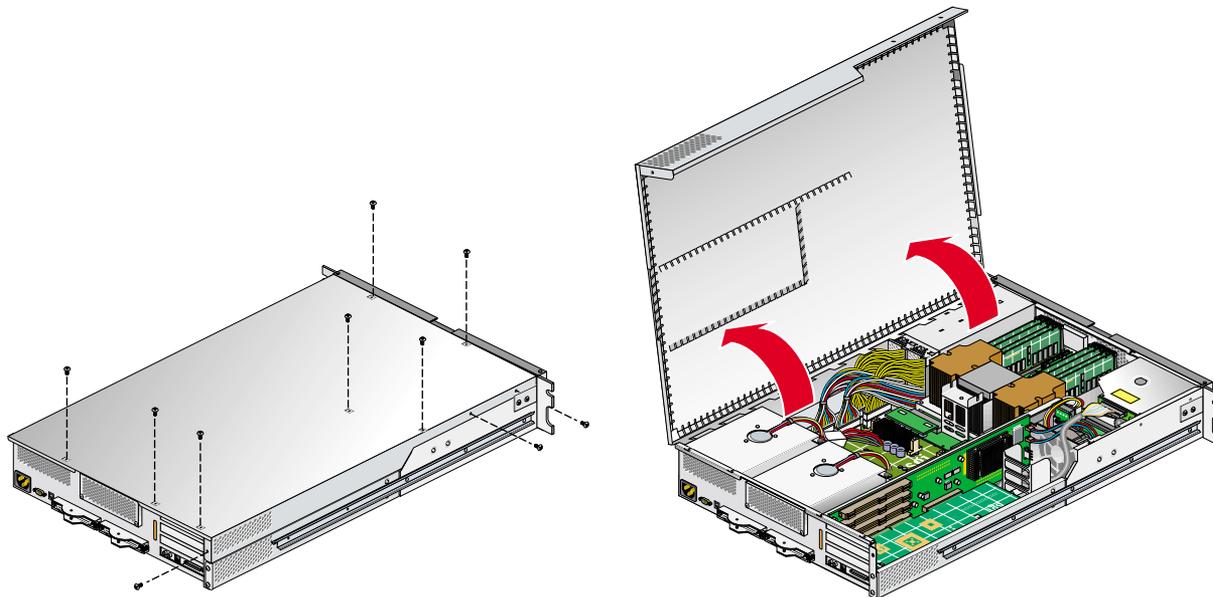
Figure 7-1   Opening the System Cover

3. Close the hinged cover on the system and screw in the ten Phillips screws to secure the cover, as shown in Figure 7-2.
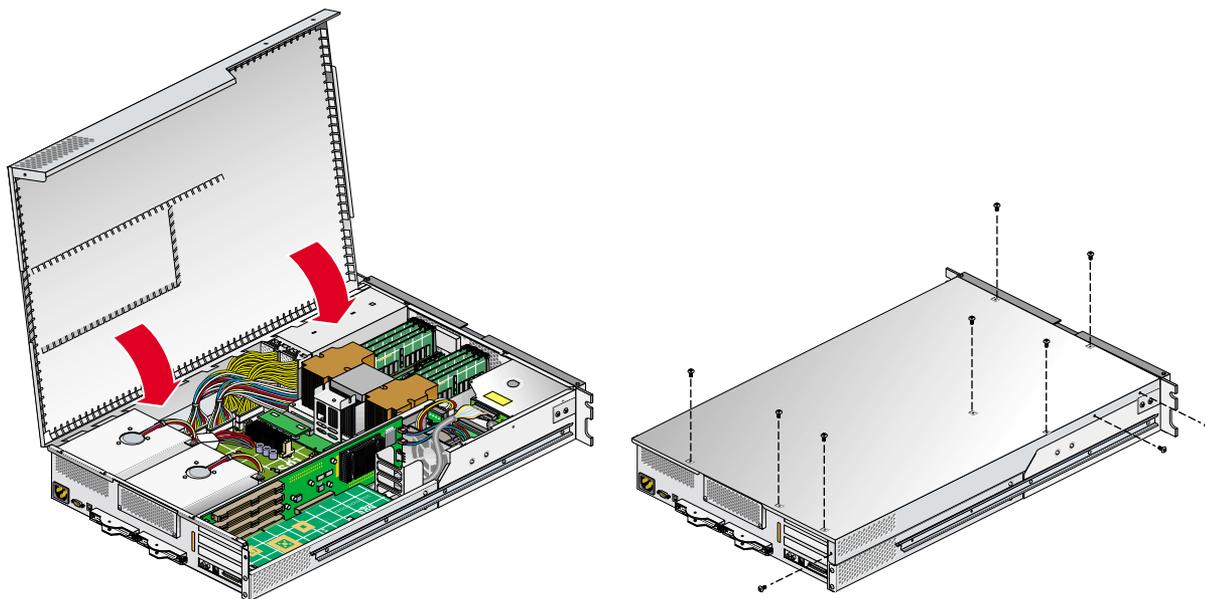
Figure 7-2   Closing the System Cover

PCI and PCI-X Cards

Your system module and various optional modules in your system support PCI and PCI-X cards. The following instructions, which describe how to install and remove a PCI or PCI-X card from system base compute module, can be used to install and remove PCI and PCI-X cards from the expansion compute module or a compute, memory and PCI expansion (CMPX) module.

Figure 7-3 shows the location of the PCI and PCI-X card slots in the base compute module. An optional IO9 base I/O card is shown in the illustration.

For an updated list of supported PCI and PCI-X cards, see SGI Supportfolio at http://support.sgi.com.

This section describes the following:
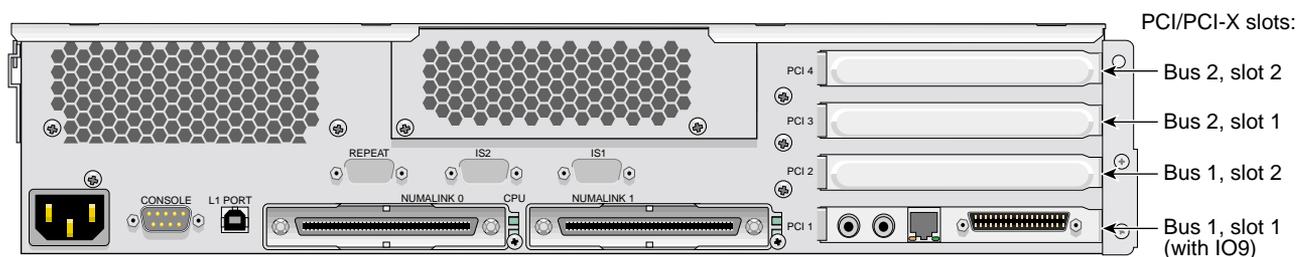
Figure 7-3   PCI and PCI-X Card Slots in the Base Compute Module

Rules for Card Installation and Removal

When installing or removing PCI or PCI-X cards from your system, be aware of the following rules:

- If you run a PCI and PCI-X cards on the same bus at the same time, the PCI-X card will run on PCI mode.

- If you run cards of different speeds on the same bus, the highest-speed card will run at the speed of the slower card. For example, if a card is running at 100 MHz in one slot of a bus and a card is running at 33 MHz on the second slot of the same bus, both cards will run at 33 MHz.

- When deciding to install a PCI or PCI-X card, be aware that if a base I/O card (a PCI card that runs at 66 MHz) is installed in your module (in slot 1 of bus1), and if you want to install a card in slot 2 of bus 1, (the slot immediately above where the IO10 or IO9 base I/O card is installed), the slot will operate only in PCI mode at a speed no faster than 66 MHz.

- The base I/O card is installed/replaced by trained service personnel only.

- Note the following caution when installing or removing a card:

⚠ Caution: Electronic equipment can be irreparably damaged by electrostatic discharge (ESD). Always follow these preventive measures when you handle a system component:

- Remove a component from its antistatic bag only when you are ready to install it.

- If you handle a component before installation, do not place it on surfaces that produce ESD (carpeting, for example) or near devices that create static electricity.

- Attach a static wrist strap to a grounded connection on your system when you install or remove a component.

Installing a PCI or PCI-X Card

To install a PCI or PCI-X card, follow these steps:

1. Power off the server system. For power off instructions, see "Powering the System On and Off" in Chapter 1.

2. Disconnect all of the cables at the rear of the module.

⚠ Warning: Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.

3. If your module is rackmounted, remove the two screws that secure the module to the front rails of the rack. If the module is mounted with shelf rails, remove the screws at the rear. If your module is not rackmounted, proceed to step 5.

4. If the module is mounted with the optional slide rail kit, pull the module from the rack until it is stopped by the safety latches. Otherwise, two people should lift the unit from the rack and place it on a stable work surface.

5. Open the top cover as described in "Accessing the System's Internal Components" on page 157.

6. If you are installing a card into the top two PCI/PCI-X slots, you can install it without completely removing the module from the rack (optional slide rails only).

Note: If you are removing a card from one of the two lower slots (bus 1, slot 1, or bus 1, slot 2), you must remove the module from the rack. For instructions, see "Removing a Module on Slide Rails from a Rack" on page 39.

7. Make sure that you read "Safety Instructions" on page 155, and "Rules for Card Installation and Removal" on page 159 before beginning your card installation.

8. If you are installing a card in one of the two bottommost card slots, you may also need to remove the optional chassis rail by unscrewing the five Phillips screws, as shown in Figure 7-4. (If you are not installing a card into one of the bottom-most card slots or your module is not slide-rail mounted, proceed to step 9.)

⚠ **Caution:** The module may or may not have a factory-installed base I/O card, which always comes installed in the lowermost slot. To prevent damage to your system, only a trained SGI service support engineer can install or remove a base I/O card.
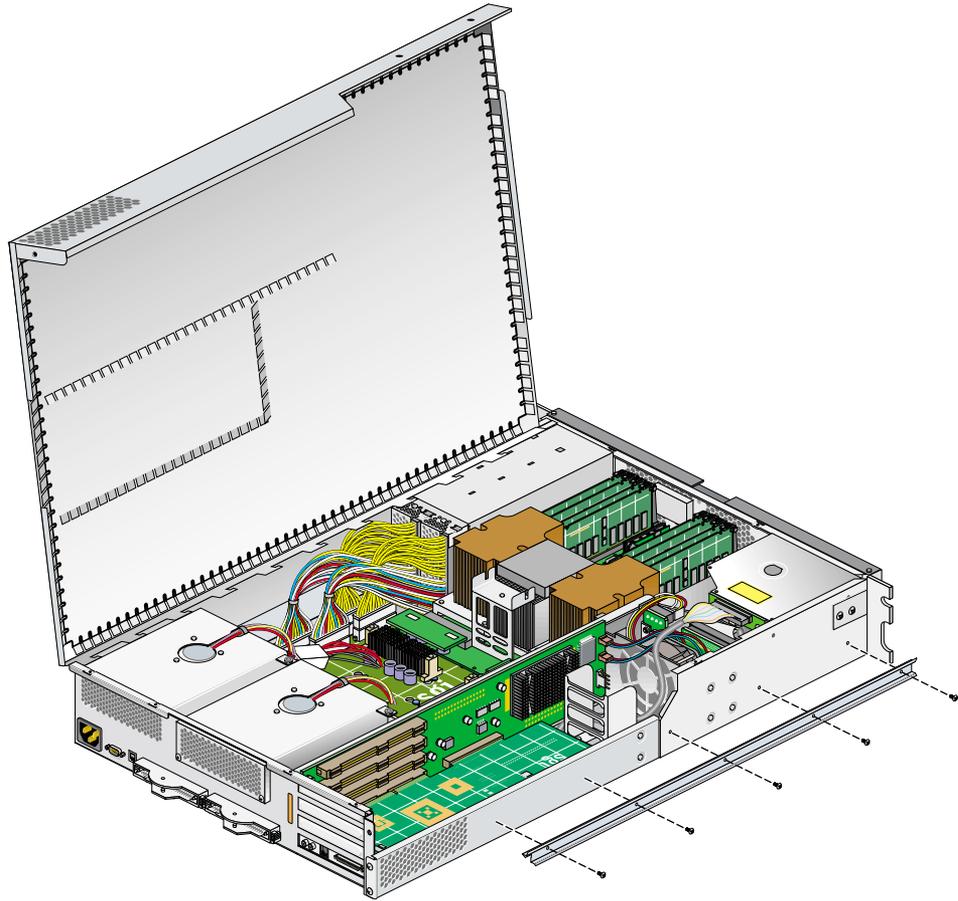
Figure 7-4   Removing an Optional Chassis Rail

9. If you are installing a card in one of the two lowermost card slots, you must remove the lower PCI/PCI-X support bracket that covers the two lowermost slots, as shown in Figure 7-5, by removing the four Phillips screws.
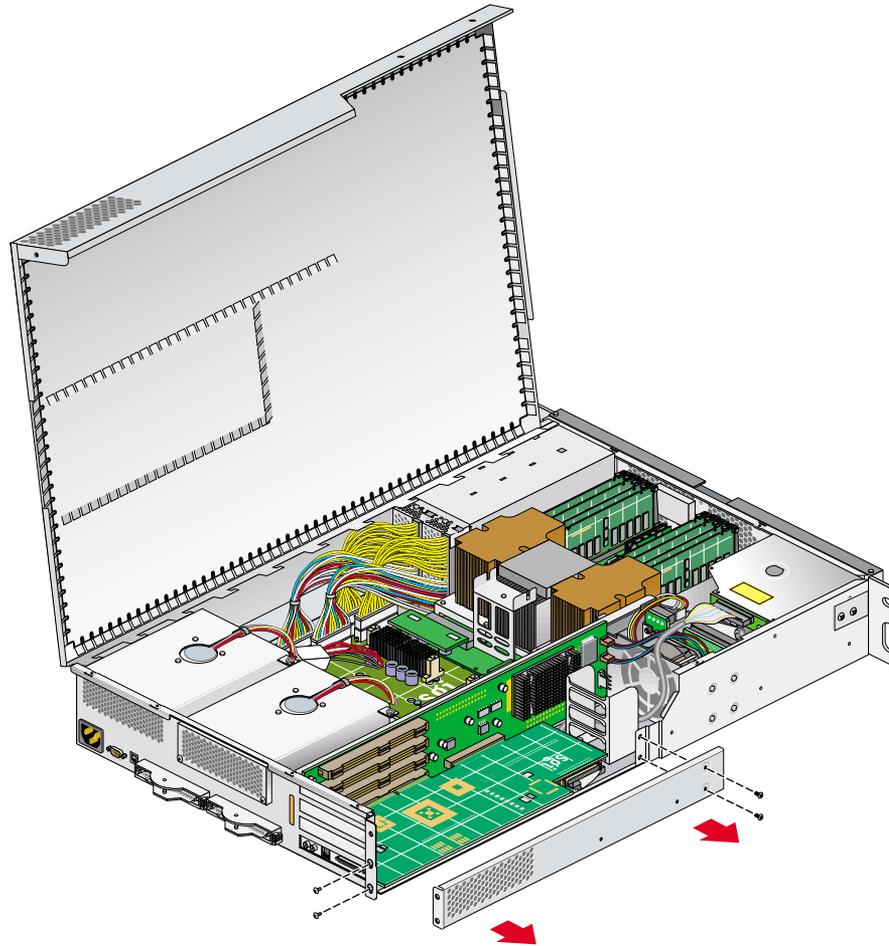
Figure 7-5   Removing the Lower PCI/PCI-X Support Bracket

10. If a blanking plate covers the slot that is needed for the installation, remove the retaining screw, as shown in Figure 7-6, and the blanking plate.
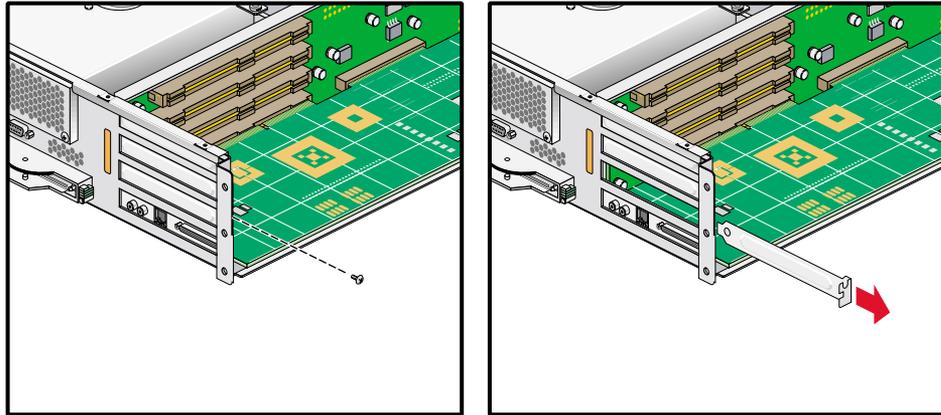
Figure 7-6   Removing the Blanking Plate

11. Insert the card into the slot by pushing the card into the connector until it is properly seated and install the retaining screw, as shown in Figure 7-7. If you have installed the card into one of the upper two slots, proceed to step 13.
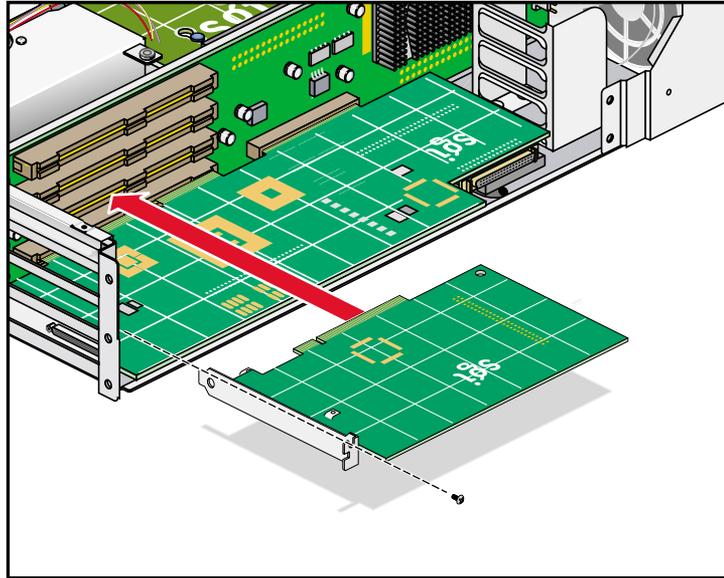
Figure 7-7   Installing the Card and Retaining Screw

12. If you have installed a card in one of the two bottommost card slots, replace the lower PCI/PCI-X support bracket that covers the two bottommost slots and screw in the four Phillips screws, as shown in Figure 7-8.
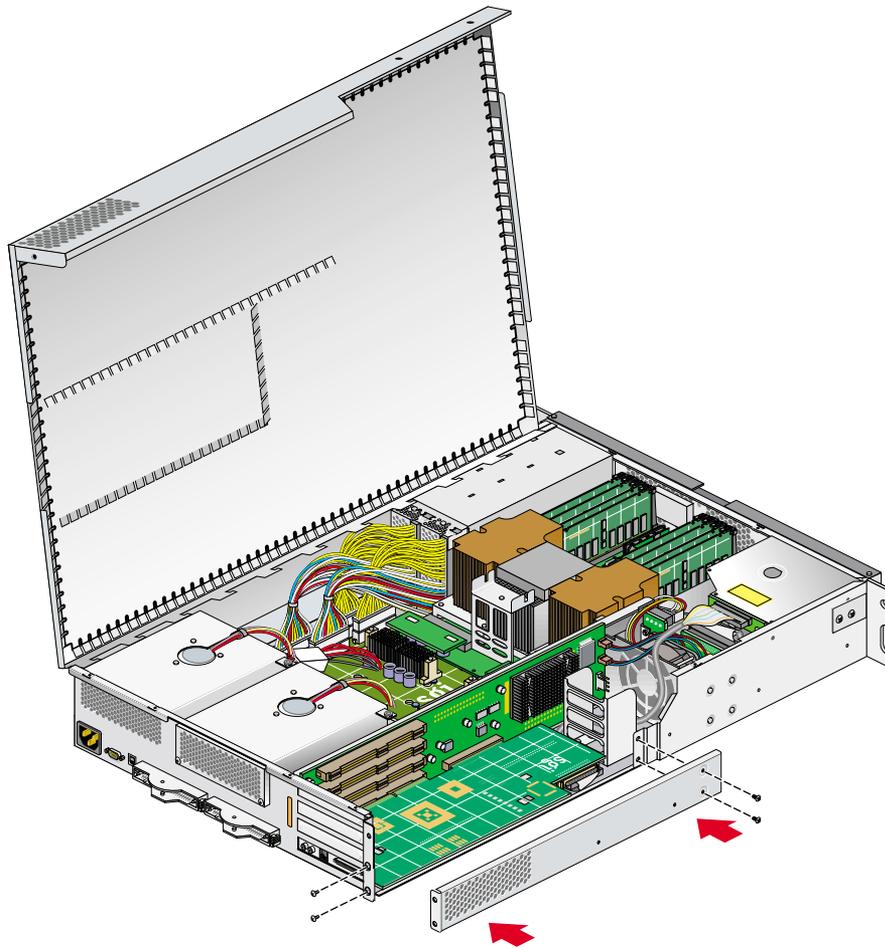
Figure 7-8   Replacing the Lower PCI/PCI-X Support Bracket

13. Replace the optional chassis rail (if applicable) by screwing in the five Phillips screws, as shown in Figure 7-9.
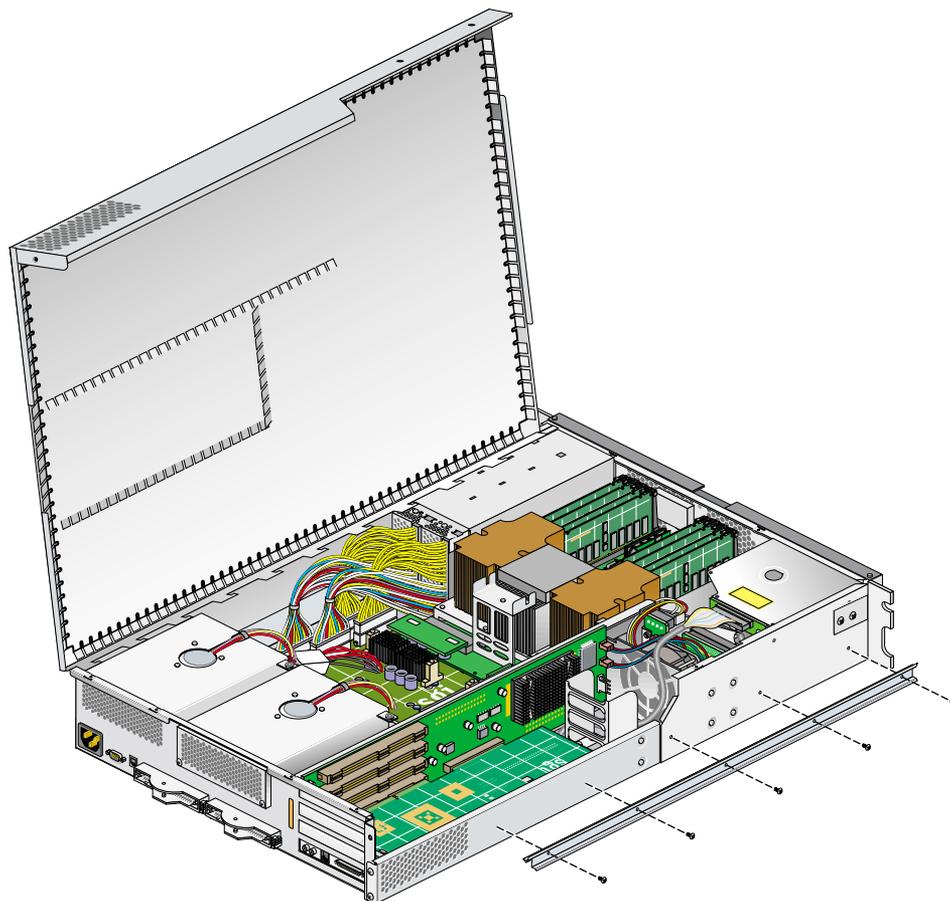
Figure 7-9   Replacing the Chassis Rail

14. If you removed the module from the rack, perform the following substeps. (If you have not removed the module from the rack, proceed to step 15.)

   a.   Fully extend the left and right slide rails from the rack until they lock into place.

   b.   This step requires two people. With one person holding each side of the module, align the chassis rails of the module with the slide rails of the rack.

    c.   Slide the chassis rails into the slide rails until the chassis rails are stopped by the safety latches.

15. Press the safety latches on both sides of the module and slide the module into the rack.

16. Install the two screws that secure the module to the front rails of the rack. For shelf mounted units, install the two screws at the rear of the module.

17. Install all of the cables at the rear of the module.

18. Power on the server system. For power on instructions, see "Powering the System On and Off" on page 54.

Removing a Card

To remove a PCI or PCI-X card, follow these steps:

1. Power off the server system. For powering off instructions, see "Powering the System On and Off" on page 54.

2. Disconnect all of the cables at the rear of the module.

Warning: **Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.**

3. Remove the two screws that secure the module to the front rails of the rack.

4. Pull the module from the rack until it is stopped by the safety latches.

Note: If you are removing a PCI or PCI-X card from one of the two lower slots (bus 1, slot 1, or bus 1, slot 2), you must remove the module from the rack. For instructions, see "Removing a Module on Slide Rails from a Rack" on page 39.

5. Make sure that you read "Safety Instructions" on page 155, and "Rules for Card Installation and Removal" on page 159, before installing the card.

6. To access the card, remove the ten Phillips screws, as shown in Figure 7-10, and lift the hinged cover.
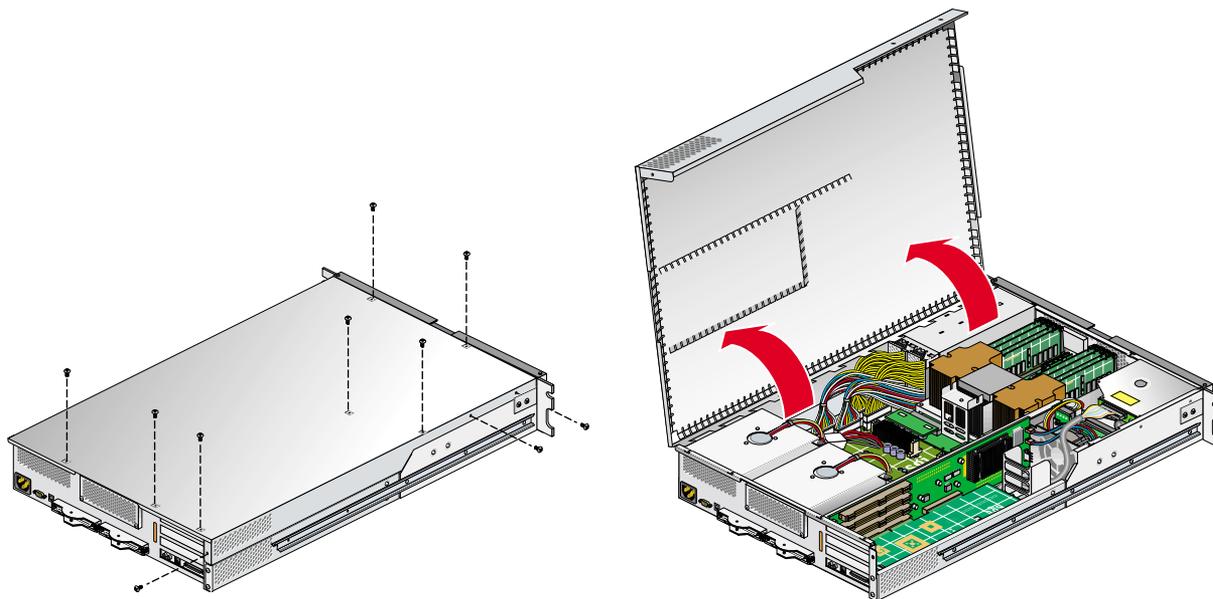
Figure 7-10   Opening the Cover to Remove the Card

7. If you are removing a card from one of the two lowermost card slots and your system uses optional slide rails, remove the chassis rail, by unscrewing the five Phillips screws as shown in Figure 7-11. (If you are not removing a PCI/PCI-X card from one of the two lowermost card slots, proceed to step 9.)

⚠ **Caution:** Only a trained SGI service support engineer can install and remove a base I/O card. Otherwise, your system could be damaged. Therefore, if a base I/O card is installed in your system (it is always installed in the lowermost slot), you can remove a card only from the upper three slots.
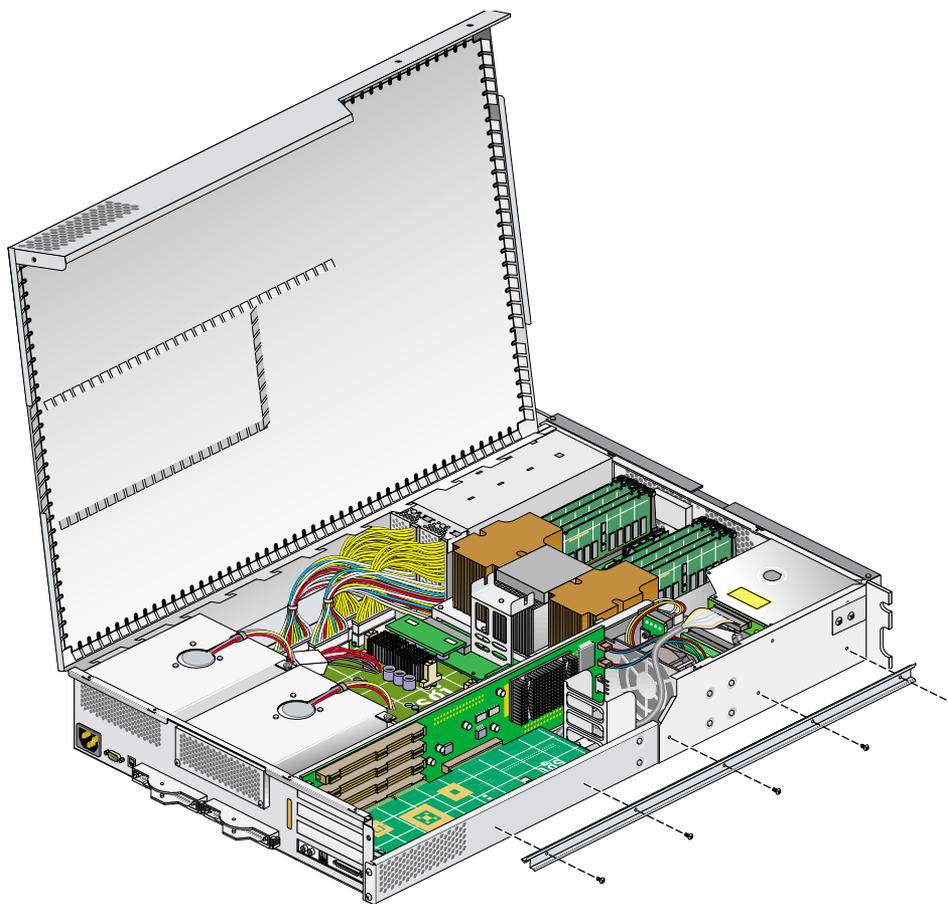
Figure 7-11   Removing the Chassis Rail

8. If you are removing a card from one of the two lowermost slots, you must also remove the lower PCI/PCI-X support bracket that covers the two lowermost slots by unscrewing the four Phillips screws, as shown in Figure 7-12.

Figure 7-12   Removing the Lower PCI/PCI-X Support Bracket

9. Unscrew the retaining screw from the card that you will remove, and extract the card, as shown in Figure 7-13. Place the card on an ESD-safe surface.
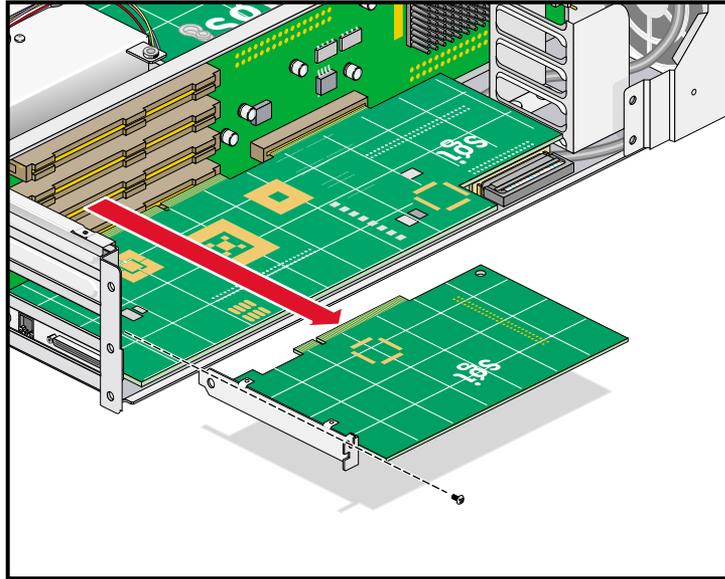
Figure 7-13   Removing the Retaining Screw and Extracting the Card

10. If you are replacing the card that you have removed, reference the instructions in "Installing a PCI or PCI-X Card" on page 160. If you are not replacing the card that you have removed, proceed to the next step.

11. Place a blanking plate to cover the slot where you removed the card, and screw in the retaining screw, as shown in Figure 7-14. After installing the blanking plate, if you have removed a card from one of the two lowermost slots, proceed to the next step. Otherwise, proceed to step 14.
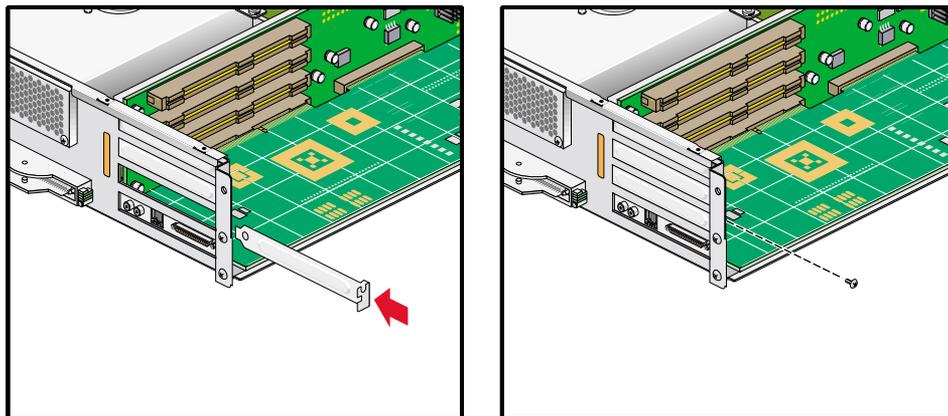
Figure 7-14   Replacing a Blanking Plate

12. If you have removed a card from one of the two bottommost card slots, replace the lower PCI/PCI-X support bracket that covers the two bottommost slots, and screw in the four Phillips screws, as shown in Figure 7-15.

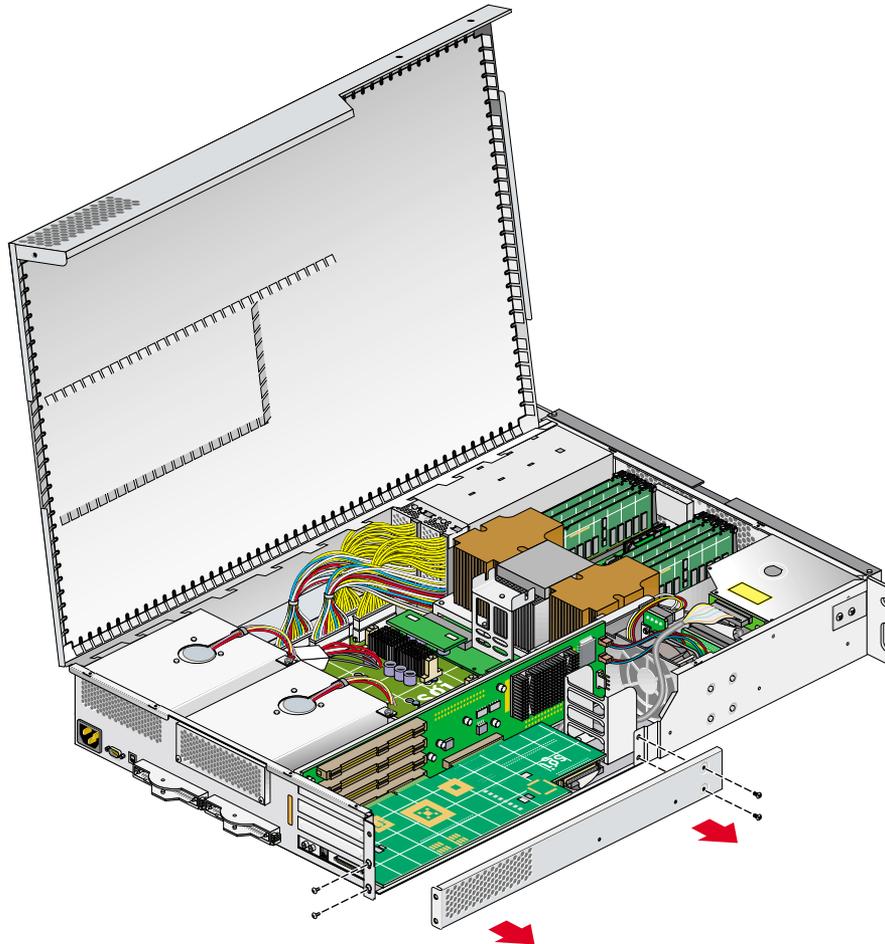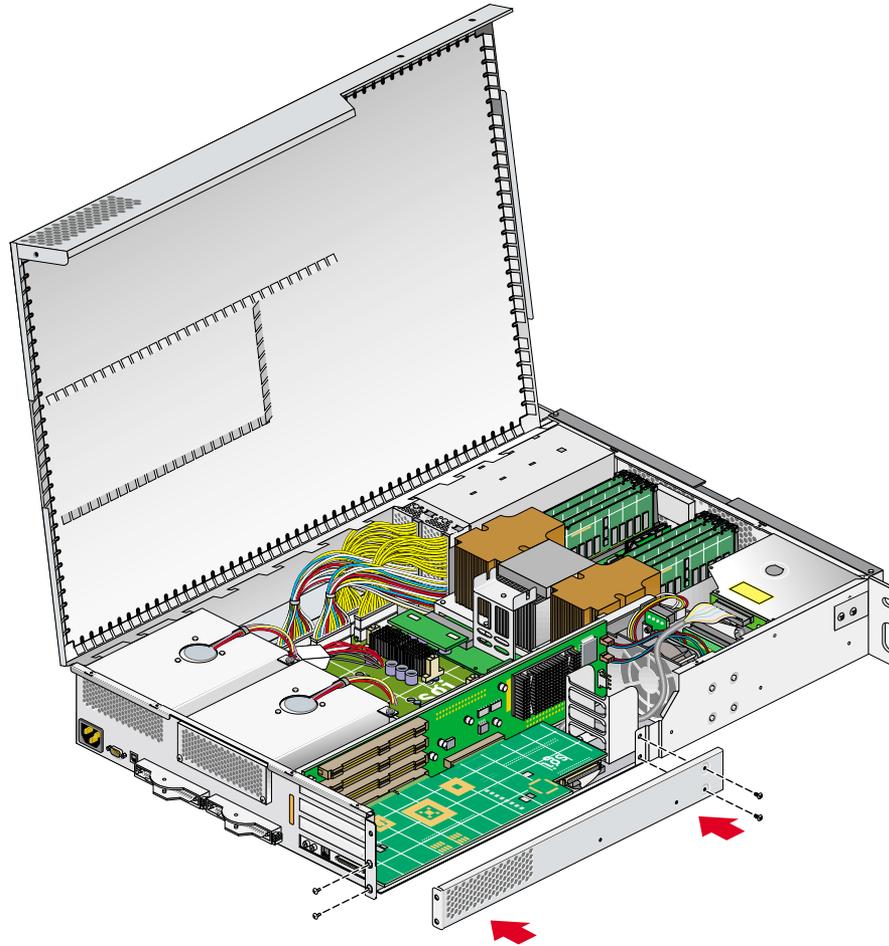**Figure 7-15**   Replacing the Lower PCI/PCI-X Support Bracket

13. Replace the optional chassis rail (if applicable), by attaching the five Phillips screws, as shown in Figure 7-16.
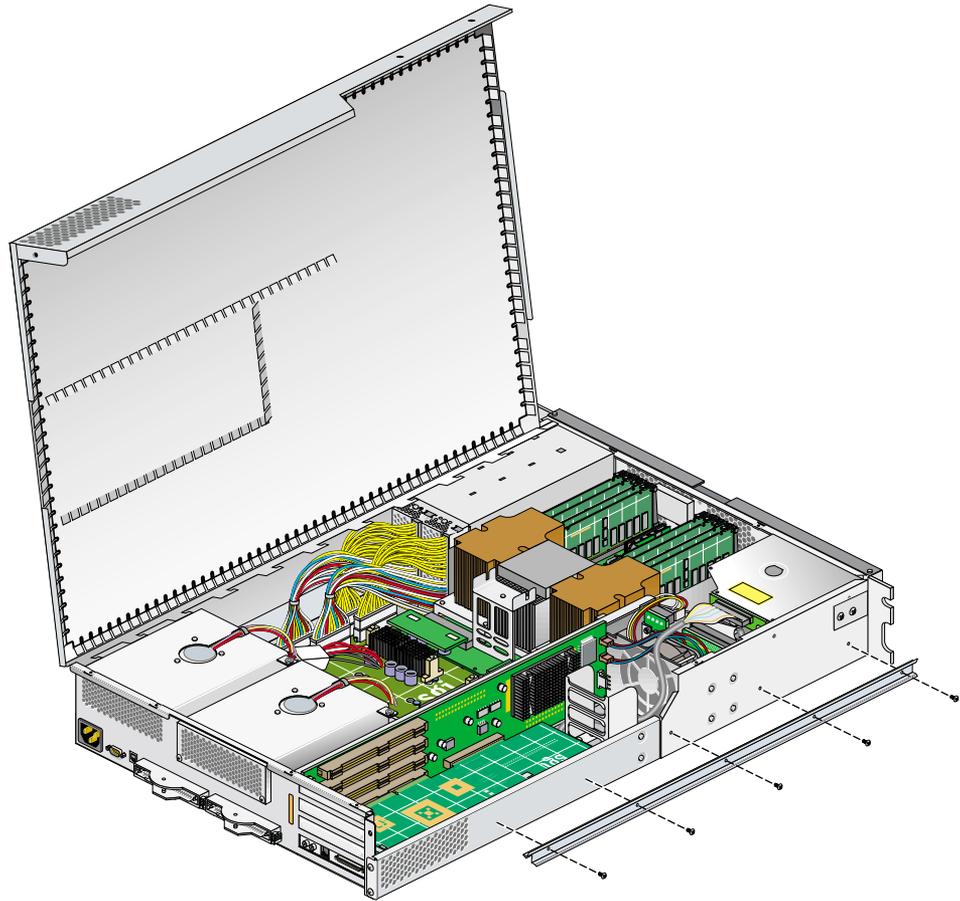
Figure 7-16   Replacing the Optional Chassis Rail

14. Close the hinged cover on the system and screw in the ten Phillips screws to secure the cover, as shown in Figure 7-17.
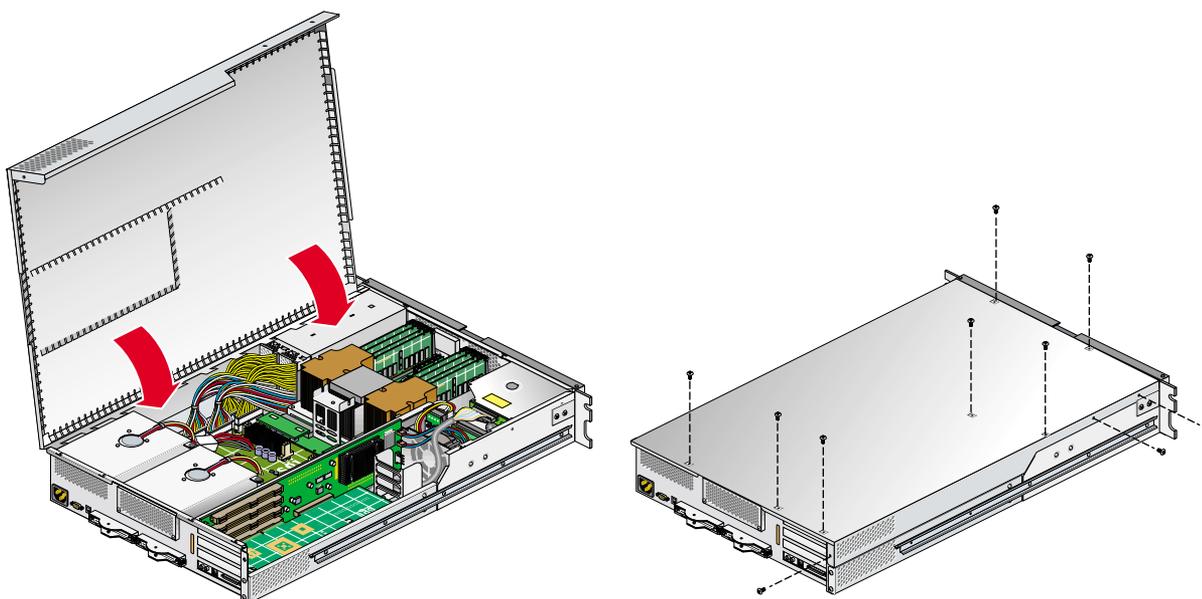
Figure 7-17   Close and Screw Down Cover

15. If your system uses optional slide rails and you removed the module from the rack, follow these substeps. (If you have not removed the module from the rack, proceed to step 16.)

    a. Fully extend the left and right slide rails from the rack until they lock into place.

    b. This step requires two people. With one person holding each side of the module, align the chassis rails of the module with the slide rails of the rack.

    c. Slide the chassis rails into the slide rails until the chassis rails are stopped by the safety latches.

16. Press the safety latches on both sides of the module, and slide the module into the rack.

17. For modules mounted on shelf rails, use two people to slide the unit into the rack.

18. Install the two screws that secure the module to the front rails of the rack. For shelf mounted units, secure the two screws at the back.

19. Install all of the cables at the rear of the module.

20. Power on the server system. For powering on instructions, see "Powering the System On and Off" on page 54.

Disk Drives

Each base compute module contains one or two sled-mounted hard disk drives (see Figure 7-18).

Note: A CMPX module may or may not contain disk drives. These modules would require a base I/O PCI card in order to have a disk drive(s).
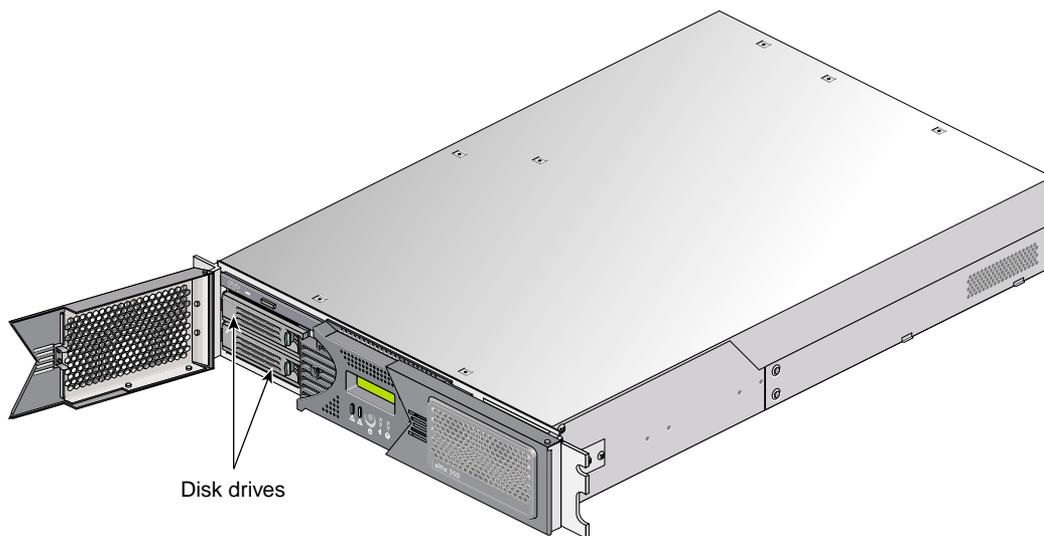
Disk drives

Figure 7-18   Disk Drive Location

Installing a Disk Drive

To install a disk drive, follow these steps:

1. Open the bezel door as far as it will open. Position the drive assembly so that it engages the bay guide rails and, with the locking handle fully swung open, gently push the drive into the bay until the locking handle engages with left side of the bay opening, as shown in Figure 7-19A.

   Note: If you will have only one disk drive in your system, it should be located in the bottom-most slot.

2. Swing the locking handle towards the chassis until the locking handle engages the latch, as shown in Figure 7-19B and Figure 7-19C.
3. Close the bezel door, as shown in Figure 7-19D.
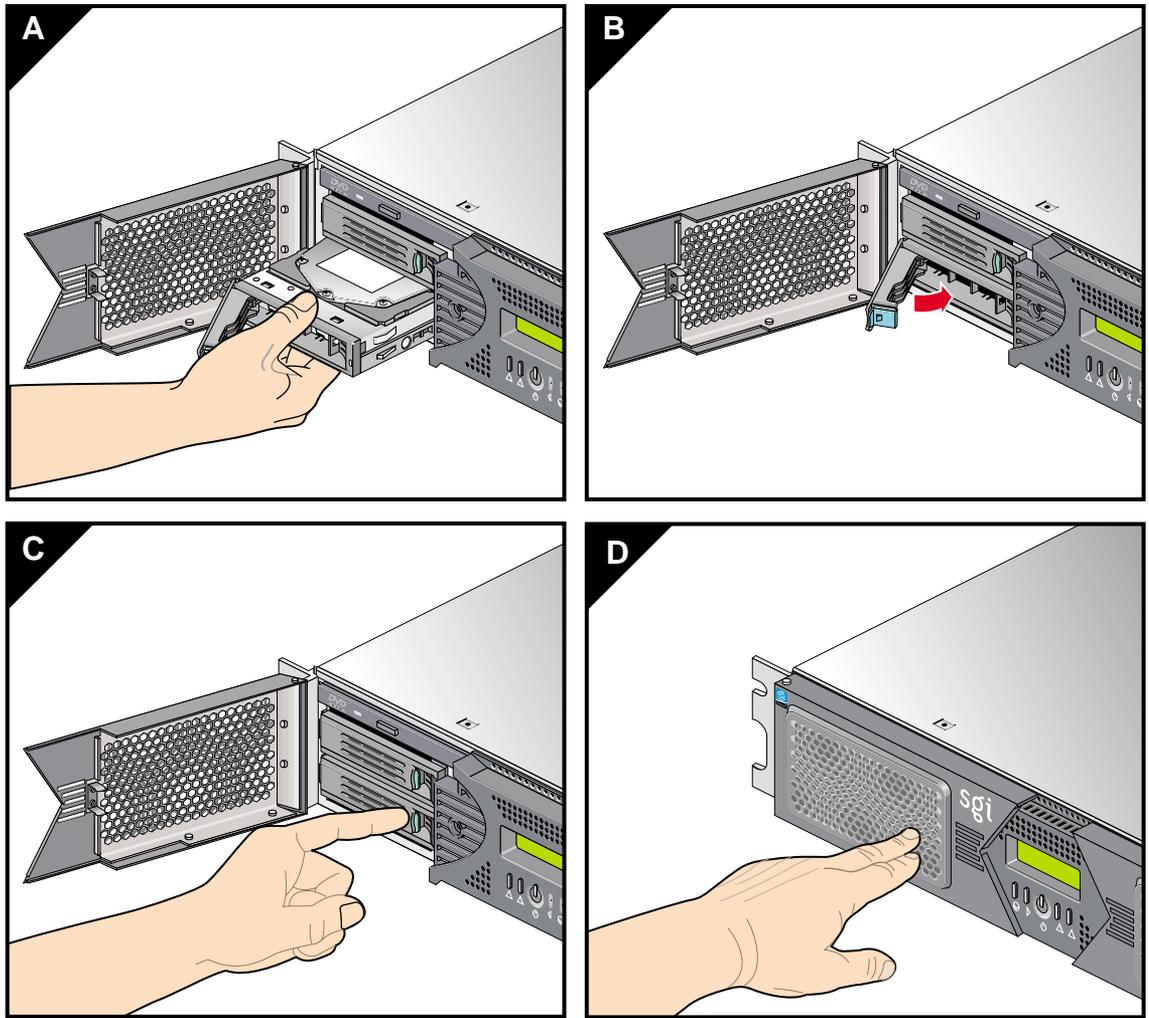
Figure 7-19   Installing a Disk Drive

Removing a Disk Drive

To remove a disk drive, follow these steps:

1. If you are replacing a data drive, ensure that the drive has spun down before you remove it.

2. If you are replacing the system drive, you must first power off the server system. For instructions to power off the server system, see "Powering the System On and Off" on page 54.

3. Open the bezel door located on the left side of the front panel of the module, as shown in Figure 7-20A. (Make sure that you open the door as far as it will open.)

4. Remove the drive by depressing the locking handle with your forefinger (Figure 7-20B). Then swing open the locking handle away from the chassis until the handle disengages the drive connector from the backplane connector (see Figure 7-20C).

   Note: If you will have only one disk drive, it should be located in the bottom-most slot.

5. Carefully slide the drive out of the bay (see Figure 7-20D) and gently place it on a flat ESD-safe surface. (Do not use the handle to pull the drive out of the bay.)

6. If you are replacing the disk drive, proceed to "Installing a Disk Drive" on page 178. (After you have replaced the disk drive, return to step 8 for instructions to power on your module.) If you are not replacing the disk drive, proceed to the next step.

7. Close the bezel door.

8. Power on the server system as described in "Powering the System On and Off" on page 54.
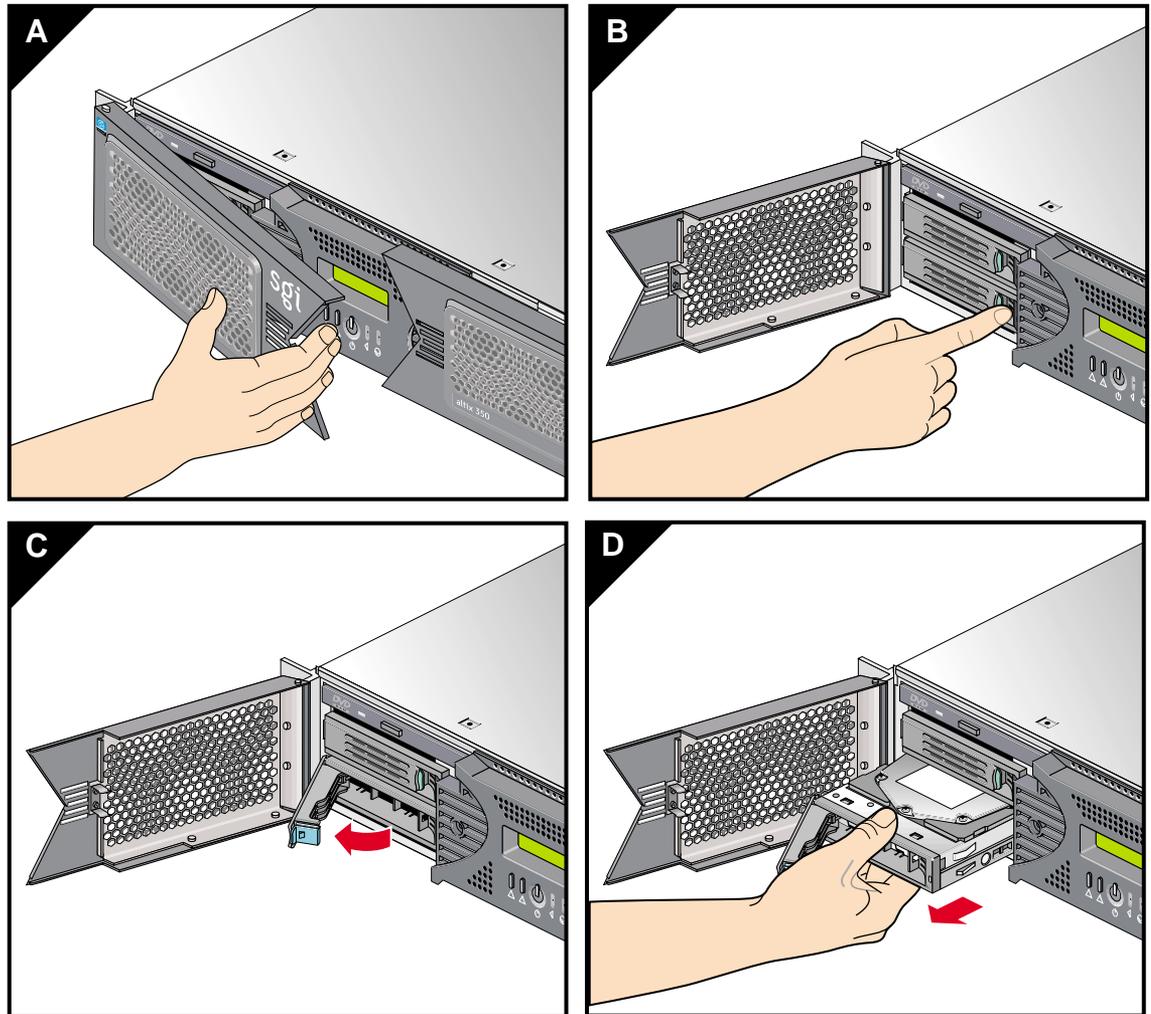
Figure 7-20   Removing a Disk Drive

Power Supplies

Each Altix 350 server system compute module and CMPX module can contain one or two sled-mounted power supplies (refer to Figure 7-21). The second is a redundant power supply to assure that your system always has power.

This section provides the following information:

- "Reading the Power Supply LEDs" on page 183
- "Replacing a Power Supply" on page 183
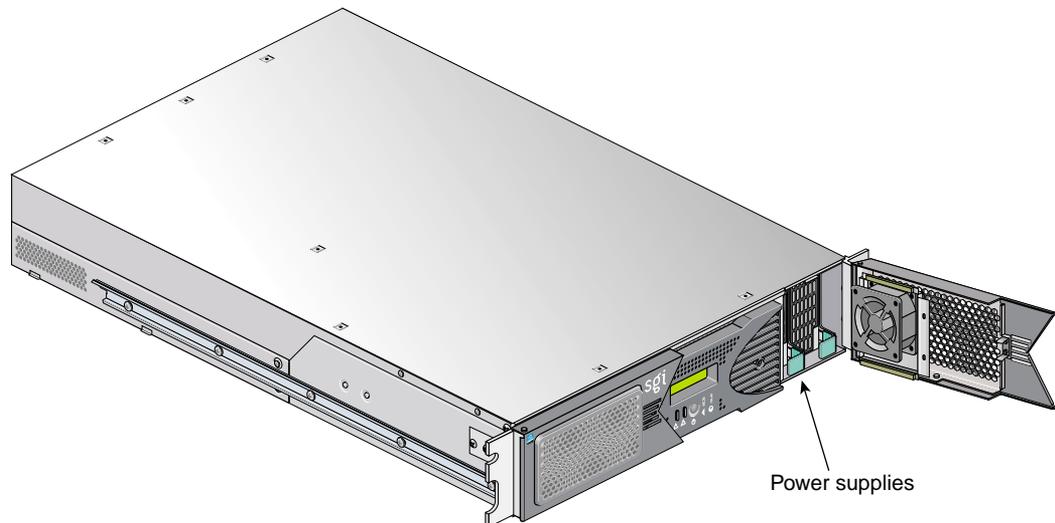
Power supplies

Figure 7-21   Power Supplies Location

Reading the Power Supply LEDs

Use the LED located on the front (towards the top) of the power supply to read the condition of the power supply. Table 7-1 shows the LED status and the power supply condition the LED status indicates.

Table 7-1   LED Status and Power Supply Condition

LED Status	Power Supply Condition Indicated
Off	If your system has one power supply, it indicates that the power supply is not receiving AC power. If your system has two power supplies, the LED on both power supplies would be Off, and it would indicate that both power supplies are not receiving AC power. Power supplies will not be receiving AC power because either the module is not plugged into power, or a electrical fuse has blown.
Amber	Indicates a fault condition for one of the following reasons: - In a system where you have two power supplies, one of the power supplies is not receiving AC power. - The voltage limit has been exceeded. - The temperature limit has been exceeded. - The current limit has been exceeded.
Blinking Green	The power supply is receiving AC power, but the main primary DC power has not yet activated.
Green	The power supply is operating properly.

Replacing a Power Supply

To replace a power supply, follow these steps:

1. If you are replacing a power supply in a module that has only one power supply (no redundant power supply), power off the server system as described in the "Powering the System On and Off" on page 54. If you are replacing a redundant power supply, you do not have to power off your server system to replace the power supply.

2. Remove the power supply to be replaced, as follows:

    a. Swing open the bezel door located on the right side of the module front panel. With a Phillips screw driver, unscrew the two screws on the screen cover as shown in Figure 7-22A.

    b. Swing open the screen cover as shown in Figure 7-22B.

    c. Disengage the power supply from the power supply bay by pushing the interior release button to the right and pulling up and out on the green-colored handle lock as shown in Figure 7-22C.

    d. Gently pull out the power supply from the chassis until it clears the power supply bay as shown in Figure 7-22D. Place the power supply on an ESD-safe surface.

Caution: When pulling out the power supply from the chassis, make sure not to disturb the power supply fan's ribbon cable.

3. Install the replacement power supply, as follows:

    a. Position the power supply in the slot and with the power supply handle pulled up (fully opened), gently push the power supply into the bay as shown in Figure 7-23A.

Caution: When installing the power supply, make sure that the power supply does not clip or pinch the power supply fan's ribbon cable.

    b. Push in and down on the green-colored handle and snap the power supply into place as shown in Figure 7-23B.

    c. After you have installed the power supply, swing the screen cover until it closes as shown in Figure 6-23C.

Caution: When closing the screen cover, make sure that the cover does not clip or pinch the power supply fan's ribbon cable.

    d. Screw in the two Phillips screws that you had removed as shown in Figure 6-23D, and close the bezel door.

4. If you have replaced a power supply in a module that has only one power supply, power on the server system, as described in "Powering the System On and Off" on page 54.
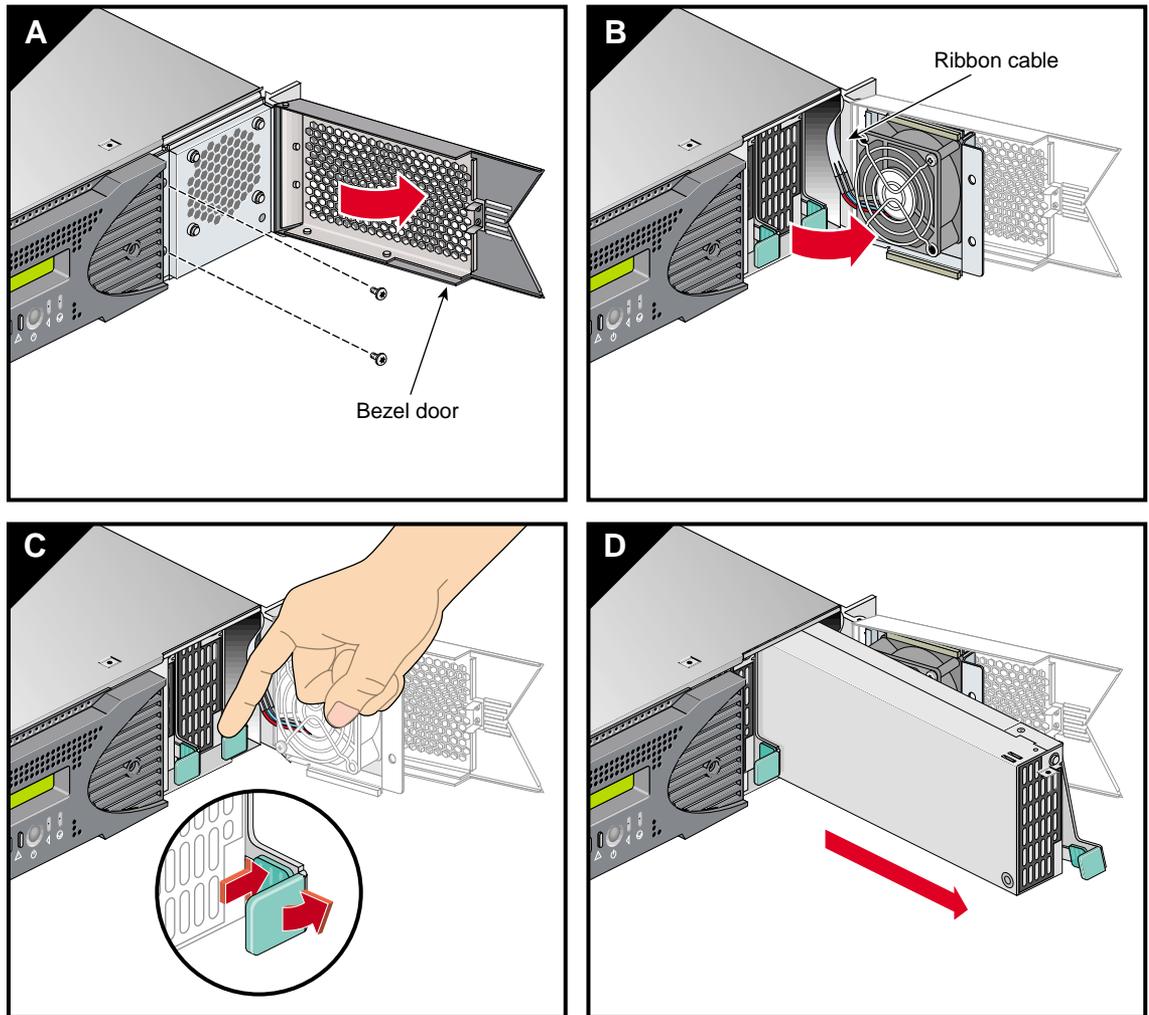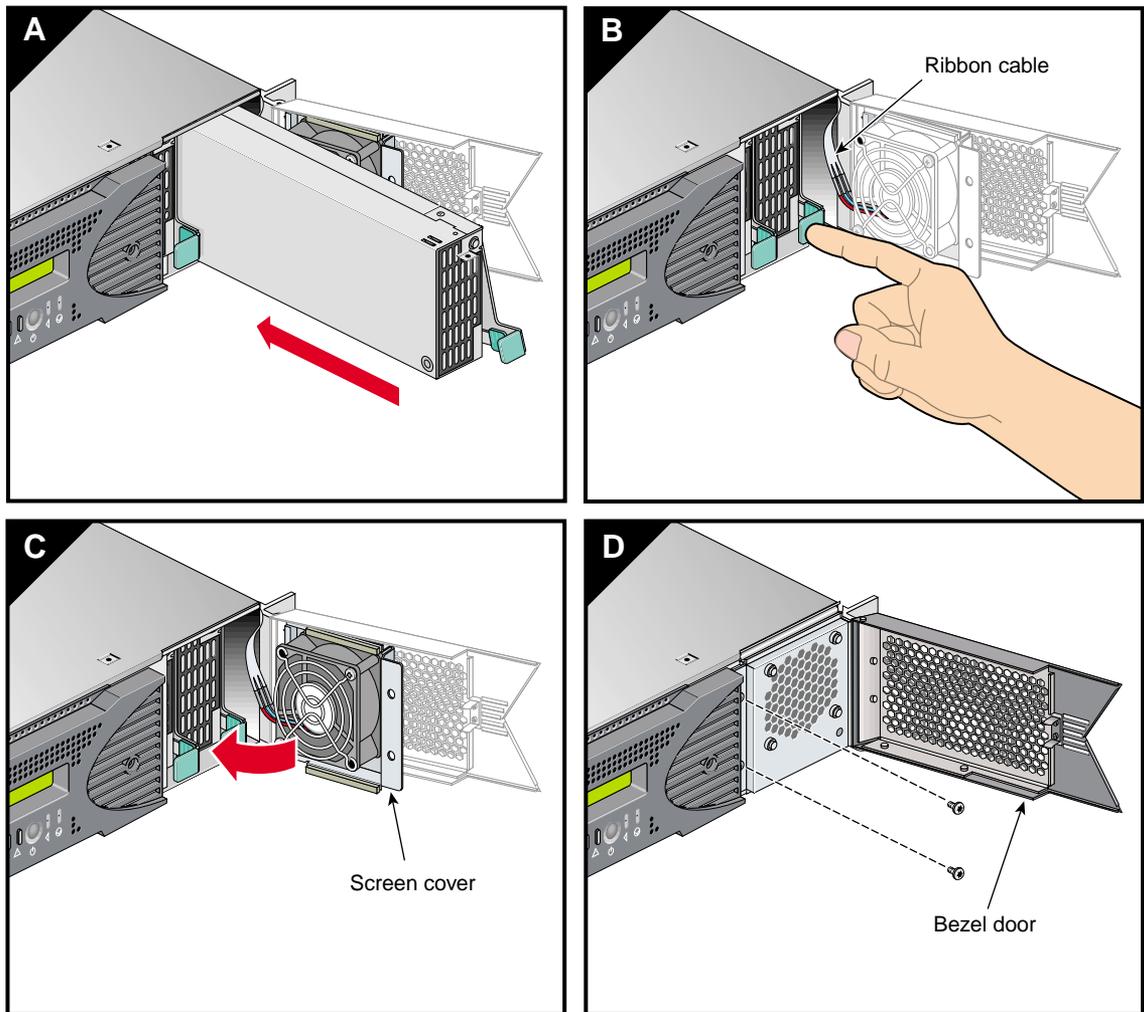
Figure 7-22   Removing a Power Supply

Figure 7-23   Installing the power supply

Memory DIMM Group Placement and Guidelines

Memory is contained on cards that are referred to as DIMMs (dual inline memory modules). Each server system base compute module, system expansion compute module, and CMPX module can contain four, eight, or twelve DIMMs installed in DIMM slots located on the module.

These twelve DIMM slots are organized into three groups of (4 DIMMs each) as shown in Figure 7-24 on page 188.

DIMMs are installed one per DIMM slot, and four at a time (group of four).

You must note these guidelines when installing DIMM groups:

- Memory is increased or decreased in four-DIMM group increments only.

- Each of the four DIMMs that make up a DIMM group must be the same memory size and speed; however, different groups of DIMMs can differ in memory size.

- The first four DIMMs (group 0) must be in place for the base module to operate properly.

- Mixing DIMM groups with different access speeds will cause the memory bus to default to the speed used for the slowest group.

- The maximum bus speed for a completely full set of DIMM memory slots (three installed groups), defaults to 100 MHz or 133 MHz, depending on the type of DIMMs installed.

- The DIMMs used in the Altix 350 server system base compute module, expansion compute module, and CMPX module are not compatible with DIMMs used in the Origin 200, Origin 350 series, SGI 3000 series, SGI 2000 series, Onyx systems, Fuel, Octane or Tezro systems.

Note: Installation of DIMMs not certified or approved by SGI for use in the Altix 350 may impair the functionality or performance of your system. Installation of DIMMs not approved by SGI may also violate your warranty and/or support contract. Check with your SGI sales or service representative before installing any DIMMs not specifically designated for the Altix 350.
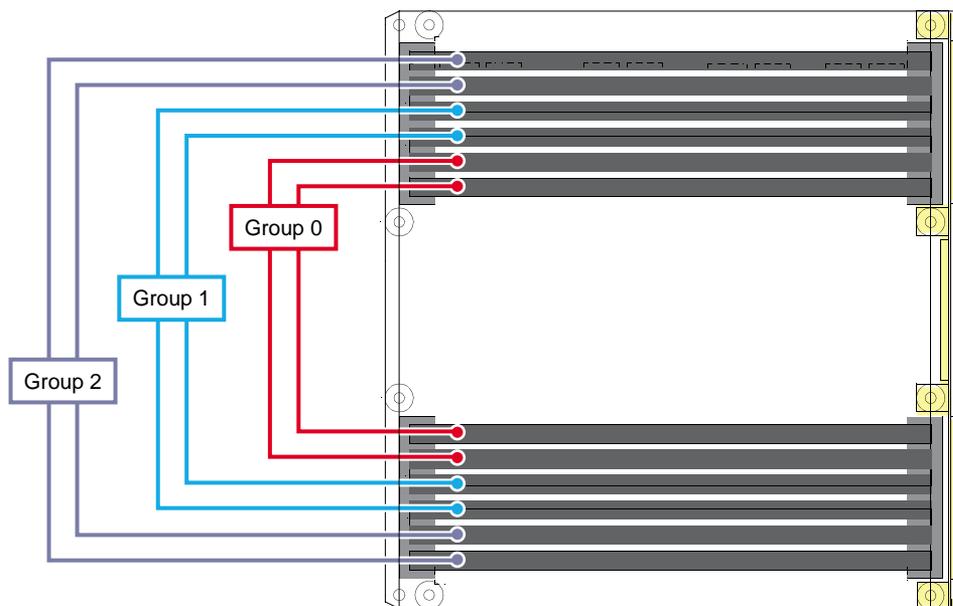
Figure 7-24   Layout of Slots and DIMM Memory Groups

Caution: Electronic equipment can be irreparably damaged by electrostatic discharge (ESD). Always follow these preventive measures when you handle a system component:

- Remove a component from its antistatic bag only when you are ready to install it.

- If you handle a component before installation, do not place it on surfaces that produce ESD (carpeting, for example) or near devices that create static electricity.

- Attach a static wrist strap to a grounded connection on your system when you install or remove a component.

Installing a DIMM Group

To install a DIMM group, follow these steps:

1. Power off the server system. For powering off instructions, see "Powering the System On and Off" on page 54.

2. Disconnect all of the cables at the rear of the module.

Warning: **Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.**

3. Remove the two screws that secure the module to the front rails of the rack. For shelf-mounted modules, remove the two screws at the rear of the unit.

4. With shelf-mounted rails, use two people to slide the module out and move it to a stable work surface. With optional slide rails, pull the module from the rack until it is stopped by the safety latches.

5. To access the DIMMs, remove the ten Phillips screws shown in Figure 7-25 and lift and open the hinged cover.
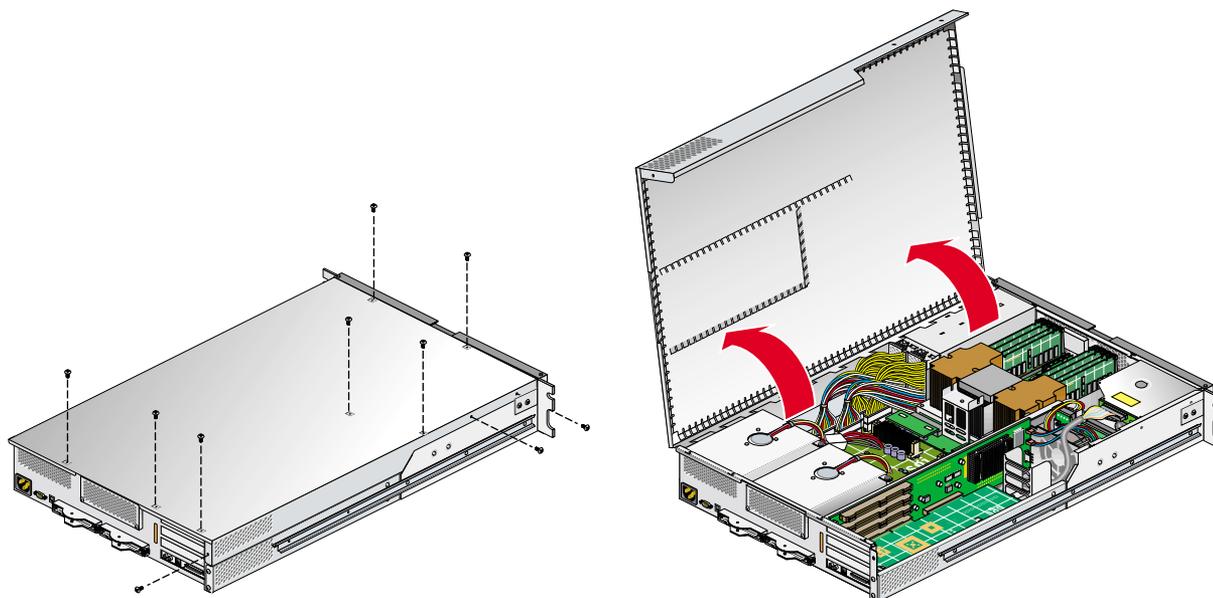
Figure 7-25   Opening Module Cover to Install DIMMs

6. Install the DIMMs, as follows (see Figure 7-26):

Note: If you need to find the correct locations in which to install the DIMMs, make sure to read the introductory material in "Memory DIMM Group Placement and Guidelines" on page 187.

---

a. Ensure the ejector latches are in the open position (leaning away from the slot).

b. Hold the DIMM only by its edges and remove it from its antistatic package.

c. Align the bottom edge of the DIMM with the keyed socket.

d. Insert the bottom edge of the DIMM into the socket, and then press down evenly on the DIMM until it seats correctly. Use extreme care when you install a DIMM. If you apply too much pressure, you can damage the socket.

e. When the DIMM is fully seated in the connector, the ejector latches snap into place flush with each end of the DIMM, see Figure 7-26.

7. Attach the hinged cover and secure it to the module with ten Phillips screws.

8. If using optional slide rails, press the safety latches on both sides of the module and slide the module into the rack. For shelf-mounted units, use two people to slide the module back into the rack.

9. Install the two screws that secure the module to the front rails of the rack. If shelf rails are used, install the two rear screws.

10. Install all of the cables at the rear of the module.

11. Power on the server system as described in "Powering the System On and Off" on page 54.
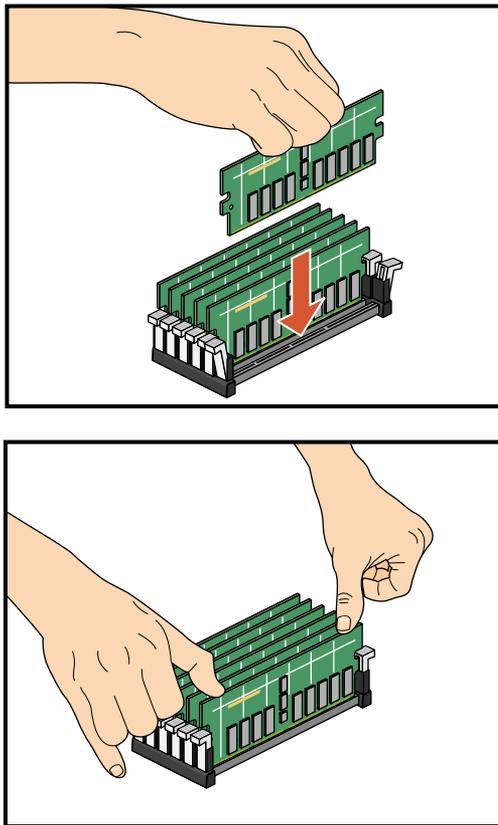
Figure 7-26   Inserting a DIMM

Removing a DIMM

To remove a DIMM, follow these steps:

1. Power off the server system. For powering off instructions, see "Powering the System On and Off" on page 54.

2. Disconnect all of the cables at the rear of the module.

Warning: **Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.**

3. Remove the two screws that secure the module to the front rails of the rack. For shelf-mounted modules, remove the two screws at the rear of the unit.

4. With shelf-mounted rails, use two people to slide the module out and move it to a stable work surface. With optional slide rails, pull the module from the rack until it is stopped by the safety latches.

5. To access the DIMMs, remove the ten Phillips screws shown in Figure 7-27 and open the hinged cover.
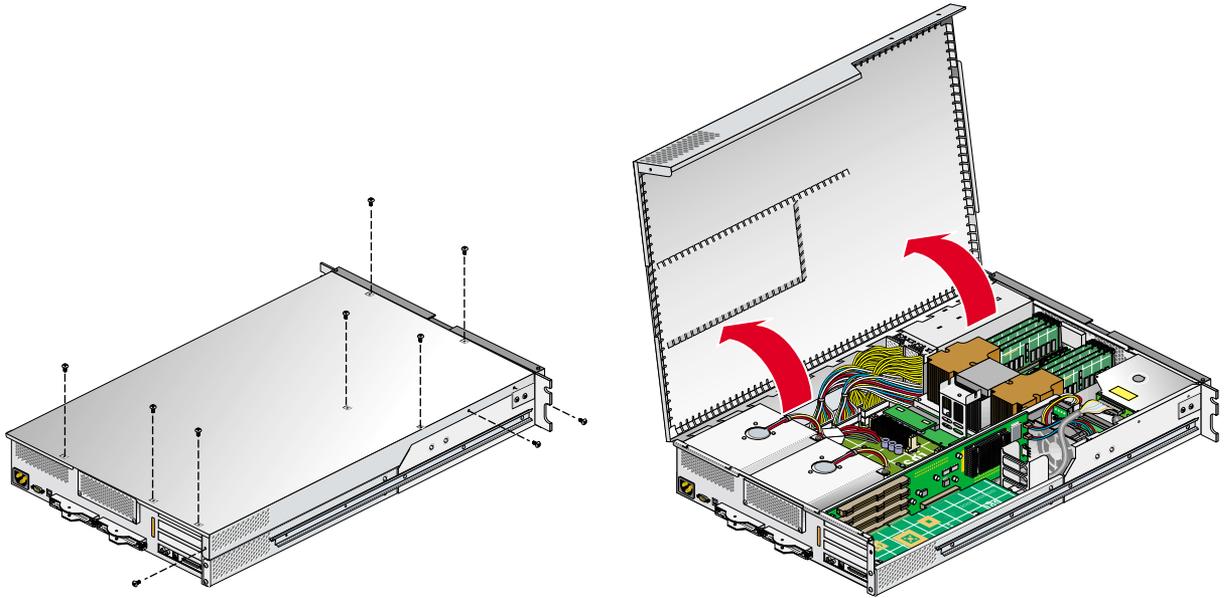
Figure 7-27   Opening Module to Remove DIMM

6. Remove the DIMM, as follows (see Figure 7-28):

> **Note:** If you need to find the correct location from which to remove the DIMMs, make sure to read the introductory material in "Memory DIMM Group Placement and Guidelines" on page 187.

   a. Push out and down on the two ejector latches (located at each end of the DIMM socket) to disengage the DIMM from its connector.

   b. Carefully grasp the DIMM and pull it up and out of the guide rails.

   > **Note:** Hold the DIMM only by its edges. Be careful not to touch its components or gold edge connectors.

   c. Place the DIMM on an ESD-safe surface.

7. If you are installing a new DIMM, proceed to "Installing a DIMM Group" on page 189. If you are not installing a new DIMM, proceed to the next step.

8. Attach or close the hinged cover and secure it to the module with the ten Phillips screws.

9. If using optional slide rails, press the safety latches on both sides of the module and slide the module into the rack. For shelf-mounted units, use two people to slide the module back into the rack.

10. Install the two screws that secure the module to the front rails of the rack. If shelf rails are used, install the two rear screws.

11. Install all of the cables at the rear of the module.

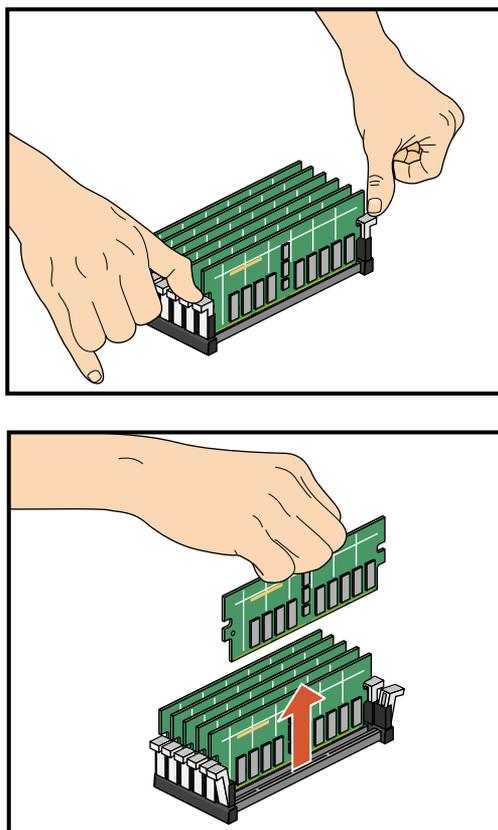12. Power on the server system as described in "Powering the System On and Off" on page 54.

Figure 7-28   Removing a DIMM

L1 Controller Display

The L1 controller, which is used to monitor and manage the base compute module of the Altix 350 server system, has a display located on the front panel of the base compute module as shown in Figure 7-29. Every Altix 350 server system module is factory-shipped with an L1 controller display. This section describes how to replace an L1 controller display panel for a base compute module. (You can also use these instructions to replace an L1 controller display panel for a system expansion compute module or a CMPX module.)

L1 controller display
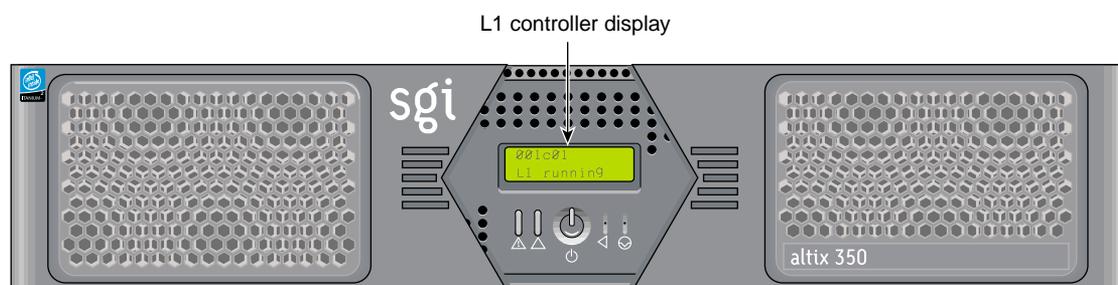
Figure 7-29   L1 Controller Display on Base Compute Module

To replace an L1 controller display, follow these steps:

1. Power off the server system as described in "Powering the System On and Off" on page 54.

2. Disconnect all of the cables at the rear of the module.

Warning: **Components may be hot. To avoid injury, allow the components to cool for approximately five minutes before you proceed with these instructions.**

3. Remove the two screws that secure the module to the front rails of the rack. For shelf-mounted modules, remove the two screws at the rear of the unit.

4. With shelf-mounted rails, use two people to slide the module out and move it to a stable work surface. With optional slide rails, pull the module from the rack until it is stopped by the safety latches.

5. To access the area where the L1 display is replaced, remove the ten Phillips screws shown in Figure 7-30, and lift and open the hinged cover.
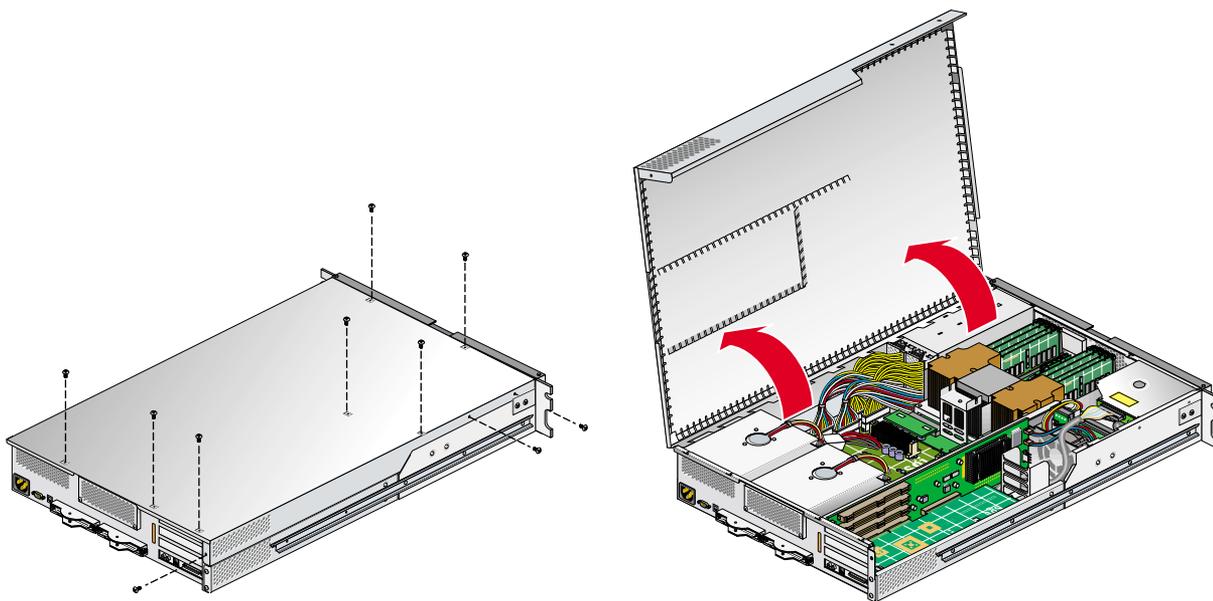
Figure 7-30   Opening the Module to Access the L1 Controller Display

6. On the front panel of your system, remove the front bezel by unscrewing the two Phillips screws holding the bezel to the chassis, as shown in Figure 7-31A.

7. Holding the L1 display cover with one hand, unscrew the single Phillips screw holding the L1 display cover to the chassis, as shown in Figure 7-31B. Gently unhook and pull away the L1 display cover from the chassis.

8. Unscrew the two Phillips screws holding the L1 controller display panel to the L1 display protective cover, as shown in Figure 7-31C.

9. Gently disconnect the L1 controller cable from the connector on the L1 controller display, as shown in Figure 7-31D.

Hook slots
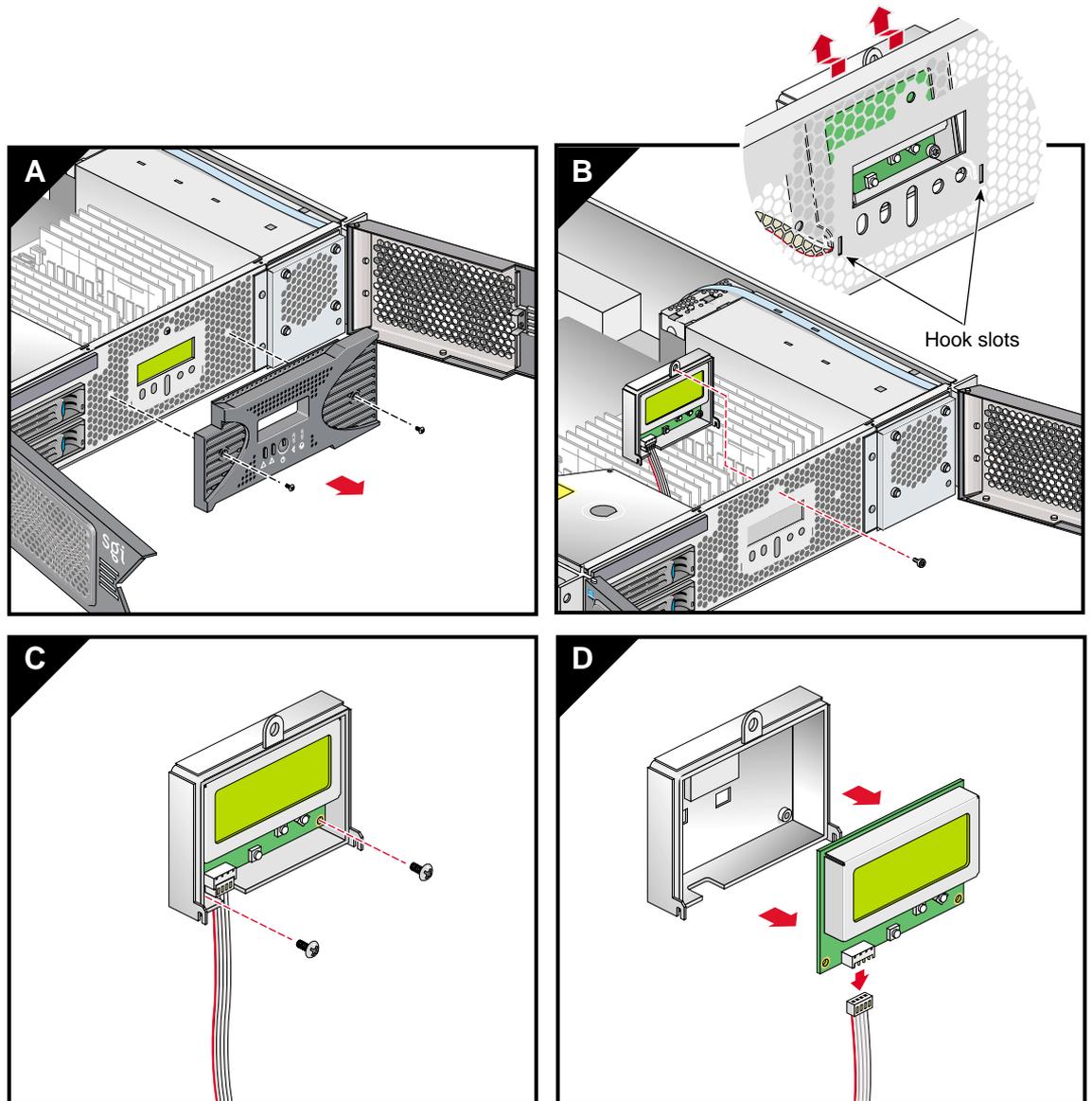
Figure 7-31   Removing the L1 Controller Display Panel

10. Connect the L1 controller cable to the connector on the new L1 controller display, making sure that the red stripe is to your left, as shown in Figure 7-32A.

11. Align the two screw holes on the L1 controller display with the holes on the L1 display protective cover, and screw in the two Phillips screws, as shown in Figure 7-32B.

12. Hook in the L1 display protective cover onto the slots on the front chassis and, holding the L1 display cover up against the front chassis, screw in the Phillips screw, as shown in Figure 7-32C.

13. Replace the front bezel onto the front chassis of the system by screwing in the two Phillips screws holding the bezel to the chassis, as shown in Figure 7-32D.

Red stripe

Hook slots
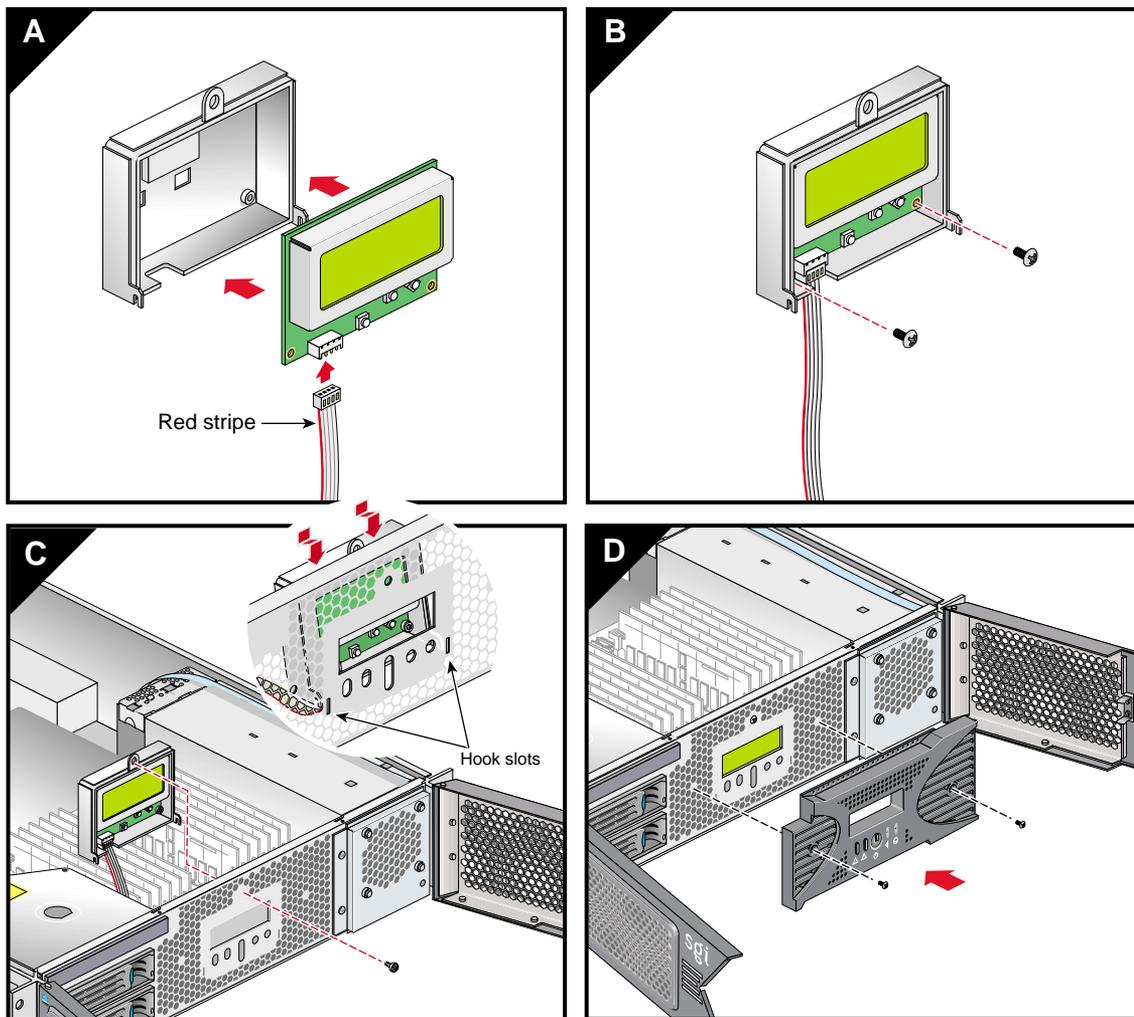
Figure 7-32   Installing an L1 Controller Display Panel

14. Attach the hinged cover and secure it to the module with the ten Phillips screws.

15. If using optional slide rails, press the safety latches on both sides of the module and slide the module into the rack. For shelf-mounted units, use two people to slide the module back into the rack.

16. Install the two screws that secure the module to the front rails of the rack. If shelf rails are used, install the two rear screws.

17. Install all of the cables at the rear of the module.

18. Power on the server system as described in "Powering the System On and Off" on page 54.

Troubleshooting

This chapter provides the following sections to help you troubleshoot your system:

- "Troubleshooting Chart" on page 202
- "L1 Controller Error Messages" on page 203
- "SGI Electronic Support" on page 206

Troubleshooting Chart

Table 8-1 lists recommended actions for problems that can occur on your system. For problems that are not listed in this table, use the SGI Electronic Support system to help solve your problem or contact your SGI system support engineer (SSE). More information about the SGI Electronic Support system is provided later in this chapter.

Table 8-1   Troubleshooting Chart

Problem Description	Recommended Action
The system will not power on.	Ensure that the power cord of the PDU is seated properly in the power receptacle.
	Ensure that the PDU circuit breaker is on.
	If the power cord is plugged in and the circuit breaker is on, contact your SSE.
An individual module will not power on.	View the L1 display; see Table 8-2 if an error message is present.
	If the L1 controller is not running, contact your SSE.
	Check the connection between the module and its power source.
The system will not boot the operating system.	Contact your SSE.
The service-required LED illuminates on a module.	View the L1 display of the failing module; see Table 8-2 for a description of the error message.
The failure LED illuminates on a module.	View the L1 display of the failing module; see Table 8-2 for a description of the error message.
The green or yellow LED of a NUMAlink port is not illuminated.	Ensure both ends of the NUMAlink cable are seated properly and the destination module is powered on.
The PWR LED of a populated PCI slot is not illuminated.	Reseat the PCI card.
The fault LED of a populated PCI slot is illuminated (on).	Reseat the PCI card. If the fault LED remains on, replace the PCI card.
The system status LED of the TP900 is amber.	Contact your SSE.

Table 8-1   Troubleshooting Chart **(continued)**

Problem Description	Recommended Action
The power status LED of the TP900 is amber.	Contact your SSE to replace the power supply module. The power supply module also has an amber LED that indicates a fault.
The cooling status LED of the TP900 is amber.	Contact your SSE to replace the cooling module. The cooling module also has an amber LED that indicates a fault.
The amber LED of a disk drive is on.	Replace the disk drive.

L1 Controller Error Messages

Table 8-2 lists error messages that the L1 controller generates and displays on the L1 display. This display is located on the front of the base compute modules, compute expansion and CMPX modules. For serial number related errors, check with your service provider for documentation on prevention and solutions.

The serial number error messages listed at the end of Table 8-2 are messages that will come across the L1 console (at the L1 or optional L2 prompt). The log being referenced is the L1 log. Users can get the contents by using the `log` command from an L1 prompt, or `l1 log` command from an optional L2 prompt.

Actions that could cause serial number error messages include:

- Moving a base compute, expansion, or CMPX module from one system to another.

- Replacing the interface board of an Altix 350 module.

- L1 NVRAM memory failure.

- Incorrect serial number setting on an optional L2 system controller.

Note: In Table 8-2, a voltage warning occurs when a supplied level of voltage is below or above the nominal (normal) voltage by 10 percent. A voltage fault occurs when a supplied level is below or above the nominal voltage by 20 percent.

Table 8-2   L1 Controller Messages

L1 System Controller Message	Message Meaning and Action Needed
Internal voltage messages:	
ATTN: x.xV high fault limit reached @ x.xxV	30-second power-off sequence for the module.
ATTN: x.xV low fault limit reached @ x.xxV	30-second power-off sequence for the module.
ATTN: x.xV high warning limit reached @ x.xxV	A higher than nominal voltage condition is detected.
ATTN: x.xV low warning limit reached @ x.xxV	A lower than nominal voltage condition is detected.
ATTN: x.xV level stabilized @ x.xV	A monitored voltage level has returned to within acceptable limits.
Fan messages:	
ATTN: FAN # x fault limit reached @ xx RPM	A fan has reached its maximum RPM level. The ambient temperature may be too high. Check to see if a fan has failed.
ATTN: FAN # x warning limit reached @ xx RPM	A fan has increased its RPM level. Check the ambient temperature. Check to see if the fan stabilizes.
ATTN: FAN # x stabilized @ xx RPM	An increased fan RPM level has returned to normal.

Table 8-2   L1 Controller Messages **(continued)**

L1 System Controller Message	Message Meaning and Action Needed
Temperature messages: low alt.	
ATTN: TEMP # advisory temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 30 ºC.
ATTN: TEMP # critical temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 35 ºC.
ATTN: TEMP # fault temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 40 ºC.
Temperature messages: high alt.	
ATTN: TEMP # advisory temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 27 ºC.
ATTN: TEMP # critical temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 31 ºC.
ATTN: TEMP # fault temperature reached @ xxC xxF	The ambient temperature at the module's air inlet has exceeded 35 ºC.
Temperature stable message:	
ATTN: TEMP # stabilized @ xxC/xxF	The ambient temperature at the module's air inlet has returned to an acceptable level.
Power off messages:	
Auto power down in xx seconds	The L1 controller has registered a fault and is shutting down. The message displays every five seconds until shutdown.
Base module appears to have been powered down	The L1 controller has registered a fault and has shut down.
Serial number messages:	
Brick Serial Number mismatch	See L1 log for details.
System Serial Number mismatch	See L1 log for details.
Invalid System Serial Number format	See L1 log for details.
No assigned System Serial Number	See L1 log for details.

SGI Electronic Support

SGI Electronic Support provides system support and problem-solving services that function automatically, which helps resolve problems before they can affect system availability or develop into actual failures. SGI Electronic Support integrates several services so they work together to monitor your system, notify you if a problem exists, and search for solutions to the problem.

Figure 8-1 shows the sequence of events that occurs if you use all of the SGI Electronic Support capabilities.
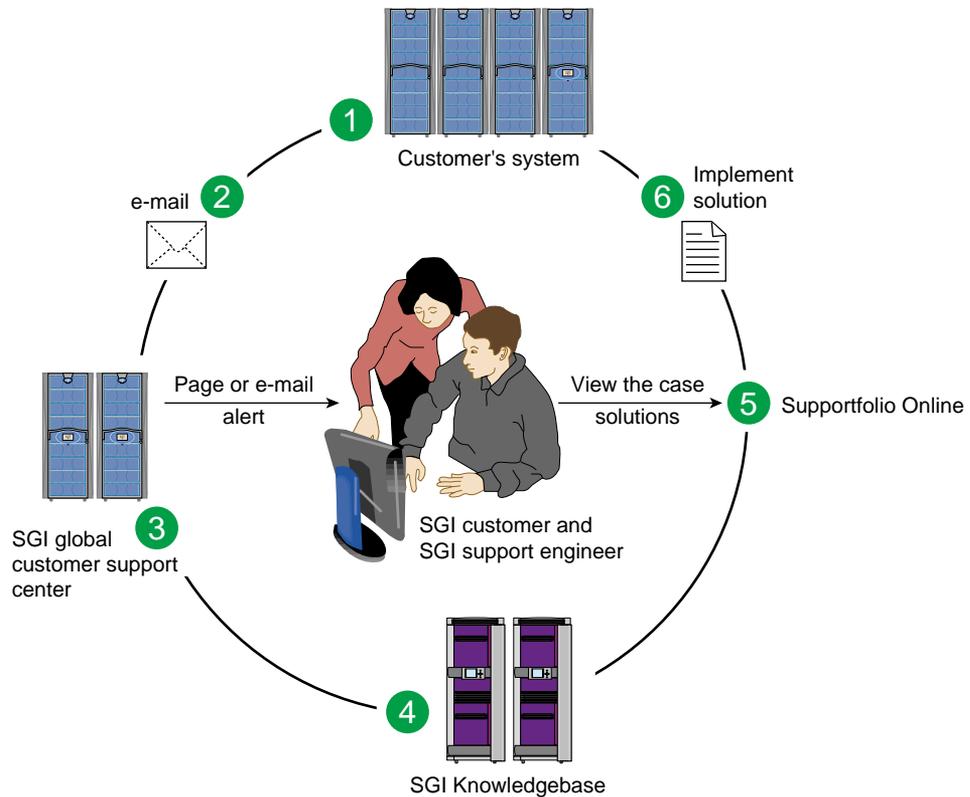

Figure 8-1   Full Support Sequence

The sequence of events can be described as follows:

1. Embedded Support Partner (ESP) monitors your system 24 hours a day.

2. When a specified system event is detected, ESP notifies SGI via e-mail (plain text or encrypted).

3. Applications that are running at SGI analyze the information, determine whether a support case should be opened, and open a case if necessary. You and SGI support engineers are contacted (via pager or e-mail) with the case ID and problem description.

4. SGI Knowledgebase searches thousands of tested solutions for possible fixes to the problem. Solutions that are located in SGI Knowledgebase are attached to the service case.

5. You and the SGI support engineers can view and manage the case by using Supportfolio Online as well as search for additional solutions or schedule maintenance.

6. Implement the solution.

Most of these actions occur automatically, and you may receive solutions to problems before they affect system availability. You also may be able to return your system to service sooner if it is out of service.

In addition to the event monitoring and problem reporting, SGI Electronic Support monitors both system configuration (to help with asset management) and system availability and performance (to help with capacity planning).

The following three components compose the integrated SGI Electronic Support system:

SGI Embedded Support Partner (ESP) is a set of tools and utilities that are embedded in the IRIX operating system. ESP can monitor a single system or group of systems for system events, software and hardware failures, availability, performance, and configuration changes, and then perform actions based on those events. ESP can detect system conditions that indicate potential problems, and then alert appropriate personnel by pager, console messages, or e-mail (plain text or encrypted). You also can configure ESP to notify an SGI call center about problems; ESP then sends e-mail to SGI with information about the event.

SGI Knowledgebase is a database of solutions to problems and answers to questions that can be searched by sophisticated knowledge management tools. You can log on to SGI Knowledgebase at any time to describe a problem or ask a question. Knowledgebase searches thousands of possible causes, problem descriptions, fixes, and how-to instructions for the solutions that best match your description or question.

Supportfolio Online is a customer support resource that includes the latest information about patch sets, bug reports, and software releases.

The complete SGI Electronic Support services are available to customers who have a valid SGI Warranty, FullCare, FullExpress, or Mission-Critical support contract. To purchase a support contract that allows you to use the complete SGI Electronic Support services, contact your SGI sales representative. For more information about the various support contracts, see the following website:

http://www.sgi.com/support/customerservice.html

For more information about SGI Electronic Support, see the following website:

http://www.sgi.com/support/es

Technical Specifications

This appendix contains technical specification information about your system, as follows:

- "Environmental System Specifications" on page 210
- "Compute Module Specifications" on page 211
- "CMPX Module Specifications" on page 213
- "Rack Specifications" on page 214
- "SGI TP900 Storage Module Specifications" on page 215
- "Non-proprietary I/O Port Specifications" on page 215

Environmental System Specifications

Table A-1 lists the environmental specifications of the Altix 350 server system.

Table A-1   Environmental Specifications

Characteristic	Specification
Temperature, operating	+5 ºC (+41 ºF) to +35 ºC (+95 ºF) (up to 1500 m [5,000 ft]) +5 ºC (+41 ºF) to +30 ºC (+86 ºF) (1500 m to 3000 m [5,000 ft to 10,000 ft])
Temperature, non-operating	-40 ºC (-40 ºF) to +60 ºC (+140 ºF)
Humidity	10% to 95% RH, noncondensing
Altitude	Sea level to 40,000 ft (nonoperating) Sea level to 10,000 ft (3000 m) (operating)

Compute Module Specifications

Table A-2 lists the bandwidth characteristics of the compute module.

Table A-2   Bandwidth Characteristics of the Compute Module

Characteristic	Peak Bandwidth	Sustainable Bandwidth
NUMAlink channel	6.4 GB/s full duplex 3.2 GB/s each direction	~2.8 GB/s each direction
Main memory	Up to 10.8 GB/s	Up to 10.8 GB/s
Front Side Bus (FSB)	6.4 GB/s	~6.4 GB/s

Table A-3 summarizes the general features of the compute module.

Note: The following table assumes that the expansion compute module does not include a base I/O PCI card (IO9 or IO10). The base I/O card is also needed to support the DVD-ROM drive.

Table A-3   General Features of the Compute Module

Feature	Base Compute Module	Expansion Compute Module
NUMAlink ports	2 (3.2 GB/s each direction)	2 (3.2 GB/s each direction)
Serial console port	1	1
L1 port	1	1
RT interrupt input port	1 (not functional under Linux)	
RT interrupt output port	1 (not functional under Linux)	
Ethernet port	1 10BaseT/100BaseT/1000BaseT	
Multiport Serial Adapter	36-pin MDR port (IO10	
Internal SATA drive	One or two Serial ATA drives	
SCSI port (external) IO9	1 Ultra3 SCSI (VHDCI)	
SCSI port (internal) IO9	1 Ultra3 SCSI, 160 MB/s	

Table A-3   General Features of the Compute Module **(continued)**

Feature	Base Compute Module	Expansion Compute Module
3.5-in. drive bay	1 or 2	
64-bit Intel processor	1 or 2	1 or 2
Memory	up to 24 GB	up to 24 GB
Expansion slot	1 PCI, 2 PCI-X	4 PCI-X

Table A-4 lists the specifications for the compute module.

Table A-4   Compute Module Specifications

Characteristic	Specification
Height	3.44 in. (8.74 cm)
Width	17.06 in. (43.33 cm)
Depth	27 in. (68.58 cm) (with bezel)
Weight	50 lb (22.7 kg) maximum configuration[a]
Noise	6.0 Bells sound power, up to 30 ºC
Heat dissipation	1577 Btu/hr maximum
Input power	120 - 240 VAC

a. Weight will vary depending on whether the system has one or two processors, one or two power supplies, on the amount of DIMMs installed, and on whether you have one or two disk drives in your system.

CMPX Module Specifications

Table A-5 lists the bandwidth characteristics of the CMPX module.

Table A-5   Bandwidth Characteristics of the CMPX Module

Characteristic	Peak Bandwidth	Sustainable Bandwidth
NUMAlink channel	6.4 GB/s full duplex 3.2 GB/s each direction	~2.8 GB/s each direction
Main memory	Up to 10.8 GB/s	Up to 10.8 GB/s
Front Side Bus (FSB)	6.4 GB/s	~6.4 GB/s

Table A-6 lists the specifications for the CMPX module.

Table A-6   CMPX Module Specifications

Characteristic	Specifications
Height	3.44 in. (8.80 cm)
Width	17.06 in. (43.36 cm)
Depth	27 in. (68.58 cm) (with bezel)
Weight	50 lb (22.7 kg) maximum configuration[a]
Heat dissipation	1467 Btu/hr maximum
Input power	120 - 240 VAC

a. Weight will vary slightly depending on whether the module has processors, one or two power supplies, on the number of DIMMs installed, and on PCI cards in the unit.

Rack Specifications

The server system can be housed in short (17U) or tall (39U) racks.

Note: One U is 1.75 in. (4.45 cm).

Table A-7 lists the specifications of the short rack.

Table A-7   Short Rack Specifications (with Skins)

Characteristic	Specification
Height	36.06 in. (916 mm)
Width	25.38 in. (645 mm)
Depth	40.63 in. (1032 mm)
Weight (maximum)	610 lb (277 kg)
Shipping weight (maximum)	685 lb (312 kg)

Table A-8 lists the specifications of the tall rack.

Table A-8   Tall Rack Specifications

Characteristic	Specification
Height	75.82 in. (1925.83 mm)
Width	23.62 in. (599.95 mm)
Depth	41.25 in. (1048 mm)
Weight (maximum)	1,366 lb (620 kg)
Shipping weight (maximum)	1,547 lb (702 kg)

SGI TP900 Storage Module Specifications

Table A-9 lists the specifications of the SGI TP900 storage module.

Table A-9   TP900 Storage Module Specifications

Characteristic	Specification
Height	3.37 in. (85.7 mm)
Width	17.6 in. (447 mm)
Depth	21.46 in. (545 mm)
Input power	100 - 254 VAC (~175 W)
Weight: Maximum configuration Empty enclosure	 48.5 lb (22 kg) 14.3 lb (6.5 kg)

Non-proprietary I/O Port Specifications

This section provides pin assignment information for the non-proprietary connectors on the following components:

- Compute module (base and expansion)

- CMPX module

- L2 controller

- TP900 storage module

Compute Module

Table A-10 lists the non-proprietary connectors that are located on the rear panel of the compute module (see Figure A-1). The third column of the table indicates where you can find the pin assignments for these connectors.

Table A-10   Compute Module Connectors

Port	Connector	Pin Assignments
Optional PCI serial ports [a]	DB-9	See Figure A-5 on page 221
Console port	DB-9	See Figure A-5 on page 221
Ethernet port	RJ-45	See Figure A-6 on page 222 and Table A-13 on page 222
External serial port	IEEE 1284 36-pin MDR multi-port serial adapter	See Figure A-8 on page 225 and Table A-15 on page 225
External SCSI port[b]	SCSI 68-pin VHDCI	See Figure A-7 on page 223 and Table A-14 on page 223
RT interrupt input and output ports[c]	Stereo jack	Not supported under Linux
L1 port	USB type B	See Figure A-10 on page 228 and Table A-17 on page 228

a. Standard with IO10 base I/O PCI card via adapter cable, requires optional PCI card with IO9.

b. These connectors are available only when the compute module has an IO9 PCI card.

c. These connectors are not functionally supported under SGI Linux + ProPack.
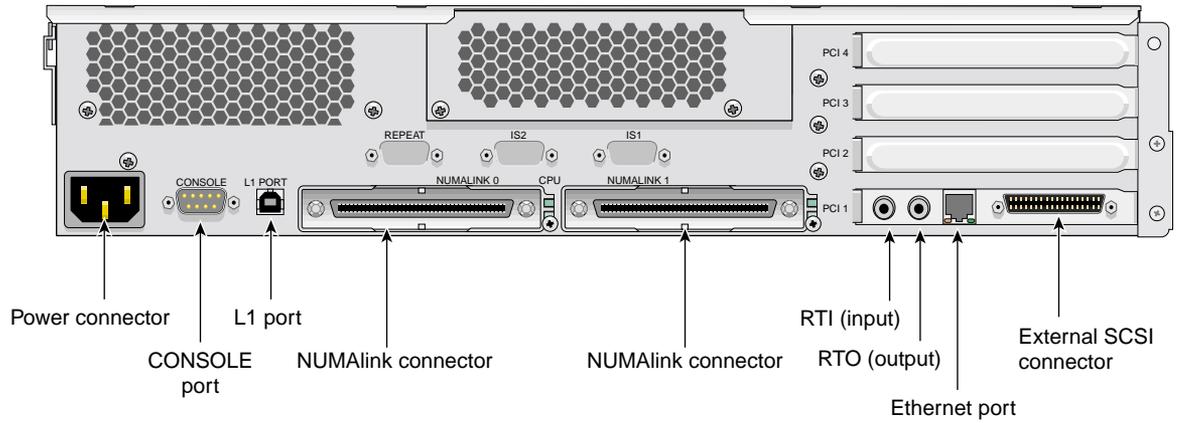
Figure A-1   Rear Panel of Compute Module Wth Optional IO9

Note: The RT interrupt input and RT interrupt output functionality of the IO10 or optional IO9 base I/O PCI card is not supported under SGI Linux + ProPack.

CMPX Module

Table A-11 lists the non-proprietary connectors that are located on the rear panel of the CMPX module (see Figure A-2). The third column of the table indicates where you can find the pin assignments for these connectors.

Table A-11   CMPX Module Connectors

Port	Connector	Pin Assignments
Console port	DB-9	See Figure A-5 on page 221
L1 port	USB type B	See Figure A-10 on page 228 and Table A-17 on page 228
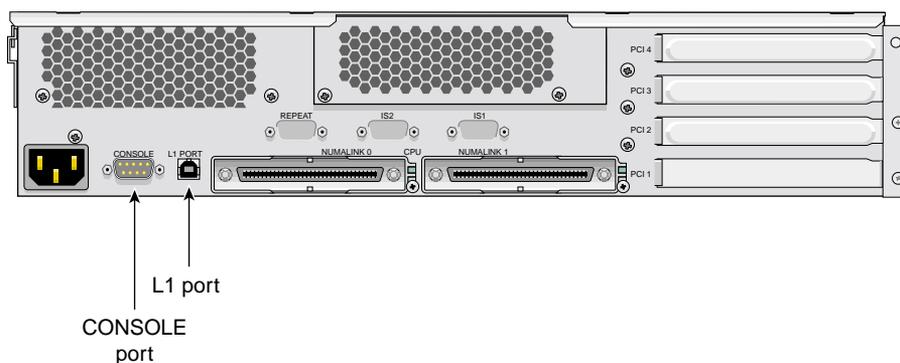
Figure A-2   Non-Proprietary Connectors on Rear Panel of CMPX Module

L2 Controller

Table A-12 lists the non-proprietary connectors that are located on the rear panel of the optional L2 controller (see Figure A-3). The third column of the table indicates where you can find the pin assignments for these connectors.

Table A-12   L2 Controller Connectors

Port	Connector	Pin Assignments
Console (serial port)	DB-9	See Figure A-5 on page 221
Modem (serial port)	DB-9	See Figure A-5 on page 221
Ethernet port	RJ-45	See Figure A-6 on page 222 and Table A-13 on page 222
L1 ports (four ports)	USB type A	See Figure A-9 on page 227 and Table A-16 on page 227
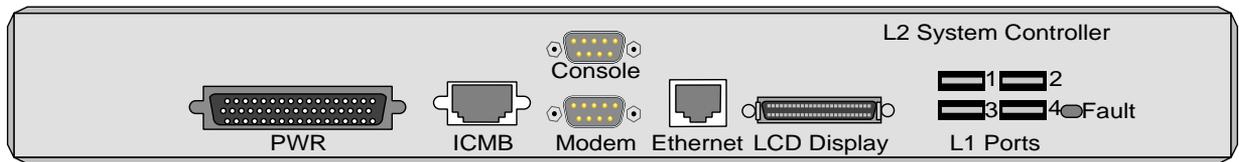
Figure A-3   Non-Proprietary Connectors on Rear of Optional L2 Controller

SGI TP900 Storage Module

Figure A-4 shows the two SCSI port connectors on the rear panel of the TP900 storage module. Figure A-7 on page 223 shows how the pin numbers are distributed on the SCSI connector, and Table A-14 on page 223 lists the pin assignments.

SCSI port connectors
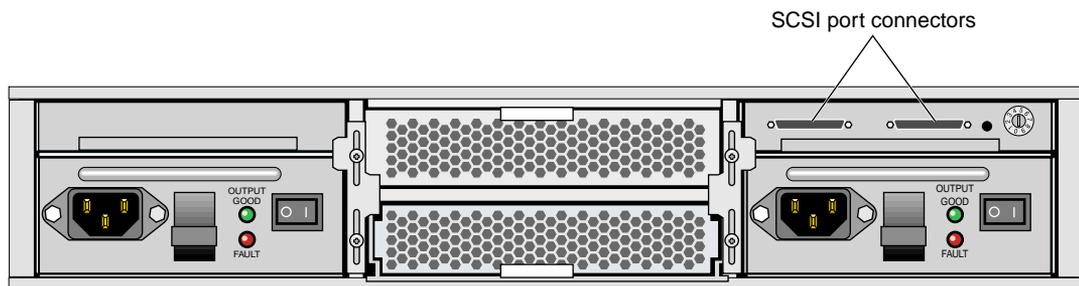
Figure A-4   Non-proprietary Connectors on Rear Panel of TP900 Module

DB-9 Connector

Figure A-5 shows the DB-9 connector pin assignments. This connector is used for the console port of the compute module. It is also used as the console port of the CMPX module, and the console and modem ports of the optional L2 controller.

Pin 2
Receive
data
(RD)

Pin 4
Data terminal
ready (DTR)
(not used)

Pin 1
Data carrier
detect (DCD)
(not used)

Pin 3
Transmit
data (TD)

Pin 5
Ground

Pin 6
Data set
ready (DSR)
(not used)

Pin 9
Ringing indicator (RI)
(not used)

Pin 7
Request to
send (RTS)

Pin 8
Clear to
send (CTS)
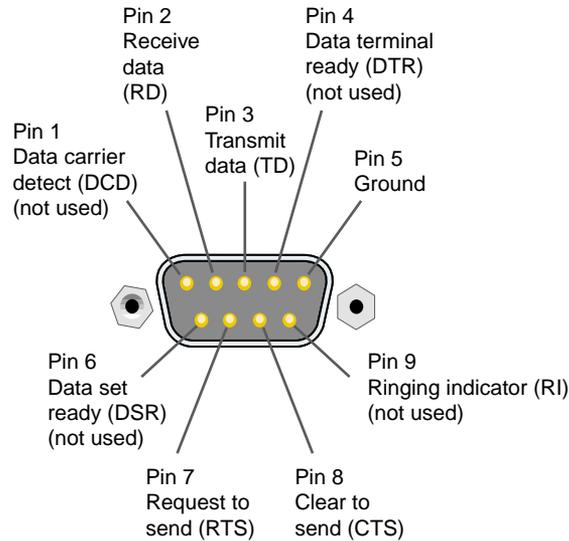
Figure A-5   DB-9 Connector Pin Assignments

RJ-45 Connector

Figure A-6 shows the pin locations for the RJ-45 connector on the base I/O PCI card and the optional L2 controller. Table A-13 shows the pin assignments for the RJ-45 connector.
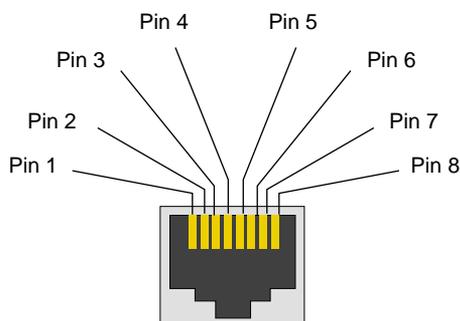
Figure A-6   RJ-45 Connector Pin Assignments

Table A-13   Ethernet Connector Pin Assignments

10/100BaseT Ethernet Pinouts Pin	Assignment	1000BaseT Ethernet Pinouts Pin	Assignment
1	Transmit +	1	Transmit/Receive 0+
2	Transmit –	2	Transmit/Receive 0–
3	Receive +	3	Transmit/Receive 1+
4	Not used	4	Transmit/Receive 2+
5	Not used	5	Transmit/Receive 2–
6	Receive –	6	Transmit/Receive 1–
7	Not used	7	Transmit/Receive 3+
8	Not used	8	Transmit/Receive 3–

External SCSI Port Connector (Optional IO9)

Figure A-7 shows the connector pin locations for the external SCSI VHDCI connector. This connector is used on the optional IO9 base I/O PCI card and the TP900 storage module. Table A-14 lists the pin assignments for this SCSI connector.
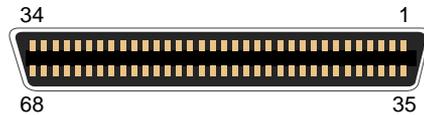
Figure A-7   Pin Number Locations for External SCSI Port

Table A-14   SCSI VHDCI Pin Assignments

Pin Number	Signal Name	Pin Number	Signal Name
1	+DB (12)	35	-DB (12)
2	+DB (13)	36	-DB (13)
3	+DB (14)	37	-DB (14)
4	+DB (15)	38	-DB (15)
5	+DB (P1)	39	-DB (P1)
6	+DB (0)	40	-DB (0)
7	+DB (1)	41	-DB (1)
8	+DB (2)	42	-DB (2)
9	+DB (3)	43	-DB (3)
10	+DB (4)	44	-DB (4)
11	+DB (5)	45	-DB (5)
12	+DB (6)	46	-DB (6)
13	+DB (7)	47	-DB (7)
14	+DB (P0)	48	-DB (P0)
15	Ground	49	Ground

Table A-14   SCSI VHDCI Pin Assignments **(continued)**

Pin Number	Signal Name	Pin Number	Signal Name
16	DIFFSENS	50	Ground
17	TERMPWR	51	TERMPWR
18	TERMPWR	52	TERMPWR
19	Reserved	53	Reserved
20	Ground	54	Ground
21	+ATN	55	-ATN
22	Ground	56	Ground
23	+BSY	57	-BSY
24	+ACK	58	-ACK
25	+RST	59	-RST
26	+MSG	60	-MSG
27	+SEL	61	-SEL
28	+CD	62	-CD
29	+REQ	63	-REQ
30	+IO	64	-IO
31	+DB (8)	65	-DB (8)
32	+DB (9)	66	-DB (9)
33	+DB (10)	67	-DB(10)
34	+DB (11)	68	-DB (11)

External Multi-port Serial Adapter Connector

Figure A-8 shows the connector pin locations for the multi-port serial adapter connector located on the IO10 base I/O PCI card.
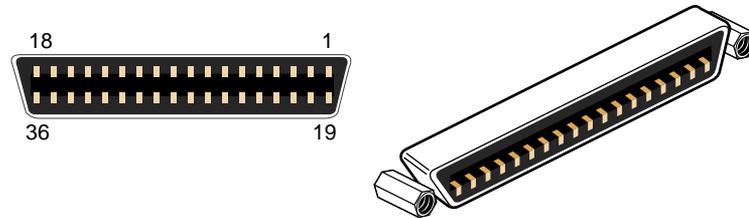
Figure A-8   Pin Number Locations for 36-pin MDR Connector

Table A-15 lists the pin assignments for the multi-port serial adapter connector.

Table A-15   Multi-port Serial Adapter Pinouts

Pin	Assignment	Pin	Assignment
1	GND	19	S0 DSR
2	S0 DCD	20	S0 RTS
3	S0 RXD	21	S0 CTS
4	S0 TXD	22	S0 RI
5	S0 DTR	23	GND
6	S1 DSR	24	S1 DCD
7	S1 RTS	25	S1 RXD
8	S1 CTS	26	S1 TXD
9	S1 RI	27	S1 DTR
10	GND	28	S2 DSR
11	S2 DCD	29	S2 RTS
12	S2 RXD	30	S2 CTS
13	S2 TXD	31	S2 RI

Table A-15   Multi-port Serial Adapter Pinouts **(continued)**

Pin	Assignment	Pin	Assignment
14	S2 DTR	32	GND
15	S3 DSR	33	S3 DCD
16	S3 RTS	34	S3 RXD
17	S3 CTS	35	S3 TXD
18	S3 RI	36	S3 DTR

USB Type A Connector

Figure A-9 shows the USB type A connector that is used for USB ports 1 through 4 of the optional L2 controller that connect to the compute and/or CMPX modules. Table A-16 lists the pin assignments.
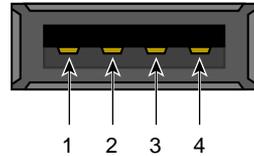
Figure A-9   Pin Number Locations for USB Type A Connector

Table A-16   Pin Assignments for USB Type A Connector

Signal	Color	Pin Number
VCC	Red	1
-Data	White	2
+Data	Green	3
Ground	Black	4

USB Type B Connector

Figure A-10 shows the USB type B connector that is used for the USB L1 port of the compute module and the CMPX module. Table A-17 lists the pin assignments.
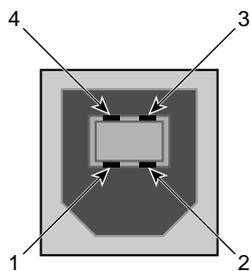
Figure A-10   Pin Number Locations for USB Type B Connector

Table A-17   Pin Assignments for USB Type B Connector

Signal	Color	Pin Number
VCC	Red	1
-Data	White	2
+Data	Green	3
Ground	Black	4

Regulatory Specifications and Safety Information

This appendix presents regulatory information that may be important to the operation of your SGI Altix 350 server system.

Manufacturer's Regulatory Declarations

The Altix 350 server system products conform to several national and international specifications and European Directives listed on the "Manufacturer's Declaration of Conformity." The CE insignia displayed on each device is an indication of conformity to the European requirements.

⚠ **Caution:** Each SGI server system has several governmental and third-party approvals, licenses, and permits. Do not modify this product in any way that is not expressly approved by SGI. If you do, you may lose these approvals and your governmental agency authority to operate this device.

Server Model Number

The CMN (model) number for each server is printed on the system label on the unit.

CE Notice and Manufacturer's Declaration of Conformity

The "CE" symbol indicates compliance of the device to directives of the European Community. A "Declaration of Conformity" in accordance with the standards has been made and is available from SGI upon request.

Electromagnetic Emissions

This section provides the contents of electromagnetic emissions notices for various countries.

FCC Notice (USA Only)

This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.

- This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, you are encouraged to try to correct the interference by using one or more of the following methods:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

Caution: Changes or modifications to the equipment not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

Industry Canada Notice (Canada Only)

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique német pas de perturbations radioélectriques dépassant les normes applicables aux appareils numériques de Classe A préscrites dans le Règlement sur les interferences radioélectriques établi par le Ministère des Communications du Canada.

VCCI Notice (Japan Only)

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に
基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると
電波妨害を引き起こすことがあります。この場合には使用者が適切な
対策を講ずるよう要求されることがあります。

Chinese Class A Regulatory Notice

警告使用者：

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻
干擾，在這種情況下，使用者會被要求採取某些適當的對策．

Korean Class A Regulatory Notice

이 기기는 업무용으로 전자파적합등록을 한 기기이오니 판매자
또는 사용자는 이 점을 주의하시기 바라며 만약 잘못 판매 또는
구입하였을 때에는 가정용으로 교환하시기 바랍니다.

Shielded Cables

The Altix 350 server system product is FCC compliant under test conditions that include the use of shielded cables between the server and its peripherals. Your server and any peripherals that you purchase from SGI have shielded cables. Shielded cables reduce the possibility of interference with radio, television, and other devices. If you use any cables that are not from SGI, ensure that they are shielded. Telephone cables do not require shielding.

Optional monitor cables supplied with your server system use additional filtering molded into the cable jacket to reduce radio frequency interference. Always use the cable that is supplied with your system. If your monitor cable becomes damaged, obtain a replacement cable from SGI.

Electrostatic Discharge

SGI designs and tests its products to be resistant to the effects of electrostatic discharge (ESD). ESD is a source of electromagnetic interference and can cause problems ranging from data errors and lockups to permanent component damage.

It is important that you keep all the covers and doors, including the plastics, in place while you are operating the server system. The shielded cables that came with the server and its peripherals should be installed correctly, with all thumbscrews fastened securely.

An ESD wrist strap may be included with some products, such as memory or PCI upgrades. Use the wrist strap when you install these upgrades to prevent the flow of static electricity; it is designed to protect your system from ESD damage.

Laser Compliance Statements

The DVD-ROM drive in this computer is a Class 1 laser product. The DVD-ROM drive-classification label is located on the drive.

Warning: **Invisible laser radiation when open. Avoid exposure to beam.**

Warning: Attention: Radiation du faisceau laser invisible en cas d'ouverture. Evitter toute exposition aux rayons.

Warning: Vorsicht: Unsichtbare Laserstrahlung, Wenn Abdeckung geöffnet, nicht dem Strahl aussetzen.

Warning: Advertencia: Radiación láser invisible al ser abierto. Evite exponerse a los rayos.

Warning: Advarsel: Laserstråling vedåbning se ikke ind i strålen

Warning: Varo! Lavattaessa Olet Alttina Lasersåteilylle

Warning: Varning: Laserstrålning når denna del år öppnad ålå tuijota såteeseenstirra ej in i strålen.

Warning: Varning: Laserstrålning nar denna del år öppnadstirra ej in i strålen.

Warning: Advarsel: Laserstråling nar deksel åpnesstirr ikke inn i strålen.

Lithium Battery Statement

Warning: Only qualified service personnel should replace the soldered lithium battery (or batteries) in the SGI Altix 350 server system.

Warning: Advarsel!: Lithiumbatteri - Eksplosionsfare ved fejlagtig håndtering. Udskiftning må kun ske med batteri af samme fabrikat og type. Léver det brugte batteri tilbage til leverandøren.

Warning: Advarsel: Eksplosjonsfare ved feilaktig skifte av batteri. Benytt samme batteritype eller en tilsvarende type anbefalt av apparatfabrikanten. Brukte batterier kasseres i henhold til fabrikantens instruksjoner.

Warning: Varning: Explosionsfara vid felaktigt batteribyte. Använd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren. Kassera använt batteri enligt fabrikantens instruktion.

Warning: Varoitus: Paristo voi räjähtää, jos se on virheellisesti asennettu. Vaihda paristo ainoastaan laitevalmistajan suosittelemaan tyyppiin. Hävitä käytetty paristo valmistajan ohjeiden mukaisesti.

Warning: Vorsicht!: Explosionsgefahr bei unsachgemäßen Austausch der Batterie. Ersatz nur durch denselben oder einen vom Hersteller empfohlenem ähnlichen Typ. Entsorgung gebrauchter Batterien nach Angaben des Herstellers.

Index