SGI® Altix® 450 System User's Guide

Record of Revision

Version	Description
-001	August 2006, First release
-002	March 2007, Engineering updates to cover RAID 1, DVD-R/W, 2D graphics and IA2.
-003	October, 2007 Engineering updates covering enhanced processor/memory boards.

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About This Guide

This guide provides an overview of the installation, architecture, general operation and descriptions of the major components that compose the SGI® Altix® 450 family of systems. It also provides the standard procedures for powering on and powering off the system, basic troubleshooting and maintenance information, and important safety and regulatory specifications.

Audience

This guide is written for owners, installers, system administrators, and users of SGI Altix 450 computer systems. It is written with the assumption that the reader has a good working knowledge of computers and computer systems.

Important Information

Warning: **To avoid problems that could void your warranty, your SGI or other approved system support engineer (SSE) should perform any replacement of parts, or service of your SGI Altix 450 system not covered in the following list of items that you can perform yourself:**

- Unpacking, setting up and connecting the system rack(s) and individual rack units IRU(s).

- Using your system console and your L1 controller to enter commands and perform system functions such as powering on and powering off, as described in this guide.

- Adding and replacing system blades and DIMM memory as described in this guide.

- Adding and replacing PCI, PCI-X and PCI express cards, as described in this guide.

- Replacing fan modules and power supplies in the individual rack unit (IRU) enclosures.

- Adding and replacing DVD or disk drives in the base IA/IA2 (I/O) blade.

- Using the On/Off switch and other switches (the reset and non-maskable interrupt [NMI] switches) on the system IA or IA2 blade (base I/O).

- Using the ESI/ops panel (operating panel) on optional mass storage bricks. See the user's guide for your optional SGI mass storage enclosure.

Chapter Descriptions

The following topics are covered in this guide:

- Chapter 1, "System Installation" guides an installer through the steps of unpacking and positioning the system rack(s). Rack mounting guidelines and basic cabling for the IRUs is also covered.

- Chapter 2, "Operation Procedures," provides instructions for operation of the system including powering on and powering off your system.

- Chapter 3, "System Overview," provides environmental and technical information needed to properly set up and configure the Altix 450 series system.

- Chapter 4, "System Control," describes the function of the L1 and L2 controllers and provides instructions for operating the controllers.

- Chapter 5, "Rack Information," describes the rack sizes and features.

- Chapter 6, "Maintenance and Upgrade Procedures," provides instructions for installing or removing the customer-replaceable components of your system.

- Chapter 7, "Troubleshooting and Diagnostics," provides recommended actions if problems occur on your system.

- Appendix A, "Technical Specifications and Pinouts," provides physical, environmental, and power specifications for your system. Also included are the pinouts for the non-proprietary connectors.

- Appendix B, "Safety Information and Regulatory Specifications," lists all regulatory information related to use of the Altix 450 system in the United States and other countries. It also provides a list of safety instructions to follow when installing, operating, or servicing the product.

Related Publications

The following SGI documents are relevant to the Altix 450 series system:

- *SGI L1 and L2 Controller Software User's Guide*
  (P/N 007-3938-00*x*)

  This guide describes how to use the L1 and L2 controller commands at your system console to monitor and manage your SGI system.

- *SGI InfiniteStorage 120 Mass Storage Hardware Topics*
  (P/N 007-4853-00*x*)

  This document provides a hardware overview of the SGI non-RAID 12-drive optional mass storage enclosure used with Altix 450 systems.

- *Reconfigurable Application-Specific Computing User's Guide*
  (P/N 007-4718-00*x*)

  This guide discusses the optional SGI reconfigurable application-specific software computing (RASC) program that delivers scalable, configurable computing elements for the SGI Altix family of servers and superclusters.

- Man pages (online)

  Man pages locate and print the titled entries from the online reference manuals.

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.

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

- You can also view man pages by typing **man** *<title>* on a command line.

SGI systems include a set of Linux man pages, formatted in the standard UNIX "man page" style. Important system configuration files and commands are documented on man pages. These are found online on the internal system disk (or on a DVD) and are displayed using the `man` command. For example, to display the man page for the `xscsidisktest` command, type the following on a command line:

```
man xscsidisktest
```

References in the documentation to these pages include the name of the command and the section number in which the command is found.

For additional information about displaying man pages using the `man` command, see `man(1)`.

In addition, the `apropos` command locates man pages based on keywords. For example, to display a list of man pages that describe disks, type the following on a command line:

`apropos disk`

For information about setting up and using `apropos`, see `apropos(1)`.

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 bold 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

*   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
    1140 East Arques Avenue, M/S 50-1-946
    Sunnyvale, California 94085

SGI values your comments and will respond to them promptly.

System Installation

This chapter describes how to unpack and install your Altix 450 system. Specifically, the following topics are covered:

If you have arranged to have your system installed and set up by SGI professional services personnel, you can skip this chapter and go on to Chapter 2, "Operation Procedures".

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 IRUs to a Power Source" on page 31

    – "Connecting the System Console" on page 36

- If you have ordered un-racked IRU modules 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

    – "Installing the IRUs in a Rack" on page 24

    – "NUMAlink Cabling the System IRUs" on page 29

    – "Cabling the System IRUs to a Power Source" on page 31

    – "Connecting the System Console" on page 36

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

- 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

Before you install an Altix 450 system, you should familiarize yourself with the safety precautions discussed in the following subsections:

Hazard Statements

During the installation of your Altix 450 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 an IRU, to move the IRU(s) from one location to another, and to install the IRU(s) in a rack. Otherwise, someone could be seriously injured. Note that IRUs should have blades and power supplies removed to make the unit easier to lift and position.**

- 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 PDU 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 a rack from toppling over:
    - Install all equipment in the lowest available position in the rack.
    - Use optional seismic tiedowns where appropriate.
    - Always site the unit on a level surface.

Installing a Rack

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

- "Preinstallation Activities" on page 6

- "Unloading and Moving System Equipment" on page 12

- "Removing a Short Rack from the Shipping Crate" on page 16

- "Unpacking and Installing the Tall Rack" on page 18

- "Positioning and Leveling Racks" on page 21

After you have completed installing your rack, proceed to "Cabling the System IRUs to a Power Source" on page 31 to continue your installation.

If your system components were not shipped in a rack, skip this section and proceed to "Unpacking and Inspecting Modules" on page 22 to begin your installation.

Preinstallation Activities

Perform the following preinstallation activities:

- Perform site verifications (see "Site Plan Verification" on page 6)

- Gather appropriate tools to complete the installation (see "Tools Required" on page 7)

- Ensure that the correct power receptacle is installed and properly wired (see "Power Receptacle Verification" on page 8)

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).

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 450 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.

Optional three-phase power distribution is available in systems mounted in 42U (tall) racks.

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.
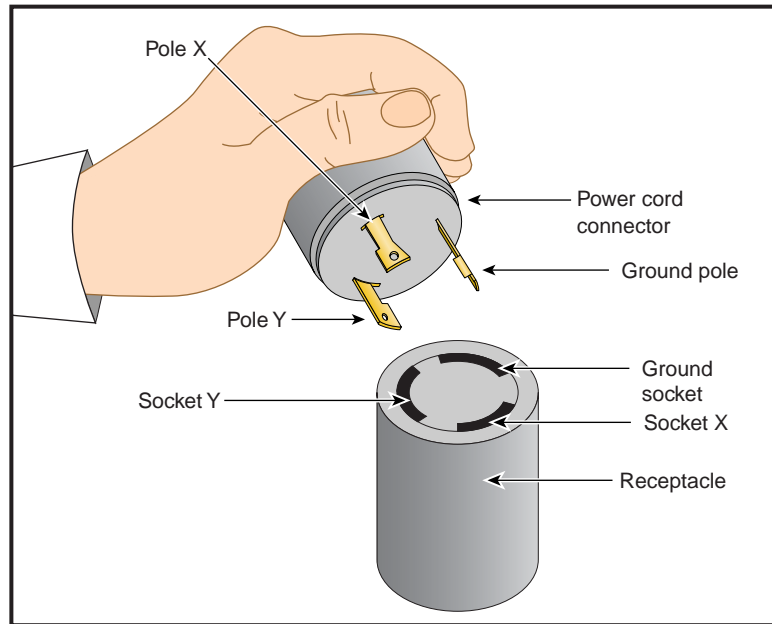
Figure 1-1   30-amp Single-phase Power Receptacle for North American Sites

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.
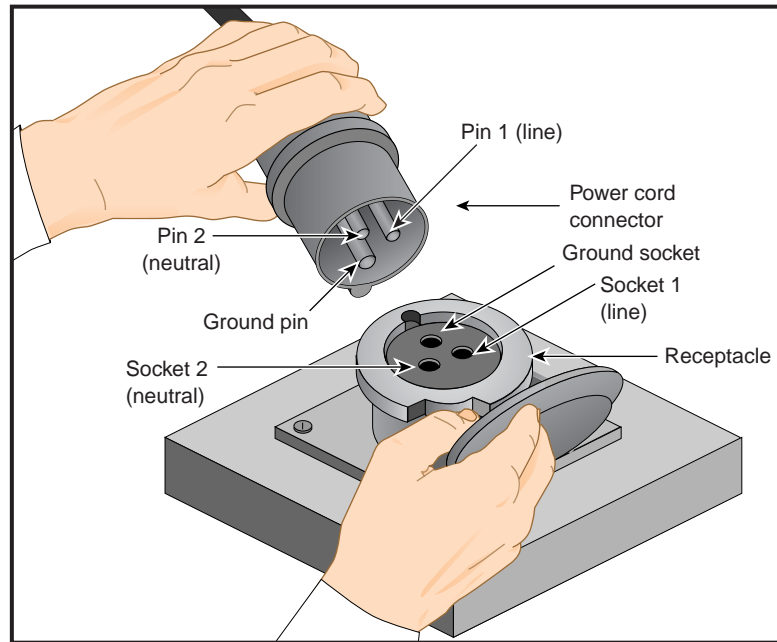
Figure 1-2   32-amp Single-phase Power Plug for International Sites

Unloading and Moving System Equipment

Your Altix 450 system arrives at the site in a pallet-mounted cardboard shipping crate.

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. Optional storage or monitors are shipped in a separate carton.

For a tall rack system, the system documentation; accessories; and other optional hardware arrive in separate cartons.

If you have purchased optional installation support from SGI service skip the following sections and go on to the next chapter.

This section describes how to unload and transport the rack 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 SGI site planning by e-mail (site@sgi.com).

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.
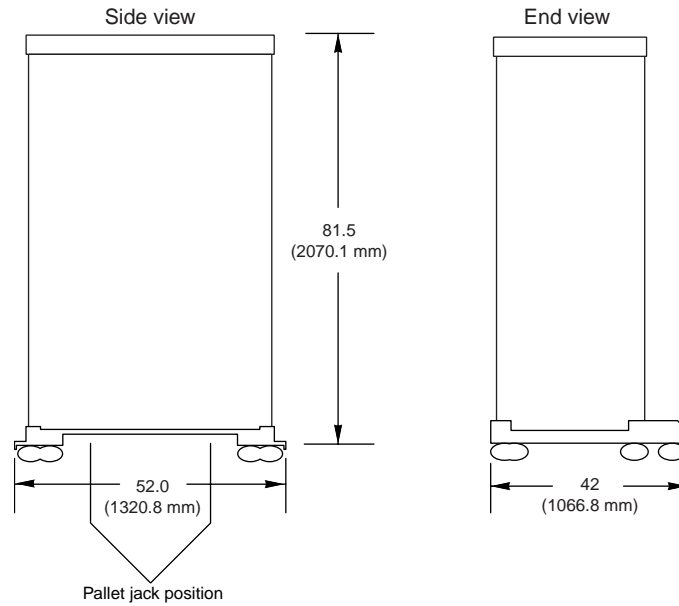
Figure 1-3   Dimensions of Tall Rack Shipping Crate

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.
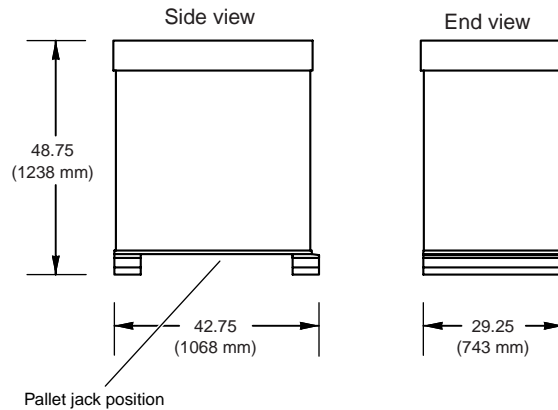
Figure 1-4   Dimensions of Short Rack Shipping Crate

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.

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 ºF (22 ºC) 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. Use a pallet jack to move the rack to the unpacking site. 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 and move the crate to the installation location.

2. Remove all external banding and lift the crate's ramp away from the unit.

3. Remove the cardboard carton top and packing/insulation materials.

4. Prepare to move the rack off the crate using the following steps:

    a. Remove the two bolts that hold the pallet's rear retention bracket in place.

    b. Remove the two bolts that hold the rear "gate" of the pallet in place.

    c. Remove the two bolts that hold the pallet's front retention bracket in place.

5. Align the holes in the edge of the ramp with the holes at the rear of the crate and secure the ramp in place using the two bolts removed from the pallet's rear gate.

6. Using two people, carefully pull the rack off the crate and roll it down the ramp.

Warning: The maximum weight of the short rack is 750 lbs (340 kg). Use caution when you roll the rack down the ramp.
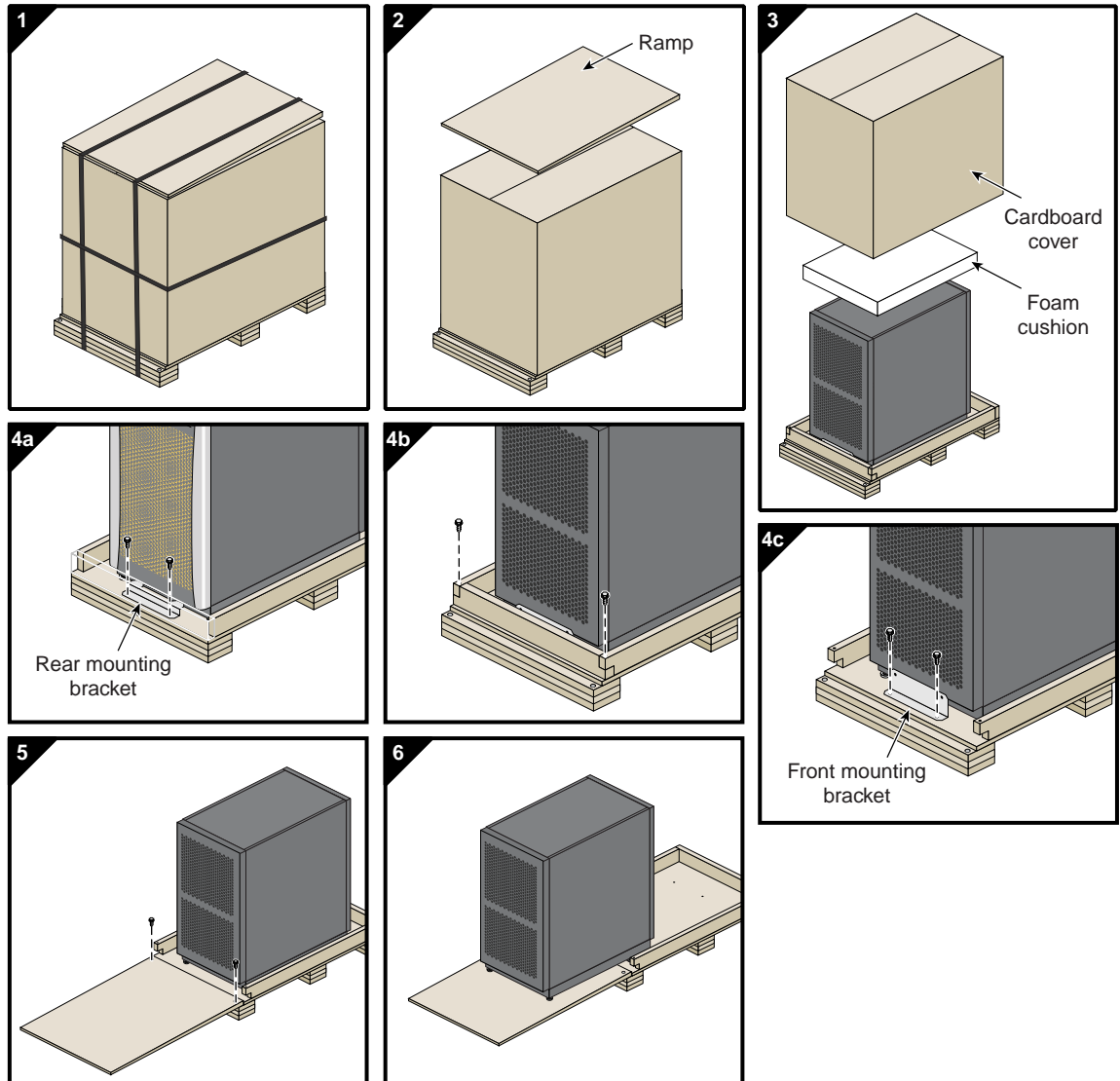
Figure 1-5   Removing a Short Rack from the Shipping Crate

Unpacking and Installing the Tall Rack

Warning: **In its maximum configuration, a (42U) tall rack system weighs approximately 1,450 lb (658 kg). Use caution when you unpack and move this rack. A pallet jack is needed to move the rack prior to unpacking. 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 (15.3 cm), 3/8-in. (13mm) drive

*   13-mm standard 3/8-in. drive socket

*   Ratchet, reversible, 3/8-in. (13mm) drive

See Figure 1-6 as you follow these steps; the numbered illustrations correspond to the numbered steps. Ensure that the temperature of the rack is acclimated to the installation environment and that the system crate is stable, and in an upright position.

1. Use a sharp cutting tool to remove the bands that secure the cardboard crate, then remove the outer packing materials.

2. Remove the cover bag and bungee cushion from the rack.

3. Locate and remove the 8 bolts that secure the wooden frame pieces to the base.

4. The rack's front and rear doors must be removed before you can remove the rack's shipping runners.

5. Remove and discard the foam plugs from either end of the rack's base. At this time you will need to place a pallet jack under the rack and lift it until the shipping runners are clear of the floor.

6. Undo and remove the two bolts on the shipping runners at either end of the rack and set the runners aside.

7. Use the pallet jack to lower the rack to the floor and use at least two people to roll the rack to the installation site.

Warning: **Personal injury and system damage could result if the rack becomes unbalanced or gains too much momentum when rolled.**

Reattach the doors to the front and rear before you move the rack to its designated location (see Figure 1-7 on page 20).
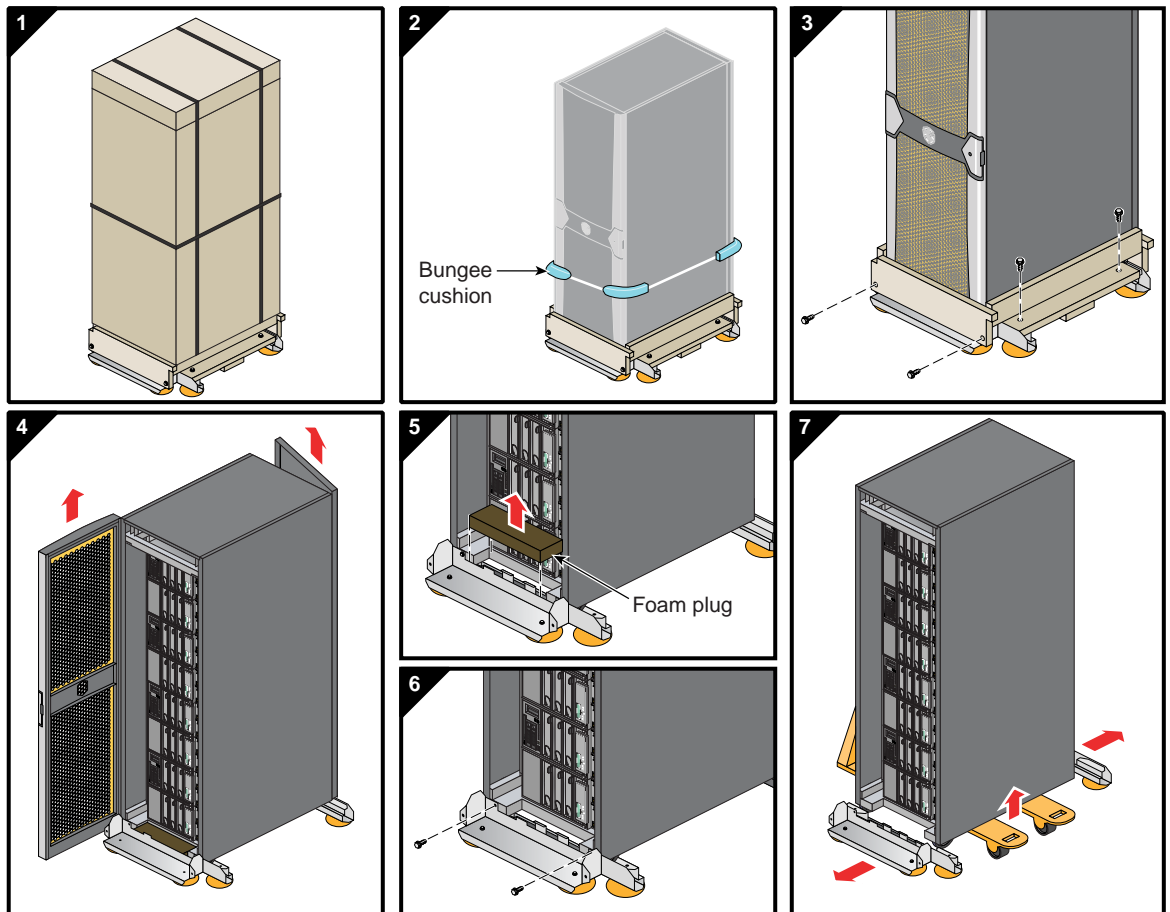
Figure 1-6   Removing a Tall Rack from the Shipping Crate
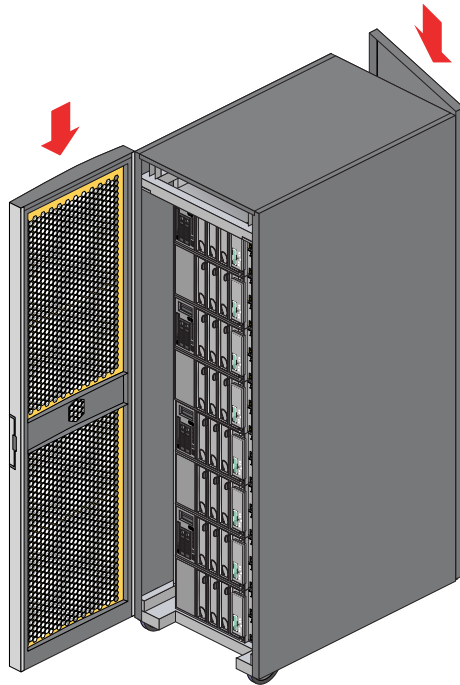
Figure 1-7   Reattaching the Tall Rack Doors

Positioning and Leveling 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 your system 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 a rack, as shown in Figure 1-8, until the rack is level.
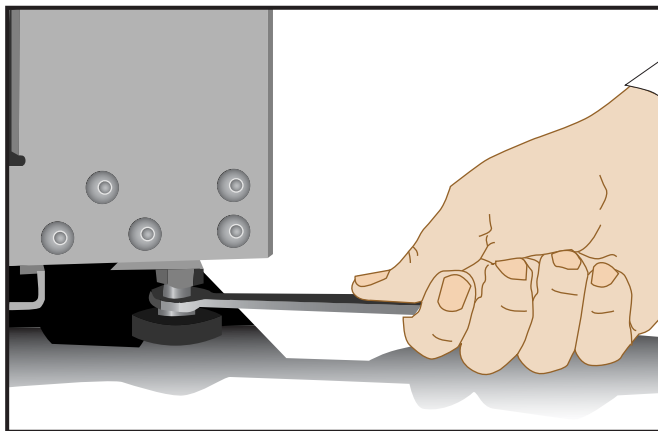
Figure 1-8   Leveling Bolts

4. If you are installing additional racks, repeat until all of the racks are level.

5. 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.

6. It is recommended you secure all racks with optional 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 1-9). Use these holes to secure the seismic tie-downs. Note that SGI does not supply the seismic tie-downs.

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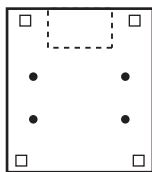
Top view of tall rack
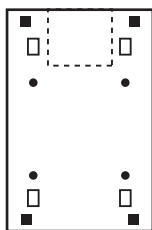
- Seismic tie-down attachment points

☐ Casters

■ Leveling pads

Figure 1-9   Seismic Tie-down Attachment Points

Unpacking and Inspecting Modules

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

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

Note: When using the IRU as a stand-alone unit (set on a desk or table top) you must secure the IRU and its fan module together with connection plates. IRUs mounted in a rack are held in place by the screws at the front and rear of the unit.

Firmly connect the base module of the IRU to the fan module using these steps:

1. Align the rear connectors of the fan module with the rear of the IRU base module and carefully slide it in until it fully joins together.

2. Align the right side joining plate screw holes with the eight holes in the two adjacent modules. See Figure 1-10 for an example.

3. Insert and tighten the eight retention screws that hold the connection plate in place.

4. Repeat the process for mounting the joining plate on the left side of the IRU.
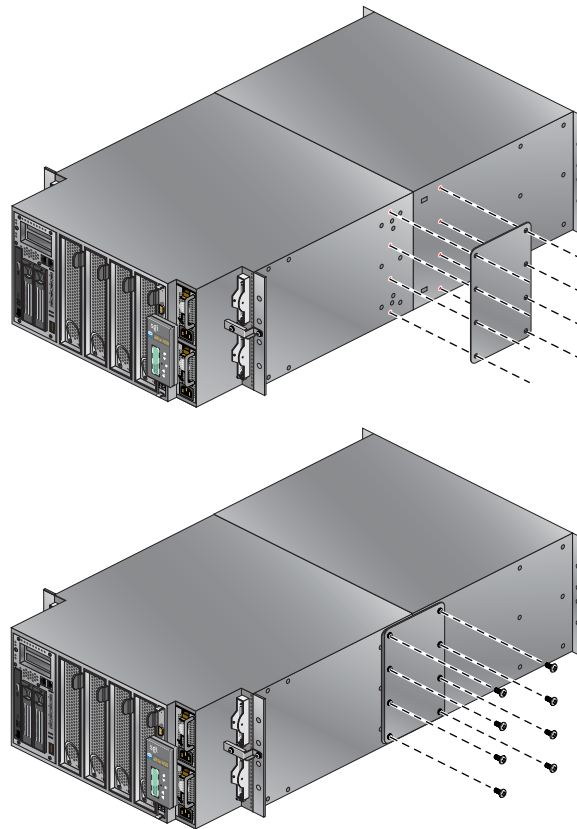
Figure 1-10   IRU Connection Plate for Desktop Systems

Installing the IRUs in a Rack

This section describes how to install the IRUs that compose an Altix 450 system in a rack. This section also describes how to remove the IRUs from a rack. You can use the instructions to rackmount one or more IRUs in a 20U (short) or 42U (tall) Altix rack.

> ⚠ **Caution:** Always use at least two people when moving, installing, or removing a rackmounted Altix 450 IRU.

This rackmounting information is found in the following sections:

- "Determining Space Requirements" on page 24
- "Determining Where to Attach Rails in a Rack" on page 25
- "Rackmounting IRUs with Shelf Rails" on page 26

Determining Space Requirements

Table 1-2 specifies the space requirements when rackmounting an IRU in a 19-inch rack.

Table 1-2   IRU Space Requirements

Height	(5U) 8.68 inches (22 cm)
Width	17.5 inches (44.45 cm)
Depth	32.5 inches (82.5 cm) with blower attached
Weight	~130 lb (59 kg) max config[a]
Required front clearance for IRU	8.25 in. (20.96 cm)
Required rear clearance for IRU	10 in. (25.40 cm)
Required side clearance for IRU	No clearance requirement
Required front clearance for rack	48 in. (122 cm)
Required rear clearance for rack	48 in. (122 cm)

a. Weight will vary slightly depending on the number of blades installed and the amount of DIMMs installed, and on whether you have one or two disk drives in the IRU.

Determining Where to Attach Rails in a Rack

The base IRU, and any additional IRUs, each require five units (5U) of vertical space within the rack (one unit is equivalent to 1.75 inches [44.5 mm]). To determine where you should install the unit's shelf rails in the rack, you must count mounting holes. Each U contains three mounting holes; therefore, in the 5U of space that the module occupies, there are 15 mounting holes. The bottom hole of the 5U space is hole 1. The top mounting hole in the 5U space is hole 15. See Figure 1-11.

Note: An IRU in the rack is identified by the lowest U number that it occupies. For example, in Figure 1-11 the IRU's bottom is in U1 (the first unit within the rack).
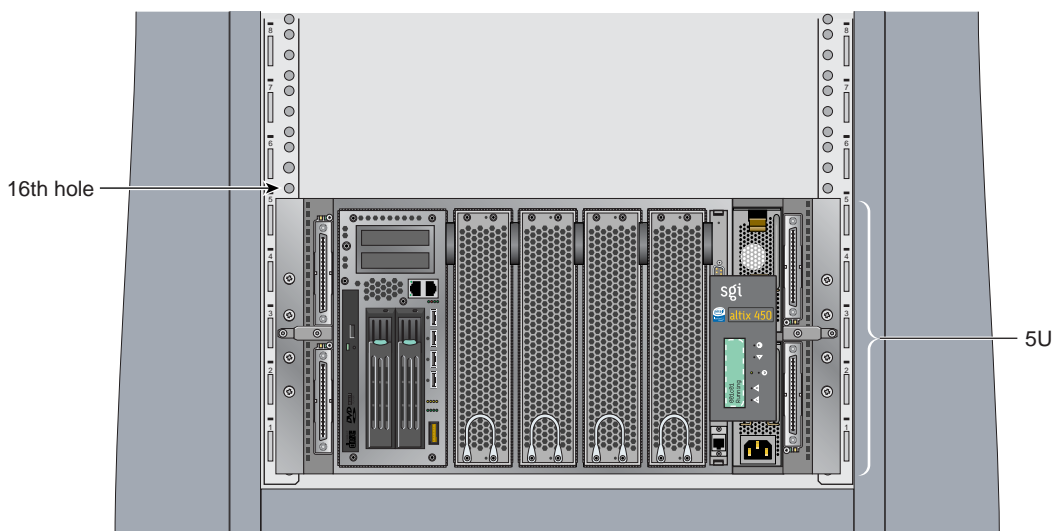
Figure 1-11   Mounting Hole Pattern of Rack Rails

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 U6 through U11, count 16 mounting holes (3 x 6 - 2) starting from the bottom of the rack. The 16th hole is the first mounting hole of U6.

Rackmounting IRUs with Shelf Rails

This section describes how to rackmount an IRU 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 IRU. See "Determining Where to Attach Rails in a Rack" on page 25 if you are uncertain.

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 1-12).

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 shelf 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. The shelf rail is held in by gravity and the tabs.

6. Repeat these steps for the right shelf rail.
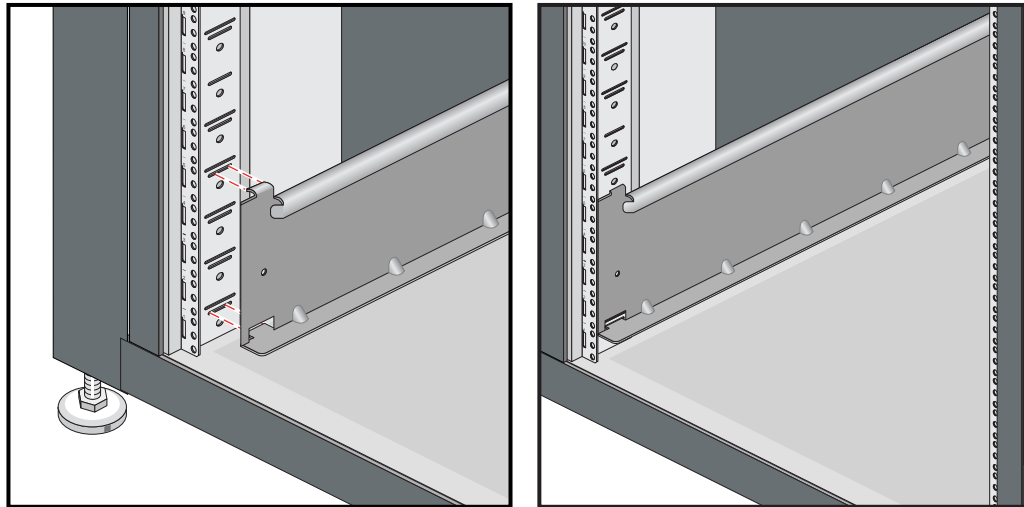
Figure 1-12   Installing the Shelf Rails in the Rack

Note: Even with the blades, power supplies and fan module disconnected, the IRU's base unit is heavy. Always use two people when installing it into a rack.

7. Working from the front of the rack, set the rear edge of the IRU module on the shelf rails. Then slide the module into the rack until the module ears are snug against the front rack rails. See Figure 1-13.

8. Fasten the module to the front rails of the rack with the screws provided. See Figure 1-13.

9. Working from the rear of the rack, align the rear connectors of the fan module with the rear of the IRU base module and carefully slide it in until it fully connects together.

10. Fasten the fan module to the rear rails of the rack with the screws provided.

10-32 x 1/2-inch screws
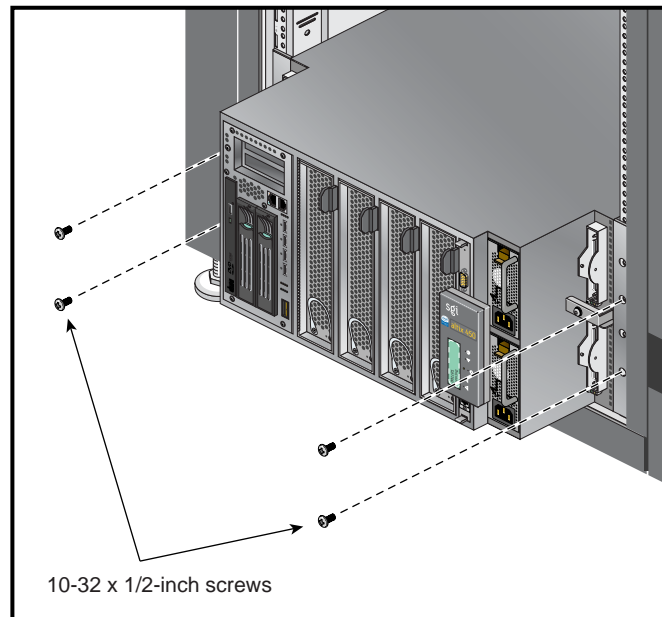
Figure 1-13   Securing the Module to the Front of the Rack

Removing a Rackmounted IRU Module

To remove an IRU that is already mounted 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 38.

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

3. Removing the system blades and power supplies from the IRU is recommended to decrease the overall weight of the unit. Be sure to place any system blades in a static-free area.

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

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

5. Remove the screws that secure the IRU at the rear of the rack.

Caution: Always use at least two people when installing or removing a rackmounted Altix 450 IRU.

6. Use a minimum of two people to slide the unit out the front of the rack. Both lifters need to place one hand securely under the IRU as it slides out to support the weight of the unit as it clears the rack.

7. Place the IRU base module on a flat, stable surface.

8. Remove the IRU's fan module from the rear of the rack and place it nearby.

NUMAlink Cabling the System IRUs

Some configurations of an Altix 450 system will consist of either two or more IRUs. This section describes how to cable together these multiple units. If your system was shipped with all the cables pre-installed, go on to the next section.

Note: If your system is made up of a single module, you can skip this section and proceed to "Cabling the System IRUs to a Power Source" on page 31 for instructions to connect your system to power.

The primary IRU module (housing the system disk), connects to additional Altix 450 IRUs via the module's front NUMAlink connectors. Figure 1-14 shows an example.

Note: Before you connect two Altix 450 IRUs to each other, you must assign unique system ID numbers to the compute modules, as follows:

1. Designate one of the IRU modules as the master server and the other IRU chassis as the slave.

2. Connect a console to the master IRU (see "Connecting the System Console" on page 36), and then power on the IRU (see "Powering the System On and Off" on page 38).

3. Use the *<slotnumber>* L1 command to set the secondary IRU's ID number to a higher number than the primary IRU's ID number. For example, if the master IRU unit's L1 prompt indicates that its ID number is 01 (001c01-L1>), then the subsidiary IRU 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.
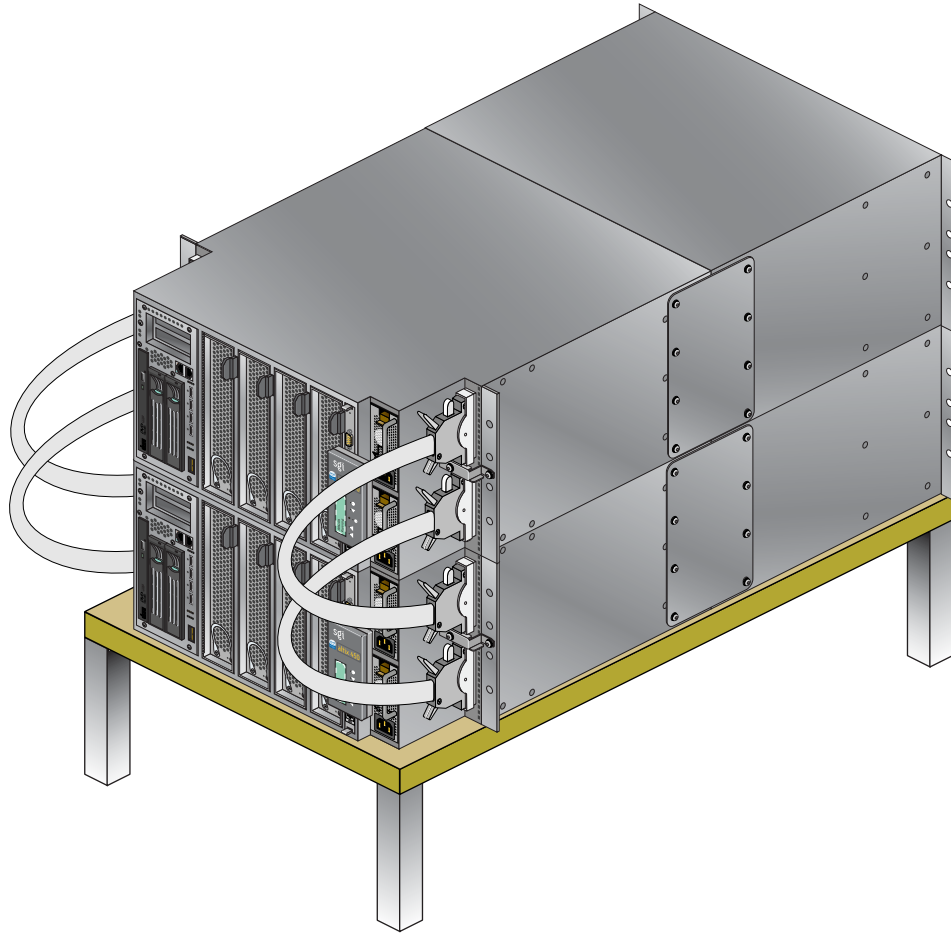
Figure 1-14   NUMAlink Cabling an IRU to an Additional IRU

To connect two Altix 450 compute modules to each other with NUMAlink cables, follow these steps:

1.   Power off both compute modules (see "Powering the System On and Off" on page 38).

2.   Connect the NUMAlink cables to the NUMAlink connectors on both IRU modules.

3.   Connect a system console to the master IRU (the one with the system disk), as described in "Connecting the System Console" on page 36.

4.   Power on both IRUs as described in "Powering the System On and Off" on page 38.

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

Note: 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.)

Cabling the System IRUs to a Power Source

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

- "Connecting an IRU Module to a Power Source (No Rack)" on page 31
- "Connecting System Modules to a Rack Power Source" on page 34

Connecting an IRU Module to a Power Source (No Rack)

If you are operating your system on a table top, connect the IRU(s) to an approved electric receptacle. See Figure 1-15 for the location of the IRU's power connectors.
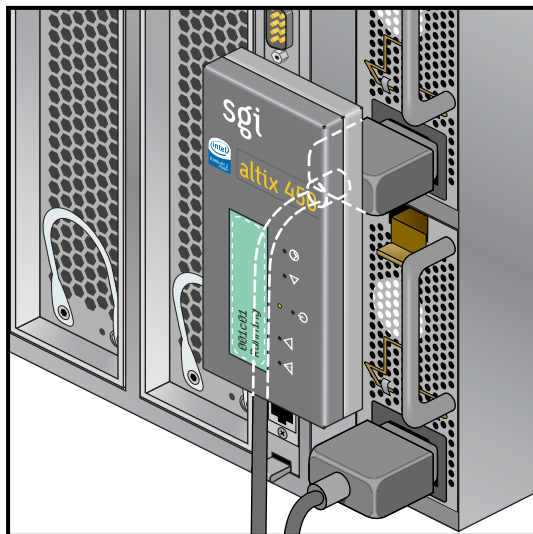
Figure 1-15   Power-Supply Connectors on the IRU Module

Figure 1-16 shows the connecting of a dual-IRU system located on either a tabletop or desktop, to a power source.

Power
distribution
unit (PDU)
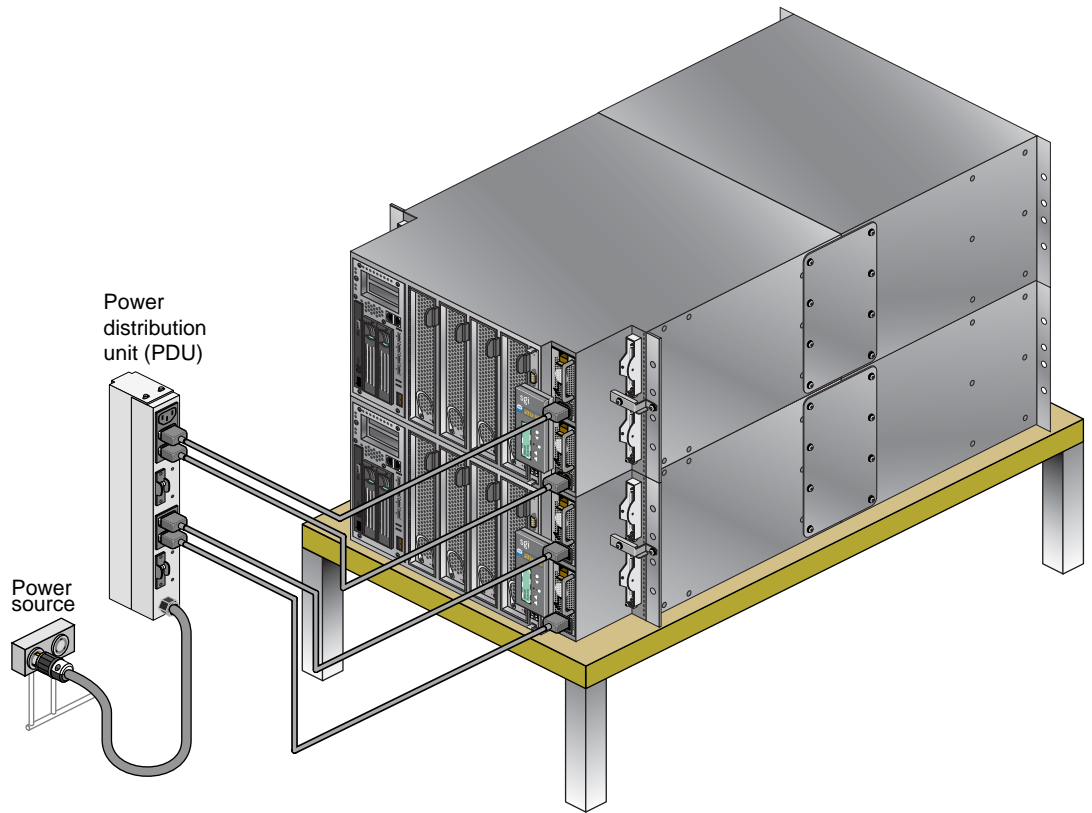
Power
source

Figure 1-16   Connecting an Unracked IRU System to a Power Source

Connecting System Modules to a Rack Power Source

If your Altix 450 system is shipped from SGI in a rack, there will be at least one power distribution unit (PDU) installed in the rack. Note that each single-phase PDU can support a maximum of two Altix 450 IRUs. Plug both power cords from each IRU into the PDU(s) installed in your short or tall rack.

Figure 1-17 shows an example of cabling the system modules that reside in a rack to a PDU.

Power distribution unit (PDU)

Power source

Components within rack
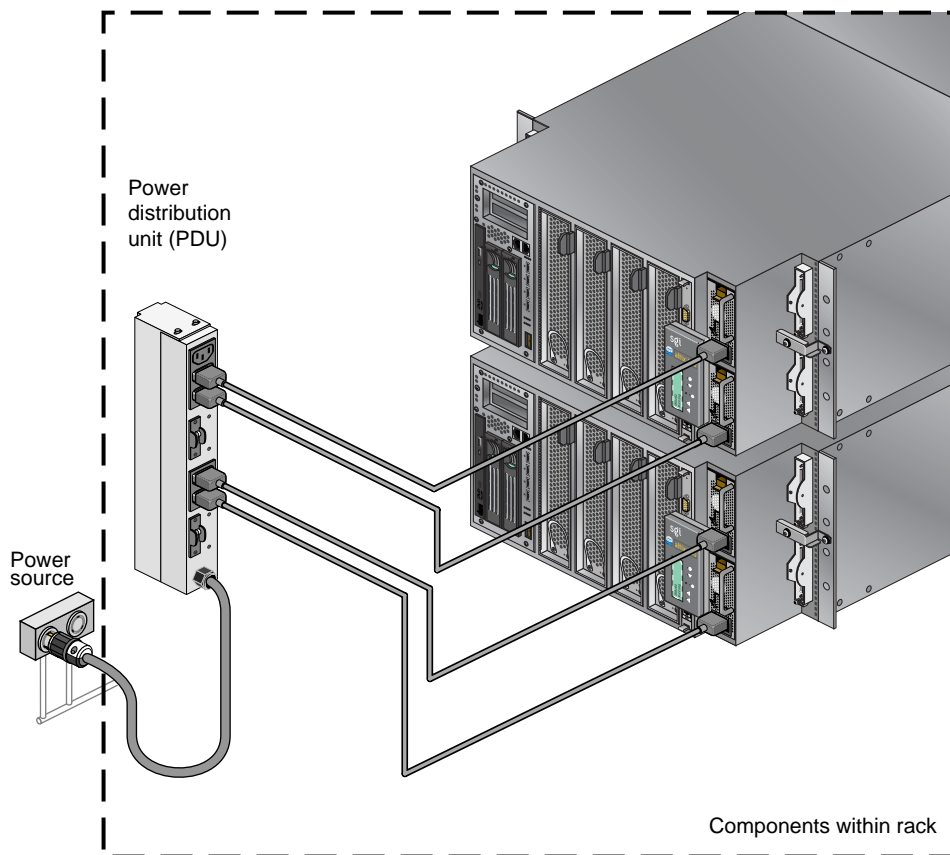
Figure 1-17   Connecting Multiple Modules to a PDU

An optional three-phase PDU (used in 42U system racks only) has 18 outlet connections, of which up to 16 may be needed to power eight IRUs. Each three-phase rack system houses a single PDU.

Figure 1-18 shows an example of the optional three-phase PDU available in tall racks only.

Power
distribution
unit (PDU)
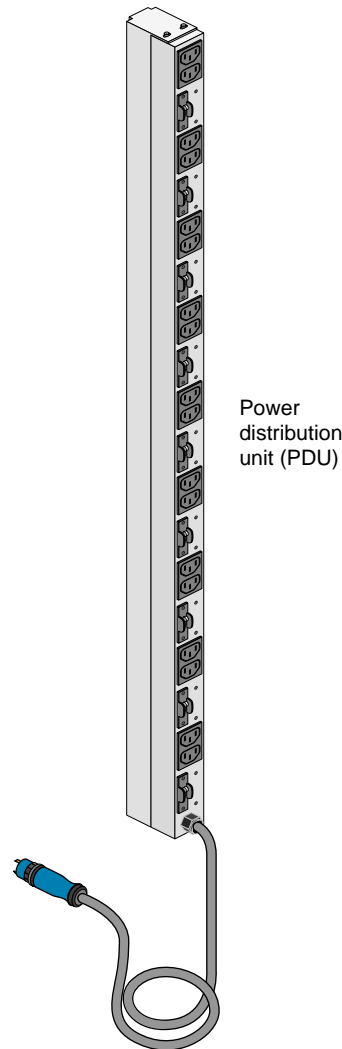
Figure 1-18   Optional Three-Phase PDU Example

Connecting the System Console

This section explains how to attach and establish a connection between a system console and an Altix 450 system. The system console enables you to perform the following activities:

- Start a Linux 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.

To attach a PC to your server system, connect a null modem serial cable between the PC and the Console port of the IRU (see Figure 1-19). 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 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.
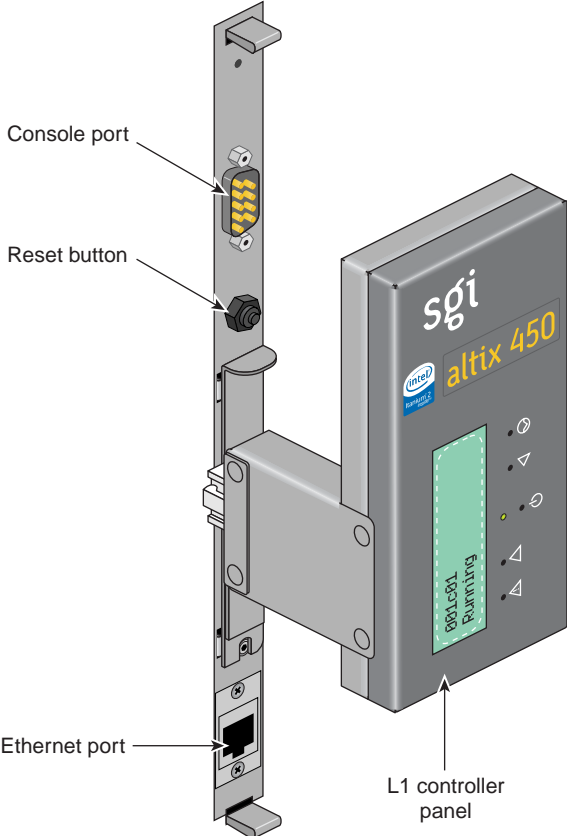
Figure 1-19   Location of the L1 Console Port

Operating Your System

This section describes how to operate your Altix 450 system, as follows:

- "Powering the System On and Off" on page 38

- "L1 Front Panel Controls" on page 44

- "Operating the L1 Controller" on page 45

Powering the System On and Off

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

- "Preparing to Power On" on page 38

- "Powering Off at the System Console" on page 42

- "Powering On Manually or With L1 Console" on page 41

- "Powering Off at the System Console" on page 42

- "Powering Off Manually" on page 43

Preparing to Power On

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

1. Confirm that all the cable connections between the IRUs and other system items are connected securely. If necessary, see "NUMAlink Cabling the System IRUs" on page 29 for information.

2. Confirm that all the power cables are plugged in securely to a power source. If necessary, see "Cabling the System IRUs to a Power Source" on page 31 for information.

Note: You must manually power on any optional storage modules by placing the power switch(es) in the ON (**I**) position. Note that you should turn any optional storage module on before starting the operating system.

Powering On With Optional System Console and L1/L2 Controller

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

1. If not yet done so, connect a system console to the server system as described in "Connecting the System Console" on page 36.

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 on/off circuit breaker switchs of the PDU as shown in Figure 1-20.
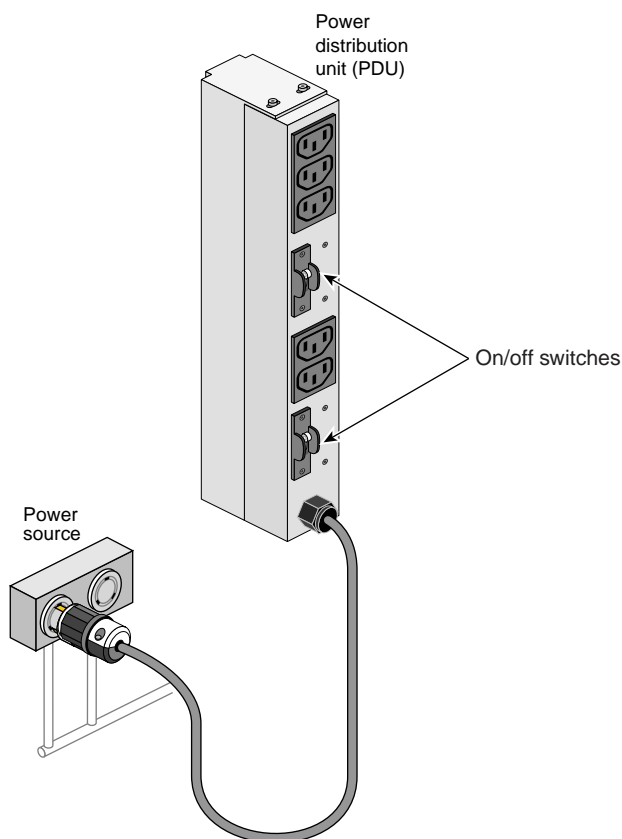
Figure 1-20 PDU Circuit Breakers Example

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

7. From the L2 prompt (L2>), power on an individual IRU 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 IRU 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 IRU within the rack.

   If you want to power on two selected IRUs of a rack at the same time, you must enter the rack number followed by the slot numbers of the IRUs that you want to power on. For example, to power on the IRUs in slots 16 and 21, enter the following command:

   `L2> `**`r 1 s 16,21 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 IRU 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 the circuit breaker switchs of the PDU to the on position, see Figure 1-20 on page 39.

3. Press the power buttons (see Figure 1-21) on each of the IRUs that you want to power on. Note that any optional storage modules should be powered up first.

L1 controller display →   ← Power button with LED
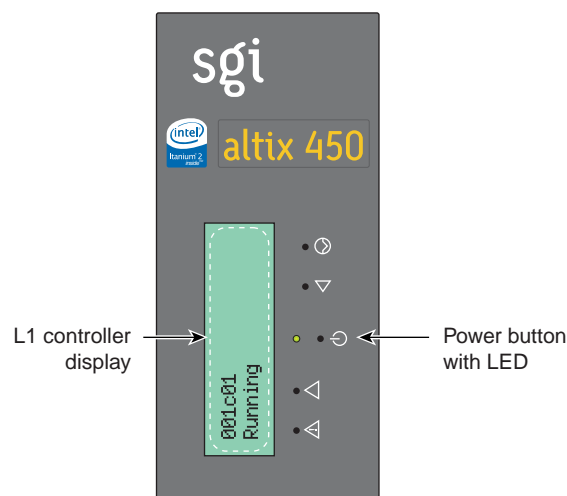
Figure 1-21   Location of the Power Button

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 system type:

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

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

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 IRU 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 IRU in rack 1, slot 16, enter the following command:

   L2> **r 1 s 16 pwr d**

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

   If you want to power off more than one IRU in the rack at the same time, enter the rack number followed by the slot numbers of the IRUs that you want to power off. For example, to power off the IRUs in slots 16 and 21, enter the following command:

   L2> **r 1 s 16,21 pwr d**

4. If you want to power off all of the IRUs 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 IRU is powered off. The L1 controller is still powered on.

5. To completely power down an L1 controller, unplug the IRU's power cords from the PDU or two front power supplies.

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 IRUs that you want to power off. You may power off the IRUs in any order:

    •   To power off the optional storage units, press the power button(s) on its rear panel to the OFF (**O**) position.

    •   To power off the IRUs, press the power button with the LED on the front panel of each unit (see Figure 1-21 on page 41).

L1 Front Panel Controls

The L1 front panel of the Altix 450 IRU provides the following control features, as shown in Figure 1-22:

- **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 IRU is operating.

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

- **Power button.** Normally you power on the system from the system console. Alternatively, you can press this button to power on the module.

- **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" actuators on the front panel.
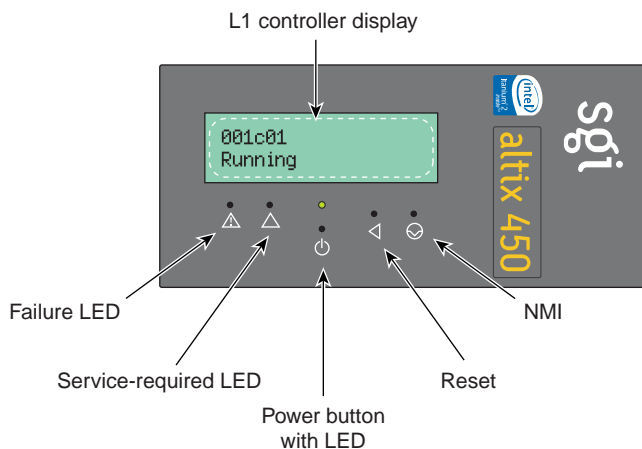
Figure 1-22   L1 Front Panel Functions

Note: If your system includes an optional storage module, see the user's guide that comes with the product 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>
```

Operation Procedures

This chapter explains how to operate your new system in the following sections:

Precautions

Before operating your system, familiarize yourself with the safety information in the following sections:

ESD Precaution

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

Wear an SGI-approved wrist strap when you handle an ESD-sensitive device to eliminate possible ESD damage to equipment. Connect the wrist strap cord directly to earth ground.

Safety Precautions

Warning: Before operating or servicing any part of this product, read the "Safety Information" on page 167.

Danger: 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.

Caution: Power off the system only after the system software has been shut down in an orderly manner. If you power off the system before you halt the operating system, data may be corrupted.

Warning: If a lithium battery is installed in your system as a soldered part, only qualified SGI service personnel should replace this lithium battery. For a battery of another type, replace it only with the same type or an equivalent type recommended by the battery manufacturer, or an explosion could occur. Discard used batteries according to the manufacturer's instructions.

System Controller Network

All Altix 450 enclosures contain an embedded microprocessor board and display assembly known as the system controller. This microprocessor runs an embedded version of the Linux operating system. The system controller runs off standby power and is running as long as the enclosure is connected to an active power source.

There are two primary applications that run on the system controller. The L1, or Level 1 system controller, is an application that provides control and monitoring functionality for each individual rack unit enclosure (IRU), and communication to other L1s in adjacent enclosures connected via NUMALink 4 cables. The L1 is always resident.

The console mode Level 2 (L2) system controller is an application that provides control over multiple L1s and communication to other L2s. The L2 is resident and active when the enclosure is connected by an Ethernet connection to a Local Area Network (LAN).

The system controller network provides the following functionality:

- Powering the entire system on and off.

- Powering individual IRUs on and off.

- Monitoring the environmental state of the system

- Viewing the system's status and error message information generated and displayed by the SGI system's L1 controller.

- Enter L1 controller commands to monitor or change particular system functions. You can, for example, monitor the speed of fans for a particular individual rack unit (IRU) enclosure. See the *SGI L1 and L2 Controller Software User's Guide* for a complete list of commands.

- Provides access to the system OS console allowing you to run diagnostics and boot the system.

Console Connections

A console is defined as a connection to the system that provides access to the system controller network. A console can be a personal computer (Ethernet connection) or a dumb terminal (serial connection).

The Altix 450 series supports multiple types of console connections:

- An ethernet connection on the system control board of an IRU - an RJ45 connection is typically labeled "L2 host"

- A serial connection to the serial console port on the system control board - a DB9 connector typically labeled "Console"

- A 2D video card installed in the base I/O blade (not available with RHEL 5) - this low-profile PCI video interface card requires use of a USB keyboard and mouse

Connecting to the System Controller

The ethernet connection is generally the preferred method of accessing the system console. Depending on the size of the system, there will be one or more ethernet connections utilized.

When an enclosure is connected to the LAN, the system controller will start the ethernet interface with either the pre-assigned IP address or will attempt to acquire an IP address via DHCP, and will then spawn the L2 application. See the section on setting up an IP address for further details. Once the system controller is connected to the LAN, it can be accessed via a simple telnet session. The serial connection is used to communicate directly with the L1 system controller. This connection is typically used for service purposes or for system controller and system console access in small systems where an ethernet connection is not available.

Caution: An L1/L2 network connection must be kept on a private and physically secure network connection. The System Controller does not provide software security, authentication, or safeguards against malicious or careless users. The consequences of unauthorized access to the System Controllers are potential system unavailability, system reconfiguration, and detailed access to every aspect of the system. The recommended configuration for the L1/L2 network connection is a separate, private and physically secure network attachment to an equally separate and physically secure PC. Any Linux system hosting L3 software must be administered to prevent unauthorized access.Optional L3 software is a package that runs on a Linux based PC. It is mainly used by service personnel as a diagnostic aid.

Communicating with the System Controller

Once a connection to the console is established, the user will be presented with either an L2 prompt (ethernet connection), known as L2 mode, or and L1 prompt (serial connection), known as L1 mode. From either of these prompts various system controller commands can be entered.

```
001c01-L1> <l1 command>

olympic-101-L2> <l2 command>
```

To access the system console, known as console mode, a control-d is entered at either the L1 prompt or the L2 prompt. To return to or escape back to the L1 or L2 mode, a control-t is entered. This escape is only temporary and you will be returned to console mode once the "Return/Enter" key is pressed. To re-engage L1 or L2 mode, enter control-t followed by either "l1" or "l2" depending on the original mode. System control commands are always entered in lower case unless otherwise specified.

Powering the System On and Off

This section explains how to power on and power off individual rack units, or your entire Altix 450 system, as follows:

- "Preparing to Power On" on page 52
- "Powering On and Off at the Console" on page 54

For servers with a system console, you can power on and power off individual IRUs or the entire system at the system console.

You may also monitor and manage your server with tools such as VACM, Console Manager, and PCP. For details, see the documentation for the particular tool.

The Embedded Support Partner (ESP) program enables you and your SGI system support engineer (SSE) to monitor your server remotely and resolve issues before they become problems. For details on this program, see "Using Embedded Support Partner (ESP)" on page 56.

Preparing to Power On

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

1. Check to ensure that the cabling between the rack's power distribution unit (PDU) and the wall power-plug receptacle is secure.

2. For each individual IRU that you want to power on, make sure that the power cables are plugged into all the IRU power supplies correctly, as shown in Figure 2-1. Setting the circuit breakers on the PDUs to the "On" position will apply power to the IRU and will start the system controller(s) in the IRUs. Note that the system controller in each IRU stays powered on as long as there is power coming into the unit.
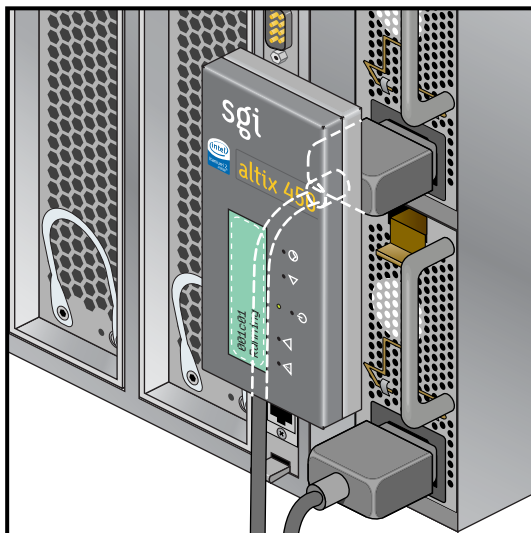
Figure 2-1   IRU Power Supply Cable Location Example

3. If you plan to power on a server that includes optional mass storage enclosures, make sure that the power switch on the rear of each PSU/cooling module (one or two per enclosure) is in the **1** (on) position.

4. Make sure that all PDU circuit breaker switches (see the example in Figure 2-2 on page 53) are turned on to provide power to the server system when it is switched on.

Power
distribution
unit (PDU)

On/off switches
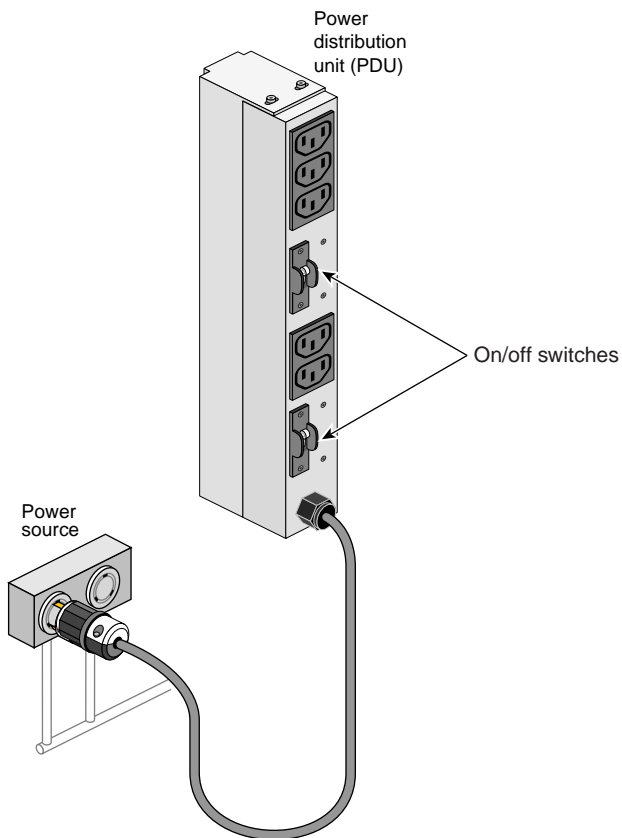
Power
source

Figure 2-2   Single-Phase Rack PDU Circuit Breaker Switches

Powering On and Off at the Console

The power-on and off procedure at a console varies with your server setup, as follows:

- If you have a console connected to a server with a serial interface, you can toggle between L1 and console mode. This enables you to power on your server with L1 commands and view the activity by changing to the console mode.

  For detailed instructions on using a system console using the L1 mode, see "Operating the L1" on page 84.

- If you have a system console connected to a server with an ethernet interface, you can toggle between L2 and console mode, and power on your server with L2 controller commands, and monitor the power-on activity by changing to the console mode.

Powering On and Off from the L1

Commands issued at the L1 prompt typically only affect the local IRU. The following sections describe how to power on and power off your system in L1 mode.

The L1 controller display, located on the front of each IRU, should display `L1 running` once the power-on procedure starts (storage modules do not have L1s). The prompt on your console screen shows the rack and slot number of the IRU to which you have connected your console.

Note: If you have a problem while powering on and an error message appears on your console display, see "L1 Controller Error Messages" on page 147 to learn what the error message indicates and how to resolve the problem.

If you want to power on the IRU (001c01 in our example) indicated in the prompt, enter the following command.

```
001c01-L1> power up
```

To power off:

```
001c01-L1> power down
```

If you are attempting to power on or power off a system with multiple IRUs from the L1 prompt, you will need to prepend the command with an asterisk as follows:

```
oo1c01-L1> * power up
```

```
or
```

```
oo1c01-L1> * power down
```

(* indicates all)

From the L1 prompt, display the system configuration information by entering the following command:

```
001c01-L1> config
:0 001c01 L0C
:2 002r01 L1H
:4 002r05 L3H
001c01-L1>
```

In L1 mode, you can obtain only limited information about the system configuration. An IRU has information about its internal blades, and also when other IRUs are NUMAlink attached to the IRU, information about those IRUs.

Note: Verify that the power LED on the L1 display turns on and lights green and that your controllers display that the system is powered on for each segment of the procedure, which indicates that the power-on procedure is proceeding properly. If you have a problem while powering on and an error message appears on the L1 controller, or the system console, see your online log files and the information in "L1 Controller Error Messages" on page 147 to learn what the error message indicates and how to best resolve the problem.

Powering-On and Off From the L2

Commands issued at the L2 prompt are typically sent to all NUMAlink connected IRU enclosures in the system.

To power on a system:

```
system-101-L2> power up
```

To power off a system:

```
system-101-L2> power down
```

Using Embedded Support Partner (ESP)

Embedded Support Partner (ESP) automatically detects system conditions that indicate potential future problems and then notifies the appropriate personnel. This enables you and SGI system support engineers (SSEs) to proactively support systems and resolve issues before they develop into actual failures.

ESP enables users to monitor one or more systems at a site from a local or remote connection. ESP can perform the following functions:

• Monitor the system configuration, events, performance, and availability.

• Notify SSEs when specific events occur.

• Generate reports.

ESP also supports the following:

• Remote support and on-site troubleshooting.

• System group management, which enables you to manage an entire group of systems from a single system.

For additional information on this and other available monitoring services, see the section "SGI Electronic Support" in Chapter 7.

Monitoring Your Server

You can monitor your Altix 450 server from the following sources:

- On the L1 controller's display at the front of the IRU as shown in Figure 2-3, you can monitor system operational status. For example, you can monitor error messages that warn of power or temperature values that are out of tolerance.

- You can connect and monitor the system via an Ethernet port adapter. You will need to connect either a local or remote workstation to monitor the system via Ethernet.

  These console connections enable you to view the status and error messages generated by the L1/L2 controllers in your Altix 450 rack. You can also use these consoles to input L1/L2 commands to manage and monitor your system.

- A DVI /VGA video card allows you to interact directly with the system, though not directly with the system's L1/L2 interface. See "2D Graphics Video Interface" on page 58 for more information. SLES 10 or later is required for this card. RHEL 5 is *not* supported.
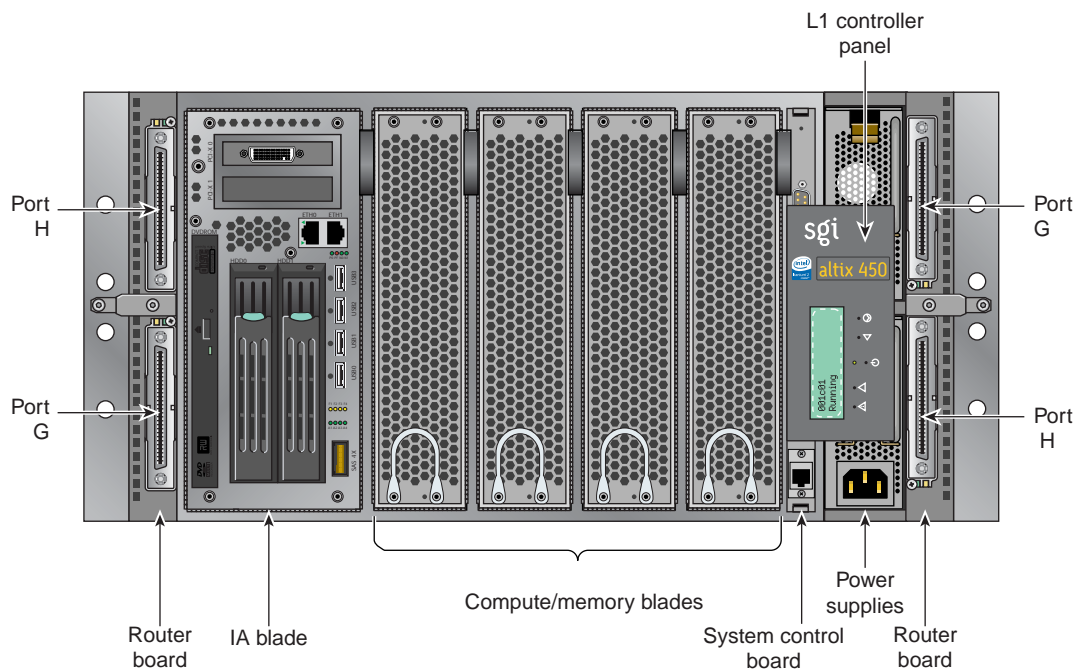
Figure 2-3   IRU L1 Controller Display Location Example

2D Graphics Video Interface

If your system was ordered in January 2007 or later, it may come equipped with an optional 2D graphics board interface (supported with SLES 10 or later system software). This low-profile PCI interface card is installed in the base I/O blade in the Altix system (see Figure 2-4 on page 59). Note that this blade is commonly referred to as the IA2 blade. One 2D card is supported per system or partition; no audio function is supported. The 2D video card has the following features:

- 64 MB DDR graphics memory
- DMS-59 display connector for two display support (no synchronization between monitors)
- Simultaneous display to DVI and VGA monitors using an adapter
- Analog resolution up to 2048 x 1536 per display
- DVI resolution up to 1600 x 1200 per display

Note: A single USB keyboard/mouse is supported by the IA2 (base I/O) blade.

The 2D video interface card can be used for all basic interaction with your Altix system. You should note that it does **not** provide an interface to the L1/L2 controller and L1/L2 administrative commands cannot be issued through the 2D video interface.
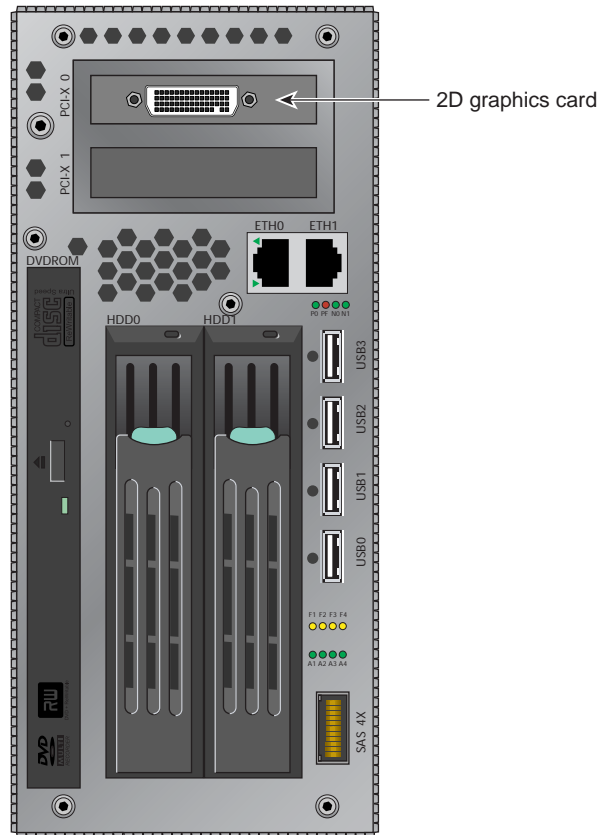
Figure 2-4   2D Graphics Card Location in IA2 (base I/O) Blade

Installing Optional Components

Besides adding a system console, you can add or replace the following hardware items on your Altix 450 series server:

- Peripheral component interface (PCI) cards into your system I/O blades.

- Disk drives in your IA/IA2 blade (base I/O).

The sections that follow discuss these activities in more detail.

Warning: **You can add or replace only the items listed in this section. For your safety and for the protection of your server system, contact your SGI system support engineer (SSE) to install any hardware items not listed in this section.**

Warning: **Before installing, operating, or servicing any part of this product, read the "Safety Information" on page 167.**

I/O Blade Overview

System I/O is primarily accomplished through standard and optional blades in the SGI Altix 450 IRUs. The PCI, PCI-X and PCIe based I/O sub-systems, are industry standard for connecting peripherals, storage and graphics to a processor blade. These are the primary configurable I/O system interfaces for the Altix 450 series systems:

- The IA/IA2 blade (base I/O) used in the Altix 450 system includes two half-height PCI/PCI-X slots. The two option cards install adjacent to the system disk and DVD drives that are also resident in the IA blade. The IA2 blade differs from the original IA base I/O in that it supports RAID 1 disk mirroring and DVD-R/W capabilities.

- The optional three-slot PCI/PCI-X double-wide blade holds three sled-mounted PCI/PCI-X cards for easy insertion and extraction from the system. It is only used in A450 systems that have more than one IRU.

- The optional single-wide two-slot PCI-X blade supports two PCI or PCI-X option cards.

- The optional single-wide PCI express (PCIe) blade supports two optional PCI express cards.

- The optional double-wide PCI express (PCIe) blade is used only in Altix 450 systems with two or more IRUs. It houses two PCIe slots and two PCI-X slots. Note that use of two PCIe (3D) graphics cards in this blade precludes using the two PCI-X slots due to space limitations.

Not all blades may be available with your system configuration. Check with your SGI sales or service representative for availability. See Chapter 6, "Maintenance and Upgrade Procedures" for detailed instructions on installing or removing PCI cards and blades.

Adding or Removing Disk Drives

The IA/IA2 blade (base I/O blade) within the IRU supports the system boot functions and contains one or two low-profile disk drives. See "Installing or Replacing a Disk Drive in the IA Blade" on page 141 for detailed instructions on installing or removing disk drives.

For information on removing or replacing disk drives in optional mass storage enclosures, see the hardware document supplied with the storage option.

Reconfigure the System Disk Drive(s) for RAID 1

System disk drive(s) ordered starting in March 2007 may come configured as either a non-RAID (jbod) or as a RAID 1 (disk mirror) system. Note that while RAID 0 (striping) is supported by the hardware, SGI recommends using RAID 1 to ensure maximum reliability and data retention.

The type of disk configuration is ordered by the customer and configured at the SGI factory. If a requirement exits to reconfigure the system disk(s), use the following information to make the changes needed. The lsiutil configuration software is the only supported methodology for modifying the disks at the time this document was published. Use of other software interfaces has not been verified and cannot be supported.

Important: The example process that follows presumes there are two disks identical in size and speed installed in your Altix system IA2 (base I/O) blade. Also, note that this example of re-imaging a disk is done via network access.

The lsiutil file (efi version) resides at /boot/efi

Launch the configuration utility with the command:

```
fs0:\> lsiutil64.efi
```

You should see an interactive interface similar to the following:

```
LSI Logic MPT Configuration Utility, Version 1.xx, November 7, 200X
1 MPT Port  found
Port Name          Chip Vendor/Type/Rev    MPT Rev   Firmware Rev   IOC
 1.  01/00/01/0       LSI Logic SAS1068 B0     105       01100000     0
```

The SAS1068 is the chip that controls the device that the lsiutil utility was loaded from.

```
Select a device:  [1-1 or 0 to quit] 1

 1.   Identify firmware, BIOS, and/or FCode
 2.   Download firmware (update the FLASH)
 4.   Download/erase BIOS and/or FCode (update the FLASH)
 8.   Scan for devices
10.   Change IOC settings (interrupt coalescing)
13.   Change SAS IO Unit settings
16.   Display attached devices
18.   Change WWID
20.   Diagnostics
21.   RAID actions
22.   Reset bus
23.   Reset target
24.   Clear ACA
39.   Force firmware download boot
45.   Concatenate SAS firmware and NVDATA files
60.   Show non-default settings
61.   Restore default settings
97.   Reset SAS phy
98.   Reset SAS link
99.   Reset port
 e    Enable expert mode in menus
 p    Enable paged mode in menus
 w    Enable logging

Main menu, select an option:  [1-99 or e/p/w or 0 to quit] 8
```

Important: After this command is entered, the load device cannot be accessed again to open files
until `lsiutil` has been exited and restarted.

```
SAS1068's links are 3.0 G, 3.0 G, down, down, down, down, down, down

 B___T___L  Type       Vendor    Product      Rev    SASAddress       PhyNum
 0   0   0  Disk       SGI       ST3146854SS  X422   5000c5000002cb45   0
 0   1   0  Disk       SGI       ST3146854SS  X422   5000c500000121cd   1

Main menu, select an option:  [1-99 or e/p/w or 0 to quit] 0

      Port Name         Chip Vendor/Type/Rev    MPT Rev  Firmware Rev  IOC
 1.  01/00/01/0         LSI Logic SAS1068 B0      105      01100000      0

Select a device:  [1-1 or 0 to quit] 1
```

```
 1.  Identify firmware, BIOS, and/or FCode
 2.  Download firmware (update the FLASH)
 4.  Download/erase BIOS and/or FCode (update the FLASH)
 8.  Scan for devices
10.  Change IOC settings (interrupt coalescing)
13.  Change SAS IO Unit settings
16.  Display attached devices
18.  Change WWID
20.  Diagnostics
21.  RAID actions
22.  Reset bus
23.  Reset target
24.  Clear ACA
39.  Force firmware download boot
45.  Concatenate SAS firmware and NVDATA files
60.  Show non-default settings
61.  Restore default settings
97.  Reset SAS phy
98.  Reset SAS link
99.  Reset port
 e   Enable expert mode in menus
 p   Enable paged mode in menus
 w   Enable logging

Main menu, select an option:  [1-99 or e/p/w or 0 to quit] 21

 1.  Show volumes
 2.  Show physical disks
 3.  Get volume state
23.  Replace physical disk
30.  Create volume
31.  Delete volume
32.  Change volume settings
50.  Create hot spare
99.  Reset port
 e   Enable expert mode in menus
 p   Enable paged mode in menus
 w   Enable logging

RAID actions menu, select an option:  [1-99 or e/p/w or 0 to quit] 1

0 volumes are active, 0 physical disks are active

RAID actions menu, select an option:  [1-99 or e/p/w or 0 to quit] 30
```

```
      B___T___L  Type        Vendor    Product       Rev    Disk Blocks  Disk MB
 1.   0   0   0  Disk        SGI       ST3146854SS   X422   286749488   140014
 2.   0   1   0  Disk        SGI       ST3146854SS   X422   286749488   140014

To create a volume, select two or more of the available targets

Select a target:  [1-2 or RETURN to quit] 1
Select a target:  [1-2 or RETURN to quit] 2

2 physical disks were created

Select volume type:  [0=Mirroring, 1=Striping, default is 0]
Select volume size:  [1 to 139898 MB, default is 139898]
Enable write caching:  [Yes or No, default is No]
Zero the first and last blocks of the volume?  [Yes or No, default is No]

Volume was created


RAID actions menu, select an option:  [1-99 or e/p/w or 0 to quit] 1

1 volume is active, 2 physical disks are active

Volume 0 is Bus 0 Target 0, Type IM (Integrated Mirroring)
  Volume State:  degraded, enabled , resync in progress
  Volume Settings:  write caching disabled , auto configure
  Volume Size 139898 MB, Stripe Size 0 KB, 2 Members
  Primary is PhysDisk 0 (Bus 0 Target 56)
  Secondary is PhysDisk 1 (Bus 0 Target 1)

RAID actions menu, select an option:  [1-99 or e/p/w or 0 to quit] 99

Resetting port...

RAID actions menu, select an option:  [1-99 or e/p/w or 0 to quit] 0

Main menu, select an option:  [1-99 or e/p/w or 0 to quit] 0

     Port Name        Chip Vendor/Type/Rev   MPT Rev  Firmware Rev  IOC
 1.  01/00/01/0       LSI Logic SAS1068 B0     105      01100000     0


Select a device:  [1-1 or 0 to quit] 0
Sas(Pun0,Lun0) LSILOGICLogical Volume  3000
```

```
fs0:\> reset
.
.
.
EFI Boot Manager ver 1.10 [14.62]

Partition  0:                              Enabled Disabled
    CBlades         2          Nodes           3        0
    RBlades         0          CPUs            4        0
    IOBlades        1          Mem(GB)         6        0

Please select a boot option

    EFI Shell
>>> netboot
    Boot option maintenance menu

Loading: netboot
Running LoadFile()

CLIENT MAC ADDR: 08 00 69 14 E3 0C
CLIENT IP: 137.38.82.91  MASK: 255.255.255.0  DHCP IP: 137.38.228.4
GATEWAY IP: 137.38.82.252  137.38.82.254

TSize.Running LoadFile()

Starting: netboot
ELILO
.
.
.
.
Quietly populating /dev/sda2 and /dev/sda1 with
ia64-propack51-sles10-Jan19


# reboot....
```

Note: The initial resynchronization of the mirrored disk (depending on the size of the disk) may take up to 45 minutes or longer.

```
RAID actions menu, select an option:  [1-99 or e/p/w or 0 to quit] 1
```

```
1 volume is active, 2 physical disks are active

Volume 0 is Bus 0 Target 0, Type IM (Integrated Mirroring)
  Volume State:  optimal, enabled
  Volume Settings:  write caching disabled, auto configure
  Volume draws from Hot Spare Pools:  0
  Volume Size 139898 MB, Stripe Size 0 KB, 2 Members
  Primary is PhysDisk 1 (Bus 0 Target 56)
  Secondary is PhysDisk 0 (Bus 0 Target 1)
```

For information on the two RAID 1 disks, use the lsscsi command as shown in the following example:

```
# lsscsi

[1:0:0:0]    disk    SGI        ST3146854SS    X422   -          /dev/sg2
[1:0:1:0]    disk    SGI        ST3146854SS    X422   -          /dev/sg3
[1:1:0:0]    disk    LSILOGIC Logical Volume   3000   /dev/sdc   /dev/sg4
```

This is an example of what you'll see on SLES10 or RHEL5 Linux operating systems. Disk [1:0:0:0] and [1:0:1:0] are the individual drives in the RAID 1, but you cannot access them through the disk driver. You access [1:1:0:0], which is /dev/sdc in this case. Caution must be exercised when entering Linux SCSI generic (sg) commands via the sg devices.

System Overview

This chapter provides an overview of the physical and architectural aspects of your SGI Altix 450 system. The major components of the Altix 450 series systems are described and illustrated.

The Altix 450 series is a family of multiprocessor distributed shared memory (DSM) computer systems that initially scale from 2 to 76 Intel 64-bit processor cores as a cache-coherent single system image (SSI). Contact your SGI sales or service representative for the most current information on this topic.

In a DSM system, each processor board contains memory that it shares with the other processors in the system. Because the DSM system is modular, it combines the advantages of low entry-level cost with global scalability in processors, memory, and I/O. You can install and operate the Altix 450 series system in your lab or server room. Each 20U SGI rack holds from one to four 5U high enclosures that support up to five compute/memory and I/O sub modules known as "blades." These blades are single printed circuit boards (PCBs) with ASICS, processors, memory components and I/O chipsets mounted on a mechanical carrier. The blades slide directly into and out of the Altix 450 IRU enclosures.

This chapter consists of the following sections:

*   "System Models" on page 68
*   "System Architecture" on page 70
*   "System Features" on page 72
*   "System Components" on page 76

Figure 3-1 shows the front view of a 20U rack used to house the Altix 450 system.
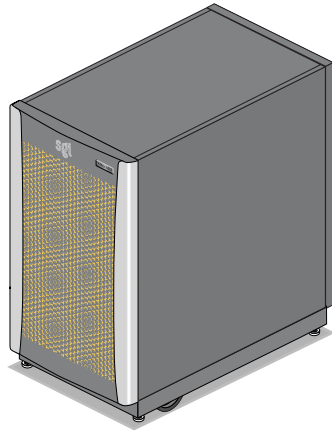
Figure 3-1   SGI Altix 450 System (Short Rack)

System Models

The basic enclosure within the Altix 450 system is the 5U high (8.68 inch or 22 cm) "individual rack unit" (IRU). The IRU enclosure houses a maximum of four single-wide blades and one double-wide blade. Each IRU comes with two built-in high-speed routers. The routers connect to the installed blades via a backplane. Each router has two ports that are brought out to external NUMAlink 4 connectors. The 20U or 42U rack for this server houses all IRU enclosures, option modules, and other components; up to a 76-processor core configuration (38 processor sockets) in a single rack. The Altix 450 server system needs a minimum of one IA/IA2 blade (base I/O).

The rack system requires a minimum of one 20U-high rack with one single-phase power distribution unit (PDU) installed in the rack. Each single-phase PDU has 5 outlets (to support two IRUs).

Figure 3-2 shows an example configuration of a 42U Altix 450 system "tall rack."
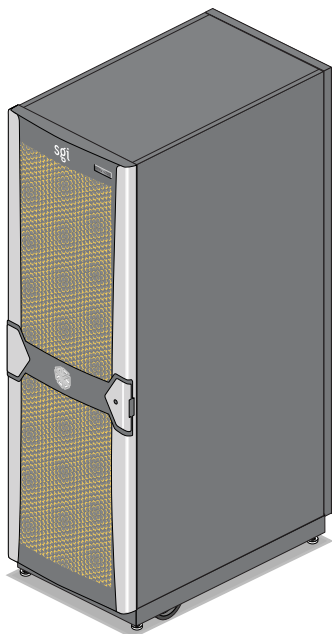
Figure 3-2   SGI Altix 450 Server System (Tall Rack)

You can also add additional PCI expansion blades or RAID and non-RAID disk storage to your server system.

Figure 3-3 shows an individual blade, IRU and Rack.

Rack
(Contains 4 IRUs)

Blade

Individual Rack Unit (IRU)
(Contains 5 blades)
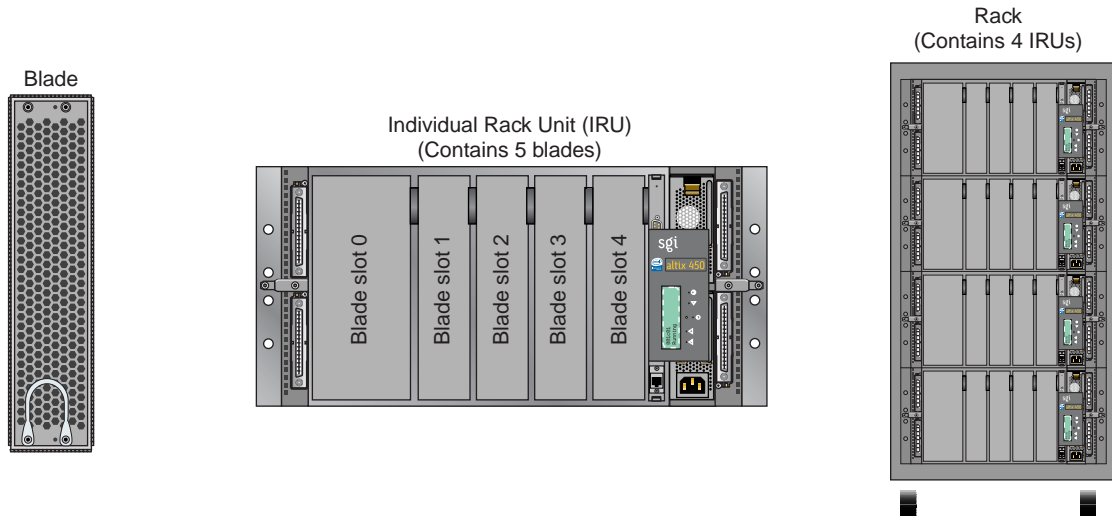
Figure 3-3   Blade, IRU and Rack Components

System Architecture

The Altix 450 computer system is based on a distributed shared memory (DSM) architecture. The system uses a global-address-space, cache-coherent multiprocessor that scales up to 76 Intel 64-bit processor cores in a single rack. Because it is modular, the DSM combines the advantages of lower entry cost with the ability to scale processors, memory, and I/O independently.

The system architecture for the Altix 450 system is a fourth-generation NUMAflex DSM architecture known as NUMAlink 4. In the NUMAlink 4 architecture, all processors and memory are tied together into a single logical system with special crossbar switches (routers). This combination of processors, memory, and crossbar switches constitute the interconnect fabric called NUMAlink. There are two internal router switches on each 5U IRU enclosure.

The basic expansion building block for the NUMAlink interconnect is the processor node; each processor node consists of a Super-Hub (SHub) ASIC and one or two 64-bit processors with three levels of on-chip secondary caches. The Intel 64-bit processors are connected to the SHub ASIC via a single high-speed front side bus.

The SHub ASIC is the heart of the processor and memory node blade technology. This specialized ASIC acts as a crossbar between the processors, local SDRAM memory, and the network

007-4857-003

interface. The SHub ASIC memory interface enables any processor in the system to access the memory of all processors in the system.

Another component of the NUMAlink 4 architecture is the router ASIC. The router ASIC is a custom designed 8-port crossbar ASIC. Using the router ASICs with a highly specialized backplane and NUMAlink 4 cables provides a high-bandwidth, extremely low-latency interconnect between all processor, I/O, and other option blades within the system.

Figure 3-4 shows a functional block diagram of the Altix 450 series IRU components.
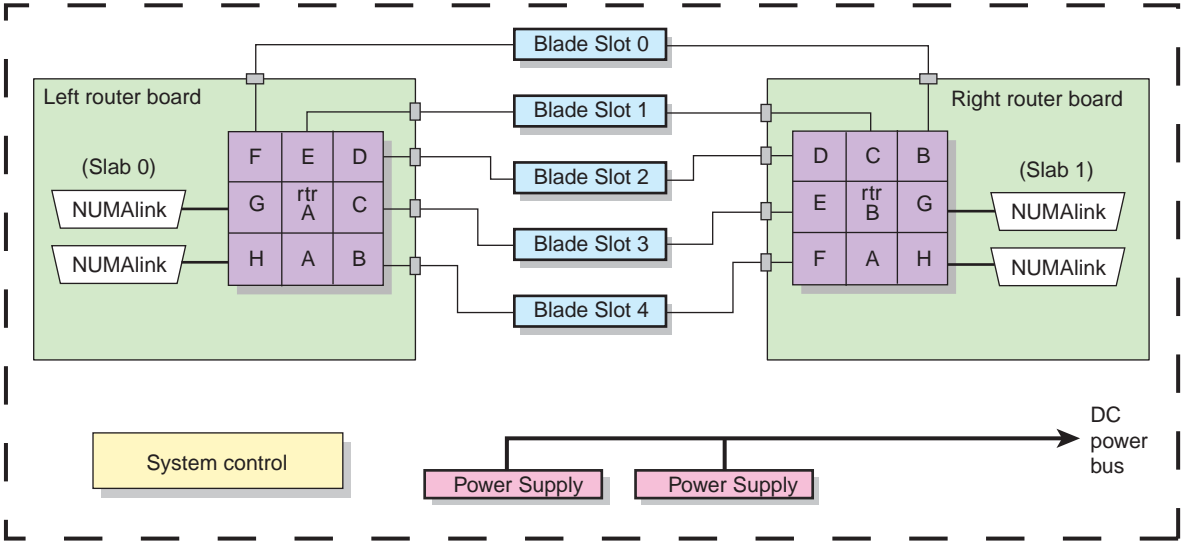
Figure 3-4   Functional Block Diagram of the Individual Rack Unit (IRU)

System Features

The main features of the Altix 450 series server systems are introduced in the following sections:

- "Modularity and Scalability" on page 72

- "Distributed Shared Memory (DSM)" on page 72

- "Distributed Shared I/O" on page 73

- "Reliability, Availability, and Serviceability (RAS)" on page 75

Modularity and Scalability

The Altix 450 series systems are modular systems. The components are primarily housed in building blocks referred to as individual rack units (IRUs). Additional optional mass storage may be added to the rack along with additional IRUs. You can add different types of blade options to a system IRU to achieve the desired system configuration. You can easily configure systems around processing capability, I/O capability, memory size, or storage capacity. You place individual blades that create the basic functionality (compute/memory, I/O, and power) into IRUs. The air-cooled IRU enclosure system has redundant, hot-swap fans and redundant, hot-swap power supplies at the IRU level.

Distributed Shared Memory (DSM)

In the Altix 450 system, memory is physically distributed both within and among the IRU enclosures (compute/memory/I/O blades); however, it is accessible to and shared by all NUMAlinked devices within the single-system image. This is to say that all NUMAlinked components sharing a single Linux operating system operate and share the memory "fabric" of the system.

Note the following sub-types of memory within a system:

- If a processor accesses memory that is connected to the same SHub ASIC on a compute node blade, the memory is referred to as the node's *local memory*. Figure 3-5 on page 73 shows a conceptual block diagram of an 8-DIMM blade's memory, compute and I/O pathways.

- If processors access memory located in other blade nodes within the IRU, (or other NUMAlinked IRUs) the memory is referred to as *remote memory*.

- The total memory within the NUMAlinked system is referred to as *global memory*.

Memory latency is the amount of time required for a processor to retrieve data from memory. Memory latency is lowest when a processor accesses local memory.
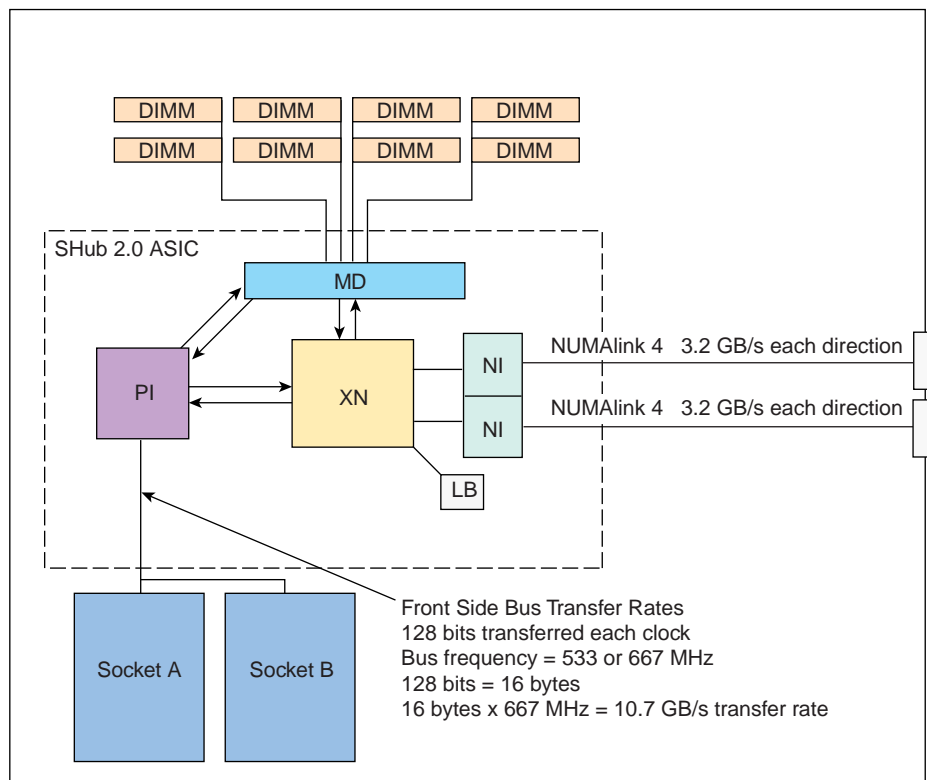
Figure 3-5   Blade Node Local Compute/Memory Block Diagram Example

Distributed Shared I/O

Like DSM, I/O devices are distributed among the blade nodes within the IRUs (each base I/O blade node has two NUMAlink ports) and are accessible by all compute nodes within the SSI through the NUMAlink interconnect fabric.

ccNUMA Architecture

As the name implies, the cache-coherent non-uniform memory access (ccNUMA) architecture has two parts, *cache coherency* and *nonuniform memory access*, which are discussed in the sections that follow.

Cache Coherency

The Altix 450 systems use caches to reduce memory latency. Although data exists in local or remote memory, copies of the data can exist in various processor caches throughout the system. Cache coherency keeps the cached copies consistent.

To keep the copies consistent, the ccNUMA architecture uses directory-based coherence protocol. In directory-based coherence protocol, each block of memory (128 bytes) has an entry in a table that is referred to as a directory. Like the blocks of memory that they represent, the directories are distributed among the compute/memory blade nodes. A block of memory is also referred to as a cache line.

Each directory entry indicates the state of the memory block that it represents. For example, when the block is not cached, it is in an unowned state. When only one processor has a copy of the memory block, it is in an exclusive state. And when more than one processor has a copy of the block, it is in a shared state; a bit vector indicates which caches contain a copy.

When a processor modifies a block of data, the processors that have the same block of data in their caches must be notified of the modification. The Altix 450 server series use an invalidation method to maintain cache coherence. The invalidation method purges all unmodified copies of the block of data, and the processor that wants to modify the block receives exclusive ownership of the block.

Non-uniform Memory Access (NUMA)

In DSM systems, memory is physically located at various distances from the processors. As a result, memory access times (latencies) are different or "non-uniform." For example, it takes less time for a processor blade to reference its locally installed memory than to reference remote memory.

Reliability, Availability, and Serviceability (RAS)

The Altix 450 server series components have the following features to increase the reliability, availability, and serviceability (RAS) of the systems.

- **Power and cooling:**

    – IRU power supplies are redundant and can be hot-swapped under most circumstances. Note that this might not be possible in a "fully loaded" system. If all the blade positions are filled, be sure to consult with a service technician before removing a power supply while the system is running.

    – IRUs have overcurrent protection at the blade and power supply level.

    – Fans are redundant and can be hot-swapped.

    – Fans run at multiple speeds in the IRUs. Speed increases automatically when temperature increases or when a single fan fails.

- **System monitoring:**

    – System controllers monitor the internal power and temperature of the IRUs, and can automatically shut down an enclosure to prevent overheating.

    – Memory, L2 cache, L3 cache, and all external bus transfers are protected by single-bit error correction and double-bit error detection (SECDED).

    – The NUMAlink interconnect network is protected by cyclic redundancy check (CRC).

    – The L1 primary cache is protected by parity.

    – Each IRU and each blade/node installed has failure LEDs that indicate the failed part; LEDs are readable at the front of the IRU or via the system controllers.

    – Systems support the optional Embedded Support Partner (ESP), a tool that monitors the system; when a condition occurs that may cause a failure, ESP notifies the appropriate SGI personnel.

    – Systems support remote console and maintenance activities.

- **Power-on and boot:**

    – Automatic testing occurs after you power on the system. (These power-on self-tests or POSTs are also referred to as power-on diagnostics or PODs).

    – Processors and memory are automatically de-allocated when a self-test failure occurs.

    – Boot times are minimized.

- **Further RAS features:**

  – Optional RAID 1 in base I/O (IA2 blade), check with your SGI sales or service representative for availability. Note that RAID 0 (striping), while supported by the IA2 hardware, is *not* recommended as a RAS option.

  – Systems have a local field-replaceable unit (FRU) analyzer.

  – All system faults are logged in files.

  – Memory can be scrubbed using error checking code (ECC) when a single-bit error occurs.

System Components

The Altix 450 series system features the following major components:

- **20U rack.** The "short" rack is a custom rack used with the Altix 450 system. It holds up to 4 IRUs or a combination of IRUs and option modules (such as mass storage).

- **42U rack.** The "tall" rack is a custom rack used for both the compute and I/O rack in the Altix 450 system. Up to 8 IRUs can be installed in each rack. There is also a 2U space reserved at the top for an option module.

- **Individual Rack Unit (IRU).** This enclosure contains the compute/memory blades, IA blade (base I/O), standard routers and optional I/O blades for the Altix 450 series systems. The enclosure is 5U high.

- **Compute/Memory blade.** Holds up to two IA-64 processor sockets and 4, 8 or 12 memory DIMMs.

- **Memory-only blade.** This blade acts as a memory expansion node with no processor compute circuitry included on the blade. This blade holds 4, 8, or 12 memory DIMMs.

- **Single-wide PCI-X expansion blade.** This two-slot PCI/PCI-X option blade supplies an individual PCI bus for each option card.

- **Double-wide PCI-X expansion blade.** Supports three PCI/PCI-X 133 MHz 64-bit option cards. This three-slot blade features card carriers that allow you to slide PCI/PCI-X boards directly into and out of the unit.

- **Single-wide PCIe expansion blade.** The single wide PCI blade supports one or two PCI Express option cards. Note that when used with a 3D PCIe graphics card, only one can be inserted due to space constraints.

- **Double-wide PCIe/PCI-X expansion blade.** This blade supports two PCI Express option cards and two PCI/PCI-X option cards. Note that when this blade is used with two 3D PCIe graphics cards the PCI-X slots cannot be used due to space constraints.

- **IA/IA2 blade (Base I/O blade).** Double-wide I/O blade that supports all base system I/O functions including one or two disk drives, a DVD drive, two low-profile PCI-X card slots, two ethernet ports, one SAS/SATAII port, and four USB ports. Optional RAID 1 functionality and DVD-R/W is available with the IA2 version of the base I/O blade only.

Figure 3-6 shows the Altix 450 IRU system components.
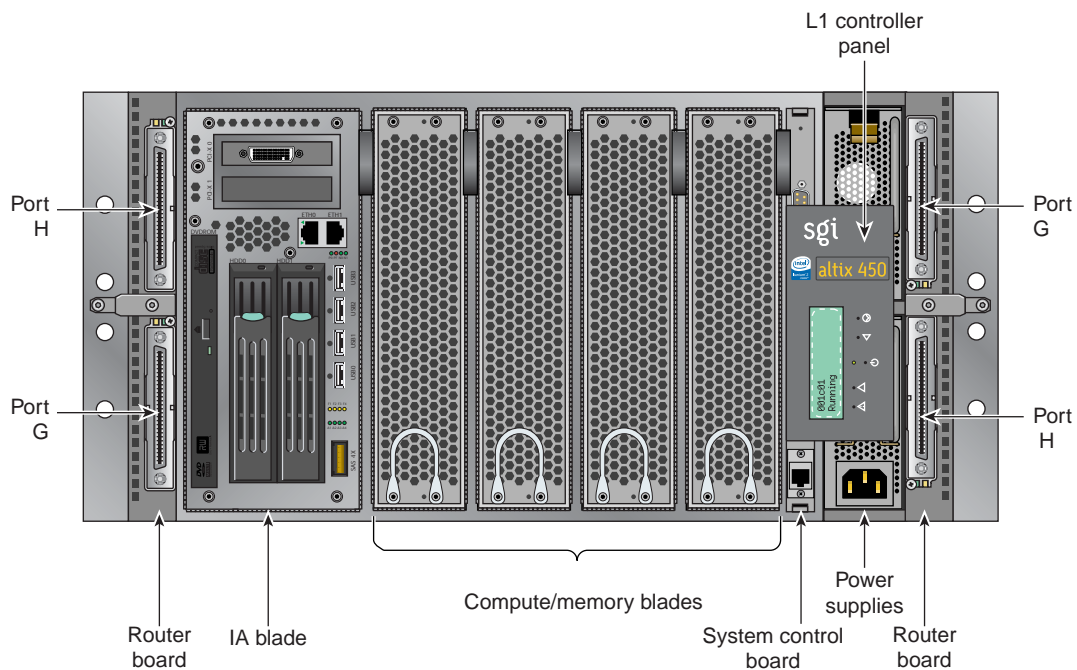
Figure 3-6   Altix 450 IRU System Components Example

Bay (Unit) Numbering

Bays in the racks are numbered using standard units. A standard unit (SU) or unit (U) is equal to 1.75 inches (4.445 cm). Because IRUs occupy multiple standard units, IRU locations within a rack are identified by the bottom unit (U) in which the IRU resides. For example, in a 42U rack, an IRU positioned in U01 through U05 is identified as U01.

Rack Numbering

Each rack is numbered with a three-digit number sequentially beginning with 001. A rack contains IRU enclosures, optional mass storage enclosures, and potentially other options. In a single compute rack system, the rack number is always 001.

Optional System Components

Availability of optional components for the SGI 450 systems may vary based on new product introductions or end-of-life components. Some options are listed in this manual, others may be introduced after this document goes to production status. Check with your SGI sales or support representative for the most current information on available product options not discussed in this manual.

System Control

This chapter describes the interaction and functions of system controllers in the following sections:

*   "Levels of System Control" on page 80

*   "System Controller Interaction" on page 81

*   "L1 Controller" on page 81

*   "Console Hardware Requirements" on page 84

*   "Operating the L1" on page 84

*   "L2 Operation" on page 89

*   "Upgrading L1 Firmware" on page 99

The control system for the SGI Altix 450 series servers manages power control and sequencing, provides environmental control and monitoring, initiates system resets, stores identification and configuration information, and provides console/diagnostic and scan interface.

Each IRU enclosure has a system controller that can communicate with other IRU system controllers when they are NUMAlinked together under a single system image. Each system controller constantly shares its information with all controllers in the system. Note that optional mass storage enclosures do not have a system controller.

Figure 4-1 shows an example system control network using a separate (remote) workstation to monitor a single-rack Altix 450 system.
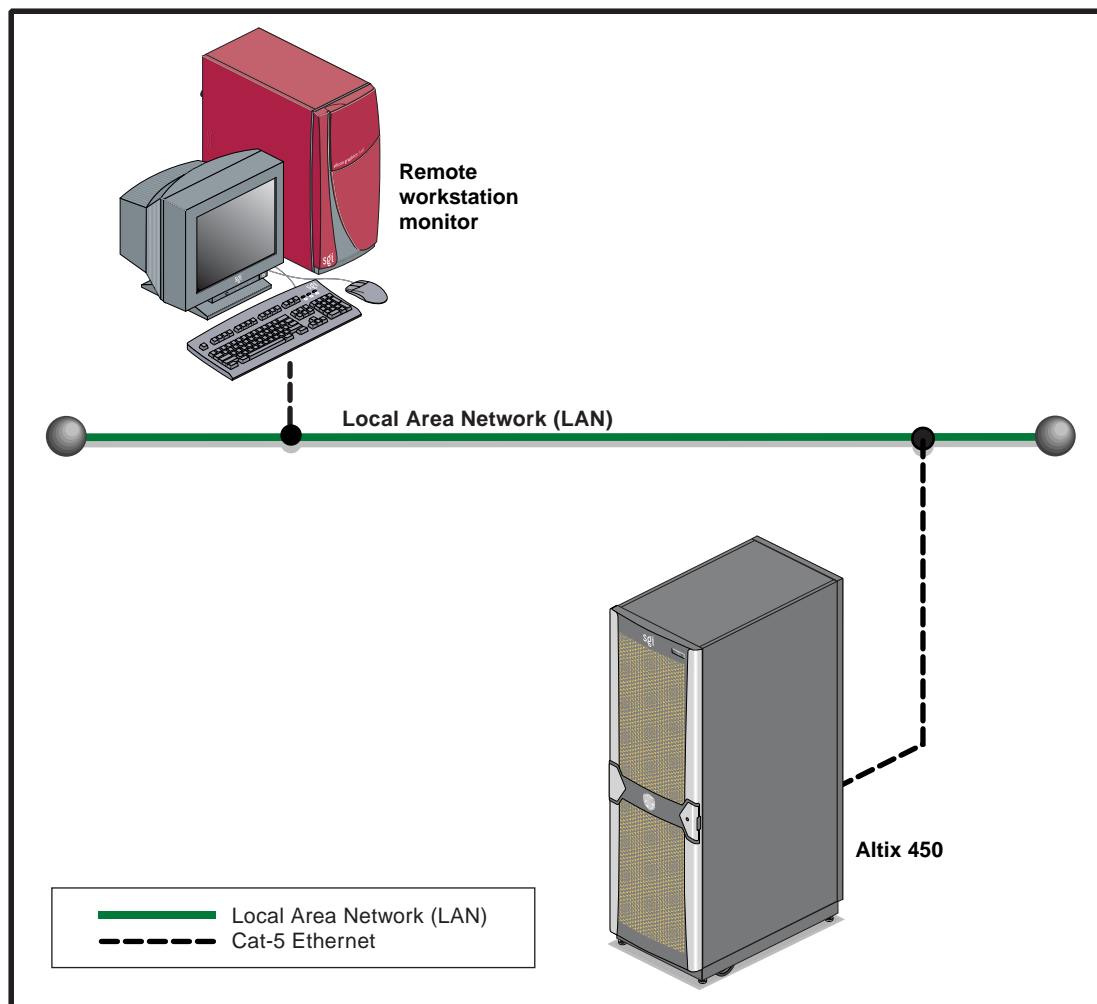
Figure 4-1   SGI Altix 450 System Control Network (Example)

Levels of System Control

The system control network configuration of your server will depend on the size of the system and control options selected. Typically, an Ethernet connection to the system controller network is used. This Ethernet connection is usually made from the IRU housing the system disk(s).

The system controller is designed into all IRUs. An Ethernet connection directly from the IRU to a local private or public Ethernet allows the system to be administered directly from a local or remote console. Note that there is no interconnected system controller function in the optional storage modules.

The L1 controllers within the system report and share status information via the NUMAlink cables, thus maintaining controller configuration and topology information between all controllers in the system.

Note: Mass storage option enclosures are not specifically monitored by the system controller network. Most optional mass storage enclosures have their own internal microcontrollers for monitoring and controlling all elements of the disk array. See the owner's guide for your mass storage option for more information on this topic.

System Controller Interaction

In all Altix 450 servers all the system controllers communicate with each other in the following ways:

• All IRU enclosures within an Altix 450 system communicate with each other through their NUMAlink connections using low voltage differential signaling (LVDS).

• When connecting to the L2 host Ethernet connection on the system control board of an IRU, the system controller spawns an L2 application providing L2 functionality.

L1 Controller

All Altix 450 IRUs have L1 controllers. The following subsections describe the basic features of the L1 controllers:

• "L1 Controller Functions" on page 82

• "L1 Front Panel Display" on page 82

Note: For additional information on L1 controller commands, see the *SGI L1 and L2 Controller Software User's Guide (007-3938-xxx).*

L1 Controller Functions

The following list summarizes the control and monitoring functions that the L1 controller performs:

- Controls voltage margining within the IRUs

- Controls and monitors IRU fan speeds

- Reads system identification (ID) PROMs

- Monitors voltage levels and reports failures

- Monitors and controls warning LEDs on the IRU

- Monitors the On/Off power switch

- Monitors the reset switch and the nonmaskable interrupt (NMI) switch

- Reports the population of the PCI cards and the power levels of the PCI slots in installed I/O blades

- Powers on the PCI slots and their associated LEDs

L1 Front Panel Display

Figure 4-2 shows the L1 controller front panel features.
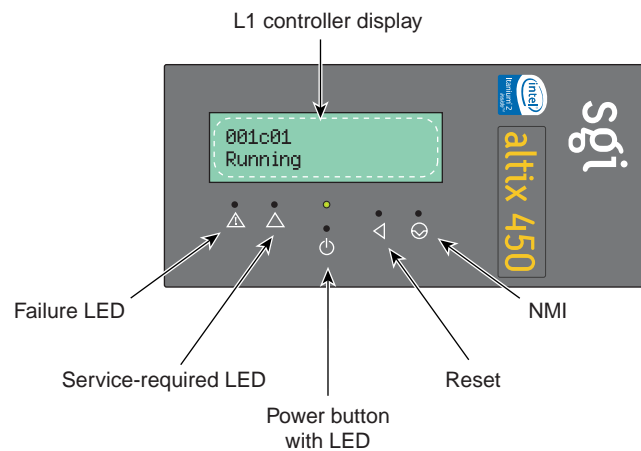
Figure 4-2   L1 Front Panel

The front panel display contains the following items:

- 2 x 12 character liquid crystal display (LCD). The display identifies the IRU, shows system status, warns of required service, and identifies a failed component.

- Power (On/Off) button (insert paper clip to actuate) and power on LED.

- Service required LED.

- Failure LED.

- Reset switch (insert paper clip to actuate).

- Non-maskable interrupt (NMI) switch (insert paper clip to actuate).

Note: The reset and NMI switch functions on any IRU in a NUMAlink connected system will affect all the IRUs in the system.

Ethernet Switch

Use of an Ethernet switch is the preferred method of interconnecting large systems with multiple L2s and remote support hardware to multiple systems. An optional Ethernet switch provides multiple additional Ethernet connectors. Figure 4-3 shows sample connections between an Ethernet switch, a remote workstation, an IRU, and other SGI systems.
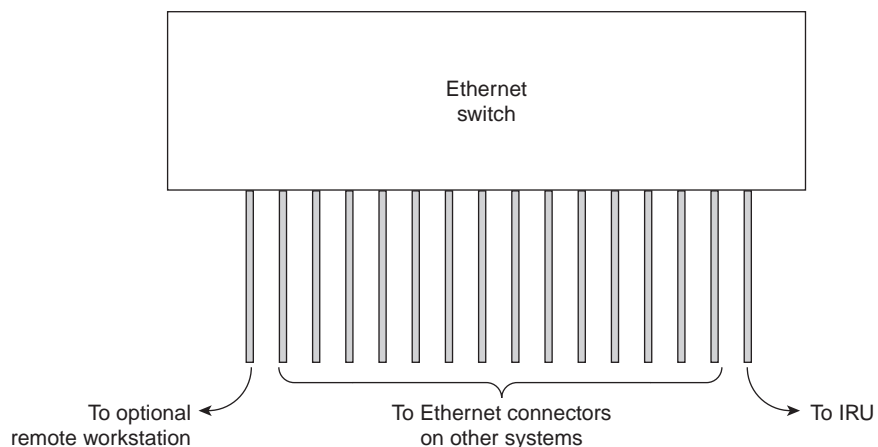
Figure 4-3   Ethernet Switch System Controller Block Diagram (Example)

Console Hardware Requirements

The console type and how these console types are connected to the Altix 450 servers is determined by what console option is chosen.

If you have an Altix 450 server with a dumb terminal, you can connect the terminal via a serial cable to the (DB-9) console port connector on the system control board of the IRU.

The terminal should be set to the following functional modes:

- Baud rate of 38,400

- 8 data bits

- One stop bit, no parity

- Hardware flow control (RTS/CTS)

Note that the serial console is generally connected to the first (bottom) IRU in a rack configuration.

You can also connect to the RJ45 Ethernet connector on the system control board of the IRU and place it on a network. This starts an L2 on the IRU's system controller. You can use the `telnet` command to connect.

By default the L2 uses DHCP to obtain an IP address. To set a static IP, see "Configuring an L2's IP Address" on page 89.

These console connections enable you to view the status and error messages generated by the system controllers on your system. You can also use the console to input commands to manage and monitor your system(s). For more information on the L2, see "L2 Operation" on page 89.

For more details on connecting a console to an Altix 450 series server, see "System Controller Network" on page 49. For more information on monitoring your server, see "Monitoring Your Server" on page 57.

Operating the L1

Each IRU in the Altix 450 system has an updated and enhanced system control implementation. This updated system controller provides both L1 and L2 functionality. The system controller utilizes an embedded version of the Linux operating system. L1 functionality is provided by an

application that is always running on the system controller. When the enclosure is connected to a LAN via the L2 host connector, the system controller spawns an application that provides L2 functionality.

The L1 operates in one of these two modes, which are discussed in the sections that follow:

L1 Mode

The L1 prompt is visible and all input is directed to the L1 command processor. The Altix 450 server L1 system control can perform the following:

- Managing power and sequencing control

- Environmental monitoring and control functions

- Initiation of system resets

- Read/write storage for identification and configuration information

- Provides console/diagnostic and scan interface

The L1 controller in each of the enclosures is a complete and fully functional system controller. All the blades are interconnected by NUMAlink and each shares its system control information with all other system controllers.

Console Mode from L1

Output from the system is visible and all input is directed to the system console.

Note: The "console mode from L1" mode is supported only if the system console L1 port is connected directly to the console system (laptop, PC, etc.).

L1 Mode

If you see a prompt of the following form, the L1 is ready to accept commands.

```
001c01-L1>
```

Common operations are discussed in the following sections:

- "Viewing Information, Warnings, and Error Messages" on page 94

Viewing System Configuration (from an IRU's Perspective)

An L1 has limited knowledge of the system topology, depending on the system's configuration. Typically, an L1 has information only about L1s that are directly NUMAlink connected.

In large configurations with more than one L1, the L1 may have knowledge of only a portion of the L1s in the system. These configurations require the use of the L2, see "L2 Operation" on page 89 for further details.

You can view an IRUs configuration information with the config command as in the following:

```
001c01-L1> config
:0  001c01 LOC
001c01-L1>
```

This example is a system with one IRU. The *<number>* that follows the colon (0, 1, and 2, from top to bottom in this example), refers to which local port the IRU is connected to or accessed through. The local (LOC) IRU is the IRU that is processing the command.

On all IRUs :0 is the local IRU, with other values referring to various ports. The specific port description follows the IRU's rack/type/slot field: (i.e. LOC, U-F, U-G, etc.)

```
021c01-L1> config
:0 021c01 L0C
:2 021c11 L1H
021c01-L1>
```

Command Targeting

All commands entered affect only the local IRU. You can target a command to all IRUs (including the local IRU) by prefixing the command with an asterisk (*).

```
001c01-L1> * version
001c01:
L1 0.7.37 (Image A), Built 08/24/2006 14:59:42 [2MB image]
001c11:
L1 0.7.37 (Image A), Built 08/24/2006 14:59:42 [2MB image]
001c21:
L1 0.7.37 (Image A), Built 08/24/2006 14:59:42 [2MB image]
001c01-L1>
```

Commands can be targeted to other L1s by preceding the command with a rack and slot:

```
001c01-L1> 1.11 version
```

The command above issues a version command to the IRU in rack 001, U position 11.

Some commands can be targeted to a specific blade within an IRU. Precede the command with the blade designator:

```
001c01-L1> b1 power down
```

The command above issues a power down command to the blade in blade slot 1 of the IRU in rack 001, U position 01.

Console Mode from L1

In console mode, output from the system boot process or OS is visible and all input is directed to the system. To enter console mode, press Ctrl+D at the L1 prompt:

```
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:

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

While in L1 mode, you can enter any L1 command. Once the command is executed, 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:

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

L1 Console Selection

If the system contains more than one IRU and a serial connection is utilized for the console, the serial cable must be connected to the IRU that is located in the lowest rack and slot position.

The `select` command shows the current console mode settings:

```
001c01-L1> select
console input: 001c01 console0
console output: not filtered
```

The following are common subchannels associated with console communications:

- Subchannel 0A specifies Blade 0, CPU A.

- Subchannel 0C specifies Blade 0 CPU C.

- Subchannel 1A specifies Blade 1, CPU A.

- Subchannel 1C specifies Blade 1, CPU C.

- Subchannel 2A specifies Blade 2, CPU A.

- Subchannel 2C specifies Blade 2, CPU C.

- Subchannel 3A specifies Blade 3, CPU A.

- Subchannel 3C specifies Blade 3, CPU C.

- Subchannel console0 Blade 0 console subchannel.

- Subchannel console1 Blade 1 console subchannel.

The output from the select command:
"`console input: 001c01 console0`"
shows that the system controller will send input to IRU 001c01 blade 0 and the subchannel to be used is the console subchannel.

During the boot process, there is a window of time in which all processors may be producing output. This output can produce a somewhat jumbled output at the L1.

However, you can filter the console output so that the L1 shows output from only the processor chosen to receive console input. You can turn filtering on and off with the `select filter` command.

If you attempt to communicate with a IRU that is not responding, a time-out condition results:

```
001c01-L1>

entering console mode 001c01 console, <CTRL-T> to escape to L1
no response from 001c01 junk bus console UART:UART_TIMEOUT
```

When this time-out condition occurs, either the IRU is hung or the subchannel is incorrect. An IRU is identified by its rack, type, and slot (001c01).

Viewing Information, Warnings, and Error Messages

All information, warnings, and error messages generated by any of the system controllers are in the following form:

```
001c01 ERROR: invalid arguments for 'ver' command, try "help ver"
```

The general format includes a IRU identification and the type of message, followed by the message. A message may be the result of an invalid command, as shown in the example, or the result of tasks running on the L1, such as the environmental monitor.

Each L1 has a log of local events. Use the L1 command `log` to view events on any of the L1s.

L2 Operation

As mentioned in "System Controller Interaction" on page 81 the system controller in an Altix 450 system can provide L2 functionality.

An Ethernet cable can be plugged into the RJ45 connector on the IRU enclosure. Connecting the IRU to an active LAN via the L2 host connector will cause the system controller to spawn an L2. This connection provides network access to the system controller through the L2.

Configuring an L2's IP Address

This section refers to setting the IP address on the IRU enclosure when using an Ethernet connection.

Setting the IP address of the L2 on the target IRUs should be done before connecting the IRUs to the network as follows:

Connect a serial cable to the serial console port on the target IRU and get the L1 prompt.

To see if the L2 is running (it will be if the LAN cable is plugged in and the cable is connected to an active LAN).

At the L1 prompt type:
```
001c01-L1> l2
L2 Controller is running.
001c01-L1>
```

If the L2 is not running type:
```
001c01-L1>!  init  4
```

This switches the system controller to run level 4 and forces the L2 to be started whether or not the LAN is plugged in. There is a space between the "!" and "init"

Verify the L2 is running again as above.

To set the IP address on the L2 type:
```
001c01-L1> l2 ip a.b.c.d 255.255.255.0 a.b.c.255
```

Verifying that the system serial number is set on the L2:
```
001c01-L1> l2 serial
```

To set the L2 system serial number:
```
001c01-L1> l2 serial set <serial number>
```

Verifying that msys is enabled (this allows multiple L2s in a system to exist peacefully with other L2s from another system on the same subnet)
```
001c01-L1> l2 msys
```

If msys is off, turn it on:
```
001c01-L1> l2 msys on
```

Reboot the system controller to make the IP address change take effect.
```
001c01-L1> reboot_l1
```

Once this is done for all target IRUs and Dense routers, connect them to the network (using an optional Ethernet switch if necessary).

The rackid on the L2 cannot be set with the L2 "rackid" command, instead it will be inherited from the local L1. As an example: the L2 running on the system controller in 1r41 will have a rack id of 141 (rack * 100 + slot of the local L1).

Once the L2 is running, you can telnet to the L2, or use an optional SGIconsole.

After the connection to the L2 controller is established, the following prompt appears, indicating that the L2 is ready to accept commands:

```
olympic-101-L2>
```

Common operations are discussed in the subsections that follow.

Viewing System Configuration

You can use the L2's `config` command to view the current system configuration from an IRU level:

```
olympic-101-L2> config
L2 127.0.0.1: - 001 (LOCAL)
L1 127.0.0.1:0:0 - 001c31
L1 127.0.0.1:0:1 - 001c21
L1 127.0.0.1:0:2 - 001c11
L1 127.0.0.1:0:3 - 001c01
L2>
```

As shown above, `config` produces a list of IRUs and their locations in the system and the system controller address of each IRU. This is similar to the output from using the `config` command on the L1 with the addition of the L2 IP address, L1 connection, and L1 index.

The structure of the IRU address is as follows:

```
a.b.c.d:x:y
```

where:

a.b.c.d   is the IP address of the L2. (In the example above, the IP address is 127.0.0.1.)

x   connection number is only 0 for Altix 450

y   is the L1 index - the index identifies an IRU by its rack, type, and slot (001c01). The structure of the IRU location is as follows:

rrrbss.p

where:

rrr   is the rack number.

b   is the enclosure type.

ss   is the slot location of the enclosure.

p   is the partition of the enclosure (not present if the system is not partitioned).

In the example shown above, 001c01 is an IRU in rack 001 and slot position 01.

Setting Command Targeting

If a command is not understood by the L2 system controller, in general it is passed to the L1 system controllers. The destination determines which L1s receive the command. A destination, specified by the following, is a range of racks and slots:

rack <*rack list*> slot <*slot list*>

The <rack list> specifies a list of racks. This can be a list delimited by commas, such that 2,4,7 specifies racks 2, 4, and 7. You can use a dash to specify a range of racks, such that 2-4 specifies racks 2, 3, and 4. Both nomenclatures can be combined, such that 2-4,7 specifies racks 2, 3, 4, and 7.

You can specify the <*slot list*> using the same nomenclature. The slot number, sometimes referred to as a bay number, is the unit position number located on the rack, slightly above where the bottom of the IRU sits. Each rack unit position number is located toward the top of the two lines that mark the unit position that the number represents. For example, the rack numbering for an IRU located in slot 10 would appear on the left front side of the rack.

The slot <*slot list*> is optional; if not given, then all slots in the specified rack(s) are implied. You should avoid specifying a rack list and a slot list that includes multiple racks and slots, such as rack 2-4,7 slot 1-8,11,13. Generally, you specify a rack and slot together to specify an individual IRU.

You can use the aliases r and s to specify rack and slot, respectively. You can use the alias all or * in both the <*rack list*> and the <*slot list*>, or by themselves, to specify all racks and all slots.

To send a command to all IRUs in a partition, enter the following:

partition <*partition*> <*cmd*>

Individual IRU and Dense routers can also be targeted with a short <rack>.<slot> prefix. As in 1.11 <command>.

To target individual blades in an IRU use the following syntax:

```
olympic-101-L2> 1.11 b1 power down
```

Executing the above command will power down the blade in blade slot 1 of the IRU in rack 001 U position 11.

Default Destination

When the L2 starts, the default destination is set to all racks and all slots. You can determine the default destination by using the `destination` command:

```
L2> destination
all racks, all slots
L2>
```

The following command sets the destinations to rack 2 and 3, all slots:

```
L2> r 2,3 destination
2 default destination(s) set
L2>
```

The following example shows what IRUs are found in the default destination. If you enter a command not understood by the L2, the command is sent to these IRUs.

Note: In the current implementation, if you add an IRU to either rack 2 or 3, it would not be automatically included in the default destination. You would need to reset the default destination.

```
L2> destination
001c01 (127.0.0.1:0:2)
001c01 (127.0.0.1:0:0)
L2>
```

The following command resets the default destination to all racks and all slots:

```
L2> destination reset
default destination reset to all racks and slots
L2>
```

Current Destination

The current destination is a range of racks and slots for a given command. For example, the following command sends the command `<L1 command>` to all IRUs in racks 2, 3, 4, and 7:

```
L2> r 2-4,7 <L1 command>
```

This is a one-time destination.

Command Interpretation

Some L2 commands are the same as the L1 commands. In many cases, this is intentional because the L2 provides sequencing that is necessary for a command to function correctly.

When L1 and L2 commands are similar, you can ensure that an L1 command is entered for the IRUs current destination by preceding the command <L1 command> with the l1 command:

```
L2> r 2-4,7 l1 <L1 command>
```

This is a one-time destination.

Viewing Information, Warnings, and Error Messages

All information, warnings, and error messages generated by any of the system controllers are in the following form:

```
001c01 ERROR: invalid arguments for 'ver' command, try "help ver"
```

The general format includes an IRU identification and the type of message, followed by the message. A message may be the result of an invalid command, as shown in the example, or the result of tasks running on the L1, such as the environmental monitor.

Each L1 has a log of local events. Use the L1 command log to view events on any of the L1s.

Powering On, Powering Off, and Resetting the System From the L2

You can power on and power off the system with the power command. This command is interpreted by the L2, because the IRUs must be powered on in a specific order.

```
L2> power up
L2>
```

The power command may require several seconds to several minutes to complete. In the example above, all racks and slots in the default destination are affected. Any errors or warnings are reported as described above in "Viewing Information, Warnings, and Error Messages."

To power on or power off a specific IRU, specify a current destination:

```
L2> r 2 s 5 power up
L2>
```

To power on or power off all IRUs in a partition, enter the following:

```
L2> partition <partition number> <power up or power down>
```

To reset the system, enter the following:

```
L2> reset
L2>
```

This command restarts the system by resetting all registers to their default settings and rebooting the system controllers. Resetting a running system will cause the operating system to reboot and all data in memory will be lost.

Console Mode from the L2

In console mode, all output from the system is visible and all input is directed to the system.

To enter console mode from L2, press Ctrl+D at the L2 prompt and observe the response:

```
L2> Ctrl+D
entering system console mode (001c01 console0),
<CTRL_T> to escape to L2
.
<system output appears here>
.
```

To return to L2 mode from console mode, press Ctrl+T:

```
Ctrl+T
escaping to L2 system controller
L2>
```

At this point, you can enter any L2 or L1 command. When the command completes, the L2 returns to console mode:

```
Re-entering system console mode (001c01 console0),
<CTRL_T> to escape to L2
```

To permanently engage the L2 mode, press Ctrl+T and then enter the l2 command:

```
Ctrl+T
escaping to L2 system controller
L2> l2
L2 command processor engaged, <CTRL_D> for console mode.
L2>
```

Console Selection

When in console mode, the L2 communicates with the IRU set with the `select` command to be the system console or global master. All input from the console is directed to that IRU. You can set and view the system console with the `select` command.

The L2 chooses an IRU as the default console in the following order of priority:

- The IRU in the lowest numbered rack and slot, which has previously produced console output.

- The IRU in the lowest numbered rack and slot.

The `select` command by itself shows the current console mode settings:

```
L2> select
known system consoles (non-partitioned)

001c01-L2 detected

current system console

console input: 001c01 CPU 0A
console output: not filtered
```

The following are ten common subchannels associated with console communications:

- Subchannel 0A specifies Blade 0, CPU A.

- Subchannel 0C specifies Blade 0 CPU C.

- Subchannel 1A specifies Blade 1, CPU A.

- Subchannel 1C specifies Blade 1, CPU C.

- Subchannel 2A specifies Blade 2, CPU A.

- Subchannel 2C specifies Blade 2, CPU C.

- Subchannel 3A specifies Blade 3, CPU A.

- Subchannel 3C specifies Blade 3, CPU C.

- Subchannel console0 Blade 0 console subchannel.

- Subchannel console1 Blade 1 console subchannel.

The select command output: "`console input: 001c01 console0`" shows that the L2 will send console input to IRU 001c01 blade 0 and the console subchannel will be used.

To change the IRU that will be the system console, use the `select <rack>.<slot>` command, where `<rack>` is the rack and `<slot>` is the slot where the IRU is located:

```
L2> select 1.1
console input: 001c01 console
console output: no filtered
console detection: L2 detected
```

To change the subchannel used on the selected IRU, use the `select subchannel <0A|0C|1A|1C>` command. (Use the `select subchannel console` to select the current console as the subchannel of the IRU to be the system console.) For example, to select blade 1, CPU A as the subchannel of the IRU to be the system console, enter the following:

```
L2> select subchannel 1A
console input: 001c01 console CPU1A
console output: not filtered
```

During the boot process on a system with multiple CPUs, there is a window of time in which the CPUs are all producing output. This can result in a somewhat jumbled output from the L2. However, you can filter console output so that the L2 will show output from only the IRU chosen to receive console input. You can turn on filtering with the `select filter on` command and turn off filtering with the `select filter off` command.

If you attempt to communicate with an IRU chosen to receive console input but that is not responding, a time-out condition results:

```
L2> Ctrl+D
entering console mode 001c01 CPU1A, <CTRL_T> to escape to L2

no response from 001c01 Junk bus CPU1A system not responding
no response from 001c01 Junk bus CPU1A system not responding
```

When this time-out condition occurs, either the IRU is hung or the subchannel is not correct.

Generally, the L2 will track the correct IRU rack, slot, blade, and subchannel for system console input and no user setting should be required. If the default value was manually overridden, it can be reset by entering the following command:

```
001c01-L1> select reset
```

L1 Mode From L2

In L1 mode, the prompt from a single L1 is visible, and all input is directed to that L1 command processor.

To enter L1 mode, enter the rack and a slot followed by l1:

```
L2> r 2 s 1 l1
```

An alternate method is:

```
L2> 2.1 l1
enterling L1 mode 001c01, <CTRL-T> to escape to L2
001c01-L1>
```

To return to L2 mode, press Ctrl+T:

```
001c01-L1> Ctrl+T
escaping to L2 system controller, <CTRL-T> to send escape to L1
L2>
```

At this point, you can enter any L2 command. Once the command is executed, the L2 returns to L1 mode:

```
re-entering L1 mode 001c01, <CTRL-T> to escape to L2

001c01-L1>
```

To permanently engage the L2 mode, press Ctrl+T and enter the l2 command:

```
001c01-L1> Ctrl+T
escaping to L2 system controller, <CTRL-T> to send escape to L1
L2> l2
L2 command processor engaged, <CTRL-T> for console mode.

L2>
```

Upgrading L1 Firmware

The L1 firmware is currently distributed as part of the `snxsc_firmware` package. To determine which version of the package is installed on your system console, enter the following command:

```
$> rpm -q snxsc_firmware
```

If the package is installed, the full package name (including the revision) is returned:

```
snxsc_firmware-1.18.3-1
```

The L1 firmware binary and the utilities used to update it are stored in `/usr/cpu/firmware/sysco`.

Upgrading L1 Firmware

Note that an Ethernet connection or console option is required to execute the commands described in this section. See "Console Hardware Requirements" on page 84 and Figure 4-1 on page 80 for descriptions of the hardware connections.

The L1 firmware consists of three parts:

- Boot image
- A image
- B image

At boot time, the boot image validates the A and B image, and if it is not instructed otherwise, it executes the newer of the two images. Because the L1 is running one of the two images, the image not in use is the image that will be overwritten when the firmware is upgraded. You need to re-boot any L1 update either by power-cycling the IRU or by using the L1 command `reboot_l1`.

Typically, you will upgrade the firmware through the network connection from the console to the L1:

```
$> /usr/cpu/firmware/sysco/flashsc --l2 10.1.1.1 -p
/usr/cpu/firmware/sysco/l1.bin all
```

This updates all the IRUs in the system. The `-p` at the end of the first line instructs the firmware to flash the proms in parallel.

You can update individual IRUs by replacing *all* with a rack and slot number:

```
$> /usr/cpu/firmware/sysco/flashsc --12 10.1.1.1
/usr/cpu/firmware/sysco/l1.bin 1.16
```

This updates only the IRU in rack 1, slot 16.

Rack Information

This chapter describes the physical characteristics of the tall (42U) and short (20U) Altix racks in the following sections:

- "Overview" on page 101

- "Altix 42U and 20U Rack Features" on page 102

- "Technical Specifications" on page 104

Overview

At the time this document was published only the tall (42U) and short (20U) Altix racks shown in Figure 5-1 and Figure 5-2 were tested and approved for use with Altix 450 systems. Use of other racks are at the discretion of the owner and no testing of usability, serviceability or durability is implied.

Note: While the Altix 450 can be installed in a non-Altix 450 rack, it is preferable to install it in an Altix 450 tall (42U) or short (20U) rack. The mounting rails on the Altix racks are recessed to allow for flush mounting of the IRU in the rack. The Altix rack also has provisions for PDUs to be mounted in the front. Installing the Altix 450 in a third-party rack will require that the unit protrude from the front of the rack. It will not be possible to use a front door on the third-party rack due to the protrusion of the unit. Power cables for the IRU power supplies will need to be routed to the rear of the rack if the PDUs are located in the rear of the rack. Airflow in the rack must be front to rear. Other devices installed in a rack must have their airflow direction front to rear. Cables may need to be routed from the rear of the devices to the front of the Altix 450 IRU. Vertical space must be left (U space) for cable routing front to rear in the rack.

Altix 42U and 20U Rack Features

The Altix racks (shown in Figure 5-1 and Figure 5-2) have the following features and components:

- **Front and rear door**. The front door is opened by grasping the wide end of the triangle-shaped door piece and pulling outward. Note that the tall rack uses a key lock for security purposes; the short (20U) rack does not.

  The rear door of the tall (42U) rack has a push-button key lock to prevent unauthorized access to the system. The tall rack's front door and rear door locks are keyed differently. You cannot use the rear door key to secure the front door lock.

- **Cable entry/exit area.** Cable access openings are located in the front floor and top of the rack. Cables are only attached to the front of the IRUs; therefore, cable management occurs primarily in the front of the rack. In the case of storage modules, cables are attached to the front connectors on the IRU and routed to the rear of the storage enclosure. I/O and power cables normally pass through the bottom of the rack.

- **Rack structural features.** Each rack is mounted on four casters; the two rear casters swivel. There are four leveling pads available at the base of the tall rack. The base of both racks have attachment points to support an optional ground strap, and/or seismic tie-downs.

- **Power distribution units within the racks.** Up to four single-phase power distribution units (PDUs) are needed in a tall rack, depending on the number of IRUs and other optional modules installed. The 42U rack systems are also available with one (18-socket) three-phase PDU. Short racks use a maximum of two single-phase PDUs. Each IRU requires two outlets from the 5-outlet single-phase PDUs.
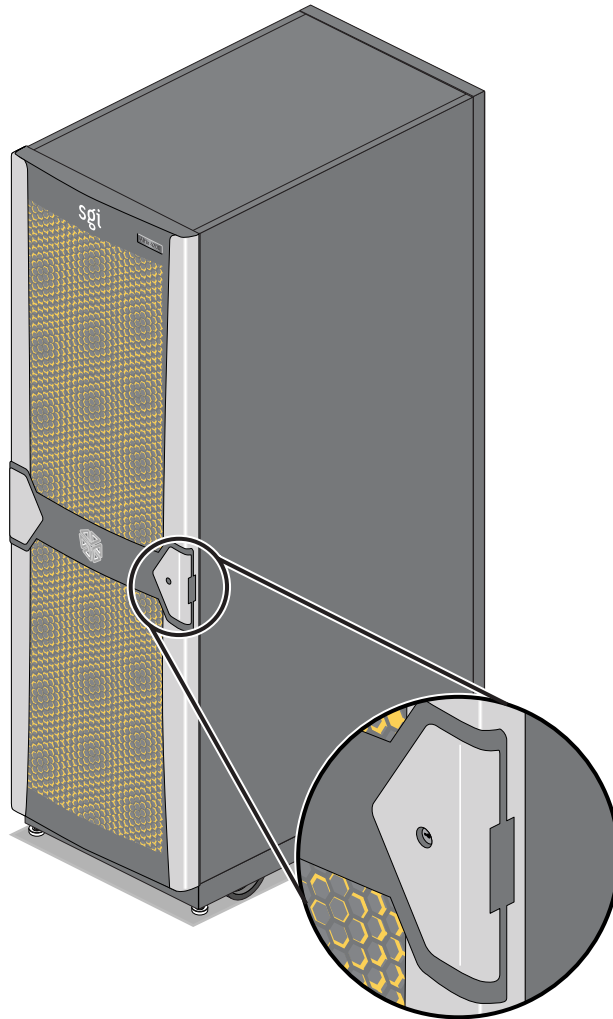
Figure 5-1   Tall (42U) Altix Rack and Front Lock
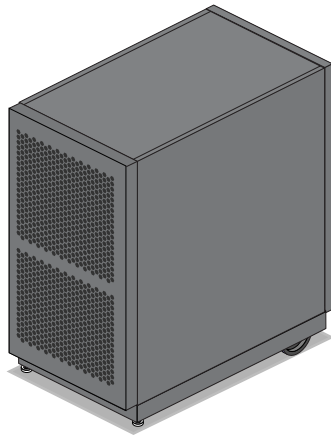
Figure 5-2   Short (20U) Altix Rack (Rear View)

Technical Specifications

Table 5-1 lists the technical specifications of the Altix 450 tall rack.

Table 5-1   Tall Altix Rack Technical Specifications

Characteristic	Specification
Height	79.5 in. (201.9 cm)
Width	25.8 in. (65.5 cm)
Depth	43.45 in. (110.4 cm)
Weight (full)	1500 lb (682 kg)

Table 5-2 lists the technical specifications of the Altix 450 short rack.

Table 5-2   Short Altix Rack Technical Specifications

Characteristic	Specification
Height	42.8 in. (108.7 cm)
Width	25.8 in. (65.5 cm)

Table 5-2   Short Altix Rack Technical Specifications **(continued)**

Characteristic	Specification
Depth	40.9 in. (103.9 cm)
Weight (full)	750 lb (340 kg)

Maintenance and Upgrade Procedures

This chapter provides information about installing or removing components from your SGI system, as follows:

- "Maintenance Precautions and Procedures" on page 107

- "Installing or Removing Internal Parts" on page 109

- "Adding or Replacing PCI/PCI-X Cards" on page 131

- "Installing or Replacing a Disk Drive in the IA Blade" on page 141

Maintenance Precautions and Procedures

This section describes how to open the system for maintenance and upgrade, protect the components from static damage, and return the system to operation. The following topics are covered:

- "Preparing the System for Maintenance or Upgrade" on page 108

- "Returning the System to Operation" on page 108

- "Installing or Removing Internal Parts" on page 109

Preparing the System for Maintenance or Upgrade

To prepare the system for maintenance, follow these steps:

1. If you are logged on to the system, log out. Follow standard procedures for gracefully halting the operating system.

2. At your system console, switch from console mode to system control mode by entering the following command:

    ```
    $> Ctrl+T
    ```

    The system will respond with the system control prompt:

    ```
    L2>
    ```

3. From the system control prompt (L2>), power off the system with the following command:

    ```
    L2> power down
    ```

4. Locate the power distribution unit(s) (PDUs) in the front of the rack and turn off the circuit breaker switches on each PDU.

Returning the System to Operation

When you finish installing or removing components, return the system to operation as follows:

1. Turn each of the PDU circuit breaker switches to the "on" position.

2. At your system console, enter the following command:

    ```
    L2> power up
    ```

3. Verify that the LEDs on the L1 controller(s) turn on and illuminate green and that your controllers display that the system is powered on for each segment of the procedure, which indicates that the power-on procedure is proceeding properly.

If your system does not boot correctly, see "Troubleshooting Chart" in Chapter 7, for troubleshooting procedures.

Installing or Removing Internal Parts

<div style="margin-left:auto">⚠</div>

Caution: The components inside the system are extremely sensitive to static electricity. Always wear a wrist strap when you work with parts inside your system.

To use the wrist strap, follow these steps:

1. Unroll the first two folds of the band.

2. Wrap the exposed adhesive side firmly around your wrist, unroll the rest of the band, and then peel the liner from the copper foil at the opposite end.

3. Attach the copper foil to an exposed electrical ground, such as a metal part of the chassis.

Caution: Do not attempt to install or remove components that are not listed in Table 6-1. Components not listed must be installed or removed by a qualified SGI field engineer.

Table 6-1 lists the customer-replaceable components and the page on which you can find the instructions for installing or removing the component.

Table 6-1   Customer-replaceable Components and Maintenance Procedures

Component	Procedure
L1 controller panel	"Remove and Replace the System Control Display Panel" on page 110
IRU power supplies	"Removing or Adding IRU Power Supplies" on page 113
IRU fans (blowers)	"Removing and Replacing IRU Fans (Blowers)" on page 114
Replacing IRU blades	"Removing and Replacing a Compute/Memory Blade" on page 118
Add or replace DIMMs	"Memory DIMM Replacement Overview" on page 121
Replace the DVD drive	"Remove and Replace the DVD Drive" on page 127
PCI, PCI-X, PCIe cards	"Adding or Replacing PCI/PCI-X Cards" on page 131
Base I/O blade disk drives	"Installing or Replacing a Disk Drive in the IA Blade" on page 141

Replacing IRU Components

While the individual rack units (IRUs) are not considered end-user replaceable, a number of their internal components can be removed and replaced. These include:
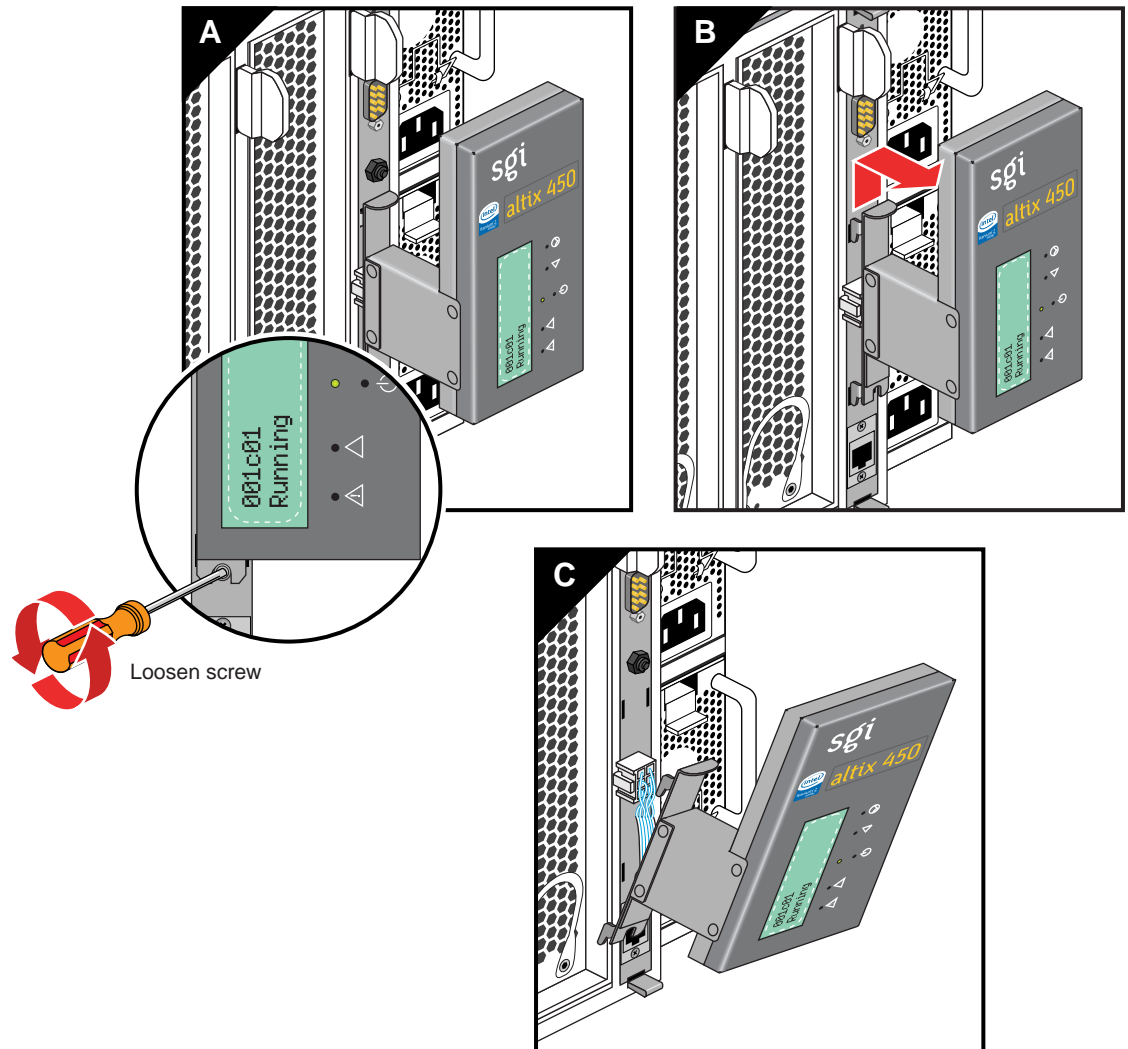
- L1 controller panel

- IRU power supplies

- IRU cooling fans (also called blowers)

- IRU blades and their components

Remove and Replace the System Control Display Panel

To remove and replace either of the two power supplies in an IRU, you must first remove the system control display panel. Use the following steps to remove the system control display:

1. Using a T10 torx driver, loosen the lower screw that holds the display panel to the IRU chassis, see Figure 6-1 on page 111.

2. Lift the display assembly up about 1/3-inch (84 mm) and pull it outward from the IRU chassis.

3. Don't unplug the ribbon cable unless you are replacing the system control panel.

4. Let the control panel gently dangle and go to the section "Removing or Adding IRU Power Supplies" on page 113.

5. Replace the applicable power supply and then use the following set of steps to replace the system control panel.
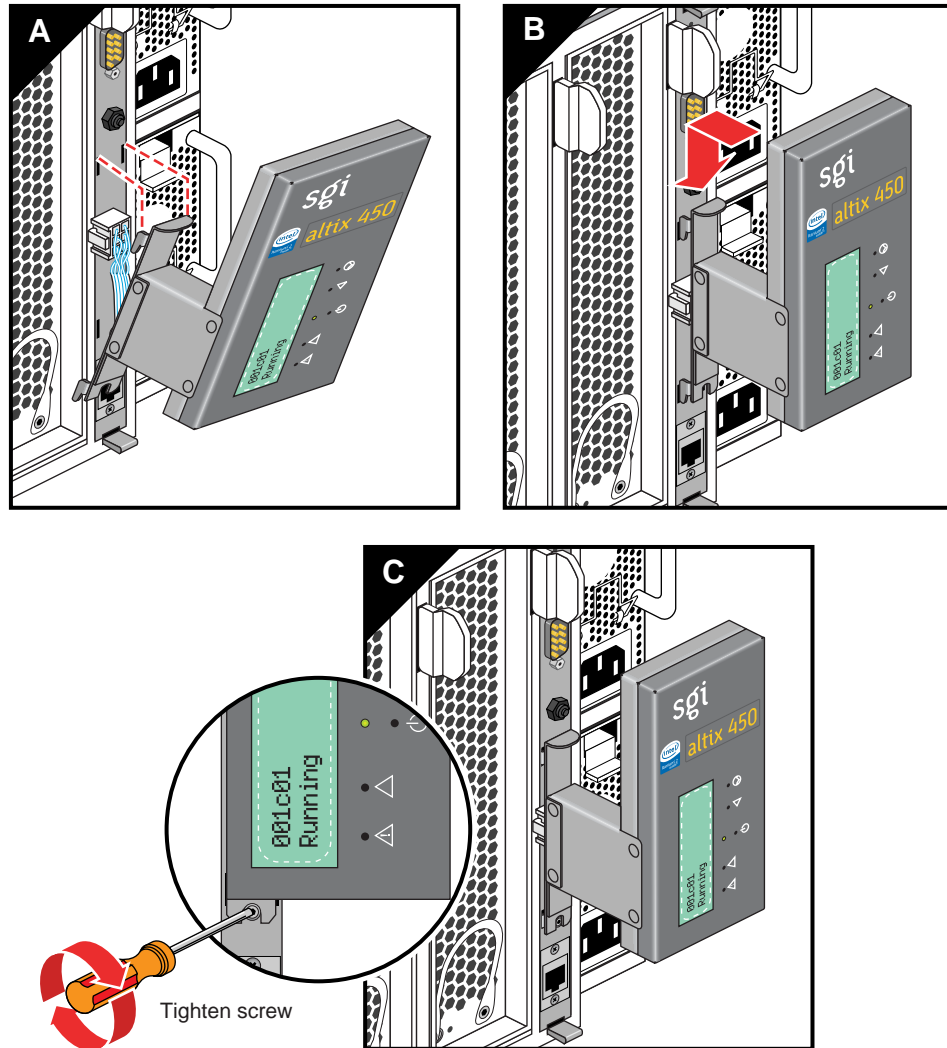
Figure 6-1   Removing the L1 Controller Panel

Replace the system control panel using the following steps:

1.   Position the controller panel assembly slightly above the retention screw.

2.   Carefully slid it back into place, see Figure 6-2.

3. Be careful not to snag the ribbon cable while replacing the panel.

4. Use the T10 torx driver to tighten the retention screw holding the panel to the IRU.

5. Restart the IRU or system as applicable.

Figure 6-2　　Replacing the L1 Controller Panel
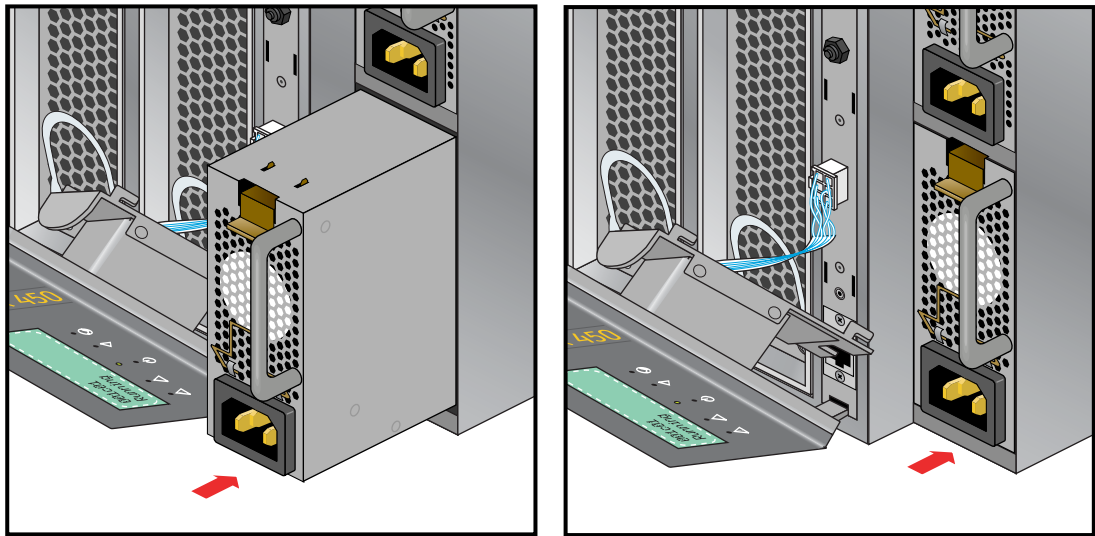
Removing or Adding IRU Power Supplies

Under most circumstances a single power supply in an IRU can be replaced without shutting down the IRU or the complete system. In the case of a fully configured (loaded) IRU, this may not be possible. In a fully loaded system, power supply failure could result in shutdown of the IRU due to the power loss. Note that when replacing either of the supplies, it is necessary to remove the system controller panel (see "Remove and Replace the System Control Display Panel" on page 110 before proceeding). Use the following steps to remove and replace a power supply in the IRU:

1. Disconnect the power cord from the IRU power supply.

2. Press down on the retention latch at the top of the power supply, see Figure 6-3.

3. Using the power supply handle, pull the power supply straight out of the IRU.

Press latch
down
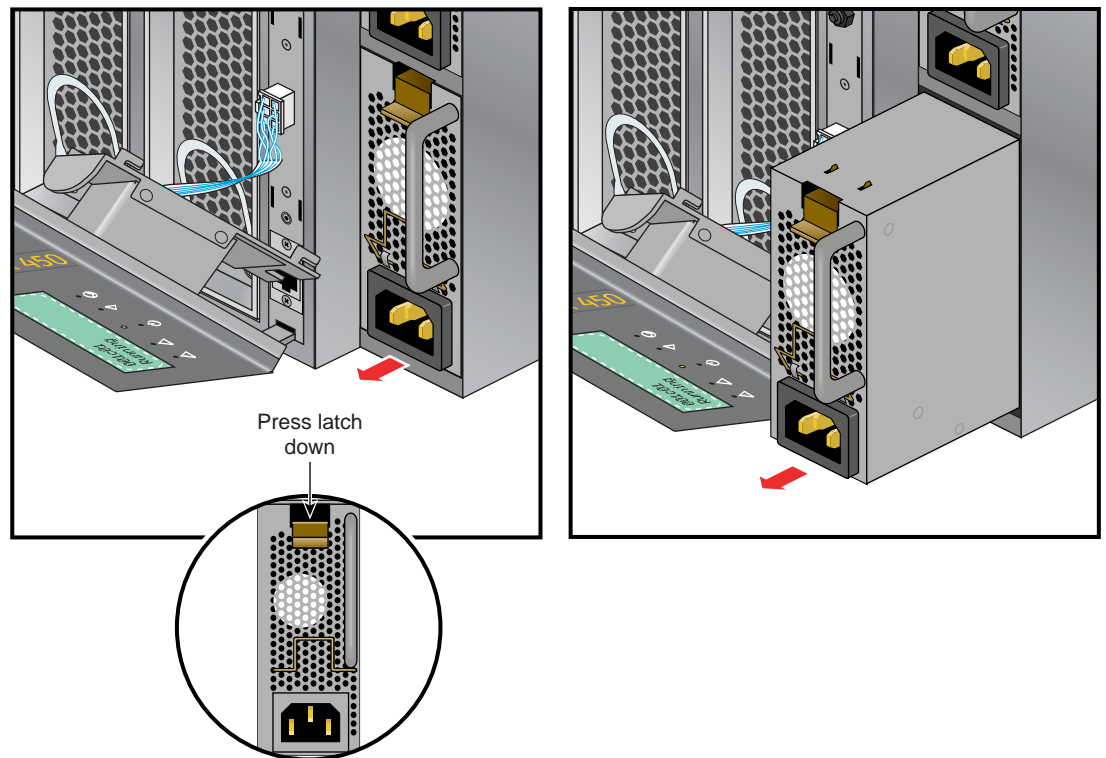
Figure 6-3   Removing an IRU Power Supply

4. Install the new power supply with the retention latch at the top of the supply.

5. Slide the power supply into the chassis until the retention latch engages.

6. Reconnect the power cord to the power supply.

7. Reattach the L1 front panel using the information in "Remove and Replace the System Control Display Panel" on page 110.

**Figure 6-4**   Replacing an IRU Power Supply

Removing and Replacing IRU Fans (Blowers)

The IRU fans (blowers) are located at the rear of the unit (see Figure 6-5). You will need to access the rack from the back to remove and replace a fan. The IRU's system controller issues a warning message when a fan is not running properly. This means the RPM level of the fan is not within tolerance. When an IRU fan fails, the following things happen:

1. The L1 display on the IRU with the failed fan shows a warning message

    ```
    ATTN: Fan (number) warning
    ```

2. The console will show the same warning indicating the rack and IRU position

    ```
    001c01 L2> Fan (number) warning limit reached @ 0 RPM
    ```

3. A line will be added to the L1 system controller's log file indicating the fan warning.

4. If ESP is used, a warning message will be sent to it also, (see "SGI Electronic Support" on page 151).

The system controller monitors the temperature within each IRU. If the temperature increases due to the failed fan, the remaining fans will run at a higher RPM to compensate for the failed fan. The system will continue running until a scheduled maintenance occurs. The fan numbers for the IRU (as viewed from the rear) are shown in Figure 6-5.
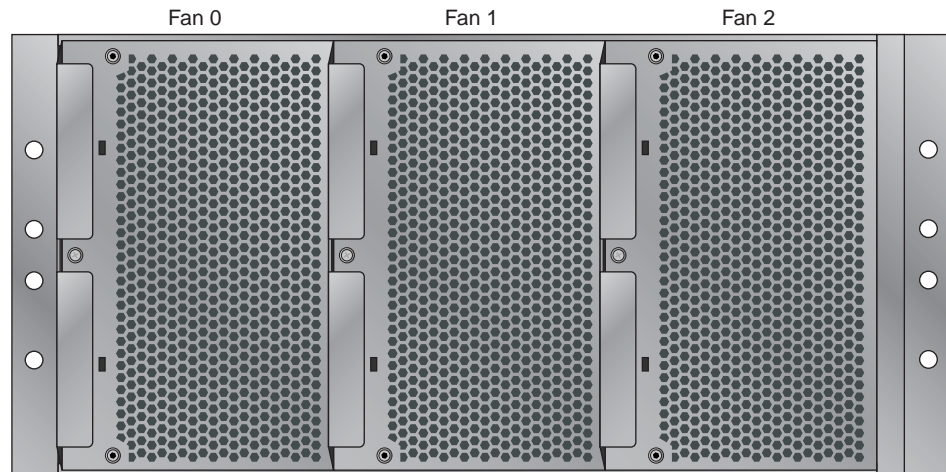

Figure 6-5   IRU Fan Assembly (Blowers)

Note that a fan can be replaced while the IRU is operating. You will need a number 1 phillips-head screw driver to complete the procedure.

Use the following steps and illustrations to replace an IRU fan:

1. Undo the (captive) screw (located in the middle of the blower assembly handle). The handle has a notch for the screw access, see Figure 6-6.

2. Grasp the blower assembly handle and pull the assembly straight out.
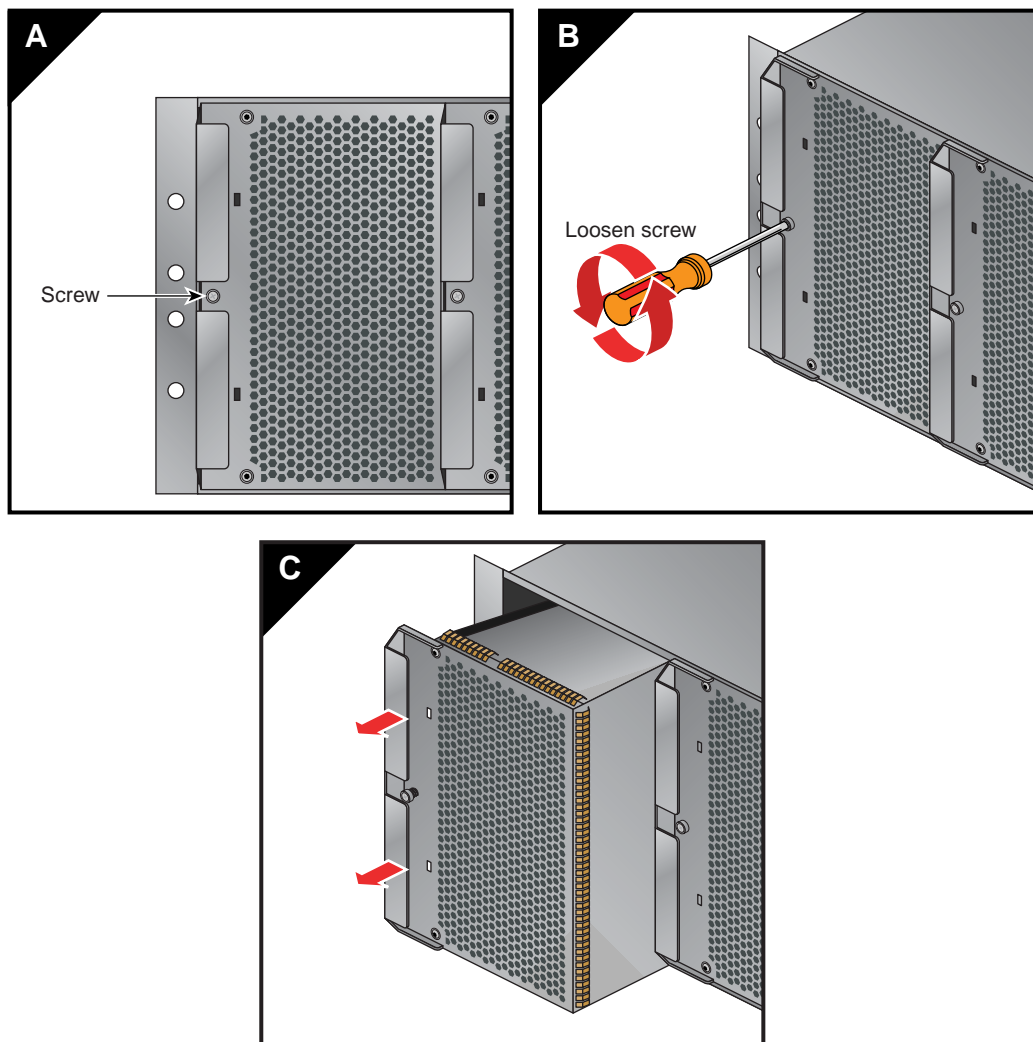
Figure 6-6   Removing a Fan From the IRU

3.   Slide a new blower assembly completely into the open slot, see Figure 6-7.

4.   Tighten the blower assembly screw to secure the new fan.
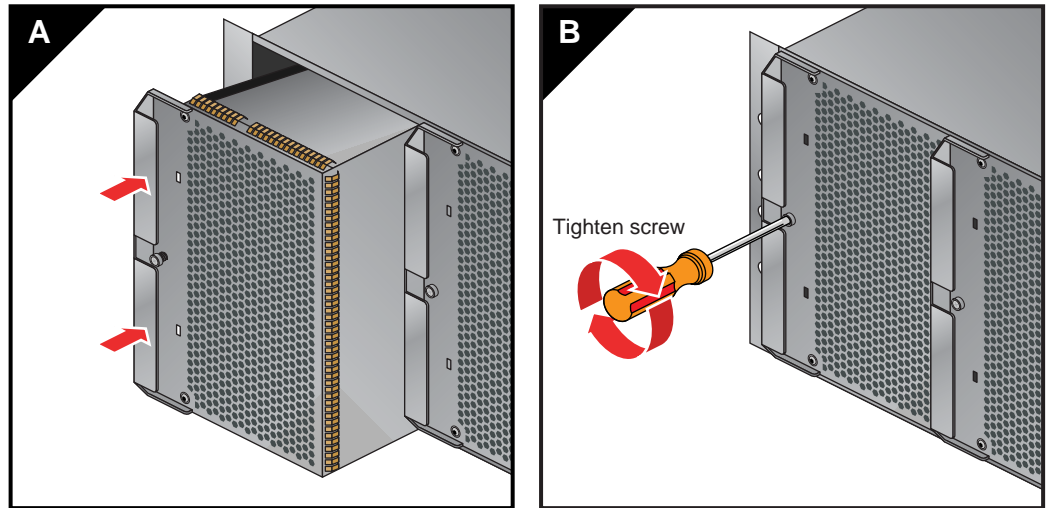
Figure 6-7   Replacing an IRU Fan

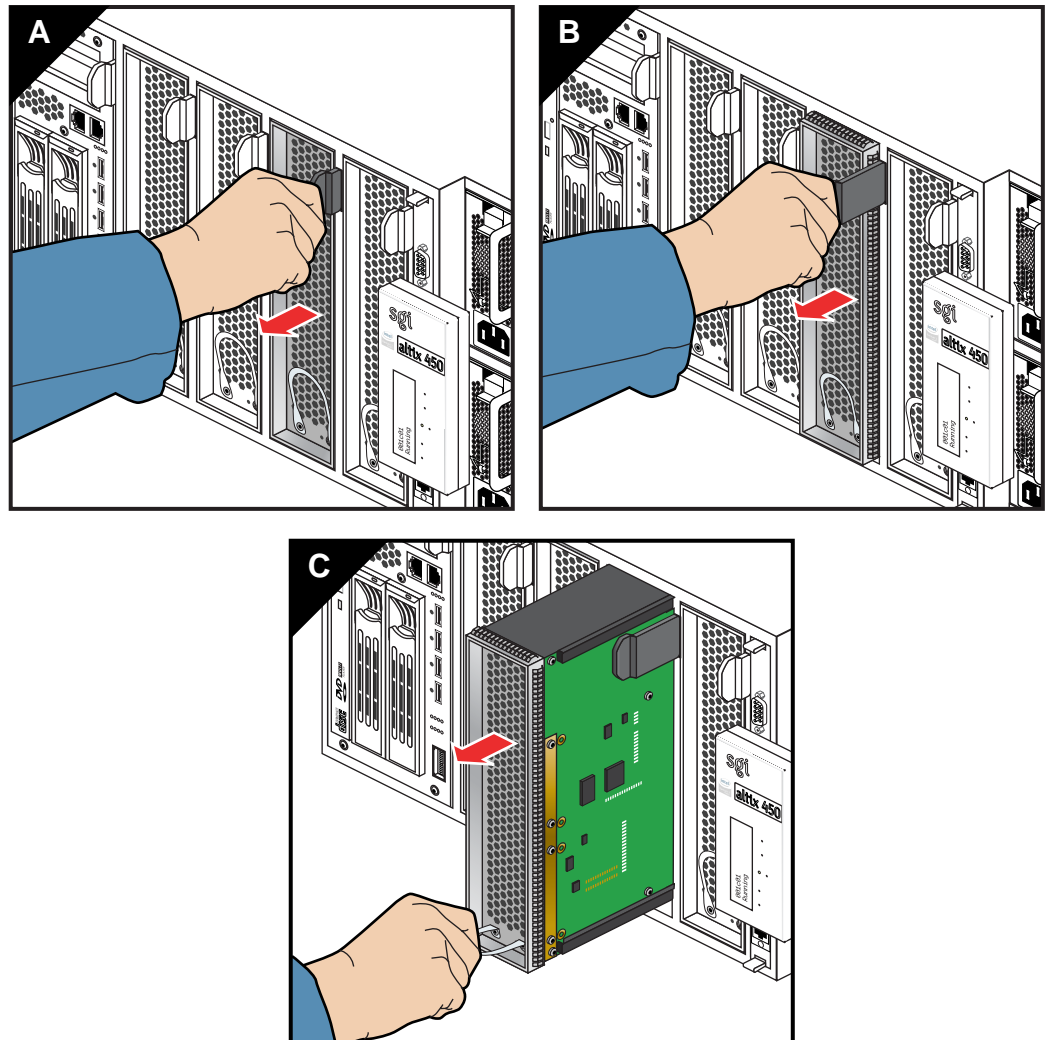## Removing or Replacing a System Blade From the IRU

The blades installed in your SGI Altix 450 can generally be removed from or installed in an IRU without powering down the entire system. However, the operating system should be halted and the power to the IRU should be shut down in most cases. Note that the IA blade holding your system disk(s) should never be removed without backing up and gracefully powering down the unit.

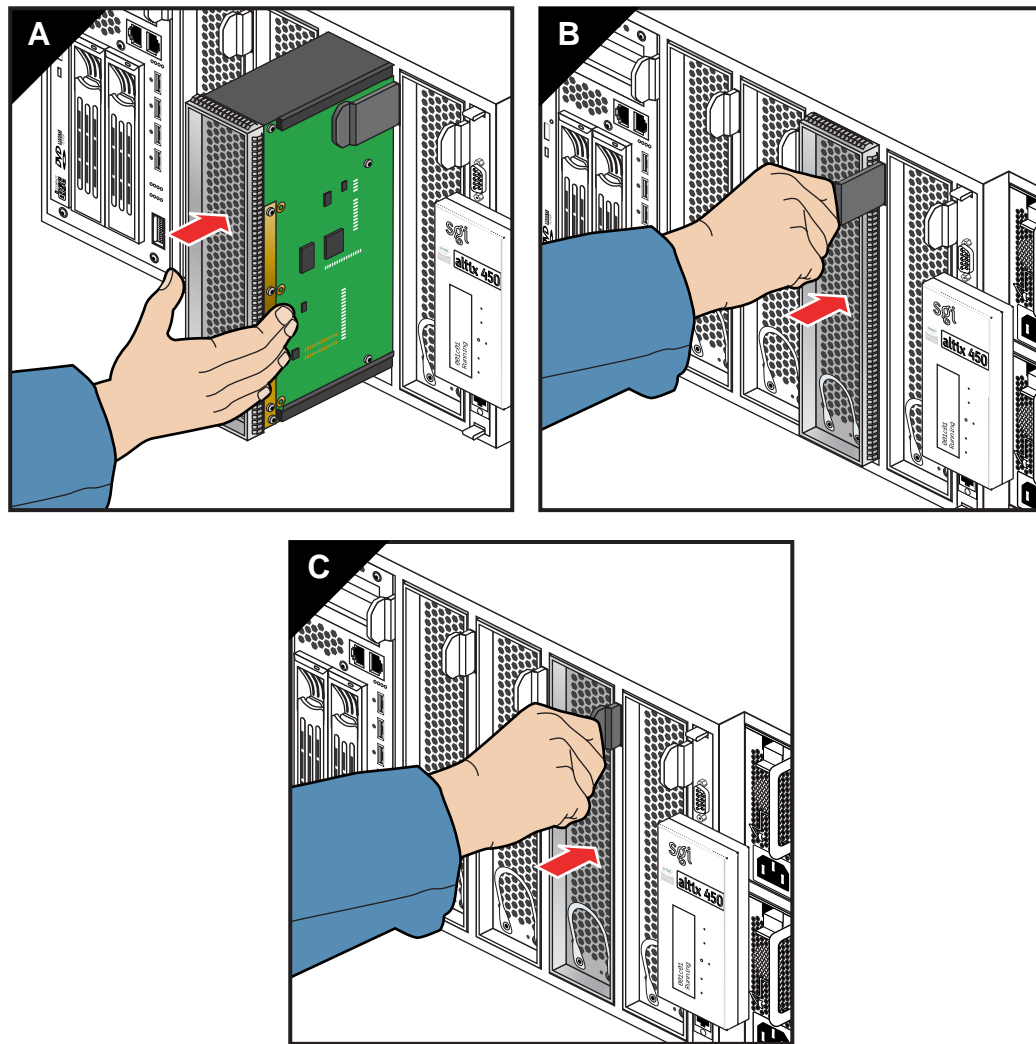## Removing and Replacing a Compute/Memory Blade

Use the following information and illustrations to remove and replace a compute/memory blade from the host IRU:

1. Open the front door of the rack and access the IRU blade slated for replacement.

2. Move the blade's retention tab gently to the left to disengage the locking tab. Be careful not to use too much force as the tab is breakable.

3. Pull the blade's retention tab outward until it is fully extended, see Figure 6-8.

4. Slide the blade outward by pulling the bottom ring gently out.

5. Remove the blade completely from the IRU and place it on an anti-static work surface or in anti-static packaging.

6. Slide the new blade carefully into the IRU slot until seated in the slotting mechanism.

7. Carefully push the retention tab back into place so that the blade is seated and locked down, see Figure 6-9 for an example. Note that pushing in the tab fully seats the blade (moves it deeper into the IRU) and locks it in place.

8. Restart the IRU or system.

Figure 6-8   Removing a Compute/Memory Blade From the IRU

Figure 6-9   Replacing a Compute/Memory Blade in the IRU

Memory DIMM Replacement Overview

The compute/memory boards installed in your system IRU(s) have space for a total of either eight or twelve dual-inline memory modules (DIMMs). The guidelines for use of these DIMMs are similar for the two styles of board.

Verify the number of DIMM slots on your board and review the guidelines and descriptions in the applicable section before upgrading or replacing memory on a blade.

Memory DIMM Group Placement and Guidelines (12-DIMM Boards)

Memory is contained on cards that are referred to as DIMMs (dual in-line memory modules). Each individual memory or compute/memory blade can contain four, eight, or twelve DIMMs installed in DIMM slots located on the blade's node board. These twelve DIMM slots are organized into three groups of four DIMMs each, see Figure 6-10 on page 122.

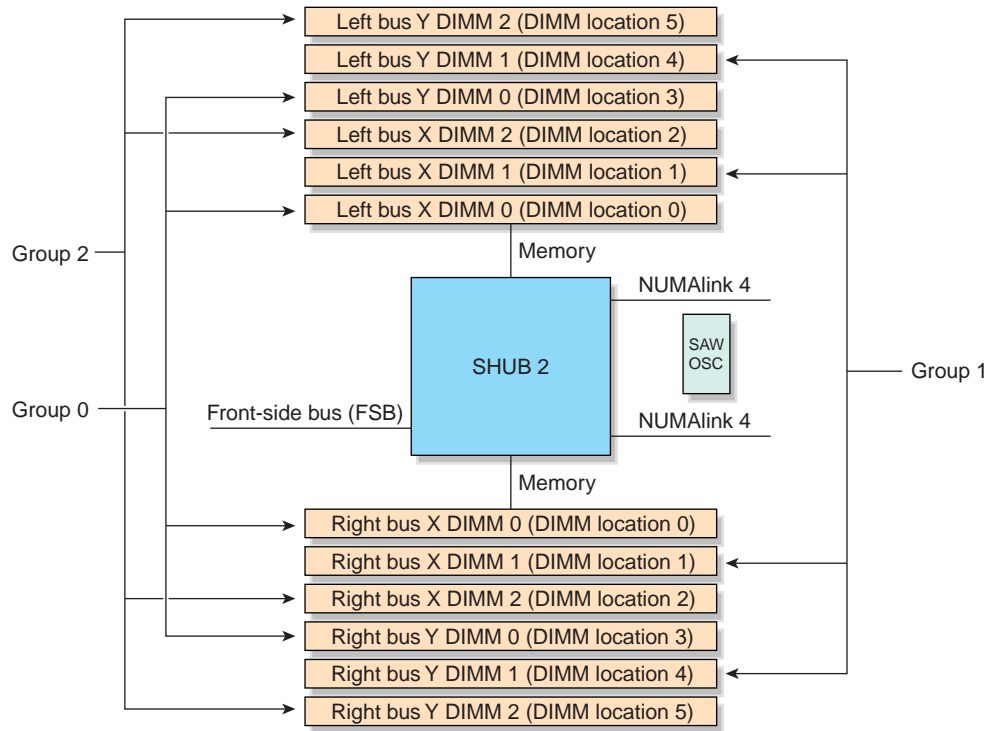**Important:** DIMMs are installed one per DIMM slot, and must be installed in groups of four in the 12-DIMM boards.

Figure 6-11 on page 123 shows an example of the physical DIMM locations within the processor blade assembly.

Follow these guidelines when installing DIMM groups in the 12-DIMM boards:

*   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 blades can differ in memory size.

*   The first four DIMMs (group 0) must be in place for the blade's memory to operate properly.

*   Mixing blades with different capacity DIMM groups within an IRU is permitted.

*   When installing 4 GB DIMMs, check with your SGI service representative. Space limitations may require that a maximum of eight 4 GB DIMMs be installed on each blade.

Figure 6-10   12-DIMM Board Group Locations Diagram
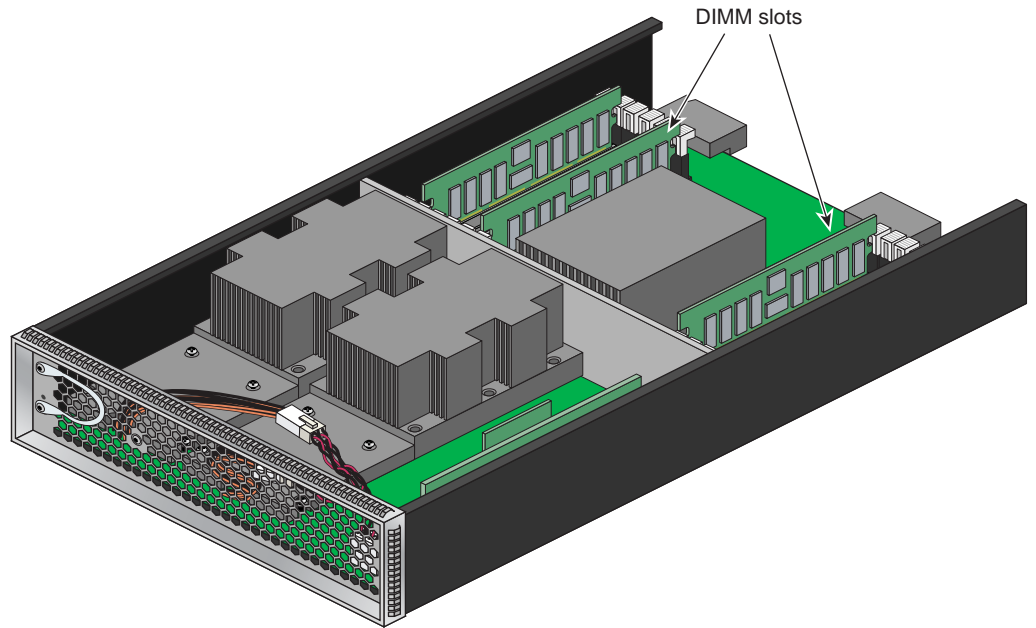
Figure 6-11   12-DIMM Board Memory Slot Location Example

Memory DIMM Group Placement and Guidelines (8-DIMM Boards)

Memory is contained on cards that are referred to as DIMMs (dual in-line memory modules). Each individual compute/memory blade can contain four or eight DIMMs installed in DIMM slots located on the blade's node board. At the time this document was published, the 8-DIMM blade was not available as a memory-only node.

The eight DIMM slots are organized into two groups of four DIMMs each, see Figure 6-12 on page 125.

Important: DIMMs are installed one per DIMM slot, and must be installed in groups of four in the 8-DIMM boards.

Figure 6-13 on page 126 shows an example of the physical DIMM locations within the processor blade assembly.

Follow these guidelines when installing DIMM pairs in the 8-DIMM boards:

- Memory is increased or decreased in four-DIMM group increments only. Each set of four DIMMs that make up a DIMM group *must* be the same memory size and speed.

- Group 0 can be a different memory capacity than group 1.

- The first four DIMMs (group 0) *must* be in place for the blade's memory to operate properly.

- Mixing blades with different capacity DIMM groups within an IRU is permitted.
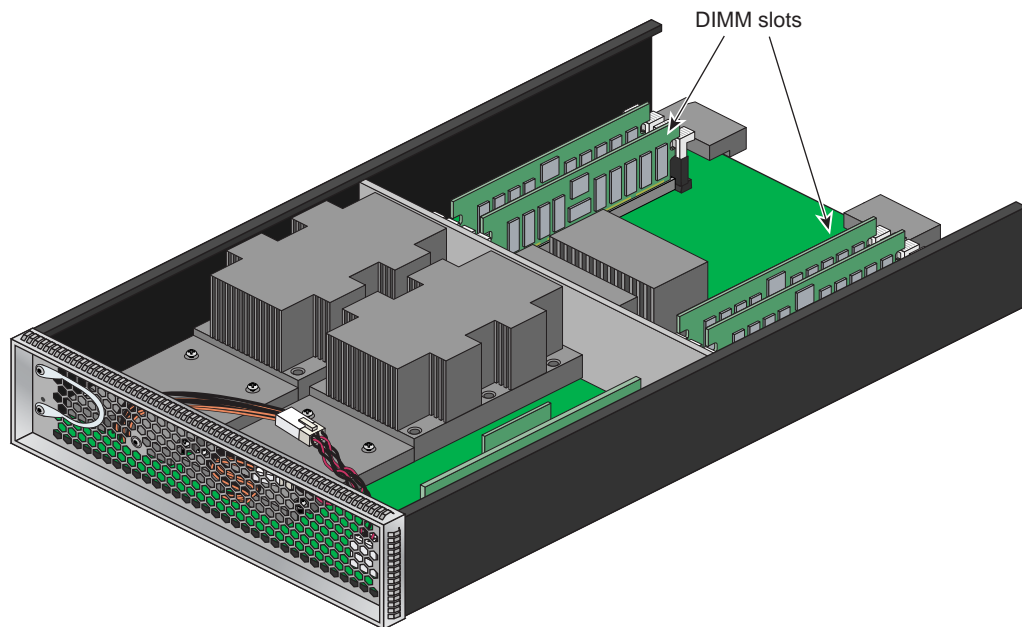

Note: Use of 4GB "stacked" DIMMs will necessitate using only group 0 slots on the blade. A stacked DIMM uses two memory chips "piggybacked" on the same memory part location.
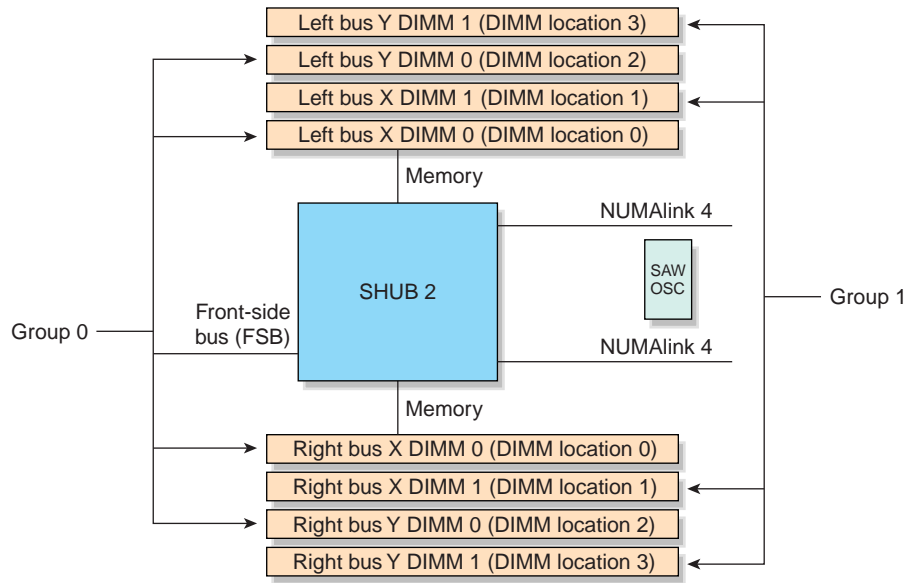
Figure 6-12   8-DIMM Board Group Locations Diagram

Figure 6-13   8-DIMM Board Memory Slot Location Example

**Note:** Only the group 0 DIMMs are shown in the example in Figure 6-13.

Remove and Replace the DVD Drive

Use the following steps to remove the DVD drive from an IA blade:

1. Power off the IRU, use instructions in "Powering the System On and Off" on page 51.

2. Extract the IA blade you are going to install the new DVD drive in. See the information in "Replacing IRU Components" on page 110.

3. After removing the IA blade from the IRU chassis, place it on a stable flat surface with the left side facing upward (see Figure 6-14).

4. Use a Phillips type screwdriver to remove the DVD access panel screw, (see Figure 6-14).

5. Lift the DVD access panel clear of the IA blade and set it aside.

6. Unscrew and remove the DVD drive assembly retention screw.

7. Gently but firmly disengage the DVD power and data cable connectors from the old DVD drive and slide the DVD unit out of the IA blade housing.

8. Slide the new DVD drive assembly into the IA blade housing.

9. Connect the DVD power and data cable connectors to the replacement drive.

10. Screw in the DVD drive assembly retention screw.

11. Replace the DVD access panel and tighten the retention screw.

12. Return the IA blade to its IRU slot.

13. Power-up the IRU and/or system.
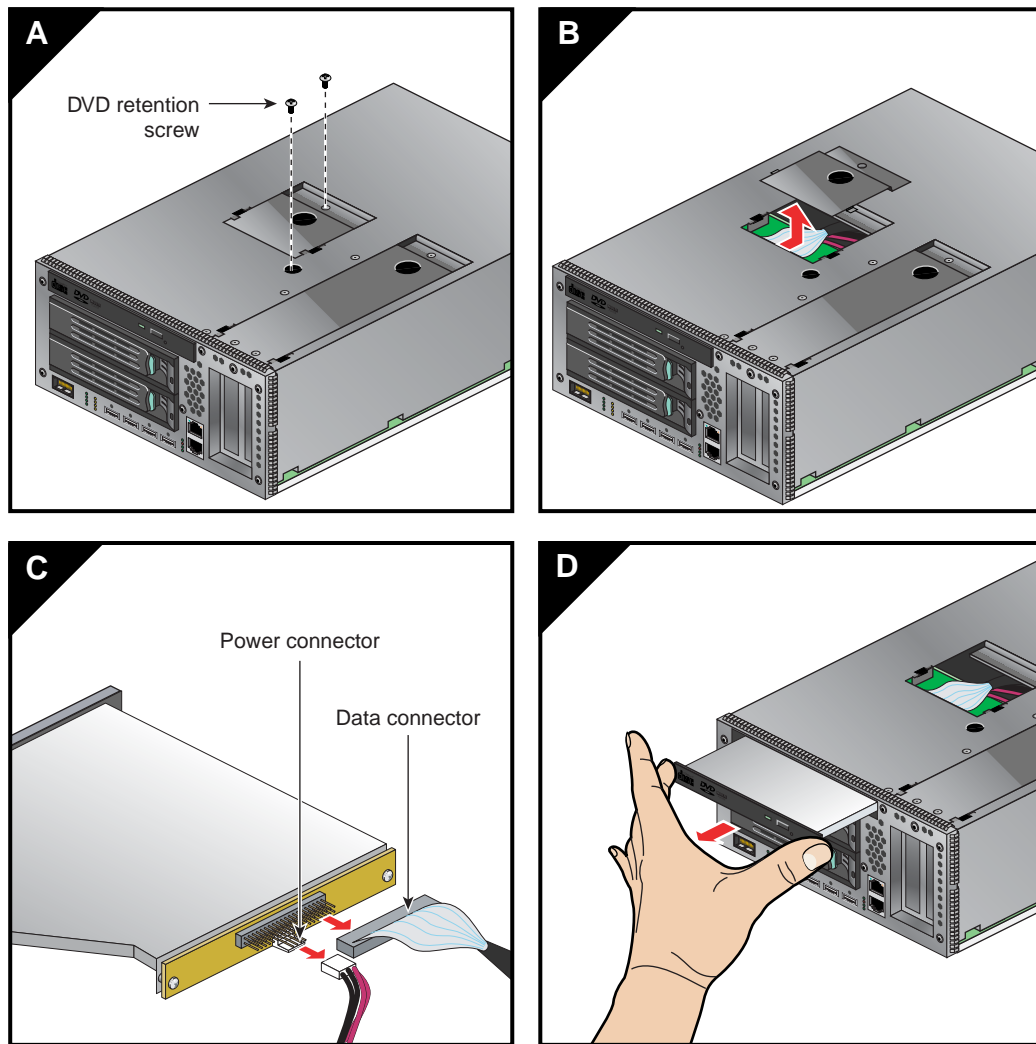
Figure 6-14   DVD Removal from IA Blade
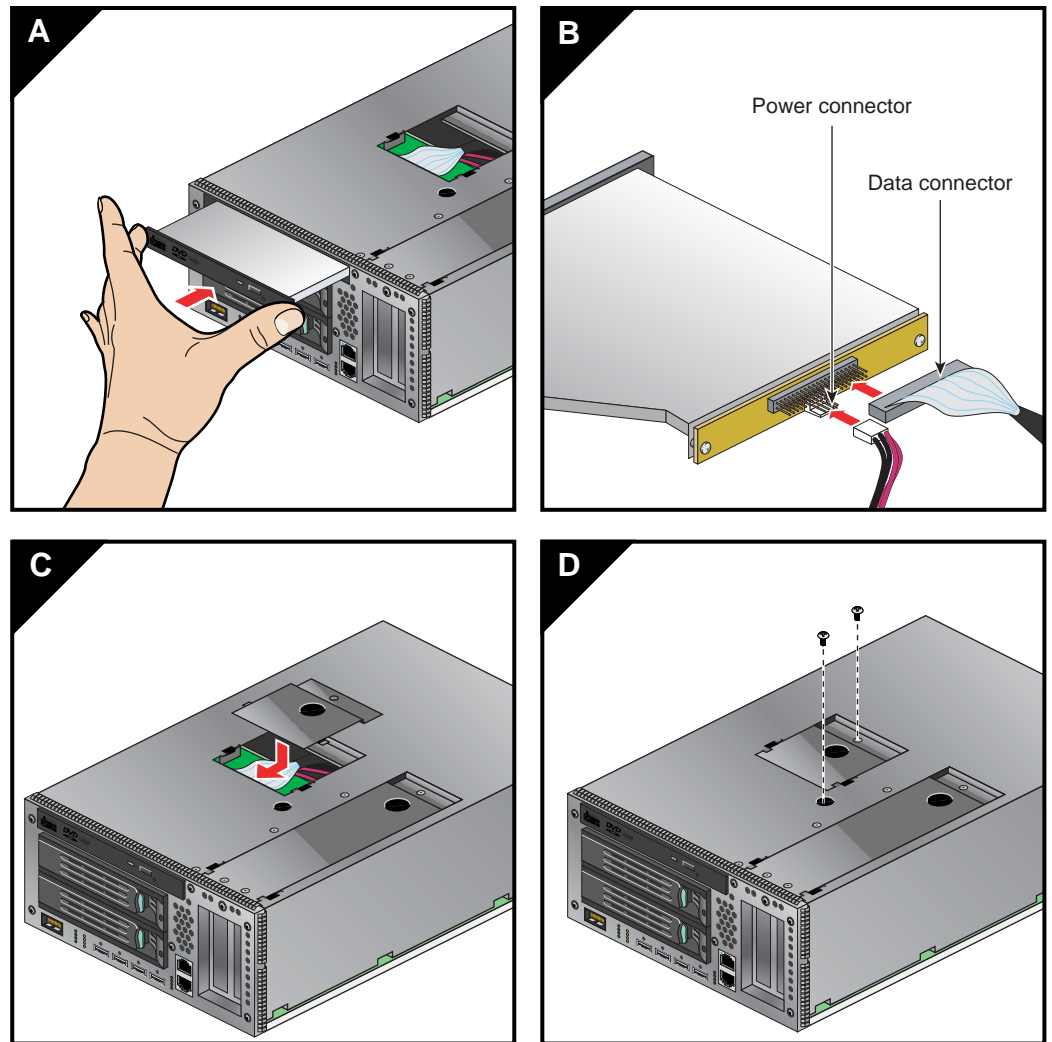
Figure 6-15   DVD Drive Replacement in the IA Blade

Overview of PCI Express Operation

This section provides a brief overview of the new PCI Express (PCIe) technology that will be available as an option with your system. PCI Express has both compatibility and differences with older PCI/PCI-X technology. Check with your SGI sales or service representative for more detail on PCI Express options available with the SGI Altix 450.

PCI Express is compatible with PCI/PCI-X in the following ways:

• Compatible software layers

• Compatible device driver models

• Same basic board form factors

• PCIe controlled devices appear the same as PCI/PCI-X devices to most software

PCI Express technology is different from PCI/PCI-X in the following ways:

• PCI Express uses a point-to-point serial interface vs. a shared parallel bus interface used in older PCI/PCI-X technology

• PCIe hardware connectors are not compatible with PCI/PCI-X (see Figure 6-16)

• Potential sustained throughput of x16 PCI Express is approximately four times that of the fastest PCI-X throughputs
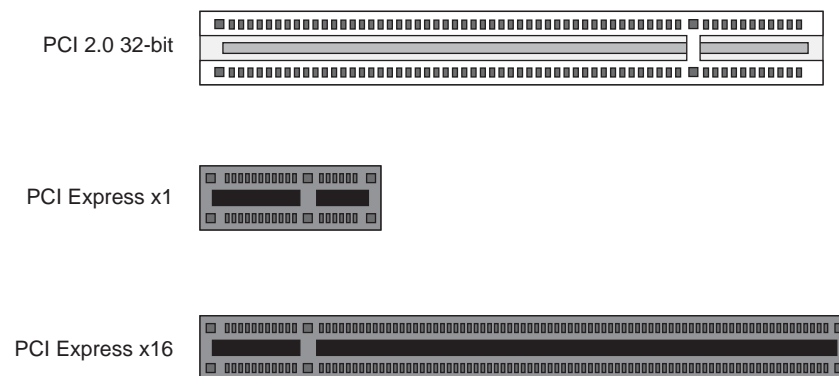
Figure 6-16　Comparison of PCI/PCI-X Connector with PCI Express Connectors

PCI Express technology uses two pairs of wires for each transmit and receive connection (4 wires total). These four wires are generally referred to as a lane or x1 connection. This is also called "by

1". SGI Altix 450 technology uses an x16 connector (64 wires) or "by 16" in PCI Express card slots. This technology will support PCIe boards that use connectors up to x16 in size. Table 6-2 shows this concept.

Table 6-2   SGI PCIe Support Levels

SGI x16 PCIe Connector	
x1 PCIe cards	Supported
x2 PCIe cards	Supported
x4 PCIe cards	Supported
x8 PCIe cards	Supported
x16 PCIe cards	Supported
x32 PCIe cards	Not supported

Adding or Replacing PCI/PCI-X Cards

Warning: **Before installing, operating, or servicing any part of this product, read the "Safety Information" on page 167.**

This section provides instructions for adding or replacing a PCI/PCI-X card in the I/O blade or PCI expansion blades installed in your system's Individual Rack Units (IRUs). To maximize the operating efficiency of your cards, be sure to read all the introductory matter before beginning the installation.

There are different types of blades used in the IRU that hold PCI/PCI-X boards. Note the following guidelines:

• The IA/IA2 blade (base I/O blade) containing the system disk and DVD drive will **only** accommodate half-height PCI/PCI-X cards.

• The three-slot double-wide PCI blade supports **only** PCI/PCI-X cards that mount and install with an SGI sliding card carrier.

> ⚠ **Caution:** To protect the PCI cards from ESD damage, SGI recommends that you use a grounding wrist strap while installing a PCI card.

Installing PCI Cards in the Three-Slot Blade

Use the following instructions and illustrations to install or replace a PCI/PCI-X card in the three-slot blade:

1. Follow the instructions in "Replacing IRU Components" on page 110 and extract the three-slot blade from the IRU.

2. To extract the card carrier from a slot in the blade, pull the handle on the selected card carrier straight out, as shown in Figure 6-17.

3. If you are replacing a card, gently remove the existing card from the carrier.

4. If you are adding a card, extract the carrier metal filler plate by pushing down on it, as shown in Figure 6-18. This filler plate covers the area where your card connectors will protrude out to the rear panel of the blade.
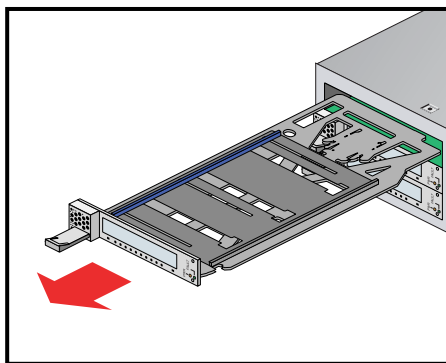
**Figure 6-17**   Removing a Card Carrier From the Three-Slot Blade
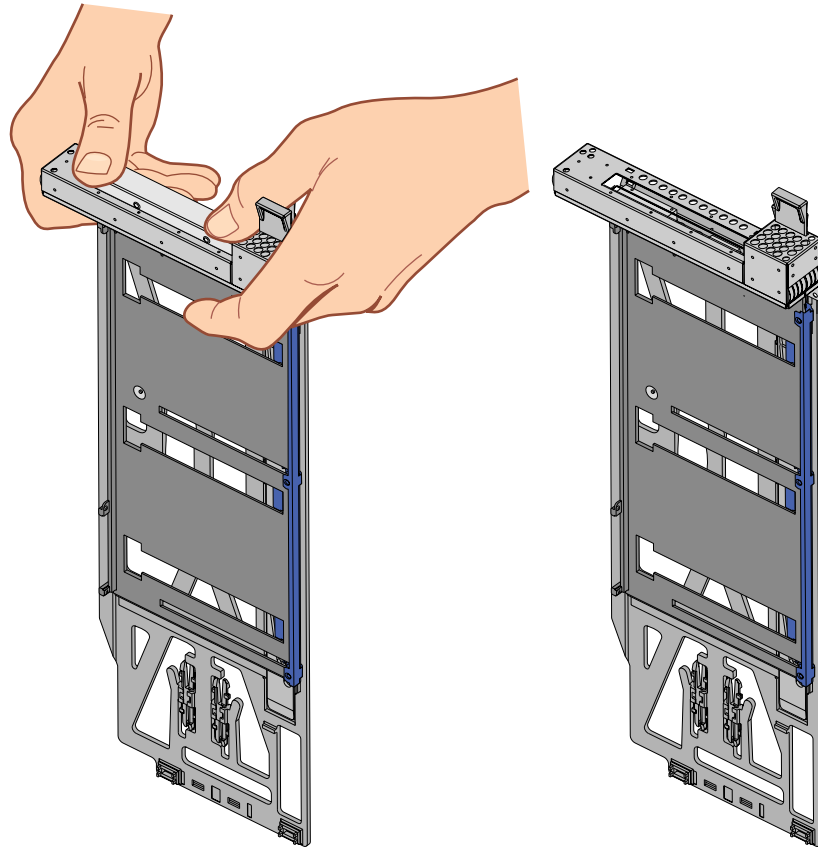
Figure 6-18 Extracting the Carrier Metal Filler Plate

Note: If you are adding or replacing a half-height PCI card, skip ahead to step 6.

5. If the full-height card that you want to install does not fit in the carrier, follow these steps:

    a. Loosen the three screws on the guide bar with a Phillips screwdriver (if your carrier uses T8 Torx screws, you will need a Torx screw driver).

    b. Adjust the carrier guide bar (also known as the alignment rail) up or down as necessary (see Figure 6-19).
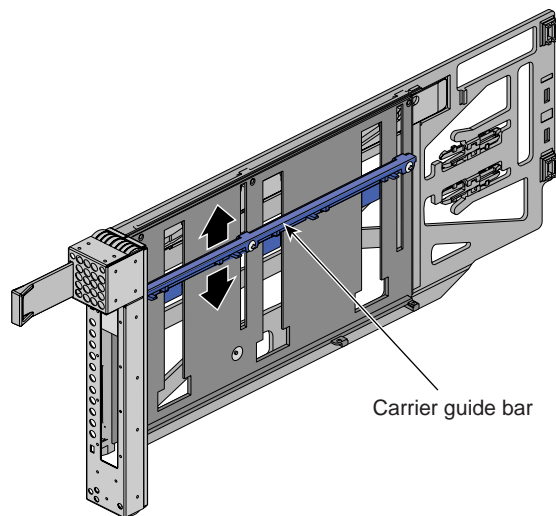
Carrier guide bar

Figure 6-19   Adjusting the Carrier Guide Bar

    c.   Mount the card in the carrier, (see Figure 6-20) and ensure the following occurs:

       – The card connectors protrude through the bulkhead where the metal filler plate was located.

       – The edge connectors fit between the bottom guides of the carrier.

       – The top of the card fits under the clips on the guide bar.

    d.   Tighten the three screws on the guide bar. Skip step 6 and proceed to step 7.
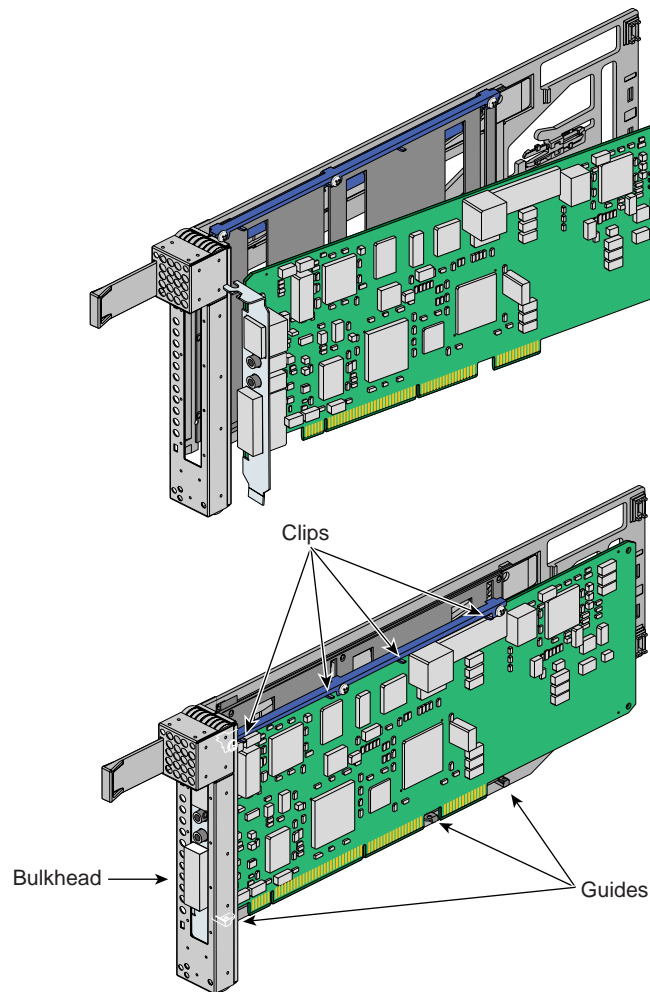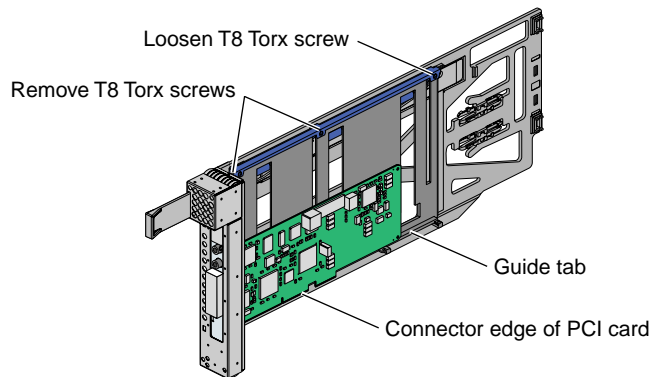

Figure 6-20   Mounting Card in Carrier

6. To install a half-height PCI card in a carrier, follow these steps:

    a. Remove the two screws from the carrier guide bar, as shown in Figure 6-21.

    Note: Take care not to lose the threaded inserts in the carrier guide bar.

    ---

    b. Loosen the third screw of the carrier guide bar.

    c. Place the half-height PCI card in the carrier so that the connector edge of the card rests against the lower guide tab of the carrier (see Figure 6-21).

Figure 6-21   Mounting Half-height PCI Card into Carrier

    d. Move the carrier guide bar (adjustment rail) so that it holds the card firmly in place (see Figure 6-22).
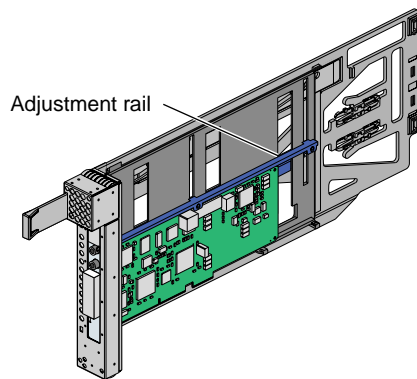
Figure 6-22   Moving Carrier Guide Bar to Secure Half-height PCI Card

e. Place the PCI card bracket so that the screw holes of the bracket align with the empty screw holes of the carrier guide bar, as shown in Figure 6-23.

f. Secure the bracket to the carrier guide bar with two T8 Torx screws.

g. Tighten the screw that you loosened in step 6b.
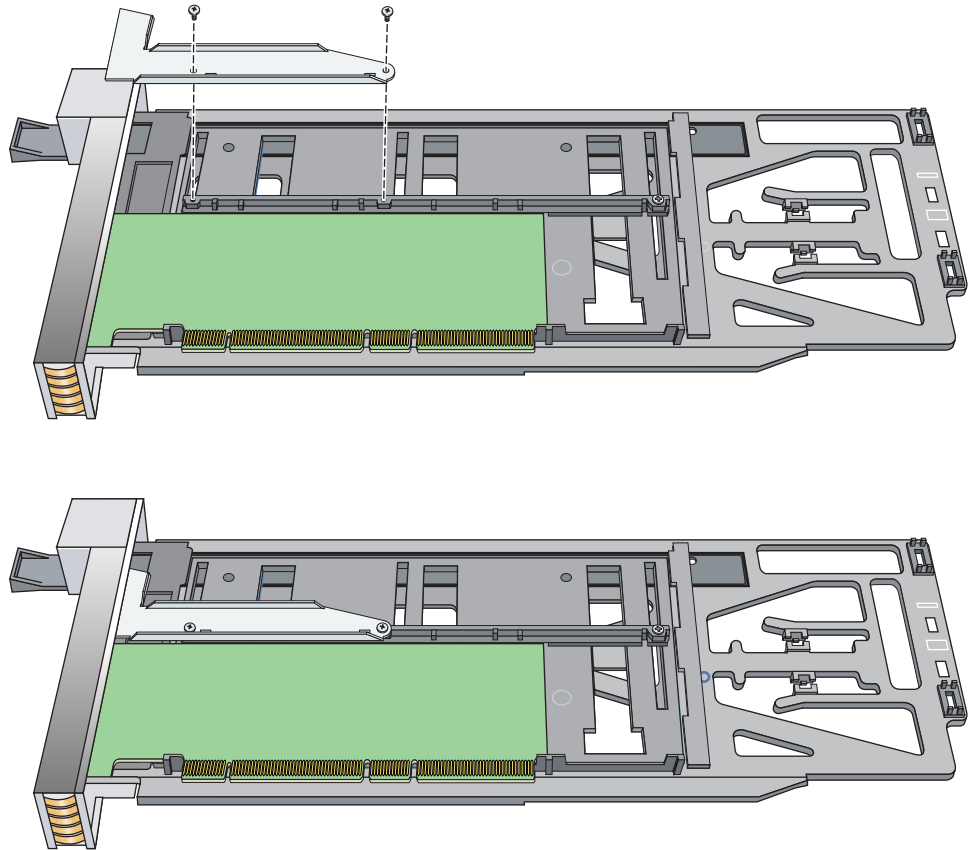
Figure 6-23   Installing the Bracket to Secure a Half-height PCI Card

7.   Insert the carrier-mounted PCI card into the vacant slot, using the slot guide, as shown in Figure 6-24.

Figure 6-24   Installing a Card in a Slot

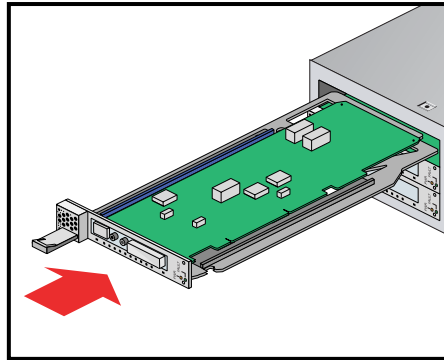8.   Push in horizontally on the carrier seating bar, as shown in Figure 6-25, to seat the card securely in the slot.
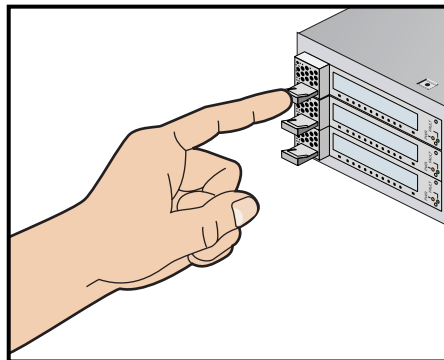
Figure 6-25   Seating the Card in the Slot

9.   Install the blade into the IRU.

10. Power on the IRU or restart the system.

11. Run the `ls -pci` PCI hardware inventory command to verify the installation. This command lists PCI hardware that the operating system discovered during the boot operation.

Add or Remove a PCI Card in Base IA Blades

To add or replace a PCI card in the base IA blade (base I/O), follow these steps:

1. Power off the IRU by following the power-off instructions in the "Powering the System On and Off" on page 51 if you are removing the IA blade.

2. Extract the blade you are going to install the new PCI card in. See the information in "Replacing IRU Components" on page 110 if you have not already removed the blade. Note that in the case of extracting an IA blade that holds the system disk, you must shut down the operating system.

3. After removing the IA blade from the IRU chassis, place it on a stable flat surface with left side facing upward (see Figure 6-26).

4. Using a Tx20 Torx driver, remove the front screw securing the PCI card access door.

5. Using a Tx20 Torx driver, remove the top PCI card access door screw.

6. Remove the PCI card access door.

7. Add/replace/remove a PCI card(s) following standard ESD rules. Make sure any newly installed PCI card(s) are firmly seated in the slot and secure.
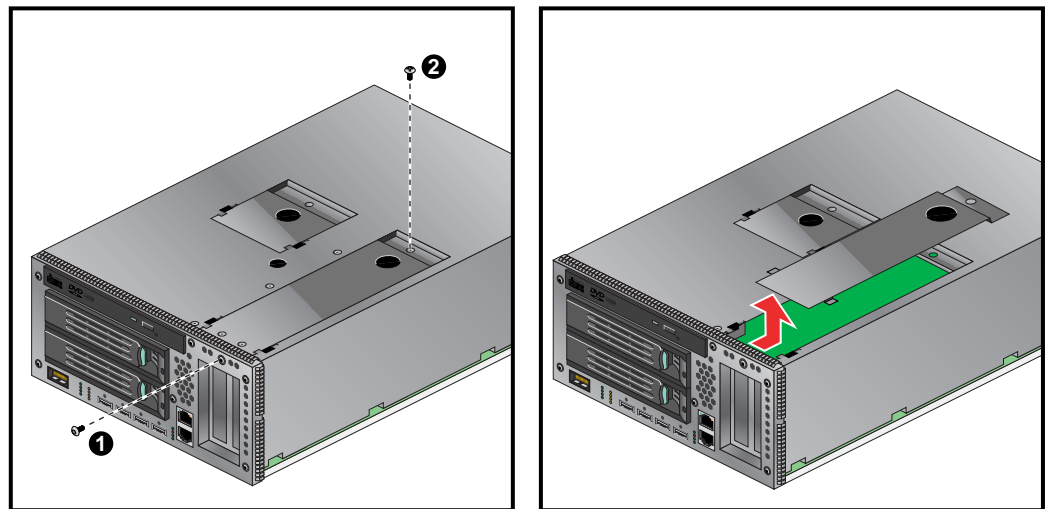
Figure 6-26   Removing the Card Access Panel From the IA Blade
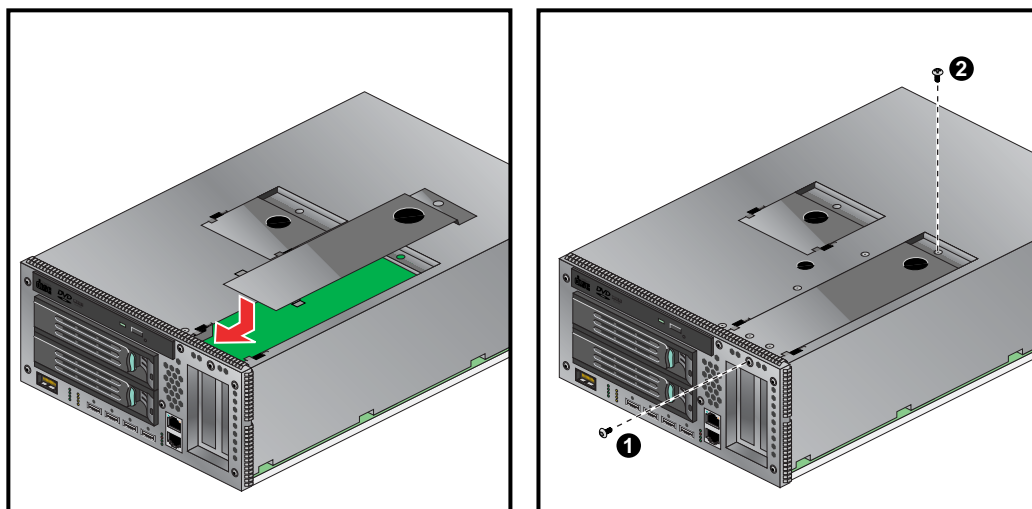
Figure 6-27　　Replacing the IA Blade PCI Access Door

8. Replace the PCI card access door by installing it into the slotted opening and sliding it forward, as shown in Figure 6-27.

9. Reinstall the top PCI card access door screw.

10. Reinstall the front PCI card access door screw.

11. Reinstall the IA blade in the IRU chassis.

12. Return the system to service.

13. Boot your operating system software. (See your software operation guide if you need instructions to boot your operating system.)

14. Run the `ls -pci` PCI hardware inventory command to verify the installation. This command lists PCI hardware that the operating system discovered during the boot operation.

Installing or Replacing a Disk Drive in the IA Blade

The IA/IA2 blade (base I/O) in an IRU has two system disk drive bays as shown in Figure 6-28. This section describes how to install or remove the drives.
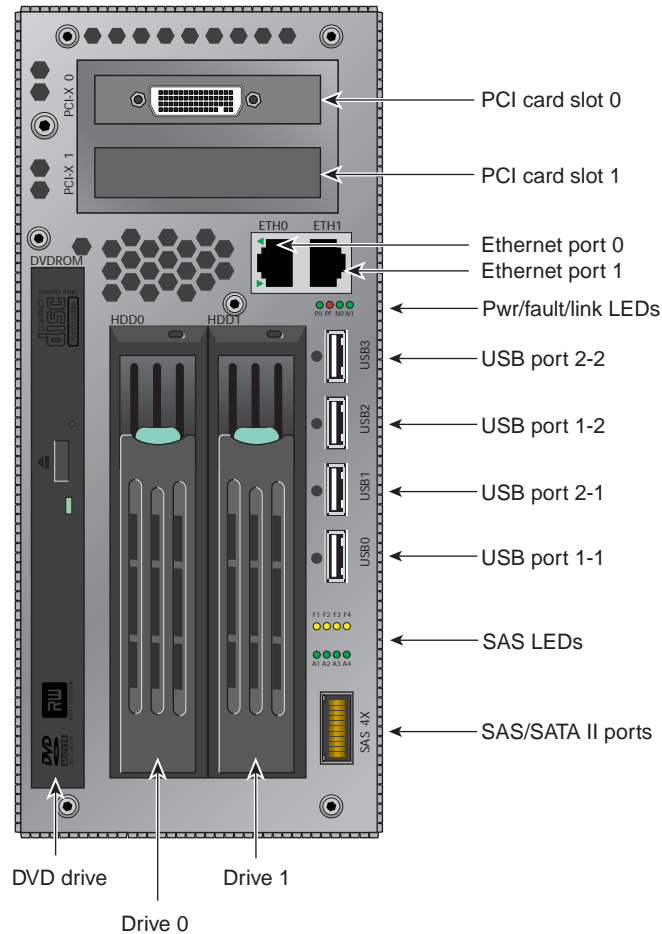
Figure 6-28   Location of Disk Drive Bays on IA/IA2 Blade

Removing a System Disk Drive

Before you remove a disk drive, you must power off the IRU or system according to the instructions in the "Powering the System On and Off" on page 51.

To remove a disk drive, follow these steps:

1. Open the front of the rack and access the two disk drive bays, as shown in panel 1 of Figure 6-29.

2. Remove the disk drive by depressing its handle lock with your thumb and pulling the handle away from the chassis until the handle disengages the disk drive connector from the blade's backplane connector.

3. Carefully slide the disk drive out of the blade and place it on an ESD-safe surface. Do not use the handle to pull the disk drive out of the bay.

After you remove the disk drive, go on to the next section "Installing a System Disk Drive" and install the replacement drive. Power on the IRU according to the instructions in the "Powering the System On and Off" on page 51.
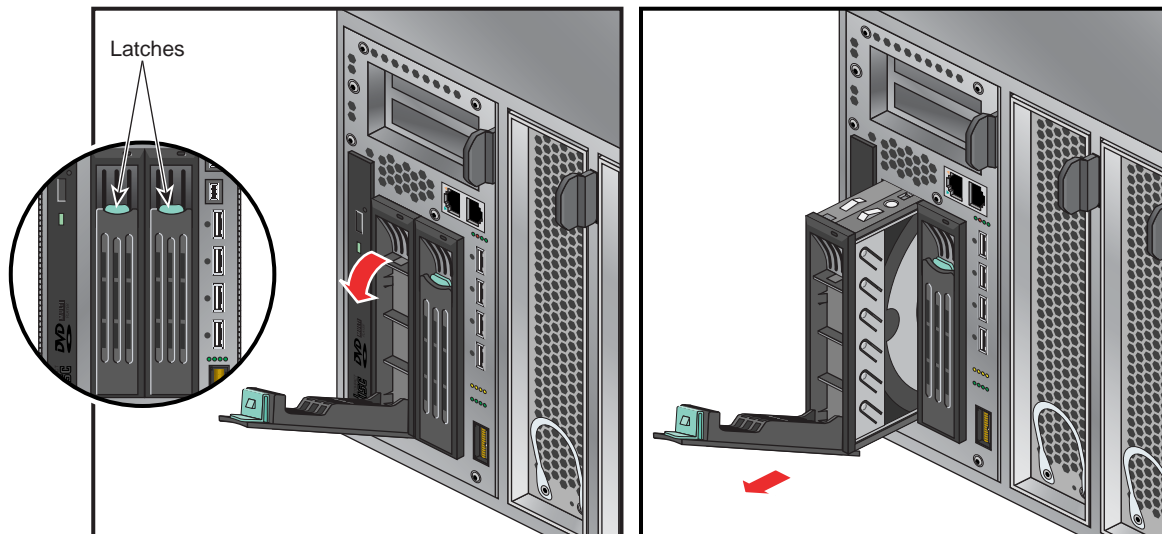
Figure 6-29   Removing a Disk Drive

Installing a System Disk Drive

Before you install a disk drive, you must power off the IRU that houses the IA blade (base I/O) where the disk(s) are installed, see the instructions in the "Powering the System On and Off" on page 51.

Note that you should always back up all files before replacement of the disk. Be sure to replace any Altix 450 hard disk with an SGI approved drive.

⚠ **Caution:** To protect the system from ESD damage, SGI recommends that you use a grounding wrist strap while installing the disk drive.

To install a disk drive, see Figure 6-30 and follow these steps:

1. Access the two disk drive bays (see panel 1 in Figure 6-30).

   Note: If you are installing only one disk drive, install it in the left-side housing nearest the DVD drive.

2. Position the drive assembly so that it engages the bay guide rails, and then gently push the drive into the blade. Do not use the locking handle to push the drive into the bay.

3. Swing the locking handle towards the chassis until the locking handle engages the latch.

After you finish installing the disk drive, power on the IRU or system according to the instructions in the "Powering the System On and Off" on page 51.
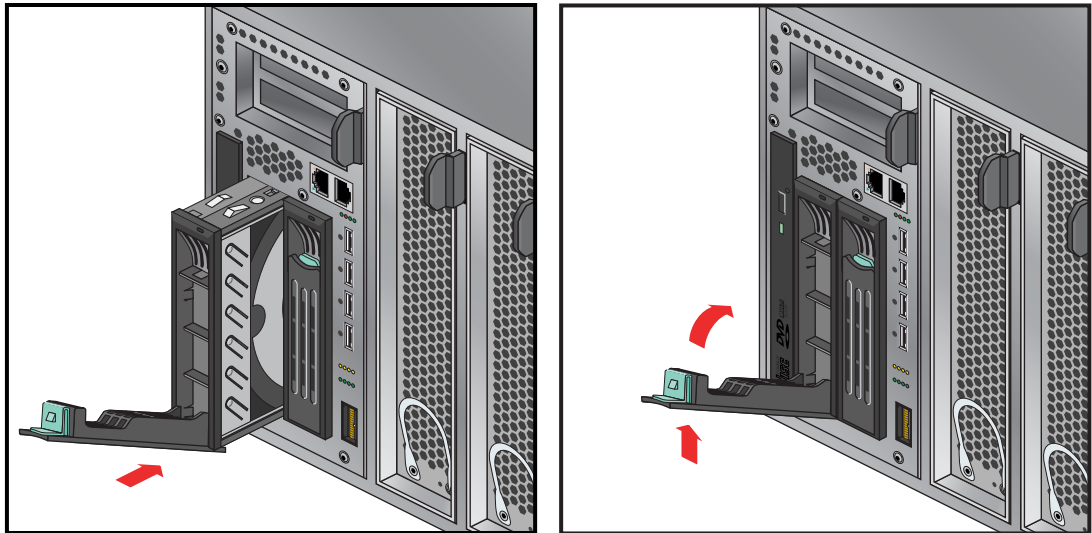
Figure 6-30   Replacing a Disk Drive

Troubleshooting and Diagnostics

This chapter provides the following sections to help you troubleshoot your system:

- "Troubleshooting Chart" on page 146

- "L1 Controller Error Messages" on page 147

- "SGI Electronic Support" on page 151

Troubleshooting Chart

Table 7-1 lists recommended actions for problems that can occur. To solve problems that are not listed in this table, use the SGI Electronic Support system or contact your SGI system support engineer (SSE). For more information about the SGI Electronic Support system, see the "SGI Electronic Support" on page 151.

Table 7-1   Troubleshooting Chart

Problem Description	Recommended Action
The system will not power on.	Ensure that the power cords of the IRU are seated properly in the power receptacles.
	Ensure that the PDU circuit breakers are on and properly connected to the wall source.
	If the power cord is plugged in and the circuit breaker is on, contact your SSE.
An individual IRU will not power on.	Ensure the power cables of the IRU are plugged in.
	View the L1 display; see Table 7-2 if an error message is present.
	If the L1 controller is not running, contact your SSE.
The system will not boot the operating system.	Ensure the IA/IA2 (base I/O) blade that houses the system disk(s) is properly seated in the IRU. Contact your SSE.
The Service Required LED illuminates on an IRU.	View the L1 display of the failing IRU; see Table 7-2 for a description of the error message.
The Failure LED illuminates on an IRU.	View the L1 display of the failing IRU; see Table 7-2 for a description of the error message.
The green or yellow LED of a NUMAlink port is not illuminated.	Ensure that the NUMAlink cable is seated properly on both ends.
The PWR LED of a populated PCI slot is not illuminated.	Reseat the PCI card. Check to make sure the blade is seated fully in the IRU.
The Fault LED of a populated PCI slot is illuminated (on).	Reseat the PCI card. Check to make sure the blade is seated properly in the IRU. If the fault LED remains on, replace the PCI card.
The amber LED of a disk drive is on.	Replace the disk drive.

L1 Controller Error Messages

Table 7-2 lists error messages that the L1 controller generates and displays on the L1 display. This display is located on the front of the IRU.

Note: In Table 7-2, 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 7-2   L1 Controller Messages

L1 System Controller Message	Message Meaning and Action Needed
Internal voltage messages:	
ATTN: <*power VRM description*> high fault limit reached @ x.xxV	30-second power-off sequence for the IRU.
ATTN: <*power VRM description*> low fault limit reached @ x.xxV	30-second power-off sequence for the IRU.
ATTN: <*power VRM description*> high warning limit reached @ x.xxV	A higher than nominal voltage condition is detected.
ATTN: <*power VRM description*> low warning limit reached @ x.xxV	A lower than nominal voltage condition is detected.
ATTN: <*power VRM description*> level stabilized @ x.xxV	A monitored voltage level has returned to within acceptable limits.
Fan messages:	
ATTN: FAN <fan description> 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 <fan description> 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 <fan description> stabilized @ xx RPM	An increased fan RPM level has returned to normal.

Table 7-2   L1 Controller Messages **(continued)**

L1 System Controller Message	Message Meaning and Action Needed
Temperature messages: low alt.	
ATTN: <temp sensor description> advisory temperature reached @ xxC xxF	The ambient temperature at the IRU's air inlet has exceeded 30° C.
ATTN: <temp sensor description> critical temperature reached @ xxC xxF	The ambient temperature at the IRU's air inlet has exceeded 35 °C.
ATTN: <temp sensor description> fault temperature reached @ xxC xxF	The ambient temperature at the IRU's air inlet has exceeded 40 °C.
Temperature messages: high alt.	
ATTN: <temp sensor description> advisory temperature reached @ xxC xxF	The ambient temperature at the IRU's air inlet has exceeded 27 °C.
ATTN: <temp sensor description> critical temperature reached @ xxC xxF	The ambient temperature at the IRU's air inlet has exceeded 31 °C.
ATTN: <temp sensor description> fault temperature reached @ xxC xxF	The ambient temperature at the IRU's air inlet has exceeded 35 °C.
Temperature stable message:	
ATTN: <temp sensor description> stabilized @ xxC/xxF	The ambient temperature at the IRU'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.
IRU appears to have been powered down	The L1 controller has registered a fault and has shut down.

LED Status Indicators

There are a number of LEDs on the front of the IRUs that can help you detect, identify and potentially correct functional interruptions in the system. The following subsections describe these LEDs and ways to use them to understand potential problem areas.

IRU Power Supply LEDs

Each power supply installed in an IRU has a single bi-color (green/amber) status LED. The LED will either light green or amber (yellow), or flash green or yellow to indicate the status of the individual supply. See Table 7-3 for a complete list.

Table 7-3   Power Supply LED States

Power supply status	Green LED	Amber LED
No AC power to the supply	Off	Off
Power supply has failed	Off	On
Power supply problem warning	Off	Blinking
AC available to supply (standby) but IRU is off	Blinking	Off
Power supply on (IRU on)	On	Off

IRU NUMAlink Router Port LEDs

Each IRU supports a total of four external NUMAlink connectors (located on the front of the unit). Each of these connectors has two status LEDs (one green and one amber).

- The amber LED illuminates to indicate that both the Altix 450 IRU NUMAlink connector and the module to which it is connected are powered on.

- The green LED illuminates when a link has been established between the Altix 450 NUMAlink connector and the module to which it is connected.

If both LEDs are dark, check the connections at both ends of the NUMAlink cable to ensure they are firmly seated. Check the power-on status of both units the cable is connected with.

Compute/Memory Blade LEDs

Each compute/memory blade installed in an IRU has a total of eight LED indicators arranged in two rows of four and
behind the perforated
of the blade:

- One green LED shows power-on complete status for the blade.

- One red LED shows power failure or bad voltage status within the blade.

- Two green NUMAlink indicators show NI0 and NI1 connection status between the blade and the router board within the IRU. Constant green is a good connection.

- Four amber (heartbeat LEDs) indicate compute activity (the LEDs light up according to the number, activity and type of processors installed in the blade). If the IRU is fully powered on and booted and none of the amber LEDs are lit there is most likely a problem with the compute/memory blade. Try reseating the blade in the slot. Confirm the two green NUMAlink status LEDs are on. If there is no LED activity on the blade, it must be replaced.
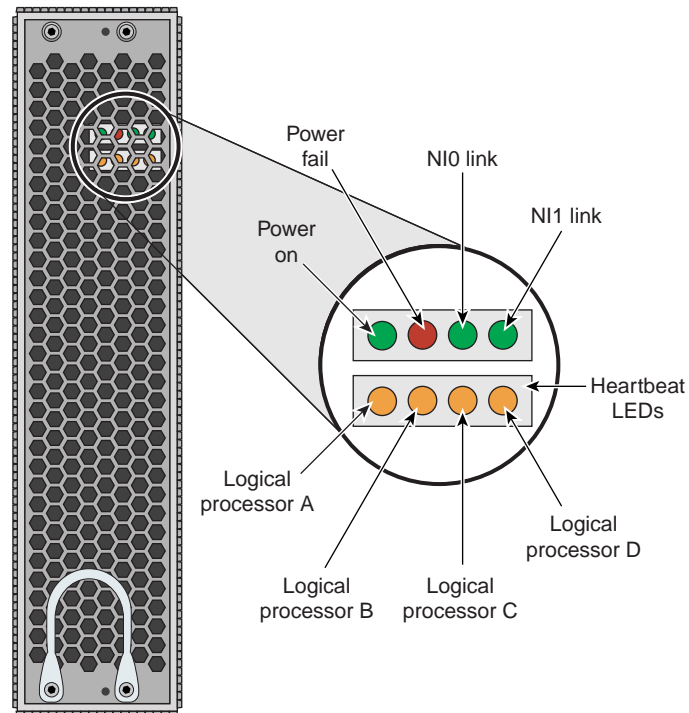
Figure 7-1   Compute Blade Status LED Locations

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 problems.

Figure 7-2 shows the sequence of events that occurs if you use all of the SGI Electronic Support capabilities.
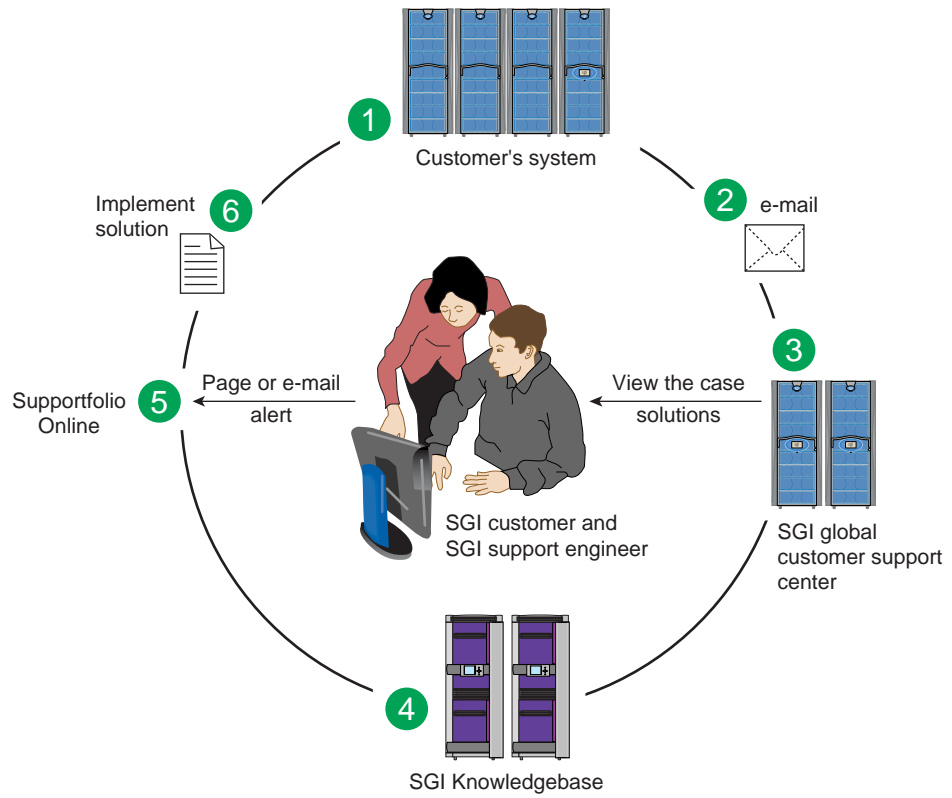
Figure 7-2   Full Support Sequence

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 SGI Linux ProPack release. 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 Web page:

http://www.sgi.com/support/customerservice.html

For more information about SGI Electronic Support, see the following Web page:

http://www.sgi.com/support/es

Technical Specifications and Pinouts

This appendix contains technical specification information about your system, as follows:

- "System-level Specifications" on page 155

- "Physical Specifications" on page 156

- "Environmental Specifications" on page 158

- "Power Specifications" on page 159

- "I/O Port Specifications" on page 160

System-level Specifications

Table A-1 summarizes the Altix 450 system configuration ranges. Note that while each compute/memory board can house either one or two processor sockets; each socket holds two processor "cores".

Table A-1   Altix 450 System Configuration Ranges

Category	Minimum	Maximum
Processor cores	4[a]	76
Individual Rack Units (IRUs)	1 per rack	4 per system image[b]
Compute/memory blade DIMM capacity	4 DIMMs per blade	12 DIMMs per blade
System main memory DIMMs	4 per system image	228 per system image
Number of base I/O blades	One per IRU	4 per system image

a. Single-socket compute blades support two cores each.
    Dual-socket blades support two or four cores per blade.

b. Two complete systems of four IRUs each can be installed in the same 42U tall rack.

Physical Specifications

Table A-2 shows the physical specifications of the Altix 450 system in a 42U rack.

Table A-2   Altix 450 Tall Rack System Physical Specifications

Feature	Specification
Dimensions for a single tall (42U) rack system, including doors and side panels	Height: 79.5 in. (201.9 cm) Width: 25.8 in. (65.5 cm) Depth: 43.45 in. (110. 4 cm)
Shipping dimensions	Height: 81.5 in. (207 cm) Width: 42 in. (106.7 cm) Depth: 52 in. (132.1 cm)
Weight of full rack (maximum)	~1450 lb (658 kg)
Shipping weight (maximum)	~1600 lb (727 kg)
Access requirements	
Front	48 in. (121.9 cm)
Rear	48 in. (121.9 cm)
Side	None
Individual Rack Unit (IRU) enclosure specifications	Dimensions: 6.68 in high x 17.5 in wide x 17 in deep (22 cm high x 44.45 cm wide x 43.2 cm deep) Weight: ~130 lbs. (59.1 kg)

Table A-3 on page 157 lists the physical specifications of the Altix 450 system in a 20U rack.

Table A-3   Altix 450 Short Rack System Physical Specifications

Feature	Specification
Dimensions for a single short (20U) rack system, including doors and side panels	Height: 41.8 in. (106.2 cm) Width: 25.8 in. (65.5 cm) Depth: 40.9 in. (103.9 cm)
Shipping dimensions	Height: 47.5 in. (120.7 cm) Width: 31.25 in. (79.4 cm) Depth: 49.5 in. (125.7 cm)
Weight of full rack (maximum)	750 lb (340 kg)
Shipping weight (maximum)	862 lb (391 kg)
Access requirements	
Front	48 in. (121.9 cm)
Rear	48 in. (121.9 cm)
Side	None
Individual Rack Unit (IRU) enclosure specifications	Dimensions: 8.68 in high x 17.5 in wide x 17 in deep (22 cm high x 44.45 cm wide x 43.2 cm deep) Weight: ~130 lbs. (59.1 kg)

Environmental Specifications

Table A-4 lists the environmental specifications of the 42U rack system. Table A-5 provides the environmental information for the 20U system.

Table A-4   Environmental Specifications (42U Rack)

Feature	Specification
Temperature tolerance (operating)	+5 °C (41 °F) to +35 °C (95 °F) (up to 1500 m / 5000 ft.) +5 °C (41 °F) to +30 °C (86 °F) (1500 m to 3000 m /5000 ft. to 10,000 ft.)
Temperature tolerance (non-operating)	-40 °C (-40 °F) to +60 °C (140 °F)
Relative humidity	10% to 90% operating (no condensation) 8% to 95% non-operating (no condensation)
Heat dissipation	
Altix 450 (42U rack)	59.71 kBTU/hr maximum (based on 17.5 kW)
Cooling requirement	Ambient air cooling
Air flow: intake (front), exhaust (rear)	Approximately 1400 CFM (normal operation)
Maximum altitude	10,000 ft. (3,049 m) operating 40,000 ft. (12,195 m) non-operating
Acoustical noise level	Less than 65 dBa maximum (with doors)

.

Table A-5   Environmental Specifications (20U Rack)

Feature	Specification
Temperature tolerance (operating)	+5 °C (41 °F) to +35 °C (95 °F) (up to 1500 m / 5000 ft.) +5 °C (41 °F) to +30 °C (86 °F) (1500 m to 3000 m /5000 ft. to 10,000 ft.)
Temperature tolerance (non-operating)	-40 °C (-40 °F) to +60 °C (140 °F)
Relative humidity	10% to 90% operating (no condensation) 8% to 95% non-operating (no condensation)

Table A-5   Environmental Specifications (20U Rack) **(continued)**

Feature	Specification
Heat dissipation	
Altix 450	29.86 kBTU/hr maximum (based on 8.75 kW)
Cooling requirement	Ambient air cooling only
Air flow: intake (front), exhaust (rear)	Approximately 750 CFM (normal operation)
Maximum altitude	10,000 ft. (3,049 m) operating 40,000 ft. (12,195 m) non-operating
Acoustical noise level	Less than 65 dBa maximum (with doors)

Power Specifications

Table A-6 shows the power specifications for the system.

Table A-6   Power Specifications

Feature	Specification
Single-phase power requirements	
Voltage	200-240V (180-254 VAC min/max)
Frequency	50-60 Hz
Power	17.5 kW max per tall rack
	8.75 kW max per short rack
Hold-up time	16 ms
Total harmonic distortion	Less than 10% at full load

I/O Port Specifications

This section contains specifications and port pinout information for the base I/O ports of your system, as follows:

- "Ethernet Port" on page 161
- "Serial Ports" on page 162
- "External SAS/SATA Port Connector" on page 164
- "USB Type A Connector" on page 165

Ethernet Port

The system auto-selects the Ethernet port speed and type (duplex vs. half-duplex) when the server is booted, based on what it is connected to. Figure A-1 shows the Ethernet port.
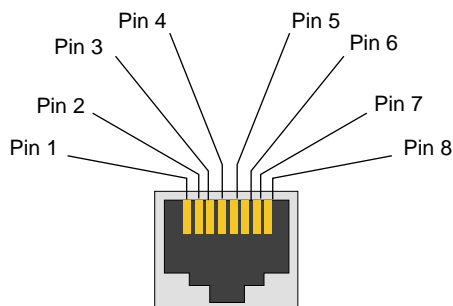
Figure A-1   Ethernet Port

Table A-7 shows the cable pinout assignments for the Ethernet port operating in 10/100-Base-T mode and also operating in 1000Base-T mode.

Table A-7   Ethernet Pinouts

Ethernet 10/100Base-T Pinouts		Gigabit Ethernet Pinouts	
Pins	**Assignment**	**Pins**	**Assignment**
1	Transmit +	1	Transmit/Receive 0 +
2	Transmit –	2	Transmit/Receive 0 –
3	Receive +	3	Transmit/Receive 1 +
4	NU	4	Transmit/Receive 2 +
5	NU	5	Transmit/Receive 2 –
6	Receive –	6	Transmit/Receive 1 –
7	NU	7	Transmit/Receive 3 +
8	NU	8	Transmit/Receive 3 –

NU = Not used

Serial Ports

The IRU modules have 9-pin serial interface connectors. These ports are for console interface and are capable of transferring data at rates as high as 230 kbps. Other features of the ports include the following:

- Programmable data, parity, and stop bits

- Programmable baud rate and modem control

Figure A-2 shows a serial port example.
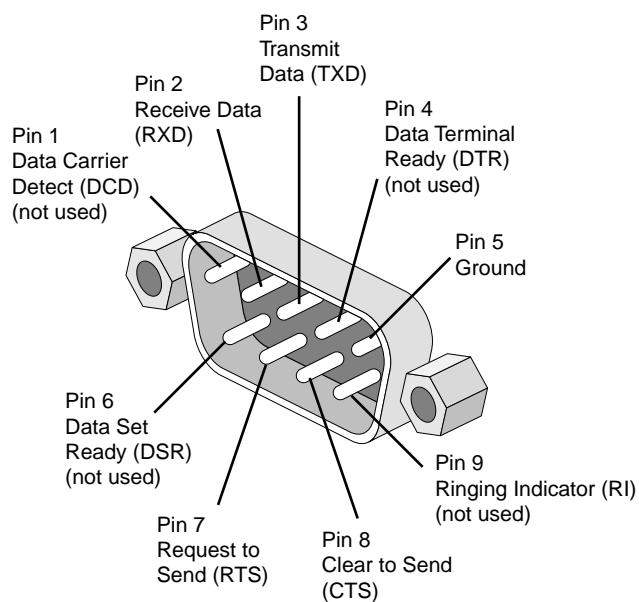
Figure A-2   Serial Port Connector

Table A-8 shows pinout assignments for the 9-pin male DB-9 connector.

Table A-8   Serial Port Pinout

Pin	Assignment	Description
1	DCD	Data carrier detect
2	RXD	Receive data
3	TXD	Transmit data
4	DTR	Data terminal ready
5	GND	Signal ground
6	DSR	Data set ready
7	RTS	Request to send
8	CTS	Clear to send
9	RI	Ring indicator

External SAS/SATA Port Connector

Figure A-3 shows the connector pin locations for the external single-channel Serial Attached SCSI (SAS) and Serial Advanced Technology Attachment (SATA) connector. This combined technology connector is used to support optional external storage. Table A-9 lists the pin assignments for the 14-pin SAS/SATA connector.

Pin 1

Pin 8
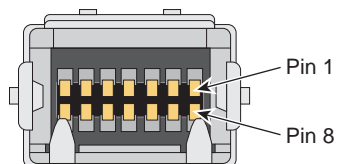
Figure A-3   Pin Number Locations for External SAS/SATA Port

Table A-9   SAS/SATA Pin Assignments

Pin Number	Signal Name	Pin Number	Signal Name
1	Gnd	8	Gnd
2	2tx_h	9	3tx_h
3	2tx_1	10	3tx_1
4	Gnd	11	Gnd
5	2rx_1	12	3rx_1
6	2rx_h	13	3rx_h
7	Gnd	14	Gnd

USB Type A Connector

Figure A-4 shows the USB type A connector provided on the base I/O that supports general USB applications and optional keyboard and mouse configurations.

Table A-10 lists the pin assignments for the USB type A connector.
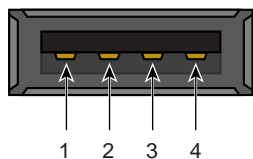
Figure A-4   Pin Number Locations for USB Type A Connector

Table A-10   Pin Assignments for USB Type A Connector

Signal	Color	Pin Number
VCC	Red	1
-Data	White	2
+Data	Green	3
Ground	Black	4

Safety Information and Regulatory Specifications

This appendix provides safety information and regulatory specifications for your system in the following sections:

- "Safety Information" on page 167
- "Regulatory Specifications" on page 169

Safety Information

Read and follow these instructions carefully:

1. Follow all warnings and instructions marked on the product and noted in the documentation included with this product.

2. Unplug this product before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.

3. Do not use this product near water.

4. 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.

5. Slots and openings in the system are provided for ventilation. To ensure reliable operation of the product and to protect it from overheating, these 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.

6. This product should be operated from 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.

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

8. Never push objects of any kind into this product through cabinet slots as 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.

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

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

    • When the power cord or plug is damaged or frayed.

    • If liquid has been spilled into the product.

    • If the product has been exposed to rain or water.

    • If the product does not operate normally when the operating instructions are followed. Adjust only those controls that are covered by the operating instructions since 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 the cabinet has been damaged.

    • If the product exhibits a distinct change in performance, indicating a need for service.

11. If a lithium battery is a soldered part, only qualified SGI service personnel should replace this lithium battery. For other types, replace it only with the same type or an equivalent type recommended by the battery manufacturer, or the battery could explode. Discard used batteries according to the manufacturer's instructions.

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

13. Do not attempt to move the system alone. Moving a rack requires at least two people.

14. Keep all system cables neatly organized in the cable management system. Loose cables are a tripping hazard that cause injury or damage the system.

Regulatory Specifications

The following topics are covered in this section:

- "CMN Number" on page 169
- "CE Notice and Manufacturer's Declaration of Conformity" on page 169
- "Electromagnetic Emissions" on page 170
- "Shielded Cables" on page 172
- "Electrostatic Discharge" on page 172
- "Laser Compliance Statements" on page 173
- "Lithium Battery Statements" on page 174

This SGI system conforms to several national and international specifications and European Directives listed on the "Manufacturer's Declaration of Conformity." The CE mark insignia displayed on each device is an indication of conformity to the European requirements.

> ⚠ **Caution:** This product 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.

CMN Number

The model number, or CMN number, for the system is on the system label, which may be on the IRU or mounted inside the rear door on the base of the rack.

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 from 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。

Figure B-1   VCCI Notice (Japan Only)

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．

Figure B-2   Chinese Class A Regulatory Notice

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.

Figure B-3   Korean Class A Regulatory Notice

Shielded Cables

This SGI system is FCC-compliant under test conditions that include the use of shielded cables between the system and its peripherals. Your system and any peripherals 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 need to be shielded.

Optional monitor cables supplied with your system use additional filtering molded into the cable jacket to reduce radio frequency interference. Always use the cable 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 immune 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 any plastics, in place while you are operating the system. The shielded cables that came with the unit 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. The wrist strap is used during the installation of these upgrades to prevent the flow of static electricity, and it should protect your system from ESD damage.

Laser Compliance Statements

The DVD drive in this computer is a Class 1 laser product. The DVD drive's classification label is located on the drive.

Warning: **Avoid exposure to the invisible laser radiation beam when the device is open.**

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 Statements

Warning: If a lithium battery is a soldered part, only qualified SGI service personnel should replace this lithium battery. For other types, replace the battery only with the same type or an equivalent type recommended by the battery manufacturer, or the battery could explode. Discard used batteries according to the manufacturer's instructions.

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: Päristo 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.

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