

# SGI® Altix® UV 1000 System User's Guide

Document Number 007-5663-001

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# Contents

<b>List of Figures</b>	ix
<b>List of Tables</b>	xi
Audience	xiii
Important Information	xiii
Chapter Descriptions	xiv
Related Publications	xv
Conventions	xvi
Product Support	xvii
Reader Comments	xvii
<b>1. Operation Procedures</b>	<b>1</b>
Precautions	1
ESD Precaution	1
Safety Precautions	2
System Control Network Overview	3
Console Connections	4
Connecting to the UV System Control Network	4
Communicating with the System	5
The Command Line Interface	5
The SGI Management Center Interface	6
Powering the System On and Off	6
Preparing to Power On	7

Powering On and Off at the Console . . . . .	11
Powering On and Off from the Command Line Interface . . . . .	11
Power On an Altix UV System . . . . .	11
Monitoring Power On . . . . .	13
Power off an Altix UV System . . . . .	14
Powering-On and Off From the SGI Management Center Interface . . . . .	15
Using Embedded Support Partner (ESP). . . . .	16
System Control Interface Options . . . . .	17
Optional Components . . . . .	17
PCIe Cards . . . . .	17
<b>2. System Control . . . . .</b>	<b>19</b>
Levels of System Control . . . . .	19
System Management Node (SMN) Overview . . . . .	20
CMC Overview . . . . .	21
BMC Overview . . . . .	23
System Controller Interaction . . . . .	23
Controllers . . . . .	24
Chassis Management Controller Functions . . . . .	24
Console Hardware Requirements . . . . .	24
1U Console Option . . . . .	25
Flat Panel Rackmount Console Option Features . . . . .	26
<b>3. System Overview . . . . .</b>	<b>29</b>
System Models . . . . .	31
System Architecture . . . . .	32

System Features . . . . .	35
Modularity and Scalability . . . . .	35
Distributed Shared Memory (DSM) . . . . .	35
Distributed Shared I/O . . . . .	37
Chassis Management Controller (CMC) . . . . .	37
ccNUMA Architecture . . . . .	37
Cache Coherency . . . . .	37
Non-uniform Memory Access (NUMA) . . . . .	38
Reliability, Availability, and Serviceability (RAS) . . . . .	38
System Components . . . . .	40
Bay (Unit) Numbering . . . . .	42
Rack Numbering . . . . .	42
Optional System Components . . . . .	42
<b>4. Rack Information . . . . .</b>	<b>43</b>
Overview . . . . .	43
Altix UV 1000 Series Rack (42U) . . . . .	44
Altix System Rack Technical Specifications . . . . .	48
<b>5. PCIe and Disk Add or Replace Procedures . . . . .</b>	<b>49</b>
Maintenance Precautions and Procedures . . . . .	49
Preparing the System for Maintenance or Upgrade . . . . .	50
Returning the System to Operation . . . . .	50
Overview of PCI Express (PCIe) Operation . . . . .	51
Adding or Replacing PCIe Cards . . . . .	52
Installing Cards in the 1U PCIe Expansion Chassis . . . . .	53
Installing or Replacing a Drive in the Dual Disk Riser Blade . . . . .	56
<b>6. Troubleshooting and Diagnostics . . . . .</b>	<b>61</b>
Troubleshooting Chart . . . . .	62
LED Status Indicators . . . . .	63
IRU Power Supply LEDs . . . . .	63
Compute/Memory Blade LEDs . . . . .	63
SGI Electronic Support . . . . .	66

<b>A.</b>	<b>Technical Specifications and Pinouts</b>	. . . . .	69
	System-level Specifications	. . . . .	69
	Physical Specifications	. . . . .	70
	Environmental Specifications	. . . . .	71
	Power Specifications	. . . . .	72
	I/O Port Specifications	. . . . .	73
	Ethernet Port	. . . . .	74
	Serial Ports	. . . . .	75
	USB Type A Connector	. . . . .	77
<b>B.</b>	<b>Safety Information and Regulatory Specifications</b>	. . . . .	79
	Safety Information	. . . . .	79
	Regulatory Specifications	. . . . .	81
	CMN Number	. . . . .	81
	CE Notice and Manufacturer’s Declaration of Conformity	. . . . .	81
	Electromagnetic Emissions	. . . . .	82
	FCC Notice (USA Only)	. . . . .	82
	Industry Canada Notice (Canada Only)	. . . . .	83
	VCCI Notice (Japan Only)	. . . . .	83
	Korean Class A Regulatory Notice	. . . . .	83
	Shielded Cables	. . . . .	84
	Electrostatic Discharge	. . . . .	84
	Laser Compliance Statements	. . . . .	85
	Lithium Battery Statements	. . . . .	86



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# List of Figures

<b>Figure 1-1</b>	UV CMC Connections . . . . .	4
<b>Figure 1-2</b>	IRU Power Supply Cable Location Example . . . . .	7
<b>Figure 1-3</b>	Single-Phase 2-Plug PDU Example . . . . .	8
<b>Figure 1-4</b>	Single-Phase Rack 8-Plug PDU Circuit Breaker Switches . . . . .	9
<b>Figure 1-5</b>	Three-Phase PDU Examples . . . . .	10
<b>Figure 2-1</b>	System Management Node Front and Rear Panels . . . . .	21
<b>Figure 2-2</b>	SGI Altix UV 1000 LAN-attached System Control Network . . . . .	22
<b>Figure 2-3</b>	Optional 1U Rackmount Console . . . . .	26
<b>Figure 2-4</b>	System Management Node (SMN) Direct Video Connection Ports . . . . .	27
<b>Figure 3-1</b>	SGI Altix UV 1000 System Example . . . . .	30
<b>Figure 3-2</b>	SGI Altix UV 1000 IRU and Rack . . . . .	32
<b>Figure 3-3</b>	Functional Block Diagram of the Individual Rack Unit . . . . .	34
<b>Figure 3-4</b>	Blade Node Block Diagram . . . . .	36
<b>Figure 3-5</b>	Altix UV 1000 IRU System Components Example . . . . .	41
<b>Figure 3-6</b>	BaseIO Riser Enabled Blade Front Panel Example . . . . .	42
<b>Figure 4-1</b>	Altix UV 1000 Series Rack Example . . . . .	45
<b>Figure 4-2</b>	Front Lock on Tall (42U) Altix Rack . . . . .	46
<b>Figure 4-3</b>	Optional Water-Chilled Doors on Rear of Altix Rack . . . . .	47
<b>Figure 5-1</b>	Comparison of PCI/PCI-X Connector with PCI Express Connectors . . . . .	51
<b>Figure 5-2</b>	The PCIe Expansion Enclosure . . . . .	54
<b>Figure 5-3</b>	Card Slot Locations . . . . .	55
<b>Figure 5-4</b>	Location of Disk Drive Bays . . . . .	57
<b>Figure 5-5</b>	Removing a Disk Drive . . . . .	58
<b>Figure 6-1</b>	UV Compute Blade Status LED Locations . . . . .	65
<b>Figure 6-2</b>	Full Support Sequence Example . . . . .	66
<b>Figure A-1</b>	Ethernet Port . . . . .	74
<b>Figure A-2</b>	Serial Port Connector. . . . .	75

<b>Figure A-3</b>	Pin Number Locations for USB Type A Connector . . . . .	77
<b>Figure B-1</b>	VCCI Notice (Japan Only) . . . . .	83
<b>Figure B-2</b>	Chinese Class A Regulatory Notice . . . . .	83
<b>Figure B-3</b>	Korean Class A Regulatory Notice . . . . .	83

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## List of Tables

<b>Table 4-1</b>	Tall Altix Rack Technical Specifications . . . . .	48
<b>Table 5-1</b>	SGI Altix UV 1000 PCIe Support Levels . . . . .	52
<b>Table 5-2</b>	PCIe Expansion Slot Bandwidth Support Levels . . . . .	53
<b>Table 6-1</b>	Troubleshooting Chart . . . . .	62
<b>Table 6-2</b>	Power Supply LED States . . . . .	63
<b>Table 6-3</b>	Altix UV Blade LED Status Information . . . . .	64
<b>Table A-1</b>	Altix UV 1000 System Configuration Ranges . . . . .	69
<b>Table A-2</b>	Altix UV 1000 Physical Specifications . . . . .	70
<b>Table A-3</b>	Environmental Specifications . . . . .	71
<b>Table A-4</b>	Power Specifications . . . . .	72
<b>Table A-5</b>	Ethernet Pinouts . . . . .	74
<b>Table A-6</b>	Serial Port Pinout. . . . .	76
<b>Table A-7</b>	Pin Assignments for USB Type A Connector . . . . .	77



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# About This Guide

This guide provides an overview of the architecture, general operation and descriptions of the major components that compose the SGI® Altix® UV 1000 family of servers. 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, system administrators, and users of SGI Altix UV 1000 computer systems. It is written with the assumption that the reader has a good working knowledge of computers and computer systems.

## Important Information



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**Warning:** To avoid problems that could void your warranty, your SGI or other approved system support engineer (SSE) should perform all the set up, addition, or replacement of parts, cabling, and service of your SGI Altix UV 1000 system, with the exception of the following items that you can perform yourself:

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- Using your system console controller to enter commands and perform system functions such as powering on and powering off, as described in this guide.
- Adding and replacing PCIe cards, as described in this guide.
- Adding and replacing disk drives in dual-disk enabled riser blades.
- Using the On/Off switch and other switches on the rack PDUs.
- Using the ESI/ops panel (operating panel) on optional mass storage bricks.

## Chapter Descriptions

The following topics are covered in this guide:

- Chapter 1, “Operation Procedures,” provides instructions for powering on and powering off your system.
- Chapter 2, “System Control,” describes the function of the overall system control network interface and provides basic instructions for operating the controllers.
- Chapter 3, “System Overview,” provides technical overview information needed to understand the basic functional architecture of the SGI Altix UV 1000 systems.
- Chapter 4, “Rack Information,” describes the rack sizes and general features.
- Chapter 5, “PCIe and Disk Add or Replace Procedures,” provides instructions for installing or removing the customer-replaceable components of your system.
- Chapter 6, “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 regulatory information related to use of the Altix UV 1000 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 UV 1000 series system:

- *SGI UV CMC Controller Software User's Guide*  
(P/N 007-5636-00x)

This guide describes how to use the system console controller commands to monitor and manage your SGI Altix UV 1000 or UV 100 system via line commands. Coverage of control includes descriptions of the interface and usage of the commands. These commands are primarily used when a system management node is not present in the system. Note that it does **not** cover controller command information for the SGI Altix UV 10.

- *SGI Management Center System Administrator's Guide*  
(P/N 007-5642-00x)

This guide is intended for system administrators who work with the SGI Management Center software GUI to manage and control Altix UV 100 or 1000 systems. Depending on your system configuration and implementation, this guide may be optional. The manual is written with the assumption the user has a good working knowledge of Linux.

- *SGI UV Systems Linux Configuration and Operations Guide*  
(P/N 007-5629-00x)

This guide discusses the operational management of SGI ProPack for Linux when used on the SGI Altix UV 100 or UV 1000 family of servers. It explains how to perform general system configuration and operation under Linux.

- *SGI UV Systems Installation Guide*  
(P/N 007-5675-00x)

This guide covers software installation on UV 100 or UV 1000 systems and their SMNs.

- 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 shipped with Linux 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 DVD) and are displayed using the `man` command. References in the documentation to these pages include the name of the command and the section number in which the command is found. For example, to display a man page, type the request on a command line:

```
man commandx
```

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:

<b>Convention</b>	<b>Meaning</b>
Command	This fixed-space font denotes literal items such as commands, files, routines, path names, signals, messages, and programming language structures.
<i>variable</i>	The italic typeface denotes variable entries and words or concepts being defined. Italic typeface is also used for book titles.
<b>user input</b>	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.
<b>GUI element</b>	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

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## 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.)

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Fremont, California 94538

SGI values your comments and will respond to them promptly.



# Operation Procedures

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

- “Precautions” on page 1
- “System Control Network Overview” on page 3
- “Powering the System On and Off” on page 8
- “Using Embedded Support Partner (ESP)” on page 18
- “System Control Interface Options” on page 19
- “Optional Components” on page 20

## Precautions

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

- “ESD Precaution” on page 1
- “Safety Precautions” on page 2

## ESD Precaution

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

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Wear a grounding wrist strap when you handle any ESD-sensitive device to eliminate possible ESD damage to equipment. Connect the wrist strap cord directly to earth ground.

## Safety Precautions



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**Warning:** Before operating or servicing any part of this product, read the “Safety Information” on page 79.

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**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.

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**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.

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**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.

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## System Control Network Overview

All Altix UV 1000 system individual rack units (IRUs) use an embedded chassis management controller (CMC). The CMC communicates with both the blade-level board management controllers (BMCs) and the system management node (SMN), which runs the SGI Management Center software. In concert with the SGI Management Center software, they are generically known as the system control network.

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**Note:** Each IRU can have an optional second CMC installed to back up the primary CMC.

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The *SGI Management Center System Administrator's Guide* (P/N 007-5642-00x) provides information on using the GUI to administer your Altix UV 1000 system.

The Altix UV 1000 system control network provides control and monitoring functionality for each compute blade, power supply, and fan assembly in each IRU enclosure in the system.

The SGI Management Center is an application that provides control over multiple IRUs, and communication to other UV systems. Remote administration requires that the SMN be connected by an Ethernet connection to a private or public Local Area Network (LAN).

The CMC network provides the following functionality:

- Powering the entire system on and off.
- Powering individual IRUs on and off.
- Power on/off individual blades in an IRU.
- Monitoring the environmental state of the system.
- Partitioning the system.
- Enter controller commands to monitor or change particular system functions within a particular IRU. See the *SGI UV CMC Controller Software User's Guide* (P/N 007-5636-00x) for a complete list of command line interface (CLI) commands.
- Provides access to the system OS console allowing you to run diagnostics and boot the system.

## System Controller Access

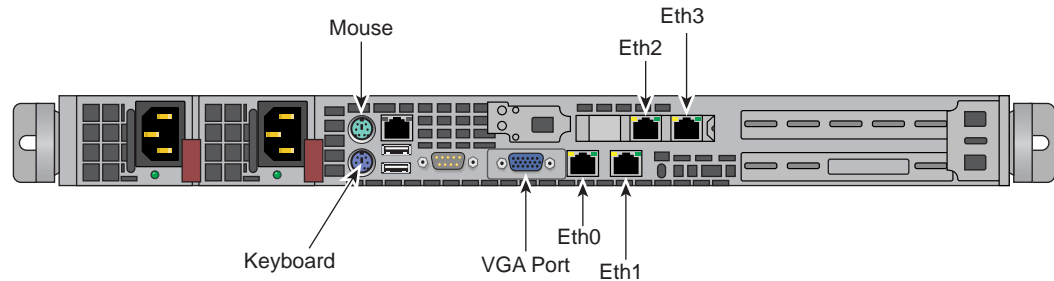
Access to the UV system controller network is accomplished by the following connection methods:

- A LAN connection to the system management node (running the SGI Management Center software application). This can also be done using an optional VGA-connected console, see Figure 1-1.
- A direct ethernet connection (see Figure 1-2) to a CMC (also see the note below).
- A serial connection to the “Console” port on the CMC (see note below).

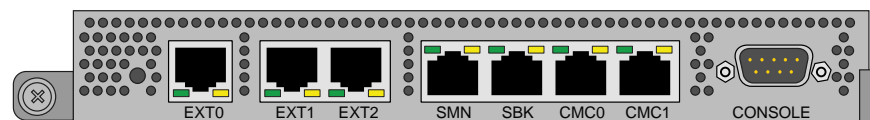
---

**Note:** In systems with less than four racks, a connection to any CMC is supported. In systems with more than four racks, use a CMC that is also used to interconnect the four rack building block groups - this CMC will have a connection to the SBK connector.

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**Figure 1-1** System Management Node Rear Connections



**Figure 1-2** UV CMC Connections

## Connecting to the UV System Control Network

The ethernet connection is the preferred method of accessing the system console.

Administrators can perform one of the following options for connectivity:

- If the SMN is plugged into the customer LAN, connect to the SMN (SSH w/ X11 Forwarding) and start the SGI Management Center remotely.
- An in-rack system console can be directly connected to the system management node via VGA and PS2. You can then log into the SMN and perform system administration either through CLI commands or via the SGI Management Center interface.
- A serial connection is used to communicate directly with the CMC. This connection is typically used for service purposes or for system controller and system console access in small systems where an ethernet connection or in-rack system console is not used or available.

## Communicating with the System

The two primary ways to communicate with and administer the UV 1000 system are through SGI Management Center interface or the UV command line interface (CLI).

### The Command Line Interface

The UV command line interface is accessible by logging into either a system maintenance node (SMN) or chassis management controller (CMC).

Log in as `root`, when logging into the CMC.

Login as `sysco`, when logging into the SMN.

Once a connection to the SMN or CMC is established, various system control commands can be entered.

See “Powering On and Off from the Command Line Interface” on page 13 for specific examples of using the CLI commands.

## SMN Specific CLI Commands

The following CLI command options are available specifically for the SMN:

- h|--help This help message.
- hh|--help This help message + CLI help message.
- q|--quiet No diagnostic message.
- s|--system Select UV system. If only one system is present, this one is selected.  
Otherwise, this option is mandatory.
- S|--show depth Show nodes at depth >= 1 using optional supplied pattern.  
Default pattern=\*
- t|--target One target in one of the two following formats:
  - a. rack[/slot[/blade]]
  - b. r{1..}{s{i}}{1..2}{{b{n}}{0..15}}

---

**Note:** This format is NOT for `uvcli` only.

---

Examples: r1i02 = rack 1, slot 2

r2i1b4 = rack 2, slot 1, blade 4

Select the target from the CLI command itself, or, if not available, using the `-t` option.

The following are examples of `uvcli` commands:

- `uvcli --help` This help.
- `uvcli -- leds --help` Help on leds command.
- `uvcli leds r1i1b4` Show leds on BMC located at rack 1, slot1, blade 4.
- `uvcli -t 1/1 leds` Show leds on all BMCs in rack 1, slot 1.



uvcli -- leds -v r1i1 Same as previous command but more verbose.

uvcli -S 1 Show all system serial numbers.

uvcli -S 1 '\*/part\*' Show all system partitions.

### **List of Valid CLI Commands Used With the System Management Node (SMN):**

The following list of available CLI commands are specifically for the SMN:

auth authenticate SSN/APPWT change

bios perform bios actions

bmc access BMC shell

cmc access CMC shell

config show system configuration

console access system consoles

help list available commands

hel access hardware error logs

hwcfg access hardware configuration variable

leds display system LED values

log display system controller logs

power access power control/status

Type '<cmd> --help' for help on individual commands.

## The SGI Management Center Graphical User Interface

The SGI Management Center interface is a server monitoring and management system. The SGI Management Center provides status metrics on operational aspects for each node in a system. The interface can also be customized to meet the specific needs of individual systems.

The *SGI Management Center System Administrator's Guide* (P/N 007-5642-00x) provides information on using the interface to monitor and maintain your Altix UV 1000 system. Also, see Chapter 2 in this guide for additional reference information on the SGI Management Center interface.

## Powering the System On and Off

This section explains how to power on and power off individual rack units, or your entire Altix UV 1000 system, as follows:

- “Preparing to Power On” on page 9
- “Power On an Altix UV System” on page 14
- “Power off an Altix UV System” on page 16

Using a system controller connection, you can power on and power off individual blades, IRUs or the entire system.

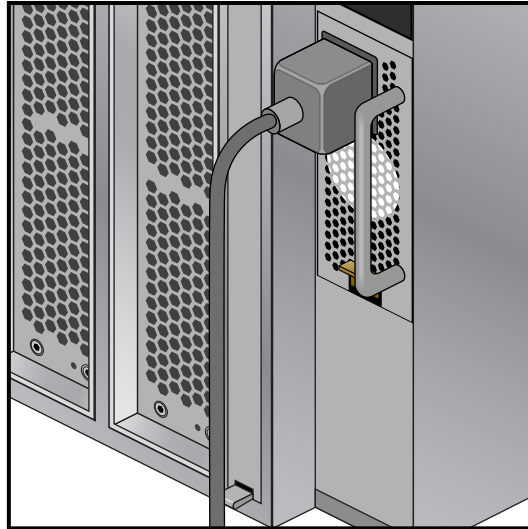
If you are using an SGI Management Center interface, you can monitor and manage your server from a remote location. For details, see the documentation for the power management tool you are using in concert with the SGI Management Center.

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 18.

## Preparing to Power On

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

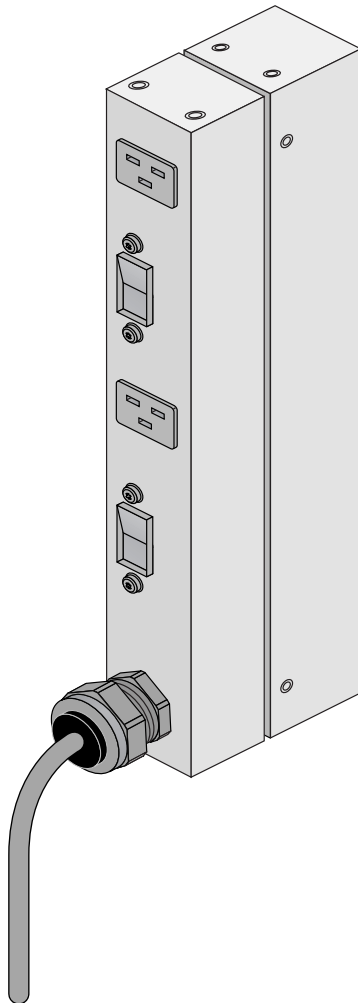
1. Check to ensure that the power connector on the cable between the rack's power distribution units (PDUs) and the wall power-plug receptacles are securely plugged in.
2. For each individual IRU that you want to power on, make sure that the power cables are plugged into all the IRU power supplies correctly, see the example in Figure 1-3. Setting the circuit breakers on the PDUs to the "On" position will apply power to the IRUs and will start the CMCs in the IRUs. Note that the CMC in each IRU stays powered on as long as there is power coming into the unit. Turn off the PDU breaker switch on each of the PDUs that supply voltage to the IRUs power supplies if you want to remove all power from the unit.



**Figure 1-3** IRU Power Supply Cable Location Example

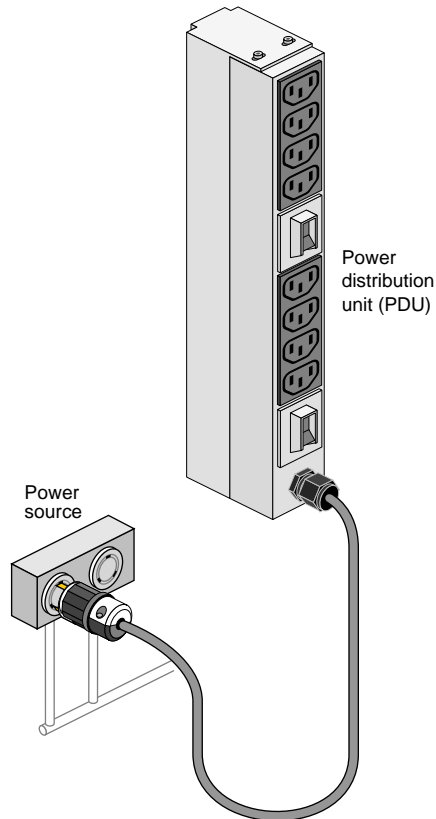
3. If you plan to power on a server that includes optional mass storage enclosures, make sure that the power switch on the rear of each PSU/cooling module (one or two per enclosure) is in the **1** (on) position.
4. Make sure that all PDU circuit breaker switches (see the examples in the following three figures) are turned on to provide power to the server when the system is powered on.

Figure 1-4 shows an example of a single-phase 2-plug PDU that can be used with the Altix UV 1000 system. This is the PDU that is used to distribute power to the IRUs when the system is configured with single-phase power.



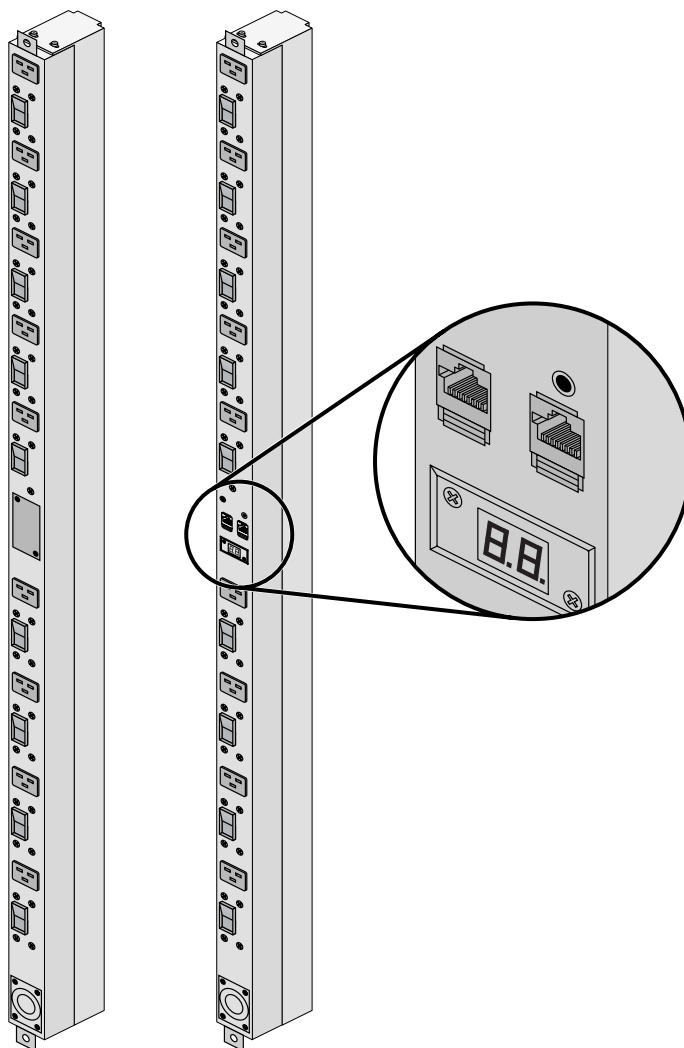
**Figure 1-4** Single-Phase 2-Outlet PDU Example

Figure 1-5 shows an example of an eight-plug single-phase PDU that can be used in the Altix UV 1000 rack system. This unit is used to support auxiliary equipment in the rack.



**Figure 1-5** Single-Phase 8-Outlet PDU

Figure 1-6 shows examples of the three-phase PDUs that can be used in the SGI Altix UV 1000 system. These PDUs are used to distribute power to the IRUs when the system is configured with three-phase power



**Figure 1-6** Three-Phase PDU Examples

## Powering On and Off from the Command Line Interface

The Altix UV 1000 command line interface is accessible by logging into either the system management node (SMN) as **sysco** or the CMC as **root**.

Instructions issued at the command line interface of a local console prompt typically only affect the local partition or a part of the system. Depending on the directory level you are logged in at, you may power up an entire partition (SSI), a single rack, or a single IRU enclosure. In CLI command console mode, you can obtain only limited information about the overall system configuration. An SMN has information about the IRUs in its SSI. Each IRU has information about its internal blades, and also (if other IRUs are attached via NUMALink to the IRU) information about those IRUs.

## Power On an Altix UV System

Once logged into the SMN or CMC, either the SMN prompt or the CMC prompt will be presented.

The following example shows the CMC prompt:

```
SGI Chassis Manager Controller, Firmware Rev. 0.x.xx
```

```
CMC:r1i1c>
```

Typically, the default password for the CMC set out of the SGI factory is **root**. The default password for the SMN is **sysco**.

---

**Note:** The commands are the same from the CMC or SMN.

---

The CMC prompt appears.

```
CMC:r1i1c>
```

This refers to rack 1, IRU 1, CMC.

Power up your Altix UV system using the power-on command, as follows:

```
CMC:r1i1c> power on
```

To monitor the power-on sequence during boot, see the next section “Monitoring Power On” on page 15.



## Monitoring Power On

Establish another connection to the SMN or CMC and use the `uvcon` command to open a system console and monitor the system boot process. Use the following steps:

```
CMC:r1i1c> uvcon
uvcon: attempting connection to localhost...
uvcon: connection to SMN/CMC (localhost) established.
uvcon: requesting baseio console access at r001i01b00...
uvcon: tty mode enabled, use 'CTRL-]' 'q' to exit
uvcon: console access established
uvcon: CMC <--> BASEIO connection active
*****
***** START OF CACHED CONSOLE OUTPUT *****
*****
***** [20100512.143541] BMC r001i01b10: Cold Reset via NL
broadcast reset
***** [20100512.143541] BMC r001i01b07: Cold Reset via NL
broadcast reset
***** [20100512.143540] BMC r001i01b08: Cold Reset via NL
broadcast reset
***** [20100512.143540] BMC r001i01b12: Cold Reset via NL
broadcast reset
***** [20100512.143541] BMC r001i01b14: Cold Reset via NL
broadcast reset
***** [20100512.143541] BMC r001i01b04: Cold Reset via NL....
```

---

**Note:** Use CTRL-] q to exit the console.

---

Depending upon the size of your system, it can take 5 to 10 minutes for the Altix UV system to boot to the EFI shell. When the `shell>` prompt appears, enter `fs0`, as follows:

```
shell> fs0
```

At the `fs0` prompt, enter the Linux boot loader information, as follows:

```
fs0> /efi/suse/elilo
```

The ELILO Linux Boot loader is called and various SGI configuration scripts are run and the SUSE Linux Enterprise Server 11 Service Pack *x* installation program appears.

## Power off an Altix UV System

To power down the Altix UV system, use the `power off` command, as follows:

```
CMC:r1i1c> power off  
==== r001i01c (PRI) ====
```

You can also use the `power status` command, to check the power status of your system

```
CMC:r1i1c> power status  
==== r001i01c (PRI) ====
```

```
on: 0, off: 32, unknown: 0, disabled: 0
```

## Powering-On and Off From the SGI Management Center Interface

Commands issued from the SGI Management Center interface are typically sent to all enclosures and blades in the system (up to a maximum 4096 compute cores) depending on set parameters. SGI Management Center services are started and stopped from scripts that exist in */etc/init.d*

SGI Management Center, is commonly installed in */opt/sgi/sgimc*, and is controlled by one of these services—this allows you to manage SGI Management Center services using standard Linux tools such as `chkconfig` and `service`.

If your SGI Management Center interface is not already running, or you are bringing it up for the first time, use the following steps:

1. Open a command line console.
2. Log in as `root`.
3. On the command line, enter `mgrclient` and press **Enter**. The SGI Management Center Login dialog box is displayed.
4. Enter a user name (`root` by default) and password (`root` by default) and click **OK**. The SGI Management Center interface is displayed.
5. The power on (green button) and power off (red button) are located in the middle of the SGI Management Center GUI's Tool Bar - icons which provide quick access to common tasks and features.

See the *SGI Management Center System Administrator's Guide* for more information.

## 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 6.

## System Control Interface Options

You can monitor and interact with your Altix UV 1000 server from the following sources:

- Using the SGI 1U rackmount console option you can connect directly to the system management node (SMN) for basic monitoring and administration of the Altix system. See “1U Console Option” on page 25 for more information; SLES 11 or later is required.
- A PC or workstation on the local area network can connect to the SMN’s external ethernet port and set up remote console sessions or display GUI objects from the SGI Management Center interface.
- A serial console display can be plugged into the CMC at the rear of IRU 001. You can also monitor IRU information and system operational status from other IRUs that are connected to IRU 001.

These console connections enable you to view the status and error messages generated by the chassis management controllers in your Altix UV 1000 rack. For example, you can monitor error messages that warn of power or temperature values that are out of tolerance. See the section “Console Hardware Requirements” in Chapter 2, for additional information.

## Optional Components

Besides adding a network-connected system console or basic VGA monitor, you can add or replace the following hardware items on your Altix UV 1000 series server:

- Peripheral component interface (PCIe) cards into the optional PCIe expansion chassis.
- Disk drives in your dual disk drive riser card equipped compute blade.

## PCIe Cards

The PCIe based I/O sub-systems, are industry standard for connecting peripherals, storage, and graphics to a processor blade. The following are the primary configurable I/O system interfaces for the Altix UV 1000 series systems:

- The optional two-slot internal PCIe riser card is a compute blade-installed riser card that supports one x8 and one x16 PCIe Gen2 card.
- The optional external PCIe riser card is a compute blade-installed riser card that supports two x16 PCI express Gen2 ports. These ports can be used to connect to an optional I/O expansion chassis that supports multiple PCIe cards. Each x16 connector on the riser card can support one I/O expansion chassis.

---

**Important:** PCIe cards installed in a two-slot internal PCIe riser card are *not* hot swappable or hot pluggable. The compute blade using the PCIe riser must be powered down and removed from the system before installation or removal of a PCIe card. Also see “Installing Cards in the 1U PCIe Expansion Chassis” on page 53 for more information.

---

Not all blades or PCIe cards may be available with your system configuration. Check with your SGI sales or service representative for availability. See Chapter 5, “PCIe and Disk Add or Replace Procedures” for detailed instructions on installing or removing PCIe cards or UV 1000 system disk drives.

## System Control

This chapter describes the general interaction and functions of the overall Altix UV 1000 system control. System control parameters depend somewhat on the overall size and complexity of the SGI Altix UV 1000 but will generally include the following three areas:

- The system management node (SMN) which runs the SGI Management Center software
- The chassis management controllers (CMC) boards - one or two per IRU
- The individual blade-based board management controllers (BMC) - report to the CMCs

---

**Note:** While it is possible to operate and administer a very basic (single-rack) SGI Altix UV 1000 system without using an SMN and SGI Management Center, this is an exception rather than rule.

---

### 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 LAN connection to the system controller network is used. This Ethernet connection is made from a remote PC/workstation connected to the system management node (SMN). The SMN is a separate stand-alone server installed in the SGI Altix UV 1000 rack. The SMN acts as a gateway and buffer between the UV system control network and any other public or private local area networks.

---

**Important:** The SGI Altix UV system control network is a private, closed network. It should not be reconfigured in any way to change it from the standard SGI Altix UV factory installation. It should not be directly connected to any other network. The Altix UV system control network is not designed for and does not accommodate additional network traffic, routing, address naming (other than its own schema), or DHCP controls (other than its own configuration). The Altix UV system control network also is not security hardened, nor is it tolerant of heavy network traffic, and is vulnerable to Denial of Service attacks.

---

## System Management Node (SMN) Overview

An Ethernet connection directly from the SMN (Figure 2-1 on page 21) to a local private or public Ethernet allows the system to be administered directly from a local or remote console via the SGI Management Center interface (most often installed on the SMN). Note that there is no direct inter-connected system controller function in the optional expansion PCIe modules.

The system controller network is designed into all IRUs. Controllers within the system report and share status information via the CMC Ethernet interconnect cables. This maintains controller configuration and topology information between all controllers in an SSI. Figure 2-2 on page 22 shows an example system control network using an optional and separate (remote) workstation to monitor a single-rack SGI Altix UV 1000 system. It is also possible to connect an optional PC or console directly to the SMN, see Figure 2-4 on page 27.

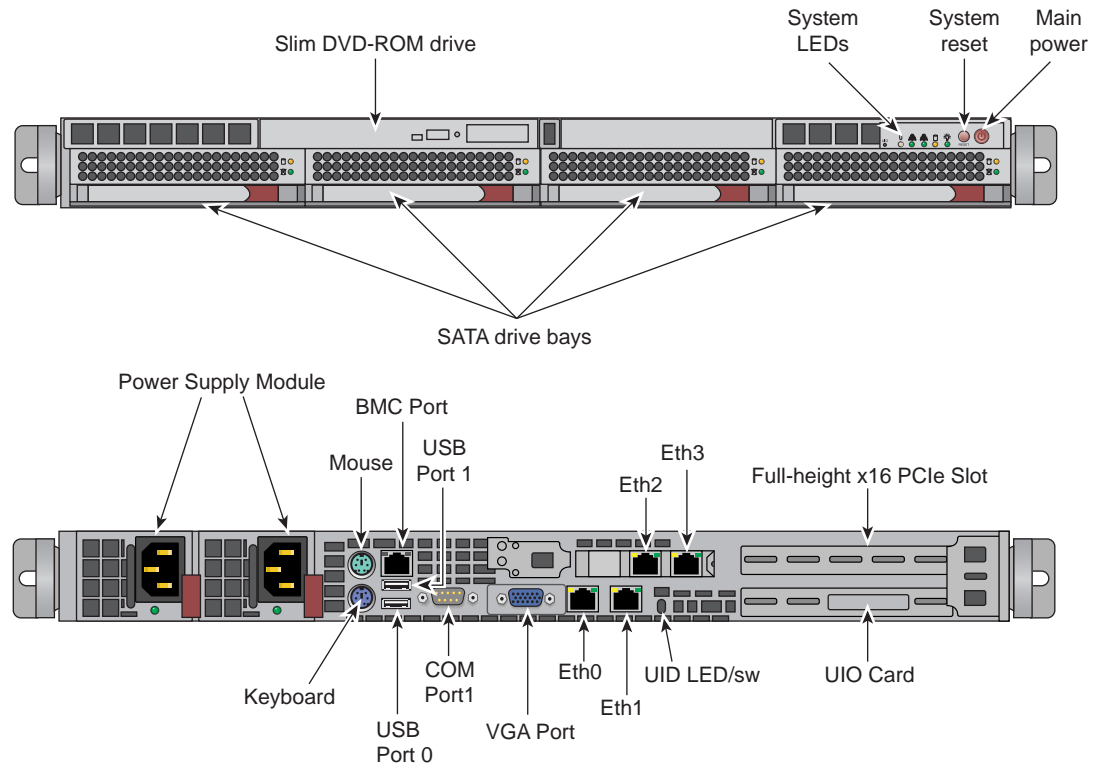
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**Note:** Mass storage option enclosures are not specifically monitored by the system controller network. Most optional mass storage enclosures have their own internal microcontrollers for monitoring and controlling all elements of the disk array.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

---

For information on administering network connected SGI systems using the SGI Management Center, see the *SGI Management Center System Administrator's Guide* (P/N 007-5642-00x).





**Figure 2-1** System Management Node Front and Rear Panels

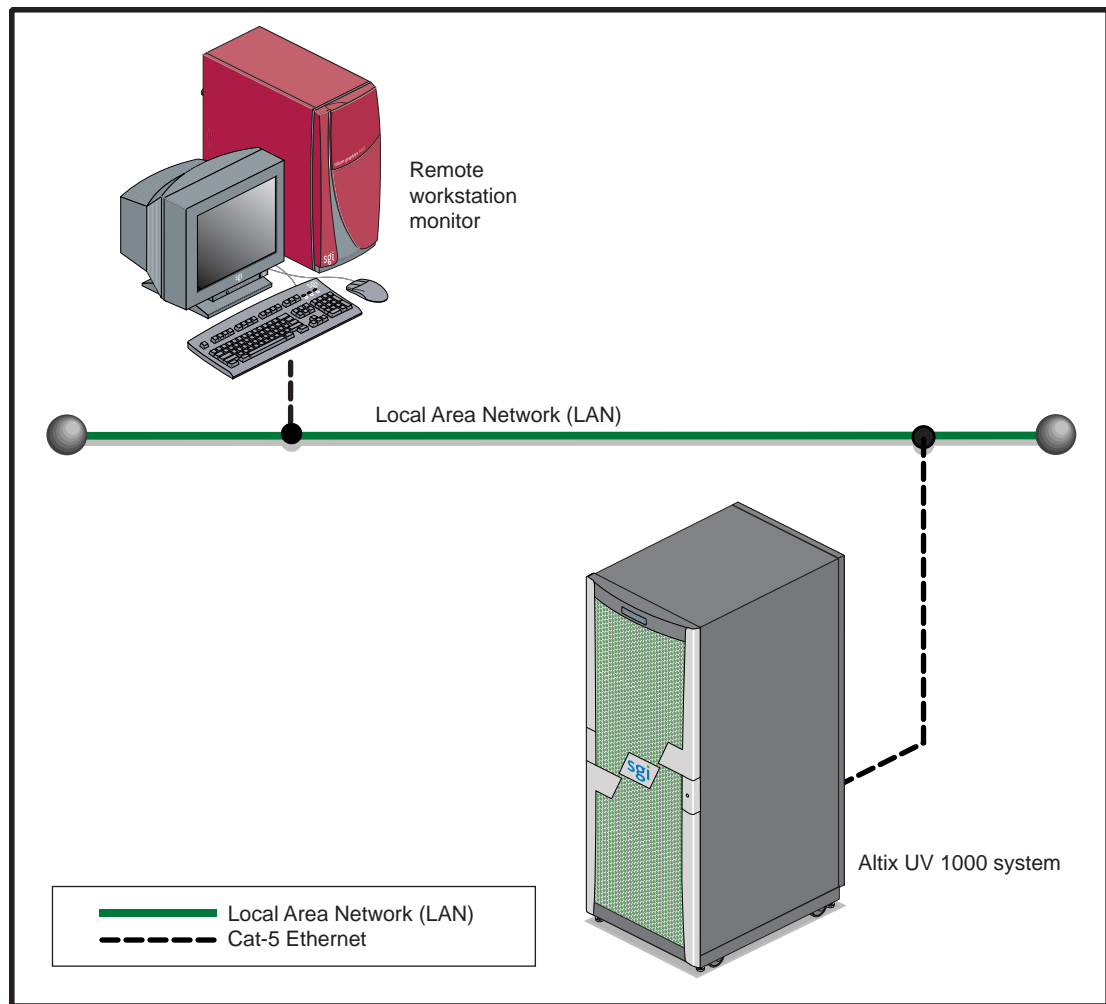
## CMC Overview

The CMC system for the SGI Altix UV 1000 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.

Viewing the system from the rear, the CMC blade on the right side of the IRU is the primary CMC. The CMC blade on the left is an optional unit that can act as a backup to the primary unit. The CMC accepts direction from the SMN and supports powering-up and powering-down individual or groups of compute blades and environmental monitoring of all units within the IRU. The CMC sends operational requests to the Baseboard Management Controller (BMC) on each

compute/memory blade installed. The CMC provides data collected from the compute nodes within the IRU to the system management node upon request.

CMCs can communicate with the blade BMCs and other IRU CMCs when they are linked together under a single system image (SSI); also called a partition. Each CMC shares its information with the SMN and other CMCs within the SSI. Note that the system management node (server), optional mass storage units and PCIe expansion enclosures do *not* have a CMC installed.



**Figure 2-2** SGI Altix UV 1000 LAN-attached System Control Network

## BMC Overview

Each compute blade in an IRU has a baseboard management controller (BMC). The BMC is a built-in specialized microcontroller hardware component that monitors and reports on the functional “health” status of the blade. The BMC provides a key functional element in the overall Intelligent Platform Management Interface (IPMI) architecture.

The BMC acts as an interface to the higher levels of system control such as the IRU’s CMC boards and the higher level control system used in the system management node. The BMC can report any on-board sensor information that it has regarding temperatures, power status, operating system condition and other functional parameters that may be reported by the blade. When any of the preset limits fall out of bounds, the information will be reported by the BMC and an administrator can take some corrective action. This could entail a node shutdown, reset (NMI) or power cycling of the individual blade.

The individual blade BMCs do not have information on the status of other blades within the IRU. This function is handled by the CMCs and the system management node. Note that blades equipped with an optional BaseIO riser board have a dedicated BMC Ethernet port.

## System Controller Interaction

In all Altix UV 1000 servers all the system controller types (SMNs, CMCs and BMCs) communicate with each other in the following ways:

- System control commands and communications are passed between the SMN and CMCs via a private dedicated gigabit Ethernet. The CMCs communicate directly with the BMC in each installed blade by way of the IRU’s internal backplane.
- All the primary CMCs can communicate with each other via an Ethernet “ring” configuration network. If the IRUs in the system use secondary CMCs, these can also be configured in a secondary Ethernet ring network.
- In larger configurations the system control communication path includes a private, dedicated Ethernet switch.

## Controllers

All IRUs have one or two CMC boards installed. The following subsections describe the basic features of the controllers:

---

**Note:** For additional information on controller commands, see the *SGI UV CMC Controller Software User's Guide* (P/N 007-5636-00x).

---

### Chassis Management Controller Functions

The following list summarizes the control and monitoring functions that the CMC performs. Many of the controller functions are common across all IRUs, however, some functions are specific to the type of enclosure.

- Controls voltage margining within the IRU
- Monitors individual blade status via blade BMCs
- Controls and monitors IRU fan speeds
- Reads system identification (ID) PROMs
- Monitors voltage levels and reports failures
- Monitors and controls warning LEDs
- Monitors the On/Off power cycles
- Monitors the reset and the nonmaskable interrupt (NMI) status of the IRU
- Reports the population of the PCIe cards and the power levels of the PCIe slots in installed PCIe enabled riser blades

### Console Hardware Requirements

The console type and how these console types are connected to the Altix UV 1000 servers is determined by what console option is chosen.

If you have an Altix UV 1000 server and wish to use a serially-connected “dumb terminal”, you can connect the terminal via a serial cable to the (DB-9) RS-232-style console port connector on the CMC.

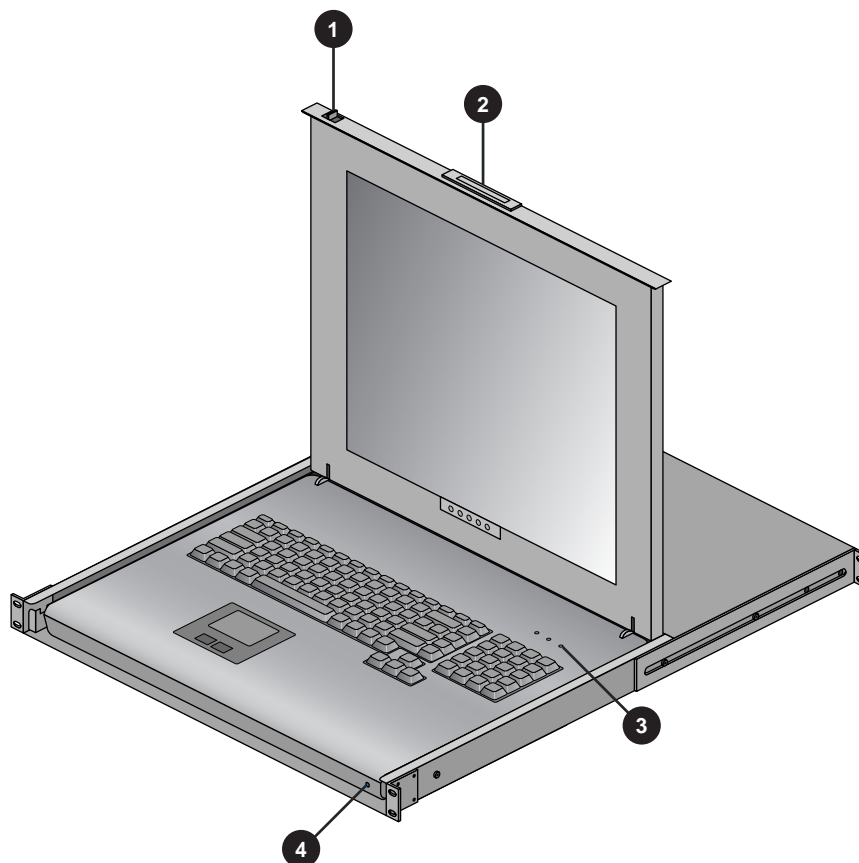
The terminal should be set to the following functional modes:

- Baud rate of 115,200
- 8 data bits
- One stop bit, no parity
- No hardware flow control (RTS/CTS)

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

## **1U Console Option**

The SGI optional 1U console (Figure 2-3 on page 26) is a rackmountable unit that includes a built-in keyboard/touchpad. It uses a 17-inch (43-cm) LCD flat panel display of up to 1280 x 1024 pixels.



**Figure 2-3** Optional 1U Rackmount Console

### Flat Panel Rackmount Console Option Features

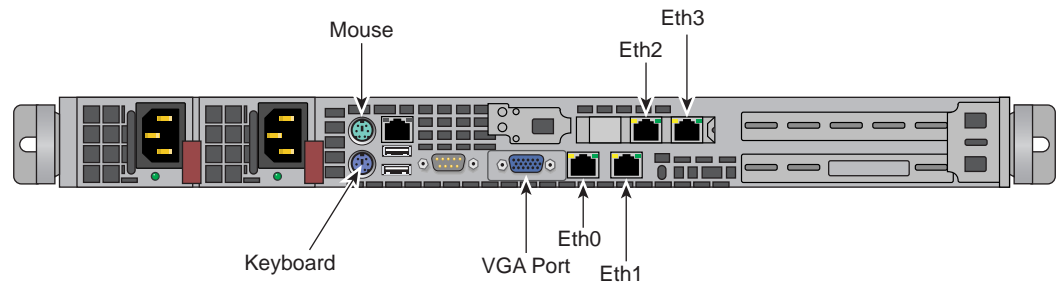
The 1U flat panel console option has the following listed features:

1. **Slide Release** - Move this tab sideways to slide the console out. It locks the drawer closed when the console is not in use and prevents it from accidentally sliding open.
2. **Handle** - Used to push and pull the module in and out of the rack.
3. **LCD Display Controls** - The LCD controls include On/Off buttons and buttons to control the position and picture settings of the LCD display.

4. **Power LED** - Illuminates blue when the unit is receiving power.

The 1U console attaches to the system management node server using PS/2 and HD15M connectors or to an optional KVM switch (not provided by SGI). See Figure 2-4 for the SMN video connection points. The 1U console is basically a “dumb” VGA terminal, it cannot be used as a workstation or loaded with any system administration program.

The 27-pound (12.27-kg) console automatically goes into sleep mode when the cover is closed.



**Figure 2-4** System Management Node (SMN) Direct Video Connection Ports





## System Overview

This chapter provides an overview of the physical and architectural aspects of your SGI Altix UV 1000 series system. The major components of the Altix UV 1000 series systems are described and illustrated.

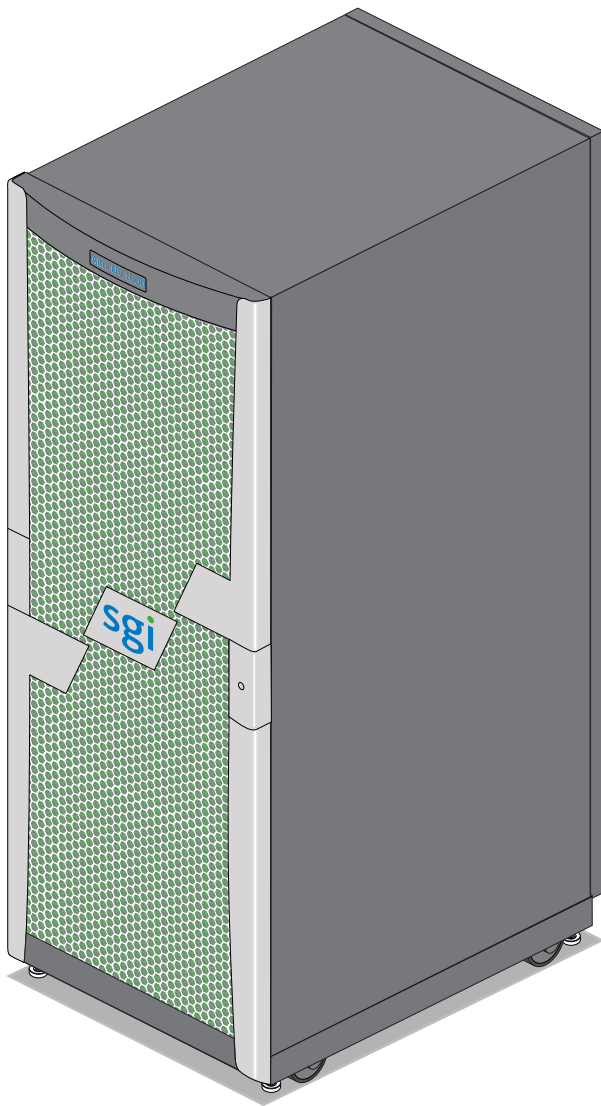
The Altix UV 1000 series is a family of multiprocessor distributed shared memory (DSM) computer systems that initially scale from 32 to 4,096 Intel processor cores as a cache-coherent single system image (SSI). Future releases may scale to larger processor counts for single system image (SSI) applications. 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 lower entry-level cost with global scalability in processors, memory, and I/O. You can install and operate the Altix UV 1000 series system in your lab or server room. Each 42U SGI rack holds one or two 18-U high enclosures that support up to 16 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 in and out of the Altix UV 1000 IRU enclosures.

This chapter consists of the following sections:

- “System Models” on page 31
- “System Architecture” on page 33
- “System Features” on page 35
- “System Components” on page 40

Figure 3-1 shows the front view of a single-rack Altix UV 1000 system.



**Figure 3-1** SGI Altix UV 1000 System Example

## System Models

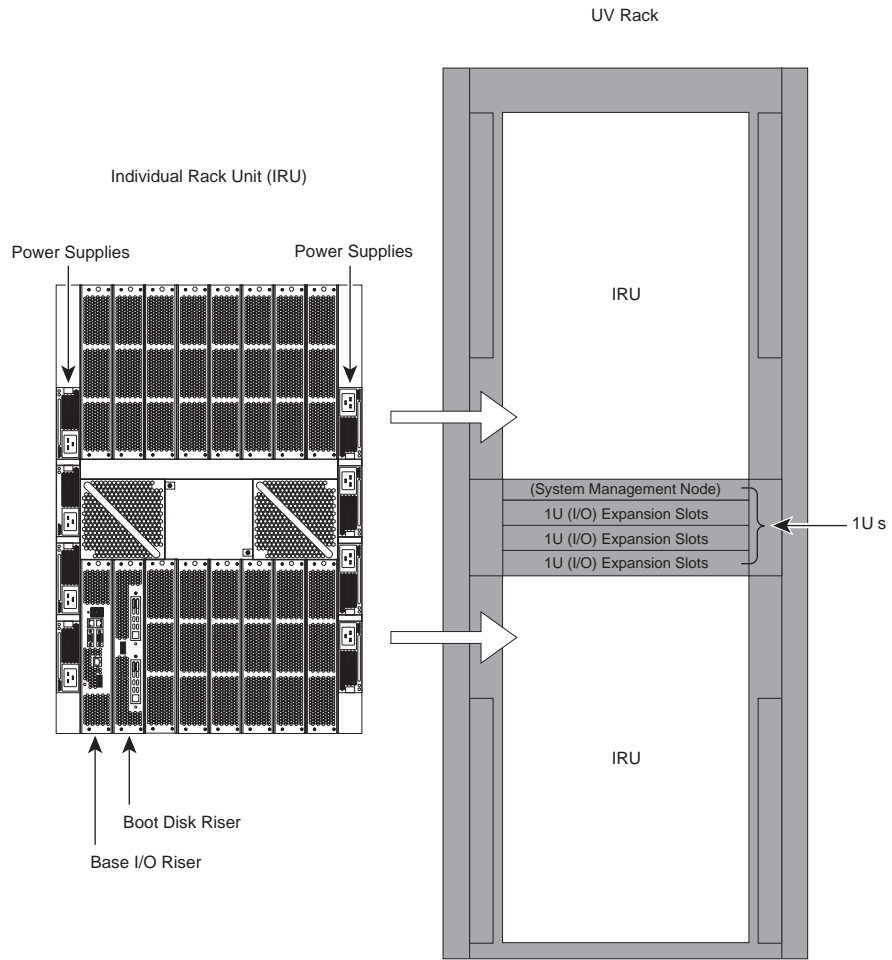
The basic enclosure within the Altix UV 1000 system is the 18U high “individual rack unit” (IRU). The IRU enclosure contains up to 16 single-wide blades connected to each other via a backplane. Each IRU has ports that are brought out to external NUMALink 5 connectors. The 42U rack for this server houses all IRU enclosures, option modules, and other components; up to 64 processor sockets (512 processor cores) in a single rack. The Altix UV 1000 server system can expand up to 4,096 Intel processor cores per SSI; a minimum of one BaseIO equipped blade is required for every 4,096 processor cores. Higher core counts in an SSI may be available in future releases, check with your SGI sales or service representative for current information.

Figure 3-2 shows an example of how IRU placement is done in a single-rack Altix UV 1000 server.

The system requires a minimum of one 42U tall rack with four single-phase power distribution units (PDUs) per IRU installed in the rack. Each single-phase PDU has two outlets (five are required to support the eight power supplies in an IRU and two power connections to the SMN).

The three-phase PDU has 9 outlets (8 connections are required to support each IRU installed in a rack).

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



**Figure 3-2** SGI Altix UV 1000 IRU and Rack

## System Architecture

The Altix UV 1000 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 512 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 to a maximum of 512 processor cores in each of 4 racks (2,048 cores) on a single-system image (SSI). Larger SSI configurations may be offered in the future, contact your SGI sales or service representative for information.

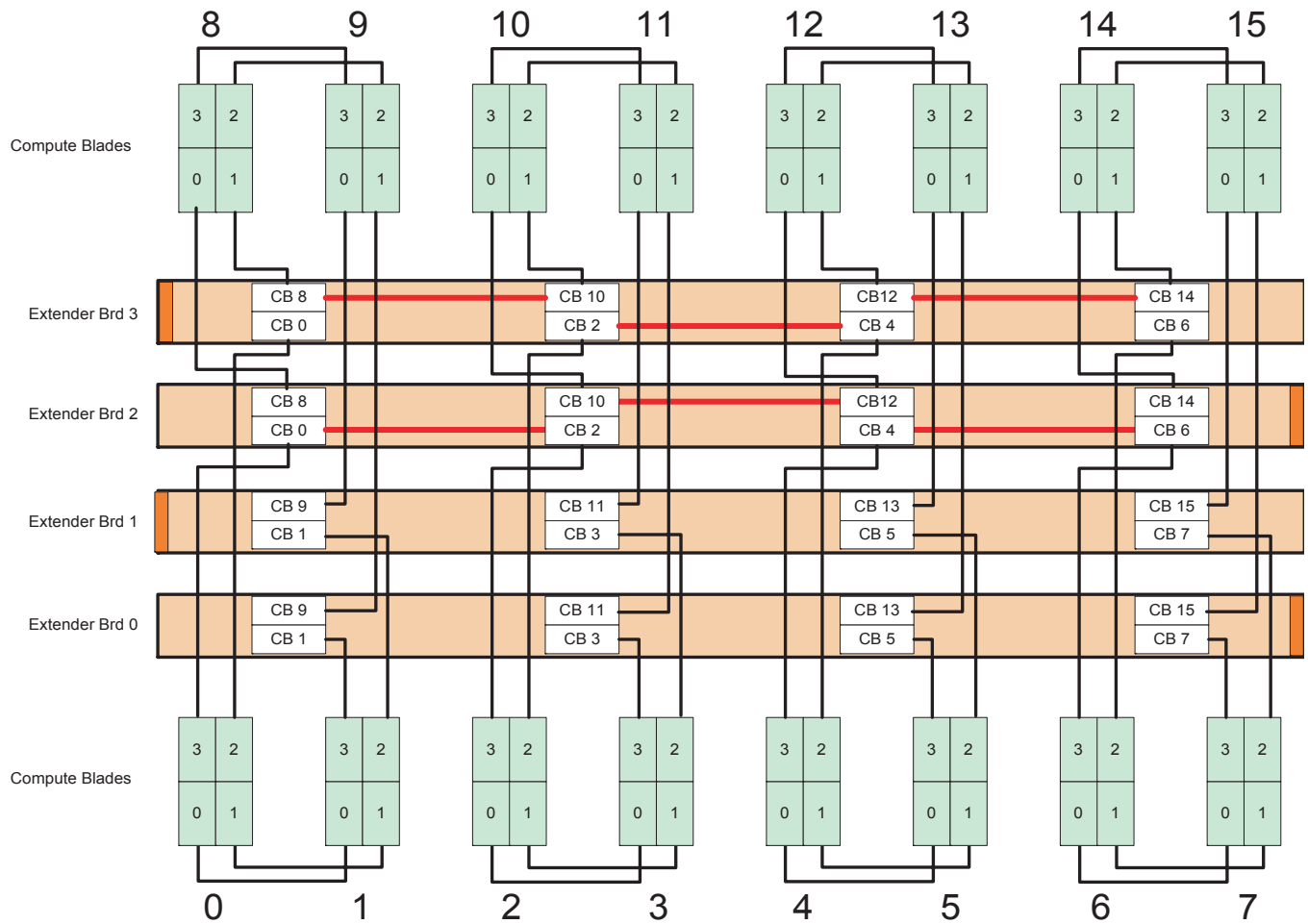
The system architecture for the Altix UV 1000 system is a fifth-generation NUMAflex DSM architecture known as NUMALink 5. In the NUMALink 5 architecture, all processors and memory can be tied together into a single logical system. This combination of processors, memory, and internal switches constitute the interconnect fabric called NUMALink within each 18U IRU enclosure.

The basic expansion building block for the NUMALink interconnect is the processor node; each processor node consists of a Hub ASIC and two four-core, six-core, or eight-core processors with on-chip secondary caches. The Intel processors are connected to the Hub ASIC via quick path interconnects.

The Hub ASIC is the heart of the processor and memory node blade technology. This specialized ASIC acts as a crossbar between the processors and the network interface. The Hub ASIC enables any processor in the SSI to access the memory of all processors in the SSI.

Figure 3-3 on page 34 shows a functional block diagram of the Altix UV 1000 series system IRU.

A two-port channel extender blade is used in routerless system topologies to reduce the number of external NUMALink cables required to interconnect a system. The two-port channel extender blade installs in the NUMALink network slots 0 through 3 in a single IRU system. NUMALink network slots 0 and 1 are reserved for 8-port channel extender blades used in multi-IRU systems.



**Figure 3-3** Functional Block Diagram of the Individual Rack Unit

## System Features

The main features of the Altix UV 1000 series server systems are discussed in the following sections:

- “Modularity and Scalability” on page 35
- “Distributed Shared Memory (DSM)” on page 35
- “Chassis Management Controller (CMC)” on page 37
- “Distributed Shared I/O” on page 37
- “Reliability, Availability, and Serviceability (RAS)” on page 38

### Modularity and Scalability

The Altix UV 1000 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. 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)

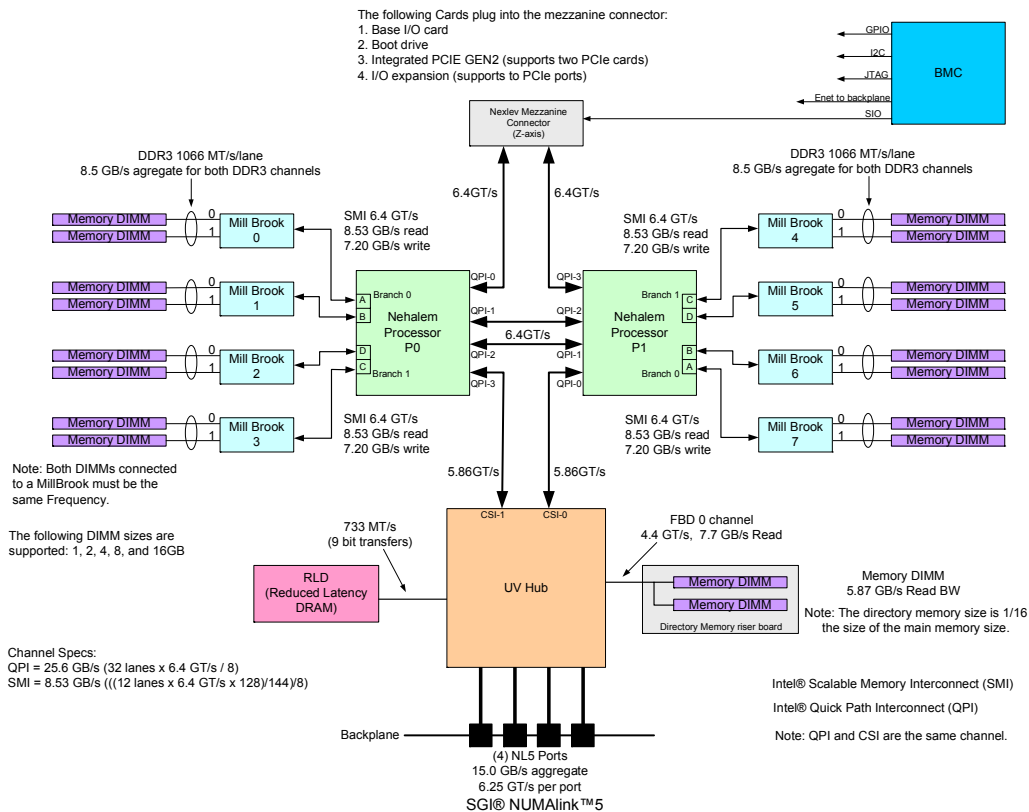
In the Altix UV 1000 series server, memory is physically distributed both within and among the IRU enclosures (compute/memory/I/O blades); however, it is accessible to and shared by all NUMAlinked devices within the single-system image (SSI). This is to say that all NUMAlinked components sharing a single 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 it is connected to on a compute node blade, the memory is referred to as the node’s *local memory*. Figure 3-4 on page 36 shows a conceptual block diagram of the 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 3-4** Blade Node Block Diagram



## Distributed Shared I/O

Like DSM, I/O devices are distributed among the blade nodes within the IRUs. Each BaseIO riser card equipped blade node is accessible by all compute nodes within the SSI (partition) through the NUMAlink interconnect fabric.

## Chassis Management Controller (CMC)

Each IRU has two chassis management controllers (CMC) slots which are located directly below the upper set of cooling fans in the rear of the IRU. The chassis manager supports powering up and down of the compute blades and environmental monitoring of all units within the IRU.

One GigE port from each compute blade connects to each CMC blade via the internal IRU backplane. A second GigE port from each even number blade slot is also connected to the CMC. This second port is used to support an optional BaseIO riser card in the even numbered slots.

One of the CMCs is the primary interface and the second is an optional backup or redundant CMC.

## 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 UV 1000 server series 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 may 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 UV 1000 server series uses 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 UV 1000 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.
  - All main memory has Intel Single Device Data Correction, to detect and correct 8 contiguous bits failing in a memory device. Additionally, the main memory can detect and correct any two-bit errors coming from two memory devices (8 bits or more apart).

- All high speed links including Intel Quick Path Interconnect (QPI), Intel Scalable Memory Interconnect (SMI), and PCIe have CRC check and retry.
- The NUMALink interconnect network is protected by cyclic redundancy check (CRC).
- Each blade/node installed has status LEDs that indicate the blade's operational condition; LEDs are readable at the front of the IRU.
- 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:**
  - 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 UV 1000 series system features the following major components:

- **42U rack.** This is a custom rack used for both the compute and I/O rack in the Altix UV 1000 system. Up to two IRUs can be installed in each rack. There is also space reserved for a system management node and other optional 19-inch rackmounted components.
- **Individual Rack Unit (IRU).** This enclosure contains eight power supplies, 2-16 compute/memory blades, BaseIO and other optional riser enabled blades for the Altix UV 1000. The enclosure is 18U high. Figure 3-5 on page 41 shows the Altix UV 1000 IRU system components.
- **Compute blade.** Holds two processor sockets and 8 or 16 memory DIMMs. Each compute blade can be ordered with a riser card that enables the blade to support various I/O options.
- **BaseIO enabled compute blade.** I/O riser enabled blade that supports all base system I/O functions including two ethernet connectors, one SAS port, one BMC ethernet port and three USB ports.

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**Note:** While the BaseIO blade is capable of RAID 0 support, SGI does not recommend the end user configure it in this way. RAID 0 offers no fault tolerance to the system disks, and a decrease in overall system reliability. In a RAID 0 configuration, failure of either system disk will result in data being lost on both disks, resulting in system shutdown. The Altix UV 1000 ships with RAID 1 functionality (disk mirroring) configured if the option is ordered.

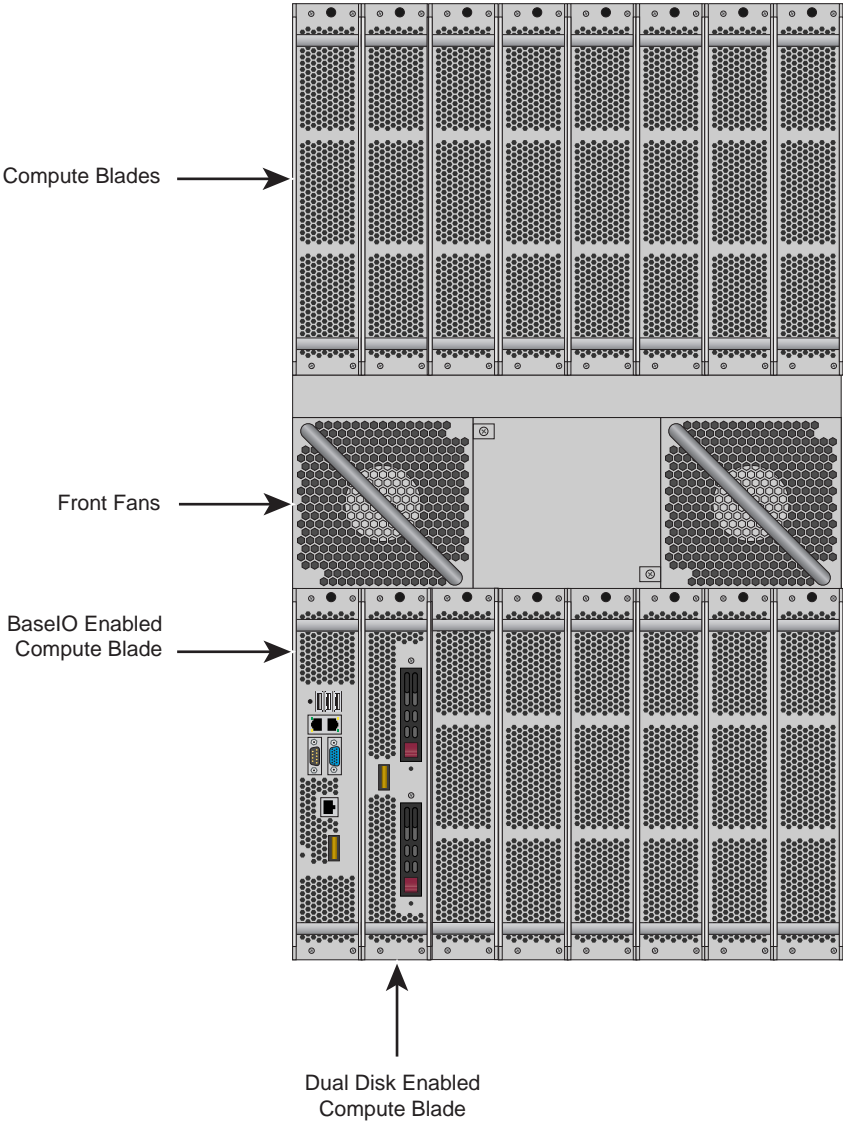
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- **Dual disk enabled compute blade.** This riser enabled blade supports two hard disk drives that act as the system disks for the SSI. This blade must be installed adjacent to and physically connected with the BaseIO enabled compute blade. Jbod, RAID 0 and RAID 1 are supported. Note that you must have the BaseIO riser blade optionally enabled to use RAID 1 mirroring on your system disk pair.
- **Two-Slot Internal PCIe enabled compute blade.** The internal PCIe riser based compute blade supports two internally installed PCI Express option cards.
- **External PCIe enabled compute blade.** This riser enabled board must be used in conjunction with a PCIe expansion enclosure. A x16 adapter card connects from the blade to the expansion enclosure, supporting up to four PCIe option cards.

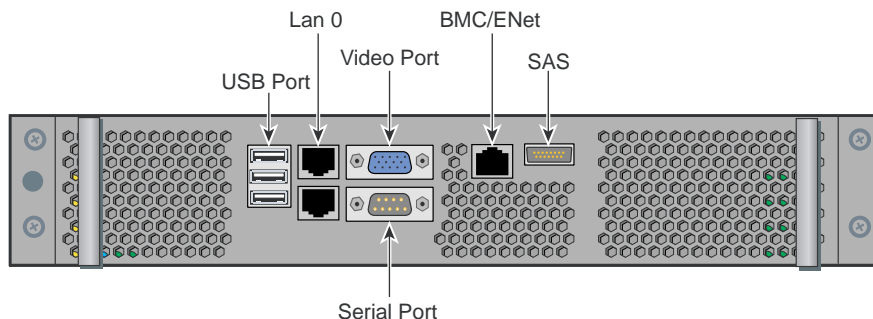
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**Note:** PCIe card options may be limited, check with your SGI sales or support representative.

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**Figure 3-5** Altix UV 1000 IRU System Components Example



**Figure 3-6** BaseIO Riser Enabled Blade Front Panel 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 U18 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 UV 1000 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 current information on available product options not discussed in this manual.

## Rack Information

This chapter describes the physical characteristics of the tall (42U) UV 1000 racks in the following sections:

- “Overview” on page 43
- “Altix UV 1000 Series Rack (42U)” on page 44
- “Altix System Rack Technical Specifications” on page 48

### Overview

At the time this document was published only the tall (42U) Altix rack (shown in Figure 4-2) was available from the SGI factory for use with the Altix UV 1000 systems. Other racks may be available to house the system IRUs, check with your SGI sales or service representative for information.

## Altix UV 1000 Series Rack (42U)

The tall rack (shown in Figure 4-1 on page 45) has the following features and components:

- **Front and rear door.** The front door is opened by grasping the outer end of the rectangular-shaped door piece and pulling outward. It uses a key lock for security purposes that should open all the front doors in a multi-rack system (see Figure 4-2 on page 46).

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**Note:** The front door and rear door locks are keyed differently. The optional water-chilled rear door (see Figure 4-3 on page 47) does not use a lock.

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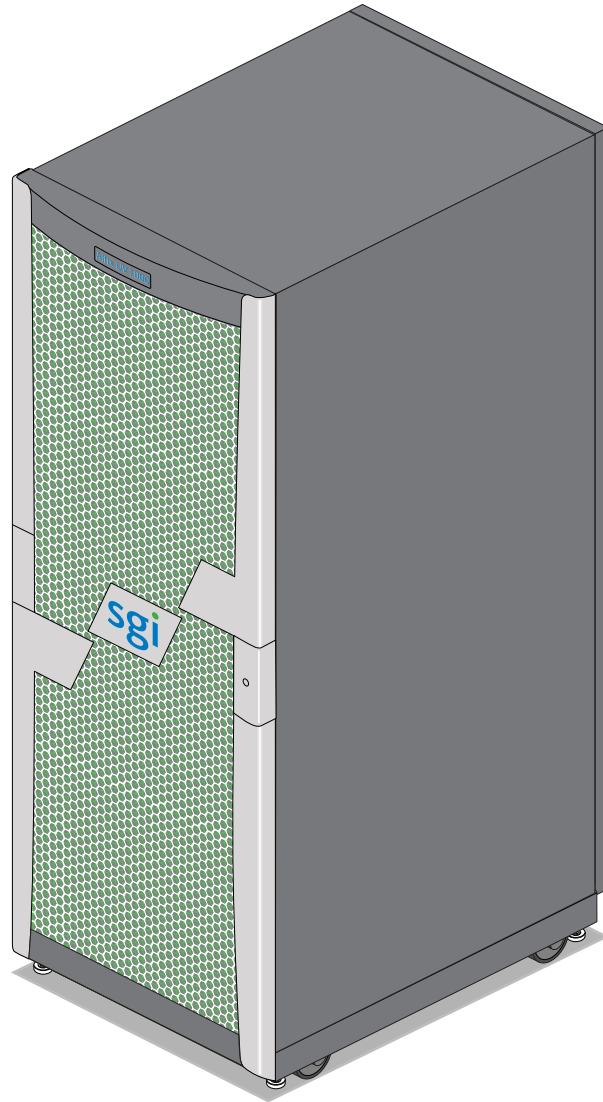
The standard rear door has a push-button key lock to prevent unauthorized access to the system. The rear doors have a master key that locks and unlocks all rear doors in a system made up of multiple racks. You cannot use the rear door key to secure the front door lock.

- **Cable entry/exit area.** Cable access openings are located in the front floor and top of the rack. Multiple cables are attached to the front of the IRUs; therefore, a significant part of the cable management occurs in the front part of the rack. The stand-alone system management nodes have cables that attach at the rear of the rack. Rear cable connections will also be required for optional storage modules installed in the same rack with the IRU(s). Optional inter-rack communication cables can pass through the top of the rack. These are necessary whenever the system consists of multiple racks. I/O and power cables normally pass through the bottom of the rack.
- **Rack structural features.** The rack is mounted on four casters; the two rear casters swivel. There are four leveling pads available at the base of the rack. The base of the rack also has attachment points to support an optional ground strap, and/or seismic tie-downs.
- **Power distribution units in the rack.** Ten outlets are required for a single IRU system as follows:
  - Allow eight outlets for the first IRU
  - Two outlets for a maintenance node (server)
  - Allow eight more outlets for each additional IRU in the system

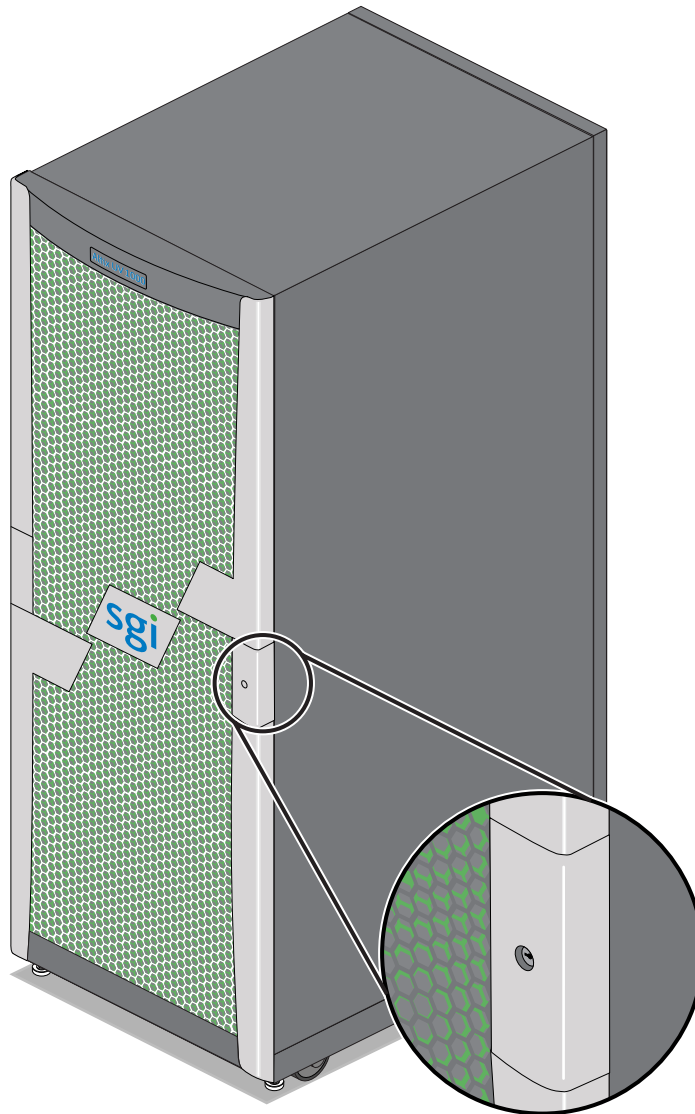
Eight two-outlet single-phase power distribution units (PDUs) are needed for a base rack system with two IRUs.



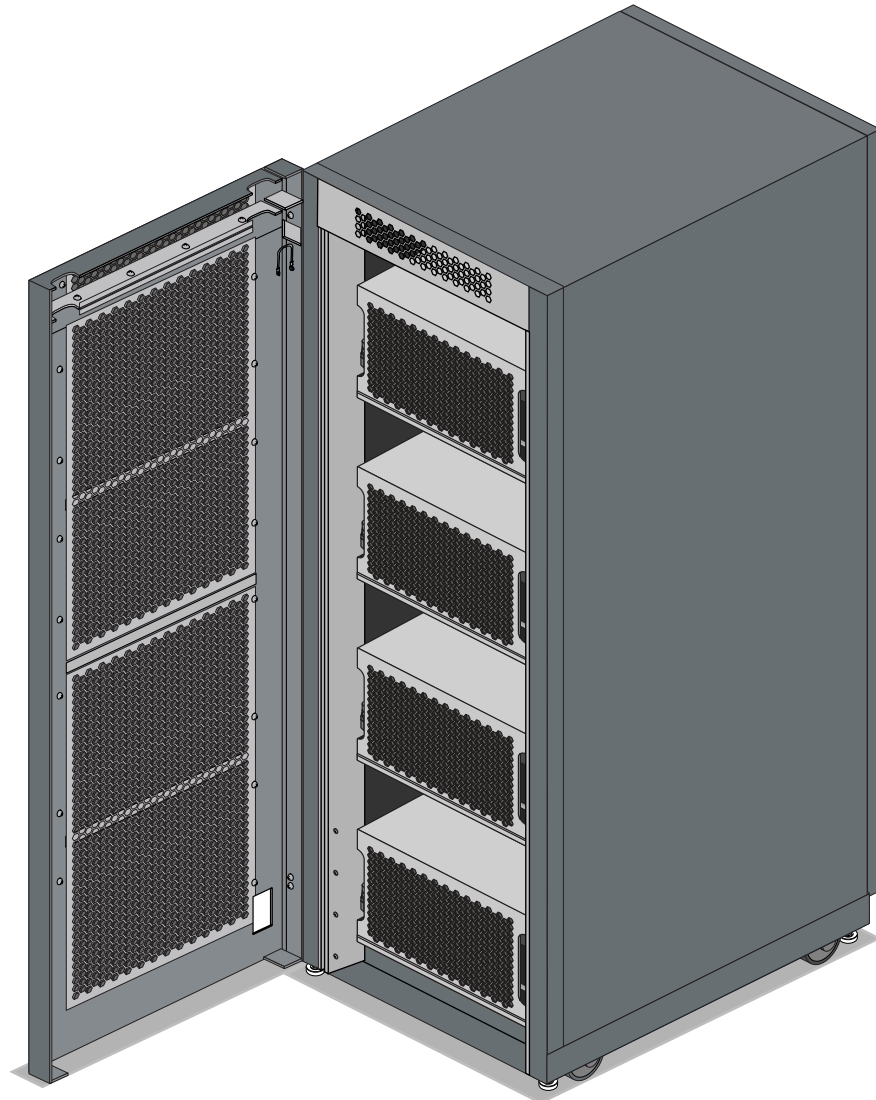
In addition an 8 outlet single-phase PDU is required for the system management node and other optional equipment. Each three-phase power distribution unit has 9 outlet connections; 18 outlets are required to power two IRUs.



**Figure 4-1** Altix UV 1000 Series Rack Example



**Figure 4-2** Front Lock on Tall (42U) Altix Rack



**Figure 4-3** Optional Water-Chilled Cooling Units on Rear of Altix Rack

## Altix System Rack Technical Specifications

Table 4-1 lists the technical specifications of the Altix UV 1000 series tall rack.

**Table 4-1** Tall Altix Rack Technical Specifications

<b>Characteristic</b>	<b>Specification</b>
Height	79.5 in. (201.9 cm)
Width	31.3 in. (79.5 cm)
Depth	45.8 in. (116.3 cm)
Single-rack shipping weight (approximate)	2,381 lbs. (1,082 kg) air cooled 2,581 (1,173 kg) water assist cooling
Single-rack system weight (approximate)	2,300 lbs. (1,045 kg) air cooled 2,500 lbs (1,136 kg) water assist cooling
Voltage range	North America/International
Nominal	200-240 VAC /230 VAC
Tolerance range	180-264 VAC
Frequency	North America/International
Nominal	60 Hz /50 Hz
Tolerance range	47-63 Hz
Phase required	Single-phase or 3-phase
Power requirements (max)	34.57 kVA (33.88 kW) approximate
Hold time	16 ms
Power cable	8 ft. (2.4 m) pluggable cords

## PCIe and Disk Add or Replace Procedures

This chapter provides information about installing and removing PCIe cards and system disk drives from your SGI system, as follows:

- “Maintenance Precautions and Procedures” on page 49
- “Adding or Replacing PCIe Cards” on page 52
- “Installing or Replacing a Drive in the Dual Disk Riser Blade” on page 56

### 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 50
- “Returning the System to Operation” on page 50



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**Warning:** To avoid problems that could void your warranty, your SGI or other approved system support engineer (SSE) should perform all the setup, addition, or replacement of parts, cabling, and service of your SGI Altix UV 1000 system, with the exception of the following items that you can perform yourself:

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- Using your system console or network access workstation to enter commands and perform system functions such as powering on and powering off, as described in this guide.
- Installing, removing or replacing PCIe cards in the optional 1U PCIe expansion chassis.
- Adding and replacing disk drives used with your system and using the ESI/ops panel (operating panel) on optional mass storage.

## 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. Go to the section “Powering the System On and Off” in Chapter 1 if you are not familiar with power down procedures.
3. After the system is powered off, locate the power distribution unit(s) (PDUs) in the front of the rack and turn off the circuit breaker switches on each PDU.

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**Note:** Powering the system off is not a requirement when replacing a RAID 1 system disk. Addition of a non-RAID disk can be accomplished while the system is powered on, but the disk is not automatically recognized by system software.

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## 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. Power up the system. If you are not familiar with the proper power down procedure, review the section “Powering the System On and Off” in Chapter 1.
3. Verify that the LEDs on the system power supplies and system blades turn on and illuminate green which indicates that the power-on procedure is proceeding properly.

If your system does not boot correctly, see “Troubleshooting Chart” in Chapter 6, for troubleshooting procedures.

## Overview of PCI Express (PCIe) Operation

This section provides a brief overview of the PCI Express (PCIe) technology 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 specific PCI Express board options available with the SGI Altix UV 1000.

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 5-1)
- Potential sustained throughput of x16 PCI Express is approximately four times that of the fastest PCI-X throughputs



**Figure 5-1** 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 - also called “by 1”.

SGI Altix UV 1000 PCIe technology is available up to a 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 5-1 shows this concept.

For information on which slots in the PCIe expansion chassis support what lane levels, see Table 5-2 on page 53.

**Table 5-1** SGI Altix UV 1000 PCIe Support Levels

<b>SGI x16 PCIe Connectors</b>	<b>Support levels in optional chassis</b>
x1 PCIe cards	Supported in all four slots
x2 PCIe cards	Supported in all four slots
x4 PCIe cards	Supported in all four slots
x8 PCIe cards	Supported in two slots
x16 PCIe cards	1 slot supported
x32 PCIe cards	Not supported

## Adding or Replacing PCIe Cards



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**Warning:** Before installing, operating, or servicing any part of this product, read the “Safety Information” on page 79.

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This section provides instructions for adding or replacing a PCIe card in a PCIe expansion enclosure installed in your system. To maximize the operating efficiency of your cards, be sure to read all the introductory matter before beginning the installation.



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

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## Installing Cards in the 1U PCIe Expansion Chassis

The PCIe expansion chassis functions in a similar manner to a computer chassis that supports PCIe slots. Always follow the manufacturer's instructions or restrictions for installing their card.

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**Important:** When installing PCIe cards, please ensure that the input current rating specified on the AC input label is not exceeded.

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The EB4-1U-SGI chassis provides space for up to four (4) PCIe cards in the following “lane” bandwidth configurations:

**Table 5-2** PCIe Expansion Slot Bandwidth Support Levels

PCIe expansion enclosure slot #	PCIe connector level supported by slot	PCIe slot number location in board “carriage”
Slot 1	Up to x16	Bottom-left side
Slot 2	Up to x4	Top-left side
Slot 3	Up to x8	Top-right side
Slot 4	Up to x4	Bottom-right side

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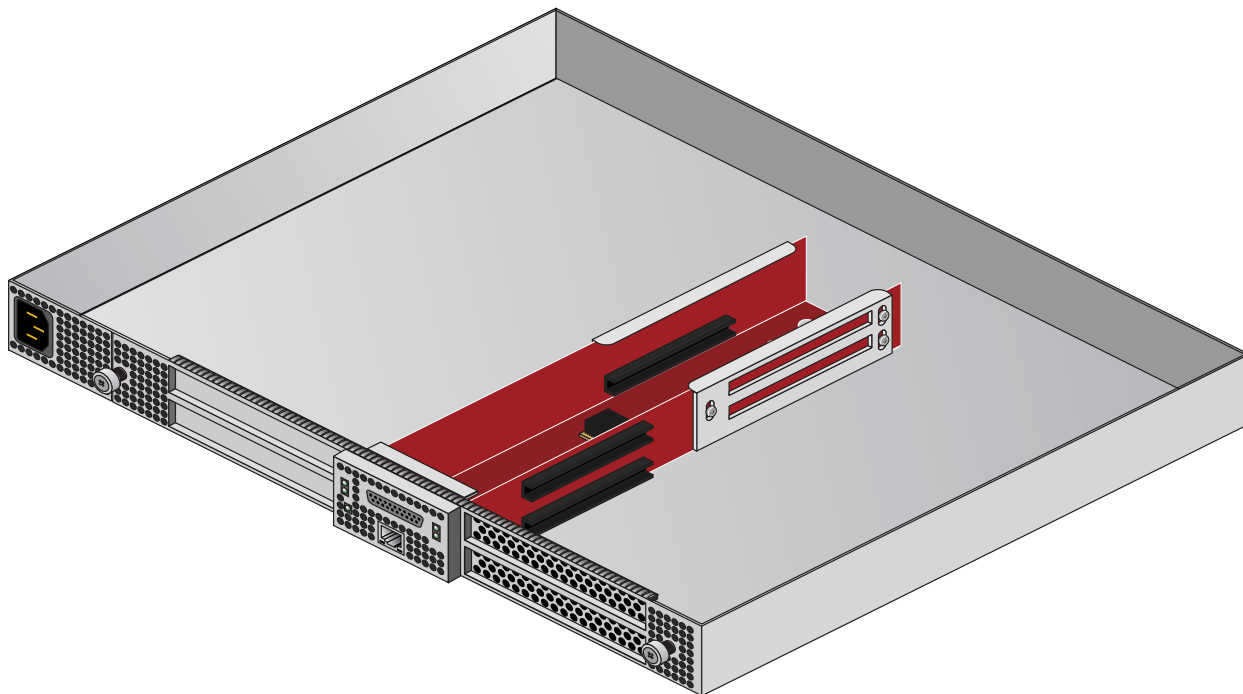
**Note:** Before installing the PCIe expansion cards, be sure to remove each respective slot cover and use its screw to secure your expansion card in place.

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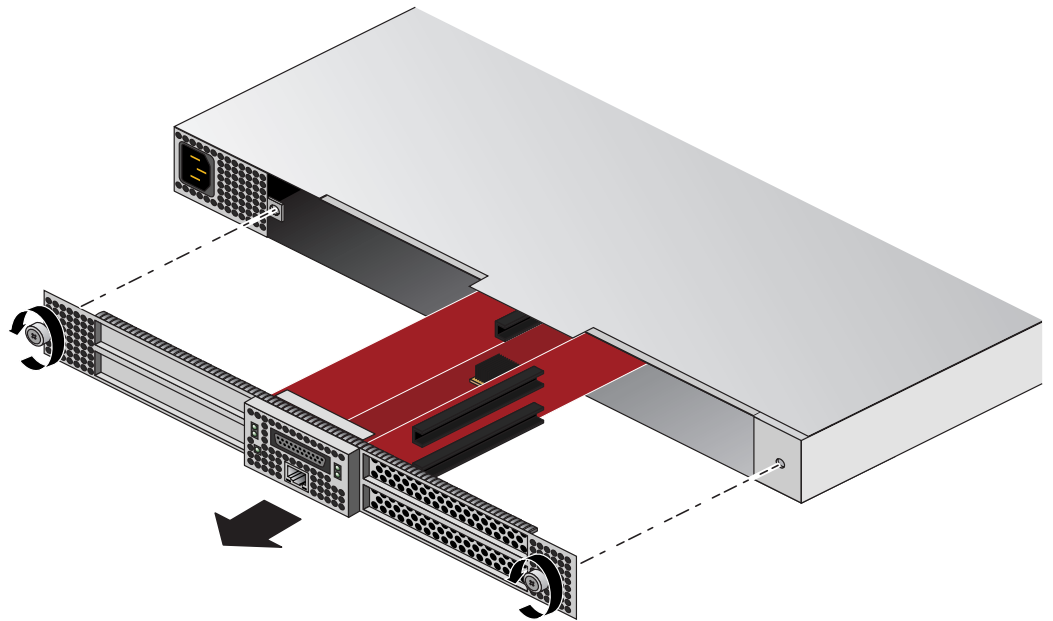
1. Working from the front of the expansion chassis, locate the two “thumb screws” that hold the PCIe board “carriage” in the expansion chassis.
2. Turn the two thumb screws counter-clockwise until they disengage from the 1U chassis.
3. Pull the T-shaped board “carriage” out of the chassis until the slots are clear of the unit.
4. Select an available slot based on the lane support your PCIe card requires, see Table 5-2.
5. Remove the metal slot cover from the selected slot and retain its screw.
6. Fit the PCIe card into the slot connector with the connector(s) extending out the front of the bracket, then secure the board with the screw that previously held the metal slot cover.
7. Push the PCIe board “carriage” back into the enclosure until it is seated and twist the retaining thumb screws clockwise (right) until fully secure.

**Important:** After installation, be sure to power on the PCIe expansion enclosure before re-booting your system.

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**Figure 5-2** The PCIe Expansion Enclosure



**Figure 5-3** Card Slot Locations

## Installing or Replacing a Drive in the Dual Disk Riser Blade

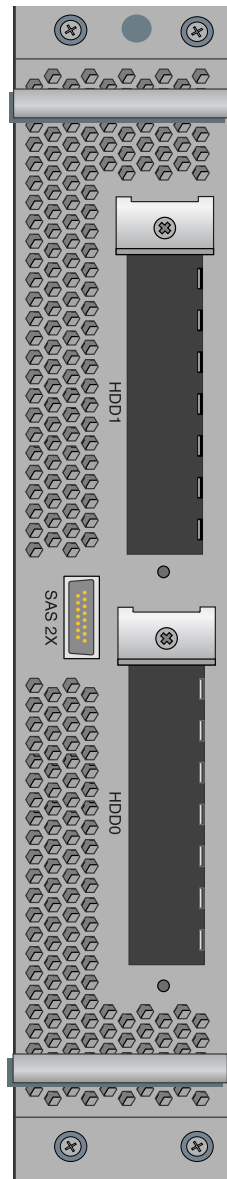
The dual-disk drive riser card permits a blade to house two system disk drive bays as shown in Figure 5-4. This section describes how to install or remove the drives. The blade supports RAID 1, RAID 0 and jbod disk drives.

Use the following steps and illustrations to add or replace a disk drive in the Altix UV 1000 dual disk drive riser blade:

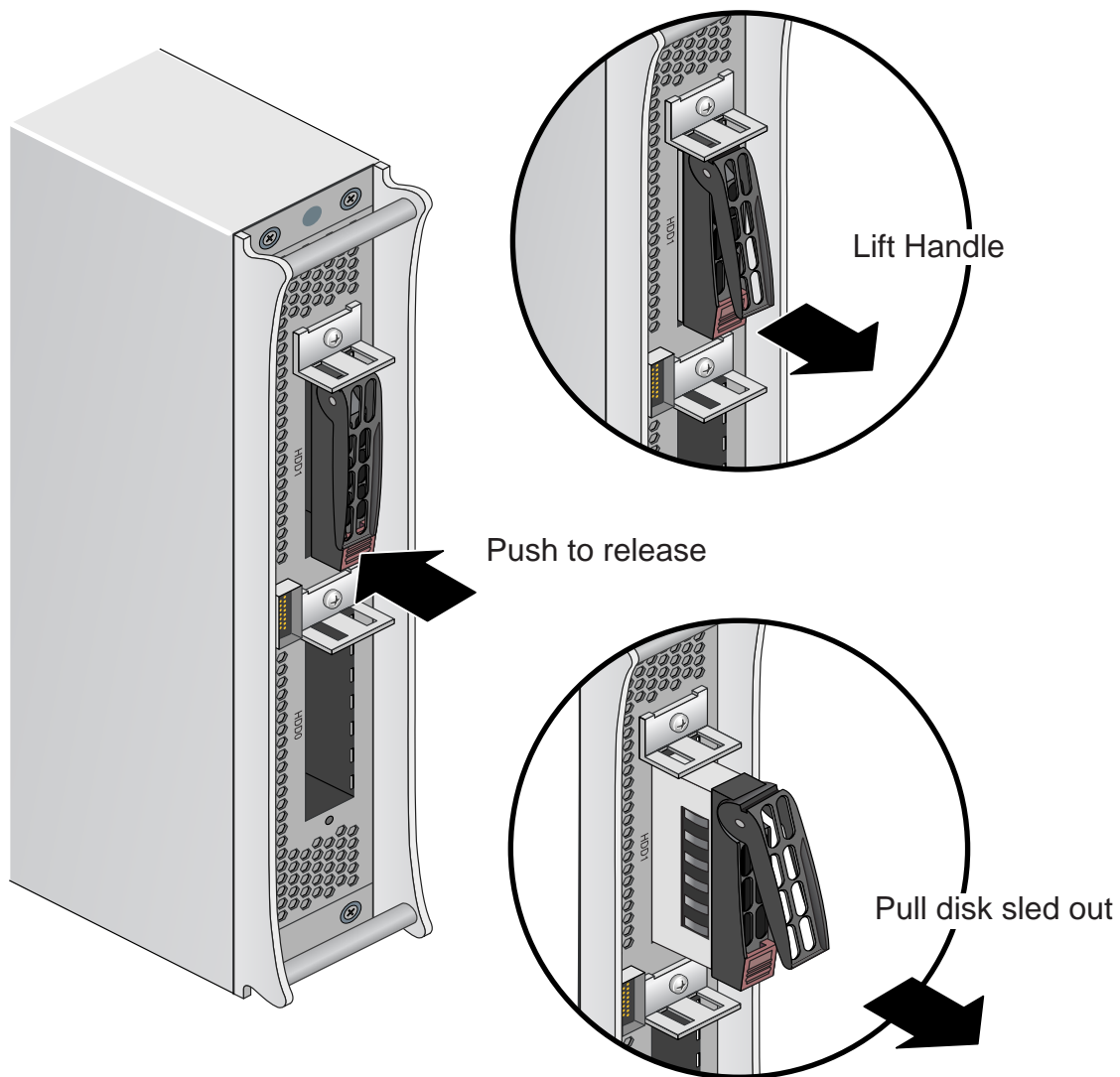
1. Install a drive (pre-mounted on sled) into the dual disk drive riser blade with the red button at the bottom.
2. Slide the disk and sled into the riser until the actuating teeth can grab the riser plate.
3. Use care - do not insert too far into the disk riser blade.
4. Push the drive handle down until the handle clicks into place (this completes the insertion of the disk drive).

To remove a disk drive:

1. Press in and down on the red button until the handle is released.
2. Pull the handle upward and out until the locking mechanism is cleared.
3. Grasp the disk drive by the side and extract it from the disk riser blade.



**Figure 5-4** Location of Disk Drive Bays



**Figure 5-5** Removing a Disk Drive

## Troubleshooting and Diagnostics

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

- “Troubleshooting Chart” on page 62
- “LED Status Indicators” on page 63
- “SGI Electronic Support” on page 66

## Troubleshooting Chart

Table 6-1 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 66.

**Table 6-1** Troubleshooting Chart

<b>Problem Description</b>	<b>Recommended Action</b>
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. Confirm the PDU(s) supporting the IRU are on.
The system will not boot the operating system.	Contact your SSE.
An amber LED illuminates on a blade.	See Table 6-2 on page 63 for a description of the status message.
The amber (yellow) status LED of an IRU power supply is lit or the LED is not lit at all. See Table 6-2 on page 63.	Ensure the power cable to the supply is firmly connected at both ends and that the PDU is turned to on. Check and confirm the supply is fully plugged into it's slot. If the green LED does not light, contact your support engineer.
The PWR LED of a populated PCIe slot is not illuminated.	Reseat the PCI card.
The Fault LED of a populated PCIe slot is illuminated (on).	Reseat the card. If the fault LED remains on, replace the card.
The amber LED of a disk drive is on.	Replace the disk drive.



## 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 bi-color 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 6-2 for a complete list.

**Table 6-2** 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

### Compute/Memory Blade LEDs

Each compute/memory blade installed in an IRU has a total of 19 LED indicators visible behind the perforated sheetmetal of the blade. Note that the heartbeat LEDs may not be available or functional on all versions of the compute blades:

At the bottom end (or left side) of the blade:

- There are 8 amber heartbeat LEDs
- One green 12V power good LED
- One blue unit identifier (UI) LED
- One green 3.3V auxiliary power LED

At the top end (or right side) of the blade:

- There are four green NumaLink status LEDs
- An auxiliary power good green LED
- System power good green LED
- Ethernet 0 green LED
- Ethernet 1 green LED

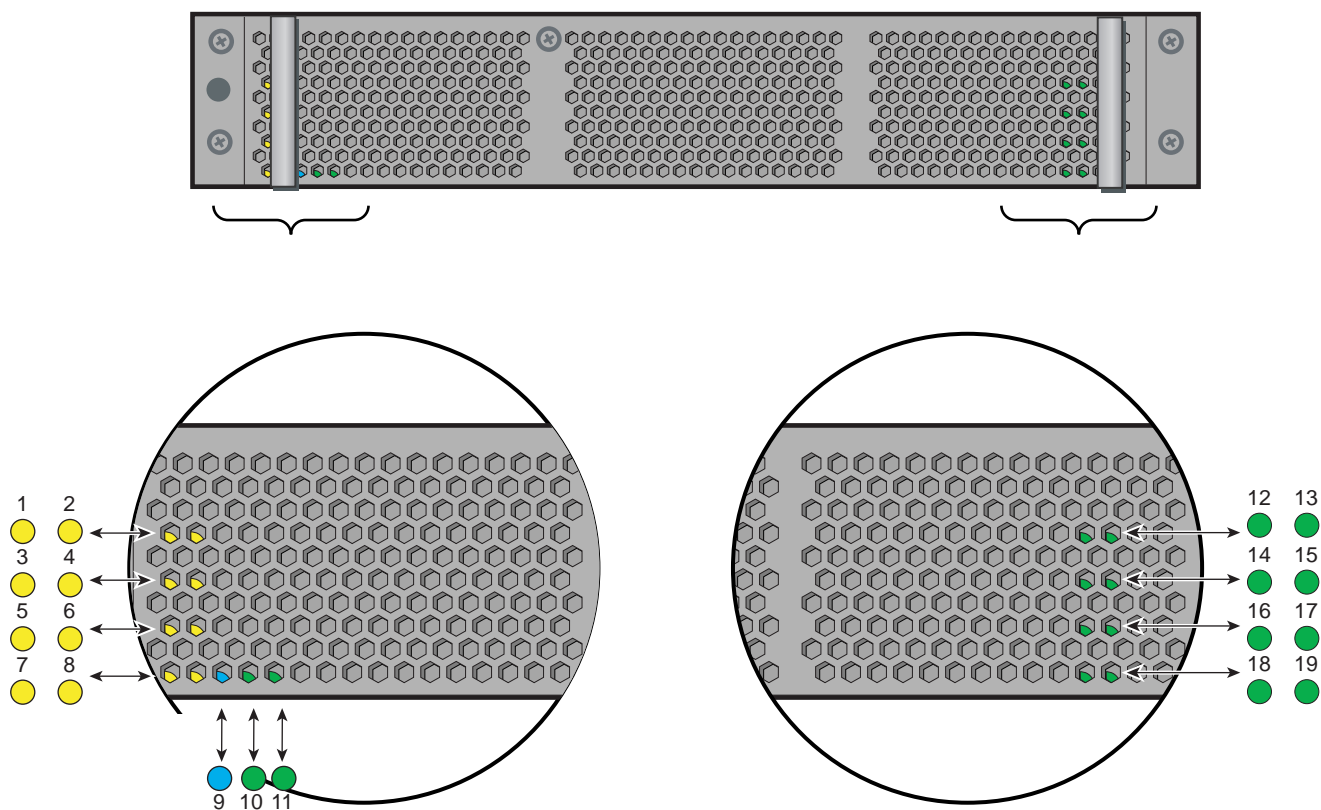
If the blade is properly seated and the system is powered on and there is no LED activity showing on the blade, it must be replaced. Table 6-3 lists the blade's LED status information, Figure 6-1 on page 65 shows the locations of the blade LEDs.

**Table 6-3** Altix UV Blade LED Status Information

LED #	LED color	LED status information/message
01	Amber	CPU 0 heartbeat
02	Amber	CPU 1 heartbeat
03	Amber	CPU 0 heartbeat
04	Amber	CPU 1 heartbeat
05	Amber	CPU 0 heartbeat
06	Amber	CPU 1 heartbeat
07	Amber	CPU 0 heartbeat
08	Amber	CPU 1 heartbeat
09	Green	12V power good to blade
10	Blue	Unit (blade) Identifier - blade is selected when lighted
11	Green	3.3V auxiliary power is present on the blade
12	Green	NUMALink 0 status on blade
13	Green	Auxiliary power to blade is good
14	Green	NUMALink 01 status on blade
15	Green	System power to blade is good

**Table 6-3 (continued)** Altix UV Blade LED Status Information

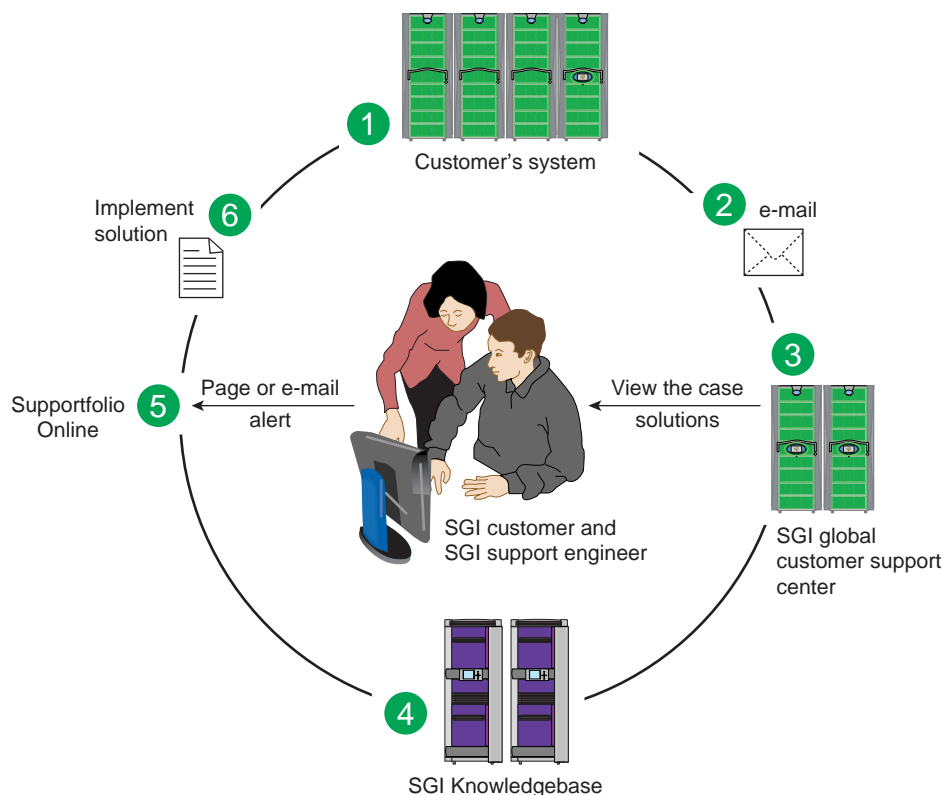
LED #	LED color	LED status information/message
16	Green	NUMALink 02 status on blade
17	Green	Ethernet 0 activity on blade
18	Green	NUMALink 03 status on blade
19	Green	Ethernet 1 activity on blade

**Figure 6-1** UV 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 6-2 shows the sequence of events that occurs if you use all of the SGI Electronic Support capabilities.



**Figure 6-2** Full Support Sequence Example

The sequence of events can be described as follows:

1. Embedded Support Partner (ESP) software 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>

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 69
- “Physical Specifications” on page 70
- “Environmental Specifications” on page 71
- “Power Specifications” on page 72
- “I/O Port Specifications” on page 73

### System-level Specifications

Table A-1 summarizes the Altix UV 1000 system configuration ranges. Note that while each compute/memory board can house two processor sockets; each socket can potentially hold four, six or eight processor “cores”.

**Table A-1** Altix UV 1000 System Configuration Ranges

Category	Minimum	Maximum
Processors	8 processor cores (2 blades) <sup>a</sup>	4,096 processor cores
Individual Rack Units (IRUs)	1 per rack	2 per rack
Blades per IRU	2 per IRU	16 per IRU
Compute/memory blade DIMM capacity	8 DIMMs per blade	16 DIMMs per blade
CMC units	1 per IRU	2 per IRU
Number of BaseIO riser enabled blades	One per SSI	One per SSI

a. Dual-socket blades support eight to 16 cores per blade.

## Physical Specifications

Table A-2 shows the physical specifications of the Altix UV 1000 system.

**Table A-2** Altix UV 1000 Physical Specifications

<b>Feature</b>	<b>Specification</b>
Dimensions for a single 24-inch wide tall rack, 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: 81.25 in. (206.4 cm) Width: 42 in. (106.7 cm) Depth: 51 in. (129.5 cm)
Single-rack shipping weight (approximate)	2,381 lbs. (1,082 kg) air cooled 2,581 lbs. (1,173 kg) water assist cooling
Single-rack system weight (approximate)	2,300 lbs. (1,045 kg) air cooled 2,500 lbs. (1,136 kg) water assist cooling
Access requirements	
Front	48 in. (121.9 cm)
Rear	48 in. (121.9 cm)
Side	None
18U-high Individual Rack Unit (IRU) enclosure specifications	Dimensions: 30.5 in high x 24 in (flange width) wide x 29 in deep 77.5 cm high x 70 cm wide x 73.6 cm deep Weight: ~610 lbs. (277 kg)



## Environmental Specifications

Table A-3 lists the environmental specifications of the system.

**Table A-3** Environmental Specifications

<b>Feature</b>	<b>Specification</b>
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 80% operating (no condensation) 8% to 95% non-operating (no condensation)
Heat dissipation full Altix UV 1000 (rack)	115.6 kBTU/hr maximum (based on 33.88 kW) approximate
Cooling requirement	Ambient air or optional water cooling
Air flow: intake (front), exhaust (rear)	Approximately 2,800 CFM (normal operation)
Maximum altitude	10,000 ft. (3,049 m) operating 40,000 ft. (12,195 m) non-operating

## Power Specifications

Table A-4 shows the power specifications for the system.

**Table A-4** Power Specifications

<b>Feature</b>	<b>Specification</b>
Single-phase power requirements	
Voltage	200-240V (180-254 VAC min/max)
Frequency	50-60 Hz
Power	33.88 kW per rack
Hold-up time	16 ms
Three-phase power requirements	
Voltage	US/Japan 208V (180-254 VAC) International 400V (312-440 VAC)
Frequency	50-60 Hz
Power	33.88 kW per compute rack
Total harmonic distortion	Less than 10% at full load

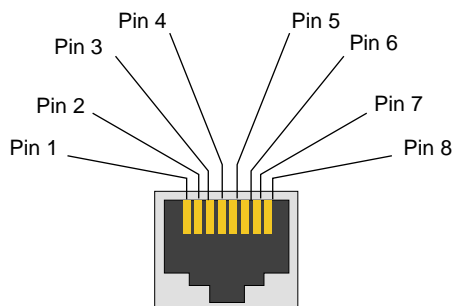
## I/O Port Specifications

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

- “Ethernet Port” on page 74
- “Serial Ports” on page 75
- “USB Type A Connector” on page 77

## 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-5 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-5** 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 -

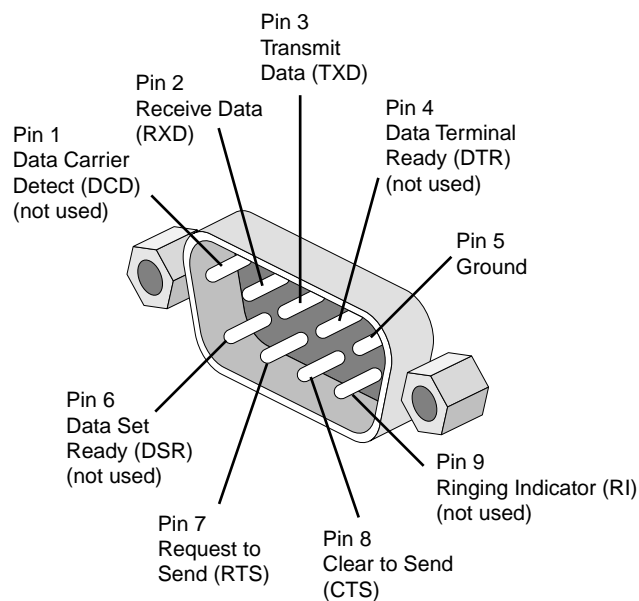
NU = Not used

## Serial Ports

The IRU and the optional router 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.



**Figure A-2** Serial Port Connector

Table A-6 shows pinout assignments for the 9-pin male DB-9 connector.

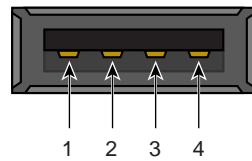
**Table A-6** Serial Port Pinout

<b>Pin</b>	<b>Assignment</b>	<b>Description</b>
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

## USB Type A Connector

Figure A-3 shows the USB type A connector provided on the BaseIO riser blade that supports general USB applications and optional keyboard and mouse configurations.

Table A-7 lists the pin assignments for the USB type A connector.



**Figure A-3** Pin Number Locations for USB Type A Connector

**Table A-7** 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 79
- “Regulatory Specifications” on page 81

### 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 node and switch internal components may expose you to dangerous voltage points or other risks. Refer all servicing 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 81
- “CE Notice and Manufacturer’s Declaration of Conformity” on page 81
- “Electromagnetic Emissions” on page 82
- “Shielded Cables” on page 84
- “Electrostatic Discharge” on page 84
- “Laser Compliance Statements” on page 85
- “Lithium Battery Statement” on page 86

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.



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**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.

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### CMN Number

The model number, or CMN number, for the system is on the system label, which is 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.

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**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.

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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.



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**Caution:** Changes or modifications to the equipment not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

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**Industry Canada Notice (Canada Only)**

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique n'émet pas de perturbations radioélectriques dépassant les normes applicables aux appareils numériques de Classe A prescrites dans le Règlement sur les interférences 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)

**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-2** 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 the 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-ROM drive in this computer is a Class 1 laser product. The DVD-ROM 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. Eviter 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 ved åbning se ikke ind i strålen



**Warning:** Varo! Lavattaessa Olet Alttina Lasersäteilylle



**Warning:** Varning: Laserstrålning när denna del är öppnad ålâ tuijota såteeseenstirra ej in i strålen.



**Warning:** Varning: Laserstrålning nar denna del år öppnadstirra ej in i strålen.



**Warning:** Advarsel: Laserstråling nar deksel åpnesstirr ikke inn i strålen.

## Lithium Battery Statement



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**Warning:** There is danger of explosion if a lithium battery is incorrectly replaced in this product. Replace a battery only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

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