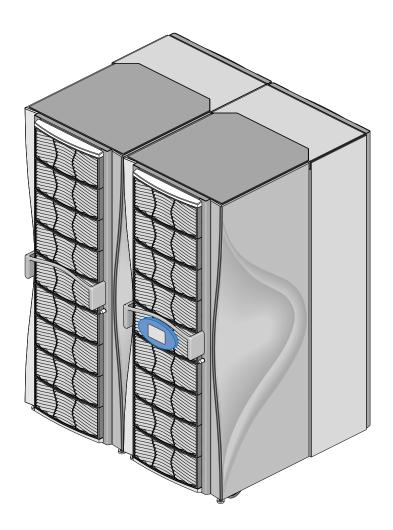
# SGI™ Origin 3000 Series Technical Configuration Owner's Guide



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#### 1. Introduction

### 1.1 Scope

This manual is intended for Silicon Graphics customers.

This manual is designed as an informational tool to:

- Enable quick, accurate identification of the specific components required to fit a specific customer solution.
- Establish and support SGI's relationship and credibility with the customer (both
  new and existing customers) in a way that enables us to expedite order processing
  while improving the quality and accuracy of the shipped system. The goal of the
  SGI Origin 3000 Series Technical Configuration Owner's Guide is to create immediate
  confidence that can be built into a positive, ongoing customer relationship.

The organization of the SGI Origin 3000 Series Technical Configuration Owner's Guide focuses on the configuration process rather than the hardware architecture. Hardware architecture information is included, but it is placed in the broader sales context of identifying and meeting customer needs and expectations. Once you understand the customer's solution requirements, you can use the configuration manual to create a specific SGI Origin 3000 series solution.

### 1.2 Configuration Manual Sections

The configuration manual consists of the following sections:

- Chapter 1, "Introduction."
   Purpose and structure of the configuration manual.
- Chapter 2, "Introducing the SGI Origin 3000 Server Family." Overview of the SGI Origin 3000 series.

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- Chapter 3, "SGI Origin 3000 Server Series System Overview."
   Technical overview of the SGI Origin 3000 series and its capabilities to support various customer workloads.
- Chapter 4, "Performance and Bandwidth Characteristics."
   Performance and bandwidth information for all bricks.
- Chapter 5, "System Interconnection Fabric Drawings." System drawings that show C-brick-to-router and router-to-router cabling.
- Chapter 6, "System Partitioning." System partitioning and the system partitioning rules.
- Chapter 7, "Configuration Guidelines."
   Step-by-step guide that defines the proper configuration for a given customer and application.
- Chapter 8, "Expanding the SGI Origin 3000 Series System."
   Information to expand a system or add to the base configuration.
- Chapter 9, "SGI Origin 3000 Series Software Requirements." Description of the basic software as well as:
  - · optional software and
  - third-party applications
- Appendixes

Supplemental information and drawings for system configuration, and mechanical and electrical specifications.

# 1.3 Technical Terms

Term	Description
Bedrock	A crossbar ASIC in the C-brick that provides connections among the processors, the memory, the interconnection fabric, and the I/O subsystem. Each C-brick has one Bedrock ASIC.
brick	A functional subrack; for example, C-brick, R-brick; a 19-inch rack-mounted enclosure.
cabinet	See rack.
cable assembly	A group of conductors in a sheath with connectors on both ends.
cable management bracket	Secures cables to the side of a rack.
cable management clip	A device that secures a cable to a bracket.
cable management shelf	A horizontal bracket that supports routing of cables.
cable dock	A mechanical sleeve that provides a guide, strain relief and locking mechanism for attaching a connector to a bulkhead.
card	A printed circuit board assembly (PCBA) that typically has an edge connector and plugs into a subassembly.
carrier	A hardware fixture that attaches to one or more printed circuit board assemblies. The purpose of a carrier is to enable easy installation or removal of PCBAs from an enclosure. The following types of carriers exist:
	• logic carrier
	Attaches to a motherboard and/or a power board.  • PCI carrier
	Attaches to a PCI card to enable insertion of the PCI card into I/O bricks without removing the I/O brick cover; this enables hot-plugging of PCI cards.
carrier actuator	A lever that, when moved, inserts or removes a card from a connector. The PCI carrier has a carrier actuator.
C-brick	A 19-inch rackmount enclosure that contains the memory and processors; performs the compute function for the SGI Origin 3000 series. Also referred to as the <i>compute node</i> .

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Term	Description
channel	A communication path between two devices that uses a specific protocol. Additional devices cannot be added to the channel without reconfiguration of the channel. A channel provides the highest data rates for transfers. Example: the Xtown2 channel connects the C-brick and an I/O brick.
chassis	See rack.
compute node	See C-brick.
CPU	See processor.
Crosstalk	1. An I/O channel protocol name. 2. A single-ended I/O channel that uses the Crosstalk channel protocol. Crosstalk transfers data between Xbridge ASICs or between Xbridge and XC chips within a brick.
Crosstown	See Xtown
D-brick	The D-brick is a purchased disk enclosure that supports twelve disk drives. The D-brick is 4-U high and mounts in a standard 19-inch rack.
DIMM (dual inline memory module)	A printed circuit board assembly (PCBA) that contains main and directory memory. Two DIMMs represent a bank of memory.
DPS (distributed power supply)	One of six power supply units that are inserted into the power bay.
drive dock	The slot, compartment, or receptacle cavity within the chassis that receives the wrapper and provides connectivity for the hard drive.
harness assembly	A group of connectors that are interconnected by two or more cables.
hot plug	Hot plug requires that the device be deconfigured from the system prior to removing, adding, or replacing the device. After the new device is installed, action must be taken to reconfigure the system before the new device can be used. The system remains powered on and functioning during this operation. Examples of Hot Pluggable devices: PCI cards and disk drives.
hot swap	Hot swap is the ability to remove, add, or replace a device without informing the system. This action is taken with power on and the system functioning. Example: the cooling fans on a brick and the power supplies in the power bay are components that can be hot swapped.
I-brick	The rackmount enclosure that contains the electronics and hardware necessary to boot a system and supports four additional PCI cards. The I-brick is 4 U high and mounts in a standard 19-inch rack.

Term	Description	
interconnection fabric	The interconnection fabric consists of a set of cables and routers that link together compute nodes (C-bricks).	
L1 system controller	The brick-level system controller. It is responsible for power control and sequencing, environmental control and monitoring, initiation of reset, and the storage of identification and configuration information for its host brick. Also referred to as the <i>Level 1</i> system controller.	
L2 system controller	The rack-level system controller. It manages central communications for the rack and controls all the bricks in that rack. When an L2 is configured in a system, all L1 system controllers are connected to the L2 controller. Also referred to as the <i>Level 2</i> system controller.	
L2 touchscreen display	A 2.5-inch by 4-inch 70-position touchscreen display that is used to access system control information.	
L3 system controller	The L3 system controller is a standalone workstation (or laptop) that runs the Linux operating system. The L3 system controller provides a central point of control for the entire system. Also referred to as the <i>Level 3</i> system controller.	
link	A one-to-one connection between two processors or nodes in a multiprocessor computer system.	
Merced	An Intel code name/trademark for a class of 64-bit processor chips (IA64) designed by Intel corporation. The new name for Merced is Itanium.	
Metarouter	The Metarouter is identical to the router, extends the interconnect fabric, and is used for the interconnection of routers.	
midplane board	A PCBA that is mounted vertically in a frame; it has connectors on both sides into which other PCBAs are inserted. A midplane board generally has minimal logic; the main function of a midplane board is to interconnect multiple PCBAs.	
MIPS	1. An acronym for million of instructions per second. 2. MIPS Technologies, Inc. is the name of a former SGI subsidiary that develops processor ASICs. These processor ASICS are referred to as MIPS processors.	
module	An independent assembly of electronic components with some distinct function.	
motherboard	A printed circuit board assembly (PCBA) on which other boards or cards can be mounted.	
mounting bracket	A bracket that attaches the brick to the rack.	
mounting shelf	An L-shaped bracket that is installed in a rack to support installation of a subassembly.	

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Term	Description		
network	A network is a communication channel that enables many different devices to be connected. A network is slower than a channel; it enables devices to be added or removed without affecting the operation of the network.		
node	An addressable device that is attached to a network; can have multiple processors. A C-brick is referred to as a node.		
NUMAlink 3	A communication channel between C-bricks. The bandwidth is 1.6 GB/s one direction (half duplex) and 3.2 GB/s both directions (full duplex).		
partition	A software-defined group of processors that work collectively.		
P-brick	The rackmount enclosure that provides a crosstalk to a PCI interface. It supports 12 PCI cards on 6 PCI buses. The enclosure is 4 U high and mounts in a standard 19-inch rack.		
PCI (peripheral component interconnect)	An industry standard for connecting peripherals to a processor.		
PIMM (processor integrated memory module)	A printed circuit assembly that contains two processors and memory. The C-brick can be configured with either one or two PIMMs.		
POD (power-on diagnostic)	Diagnostics that run automatically at power-up of a system.		
port	A set of input/output registers on a device. The term port refers to one side of a channel. Example: Connect one end of the Xtown2 cable to port 1 of the C-brick.		
power bay	A standard 3-U-high, 19-inch rackmount enclosure that contains six removable AC-to-DC power supplies.		
power board	A PCBA that regulates DC power.		
processor	A single ASIC that contains a control unit, arithmetic and logic unit, and cache.		
rack	A frame assembly in which 19-inch components are mounted. Also referred to as <i>cabinet, chassis.</i>		
	• short rack     A 17-U-high rack. Only SGI™ 3200 series systems use the short rack.		
	• tall rack A 39-U- high rack. The SGI Origin 3400 and SGI Origin 3800 series systems use the tall rack.		

Term	Description		
rack front	The side of a rack that a customer views. Note: The door on the front of the rack includes the SGI logo.		
rackmount	Describes components that are mounted in a rack system.		
rack rear	The side of a rack that is accessed when configuring a system. The door on the rear of the rack is plain.		
R-brick	A 19-inch rackmount enclosure that functions as either a router or MetaRouter depending on its physical locations and cabling within the system. When an R-brick functions as a router, it routes information between C-bricks. When the R-brick functions as a MetaRouter, it routes information between R-bricks. The R-brick is a 2U enclosure.		
router	A device that determines the most efficient connection of receive and send ports.		
service shelf	A portable shelf that is used to insert and remove bricks within a rack.		
service shelf lift	A device used in conjunction with a service shelf that allows the brick to be raise or lowered to the desired level for easier insertion or removal.		
SGI Origin 3200	An entry-level system that is contained within a single cabinet and has a maximum of 8 processors.		
SGI Origin 3400	A class of computer systems that has a maximum of 1 processor rack and 32 processors. Additional racks with I/O and disks can be configured in an SGI Origin 3400 system.		
SGI Origin 3800	A class of computer systems that scales from 16 processors to 512 processors. Additional I/O and disk racks are configured in an SGI Origin 3800 system		
sled	See wrapper		
U	Unit; one U is equivalent to 1.75 inches of configurable vertical space in a rack.		
USB (Universal Serial Bus)	An external peripheral interface standard that enables communication between a computer and external peripherals via cables using biserial transmission. The USB has a peak bandwidth of 12 Mb/s.		
VRM (voltage regulator module)	A printed circuit board assembly that provides a regulated DC voltage from a 48-Vdc power source.		
wrapped drive	The hard drive that is sheathed within and fastened to its wrapper.		

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Term	Description
wrapper	The mechanical device to which a hard drive is fastened. The wrapper slides into a system chassis to facilitate the proper electrical and mechanical connections between the disk drive and the backplane. Also referred to as a <i>sled</i> .
X-brick	A 4-U high rackmount enclosure that supports 4 half-height XIO cards.
XIO	An SGI proprietary I/O channel, rated at 800 MB/s full duplex.
Xtown2	A differential I/O channel that uses the crosstalk channel protocol. Xtown2 is used to transfer data between the C-brick node and an I/O brick. The bandwidth is 1.2 GB/s one direction (half duplex) and 2.4 GB/s both directions (full duplex). Xtown2 is pronounced <i>Crosstown two</i> .

### 2. Introducing the SGI Origin 3000 Server Family

The SGI Origin 3000 series comprises a family of multiprocessor distributed shared memory (DSM) computer systems. The SGI Origin 3000 series uses a global-address-space cache-coherent multiprocessor that scales to 512 processors (~410 GFLOPS peak) in a cache-coherent domain. Four processors, each with 8 Mbytes of private secondary cache, are connected at a Bedrock ASIC. This Bedrock ASIC acts as a crossbar between the processors, local SDRAM memory, the network interface, and the I/O interface. Four Bedrocks, each supporting four processors, are connected to an 8-ported router that can connect up to 32 router chips in a maximum  $4 \times 4 \times 32$  extended hypercube topology. The modularity of the DSM approach combines the advantages of low entry-level cost with global scalability in processors, memory, and I/O.

Initial versions of the SGI Origin 3000 series are based upon the MIPS R12000 processor. The MIPS R12000 processor is a four-way, 64-bit superscalar RISC processor. "Four-way" means that it fetches and decodes four instructions per clock cycle and issues them to five fully pipelined execution units. "Superscalar" means that it has enough independent, pipelined execution units that it can complete more than one instruction per clock cycle. The MIPS R12000 also has speculative branching and out-of-order execution and is initially designed with a 400-MHz clock speed.

The SGI Origin 3000 series uses a PCI-based I/O subsystem as its primary I/O protocol. A Crosstalk I/O system, that is compatible with some XIO boards from Origin 2000 and Octane systems, is available to support legacy I/O devices and certain specialized devices such as HIPPI-6400.

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Table 2-1 describes ranges of system capacities and performance.

 Table 2-1
 System Configuration Ranges

Category	Minimum	Maximum	
Number of Processors	2	512	
Peak Performance	~1600 MFLOPS (one 2-processor node brick)	~410 GFLOPS (128 four-processor node bricks)	
C-brick Memory Capacity	0.512 Gbytes	8 Gbytes	
System Main Memory Capacity	0.512 Gbytes (one node brick)	1024 Gbytes (128 node bricks)	
Number of I/O Channels	1	128	
Aggregated peak I/O bandwidth	0.768 GB/s (one I-brick)	~ 152 GB/s (one I-brick and 63 P-bricks)	

### 2.1 SGI Origin 3000 Series Model Naming Conventions

Table 2-2 describes the three classes of the SGI Origin 3000 series systems.

**Table 2-2** SGI Origin 3000 Series Systems

Series	Description
SGI Origin 3200	Contains 2 to 8 processors with a maximum of 2 I/O bricks in a short rack. Additional racks can be added for disks.
SGI Origin 3400	Contains 4 to 32 processors. The standard processor and I/O configuration is contained in a single tall rack. However, the configuration can be expanded to include a second tall rack for larger I/O configurations. Additional disk racks can be added as required.
SGI Origin 3800	Contains from 16 processors to 512 processors (from one to sixteen tall racks) and a maximum of eight I/O racks. Each I/O rack contains a maximum of eight I/O bricks. Additional disk racks can be added as required.

### 3. SGI Origin 3000 Server Series System Overview

This section provides a general, technical description of the SGI Origin 3000 server series hardware architecture, especially as it relates to configuration issues.

The SGI Origin 3000 series systems are distributed shared memory (DSM) computer systems that scale from 2 to 512 processors. In a DSM system, each processor contains memory that it shares with the other processors in the system. The modularity of the DSM systems combine the advantages of low entry-level cost with global scalability in processors, memory, and I/O. Table 2-1 lists the system configuration ranges for the SGI Origin 3000 series system.

Initial SGI Origin 3000 series systems use the MIPS R12000 processor that is a 64-bit RISC, superscalar processor with speculative branching, out-of-order execution, and a 400-MHz operating clock speed.

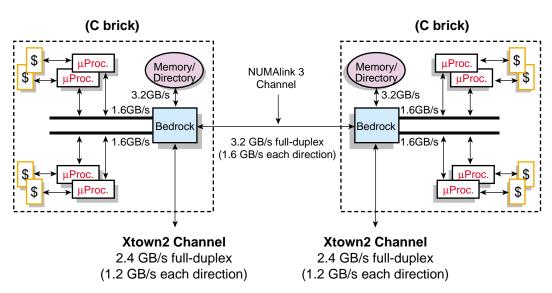
Four processors, each with 8 Mbytes of private secondary cache, are connected at a Bedrock (refer to Figure 3-1). This Bedrock ASIC acts as a crossbar between the processor interface, local memory interface, the network interface, and the I/O interface.

Four Bedrocks, each supporting four processors, connect to an eight-port router that can connect up to 32 routers in a maximum 4 x 4 x 32 extended hypercube topology.

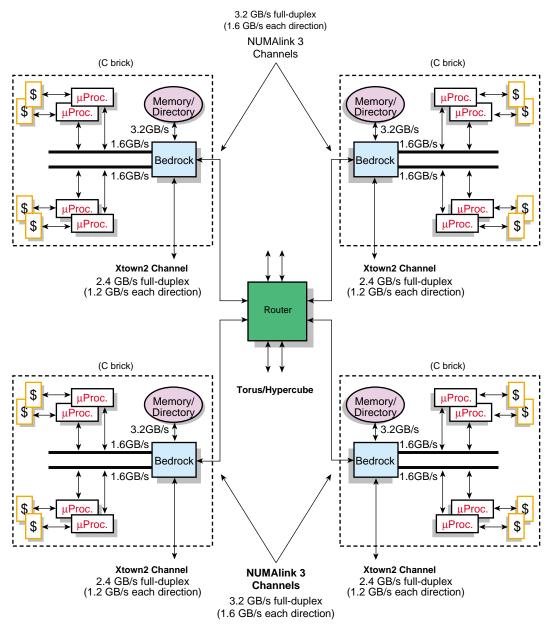
**Note:** All transfer rates in Figure 3-1 and Figure 3-2 are peak rates.

**Note:** The "\$" in Figure 3-1 and Figure 3-2 means "cache".

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**Figure 3-1** Eight-processor SGI Origin 3000 Series Block Diagram



**Figure 3-2** Sixteen-processor SGI Origin 3000 Series Block Diagram

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### 3.1 Tall Rack

The SGI Origin 3000 series tall rack can house the following standard 19-inch rackmounted subassemblies: C-brick, D-brick, G-brick, I-brick, P-brick, R-brick, X-brick, and power bay. The tall rack is used by SGI Origin 3200C, SGI Origin 3400 and SGI Origin 3800 systems. The outer dimensions of the tall rack with casters, side panels, and decorative doors does not exceed 74 in. high  $\times$  30 in. wide  $\times$  50 in. deep.

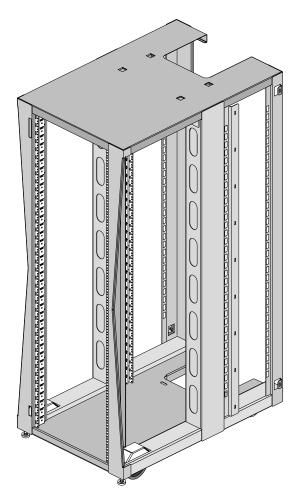


Figure 3-3 Tall Rack (Front View)

#### Main features of the tall rack:

- 19-inch EIA standard mounting rails
- 39 U of space (1U = 1.75 inch)
- Mounted on casters
- All subracks must provide self cooling with airflow from front to rear
- Power distribution strip (PDS), 200-250 Vac, 10 A, single-phase power for D-bricks and third-party equipment

#### 3.2 Short Rack

The SGI Origin 3000 series short rack can house the following standard 19-inch rack mounted subassemblies: C-brick, D-brick, I-brick, P-brick, X-brick, and power bay. The short rack is used by SGI Origin 3200 systems. The outer dimensions of the short rack with casters, side panels, and decorative doors does not exceed 36 in. high  $\times$  26 in. wide  $\times$  41.5 in. deep.

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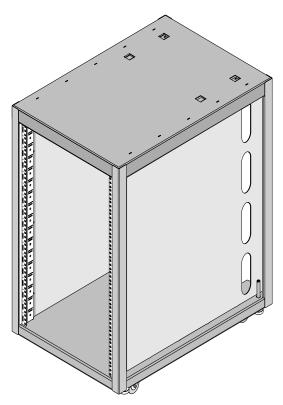


Figure 3-4 Short Rack (Front View)

#### Main Features of the short rack:

- 19-inch EIA standard mounting rails
- 17 U of space (1 U = 1.75 inch)
- Mounted on casters
- All subracks must provide self-cooling with airflow from front to rear
- One power distribution strip (PDS), 200-250 Vac, single-phase, 10 A, power for the power bay, D-bricks, and third-party equipment

### 3.3 Power Bay

The power bay houses from two to six hot-swap, distributed power supplies (DPSs). It supplies AC power to the DPSs and provides power control and monitoring. A minimum of two DPSs must be present at all times to provide standby 48-Vdc power. The outputs of the DPSs are bused together to provide 4750 watts of available power in an N+1 redundant configuration. DPSs are added when additional subracks are added to the configuration.

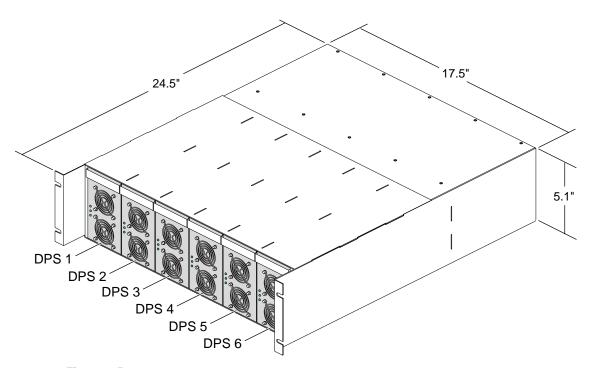


Figure 3-5 Power Bay - Front View

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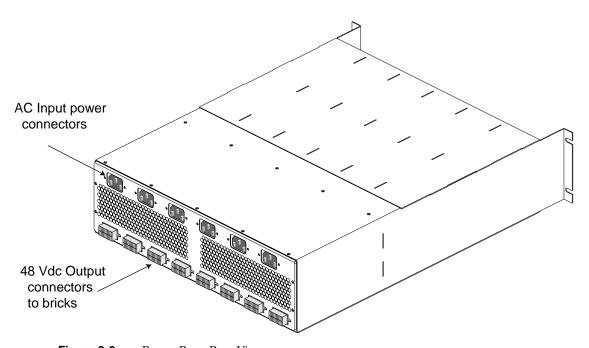


Figure 3-6 Power Bay - Rear View

#### Main Features of a power bay:

- Height: 3 U
- Dimensions in inches:  $5.1 \text{ H} \times 17.5 \text{ W} \times 24.5 \text{ D}$
- Weight: 72 lbs (fully loaded with 6 power supplies)
- Provides 4.75 KW continuous N+1 power
- Provides eight 48-Vdc power output connections that use 21-pin Foxconn connectors

#### Main Features of a Distributed Power Supply:

- Installs from the front of the rack
- Dimension in inches:  $5.0 \text{ H} \times 2.8 \text{ W} \times 13 \text{ D}$
- Approximate weight of 7.5 lbs
- Rated at 950 W maximum output power

### 3.4 Power Distribution Unit (PDU)

The SGI Origin 3400 and SGI Origin 3800 systems support five types of PDUs (refer to Table 3-1). The PDUs protect against over-current conditions and provide an on/off switch to remove power from the rack.

**Note:** The SGI Origin 3200 systems do not use PDUs; instead they use a power distribution strip.

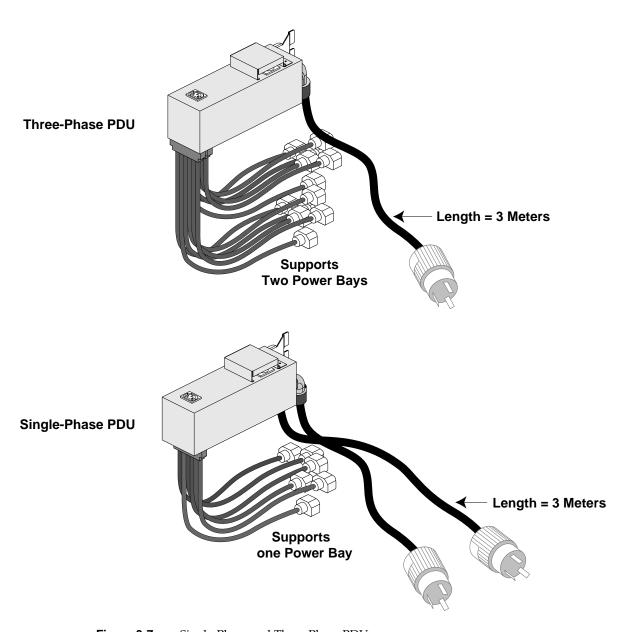
Customer sites that use single-phase power require one single-phase PDU for each power bay. Customer sites that use three-phase power require one three-phase PDU for each rack.

The physical dimensions of the PDU enclosure are  $4 \times 5 \times 10$  inches. It mounts in the lower cable management area in the rear of the tall racks.

 Table 3-1
 PDU Specifications

Marketing Code	Destination Location	Power Cord	Input Power Connector
DK-N1P-003	Domestic, Mexico,	UL Listed Cord	NEMA L6-30 1Ph 30A
(Single-phase NEMA Connector)	Canada, and Japan	30A 3 Wire	Plug 208/240 VAC
DK-N1P-001	Domestic, Mexico,	UL Listed Cord	IEC 60309 1Ph 30A
(Single-phase IEC Connector)	Canada, and Japan	30A 3 Wire	Plug 208/240 VAC
DK-1P-002	Europe and other	32A Harmonized Cord	IEC 60309 1Ph 32A
(Single-phase IEC Connector)		3 Wire	Plug 208 / 240 VAC
DK-N3P-001	Domestic, Mexico,	UL Listed Cord	IEC 60309 3Ph 60A
(Three-phase Wye)	Canada, and Japan	60A 4 Wire	Plug 200/240 VAC
DK-N3P-002	Europe and other	5 Wire Harmonized Cord	IEC 60309 32A 3Ph
(Three-phase Delta)		32A IEC Rated	Plug 400 VAC

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**Figure 3-7** Single-Phase and Three-Phase PDUs

### 3.5 Power Distribution Strip (PDS)

All SGI Origin 3000 series systems use power distribution strips. In the SGI Origin 3200 short rack the PDS provides:

- AC power distribution to the power bay
- AC power to a D-brick
- AC power to third party equipment
- Over-current protection for all equipment in the short rack
- An on/off switch to remove power from the short rack

In SGI Origin 3400 and SGI Origin 3800 tall racks the PDS provides:

- AC power to a D-brick
- AC power for third party equipment
- Over-current protection for a D-brick and third party equipment
- An on/off switch to remove power from D-bricks and third party equipment

In both the short rack and tall rack, the PDS is located on the inside rear wall. Its dimensions are  $12 \times 2.5 \times 3.5$  inches. In a short rack, a three-meter power cord connects the PDS to either the AC wall or underfloor outlet. In a tall rack, a 1.5-meter power cord connects the PDS to the PDU.

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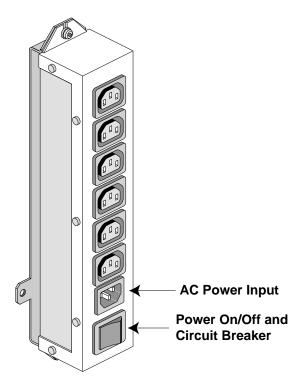


Figure 3-8 Power Distribution Strip

### 3.6 Compute Node (C-brick)

The C-brick is a 3-U-high 19-inch rackmountable enclosure that contains:

- Either two or four 64-bit RISC processors with an 8-MB secondary cache
- Eight DIMM slots; each DIMM pair has two banks of memory
- Node electronics
- One L1 controller

The node electronics, L1 controller, and power regulators are contained on a single printed circuit board (PCB). The processors and cache are housed on separate PIMM

boards. Each PIMM contains two processors and secondary cache. Figure 3-9 shows the block diagram of a C-brick.

**Note:** All transfer rates in Figure 3-9 are peak rates.

**Note:** The "\$" in Figure 3-9 means "cache."

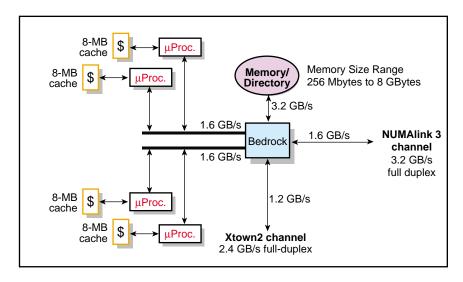


Figure 3-9 C-brick Block Diagram

#### The C-brick has the following electrical features:

- Configurable as either a 2-processor or 4-processor node
- Configurable from 512 Mbytes to 8 Gbytes of main memory
- Contains one 8-Mbyte secondary cache per processor
- Contains one 1.6-GB/s (each direction) NUMAlink channel
- Contains one 1.2-GB/s (each direction) Xtown2 channel
- Contains one USB port that connects to the L2 controller (optional in SGI Origin 3200 systems)

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Contains one console port with DB9 connector

Figure 3-10 shows a front view of the C-brick logic carrier (the assembly that holds the C-brick components).

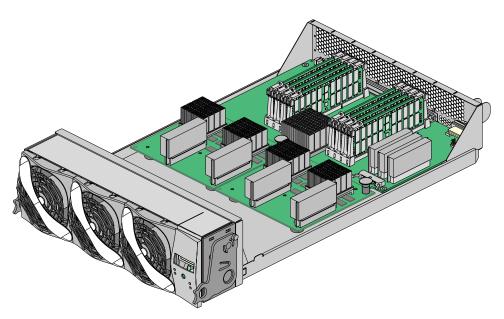


Figure 3-10 C-brick Logic Carrier Assembly - Front View

#### The C-brick has the following mechanical features:

- Height: 3 U
- Weight: 65 lbs (fully loaded)
- Dimensions in inches:  $5.06 \text{ H} \times 17.19 \text{ W} \times 27.80 \text{ D}$
- Installs from the front of the rack
- Cables are located in the rear
- Cooling fans are hot-swappable
- Input power is +48 Vdc (~308 Watts)

#### 3.6.1 Processor

Two 400-MHz MIPS R12000 processors and 8-MB of secondary cache are mounted on a PCB. This assembly is called the processor-integrated memory module (PIMM).

### The MIPS R12000 processor has the following features:

- 64-bit RISC design, 0.25-micron CMOS process
- Single-chip superscalar RISC dataflow architecture
- 8-MB secondary cache
- 32-KB 2-way set-associative data cache
- 32-KB 2-way set-associative instruction cache
- 2,048-entry branch prediction table
- 48-entry active list
- 32-entry two-way set-associative branch target address cache (BTAC)
- Doubled secondary cache prediction table for improved hit rate
- Improved branch prediction by using global history mechanism
- Maintains code and instruction set compatibility with the MIPS R10000

#### **3.6.2 Memory**

Main memory consists of up to eight banks per node; each bank is split between two DIMMs of a DIMM pair with each DIMM pair supporting two banks. Memory must be increased or decreased in two-DIMM increments. The reason for this is that a single bank of memory is contained on two DIMMs and the memory size must be increased or decreased in whole banks. The DIMMs that make up a single bank must be the same memory size; however, each DIMM pair within a brick can be a different memory size. Refer to Table 3-2 for the main memory size matrix. This table does not include systems that have multiple-size memory banks. Refer to Table 8-1 for memory sizes that use mixed size memory DIMMs.

The clock speed of the memory parts is 100-MHz address and 200-MHz data, which produces a memory bandwidth of 3200 MB/s.

**Table 3-2** Main-memory DIMM Sizes

DRAM Technology	Single DIMM Size	Minimum Increment (2 Dimms)	1 DIMM Pair Installed	2 DIMM Pairs Installed	3 DIMM Pairs Installed	4 DIMM Pairs Installed
128 Mbits	256 Mbytes	512 Mbytes	512 Mbytes	1 Gbytes	1.5 Gbytes	2 Gbytes
128 Mbits	512 Mbytes <sup>a</sup>	1 Gbytes	1 Gbytes	2 Gbytes	3 Gbytes	4 Gbytes
256 Mbits	1 Gbytes <sup>a</sup>	2 Gbytes	2 Gbytes	4 Gbytes	6 Gbytes	8 Gbytes

a. Single DIMM sizes of 512 Mbytes and 1 Gbytes are available as meta memory DIMMs.

There are two DIMM types used:

- Standard memory DIMM for systems with a maximum of 128 processors
- Meta memory DIMM Contains one additional memory chip per DIMM to provide
  additional directory memory for building configurations larger than 128 processors.
  Customers who plan to upgrade their systems beyond 128 processors should order
  the meta memory DIMMs. The cost to remove the existing standard memory and
  replace it with meta memory is high.

**Note:** SGI Origin 3000 series DIMMs are not compatible with the DIMMs used in SGI Origin 200, SGI Origin 2000, or SGI Octane systems.

## 3.7 Disk (D-brick)

The D-brick is a 4-U high disk enclosure that supports JBOD (just a bunch of disks) and RAID within an SGI Origin 3000 series rack.

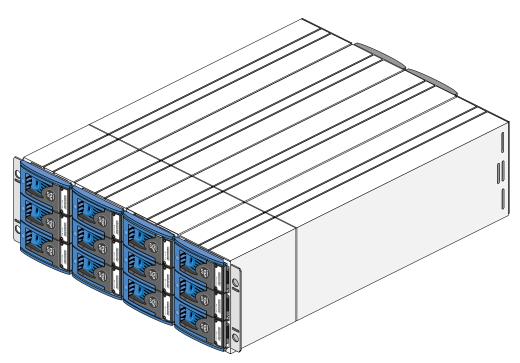


Figure 3-11 D (Disk) Brick Assembly

The SGI TP-9100 storage system is another storage solution for SGI Origin 3000 series systems. For more information about the SGI TP-9100 storage system, refer to the SGI Total Performance 9100 Storage System Owner's Guide, publication number 007-4068-xxx.

## The D-brick has the following features:

- Height: 4 U
- Weight: 94 lbs (fully loaded)
- Dimensions in inches:  $6.95 \text{ H} \times 17.50 \text{ W} \times 23.00 \text{ D}$
- Maximum number of disk drives: 12
- Requires a minimum of two disk drives
- Disks are hot-pluggable and sled-mounted
- Mounts in a standard 19-inch rack
- Occupies a fixed position; does not slide out

- Supports 2 Fibre Channel loops (disk arrays)
- Input power is 200 to 230 Vac single-phase, 50/60 Hz
- Typical power consumption is 400 VA or less

## 3.8 System Boot (I-brick)

The I-brick provides the boot I/O functions for all SGI Origin 3000 series systems. It supports five hot-pluggable PCI cards, two sled-mounted 3.5 inch Fibre Channel disk drives, and a specialized slot for a CD-ROM. The five hot-pluggable PCI slots support full-length cards with 64-bit data/addressing. Refer to Figure 3-12 for the I-brick block diagram.

The five PCI slots are configured on two buses: bus 1 supports three 33-MHz PCI slots and bus 2 supports two 66-MHz PCI slots. Separate buses enable the I-brick to run 33-MHz and 66-MHz devices in the same brick. Various types of PCI cards can be used in the I-brick, such as SCSI, Fibre Channel, ATM, Gigabit Ethernet, etc. Refer to Table 4-7 for a list of supported PCI cards.

The I-brick also provides access to a network via a 10/100BaseT Ethernet port, and access to peripherals via one 1394 channel and two USB channels. Refer to Chapter 7 for configuration guidelines.

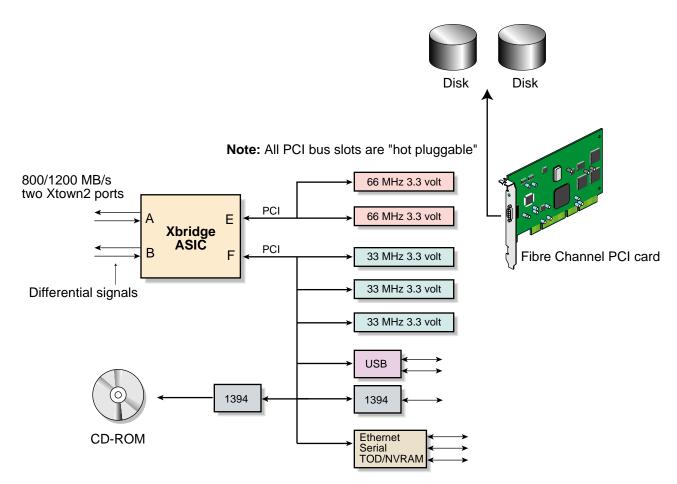


Figure 3-12 I-brick Block Diagram

Figure 3-13 shows a rear view of the I-brick with the cover removed.

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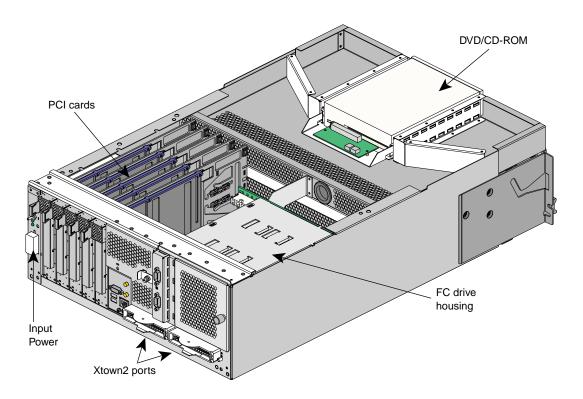


Figure 3-13 I-brick Assembly - Rear View

## The I-brick has the following electrical features:

- One serial port (RS-232 or RS-422)
- Two 1394 ports (one internal, one external)
- Two external USB ports
- One 10/100BaseT Ethernet port
- RTI and RTO connections (Real Time sync I/O)
- Two Xtown2 800 MB/s (each direction) ports

## The I-brick has the following mechanical features:

• Height: 4 U

- Weight: 69 lbs (fully loaded)
- Dimensions in inches:  $6.64 \text{ H} \times 17.50 \text{ W} \times 27.74 \text{ D}$
- Hard mounts in a standard 19-inch rack (does not slide out of the rack)
- Supports a CD-ROM
- Supports five 3.3-Vdc PCI cards (3 PCI cards at 33 MHz and two PCI cards at 66 MHz)

**Note:** One of the five PCI slots is reserved for a Fibre Channel disk controller.

- Supports two 3.5-inch sled-mounted Fibre Channel disk drives
- Cooling fans are hot-swappable
- Input power is +48 Vdc (~190 watts)

## 3.9 PCI Expansion (P-brick)

The P-brick is a Crosstalk-to-PCI based I/O expansion subsystem that supports a maximum of 12 hot-pluggable PCI cards. It has two Xtown2 ports (1.2 GB/s each direction); each Xtown2 port can connect to an Xtown2 port on a C-brick. The 12 PCI slots are configured on six buses; each bus supports two 33- or 66-MHz slots.

Refer to Table 4-7 for a list of supported PCI cards and to Chapter 7 for configuration guidelines.

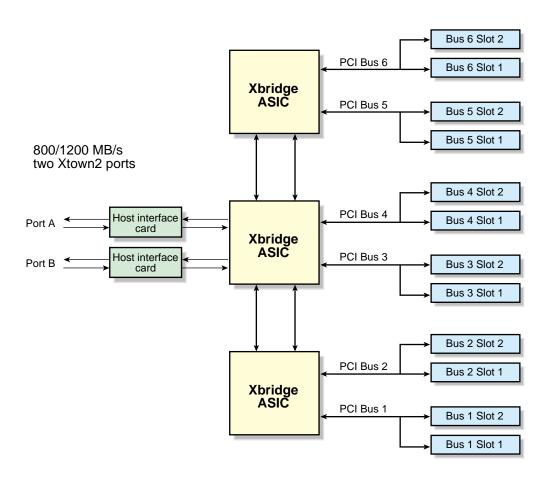


Figure 3-14 P-brick Block Diagram

Figure 3-15 shows a rear view of a P-brick with the cover removed.

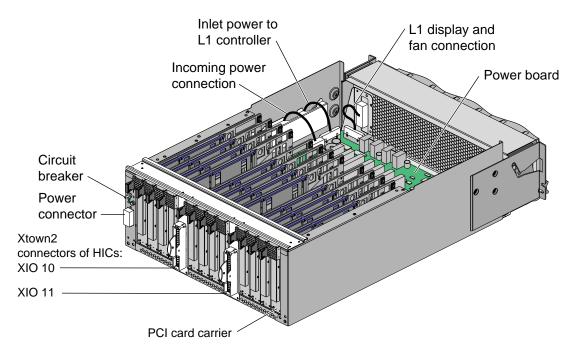


Figure 3-15 P-brick Assembly - Rear View

## The P-brick has the following electrical feature:

• Two Xtown2 ports (1.2 GB/s each direction)

## The P-brick has the following mechanical features:

- Height: 4 U
- Weight: 70 lbs (fully loaded)
- Dimensions in inches:  $6.64 \text{ H} \times 17.50 \text{ W} \times 27.74 \text{ D}$
- Hard mounts in a standard 19-inch rack (does not slide out of the rack)
- Supports twelve 3.3-volt PCI cards
- Cooling fans are hot-swappable
- Input power is +48 Vdc (~225 watts)

## 3.10 XIO Expansion (X-brick)

The X-brick is an I/O expansion brick; it contains four XIO slots that support many XIO cards when used with SGI Origin 3000 servers. This enables existing Origin customers to migrate their XIO cards to the SGI Origin 3000 series systems. Not all SGI XIO adapters will be supported in the X-brick, so please refer to Table 4-6 for a list of supported XIO adapters.

The X-brick has two Xtown2 ports (800 MB/s each direction); each Xtown2 port can connect to an Xtown2 port on a C-brick.

Refer to Figure 3-16 for the X-brick block diagram.

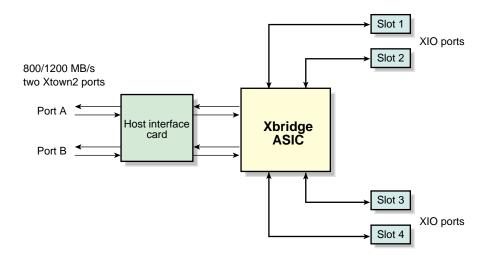


Figure 3-16 X-brick Block Diagram

Figure 3-17 shows a rear view of the X-brick with the cover removed.

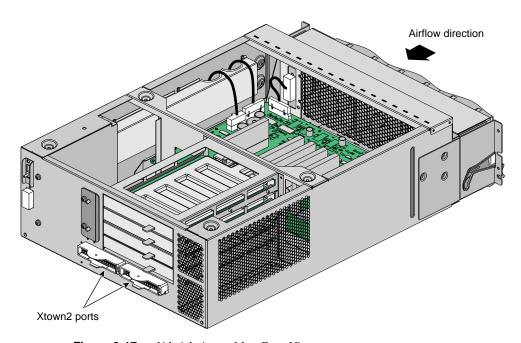


Figure 3-17 X-brick Assembly - Rear View

## The X-brick has the following electrical feature:

• Two Xtown2 ports (800 MB/s each direction)

## The X-brick has the following mechanical features:

- Height: 4 U
- Weight: 69 lbs (fully loaded)
- Dimensions in inches:  $6.64 \text{ H} \times 17.50 \text{ W} \times 27.74 \text{ D}$
- Hard mounts in a standard 19-inch rack (does not slide out of the rack)
- Cooling fans are hot-swappable
- Input power is +48 Vdc (~225 watts)

## 3.11 Router (R-brick)

The R-brick is an eight-port crossbar that connects any input-link channel to any of seven possible output-Link channels. It contains a router ASIC that is mounted on a PCB with its associated power circuitry, L1 controller, and a USB hub. The hub fans out USB signals from the L2 controller to the L1 controller inside the R-brick and to the four nodes (C bricks) that may be connected to the router.

The R-brick has a total of eight 100-pin link connectors located on its rear panel. Four of these connect to C-bricks and carry USB signals as well as link signals. The others are only for connection to other routers and do not carry USB signals. Refer to Figure 3-19. Metarouters and repeat routers use all eight ports to connect to other R-bricks.

When an R-brick-to-R-brick connection is made through ports that carry USB signals, the USB signals are ignored. USB signals to the C-bricks are distributed over the network cables. Because an R-brick can have a maximum of four C-bricks attached to it, only four of the R-brick's 100-pin network connectors have USB signals routed to them. Ports 2, 3, 4, and 5 carry USB signals. Therefore, a C-brick must connect to an R-brick via port 2, 3, 4, or 5.

Each R-brick has a dedicated USB connection to the L2 controller through a 4-pin USB connector on its rear panel. Therefore, it is not necessary for an R-brick to distribute USB signals to other R bricks. R-brick-to-R-brick network connections are normally made through the four port connectors that do not carry USB signals; however, they are not restricted to these four ports.

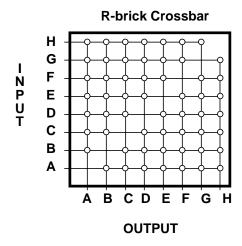


Figure 3-18 R-brick Crossbar

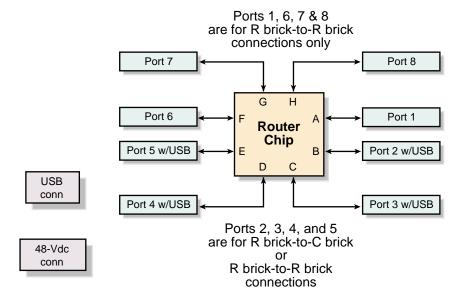


Figure 3-19 R-brick Block Diagram

## The R-brick has the following electrical features:

- One USB port (connects to the L2 controller)
- Eight NUMAlink I/O connectors (located in the rear)

## The R-brick has the following mechanical features:

- Height: 2 U
- Weight: 18 lbs
- Dimensions:  $3.35 \text{ H} \times 17.38 \text{ W} \times 27.5 \text{ D}$
- Installs from the front of the rack
- Mounts in a standard 19-inch rack
- Occupies a fixed position, does not slide out
- Cooling fans are hot-swappable
- Input power is +48 Vdc (~60 watts)

Figure 3-20 shows a rear view of the R-brick enclosure with the cover removed.

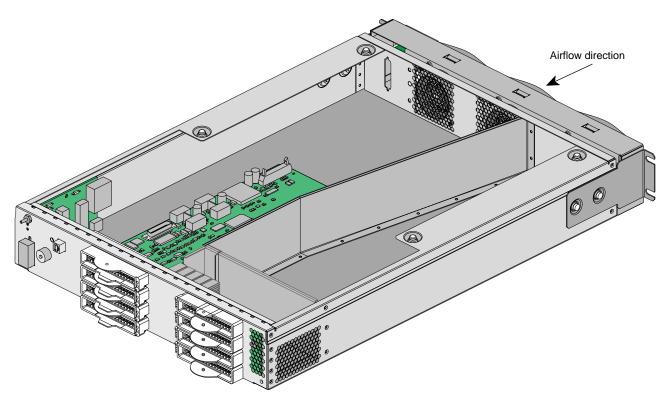


Figure 3-20 R-brick Assembly

# 3.12 Graphics Subsystem (G-brick)

The G-brick is a graphics subsystem that can be scaled from 1 to 8 pipes (eight G-bricks in a system). The G-brick is 18 U high and is rackmounted in a SGI Origin 3000 series rack. Each G-brick has one 2RM port and one 4RM port. The higher the number of RMs (Raster Managers) per port the higher the performance of the pipe. The G-brick is the base graphics used in the SGI Onyx 3000 family of visualization systems.

Each tall rack can hold from one to two G-bricks. Each pipe of a G-brick connects to a Xtown2 channel of an I- or X-brick via a NUMAlink cable. The G-brick's input power cord plugs into the AC wall outlet and the L1 controller is connected to a L2 controller

via a USB cable. If a G-brick is in a rack that does not have an L2 controller, a USB hub can be used to pass the system controller information to an L2 in an adjacent rack.

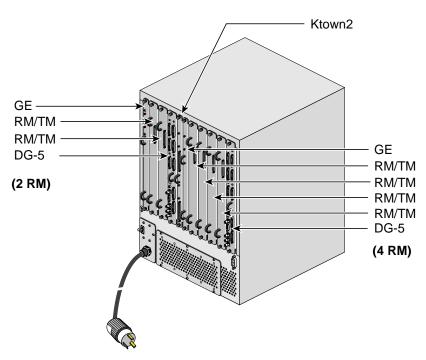


Figure 3-21 G-brick - Rear View

# 3.13 Peripherals

An SGI Origin 3000 series system supports a wide range of peripherals to deliver unmatched performance for large supercomputing workloads. Refer to Table 4-6 and Table 4-7 for a list of the supported XIO and PCI cards.

## 3.14 PCI Based I/O Channels

The I-brick and P-brick are the subsystems that provide PCI support for the SGI Origin 3000 series systems. The I-brick provides five PCI slots: four slots for customer-defined

PCI cards and one slot for a Fibre Channel disk controller PCI card. When additional PCI slots are required, a P-brick is configured into the system. The P-brick supports 12 PCI slots. Table 3-3 describes the maximum number of PCI slots that are available in SGI 3200, SGI Origin 3400, and SGI Origin 3800 systems.

**Table 3-3** Number of Available PCI Slots

System I/O Bricks		Maximum Number of PCI Slots Available	
SGI Origin 3200	one I-brick and one P-brick	17	
SGI Origin 3400	one I-brick and seven P-bricks	102	
SGI Origin 3800	one I-brick and 63 P-bricks	761	

## 3.15 System Control

The purpose of the SGI Origin 3000 series control system is to:

- Manage power control and sequencing
- Provide environmental control and monitoring
- Initiate system resets
- Provide storage for identification and configuration information
- Provide a console/diagnostic and scan interface

The SGI Origin 3000 series control system is composed of three levels:

- L1 controller brick-level system controller
- L2 controller rack-level system controller
- L3 controller system-level controller

#### 3.15.1 L1 Controller

The L1 controller is not configurable; it is designed into all bricks except the D-brick.

#### 3.15.2 L2 Controller

The L2 controller is optional in SGI Origin 3200 systems, however, it is standard on all SGI 3400 and SGI Origin 3800 systems. The L2 controller is a 5.5 in.  $\times$  11.1 in. PCB assembly that is mounted in the top of the rack. The L2 controller does not use configurable rack space. It receives 48-Vdc power ( $\sim$ 30 watts) from the power bay.

The L2 provides the following communication ports (refer to Figure 3-22):

- One USB host controller with 4 ports
- One 10/100BaseT auto-negotiating Ethernet port with RJ45 connector
- Two RS-232 ports with a modem control that is capable of 115 Kbaud
- One RS-485 port that is capable of 19.2 Kbaud
- One rack display connector

The L2 controller is required in a rack when:

- The rack contains an R-brick
- Remote maintenance of the system is required (SGI Origin 3200 systems)
- A rack display is desired

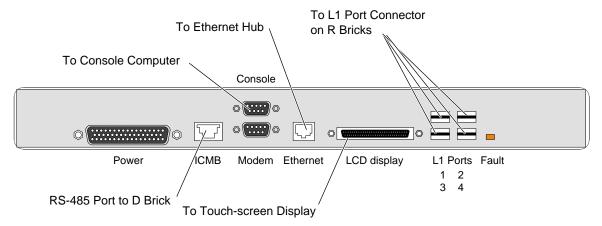


Figure 3-22 Rear View of L2 Controller

#### 3.15.3 L3 Controller

The L3 controller is a system-level controller. The L3 controller is software that runs on a stand-alone workstation or laptop computer. The L3 connects to the L2 controllers via a 10BaseT Ethernet hub. In an SGI Origin 3200 system, the L3 can connect directly to an L1 controller in a C-brick via a USB port. The L3 controller is optional in all system sizes.

The system control network configuration depends on the class of the SGI Origin 3000 series system. Figure 3-23 shows a typical SGI Origin 3800 system control configurations.

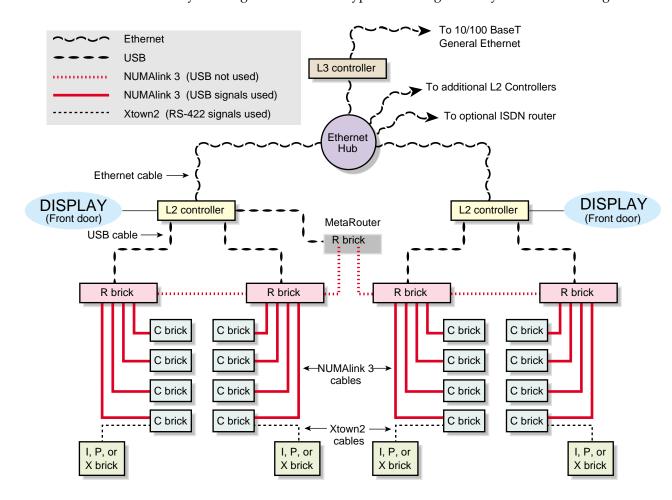


Figure 3-23 SGI Origin 3800 System Control Network (Typical)

#### 3.15.4 Ethernet Hub

Systems that have multiple compute racks require an Ethernet hub. The Ethernet hub is used to interconnect L2 controllers. One Ethernet hub supports a maximum of seven compute racks and an L3 controller. The Ethernet hub is located on a 2-U utility shelf in the top two locations of a compute rack.

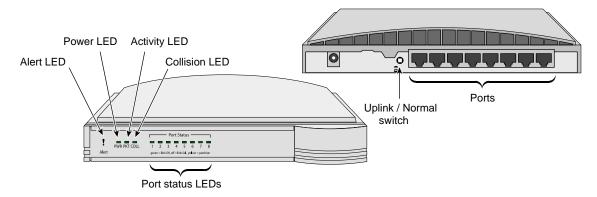
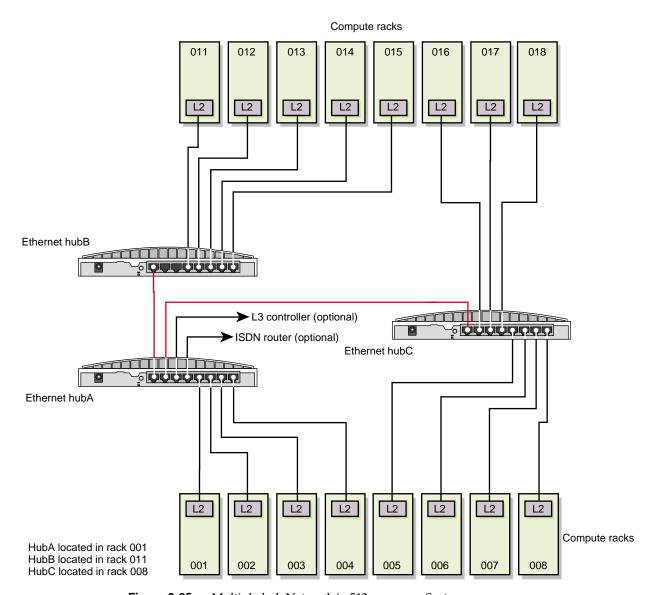


Figure 3-24 Eight-Port Ethernet Hub

#### The Ethernet hub has the following features:

- Eight RJ-45 ports (port 8 is controlled by Uplink/Normal switch)
- One RJ-45 MDI cascade port
- Maximum 100 meter cable length
- Weight: 1.1 lbs
- Dimensions in inches:  $1.4 \text{ H} \times 9.0 \text{ W} \times 5.3 \text{ D}$
- Input power: requires an adapter which converts AC wall power to 8-9 Vac, 50-60 Hz, 1000 mA maximum. The standard power adapter for the Ethernet hub plugs into a power strip located on the inside rear wall of the rack.

Figure 3-25 illustrates how Ethernet hubs are cabled to the L2 controllers.



**Figure 3-25** Multiple-hub Network in 512-processor System

# 3.16 ISDN Router

An optional ISDN router can be added to the Ethernet hub network to allow a secure remote connection. The ISDN router is located on the utility shelf in rack 001 and is connected to the Ethernet hub via an Ethernet cable.



Figure 3-26 ISDN Router - Rear View

# 3.17 System Cooling

All SGI Origin 3000 series systems are air-cooled. Each brick has fans to provide cooling. Air flows from the front of the brick to the rear.

## 4. Performance and Bandwidth Characteristics

This section provides channel bandwidth tables for each of the bricks to help you create a configuration that meets customer requirements for performance, capacity and connectivity. When you configure a system for performance, evaluate the sustained bandwidths of the compute nodes (C-bricks) and the I/O nodes (I-, P-, X-bricks) to determine the sustainable channel bandwidth.

## 4.1 C-brick (Compute Node)

Each C-brick consists of two or four MIPS R12000A processors running at 400 MHz, each with an 8-MB secondary cache. Each processor is capable of executing two floating-point instructions per cycle, which supports a peak speed of 800 MFLOPS. The peak and sustained bandwidths for each of the C-brick's channels are listed in Table 4-1. The memory is a distributed shared memory (DSM) scheme, in which the memory is physically partitioned among the nodes but is accessible by all nodes. Cache coherence is maintained through a directory-based scheme. Refer to "Compute Node (C-brick)" on page 22 for detailed information on the C-brick.

 Table 4-1
 Bandwidth Characteristics of the C-brick

Description	PEAK Bandwidth	Sustainable Bandwidth
Link Channel Bandwidth	3.2 GB/s full-duplex 1.6 MB/s each direction	~ 1420 MB/s each direction
Xtown2 Channel Bandwidth	2.4 GB/s full-duplex 1.2 GB/s each direction	~ 1066 MB/s half duplex ~ 1744 MB/s full-duplex ~ 872 MB/s each direction
Main Memory Bandwidth	3200 MB/s	3200 MB/s
SYSAD Bandwidth (each SYSAD)	1600 MB/s	~ 1400 MB/s

## 4.2 D-brick (Fibre Channel Disk)

The D-brick supports a maximum of twelve 3.5-inch Fibre Channel (FC) disk drives. The twelve dual-ported disk drives connect to two Fibre Channel loops. The aggregate channel bandwidth of a Fibre Channel depends on the bandwidth capability of the FC controller and the number and type of FC disk drives on the channel. Refer to Table 4-7 for controller bandwidth values and to Table 4-2 for bandwidth values of individual drives.

**Table 4-2** Bandwidth Characteristics of the D-brick

Description	PEAK Bandwidth
18.2-GB FC Disk Drive (10K RPM)	(TBD)
36.4-GB FC Disk Drive (10K RPM)	~ 30 MB/s

## 4.3 I-brick (System Boot with PCI Bus)

The I-brick is a Crosstalk-to-PCI based I/O subsystem. It has two 1200-MB/s Xtown2 ports that connect to C bricks. There are five PCI slots that are configured on two buses and two drive bays that support Fibre Channel disk drives. For more information about the I-brick refer to the "System Boot (I-brick)" on page 28. Refer to Table 4-3 for the peak and sustained bandwidth values.

**Table 4-3** Bandwidth Characteristics of the I-brick

Description	Peak Bandwidth
Xtown2 Ports A and B	2 modes, software selectable 800 MB/s or 1200 MB/s
PCI Bus 1 Slots 1 through 3 at 33 MHz	128 MB/s in 32-bit mode 256 MB/s in 64-bit mode
PCI Bus 2 slots 1 and 2 at 66 MHz	256 MB/s in 32-bit mode 512 MB/s in 64-bit mode

# 4.4 P-brick (PCI Expansion)

The P-brick has two 1200-MB/s Xtown2 ports that connect to C-bricks. There are 12 PCI slots that are configured on six buses. For more information about the P-brick, refer to the "PCI Expansion (P-brick)" on page 31. Refer to Table 4-4 for the peak and sustained bandwidth values.

Table 4-4 Bandwidth Characteristics of the P-brick

Description	Peak Bandwidth
Xtown2 Ports A and B	2 modes software selectable 800 MB/s or 1200 MB/s
PCI Bus 1-6 at 66MHz (two slots per bus)	256 MB/s in 32-bit mode 512 MB/s in 64-bit mode

# 4.5 X-brick (XIO Expansion)

The X-brick provides four expansion slots for XIO interface cards, such as HIPPI, DVC, and GSN. For more information about the X-brick, refer to the "XIO Expansion (X-brick)" on page 34. Refer to Table 4-5 for the bandwidth values.

 Table 4-5
 Bandwidth Characteristics of the X-brick

Description	Peak Bandwidth
Xtown2 Ports A and B	2 modes, software selectable 800 MB/s or 1200 MB/s
XIO Ports	800 MB/s full-duplex

# 4.6 Supported XIO Cards

The X-brick supports the XIO cards that are listed in Table 4-6 for First Customer Ship (FCS). Additional XIO cards will be added to this table as they qualify.

**Table 4-6** Supported XIO Cards

Description	Bandwidth (Peak)	Max-per Brick	Max-per System
Digital video XIO card	TBD	TBD	TBD
Digital video I/O DVC Onyx2	TBD	TBD	TBD
XIO 1-port FDDI Dual Attach Station (DAS)	TBD	6	6
GSN adapter single port XIO card copper	800 MB/s	2	2
GSN adapter two port XIO card copper (Note: This is a two-card set that uses two XIO slots in the X-brick)	1600 MB/s	2	2
XIO high definition video I/O	TBD	TBD	TBD
Single-port serial HIPPI XIO card	100 MB/s	4	4
XIO to VME adapter 6 U	TBD	4	4
XIO to VME adapter 9 U	TBD	4	4
Four-port ATM OC3	19 MB/s	4	16

# 4.7 Supported PCI Cards

The PCI cards listed in Table 4-7 are supported in the I, P, and X-bricks for initial shipments. Additional PCI cards will be added to this table as they qualify.

 Table 4-7
 Supported PCI Cards

Description	PCI Bus Clock/Data	Bandwidth (Peak) (per port)			
SCSI					
Two-port Ultra SCSI high voltage differential	33-MHz / 64-bit	40 MB/s (wide) 20 MB/s (narrow)			
Two-port Ultra2 SCSI low voltage differential	33-MHz / 64-bit	80 MB/s (wide) 40 MB/s (narrow)			
Fibre Channel	•				
Single-port 1-Gb Fiber Channel with fibre optic cable	66-MHz / 64-bit	100 MB/s			
Single-port 1-Gb Fibre Channel with copper cable	66-MHz / 64-bit	100 MB/s			
Networking					
Single-port gigabit Ethernet Fiber optic	66-MHz / 64-bit	125 MB/s			
Single-port gigabit Ethernet card 10/100/1000BaseT Unshielded Twisted Pair	66-MHz / 64-bit	125 MB/s			
Single-port ATM OC3	33-MHz/ 64-bit	19.3 MB/s			
Single-port ATM OC12	66-MHz / 64-bit	78 MB/s			
Miscellaneous					
8-channel digital audio	33-MHz / 32-bit	2.88 MB/s			
Multi-port RS-232 Serial Port Card	33-MHz / 32-bit	.0143 MB/s			

 Table 4-8
 PCI Controller brick and System Maximum Quantities

Description	PCI Bus	Maximum Cards per Brick	Maximum Cards per System			
SCSI						
Two-port Ultra SCSI high voltage differential	33-MHz / 64-bit	I-brick - 2 per bus (04 total) P-brick -2 per bus (12 total)	24			
Two-port Ultra2 SCSI low voltage differential	33-MHz / 64-bit	I-brick - 2 per bus (04 total) P-brick - 2 per bus (12 total)	12			
Fibre Channel						
Single-port 1-Gb Fiber Channel with fibre optic cable	66-MHz / 64-bit	I-brick - 2 per bus (04 total) P-brick -2 per bus (12 total)	24			
Single-port 1-Gb Fibre Channel with copper cable	66-MHz / 64-bit	I-brick - 2 per bus (04 total) P-brick -2 per bus (12 total)	24			
Networking						
Single-port gigabit Ethernet Fiber optic	66-MHz / 64-bit	I-brick - 2 on bus 2 (02 total) P-brick -2 per bus (10 total)	20			
Single-port gigabit Ethernet card 10/100/1000BaseT Unshielded Twisted Pair	66-MHz / 64-bit	I-brick - 2 on bus 2 (02 total) P-brick -2 per bus (10 total)	20			
Single-port ATM OC3	33-MHz/ 32-bit	I-brick - 2 on bus 2 (02 total) P-brick -2 per bus (12 total)	8			
Single-port ATM OC12	66-MHz / 64-bit	I-brick - 1 on bus 2 (01 total) P-brick -1 per bus (06 total)	8			
Miscellaneous						
8-channel digital audio	33-MHz / 32-bit	6	6			
Multi-port Serial Port Card	TBD	TBD	TBD			

# 4.8 Supported Tape Drives

The tape drives listed in Table 4-9 are available for SGI Origin 3000 series systems.

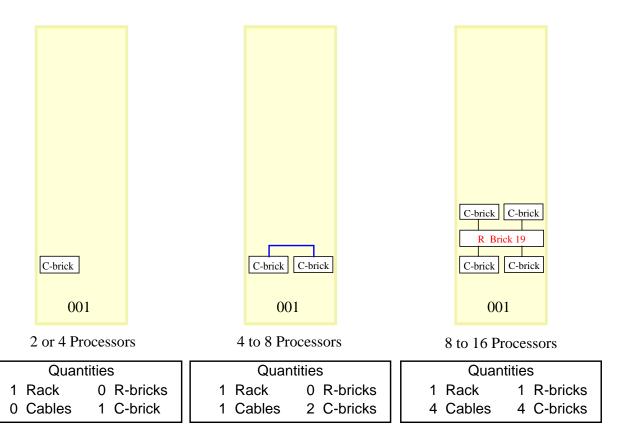
 Table 4-9
 Supported Tape Drive Subsystems

Peripheral Product Designator	Interface Type	Storage Capacity (Mbytes)	Transfer Rate (MBytes)
DLT 7000	SCSI only	35,000	5.0
FUJITSU M2483/M2485/M2488	SCSI only	24,000	3.0
IBM 3480/3490/3490E	SCSI only	800	4.5
IBM 3590 Magstar	SCSI only	20,000	9.0
STK 9840	SCSI and FC	20,000	9.0
STK 4480 (18 track)	SCSI only	200	3.0
STK 4490 Silverton (36 track)	SCSI only	800	3.0
STK 9490 Timberline (36 track)	SCSI only	800	6.0
SONY AIT-2	SCSI only	60,000	6.0

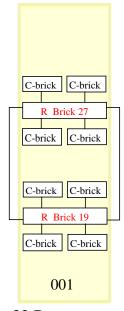
# 5. System Interconnection Fabric Drawings

The following figures illustrate the system interconnection fabric for various system configurations of the SGI Origin 3000 series systems.

## 5.1 2-processor through 16-processor Systems

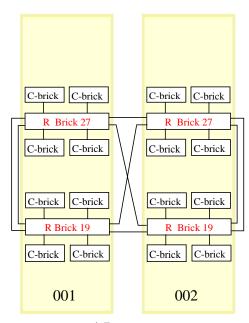


# 5.2 32-processor and 64-processor Systems



32 Processors

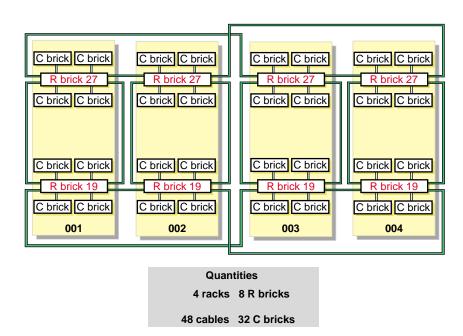
Quantities
1 Rack 2 R bricks
10 Cables 8 C bricks



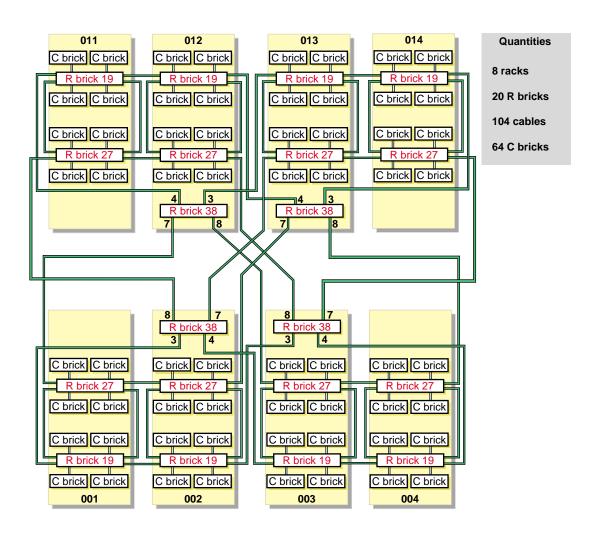
**64 Processors** 

Quantities
2 Racks 4 R bricks
24 Cables 16 C bricks

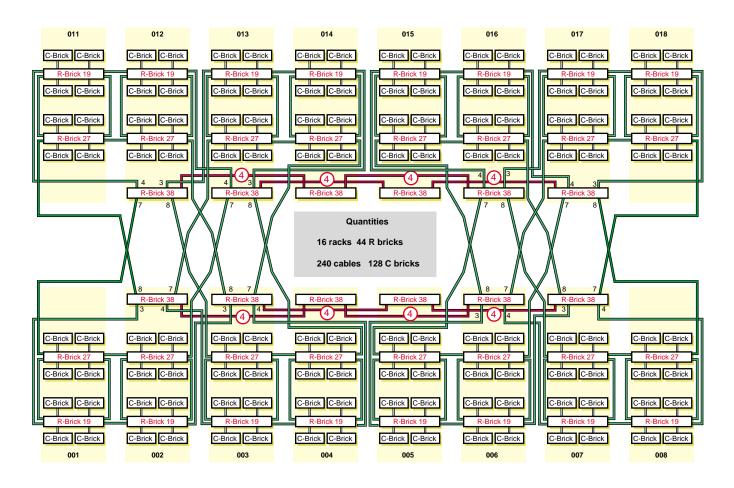
# 5.3 128-processor System



# 5.4 256-processor System



# 5.5 512-processor System



# System Partitioning

## 6.1 Partitioning Overview

Partitioning is defined as the ability to take a multinode distributed shared memory (DSM) system, such as an SGI Origin 3000 series system, and divide it into a collection of smaller systems.

The two primary characteristics of partitioning are:

- The ability to run individual partitions. Each partition runs its own operating
  system kernel and behaves as a standalone system, without having to physically
  recable the system. A partition can be booted, powered down/up, and rebooted
  without affecting the normal operation of other partitions.
- The partitions are tightly coupled through the system's interconnection network (NUMAlink) as a low latency/ high bandwidth interconnect. A failure that causes a kernel in one partition to crash will not cause a kernel in another partition to crash.

Partitioning can be thought of as "clustering in a box", or a tightly coupled cluster.

### 6.2 Definition of Terms

There has been much discussion on the terminology used to described the different divisions of a system. The following definitions are not final, but are used as a starting point.

TERM	DESCRIPTION
array	One or more "hosts" linked together using the array software. It may be used to link together one or more partitions, but this is TBD.
array node	An element known to the array management software. Currently an array node is a "host".

TERM	DESCRIPTION
domain	A host which is a subset of a system.
host	A single IRIX image running on a partition.
partition	A subset of a system that runs an IRIX kernel and is protected by hardware barriers. A partition is identified by a Partition ID. The terms partition, host, and domain all have the same meaning, and can be used interchangeably in this context.
partitioning	Breaking a large physical machine into two or more smaller machines.
partition ID	A 16-bit quantity that identifies a particular partition. It is essentially a new name space.
system	A collection of hardware that supports shared memory running one or more partitions.

### 6.3 Partitioning Rules

Partitioning rules define the set of valid configurations for a partitioned system.

Fault isolation is one of the major reasons for partitioning a system. A software or hardware failure in one partition should not cause a failure in another partition. To accomplish this, the following restrictions are placed on partitions:

- The minimum granularity for a partition is one C-brick (with its own power supply setup). On SGI Origin 3000 series systems, this means four processors (assuming fully populated modules) is the minimum level of hardware isolation. There is no requirement for a module to be fully populated with processors.
- Each partition must have the infrastructure to run as a standalone system. This infrastructure includes a system disk and console connection.
- An I/O brick belongs to the partition that the attached C-brick belongs to. If an I/O brick is attached to two C-bricks, both C-bricks must be in the same partition. I/O bricks cannot be shared by two partitions. Peripherals, such as dual-ported disks, can be shared the same way two nodes in a cluster can share peripherals.
- Partitions must be contiguous in the topology (for example, the route between any
  two nodes in the same partition must be contained within that partition and not
  route through any other partition). This allows intra-partition communication to be
  independent of other partitions.

- Partitions should not divide metarouters that are only connected to other metarouters.
- Partitions must be fully interconnected. That is to say, for any two partitions, there is a direct route between those partitions without passing through a third. This is required to fulfill true isolation of a hardware or software fault to the partition in which it occurs.
- When the full system is greater than 64 C-bricks (256 processors), it runs in coarse mode. In coarse mode the minimum partition size is four C-bricks (16 processors).

# 6.4 Valid Configurations

Table 6-1 lists the valid system partitions for the SGI Origin 3000 systems.

**Table 6-1** Valid System Partitioning

Number of C bricks in the System	Number of Partitions	Number of Partitions	Number of C bricks in each Partition	Maximum Number of Processors in each Partition
1	1 partition	with	1 C-brick	4 processors
2	1 partition	with	2 C-bricks	8 processors
	2 partitions	with	1 C-brick	4 processors
4	1 partition	with	4 C-bricks	16 processors
	2 partitions	with	2 C-bricks	8 processors
	1 partition 2 partitions	with with	2 C-bricks 1 C-brick	8 processors 4 processors

 Table 6-1
 Valid System Partitioning

Number of C bricks in the System	Number of Partitions	Number of Partitions	Number of C bricks in each Partition	Maximum Number of Processors in each Partition
8	1 partition	with	8 C-bricks	32 processors
	2 partitions	with	4 C-bricks	16 processors
	4 partitions	with	2 C-bricks	8 processors
	8 partitions	with	1 C-brick	4 processors
	1 partition 2 partitions	with with	4 C-bricks 2 C-bricks	16 processors 8 processors
	1 partition 1 partition 2 partitions	with with with	4 C-bricks 2 C-bricks 1 C-brick	16 processors 8 processors 4 processors
	1 partition 4 partitions	with with	4 C-bricks 1 C-brick	16 processors 4 processors
16	1 partition	with	16 C-bricks	64 processors
	2 partitions	with	8 C-bricks	32 processors
	4 partitions	with	4 C-bricks	16 processors
	8 partitions	with	2 C-bricks	8 processors
	1 partition 2 partitions	with with	8 C-bricks 4 C-bricks	32 processors 16 processors
	1 partition 1 partition 2 partitions	with with with	8 C-bricks 4 C-bricks 2 C-bricks	32 processors 16 processors 8 processors
	1 partition 4 partitions	with with	8 C-bricks 2 C-bricks	32 processors 8 processors

 Table 6-1
 Valid System Partitioning

Number of C bricks in the System	Number of Partitions	Number of Partitions	Number of C bricks in each Partition	Maximum Number of Processors in each Partition
32	1 partition	with	32 C-bricks	128 processors
	2 partitions	with	16 C-bricks	64 processors
	4 partitions	with	8 C-bricks	32 processors
	8 partitions	with	4 C-bricks	16 processors
	1 partition 2 partitions	with with	16 C-bricks 8 C-bricks	64 processors 32 processors
	1 partition 1 partition 2 partitions	with with with	16 C-bricks 8 C-bricks 4 C-bricks	64 processors 32 processors 16 processors
	1 partition 4 partitions	with with	16 C-bricks 4 C-bricks	64 processors 16 processors
64	1 partition	with	64 C-bricks	256 processors
	2 partitions	with	32 C-bricks	128 processors
	4 partitions	with	16 C-bricks	64 processors
	8 partitions	with	8 C-bricks	32 processors
	16 partitions	with	4 C-bricks	16 processors
	32 partitions	with	2 C-bricks	8 processors
	1 partition 2 partitions	with with	32 C-bricks 16 C-bricks	128 processors 64 processors
	1 partition 1 partition 2 partitions	with with with	32 C-bricks 16 C-bricks 8 C-bricks	128 processors 64 processors 32 processors
	1 partition 4 partitions	with with	32 C-bricks 8 C-bricks	128 processors 32 processors

**Table 6-1** Valid System Partitioning

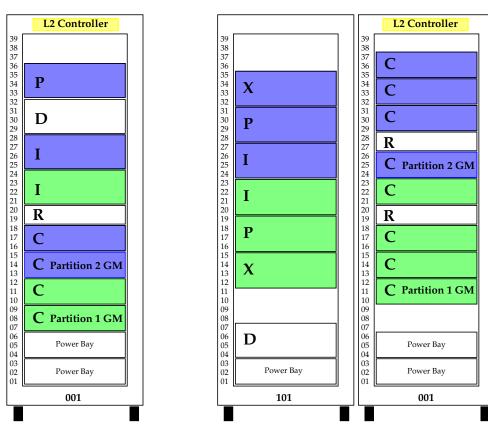
Number of C bricks in the System	Number of Partitions	Number of Partitions	Number of C bricks in each Partition	Maximum Number of Processors in each Partition
128	1 partition	with	128 C-bricks	512 processors
	2 partitions	with	64 C-bricks	256 processors
	4 partitions	with	32 C-bricks	128 processors
	8 partitions	with	16 C-bricks	64 processors
	16 partitions	with	8 C-bricks	32 processors
	32 partitions	with	4 C-bricks	16 processors
	1 partition 2 partitions	with with	64 C-bricks 32 C-bricks	256 processors 128 processors
	1 partition 1 partition 2 partitions	with with with	64 C-bricks 32 C-bricks 16 C-bricks	256 processors 128 processors 64 processors
	1 partition 1 partition 1 partition 2 partitions	with with with with with	64 C-bricks 32 C-bricks 16 C-bricks 8 C-bricks	256 processors 128 processors 64 processors 32 processors
	1 partition 1 partition 1 partition 1 partition 2 partitions	with with with with with	64 C-bricks 32 C-bricks 16 C-bricks 8 C-bricks 4 C-bricks	256 processors 128 processors 64 processors 32 processors 16 processors

**Note:** A single entry in a table row defines a legal configuration where all partitions are the same size. Multiple entries in a table row defines a legal configuration of mixed partition sizes.

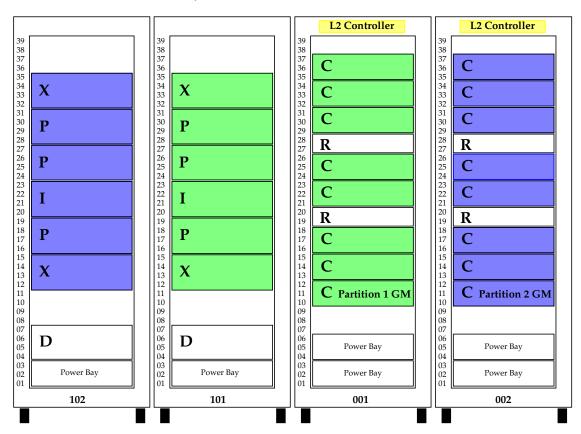
Shaded partitions are special order only.

### 16 Processor System Partitioned as Two 8 Processor Partitions

# 32 Processor System Partitioned as Two 16 Processor Partitions



**Figure 6-1** SGI Origin 3400 Partitioned systems



### 64 Processor System - Partitioned as Two 32 Processor Partitions

Figure 6-2 SGI Origin 3800 Partitioned Systems

# 7. Configuration Guidelines

This section provides guidelines for configuring SGI Origin 3000 series systems. These systems have a PCI-based I/O subsystem for the primary I/O and an optional Crosstalk I/O subsystem.

## 7.1 System Configuration Process

To configure a system within the SGI Origin 3000 series, follow these five steps:

- 1. Determine the processor requirements.
- 2. Determine the memory requirements.
- Determine the system partitioning requirements.
- 4. Determine the I/O subsystem requirements.
  - Select the disk subsystems.
  - Select the tape subsystems.
  - Determine the network bandwidth requirements.

Does the customer have any network protocols/interfaces that are required for interoperability with other equipment (either already owned or intended for purchase)?

What are the network bandwidth requirements for this customer's applications?

5. Select the physical configuration to meet the present requirements and also the future needs.

Some of the items that are determined or selected in this process are not included in the base system price. The following items may be required for a system, but must be purchased separately.

Disk drives

- Tape drives and other storage devices
- Network communication devices
- Peripheral controller for external devices
- Additional I/O subsystems
- Additional racks
- Compilers and programming environments
- Other layered software
- A table and chair for the system console and remote support equipment

### 7.2 Guidelines for Configuring the C-brick

To configure a C-brick, follow these guidelines:

Select the number of processors:

• SGI Origin 3200 systems can be configured with 2, 4, 6, or 8 processors.

**Note:** The 4-processor configuration is offered as: One 4 processor C-brick or two C-bricks, each with two processors (2×2).

- SGI Origin 3200 system sizes can be increased in 2-or 4-processor increments.
- SGI Origin 3400 systems can be configured with 4, 8, 16, or 32 processors; upgrades are in 4-processor increments.
- SGI Origin 3800 systems can be configured with 16 to 512 processors; upgrades are as follows.
  - The existing system has between 16 and 128 processors; the system sizes increase in 4-processor increments.
  - The existing system is equal or greater than 128 processors; the system sizes increases in 32-processor increments.

Select the memory:

- Each DIMM pair has two banks of memory. Each of the two memory banks are split between the two DIMMs, half of each bank is located on the first DIMM and the other half of each bank is located on the other DIMM of the DIMM pair.
- Memory is added in whole-bank increments (two DIMMs).
- The DIMMs that compose a single bank of memory must be the same size.
- All DIMM pairs do not have to be the same size. For example, one DIMM pair could be 512-MB and the next DIMM pair could be 1-GB.
- Three DIMM sizes (per two DIMMs) are available:
  - 512 MB (standard directory memory)
  - 1 GB (meta directory memory)
  - 2 GB (meta memory available early CY 2001)

Meta DIMMS are required for systems that have more than 128 processors, but can be used on systems of any size.

**Note:** Refer to Table 8-1 for memory sizes.

Table 7-1 lists memory sizes of various DIMM combinations for a single C brick. The number of C-bricks within a system determines the range of system memory. For example, a system with 4 C-bricks has a memory size range of 2 Gbytes to 32 Gbytes in either 512-Mbyte or 1-Gbyte increments. To ensure the best system performance, distribute the memory uniformly across all C-bricks within a system.

**Table 7-1** C-brick Memory Configurations

C Brick Memory Size	Memory per Processor (4-P C-brick)	Configuration Possibility 1	Configuration Possibility 2	Configuration Possibility 3		
STANDARD I	STANDARD MEMORY SIZES					
512 Mbytes	128 MBs	One MEM-512				
1.0 Gbyte	256 MBs	One MEM-1G	Two MEM-512			
1.5 Gbytes	375 MBs	One MEM-1G (plus) One MEM-512	Three MEM-512			

**Table 7-1** C-brick Memory Configurations

C Brick Memory Size	Memory per Processor (4-P C-brick)	Configuration Possibility 1	Configuration Possibility 2	Configuration Possibility 3
2.0 Gbytes	512 MBs	Two MEM-1G	One MEM-1G (plus) Two MEM-512	Four MEM-512
3.0 Gbytes	750 MBs	One MEM-2G (plus) One MEM-1G	One MEM-2G (plus) Two MEM-512	
4.0 Gbytes	1.0 GBs	Two MEM-2G	Four MEM-1G	
6.0 Gbytes	1.5 GBs	Three MEM-2G	Two MEM-2G (plus) Two MEM-1G	
8.0 Gbytes	2.0 GBs	Four MEM-2G		
CUSTOM ME	MORY SIZES			•
2.5 Gbytes	625 MBs	One MEM-2G (plus) One MEM-512	Two MEM-1G (plus) One MEM-512	
3.5 Gbytes	875 MBs	One MEM-2G (plus) Three MEM-512	One MEM-2G (plus) One MEM-1G (plus) One MEM-512	
4.5 Gbytes	1.125 GBs	Two MEM-2G (plus) One MEM-512		
5.0 Gbytes	1.25 GBs	Two MEM-2G (plus) One MEM-1G	Two MEM-2G (plus) Two MEM-512	
7.0 Gbytes	1.75 GBs	Three MEM-2G (plus) One MEM-1G		

# 7.3 Guidelines for Configuring D-bricks

To configure Fibre Channel disks follow these guidelines:

There are two methods of configuring Fibre Channel disks: JBOD and RAID.

D-bricks that reside within an SGI Origin 3000 series rack are configured as JBOD. RAID configurations are dropped shipped directly to the customer site from a separate integration facility. D-bricks configured as JBOD are configured at the factory and shipped as part of the system to the customer.

#### Features of a D-brick:

- The D-brick is a dual-ported 4-U high brick.
- A maximum of nine D-bricks can be placed in a 39-U disk rack.
- The D-brick may be configured with 2-to-12 Fibre Channel (3.5" media) disk drives.
- Each Fibre Channel loop configured as JBOD can support up to 84 disk drives.
- The disk system performance that the customer requires determines the number of required D-bricks and the number of disk drives per D-brick. Follow these guidelines to determine the quantity of D-bricks and disk drives for a system:
  - Performance system if the customer requires maximum bandwidth; configure
    the disk system with smaller capacity disks by using more D-brick enclosures.
    This creates more I/O channels, which increases the I/O bandwidth of the disk
    system.
  - Capacity system if the customer wants large amounts of storage and bandwidth is not an issue, configure the disk system with large capacity disks that need fewer I/O channels.

RAID storage is ordered as part of the TP-9100 storage system. The TP-9100 is a separate 38-U high rack that holds a maximum of nine modules and can be configured as JBOD and/or RAID.

# 7.4 Guidelines for Configuring Controller Cards within I/O Bricks

The goal of this section is to provide guidelines that support consistent configuration of I/O bricks. The PCI bus slots of an I or P-brick can support all of the various types of 3.3-volt PCI cards. No single slot is dedicated to a specific type of controller. Therefore, the guidelines serve to ensure an even distribution of bandwidth and to provide consistency from one configuration to the next.

#### 7.4.1 General Guidelines

There are two ways to configure a system: performance and capacity. The following guidelines are directed toward performance configuration:

#### DO NOT

- Do not intermix different types of SCSI controllers on a single PCI bus.
- Do not intermix Fibre Channel and SCSI controllers on a single PCI bus.
- Do not mix 33-MHz and 66-MHz cards on the same 66 MHz bus (if possible).
- Do not configure PCI or XIO cards so that the bandwidth of the brick is exceeded. This guideline can be violated for capacity configurations.

#### DO

- When possible, intermix high and low bandwidth controllers within the same brick. This balances the bandwidth demands across bricks.
- Install cards starting with the lowest numbered bus/slot.
- Distribute I/O cards within the brick; ensure that all buses have one controller card installed before you place two controller cards on one bus.

To install I/O cards in systems with multiple I/O bricks, follow these guidelines:

• Organize the I/O adapter cards by card type. Distribute the types of adapter cards evenly among I/O bricks. For example, if there are eight Fibre Channel controllers and two P-bricks, place 4 Fibre Channel controllers in each P-brick.

# 7.5 Base System Components

### 7.5.1 SGI Origin 3200 System

Four basic marketing codes define the SGI Origin 3200 system. These marketing codes are referred to as bundles.

#### 2 Processor System

- One short rack with trim
- One power bay with three power supplies
- One single-phase power distribution strip
- One 2-processor C-brick without memory
- One I-brick with Fibre Channel PCI card and cable

- One 18-GB system disk
- One 1-meter NUMAlink cable
- Two 1.0-meter power cables
- System software (IRIX) SC4-ASE-6.5

### 4 Processor System (Single C-brick)

- One short rack with trim
- One power bay with three power supplies
- One single-phase power distribution strip
- One 4-processor C-brick without memory
- One I-brick with Fibre Channel PCI card and cable
- One 18-GB system disk
- One 1-meter NUMAlink cable
- Two 1.0-meter power cables
- System software (IRIX) SC4-ASE-6.5

#### 4 Processor System (Dual C-bricks)

- One short rack with trim
- One power bay with three power supplies
- One single-phase power distribution strip
- Two 2-processor C-bricks without memory
- One I-brick with Fibre Channel PCI card and cable
- One 18-GB system disk
- Two 1-meter NUMAlink cables
- Three 1.0-meter power cables
- System software (IRIX) SC4-ASE-6.5

### 8 Processor System

• One short rack with trim

- One power bay with three power supplies
- One single-phase power distribution strip
- Two 4-processor C-bricks without memory
- One I-brick with Fibre Channel PCI card and cable
- One 18-GB system disk
- Two 1-meter NUMAlink cables
- Three 1.0-meter power cables
- System software (IRIX) SC4-ASE-6.5

Each of the four SGI Origin 3200 system bundles require that you select from following items to complete the system configuration:

Memory DIMMs for the C-bricks

**Note:** The following items are customer configurable options:

- Customer configurable PCI cards and optional disk drive for I-brick
- One additional I-, P-, or X-brick
- Customer configurable XIO cards, if an X-brick is configured
- Customer configurable PCI cards, if a P-brick is configured
- A D-brick and quantity of disk drives for additional disk storage
- Additional software packages
- Optional L2 or L3 controller

### 7.5.2 SGI Origin 3400 System

Four basic marketing codes define the SGI Origin 3400 system.

### 4 Processor System

- One tall rack with trim
- One power bay with four power supplies
- One single-phase or three-phase PDU

- One 4-processor C-brick without memory
- Two R-bricks
- One I-brick with Fibre Channel PCI card and cable
- One 18-GB system disk
- One L2 controller
- Three 1-meter NUMAlink cables
- One 2-meter NUMAlink cable
- Three 1.0-meter power cords
- One 2.0-meter power cord
- System software (IRIX) SC4-ASE-6.5

### 8 Processor System

- One tall rack with trim
- One power bay with four power supplies
- One single-phase or three-phase PDU
- Two 4-processor C-bricks without memory
- Two R-bricks
- One I-brick with Fibre Channel PCI card and cable
- One 18-GB system disk
- One L2 controller
- Four 1-meter NUMAlink cables
- One 2-meter NUMAlink cable
- Three 1.0-meter power cords
- Two 2.0-meter power cord
- System software (IRIX) SC4-ASE-6.5

#### 16 Processor System

- One tall rack with trim
- One power bay with four power supplies

- One single-phase or three-phase PDU
- Four 4-processor C-bricks without memory
- Two R-bricks
- One I-brick with Fibre Channel PCI card and cable
- One 18-GB system disk
- One L2 controller
- Six 1-meter NUMAlink cables
- One 2-meter NUMAlink cable
- Three 1.0-meter power cords
- Four2.0-meter power cord
- System software (IRIX) SC4-ASE-6.5

#### 32 Processor System

- One tall rack with trim
- Two power bays with eight power supplies
- Two single-phase PDUs or one three-phase PDU
- Eight 4-processor C-bricks without memory
- Two R-bricks
- One I-brick with Fibre Channel PCI card and cable
- One 18-GB system disk
- One L2 controller
- Ten 1-meter NUMAlink cables
- One 2-meter NUMAlink cable
- Three 1.0-meter power cords
- Eight 2.0-meter power cords
- System software (IRIX) SC4-ASE-6.5

Each of the four SGI Origin 3400 system bundles require that you select from the following items to complete the system configuration:

Select the memory DIMMs for the C-bricks

**Note:** The following items are customer configurable options:

- Customer configurable PCI cards for I-brick
- Optional disk drive for the I-bricks
- Additional I-, P-, or X-bricks
- Customer configurable XIO cards, if an X-brick is configured
- Customer configurable PCI cards, if P-brick is configured
- Additional I/O racks if required (eight I/O bricks per rack)
- A D-brick and the quantity of disk drives for additional disk storage
- An additional 39-U rack if configurable space in the first rack is full
- An additional 39-U rack for disk storage
- Additional software packages
- L3 controller

### 7.5.3 SGI Origin 3800 Systems

The SGI Origin 3800 system is configured with a minimum of two 39-U racks. One rack contains the C-bricks and R-bricks (compute rack) and the other rack contains the I-, P-, X-, and D-bricks (I/O rack). The SGI Origin 3800 system can have up to sixteen compute racks; the number of racks depends on the number of C-bricks in the system. The system size ranges from 4 to 128 C-bricks. The minimum system upgrade is done in one C-brick increments.

The base compute rack has the following basic components:

#### 16 Processor System

- One tall rack with trim
- One power bay with four power supplies
- One single-phase or three-phase PDU
- Four 4-processor C-bricks without memory

- Two R-bricks
- One L2 controller
- One Ethernet cable (L2)
- Six 1-meter NUMAlink cables
- Three 1.0-meter power cables
- Five 2.0-meter power cables
- System software (IRIX) SC4-ASE-6.5

#### 32 Processor System

- One tall rack with trim
- Two power bays with eight power supplies
- Two single-phase PDUs or one three-phase PDU
- Eight 4-processor C-bricks without memory
- Two R-bricks
- One L2 controller
- Ten 1-meter NUMAlink cables
- Three 1.0-meter power cables
- Seven 2.0-meter power cables
- System software (IRIX) SC4-ASE-6.5

### The base I/O rack has the following components:

- One tall rack with trim
- One power bay with five power supplies
- One single-phase or three-phase PDU
- One I-brick with Fibre Channel PCI card and cable
- One 18-GB system disk
- One P-brick
- Two 2-meter NUMAlink cable
- Two 2.0-meter power cable

To complete the SGI Origin 3800 system configuration select from the following items:

memory DIMMs for the C-bricks

**Note:** The following items are customer configurable options:

- Additional 4-processor C-bricks
- Additional compute racks if required (eight C-bricks per rack)
- Additional I-, P-, or X-brick
- Customer configurable XIO cards, if an X-brick is configured
- Customer configurable PCI cards, if P-brick is configured
- Select customer configurable PCI cards for I-brick
- Optional disk drive for the I-brick
- D-bricks and the quantity of disk drives for additional disk storage
- An additional 39-U rack if configurable space in the first rack is full
- An additional 39-U rack for disk storage
- Additional software packages
- L3 controller

# 8. Expanding the SGI Origin 3000 Series System

There are three areas in which an SGI Origin 3000 series system can be expanded: processor capacity, memory capacity, and peripheral capacity. Note that expansion in one area often affects another area.

# 8.1 Processor Capacity

Each system size has a maximum number of C-bricks that the system supports.

SGI Origin 3200 systems can have C-bricks that contains two or four-processors. C-bricks that contain two processors can be upgraded by adding an additional PIMM (a PIMM contains two processors) to each two-processor C-brick. A system with a single four-processor C-brick can be upgraded by adding an additional four-processor C-brick.

SGI Origin 3400 systems are configured with four-processor C-bricks. SGI Origin 3400 systems can be expanded to a maximum of 8 four-processor C-bricks.

SGI Origin 3800 systems are configured with four-processor C-bricks. SGI Origin 3800 systems can be expanded to a maximum of 128 four-processor C-bricks. Each compute rack can hold a maximum of eight C-bricks; therefore, additional racks must be configured when the number of C-bricks exceed the capacity of existing racks.

# 8.2 Main Memory Capacity

Memory can be expanded in single-bank increments. There are three bank sizes to choose from: 512 Mbytes, 1 Gbytes, and 2 Gbytes. Each C-brick has four memory banks that can contain any combination of DIMM pairs; however, each DIMM in a DIMM pair must be

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the same memory size. Table 8-1 lists the marketing codes for the three memory bank sizes.

**Table 8-1** Memory Marketing Codes

Memory Size	Marketing Code
512 MBytes	MEM-512
1 Gbyte	MEM-1G
1 Gbyte	MEM-1G-D
2 Gbytes	MEM-2G-D

If a customer requires more memory, but the memory in the existing C-bricks are filled; additional memory can be added by increasing the number of C-bricks, up to the system maximum (refer to "Processor Capacity" on page 83).

# 8.3 Peripheral Capacity

When expanding peripheral capacity, the number of I/O bricks in the system cannot exceed the number of C-bricks in the system. If the number of I/O bricks in the system equals the number of C-bricks, the number of I/O bricks can be increased by adding an additional C-brick for each new I/O brick.

**Note:** Each system type has a maximum number of C-bricks that it can support.

# 9. SGI Origin 3000 Series Software Requirements

### 9.1 Required Software

SGI Origin 3000 series systems use the IRIX 6.5 Advanced Server Environment software (ASE). The marketing code for this package is SC4-ASE-6.5. The following software is included in ASE:

- IRIX 6.5 operating system
- License for NFS NFS is a file-mounting/sharing tool.
- License for Database Accelerator (DBA from SGI)
   DBA provides optimized database scalability and enhanced manageability of decision support systems and data warehouse systems.
- License for host access to HP (referred to as HP MIB)
- License for CA Unicenter TNG Framework
   Basis for Computer Associates large-enterprise system management tool for
   heterogeneous environments.
- Temp license for Enlighten DSM (from Enlighten)
   Distributed system management for small enterprises and work groups.
- Temp license for Roboinst (from SGI)
   Roboinst provides remote software distribution for heterogeneous networked environments.
- CD pack for Hot Mix (SGI)
- CD pack for SGI freeware

# **SGI Origin 3200 System Configuration**

### **System Definition:**

• Single 17-U high short rack configuration; no additional racks for processors or I/O

### **Main Memory:**

- Minimum memory size: 512 MB (one C-brick with one 512-MB bank)
- Maximum memory size: 16 GB (two C-bricks; each C-brick has four 2-GB banks)

#### **Processors:**

- Minimum of one C-brick (2 processors)
- Maximum of two C-bricks (8 processors) Input/output
- Maximum of two I/O bricks; one of the I/O bricks must be an I-brick

#### Disk:

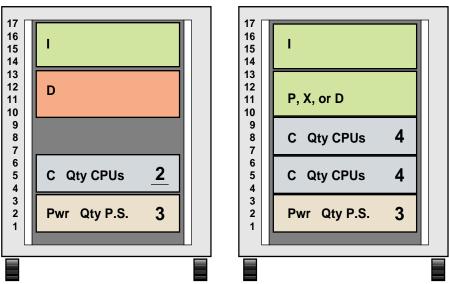
- Maximum of two D-bricks in the base rack
- 1 to 2 additional D-brick racks as required

#### Miscellaneous:

- One power bay
- One L2 controller (optional)
- One L3 controller (optional)

Note: The R-brick is not supported in SGI Origin 3200 systems.

# SGI Origin 3200 Systems



Note: Disks can be placed in a separate SGI or third-party disk rack.

# **SGI Origin 3400 System Configuration**

### **System Definition:**

• Single tall rack configuration; additional racks for I/O and disks as required

### Main Memory:

- Minimum memory size 512 MB: (one C-brick with one 512-MB bank)
- Maximum memory size 64 GB: (eight C-bricks, each C-brick has four 2-GB banks)

#### **Processors:**

- Minimum of one C-brick (4 processors)
- Maximum of eight C-bricks (32 processors) Input/output
- Minimum of one I-brick; maximum of eight I/O bricks

#### Disk:

- D-bricks may be included in the base rack
- Additional D-brick rack(s) for disks as required

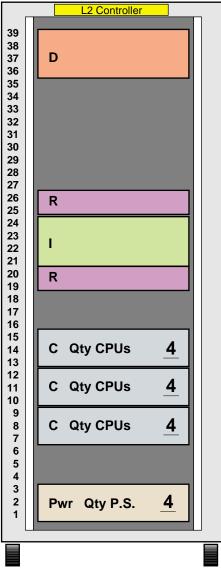
### Miscellaneous:

- Maximum of two R-brick-16s
- Minimum of 1 power bay, maximum of 2 power bays
- L3 controller (optional)

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# 12-processor System

## 16-processor System



Note: Additional D-brick

SGI Origin 3400

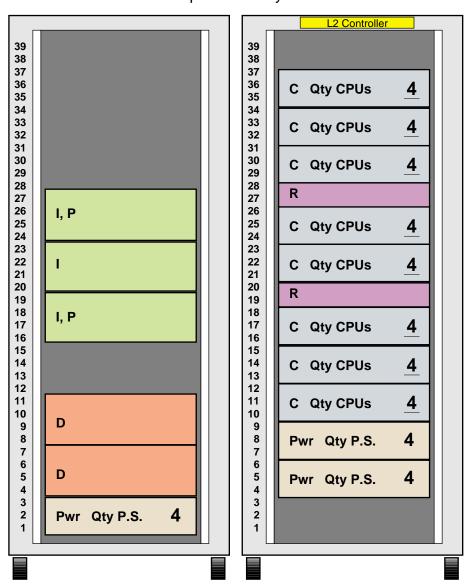
Systems

racks not shown

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FRONT VIEW

32-processor System



SGI Origin 3400 System

# SGI Origin 3800 System Configuration

### System definition:

#### Main Memory:

- Minimum memory size: 2 GB (four C-bricks, each C-brick has one 512-MB bank)
- Maximum memory size: 1024 GB (128 C-bricks, each C-brick has four 2-GB banks)
- System sizes above 128 processors require premium DIMMs

#### **Processors:**

- 16 to 128 processors (minimum increment of 4 processors)
- 128 to 512 processors (minimum increment of 32 processors)

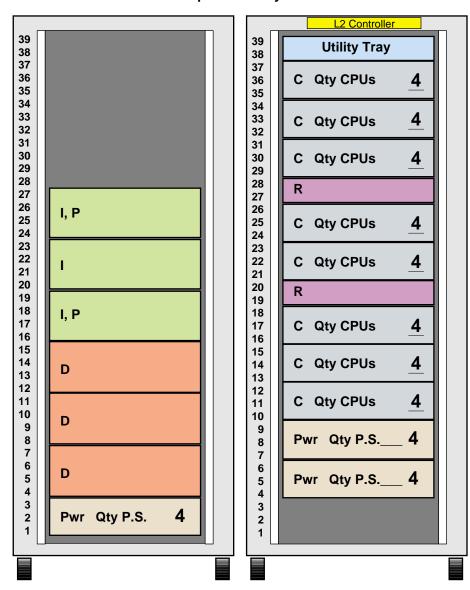
### **Rack Configurations:**

- Compute racks contain only C-bricks and R-bricks
- Maximum of two power bays in compute racks
- Maximum of sixteen compute racks
- Maximum of eight C-bricks per rack
- Maximum of three R-bricks per rack
- I/O racks can contain both D-bricks and I/O bricks
- Maximum of eight I/O bricks per I/O rack
- Maximum of one power bay in I/O racks
- Maximum of nine D-bricks per rack (no power bays in rack)

#### Miscellaneous:

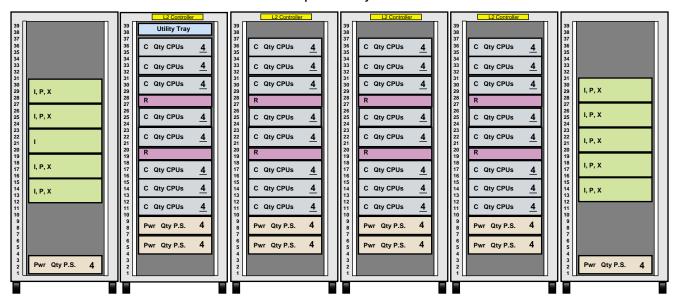
- One L2 controller is mandatory for all compute racks
- L3 controller is optional

### 32-processor System



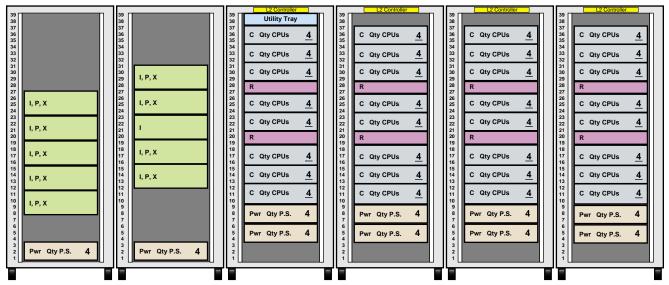
SGI 3800 System

SGI Origin 3800 System 128-processor system

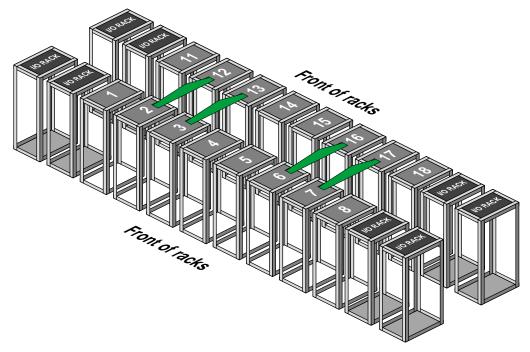


Note: Racks that contain the D bricks are not shown.

### SGI Origin 3800 System One quadrant of 512-processor System

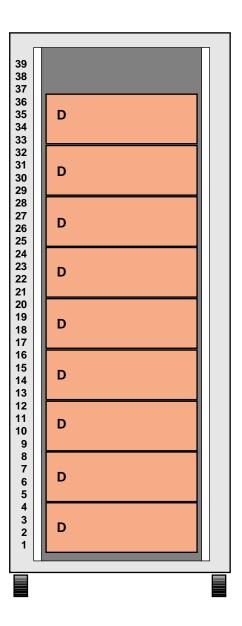


Note: Racks that contain the D bricks are not shown.



512-processor SGI Origin 3800 System

## **D-brick Rack Configuration**



## **Mechanical and Electrical Specifications**

#### **Short Rack Mechanical and Electrical Specifications**

Characteristic		SGI 3000 Seri	es	
Short Rack Mechanica	al Requirements	<u>'</u>		
Height		35.50 in.	(902 mm)	
Width		25.38 in.	(645 mm)	
Depth (less system dis	play)	40.63 in.	(1032 mm)	)
Weight (maximum)				
	Short Rack	600 lbs.	(272 kg)	
Shipping Weight (Max	imum)			
	Short Rack	750 lbs.	(340 kg)	
Access Requirements:				
	Front	36.0 in. min.	(914 mm)	(48.0 in. recommended)
	Rear Side	36.0 in. None	(914 mm)	
Short Rack Electrical	Requirements	1		
Voltage		North Ameri	ca / Japan	International
	Nominal	200-240 Vac		230 Vac
	Tolerance	180-254 Vac		180-254 Vac
Frequency		North Ameri	ca / Japan	International
	Nominal	50/60 Hz		50 Hz
	Tolerance	47-63 Hz		47-63 Hz
Phases		Single-Phase		

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Characteristic	SGI 3000 Series	
Power Requirements (maximum)		
Short Rack	1.18 kVA	(1.16 kW)
Hold-up Time	20 ms	
Power Cable	8 ft. (2.4m) pluggable deep cords	
Power Receptacle	North America/Japan	International
Short rack (Single-phase Option)	NEMA 6-15R	Country specific
Wall Breaker Size		
Single-phase Single-phase (Europe)	30 A 32 A	
Short Rack Environmental Requirements		
Non-Operating Environment		
Temperature	-40 to 140° F (-40 to +60° C)	
Humidity Altitude	10% to 95% non-condensing 40,000 ft. max.	
Operating Environment		
Air Temp (0 to 5000 ft).	41 to 95° F (+5 to +35° C)	
Air Temp (5000 ft to 10,000 ft)	41 to 86° F (+5 to +30° C)	
Humidity Dewpoint	10% to 95% non-condensing	
Altitude	0 to 10,000 ft. (0 to 3048 m)	
Acoustical Noise Level (maximum)	Less than 65 dBA	
Heat Dissipation to Air (maximum)	4.78 Kbtu/hr (Based on 1.4 kW)	
Cooling Requirement	Ambient air	
Airflow: (Intake, Front; Exhaust, Rear)	Less than 2000 CFM	

#### **Tall Rack Mechanical and Electrical Specifications**

Characteristic	racteristic SGI 3000 Series				
Tall Rack Mechanical Requ	Tall Rack Mechanical Requirements				
Height		74.25 in. (1886 mm)			
Width		30.00 in. (	762 mm)		
Depth (less system display)		51.50 in. (	1308 mm)		
Weight (maximum)					
	Compute Rack I/O Rack Disk Rack	1050 lbs. (	440 kg) 478 kg) 558 kg)		
Shipping Weight (Maximum	n)				
	Compute Rack I/O Rack Disk Rack	1415 lbs. (	605 kg) 642 kg) 728 kg)		
Access Requirements:					
	Front Rear Side	36.0 in. min. (914 m) 36.0 in. (914 m) None			
Tall Rack Electrical Require	ements				
Voltage		North America / Japa	n International		
	Nominal Tolerance	200-240 Vac 180-254 Vac	230 Vac 180-254 Vac		
Frequency		North America / Japa	n International		
	Nominal Tolerance	50/60 Hz 47-63 Hz	50 Hz 47-63 Hz		
Phases Single-Phase or Optional Three-Phase		nal Three-Phase			

Characteristic		SGI 3000 Series	
Power Requireme	nts (maximum)  Compute Rack I/O Rack Disk Rack	2.18 kVA.	(2.58 kW) (2.14 kW) (2.97 kW)
Hold-up Time		20 ms	
Power Cable		8 ft. (2.4m) pluggable deep	o cords
Power Receptacle		North America / Japan	International
	Compute Rack (Three-phase Option)	(1) 60 Amp, IEC60309 (Hubbell 460C9W or Equi	(1) 32 Amp, v.)IEC60309
	I/O or Disk Rack (Three-phase Option)	(1) 60 Amp, IEC60309 (Hubbell 460C9W or Equi	(1) 32 Amp, v.)IEC60309
	Compute Rack (Single-phase Option)	(2 or 4) 30 Amp, L6-30R	(2 or 4) 32 Amp, IEC60309
	I/O or Disk Rack (Single-phase Option)	(2) 30 Amp, NEMA L6-30	R (2) 32 Amp, IEC603091
Wall Breaker Size	Single-phase Single-phase (Europe) Three-phase	Multiple 30 A 32A 60A	
Tall Rack Enviror	nmental Requirements	1	
Non-Operating Er Temperature Humidity Altitude	nvironment	-40 to 140° F (-40 to +60° C 10% to 95% non-condensis 40,000 ft. max.	
Operating Enviror Air Temp (0 to Air Temp (5000 Humidity Dewpoint Altitude Facilities Water	5000 ft).	41 to 95° F (+5 to +35° C) 41 to 86° F (+5 to +30° C) 10% to 95% non-condensing TBD 0 to 10,000 ft. (0 to 3048 m 4.4° C to 15.6° C	

Characteristic	SGI 3000 Series
Acoustical Noise Level (maximum)	Less than 65 dBA
Heat Dissipation to Air (maximum)	10.24 Kbtu/hr (Based on 3.00 kW)
Cooling Requirement	Ambient air
Airflow: (Intake, Front; Exhaust, Rear)	Less than 3200 CFM

### **System / Channel Bandwidths**

Description	Peak Bandwidth	Sustained Bandwidth	Clock Frequency
Main memory bandwidth	3200 MB/s	3200 MB/s	200 MHz
NUMAlink 3 channel bandwidth	3.2 GB/s (full-duplex) 1.6 GB/s each direction	1420 MB/s each direction	800 MHz
Xtown2 channel bandwidth	2.4 GB/s (full-duplex) 1.2 GB/s each direction	~ 1066 MB/s half duplex ~ 1744 MB/s full-duplex ~ 872 MB/s each direction	600 MHz
Xtown channel bandwidth	1.6 GB/s (full-duplex) 800 MB/s each direction	~700 MB/s half duplex 1120 MBs/ full-duplex ~560 MB/s each direction	400 MHz
PCI channel bandwidth	128 MB/s in 32-bit mode 256 MB/s in 64-bit mode	N/A	33 MHz
	256 MB/s in 32-bit mode 512 MB/s in 64-bit mode	N/A	66 MHz

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# **Component Dimensions, Weights, and Power**

Product Name	Dimensions	Weight	Power	Number 0f U
Tall Rack	74 in. $H \times 32$ in. $W \times 48$ in. D	400 lbs (empty)	N/A	N/A
Short Rack	34 in. H × 24 in. W × 42 in. D	200 lbs (empty)	N/A	N/A
C-brick	5.06 in. H × 17.19 in. W × 27.80 in. D	65 lbs (fully loaded)	~308 watts	3
D-brick	6.64 in. H × 19.0 in. W × 27.74 in. D	94 lbs (fully loaded)	~400 VA	4
G-brick	31.5 in. H × 17.50 in. W × 20.0 in. D	215 lbs (fully loaded)	2000 watts	18
I-brick	6.64 in. H × 17.50 in. W × 27.74 in. D	69 lbs (fully loaded)	~190 watts	4
R-brick	3.35 in. H × 17.38 in. W × 27.5 in. D	18 lbs	~60 watts	2
P-brick	6.64 in. H × 17.50 in. W × 27.74 in. D	70 lbs (fully loaded)	~225 watts	4
X-brick	6.64 in. H × 17.50 in. W × 27.74 in. D	69 lbs (fully loaded)	~225 watts	4
Power Bay	5.01 in. H × 17.5 in. W × 24.5 in. D	72 lbs (fully loaded)	N/A	3

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