

Array Installation Instructions

Document Number 108-0138-004

Contributors

Written by Carolyn Curtis and Pablo Rozal

Illustrated by Dan Young, Dany Galgani, and Cheri Brown

Production by Mike Dixon

Engineering contributions by Jim Pinkerton, Rob Bradshaw, Ajit Dandapani, and Robert Thome

© 1995, 1996, 1997 Silicon Graphics, Inc.— All Rights Reserved

The contents of this document may not be copied or duplicated in any form, in whole or in part, without the prior written permission of Silicon Graphics, Inc.

Restricted Rights Legend

Use, duplication, or disclosure of the technical data contained in this document by the Government is subject to restrictions as set forth in subdivision (c) (1) (ii) of the Rights in Technical Data and Computer Software clause at DFARS 52.227-7013 and/or in similar or successor clauses in the FAR, or in the DOD or NASA FAR Supplement. Unpublished rights reserved under the Copyright Laws of the United States. Contractor/manufacturer is Silicon Graphics, Inc., 2011 N. Shoreline Blvd., Mountain View, CA 94043-1389.

FCC Warning

This equipment has been tested and found compliant with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Attention

This product requires the use of external shielded cables in order to maintain compliance pursuant to Part 15 of the FCC Rules.

**Array Installation Instructions
Document Number 108-0138-004****Silicon Graphics, Inc.
Mountain View, California**

Silicon Graphics, IRIS, Indy, and CHALLENGE are registered trademarks and Origin, Origin2000, Onyx2, O2, IRISconsole, IRIX, IRIXpro, Onyx, Performance Co-Pilot, POWER CHALLENGE, POWER Onyx, POWER CHALLENGEarray, RealityEngine², and XFS are trademarks of Silicon Graphics, Inc. CrayLink is a trademark of Cray Research, Inc. Extreme is a trademark used under license by Silicon Graphics, Inc. R4400 and R8000 are registered trademarks and R10000 is a trademark is MIPS Technologies, Inc. PerfAcct is a trademark of Instrumental, Inc. LSF is a trademark of Platform Computing, Inc. NFS is a registered trademark of Sun Microsystems, Inc. UNIX is a registered trademark in the United States and other countries, licensed exclusively through X/Open Company, Ltd.

Contents

About This Guide.....	xi
What This Document Contains.....	xi
Related Documents.....	xii
Safety Information	xiii
Typographical Conventions	xiii
1. Features of the Array	1-1
1.1 Constructing an Array.....	1-2
1.1.1 Array Hardware.....	1-2
1.1.2 Array Software Components.....	1-3
1.1.3 Parallel Processing Strategy	1-4
1.1.4 Array Services Software.....	1-4
1.2 Product Configurations.....	1-5
1.2.1 Base Configurations.....	1-5
1.2.2 Array Hardware Configuration.....	1-10
1.3 Upgrading Existing Systems to Array Nodes.....	1-10
2. Installation Planning and Site Preparation	2-1
2.1 Setting Customer Expectations	2-2
2.2 SSE Preparation.....	2-2
2.2.1 Number of SSEs and Prerequisite Knowledge	2-2
2.2.2 SSE Planning Guidelines.....	2-2
2.3 Site Preparation General Guidelines.....	2-3
2.4 Raised-Floor and Floor-Loading Considerations.....	2-5
2.5 Space Requirements for Nodes.....	2-6
2.5.1 Origin2000 Deskside Space Requirements.....	2-7
2.5.2 Origin2000/Onyx2 Rackmount Space Requirements	2-10
2.5.3 Challenge Deskside Space Requirements.....	2-15
2.5.4 Challenge Rackmount Space Requirements	2-17
2.6 Space Requirements for Other Components.....	2-21
2.6.1 O2 Workstation Space Requirements.....	2-22
2.6.2 Indy Workstation Space Requirements	2-22
2.6.3 Multiplexer Space Requirements.....	2-23

2.7	Space Requirements for Array Configurations	2-23
2.7.1	Two-Node Configuration (No HIPPI Switch)	2-23
2.7.2	Two-Node Configuration (with HIPPI Switch).....	2-24
2.7.3	Four-Node Configuration.....	2-25
2.7.4	Eight-Node Configuration.....	2-26
2.8	Environmental Requirements	2-27
2.8.1	Air Temperature and Quality	2-28
2.8.2	Array Heat Dissipation	2-31
2.8.3	Array Vibration Limits.....	2-31
2.8.4	Acoustics	2-32
2.9	Array Power Requirements.....	2-33
2.10	Preparing to Receive the Array.....	2-35
2.10.1	Required Tools for Receiving and Installing the Array	2-35
2.10.2	Arranging for Assistance	2-36
2.10.3	Checking the Delivery Route	2-36
3.	Preinstallation Checklist.....	3-1
3.1	Before You Begin Installation.....	3-1
3.2	Establishing Customer Contact.....	3-2
3.3	Verifying and Inventorying the Components	3-3
3.4	Assigning Node Numbers	3-3
3.5	Completing Floor Space, Network, and Environmental Planning.....	3-4
3.6	Assigning IRISconsole Ports for Each Array Node.....	3-4
3.7	Determining the HIPPI Connection Scheme.....	3-4
3.7.1	Drawing a HIPPI Connection Diagram	3-4
3.7.2	Handling and Labeling HIPPI Cables.....	3-5
3.8	Determining HIPPI Routing and I-Field Assignment	3-5
3.9	Assigning an Array Name	3-6
3.10	Determining Local Net IP Addresses and Hostnames.....	3-6
3.11	Determining HIPPI Network IP Addresses and Hostnames	3-6
4.	Installing the Array	4-1
4.1	Performing Preliminary Steps.....	4-2
4.2	Positioning the Array Components.....	4-5

4.3	Setting Up the IRISconsole	4-5
4.3.1	Set Up the Workstation for the IRISconsole.....	4-6
4.3.2	Installing the Software on the Workstation	4-7
4.3.3	Connecting the Multiplexer to the Workstation.....	4-7
4.3.4	Connecting the IRISconsole Multiplexer to the Array Nodes	4-10
4.3.5	Configuring the Array Nodes With IRISconsole.....	4-15
4.3.6	Adding the Array Nodes to the IRISconsole Site	4-17
4.3.7	Verifying the Array Configuration on the IRISconsole	4-19
4.4	Bringing Up the Array Nodes.....	4-21
4.5	Configuring the Base Node	4-22
4.5.1	Installing HIPPI and Additional Hardware.....	4-23
4.5.2	Powering Up the Array Nodes	4-25
4.5.3	Installing Software on the Array Nodes	4-25
4.5.4	HIPPI Testing.....	4-28
4.5.5	Base Node Testing	4-28
4.6	Configuring LAN Nodes	4-29
4.7	Cabling, Configuring, and Testing the HIPPI Network.....	4-29
4.7.1	HIPPI Cabling.....	4-29
4.7.2	HIPPI Configuration.....	4-33
4.7.3	HIPPI Bypass Function	4-34
4.7.4	HIPPI Node Testing.....	4-37
4.8	Bringing Up the Array	4-38
4.8.1	Configuring Array Services and Starting the Array Daemons	4-38
4.8.2	Array Node Testing.....	4-38
4.8.3	Live Testing.....	4-38
4.9	Installing Other Silicon Graphics Software Applications	4-39
A.	Array Diagnostics.....	A-1
A.1	Base Node Tests.....	A-1
A.2	LAN Tests.....	A-2
A.3	HIPPI Tests.....	A-4
A.4	Complete Array Configuration Test	A-5
	Glossary	Glossary-1
	Index	Index-1

Figures

Figure 1-1	Example Array Configuration With Maximum of Eight Nodes.....	1-1
Figure 1-2	Two-Node Configuration (No HIPPI Switch)	1-6
Figure 1-3	Two-Node Configuration With HIPPI Switch.....	1-7
Figure 1-4	Four-Node Configuration With HIPPI Switch	1-8
Figure 1-5	Eight-Node Configuration With HIPPI Switch	1-9
Figure 2-1	Origin2000 and Onyx2 Deskside Caster Positions.....	2-8
Figure 2-2	Origin2000 and Onyx2 Deskside Airflow	2-9
Figure 2-3	Origin2000/Onyx2 Rack Chassis Clearances	2-11
Figure 2-4	Origin2000 Rack Chassis Caster (Shaded Squares) and Leveler (Shaded Hexagons) Locations.....	2-12
Figure 2-5	Origin2000 Rack Chassis Airflow	2-13
Figure 2-6	Origin2000/Onyx2 Rack Chassis Cable Opening	2-14
Figure 2-7	Challenge Deskside Chassis Dimensions	2-15
Figure 2-8	Challenge Deskside Chassis Airflow	2-16
Figure 2-9	Deskside Wheel Locations (Bottom View)	2-17
Figure 2-10	Rackmount Chassis Clearance	2-19
Figure 2-11	Challenge Rackmount Chassis Airflow	2-20
Figure 2-12	Challenge Rackmount Caster and Leveler Locations.....	2-21
Figure 2-13	Indy Workstation Chassis Dimensions.....	2-22
Figure 2-14	Example Space Requirements for Two-Node Array (No HIPPI Switch)	2-24
Figure 2-15	Example Two-Node Array Configuration (With HIPPI Switch)	2-25
Figure 2-16	Example Four-Node Array Space Requirements	2-26
Figure 2-17	Example Eight-Node Array Space Requirements	2-27
Figure 4-1	Overview of the Array Installation (Part 1)	4-3
Figure 4-2	Overview of the Array Installation (Part 2)	4-4
Figure 4-3	Setting Up the IRISconsole	4-6
Figure 4-4	IRISconsole O2 Workstation.....	4-8
Figure 4-5	IRISconsole: Indy Workstation	4-9
Figure 4-6	Setting the Multiplexer SCSI ID.....	4-10
Figure 4-7	Connecting the Serial Cables to the SPM: Example	4-11
Figure 4-8	Connecting the Serial Cables to the Origin2000/Onyx2 Deskside Server	4-12
Figure 4-9	Connecting the Serial Cables to the Origin2000/Onyx2 Rackmount Server.....	4-13

Figure 4-10	Connecting the Serial Cables to the Challenge Server.....	4-14
Figure 4-11	IRISconsole Main Menu	4-15
Figure 4-12	Change IRISconsole Config Dialog Box.....	4-16
Figure 4-13	Site Window.....	4-17
Figure 4-14	Change Site Config Dialog Box.....	4-18
Figure 4-15	Example of an Array Site Icons Created Through the IRISconsole	4-19
Figure 4-16	Site Window (With Systems Added Example).....	4-20
Figure 4-17	Array Node Window on the IRISconsole GUI	4-21
Figure 4-18	Array Hardware Setup.....	4-23
Figure 4-19	Internal VME HIPPI Hardware Components for Challenge Servers.....	4-24
Figure 4-20	Internal HIPPI XIO Board for Origin2000/Onyx2 Servers	4-25
Figure 4-21	Multi-Port HIPPI Switch.....	4-30
Figure 4-22	Connecting the Array Node to the HIPPI Switch	4-31
Figure 4-23	Example HIPPI Cabling for Nodes.....	4-32

Tables

Table 1-1	Prepackaged Array System Components.....	1-10
Table 2-1	Site Preparation Checklist.....	2-4
Table 2-2	Floor Loads for Servers	2-6
Table 2-3	Origin2000 Deskside Physical Specifications.....	2-7
Table 2-4	Origin2000 Deskside Minimum Airflow Clearances.....	2-7
Table 2-5	Origin2000/Onyx2 Rackmount Physical Specifications	2-10
Table 2-6	Origin2000/Onyx2 Airflow	2-10
Table 2-7	Challenge Deskside Physical Specifications	2-15
Table 2-8	Challenge Deskside Airflow Clearances	2-16
Table 2-9	Rackmount Physical Specifications	2-17
Table 2-10	Rackmount Floor-Load Requirements.....	2-20
Table 2-11	O2 Workstation Physical Specifications	2-22
Table 2-12	Indy Workstation Physical Specifications	2-22
Table 2-13	IRISconsole Physical Specifications.....	2-23
Table 2-14	Origin2000 Environmental Specifications	2-28
Table 2-15	Origin2000 Base Module Cooling Requirements	2-28
Table 2-16	Challenge Deskside Environmental Specifications.....	2-29
Table 2-17	Workstation Environmental Specifications.....	2-29
Table 2-18	Multiplexer (SPM) Environmental Specifications	2-30
Table 2-19	Multi-Port HIPPI Switch Environmental Specifications	2-30
Table 2-20	Array Heat Dissipation (Challenge Nodes)	2-31
Table 2-21	Array Heat Dissipation (Origin2000/Onyx2 Nodes, 220-V, 1-phase)	2-31
Table 2-22	Challenge/Onyx Vibration Limits	2-31
Table 2-23	Challenge Rackmount, Deskside, and Indy Acoustic Levels	2-32
Table 2-24	Origin2000 Base Module and Rackmount Power Specifications.....	2-33
Table 2-25	Challenge and Onyx System Power Requirements	2-33
Table 2-26	Challenge Array Approximate Total Power Consumption.....	2-34
Table 2-27	Origin2000/onyx2 Array Approximate Total Power Consumption.....	2-34
Table 2-28	O2 Workstation Power Specifications.....	2-34
Table 2-29	Indy Workstation Power Specifications	2-34
Table 2-30	SPM IRISconsole Power Specifications.....	2-35
Table 2-31	Tools Required for Receiving and Installing Systems	2-35
Table 2-32	Shipping Dimensions	2-37

Table 3-1	Preinstallation Checklist	3-1
Table 3-2	Array Parts List	3-3

About This Guide

This guide describes the hardware and software installation procedures to set up an array configuration. The array combines the power of up to eight different Silicon Graphics® systems, such as Origin2000™, Onyx2™, CHALLENGE, POWER CHALLENGE™, or POWER Onyx™, systems, with single-point administration provided by IRISconsole™ software running on an Indy® or O2™ workstation. This array configuration provides a supercomputing platform that is well suited to meet the computational needs of large research and production environments.

The Array software release 3.0 requires IRIX™ 6.2 or later.

Note: For ease in reading, CHALLENGE is written as Challenge in the balance of this guide, except in document names.

This guide is written for Silicon Graphics system support engineers (SSEs) and third-party field support groups responsible for product installation and testing.

What This Document Contains

This guide is divided into four chapters and an appendix

- Chapter 1, “Features of the Array,” summarizes the array hardware and software and describes the features of the array.
- Chapter 2, “Installation Planning and Site Preparation,” describes how to prepare a customer site and plan for the array installation.
- Chapter 3, “Preinstallation Checklist,” provides an activities checklist to perform before you begin actual installation.
- Chapter 4, “Installing the Array,” discusses how to install the array hardware and software.
- Appendix A, “Array Diagnostics,” provides information on running the diagnostics on the array.

A glossary and an index complete this guide.

Related Documents

This section lists related Silicon Graphics documents that you may need to consult for additional information. Be sure you get the latest version of each document.

- POWER CHALLENGEarray™ Web site:
 - <http://www.asd.sgi.com/mktg/PCarray.html>, (viewable only by Silicon Graphics employees inside the Silicon Graphics firewall)
 - <http://www.sgi.com/Products/PowerChallengeArray> (viewable by anyone with World Wide Web access)
- CHALLENGE DataArray
<http://www-nsd.engr.sgi.com/nsd/htmls/prodmkt/DataArray/index.html>
(viewable only by Silicon Graphics employees inside the Silicon Graphics firewall)
- *Getting Started With the Array* (document number 007-3058-xxx)
- *Site Preparation for Origin Family and Onyx2* (007-3452-xxx)
- *Origin2000 and Onyx2 Deskside and Rackmount Installation Instructions* (108-0155-002 or later)
- *Origin2000 Rackmount Owner's Guide* (007-3456-xxx)
- *Origin2000 Deskside Server Owner's Guide* (007-3453-xxx)
- *CHALLENGE/Onyx Site Preparation Guide* (108-7040-xxx)
- *CHALLENGE/Onyx XL Rackmount Installation Instructions* (007-7042-xxx)
- *CHALLENGE/Onyx L Deskside Installation Instructions* (007-7039-xxx)
- *O2 Workstation Hardware Reference Manual* (007-3275-xxx)
- *Indy Workstation Owner's Guide* (007-9804-xxx)
- *IRISconsole Multiplexer Installation Guide* (007-2839-002 or later)
- *IRISconsole Administrator's Guide* (007-2872-xxx)
- *IRIS HIPPI-Serial XIO Board Installation Instructions* (108-0160-001)
- *IRIS HIPPI Installation Instructions* (108-0106-003 or later)
- *IRIS HIPPI Administrator's Guide* (007-2229-004 or later)

Note: See also the Technical Publications Library Web page at <http://techpubs.engr.sgi.com>.

Safety Information

Be sure to read the following information before you begin installation.



Warning: Installation of these products requires specific training and technical knowledge. These instructions are provided for use by Silicon Graphics system support engineers (SSEs) or other Silicon Graphics trained personnel only. This equipment utilizes electrical power internally that is hazardous if the equipment is improperly disassembled.

Caution: This equipment is extremely sensitive and is susceptible to damage caused by electrostatic discharge (ESD). ESD is an electrical discharge caused by the build-up of electrostatic potential on clothing and other materials. You must use proper measures.

Follow these ESD measures:

- Connect a ground strap to your wrist when installing and removing peripherals.
- Be sure that you and all of the electrical equipment that you handle during this installation remain at a ground potential of zero to avoid damage from ESD.
- Remove a board from its antistatic bag only when you are properly grounded with a ground strap, and only when you are working on the board or installing it.
- Do not use an ohmmeter on a board.

Typographical Conventions

These type conventions and symbols are used throughout this guide:

<i>Italics</i>	Filenames, variables, IRIX command arguments, command flags, titles of publications, icon names.
Screen type	Code examples, file excerpts, and screen displays (including error messages).
Bold Screen type	User input.
(Parentheses)	Following IRIX commands, they surround the reference page (man page) section where the command is described.
[Brackets]	Surrounding optional syntax statement arguments.
#	IRIX shell prompt for the superuser (<i>root</i>).

Chapter 1

Features of the Array

This chapter provides a top-level overview of the array hardware and software and also describes the array features and available configurations.

Note: The Array 3.0 software release requires IRIX 6.2 or later.

Unless otherwise stated, the term *array* refers to a homogeneous or heterogeneous array with Origin2000, Onyx2, Challenge, or POWER Challenge servers, including the POWER CHALLENGEarray, the POWER CHALLENGEarray 10000, or the CHALLENGE DataArray.

The array (see Figure 1-1) is a flexible, scalable platform for extreme-performance interactive supercomputing.

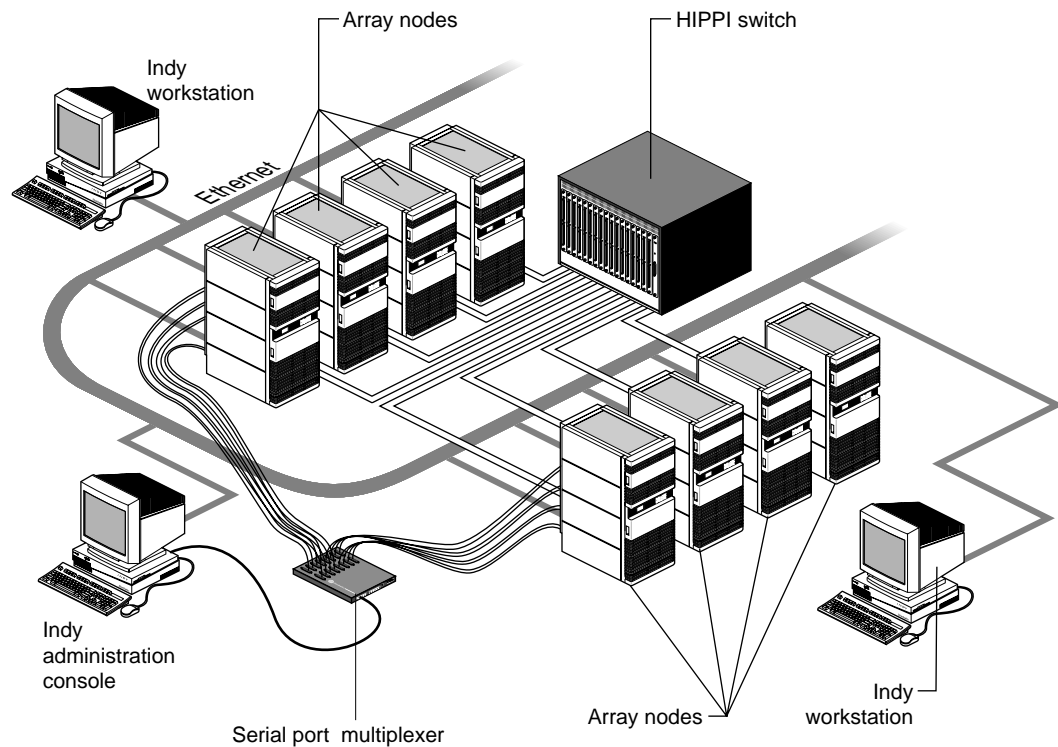


Figure 1-1 Example Array Configuration With Maximum of Eight Nodes

The array

- serves as a network of powerful symmetric multiprocessing (SMP) computer servers or workstations for general-purpose mission-critical applications in production and research environments
- provides a highly scalable supercomputing configuration accommodating from two CPU boards (in the minimum two-node setup) to 72 or 128 CPU boards (for example, for eight POWER CHALLENGE XLs or Origin2000, respectively)
- provides up to four 100 MB/sec HIPPI interconnects between systems, using high-bandwidth performance HIPPI networking for efficient and rapid movement of large amounts of data between nodes in the array

The HIPPI driver appears as a single virtual HIPPI to applications, providing applications with a fault-tolerant and higher bandwidth internode communications path.

- supports up to 128 GB main memory (Challenge-only arrays) or up to 32 Scalable Shared Memory Multiprocessing (S2MP) and Symmetric Multiprocessing (SMP) systems (Origin2000/Onyx2-only arrays)
- provides up to 1.2 GB/sec I/O bandwidth (Challenge-only arrays) or up to 20GB/sec sustained I/O bandwidth (Origin2000/Onyx2-only arrays)
- provides single-point system administration
- includes enhanced communications and process management software, sophisticated development and administration tools, and power 3D graphics

1.1 Constructing an Array

The array is fundamentally a collection of Origin2000, Onyx2, POWER CHALLENGE, or POWER Onyx servers, bound together with a high-performance network and layered software.

Chapter 4 details the installation process of the array. As the array is installed, it evolves through various stages of functionality; each stage can be independently tested. The stages include

- single isolated server with hardware tested (base node)
- single server operating on local area network (LAN node)
- single server operating on HIPPI network (HIPPI node)
- fully operational array (array node)

1.1.1 Array Hardware

The array (see Figure 1-1) consists of two to eight systems, each called an array node. The array nodes are interconnected by a high-performance parallel HIPPI network and a conventional local area network, for data sharing between array nodes. An Indy or O2

workstation equipped with IRISconsole software and multiplexer provides for centralized control and administration of the array nodes.

The array contains the following hardware:

- two to eight array nodes: Origin2000/Onyx2, Challenge/POWER Challenge, Onyx/POWER Onyx SMP servers (individually known as array nodes)
Note: A POWER Challenge system can be optionally equipped with Extreme™ Graphics visualization consoles or RealityEngine2™ graphics heads
- one to four bidirectional HIPPI network interfaces per array node
- one Multi-Port HIPPI switch (optional for dual-node arrays)
- one IRISconsole as an administration console, consisting of Indy or O2 workstation running IRISconsole 1.2 software (or later), an ST-1616 serial port multiplexer, and cabling

The following systems are supported in an array configuration:

- Origin2000 deskside and rackmount systems (with between one and 32 R10000™ CPUs)
- Onyx2 deskside and rackmount systems
- Challenge DM, L, or XL (with R4400® or R10000 CPUs)
- POWER Challenge L or XL (with R8000® or R10000 CPUs)
- Onyx deskside or rackmount systems (with R4400 or R10000 CPUs)
- POWER Onyx deskside or rackmount systems (with R8000 or R10000 CPUs)

Caution: To upgrade an existing HIPPI switch that has parallel switch cards for Challenge, you must replace the existing parallel cards with a serial card (fiber optic interface) in order for the HIPPI switch to work with Origin2000/Onyx2 nodes.

1.1.2 Array Software Components

The array software binds the computation and communication hardware into a powerful supercomputing platform. It consists of base and optional packages. Base array software includes

- IRIX 6.2 or later symmetric multiprocessing operating system
- XFS™ high-performance, extreme-capacity, journaled filesystem
- NFS® (Network File system)
- HIPPI high-performance networking software
- Array services array management software
- IRISconsole centralized server administration software
- MPI (message-passing interface) communication software
- PVM (parallel virtual machine) communication software

- array diagnostics
- array gifts

For a complete description of the available array software packages, see *Getting Started With the Array* (p/n 007-3058-xxx).

1.1.3 Parallel Processing Strategy

A principal use of an array system is to run jobs that are large enough to span two or more servers. To help accomplish this task, the array uses Array Services software to monitor and manipulate jobs (programs) running across several nodes of the array. Message passing libraries such as the message passing interface (MPI) and parallel virtual machine (PVM) allow the nodes to interact and send messages to one another.

The array implements these three major parallel processing methods for maximized performance:

- Multiple CPUs (IP19, 1P21, IP25, or IP27) so that appropriate tasks can be automatically time-sliced among available processors.
- Threaded execution in which applications can be parallelized into alternating sections of serial and parallel tasks. When the application comes to a parallel segment, it splits into a number of threads that execute various portions of the parallel segment at the same time. At the end of the parallel segment is a barrier at which the threads are collected together until all are finished executing, at which time the execution of the next serial segment begins.
- Message-passing facilities such as PVM and MPI, which use internode communication to implement parallelism within the application. PVM and MPI are both industry-standard libraries for sending “messages” (which are chunks of data with a message “type” added) between nodes. The idea is to start a group of programs on different systems, and have them interact by sending “messages” to one another.

1.1.4 Array Services Software

The array services software has the primary task of administering and managing the array and also performs several other duties:

- It knows the current array configuration and can provide that information to other commands and programs in the array.
- It can determine which processes belong to a particular array session and provide that information to other commands and programs.
- It can display the load, process, and indicate the users on all the nodes of an array.
- It can forward commands to all of the systems in an array.

The IRISconsole consists of an O2 or Indy workstation and the Serial Port Multiplexer. It provides a central array system administration station with a graphical user interface (GUI). The IRISconsole allows the system administrator to set up and administer array

nodes. Once the nodes are connected to the Serial Port Multiplexer and workstation, you can use the IRISconsole GUI to:

- set up, add, or delete the systems in a site
- for Challenge systems, view real-time graphs of hardware operating statistics, such as voltage, operating temperature, and blower RPM, of a system in a site
- for Challenge systems, set a threshold for operating statistics so that an alarm is activated when the threshold is reached
- take control of a system by obtaining exclusive access to its console
- reset individual nodes of the array

The *IRISconsole Administrator's Guide* (007-2872-xxx) explains how to set up and administer sites.

1.2 Product Configurations

This section describes the available configurations of the array and minimum system requirements.

1.2.1 Base Configurations

The array comes in the following standard configurations:

- a two-node system without a HIPPI router switch (see Figure 1-2 for an example)
- a two-node system with a HIPPI router switch (see Figure 1-3 for an example)
- a four-node system with a HIPPI router switch (see Figure 1-4 for an example)
- an eight-node system with a HIPPI router switch (see Figure 1-5 for an example)

Note: The rack systems have twice as many HIPPI connections as shown in the following figures.

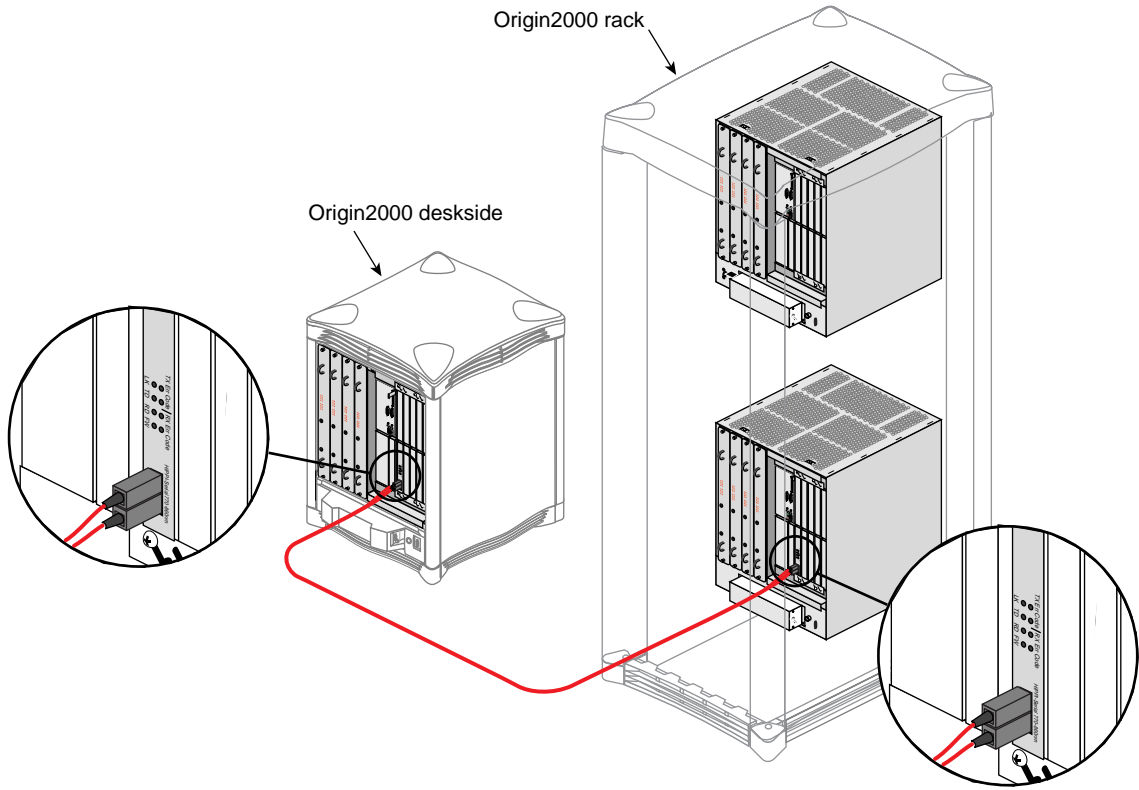


Figure 1-2 Two-Node Configuration (No HIPPI Switch)

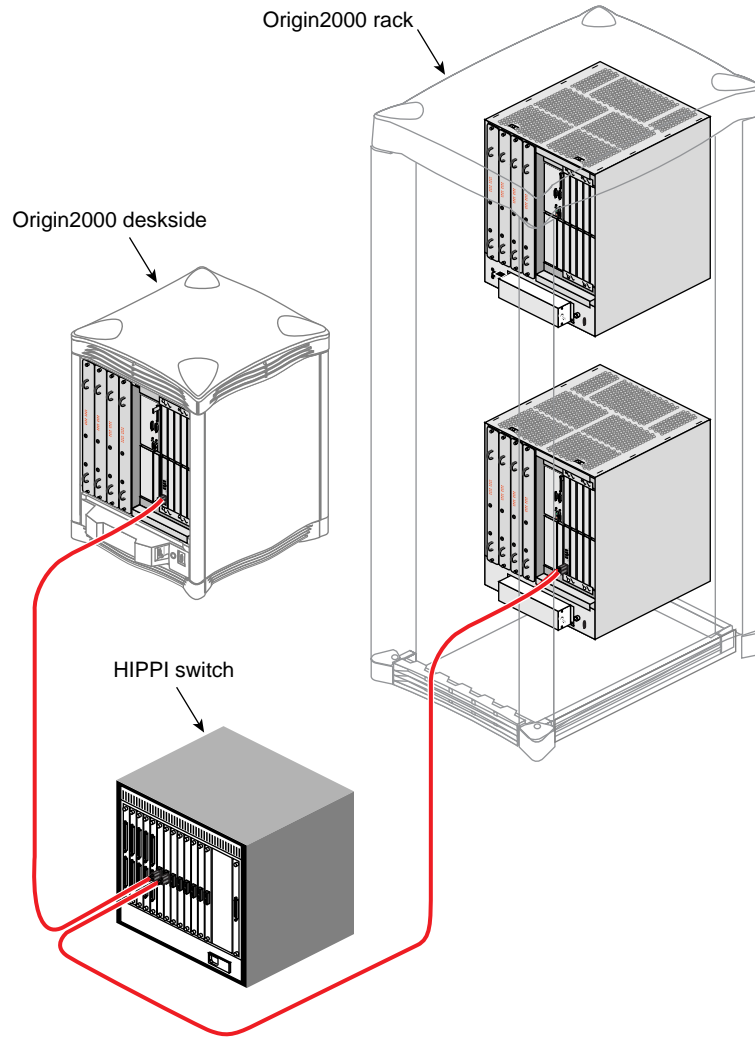


Figure 1-3 Two-Node Configuration With HIPPI Switch

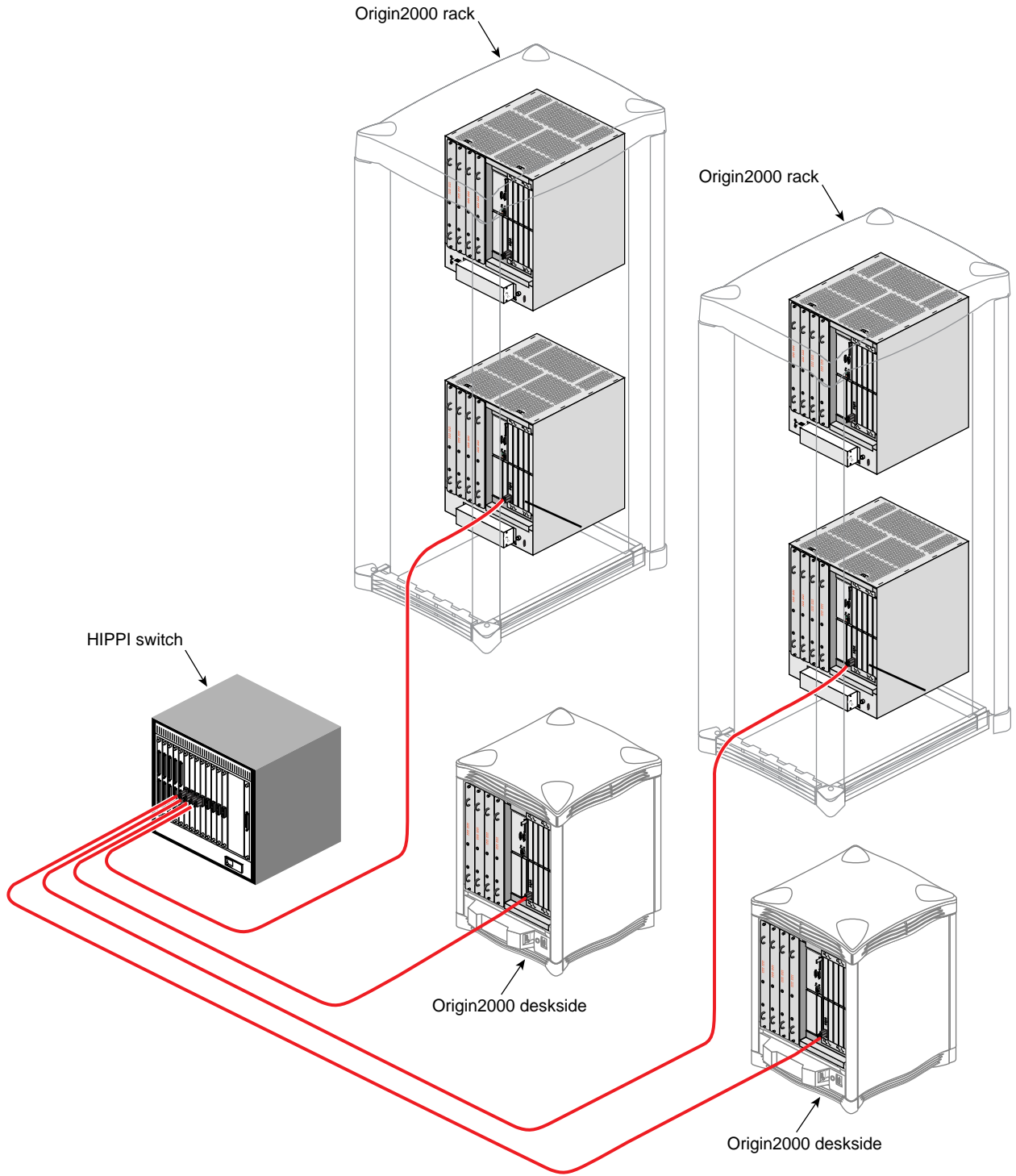


Figure 1-4 Four-Node Configuration With HIPPI Switch

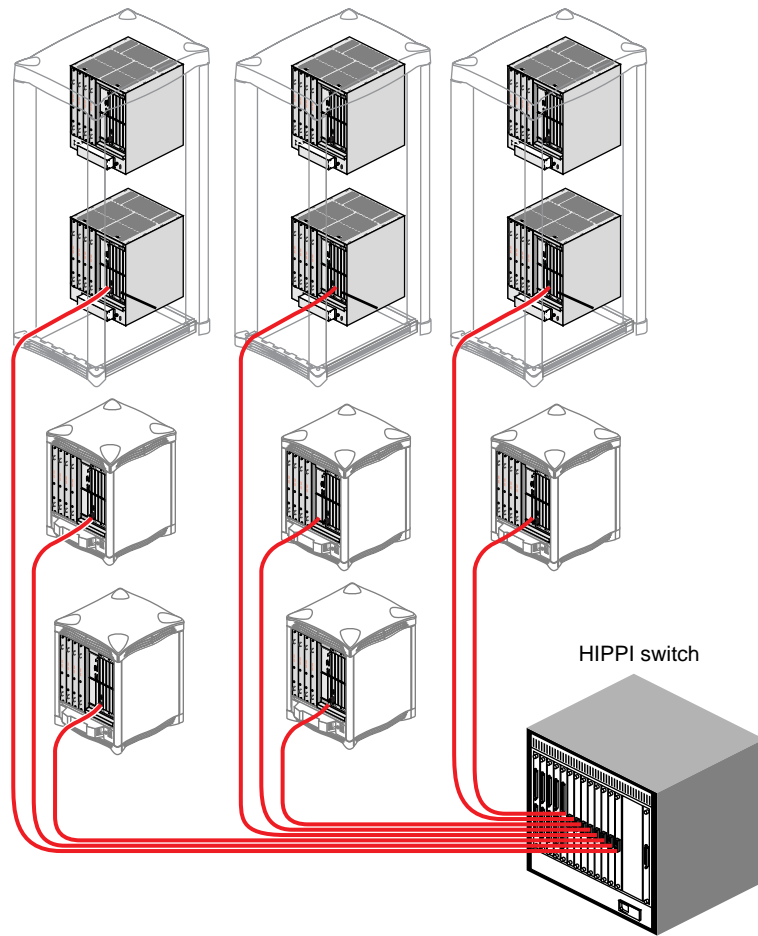


Figure 1-5 Eight-Node Configuration With HIPPI Switch

1.2.2 Array Hardware Configuration

Prepackaged rackmount array node systems ship from Silicon Graphics with the hardware configuration shown in Table 1-1.

Table 1-1 Prepackaged Array System Components

Component	Origin2000/Onyx2 Deskside	Origin2000/Onyx2 Rackmount	Challenge/Onyx Deskside	Challenge/Onyx Rackmount
CPU boards	4 or fewer	16 or fewer	Challenge: 3 or fewer Onyx: one	4
Processors	8 or fewer	32 or fewer	4, on two IP21 boards	
Main memory	16 GB	64 MB to 64GB (using 16 Node boards)	512 MB	2 GB

Table 1-1 Prepackaged Array System Components

Component	Origin2000/Onyx2 Deskside	Origin2000/Onyx2 Rackmount	Challenge/Onyx Deskside	Challenge/Onyx Rackmount
Main memory interleaving			Two-way	Eight-way
System disk	Varies	Varies	4-GB	4-GB
Additional drives	Four 9-GB	Four 9-GB	One 4-GB	One 4-GB
HIPPI boards	HIPPI: Serial XIO	HIPPI: Serial XIO	HIPPI HIO	HIPPI HIO
I/O boards	One IO6 or IO6G	One IO6 or IO6G per module	Challenge: one-three IO4 Onyx: one IO4	Two IO4

1.3 Upgrading Existing Systems to Array Nodes

It is possible to convert existing systems in the field into an array, as long as the systems meet the recommended hardware configuration guidelines. For example, the array should consist of two, four, or eight array nodes. In addition, it is recommended that all the nodes in the array be of the same system type.

The HIPPI switch for Challenge servers has a parallel card only and copper cabling; the Origin2000 server requires a serial card and fiber optic cabling. You can use the same HIPPI switch for Origin2000 servers as Challenge servers as long as you replace the parallel switch card with a new serial switch card. Installing the HIPPI board is explained in the *IRIS HIPPI Installation Instructions* (108-0106-003 or later; Challenge) or *IRIS HIPPI-Serial XIO Board Installation Instructions* (108-0160-001 or later; Origin2000/Onyx2).

It is recommended that the nodes in an array be balanced; that is, each node should have roughly the same amount of memory, the same number of processors, and the same amount of disk space.

Chapter 2

Installation Planning and Site Preparation

This chapter describes the activities required to prepare for the arrival and installation of the array. The information presented here is intended to augment the *Site Preparation for Origin Family and Onyx2* (007-3452-002) and the *CHALLENGE/Onyx Site Preparation Guide* (108-7040-xxx).

The array consists of the following major hardware components:

- rackmount or deskside systems
- O2 or Indy workstation
- ST-1616 Serial Port Multiplexer (SPM)
- multiport HIPPI switch

This chapter provides site preparation information primarily for the various array configurations, as well as the O2 or Indy, the SPM, and the HIPPI switch. The *Site Preparation for Origin Family and Onyx* and the *CHALLENGE/Onyx Site Preparation Guide* do not cover these array components. This chapter also covers site preparatory information for the array nodes, but only as it relates to the array.

This chapter explains

- setting customer expectations
- SSE preparation
- site preparation general guidelines
- raised-floor and floor-loading considerations
- space requirements for nodes
- space requirements for other array components
- space requirements for array configurations
- environmental requirements
- array power requirements
- preparing to receive the array

For complete site preparation and planning information on the array node systems, consult the site preparation manuals mentioned above and the installation guides for the pertinent servers.

2.1 Setting Customer Expectations

Due to the number of hardware and software components that make up an array, the installation is significantly more complex and different from other Silicon Graphics products. As a result, managing customer expectations for the installation becomes a key factor towards assuring a successful array bring-up process. Significant issues regarding the customer expectations and the installation are as follows:

- The array is a high-profile and important product for the customer due to the cost. Identify the array decision makers in the customers' organization, and involve them in the planning and naming of the array and nodes.
- Unlike the installation of a complex network of workstations and servers, where individual nodes coming online signal progress, an array may not provide the customer needed functionality until the installation is complete. Be sure to let the customer know about this condition.

2.2 SSE Preparation

This section includes preinstallation information for SSEs.

2.2.1 Number of SSEs and Prerequisite Knowledge

It is recommended that two SSEs perform the installation. More than two can be involved in the bring-up process. However, the following situations may occur:

- There may not be enough installation activities to keep more than two SSEs continually occupied during the array bring-up. The additional SSEs must then observe rather than participate in the installation.
- Depending on the size of the installation site, there may not be enough room for more than two SSEs to work efficiently or effectively during the array bring-up.

It is also recommended least one of the SSEs have a strong background in HIPPI installation, configuration, and network administration. This helps to assure an efficient and timely installation.

2.2.2 SSE Planning Guidelines

The following steps are suggested as a guide for the installation planning process:

1. Read and study related materials (see "Related Documents" on page xii). You can expect that product information may change and evolve significantly in future releases.
2. Contact other SSEs who have installed an array for tips and warnings. Also check the array Web pages; see "Related Documents" on page xii for the Web locations.
3. If possible, schedule a dry run of the installation to familiarize yourself with the procedures and prepare yourself for the next step.

4. Meet with the customer to develop an installation plan. See Table 2-1 and Section 3.1, “Before You Begin Installation,” for pointers on how to develop a plan. This helps to get the customer oriented to the process as well as to make decisions that affect the efficiency and success of the installation effort. Decisions regarding node names, network addresses, and so on should be mapped out in detail as a part of the meeting. It is amazing how much time and trouble such seemingly trivial details can cost.

Once you have developed an installation plan, set up the array site, and received, uncrated, and positioned the hardware components in their approximate locations, the actual installation (cabling, booting, software installation, configuration, and testing) takes at least 12 hours to complete.

2.3 Site Preparation General Guidelines

Because of the number of hardware components involved, planning for an array configuration is very involved. Be sure to perform the tasks in Table 2-1 and pay particular attention to the special array setup activities that are called out.

Some sites require specialized knowledge to plan and install services such as power and safety equipment. Always follow local and regional codes and recommendations while performing activities under regulation. When using consultants, verify that they are licensed and knowledgeable about local regulations.

Site preparation also involves thinking about the future. As configurations grow, site requirements change. While planning a site, consider how and when a site will need modification, and plan accordingly.

To minimize mistakes and unforeseen situations for complex sites, assign one person as a coordinator to read this guide and assign tasks. Table 2-1 is only a guideline and cannot cover all circumstances involved in site preparation. Also, many activities are interdependent and involve compromises. After the coordinator evaluates the dependencies and compromises, this guide can be divided among several people so that activities can be performed at the same time.

Start with the activities that take the longest time. Pay particular attention to activities that involve dependency on others, such as having an electrician install power circuits.

When you have completed the activities outlined in Table 2-1, the site is prepared and is ready to receive the system. To proceed, read Section 2.6, “Preparing to Receive the Array,” then continue to the installation instructions provided for the system. See the “Introduction,” for a list of related documents.

Table 2-1 Site Preparation Checklist

Activity	Date Completed	Notes
Prepare to receive shipment	__/__/__	
Required tools	__/__/__	
Size and weight of shipping cartons	__/__/__	
Assistance for moving large objects	__/__/__	
Prepare physical location	__/__/__	
System chassis	__/__/__	
Raised floors - highly recommended for array configuration	__/__/__	
O2 or Indy workstation and Serial Port Multiplexer (IRISconsole) location. Note: It is recommended that these be placed on a desk or table.	__/__/__	
Local devices: monitor, keyboard, mouse	__/__/__	
Expansion chassis	__/__/__	
Multi-Port HIPPI switch	__/__/__	
Upgrade HIPPI switch for Origin2000/Onyx2, if necessary	__/__/__	
Check environmental conditions	__/__/__	
Air conditioning	__/__/__	
Electrical interference (EMI, ESD)	__/__/__	
Vibration	__/__/__	
Acoustics	__/__/__	
Site safety	__/__/__	
Install power	__/__/__	
Determine power requirements	__/__/__	
Install power circuits	__/__/__	
Install safety and protection equipment	__/__/__	
Prepare cabling for local devices	__/__/__	
Monitors	__/__/__	
Terminals	__/__/__	
Input devices	__/__/__	

Table 2-1 (continued) Site Preparation Checklist

Activity	Date Completed	Notes
Serial devices	__/__/__	
Parallel devices	__/__/__	
Networks (Ethernet and HIPPI)	__/__/__	
Printers	__/__/__	
Modems	__/__/__	
HIPPI cables	__/__/__	
Obtain IP addresses and serial numbers	__/__/__	
HIPPI addresses	__/__/__	
Ethernet address	__/__/__	
Host names for systems	__/__/__	
System serial numbers	__/__/__	
Label Cables	__/__/__	
Label networking and other cables	__/__/__	
For Origin2000 systems, label Craylink™ cables with numbers that can be matched up later	__/__/__	

2.4 Raised-Floor and Floor-Loading Considerations

It is highly recommended that an array be installed in a raised-floor room, because of the thick HIPPI cables if parallel HIPPI is used, or because of the mechanical durability if HIPPI serial is used.

Note: For parallel HIPPI, the cutouts in the floor should be large enough to accommodate HIPPI cable pairs. HIPPI cables are heavy; a pair weighs approximately 23 lbs (10.4 kg).

For installations on raised floors, check that the construction can properly support the distribution of the weight. Origin2000/Onyx2 rack systems use four casters or four stabilizing levelers that distribute the weight load to the site floor. See Figure 2-4 for the caster and leveler locations. If a floor has been modified, such as by cutting new access panels in computer-floor tiles, determine if additional reinforcement is required.

Note: Origin2000/Onyx2 rack systems are very heavy, and some sites do not have a floor-load rating capable of handling them.

Table 2-2 gives floor loads for various servers.

Table 2-2 Floor Loads for Servers

Server	Chassis Configuration	Floor Loading
Origin2000 deskside	Minimum	36 lb/ft ² (175 kg/m ²)
	Maximum	51 lb/ft ² (250 kg/m ²)
Origin2000 rackmount	Minimum	38 lb/ft ² (185 kg/m ²)
	Maximum	95 lb/ft ² (466 kg/m ²)
Challenge deskside	Minimum	36 lb/ft ² (175 kg/m ²)
	Maximum	51 lb/ft ² (250 kg/m ²)
Challenge rackmount	Minimum	62 lb/ft ² (249 kg/m ²)
	Maximum	133 lb/ft ² (533 kg/m ²)

2.5 Space Requirements for Nodes

Using the clearance guidelines in this section, select a location that allows proper airflow, cabling, routine activities, and maintenance. As a general rule, use these guidelines to ensure the best system performance. All systems include thermal overrides to prevent damage caused by excessive heat, but an improperly positioned system leads to unnecessary service calls and system downtime.

Every location and system is different, requiring flexibility during installation. This section provides minimum space guidelines for a fully loaded system.

- systems that are not fully configured, depending on the number and type of devices installed in the chassis
- Silicon Graphics systems arranged next to each other

The final test for any system is actual operation, and some adjustments may be required after initial installation.

This section explains

- Origin2000 deskside space requirements
- Origin2000 rackmount space requirements
- Challenge deskside space requirements
- Challenge rackmount space requirements

2.5.1 Origin2000 Deskside Space Requirements

Table 2-3 summarizes the physical characteristics of the Origin2000 base module.

Table 2-3 Origin2000 Deskside Physical Specifications

Parameter		Value
Dimensions		
With skins	length	24" (61 cm)
	width	20" (50.8 cm)
	height	26.5" (67.3 cm)
Without skins	length	19" (48.3 cm)
	width	17.75" (45.1 cm)
	height	24" (61 cm)
Shipping	length	31.5" (80 cm)
	width	24" (61 cm)
	height	41" (104.1 cm)
Weight	minimum	120 lbs (54.4 kg)
	maximum	170 lbs (77 kg)
	shipping (max.)	190 lbs (86.2 kg)

Table 2-4 lists the minimum clearances for airflow to the Origin2000/Onyx2 deskside chassis. The clearances are listed in two groups: The first group applies if the chassis has 6" or less of unobstructed air space above it. The second group applies if the chassis has more than 6" of unobstructed air space above it.

Table 2-4 Origin2000 Deskside Minimum Airflow Clearances

Unobstructed Air Space	Top Clearance	Side	Front	Back
Less than 6" (15 cm)	6" (15 cm) or less	6" (15 cm)	8" (20 cm)	8" (20 cm)
More than 6" (15 cm)	More than 6" (15 cm)	1" (2.5 cm)	8" (20 cm)	6" (15 cm)

Figure 2-1 shows the approximate caster positions for the Origin2000 and Onyx2 base module. Ensure that these do not present a problem at the intended site.

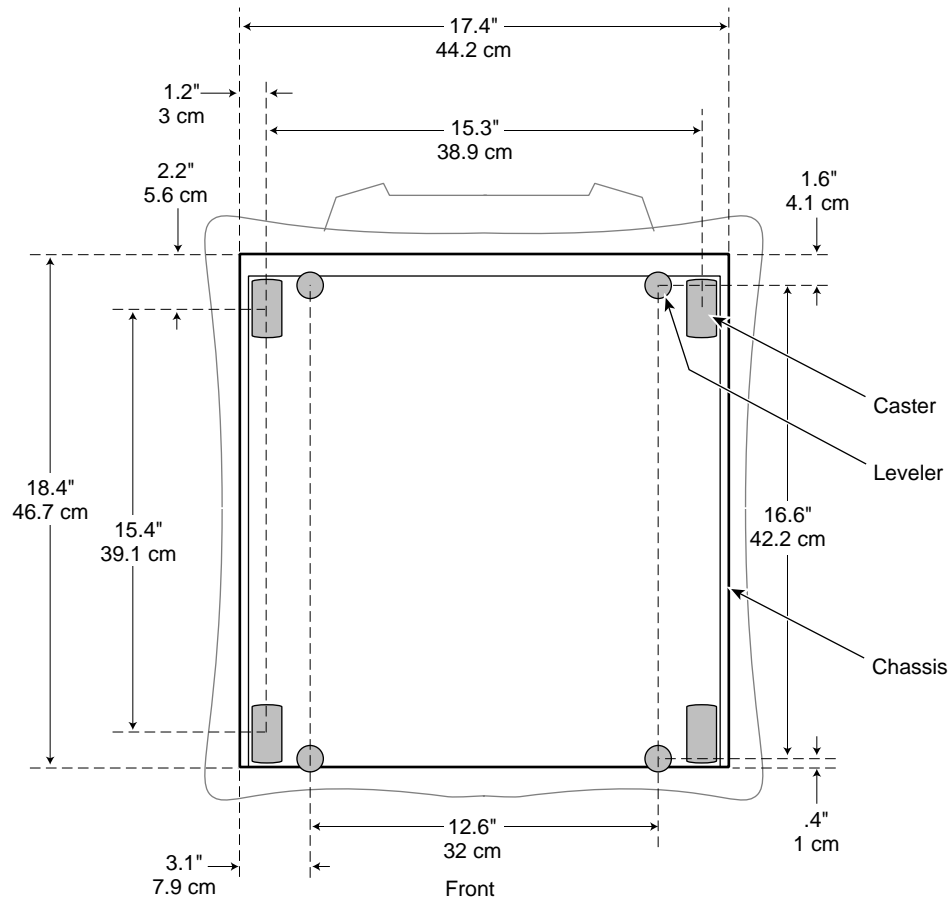


Figure 2-1 Origin2000 and Onyx2 Deskside Caster Positions

Plan to position the chassis so that it receives proper air circulation. Figure 2-2 illustrates the airflow path through the Origin2000 and Onyx2 deskside chassis. It is important that nothing block the areas shown by arrows. Origin2000 and Onyx2 systems are designed for use in typical office computing environments: the air temperature should not fluctuate dramatically, air should circulate freely, and the location should be relatively dust-free.

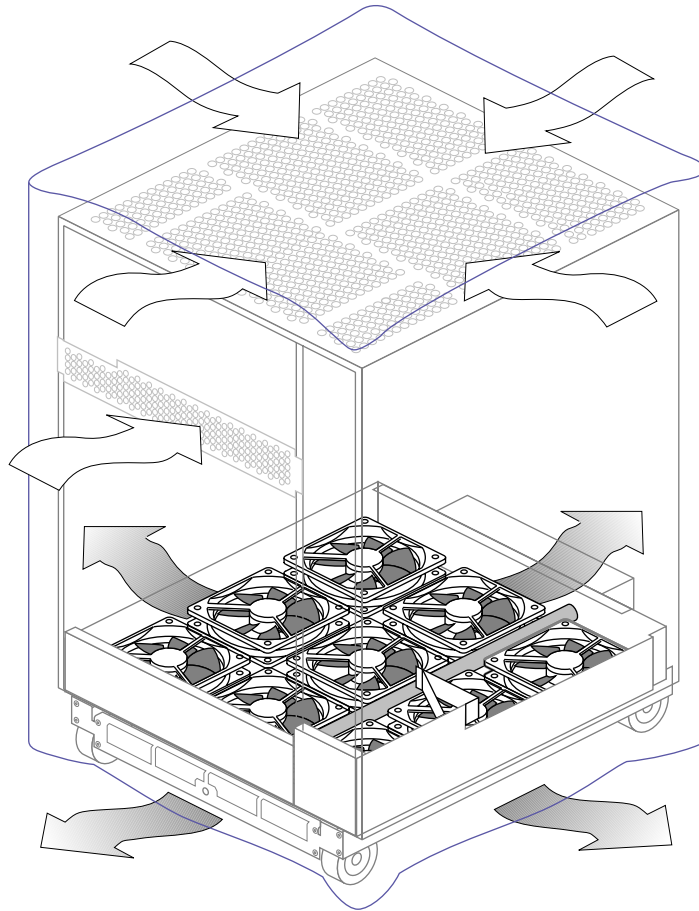


Figure 2-2 Origin2000 and Onyx2 Deskside Airflow

Ensure that the floor-load rating of the intended site meets the requirements for the system in question, as explained in “Raised-Floor and Floor-Loading Considerations.”

Caution: Do not plan to place more than 25 pounds (11.5 kg) on top of an Origin2000 or Onyx2 deskside chassis. Though there is no airflow through the top, it is not designed to support heavy loads.

2.5.2 Origin2000/Onyx2 Rackmount Space Requirements

Table 2-5 lists the physical characteristics of the Origin2000/Onyx2 rack chassis.

Table 2-5 Origin2000/Onyx2 Rackmount Physical Specifications

Parameter		Value
Dimensions		
Installed	length	39" (99 cm)
	width	29" (74 cm)
	height	73" (185 cm)
Shipping	length	81" (206 cm)
	width	47" (120 cm)
	height	49" (125 cm)
Weight	minimum (empty rack)	300 lbs (136 kg)
	maximum (full rack)	750 lbs (340 kg)
	shipping (maximum)	900 lbs (408 kg)

Table 2-6 lists the minimum clearances for airflow to the Origin2000/Onyx2 rackmount chassis.

Table 2-6 Origin2000/Onyx2 Airflow

Direction	Value
Top	12" (30.5 cm)
Side	12" (30.5 cm)
Front	36" (91.5 cm)
Rear	36" (91.5 cm)

Note: In Origin2000/Onyx2 multirack configurations, up to four racks can be placed directly beside each other. Remove the side panels, except for the left panel of the rack on the left end and the right panel of the rack on the right end (that is, the outside panels of the entire group). In these configurations, you must install ground straps between the racks. See Chapter 8 of *Site Preparation for O2, OCTANE, Origin Family, and Onyx2* (007-3452-002) or Chapter 6 of the *Origin2000 and Onyx23 Deskside and Rackmount Installation Instructions*.

An Origin2000/Onyx2 rack system requires enough space for the front doors to open, for the cable cover to swing to the side of the chassis, and for a base module to be lifted into place and mounted in the rack. It is also important that there be room to access the rear of the system, since most of the cables are routed to the back of the chassis.

Installing and removing base modules requires at least three feet of space at the rear of the system, or it should be possible to move the system to make space.

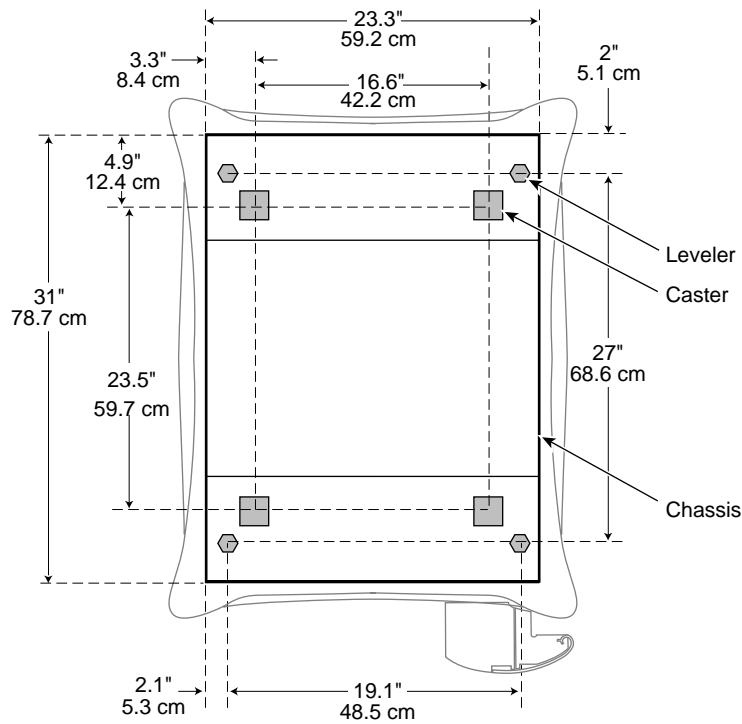


Figure 2-4 Origin2000 Rack Chassis Caster (Shaded Squares) and Leveler (Shaded Hexagons) Locations

Position the chassis so that it receives proper air circulation. As shown in Figure 2-5, the airflow in the rack systems is in from the front and top, and out the back. An ideal location provides cool air near the chassis air-intake vents and removes warm air from the area of the chassis air outlets.

Origin2000 and Onyx2 systems are designed for use in typical office computing environments: the air temperature should not fluctuate dramatically, air should circulate freely, and the location should be relatively dust free.

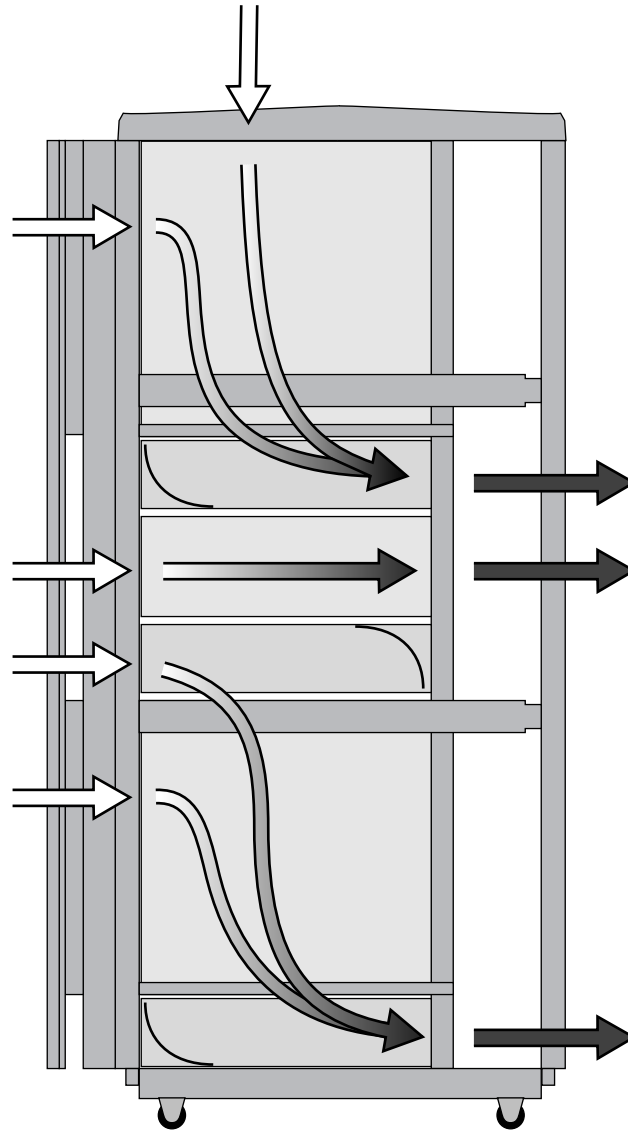


Figure 2-5 Origin2000 Rack Chassis Airflow

At the bottom rear of the Origin2000/Onyx2 rack chassis is an opening through which cables may be routed. Figure 2-6 shows the dimensions of the opening and its location relative to the edges of the chassis.

In installations with raised floors, it may be desirable to have a matching hole in the tile below the cutout. Important precautions are as follows.

- Make sure that the edges of any such hole are not sharp or rough, and will not damage the cables.
- Be careful that the hole in the tile does not reduce the strength of the raised floor.
- Since the casters are very close to the cutout, ensure that none of the casters fall into the hole, potentially causing the system to tip.

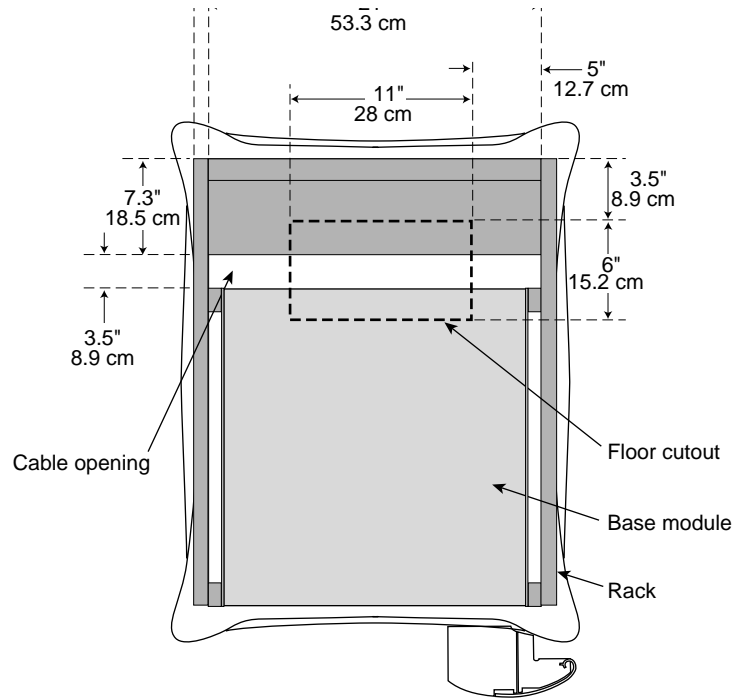


Figure 2-6 Origin2000/Onyx2 Rack Chassis Cable Opening

2.5.3 Challenge Deskside Space Requirements

To determine the minimum space requirements for a chassis, add the chassis dimensions shown in Figure 2-7 and the appropriate clearances shown in Table 2-8.

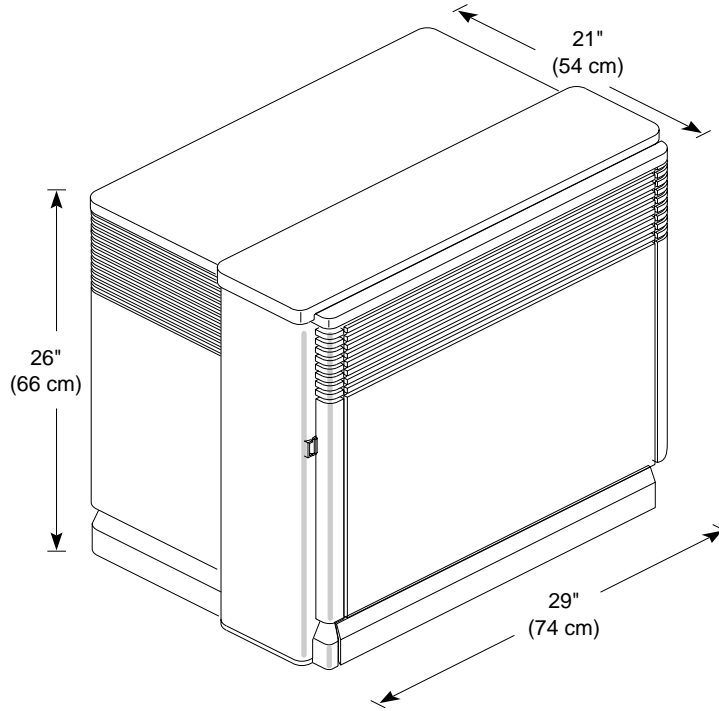


Figure 2-7 Challenge Deskside Chassis Dimensions

Table 2-7 summarizes Challenge deskside physical specifications.

Table 2-7 Challenge Deskside Physical Specifications

Parameter	Value
Dimensions, chassis	
Height	26" (66 cm)
Width	21" (53.3 cm)
Depth	29" (73.7 cm)
Dimensions, shipping	
Height	37" (94 cm)
Width	32" (81.3 cm)
Depth	42" (107 cm)
Weight	
Minimum	195 lbs (88.5 kg)

Table 2-7 (continued) Challenge Deskside Physical Specifications

Parameter	Value
Maximum	300 lbs (136 kg)
Shipping	325 lbs (147 kg)

Table 2-8 gives airflow clearances for the Challenge deskside server.

Table 2-8 Challenge Deskside Airflow Clearances

Top Clearance	Left Side*	Right Side ^a	Front	Back
More than 6"	3" (8 cm)	≥ 6" (15 cm)	≥ 6" (15 cm)	≥ 6" (15 cm)
Less than 6"	6" (15 cm)	≥ 10" (25 cm)	≥ 8" (20 cm)	≥ 8" (20 cm)

*. As viewed from the front of the chassis

The different clearances are based on the airflow requirements of the chassis. If the top of the chassis is unobstructed, less clearance is required on the sides and back. If the top of the chassis is obstructed, however, the sides and back of the chassis must compensate for the smaller air exhaust path. Figure 2-8 shows the airflow path of the chassis.

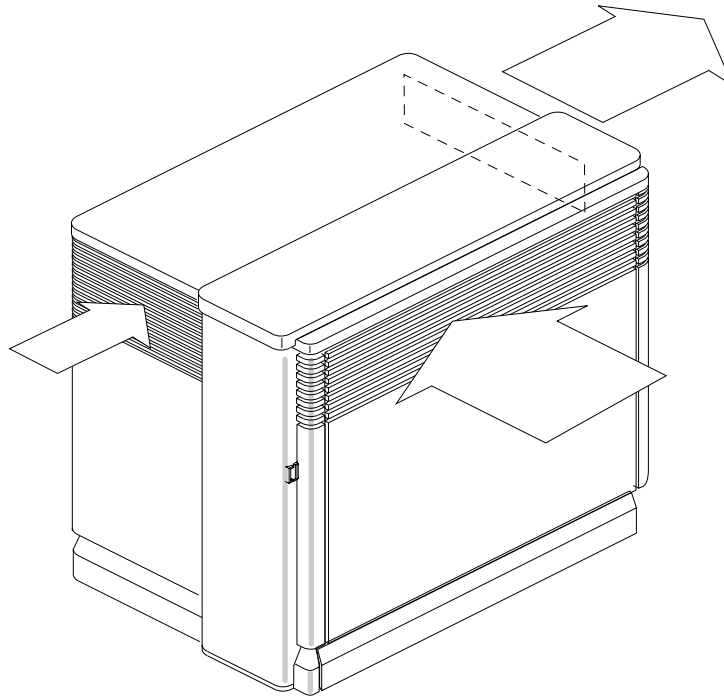


Figure 2-8 Challenge Deskside Chassis Airflow

Additional space is required to service the chassis, such as connecting or disconnecting cables and changing internal drives, boards, and other components. Be sure to allow sufficient space either in front of or behind the chassis to facilitate future installation, service, and cabling activities.

The chassis includes wheels for easier front-to-back movement. See Figure 2-9 for the wheel locations. You can fix the wheels in place by using the chassis levelers or by using a wheel chock (Silicon Graphics part number 040-0220-001).

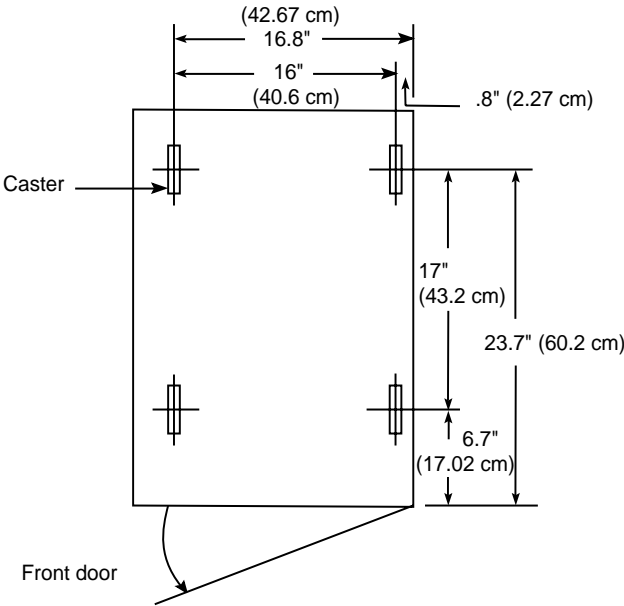


Figure 2-9 Deskside Wheel Locations (Bottom View)

2.5.4 Challenge Rackmount Space Requirements

Table 2-9 summarizes Challenge rackmount physical specifications.

Table 2-9 Rackmount Physical Specifications

Parameter	Value
Dimensions, chassis	
Height	62.3" (159 cm)
Width	27" (69 cm)
Depth	48" (122 cm)
Dimensions, shipping	
Height	74.5" (189 cm)
Width	46" (117 cm)
Depth	59.5" (151 cm)
Weight	
Minimum	560 lbs (254 kg)
Maximum	1,200 lbs (544 kg)

Table 2-9 (continued) Rackmount Physical Specifications

Parameter	Value
Shipping	1,500 lbs (680 kg)
Cardcage dimensions (2 and 3)	
Height	15" (38 cm)
Width	17.345" (44 cm)
Depth	19" (48.3 cm)

Provide an appropriate location for a rackmount chassis, with clearance for the front and rear cabinet doors in their fully opened positions. The chassis requires minimal side clearances because most of the airflow and servicing is through the front, rear, and top of the chassis. Side access is required to

- remove and install a midplane
- remove and install a SCSI box (Challenge or POWER Challenge or Origin vault (Origin2000, Onyx2))

For activities requiring side access, determine if the chassis can be rolled forward or backward to provide adequate side clearance. If an installation is semipermanent, such as at sites with chassis bolted directly to the floor to prevent movement, allow a total width of 96 inches (244 cm). Use the dimensions shown in Figure 2-10 for rackmount chassis clearance.

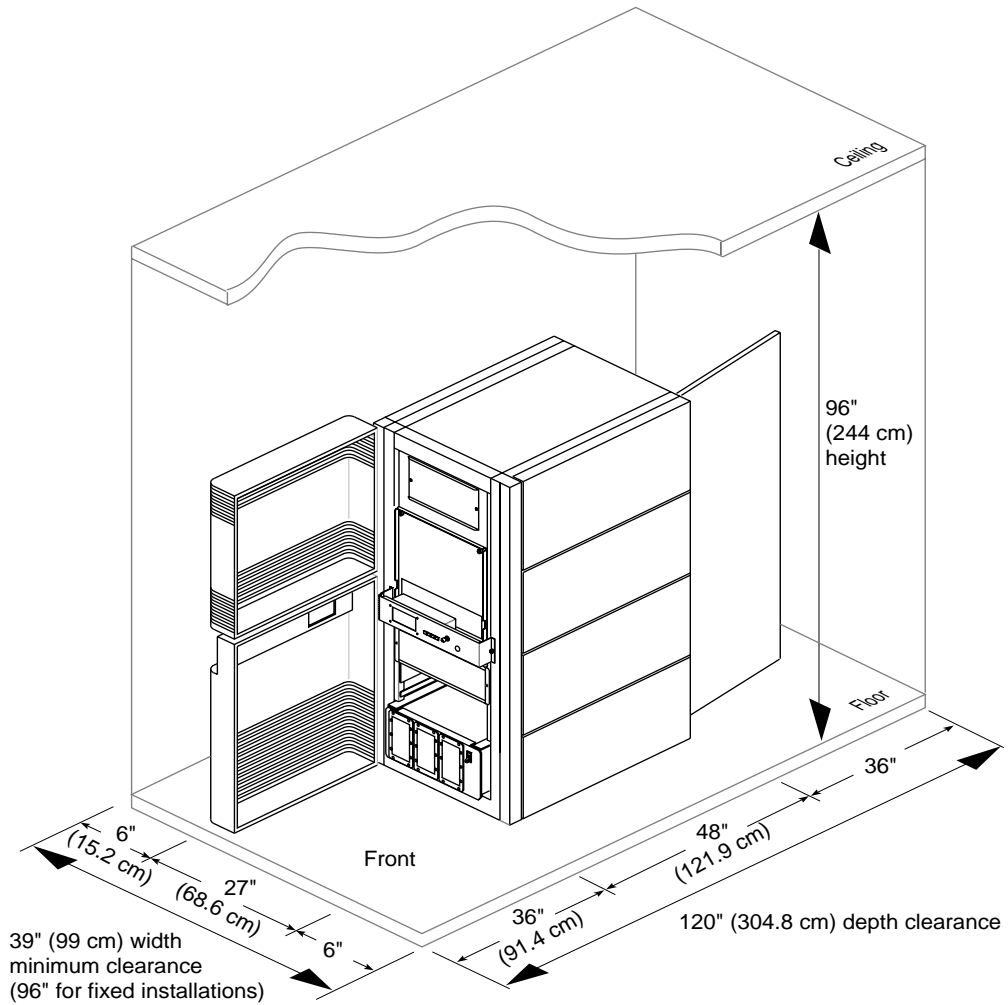


Figure 2-10 Rackmount Chassis Clearance

Position the chassis so that it receives proper air circulation. See Figure 2-11 for the airflow through the chassis. An ideal location provides cool air near the chassis air intake vents and warm air removal near the chassis air outlets. Air temperature should not fluctuate dramatically, and the air should circulate freely.

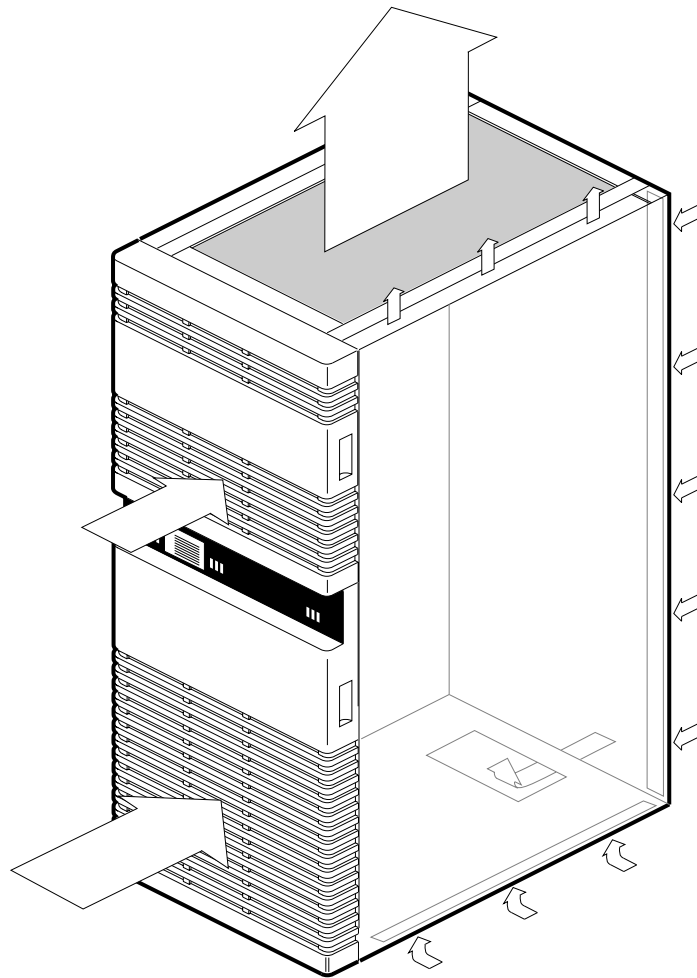


Figure 2-11 Challenge Rackmount Chassis Airflow

Note: Keep the top of the chassis clear of any obstruction. The top of the chassis is the primary air venting surface and is not structurally designed to hold weight.

Compare the floor-load rating of the site with the values listed in Table 2-10. Some site floor-load ratings are as low as 100 lb/ft². To ensure that the flooring is adequate for all future chassis upgrades, you must make sure the floor-load rating meets 133 lb/ft².

Table 2-10 Rackmount Floor-Load Requirements

Chassis Configuration	Weight	Floor-Load Rating (lb/ft. ²)
Minimum	560 lbs (254 kg)	62 lb/ft ² (249 kg/m ²)
Maximum	1,200 lbs (544 kg)	133 lb/ft ² (533 kg/m ²)

For installations on raised floors, check that the construction will properly support the distribution of the weight. The Challenge rackmount chassis uses four casters and four stabilizing levelers that distribute the weight load to the site floor. See Figure 2-12 for the

caster and leveler locations. If a floor is modified, such as by cutting new access panels in computer floor tiles, determine if additional reinforcement is required.

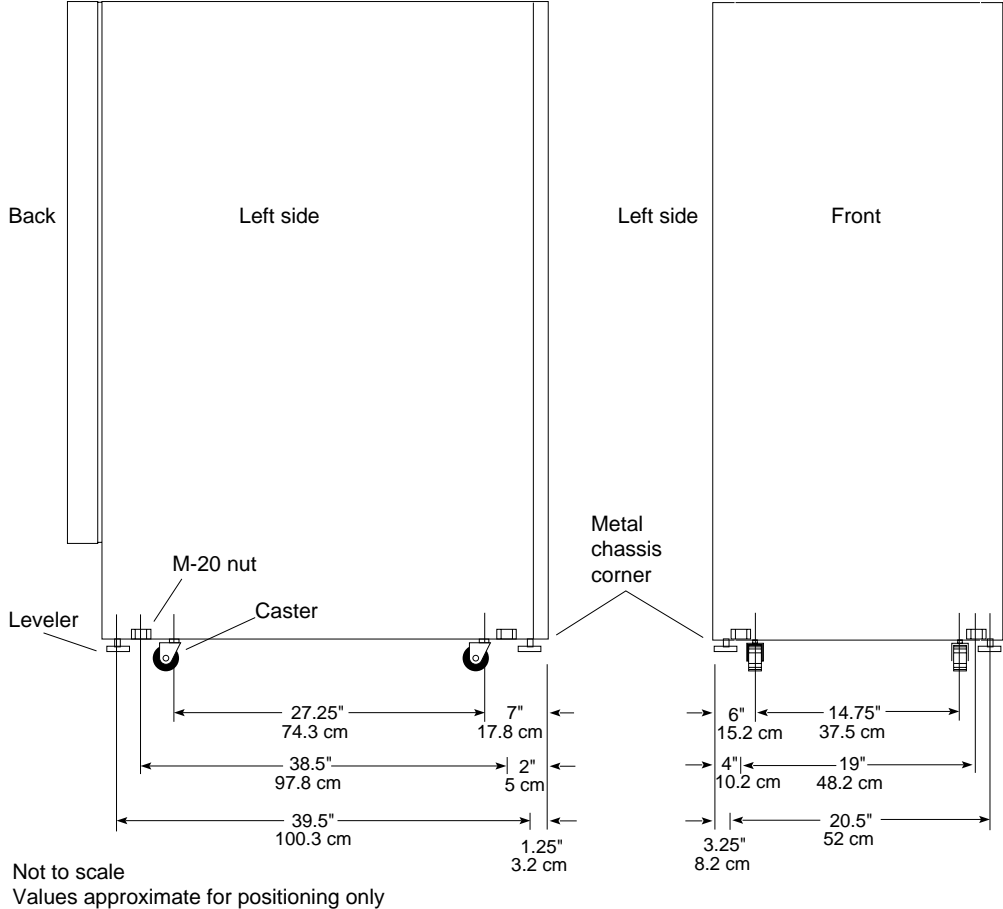


Figure 2-12 Challenge Rackmount Caster and Leveler Locations

2.6 Space Requirements for Other Components

This section explains

- O2 space requirements
- Indy space requirements
- multiplexer (SPM) space requirements

See the HIPPI switch manual for its physical specifications.

2.6.1 O2 Workstation Space Requirements

Table 2-11 summarizes O2 physical specifications.

Table 2-11 O2 Workstation Physical Specifications

Parameter	Value
Height	12.7" (32.3 cm)
Width	9" (22.9 cm)
Depth	11.5" (29.2 cm)
Weight, typical	40 lbs (18.1 kg)

2.6.2 Indy Workstation Space Requirements

Table 2-12 and Figure 2-13 summarize Indy physical specifications.

Table 2-12 Indy Workstation Physical Specifications

Parameter	Value
Height	3" (7.6 cm)
Width	16" (41 cm)
Depth	14" (35.5 cm)
Weight, typical	16 lb (7.3 kg)

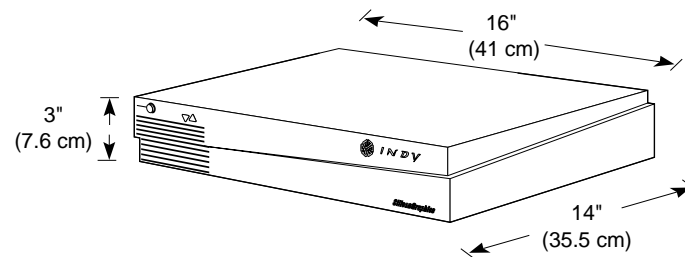


Figure 2-13 Indy Workstation Chassis Dimensions

2.6.3 Multiplexer Space Requirements

Table 2-13 summarizes multiplexer physical specifications.

Table 2-13 IRISconsole Physical Specifications

Parameter	Value
Height	1.2" (3.1 cm)
Width	11" (28.1 cm))
Depth	8.1" (20.6 cm
Weight, typical	3.8 lbs (1.7 kg)
Weight, shipping	14 lbs (6.4 kg)

2.7 Space Requirements for Array Configurations

Caution: When multiple Origin2000 or Onyx2 rack chassis are installed in the same location, and are connected with CrayLink or XTown cables, the Origin2000 or Onyx2 rack systems must be connected with special grounding straps supplied by Silicon Graphics for this purpose. These straps ensure that the chassis maintain the same chassis ground, a factor that is very important for systems connected with CrayLink or XTown cables.

This section defines the space required for the following array configurations:

- two-system configuration (no HIPPI switch)
- two-system configuration (with HIPPI switch)
- four-system configuration (with HIPPI switch)
- eight-system configuration (with HIPPI switch)

Caution: To upgrade an existing HIPPI switch that has parallel switch cards for Challenge, you must replace the existing parallel cards with a serial card (fiber optic interface) in order for the HIPPI switch to work with Origin2000/Onyx2 nodes.

2.7.1 Two-Node Configuration (No HIPPI Switch)

Figure 2-14 shows the space requirements for an example two-node configuration without the Multi-Port HIPPI switch. This figure shows the maximum spatial configuration using rackmount systems. To determine spatial requirements for a deskside system, see Section 2.5.1 and Section 2.5.3.

Note: This two-node configuration needs a HIPPI switch added before it can be upgraded to a larger array setup.

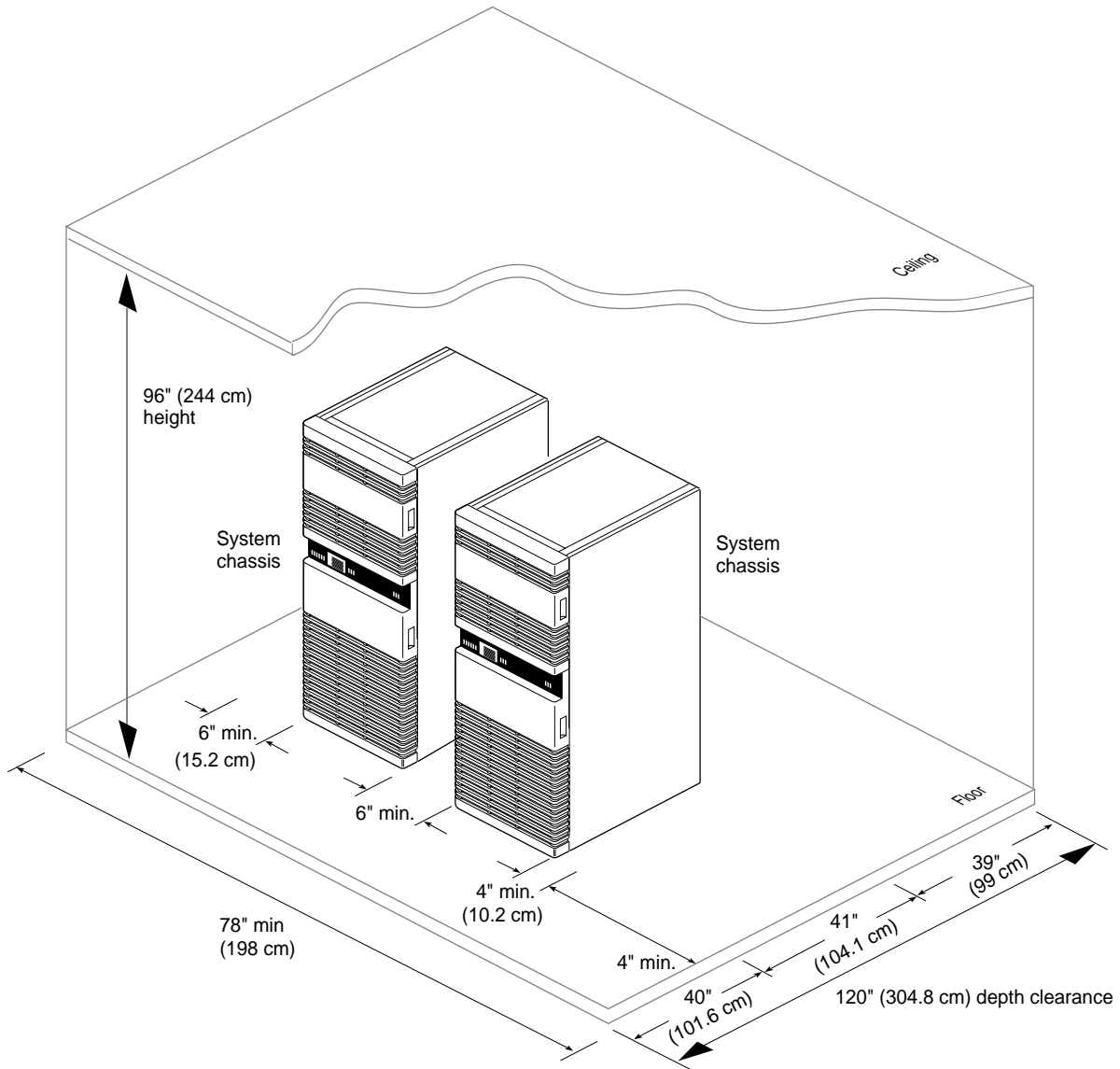


Figure 2-14 Example Space Requirements for Two-Node Array (No HIPPI Switch)

2.7.2 Two-Node Configuration (with HIPPI Switch)

Figure 2-15 shows the space requirement for an example two-node configuration with a HIPPI switch. This figure shows the maximum spatial configuration using rackmount systems. To determine spatial requirements for a deskside system, see Section 2.5.1 and Section 2.5.3.

Note: With this two-node configuration, you can directly upgrade to a four- or eight-node setup by adding systems and array software.

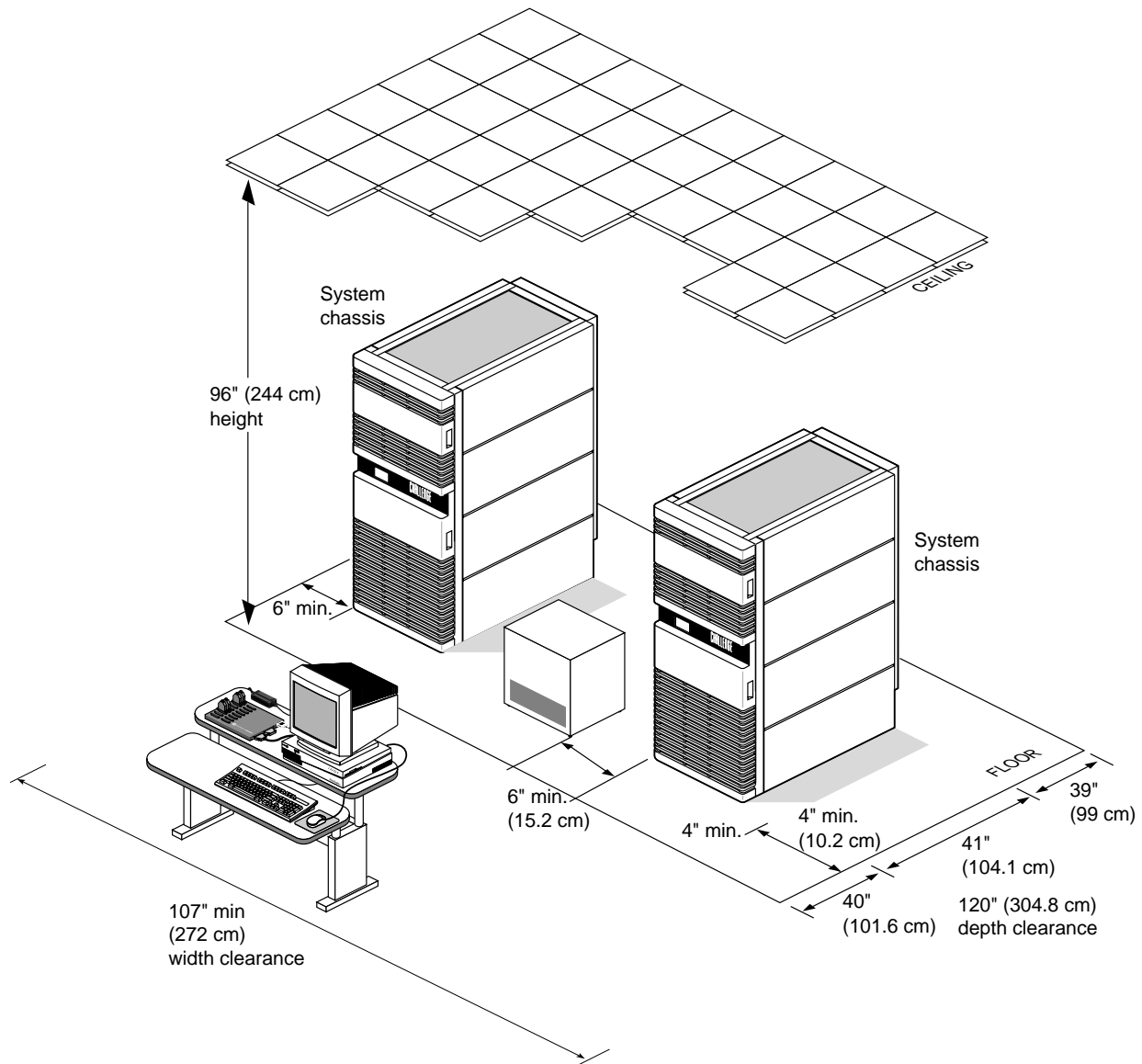


Figure 2-15 Example Two-Node Array Configuration (With HIPPI Switch)

Note: Figure 2-15 does not include a table/desk measurements for the IRISconsole; be sure to add these. Where servers differ, use the larger space requirement.

2.7.3 Four-Node Configuration

Figure 2-16 shows the space requirements for an example four-node configuration. This figure shows the maximum spatial configuration using rackmount systems. To determine spatial requirements for a deskside system, see Section 2.5.1 and Section 2.5.3.

Note: The four-node array requires a HIPPI switch for operation.

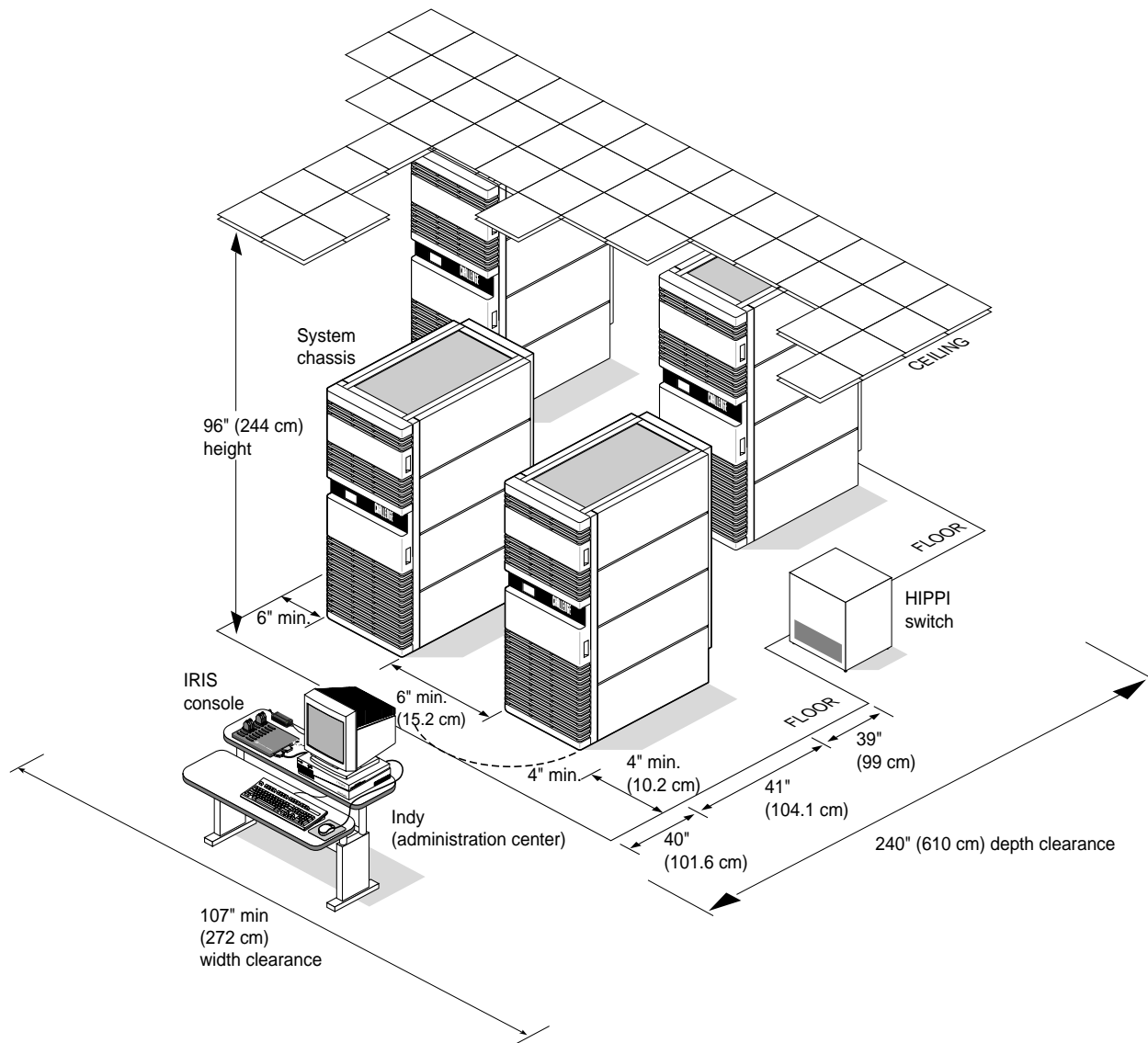


Figure 2-16 Example Four-Node Array Space Requirements

Note: Figure 2-16 does not include a table/desk measurements for the IRIS console; be sure to add these. Where servers differ, use the larger space requirement.

2.7.4 Eight-Node Configuration

Figure 2-17 shows the space requirements for an example eight-node configuration. This figure shows the maximum spatial configuration using rackmount systems. To determine spatial requirements for a deskside system, see Section 2.5.1 and Section 2.5.3.

Note: The eight-node array requires a HIPPI switch for operation.

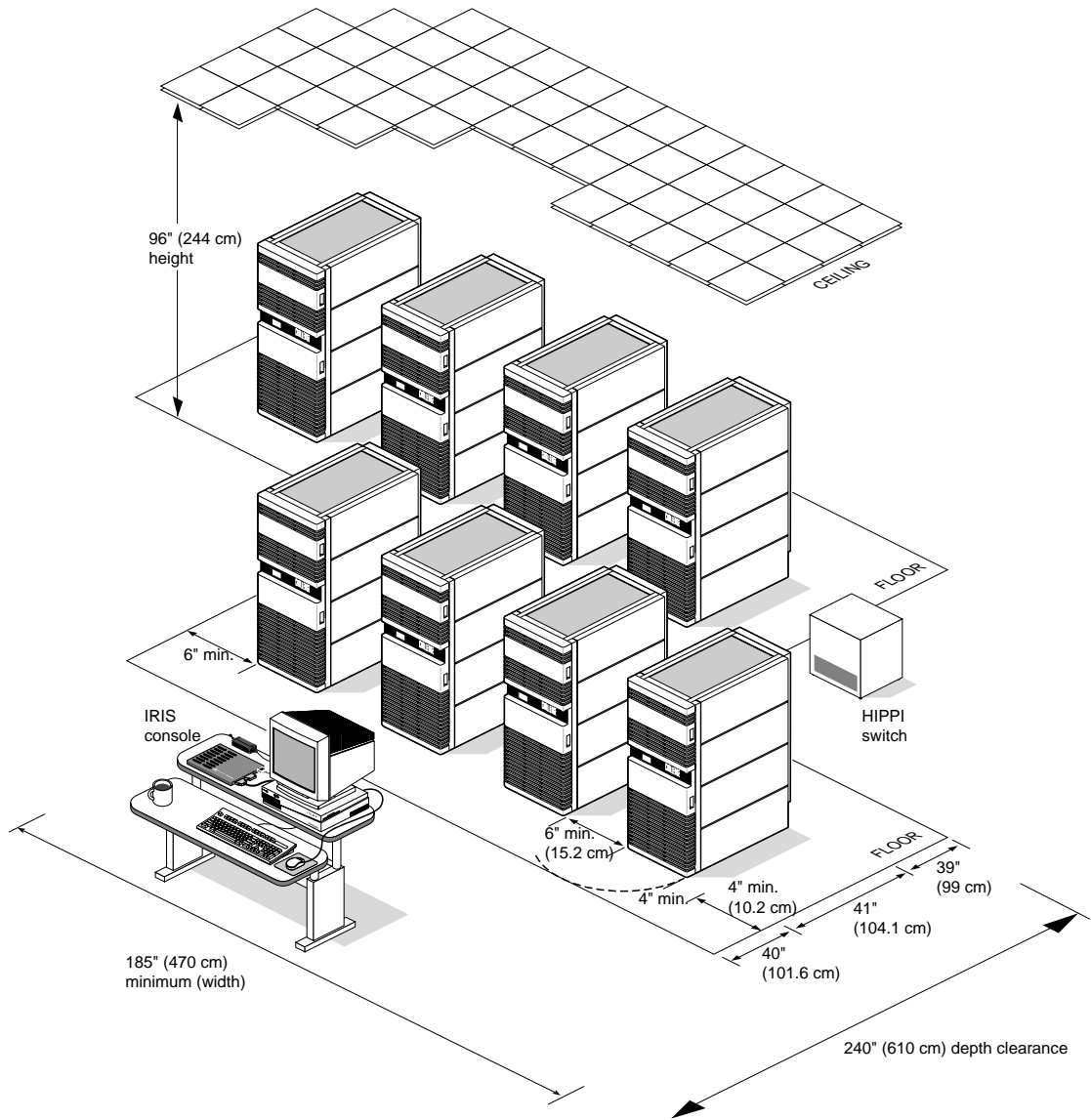


Figure 2-17 Example Eight-Node Array Space Requirements

Note: Figure 2-17 does not include a table/desk measurements for the IRIS console; be sure to add these. Where servers differ, use the larger space requirement.

2.8 Environmental Requirements

Check your site for these environmental factors:

- air temperature and quality (including factors related to altitude)
- array heat dissipation

- array vibration limits
- acoustics

2.8.1 Air Temperature and Quality

Each site must provide proper air temperature, humidity, and filtration. Use Table 2-14 through Table 2-19 to prepare the site air conditioning.

Note: Temperature ranges apply to systems inside a building and out of direct sunlight. For installations at or above 8,000 feet, the system fans must be set on high speed during operation.

This section lists the temperature and related requirements for the following array components:

- Origin2000 deskside and rackmount systems (Table 2-14 and Table 2-15)
- Challenge/Onyx deskside and rackmount systems (Table 2-16)
- O2 or Indy workstation (Table 2-17)
- IRISconsole SPM multiplexer (Table 2-18)
- HIPPI switch (Table 2-19)

Table 2-14 Origin2000 Environmental Specifications

Parameter		Value
Air temperature	operating (< 5000 ft)	41° to 95° F (5° to 35° C)
	operating (> 5000 ft)	41° to 86° F (5° to 30° C)
	nonoperating	-4° to 140° F (-20° to 60° C)
Thermal gradient	maximum	18° F (10° C) per hour
Altitude	operating	10,000 ft (3,048 m) MSL, maximum
	nonoperating	40,000 ft (12,192 m) MSL, maximum
Humidity	operating	10-90% (noncondensing)
	nonoperating	10-95% (noncondensing)
Humidity gradient	maximum	10% relative humidity per hour

Table 2-15 Origin2000 Base Module Cooling Requirements

Parameter	Voltage	Value
Origin2000 base module	At 220 volts	8,840 Btu/hr (0.74-ton AC load) maximum
	At 110 volts	6,460 Btu/hr (0.54-ton AC load) maximum
Origin2000 rackmount	At 220 volts	19,550 Btu/hr (1.63-ton AC load) maximum

Table 2-16 Challenge Deskside Environmental Specifications

Parameter	Value
Air temperature range	
Operating	5° to 35° C at sea level 5° to 30° C above 5,000 feet
Nonoperating	-20° to 60° C at sea level
Heat dissipation (maximum configurations)	
Deskside server and graphics chassis, 110V	6,500 Btu/hour (.54-ton AC load)
Deskside server and graphics chassis, 220V	8,100 Btu/hour (.68-ton AC load)
Rackmount server and graphics chassis, 220V 1-phase	16,000 Btu/hour (1.3-ton AC load)
Rackmount server and graphics chassis, 220V 3-phase	24,000 Btu/hour (2-ton AC load)
Monitor, 19-inch and 21-inch	512 Btu/hour (.042-ton AC load)
Humidity range	
Operating	10 to 80%, noncondensing
Nonoperating	10 to 95%, noncondensing
Altitude	
Operating	10,000 feet MSL*, maximum
Nonoperating	40,000 feet MSL*, maximum

*. MSL indicates mean (average) sea level or 29.92" (76 cm) of mercury barometric pressure.

Table 2-17 Workstation Environmental Specifications

Parameter	O2 Workstation	Indy Workstation
Air temperature range		
Operating	13° to 35° C	13° to 35° C
Nonoperating	-40° to 65° C	-40° to 65° C
Heat dissipation	2,600 Btu/hr (0.22-ton AC load)	900 Btu/hour (1-ton AC load)
Humidity range		
Operating	10% to 80%, noncondensing	10 to 80%, noncondensing
Nonoperating	5 to 95%, noncondensing	5 to 95%, noncondensing
Altitude		
Operating	10,000 feet MSL*, maximum	10,000 feet MSL ^a , maximum

Table 2-17 (continued) Workstation Environmental Specifications

Parameter	O2 Workstation	Indy Workstation
Nonoperating	40,000 feet MSL*, maximum	40,000 feet MSL ^a , maximum

*. MSL indicates mean (average) sea level or 29.92" (76 cm) of mercury barometric pressure.

Table 2-18 Multiplexer (SPM) Environmental Specifications

Parameter	Value
Air temperature range	
Operating	0° to 55° C
Nonoperating	-40° to 75° C
Humidity range	
Operating or nonoperating	0 to 95%, noncondensing

Table 2-19 Multi-Port HIPPI Switch Environmental Specifications

Parameter	Value
Air temperature range	
Operating	0° to 40° C
Nonoperating	-30 ° to 85° C
Humidity range	
Operating or nonoperating	10 to 90%, noncondensing
Altitude	
Operating	10,000 feet MSL*, maximum
Nonoperating	40,000 feet MSL*, maximum

*. MSL indicates mean (average) sea level or 29.92" (76 cm) of mercury barometric pressure.

2.8.2 Array Heat Dissipation

Table 2-20 and Table 2-21 provide heat dissipation specifications for a rackmount and deskside array.

Table 2-20 Array Heat Dissipation (Challenge Nodes)

Configurations	Approximate Heat Dissipation (Btu/Hour), Rackmount Configurations	Approximate Heat Dissipation (Btu/Hour), Deskside Configurations
Two nodes (220 V, 1-phase)	33,000 (2.8-ton AC load)	15,000 (1.2-ton AC load)
Two nodes (220 V, 3-phase)	50,000 (4.2-ton AC load)	18,000 (1.5-ton AC load)
Four nodes (220 V, 1-phase)	66,000 (5.5-ton AC load)	28,000 (2.3-ton AC load)
Four nodes (220 V, 3-phase)	98,000 (8.2-ton AC load)	34,000 (2.8-ton AC load)
Eight nodes (220 V, 1-phase)	130,000 (11-ton AC load)	54,000 (4.5-ton AC load)
Eight nodes (220 V, 3-phase)	194,000 (16.2-ton AC load)	67,000 (5.6-ton AC load)

Table 2-21 Array Heat Dissipation (Origin2000/Onyx2 Nodes, 220-V, 1-phase)

Configurations	Approximate Heat Dissipation (Btu/Hour), Rackmount Configurations	Approximate Heat Dissipation (Btu/Hour), Deskside Configurations
Two nodes	39,000 (3.26-ton AC load)	17,700 (14.8-ton AC load)
Four nodes	78,000 (6.52-ton AC load)	35,400 (29.6-ton AC load)
Eight nodes	156,000 (13.0-ton AC load)	70,800 (59.6-ton AC load)

2.8.3 Array Vibration Limits

The Origin2000/Onyx2 and Challenge/Onyx product lines are designed for the typical office and computing environment, requiring no special modifications or protection. If a system is installed at an industrial site, check that vibrations are kept within the limits shown in Table 2-22.

Table 2-22 Challenge/Onyx Vibration Limits

Description	Value
Origin2000	
Maximum sustained vibration, operating	5-10 Hz @ .01" total excursion, 10-500 Hz @ 0.1g
Maximum peak vibration, operating	5-10 Hz @ .02" total excursion, 10-500 Hz @ 0.1g
Sensitive frequency, operating	8-33 Hz (varies with configuration)

Table 2-22 (continued) Challenge/Onyx Vibration Limits

Description	Value
Challenge/Onyx	
Sustained vibration, operating	Less than 5-10 Hz at 0.01" total excursion, 10-500 Hz at 0.1 g
Peak vibration, operating	Less than 5-10 Hz at 0.02" total excursion, 10-500 Hz at 0.1 g
Sensitive (harmonic) frequencies, operating	8-33 Hz, depending on configuration
O2 peak vibration, operating	0.02" displacement, 5-19 Hz, 0.25 G, 5 - 500 Hz
Indy peak vibration, operating	Less than 5-19 Hz at 0.02" total excursion, 5-500 Hz at 0.25 g

2.8.4 Acoustics

Check that the additional computer equipment acoustics (noise-emission levels) are within the limits for the particular site (see Table 2-23).

Table 2-23 Challenge Rackmount, Deskside, and Indy Acoustic Levels

Parameter	Typical	Maximum
Origin2000 deskside	50 dB	
Origin2000 rackmount	55 dB	
Challenge/Onyx deskside	57 dB	65 dB
Challenge/Onyx rackmount	60 dB	66 dB
O2 workstation	35 dB	
Indy workstation	36 dB	

Note: Check local codes to ensure that the site is compliant with worker safety regulations, such as those provided by UL, TUV, and CSA.

The systems are designed for computer rooms. The measurements in this section are only guidelines because acoustics depend on many factors outside the control of the manufacturer. Room characteristics such as carpeting and wall coverings affect the noise levels at an installation.

If a site exceeds desirable noise levels:

- Reduce the amount of flat reflective surfaces such as glass, tile, or metal.
- Add sound-absorbing carpet, wall coverings, and drapes.
- Add sound baffles in critical locations, but be careful not to block airflow.
- Install ceiling tiles with sound-absorbing properties.
- Modify office space to isolate operators and hardware.

2.9 Array Power Requirements

This section lists the power specifications for the following array components:

- Origin2000 deskside and rackmount systems (Table 2-24)
- Challenge/Onyx deskside and rackmount systems (Table 2-25)
- deskside and rackmount array power consumption examples (Table 2-26 and Table 2-27)
- O2 workstation (Table 2-28)
- Indy workstation (Table 2-29)
- IRISconsole SPM multiplexer (Table 2-30)

Table 2-24 Origin2000 Base Module and Rackmount Power Specifications

Parameter	Value
Voltage	87-264 volts, 1 phase
Wattage (from the wall):	2600 watts maximum at 220 volts 1900 watts maximum at 110 volts
Power factor	0.98 minimum
Inrush current	140 amps maximum
Frequency	47-63 Hertz

Table 2-25 Challenge and Onyx System Power Requirements

Description	Country	Power VAC input			Hertz		Phase	Rating amps	Power Supply watts
		nom	min	max	min	max			
Deskside 110 VAC Nom	US/Japan	110	100	132	50	60	1	16	1500
Deskside 95 VAC Nom	Japan	90	85	132	50	60	1	16	1200
Deskside 220 VAC	US/Int'l	220	187	264	50	60	1	13	1900
Rackmount 220 VAC 1P	US/Int'l	208	187	264	50	60	1	24	3800
Rackmount 220 VAC 3P	US	208	187	264	50	60	3	24	5700
Rackmount 220 VAC 3P	Int'l	400	360	480	50	60	3	24	5700

Table 2-26 Challenge Array Approximate Total Power Consumption

Array Configuration	Deskside	Rackmount
Two-node configuration (95 to 110 VAC)	41 amps	
Four-node configuration (95 to 110 VAC)	71 amps	
Eight-node configuration (95 to 110 VAC)	137 amps	
Two-node configuration (220 VAC)	33 amps	54 amps
Four-node configuration (95 to 110 VAC)	58 amps	102 amps
Eight-node configuration (95 to 110 VAC)	110 amps	198 amps

Table 2-27 Origin2000/Onyx2 Array Approximate Power Consumption (220V Only; No Other Components)

Array Configuration	Deskside	Rackmount
Two-node configuration	24 amps	52 amps
Four-node configuration	48 amps	104 amps
Eight-node configuration	96 amps	208 amps

Table 2-28 O2 Workstation Power Specifications

Parameter	Specifications
Input voltage (US/Japan)	100 - 132 VAC
Input voltage (international)	200 - 264 VAC
Frequency	47 - 63 Hz
Current	2.4 - 1.8A 1.2 - 0.9 A

Table 2-29 Indy Workstation Power Specifications

Parameter	Specifications
Input voltage (US/Japan)	100 to 132 VAC
Input voltage (international)	200 to 264 VAC
Frequency	47 to 63 Hz
Current	2.4 to 1.8 A (at 115 VAC) 1-2 to 0.9 A (at 220 VAC)

Table 2-30 SPM IRISconsole Power Specifications

Power Usage (Typical)	Specifications
+5 VDC	1500 mA maximum, 1110 mA typical
+12 VDC	100 mA maximum (full load), 1 mA (unloaded)

All power requirements are provided by the standalone power supply included with the SPM. The power supply is autoranging and comes with a 110 VAC power cord in Japan and North America. All other destinations should use a 220 VAC rated power cord.

2.10 Preparing to Receive the Array

To prepare for the arrival of a system, plan these activities:

- Obtain tools required to receive and install equipment.
- Arrange assistance for moving large and/or heavy cartons and crates.
- Check the path to the system's destination.

2.10.1 Required Tools for Receiving and Installing the Array

Use Table 2-31 to determine the tools required for each listed activity.

Table 2-31 Tools Required for Receiving and Installing Systems

Activity	Component	Tools Required
Unloading crates and boxes	Origin2000/Onyx2 deskside	Pallet jack, up to 200 lbs (90.7 kg)
	Origin2000/Onyx2 rackmount	Pallet jack, up to 1000 lbs (453.6 kg)
	Challenge rackmount	Pallet jack, up to 300 lbs (136.1 kg)
	Challenge deskside	Pallet jack, up to 1500 lbs (680.4 kg))
		Note: A forklift or the lift gate on a truck is required to unload the system from a vehicle. Afterwards, you can use a pallet jack to transfer the systems within a building.
	Indy workstation or serial port multiplexer	Hand truck/dolly; approximately 20-lb (9.1 kg) load
	Monitors	Hand truck/dolly; approximately 50- to 80-lb load (22.7-36.3 kg)
	O2 workstation or Multi-Port HIPPI switch	Hand truck/dolly; approximately 40-lb load (18.1 kg)

Table 2-31 (continued) Tools Required for Receiving and Installing Systems

Activity	Component	Tools Required
Opening shipping cartons or crates	Deskside	Knife (to cut strapping bands); wrench, 7/16" or adjustable
	Rackmount	Gloves (protection from crate splinters); pliers (for stuck fasteners)
	Monitor, destination kit, O2 or Indy workstation, Serial-port multiplexer, Multi-Port HIPPI switch	Knife (to cut packing tape)
Moving system		Low-profile dolly that keeps chassis vertical; moving blankets or wraps
Installing chassis		Under normal circumstances, no tools are required; for adding optional components, medium slothead and cross-recess screwdrivers may be required
Connecting cables		Small slothead and cross-recess screwdrivers
Stabilizing chassis (seismic protection)	Rackmount, Vault	Stabilizers, 2.5" length minimum, to fit one of two types of nuts on the chassis underside: 1) 1/2-13 UNC (Unified National Coarse) 2) M-20

2.10.2 Arranging for Assistance

Assistance is required to receive a shipment, uncrate a chassis, and move a chassis. The rackmount chassis requires assistance to unbolt and remove the crate's front panel and to remove the chassis from the crate. It also requires assistance to move any distance.

Always use assistance when moving equipment up or down ramps. For rackmount systems, use a minimum of three individuals. On fully configured systems, up to five people may be required to safely move the chassis. Avoid ramps that exceed a 20° angle.

2.10.3 Checking the Delivery Route

Walk through the proposed route for moving a system to its destination. Pay particular attention to corners, ramps, restricted doorways, low ceilings, and fixed obstructions. Table 2-32 shows the shipping dimensions of the main containers.

Table 2-32 Shipping Dimensions

System	Shipping Dimensions		
	Height	Width	Depth
Origin2000/Onyx2 deskside	42.5" (108.0 cm)	25.8" (65.5 cm)	30.9" (78.5 cm)
Origin2000Onyx2 rackmount	81" (205.7 cm)	47.5" (120.9 cm)	48.6" (123.4 cm)
Challenge deskside	42" (107 cm)	32" (81.3 cm)	37" (94 cm)
Challenge rackmount	74.5" (190 cm)	46" (117 cm)	59.5" (152 cm)

For installations above or below ground floor, check that the system is within the size and weight limits of elevators or similar cargo machinery. If freight blankets are available, use them on elevator sides. Use straps to keep the chassis from shifting while being moved in an elevator.

For uncrated challenge deskside chassis, the wheels work well on smooth surfaces, but are not designed for carpeting and rough flooring.

Chapter 3

Preinstallation Checklist

This chapter provides the preparatory steps that must be performed before you can begin actual installation. It is extremely important to read and perform these steps.

It is recommended that two SSEs perform the array installation. One of the SSEs should be the “designated driver,” who operates the IRISconsole station and installs and configures the software and then sets up the network. For example, a second SSE can help verify and check off steps during the procedures, install hardware, and cable HIPPI.

Note: It is highly recommended that at least one of the SSEs be familiar with network configuration and HIPPI configuration.

3.1 Before You Begin Installation

The installation of the array will go much more smoothly if a set of preinstallation information is obtained in advance of hardware bring-up, as described in Table 3-1. Much of this information can be obtained days or weeks in advance of customer hardware rollout.

The array site should have already been selected and prepared as described in the Chapter 2, “Installation Planning and Site Preparation.”

In addition, be sure to perform and check off the following technical, administrative, and bureaucratic tasks prior to installation, to help ensure a successful array setup.

Table 3-1 Preinstallation Checklist

Activity	Date Completed	Notes
Read supporting manuals, array Web pages, release notes, and reference pages (man pages).	__/__/__	
Gather the supporting documentation. See “Related Documents” on page xi.	__/__/__	
Look at the two array World-Wide Web (WWW) sources for latest information; see, “About This Guide.”	__/__/__	

Table 3-1 Preinstallation Checklist

Activity	Date Completed	Notes
Read the related release notes and man pages. These documents contain important information not covered in the array manuals such as diagnostics testing and array command definition.	__/__/__	
Establish clear lines of communication with the customer.	__/__/__	
Ensure that you have strategic points of contact with the field and with the customer (see Section 3.2). The customer contacts should represent the customer's needs and have authority to make decisions.	__/__/__	
Verify that all the required hardware and software have been received and inventoried (see Section 3.3).	__/__/__	
Obtain the inventory list and the system serial numbers from the customer.	__/__/__	
Verify that floor space and local area networking, and environmental preparations have been properly completed (see Section 3.5).	__/__/__	
Assign each array node a node number from 1 to N, where N is the number of nodes (see Section 3.4).	__/__/__	
Determine the array name (see Section 3.9).	__/__/__	
Plan the local area network and HIPPI setup with the customer.	__/__/__	
Draw a HIPPI connectivity diagram. For arrays with HIPPI switches, identify the HIPPI switch ports for each HIPPI interface connection (Section 3.7).	__/__/__	
Make sure there is adequate cabling on hand, with appropriate cable lengths.	__/__/__	
Determine if logical or source routing is to be used for HIPPI network routing, and determine HIPPI I-fields for each array node (see Section 3.8).	__/__/__	
Determine the local area network (typically Ethernet) IP addresses and hostnames for the IRISconsole and array nodes, and be sure they've been properly allocated and registered at the site (see Section 3.10).	__/__/__	
Determine the HIPPI IP addresses and hostnames for the array nodes, and be sure they've been properly allocated and registered at the site (see Section 3.11).	__/__/__	
Assign IRISconsole multiplexer ports for each array node (see Section 3.6).	__/__/__	
Label the networking cables (see Section 3.7.2).	__/__/__	

3.2 Establishing Customer Contact

Because arrays are commonly placed in large organizations, it is important to configure the array with respect to the administrative structure in place at the site. More organizational coordination may be required for array installations than for workstation and single server

installations. Be sure that your contacts have the ability and authority to make the required decisions.

3.3 Verifying and Inventorying the Components

The array consists of many layered hardware and software components, which if absent prevent the complete and proper operation of the system. Carefully ensure that all inventory has arrived at the site, and has cleared the customer's local inventory control procedures. Collect and record the system serial numbers. Table 3-2 lists some of the major hardware and software components of the array.

Table 3-2 Array Parts List

Description	Part Number or Marketing Code
Multi-Port HIPPI switch (optional for an array with 2 nodes)	9110124; HPS16-1004
HIPPI XIO board for Origin2000/Onyx2 systems	030-0968-004; XT-HIPPI-800-SER
HIPPI board for Challenge systems	030-0522-007 or later (Note: The HIPPI board must be at revision 7 or later to properly support the HIPPI bypass function and the new version of MPI).
HIPPI cable assemblies:	
Origin2000/Onyx2: 2 fiber optic per HIPPI interface if using switch, 1 per HIPPI connection if switchless	018-0656-001 (X-F-OPT-3M) 3-m 018-0656-101 (X-F-OPT-101) 10-m 018-0656-201 (X-F-OPT-25M) 25-m 018-0656-301 (X-F-OPT-100M) 100-m 018-0664-001 (X-F-OPT-LOOP) optic loopback
Challenge: 2 pairs copper per HIPPI interface if using switch, 1 pair per HIPPI interface if switchless)	9290123 15-m
HIPPI software	813-0306-00x
IRISconsole software version 1.2 or later; for Challenge systems, earlier versions are acceptable	813-0384-00x and 013-0385-00x
Serial Port Multiplexer	933210
Array software package (3.0 release)	SC4-PCAS-3.0
Message-Passing Interface (MPI 3.0; 1.1 release)	SC4-MPT-1.1

3.4 Assigning Node Numbers

Because the array may consist of a large number of servers, it is useful to assign each server an increasing number starting at 1. These node numbers can be used to assist in proper network wiring and to compute configuration table entries.

3.5 Completing Floor Space, Network, and Environmental Planning

Be sure the proper physical, electrical, and environmental preparations have been completed in advance of the array installation, as discussed in Chapter 2.

Be sure proper floor space has been allocated to permit connectivity of the IRISconsole to the array nodes, connectivity of the HIPPI components, and connectivity of optional graphics displays to array nodes. Be sure networking plans have been constructed to place the array on a local Ethernet and to support the HIPPI network. Be sure proper power and cooling have been arranged.

3.6 Assigning IRISconsole Ports for Each Array Node

The IRISconsole multiplexer (SPM) connects to an O2 or Indy workstation through a SCSI cable, and to each array node through two special IRISconsole serial cables (p/n 018-0527-001), one for the array node system console port, and one cable for the array node diagnostic port. Prepare a console connectivity diagram in advance of the installation. Refer to the *IRISconsole Administrator's Guide* (p/n 007-2872-xxx) for more information.

3.7 Determining the HIPPI Connection Scheme

The HIPPI interfaces, cables, and switch (optional for two-node arrays) form a high-speed network connecting the array nodes. Careful, well-organized planning up front can dramatically ease the subsequent HIPPI network wiring and configuration as described in this section.

First, it is important for you to be familiar with the installation of HIPPI interfaces, and some of the basic administration. Refer to the *IRIS HIPPI-Serial XIO Board Installation Instructions* (Origin2000/Onyx2) or the *IRIS HIPPI Installation Instructions* (Challenge systems), and the *IRIS HIPPI Administrator's Guide* for detailed information about the theory and practice of HIPPI networking.

3.7.1 Drawing a HIPPI Connection Diagram

Once you are familiar with the basics of HIPPI, draw a diagram showing the cabling connections between HIPPI interfaces, and between the switch, if present. For each interface:

- Origin2000/Onyx2: serial interface requiring one fiber optic cable with a double connector at each end for outgoing and incoming data, respectively
- Challenge: parallel interface requiring two copper cables, one for outgoing data, and one for incoming data.

Note: The source on one interface (or switch port) must be connected to the destination on another interface or switch port.

If there are only two array nodes, no switch is required. An interface on one system can be directly connected to the corresponding interface on the other.

If there is a switch, the interface on a system must be connected to a port on the switch. It is important to record the port number to which each array node and each interface is connected. A good systematic scheme for port assignment is:

- For single HIPPI interface arrays, it is suggested that you connect the HIPPI interface of node 1 to HIPPI switch port 0 (the first available HIPPI port, assuming node numbers start at 1).
- For double HIPPI interface arrays, it is suggested that you connect the first HIPPI interface of node 1 to HIPPI switch port 0, the second HIPPI interface of node 1 to HIPPI switch port 1, the first HIPPI interface of node 2 to HIPPI switch port 2, and the second HIPPI interface of node 2 to HIPPI switch port 3.

Be sure the HIPPI networking diagram is complete before continuing.

3.7.2 Handling and Labeling HIPPI Cables

Familiarize yourself thoroughly with the information in *IRIS HIPPI-Serial XIO Board Installation Instructions* (Origin2000/Onyx2) or the *IRIS HIPPI Installation Instructions* (Challenge systems) on handling and cleaning the cables.

Label both ends of a cable with a cable number to match them up later.

3.8 Determining HIPPI Routing and I-Field Assignment

Before you can configure the HIPPI network, you need to decide the routing method to use. HIPPI supports two methods of routing data between the sending and receiving interfaces; these are called *source routing* and *logical routing*. I-Fields in source routing describe the *exact path* a connection makes through switch ports. I-Fields in logical routing indicate a node number, and the switches internally decide the appropriate path to take to get to another node's interface. Logical routing requires switch configuration; source routing does not. Therefore, it is recommended that you use source routing unless the customer specifically requests otherwise.

HIPPI *I-Fields* are values that describe how to route data from a transmitting interface to a particular receiving interface through a HIPPI network. The I-Fields are required because a HIPPI network may consist of multiple switches and numerous HIPPI interfaces. The I-Fields indicate the path and connection attributes the network should use when forming connections. Each array node has a file, `/usr/etc/hippi.imap`, that contains I-Fields describing how to connect to the other HIPPI interfaces. The array node consults this file when connecting to other HIPPI interfaces.

Determine and record the I-Fields for every array node, as described in the *IRIS HIPPI Administrator's Guide* (007-2229-004).

3.9 Assigning an Array Name

The array requires a name. The name is used by various array facilities. Ask the customer to determine a convenient, descriptive name (for example, *sgi_array* or *hotbox*). The name may contain alphanumeric characters beginning with a letter. Keep the array name sensibly short, so it does not become unwieldy.

3.10 Determining Local Net IP Addresses and Hostnames

The nodes of an array are connected to the IRISconsole and two other computer systems via a local area network (LAN). This local area network is separate from the HIPPI network described earlier. The most commonly used local area network is Ethernet.

You must have the following information to configure the LAN:

- a network number
- IP addresses and hostnames on this network for each array node, and for the IRISconsole workstation

These addresses and hostnames must be allocated and registered at the customer's site. Be sure to have the network address, host IP addresses and hostnames before continuing.

Note: It is recommended that the primary hostname of each array node be a simple name followed by the node number. This will ease configuration. For example, a four-node array called "hotbox", in the domain *enr.sgi.com* might have nodes named *hotbox1.enr.sgi.com* through *hotbox4.enr.sgi.com*.

3.11 Determining HIPPI Network IP Addresses and Hostnames

Similarly, you must have a network address for the HIPPI network, and host addresses and names for each array node on the HIPPI network. The IRISconsole is not on the HIPPI network, so no HIPPI IP addresses need to be created for the workstation.

Note: It is recommended that you select the names of the array nodes on the HIPPI network to be a prefixed version of the local area network hostnames. If available, it is recommended that you use "gate2-" as the prefix for the HIPPI interface "hip0-", and "gate3-" as the prefix for the interface "hip1-". For example, the HIPPI interfaces for host *hotbox3.enr.sgi.com* might be called *gate2-hotbox3.enr.sgi.com* and *gate3-hotbox3.enr.sgi.com*.

At this point, the preparatory steps should be complete. Verify that the preconfiguration checklist in Table 3-1 is complete before you begin the actual installation.

Chapter 4

Installing the Array

This chapter describes the hardware and software installation procedures to install and configure an array. The entire installation process takes at least 12 hours to complete.

Note: The Array 3.0 software release requires IRIX 6.2 or later.

As the array is installed, each array node evolves through various stages of functionality, each of which can be independently tested. The stages include

- base node: isolated node that has
 - has all hardware and software installed
 - has HIPPI tested in loopback
 - is connected to the IRISconsole
 - has no LAN or HIPPI network configured or cabled
- LAN node: base node with LAN configured and cabled
- HIPPI node: base node with HIPPI configured and cabled
- array node (generic term): node within the array, at any stage of functionality—base node, LAN node, HIPPI node

A fully functional array node is a HIPPI node with array services configured and operational

This chapter explains

- performing preliminary steps
- positioning the array components
- setting up the IRISconsole
- bringing up the array nodes
- configuring the base node
- configuring LAN nodes
- cabling, configuring, and testing HIPPI nodes
- bringing up the array
- installing other Silicon Graphics software applications

4.1 Performing Preliminary Steps

The array is a multilayered configuration, composed of systems called array nodes. Software and hardware extensions provide extra array functionality. Because the fundamental component of the array is the node server, much of the array installation process is similar to a single server installation.

The general array installation procedure is as follows (see also Figure 4-1 and Figure 4-2).

1. Obtain preinstallation information (see Table 3-1 in Chapter 3).
2. Position the major hardware components (see Section 4.2).
3. Bring up the IRISconsole (see Section 4.3).
4. Configure individual base nodes and test HIPPI in loopback (see Section 4.5).
5. Bring up the local area network (see Section 4.6).
6. Cable and configure the HIPPI network; test it (see Section 4.7).
7. Install, configure, start, and test the array-specific features (see Section 4.8).
8. Install other Silicon Graphics application software (see Section 4.9).

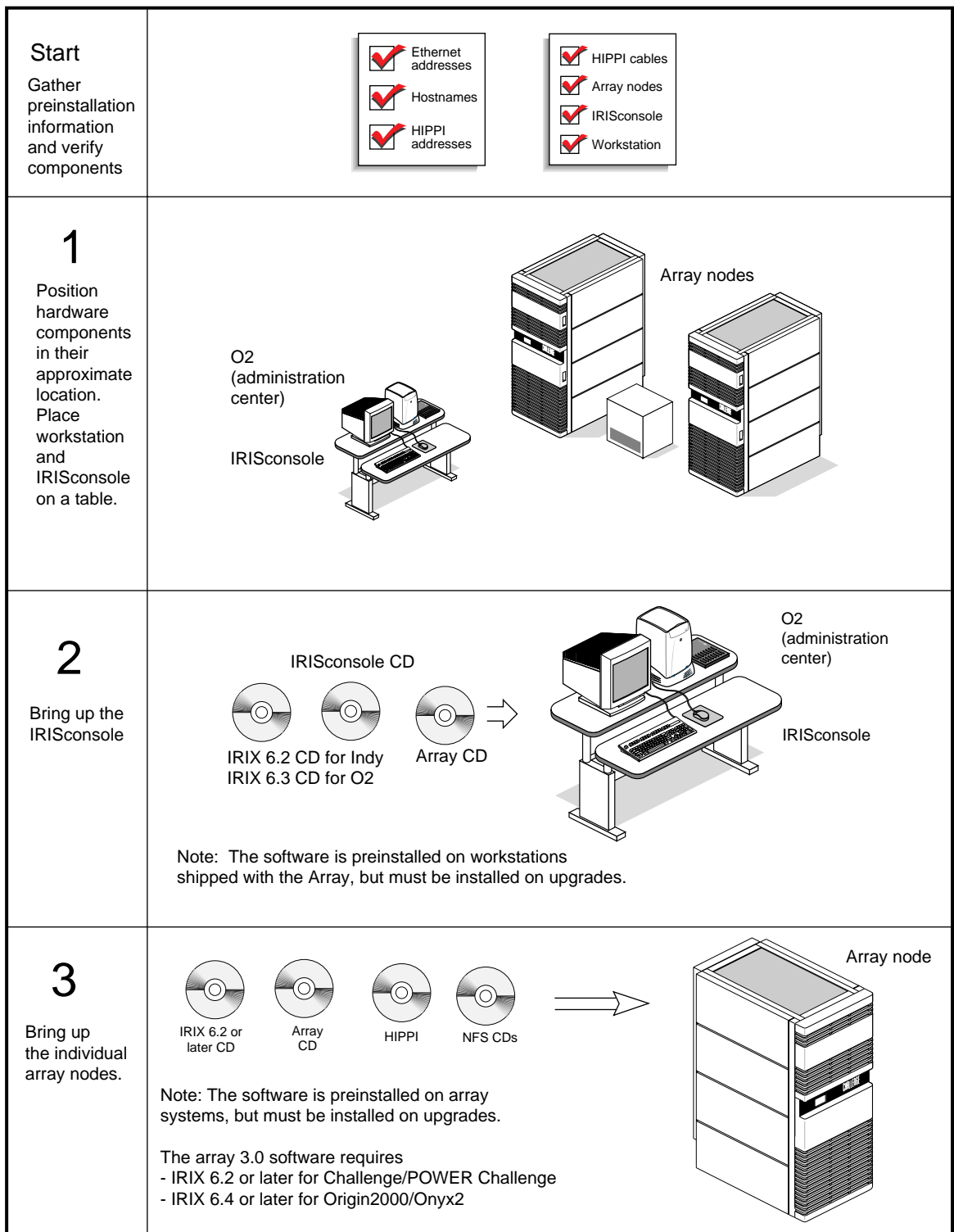


Figure 4-1 Overview of the Array Installation (Part 1)

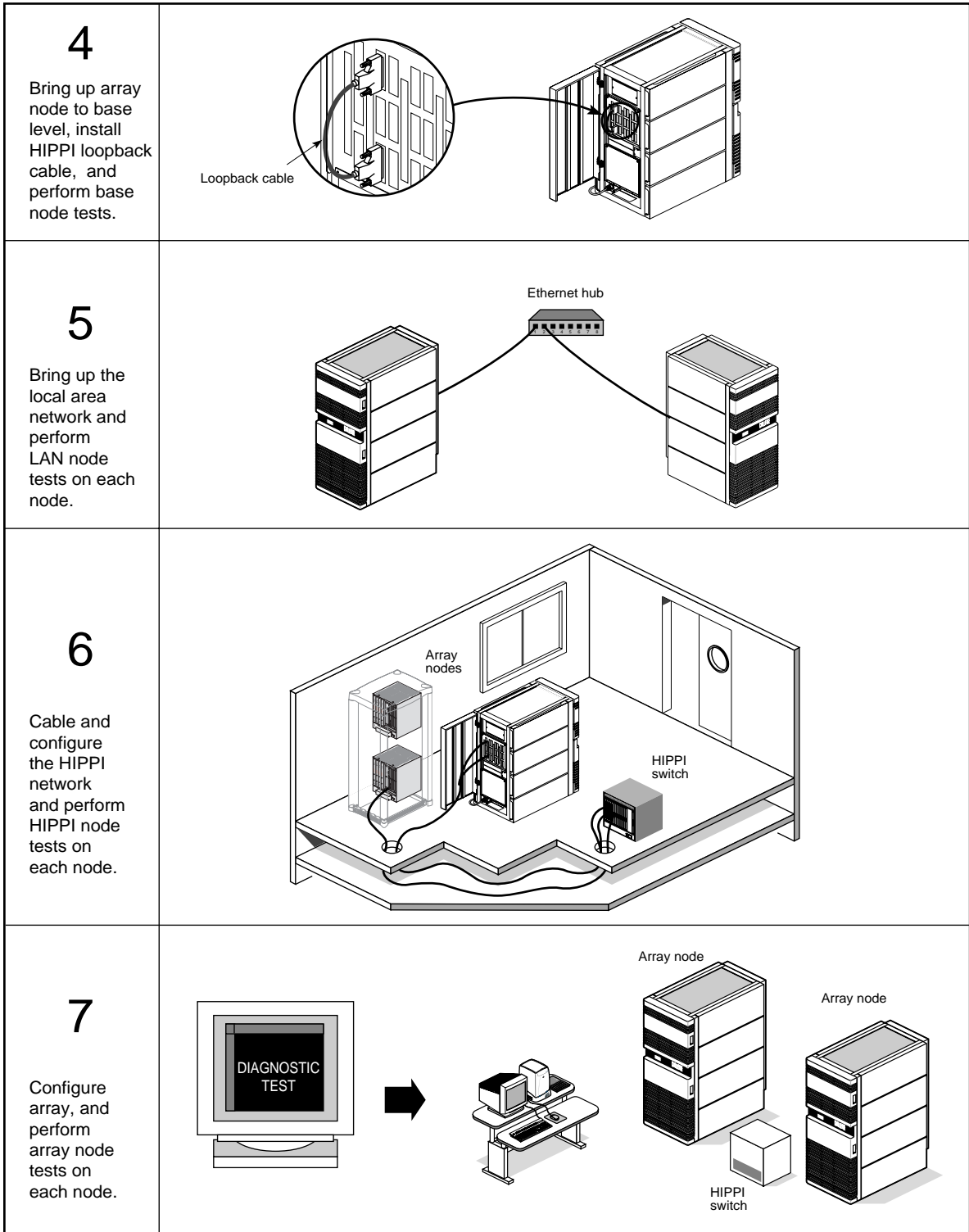


Figure 4-2 Overview of the Array Installation (Part 2)

At this point the preparatory steps have been completed. Verify that the preconfiguration checklist in Table 3-1 in Chapter 3 is complete before you begin the actual installation. The following information, Section 4.2 through Section 4.9, provides specific information on installing and configuring an array.

4.2 Positioning the Array Components

After the hardware has arrived and has been inventoried, and once the floor planning has been completed, you can position the array nodes, the Indy workstation, and any HIPPI switch and graphics monitors at their planned locations.

Do not perform any cabling or additional hardware configuration at this point.

4.3 Setting Up the IRISconsole

The IRISconsole connects the remote system console port and diagnostic port of each array node to a single O2 or Indy workstation through a multiplexer box, as an alternative to connecting an ASCII terminal to each array node (see Figure 4-3). This setup enables the IRISconsole to act as a centralized console for all array node servers, making it much easier to bring up a large array. Furthermore, the IRISconsole provides additional server management features not present on ASCII terminals, such as the ability to power-cycle and reset sets of systems with a click of a button.

Since the IRISconsole is the centralized console for all array node servers, set up the IRISconsole first. Once the IRISconsole is operational, you can bring up the individual array nodes.

The IRISconsole is set up in several stages:

- Set up the O2 or Indy workstation hardware.
- Connect the serial port multiplexer to the workstation.
- Install IRIX (O2: 6.3 or later; Indy: 6.2 or later), IRISconsole, and array software as required.
- Connect the IRISconsole to the array nodes.
- Configure the array nodes with IRISconsole.
- Add the nodes to the IRISconsole array site.

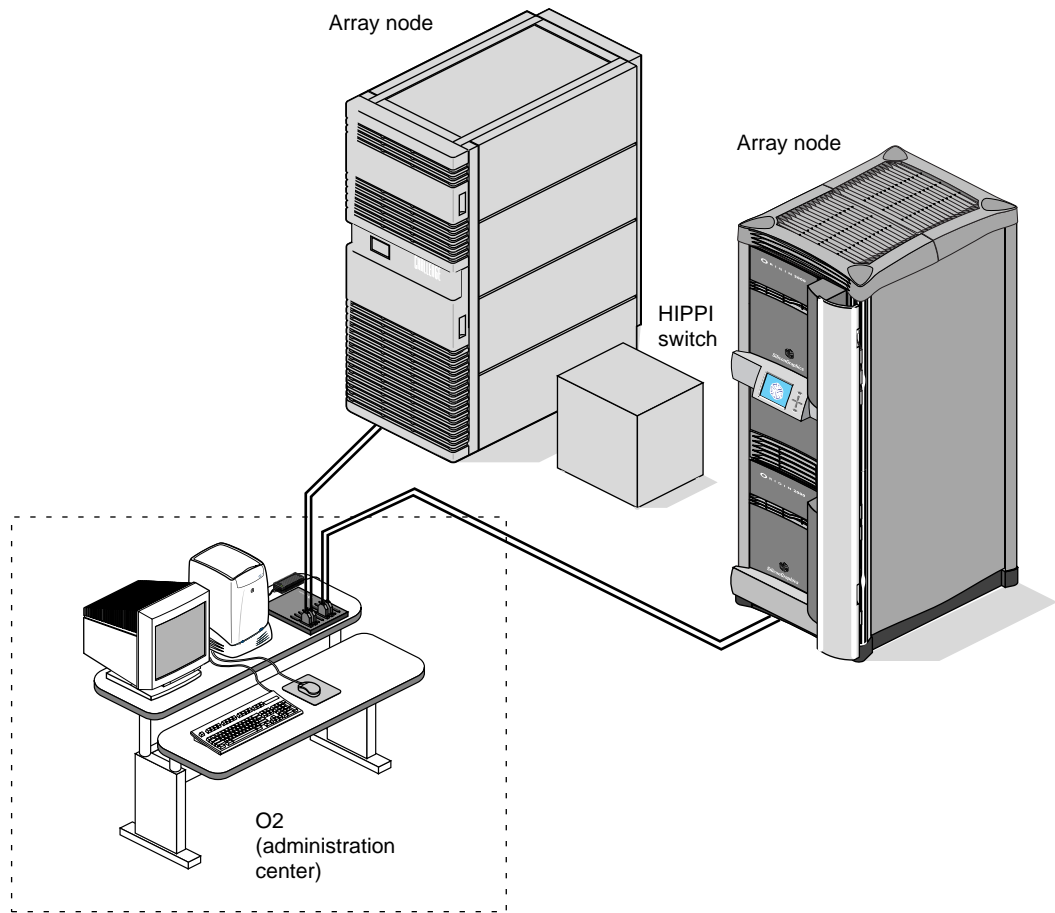


Figure 4-3 Setting Up the IRISconsole

4.3.1 Set Up the Workstation for the IRISconsole

The O2 or Indy workstation provides the graphical interface for array system administration. See the latest version of the owner's guide for complete information on setting up the workstation.

Note: If you are modifying existing systems into an array, you must make sure that you have an IRIX CD (6.2 or later) for the system.

4.3.2 Installing the Software on the Workstation

Follow these instructions to install software on the workstation.

Note: If the customer purchased a complete array package, all the required software should already have been installed at the factory.

1. Install the IRIX software with XFS and perl (if not already installed) from the IRIX CD on the workstation.

Note: You may need to provide this software on CD if it is not already installed.

2. Install the IRISconsole software from the IRISconsole CD.
3. Install the *arraysvcs* software from the array CD.
4. Verify that you have the array services and *perl* software installed on the workstation, by entering the following commands:

```
# versions arraysvcs
```

For an Indy workstation, you should see a display similar to the following:

```
I = Installed, R = Removed
```

Name	Date	Description
I arraysvcs	04/24/97	Array Services 3.0
I arraysvcs.man	04/24/97	Array Services Documentation
I arraysvcs.man.base	04/24/97	Array Services 3.0 man pages
I arraysvcs.man.relnotes	04/24/97	Array Services 3.0 release notes
I arraysvcs.sw	04/24/97	Array Services Software for O32/N32
I arraysvcs.sw.aview	04/24/97	ArrayView 3.0 visual array monitor
I arraysvcs.sw.base	04/24/97	Array Services 3.0 software
I arraysvcs.sw.dso	04/24/97	Array Services 3.0 32-bit libraries

```
# versions eoe
```

5. A display like the following appears:

```
I eoe.sw.gifts_perl 12/22/96 Perl Software
```

4.3.3 Connecting the Multiplexer to the Workstation

The high-performance serial port multiplexer (SPM) acts as an integral part of the IRISconsole station (see Figure 4-5). This section provides brief information on connecting the SPM to a workstation. For complete instructions, consult the *IRISconsole Multiplexer Installation Guide* (p/n 007-2839-xxx).

1. Obtain the serial cables needed to connect the SPM (P/N 018-0527-001) to the site's target systems.
2. Power off the workstation.
3. Connect the serial port multiplexer to the workstation's SCSI port, as shown in Figure 4-4 and Figure 4-5.
4. Attach the other end of the cable to the leftmost socket on the back of the multiplexer, as shown in Figure 4-4 and Figure 4-5.

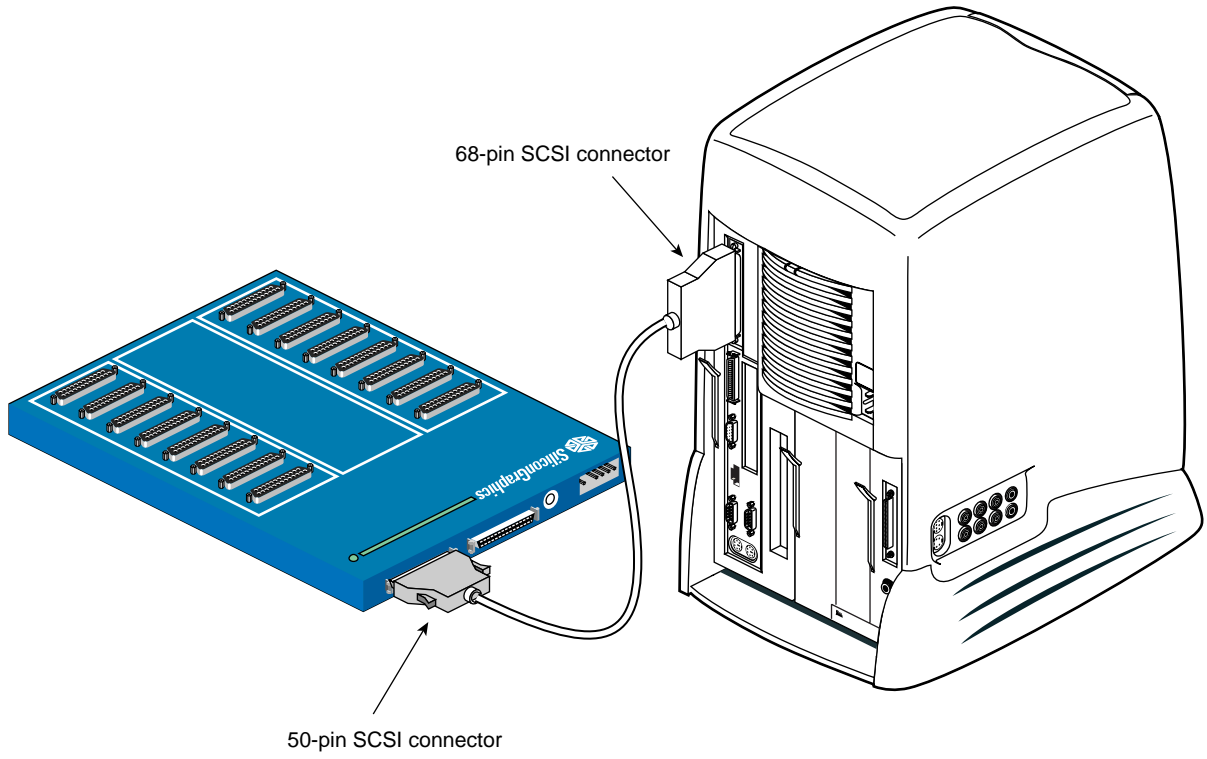


Figure 4-4 IRISconsole O2 Workstation

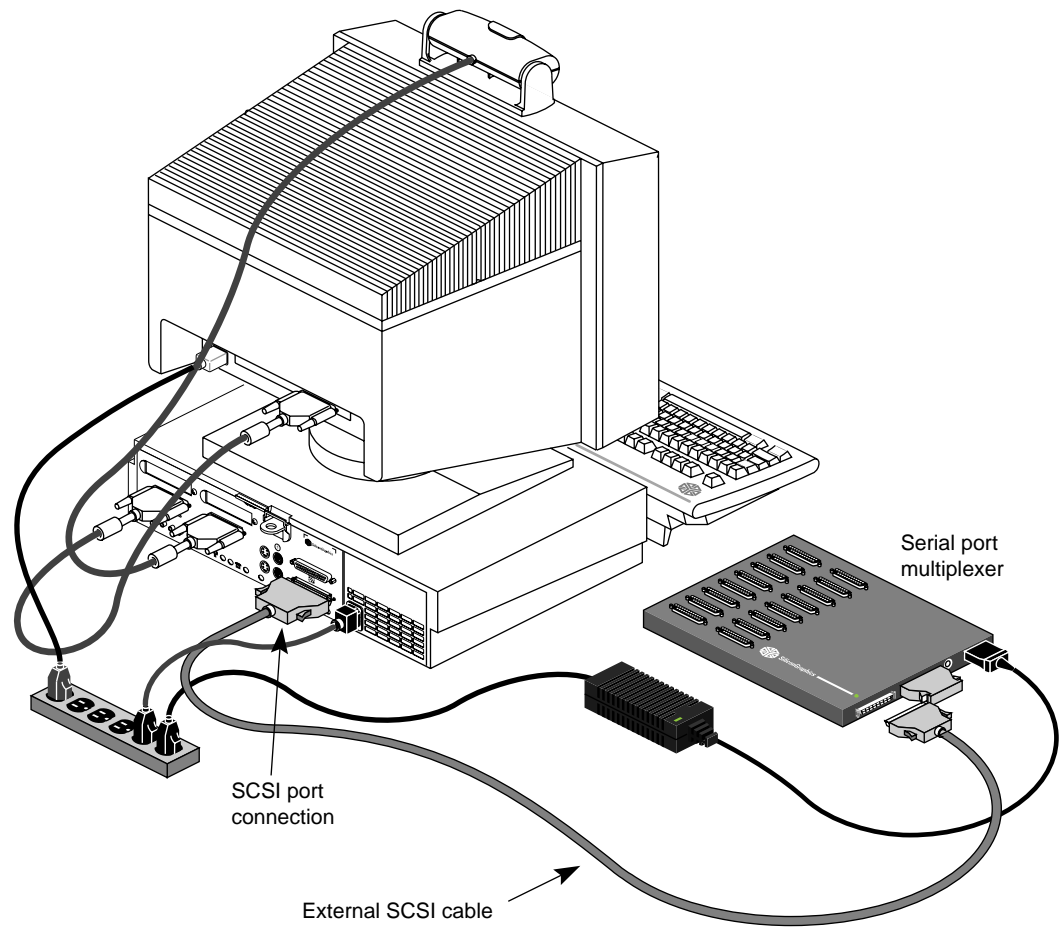


Figure 4-5 IRISconsole: Indy Workstation

5. Select an appropriate SCSI ID number for the multiplexer by inserting a small screwdriver or other tool into the SCSI ID select switch and rotating the arrow, as shown in Figure 4-6. A commonly used SCSI ID for the multiplexer is 5. Using SCSI ID 7 on early models of the multiplexer causes the power indication LED to blink. Select another ID and the LED glows steadily with no blink.

Note: Ensure that you select a unique SCSI ID for the multiplexer. The system disk in the workstation is always SCSI target ID 1, so never select SCSI ID 1 for the multiplexer.

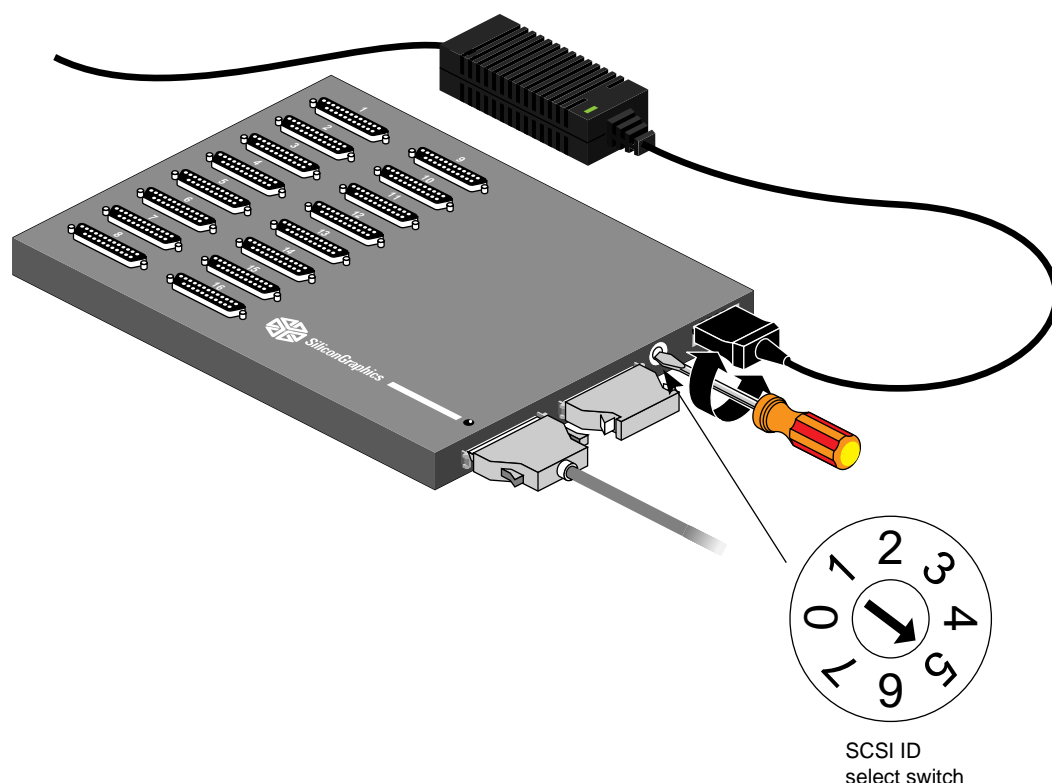


Figure 4-6 Setting the Multiplexer SCSI ID

6. If the multiplexer is the last SCSI device on the workstation's standard external SCSI port, it must be properly terminated.
7. Power on the workstation.

4.3.4 Connecting the IRISconsole Multiplexer to the Array Nodes

You can use the IRISconsole to interact with the array nodes through their console or system controller port (MMSC for Origin2000/Onyx2 racks). You first need to connect the IRISconsole to the console port of the array nodes (as shown in Figure 4-7 and Figure 4-10), connect IRISconsole to the system controller, and then configure the IRISconsole to associate particular multiplexer ports with particular array nodes.

This section summarizes the steps to connect the SPM to the array nodes. This example configuration is for array node 1. For additional information, see the *IRISconsole Multiplexer Installation Guide* (p/n 007-2839-003 or later). Follow these general steps to connect the nodes to the SPM.

Follow these steps for each array node in the array:

1. Connect the 25-pin end of a serial cable to an appropriate port on the multiplexer, and connect another serial cable to another appropriate port. Figure 4-7 shows an example.

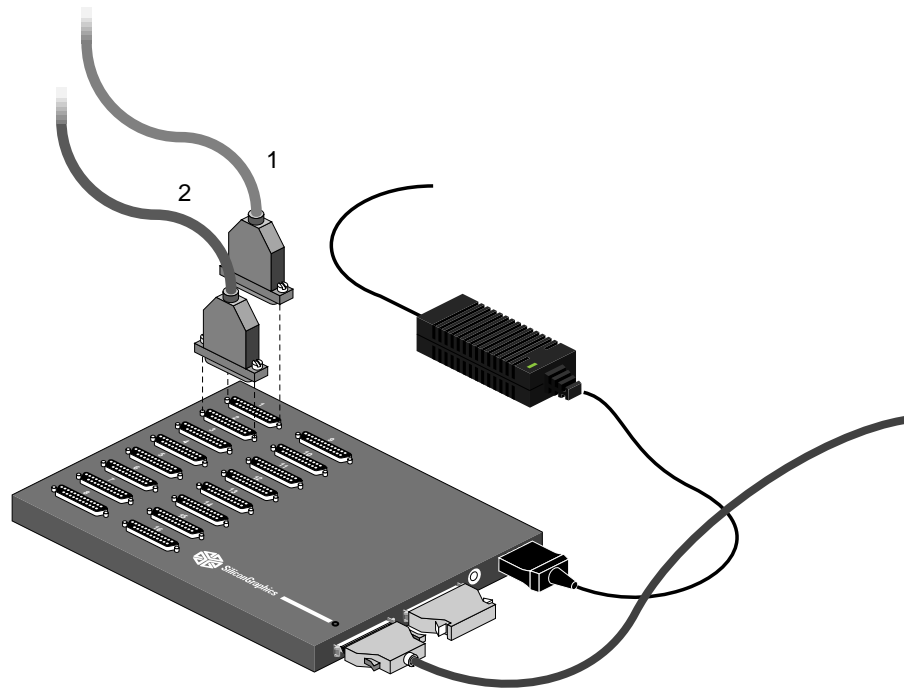


Figure 4-7 Connecting the Serial Cables to the SPM: Example

2. Attach the connector from serial port 1 on the multiplexer to
 - Origin2000/Onyx2 deskside: tty_1 (console) port (the tty port on the right on the BaseIO panel)
 - Origin2000/Onyx2 rackmount: **CONSOLE** port on the Origin Rack MMSC
 - Challenge: the connector labeled **System Console tty_1** on the I/O panel of the array node
3. Attach the 9-pin connector from serial port 2 on the multiplexer to
 - Origin2000/Onyx2 deskside: 9-pin sub-D serial port on the rear

Caution: The 9-pin sub-D serial port on the rear of the system is the same electrically as the 8-pin mini-DIN serial port on the front of the Origin2000 server. If anything is attached to either port before you begin installing the array, it must be removed.

- Origin2000/Onyx2 rackmount: **ALTERNATE CONSOLE** port on the Origin Rack MMSC
- Challenge: the connector labeled **Remote System Control SSE Use Only** on the panel to the right of the I/O panel on the array node (see Figure 4-10).

Figure 4-8, Figure 4-9, and Figure 4-10 show these connections.

4. Repeat these steps to connect additional array nodes to the SPM used as part of the IRISconsole.

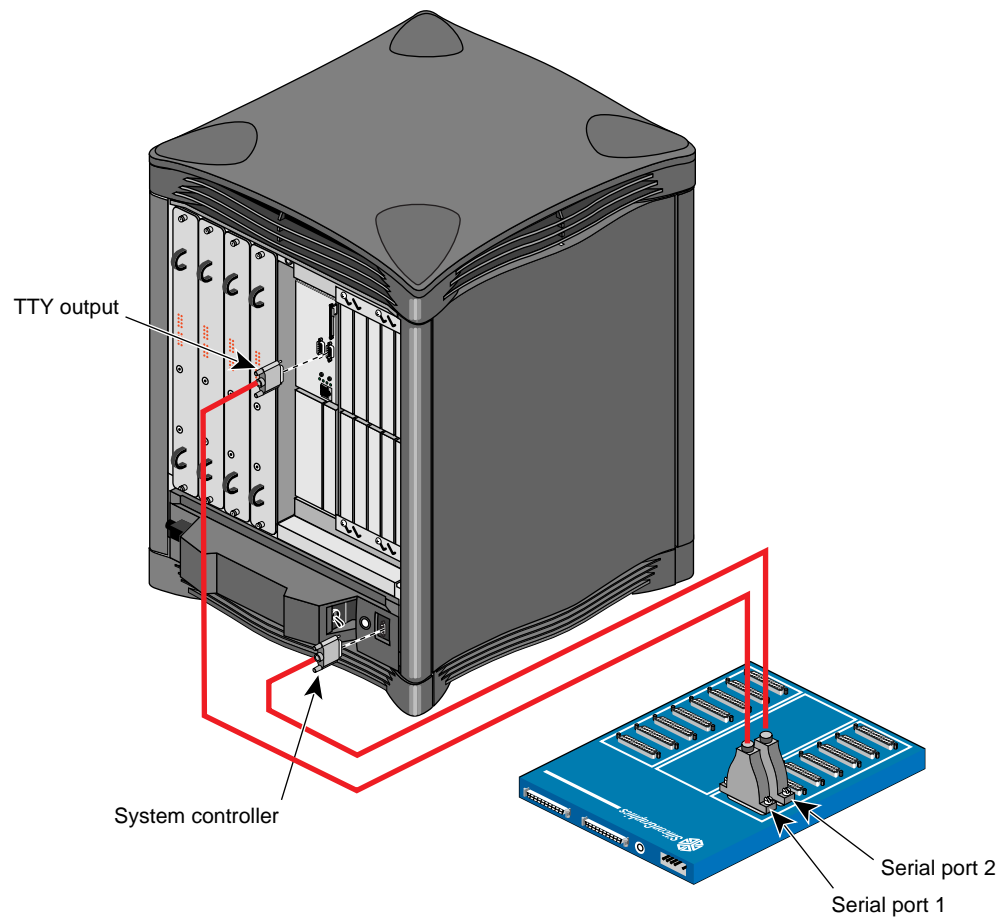


Figure 4-8 Connecting the Serial Cables to the Origin2000/Onyx2 Deskside Server

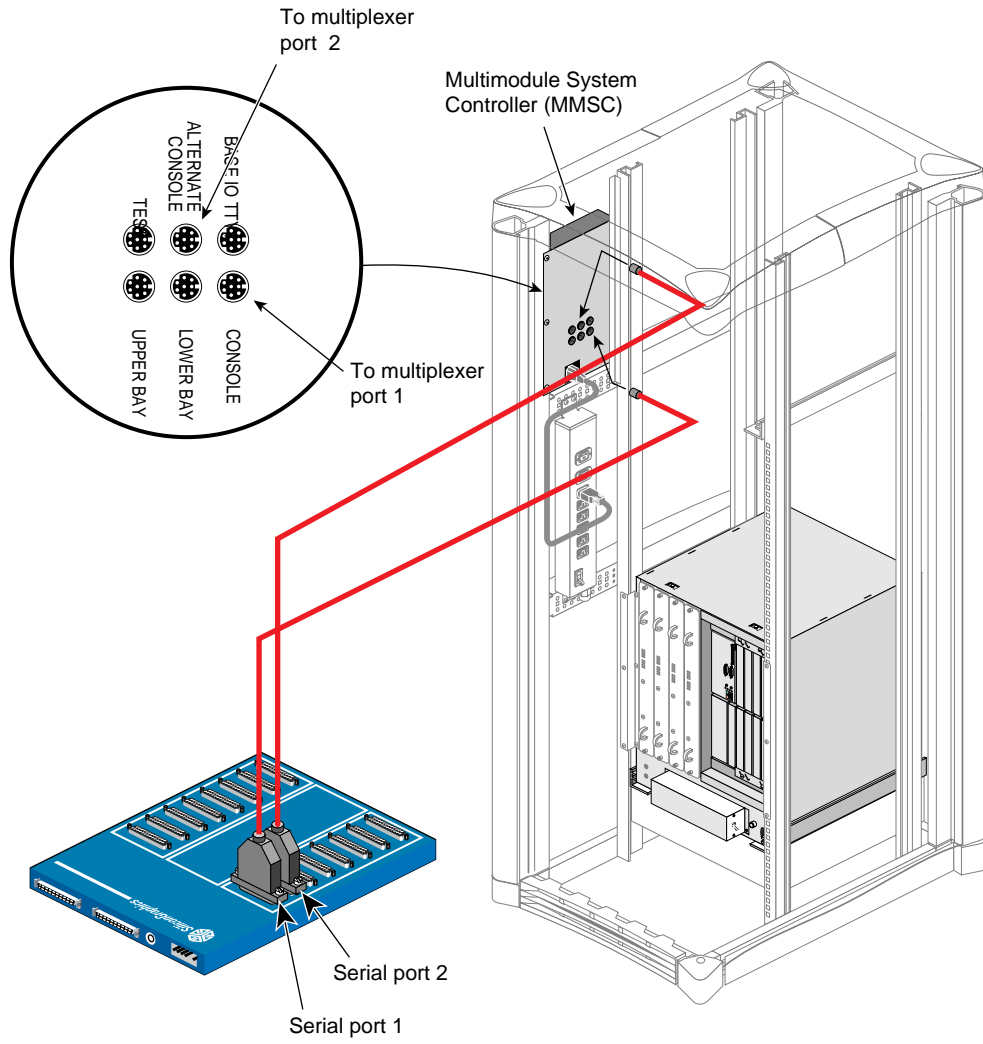


Figure 4-9 Connecting the Serial Cables to the Origin2000/Onyx2 Rackmount Server

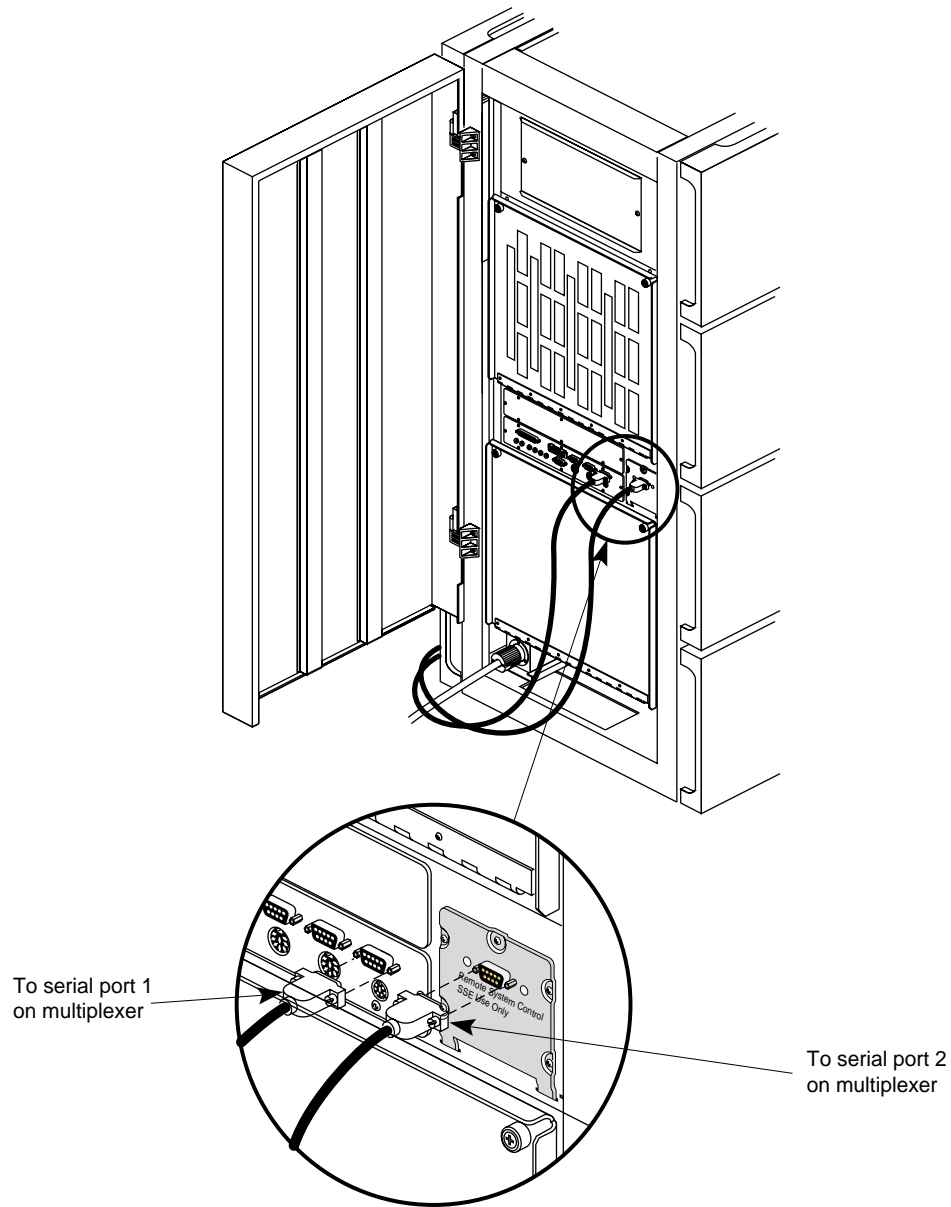


Figure 4-10 Connecting the Serial Cables to the Challenge Server

4.3.5 Configuring the Array Nodes With IRISconsole

Now that the IRISconsole is operational, you need to register the array nodes in the array with the IRISconsole.

1. Autoconfig and reboot the workstation.
2. Bring up the IRISconsole to determine that the software is working properly by entering:

```
/usr/sbin/ic
```

You should get the IRISconsole main menu shown in Figure 4-11.

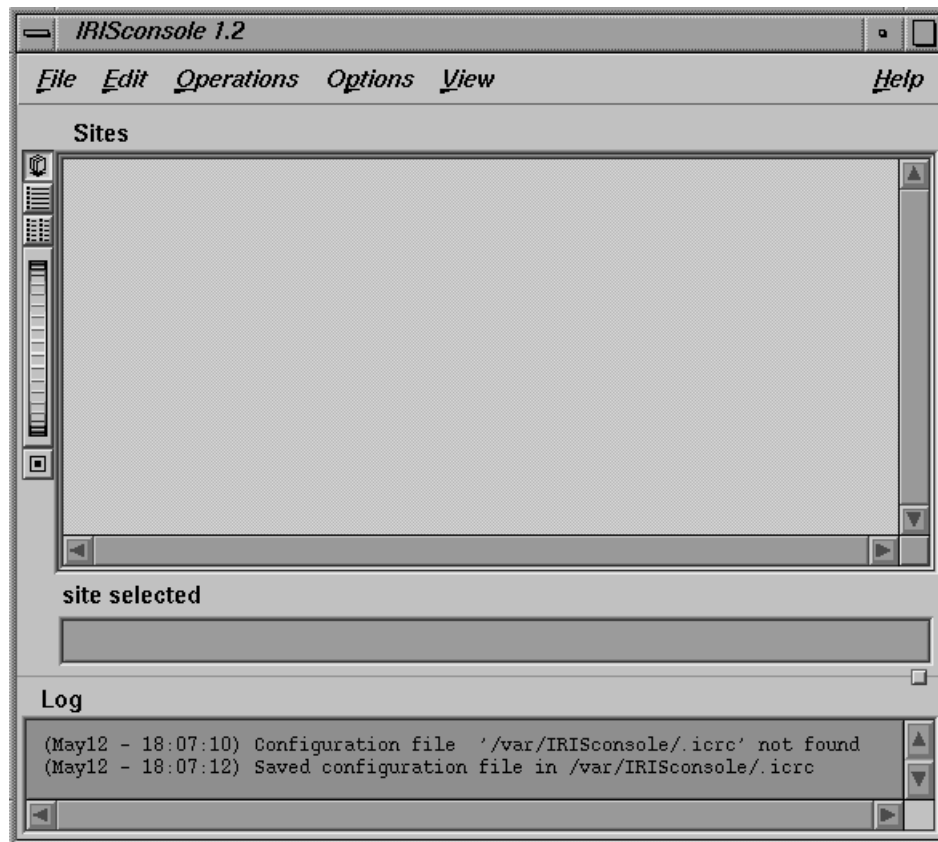


Figure 4-11 IRISconsole Main Menu

3. From the Edit menu, choose Add New Site... The Change IRISconsole Config dialog box appears, as shown in Figure 4-12.

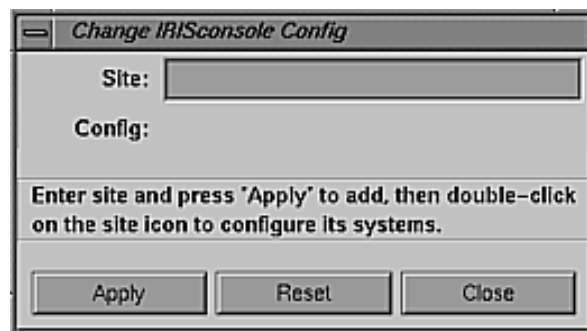


Figure 4-12 Change IRISconsole Config Dialog Box

4. In the Site: field, type the name of the user's array, for example, hotbox.
5. Click *Apply*.

The name of the configuration file appears in the Config: field; its name is based on the site name. For example, `/var/IRISconsole/.icrc.netwk1` is the configuration file for the site `netwk1`. The format of this filename, `.icrc.sitename`, cannot be changed.

6. When you see `New site <site name> added`, click *OK*.
7. Close the site window by clicking *Close*. If you wish to add more array sites, repeat steps 3 through 7.
8. To save these changes, choose *Save IRISconsole Config* from the File menu. The file is saved to the IRISconsole directory, `/var/IRISconsole/`.
9. Go to Section 4.3.6 when you are done creating array sites.

Note: You can rename or delete a site using choices in the IRISconsole main window Edit menu.

4.3.6 Adding the Array Nodes to the IRISconsole Site

To register an array node in the IRISconsole site, follow these steps:

1. In the IRISconsole main window, double-click on the site to which you want to add a system (or select the system and choose *Open Site...* from the Operations menu). The site window opens, as shown in Figure 4-13.

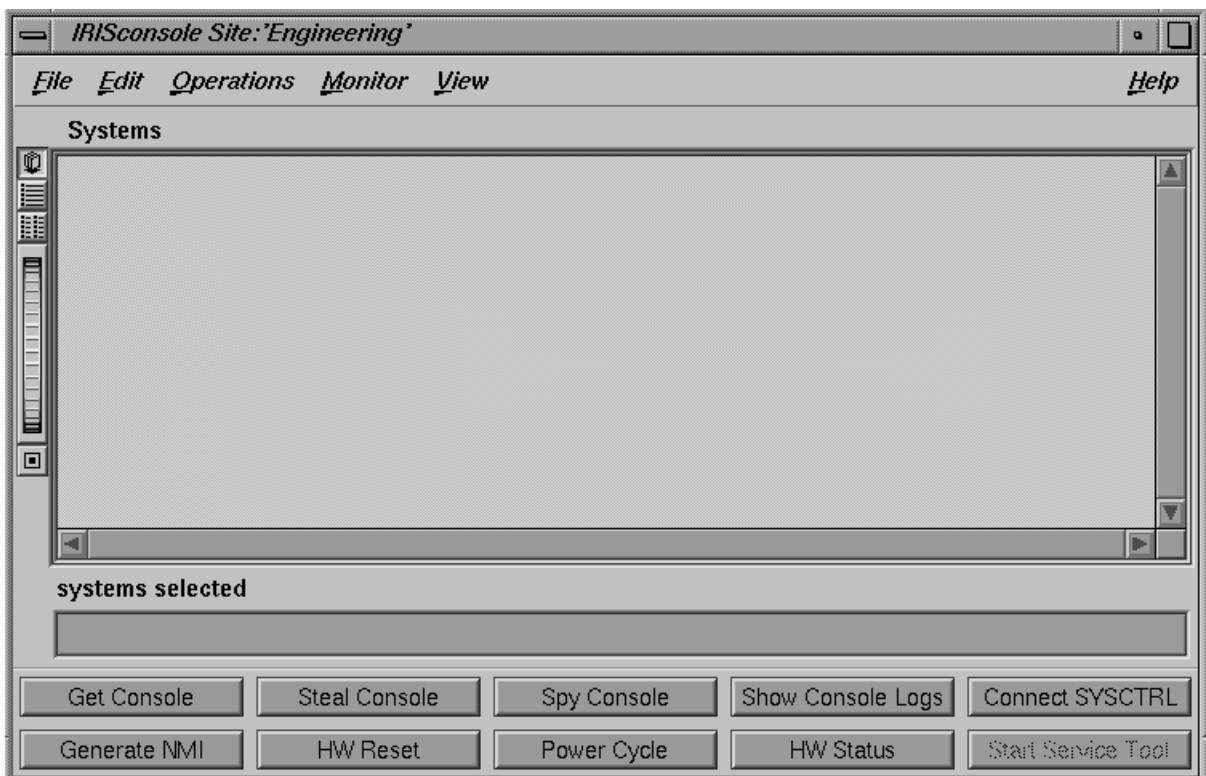


Figure 4-13 Site Window

2. In the site window, choose Add New System... from the Edit menu. If IRISconsole security is on, you are prompted for your password.

After you enter your password, the Change Site Config dialog box appears, as shown in Figure 4-14.

The screenshot shows a dialog box titled "Change Site Config: 'ictest'". It contains several input fields and checkboxes. The fields are: "System Name:", "ST-1600/1616 SCSI ID# (2-7):", "Console Port# (1-16):", "Remote System Control Port# (1-16):", "Login:", and "Baud Rate:". There are two checked checkboxes: "Log Console Activity to File:" and "Default System Controller Password:". The "System Type:" dropdown menu is set to "Challenge S". At the bottom, there are three buttons: "Apply", "Reset", and "Close". A note at the bottom of the dialog box reads: "If a port is not attached, enter '-1'. Console must be open for its output to get logged."

Figure 4-14 Change Site Config Dialog Box

3. In the System Name: field, type the hostname of the array node you want to add to this site; for example, hotbox1.engr.sgi.com.
4. In the ST-1600/ST-1616 SCSI ID# field, enter the SCSI ID number of the SPM.
5. Based on port assignments that were designated in Section 3.6, "Assigning IRISconsole Ports for Each Array Node," enter the SPM port numbers to which cables to the Console port and Remote System Control port are connected in the Console Port# and Remote System Control Port# fields, respectively.
6. In the Login: field, enter the user name (login) under which all operations requiring access to the system via the network can be performed. This login is the one used in the command:

```
rsh login@system /usr/etc/sysctldr -p
```

Note: The IRISconsole security login is separate from this system login; IRISconsole security is explained in the *IRISconsole Administrator's Guide* (p/n 007-2872-xxx). As an example, you may want to use the name of the array as a login.

7. In the Baud Rate: field, enter the baud rate at which this system sends data to IRISconsole; the default for the array node is 9600. If you enter a different baud rate, be sure that the node has been configured for that rate.
8. Click the box at the Log Console Activity to File: if you want console activity logged to a file in the `/var/IRISconsole/logs/console_logs/` directory that has the format `<systemname>.<timestamp>.log`. The format of this filename cannot be changed.

Note: To view a log of a system's console activity (Spy Console button or command) or to view console activity logs (View Console Logs button or command), this box must be checked when the system is added to a site.

9. When you are satisfied with the settings for this system, click *Apply* to add this system to the site.
10. To save the configuration, choose Save Site Config (or Save Site Config As...) in the site window File menu.
11. To add another system to the site, edit the entries in the fields of the Change Site Config dialog box, or click *Reset* to clear all entries and begin entering again. Follow instructions in steps 3 through 10 for the new system.
12. When you are finished adding systems to the site, close the Change Site Config dialog box by clicking the *Close* button.

If your hardware configuration changes, use Modify System Config... in the site window Edit menu to change the parameters for a system in a site. To delete a system from a site, select it in the site window and choose Delete Selected in the Edit menu.
13. Exit from the IRISconsole.

4.3.7 Verifying the Array Configuration on the IRISconsole

You have now created the array through the IRISconsole. Verify the configuration by following the steps outlined in this section. Make the required changes as applicable, if the configuration is not accurate.

1. Open the main IRISconsole window by entering `/usr/sbin/ic` as superuser. You should see a display similar to Figure 4-15 that shows the name of the newly created array. Figure 4-15 shows an array called `ictest`.

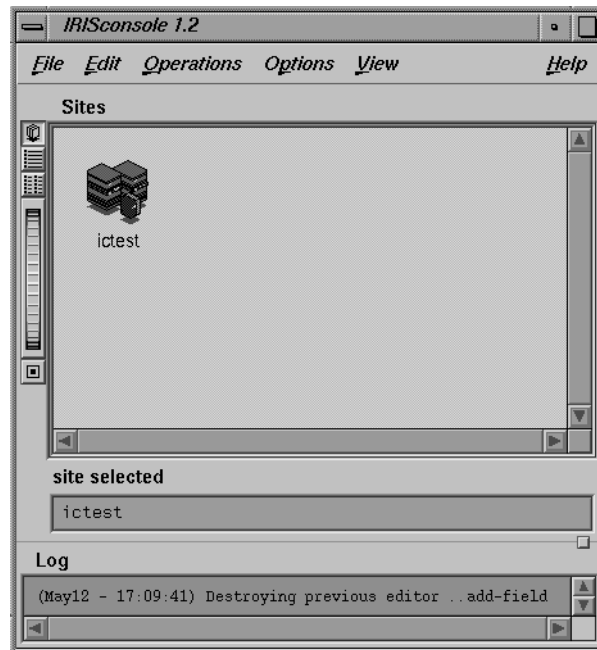


Figure 4-15 Example of an Array Site Icons Created Through the IRISconsole

2. Double-click the array icon. You should see a display similar to Figure 4-16 that shows the individual nodes of the array. In this example, array `ictest` is expanded into the array node called `datarray`.
3. Open up a node by double-clicking its icon.

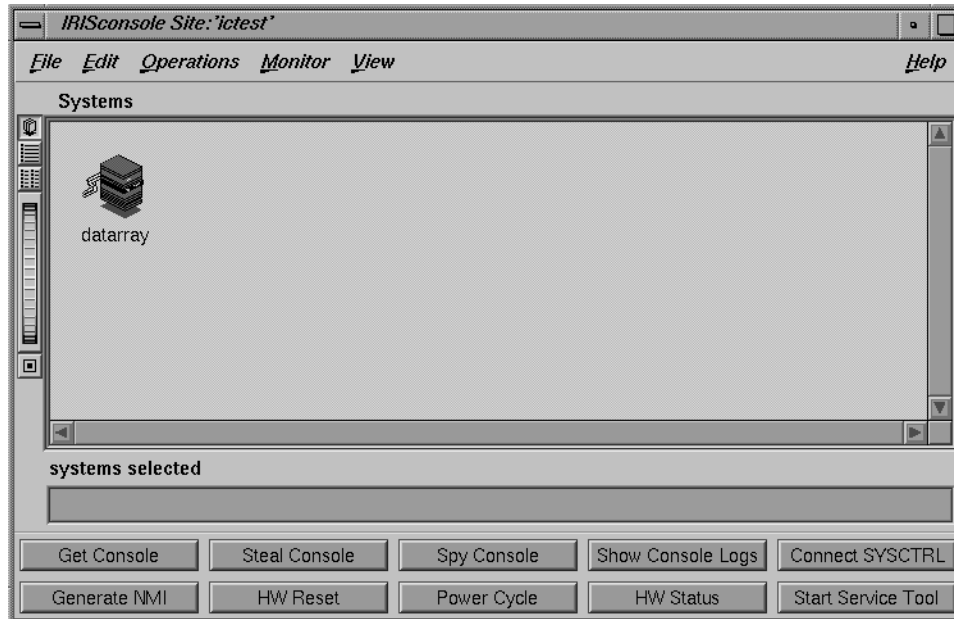


Figure 4-16 Site Window (With Systems Added Example)

4. Click *Get Console* to get a display similar to the one shown in Figure 4-17. This window represents the console shell of the selected array node.

```
datarray.Engineering (/dev/ttyd150) Console
IRISconsole V1.2
Attempting to connect to device '/dev/ttyd150'

----- Connected Port=/dev/ttyd150 -----

9600 BAUD 8 NONE 1 SWFC=ON HWFC=OFF
CAR=ON DTR=ON RTS=ON CTS=OFF DSR=ON
Type ~? for Help, ~X to Exit.
Connection Ready.

[datarray:/usr/people/rdb] %
```

Figure 4-17 Array Node Window on the IRISconsole GUI

At this point, your IRISconsole can manage the nodes of the array. You can now begin to bring the array nodes up to their first stage of array evolution, the “base node” stage.

4.4 Bringing Up the Array Nodes

Section 4.5 through Section 4.8 describe how to bring up each node of the array, first as a basic standalone system (base node), then as a node in a LAN (LAN node), next as a node in a HIPPI network (HIPPI node), and finally as a node in an array configuration (array node).

Bring up the nodes first as individual array node servers, without any array-specific features, to simplify the installation process. If required, you will install the HIPPI interfaces, IRIX 6.2 or later (see Note below), and HIPPI and NFS software. Afterward, you must configure the local area network, then bring up and test the systems.

For complete instructions on setting up the systems, consult the installation instructions for the servers.

4.5 Configuring the Base Node

The first stage of array node bring-up involves installing the customer hardware, installing the base array software, and bringing the system up. During this stage, the goal is to eliminate any immediate hardware problems. At this point, the array node is not even operational on the network. You will interact with the nodes through the IRISconsole.

Here are the basic steps to set up a node for the array. Many of these steps are described in detail in this section.

1. Be sure the array nodes are properly positioned (see Figure 4-17).
2. Be sure array nodes are properly attached to the multiplexer, and the IRISconsole is configured.
3. Install any additional hardware and interfaces into the array nodes.
4. Set up and power on the array nodes.
5. Install the major software modules on each array node (as required).
 - IRIX 6.2 or later for Challenge/POWER Challenge; IRIX 6.4 or later for Origin2000/Onyx2

Note: Be sure to install the *perl* software (*eo.sw.gifts_perl* in IRIX 6.2), as well.

 - NFS3
 - HIPPI
 - IRIX array services software and all other desired array software modules from the array CD.

Note: These software modules are preinstalled on all complete array configurations.
6. Run base node diagnostics for the chassis to test the individual array node hardware and HIPPI interface (see Appendix A for additional information on diagnostic testing).

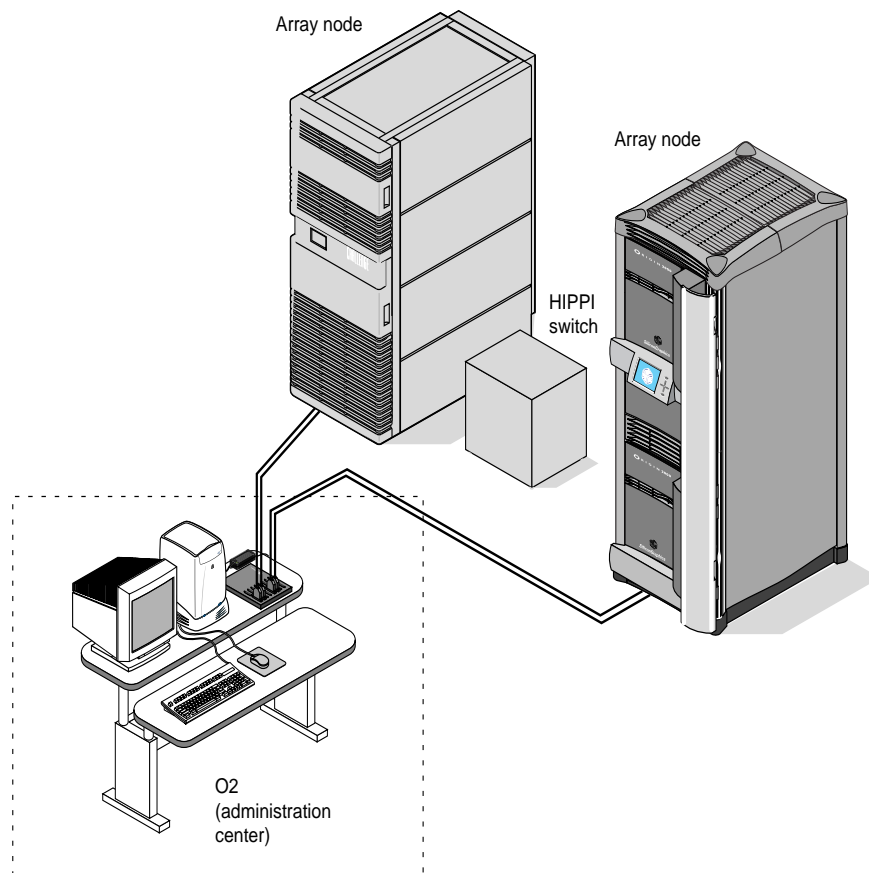


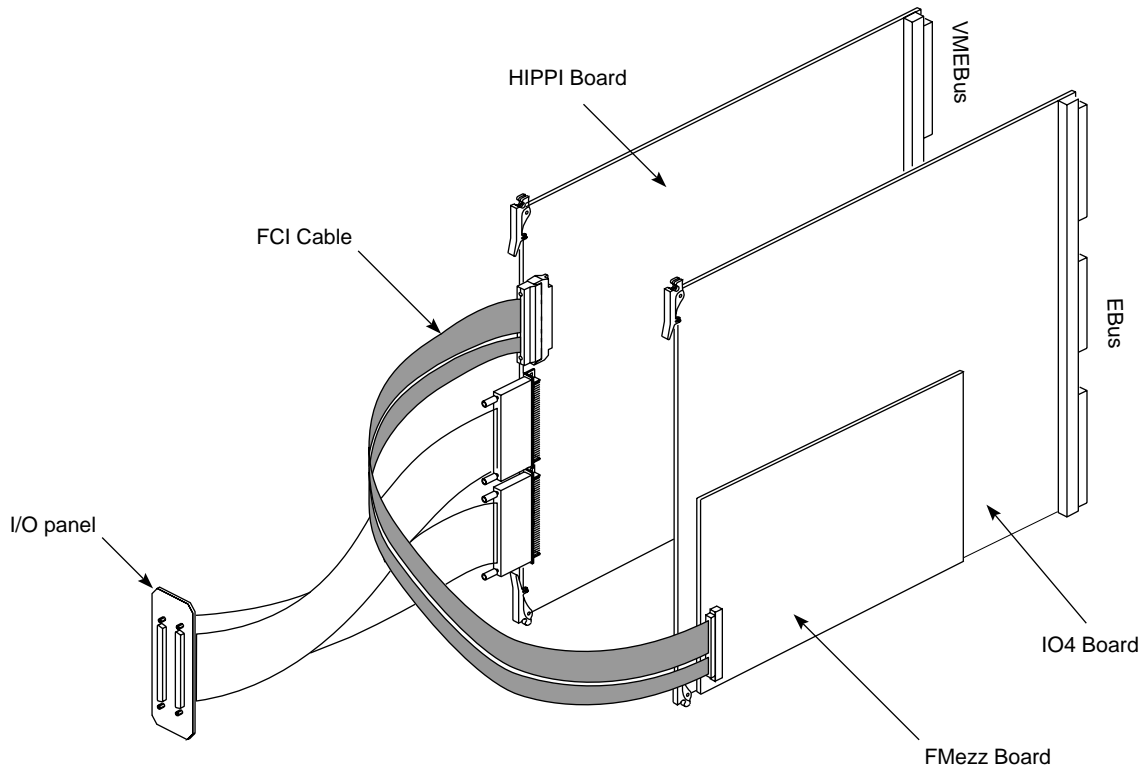
Figure 4-18 Array Hardware Setup

4.5.1 Installing HIPPI and Additional Hardware

If the customer purchased a complete array configuration, the HIPPI board(s) should already be installed in the system at the factory. If you are upgrading existing server clusters into an array, you may need to install HIPPI boards and internal cabling. If this is the case, install these boards now, following instructions in

- Origin2000/Onyx2 systems: *IRIS HIPPI-Serial XIO Board Installation Instructions* (108-0160-001)
- Challenge systems: *IRIS HIPPI Installation Instructions*

Figure 4-19 shows the internal HIPPI hardware components for Challenge systems.



This illustration accurately displays the connections between components. The positioning shown does not reflect actual positions when the components are installed.

Figure 4-19 Internal VME HIPPI Hardware Components for Challenge Servers

Note: The HIPPI board set for a Challenge server consists of a short F mezzanine board that resides on the IO4 and a 9U VME form factor board.

Figure 4-20 shows the HIPPI XIO board for Origin2000/Onyx2 systems.

For more information on each board, see its manual.

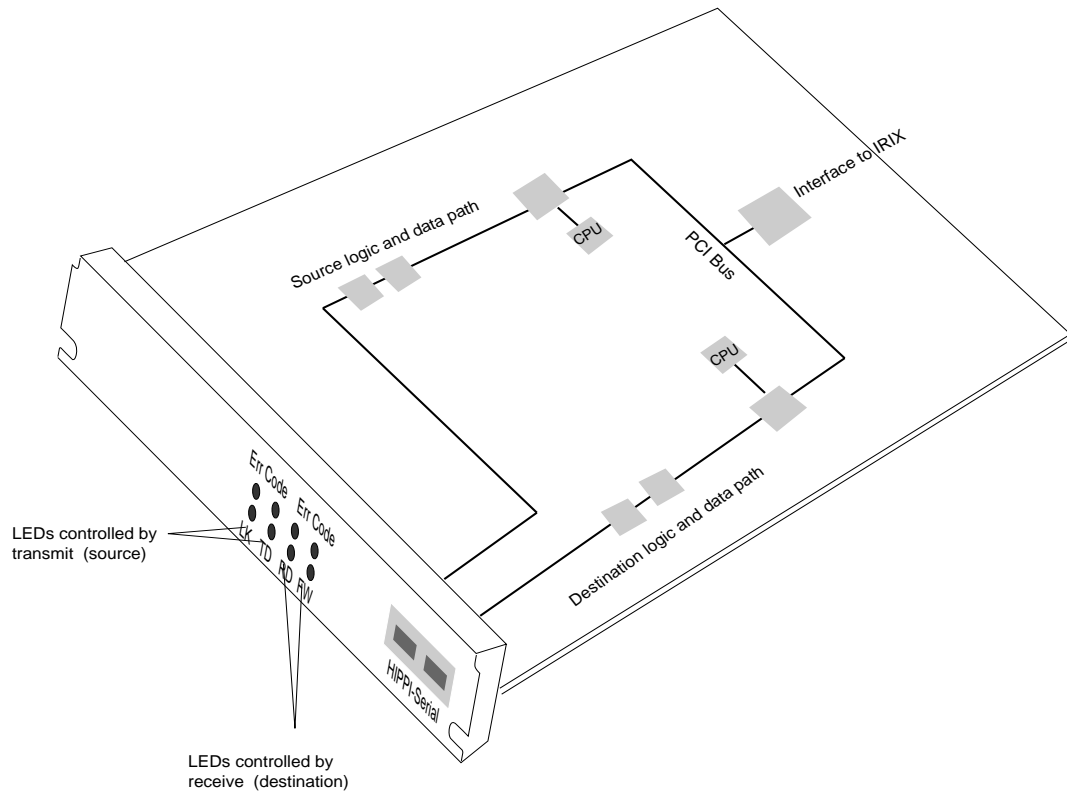


Figure 4-20 Internal HIPPI XIO Board for Origin2000/Onyx2 Servers

If there is additional hardware the customer has ordered, but is not installed, install that hardware into the array nodes now.

4.5.2 Powering Up the Array Nodes

Using the IRISconsole as the terminal interface, boot up the individual array nodes. Identify and rectify any immediate hardware problems. If the customer purchased a complete array package, you can skip Section 4.5.3 and proceed to Section 4.5.4. All the required software modules to operate an array are installed at the factory.

4.5.3 Installing Software on the Array Nodes

Now you can begin to install the bare minimum software release. If the customer purchased a complete array package, all the required software modules to operate an array (for example, IRIX operating system, array services, NFS, and HIPPI) are installed at the factory. If you are converting existing systems into an array configuration, follow the software installation procedures outlined in this section.

4.5.3.1 Installing the IRIX Operating System Software

To install IRIX 6.2 or later, follow these steps to boot the miniroot and install the operating system using the IRISconsole.

1. Verify that the CD-ROM drive is still attached to the system and then install the operating system CD in the drive.
2. At the System Maintenance Menu, select option 2, `Install System Software`.

You should see the following prompt:

```
Load software from local CD-ROM? (y/n) [y]
```

3. Press **Enter** to boot the miniroot from the CD-ROM drive.

After a while, you see the `Inst>` prompt. A default set of subsystems is selected for installation. You may wish to add or delete subsystems depending upon your customer's needs.

4. After you have selected the appropriate subsystems, enter `go` at the `Inst>` prompt.
5. Install any application CDs as required.

Caution: Verify that the customer system has all the required replacement software applications to run on the new version of the operating system. Otherwise, you could receive an error similar to the following when you boot the system:

```
incompatible SW products
```

If this occurs and you do not have the replacement application software, you need to remove the existing application.

6. Verify that the perl software is installed on each node by entering `versions eoe.sw.gifts_perl`

You should receive a confirming output line, if this module is present.

Note: This software *must* be present for the array configuration to operate properly.

4.5.3.2 Installing HIPPI Software

HIPPI software releases are

- for Origin2000/Onyx2: 3.1 or later
- for Challenge: 2.4 or later

Install the HIPPI software through the miniroot, as required. To check if HIPPI software is present, enter

```
versions hipp
```

The display then indicates whether or not the software is installed.

Note: If the customer purchased a complete array configuration, the software is installed at the factory.

4.5.3.3 Installing NFS3

Install the NFS software through the miniroot, as required. To check if NFS software is installed, enter

```
versions nfs
```

Note: If the customer purchased a complete array configuration, the software is installed at the factory.

4.5.3.4 Installing the Array CD

Install the desired array software through the miniroot, as required. There are a number of available array software modules. The customer needs to determine which modules are applicable to his or her configuration.

Note: If the customer purchased a complete array configuration, the software is installed at the factory.

Caution: Be sure to install IRIX 6.2 or later of the array services software on the array node. Do not attempt to install IRIX 5.3 on an array node, or software conflicts will arise.

Verify that the array services software is installed on each node by entering

```
versions arraysvcs
```

You should receive the confirming output lines if this module is present.

Note: This software *must* be present for the array configuration to operate properly.

4.5.3.5 Installing the Patch CDs

You may be required to install additional software patches from the patch CD. This should generally be done after you have installed the main IRIX CD.

The patch software installs through the miniroot. Follow these steps to select a patch for installation:

1. At the `Inst>` prompt, enter

```
Inst> install patchSGxxxxxx
```

where `xxxxxx` is the number of the patch you wish to install.

Caution: You must specify each required patch, since you cannot install all the patches at one time. For example, if you give the command `install default`, you see the error `desktop_tools.sw.tools requires desktop_eoe.sw.fam 1019999999`.

Select the desired patches for installation.

2. Once all the patches are installed, enter `quit` to exit from `Inst`.

4.5.3.6 Completing Software Installation

After you have installed all the system software, follow these instructions to complete and verify proper operating system and array software installation:

1. Reboot the system and watch the display messages carefully to verify a normal boot process.
2. Log in and enter the following command to verify the installation and that the operating system is IRIX 6.2 or later:

```
uname -a
```

If *uname* reports that the system is running the IRIX 6.2 or later for an array node, the installation is successful.

4.5.4 HIPPI Testing

Once the HIPPI software is installed, you can test the interfaces on each of the nodes using a loopback cable as described in this section.

1. Connect a loopback cable between the source and destination of each HIPPI interface.

Note: Any HIPPI cable can be used as a loopback cable. However, specially made, short testing cables are available for easier hookups.

2. Run the *hiptest* program to test the interface. To test the first HIPPI interface (*/dev/hippi0*), enter

```
hiptest -D/dev/hippi0
```

To test the second HIPPI interface (*/dev/hippi1*), enter

```
hiptest -D/dev/hippi1
```

Refer to *hiptest(1M)* reference page or the HIPPI installation manuals (*IRIS HIPPI-Serial XIO Board Installation Instructions* for Origin2000/Onyx2, *IRIS HIPPI Installation Instructions* for Challenge) for more information about *hiptest*, loopback cables, and fault diagnosis. If necessary, consult the *IRIS HIPPI Administrator's Guide*.

4.5.5 Base Node Testing

The array nodes are now at the base node stage of evolution. You can perform a full base node diagnostic using the array test diagnostic. Leave loopback cables attached, and execute the base node test on each node:

```
/usr/array/diags/arraytest -stage base_node
```

Note: See Appendix A for information on additional array tests.

4.6 Configuring LAN Nodes

At this point, the array nodes should all be successfully running as unnetworked base nodes. You can now bring the nodes up on the network. Follow these steps:

1. Connect the local area network to the array nodes. For most sites, this is an Ethernet network. Configure each array node to operate as a conventional networked server on the local area network. See the *IRIX Admin: Networking and Mail* manual (007-2860-xxx) for additional information.
2. Ensure that the array nodes can *ping* each other.
3. Execute the LAN node test. Test the local area network by running the array test diagnostic with the **-lan_node** option on each array node. Specify the hostnames of all the array nodes on the command line. For example, for an array with hostnames hotbox1 through hotbox4, run the diagnostics on each node as

```
/usr/array/diags/arraytest -stage -lan_node hotbox1 hotbox2 hotbox3  
hotbox4
```

See Appendix A for additional information on diagnostic testing.

4.7 Cabling, Configuring, and Testing the HIPPI Network

You can begin cabling the nodes into the array's HIPPI network once the following tasks are done:

- The array nodes are stabilized and are up on the local area network.
- The HIPPI interfaces have passed the loopback tests on all base nodes.

This section explains

- HIPPI cabling
- HIPPI configuration
- HIPPI bypass function
- HIPPI node testing

4.7.1 HIPPI Cabling

The multi-port switch provides two types of HIPPI ports, each with destination (in) and source (out):

- serial (fiber optic cable), with dual connectors
- parallel (copper cable), with separate connectors for destination and source

Some HIPPI switches label the connectors **DEST IN** and **SRC OUT**.

Figure 4-21 shows a typical HIPPI switch with both types of connectors.

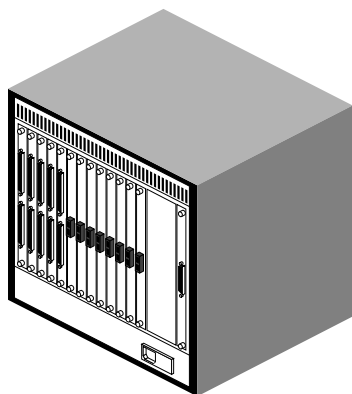


Figure 4-21 Multi-Port HIPPI Switch

To install the HIPPI cables, follow these steps:

1. Have ready the HIPPI networking diagram you prepared earlier.
2. If the HIPPI switch is powered on, power it off.
3. Because it is easy to miscable the network, make sure to label both ends of each cable with a unique cable identification number as described in Section 3.7.2, according to the port number on the HIPPI switch (see Figure 4-22).
4. Cable the HIPPI switch: plug cable connectors into the **DEST IN** and **SRC OUT**. Both serial and parallel connectors are keyed. See Figure 4-21.

Caution: Do not remove HIPPI parallel connectors at an angle, or pins can be easily bent. Check the pins for alignment if there are suspected HIPPI problems. The HIPPI serial connector's fiber optic interface must be kept clean for proper operation. See the *IRIS HIPPI-Serial XIO Board Installation Instructions* for handling and cleaning instructions.

Tip: Run the cables under a raised floor if possible.

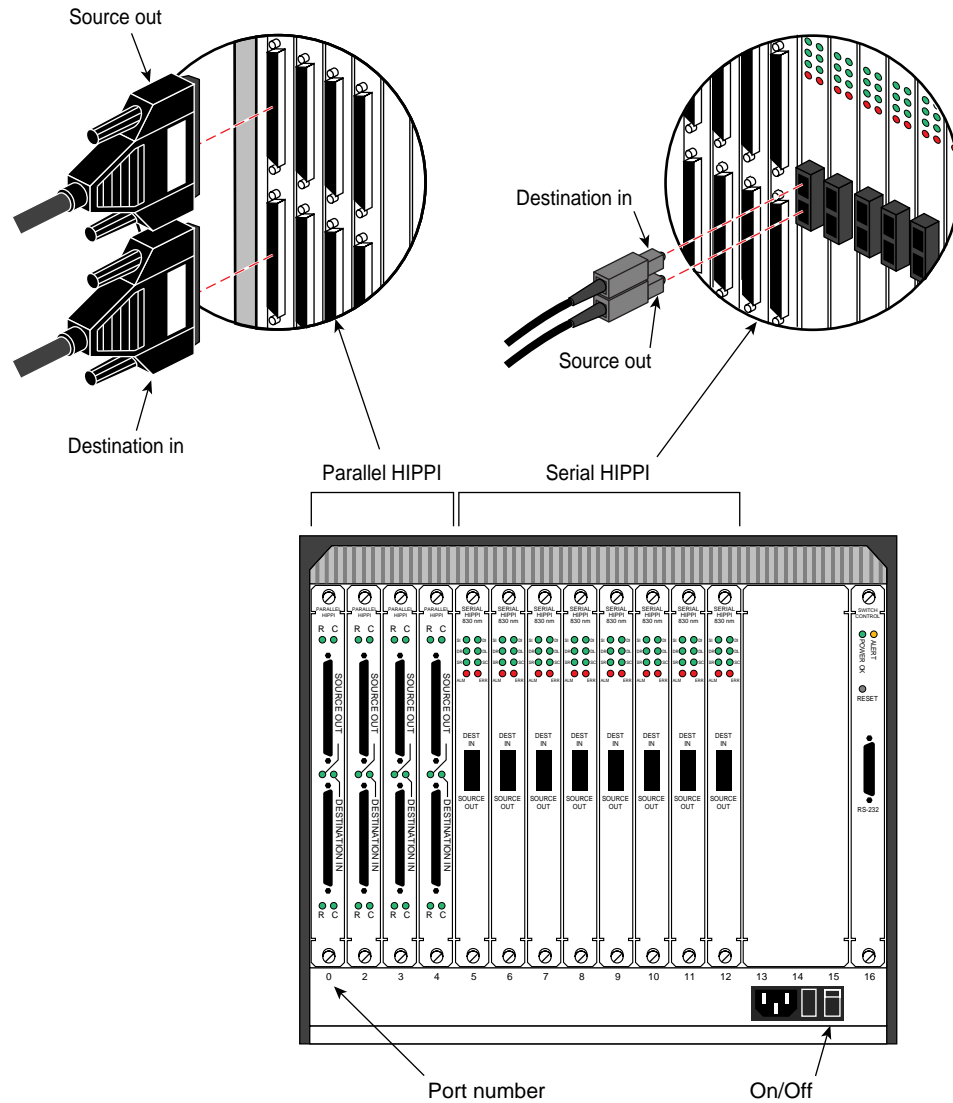


Figure 4-22 Connecting the Array Node to the HIPPI Switch

5. For HIPPI parallel, make sure you label each connector **SOURCE** or **DESTINATION**.
6. Cable the nodes: plug cable connectors into the appropriate connectors on the node, or directly to the other interface for switchless arrays. See Figure 4-23.

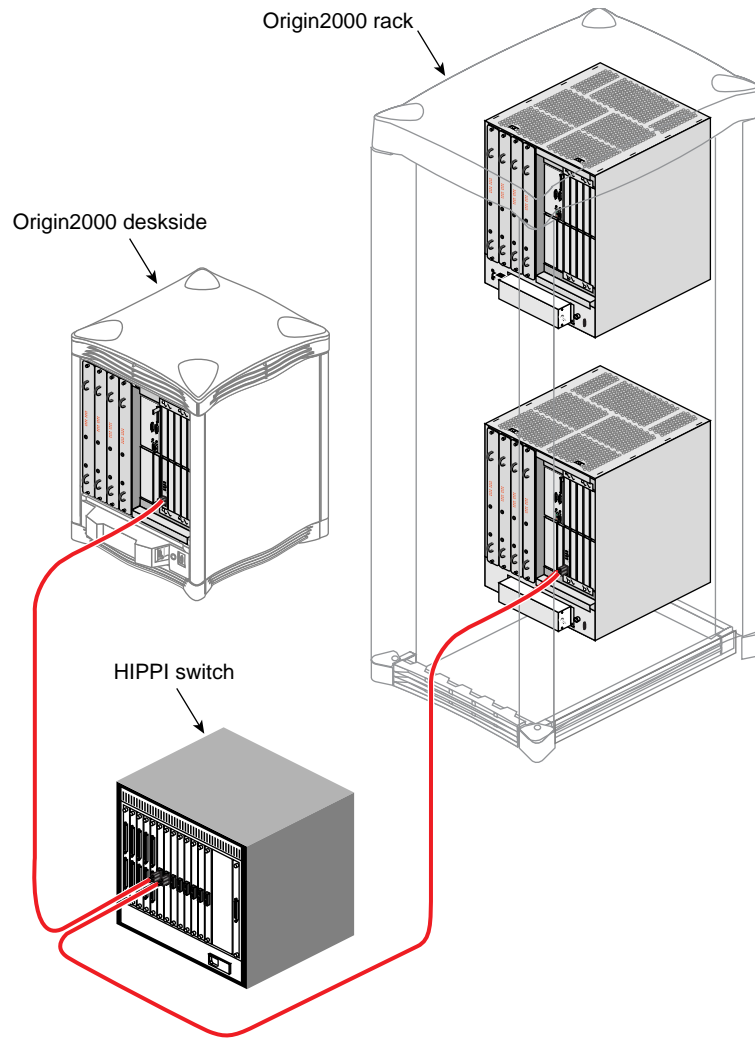


Figure 4-23 Example HIPPI Cabling for Nodes

7. If necessary, plug in the HIPPI switch and power it on. Consult the multi-port switch manual or Chapter 2 for power issues as required.
8. Note the LED activity to determine whether cabling is correct.

HIPPI supports a link light to verify that the link is properly connected. Because HIPPI is dual simplex, each direction has an LED.

- HIPPI board (serial), Origin2000/Onyx2:
 - link light (LK) does not light: connectors might be inserted in reverse order (source/destination), fiber plant could be dirty, or one end of the connection may be malfunctioning
 - yellow LED (Err Code) lit: HIPPI XIO hardware is malfunctioning; see the *IRIS HIPPI-Serial XIO Board Installation Instructions* for further information

The link LED indicates the level of synchronization at the destination only, which is generally sufficient; a broken or misconnected cable affects both fiber links. However, to be certain, check the link light at both ends of the cable.

- HIPPI board (parallel), Challenge: see *IRIS HIPPI Installation Instructions*
- HIPPI switch, serial: typically, two separate link LEDs (for example, labeled **SRC OUT** and **DEST IN**) above the pair of serial sockets
- HIPPI switch, parallel: typically, two separate link LEDs (for example, labeled **SRC** and **DEST**) between the two parallel connectors

4.7.2 HIPPI Configuration

Configure the HIPPI network as described in the *IRIS HIPPI Administrator's Guide* (007-2229-004 or later). You typically edit

- `/usr/etc/hippi.imap` to define the endpoint I-Fields
- `/etc/config/netif.options` to associate the HIPPI interfaces with IP hostnames
- `/etc/hosts` (or other hostname resolution mechanism) to bind HIPPI IP hostnames with HIPPI IP addresses

Note: You can quickly replicate information for each of the nodes by using the mouse to copy and paste in IRISconsole windows.

To verify that each interface has booted up, execute `hipcntl hipp # status`. The `hippi #` variable specifies the interface number to be checked. If you do not specify the HIPPI board or interface number, the command defaults to HIPPI 0. For Origin2000/Onyx2 servers, the output might resemble the following:

```
Origin HIPPI Serial XIO Adapter
FLAGS:  ACCEPTING  DST.LNK_RDY  DST.FSYNC  DST.OH8SYNC  DST.SIG_DET

SRC connections          :    618
SRC packets              :    618
SRC rejects              :     0
SRC glink reset         :     2
SRC glink lost          :     0
SRC time outs           :     0
SRC connects lost       :     0
SRC parity errs         :     0
SRC number bytes sent   :  834178000
DST connections         :    618
DST packets             :    618
DST rcv on bad ulp     :     0
DST hippie-le drop     :     0
DST llrc                :     0
DST parity              :     0
DST frame/state err    :     0
DST flag err           :     0
DST illegal burst      :     0
DST link rdy lost in pkt :     0
DST null connections   :     0
DST ready errors       :     0
```

```
DST bad packet starts      :      0
DST number bytes received : 834178000
```

For Origin2000/Onyx2 servers, if the flags DST.LNK_RDY, DST.FSYNC, DST.0H8SYNC, and DST.SIG_SET are not on, there is a problem with the fiber optic cabling. See the *IRIS HIPPI-Serial XIO Board Installation Instructions* for information.

For Challenge/POWER Challenge/Onyx servers, the output might resemble the following:

```
FLAGS: DSIC SDIC ACCEPTING
SRC connections      : 63682
SRC packets         : 63682
SRC rejects         : 0
SRC seq errors (dm) : 0
SRC seq errors (cd) : 0
SRC seq errors (cs) : 0
SRC dsic lost       : 0
SRC time outs       : 0
SRC connects lost   : 0
SRC parity errs     : 0
DST connections     : 63682
DST packets         : 63682
DST rcv on bad ulp  : 1
DST hippi-le drop   : 0
DST llrc            : 0
DST parity          : 0
DST sequence err    : 0
DST sync err        : 0
DST illegal burst   : 0
DST sdic lost       : 0
DST null connections : 0
```

For Challenge/POWER Challenge/Onyx servers, if the flags DSIC (destination to source interconnect) and SDIC (source to destination interconnect) are not on, there is a problem with the parallel cables. See the *IRIS HIPPI Installation Instructions* for information.

4.7.3 HIPPI Bypass Function

The HIPPI bypass option is available only on Array 3.0 HIPPI distribution software and is automatically installed when the array software is loaded. This option enables the application to communicate directly with the HIPPI adapter rather than using the operating system to move packets between the adapter and the application program. Because the operating system overhead is eliminated or bypassed, packet latency is significantly reduced.

Up to 16 jobs (or applications) on Origin2000/Onyx2 servers or eight jobs on Challenge servers can use the HIPPI bypass for each HIPPI interface (board). MPI 3.0 uses one bypass job per MPI job.

Caution: For Challenge, HIPPI bypass requires HIPPI board p/n 030-0522-007 (or later) for proper operation. If you are not sure of the board revision level, ensure that the chip part number at board location H1I7 is 74ALS808A (or later). If the part number is 74AS808, get an updated HIPPI board.

There are several bypass control options available—see the `hipcntl(1M)` reference (man) page for additional information. Consult with the array administrator to determine how these bypass (bp) fields should be set.

Execute the `hipcntl` commands as root using the format `hipcntl hipp # bypass option`. Here is an example using the `bpstatus` (bypass status) option. This command provides status information on bypass packets sent and received over a given HIPPI interface. The `hippi #` variable specifies the interface number to be checked. If you do not specify the HIPPI board or interface number, the command defaults to HIPPI 0.

As root, enter the command `hipcntl hipp0 bpstatus`. For Origin2000/Onyx2 servers, the output might resemble the following:

```
Job 0: BUSY
Job 1: BUSY
Job 2: IDLE
Job 3: IDLE
Job 4: IDLE
Job 5: IDLE
Job 6: IDLE
Job 7: IDLE
Job 8: IDLE
Job 9: IDLE
Job 10: IDLE
Job 11: IDLE
Job 12: IDLE
Job 13: IDLE
Job 14: IDLE
Job 15: IDLE

Bypass ulp          : 144
Bypass max jobs    : 8
Bypass max ports   : 1024
Bypass max src pages : 1088
Bypass max dst pages : 1024

SRC descriptors    : 512
SRC packets       : 512
SRC bytes         : 6206592
SRC desc err: ifield : 0
SRC desc err: bufx  : 0
SRC desc err: opcode : 0
SRC desc err: addr  : 0
DST descriptors   : 512
DST packets      : 512
DST bytes        : 6206592
DST err: port disabled: 0
DST err: job disabled : 0
DST err: no buffs   : 0
DST err: inv bufx  : 0
DST err: inv auth   : 0
```

```
DST err: inv offset   : 0
DST err: inv opcode   : 0
DST err: inv version  : 0
DST err: inv seq num  : 0
```

For Challenge servers, the output might resemble the following:

```
Job 0: IDLE
Job 1: IDLE
Job 2: BUSY
Job 3: IDLE
Job 4: IDLE
Job 5: IDLE
Job 6: IDLE
Job 7: IDLE
```

```
Bypass ulp : 144
Bypass max jobs : 8
Bypass max ports : 1024
Bypass max src pages : 1024
Bypass max dst pages : 1024
```

```
SRC descriptors : 456314483
SRC packets : 549519990
SRC bytes : 4390184105472
SRC desc err: ifield : 0
SRC desc err: bufx : 0
SRC desc err: opcode : 0
SRC desc err: addr : 0
SRC err: job disabled : 0
DST descriptors : 456314491
DST packets : 549520689
DST bytes : 4390195410816
DST err: port disabled: 6
DST err: job disabled : 0
DST err: no buffs : 0
DST err: inv bufx : 0
DST err: inv auth : 0
DST err: inv offset : 0
DST err: inv opcode : 0
DST err: inv version : 0
DST err: inv seq num : 0
```

4.7.3.1 Creating New HIPPI Bypass /dev Files for Additional HIPPI Interfaces

By default, bypass device-special files are created for two HIPPI interfaces only. These are `/dev/hippibp0[00-07]` and `/dev/hippibp1[00-07]`. The numbers `0` and `1` in `hippibp0` and `hippibp1` are the interface numbers in decimal. The numbers `[00-07]` are the virtual device number or job numbers.

If the array node has more than two HIPPI interfaces, create the rest of the bypass character special files for the `/dev` directory.

- For Origin2000/Onyx2 arrays, use the `ln` command to create links to the character special files in `/hw/hippi`.

To create the */dev* file for HIPPI bypass interface 201, where 2 is the interface number and 01 is the job number, insert the proper variables for the *ln* command. For example:

```
ln -s /hw/hippi/2 /dev/hippibp201
```

- For Challenge/POWER Challenge arrays, you must use the *mknod(1M)* command to create the rest of the bypass character special files.

For POWER Challenge arrays, to create the */dev* files for HIPPI bypass interface 201, where 2 is the interface or device number and 01 is the job number, insert the proper variables for the *mknod* command:

```
/sbin/mknod name c 251 minor_number
```

In this example, the *name* is *hippibp201*, the argument *c* designates the HIPPI character device, and the *major number* is 251, which is always used as the major number for HIPPI devices.

Use this formula to determine the minor number:

```
interface_num * 4096 + bp_offset (2048) + bp_job_num
```

To find the minor number for HIPPI bypass interface 201, multiply 2 (which is the interface number) times 4096, add the bypass offset number 2048, and then add the bypass job number, 1. Your answer should be 10241.

As root, enter the command

```
mknod /dev/hippibp201 c 251 10241
```

For either server type, check the */dev* directory to determine if the new HIPPI bypass device was created.

4.7.3.2 Setting the Bypass Limits

The system administrator needs to be familiar with the upper limits settable by the various *hipcntl(1M)* bypass control commands (such as *hipcntl bpspages*) to suit the resource usage at the site. The *hipcntl bpstatus* commands lists the current settings.

Note: Resource usage is the amount of system memory that the bypass can pin. The worst case amount of physical memory that can be pinned (or used) is:
#jobs * [(max-source-pages + max -destination-pages) + 1] * 16384 bytes =
maximum memory used.

4.7.4 HIPPI Node Testing

Test the HIPPI network by running the array test diagnostic with the **-stage** *hippi_node* option on each array node. Specify the hostnames of all the array node on the command line. For example, for an array with hostnames *hotbox1* and *hotbox2*, run the diagnostics on each node as

```
/usr/array/diags/arraytest -stage hippie_node hotbox1 hotbox2
```

Note: See Appendix A for information on additional array tests.

4.8 Bringing Up the Array

At this point, you now have a cluster of array nodes, communicating via the local area network and the HIPPI network. The final stage occurs when you create the array using the IRISconsole and configure the array services software.

4.8.1 Configuring Array Services and Starting the Array Daemons

The *arrayconfig* command performs three major tasks to activate the array:

- It builds the array services daemon configuration file (*arrayd.conf*).
- It ships the *arrayd.conf* file to the specified array nodes in the array.
- It starts the array services daemons on the specified array nodes in the array.

You can execute *arrayconfig* from the workstation using the following command structure:

```
/usr/etc/arrayconfig [-a arrayname] [-m] [-d] host...
```

The following example uses “LTD” as the array name with hosts, hydra1 through hydra4.

```
/usr/etc/arrayconfig -a LTD -m -d hydra1 hydra2 hydra3 hydra4
```

If the array configuration is successful, the following confirmation statement is displayed:

```
Configuration of array <arrayname> complete
```

4.8.2 Array Node Testing

Test the array services configuration by running the array test diagnostics on each of the nodes as follows:

```
/usr/array/diags/arraytest -stage array_node
```

Read the array release notes for information on running other diagnostic tests on the array. The array reference pages provide information on the available array commands.

In addition, see *Getting Started With the Array Guide* (p/n 007-3058-xxx) for information on running the Rend Asunder demo program.

4.8.3 Live Testing

On a complex configuration such as an array, you should also perform some “live testing.” The additional testing may add significantly to the installation time, but this step is highly recommended. Live testing means having preferably “friendly” users test the array with real-life applications.

4.9 Installing Other Silicon Graphics Software Applications

Once the array features have been configured, started, and tested, the array is operational. You can proceed with the installation of other applications or patch CDs, as required.

Appendix A

Array Diagnostics

This appendix provides additional information on running the array diagnostics. Use this information with specified sections of Chapter 4 to test the configuration.

There are four major stages of array testing. As the array evolves through various stages of functionality; each can be independently tested. The stages are:

- single isolated server with hardware tested (base node)
- single server operating on local area network (LAN node)
- single server operating on HIPPI network (HIPPI node)
- fully operational array (array node)

The diagnostic tests are automatically loaded when you install the array CD software.

A.1 Base Node Tests

These diagnostics test the base nodes of an array (see Section 4.5.5, “Base Node Testing”) by

- determining if IRIX 6.2 or greater is installed
- determining if the HIPPI software is installed
- determining if */dev/hippi** devices exist
- determining the */dev/hippi** permission level.
- performing a HIPPI loopback test via *hiptest*

Note: These tests do not perform additional array node hardware tests. For a description of those tests, see the *CHALLENGE/Onyx Diagnostics Road Map* (108-7045-xxx).

Invoke the test by becoming a superuser and entering

```
/usr/array/diags/arraytest -stage base_node
```

You should get a display similar to the following.

```
STARTUP: DiagsPath = '/usr/array/diags'
NOTICE: Running Array Diagnostics
```

```

+++++
+ Running Diagnostics for Stage 'Base Node' +
+++++
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Beginning Stage 'Base Node' %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

NOTICE: Testing OS Level
NOTICE: OS Version 6.2-jackj-root is Correct
NOTICE: Testing HiPPI Software Installation
NOTICE: HiPPI Software Installed

```

If the test was successful, you receive a message similar to the following:

```
SUCCESS: Diagnostics Succeed for 'Base Node' Stage
```

If the test fails, because you did not install HiPPI boards (for example), you get the following message:

```
NOTICE: Testing HiPPI Device Inventory
```

```
FATAL ERROR: No HiPPI Devices Show Up In Inventory
```

A.2 LAN Tests

These diagnostics provide local area network (LAN) tests (see Section 4.6, “Configuring LAN Nodes”) on each array node by

- determining if *chkconfig network* is on
- determining if *chkconfig nfs* is on
- determining if *chkconfig automount/amd/autofs* is on
- checking if the array can get IP addresses for each host (with timeout)
- checking if each array node can ping itself (with timeout)
- checking if each array node can ping other machines (with timeout)
- checking if the array can run a guest *rsh* (remote shell) to other nodes (with timeout)
- checking if the array can *ttcp* between nodes (with timeout)
- checking if the array can NFS-mount other filesystems (with timeout)

You can invoke the test by becoming superuser and entering

```
/usr/array/diags/arraytest -stage lan_node
```

Note: If no hostnames are supplied, the diagnostics assume local node tests only. If you want to test some or all of the nodes, specify the hostname(s) in the command line.

You should then get display similar to the following.

```
STARTUP: DiagsPath = '/usr/array/diags'
NOTICE: Running Array Diagnostics

+++++
+ Running Diagnostics for Stage 'LAN Configured Node' +
+++++

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% Beginning Stage 'Base Node' %

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

NOTICE: Testing OS Level
NOTICE: OS Version 6.2 is Correct
NOTICE: Testing HiPPI Software Installation
NOTICE: HiPPI Software Installed
NOTICE: Testing HiPPI Device Inventory
NOTICE: 1 HiPPI Interfaces Show Up In Inventory
.
.
.

NOTICE: Some HiPPI Devices Have Non-Recommended Permissions and Ownership
NOTICE: Calling Stage Is 'lan_node', Bypassing Base Node Loopback Test
SUCCESS: Diagnostics Succeed for 'Base Node' Stage
```

If these tests are successful, the diagnostics progresses to the next level as shown below:

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% Beginning Stage 'LAN Configured Node' %

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

NOTICE: Ensuring That Local LAN Services Are Properly Configured
NOTICE: Ensured That Local LAN Services Are Properly Configured
NOTICE:
NOTICE: Verifying I Can Ping Myself (disarray.engr.sgi.com)
NOTICE: Successfully Pinged 'disarray.engr.sgi.com'
NOTICE:
NOTICE: Doing 'guest rsh' to Myself (disarray.engr.sgi.com)
NOTICE: Successful 'guest rsh' To 'disarray.engr.sgi.com'
NOTICE:
NOTICE: Testing Local NFS & Automounter
NOTICE: Checking nfs Version On 'disarray.engr.sgi.com'
NOTICE: NFS Installed On 'disarray.engr.sgi.com'
NOTICE: Verifying NFS Configuration Flags
NOTICE: Network/NFS Configuration Flags Are Correct For
'disarray.engr.sgi.com'
NOTICE: Ensuring 'automount' Operational On 'disarray.engr.sgi.com'
```

```
NOTICE: Automounter Running On 'disarray.engr.sgi.com'
NOTICE: Entries In 'disarray.engr.sgi.com:/etc/exports' Pass Verification
```

If the test passes, you should see a message similar to:

```
SUCCESS: Diagnostics Succeed for 'LAN Configured Node' Stage
```

If the test fails, you receive a corresponding error message. Recheck the LAN connections and setup, and retry the test.

A.3 HIPPI Tests

These diagnostics tests the HIPPI interface and network (see Section 4.7.4, "HIPPI Node Testing").

You can invoke the test by becoming superuser and entering

```
/usr/array/diags/arraytest -stage hippo_node
```

Note: If no hostnames are supplied, the diagnostics assume local node tests only. If you want to test some or all of the nodes, specify the hostname(s) in the command line.

You should then get a display similar to the following.

```
STARTUP: DiagsPath = '/usr/array/diags'
NOTICE: Running Array Diagnostics

+++++
+ Running Diagnostics for Stage 'LAN and HIPPI Configured Node' +
+++++
```

The diagnostics then runs each of the testing stages as follows:

```
%%%%%%%%%%
% Beginning Stage 'Base Node' %
%%%%%%%%%%
```

If the test is successful, it brings up the next test set.

```
+++++
+ Running Diagnostics for Stage 'LAN Configured Node' +
+++++
```

These tests should be followed by the HIPPI test stage as follows:

```

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Beginning Stage 'LAN and HIPPI Configured Node' %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

NOTICE: 1 HIPPI Devices Registered With System
NOTICE: HIPPI Device 'hippi0' Appears in Slot 15
NOTICE: HIPPI Device '/dev/hippi0' Exists With Proper Permissions
NOTICE:
NOTICE: Verifying The 8 Entries In '/usr/etc/hippi.imap'
NOTICE: Ifield For 'gate2-disarray.engr.sgi.com' Is '0x01000000'
NOTICE: (0x01000000 = [L:0 VU:0 W:32 D:LSB PS:Source C:Camp RC:0x000000])
NOTICE: Ifield For 'gate3-disarray.engr.sgi.com' Is '0x01000001'
NOTICE: (0x01000001 = [L:0 VU:0 W:32 D:LSB PS:Source C:Camp RC:0x000001])
NOTICE: Ifield For 'gate2-datarray.engr.sgi.com' Is '0x01000002'
NOTICE: (0x01000002 = [L:0 VU:0 W:32 D:LSB PS:Source C:Camp RC:0x000002])
NOTICE: Loopback Testing HIPPI Interface /dev/hippi0 (Ifield '0x01000000')
NOTICE: Testing HIPPI Device '/dev/hippi0' Via Ifield '0x01000000'
NOTICE: Sending 50 HIPPI Packets:
.....

NOTICE: HIPPI Loopback Test Of '/dev/hippi0' Successful

```

If the test passes, you get a message similar to the following:

```
SUCCESS: Diagnostics Succeed for 'LAN and HIPPI Configured Node' Stage
```

If the tests fails, you get a corresponding error message. Recheck the HIPPI interface (cabling and software installation) and then retry the test.

A.4 Complete Array Configuration Test

After the entire array has been configured, invoke the array-wide test by becoming superuser and entering

```
/usr/array/diags/arraytest -stage array_node
```

You should get a display similar to the following:

```

STARTUP: DiagsPath = '/usr/array/diags'
NOTICE: Running Array Diagnostics

+++++
+ Running Diagnostics for Stage 'Complete Array' +
+++++

NOTICE: Array Is Comprised Of Following Nodes:
NOTICE: <disarray>
NOTICE: <datarray>

```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%  
%                               Beginning Stage 'Base Node'                               %
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
NOTICE: Testing OS Level  
NOTICE: OS Version 6.2 is Correct  
NOTICE: Testing HIPPI Software Installation  
NOTICE: HIPPI Software Installed  
NOTICE: Testing HIPPI Device Inventory
```

```
.  
. .
```

If these tests are successful, it brings up the next stage of testing.

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
%                               Beginning Stage 'LAN Configured Node'                               %  
%                                                                                               %
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
NOTICE: Ensuring That Local LAN Services Are Properly Configured  
NOTICE: Ensured That Local LAN Services Are Properly Configured  
NOTICE: Ensuring Node Can Get IP Addresses For All Specified Hosts
```

```
NOTICE:
```

```
NOTICE: Verifying I Can Ping Myself (disarray.engr.sgi.com)  
NOTICE: Successfully Pinged 'disarray.engr.sgi.com'  
NOTICE: Verifying I Can Ping Other Nodes
```

```
.  
. .
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%  
%                               Beginning Stage 'LAN and HIPPI Configured Node'                               %
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
NOTICE: 2 HIPPI Devices Registered With System  
NOTICE: HIPPI Device 'hippi0' Appears in Slot 15  
NOTICE: HIPPI Device 'hippi1' Appears in Slot 15  
NOTICE: HIPPI Device '/dev/hippi0' Exists With Proper Permissions
```

```
.  
. .
```

The test continues to go through all the array evolution stages until completion. If errors are encountered during testing, the diagnostics stop immediately and display the corresponding error message.

Glossary

array node

Node within the array, at any stage of functionality—base node, HIPPI node, LAN node. A fully functional array node is a HIPPI node with array services configured and operational.

array services

Software that coordinates jobs or programs running on different nodes across the array.

base node

An isolated node that has all hardware and software installed and HIPPI tested in loopback, but no LAN or HIPPI network configured or cabled. A base node is connected to the IRISconsole.

HIPPI

High-performance parallel interface.

HIPPI node

LAN node with HIPPI configured and cabled.

IPC

Interprocess communication. IPC provides sockets interface for low-level access for network and data transfers.

IRISconsole

Single-point administration software for the array, running on an Indy or O2 workstation and using the serial port multiplexer (SPM).

LAN node

Base node with LAN configured and cabled.

LSF

Load-sharing facility. A networking computing system running on top of heterogeneous UNIX systems that transparently schedules applications to improve performance and resource availability.

MPI

Message-passing interface. MPI allows processes to communicate by “mailing” data messages to other processes running on distant computers. Message-passing programs can execute on tightly coupled shared-memory multiprocessors, networked multicomputers, and wide-area distributed systems. MPI is a relatively new standard

and is intended more for parallel computers made by the same vendor.

PVM

Parallel virtual machine. A software package that permits a heterogeneous collection of UNIX computers connected by a network to be used as a single large parallel computer.

shared memory

Various executing processes sharing memory on a virtual level.

socket

The basic building block for sockets-based IPC. A socket is an endpoint of communication to which a name can be bound. Sockets are typed according to their communication properties, for example, stream sockets, datagram sockets, and raw sockets.

SMP

Symmetric multiprocessor.

TLI

Transport layer interface. TLI provides generalized functions that support network communications using many standard protocols. TLI is the AT&T version of Berkeley sockets. It interfaces with transport services and applications to provide client-server environments

XFS

X file server.

Index

A

- acoustics, 2-32
- air temperature and quality requirements, 2-28 through 2-30
- altitude, 2-28 through 2-30
- array
 - assigning name, 3-6
 - base configurations, 1-5 through 1-10
 - space requirements, 2-23 through 2-27
 - bringing up, 4-38 through 4-39
 - base node, 4-22 through 4-28
 - overview, 4-22
 - LAN node, 4-29
 - bringing up nodes, 4-21 through 4-38
 - daemons, starting, 4-38
 - features, 1-2
 - hardware, 1-3
 - system configuration, 1-10
 - heat dissipation, 2-31
 - installing, 4-1 through 4-39
 - overview, 4-2 through 4-4
 - name, 3-6
 - powering up nodes, 4-25
 - power requirements, 2-33 through 2-35
 - receiving, 2-35 through 2-37
 - services, configuring, 4-38
 - software, 1-3, 3-3
 - array services, 1-4 through 1-5
 - installing, 4-27
 - testing node, 4-38 through 4-39
 - vibration limits, 2-31 through 2-32
- arrayconfig*, 4-38

B

- baud rate, configuring, 4-18

C

- cable
 - port number
 - configuring, 4-18
- casters
 - Challenge rack, 2-20 through 2-21
 - Origin2000/Onyx2 deskside, 2-8
 - Origin2000/Onyx2 rack, 2-5, 2-11 through 2-12
- Challenge deskside
 - airflow, 2-16
 - chassis levelers, 2-17
 - clearances, 2-16
 - dimensions and weight, 2-15
 - shipping dimensions, 2-37
 - wheels, 2-17
- Challenge rack
 - airflow, 2-19 through 2-20
 - casters, 2-20 through 2-21
 - chassis levelers, 2-21
 - clearances
 - service, 2-18 through 2-19
 - dimensions and weight, 2-17 through 2-18
 - floor loading, 2-20
 - on raised floors, 2-20
 - shipping dimensions, 2-37
 - top, loads upon, 2-20
- Console port, configuring, 4-18
- CrayLink cables, 2-23

D

- diagnostics, A-1 through A-7
 - base node, 4-22

E

- environmental requirements, 2-27 through 2-32

F

- features, 1-2
- floor loading
 - Challenge rack, 2-20
 - Origin2000/Onyx2 rack, 2-5 through 2-6, 2-11

G

grounding straps, 2-23

H

hardware

in array, 1-3

installing additional, 4-25

heat dissipation, 2-31

HIPPI

board, 3-3

installing, 4-23 through 4-25

upgrading, 1-10

bypass function, 4-35 through 4-37

cable, 3-3, 3-5

configuring, 4-33

I-Fields, 3-5

installing, 4-23 through 4-28

LEDs, 4-33

link light, 4-33

network

cabling, 4-29 through 4-33

network addresses, names, 3-6

planning connections, 3-4 through 3-5

routing, 3-5

software, 3-3

installing, 4-26

switch, 1-3, 1-7, 1-8, 1-9, 3-3

upgrading, 1-3, 1-10, 2-23

testing, 4-28

node, 4-38

hostnames, determining, 3-6

I

.icrc.sitename, 4-16

Indy

dimensions and weight, 2-22

setting up for IRISconsole, 4-6 through 4-10

Installing, 1-10

IP addresses, determining, 3-6

IRISconsole

connecting to nodes, 4-10 through 4-14

GUI. *See* IRISconsole software

security login and system login, 4-18

setting up, 4-5 through 4-21

software, 3-3

configuring nodes with, 4-15 through 4-21

installing, 4-7

invoking, 4-15, 4-19

IRIX

installing, 4-26

version required, xi, 1-1, 4-27

L

log file for system activity, configuring, 4-18

login, configuring, 4-18

and IRISconsole security login, 4-18

M

Message-Passing Interface. *See* MPI

MPI, 1-3, 1-4, 3-3, 4-35

N

NFS3, installing, 4-27

node numbers, assigning, 3-3

O

O2

dimensions and weight, 2-22

setting up for IRISconsole, 4-6 through 4-10

Origin2000/Onyx2 deskside

airflow, 2-8 through 2-9

casters, 2-8

clearances, 2-7

dimensions and weight, 2-7

shipping dimensions, 2-36

top, loads upon, 2-9

Origin2000/Onyx2 rack

airflow, 2-12 through 2-13

cable opening, 2-13 through 2-14

casters, 2-5, 2-11 through 2-12

clearances and airflow, 2-10 through 2-11

dimensions and weight, 2-10

floor loading, 2-5 through 2-6, 2-11

grounding straps, 2-23

on raised floors, 2-11, 2-13

shipping dimensions, 2-37

other documents, xii

P

parallel processing, 1-4
PVM (parallel virtual machine), 1-3, 1-4

R

Remote System Control port, configuring, 4-18

S

SCSI ID for SPM
 configuring, 4-18
 setting, 4-10
serial cables. *See* IRISconsole, connecting to nodes
site
 adding, 4-15 through 4-16
 adding systems to, 4-17 through 4-19
 configuration file, 4-16
 configuring, 4-16 through 4-19
 entering changes, 4-19
 verifying, 4-19 through 4-21
 preparation
 checklist, 3-1 through 3-2
 guidelines, 2-3 through 2-5
software
 in array, 1-3
 installing, 4-25 through 4-28
 other applications, 4-39
SPM, 3-3
 connecting to workstation, 4-7 through 4-10
 dimensions and weight, 2-23
 planning connections, 3-4
 SCSI ID
 configuring, 4-18
 setting, 4-10
ST-1616, ST-1600. *See* SPM
systems supported/servers supported, 1-3

T

testing
 array node, 4-38 through 4-39
 base node, 4-28
 HIPPI, 4-28
 node, 4-38
testing. *See also* diagnostics

U

upgrading, 1-10
 HIPPI switch, 1-3, 1-10, 2-23

V

vibration limits, 2-31 through 2-32

W

web page, xii

X

XTown cables, 2-23

