

# TruCluster Server

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## Technical Update for StorageWorks XP Disk Arrays

**June 2004**

**Product Version:** StorageWorks XP Disk Array

**Operating System and Version:** Tru64 UNIX Version 5.1A and 5.1B

This Technical Update describes how to install and configure any enterprise class StorageWorks XP Disk Array (XP48, XP128, XP512, and XP1024) in a TruCluster Server environment.

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## About This Technical Update

This technical update provides important information about installing and configuring a StorageWorks XP Disk Array in a Tru64 UNIX configuration. This update supports the following models: XP48, XP128, XP512, and XP1024. The XP256 is no longer available.

### Audience

This Technical Update is intended for trained HP Services personnel or qualified self-maintenance customers who need to install and configure a StorageWorks XP Disk Array on an AlphaServer system running the Tru64 UNIX operating system.

### Organization

This document contains the following sections:

<i>Chapter 1</i>	Introduces the family of StorageWorks XP Disk Arrays.
<i>Chapter 2</i>	Describes the requirements and restrictions for using StorageWorks XP Disk Arrays in a TruCluster Server environment.
<i>Chapter 3</i>	Includes examples of minimum and maximum configurations.
<i>Chapter 4</i>	Provides installation and configuration procedures for StorageWorks XP Disk Arrays.
<i>Chapter 5</i>	Identifies known error conditions and provides workarounds.
<i>Appendix A</i>	Provides blank worksheets on which to log your Fibre Channel Host Bus Adapter Worldwide Names and information about how you allocated storage for the cluster.



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## Introduction

This chapter provides an overview of the StorageWorks XP family of disk arrays, including the key features of each model and a list of resources for more information about StorageWorks XP products and services.

### 1.1 Overview

The hp StorageWorks XP Disk Array platforms offer the highest availability, heterogeneity, and scalability. These disk arrays provide the following advantages:

- No single point of failure
- Non-disruptive upgrades
- Zero downtime backup
- Multi-terabyte scalability
- Supports multiple operating systems

### 1.2 Key Features

These disk arrays provide the following key features:

- **Scalable:** Disk capacity can increase to terabytes of storage online with no interruptions to applications or hosts, to accommodate growing storage needs.
  - XP48 – Up to 48 disks, storage capacity from 72 GB to a maximum of 8.7 TB, 24 Fibre Channel ports.
  - XP128 – From 8 drives to 128 drives, storage capacity to a maximum of 18 TB, 48 Fibre Channel ports.
  - XP512 – Up to 512 disks, storage capacity from 72 GB to a maximum of 93 TB, and 32 Fibre Channel ports.
  - XP1024 – From 8 to 1,024 disk drives, storage capacity to over 149 TB, 64 Fibre Channel ports.
- **Flexible:** Supports a mixture of disk drives, RAID levels, and Fibre Channel connections.

- **Disk Capacities:** 18 GB 15,000 RPM, 73 GB 10,000 RPM and 181 GB 7,200 RPM Fibre Channel drives provide choice, scalability, and reliability to fit your capacity requirements.
- **Architecture:** Innovative Crossbar Architecture (3.2 MB/sec) enables high performance and scalability.
- **Cache:** Battery-protected, mirrored write cache ensures all your data will be safe.
- **Availability:** All critical components are redundant and hot-replaceable to provide extreme reliability and availability, including processors, I/O interfaces, power supplies, batteries, and control processors.
- **Manageable:** Multiple arrays and hundreds of terabytes can be managed from a single station, by existing staff, with no increase in staffing.
- **Open systems:** HP-UX, Tru64 UNIX, OpenVMS, MPE/iX, Windows NT and Windows 2000, Solaris, S390 compatible mainframe operating systems, AIX, Linux, Netware, and more.

### 1.3 Related Documents

For more information on StorageWorks XP products and services, refer to the following documentation:

- *64-Bit PCI-to-Fibre Channel Host Bus Adapter User Guide*
- *Tru64 UNIX and OpenVMS FCA-2354 Host Bus Adapter Installation Guide*
- *hp StorageWorks FCA2384 PCI-X Host Bus Adapter for OpenVMS and Tru64 UNIX Installation Guide*
- *wwidmgr User's Manual*, available on the Alpha Systems Firmware Update CD-ROM in the DOC directory
- StorageWorks XP Firmware Update CD
- *hp StorageWorks SAN Design Reference Guide*
- *Tru64 UNIX Installation Guide*
- *TruCluster Server Cluster Installation Manual*

# 2

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## Requirements and Restrictions

This chapter describes the hardware requirements and restrictions for use of a StorageWorks XP Disk Array in a TruCluster Server environment. It includes lists of supported Tru64 UNIX operating system and TruCluster Server versions, AlphaServer systems, SRM firmware, available software, Fibre Channel and SCSI host bus adapters, and other general requirements and restrictions.

### 2.1 Hardware Requirements

The following hardware is required or supported.

- AlphaServer systems

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<b>XP Disk Array</b>	<b>AlphaServer</b>
XP48, XP128, XP512, XP1024	AS800, AS1200, AS4000, AS4100, AS8200, AS8400, DS10, DS15, DS10L, DS20, DS20E, DS20L, DS25, ES40, ES45, ES47 (PCI-X), ES80 (PCI-X), GS60, GS60E, GS80, GS140, GS160, GS320, GS1280 (PCI-X)

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- Fibre Channel adapters

Make sure that all utilities, tools, and drivers supplied with the adapters are installed. See the section on Host Bus Adapters Supported for more information.

### 2.2 Firmware Requirements

For AlphaServer systems, firmware should be at the latest available revision. Go to the following link: <http://h18002.www1.hp.com/alphaserver/products/options.html> Click on the Firmware link to find the latest revision for your system. See Section 4.7 for more information.

## 2.3 Software Requirements

The following versions of Tru64 UNIX support StorageWorks XP Disk Arrays. In addition, you should install the most recent software patches.

XP Disk Array	Tru64 UNIX Version
XP48, XP512	4.0 F/G, 5.1A, 5.1B
XP128, XP1024	5.1A, 5.1B

Superuser (root) login access to the host system is also required.

## 2.4 Host Bus Adapters Supported

The XP Disk Arrays support the 1 and 2 Gbps (100 and 200 MBps) Fibre Channel interface including the following:

- Shortwave non-open fibre control (non-OFC) optical interface. (Do not connect any OFC-type connector to the disk array.)
- Multimode optical cables with Subscriber Connector (SC) connectors
- Fibre Channel, arbitrated loop (FC-AL), and fabric topologies

The following host bus adapters support XP Disk Arrays.

XP Disk Array	Fibre Channel Host Bus Adapter
XP48, XP128, XP512, XP1024	KGPSA-BC (1 Gb, 32-bit, 33 MHz PCI) DS-KGPSA-CA (1 Gb, 64-bit, 66 MHz PCI) DS-KGPSA-DA (FCA2354, 2 Gb, 64-bit, 66 MHz PCI) DS-KGPSA-EA (FCA2384, 2 Gb, 64-bit, 133 MHz PCI-X)

The maximum length of the optical cable between a Fibre Channel adapter and a Fibre Channel switch or between a Fibre Channel Switch and the XP Disk Array is as follows:

- 500 meters (1640.4 feet) via shortwave multimode Fibre Channel cable at 1 Gb/sec
- 300 meters (924 feet) at 2 Gb/sec

For more information, refer to the section on Fiber Optic Interconnect Rules in the *hp StorageWorks SAN Design Reference Guide*.

## 2.5 Device Types Supported

The XP Disk array supports these types of devices:

- OPEN-x devices
- LUSE devices (OPEN-x\*n)

The Logical Unit Size Expansion (LUSE) feature of the disk array allows you to configure custom-size LUNs, which are larger than standard OPEN-x LUNs.

- VSC devices

Volume Size Customization Devices (VSC) allow you to divide a storage set into several smaller LUNs to best fit the application needs and improve host access to frequently used files.

VSC LUSE combines VSC devices (instead of standard OPEN emulation LUs) into LUSE devices. VSC is first used to create custom-sized devices, and then LUSE is used to combine the VSC devices. You can combine from 2 to 36 VSC devices into one VSC LUSE device. For example, an OPEN-3 LUSE volume is designated as an OPEN-3\*10 VSC device.

## 2.6 Failover Support

The XP Disk Array supports industry-standard products and functions that provide host or application failover, I/O path failover, and Logical Storage Management (LSM).

## 2.7 Included, Optional, and Recommended Software

The following software is recommended for use with XP Disk Arrays.

XP Software	XP Disk Array
Data Exchange XP — Allows you to share information across your computing platforms. Together with Resource Manager XP, this product frees your network of host-to-host data conversion traffic.	All
Business Copy XP — Creates multiple real-time online copies of critical business data without adversely impacting primary production operation.	All
Continuous Access XP and Continuous Access XP Extension <sup>a</sup> — Provide high-availability data and disaster recovery solutions that deliver host-independent real-time remote data mirroring between XP disk arrays.	All

<b>XP Software</b>	<b>XP Disk Array</b>
RAID Manager XP — Enables you to perform operations on the disk array by using StorageWorks Continuous Access XP and StorageWorks Business Copy XP to issue commands from the server host to the disk array.	All
Command View XP <sup>b</sup> — Provides centralized, web-based management for XP disk arrays, thus enabling collaboration among global team members.	All
Secure Manager XP — Provides controlled access to your XP disk array by preventing unauthorized servers from accessing your data.	All
LUN Configuration Manager XP — Allows you to create and delete LUNs, set host mode, set/reset command devices, configure fibre channel ports, and create and release expanded LUNs.	All
Cache LUN XP — Speeds up access to mission-critical data, whether you are running an e-commerce site, a business-to-business portal, or large databases.	All
Performance Advisor XP <sup>c</sup> — Provides a web-based application that collects and monitors real-time performance of XP disk arrays, either standalone or integrated with Command View XP.	All
Auto LUN XP — Provides automatic monitoring and workload balancing for your XP disk arrays.	All
Continuous Track XP — Provides proactive diagnostics for the XP128 and XP1024 Disk Arrays.	All

<sup>a</sup> Tru64 UNIX BL25 with the latest StorageWorks XP firmware adds limited support for Continuous Access mirroring of non-LSM data disks and for TruClusters.

<sup>b</sup> Limited. No host map information is available.

<sup>c</sup> Limited. No host performance information is available.

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## Sizing the Configuration

This chapter provides minimum and maximum specifications and a sample minimum configuration for an XP Disk Array. You can use this configuration example to help a customer understand the range of choices available or you can use them as a quick reference for the configuration to be installed.

Maximum configurations are available in such a wide variety of designs that it is not possible to cover them in this guide. Contact your HP Service representative for help with a configuration that meets your current and future needs.

### 3.1 Minimum and Maximum Specifications

The minimum number of AlphaServer systems for a TruCluster configuration is two (2) nodes and the maximum is eight (8) nodes.

The maximum number of supported logical unit numbers (LUNs) is 256 per port per XP Disk Array.

A no-single-point-of-failure configuration requires a minimum of two nodes, two XP Channel Adapter modules, two Fibre Channel switches, two Fibre Channel Host Bus Adapters per system, and use of RAID 1 or RAID 5 data sets.

Each XP Disk Array includes a minimum number of disks. The model number indicates the maximum number of disks.

### 3.2 No-Single-Point-of-Failure Cluster Configuration

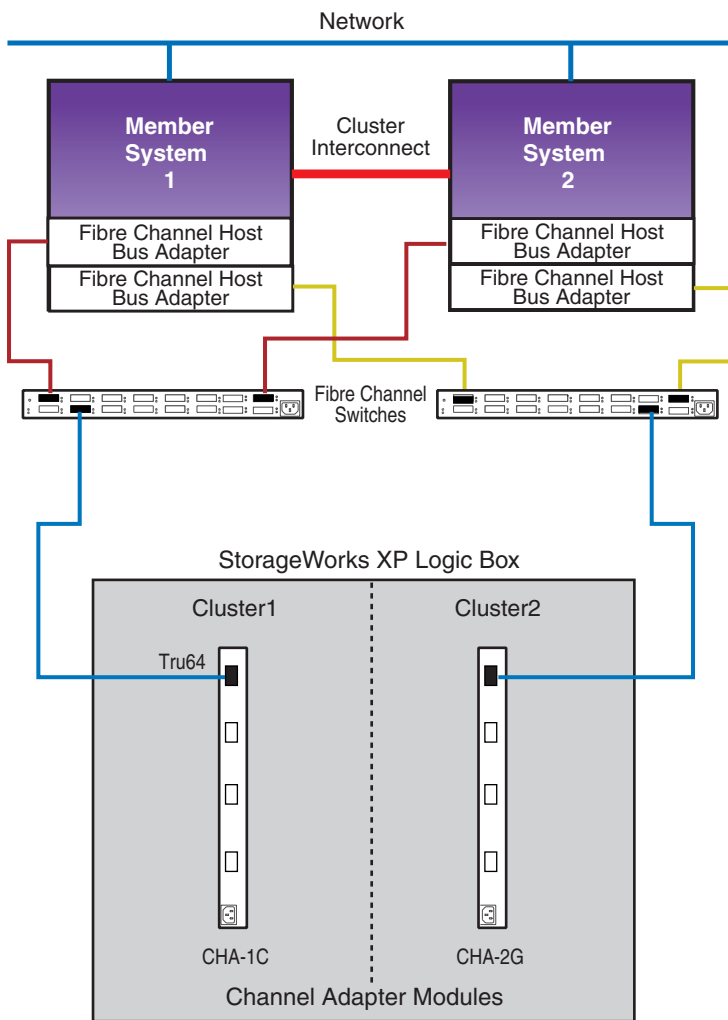
Figure 3-1 is a no-single-point-of-failure (NSPOF) TruCluster Server configuration using an XP Disk Array. This configuration holds true for all models from the XP48 to XP1024.

This minimum configuration uses two Fibre Channel switches in a dual fabric to provide the input to the Channel Adapter (CHA) modules in the XP Disk Array's Logic Box. The Logic Box is divided into two areas, Cluster 1 and Cluster 2. The figure shows a minimum of one Channel Adapter in each cluster with each Channel Adapter providing four ports. One fiber optic cable connects each Channel Adapter to a Fibre Channel Switch. Additional fiber optic cables would increase performance and throughput.

Channel Adapter modules are available in two types:

- The 2-GB module is available with either 4 or 8 ports.
- The 1-GB module is available with either 2 or 4 ports.

**Figure 3-1: NSPOF TruCluster Server XP Disk Array Configuration Using Fibre Channel Switches and Channel Adapter Modules**



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# 4

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## Installing and Configuring a StorageWorks XP Disk Array

This chapter provides procedures for setting up, installing, and configuring a StorageWorks XP Disk Array storage system and its associated disks for use with a Tru64 UNIX TruCluster Server host system. It is assumed that the XP Disk Array cabinets and hardware components have been assembled on site by qualified HP Services personnel using the instructions supplied with the storage system.

As a final procedure, you can choose to install Tru64 UNIX and TruCluster Server software on the XP storage disks.

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### Caution

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These procedures must be performed by qualified HP Services personnel or qualified self-maintenance customers only. Failure to do so could result in disruption of services or loss of data.

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To successfully complete this process, you must perform the following major tasks. The list of tasks assumes that this is a new installation, including AlphaServer systems. If you are installing the XP Disk Array into an existing Tru64 UNIX TruCluster Server configuration, then you can skip steps 1, 2 and 4.

1. Install and configure the Fibre Channel host bus adapters into the AlphaServer systems. (Section 4.1)
2. Install all Fibre Channel switches. (Section 4.2)
3. Connect all fiber optic cables between the XP storage system's Channel Adapter modules, Fibre Channel Switches, and Fibre Channel host bus adapters. (Section 4.3)
4. Power up the XP storage array. (Section 4.4)
5. Power up the AlphaServer systems and Fibre Channel switches. (Section 4.5)
6. Perform a Define Configuration and Install (DCI) procedure (aka Installation and De-Installation). (Section 4.6)

7. Check the firmware revision and upgrade the firmware if necessary. (Section 4.7)
8. Configure the storage system logical unit numbers (LUNs) and the Fibre Channel host bus adapter connections. (Section 4.8)
9. Add the XP Storage Array to the TruCluster Server configuration. (Section 4.9)
10. Install Tru64 UNIX and TruCluster Server software to a local disk. (Section 4.10)
11. Determine and prepare XP Disk Array target disks for TruCluster Server software. (Section 4.11)
12. Build a cluster using `clu_create`. (Section 4.12)

## 4.1 Installing and Configuring Fibre Channel Host Bus Adapters into AlphaServer Systems

The following sections discuss Fibre Channel adapter (FCA) installation and configuration.

---

### Note

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Skip these sections if there is an existing AlphaServer configuration. Continue with Section 4.3.

---

### 4.1.1 Installing the Fibre Channel Adapter Modules

To install the DS-KGPSA-CA, DS-KGPSA-DA (FCA2354), or DS-KGPSA-EA (FCA2384) Fibre Channel host bus adapter modules, follow these steps.

---

### Caution

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Static electricity can damage modules and electronic components. We recommend using a grounded antistatic wrist strap and a grounded work surface when handling modules.

---

1. Using the documentation that came with your Fibre Channel host bus adapter, install the Fibre Channel adapter in an open 64-bit PCI slot.  
These KGPSA adapters are high-speed, high-throughput options. Multiple options can obtain higher performance when spread across multiple PCI busses rather than placed on the same PCI bus.
2. Set the Fibre Channel adapter to run on fabric (see Section 4.1.2).

3. Obtain the Fibre Channel adapter worldwide node and worldwide port names (see Section 4.1.3).

For more information, refer to the following documentation:

- *64-Bit PCI-to-Fibre Channel Host Bus Adapter User Guide*
- *Tru64 UNIX and OpenVMS FCA-2354 Host Bus Adapter Installation Guide*
- *hp StorageWorks FCA2384 PCI-X Host Bus Adapter for OpenVMS and Tru64 UNIX Installation Guide*

## 4.1.2 Setting the Fibre Channel Adapter to Run on a Fabric

The Fibre Channel host bus adapter (FCA) defaults to fabric mode, and can be used in a fabric without taking any action. However, if you install an FCA that has been used in the loop mode on another system, you will need to reformat the nonvolatile RAM (NVRAM) and configure it to run in a Fibre Channel fabric configuration.

At the SRM console, use the worldwide ID manager (`wwidmgr`) console utility to determine the mode of operation of the Fibre Channel host bus adapter, and to set the mode if it needs to be changed (for example, from loop to fabric).

Use the `wwidmgr` utility to verify that the topology for all Fibre Channel host bus adapters are set to fabric as shown in Example 4-1 and Example 4-2.

### Example 4-1: Verifying Fibre Channel Host Bus Adapter Topology

---

```
P00>>> wwidmgr -show adapter
Link is down.
item      adapter      WWN              Cur. Topo  Next Topo
pga0.0.0.3.1 - Nvram read failed
[ 0] pga0.0.0.2.0      1000-0000-c937-40b6  FABRIC    UNAVAIL
pgb0.0.0.4.0 - Nvram read failed
[ 1] pgb0.0.0.4.0      1000-0000-c937-40b5  FABRIC    UNAVAIL
[9999] All of the above.
```

---

A `Link is down` message indicates that one of the adapters is not available, which means that its probably not plugged into a switch.

The warning message `Nvram read failed` indicates that the Fibre Channel host bus adapter nonvolatile random-access memory (NVRAM) has not been initialized and formatted. The next topology will always be `UNAVAIL` for the host bus adapter that has an unformatted NVRAM. Both messages are benign and can be ignored for the fabric mode of operation.

The display in Example 4-1 shows that both Fibre Channel host bus adapters are set for fabric topology as the current topology, the default.

When operating in a fabric, if the current topology is FABRIC, it does not matter if the next topology is Unavail, or that the NVRAM is not formatted (Nvram read failed).

To correct the Nvram read failed situation and set the next topology to fabric, use the SRM command `wwidmgr -set adapter` as shown in Example 4-2. This command initializes the NVRAM and sets the mode of all Fibre Channel host bus adapters to fabric.

#### Example 4-2: Correcting NVRAM Read Failed Message and Setting Fibre Channel Adapters to Run on Fabric

---

```
P00>>> wwidmgr -set adapter -item 9999 -topo fabric
Reformatting nvram
Reformatting nvram
P00>>> init
```

---

The `item 9999` qualifier sets all Fibre Channel adapters. To set a single Fibre Channel adapter, use the `item` qualifier with that Fibre Channel adapter's item number (for example, 0 or 1 in Example 4-1).

If, for some reason, the current topology is LOOP, you have to change the topology to FABRIC to operate in a fabric. You will never see the `Nvram read failed` message if the current topology is LOOP. The NVRAM has to have been formatted to change the current mode to LOOP.

Consider the case where the Fibre Channel host bus adapter current topology is LOOP as follows:

```
P00>>> wwidmgr -show adapter
item      adapter      WWN          Cur. Topo  Next Topo
[ 0] pga0.0.0.2.0  1000-0000-c937-40b6  LOOP      LOOP
[ 1] pgb0.0.0.4.0  1000-0000-c937-40b5  LOOP      LOOP
[9999] All of the above.
```

If the current topology for an adapter is LOOP, set an individual adapter to FABRIC by using the `item` number for that adapter (for example, 0 or 1). Use 9999 to set all adapters as shown in Example 4-2.

Displaying the adapter information again will show the topology that the adapters will assume after the next console initialization:

```
P00>>> wwidmgr -show adapter
item      adapter      WWN          Cur. Topo  Next Topo
[ 0] pga0.0.0.2.0  1000-0000-c937-40b6  LOOP      FABRIC
[ 1] pgb0.0.0.4.0  1000-0000-c937-40b5  LOOP      FABRIC
[9999] All of the above.
```

This display shows that the current topology for both Fibre Channel host bus adapters is LOOP, but will be FABRIC after the next initialization:

```
P00>>> init
P00>>> wwidmgr -show adapter
item      adapter      WWN          Cur. Topo  Next Topo
```

```
[ 0] pga0.0.0.2.0          1000-0000-c937-40b6   FABRIC   FABRIC
[ 1] pgb0.0.0.4.0          1000-0000-c937-40b5   FABRIC   FABRIC
[9999] All of the above.
```

---

### Notes

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The console remains in `wwid` manager mode, and you cannot boot until the system is reinitialized. Use the `init` command or a system reset to reinitialize the system after using the `wwid` manager.

If you try to boot the system and receive the following error, initialize the console to get out of WWID manager mode and reboot:

```
P00>>> boot
warning -- main memory zone is not free
P00>>> init
      :
P00>>> boot
```

If you shut down the operating system and try to use the `wwidmgr` utility, you may be prevented from doing so. If you receive the following error, initialize the system and retry the `wwidmgr` command:

```
P00>>> wwidmgr -show adapter
wwidmgr available only prior to booting.
Reinit system and try again.
P00>>> init
      :
P00>>> wwidmgr -show adapter
      :
```

For more information on the `wwidmgr` utility, see the *wwidmgr User's Manual*, which is on the Alpha Systems Firmware Update CD-ROM in the `DOC` directory.

---

### 4.1.3 Obtain the Fibre Channel Adapter Worldwide Name

A worldwide name (WWN) is a unique number assigned to a subsystem by the Institute of Electrical and Electronics Engineers (IEEE) and set by the manufacturer prior to shipping. The worldwide name assigned to a subsystem never changes. We recommend that you obtain and record the worldwide names of Fibre Channel components in case you need to verify their target ID mappings in the operating system.

There are multiple ways to obtain a Fibre Channel adapter node or port WWN:

- You can obtain the WWN from a label on the Fibre Channel adapter module before you install it.

---

**Note**

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The label on the Fibre Channel adapter module provides the least significant 12 hex digits of both the node and port WWN. Software adds the most significant 4 hex digits (either 2000 for the node WWN or 1000 for the port WWN).

---

- You can use the `show device` command to obtain the port WWN (labeled WWN) as follows:

```
P00>>> show device
      :
pga0.0.0.7.0      PGA0      WWN 1000-0000-c937-40b6
pgb0.0.0.8.0      PGB0      WWN 1000-0000-c937-40b5
```

- You can use the `wwidmgr -show adapter` command as follows to obtain the port WWN:

```
P00>>> wwidmgr -show adapter
item      adapter      WWN      Cur. Topo  Next Topo
[ 0]      pga0.0.0.7.0  1000-0000-c937-40b6  FABRIC     FABRIC
[ 1]      pgb0.0.0.8.0  1000-0000-c937-40b5  FABRIC     FABRIC
[9999]    All of the above.
```

Record in Table A-1 (Appendix) the port WWN of each installed Fibre Channel adapter for later use. Table 4-1 lists the WWNs for the systems used in the examples in this chapter. The examples refer to the sample two-member TruCluster Server cluster configuration shown in Chapter 3. As you proceed through the installation process, fill out Table A-2 with disk information specific for your cluster.

**Table 4-1: Fibre Channel Host Bus Adapter Port Worldwide Names**

Cluster Member	Fibre Channel Adapter	Port Worldwide Name
Member 1 (swiss)	emx0	1000-0000-c937-40b6
	emx1	1000-0000-c937-40b5
Member 2 (rye)	emx0	1000-0000-c92c-2c81
	emx1	1000-0000-c92c-2c10

## 4.2 Installing All Fibre Channel Switches

A no-single-point-of-failure configuration requires a minimum of two nodes, two StorageWorks XP Channel Adapter modules, two Fibre Channel switches, and two Fibre Channel Host Bus Adapters, and the use of redundant data sets (either RAID 1 or RAID 5). Figure 3-1 illustrates a sample of such a configuration.

---

**Note**

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Skip this section if there is an existing AlphaServer configuration. Continue with Section 4.3.

---

Ensure that the member systems, the Fibre Channel switches, and the XP Disk Array are placed within the lengths of the optical cables that you will be using.

Install and set up the Fibre Channel switches using the documentation that came with the switch as follows:

- Install a minimum of two Fibre Channel switches if you have plans for a no-single-point-of-failure (NSPOF) configuration.
- Verify that all switches have a 10Base-T Ethernet (RJ45) port, and after the IP address is set, the Ethernet connection allows you to manage the switch:
  - Remotely using a Telnet TCP/IP connection
  - With the Simple Network Management Protocol (SNMP)
  - Using Web management tools

If it is necessary to set up switch zoning, you can do so after installing the Fibre Channel host bus adapters, storage hardware, and associated cabling.

## 4.3 Connecting All Fiber Optic Cables

The type of Fibre Channel host bus adapter and Fibre Channel switch determine the types of fiber-optic cables used.

The fiber-optic cables used will have either subscriber connector (SC) or Lucent connector (LC) connectors, and the cables may be SC-to-SC, SC-to-LC, or LC-to-LC, depending upon the hardware used. The 1-Gb hardware uses the SC connector while the 2-Gb hardware uses the LC connector.

Install the fiber-optic cables as follows:

- For each member system, install an SC-to-SC, SC-to-LC, or LC-to-LC fiber-optic cable between the first Fibre Channel host bus adapter and the first Fibre Channel switch.
- For each member system, install a second SC-to-SC, SC-to-LC, or LC-to-LC fiber-optic cable between the second Fibre Channel host bus adapter and the second Fibre Channel switch.
- Install an SC-to-LC or LC-to-LC fiber-optic cable between the first Fibre Channel switch and the leftmost CHA module - CHA-1C port 1A. (Note that the port used is optional, that is, IA, IB, IC ,ID are all valid.) .
- Install a second SC-to-LC or LC-to-LC fiber-optic cable between the second Fibre Channel switch and the corresponding CHA module in cluster 2 - CHA-2G port 2A. (Note that the port used is optional - 2A, 2B, 2C ,2D are all valid - but it is recommended that you use the same port letter as in the previous step.)

## 4.4 Powering Up the XP Storage Array

Connect the two power cables to the power supplies at the rear of the XP Disk Array cabinet. Power up the XP storage array according to the procedures described in the StorageWorks XP Firmware Update CD that was shipped with the storage system. Refer to the Power On/Off Procedure in the PDF file that is typically named 04inst3.pdf.

## 4.5 Powering Up AlphaServer Systems and Fibre Channel Switches

Power up the AlphaServer systems and the Fibre Channel switches. For detailed instructions, refer to the installation manuals that were shipped with these components.

---

### Note

---

Skip this section if there is an existing AlphaServer configuration.

---

## 4.6 Performing a Define Configuration and Install (DCI) Procedure

This major procedure covers topics like unpacking, installing various components, changing configuration information, and troubleshooting. This procedure is also called the Installation and De-Installation Procedure. Refer to the StorageWorks XP Firmware Update CD that was shipped with

the storage system. On that CD, refer to the Installation Section in the PDF file that is typically named 04inst12.pdf.

## 4.7 Checking the Firmware Revision

Each XP Disk Array includes a built-in laptop computer called the Service Processor (SVP). The SVP, located in the disk control frame cabinet, is the local interface to the storage system and provides tools for configuring, maintaining, and troubleshooting the storage system. The SVP is used by your HP Service Representative only.

---

### Caution

---

The following steps are restricted to qualified HP Services personnel only.

---

To determine whether the firmware needs to be updated, follow these steps:

1. Power up the SVP and wait for the main window to display.
2. At the SVP main window, click on the Maintenance button.
3. At the Maintenance window, click on the Version command.
4. At the Version Information window, look at the DKCMAIN field. The firmware revision is a number like 21-08-05-00/00. Record this number for reference.
5. Compare this firmware revision with the version of the firmware image on your StorageWorks XP Firmware Update CD. You can also go to the following web page: <http://h18002.www1.hp.com/alphaserver/products/options.html> and click on the Firmware link. Another option is to login to this HP web site: [http://program-web.boi.hp.com/fw\\_sw\\_updates/index\\_firmware\\_sw.html](http://program-web.boi.hp.com/fw_sw_updates/index_firmware_sw.html) . Since this web site is classified as HP Restricted, an HP Services representative will need an authorized account to access this information. Self-maintenance customers will need to contact HP Service for this information.
6. If needed, update the firmware from the StorageWorks XP Firmware Update CD using the instructions on that CD. Refer to the Maintenance manual file named 05micro.pdf, and the section called "Micro Program Exchange Procedure Online." These instructions cover most situations.

## 4.8 Configuring Storage System LUNs and Fibre Channel HBA Connections

Authorized HP Service personnel can now configure the storage system LUNs and the Fibre Channel HBA connections as follows.

1. From the SVP, set Host Mode for group Tru64 to 07.
2. Also set System Mode (aka Modemode) for Tru64 UNIX by setting modes 161, 198, and 278 to On (checked). This enables the DEC HSG80 disk naming convention. Mode 247 must be set to Off.

---

### Note

---

Mode 247 enables the HP OPEN disk naming convention which is supported for the XP128 and XP1024 only. If you enable mode 247, you must disable mode 198.

---

The following mode settings are available.

- 161 – Microcode update forces information to flash memory on the microprocessors of the Fibre cards (CHT, also called CHF) instead of the microcode only being updated in local memory on the microprocessors.
- 198 – DEC HSG80 disk naming convention for existing installations (mode 247 must be off). Mode 198 *must be used* for XP48 and XP512 Disk Arrays, on Tru64 UNIX V4 installations, and on Tru64 UNIX V5.1A/B installations prior to BL25.

Also, mode 198 supports either XP or HSG80 arrays but not both on the same system at the same time.

- 247 – HP OPEN disk naming convention for new installations (mode 198 must be off). This works on StorageWorks XP128 and XP1024 models, but *should not be used* on StorageWorks XP48 and XP512 models. For this function to operate properly, Tru64 UNIX V5.1A needs Patch Kit 7 / BL25 and Tru64 UNIX V5.1B needs Patch Kit 4 / BL25.
- 272 – Continuous Access (CA) replicated WWID (mode 247 must be on). Also requires BL25 or later. Required for CA boot or LSM volumes.
- 278 – Registered State Change Notification (RSCN) – notifies a host when a port is first usable by that host (replacement for the zone re-enabling workaround).

## 4.9 Adding the XP Storage Array to the TruCluster Server Configuration

If you have added a StorageWorks XP Disk Array to an existing TruCluster Server configuration, perform the following steps:

1. At the system prompt at the Tru64 UNIX console, enter the following command, which scans for new hardware. (This is usually not required.)

```
# hwmgr -scan component -cluster
```

2. With the Tru64 UNIX operating system at single-user or multi-user mode, use the hardware manager utility (`hwmgr -view devices`) to display all devices on the system. The system responds with a list of all devices. For large disk arrays, the list can contain hundreds of entries. The following sample shows only a small number of representative entries. The StorageWorks XP disks appear as OPEN-*x* models (when mode 247 is set).

### Example 4-3: Using hwmgr to Display All Device Types

---

```
# hwmgr -view devices
HWID: Device Name           Mfg      Model          Location
-----
 10: /dev/dmapi/dmapi
167: /dev/disk/dsk1c        DEC      HSG80          IDENTIFIER=32
168: /dev/disk/dsk2c        DEC      HSG80          IDENTIFIER=33
  :
  :
179: /dev/disk/dsk12c       COMPAQ   HSV110 (C) COMPAQ  IDENTIFIER=1
180: /dev/disk/dsk13c       COMPAQ   HSV110 (C) COMPAQ  IDENTIFIER=2
181: /dev/disk/dsk14c       COMPAQ   HSV110 (C) COMPAQ  IDENTIFIER=3
  :
  :
397: /dev/disk/dsk229c      HP       OPEN-3         IDENTIFIER=3
398: /dev/disk/dsk230c      HP       OPEN-8         IDENTIFIER=256
399: /dev/disk/dsk231c      HP       OPEN-8         IDENTIFIER=257
400: /dev/disk/dsk232c      HP       OPEN-8         IDENTIFIER=258
401: /dev/disk/dsk233c      HP       OPEN-9         IDENTIFIER=769
  :
  :
```

---

3. You can narrow down the display to show only the XP disks in the array. Pipe the `hwmgr` command through the `grep` utility and search for devices based on the System Mode setting. If mode 247 is turned on, then search for OPEN device types as shown in Example 4-4.

#### Example 4-4: Using hwmgr to Display OPEN Device Types \*

```
# hwmgr -view devices | grep OPEN
HWID: Device Name           Mfg      Model      Location
-----
392: /dev/cport/scp1         HP       OPEN-3-CM  bus-1-targ-4-lun-0
393: /dev/disk/dsk225c      HP       OPEN-E     IDENTIFIER=144
394: /dev/disk/dsk226c      HP       OPEN-E     IDENTIFIER=145
395: /dev/disk/dsk227c      HP       OPEN-3     IDENTIFIER=1
396: /dev/disk/dsk228c      HP       OPEN-3     IDENTIFIER=2
397: /dev/disk/dsk229c      HP       OPEN-3     IDENTIFIER=3
398: /dev/disk/dsk230c      HP       OPEN-8     IDENTIFIER=256
399: /dev/disk/dsk231c      HP       OPEN-8     IDENTIFIER=257
400: /dev/disk/dsk232c      HP       OPEN-8     IDENTIFIER=258
```

\* Modemode 247 is on (198 is off).

If mode 198 is turned on, then search for HSG80 device types as shown in Example 4-5.

#### Example 4-5: Using hwmgr to Display HSG80 Device Types \*

```
# hwmgr -view devices | grep HSG80
HWID: Device Name           Mfg      Model      Location
-----
167: /dev/disk/dsk1c        DEC      HSG80      IDENTIFIER=32
168: /dev/disk/dsk2c        DEC      HSG80      IDENTIFIER=33
169: /dev/disk/dsk3c        DEC      HSG80      IDENTIFIER=34
170: /dev/disk/dsk4c        DEC      HSG80      IDENTIFIER=35
171: /dev/disk/dsk5c        DEC      HSG80      IDENTIFIER=36
172: /dev/disk/dsk6c        DEC      HSG80      IDENTIFIER=37
173: /dev/disk/dsk7c        DEC      HSG80      IDENTIFIER=38
174: /dev/disk/dsk8c        DEC      HSG80      IDENTIFIER=39
175: /dev/disk/dsk9c        DEC      HSG80      IDENTIFIER=40
176: /dev/disk/dsk10c       DEC      HSG80      IDENTIFIER=41
177: /dev/cport/scp0         HP       OPEN-3-CM  bus-1-targ-5-lun-10
```

\* Modemode 198 is on, 247 is off.

To distinguish between XP disks and true HSG80 disks, you need to make an educated guess. This is done by knowing how many LUNs each array presents and what are the settings for the IDENTIFIERS.

## 4.10 Installing Tru64 UNIX and TruCluster Server Software to Local Disk

If this a new installation, install Tru64 UNIX software onto a local internal SCSI disk on the AlphaServer system. Refer to the instructions in the *Tru64 UNIX Installation Guide*. (Installing the base operating system on an XP disk is beyond the scope of this guide.)

Also install TruCluster Server software onto the same local internal SCSI disk. Refer to the instructions in the *TruCluster Server Cluster Installation Manual*.

## 4.11 Determining and Preparing XP Disk Array Target Disks for TruCluster Server Software

You need to identify the XP Disk Array disks onto which you plan to install TruCluster Server Software. The next several sections explain how to do just that.

### 4.11.1 Identifying XP Disk Array Disks

From the base operating system disk, perform the following command to display a list of all devices. An excerpt is shown in Example 4-6.

#### Example 4-6: Looking for XP Disks

---

```
node1> hwmgr -view devices
HWID: Device Name           Mfg      Model      Location
-----
  10: /dev/dmapi/dmapi
 167: /dev/disk/dsk1c        DEC      HSG80      IDENTIFIER=32
 168: /dev/disk/dsk2c        DEC      HSG80      IDENTIFIER=33
  :
  :
 393: /dev/disk/dsk225c      HP       OPEN-E     IDENTIFIER=144 Cluster root,
                                     /usr, /var
 394: /dev/disk/dsk226c      HP       OPEN-E     IDENTIFIER=145 Quorum disk
 395: /dev/disk/dsk227c      HP       OPEN-3     IDENTIFIER=1 Member 1 boot disk
 396: /dev/disk/dsk228c      HP       OPEN-3     IDENTIFIER=2 Member 2 boot disk
 397: /dev/disk/dsk229c      HP       OPEN-3     IDENTIFIER=3
 398: /dev/disk/dsk230c      HP       OPEN-8     IDENTIFIER=256
 399: /dev/disk/dsk231c      HP       OPEN-8     IDENTIFIER=257
 400: /dev/disk/dsk232c      HP       OPEN-8     IDENTIFIER=258
```

---

Select a set of disks on the XP Disk Array. In the preceding example, the printout has been modified to identify the disks (with hardware IDs of 393, 394, 395, and 396) that are to be used as the cluster disk (root (/), /usr, /var), quorum disk, and two member boot disks. Separate disks may be used for these AdvFS file systems.

### 4.11.2 Determining WWIDs of Member Disks

Determine the worldwide ID numbers (WWIDs) of the cluster member disks. From the base operating system disk, perform the following command to display the attributes of the first cluster member's boot disk identified in the preceding section. Record the WWID number. Example 4-7 shows the WWID for the disk with HWID 395 listed in the previous example.

### Example 4-7: Displaying WWID of First Cluster Member Boot Disk

---

```
node1> hwmgr -get attrib -id 395 | grep name
name = SCSI-WWID:01000010:6006-0e80-0350-6200-0009-0010-5062-0001
dev_base_name = dsk227
user_name = (null) (settable)
consistent_name = 1
node1>
```

---

Repeat this command for each cluster member's boot disk.

### 4.11.3 Labeling the Disks to Be Used to Create the Cluster

Before you run `clu_create` to create the first cluster member or `clu_add_member` to add subsequent cluster members, you must label the disks to be used for cluster software.

On the system where you installed the Tru64 UNIX operating system, if you have not already done so, boot the system. Determine the `/dev/disk/dskn` values to use for cluster installation (see Example 4-6 or Table A-2).

Initialize disk labels for all disks needed to create the cluster. Example 4-6 uses disk `dsk225` for cluster root (`/`), `/usr`, and `/var`, `dsk226` for Quorum disk, `dsk227` for member 1 boot disk, and `dsk228` for member 2 boot disk. For example:

```
# disklabel -z dsk225
disklabel: Disk /dev/rdisk/dsk225c is unlabeled
# disklabel -rw dsk225
```

### 4.11.4 Maximizing Usable Disk Space on root, /usr, and /var Disk

A disk is typically formatted into partitions A through H, but the default disk partitions created by `disklabel` are inadequate. To maximize the usable space for installed software on the cluster root (`/`), `/usr`, and `/var` disks, it is recommended that you run the `diskconfig` command on the appropriate disk as explained in the following procedure. In Example 4-6, this disk is labeled `/dev/disk/dsk225c`.

1. Enter the `diskconfig` command at the system prompt. A graphical window displays a list of all devices.
2. Select the device to be partitioned and click on Configure.
3. Below the graph of the selected disk, check the partitions labeled B, G, and H.
4. Click and drag the vertical partition bars until B, G, and H are of equal width (1/3 each).
5. Save the settings.

### 4.11.5 Clearing Stored Environment Variables

At this point, you need to clear all `wwid $n$`  and `N $n$`  variables. But you must initialize the console before you can use the `wwidmgr` command to clear the variables.

From the AlphaServer SRM console, use the `init` command, then use the `wwidmgr -clear all` command to clear the stored Fibre Channel `wwid1`, `wwid2`, `wwid3`, `wwid4`, `N1`, `N2`, `N3`, and `N4` SRM environment variables.

The following example illustrates these commands.

#### Example 4-8: Clearing Stored Environmental Variables

---

```
P00>>> init
:
P00>>> wwidmgr -clear all
P00>>> show wwid*
wwid0
wwid1
wwid2
wwid3

P00>>> show n*
N1
N2
N3
N4
```

---

#### Note

---

The console only creates devices for which the `wwid $n$`  SRM environment variable has been set, and that are accessible through an XP Disk Array `N_Port` as specified by the `N $n$`  SRM environment variable also being set. These SRM environment variables are set with the `wwidmgr -quickset` or `wwidmgr -set wwid` commands.

---

## 4.11.6 Setting Device Unit Number for Cluster Member Boot Disk

To set the device unit number for a cluster member boot disk, follow these steps.

1. At the SRM console on the first member's boot disk, search for the WWID number found in Example 4-7. In that example, the disk with HWID 395 had the following WWID number. SCSI-WWID:01000010:6006-0e80-0350-6200-0009-0010-5062-0001
2. Use the `wwidmgr` command to display all the WWID numbers. In Example 4-9, item 267 contains that WWID number. (The labels to the right of some entries were added as a visual aid.) An interesting detail is that WWID numbers for disks connected to a specific port differ only in the last set of digits.

### Example 4-9: Searching for a WWID Number

---

```
P00>>> wwidmgr -show wwid | more
[0] UDID: 6 WWID:01000010:6005-08b4-0001-4189-0003-7000-01a3-0000 (ev:none)
[1] UDID:-1 WWID:01000010:6008-05f3-0009-fc90-0000-0000-02da-0007 (ev:none)
[2] UDID:-1 WWID:01000010:6008-05f3-0009-fc90-0000-0000-8d38-0008 (ev:none)
[3] UDID:-1 WWID:01000010:6008-05f3-0009-fc90-0000-0000-6062-0009 (ev:none)
:
:
[265] UDID:144 WWID:01000010:6006-0e80-0350-6200-0009-0010-5062-0090 (ev:none) Cluster /root,
                                     /usr, /var
[266] UDID:145 WWID:01000010:6006-0e80-0350-6200-0009-0010-5062-0091 (ev:none) Quorum
[267] UDID: 1 WWID:01000010:6006-0e80-0350-6200-0009-0010-5062-0001 (ev:none) Member 1 boot disk
[268] UDID: 2 WWID:01000010:6006-0e80-0350-6200-0009-0010-5062-0002 (ev:none)
[269] UDID: 3 WWID:01000010:6006-0e80-0350-6200-0009-0010-5062-0003 (ev:none)
```

---

3. The next step is to set the device unit number for the member boot disk and dump disk using the `wwidmgr` command as shown in Example 4-10.

### Example 4-10: Setting the Device Unit Number

---

```
P00>>> wwidmgr -quickset -item 267 -unit 1

Disk assignment and reachability after next initialization:

6005-08b4-0001-4189-0003-7000-01a3-0000
      via adapter:          via fc nport:          connected:

6006-0e80-0350-6200-0009-0010-5062-0001
      via adapter:          via fc nport:          connected:
dgb1.1001.0.109.0          pgb0.0.0.109.0          5006-0e80-0350-6201          Yes
dgb1.1002.0.109.0          pgb0.0.0.109.0          5006-0e80-0350-6206          Yes
dga1.1003.0.9.0            pga0.0.0.9.0            5006-0e80-0350-6211          Yes
dga1.1004.0.9.0            pga0.0.0.9.0            5006-0e80-0350-6216          Yes
P00>>>
```

---

4. Repeat this procedure on each system or cluster member to set the device unit number for that system's cluster member boot disk.

### 4.11.7 Preparing a Member Disk to Enable Boot

To prepare a member disk to enable boot, use the following command. The `set bootdef_dev` command sets the SRM `bootdef_dev` environment variable for the cluster member boot disk to be a comma-separated list of boot devices (up to four). This allows for multiple boot paths in case a disk becomes unreachable.

#### Example 4-11: Setting the Boot Path

---

```
P00>>>set bootdef_dev dgb1.1001.0.109.0 , dgb1.1002.0.109.0,  
dga1.1003.0.9.0, dga1.1004.0.9.0
```

---

## 4.12 Building a Cluster Using `clu_create`

Use the information in the following sections to build a TruCluster Server cluster.

### 4.12.1 Installing TruCluster Server Software and Creating the First Cluster Member

After labeling and formatting the cluster disks using sections Section 4.11.3 and Section 4.11.4, use the *TruCluster Server Cluster Installation Manual* procedures for your operating system version and create the TruCluster Server cluster using the `clu_create` command.

Once `clu_create` is completed, shutdown the system, and boot the first cluster member's boot disk (set up in Section 4.11.7).

### 4.12.2 Adding Another System to the Cluster

To add another system to the cluster, follow these steps:

---

**Note**

---

You can have up to eight member systems in a cluster.

---

1. Referring to the *TruCluster Server Cluster Installation Manual* procedures, use `clu_add_member` to add a cluster member. The WWID of the cluster member's boot disk will be displayed near the finish of the `clu_add_member` command.

2. Boot the new cluster member system into the cluster and complete the cluster installation. Cluster members added with `clu_add_member` must boot the generic `vmunix` kernel on the first boot using the SRM command, `boot -file genvmunix`. The cluster member disk configures and loads software packages and patches, and finally reaches a point where it prompts for the network interface to be configured.
3. When prompted to configure the network interface, it is recommended that you do so.
4. Once completely booted, login, then shutdown the system, and reboot the kernel built for this cluster member from the SRM prompt using the command, `boot -file vmunix`.

---

**Note**

---

The cluster installation procedure sets the `bootdef_dev` SRM environment variable to multiple paths.

Depending on your configuration, you can enhance boot availability by setting multiple paths. To determine the additional paths to the boot disk, enter the `wwidmgr -show reachability` command. Depending on how many of the entries are required for dump devices, the remaining devices can be used to specify multiple boot paths.

The following is an example of the reachability display.

```
P00>>> wwidmgr -show reachability

6005-08b4-0001-4189-0003-7000-01a3-0000
      via adapter:          via fc nport:          connected:

6006-0e80-0350-6200-0009-0010-5062-0001
      via adapter:          via fc nport:          connected:
dgb1.1001.0.109.0          pgb0.0.0.109.0        5006-0e80-0350-6201      Yes
dgb1.1002.0.109.0          pgb0.0.0.109.0        5006-0e80-0350-6206      Yes
dga1.1003.0.9.0            pga0.0.0.9.0          5006-0e80-0350-6211      Yes
dga1.1004.0.9.0            pga0.0.0.9.0          5006-0e80-0350-6216      Yes
P00>>>
```

Set the `bootdef_dev` SRM environment variable, as shown in Section 4.11.7.

---

Repeat this procedure for each additional system to be added to the cluster.

# 5

---

## Troubleshooting

This chapter identifies known error conditions and provides workarounds.



# A

---

## Worksheets

This appendix provides blank worksheets on which to log your Fibre Channel Host Bus Adapter Worldwide Names and information about how you allocated storage for the cluster.

**Table A-1: Fibre Channel Host Bus Adapter Worldwide Names**

Cluster Member	Fibre Channel Adapter	Port Worldwide Name
Member 1	emx0	
	emx1	
Member 2	emx0	
	emx1	
Member 3	emx0	
	emx1	
Member 4	emx0	
	emx1	
Member 5	emx0	
	emx1	
Member 6	emx0	
	emx1	
Member 7	emx0	
	emx1	
Member 8	emx0	
	emx1	

**Table A-2: Storage Allocation for TruCluster Server Installation**

<b>File System or Disk</b>	<b>Size</b>	<b>Unit Number</b>	<b>Unit ID</b>	<b>Device Name</b>	<b>dsk<sub>n</sub></b>
Tru64 UNIX disk					
Cluster root (/)					
Cluster /usr					
Cluster /var					
Quorum disk					
Member 1 boot disk					
Member 2 boot disk					
Member 3 boot disk					
Member 4 boot disk					
Member 5 boot disk					
Member 6 boot disk					
Member 7 boot disk					
Member 8 boot disk					

---

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