

Compaq StorageWorks

RAID Array 8000/ESA12000 Fibre
Channel Cluster Solutions for
Windows NT

Installation Guide

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Compaq Computer Corporation

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Revision Record

This Revision Record provides a concise publication history of this guide. It lists the guide revision levels, release dates, and reasons for the revisions. It also describes how the changes to affected pages are marked in the guide.

The following revision history lists all revisions of this publication and their effective dates. The publication part number is included in the Revision Level column, with the last entry denoting the latest revision.

This publication supports the StorageWorks RA8000 or ESA12000 Subsystem configured with a Compaq Fibre Channel Storage Hub 12 to two host servers running the Windows NT operating system, and each containing a StorageWorks KGPSA-BC fibre channel host adapter. NT Cluster software is supported by this publication.

Revision Level	Date	Summary of Changes
EK-NTC8K-IG. A01 101471-001	November 1998	Original Release.
EK-NTC8K-IG. B01 101471-002	March 1999	Supports Fibre Channel Switch.

About This Guide

This section provides an overview of the RA8000/ESA12000 Fibre Channel system cluster concept for Windows NT, and defines the scope and conventions of this guide. It also identifies the associated reference documentation, and the StorageWorks sales, service, and technical support contacts worldwide.

Forward

Fiber Channel technology employs several physical topologies for *node* connectivity. Two of these topologies, known as the Fibre Channel Arbitrated Loop (FC-AL) and Fibre Channel Switch Fabric (FC-SW) are well suited for Windows NT cluster configurations.

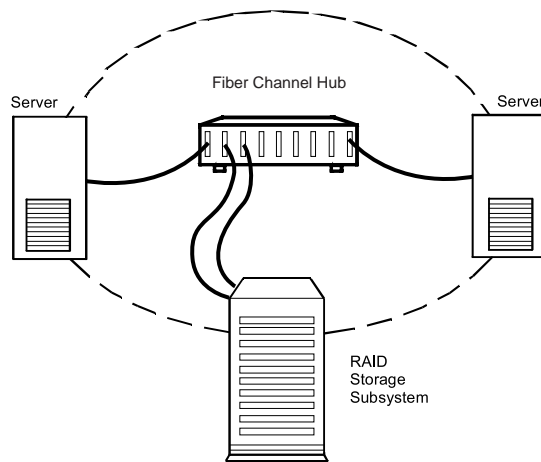
These Fibre Channel topologies simplifies cluster configurations by eliminating many of the pitfalls that restrict the SCSI parallel bus when configured with multiple initiators. Issues such as bus termination, unfair arbitration, restrictive cable lengths and device addressability are alleviated using the FC-AL topology. In short, the use of FC-AL or FC-SW in a cluster configuration is much more intuitive and practical for the NT Cluster solution.

This manual discusses the basic Fibre Channel NT cluster configurations and software installation requirements to support the Compaq StorageWorks RA8000 and RA12000 Subsystems.

An Overview of RA8000/ESA12000 Fibre Channel Cluster Solutions for Windows NT

A Windows NT Fibre Channel cluster enables two host servers configured with the Windows NT cluster software to share a Fibre Channel storage subsystem through a Fibre Channel Arbitrated Loop. Should a failure on a server occur, the failure is detected and the storage I/O is re-routed through to the functioning server. This process, called failover, requires no resource downtime - ensuring the high availability of data. The failed component(s) can be warm-swapped or serviced while functioning components remain active.

Figure 1 RA8000/ESA12000 System Fibre Channel Cluster Concept



Audience

This guide is intended for administrators and system integrators of NT-based host servers and StorageWorks Fibre Channel RAID systems equipment. Setting up a Fibre Channel cluster requires a general understanding of server networks, RAID storage concepts, Windows NT Cluster software and Fibre Channel hardware configurations. Or, contact your service representative for installation assistance.

Document Structure

This guide contains the following chapters:

Getting Started

This section provides a roadmap to serve as the master procedural guide for establishing a Fibre Channel cluster.

Chapter 1: Fibre Channel NT Cluster Configuration Guidelines

This chapter depicts the major components of a Fibre Channel Windows NT Cluster and describes the basic configuration rules for each.

Chapter 2: Installing Software for a Fibre Channel Cluster

This chapter identifies the software setups, in sequence, required to prepare the StorageWorks RA Subsystem and two NT host servers for a Fibre Channel cluster environment.

Appendix A: Troubleshooting

This appendix describes how to troubleshoot the RA8000/ESA12000 Subsystem Fibre Channel cluster.

Appendix B: Valid ALPA Settings

This appendix provides a table of the valid arbitrated loop physical addresses (ALPA) available for the Fibre Channel arbitrated loop (FC-AL).

Associated Documents

In addition to this guide, the following documentation is useful to the reader:

Table 1 Associated Documents

Document Title	Order Number
<i>Command Console Version 2.1</i>	
<i>Fibre Channel User's Guide</i>	AA-RFA2C-TE/387405-003
<i>Quick Setup Guide RA8000/ESA12000 Fibre Channel Storage Subsystem for Windows NT - Intel</i>	
<i>ACS V8.4 for Fibre Channel Switch</i>	AA-RHH5A-TE
<i>RA8000 and ESA 12000 Storage Subsystem User's Guide</i>	EK-SMCPR-UG
<i>The RAIDBOOK—A Source for RAID Technology</i>	RAID Advisory Board
<i>Fibre Channel Storage Hub 12 Installation Guide</i>	340662-001
<i>Fibre Channel Switch User's Guide</i>	AA-RHBYA-TE
<i>RA8000/ESA12000 FC-AL High-Availability Configurations for Windows NT - Intel Application Notes</i>	AA-RH0SA-TE
<i>RA8000/ESA12000 Fibre Channel Fabric Configurations for Windows NT - Intel</i>	AA-RHH6A-TE

Conventions

In this guide, references to RAID, RA8000/ESA12000 Subsystem, *HSG80*, controller, or Storage subsystem pertain to the following:

- The StorageWorks RAID Array 8000 Fibre Channel system or the StorageWorks RAID Array ESA12000 system.

This guide uses the following documentation conventions:

Table 2 Style Conventions

Style	Meaning
boldface monospace type	To be input by the user.
<i>italic type</i>	For emphasis, manual titles, utilities, menus, screens, and filenames.
plain monospace type	Screen text.

Getting Help

If you have a problem and have exhausted the information in this guide, you can get further information and other help in the following locations.

Compaq Web Site

The Compaq Web Site has information on this product as well as the latest drivers and Flash ROM images. To access the Compaq Web Site, log on to the Internet at:

<http://www.compaq.com/products/storageworks>

Telephone Numbers

For the name of your nearest Compaq Authorized Reseller:

In the United States, call 1-800-345-1518

In Canada, call 1-800-263-5868

For Compaq technical support:

In the United States and Canada, call 1-800-386-2172

Getting Started

This section contains a roadmap to serve as your master guide for establishing a Fibre Channel cluster between two NT host servers and a shared RA8000/ESA12000 Subsystem. This roadmap presides over all other documentation supplied with your equipment, and refers to those resources as more technical depth is required.

NOTE

Depending on your current system environment, you may not need to perform all the tasks on this roadmap.

RA8000/ESA12000 Fibre Channel Clusters for Windows NT Roadmap

STEP	PERFORM THIS PROCEDURE...	DESCRIBED IN...
□ 1	Unpack and Setup the RAID Subsystem	<i>See instructions supplied on the shipping box.</i>
□ 2	Cable the RAID Subsystem Fibre Channel Cluster Components	RAID 8000 and ESA12000 Storage Subsystem User's Guide, EK-SMCPR-UG.A01/387404-001
□ 3	Install RAID Manager (SWCC) Software and Create the RAID StorageSets	<i>Command Console Version 2.1 (HSG80) User's GuideAA-RFA2A-TE/ 387405-001</i>
□ 4	Perform Software Setups Required for a Cluster, Including... <ul style="list-style-type: none">◇ Prepare the RA8000/ESA12000 for a Cluster◇ Prepare Host A for a Cluster◇ Prepare Host B for a Cluster◇ Install and Configure Cluster Software	<i>See Chapter 2 of this manual.</i>

After these steps have been successfully completed in sequence, your RA8000/ESA12000 FC cluster for Windows NT will be operational.

1

Fibre Channel Windows NT Cluster Configuration Guidelines

The Compaq RA8000 and ESA12000 are Microsoft Cluster Server (MSCS) certified Fibre Channel RAID systems. These Fibre Channel RAID systems can be configured for use in various MSCS configurations and Fibre Channel topologies. This chapter describes the required Fibre Channel SAN components and supported NT Cluster configurations.

1.1 Fibre Channel Cluster Hardware Overview

RA8000/ESA12000

The RAID Array 8000 (RA8000) and Enterprise Storage Array 12000 (ESA12000) are Fibre Channel RAID systems that support Storage Area Network (SAN) constructs using Fibre Channel Switch and Arbitrated Loop topologies.

These storage systems can be configured in high availability configurations using Microsoft Cluster Server and Compaq's Secure Path Software. These high availability Windows NT software products coupled with standard fault tolerant features supported by the RA8000 and ESA12000 provide a no-single-point-of-failure solution.

Servers

The RA8000 and ESA12000 are supported in a Microsoft Windows NT Cluster by a wide range of servers including Compaq ProLiant, and Multivendor Intel servers. Reference the Microsoft cluster hardware compatibility list available from the Microsoft Web site at <http://www.microsoft.com/hwtest/hcl/> for a complete list of supported servers submitted by Compaq for the RA8000 and ESA12000 RAID systems.

Fibre Channel Host bus Adapter

The KGPSA is a Microsoft certified cluster Fibre Channel adapter supported with the RA8000/ESA12000. The KGPSA supports both Fibre Channel Arbitrated Loop and Fibre Channel Switch topologies. It is supplied with a GLM Fibre optic module for connectivity to your Fibre Channel hub or switch.

Cables

The media supported by the RA8000 system is a 50-micron multimode fibre optic cable. The maximum cable length is 500 meters from the host adapter to the Fibre Channel hub or switch and an additional 500 meters from the Fibre Channel hub to the Storage Array. At least one Fibre Channel hub or Fibre Channel switch is required for each MSCS configuration.

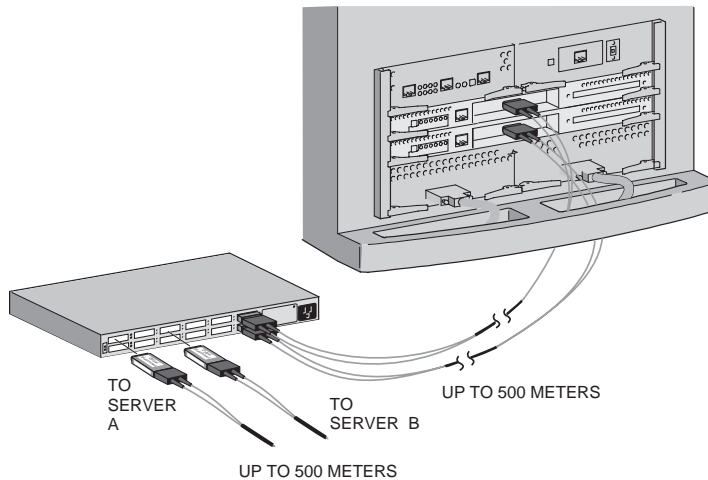
Fibre Channel Storage Hubs and Switches

The Compaq Fibre Channel Storage Hub 7 or the Fibre Channel Storage Hub 12 is the supported hubs for the RA8000. These are active hubs that provide the necessary Fibre Channel Loop connectivity for the required MSCS configuration. Refer to your *Fibre Channel Storage Hub Installation Guide* for details on hub configuration and setup.

The Compaq Fibre Channel Storage Switch is a 16 port Fibre Channel switch supported with the RA8000. Refer to your *Fibre Channel Storage Switch Installation Guide* for details on switch configuration and setup

All fiber optic cables that originate from the Fibre Channel host adapter and your RA8000 storage subsystem must connect to either a hub or a switch. Reference Figure 1-1.

Figure 1-1 Cable Connection – RA8000 Storage Array to Fibre Channel Hub



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1.2 RA8000/ESA12000 Cluster Configurations

The RA8000 and ESA12000 operate in a Storage Area Network (SAN) using Fibre Channel Switch or Arbitrated Loop topologies. This section highlights some of the possible NT Cluster configurations that can be realized using either of these Fibre Channel topologies. Use the configuration maximums outlined in this section to determine the viability of NT Cluster configurations that are not shown.

NOTE

Refer to the Compaq StorageWorks Application note, RA8000/ESA12000 FC-AL High Availability Configurations for Windows NT, for a comprehensive review of High Availability MSCS FC-AL configurations.

1.2.1 NT Cluster Fibre Channel Arbitrated Loop Configurations

The RA8000/ESA12000 can be used in various configurations in a Fibre Channel Arbitrated Loop (FC-AL) topology. The following list highlights Fibre Channel Arbitrated Loop configuration limits with emphasis on MSCS Configurations.

Fibre Channel Arbitrated Loop Configuration Limits

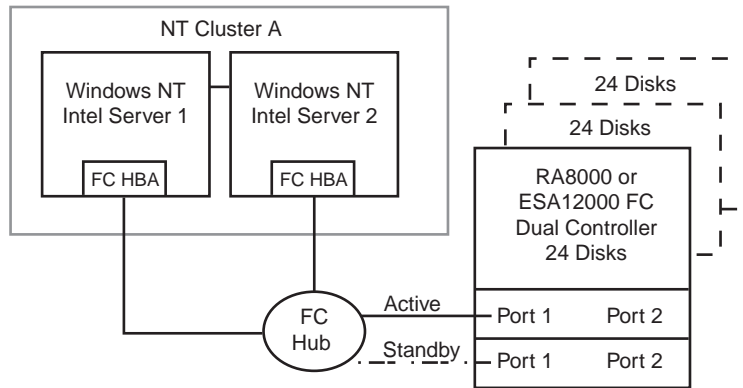
- Up to four servers or two MSCS clusters are supported on a FC loop.
- A maximum of two Fibre Channel Loops can be configured per one RA8000 or ESA12000 system.
- Up to two RA8000s or two ESA12000s are supported on one FC loop.
- A maximum cable length of 500 meters is supported using 50 micron multimode fibre-optic cable.
- The Fibre Channel 7 port hub or 12 port hubs are supported on a FC Loop.
- The RA8000 /ESA12000 configured in multi-bus mode requires the installation of Secure Path V2.1 software on each NT server.
- The RA8000/ESA12000 must be configured using FC-AL hard addressing mode

Single NT Cluster Fibre Channel Configuration

A single NT cluster Fibre Channel configuration requires that all Fibre Channel components reside on the same Fibre Channel Loop. This cluster configuration allocates all storage partitions to one Windows NT Cluster and supports a maximum of two RA8000 or two ESA12000 systems on one Fibre Channel loop. Figure 1–2 illustrates a single NT Cluster Fiber Channel configuration with one RA8000 Fibre Channel system.

A single cluster supports the use of both HSG80 host ports. This allows you to create an additional 8 storage units. A single NT Cluster configuration, when configured with multiple Storage Arrays and expansion storage cabinets, can accommodate more than two terabytes of data.

Figure 1–2 Single Cluster Fibre Channel Configuration



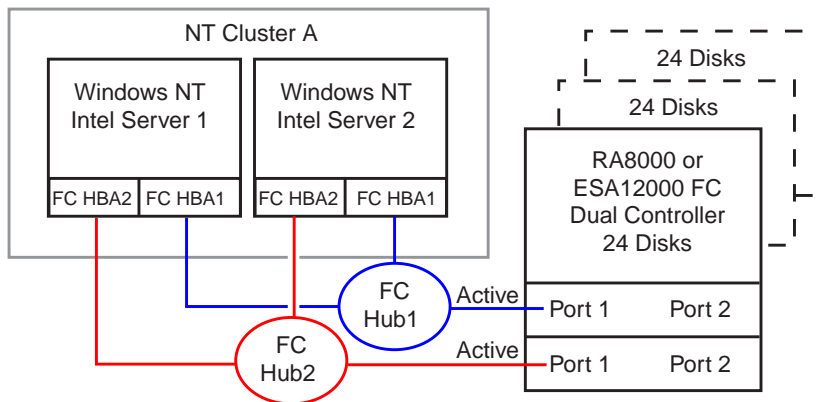
SHR-1301

The Configuration in Figure 1-2 features the following attributes:

- One NT Cluster (MSCS)
- Single Fibre Channel Loop
- Up to 72 UltraSCSI drives with optional expansion enclosures
- Dual-redundant HSG80 RAID controllers operating in transparent failover mode
- Scalable to add a second RA8000 and both HSG80 host ports

Adding a redundant I/O path to your RA8000 system enhances the previous configuration by increasing data throughput, load balancing your storage and eliminating the I/O bus as a single point of failure. This high availability and no-single-point-of-failure configuration requires Compaq's Secure Path for Windows NT value-added software and requires you to change the operating mode of your RA8000 to Multibus mode. Figure 1-3 illustrates a Fibre Channel NT Cluster configuration with a redundant I/O path.

Figure 1-3 Single Cluster Fibre Channel Configuration with Secure Path



SHR-1304

The Configuration in Figure 1-3 features the following attributes:

- One NT Cluster (MSCS)
- Secure Path V2.1
- Two Fibre Channel Loops
- 2x the data transfer rate compared to Figure 1-2
- I/O load balance capability across data paths and servers
- Up to 72 UltraSCSI drives with optional expansion enclosures
- Dual-redundant HSG80 RAID controllers operating in Multibus mode

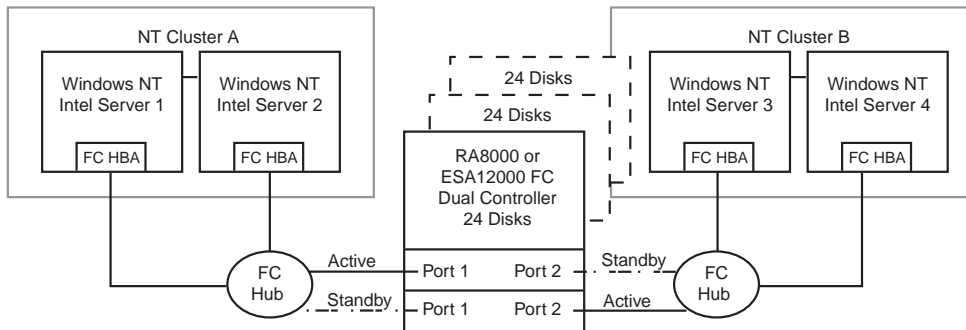
Two-Cluster Fibre Channel Configuration

A two-cluster Fibre Channel configuration allows two NT Clusters to share one RA8000 or one ESA12000 subsystem by utilizing both HSG80 host ports. This configuration requires you to partition your Fibre Channel storage across two separate Windows NT clusters. This is accomplished by utilizing both Fibre Channel host ports on each of your HSG80 controllers. Storage partitions configured on one HSG80 host port are exclusive to one Windows NT cluster while storage partitions on the other HSG80 host port are exclusive to the other Windows NT cluster. The two-cluster Fibre Channel configuration promotes an expansive use of your Fibre Channel storage capabilities and provides greater accessibility of your data by segmenting your storage requirements across multiple Windows NT Clusters.

NOTE

Refer to the Compaq StorageWorks ACS V8.4 Configuration and CLI Reference Guide for details on creating storage units that are exclusive to a host connection.

Figure 1-4 Two-Cluster Fibre Channel Configuration



SHR-1303

The Configuration in Figure 1-4 features the following attributes:

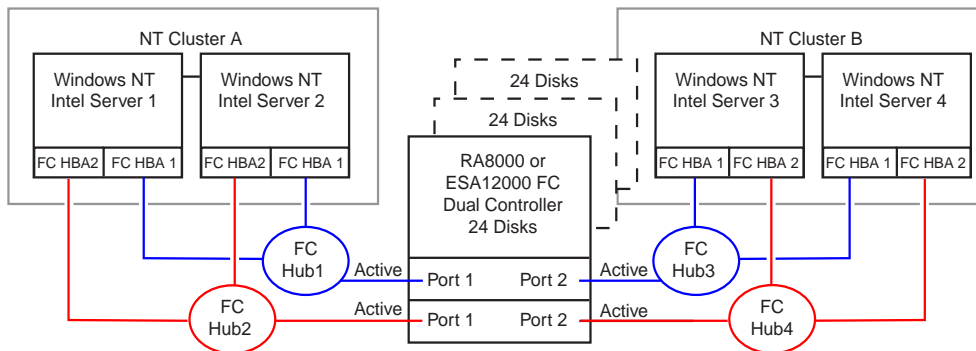
- Two NT Clusters (MSCS)
- Two Fibre Channel Loops
- Dual-redundant HSG80 RAID controllers operating in transparent failover mode
- Up to 72 UltraSCSI drives with optional expansion enclosures
- Up to 16 LUNs total. 8 LUNs per cluster with 2 active controller host ports

The configuration in Figure 1-5 builds on the previous NT cluster configuration by adding a redundant I/O path from each server to the RA8000. This configuration requires Secure Path software and changing the RA8000 to run in Multibus mode. This configuration significantly improves I/O performance by utilizing all HSG80 host ports. Secure Path also gives you the added benefits of load balancing your storage and eliminates the I/O bus as a single point of failure.

NOTE

Refer to the Compaq Secure Path documentation for detail instructions on configuring NT clusters with Secure Path.

Figure 1-5 Two-Cluster Fibre Channel Configuration with Secure Path



SHR-1306

The Configuration in Figure 1-5 features the following attributes:

- Two NT Clusters (MSCS)
- Secure Path V2.1
- Four Fibre Channel Loops
- 2x the data transfer rate compared to Figure 1-4
- I/O load balance capability across data paths
- Up to 72 UltraSCSI drives with optional expansion enclosures
- Dual-redundant HSG80 RAID controllers operating in Multibus mode

1.2.2 NT Cluster Fibre Channel Switch Configurations

The Fibre Channel Switch topology offers greater configuration flexibility and more server and storage connectivity than the Arbitrated Loop topology. The potential NT Cluster configurations are too numerous to illustrate. Use the following configuration rules to determine the viability of an NT Cluster configuration.

NOTE

Refer to the Compaq StorageWorks Application note, RA8000/ESA12000 FC-Fabric Configurations for Windows NT, for an overview of Fibre Channel Switch Fabric configuration guidelines.

Fibre Channel Switch Configuration Rules

Any combination of NT servers and RA8000/ESA12000 Fibre Channel Storage Systems can be configured on the Compaq StorageWorks Fibre Channel switch providing that the following rules are met:

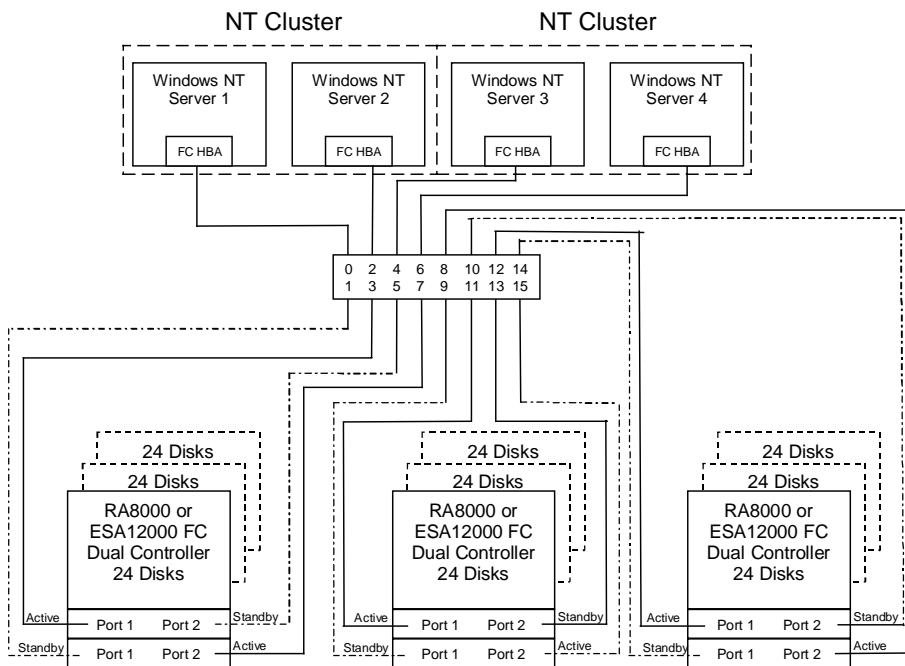
- A maximum of 8 NT servers can have access to one RA8000 HSG80 controller port. Five or more servers (up to 8) connected to one HSG80 controller port is considered an **Extended Configuration**. See the note below for more information concerning an Extended Configuration.
- There are no limits of RA8000 on a Fibre Channel Storage Switch when configured in Transparent Failover mode. A maximum of 4 RA8000 or 4 ESA12000 (with one HSG80 controller pair) can be configured on the Fibre Channel switch when configured in Multibus mode and using Secure Path V2.2.
- The maximum number of FC HBAs per server is 4 (or total allowed in the server if less than 4)
- 500 meters per optical cable segment, 1 kilometer distance between server and storage

NOTE

Extended Configuration - If you configure 5 or more (up to 8) Windows NT servers for access to a single HSG80 controller host port on an RA8000/ESA12000 Fibre Channel storage system, you must select the "Extended Configuration" check box in the StorageWorks Fibre Channel Software Setup utility custom installation setup. Each NT server that comprises this configuration must have the option selected.

Figure 1–6 shows two NT Clusters configured on a Fibre Channel Switch. Three RA8000s configured in transparent failover mode are also connected to the switch. Each cluster has access to each RA8000 via storage access control primitives.

Figure 1–6 Two NT Clusters – Fibre Channel Switch



The Configuration in Figure 1–6 features the following attributes:

- Switch Fabric configuration using all 16 Switch Ports
- Two NT Clusters (MSCS)
- 3 RA8000s with storage units partition across both NT Clusters
- Dual-redundant HGS80 controllers running in Transparent failover mode
- Up to 216 UltraSCSI drives with optional expansion enclosures

2

Installing Software for a Fibre Channel Cluster

This chapter identifies the software setups, in sequence, required to prepare the StorageWorks RA8000/ESA12000 subsystem and two Windows NT host servers for a Fibre Channel cluster.

2.1 Designating Servers as Host A and Host B

Performing the installation of an NT Cluster requires a series of software procedures to be performed one host server at a time. Therefore, the servers must be clearly designated as Host A and Host B prior to the setup process. If both servers are new, either one can be designated as Host A, and the other, Host B.

However, if you are adding a second server (only) to an existing RAID subsystem environment, this documentation assumes it will be designated as Host B, and the existing server as Host A.

Server designation must remain constant through the configuration process.

2.2 Software Setup Summary for a Fibre Channel Cluster

The software setup procedures required for a cluster are presented in this section in the order that they must occur, which is as follows:

- Prepare the Fibre Channel RAID Subsystem for a Cluster
- Prepare Host A for a Cluster
- Prepare Host B for a Cluster
- Install and configure Windows NT Cluster Software on *both* host servers.

After completing these four main procedures in sequence, as described in Sections 2.3, *Checklist for Preparing the RA8000/ESA12000, Host A and Host B for a FC Cluster* through Section 2.4, *Installing and Configuring NT Cluster Software on Both Host Servers* you will have successfully established a Fibre Channel cluster between the shared RA8000/ESA12000 subsystem and the two host servers.

2.3 Checklist for Preparing the RA8000/ESA12000, Host A and Host B for a FC Cluster

The procedures for preparing the RA8000/ESA12000 and each host server for a cluster are provided below. Detailed procedures follow.

RA8000/ESA12000:

1. Verify that your storage subsystem and FC Host Adapter settings are correct for your NT Cluster configuration and Fibre Channel Topology.
2. Verify that your storage units are accessible to the servers in your NT Cluster configuration.
3. Reboot the RA8000/ESA12000 subsystem if you have made changes to the HSG80 controllers

Host A: (with Host B powered down)

1. Install the KGPSA Fibre Channel Host Adapter Device Driver.
2. [If Needed] Temporarily de-assign drive letters on all NTFS partition on your RA8000. This step is required only when you have created NTFS partitions on your RA8000 system **before** installing the HSZDISK class driver. The HSZDISK class driver is installed during step 3.
3. Run the Fibre Channel Software Setup Utility
4. Reboot the server (Host A).
5. [If Needed] Reassign previous NTFS Partition Drive Letters from step 2.

Host B: (Host A can remain powered up)

1. Install the KGPSA Fibre Channel Host Adapter Device Driver.
2. [If needed] Temporarily de-assign drive letters on all NTFS partition on your RA8000. This step is required only when you have created NTFS partitions on your RA8000 system **before** installing the HSZDISK class driver. The HSZDISK class driver is installed during step 3.
3. Run the Fibre Channel Software Setup Utility
4. Reboot the server (Host B).
5. [If Needed] Reassign previous NTFS Partition Drive Letters from step 2.

2.3.1 Preparing the RA8000 for a FC Cluster

Your RA8000 Fibre Channel system is preconfigured with specific parameters based on either the Fibre Channel Arbitrated Loop or Switch Fabric topology. You may need to change these parameters when implementing certain NT Cluster configurations in a Fibre Channel Arbitrated Loop. This section will review the required steps to make these changes.

Verifying Your Fibre Channel Storage settings for FC-AL Topology

You will need to verify that your Fibre Channel storage system and host bus adapters are configured with the required settings to support your Windows NT Fibre Channel Cluster.

Your HSG80 RAID system is preset to a port topology of LOOP_HARD and your HSG80 hosts ports are preset to ALPA (Arbitrated Loop Physical Address) settings 71 and 72. These settings are recommended for NT cluster configurations. If your HSG80 RAID controller is not configured with these settings then you will need to make the appropriate corrections. Refer to the *HSG80 ACS V8.4 Configuration and CLI Reference Guide* for details on changing these setting.

Your Fibre Channel Host Adapters (KGPSA) require specific settings for your NT Cluster configuration. This is accomplished by running the Fibre Channel Software Setup Utility. Refer to Section 2.3.2 in this guide for more information.

Compaq recommends using the settings in Table 2-1 for your NT Cluster configuration when configured for FC-AL topology.

Table 2-1 Recommended HSG80 and FC Host Adapter Settings

FC-AL Component	FC Topology	ALPA Setting
FC Host Adapter - Server 1 (NT Cluster A)	FC-AL	1 (recommended)
FC Host Adapter - Server 2 (NT Cluster A)	FC-AL	2 (recommended)
FC Host Adapter - Server 3 (NT Cluster B)	FC-AL	4 (recommended)
FC Host Adapter - Server 4 (NT Cluster B)	FC-AL	8 (recommended)
RA8000/ESA12000 Subsystem		
HSG80 host port 1	Loop Hard	71 (preset)
HSG80 host port 2	Loop Hard	72 (preset)
Second RA8000/ESA12000 Subsystem (Optional)		
HSG80 host port 1	Loop Hard	73 (recommended)
HSG80 host port 2	Loop Hard	74 (recommended)

Adding a Second RA8000 to a Fibre Channel Loop

Your Windows NT Fibre Channel Cluster configuration may include an additional RA8000 or ESA12000 on the same Fibre Channel loop. Adding an additional subsystem will require you to change the AL_PA settings for host port 1 and host port 2 to AL_PA settings 73 and 74 respectively. See Example 1 on changing your AL_PA settings and refer to Figure 2-1.

Example 1 – Changing arbitrated loop physical address settings

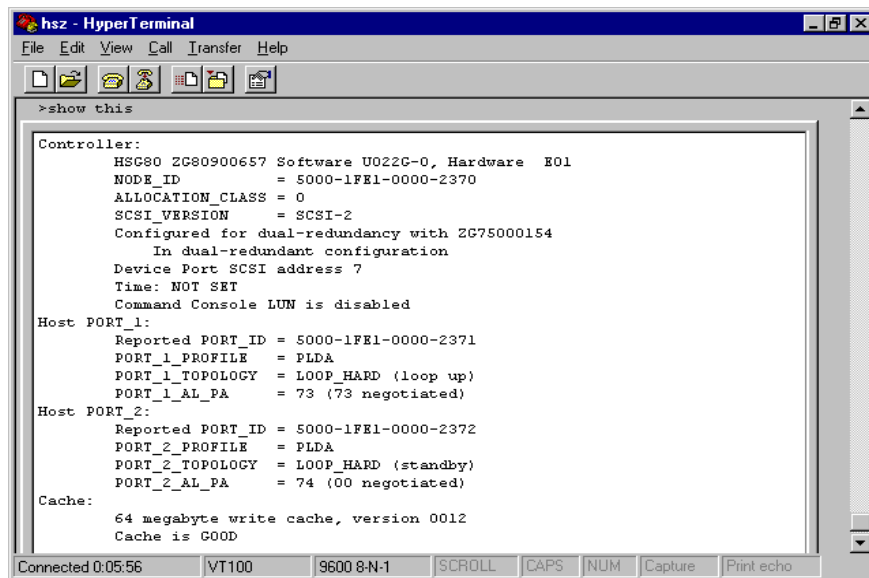
```
HSG80>Set This_Controller Port_1_AL_PA=73
```

```
HSG80>Set This_Controller Port_2_AL_PA=74
```

NOTE

You must reboot both of your HSG80 controllers if you change the port topology or AL_PA settings.

Figure 2–1. Controllers Settings for Second RA8000 System



Verifying Storage Unit access for an NT Cluster Configuration

In an NT cluster configuration, you need to enable multiple host access to all storage units that will be shared by both NT cluster servers. You can either specify the hosts connection names of the two cluster servers when using the StorageWorks Command Console or you can enable access to all hosts on a per LUN basis using the Command Line Interface (CLI). To enable access to the servers comprising your NT cluster, refer to Example 2.

Example 2 – Enabling access for specific NT Cluster Servers

```
HSG80>Set D0 Enable_Access_Path = NTSERVER1, NTSERVER2
```

Compaq recommends enabling access to all connections if the only hosts on the loop are your NT Cluster servers. To enable access to all hosts on the loop, issue the CLI command shown in Example 3. You will need to perform this command for every LUN that will be shared among the two cluster servers.

Example 3 – Enabling access for all FC loop connections

```
HSG80>Set D0 Enable_Access_Path = ALL
```

2.3.2 Preparing Both Host Servers for a FC Cluster

Perform all of the steps in this section on Host A, while Host B is powered down. When finished, power up Host B and repeat all of the steps on Host B.

NOTE

Follow normal procedures to **POWER DOWN Host B** before preparing Host A for a cluster.

Installing the Fibre Channel Host Adapter Device Driver

The Fibre Channel Host Adapter device driver is provided with your Fibre Channel Host Adapter. Install the Fibre Channel Host Adapter device driver for your server platform as described in Chapter 1 of the *RAID Array 8000/ESA 12000 Fibre Channel Solution Software for Windows NT - Intel Installation Reference Guide*, AA-RFA9B-TE/387387-002

Temporarily De-assigning Drive Letters on your RA8000 system

This section is required only when you have created NTFS partitions on your RA8000 system before the installation of the HszDisk class driver. If you have not created NTFS partitions, proceed to Page 2–10 with instructions on running the Fibre Channel Software Setup Utility.

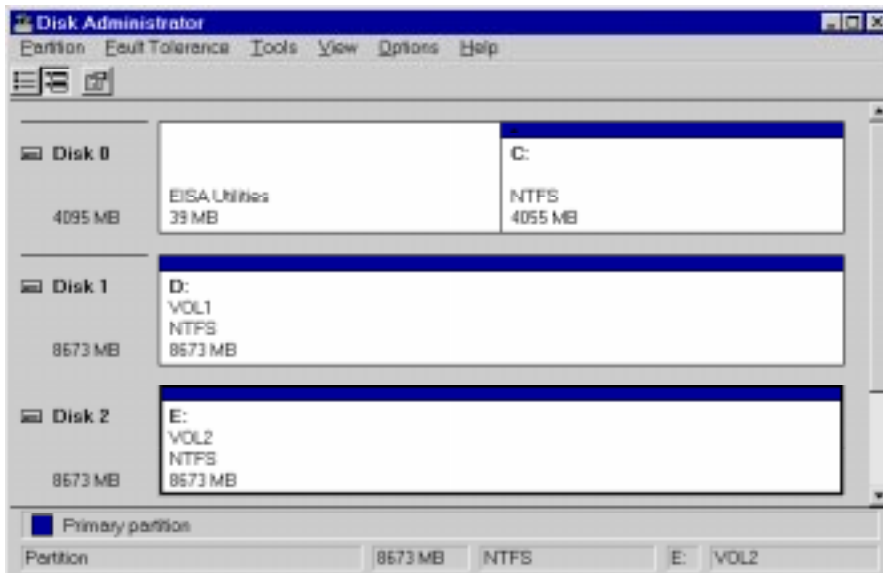
The inclusion of the HszDisk class driver when NTFS partitions exist on your RA8000 system causes Windows NT to reassign the drive letters. HszDisk inserts all NTFS partitions on your RA8000 ahead of any local (non-shared bus) partitions. Windows NT would, for example, reassign drive letter C from your system disk to the first NTFS formatted storage set partition, Disk 0).

Since drive letter reassignments by the HszDisk class driver could invalidate your drive mappings, **you must temporarily remove NTFS drive letter assignments** for all partitions on the RA8000 prior to installing the HszDisk driver. Do not remove drive letters for any drives that are not configured on your RA8000 Fibre Channel system.

To Temporarily Remove Drive Letter Assignments, follow these steps:

1. Start Disk Administrator. Figure 2–2 shows the Disk Administrator window displaying current partitions.

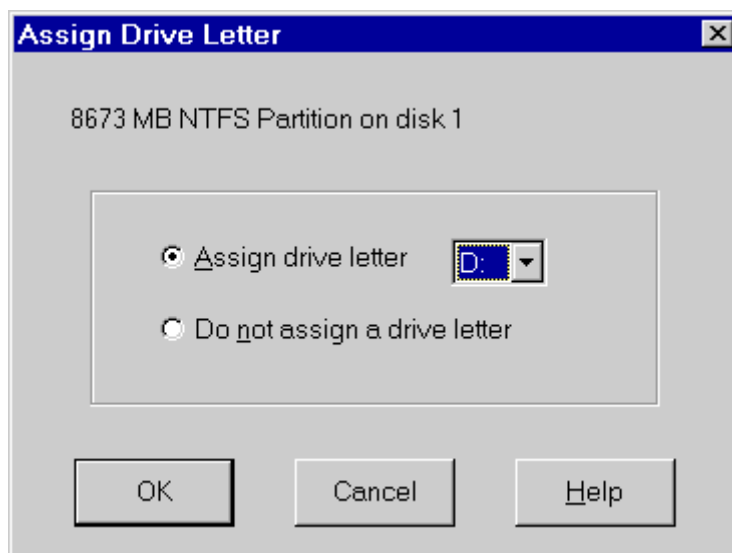
Figure 2–2 Current Partitions



2. Label your partitions, if they are not already labeled, so that you can distinguish each one.
3. Record the drive letters currently associated with each of the partition labels.
4. Click on an NTFS partition that exists on your RA8000 system.
5. From the *Tools* menu select *Assign Drive Letter*.

The Assign Drive Letter dialog box appears, similar to Figure 2–3.

Figure 2–3 Assign Drive Letter

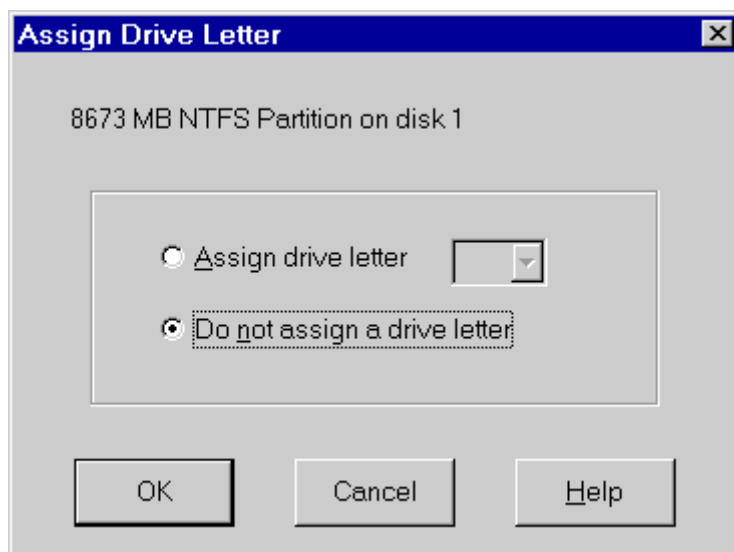


6. Click the *Do not assign a drive letter* button (as shown in Figure 2–4) and then click OK.

CAUTION

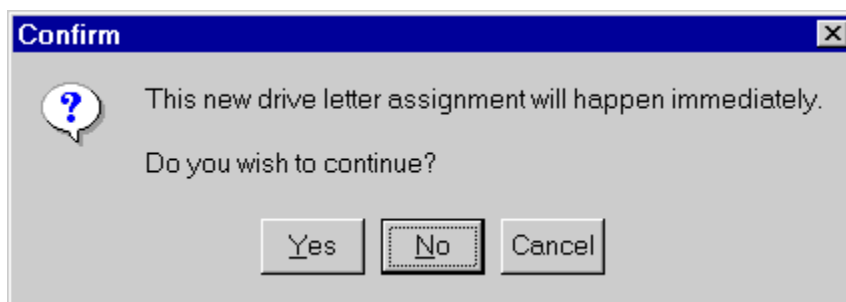
Do not remove the drive letters for any drive that is not connected to your RA8000.

Figure 2-4 Do Not Assign a Drive Letter



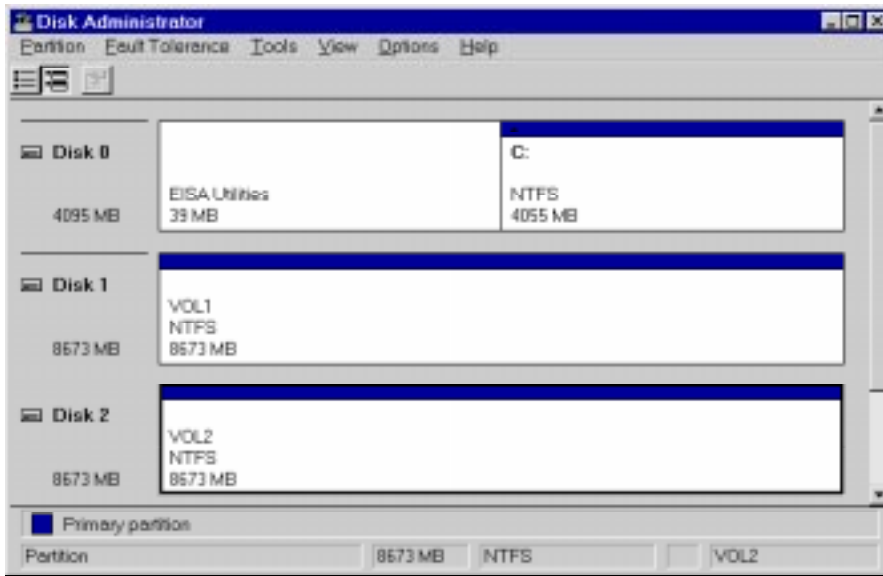
A confirmation dialog box appears as shown in Figure 2-5.

Figure 2-5 Drive Letter Confirmation



7. Click Yes. The partition now appears without a drive letter designator similar to the screen shown in Figure 2-6.

Figure 2-6 No Drive Letter Assignments



- Repeat Steps 4 through 7 for each of your partitions except the local and boot partitions.

Running the Fibre Channel Software Setup Utility

The Fibre Channel Software Setup Utility serves various purposes including the installation of the HszDisk Class driver, setting Fibre Channel Host Bus adapter registry settings, querying for Arbitrated Loop addresses, establishing Extended Configuration settings, check the event log for specific error conditions and reviewing driver revision levels.

NOTE

For additional information on running the Fibre Channel Software Setup, refer to Chapter 1 of the RAID Array 8000/ESA 12000 Fibre Channel Solutions Software for Windows NT - Intel Installation Reference Guide, AA-RFA9B-TE/387387-002.

Locate the CD-ROM disk labeled *RA8000/ESA12000 Solution Software for Windows NT* and select the solution for your specific configuration.

Perform the following steps: (This Example shows the steps for the Arbitrated Loop Configuration)

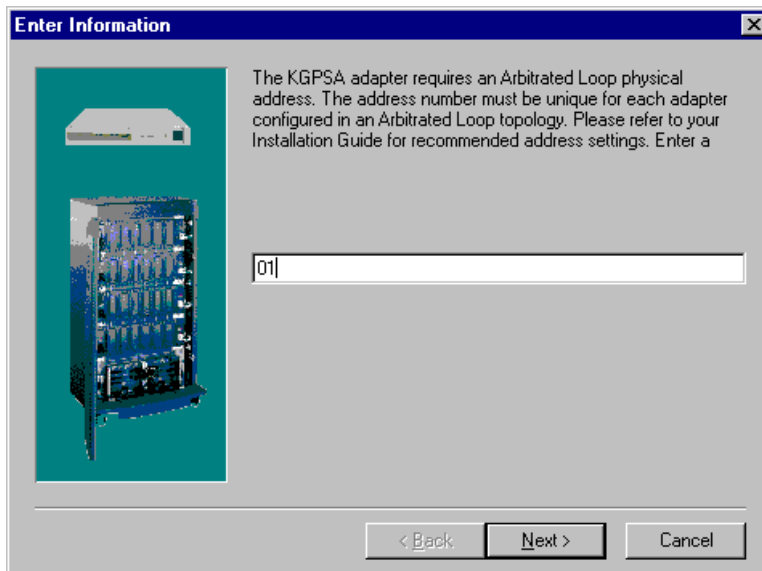
1. Insert the CD-ROM into your CD-ROM drive.
2. Select the solution software (FC-AL or FC-SW) for your specific configuration.
3. Run the Fibre Channel Software Setup program
4. Follow the migration wizard to complete the installation.

NOTE

The KGPSA Host Adapter and device driver must be installed on your server as described in your adapter guide before setting the ALPA.

If you have chosen the Solution Software for FC Hub selection, the FC Software Setup Utility will set up the required NT driver registry parameters and prompt you to select an Arbitrated Loop Physical Address (ALPA) for each of your FC Host Adapters. Compaq recommends using ALPA 1 for Host A and ALPA 2 for Host B for the FC Host Adapters. Refer to Figure 2-7 for an example of selecting an ALPA address. Refer to Table 2-1 for the preferred list of ALPA addresses.

Figure 2–7 Selecting an FC Arbitrated Loop Physical Address



7. Reboot the system.

Verifying Successful HszDisk Class Driver Installation

Once the host server is rebooted, verify that the HszDisk class driver installed successfully. To verify the HszDisk installation, follow these steps:

1. Open the *Event Viewer* from the *Administrative Tools* group.
2. Locate an information icon in the *Event Viewer* window with HszDisk for the *Source*.
3. Double click on the HszDisk entry and an entry detail screen appears.

The message in the detail screen indicates whether the HszDisk class driver was successfully installed.

Upon successful HszDisk class driver installation, proceed to *NTFS Partition Drive Letter Reassignment or Creation*, in this section if no drive letters have been created yet.

NTFS Partition Drive Letter Reassignment *or* Creation

NOTE: IF PREPARING HOST A

If you have not yet created any NTFS partitions on the RA8000 RAID system, create them now by running the Disk Administrator utility on Host A. After so doing, you will have successfully prepared Host A for a cluster, and must return to Section 2.3.2, *Procedures for Preparing Both Host Servers for a Cluster*, to repeat the preceding software setups on Host B.

NOTE: IF PREPARING HOST B

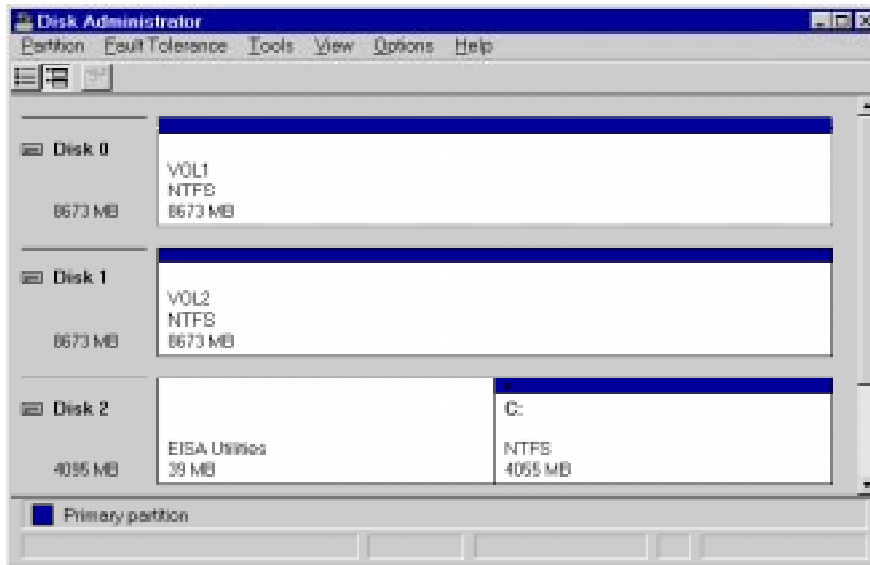
THE SHARED DRIVE LETTERS MUST BE *IDENTICAL* ON BOTH HOST SERVERS IN A CLUSTER ENVIRONMENT. Reassign the same drive letters to HOST B that you assigned to HOST A, using the following the procedures.

This section describes how to reassign drive letters to NTFS partitions on a host if they were temporarily de-assigned as described in *Preparing for the HszDisk Class Driver Installation* found in Section 2.3.2

To Reassign Drive Letters, follow these steps:

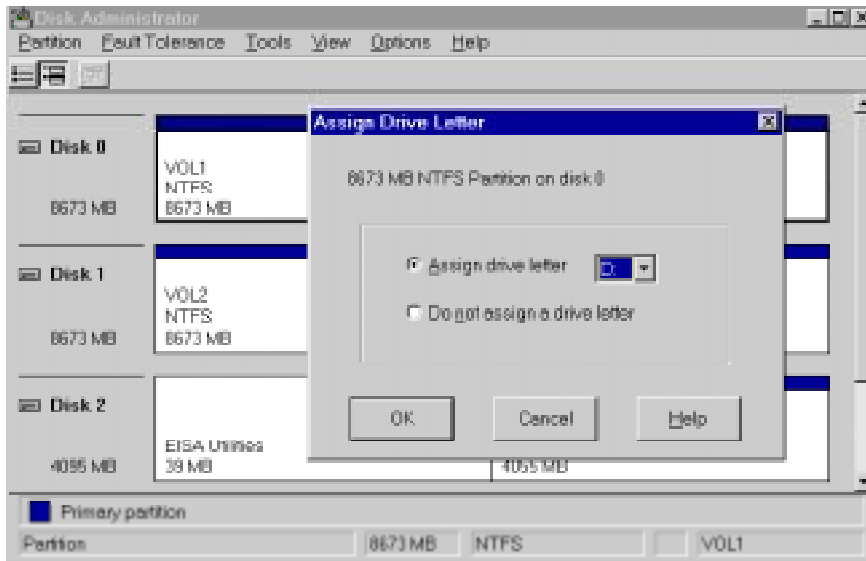
1. Start Disk Administrator. The disk administrator displays all the existing partitions, similar to the window shown in Figure 2-8. (The only partitions with drive letters are the boot partition and any non-disk devices, such as a CD-ROM drive).

Figure 2-8 Partition Appearance - (post HszDisk driver installation)



2. Highlight a (RAID Array storageset) partition and from the *Tools* menu select *Assign Drive Letter*. The Assign Drive Letter window appears displaying the next available drive letter, similar to the window shown in Figure 2-9.

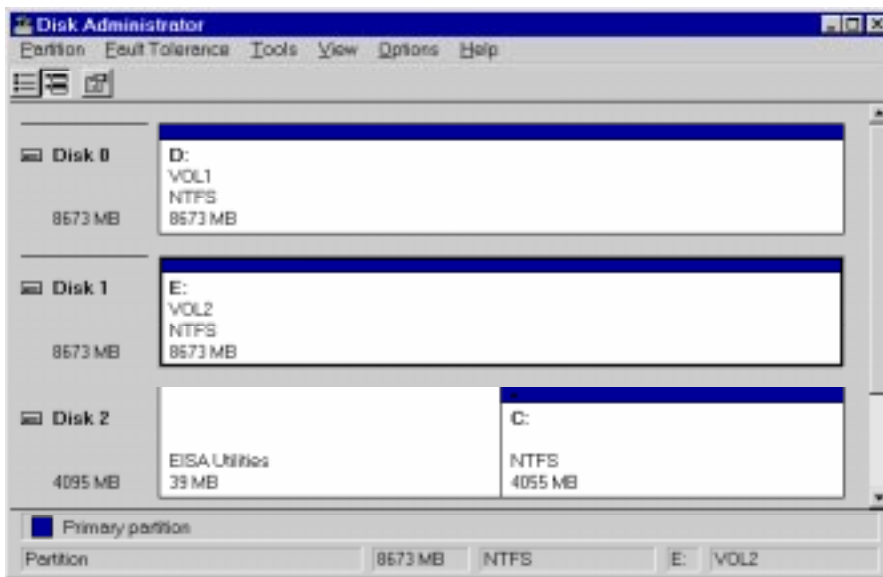
Figure 2-9 Driver Letter Availability



3. Click OK if you want to assign the selected drive letter. Otherwise, click the *Assign drive letter* radio button. Select another drive letter from the pick list and click OK. If the letter you want to assign doesn't appear in the list, Windows NT may have already assigned that letter to the CD-ROM drive. You can de-assign that letter from the CD-ROM to free it for use.
4. At the confirmation dialog box, Click "Yes". The partition now appears with the specified drive letter designator .

- Repeat Steps 2 through 4 until you have assigned drive letters to all of the partitions that need one, similar to the window shown in Figure 2-10.

Figure 2-10 All the Drive Letters Reassigned



IF PREPARING HOST A

With the NTFS partition drive letters successfully reassigned, or newly created, as applicable, Host A is prepared for a cluster. To prepare Host B, return to Section 2.3.3, *Procedures for Preparing Both Host Servers for a Cluster* and repeat all of the preceding steps on Host B.

IF PREPARING HOST B

With the NTFS partition drive letters successfully reassigned, Host B is prepared for a cluster. Proceed to Section 2.4.

2.4 Installing and Configuring NT Cluster Software on Both Host Servers

NOTE

The RA8000/ESA12000, Host A and Host B must be prepared for a Fibre Channel cluster (refer to Section 2.3.3) before installing NT Cluster software.

You are now ready to install and configure NT Cluster software on both of your host servers, as described in the manual provided with your cluster software.

A

Troubleshooting

This appendix describes how to troubleshoot a Fibre Channel NT cluster.

A.1 Summary

As described in the following sections, troubleshooting the RA8000/ESA12000 Subsystem Fibre Channel Cluster involves verifying the following characteristics:

- Device Driver Initialization for the FC Host Adapters
- Windows NT Registry Device Driver Parameter Settings
- Connectivity of Cluster Components to the FC Arbitrated Loop

A.1.1 Verifying Device Driver Initialization

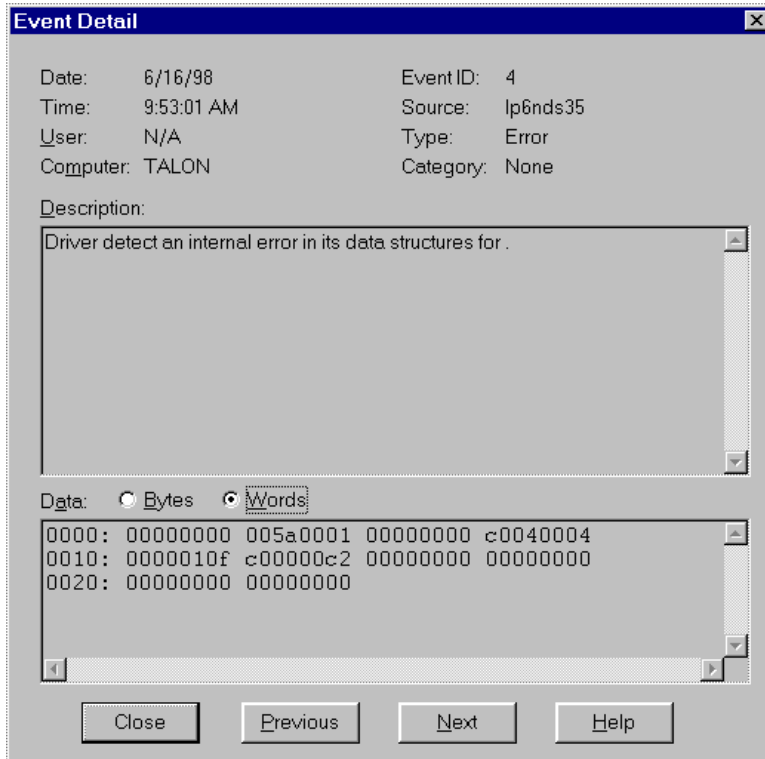
A problem with Windows NT's HAL (Hardware Abstraction Layer) may prevent the KGPSA device driver (LP6NDS35.SYS) from initializing during system boot. The consequence of this problem is that none of your devices connected to your KGPSA adapter will be available and the event log entry, depicted in Figure A-1, will be entered in the system event log.

The Windows NT HAL reconfiguring the PCI adapter with conflicting resources causes the problem. A workaround is available that causes the HAL to use the BIOS assigned defaults, and not to reassign PCI resources. The workaround (from Microsoft) involves editing the BOOT.INI file (you may need to remove the read-only file attribute, (e.g. `attrib -r -h -s c:\boot.ini`), and adding the `/PCILOCK` option to the system boot entry, and rebooting. Reference the following example.

Example boot.ini

```
[boot loader]
timeout=30
default=multi(0)disk(0)rdisk(0)partition(2)\WINNT
[operating systems]
multi(0)disk(0)rdisk(0)partition(2)\WINNT="Windows NT Server, Enterprise Edition
Version 4.00" /pcilock
```

Figure A-1 Device Driver Initialization Event Log Entry



A.1.2 Verify the Windows NT Registry Device Driver Parameters

The KGPSA device driver parameters in the Windows NT registry must be set correctly for proper operation of your RA8000 or ESA12000 storage subsystem configured in a Windows NT cluster. Locate the registry key in your system as depicted in Figure A-2 and review the registry setting values and compare them with the correct values that are listed in Table A-1 (Note, all values are decimal unless noted). If discrepancies are found, run the Fibre Channel Software Setup Utility and select the *Custom* button. Click on the *KGPSA Adapter Driver Setup* option. This will automatically correct the registry settings configured in your system. Reboot your system after completing the Setup.

WARNING

StorageWorks does not recommend using the Registry Editor to adjust registry settings. Fatal system errors may result. Please use the HSZInstall FC Utility. This utility will properly set the registry settings for the KGPSA adapter.

Figure A-2 Windows NT Registry Key

```
HKEY_LOCAL_MACHINE -
- SYSTEM
  -CurrentControlSet
    - Services
      - Lp6nds35
        - Parameters
          Number of Requests=50
          Maximum SGList=33 for Intel Servers or
          17 for Alpha Servers
Devices {Refer to Table A-1, of this manual for device driver parameters.}
```

Table A-1 LP6NDS35 Device Driver Parameters

Driver Parameter	Correct Value
RetryIoTimeOut	1
RetryInterval	52
RATOV	10
EnableDPC	1
QueueTarget	1
QueueDepth	25 (15 for Extended Configurations)
ResetFF	0
ResetTPRLO	1 (Required for MSCS)
Fibre Channel Topology	0 for FC-AL 1 for FC-SW
ScanDown	1
HardALPa*	Refer to the following note

NOTE

*StorageWorks recommends using ALPA values 1 and 2 for the host adapters in a Fibre Channel Windows NT Cluster. The HardAlpa is not applicable for the Fibre Channel Switch Topology.

Additional parameters are included when the host is configured with Secure Path Software

A.1.3 Verifying Connectivity to the Fibre Channel Arbitrated Loop

This section outlines the procedure to troubleshoot a Fibre Channel NT Cluster when one or both servers can not access the Fibre Channel Storage Array. The recommended troubleshooting steps are as follows;

NOTE

Before proceeding, verify that your configuration meets are minimum requires revisions as described in your documentation set. These procedures are only relevant for the Fibre Channel Arbitrated Loop.

1. Verify that each HSG80 host port is properly configured and online to the Fibre Channel Loop.
2. Verify that your NT Servers are connected and online to the Fibre Channel Loop.
3. Verify that your Fibre Channel storage partitions (units) allow appropriate access for your NT Cluster servers.

1. Verifying HSG80 settings and connectivity to the Loop

Issue the CLI command **show this_controller**, (refer to Figure A-4), to ensure that your HSG80 host ports are connected to the loop. The port 1 topology and port 2 topology, if used, should be LOOP_HARD and indicate a status of *Loop Up* or *Standby*. If one HSG80 controller indicates a Loop Up state, then the other controller will be in a Standby state. If your port topology and state is correct then proceed to Step 2.

If the HSG80 host ports that you have configured are in an *Offline* state, then perform the following:

- Shutdown and power off both NT Servers
- Verify that the Fibre Optic cable is properly seated in the GBIC module in your hub and in the GLM module in your HSG80 controller. Ensure that your Fibre Channel Hub is powered on and the LEDs are illuminated.
- Reboot both HSG80 controllers.

If your HSG80 controllers continue to indicate an offline state, then refer to the troubleshooting section in your HSG80 Array Controller ACS Version 8.3 Maintenance and Service guide for troubleshooting suggestions.

2. Verify that your NT Servers (hosts) are connected to the Fibre Channel Loop

To verify that your Windows NT servers are connected to the loop, issue the CLI command **show connection**. As shown in Figure A-3, the output of this command shows information about present and previous host connections to the loop. The unit address column refers to the Arbitrated Loop Physical Address that you assigned when running the HSG80 FC utility. The Status Column indicates the host connection (NT server) is *On-Line* to either the HSG80 controller that you are connected to (OL this) or the other HSG80 controller (OL other).

Compaq recommends to **rename** the connection-name field to the computer name of your server. This will facilitate your ability to discern loop connections. The recommended method of discerning loop connection names is to boot one server at a time and issue the **show connection** command. The new On-line connection that is displayed will be the server that you just booted.

Figure A-3 Verifying FC-AL Connectivity of the Host Servers

```
HSG80> show connection
```

Connection			Unit			
Name	Operating system	Controller	Port	Address	Status	Offset
SERVER_A	WINNT	THIS	1	000001	OL other	0
		HOST_ID=1000-0000-C920-3C2B	ADAPTER_ID=1000-0000-C920-3C2B			
SERVER_B	WINNT	THIS	1	000002	OL other	0
		HOST_ID=1000-0000-C920-3C20	ADAPTER_ID=1000-0000-C920-3C20			

If your NT servers are not connect to the Fibre Channel loop, verify the KGPSA driver (lp6nds35) has started by invoking the **Device** applet in the Control Panel. Check the event log for errors by the lp6nds35 device driver. Also, check the Fibre Channel cable from your host bus adapter to the Fibre Channel hub. Verify the LEDs are illuminated where the Fibre Channel cable is connected to the hub and on the back of the Fibre Channel adapter. If your Host servers are connected to the loop, proceed to Step 3.

3. Verifying the Storage Units have access to all host connections

Using the StorageWorks Command Console utility to create your storage partitions will, by default, restrict host access to the storage devices. To check host access, issue the CLI command as shown in Example 1.

Example 1 – Viewing Device Unit Information

HSG80> Show Units Full

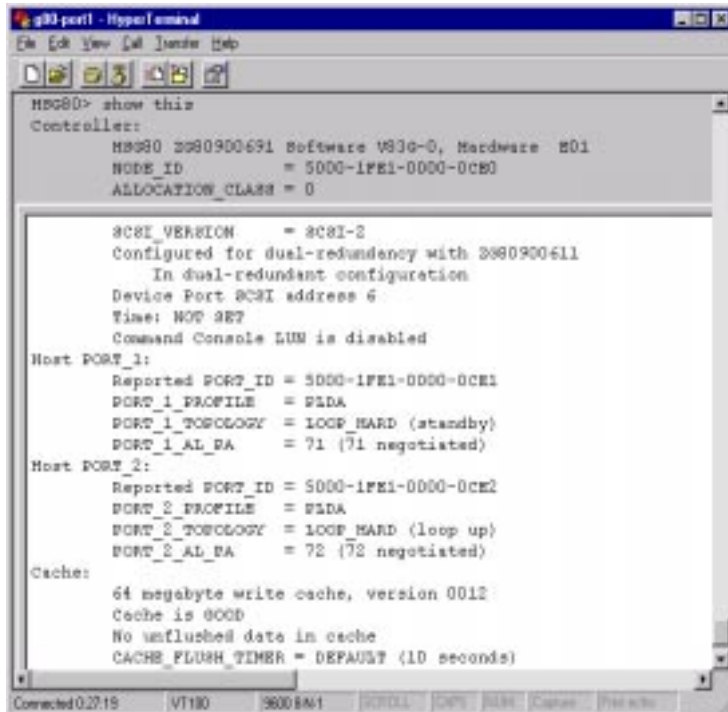
If your device units have a host access of **none** or restrict access to a specific host connection name, then modify each device units to allow for **all** host access capabilities. Example 2 shows how to modify device unit D0 to allow unlimited hosts access. You will need to issue this command for each device storage unit.

Example 2 – Modifying access to your device units

HSG80>Set D0 Enable_Access = ALL

Figure A-4 Verifying FC-AL Connectivity of the RA8000/ESA12000 Subsystem

HSG80> show this_controller



B

Valid ALPA Settings

This appendix provides a table of the valid arbitrated loop physical addresses available for hard addressing the fibre channel arbitrated loop.

B.1 Valid ALPA Settings

Table B-1 lists the valid ALPA settings for the Fibre Channel arbitrated loop.

Table B-1 Valid Arbitrated Loop Physical Address (ALPA) Settings

0x01	0x02	0x04	0x08	0x0F	0x10	0x17	0x18	0x1B
0x1D	0x1E	0x1F	0x23	0x25	0x26	0x27	0x29	0x2A
0x2B	0x2C	0x2D	0x2E	0x31	0x32	0x33	0x34	0x35
0x36	0x39	0x3A	0x3C	0x43	0x45	0x46	0x47	0x49
0x4A	0x4B	0x4C	0x4D	0x4E	0x51	0x52	0x53	0x54
0x55	0x56	0x59	0x5A	0x5C	0x63	0x65	0x66	0x67
0x69	0x6A	0x6B	0x6C	0x6D	0x6E	0x71	0x72	0x73
0x74	0x75	0x76	0x79	0x7A	0x7C	0x80	0x81	0x82
0x84	0x88	0x8F	0x90	0x97	0x98	0x9B	0x9D	0x9E
0x9F	0xA3	0xA5	0xA6	0xA7	0xA9	0xAA	0xAB	0xAC
0xAD	0xAE	0xB1	0xB2	0xB3	0xB4	0xB5	0xB6	0xB9
0xBA	0xBC	0xC3	0xC5	0xC6	0xC7	0xC9	0xCA	0xCB
0xCC	0xCD	0xCE	0xD1	0xD2	0xD3	0xD4	0xD5	0xD6
0xD9	0xDA	0xDC	0xE0	0xE1	0xE2	0xE4	0xE8	0xEF

