

SANworks by Compaq

Windows NT and 2000 Kit V2.0 for Enterprise Virtual Array Installation and Configuration Guide

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Second Edition (July 2002)

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This guide describes how to install and configure Windows NT and Windows 2000 servers with an Enterprise Virtual Array.

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Contents

About this Guide

Intended Audience	v
Related Documentation	vi
Text Conventions	vi
Symbols in Text	viii
Symbols on Equipment	viii
Rack Stability	x
Getting Help	x
Compaq Technical Support	x
Compaq Website	xi
Compaq Authorized Reseller	xi

1 Understanding the Enterprise Virtual Array

About Virtualization	1-2
About the Enterprise Virtual Array	1-2
Storage Configuration	1-3
Hosts and the Enterprise Virtual Array	1-4
SAN Considerations	1-6
Multiple Path Support	1-6
Host Presentation Compared with Enterprise Modular Array	1-6
Virtual RAID Considerations	1-6

2 Installing the Windows Kit

Installing the Fibre Channel Adapter	2-2
Installing Secure Path	2-2
Installing the Host Kit	2-2
Installing a Generic Driver for Windows NT 4.0	2-3
Updating the FCA Driver for Windows NT and Windows 2000	2-5
Installing the Fibre Channel Software	2-6

Installing the Storage System Scripting Utility	2-6
Upgrading a V1.0 Server to V2.0	2-7

3 Testing Connections to the Enterprise Virtual Array

Testing the Storage System Scripting Utility	3-2
Testing Connectivity to Virtual Disks	3-2
Host Connectivity to the Fabric	3-2
Adding Hosts	3-2
Creating and Presenting Virtual Disks	3-3
Verifying Virtual Disks from the Host	3-3
Configuring Virtual Disks from the Host	3-4
Configuring Disks on Windows NT	3-4
Configuring Disks on Windows 2000	3-4

4 Additional Host Considerations

Connecting Hosts to Switches	4-2
Working with Clusters	4-3
Expanding Volumes	4-4
Volume Expansion Workaround	4-5

Glossary

Index

Figures

1-1	SAN architecture	1-5
4-1	Overview of Enterprise Virtual Array component connections	4-2
4-2	Cabling Hosts to Switches	4-3

Tables

1	Text Conventions	vi
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About this Guide

The following sections are covered:

- Intended Audience
- Related Documentation
- Text Conventions
- Symbols in Text
- Symbols on Equipment
- Rack Stability
- Getting Help
- Compaq Authorized Reseller

Intended Audience

This guide is intended for storage administrators who are experienced with the following:

- Configuration of SAN fabrics.
- Customer host environments, such as Windows 2000, Windows NT, Sun Solaris, OpenVMS, Tru64 UNIX, HP-UX, and IBM AIX.

Related Documentation

This section lists documents that provide additional information:

- *SANworks by Compaq Windows Kit V2.0 for Enterprise Virtual Array Release Notes*
- *StorageWorks by Compaq Enterprise Virtual Array Users Guide*
- *StorageWorks by Compaq Enterprise Virtual Array - How to Get More Information*
- *StorageWorks by Compaq Enterprise Virtual Array Release Notes*
- *StorageWorks by Compaq Enterprise Virtual Array Storage System Read Me First*
- *StorageWorks by Compaq Enterprise Virtual Array Storage System World Wide Name Label*
- *StorageWorks by Compaq Interactive Help for HSV Element Manager*
- *StorageWorks by Compaq Enterprise Virtual Array Configuration Guide*
- *StorageWorks by Compaq Enterprise Virtual Array Upgrade Instructions*
- *StorageWorks by Compaq Enterprise Virtual Array License Instructions*
- *StorageWorks by Compaq Enterprise Virtual Array Catalog of Associated Documentation*
- *StorageWorks by Compaq Enterprise Virtual Array Storage System Installation Instructions*
- *StorageWorks by Compaq Heterogeneous Open SAN Design Reference Guide*

Text Conventions

The conventions included in Table 1 apply in most cases.

Table 1: Text Conventions

Element	Convention	Examples
<ul style="list-style-type: none"> • Named Keys • Key Sequences 	<p>Bold</p> <p>A plus sign (+) between two keys means that you should press them simultaneously.</p>	<p>Home, Print Screen, Num Lock, Esc, PgUp</p> <p>Ctrl+A, Ctrl+Home, Alt+Ctrl+Del</p> <p>To back up files, click Backup Now.</p>

Table 1: Text Conventions (Continued)

Element	Convention	Examples
<ul style="list-style-type: none"> • Menu Items and Sequences • Buttons • Dialog Box Names 	<p>Bold</p> <p>A right angle bracket (>) between items refers to the sequence for navigating through menu selections.</p>	<p>Choose Start > Programs > Backup.</p> <p>Click Make Backup.</p> <p>In the Save As dialog box, choose the drive, then the folder.</p>
<ul style="list-style-type: none"> • Directory Names and Paths 	<p>Initial Caps (for UNIX-based directory names, the exact case is displayed).</p>	<p>Save the file in the C:\StorageSets\Default directory.</p> <p>(UNIX-based): Save the file in the /home/newuser/practice directory.</p>
<ul style="list-style-type: none"> • <i>file names</i> 	<p><i>Italics</i> unless the file name is included in a directory name/path.</p>	<p>To configure storage, edit <i>storageset.ini</i>.</p> <p>(Directory name/path): Errors are logged to \syslog\errors\config_errors.txt.</p>
<ul style="list-style-type: none"> • User Input and System Responses (Output and Error Messages) • COMMAND NAMES • Drive Names 	<p>Monospace font.</p> <p>COMMAND NAMES appear in uppercase, unless they are case sensitive (UNIX-based command names are case sensitive and will not appear in uppercase).</p> <p>Entered <variables> are displayed in angle brackets (< >) and all lowercase.</p>	<p>User Input and System Responses:</p> <ul style="list-style-type: none"> • To exit from the program, type <code>exit</code>. • At the prompt, type this command: <code>SHOW THIS_CONTROLLER</code> (no variable). • To see your settings, give the command: <code>SHOW <storagesets> FULL</code> (with variable). You will see the <code>Disk Full</code> message. <p>Command Names</p> <ul style="list-style-type: none"> • Use <code>SET THIS_CONTROLLER</code> to change parameters. • To manage storage, <code>RUN SYSMGR.EXE</code>. • (UNIX-based): To list files, use the <code>ls</code> command. • Drive Names: Navigate to your CD-ROM drive (usually <code>D:</code> or <code>E:</code>).
<ul style="list-style-type: none"> • URLs 	<p>Sans serif font.</p>	<p>For update notices, visit: http://www.compaq.com/products/updates</p>

Symbols in Text

These symbols may be found in the text of this guide. They have the following meanings.



WARNING: Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or loss of life or damage to equipment.



CAUTION: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

IMPORTANT: Text set off in this manner presents clarifying information or specific instructions.

NOTE: Text set off in this manner presents commentary, sidelights, or interesting points of information.

Symbols on Equipment



Any enclosed surface or area of the equipment marked with these symbols indicates the presence of electrical shock hazards. Enclosed area contains no operator serviceable parts.

WARNING: To reduce the risk of injury from electrical shock hazards, do not open this enclosure.



Any RJ-45 receptacle marked with these symbols indicates a network interface connection.

WARNING: To reduce the risk of electrical shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle.



Any surface or area of the equipment marked with these symbols indicates the presence of a hot surface or hot component. Contact with this surface could result in injury.

WARNING: To reduce the risk of injury from a hot component, allow the surface to cool before touching.



Power supplies or systems marked with these symbols indicate the presence of multiple sources of power.

WARNING: To reduce the risk of injury from electrical shock, remove all power cords to completely disconnect power from the supplies and systems.



Any product or assembly marked with these symbols indicates that the component exceeds the recommended weight for one individual to handle safely.

WARNING: To reduce the risk of personal injury or damage to the equipment, observe local occupational health and safety requirements and guidelines for manually handling material.

Rack Stability



WARNING: To reduce the risk of personal injury or damage to the equipment, be sure that:

- The leveling jacks are extended to the floor.
- The full weight of the rack rests on the leveling jacks.
- In single rack installations, the stabilizing feet are attached to the rack.
- In multiple rack installations, the racks are coupled together.
- Only one rack component is extended at any time. A rack may become unstable if more than one rack component is extended for any reason.

Getting Help

If you still have a question after reading this guide, contact your service representatives or visit our website.

Compaq Technical Support

In North America, call the Compaq technical support at 1-800-OK-COMPAQ. This service is available 24 hours a day, 7 days a week.

NOTE: For continuous quality improvement, calls may be recorded or monitored.

Outside North America, call Compaq technical support at the nearest location. Telephone numbers for worldwide technical support are listed on the Compaq website: <http://www.compaq.com>.

Be sure to have the following information available before you call Compaq:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions

Compaq Website

The Compaq website has the latest information on this product as well as the latest drivers. Access the Compaq website at: <http://www.compaq.com/storage>. From this website, select SANworks.

Compaq Authorized Reseller

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.
- Elsewhere, see the Compaq website for locations and telephone numbers.

Understanding the Enterprise Virtual Array

This chapter introduces the Enterprise Virtual Array components and explains how the host servers are integrated. The following topics are covered:

- About Virtualization, page 1–2
- About the Enterprise Virtual Array, page 1–2
 - Storage Configuration, page 1–3
 - Hosts and the Enterprise Virtual Array, page 1–4
 - SAN Considerations, page 1–6
 - Multiple Path Support, page 1–6
 - Host Presentation Compared with Enterprise Modular Array, page 1–6
- Virtual RAID Considerations, page 1–6

About Virtualization

Virtualization is a new technology used to simplify the creation, presentation, and administration of storage to multivendor host servers in a Storage Area Network (SAN). Virtualization changes the way the storage administrator interacts with storage—streamlining the work required to manage and implement the storage environment. This section describes how virtualization affects storage configuration.

The storage administrator no longer needs to make decisions about planning, creating, and configuring stripesets, mirrorsets, and RAIDsets. The software now automates these decisions. The decisions are simplified to basic choices on virtual disk capacity and redundancy levels. All of this work is done from a central location—the HSV Element Manager. See the HSV Element Manager online help for more information.

Three levels of virtualization are possible within a SAN—server, fabric, and storage system. The Enterprise Virtual Array implements storage system level virtualization.

- **Server level**—useful for small systems—*SANworks*™ Virtual Replicator by Compaq implements small scale virtualization of storage in a Windows NT and 2000 environment
- **Fabric level**—SAN-wide virtualization with increased efficiency
- **Storage system level**—provides large volumes of pooled storage in virtual disks and simplifies management tasks

Virtualization technology, at the storage system level, creates “virtual disks.” These virtual disks are created using all the available physical disk drives, not individual or grouped sets of disks. The host recognizes and uses these virtual disks like any other disk device.

About the Enterprise Virtual Array

Storage system level virtualization is a new concept in the storage industry that allows storage administrators to focus on higher-level concerns regarding their specific storage needs.

With the Enterprise Virtual Array, the storage administrator no longer needs to manually present storage pools to the host servers. That is, you do not choose specific disks and sets of disks to create levels of redundancy. No decisions need to be made as to which physical disks are involved in each storage unit. When the virtual disks are created, the entire set of disks in the cabinet are used for load balancing and sparing,

which sets aside extra disk space for failure protection. The Enterprise Virtual Array improves performance as the data is written across many disks and not directed towards a single or specific set of disks.

Setup and management of virtualization is achieved with new software and hardware resources. The storage administrator has greater freedom and control with the following benefits:

- Faster performance with improved system response time
- All SAN and storage management done from a web browser
- Simplified load balanced storage
- Simplified decisions about physical disk setup and partitioning
- Increased bandwidth—use of striping algorithms across many disks accessed with multiple spindles
- Simplified high-availability storage techniques
- Recovery from disk failures includes automatic load balancing

Storage Configuration

All complex choices previously made manually, regarding physical disk usage, are now performed by the software. The end result is overall better performance and less intervention from the storage administrator.

The HSV Element Manager software automatically makes complex choices about physical disk usage. Virtual disks are created behind the scenes with this software. The storage administrator only makes relatively simple choices regarding virtual disk capacity, which host to present to, and the level of redundancy.

The following list provides an overview of the storage configuration process for the Enterprise Virtual Array:

1. Initialize the storage system.
2. Create disk groups.
3. Add hosts to the storage system.
4. Create virtual disks.
5. Present virtual disks to hosts.

For more information on setting up the Enterprise Virtual Array, see the *Enterprise Virtual Array User Guide* and the HSV Element Manager online help system.

Hosts and the Enterprise Virtual Array

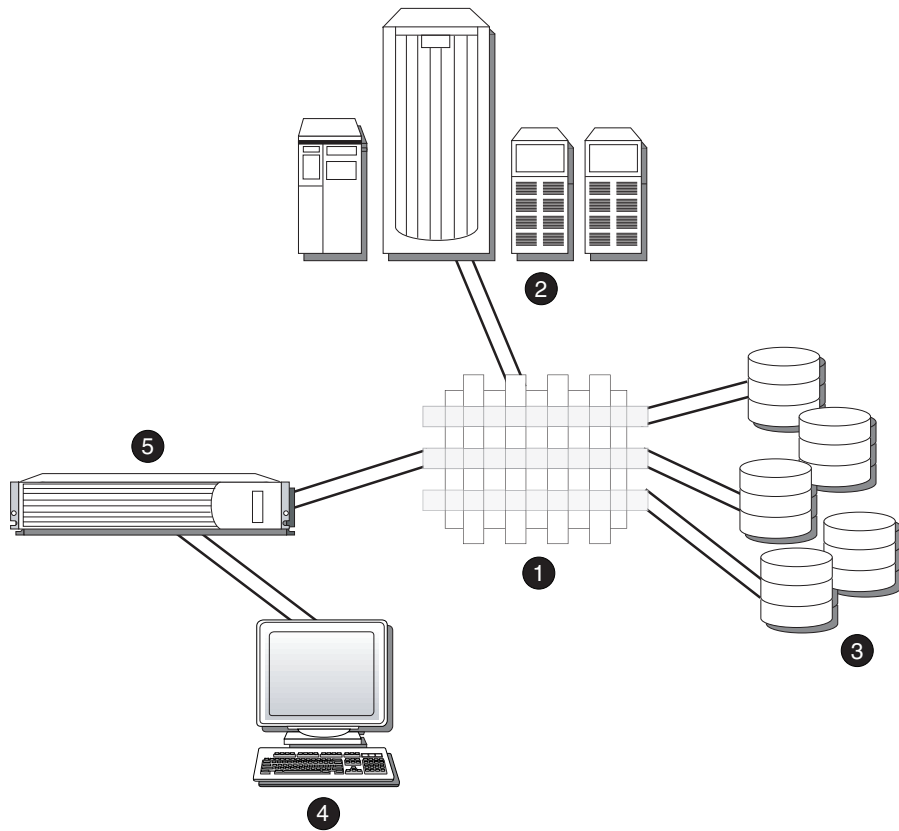
This section describes how the host servers fit in the overall Enterprise Virtual Array. Below is a list of the hosts that can attach and interact with the Enterprise Virtual Array:

- Windows NT and Windows 2000
- Compaq *Tru64 UNIX*
- Compaq *OpenVMS*
- Sun Solaris
- HP-UX
- IBM AIX

Be sure you are running a supported version of each operating system in your SAN (see the platform-specific release notes for details).

Figure 1–1 shows an overall SAN architecture. The control center for the Enterprise Virtual Array is the HSV Element Manager, which resides on the StorageWorks Management Appliance (SWMA) and is accessed from a browser anywhere on the network.

The hosts are components of the Enterprise Virtual Array storage system (see Figure 1–1). These host servers attach to the storage pools of the Enterprise Virtual Array and use the virtual disks just like any other disk resource. To the host server, virtual disks appear the same as other storage system disk resources.



SHR-2503AA

Figure 1–1: SAN architecture

- ❶ Fabric
- ❷ Host servers
- ❸ Enterprise Virtual Array storage systems
- ❹ Browser for controlling the HSV Element Manager
- ❺ StorageWorks Management Appliance (SWMA)—where the HSV Element Manager resides

Become familiar with the configuration requirements and the physical layout of your Enterprise Virtual Array (see the documentation that came with your hardware). Also, read the documentation and release notes for the additional hardware and software used throughout your SAN.

SAN Considerations

Ensure that your SAN components are all supported for use with the Enterprise Virtual Array. Design your SAN with a Compaq standard topology or by following the Compaq SAN design rules for creating custom topologies. See the *Heterogeneous Open SAN Design Reference Guide* for help with topology rules. The most up-to-date version of this guide can be found on the Compaq website at <http://www.compaq.com>.

Multiple Path Support

Enterprise Virtual Array requires a multiple path environment. Each host you attach must have supported multiple pathing software (see the platform-specific release notes for the supported versions).

Host Presentation Compared with Enterprise Modular Array

In previous technology (Enterprise Modular Array family), the term “virtual disks” was used to describe what is presented to the host. Those virtual disks were derived from logical slices of storage, using specific sets of physical disks designed by the administrator.

With Enterprise Virtual Array, the disk pool used to derive virtual disks can be up to the entire set of physical disks available to the controllers. The storage administrator does not need to be concerned with which physical disks are used to create the virtual disks. However, the storage administrator does make decisions regarding disk groups, which are the number of physical disks used.

Virtual disks presented to the host servers with either technology appear like any other SAN disk resource. From the server side, there is no difference. Hosts access the virtual disks as a LUN with capacity knowledge.

Virtual RAID Considerations

Virtual RAID helps determine the level to which user data is protected—VraidX, where X can be 0, 1, or 5. Redundancy is directly proportional to cost in terms of storage usage—the greater the level of data protection, the more storage space is required. There are three types of redundancy available with the Enterprise Virtual Array:

- **Vraid0**—No failure tolerance of data is provided.
- **Vraid1**—All data is duplicated within the storage system. This is the highest level of storage use with the lowest amount of read/write overhead.

- **Vraid5**—All data is protected by parity. This is the lowest level of storage use while maintaining redundancy at a cost of a higher amount of read/write overhead.

Installing the Windows Kit

This chapter provides instructions for installing the Windows Kit for Enterprise Virtual Array. This kit lets you connect host servers to the virtual disks of the Enterprise Virtual Array. The following topics are covered:

- Installing the Fibre Channel Adapter, page 2–2
- Installing Secure Path, page 2–2
- Installing the Host Kit, page 2–2
 - Installing a Generic Driver for Windows NT 4.0, page 2–3
 - Updating the FCA Driver for Windows NT and Windows 2000, page 2–5
 - Installing the Fibre Channel Software, page 2–6
 - Installing the Storage System Scripting Utility, page 2–6
- Upgrading a V1.0 Server to V2.0, page 2–7

Installing the Fibre Channel Adapter

Supported Fibre Channel Adapters (FCAs) must be installed in the host server in order to communicate with the Enterprise Virtual Array. See the platform-specific release notes for a list of supported FCAs. Since the Enterprise Virtual Array requires a multiple path environment, a minimum of two FCAs are required for each host.

NOTE: Traditionally, the adapter used to connect the host server to the fabric is called a Host Bus Adapter (HBA). The HBA used in the Enterprise Virtual Array is called a Fibre Channel Adapter (FCA). You may also see the adapter referred to as a Fibre Channel Host Bus Adapter (FC HBA) in other related documents.

You should follow the rules and conventions for installing hardware for your server type. The Fibre Channel Adapter is shipped with its own documentation for installation. Refer to that documentation for complete instructions.

NOTE: “Installing the Host Kit” on page 2–2 describes how to update the drivers to the Enterprise Virtual Array supported version.

You need the following items to begin:

- FCA boards and the installation instructions included with the adapter kit
- CD-ROM to install the FCA drivers
- The computer’s hardware manual for instructions on installing adapters
- Appropriate tools to service your computer

The FCA board plugs into a standard PCI slot in the host computer. Refer to the system manual for instructions on plugging in boards.

Installing Secure Path

The Enterprise Virtual Array requires a multiple path-only environment. Secure Path for Windows provides this multiple path environment. You must have Secure Path installed on the host before any virtual disks can be recognized and configured.

Install Secure Path after installing the Windows host kit but before connecting the FCAs to the switches.

Installing the Host Kit

The Windows Kit V2.0 for Enterprise Virtual Array installs the supported FCA driver and the Storage System Scripting Utility (SSSU).

The HSV controllers can be configured with SSSU as an alternate to the HSV Element Manager. SSSU allows a command line interface for issuing commands directly to the controller. Complex configuration requests and operations can be handled by either the HSV Element Manager or SSSU. Simple or initial configuration requests can be handled easily and expediently through the element manager, but repetitious and complex configuration steps can be scripted and executed through the command line interface.

IMPORTANT: The SSSU CAPTURE CONFIGURATION command (see the entry on the CAPTURE CONFIGURATION command in the Storage System Scripting Utility reference guide) is the only way to capture, save, and recreate a storage system's configuration.

See the *Storage System Scripting Utility V2.0 for Enterprise Virtual Array Reference Guide* for more information on using SSSU (included on the CD-ROM that comes with this kit).

Installing a Generic Driver for Windows NT 4.0

The procedure for installing drivers includes installing a default FCA driver for Windows NT and then updating it to the latest supported fabric (switched-based) version. During an initial installation on Windows NT 4.0, you are asked to install a device driver. Your choices for a device driver are the CD-ROM included in this kit or the diskette that ships with the adapter. In either case, the driver you install is generic and creates initial registry settings, which are required for the subsequent driver update.

1. Choose **Start > Settings > Control Panel**.
2. Double-click **SCSI Adapters**.
3. Click **Add** on the **Drivers** tab.

The **Add Drivers** dialog box displays.

4. Click **Have Disk**.
5. Insert either the diskette labeled *KGPSA NT DEVICE DRIVER AND DOWNLOAD UTILITY* or the CD-ROM that came with this kit.
6. Specify the path to the Windows NT driver:
 - Diskette method: install from `\I386` on the diskette
 - CD-ROM method: install from `\driver` and `firmware\driver\NT` on the CD-ROM root
7. Select Emulex **LP6000/LP7000/LP8000, PCI-Fibre Channel Adapter** from the SCSI Adapter list and click **OK**.

8. Restart your computer now or later after updating the driver (see “Updating the FCA Driver for Windows NT and Windows 2000” on page 2–5).

Installing a Generic Driver for Windows 2000

Windows 2000 already has the default driver as part of the operating system for all but the LP952. If an LP952 is the only FCA in the server, follow the follow the steps below to update the driver.

1. Choose **Start > Settings > Control Panel**.
2. Double-click **Administrative Tools**.
3. Double-click **Computer Management**.
4. Choose **Device Manager**.

If this is a new LP952 installation, the device appears in the **Other Devices** section with a yellow question mark. If an LP8000 has been in the system before, and you replaced it with the LP952, the device appears under the **SCSI and RAID controllers** section with a yellow exclamation point.

5. Expand either the **Other Devices** or **SCSI and RAID controllers** on the right-hand panel.
6. Right-click the **Fibre Channel Controller** (with the yellow question mark or exclamation point) and choose **Properties**.
7. The **Fibre Controller Channel Properties** dialog box displays.
8. Select the **Driver** tab.
9. Click **Update Driver**.
The **Update Device Driver** wizard starts.
10. Click **Next** and follow the wizard instructions to install the driver update.
11. Restart your computer now or later after updating the driver (see “Updating the FCA Driver for Windows NT and Windows 2000” on page 2–5).

Updating the FCA Driver for Windows NT and Windows 2000

This procedure updates either Windows NT 4.0 or Windows 2000 to the Enterprise Virtual Array supported FCA driver version.

1. Insert the Windows NT and 2000 Kit V2.0 for Enterprise Virtual Array CD-ROM into the CD-ROM drive. If autorun is enabled, the installation program starts. Otherwise, navigate to the root of the CD-ROM and double-click the file: *Launch.exe*.
2. Click **Solution Software V2.0 for Windows NT/2000** on the first screen.
3. Click **Perform Fibre Channel Adapter Driver version 4.81a9 Update** on the second screen.
4. Follow the instructions to complete the installation.
5. Choose the restart option on the final wizard screen, which is the default.

Installing the Fibre Channel Software

You must install the Fibre Channel Software next to prepare the server.

1. Click **Solution Software V2.0 for Windows NT/2000** on the first screen.
2. Click **Skip Driver Upgrade** on the bottom left of the second screen.
3. Click **Install Fibre Channel Software** to start the Fibre Channel setup wizard, which adds the appropriate Registry settings and installs the driver. During the wizard, you can choose to install Extended Configuration and HS_Service.
 - Extended Configuration is used when five or more Windows servers have exclusive access to the Enterprise Virtual Array.
 - HS_Service is used for logging environmental changes.
4. Choose to not restart the server (the default), on the final wizard screen.

Installing the Storage System Scripting Utility

Follow this procedure to install the SSSU application.

1. Insert the Windows NT and 2000 Kit V2.0 for Enterprise Virtual Array CD-ROM. If autorun is enabled, the installation program starts. Otherwise, navigate to the root of the CD-ROM and double-click the file: *Launch.exe*.
2. Click **Solution Software V2.0 for Windows NT/2000** on the first screen.
3. Click **Skip Driver Upgrade** on the bottom left of the second screen.
4. Click **Install SSSU**.

The installation wizard starts.
5. Follow the instructions to complete the installation.

You can run SSSU directly from the CD-ROM. The SSSU executable is located in the SSSU directory on the CD-ROM. Also, you can copy the executable to your server and run it from a directory of your choosing.

Upgrading a V1.0 Server to V2.0

Follow this procedure to upgrade an existing V1.0 host server to V2.0.

1. Upgrade the Virtual Controller Software (VCS) and the HSV Element Manager software from V1.0 to V2.0 (see the upgrade instructions that come with the VCS kit).
2. Upgrade the server's Secure Path software from V3.1A to V4.0 (see the upgrade instructions that come with Secure Path V4.0).
3. Restart the server.
4. Update the FCA drivers (see "Updating the FCA Driver for Windows NT and Windows 2000" on page 2–5).

You may also need to upgrade the FCA firmware. Check the platform-specific release notes for supported FCA versions.

5. Install the Fibre Channel software (see "Installing the Fibre Channel Software" on page 2–6).
6. Depending on your host operating system, another restart may be required.

Testing Connections to the Enterprise Virtual Array

This chapter describes how to test that the Windows host servers can connect to the Enterprise Virtual Array. This chapter also describes how to test that the Storage System Scripting Utility (SSSU) can connect to the Enterprise Virtual Array. The following topics are covered:

- Testing the Storage System Scripting Utility, page 3–2
- Testing Connectivity to Virtual Disks, page 3–2
 - Host Connectivity to the Fabric, page 3–2
 - Adding Hosts, page 3–2
 - Creating and Presenting Virtual Disks, page 3–3
 - Verifying Virtual Disks from the Host, page 3–3
- Configuring Virtual Disks from the Host, page 3–4
 - Configuring Disks on Windows NT, page 3–4
 - Configuring Disks on Windows 2000, page 3–4

Testing the Storage System Scripting Utility

The Storage System Scripting Utility (SSSU) is installed from the Windows Kit V2.0 for Enterprise Virtual Array (see “Installing the Storage System Scripting Utility” on page 2–6). You should verify that SSSU runs from your host server.

The SSSU executable is installed in the following directory by default:

C:\Program Files\Compaq\SSSU

To start SSSU:

Choose **Start > Programs > SSSU** and SSSU opens in a DOS window.

Testing Connectivity to Virtual Disks

Virtual disks need to be set up and presented to your host server in order to test the connectivity and begin using them. This section briefly describes how to create, present, and access virtual disks.

Host Connectivity to the Fabric

Once you have installed the FCA, you need to connect the host to the switches. See “Connecting Hosts to Switches” on page 4–2 for the specific cabling instructions.

IMPORTANT: Ensure that you install Secure Path before you connect your host to the switches.

Adding Hosts

You add a host using the HSV Element Manager. You need to add each FCA installed in the host system in order for the host to work with the Enterprise Virtual Array.

1. Collect information on the WWN for each FCA on your server. You need this information when choosing the host FCAs in the HSV Element Manager.

Adding hosts through the HSV Element Manager software consists of adding each FCA adapter installed in the host. The first step uses the **Add Host** function and each subsequent adapter uses the **Add Port** function. Ensure that you add a port for each active FCA.

2. Add the host from the HSV Element Manager.
3. Ensure that the host FCAs have been added by inspecting the **Host** folder in the **Navigation** tree of the HSV Element Manager.

Creating and Presenting Virtual Disks

This section describes how to create and present additional virtual disks to host servers and verify that the hosts can access them.

1. Create a virtual disk family on the Enterprise Virtual Array using the HSV Element Manager.
2. Set values for the following:
 - Virtual Disk Name
 - Vraid level
 - Size
 - Present to Host (preferably to the host you just created)
3. If you chose a specific LUN on the **Virtual Disk Properties** page, you are prompted to select a LUN number.
4. Restart the server or rescan the bus.

Verifying Virtual Disks from the Host

With Windows NT 4.0, you must restart the operating system for new virtual disks to be accessible. After you restart the system, you must partition, format, and assign drive letters according to standard Windows NT 4.0 conventions.

With Windows 2000, you must rescan for new virtual disks to be accessible. Once rescanned, you must select the disk type (basic only), partition, format, and assign drive letters or mount points according to standard Windows 2000 conventions.

If you are unable to access the virtual disk, check the following:

- Verify all cabling to the switch, Enterprise Virtual Array, and host.
- Verify all firmware levels (check the Enterprise Virtual Array QuickSpecs and associated release notes for details).
- Ensure you are running a supported version of the host operating system (see the release notes included with this kit).
- Ensure that the correct host is selected for this virtual disk in the HSV Element Manager.
- Ensure Windows NT and 2000 is selected as the operating system for the virtual disk in the HSV Element Manager.

Configuring Virtual Disks from the Host

Once you have set up the virtual disks on the Enterprise Virtual Array and rescanned or restarted the host, you need to follow the host-specific conventions for configuring these new disk resources. These disk resources then become usable just like any other disk resource to the host system. Refer to the documentation that came with your server for specific instructions on setting up disk resources.

Configuring Disks on Windows NT

Windows NT 4.0 requires that disks be partitioned, formatted, and assigned drive letters.

- Format the partition with NTFS
- Assign drive letters (each partition needs its own drive letter)

Use Disk Administrator to configure these virtual disks using standard Windows NT conventions.

Configuring Disks on Windows 2000

Windows 2000 requires the same disk setup as Windows NT 4.0 (partition, format, and drive letters).

Use the Disk Management utility within the Computer Management application to configure the virtual disks using standard Windows 2000 conventions.

Additional Host Considerations

This chapter includes additional considerations for the host operating systems in an Enterprise Virtual Array. The following topics are covered:

- Connecting Hosts to Switches, page 4–2
- Working with Clusters, page 4–3
- Expanding Volumes, page 4–4

Connecting Hosts to Switches

This section describes how to connect your host servers to the SAN switches in order to access the virtual disks. The documentation that came with the Enterprise Virtual Array hardware describes how to cable the controllers to the SAN switches.

Figure 4–1 provides an overview of connecting the Enterprise Virtual Array components.

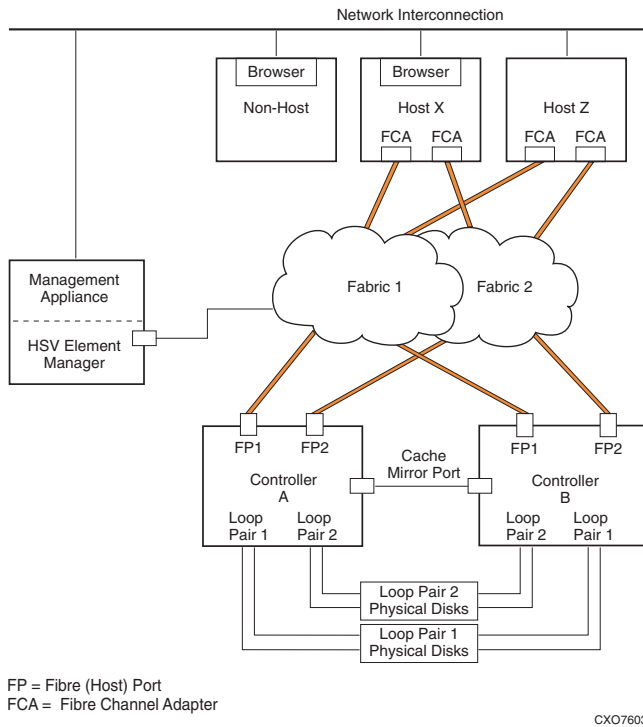


Figure 4–1: Overview of Enterprise Virtual Array component connections

Each host must attach to two redundant switches (fabrics) using standard fiber channel cables. These two switches in turn attach to the two HSV110 controllers on the Enterprise Virtual Array.

NOTE: This is the most basic configuration. More than two SAN switches can be used.

1. Plug one end of the fiber channel cables into the FCAs on the servers. There must be at least two FCAs.

2. Plug the other ends of the cables into the two switches. You must plug each cable from the host's FCAs into different switches.

Figure 4–2 displays the connections between a single server with two FCAs and two switches.

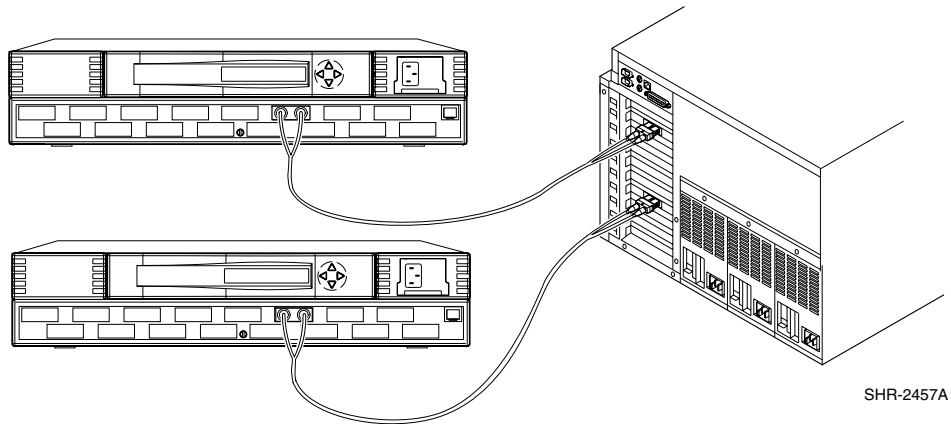


Figure 4–2: Cabling Hosts to Switches

Working with Clusters

Clustering is the connecting of two or more computers together in such a way that they behave like a single computer. Clustering is used for parallel processing, load balancing, and fault tolerance.

The supported clustering software for Windows is Microsoft Cluster Server (MSCS). See the platform-specific release notes for the specific version of the supported clustering software.

Be sure to install the Windows Kit on each server in the cluster. Refer to the documentation that came with the clustering software for more specific information.

Expanding Volumes

You can increase the volume size of the virtual disk with the HSV Element Manager. You simply change the size parameter on the particular virtual disk's property page. However, only Windows 2000 supports volume expansion.

NOTE: Once a virtual disk is created, you can only increase the size, not decrease it.

Windows NT does not support dynamically growing a virtual disk volume. If you need to increase the size of a virtual disk, use the workaround that follows (see "Volume Expansion Workaround" on page 4–5).

IMPORTANT: As with any large-scale operation, it is always best to first create a backup of your data.

The disk management utility DiskPart is necessary to expand volumes on Windows 2000. DiskPart is included in the Microsoft Windows 2000 Resource Kit or from the Microsoft website. If this utility is not installed, install it before attempting to expand virtual disks on the Enterprise Virtual Array.

Only Basic Disk volumes formatted with NTFS can be expanded with the procedure described here. You do not need to stop applications while expanding the volume.

1. Increase the virtual disk size using the HSV Element Manager.
2. Run DiskPart with the following commands:
 - a. LIST DISK—This displays a list of disks. There will be one that displays with non-zero free space. This is the one you increased from the HSV Element Manager.
 - b. LIST VOLUME—This displays all of the volumes. Make note of the volume size for the unit you are increasing.
 - c. SELECT VOLUME X (where X is the number for the increased volume)—This selects the volume you want to extend.
 - d. EXTEND SIZE=XXXX (where XXXX is the number of MBs you wish to extend)—This extends the volume to the new size. Do not use the entire amount.
 - e. LIST VOLUME—Use this command to ensure that the volume increased as expected.
3. Check that load is still running and that no jobs were lost for the volume.

4. Check that the size is reported correctly using **Disk Management (Start > Settings > Control Panel > Administrative Tools > Computer Management > Disk Management)**. You may need to rescan.

Volume Expansion Workaround

1. Copy any existing data to a safe place (tape or other device).
2. Stop all applications using the virtual disk.
3. Unattach the host server from the virtual disk.
4. Expand the virtual disk using the HSV Element Manager.
5. Reconnect the host to the virtual disk.
6. Format and partition as necessary.
7. Restore data from the backup.

The expanded virtual disk is available for use.

Glossary

This glossary defines Enterprise Virtual Array terms used in this publication or related to this product and is not a comprehensive glossary of computer terms.

active virtual disk

A virtual disk (VD) is a simulated disk drive created by the controllers as storage for one or more hosts. An active virtual disk is accessible by one or more hosts for normal storage. An active virtual disk and its snapshot, if one exists, constitute a virtual disk family. An active virtual disk is the only necessary member of a virtual disk family.

See also **virtual disk, virtual disk copy, virtual disk family, and snapshot.**

adapter

See **controller.**

array

All the physical disk drives in a storage system that are known to and under the control of a controller pair.

array controller

See **controller.**

cable assembly

A fiber optic cable that has connectors installed on one or both ends. General use of these cable assemblies includes the interconnection of multimode fiber optic cable assemblies with either LC or SC type connectors.

- When there is a connector on only one end of the cable, the cable assembly is referred to as a pigtail.
- When there is a connector on both ends of the cable, the cable assembly is referred to as a jumper.

cache

High-speed memory that sets aside data as an intermediate data buffer between a host and the storage media. The purpose of cache is to improve performance.

See also **read cache, write cache, and mirrored cache.**

communication logical unit number (LUN)

See **console LUN.**

console LUN

A SCSI-3 virtual object that makes a controller pair accessible by the host before any virtual disks are created. *Also* called a communication LUN.

console LUN ID

The ID that can be assigned when a host operating system requires a unique ID. The console LUN ID is assigned by the user, usually when the storage system is initialized.

See also **console LUN.**

controller

A hardware/firmware device that manages communications between host systems and other devices. Controllers typically differ by the type of interface to the host and provide functions beyond those the devices support.

controller pair

Two interconnected controller modules which together control a physical disk array. A controller pair and the disk array together constitute a storage system.

Element Manager

The graphical user interface through which a user controls and monitors a storage system. The HSV Element Manager software can be installed on more than one management appliance in a fabric. Each installation of the HSV Element Manager software is a management agent.

Enterprise Virtual Array

The Compaq name used to describe the storage system that includes HSV controllers, storage devices, enclosures, cables, and power supplies. *Also* called the Enterprise Storage System.

fabric

A Fibre Channel fabric switch or two or more interconnected Fibre Channel switches allowing data transmission.

fabric port

A port which is capable of supporting an attached arbitrated loop. This port on a loop will have the AL_PA hexadecimal address 00 (loop ID 7E), giving the fabric the highest priority access to the loop. A loop port is the gateway to the fabric for the node ports on a loop.

failover

The process that takes place when one controller assumes the workload of a failed companion controller. Failover continues until the failed controller is operational.

FC HBA

Fibre Channel Host Bus Adapter. An interchangeable term for Fibre Channel adapter.

See also FCA.

FCA

Fiber Channel Adapter. An adapter used to connect the host server to the fabric. *Also* called a Host Bus Adapter (HBA) or a Fibre Channel Host Bus Adapter (FC HBA).

See also FC HBA

fiber

The optical media used to implement Fibre Channel.

fibres

The international spelling that refers to the Fibre Channel standards for optical media.

Fibre Channel

A data transfer architecture designed for mass storage devices and other peripheral devices that require very high bandwidth.

Fibre Channel adapter

See FCA.

GB

Gigabyte. A unit of measurement defining either:

- A data transfer rate.
See also GBps
- A storage or memory capacity of 1,073,741,824 (2^{30}) bytes.

GBps

Gigabytes per second. A measurement of the rate at which the transfer of bytes of data occurs. A GBps is a transfer rate of 1,000,000,000 (10^9) bits per second.

See also GB.

Giga (G)

The notation to represent 10^9 or 1 billion (1,000,000,000).

HBA

Host Bus Adapter.

See FCA.

host

A computer that runs user applications and uses (or can potentially use) one or more virtual disks created and presented by the controller pair.

Host Bus Adapter

See FCA.

host computer

See host.

host ports

A connection point to one or more hosts through a Fibre Channel fabric. A host is a computer that runs user applications and that uses (or can potentially use) one or more of the virtual disks that are created and presented by the controller pair.

host-side ports

See **host ports**.

HSV Element Manager

See **Element Manager**.

initialization

A process that prepares a storage system for use. Specifically, the system binds controllers together as an operational pair and establishes preliminary data structures on the disk array. Initialization also sets up the first disk group, called the default disk group.

K

Kilo. A scientific notation denoting a multiplier of one thousand (1,000).

KB

Kilobyte. A unit of measurement defining either storage or memory capacity.

1. For storage, a KB is a capacity of 1,000 (10^3) bytes of data.
2. For memory, a KB is a capacity of 1,024 (2^{10}) bytes of data.

LUN

Logical Unit Number. A unique identifier used on a SCSI bus to distinguish between devices that share the same bus. SCSI is a parallel interface that allows up to eight devices to be connected along a single cable.

management agent

The HSV Element Manager software that controls and monitors the Enterprise Storage System. The software can exist on more than one management appliance in a fabric. Each installation of the HSV Element Manager software is a management agent.

MB

Megabyte. A term defining either:

- A data transfer rate.
See also **MBps**.
- A measure of either storage or memory capacity of 1,048,576 (2^{20}) bytes.

MBps

Megabytes per second. A measure of bandwidth or data transfers occurring at a rate of 1,000,000 (10⁶) bytes per second.

Mega

A notation denoting a multiplier of 1 million (1,000,000).

metadata

Information that a controller pair writes on the disk array. This information is used to control and monitor the array and is not readable by the host.

mini-port driver

The Windows driver type used for connecting to the Enterprise Virtual Array through the SAN fabric.

mirrored caching

A process in which half of each controller's write cache mirrors the companion controller's write cache. The total memory available for cached write data is reduced by half, but the level of protection is greater.

mirroring

The act of creating an exact copy or image of data.

node port

A device port that can operate on the arbitrated loop topology.

NSC

Network Storage Controller. The HSV Controllers used by the Enterprise Storage System.

OSM

Open SAN Manager. A centralized, appliance-based monitoring and management interface that supports multiple applications, operating systems, hardware platforms, storage systems, tape libraries and SAN-related interconnect devices. It is included and resides on the SANworks Management Appliance, a single aggregation point for data management.

password

A security interlock whose purpose is to allow:

- a management agent control of only certain storage systems
- only certain management agents control of a storage system

physical disk

A disk drive mounted in a disk drive enclosure that communicates with a controller pair through the device-side Fibre Channel loops. A physical disk is hardware with embedded software, as opposed to a virtual disk, which is constructed by the controllers. Only the controllers can communicate directly with the physical disks.

The physical disks, in aggregate, are called the array and constitute the storage pool from which the controllers create virtual disks.

physical disk array

See array.

port

A Fibre Channel connector on a Fibre Channel device.

port_name

A 64-bit unique identifier assigned to each Fibre Channel port. The port_name is communicated during the login and port discovery processes.

preferred path

A preference for which controller of the controller pair manages the virtual disk. This preference is set by the user through the HSV Element Manager when creating the virtual disk. A host can change the preferred path of a virtual disk at any time. The primary purpose of preferring a path is load balancing.

read caching

A cache method used to decrease subsystem response times to a read request by allowing the controller to satisfy the request from the cache memory rather than from the disk drives. Reading data from cache memory is faster than reading data from a disk. The read cache is specified as either on or off for each virtual disk. The default state is on.

read ahead caching

A cache management method used to decrease the subsystem response time to a read request by allowing the controller to satisfy the request from the cache memory rather than from the disk drives.

redundancy

1. Element Redundancy—The degree to which logical or physical elements are protected by having another element that can take over in case of failure. For example, each loop of a device-side loop pair normally work independently but can take over for the other in case of failure.
2. Data Redundancy—The level to which user data is protected. Redundancy is directly proportional to cost in terms of storage usage; the greater the level of data protection, the more storage space is required.

SANworks by Compaq HSV Element Manager

See **HSV Element Manager**.

SCSI

1. Small Computer System Interface. An American National Standards Institute (ANSI) interface which defines the physical and electrical parameters of a parallel I/O bus used to connect computers and a maximum of 16 bus elements.
2. The communication protocol used between a controller pair and the hosts. Specifically, the protocol is FC-AL or SCSI on a Fibre Channel. SCSI is the higher command-level protocol and Fibre Channel is the low-level transmission protocol. The controllers have full support for SCSI-2; additionally, they support some elements of SCSI-3.

SCSI-3

The ANSI standard that defines the operation and function of Fibre Channel systems.

small computer system interface

See **SCSI**.

SMART

Self-Monitoring, Analysis, and Reporting Technology. An industry standard for running internal diagnostics on disk drives and making predictive failure analysis. If a physical disk drive reports an imminent failure, the controllers redistribute data to other drives. The SMART message is reported and should trigger the immediate corrective action to replace the drive.

snapshot

A temporary virtual disk (VD) that reflects the contents of another virtual disk at a particular point in time. A snapshot operation is only done on an active virtual disk. Only one snapshot of an active virtual disk can exist at any point. The active disk and its snapshot constitute a virtual family.

See also **active virtual disk, virtual disk copy, and virtual disk family.**

SSN

Storage System Name. An HSV Element Manager-assigned, unique 20-character name that identifies a specific storage system.

storage pool

The aggregated blocks of available storage in the total physical disk array.

storage system

The controllers, storage devices, enclosures, cables, and power supplies and their software.

Storage System Scripting Utility (SSSU)

A command-line application supplied in the host operating system kits that allows for control of the Enterprise Virtual Array.

Storage System Name

See SSN.

StorageWorks by Compaq

The Compaq trademarked name used to describe the set of rack-mounted enclosures containing controllers, transceivers, I/O modules, EMUs, disk drives, cables, blowers, and power supplies used to design and configure a solution-specific storage system.

switch

An electro-mechanical device that initiates an action or completes a circuit.

TB

Terabyte. A term defining either:

- A data transfer rate.
See also **TBps**.
- A measure of either storage or memory capacity of 1,099,511,627,776 (2^{40}) bytes.

TBps

Terabytes per second. A data transfer rate of 1,000,000,000,000 (10^{12}) bytes per second.

uninitialized system

A state in which the storage system is not ready for use.

See also **initialization**.

Virtual Disk

A simulated disk drive created by the controllers as storage for one or more hosts. The virtual disk characteristics, chosen by the storage administrator, provide a specific combination of capacity, availability, performance, and accessibility. A controller pair simulates the characteristics of the virtual disk by deploying the disk group from which the virtual disk was created.

The host computer sees the virtual disk as “real,” with the characteristics of an identical physical disk.

See also **active virtual disk, virtual disk copy, virtual disk family, and virtual disk snapshot**

virtual disk copy

A clone or exact replica of another virtual disk at a particular point in time. Only an active virtual disk can be copied. A copy immediately becomes the active disk of its own virtual disk family.

See also **active virtual disk, virtual disk family, and virtual disk snapshot**

virtual disk family

A virtual disk and its snapshot, if a snapshot exists, constitute a family. The original virtual disk is called the active disk. When you first create a virtual disk family, the only member is the active disk.

See also **active virtual disk**, **virtual disk copy**, and **virtual disk snapshot**.

virtual disk snapshot

See **snapshot**.

Vraid0

A virtualization technique that provides no data protection. Data from the host is broken down into chunks and distributed on the disks comprising the disk group from which the virtual disk was created. Reading and writing to a Vraid0 virtual disk is very fast and makes the fullest use of the available storage, but there is no data protection (redundancy) unless there is parity.

Vraid1

A virtualization technique that provides the highest level of data protection. All data blocks are mirrored or written twice on separate physical disks. For read requests, the block can be read from either disk, which can increase performance. Mirroring takes the most storage space because twice the storage capacity must be allocated for a given amount of data.

Vraid5

A virtualization technique that uses parity striping to provide moderate data protection. Parity is a data protection mechanism for a striped virtual disk. A striped virtual disk is one whose data to and from the host is broken down into chunks and distributed on the physical disks comprising the disk group in which the virtual disk was created. If the striped virtual disk has parity, another chunk (a parity chunk) is calculated from the set of data chunks and written to the physical disks. If one of the data chunks becomes corrupted, the data can be reconstructed from the parity chunk and the remaining data chunks.

World Wide Name

See **WWN**.

write back caching

A controller process that notifies the host that the write operation is complete when the data is written to the cache. This occurs before transferring the data to the disk. Write back caching improves response time since the write operation completes as soon as the data reaches the cache. As soon as possible after caching the data, the controller then writes the data to the disk drives.

write caching

A process when the host sends a write request to the controller, and the controller places the data in the controller cache module. As soon as possible, the controller transfers the data to the physical disk drives.

WWN

World Wide Name. A unique Fibre Channel identifier consisting of a 16-character hexadecimal number. A WWN is required for each Fibre Channel communication port.

Index

A

authorized reseller, Compaq xi

B

button names, convention defined vii

C

CAPTURE CONFIGURATION 2–3

Caution, symbol and definition viii

clusters, and Enterprise Virtual Array 4–3

command names, convention defined vii

Compaq

authorized reseller xi

technical support x

website xi

components, of the Enterprise Virtual Array 4–2

configuration, of storage 1–3

configuring virtual disks

on Windows 2000 3–4

on Windows NT 3–4

connectivity, testing 3–1

conventions

button names, defined vii

command names, defined vii

dialog box names, defined vii

directory names, defined vii

drive names, defined vii

file names, defined vii

key sequences, defined vi

keyboard keys, defined vi

menu items, defined vii

menu sequences, defined vii

system responses, defined vii

URLs, defined vii

user input, defined vii

creating

storage configuration with SSSU 2–3

virtual disks 3–3

D

dialog box names, convention defined vii

directory names, convention defined vii

DiskPart, using for extending volumes 4–4

documentation, related books vi

drive names, convention defined vii

E

electrical shock hazard, symbol and definition viii

Enterprise Modular Array, compared with Enterprise Virtual Array 1–6

Enterprise Virtual Array

about 1–2

and hosts 1–4

benefits 1–2

components 4–2

host kit installation 2–1

host operating systems 1–4

in SAN architecture 1–5

testing host connectivity 3–1

understanding 1–1

working with clusters 4–3

equipment symbols viii

excessive weight, symbol and definition ix

expanding volumes 4–4

F

fabric

- connecting host to 3–2
- in SAN architecture 1–5
- FCA installation 2–2
- file names, convention defined vii
- G**
- getting help x
 - Compaq technical support x
 - Compaq website xi
- H**
- HBA 2–2
- help, obtaining x
- host
 - adding 3–2
 - additional considerations 4–1
 - and the Enterprise Virtual Array 1–4, 1–5
 - configuring virtual disks 3–4
 - connecting to switches 4–2
 - connecting to virtual disks 3–2
 - connectivity to fabric 3–2
 - FCA installation 2–2
 - installing Secure Path before connecting fabric 3–2
 - kit installation 2–1
 - PCI slot 2–2
 - preparation of 2–1
 - presentation compared with previous technology 1–6
 - testing connectivity to the Enterprise Virtual Array 3–1
 - testing connectivity to virtual disks 3–2
 - upgrading from V1.0 2–7
 - verifying virtual disks 3–3
- host kit
 - installing 2–2
- hot surface, symbol and definition ix
- HP-UX 1–4
- HSV Element Manager
 - and virtualization 1–2
 - and volume expansion 4–4
- HSV Element Manager, and SAN architecture 1–5

- I**
- IBM AIX 1–4
- Important, defined viii
- installing
 - Fibre Channel Adapter 2–2
 - generic driver for Windows NT 4.0 and 2000 2–3
 - host kit 2–2
 - Secure Path 2–2
 - SSSU 2–2, 2–6
- introduction, to the Enterprise Virtual Array 1–1
- K**
- key sequences, convention defined vi
- keyboard keys, convention defined vi
- M**
- Management Appliance 1–5
- menu items, convention defined vii
- menu sequences, convention defined vii
- mirrorsets 1–2
- multiple path
 - considerations 1–6
 - support 1–6
- multiple power source, symbol and definition ix
- N**
- network interface connection, symbol and definition viii
- Note, defined viii
- O**
- OpenVMS 1–4
- operating systems, for the Enterprise Virtual Array 1–4
- P**
- PCI slot 2–2
- port, adding 3–2
- presenting, virtual disks family 3–3
- R**
- rack stability x
- RAID, considerations for virtual disks 1–6

RAIDsets 1–2

related documentation vi

S

SAN

architecture 1–5

considerations 1–6

Secure Path

installing 2–2

installing before connecting host 3–2

SSSU

CAPTURE CONFIGURATION 2–3

insallation location 3–2

installing 2–2, 2–6

testing 3–2

storage

capturing configuration 2–3

configuration 1–3

stripesets 1–2

Sun Solaris 1–4

switches, connecting hosts 4–2

symbols

in text viii

on equipment viii

system responses, convention defined vii

T

technical support, Compaq x

text symbols viii

Tru64 UNIX 1–4

U

upgrading hosts 2–7

URLs, convention defined vii

user input, convention defined vii

V

virtual disk

and volume expansion 4–4

configuring on host 3–4

creating and presenting 3–3

host connection 3–2

properties page 3–3

troubleshooting access to 3–3

verifying from host 3–3

virtual RAID considerations 1–6

virtualization

about 1–2

types 1–2

volume expansion 4–4

and HSV Element Manager 4–4

using DiskPart 4–4

workaround 4–5

W

Warning

electrical shock hazard symbol, defined viii

excessive weight symbol, defined ix

hot surface symbol, defined ix

multiple power source symbol, defined ix

network interface connection symbol, defined viii

symbol and definition viii

websites

Compaq storage xi

Compaq technical support x

Windows 2000 1–4

configuring virtual disks 3–4

installing Fibre Channel Software 2–6

Windows NT 1–4

configuring virtual disks 3–4

installing Fibre Channel Software 2–6

