

SANworks by Compaq

IBM AIX Kit V2.0 for Enterprise Virtual Array Installation and Configuration Guide

Part Number: AA-RSWZA-TE

First Edition (July 2002)

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This guide describes how to install and configure IBM AIX servers with an Enterprise Virtual Array.

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IBM AIX Kit V2.0 for Enterprise Virtual Array Installation and Configuration Guide
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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 IBM AIX 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

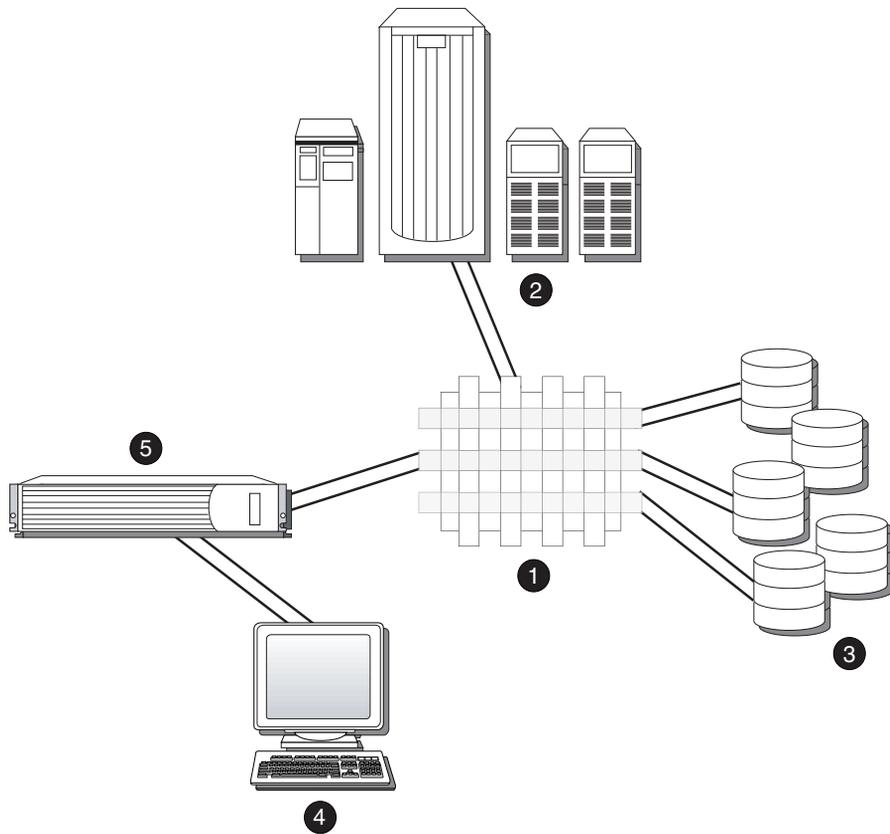
This section describes how the host servers fit in the overall Enterprise Virtual Array. Below is a list of the hosts that can attach and interact with the Enterprise Virtual Array:

- 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. For IBM AIX, Secure Path is required (see the release notes for supported version information).

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 IBM AIX Kit

This chapter provides instructions for installing the IBM AIX 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 2–3
 - Installing the IBM AIX Kit, page 2–3
 - Uninstalling the IBM AIX Kit, page 2–7,
 - Installing in an Existing Environment, page 2–8

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 2–3 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 IBM AIX provides this multiple path environment. You must have Secure Path installed on the host before any virtual disks can be recognized and configured.

The IBM AIX kit installation requires either the Secure Path CD-ROM or a Secure Path image if you wish to install Secure Path while installing this kit (see Installing the IBM AIX Kit on page 2–3).

LUN Limitations for Secure Path 2.0B on IBM AIX

There is a limitation to the number of LUNs (virtual disks) that a server can see based upon the number of FCAs in the server and the number of Enterprise Virtual Arrays attached to the server. Each pair of FCAs can support 4 Enterprise Virtual Array

systems and Secure Path 2.0B can see 32 LUNs per Enterprise Virtual Array system. So the maximum number of LUNs that can be supported per server is 512 (4 Enterprise Virtual Array systems * 4 HBA pairs * 32 LUNs per EVA system).

Installing the Host Kit

The IBM AIX 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).

sssu_v2_hpux.depotsssu_v2_hpux.depot The following sections describe how to install and uninstall the IBM AIX Kit, including the Secure Path driver on the IBM AIX host server. The Secure Path driver is necessary for your IBM AIX server to interact with the Enterprise Virtual Array.

Installing the IBM AIX Kit

Before you install the IBM AIX Kit V2.0 for the Enterprise Virtual Array, you should also have the Secure Path for IBM AIX CD-ROM or the Secure Path driver image. Since Enterprise Virtual Array is a multiple path product, Secure Path is a requirement. There is no transparent failover mode on the Enterprise Virtual Array (HSV110 controller) as there is on the HSG80 controller series.

Once you have the Secure Path software, perform the following steps to install both the IBM AIX Kit V2.0 for the Enterprise Virtual Array and the Secure Path software.



CAUTION: The firmware on all Enterprise Virtual Array systems that you want to attach an IBM AIX server must be upgraded to VCS V2.0 before you attach the server. IBM AIX is not supported with VCS V1.0 firmware.

Also, do not attempt to upgrade the VCS firmware while you have any active I/O running from an IBM AIX server. The Enterprise Virtual Array restarts both controllers at the same time during a firmware upgrade. Secure Path 2.x is not designed to handle this condition and this may result in a loss of I/O or the server requiring a restart.

1. Insert the IBM AIX Kit V2.0 for Enterprise Virtual Array CD-ROM into the CD-ROM drive.

2. If a directory called `/cdrom` does not exist, create it with the command:

```
mkdir /cdrom
```

3. Find your CD-ROM device by issuing the command:

```
lsdev -Cc cdrom
```

The CD-ROM device is probably `cd0` or another similar looking device

4. Mount the CD-ROM by issuing the command:

```
mount -rv cdrfs /dev/cd0 /cdrom
```

Where `/dev/cd0` is your CD-ROM device and `/cdrom` is the directory where you want to mount the CD-ROM.

NOTE: These parameters may vary from machine to machine.

5. Change directory to the root directory (`/`).

```
cd /
```

It is important that you do not start the `INSTALL` program from the directory where the CD-ROM is mounted because the `INSTALL` program will later prompt you to insert the Secure Path CD-ROM. Before you insert the Secure Path CD-ROM, the `INSTALL` program will attempt to unmount the IBM AIX Kit V2.0 for the Enterprise Virtual Array CD-ROM and it cannot do so if the current directory is one where the CD-ROM is mounted.

6. From the root directory, issue the command:

For example: `/cdrom/INSTALL`

7. The output of the `INSTALL` program should look similar to the following.

NOTE: Comments are inserted within the output shown here using the indication of “**NOTE:**” as a way to provide helpful explanations about the process. These notes do not appear in the actual output of the host.

Compaq Enterprise Host Installation Utility for AIX, V2.0

 This installation installs HSV110 device support and the Storage System Scripting Utility and will then prompt you for the Secure Path CD to Install the Secure Path driver and HACMP support if needed. If you Have not purchased Secure Path 2.0B for AIX, you will need to do so to Correctly attach to the Enterprise Virtual Array. Details on the Secure Path 2.0B driver for AIX can be obtained at:
www.compaq.com/products/sanworks/secure-path/sp-ibmaix.html
 If the Secure Path image resides in a specific directory, then You will be given an opportunity to install it from that directory.

Would you like to continue (Y/n)? y

Installing HSV110 device support...OK
 Installing Storage System Scripting Utility Applications...OK
 Installing HSV110 snapshot utilities...OK

NOTE: Here you choose the installation method for Secure Path. If you have the Secure Path CD-ROM, press ENTER. If you want to install from a directory, type “d” and you are prompted to enter a directory name where the Secure Path image resides. If you want to install Secure Path at a later date, enter “c”.

About to install the Secure Path driver.
 Press ENTER to install Secure Path from CD or
 Enter “d” to install from a specific directory or
 Enter “c” to skip the Secure Path installation and continue:

NOTE: The following output is what the script prints if you elect to install the Secure Path driver from the CD-ROM. After the line “Insert Secure Path CD-ROM and then press ENTER” displays, replace the IBM AIX Kit V2.0 for Enterprise Virtual Array CD-ROM with the Secure Path CD-ROM. After you insert the Secure Path CD-ROM, you should wait a few seconds before you press ENTER—giving the CD-ROM drive a chance to initialize. When the drive has initialized, press ENTER.

Insert Secure Path CD-ROM and then press ENTER
 Installing Secure Path 2.0B...OK

NOTE: The following is the output from the script if you elect to install the Secure Path driver from an image. Enter the directory where the file PC1000SP.image resides.

Enter the directory name where the Secure Path image resides: /tmp
 Installing Secure Path 2.0B...OK

NOTE: This marks the end of Secure Path installation. The installation of Highly Available Clustered Multi-processing (HACMP) support takes place only if you have HACMP/ES version 4.4.1.

```
Installing patches for Secure Path 2.0B...OK
Installing HACMP Secure Path support files...OK
Issuing bosboot command...OK
```

NOTE: This allows you to configure your Cambex adapters and search for Enterprise Virtual Array disk devices. This is optional but recommended.

```
Would you like to search for adapter and disk devices (Y/n)? y
```

```
Searching...OK
Enterprise Virtual Array Devices
```

```
-----
hdisk3 Available 17-08-00-0,0 Compaq HSV110 Enterprise Virtual Array
hdisk4 Available 17-08-00-1,0 Compaq HSV110 Enterprise Virtual Array
hdisk5 Available 1A-08-00-0,0 Compaq HSV110 Enterprise Virtual Array
hdisk6 Available 1A-08-00-1,0 Compaq HSV110 Enterprise Virtual Array
```

NOTE: This listing is a list of which Cambex adapters are being used by Secure Path as redundant paths.

```
Press ENTER to continue
```

```
Adapter Path Information
```

```
-----
# Device    Status
scsi2      Active
scsi3      Active
```

```
Press ENTER to continue
```

```
Software Installation Complete.
```

```
The software that was just installed can be removed by issuing the Command:
/usr/sbin/cpq_hsv_uninstall or by mounting the kit CD-ROM and issuing the UNINSTALL
command.
```

The IBM AIX Kit V2.0 for Enterprise Virtual Array installation is now complete. The host is ready to configure and use Enterprise Virtual Array disk devices. See Chapter 3 “Testing Connections to the Enterprise Virtual Array” for information on configuring virtual disk devices. See “Uninstalling the IBM AIX Kit” on page 2–7 for information on uninstalling this kit. See “Details about Installed Components and Software” on page 4–13 for details on how to use the additional software that is installed with this kit.

Uninstalling the IBM AIX Kit

You can uninstall the IBM AIX Kit V2.0 for Enterprise Virtual Array in two ways. You can either run the UNINSTALL utility from the kit CD-ROM or you can execute the `cpq_hsv_uninstall` command. The following example uses the `cpq_hsv_uninstall` command. The output looks the same for either method.

IMPORTANT: Before you uninstall the IBM AIX Kit V2.0 for Enterprise Virtual Array, you should stop all applications that use Enterprise Virtual Array disk devices as well as remove any volume group data that may exist on any of the virtual disks.

The Uninstall utility does the following:

- Removes any Enterprise Virtual Array virtual disks
- Removes any Cambex adapters (optional)
- Removes the Secure Path driver (optional)
- Removes HACMP support (optional, if installed)
- Removes support for Enterprise Virtual Array (HSV110) devices
- Removes the Storage System Scripting Utility applications
- Removes the programs in `/usr/sbin`
- Runs the `bosboot -ad /dev/ipldevice` command

Use the following procedure to uninstall the Enterprise Virtual Array kit.

1. Issue the `cpq_hsv_uninstall` command (if you do not have `/usr/sbin` in your path, the command is `/usr/sbin/cpq_hsv_uninstall`).
2. Inspect the output, which should look similar to the following:

```
Enterprise Uninstall Utility for AIX, v2.0
-----
```

```
This script will delete Enterprise Virtual Array disks and Cambex adapters
```

```
And remove the following filesets:
```

```
PC1000.driver.obj: Secure-Path Driver
```

```
cluster.HSGXX.scsi.support.1.0.0.1: HACMP support for Secure Path
```

```
hsv110.rte: Enterprise Virtual Array device support
```

sssu.rte: Storage System Scripting Utility Applications
hsv-snapshot.rte: HSV110 Snapshot Utilities

This script assumes that all volume group data has been removed from the Enterprise Virtual Array Disks.

Do you wish to continue (Y/n)?

Removing Enterprise Virtual Disks...OK

Do you want to remove Secure Path 2.0B (Y/n)?

NOTE: If you are running any other storage, such as an MA8000, you do not want to remove Secure Path 2.0B.

NOTE: The next three items are only executed if you remove Secure Path 2.0B.

Removing Cambex Adapters...OK

Removing Secure Path 2.0B...OK

Removing HACMP Support For Secure Path (if installed)...OK

Removing HSV110 Snapshot Utilities...OK

Removing Storage System Scripting Utility Applications...OK

Removing Enterprise Virtual Disk Support...OK

Removing files in /usr/sbin...OK

Issuing bosboot command...OK

Uninstall Complete.

Installing in an Existing Environment

If you are installing this kit on an existing server, you need to check the installed version of Secure Path. There are two types of existing setups:

- Secure Path 2.0 installed with RA8000/MA8000/MA6000 storage
- Secure Path 2.0A installed with RA8000/MA8000/MA6000 storage

You can issue the following command to determine which version of Secure Path is installed on your host:

```
lspp -l PC1000.driver.obj
```

If you have Secure Path 2.0, the output displays as:

Fileset	Level	State	Description

Path:	/usr/lib/objrepos		

```
PC1000.driver.obj  1.5.10.1  COMMITTED  StorageWorks AIX Dual-Rail
                  V1.0 Fabric and Loop
```

If you have Secure Path 2.0A, the output displays as:

```
Fileset           Level   State      Description
-----
Path: /usr/lib/objrepos
PC1000.driver.obj 1.5.15.1 COMMITTED  Secure Path AIX Fabric Driver
```

You must have Secure Path 2.0B installed for the IBM AIX Kit V2.0 for Enterprise Virtual Array to work. If you have Secure Path 2.0 installed (Cambex driver version 1.5.10.1) or Secure Path 2.0A (Cambex driver version 1.5.15.1), you must upgrade Secure Path to V2.0B, as Secure Path 2.0 for IBM AIX is not supported with Enterprise Virtual Array. See the Secure Path 2.0B installation and configuration guide for upgrade instructions.

The Enterprise Virtual Array can coexist with an HSG80 subsystem if it is running either V8.6 or V8.7 of the ACS firmware code.

Also, there are specific rules for switch zoning with the Enterprise Virtual Array when you are connecting it to an IBM RS/6000 or a p-series server. These zoning rules should be applied before you install the kit. See “Zoning Considerations” on page 4–3 for details on this zoning.

Once you have met the prerequisite criteria, follow these steps:

1. Insert the IBM AIX Kit V2.0 for Enterprise Virtual Array CD-ROM.
2. If a directory called `/cdrom` does not exist, create it with the command:

```
mkdir /cdrom
```

3. Find your cdrom device by issuing the command:

```
lsdev -Cc cdrom
```

The CD-ROM device is probably `cd0` or another similar looking device

4. Mount the CD-ROM by issuing the command:

```
mount -rv cdrfs /dev/cd0 /cdrom
```

Where `/dev/cd0` is your CD-ROM device and `/cdrom` is the directory where you want to mount the CD-ROM. These parameters may vary from machine to machine.

5. Change directory to the CD-ROM directory.

```
cd /cdrom
```

6. Execute the command: `./INSTALL`

The following shows how the output of the installation utility should look.

NOTE: Comments are inserted within the output shown here using the indication of “**NOTE:**” as a way to provide helpful explanations about the process. These notes do not appear in the actual output of the host.

Compaq Enterprise Host Installation Utility for AIX, V2.0

This installation installs HSV110 device support and the Storage System Scripting Utility and will then prompt you for the Secure Path CD to Install the Secure Path driver and HACMP support if needed. If you Have not purchased Secure Path 2.0B for AIX, you will need to do so to Correctly attach to the Enterprise Virtual Array. Details on the Secure Path 2.0B driver for AIX can be obtained at:

www.compaq.com/products/sanworks/secure-path/sp-ibmaix.html

If the Secure Path image resides in a specific directory, then You will be given an opportunity to install it from that directory.

NOTE: The default here is yes, so you can simply press ENTER.

Would you like to continue (Y/n)? y

NOTE: The two main filesets in the Enterprise Virtual Array kit are installed here.

Installing HSV110 device support...OK
Installing Storage System Scripting Utility Applications...OK
Installing HSV110 Snapshot Utilities...OK

NOTE: If Secure Path 2.0B is already installed, the script should output the following message. If the script outputs a message saying that another version of the Cambex adapter driver is installed, see the Secure Path 2.0B Installation and Configuration Guide for upgrade instructions.

Secure Path 2.0B Already Installed

Installing HACMP secure path support fileset...OK
Issuing bosboot command...OK

NOTE: Searching for adapter devices executes a `cfgmgr` command.

Would you like to search for adapter and disk devices (Y/n)?

Searching...OK

NOTE: If your zoning is correct, you should only see two HSV110 devices. These devices are only access devices and not real LUN's. They should not be used for any input or output. Access devices on an Enterprise Virtual Array will always have the LUN ID that is set on Enterprise Virtual Array as the Console LUN ID. Secure Path does not configure LUN 0 for dual-redundant paths, so the Command Console ID must be 0.

Enterprise Virtual Array Devices

```
hdisk3    Available 37-08-00-4,0 Compaq HSV110 Enterprise Virtual Array
hdisk4    Available 3A-08-00-4,0 Compaq HSV110 Enterprise Virtual Array
```

Press ENTER to continue

Adapter Path Information

```
# Device    Status
scsi2      Active
scsi3      Active
```

Press ENTER to continue

Software Installation Complete.

The software that was just installed can be removed by issuing the
Command: `/usr/sbin/cpq_hsv_uninstall`
or by mounting the platform kit CD and issuing the UNINSTALL command.

This completes the installation of the Enterprise Virtual Array kit in an existing environment.

You should be able to add Enterprise Virtual Array virtual disks for your IBM RS/6000 or p-series server to use. See “Testing Connectivity to Virtual Disks” on page 3–2 for more information.

Uninstalling an Earlier Secure Path Version

See the Secure Path 2.0B Installation and Configuration guide for upgrade instructions.

Testing Connections to the Enterprise Virtual Array

This chapter describes how to test that the IBM AIX 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 3–4
- Configuring Virtual Disks from the Host, page 3–5

Testing the Storage System Scripting Utility

The Storage System Scripting Utility (SSSU) is installed from the IBM AIX Kit V2.0 for Enterprise Virtual Array (see “Installing the Host Kit” on page 2–3). You should verify that SSSU runs from your host server.

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

```
/usr/sbin
```

usr/opt/ENTP002/To start SSSU, type the following at the command prompt:

```
# sssu
```

SSSU is contained in a fileset called `sssu.rte` in the `/aix_spec` directory on the CD-ROM.

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.

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.

Gather the following information:

- a. Determine the active Cambex FCAs on the IBM AIX host by issuing the command:

```
/usr/lpp/cbxfc/cbxfesm listadapt
```

The output should look similar to:

```
# Device    Status
scsi2      Active
scsi3      Active
```

- b. Determine the World Wide Names (WWNs) of the FCAs by issuing the command:

```
show_wwid
```

The output should look similar to:

```
scsi2: 500502E0100009FE
scsi3: 500502E01000018B
```

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.

NOTE: For IBM AIX, the host type should be set to IBM.

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)

The two following values must be set as indicated:

- OS Unit ID should be set to 0

- Preferred path/mode should be set to “No Preference”
3. If you chose a specific LUN on the **Virtual Disk Properties** page, you are prompted to select a LUN number. Valid values are 1–15 as Secure Path 2.0B supports 32 LUNs per target, including the CCL.
 4. Restart the server or rescan the bus.

OS Unit ID

There is a field on the **Virtual Disk** properties page for OS Unit ID. Set the OS Unit ID to zero for IBM AIX hosts.

Verifying Virtual Disks from the Host

This section describes how to verify that IBM AIX hosts can access the virtual disks created on the Enterprise Virtual Array with the HSV Element Manager. The host can recognize devices either through a system restart or by rescanning the bus.

Scanning the Bus

Use the following procedure for the host to recognize virtual disks presented after the initial program load (IPL).

1. Execute the command:

```
cfgmgr -v
```

The `cfgmgr` command rescans the bus for additional resources. The `-v` switch (verbose output) requests a full output.

2. Execute the command:

```
lshsv
```

The `lshsv` command lists all of the Enterprise Virtual Array devices. The output should look similar to the following:

```
hdisk3 Available 37-08-00-4,0 Compaq HSV110 Enterprise Virtual Array CCL
hdisk5 Available 3A-08-00-4,0 Compaq HSV110 Enterprise Virtual Array CCL
hdisk6 Available 37-08-00-4,1 Compaq HSV110 Enterprise Virtual Array
```

NOTE: You should see a disk with the LUN ID that was assigned to the virtual disk in the HSV Element Manager. In the sample output above, the LUN ID is 1.

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 IBM AIX 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.

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
- Zoning Considerations, page 4–3
- Working with Clusters, page 4–5
- Snapshot Support, page 4–11
- Expanding Volumes, page 4–13
- Details about Installed Components and Software, page 4–13

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.

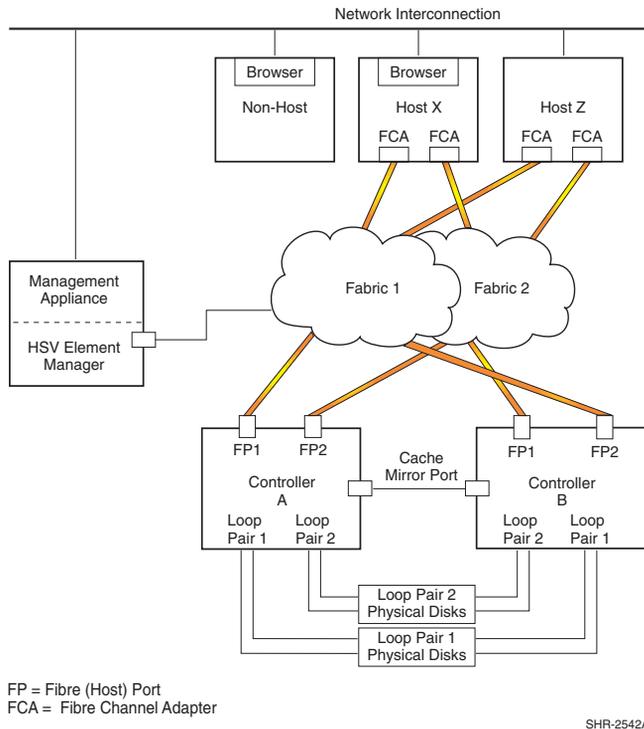


Figure 4–1: Overview of Enterprise Virtual Array component connections

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.

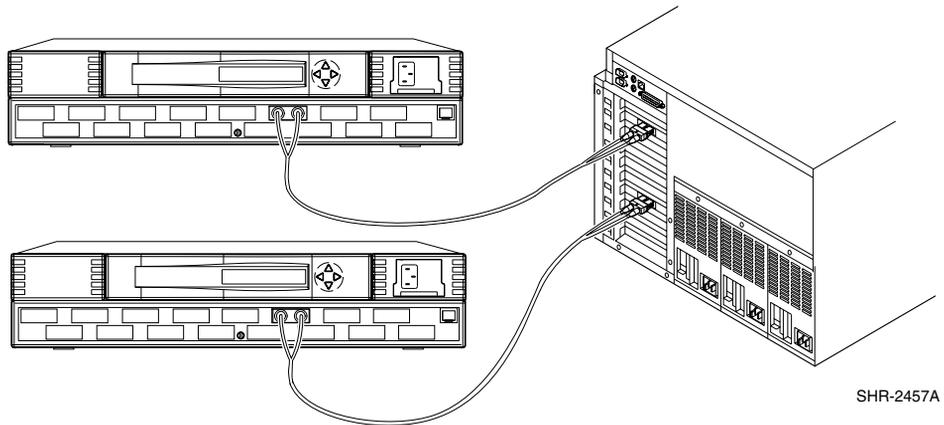


Figure 4–2: Cabling Hosts to Switches

Zoning Considerations

This section provides specific zoning rules for IBM AIX servers in an Enterprise Virtual Array environment. These rules apply currently to FC SAN switches only, not the SAN Director switches. For SAN Director switches, you should create three zones like the ones described for both switches.

On the switch that the SANworks Management Appliance (SWMA) is connected to (“Fabric 1” in Figure 4–1), there should be two zones within one configuration:

- Zone 1 should contain the SWMA, the World Wide Node Name of the Enterprise Virtual Array, and the World Wide Port Names of the two host ports from the HSV110 controller attached to Fabric 1.
- Zone 2 should contain the World Wide Port Name of Fiber Port 1 (FP1) of Controller A and any IBM AIX servers that are attached to Fabric 1.

On the switch without the SWMA (Fabric 2 in Figure 4–1), there should be one zone within one configuration:

- Zone 1 should contain the World Wide Port Name of FP1 of Controller B and any IBM AIX servers that are attached to Fabric 2.

IBM AIX Zoning Example

The output of the `cfgShow` command on each Compaq FC SAN switch is used to show what the zoning for an Enterprise Virtual Array should look like. This particular configuration includes one Enterprise Virtual Array with two controllers, an SWMA, two switches and two RS/6000 servers running IBM AIX.

The following list shows the World Wide Name of each of the components:

Controller A:

World Wide Node Name: 50:00:1f:e1:00:08:0b:c0
Port A World Wide Port Name: 50:00:1f:e1:00:08:0b:cc
Port B World Wide Port Name: 50:00:1f:e1:00:08:0b:cd

Controller B:

World Wide Node Name: 50:00:1f:e1:00:08:0b:c0
Port A World Wide Port Name: 50:00:1f:e1:00:08:0b:c8
Port B World Wide Port Name: 50:00:1f:e1:00:08:0b:c9

SWMA:

World Wide Name: 10:00:00:00:c9:23:df:5d

Server 1(Miranda):

Adapter 1 World Wide Name: 50:05:02:e0:10:00:09:2a
Adapter 2 World Wide Name: 50:05:02:e0:10:00:03:ec

Server 2(Brutus):

Adapter 1 World Wide Name: 50:05:02:e0:10:00:01:8b
Adapter 2 World Wide Name: 50:05:02:e0:10:00:09:fe

The following is a sample output of the zoning configuration for Fabric 1:

Defined configuration:

```
cfg:  switch1_cfg          zone2; zone1
zone: zone2              miranda; brutus; hsv110_port_1
zone: zone1              san_app; hsv110_port_1_2
alias: brutus            50:05:02:e0:10:00:01:8b
alias: miranda           50:05:02:e0:10:00:09:2a
alias: san_app           10:00:00:00:c9:23:df:5d
alias: hsv110_port_1    50:00:1f:e1:00:08:0b:c9
alias: hsv110_port_1_2  50:00:1f:e1:00:08:0b:c0; 50:00:1f:e1:00:08:0b:c9;
                        50:00:1f:e1:00:08:0b:cc
```

Effective configuration:

```

cfg:    switch1_cfg
zone:   zone2
        Protocol:ALL
        50:05:02:e0:10:00:09:2a
        50:05:02:e0:10:00:01:8b
        50:00:1f:e1:00:08:0b:c9
zone:   zone1
        Protocol:ALL
        10:00:00:00:c9:23:df:5d
        50:00:1f:e1:00:08:0b:c0
        50:00:1f:e1:00:08:0b:c9
        50:00:1f:e1:00:08:0b:cc

```

The following is a sample output of the zoning configuration for Fabric 2:

Defined configuration:

```

cfg:    switch2_cfg   zone1
zone:   zone1        miranda; brutus; hsv110_port_1
alias:  brutus       50:05:02:e0:10:00:09:fe
alias:  miranda      50:05:02:e0:10:00:03:ec
alias:  hsv110_port_1 50:00:1f:e1:00:08:0b:cd

```

Effective configuration:

```

cfg:    switch2_cfg
zone:   zone1
        Protocol:ALL
        50:05:02:e0:10:00:03:ec
        50:05:02:e0:10:00:09:fe
        50:00:1f:e1:00:08:0b:cd

```

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 IBM AIX is High Availability Cluster Multi-Processing (HACMP). See the platform-specific release notes for the specific version of the supported clustering software.

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

The following section explains some HACMP-specific concerns with clustered IBM AIX servers when attached to an Enterprise Virtual Array.

The only version of HACMP supported with the Enterprise Virtual Array is HACMP/ES 4.4.1.x. HACMP in IBM AIX 5.1 with the 64-bit kernel enabled is not supported. IBM has not formally announced support for HACMP in IBM AIX 5.1 in 64-bit mode at the time this document was written.

Installing the IBM AIX Kit V2.0 on an HACMP Cluster

The installation procedures are the same as those for a standalone node (see “Installing the IBM AIX Kit” on page 2–3). The IBM AIX Kit V2.0 for Enterprise Virtual Array must be loaded on each server in the cluster as if it were a standalone node.

Uninstalling the IBM AIX Kit V2.0 on an HACMP Cluster

The uninstall procedure is the same as for a standalone node (see “Uninstalling the IBM AIX Kit” on page 2–7).

You should remove any volume groups that are associated with any Enterprise Virtual Array disks before you execute either `cpq_hsv_uninstall` or the `UNINSTALL` utility.

Uninstall the IBM AIX Kit V2.0 for Enterprise Virtual Array on each node in the cluster.

Adding a Virtual Disk to an HACMP Cluster

Adding a virtual disk in an HACMP cluster is slightly different than adding a virtual disk to be used by a standalone node. The differences are in adding a host using and adding a volume group in the cluster that will be used by HACMP. Each is described in the following sections.

Adding a Host for Use by an HACMP Cluster

From the host nodes in the cluster:

1. Determine the active Cambex adapters by issuing the command:

```
/usr/lpp/cbxfc/cbxfcsm listadapt
```

The output should look similar to:

# Device	Status
scsi2	Active
scsi3	Active

2. Find out what the World Wide Names of the adapters are by issuing the command:

```
show_wwid
```

The output should look similar to:

```
scsi2: 500502E0100009FE  
scsi3: 500502E01000018B
```

3. Repeat steps 1 and 2 for each node in the HACMP cluster.
4. Add the host from the HSV Element Manager.

NOTE: 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 adapters use the **Add Port** function. Ensure that you add a port for each active FCA.

IMPORTANT: Enter a name for the cluster in the first step of the **Add Host** wizard.

5. Continue until all ports have been added for each FCA in each host server within the cluster.
6. Ensure that the host FCAs have been added by inspecting the **Host** folder in the **Navigation Tree** of the HSV Element Manager.

When you are finished, you should have one host that will present a virtual disk to each node in the HACMP cluster. For example, if you have a two node cluster with two Cambex adapters in each, you should have a host that contains four World Wide Names.

Adding a Virtual Disk to an HACMP Cluster

The steps for creating and adding a virtual disk to an HACMP cluster are the same as those for a standalone node. The only difference is that you to execute a `cfgmgr -v` command on each node in the cluster to add the device definition for the virtual disk.

Creating a Volume Group on a Virtual Disk

The following example procedure was created on a two node cluster with the names *brutus* and *miranda*, running HACMP/ES 4.4.1.

This procedure does not supersede the procedure outlined in the HACMP documentation on creating a shared volume group. These steps are just meant as a guide. Consult your HACMP documentation for any changes on creating a shared volume group.



CAUTION: Using C-SPOC for HACMP will not work for Enterprise Virtual Array devices.

1. Show a list of devices on each node in the cluster to determine which device you want to create a shared volume group on by issuing the `lshsv` command on each node.

The output from *brutus* displays as:

```
hdisk3 Available 37-08-00-4,0 Compaq HSV110 Enterprise Virtual Array CCL
hdisk5 Available 37-08-00-4,1 Compaq HSV110 Enterprise Virtual Array
hdisk6 Available 3A-08-00-4,0 Compaq HSV110 Enterprise Virtual Array CCL
```

The output from *miranda* displays as:

```
hdisk3 Available 17-08-00-4,0 Compaq HSV110 Enterprise Virtual Array CCL
hdisk4 Available 17-08-00-4,1 Compaq HSV110 Enterprise Virtual Array
hdisk5 Available 1A-08-00-4,0 Compaq HSV110 Enterprise Virtual Array CCL
```

NOTE: Here, we will use `hdisk5` from node *brutus* and `hdisk4` from node *miranda*. These are actually the same disks being presented to different nodes.

2. Find out the Physical Volume Identifier (PVID) using the `lspv` command on each node.

The output from *brutus* displays as:

hdisk0	0002997fb3fcfab5	None
hdisk1	0002997f32d9425d	rootvg
hdisk2	none	None
hdisk3	none	None
hdisk4	none	None
hdisk5	none	None
hdisk6	none	None

The output from *miranda* displays as:

hdisk0	0000981f0ebaf585	None
hdisk1	0000981f6f1f38bb	None
hdisk2	0000981f6c12e583	rootvg
hdisk3	none	None
hdisk4	none	None
hdisk5	none	None

There is no PVID for the disk on either node. Assign a PVID on one node and have the other node use the same PVID.

NOTE: Select one node for the configuration and then use the other node to import the needed information. In this case, node *brutus* was used as the main node and *miranda* as the other node.

3. On node *brutus*, execute the command:

```
chdev -a pv=yes -l hdisk5
```

4. On node *miranda*, execute the command:

```
chdev -a pv=yes -l hdisk4
```

5. Using the `lspv` command, examine the PVID on each disk to make sure that they are the same.

The output from *brutus* displays as:

```
hdisk0 0002997fb3fcfab5 None
hdisk1 0002997f32d9425d rootvg
hdisk2 none None
hdisk3 none None
hdisk4 none None
hdisk5 0002997f95945b06 None
hdisk6 none None
```

The output from *miranda* displays as:

```
hdisk0 0000981f0ebaf585 None
hdisk1 0000981f6f1f38bb None
hdisk2 0000981f6c12e583 rootvg
hdisk3 none None
hdisk4 0002997f95945b06 None
hdisk5 none None
```

6. Execute the command `lvlstmajor` on each node in the cluster to get the next available major number to use for a volume group:

The output from *brutus* displays as:

```
45...
```

The output from *miranda* displays as:

```
44...
```

Use the greater of the two numbers, in this case 45.

7. Create the volume group on node *brutus* using the command:

```
mkvg -f -V 45 -s 32 -y sharedvg hdisk5
```

NOTE: All commands from this step on are executed on *brutus* unless otherwise specified. The arguments to `mkvg` can and will vary. Use arguments that are appropriate to the size and purpose of your device.

8. Execute the command `lsvg sharedvg` to get the number of Free Physical Partitions.

This number can be found in the “Free PPs:” field.

The output should look similar to the following:

```
VOLUME GROUP: sharedvg  VG IDENTIFIER: 0002997f00004c00000000ec959cb382
VG STATE:      active    PP SIZE:      32 megabyte(s)
VG PERMISSION: read/write TOTAL PPs:     31 (992 megabytes)
MAX LVs:       256      FREE PPs:    31 (992 megabytes)
LVs:           0        USED PPs:    0 (0 megabytes)
OPEN LVs:      0        QUORUM:      2
TOTAL PVs:     1        VG DESCRIPTORS: 2
STALE PVs:     0        STALE PPs:   0
ACTIVE PVs:    1        AUTO ON:     yes
MAX PPs per PV: 1016    MAX PVs:     32
LTG size:      128 kilobyte(s) AUTO SYNC:      no
HOT SPARE:     no
```

In this case, the number of free PPs is 31. Use the number of Free PPs minus 1 because there needs to be 1 PP free to create a file system. The arguments to `mklv` can and will vary. Use arguments that are appropriate to the purpose of your device.

9. Create a volume group using a command similar to:

```
mklv -y sharedlv sharedvg 30
```

10. Create a file system on the logical volume. In this case, create a file system that spans the whole disk. This is not mandatory.

Use a command similar to:

```
crfs -v jfs -d sharedlv -m /sharedfs
```

NOTE: The arguments to `crfs` can and will vary. Use arguments that are appropriate to the purpose of the filesystem.

11. Quickly mount and unmount the filesystem at its mount point to ensure that the filesystem has been correctly made.

```
mount /sharedfs
```

```
umount /sharedfs
```

12. Change the volume group so that it does not “autovaryon” at boot time:

```
chvg -a n sharedvg
```

13. Deactivate the volume group so that it can be imported by the other node:

```
varyoffvg sharedvg
```

14. On node *miranda*, execute the `importvg` command to get the volume group definition from the device itself:

NOTE: All the commands that follow apply to node *miranda*.

```
importvg -V 45 -y sharedvg hdisk4
```

15. Change the volume group so that it sets not “autovaryon” at boot time:

```
chvg -a n sharedvg
```

16. Deactivate the volume group:

```
varyoffvg sharedvg
```

The virtual disk is now ready to be added to your HACMP configuration.

Snapshot Support

One of the features of the Enterprise Virtual Array is the ability to create snapshots or snapclones of virtual disks. Snapshots and snapclones are copies of a virtual disk. These copies are ideal for a snapshot-in-time backup or making changes to data without actually affecting the original data. The problem that snapshots and snapclones present to IBM AIX is duplicate physical volume identifiers. Since snapshots and snapclones are copies of virtual disks, they contain all the data of the original, including any volume group information. Since a virtual disk and its snapshots and snapclones contain the same data, they appear as the same disk to the logical volume manager. The IBM AIX kit includes a utility that will recreate the data on a disk so that it appears as a different disk than the original virtual disk.

NOTE: To use the snapshot utility, you will need the file `/usr/sbin/recreatevg`. If your system does not contain this file, you may need to get a version of the `bos.rte.lvm` fileset (4.3.3.0 or later).

You can find the snapshot utility through SMIT in **Applications >Compaq HSV110 Snapshots >Recreate Volume Group of a Snapshot**.

There are two menu items (each are described in the sections that follow):

- **Show Disks with the Same Physical Volume ID**
- **Recreate Volume Group**

Show Disks with the Same Physical Volume ID

This menu item displays each Enterprise Virtual Array virtual disk and any virtual disks that have the same physical volume identifier.

Recreate Volume Group

This menu item allows you to recreate the volume group of a virtual disk that has the same physical volume identifier as another.

1. Open the snapshot utility and choose **Recreate Volume Group**.
2. Choose the virtual disk from the list of presented disks.

The utility changes the physical volume ID on the disk, issues the `recreatevg` command on the disk, and then mounts any file systems on the disk.

The new volume group name is in the form of `snapX_<old volume group name>` and any of the file systems are mounted in the directory `/snapX`.

Table 4–1 displays an example of how the recreated volumes are named and mounted.

Table 4–1: Recreate Volume Group Example

	Original Virtual Disk	Recreated Virtual Disk
Name	testdisk1	snap1_testdisk1
Mounted on	/testdisk1	/snap1/testdisk1

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.

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

IBM AIX 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.

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

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.

Details about Installed Components and Software

The IBM AIX Kit V2.0 for Enterprise Virtual Array software contains three main filesets:

- `hsv110.rte`
- `hsv_snapshot.rte`
- `sssu.rte`

These filesets contain the functionality described in the next sections.

Functionality of the `hsv110.rte`

The `hsv110.rte` fileset adds the following commands to the `/usr/sbin` folder:

- **cpq_hsv_uninstall**—uninstalls the IBM AIX Kit V2.0 for Enterprise Virtual Array including Secure Path 2.0B if necessary.
- **lshsv**—lists all of the Enterprise Virtual Array devices on your system and identifies which ones are access devices (CCLs).
- **show_path**—displays redundant path information for disks using Cambex adapters.
- **show_wwid**—shows the World Wide Names of Cambex adapters on your system.

The `hsv110.rte` fileset also adds the following System Management Interface Tool (SMIT) menu items which can be accessed in **Devices >HSV110 Configuration**:

- **Configure Adapter and Disk Devices**—looks for Cambex adapters and HSV110 devices (executes a `cfgmgr -v`).
- **List HSV110 Devices**—lists all the Enterprise Virtual Array devices on your system.
- **List Cambex Adapter WWIDs**—lists the World Wide Names of all the Cambex adapters on your system.
- **List Redundant Path Information**—shows all the disks managed by Cambex adapters and their path information.

Functionality of the `ssu.rte`

The `ssu.rte` fileset contains the Storage System Scripting Utility, along with supporting applications which allow you to save the configuration of your Enterprise Virtual Array.

The Storage System Scripting Utility executable, `SSU`, is located in the `/usr/sbin` directory, so it can be launched from anywhere by typing `ssu`.

The supporting applications can be accessed from the SMIT menu item, **Communication Applications and Services >Storage System Scripting Utility Applications**.

The supporting applications for `SSU` allow you to save and restore your HSV110 configuration from configuration scripts that are stored on your server. The applications contact a specific management appliance and saves the configuration of the first storage cell seen in a configuration script file. Then, if something happens to your Enterprise Virtual Array configuration, you can restore from one of these previously stored configurations. The only following limitations apply:

- Only one Enterprise Virtual Array cell can be on the specific management appliance.
- The management appliance must have a fixed IP address that can map to a DNS hostname.

Saving an Enterprise Virtual Array Configuration

There are three major procedures to saving your configuration:

1. Adding an appliance definition.
2. Setting the snapshot directory.
3. Getting a snapshot of the Enterprise Virtual Array configuration.

These procedures are outlined in the following sections.

Adding an Appliance Definition

1. Invoke SMIT.
2. Go to the menu item **Communication Applications and Services > Storage System Scripting Utility Applications > Add SWMA Appliance Definition**.
3. Enter the hostname of your management appliance in the **SWMA Appliance Name** field.
4. Enter the user name you want to use to access the management appliance (it should be the user name you use to log onto the appliance) in the **User Name** field.
5. Enter your password in the **Password** field.
6. Execute the command.

Setting the Snapshot Directory

The default directory where the snapshot scripts reside is
`/usr/lpp/cpq_snapshot/snapshots`.

You can change this directory by using the **Communication Applications and Services-> Storage System Scripting Utility Applications->SWMA Appliance Capture Configuration-> Change Capture Configuration Directory** SMIT menu item.

Taking a Snapshot of an Enterprise Virtual Array Configuration

1. Invoke SMIT.
2. Go to the **Communication Applications and Services > Storage System Scripting Utility Applications > SWMA Appliance Capture Configuration > Capture the Configuration of a SWMA Appliance** SMIT menu item.
3. Select the management appliance you want to use to capture the configuration of in the **SWMA Appliance Name** item from the list of management appliances.
4. Enter the password for the management appliance in the **SWMA Appliance Password** field.

The password here is compared against the password you supplied when you added a management appliance definition. If the password you specified in the management appliance definition is wrong (as compared to the password on the actual appliance), then the apply command may fail because the management appliance will not recognize the password it is sent. If this happens, delete the current management appliance definition and re-add it with the correct password.

5. Enter the name of the configuration in the **Configuration Name** field. The name should follow the rules that apply for normal UNIX filenames.
6. Execute the command.

Automatic Configuration Snapshots

You can also setup configuration snapshots so that they are done automatically. This is done by entering a command into the `/var/spool/cron/crontabs/root` file. You can set this by using the **Communication Applications and Services > Storage System Scripting Utility Applications > SWMA Appliance Capture Configuration > Add Entry to Crontab to Do Automatic Configuration Captures**.

The configuration snapshot scripts will be stored in the current configuration snapshot directory in the form of `autosnap_<appliance name>`. If your management appliance name were `mvlab8`, then the name of the configuration snapshot would be `autosnap_mvlab8`.

You can apply the configuration snapshots the same way you would if you had taken the configuration snapshot manually.

Restoring an Enterprise Virtual Array Configuration

If there is a failure or corruption of your Enterprise Virtual Array, you can use the configuration snapshot to restore it to the previous state.

There are two major procedures to restoring your configuration:

1. Adding an appliance definition.
2. Restoring to an uninitialized Enterprise Virtual Array.

Adding an Appliance Definition

See the “Adding an Appliance Definition” on page 4–15 for instructions on how to add the appliance definition.

Restoring to an Uninitialized Enterprise Virtual Array

Before you restore your configuration, you should check to make sure that the Enterprise Virtual Array storage cell is in an uninitialized state. This procedure may not work if the array is not in an uninitialized state.

1. Invoke SMIT.
2. Go to the **Communication Applications and Services > Storage System Scripting Utility Applications > SWMA Appliance Capture Configuration > Apply a Captured Configuration** SMIT menu item
3. Select a management appliance from the list for the **SWMA Appliance Name** field.
4. Enter the password for the management appliance in the **SWMA Appliance Password** field.

NOTE: The password here is compared against the password you supplied when you added an management appliance definition. If the password you specified in the management appliance definition is wrong (as compared to the password on the actual appliance), then the apply may fail because the management appliance will not recognize the password it is sent. If this happens, delete the current management appliance definition and add it again with the correct password.

5. Select the configuration you want to apply to the storage cell contained on the selected management appliance from the list for the **Configuration Name** field.
6. Execute the command.

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.

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