installation and configuration guide

# hp StorageWorks Linux Single Path kit v3.0 for enterprise virtual array

**Product Version:** 3.0

First Edition (May 2003)

**Part Number:** AA-RUHVA-TE

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

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# contents

## Figures



## Tables

# about this guide

This installation and configuration guide provides information to help you:

- Become familiar with the Enterprise Virtual Array technology
- Install the Linux Kit for Enterprise Virtual Array storage systems
- Test connections to the Enterprise Virtual Array storage systems

“About this Guide” topics include:

# Overview

This section covers the following topics:



## Intended Audience

This book is intended for use by storage administrators who are experienced with the following:

- Configuration of storage area networks (SANs).
- Host environments, such as Windows 2000, Windows NT, Windows Server 3000, Sun Solaris, OpenVMS, Tru64 UNIX, HP-UX, IBM AIX, Linux, and Novell NetWare.
- Enterprise Virtual Array (EVA5000) storage systems

## Related Documentation

In addition to this guide, HP provides corresponding information:

- *HP StorageWorks Kit V3.0 for Enterprise Virtual Array Release Notes*
- *HP StorageWorks Enterprise Virtual Array User Guide*
- *HP StorageWorks Enterprise Virtual Array Release Notes*
- *HP StorageWorks Enterprise Virtual Array Read Me First*
- *HP StorageWorks Enterprise Virtual Array World Wide Name Label*
- *HP StorageWorks Command View EVA Interactive Help File*
- *HP StorageWorks Enterprise Virtual Array Hardware Configuration Guide*
- *HP StorageWorks Enterprise Virtual Array Upgrading to V3.0 Instructions*
- *HP StorageWorks Enterprise Virtual Array License Instructions*
- *HP StorageWorks System Software Enterprise Virtual Array Installation Instructions*
- *HP StorageWorks SAN Design Reference Guide*

# Conventions

Conventions consist of the following:

- Document Conventions
- Text Symbols
- Equipment Symbols

## Document Conventions

The document conventions included in Table 1 apply in most cases.

**Table 1: Document Conventions**

| Element | Convention |
|---|---|
| Cross-reference links | Blue text: Figure 1 |
| Key and field names, menu items, buttons, and dialog box titles | **Bold** |
| File names, application names, and text emphasis | *Italics* |
| User input, command and directory names, and system responses (output and messages) | `Monospace font`<br>`COMMAND NAMES` are uppercase monospace font unless they are case sensitive |
| Variables | `<monospace, italic font>` |
| Website addresses | Blue, underlined sans serif font text: http://www.hp.com |

## Text Symbols

The following 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 death.

**Caution:** Text set off in this manner indicates that failure to follow directions could result in damage to equipment or data.

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

## Equipment Symbols

The following equipment symbols may be found on hardware for which this guide pertains. They have the following meanings.

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 personal safety 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 personal safety 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 personal safety from electrical shock, remove all power cords to completely disconnect power from the power 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 safety or damage to the equipment, observe local occupational health and safety requirements and guidelines for manually handling material.

# Rack Stability

Rack stability protects personnel and equipment.

**WARNING:** To reduce the risk of personal safety 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.
- 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 an HP authorized service provider or access our website: http://www.hp.com.

## HP Technical Support

Telephone numbers for worldwide technical support are listed on the following HP website: http://www.hp.com/support/. From this website, select the country of origin.

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

Be sure to have the following information available before calling:

- 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

## HP Storage Website

The HP website has the latest information on this product, as well as the latest drivers. Access storage at: http://www.hp.com/country/us/eng/prodserv/storage.html. From this website, select the appropriate product or solution.

## HP Authorized Reseller

For the name of your nearest HP authorized reseller:

- In the United States, call 1-800-345-1518
- In Canada, call 1-800-263-5868
- Elsewhere, see the HP website for locations and telephone numbers: http://www.hp.com.

# Understanding the Enterprise Virtual Array

1

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

# About Virtualization

Virtualization is 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.

You do not need 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 Command View EVA Element Manager. See the Command View EVA Element Manager online help for more information.

Three levels of virtualization are possible within a SAN—server, fabric, and storage system.

- **Server level**—useful for small systems—StorageWorks Virtual Replicator 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

The Enterprise Virtual Array implements storage system level virtualization. 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 concept in the storage industry that allows you to focus on higher-level concerns regarding your specific storage needs.

With the Enterprise Virtual Array, you no longer need 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 you create virtual disks, 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 toward a single or specific set of disks.

Setup and management of virtualization is achieved with software and hardware resources. You have 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 regarding physical disk usage, previously made manually, are now performed by the software. The end result is overall better performance and less intervention.

The Command View EVA Element Manager software automatically makes complex choices about physical disk usage. Virtual disks are created behind the scenes with this software. You make 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 Command View EVA 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, Windows 2000, Windows Server 2003
- Tru64 UNIX
- OpenVMS
- Sun Solaris
- HP-UX
- IBM AIX
- Linux
- Novell NetWare

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 shows an overall SAN architecture for the Enterprise Virtual Array. The control center for the Enterprise Virtual Array is the Command View EVA Element Manager, which resides on a management appliance. The management appliance is accessed from a browser anywhere on the network.

The hosts are components of the Enterprise Virtual Array storage systems. 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.

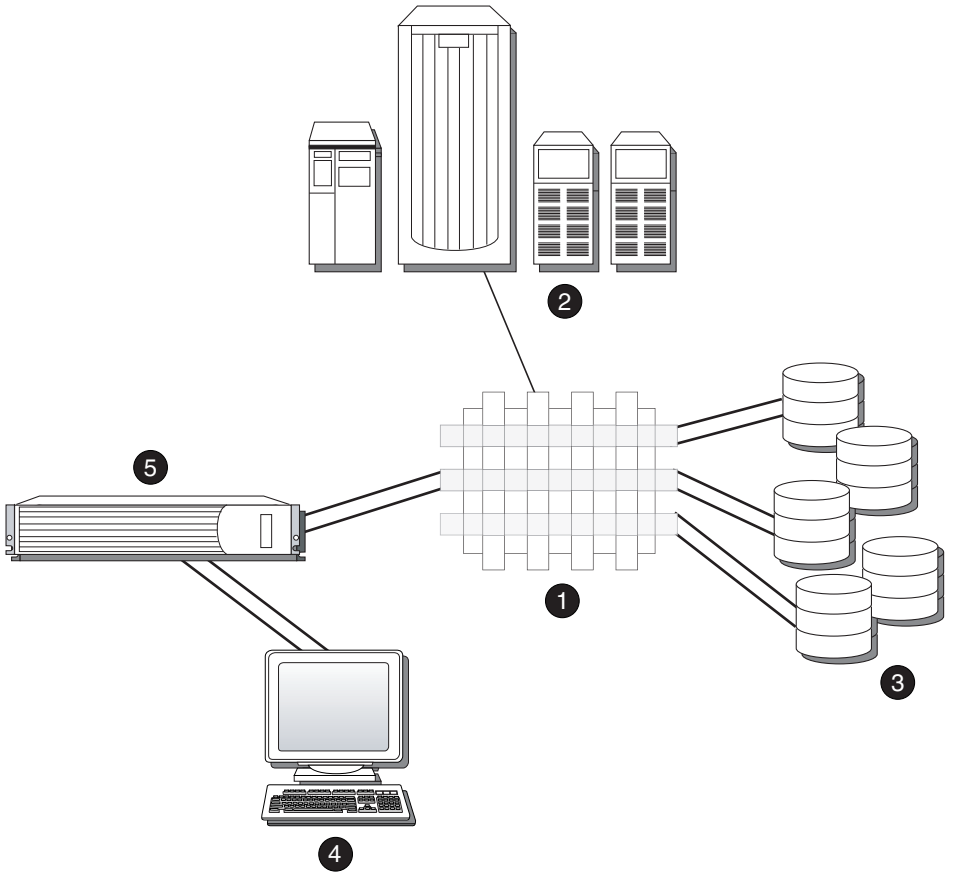


**Figure 1: SAN architecture for single path**

❶ Fabric

❷ Host servers

❸ Enterprise Virtual Array storage systems

❹ Browser for controlling the Command View EVA Element Manager

❺ Management Appliance—where the Command View Element Manager resides

Become familiar with the configuration requirements and the physical layout of your Enterprise Virtual Array. Refer to 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 an HP standard topology or by following the HP SAN design rules for creating custom topologies. Refer to the H*P StorageWorks SAN Design Reference Guide* for help with topology rules. The most up-to-date version of this guide can be found on the HP website at http://h18004.www1.hp.com/products/storageworks/san/documentation.html

## 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. You do not need to be concerned with which physical disks are used to create the virtual disks. However, you do 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 Linux Kit

2

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

# 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. Refer to the platform-specific release notes for a list of supported FCAs.

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**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.

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

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**Note:** "Installing the Host Kit" on page 22 describes how to update the drivers to the Enterprise Virtual Array supported version

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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 the Host Kit

The Linux Kit V3.0 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 Command View EVA 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 Command View EVA 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.

See the Storage System Scripting Utility V3.0 for Enterprise Virtual Array Reference Guide for more information on using SSSU (included on the CD-ROM that comes with this kit)

## Installing SSSU Only

If you have already installed the FCA drivers, you can choose to install just the SSSU.

1. Mount the CD-ROM
2. Change to the RPMS directory
3. Enter the following command:

```
# rpm -ivh ENTsssu-<version>.rpm
```

## Configuring RedHat and SuSE Linux

The configuration process for Redhat and SuSE Linux operating systems in an EBS involves:

- Upgrading essential EBS hardware components to meet the minimum firmware and device driver requirements.
- Installing the Linux OS onto the Intel-based HP Proliant servers.
- Installing the latest Qlogic HBA driver from the HP Linux Solution Kit.

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**Note:** Refer to the EBS Compatibility Matrix for all current and required hardware, software, firmware, and device driver versions at http://h18000.www1.hp.com/products/storageworks/ebs/EBScompatmatrix.html.

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Refer to the *Quick Checklist* section to ensure you have correctly installed and configured all of the hardware and software in the SAN.

# Considerations before Installing the Platform Software

## Kernel Configuration Considerations

The configuration of your kernel sources is important to check before you install the platform software. The platform software may have to compile the adapter driver from source or compile a new SCSI mid-layer module (`scsi_mod.o`), so the configuration of the kernel sources is important.

## Assessing the Kernel Sources and .config File

Perform the following steps to check whether you have the kernel source files for your kernel installed.

1. Enter the `uname -r` command to get the current running kernel version. The output from this command displays a version number as shown in the following example:

   ```
   2.4.7-64GB-SMP
   ```

2. Enter the `rpm -q kernel-source` command. This command gives you the version of the kernel sources RPM, if it is installed. An example follows:

   ```
   # rpm -q kernel-source
   kernel-source-2.4.7.SuSE-17
   ```

3. Do one of the following depending upon the state of your kernel Source RPM:
   - Install the kernel Source RPM, if the kernel source is not installed. Use an RPM that is compatible with your operating system (Red Hat or SuSE).
   - If your kernel source RPM is installed, check that the kernel sources match the running kernel. For example, you are running a 2.4.7 kernel and SuSE SLES-7 and you have the 2.4.7 sources, produced by SuSE, installed.
4. Ensure that a *.config* file exists in the kernel source directory. The kernel source directory is usually either `/usr/src/linux-2.4` on Red Hat systems and */usr/src/linux* on SuSE systems. The *.config* file contains the current kernel configuration.
5. Execute the command `ls .config to` verify the existence of the *.config* file. If this file does not exist, create it using one of the kernel configuration programs.

### Verifying the Current Kernel Type

The kernel that you are running may be SMP (symmetric multiprocessing) or UNI (uniprocessor). To check this execute the command `more /proc/version`. If the string *SMP* appears in the output, then the current kernel is a SMP kernel. If *SMP* is not in the output, then your system is running an UNI kernel.

### Configuring the Kernel

It is important to check the kernel configuration because if the configuration doesn't match that of the current kernel, the modules compiled may not load. This can have consequences ranging from unconfigured FC adapters to the system not being able to boot because it cannot load the SCSI mid-layer module from the *initrd*. To check and/or change the kernel configuration, perform the following steps:

1. Go to the kernel source directory (either `/usr/src/linux-2.4` or `/usr/src/linux`)
2. Invoke the configuration tool by executing the command `make menuconfig` (or invoke another kernel configuration tool such as `make xconfig`).
6. Check the following kernel options to ensure they are enabled:
   - **Processor type and features>Symmetric multi-processing support** (This should only be enabled if you are running a SMP kernel or will boot into a SMP kernel)
   - **SCSI support>SCSI support** (for Red Hat systems, this should be set to modular, for SuSE systems, it should be set to be part of the kernel)
   - **SCSI support>SCSI disk support** (for Red Hat systems, this should be set to modular, for SuSE systems, it should be set to be part of the kernel)
   - **SCSI support>SCSI generic support**
   - **SCSI support>Probe all LUNs on each SCSI device**

## Installing the Platform Kit

To install the Platform software, perform the following steps:

1. Mount the platform software CD. For example:

   ```
   # mount /mnt/cdrom
   ```

2. Execute the command `./install_stgwks.v3`

The script will install all the components. The only intervention that may be required is if the qla2x00 RPMs do not have a precompiled binary driver for your system. In this case, the driver binaries will have to be compiled during the installation. To do this, simply answer **y** when the script asks you if you want to compile the driver modules.

The following output is an example of an installation where the driver RPM has precompiled binaries for the distribution you are running.

```
qalab016:/mnt/cdrom # ./install_stgwks.v3


Installing qla2x00 driver RPM for SuSE SLES-7.


qla2x00 ################################################
Edits made to /etc/rc.d/boot
Removing references to qla2300 from /etc/rc.config
RPM has precompiled modules for 2.4.7-64GB-SMP
System is running a SMP kernel
Attempting to load qla2300...OK


Installing fibreutils RPM.


fibreutils #############################################
Installing ENTsssu RPM.


ENTsssu ################################################


   Installation log is in
   /var/local/ENTsssu/log/ENTsssu.20020515:01:38
   Please review this file for any messages.
```

The following is an example of an installation where the driver RPM has to be compiled.

```
root@alkmaar:/mnt/cdrom[root@alkmaar cdrom]#
./install_stgwks.v3


Installing qla2x00 driver RPM for Red Hat 7.2.


Preparing... (100%)#####################################[100%]
 1:qla2x00   (100%)#####################################[100%]
Edits made to /etc/rc.d/rc.sysinit
Removing references to qla2300 from /etc/modules.conf
Your current kernel does not match 2.4.7-10, 2.4.7-10smp,
2.4.9-34 or 2.4.9-34smp, so this RPM does not contain any
precompiled
modules for your kernel.
You will have to manually recompile the qla2300 module.
The driver source is located in
/opt/hp/storage_drivers/qla604/src. Once you
have recompiled the modules, you will need to copy them to
/lib/modules/2.4.9-34custom/kernel/drivers/scsi



Don't forget to run the
/opt/hp/storage_drivers/qla604/utils/edit_initrd.redhat
script to modify the SCSI blacklist!


Do you want to compile a new qla2x00 driver (Y/n)? y


Making dependencies.


make SMP=1 OSVER=linux-2.4 HSG80=n


cc -D__KERNEL__ -DMODULE -Wall -O -g -DUDEBUG -DLINUX -Dlinux
-DINTAPI
-DEXPORT_SYMTAB -DMODVERSIONS -include
/usr/src/linux-2.4/include/linux/modversions.h
```

```
-I/usr/src/linux-2.4/include
-I/usr/src/linux-2.4/include/../drivers/scsi

-falign-functions=2 -falign-jumps=2 -falign-loops=2 -Wall
-Wstrict-prototypes

-fomit-frame-pointer -fno-strength-reduce -pipe
-DCONFIG_X86_LOCAL_APIC

-fno-strict-aliasing -fno-common -mpreferred-stack-boundary=2
-march=i686

cc -D__KERNEL__ -DMODULE -Wall -O -g -DUDEBUG -DLINUX -Dlinux
-DINTAPI

-DEXPORT_SYMTAB -DMODVERSIONS -include
/usr/src/linux-2.4/include/linux/modversions.h

-I/usr/src/linux-2.4/include
-I/usr/src/linux-2.4/include/../drivers/scsi

-falign-functions=2 -falign-jumps=2 -falign-loops=2 -Wall
-Wstrict-prototypes

-fomit-frame-pointer -fno-strength-reduce -pipe
-DCONFIG_X86_LOCAL_APIC

-fno-strict-aliasing -fno-common -mpreferred-stack-boundary=2
-march=i686

-D__SMP__  -DCONFIG_SMP   -c qla2300.c -o qla2300.o


You are running 2.4.9-34custom. This is the kernel version that
the QLogic driver has been compiled for.


Copying new modules to
/lib/modules/2.4.9-34custom/kernel/drivers/scsi.


Starting qla2300...OK


Installing fibreutils RPM.


Preparing...(100%)########################################[100%]

1:fibreutils(100%)########################################[100%]


Installing ENTsssu RPM.


Preparing...(100%)########################################[100%]
```

```
1:ENTsssu (100%)########################################[100%]


   Installation log is in
   /var/local/ENTsssu/log/ENTsssu.20030305:03:11

   Please review this file for any messages.
```

## Modifying the SCSI Blacklist

If you are running a Red Hat system, the SCSI Blacklist will have to be modified. The SCSI blacklist is a list of recognized SCSI devices in one of the SCSI layer source files *(/usr/src/linux-2.4/drivers/scsi/scsi_scan.c)*.

There are three things that have to be done to correctly edit the SCSI blacklist.:

- Entries for some supported HP devices need to be entered into this list
- The SCSI layer modules (*scsi_mod.o*) needs to be recompiled.
- A new *initrd* needs to be created.

There is a script included with the Red Hat driver RPMs that does these tasks automatically. To run this script, execute the following command:

```
# /opt/hp/storage_drivers/qla604/utils/edit_initrd.redhat
```

The script will ask you which *initrd* that you want to edit. The filename of the *initrd* that you want to edit is usually in the form of *initrd-<kernel version>.img*. For example, if your kernel version is 2.4.7-10, the *initrd* filename will be *initrd-2.4.7-10.img*.

The following is an example of the output displayed when you run the `edit_initrd.redhat` script:

```
root@alkmaar:/mnt/cdrom#
/opt/hp/storage_drivers/qla604/utils/edit_initrd.redhat


This script will make changes to the SCSI blacklist in

/usr/src/linux-2.4/drivers/scsi/scsi_scan.c, compile a new
scsi_mod.o,

and insert the new scsi_mod.o into the initial ramdisk.


Do you want to continue (Y/n)?


Choose initrd file to use:
```

```
initrd-2.4.7-10.img
initrd-2.4.7-10smp.img
initrd-2.4.7-10smp.img.old
initrd-2.4.9-34custom.img
initrd-2.4.9-34custom.img.old
initrd-2.4.9-34custom.img.old.old

Enter filename: initrd-2.4.9-34custom.img

Compiling new scsi_mod.o...

Saving scsi_mod.o and scsi_scan.o.
Making edits to scsi_scan.c.
Executing make dep.
Executing make clean.
Executing make SUBDIRS=drivers/scsi modules.
Checking for /usr/src/linux-2.4/drivers/scsi/scsi_mod.o.

Inserting scsi_mod.o into initrd...

Moving scsi_mod.o to
/lib/modules/2.4.9-34custom/kernel/drivers/scsi
Creating new ramdisk image.
Uncompressing initrd.
Mounting initrd.
Removing any qla2x00,or qla2300 modules from initrd.
Umounting initrd.
Compressing initrd.
Saving /boot/initrd-2.4.9-34custom.img as
/boot/initrd-2.4.9-34custom.img.old.
Moving new initrd into place.
```

```
If you are using lilo as your boot loader, you will have to run
the command /sbin/lilo to update lilo.conf!


You will have to reboot your machine for the changes to take
effect!
```

If you are using LILO as your boot loader, you will have to run `/sbin/lilo` to reconfigure the boot loader. Failure to do so may result in not being able to see storage or not being able to boot the system.

### Removing qla2300 Modules from initrd

If you are running a SuSE distribution and you have a qla2300 module embedded in *initrd*, you have to remove it. You can automatically remove *initrd* using the *remove_qla2x00.suse* script with the following command:

```
# /opt/hp/storage_drivers/qla604/utils/remove_qla2x00.suse
```

## Uninstalling the Platform Kit

To uninstall the Platform kit, execute the following steps:

1. Mount the solution software CD. For example:

   ```
   # mount /mnt/cdrom
   ```

2. Execute the command `./install_stgwks.v3 -u`

The output will look similar to:

```
[root@alkmaar cdrom]# ./install_stgwks.v3 -u
Removing fibreutils RPM.
Removing ENTsssu RPM.
Removing qla2x00 RPM.
```

# Working with the QLA2x00 Driver RPM

There are two driver RPMs for the *qla2x00* driver, one for each of the supported distributions. These distributions are:

- Red Hat Advanced Server 2.1
- SuSE SLES-7

For specific kernel versions that are supported with each distribution, see the supported OS table in the *HP StorageWorks Linux Kit V3.0 for Enterprise Virtual Array release notes.*

## Installation and Uninstall

The *qla2x00* RPM is installed as part of the normal installation of the solution kit. The *qla2x00* RPM can also be installed by copying the *.rpm* file to your system and entering the command:

```
# rpm -i  qla2x00-6.0.4-<revision>.<distribution>.i386.rpm
```

To remove the *qla2x00* package, enter the command:

```
# rpm –e qla2x00
```

## Components

### Driver Source Code

The driver source code is located in the `/opt/hp/storage_drivers/qla604/src` directory. You may need to compile a new driver module if you rebuild your kernel. It is recommended that you use the *hp_fccfg.sh* script in the *fibreutils* RPM, however, if you want to rebuild the driver modules manually, perform the following steps:

---

**Note:** You must have the kernel sources for the current kernel installed to proceed with the driver module recompilation.

---

1. Change directory to `/opt/hp/storage_drivers/qla604/src`
3. Remove any previously compiled drivers by entering the following command:

```
# make -f makefile.nonsp clean
```

2. Compile the driver modules by entering the following command

```
# make -f makefile.nonsp SMP=x
```

If you are using a uni-processor machine the x is equal to 0. If you are using an SMP machine, the x is equal to 1.

---

**Note:** If you are using a SuSE distribution, you will have to add the flag `OSVER=linux` at the end of the make command

---

3. Copy the *qla2300.o* files the `/lib/modules/<kernel version>/kernel/drivers/scsi` directory.
4. Reload the qla2300 modules or reboot your server.

## Precompiled Driver Binaries

Also included in the RPM are precompiled *qla2300* driver modules. The modules were compiled for the supported base kernel and errata kernel. The RPM installer will attempt to load the precompiled modules when the RPM is installed. The driver may fail to load if you are not running a supported kernel or your kernel name does not match the standard naming convention. If the driver load fails for some reason, you can recompile the driver modules for your environment by following the steps above.

## System Startup Scripts

There is code that is put into either the /etc/rc.d/rc.sysinit (Red Hat systems) or /etc/rc.d/boot (SuSE systems) script so that the *qla2300* module will load when the system is booted.

## Edit_initrd.redhat script

In the `/opt/hp/storage_drivers/qla604/utils` directory on Red Hat systems there is a script called *edit_initrd.redhat*. This script has to be run after the driver RPM is installed so that HP Storageworks storage will appear correctly to the system. A description of how to run this script can be found in the installation section.

### Remove_qla2x00.suse script

If you are running a SuSE distribution and you have a *qla2300* module embedded in your initrd, you will have to remove it. You can automatically remove *initrd* using the *remove_qla2x00.suse* script with the following command:

```
# opt/hp/storage_drivers/qla604/utils/remove_qla2x00.suse
```

The script takes the name of the initrd from boot that you want to change as its only argument.

## Fibre Channel Utilities

The RPM, (*fibreutils-1.0.0-5.i386.rpm*) contains assorted utilities that complement the *qla2x00* driver package. The *fibreutils* package contains the main *hp_fccfg.sh* utility. The *hp_fccfg.sh* script allows you to recompile the driver if needed and change the default queue depth for disk devices attached to a qla2300 series Fibre Channel adapter.

### Installation and Uninstall

The fibreutils RPM is installed during the normal installation procedure. To install the *fibreutils* RPM, follow the directions that are in the RDP documentation for deploying RPMs to a Proliant server. The *fibreutils* RPM can also be installed by copying the *.rpm* file to your system and invoking the command:

```
# rpm -i fibreutils-1.2.0-3.i386.rpm
```

To remove the *fibreutils* package, issue the command:

```
# rpm -e fibreutils
```

### Components

The main user utility of the fibreutils package is the *hp_fccfg.sh* script.

The *hp_fccfg.sh* script allows you to recompile the qla2300.o modules, change the default queue depth of the disk devices attached to a qla23xx adapter, modify the current kernel source configuration, and reload the qla2300 modules. To use this script, you must have the *qla2x00* driver RPM installed on your system, as well as the kernel sources. You can start the script by issuing the following command:

```
# hp_fccfg.sh
```

When you start the script, a menu displays as follows:

```
Main Menu
---------------
Distribution: Red Hat, 2.4.9-e.3smp
Number of CPU's: 4
1)   Recompile QLA Driver
2)   Change Default QDepth
3)   Run make menuconfig
4)   Run make xconfig
5)   Reload qla2300
Q|q) Quit
Choice:
```

The following is a description of all the options

### Option 1: Recompile driver

```
Recompile and Reload QLA Driver
-----------------------------------


1) Compile SMP QLA Single Path Driver
2) Compile SMP Secure Path Compatible Driver
3) Compile UNI QLA Single Path Driver
4) Compile UNI Secure Path Compatible Driver
5) Back to Main Menu


Choice:
```

Each option compiles the qla2300.o and places the modules in the correct directory to be used by *insmod*. Any change to driver module files, such as copying, can be seen in the */var/log/message*s file.

---

**Note:** For single path configurations, you should use options 1 or 3.

---

### Option 2: Change default queue depth

This option allows you to change the default queue depth for all devices seen by the QLA2xxx adapter. When you select this option, the previous queue depth number is displayed and you will be prompted for a new number. The number must be between 1 and 256. The adapter driver must be reloaded or the system rebooted for the new queue depth number to take effect

### Options 3 and 4: Changing kernel configuration

These options run the standard kernel source configuration programs. Make menuconfig is a text based program while make xconfig is a windowing program written in TCL.

### Option 5: Reload qla2300 modules

This option allows you to reload the adapter driver modules. This is especially useful after the user has recompiled the drivers. This option will attempt to run the `rmmod` command against the qla2300 kernel modules. It will then use the module startup scripts in */etc/init.d* to reload the driver.

---

**Note:** Sometimes the kernel modules appear to fail to unload because the modules are not loaded. If this is the case, you can ignore the failure messages.

---

## Configuring the SAN

This procedural overview provides the necessary steps to configure an x86-based Linux server host into an EBS. Refer to the documentation provided with each Storage Area Network (SAN) component for additional component setup and configuration information.

Refer to the *HP StorageWorks Linux Kit V3.0 for Enterprise Virtual Array Release Notes* for the latest FCA information supported for Linux platforms in an EBS environment.

This procedure uses the latter as the example.

1. Prepare the required rack mounted hardware and cabling in accordance with the specifications listed in backup software user guide as well as the installation and support documentation for each component in the SAN.

---

**Note:** To complete this installation, you must log into the Linux server as root.

---

2. After installing the Qlogic FCA, install the device driver from the HP Linux Solution Kit.
3. Execute the following command to install the device driver from the Linux V3.0 Kit:

   ```
   #./install_stgwks.v3
   ```

   Follow the instructions provided by the installation script. Accept all the default settings when prompted.
4. Reboot the server when the device driver is installed. When the server is backed up, type the following to check the driver installation:

   ```
   #lsmod
   Module                  Size        Used by
   sg                      28608       0
   qla2300                 192128      0
   ide-cd                  27072       0  (autoclean)
   cdrom                   28512       0  (autoclean) [ide-cd]
   soundcore               4464        0  (autoclean)
   binfmt_misc             6416        1
   autofs                  11520       0  (autoclean) (unused)
   eepro100                17664       1
   ext3                    64624       2
   jbd                     40992       2  [ext3]
   sym53c8xx               57504       3
   sd_mod                  11584       3
   scsi_mod                95664       4  [sg qla2300 sym53c8xx sd_mod
   ```

   The QLA2300 and sg device drivers should be loaded.
5. Inspect the system configuration file to make sure that all the tape devices are detected correctly. Enter the following command:

   ```
   #cat /proc/scsi/scsi
   ```

The output should look like the following:

```
[root@jazz V3]# cat /proc/scsi/scsi
Attached devices:
Host: scsi0 Channel: 00 Id: 00 Lun: 00
Vendor: COMPAQ   Model: BB00911CA0       Rev: 3B07
  Type:   Direct-Access                   ANSI SCSI revision: 02
Host: scsi2 Channel: 00 Id: 00 Lun: 00
  Vendor: COMPAQ   Model: DATA ROUTER      Rev: 1187
  Type:   Unknown                         ANSI SCSI revision: 02
Host: scsi2 Channel: 00 Id: 00 Lun: 01
  Vendor: COMPAQ   Model: MSL5000 Series   Rev: 0403
  Type:   Medium Changer                  ANSI SCSI revision: 02
Host: scsi2 Channel: 00 Id: 00 Lun: 02
  Vendor: COMPAQ   Model: SDLT320          Rev: 2E2E
  Type:   Sequential-Access               ANSI SCSI revision: 02
Host: scsi2 Channel: 00 Id: 00 Lun: 03
  Vendor: COMPAQ   Model: SDLT320          Rev: 2E2E
  Type:   Sequential-Access               ANSI SCSI revision: 02
```

6. If no tape devices are detected, make sure that all connections and hardware configurations downstream are correctly configured. Issue the following command to rescan the SCSI bus:

   ```
   #probe-luns -i -l qla2300
   ```

7. The tape devices are accessed through the device files located in the */dev* directory as *nstx*, where x starts from 0. Therefore, if you have two devices, the last tape device will be accessed through `/dev/nst1`.

8. You can also use the `scsi_info` command to query the tape device as shown below:

   ```
   # scsi_info /dev/nst0
   SCSI_ID="2,0,0,2":VENDOR="COMPAQ":MODEL="SDLT320":FW_REV="2E2E"
   :SN="PMC23Y0228":WWN="0000000000000000":LUN="434f4d5041512020-5
   3444c5433323020":
   Removing HSV110 devices...OK?
   ```

# Upgrading a V2.0 Server to V3.0

Follow this procedure to upgrade an existing V2.0 host server to V3.0.

1. Upgrade the Virtual Controller Software (VCS) and the Command View EVA Element Manager software from V2.0 to V3.0 (see the upgrade instructions that come with the VCS kit).
2. Uninstall the V2.0 kit (drivers, Secure Path, and SSSU).
3. Install the V3.0 kit (see "Installing the Host Kit" on page 22).

   Install the supported version of Secure Path.You may also need to upgrade the FCA firmware. Check the platform-specific release notes for supported FCA versions.
4. Restart the server.

# Testing Connections to the Enterprise Virtual Array

3

This chapter describes how to test that the Linux 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

The Storage System Scripting Utility (SSSU) is installed from the Linux Kit V3.0 for Enterprise Virtual Array (seeInstalling the Host Kit" on page 22). You should verify that SSSU runs from your host server.

# 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 to 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. Refer to "Connecting Hosts to Switches" on page 45 for the specific cabling instructions.

## Adding Hosts

You add a host using the Command View EVA 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 Command View EVA Element Manager.

   Adding hosts through the Command View EVA 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 Command View EVA Element Manager.
3. Ensure that the host FCAs have been added by inspecting the **Host** folder in the **Navigation** tree of the Command View EVA 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 Command View EVA 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.

# Verifying Virtual Disks from the Host

To verify you can see the virtual disks that you just created for the host, enter the following command:

```
# more /proc/scsi/scsi
```

This file is a listing of all SCSI devices your Linux server sees. An entry for an EVA LUN will look similar to the following output:

```
Host: scsi0 Channel: 00 Id: 06 Lun: 01
Vendor: COMPAQ   Model: HSV110 (C)COMPAQ Rev: 3000
Type:   Direct-Access ANSI SCSI revision: 02
```

# Configuring Virtual Disks from the Host

Once you have set up the virtual disks on the Enterprise Virtual Array and have 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

4

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



## 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.

Each host must attach to one switch (fabric) using standard fiber channel cables. Each host has one FCA connected through switches on a SAN to one port of an Enterprise Virtual Array.

---

**Note:** For single path, ensure that the path is zoned. Refer to the *HP StorageWorks SAN Design Reference Guide for zoning instructions.*

---

1. Plug one end of the fiber channel cable into the FCA on the server.
2. Plug the other end of the cable into the switch.

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

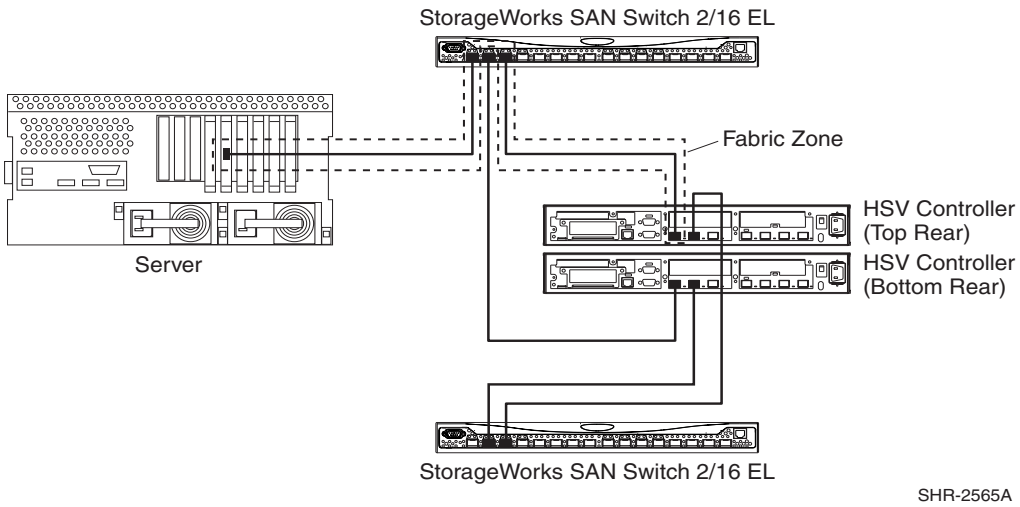


**Figure 2: Single Path Cabling diagram**

# Expanding Volumes

You can increase the volume size of the virtual disk with the Command View EVA Element Manager. You simply change the size parameter in the particular virtual disk's property page.

---

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

---

Linux 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

---

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

---

1. Back up any existing data to a secure place (tape or other device).

2. Stop all applications using the virtual disk and unattach the host server from the virtual disk. For example:

   ```
   # umount /dev/sdxx
   ```

   The *xx* designation represents the actual device number.

3. Expand the virtual disk using the Command View EVA Element Manager.
4. Reconnect the host to the virtual disk. For example:

   ```
   #mount /dev/sdxx
   ```

5. Restore data from the backup.

# 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 Command View EVA Element Manager software can be installed on more than one management appliance in a fabric. Each installation of the Command View EVA Element Manager software is a management agent.

**Enterprise Virtual Array**
The HP 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.

### fibre
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.
- A storage or memory capacity of 1,073,741,824 ($2^{30}$) bytes.

  *See also* **GBps**

### 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.**

### Command View EVA 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 Command View EVA 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 Command View EVA Element Manager software is a management agent.

**MB**
Megabtye. A term defining either:

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

  *See also* **MBps.**

**MBps**
Megabytes per second. A measure of bandwidth or data transfers occurring at a rate of 1,000,000 ($10^6$) 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 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 Command View EVA 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.

### 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 Command View EVA 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
The HP 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.
- A measure of either storage or memory capacity of 1,099,5111,627,776 ($2^{40}$) bytes.

  *See also* **TBps.**

### 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

## W