

Storage Foundation and High Availability 7.2 Configuration and Upgrade Guide - AIX

Storage Foundation and High Availability Configuration and Upgrade Guide

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https://sort.veritas.com/data/support/SORT_Data_Sheet.pdf

Contents

Section 1	Introduction to SFHA	13
Chapter 1	Introducing Storage Foundation and High Availability	14
	About Storage Foundation High Availability	14
	About Veritas Replicator Option	15
	About Veritas InfoScale Operations Manager	15
	About Storage Foundation and High Availability features	16
	About LLT and GAB	16
	About I/O fencing	16
	About global clusters	18
	About Veritas Services and Operations Readiness Tools (SORT)	18
	About configuring SFHA clusters for data integrity	19
	About I/O fencing for SFHA in virtual machines that do not support SCSI-3 PR	19
	About I/O fencing components	20
Section 2	Configuration of SFHA	23
Chapter 2	Preparing to configure	24
	I/O fencing requirements	24
	Coordinator disk requirements for I/O fencing	24
	CP server requirements	25
	Non-SCSI-3 I/O fencing requirements	27
Chapter 3	Preparing to configure SFHA clusters for data integrity	28
	About planning to configure I/O fencing	28
	Typical SFHA cluster configuration with server-based I/O fencing	32
	Recommended CP server configurations	33
	Setting up the CP server	36
	Planning your CP server setup	36

	Installing the CP server using the installer	37
	Configuring the CP server cluster in secure mode	38
	Setting up shared storage for the CP server database	38
	Configuring the CP server using the installer program	39
	Configuring the CP server manually	48
	Configuring CP server using response files	53
	Verifying the CP server configuration	57
Chapter 4	Configuring SFHA	58
	Configuring Storage Foundation High Availability using the installer	58
	Overview of tasks to configure SFHA using the product installer	58
	Required information for configuring Storage Foundation and High Availability Solutions	59
	Starting the software configuration	60
	Specifying systems for configuration	60
	Configuring the cluster name	61
	Configuring private heartbeat links	61
	Configuring the virtual IP of the cluster	66
	Configuring SFHA in secure mode	67
	Configuring a secure cluster node by node	67
	Adding VCS users	72
	Configuring SMTP email notification	73
	Configuring SNMP trap notification	74
	Configuring global clusters	76
	Completing the SFHA configuration	76
	Verifying and updating licenses on the system	77
	Configuring SFDB	79
Chapter 5	Configuring SFHA clusters for data integrity	81
	Setting up disk-based I/O fencing using installer	81
	Initializing disks as VxVM disks	81
	Checking shared disks for I/O fencing	82
	Configuring disk-based I/O fencing using installer	87
	Refreshing keys or registrations on the existing coordination points for disk-based fencing using the installer	89
	Setting up server-based I/O fencing using installer	91
	Refreshing keys or registrations on the existing coordination points for server-based fencing using the installer	99
	Setting the order of existing coordination points for server-based fencing using the installer	101

	Setting up non-SCSI-3 I/O fencing in virtual environments using installer	104
	Setting up majority-based I/O fencing using installer	106
	Enabling or disabling the preferred fencing policy	108
Chapter 6	Manually configuring SFHA clusters for data integrity	111
	Setting up disk-based I/O fencing manually	111
	Removing permissions for communication	112
	Identifying disks to use as coordinator disks	112
	Setting up coordinator disk groups	113
	Creating I/O fencing configuration files	113
	Modifying VCS configuration to use I/O fencing	114
	Verifying I/O fencing configuration	116
	Setting up server-based I/O fencing manually	116
	Preparing the CP servers manually for use by the SFHA cluster	117
	Generating the client key and certificates manually on the client nodes	119
	Configuring server-based fencing on the SFHA cluster manually	121
	Configuring CoordPoint agent to monitor coordination points	127
	Verifying server-based I/O fencing configuration	129
	Setting up non-SCSI-3 fencing in virtual environments manually	129
	Sample /etc/vxfenmode file for non-SCSI-3 fencing	131
	Setting up majority-based I/O fencing manually	135
	Creating I/O fencing configuration files	135
	Modifying VCS configuration to use I/O fencing	135
	Verifying I/O fencing configuration	137
Chapter 7	Performing an automated SFHA configuration using response files	139
	Configuring SFHA using response files	139
	Response file variables to configure SFHA	140
	Sample response file for SFHA configuration	149
Chapter 8	Performing an automated I/O fencing configuration using response files	151
	Configuring I/O fencing using response files	151
	Response file variables to configure disk-based I/O fencing	152
	Sample response file for configuring disk-based I/O fencing	155

	Response file variables to configure server-based I/O fencing	156
	Sample response file for configuring server-based I/O fencing	158
	Sample response file for configuring non-SCSI-3 I/O fencing	159
	Response file variables to configure non-SCSI-3 I/O fencing	159
	Response file variables to configure majority-based I/O fencing	161
	Sample response file for configuring majority-based I/O fencing	162
Section 3	Upgrade of SFHA	163
Chapter 9	Planning to upgrade SFHA	164
	About the upgrade	164
	Supported upgrade paths	165
	Considerations for upgrading SFHA to 7.2 on systems configured with an Oracle resource	166
	Preparing to upgrade SFHA	166
	Getting ready for the upgrade	166
	Preparing for an upgrade of Storage Foundation and High Availability	168
	Creating backups	168
	Pre-upgrade planning for Volume Replicator	169
	Preparing to upgrade VVR when VCS agents are configured	172
	Verifying that the file systems are clean	175
	Upgrading the array support	176
	Using Install Bundles to simultaneously install or upgrade full releases (base, maintenance, rolling patch), and individual patches	177
Chapter 10	Upgrading Storage Foundation and High Availability	180
	Upgrading Storage Foundation and High Availability with the product installer	180
	Upgrade Storage Foundation and High Availability and AIX on a DMP-enabled rootvg	182
	Upgrading from prior version of SFHA on AIX 7.1 to SFHA 7.2 on a DMP-enabled rootvg	183
	Upgrading the operating system from AIX 7.1 to AIX 7.2 in Veritas InfoScale 7.2	183
	Upgrading the AIX operating system	184
	Upgrading Volume Replicator	185
	Upgrading VVR without disrupting replication	185
	Upgrading SFDB	187

Chapter 11	Performing a rolling upgrade of SFHA	188
	About rolling upgrade	188
	Performing a rolling upgrade using the product installer	191
Chapter 12	Performing a phased upgrade of SFHA	195
	About phased upgrade	195
	Prerequisites for a phased upgrade	195
	Planning for a phased upgrade	196
	Phased upgrade limitations	196
	Phased upgrade example	196
	Phased upgrade example overview	197
	Performing a phased upgrade using the product installer	198
	Moving the service groups to the second subcluster	198
	Upgrading the operating system on the first subcluster	201
	Upgrading the first subcluster	202
	Preparing the second subcluster	202
	Activating the first subcluster	206
	Upgrading the operating system on the second subcluster	207
	Upgrading the second subcluster	208
	Finishing the phased upgrade	208
Chapter 13	Performing an automated SFHA upgrade using response files	212
	Upgrading SFHA using response files	212
	Response file variables to upgrade SFHA	213
	Sample response file for SFHA upgrade	215
Chapter 14	Performing post-upgrade tasks	217
	Optional configuration steps	217
	Recovering VVR if automatic upgrade fails	218
	Post-upgrade tasks when VCS agents for VVR are configured	218
	Unfreezing the service groups	218
	Restoring the original configuration when VCS agents are configured	219
	CVM master node needs to assume the logowner role for VCS managed VVR resources	221
	Resetting DAS disk names to include host name in FSS environments	222
	Upgrading disk layout versions	222
	Upgrading VxVM disk group versions	223

	Updating variables	224
	Setting the default disk group	224
	About enabling LDAP authentication for clusters that run in secure mode	224
	Enabling LDAP authentication for clusters that run in secure mode	226
	Verifying the Storage Foundation and High Availability upgrade	230
Section 4	Post-installation tasks	231
Chapter 15	Performing post-installation tasks	232
	Switching on Quotas	232
	About configuring authentication for SFDB tools	232
	Configuring vxdbd for SFDB tools authentication	233
Section 5	Adding and removing nodes	234
Chapter 16	Adding a node to SFHA clusters	235
	About adding a node to a cluster	235
	Before adding a node to a cluster	236
	Adding a node to a cluster using the Veritas InfoScale installer	238
	Adding the node to a cluster manually	241
	Starting Veritas Volume Manager (VxVM) on the new node	242
	Configuring cluster processes on the new node	243
	Setting up the node to run in secure mode	244
	Starting fencing on the new node	245
	Configuring the ClusterService group for the new node	245
	Adding a node using response files	246
	Response file variables to add a node to a SFHA cluster	246
	Sample response file for adding a node to a SFHA cluster	247
	Configuring server-based fencing on the new node	247
	Adding the new node to the vxfen service group	248
	After adding the new node	248
	Adding nodes to a cluster that is using authentication for SFDB tools	249
	Updating the Storage Foundation for Databases (SFDB) repository after adding a node	250

Chapter 17	Removing a node from SFHA clusters	251
	Removing a node from a SFHA cluster	251
	Verifying the status of nodes and service groups	252
	Deleting the departing node from SFHA configuration	253
	Modifying configuration files on each remaining node	256
	Removing the node configuration from the CP server	256
	Removing security credentials from the leaving node	257
	Unloading LLT and GAB and removing Veritas InfoScale Availability or Enterprise on the departing node	257
	Updating the Storage Foundation for Databases (SFDB) repository after removing a node	259
Section 6	Configuration and upgrade reference	260
Appendix A	Installation scripts	261
	Installation script options	261
	About using the postcheck option	266
Appendix B	SFHA services and ports	269
	About InfoScale Enterprise services and ports	269
Appendix C	Configuration files	271
	About the LLT and GAB configuration files	271
	About the AMF configuration files	274
	About the VCS configuration files	275
	Sample main.cf file for VCS clusters	276
	Sample main.cf file for global clusters	277
	About I/O fencing configuration files	279
	Sample configuration files for CP server	281
	Sample main.cf file for CP server hosted on a single node that runs VCS	282
	Sample main.cf file for CP server hosted on a two-node SFHA cluster	284
	Sample CP server configuration (/etc/vxcps.conf) file output	287

Appendix D	Configuring the secure shell or the remote shell for communications	288
	About configuring secure shell or remote shell communication modes before installing products	288
	Manually configuring passwordless ssh	289
	Setting up ssh and rsh connection using the installer -comsetup command	293
	Setting up ssh and rsh connection using the pwdutil.pl utility	294
	Restarting the ssh session	297
	Enabling rsh for AIX	298
Appendix E	Sample SFHA cluster setup diagrams for CP server-based I/O fencing	299
	Configuration diagrams for setting up server-based I/O fencing	299
	Two unique client clusters served by 3 CP servers	299
	Client cluster served by highly available CPS and 2 SCSI-3 disks	300
	Two node campus cluster served by remote CP server and 2 SCSI-3 disks	301
	Multiple client clusters served by highly available CP server and 2 SCSI-3 disks	303
Appendix F	Changing NFS server major numbers for VxVM volumes	304
	Changing NFS server major numbers for VxVM volumes	304
Appendix G	Configuring LLT over UDP	306
	Using the UDP layer for LLT	306
	When to use LLT over UDP	306
	Manually configuring LLT over UDP using IPv4	306
	Broadcast address in the /etc/lldtab file	307
	The link command in the /etc/lldtab file	308
	The set-addr command in the /etc/lldtab file	308
	Selecting UDP ports	309
	Configuring the netmask for LLT	310
	Configuring the broadcast address for LLT	311
	Sample configuration: direct-attached links	311
	Sample configuration: links crossing IP routers	312
	Using the UDP layer of IPv6 for LLT	314
	When to use LLT over UDP	314

Manually configuring LLT over UDP using IPv6	314
Sample configuration: direct-attached links	314
Sample configuration: links crossing IP routers	316
Index	318

Introduction to SFHA

- [Chapter 1. Introducing Storage Foundation and High Availability](#)

Introducing Storage Foundation and High Availability

This chapter includes the following topics:

- [About Storage Foundation High Availability](#)
- [About Veritas InfoScale Operations Manager](#)
- [About Storage Foundation and High Availability features](#)
- [About Veritas Services and Operations Readiness Tools \(SORT\)](#)
- [About configuring SFHA clusters for data integrity](#)

About Storage Foundation High Availability

Storage Foundation High Availability (SFHA) includes the following:

Storage Foundation

Storage Foundation includes the following:

- Veritas File System (VxFS) is a high-performance journaling file system that provides easy management and quick-recovery for applications. Veritas File System delivers scalable performance, continuous availability, increased I/O throughput, and structural integrity.
- Veritas Volume Manager (VxVM) removes the physical limitations of disk storage. You can configure, share, manage, and optimize storage I/O performance online without interrupting data availability. Veritas Volume Manager also provides easy-to-use, online storage management tools to reduce downtime.

VxFS and VxVM are a part of all Storage Foundation products. Do not install or update VxFS or VxVM as individual components.

Cluster Server (VCS)

Cluster Server is a clustering solution that provides the following benefits:

- Reduces application downtime
- Facilitates the consolidation and the failover of servers
- Manages a range of applications in heterogeneous environments

Veritas agents

Veritas agents provide high availability for specific resources and applications. Each agent manages resources of a particular type. For example, the Oracle agent manages Oracle databases. Agents typically start, stop, and monitor resources and report state changes.

About Veritas Replicator Option

Veritas Replicator Option is an optional, separately-licensable feature.

Volume Replicator replicates data to remote locations over any standard IP network to provide continuous data availability and disaster recovery.

About Veritas InfoScale Operations Manager

Veritas InfoScale Operations Manager provides a centralized management console for Veritas InfoScale products. You can use Veritas InfoScale Operations Manager to monitor, visualize, and manage storage resources and generate reports.

Veritas recommends using Veritas InfoScale Operations Manager to manage Storage Foundation and Cluster Server environments.

You can download Veritas InfoScale Operations Manager from <https://sort.veritas.com/>.

Refer to the Veritas InfoScale Operations Manager documentation for installation, upgrade, and configuration instructions.

The Veritas Enterprise Administrator (VEA) console is no longer packaged with Veritas InfoScale products. If you want to continue using VEA, a software version is available for download from <https://www.veritas.com/product/storage-management/infoscale-operations-manager>. Storage Foundation Management Server is deprecated.

If you want to manage a single cluster using Cluster Manager (Java Console), a version is available for download from <https://www.veritas.com/product/storage-management/infoscale-operations-manager>. You cannot manage the new features of this release using the Java Console. Cluster Server Management Console is deprecated.

About Storage Foundation and High Availability features

The following section describes different features in the Storage Foundation and High Availability product.

About LLT and GAB

VCS uses two components, LLT and GAB, to share data over private networks among systems. These components provide the performance and reliability that VCS requires.

LLT (Low Latency Transport) provides fast kernel-to-kernel communications, and monitors network connections.

GAB (Group Membership and Atomic Broadcast) provides globally ordered message that is required to maintain a synchronized state among the nodes.

About I/O fencing

I/O fencing protects the data on shared disks when nodes in a cluster detect a change in the cluster membership that indicates a split-brain condition.

The fencing operation determines the following:

- The nodes that must retain access to the shared storage
- The nodes that must be ejected from the cluster

This decision prevents possible data corruption. The installer installs the I/O fencing driver, part of VRTSvxfen files, when you install Veritas InfoScale Enterprise. To protect data on shared disks, you must configure I/O fencing after you install Veritas InfoScale Enterprise and configure SFHA.

I/O fencing modes - disk-based and server-based I/O fencing - use coordination points for arbitration in the event of a network partition. Whereas, majority-based I/O fencing mode does not use coordination points for arbitration. With majority-based I/O fencing you may experience loss of high availability in some cases. You can configure disk-based, server-based, or majority-based I/O fencing:

Disk-based I/O fencing	<p>I/O fencing that uses coordinator disks is referred to as disk-based I/O fencing.</p> <p>Disk-based I/O fencing ensures data integrity in a single cluster.</p>
Server-based I/O fencing	<p>I/O fencing that uses at least one CP server system is referred to as server-based I/O fencing.</p> <p>Server-based fencing can include only CP servers, or a mix of CP servers and coordinator disks.</p> <p>Server-based I/O fencing ensures data integrity in clusters.</p> <p>In virtualized environments that do not support SCSI-3 PR, SFHA supports non-SCSI-3 I/O fencing.</p> <p>See “About I/O fencing for SFHA in virtual machines that do not support SCSI-3 PR” on page 19.</p>
Majority-based I/O fencing	<p>Majority-based I/O fencing mode does not need coordination points to provide protection against data corruption and data consistency in a clustered environment.</p> <p>Use majority-based I/O fencing when there are no additional servers and or shared SCSI-3 disks to be used as coordination points.</p>

See [“ About planning to configure I/O fencing”](#) on page 28.

Note: Veritas recommends that you use I/O fencing to protect your cluster against split-brain situations.

See the *Cluster Server Administrator's Guide*.

About global clusters

Global clusters provide the ability to fail over applications between geographically distributed clusters when disaster occurs. You must add this license during the installation. The installer asks about configuring global clusters.

See the *Cluster Server Administrator's Guide*.

About Veritas Services and Operations Readiness Tools (SORT)

[Veritas Services and Operations Readiness Tools \(SORT\)](#) is a Web site that automates and simplifies some of the most time-consuming administrative tasks. SORT helps you manage your datacenter more efficiently and get the most out of your Veritas products.

SORT can help you do the following:

- | | |
|---|--|
| Prepare for your next installation or upgrade | <ul style="list-style-type: none"> ■ List product installation and upgrade requirements, including operating system versions, memory, disk space, and architecture. ■ Analyze systems to determine if they are ready to install or upgrade Veritas products. ■ Download the latest patches, documentation, and high availability agents from a central repository. ■ Access up-to-date compatibility lists for hardware, software, databases, and operating systems. |
| Manage risks | <ul style="list-style-type: none"> ■ Get automatic email notifications about changes to patches, array-specific modules (ASLs/APMs/DDIs/DDIs), and high availability agents from a central repository. ■ Identify and mitigate system and environmental risks. ■ Display descriptions and solutions for hundreds of Veritas error codes. |
| Improve efficiency | <ul style="list-style-type: none"> ■ Find and download patches based on product version and platform. ■ List installed Veritas products and license keys. ■ Tune and optimize your environment. |

Note: Certain features of SORT are not available for all products. Access to SORT is available at no extra cost.

To access SORT, go to:

<https://sort.veritas.com>

About configuring SFHA clusters for data integrity

When a node fails, SFHA takes corrective action and configures its components to reflect the altered membership. If an actual node failure did not occur and if the symptoms were identical to those of a failed node, then such corrective action would cause a split-brain situation.

Some example scenarios that can cause such split-brain situations are as follows:

- **Broken set of private networks**
If a system in a two-node cluster fails, the system stops sending heartbeats over the private interconnects. The remaining node then takes corrective action. The failure of the private interconnects, instead of the actual nodes, presents identical symptoms and causes each node to determine its peer has departed. This situation typically results in data corruption because both nodes try to take control of data storage in an uncoordinated manner.
- **System that appears to have a system-hang**
If a system is so busy that it appears to stop responding, the other nodes could declare it as dead. This declaration may also occur for the nodes that use the hardware that supports a "break" and "resume" function. When a node drops to PROM level with a break and subsequently resumes operations, the other nodes may declare the system dead. They can declare it dead even if the system later returns and begins write operations.

I/O fencing is a feature that prevents data corruption in the event of a communication breakdown in a cluster. SFHA uses I/O fencing to remove the risk that is associated with split-brain. I/O fencing allows write access for members of the active cluster. It blocks access to storage from non-members so that even a node that is alive is unable to cause damage.

After you install Veritas InfoScale Enterprise and configure SFHA, you must configure I/O fencing in SFHA to ensure data integrity.

See “[About planning to configure I/O fencing](#)” on page 28.

About I/O fencing for SFHA in virtual machines that do not support SCSI-3 PR

In a traditional I/O fencing implementation, where the coordination points are coordination point servers (CP servers) or coordinator disks, Clustered Volume Manager (CVM) and Veritas I/O fencing modules provide SCSI-3 persistent reservation (SCSI-3 PR) based protection on the data disks. This SCSI-3 PR

protection ensures that the I/O operations from the losing node cannot reach a disk that the surviving sub-cluster has already taken over.

See the *Cluster Server Administrator's Guide* for more information on how I/O fencing works.

In virtualized environments that do not support SCSI-3 PR, SFHA attempts to provide reasonable safety for the data disks. SFHA requires you to configure non-SCSI-3 I/O fencing in such environments. Non-SCSI-3 fencing either uses server-based I/O fencing with only CP servers as coordination points or majority-based I/O fencing, which does not use coordination points, along with some additional configuration changes to support such environments.

See [“Setting up non-SCSI-3 I/O fencing in virtual environments using installer”](#) on page 104.

See [“Setting up non-SCSI-3 fencing in virtual environments manually”](#) on page 129.

About I/O fencing components

The shared storage for SFHA must support SCSI-3 persistent reservations to enable I/O fencing. SFHA involves two types of shared storage:

- Data disks—Store shared data
See [“About data disks”](#) on page 20.
- Coordination points—Act as a global lock during membership changes
See [“About coordination points”](#) on page 20.

About data disks

Data disks are standard disk devices for data storage and are either physical disks or RAID Logical Units (LUNs).

These disks must support SCSI-3 PR and must be part of standard VxVM disk groups. VxVM is responsible for fencing data disks on a disk group basis. Disks that are added to a disk group and new paths that are discovered for a device are automatically fenced.

About coordination points

Coordination points provide a lock mechanism to determine which nodes get to fence off data drives from other nodes. A node must eject a peer from the coordination points before it can fence the peer from the data drives. SFHA prevents split-brain when vxfen races for control of the coordination points and the winner partition fences the ejected nodes from accessing the data disks.

Note: Typically, a fencing configuration for a cluster must have three coordination points. Veritas also supports server-based fencing with a single CP server as its only coordination point with a caveat that this CP server becomes a single point of failure.

The coordination points can either be disks or servers or both.

- **Coordinator disks**

Disks that act as coordination points are called coordinator disks. Coordinator disks are three standard disks or LUNs set aside for I/O fencing during cluster reconfiguration. Coordinator disks do not serve any other storage purpose in the SFHA configuration.

You can configure coordinator disks to use Veritas Volume Manager's Dynamic Multi-pathing (DMP) feature. Dynamic Multi-pathing (DMP) allows coordinator disks to take advantage of the path failover and the dynamic adding and removal capabilities of DMP. So, you can configure I/O fencing to use DMP devices. I/O fencing uses SCSI-3 disk policy that is dmp-based on the disk device that you use.

Note: The dmp disk policy for I/O fencing supports both single and multiple hardware paths from a node to the coordinator disks. If few coordinator disks have multiple hardware paths and few have a single hardware path, then we support only the dmp disk policy. For new installations, Veritas only supports dmp disk policy for IO fencing even for a single hardware path.

See the *Storage Foundation Administrator's Guide*.

- **Coordination point servers**

The coordination point server (CP server) is a software solution which runs on a remote system or cluster. CP server provides arbitration functionality by allowing the SFHA cluster nodes to perform the following tasks:

- Self-register to become a member of an active SFHA cluster (registered with CP server) with access to the data drives
- Check which other nodes are registered as members of this active SFHA cluster
- Self-unregister from this active SFHA cluster
- Forcefully unregister other nodes (preempt) as members of this active SFHA cluster

In short, the CP server functions as another arbitration mechanism that integrates within the existing I/O fencing module.

Note: With the CP server, the fencing arbitration logic still remains on the SFHA cluster.

Multiple SFHA clusters running different operating systems can simultaneously access the CP server. TCP/IP based communication is used between the CP server and the SFHA clusters.

About preferred fencing

The I/O fencing driver uses coordination points to prevent split-brain in a VCS cluster. By default, the fencing driver favors the subcluster with maximum number of nodes during the race for coordination points. With the preferred fencing feature, you can specify how the fencing driver must determine the surviving subcluster.

You can configure the preferred fencing policy using the cluster-level attribute PreferredFencingPolicy for the following:

- Enable system-based preferred fencing policy to give preference to high capacity systems.
- Enable group-based preferred fencing policy to give preference to service groups for high priority applications.
- Enable site-based preferred fencing policy to give preference to sites with higher priority.
- Disable preferred fencing policy to use the default node count-based race policy.

See the *Cluster Server Administrator's Guide* for more details.

See [“Enabling or disabling the preferred fencing policy”](#) on page 108.

Configuration of SFHA

- [Chapter 2. Preparing to configure](#)
- [Chapter 3. Preparing to configure SFHA clusters for data integrity](#)
- [Chapter 4. Configuring SFHA](#)
- [Chapter 5. Configuring SFHA clusters for data integrity](#)
- [Chapter 6. Manually configuring SFHA clusters for data integrity](#)
- [Chapter 7. Performing an automated SFHA configuration using response files](#)
- [Chapter 8. Performing an automated I/O fencing configuration using response files](#)

Preparing to configure

This chapter includes the following topics:

- [I/O fencing requirements](#)

I/O fencing requirements

Depending on whether you plan to configure disk-based fencing or server-based fencing, make sure that you meet the requirements for coordination points:

- Coordinator disks
See [“Coordinator disk requirements for I/O fencing”](#) on page 24.
- CP servers
See [“CP server requirements”](#) on page 25.

If you have installed Veritas InfoScale Enterprise in a virtual environment that is not SCSI-3 PR compliant, review the requirements to configure non-SCSI-3 fencing.

See [“Non-SCSI-3 I/O fencing requirements”](#) on page 27.

Coordinator disk requirements for I/O fencing

Make sure that the I/O fencing coordinator disks meet the following requirements:

- For disk-based I/O fencing, you must have at least three coordinator disks or there must be odd number of coordinator disks.
- The coordinator disks must be DMP devices.
- Each of the coordinator disks must use a physically separate disk or LUN. Veritas recommends using the smallest possible LUNs for coordinator disks.
- Each of the coordinator disks should exist on a different disk array, if possible.
- The coordinator disks must support SCSI-3 persistent reservations.

- Coordinator devices can be attached over iSCSI protocol but they must be DMP devices and must support SCSI-3 persistent reservations.
- Veritas recommends using hardware-based mirroring for coordinator disks.
- Coordinator disks must not be used to store data or must not be included in disk groups that store user data.
- Coordinator disks cannot be the special devices that array vendors use. For example, you cannot use EMC gatekeeper devices as coordinator disks.
- The coordinator disk size must be at least 128 MB.

CP server requirements

SFHA 7.2 clusters (application clusters) support coordination point servers (CP servers) that are hosted on the following VCS and SFHA versions:

- VCS 6.1 or later single-node cluster
- SFHA 6.1 or later cluster

Upgrade considerations for CP servers

- Upgrade VCS or SFHA on CP servers to version 7.2 if the current release version is prior to version 6.1.
- You do not need to upgrade CP servers to version 7.2 if the release version is 6.1 or later.
- CP servers on version 6.1 or later support HTTPS-based communication with application clusters on version 6.1 or later.
- CP servers on version 6.1 to 7.0 support IPM-based communication with application clusters on versions before 6.1.
- You need to configure VIPs for HTTPS-based communication if release version of application clusters is 6.1 or later.

Make sure that you meet the basic hardware requirements for the VCS/SFHA cluster to host the CP server.

See the *Veritas InfoScale™ Installation Guide*.

Note: While Veritas recommends at least three coordination points for fencing, a single CP server as coordination point is a supported server-based fencing configuration. Such single CP server fencing configuration requires that the coordination point be a highly available CP server that is hosted on an SFHA cluster.

Make sure you meet the following additional CP server requirements which are covered in this section before you install and configure CP server:

- Hardware requirements
- Operating system requirements
- Networking requirements (and recommendations)
- Security requirements

[Table 2-1](#) lists additional requirements for hosting the CP server.

Table 2-1 CP server hardware requirements

Hardware required	Description
Disk space	To host the CP server on a VCS cluster or SFHA cluster, each host requires the following file system space: <ul style="list-style-type: none"> ■ 550 MB in the /opt directory (additionally, the language pack requires another 15 MB) ■ 300 MB in /usr ■ 20 MB in /var ■ 10 MB in /etc (for the CP server database)
Storage	When CP server is hosted on an SFHA cluster, there must be shared storage between the nodes of this SFHA cluster.
RAM	Each CP server requires at least 512 MB.
Network	Network hardware capable of providing TCP/IP connection between CP servers and SFHA clusters (application clusters).

[Table 2-2](#) displays the CP server supported operating systems and versions. An application cluster can use a CP server that runs any of the following supported operating systems.

Table 2-2 CP server supported operating systems and versions

CP server	Operating system and version
CP server hosted on a VCS single-node cluster or on an SFHA cluster	<p>CP server supports any of the following operating systems:</p> <ul style="list-style-type: none"> ■ AIX 7.1 and 7.2 <p>Review other details such as supported operating system levels and architecture for the supported operating systems.</p> <p>See the <i>Veritas InfoScale 7.2 Release Notes</i> for that platform.</p>

Following are the CP server networking requirements and recommendations:

- Veritas recommends that network access from the application clusters to the CP servers should be made highly-available and redundant. The network connections require either a secure LAN or VPN.
- The CP server uses the TCP/IP protocol to connect to and communicate with the application clusters by these network paths. The CP server listens for messages from the application clusters using TCP port 443 if the communication happens over the HTTPS protocol. TCP port 443 is the default port that can be changed while you configure the CP server.
Veritas recommends that you configure multiple network paths to access a CP server. If a network path fails, CP server does not require a restart and continues to listen on all the other available virtual IP addresses.
- The CP server only supports Internet Protocol version 4 (IPv4) when communicating with the application clusters over the HTTPS protocol.
- When placing the CP servers within a specific network configuration, you must take into consideration the number of hops from the different application cluster nodes to the CP servers. As a best practice, Veritas recommends that the number of hops and network latency from the different application cluster nodes to the CP servers should be equal. This ensures that if an event occurs that results in an I/O fencing scenario, there is no bias in the race due to difference in number of hops or network latency between the CPS and various nodes.

For communication between the SFHA cluster (application cluster) and CP server, review the following support matrix:

For information about establishing secure communications between the application cluster and CP server, see the *Cluster Server Administrator's Guide*.

Non-SCSI-3 I/O fencing requirements

Supported virtual environment for non-SCSI-3 fencing:

- IBM P Server LPARs with VIOS running
Guest operating system: AIX 7.1 or 7.2

Make sure that you also meet the following requirements to configure fencing in the virtual environments that do not support SCSI-3 PR:

- SFHA must be configured with Cluster attribute UseFence set to SCSI3
- For server-based I/O fencing, all coordination points must be CP servers

Preparing to configure SFHA clusters for data integrity

This chapter includes the following topics:

- [About planning to configure I/O fencing](#)
- [Setting up the CP server](#)

About planning to configure I/O fencing

After you configure SFHA with the installer, you must configure I/O fencing in the cluster for data integrity. Application clusters on release version 7.2 (HTTPS-based communication) only support CP servers on release version 6.1 and later.

You can configure disk-based I/O fencing, server-based I/O fencing, or majority-based I/O fencing. If your enterprise setup has multiple clusters that use VCS for clustering, Veritas recommends you to configure server-based I/O fencing.

The coordination points in server-based fencing can include only CP servers or a mix of CP servers and coordinator disks.

Veritas also supports server-based fencing with a single coordination point which is a single highly available CP server that is hosted on an SFHA cluster.

Warning: For server-based fencing configurations that use a single coordination point (CP server), the coordination point becomes a single point of failure. In such configurations, the arbitration facility is not available during a failover of the CP server in the SFHA cluster. So, if a network partition occurs on any application cluster during the CP server failover, the application cluster is brought down. Veritas recommends the use of single CP server-based fencing only in test environments.

You use majority fencing mechanism if you do not want to use coordination points to protect your cluster. Veritas recommends that you configure I/O fencing in majority mode if you have a smaller cluster environment and you do not want to invest additional disks or servers for the purposes of configuring fencing.

Note: Majority-based I/O fencing is not as robust as server-based or disk-based I/O fencing in terms of high availability. With majority-based fencing mode, in rare cases, the cluster might become unavailable.

If you have installed SFHA in a virtual environment that is not SCSI-3 PR compliant, you can configure non-SCSI-3 fencing.

See [Figure 3-2](#) on page 31.

[Figure 3-1](#) illustrates a high-level flowchart to configure I/O fencing for the SFHA cluster.

Figure 3-1 Workflow to configure I/O fencing

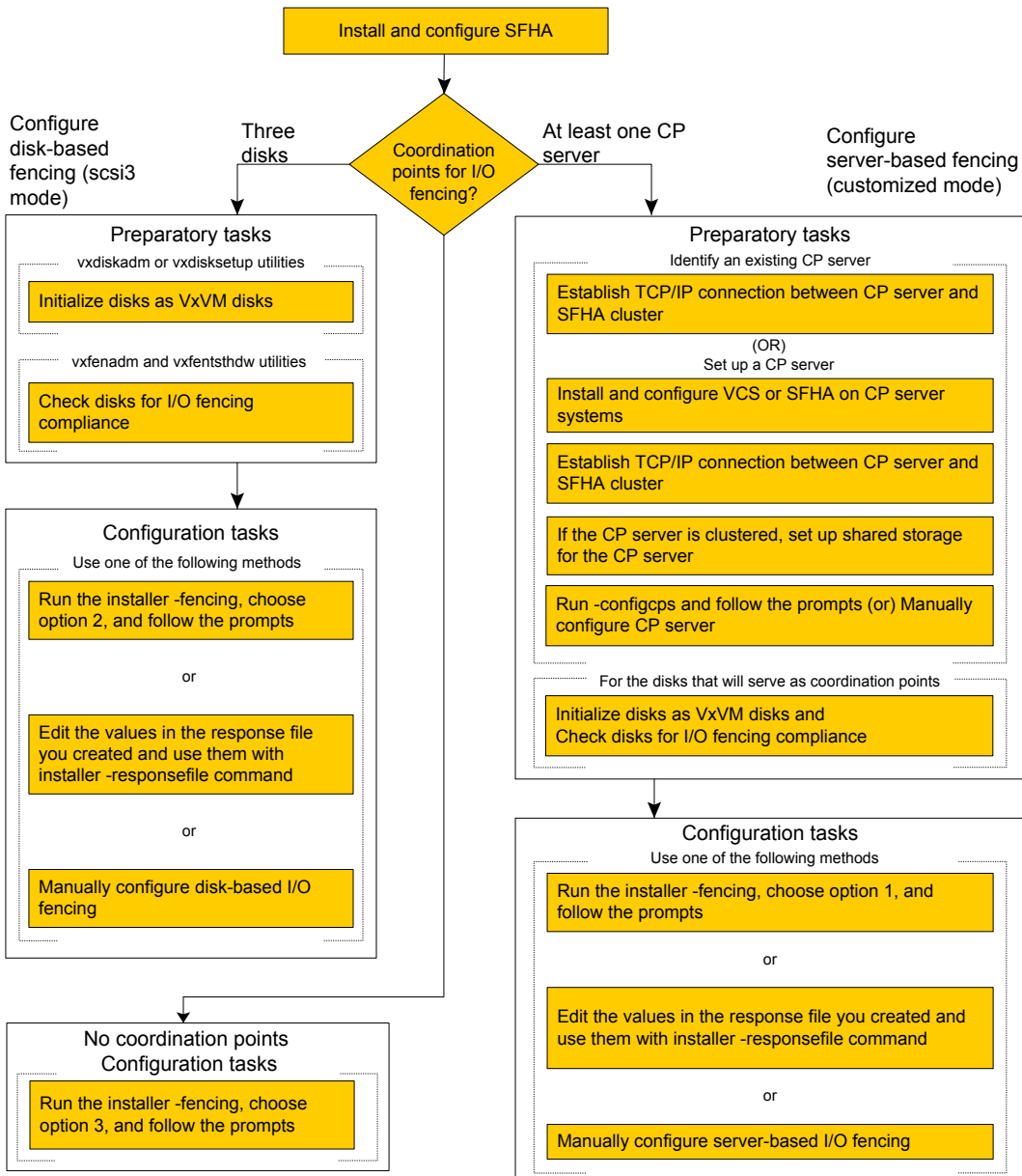
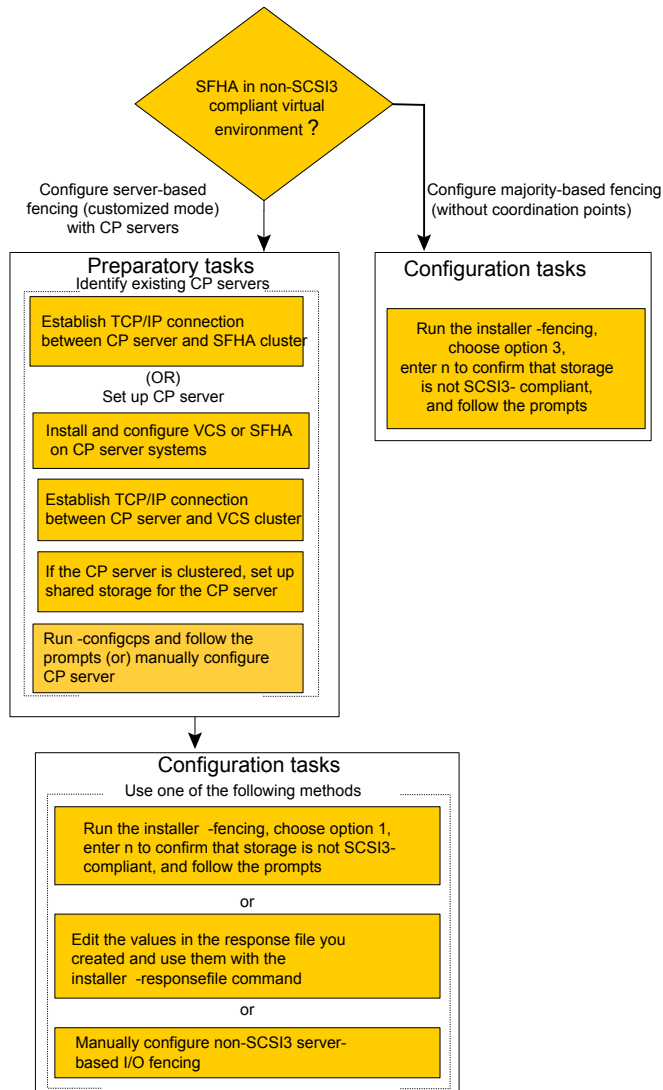


Figure 3-2 illustrates a high-level flowchart to configure non-SCSI-3 I/O fencing for the SFHA cluster in virtual environments that do not support SCSI-3 PR.

Figure 3-2 Workflow to configure non-SCSI-3 I/O fencing



After you perform the preparatory tasks, you can use any of the following methods to configure I/O fencing:

Using the installer	<p>See “Setting up disk-based I/O fencing using installer” on page 81.</p> <p>See “Setting up server-based I/O fencing using installer” on page 91.</p> <p>See “Setting up non-SCSI-3 I/O fencing in virtual environments using installer” on page 104.</p> <p>See “Setting up majority-based I/O fencing using installer” on page 106.</p>
Using response files	<p>See “Response file variables to configure disk-based I/O fencing” on page 152.</p> <p>See “Response file variables to configure server-based I/O fencing” on page 156.</p> <p>See “Response file variables to configure non-SCSI-3 I/O fencing” on page 159.</p> <p>See “Response file variables to configure majority-based I/O fencing” on page 161.</p> <p>See “Configuring I/O fencing using response files” on page 151.</p>
Manually editing configuration files	<p>See “Setting up disk-based I/O fencing manually” on page 111.</p> <p>See “Setting up server-based I/O fencing manually” on page 116.</p> <p>See “Setting up non-SCSI-3 fencing in virtual environments manually” on page 129.</p> <p>See “Setting up majority-based I/O fencing manually ” on page 135.</p>

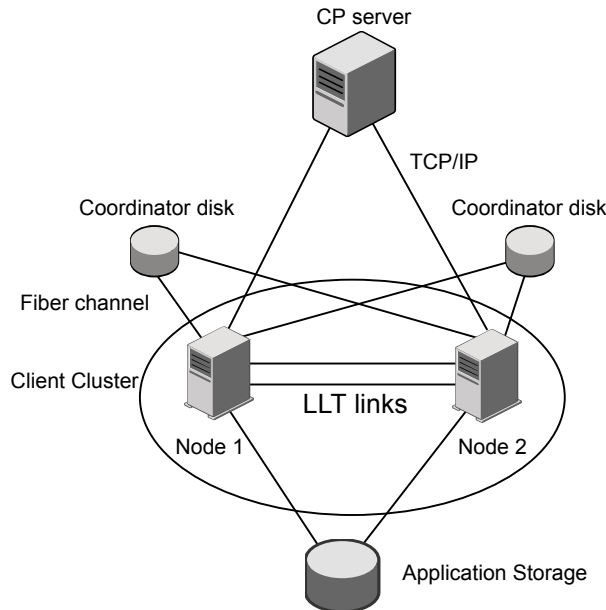
You can also migrate from one I/O fencing configuration to another.

See the *Storage foundation High Availability Administrator’s Guide* for more details.

Typical SFHA cluster configuration with server-based I/O fencing

[Figure 3-3](#) displays a configuration using a SFHA cluster (with two nodes), a single CP server, and two coordinator disks. The nodes within the SFHA cluster are connected to and communicate with each other using LLT links.

Figure 3-3 CP server, SFHA cluster, and coordinator disks



Recommended CP server configurations

Following are the recommended CP server configurations:

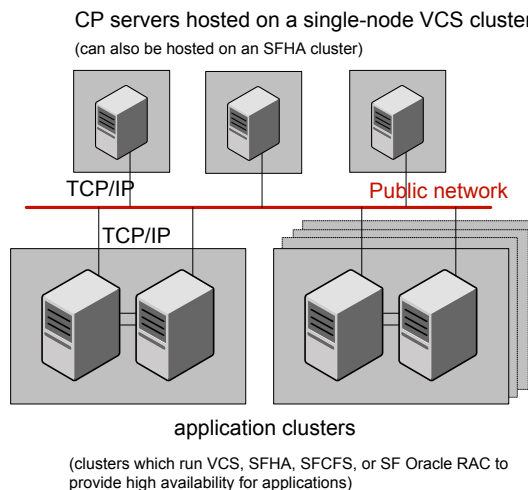
- Multiple application clusters use three CP servers as their coordination points
 See [Figure 3-4](#) on page 34.
- Multiple application clusters use a single CP server and single or multiple pairs of coordinator disks (two) as their coordination points
 See [Figure 3-5](#) on page 35.
- Multiple application clusters use a single CP server as their coordination point
 This single coordination point fencing configuration must use a highly available CP server that is configured on an SFHA cluster as its coordination point.
 See [Figure 3-6](#) on page 35.

Warning: In a single CP server fencing configuration, arbitration facility is not available during a failover of the CP server in the SFHA cluster. So, if a network partition occurs on any application cluster during the CP server failover, the application cluster is brought down.

Although the recommended CP server configurations use three coordination points, you can use more than three coordination points for I/O fencing. Ensure that the total number of coordination points you use is an odd number. In a configuration where multiple application clusters share a common set of CP server coordination points, the application cluster as well as the CP server use a Universally Unique Identifier (UUID) to uniquely identify an application cluster.

[Figure 3-4](#) displays a configuration using three CP servers that are connected to multiple application clusters.

Figure 3-4 Three CP servers connecting to multiple application clusters



[Figure 3-5](#) displays a configuration using a single CP server that is connected to multiple application clusters with each application cluster also using two coordinator disks.

Figure 3-5 Single CP server with two coordinator disks for each application cluster

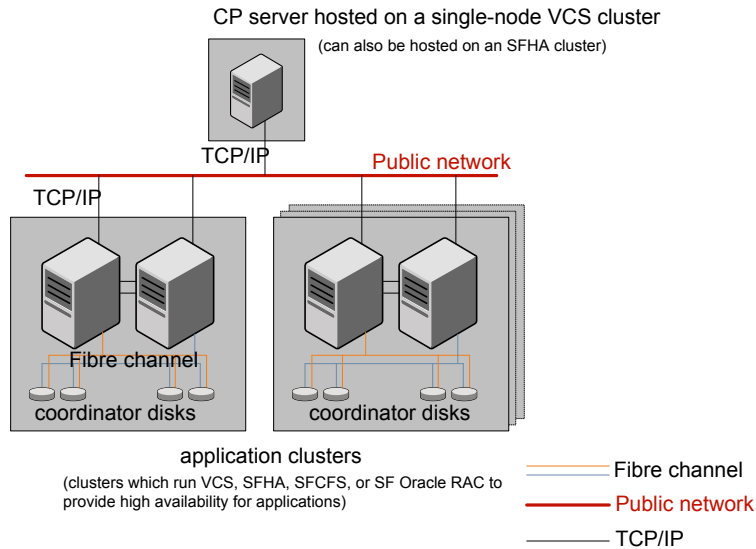
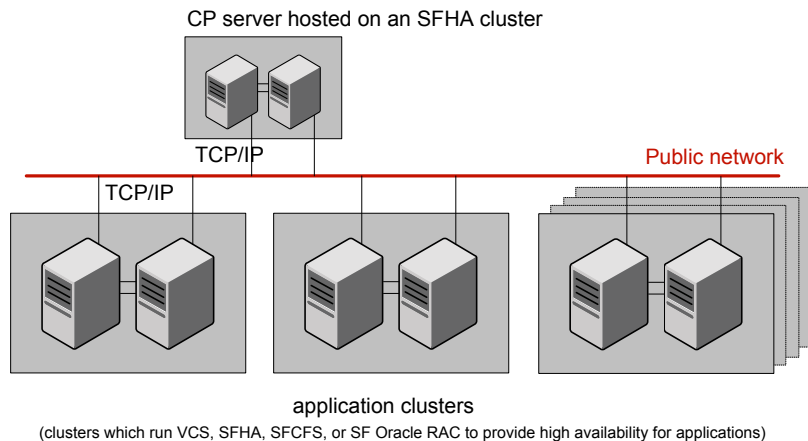


Figure 3-6 displays a configuration using a single CP server that is connected to multiple application clusters.

Figure 3-6 Single CP server connecting to multiple application clusters



See “[Configuration diagrams for setting up server-based I/O fencing](#)” on page 299.

Setting up the CP server

[Table 3-1](#) lists the tasks to set up the CP server for server-based I/O fencing.

Table 3-1 Tasks to set up CP server for server-based I/O fencing

Task	Reference
Plan your CP server setup	See “Planning your CP server setup” on page 36.
Install the CP server	See “Installing the CP server using the installer” on page 37.
Configure the CP server cluster in secure mode	See “Configuring the CP server cluster in secure mode” on page 38.
Set up shared storage for the CP server database	See “Setting up shared storage for the CP server database” on page 38.
Configure the CP server	See “Configuring the CP server using the installer program” on page 39. See “Configuring the CP server manually” on page 48. See “Configuring CP server using response files” on page 53.
Verify the CP server configuration	See “Verifying the CP server configuration” on page 57.

Planning your CP server setup

Follow the planning instructions to set up CP server for server-based I/O fencing.

To plan your CP server setup

- 1 Decide whether you want to host the CP server on a single-node VCS cluster, or on an SFHA cluster.

Veritas recommends hosting the CP server on an SFHA cluster to make the CP server highly available.
- 2 If you host the CP server on an SFHA cluster, review the following information. Make sure you make the decisions and meet these prerequisites when you set up the CP server:
 - You must set up shared storage for the CP server database during your CP server setup.

- Decide whether you want to configure server-based fencing for the SFHA cluster (application cluster) with a single CP server as coordination point or with at least three coordination points.
Veritas recommends using at least three coordination points.
- 3** Set up the hardware and network for your CP server.
See [“CP server requirements”](#) on page 25.
- 4** Have the following information handy for CP server configuration:
- Name for the CP server
The CP server name should not contain any special characters. CP server name can include alphanumeric characters, underscore, and hyphen.
 - Port number for the CP server
Allocate a TCP/IP port for use by the CP server.
Valid port range is between 49152 and 65535. The default port number for HTTPS-based communication is 443.
 - Virtual IP address, network interface, netmask, and networkhosts for the CP server
You can configure multiple virtual IP addresses for the CP server.

Installing the CP server using the installer

Perform the following procedure to install Veritas InfoScale Enterprise and configure VCS or SFHA on CP server systems.

To install Veritas InfoScale Enterprise and configure VCS or SFHA on the CP server systems

- ◆ Depending on whether your CP server uses a single system or multiple systems, perform the following tasks:

CP server setup uses a single system Install Veritas InfoScale Enterprise or Veritas InfoScale Availability and configure VCS to create a single-node VCS cluster.

See the *Veritas InfoScale Installation Guide* for instructions on CP server installation.

See the *Cluster Server Configuration and Upgrade Guide* for configuring VCS.

Proceed to configure the CP server.

See “[Configuring the CP server using the installer program](#)” on page 39.

See “[Configuring the CP server manually](#)” on page 48.

CP server setup uses multiple systems Install Veritas InfoScale Enterprise and configure SFHA to create an SFHA cluster. This makes the CP server highly available.

Proceed to set up shared storage for the CP server database.

Configuring the CP server cluster in secure mode

You must configure security on the CP server only if you want IPM-based (Veritas Product Authentication Service) secure communication between the CP server and the SFHA cluster (CP server clients). However, IPM-based communication enables the CP server to support application clusters prior to release 6.1.

This step secures the HAD communication on the CP server cluster.

Note: If you already configured the CP server cluster in secure mode during the VCS configuration, then skip this section.

To configure the CP server cluster in secure mode

- ◆ Run the installer as follows to configure the CP server cluster in secure mode.

```
# /opt/VRTS/install/installer -security
```

Setting up shared storage for the CP server database

If you configured SFHA on the CP server cluster, perform the following procedure to set up shared storage for the CP server database.

The installer can set up shared storage for the CP server database when you configure CP server for the SFHA cluster.

Veritas recommends that you create a mirrored volume for the CP server database and that you use the VxFS file system type.

To set up shared storage for the CP server database

- 1 Create a disk group containing the disks. You require two disks to create a mirrored volume.

For example:

```
# vxdg init cps_dg disk1 disk2
```

- 2 Create a mirrored volume over the disk group.

For example:

```
# vxassist -g cps_dg make cps_vol volume_size layout=mirror
```

- 3 Create a file system over the volume.

The CP server configuration utility only supports vxfs file system type. If you use an alternate file system, then you must configure CP server manually.

Depending on the operating system that your CP server runs, enter the following command:

```
AIX # mkfs -V vxfs /dev/vx/rdisk/cps_dg/cps_volume
```

Configuring the CP server using the installer program

Use the configcps option available in the installer program to configure the CP server.

Perform one of the following procedures:

For CP servers on single-node VCS cluster:	See “To configure the CP server on a single-node VCS cluster” on page 40.
--	---

For CP servers on an SFHA cluster:	See “To configure the CP server on an SFHA cluster” on page 43.
------------------------------------	---

To configure the CP server on a single-node VCS cluster

- 1 Verify that the `VRTScps` fileset is installed on the node.
- 2 Run the installer program with the `configcps` option.

```
# /opt/VRTS/install/installer -configcps
```

- 3 Installer checks the cluster information and prompts if you want to configure CP Server on the cluster.

Enter **y** to confirm.

- 4 Select an option based on how you want to configure Coordination Point server.

```
1) Configure Coordination Point Server on single node VCS system
2) Configure Coordination Point Server on SFHA cluster
3) Unconfigure Coordination Point Server
```

- 5 Enter the option: [1-3,q] **1**.

The installer then runs the following preconfiguration checks:

- Checks to see if a single-node VCS cluster is running with the supported platform.

The CP server requires VCS to be installed and configured before its configuration.

The installer automatically installs a license that is identified as a CP server-specific license. It is installed even if a VCS license exists on the node. CP server-specific key ensures that you do not need to use a VCS license on the single-node. It also ensures that Veritas Operations Manager (VOM) identifies the license on a single-node coordination point server as a CP server-specific license and not as a VCS license.

- 6 Restart the VCS engine if the single-node only has a CP server-specific license.

```
A single node coordination point server will be configured and
VCS will be started in one node mode, do you want to
continue? [y,n,q] (y)
```

- 7 Communication between the CP server and application clusters is secured by using the HTTPS protocol from release 6.1.0 onwards.

Enter the name of the CP Server.

```
Enter the name of the CP Server: [b] cps1
```


- 8 Enter valid virtual IP addresses for the CP Server with HTTPS-based secure communication. A CP Server can be configured with more than one virtual IP address. For HTTPS-based communication, only IPv4 addresses are supported.

```
Enter Virtual IP(s) for the CP server for HTTPS,
separated by a space: [b] 10.200.58.231 10.200.58.232
10.200.58.233
```

Note: Ensure that the virtual IP address of the CP server and the IP address of the NIC interface on the CP server belongs to the same subnet of the IP network. This is required for communication to happen between client nodes and CP server.

- 9 Enter the corresponding CP server port number for each virtual IP address or press **Enter** to accept the default value (443).

```
Enter the default port '443' to be used for all the
virtual IP addresses for HTTPS communication or assign the
corresponding port number in the range [49152, 65535] for
each virtual IP address. Ensure that each port number is
separated by a single
space: [b] (443) 54442 54443 54447
```

- 10 Enter the absolute path of the CP server database or press **Enter** to accept the default value (/etc/VRTScps/db).

```
Enter absolute path of the database: [b] (/etc/VRTScps/db)
```

- 11 Verify and confirm the CP server configuration information.

```
CP Server configuration verification:
-----
CP Server Name: cps1
CP Server Virtual IP(s) for HTTPS: 10.200.58.231, 10.200.58.232,
10.200.58.233
CP Server Port(s) for HTTPS: 54442, 54443, 54447
CP Server Database Dir: /etc/VRTScps/db
-----

Is this information correct? [y,n,q,?] (y)
```

- 12** The installer proceeds with the configuration process, and creates a vxcps.conf configuration file.

```
Successfully generated the /etc/vxcps.conf configuration file
Successfully created directory /etc/VRTScps/db on node
```

- 13** Configure the CP Server Service Group (CPSSG) for this cluster.

```
Enter how many NIC resources you want to configure (1 to 2): 2
```

Answer the following questions for each NIC resource that you want to configure.

- 14** Enter a valid network interface for the virtual IP address for the CP server process.

```
Enter a valid network interface on sys1 for NIC resource - 1: en0
```

```
Enter a valid network interface on sys1 for NIC resource - 2: en1
```

- 15** Enter the NIC resource you want to associate with the virtual IP addresses.

```
Enter the NIC resource you want to associate with the virtual IP 10.200.58.231 (1 to 2): 1
```

```
Enter the NIC resource you want to associate with the virtual IP 10.200.58.232 (1 to 2): 2
```

- 16** Enter the networkhosts information for each NIC resource.

Veritas recommends configuring NetworkHosts attribute to ensure NIC resource to be always online

```
Do you want to add NetworkHosts attribute for the NIC device en0
on system sys1? [y,n,q] y
```

```
Enter a valid IP address to configure NetworkHosts for NIC en0
on system sys1: 10.200.56.22
```

```
Do you want to add another Network Host? [y,n,q] n
```

- 17** Enter the netmask for virtual IP addresses. If you entered an IPv6 address, enter the prefix details at the prompt.

Note that if you are using HTTPS-based communication, only IPv4 addresses are supported.

```
Enter the netmask for virtual IP for
HTTPS 192.169.0.220: (255.255.252.0)
```

- 18** Installer displays the status of the Coordination Point Server configuration. After the configuration process has completed, a success message appears.

For example:

```
Updating main.cf with CPSSG service group.. Done
Successfully added the CPSSG service group to VCS configuration.
Trying to bring CPSSG service group
ONLINE and will wait for upto 120 seconds
```

```
The Veritas coordination point server is ONLINE
```

```
The Veritas coordination point server has
been configured on your system.
```

- 19** Run the `hagrp -state` command to ensure that the CPSSG service group has been added.

For example:

```
# hagrp -state CPSSG
#Group Attribute System Value
CPSSG State.... |ONLINE|
```

It also generates the configuration file for CP server (`/etc/vxcps.conf`). The `vxcpserv` process and other resources are added to the VCS configuration in the CP server service group (CPSSG).

For information about the CPSSG, refer to the *Cluster Server Administrator's Guide*.

To configure the CP server on an SFHA cluster

- 1** Verify that the `VRTScps` fileset is installed on each node.
- 2** Ensure that you have configured passwordless ssh or rsh on the CP server cluster nodes.
- 3** Run the installer program with the `configcps` option.

```
# ./installer -configcps
```

- 4** Specify the systems on which you need to configure the CP server.
- 5** Installer checks the cluster information and prompts if you want to configure CP Server on the cluster.

Enter **y** to confirm.

6 Select an option based on how you want to configure Coordination Point server.

- 1) Configure Coordination Point Server on single node VCS system
- 2) Configure Coordination Point Server on SFHA cluster
- 3) Unconfigure Coordination Point Server

7 Enter **2** at the prompt to configure CP server on an SFHA cluster.

The installer then runs the following preconfiguration checks:

- Checks to see if an SFHA cluster is running with the supported platform.
 The CP server requires SFHA to be installed and configured before its configuration.

8 Communication between the CP server and application clusters is secured by HTTPS from Release 6.1.0 onwards.

Enter the name of the CP server.

Enter the name of the CP Server: [b] **cps1**

9 Enter valid virtual IP addresses for the CP Server. A CP Server can be configured with more than one virtual IP address. For HTTPS-based communication, only IPv4 addresses are supported.

Enter Virtual IP(s) for the CP server for HTTPS,
 separated by a space: [b] **10.200.58.231 10.200.58.232 10.200.58.233**

10 Enter the corresponding CP server port number for each virtual IP address or press Enter to accept the default value (443).

Enter the default port '443' to be used for all the virtual IP addresses for HTTPS communication or assign the corresponding port number in the range [49152, 65535] for each virtual IP address. Ensure that each port number is separated by a single space: [b] **(443) 65535 65534 65537**

11 Enter absolute path of the database.

CP Server uses an internal database to store the client information. As the CP Server is being configured on SFHA cluster, the database should reside on shared storage with vxfs file system. Please refer to documentation for information on setting up of shared storage for CP server database.

Enter absolute path of the database: [b] **/cpsdb**

12 Verify and confirm the CP server configuration information.

CP Server configuration verification:

```
CP Server Name: cps1
CP Server Virtual IP(s) for HTTPS: 10.200.58.231, 10.200.58.232,
10.200.58.233
CP Server Port(s) for HTTPS: 65535, 65534, 65537
CP Server Database Dir: /cpsdb
```

Is this information correct? [y,n,q,?] (y)

13 The installer proceeds with the configuration process, and creates a vxcps.conf configuration file.

```
Successfully generated the /etc/vxcps.conf configuration file
Copying configuration file /etc/vxcps.conf to sys0....Done
Creating mount point /cps_mount_data on sys0. ... Done
Copying configuration file /etc/vxcps.conf to sys0. ... Done
Press Enter to continue.
```

14 Configure CP Server Service Group (CPSSG) for this cluster.

Enter how many NIC resources you want to configure (1 to 2): 2

Answer the following questions for each NIC resource that you want to configure.

15 Enter a valid network interface for the virtual IP address for the CP server process.

Enter a valid network interface on sys1 for NIC resource - 1: en0

Enter a valid network interface on sys1 for NIC resource - 2: en1

16 Enter the NIC resource you want to associate with the virtual IP addresses.

Enter the NIC resource you want to associate with the virtual IP 10.200.58.231 (1 to 2): 1

Enter the NIC resource you want to associate with the virtual IP 10.200.58.232 (1 to 2): 2

17 Enter the networkhosts information for each NIC resource.

Veritas recommends configuring NetworkHosts attribute to ensure NIC resource to be always online

```
Do you want to add NetworkHosts attribute for the NIC device en0
on system sys1? [y,n,q] y
Enter a valid IP address to configure NetworkHosts for NIC en0
on system sys1: 10.200.56.22
```

```
Do you want to add another Network Host? [y,n,q] n
Do you want to apply the same NetworkHosts for all systems? [y,n,q] (y)
```

18 Enter the netmask for virtual IP addresses. If you entered an IPv6 address, enter the prefix details at the prompt.

Note that if you are using HTTPS-based communication, only IPv4 addresses are supported.

```
Enter the netmask for virtual IP for
HTTPS 192.168.0.111: (255.255.252.0)
```

19 Configure a disk group for CP server database. You can choose an existing disk group or create a new disk group.

Veritas recommends to use the disk group that has at least two disks on which mirrored volume can be created.
Select one of the options below for CP Server database disk group:

- 1) Create a new disk group
- 2) Using an existing disk group

```
Enter the choice for a disk group: [1-2,q] 2
```

20 Select one disk group as the CP Server database disk group.

```
Select one disk group as CP Server database disk group: [1-3,q] 3
1) mycpsdg
2) cpsdgl
3) newcpsdg
```

21 Select the CP Server database volume.

You can choose to use an existing volume or create new volume for CP Server database. If you chose newly created disk group, you can only choose to create new volume for CP Server database.

Select one of the options below for CP Server database volume:

- 1) Create a new volume on disk group newcpsdg
- 2) Using an existing volume on disk group newcpsdg

22 Enter the choice for a volume: [1-2,q] 2.

23 Select one volume as CP Server database volume [1-1,q] 1

- 1) newcpsvol

24 After the VCS configuration files are updated, a success message appears.

For example:

```
Updating main.cf with CPSSG service group .... Done
Successfully added the CPSSG service group to VCS configuration.
```

25 If the cluster is secure, installer creates the softlink

`/var/VRTSvc/vcsauth/data/CPSERVER` to `/cpsdb/CPSERVER` and check if credentials are already present at `/cpsdb/CPSERVER`. If not, installer creates credentials in the directory, otherwise, installer asks if you want to reuse existing credentials.

```
Do you want to reuse these credentials? [y,n,q] (y)
```

26 After the configuration process has completed, a success message appears.

For example:

```
Trying to bring CPSSG service group ONLINE and will wait for upto 120 seconds
The Veritas Coordination Point Server is ONLINE
The Veritas Coordination Point Server has been configured on your system.
```

27 Run the `hagrp -state` command to ensure that the CPSSG service group has been added.

```
For example:
# hagrp -state CPSSG
#Group Attribute System Value
CPSSG State cps1 |ONLINE|
CPSSG State cps2 |OFFLINE|
```

It also generates the configuration file for CP server (`/etc/vxcps.conf`). The `vxcperv` process and other resources are added to the VCS configuration in the CP server service group (CPSSG).

For information about the CPSSG, refer to the *Cluster Server Administrator's Guide*.

Configuring the CP server manually

Perform the following steps to manually configure the CP server.

You need to manually generate certificates for the CP server and its client nodes to configure the CP server for HTTPS-based communication.

Table 3-2 Tasks to configure the CP server manually

Task	Reference
Configure CP server manually for HTTPS-communication	See “Configuring the CP server manually for HTTPS-based communication” on page 49. See “Generating the key and certificates manually for the CP server” on page 49. See “Completing the CP server configuration” on page 53.

Configuring the CP server manually for HTTPS-based communication

Perform the following steps to manually configure the CP server in HTTPS-based mode.

To manually configure the CP server

- 1 Stop VCS on each node in the CP server cluster using the following command:

```
# hstop -local
```

- 2 Edit the `main.cf` file to add the CPSSG service group on any node. Use the CPSSG service group in the sample `main.cf` as an example:

See [“Sample configuration files for CP server”](#) on page 281.

Customize the resources under the CPSSG service group as per your configuration.

- 3 Verify the `main.cf` file using the following command:

```
# hacf -verify /etc/VRTSvcs/conf/config
```

If successfully verified, copy this `main.cf` to all other cluster nodes.

- 4 Create the `/etc/vxcps.conf` file using the sample configuration file provided at `/etc/vxcps/vxcps.conf.sample`.

Veritas recommends enabling security for communication between CP server and the application clusters.

If you configured the CP server in HTTPS mode, do the following:

- Edit the `/etc/vxcps.conf` file to set `vip_https` with the virtual IP addresses required for HTTPS communication.
- Edit the `/etc/vxcps.conf` file to set `port_https` with the ports used for HTTPS communication.

- 5 Manually generate keys and certificates for the CP server.

See [“Generating the key and certificates manually for the CP server”](#) on page 49.

Generating the key and certificates manually for the CP server

CP server uses the HTTPS protocol to establish secure communication with client nodes. HTTPS is a secure means of communication, which happens over a secure communication channel that is established using the SSL/TLS protocol.

HTTPS uses x509 standard certificates and the constructs from a Public Key Infrastructure (PKI) to establish secure communication between the CP server and client. Similar to a PKI, the CP server, and its clients have their own set of certificates signed by a Certification Authority (CA). The server and its clients trust the certificate.

Every CP server acts as a certification authority for itself and for all its client nodes. The CP server has its own CA key and CA certificate and a server certificate generated, which is generated from a server private key. The server certificate is issued to the Universally Unique Identifier (UUID) of the CP server. All the IP addresses or domain names that the CP server listens on are mentioned in the Subject Alternative Name section of the CP server's server certificate

The OpenSSL library must be installed on the CP server to create the keys or certificates.. If OpenSSL is not installed, then you cannot create keys or certificates. The `vxcps.conf` file points to the configuration file that determines which keys or certificates are used by the CP server when SSL is initialized. The configuration value is stored in the `ssl_conf_file` and the default value is `/etc/vxcps_ssl.properties`.

To manually generate keys and certificates for the CP server:

- 1 Create directories for the security files on the CP server.

```
# mkdir -p /var/VRTScps/security/keys /var/VRTScps/security/certs
```

- 2 Generate an OpenSSL config file, which includes the VIPs.

The CP server listens to requests from client nodes on these VIPs. The server certificate includes VIPs, FQDNs, and host name of the CP server. Clients can reach the CP server by using any of these values. However, Veritas recommends that client nodes use the IP address to communicate to the CP server.

The sample configuration uses the following values:

- Config file name: *https_ssl_cert.conf*
- VIP: *192.168.1.201*
- FQDN: *cpsone.company.com*
- Host name: *cpsone*

Note the IP address, VIP, and FQDN values used in the `[alt_names]` section of the configuration file are sample values. Replace the sample values with your configuration values. Do not change the rest of the values in the configuration file.

```
[req]
distinguished_name = req_distinguished_name
```

```

req_extensions = v3_req

[req_distinguished_name]
countryName = Country Name (2 letter code)
countryName_default = US
localityName = Locality Name (eg, city)
organizationalUnitName = Organizational Unit Name (eg, section)
commonName = Common Name (eg, YOUR name)
commonName_max = 64
emailAddress = Email Address
emailAddress_max = 40

[v3_req]
keyUsage = keyEncipherment, dataEncipherment
extendedKeyUsage = serverAuth
subjectAltName = @alt_names

[alt_names]
DNS.1 = cpsone.company.com
DNS.2 = cpsone
DNS.3 = 192.168.1.201

```

3 Generate a 4096-bit CA key that is used to create the CA certificate.

The key must be stored at `/var/VRTScps/security/keys/ca.key`. Ensure that only root users can access the CA key, as the key can be misused to create fake certificates and compromise security.

```
# /usr/bin/openssl genrsa -out /var/VRTScps/security/keys/ca.key
4096
```

4 Generate a self-signed CA certificate.

```
# /usr/bin/openssl req -new -x509 -days days -sha256 -key
/var/VRTScps/security/keys/ca.key -subj \
'/C=countryname/L=localityname/OU=COMPANY/CN=CACERT' -out \
/var/VRTScps/security/certs/ca.crt
```

Where, *days* is the days you want the certificate to remain valid, *countryname* is the name of the country, *localityname* is the city, *CACERT* is the certificate name.

5 Generate a 2048-bit private key for CP server.

The key must be stored at `/var/VRTScps/security/keys/server_private.key`.

```
# /usr/bin/openssl genrsa -out \  
/var/VRTScps/security/keys/server_private.key 2048
```

6 Generate a Certificate Signing Request (CSR) for the server certificate.

The Certified Name (CN) in the certificate is the UUID of the CP server.

```
# /usr/bin/openssl req -new -sha256 -key \  
/var/VRTScps/security/keys/server_private.key \  
-config https_ssl_cert.conf -subj \  
'/C=CountryName/L=LocalityName/OU=COMPANY/CN=UUID' \  
-out /var/VRTScps/security/certs/server.csr
```

Where, *countryname* is the name of the country, *localityname* is the city, *UUID* is the certificate name.

7 Generate the server certificate by using the key certificate of the CA.

```
# /usr/bin/openssl x509 -req -days days -sha256 -in \  
/var/VRTScps/security/certs/server.csr \  
-CA /var/VRTScps/security/certs/ca.crt -CAkey \  
/var/VRTScps/security/keys/ca.key \  
-set_serial 01 -extensions v3_req -extfile https_ssl_cert.conf \  
-out /var/VRTScps/security/certs/server.crt
```

Where, *days* is the days you want the certificate to remain valid, *https_ssl_cert.conf* is the configuration file name.

You successfully created the key and certificate required for the CP server.

8 Ensure that no other user except the root user can read the keys and certificates.

9 Complete the CP server configuration.

See [“Completing the CP server configuration”](#) on page 53.

Completing the CP server configuration

To verify the service groups and start VCS perform the following steps:

- 1 Start VCS on all the cluster nodes.

```
# hstart
```

- 2 Verify that the CP server service group (CPSSG) is online.

```
# hagrps -state CPSSG
```

Output similar to the following appears:

```
# Group Attribute System Value
CPSSG State cps1.example.com |ONLINE|
```

Configuring CP server using response files

You can configure a CP server using a generated responsefile.

On a single node VCS cluster:

- ◆ Run the `installer` command with the `responsefile` option to configure the CP server on a single node VCS cluster.

```
# /opt/VRTS/install/installer -responsefile '/tmp/sample1.res'
```

On a SFHA cluster:

- ◆ Run the `installer` command with the `responsefile` option to configure the CP server on a SFHA cluster.

```
# /opt/VRTS/install/installer -responsefile '/tmp/sample1.res'
```

Response file variables to configure CP server

Table 3-3 describes the response file variables to configure CP server.

Table 3-3 describes response file variables to configure CP server

Variable	List or Scalar	Description
CFG{opt}{configcps}	Scalar	This variable performs CP server configuration task
CFG{cps_singlenode_config}	Scalar	This variable describes if the CP server will be configured on a singlenode VCS cluster

Table 3-3 describes response file variables to configure CP server
(continued)

Variable	List or Scalar	Description
CFG{cps_sfha_config}	Scalar	This variable describes if the CP server will be configured on a SFHA cluster
CFG{cps_unconfig}	Scalar	This variable describes if the CP server will be unconfigured
CFG{cpsname}	Scalar	This variable describes the name of the CP server
CFG{cps_db_dir}	Scalar	This variable describes the absolute path of CP server database
CFG{cps_reuse_cred}	Scalar	This variable describes if reusing the existing credentials for the CP server
CFG{cps_https_vips}	List	This variable describes the virtual IP addresses for the CP server configured for HTTPS-based communication
CFG{cps_https_ports}	List	This variable describes the port number for the virtual IP addresses for the CP server configured for HTTPS-based communication
CFG{cps_nic_list}{cpsvip<n>}	List	This variable describes the NICs of the systems for the virtual IP address
CFG{cps_netmasks}	List	This variable describes the netmasks for the virtual IP addresses
CFG{cps_prefix_length}	List	This variable describes the prefix length for the virtual IP addresses
CFG{cps_network_hosts}{cpsnic<n>}	List	This variable describes the network hosts for the NIC resource
CFG{cps_vip2nics_map}{<vip>}	Scalar	This variable describes the NIC resource to associate with the virtual IP address
CFG{cps_diskgroup}	Scalar	This variable describes the disk group for the CP server database
CFG{cps_volume}	Scalar	This variable describes the volume for the CP server database

Table 3-3 describes response file variables to configure CP server
(continued)

Variable	List or Scalar	Description
CFG{cps_newdgd_disks}	List	This variable describes the disks to be used to create a new disk group for the CP server database
CFG{cps_newvol_volsize}	Scalar	This variable describes the volume size to create a new volume for the CP server database
CFG{cps_delete_database}	Scalar	This variable describes if deleting the database of the CP server during the unconfiguration
CFG{cps_delete_config_log}	Scalar	This variable describes if deleting the config files and log files of the CP server during the unconfiguration
CFG{cps_reconfig}	Scalar	This variable defines if the CP server will be reconfigured

Sample response file for configuring the CP server on single node VCS cluster

Review the response file variables and their definitions.

See [Table 3-3](#) on page 53.

```
# Configuration Values:
#
our %CFG;

$CFG{cps_db_dir}="/etc/VRTScps/db";
$CFG{cps_https_ports}=[ 443 ];
$CFG{cps_https_vips}=[ "192.168.59.77" ];
$CFG{cps_netmasks}=[ "255.255.248.0" ];
$CFG{cps_network_hosts}{cpsnic1}=
[ "10.200.117.70" ];
$CFG{cps_nic_list}{cpsvip1}=[ "en0" ];
$CFG{cps_singlenode_config}=1;
$CFG{cps_vip2nicres_map}{"192.168.59.77"}=1;
$CFG{cpsname}="cps1";
```

```

$CFG{opt}{configcps}=1;
$CFG{opt}{configure}=1;
$CFG{opt}{noipc}=1;
$CFG{opt}{redirect}=1;
$CFG{prod}="AVAILABILITY72";
$CFG{systems}=[ "aix1" ];
$CFG{vcs_clusterid}=23172;
$CFG{vcs_clustername}="clus72";

1;

```

Sample response file for configuring the CP server on SFHA cluster

Review the response file variables and their definitions.

See [Table 3-3](#) on page 53.

```

#
# Configuration Values:
#
our %CFG;

$CFG{cps_db_dir}="/cpsdb";
$CFG{cps_diskgroup}="cps_dg1";
$CFG{cps_https_ports}=[ qw(50006 50007) ];
$CFG{cps_https_vips}=[ qw(10.198.90.6 10.198.90.7) ];
$CFG{cps_netmasks}=[ qw(255.255.248.0 255.255.248.0 255.255.248.0) ];
$CFG{cps_network_hosts}{cpsnic1}=[ qw(10.198.88.18) ];
$CFG{cps_network_hosts}{cpsnic2}=[ qw(10.198.88.18) ];
$CFG{cps_newdg_disks}=[ qw(emc_clariion0_249) ];
$CFG{cps_newvol_volsize}=10;
$CFG{cps_nic_list}{cpsvip1}=[ qw(en0 en0) ];
$CFG{cps_sfha_config}=1;
$CFG{cps_vip2nicres_map}{"10.198.90.6"}=1;
$CFG{cps_volume}="volcps";
$CFG{cpsname}="cps1";
$CFG{opt}{configcps}=1;
$CFG{opt}{configure}=1;
$CFG{opt}{noipc}=1;

```



```
$CFG{prod}="ENTERPRISE72";

$CFG{activecomponent}=[qw(SFHA72)];
$CFG{systems}=[ qw(cps1 cps2) ];
$CFG{vcs_clusterid}=49604;
$CFG{vcs_clustername}="sfha2233";

1;
```

Verifying the CP server configuration

Perform the following steps to verify the CP server configuration.

To verify the CP server configuration

- 1 Verify that the following configuration files are updated with the information you provided during the CP server configuration process:
 - `/etc/vxcps.conf` (CP server configuration file)
 - `/etc/VRTSvcs/conf/config/main.cf` (VCS configuration file)
 - `/etc/VRTScps/db` (default location for CP server database for a single-node cluster)
 - `/cps_db` (default location for CP server database for a multi-node cluster)
- 2 Run the `cpsadm` command to check if the `vxcpserv` process is listening on the configured Virtual IP.

If the application cluster is configured for HTTPS-based communication, no need to provide the port number assigned for HTTP communication.

```
# cpsadm -s cp_server -a ping_cps
```

where `cp_server` is the virtual IP address or the virtual hostname of the CP server.

Configuring SFHA

This chapter includes the following topics:

- [Configuring Storage Foundation High Availability using the installer](#)
- [Configuring SFDB](#)

Configuring Storage Foundation High Availability using the installer

Storage Foundation HA configuration requires configuring the HA (VCS) cluster. Perform the following tasks to configure the cluster.

Overview of tasks to configure SFHA using the product installer

[Table 4-1](#) lists the tasks that are involved in configuring SFHA using the script-based installer.

Table 4-1 Tasks to configure SFHA using the script-based installer

Task	Reference
Start the software configuration	See “Starting the software configuration” on page 60.
Specify the systems where you want to configure SFHA	See “Specifying systems for configuration” on page 60.
Configure the basic cluster	See “Configuring the cluster name” on page 61. See “Configuring private heartbeat links” on page 61.

Table 4-1 Tasks to configure SFHA using the script-based installer
(continued)

Task	Reference
Configure virtual IP address of the cluster (optional)	See “Configuring the virtual IP of the cluster” on page 66.
Configure the cluster in secure mode (optional)	See “Configuring SFHA in secure mode” on page 67.
Add VCS users (required if you did not configure the cluster in secure mode)	See “Adding VCS users” on page 72.
Configure SMTP email notification (optional)	See “Configuring SMTP email notification” on page 73.
Configure SNMP email notification (optional)	See “Configuring SNMP trap notification” on page 74.
Configure global clusters (optional)	See “Configuring global clusters” on page 76.
Complete the software configuration	See “Completing the SFHA configuration” on page 76.

Required information for configuring Storage Foundation and High Availability Solutions

To configure Storage Foundation High Availability, the following information is required:

See also the *Cluster Server Installation Guide*.

- A unique Cluster name
- A unique Cluster ID number between 0-65535
- Two or more NIC cards per system used for heartbeat links
One or more heartbeat links are configured as private links and one heartbeat link may be configured as a low priority link.

You can configure Storage Foundation High Availability in secure mode.

Running SFHA in Secure Mode guarantees that all inter-system communication is encrypted and that users are verified with security credentials. When running in Secure Mode, NIS and system usernames and passwords are used to verify identity. SFHA usernames and passwords are no longer used when a cluster is running in Secure Mode.

The following information is required to configure SMTP notification:

- The domain-based hostname of the SMTP server
- The email address of each SMTP recipient
- A minimum severity level of messages to be sent to each recipient

The following information is required to configure SNMP notification:

- System names of SNMP consoles to receive VCS trap messages
- SNMP trap daemon port numbers for each console
- A minimum severity level of messages to be sent to each console

Starting the software configuration

You can configure SFHA using the product installer.

Note: If you want to reconfigure SFHA, before you start the installer you must stop all the resources that are under VCS control using the `hastop` command or the `hagrp -offline` command.

To configure SFHA using the product installer

- 1 Confirm that you are logged in as a superuser.
- 2 Start the configuration using the installer.

```
# /opt/VRTS/install/installer -configure
```

The installer starts the product installation program with a copyright message and specifies the directory where the logs are created.

- 3 Select the component to configure.
- 4 Continue with the configuration procedure by responding to the installer questions.

Specifying systems for configuration

The installer prompts for the system names on which you want to configure SFHA. The installer performs an initial check on the systems that you specify.

To specify system names for configuration

- 1 Enter the names of the systems where you want to configure SFHA.

Enter the *operating_system* system names separated
 by spaces: [q,?] (sys1) **sys1 sys2**

- 2 Review the output as the installer verifies the systems you specify.

The installer does the following tasks:

- Checks that the local node running the installer can communicate with remote nodes
 If the installer finds ssh binaries, it confirms that ssh can operate without requests for passwords or passphrases. If ssh binaries cannot communicate with remote nodes, the installer tries rsh binaries. And if both ssh and rsh binaries fail, the installer prompts to help the user to setup ssh or rsh binaries.
- Makes sure that the systems are running with the supported operating system
- Checks whether Veritas InfoScale Enterprise is installed
- Exits if Veritas InfoScale Enterprise7.2 is not installed

- 3 Review the installer output about the I/O fencing configuration and confirm whether you want to configure fencing in enabled mode.

Do you want to configure I/O Fencing in enabled mode? [y,n,q,?] (y)

See “[About planning to configure I/O fencing](#)” on page 28.

Configuring the cluster name

Enter the cluster information when the installer prompts you.

To configure the cluster

- 1 Review the configuration instructions that the installer presents.
- 2 Enter a unique cluster name.

Enter the unique cluster name: [q,?] **clus1**

Configuring private heartbeat links

You now configure the private heartbeat links that LLT uses.

VCS provides the option to use LLT over Ethernet or LLT over UDP (User Datagram Protocol). Veritas recommends that you configure heartbeat links that use LLT over Ethernet for high performance, unless hardware requirements force you to use LLT over UDP. If you want to configure LLT over UDP, make sure you meet the prerequisites.

You must not configure LLT heartbeat using the links that are part of aggregated links. For example, link1, link2 can be aggregated to create an aggregated link, aggr1. You can use aggr1 as a heartbeat link, but you must not use either link1 or link2 as heartbeat links.

See [“Using the UDP layer for LLT”](#) on page 306.

The following procedure helps you configure LLT heartbeat links.

To configure private heartbeat links

- 1 Choose one of the following options at the installer prompt based on whether you want to configure LLT over Ethernet or LLT over UDP.
 - Option 1: Configure the heartbeat links using LLT over Ethernet (answer installer questions)
Enter the heartbeat link details at the installer prompt to configure LLT over Ethernet.
Skip to step [2](#).
 - Option 2: Configure the heartbeat links using LLT over UDP (answer installer questions)
Make sure that each NIC you want to use as heartbeat link has an IP address configured. Enter the heartbeat link details at the installer prompt to configure LLT over UDP. If you had not already configured IP addresses to the NICs, the installer provides you an option to detect the IP address for a given NIC.
Skip to step [3](#).
 - Option 3: Automatically detect configuration for LLT over Ethernet
Allow the installer to automatically detect the heartbeat link details to configure LLT over Ethernet. The installer tries to detect all connected links between all systems.
Skip to step [5](#).

Note: Option 3 is not available when the configuration is a single node configuration.

- 2 If you chose option 1, enter the network interface card details for the private heartbeat links.

The installer discovers and lists the network interface cards.

You must not enter the network interface card that is used for the public network (typically en0.)

Enter the NIC for the first private heartbeat link on sys1:

[b,q,?] **en2**

Would you like to configure a second private heartbeat link?

[y,n,q,b,?] (y)

Enter the NIC for the second private heartbeat link on sys1:

[b,q,?] **en3**

Would you like to configure a third private heartbeat link?

[y,n,q,b,?] (n)

Do you want to configure an additional low priority heartbeat link? [y,n,q,b,?] (n)

- 3** If you chose option 2, enter the NIC details for the private heartbeat links. This step uses examples such as *private_NIC1* or *private_NIC2* to refer to the available names of the NICs.

```
Enter the NIC for the first private heartbeat link on sys1: [b,q,?]
private_NIC1
Some configured IP addresses have been found on
the NIC private_NIC1 in sys1,
Do you want to choose one for the first private heartbeat link? [y,n,q,?]
Please select one IP address:
    1) 192.168.0.1/24
    2) 192.168.1.233/24
    b) Back to previous menu
```

```
Please select one IP address: [1-2,b,q,?] (1)
Enter the UDP port for the first private heartbeat link on sys1:
[b,q,?] (50000)
```

```
Enter the NIC for the second private heartbeat link on sys1: [b,q,?]
private_NIC2
Some configured IP addresses have been found on the
NIC private_NIC2 in sys1,
Do you want to choose one for the second
private heartbeat link? [y,n,q,?] (y)
Please select one IP address:
    1) 192.168.1.1/24
    2) 192.168.2.233/24
    b) Back to previous menu
```

```
Please select one IP address: [1-2,b,q,?] (1) 1
Enter the UDP port for the second private heartbeat link on sys1:
[b,q,?] (50001)
```

```
Would you like to configure a third private heartbeat
link? [y,n,q,b,?] (n)
```

```
Do you want to configure an additional low-priority heartbeat
link? [y,n,q,b,?] (n) y
```

```
Enter the NIC for the low-priority heartbeat link on sys1: [b,q,?]
private_NIC0
Some configured IP addresses have been found on
```



```

the NIC private_NIC0 in sys1,
Do you want to choose one for the low-priority
heartbeat link? [y,n,q,?] (y)
Please select one IP address:
    1) 10.200.59.233/22
    2) 192.168.3.1/22
    b) Back to previous menu

Please select one IP address: [1-2,b,q,?] (1) 2
Enter the UDP port for the low-priority heartbeat link on sys1:
[b,q,?] (50010)

```

4 Choose whether to use the same NIC details to configure private heartbeat links on other systems.

```

Are you using the same NICs for private heartbeat links on all
systems? [y,n,q,b,?] (y)

```

If you want to use the NIC details that you entered for sys1, make sure the same NICs are available on each system. Then, enter **y** at the prompt.

For LLT over UDP, if you want to use the same NICs on other systems, you still must enter unique IP addresses on each NIC for other systems.

If the NIC device names are different on some of the systems, enter **n**. Provide the NIC details for each system as the program prompts.

5 If you chose option 3, the installer detects NICs on each system and network links, and sets link priority.

If the installer fails to detect heartbeat links or fails to find any high-priority links, then choose option 1 or option 2 to manually configure the heartbeat links.

See [step 2](#) for option 1, or [step 3](#) for option 2 or [step 5](#) for option 3.

6 Enter a unique cluster ID:

```

Enter a unique cluster ID number between 0-65535: [b,q,?] (60842)

```

The cluster cannot be configured if the cluster ID 60842 is in use by another cluster. Installer performs a check to determine if the cluster ID is duplicate. The check takes less than a minute to complete.

```

Would you like to check if the cluster ID is in use by another
cluster? [y,n,q] (y)

```

7 Verify and confirm the information that the installer summarizes.

Configuring the virtual IP of the cluster

You can configure the virtual IP of the cluster to use to connect from the Cluster Manager (Java Console), Veritas InfoScale Operations Manager, or to specify in the RemoteGroup resource.

See the *Cluster Server Administrator's Guide* for information on the Cluster Manager.

See the *Cluster Server Bundled Agents Reference Guide* for information on the RemoteGroup agent.

To configure the virtual IP of the cluster

- 1 Review the required information to configure the virtual IP of the cluster.
- 2 When the system prompts whether you want to configure the virtual IP, enter `y`.
- 3 Confirm whether you want to use the discovered public NIC on the first system.

Do one of the following:

- If the discovered NIC is the one to use, press `Enter`.
- If you want to use a different NIC, type the name of a NIC to use and press `Enter`.

```
Active NIC devices discovered on sys1: en0
Enter the NIC for Virtual IP of the Cluster to use on sys1:
[b,q,?] (en0)
```

- 4 Confirm whether you want to use the same public NIC on all nodes.

Do one of the following:

- If all nodes use the same public NIC, enter `y`.
- If unique NICs are used, enter `n` and enter a NIC for each node.

```
Is en0 to be the public NIC used by all systems
[y,n,q,b,?] (y)
```

If you want to set up trust relationships for your secure cluster, refer to the following topics:

See [“Configuring a secure cluster node by node”](#) on page 67.

Configuring SFHA in secure mode

Configuring SFHA in secure mode ensures that all the communication between the systems is encrypted and users are verified against security credentials. SFHA user names and passwords are not used when a cluster is running in secure mode.

To configure SFHA in secure mode

- 1 To install and configure SFHA in secure mode, run the command:

```
# ./installer -security
```

- 2 The installer displays the following question before the installer stops the product processes:

- Do you want to grant read access to everyone? [y,n,q,?]
 - To grant read access to all authenticated users, type **y**.
 - To grant usergroup specific permissions, type **n**.
- Do you want to provide any usergroups that you would like to grant read access?[y,n,q,?]
 - To specify usergroups and grant them read access, type **y**
 - To grant read access only to root users, type **n**. The installer grants read access read access to the root users.
- Enter the usergroup names separated by spaces that you would like to grant read access. If you would like to grant read access to a usergroup on a specific node, enter like 'usrgrp1@node1', and if you would like to grant read access to usergroup on any cluster node, enter like 'usrgrp1'. If some usergroups are not created yet, create the usergroups after configuration if needed. [b]

- 3 To verify the cluster is in secure mode after configuration, run the command:

```
# haclus -value SecureClus
```

The command returns 1 if cluster is in secure mode, else returns 0.

Configuring a secure cluster node by node

For environments that do not support passwordless ssh or passwordless rsh, you cannot use the `-security` option to enable secure mode for your cluster. Instead, you can use the `-securityonenode` option to configure a secure cluster node by node. Moreover, to enable security in fips mode, use the `-fips` option together with `-securityonenode`.

Table 4-2 lists the tasks that you must perform to configure a secure cluster.

Table 4-2 Configuring a secure cluster node by node

Task	Reference
Configure security on one node	See “Configuring the first node” on page 68.
Configure security on the remaining nodes	See “Configuring the remaining nodes” on page 69.
Complete the manual configuration steps	See “Completing the secure cluster configuration” on page 69.

Configuring the first node

Perform the following steps on one node in your cluster.

To configure security on the first node

- 1 Ensure that you are logged in as superuser.
- 2 Enter the following command:

```
# /opt/VRTS/install/installer -securityonone
```

The installer lists information about the cluster, nodes, and service groups. If VCS is not configured or if VCS is not running on all nodes of the cluster, the installer prompts whether you want to continue configuring security. It then prompts you for the node that you want to configure.

```
VCS is not running on all systems in this cluster. All VCS systems
must be in RUNNING state. Do you want to continue? [y,n,q] (n) y
```

```
1) Perform security configuration on first node and export
security configuration files.
```

```
2) Perform security configuration on remaining nodes with
security configuration files.
```

```
Select the option you would like to perform [1-2,q,?] 1
```

Warning: All VCS configurations about cluster users are deleted when you configure the first node. You can use the `/opt/VRTSvcs/bin/hauser` command to create cluster users manually.

- 3 The installer completes the secure configuration on the node. It specifies the location of the security configuration files and prompts you to copy these files to the other nodes in the cluster. The installer also specifies the location of log files, summary file, and response file.
- 4 Copy the security configuration files from the location specified by the installer to temporary directories on the other nodes in the cluster.

Configuring the remaining nodes

On each of the remaining nodes in the cluster, perform the following steps.

To configure security on each remaining node

- 1 Ensure that you are logged in as superuser.
- 2 Enter the following command:

```
# /opt/VRTS/install/installer -securityonnode
```

The installer lists information about the cluster, nodes, and service groups. If VCS is not configured or if VCS is not running on all nodes of the cluster, the installer prompts whether you want to continue configuring security. It then prompts you for the node that you want to configure. Enter **2**.

```
VCS is not running on all systems in this cluster. All VCS systems
must be in RUNNING state. Do you want to continue? [y,n,q] (n) y
```

```
1) Perform security configuration on first node and export
security configuration files.
```

```
2) Perform security configuration on remaining nodes with
security configuration files.
```

```
Select the option you would like to perform [1-2,q,?] 2
```

```
Enter the security conf file directory: [b]
```

The installer completes the secure configuration on the node. It specifies the location of log files, summary file, and response file.

Completing the secure cluster configuration

Perform the following manual steps to complete the configuration.

To complete the secure cluster configuration

- 1** On the first node, freeze all service groups except the ClusterService service group.

```
# /opt/VRTSvcs/bin/haconf -makerw
# /opt/VRTSvcs/bin/hagrp -list Frozen=0
# /opt/VRTSvcs/bin/hagrp -freeze groupname -persistent
# /opt/VRTSvcs/bin/haconf -dump -makero
```

- 2** On the first node, stop the VCS engine.

```
# /opt/VRTSvcs/bin/hastop -all -force
```

- 3** On all nodes, stop the CmdServer.

```
# /opt/VRTSvcs/bin/CmdServer -stop
```

- 4** To grant access to all users, add or modify `SecureClus=1` and `DefaultGuestAccess=1` in the cluster definition.

For example:

To grant read access to everyone:

```
Cluster clus1 (
  SecureClus=1
  DefaultGuestAccess=1
)
```

Or

To grant access to only root:

```
Cluster clus1 (
  SecureClus=1
)
```

Or

To grant read access to specific user groups, add or modify `SecureClus=1` and `GuestGroups={} to the cluster definition.`

For example:

```
cluster clus1 (
  SecureClus=1
  GuestGroups={staff, guest}
```

- 5** Modify `/etc/VRTSvcs/conf/config/main.cf` file on the first node, and add `-secure` to the WAC application definition if GCO is configured.

For example:

```
Application wac (
  StartProgram = "/opt/VRTSvcs/bin/wacstart -secure"
  StopProgram = "/opt/VRTSvcs/bin/wacstop"
  MonitorProcesses = {"/opt/VRTSvcs/bin/wac -secure"}
  RestartLimit = 3
)
```

- 6 On all nodes, create the `/etc/VRTSvcs/conf/config/.secure` file.

```
# touch /etc/VRTSvcs/conf/config/.secure
```
- 7 On the first node, start VCS. Then start VCS on the remaining nodes.

```
# /opt/VRTSvcs/bin/hastart
```
- 8 On all nodes, start CmdServer.

```
# /opt/VRTSvcs/bin/CmdServer
```
- 9 On the first node, unfreeze the service groups.

```
# /opt/VRTSvcs/bin/haconf -makerw
# /opt/VRTSvcs/bin/hagrp -list Frozen=1
# /opt/VRTSvcs/bin/hagrp -unfreeze groupname -persistent
# /opt/VRTSvcs/bin/haconf -dump -makero
```

Adding VCS users

If you have enabled a secure VCS cluster, you do not need to add VCS users now. Otherwise, on systems operating under an English locale, you can add VCS users at this time.

To add VCS users

- 1 Review the required information to add VCS users.
- 2 Reset the password for the Admin user, if necessary.

```
Do you wish to accept the default cluster credentials of
'admin/password'? [y,n,q] (y) n
Enter the user name: [b,q,?] (admin)
Enter the password:
Enter again:
```

- 3 To add a user, enter **y** at the prompt.

```
Do you want to add another user to the cluster? [y,n,q] (y)
```


- 4 Enter the user's name, password, and level of privileges.

```
Enter the user name: [b,q,?] smith
Enter New Password:*****

Enter Again:*****
Enter the privilege for user smith (A=Administrator, O=Operator,
G=Guest): [b,q,?] a
```

- 5 Enter **n** at the prompt if you have finished adding users.

```
Would you like to add another user? [y,n,q] (n)
```

- 6 Review the summary of the newly added users and confirm the information.

Configuring SMTP email notification

You can choose to configure VCS to send event notifications to SMTP email services. You need to provide the SMTP server name and email addresses of people to be notified. Note that you can also configure the notification after installation.

Refer to the *Cluster Server Administrator's Guide* for more information.

To configure SMTP email notification

- 1 Review the required information to configure the SMTP email notification.
- 2 Specify whether you want to configure the SMTP notification.

If you do not want to configure the SMTP notification, you can skip to the next configuration option.

See [“Configuring SNMP trap notification”](#) on page 74.

- 3 Provide information to configure SMTP notification.

Provide the following information:

- Enter the SMTP server's host name.

```
Enter the domain-based hostname of the SMTP server
(example: smtp.yourcompany.com): [b,q,?] smtp.example.com
```

- Enter the email address of each recipient.

```
Enter the full email address of the SMTP recipient
(example: user@yourcompany.com): [b,q,?] ozzie@example.com
```

- Enter the minimum security level of messages to be sent to each recipient.

```
Enter the minimum severity of events for which mail should be
sent to ozzie@example.com [I=Information, W=Warning,
E=Error, S=SevereError]: [b,q,?] W
```

4 Add more SMTP recipients, if necessary.

- If you want to add another SMTP recipient, enter **y** and provide the required information at the prompt.

```
Would you like to add another SMTP recipient? [y,n,q,b] (n) y
```

```
Enter the full email address of the SMTP recipient
(example: user@yourcompany.com): [b,q,?] harriet@example.com
```

```
Enter the minimum severity of events for which mail should be
sent to harriet@example.com [I=Information, W=Warning,
E=Error, S=SevereError]: [b,q,?] E
```

- If you do not want to add, answer **n**.

```
Would you like to add another SMTP recipient? [y,n,q,b] (n)
```

5 Verify and confirm the SMTP notification information.

```
SMTP Address: smtp.example.com
Recipient: ozzie@example.com receives email for Warning or
higher events
Recipient: harriet@example.com receives email for Error or
higher events

Is this information correct? [y,n,q] (y)
```

Configuring SNMP trap notification

You can choose to configure VCS to send event notifications to SNMP management consoles. You need to provide the SNMP management console name to be notified and message severity levels.

Note that you can also configure the notification after installation.

Refer to the *Cluster Server Administrator's Guide* for more information.

To configure the SNMP trap notification

- 1 Review the required information to configure the SNMP notification feature of VCS.

- 2 Specify whether you want to configure the SNMP notification.

If you skip this option and if you had installed a valid HA/DR license, the installer presents you with an option to configure this cluster as global cluster. If you did not install an HA/DR license, the installer proceeds to configure SFHA based on the configuration details you provided.

See [“Configuring global clusters”](#) on page 76.

- 3 Provide information to configure SNMP trap notification.

Provide the following information:

- Enter the SNMP trap daemon port.

```
Enter the SNMP trap daemon port: [b,q,?] (162)
```

- Enter the SNMP console system name.

```
Enter the SNMP console system name: [b,q,?] sys5
```

- Enter the minimum security level of messages to be sent to each console.

```
Enter the minimum severity of events for which SNMP traps
should be sent to sys5 [I=Information, W=Warning, E=Error,
S=SevereError]: [b,q,?] E
```

- 4 Add more SNMP consoles, if necessary.

- If you want to add another SNMP console, enter `y` and provide the required information at the prompt.

```
Would you like to add another SNMP console? [y,n,q,b] (n) y
Enter the SNMP console system name: [b,q,?] sys4
Enter the minimum severity of events for which SNMP traps
should be sent to sys4 [I=Information, W=Warning,
E=Error, S=SevereError]: [b,q,?] S
```

- If you do not want to add, answer `n`.

Would you like to add another SNMP console? [y,n,q,b] (n)

5 Verify and confirm the SNMP notification information.

```
SNMP Port: 162
Console: sys5 receives SNMP traps for Error or
higher events
Console: sys4 receives SNMP traps for SevereError or
higher events

Is this information correct? [y,n,q] (y)
```

Configuring global clusters

You can configure global clusters to link clusters at separate locations and enable wide-area failover and disaster recovery. The installer adds basic global cluster information to the VCS configuration file. You must perform additional configuration tasks to set up a global cluster.

See the *Cluster Server Administrator's Guide* for instructions to set up SFHA global clusters.

Note: If you installed a HA/DR license to set up replicated data cluster or campus cluster, skip this installer option.

To configure the global cluster option

- 1 Review the required information to configure the global cluster option.
- 2 Specify whether you want to configure the global cluster option.

If you skip this option, the installer proceeds to configure VCS based on the configuration details you provided.

- 3 Provide information to configure this cluster as global cluster.

The installer prompts you for a NIC, a virtual IP address, and value for the netmask.

You can also enter an IPv6 address as a virtual IP address.

Completing the SFHA configuration

After you enter the SFHA configuration information, the installer prompts to stop the SFHA processes to complete the configuration process. The installer continues to create configuration files and copies them to each system. The installer also

configures a cluster UUID value for the cluster at the end of the configuration. After the installer successfully configures SFHA, it restarts SFHA and its related processes.

To complete the SFHA configuration

- 1 If prompted, press Enter at the following prompt.

```
Do you want to stop InfoScale Enterprise processes now? [y,n,q,?] (y)
```

- 2 Review the output as the installer stops various processes and performs the configuration. The installer then restarts SFHA and its related processes.
- 3 Enter y at the prompt to send the installation information to Veritas.

```
Would you like to send the information about this installation
to us to help improve installation in the future?
[y,n,q,?] (y) y
```

- 4 After the installer configures SFHA successfully, note the location of summary, log, and response files that installer creates.

The files provide the useful information that can assist you with the configuration and can also assist future configurations.

summary file	Describes the cluster and its configured resources.
log file	Details the entire configuration.
response file	Contains the configuration information that can be used to perform secure or unattended installations on other systems.
See “Configuring SFHA using response files” on page 139.	

Verifying and updating licenses on the system

After you install Veritas InfoScale Enterprise, you can verify the licensing information using the vxlicrep program. You can replace the demo licenses with a permanent license.

See [“Checking licensing information on the system”](#) on page 77.

See [“Updating product licenses”](#) on page 78.

Checking licensing information on the system

You can use the vxlicrep program to display information about the licenses on a system.

To check licensing information

- 1 Navigate to the `/sbin` folder containing the `vxlicrep` program and enter:

```
# vxlicrep
```

- 2 Review the following output to determine the following information:

- The license key
- The type of license
- The product for which it applies
- Its expiration date, if any. Demo keys have expiration dates. Permanent keys and site keys do not have expiration dates.

```
License Key           = xxx-xxx-xxx-xxx-xxx
Product Name          = Veritas InfoScale Enterprise
Serial Number         = xxxxxx
License Type          = PERMANENT
OEM ID                = xxxxxx
```

```
Features :=
Platform           = AIX
Version            = 7.2
Tier               = 0
Reserved           = 0
Mode               = VCS
```

Updating product licenses

You can use the `./installer -license` command or the `vxlicinstupgrade -k` to add the Veritas InfoScale Enterprise license key on each node. If you have Veritas InfoScale Enterprise already installed and SFHA configured and you use a demo license, you can replace the demo license.

See [“Replacing a Veritas InfoScale Enterprise demo license with a permanent license”](#) on page 79.

To update product licenses using the installer command

- 1 On any one node, enter the license key using the command:

```
# ./installer -license
```

- 2 At the prompt, enter your license number.

To update product licenses using the vxlicinst command

- ◆ On each node, enter the license key using the command:

```
# vxlicinstupgrade -k license key
```

Replacing a Veritas InfoScale Enterprise demo license with a permanent license

When a SFHA demo key license expires, you can replace it with a permanent license using the `vxlicinstupgrade(1)` program.

To replace a demo key

- 1 Make sure you have permissions to log in as root on each of the nodes in the cluster.
- 2 Shut down SFHA on all nodes in the cluster:

```
# hstop -all -force
```

This command does not shut down any running applications.

- 3 Enter the permanent license key using the following command on each node:

```
# vxlicinstupgrade -k license key
```

- 4 Make sure demo licenses are replaced on all cluster nodes before starting SFHA.

```
# vxlicrep
```

- 5 Start SFHA on each node:

```
# hstart
```

Configuring SFDB

By default, SFDB tools are disabled that is the vxdbd daemon is not configured. You can check whether SFDB tools are enabled or disabled using the `/opt/VRTS/bin/sfae_config status` command.

To enable SFDB tools

- 1 Log in as root.
- 2 Run the following command to configure and start the vxdbd daemon. After you perform this step, entries are made in the system startup so that the daemon starts on a system restart.

```
#/opt/VRTS/bin/sfae_config enable
```

To disable SFDB tools

- 1 Log in as root.
- 2 Run the following command:

```
#/opt/VRTS/bin/sfae_config disable
```


Configuring SFHA clusters for data integrity

This chapter includes the following topics:

- [Setting up disk-based I/O fencing using installer](#)
- [Setting up server-based I/O fencing using installer](#)
- [Setting up non-SCSI-3 I/O fencing in virtual environments using installer](#)
- [Setting up majority-based I/O fencing using installer](#)
- [Enabling or disabling the preferred fencing policy](#)

Setting up disk-based I/O fencing using installer

You can configure I/O fencing using the `-fencing` option of the installer.

Initializing disks as VxVM disks

Perform the following procedure to initialize disks as VxVM disks.

To initialize disks as VxVM disks

- 1 Scan for the new hdisk devices.

```
# /usr/sbin/cfgmgr
```

- 2 List the new external disks or the LUNs as recognized by the operating system. On each node, enter:

```
# lsdev -Cc disk
```

3 Determine the VxVM name by which a disk drive (or LUN) is known.

In the following example, VxVM identifies a disk with the AIX device name `/dev/rhdisk75` as `EMC0_17`:

```
# vxddmpadm getddmpnode nodename=hdisk75
```

NAME	STATE	ENCLR-TYPE	PATHS	ENBL	DSBL	ENCLR-NAME
EMC0_17	ENABLED	EMC	1	1	0	EMC0

Notice that in the example command, the AIX device name for the block device was used.

As an option, you can run the command `vxdisk list vxvm_device_name` to see additional information about the disk like the AIX device name. For example:

```
# vxdisk list EMC0_17
```

4 To initialize the disks as VxVM disks, use one of the following methods:

- Use the interactive `vxdiskadm` utility to initialize the disks as VxVM disks. For more information, see the *Storage Foundation Administrator's Guide*.
- Use the `vxdisksetup` command to initialize a disk as a VxVM disk.

```
# vxdisksetup -i device_name
```

The example specifies the CDS format:

```
# vxdisksetup -i EMC0_17
```

Repeat this command for each disk you intend to use as a coordinator disk.

Checking shared disks for I/O fencing

Make sure that the shared storage you set up while preparing to configure SFHA meets the I/O fencing requirements. You can test the shared disks using the `vxfcntlshdw` utility. The two nodes must have `ssh` (default) or `rsh` communication. To confirm whether a disk (or LUN) supports SCSI-3 persistent reservations, two nodes must simultaneously have access to the same disks. Because a shared disk is likely to have a different name on each node, check the serial number to verify the identity of the disk. Use the `vxfcntlshdw` command with the `-i` option. This command option verifies that the same serial number for the LUN is returned on all paths to the LUN.

Make sure to test the disks that serve as coordinator disks.

You can use the `vxfcntlshdw` utility to test disks either in DMP format or in raw format.

- If you test disks in DMP format, use the VxVM command `vxdisk list` to get the DMP path name.
- If you test disks in raw format for Active/Passive disk arrays, you must use an active enabled path with the `vxfcntlsthaw` command. Run the `vxdmppadm getsubpaths dmpnodename=enclosure-based_name` command to list the active enabled paths.
DMP opens the secondary (passive) paths with an exclusive flag in Active/Passive arrays. So, if you test the secondary (passive) raw paths of the disk, the `vxfcntlsthaw` command may fail due to DMP's exclusive flag.

The `vxfcntlsthaw` utility has additional options suitable for testing many disks. Review the options for testing the disk groups (`-g`) and the disks that are listed in a file (`-f`). You can also test disks without destroying data using the `-r` option.

See the *Cluster Server Administrator's Guide*.

Checking that disks support SCSI-3 involves the following tasks:

- Verifying the Array Support Library (ASL)
See [“Verifying Array Support Library \(ASL\)”](#) on page 83.
- Verifying that nodes have access to the same disk
See [“Verifying that the nodes have access to the same disk”](#) on page 84.
- Testing the shared disks for SCSI-3
See [“Testing the disks using vxfcntlsthaw utility”](#) on page 85.

Verifying Array Support Library (ASL)

Make sure that the Array Support Library (ASL) for the array that you add is installed.

To verify Array Support Library (ASL)

- 1 If the Array Support Library (ASL) for the array that you add is not installed, obtain and install it on each node before proceeding.

The ASL for the supported storage device that you add is available from the disk array vendor or Veritas technical support.

- 2 Verify that the ASL for the disk array is installed on each of the nodes. Run the following command on each node and examine the output to verify the installation of ASL.

The following output is a sample:

```
# vxddladm listsupport all
```

LIBNAME	VID	PID
libvx3par.so	3PARdata	VV
libvxCLARiiON.so	DGC	All
libvxFJTSYe6k.so	FUJITSU	E6000
libvxFJTSYe8k.so	FUJITSU	All
libvxcompellent.so	COMPELNT	Compellent Vol
libvxcopan.so	COPANSYS	8814, 8818
libvxddns2a.so	DDN	S2A 9550, S2A 9900, S2A 9700

- 3 Scan all disk drives and their attributes, update the VxVM device list, and reconfigure DMP with the new devices. Type:

```
# vxdisk scandisks
```

See the Veritas Volume Manager documentation for details on how to add and configure disks.

Verifying that the nodes have access to the same disk

Before you test the disks that you plan to use as shared data storage or as coordinator disks using the vxfstshdw utility, you must verify that the systems see the same disk.

To verify that the nodes have access to the same disk

- 1 Verify the connection of the shared storage for data to two of the nodes on which you installed Veritas InfoScale Enterprise.
- 2 Ensure that both nodes are connected to the same disk during the testing. Use the vxfenadm command to verify the disk serial number.

```
# vxfenadm -i diskpath
```

For A/P arrays, run the `vxfentsthdw` command only on secondary paths.

Refer to the `vxfenadm` (1M) manual page.

For example, an EMC disk is accessible by the `/dev/rhdisk75` path on node A and the `/dev/rhdisk76` path on node B.

From node A, enter:

```
# vxfenadm -i /dev/rhdisk75
```

```
Vendor id : EMC
Product id : SYMMETRIX
Revision : 5567
Serial Number : 42031000a
```

The same serial number information should appear when you enter the equivalent command on node B using the `/dev/rhdisk76` path.

On a disk from another manufacturer, Hitachi Data Systems, the output is different and may resemble:

```
Vendor id      : HITACHI
Product id     : OPEN-3
Revision       : 0117
Serial Number  : 0401EB6F0002
```

Testing the disks using vxfentsthdw utility

This procedure uses the `/dev/rhdisk75` disk in the steps.

If the utility does not show a message that states a disk is ready, the verification has failed. Failure of verification can be the result of an improperly configured disk array. The failure can also be due to a bad disk.

If the failure is due to a bad disk, remove and replace it. The `vxfentsthdw` utility indicates a disk can be used for I/O fencing with a message resembling:

```
The disk /dev/rhdisk75 is ready to be configured for I/O Fencing on
node sys1
```

For more information on how to replace coordinator disks, refer to the *Cluster Server Administrator's Guide*.

To test the disks using vxfststhdw utility

- 1 Make sure system-to-system communication functions properly.
 See [“About configuring secure shell or remote shell communication modes before installing products”](#) on page 288.
- 2 From one node, start the utility.
- 3 The script warns that the tests overwrite data on the disks. After you review the overview and the warning, confirm to continue the process and enter the node names.

Warning: The tests overwrite and destroy data on the disks unless you use the `-r` option.

```
***** WARNING!!!!!!!!!! *****
THIS UTILITY WILL DESTROY THE DATA ON THE DISK!!
```

```
Do you still want to continue : [y/n] (default: n) y
Enter the first node of the cluster: sys1
Enter the second node of the cluster: sys2
```

- 4 Review the output as the utility performs the checks and reports its activities.
- 5 If a disk is ready for I/O fencing on each node, the utility reports success for each node. For example, the utility displays the following message for the node sys1.

```
The disk is now ready to be configured for I/O Fencing on node
sys1
```

```
ALL tests on the disk /dev/rhdisk75 have PASSED
The disk is now ready to be configured for I/O fencing on node
sys1
```

- 6 Run the vxfststhdw utility for each disk you intend to verify.

Note: Only dmp disk devices can be used as coordinator disks.

Configuring disk-based I/O fencing using installer

Note: The installer stops and starts SFHA to complete I/O fencing configuration. Make sure to unfreeze any frozen VCS service groups in the cluster for the installer to successfully stop SFHA.

To set up disk-based I/O fencing using the installer

- 1 Start the installer with `-fencing` option.

```
# /opt/VRTS/install/installer -fencing
```

The installer starts with a copyright message and verifies the cluster information.

Note the location of log files which you can access in the event of any problem with the configuration process.

- 2 Enter the host name of one of the systems in the cluster.
- 3 Confirm that you want to proceed with the I/O fencing configuration at the prompt.

The program checks that the local node running the script can communicate with remote nodes and checks whether SFHA 7.2 is configured properly.

- 4 Review the I/O fencing configuration options that the program presents. Type **2** to configure disk-based I/O fencing.

```
1. Configure Coordination Point client based fencing
2. Configure disk based fencing
3. Configure majority based fencing
4. Configure fencing in disabled mode
```

```
Select the fencing mechanism to be configured in this
Application Cluster [1-4,q.?] 2
```

- 5 Review the output as the configuration program checks whether VxVM is already started and is running.
 - If the check fails, configure and enable VxVM before you repeat this procedure.
 - If the check passes, then the program prompts you for the coordinator disk group information.
- 6 Choose whether to use an existing disk group or create a new disk group to configure as the coordinator disk group.

The program lists the available disk group names and provides an option to create a new disk group. Perform one of the following:

- To use an existing disk group, enter the number corresponding to the disk group at the prompt.
 The program verifies whether the disk group you chose has an odd number of disks and that the disk group has a minimum of three disks.
- To create a new disk group, perform the following steps:
 - Enter the number corresponding to the **Create a new disk group** option.
 The program lists the available disks that are in the CDS disk format in the cluster and asks you to choose an odd number of disks with at least three disks to be used as coordinator disks.
 Veritas recommends that you use three disks as coordination points for disk-based I/O fencing.
 - If the available VxVM CDS disks are less than the required, installer asks whether you want to initialize more disks as VxVM disks. Choose the disks you want to initialize as VxVM disks and then use them to create new disk group.
 - Enter the numbers corresponding to the disks that you want to use as coordinator disks.
 - Enter the disk group name.

7 Verify that the coordinator disks you chose meet the I/O fencing requirements.

You must verify that the disks are SCSI-3 PR compatible using the `vxfsentsthdw` utility and then return to this configuration program.

See [“Checking shared disks for I/O fencing”](#) on page 82.

8 After you confirm the requirements, the program creates the coordinator disk group with the information you provided.

9 Verify and confirm the I/O fencing configuration information that the installer summarizes.

10 Review the output as the configuration program does the following:

- Stops VCS and I/O fencing on each node.
- Configures disk-based I/O fencing and starts the I/O fencing process.
- Updates the VCS configuration file `main.cf` if necessary.
- Copies the `/etc/vxfenmode` file to a date and time suffixed file `/etc/vxfenmode-date-time`. This backup file is useful if any future fencing configuration fails.

- Updates the I/O fencing configuration file `/etc/vxfenmode`.
 - Starts VCS on each node to make sure that the SFHA is cleanly configured to use the I/O fencing feature.
- 11** Review the output as the configuration program displays the location of the log files, the summary files, and the response files.
 - 12** Configure the Coordination Point Agent.

```
Do you want to configure Coordination Point Agent on
the client cluster? [y,n,q] (y)
```

- 13** Enter a name for the service group for the Coordination Point Agent.

```
Enter a non-existing name for the service group for
Coordination Point Agent: [b] (vxfen) vxfen
```

- 14** Set the level two monitor frequency.

```
Do you want to set LevelTwoMonitorFreq? [y,n,q] (y)
```

- 15** Decide the value of the level two monitor frequency.

```
Enter the value of the LevelTwoMonitorFreq attribute: [b,q,?] (5)
```

Installer adds Coordination Point Agent and updates the main configuration file.

- 16** Enable auto refresh of coordination points.

```
Do you want to enable auto refresh of coordination points
if registration keys are missing
on any of them? [y,n,q,b,?] (n)
```

See [“Configuring CoordPoint agent to monitor coordination points”](#) on page 127.

Refreshing keys or registrations on the existing coordination points for disk-based fencing using the installer

You must refresh registrations on the coordination points in the following scenarios:

- When the CoordPoint agent notifies VCS about the loss of registration on any of the existing coordination points.
- A planned refresh of registrations on coordination points when the cluster is online without having an application downtime on the cluster.

Registration loss may happen because of an accidental array restart, corruption of keys, or some other reason. If the coordination points lose the registrations of the cluster nodes, the cluster may panic when a network partition occurs.

Warning: Refreshing keys might cause the cluster to panic if a node leaves membership before the coordination points refresh is complete.

To refresh registrations on existing coordination points for disk-based I/O fencing using the installer

- 1 Start the installer with the `-fencing` option.

```
# /opt/VRTS/install/installer -fencing
```

The installer starts with a copyright message and verifies the cluster information.

Note down the location of log files that you can access if there is a problem with the configuration process.

- 2 Confirm that you want to proceed with the I/O fencing configuration at the prompt.

The program checks that the local node running the script can communicate with the remote nodes and checks whether SFHA 7.2 is configured properly.

- 3 Review the I/O fencing configuration options that the program presents. Type the number corresponding to refresh registrations or keys on the existing coordination points.

```
Select the fencing mechanism to be configured in this  
Application Cluster [1-6,q]
```

- 4 Ensure that the disk group constitution that is used by the fencing module contains the same disks that are currently used as coordination disks.

5 Verify the coordination points.

```
For example,
Disk Group: fendg
Fencing disk policy: dmp
Fencing disks:
    emc_clariion0_62
    emc_clariion0_65
    emc_clariion0_66
```

Is this information correct? [y,n,q] **(y)**.

```
Successfully completed the vxfseswap operation
```

The keys on the coordination disks are refreshed.

- 6** Do you want to send the information about this installation to us to help improve installation in the future? [y,n,q,?] **(y)**.
- 7** Do you want to view the summary file? [y,n,q] **(n)**.

Setting up server-based I/O fencing using installer

You can configure server-based I/O fencing for the SFHA cluster using the installer. With server-based fencing, you can have the coordination points in your configuration as follows:

- Combination of CP servers and SCSI-3 compliant coordinator disks
- CP servers only
Veritas also supports server-based fencing with a single highly available CP server that acts as a single coordination point.

See “[About planning to configure I/O fencing](#)” on page 28.

See “[Recommended CP server configurations](#)” on page 33.

This section covers the following example procedures:

Mix of CP servers and coordinator disks	See “ To configure server-based fencing for the SFHA cluster (one CP server and two coordinator disks) ” on page 92.
Single CP server	See “ To configure server-based fencing for the SFHA cluster ” on page 96.

To configure server-based fencing for the SFHA cluster (one CP server and two coordinator disks)

- 1 Depending on the server-based configuration model in your setup, make sure of the following:
 - CP servers are configured and are reachable from the SFHA cluster. The SFHA cluster is also referred to as the application cluster or the client cluster. See [“Setting up the CP server”](#) on page 36.
 - The coordination disks are verified for SCSI3-PR compliance. See [“Checking shared disks for I/O fencing”](#) on page 82.

- 2 Start the installer with the `-fencing` option.

```
# /opt/VRTS/install/installer -fencing
```

The installer starts with a copyright message and verifies the cluster information.

Note the location of log files which you can access in the event of any problem with the configuration process.

- 3 Confirm that you want to proceed with the I/O fencing configuration at the prompt.

The program checks that the local node running the script can communicate with remote nodes and checks whether SFHA 7.2 is configured properly.

- 4 Review the I/O fencing configuration options that the program presents. Type **1** to configure server-based I/O fencing.

```
Select the fencing mechanism to be configured in this
Application Cluster [1-3,b,q] 1
```

- 5 Make sure that the storage supports SCSI3-PR, and answer **y** at the following prompt.

```
Does your storage environment support SCSI3 PR? [y,n,q] (y)
```

- 6 Provide the following details about the coordination points at the installer prompt:

- Enter the total number of coordination points including both servers and disks. This number should be at least 3.

```
Enter the total number of co-ordination points including both
Coordination Point servers and disks: [b] (3)
```

- Enter the total number of coordinator disks among the coordination points.

Enter the total number of disks among these:

[b] (0) 2

7 Provide the following CP server details at the installer prompt:

- Enter the total number of virtual IP addresses or the total number of fully qualified host names for each of the CP servers.

How many IP addresses would you like to use to communicate
to Coordination Point Server #1?: [b,q,?] (1) 1

- Enter the virtual IP addresses or the fully qualified host name for each of the CP servers. The installer assumes these values to be identical as viewed from all the application cluster nodes.

Enter the Virtual IP address or fully qualified host name #1
for the HTTPS Coordination Point Server #1:

[b] 10.209.80.197

The installer prompts for this information for the number of virtual IP addresses you want to configure for each CP server.

- Enter the port that the CP server would be listening on.

Enter the port that the coordination point server 10.209.80.197
would be listening on or accept the default port
suggested: [b] (443)

8 Provide the following coordinator disks-related details at the installer prompt:

- Choose the coordinator disks from the list of available disks that the installer displays. Ensure that the disk you choose is available from all the SFHA (application cluster) nodes.

The number of times that the installer asks you to choose the disks depends on the information that you provided in step 6. For example, if you had chosen to configure two coordinator disks, the installer asks you to choose the first disk and then the second disk:

Select disk number 1 for co-ordination point

1) rhdisk75
2) rhdisk76
3) rhdisk77

Please enter a valid disk which is available from all the
cluster nodes for co-ordination point [1-3,q] 1

- If you have not already checked the disks for SCSI-3 PR compliance in step 1, check the disks now.
 The installer displays a message that recommends you to verify the disks in another window and then return to this configuration procedure.
 Press Enter to continue, and confirm your disk selection at the installer prompt.
- Enter a disk group name for the coordinator disks or accept the default.

```
Enter the disk group name for coordinating disk(s):
[b] (vxfencoorddg)
```

9 Verify and confirm the coordination points information for the fencing configuration.

For example:

```
Total number of coordination points being used: 3
Coordination Point Server ([VIP or FQHN]:Port):
    1. 10.209.80.197 ([10.209.80.197]:443)
SCSI-3 disks:
    1. rhdisk75
    2. rhdisk76
Disk Group name for the disks in customized fencing: vxfencoorddg
Disk policy used for customized fencing: dmp
```

The installer initializes the disks and the disk group and depots the disk group on the SFHA (application cluster) node.

10 Verify and confirm the I/O fencing configuration information.

```
CPS Admin utility location: /opt/VRTScps/bin/cpsadm
Cluster ID: 2122
Cluster Name: clus1
UUID for the above cluster: {ae5e589a-1dd1-11b2-dd44-00144f79240c}
```

- 11** Review the output as the installer updates the application cluster information on each of the CP servers to ensure connectivity between them. The installer then populates the `/etc/vxfenmode` file with the appropriate details in each of the application cluster nodes.

```
Updating client cluster information on Coordination Point Server 10.209.80.197

Adding the client cluster to the Coordination Point Server 10.209.80.197 ..... Done

Registering client node sys1 with Coordination Point Server 10.209.80.197..... Done
Adding CPClient user for communicating to Coordination Point Server 10.209.80.197 .... Done
Adding cluster clus1 to the CPClient user on Coordination Point Server 10.209.80.197 .. Done

Registering client node sys2 with Coordination Point Server 10.209.80.197 ..... Done
Adding CPClient user for communicating to Coordination Point Server 10.209.80.197 .... Done
Adding cluster clus1 to the CPClient user on Coordination Point Server 10.209.80.197 ..Done

Updating /etc/vxfenmode file on sys1 ..... Done
Updating /etc/vxfenmode file on sys2 ..... Done
```

See [“About I/O fencing configuration files”](#) on page 279.

- 12** Review the output as the installer stops and restarts the VCS and the fencing processes on each application cluster node, and completes the I/O fencing configuration.
- 13** Configure the CP agent on the SFHA (application cluster). The Coordination Point Agent monitors the registrations on the coordination points.

```
Do you want to configure Coordination Point Agent on
the client cluster? [y,n,q] (y)
```

```
Enter a non-existing name for the service group for
Coordination Point Agent: [b] (vxfen)
```

- 14** Additionally the coordination point agent can also monitor changes to the Coordinator Disk Group constitution such as a disk being accidentally deleted from the Coordinator Disk Group. The frequency of this detailed monitoring can be tuned with the `LevelTwoMonitorFreq` attribute. For example, if you set this attribute to 5, the agent will monitor the Coordinator Disk Group constitution every five monitor cycles.

Note that for the `LevelTwoMonitorFreq` attribute to be applicable there must be disks as part of the Coordinator Disk Group.

```
Enter the value of the LevelTwoMonitorFreq attribute: (5)
```

- 15** Enable auto refresh of coordination points.

```
Do you want to enable auto refresh of coordination points
if registration keys are missing
on any of them? [y,n,q,b,?] (n)
```

- 16** Note the location of the configuration log files, summary files, and response files that the installer displays for later use.

- 17** Verify the fencing configuration using:

```
# vxfenadm -d
```

- 18** Verify the list of coordination points.

```
# vxfenconfig -l
```

To configure server-based fencing for the SFHA cluster

- 1** Make sure that the CP server is configured and is reachable from the SFHA cluster. The SFHA cluster is also referred to as the application cluster or the client cluster.
- 2** See [“Setting up the CP server”](#) on page 36.
- 3** Start the installer with `-fencing` option.

```
# /opt/VRTS/install/installer -fencing
```

The installer starts with a copyright message and verifies the cluster information.

Note the location of log files which you can access in the event of any problem with the configuration process.

- 4 Confirm that you want to proceed with the I/O fencing configuration at the prompt.

The program checks that the local node running the script can communicate with remote nodes and checks whether SFHA 7.2 is configured properly.

- 5 Review the I/O fencing configuration options that the program presents. Type **1** to configure server-based I/O fencing.

```
Select the fencing mechanism to be configured in this
Application Cluster [1-7,q] 1
```

- 6 Make sure that the storage supports SCSI3-PR, and answer **y** at the following prompt.

```
Does your storage environment support SCSI3 PR? [y,n,q] (y)
```

- 7 Enter the total number of coordination points as **1**.

```
Enter the total number of co-ordination points including both
Coordination Point servers and disks: [b] (3) 1
```

Read the installer warning carefully before you proceed with the configuration.

- 8 Provide the following CP server details at the installer prompt:

- Enter the total number of virtual IP addresses or the total number of fully qualified host names for each of the CP servers.

```
How many IP addresses would you like to use to communicate
to Coordination Point Server #1? [b,q,?] (1) 1
```

- Enter the virtual IP address or the fully qualified host name for the CP server. The installer assumes these values to be identical as viewed from all the application cluster nodes.

```
Enter the Virtual IP address or fully qualified host name
#1 for the Coordination Point Server #1:
[b] 10.209.80.197
```

The installer prompts for this information for the number of virtual IP addresses you want to configure for each CP server.

- Enter the port that the CP server would be listening on.

```
Enter the port in the range [49152, 65535] which the
Coordination Point Server 10.209.80.197
```

```
would be listening on or simply accept the default
port suggested: [b] (443)
```

9 Verify and confirm the coordination points information for the fencing configuration.

For example:

```
Total number of coordination points being used: 1
Coordination Point Server ([VIP or FQHN]:Port):
    1. 10.209.80.197 ([10.209.80.197]:443)
```

10 Verify and confirm the I/O fencing configuration information.

```
CPS Admin utility location: /opt/VRTScps/bin/cpsadm
Cluster ID: 2122
Cluster Name: clus1
UUID for the above cluster: {ae5e589a-1dd1-11b2-dd44-00144f79240c}
```

11 Review the output as the installer updates the application cluster information on each of the CP servers to ensure connectivity between them. The installer then populates the `/etc/vxfenmode` file with the appropriate details in each of the application cluster nodes.

The installer also populates the `/etc/vxfenmode` file with the entry `single_cp=1` for such single CP server fencing configuration.

```
Updating client cluster information on Coordination Point Server 10.209.80.197

Adding the client cluster to the Coordination Point Server 10.209.80.197 ..... Done

Registering client node sys1 with Coordination Point Server 10.209.80.197..... Done
Adding CPClient user for communicating to Coordination Point Server 10.209.80.197 .... Done
Adding cluster clus1 to the CPClient user on Coordination Point Server 10.209.80.197 .. Done

Registering client node sys2 with Coordination Point Server 10.209.80.197 ..... Done
Adding CPClient user for communicating to Coordination Point Server 10.209.80.197 .... Done
Adding cluster clus1 to the CPClient user on Coordination Point Server 10.209.80.197 .. Done

Updating /etc/vxfenmode file on sys1 ..... Done
Updating /etc/vxfenmode file on sys2 ..... Done
```

See [“About I/O fencing configuration files”](#) on page 279.

- 12** Review the output as the installer stops and restarts the VCS and the fencing processes on each application cluster node, and completes the I/O fencing configuration.

- 13** Configure the CP agent on the SFHA (application cluster).

```
Do you want to configure Coordination Point Agent on the
client cluster? [y,n,q] (y)
```

```
Enter a non-existing name for the service group for
Coordination Point Agent: [b] (vxfen)
```

- 14** Enable auto refresh of coordination points.

```
Do you want to enable auto refresh of coordination points
if registration keys are missing
on any of them? [y,n,q,b,?] (n)
```

- 15** Note the location of the configuration log files, summary files, and response files that the installer displays for later use.

Refreshing keys or registrations on the existing coordination points for server-based fencing using the installer

You must refresh registrations on the coordination points in the following scenarios:

- When the CoordPoint agent notifies VCS about the loss of registration on any of the existing coordination points.
- A planned refresh of registrations on coordination points when the cluster is online without having an application downtime on the cluster.

Registration loss might occur because of an accidental array restart, corruption of keys, or some other reason. If the coordination points lose registrations of the cluster nodes, the cluster might panic when a network partition occurs.

Warning: Refreshing keys might cause the cluster to panic if a node leaves membership before the coordination points refresh is complete.

To refresh registrations on existing coordination points for server-based I/O fencing using the installer

- 1 Start the installer with the `-fencing` option.

```
# /opt/VRTS/install/installer -fencing
```

The installer starts with a copyright message and verifies the cluster information.

Note the location of log files that you can access if there is a problem with the configuration process.

- 2 Confirm that you want to proceed with the I/O fencing configuration at the prompt.

The program checks that the local node running the script can communicate with the remote nodes and checks whether SFHA 7.2 is configured properly.

- 3 Review the I/O fencing configuration options that the program presents. Type the number corresponding to the option that suggests to refresh registrations or keys on the existing coordination points.

```
Select the fencing mechanism to be configured in this
Application Cluster [1-7,q] 6
```

- 4 Ensure that the `/etc/vxfentab` file contains the same coordination point servers that are currently used by the fencing module.

Also, ensure that the disk group mentioned in the `/etc/vxfendg` file contains the same disks that are currently used by the fencing module as coordination disks.

- 5 Verify the coordination points.

For example,

```
Total number of coordination points being used: 3
```

```
Coordination Point Server ([VIP or FQHN]:Port):
```

```
1. 10.198.94.146 ([10.198.94.146]:443)
```

```
2. 10.198.94.144 ([10.198.94.144]:443)
```

```
SCSI-3 disks:
```

```
1. emc_clariion0_61
```

```
Disk Group name for the disks in customized fencing: vxfencoordg
```

```
Disk policy used for customized fencing: dmp
```

6 Is this information correct? [y,n,q] (y)

```
Updating client cluster information on Coordination Point Server  
IPaddress
```

```
Successfully completed the vxfsnwap operation
```

The keys on the coordination disks are refreshed.

7 Do you want to send the information about this installation to us to help improve installation in the future? [y,n,q,?] (y).

8 Do you want to view the summary file? [y,n,q] (n).

Setting the order of existing coordination points for server-based fencing using the installer

This section describes the reasons, benefits, considerations, and the procedure to set the order of the existing coordination points for server-based fencing.

About deciding the order of existing coordination points

You can decide the order in which coordination points can participate in a race during a network partition. In a network partition scenario, I/O fencing attempts to contact coordination points for membership arbitration based on the order that is set in the `vxfsentab` file.

When I/O fencing is not able to connect to the first coordination point in the sequence it goes to the second coordination point and so on. To avoid a cluster panic, the surviving subcluster must win majority of the coordination points. So, the order must begin with the coordination point that has the best chance to win the race and must end with the coordination point that has the least chance to win the race.

For fencing configurations that use a mix of coordination point servers and coordination disks, you can specify either coordination point servers before coordination disks or disks before servers.

Note: Disk-based fencing does not support setting the order of existing coordination points.

Considerations to decide the order of coordination points

- Choose the coordination points based on their chances to gain membership on the cluster during the race and hence gain control over a network partition. In effect, you have the ability to save a partition.

- First in the order must be the coordination point that has the best chance to win the race. The next coordination point you list in the order must have relatively lesser chance to win the race. Complete the order such that the last coordination point has the least chance to win the race.

Setting the order of existing coordination points using the installer

To set the order of existing coordination points

- 1 Start the installer with `-fencing` option.

```
# /opt/VRTS/install/installer -fencing
```

The installer starts with a copyright message and verifies the cluster information.

Note the location of log files that you can access if there is a problem with the configuration process.

- 2 Confirm that you want to proceed with the I/O fencing configuration at the prompt.

The program checks that the local node running the script can communicate with remote nodes and checks whether SFHA 7.2 is configured properly.

- 3 Review the I/O fencing configuration options that the program presents. Type the number corresponding to the option that suggests to set the order of existing coordination points.

For example:

```
Select the fencing mechanism to be configured in this  
Application Cluster [1-7,q] 7
```

Installer will ask the new order of existing coordination points. Then it will call `vxfsnwap` utility to commit the coordination points change.

Warning: The cluster might panic if a node leaves membership before the coordination points change is complete.

4 Review the current order of coordination points.

Current coordination points order:

(Coordination disks/Coordination Point Server)

Example,

- 1) /dev/vx/rdmp/emc_clariion0_65,/dev/vx/rdmp/emc_clariion0_66,
/dev/vx/rdmp/emc_clariion0_62
- 2) [10.198.94.144]:443
- 3) [10.198.94.146]:443
- b) Back to previous menu

5 Enter the new order of the coordination points by the numbers and separate the order by space [1-3,b,q] **3 1 2.**

New coordination points order:

(Coordination disks/Coordination Point Server)

Example,

- 1) [10.198.94.146]:443
- 2) /dev/vx/rdmp/emc_clariion0_65,/dev/vx/rdmp/emc_clariion0_66,
/dev/vx/rdmp/emc_clariion0_62
- 3) [10.198.94.144]:443

6 Is this information correct? [y,n,q] **(y).**

Preparing vxfenmode.test file on all systems...

Running vxfenswap...

Successfully completed the vxfenswap operation

7 Do you want to send the information about this installation to us to help improve installation in the future? [y,n,q,?] **(y).**

8 Do you want to view the summary file? [y,n,q] **(n).**

- 9** Verify that the value of `vxfen_honor_cp_order` specified in the `/etc/vxfenmode` file is set to 1.

```
For example,
vxfen_mode=customized
vxfen_mechanism=cps
port=443
scsi3_disk_policy=dmp
cps1=[10.198.94.146]
vxfendg=vxfencoordg
cps2=[10.198.94.144]
vxfen_honor_cp_order=1
```

- 10** Verify that the coordination point order is updated in the output of the `vxfenconfig -l` command.

```
For example,
I/O Fencing Configuration Information:
=====

single_cp=0
[10.198.94.146]:443 {e7823b24-1dd1-11b2-8814-2299557f1dc0}
/dev/vx/rmp/emc_clariion0_65 60060160A38B1600386FD87CA8FDDDD11
/dev/vx/rmp/emc_clariion0_66 60060160A38B1600396FD87CA8FDDDD11
/dev/vx/rmp/emc_clariion0_62 60060160A38B16005AA00372A8FDDDD11
[10.198.94.144]:443 {01f18460-1dd2-11b2-b818-659cbc6eb360}
```

Setting up non-SCSI-3 I/O fencing in virtual environments using installer

If you have installed Veritas InfoScale Enterprise in virtual environments that do not support SCSI-3 PR-compliant storage, you can configure non-SCSI-3 fencing.

To configure I/O fencing using the installer in a non-SCSI-3 PR-compliant setup

- 1 Start the installer with `-fencing` option.

```
# /opt/VRTS/install/installer -fencing
```

The installer starts with a copyright message and verifies the cluster information.

- 2 Confirm that you want to proceed with the I/O fencing configuration at the prompt.

The program checks that the local node running the script can communicate with remote nodes and checks whether SFHA 7.2 is configured properly.

- 3 For server-based fencing, review the I/O fencing configuration options that the program presents. Type **1** to configure server-based I/O fencing.

```
Select the fencing mechanism to be configured in this
Application Cluster
[1-7,q] 1
```

- 4 Enter **n** to confirm that your storage environment does not support SCSI-3 PR.

```
Does your storage environment support SCSI3 PR?
[y,n,q] (y) n
```

- 5 Confirm that you want to proceed with the non-SCSI-3 I/O fencing configuration at the prompt.
- 6 For server-based fencing, enter the number of CP server coordination points you want to use in your setup.
- 7 For server-based fencing, enter the following details for each CP server:

- Enter the virtual IP address or the fully qualified host name.
- Enter the port address on which the CP server listens for connections.
The default value is 443. You can enter a different port address. Valid values are between 49152 and 65535.

The installer assumes that these values are identical from the view of the SFHA cluster nodes that host the applications for high availability.

- 8 For server-based fencing, verify and confirm the CP server information that you provided.
- 9 Verify and confirm the SFHA cluster configuration information.

Review the output as the installer performs the following tasks:

- Updates the CP server configuration files on each CP server with the following details for only server-based fencing, :
 - Registers each node of the SFHA cluster with the CP server.
 - Adds CP server user to the CP server.
 - Adds SFHA cluster to the CP server user.
 - Updates the following configuration files on each node of the SFHA cluster
 - `/etc/vxfenmode` file
 - `/etc/default/vxfen` file
 - `/etc/vxenvirom` file
 - `/etc/llttab` file
 - `/etc/vxfentab` (only for server-based fencing)
- 10** Review the output as the installer stops SFHA on each node, starts I/O fencing on each node, updates the VCS configuration file `main.cf`, and restarts SFHA with non-SCSI-3 fencing.
- For server-based fencing, confirm to configure the CP agent on the SFHA cluster.
- 11** Confirm whether you want to send the installation information to us.
- 12** After the installer configures I/O fencing successfully, note the location of summary, log, and response files that installer creates.
- The files provide useful information which can assist you with the configuration, and can also assist future configurations.

Setting up majority-based I/O fencing using installer

You can configure majority-based fencing for the cluster using the installer .

Perform the following steps to configure majority-based I/O fencing

- 1 Start the installer with the `-fencing` option.

```
# /opt/VRTS/install/installer -fencing
```

Where *version* is the specific release version. The installer starts with a copyright message and verifies the cluster information.

Note: Make a note of the log file location which you can access in the event of any issues with the configuration process.

- 2 Confirm that you want to proceed with the I/O fencing configuration at the prompt. The program checks that the local node running the script can communicate with remote nodes and checks whether SFHA is configured properly.
- 3 Review the I/O fencing configuration options that the program presents. Type **3** to configure majority-based I/O fencing.

```
Select the fencing mechanism to be configured in this
Application Cluster [1-7,b,q] 3
```

Note: The installer will ask the following question. Does your storage environment support SCSI3 PR? [y,n,q,?] Input 'y' if your storage environment supports SCSI3 PR. Other alternative will result in installer configuring non-SCSI3 fencing(NSF).

- 4 The installer then populates the `/etc/vxfenmode` file with the appropriate details in each of the application cluster nodes.

```
Updating /etc/vxfenmode file on sys1 ..... Done
Updating /etc/vxfenmode file on sys2 ..... Done
```

- 5 Review the output as the installer stops and restarts the VCS and the fencing processes on each application cluster node, and completes the I/O fencing configuration.
- 6 Note the location of the configuration log files, summary files, and response files that the installer displays for later use.
- 7 Verify the fencing configuration.

```
# vxfenadm -d
```

Enabling or disabling the preferred fencing policy

You can enable or disable the preferred fencing feature for your I/O fencing configuration.

You can enable preferred fencing to use system-based race policy, group-based race policy, or site-based policy. If you disable preferred fencing, the I/O fencing configuration uses the default count-based race policy.

Preferred fencing is not applicable to majority-based I/O fencing.

See [“About preferred fencing”](#) on page 22.

To enable preferred fencing for the I/O fencing configuration

- 1 Make sure that the cluster is running with I/O fencing set up.

```
# vxfenadm -d
```

- 2 Make sure that the cluster-level attribute UseFence has the value set to SCSI3.

```
# haclus -value UseFence
```

- 3 To enable system-based race policy, perform the following steps:

- Make the VCS configuration writable.

```
# haconf -makerw
```

- Set the value of the cluster-level attribute PreferredFencingPolicy as System.

```
# haclus -modify PreferredFencingPolicy System
```

- Set the value of the system-level attribute FencingWeight for each node in the cluster.

For example, in a two-node cluster, where you want to assign sys1 five times more weight compared to sys2, run the following commands:

```
# hasys -modify sys1 FencingWeight 50  
# hasys -modify sys2 FencingWeight 10
```

- Save the VCS configuration.

```
# haconf -dump -makero
```

- Verify fencing node weights using:

```
# vxfenconfig -a
```

4 To enable group-based race policy, perform the following steps:

- Make the VCS configuration writable.

```
# haconf -makerw
```

- Set the value of the cluster-level attribute PreferredFencingPolicy as Group.

```
# haclus -modify PreferredFencingPolicy Group
```

- Set the value of the group-level attribute Priority for each service group.
For example, run the following command:

```
# hagrps -modify service_group Priority 1
```

Make sure that you assign a parent service group an equal or lower priority than its child service group. In case the parent and the child service groups are hosted in different subclusters, then the subcluster that hosts the child service group gets higher preference.

- Save the VCS configuration.

```
# haconf -dump -makero
```

5 To enable site-based race policy, perform the following steps:

- Make the VCS configuration writable.

```
# haconf -makerw
```

- Set the value of the cluster-level attribute PreferredFencingPolicy as Site.

```
# haclus -modify PreferredFencingPolicy Site
```

- Set the value of the site-level attribute Preference for each site.

For example,

```
# hasite -modify Pune Preference 2
```

- Save the VCS configuration.

```
# haconf -dump -makero
```

6 To view the fencing node weights that are currently set in the fencing driver, run the following command:

```
# vxfenconfig -a
```

To disable preferred fencing for the I/O fencing configuration

- 1** Make sure that the cluster is running with I/O fencing set up.

```
# vxfenadm -d
```

- 2** Make sure that the cluster-level attribute UseFence has the value set to SCSI3.

```
# haclus -value UseFence
```

- 3** To disable preferred fencing and use the default race policy, set the value of the cluster-level attribute PreferredFencingPolicy as Disabled.

```
# haconf -makerw
```

```
# haclus -modify PreferredFencingPolicy Disabled
```

```
# haconf -dump -makero
```

Manually configuring SFHA clusters for data integrity

This chapter includes the following topics:

- [Setting up disk-based I/O fencing manually](#)
- [Setting up server-based I/O fencing manually](#)
- [Setting up non-SCSI-3 fencing in virtual environments manually](#)
- [Setting up majority-based I/O fencing manually](#)

Setting up disk-based I/O fencing manually

[Table 6-1](#) lists the tasks that are involved in setting up I/O fencing.

Table 6-1

Task	Reference
Initializing disks as VxVM disks	See "Initializing disks as VxVM disks" on page 81.
Identifying disks to use as coordinator disks	See "Identifying disks to use as coordinator disks" on page 112.
Checking shared disks for I/O fencing	See "Checking shared disks for I/O fencing" on page 82.
Setting up coordinator disk groups	See "Setting up coordinator disk groups" on page 113.

Table 6-1 (continued)

Task	Reference
Creating I/O fencing configuration files	See “Creating I/O fencing configuration files” on page 113.
Modifying SFHA configuration to use I/O fencing	See “Modifying VCS configuration to use I/O fencing” on page 114.
Configuring CoordPoint agent to monitor coordination points	See “Configuring CoordPoint agent to monitor coordination points” on page 127.
Verifying I/O fencing configuration	See “Verifying I/O fencing configuration” on page 116.

Removing permissions for communication

Make sure you completed the installation of Veritas InfoScale Enterprise and the verification of disk support for I/O fencing. If you used `rsh`, remove the temporary `rsh` access permissions that you set for the nodes and restore the connections to the public network.

If the nodes use `ssh` for secure communications, and you temporarily removed the connections to the public network, restore the connections.

Identifying disks to use as coordinator disks

Make sure you initialized disks as VxVM disks.

See [“Initializing disks as VxVM disks”](#) on page 81.

Review the following procedure to identify disks to use as coordinator disks.

To identify the coordinator disks

- 1 List the disks on each node.

For example, execute the following commands to list the disks:

```
# vxdisk -o all dgs list
```

- 2 Pick three SCSI-3 PR compliant shared disks as coordinator disks.

See [“Checking shared disks for I/O fencing”](#) on page 82.

Setting up coordinator disk groups

From one node, create a disk group named `vxfencoorddg`. This group must contain three disks or LUNs. You must also set the coordinator attribute for the coordinator disk group. VxVM uses this attribute to prevent the reassignment of coordinator disks to other disk groups.

Note that if you create a coordinator disk group as a regular disk group, you can turn on the coordinator attribute in Volume Manager.

Refer to the *Storage Foundation Administrator's Guide* for details on how to create disk groups.

The following example procedure assumes that the disks have the device names `hdisk10`, `hdisk11`, and `hdisk12`.

To create the `vxfencoorddg` disk group

- 1 On any node, create the disk group by specifying the device names:

```
# vxdg init vxfencoorddg hdisk10 hdisk11 hdisk12
```

- 2 Set the coordinator attribute value as "on" for the coordinator disk group.

```
# vxdg -g vxfencoorddg set coordinator=on
```

- 3 Deport the coordinator disk group:

```
# vxdg deport vxfencoorddg
```

- 4 Import the disk group with the `-t` option to avoid automatically importing it when the nodes restart:

```
# vxdg -t import vxfencoorddg
```

- 5 Deport the disk group. Deporting the disk group prevents the coordinator disks from serving other purposes:

```
# vxdg deport vxfencoorddg
```

Creating I/O fencing configuration files

After you set up the coordinator disk group, you must do the following to configure I/O fencing:

- Create the I/O fencing configuration file `/etc/vxfendg`
- Update the I/O fencing configuration file `/etc/vxfenmode`

To update the I/O fencing files and start I/O fencing

- 1 On each nodes, type:

```
# echo "vxfencoordg" > /etc/vxfendg
```

Do not use spaces between the quotes in the "vxfencoordg" text.

This command creates the /etc/vxfendg file, which includes the name of the coordinator disk group.

- 2 On all cluster nodes specify the use of DMP disk policy in the /etc/vxfenmode file.

```
■ # cp /etc/vxfen.d/vxfenmode_scsi3_dmp /etc/vxfenmode
```

- 3 To check the updated /etc/vxfenmode configuration, enter the following command on one of the nodes. For example:

```
# more /etc/vxfenmode
```

- 4 Ensure that you edit the following file on each node in the cluster to change the values of the VXFEN_START and the VXFEN_STOP environment variables to 1:

```
/etc/default/vxfen
```

Modifying VCS configuration to use I/O fencing

After you add coordination points and configure I/O fencing, add the UseFence = SCSI3 cluster attribute to the VCS configuration file /etc/VRTSvcs/conf/config/main.cf.

If you reset this attribute to UseFence = None, VCS does not make use of I/O fencing abilities while failing over service groups. However, I/O fencing needs to be disabled separately.

To modify VCS configuration to enable I/O fencing

- 1 Save the existing configuration:

```
# haconf -dump -makero
```

- 2 Stop VCS on all nodes:

```
# hastop -all
```

- 3 To ensure High Availability has stopped cleanly, run `gabconfig -a`.

In the output of the commands, check that Port h is not present.

- 4 If the I/O fencing driver `vxfen` is already running, stop the I/O fencing driver.

```
# /etc/init.d/vxfen.rc stop
```

- 5 Make a backup of the `main.cf` file on all the nodes:

```
# cd /etc/VRTSvcs/conf/config
# cp main.cf main.orig
```

- 6 On one node, use `vi` or another text editor to edit the `main.cf` file. To modify the list of cluster attributes, add the `UseFence` attribute and assign its value as `SCSI3`.

```
cluster clus1(
UserNames = { admin = "cDRpdxPmHpzS." }
Administrators = { admin }
HacliUserLevel = COMMANDROOT
CounterInterval = 5
UseFence = SCSI3
)
```

Regardless of whether the fencing configuration is disk-based or server-based, the value of the cluster-level attribute `UseFence` is set to `SCSI3`.

- 7 Save and close the file.

- 8 Verify the syntax of the file `/etc/VRTSvcs/conf/config/main.cf`:

```
# hacf -verify /etc/VRTSvcs/conf/config
```

- 9 Start the I/O fencing driver and VCS. Perform the following steps on each node:

- Start the I/O fencing driver.
The `vxfen` startup script also invokes the `vxfenconfig` command, which configures the `vxfen` driver to start and use the coordination points that are listed in `/etc/vxfentab`.

```
# /etc/init.d/vxfen.rc start
```

- Start VCS on the node where `main.cf` is modified.

```
# /opt/VRTS/bin/hastart
```

- Start VCS on all other nodes once VCS on first node reaches RUNNING state.

```
# /opt/VRTS/bin/hastart
```

Verifying I/O fencing configuration

Verify from the vxfenadm output that the SCSI-3 disk policy reflects the configuration in the /etc/vxfenmode file.

To verify I/O fencing configuration

- 1 On one of the nodes, type:

```
# vxfenadm -d
```

Output similar to the following appears if the fencing mode is SCSI3 and the SCSI3 disk policy is dmp:

```
I/O Fencing Cluster Information:
=====
```

```
Fencing Protocol Version: 201
```

```
Fencing Mode: SCSI3
```

```
Fencing SCSI3 Disk Policy: dmp
```

```
Cluster Members:
```

```
* 0 (sys1)
```

```
1 (sys2)
```

```
RFSM State Information:
```

```
node 0 in state 8 (running)
```

```
node 1 in state 8 (running)
```

- 2 Verify that the disk-based I/O fencing is using the specified disks.

```
# vxfenconfig -l
```

Setting up server-based I/O fencing manually

Tasks that are involved in setting up server-based I/O fencing manually include:

Table 6-2 Tasks to set up server-based I/O fencing manually

Task	Reference
Preparing the CP servers for use by the SFHA cluster	See “Preparing the CP servers manually for use by the SFHA cluster” on page 117.
Generating the client key and certificates on the client nodes manually	See “Generating the client key and certificates manually on the client nodes ” on page 119.
Modifying I/O fencing configuration files to configure server-based I/O fencing	See “Configuring server-based fencing on the SFHA cluster manually” on page 121.
Modifying SFHA configuration to use I/O fencing	See “Modifying VCS configuration to use I/O fencing” on page 114.
Configuring Coordination Point agent to monitor coordination points	See “Configuring CoordPoint agent to monitor coordination points” on page 127.
Verifying the server-based I/O fencing configuration	See “Verifying server-based I/O fencing configuration” on page 129.

Preparing the CP servers manually for use by the SFHA cluster

Use this procedure to manually prepare the CP server for use by the SFHA cluster or clusters.

[Table 6-3](#) displays the sample values used in this procedure.

Table 6-3 Sample values in procedure

CP server configuration component	Sample name
CP server	cps1
Node #1 - SFHA cluster	sys1
Node #2 - SFHA cluster	sys2
Cluster name	clus1
Cluster UUID	{f0735332-1dd1-11b2}

To manually configure CP servers for use by the SFHA cluster

- 1 Determine the cluster name and uuid on the SFHA cluster.

For example, issue the following commands on one of the SFHA cluster nodes (sys1):

```
# grep cluster /etc/VRTSvcs/conf/config/main.cf

cluster clus1

# cat /etc/vx/.uuids/clusuuid

{f0735332-1dd1-11b2-bb31-00306eea460a}
```

- 2 Use the `cpsadm` command to check whether the SFHA cluster and nodes are present in the CP server.

For example:

```
# cpsadm -s cps1.example.com -a list_nodes
```

ClusName	UUID	Hostname (Node ID)	Registered
clus1	{f0735332-1dd1-11b2-bb31-00306eea460a}	sys1 (0)	0
clus1	{f0735332-1dd1-11b2-bb31-00306eea460a}	sys2 (1)	0

If the output does not show the cluster and nodes, then add them as described in the next step.

For detailed information about the `cpsadm` command, see the *Cluster Server Administrator's Guide*.

3 Add the SFHA cluster and nodes to each CP server.

For example, issue the following command on the CP server (cps1.example.com) to add the cluster:

```
# cpsadm -s cps1.example.com -a add_clus\  
-c clus1 -u {f0735332-1dd1-11b2}
```

Cluster clus1 added successfully

Issue the following command on the CP server (cps1.example.com) to add the first node:

```
# cpsadm -s cps1.example.com -a add_node\  
-c clus1 -u {f0735332-1dd1-11b2} -h sys1 -n0
```

Node 0 (sys1) successfully added

Issue the following command on the CP server (cps1.example.com) to add the second node:

```
# cpsadm -s cps1.example.com -a add_node\  
-c clus1 -u {f0735332-1dd1-11b2} -h sys2 -n1
```

Node 1 (sys2) successfully added

See [“Generating the client key and certificates manually on the client nodes”](#) on page 119.

Generating the client key and certificates manually on the client nodes

The client node that wants to connect to a CP server using HTTPS must have a private key and certificates signed by the Certificate Authority (CA) on the CP server

The client uses its private key and certificates to establish connection with the CP server. The key and the certificate must be present on the node at a predefined location. Each client has one client certificate and one CA certificate for every CP server, so, the certificate files must follow a specific naming convention. Distinct certificate names help the `cpsadm` command to identify which certificates have to be used when a client node connects to a specific CP server.

The certificate names must be as follows: `ca_cps-vip.crt` and `client_cps-vip.crt`

Where, `cps-vip` is the VIP or FQHN of the CP server listed in the `/etc/vxsfenmode` file. For example, for a sample VIP, `192.168.1.201`, the corresponding certificate name is `ca_192.168.1.201`.

To manually set up certificates on the client node

1 Create the directory to store certificates.

```
# mkdir -p /var/VRTSvxfen/security/keys
/var/VRTSvxfen/security/certs
```

Note: Since the openssl utility might not be available on client nodes, Veritas recommends that you access the CP server using SSH to generate the client keys or certificates on the CP server and copy the certificates to each of the nodes.

2 Generate the private key for the client node.

```
# /usr/bin/openssl genrsa -out client_private.key 2048
```

3 Generate the client CSR for the cluster. CN is the UUID of the client's cluster.

```
# /usr/bin/openssl req -new -key -sha256 client_private.key\
-subj '/C=countryname/L=localityname/OU=COMPANY/CN=CLUS_UUID'\
-out client_192.168.1.201.csr
```

Where, *countryname* is the country code, *localityname* is the city, *COMPANY* is the name of the company, and *CLUS_UUID* is the certificate name.

4 Generate the client certificate by using the CA key and the CA certificate. Run this command from the CP server.

```
# /usr/bin/openssl x509 -req -days days -sha256 -in
client_192.168.1.201.csr\
-CA /var/VRTScps/security/certs/ca.crt -CAkey\
/var/VRTScps/security/keys/ca.key -set_serial 01 -out
client_192.168.10.1.crt
```

Where, *days* is the days you want the certificate to remain valid, *192.168.1.201* is the VIP or FQHN of the CP server.

- 5 Copy the client key, client certificate, and CA certificate to each of the client nodes at the following location.

Copy the client key at

`/var/VRTSvxfen/security/keys/client_private.key`. The client is common for all the client nodes and hence you need to generate it only once.

Copy the client certificate at

`/var/VRTSvxfen/security/certs/client_192.168.1.201.crt`.

Copy the CA certificate at

`/var/VRTSvxfen/security/certs/ca_192.168.1.201.crt`

Note: Copy the certificates and the key to all the nodes at the locations that are listed in this step.

- 6 If the client nodes need to access the CP server using the FQHN and or the host name, make a copy of the certificates you generated and replace the VIP with the FQHN or host name. Make sure that you copy these certificates to all the nodes.
- 7 Repeat the procedure for every CP server.
- 8 After you copy the key and certificates to each client node, delete the client keys and client certificates on the CP server.

Configuring server-based fencing on the SFHA cluster manually

The configuration process for the client or SFHA cluster to use CP server as a coordination point requires editing the `/etc/vxfenmode` file.

You need to edit this file to specify the following information for your configuration:

- Fencing mode
- Fencing mechanism
- Fencing disk policy (if applicable to your I/O fencing configuration)
- CP server or CP servers
- Coordinator disk group (if applicable to your I/O fencing configuration)
- Set the order of coordination points

Note: Whenever coordinator disks are used as coordination points in your I/O fencing configuration, you must create a disk group (vxencoorddg). You must specify this disk group in the `/etc/vxfenmode` file.

See [“Setting up coordinator disk groups”](#) on page 113.

The customized fencing framework also generates the `/etc/vxfentab` file which has coordination points (all the CP servers and disks from disk group specified in `/etc/vxfenmode` file).

To configure server-based fencing on the SFHA cluster manually

- 1 Use a text editor to edit the following file on each node in the cluster:

```
/etc/default/vxfen
```

You must change the values of the `VXFEN_START` and the `VXFEN_STOP` environment variables to 1.

- 2 Use a text editor to edit the `/etc/vxfenmode` file values to meet your configuration specifications.
 - If your server-based fencing configuration uses a single highly available CP server as its only coordination point, make sure to add the `single_cp=1` entry in the `/etc/vxfenmode` file.
 - If you want the `vxfen` module to use a specific order of coordination points during a network partition scenario, set the `vxfen_honor_cp_order` value to be 1. By default, the parameter is disabled.

The following sample file output displays what the `/etc/vxfenmode` file contains:

See [“Sample vxfenmode file output for server-based fencing”](#) on page 122.

- 3 After editing the `/etc/vxfenmode` file, run the `vxfen` init script to start fencing.

For example:

```
# /etc/init.d/vxfen.rc start
```

Sample vxfenmode file output for server-based fencing

The following is a sample `vxfenmode` file for server-based fencing:

```
#
# vxfen_mode determines in what mode VCS I/O Fencing should work.
#
# available options:
```

```
# scsi3      - use scsi3 persistent reservation disks
# customized - use script based customized fencing
# disabled   - run the driver but don't do any actual fencing
#
vxfen_mode=customized

# vxfen_mechanism determines the mechanism for customized I/O
# fencing that should be used.
#
# available options:
# cps      - use a coordination point server with optional script
#            controlled scsi3 disks
#
vxfen_mechanism=cps

#
# scsi3_disk_policy determines the way in which I/O fencing
# communicates with the coordination disks. This field is
# required only if customized coordinator disks are being used.
#
# available options:
# dmp - use dynamic multipathing
#
scsi3_disk_policy=dmp

#
# vxfen_honor_cp_order determines the order in which vxfen
# should use the coordination points specified in this file.
#
# available options:
# 0 - vxfen uses a sorted list of coordination points specified
# in this file,
# the order in which coordination points are specified does not matter.
# (default)
# 1 - vxfen uses the coordination points in the same order they are
# specified in this file

# Specify 3 or more odd number of coordination points in this file,
# each one in its own line. They can be all-CP servers,
# all-SCSI-3 compliant coordinator disks, or a combination of
# CP servers and SCSI-3 compliant coordinator disks.
# Please ensure that the CP server coordination points
# are numbered sequentially and in the same order
```

```

# on all the cluster nodes.
#
# Coordination Point Server(CPS) is specified as follows:
#
# cps<number>=[<vip/vhn>]:<port>
#
# If a CPS supports multiple virtual IPs or virtual hostnames
# over different subnets, all of the IPs/names can be specified
# in a comma separated list as follows:
#
# cps<number>=[<vip_1/vhn_1>]:<port_1>,<vip_2/vhn_2>]:<port_2>,
# ..., [<vip_n/vhn_n>]:<port_n>
#
# Where,
# <number>
# is the serial number of the CPS as a coordination point; must
# start with 1.
# <vip>
# is the virtual IP address of the CPS, must be specified in
# square brackets ("[]").
# <vhn>
# is the virtual hostname of the CPS, must be specified in square
# brackets ("[]").
# <port>
# is the port number bound to a particular <vip/vhn> of the CPS.
# It is optional to specify a <port>. However, if specified, it
# must follow a colon (":") after <vip/vhn>. If not specified, the
# colon (":") must not exist after <vip/vhn>.
#
# For all the <vip/vhn>s which do not have a specified <port>,
# a default port can be specified as follows:
#
# port=<default_port>
#
# Where <default_port> is applicable to all the <vip/vhn>s for
# which a <port> is not specified. In other words, specifying
# <port> with a <vip/vhn> overrides the <default_port> for that
# <vip/vhn>. If the <default_port> is not specified, and there
# are <vip/vhn>s for which <port> is not specified, then port
# number 14250 will be used for such <vip/vhn>s.
#
# Example of specifying CP Servers to be used as coordination points:
# port=57777
    
```

```
# cps1=[192.168.0.23],[192.168.0.24]:58888,[cps1.company.com]
# cps2=[192.168.0.25]
# cps3=[cps2.company.com]:59999
#
# In the above example,
# - port 58888 will be used for vip [192.168.0.24]
# - port 59999 will be used for vhn [cps2.company.com], and
# - default port 57777 will be used for all remaining <vip/vhn>s:
#   [192.168.0.23]
#   [cps1.company.com]
#   [192.168.0.25]
# - if default port 57777 were not specified, port 14250
# would be used for all remaining <vip/vhn>s:
#   [192.168.0.23]
#   [cps1.company.com]
#   [192.168.0.25]
#
# SCSI-3 compliant coordinator disks are specified as:
#
# vxfendg=<coordinator disk group name>
# Example:
# vxfendg=vxfencoorddg
#
# Examples of different configurations:
# 1. All CP server coordination points
# cps1=
# cps2=
# cps3=
#
# 2. A combination of CP server and a disk group having two SCSI-3
# coordinator disks
# cps1=
# vxfendg=
# Note: The disk group specified in this case should have two disks
#
# 3. All SCSI-3 coordinator disks
# vxfendg=
# Note: The disk group specified in case should have three disks
# cps1=[cps1.company.com]
# cps2=[cps2.company.com]
# cps3=[cps3.company.com]
# port=443
```

Table 6-4 defines the vxfenmode parameters that must be edited.

Table 6-4 vxfenmode file parameters

vxfenmode File Parameter	Description
vxfen_mode	Fencing mode of operation. This parameter must be set to “customized”.
vxfen_mechanism	Fencing mechanism. This parameter defines the mechanism that is used for fencing. If one of the three coordination points is a CP server, then this parameter must be set to “cps”.
scsi3_disk_policy	Configure the vxfen module to use DMP devices, “dmp”. Note: The configured disk policy is applied on all the nodes.
cps1, cps2, or vxfendg	Coordination point parameters. Enter either the virtual IP address or the FQHN (whichever is accessible) of the CP server. <i>cps<number>=[virtual_ip_address/virtual_host_name]:port</i> Where <i>port</i> is optional. The default port value is 443. If you have configured multiple virtual IP addresses or host names over different subnets, you can specify these as comma-separated values. For example: <i>cps1=[192.168.0.23],[192.168.0.24]:58888,[cps1.company.com]</i> Note: Whenever coordinator disks are used in an I/O fencing configuration, a disk group has to be created (vxencoorddg) and specified in the /etc/vxfenmode file. Additionally, the customized fencing framework also generates the /etc/vxfentab file which specifies the security setting and the coordination points (all the CP servers and the disks from disk group specified in /etc/vxfenmode file).
port	Default port for the CP server to listen on. If you have not specified port numbers for individual virtual IP addresses or host names, the default port number value that the CP server uses for those individual virtual IP addresses or host names is 443. You can change this default port value using the port parameter.

Table 6-4 vxfenmode file parameters (*continued*)

vxfenmode File Parameter	Description
single_cp	Value 1 for single_cp parameter indicates that the server-based fencing uses a single highly available CP server as its only coordination point. Value 0 for single_cp parameter indicates that the server-based fencing uses at least three coordination points.
vxfen_honor_cp_order	Set the value to 1 for vxfen module to use a specific order of coordination points during a network partition scenario. By default the parameter is disabled. The default value is 0.

Configuring CoordPoint agent to monitor coordination points

The following procedure describes how to manually configure the CoordPoint agent to monitor coordination points.

The CoordPoint agent can monitor CP servers and SCSI-3 disks.

See the *Storage Foundation and High Availability Bundled Agents Reference Guide* for more information on the agent.

To configure CoordPoint agent to monitor coordination points

- 1 Ensure that your SFHA cluster has been properly installed and configured with fencing enabled.
- 2 Create a parallel service group vxfen and add a coordpoint resource to the vxfen service group using the following commands:

```
# haconf -makerw
# hagrps -add vxfen
# hagrps -modify vxfen SystemList sys1 0 sys2 1
# hagrps -modify vxfen AutoFailOver 0
# hagrps -modify vxfen Parallel 1
# hagrps -modify vxfen SourceFile "./main.cf"
# hares -add coordpoint CoordPoint vxfen
# hares -modify coordpoint FaultTolerance 0
# hares -override coordpoint LevelTwoMonitorFreq
# hares -modify coordpoint LevelTwoMonitorFreq 5
# hares -modify coordpoint Enabled 1
# haconf -dump -makero
```

3 Configure the Phantom resource for the vxfen disk group.

```
# haconf -makerw
# hares -add RES_phantom_vxfen Phantom vxfen
# hares -modify RES_phantom_vxfen Enabled 1
# haconf -dump -makero
```

4 Verify the status of the agent on the SFHA cluster using the `hares` commands. For example:

```
# hares -state coordpoint
```

The following is an example of the command and output::

```
# hares -state coordpoint

# Resource      Attribute  System  Value
coordpoint      State      sys1    ONLINE
coordpoint      State      sys2    ONLINE
```

5 Access the engine log to view the agent log. The agent log is written to the engine log.

The agent log contains detailed CoordPoint agent monitoring information; including information about whether the CoordPoint agent is able to access all the coordination points, information to check on which coordination points the CoordPoint agent is reporting missing keys, etc.

To view the debug logs in the engine log, change the `dbg` level for that node using the following commands:

```
# haconf -makerw

# hatype -modify Coordpoint LogDbg 10

# haconf -dump -makero
```

The agent log can now be viewed at the following location:

`/var/VRTSvcS/log/engine_A.log`

Note: The Coordpoint agent is always in the online state when the I/O fencing is configured in the majority or the disabled mode. For both these modes the I/O fencing does not have any coordination points to monitor. Thereby, the Coordpoint agent is always in the online state.

Verifying server-based I/O fencing configuration

Follow the procedure described below to verify your server-based I/O fencing configuration.

To verify the server-based I/O fencing configuration

- 1 Verify that the I/O fencing configuration was successful by running the `vxfenadm` command. For example, run the following command:

```
# vxfenadm -d
```

Note: For troubleshooting any server-based I/O fencing configuration issues, refer to the *Cluster Server Administrator's Guide*.

- 2 Verify that I/O fencing is using the specified coordination points by running the `vxfenconfig` command. For example, run the following command:

```
# vxfenconfig -l
```

If the output displays `single_cp=1`, it indicates that the application cluster uses a CP server as the single coordination point for server-based fencing.

Setting up non-SCSI-3 fencing in virtual environments manually

To manually set up I/O fencing in a non-SCSI-3 PR compliant setup

- 1 Configure I/O fencing either in majority-based fencing mode with no coordination points or in server-based fencing mode only with CP servers as coordination points.

See [“Setting up server-based I/O fencing manually”](#) on page 116.

See [“Setting up majority-based I/O fencing manually”](#) on page 135.

- 2 Make sure that the SFHA cluster is online and check that the fencing mode is customized mode or majority mode.

```
# vxfenadm -d
```

- 3 Make sure that the cluster attribute `UseFence` is set to SCSI-3.

```
# haclus -value UseFence
```

- 4 On each node, edit the `/etc/vxenviro` file as follows:

```
data_disk_fencing=off
```

- 5 Enter the following command to change the `vxfen_min_delay` parameter value:

```
# chdev -l vxfen -P -a vxfen_vxfnd_tmt=25
```

- 6 On each node, edit the `/etc/vxfenmode` file as follows:

```
loser_exit_delay=55
vxfen_script_timeout=25
```

Refer to the sample `/etc/vxfenmode` file.

- 7 On each node, set the value of the LLT sendhbcap timer parameter value as follows:

- Run the following command:

```
lltconfig -T sendhbcap:3000
```

- Add the following line to the `/etc/llttab` file so that the changes remain persistent after any reboot:

```
set-timer senhbcap:3000
```

- 8 On any one node, edit the VCS configuration file as follows:

- Make the VCS configuration file writable:

```
# haconf -makerw
```

- For each resource of the type `DiskGroup`, set the value of the `MonitorReservation` attribute to 0 and the value of the `Reservation` attribute to `NONE`.

```
# hares -modify <dg_resource> MonitorReservation 0
```

```
# hares -modify <dg_resource> Reservation "NONE"
```

- Run the following command to verify the value:

```
# hares -list Type=DiskGroup MonitorReservation!=0
```

```
# hares -list Type=DiskGroup Reservation!="NONE"
```

The command should not list any resources.

- Modify the default value of the Reservation attribute at type-level.

```
# haattr -default DiskGroup Reservation "NONE"
```

- Make the VCS configuration file read-only

```
# haconf -dump -makero
```

- 9 Make sure that the UseFence attribute in the VCS configuration file main.cf is set to SCSI-3.
- 10 To make these VxFEN changes take effect, stop and restart VxFEN and the dependent modules

- On each node, run the following command to stop VCS:

```
# /etc/init.d/vcs.rc stop
```

- After VCS takes all services offline, run the following command to stop VxFEN:

```
# /etc/init.d/vxfen.rc stop
```

- On each node, run the following commands to restart VxFEN and VCS:

```
# /etc/init.d/vxfen.rc start
# /etc/init.d/vcs.rc start
```

Sample /etc/vxfenmode file for non-SCSI-3 fencing

```
#
# vxfen_mode determines in what mode VCS I/O Fencing should work.
#
# available options:
# scsi3          - use scsi3 persistent reservation disks
# customized     - use script based customized fencing
# disabled       - run the driver but don't do any actual fencing
#
vxfen_mode=customized

# vxfen_mechanism determines the mechanism for customized I/O
# fencing that should be used.
#
```

```
# available options:
# cps      - use a coordination point server with optional script
#            controlled scsi3 disks
#
vxfen_mechanism=cps

#
# scsi3_disk_policy determines the way in which I/O fencing
# communicates with the coordination disks. This field is
# required only if customized coordinator disks are being used.
#
# available options:
# dmp - use dynamic multipathing
#
scsi3_disk_policy=dmp

#
# Seconds for which the winning sub cluster waits to allow for the
# losing subcluster to panic & drain I/Os. Useful in the absence of
# SCSI3 based data disk fencing loser_exit_delay=55
#
# Seconds for which vxfsend process wait for a customized fencing
# script to complete. Only used with vxfen_mode=customized
# vxfen_script_timeout=25

#
# vxfen_honor_cp_order determines the order in which vxfen
# should use the coordination points specified in this file.
#
# available options:
# 0 - vxfen uses a sorted list of coordination points specified
# in this file, the order in which coordination points are specified
# does not matter.
# (default)
# 1 - vxfen uses the coordination points in the same order they are
# specified in this file

# Specify 3 or more odd number of coordination points in this file,
# each one in its own line. They can be all-CP servers, all-SCSI-3
# compliant coordinator disks, or a combination of CP servers and
# SCSI-3 compliant coordinator disks.
# Please ensure that the CP server coordination points are
# numbered sequentially and in the same order on all the cluster
```

```
# nodes.
#
# Coordination Point Server(CPS) is specified as follows:
#
# cps<number>=[<vip/vhn>]:<port>
#
# If a CPS supports multiple virtual IPs or virtual hostnames
# over different subnets, all of the IPs/names can be specified
# in a comma separated list as follows:
#
# cps<number>=[<vip_1/vhn_1>]:<port_1>,[<vip_2/vhn_2>]:<port_2>,
# ..., [<vip_n/vhn_n>]:<port_n>
#
# Where,
# <number>
#   is the serial number of the CPS as a coordination point; must
#   start with 1.
# <vip>
#   is the virtual IP address of the CPS, must be specified in
#   square brackets ("[]").
# <vhn>
#   is the virtual hostname of the CPS, must be specified in square
#   brackets ("[]").
# <port>
#   is the port number bound to a particular <vip/vhn> of the CPS.
#   It is optional to specify a <port>. However, if specified, it
#   must follow a colon (":") after <vip/vhn>. If not specified, the
#   colon (":") must not exist after <vip/vhn>.
#
# For all the <vip/vhn>s which do not have a specified <port>,
# a default port can be specified as follows:
#
# port=<default_port>
#
# Where <default_port> is applicable to all the <vip/vhn>s for which a
# <port> is not specified. In other words, specifying <port> with a
# <vip/vhn> overrides the <default_port> for that <vip/vhn>.
# If the <default_port> is not specified, and there are <vip/vhn>s for
# which <port> is not specified, then port number 14250 will be used
# for such <vip/vhn>s.
#
# Example of specifying CP Servers to be used as coordination points:
# port=57777
```

```
# cps1=[192.168.0.23],[192.168.0.24]:58888,[cps1.company.com]
# cps2=[192.168.0.25]
# cps3=[cps2.company.com]:59999
#
# In the above example,
# - port 58888 will be used for vip [192.168.0.24]
# - port 59999 will be used for vhn [cps2.company.com], and
# - default port 57777 will be used for all remaining <vip/vhn>s:
#   [192.168.0.23]
#   [cps1.company.com]
#   [192.168.0.25]
# - if default port 57777 were not specified, port 14250 would be
#   used for all remaining <vip/vhn>s:
#   [192.168.0.23]
#   [cps1.company.com]
#   [192.168.0.25]
#
# SCSI-3 compliant coordinator disks are specified as:
#
# vxfendg=<coordinator disk group name>
# Example:
# vxfendg=vxfencoorddg
#
# Examples of different configurations:
# 1. All CP server coordination points
# cps1=
# cps2=
# cps3=
#
# 2. A combination of CP server and a disk group having two SCSI-3
# coordinator disks
# cps1=
# vxfendg=
# Note: The disk group specified in this case should have two disks
#
# 3. All SCSI-3 coordinator disks
# vxfendg=
# Note: The disk group specified in case should have three disks
# cps1=[cps1.company.com]
# cps2=[cps2.company.com]
# cps3=[cps3.company.com]
# port=443
```

Setting up majority-based I/O fencing manually

Table 6-5 lists the tasks that are involved in setting up I/O fencing.

Task	Reference
Creating I/O fencing configuration files	Creating I/O fencing configuration files
Modifying VCS configuration to use I/O fencing	Modifying VCS configuration to use I/O fencing
Verifying I/O fencing configuration	Verifying I/O fencing configuration

Creating I/O fencing configuration files

To update the I/O fencing files and start I/O fencing

- 1 On all cluster nodes, run the following command
- # cp /etc/vxfen.d/vxfenmode_majority /etc/vxfenmode
- 2 To check the updated /etc/vxfenmode configuration, enter the following command on one of the nodes.
- # cat /etc/vxfenmode
- 3 Ensure that you edit the following file on each node in the cluster to change the values of the `VXFEN_START` and the `VXFEN_STOP` environment variables to 1.
- /etc/sysconfig/vxfen

Modifying VCS configuration to use I/O fencing

After you configure I/O fencing, add the `UseFence = SCSI3` cluster attribute to the VCS configuration file `/etc/VRTSvcs/conf/config/main.cf`.

If you reset this attribute to `UseFence = None`, VCS does not make use of I/O fencing abilities while failing over service groups. However, I/O fencing needs to be disabled separately.

To modify VCS configuration to enable I/O fencing

- 1 Save the existing configuration:

```
# haconf -dump -makero
```

- 2 Stop VCS on all nodes:

```
# hstop -all
```

- 3 To ensure High Availability has stopped cleanly, run `gabconfig -a`.

In the output of the commands, check that Port h is not present.

- 4 If the I/O fencing driver vxfen is already running, stop the I/O fencing driver.

```
# /etc/init.d/vxfen.rc stop
```

- 5 Make a backup of the main.cf file on all the nodes:

```
# cd /etc/VRTSvcs/conf/config
```

```
# cp main.cf main.orig
```

- 6 On one node, use vi or another text editor to edit the main.cf file. To modify the list of cluster attributes, add the UseFence attribute and assign its value as SCSI3.

```
cluster clus1(
UserNames = { admin = "cDRpdxPmHpzS." }
Administrators = { admin }
HacliUserLevel = COMMANDROOT
CounterInterval = 5
UseFence = SCSI3
)
```

For fencing configuration in any mode except the disabled mode, the value of the cluster-level attribute UseFence is set to SCSI3.

- 7 Save and close the file.

- 8 Verify the syntax of the file `/etc/VRTSvcs/conf/config/main.cf`:

```
# hacf -verify /etc/VRTSvcs/conf/config
```


- 9 Using rcp or another utility, copy the VCS configuration file from a node (for example, sys1) to the remaining cluster nodes.

For example, on each remaining node, enter:

```
# rcp sys1:/etc/VRTSvcs/conf/config/main.cf \
/etc/VRTSvcs/conf/config
```

- 10 Start the I/O fencing driver and VCS. Perform the following steps on each node:

- Start the I/O fencing driver.
The vxfen startup script also invokes the `vxfenconfig` command, which configures the vxfen driver.

```
# /etc/init.d/vxfen.rc start
```

- Start VCS on the node where main.cf is modified.

```
# /opt/VRTS/bin/hastart
```

- Start VCS on all other nodes once VCS on first node reaches RUNNING state.

```
# /opt/VRTS/bin/hastart
```

Verifying I/O fencing configuration

Verify from the vxfenadm output that the fencing mode reflects the configuration in the `/etc/vxfenmode` file.

To verify I/O fencing configuration

- ◆ On one of the nodes, type:

```
# vxfsadm -d
```

Output similar to the following appears if the fencing mode is majority:

```
I/O Fencing Cluster Information:
=====
```

```
Fencing Protocol Version: 201
```

```
Fencing Mode: MAJORITY
```

```
Cluster Members:
```

```
    * 0 (sys1)
```

```
    1 (sys2)
```

```
RFSM State Information:
```

```
node    0 in state  8 (running)
```

```
node    1 in state  8 (running)
```

Performing an automated SFHA configuration using response files

This chapter includes the following topics:

- [Configuring SFHA using response files](#)
- [Response file variables to configure SFHA](#)
- [Sample response file for SFHA configuration](#)

Configuring SFHA using response files

Typically, you can use the response file that the installer generates after you perform SFHA configuration on one cluster to configure SFHA on other clusters.

To configure SFHA using response files

- 1 Make sure the Veritas InfoScale Availability or Enterprise filesets are installed on the systems where you want to configure SFHA.
- 2 Copy the response file to one of the cluster systems where you want to configure SFHA.

- 3 Edit the values of the response file variables as necessary.

To configure optional features, you must define appropriate values for all the response file variables that are related to the optional feature.

See [“Response file variables to configure SFHA”](#) on page 140.
- 4 Start the configuration from the system to which you copied the response file.
For example:

```
# /opt/VRTS/install/installer -responsefile
/tmp/response_file
```

Where `/tmp/response_file` is the response file’s full path name.

Response file variables to configure SFHA

[Table 7-1](#) lists the response file variables that you can define to configure SFHA.

Table 7-1 Response file variables specific to configuring SFHA

Variable	List or Scalar	Description
CFG{opt}{configure}	Scalar	Performs the configuration if the filesets are already installed. (Required) Set the value to 1 to configure SFHA.
CFG{accepteula}	Scalar	Specifies whether you agree with EULA.pdf on the media. (Required)
CFG{activecomponent}	List	Defines the component to be configured. The value is SFHA72 for SFHA (Required)
CFG{keys}{keyless} CFG{keys}{license}	List	CFG{keys}{keyless} gives a list of keyless keys to be registered on the system. CFG{keys}{license} gives a list of user defined keys to be registered on the system. (Optional)

Table 7-1 Response file variables specific to configuring SFHA (*continued*)

Variable	List or Scalar	Description
CFG{systems}	List	List of systems on which the product is to be configured. (Required)
CFG{prod}	Scalar	Defines the product for operations. The value is ENTERPRISE72 for Veritas InfoScale Enterprise. (Required)
CFG{opt}{keyfile}	Scalar	Defines the location of an ssh keyfile that is used to communicate with all remote systems. (Optional)
CFG{opt}{rsh}	Scalar	Defines that <i>rsh</i> must be used instead of <i>ssh</i> as the communication method between systems. (Optional)
CFG{opt}{logpath}	Scalar	Mentions the location where the log files are to be copied. The default location is /opt/VRTS/install/logs. Note: The installer copies the response files and summary files also to the specified <i>logpath</i> location. (Optional)
CFG{uploadlogs}	Scalar	Defines a Boolean value 0 or 1. The value 1 indicates that the installation logs are uploaded to the Veritas website. The value 0 indicates that the installation logs are not uploaded to the Veritas website. (Optional)

Note that some optional variables make it necessary to define other optional variables. For example, all the variables that are related to the cluster service group

(csgnic, csgvip, and csgnetmask) must be defined if any are defined. The same is true for the SMTP notification (smtpserver, smtprecp, and smtpsevr), the SNMP trap notification (snmpport, snmpcons, and snmpcsev), and the Global Cluster Option (gconic, gcovip, and gconetmask).

[Table 7-2](#) lists the response file variables that specify the required information to configure a basic SFHA cluster.

Table 7-2 Response file variables specific to configuring a basic SFHA cluster

Variable	List or Scalar	Description
CFG{donotreconfigurevcs}	Scalar	Defines if you need to re-configure VCS. (Optional)
CFG{donotreconfigurefencing}	Scalar	Defines if you need to re-configure fencing. (Optional)
CFG{vcs_clusterid}	Scalar	An integer between 0 and 65535 that uniquely identifies the cluster. (Required)
CFG{vcs_clustername}	Scalar	Defines the name of the cluster. (Required)
CFG{vcs_allowcomms}	Scalar	Indicates whether or not to start LLT and GAB when you set up a single-node cluster. The value can be 0 (do not start) or 1 (start). (Required)
CFG{fencingenabled}	Scalar	In a SFHA configuration, defines if fencing is enabled. Valid values are 0 or 1. (Required)

[Table 7-3](#) lists the response file variables that specify the required information to configure LLT over Ethernet.

Table 7-3 Response file variables specific to configuring private LLT over Ethernet

Variable	List or Scalar	Description
CFG{vcs_lltlink#} { <i>"system"</i> }	Scalar	<p>Defines the NIC to be used for a private heartbeat link on each system. At least two LLT links are required per system (lltlink1 and lltlink2). You can configure up to four LLT links.</p> <p>You must enclose the system name within double quotes.</p> <p>(Required)</p>
CFG{vcs_lltlinklowpri#} { <i>"system"</i> }	Scalar	<p>Defines a low priority heartbeat link. Typically, lltlinklowpri is used on a public network link to provide an additional layer of communication.</p> <p>If you use different media speed for the private NICs, you can configure the NICs with lesser speed as low-priority links to enhance LLT performance. For example, lltlinklowpri1, lltlinklowpri2, and so on.</p> <p>You must enclose the system name within double quotes.</p> <p>(Optional)</p>

Table 7-4 lists the response file variables that specify the required information to configure LLT over UDP.

Table 7-4 Response file variables specific to configuring LLT over UDP

Variable	List or Scalar	Description
CFG{lltoverudp}=1	Scalar	<p>Indicates whether to configure heartbeat link using LLT over UDP.</p> <p>(Required)</p>

Table 7-4 Response file variables specific to configuring LLT over UDP
(continued)

Variable	List or Scalar	Description
CFG{vcs_udplink<n>_address} {<sys1>}	Scalar	Stores the IP address (IPv4 or IPv6) that the heartbeat link uses on node1. You can have four heartbeat links and <n> for this response file variable can take values 1 to 4 for the respective heartbeat links. (Required)
CFG {vcs_udplinklowpri<n>_address} {<sys1>}	Scalar	Stores the IP address (IPv4 or IPv6) that the low priority heartbeat link uses on node1. You can have four low priority heartbeat links and <n> for this response file variable can take values 1 to 4 for the respective low priority heartbeat links. (Required)
CFG{vcs_udplink<n>_port} {<sys1>}	Scalar	Stores the UDP port (16-bit integer value) that the heartbeat link uses on node1. You can have four heartbeat links and <n> for this response file variable can take values 1 to 4 for the respective heartbeat links. (Required)
CFG{vcs_udplinklowpri<n>_port} {<sys1>}	Scalar	Stores the UDP port (16-bit integer value) that the low priority heartbeat link uses on node1. You can have four low priority heartbeat links and <n> for this response file variable can take values 1 to 4 for the respective low priority heartbeat links. (Required)

Table 7-4 Response file variables specific to configuring LLT over UDP
(continued)

Variable	List or Scalar	Description
CFG{vcs_udplink<n>_netmask} {<sys1>}	Scalar	Stores the netmask (prefix for IPv6) that the heartbeat link uses on node1. You can have four heartbeat links and <n> for this response file variable can take values 1 to 4 for the respective heartbeat links. (Required)
CFG {vcs_udplinklowpri<n>_netmask} {<sys1>}	Scalar	Stores the netmask (prefix for IPv6) that the low priority heartbeat link uses on node1. You can have four low priority heartbeat links and <n> for this response file variable can take values 1 to 4 for the respective low priority heartbeat links. (Required)

Table 7-5 lists the response file variables that specify the required information to configure virtual IP for SFHA cluster.

Table 7-5 Response file variables specific to configuring virtual IP for SFHA cluster

Variable	List or Scalar	Description
CFG{vcs_csgnic} {system}	Scalar	Defines the NIC device to use on a system. You can enter 'all' as a system value if the same NIC is used on all systems. (Optional)
CFG{vcs_csgvip}	Scalar	Defines the virtual IP address for the cluster. (Optional)
CFG{vcs_csgnetmask}	Scalar	Defines the Netmask of the virtual IP address for the cluster. (Optional)

Table 7-6 lists the response file variables that specify the required information to configure the SFHA cluster in secure mode.

Table 7-6 Response file variables specific to configuring SFHA cluster in secure mode

Variable	List or Scalar	Description
CFG{vcs_eat_security}	Scalar	Specifies if the cluster is in secure enabled mode or not.
CFG{opt}{securityonemode}	Scalar	Specifies that the securityonemode option is being used.
CFG{securityonemode_menu}	Scalar	Specifies the menu option to choose to configure the secure cluster one at a time. <ul style="list-style-type: none"> 1—Configure the first node 2—Configure the other node
CFG{secusrgrps}	List	Defines the user groups which get read access to the cluster. List or scalar: list Optional or required: optional
CFG{rootsecusrgrps}	Scalar	Defines the read access to the cluster only for root and other users or user groups which are granted explicit privileges in VCS objects. (Optional)
CFG{security_conf_dir}	Scalar	Specifies the directory where the configuration files are placed.
CFG{opt}{security}	Scalar	Specifies that the security option is being used.
CFG{defaultaccess}	Scalar	Defines if the user chooses to grant read access to everyone. Optional or required: optional
CFG{vcs_eat_security_fips}	Scalar	Specifies that the enabled security is FIPS compliant.

Table 7-7 lists the response file variables that specify the required information to configure VCS users.

Table 7-7 Response file variables specific to configuring VCS users

Variable	List or Scalar	Description
CFG{vcs_userenpw}	List	List of encoded passwords for VCS users The value in the list can be "Administrators Operators Guests" Note: The order of the values for the vcs_userenpw list must match the order of the values in the vcs_username list. (Optional)
CFG{vcs_username}	List	List of names of VCS users (Optional)
CFG{vcs_userpriv}	List	List of privileges for VCS users Note: The order of the values for the vcs_userpriv list must match the order of the values in the vcs_username list. (Optional)

[Table 7-8](#) lists the response file variables that specify the required information to configure VCS notifications using SMTP.

Table 7-8 Response file variables specific to configuring VCS notifications using SMTP

Variable	List or Scalar	Description
CFG{vcs_smtpserver}	Scalar	Defines the domain-based hostname (example: smtp.example.com) of the SMTP server to be used for web notification. (Optional)
CFG{vcs_smtprecip}	List	List of full email addresses (example: user@example.com) of SMTP recipients. (Optional)

Table 7-8 Response file variables specific to configuring VCS notifications using SMTP *(continued)*

Variable	List or Scalar	Description
CFG{vcs_smtpsev}	List	Defines the minimum severity level of messages (Information, Warning, Error, SevereError) that listed SMTP recipients are to receive. Note that the ordering of severity levels must match that of the addresses of SMTP recipients. (Optional)

Table 7-9 lists the response file variables that specify the required information to configure VCS notifications using SNMP.

Table 7-9 Response file variables specific to configuring VCS notifications using SNMP

Variable	List or Scalar	Description
CFG{vcs_snmpport}	Scalar	Defines the SNMP trap daemon port (default=162). (Optional)
CFG{vcs_snmpcons}	List	List of SNMP console system names (Optional)
CFG{vcs_snmpcsev}	List	Defines the minimum severity level of messages (Information, Warning, Error, SevereError) that listed SNMP consoles are to receive. Note that the ordering of severity levels must match that of the SNMP console system names. (Optional)

Table 7-10 lists the response file variables that specify the required information to configure SFHA global clusters.

Table 7-10 Response file variables specific to configuring SFHA global clusters

Variable	List or Scalar	Description
CFG{vcs_gconic} {system}	Scalar	Defines the NIC for the Virtual IP that the Global Cluster Option uses. You can enter 'all' as a system value if the same NIC is used on all systems. (Optional)
CFG{vcs_gcovip}	Scalar	Defines the virtual IP address to that the Global Cluster Option uses. (Optional)
CFG{vcs_gconetmask}	Scalar	Defines the Netmask of the virtual IP address that the Global Cluster Option uses. (Optional)

Sample response file for SFHA configuration

The following example shows a response file for configuring Storage Foundation High Availability.

```
#####
#Auto generated sfha responsefile #
#####

our %CFG;
$CFG{accepteula}=1;
$CFG{opt}{rsh}=1;
$CFG{vcs_allowcomms}=1;
$CFG{opt}{gco}=1;
$CFG{opt}{vvr}=1;
$CFG{opt}{configure}=1;
$CFG{activecomponent}=[ qw(SFHA72) ];
$CFG{prod}="ENTERPRISE72";
$CFG{systems}=[ qw( sys1 sys2 ) ];
$CFG{vm_restore_cfg}{sys1}=0;
$CFG{vm_restore_cfg}{sys2}=0;
$CFG{vcs_clusterid}=127;
$CFG{vcs_clustername}="clus1";
```

```
$CFG{vcs_username}=[ qw(admin operator) ];
$CFG{vcs_userenpw}=[ qw(JlmElgLimHmKumGlj bQOsOUUnVQoOUUnTQsOSnUQuOUUnPQtOS) ];
$CFG{vcs_userpriv}=[ qw(Administrators Operators) ];
$CFG{vcs_11tlink1}{"sys1"}="en1";
$CFG{vcs_11tlink2}{"sys1"}="en2";
$CFG{vcs_11tlink1}{"sys2"}="en3";
$CFG{vcs_11tlink2}{"sys2"}="en4";
$CFG{opt}{logpath}="/opt/VRTS/install/logs/installer-xxxxxx/installer-xxxxxx.response";

1;
```

Performing an automated I/O fencing configuration using response files

This chapter includes the following topics:

- [Configuring I/O fencing using response files](#)
- [Response file variables to configure disk-based I/O fencing](#)
- [Sample response file for configuring disk-based I/O fencing](#)
- [Response file variables to configure server-based I/O fencing](#)
- [Sample response file for configuring non-SCSI-3 I/O fencing](#)
- [Response file variables to configure non-SCSI-3 I/O fencing](#)
- [Response file variables to configure majority-based I/O fencing](#)
- [Sample response file for configuring majority-based I/O fencing](#)

Configuring I/O fencing using response files

Typically, you can use the response file that the installer generates after you perform I/O fencing configuration to configure I/O fencing for SFHA.

To configure I/O fencing using response files

- 1 Make sure that SFHA is configured.
- 2 Based on whether you want to configure disk-based or server-based I/O fencing, make sure you have completed the preparatory tasks.
 See “[About planning to configure I/O fencing](#)” on page 28.
- 3 Copy the response file to one of the cluster systems where you want to configure I/O fencing.
 See “[Sample response file for configuring disk-based I/O fencing](#)” on page 155.
 See “[Sample response file for configuring server-based I/O fencing](#)” on page 158.
 See “[Sample response file for configuring non-SCSI-3 I/O fencing](#)” on page 159.
 See “[Sample response file for configuring majority-based I/O fencing](#)” on page 162.
- 4 Edit the values of the response file variables as necessary.
 See “[Response file variables to configure disk-based I/O fencing](#)” on page 152.
 See “[Response file variables to configure server-based I/O fencing](#)” on page 156.
 See “[Response file variables to configure non-SCSI-3 I/O fencing](#)” on page 159.
 See “[Response file variables to configure majority-based I/O fencing](#)” on page 161.
- 5 Start the configuration from the system to which you copied the response file.
 For example:

```
# /opt/VRTS/install/installer
-responsefile /tmp/response_file
```

Where `/tmp/response_file` is the response file’s full path name.

Response file variables to configure disk-based I/O fencing

[Table 8-1](#) lists the response file variables that specify the required information to configure disk-based I/O fencing for SFHA.

Table 8-1 Response file variables specific to configuring disk-based I/O fencing

Variable	List or Scalar	Description
CFG{opt}{fencing}	Scalar	Performs the I/O fencing configuration. (Required)
CFG{fencing_option}	Scalar	Specifies the I/O fencing configuration mode. <ul style="list-style-type: none"> 1—Coordination Point Server-based I/O fencing 2—Coordinator disk-based I/O fencing 3—Disabled-based I/O fencing 4—Online fencing migration 5—Refresh keys/registrations on the existing coordination points 6—Change the order of existing coordination points 7—Majority-based fencing (Required)
CFG{fencing_dgname}	Scalar	Specifies the disk group for I/O fencing. (Optional) <p>Note: You must define the <code>fencing_dgname</code> variable to use an existing disk group. If you want to create a new disk group, you must use both the <code>fencing_dgname</code> variable and the <code>fencing_newdg_disks</code> variable.</p>
CFG{fencing_newdg_disks}	List	Specifies the disks to use to create a new disk group for I/O fencing. (Optional) <p>Note: You must define the <code>fencing_dgname</code> variable to use an existing disk group. If you want to create a new disk group, you must use both the <code>fencing_dgname</code> variable and the <code>fencing_newdg_disks</code> variable.</p>

Table 8-1 Response file variables specific to configuring disk-based I/O fencing (*continued*)

Variable	List or Scalar	Description
CFG{fencing_cpagent_monitor_freq}	Scalar	<p>Specifies the frequency at which the Coordination Point Agent monitors for any changes to the Coordinator Disk Group constitution.</p> <p>Note: Coordination Point Agent can also monitor changes to the Coordinator Disk Group constitution such as a disk being accidentally deleted from the Coordinator Disk Group. The frequency of this detailed monitoring can be tuned with the LevelTwoMonitorFreq attribute. For example, if you set this attribute to 5, the agent will monitor the Coordinator Disk Group constitution every five monitor cycles. If LevelTwoMonitorFreq attribute is not set, the agent will not monitor any changes to the Coordinator Disk Group. 0 means not to monitor the Coordinator Disk Group constitution.</p>
CFG {fencing_config_cpagent}	Scalar	<p>Enter '1' or '0' depending upon whether you want to configure the Coordination Point agent using the installer or not.</p> <p>Enter "0" if you do not want to configure the Coordination Point agent using the installer.</p> <p>Enter "1" if you want to use the installer to configure the Coordination Point agent.</p>
CFG {fencing_cpagentgrp}	Scalar	<p>Name of the service group which will have the Coordination Point agent resource as part of it.</p> <p>Note: This field is obsolete if the fencing_config_cpagent field is given a value of '0'.</p>

Table 8-1 Response file variables specific to configuring disk-based I/O fencing (*continued*)

Variable	List or Scalar	Description
CFG{fencing_auto_refresh_reg}	Scalar	Enable the auto refresh of coordination points variable in case registration keys are missing on any of CP servers.

Sample response file for configuring disk-based I/O fencing

Review the disk-based I/O fencing response file variables and their definitions.

See [“Response file variables to configure disk-based I/O fencing”](#) on page 152.

```
# Configuration Values:
#
our %CFG;
$CFG{fencing_config_cpagent}=1;
$CFG{fencing_auto_refresh_reg}=1;
$CFG{fencing_cpagent_monitor_freq}=5;
$CFG{fencing_cpagentgrp}="vxfen";
$CFG{fencing_dgname}="fencingdg1";
$CFG{fencing_newdg_disks}=[ qw(emc_clariion0_155
    emc_clariion0_162 emc_clariion0_163) ];
$CFG{fencing_option}=2;
$CFG{opt}{configure}=1;
$CFG{opt}{fencing}=1;
$CFG{prod}="AVAILABILITY72";

$CFG{prod}="ENTERPRISE72";

$CFG{systems}=[ qw(sys1sys2) ];
$CFG{vcs_clusterid}=32283;
$CFG{vcs_clustername}="clus1";
1;
```

Response file variables to configure server-based I/O fencing

You can use a coordination point server-based fencing response file to configure server-based customized I/O fencing.

Table 8-2 lists the fields in the response file that are relevant for server-based customized I/O fencing.

Table 8-2 Coordination point server (CP server) based fencing response file definitions

Response file field	Definition
CFG {fencing_config_cpagent}	<p>Enter '1' or '0' depending upon whether you want to configure the Coordination Point agent using the installer or not.</p> <p>Enter "0" if you do not want to configure the Coordination Point agent using the installer.</p> <p>Enter "1" if you want to use the installer to configure the Coordination Point agent.</p>
CFG {fencing_cpagentgrp}	<p>Name of the service group which will have the Coordination Point agent resource as part of it.</p> <p>Note: This field is obsolete if the <code>fencing_config_cpagent</code> field is given a value of '0'.</p>
CFG {fencing_cps}	Virtual IP address or Virtual hostname of the CP servers.

Table 8-2 Coordination point server (CP server) based fencing response file definitions (*continued*)

Response file field	Definition
CFG {fencing_reusedg}	<p>This response file field indicates whether to reuse an existing DG name for the fencing configuration in customized fencing (CP server and coordinator disks).</p> <p>Enter either a "1" or "0".</p> <p>Entering a "1" indicates reuse, and entering a "0" indicates do not reuse.</p> <p>When reusing an existing DG name for the mixed mode fencing configuration, you need to manually add a line of text, such as "\$CFG{fencing_reusedg}=0" or "\$CFG{fencing_reusedg}=1" before proceeding with a silent installation.</p>
CFG {fencing_dgname}	The name of the disk group to be used in the customized fencing, where at least one disk is being used.
CFG {fencing_disks}	The disks being used as coordination points if any.
CFG {fencing_ncp}	Total number of coordination points being used, including both CP servers and disks.
CFG {fencing_ndisks}	The number of disks being used.
CFG {fencing_cps_vips}	The virtual IP addresses or the fully qualified host names of the CP server.
CFG {fencing_cps_ports}	The port that the virtual IP address or the fully qualified host name of the CP server listens on.

Table 8-2 Coordination point server (CP server) based fencing response file definitions (*continued*)

Response file field	Definition
CFG{fencing_option}	<p>Specifies the I/O fencing configuration mode.</p> <ul style="list-style-type: none"> ■ 1—Coordination Point Server-based I/O fencing ■ 2—Coordinator disk-based I/O fencing ■ 3—Disabled-based I/O fencing ■ 4—Online fencing migration ■ 5—Refresh keys/registrations on the existing coordination points ■ 6—Change the order of existing coordination points ■ 7—Majority-based fencing (Required)
CFG{fencing_auto_refresh_reg}	<p>Enable this variable if registration keys are missing on any of the CP servers.</p>

Sample response file for configuring server-based I/O fencing

The following is a sample response file used for server-based I/O fencing:

```
$CFG{fencing_config_cpagent}=0;
$CFG{fencing_cps}=[ qw(10.200.117.145) ];
$CFG{fencing_cps_vips}{"10.200.117.145"}=[ qw(10.200.117.145) ];
$CFG{fencing_dgname}="vxfencoorddg";
$CFG{fencing_disks}=[ qw(emc_clariion0_37 emc_clariion0_12) ];
$CFG{fencing_ncp}=3;
$CFG{fencing_ndisks}=2;
$CFG{fencing_cps_ports}{"10.200.117.145"}=443;
$CFG{fencing_reusedg}=1;
$CFG{opt}{configure}=1;
$CFG{opt}{fencing}=1;
$CFG{prod}="ENTERPRISE72";
$CFG{systems}=[ qw(sys1 sys2) ];
$CFG{vcs_clusterid}=1256;
$CFG{vcs_clustername}="clus1";
$CFG{fencing_option}=1;
```

Sample response file for configuring non-SCSI-3 I/O fencing

The following is a sample response file used for non-SCSI-3 I/O fencing :

```
# Configuration Values:
# our %CFG;
$CFG{fencing_config_cpagent}=0;
$CFG{fencing_cps}=[ qw(10.198.89.251 10.198.89.252 10.198.89.253) ];
$CFG{fencing_cps_vips}{"10.198.89.251"}=[ qw(10.198.89.251) ];
$CFG{fencing_cps_vips}{"10.198.89.252"}=[ qw(10.198.89.252) ];
$CFG{fencing_cps_vips}{"10.198.89.253"}=[ qw(10.198.89.253) ];
$CFG{fencing_ncp}=3;
$CFG{fencing_ndisks}=0;
$CFG{fencing_cps_ports}{"10.198.89.251"}=443;
$CFG{fencing_cps_ports}{"10.198.89.252"}=443;
$CFG{fencing_cps_ports}{"10.198.89.253"}=443;
$CFG{non_scsi3_fencing}=1;
$CFG{opt}{configure}=1;
$CFG{opt}{fencing}=1;
$CFG{prod}="ENTERPRISE72";
$CFG{systems}=[ qw(sys1 sys2) ];
$CFG{vcs_clusterid}=1256;
$CFG{vcs_clustername}="clus1";
$CFG{fencing_option}=1;
```

Response file variables to configure non-SCSI-3 I/O fencing

[Table 8-3](#) lists the fields in the response file that are relevant for non-SCSI-3 I/O fencing.

See [“About I/O fencing for SFHA in virtual machines that do not support SCSI-3 PR”](#) on page 19.

Table 8-3 Non-SCSI-3 I/O fencing response file definitions

Response file field	Definition
CFG{non_scsi3_fencing}	Defines whether to configure non-SCSI-3 I/O fencing. Valid values are 1 or 0. Enter 1 to configure non-SCSI-3 I/O fencing.
CFG {fencing_config_cpagent}	Enter '1' or '0' depending upon whether you want to configure the Coordination Point agent using the installer or not. Enter "0" if you do not want to configure the Coordination Point agent using the installer. Enter "1" if you want to use the installer to configure the Coordination Point agent. Note: This variable does not apply to majority-based fencing.
CFG {fencing_cpagentgrp}	Name of the service group which will have the Coordination Point agent resource as part of it. Note: This field is obsolete if the <code>fencing_config_cpagent</code> field is given a value of '0'. This variable does not apply to majority-based fencing.
CFG {fencing_cps}	Virtual IP address or Virtual hostname of the CP servers. Note: This variable does not apply to majority-based fencing.
CFG {fencing_cps_vips}	The virtual IP addresses or the fully qualified host names of the CP server. Note: This variable does not apply to majority-based fencing.
CFG {fencing_ncp}	Total number of coordination points (CP servers only) being used. Note: This variable does not apply to majority-based fencing.
CFG {fencing_cps_ports}	The port of the CP server that is denoted by <i>cps</i> . Note: This variable does not apply to majority-based fencing.

Table 8-3 Non-SCSI-3 I/O fencing response file definitions (*continued*)

Response file field	Definition
CFG{fencing_auto_refresh_reg}	Enable this variable if registration keys are missing on any of the CP servers.

Response file variables to configure majority-based I/O fencing

[Table 8-4](#) lists the response file variables that specify the required information to configure disk-based I/O fencing for SFHA.

Table 8-4 Response file variables specific to configuring majority-based I/O fencing

Variable	List or Scalar	Description
CFG{opt}{fencing}	Scalar	Performs the I/O fencing configuration. (Required)
CFG{fencing_option}	Scalar	Specifies the I/O fencing configuration mode. <ul style="list-style-type: none"> 1—Coordination Point Server-based I/O fencing 2—Coordinator disk-based I/O fencing 3—Disabled-based fencing 4—Online fencing migration 5—Refresh keys/registrations on the existing coordination points 6—Change the order of existing coordination points 7—Majority-based fencing (Required)

Sample response file for configuring majority-based I/O fencing

```
# Configuration Values:
# our %CFG;
$CFG{fencing_option}=7;
$CFG{config_majority_based_fencing}=1;
$CFG{opt}{configure}=1;
$CFG{opt}{fencing}=1;
$CFG{prod}="ENTERPRISE72";
$CFG{systems}=[ qw(sys1 sys2) ];
$CFG{vcs_clusterid}=59082;
$CFG{vcs_clustername}="clus1";
```

Upgrade of SFHA

- [Chapter 9. Planning to upgrade SFHA](#)
- [Chapter 10. Upgrading Storage Foundation and High Availability](#)
- [Chapter 11. Performing a rolling upgrade of SFHA](#)
- [Chapter 12. Performing a phased upgrade of SFHA](#)
- [Chapter 13. Performing an automated SFHA upgrade using response files](#)
- [Chapter 14. Performing post-upgrade tasks](#)

Planning to upgrade SFHA

This chapter includes the following topics:

- [About the upgrade](#)
- [Supported upgrade paths](#)
- [Considerations for upgrading SFHA to 7.2 on systems configured with an Oracle resource](#)
- [Preparing to upgrade SFHA](#)
- [Using Install Bundles to simultaneously install or upgrade full releases \(base, maintenance, rolling patch\), and individual patches](#)

About the upgrade

This release supports upgrades from 6.0.1 and later versions. If your existing installation is from a pre-60 version, you must first upgrade to version 6.0.1, then follow the procedures mentioned in this document to upgrade the product.

The installer supports the following types of upgrade:

- Full upgrade
- Automated upgrade using response files
- Phased Upgrade
- Rolling Upgrade

[Table 9-1](#) describes the product mapping after an upgrade.

Table 9-1 Veritas InfoScale product mapping after upgrade

Product (6.2.x and earlier)	Product (7.0 and later)	Component (7.0 and later)
SFHA	Veritas InfoScale Enterprise	SFHA

Note: From 7.0 onwards, the existing Veritas InfoScale product upgrades to the higher version of the same product. For example, Veritas InfoScale Enterprise 7.1 gets upgraded to Veritas InfoScale Enterprise 7.2.

During the upgrade, the installation program performs the following tasks:

1. Stops the product before starting the upgrade
2. Upgrades the installed packages and installs additional packages

If your current installation uses a permanent license key, you will be prompted to update the license to 7.2. If you choose not to update, you can continue to use the old license, limiting the capability of your product to the corresponding component. For example, if you choose not to update the permanent license of your existing SFHA installation, the installer after upgrade will enable SFHA component. The capabilities of other components in the product Veritas InfoScale Enterprise will not be available to you. If your installation uses a keyless license, the installer registers the new keys for the new product with full product capabilities.
3. Restores the existing configuration.

For example, if your setup contains an SFHA installation, the installer upgrades and restores the configuration to SFHA. If your setup included multiple components, the installer upgrades and restores the configuration of the components.
4. Starts the configured components.

Supported upgrade paths

[Table 9-2](#) lists the supported upgrade paths.

Table 9-2 Supported upgrade paths

From product version	From OS version	To OS version	To product version	To component
6.0.1, 6.0.3, 6.0.5, 6.1, 6.1.1 6.2, 6.2.1 7.0, 7.0.1 7.1	AIX 6.1 TLx	AIX 7.1 TL3, TL4 AIX 7.2 TL0	Veritas InfoScale Enterprise 7.2	SFHA
	AIX 7.1 TLx	AIX 7.1 TL3, TL4 AIX 7.2 TL0	Veritas InfoScale Enterprise 7.2	SFHA
	AIX 7.2 TL0	AIX 7.2 TL0	Veritas InfoScale Enterprise 7.2	SFHA

Considerations for upgrading SFHA to 7.2 on systems configured with an Oracle resource

If you plan to upgrade SFHA running on systems configured with an Oracle resource, set the `MonitorOption` attribute to 0 (zero) before you start the upgrade.

For more information on enabling the Oracle health check, see the *Cluster Server Agent for Oracle Installation and Configuration Guide*.

Preparing to upgrade SFHA

Before you upgrade, you need to prepare the systems and storage. Review the following procedures and perform the appropriate tasks.

Getting ready for the upgrade

Complete the following tasks before you perform the upgrade:

- Review the *Veritas InfoScale 7.2 Release Notes* for any late-breaking information on upgrading your system.
- Review the Veritas Technical Support website for additional information:
https://www.veritas.com/support/en_US.html
- Make sure that the administrator who performs the upgrade has root access and a good knowledge of the operating system's administration.
- Make sure that all users are logged off and that all major user applications are properly shut down.

- Make sure that you have created a valid backup.
See [“Creating backups”](#) on page 168.
- Ensure that you have enough file system space to upgrade. Identify where you want to copy the filesets, for example `/packages/Veritas` when the root file system has enough space or `/var/tmp/packages` if the `/var` file system has enough space.
Do not put the files on a file system that is inaccessible before running the upgrade script.
You can use a Veritas-supplied disc for the upgrade as long as modifications to the upgrade script are not required.
If `/usr/local` was originally created as a slice, modifications are required.
- For any startup scripts in `/etc/init.d/`, comment out any application commands or processes that are known to hang if their file systems are not present.
- Make sure that the current operating system supports version 7.2 of the product.
If the operating system does not support it, plan for a staged upgrade.
- Schedule sufficient outage time and downtime for the upgrade and any applications that use the Veritas InfoScale products. Depending on the configuration, the outage can take several hours.
- Make sure that the file systems are clean before upgrading.
See [“Verifying that the file systems are clean”](#) on page 175.
- Upgrade arrays (if required).
See [“Upgrading the array support”](#) on page 176.
- To reliably save information on a mirrored disk, shut down the system and physically remove the mirrored disk. Removing the disk in this manner offers a failback point.
- Make sure that DMP support for native stack is disabled
(`dmp_native_support=off`). If DMP support for native stack is enabled
(`dmp_native_support=on`), the installer may detect it and ask you to restart the system.
- If you want to upgrade the application clusters that use CP server based fencing to version 6.1 and later, make sure that you first upgrade VCS or SFHA on the CP server systems to version 6.1 and later. And then, from 7.0.1 onwards, CP server supports only HTTPS based communication with its clients and IPM-based communication is no longer supported. CP server needs to be reconfigured if you upgrade the CP server with IPM-based CP server configured.
For instructions to upgrade VCS or SFHA on the CP server systems, refer to the relevant Configuration and Upgrade Guides.

Preparing for an upgrade of Storage Foundation and High Availability

Before the upgrade of Storage Foundation and High Availability to a new release, shut down processes and synchronize snapshots.

To prepare for an upgrade of Storage Foundation and High Availability

- 1 Log in as `root`.
- 2 Stop activity to all file systems and raw volumes, for example by unmounting any file systems that have been created on volumes.

```
# umount mnt_point
```

- 3 Stop all the volumes by entering the following command for each disk group:

```
# vxvol -g diskgroup stopall
```

- 4 Before the upgrade of a high availability (HA) product, take all service groups offline.

List all service groups:

```
# /opt/VRTSvcs/bin/hagrp -list
```

For each service group listed, take it offline:

```
# /opt/VRTSvcs/bin/hagrp -offline service_group \  
    -sys system_name
```

- 5 Upgrade AIX on your system to the required levels if applicable.

Creating backups

Save relevant system information before the upgrade.

To create backups

- 1 Log in as superuser.
- 2 Make a record of the mount points for VxFS file systems and the VxVM volumes that are defined in the `/etc/filesystems` file. You need to recreate these entries in the `/etc/filesystems` file on the freshly upgraded system.
- 3 Before the upgrade, ensure that you have made backups of all data that you want to preserve.

- 4 Installer verifies that recent backups of configuration files in VxVM private region have been saved in `/etc/vx/cbr/bk`.

If not, a warning message is displayed.

Warning: Backup `/etc/vx/cbr/bk` directory.

- 5 Copy the `filesystems` file to `filesystems.orig`:

```
# cp /etc/filesystems /etc/filesystems.orig
```
- 6 Run the `vxlicrep`, `vxdisk list`, and `vxprint -ht` commands and record the output. Use this information to reconfigure your system after the upgrade.
- 7 If you install Veritas InfoScale Enterprise 7.2 software, follow the guidelines that are given in the *Cluster Server Configuration and Upgrade Guide* for information on preserving your VCS configuration across the installation procedure.
- 8 Back up the external `quotas` and `quotas.grp` files.

If you are upgrading from 6.0.3, you must also back up the `quotas.grp.64` and `quotas.64` files.
- 9 Verify that `quotas` are turned off on all the mounted file systems.

Pre-upgrade planning for Volume Replicator

Before installing or upgrading Volume Replicator (VVR):

- Confirm that your system has enough free disk space to install VVR.
- Make sure you have root permissions. You must have root permissions to perform the install and upgrade procedures.
- If replication using VVR is configured, Veritas recommends that the disk group version is at least 110 prior to upgrading.
You can check the Disk Group version using the following command:

```
# vxdg list diskgroup
```
- If replication using VVR is configured, make sure the size of the SRL volume is greater than 110 MB.
Refer to the *Veritas InfoScale™ Replication Administrator's Guide*.
- If replication using VVR is configured, verify that all the Primary RLINKs are up-to-date on all the hosts.

```
# /usr/sbin/vxlink -g diskgroup status rlink_name
```

Note: Do not continue until the primary RLINKs are up-to-date.

- If VCS is used to manage VVR replication, follow the preparation steps to upgrade VVR and VCS agents.

See the *Veritas InfoScale™ Replication Administrator's Guide* for more information.

See the *Getting Started Guide* for more information on the documentation.

Planning an upgrade from the previous VVR version

If you plan to upgrade VVR from the previous VVR version, you can upgrade VVR with reduced application downtime by upgrading the hosts at separate times. While the Primary is being upgraded, the application can be migrated to the Secondary, thus reducing downtime. The replication between the (upgraded) Primary and the Secondary, which have different versions of VVR, will still continue. This feature facilitates high availability even when the VVR upgrade is not complete on both the sites. Veritas recommends that the Secondary hosts be upgraded before the Primary host in the Replicated Data Set (RDS).

See the *Veritas InfoScale™ Release Notes* for information regarding VVR support for replicating across Storage Foundation versions.

Replicating between versions is intended to remove the restriction of upgrading the Primary and Secondary at the same time. VVR can continue to replicate an existing RDS with Replicated Volume Groups (RVGs) on the systems that you want to upgrade. When the Primary and Secondary are at different versions, VVR does not support changing the configuration with the `vradmin` command or creating a new RDS.

Also, if you specify TCP as the network protocol, the VVR versions on the Primary and Secondary determine whether the checksum is calculated. As shown in [Table 9-3](#), if either the Primary or Secondary are running a version of VVR prior to 7.2, and you use the TCP protocol, VVR calculates the checksum for every data packet it replicates. If the Primary and Secondary are at VVR 7.2, VVR does not calculate the checksum. Instead, it relies on the TCP checksum mechanism.

Table 9-3 VVR versions and checksum calculations

VVR prior to 7.2 (DG version <= 140)	VVR 7.2 (DG version >= 150)	VVR calculates checksum TCP connections?
Primary	Secondary	Yes

Table 9-3 VVR versions and checksum calculations (*continued*)

VVR prior to 7.2 (DG version <= 140)	VVR 7.2 (DG version >= 150)	VVR calculates checksum TCP connections?
Secondary	Primary	Yes
Primary and Secondary		Yes
	Primary and Secondary	No

Note: When replicating between versions of VVR, avoid using commands associated with new features. The earlier version may not support new features and problems could occur.

If you do not need to upgrade all the hosts in the RDS simultaneously, you can use replication between versions after you upgrade one host. You can then upgrade the other hosts in the RDS later at your convenience.

Note: If you have a cluster setup, you must upgrade all the nodes in the cluster at the same time.

Planning and upgrading VVR to use IPv6 as connection protocol

SFHA supports using IPv6 as the connection protocol.

This release supports the following configurations for VVR:

- VVR continues to support replication between IPv4-only nodes with IPv4 as the internet protocol
- VVR supports replication between IPv4-only nodes and IPv4/IPv6 dual-stack nodes with IPv4 as the internet protocol
- VVR supports replication between IPv6-only nodes and IPv4/IPv6 dual-stack nodes with IPv6 as the internet protocol
- VVR supports replication between IPv6 only nodes
- VVR supports replication to one or more IPv6 only nodes and one or more IPv4 only nodes from a IPv4/IPv6 dual-stack node
- VVR supports replication of a shared disk group only when all the nodes in the cluster that share the disk group are at IPv4 or IPv6

Preparing to upgrade VVR when VCS agents are configured

To prepare to upgrade VVR when VCS agents for VVR are configured, perform the following tasks in the order presented:

- Freezing the service groups and stopping all the applications
- Preparing for the upgrade when VCS agents are configured

Freezing the service groups and stopping all the applications

This section describes how to freeze the service groups and stop all applications.

To freeze the service groups and stop applications

Perform the following steps for the Primary and Secondary clusters:

- 1 Log in as the superuser.
- 2 Make sure that `/opt/VRTS/bin` is in your PATH so that you can execute all the product commands.
- 3 Before the upgrade, cleanly shut down all applications.
 - OFFLINE all application service groups that do not contain RVG resources. Do not OFFLINE the service groups containing RVG resources.
 - If the application resources are part of the same service group as an RVG resource, then OFFLINE only the application resources. In other words, ensure that the RVG resource remains ONLINE so that the private disk groups containing these RVG objects do not get deported.

Note: You must also stop any remaining applications not managed by VCS.

- 4 On any node in the cluster, make the VCS configuration writable:

```
# haconf -makerw
```

- 5 On any node in the cluster, list the groups in your configuration:

```
# hagrps -list
```

- 6 On any node in the cluster, freeze all service groups except the ClusterService group by typing the following command for each group name displayed in the output from step 5.

```
# hagrps -freeze group_name -persistent
```

Note: Make a note of the list of frozen service groups for future use.

- 7 On any node in the cluster, save the configuration file (`main.cf`) with the groups frozen:

```
# haconf -dump -makero
```

Note: Continue only after you have performed steps 3 to step 7 for each node of the cluster.

- 8 Display the list of service groups that have RVG resources and the nodes on which each service group is online by typing the following command on any node in the cluster:

```
# hares -display -type RVG -attribute State
Resource      Attribute      System      Value
VVRGp         State          sys2        ONLINE
ORAGp         State          sys2        ONLINE
```

Note: For the resources that are ONLINE, write down the nodes displayed in the System column of the output.

- 9 Repeat step 8 for each node of the cluster.
- 10 For private disk groups, determine and note down the hosts on which the disk groups are imported.

See [“Determining the nodes on which disk groups are online”](#) on page 173.

Determining the nodes on which disk groups are online

For private disk groups, determine and note down the hosts on which the disk groups containing RVG resources are imported. This information is required for restoring the configuration after the upgrade.

To determine the online disk groups

- 1 On any node in the cluster, list the disk groups in your configuration, and note down the disk group names listed in the output for future use:

```
# hares -display -type RVG -attribute DiskGroup
```

Note: Write down the list of the disk groups that are under VCS control.

- 2 For each disk group listed in the output in step 1, list its corresponding disk group resource name:

```
# hares -list DiskGroup=diskgroup Type=DiskGroup
```

- 3 For each disk group resource name listed in the output in step 2, get and note down the node on which the disk group is imported by typing the following command:

```
# hares -display dg_resname -attribute State
```

The output displays the disk groups that are under VCS control and nodes on which the disk groups are imported.

Preparing for the upgrade when VCS agents are configured

If you have configured the VCS agents, it is recommended that you take backups of the configuration files, such as `main.cf` and `types.cf`, which are present in the `/etc/VRTSvcs/conf/config` directory.

To prepare a configuration with VCS agents for an upgrade

- 1 List the disk groups on each of the nodes by typing the following command on each node:

```
# vxdisk -o alldgs list
```

The output displays a list of the disk groups that are under VCS control and the disk groups that are not under VCS control.

Note: The disk groups that are not locally imported are displayed in parentheses.

- 2 If any of the disk groups have not been imported on any node, import them. For disk groups in your VCS configuration, you can import them on any node. For disk groups that are not under VCS control, choose an appropriate node on which to import the disk group. Enter the following command on the appropriate node:

```
# vxdg -t import diskgroup
```

- 3 If a disk group is already imported, then recover the disk group by typing the following command on the node on which it is imported:

```
# vxrecover -bs
```

- 4 Verify that all the Primary RLINKs are up to date.

```
# vxrlink -g diskgroup status rlink_name
```

Note: Do not continue until the Primary RLINKs are up-to-date.

Verifying that the file systems are clean

Verify that all file systems have been cleanly unmounted.

To make sure the file systems are clean

- 1** Verify that all file systems have been cleanly unmounted:

```
# echo "8192B.p S" | /opt/VRTS/bin/fsdb filesystem | \
    grep clean
    flags 0 mod 0 clean clean_value
```

A *clean_value* value of 0x5a indicates the file system is clean. A value of 0x3c indicates the file system is dirty. A value of 0x69 indicates the file system is dusty. A dusty file system has pending extended operations.

- 2** If a file system is not clean, enter the following commands for that file system:

```
# /opt/VRTS/bin/fsck -V vxfs filesystem
# /opt/VRTS/bin/mount -V vxfs filesystem mountpoint
# /opt/VRTS/bin/umount mountpoint
```

These commands should complete any extended operations on the file system and unmount the file system cleanly.

A pending large fileset clone removal extended operation might be in progress if the `umount` command fails with the following error:

```
file system device busy
```

An extended operation is in progress if the following message is generated on the console:

```
Storage Checkpoint asynchronous operation on file_system
file system still in progress.
```

- 3** If an extended operation is in progress, you must leave the file system mounted for a longer time to allow the operation to complete. Removing a very large fileset clone can take several hours.
- 4** Repeat step 1 to verify that the unclean file system is now clean.

Upgrading the array support

The Veritas InfoScale 7.2 release includes all array support in a single fileset, `VRTSaslapm`. The array support fileset includes the array support previously included in the `VRTSvxvm` fileset. The array support fileset also includes support previously packaged as external Array Support Libraries (ASLs) and array policy modules (APMs).

See the 7.2 Hardware Compatibility List for information about supported arrays.

When you upgrade Storage Foundation products with the product installer, the installer automatically upgrades the array support. If you upgrade Storage Foundation products with manual steps, you should remove any external ASLs or APMs that were installed previously on your system. Installing the `VRTSvxvm` fileset exits with an error if external ASLs or APMs are detected.

After you have installed Veritas InfoScale 7.2, Veritas provides support for new disk arrays through updates to the `VRTSaslapm` fileset.

For more information about array support, see the *Storage Foundation Administrator's Guide*.

Using Install Bundles to simultaneously install or upgrade full releases (base, maintenance, rolling patch), and individual patches

Beginning with version 6.1, you can easily install or upgrade your systems directly to a base, maintenance, patch level or a combination of multiple patches and packages together in one step using Install Bundles. With Install Bundles, the installer has the ability to merge so that customers can install or upgrade directly to maintenance or patch levels in one execution. The various scripts, filesets, and patch components are merged, and multiple releases are installed together as if they are one combined release. You do not have to perform two or more install actions to install or upgrade systems to maintenance levels or patch levels.

Releases are divided into the following categories:

Table 9-4 Release Levels

Level	Content	Form factor	Applies to	Release types	Download location
Base	Features	filesets	All products	Major, minor, Service Pack (SP), Platform Release (PR)	FileConnect
Maintenance	Fixes, new features	filesets	All products	Maintenance Release (MR), Rolling Patch (RP)	Veritas Services and Operations Readiness Tools (SORT)

Table 9-4 Release Levels (*continued*)

Level	Content	Form factor	Applies to	Release types	Download location
Patch	Fixes	filesets	Single product	P-Patch, Private Patch, Public patch	SORT, Support site

When you install or upgrade using Install Bundles:

- Veritas InfoScale products are discovered and assigned as a single version to the maintenance level. Each system can also have one or more patches applied.
- Base releases are accessible from FileConnect that requires customer serial numbers. Maintenance and patch releases can be automatically downloaded from SORT.
- Patches can be installed using automated installers from the 6.0.1 version or later.
- Patches can now be detected to prevent upgrade conflict. Patch releases are not offered as a combined release. They are only available from Veritas Technical Support on a need basis.

You can use the `-base_path` and `-patch_path` options to import installation code from multiple releases. You can find filesets and patches from different media paths, and merge fileset and patch definitions for multiple releases. You can use these options to use new task and phase functionality to correctly perform required operations for each release component. You can install the filesets and patches in defined phases using these options, which helps you when you want to perform a single start or stop process and perform pre and post operations for all level in a single operation.

Four possible methods of integration exist. All commands must be executed from the highest base or maintenance level install script.

In the example below:

- 7.2 is the base version
- 7.2.1 is the maintenance version
- 7.2.1.100 is the patch version for 7.2.1
- 7.2.0.100 is the patch version for 7.2

1. Base + maintenance:

This integration method can be used when you install or upgrade from a lower version to 7.2.1.

Enter the following command:

```
# installmr -base_path <path_to_base>
```

2. Base + patch:

This integration method can be used when you install or upgrade from a lower version to 7.2.0.100.

Enter the following command:

```
# installer -patch_path <path_to_patch>
```

3. Maintenance + patch:

This integration method can be used when you upgrade from version 7.2 to 7.2.1.100.

Enter the following command:

```
# installmr -patch_path <path_to_patch>
```

4. Base + maintenance + patch:

This integration method can be used when you install or upgrade from a lower version to 7.2.1.100.

Enter the following command:

```
# installmr -base_path <path_to_base>  
-patch_path <path_to_patch>
```

Note: From the 6.1 or later release, you can add a maximum of five patches using `-patch_path <path_to_patch> -patch2_path <path_to_patch> ... -patch5_path <path_to_patch>`

Upgrading Storage Foundation and High Availability

This chapter includes the following topics:

- [Upgrading Storage Foundation and High Availability with the product installer](#)
- [Upgrade Storage Foundation and High Availability and AIX on a DMP-enabled rootvg](#)
- [Upgrading the AIX operating system](#)
- [Upgrading Volume Replicator](#)
- [Upgrading SFDB](#)

Upgrading Storage Foundation and High Availability with the product installer

This section describes upgrading from Storage Foundation and High Availability products to 7.2.

To upgrade Storage Foundation and High Availability

- 1 Log in as superuser.
- 2 Unmount any mounted VxFS file systems.

The installer supports the upgrade of multiple hosts, if each host is running the same version of VxVM and VxFS. Hosts must be upgraded separately if they are running different versions.

- 3 If you want to upgrade Storage Foundation and High Availability, take all service groups offline.

List all service groups:

```
# /opt/VRTSvcs/bin/hagrp -list
```

For each service group listed, take it offline:

```
# /opt/VRTSvcs/bin/hagrp -offline service_group \  
-sys system_name
```

- 4 Enter the following commands on each node to freeze HA service group operations:

```
# haconf -makerw  
# hasys -freeze -persistent nodename  
# haconf -dump -makero
```

- 5 If replication using VVR is configured, verify that all the Primary RLINKs are up-to-date:

```
# /usr/sbin/vxlink -g diskgroup status rlink_name
```

Note: Do not continue until the Primary RLINKs are up-to-date.

- 6 Load and mount the disc. If you downloaded the software, navigate to the top level of the download directory.
- 7 From the disc (or if you downloaded the software) , run the `installer` command.

```
# ./installer
```

- 8 Enter `G` to upgrade and select the **Full Upgrade**.
- 9 You are prompted to enter the system names (in the following example, "sys1") on which the software is to be upgraded. Enter the system name or names and then press Return.

```
Enter the system names separated by spaces: [q,?] sys1 sys2
```

Depending on your existing configuration, various messages and prompts may appear. Answer the prompts appropriately.

- 10 The installer asks if you agree with the terms of the End User License Agreement. Press **y** to agree and continue.
- 11 Stop the product's processes.

Do you want to stop SFHA processes now? [y,n,q] (y) **y**

If you select **y**, the installer stops the product processes and makes some configuration updates before it upgrades.
- 12 The installer stops, uninstalls, reinstalls, and starts specified filesets.
- 13 The Storage Foundation and High Availability software is verified and configured.
- 14 The installer prompts you to provide feedback, and provides the log location for the upgrade.
- 15 Restart the nodes when the installer prompts restart. Then, unfreeze the nodes and start the cluster by entering the following:

```
# haconf -makerw
# hasys -unfreeze -persistent nodename
# haconf -dump -makero
# hstart
```

Upgrade Storage Foundation and High Availability and AIX on a DMP-enabled rootvg

The following upgrade paths are supported to upgrade SFHA and AIX on a DMP-enabled rootvg

Table 10-1 Upgrade paths for SFHA on a DMP-enabled rootvg

Upgrade path	Procedure
Previous version of SFHA on AIX 6.1	See “Upgrading from prior version of SFHA on AIX 7.1 to SFHA 7.2 on a DMP-enabled rootvg” on page 183.
Upgrade from AIX 6.1 to AIX 7.1 in Veritas InfoScale 7.2	See “Upgrading the operating system from AIX 7.1 to AIX 7.2 in Veritas InfoScale 7.2 ” on page 183.

Upgrading from prior version of SFHA on AIX 7.1 to SFHA 7.2 on a DMP-enabled rootvg

When you upgrade from a previous version of SFHA on a DMP-enabled rootvg to Veritas InfoScale Storage 7.2, you must disable DMP root support before performing the upgrade. Enable the DMP root support after the upgrade. If the AIX version is not supported by Veritas InfoScale Storage 7.2, an operating system upgrade is required.

To upgrade from an earlier release of SFHA to SFHA 7.2 on a DMP-enabled rootvg

- 1 Disable DMP support for the rootvg:

For release SFHA 5.1 or later:

```
# vxddmpadm native disable vgroup=rootvg
Please reboot the system to disable DMP support for LVM
bootability
```

- 2 Restart the system.

- 3 Upgrade SFHA to 7.2.

Run the installer command on the disc, and enter G for the upgrade task.

See [“Upgrading Storage Foundation and High Availability with the product installer”](#) on page 180.

- 4 Restart the system.

- 5 Enable DMP for rootvg.

```
# vxddmpadm native enable vgroup=rootvg
Please reboot the system to enable DMP support for LVM bootability
```

- 6 Restart the system. After the restart, the system has DMP root support enabled.

Upgrading the operating system from AIX 7.1 to AIX 7.2 in Veritas InfoScale 7.2

In Veritas InfoScale 7.2, when you upgrade the operating system from AIX 7.1 to AIX 7.2, DMP root support is not automatically enabled.

To upgrade AIX and enable DMP support for rootvg

- 1 Disable DMP support for rootvg.

- 2 Restart the system.

- 3 Upgrade the operating system from AIX 7.1 to AIX 7.2.
- 4 Enable DMP support for rootvg.
- 5 Restart the system. After the restart, the system has DMP root support enabled.

Upgrading the AIX operating system

Use this procedure to upgrade the AIX operating system if OS upgrade is needed. You must upgrade to a version that Veritas InfoScale Enterprise 7.2 supports.

To upgrade the AIX operating system

- 1 Create the `install-db` file.

```
# touch /etc/vx/reconfig.d/state.d/install-db
```

Note: The AIX OS upgrade may involve single or multiple reboots. It is necessary to create this file to prevent Veritas Volume Manager from starting VxVM daemons or processes.

- 2 Set the `LLT_START` attribute to 0 in the `/etc/default/llt` file to prevent LLT from starting automatically after restart:

```
LLT_START=0
```

- 3 Stop activity to all file systems and raw volumes, for example by unmounting any file systems that have been created on volumes.

```
# umount mnt_point
```

- 4 Stop all the volumes by entering the following command for each disk group:

```
# vxvol -g diskgroup stopall
```

- 5 If you want to upgrade a high availability (HA) product, take all service groups offline.

List all service groups:

```
# /opt/VRTSvcs/bin/hagrp -list
```

For each service group listed, take it offline:

```
# /opt/VRTSvcs/bin/hagrp -offline service_group \  
-sys system_name
```


6 Upgrade the AIX operating system. See the operating system documentation for more information.

7 Apply the necessary APARs.

For information about APARs required for Veritas InfoScale Storage 7.2, refer to the *Veritas InfoScale 7.2 Release Notes*.

8 Restart the system.

```
# shutdown -Fr
```

9 Enable SFHA to start after you restart.

```
# rm /etc/vx/reconfig.d/state.d/install-db
```

10 Change `/etc/default/llt` to start LLT on the nodes by setting the `LLT_START` attribute to 1: `LLT_START=1`.

```
LLT_START=1
```

Upgrading Volume Replicator

If a previous version of Volume Replicator (VVR) is configured, the product installer upgrades VVR automatically when you upgrade the Storage Foundation products.

You have the option to upgrade without disrupting replication.

See [“Upgrading VVR without disrupting replication”](#) on page 185.

Upgrading VVR without disrupting replication

This section describes the upgrade procedure from an earlier version of VVR to the current version of VVR when replication is in progress, assuming that you do not need to upgrade all the hosts in the RDS simultaneously.

You may also need to set up replication between versions.

See [“Planning an upgrade from the previous VVR version”](#) on page 170.

When both the Primary and the Secondary have the previous version of VVR installed, the upgrade can be performed either on the Primary or on the Secondary. We recommend that the Secondary hosts be upgraded before the Primary host in the RDS. This section includes separate sets of steps, for the Primary upgrade and for the Secondary upgrade.

Note: If you have a cluster setup, you must upgrade all the nodes in the cluster at the same time.

Upgrading VVR on the Secondary

Follow these instructions to upgrade the Secondary hosts.

To upgrade the Secondary

- 1 Stop replication to the Secondary host by initiating a Primary pause using the following command:

```
# vradmin -g diskgroup pauserep local_rvgname sec_hostname
```

- 2 Upgrade from VVR 6.0.1 or later to VVR 7.2 on the Secondary.

- 3 Do one of the following:

- Upgrade the disk group now. Enter the following:

```
# vxdg upgrade dgroup
```

- Upgrade the disk group later.

If you upgrade the disk group later, be sure to pause replication before you upgrade the disk group. Also, after pausing replication, upgrade the disk group on Primary as well as Secondary.

- 4 Resume the replication from the Primary using the following command:

```
# vradmin -g diskgroup resumerep local_rvgname sec_hostname
```

Upgrading VVR on the Primary

After you upgrade the Secondary, use the product installer to upgrade the Primary.

To upgrade the Primary

- 1 Stop replication to the Primary host by initiating a Primary pause using the following command:

```
# vradmin -g diskgroup pauserep local_rvgname
```

- 2 Upgrade from VVR 6.0.1 or later to VVR 7.2 on the Secondary.

- 3 Do one of the following:

- Upgrade the disk group now. Enter the following:

```
# vxdg upgrade dgroup
```

- Upgrade the disk group later.
If you upgrade the disk group later, be sure to pause replication before you upgrade the disk group. Also, after pausing replication, upgrade the disk group on Primary as well as Secondary.
- 4 Resume the replication from the Primary using the following command:

```
# vradmin -g diskgroup resumerep local_rvgname  
sec_hostname
```

See [“Planning an upgrade from the previous VVR version”](#) on page 170.

Upgrading SFDB

While upgrading to 7.2, the SFDB tools are enabled by default, which implies that the vxdbd daemon is configured. You can enable the SFDB tools, if they are disabled.

To enable SFDB tools

- 1 Log in as root.
- 2 Run the following command to configure and start the vxdbd daemon.

```
# /opt/VRTS/bin/sfae_config enable
```

Note: If any SFDB installation with authentication setup is upgraded to 7.2, the commands fail with an error. To resolve the issue, setup the SFDB authentication again. For more information, see the *Veritas InfoScale™ Storage and Availability Management for Oracle Databases* or *Veritas InfoScale™ Storage and Availability Management for DB2 Databases*.

Performing a rolling upgrade of SFHA

This chapter includes the following topics:

- [About rolling upgrade](#)
- [Performing a rolling upgrade using the product installer](#)

About rolling upgrade

Rolling upgrade minimizes downtime for highly available clusters to the amount of time that it takes to perform a service group failover. The rolling upgrade has two main phases where the installer upgrades kernel filesets in phase 1 and VCS agent related filesets in phase 2.

Note: You need to perform a rolling upgrade on a completely configured cluster.

If the Oracle agent is configured, set the `MonitorFrequency` to 1 to ensure proper functioning of traditional monitoring during the upgrade.

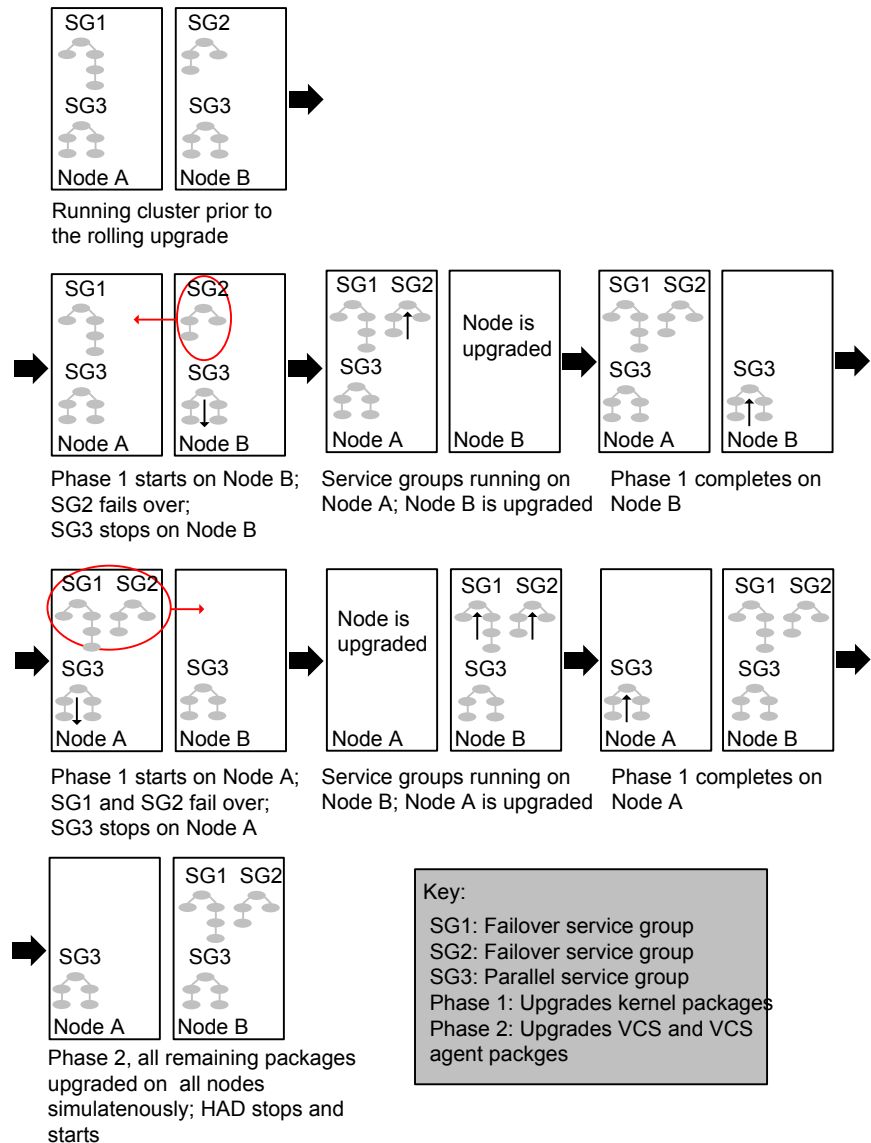
The following is an overview of the flow for a rolling upgrade:

1. The installer performs prechecks on the cluster.
2. Application downtime occurs during the first phase as the installer moves service groups to free nodes for the upgrade. The only downtime that is incurred is the normal time required for the service group to failover. The downtime is limited to the applications that are failed over and not the entire cluster.

3. The installer performs the second phase of the upgrade on all of the nodes in the cluster. The second phase of the upgrade includes downtime of the Cluster Server (VCS) engine HAD, but does not include application downtime.

Figure 11-1 illustrates an example of the installer performing a rolling upgrade for three service groups on a two node cluster.

Figure 11-1 Example of the installer performing a rolling upgrade



The following limitations apply to rolling upgrades:

- Rolling upgrades are not compatible with phased upgrades. Do not mix rolling upgrades and phased upgrades.
- You can perform a rolling upgrade from 6.0.1 and later versions.

- The rolling upgrade procedures support only minor operating system upgrades.
- The rolling upgrade procedure requires the product to be started before and after upgrade. If the current release does not support your current operating system version and the installed old release version does not support the operating system version that the current release supports, then rolling upgrade is not supported.

Performing a rolling upgrade using the product installer

Before you start the rolling upgrade, make sure that Cluster Server (VCS) is running on all the nodes of the cluster.

Stop all activity for all the VxVM volumes that are not under VCS control. For example, stop any applications such as databases that access the volumes, and unmount any file systems that have been created on the volumes. Then stop all the volumes.

Unmount all VxFS file systems that are not under VCS control.

To perform a rolling upgrade

- 1 Phase 1 of rolling upgrade begins on the first subcluster. Complete the preparatory steps on the first subcluster.

Unmount all VxFS file systems not under VCS control:

```
# umount mount_point
```

- 2 Complete updates to the operating system, if required.

Make sure that the existing version of SFHA supports the operating system update you apply. If the existing version of SFHA does not support the operating system update, first upgrade SFHA to a version that supports the operating system update.

For instructions, see the operating system documentation.

Switch applications to remaining subcluster and upgrade the operating system of the first subcluster.

The nodes are restarted after the operating system update.

- 3 Log in as superuser and mount the SFHA 7.2 installation media.
- 4 From root, start the installer.

```
# ./installer
```

- 5 From the menu, select **Upgrade a Product** and from the sub menu, select **Rolling Upgrade**.
- 6 The installer suggests system names for the upgrade. Press **Enter** to upgrade the suggested systems, or enter the name of any one system in the cluster on which you want to perform a rolling upgrade and then press **Enter**.
- 7 The installer checks system communications, release compatibility, version information, and lists the cluster name, ID, and cluster nodes. Type **y** to continue.
- 8 The installer inventories the running service groups and determines the node or nodes to upgrade in phase 1 of the rolling upgrade. Type **y** to continue. If you choose to specify the nodes, type **n** and enter the names of the nodes.
- 9 The installer performs further prechecks on the nodes in the cluster and may present warnings. You can type **y** to continue or quit the installer and address the precheck's warnings.
- 10 Review the end-user license agreement, and type **y** if you agree to its terms.
- 11 After the installer detects the online service groups, the installer prompts the user to do one of the following:
 - Manually switch service groups
 - Use the CPI to automatically switch service groups

The downtime is the time that it normally takes for the service group's failover.

Note: It is recommended that you manually switch the service groups. Automatic switching of service groups does not resolve dependency issues.

- 12 The installer prompts you to stop the applicable processes. Type **y** to continue.
The installer evacuates all service groups to the node or nodes that are not upgraded at this time. The installer stops parallel service groups on the nodes that are to be upgraded.
- 13 The installer stops relevant processes, uninstalls old kernel filesets, and installs the new filesets. The installer asks if you want to update your licenses to the current version. Select **Yes** or **No**. Veritas recommends that you update your licenses to fully use the new features in the current release.

- 14** If the cluster has configured Coordination Point Server based fencing, then during upgrade, installer may ask the user to provide the new HTTPS Coordination Point Server.

The installer performs the upgrade configuration and starts the processes. If the boot disk is encapsulated before the upgrade, installer prompts the user to reboot the node after performing the upgrade configuration.

- 15** Complete the preparatory steps on the nodes that you have not yet upgraded. Unmount all VxFS file systems not under VCS control on all the nodes.

```
# umount mount_point
```

- 16** If operating system updates are not required, skip this step.

Go to step 17.

Else, complete updates to the operating system on the nodes that you have not yet upgraded. For instructions, see the operating system documentation.

Repeat steps 3 to 14 for each node.

Phase 1 of rolling upgrade is complete on the first subcluster. Phase 1 of rolling upgrade begins on the second subcluster.

- 17** The installer begins phase 1 of the upgrade on the remaining node or nodes. Type **y** to continue the rolling upgrade. If the installer was invoked on the upgraded (rebooted) nodes, you must invoke the installer again.

If the installer prompts to restart nodes, restart the nodes. Restart the installer.

The installer repeats step 8 through step 14.

For clusters with larger number of nodes, this process may repeat several times. Service groups come down and are brought up to accommodate the upgrade.

- 18** When Phase 1 of the rolling upgrade completes, mount all the VxFS file systems that are not under VCS control manually. Begin Phase 2 of the upgrade. Phase 2 of the upgrade includes downtime for the VCS engine (HAD), which does not include application downtime. Type **y** to continue. Phase 2 of the rolling upgrade begins here.

- 19** The installer determines the remaining filesets to upgrade. Press **Enter** to continue.

- 20** The installer displays the following question before the installer stops the product processes. If the cluster was configured in secure mode and version is prior to 6.2 before the upgrade, these questions are displayed.

- Do you want to grant read access to everyone? [y,n,q,?]

- To grant read access to all authenticated users, type **y**.
 - To grant usergroup specific permissions, type **n**.
 - Do you want to provide any usergroups that you would like to grant read access?[y,n,q,?]
 - To specify usergroups and grant them read access, type **y**
 - To grant read access only to root users, type **n**. The installer grants read access read access to the root users.
 - Enter the usergroup names separated by spaces that you would like to grant read access. If you would like to grant read access to a usergroup on a specific node, enter like 'usrgrp1@node1', and if you would like to grant read access to usergroup on any cluster node, enter like 'usrgrp1'. If some usergroups are not created yet, create the usergroups after configuration if needed. [b]
- 21** The installer stops Cluster Server (VCS) processes but the applications continue to run. Type **y** to continue.
- The installer performs prestop, uninstalls old filesets, and installs the new filesets. It performs post-installation tasks, and the configuration for the upgrade.
- 22** If you have network connection to the Internet, the installer checks for updates. If updates are discovered, you can apply them now.
- 23** A prompt message appears to ask if the user wants to read the summary file. You can choose **y** if you want to read the install summary file.

Performing a phased upgrade of SFHA

This chapter includes the following topics:

- [About phased upgrade](#)
- [Performing a phased upgrade using the product installer](#)

About phased upgrade

Perform a phased upgrade to minimize the downtime for the cluster.

Depending on the situation, you can calculate the approximate downtime as follows:

Table 12-1

Fail over condition	Downtime
You can fail over all your service groups to the nodes that are up.	Downtime equals the time that is taken to offline and online the service groups.
You have a service group that you cannot fail over to a node that runs during upgrade.	Downtime for that service group equals the time that is taken to perform an upgrade and restart the node.

Prerequisites for a phased upgrade

Before you start the upgrade, confirm that you have licenses for all the nodes that you plan to upgrade.

Planning for a phased upgrade

Plan out the movement of the service groups from node-to-node to minimize the downtime for any particular service group.

Some rough guidelines follow:

- Split the cluster into two subclusters of equal or near equal size.
- Split the cluster so that your high priority service groups remain online during the upgrade of the first subcluster.
- Before you start the upgrade, back up the VCS configuration files `main.cf` and `types.cf` which are in the `/etc/VRTSvcs/conf/config/` directory.
- Before you start the upgrade make sure that all the disk groups have the latest backup of configuration files in the `/etc/vx/cbr/bk` directory. If not, then run the following command to take the latest backup.

```
# /etc/vx/bin/vxconfigbackup -l [dir] [dgid]
```

Phased upgrade limitations

The following limitations primarily describe not to tamper with configurations or service groups during the phased upgrade:

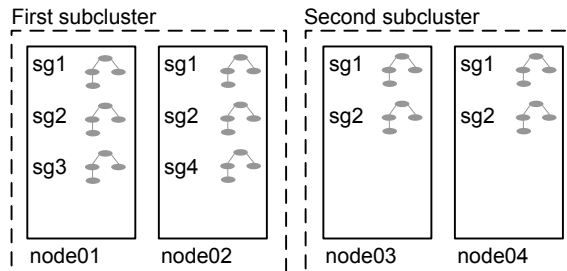
- While you perform the upgrades, do not start any modules.
- When you start the installer, only select SFHA.
- While you perform the upgrades, do not add or remove service groups to any of the nodes.
- After you upgrade the first half of your cluster (the first subcluster), you need to set up password-less ssh or rsh. Create the connection between an upgraded node in the first subcluster and a node from the other subcluster. The node from the other subcluster is where you plan to run the installer and also plan to upgrade.
- Depending on your configuration, you may find that you cannot upgrade multiple nodes at the same time. You may only be able to upgrade one node at a time.
- For very large clusters, you might have to repeat these steps multiple times to upgrade your cluster.

Phased upgrade example

In this example, you have a secure cluster that you have configured to run on four nodes: node01, node02, node03, and node04. You also have four service groups:

sg1, sg2, sg3, and sg4. For the purposes of this example, the cluster is split into two subclusters. The nodes node01 and node02 are in the first subcluster, which you first upgrade. The nodes node03 and node04 are in the second subcluster, which you upgrade last.

Figure 12-1 Example of phased upgrade set up



Each service group is running on the nodes as follows:

- sg1 and sg2 are parallel service groups and run on all the nodes.
- sg3 and sg4 are failover service groups. sg3 runs on node01 and sg4 runs on node02.

In your system list, you have each service group that fails over to other nodes as follows:

- sg1 and sg2 are running on all the nodes.
- sg3 and sg4 can fail over to any of the nodes in the cluster.

Phased upgrade example overview

This example's upgrade path follows:

- Move all the failover service groups from the first subcluster to the second subcluster.
- Take all the parallel service groups offline on the first subcluster.
- Upgrade the operating system on the first subcluster's nodes, if required.
- On the first subcluster, start the upgrade using the installation program.
- Get the second subcluster ready.
- Activate the first subcluster. After activating the first cluster, switch the service groups online on the second subcluster to the first subcluster.
- Upgrade the operating system on the second subcluster's nodes, if required.
- On the second subcluster, start the upgrade using the installation program.

- Activate the second subcluster.

See [“Performing a phased upgrade using the product installer”](#) on page 198.

Performing a phased upgrade using the product installer

This section explains how to perform a phased upgrade of SFHA on four nodes with four service groups. Note that in this scenario, VCS and the service groups cannot stay online on the second subcluster during the upgrade of the second subcluster. Do not add, remove, or change resources or service groups on any nodes during the upgrade. These changes are likely to get lost after the upgrade.

An example of a phased upgrade follows. It illustrates the steps to perform a phased upgrade. The example makes use of a secure SFHA cluster.

You can perform a phased upgrade from SFHA 6.0.1 to SFHA 7.2.

See [“About phased upgrade”](#) on page 195.

See [“Phased upgrade example”](#) on page 196.

Moving the service groups to the second subcluster

Perform the following steps to establish the service group's status and to switch the service groups.

To move service groups to the second subcluster

- 1 On the first subcluster, determine where the service groups are online.

```
# hagrps -state
```

The output resembles:

#Group	Attribute	System	Value
sg1	State	node01	ONLINE
sg1	State	node02	ONLINE
sg1	State	node03	ONLINE
sg1	State	node04	ONLINE
sg2	State	node01	ONLINE
sg2	State	node02	ONLINE
sg2	State	node03	ONLINE
sg2	State	node04	ONLINE
sg3	State	node01	ONLINE
sg3	State	node02	OFFLINE
sg3	State	node03	OFFLINE
sg3	State	node04	OFFLINE
sg4	State	node01	OFFLINE
sg4	State	node02	ONLINE
sg4	State	node03	OFFLINE
sg4	State	node04	OFFLINE

- 2 Offline the parallel service groups (sg1 and sg2) from the first subcluster. Switch the failover service groups (sg3 and sg4) from the first subcluster (node01 and node02) to the nodes on the second subcluster (node03 and node04). For SFHA, vxfs sg is the parallel service group.

```
# hagrps -offline sg1 -sys node01
# hagrps -offline sg2 -sys node01
# hagrps -offline sg1 -sys node02
# hagrps -offline sg2 -sys node02
# hagrps -switch sg3 -to node03
# hagrps -switch sg4 -to node04
```

- 3 On the nodes in the first subcluster, unmount all the VxFS file systems that VCS does not manage, for example:

```
# df -k
```

Filesystem	1024-blocks	Free	%Used	Iused	%Iused	Mounted on
/dev/hd4	20971520	8570080	60%	35736	2%	/
/dev/hd2	5242880	2284528	57%	55673	9%	/usr
/dev/hd9var	4194304	3562332	16%	5877	1%	/var
/dev/hd3	6291456	6283832	1%	146	1%	/tmp
/dev/hd1	262144	261408	1%	62	1%	/home
/dev/hd11admin	262144	184408	30%	6	1%	/admin
/proc	-	-	-	-	-	/proc
/dev/hd10opt	20971520	5799208	73%	65760	5%	/opt
/dev/vx/dsk/dg2/dg2vol1	10240	7600	26%	4	1%	/mnt/dg2/dg2vol1
/dev/vx/dsk/dg2/dg2vol2	10240	7600	26%	4	1%	/mnt/dg2/dg2vol2
/dev/vx/dsk/dg2/dg2vol3	10240	7600	26%	4	1%	/mnt/dg2/dg2vol3

```
# umount /mnt/dg2/dg2vol1
```

```
# umount /mnt/dg2/dg2vol2
```

```
# umount /mnt/dg2/dg2vol3
```

- 4 On the nodes in the first subcluster, stop all VxVM volumes (for each disk group) that VCS does not manage.
- 5 Make the configuration writable on the first subcluster.

```
# haconf -makerw
```

- 6 Freeze the nodes in the first subcluster.

```
# hasys -freeze -persistent node01
```

```
# hasys -freeze -persistent node02
```


- 7 Dump the configuration and make it read-only.

```
# haconf -dump -makero
```

- 8 Verify that the service groups are offline on the first subcluster that you want to upgrade.

```
# hagrps -state
```

Output resembles:

```
#Group Attribute System Value
sg1 State node01 |OFFLINE|
sg1 State node02 |OFFLINE|
sg1 State node03 |ONLINE|
sg1 State node04 |ONLINE|
sg2 State node01 |OFFLINE|
sg2 State node02 |OFFLINE|
sg2 State node03 |ONLINE|
sg2 State node04 |ONLINE|
sg3 State node01 |OFFLINE|
sg3 State node02 |OFFLINE|
sg3 State node03 |ONLINE|
sg3 State node04 |OFFLINE|
sg4 State node01 |OFFLINE|
sg4 State node02 |OFFLINE|
sg4 State node03 |OFFLINE|
sg4 State node04 |ONLINE|
```

Upgrading the operating system on the first subcluster

You can perform the operating system upgrade on the first subcluster, if required.

Before performing operating system upgrade, it is better to prevent LLT from starting automatically when the node starts. For example, you can do the following:

```
# mv /etc/llttab /etc/llttab.save
```

or you can change the `/etc/default/llt` file by setting `LLT_START = 0`.

After you finish upgrading the OS, remember to change the LLT configuration to its original configuration.

Refer to the operating system's documentation for more information.

Upgrading the first subcluster

You now navigate to the installer program and start it.

To start the installer for the phased upgrade

- 1** Confirm that you are logged on as the superuser and you mounted the product disc.
- 2** Navigate to the folder that contains the installer.
- 3** Make sure that you can ssh or rsh from the node where you launched the installer to the nodes in the second subcluster without requests for a password.
- 4** Start the `installsfha` program, specify the nodes in the first subcluster (`node1` and `node2`).

```
# ./installer -upgrade node1 node2
```

The program starts with a copyright message and specifies the directory where it creates the logs. It performs a system verification and outputs upgrade information.

- 5** Enter **y** to agree to the End User License Agreement (EULA).

```
Do you agree with the terms of the End User License Agreement
as specified in the EULA/en/EULA_InfoScale_Ux_7.2.pdf file present
on media? [y,n,q,?] y
```

- 6** When you are prompted, reply **y** to stop appropriate processes.

```
Do you want to stop SFHA processes now? [y,n,q] (y)
```

The installer stops processes, uninstalls filesets, and installs filesets.

The upgrade is finished on the first subcluster. Do not reboot the nodes in the first subcluster until you complete the [Preparing the second subcluster](#) procedure.

Preparing the second subcluster

Perform the following steps on the second subcluster before rebooting nodes in the first subcluster.

To prepare to upgrade the second subcluster

1 Get the summary of the status of your resources.

```
# hastatus -summ
-- SYSTEM STATE
-- System          State          Frozen

A  node01          EXITED          1
A  node02          EXITED          1
A  node03          RUNNING        0
A  node04          RUNNING        0

-- GROUP STATE
-- Group           System    Probed    AutoDisabled    State

B  SG1            node01    Y         N               OFFLINE
B  SG1            node02    Y         N               OFFLINE
B  SG1            node03    Y         N               ONLINE
B  SG1            node04    Y         N               ONLINE
B  SG2            node01    Y         N               OFFLINE
B  SG2            node02    Y         N               OFFLINE
B  SG2            node03    Y         N               ONLINE
B  SG2            node04    Y         N               ONLINE
B  SG3            node01    Y         N               OFFLINE
B  SG3            node02    Y         N               OFFLINE
B  SG3            node03    Y         N               ONLINE
B  SG3            node04    Y         N               OFFLINE
B  SG4            node01    Y         N               OFFLINE
B  SG4            node02    Y         N               OFFLINE
B  SG4            node03    Y         N               OFFLINE
B  SG4            node04    Y         N               ONLINE
```

2 Unmount all the VxFS file systems that VCS does not manage, for example:

```
# df -k
```

Filesystem	1024-blocks	Free	%Used	Iused	%Iused	Mounted on
/dev/hd4	20971520	8570080	60%	35736	2%	/
/dev/hd2	5242880	2284528	57%	55673	9%	/usr
/dev/hd9var	4194304	3562332	16%	5877	1%	/var
/dev/hd3	6291456	6283832	1%	146	1%	/tmp
/dev/hd1	262144	261408	1%	62	1%	/home
/dev/hd11admin	262144	184408	30%	6	1%	/admin
/proc	-	-	-	-	-	/proc
/dev/hd10opt	20971520	5799208	73%	65760	5%	/opt
/dev/vx/dsk/dg2/dg2vol1	10240	7600	26%	4	1%	/mnt/dg2/dg2vol1
/dev/vx/dsk/dg2/dg2vol2	10240	7600	26%	4	1%	/mnt/dg2/dg2vol2
/dev/vx/dsk/dg2/dg2vol3	10240	7600	26%	4	1%	/mnt/dg2/dg2vol3

```
# umount /mnt/dg2/dg2vol1
# umount /mnt/dg2/dg2vol2
# umount /mnt/dg2/dg2vol3
```

3 Make the configuration writable on the second subcluster.

```
# haconf -makerw
```

4 Unfreeze the service groups.

```
# hagrps -unfreeze sg1 -persistent
# hagrps -unfreeze sg2 -persistent
# hagrps -unfreeze sg3 -persistent
# hagrps -unfreeze sg4 -persistent
```

5 Dump the configuration and make it read-only.

```
# haconf -dump -makero
```

6 Take the service groups offline on node03 and node04.

```
# hagrps -offline sg1 -sys node03
# hagrps -offline sg1 -sys node04
# hagrps -offline sg2 -sys node03
# hagrps -offline sg2 -sys node04
# hagrps -offline sg3 -sys node03
# hagrps -offline sg4 -sys node04
```

7 Verify the state of the service groups.

```
# hagrps -state
```

#Group	Attribute	System	Value
SG1	State	node01	OFFLINE
SG1	State	node02	OFFLINE
SG1	State	node03	OFFLINE
SG1	State	node04	OFFLINE
SG2	State	node01	OFFLINE
SG2	State	node02	OFFLINE
SG2	State	node03	OFFLINE
SG2	State	node04	OFFLINE
SG3	State	node01	OFFLINE
SG3	State	node02	OFFLINE
SG3	State	node03	OFFLINE
SG3	State	node04	OFFLINE

8 Stop all VxVM volumes (for each disk group) that VCS does not manage.

- 9 Stop VCS, I/O Fencing, GAB, and LLT on node03 and node04.

```
# /opt/VRTSvcs/bin/hastop -local
# /etc/init.d/vxfen.rc stop
# /etc/init.d/gab.rc stop
# /etc/init.d/llt.rc stop
```

- 10 Make sure that the VXFEN, GAB, and LLT modules on node03 and node04 are not loaded.

```
# /sbin/vxfenconfig -l
VXFEN vxfenconfig ERROR V-11-2-1087 There are 0 active
coordination points for this node

# /sbin/gabconfig -l
GAB Driver Configuration
Driver state          : Unconfigured
Partition arbitration: Disabled
Control port seed     : Disabled
Halt on process death: Disabled
Missed heartbeat halt: Disabled
Halt on rejoin        : Disabled
Keep on killing       : Disabled
Quorum flag           : Disabled
Restart               : Disabled
Node count            : 0
Disk HB interval (ms): 1000
Disk HB miss count    : 4
IOFENCE timeout (ms) : 15000
Stable timeout (ms)   : 5000

# /usr/sbin/strload -q -d /usr/lib/drivers/pse/llt
/usr/lib/drivers/pse/llt: no
```

Activating the first subcluster

Get the first subcluster ready for the service groups.

To activate the first subcluster

- 1 Start LLT and GAB on one node in the first half of the cluster..
- 2 Seed node01 in the first subcluster.

```
# gabconfig -x
```

- 3 On the first half of the cluster, start SFHA:

```
# cd /opt/VRTS/install  
  
# ./installer -start sys1 sys2
```

- 4 Make the configuration writable on the first subcluster.

```
# haconf -makerw
```

- 5 Unfreeze the nodes in the first subcluster.

```
# hasys -unfreeze -persistent node01  
# hasys -unfreeze -persistent node02
```

- 6 Dump the configuration and make it read-only.

```
# haconf -dump -makero
```

- 7 Bring the service groups online on node01 and node02.

```
# hagrps -online sg1 -sys node01  
# hagrps -online sg1 -sys node02  
# hagrps -online sg2 -sys node01  
# hagrps -online sg2 -sys node02  
# hagrps -online sg3 -sys node01  
# hagrps -online sg4 -sys node02
```

Upgrading the operating system on the second subcluster

You can perform the operating system upgrade on the second subcluster, if required.

Before performing operating system upgrade, it is better to prevent LLT from starting automatically when the node starts. For example, you can do the following:

```
# mv /etc/llttab /etc/llttab.save
```

or you can change the `/etc/default/llt` file by setting `LLT_START = 0`.

After you finish upgrading the OS, remember to change the LLT configuration to its original configuration.

Refer to the operating system's documentation for more information.

Upgrading the second subcluster

Perform the following procedure to upgrade the second subcluster (node03 and node04).

To start the installer to upgrade the second subcluster

- 1** Confirm that you are logged on as the superuser and you mounted the product disc.
- 2** Navigate to the folder that contains the installer.
- 3** Confirm that SFHA is stopped on node03 and node04. Start the installsfha program, specify the nodes in the second subcluster (node3 and node4).

```
# ./installer -upgrade node3 node4
```

The program starts with a copyright message and specifies the directory where it creates the logs.

- 4** Enter **y** to agree to the End User License Agreement (EULA).

```
Do you agree with the terms of the End User License Agreement
as specified in the EULA/en/EULA_InfoScale_Ux_7.2.pdf file present
on media? [y,n,q,?] y
```

- 5** When you are prompted, reply **y** to stop appropriate processes.

```
Do you want to stop SFHA processes now? [y,n,q] (y)
```

The installer stops processes, uninstalls filesets, and installs filesets.

- 6** Monitor the installer program answering questions as appropriate until the upgrade completes.

Finishing the phased upgrade

Complete the following procedure to complete the upgrade.

To finish the upgrade

- 1 Verify that the cluster UUID is the same on the nodes in the second subcluster and the first subcluster. Run the following command to display the cluster UUID:

```
# /opt/VRTSvcs/bin/uuidconfig.pl  
-clus -display node1 [node2 ...]
```

If the cluster UUID differs, manually copy the cluster UUID from a node in the first subcluster to the nodes in the second subcluster. For example:

```
# /opt/VRTSvcs/bin/uuidconfig.pl [-rsh] -clus  
-copy -from_sys node01 -to_sys node03 node04
```

- 2 Reboot the node03 and node04 in the second subcluster.

```
# /usr/sbin/shutdown -r
```

The nodes in the second subcluster join the nodes in the first subcluster.

- 3 In the `/etc/default/llt` file, change the value of the `LLT_START` attribute.
In the `/etc/default/gab` file, change the value of the `GAB_START` attribute.
In the `/etc/default/vxfen` file, change the value of the `VXFEN_START` attribute.
In the `/etc/default/vcs` file, change the value of the `VCS_START` attribute.

```
LLT_START = 1  
GAB_START = 1  
VXFEN_START =1  
VCS_START =1
```

- 4 Start LLT and GAB.

```
# /etc/init.d/llt.rc start  
  
# /etc/init.d/gab.rc start
```

- 5 Seed node03 and node04 in the second subcluster.

```
# gabconfig -x
```

- 6 On the second half of the cluster, start SFHA:

```
# cd /opt/VRTS/install  
  
# ./installer -start sys3 sys4
```

7 Check to see if SFHA and High Availability and its components are up.

```
# gabconfig -a
GAB Port Memberships
=====
Port a gen      nxxxxnn membership 0123
Port b gen      nxxxxnn membership 0123
Port h gen      nxxxxnn membership 0123
```

8 Run an `hastatus -sum` command to determine the status of the nodes, service groups, and cluster.

```
# hastatus -sum

-- SYSTEM STATE
-- System          State          Frozen

A  node01          RUNNING        0
A  node02          RUNNING        0
A  node03          RUNNING        0
A  node04          RUNNING        0

-- GROUP STATE
-- Group   System   Probed   AutoDisabled   State
B  sg1      node01    Y           N             ONLINE
B  sg1      node02    Y           N             ONLINE
B  sg1      node03    Y           N             ONLINE
B  sg1      node04    Y           N             ONLINE
B  sg2      node01    Y           N             ONLINE
B  sg2      node02    Y           N             ONLINE
B  sg2      node03    Y           N             ONLINE
B  sg2      node04    Y           N             ONLINE
B  sg3      node01    Y           N             ONLINE
B  sg3      node02    Y           N             OFFLINE
B  sg3      node03    Y           N             OFFLINE
B  sg3      node04    Y           N             OFFLINE
B  sg4      node01    Y           N             OFFLINE
B  sg4      node02    Y           N             ONLINE
B  sg4      node03    Y           N             OFFLINE
B  sg4      node04    Y           N             OFFLINE
```

9 After the upgrade is complete, start the VxVM volumes (for each disk group) and mount the VxFS file systems.

In this example, you have performed a phased upgrade of SFHA. The service groups were down when you took them offline on node03 and node04, to the time SFHA brought them online on node01 or node02.

Note: If you want to upgrade the application clusters that use CP server based fencing to version 6.1 and later, make sure that you first upgrade VCS or SFHA on the CP server systems to version 6.1 and later. And then, from 7.0.1 onwards, CP server supports only HTTPS based communication with its clients and IPM-based communication is no longer supported. CP server needs to be reconfigured if you upgrade the CP server with IPM-based CP server configured.

Performing an automated SFHA upgrade using response files

This chapter includes the following topics:

- [Upgrading SFHA using response files](#)
- [Response file variables to upgrade SFHA](#)
- [Sample response file for SFHA upgrade](#)

Upgrading SFHA using response files

Typically, you can use the response file that the installer generates after you perform SFHA upgrade on one system to upgrade SFHA on other systems.

To perform automated SFHA upgrade

- 1 Make sure the systems where you want to upgrade SFHA meet the upgrade requirements.
- 2 Make sure the pre-upgrade tasks are completed.
- 3 Copy the response file to the system where you want to upgrade SFHA.
- 4 Edit the values of the response file variables as necessary.

- 5 Mount the product disc and navigate to the folder that contains the installation program.
- 6 Start the upgrade from the system to which you copied the response file. For example:

```
# ./installer -responsefile /tmp/response_file
```

Where `/tmp/response_file` is the response file's full path name.

Response file variables to upgrade SFHA

[Table 13-1](#) lists the response file variables that you can define to configure SFHA.

Table 13-1 Response file variables for upgrading SFHA

Variable	Description
CFG{accepteula}	Specifies whether you agree with the EULA.pdf file on the media. List or scalar: scalar Optional or required: required
CFG{systems}	List of systems on which the product is to be installed or uninstalled. List or scalar: list Optional or required: required
CFG{upgrade}	Upgrades all filesets installed. List or scalar: list Optional or required: required
CFG{keys}{keyless} CFG{keys}{license}	CFG{keys}{keyless} gives a list of keyless keys to be registered on the system. CFG{keys}{license} gives a list of user defined keys to be registered on the system. List or scalar: list Optional or required: required
CFG{opt}{keyfile}	Defines the location of an ssh keyfile that is used to communicate with all remote systems. List or scalar: scalar Optional or required: optional

Table 13-1 Response file variables for upgrading SFHA (*continued*)

Variable	Description
CFG{opt}{tmppath}	<p>Defines the location where a working directory is created to store temporary files and the filesets that are needed during the install. The default location is /var/tmp.</p> <p>List or scalar: scalar</p> <p>Optional or required: optional</p>
CFG{opt}{logpath}	<p>Mentions the location where the log files are to be copied. The default location is /opt/VRTS/install/logs.</p> <p>List or scalar: scalar</p> <p>Optional or required: optional</p>
CFG{opt}{disable_dmp_native_support}	<p>If it is set to 1, Dynamic Multi-pathing support for the native LVM volume groups and ZFS pools is disabled after upgrade. Retaining Dynamic Multi-pathing support for the native LVM volume groups and ZFS pools during upgrade increases fileset upgrade time depending on the number of LUNs and native LVM volume groups and ZFS pools configured on the system.</p> <p>List or scalar: scalar</p> <p>Optional or required: optional</p>
CFG{opt}{patch_path}	<p>Defines the path of a patch level release to be integrated with a base or a maintenance level release in order for multiple releases to be simultaneously installed .</p> <p>List or scalar: scalar</p> <p>Optional or required: optional</p>
CFG{opt}{patch2_path}	<p>Defines the path of a second patch level release to be integrated with a base or a maintenance level release in order for multiple releases to be simultaneously installed.</p> <p>List or scalar: scalar</p> <p>Optional or required: optional</p>

Table 13-1 Response file variables for upgrading SFHA (*continued*)

Variable	Description
CFG{opt}{patch3_path}	<p>Defines the path of a third patch level release to be integrated with a base or a maintenance level release in order for multiple releases to be simultaneously installed.</p> <p>List or scalar: scalar</p> <p>Optional or required: optional</p>
CFG{opt}{patch4_path}	<p>Defines the path of a fourth patch level release to be integrated with a base or a maintenance level release in order for multiple releases to be simultaneously installed.</p> <p>List or scalar: scalar</p> <p>Optional or required: optional</p>
CFG{opt}{patch5_path}	<p>Defines the path of a fifth patch level release to be integrated with a base or a maintenance level release in order for multiple releases to be simultaneously installed.</p> <p>List or scalar: scalar</p> <p>Optional or required: optional</p>
CFG{rootsecusrgrps}	<p>Defines if the user chooses to grant read access to the cluster only for root and other users/usergroups which are granted explicit privileges on VCS objects.</p> <p>List or scalar: scalar</p> <p>Optional or required: optional</p>
CFG{secusrgrps}	<p>Defines the usergroup names that are granted read access to the cluster.</p> <p>List or scalar: scalar</p> <p>Optional or required: optional</p>

Sample response file for SFHA upgrade

The following example shows a response file for upgrading Storage Foundation High Availability.

```

our %CFG;
$CFG{accepteula}=1;
$CFG{client_vxfen_warning}=1;
$CFG{keys}{keyless}=[ qw(ENTERPRISE) ];
$CFG{fencing_cps}=[ qw(10.198.92.157 10.198.92.158) ];
$CFG{fencing_cps_ports}{"10.198.92.157"}=443;
$CFG{fencing_cps_ports}{"10.198.92.158"}=443;
$CFG{fencing_cps_vips}{"10.198.92.157"}=[ qw(10.198.92.157) ];
$CFG{fencing_cps_vips}{"10.198.92.158"}=[ qw(10.198.92.158) ];
$CFG{opt}{noipc}=1;
$CFG{opt}{upgrade}=1;
$CFG{prod}="ENTERPRISE72";
$CFG{systems}=[ qw(cdclab-p51a-03 cdclab-p51a-04) ];
$CFG{vcs_allowcomms}=1;
1;

```

The `vcs_allowcomms` variable is set to 0 if it is a single-node cluster, and the `llt` and `gab` processes are not started before upgrade.

Performing post-upgrade tasks

This chapter includes the following topics:

- [Optional configuration steps](#)
- [Recovering VVR if automatic upgrade fails](#)
- [Post-upgrade tasks when VCS agents for VVR are configured](#)
- [Resetting DAS disk names to include host name in FSS environments](#)
- [Upgrading disk layout versions](#)
- [Upgrading VxVM disk group versions](#)
- [Updating variables](#)
- [Setting the default disk group](#)
- [About enabling LDAP authentication for clusters that run in secure mode](#)
- [Verifying the Storage Foundation and High Availability upgrade](#)

Optional configuration steps

After the upgrade is complete, additional tasks may need to be performed.

You can perform the following optional configuration steps:

- If Volume Replicator (VVR) is configured, do the following steps in the order shown:
 - Reattach the RLINKs.
 - Associate the SRL.

- To upgrade VxFS Disk Layout versions and VxVM Disk Group versions, follow the upgrade instructions.
See [“Upgrading VxVM disk group versions”](#) on page 223.

Recovering VVR if automatic upgrade fails

If the upgrade fails during the configuration phase, after displaying the VVR upgrade directory, the configuration needs to be restored before the next attempt. Run the scripts in the upgrade directory in the following order to restore the configuration:

```
# restoresrl
# addddcm
# srlprot
# attrlink
# start.rvg
```

After the configuration is restored, the current step can be retried.

Post-upgrade tasks when VCS agents for VVR are configured

The following lists post-upgrade tasks with VCS agents for VVR:

- [Unfreezing the service groups](#)
- [Restoring the original configuration when VCS agents are configured](#)

Unfreezing the service groups

This section describes how to unfreeze services groups and bring them online.

To unfreeze the service groups

- 1 On any node in the cluster, make the VCS configuration writable:

```
# haconf -makerw
```

- 2 Edit the `/etc/VRTSvcs/conf/config/main.cf` file to remove the deprecated attributes, SRL and RLinks, in the RVG and RVGShared resources.
- 3 Verify the syntax of the main.cf file, using the following command:

```
# hacf -verify
```

- 4 Unfreeze all service groups that you froze previously. Enter the following command on any node in the cluster:

```
# hagrps -unfreeze service_group -persistent
```

- 5 Save the configuration on any node in the cluster.

```
# haconf -dump -makero
```

- 6 If you are upgrading in a shared disk group environment, bring online the RVGShared groups with the following commands:

```
# hagrps -online RVGShared -sys masterhost
```

- 7 Bring the respective IP resources online on each node.

See [“Preparing for the upgrade when VCS agents are configured”](#) on page 174.

Type the following command on any node in the cluster.

```
# hares -online ip_name -sys system
```

This IP is the virtual IP that is used for replication within the cluster.

- 8 In shared disk group environment, online the virtual IP resource on the master node.

Restoring the original configuration when VCS agents are configured

This section describes how to restore a configuration with VCS configured agents.

Note: Restore the original configuration only after you have upgraded VVR on all nodes for the Primary and Secondary cluster.

To restore the original configuration

- 1 Import all the disk groups in your VVR configuration.

```
# vxdg -t import diskgroup
```

Each disk group should be imported onto the same node on which it was online when the upgrade was performed. The reboot after the upgrade could result in another node being online; for example, because of the order of the nodes in the AutoStartList. In this case, switch the VCS group containing the disk groups to the node on which the disk group was online while preparing for the upgrade.

```
# hagrps -switch grpname -to system
```

- 2 Recover all the disk groups by typing the following command on the node on which the disk group was imported in step 1.

```
# vxrecover -bs
```

- 3 Upgrade all the disk groups on all the nodes on which VVR has been upgraded:

```
# vxdg upgrade diskgroup
```

- 4 On all nodes that are Secondary hosts of VVR, make sure the data volumes on the Secondary are the same length as the corresponding ones on the Primary. To shrink volumes that are longer on the Secondary than the Primary, use the following command on each volume on the Secondary:

```
# vxassist -g diskgroup shrinkto volume_name volume_length
```

where *volume_length* is the length of the volume on the Primary.

Note: Do not continue until you complete this step on all the nodes in the Primary and Secondary clusters on which VVR is upgraded.

- 5 Restore the configuration according to the method you used for upgrade:

If you upgraded with the VVR upgrade scripts

Complete the upgrade by running the `vvr_upgrade_finish` script on all the nodes on which VVR was upgraded. We recommend that you first run the `vvr_upgrade_finish` script on each node that is a Secondary host of VVR.

Perform the following tasks in the order indicated:

- To run the `vvr_upgrade_finish` script, type the following command:

```
# /disc_path/scripts/vvr_upgrade_finish
```

where *disc_path* is the location where the Veritas software disc is mounted.

- Attach the RLINKs on the nodes on which the messages were displayed:

```
# vxrlink -g diskgroup -f att rlink_name
```

If you upgraded with the product installer

Use the Veritas InfoScale product installer and select start a Product. Or use the installation script with the `-start` option.

- 6 Bring online the RVGLogowner group on the master:

```
# hagrps -online RVGLogownerGrp -sys masterhost
```

- 7 If you plan on using IPv6, you must bring up IPv6 addresses for virtual replication IP on primary/secondary nodes and switch from using IPv4 to IPv6 host names or addresses, enter:

```
# vradm changeip newpri=v6 newsec=v6
```

where *v6* is the IPv6 address.

- 8 Restart the applications that were stopped.

CVM master node needs to assume the logowner role for VCS managed VVR resources

If you use VCS to manage RVGLogowner resources in an SFCFSHA environment or an SF Oracle RAC environment, Veritas recommends that you perform the following procedures. These procedures ensure that the CVM master node always assumes the logowner role. Not performing these procedures can result in unexpected issues that are due to a CVM slave node that assumes the logowner role.

For a service group that contains an RVGLogowner resource, change the value of its `TriggersEnabled` attribute to `PREONLINE` to enable it.

To enable the TriggersEnabled attribute from the command line on a service group that has an RVGLogowner resource

- ◆ On any node in the cluster, perform the following command:

```
# hagrps -modify RVGLogowner_resource_sg TriggersEnabled PREONLINE
```

Where *RVGLogowner_resource_sg* is the service group that contains the RVGLogowner resource.

To enable the `preonline_vvr` trigger, do one of the following:

- If `preonline` trigger script is not already present, copy the `preonline` trigger script from the `sample triggers` directory into the `triggers` directory:

```
# cp /opt/VRTSvcs/bin/sample_triggers/VRTSvcs/preonline_vvr  
/opt/VRTSvcs/bin/triggers/preonline
```


Change the file permissions to make it executable.
- If `preonline` trigger script is already present, create a directory such as `/preonline` and move the existing `preonline` trigger as `T0preonline` to that directory. Copy the `preonline_vvr` trigger as `T1preonline` to the same directory.
- If you already use multiple triggers, copy the `preonline_vvr` trigger as `TNpreonline`, where `TN` is the next higher `TNumber`.

Resetting DAS disk names to include host name in FSS environments

If you are on a version earlier than 7.1, the `VxVM` disk names in the case of DAS disks in FSS environments, must be regenerated to use the host name as a prefix. The host prefix helps to uniquely identify the origin of the disk. For example, the device name for the disk `disk1` on the host `sys1` is now displayed as `sys1_disk1`.

To regenerate the disk names, run the following command:

```
# vxddladm -c assign names
```

The command must be run on each node in the cluster.

Upgrading disk layout versions

In this release, you can create and mount only file systems with disk layout Version 7, 8, 9, and 10. You can only local mount disk layout Version 6 only to upgrade to a later disk layout version.

Note: If you plan to use 64-bit quotas, you must upgrade to the latest disk layout Version 10. The use of 64-bit quota on earlier disk layout versions is deprecated in this release.

Disk layout Version 6 has been deprecated and you cannot cluster mount an existing file system that has disk layout Version 6. To upgrade a cluster file system with disk layout Version 6, you must local mount the file system and then upgrade the file system using the `vxupgrade` utility to a later version.

To upgrade the disk layout versions

- ◆ To get to disk layout Version 10 from Version 6. You must incrementally upgrade the disk layout of this file system. For example:

```
# vxupgrade -n 7 /mnt
# vxupgrade -n 8 /mnt
# vxupgrade -n 9 /mnt
# vxupgrade -n 10 /mnt
```

See the `vxupgrade(1M)` manual page.

You must upgrade any existing file systems with disk layout Version 4 to disk layout Version 7 or later using the `vxfsconvert` command.

See the `vxfsconvert(1M)` manual page.

Note: Veritas recommends that you upgrade existing file systems to the highest supported disk layout version prior to upgrading to this release. Once a disk layout version has been upgraded, it is not possible to downgrade to the previous version.

You can check which disk layout version your file system has by using the following command:

```
# fstyp -v /dev/vx/dsk/dg1/voll | grep -i version
```

For more information about disk layout versions, see the *Storage Foundation Administrator's Guide*.

Upgrading VxVM disk group versions

All Veritas Volume Manager disk groups have an associated version number. Each VxVM release supports a specific set of disk group versions. VxVM can import and perform tasks on disk groups with those versions. Some new features and tasks work only on disk groups with the current disk group version. Before you can perform the tasks or use the features, upgrade the existing disk groups.

For 7.2, the Veritas Volume Manager disk group version is different than in previous VxVM releases. Veritas recommends that you upgrade the disk group version if you upgraded from a previous VxVM release.

After upgrading to SFHA 7.2, you must upgrade any existing disk groups that are organized by ISP. Without the version upgrade, configuration query operations continue to work fine. However, configuration change operations will not function correctly.

For more information about ISP disk groups, refer to the *Storage Foundation Administrator's Guide*.

Use the following command to find the version of a disk group:

```
# vxdg list diskgroup
```

To upgrade a disk group to the current disk group version, use the following command:

```
# vxdg upgrade diskgroup
```

For more information about disk group versions, see the *Storage Foundation Administrator's Guide*.

Updating variables

In `/etc/profile`, update the `PATH` and `MANPATH` variables as needed.

`MANPATH` can include `/opt/VRTS/man` and `PATH` can include `/opt/VRTS/bin`.

Setting the default disk group

You may find it convenient to create a system-wide default disk group. The main benefit of creating a default disk group is that VxVM commands default to the default disk group. You do not need to use the `-g` option.

You can set the name of the default disk group after installation by running the following command on a system:

```
# vxdctl defaultdg diskgroup
```

See the *Storage Foundation Administrator's Guide*.

About enabling LDAP authentication for clusters that run in secure mode

Veritas Product Authentication Service (AT) supports LDAP (Lightweight Directory Access Protocol) user authentication through a plug-in for the authentication broker. AT supports all common LDAP distributions such as OpenLDAP and Windows Active Directory.

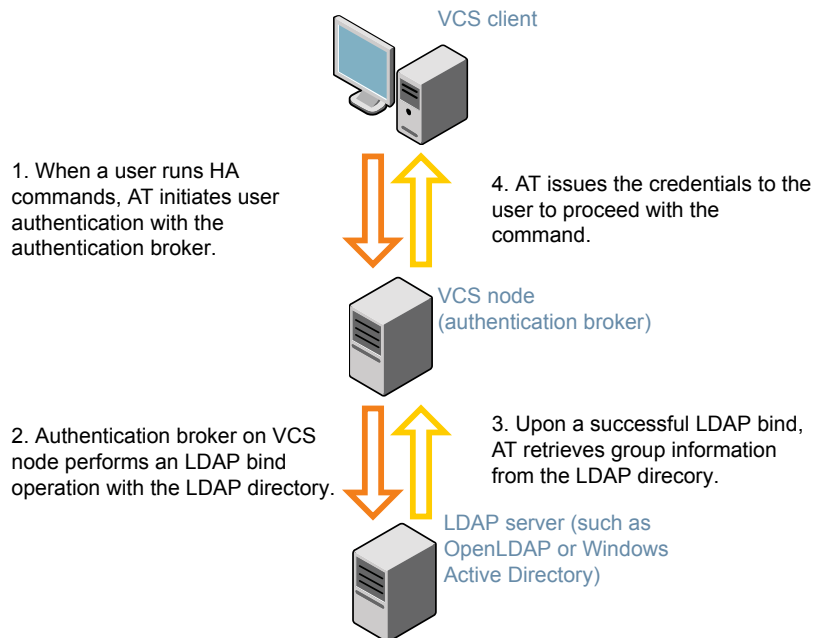
For a cluster that runs in secure mode, you must enable the LDAP authentication plug-in if the VCS users belong to an LDAP domain.

If you have not already added VCS users during installation, you can add the users later.

See the *Cluster Server Administrator's Guide* for instructions to add VCS users.

Figure 14-1 depicts the SFHA cluster communication with the LDAP servers when clusters run in secure mode.

Figure 14-1 Client communication with LDAP servers



The LDAP schema and syntax for LDAP commands (such as `ldapadd`, `ldapmodify`, and `ldapsearch`) vary based on your LDAP implementation.

Before adding the LDAP domain in Veritas Product Authentication Service, note the following information about your LDAP environment:

- The type of LDAP schema used (the default is RFC 2307)
 - UserObjectClass (the default is `posixAccount`)
 - UserObject Attribute (the default is `uid`)
 - User Group Attribute (the default is `gidNumber`)
 - Group Object Class (the default is `posixGroup`)
 - GroupObject Attribute (the default is `cn`)

- Group GID Attribute (the default is gidNumber)
- Group Membership Attribute (the default is memberUid)
- URL to the LDAP Directory
- Distinguished name for the user container (for example, UserBaseDN=ou=people,dc=comp,dc=com)
- Distinguished name for the group container (for example, GroupBaseDN=ou=group,dc=comp,dc=com)

Enabling LDAP authentication for clusters that run in secure mode

The following procedure shows how to enable the plug-in module for LDAP authentication. This section provides examples for OpenLDAP and Windows Active Directory LDAP distributions.

Before you enable the LDAP authentication, complete the following steps:

- Make sure that the cluster runs in secure mode.

```
# haclus -value SecureClus
```

The output must return the value as 1.

- Make sure that the AT version is 6.1.6.0 or later.

```
# /opt/VRTSvcs/bin/vcsauth/vcsauthserver/bin/vssat showversion
vssat version: 6.1.12.8
```

To enable OpenLDAP authentication for clusters that run in secure mode

- 1 Run the LDAP configuration tool `atldapconf` using the `-d` option. The `-d` option discovers and retrieves an LDAP properties file which is a prioritized attribute list.

```
# /opt/VRTSvcs/bin/vcsauth/vcsauthserver/bin/atldapconf \
-d -s domain_controller_name_or_ipaddress -u domain_user
```

Attribute list file name not provided, using AttributeList.txt

Attribute file created.

You can use the `catatldapconf` command to view the entries in the attributes file.

- 2 Run the LDAP configuration tool using the `-c` option. The `-c` option creates a CLI file to add the LDAP domain.

```
# /opt/VRTSvcs/bin/vcsauth/vcsauthserver/bin/atldapconf \
-c -d LDAP_domain_name
```

Attribute list file not provided, using default AttributeList.txt

CLI file name not provided, using default CLI.txt

CLI for addldapdomain generated.

- 3 Run the LDAP configuration tool `atldapconf` using the `-x` option. The `-x` option reads the CLI file and executes the commands to add a domain to the AT.

```
# /opt/VRTSvcs/bin/vcsauth/vcsauthserver/bin/atldapconf -x
```

Using default broker port 14149

CLI file not provided, using default CLI.txt

Looking for AT installation...

AT found installed at ./vssat

Successfully added LDAP domain.

- 4 Check the AT version and list the LDAP domains to verify that the Windows Active Directory server integration is complete.

```
# /opt/VRTSvcs/bin/vcsauth/vcsauthserver/bin/vssat showversion

vssat version: 6.1.12.8

# /opt/VRTSvcs/bin/vcsauth/vcsauthserver/bin/vssat listldapdomains

Domain Name : mydomain.com

Server URL : ldap://192.168.20.32:389

SSL Enabled : No

User Base DN : CN=people,DC=mydomain,DC=com

User Object Class : account

User Attribute : cn

User GID Attribute : gidNumber

Group Base DN : CN=group,DC=domain,DC=com

Group Object Class : group

Group Attribute : cn

Group GID Attribute : cn

Auth Type : FLAT

Admin User :

Admin User Password :

Search Scope : SUB
```

- 5 Check the other domains in the cluster.

```
# /opt/VRTSvcs/bin/vcsauth/vcsauthserver/bin/vssat showdomains -p vx
```

The command output lists the number of domains that are found, with the domain names and domain types.

6 Generate credentials for the user.

```
# unset EAT_LOG

# /opt/VRTSvcs/bin/vcsauth/vcsauthserver/bin/vssat authenticate \
-d ldap:LDAP_domain_name -p user_name -s user_password -b \
localhost:14149
```

7 Add non-root users as applicable.

```
# useradd user1

# passwd pw1

Changing password for "user1"

user1's New password:

Re-enter user1's new password:

# su user1

# bash

# id

uid=204(user1) gid=1(staff)

# pwd

# mkdir /home/user1

# chown user1 /home/ user1
```

- Add the non-root user to the VCS configuration.

```
# haconf -makerw
# hauser -add user1
# haconf -dump -makero
```

- Log in as non-root user and run VCS commands as LDAP user.

```
# cd /home/user1

# ls

# cat .vcspwd

101 localhost mpise LDAP_SERVER ldap

# unset VCS_DOMAINTYPE

# unset VCS_DOMAIN

# /opt/VRTSvcs/bin/hasys -state
```

#System	Attribute	Value
cluster1:sysA	SysState	FAULTED
cluster1:sysB	SysState	FAULTED
cluster2:sysC	SysState	RUNNING
cluster2:sysD	SysState	RUNNING

Verifying the Storage Foundation and High Availability upgrade

Refer to the *Verifying the Veritas InfoScale installation* chapter in the *Veritas InfoScale Installation Guide*.

Post-installation tasks

- [Chapter 15. Performing post-installation tasks](#)

Performing post-installation tasks

This chapter includes the following topics:

- [Switching on Quotas](#)
- [About configuring authentication for SFDB tools](#)

Switching on Quotas

This turns on the group and user quotas once all the nodes are upgraded to 7.2, if it was turned off earlier.

To turn on the group and user quotas

- ◆ Switch on quotas:

```
# vxquotaon -av
```

About configuring authentication for SFDB tools

To configure authentication for Storage Foundation for Databases (SFDB) tools, perform the following tasks:

Configure the `vxdbd` daemon to require authentication

See [“Configuring vxdbd for SFDB tools authentication”](#) on page 233.

Add a node to a cluster that is using authentication for SFDB tools

See [“Adding nodes to a cluster that is using authentication for SFDB tools”](#) on page 249.

Configuring vxdbd for SFDB tools authentication

To configure vxdbd, perform the following steps as the root user

- 1 Run the `sfae_auth_op` command to set up the authentication services.

```
# /opt/VRTS/bin/sfae_auth_op -o setup
Setting up AT
Starting SFAE AT broker
Creating SFAE private domain
Backing up AT configuration
Creating principal for vxdbd
```

- 2 Stop the vxdbd daemon.

```
# /opt/VRTS/bin/sfae_config disable
vxdbd has been disabled and the daemon has been stopped.
```

- 3 Enable authentication by setting the `AUTHENTICATION` key to `yes` in the `/etc/vx/vxdbed/admin.properties` configuration file.

```
If /etc/vx/vxdbed/admin.properties does not exist, then use cp
/opt/VRTSdbed/bin/admin.properties.example
/etc/vx/vxdbed/admin.properties.
```

- 4 Start the vxdbd daemon.

```
# /opt/VRTS/bin/sfae_config enable
vxdbd has been enabled and the daemon has been started.
It will start automatically on reboot.
```

The vxdbd daemon is now configured to require authentication.

Adding and removing nodes

- [Chapter 16. Adding a node to SFHA clusters](#)
- [Chapter 17. Removing a node from SFHA clusters](#)

Adding a node to SFHA clusters

This chapter includes the following topics:

- [About adding a node to a cluster](#)
- [Before adding a node to a cluster](#)
- [Adding a node to a cluster using the Veritas InfoScale installer](#)
- [Adding the node to a cluster manually](#)
- [Adding a node using response files](#)
- [Configuring server-based fencing on the new node](#)
- [After adding the new node](#)
- [Adding nodes to a cluster that is using authentication for SFDB tools](#)
- [Updating the Storage Foundation for Databases \(SFDB\) repository after adding a node](#)

About adding a node to a cluster

After you install Veritas InfoScale and create a cluster, you can add and remove nodes from the cluster. You can create clusters of up to 64 nodes.

You can add a node:

- Using the product installer
- Manually

The following table provides a summary of the tasks required to add a node to an existing SFHA cluster.

Table 16-1 Tasks for adding a node to a cluster

Step	Description
Complete the prerequisites and preparatory tasks before adding a node to the cluster.	See “Before adding a node to a cluster” on page 236.
Add a new node to the cluster.	See “Adding a node to a cluster using the Veritas InfoScale installer” on page 238. See “Adding the node to a cluster manually” on page 241.
If you are using the Storage Foundation for Databases (SFDB) tools, you must update the repository database.	See “Adding nodes to a cluster that is using authentication for SFDB tools” on page 249. See “Updating the Storage Foundation for Databases (SFDB) repository after adding a node” on page 250.

The example procedures describe how to add a node to an existing cluster with two nodes.

Before adding a node to a cluster

Before preparing to add the node to an existing SFHA cluster, perform the required preparations.

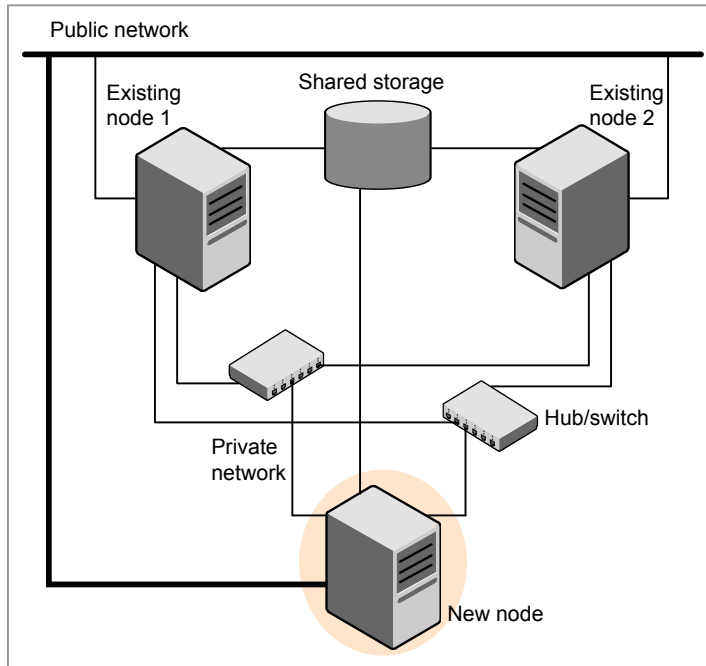
- Verify hardware and software requirements are met.
- Set up the hardware.
- Prepare the new node.

To verify hardware and software requirements are met

- 1 Review hardware and software requirements for SFHA.
- 2 Verify the new system has the same identical operating system versions and patch levels as that of the existing cluster
- 3 Verify the existing cluster is installed with Enterprise and that SFHA is running on the cluster.

Before you configure a new system on an existing cluster, you must physically add the system to the cluster as illustrated in [Figure 16-1](#).

Figure 16-1 Adding a node to a two-node cluster using two switches



To set up the hardware

1 Connect the SFHA private Ethernet controllers.

Perform the following tasks as necessary:

- When you add nodes to a cluster, use independent switches or hubs for the private network connections. You can only use crossover cables for a two-node cluster, so you might have to swap out the cable for a switch or hub.
- If you already use independent hubs, connect the two Ethernet controllers on the new node to the independent hubs.

Figure 16-1 illustrates a new node being added to an existing two-node cluster using two independent hubs.

2 Make sure that you meet the following requirements:

- The node must be connected to the same shared storage devices as the existing nodes.
- The node must have private network connections to two independent switches for the cluster.

For more information, see the *Cluster Server Configuration and Upgrade Guide*.

- The network interface names used for the private interconnects on the new node must be the same as that of the existing nodes in the cluster.

Complete the following preparatory steps on the new node before you add it to an existing SFHA cluster.

To prepare the new node

- 1 Navigate to the folder that contains the installer program. Verify that the new node meets installation requirements. Verify that the new node meets installation requirements.

```
# ./installer -precheck
```

- 2 Install Veritas InfoScale Enterprise filesets only without configuration on the new system. Make sure all the VRTS filesets available on the existing nodes are also available on the new node.

```
# ./installer
```

Do not configure SFHA when prompted.

```
Would you like to configure InfoScale Enterprise after installation?
[y,n,q] (n) n
```

Adding a node to a cluster using the Veritas InfoScale installer

You can add a node to a cluster using the `-addnode` option with the Veritas InfoScale installer.

The Veritas InfoScale installer performs the following tasks:

- Verifies that the node and the existing cluster meet communication requirements.
- Verifies the products and filesets installed but not configured on the new node.
- Discovers the network interfaces on the new node and checks the interface settings.
- Creates the following files on the new node:

```
/etc/llttab
/etc/VRTSvcs/conf/sysname
```

- Updates and copies the following files to the new node from the existing node:

```
/etc/llthosts
/etc/gabtab
/etc/VRTSvcs/conf/config/main.cf
```

- Copies the following files from the existing cluster to the new node
 - /etc/vxfenmode
 - /etc/vxfendg
 - /etc/vx/.uuids/clusuuid
 - /etc/default/llt
 - /etc/default/gab
 - /etc/default/vxfen
- Configures disk-based or server-based fencing depending on the fencing mode in use on the existing cluster.

At the end of the process, the new node joins the SFHA cluster.

Note: If you have configured server-based fencing on the existing cluster, make sure that the CP server does not contain entries for the new node. If the CP server already contains entries for the new node, remove these entries before adding the node to the cluster, otherwise the process may fail with an error.

See [“Removing the node configuration from the CP server”](#) on page 256.

To add the node to an existing cluster using the installer

- 1 Log in as the root user on one of the nodes of the existing cluster.
- 2 Run the Veritas InfoScale installer with the `-addnode` option.

```
# cd /opt/VRTS/install
# ./installer -addnode
```

The installer displays the copyright message and the location where it stores the temporary installation logs.

- 3 Enter the name of a node in the existing SFHA cluster.

The installer uses the node information to identify the existing cluster.

```
Enter the name of any one node of the InfoScale ENTERPRISE cluster
where you would like to add one or more new nodes: sys1
```

- 4 Review and confirm the cluster information.

- 5 Enter the name of the systems that you want to add as new nodes to the cluster.

Enter the system names separated by spaces
to add to the cluster: **Sys5**

Confirm if the installer prompts if you want to add the node to the cluster.

The installer checks the installed products and filesets on the nodes and discovers the network interfaces.

- 6 Enter the name of the network interface that you want to configure as the first private heartbeat link.

Enter the NIC for the first private heartbeat
link on Sys5: [b,q,?] **en1**

Enter the NIC for the second private heartbeat
link on Sys5: [b,q,?] **en2**

Note: At least two private heartbeat links must be configured for high availability of the cluster.

- 7 Depending on the number of LLT links configured in the existing cluster, configure additional private heartbeat links for the new node.

The installer verifies the network interface settings and displays the information.

- 8 Review and confirm the information.

- 9 If you have configured SMTP, SNMP, or the global cluster option in the existing cluster, you are prompted for the NIC information for the new node.

Enter the NIC for VCS to use on Sys5: **en3**

- 10

If the existing cluster uses server-based fencing, the installer will configure server-based fencing on the new nodes.

The installer then starts all the required processes and joins the new node to cluster.

The installer indicates the location of the log file, summary file, and response file with details of the actions performed.

If you have enabled security on the cluster, the installer displays the following message:

```
Since the cluster is in secure mode, check the main.cf whether
you need to modify the usergroup that you would like to grant
read access. If needed, use the following commands to modify:
```

```
# haconf -makerw

# hauser -addpriv <user group> GuestGroup

# haconf -dump -makero
```
- 11

Confirm that the new node has joined the SFHA cluster using `lltstat -n` and `gabconfig -a` commands.

Adding the node to a cluster manually

Perform this procedure after you install Veritas InfoScale Enterprise only if you plan to add the node to the cluster manually.

Table 16-2 Procedures for adding a node to a cluster manually

Step	Description
Start the Veritas Volume Manager (VxVM) on the new node.	See “Starting Veritas Volume Manager (VxVM) on the new node” on page 242.
Configure the cluster processes on the new node.	See “Configuring cluster processes on the new node” on page 243.

Table 16-2 Procedures for adding a node to a cluster manually (*continued*)

Step	Description
Configure fencing for the new node to match the fencing configuration on the existing cluster. If the existing cluster is configured to use server-based I/O fencing, configure server-based I/O fencing on the new node.	See “Starting fencing on the new node” on page 245.
Start VCS.	See “To start VCS on the new node” on page 249.
If the ClusterService group is configured on the existing cluster, add the node to the group.	See “Configuring the ClusterService group for the new node” on page 245.

Starting Veritas Volume Manager (VxVM) on the new node

Veritas Volume Manager (VxVM) uses license keys to control access. As you run the `vxinstall` utility, answer **n** to prompts about licensing. You installed the appropriate license when you ran the `installer` program.

To start VxVM on the new node

- 1 To start VxVM on the new node, use the `vxinstall` utility:

```
# vxinstall
```

- 2 Enter **n** when prompted to set up a system wide disk group for the system.
The installation completes.

- 3 Verify that the daemons are up and running. Enter the command:

```
# vxdisk list
```

Make sure the output displays the shared disks without errors.

Configuring cluster processes on the new node

Perform the steps in the following procedure to configure cluster processes on the new node.

- 1 Edit the `/etc/llthosts` file on the existing nodes. Using `vi` or another text editor, add the line for the new node to the file. The file resembles:

```
0 sys1
1 sys2
2 sys5
```

- 2 Copy the `/etc/llthosts` file from one of the existing systems over to the new system. The `/etc/llthosts` file must be identical on all nodes in the cluster.
- 3 Create an `/etc/llttab` file on the new system. For example:

```
set-node Sys5
set-cluster 101

link en1 /dev/dlpi/en:1 - ether - -
link en2 /dev/dlpi/en:2 - ether - -
```

Except for the first line that refers to the node, the file resembles the `/etc/llttab` files on the existing nodes. The second line, the cluster ID, must be the same as in the existing nodes.

- 4 Use `vi` or another text editor to create the file `/etc/gabtab` on the new node. This file must contain a line that resembles the following example:

```
/sbin/gabconfig -c -nN
```

Where `N` represents the number of systems in the cluster including the new node. For a three-system cluster, `N` would equal 3.

- 5 Edit the `/etc/gabtab` file on each of the existing systems, changing the content to match the file on the new system.
- 6 Use `vi` or another text editor to create the file `/etc/VRTSvcs/conf/sysname` on the new node. This file must contain the name of the new node added to the cluster.

For example:

```
Sys5
```

7 Create the Unique Universal Identifier file `/etc/vx/.uuids/clusuuid` on the new node:

```
# /opt/VRTSvc/bin/uuidconfig.pl -rsh -clus -copy \
-from_sys sys1 -to_sys Sys5
```

8 Start the LLT, GAB, and ODM drivers on the new node:

```
# /etc/init.d/llt.rc start

# /etc/init.d/gab.rc start

# /etc/rc.d/rc2.d/S99odm start
```

9 On the new node, verify that the GAB port memberships:

```
# gabconfig -a
GAB Port Memberships
=====
Port a gen df204 membership 012
```

Setting up the node to run in secure mode

You must follow this procedure only if you are adding a node to a cluster that is running in secure mode. If you are adding a node to a cluster that is not running in a secure mode, proceed with configuring LLT and GAB.

[Table 16-3](#) uses the following information for the following command examples.

Table 16-3 The command examples definitions

Name	Fully-qualified host name (FQHN)	Function
sys5	sys5.nodes.example.com	The new node that you are adding to the cluster.

Setting up SFHA related security configuration

Perform the following steps to configure SFHA related security settings.

Setting up SFHA related security configuration

1 Start `/opt/VRTSat/bin/vxatd` process.

2 Create `HA_SERVICES` domain for SFHA.

```
# vssat createpd --pdrtype ab --domain HA_SERVICES
```

3 Add SFHA and webserver principal to AB on node sys5.

```
# vssat addprpl --pdrtype ab --domain HA_SERVICES --prplname \  
webserver_VCS_prplname --password new_password --prpltype \  
service --can_proxy
```

4 Create /etc/VRTSvcs/conf/config/.secure file:

```
# touch /etc/VRTSvcs/conf/config/.secure
```

Starting fencing on the new node

Perform the following steps to start fencing on the new node.

To start fencing on the new node

- 1 For disk-based fencing on at least one node, copy the following files from one of the nodes in the existing cluster to the new node:

```
/etc/default/vxfen  
/etc/vxfendg  
/etc/vxfenmode
```

See [“Configuring server-based fencing on the new node”](#) on page 247.

- 2 Start fencing on the new node:

```
# /etc/init.d/vxfen.rc start
```

Configuring the ClusterService group for the new node

If the ClusterService group is configured on the existing cluster, add the node to the group by performing the steps in the following procedure on one of the nodes in the existing cluster.

To configure the ClusterService group for the new node

- 1 On an existing node, for example sys1, write-enable the configuration:

```
# haconf -makerw
```

- 2 Add the node Sys5 to the existing ClusterService group.

```
# hagrps -modify ClusterService SystemList -add Sys5 2  
  
# hagrps -modify ClusterService AutoStartList -add Sys5
```

- 3 Modify the IP address and NIC resource in the existing group for the new node.

```
# hares -modify gcoip Device en0 -sys Sys5  
  
# hares -modify gconic Device en0 -sys Sys5
```

- 4 Save the configuration by running the following command from any node.

```
# haconf -dump -makero
```

Adding a node using response files

Typically, you can use the response file that the installer generates on one system to add nodes to an existing cluster.

To add nodes using response files

- 1 Make sure the systems where you want to add nodes meet the requirements.
- 2 Make sure all the tasks required for preparing to add a node to an existing SFHA cluster are completed.
- 3 Copy the response file to one of the systems where you want to add nodes.
See [“Sample response file for adding a node to a SFHA cluster”](#) on page 247.
- 4 Edit the values of the response file variables as necessary.
See [“Response file variables to add a node to a SFHA cluster”](#) on page 246.
- 5 Mount the product disc and navigate to the folder that contains the installation program.
- 6 Start adding nodes from the system to which you copied the response file. For example:

```
# ./installer -responsefile /tmp/response_file
```

Where `/tmp/response_file` is the response file's full path name.

Depending on the fencing configuration in the existing cluster, the installer configures fencing on the new node. The installer then starts all the required processes and joins the new node to cluster. The installer indicates the location of the log file and summary file with details of the actions performed.

Response file variables to add a node to a SFHA cluster

[Table 16-4](#) lists the response file variables that you can define to add a node to an SFHA cluster.

Table 16-4

Response file variables for adding a node to an SFHA cluster

Variable	Description
\$CFG{opt}{addnode}	Adds a node to an existing cluster. List or scalar: scalar Optional or required: required
\$CFG{newnodes}	Specifies the new nodes to be added to the cluster. List or scalar: list Optional or required: required

Sample response file for adding a node to a SFHA cluster

The following example shows a response file for adding a node to a SFHA cluster.

```
our %CFG;

$CFG{clustersystems}=[ qw(sys1) ];
$CFG{newnodes}=[ qw(sys5) ];
$CFG{opt}{addnode}=1;
$CFG{opt}{configure}=1;
$CFG{opt}{vr}=1;

$CFG{prod}=" ENTERPRISE72";

$CFG{systems}=[ qw(sys1 sys5) ];
$CFG{vcs_allowcomms}=1;
$CFG{vcs_clusterid}=101;
$CFG{vcs_clustername}="clus1";
$CFG{vcs_lltlink1}{sys5}="en1";
$CFG{vcs_lltlink2}{sys5}="en2";

1;
```

Configuring server-based fencing on the new node

This section describes the procedures to configure server-based fencing on a new node.

To configure server-based fencing on the new node

- 1 Log in to each CP server as the root user.
- 2 Update each CP server configuration with the new node information:

```
# cpsadm -s cps1.example.com \  
-a add_node -c clus1 -h sys5 -n2
```

```
Node 2 (sys5) successfully added
```

- 3 Verify that the new node is added to the CP server configuration:

```
# cpsadm -s cps1.example.com -a list_nodes
```

The new node must be listed in the output.

- 4 Copy the certificates to the new node from the peer nodes.

See [“Generating the client key and certificates manually on the client nodes”](#) on page 119.

Adding the new node to the vxfen service group

Perform the steps in the following procedure to add the new node to the vxfen service group.

To add the new node to the vxfen group using the CLI

- 1 On one of the nodes in the existing SFHA cluster, set the cluster configuration to read-write mode:

```
# haconf -makerw
```

- 2 Add the node sys5 to the existing vxfen group.

```
# hagrps -modify vxfen SystemList -add sys5 2
```

- 3 Save the configuration by running the following command from any node in the SFHA cluster:

```
# haconf -dump -makero
```

After adding the new node

Start VCS on the new node.

To start VCS on the new node

- ◆ Start VCS on the new node:

```
# hastart
```

Adding nodes to a cluster that is using authentication for SFDB tools

To add a node to a cluster that is using authentication for SFDB tools, perform the following steps as the root user

- 1 Export authentication data from a node in the cluster that has already been authorized, by using the `-o export_broker_config` option of the `sfae_auth_op` command.

Use the `-f` option to provide a file name in which the exported data is to be stored.

```
# /opt/VRTS/bin/sfae_auth_op \  
-o export_broker_config -f exported-data
```

- 2 Copy the exported file to the new node by using any available copy mechanism such as `scp` or `rcp`.
- 3 Import the authentication data on the new node by using the `-o import_broker_config` option of the `sfae_auth_op` command.

Use the `-f` option to provide the name of the file copied in Step 2.

```
# /opt/VRTS/bin/sfae_auth_op \  
-o import_broker_config -f exported-data
```

Setting up AT

Importing broker configuration

Starting SFAE AT broker

- 4 Stop the `vxdbd` daemon on the new node.

```
# /opt/VRTS/bin/sfae_config disable
```

`vxdbd` has been disabled and the daemon has been stopped.

Updating the Storage Foundation for Databases (SFDB) repository after adding a node

- 5 Enable authentication by setting the `AUTHENTICATION` key to `yes` in the `/etc/vx/vxdbed/admin.properties` configuration file.

If `/etc/vx/vxdbed/admin.properties` does not exist, then use `cp /opt/VRTSdbed/bin/admin.properties.example /etc/vx/vxdbed/admin.properties`

- 6 Start the `vxdbd` daemon.

```
# /opt/VRTS/bin/sfae_config enable
vxdbd has been enabled and the daemon has been started.
It will start automatically on reboot.
```

The new node is now authenticated to interact with the cluster to run SFDB commands.

Updating the Storage Foundation for Databases (SFDB) repository after adding a node

If you are using Database Storage Checkpoints, Database FlashSnap, or SmartTier for Oracle in your configuration, update the SFDB repository to enable access for the new node after it is added to the cluster.

To update the SFDB repository after adding a node

- 1 Copy the `/var/vx/vxdba/rep_loc` file from one of the nodes in the cluster to the new node.
- 2 If the `/var/vx/vxdba/auth/user-authorizations` file exists on the existing cluster nodes, copy it to the new node.

If the `/var/vx/vxdba/auth/user-authorizations` file does not exist on any of the existing cluster nodes, no action is required.

This completes the addition of the new node to the SFDB repository.

Removing a node from SFHA clusters

This chapter includes the following topics:

- [Removing a node from a SFHA cluster](#)

Removing a node from a SFHA cluster

[Table 17-1](#) specifies the tasks that are involved in removing a node from a cluster. In the example procedure, the cluster consists of nodes sys1, sys2, and sys5; node sys5 is to leave the cluster.

Table 17-1 Tasks that are involved in removing a node

Task	Reference
<ul style="list-style-type: none">■ Back up the configuration file.■ Check the status of the nodes and the service groups.	See “Verifying the status of nodes and service groups” on page 252.
<ul style="list-style-type: none">■ Switch or remove any SFHA service groups on the node departing the cluster.■ Delete the node from SFHA configuration.	See “Deleting the departing node from SFHA configuration” on page 253.
Modify the llthosts(4) and gabtab(4) files to reflect the change.	See “Modifying configuration files on each remaining node” on page 256.
For a cluster that is running in a secure mode, remove the security credentials from the leaving node.	See “Removing security credentials from the leaving node” on page 257.

Table 17-1 Tasks that are involved in removing a node *(continued)*

Task	Reference
On the node departing the cluster: <ul style="list-style-type: none">■ Modify startup scripts for LLT, GAB, and SFHA to allow reboot of the node without affecting the cluster.■ Unconfigure and unload the LLT and GAB utilities.■ Remove the Veritas InfoScale filesets.	See “Unloading LLT and GAB and removing Veritas InfoScale Availability or Enterprise on the departing node” on page 257.

Verifying the status of nodes and service groups

Start by issuing the following commands from one of the nodes to remain in the cluster node sys1 or node sys2 in our example.

To verify the status of the nodes and the service groups

- 1 Make a backup copy of the current configuration file, main.cf.

```
# cp -p /etc/VRTSvcs/conf/config/main.cf \
/etc/VRTSvcs/conf/config/main.cf.goodcopy
```

- 2 Check the status of the systems and the service groups.

```
# hastatus -summary

-- SYSTEM STATE
-- System      State      Frozen
A sys1        RUNNING    0
A sys2        RUNNING    0
A sys5        RUNNING    0

-- GROUP STATE
-- Group      System      Probed   AutoDisabled   State
B grp1        sys1        Y        N               ONLINE
B grp1        sys2        Y        N               OFFLINE
B grp2        sys1        Y        N               ONLINE
B grp3        sys2        Y        N               OFFLINE
B grp3        sys5        Y        N               ONLINE
B grp4        sys5        Y        N               ONLINE
```

The example output from the `hastatus` command shows that nodes `sys1`, `sys2`, and `sys5` are the nodes in the cluster. Also, service group `grp3` is configured to run on node `sys2` and node `sys5`, the departing node. Service group `grp4` runs only on node `sys5`. Service groups `grp1` and `grp2` do not run on node `sys5`.

Deleting the departing node from SFHA configuration

Before you remove a node from the cluster you need to identify the service groups that run on the node.

You then need to perform the following actions:

- Remove the service groups that other service groups depend on, or
- Switch the service groups to another node that other service groups depend on.

To remove or switch service groups from the departing node

- 1 Switch failover service groups from the departing node. You can switch grp3 from node sys5 to node sys2.

```
# hagr -switch grp3 -to sys2
```

- 2 Check for any dependencies involving any service groups that run on the departing node; for example, grp4 runs only on the departing node.

```
# hagr -dep
```

- 3 If the service group on the departing node requires other service groups—if it is a parent to service groups on other nodes—unlink the service groups.

```
# haconf -makerw
```

```
# hagr -unlink grp4 grp1
```

These commands enable you to edit the configuration and to remove the requirement grp4 has for grp1.

- 4 Stop SFHA on the departing node:

```
# hastop -sys sys5
```

- 5 Check the status again. The state of the departing node should be EXITED. Make sure that any service group that you want to fail over is online on other nodes.

```
# hastatus -summary
```

```
-- SYSTEM STATE
-- System      State      Frozen
A  sys1        RUNNING    0
A  sys2        RUNNING    0
A  sys5        EXITED     0

-- GROUP STATE
-- Group        System      Probed   AutoDisabled   State
B  grp1         sys1        Y         N              ONLINE
B  grp1         sys2        Y         N              OFFLINE
B  grp2         sys1        Y         N              ONLINE
B  grp3         sys2        Y         N              ONLINE
B  grp3         sys5        Y         Y              OFFLINE
B  grp4         sys5        Y         N              OFFLINE
```

- 6 Delete the departing node from the SystemList of service groups grp3 and grp4.

```
# haconf -makerw
# hagr -modify grp3 SystemList -delete sys5
# hagr -modify grp4 SystemList -delete sys5
```

Note: If sys5 was in the autostart list, then you need to manually add another system in the autostart list so that after reboot, the group comes online automatically.

- 7 For the service groups that run only on the departing node, delete the resources from the group before you delete the group.

```
# hagr -resources grp4
    processx_grp4
    processy_grp4
# hares -delete processx_grp4
# hares -delete processy_grp4
```

- 8 Delete the service group that is configured to run on the departing node.

```
# hagr -delete grp4
```

- 9 Check the status.

```
# hastatus -summary
-- SYSTEM STATE
-- System      State          Frozen
A  sys1        RUNNING        0
A  sys2        RUNNING        0
A  sys5        EXITED         0

-- GROUP STATE
-- Group      System      Probed   AutoDisabled   State
B  grp1       sys1        Y         N                ONLINE
B  grp1       sys2        Y         N                OFFLINE
B  grp2       sys1        Y         N                ONLINE
B  grp3       sys2        Y         N                ONLINE
```

- 10 Delete the node from the cluster.

```
# hasys -delete sys5
```

- 11 Save the configuration, making it read only.

```
# haconf -dump -makero
```

Modifying configuration files on each remaining node

Perform the following tasks on each of the remaining nodes of the cluster.

To modify the configuration files on a remaining node

- 1 If necessary, modify the `/etc/gabtab` file.

No change is required to this file if the `/sbin/gabconfig` command has only the argument `-c`. Veritas recommends using the `-nN` option, where *N* is the number of cluster systems.

If the command has the form `/sbin/gabconfig -c -nN`, where *N* is the number of cluster systems, make sure that *N* is not greater than the actual number of nodes in the cluster. When *N* is greater than the number of nodes, GAB does not automatically seed.

Veritas does not recommend the use of the `-c -x` option for `/sbin/gabconfig`.

- 2 Modify `/etc/llhosts` file on each remaining nodes to remove the entry of the departing node.

For example, change:

```
0 sys1
1 sys2
2 sys5
```

To:

```
0 sys1
1 sys2
```

Removing the node configuration from the CP server

After removing a node from a SFHA cluster, perform the steps in the following procedure to remove that node's configuration from the CP server.

Note: The `cpsadm` command is used to perform the steps in this procedure. For detailed information about the `cpsadm` command, see the *Cluster Server Administrator's Guide*.

To remove the node configuration from the CP server

1 Log into the CP server as the root user.

2 View the list of VCS users on the CP server.

If the CP server is configured to use HTTPS-based communication, run the following command:

```
# cpsadm -s cp_server -a list_users
```

Where `cp_server` is the virtual IP/ virtual hostname of the CP server.

3 Remove the node entry from the CP server:

```
# cpsadm -s cp_server -a rm_node -h sys5 -c clus1 -n 2
```

4 View the list of nodes on the CP server to ensure that the node entry was removed:

```
# cpsadm -s cp_server -a list_nodes
```

Removing security credentials from the leaving node

If the leaving node is part of a cluster that is running in a secure mode, you must remove the security credentials from node `sys5`. Perform the following steps.

To remove the security credentials

1 Stop the AT process.

```
# /opt/VRTSvcs/bin/vcsauth/vcsauthserver/bin/vcsauthserver.sh \
stop
```

2 Remove the credentials.

```
# rm -rf /var/VRTSvcs/vcsauth/data/
```

Unloading LLT and GAB and removing Veritas InfoScale Availability or Enterprise on the departing node

On the node departing the cluster, unconfigure and unload the LLT and GAB utilities, and remove the Veritas InfoScale Availability or Enterprise filesets.

You can use script-based installer to uninstall Veritas InfoScale Availability or Enterprise on the departing node or perform the following manual steps.

If you have configured Storage Foundation and High Availability as part of the InfoScale products, you may have to delete other dependent filesets before you can delete all of the following ones.

To stop LLT and GAB and remove Veritas InfoScale Availability or Enterprise

- 1** If you had configured I/O fencing in enabled mode, then stop I/O fencing.

```
# /etc/init.d/vxfen.rc stop
```

- 2** Stop GAB and LLT:

```
# /etc/init.d/gab.rc stop
# /etc/init.d/llt.rc stop
```

- 3** To determine the filesets to remove, enter:

```
# lsllpp -L |grep VRTS
```

- 4** To permanently remove the Availability or Enterprise filesets from the system, use the `installp -u` command. Start by removing the following filesets, which may have been optionally installed, in the order shown:

```
# installp -u VRTSsfcp
# installp -u VRTSvcswiz
# installp -u VRTSvbs
# installp -u VRTSsfmh
# installp -u VRTSvcsea
# installp -u VRTSvcsg
# installp -u VRTScps
# installp -u VRTSvc
# installp -u VRTSamf
# installp -u VRTSvxfen
# installp -u VRTSgab
# installp -u VRTSllt
# installp -u VRTSspt
# installp -u VRTSvlic
# installp -u VRTSperl
```

- 5** Remove the LLT and GAB configuration files.

```
# rm /etc/llttab  
# rm /etc/gabtab  
# rm /etc/llthosts
```

Updating the Storage Foundation for Databases (SFDB) repository after removing a node

After removing a node from a cluster, you do not need to perform any steps to update the SFDB repository.

For information on removing the SFDB repository after removing the product:

Configuration and upgrade reference

- [Appendix A. Installation scripts](#)
- [Appendix B. SFHA services and ports](#)
- [Appendix C. Configuration files](#)
- [Appendix D. Configuring the secure shell or the remote shell for communications](#)
- [Appendix E. Sample SFHA cluster setup diagrams for CP server-based I/O fencing](#)
- [Appendix F. Changing NFS server major numbers for VxVM volumes](#)
- [Appendix G. Configuring LLT over UDP](#)

Installation scripts

This appendix includes the following topics:

- [Installation script options](#)
- [About using the postcheck option](#)

Installation script options

[Table A-1](#) shows command line options for the installation script. For an initial install or upgrade, options are not usually required. The installation script options apply to all Veritas InfoScale product scripts, except where otherwise noted.

Table A-1 Available command line options

Command Line Option	Function
-addnode	Adds a node to a high availability cluster.
-allpkgs	Displays all filesets required for the specified product. The filesets are listed in correct installation order. The output can be used to create scripts for command line installs, or for installations over a network.
-comcleanup	The <code>-comcleanup</code> option removes the secure shell or remote shell configuration added by installer on the systems. The option is only required when installation routines that performed auto-configuration of the shell are abruptly terminated.
-comsetup	The <code>-comsetup</code> option is used to set up the ssh or rsh communication between systems without requests for passwords or passphrases.

Table A-1 Available command line options (*continued*)

Command Line Option	Function
-configcps	The <code>-configcps</code> option is used to configure CP server on a running system or cluster.
-configure	Configures the product after installation.
-disable_dmp_native_support	Disables Dynamic Multi-pathing support for the native LVM volume groups and ZFS pools during upgrade. Retaining Dynamic Multi-pathing support for the native LVM volume groups and ZFS pools during upgrade increases fileset upgrade time depending on the number of LUNs and native LVM volume groups and ZFS pools configured on the system.
-fencing	Configures I/O fencing in a running cluster.
-fips	The <code>-fips</code> option is used to enable or disable security with fips mode on a running VCS cluster. It could only be used together with <code>-security</code> or <code>-securityonnode</code> option.
-hostfile <i>full_path_to_file</i>	Specifies the location of a file that contains a list of hostnames on which to install.
-install	Used to install products on system
-online_upgrade	Used to perform online upgrade. Using this option, the installer upgrades the whole cluster and also supports customer's application zero down time during the upgrade procedure. Now this option only supports VCS and ApplicationHA.
-patch_path	Defines the path of a patch level release to be integrated with a base or a maintenance level release in order for multiple releases to be simultaneously installed .
-patch2_path	Defines the path of a second patch level release to be integrated with a base or a maintenance level release in order for multiple releases to be simultaneously installed.

Table A-1 Available command line options (*continued*)

Command Line Option	Function
-patch3_path	Defines the path of a third patch level release to be integrated with a base or a maintenance level release in order for multiple releases to be simultaneously installed.
-patch4_path	Defines the path of a fourth patch level release to be integrated with a base or a maintenance level release in order for multiple releases to be simultaneously installed.
-patch5_path	Defines the path of a fifth patch level release to be integrated with a base or a maintenance level release in order for multiple releases to be simultaneously installed.
-keyfile <i>ssh_key_file</i>	Specifies a key file for secure shell (SSH) installs. This option passes <code>-I ssh_key_file</code> to every SSH invocation.
-license	Registers or updates product licenses on the specified systems.
-logpath <i>log_path</i>	Specifies a directory other than <code>/opt/VRTS/install/logs</code> as the location where installer log files, summary files, and response files are saved.
-noipc	Disables the installer from making outbound networking calls to Veritas Services and Operations Readiness Tool (SORT) in order to automatically obtain patch and release information updates.
-nolic	Allows installation of product filesets without entering a license key. Licensed features cannot be configured, started, or used when this option is specified.
-pkgtable	Displays product's filesets in correct installation order by group.
-postcheck	Checks for different HA and file system-related processes, the availability of different ports, and the availability of cluster-related service groups.

Table A-1 Available command line options (*continued*)

Command Line Option	Function
-precheck	Performs a preinstallation check to determine if systems meet all installation requirements. Veritas recommends doing a precheck before installing a product.
-prod	Specifies the product for operations.
-component	Specifies the component for operations.
-redirect	Displays progress details without showing the progress bar.
-require	Specifies an installer patch file.
-responsefile <i>response_file</i>	Automates installation and configuration by using system and configuration information stored in a specified file instead of prompting for information. The <i>response_file</i> must be a full path name. You must edit the response file to use it for subsequent installations. Variable field definitions are defined within the file.
-rolling_upgrade	Starts a rolling upgrade. Using this option, the installer detects the rolling upgrade status on cluster systems automatically without the need to specify rolling upgrade phase 1 or phase 2 explicitly.
-rollingupgrade_phase1	The <code>-rollingupgrade_phase1</code> option is used to perform rolling upgrade Phase-I. In the phase, the product kernel filesets get upgraded to the latest version.
-rollingupgrade_phase2	The <code>-rollingupgrade_phase2</code> option is used to perform rolling upgrade Phase-II. In the phase, VCS and other agent filesets upgrade to the latest version. Product kernel drivers are rolling-upgraded to the latest protocol version.
-rsh	Specify this option when you want to use RSH and RCP for communication between systems instead of the default SSH and SCP. See “About configuring secure shell or remote shell communication modes before installing products” on page 288.

Table A-1 Available command line options (*continued*)

Command Line Option	Function
-security	The -security option is used to convert a running VCS cluster between secure and non-secure modes of operation.
-securityonenode	The -securityonenode option is used to configure a secure cluster node by node.
-securitytrust	The -securitytrust option is used to setup trust with another broker.
-serial	Specifies that the installation script performs install, uninstall, start, and stop operations on each system in a serial fashion. If this option is not specified, these operations are performed simultaneously on all systems.
-settunables	Specify this option when you want to set tunable parameters after you install and configure a product. You may need to restart processes of the product for the tunable parameter values to take effect. You must use this option together with the -tunablesfile option.
-start	Starts the daemons and processes for the specified product.
-stop	Stops the daemons and processes for the specified product.
-timeout	The -timeout option is used to specify the number of seconds that the script should wait for each command to complete before timing out. Setting the -timeout option overrides the default value of 1200 seconds. Setting the -timeout option to 0 prevents the script from timing out. The -timeout option does not work with the -serial option.
-tmppath <i>tmp_path</i>	Specifies a directory other than /var/tmp as the working directory for the installation scripts. This destination is where initial logging is performed and where filesets are copied on remote systems before installation.

Table A-1 Available command line options (*continued*)

Command Line Option	Function
-tunables	Lists all supported tunables and create a tunables file template.
-tunables_file <i>tunables_file</i>	Specify this option when you specify a tunables file. The tunables file should include tunable parameters.
-uninstall	This option is used to uninstall the products from systems
-upgrade	Specifies that an existing version of the product exists and you plan to upgrade it.
-version	Checks and reports the installed products and their versions. Identifies the installed and missing filesets and patches where applicable for the product. Provides a summary that includes the count of the installed and any missing filesets and patches where applicable. Lists the installed patches, patches, and available updates for the installed product if an Internet connection is available.

About using the postcheck option

You can use the installer's post-check to determine installation-related problems and to aid in troubleshooting.

Note: This command option requires downtime for the node.

When you use the `postcheck` option, it can help you troubleshoot the following VCS-related issues:

- The heartbeat link does not exist.
- The heartbeat link cannot communicate.
- The heartbeat link is a part of a bonded or aggregated NIC.
- A duplicated cluster ID exists (if LLT is not running at the check time).
- The VRTSIlt pkg version is not consistent on the nodes.
- The Ilt-linkinstall value is incorrect.

- The `/etc/llthosts` and `/etc/llttab` configuration is incorrect.
- the `/etc/gabtab` file is incorrect.
- The incorrect GAB linkinstall value exists.
- The VRTSgab pkg version is not consistent on the nodes.
- The `main.cf` file or the `types.cf` file is invalid.
- The `/etc/VRTSvcs/conf/sysname` file is not consistent with the hostname.
- The cluster UUID does not exist.
- The `uuidconfig.pl` file is missing.
- The VRTSvcs pkg version is not consistent on the nodes.
- The `/etc/vxfenmode` file is missing or incorrect.
- The `/etc/vxfendg` file is invalid.
- The vxfen link-install value is incorrect.
- The VRTSvxfen pkg version is not consistent.

The `postcheck` option can help you troubleshoot the following SFHA or SFCFSHA issues:

- Volume Manager cannot start because the `/etc/vx/reconfig.d/state.d/install-db` file has not been removed.
- Volume Manager cannot start because the `volboot` file is not loaded.
- Volume Manager cannot start because no license exists.
- Cluster Volume Manager cannot start because the CVM configuration is incorrect in the `main.cf` file. For example, the Autostartlist value is missing on the nodes.
- Cluster Volume Manager cannot come online because the node ID in the `/etc/llthosts` file is not consistent.
- Cluster Volume Manager cannot come online because Vxfen is not started.
- Cluster Volume Manager cannot start because gab is not configured.
- Cluster Volume Manager cannot come online because of a CVM protocol mismatch.
- Cluster Volume Manager group name has changed from "cvm", which causes CVM to go offline.

You can use the installer's post-check option to perform the following checks:

General checks for all products:

- All the required filesets are installed.

- The versions of the required filesets are correct.
- There are no verification issues for the required filesets.

Checks for Volume Manager (VM):

- Lists the daemons which are not running (`vxattachd`, `vxconfigbackupd`, `vxesd`, `vxrelocd` ...).
- Lists the disks which are not in 'online' or 'online shared' state (`vxdisk list`).
- Lists the diskgroups which are not in 'enabled' state (`vxdg list`).
- Lists the volumes which are not in 'enabled' state (`vxprint -g <dgname>`).
- Lists the volumes which are in 'Unstartable' state (`vxinfo -g <dgname>`).
- Lists the volumes which are not configured in `/etc/filesystems`.

Checks for File System (FS):

- Lists the VxFS kernel modules which are not loaded (`vxfs/fdd/vxportal`).
- Whether all VxFS file systems present in `/etc/filesystems` file are mounted.
- Whether all VxFS file systems present in `/etc/filesystems` are in disk layout 6 or higher.
- Whether all mounted VxFS file systems are in disk layout 6 or higher.

Checks for Cluster File System:

- Whether FS and ODM are running at the latest protocol level.
- Whether all mounted CFS file systems are managed by VCS.
- Whether cvm service group is online.

SFHA services and ports

This appendix includes the following topics:

- [About InfoScale Enterprise services and ports](#)

About InfoScale Enterprise services and ports

If you have configured a firewall, ensure that the firewall settings allow access to the services and ports used by InfoScale Enterprise.

[Table B-1](#) lists the services and ports used by InfoScale Enterprise .

Note: The port numbers that appear in bold are mandatory for configuring InfoScale Enterprise.

Table B-1 SFHA services and ports

Port Number	Protocol	Description	Process
4145	TCP/UDP	VVR Connection Server VCS Cluster Heartbeats	vxio
5634	HTTPS	Veritas Storage Foundation Messaging Service	xprtld
8199	TCP	Volume Replicator Administrative Service	vras
8989	TCP	VVR Resync Utility	vxreserver

Table B-1 SFHA services and ports (*continued*)

Port Number	Protocol	Description	Process
14141	TCP	Veritas High Availability Engine Veritas Cluster Manager (Java console) (ClusterManager.exe) VCS Agent driver (VCSAgDriver.exe)	had
14144	TCP/UDP	VCS Notification	Notifier
14149	TCP/UDP	VCS Authentication	vcsauthserver
14150	TCP	Veritas Command Server	CmdServer
14155	TCP/UDP	VCS Global Cluster Option (GCO)	wac
14156	TCP/UDP	VCS Steward for GCO	steward
443	TCP	Coordination Point Server	Vxcpserv
49152-65535	TCP/UDP	Volume Replicator Packets	User configurable ports created at kernel level by vxio.sys file

Configuration files

This appendix includes the following topics:

- [About the LLT and GAB configuration files](#)
- [About the AMF configuration files](#)
- [About the VCS configuration files](#)
- [About I/O fencing configuration files](#)
- [Sample configuration files for CP server](#)

About the LLT and GAB configuration files

Low Latency Transport (LLT) and Group Membership and Atomic Broadcast (GAB) are VCS communication services. LLT requires `/etc/llthosts` and `/etc/llttab` files. GAB requires `/etc/gabtab` file.

[Table C-1](#) lists the LLT configuration files and the information that these files contain.

Table C-1 LLT configuration files

File	Description
/etc/default/llt	<p>This file stores the start and stop environment variables for LLT:</p> <ul style="list-style-type: none">■ LLT_START—Defines the startup behavior for the LLT module after a system reboot. Valid values include: 1—Indicates that LLT is enabled to start up. 0—Indicates that LLT is disabled to start up.■ LLT_STOP—Defines the shutdown behavior for the LLT module during a system shutdown. Valid values include: 1—Indicates that LLT is enabled to shut down. 0—Indicates that LLT is disabled to shut down. <p>The installer sets the value of these variables to 1 at the end of SFHA configuration.</p>
/etc/llthosts	<p>The file <code>llthosts</code> is a database that contains one entry per system. This file links the LLT system ID (in the first column) with the LLT host name. This file must be identical on each node in the cluster. A mismatch of the contents of the file can cause indeterminate behavior in the cluster.</p> <p>For example, the file <code>/etc/llthosts</code> contains the entries that resemble:</p> <pre>0 sys1 1 sys2</pre>

Table C-1 LLT configuration files (*continued*)

File	Description
/etc/llttab	<p>The file <code>llttab</code> contains the information that is derived during installation and used by the utility <code>lltconfig(1M)</code>. After installation, this file lists the LLT network links that correspond to the specific system.</p> <p>For example, the file <code>/etc/llttab</code> contains the entries that resemble:</p> <pre> set-node sys1 set-cluster 2 link en1 /dev/dlpi/en:1 - ether - - link en2 /dev/dlpi/en:2 - ether - - set-node sys1 set-cluster 2 link en1 /dev/en:1 - ether - - link en2 /dev/en:2 - ether - - </pre> <p>The first line identifies the system. The second line identifies the cluster (that is, the cluster ID you entered during installation). The next two lines begin with the <code>link</code> command. These lines identify the two network cards that the LLT protocol uses.</p> <p>If you configured a low priority link under LLT, the file also includes a "link-lowpri" line.</p> <p>Refer to the <code>llttab(4)</code> manual page for details about how the LLT configuration may be modified. The manual page describes the ordering of the directives in the <code>llttab</code> file.</p>

[Table C-2](#) lists the GAB configuration files and the information that these files contain.

Table C-2 GAB configuration files

File	Description
/etc/default/gab	<p>This file stores the start and stop environment variables for GAB:</p> <ul style="list-style-type: none"> ■ GAB_START—Defines the startup behavior for the GAB module after a system reboot. Valid values include: <ul style="list-style-type: none"> 1—Indicates that GAB is enabled to start up. 0—Indicates that GAB is disabled to start up. ■ GAB_STOP—Defines the shutdown behavior for the GAB module during a system shutdown. Valid values include: <ul style="list-style-type: none"> 1—Indicates that GAB is enabled to shut down. 0—Indicates that GAB is disabled to shut down. <p>The installer sets the value of these variables to 1 at the end of SFHA configuration.</p>

Table C-2 GAB configuration files (*continued*)

File	Description
/etc/gabtab	<p>After you install SFHA, the file /etc/gabtab contains a <code>gabconfig(1)</code> command that configures the GAB driver for use.</p> <p>The file /etc/gabtab contains a line that resembles:</p> <pre>/sbin/gabconfig -c -nN</pre> <p>The <code>-c</code> option configures the driver for use. The <code>-nN</code> specifies that the cluster is not formed until at least <i>N</i> nodes are ready to form the cluster. Veritas recommends that you set <i>N</i> to be the total number of nodes in the cluster.</p> <p>Note: Veritas does not recommend the use of the <code>-c -x</code> option for /sbin/gabconfig. Using <code>-c -x</code> can lead to a split-brain condition. Use the <code>-c</code> option for /sbin/gabconfig to avoid a split-brain condition.</p>

About the AMF configuration files

Asynchronous Monitoring Framework (AMF) kernel driver provides asynchronous event notifications to the VCS agents that are enabled for intelligent resource monitoring.

Table C-3 lists the AMF configuration files.

Table C-3 AMF configuration files

File	Description
/etc/default/amf	<p>This file stores the start and stop environment variables for AMF:</p> <ul style="list-style-type: none"> ■ AMF_START—Defines the startup behavior for the AMF module after a system reboot or when AMF is attempted to start using the init script. Valid values include: <ul style="list-style-type: none"> 1—Indicates that AMF is enabled to start up. (default) 0—Indicates that AMF is disabled to start up. ■ AMF_STOP—Defines the shutdown behavior for the AMF module during a system shutdown or when AMF is attempted to stop using the init script. Valid values include: <ul style="list-style-type: none"> 1—Indicates that AMF is enabled to shut down. (default) 0—Indicates that AMF is disabled to shut down.

Table C-3 AMF configuration files (*continued*)

File	Description
/etc/amftab	<p>After you install VCS, the file <code>/etc/amftab</code> contains a <code>amfconfig(1)</code> command that configures the AMF driver for use.</p> <p>The AMF init script uses this <code>/etc/amftab</code> file to configure the AMF driver. The <code>/etc/amftab</code> file contains the following line by default:</p> <pre>/opt/VRTSamf/bin/amfconfig -c</pre>

About the VCS configuration files

VCS configuration files include the following:

- **main.cf**
The installer creates the VCS configuration file in the `/etc/VRTSvcs/conf/config` folder by default during the SFHA configuration. The `main.cf` file contains the minimum information that defines the cluster and its nodes.
See [“Sample main.cf file for VCS clusters”](#) on page 276.
See [“Sample main.cf file for global clusters”](#) on page 277.
- **types.cf**
The file `types.cf`, which is listed in the include statement in the `main.cf` file, defines the VCS bundled types for VCS resources. The file `types.cf` is also located in the folder `/etc/VRTSvcs/conf/config`.
Additional files similar to `types.cf` may be present if agents have been added, such as `OracleTypes.cf`.

Note the following information about the VCS configuration file after installing and configuring VCS:

- The cluster definition includes the cluster information that you provided during the configuration. This definition includes the cluster name, cluster address, and the names of users and administrators of the cluster.
Notice that the cluster has an attribute `UserNames`. The installer creates a user “admin” whose password is encrypted; the word “password” is the default password.
- If you set up the optional I/O fencing feature for VCS, then the `UseFence = SCSI3` attribute is present.
- If you configured the cluster in secure mode, the `main.cf` includes “SecureClus = 1” cluster attribute.

- The installer creates the ClusterService service group if you configured the virtual IP, SMTP, SNMP, or global cluster options.

The service group also has the following characteristics:

- The group includes the IP and NIC resources.
- The service group also includes the notifier resource configuration, which is based on your input to installer prompts about notification.
- The installer also creates a resource dependency tree.
- If you set up global clusters, the ClusterService service group contains an Application resource, wac (wide-area connector). This resource's attributes contain definitions for controlling the cluster in a global cluster environment. Refer to the *Cluster Server Administrator's Guide* for information about managing VCS global clusters.

Refer to the *Cluster Server Administrator's Guide* to review the configuration concepts, and descriptions of main.cf and types.cf files for AIX systems.

Sample main.cf file for VCS clusters

The following sample main.cf file is for a three-node cluster in secure mode.

```
include "types.cf"
include "OracleTypes.cf"
include "OracleASMTTypes.cf"
include "Db2udbTypes.cf"
include "SybaseTypes.cf"

cluster vcs02 (
    SecureClus = 1
)

system sysA (
)

system sysB (
)

system sysC (
)

group ClusterService (
    SystemList = { sysA = 0, sysB = 1, sysC = 2 }
```

```

    AutoStartList = { sysA, sysB, sysC }
    OnlineRetryLimit = 3
    OnlineRetryInterval = 120
)

NIC csgnic (
    Device = en0
    NetworkHosts = { "10.182.13.1" }
)

NotifierMngr ntfr (
    SnmpConsoles = { sys4" = SevereError }
    SmtperServer = "smtp.example.com"
    SmtperRecipients = { "ozzie@example.com" = SevereError }
)

ntfr requires csgnic

// resource dependency tree
//
//     group ClusterService
//     {
//         NotifierMngr ntfr
//         {
//             NIC csgnic
//         }
//     }

```

Sample main.cf file for global clusters

If you installed SFHA with the Global Cluster option, note that the ClusterService group also contains the Application resource, wac. The wac resource is required to control the cluster in a global cluster environment.

In the following main.cf file example, bold text highlights global cluster specific entries.

```

include "types.cf"

cluster vcs03 (
    ClusterAddress = "10.182.13.50"
    SecureClus = 1
)

```

```
system sysA (
)

system sysB (
)

system sysC (
)

group ClusterService (
    SystemList = { sysA = 0, sysB = 1, sysC = 2 }
    AutoStartList = { sysA, sysB, sysC }
    OnlineRetryLimit = 3
    OnlineRetryInterval = 120
)

Application wac (
    StartProgram = "/opt/VRTSvcs/bin/wacstart -secure"
    StopProgram = "/opt/VRTSvcs/bin/wacstop"
    MonitorProcesses = { "/opt/VRTSvcs/bin/wac -secure" }
    RestartLimit = 3
)

IP gcoip (
    Device = en0
    Address = "10.182.13.50"
    NetMask = "255.255.240.0"
)

NIC csgnic (
    Device = en0
    NetworkHosts = { "10.182.13.1" }
)

NotifierMngr ntfr (
    SntpConsoles = { sys4 = SevereError }
    SntpServer = "smtp.example.com"
    SntpRecipients = { "ozzie@example.com" = SevereError }
)

gcoip requires csgnic
ntfr requires csgnic
```

```
wac requires gcoip

// resource dependency tree
//
//     group ClusterService
//     {
//         NotifierMngr ntfr
//         {
//             NIC csgnic
//         }
//     }
//     Application wac
//     {
//         IP gcoip
//         {
//             NIC csgnic
//         }
//     }
// }
```

About I/O fencing configuration files

[Table C-4](#) lists the I/O fencing configuration files.

Table C-4 I/O fencing configuration files

File	Description
/etc/default/vxfen	<p>This file stores the start and stop environment variables for I/O fencing:</p> <ul style="list-style-type: none"> ■ VXFEN_START—Defines the startup behavior for the I/O fencing module after a system reboot. Valid values include: <ul style="list-style-type: none"> 1—Indicates that I/O fencing is enabled to start up. 0—Indicates that I/O fencing is disabled to start up. ■ VXFEN_STOP—Defines the shutdown behavior for the I/O fencing module during a system shutdown. Valid values include: <ul style="list-style-type: none"> 1—Indicates that I/O fencing is enabled to shut down. 0—Indicates that I/O fencing is disabled to shut down. <p>The installer sets the value of these variables to 1 at the end of SFHA configuration.</p>
/etc/vxfendg	<p>This file includes the coordinator disk group information.</p> <p>This file is not applicable for server-based fencing and majority-based fencing.</p>

Table C-4 I/O fencing configuration files (*continued*)

File	Description
/etc/vxfenmode	<p>This file contains the following parameters:</p> <ul style="list-style-type: none"> ■ vxfen_mode <ul style="list-style-type: none"> ■ scsi3—For disk-based fencing. ■ customized—For server-based fencing. ■ disabled—To run the I/O fencing driver but not do any fencing operations. ■ majority— For fencing without the use of coordination points. ■ vxfen_mechanism <p>This parameter is applicable only for server-based fencing. Set the value as cps.</p> ■ scsi3_disk_policy <ul style="list-style-type: none"> ■ dmp—Configure the vxfen module to use DMP devices The disk policy is dmp by default. If you use iSCSI devices, you must set the disk policy as dmp. <p>Note: You must use the same SCSI-3 disk policy on all the nodes.</p> ■ List of coordination points <p>This list is required only for server-based fencing configuration.</p> <p>Coordination points in server-based fencing can include coordinator disks, CP servers, or both. If you use coordinator disks, you must create a coordinator disk group containing the individual coordinator disks.</p> <p>Refer to the sample file /etc/vxfen.d/vxfenmode_cps for more information on how to specify the coordination points and multiple IP addresses for each CP server.</p> ■ single_cp <p>This parameter is applicable for server-based fencing which uses a single highly available CP server as its coordination point. Also applicable for when you use a coordinator disk group with single disk.</p> ■ autoseed_gab_timeout <p>This parameter enables GAB automatic seeding of the cluster even when some cluster nodes are unavailable.</p> <p>This feature is applicable for I/O fencing in SCSI3 and customized mode.</p> <p>0—Turns the GAB auto-seed feature on. Any value greater than 0 indicates the number of seconds that GAB must delay before it automatically seeds the cluster.</p> <p>-1—Turns the GAB auto-seed feature off. This setting is the default.</p>

Table C-4 I/O fencing configuration files (*continued*)

File	Description
/etc/vxfentab	<p>When I/O fencing starts, the vxfen startup script creates this /etc/vxfentab file on each node. The startup script uses the contents of the /etc/vxfendg and /etc/vxfenmode files. Any time a system is rebooted, the fencing driver reinitializes the vxfentab file with the current list of all the coordinator points.</p> <p>Note: The /etc/vxfentab file is a generated file; do not modify this file.</p> <p>For disk-based I/O fencing, the /etc/vxfentab file on each node contains a list of all paths to each coordinator disk along with its unique disk identifier. A space separates the path and the unique disk identifier. An example of the /etc/vxfentab file in a disk-based fencing configuration on one node resembles as follows:</p> <ul style="list-style-type: none"> ■ DMP disk: <pre> /dev/vx/rmdp/rhdisk75 HITACHI%5F1724-100%20%20FASTt%5FDISKS%5F6 00A0B8000215A5D000006804E795D075 /dev/vx/rmdp/rhdisk76 HITACHI%5F1724-100%20%20FASTt%5FDISKS%5F6 00A0B8000215A5D000006814E795D076 /dev/vx/rmdp/rhdisk77 HITACHI%5F1724-100%20%20FASTt%5FDISKS%5F6 00A0B8000215A5D000006824E795D077 </pre> <p>For server-based fencing, the /etc/vxfentab file also includes the security settings information.</p> <p>For server-based fencing with single CP server, the /etc/vxfentab file also includes the single_cp settings information.</p> <p>This file is not applicable for majority-based fencing.</p>

Sample configuration files for CP server

The /etc/vxcps.conf file determines the configuration of the coordination point server (CP server.)

See “[Sample CP server configuration \(/etc/vxcps.conf\) file output](#)” on page 287.

The following are example main.cf files for a CP server that is hosted on a single node, and a CP server that is hosted on an SFHA cluster.

- The main.cf file for a CP server that is hosted on a single node:
See “[Sample main.cf file for CP server hosted on a single node that runs VCS](#)” on page 282.
- The main.cf file for a CP server that is hosted on an SFHA cluster:

See [“Sample main.cf file for CP server hosted on a two-node SFHA cluster”](#) on page 284.

The example main.cf files use IPv4 addresses.

Sample main.cf file for CP server hosted on a single node that runs VCS

The following is an example of a single CP server node main.cf.

For this CP server single node main.cf, note the following values:

- Cluster name: cps1
- Node name: cps1

```
include "types.cf"
include "/opt/VRTScps/bin/Quorum/QuorumTypes.cf"

// cluster name: cps1
// CP server: cps1

cluster cps1 (
    UserNames = { admin = bMnFMHmJNiNNlVNhMK, haris = fopKojNvpHouNn,
                  "cps1.example.com@root@vx" = aj,
                  "root@cps1.example.com" = hq }
    Administrators = { admin, haris,
                       "cps1.example.com@root@vx",
                       "root@cps1.example.com" }
    SecureClus = 1
    HacliUserLevel = COMMANDROOT
)

system cps1 (
)

group CPSSG (
    SystemList = { cps1 = 0 }
    AutoStartList = { cps1 }
)

IP cpsvipl (
    Critical = 0
    Device @cps1 = en0
    Address = "10.209.3.1"
```

```

        NetMask = "255.255.252.0"
    )

    IP cpsvip2 (
        Critical = 0
        Device @cps1 = en1
        Address = "10.209.3.2"
        NetMask = "255.255.252.0"
    )

    NIC cpsnic1 (
        Critical = 0
        Device @cps1 = en0
        PingOptimize = 0
        NetworkHosts @cps1 = { "10.209.3.10" }
    )

    NIC cpsnic2 (
        Critical = 0
        Device @cps1 = en1
        PingOptimize = 0
    )

    Process vxcpserve (
        PathName = "/opt/VRTScps/bin/vxcpserve"
        ConfInterval = 30
        RestartLimit = 3
    )

    Quorum quorum (
        QuorumResources = { cpsvip1, cpsvip2 }
    )

    cpsvip1 requires cpsnic1
    cpsvip2 requires cpsnic2
    vxcpserve requires quorum

    // resource dependency tree
    //
    // group CPSSG
    // {
    // IP cpsvip1

```

```
//      {
//      NIC cpsnic1
//      }
// IP cpsvip2
//      {
//      NIC cpsnic2
//      }
// Process vxcperv
//      {
//      Quorum quorum
//      }
// }
```

Sample main.cf file for CP server hosted on a two-node SFHA cluster

The following is an example of a main.cf, where the CP server is hosted on an SFHA cluster.

For this CP server hosted on an SFHA cluster main.cf, note the following values:

- Cluster name: cps1
- Nodes in the cluster: cps1, cps2

```
include "types.cf"
include "CFSTypes.cf"
include "CVMTTypes.cf"
include "/opt/VRTScps/bin/Quorum/QuorumTypes.cf"

// cluster: cps1
// CP servers:
// cps1
// cps2

cluster cps1 (
    UserNames = { admin = ajkCjeJgkFkkIskEjh,
                  "cps1.example.com@root@vx" = JK,
                  "cps2.example.com@root@vx" = dl }
    Administrators = { admin, "cps1.example.com@root@vx",
                       "cps2.example.com@root@vx" }
    SecureClus = 1
)

system cps1 (
```

```

    )

system cps2 (
)

group CPSSG (
    SystemList = { cps1 = 0, cps2 = 1 }
    AutoStartList = { cps1, cps2 } )

    DiskGroup cpsdg (
        DiskGroup = cps_dg
    )

    IP cpsvip1 (
        Critical = 0
        Device @cps1 = en0
        Device @cps2 = en0
        Address = "10.209.81.88"
        NetMask = "255.255.252.0"
    )

    IP cpsvip2 (
        Critical = 0
        Device @cps1 = en1
        Device @cps2 = en1
        Address = "10.209.81.89"
        NetMask = "255.255.252.0"
    )

    Mount cpsmount (
        MountPoint = "/etc/VRTScps/db"
        BlockDevice = "/dev/vx/dsk/cps_dg/cps_volume"
        FSType = vxfs
        FsckOpt = "-y"
    )

    NIC cpsnic1 (
        Critical = 0
        Device @cps1 = en0
        Device @cps2 = en0
        PingOptimize = 0
        NetworkHosts @cps1 = { "10.209.81.10" }
    )

```

```

NIC cpsnic2 (
    Critical = 0
    Device @cps1 = en1
    Device @cps2 = en1
    PingOptimize = 0
)

Process vxcpserve (
    PathName = "/opt/VRTScps/bin/vxcpserve"
)

Quorum quorum (
    QuorumResources = { cpsvip1, cpsvip2 }
)

Volume cpsvol (
    Volume = cps_volume
    DiskGroup = cps_dg
)

cpismount requires cpsvol
cpsvip1 requires cpsnic1
cpsvip2 requires cpsnic2
cpsvol requires cpsdg
vxcpserve requires cpismount
vxcpserve requires quorum

// resource dependency tree
//
// group CPSSG
// {
// IP cpsvip1
//     {
//     NIC cpsnic1
//     }
// IP cpsvip2
//     {
//     NIC cpsnic2
//     }
// Process vxcpserve
//     {

```

```
//      Quorum quorum
//      Mount cpsmount
//      {
//          Volume cpsvol
//          {
//              DiskGroup cpsdg
//          }
//      }
//  }
// }
```

Sample CP server configuration (/etc/vxcps.conf) file output

The following is an example of a coordination point server (CP server) configuration file `/etc/vxcps.conf` output.

```
## The vxcps.conf file determines the
## configuration for Veritas CP Server.
cps_name=cps1
vip=[10.209.81.88]
vip=[10.209.81.89]:56789
vip_https=[10.209.81.88]:55443
vip_https=[10.209.81.89]
port=14250
port_https=443
security=1
db=/etc/VRTScps/db
ssl_conf_file=/etc/vxcps_ssl.properties
```

Configuring the secure shell or the remote shell for communications

This appendix includes the following topics:

- [About configuring secure shell or remote shell communication modes before installing products](#)
- [Manually configuring passwordless ssh](#)
- [Setting up ssh and rsh connection using the installer -comsetup command](#)
- [Setting up ssh and rsh connection using the pwdutil.pl utility](#)
- [Restarting the ssh session](#)
- [Enabling rsh for AIX](#)

About configuring secure shell or remote shell communication modes before installing products

Establishing communication between nodes is required to install Veritas InfoScale software from a remote system, or to install and configure a system. The system from which the installer is run must have permissions to run `rsh` (remote shell) or `ssh` (secure shell) utilities. You need to run the installer with superuser privileges on the systems where you plan to install the Veritas InfoScale software.

You can install products to remote systems using either secure shell (`ssh`) or remote shell (`rsh`). Veritas recommends that you use `ssh` as it is more secure than `rsh`.

You can set up ssh and rsh connections in many ways.

- You can manually set up the ssh and rsh connection with UNIX shell commands.
- You can run the `installer -comsetup` command to interactively set up ssh and rsh connection.
- You can run the password utility, `pwdutil.pl`.

This section contains an example of how to set up ssh password free communication. The example sets up ssh between a source system (sys1) that contains the installation directories, and a target system (sys2). This procedure also applies to multiple target systems.

Note: The product installer supports establishing passwordless communication.

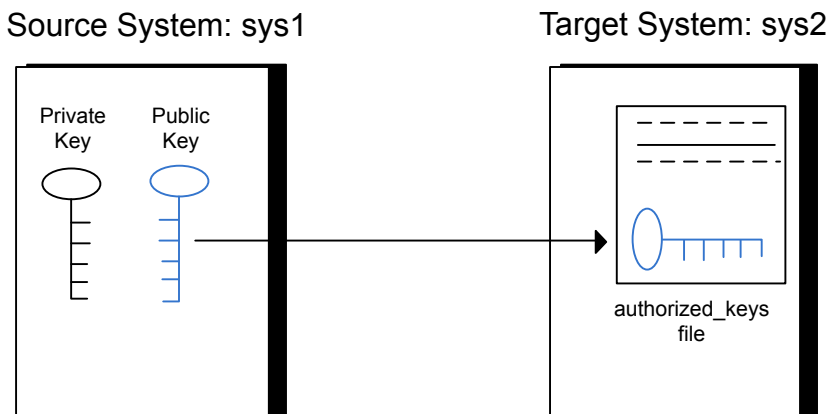
Manually configuring passwordless ssh

The ssh program enables you to log into and execute commands on a remote system. ssh enables encrypted communications and an authentication process between two untrusted hosts over an insecure network.

In this procedure, you first create a DSA key pair. From the key pair, you append the public key from the source system to the `authorized_keys` file on the target systems.

[Figure D-1](#) illustrates this procedure.

Figure D-1 Creating the DSA key pair and appending it to target systems



Read the ssh documentation and online manual pages before enabling ssh. Contact your operating system support provider for issues regarding ssh configuration.

Visit the Openssh website that is located at: <http://www.openssh.com/> to access online manuals and other resources.

To create the DSA key pair

- 1** On the source system (sys1), log in as root, and navigate to the root directory.

```
sys1 # cd /
```

- 2** Make sure the `/.ssh` directory is on all the target installation systems (sys2 in this example). If that directory is not present, create it on all the target systems and set the write permission to root only:

Change the permissions of this directory, to secure it.

- 3** To generate a DSA key pair on the source system, type the following command:

```
sys1 # ssh-keygen -t dsa
```

System output similar to the following is displayed:

```
Generating public/private dsa key pair.  
Enter file in which to save the key (//.ssh/id_dsa):
```

- 4** Press Enter to accept the default location of `/.ssh/id_dsa`.
- 5** When the program asks you to enter the passphrase, press the Enter key twice.

```
Enter passphrase (empty for no passphrase):
```

Do not enter a passphrase. Press Enter.

```
Enter same passphrase again:
```

Press Enter again.

To append the public key from the source system to the `authorized_keys` file on the target system, using secure file transfer

- 1 From the source system (sys1), move the public key to a temporary file on the target system (sys2).

Use the secure file transfer program.

In this example, the file name `id_dsa.pub` in the root directory is the name for the temporary file for the public key.

Use the following command for secure file transfer:

```
sys1 # sftp sys2
```

If the secure file transfer is set up for the first time on this system, output similar to the following lines is displayed:

```
Connecting to sys2 ...
The authenticity of host 'sys2 (10.182.00.00)'
can't be established. DSA key fingerprint is
fb:6f:9f:61:91:9d:44:6b:87:86:ef:68:a6:fd:88:7d.
Are you sure you want to continue connecting (yes/no)?
```

- 2 Enter `yes`.

Output similar to the following is displayed:

```
Warning: Permanently added 'sys2,10.182.00.00'
(DSA) to the list of known hosts.
root@sys2 password:
```

- 3 Enter the root password of sys2.
- 4 At the `sftp` prompt, type the following command:

```
sftp> put /.ssh/id_dsa.pub
```

The following output is displayed:

```
Uploading /.ssh/id_dsa.pub to /id_dsa.pub
```

- 5 To quit the SFTP session, type the following command:

```
sftp> quit
```

- 6** To begin the `ssh` session on the target system (sys2 in this example), type the following command on sys1:

```
sys1 # ssh sys2
```

Enter the root password of sys2 at the prompt:

```
password:
```

- 7** After you log in to sys2, enter the following command to append the `id_dsa.pub` file to the `authorized_keys` file:

```
sys2 # cat /id_dsa.pub >> /.ssh/authorized_keys
```

- 8** After the `id_dsa.pub` public key file is copied to the target system (sys2), and added to the authorized keys file, delete it. To delete the `id_dsa.pub` public key file, enter the following command on sys2:

```
sys2 # rm /id_dsa.pub
```

- 9** To log out of the `ssh` session, enter the following command:

```
sys2 # exit
```

- 10** Run the following commands on the source installation system. If your `ssh` session has expired or terminated, you can also run these commands to renew the session. These commands bring the private key into the shell environment and make the key globally available to the user `root`:

```
sys1 # exec /usr/bin/ssh-agent $SHELL
```

```
sys1 # ssh-add
```

```
Identity added: //./ssh/id_dsa
```

This shell-specific step is valid only while the shell is active. You must execute the procedure again if you close the shell during the session.

To verify that you can connect to a target system

- 1 On the source system (sys1), enter the following command:

```
sys1 # ssh -l root sys2 uname -a
```

where sys2 is the name of the target system.

- 2 The command should execute from the source system (sys1) to the target system (sys2) without the system requesting a passphrase or password.
- 3 Repeat this procedure for each target system.

Setting up ssh and rsh connection using the installer -comsetup command

You can interactively set up the ssh and rsh connections using the `installer -comsetup` command.

Enter the following:

```
# ./installer -comsetup
```

Input the name of the systems to set up communication:

Enter the <platform> system names separated by spaces:

```
[q,?] sys2
```

Set up communication for the system sys2:

```
Checking communication on sys2 ..... Failed
```

```
CPI ERROR V-9-20-1303 ssh permission was denied on sys2. rsh
permission was denied on sys2. Either ssh or rsh is required
to be set up and ensure that it is working properly between the local
node and sys2 for communication
```

```
Either ssh or rsh needs to be set up between the local system and
sys2 for communication
```

```
Would you like the installer to setup ssh or rsh communication
automatically between the systems?
```

```
Superuser passwords for the systems will be asked. [y,n,q,?] (y) y
```

Enter the superuser password for system sys2:

```
1) Setup ssh between the systems
```

```

2) Setup rsh between the systems
b) Back to previous menu

Select the communication method [1-2,b,q,?] (1) 1

Setting up communication between systems. Please wait.
Re-verifying systems.

Checking communication on sys2 ..... Done

Successfully set up communication for the system sys2

```

Setting up ssh and rsh connection using the pwduutil.pl utility

The password utility, `pwduutil.pl`, is bundled under the `scripts` directory. The users can run the utility in their script to set up the ssh and rsh connection automatically.

```
# ./pwduutil.pl -h
```

Usage:

Command syntax with simple format:

```
pwduutil.pl check|configure|unconfigure ssh|rsh <hostname|IP addr>
[<user>] [<password>] [<port>]
```

Command syntax with advanced format:

```
pwduutil.pl [--action|-a 'check|configure|unconfigure']
            [--type|-t 'ssh|rsh']
            [--user|-u '<user>']
            [--password|-p '<password>']
            [--port|-P '<port>']
            [--hostfile|-f '<hostfile>']
            [--keyfile|-k '<keyfile>']
            [--debug|-d]
            <host_URI>
```

```
pwduutil.pl -h | -?
```

Table D-1 Options with `pwdutil.pl` utility

Option	Usage
<code>--action -a 'check configure unconfigure'</code>	Specifies action type, default is 'check'.
<code>--type -t 'ssh rsh'</code>	Specifies connection type, default is 'ssh'.
<code>--user -u '<user>'</code>	Specifies user id, default is the local user id.
<code>--password -p '<password>'</code>	Specifies user password, default is the user id.
<code>--port -P '<port>'</code>	Specifies port number for ssh connection, default is 22
<code>--keyfile -k '<keyfile>'</code>	Specifies the private key file.
<code>--hostfile -f '<hostfile>'</code>	Specifies the file which list the hosts.
<code>-debug</code>	Prints debug information.
<code>-h -?</code>	Prints help messages.
<code><host_URI></code>	Can be in the following formats: <code><hostname></code> <code><user>:<password>@<hostname></code> <code><user>:<password>@<hostname>:</code> <code><port></code>

You can check, configure, and unconfigure ssh or rsh using the `pwdutil.pl` utility. For example:

- To check ssh connection for only one host:

```
pwdutil.pl check ssh hostname
```

- To configure ssh for only one host:

```
pwdutil.pl configure ssh hostname user password
```

- To unconfigure rsh for only one host:

```
pwdutil.pl unconfigure rsh hostname
```

- To configure ssh for multiple hosts with same user ID and password:

```
pwdutil.pl -a configure -t ssh -u user -p password hostname1
hostname2 hostname3
```

- To configure ssh or rsh for different hosts with different user ID and password:

```
pwdutil.pl -a configure -t ssh user1:password1@hostname1
user2:password2@hostname2
```

- To check or configure ssh or rsh for multiple hosts with one configuration file:

```
pwdutil.pl -a configure -t ssh --hostfile /tmp/sshrsh_hostfile
```

- To keep the host configuration file secret, you can use the 3rd party utility to encrypt and decrypt the host file with password.

For example:

```
### run openssl to encrypt the host file in base64 format
# openssl aes-256-cbc -a -salt -in /hostfile -out /hostfile.enc
enter aes-256-cbc encryption password: <password>
Verifying - enter aes-256-cbc encryption password: <password>
```

```
### remove the original plain text file
# rm /hostfile
```

```
### run openssl to decrypt the encrypted host file
# pwdutil.pl -a configure -t ssh `openssl aes-256-cbc -d -a
-in /hostfile.enc`
enter aes-256-cbc decryption password: <password>
```

- To use the ssh authentication keys which are not under the default \$HOME/.ssh directory, you can use --keyfile option to specify the ssh keys. For example:

```
### create a directory to host the key pairs:
# mkdir /keystore
```

```
### generate private and public key pair under the directory:
# ssh-keygen -t rsa -f /keystore/id_rsa
```

```
### setup ssh connection with the new generated key pair under
the directory:
# pwdutil.pl -a configure -t ssh --keyfile /keystore/id_rsa
user:password@hostname
```

You can see the contents of the configuration file by using the following command:


```
# cat /tmp/sshrsh_hostfile
user1:password1@hostname1
user2:password2@hostname2
user3:password3@hostname3
user4:password4@hostname4

# all default: check ssh connection with local user
hostname5
The following exit values are returned:

0      Successful completion.
1      Command syntax error.
2      Ssh or rsh binaries do not exist.
3      Ssh or rsh service is down on the remote machine.
4      Ssh or rsh command execution is denied due to password is required.
5      Invalid password is provided.
255    Other unknown error.
```

Restarting the ssh session

After you complete this procedure, ssh can be restarted in any of the following scenarios:

- After a terminal session is closed
- After a new terminal session is opened
- After a system is restarted
- After too much time has elapsed, to refresh ssh

To restart ssh

- 1 On the source installation system (sys1), bring the private key into the shell environment.

```
sys1 # exec /usr/bin/ssh-agent $SHELL
```

- 2 Make the key globally available for the user `root`

```
sys1 # ssh-add
```

Enabling rsh for AIX

To enable `rsh`, create a `/.rhosts` file on each target system. Then add a line to the file specifying the full domain name of the source system. For example, add the line:

```
sysname.domainname.com root
```

Change permissions on the `/.rhosts` file to 600 by typing the following command:

```
# chmod 600 /.rhosts
```

After you complete an installation procedure, delete the `.rhosts` file from each target system to ensure security:

```
# rm -f /.rhosts
```

Sample SFHA cluster setup diagrams for CP server-based I/O fencing

This appendix includes the following topics:

- [Configuration diagrams for setting up server-based I/O fencing](#)

Configuration diagrams for setting up server-based I/O fencing

The following CP server configuration diagrams can be used as guides when setting up CP server within your configuration:

- Two unique client clusters that are served by 3 CP servers:
- Client cluster that is served by highly available CP server and 2 SCSI-3 disks:
- Two node campus cluster that is served by remote CP server and 2 SCSI-3 disks:
- Multiple client clusters that are served by highly available CP server and 2 SCSI-3 disks:

Two unique client clusters served by 3 CP servers

In the `vxfenmode` file on the client nodes, `vxfenmode` is set to `customized` with `vxfen` mechanism set to `cps`.

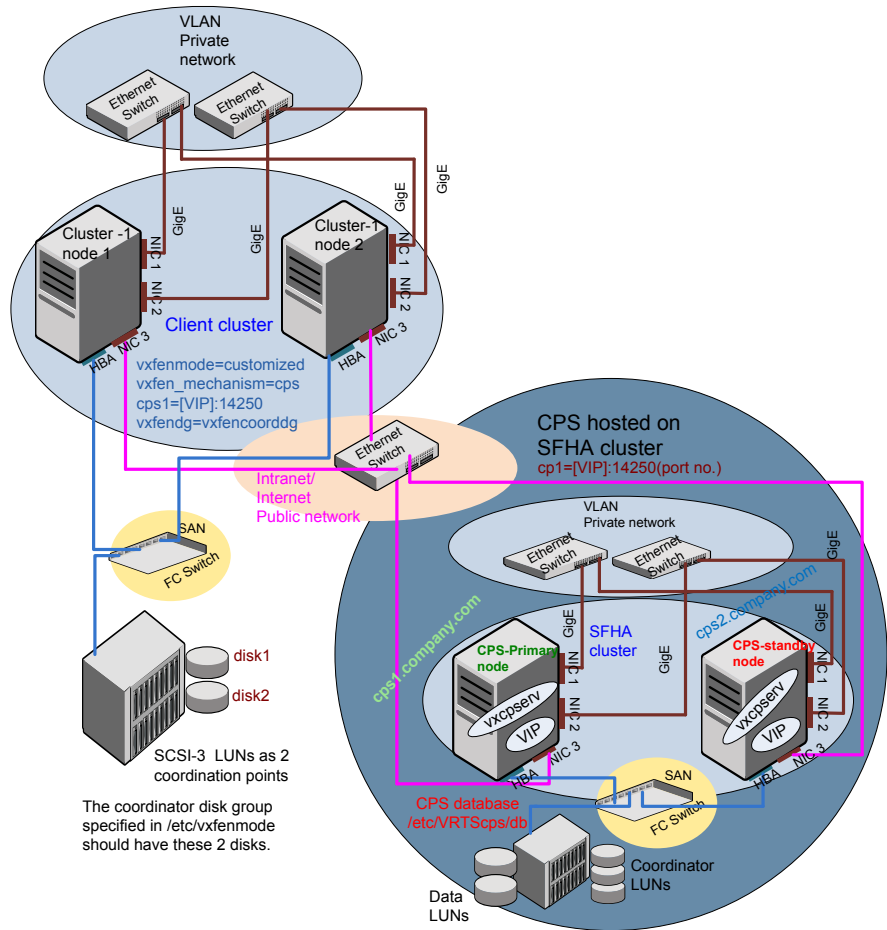
Client cluster served by highly available CPS and 2 SCSI-3 disks

Figure E-1 displays a configuration where a client cluster is served by one highly available CP server and 2 local SCSI-3 LUNs (disks).

In the `vxfsenmode` file on the client nodes, `vxfsenmode` is set to customized with `vxfsen` mechanism set to `cps`.

The two SCSI-3 disks are part of the disk group `vxfsencoorddg`. The third coordination point is a CP server hosted on an SFHA cluster, with its own shared database and coordinator disks.

Figure E-1 Client cluster served by highly available CP server and 2 SCSI-3 disks



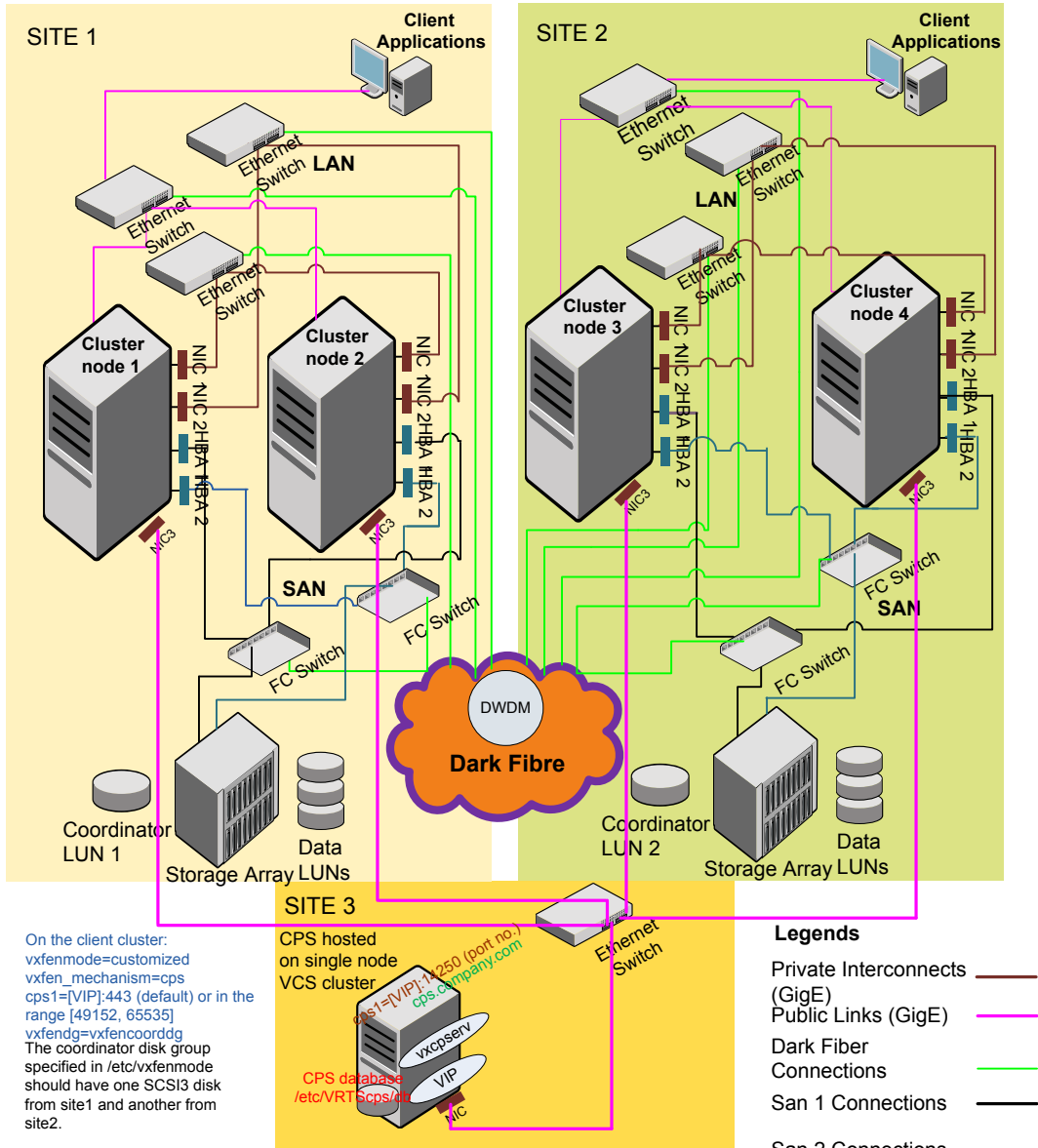
Two node campus cluster served by remote CP server and 2 SCSI-3 disks

Figure E-2 displays a configuration where a two node campus cluster is being served by one remote CP server and 2 local SCSI-3 LUN (disks).

In the `vxfenmode` file on the client nodes, `vxfenmode` is set to `customized` with `vxfen` mechanism set to `cps`.

The two SCSI-3 disks (one from each site) are part of disk group vxfencoordg.
 The third coordination point is a CP server on a single node VCS cluster.

Figure E-2 Two node campus cluster served by remote CP server and 2 SCSI-3



Multiple client clusters served by highly available CP server and 2 SCSI-3 disks

In the `vxfenmode` file on the client nodes, `vxfenmode` is set to `customized` with `vxfen` mechanism set to `cps`.

The two SCSI-3 disks are part of the disk group `vxfencoorddg`. The third coordination point is a CP server, hosted on an SFHA cluster, with its own shared database and coordinator disks.

Changing NFS server major numbers for VxVM volumes

This appendix includes the following topics:

- [Changing NFS server major numbers for VxVM volumes](#)

Changing NFS server major numbers for VxVM volumes

In a VCS cluster, block devices providing NFS service must have the same major and minor numbers on each cluster node. Major numbers identify required device drivers (such as AIX partition or VxVM volume). Minor numbers identify the specific devices themselves. NFS also uses major and minor numbers to identify the exported file system. Major and minor numbers must be verified to ensure that the NFS identity for the file system is the same when exported from each node.

Use the `haremajor` command to determine and reassign the major number that a system uses for shared VxVM volume block devices. For Veritas Volume Manager, the major number is set to the `vxio` driver number. To be highly available, each NFS server in a VCS cluster must have the same `vxio` driver number, or major number.

To list the major number currently in use on a system

- ◆ Use the command:

```
# haremajor -v
```


Run this command on each cluster node. If major numbers are not the same on each node, you must change them on the nodes so that they are identical.

To list the available major numbers for a system

- ◆ Use the command:

```
# haremajor -a  
54, 56..58, 60, 62..
```

The output shows the numbers that are not in use on the system where the command is issued.

To reset the major number on a system

- ◆ You can reset the major number to an available number on a system. For example, to set the major number to 75 type:

```
# haremajor -s 75
```

Configuring LLT over UDP

This appendix includes the following topics:

- [Using the UDP layer for LLT](#)
- [Manually configuring LLT over UDP using IPv4](#)
- [Using the UDP layer of IPv6 for LLT](#)
- [Manually configuring LLT over UDP using IPv6](#)

Using the UDP layer for LLT

SFHA provides the option of using LLT over the UDP (User Datagram Protocol) layer for clusters using wide-area networks and routers. UDP makes LLT packets routable and thus able to span longer distances more economically.

When to use LLT over UDP

Use LLT over UDP in the following situations:

- LLT must be used over WANs
- When hardware, such as blade servers, do not support LLT over Ethernet

LLT over UDP is slower than LLT over Ethernet. Use LLT over UDP only when the hardware configuration makes it necessary.

Manually configuring LLT over UDP using IPv4

The following checklist is to configure LLT over UDP:

- Make sure that the LLT private links are on separate subnets. Set the broadcast address in `/etc/lltab` explicitly depending on the subnet for each link.

See [“Broadcast address in the /etc/llttab file”](#) on page 307.

- Make sure that each NIC has an IP address that is configured before configuring LLT.
- Make sure the IP addresses in the /etc/llttab files are consistent with the IP addresses of the network interfaces.
- Make sure that each link has a unique not well-known UDP port.
See [“Selecting UDP ports”](#) on page 309.
- Set the broadcast address correctly for direct-attached (non-routed) links.
See [“Sample configuration: direct-attached links”](#) on page 311.
- For the links that cross an IP router, disable broadcast features and specify the IP address of each link manually in the /etc/llttab file.
See [“Sample configuration: links crossing IP routers”](#) on page 312.

Broadcast address in the /etc/llttab file

The broadcast address is set explicitly for each link in the following example.

- Display the content of the /etc/llttab file on the first node sys1:

```
sys1 # cat /etc/llttab

set-node sys1
set-cluster 1
link link1 /dev/xti/udp - udp 50000 - 192.168.9.1 192.168.9.255
link link2 /dev/xti/udp - udp 50001 - 192.168.10.1 192.168.10.255
```

Verify the subnet mask using the ifconfig command to ensure that the two links are on separate subnets.

- Display the content of the /etc/llttab file on the second node sys2:

```
sys2 # cat /etc/llttab

set-node sys2
set-cluster 1
link link1 /dev/xti/udp - udp 50000 - 192.168.9.2 192.168.9.255
link link2 /dev/xti/udp - udp 50001 - 192.168.10.2 192.168.10.255
```

Verify the subnet mask using the ifconfig command to ensure that the two links are on separate subnets.

The link command in the /etc/llttab file

Review the link command information in this section for the /etc/llttab file. See the following information for sample configurations:

- See [“Sample configuration: direct-attached links”](#) on page 311.
- See [“Sample configuration: links crossing IP routers”](#) on page 312.

[Table G-1](#) describes the fields of the link command that are shown in the /etc/llttab file examples. Note that some of the fields differ from the command for standard LLT links.

Table G-1 Field description for link command in /etc/llttab

Field	Description
<i>tag-name</i>	A unique string that is used as a tag by LLT; for example link1, link2,....
<i>device</i>	The device path of the UDP protocol; for example /dev/xti/udp.
<i>node-range</i>	Nodes using the link. "-" indicates all cluster nodes are to be configured for this link.
<i>link-type</i>	Type of link; must be "udp" for LLT over UDP.
<i>udp-port</i>	Unique UDP port in the range of 49152-65535 for the link. See “Selecting UDP ports” on page 309.
<i>MTU</i>	"-" is the default, which has a value of 8192. The value may be increased or decreased depending on the configuration. Use the <code>lltstat -l</code> command to display the current value.
<i>IP address</i>	IP address of the link on the local node.
<i>bcast-address</i>	<ul style="list-style-type: none">■ For clusters with enabled broadcasts, specify the value of the subnet broadcast address.■ "-" is the default for clusters spanning routers.

The set-addr command in the /etc/llttab file

The `set-addr` command in the /etc/llttab file is required when the broadcast feature of LLT is disabled, such as when LLT must cross IP routers.

See [“Sample configuration: links crossing IP routers”](#) on page 312.

[Table G-2](#) describes the fields of the set-addr command.

Table G-2 Field description for set-addr command in /etc/llttab

Field	Description
<i>node-id</i>	The node ID of the peer node; for example, 0.
<i>link tag-name</i>	The string that LLT uses to identify the link; for example link1, link2,....
<i>address</i>	IP address assigned to the link for the peer node.

Selecting UDP ports

When you select a UDP port, select an available 16-bit integer from the range that follows:

- Use available ports in the private range 49152 to 65535
- Do not use the following ports:
 - Ports from the range of well-known ports, 0 to 1023
 - Ports from the range of registered ports, 1024 to 49151

To check which ports are defined as defaults for a node, examine the file /etc/services. You should also use the `netstat` command to list the UDP ports currently in use. For example:

```
# netstat -a | more
UDP
  Local Address      Remote Address      State
  -----
    *. *
    *.32771           Idle
    *.32776           Idle
    *.32777           Idle
    *.name            Idle
    *.biff            Idle
    *.talk            Idle
    *.32779           Idle
    .
    .
    .
    *.55098           Idle
    *.syslog          Idle
    *.58702           Idle
    *. *             Unbound
```

```
# netstat -a | head -2; netstat -a | grep udp
Active Internet connections (including servers)
Proto Recv-Q Send-Q Local Address Foreign Address (state)
udp4      0      0 *.daytime  *.*
udp4      0      0 *.time    *.*
udp4      0      0 *.sunrpc  *.*
udp4      0      0 *.snmp    *.*
udp4      0      0 *.syslog  *.*
```

Look in the UDP section of the output; the UDP ports that are listed under Local Address are already in use. If a port is listed in the `/etc/services` file, its associated name is displayed rather than the port number in the output.

Configuring the netmask for LLT

For nodes on different subnets, set the netmask so that the nodes can access the subnets in use. Run the following command and answer the prompt to set the netmask:

```
# ifconfig interface_name netmask netmask
```

For example:

- For the first network interface on the node sys1:

```
IP address=192.168.9.1, Broadcast address=192.168.9.255,
Netmask=255.255.255.0
```

For the first network interface on the node sys2:

```
IP address=192.168.9.2, Broadcast address=192.168.9.255,
Netmask=255.255.255.0
```

- For the second network interface on the node sys1:

```
IP address=192.168.10.1, Broadcast address=192.168.10.255,
Netmask=255.255.255.0
```

For the second network interface on the node sys2:

```
IP address=192.168.10.2, Broadcast address=192.168.10.255,
Netmask=255.255.255.0
```

Configuring the broadcast address for LLT

For nodes on different subnets, set the broadcast address in `/etc/llttab` depending on the subnet that the links are on.

An example of a typical `/etc/llttab` file when nodes are on different subnets. Note the explicitly set broadcast address for each link.

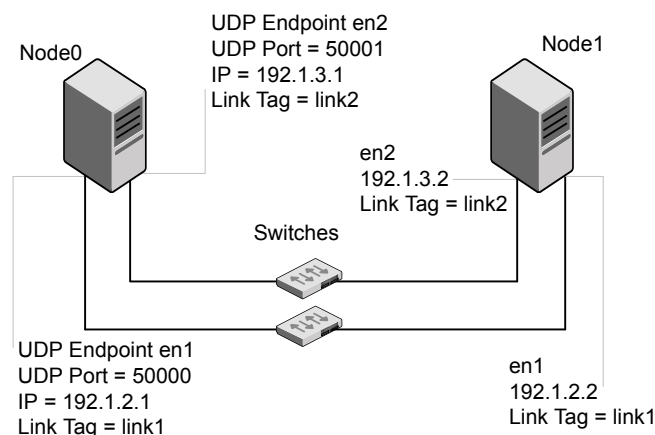
```
# cat /etc/llttab
set-node nodexyz
set-cluster 100

link link1 /dev/xti/udp - udp 50000 - 192.168.30.1
192.168.30.255
link link2 /dev/xti/udp - udp 50001 - 192.168.31.1
192.168.31.255
```

Sample configuration: direct-attached links

Figure G-1 depicts a typical configuration of direct-attached links employing LLT over UDP.

Figure G-1 A typical configuration of direct-attached links that use LLT over UDP



The configuration that the `/etc/llttab` file for Node 0 represents has directly attached crossover links. It might also have the links that are connected through a hub or switch. These links do not cross routers.

LLT sends broadcast requests to peer nodes to discover their addresses. So the addresses of peer nodes do not need to be specified in the `/etc/llttab` file using the

`set-addr` command. For direct attached links, you do need to set the broadcast address of the links in the `/etc/lltab` file. Verify that the IP addresses and broadcast addresses are set correctly by using the `ifconfig -a` command.

```
set-node Node0
set-cluster 1
#configure Links
#link tag-name device node-range link-type udp port MTU \
IP-address bcast-address
link link1 /dev/xti/udp - udp 50000 - 192.1.2.1 192.1.2.255
link link2 /dev/xti/udp - udp 50001 - 192.1.3.1 192.1.3.255
```

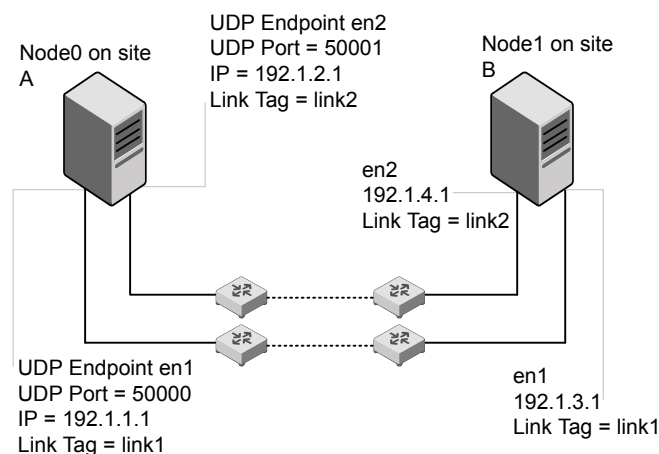
The file for Node 1 resembles:

```
set-node Node1
set-cluster 1
# configure Links
# link tag-name device node-range link-type udp port MTU \
IP-address bcast-address
link link1 /dev/xti/udp - udp 50000 - 192.1.2.2 192.1.2.255
link link2 /dev/xti/udp - udp 50001 - 192.1.3.2 192.1.3.255
```

Sample configuration: links crossing IP routers

Figure G-2 depicts a typical configuration of links crossing an IP router employing LLT over UDP. The illustration shows two nodes of a four-node cluster.

Figure G-2 A typical configuration of links crossing an IP router



The configuration that the following `/etc/llttab` file represents for Node 1 has links crossing IP routers. Notice that IP addresses are shown for each link on each peer node. In this configuration broadcasts are disabled. Hence, the broadcast address does not need to be set in the `link` command of the `/etc/llttab` file.

```
set-node Node1
set-cluster 1
link link1 /dev/xti/udp - udp 50000 - 192.1.3.1 -
link link2 /dev/xti/udp - udp 50001 - 192.1.4.1 -

#set address of each link for all peer nodes in the cluster
#format: set-addr node-id link tag-name address
set-addr      0 link1 192.1.1.1
set-addr      0 link2 192.1.2.1
set-addr      2 link1 192.1.5.2
set-addr      2 link2 192.1.6.2
set-addr      3 link1 192.1.7.3
set-addr      3 link2 192.1.8.3

#disable LLT broadcasts
set-bcasthb   0
set-arp       0
```

The `/etc/llttab` file on Node 0 resembles:

```
set-node Node0
set-cluster 1

link link1 /dev/xti/udp - udp 50000 - 192.1.1.1 -
link link2 /dev/xti/udp - udp 50001 - 192.1.2.1 -

#set address of each link for all peer nodes in the cluster
#format: set-addr node-id link tag-name address
set-addr      1 link1 192.1.3.1
set-addr      1 link2 192.1.4.1
set-addr      2 link1 192.1.5.2
set-addr      2 link2 192.1.6.2
set-addr      3 link1 192.1.7.3
set-addr      3 link2 192.1.8.3

#disable LLT broadcasts
set-bcasthb   0
set-arp       0
```

Using the UDP layer of IPv6 for LLT

Storage Foundation and High Availability 7.2 provides the option of using LLT over the UDP (User Datagram Protocol) layer for clusters using wide-area networks and routers. UDP makes LLT packets routable and thus able to span longer distances more economically.

When to use LLT over UDP

Use LLT over UDP in the following situations:

- LLT must be used over WANs
- When hardware, such as blade servers, do not support LLT over Ethernet

Manually configuring LLT over UDP using IPv6

The following checklist is to configure LLT over UDP:

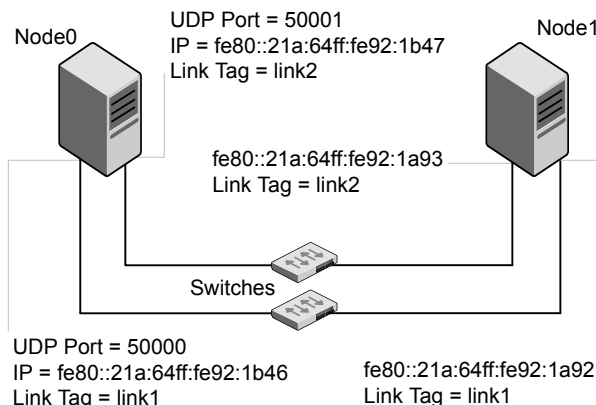
- For UDP6, the multicast address is set to "-".
- Make sure that each NIC has an IPv6 address that is configured before configuring LLT.
- Make sure the IPv6 addresses in the `/etc/llttab` files are consistent with the IPv6 addresses of the network interfaces.
- Make sure that each link has a unique not well-known UDP port.
- For the links that cross an IP router, disable multicast features and specify the IPv6 address of each link manually in the `/etc/llttab` file.

See [“Sample configuration: links crossing IP routers”](#) on page 316.

Sample configuration: direct-attached links

[Figure G-3](#) depicts a typical configuration of direct-attached links employing LLT over UDP.

Figure G-3 A typical configuration of direct-attached links that use LLT over UDP



The configuration that the `/etc/llttab` file for Node 0 represents has directly attached crossover links. It might also have the links that are connected through a hub or switch. These links do not cross routers.

LLT uses IPv6 multicast requests for peer node address discovery. So the addresses of peer nodes do not need to be specified in the `/etc/llttab` file using the `set-addr` command. Use the `ifconfig -a` command to verify that the IPv6 address is set correctly.

```
set-node Node0
set-cluster 1
#configure Links
#link tag-name device node-range link-type udp port MTU \
IP-address mcast-address
link link1 /dev/xti/udp6 - udp6 50000 - fe80::21a:64ff:fe92:1b46 -
link link1 /dev/xti/udp6 - udp6 50001 - fe80::21a:64ff:fe92:1b47 -
```

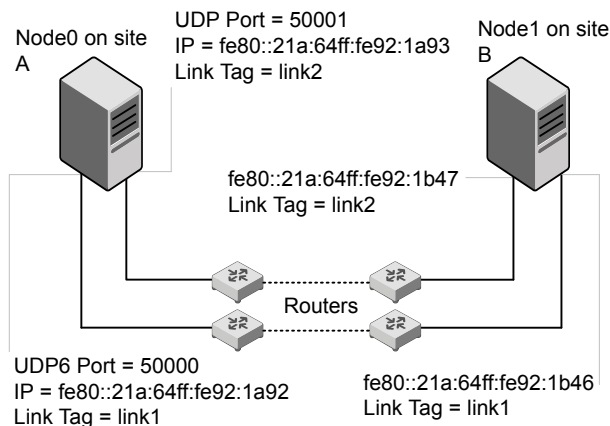
The file for Node 1 resembles:

```
set-node Node1
set-cluster 1
# configure Links
# link tag-name device node-range link-type udp port MTU \
IP-address mcast-address
link link1 /dev/xti/udp6 - udp6 50000 - fe80::21a:64ff:fe92:1a92 -
link link1 /dev/xti/udp6 - udp6 50001 - fe80::21a:64ff:fe92:1a93 -
```

Sample configuration: links crossing IP routers

Figure G-4 depicts a typical configuration of links crossing an IP router employing LLT over UDP. The illustration shows two nodes of a four-node cluster.

Figure G-4 A typical configuration of links crossing an IP router



The configuration that the following `/etc/llttab` file represents for Node 1 has links crossing IP routers. Notice that IPv6 addresses are shown for each link on each peer node. In this configuration multicasts are disabled.

```
set-node Node1
set-cluster 1

link link1 /dev/xti/udp6 - udp6 50000 - fe80::21a:64ff:fe92:1a92 -
link link1 /dev/xti/udp6 - udp6 50001 - fe80::21a:64ff:fe92:1a93 -

#set address of each link for all peer nodes in the cluster
#format: set-addr node-id link tag-name address
set-addr 0 link1 fe80::21a:64ff:fe92:1b46
set-addr 0 link2 fe80::21a:64ff:fe92:1b47
set-addr 2 link1 fe80::21a:64ff:fe92:1d70
set-addr 2 link2 fe80::21a:64ff:fe92:1d71
set-addr 3 link1 fe80::209:6bff:fe1b:1c94
set-addr 3 link2 fe80::209:6bff:fe1b:1c95

#disable LLT multicasts
set-bcasthb 0
set-arp 0
```

The `/etc/llttab` file on Node 0 resembles:

```
set-node Node0
set-cluster 1

link link1 /dev/xti/udp6 - udp6 50000 - fe80::21a:64ff:fe92:1b46 -
link link2 /dev/xti/udp6 - udp6 50001 - fe80::21a:64ff:fe92:1b47 -

#set address of each link for all peer nodes in the cluster
#format: set-addr node-id link tag-name address
set-addr 1 link1 fe80::21a:64ff:fe92:1a92
set-addr 1 link2 fe80::21a:64ff:fe92:1a93
set-addr 2 link1 fe80::21a:64ff:fe92:1d70
set-addr 2 link2 fe80::21a:64ff:fe92:1d71
set-addr 3 link1 fe80::209:6bff:fe1b:1c94
set-addr 3 link2 fe80::209:6bff:fe1b:1c95

#disable LLT multicasts
set-bcasthb      0
set-arp          0
```

Index

A

- about
 - global clusters 18
 - Veritas InfoScale Operations Manager 15
- adding
 - users 72
- applications, stopping 174
- attributes
 - UseFence 114, 135

C

- cables
 - cross-over Ethernet 237
- cluster
 - removing a node from 251
- commands
 - lltconfig 271
 - vxdisksetup (initializing disks) 81
 - vxlicinst 78
 - vxlicinstupgrade 79
 - vxlicrep 77
- configuration
 - restoring the original 219
- configuring SFHA
 - product installer 58
- configuring VCS
 - adding users 72
 - event notification 73–74
 - global clusters 76
 - starting 60
- coordinator disks
 - DMP devices 20
 - for I/O fencing 20
 - setting up 113
- creating
 - backups 168

D

- data disks
 - for I/O fencing 20

disks

- adding and initializing 81
- coordinator 113
- testing with vxfcntlsthew 82
- verifying node access 84

E

- Ethernet controllers 237

F

- freezing service groups 174

G

- GAB
 - description 16
- gabtab file
 - verifying after installation 271
- global clusters 18
 - configuration 76

H

- hubs
 - independent 237

I

- I/O fencing
 - checking disks 82
 - setting up 111
 - shared storage 82
- I/O fencing requirements
 - non-SCSI-3 27
- Install Bundles
 - integration options 177
- installation script options 261
- installing
 - post 76

L

- license keys
 - adding with vxlicinstupgrade 78
 - replacing demo key 79
- licenses
 - information about 27
- links
 - private network 271
- LLT
 - description 16
- lltconfig command 271
- llthosts file
 - verifying after installation 271
- llttab file
 - verifying after installation 271

M

- main.cf file
 - contents after installation 276
- main.cf files 281

N

- nodes
 - adding application nodes
 - configuring GAB 243
 - configuring LLT 243
 - configuring VXFEN 243
 - starting Volume Manager 242
- non-SCSI-3 fencing
 - manual configuration 129
 - setting up 129
- non-SCSI-3 I/O fencing
 - requirements 27
- non-SCSI3 fencing
 - setting up 104
 - using installer 104

O

- original configuration
 - restoring the 219

P

- phased 195
- phased upgrade 195, 197
 - example 196
- planning to upgrade VVR 169

post-upgrade

- updating variables 224
 - verifying 230
- preinstallation 169
- preparing to upgrade 166
- preparing to upgrade VVR 174
- product installer
 - SFHA configuration overview 58

R

- removing a system from a cluster 251
- response files
 - upgrading 212
- restoring the original configuration 219
- rolling upgrade
 - about 188
 - using the product installer 191
- rsh 60

S

- SCSI-3 persistent reservations
 - verifying 111
- service groups
 - freezing 174
 - unfreezing 218
- SFDB authentication 232
 - adding nodes 249
 - configuring vxdbd 233
- SFHA
 - configuring 58
 - coordinator disks 113
- simultaneous install or upgrade 177
- SMTP email notification 73
- SNMP trap notification 74
- ssh 60
- starting configuration
 - installer program 60
 - product installer 60
- stopping
 - applications 174

U

- unfreezing service groups 218
- upgrade
 - array support 176
 - creating backups 168
 - getting ready 166
 - phased 195, 197

- upgrade (*continued*)
 - preparing for upgrade 168
- upgrading
 - AIX operating system 184
 - DMP-enabled rootvg 182–183
 - phased 195
 - using product installer 180
 - using response files 212
- upgrading VVR
 - from 4.0 170
 - planning 169
 - preparing 174

V

- VCS
 - configuration files
 - main.cf 275
- VVR 4.0
 - planning an upgrade from 170
- vvr_upgrade_finish script 220
- vxdisksetup command 81
- vxlicinst command 78
- vxlicrep command 77