Veritas Cluster Server Installation Guide

HP-UX 11i v3

5.0.1

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Chapter 1

Introducing Veritas Cluster Server

This chapter includes the following topics:

About Veritas Cluster Server

Veritas™ Cluster Server by Symantec is a high-availability solution for cluster configurations. Veritas Cluster Server (VCS) monitors systems and application services, and restarts services when hardware or software fails.

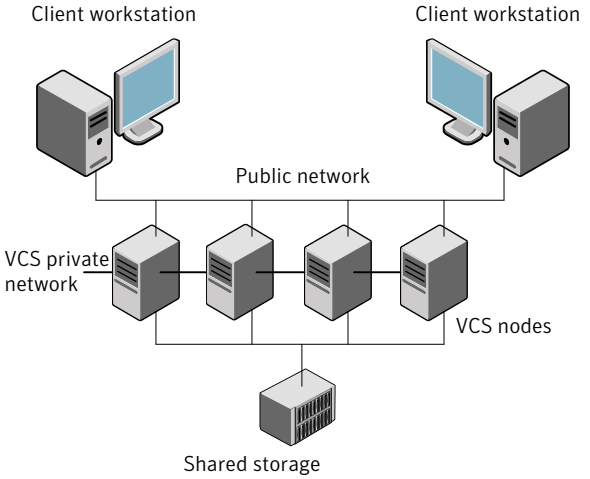
About VCS basics

A single VCS cluster consists of multiple systems that are connected in various combinations to shared storage devices. When a system is part of a VCS cluster, it is a node. VCS monitors and controls applications running in the cluster on nodes, and restarts applications in response to a variety of hardware or software faults.

Applications can continue to operate with little or no downtime. In some cases, such as NFS, this continuation is transparent to high-level applications and users. In other cases, a user might have to retry an operation, such as a Web server reloading a page.

Figure 1-1 illustrates a typical VCS configuration of four nodes that are connected to shared storage.

Figure 1-1 Example of a four-node VCS cluster



Client workstations receive service over the public network from applications running on VCS nodes. VCS monitors the nodes and their services. VCS nodes in the cluster communicate over a private network.

About multiple nodes

VCS runs in a replicated state on each node in the cluster. A private network enables the nodes to share identical state information about all resources. The private network also recognizes active nodes, the nodes that join or leave the cluster, and failed nodes. The private network requires two communication channels to guard against network partitions.

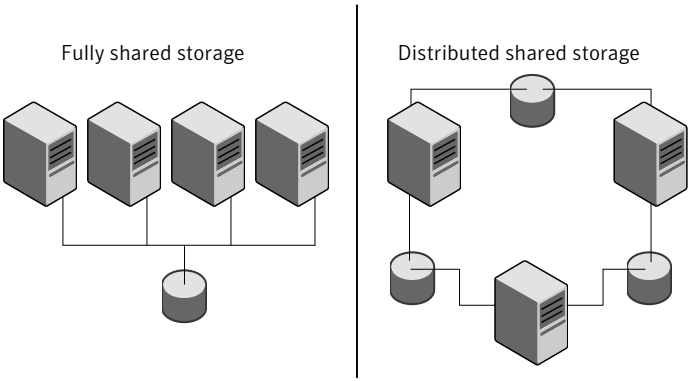
About shared storage

A VCS hardware configuration typically consists of multiple nodes that are connected to shared storage through I/O channels. Shared storage provides multiple systems with an access path to the same data. It also enables VCS to restart applications on alternate nodes when a node fails, which ensures high availability.

VCS nodes can only access physically-attached storage.

Figure 1-2 illustrates the flexibility of VCS shared storage configurations.

Figure 1-2 Two examples of shared storage configurations



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.

LLT configuration files are as follows:

- /etc/llthosts—lists all the nodes in the cluster
- /etc/llttab file—describes the local system's private network links to the other nodes in the cluster

GAB (Group Membership and Atomic Broadcast) provides the global message order that is required to maintain a synchronized state among the nodes. It monitors disk communications such as the VCS heartbeat utility. The /etc/gabtab file is the GAB configuration file.

See "About the LLT and GAB configuration files" on page 117.

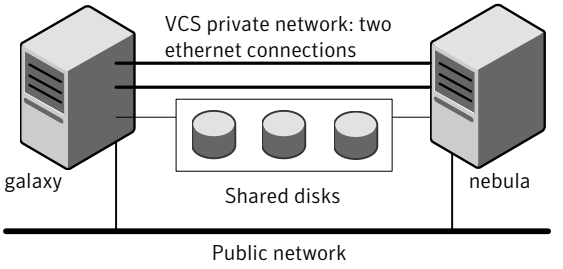
About network channels for heartbeating

For the VCS private network, two network channels must be available to carry heartbeat information. These network connections also transmit other VCS-related information.

Each HP-UX cluster configuration requires at least two network channels between the systems. The requirement for two channels protects your cluster against network partitioning. For more information on network partitioning, refer to the *Veritas Cluster Server User's Guide*.

Figure 1-3 illustrates a two-node VCS cluster where the nodes galaxy and nebula have two private network connections.

Figure 1-3 Two Ethernet connections connecting two nodes



About preexisting network partitions

A preexisting network partition refers to a failure in the communication channels that occurs while the systems are down and VCS cannot respond. When the systems start, VCS is vulnerable to network partitioning, regardless of the cause of the failure.

About VCS seeding

To protect your cluster from a preexisting network partition, VCS uses a seed. A seed is a function of GAB that determines whether or not all nodes have joined a cluster. For this determination, GAB requires that you declare the number of nodes in the cluster. Note that only seeded nodes can run VCS.

GAB automatically seeds nodes under the following conditions:

- An unseeded node communicates with a seeded node
- All nodes in the cluster are unseeded but can communicate with each other

When the last system starts and joins the cluster, the cluster seeds and starts VCS on all nodes. You can then bring down and restart nodes in any combination. Seeding remains in effect as long as at least one instance of VCS is running somewhere in the cluster.

Perform a manual seed to run VCS from a cold start when one or more systems of the cluster are unavailable. VCS does not start service groups on a system until it has a seed.

About VCS features

You can use the Veritas Installation Assessment Service to assess your setup for VCS installation.

See "Veritas Installation Assessment Service" on page 17.

VCS offers the following features that you can configure during VCS configuration:

VCS notifications	See "About VCS notifications" on page 17.
VCS global clusters	See "About global clusters" on page 17.
I/O fencing	See "About I/O fencing" on page 18.

Veritas Installation Assessment Service

The Veritas Installation Assessment Service (VIAS) utility assists you in getting ready for a Veritas Storage Foundation and High Availability Solutions installation or upgrade. The VIAS utility allows the preinstallation evaluation of a configuration, to validate it prior to starting an installation or upgrade.

https://vias.symantec.com/

About VCS notifications

You can configure both SNMP and SMTP notifications for VCS. Symantec recommends you to configure one of these notifications. You have the following options:

- Configure SNMP trap notification of VCS events using the VCS Notifier component
- Configure SMTP email notification of VCS events using the VCS Notifier component.

See the *Veritas Cluster Server User's Guide*.

About global clusters

Global clusters provide the ability to fail over applications between geographically distributed clusters when disaster occurs. You require a separate license to configure global clusters. You must add this license during the installation. The installer only asks about configuring global clusters if you have used the global cluster license.

See the *Veritas Cluster Server User's Guide*.

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.

See the *Veritas Cluster Server User's Guide*.

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 installvcs program installs the VCS I/O fencing driver, VRTSvxfen. To protect data on shared disks, you must configure I/O fencing after you install and configure VCS.

I/O fencing technology uses coordination points for arbitration in the event of a network partition.

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

About VCS optional components

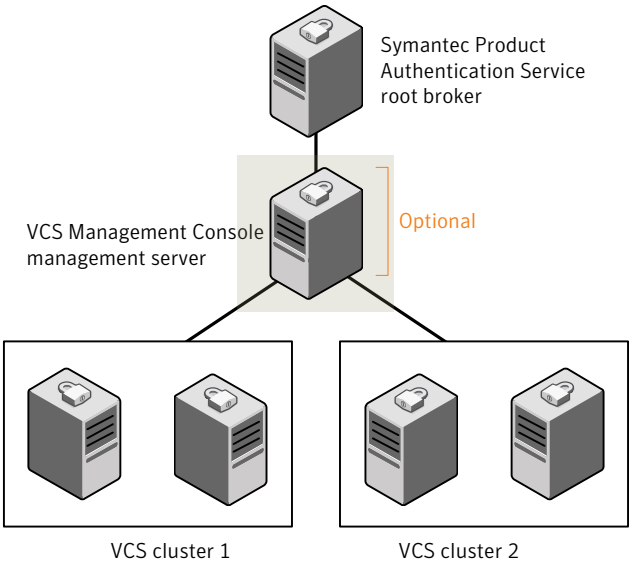
You can add the following optional components to VCS:

Symantec Product Authentication Service	See "About Symantec Product Authentication Service (AT)" on page 19.
Veritas Cluster Server Management Console	See "About Veritas Cluster Server Management Console" on page 20.
Cluster Manager (Java console)	See "About Cluster Manager (Java Console)" on page 20.
VCS Simulator	See "About VCS Simulator" on page 20.

To configure the optional components, make sure to install all depots when the installation program prompts you.

Figure 1-4 illustrates a sample VCS deployment with the optional components configured.

Figure 1-4 Typical VCS setup with optional components



About Symantec Product Authentication Service (AT)

VCS uses Symantec Product Authentication Service (AT) to provide secure communication between cluster nodes and clients. It uses digital certificates for authentication and SSL to encrypt communication over the public network to secure communications.

AT uses the following brokers to establish trust relationship between the cluster components:

- Root broker
  A root broker serves as the main registration and certification authority; it has a self-signed certificate and can authenticate other brokers. The root broker is only used during initial creation of an authentication broker.
  A root broker can serve multiple clusters. Symantec recommends that you install a single root broker on a utility system. The utility system, such as an email server or domain controller, can be highly available.
- Authentication brokers
  Authentication brokers serve as intermediate registration and certification authorities. Authentication brokers have root-signed certificates. Each node in VCS serves as an authentication broker.

See Symantec Product Authentication Service documentation for more information.

See "Preparing to configure the clusters in secure mode" on page 27.

About Cluster Manager (Java Console)

Cluster Manager (Java Console) offers complete administration capabilities for your cluster. Use the different views in the Java Console to monitor clusters and VCS objects, including service groups, systems, resources, and resource types.

You can perform many administrative operations using the Java Console. You can also perform these operations using the command line interface or using the Veritas Cluster Server Management Console.

See "Installing the Java Console" on page 83.

See *Veritas Cluster Server User's Guide*.

About Veritas Cluster Server Management Console

Veritas Cluster Server Management Console is a high availability management solution that enables monitoring and administering clusters from a single Web console.

You can configure Veritas Cluster Server Management Console to manage multiple clusters.

Refer to the *Veritas Cluster Server Management Console Implementation Guide* for installation, upgrade, and configuration instructions.

For information on updates and patches for VCS Management Console, see http://seer.entsupport.symantec.com/docs/308405.htm.

To download the most current version of VCS Management Console, go to www.symantec.com/business/cluster-server and click **Utilities**.

About VCS Simulator

VCS Simulator enables you to simulate and test cluster configurations. Use VCS Simulator to view and modify service group and resource configurations and test failover behavior. VCS Simulator can be run on a stand-alone system and does not require any additional hardware.

VCS Simulator runs an identical version of the VCS High Availability Daemon (HAD) as in a cluster, ensuring that failover decisions are identical to those in an actual cluster.

You can test configurations from different operating systems using VCS Simulator. For example, you can run VCS Simulator on a Windows system and test VCS

configurations for Windows, Linux, and Solaris clusters. VCS Simulator also enables creating and testing global clusters.

You can administer VCS Simulator from the Java Console or from the command line.

Chapter 2

Planning to install VCS

This chapter includes the following topics:

About planning to install VCS

Every node where you want to install VCS must meet the hardware and software requirements.

For the latest information on updates, patches, and software issues, read the following Veritas Technical Support TechNote:

http://entsupport.symantec.com/docs/331560

To find information on supported hardware, see the hardware compatibility list (HCL) in the following TechNote:

http://entsupport.symantec.com/docs/283282

Hardware requirements

Table 2-1 lists the hardware requirements for a VCS cluster.

Table 2-1 Hardware requirements for a VCS cluster

Item	Description
VCS nodes	From 1 to 32 HP (Itanium or PA-RISC) systems running HP-UX 11i v3.

Table 2-1 Hardware requirements for a VCS cluster *(continued)*

Item	Description
DVD drive	One drive in a system that can communicate to all the nodes in the cluster.
Disks	Typical VCS configurations require that shared disks support the applications that migrate between systems in the cluster. The VCS I/O fencing feature requires that all data and coordinator disks support SCSI-3 Persistent Reservations (PR). **Note:** On HP-UX 11i v3, you must use only DMP disk devices for I/O fencing. See "About setting up I/O fencing" on page 103.
Disk space	To run VCS, LLT, GAB, the Web Console, and the Java Console, each VCS node requires the following file system space: ■ 900 MB in /var If you do not have enough free space in /var, then use the `installvcs` command with `tmppath` option. Make sure that the specified tmppath file system has the required free space. ■ 800 MB in /opt ■ 100 MB in /usr ■ 100 MB in / **Note:** VCS may require more temporary disk space during installation than the specified disk space.
Network Interface Cards (NICs)	In addition to the built-in public NIC, VCS requires at least one more NIC per system. Symantec recommends two additional NICs. You can also configure aggregated interfaces.
Fibre Channel or SCSI host bus adapters	Typical VCS configuration requires at least one SCSI or Fibre Channel Host Bus Adapter per system for shared data disks.
RAM	Each VCS node requires at least 2 GB.

Supported operating systems

VCS supports the following operating system versions:

■ HP-UX 11i v3 March 2009 OEUR release or later

Note: Within a cluster, all systems must run on the same processor type and use the same operating system version and patch level. Mixed PA-RISC and Itanium clusters are not supported.

Supported software

Veritas Cluster Server supports the previous and next versions of Storage Foundation to facilitate product upgrades.

VCS supports the following volume managers and files systems:

- Logical Volume Manager (LVM)
- HP File System (HFS)
- Veritas Volume Manager (VxVM) with Veritas File System (VxFS)
  - VxVM 4.1 with VxFS 4.1
  - VxVM 5.0 with VxFS 5.0
  - VxVM 5.0 MP1 with VxFS 5.0 MP1
  - VxVM 5.0.1 with VxFS 5.0.1

Other required HP-UX software

If you plan to install VCS from an NFS mounted directory, you must install the software `ONCplus - HP-UX 11i v3 version B.11.31.07.01`. The `ONCplus B.11.31.06` software bundled with HP-UX 11i v3 March 2009 OEUR release reports issues with long path names. This causes the installation to fail as the installer cannot copy files from the mounted directory to the systems on which you want to install VCS.

To download the software:

- Go to http://software.hp.com.
- Search for the software depot `ONCplus`.
- Download ONCplus for HP-UX 11i v3 version B.11.31.07.01.

Chapter 3

Preparing to install VCS

This chapter includes the following topics:

About preparing to install VCS

Before you perform the preinstallation tasks, make sure you reviewed the installation requirements, set up the basic hardware, and planned your VCS setup.

Preparing to configure the clusters in secure mode

You can set up Symantec Product Authentication Service (AT) for the cluster during the VCS installation or after the installation.

If you want to enable AT in a cluster at a later time, refer to the *Veritas Cluster Server User's Guide* for instructions.

The prerequisites to configure a cluster in secure mode are as follows:

- A system in your enterprise is configured as root broker (RB).
  If a root broker system does not exist, install and configure root broker on a system.
  See "Installing the root broker for the security infrastructure" on page 31.
- An authentication broker (AB) account for each node in the cluster is set up on the root broker system.
  See "Creating authentication broker accounts on root broker system" on page 32.

- The system clocks of the root broker and authentication brokers must be in sync.

The installvcs program provides the following configuration modes:

Automatic mode	The root broker system must allow remsh or ssh passwordless login to use this mode.
Semi-automatic mode	This mode requires encrypted files (BLOB files) from the AT administrator to configure a cluster in secure mode. The nodes in the cluster must allow remsh or ssh passwordless login. See "Setting up inter-system communication" on page 39.
Manual mode	This mode requires root_hash file and the root broker information from the AT administrator to configure a cluster in secure mode. The nodes in the cluster must allow remsh or ssh passwordless login. See "Setting up inter-system communication" on page 39.

Figure 3-1 depicts the flow of configuring VCS cluster in secure mode.

Figure 3-1 Workflow to configure VCS cluster in secure mode

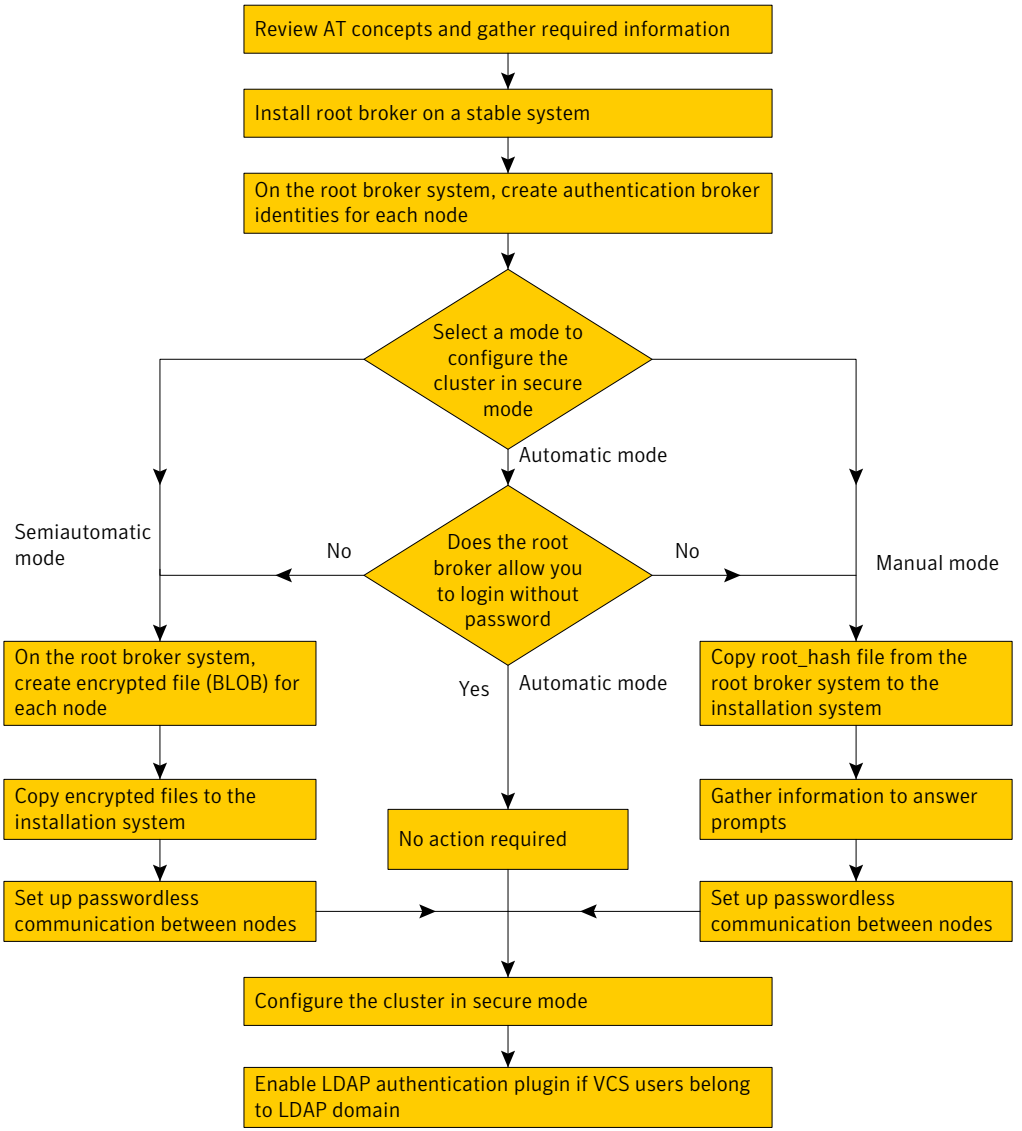


Table 3-1 lists the preparatory tasks in the order which the AT and VCS administrators must perform.

Table 3-1 Preparatory tasks to configure a cluster in secure mode

Tasks	Who performs this task
Decide one of the following configuration modes to set up a cluster in secure mode: ■ Automatic mode ■ Semi-automatic mode ■ Manual mode	VCS administrator
Install the root broker on a stable system in the enterprise. See "Installing the root broker for the security infrastructure" on page 31.	AT administrator
On the root broker system, create authentication broker accounts for each node in the cluster. See "Creating authentication broker accounts on root broker system" on page 32. AT administrator requires the following information from the VCS administrator: ■ Node names that are designated to serve as authentication brokers ■ Password for each authentication broker	AT administrator
To use the semi-automatic mode, create the encrypted files (BLOB files) for each node and provide the files to the VCS administrator. See "Creating encrypted files for the security infrastructure" on page 33. AT administrator requires the following additional information from the VCS administrator: ■ Administrator password for each authentication broker Typically, the password is the same for all nodes.	AT administrator
To use the manual mode, provide the root_hash file (/opt/VRTSat/bin/root_hash) from the root broker system to the VCS administrator.	AT administrator
Copy the files that are required to configure a cluster in secure mode to the system from where you plan to install and configure VCS. See "Preparing the installation system for the security infrastructure" on page 35.	VCS administrator

Installing the root broker for the security infrastructure

Install the root broker only if you plan to use AT to configure the cluster in secure mode. The root broker administrator must install and configure the root broker before you configure the Authentication Service for VCS. Symantec recommends that you install the root broker on a stable system that is outside the cluster.

You can install the root broker on an AIX, HP-UX, Linux, or Solaris system.

See Symantec Product Authentication Service documentation for more information.

See "About Symantec Product Authentication Service (AT)" on page 19.

To install the root broker

1. Change to the directory where you can start the Veritas product installer:

```
# ./installer
```

2. From the opening Selection Menu, choose: I for "Install/Upgrade a Product."
3. From the displayed list of products to install, choose: Symantec Product Authentication Service.
4. To install the root broker, select the mode of AT installation as root mode from the three choices that the installer presents:

```
1)Root+AB Mode
2)Root Mode
3)AB Mode

Enter the mode which you would like AT installed? [1-3,q] 2
```

5. Enter the name of the system where you want to install the root broker.

```
Enter the system name on which to install AT: venus
```

6. Review the output as the installer does the following:
   - Checks to make sure that VCS supports the operating system
   - Checks if the system is already configured for security
7. Review the output as the installer checks for the installed depots on the system.

   The installer lists the depots that the program is about to install on the system. Press Enter to continue.
8. Review the output as the installer installs the root broker on the system.

9 Enter **y** when the installer prompts you to configure the Symantec Product Authentication Service.

10 Press the Enter key to start the Authentication Server processes.

```
Do you want to start Symantec Product Authentication Service
processes now? [y,n,q] y
```

11 Enter an encryption key. Make sure that you enter a minimum of five characters.

You must use this encrypted key with the `-enckeyfile` option when you use the `-responsefile` option for installation.

12 Press Enter to continue and review the output as the installer displays the location of the installation log files, summary file, and the response file.

Creating authentication broker accounts on root broker system

On the root broker system, the administrator must create an authentication broker (AB) account for each node in the cluster.

To create authentication broker accounts on root broker system

1 Determine the root broker domain name. Enter the following command on the root broker system:

```
venus> # vssat showalltrustedcreds
```

For example, the domain name resembles "Domain Name: root@venus.symantecexample.com" in the output.

2 For each node in the cluster, verify whether an account exists on the root broker system.

For example, to verify that an account exists for node galaxy:

```
venus> # vssat showprpl --pdrtype root \
--domain root@venus.symantecexample.com --prplname galaxy
```

- If the output displays the principal account on root broker for the authentication broker on the node, then delete the existing principal accounts. For example:

```
venus> # vssat deleteprpl --pdrtype root \
--domain root@venus.symantecexample.com \
--prplname galaxy --silent
```

- If the output displays the following error, then the account for the given authentication broker is not created on this root broker:

  ```
  "Failed To Get Attributes For Principal"
  ```

  Proceed to step 3.

3 Create a principal account for each authentication broker in the cluster. For example:

```
venus> # vssat addprpl --pdrtype root --domain \
root@venus.symantecexample.com --prplname galaxy \
--password password --prpltype service
```

You must use this password that you create in the input file for the encrypted file.

Creating encrypted files for the security infrastructure

Create encrypted files (BLOB files) only if you plan to choose the semiautomatic mode that uses an encrypted file to configure the Authentication Service. The administrator must create the encrypted files on the root broker node. The administrator must create encrypted files for each node that is going to be a part of the cluster before you configure the Authentication Service for VCS.

To create encrypted files

1 Make a note of the following root broker information. This information is required for the input file for the encrypted file:

hash	The value of the root hash string, which consists of 40 characters. Execute the following command to find this value: `venus> # vssat showbrokerhash`
root_domain	The value for the domain name of the root broker system. Execute the following command to find this value: `venus> # vssat showalltrustedcreds`

2 Make a note of the following authentication broker information for each node. This information is required for the input file for the encrypted file:

identity	The value for the authentication broker identity, which you provided to create authentication broker principal on the root broker system. This is the value for the **--prplname** option of the `addprpl` command. See "Creating authentication broker accounts on root broker system" on page 32.
password	The value for the authentication broker password, which you provided to create authentication broker principal on the root broker system. This is the value for the **--password** option of the `addprpl` command. See "Creating authentication broker accounts on root broker system" on page 32.
broker_admin_password	The value for the authentication broker password for Administrator account on the node. This password must be at least five characters.

3 For each node in the cluster, create the input file for the encrypted file.

The installer presents the format of the input file for the encrypted file when you proceed to configure the Authentication Service using encrypted file. For example, the input file for authentication broker on galaxy resembles:

```
[setuptrust]
broker=venus.symantecexample.com
hash=758a33dbd6fae751630058ace3dedb54e562fe98
securitylevel=high

[configab]
identity=galaxy
password=password
root_domain=vx:root@venus.symantecexample.com
root_broker=venus.symantecexample.com:2821
broker_admin_password=ab_admin_password
start_broker=false
enable_pbx=false
```

4 Back up these input files that you created for the authentication broker on each node in the cluster.

Note that for security purposes, the command to create the output file for the encrypted file deletes the input file.

5 For each node in the cluster, create the output file for the encrypted file from the root broker system using the following command.

```
RootBroker> # vssat createpkg \
--in /path/to/blob/input/file.txt \
--out /path/to/encrypted/blob/file.txt \
--host_ctx AB-hostname
```

For example:

```
venus> # vssat createpkg --in /tmp/galaxy.blob.in \
--out /tmp/galaxy.blob.out --host_ctx galaxy
```

Note that this command creates an encrypted file even if you provide wrong password for "password=" entry. But such an encrypted file with wrong password fails to install on authentication broker node.

6 After you complete creating the output files for the encrypted file, you must copy these files to the installer node.

Preparing the installation system for the security infrastructure

The VCS administrator must gather the required information and prepare the installation system to configure a cluster in secure mode.

To prepare the installation system for the security infrastructure

- Depending on the configuration mode you decided to use, do one of the following:

Automatic mode	Do the following: ■ Gather the root broker system name from the AT administrator. ■ During VCS configuration, choose the configuration option 1 when the installvcs program prompts.
Semi-automatic mode	Do the following: ■ Copy the encrypted files (BLOB files) to the system from where you plan to install VCS. Note the path of these files that you copied to the installation system. ■ During VCS configuration, choose the configuration option 2 when the installvcs program prompts.

Manual mode

Do the following:

- Copy the root_hash file that you fetched to the system from where you plan to install VCS.
  Note the path of the root hash file that you copied to the installation system.
- Gather the root broker information such as name, fully qualified domain name, domain, and port from the AT administrator.
- Note the principal name and password information for each authentication broker that you provided to the AT administrator to create the authentication broker accounts.
- During VCS configuration, choose the configuration option 3 when the installvcs program prompts.

Performing preinstallation tasks

Table 3-2 lists the tasks you must perform before proceeding to install VCS.

Table 3-2 Preinstallation tasks

Task	Reference
Obtain license keys.	See "Obtaining VCS license keys" on page 37.
Set up the private network.	See "Setting up the private network" on page 38.
Enable communication between systems.	See "Setting up inter-system communication" on page 39.
Set up ssh on cluster systems.	See "Setting up ssh on cluster systems" on page 40.
Set up shared storage for I/O fencing (optional)	See "Setting up shared storage" on page 41.
Set the PATH and the MANPATH variables.	See "Setting the PATH variable" on page 46. See "Setting the MANPATH variable" on page 46.
Review basic instructions to optimize LLT media speeds.	See "Optimizing LLT media speed settings on private NICs" on page 46.

Table 3-2 Preinstallation tasks *(continued)*

Task	Reference
Review guidelines to help you set the LLT interconnects.	See "Guidelines for setting the media speed of the LLT interconnects" on page 47.
Mount the product disc	See "Mounting the product disc" on page 47.
Verify the systems before installation	See "Performing automated pre-installation check" on page 48.

Obtaining VCS license keys

This product includes a License Key certificate. The certificate specifies the product keys and the number of product licenses purchased. A single key lets you install the product on the number and type of systems for which you purchased the license. A key may enable the operation of more products than are specified on the certificate. However, you are legally limited to the number of product licenses purchased. The product installation procedure describes how to activate the key.

To register and receive a software license key, go to the Symantec Licensing Portal at the following location:

https://licensing.symantec.com

Make sure you have your Software Product License document. You need information in this document to retrieve and manage license keys for your Symantec product. After you receive the license key, you can install the product.

Click the Help link at this site to access the *License Portal User Guide* and FAQ.

The VRTSvlic package enables product licensing. After the VRTSvlic is installed, the following commands and their manual pages are available on the system:

vxlicinst	Installs a license key for a Symantec product
vxlicrep	Displays currently installed licenses
vxlictest	Retrieves the features and their descriptions that are encoded in a license key

You can only install the Symantec software products for which you have purchased a license. The enclosed software discs might include other products for which you have not purchased a license.

Setting up the private network

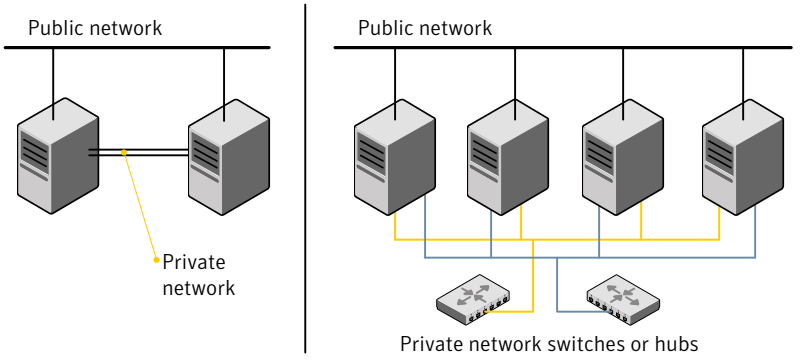
VCS requires you to set up a private network between the systems that form a cluster. You can use either NICs or aggregated interfaces to set up private network.

You can use network switches instead of hubs.

Refer to the *Veritas Cluster Server Administrator's Guide* to review VCS performance considerations.

Figure 3-2 shows two private networks for use with VCS.

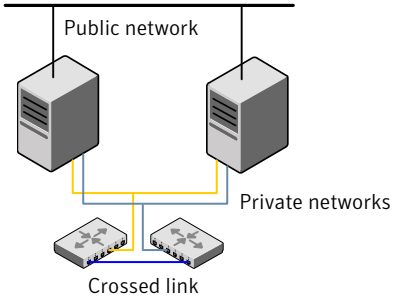
Figure 3-2 Private network setups: two-node and four-node clusters



Symantec recommends configuring two independent networks between the cluster nodes with a network switch for each network. You can also connect the two switches at layer 2 for advanced failure protection. Such connections for LLT at layer 2 are called cross-links.

Figure 3-3 shows a private network configuration with crossed links between the network switches.

Figure 3-3 Private network setup with crossed links



To set up the private network

1 Install the required network interface cards (NICs).

Create aggregated interfaces if you want to use these to set up private network.

2 Connect the VCS private NICs on each system.

3 Use crossover Ethernet cables, switches, or independent hubs for each VCS communication network. Note that the crossover Ethernet cables are supported only on two systems.

Ensure that you meet the following requirements:

- The power to the switches or hubs must come from separate sources.
- On each system, you must use two independent network cards to provide redundancy.
- The network interface card to set up private interface is not part of any aggregated interface.

During the process of setting up heartbeat connections, consider a case where a failure removes all communications between the systems.

Note that a chance for data corruption exists under the following conditions:

- The systems still run, and
- The systems can access the shared storage.

4 Test the network connections. Temporarily assign network addresses and use `telnet` or `ping` to verify communications.

LLT uses its own protocol, and does not use TCP/IP. So, you must ensure that the private network connections are used only for LLT communication and not for TCP/IP traffic. To verify this requirement, unplumb and unconfigure any temporary IP addresses that are configured on the network interfaces.

The installvcs program configures the private network in the cluster during installation.

See "About installing and configuring VCS" on page 49.

More information about configuring LLT for the private network links is in the manual installation chapter.

See "About VCS manual installation" on page 89.

Setting up inter-system communication

When you install VCS using the installvcs program, to install and configure the entire cluster at one time, make sure that communication between systems exists.

By default the installer uses ssh. You must grant root privileges for the system where you run installvcs program. This privilege facilitates to issue ssh or remsh commands on all systems in the cluster. If ssh is used to communicate between systems, it must be configured in a way such that it operates without requests for passwords or passphrases. Similarly, remsh must be configured in such a way to not prompt for passwords.

If system communication is not possible between systems using ssh or remsh, you have recourse.

See "Installing VCS with a response file where ssh or rsh are disabled" on page 203.

See "About VCS manual installation" on page 89.

Setting up ssh on cluster systems

Use the Secure Shell (ssh) to install VCS on all systems in a cluster from a system outside of the cluster. Before you start the installation process, verify that ssh is configured correctly.

Use Secure Shell (ssh) to do the following:

- Log on to another system over a network
- Execute commands on a remote system
- Copy files from one system to another

The ssh shell provides strong authentication and secure communications over channels. It is intended to replace rlogin, remsh, and rcp.

Configuring ssh

The procedure to configure ssh uses OpenSSH example file names and commands.

Note: You can configure ssh in other ways. Regardless of how ssh is configured, complete the last step in the example to verify the configuration.

To configure ssh

1. Log on to the system from which you want to install VCS.
2. Generate a DSA key pair on this system by running the following command:

   ```
   # ssh-keygen -t dsa
   ```

3. Accept the default location of ~/.ssh/id_dsa.
4. When the command prompts, enter a passphrase and confirm it.

5 Change the permissions of the .ssh directory by typing:

```
# chmod 755 ~/.ssh
```

6 The file ~/.ssh/id_dsa.pub contains a line that begins with ssh_dss and ends with the name of the system on which it was created. Copy this line to the /.ssh/authorized_keys file on all systems where you plan to installVCS.

If the local system is part of the cluster, make sure to edit the authorized_keys file on that system.

7 Run the following commands on the system where you are installing:

```
# exec /usr/bin/ssh-agent $SHELL
# ssh-add
```

This step is shell-specific and is valid for the duration the shell is alive.

8 When the command prompts, enter your DSA passphrase.

You are ready to install VCS on several systems in one of the following ways:

- Run the installvcs program on any one of the systems
- Run the installvcs program on an independent system outside the cluster

9 To verify that you can connect to the systems where you plan to install VCS, type:

```
# ssh -x -l root north ls
# ssh -x -l root south ifconfig lan0
```

The commands should execute on the remote system without having to enter a passphrase or password.

Setting up shared storage

The following sections describe how to set up the SCSI and the Fiber Channel devices that the cluster systems share. For VCS I/O fencing, the data disks must support SCSI-3 persistent reservations. You need to configure a coordinator disk group that supports SCSI-3 PR and verify that it works.

See "About setting up I/O fencing" on page 103.

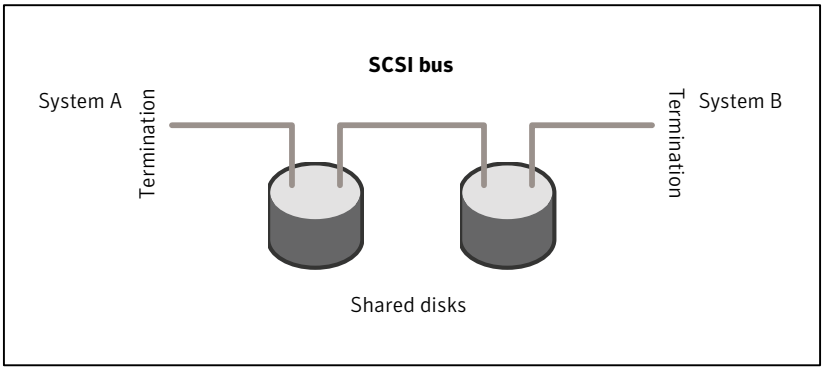
See also the *Veritas Cluster Server User's Guide* for a description of I/O fencing.

Setting up shared storage: SCSI

Perform the following steps to set up shared storage.

Figure 3-4 shows how to cable systems for shared storage.

Figure 3-4 Cabling the shared storage



To set up shared storage

1. Shut down the systems in the cluster.
2. Install the required SCSI host bus adapters and set up the external shared SCSI storage devices.
3. Cable the external shared storage devices. With cables connected to shared storage between two systems, you must terminate the two ends of the SCSI bus on the systems. as shown in the figure.

   For more than two systems, disable SCSI termination on the systems that are not positioned at the ends of the SCSI chain.

Checking and changing SCSI Initiator IDs

The SCSI Initiator IDs for the host bus adapters (HBAs) on each of the systems that access the shared storage must be unique. So, you may have to change the HBA SCSI ID on one or more systems if these IDs are the same. Typically, the host bust adapters (HBAs) for the SCSI devices are shipped with a default SCSI ID of 7. Use the following procedure to check SCSI IDs and change them if necessary.

To check and change SCSI initiator IDs

1 Turn on the power of the first system. During the boot process, the system delays for ten seconds, giving you the opportunity to stop the boot process and enter the boot menu:

```
To discontinue, press any key within 10 seconds.
```

Press any key. The boot process discontinues.

```
Boot terminated.
```

2 When you see the boot Main Menu, display the Information Menu by entering:

```
Main Menu: enter command or menu > in
```

3 From the Information Menu, enter "io" at the prompt for I/O interface information:

```
Information Menu: Enter command > io
```

The output shows information about the I/O interfaces and resembles:

```
Path       Bus     Slot    Vendor   Device
  Description      (dec)      #      #          Id           Id
  -----------      ----       ---    -----      ------     ------
  .
  .
  SCSI bus cntlr   0/3/0/0   24     10         0x1000     0xf
  .
```

4 Return to the Main Menu:

```
Information Menu: Enter command > main
```

5 Go the Service Menu:

```
Main Menu: enter command or menu > ser
```

6 Display the host bus adapter's SCSI ID:

```
Service Menu: enter command or menu > scsi
```

The output displays information about the SCSI devices:

```
 Path (dec)         Initiator  ID    SCSI Rate    Auto Term
--------------   ------------       ---------    ---------
0/3/0/0          7                  Fast         Unknown
```

The output in this example shows the SCSI ID is 7, the preset default for the HBA as shipped.

- If you choose, you can leave the ID set at 7 and return to the Main Menu:

```
Service Menu: enter command or menu > main
```

- You can change the SCSI ID for the HBA. For example, to change the SCSI ID from 7 to 6, you would enter:

```
Service Menu: Enter command > SCSI init 0/3/0/0 6
FAST
```

- To verity the change, enter "SCSI" at the prompt:

```
Service Menu: Enter command > SCSI

Path (dec)    Initiator ID   SCSI Rate   Auto

Term
--------------   ------------ ---------
0/3/0/0      6              Fast         Unknown
```

7 Return to the Main Menu:

```
Service Menu: enter command or menu > main
```

8 At the Main Menu, enter the command to boot the system. Answer "n" when you are prompted to interact with IPL:

```
Menu: Enter command or menu > boot
Interact with IPL (Y, N, or Cancel)?> n

Booting...
```

Setting up shared storage: Fiber Channel

Perform the following steps to set up fiber channel.

To set up fiber channel shared storage

1. Shut down the cluster systems that must share the devices.
2. Install the required Fiber Channel host bus adapters on each system.
3. Cable the shared devices.
4. Reboot each system.
5. Verify that each system can see all shared devices. Use the command:

```
# ioscan
-fnC disk
```

Where "disk" is the class of devices to be shared. For example, from a system galaxy type:

```
northhp# ioscan -fnC disk
Class  I  H/W Path     Driver S/W State   H/W Type  Description
===================================================================
.
.
disk      4  0/4/0/0.1.16.255.13.4.0  sdisk  CLAIMED     DEVICE
SEAGATE ST318304 CLAR18
                /dev/dsk/c4t4d0   /dev/rdsk/c4t4d0
disk      5  0/4/0/0.1.16.255.13.5.0  sdisk  CLAIMED     DEVICE
SEAGATE ST318304 CLAR18
                  /dev/dsk/c4t5d0   /dev/rdsk/c4t5d0
.
.
```

And on another system, nebula, enter:

```
south# ioscan -fnC disk
Class  I  H/W Path     Driver S/W State   H/W Type  Description
===================================================================
.
.
disk      4  0/4/0/0.1.16.255.13.4.0  sdisk  CLAIMED     DEVICE
SEAGATE ST318304 CLAR18
                  /dev/dsk/c4t4d0   /dev/rdsk/c4t4d0
disk      5  0/4/0/0.1.16.255.13.5.0  sdisk  CLAIMED     DEVICE
   SEAGATE ST318304 CLAR18
                  /dev/dsk/c4t5d0   /dev/rdsk/c4t5d0
.
.
```

Setting the PATH variable

Installation commands as well as other commands reside in the /sbin, /usr/sbin, /opt/VRTS/bin, and /opt/VRTSvcs/bin directories. Add these directories to your PATH environment variable.

To set the PATH variable

- Do one of the following:
  - For the Bourne Shell (sh or ksh), type:

```
$ PATH=/usr/sbin:/sbin:/opt/VRTS/bin:/opt/VRTSvcs/bin:\
$PATH; export PATH
```

  - For the C Shell (csh or tcsh), type:

```
% setenv PATH /usr/sbin:/sbin:/opt/VRTS/bin:\
/opt/VRTSvcs/bin:$PATH
```

Setting the MANPATH variable

Set the MANPATH variable to view the manual pages.

To set the MANPATH variable

- Do one of the following:
  - For the Bourne Shell (sh or ksh), type:

```
$ MANPATH=/usr/share/man:/opt/VRTS/man; export MANPATH
```

  - For the C Shell (csh or tcsh), type:

```
% setenv MANPATH /usr/share/man:/opt/VRTS/man
```

Optimizing LLT media speed settings on private NICs

For optimal LLT communication among the cluster nodes, the interface cards on each node must use the same media speed settings. Also, the settings for the switches or the hubs that are used for the LLT interconnections must match that of the interface cards. Incorrect settings can cause poor network performance or even network failure.

Guidelines for setting the media speed of the LLT interconnects

Review the following guidelines for setting the media speed of the LLT interconnects:

- Symantec recommends that you manually set the same media speed setting on each Ethernet card on each node.
- If you have hubs or switches for LLT interconnects, then set the hub or switch port to the same setting as used on the cards on each node.
- If you use directly connected Ethernet links (using crossover cables), set the media speed to the highest value common to both cards, typically 100_Full_Duplex.
- Symantec does not recommend using dissimilar network cards for private links.

Details for setting the media speeds for specific devices are outside of the scope of this manual. Consult the device's documentation for more information.

Mounting the product disc

You must have superuser (root) privileges to load the VCS software.

To mount the product disc

1. Log in as superuser on a system where you want to install VCS.

   The system from which you install VCS need not be part of the cluster. The systems must be in the same subnet.

2. Insert the product disc in the appropriate drive on your local system.

3. Determine the block device file for the DVD drive:

   ```
   # ioscan -fnC disk
   ```

   Make a note of the device file as it applies to your system.

4. Create a directory in which to mount the software disc and mount the disc using the appropriate drive name. For example:

   ```
   # mkdir -p /dvdrom
   # mount /dev/rdsk/c0t0d0 /dvdrom
   ```

5 Verify that the disc is mounted:

```
# mount
```

Performing automated pre-installation check

Before you begin the installation of VCS software, you can check the readiness of the systems where you plan to install VCS. The command to start the pre-installation check is:

```
installvcs -precheck system1 system2 ...
```

You can also use the Veritas Installation Assessment Service utility for a detailed assessment of your setup.

See "Veritas Installation Assessment Service" on page 17.

To check the systems

1 Navigate to the folder that contains the installvcs program.

```
# cd /dvdrom/cluster_server
```

2 Start the pre-installation check:

```
# ./installvcs -precheck galaxy nebula
```

The program proceeds in a noninteractive mode to examine the systems for licenses, depots, disk space, and system-to-system communications.

3 Review the output as the program displays the results of the check and saves the results of the check in a log file.

Chapter 4

Installing and configuring VCS

This chapter includes the following topics:

About installing and configuring VCS

You can install Veritas Cluster Server on clusters of up to 32 systems. You can install VCS using one of the following:

Veritas product installer	Use the product installer to install multiple Veritas products.
installvcs program	Use this to install just VCS.

The Veritas product installer and the installvcs program use ssh to install by default. Refer to the *Getting Started Guide* for more information.

Getting your VCS installation and configuration information ready

The VCS installation and configuration program prompts you for information about certain VCS components.

When you perform the installation, prepare the following information:

- To install VCS depots you need:

The system names where you plan to install VCS	Example: **galaxy**, **nebula**
The required license keys	Depending on the type of installation, keys include: ■ A valid site license key ■ A valid demo license key ■ A valid license key for VCS global clusters See "Obtaining VCS license keys" on page 37.
To decide whether to install: ■ the required VCS depots ■ all the VCS depots	Install only the required depots if you do not want to configure any optional components or features. The default option is to install all depots. See "Optional VCS depots" on page 52.

- To configure Veritas Cluster Server you need:

A name for the cluster	The cluster name must begin with a letter of the alphabet. The cluster name can contain only the characters "a" through "z", "A" through "Z", the numbers "0" through "9", the hyphen "-", and the underscore "_". Example: **vcs_cluster27**
A unique ID number for the cluster	A number in the range of 0-65535. Within the site that contains the cluster, each cluster must have a unique ID. Example: **7**
The device names of the NICs that the private networks use among systems	A network interface card that is not part of any aggregated interface, or an aggregated interface. Do not use the network interface card that is used for the public network, which is typically lan0. Example: **lan1, lan2**

- To configure VCS clusters in secure mode (optional), you need:

For automatic mode (default)	■ The name of the Root Broker system Example: `east` See "About Symantec Product Authentication Service (AT)" on page 19. ■ Access to the Root Broker system without use of a password.
For semiautomatic mode using encrypted files	The path for the encrypted files that you get from the Root Broker administrator. See "Creating encrypted files for the security infrastructure" on page 33.
For semiautomatic mode without using encrypted files	■ The fully-qualified hostname (FQDN) of the Root Broker . (e.g. east.symantecexample.com) The given example puts a system in the (DNS) domain symantecexample.com with the unqualified hostname east, which is designated as the Root Broker. ■ The root broker's security domain (e.g. **`root@east.symantecexample.com`**) ■ The root broker's port (e.g. **`2821`**) ■ The path to the local root hash (e.g. **`/var/tmp/privatedir/root_hash`**) ■ The authentication broker's principal name on each cluster node (e.g. **`galaxy.symantecexample.com`** and **`nebula.symantecexample.com`**)

- To add VCS users, which is not required if you configure your cluster in secure mode, you need:

User names	VCS usernames are restricted to 1024 characters. Example: **`smith`**
User passwords	VCS passwords are restricted to 255 characters. Enter the password at the prompt.
To decide user privileges	Users have three levels of privileges: A=Administrator, O=Operator, or G=Guest. Example: **`A`**

- To configure SMTP email notification (optional), you need:

The domain-based address of the SMTP server	The SMTP server sends notification emails about the events within the cluster. Example: **smtp.symantecexample.com**
The email address of each SMTP recipient to be notified	Example: **john@symantecexample.com**
To decide the minimum severity of events for SMTP email notification	Events have four levels of severity: I=Information, W=Warning, E=Error, and S=SevereError. Example: **E**

- To configure SNMP trap notification (optional), you need:

The port number for the SNMP trap daemon	The default port number is 162.
The system name for each SNMP console	Example: **saturn**
To decide the minimum severity of events for SNMP trap notification	Events have four levels of severity: I=Information, W=Warning, E=Error, and S=SevereError. Example: **E**

- To configure global clusters (optional), you need:

The name of the public NIC	You must specify appropriate values for the NIC. Example: **lan0**
The virtual IP address of the NIC	You must specify appropriate values for the virtual IP address. Example: **192.168.1.16**
The netmask for the virtual IP address	You must specify appropriate values for the netmask. Example: **255.255.240.0**
The NetworkHosts IP addresses	You must specify appropriate values for the NetworkHosts IP address. Example: **192.168.1.15**

Optional VCS depots

The optional VCS depots include the following packages:

- VRTScssim — VCS Simulator
- VRTScscm — Veritas Cluster Server Cluster Manager
- VRTSvcsmn — Manual pages for VCS commands

About the VCS installation program

You can access the installvcs program from the command line or through the Veritas product installer.

The VCS installation program is interactive and manages the following tasks:

- Licensing VCS
- Installing VCS depots on multiple cluster systems
- Configuring VCS, by creating several detailed configuration files on each system
- Starting VCS processes

You can choose to configure different optional features, such as the following:

- SNMP and SMTP notification
- The Symantec Product Authentication Services feature
- The wide area Global Cluster feature

Review the highlights of the information for which installvcs program prompts you as you proceed to configure.

See "About preparing to install VCS" on page 27.

The uninstallvcs program, a companion to installvcs program, uninstalls VCS depots.

See "About the uninstallvcs program" on page 181.

Optional features of the installvcs program

Table 4-1 specifies the optional actions that the installvcs program can perform.

Table 4-1 installvcs optional features

Optional action	Reference
Check the systems to verify that they meet the requirements to install VCS.	See "Performing automated pre-installation check" on page 48.

Table 4-1 installvcs optional features *(continued)*

Optional action	Reference
Install VCS depots without configuring VCS.	See "Installing VCS using installonly option" on page 58.
Configure or reconfigure VCS when VCS depots are already installed.	See "Configuring VCS using configure option" on page 58.
Perform secure installations using the values that are stored in a configuration file.	See "Installing VCS with a response file where ssh or rsh are disabled" on page 203.
Perform automated installations using the values that are stored in a configuration file.	See "Performing automated VCS installations" on page 195.

Interacting with the installvcs program

As you run the program, you are prompted to answer yes or no questions. A set of responses that resemble **[y, n, q, ?] (y)** typically follow these questions. The response within parentheses is the default, which you can select by pressing the Enter key. Enter the **?** character to get help to answer the prompt. Enter **q** to quit the installation.

Installation of VCS depots takes place only after you have confirmed the information. However, you must remove the partially installed VCS files before you run the installvcs program again.

See "About the uninstallvcs program" on page 181.

During the installation, the installer prompts you to type information. The installer expects your responses to be within a certain range or in a specific format. The installer provides examples. If you are prompted to enter an item from a list, enter your selection exactly as it is shown in the list.

The installer also prompts you to answer a series of questions that are related to a configuration activity. For such questions, you can enter the **b** character to return to the first prompt in the series. When the installer displays a set of information items you have entered, you are prompted to confirm it. If you answer **n**, the program lets you reenter all of the information for the set.

You can install the VCS Java Console on a single system, which is not required to be part of the cluster. Note that the installvcs program does not install the VCS Java Console.

See "Installing the Java Console" on page 83.

About installvcs program command options

In addition to the `-precheck`, `-responsefile`, `-installonly`, and `-configure` options, the installvcs program has other useful options.

The `installvcs` command usage takes the following form:

```
installvcs [ system1 system2... ] [ options ]
```

Table 4-2 lists the installvcs command options.

Table 4-2 installvcs options

Option and Syntax	Description
`-configure`	Configure VCS after using `-installonly` option to install VCS. See "Configuring VCS using configure option" on page 58.
`-enckeyfile` *encryption_key_file*	See the `-responsefile` and the `-encrypt` options.
`-encrypt` *password*	Encrypt password using the encryption key that is provided with the `-enckeyfile` option so that the encrypted password can be stored in response files.
`-hostfile`	Specifies the location of a file that contains the system names for the installer.
`-installonly`	Install product depots on systems without configuring VCS. See "Installing VCS using installonly option" on page 58.
`-installpkgs`	Display VCS packages in correct installation order. Output can be used to create scripts for command line installs, or for installations over a network. See the `requiredpkgs` option.
`-keyfile` *ssh_key_file*	Specifies a key file for SSH. The option passes `-i` *ssh_key_file* with each SSH invocation.
`-license`	Register or update product licenses on the specified systems. Useful for replacing demo license.
`-logpath` *log_path*	Specifies that log_path, not /opt/VRTS/install/logs, is the location where installvcs log files, summary file, and response file are saved.

Table 4-2 installvcs options *(continued)*

Option and Syntax	Description
`-noextrapkgs`	Specifies that additional product depots such as VxVM and VxFS need not be installed. **Note:** VCS product upgrades in the future can be simplified if you do not install additional product depots.
`-nolic`	Install product depots on systems without licensing or configuration. License-based features or variants are not installed when using this option.
`-nooptionalpkgs`	Specifies that the optional product depots such as man pages and documentation need not be installed.
`-nostart`	Bypass starting VCS after completing installation and configuration.
`-patchpath` *`patch_path`*	Specifies that patch_path contains all patches that the installvcs program is about to install on all systems. The patch_path is the complete path of a directory. **Note:** You can use this option when you download recent versions of patches.
`-pkgpath` *`pkg_path`*	Specifies that pkg_path contains all depots that the installvcs program is about to install on all systems. The pkg_path is the complete path of a directory, usually NFS mounted.
`-precheck`	Verify that systems meet the installation requirements before proceeding with VCS installation. Symantec recommends doing a precheck before installing VCS. See "Performing automated pre-installation check" on page 48.
`-requiredpkgs`	Displays all required VCS packages in correct installation order. Optional packages are not listed. Output can be used to create scripts for command line installs, or for installations over a network. See `installpkgs` option.

Table 4-2 installvcs options *(continued)*

Option and Syntax	Description
`-responsefile` *response_file* [`-enckeyfile` *encryption_key_file*]	Perform automated VCS installation using the system and the configuration information that is stored in a specified file instead of prompting for information. The response_file must be a full path name. If not specified, the response file is automatically generated as installerernumber.response where number is random. You must edit the response file to use it for subsequent installations. Variable field definitions are defined within the file. The `-enckeyfile` option and encryption_key_file name are required with the `-responsefile` option when the response file contains encrypted passwords. See "Installing VCS with a response file where ssh or rsh are disabled" on page 203. See "Performing automated VCS installations" on page 195.
`-rootpath` *root_path*	Specifies that root_path is the root location for the installation of all depots. On HP-UX, `-rootpath` passes `-I` root_path to swinstall command.
`-rsh`	Specifies that *remsh* and `rcp` are to be used for communication between systems instead of ssh and `scp`. This option requires that systems be preconfigured such that *remsh* commands between systems execute without prompting for passwords or confirmations
`-security`	Enable or disable Symantec Product Authentication Service in a VCS cluster that is running. Install and configure Root Broker for Symantec Product Authentication Service. See "About Symantec Product Authentication Service (AT)" on page 19.
`-serial`	Performs the installation, uninstallation, start, and stop operations on the systems in a serial fashion. By default, the installer performs these operations simultaneously on all the systems.
`-timeout`	Specifies the timeout value (in seconds) for each command that the installer issues during the installation. The default timeout value is set to 600 seconds.

Table 4-2 installvcs options *(continued)*

Option and Syntax	Description
`-tmppath` *tmp_path*	Specifies that tmp_path is the working directory for installvcs program. This path is different from the /var/tmp path. This destination is where initial logging is performed and where depots are copied on remote systems before installation.
`-verbose`	Displays the details when the installer installs the depots. By default, the installer displays only a progress bar during the depots installation.

Installing VCS using installonly option

In certain situations, users may choose to install the VCS depots on a system before they are ready for cluster configuration. During such situations, the `installvcs -installonly` option can be used. The installation program licenses and installs VCS depots on the systems that you enter without creating any VCS configuration files.

Configuring VCS using configure option

If you installed VCS and did not choose to configure VCS immediately, use the `installvcs -configure` option. You can configure VCS when you are ready for cluster configuration. The installvcs program prompts for cluster information, and creates VCS configuration files without performing installation.

See "Configuring the basic cluster" on page 65.

The `-configure` option can be used to reconfigure a VCS cluster. VCS must not be running on systems when this reconfiguration is performed.

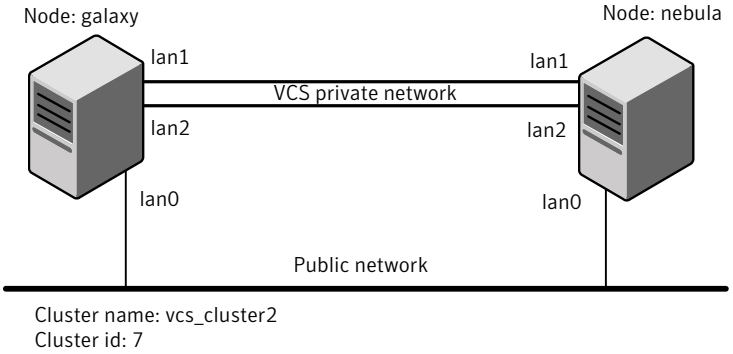
If you manually edited the main.cf file, you need to reformat the main.cf file.

Installing and configuring VCS 5.0.1

The example installation demonstrates how to install VCS on two systems: galaxy and nebula. The example installation chooses to install all VCS depots and configures all optional features. For this example, the cluster's name is vcs_cluster2 and the cluster's ID is 7.

Figure 4-1 illustrates the systems on which you would install and run VCS.

Figure 4-1 An example of a VCS installation on a two-node cluster



Overview of tasks

Table 4-3 lists the installation and the configuration tasks.

Table 4-3 Installation and configuration tasks

Task	Reference
License and install VCS	■ See "Starting the software installation" on page 60. ■ See "Specifying systems for installation" on page 61. ■ See "Licensing VCS" on page 62. ■ See "Choosing VCS depots for installation" on page 62. ■ See "Choosing to install VCS depots or configure VCS" on page 63. ■ See "Installing VCS depots" on page 73.
Configure the cluster and its features	■ See "Starting the software configuration" on page 64. ■ See "Specifying systems for configuration" on page 64. ■ See "Configuring the basic cluster" on page 65. ■ See "Adding VCS users" on page 68. (optional) ■ See "Configuring SMTP email notification" on page 69. (optional) ■ See "Configuring SNMP trap notification" on page 71. (optional) ■ See "Configuring global clusters" on page 72. (optional)
Create configuration files	See "Creating VCS configuration files" on page 74.

Table 4-3 Installation and configuration tasks *(continued)*

Task	Reference
Start VCS and its components	■ See "Starting VCS" on page 74. ■ See "Completing the installation" on page 75.
For clusters that run in secure mode, enable LDAP authentication plug-in if VCS users belong to LDAP domain.	■ See "About enabling LDAP authentication for clusters that run in secure mode" on page 75.
Perform the post-installation tasks	■ See "About configuring VCS clusters for data integrity" on page 101. ■ See "Installing the Java Console" on page 83.
Verify the cluster	See "Verifying the cluster after installation" on page 86.

Starting the software installation

You can install VCS using the Veritas product installer or the installvcs program.

To install VCS using the product installer

1. Confirm that you are logged in as the superuser and mounted the product disc.
2. Start the installer.

   ```
   # ./installer
   ```

   The installer starts the product installation program with a copyright message and specifies the directory where the logs are created.
3. From the opening Selection Menu, choose: I for "Install/Upgrade a Product."
4. From the displayed list of products to install, choose: Veritas Cluster Server.

To install VCS using the installvcs program

1 Confirm that you are logged in as the superuser and mounted the product disc.

2 Navigate to the folder that contains the installvcs program.

```
# cd /dvdrom/cluster_server
```

3 Start the installvcs program.

```
# ./installvcs [-rsh]
```

The installer begins with a copyright message and specifies the directory where the logs are created.

Specifying systems for installation

The installer prompts for the system names on which you want to install and then performs an initial system check.

To specify system names for installation

1 Enter the names of the systems where you want to install VCS.

```
Enter the system names separated by spaces on which to install
VCS: galaxy nebula
```

For a single node installation, enter one name for the system.

See "Creating a single-node cluster using the installer program" on page 171.

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

The installer does the following:

- 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.
- Makes sure the systems use the proper operating system
- Checks whether a previous version of VCS is installed
  If a previous version of VCS is installed, the installer provides an option to upgrade to VCS 5.0.1.

Licensing VCS

The installer checks whether VCS license keys are currently in place on each system. If license keys are not installed, the installer prompts you for the license keys.

See "Checking licensing information on the system" on page 86.

To license VCS

1. Review the output as the utility checks system licensing and installs the licensing depot.
2. Enter the license key for Veritas Cluster Server as the installer prompts for each node.

```
Enter a VCS license key for galaxy: [?] XXXX-XXXX-XXXX-XXXX-XXX
XXXX-XXXX-XXXX-XXXX-XXX successfully registered on galaxy
VCS license registered on galaxy
```

3. Enter keys for additional product features.

```
Do you want to enter another license key for galaxy? [y,n,q,?]
(n) y

Enter a VCS license key for galaxy: [?] XXXX-XXXX-XXXX-XXXX-XXX
XXXX-XXXX-XXXX-XXXX-XXX successfully registered on galaxy

Do you want to enter another license key for galaxy? [y,n,q,?]
(n)
```

4. Review the output as the installer registers the license key on the other nodes. Enter keys for additional product features on the other nodes when the installer prompts you.

```
XXXX-XXXX-XXXX-XXXX-XXX successfully registered on nebula
VCS license registered on nebula

Do you want to enter another license key for nebula? [y,n,q,?]
(n)
```

Choosing VCS depots for installation

The installer verifies for any previously installed depots and then based on your choice installs all the VCS depots or only the required depots.

To install VCS depots

1 Review the output as the installer checks the depots that are already installed.

2 Choose the VCS depots that you want to install.

```
Select the depots to be installed on all systems? [1-2,q,?]
(2) 2
```

Based on what depots you want to install, enter one of the following:

1	Installs only the required VCS depots.
2	Installs all the VCS depots. You must choose this option to configure any optional VCS feature.

3 View the list of depots that the installer would install on each node.

If the current version of a depot is on a system, the installer removes it from the depot installation list for the system.

Choosing to install VCS depots or configure VCS

While you must configure VCS before you can use VCS, you can do one of the following:

- Choose to install and configure VCS now.
  See "Configuring the basic cluster" on page 65.
- Install packages on the systems and leave the cluster configuration steps for later.

To install VCS packages now and configure VCS later

1 If you do not want to configure VCS now, enter n at the prompt.

```
Are you ready to configure VCS? [y,n,q] (y) n
```

The utility checks for the required file system space and makes sure that any processes that are running do not conflict with the installation. If requirements for installation are not met, the utility stops and indicates the actions required to proceed with the process.

2 Review the output as the installer uninstalls any previous versions and installs the VCS 5.0.1 packages.

3 Configure the cluster later.

See "Configuring VCS using configure option" on page 58.

Starting the software configuration

You can configure VCS using the Veritas product installer or the installvcs program.

To configure VCS using the product installer

1. Confirm that you are logged in as the superuser and mounted the product disc.
2. Start the installer.

   ```
   # ./installer
   ```

   The installer starts the product installation program with a copyright message and specifies the directory where the logs are created.
3. From the opening Selection Menu, choose: C for "Configure an Installed Product."
4. From the displayed list of products to configure, choose: Veritas Cluster Server.

To configure VCS using the installvcs program

1. Confirm that you are logged in as the superuser and mounted the product disc.
2. Navigate to the folder that contains the installvcs program.

   ```
   # cd /dvdrom/cluster_server
   ```

3. Start the installvcs program.

   ```
   # ./installvcs -configure
   ```

   The installer begins with a copyright message and specifies the directory where the logs are created.

Specifying systems for configuration

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

To specify system names for installation

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

```
Enter the system names separated by spaces on which to configure
VCS: galaxy nebula
```

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.
- Makes sure the systems use the proper operating system
- Checks whether VCS is installed
- Exits if VCS 5.0.1 is not installed

Configuring the basic cluster

Enter the cluster information when the installer prompts you.

To configure the cluster

1 Review the configuration instructions that the installer presents.

2 Enter the unique cluster name and cluster ID.

```
Enter the unique cluster name: [?] clus1
Enter the unique Cluster ID number between 0-65535: [b,?] 7
```

3 Review the NICs available on the first system as the installer discovers and reports them.

The private heartbeats can either use NIC or aggregated interfaces. To use aggregated interfaces for private heartbeat, enter the name of the aggregated interface. To use a NIC for private heartbeat, enter a NIC which is not part of an aggregated interface.

4 Enter the network interface card details for the private heartbeat links.

You can choose the network interface cards or the aggregated interfaces that the installer discovers.

You must not enter the network interface card that is used for the public network (typically lan0.)

```
Enter the NIC for the first private heartbeat NIC on galaxy:
[b,?] lan1
Would you like to configure a second private heartbeat link?
[y,n,q,b,?] (y)
Enter the NIC for the second private heartbeat NIC on galaxy:
[b,?] lan2
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)
```

5 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 galaxy, make sure the same NICs are available on each system. Then, enter **y** at the prompt.

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.

6 Verify and confirm the information that the installer summarizes.

Configuring the cluster in secure mode

If you want to configure the cluster in secure mode, make sure that you meet the prerequisites for secure cluster configuration.

The installvcs program provides different configuration modes to configure a secure cluster. Make sure that you completed the pre-configuration tasks for the configuration mode that you want to choose.

See "Preparing to configure the clusters in secure mode" on page 27.

To configure the cluster in secure mode

1 Choose whether to configure VCS to use Symantec Product Authentication Service.

```
Would you like to configure VCS to use Symantec Security
Services? [y,n,q] (n) y
```

- If you want to configure the cluster in secure mode, make sure you meet the prerequisites and enter `y`.
- If you do not want to configure the cluster in secure mode, enter `n`.
  You must add VCS users when the configuration program prompts.
  See "Adding VCS users" on page 68.

2 Select one of the options to enable security.

```
Select the Security option you would like to perform [1-3,q,?]
```

Review the following configuration modes. Based on the configuration that you want to use, enter one of the following values:

`Option 1`. Automatic configuration	Enter the name of the Root Broker system when prompted. Requires a remote access to the Root Broker. Review the output as the installer verifies communication with the Root Broker system, checks vxatd process and version, and checks security domain.
`Option 2`. Semiautomatic configuration	Enter the path of the encrypted file (BLOB file) for each node when prompted.

`Option 3`. Manual configuration

Enter the following Root Broker information as the installer prompts you:

```
Enter root Broker name:
east.symantecexample.com
Enter root broker FQDN: [b]
(symantecexample.com)
symantecexample.com
Enter root broker domain: [b]
(root@east.symantecexample.com)
root@east.symantecexample.com
Enter root broker port: [b] (2821) 2821
Enter path to the locally accessible
root hash [b] (/var/tmp/
installvcs-1Lcljr/root_hash)
     /root/root_hash
```

Enter the following Authentication Broker information as the installer prompts you for each node:

```
Enter authentication broker principal name on
galaxy [b]
(galaxy.symantecexample.com)
galaxy.symantecexample.com
Enter authentication broker password on galaxy:
Enter authentication broker principal name on
nebula [b]
(nebula.symantecexample.com)
nebula.symantecexample.com
Enter authentication broker password on nebula:
```

3 After you provide the required information to configure the cluster in secure mode, the program prompts you to configure SMTP email notification.

Note that the installer does not prompt you to add VCS users if you configured the cluster in secure mode. However, you must add VCS users later.

See *Veritas Cluster Server User's Guide* for more information.

Adding VCS users

If you have enabled Symantec Product Authentication Service, 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 want to set the password for the Admin user
(default password='password')? [y,n,q] (n) y

Enter New 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: [?] smith
Enter New Password:*******

Enter Again:*******
Enter the privilege for user smith (A=Administrator, O=Operator,
G=Guest): [?] 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 *Veritas Cluster Server User'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.

```
Do you want to configure SMTP notification? [y,n,q] (y) y
```

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 71.

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,?] smtp.example.com
```

- Enter the email address of each recipient.

```
Enter the full email address of the SMTP recipient
(example: user@yourcompany.com): [b,?] 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,?] 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,?] 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,?] 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 *Veritas Cluster Server User'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.

```
Do you want to configure SNMP notification? [y,n,q] (y)
```

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 VCS based on the configuration details you provided.

See "Configuring global clusters" on page 72.

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,?] (162)
```

- Enter the SNMP console system name.

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

- 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 saturn [I=Information, W=Warning, E=Error,
S=SevereError]: [b,?] 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,?] jupiter
Enter the minimum severity of events for which SNMP traps
should be sent to jupiter [I=Information, W=Warning,
E=Error, S=SevereError]: [b,?] 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: saturn receives SNMP traps for Error or
higher events
Console: jupiter receives SNMP traps for SevereError or
higher events

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

Configuring global clusters

If you had installed a valid HA/DR license, the installer provides you an option to configure this cluster as global cluster. If not, the installer proceeds to configure VCS based on the configuration details you provided. You can also run the gcoconfig utility in each cluster later to update the VCS configuration file for global cluster.

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 *Veritas Cluster Server User's Guide* for instructions to set up VCS 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.

   ```
   Do you want to configure the Global Cluster Option? [y,n,q] (y)
   ```

   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, value for the netmask, and value for the network hosts.

   You can also enter an IPv6 address as a virtual IP address.
4. Verify and confirm the configuration of the global cluster.

   ```
   Global Cluster Option configuration verification:

   NIC: lan0
   IP: 192.168.1.16
   Netmask: 255.255.240.0

   NetworkHosts: 192.168.1.15

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

Installing VCS depots

After the installer gathers all the configuration information, the installer installs the depots on the cluster systems. If you already installed the depots and chose to configure or reconfigure the cluster, the installer proceeds to create the configuration files.

See "Creating VCS configuration files" on page 74.

The utility checks for the required file system space and makes sure that any processes that are running do not conflict with the installation. If requirements for installation are not met, the utility stops and indicates the actions that are

required to proceed with the process. Review the output as the installer uninstalls any previous versions and installs the VCS 5.0.1 depots.

Creating VCS configuration files

After you install the depots and provide the configuration information, the installer continues to create configuration files and copies them to each system.

```
Creating Cluster Server configuration files ..... Done
Copying configuration files to galaxy..... Done
Copying configuration files to nebula..... Done
Cluster Server configured successfully.
```

If you chose to configure the cluster in secure mode, the installer also configures the Symantec Product Authentication Service.

Depending on the mode you chose to set up Authentication Service, the installer does one of the following:

- Creates the security principal
- Executes the encrypted file to create security principal on each node in the cluster

The installer then does the following before the installer starts VCS in secure mode:

- Creates the VxSS service group
- Creates the Authentication Server credentials on each node in the cluster
- Creates the Web credentials for VCS users
- Sets up trust with the root broker

Starting VCS

You can now start VCS and its components on each system. If you chose to configure the cluster in secure mode, the installer also starts the Authentication Service processes on each node in the cluster.

To start VCS

- Confirm to start VCS and its components on each node.

  Enter **y** if you want to start VCS.

  ```
  Do you want to start Veritas Cluster Server processes now?
  [y,n,q] (y) n
  ```

Completing the installation

After VCS 5.0.1 installation completes successfully, the installer creates summary, log, and response files. The files provide the useful information that can assist you with the installation and can also assist future installations.

Review the location of the installation log files, summary file, and response file that the installer displays.

Table 4-4 specifies the files that are created at the end of the installation.

Table 4-4 File description

File	Description
summary file	■ Lists the depots that are installed on each system. ■ Describes the cluster and its configured resources. ■ Provides the information for managing the cluster.
log file	Details the entire installation.
response file	Contains the configuration information that can be used to perform secure or unattended installations on other systems. See "Example response file" on page 196.

About enabling LDAP authentication for clusters that run in secure mode

Symantec 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 Sun Directory Server, Netscape, 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.

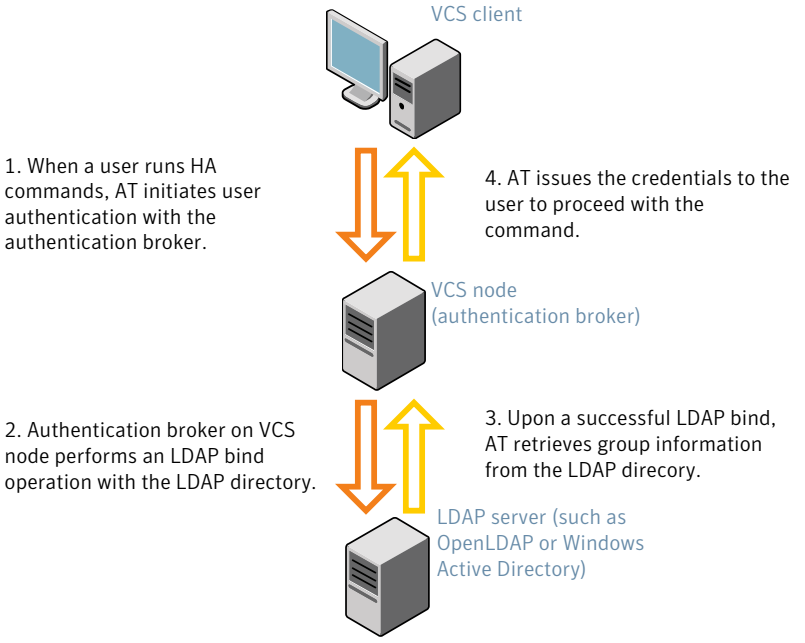
See "Enabling LDAP authentication for clusters that run in secure mode" on page 77.

If you have not already added VCS users during installation, you can add the users later.

See the *Veritas Cluster Server User's Guide* for instructions to add VCS users.

Figure 4-2 depicts the VCS cluster communication with the LDAP servers when clusters run in secure mode.

Figure 4-2 Client communication with LDAP servers



See the *Symantec Product Authentication Service Administrator's Guide.*

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 Symantec 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 4.3.40 or later.

  ```
  # /opt/VRTSat/bin/vssat showversion
  vssat version: 4.3.40.0
  ```

See the `vssat.1m` and the `atldapconf.1m` manual pages.

To enable OpenLDAP authentication for clusters that run in secure mode

1 Add the LDAP domain to the AT configuration using the `vssat` command.

The following example adds the LDAP domain, MYENTERPRISE:

```
# /opt/VRTSat/bin/vssat addldapdomain \
--domainname "MYENTERPRISE.symantecdomain.com"\
--server_url "ldap://my_openldap_host.symantecexample.com"\
--user_base_dn "ou=people,dc=symantecdomain,dc=myenterprise,dc=com"\
--user_attribute "cn" --user_object_class "account"\
--user_gid_attribute "gidNumber"\
--group_base_dn "ou=group,dc=symantecdomain,dc=myenterprise,dc=com"\
--group_attribute "cn" --group_object_class "posixGroup"\
--group_gid_attribute "member"\
--admin_user "cn=manager,dc=symantecdomain,dc=myenterprise,dc=com"\
--admin_user_password "password" --auth_type "FLAT"
```

2 Verify that you can successfully authenticate an LDAP user on the VCS nodes.

You must have a valid LDAP user ID and password to run the command. In the following example, authentication is verified for the MYENTERPRISE domain for the LDAP user, vcsadmin1.

```
galaxy# /opt/VRTSat/bin/vssat authenticate
--domain ldap:MYENTERPRISE.symantecdomain.com
--prplname vcsadmin1 --broker galaxy:2821

Enter password for vcsadmin1: ##########

authenticate
----------------------
----------------------

Authenticated User vcsadmin1
----------------------
```

3 Add the LDAP user to the main.cf file.

```
# haconf makerw
# hauser -add "CN=vcsadmin1/CN=people/\
DC=symantecdomain/DC=myenterprise/\
DC=com@myenterprise.symantecdomain.com" -priv Administrator
# haconf -dump -makero
```

If you want to enable group-level authentication, you must run the following command:

```
# hauser -addpriv \
ldap_group@ldap_domain AdministratorGroup
```

4 Verify that the main.cf file has the following lines:

```
# cat /etc/VRTSvcs/conf/config/main.cf
...
...
cluster clus1 (
  SecureClus = 1
  Administrators = {
    "CN=vcsadmin1/CN=people/DC=symantecdomain/DC=myenterprise/
    DC=com@myenterprise.symantecdomain.com" }
  AdministratorGroups = {
    "CN=symantecusergroups/DC=symantecdomain/DC=myenterprise/
    DC=com@myenterprise.symantecdomain.com " }
  )
...
...
```

5 Set the VCS_DOMAIN and VCS_DOMAINTYPE environment variables as follows:

- VCS_DOMAIN=myenterprise.symantecdomain.com
- VCS_DOMAINTYPE=ldap

For example, for the Bourne Shell (sh or ksh), run the following commands:

```
# export VCS_DOMAIN=myenterprise.symantecdomain.com
# export VCS_DOMAINTYPE=ldap
```

6 Verify that you can log on to VCS. For example

```
# halogin vcsadmin1 password
# hasys -state
VCS NOTICE V-16-1-52563 VCS Login:vcsadmin1
#System    Attribute    Value
galaxy     Attribute  RUNNING
nebula     Attribute  RUNNING
```

Similarly, you can use the same LDAP user credentials to log on to the VCS node using the VCS Cluster Manager (Java Console).

7 To enable LDAP authentication on other nodes in the cluster, perform the procedure on each of the nodes in the cluster.

To enable Windows Active Directory 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/VRTSat/bin/atldapconf -d
-s domain_controller_name_or_ipaddress
-u domain_user -g domain_group
```

For example:

```
# /opt/VRTSat/bin/atldapconf -d -s 192.168.20.32 \
-u Administrator -g "Domain Admins"
Search User provided is invalid or Authentication is required to
proceed further.
Please provide authentication information for LDAP server.

Username/Common Name: symantecdomain\administrator
Password:

Attribute file created.
```

2 Run the LDAP configuration tool atldapconf using the -c option. The -c option creates a CLI file to add the LDAP domain.

```
# /opt/VRTSat/bin/atldapconf -c -d windows_domain_name
```

For example:

```
# /opt/VRTSat/bin/atldapconf -c -d symantecdomain.com
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/VRTSat/bin/atldapconf -x
```

4 List the LDAP domains to verify that the Windows Active Directory server integration is complete.

```
# /opt/VRTSat/bin/vssat listldapdomains

Domain Name :          symantecdomain.com
Server URL :           ldap://192.168.20.32:389
SSL Enabled :          No
User Base DN :         CN=people,DC=symantecdomain,DC=com
User Object Class :    account
User Attribute :       cn
User GID Attribute :   gidNumber
Group Base DN :        CN=group,DC=symantecdomain,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 Set the VCS_DOMAIN and VCS_DOMAINTYPE environment variables as follows:

- VCS_DOMAIN=symantecdomain.com
- VCS_DOMAINTYPE=ldap

For example, for the Bourne Shell (sh or ksh), run the following commands:

```
# export VCS_DOMAIN=symantecdomain.com
# export VCS_DOMAINTYPE=ldap
```

6 Verify that you can log on to VCS. For example

```
# halogin vcsadmin1 password
# hasys -state
VCS NOTICE V-16-1-52563 VCS Login:vcsadmin1
#System    Attribute    Value
galaxy     Attribute  RUNNING
nebula     Attribute  RUNNING
```

Similarly, you can use the same LDAP user credentials to log on to the VCS node using the VCS Cluster Manager (Java Console).

7 To enable LDAP authentication on other nodes in the cluster, perform the procedure on each of the nodes in the cluster.

Installing the Java Console

You can administer VCS using the VCS Java-based graphical user interface, Java Console. After VCS has been installed, install the Java Console on a Windows system or HP-UX system. Review the software requirements for Java Console.

See "Software requirements for the Java Console" on page 83.

The system from which you run the Java Console can be a system in the cluster or a remote workstation. A remote workstation enables each system in the cluster to be administered remotely.

Review the information about using the Cluster Manager and the Configuration Editor components of the Java Console. For more information, refer to the *Veritas Cluster Server User's Guide*.

Software requirements for the Java Console

Cluster Manager (Java Console) is supported on:

- HP-UX 11i v3 IA and PA - RISC
- Windows XP, Windows 2003 Server Edition

Note: Make sure that you are using an operating system version that supports JRE 1.5.

Installing the Java Console on HP-UX

Review the procedure to install the Java console.

To install Java console on HP-UX

1. Make sure you have mounted the software disc with the VCS .
2. Use SD-UX to install the VRTScscm depot. For example, from the disc:

   ```
   # swinstall -s /cdrom/depot VRTScscm
   ```

   The `-s` option specifies the source.

Installing the Java Console on a Windows system

Review the procedure to install the Java console on a Windows system.

To install the Java Console on a Windows system

1. Insert the software disc with the VCS software into a drive on your Windows system.

   For supported languages other than English, insert the language pack media disc into the drive.
2. Using Windows Explorer, select the disc drive.
3. Go to \windows\VCSWindowsInstallers\ClusterManager.
4. Open the language folder of your choice, for example EN or JA.
5. Double-click setup.exe.
6. The Veritas Cluster Manager Install Wizard guides you through the installation process.

Installing VCS Simulator

You can administer VCS Simulator from the Java Console or from the command line. Review the software requirements for VCS Simulator.

Software requirements for VCS Simulator

VCS Simulator is supported on:

- HP-UX 11.23 IA and PA - RISC
- Windows XP, Windows 2003

Note: Make sure that you are using an operating system version that supports JRE 1.5.

Installing VCS Simulator on UNIX systems

This section describes the procedure to install VCS Simulator on UNIX systems.

To install VCS Simulator on UNIX systems

1. Insert the VCS installation disc into a drive.
2. Navigate to the following directory and locate VRTScssim.
   - HP-UX—depot
3. Install the VRTScssim package.

   To use Cluster Manager with Simulator, you must also install the VRTScscm package.

Installing VCS Simulator on Windows systems

This section describes the procedure to install VCS Simulator on Windows systems.

To install VCS Simulator on Windows systems

1. Insert the VCS installation disc into a drive.
2. Navigate to the path of the Simulator installer file:

   \cluster_server\windows\VCSWindowsInstallers\Simulator
3. Double-click the installer file.
4. Read the information in the Welcome screen and click **Next**.
5. In the Destination Folders dialog box, click **Next** to accepted the suggested installation path or click **Change** to choose a different location.
6. In the Ready to Install the Program dialog box, click **Back** to make changes to your selections or click **Install** to proceed with the installation.
7. In the Installshield Wizard Completed dialog box, click **Finish**.

Reviewing the installation

VCS Simulator installs Cluster Manager (Java Console) and Simulator binaries on the system. The Simulator installation creates the following directories:

Directory	Content
attrpool	Information about attributes associated with VCS objects
bin	VCS Simulator binaries
default_clus	Files for the default cluster configuration

Directory	Content
sample_clus	A sample cluster configuration, which serves as a template for each new cluster configuration
templates	Various templates that are used by the Java Console
types	The types.cf files for all supported platforms
conf	Contains another directory called types. This directory contains assorted resource type definitions that are useful for the Simulator. The type definition files are present in platform-specific sub directories.

Additionally, VCS Simulator installs directories for various cluster configurations.

VCS Simulator creates a directory for every new simulated cluster and copies the contents of the sample_clus directory. Simulator also creates a log directory within each cluster directory for logs that are associated with the cluster.

Verifying the cluster after installation

When you have used installvcs program and chosen to configure and start VCS, VCS and all components are properly configured and can start correctly. You must verify that your cluster operates properly after the installation.

See "About verifying the VCS installation" on page 117.

Verifying and updating licenses on the system

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

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 folder containing the `vxlicrep` program and enter:

```
# cd /opt/VRTS/bin
# ./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 Cluster Server
Serial Number                  = 1249
License Type                   = PERMANENT
OEM ID                         = 478

Features :=
Platform                       = HP-UX
Version                        = 5.0
Tier                           = 0
Reserved                       = 0
Mode                           = VCS
```

Updating product licenses using vxlicinst

You can use the `vxlicinst` command to add the VCS license key on each node. If you have VCS already installed and configured and you use a demo license, you can replace the demo license.

See "Replacing a VCS demo license with a permanent license" on page 87.

To update product licenses

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

```
# cd /opt/VRTS/bin
# ./vxlicinst -k XXXX-XXXX-XXXX-XXXX-XXXX-XXX
```

Replacing a VCS demo license with a permanent license

When a VCS demonstration key license expires, you can replace it with a permanent license using the `vxlicinst(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 VCS on all nodes in the cluster:

   ```
   # hastop -all -force
   ```

   This command does not shut down any running applications.
3. Enter the permanent license key using the following command on each node:

   ```
   # cd /opt/VRTS/bin
   # ./vxlicinst -k XXXX-XXXX-XXXX-XXXX-XXXX-XXX
   ```

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

   ```
   # cd /opt/VRTS/bin
   # ./vxlicrep
   ```

5. Start VCS on each node:

   ```
   # hastart
   ```

Accessing the VCS documentation

The software disc contains the documentation for VCS in Portable Document Format (PDF) in the cluster_server/docs directory. After you install VCS, Symantec recommends that you copy the PDF version of the documents to the /opt/VRTS/docs directory on each node to make it available for reference.

To access the VCS documentation

- Copy the PDF from the software disc (cluster_server/docs/) to the directory /opt/VRTS/docs.

Chapter 5

Manually installing and configuring VCS

This chapter includes the following topics:

About VCS manual installation

You can manually install and configure VCS instead of using the installvcs program.

Review the following criteria for a manual installation:

- You want to install a single VCS depot.
- You want to install VCS to one system in a cluster that runs VCS 5.0.1.
- You cannot install on a system over the network, which can occur when you do not have remote root user access.

Note: Symantec does not suppot partial cluster upgrades. You must upgrade all of the nodes in the cluster at the same time.

A manual installation takes a lot of time, patience, and care. Symantec recommends that you use the installvcs program instead of the manual installation when possible.

Requirements for installing VCS

Review the following requirements and verify that you are ready to install the VCS software:

- See "Hardware requirements" on page 23.
- See "Supported operating systems" on page 24.
- See "Supported software" on page 25.

Installing VCS software manually

If you manually install VCS software to upgrade your cluster, make sure to back up the previous VCS configuration files before you start the installation.

Table 5-1 lists the tasks that you must perform when you manually install and configure VCS 5.0.1.

Table 5-1 Manual installation tasks for VCS 5.0.1

Task	Reference
Install VCS software manually on each node in the cluster.	See "Installing VCS packages for a manual installation" on page 91.
Add a license key.	See "Adding a license key for a manual installation" on page 92.
Restore the configuration files from your previous VCS installation.	See "Upgrading the configuration files" on page 93.
Copy the installation guide to each node.	See "Copying the installation guide to each node" on page 93.
Configure LLT and GAB.	■ See "Configuring LLT for a manual installation" on page 93. ■ See "Configuring GAB for a manual installation" on page 96.
Configure VCS.	See "Configuring VCS" on page 96.
Start LLT, GAB, and VCS services.	See "Starting LLT, GAB, and VCS for a manual installation" on page 97.
Modify the VCS configuration.	See "Modifying the VCS configuration" on page 99.

Table 5-1 Manual installation tasks for VCS 5.0.1 *(continued)*

Task	Reference
Replace demo license with a permanent license.	See "Replacing a VCS demo license with a permanent license for manual installations" on page 99.

Preparing for a manual installation

Before you install, log in as the superuser. Mount the disc, and copy the files in a temporary folder for installation.

See "Mounting the product disc" on page 47.

To prepare for installation

1 Copy the depot from the software disc to the temporary directory:

```
# mkdir /tmp/install

# cp -rp  depot /tmp/install
```

2 List the files:

```
# ls /tmp/install
VRTSaa        VRTScutil     VRTSfssdk     VRTSobc33
VRTSacclib    VRTSdbac      VRTSgab       VRTSobgui
VRTSalloc     VRTSdbcom     VRTSgapms     VRTSodm
VRTSat        VRTSdbed      VRTSglm       VRTSorgui
VRTScavf      VRTSdbms3     VRTSgms       VRTSpbx
VRTSccg       VRTSddlpr     VRTSicsco     VRTSperl
VRTScscm      VRTSdsa       VRTSjre15     VRTSsfmh
VRTScscw      VRTSfsman     VRTSllt       VRTSspt
VRTScsocw     VRTSfsmnd     VRTSmapro     VRTSvail
VRTScssim     VRTSfspro     VRTSob        VRTSvcs
VRTSvcsag     VRTSvrpro     VRTSvcsdb     VRTSvxfen
VRTSvcsmg     VRTSvxfs      VRTSvcsmn     VRTSvxmsa
VRTSvcsor     VRTSvxvm      VRTSvcssy     VRTSweb
VRTSvcsvr     catalog       VRTSvdid      swagent.log
VRTSvlic      VRTSvmpro
```

Installing VCS packages for a manual installation

VCS has both required and optional depots. Install the required depots first. All depots are installed in the /opt directory.

When you select the optional depots, note the following information:

- Symantec recommends that you install the depots for VCS manual pages (VRTSvcsmn).
- The I/O fencing depot can be used only with the shared disks that support SCSI-3 Persistent Reservations (PR). See the *Veritas Cluster Server User's Guide* for a conceptual description of I/O fencing. You need to test shared storage for SCSI-3 PR and to implement I/O fencing.

Perform the steps to install VCS depots on each node in the cluster.

To install VCS depots on a node

- Install the required depots in the order shown:

```
# swinstall -s `pwd` VRTSicsco
# swinstall -s 'pwd' VRTSpbx
# swinstall -s 'pwd' VRTSsmf
# swinstall -s 'pwd' VRTSat
# swinstall -s 'pwd' VRTSspt
# swinstall -s 'pwd' SYMClma
# swinstall -s 'pwd' VRTSllt
# swinstall -s 'pwd' VRTSgab
# swinstall -s 'pwd' VRTSvxfen
# swinstall -s 'pwd' VRTSvcs
# swinstall -s 'pwd' VRTSacclib
# swinstall -s 'pwd' VRTSvcsag
# swinstall -s 'pwd' VRTSvcsmg
# swinstall -s 'pwd' VRTSjre
# swinstall -s 'pwd' VRTSjre15
# swinstall -s 'pwd' VRTScutil
# swinstall -s 'pwd' VRTSweb
# swinstall -s 'pwd' VRTScscw
```

Adding a license key for a manual installation

After you have installed all depots on each cluster node, use the `vxlicinst` command to add the VCS license key on each system:

```
# cd /opt/VRTS/bin
# ./vxlicinst -k XXXX-XXXX-XXXX-XXXX-XXXX-XXX
```

Checking licensing information on the system for a manual installation

Use the `vxlicrep` utility to display information about all Veritas licenses on a system. For example, enter:

```
# cd /opt/VRTS/bin
# ./vxlicrep
```

From the output, you can determine the following:

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

Upgrading the configuration files

You need to restore the configuration files from your previous VCS installation if you manually added 5.0.1 depots to upgrade your cluster to VCS.

Copying the installation guide to each node

After you install VCS, Symantec recommends that you copy the PDF version of this guide from the installation disc (cluster_server/docs/vcs_install.pdf) to the directory /opt/VRTS/docs on each node to make it available for reference.

Configuring LLT for a manual installation

VCS uses the Low Latency Transport (LLT) protocol for all cluster communications as a high-performance, low-latency replacement for the IP stack. LLT has two major functions.

It handles the following tasks:

- Traffic distribution
- Heartbeat traffic

To configure LLT, set up two files: /etc/llthosts and /etc/lltab on each node in the cluster.

Setting up /etc/llthosts for a manual installation

The file llthosts(4) is a database. It contains one entry for the system that links the LLT system ID (in the first column) with the LLT host name. You must create an identical file on each node in the cluster.

Use vi or another editor, to create the file /etc/llthosts that contains the entries that resemble:

```
0 north
1 south
```

Setting up /etc/lltab for a manual installation

The /etc/lltab file must specify the system's ID number (or its node name), and the network links that correspond to the system. In addition, the file can contain other directives. Refer also to the sample lltab file in /opt/VRTSllt.

See "LLT directives for a manual installation" on page 94.

Use vi or another editor to create the file /etc/lltab that contains the entries that resemble:

```
set-node north
set-cluster 2
link lan1 /dev/lan1 - ether - -
link lan2 /dev/lan2 - ether - -
```

The first line must identify the system where the file exists. In the example, the value for `set-node` can be: north, 0, or the file name /etc/nodename. The file needs to contain the name of the system (north in this example) to use these choices. The next two lines, beginning with the link command, identify the two private network cards that the LLT protocol uses. The order of directives must be the same as in the sample file/opt/VRTSllt/sample-lltab.

LLT directives for a manual installation

For more information about LLT directives, refer to the `lltab`(4) manual page.

Table 5-2 contains the LLT directives for a manual installation.

Table 5-2 LLT directives

Directive	Description
`set-node`	Assigns the system ID or symbolic name. The system ID number must be unique for each system in the cluster, and must be in the range 0-31. The symbolic name corresponds to the system ID, which is in /etc/llthosts file. Note that LLT fails to operate if any systems share the same ID.
`link`	Attaches LLT to a network interface. At least one link is required, and up to eight are supported. The first argument to link is a user-defined tag shown in the `lltstat(1M)` output to identify the link. It may also be used in `lltab` to set optional static MAC addresses. The second argument to link is the device name of the network interface. Its format is device_name:device_instance_number. The remaining four arguments to link are defaults; these arguments should be modified only in advanced configurations. There should be one link directive for each network interface. LLT uses an unregistered Ethernet SAP of 0xCAFE. If the SAP is unacceptable, refer to the `lltab(4)` manual page for information on how to customize SAP. Note that IP addresses do not need to be assigned to the network device; LLT does not use IP addresses.
`set-cluster`	Assigns a unique cluster number. Use this directive when more than one cluster is configured on the same physical network connection. LLT uses a default cluster number of zero.
`link-lowpri`	Use this directive in place of `link` for public network interfaces. This directive prevents VCS communication on the public network until the network is the last link, and reduces the rate of heartbeat broadcasts. Note that LLT distributes network traffic evenly across all available network connections. In addition to enabling VCS communication, broadcasts heartbeats to monitor each network connection.

For more information about LLT directives, refer to the `lltab`(4) manual page.

Additional considerations for LLT for a manual installation

You must attach each network interface that is configured for LLT to a separate and distinct physical network.

Configuring GAB for a manual installation

VCS uses the Group Membership Services/Atomic Broadcast (GAB) protocol for cluster membership and reliable cluster communications. GAB has two major functions.

It handles the following tasks:

- Cluster membership
- Cluster communications

To configure GAB, use vi or another editor to set up an /etc/gabtab configuration file on each node in the cluster. The following example shows an /etc/gabtab file:

```
/sbin/gabconfig -c -nN
```

Where the `-c` option configures the driver for use. The `-n`N option specifies that the cluster is not formed until at least N systems are ready to form the cluster. By default, N is the number of systems in the cluster.

Note: Symantec does not recommend the use of the `-c -x` option for `/sbin/gabconfig`. Using `-c -x` dramatically increases configuration time for the Gigabit Ethernet controller and can lead to a split-brain condition.

Configuring VCS

VCS configuration requires the types.cf and main.cf files on each system in the cluster. Both of the files are in the /etc/VRTSvcs/conf/config directory.

main.cf file

The main.cf configuration file requires the following minimum essential elements:

- An "include" statement that specifies the file, types.cf, which defines the VCS bundled agent resources.
- The name of the cluster.
- The name of the systems that make up the cluster.

Editing the main.cf file

When you manually install VCS, the file /etc/VRTSvcs/conf/config/main.cf contains only the line:

```
include "types.cf"
```

For a full description of the main.cf file, and how to edit and verify it, refer to the *Veritas Cluster Server User's Guide*.

To edit the main.cf file

1. Log on as superuser, and move to the directory that contains the configuration file:

   ```
   # cd /etc/VRTSvcs/conf/config
   ```

2. Use vi or another text editor to edit the main.cf file, defining your cluster name and system names. Refer to the following example.
3. Save and close the file.

Example, main.cf

An example main.cf for a two-node cluster:

```
include "types.cf"
cluster VCSCluster2 ( )
system north ( )
system south ( )
```

An example main.cf for a single-node cluster:

```
include "types.cf"
cluster VCSCluster1 ( )
system sn1
```

types.cf file

Note that the "include" statement in main.cf refers to the types.cf file. This text file describes the VCS bundled agent resources. During new installations, the types.cf file is automatically copied in to the /etc/VRTSvcs/conf/config directory.

Starting LLT, GAB, and VCS for a manual installation

Start LLT, GAB, and VCS.

To start LLT

- On each node, type:

```
# /sbin/rc2.d/S68llt start
```

If LLT is configured correctly on each node, the console output resembles:

```
Apr  5 14:46:18 north llt: LLT:10009: LLT Protocol available
```

See "Verifying LLT" on page 126.

To start GAB

- On each node, type:

```
# /sbin/rc2.d/S920gab start
```

If GAB is configured correctly on each node, the console output resembles:

```
Apr  5 14:46:29 north gab: GAB:20021: GAB available
Apr  5 14:51:50 north gab: GAB:20026: Port a registration
waiting for seed port membership
```

See "Verifying GAB" on page 128.

To start VCS

- On each node, type:

```
# /sbin/rc2.d/S990vcs start
```

If VCS is configured correctly on each node, the console output resembles:

```
VCS:10619:'HAD' starting on: northhp
VCS:10620:Waiting for local cluster configuration status
VCS:10625:Local cluster configuration valid
VCS:11034:registering for cluster membership
VCS:11035:Waiting for cluster membership
VCS:10077:received new cluster membership
VCS:10082:System (northhp) is in Regular Membership -
       Membership:0x1
VCS:10073:building from local configuration
VCS:10066:entering RUNNING state
```

See "Verifying the cluster" on page 129.

Modifying the VCS configuration

After the successful installation of VCS, you can modify the configuration of VCS using several methods. You can dynamically modify the configuration from the command line, Veritas Cluster Server Management Console, or the Cluster Manager (Java Console). For information on management tools, refer to the *Veritas Cluster Server User's Guide*.

You can also edit the main.cf file directly. For information on the structure of the main.cf file, refer to the *Veritas Cluster Server User's Guide*.

Configuring the ClusterService group

When you have installed VCS, and verified that LLT, GAB, and VCS work, you can create a service group to include the optional features. These features include the VCS notification components, and the Global Cluster option. If you manually added VCS to your cluster systems, you must manually create the ClusterService group. Presented in this guide is a reference configuration example of a system with a ClusterService group.

See "Sample main.cf file for VCS clusters" on page 120.

Replacing a VCS demo license with a permanent license for manual installations

When a VCS demonstration key license expires, you can replace it with a permanent license using the `vxlicinst` program.

See "Checking licensing information on the system" on page 86.

Chapter 6

Configuring VCS clusters for data integrity

This chapter includes the following topics:

About configuring VCS clusters for data integrity

When a node fails, VCS 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. VCS 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 and configure VCS, you must configure I/O fencing in VCS to ensure data integrity.

About I/O fencing components

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

- Data disks—Store shared data
  See "About data disks" on page 102.
- Coordination points—Act as a global lock during membership changes
  See "About coordination points" on page 102.

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 are part of standard VxVM or CVM disk groups.

CVM 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. Racing for control of the coordination points to fence data disks is the key to understand how fencing prevents split brain.

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 VCS configuration.

Dynamic Multipathing (DMP) allows coordinator disks to take advantage of the path failover and the dynamic adding and removal capabilities of DMP. On cluster nodes with HP-UX 11i v3, you must use DMP devices or iSCSI devices for I/O fencing. The following changes in HP-UX 11i v3 require you to not use raw devices for I/O fencing:

- Provides native multipathing support
- Does not provide access to individual paths through the device file entries

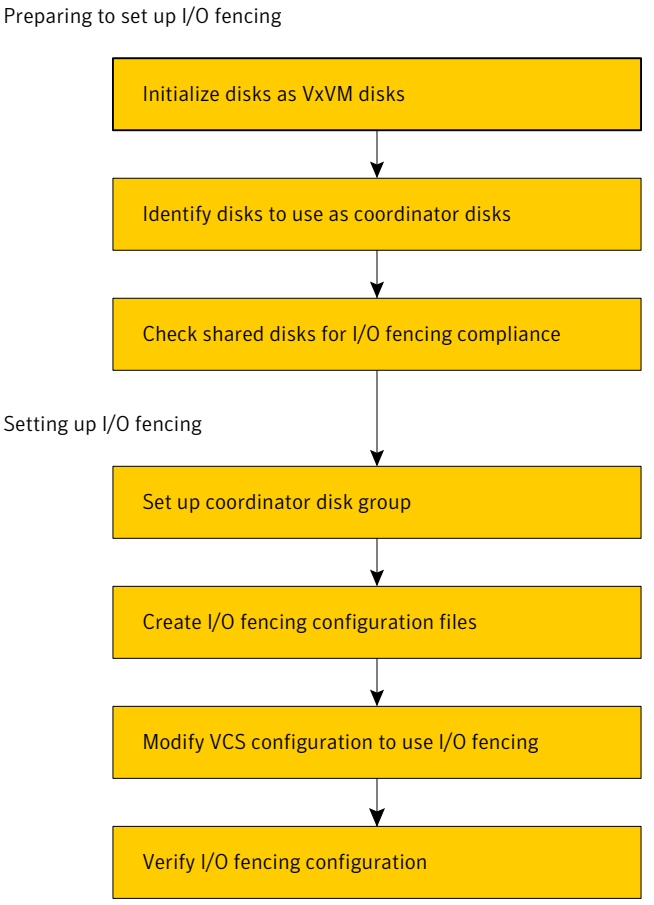
The metanode interface that HP-UX provides does not meet the SCSI-3 PR requirements for the I/O fencing feature. You can configure coordinator disks to use Veritas Volume Manager Dynamic Multipathing (DMP) feature.

See the *Veritas Volume Manager Administrator's Guide*.

About setting up I/O fencing

Figure 6-1 illustrates the tasks involved to configure I/O fencing.

Figure 6-1 Workflow to configure I/O fencing



See "Preparing to configure I/O fencing" on page 106.

See "Setting up I/O fencing" on page 111.

I/O fencing requires the coordinator disks be configured in a disk group. The coordinator disks must be accessible to each node in the cluster. These disks enable the vxfen driver to resolve potential split-brain conditions and prevent data corruption.

Review the following requirements for coordinator disks:

- You must have three coordinator disks.
  The coordinator disks can be DMP devices or iSCSI devices.
  You must use DMP disk policy for iSCSI-based coordinator disks.

For the latest information on supported hardware visit the following URL:
http://entsupport.symantec.com/docs/283161

- Each of the coordinator disks must use a physically separate disk or LUN. Symantec 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.
- Symantec 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 I/O fencing configuration files include:

/etc/vxfendg	You must create this file to include the coordinator disk group information.
/etc/vxfenmode	You must set the I/O fencing mode to SCSI-3. You must configure the vxfen module to use DMP devices or iSCSI devices, and set the SCSI-3 disk policy as dmp.

/etc/vxfentab	When you run the vxfen startup file to start I/O fencing, the script creates this /etc/vxfentab file on each node with a list of all paths to each coordinator disk. The startup script uses the contents of the /etc/vxfendg and /etc/vxfenmode files.
	Thus any time a system is rebooted, the fencing driver reinitializes the vxfentab file with the current list of all paths to the coordinator disks.
	Note: The /etc/vxfentab file is a generated file; do not modify this file.
	An example of the /etc/vxfentab file on one node resembles as follows:
	`/dev/vx/rdmp/c1t1d0`
	`/dev/vx/rdmp/c2t1d0`
	`/dev/vx/rdmp/c3t1d0`

In some cases you must remove disks from or add disks to an existing coordinator disk group.

Warning: If you remove disks from an existing coordinator disk group, then be sure to remove the registration and reservation keys from these disks before you add the disks to another disk group.

Preparing to configure I/O fencing

Make sure you performed the following tasks before configuring I/O fencing for VCS:

- Install the correct operating system.
- Install the VRTSvxfen depot when you installed VCS.
- Install a version of Veritas Volume Manager (VxVM) that supports SCSI-3 persistent reservations (SCSI-3 PR).
  Refer to the installation guide that comes with the Storage Foundation product that you use.

Perform the following preparatory tasks to configure I/O fencing:

Initialize disks as VxVM disks	See "Initializing disks as VxVM disks" on page 106.
Identify disks to use as coordinator disks	See "Identifying disks to use as coordinator disks" on page 108.
Check shared disks for I/O fencing The tasks involved in checking the shared disks for I/O fencing are as follows: ■ Verify that the nodes have access to the same disk ■ Test the disks using the vxfentsthdw utility	See "Checking shared disks for I/O fencing" on page 108.

Initializing disks as VxVM disks

Perform the following procedure to initialize disks as VxVM disks.

To initialize disks as VxVM disks

1 Make the new disks recognizable. On each node, enter:

```
# ioscan -nfC disk
# insf -e
```

Warning: The HP-UX man page for the `insf` command instructs you to run the command in single-user mode only. You can run `insf -e` in multiuser mode only when no other user accesses any of the device files. This command can change the mode, owner, or group of an existing special (device) file, or unlink and recreate a file. The special files that are currently open may be left in an indeterminate state.

2 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 Symantec technical support.

3 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
==============================================================

libvxautoraid.sl            HP
libvxCLARiiON.sl            DGC
libvxemc.sl                 EMC
```

4 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.

5 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 *Veritas Volume Managers 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 c2t13d0
  ```

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

Identifying disks to use as coordinator disks

After you add and initialize disks, 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 list
   ```

2. Pick three SCSI-3 PR compliant shared disks as coordinator disks.

Checking shared disks for I/O fencing

Make sure that the shared storage you set up while preparing to configure VCS meets the I/O fencing requirements. You can test the shared disks using the vxfentsthdw utility. The two nodes must have `ssh` (default) or `remsh` 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 `vxfenadm` 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.

The vxfentsthdw 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 *Veritas Cluster Server User's Guide*.

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

- Verifying that nodes have access to the same disk
  See "Verifying that the nodes have access to the same disk" on page 109.
- Testing the shared disks for SCSI-3
  See "Testing the disks using vxfentsthdw utility" on page 110.

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 vxfentsthdw 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 VCS.
2. Ensure that both nodes are connected to the same disk during the testing. Use the vxfenadm command to verify the disk serial number.

   ```
   /sbin/vxfenadm -i diskpath
   ```

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

   For example, an EMC disk is accessible by the /dev/vx/rdmp/c1t1d0 path on node A and the /dev/vx/rdmp/c2t1d0 path on node B.

   From node A, enter:

   ```
   # /sbin/vxfenadm -i /dev/vx/rdmp/c1t1d0

   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/vx/rdmp/c2t1d0 path.

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

   ```
   # /sbin/vxfenadm -i /dev/vx/rdmp/c3t1d0

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

Testing the disks using vxfentsthdw utility

This procedure uses the /dev/vx/rdmp/c1t1d0 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/vx/rdmp/c1t1d0 is ready to be configured for I/O Fencing on
node galaxy
```

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

To test the disks using vxfentsthdw utility

1. Make sure system-to-system communication functions properly.

   See "Setting up inter-system communication" on page 39.

   After you complete the testing process, remove permissions for communication and restore public network connections.

   See "Removing permissions for communication" on page 115.

2. From one node, start the utility.

   Do one of the following:

   - If you use `ssh` for communication:

     ```
     # /opt/VRTSvcs/vxfen/bin/vxfentsthdw
     ```

   - If you use `remsh` for communication:

     ```
     # /opt/VRTSvcs/vxfen/bin/vxfentsthdw -n
     ```

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: galaxy
Enter the second node of the cluster: nebula
```

4 Enter the names of the disks that you want to check. Each node may know the same disk by a different name:

```
Enter the disk name to be checked for SCSI-3 PGR on node galaxy in
the format: /dev/vx/rdmp/cxtxdx
/dev/vx/rdmp/c2t13d0
Enter the disk name to be checked for SCSI-3 PGR on node nebula in
the format: /dev/vx/rdmp/cxtxdx
Make sure it's the same disk as seen by nodes galaxy and nebula
/dev/vx/rdmp/c2t13d0
```

If the serial numbers of the disks are not identical. then the test terminates.

5 Review the output as the utility performs the checks and report its activities.

6 If a disk is ready for I/O fencing on each node, the utility reports success:

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

ALL tests on the disk /dev/vx/rdmp/c1t1d0 have PASSED
The disk is now ready to be configured for I/O Fencing on node
galaxy
```

7 Run the vxfentsthdw utility for each disk you intend to verify.

Setting up I/O fencing

Make sure you completed the preparatory tasks before you set up I/O fencing.

Tasks that are involved in setting up I/O fencing include:

Table 6-1 Tasks to set up I/O fencing

Action	Description
Setting up coordinator disk groups	See "Setting up coordinator disk groups" on page 112.
Creating I/O fencing configuration files	See "Creating I/O fencing configuration files" on page 113.
Modifying VCS configuration to use I/O fencing	See "Modifying VCS configuration to use I/O fencing" on page 113.
Verifying I/O fencing configuration	See "Verifying I/O fencing configuration" on page 115.

Setting up coordinator disk groups

From one node, create a disk group named vxfencoorddg. This group must contain three disks or LUNs. If you use VxVM 5.0 or later, 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 *Veritas Volume Manager Administrator's Guide* for details on how to create disk groups.

The following example procedure assumes that the disks have the device names c1t1d0, c2t1d0, and c3t1d0.

To create the vxfencoorddg disk group

1 On any node, create the disk group by specifying the device names:

```
# vxdg init vxfencoorddg c1t1d0 c2t1d0 c3t1d0
```

2 If you use VxVM 5.0 or later, 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 "vxfencoorddg" > /etc/vxfendg
```

Do not use spaces between the quotes in the "vxfencoorddg" text.

This command creates the /etc/vxfendg file, which includes the name of the coordinator disk group.

2 Update the /etc/vxfenmode file to specify to use the SCSI-3 dmp disk policy. On all cluster nodes, type:

```
# 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
```

Modifying VCS configuration to use I/O fencing

After you add coordinator disks 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 If the I/O fencing driver vxfen is already running, stop the I/O fencing driver.

```
# /sbin/init.d/vxfen stop
```

4 Make a backup copy of the main.cf file:

```
# cd /etc/VRTSvcs/conf/config
# cp main.cf main.orig
```

5 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
)
```

6 Save and close the file.

7 Verify the syntax of the file /etc/VRTSvcs/conf/config/main.cf:

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

8 Using rcp or another utility, copy the VCS configuration file from a node (for example, galaxy) to the remaining cluster nodes.

For example, on each remaining node, enter:

```
# rcp galaxy:/etc/VRTSvcs/conf/config/main.cf \
/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 coordinator disks that are listed in /etc/vxfentab.

  ```
  # /sbin/init.d/vxfen start
  ```

- Start VCS.

  ```
  # /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

- On one of the nodes, type:

```
# vxfenadm -d

I/O Fencing Cluster Information:
================================

Fencing Protocol Version: 201
Fencing Mode: SCSI3
Fencing SCSI3 Disk Policy: dmp
Cluster Members:

   * 0 (galaxy)
   1 (nebula)

RFSM State Information:
   node 0 in state 8 (running)
   node 1 in state 8 (running)
```

Removing permissions for communication

Make sure you completed the installation of VCS and the verification of disk support for I/O fencing. If you used `remsh`, remove the temporary `remsh` 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.

Chapter 7

Verifying the VCS installation

This chapter includes the following topics:

About verifying the VCS installation

After you install and configure VCS, you can inspect the contents of the key VCS configuration files that you have installed and modified during the process. These files reflect the configuration that is based on the information you supplied. You can also run VCS commands to verify the status of LLT, GAB, and the cluster.

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.

The information that these LLT and GAB configuration files contain is as follows:

- The /etc/llthosts file

The file `llthosts` 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 is identical on each node in the cluster.
For example, the file /etc/llthosts contains the entries that resemble:

```
0       galaxy
1       nebula
```

- The /etc/llttab file
  The file `llttab` contains the information that is derived during installation and used by the utility `lltconfig(1M)`. After installation, this file lists the private network links that correspond to the specific system.
  For example, the file /etc/llttab contains the entries that resemble:

  ```
  set-node galaxy
  set-cluster 2
  link lan1 /dev/lan:1 - ether - -
  link lan2 /dev/lan:2 - ether - -
  ```

  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 `link` command. These lines identify the two network cards that the LLT protocol uses.
  Refer to the `llttab(4)` manual page for details about how the LLT configuration may be modified. The manual page describes the ordering of the directives in the `llttab` file.

- The /etc/gabtab file
  After you install VCS, the file /etc/gabtab contains a `gabconfig(1)` command that configures the GAB driver for use.
  The file /etc/gabtab contains a line that resembles:

  ```
  /sbin/gabconfig -c -nN
  ```

  The `-c` option configures the driver for use. The `-nN` specifies that the cluster is not formed until at least *N* nodes are ready to form the cluster. By default, *N* is the number of nodes in the cluster.

Note: The use of the `-c -x` option for `/sbin/gabconfig` is not recommended. The Gigabit Ethernet controller does not support the use of `-c -x`.

About the VCS configuration file main.cf

The VCS configuration file /etc/VRTSvcs/conf/config/main.cf is created during the installation process.

See "Sample main.cf file for VCS clusters" on page 120.

See "Sample main.cf file for global clusters" on page 122.

The main.cf file contains the minimum information that defines the cluster and its nodes. In addition, the file types.cf, which is listed in the include statement, defines the VCS bundled types for VCS resources. The file types.cf is also located in the directory /etc/VRTSvcs/conf/config after installation.

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 installvcs program 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 that you added is present.
- If you configured the cluster in secure mode, the main.cf includes the VxSS service group and "SecureClus = 1" cluster attribute.
- The installvcs program creates the ClusterService service group. The group includes the IP, NIC, and VRTSWebApp resources.

  The service group also has the following characteristics:

  - The service group also includes the notifier resource configuration, which is based on your input to installvcs program prompts about notification.
  - The installvcs program 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 *Veritas Cluster Server User's Guide* for information about managing VCS global clusters.

Refer to the *Veritas Cluster Server User's Guide* to review the configuration concepts, and descriptions of main.cf and types.cf files for HP-UX systems.

Sample main.cf file for VCS clusters

The following sample main.cf file is for a secure cluster that is managed locally by the Cluster Management Console.

```
include "types.cf"

cluster vcs_cluster2 (
    UserNames = { admin = cDRpdxPmHpzS, smith = dKLhKJkHLh }
    ClusterAddress = "192.168.1.16"
    Administrators = { admin, smith }
    CounterInterval = 5
    SecureClus = 1
)

    system galaxy (
   )

    system nebula (
   )

    group ClusterService (
       SystemList = { galaxy = 0, nebula = 1 )
       UserStrGlobal = "LocalCluster@https://10.182.2.76:8443;"
       AutoStartList = { galaxy, nebula )
       OnlineRetryLimit = 3
       OnlineRetryInterval = 120
       )

    IP webip (
       Device = lan0
       Address = "192.168.1.16"
       NetMask = "255.255.240.0"
       )

NIC csgnic (
       Device = lan0
       NetworkHosts = { "192.168.1.17", "192.168.1.18" }
       )

NotifierMngr ntfr (
   SnmpConsoles = { "saturn" = Error, "jupiter" = SevereError }
   SmtpServer = "smtp.example.com"
   SmtpRecipients =  { "ozzie@example.com" = Warning,
```

```
                "harriet@example.com" = Error }
    )

VRTSWebApp VCSweb (
    Critical = 0
    InstallDir = "/opt/VRTSweb/VERITAS"
    TimeForOnline = 5
    RestartLimit = 3
    )

    VCSweb requires webip
    ntfr requires csgnic
    webip requires csgnic

// resource dependency tree
    //
    // group ClusterService
    // {
    //       VRTSWebApp VCSweb
    //       {
    //          IP webip
    //          {
    //             NIC csgnic
    //          }
    //       }
    //       NotifierMngr ntfr
    //       {
    //          NIC csgnic
    //       }
    // }


group VxSS (
    SystemList = { galaxy = 0, nebula = 1 }
    Parallel = 1
    OnlineRetryLimit = 3
    OnlineRetryInterval = 120
    )

    Phantom phantom_vxss (
       )
```

```
    ProcessOnOnly vxatd (
       IgnoreArgs = 1
       PathName = "/opt/VRTSat/bin/vxatd"
       )




// resource dependency tree
    //
    // group VxSS
    // {
    // Phantom phantom_vxss
    // ProcessOnOnly vxatd
    // }
```

Sample main.cf file for global clusters

If you installed VCS 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.

```
    .
    .
    group ClusterService (
       SystemList = { galaxy = 0, nebula = 1 }

       UserStrGlobal = "LocalCluster@https://10.182.2.78:8443;"

       AutoStartList = { galaxy, nebula }
       OnlineRetryLimit = 3
       OnlineRetryInterval = 120
       )

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

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"
    StopProgram = "/opt/VRTSvcs/bin/wacstop"
    MonitorProcesses = { "/opt/VRTSvcs/bin/wac" }
    RestartLimit = 3
    )

IP gcoip (
    Device = lan0
    Address = "10.182.13.50"
    NetMask = "255.255.240.0"
    )

NIC csgnic (
    Device = lan0
    )
```

```
NotifierMngr ntfr (
    SnmpConsoles = { vcslab4079 = SevereError }
    SmtpServer = "smtp.veritas.com"
    SmtpRecipients = { "johndoe@veritas.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
//             }
//         }
//     }

group VxSS (
    SystemList = { sysA = 0, sysB = 1, sysC = 2 }
    Parallel = 1
    AutoStartList = { sysA, sysB, sysC }
    OnlineRetryLimit = 3
    OnlineRetryInterval = 120
    )

Phantom phantom_vxss (
    )

ProcessOnOnly vxatd (
    IgnoreArgs = 1
    PathName = "/opt/VRTSat/bin/vxatd"
    )
```

```
// resource dependency tree
//
//      group VxSS
//      {
//      Phantom phantom_vxss
//      ProcessOnOnly vxatd
//      }
```

Verifying the LLT, GAB, and VCS configuration files

Make sure that the LLT, GAB, and VCS configuration files contain the information you provided during VCS installation and configuration.

To verify the LLT, GAB, and VCS configuration files

1 Navigate to the location of the configuration files:

- LLT
  /etc/llthosts
  /etc/llttab
- GAB
  /etc/gabtab
- VCS
  /etc/VRTSvcs/conf/config/main.cf

2 Verify the content of the configuration files.

See "About the LLT and GAB configuration files" on page 117.

See "About the VCS configuration file main.cf" on page 119.

Verifying LLT, GAB, and cluster operation

Verify the operation of LLT, GAB, and the cluster using the VCS commands.

To verify LLT, GAB, and cluster operation

1 Log in to any node in the cluster as superuser.

2 Make sure that the PATH environment variable is set to run the VCS commands.

See "Setting the PATH variable" on page 46.

3 Verify LLT operation.

See "Verifying LLT" on page 126.

4 Verify GAB operation.

See "Verifying GAB" on page 128.

5 Verify the cluster operation.

See "Verifying the cluster" on page 129.

Verifying LLT

Use the `lltstat` command to verify that links are active for LLT. If LLT is configured correctly, this command shows all the nodes in the cluster. The command also returns information about the links for LLT for the node on which you typed the command.

Refer to the `lltstat(1M)` manual page for more information.

To verify LLT

1 Log in as superuser on the node galaxy.

2 Run the `lltstat` command on the node galaxy to view the status of LLT.

```
lltstat -n
```

The output on galaxy resembles:

```
LLT node information:
    Node             State            Links
    *0 galaxy          OPEN            2
     1 nebula          OPEN            2
```

Each node has two links and each node is in the OPEN state. The asterisk (*) denotes the node on which you typed the command.

3 Log in as superuser on the node nebula.

4 Run the `lltstat` command on the node nebula to view the status of LLT.

```
lltstat -n
```

The output on nebula resembles:

```
LLT node information:
    Node             State            Links
     0 galaxy          OPEN            2
    *1 nebula          OPEN            2
```

5 To view additional information about LLT, run the `lltstat -nvv` command on each node.

For example, run the following command on the node galaxy in a two-node cluster:

```
lltstat -nvv | more
```

The output on galaxy resembles:

```
    Node          State      Link    Status      Address
    *0 galaxy      OPEN
                             lan1 UP     08:00:20:93:0E:34
                             lan2 UP     08:00:20:93:0E:34
    1 nebula       OPEN
                             lan1 UP     08:00:20:8F:D1:F2
                             lan2 DOWN
    2              CONNWAIT
                             lan1 DOWN
                             lan2 DOWN
    3              CONNWAIT
                             lan1 DOWN
                             lan2 DOWN
    .
    .
    .

    31             CONNWAIT
                             lan1 DOWN
                             /dev/lan:2 DOWN
```

Note that the output lists 32 nodes. The command reports the status on the two nodes in the cluster, galaxy and nebula, along with the details for the non-existent nodes.

For each correctly configured node, the information must show the following:

- A state of OPEN
- A status for each link of UP
- An address for each link

However, the output in the example shows different details for the node nebula. The private network connection is possibly broken or the information in the /etc/llttab file may be incorrect.

6 To obtain information about the ports open for LLT, type `lltstat -p` on any node.

For example, type `lltstat -p` on the node galaxy in a two-node cluster:

```
lltstat -p
```

The output resembles:

```
LLT port information:
  Port  Usage       Cookie
  0     gab          0x0
        opens:       0 2 3 4 5 6 7 8 9 10 11 ... 28 29 30 31
        connects:    0 1
  7     gab          0x7
        opens:       0 2 3 4 5 6 7 8 9 10 11 ... 28 29 30 31
        connects:    0 1
  31    gab          0x1F
        opens:       0 2 3 4 5 6 7 8 9 10 11 ... 28 29 30 31
        connects:    0 1
```

Verifying GAB

Verify the GAB operation using the `gabconfig -a` command. This command returns the GAB port membership information.

The ports indicate the following:

Port a
- Nodes have GAB communication
- gen a36e0003 is a randomly generated number
- membership 01 indicates that nodes 0 and 1 are connected

Port h
- VCS is started
- gen fd570002 is a randomly generated number
- membership 01 indicates that nodes 0 and 1 are both running VCS

For more information on GAB, refer to the *Veritas Cluster Server User's Guide*.

To verify GAB

1 To verify that GAB operates, type the following command on each node:

```
/sbin/gabconfig -a
```

2 Review the output of the command:

- If GAB operates, the following GAB port membership information is returned:

```
GAB Port Memberships
===================================
Port a gen a36e0003 membership 01
Port h gen fd570002 membership 01
```

- If GAB does not operate, the command does not return any GAB port membership information:

```
GAB Port Memberships
===================================
```

- If only one network is connected, the command returns the following GAB port membership information:

```
GAB Port Memberships
===================================
Port a gen a36e0003 membership 01
Port a gen a36e0003 jeopardy   ;1
Port h gen fd570002 membership 01
Port h gen fd570002 jeopardy   ;1
```

Verifying the cluster

Verify the status of the cluster using the `hastatus` command. This command returns the system state and the group state.

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

Refer to the *Veritas Cluster Server User's Guide* for a description of system states and the transitions between them.

To verify the cluster

1 To verify the status of the cluster, type the following command:

```
hastatus -summary
```

The output resembles:

```
-- SYSTEM STATE
-- System               State                Frozen

A  galaxy                RUNNING               0
A  nebula                RUNNING               0

-- GROUP STATE
-- Group           System        Probed  AutoDisabled   State


B  ClusterService  galaxy         Y       N              ONLINE
B  ClusterService  nebula         Y       N              OFFLINE
```

2 Review the command output for the following information:

- The system state
  If the value of the system state is RUNNING, the cluster is successfully started.
- The ClusterService group state
  In the sample output, the group state lists the ClusterService group, which is ONLINE on galaxy and OFFLINE on nebula.

Verifying the cluster nodes

Verify the information of the cluster systems using the `hasys -display` command. The information for each node in the output should be similar.

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

Refer to the *Veritas Cluster Server User's Guide* for information about the system attributes for VCS.

To verify the cluster nodes

- On one of the nodes, type the `hasys -display` command:

```
hasys -display
```

The example shows the output when the command is run on the node galaxy. The list continues with similar information for nebula (not shown) and any other nodes in the cluster.

```
#System    Attribute             Value

galaxy     AgentsStopped         0

galaxy     AvailableCapacity     100

galaxy     CPUBinding            BindTo None CPUNumber 0

galaxy     CPUUsage              0

galaxy     CPUUsageMonitoring    Enabled 0 ActionThreshold 0
                                 ActionTimeLimit 0 Action NONE
                                 NotifyThreshold 0 NotifyTimeLimit 0

galaxy     Capacity              100

galaxy     ConfigBlockCount      141

galaxy     ConfigCheckSum        33975

galaxy     ConfigDiskState       CURRENT

galaxy     ConfigFile            /etc/VRTSvcs/conf/config

galaxy     ConfigInfoCnt         0

galaxy     ConfigModDate         Fri May 22 17:22:48 2009

galaxy     ConnectorState        Down

galaxy     CurrentLimits

galaxy     DiskHbStatus

galaxy     DynamicLoad           0

galaxy     EngineRestarted       0

galaxy     EngineVersion         5.0.31.0

galaxy     Frozen                0

galaxy     GUIIPAddr

galaxy     LLTNodeId             0
```

```
#System    Attribute             Value

galaxy     LicenseType           DEMO

galaxy     Limits

galaxy     LinkHbStatus          lan1 UP lan2 UP

galaxy     LoadTimeCounter       0

galaxy     LoadTimeThreshold     600

galaxy     LoadWarningLevel      80

galaxy     NoAutoDisable         0

galaxy     NodeId                0

galaxy     OnGrpCnt              1

galaxy     ShutdownTimeout       120

galaxy     SourceFile            ./main.cf

galaxy     SysInfo               HP-UX:galaxy,U,B.11.31,ia64

galaxy     SysName               galaxy

galaxy     SysState              RUNNING

galaxy     SystemLocation

galaxy     SystemOwner

galaxy     TFrozen               0

galaxy     TRSE                  0

galaxy     UpDownState           Up

galaxy     UserInt               0

galaxy     UserStr

galaxy     VCSFeatures           DR

galaxy     VCSMode               VCS
```

Chapter 8

Upgrading VCS

This chapter includes the following topics:

About VCS 5.0.1 upgrade

If you are currently running a VCS cluster, you can perform a typical upgrade or a phased upgrade of VCS using the installvcs program. The installvcs program detects the current configuration and prompts you to indicate whether you want to upgrade. While the installer is not able to verify the validity of the existing configuration, it is able to run extensive upgrade requirement checks before proceeding.

VCS supported upgrade paths

Table 8-1 lists the supported upgrade paths.

Table 8-1 Supported upgrade paths

From	To
VCS 4.1 on HP-UX 11i v2	VCS 5.0.1 on HP-UX 11i v3
VCS 5.0 on HP-UX 11i v2	VCS 5.0.1 on HP-UX 11i v3
VCS 5.0 on HP-UX 11i v3	VCS 5.0.1 on HP-UX 11i v3

Note: If you are upgrading from VCS version 3.5, you need to first upgrade to version 4.1, and then upgrade to VCS 5.0.1. If you are upgrading from VCS version 3.5 U3, you need to first upgrade to version 5.0 on HP-UX 11i v2, and then upgrade to VCS 5.0.1. For instructions on upgrading to versions 4.1 or 5.0, see the Veritas Cluster Server Installation Guide. Contact Technical Support to obtain the software media or to download the software for versions 4.1 or 5.0 on HP-UX 11i v2.

About phased upgrade

Perform a phased upgrade VCS to minimize the downtime for the cluster that you want to upgrade. Depending on the situation, you can calculate the approximate downtime as follows:

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 in half. If the cluster has an odd number of nodes, calculate (n+1)/2, and start the upgrade with the even number of nodes.
- Split the cluster so that your high priority service groups remain online during the upgrade of the first subcluster.

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 VCS.
- While you perform the upgrades, do not add or remove service groups to any of the nodes.
- 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 four nodes: node01, node02, node03, and node04. You also have four service groups: sg1, sg2, sg3, and sg4. 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 one other node 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 upgrade uses four nodes with four service groups.

- The cluster is split into two subclusters. The first subcluster consists of node01 and node02 which is considered for upgrading first. The second subcluster consists of node03 and node04 which will be upgraded second.
- Switch all the failover service groups from the first subcluster to the second subcluster. Take all the parallel service groups offline on the first subcluster. Freeze the service groups.
- Stop VCS and all its components including GAB and LLT.
- Unfreeze the service groups on the second subcluster.
- Upgrade the operating system, if required.
- Upgrade VCS on the first subcluster. After the upgrade is complete, not start any of the cluster component, including VCS, GAB, and LLT.

Note: Your downtime starts from here.

- Now, you can proceed with upgrading the second subcluster.
- Take all the service groups offline on the second subcluster. Stop VCS and its components.
- Reboot the nodes in the first subcluster. Unfreeze all the service groups and bring them online.

Note: Your downtime ends here.

Note: After the first subcluster restarts, make sure that the nodes on the second subcluster do not reboot accidently. If the second subcluster restarts and joins the first subcluster, the nodes in the second subcluster may panic.

- Upgrade VCS on the second subcluster. After the upgrade is complete, do not start VCS. Reboot the nodes in the second subcluster.
  The nodes in the second subcluster automatically rejoin the cluster. All the nodes in the cluster now run the upgraded version of VCS.

See "Performing a phased upgrade of VCS" on page 145.

About changes to VCS bundled agents

Review the changes to VCS bundled agents if you upgrade to VCS 5.0.1.

Deprecated agents

The following agents are no longer supported:

- CampusCluster
- ClusterMonitorConfig
- Service group heartbeat (ServiceGroupHB)—VCS does not support service group heartbeats in this release. Symantec recommends using I/O fencing.

Removing deprecated resource types

With VCS 5.0.1, certain resource type definitions are no longer used. Before you start the upgrade process, you must remove the resources of the deprecated resource types from your cluster configuration.

The list of resource types that are not used in VCS 5.0.1 are as follows:

- CampusCluster
- ClusterMonitorConfig
- ServiceGroupHB

Note: The ClusterConnectorConfig resource type has replaced the ClusterMonitorConfig resource type.

Review the changes to VCS agents in version 5.0.1.

See "About changes to VCS bundled agents" on page 137.

If you use the resource type ServiceGroupHB, Symantec recommends the use of I/O fencing.

Note: Make sure you start VCS on the local node before starting on the other nodes. This standard ensures that HAD reads the configuration from the local node and updates it on the remaining nodes.

Perform the following steps to remove the deprecated resource types.

To remove the deprecated resource types

1 Save the VCS configuration and stop the VCS engine.

```
# haconf -dump -makero
# hastop -all -force
```

2 Back up the configuration file, main.cf to a location on the cluster node.

3 Edit the main.cf located under /etc/VRTSvcs/conf/config.

Perform the following instructions:

- Remove the resource of the deprecated resource types.
  You must modify the resource dependencies to ensure that the configuration works properly.
- Save the main.cf.
- Reformat the main.cf file.

```
# hacf -cftocmd config
# hacf -cmdtocf config
```

4 Verify the configuration.

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

5 Start VCS on the local node.

6 Start VCS on other nodes.

New and modified attributes for 5.0.1 agents

Table 8-2 lists the attributes that VCS adds or modifies when you upgrade to VCS 5.0.1.

Table 8-2 New attributes for VCS 5.0.1 agents

Agent	New attributes	Default value
DiskGroup	PanicSystemOnDGLoss	0
NFS	LockFileTimeout	180
LVMCombo	VolumeIOTimeout	15
LVMLogicalVolume	VolumeIOTimeout	15

Upgrading VCS in secure enterprise environments

In secure enterprise environments, ssh or remsh communication is not allowed between systems. In such cases, the installvcs program can upgrade VCS only on systems with which it can communicate (most often the local system only). Run the installvcs program on each node to upgrade the cluster to VCS 5.0.1. On the first node, the program updates the configuration and stops the cluster before you upgrade the system. On the other nodes, it uninstalls the previous version and installs VCS 5.0.1. After the last node is upgraded and started, the upgrade is complete.

Upgrading to VCS 5.0.1 on HP-UX 11i v3

You must upgrade the following to version 5.0.1:

VCS	Use the installvcs program to upgrade VCS. See "Upgrading from VCS 4.1 or 5.0 on HP-UX 11i v2 to VCS 5.0.1 on HP-UX 11i v3" on page 139. See "Upgrading from VCS 5.0 on HP-UX 11i v3 to VCS 5.0.1 on HP-UX 11i v3" on page 140. You can perform a phased upgrade to minimize the downtime for your system. See "Performing a phased upgrade of VCS" on page 145.
VCS agents	See "Upgrading the VCS agents" on page 153.
VCS Cluster Manager	See "Upgrading the Cluster Manager (Java Console)" on page 154.
VCS Simulator	See "Upgrading VCS Simulator" on page 154.

Upgrading from VCS 4.1 or 5.0 on HP-UX 11i v2 to VCS 5.0.1 on HP-UX 11i v3

The procedure to upgrade a cluster running previous versions of VCS to VCS 5.0.1 on HP-UX 11i v3 is described as follows.

Table 8-3 lists the tasks involved in upgrading VCS to version 5.0.1 on HP-UX 11i v3

Table 8-3 Upgrade tasks

Task to perform when you upgrade VCS	From VCS version	To VCS version
Removing deprecated resource types See "Removing deprecated resource types" on page 137.	VCS 4.1 on HP-UX 11i v2	VCS 5.0.1 on HP-UX 11i v3
Performing the pre-upgrade tasks See "Performing the pre-upgrade tasks" on page 141.	VCS 4.1 and 5.0 on HP-UX 11i v2	VCS 5.0.1 on HP-UX 11i v3
Upgrading the HP-UX operating system See "Upgrading the HP-UX operating system" on page 142.	VCS 4.1 and 5.0 on HP-UX 11i v2	VCS 5.0.1 on HP-UX 11i v3
Upgrading VCS See "Upgrading VCS" on page 143.	VCS 4.1 and 5.0 on HP-UX 11i v2	VCS 5.0.1 on HP-UX 11i v3
Starting VCS See "Starting VCS" on page 144.	VCS 4.1 and 5.0 on HP-UX 11i v2	VCS 5.0.1 on HP-UX 11i v3
Completing the upgrade See "Completing the upgrade" on page 144.	VCS 4.1 and 5.0 on HP-UX 11i v2	VCS 5.0.1 on HP-UX 11i v3
Creating new VCS accounts if you used native OS accounts	VCS 4.1 on HP-UX 11i v2	VCS 5.0.1 on HP-UX 11i v3

Upgrading from VCS 5.0 on HP-UX 11i v3 to VCS 5.0.1 on HP-UX 11i v3

If your systems are already running VCS 5.0 on HP-UX 11i v3, this section describes how to upgrade to VCS 5.0.1 on HP-UX 11i v3.

Upgrade tasks include:

- Removing deprecated resource types
  See "Removing deprecated resource types" on page 137.
- Performing the pre-upgrade tasks

See "Performing the pre-upgrade tasks" on page 141.

- Upgrading VCS
  See "Upgrading VCS" on page 143.
- Starting VCS
  See "Starting VCS" on page 144.
- Completing the upgrade
  See "Completing the upgrade" on page 144.
- Creating new VCS accounts if you used native OS accounts

Performing the pre-upgrade tasks

Perform the following procedures before you upgrade VCS.

To perform pre-upgrade tasks

1. Log in as superuser on one of the nodes where you want to upgrade VCS.
2. Mount the software disc.
3. Verify that /opt/VRTS/bin is set in your PATH environment variable to execute all product commands.
4. Make the VCS configuration writable. On a node that you want to upgrade, type:

   ```
   # haconf -makerw
   ```
5. Freeze all the service groups in the configuration.
6. Freeze the service groups. On each node that you selected to upgrade, type:

   ```
   # hasys -freeze -persistent nodename
   ```
7. Save the VCS configuration.

   ```
   # haconf -dump -makero
   ```

Stopping VCS and its components

Perform the following steps to stop VCS and its components:

To stop VCS and its components

1. Stop VCS if it is already running. On each node, run the following command:

   ```
   # hastop -local -force
   ```
2. If fencing is configured with VCS, you must disable fencing before proceeding to upgrade. To disable fencing, perform the following steps:

- If the cluster-wide attribute “UseFence” is set to SCSI3, reset the value to None in the /etc/VRTSvcs/conf/config/main.cf file.
- On each node, edit /etc/vxfenmode to configure vxfen in disabled mode.
- Stop I/O fencing on each node:

```
# cat /etc/vxfenmode
# vxfen_mode=disabled
```

- Stop I/O fencing on each node:

```
# /sbin/vxfenconfig -U
```

3 Stop GAB on each node:

```
# /sbin/gabconfig -U
```

4 Stop LLT on each node:

```
# /sbin/lltconfig -Uo
```

5 Change LLT_START=0 in "/etc/rc.config.d/lltconf" on each node.

6 Remove LLT, GAB, and VxFEN device files on each node:

- `# rm -f /dev/llt`
- `# rm -f /dev/gab*`
- `# rm -f /dev/vxfen`

Upgrading the HP-UX operating system

Upgrade the HP-UX operating system from HP-UX 11i v2 to HP-UX 11i v3, if necessary, on each node using Hewlett-Packard's `update-ux` utility. Refer to Hewlett-Packard's documentation for details regarding this utility.

Warning: On PA-RISC architecture, some VCS agents may dump core after the operating system is upgraded from HP-UX 11i v2 to HP-UX 11i v3 using the `update-ux` command.

This is because on PA-RISC architecture, the default thread stack size is limited to 64k. When the agent requires more than 64k stack memory, it may dump core due to SIGBUS error.

Refer to the *Veritas Cluster Server Release Notes* for more information on this issue.

Upgrading VCS

Perform the following procedure to upgrade VCS to version 5.0.1. make sure that VCS is running on the nodes where you perform the upgrade task.

See "VCS supported upgrade paths" on page 134.

To upgrade VCS

1. Log in as superuser.
2. Insert the VCS 5.0.1 software disc into the disc drive of one of the nodes.
3. Navigate to the folder that contains the installvcs program.
4. Upgrade to VCS 5.0.1. Enter the following command:

   ```
   # ./installvcs [-rsh]
   ```

   The installer begins with a copyright message and specifies the directory where the logs are created.

   Review the report after the program examines the configuration files and discovers the existing cluster configuration (including the ClusterService group, if it is defined).
5. To upgrade to VCS 5.0.1 press **Enter**.

   ```
   Do you want to upgrade to version 5.0.1 on these systems using the
   current configuration? [y,n,q,?] (y) y
   ```

   The installer program verifies that your systems meet the requirements for upgrading.
6. Review the output as the program verifies that the upgrade can proceed on the systems. The installvcs program checks the operating system level and system-to-system communication. It also creates logs for the VCS update.

   Review the output as the installer checks the licenses that are currently in place on the cluster nodes. The installer also prompts to add additional license keys:
7. Review the output as the installer checks for existing depots.

   Specify the depots to be installed on the cluster systems.

   The installer lists the depots that will be installed or upgraded. Press Enter at the prompt.

8 The installer is now ready to upgrade VCS. Press Enter at the prompt.

9 View the output as the program backs up the types.cf and main.cf.

The program attempts to stop VCS and uninstall the depots. Progress indicators show the status of these tasks.

The program now attempts to install VCS 5.0 depots. A progress indicator shows the status of the task.

Starting VCS

After the installvcs program upgrades the nodes, you can proceed to start VCS using the installvcs program.

To start VCS

- The program prompts you to start VCS.

```
Do you want to start Veritas Cluster Server processes now? [y,n,q]
(y)
```

Press **y** to start VCS only if the following resources are not configured.

- Perform this step only if you are upgrading from VCS 4.1.
  If you have an NFS resource configured in the cluster, press **n**and do not start VCS here. Edit the main.cf file to include details about the NFSRestart agent.
  Refer to the *Veritas Cluster Server Bundled Agents Reference Guide* for details about editing the main.cf file.
  After editing this file, attempt to start VCS.
- If you have configured resources for Oracle or Sybase databases, enter **n** and do not start VCS here.

Completing the upgrade

The upgrade is complete after starting the cluster server processes.

To complete the upgrade

1 Note the locations of the summary and log files that the program creates.

```
Upgrade log files and summary file are saved at:

/opt/VRTS/install/logs/installvcs-unique string/
```

2 Other files specific to the installer program are also created in the /opt/VRTS/install/logs/installvcs-uniquestring/ directory.

3 Configure I/O fencing to use the dmp scsi disk policy.

See “Setting up I/O fencing” on page 111.

4 Verify that the cluster is operating properly after the upgrade.

See “About verifying the VCS installation” on page 117.

Performing a phased upgrade of VCS

This section explains the procedure to perform a phased upgrade of VCS on four nodes with four service groups. Note that in this scenario, the service groups cannot stay online during the upgrade of the second subcluster. Remember to not add, remove, or change resources or service groups on any nodes during the upgrade as these changes are likely to get lost after the upgrade.

Establishing running service groups

Perform the following steps to establish running service groups.

To establish running service groups

1 Establish the nodes on which your service groups are online.

```
# hagrp -state
```

The output resembles the following:

```
#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 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).

```
# hagrp -offline sg1 -sys node01
# hagrp -offline sg2 -sys node01
# hagrp -offline sg1 -sys node02
# hagrp -offline sg2 -sys node02
# hagrp -switch sg3 -to node03
# hagrp -switch sg4 -to node04
```

3 Make the VCS configuration writable on the second subcluster.

```
# haconf -makerw
```

4 Freeze the service groups.

```
# hagrp -freeze sg1 -persistent
# hagrp -freeze sg2 -persistent
# hagrp -freeze sg3 -persistent
# hagrp -freeze sg4 -persistent
```

5 Dump the configuration and make it read-only.

```
# haconf -dump -makero
```

6 Verify that your service groups are offline on the nodes targeted for upgrade.

```
# hagrp -state
```

The output resembles the following:

```
#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|
```

During the next procedure, do not perform any configuration tasks. Do not start any modules.

7 Take a backup of the llttab, llthosts, gabtab, types.cf, and main.cf files on the first subcluster.

```
# cp /etc/llttab /etc/llttab.bkp
# cp /etc/llthosts /etc/llthosts.bkp
# cp /etc/gabtab /etc/gabtab.bkp
# cp /etc/VRTSvcs/conf/config/main.cf \
/etc/VRTSvcs/conf/config/main.cf.bkp
# cp /etc/VRTSvcs/conf/config/types.cf \
/etc/VRTSvcs/conf/config/types.cf.bkp
```

8 Stop VCS and its components on node01 and node02.

```
# /sbin/init.d/vcs stop
# /sbin/init.d/vxfen stop
# /sbin/gabconfig -U
# /sbin/lltconfig -Uo
```

9 Perform this step if you are upgrading from VCS 4.1 or VCS 5.0 on HP-UX 11i v2.

Remove LLT, GAB, and VxFEN device files on each node of the first subcluster.

```
# rm -f /dev/llt
# rm -f /dev/gab*
# rm -f /dev/vxfen
```

10 Edit the following files on the first subcluster to make the values of LLT_START, GAB_START and VXFEN_START equal to zero. (By default it is 1).

```
#  /etc/rc.config.d/lltconf
# /etc/rc.config.d/gabconf
# /etc/rc.config.d/vxfenconf
```

Performing this step prevents LLT, GAB, and VxFEN from restarting if the nodes reboot accidentally. If the node01 and node02 reboot accidentally, it may cause node03 and node04 to panic.

11 Unfreeze the service groups on the second subcluster (node03 and node04).

```
# haconf -makerw
# hagrp -unfreeze sg1 -persistent
# hagrp -unfreeze sg2 -persistent
# hagrp -unfreeze sg3 -persistent
# hagrp -unfreeze sg4 -persistent
# haconf -dump -makero
```

Upgrading the HP-UX operating system

Upgrade the HP-UX operating system to HP-UX 11i v3 March 2009 OEUR release on each node using Hewlett-Packard's update-ux utility. Refer to Hewlett-Packard's documentation for details regarding this utility.

The system reboots after the operating system is upgraded.

Upgrading the first subcluster

Upgrade VCS on the first subcluster (node01 and node02) using the following procedure.

To upgrade the first subcluster

1 On node01 and node02, start the 5.0.1 installer for VCS.

2 Select the VCS installation.

3 Enter **n** when the installer prompts the following:

```
Do you want to upgrade to version 5.0.1 on these systems using
the current configuration? [y,n,q,?] (y) n
```

4 Enter the names of the nodes that you want to upgrade:

```
Enter the system names separated by spaces on which to install
VCS: node01 node02
Do you want to continue with the system names? [y,n,q] (y)
```

5 Select either option 1 or 2 when the installer prompts:

```
Select the packages to be installed on all systems? 2
```

6 Enter **n** when the installer prompts the following:

```
Do you want to start Veritas Cluster Server processes now?
[y,n,q] (y) n
```

Note: When VCS is upgraded on the first subcluster, the installer freezes the service groups. You must manually unfreeze the service groups after rebooting the first subcluster as given in next procedure.

Upgrading the second subcluster

Perform the following procedure to upgrade the second subcluster (node03 and node04).

To upgrade the second subcluster

1 Take the service groups offline on node03 and node04.

Warning: Failure to perform this step can cause data corruption if you try to bring the failover groups (sg3 and sg4) online on the upgraded subcluster (node01 and node02)

```
# hagrp -offline sg1 -sys node03
# hagrp -offline sg1 -sys node04
# hagrp -offline sg2 -sys node03
# hagrp -offline sg2 -sys node04
# hagrp -offline sg3 -sys node03
# hagrp -offline sg4 -sys node04
```

2 Stop VCS and its components on node03 and node04.

```
# /sbin/init.d/vcs stop
# /sbin/init.d/vxfen stop
# /sbin/gabconfig -U
# /sbin/lltconfig -Uo
```

Note: Your downtime starts from here.

3 Edit the following files on node03 and node04 to make the values of LLT_START, GAB_START and VXFEN_START equal to zero. (By default it is 1).

```
#  /etc/rc.config.d/lltconf

# /etc/rc.config.d/gabconf

# /etc/rc.config.d/vxfenconf
```

Performing this step prevents LLT, GAB, and VxFEN from restarting if the nodes reboot accidentally. If node03 and node04 reboot accidentally, it may cause node01 and node02 to panic.

4 Reboot node01 and node02.

5 On node01 and node02, start VCS and its components.

```
# /sbin/init.d/llt start
# /sbin/init.d/gab start
# /sbin/gabconfig -cx
# /sbin/init.d/vxfen start
# /sbin/init.d/vcs start
```

6 Make the VCS configuration writable on node01 or node02. Note that you need to make the configuration writable because the installer froze the service groups during the upgrade.

```
# haconf -makerw
```

7 Unfreeze all the service groups node01 and node02.

```
# hagrp -unfreeze sg1 -persistent
# hagrp -unfreeze sg2 -persistent
# hagrp -unfreeze sg3 -persistent
# hagrp -unfreeze sg4 -persistent
```

8 Dump the configuration and make it read-only.

```
# haconf -dump -makero
```

Note: Your downtime ends here.

9 On node01 and node02, bring the service groups online.

```
# hagrp -online sg1 -sys node01
# hagrp -online sg1 -sys node02
# hagrp -online sg2 -sys node01
# hagrp -online sg2 -sys node02
# hagrp -online sg3 -sys node01
# hagrp -online sg4 -sys node02
```

10 Verify the state of the service groups.

```
# hagrp -state
```

The output resembles the following:

```
#Group  Attribute  System   Value
sg1     State      node01   |ONLINE|
sg1     State      node02   |ONLINE|
sg1     State      node03   |OFFLINE|
sg1     State      node04   |OFFLINE|
sg2     State      node01   |ONLINE|
sg2     State      node02   |ONLINE|
sg2     State      node03   |OFFLINE|
sg2     State      node04   |OFFLINE|
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|
```

11 Upgrade VCS on node03 and node04. Follow the procedure mentioned in the section for upgrading the first subcluster.

See "Upgrading the first subcluster" on page 149.

12 After the upgrade completes, reboot node03 and node04.

After you have rebooted the nodes, all the four nodes now run the latest version of VCS, which is 5.0.1.

In this example, you have performed a phased upgrade of VCS because the service groups were down only from the point when you took them offline on node01 and node02, to the time VCS brought them online on node03 or node04 as appropriate.

Upgrading the VCS agents

The installvcs program does not upgrade the VCS agents for DB2, Oracle, and Sybase. If previous versions of these agents are installed on your cluster, you must upgrade these agents manually.

See the Installation and Configuration Guide for the agent that you want to upgrade.

See *Veritas Cluster Server Release Notes* for supported versions of the agents with VCS 5.0.1.

Upgrading the Cluster Manager (Java Console)

This release includes updates for Cluster Manager (Java Console).

To upgrade the Java Console on a Windows client

1. Stop Cluster Manager if it is running.
2. Remove Cluster Manager from the system.
3. Insert the software disc into a drive on your Windows system.
4. Start the installer from the following path:

   windows\VCSWindowsInstallers\ClusterManager\EN\setup.exe
5. Follow the wizard instructions to complete the installation.

Upgrading VCS Simulator

Use the following procedure to upgrade VCS Simulator.

To upgrade VCS Simulator on HP-UX

1. Log in as superuser on the node where you intend to install the depot.
2. Remove VCS Simulator from the previous installation.
3. Install VCS Simulator.

To upgrade VCS Simulator on a Windows client

1. Stop all instances of VCS Simulator.
2. Stop VCS Simulator, if it is running.
3. RemoveVCS Simulator from the system.
   - From the Control Panel, double-click **Add/Remove Programs**
   - Select **VCS Simulator**.
   - Click **Add/Remove**.
   - Follow the uninstall wizard instructions.
4. Install the new Simulator.

Chapter 9

Adding and removing cluster nodes

This chapter includes the following topics:

About adding and removing nodes

After you install VCS and create a cluster, you can add and remove nodes from the cluster. You can create a cluster of up to 32 nodes.

Adding a node to a cluster

The system you add to the cluster must meet the hardware and software requirements.

Table 9-1 specifies the tasks that are involved in adding a cluster. The example demonstrates how to add a node saturn to already existing nodes, galaxy and nebula.

Table 9-1 Tasks that are involved in adding a node to a cluster

Task	Reference
Set up the hardware.	See "Setting up the hardware" on page 156.

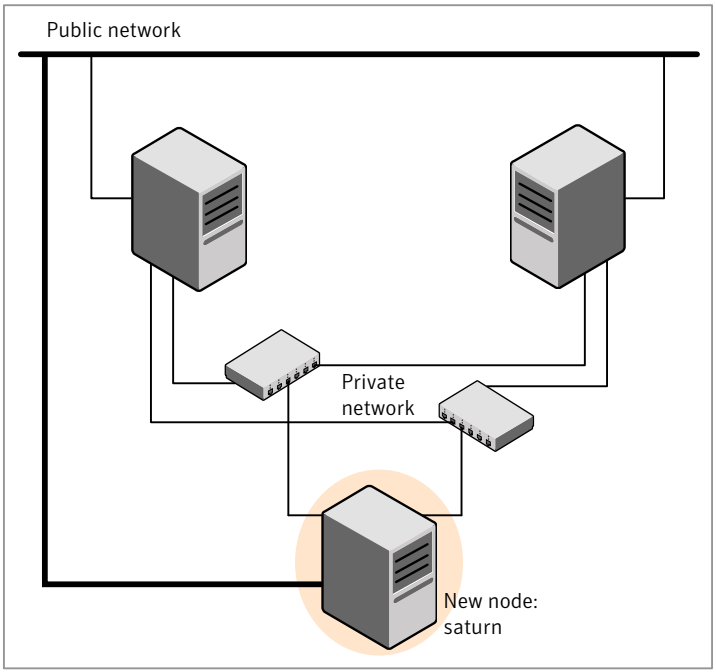
Table 9-1 Tasks that are involved in adding a node to a cluster *(continued)*

Task	Reference
Install the software manually and add a license key.	See "Installing the VCS software manually when adding a node" on page 157.
For a cluster that is running in secure mode, verify the existing security setup on the node.	See "Setting up the node to run in secure mode" on page 158.
Configure LLT and GAB.	See "Configuring LLT and GAB" on page 160.
Add the node to the existing cluster.	See "Adding the node to the existing cluster" on page 162.
Start VCS and verify the cluster.	See "Starting VCS and verifying the cluster" on page 163.

Setting up the hardware

Figure 9-1 shows that before you configure a new system on an existing cluster, you must physically add the system to the cluster.

Figure 9-1 Adding a node to a two-node cluster using two switches



To set up the hardware

1 Connect the VCS private Ethernet controllers.

Perform the following tasks as necessary:

- When you add nodes to a two-node 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 9-1 illustrates a new node being added to an existing two-node cluster using two independent hubs.

2 Connect the system to the shared storage, if required.

Installing the VCS software manually when adding a node

Install the VCS 5.0.1 depots manually and add a license key.

For more information, see the following:

- See “Installing VCS software manually” on page 90.
- See “Adding a license key for a manual installation” on page 92.

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.

See “Configuring LLT and GAB” on page 160.

Table 9-2 uses the following information for the following command examples.

Table 9-2 The command examples definitions

Name	Fully-qualified host name (FQHN)	Function
saturn	saturn.nodes.example.com	The new node that you are adding to the cluster.
RB1	RB1.brokers.example.com	The root broker for the cluster
RB2	RB2.brokers.example.com	Another root broker, not the cluster's RB

To verify the existing security setup on the node

1. If node saturn is configured as an authentication broker (AB) belonging to a root broker, perform the following steps. Else, proceed to configuring the authentication broker on node saturn.

   See “Configuring the authentication broker on node saturn” on page 159.

2. Find out the root broker to which the node saturn belongs using the following command.

```
# vssregctl -l -q -b \
"Security\Authentication\Authentication Broker" \
 -k "BrokerName"
```

3 If the node saturn already belongs to root broker RB1, it is configured as part of the cluster. Proceed to setting up VCS related security configuration.

See "Setting up VCS related security configuration" on page 160.

4 If the node saturn belongs to a different root broker (for example RB2), perform the following steps to remove the security credentials from node saturn.

- Kill /opt/VRTSat/bin/vxatd process.
- Remove the credential that RB2 has given to AB on node saturn.

```
# vssat deletecred --domain type:domainname \
--prplname prplname
```

For example:

```
# vssat deletecred --domain vx:root@RB2.brokers.example.com \
--prplname saturn.nodes.example.com
```

Configuring the authentication broker on node saturn

Configure a new authentication broker (AB) on node saturn. This AB belongs to root broker RB1.

To configure the authentication broker on node saturn

1 Create a principal for node saturn on root broker RB1. Execute the following command on root broker RB1.

```
# vssat addprpl --pdrtype root --domain domainname \
 --prplname prplname --password password \
 --prpltype service
```

For example:

```
# vssat addprpl --pdrtype root \
--domain root@RB1.brokers.example.com \
--prplname saturn.nodes.example.com \
--password flurbdicate --prpltype service
```

2 Ensure that there is no clock skew between the times on node saturn and RB1.

3 Copy the /opt/VRTSat/bin/root_hash file from RB1 to node saturn.

4 Configure AB on node saturn to talk to RB1.

```
# vxatd -o -a -n prplname -p password -x vx -y domainname -q \
rootbroker -z 2821 -h roothash_file_path
```

For example:

```
# vxatd -o -a -n saturn.nodes.example.com -p flurbdicate \
-x vx -y root@RB1.brokers.example.com -q RB1 \
-z 2821 -h roothash_file_path
```

5 Verify that AB is configured properly.

```
# vssat showbrokermode
```

The command should return 1, indicating the mode to be AB.

Setting up VCS related security configuration

Perform the following steps to configure VCS related security settings.

Setting up VCS related security configuration

1 Start /opt/VRTSat/bin/vxatd process.

2 Create HA_SERVICES domain for VCS.

```
# vssat createpd --pdrtype ab --domain HA_SERVICES
```

3 Add VCS and webserver principal to AB on node saturn.

```
# 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
```

Configuring LLT and GAB

Create the LLT and GAB configuration files on the new node and update the files on the existing nodes.

To configure LLT

1 Create the file /etc/llthosts on the new node. You must also update it on each of the current nodes in the cluster.

For example, suppose you add saturn to a cluster consisting of galaxy and nebula:

- If the file on one of the existing nodes resembles:

```
0 galaxy
1 nebula
```

- Update the file for all nodes, including the new one, resembling:

```
0 galaxy
1 nebula
2 saturn
```

2 Create the file /etc/llttab on the new node, making sure that line beginning "`set-node`" specifies the new node.

The file /etc/llttab on an existing node can serve as a guide.

The following example describes a system where node saturn is the new node on cluster number 2:

```
set-node saturn
set-cluster 2
link lan1 /dev/lan1 - ether - -
link lan2 /dev/lan2 - ether - -
```

3 On the new system, run the command:

```
# /sbin/lltconfig -c
```

To configure GAB

1 Create the file /etc/gabtab on the new system.

- If the /etc/gabtab file on the existing nodes resembles:

```
/sbin/gabconfig -c
```

The file on the new node should be the same. Symantec recommends that you use the `-c -nN` option, where *N* is the number of cluster nodes.

- If the /etc/gabtab file on the existing nodes resembles:

```
/sbin/gabconfig -c -n2
```

The file on all nodes, including the new node, should change to reflect the change in the number of cluster nodes. For example, the new file on each node should resemble:

```
/sbin/gabconfig -c -n3
```

The -n flag indicates to VCS the number of nodes that must be ready to form a cluster before VCS starts.

2 On the new node, run the command, to configure GAB:

```
# /sbin/gabconfig -c
```

To verify GAB

1 On the new node, run the command:

```
# /sbin/gabconfig -a
```

The output should indicate that port a membership shows all nodes including the new node. The output should resemble:

```
GAB Port Memberships
===================================
Port a gen a3640003 membership 012
```

See "Verifying GAB" on page 128.

2 Run the same command on the other nodes (galaxy and nebula) to verify that the port a membership includes the new node:

```
# /sbin/gabconfig -a
GAB Port Memberships
===================================
Port a gen a3640003 membership 012
Port h gen fd570002 membership 01
Port h gen fd570002    visible ; 2
```

Adding the node to the existing cluster

Perform the tasks on one of the existing nodes in the cluster.

To add the new node to the existing cluster

1 Enter the command:

```
# haconf -makerw
```

2 Add the new system to the cluster:

```
# hasys -add saturn
```

3 Stop VCS on the new node:

```
# hastop -sys saturn
```

4 Copy the main.cf file from an existing node to your new node:

```
# rcp /etc/VRTSvcs/conf/config/main.cf \
  saturn:/etc/VRTSvcs/conf/config/
```

5 Start VCS on the new node:

```
# hastart
```

6 If necessary, modify any new system attributes.

7 Enter the command:

```
# haconf -dump -makero
```

Starting VCS and verifying the cluster

Start VCS after adding the new node to the cluster and verify the cluster.

To start VCS and verify the cluster

1 From the new system, start VCS with the new system added to the cluster:

```
# hastart
```

2 Run the GAB configuration command on each node to verify that port a and port h include the new node in the membership:

```
# /sbin/gabconfig -a
  GAB Port Memberships
  ===================================
  Port a gen a3640003 membership 012
  Port h gen fd570002 membership 012
```

Removing a node from a cluster

Table 9-3 specifies the tasks that are involved in removing a node from a cluster. In the example procedure, the cluster consists of nodes galaxy, nebula, and saturn; node saturn is to leave the cluster.

Table 9-3 Tasks that are involved in removing a node

Task	Reference
■ 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 164.
■ Switch or remove any VCS service groups on the node departing the cluster. ■ Delete the node from VCS configuration.	See "Deleting the departing node from VCS configuration" on page 165.
Modify the llthosts and gabtab files to reflect the change.	See "Modifying configuration files on each remaining node" on page 168.
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 168.
On the node departing the cluster: ■ Modify startup scripts for LLT, GAB, and VCS to allow reboot of the node without affecting the cluster. ■ Unconfigure and unload the LLT and GAB utilities. ■ Remove the VCS depots.	See "Unloading LLT and GAB and removing VCS on the departing node" on page 169.

Verifying the status of nodes and service groups

Start by issuing the following commands from one of the nodes to remain, node galaxy or node nebula.

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  galaxy      RUNNING        0
A  nebula      RUNNING        0
A  saturn      RUNNING        0

-- GROUP STATE
-- Group    System      Probed   AutoDisabled   State
B  grp1     galaxy      Y        N              ONLINE
B  grp1     nebula      Y        N              OFFLINE
B  grp2     galaxy      Y        N              ONLINE
B  grp3     nebula      Y        N              OFFLINE
B  grp3     saturn      Y        N              ONLINE
B  grp4     saturn      Y        N              ONLINE
```

The example output from the `hastatus` command shows that nodes galaxy, nebula, and saturn are the nodes in the cluster. Also, service group grp3 is configured to run on node nebula and node saturn, the departing node. Service group grp4 runs only on node saturn. Service groups grp1 and grp2 do not run on node saturn.

Deleting the departing node from VCS 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 saturn to node nebula.

```
# hagrp -switch grp3 -to nebula
```

2 Check for any dependencies involving any service groups that run on the departing node; for example, grp4 runs only on the departing node.

```
# hagrp -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
# hagrp -unlink grp4 grp1
```

These commands enable you to edit the configuration and to remove the requirement grp4 has for grp1.

4 Stop VCS on the departing node:

```
# hastop -sys saturn
```

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  galaxy      RUNNING        0
    A  nebula      RUNNING        0
    A  saturn      EXITED         0

    -- GROUP STATE
    -- Group    System      Probed   AutoDisabled   State
    B  grp1     galaxy      Y        N              ONLINE
    B  grp1     nebula      Y        N              OFFLINE
    B  grp2     galaxy      Y        N              ONLINE
    B  grp3     nebula      Y        N              ONLINE
    B  grp3     saturn      Y        Y              OFFLINE
    B  grp4     saturn      Y        N              OFFLINE
```

6 Delete the departing node from the SystemList of service groups grp3 and grp4.

```
# hagrp -modify grp3 SystemList -delete saturn
# hagrp -modify grp4 SystemList -delete saturn
```

7 For the service groups that run only on the departing node, delete the resources from the group before you delete the group.

```
# hagrp -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.

```
# hagrp -delete grp4
```

9 Check the status.

```
# hastatus -summary
    -- SYSTEM STATE
    -- System      State          Frozen
    A  galaxy      RUNNING        0
    A  nebula      RUNNING        0
    A  saturn      EXITED         0

    -- GROUP STATE
    -- Group    System      Probed   AutoDisabled   State
    B  grp1     galaxy      Y        N              ONLINE
    B  grp1     nebula      Y        N              OFFLINE
    B  grp2     galaxy      Y        N              ONLINE
    B  grp3     nebula      Y        N              ONLINE
```

10 Delete the node from the cluster.

```
# hasys -delete saturn
```

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`. Symantec recommends using the `-n`*N* option, where *N* is the number of cluster systems.

If the command has the form `/sbin/gabconfig -c -n`*N*, 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.

Note: Symantec does not recommend the use of the `-c -x` option for `/sbin/gabconfig`. The Gigabit Ethernet controller does not support the use of `-c -x`.

---

2 Modify /etc/llthosts file on each remaining nodes to remove the entry of the departing node.

For example, change:

```
0 galaxy
1 nebula
2 saturn
```

To:

```
0 galaxy
1 nebula
```

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 saturn. Perform the following steps.

To remove the security credentials

1 Kill /opt/VRTSat/bin/vxatd process.

2 Remove the root credentials on node saturn.

```
# vssat deletecred --domain type:domainname --prplname prplname
```

Unloading LLT and GAB and removing VCS on the departing node

On the node departing the cluster, unconfigure and unload the LLT and GAB utilities, and remove the VCS depots.

See "Removing VCS depots manually" on page 184.

If you have configured VCS as part of the Storage Foundation and High Availability products, you may have to delete other dependent depots before you can delete all of the following ones.

Chapter 10

Installing VCS on a single node

This chapter includes the following topics:

About installing VCS on a single node

You can install VCS 5.0.1 on a single node. You can subsequently add another node to the single-node cluster to form a multinode cluster. You can also prepare a single node cluster for addition into a multi-node cluster. Single node clusters can be used for testing as well.

You can install VCS onto a single node using the installer program or you can add it manually.

See "Creating a single-node cluster using the installer program" on page 171.

See "Creating a single-node cluster manually" on page 173.

Creating a single-node cluster using the installer program

Table 10-1 specifies the tasks that are involved to install VCS on a single node using the installer program.

Table 10-1 Tasks to create a single-node cluster using the installer

Task	Reference
Prepare for installation.	See "Preparing for a single node installation" on page 172.
Install the VCS software on the system using the installer.	See "Starting the installer for the single node cluster" on page 172.

Preparing for a single node installation

You can use the installer program to install a cluster on a single system for either of the two following purposes:

- To prepare the single node cluster to join a larger cluster
- To prepare the single node cluster to be a stand-alone single node cluster

When you prepare it to join a larger cluster, install it with LLT and GAB. For a stand-alone cluster, you do not need to enable LLT and GAB.

For more information about LLT and GAB:

See "About LLT and GAB" on page 15.

Starting the installer for the single node cluster

When you install VCS on a single system, follow the instructions in this guide for installing VCS using the product installer.

See "Starting the software installation" on page 60.

During the installation, you need to answer two questions specifically for single node installations. When the installer asks:

```
Enter the system names separated by spaces on which to install
VCS:
```

Enter a single system name. The installer now asks if you want to enable LLT and GAB:

```
If you plan to run VCS on a single node without any need for
adding cluster node online, you have an option to proceed
without starting GAB and LLT.
Starting GAB and LLT is recommended.
Do you want to start GAB and LLT? [y,n,q,?] (y)
```

Answer `n` if you want to use the single node cluster as a stand-alone cluster.

Answer y if you plan to incorporate the single node cluster into a multi-node cluster in the future.

Continue with the installation.

See "Licensing VCS" on page 62.

Creating a single-node cluster manually

Table 10-2 specifies the tasks that you need to perform to install VCS on a single node.

Table 10-2 Tasks to create a single-node cluster manually

Task	Reference
Set the PATH variable	See "Setting the path variable for a manual single node installation" on page 173.
Install the VCS software manually and add a license key	See "Installing the VCS software manually on a single node" on page 173.
Remove any LLT or GAB configuration files and rename LLT and GAB startup files. A single-node cluster does not require the node-to-node communication service, LLT, or the membership communication service, GAB.	See "Renaming the LLT and GAB startup files" on page 174.
Create and modify the VCS configuration files.	See "Configuring VCS" on page 174.
Start VCS and verify single-node operation.	See "Verifying single-node operation" on page 174.

Setting the path variable for a manual single node installation

Set the path variable.

See "Setting the PATH variable" on page 46.

Installing the VCS software manually on a single node

Install the VCS 5.0.1 depots manually and install the license key.

Refer to the following sections:

- See "Installing VCS software manually" on page 90.

- See "Adding a license key for a manual installation" on page 92.

Renaming the LLT and GAB startup files

You may need the LLT and GAB startup files to upgrade the single-node cluster to a multiple-node cluster at a later time.

To rename the LLT and GAB startup files

- Rename the LLT and GAB startup files.

```
# mv /sbin/rc2.d/S68llt /sbin/rc2.d/s68llt
# mv /sbin/rc2.d/S92gab /sbin/rc2.d/s92gab
```

Configuring VCS

You now need to configure VCS.

See "Configuring VCS" on page 96.

Verifying single-node operation

After successfully creating a single-node cluster, start VCS and verify the cluster.

To verify single-node cluster

1. Bring up VCS manually as a single-node cluster using `hastart` with the `-onenode` option:

```
# hastart -onenode
```

2. Verify that the `had` and `hashadow` daemons are running in single-node mode:

```
# ps -ef | grep ha
root  285   1  0 14:49:31 ?  0:02 /opt/VRTSvcs/bin/had -onenode
root  288   1  0 14:49:33 ?  0:00 /opt/VRTSvcs/bin/hashadow
```

Adding a node to a single-node cluster

All nodes in the new cluster must run the same version of VCS. The example procedure refers to the existing single-node VCS node as Node A. The node that is to join Node A to form a multiple-node cluster is Node B.

Table 10-3 specifies the activities that you need to perform to add nodes to a single-node cluster.

Table 10-3 Tasks to add a node to a single-node cluster

Task	Reference
Set up Node B to be compatible with Node A.	See "Setting up a node to join the single-node cluster" on page 175.
■ Add Ethernet cards for private heartbeat network for Node B. ■ If necessary, add Ethernet cards for private heartbeat network for Node A. ■ Make the Ethernet cable connections between the two nodes.	See "Installing and configuring Ethernet cards for private network" on page 176.
Connect both nodes to shared storage.	See "Configuring the shared storage" on page 177.
■ Bring up VCS on Node A. ■ Edit the configuration file.	See "Bringing up the existing node" on page 177.
If necessary, install VCS on Node B and add a license key. Make sure Node B is running the same version of VCS as the version on Node A.	See "Installing the VCS software manually when adding a node to a single node cluster" on page 178.
Edit the configuration files on Node B.	See "Creating configuration files" on page 178.
Start LLT and GAB on Node B.	See "Starting LLT and GAB" on page 178.
■ Start LLT and GAB on Node A. ■ Restart VCS on Node A. ■ Modify service groups for two nodes.	See "Reconfiguring VCS on the existing node" on page 178.
■ Start VCS on Node B. ■ Verify the two-node cluster.	See "Verifying configuration on both nodes" on page 179.

Setting up a node to join the single-node cluster

The new node to join the existing single node running VCS must run the same version of operating system and patch level.

To set up a node to join the single-node cluster

1 Do one of the following tasks:

- If VCS is not currently running on Node B, proceed to step 2.

- If the node you plan to add as Node B is currently part of an existing cluster, remove the node from the cluster. After you remove the node from the cluster, remove the VCS depots and configuration files.
  See "Removing a node from a cluster" on page 163.
- If the node you plan to add as Node B is also currently a single VCS node, uninstall VCS.
  See "Removing VCS depots manually" on page 184.
- If you renamed the LLT and GAB startup files, remove them.
  See "Renaming the LLT and GAB startup files" on page 174.

2 If necessary, install VxVM and VxFS.

See "Installing VxVM or VxFS if necessary" on page 176.

Installing VxVM or VxFS if necessary

If you have either VxVM or VXFS with the cluster option installed on the existing node, install the same version on the new node.

Refer to the appropriate documentation for VxVM and VxFS to verify the versions of the installed products. Make sure the same version runs on all nodes where you want to use shared storage.

Installing and configuring Ethernet cards for private network

Both nodes require Ethernet cards (NICs) that enable the private network. If both Node A and Node B have Ethernet cards installed, you can ignore this step.

For high availability, use two separate NICs on each node. The two NICs provide redundancy for heartbeating.

See "Setting up the private network" on page 38.

To install and configure Ethernet cards for private network

1 Shut down VCS on Node A.

```
# hastop -local
```

2 Install the Ethernet card on Node A.

If you want to use aggregated interface to set up private network, configure aggregated interface.

3 Install the Ethernet card on Node B.

If you want to use aggregated interface to set up private network, configure aggregated interface.

4 Configure the Ethernet card on both nodes.

5 Make the two Ethernet cable connections from Node A to Node B for the private networks.

Configuring the shared storage

Make the connection to shared storage from Node B. Configure VxVM on Node B and reboot the node when you are prompted.

See "Setting up shared storage" on page 41.

Bringing up the existing node

Bring up the node.

To bring up the node

1 Log in as superuser.

2 Make the VCS configuration writable.

```
# haconf -makerw
```

3 Display the service groups currently configured.

```
# hagrp -list
```

4 Freeze the service groups.

```
# hagrp -freeze group -persistent
```

Repeat this command for each service group in step 4.

5 Make the configuration read-only.

```
# haconf -dump -makero
```

6 Stop VCS on Node A.

```
# hastop -local -force
```

7 Rename the GAB and LLT startup files so they can be used.

```
# mv /sbin/rc2.d/s680llt /sbin/rc2.d/S680llt
# mv /sbin/rc2.d/s920gab /sbin/rc2.d/S920gab
```

Installing the VCS software manually when adding a node to a single node cluster

Install the VCS 5.0.1 depots manually and install the license key.

Refer to the following sections:

- See "Installing VCS software manually" on page 90.
- See "Adding a license key for a manual installation" on page 92.

Creating configuration files

Create the configuration files for your cluster.

To create the configuration files

1. Create the file /etc/llttab that lists both the nodes.

   See "Setting up /etc/llttab for a manual installation" on page 94.

2. Create the file /etc/llthosts. Set up /etc/llthosts for a two-node cluster.

   See "Setting up /etc/llthosts for a manual installation" on page 94.

3. Create the file /etc/gabtab.

   See "Configuring GAB for a manual installation" on page 96.

Starting LLT and GAB

On the new node, start LLT and GAB.

To start LLT and GAB

1. Start LLT on Node B.

   ```
   # /sbin/init.d/llt start
   ```

2. Start GAB on Node B.

   ```
   # /sbin/init.d/gab start
   ```

Reconfiguring VCS on the existing node

Reconfigure VCS on the existing nodes.

To reconfigure VCS on existing nodes

1. On Node A, create the files /etc/lltab, /etc/llthosts, and /etc/gabtab. Use the files that are created on Node B as a guide, customizing the /etc/lltab for Node A.
2. Start LLT on Node A.

   ```
   # /sbin/init.d/llt start
   ```

3. Start GAB on Node A.

   ```
   # /sbin/init.d/gab start
   ```

4. Check the membership of the cluster.

   ```
   # gabconfig -a
   ```

5. Start VCS on Node A.

   ```
   # hastart
   ```

6. Make the VCS configuration writable.

   ```
   # haconf -makerw
   ```

7. Add Node B to the cluster.

   ```
   # hasys -add sysB
   ```

8. Add Node B to the system list of each service group.
   - List the service groups.

     ```
     # hagrp -list
     ```

   - For each service group that is listed, add the node.

     ```
     # hagrp -modify group SystemList -add sysB 1
     ```

Verifying configuration on both nodes

Verify the configuration for the nodes.

To verify the nodes' configuration

1 On Node B, check the cluster membership.

```
# gabconfig -a
```

2 Start the VCS on Node B.

```
# hastart
```

3 Verify that VCS is up on both nodes.

```
# hastatus
```

4 List the service groups.

```
# hagrp -list
```

5 Unfreeze the service groups.

```
# hagrp -unfreeze group -persistent
```

6 Implement the new two-node configuration.

```
# haconf -dump -makero
```

Chapter 11

Uninstalling VCS

This chapter includes the following topics:

About the uninstallvcs program

You can uninstall VCS from all nodes in the cluster or from specific nodes in the cluster using the uninstallvcs program. The uninstallvcs program does not automatically uninstall VCS enterprise agents, but offers uninstallation if proper depots dependencies on VRTSvcs are found.

If uninstallvcs program does not remove an enterprise agent, see the documentation for the specific enterprise agent for instructions on how to remove it.

Preparing to uninstall VCS

Review the following prerequisites before you uninstall VCS:

- Before you remove VCS from any node in the cluster, shut down the applications that depend on VCS. For example, applications such as Java Console or any high availability agents for VCS.
- Before you remove VCS from fewer than all nodes in a cluster, stop the service groups on the nodes from which you uninstall VCS. You must also reconfigure VCS on the remaining nodes.
  See "About adding and removing nodes" on page 155.

- If you have manually edited any of the VCS configuration files, you need to reformat them.

Uninstalling VCS 5.0.1

You must meet the following conditions to use the uninstallvcs program to uninstall VCS on all nodes in the cluster at one time:

- Make sure that the communication exists between systems. By default, the uninstaller uses ssh.
- Make sure you can execute `ssh` or `remsh` commands as superuser on all nodes in the cluster.
- Make sure that the `ssh` or `remsh` is configured to operate without requests for passwords or passphrases.

If you cannot meet the prerequisites, then you must run the uninstallvcs program on each node in the cluster.

The example demonstrates how to uninstall VCS using the uninstallvcs program. The uninstallvcs program uninstalls VCS on two nodes: galaxy nebula. The example procedure uninstalls VCS from all nodes in the cluster.

Removing VCS 5.0.1 depots

The program stops the VCS processes that are currently running during the uninstallation process.

To uninstall VCS

1. Log in as superuser from the node where you want to uninstall VCS.
2. Start uninstallvcs program.

```
# cd /opt/VRTS/install
# ./uninstallvcs
```

The program specifies the directory where the logs are created. The program displays a copyright notice and a description of the cluster:

```
VCS configuration files exist on this system with the following
information:

      Cluster Name: VCS_cluster2
      Cluster ID Number: 7
      Systems: galaxy nebula
      Service Groups: ClusterService groupA groupB
```

3 Enter the names of the systems from which you want to uninstall VCS.

The program performs system verification checks and asks to stop all running VCS processes.

4 Enter **y** to stop all the VCS processes.

The program proceeds with uninstalling the software.

5 Answer the prompt to proceed with uninstalling the software.

Select one of the following:

- To uninstall VCS on all nodes, press `Enter`.
- To uninstall VCS only on specific nodes, enter `n`.

```
Do you want to uninstall VCS from these systems? [y,n,q] (y)
```

6 If the uninstallvcs program prompts, enter a list of nodes from which you want to uninstall VCS.

The uninstallvcs program prompts this information in one of the following conditions:

- You enter `n` .
- The program finds no VCS configuration files on the local node.

7 If depots, such as enterprise agents, are found to be dependent on a VCS depot, the uninstaller prompt you on whether you want them removed. Enter `y` to remove the designated depots.

8 Review the uninstaller report after the verification.

9 Press Enter to uninstall the VCS depots.

```
Are you sure you want to uninstall VCS depots? [y,n,q] (y)
```

10 Review the output as the uninstaller stops processes, unloads kernel modules, and removes the depots.

11 Note the location of summary and log files that the uninstaller creates after removing all the depots.

Running uninstallvcs from the VCS 5.0.1 disc

You may need to use the uninstallvcs program on the VCS 5.0.1 disc in one of the following cases:

- You need to uninstall VCS after an incomplete installation.

- The uninstallvcs program is not available in /opt/VRTS/install.

Removing VCS depots manually

You must remove the VCS depots from each node in the cluster to uninstall VCS.

To manually remove VCS packages on a node

1. Shut down VCS on the local system using the `hastop` command.

```
# hastop -local
```

2. Unconfigure the GAB and the LLT utilities.

```
# /sbin/gabconfig -U
# /sbin/lltconfig -Uo
```

3. If you installed VRTSvxfen, then:

```
# kcmodule vxfen=unused
```

4. Unload the GAB driver:

```
# kcmodule gab=unused
```

5 Unload the LLT driver:

```
# kcmodule llt=unused
```

6 Remove the VCS 5.0.1 depots in the following order:

```
# swremove VRTScmccc
# swremove VRTScmcs
# swremove VRTScssim
# swremove VRTScscw
# swremove VRTSweb
# swremove VRTScscm
# swremove VRTScutil
# swremove VRTSjre15
# swremove VRTSjre
# swremove VRTSvcsdc
# swremove VRTSvcsmn
# swremove VRTSvcsmg
# swremove VRTSvcsag
# swremove VRTSacclib
# swremove VRTSvcs
# swremove VRTSvxfen
# swremove VRTSgab
# swremove VRTSllt
# swremove SYMClma
# swremove VRTSspt
# swremove VRTSat
# swremove VRTSsmf
# swremove VRTSpbx
# swremove VRTSicsco
# swremove VRTSperl
# swremove VRTSvlic
```

Appendix A

Advanced VCS installation topics

This appendix includes the following topics:

Using the UDP layer for LLT

VCS 5.0.1 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.

Configuring LLT over UDP

The following checklist is to configure LLT over UDP:

- Make sure that the LLT private links are on different physical networks.

If the LLT private links are not on different physical networks, then make sure that the links are on separate subnets. Set the broadcast address in /etc/llttab explicitly depending on the subnet for each link.
See "Broadcast address in the /etc/llttab file" on page 188.

- 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 190.
- Set the broadcast address correctly for direct-attached (non-routed) links.
See "Sample configuration: direct-attached links" on page 192.
- 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 194.

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 galaxy:

```
galaxy # cat /etc/llttab
set-node galaxy
set-cluster 1
link link1 /dev/udp - udp 50000 - 192.168.9.1 192.168.9.255
link link2 /dev/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.

```
galaxy # ifconfig lan1
lan1: flags=1843<UP,BROADCAST,RUNNING,MULTICAST,CKO>
        inet 192.168.9.1 netmask ffffff00 broadcast 192.168.9.255
galaxy # ifconfig lan2
lan2: flags=1843<UP,BROADCAST,RUNNING,MULTICAST,CKO>
        inet 192.168.10.1 netmask ffffff00 broadcast 192.168.10.255
```

- Display the content of the /etc/llttab file on the second node nebula:

```
nebula # cat /etc/llttab
set-node nebula
set-cluster 1
```

```
link link1 /dev/udp - udp 50000 - 192.168.9.2 192.168.9.255
link link2 /dev/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.

```
nebula # ifconfig lan1
lan1: flags=1843<UP,BROADCAST,RUNNING,MULTICAST,CKO>
        inet 192.168.9.2 netmask ffffff00 broadcast 192.168.9.255
nebula # ifconfig lan2
lan2: flags=1843<UP,BROADCAST,RUNNING,MULTICAST,CKO>
        inet 192.168.10.2 netmask ffffff00 broadcast 192.168.10.255
```

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 192.
- See "Sample configuration: links crossing IP routers" on page 194.

Table A-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 A-1 Field description for link command in /etc/llttab

Field	Description
tag-name	A unique string that is used as a tag by LLT; for example link1, link2,....
device	The device path of the UDP protocol; for example /dev/udp.
node-range	Nodes using the link. "-" indicates all cluster nodes are to be configured for this link.
link-type	Type of link; must be "udp" for LLT over UDP.
udp-port	Unique UDP port in the range of 49152-65535 for the link. See "Selecting UDP ports" on page 190.
MTU	"-" is the default, which has a value of 8192. The value may be increased or decreased depending on the configuration. Use the `lltstat -l` command to display the current value.
IP address	IP address of the link on the local node.

Table A-1 Field description for link command in /etc/lltab *(continued)*

Field	Description
bcast-address	■ 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/lltab file

The `set-addr` command in the /etc/lltab 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 194.

Table A-2 describes the fields of the set-addr command.

Table A-2 Field description for set-addr command in /etc/lltab

Field	Description
node-id	The ID of the cluster node; for example, 0.
link tag-name	The string that LLT uses to identify the link; for example link1, link2,....
address	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 | head -2 ; netstat -a | grep udp
Active Internet connections (including servers)
Proto Recv-Q Send-Q  Local Address Foreign Address        (state)
udp        0      0  *.ntalk                *.*
```

```
udp        0      0  *.*                    *.*
udp        0      0  *.49193                *.*
udp        0      0  *.49152                *.*
udp        0      0  *.portmap              *.*
udp        0      0  *.*                    *.*
udp        0      0  *.135                  *.*
udp        0      0  *.2121                 *.*
udp        0      0  *.xdmcp                *.*
udp        0      0  *.49196                *.*
udp        0      0  *.*                    *.*
udp        0      0  *.snmp                 *.*
udp        0      0  *.*                    *.*
udp        0      0  *.49153                *.*
udp        0      0  *.echo                 *.*
udp        0      0  *.discard              *.*
udp        0      0  *.daytime              *.*
udp        0      0  *.chargen              *.*
udp        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:

```
# set_parms ip_address
```

For example:

- For the first network interface on the node galaxy:

  ```
  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 nebula:

  ```
  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 galaxy:

```
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 nebula:

```
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.

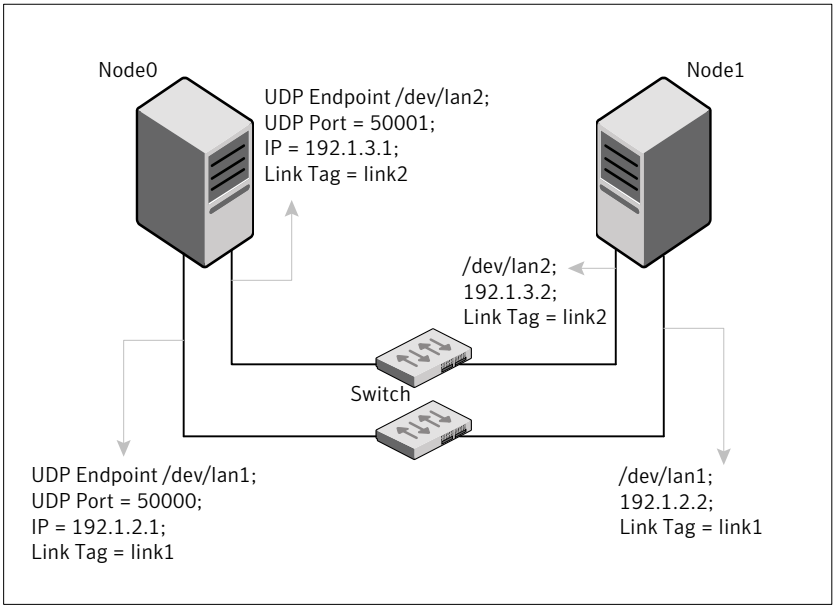
```
# cat /etc/llttab
set-node nodexyz
set-cluster 100

link link1 /dev/udp - udp 50000 - 192.168.30.1 192.168.30.255
link link2 /dev/udp - udp 50001 - 192.168.31.1 192.168.31.255
```

Sample configuration: direct-attached links

Figure A-1 depicts a typical configuration of direct-attached links employing LLT over UDP.

Figure A-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 broadcasts requests 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/llttab 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/udp - udp 50000 - 192.1.2.1 192.1.2.255
link link2 /dev/udp - udp 50001 - 192.1.3.1 192.1.3.255
```

The file for Node 1 resembles:

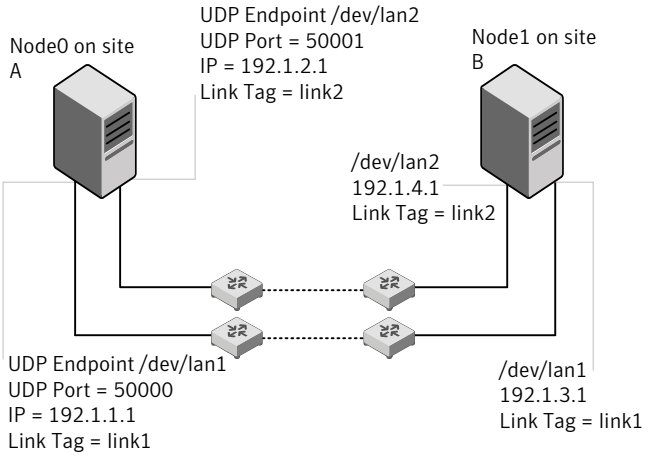
```
set-node Node1
set-cluster 1
```

```
#configure Links
#link tag-name device node-range link-type udp port MTU \
IP-address bcast-address
link link1 /dev/udp - udp 50000 - 192.1.2.2 192.1.2.255
link link2 /dev/udp - udp 50001 - 192.1.3.2 192.1.3.255
```

Sample configuration: links crossing IP routers

Figure A-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 A-2 A typical configuration of links crossing an IP router



The configuration that the following `/etc/lltab` 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/lltab` file.

```
set-node Node1
set-cluster 1

link link1 /dev/udp - udp 50000 - 192.1.3.1 -
link link2 /dev/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/lltab` file on Node 0 resembles:

```
set-node Node0
set-cluster 1

link link1 /dev/udp - udp 50000 - 192.1.1.1 -
link link2 /dev/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
```

Performing automated VCS installations

Using installvcs program with the `-responsefile` option is useful not only for installing and configuring VCS within a secure environment. This option is also useful for conducting unattended installations to other clusters as well. Typically, you can use the response file generated during the installation of VCS on one cluster to install VCS on other clusters. You can copy the file to a system in another cluster and manually edit the file to contain appropriate values.

When the systems are set up and meet the requirements for installation, you can perform an unattended installation. You perform the installation from one of the cluster systems where you have copied the response file.

To perform automated installation

1 Navigate to the folder containing the installvcs program.

```
# cd /dvdrom/cluster_server
```

2 Start the installation from one of the cluster systems where you have copied the response file.

```
# ./installvcs -responsefile /tmp/response_file
```

Where /tmp/response_file is the response file's full path name.

Syntax in the response file

The syntax of the Perl statements that are included in the response file varies. It can depend on whether the variables require scalar or list values.

For example, in the case of a string value:

```
$CFG{Scalar_variable}="value";
```

or, in the case of an integer value:

```
$CFG{Scalar_variable}=123;
```

or, in the case of a list:

```
$CFG{List_variable}=["value", "value", "value"];
```

Example response file

The example response file resembles the file that installvcs creates after the example VCS installation. The file is a modified version of the response file generated on vcs_cluster2 that you can use to install VCS on vcs_cluster3. Review the variables that are required for installation.

See "Response file variable definitions" on page 197.

```
#
# installvcs configuration values:
#
$CPI::CFG{AT_ROOTDOMAIN}="root\@east.symantecexample.com";
$CPI::CFG{CMC_CC_CONFIGURED}=1;
$CPI::CFG{CMC_CLUSTERID}{east}=1146235600;
$CPI::CFG{CMC_MSADDR}{east}="mgmtserver1";
$CPI::CFG{CMC_MSADDR}{west}="mgmtserver1";
$CPI::CFG{CMC_MS_ROOT_HASH}="758a33dbd6fae716...3deb54e562fe98";
```

```
$CPI::CFG{CMC_SERVICE_PASSWORD}="U2FsdVkX18v...n0hTSWwodThc+rX";
$CPI::CFG{ENCRYPTED}="U2FsdGVkX1+k2DHcnW7b6...ghdh+zW4G0WFIJA=";
$CPI::CFG{KEYS}{east}=[ qw(XXXX-XXXX-XXXX-XXXX-XXXX-XXX) ];
$CPI::CFG{KEYS}{west}=[ qw(XXXX-XXXX-XXXX-XXXX-XXXX-XXX) ];
$CPI::CFG{OBC_IGNOREWARNINGS}=0;
$CPI::CFG{OBC_MODE}="STANDALONE";
$CPI::CFG{OPT}{INSTALL}=1;
$CPI::CFG{OPT}{NOEXTRAPKGS}=1;
$CPI::CFG{OPT}{RSH}=1;
$CPI::CFG{SYSTEMS}=[ qw(east west) ];
$CPI::CFG{UPI}="VCS";
$CPI::CFG{VCS_ALLOWCOMMS}="Y";
$CPI::CFG{VCS_CLUSTERID}=13221;
$CPI::CFG{VCS_CLUSTERNAME}="vcs_cluster3";
$CPI::CFG{VCS_CSGNETMASK}="255.255.240.0";
$CPI::CFG{VCS_CSGNIC}{ALL}="lan0";
$CPI::CFG{VCS_CSGVIP}="10.10.12.1";
$CPI::CFG{VCS_LLTLINK1}{east}="lan1";
$CPI::CFG{VCS_LLTLINK1}{west}="lan1";
$CPI::CFG{VCS_LLTLINK2}{east}="lan2";
$CPI::CFG{VCS_LLTLINK2}{west}="lan2";

$CPI::CFG{VCS_NETWORKHOSTS}="10.10.12.2";

$CPI::CFG{VCS_SMTPRECP}=[ qw(earnie@symantecexample.com) ];
$CPI::CFG{VCS_SMTPRSEV}=[ qw(SevereError) ];
$CPI::CFG{VCS_SMTPSERVER}="smtp.symantecexample.com";
$CPI::CFG{VCS_SNMPCONS}=[ qw(neptune) ];
$CPI::CFG{VCS_SNMPCSEV}=[ qw(SevereError) ];
$CPI::CFG{VCS_SNMPPORT}=162;
```

Response file variable definitions

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 SMTPRSEV), the SNMP trap notification (SNMPPORT, SNMPCONS, and SNMPCSEV), and the Global Cluster Option (GCONIC, GCOVIP, and GCONETMASK).

Table A-3 lists the variables that the response file uses and the variable definitions.

Table A-3 Response file variables

Variable	Description
$CPI::CFG{OPT}{INSTALL}	Installs and configures VCS. List or scalar: scalar Optional or required: required
$CPI::CFG{OPT}{INSTALLONLY}	Installs VCS depots. Configuration can be performed at a later time using the `-configure` option. List or scalar: scalar Optional or required: optional
$CPI::CFG{SYSTEMS}	List of systems on which the product is to be installed, uninstalled, or configured. List or scalar: list Optional or required: required
$CPI::CFG{SYSTEMSCFG}	List of systems to be recognized in configuration if secure environment prevents all systems from being installed at once. List or scalar: list Optional or required: optional
$CPI::CFG{UPI}	Defines the product to be installed, uninstalled, or configured. List or scalar: scalar Optional or required: required
$CPI::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
$CPI::CFG{OPT}{LICENSE}	Licenses VCS only. List or scalar: scalar Optional or required: optional
$CPI::CFG{OPT}{NOLIC}	Installs the product without any license. List or scalar: scalar Optional or required: optional

Table A-3 Response file variables *(continued)*

Variable	Description
$CPI::CFG{AT_ROOTDOMAIN}	Defines the name of the system where the root broker is installed. List or scalar: list Optional or required: optional
$CPI::CFG{OPT}{PATCHPATH}	Defines a location, typically an NFS mount, from which all remote systems can install product patches. The location must be accessible from all target systems. List or scalar: scalar Optional or required: optional
$CPI::CFG{OPT}{PKGPATH}	Defines a location, typically an NFS mount, from which all remote systems can install product depots. The location must be accessible from all target systems. List or scalar: scalar Optional or required: optional
$CPI::CFG{OPT}{TMPPATH}	Defines the location where a working directory is created to store temporary files and the depots that are needed during the install. The default location is /var/tmp. List or scalar: scalar Optional or required: optional
$CPI::CFG{OPT}{RSH}	Defines that *remsh* must be used instead of ssh as the communication method between systems. List or scalar: scalar Optional or required: optional
$CPI::CFG{DONOTINSTALL}	Instructs the installation to not install the optional depots in the list. List or scalar: list Optional or required: optional
$CPI::CFG{DONOTREMOVE}	Instructs the uninstallation to not remove the optional depots in the list. List or scalar: list Optional or required: optional

Table A-3 Response file variables *(continued)*

Variable	Description
$CPI::CFG{STOPFAIL_ALLOW}	Decides whether or not the installer should proceed with the installation if failures, such as stopping of processes or unloading of drivers occurs. List or scalar: scalar Optional or required: optional
$CPI::CFG{VCS_CLUSTERNAME}	Defines the name of the cluster. List or scalar: scalar Optional or required: required
$CPI::CFG{VCS_CLUSTERID}	An integer between 0 and 65535 that uniquely identifies the cluster. List or scalar: scalar Optional or required: required
$CPI::CFG{KEYS} {SYSTEM}	List of keys to be registered on the system. List or scalar: list Optional or required: optional
$CPI::CFG{OPT_LOGPATH}	Mentions the location where the log files are to be copied. The default location is /opt/VRTS/install/logs. List or scalar: scalar Optional or required: optional
$CPI::CFG{OPT}{CONFIGURE}	Performs the configuration if the depots are already installed using the `-installonly` option. List or scalar: scalar Optional or required: optional
$CPI::CFG{VCS_LLTLINK#} {SYSTEM}	Defines the NIC to be used for a private heartbeat link on each system. Two LLT links are required per system (LLTLINK1 and LLTLINK2). Up to four LLT links can be configured. List or scalar: scalar Optional or required: required

Table A-3 Response file variables *(continued)*

Variable	Description
$CPI::CFG{VCS_LLTLINKLOWPRI} {SYSTEM}	Defines a low priority heartbeat link. Typically, LLTLINKLOWPRI is used on a public network link to provide an additional layer of communication. List or scalar: scalar Optional or required: optional
$CPI::CFG{VCS_SMTPSERVER}	Defines the domain-based hostname (example: smtp.symantecexample.com) of the SMTP server to be used for Web notification. List or scalar: scalar Optional or required: optional
$CPI::CFG{VCS_SMTPRECP}	List of full email addresses (example: user@symantecexample.com) of SMTP recipients. List or scalar: list Optional or required: optional
$CPI::CFG{VCS_SMTPRSEV}	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. List or scalar: list Optional or required: optional
$CPI::CFG{VCS_SNMPPORT}	Defines the SNMP trap daemon port (default=162). List or scalar: scalar Optional or required: optional
$CPI::CFG{VCS_SNMPCONS}	List of SNMP console system names List or scalar: list Optional or required: optional

Table A-3 Response file variables *(continued)*

Variable	Description
$CPI::CFG{VCS_SNMPCSEV}	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. List or scalar: list Optional or required: optional
$CPI::CFG{VCS_GCONIC} {SYSTEM}	Defines the NIC for the Virtual IP that the Global Cluster Option uses. 'ALL' can be entered as a system value if the same NIC is used on all systems. List or scalar: scalar Optional or required: optional
$CPI::CFG{VCS_GCOVIP}	Defines the virtual IP address to that the Global Cluster Option uses. List or scalar: scalar Optional or required: optional
$CPI::CFG{VCS_GCONETMASK}	Defines the Netmask of the virtual IP address that the Global Cluster Option uses. List or scalar: scalar Optional or required: optional
$CPI::CFG{VCS_USERENPW}	List of encoded passwords for users List or scalar: list Optional or required: optional
$CPI::CFG{VCS_USERNAME}	List of names of users List or scalar: list Optional or required: optional
$CPI::CFG{VCS_USERPRIV}	List of privileges for users List or scalar: list Optional or required: optional

Table A-3 Response file variables *(continued)*

Variable	Description
$CPI::CFG{OPT}{UNINSTALL}	List of systems where VCS must be uninstalled. List or scalar: scalar Optional or required: optional

Installing VCS with a response file where ssh or rsh are disabled

In secure enterprise environments, ssh or remsh communication is not allowed between systems. In such cases, the installvcs program can install and configure VCS only on systems with which it can communicate—most often the local system only. When installation is complete, VCS creates a response file.

See "Response file variable definitions" on page 197.

The response file that the installvcs program generates contains descriptions and explanations of the variables and their values. You copy this file to the other systems in the cluster, and edit it to reflect the current local system. You can use the installation program with the `-responsefile` option to install and configure VCS identically on each system without being prompted.

To use installvcs in a secure environment

1. On one node in the cluster, start VCS installation using the installvcs program.

   See "Starting the software installation" on page 60.

2. Review the output as the installer performs the initial system checks.

   The installer detects the inability to communicate between systems.

3. Press the Enter key to install VCS on one system and create a response file with which you can install on other systems.

   ```
   Would you like to install Cluster Server on systems galaxy only
   and create a responsefile for systems nebula? [y,n,q] (y)
   ```

4. Enter all cluster information. Proceed with the installation and configuration tasks.

   See "Installing and configuring VCS 5.0.1" on page 58.

   The installvcs program installs and configures VCS on systems where communication is possible.

5 After the installation is complete, review the installer report.

The installer stores the installvcs-*universaluniqueidentifier* response file in the /opt/VRTS/install/logs/installvcs-*universaluniqueidentifier*/.response directory where *universaluniqueidentifier* is a variable to uniquely identify the file.

6 If you start VCS before VCS is installed and started on all nodes in the cluster, you see the output similar to:

```
VCS:11306:Did not receive cluster membership, manual
intervention may be needed for seeding
```

7 Use a method of your choice (for example, by using NFS, ftp, or a floppy disk). Copy the response file in a directory such as /tmp on the system where you want to install VCS.

8 Edit the response file.

For the variables in the example, change the name of the system to reflect the current local system:

```
.
$CFG{SYSTEMS} = ["east"];
.
.
$CFG{KEYS}{east} = ["XXXX-XXXX-XXXX-XXXX-XXXX-XXX"];
.
```

For demo or site licenses, the license key need not be changed. When license keys are "node-locked" to specific cluster nodes, you must edit the license key.

9 On the next system, perform the following:

- Mount the product disc.
  See "Mounting the product disc" on page 47.
- Start the software installation using the `installvcs -responsefile` option.

  ```
  # ./installvcs -responsefile /tmp/installvcs-uui.response
  ```

  Where uui is the Universal Unique Identifier that the installer automatically assigned to the response file.
  See "Starting the software installation" on page 60.

10 Repeat step 7 through step 9 until VCS has been installed on all nodes in the cluster.

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