

# Veritas Storage Foundation™ for Sybase ASE CE Release Notes

Solaris

6.0

# Veritas Storage Foundation for Sybase ASE CE Release Notes

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Product version: 6.0

Document version: 6.0.3

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Symantec Technical Support maintains support centers globally. Technical Support's primary role is to respond to specific queries about product features and functionality. The Technical Support group also creates content for our online Knowledge Base. The Technical Support group works collaboratively with the other functional areas within Symantec to answer your questions in a timely fashion. For example, the Technical Support group works with Product Engineering and Symantec Security Response to provide alerting services and virus definition updates.

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## Contacting Technical Support

Customers with a current support agreement may access Technical Support information at the following URL:

[www.symantec.com/business/support/contact\\_techsupp\\_static.jsp](http://www.symantec.com/business/support/contact_techsupp_static.jsp)

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When you contact Technical Support, please have the following information available:

- Product release level

- Hardware information
- Available memory, disk space, and NIC information
- Operating system
- Version and patch level
- Network topology
- Router, gateway, and IP address information
- Problem description:
  - Error messages and log files
  - Troubleshooting that was performed before contacting Symantec
  - Recent software configuration changes and network changes

## Licensing and registration

If your Symantec product requires registration or a license key, access our technical support Web page at the following URL:

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- Product registration updates, such as address or name changes
- General product information (features, language availability, local dealers)
- Latest information about product updates and upgrades
- Information about upgrade assurance and support contracts
- Information about the Symantec Buying Programs
- Advice about Symantec's technical support options
- Nontechnical presales questions
- Issues that are related to CD-ROMs or manuals

## Support agreement resources

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Asia-Pacific and Japan	<a href="mailto:customercare_apac@symantec.com">customercare_apac@symantec.com</a>
Europe, Middle-East, and Africa	<a href="mailto:semea@symantec.com">semea@symantec.com</a>
North America and Latin America	<a href="mailto:supportsolutions@symantec.com">supportsolutions@symantec.com</a>

## Documentation

Your feedback on product documentation is important to us. Send suggestions for improvements and reports on errors or omissions. Include the title and document version (located on the second page), and chapter and section titles of the text on which you are reporting. Send feedback to:

[doc\\_feedback@symantec.com](mailto:doc_feedback@symantec.com)

## About Symantec Connect

Symantec Connect is the peer-to-peer technical community site for Symantec's enterprise customers. Participants can connect and share information with other product users, including creating forum posts, articles, videos, downloads, blogs and suggesting ideas, as well as interact with Symantec product teams and Technical Support. Content is rated by the community, and members receive reward points for their contributions.

<http://www.symantec.com/connect/storage-management>

# Veritas Storage Foundation for Sybase ASE CE Release Notes

This document includes the following topics:

- [About this document](#)
- [Component product release notes](#)
- [About Veritas Storage Foundation for Sybase ASE CE](#)
- [About Symantec Operations Readiness Tools](#)
- [Important release information](#)
- [Changes introduced in 6.0](#)
- [System requirements](#)
- [Fixed issues](#)
- [Known issues](#)
- [Software limitations](#)
- [Documentation](#)

## About this document

This document provides important information about Veritas Storage Foundation for Sybase ASE CE (SF Sybase CE) version 6.0 for Solaris. Review this entire document before you install or upgrade SF Sybase CE.

The information in the Release Notes supersedes the information provided in the product documents for SF Sybase CE.

This is Document version: 6.0.3 of the *Veritas Storage Foundation for Sybase ASE CE Release Notes*. Before you start, make sure that you are using the latest version of this guide. The latest product documentation is available on the Symantec Web site at:

<https://sort.symantec.com/documents>

## Component product release notes

In addition to reading this Release Notes document, review the component product release notes before installing the product.

Product guides are available at the following location on the software media in PDF formats:

`/product_name/docs`

Symantec recommends copying the `docs` directory on the software media that contains the product guides to the `/opt/VRTS` directory on your system.

This release includes the following component product release notes:

- *Veritas Storage Foundation Release Notes (6.0)*
- *Veritas Cluster Server Release Notes (6.0)*
- *Veritas Storage Foundation Cluster File System High Availability Release Notes (6.0)*

## About Veritas Storage Foundation for Sybase ASE CE

Veritas Storage Foundation™ for Sybase® Adaptive Server Enterprise Cluster Edition (SF Sybase CE) by Symantec leverages proprietary storage management and high availability technologies to enable robust, manageable, and scalable deployment of Sybase ASE CE on UNIX platforms. The solution uses cluster file system technology that provides the dual advantage of easy file system management as well as the use of familiar operating system tools and utilities in managing databases.

SF Sybase CE integrates existing Symantec storage management and clustering technologies into a flexible solution which administrators can use to:

- Create a standard toward application and database management in data centers. SF Sybase CE provides flexible support for many types of applications and databases.



- Set up an infrastructure for Sybase ASE CE that simplifies database management while fully integrating with Sybase ASE CE clustering solution.
- Apply existing expertise of Symantec technologies toward this product.

The solution stack comprises the Veritas Cluster Server (VCS), Veritas Cluster Volume Manager (CVM), Veritas Cluster File System (CFS), and Veritas Storage Foundation, which includes the base Veritas Volume Manager (VxVM) and Veritas File System (VxFS).

## Benefits of SF Sybase CE

SF Sybase CE provides the following benefits:

- Use of a generic clustered file system (CFS) technology or a local file system (VxFS) technology for storing and managing Sybase ASE CE installation binaries.
- Support for file system-based management. SF Sybase CE provides a generic clustered file system technology for storing and managing Sybase ASE CE data files as well as other application data.
- Use of Cluster File System (CFS) for the Sybase ASE CE quorum device.
- Support for a standardized approach toward application and database management. A single-vendor solution for the complete SF Sybase CE software stack lets you devise a standardized approach toward application and database management. Further, administrators can apply existing expertise of Veritas technologies toward SF Sybase CE.
- Easy administration and monitoring of SF Sybase CE clusters from a single web console.
- Enhanced scalability and availability with access to multiple Sybase ASE CE instances per database in a cluster.
- Prevention of data corruption in split-brain scenarios with robust SCSI-3 Persistent Reservation (PR) based I/O fencing.
- Support for sharing all types of files, in addition to Sybase ASE CE database files, across nodes.
- Increased availability and performance using Veritas Dynamic Multi-Pathing (DMP). DMP provides wide storage array support for protection from failures and performance bottlenecks in the Host Bus Adapters (HBAs) and Storage Area Network (SAN) switches.
- Fast disaster recovery with minimal downtime and interruption to users. Users can transition from a local high availability site to a wide-area disaster recovery environment with primary and secondary sites. If a node fails, clients that are

attached to the failed node can reconnect to a surviving node and resume access to the shared database. Recovery after failure in the SF Sybase CE environment is far quicker than recovery for a failover database.

- Support for block-level replication using VVR.

## About Symantec Operations Readiness Tools

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

SORT can help you do the following:

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

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

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To access SORT, go to:

<https://sort.symantec.com>

## Important release information

- For important updates regarding this release, review the Late-Breaking News TechNote on the Symantec Technical Support website:  
<http://www.symantec.com/docs/TECH164885>
- For the latest patches available for this release, go to:  
<http://sort.symantec.com/>
- The hardware compatibility list contains information about supported hardware and is updated regularly. For the latest information on supported hardware visit the following URL:  
<http://www.symantec.com/docs/TECH170013>  
Before installing or upgrading Storage Foundation and High Availability Solutions products, review the current compatibility list to confirm the compatibility of your hardware and software.

## Changes introduced in 6.0

This section lists the changes in Veritas Storage Foundation for Sybase ASE CE 6.0.

### Support for product deployment using Flash Archives on Solaris 10

Use a Flash archive to install the Storage Foundation and High Availability Suite of products and the Solaris 10 operating system in conjunction with JumpStart.

See the *Installation Guide* for more information.

### The installer can now detect duplicate VCS cluster IDs and can automatically generate cluster IDs

The installer can now detect duplicate VCS cluster IDs and prompt you to select an unused one. It can also generate an unused ID during installation.

### The installer can check product versions and hotfixes

You can check the existing product versions using the installer command with the `-version` option before or after you install. After you have installed the current version of the product, you can use the `showversion` script in the `/opt/VRTS/install` directory to find version information.

You can discover the following information with these commands:

- The installed version of all released Storage Foundation and High Availability Suite of products
- The missing required packages or patches as applicable for platform
- The available updates (including patches or hotfixes) from SORT for the installed products

Depending on the product, the script can identify versions from 4.0 onward.

## Using the installer's postcheck option

You can use the installer's postcheck option to diagnose installation-related problems and to provide troubleshooting information.

## Allow Response files to change tuning parameters

You can set non-default product and system tunable parameters using a tunables template file. With the file, you can set tunables such as the I/O policy or toggle native multi-pathing during or after the installation procedure.

See the *Installation Guide* for more information.

## Packaging updates

The following lists the package changes in this release.

- New `VRTSsfcp60` package for product installer scripts  
The `VRTSsfcp60` package is introduced in this release. The `VRTSsfcp60` package contains the installer scripts and libraries that the installer uses to install, configure and upgrade Veritas products.

For more information, see the *Installation Guide*.

## Changes to database agents

### Changes to the Sybase agent

The Veritas Cluster Server agent for Sybase includes the following new or enhanced features:

- The VCS agents for Sybase now supports intelligent resource monitoring.
- The `DetailMonitor` attribute is deprecated in VCS 6.0. Instead, `LevelTwoMonitorFreq` attribute of Sybase agent may be used. The default value of `LevelTwoMonitorFreq` attribute is 0 (zero).
- The long pathname limitation for `$$SYBASE` is resolved.

- With VCS 6.0 release using VCS Cluster Manager (Java Console), Sybase agents encrypt the password by default. Sybase agent supports both plain text and encrypted password. If required, the plain text value can be specified for agent attributes using the command line or by editing the configuration file.
- Sybase agent uses new timeout option during shutdown of Sybase dataserver used instead of "shutdown with nowait". For Sybase ASE Cluster Edition, the timeout option for shutdown command is supported from versions 15.5 ESD #1 onwards.

## Changes to SF Sybase CE clusters in secure mode

In this release, the installation and configuration experience of secure cluster is considerably simplified. You can easily convert the cluster into secure cluster with this simplified secure cluster configuration model.

The new architecture is based on embedded VxAT, where the security components are installed as a part of the SF Sybase CE package. The root broker is no longer a single-point-of-failure in the new architecture. There is no dependency on a separate VRTSat package. Non-root users who are already logged on SF Sybase CE hosts are now not prompted for password. Additionally, a cluster-level user feature is introduced to simplify user administration in secure clusters.

See the *Installation Guide* and *Administrator's Guide* for more information.

## Changes to LLT

This release includes the following new features and changes to LLT:

- Faster detection of LLT link failures  
LLT now has the capability to detect the LLT link failures immediately using the operating system's link-down notification feature.
- LLT now supports VLAN tagging (IEEE 802.1Q).

See the *Veritas Storage Foundation for Sybase ASE CE Installation and Configuration Guide* and the *Veritas Storage Foundation for Sybase ASE CE Administrator's Guide* for more details.

## Changes to GAB

This section covers the new features and changes related to GAB in this release.

## Better GAB and I/O fencing integration to ensure application availability

In the event of a split-brain situation before VxFEN module implements the decision, sometimes GAB proceeds with attempting to resolve the join after the split-brain. GAB removes all but one joining subcluster. This behavior can cause the entire cluster to shut down. To avoid this scenario, GAB now gives priority to the fencing module.

With the GAB and I/O fencing integration in this release, if the I/O fencing module's decision is still pending before GAB initiates a join of the subcluster, GAB delays the `iofence` message. GAB wait depends on the value of the VxFEN tunable parameter `panic_timeout_offst` based on which VxFEN computes the delay value and passes to GAB.

See the Veritas Storage Foundation for Sybase ASE CE Administrator's Guide for more details.

## GAB can now recognize clients with names in addition to ports

When kernel clients initialize GAB API, they can now define a client name string. GAB now adds a client name which enables GAB to track the client even before GAB port is registered. GAB also passes the client name information to LLT when registering the LLT port. The `lltstat -p` command also displays the GAB client names when providing the status details of the ports in use.

This feature is applicable only to GAB kernel clients, and not applicable for user-land GAB clients such as HAD.

## The `gabconfig` command has new `-C` option

The `-C` option of the `gabconfig` command lists the names of the GAB clients that have registered with GAB. The `-C` option when used with `-a` option lists the client names along with the port membership details.

## Changes to I/O fencing

This section covers the new features and changes related to I/O fencing in this release.

### Support for racer node re-election during I/O fencing race

At the time of a network partition, the VxFEN module elects the lowest node in each sub-cluster as the racer node to race for the coordination points on behalf of the sub-cluster. The other spectator nodes wait on the racer node to do the fencing.

In the previous releases, the I/O fencing race was entirely dependent on the single racer node as follows:

- If the racer node is not able to reach a majority of coordination points, then the VxFEN module on the racer node sends a LOST\_RACE message and all nodes in the subcluster also panic when they receive the LOST\_RACE message.
- If the racer node panics during the arbitration, then the spectator nodes in the sub-cluster assume that the racer node lost the race and the spectator nodes also panic.

With the new racer node re-election feature, the VxFEN module re-elects the node with the next lowest node id in the sub-cluster as the racer node. This feature optimizes the chances for the sub-cluster to continue with the race for coordination points.

See the *Veritas Storage Foundation for Sybase ASE CE Administrator's Guide* for more details.

## **With fencing enabled, GAB can now automatically seed the cluster when some cluster nodes are unavailable**

In the earlier releases, if some of the nodes are not up and running in a cluster, then GAB port does not come up to avoid any risks of preexisting split-brain. In such cases, you can manually seed GAB using the command `gabconfig -x` to bring the GAB port up. However, if you have enabled I/O fencing in the cluster, then I/O fencing can handle any preexisting split-brain in the cluster.

In this release, I/O fencing has extended this functionality to be able to automatically seed GAB as follows:

- If a number of nodes in a cluster are not up, GAB port (port a) still comes up in all the member-nodes in the cluster.
- If the coordination points do not have keys from any non-member nodes, I/O fencing (GAB port b) also comes up.

This new functionality is disabled by default. You must manually enable this automatic seeding feature of GAB in clusters where I/O fencing is configured in enabled mode.

See the *Veritas Storage Foundation for Sybase ASE CE Administrator's Guide* for more details.

You can still use the `gabconfig -x` command to manually seed the cluster.

## Graceful shutdown of a node no longer triggers I/O fencing race condition on peer nodes

In the earlier releases, a gracefully leaving node clears its I/O fencing keys from coordination points. But the remaining sub-cluster races against the gracefully leaving node to remove its registrations from the data disks. During this operation, if the sub-cluster loses access to the coordination points, the entire cluster may panic if the racer loses the race for coordination points.

In this release, this behavior has changed. When a node leaves gracefully, the CVM or other clients on that node are stopped before the VxFEN module is unconfigured. Hence, data disks are already clear of its keys. The remaining sub-cluster tries to clear the gracefully leaving node's keys from the coordination points but does not panic if it is not able to clear the keys.

## Installer support to replace I/O fencing coordination points in an online cluster

You can now use the installer to replace the coordination points for the I/O fencing configuration in an online cluster. The installer uses the `vxfsnwap` script internally.

You can also use response files to perform these I/O fencing reconfiguration operations.

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

## Availability of shared disk group configuration copies

If the Cluster Volume Manager (CVM) master node loses access to a configuration copy, CVM redirects the read or write requests over the network to another node that has connectivity to the configuration copy. This behavior ensures that the disk group stays available.

In previous releases, CVM handled disconnectivity according to the disk group failure policy (`dgfail_policy`). This behavior still applies if the disk group version is less than 170. The `dgfail_policy` is not applicable to disk groups with a version of 170 or later.

## Enhancements to CVM detach policies

In this release, the following changes have been made to the detach policies:

- A failure is considered global only if it affects all nodes in the cluster. Otherwise, a failure is treated as a local failure. Previously, any failure that affected more than one node was considered to be global.



- When the global detach policy is set, local failure of all plexes at the same time does not trigger plex detach. In this case, the volume remains enabled and I/Os fail on the node.
- When a node loses local connectivity to a disk, the disk is put in the lfailed state.

## Enhancements to master node selection for failover

If the Cluster Volume Manager (CVM) master node leaves the cluster, CVM fails over the master role to another node in the cluster. In this release, CVM selects the node for failover based on the node's connectivity to the disks in the disk group. This behavior is an enhancement over previous releases of CVM.

During regular operations, CVM dynamically assigns an offset preference value to each node. The preference assignment is automatic, and generally does not require any intervention from the administrator.

If you need greater control over the master selection, you can also set customized preference values.

When a master failover occurs, CVM uses the custom node preferences together with the offset preference values to select the new master node.

## Node join with DGDISABLED disk groups

In this release, a node can join the cluster even if there is a shared disk group that is in the DGDISABLED state. In previous releases, the node join would fail.

## Changes related to Veritas Storage Foundation for Sybase ASE CE (SF Sybase CE)

SF Sybase CE includes the new features and changes introduced in 6.0 of the underlying products.

### Support for local file system for Sybase ASE CE binaries

The Sybase ASE CE binaries can be stored on a local or shared storage, depending on your high availability requirements.

While configuring VCS service groups for Sybase ASE CE, you need to select the type of file system where Sybase ASE CE binaries reside.

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**Note:** Symantec recommends that you install the Sybase ASE CE binaries on a shared storage on CFS.

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## Licensing changes in the SFHA Solutions 6.0 release

Storage Foundation and High Availability Solutions 6.0 introduces the following licensing changes:

- The Cluster File System license is deprecated. CFS customers are entitled to the Storage Foundation Cluster File System High Availability (SFCFS HA) functionality.
- The VVR Option is renamed as Veritas Replicator Option. This option includes VVR (volume-based replication) and the new file-based replication solution.
- The VVR Enterprise license is deprecated; you can use Storage Foundation Enterprise and add Veritas Replicator Option to get this functionality. VVR Enterprise customers are entitled to Storage Foundation Enterprise with Replicator Option.
- The VCS license enables full cluster functionality as well as the limited start/stop functionality.
- Storage Foundation Enterprise CFS for Oracle RAC (Linux/x64) customers are entitled to Storage Foundation Enterprise for Oracle RAC (Linux/x64.)

The following functionality is included in the Standard and Enterprise licenses:

- The Compression feature is available with the Standard license.
- The SmartTier feature is now available with the Standard license.
- The Deduplication feature is available with the Enterprise license on Solaris SPARC.

The following products are included in this release:

- Dynamic Multi-Pathing
- VirtualStore
- Storage Foundation Basic
- Storage Foundation Standard
- Storage Foundation Enterprise
- Veritas Cluster Server
- Veritas Cluster Server HA/DR
- Storage Foundation Standard HA: Storage Foundation Standard plus Veritas Cluster Server
- Storage Foundation Enterprise HA: Storage Foundation Enterprise plus Veritas Cluster Server
- Storage Foundation Enterprise HA/DR

- Storage Foundation Enterprise Cluster File System HA
- Storage Foundation Enterprise Cluster File System HA/DR
- Storage Foundation Enterprise for Oracle RAC
- Storage Foundation Enterprise HA/DR for Oracle RAC
- Storage Foundation Enterprise for Sybase ASE CE
- Storage Foundation Enterprise HA/DR for Sybase CE

HA: High Availability

HA/DR: High Availability and Disaster Recovery

Veritas Replicator Option can be added to all Storage Foundation and High Availability products, except Dynamic Multi-Pathing and Veritas Cluster Server.

Note that products, features, and options may differ by operating system and platform. Please see the product documentation for information on supported platforms.

## Enhancements to collecting a VxExplorer troubleshooting archive

The Symantec Operations Readiness Tools (SORT) data collector contains functionality to collect and submit a VxExplorer archive. You can send this archive to Symantec Technical Support for problem diagnosis and troubleshooting. VxExplorer does not collect customer data.

The legacy `VxExplorer` script now works differently. When you run the script, it launches the SORT data collector on the specified local host with the `-vxexplorer` option.

To learn more about using the data collector to collect a VxExplorer archive, see: [www.symantec.com/docs/HOWTO32575](http://www.symantec.com/docs/HOWTO32575)

## Changes related to product documentation

The Storage Foundation and High Availability Solutions 6.0 release includes the following changes to the product documentation.

[Table 1-1](#) lists the documents introduced in this release.

**Table 1-1** New documents

New documents	Notes
<i>Veritas Storage Foundation Installation Guide</i>	Installation and upgrade information for Storage Veritas Foundation.

**Table 1-1** New documents (*continued*)

New documents	Notes
<i>Veritas Storage Foundation Administrator's Guide</i>	Administration information for Veritas Storage Foundation.
<i>Veritas Storage Foundation and High Availability Release Notes</i>	Release-specific information for Veritas Storage Foundation and High Availability users.
<i>Veritas Storage Foundation and High Availability Solutions Solutions Guide</i>	Solutions and use cases for Veritas Storage Foundation and High Availability Solutions.
<i>Veritas Storage Foundation and High Availability Solutions Troubleshooting Guide</i>	Troubleshooting information for Veritas Storage Foundation and High Availability Solutions.
<i>Symantec VirtualStore Release Notes</i>	Release-specific information Symantec VirtualStore.
<i>Veritas Storage Foundation for Sybase ASE CE Release Notes</i>	Release-specific information for Veritas Storage Foundation for Sybase ASE CE.
<i>Veritas Storage Foundation for Sybase ASE CE Installation Guide</i>	Installation information for Veritas Storage Foundation for Sybase ASE CE.
<i>Veritas Storage Foundation for Sybase ASE CE Administrator's Guide</i>	Administration information for Veritas Storage Foundation for Sybase ASE CE.
<i>Virtual Business Services–Availability User's Guide</i>	Information about Virtual Business Services. This document is available online.

**Table 1-2** lists the documents that are deprecated in this release.

**Table 1-2** Deprecated documents

Deprecated documents	Notes
<i>Veritas File System Administrator's Guide</i>	Content now appears in the <i>Veritas Storage Foundation Administrator's Guide</i> and in the <i>Veritas Storage Foundation Cluster File System High Availability Administrator's Guide</i> .
<i>Veritas Volume Manager Administrator's Guide</i>	Content now appears in the <i>Veritas Storage Foundation Administrator's Guide</i> and in the <i>Veritas Storage Foundation Cluster File System High Availability Administrator's Guide</i> .

**Table 1-2** Deprecated documents (*continued*)

Deprecated documents	Notes
<i>Veritas Storage Foundation Advanced Features Administrator's Guide</i>	Content now appears in the <i>Veritas Storage Foundation and High Availability Solutions Solutions Guide</i> .
<i>Veritas Volume Manager Troubleshooting Guide</i>	Content now appears in the <i>Veritas Storage Foundation and High Availability Solutions Troubleshooting Guide</i> .
<i>Veritas Cluster Server Agents for Veritas Volume Replicator Configuration Guide</i>	Content now appears in the <i>Veritas Cluster Server Bundled Agents Reference Guide</i> .
<i>Veritas Volume Replicator Planning and Tuning Guide</i>	Content now appears in the <i>Veritas Storage Foundation and High Availability Solutions Replication Administrator's Guide</i> .
<i>Veritas Volume Replicator Advisor User's Guide</i>	Content now appears in the <i>Veritas Storage Foundation and High Availability Solutions Replication Administrator's Guide</i> .

**Table 1-3** lists documents that are no longer bundled with the binaries. These documents are now available online.

**Table 1-3** Online documents

Document
<i>Veritas Cluster Server Agent Developer's Guide</i>
<i>Veritas Cluster Server Application Note: Dynamic Reconfiguration of Oracle Sun Servers</i>
<i>Veritas File System Programmer's Reference Guide</i>

## System requirements

The topics in this section describe the system requirements for this release.

### Important preinstallation information

Before you install SF Sybase CE, make sure you have reviewed the following information:

- Hardware compatibility list for information about supported hardware:  
<http://www.symantec.com/docs/TECH170013>

- Sybase ASE CE documentation for additional requirements pertaining to your version of Sybase ASE CE.

## Hardware requirements

[Table 1-4](#) lists the hardware requirements for SF Sybase CE.

**Table 1-4** Hardware requirements for basic clusters

Item	Description
SF Sybase CE systems	Two to four systems with two or more CPUs. For details on the additional requirements for Sybase ASE CE, see the Sybase ASE CE documentation.
DVD drive	A DVD drive on one of the nodes in the cluster.
Disk space	You can evaluate your systems for available disk space by running the product installation program. Navigate to the product directory on the product disc and run the following command:  <pre data-bbox="532 826 1063 852"># ./installsfbasece -precheck node_name</pre> You can also use the Veritas Web-based installation program to determine the available disk space.  For details on the additional space that is required for Sybase ASE CE, see the Sybase ASE CE documentation.
RAM	Each SF Sybase CE system requires at least 2 GB.
Network	Two or more private links and one public link.  Links must be 100BaseT or gigabit Ethernet directly linking each node to the other node to form a private network that handles direct inter-system communication. These links must be of the same type; you cannot mix 100BaseT and gigabit.  Symantec recommends gigabit Ethernet using enterprise-class switches for the private links.  You can also configure aggregated interfaces.
Fiber Channel or SCSI host bus adapters	At least one additional SCSI or Fibre Channel Host Bus Adapter per system for shared data disks.

## Supported Solaris operating systems

This section lists the supported operating systems for this release of Veritas products.

[Table 1-5](#) shows the supported Solaris operating systems for this release.

**Table 1-5** Supported Solaris operating systems

Operating systems	Levels	Chipsets
Solaris 10	Update 8, 9, and 10	SPARC

## Supported database software

SF Sybase CE supports Sybase ASE CE 15.5 only at time of publication.

For the latest information on the supported Sybase ASE CE database versions, see the following Technical Support TechNote:

<http://www.symantec.com/docs/DOC4848>

See the Sybase ASE CE documentation for more information.

## Supported SF Sybase CE configurations

The following Sybase configuration options are required in an SF Sybase CE environment:

- Set SF Sybase CE fencing to "sybase" mode.
- Configure Sybase private networks on LLT links
- Set Sybase cluster membership to "vcs" mode.
- Configure Sybase instances under VCS control.

## Veritas File System requirements

Veritas File System requires that the values of the Solaris variables `lwp_default_stksize` and `svc_default_stksize` are at least 0x6000. When you install the Veritas File System package, `VRTSvxfs`, the `VRTSvxfs` packaging scripts check the values of these variables in the kernel. If the values are less than the required values, `VRTSvxfs` increases the values and modifies the `/etc/system` file with the required values. If the `VRTSvxfs` scripts increase the values, the installation proceeds as usual except that you must reboot and restart the installation program. A message displays if a reboot is required.

To avoid an unexpected need for a reboot, verify the values of the variables before installing Veritas File System. Use the following commands to check the values of the variables:

```
# echo "lwp_default_stksize/X" | mdb -k
lwp_default_stksize:
lwp_default_stksize:          6000

# echo "svc_default_stksize/X" | mdb -k
svc_default_stksize:
svc_default_stksize:          6000
```

If the values shown are less than 6000, you can expect a reboot after installation.

---

**Note:** The default value of the `svc_default_stksize` variable is 0 (zero), which indicates that the value is set to the value of the `lwp_default_stksize` variable. In this case, no reboot is required, unless the value of the `lwp_default_stksize` variable is too small.

---

To avoid a reboot after installation, you can modify the `/etc/system` file with the appropriate values. Reboot the system prior to installing the packages. Add the following lines to the `/etc/system` file:

```
set lwp_default_stksize=0x6000
set rpcmod:svc_default_stksize=0x6000
```

## Supported replication technologies for global clusters

SF Sybase CE supports the software replication technology Veritas Volume Replicator (VVR) for global cluster configurations.

## Fixed issues

This section covers the incidents that are fixed in this release.

See the corresponding Release Notes for a complete list of fixed incidents related to that product.

See [“Documentation”](#) on page 35.



## Veritas Storage Foundation for Sybase ASE CE: Issues fixed in 6.0

**Table 1-6** Veritas Storage Foundation for Sybase ASE CE fixed issues

Incident number	Description
2085292	If only the Sybase database resource is stopped with a VCS command, the Sybase instance fails to start when the resource is started again. This is due to vxfsd ultimately blocking on the VxFEN driver. If Sybase database resource is restarted without restarting the vxfsd daemon, the Sybase instance fails to start.
2093659	VCS fails to start when the fencing mode is "sybase", and the attribute is "UseFence=SCSI3" in the <code>main.cf</code> file.
1424908	The vxfsd code does not drop messages with wrong generation numbers.

## Known issues

This section covers the known issues in this release.

See the corresponding Release Notes for a complete list of known issues related to that product.

See "[Documentation](#)" on page 35.

## SF Sybase CE issues

This section lists the known issues in SF Sybase CE for this release.

### Sybase Agent Monitor times out (1592996)

**Problem:** The Sybase Agent Monitor has issues with timing out, in cases where qrmutil reports delay.

The Sybase Agent monitor times out, if qrmutil fails to report the status to the agent within the defined MonitorTimeout for the agent.

**Solution:** If any of the following configuration parameters for Sybase Database is increased, it will require a change in its MonitorTimeout value:

- quorum heartbeat interval (in seconds)
- Number of retries

If the above two parameters are changed, Symantec recommends that the MonitorTimeout be set to a greater value than the following: ((number of retries + 1) \* (quorum heartbeat interval)) + 5.

### **Installer warning (151550)**

**Problem:** During configuration of Sybase instance under VCS control, if the quorum device is on CFS and is not mounted, the following warning message appears on the installer screen:

```
Error: CPI WARNING V-9-40-4563 The quorum file /qrmnt/qfile
cannot be accessed. This may be due to a file system not being mounted.
```

The above warning may be safely ignored.

### **Unexpected node reboot while probing a Sybase resource in transition (1593605)**

**Problem:** A node may reboot unexpectedly if the Sybase resource is probed while the resource is still in transition from an online to offline state.

Normally the monitor entry point for Sybase agent completes with 5-10 seconds. The monitor script for the Sybase agent uses the qrmutil binary provided by Sybase. During a monitor, if this utility takes longer time to respond, the monitor entry point will also execute for longer duration before returning status.

**Resolution:** During the transition time interval between online and offline, do not issue a probe for the Sybase resource, otherwise the node may reboot.

### **Unexpected node reboot when invalid attribute is given (2567507)**

**Problem:** A node may reboot unexpectedly if the Home, Version, or Server attributes are modified to invalid values while the Sybase resources are online in VCS.

**Resolution:** Avoid setting invalid values for the Home, Version, or Server attributes while the Sybase resources are online in VCS, to avoid panic of the node.

### **Deporting issues with shared disk groups**

If you manually deport a shared disk group, the CVMVolDg agent does not automatically reimport it as a shared disk group. You must manually reimport it as a shared disk group.

## Resources not brought online after had process is killed and restarted

If the `had` process is killed either manually or by some other means, the `hashadow` process restarts it. During `had` restart time, the resources remain in the same state unless their states are changed manually, but after restarting the `had`, process VCS may not bring some resources online.

### To work around this issue

- ◆ Manually restart the resources that were not started during `had` restart.

## AutoFailOver = 0 attribute absent in the sample files at /etc/VRTSagents/ha/conf/Sybase (2615341)

**Problem:** `AutoFailOver = 0` attribute is not present in the sample files at `/etc/VRTSagents/ha/conf/Sybase`.

**Resolution:** If you copy the `main.cf` file from the `/etc/VRTSagents/ha/conf/Sybase` location, add the `AutoFailOver = 0` attribute to the `binmnt` and `sybasece` service groups.

## Bus error while stopping the ports (2358568)

**Problem:** When the `hastop -local` command or the `hastop -all` command is issued, the `fuser -kill` command is issued on the mounted Sybase mount point. This results in bus error and a core dump, though the ports stop cleanly.

**Resolution:** Before issuing the `hastop -local` command or the `hastop -all` command, ensure that the `uafstartup.sh` script is stopped, so that the `fuser -kill` command is not issued on the mounted Sybase mount point.

## "Configuration must be ReadWrite : Use haconf -makerw" error message appears in VCS engine log when hastop -local is invoked (2609137)

A message similar to the following example appears in the `/var/VRTSvcs/log/engine_A.log` log file when you run the `hastop -local` command on any system in a SF Sybase CE cluster that has `CFSMountresources`:

```
2011/11/15 19:09:57 VCS ERROR V-16-1-11335 Configuration must be
ReadWrite : Use haconf -makerw
```

The `hastop -local` command successfully runs and you can ignore the error message.

**Workaround:** There is no workaround for this issue.

### **Removal of SAN cable from any node in a global cluster setup takes application service groups offline on all nodes (2580393)**

In a replicated global cluster setup, the removal of SAN cable from any node in the cluster causes the CFS mount points to fault. As a result, dependent application groups are taken offline and replication to the secondary site is adversely affected.

## Issues related to installation

This section describes the known issues during installation and upgrade.

### **Stopping the installer during an upgrade and then resuming the upgrade might freeze the service groups (2591399)**

The service groups freeze due to upgrading using the product installer if you stopped the installer after the installer already stopped some of the processes and then resumed the upgrade.

Workaround: You must unfreeze the service groups manually after the upgrade completes.

#### **To unfreeze the service groups manually**

- 1 List all the frozen service groups

```
# hagrps -list Frozen=1
```

- 2 Unfreeze all the frozen service groups:

```
# haconf -makerw  
# hagrps -unfreeze service_group -persistent  
# haconf -dump -makero
```

### **After Live Upgrade to Solaris 10 Update 10, boot from alternate boot environment may fail (2370250)**

If your setup involves volumes in a shared disk group that are mounted as CFS in a cluster, then during Live Upgrade using the `vxlustart` command from any supported Solaris version to Solaris 10 Update 10, boot from an alternate boot environment may fail.

**Workaround:** Run the `vxlufinish` command. Before rebooting the system, manually delete the entries of all the volumes of shared disks that are mounted as CFS in the `/altroot.5.10/etc/vfstab` directory.

## On Sparc, Live Upgrade from Solaris 9 to Solaris 10 Update 10 may fail (2424410)

On Sparc, Live Upgrade from Solaris 9 to Solaris 10 Update 10 may fail with the following error:

```
Generating file list.  
Copying data from PBE <source.24429> to ABE <dest.24429>.  
99% of filenames transferredERROR: Data duplication process terminated  
unexpectedly.  
ERROR: The output is </tmp/lucreate.13165.29314/lucopy.errors.29314>.  
  
29794 Killed  
Fixing zonepaths in ABE.  
Unmounting ABE <dest.24429>.  
100% of filenames transferredReverting state of zones in PBE  
<source.24429>.  
ERROR: Unable to copy file systems from boot environment <source.24429>  
to BE <dest.24429>.  
ERROR: Unable to populate file systems on boot environment <dest.24429>.  
Removing incomplete BE <dest.24429>.  
ERROR: Cannot make file systems for boot environment <dest.24429>.
```

This is a known issue with the Solaris `lucreate` command.

**Workaround:** Check with Oracle for possible workarounds for this issue.

## Flash Archive installation not supported if the target system's root disk is encapsulated

Symantec does not support SF Sybase CE installation using Flash Archive if the target system's root disk is encapsulated.

Make sure that the target system's root disk is unencapsulated before starting the installation.

### **Flash archive installed through JumpStart causes new system to go into maintenance mode on reboot (2379123)**

If a Flash archive is created on a golden host with encapsulated root disks, when this Flash archive is installed onto another host through JumpStart, the new system may go to maintenance mode when you initially reboot it.

This problem is caused by the predefined root disk mirror in the Flash archive. When the archive is applied to a clone system, which may have different hard drives, the newly cloned system may get stuck at root disk mirroring during reboot.

Workaround: Create the Flash archive on a golden host with no encapsulated root disks. Run `vxunroot` to clean up the mirrored root disks before you create the Flash archive.

### **The Configure Sybase ASE CE Instance in VCS option creates duplicate service groups for Sybase binary mount points (2560188)**

The CPI installer does not check to see if Sybase binary mount points are already configured on systems, nor does it give an error message. It creates a duplicate service group for Sybase binary mount points.

This issue will be resolved in a later release.

### **Incorrect server names sometimes display if there is a clock synchronization issue (2627076)**

When you install a cluster with the Web-based installer, you choose to to synchronize your systems with an NTP server due to a clock synchronization issue, you may see the NTP server name in messages instead of your server names.

Workaround:

Ignore the messages. The product is still installed on the correct servers.

### **Web installer does not ask for authentication after the first session if the browser is still open (2509330)**

If you install or configure SF Sybase CE and then close the Web installer, if you have other browser windows open, the Web installer does not ask for authentication in the subsequent sessions. Since there is no option to log out of the Web installer, the session remains open as long as the browser is open on the system.

Workaround: Make sure that all browser windows are closed to end the browser session and subsequently log in again.

## Stopping the Web installer causes Device Busy error messages (2633924)

If you start the Web installer, and then perform an operation (such as prechecking, configuring, or uninstalling), you may get an error message saying the device is busy.

Workaround:

Do one of the following:

- Kill the `start.pl` process.
- Start the webinstaller again. On the first Web page you see that the session is still active. Either take over this session and finish it or terminate it directly.

## Issues related to I/O fencing

This section covers the known issues related to I/O fencing in this release.

### When I/O fencing is not up, the `svcs` command shows VxFEN as online (2492874)

Solaris 10 SMF marks the service status based on the exit code of the start method for that service. The VxFEN start method executes the `vxfen-startup` script in the background and exits with code 0. Hence, if the `vxfen-startup` script subsequently exits with failure then this change is not propagated to SMF. This behavior causes the `svcs` command to show incorrect status for VxFEN.

Workaround: Use the `vxfenadm` command to verify that I/O fencing is running.

### The `vxfenswap` utility does not detect failure of coordination points validation due to an RSH limitation (2531561)

The `vxfenswap` utility runs the `vxfenconfig -o modify` command over RSH or SSH on each cluster node for validation of coordination points. If you run the `vxfenswap` command using RSH (with the `-n` option), then RSH does not detect the failure of validation of coordination points on a node. From this point, `vxfenswap` proceeds as if the validation was successful on all the nodes. But, it fails at a later stage when it tries to commit the new coordination points to the VxFEN driver. After the failure, it rolls back the entire operation, and exits cleanly with a non-zero error code. If you run `vxfenswap` using SSH (without the `-n` option), then SSH detects the failure of validation of coordination of points correctly and rolls back the entire operation immediately.

Workaround: Use the `vxfenswap` utility with SSH (without the `-n` option).

## Fencing does not come up on one of the nodes after a reboot (2573599)

If VxFEN unconfiguration has not finished its processing in the kernel and in the meantime if you attempt to start VxFEN, you may see the following error in the `/var/VRTSvcs/log/vxfen/vxfen.log` file:

```
VXFEN vxfenconfig ERROR V-11-2-1007 Vxfen already configured
```

However, the output of the `gabconfig -a` command does not list port b. The `vxfenadm -d` command displays the following error:

```
VXFEN vxfenadm ERROR V-11-2-1115 Local node is not a member of cluster!
```

Workaround: Start VxFEN again after some time.

## Stale `.vxfendargs` file lets hashadow restart `vxfend` in Sybase mode (2554886)

When I/O fencing is configured in customized mode, `vxfend`, the user mode daemon of I/O fencing, creates the `/opt/VRTSvcs/lock/.vxfendargs` file. VCS uses this file to restart the `vxfend` daemon when it gets killed. However, VCS does not use this file when I/O fencing is configured in Sybase mode. This file is not removed from the system when I/O fencing is unconfigured.

If user configures I/O fencing in Sybase mode and an old `/opt/VRTSvcs/lock/.vxfendargs` file is present in the system from an earlier configuration of I/O fencing in customized mode, then VCS attempts to restart the `vxfend` daemon every time it is killed. This interferes with the functioning of I/O fencing in the Sybase mode.

Workaround: Before you configure I/O fencing in Sybase mode, delete the `/opt/VRTSvcs/lock/.vxfendargs` file if it is present in the system.

## The `vxassist maxsize` option fails to report the maximum size of the volume that can be created with given constraints when the disk group has the siteconsistent flag set (2563195)

The `vxassist maxsize` option fails to report the maximum size of volume that can be created with given constraints when the disk group has the siteconsistent flag set. The following error is reported:

```
# vxassist -g dname maxsize
```

```
VxVM vxassist ERROR V-5-1-752 No volume can be created within the given constraints
```



**Workaround:**

Specify the size explicitly to the `vxassist make` command.

## Software limitations

This section covers the software limitations of this release.

See the corresponding Release Notes for a complete list of software limitations related to that component or product.

See [“Documentation”](#) on page 35.

### Only one Sybase instance is supported per node

In a Sybase ASE CE cluster, SF Sybase CE supports only one Sybase instance per node.

### SF Sybase CE is not supported in the Campus cluster environment

SF Sybase CE does not support the Campus cluster. SF Sybase CE supports the following cluster configurations. Depending on your business needs, you may choose from the following setup models:

- Basic setup
- Secure setup
- Central management setup
- Global cluster setup

See the *Installation Guide* for more information.

### Hardware-based replication technologies are not supported for replication in the SF Sybase CE environment

You can use Veritas Volume Replicator (VVR), which provides host-based volume replication. Using VVR you can replicate data volumes on a shared disk group in SF Sybase CE. Hardware-based replication is not supported at this time.

### SF Sybase CE installation is not supported by Web installer

SF Sybase CE does not support the Web-based installer at this time. You can use one of the following methods to install and configure SF Sybase CE.

- Interactive installation and configuration using the script-based installer

- Silent installation using the response file
- Installation using the JumpStart script file

See the *Installation Guide* for more information.

## Limitations related to I/O fencing

This section covers I/O fencing-related software limitations.

### **Preferred fencing limitation when VxFEN activates RACER node re-election**

The preferred fencing feature gives preference to more weighted or larger subclusters by delaying the smaller subcluster. This smaller subcluster delay is effective only if the initial RACER node in the larger subcluster is able to complete the race. If due to some reason the initial RACER node is not able to complete the race and the VxFEN driver activates the racer re-election algorithm, then the smaller subcluster delay is offset by the time taken for the racer re-election and the less weighted or smaller subcluster could win the race. This limitation though not desirable can be tolerated.

### **Stopping systems in clusters with I/O fencing configured**

The I/O fencing feature protects against data corruption resulting from a failed cluster interconnect, or “split brain.” See the *Veritas Cluster Server Administrator's Guide* for a description of the problems a failed interconnect can create and the protection I/O fencing provides.

In a cluster using SCSI-3 based fencing, I/O fencing implements data protection by placing the SCSI-3 PR keys on both the data disks and coordinator disks. In a cluster using CP server-based fencing, I/O fencing implements data protection by placing the SCSI-3 PR keys on data disks and similar registrations on CP server. The VCS administrator must be aware of several operational changes needed when working with clusters protected by I/O fencing. Specific shutdown procedures ensure keys are removed from coordination points and data disks to prevent possible difficulties with subsequent cluster startup.

Using the reboot command rather than the shutdown command bypasses shutdown scripts and can leave keys on the coordination points and data disks. Depending on the order of reboot and subsequent startup events, the cluster may warn of a possible split brain condition and fail to start up.

**Workaround:** Use the shutdown -r command on one node at a time and wait for each node to complete shutdown.

## Uninstalling VRTSvxvm causes issues when VxFEN is configured in SCSI3 mode with dmp disk policy (2522069)

When VxFEN is configured in SCSI3 mode with dmp disk policy, the DMP nodes for the coordinator disks can be accessed during system shutdown or fencing arbitration. After uninstalling VRTSvxvm package, the DMP module will no longer be loaded in memory. On a system where VRTSvxvm package is uninstalled, if VxFEN attempts to access DMP devices during shutdown or fencing arbitration, the system panics.

## Documentation

Product guides are available in the PDF format on the software media in the `/product_name/docs` directory. Additional documentation is available online.

Make sure that you are using the current version of documentation. The document version appears on page 2 of each guide. The publication date appears on the title page of each document. The latest product documentation is available on the Symantec website.

<http://sort.symantec.com/documents>

## Documentation set

**Table 1-7** lists the documentation for Veritas Storage Foundation for Sybase ASE CE.

**Table 1-7** Veritas Storage Foundation for Sybase ASE CE documentation

Document title	File name
<i>Veritas Storage Foundation for Sybase ASE CE Release Notes</i>	sfsybasece_notes_60_sol.pdf
<i>Veritas Storage Foundation for Sybase ASE CE Installation and Configuration Guide</i>	sfsybasece_install_60_sol.pdf
<i>Veritas Storage Foundation for Sybase ASE CE Administrator's Guide</i>	sfsybasece_admin_60_sol.pdf

**Table 1-8** lists the documentation for Veritas Storage Foundation Cluster File System High Availability.

**Table 1-8** Veritas Storage Foundation Cluster File System High Availability documentation

Document title	File name
<i>Veritas Storage Foundation Cluster File System High Availability Release Notes</i>	sfcfs_notes_60_sol.pdf
<i>Veritas Storage Foundation Cluster File System High Availability Installation Guide</i>	sfcfs_install_60_sol.pdf
<i>Veritas Storage Foundation Cluster File System High Availability Administrator's Guide</i>	sfcfs_admin_60_sol.pdf

[Table 1-9](#) lists the documents for Veritas Cluster Server.

**Table 1-9** Veritas Cluster Server documentation

Title	File name
<i>Veritas Cluster Server Installation Guide</i>	vcs_install_60_sol.pdf
<i>Veritas Cluster Server Release Notes</i>	vcs_notes_60_sol.pdf
<i>Veritas Cluster Server Administrator's Guide</i>	vcs_admin_60_sol.pdf
<i>Veritas Cluster Server Bundled Agents Reference Guide</i>	vcs_bundled_agents_60_sol.pdf
<i>Veritas Cluster Server Agent Developer's Guide</i>	vcs_agent_dev_60_unix.pdf
<i>Veritas Cluster Server Application Note: Dynamic Reconfiguration for Oracle Servers</i>	vcs_dynamic_reconfig_60_sol.pdf
<i>Veritas Cluster Server Agent for DB2 Installation and Configuration Guide</i>	vcs_db2_agent_60_sol.pdf
<i>Veritas Cluster Server Agent for Oracle Installation and Configuration Guide</i>	vcs_oracle_agent_60_sol.pdf
<i>Veritas Cluster Server Agent for Sybase Installation and Configuration Guide</i>	vcs_sybase_agent_60_sol.pdf

[Table 1-10](#) lists the documentation for Veritas Storage Foundation.

**Table 1-10** Veritas Storage Foundation documentation

Document title	File name
<i>Veritas Storage Foundation Release Notes</i>	sf_notes_60_sol.pdf

**Table 1-10** Veritas Storage Foundation documentation (*continued*)

Document title	File name
<i>Veritas Storage Foundation Installation Guide</i>	sf_install_60_sol.pdf
<i>Veritas Storage Foundation Administrator's Guide</i>	sf_admin_60_sol.pdf
<i>Veritas File System Programmer's Reference Guide</i>	vxfs_ref_60_sol.pdf

**Table 1-11** lists the documentation for Veritas Storage Foundation and High Availability Solutions products.

**Table 1-11** Veritas Storage Foundation and High Availability Solutions products documentation

Document title	File name
<i>Veritas Storage Foundation and High Availability Solutions Solutions Guide</i>	sfha_solutions_60_sol.pdf
<i>Veritas Storage Foundation and High Availability Solutions Virtualization Guide</i>	sfha_virtualization_60_sol.pdf
<i>Veritas Storage Foundation and High Availability Solutions Replication Administrator's Guide</i>	sf_replication_admin_60_sol.pdf

If you use Veritas Operations Manager (VOM) to manage Veritas Storage Foundation and High Availability products, refer to the VOM product documentation at:

<http://sort.symantec.com/documents>

## Manual pages

The manual pages for Veritas Storage Foundation and High Availability Solutions products are installed in the `/opt/VRTS/man` directory.

Set the `MANPATH` environment variable so the `man(1)` command can point to the Veritas Storage Foundation manual pages:

- For the Bourne or Korn shell (`sh` or `ksh`), enter the following commands:

```
MANPATH=$MANPATH:/opt/VRTS/man
export MANPATH
```

- For C shell (`csh` or `tcsh`), enter the following command:

```
setenv MANPATH ${MANPATH}:/opt/VRTS/man
```

See the `man(1)` manual page.