

Veritas Storage Foundation[™] Release Notes

AIX

5.0



Veritas Storage Foundation Release Notes

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Veritas Storage Foundation 5.0

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Veritas Storage Foundation is a licensed product. See the *Veritas Storage Foundation Installation Guide* for license installation instructions.

Technical support

For technical assistance, visit <http://support.veritas.com> and select phone or email support. Use the Knowledge Base search feature to access resources such as TechNotes, product alerts, software downloads, hardware compatibility lists, and our customer email notification service.

Contents

Chapter 1

Veritas Storage Foundation Release Notes

Storage Foundation product suites	8
Storage Foundation Standard	8
Storage Foundation Standard HA	9
Storage Foundation Enterprise	10
Storage Foundation Enterprise HA	10
Storage Foundation for DB2 Standard	11
Storage Foundation for DB2 Enterprise	11
Storage Foundation for DB2 Enterprise HA	11
Storage Foundation for Oracle Standard	11
Storage Foundation for Oracle Enterprise	12
Storage Foundation for Oracle Enterprise HA	12
New features	12
Veritas Volume Manager	13
Veritas File System	18
Veritas Storage Foundation for Databases	20
Supported software	22
Component product licensing	23
Symantec licensing commands	24
Licensable features	24
Using Veritas Quick I/O	24
Disk layout versions	25
Disk Group Versions (VxVM)	25
No longer supported and future support issues	26
Version 4 disk layout	26
File system snapshots	26
I/O error mount options	26
Array configuration through the GUI	27
Fixed Issues	27
Veritas Volume Manager fixed issues	27
Veritas Storage Foundation for DB2 fixed issues	28
Veritas Storage Foundation for Oracle fixed issues	28
Veritas File System fixed issues	29
Known issues	31
Storage Foundation known issues	31
Veritas Volume Manager known issues	32

- Veritas File System known issues 49
- VxFS Web GUI online help known issues 55
- Veritas Storage Foundation for Databases known issues 56
- Software limitations 68
 - Veritas Storage Foundation software limitations 68
 - Veritas File System software limitations 68
 - Veritas Storage Foundation for Oracle software limitations 68
 - Veritas Storage Foundation for DB2 software limitations 69
- Documentation 69
 - Veritas documentation disc 69
 - Release notes and installation guides 69
 - Veritas Storage Foundation guides 70
 - Manual Pages 73

Appendix A Third-party Legal Notices

Veritas Storage Foundation Release Notes

This document provides release information on the following versions of the Veritas Storage Foundation Release 5.0 AIX product line:

- Storage Foundation Standard
- Storage Foundation Standard HA
- Storage Foundation Enterprise
- Storage Foundation Enterprise HA
- Storage Foundation for DB2 Standard
- Storage Foundation for DB2 Enterprise
- Storage Foundation for DB2 Enterprise HA
- Storage Foundation for Oracle Standard
- Storage Foundation for Oracle Enterprise
- Storage Foundation for Oracle Enterprise HA

All versions contain sets of Symantec products that can be activated by a single license key, or features installed with the product filesets and licensed separately.

Review this entire document before installing Veritas Storage Foundation components.

Note: For the latest information on updates, patches, and software issues regarding this release, refer to the following TechNote on the Symantec Technical Support website:

<http://support.veritas.com/docs/282024.htm>

The hardware compatibility list (HCL) is available at:

<http://support.veritas.com/docs/283161>

The hardware TechNote is available at:

<http://support.veritas.com/docs/283282>

Veritas Storage Foundation is a licensed product so you must obtain a license key prior to installation. For information on obtaining a license key, see the *Veritas Storage Foundation Installation Guide*.

Note: This document does not contain release Notes for Veritas Volume Replicator or Veritas Cluster Server. For release information on these products, see the *Veritas Volume Replicator Release Notes* and the *Veritas Cluster Server Release Notes*.

Storage Foundation product suites

This section lists the components of each of the Storage foundation product suites:

- [Storage Foundation Standard](#)
- [Storage Foundation Standard HA](#)
- [Storage Foundation Enterprise](#)
- [Storage Foundation Enterprise HA](#)
- [Storage Foundation for DB2 Standard](#)
- [Storage Foundation for DB2 Enterprise](#)
- [Storage Foundation for DB2 Enterprise HA](#)
- [Storage Foundation for Oracle Standard](#)
- [Storage Foundation for Oracle Enterprise](#)
- [Storage Foundation for Oracle Enterprise HA](#)

Storage Foundation Standard

Storage Foundation Standard consists of the following components:

- Veritas Volume Manager (VxVM)
- Veritas File System (VxFS)

A Storage Foundation key licenses VxFS and VxVM.

Storage Foundation Standard HA

Storage Foundation Standard consists of the following components:

- Veritas Volume Manager (VxVM)
- Veritas File System (VxFS)
- Veritas Cluster Server (VCS)

A Storage Foundation HA key licenses VxFS, VxVM and VCS.

Storage Foundation Enterprise

Storage Foundation Enterprise consists of the following components and features:

- Veritas Volume Manager (VxVM)
- Veritas File System (VxFS)
- Veritas FlashSnap
- Dynamic Storage Tiering - with VxVM and VxFS
- FlashSnap Agent for Symmetrix

A Storage Foundation Enterprise key licenses VxFS, VxVM, Veritas FlashSnap, and Dynamic Storage Tiering. VVR is available as an option.

Feature options

Storage Foundation Enterprise offers the following feature option:

- Veritas Volume Replicator (VVR) - with VxVM

Storage Foundation Enterprise HA

Storage Foundation Enterprise HA consists of the following components and features:

- Veritas Volume Manager (VxVM)
- Veritas File System (VxFS)
- Veritas Cluster Server (VCS)
- Storage Foundation Enterprise
- Veritas FlashSnap
- Dynamic Storage Tiering - with VxVM and VxFS
- Global Cluster - with VCS
- FlashSnap Agent for Symmetrix

A Storage Foundation HA key licenses VxFS, VxVM, VCS, Storage Foundation Enterprise, Veritas FlashSnap, Dynamic Storage Tiering, and Global Cluster. VVR is available as an option.

Feature options

Storage Foundation Enterprise HA offers the following feature option:

- Veritas Volume Replicator (VVR) - with VxVM

Storage Foundation for DB2 Standard

Veritas File System

Veritas Volume Manager Veritas Quick I/O option

Optionally licensed features

Veritas Volume Replicator

Storage Foundation for DB2 Enterprise

Veritas File System

Veritas Volume Manager

Veritas Quick I/O option

Veritas Storage Checkpoint option

Veritas Storage Mapping option

Optionally licensed features

Veritas Volume Replicator

Storage Foundation for DB2 Enterprise HA

Veritas File System

Veritas Volume Manager

Veritas Cluster Server

Veritas Quick I/O option

Veritas Storage Checkpoint option

Veritas Storage Mapping option

Optionally licensed features

Veritas Volume Replicator

Storage Foundation for Oracle Standard

Veritas File System

Veritas Volume Manager

Veritas Quick I/O option

Veritas Extension for Oracle Disk Manager option

Optionally licensed features

Veritas Volume Replicator

Storage Foundation for Oracle Enterprise

Veritas File System

Veritas Volume Manager

Veritas Quick I/O option

Veritas Extension for Oracle Disk Manager option

Veritas Storage Checkpoint option

Veritas Storage Mapping option

Optionally licensed features

Veritas Volume Replicator

Storage Foundation for Oracle Enterprise HA

Veritas File System

Veritas Volume Manager

Veritas Cluster Server

Veritas Quick I/O option

Veritas Extension for Oracle Disk Manager option

Veritas Storage Checkpoint option

Veritas Storage Mapping option

Optionally licensed features

Veritas Volume Replicator

New features

We offer the following new features in this release of Veritas Storage Foundation, Veritas Volume Manager (VxVM) and Veritas File System (VxFS).

Note: For information about new features in VVR, see the *Veritas Volume Replicator Release Notes*.

Veritas Volume Manager

This release of Veritas Volume Manager includes the following new features and enhancements.

Default private region size

The default size of the private region has been increased from 1 MB to 32 MB.

Note: You do not need to change the private region size of existing disk groups to the new default value.

Changed behavior of disk group import

In previous releases, the `vxchg import` command could not import a disk group if some disks in the disk group were unusable or inaccessible. In such cases, the `-f` option had to be specified to forcibly import the disk group. With this release, a disk group can be imported successfully if all the disks are accessible that were visible when the disk group was last imported successfully. As using the `-f` option to forcibly import an incomplete disk group counts as a successful import, the disk group can subsequently be imported without specifying this option. The changed behavior applies to both private and cluster-shared disk groups.

Faster startup time

The time taken to start the Veritas Volume Manager configuration daemon, `vxconfigd`, to discover new devices, to initialize dynamic multipathing, and to import disk groups has been significantly reduced.

Faster cluster node joins

The time that nodes take to join a cluster has been reduced by allowing concurrent joins.

Remote Mirror — robust campus cluster support

The Remote Mirror feature retains the current usage model for campus cluster support (also known as stretch cluster) where a disk group can span storage from multiple sites. Existing utilities such as `vxchg` and `vxdisk` have been enhanced to achieve data set completeness, and to maintain site consistency. The preferred read policy for mirrors has been extended so that read requests are serviced locally if possible. A mechanism is also provided to deal with disk group inconsistencies between storage at different sites (serial split-brain

scenario) and to perform fire-drill testing of site failure and recovery. In this release, up to three sites are supported in a Remote Mirror configuration.

Support for 32 cluster nodes

The clustering functionality of VxVM supports up to 32 nodes, and has been tested on a 16-node cluster configuration.

SCSI 3 PR enhancement in clusters

The keys for disabled paths are removed so that node joins are not obstructed. In addition, the time taken to register keys has been reduced.

File-level SmartSync

The SmartSync feature of VxVM has been extended to support Oracle Resilvering of files in Veritas File System.

Enhancements to DDL and DMP

There are a number of enhancements to the Device Discovery Layer (DDL) and Dynamic Multipathing (DMP) features:

- **Faster failure detection and recovery by DMP**
DMP has been enhanced to allow the `vxdmpadm` command to be used to adjust the I/O error recovery and I/O throttling mechanisms on individual paths.
- **Changing DMP tunables**
The values of most DMP tunables can now be set by using the `vxdmpadm settune` command.
- **Retry period for Persistent Group Reservation (PGR)**
The maximum time period for which DMP retries the SCSI-3 Persistent Reserve operation with A/P arrays can now be tuned by using the `dmp_retry_timeout` parameter with the `vxdmpadm` command. The default value is 120 seconds, which is twice the value of the SCSI I/O timeout. This parameter has no direct effect on I/O processing by DMP. Disabling a switch port can trigger a fabric reconfiguration, which can take time to stabilize. During this period, attempting to register PGR keys through the secondary path to an array may fail with an error condition, such as unit attention or device reset, or the return of vendor-specific sense data. The retry period allows a fabric reconfiguration, which is usually a transient condition, to not be seen as an error by DMP.

To display the current value of `dmp_retry_timeout`, type:

```
# vxdmpadm gettune dmp_retry_timeout
```

To change the value of `dmp_retry_timeout`, type:

```
# vxddmpadm settune dmp_retry_timeout=value
```

Do not set the value of the retry period too high. This can delay the failover process, and result in I/O sluggishness or suppression of I/O activity during the retry period.

This parameter is not documented in the *Veritas Volume Manager Administrator's Guide* or in the `vxddmpadm(1M)` manual page.

- Coexistence of DMP with third-party drivers
Provided that a suitable array support library (ASL) is available, DMP can coexist with third-party multipathing drivers, such as EMC PowerPath.
- LVM boot disk support by DMP
DMP supports booting from multipathed LVM volumes.
- Cluster DMP changes
Failback is now a cluster-wide operation which provides significant performance improvements.
A/PF (active/passive failover) type arrays are now supported by DMP in a CVM environment.
- Persistent DMP Policies
It has been possible to change DMP I/O policies, but these changes were not persistent after a reboot. This release of VxVM solves this problem.
- Enhancements to the naming scheme
Previous releases of VxVM supported two naming schemes: OS-Native Scheme and Enclosure-based Naming. Although VxVM provided the means to change between the two schemes dynamically, it was necessary to restart `vxconfigd`, which is a time-consuming operation. With this release, the `vxconfigd` restart operation is no longer necessary.
VxVM now supports persistent device names. The disk names, once assigned, will remain constant across reconfiguration and rebooting.
- Performance Enhancements
Device discovery is now multithreaded. Performance improvements have also been made to DMP.

Enhancement of Local Detach Policy

Local detach policy now works uniformly on both master and slave nodes. If the master node cannot handle the local detach policy, it leaves the cluster rather than disabling disk groups.

Linked break-off snapshot volumes

A new variant of the third-mirror break-off snapshot type are linked break-off snapshot volumes, which use the `vxsnap addmir` command to link a specially prepared volume with the data volume. The volume that is used for the snapshot is prepared in the same way as for full-sized instant snapshots. However, unlike full-sized instant snapshots, this volume can be set up in a different disk group from the data volume. This makes linked break-off snapshots especially suitable for off-host processing applications where you may want to create the snapshot on storage with different characteristics from that used for the data volumes.

If you change the size of volume, any snapshots that are currently linked are also resized in the same operation.

Volume tags

Volumes may now be tagged with an arbitrary tag name and optional tag value. Multiple tags can be associated with a single volume. Such tags are used by features such as Remote Mirror (also known as campus cluster) and Dynamic Storage Tiering (DST).

Disk tags

Disks may now be tagged with an arbitrary tag name and optional tag value. Multiple tags can be associated with a single disk. Such tags are used by features such as Remote Mirror, Intelligent Storage Provisioning (ISP) and importing cloned disks.

Data migration

The `vxassist`, `vxevac` and `vxsd` commands have been enhanced to allow data to be migrated at the volume, disk or subdisk level respectively. Once the data migration is in the tentative state, it can either be committed or cancelled.

Raw I/O access to volume components of a volume set

A mechanism is provided to allow access to the raw device nodes of the component volumes of a volume set. This is intended to allow the component volumes to be backed up and restored individually.

Maximum number of component volumes in a volume set

The maximum number of component volumes in a volume set has been increased to 2048.

Importing cloned disks

Disks that have been duplicated outside the VxVM environment (usually using specialized hardware) are referred to as *cloned disks*. The `vxdisk` and `vxchg` commands have been enhanced to allow such cloned disks to be identified, tagged and more easily managed. For example, a subset of the disks in a disk group that are similarly tagged can be imported together in a single operation.

ISP enhancements

The following enhancements have been made to the Intelligent Storage Provisioning (ISP) feature:

- The `vxassist` command may be used instead of the `vxvoladm` command to create ISP volumes as well as non-ISP volumes. Any `vxassist` specification attributes are converted into equivalent ISP rules.
- Creation of a large number of volumes in a single operation, and retrieval of information have been speeded up.
- Annotation of storage devices may now be performed by assigning tags and optional tag values to disks and LUNs.
- The `vxassist printrules` or `vxvoladm printrules` commands may be used to display the raw set of ISP rules that were used to allocate storage to a volume.
- A specified number of volumes with a given intent can be created at the same time.
- Additional information retrieval commands are provided to support queries such as:
 - Given a template, return all template sets that refer to that template.
 - Given a template, list all the templates on which the specified template is dependent.
- The linked break-off snapshot volume feature allows ISP feature to support fast resynchronization (FastResync) with snapshot operations such as refresh and restore.
- Migration between non-ISP and ISP volumes.
- The ISP intent version number has been increased to 30.

Veritas File System

This release of Veritas File System includes the following new features and enhancements.

Dynamic Storage Tiering

Dynamic Storage Tiering (DST) allows administrators of multi-volume VxFS file systems to manage the placement of files on individual volumes in a volume set by defining placement policies that control both initial file location and the circumstances under which existing files are relocated.

Improved availability

Improved availability allows you to mount a multi-volume file system even if the component data-only volume is missing or becomes unavailable. Any I/O error on a data-only volume will not affect access to non-data-only volumes. In addition, all VxFS operations that do not access the missing data-only volume will function normally. This helps guarantee the availability of some volumes even when other volumes within the file system are not available.

File-to-volume and volume-to-file mapping in multi-volume file system support

This release provides two new commands to support this feature:

- `fsmmap` This command reports the volume location of all data or indirect extents associated with a file in a multi-volume file system, and verifies that DST policies are working as requested.
- `fsvmap` This command determines which data file is resident on a given volume for a multi-volume file system. This command recovers only the affected files when an unprotected volume is permanently lost.

2K volumes in a volume set

The limit of number of volumes allowed in a volume set is now 2048, increased from 256.

File placement policy administration

The `fsppadm` command administers the file placement policies of the DST feature, and replaces the functionality of the `fsrpadm`, `fsmove`, and `fssweep` commands.

See the `fsppadm(1M)` manual page.

Pattern-based allocation policies

Pattern tables can be assigned to directories or file systems. A pattern table contains patterns against which a file's name and creating process' UID and GID are matched as a file is created in a specified directory. The first successful match is used to set the allocation policies of the file.

Load balancing

An allocation policy with the `balance` allocation order can be defined and assigned to files that must have their allocations distributed at random between a set of specified volumes. The effect is that the distribution of extents between the volumes is mostly equal if none of the volumes are full or disabled.

Large directories

Disk layout Version 7 adds supplemental indexing to directories. This indexing improves creating, removing, and looking up files in directories that contain tens of thousands of entries and more.

Multi-volume file system availability

The multi-volume file system (MVFS) support enables several volumes to be represented by a single logical object.

MVFS availability allows you to mount a multi-volume file system even if a component data-only volume is missing or becomes unavailable. Any I/O error on a data-only volume will not affect access to non-data-only volumes. In addition, all VxFS operations that do not access the missing data-only volume will function normally. This helps guarantee the availability of some volumes even when other volumes within the file system are not available.

Preallocation API

VxFS enhances the `vxfs_setext` API for an unprivileged process by providing write permission to pre-allocate space on a file without clearing the disk blocks. An unprivileged process can pre-allocate and modify the file size to include the pre-allocated space. Any read from an uninitialized preallocated area returns zeros as data.

See the `setext . 1` manual page for additional information.

File Change Log

The VxFS File Change Log (FCL) tracks changes to files and directories in a file system. Applications that typically use the FCL include: backup utilities, webcrawlers, search engines, and replication programs.

VxFS 5.0 offers a new programming interface that provides improved compatibility, even when the on-disk FCL layout changes. The API also:

- Reduces the need to write additional code needed to parse FCL file entries and enables an application to directly read an assembled record
- Allows the user to specify a filter to indicate a subset of the event records of interest

You can then use this information to gather the following:

- Space usage statistics to determine how the space usage for different types of data
- Usage profile for the different files on a file system across different users to help determine which data has been recently accessed and by whom

JFS2 file system conversion capability

5.0 provides the ability to convert JFS2 files to a VxFS file system through the `vxconvert` utility.

JFS2 is the enhanced version of JFS (journaling file system) from IBM.

File system reorganization prevention

Some applications may require preventing extent and log reorganization. Such applications can disable file system reorganization using the `fsadm` command by creating the `/etc/fs/vxfs/vxfs_noreorg_config` file.

See the `fsadm_vxfs(1M)` manual page.

Veritas Storage Foundation for Databases

Veritas Storage Foundation for Oracle

This release of Veritas Storage Foundation for Oracle includes the following new features and enhancements.

Support for 10gR2

This release of Veritas Storage Foundation for Oracle offers support for Oracle 10gR2.

Database Dynamic Storage Tiering

Veritas Database Dynamic Storage Tiering (DBDST) enables you to manage your data so that less-frequently used data can be moved to slower, less expensive disks, allowing frequently-accessed data to be stored on the faster disks for quicker retrieval.

Improved task scheduler

The GUI for the task scheduler has been improved to permit more flexibility in scheduling tasks.

Modify clone initialization parameters

Clones can be created and started with modified initialization parameters to let clones use system resources in a different way than the primary database (for example, if the clone resides on a secondary host with different resources, or if it should use less resources if residing on the same host).

Enhanced deep mapping

Deep mapping has been enhanced to differentiate between EMC STD and BCV mirrors for EMC arrays. Use the `vxstorage_stats` command.

Table level mapping

A table name now can be used as input to the `dbed_analyzer` command (with a new `-o` option) to list the disk in which the table resides and the space it occupies on each disk.

Oracle Resilvering support

Veritas Extension for Oracle Disk Manager supports Oracle Resilvering. With Oracle Resilvering, the storage layer receives information from the Oracle database as to which regions or blocks of a mirrored data file to resynchronize after a system crash.

Enhanced CLI commands

The following Veritas Storage Foundation for Oracle CLI commands have been enhanced:

Command Name	Description
<code>dbed_clonedb</code>	New <code>-p pfile_modification_file</code> option has been added to specify modified initialization parameters (contained in <code>pfile_modification_file</code>) for the clone.
<code>dbed_vmclonedb</code>	New <code>-p pfile_modification_file</code> option has been added to specify modified initialization parameters (contained in <code>pfile_modification_file</code>) for the clone.
<code>dbed_analyzer</code>	New option <code>-o mode=table [-f file -t table]</code> lists the disk on which the specified table resides and how much space it consumes.

Veritas Storage Foundation for DB2

This release of Veritas Storage Foundation for DB2 includes the following new features and enhancements.

Support for DB2 9.1

This release of Veritas Storage Foundation for DB2 offers support for DB2 9.1.

Database Dynamic Storage Tiering

Veritas Database Dynamic Storage Tiering (DBDST) enables you to manage your data so that less-frequently used data can be moved to slower, less expensive disks, allowing frequently-accessed data to be stored on the faster disks for quicker retrieval.

GUI-based task scheduler

A task scheduler has been added to the GUI to enable easy and flexible automatic creation of storage checkpoints or snapshots, clones of them, and resynchronization of the clones to the database.

Enhanced deep mapping

Deep mapping has been enhanced to differentiate between EMC STD and BCV mirrors for EMC arrays. Use the `vxstorage_stats` command.

New CLI Commands

The following Veritas Storage Foundation for DB2 commands and corresponding manual pages have been added:

Command Name	Description
<code>edgetmsg2</code>	Manages message log files. This command is not available through the GUI.

Supported software

The minimum system requirements for this release are:

- AIX 5.2 ML6 (legacy)
- AIX 5.3 TL4 with SP4

Note: SP4 was not available at the time of this release. Veritas 5.0 products also operate on AIX 5.3 with SP3, but you must install an AIX interim fix. See the following TechNote for information on downloads, service pack availability, and other important issues related to this release.

<http://support.veritas.com/docs/282024>

The 5.0 release does not support AIX 5.1.

Note: The installation script for Storage Foundation verifies the required release and patch level before installation begins. The script terminates without installing any component of Storage Foundation if the target system fails to meet the patch requirements.

Component product licensing

A Storage Foundation Standard key licenses VxVM and VxFS.

A Storage Foundation Standard HA keys licenses VxVM, VxFS, and VCS.

A Storage Foundation Enterprise key licenses VxFS, VxVM, Veritas FlashSnap, FlashSnap Agent for Symmetrix, and Dynamic Storage Tiering.

A Storage Foundation Enterprise HA key license VxFS, VxVM, VCS, Veritas FlashSnap, FlashSnap Agent for Symmetrix, Dynamic Storage Tiering and the Global Cluster option.

When you install using the Veritas product installer, the following information is displayed on the Product Status Page:

- Products available for installation
- Products currently installed
- Products that are licensed
- Options for operations you can initiate

Select option **L** to enter the license key. You will not have to re-enter the key for other licensed products.

Note: Some features require a separate license key (see “[Licensable features](#)” on page 24).

Symantec licensing commands

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 features and their descriptions encoded in a license key

Even though other products are included on the enclosed software discs, you can only install the Symantec software products for which you have purchased a license.

Licensable features

Veritas Volume Replicator (VVR) is a data replication software designed to contribute to an effective disaster recovery plan by maintaining an exact or consistent copy of application data at one or more remote locations.

VVR is installed with Storage Foundation Standard Enterprise and Storage Foundation Enterprise HA, but requires a separate product license key.

Using Veritas Quick I/O

The Veritas File System package, VRTSvxfs, includes the Veritas Quick I/O for Databases feature. This feature is described in the *Veritas File System Administrator's Guide*. Quick I/O is intended for operation only with Veritas Storage Foundation for Databases products.

Disk layout versions

VxFS 5.0 file systems employ disk layout Version 7. Use the `vxupgrade` command (`vxupgrade(1M)`), to upgrade the disk layout on mounted file systems.

See the *Veritas Storage Foundation Installation Guide* for details on how to upgrade previous file system disk layout versions.

Caution: VxFS file systems must be cleanly unmounted before upgrading to the Veritas File System 5.0 release from any previous release. For more information, see the *Veritas Storage Foundation Installation Guide*.

Disk Group Versions (VxVM)

All disk groups have a version number associated with them. Each VxVM release supports a specific set of disk group versions and can import and perform tasks on disk groups with those versions. Some new features and tasks work only on disk groups with the current disk group version, so you need to upgrade existing disk groups before you can perform the tasks. The following table summarizes the disk group versions that correspond to each VxVM release on AIX from 3.2 to the present.

VxVM Release	Cluster Protocol Versions	Disk Group Version	Supported Disk Group Versions
3.2,3.2.2	30	90	90
4.0	50	110	90, 110
5.0	70	140	90, 110, 140

If you want to take advantage of the new features in this release, you must upgrade the *Veritas Cluster Volume Manager (CVM)* protocol Version (70), and upgrade to the latest disk group version (140).

Use the following command to find the version of a disk group:

```
# vxvg list diskgroup
```

You can also determine the version by using the `vxprint(1M)` command with the `-l` option.

To upgrade a disk group to Version 140, use the following command:

```
# vxvg upgrade diskgroup
```

For shared disk groups, the latest disk group version is only supported by the latest cluster protocol version. To see the current cluster protocol version, type:

```
# vxctl support
```

To upgrade the protocol version for the entire cluster, enter the following command on the master node:

```
# vxctl upgrade
```

See the “Administering Cluster Functionality” chapter of the *Veritas Volume Manager Administrator’s Guide*.

No longer supported and future support issues

This section lists functions that are either:

- not supported in 5.0
- may not be supported in future releases

Version 4 disk layout

VxFS disk layout Version 4 will no longer be supported in the next major release. Maintenance patches for the 4.0 release of SFCFS will continue to support previous disk layouts. Use the `vxupgrade` command to upgrade to disk layout Version 6 or 7.

See the *Veritas File System Administrator’s Guide*.

Note: Version 7 is the default disk layout version for the 5.0 release.

File system snapshots

Support for file system snapshots may be discontinued in the next release of SFCFS. It will be replaced by Storage Checkpoints. Symantec recommends using the Storage Checkpoints feature to create “point-in-time” copies.

I/O error mount options

In this and future releases, only the `ioerror=disable` mount option, which is the default, is supported for cluster-mounted file systems. Other `ioerror` mount options are not supported.

Array configuration through the GUI

Arrays can no longer be configured through the GUI. Instead, configure arrays with the `vaildiag` CLI tool. For complete details, see the *Veritas Array Integration Layer Array Configuration Guide*.

Fixed Issues

The following incidents were corrected for this release.

Veritas Volume Manager fixed issues

The following table contains information about fixed issues in this release of VxVM.

Incident	Description
137175	The <code>vxdiskadm</code> utility no longer truncates default disk names to 9 characters.
140947	I/O policy settings were not persistent between reboots.
229538	Multiple enclosures of the same type generated unexpected enclosure-based names.
272263	Changing a disk's I/O policy could hang <code>vxconfigd</code> .
272309	Incomplete records in <code>/etc/vx/disk.info</code> could cause <code>vxconfigd</code> to dump core.
272891	<code>vxnotify</code> did not receive events relating to the change of controller states in DMP.
311530	Renaming an enclosure with a longer name caused <code>vxconfigd</code> to dump core.
506139	If <code>vxconfigd</code> was restarted during a change between OS-based device naming and enclosure-based naming, the default arguments were not preserved.

Veritas Storage Foundation for DB2 fixed issues

The following table contains information about fixed issues in this release of Veritas Storage Foundation for DB2:

Incident	Description
34432	Quota information now can be retrieved for a Storage Checkpoint in file system layout version 5 or older.
74780	In the DB2 GUI Rollback Wizard, the Rollback Buffer field format is now localized.
75222	In the Japanese version of this product, the Write Resume Time field for writable version checkpoint is no longer blank in the GUI.
105379	The VEA client and the VEA server now can be installed on the same AIX machine without displaying a Time Out error, or causing delays and poor performance of some functions.
217003	Installing VERITAS Storage Foundation for DB2 and VERITAS Storage Foundation for Oracle on the same machine using an alternative method of installation (something other than the VERITAS product installer or the installation script), no longer produces warning messages.

Veritas Storage Foundation for Oracle fixed issues

The following table contains information about fixed issues in this release of Veritas Storage Foundation for Oracle:

Incident	Description
41192	In the GUI object tree, some tool bar icons are no longer truncated or invisible.
129887	VERITAS Storage Foundation for Oracle now supports Japanese datafiles, names, and tablespace names. Also, a Japanese SID for a clone database when using <code>dbed_clonedb</code> and <code>dbed_vmc_lonedb</code> is fully supported.
217003	Warning messages are no longer shown when you install VERITAS Storage Foundation for Oracle and VERITAS Storage Foundation for DB2 on the same machine using an alternative method of installation (installation methods other than the VERITAS product installer or the installation script).

Incident	Description
218987	Using the GUI to rescan the Oracle database instance now works.
221759	<p>The EMC Symmetrix VAIL provider no longer dumps core in the following conditions:</p> <ul style="list-style-type: none"> ■ A Symmetrix device (<code>symdev=xyz</code>) had two or more bindings. ■ The host running the EMC Symmetrix VAIL provider had multi-pathed access to the device through all the Symmetrix ports it was bound to. For example, the host's adapters were connected to all the ports the device was bound to and the device was masked to the host appropriately. So, if there were '<i>n</i>' bindings on the device, the host saw '<i>n</i>' different OS handles for the same device. ■ If the principal OS handle to the device ("OSHandle#1") was a substring of the other <i>n</i>-1 OS handles to the device ("OSHandle#2," "OSHandle#3"..."OSHandle#<i>n</i>"). "OSHandle#1" is the OS handle to the device as reported by <code>symdev show xyz</code>, displayed against "Device Physical Name." "OSHandle#2," "OSHandle#3," and "OSHandle#<i>n</i>" are the other OS handles to the device as shown by <code>symdev show xyz</code>, displayed under "Front Director Paths."
221891	In the Topology/Statistics window of the GUI, the units for the Offset column now correctly refers to sectors, not bytes.
295741	When using Oracle Managed Files (OMF) to manage temporary tablespaces, our database cloning commands could not recreate them on the cloned database. This has been fixed.

Veritas File System fixed issues

The following table contains information about fixed issues in this release of VxFS.

Incident	Description
149930	Resolved a race condition resulting in a crash when two threads attempt <code>getattr</code> on the same file resulting in an unsynchronized update to internal data structures.
153702	Files with certain geometry fails truncation with <code>ENOSPC</code> when the file system is full
154569	<code>lsfs</code> does not determine block dev or mountpoint

Incident	Description
e495235	database creation hangs on Oracle10gR2
e495230	panic while accessing vp->v_vfsp of a dummy vnode.
e495221	Work Load Manager gen count is not being returned for VxFS
e497804	Storage Foundation is consuming 3 times of CPUs and throughput drop 50% in comparing to the SF 4.0MP2 on SPECsfs performance test
e569580	vxdump fails to detect "End of tape" on ENOSPC
e605754	AIX kernel stack corruption caused by array overrun in vx_bufs_bulk_sort 32-bit only

Known issues

For the latest information on updates, patches, and software issues regarding this release, refer to the following TechNote on the Veritas Technical Support website:

<http://support.veritas.com/docs/282024.htm>

Storage Foundation known issues

The following incidents were reported for this release.

Software disc cannot be ejected during installation

During installation, it may not be possible to eject the software disc under the following circumstances:

- If the language pack disc needs be loaded so that the associated packages can be installed.
- A product was installed that did not require a system reboot to complete the installation.

This problem is not an issue if a product was installed or upgraded that required a system reboot to complete the installation.

To avoid this problem at install time

- 1 Specify the `-installonly` option to the `installer` script in addition to any other options.
- 2 Eject the software disc.
- 3 Run the `installer` script with the `-configure` option specified.

If a software disc cannot be ejected

- 1 Stop the event source daemon:

```
# /usr/sbin/vxddladm stop eventsource
```
- 2 Kill the `vxcached`, `vxrelocd` and `vxnotify` processes by using the `kill -9` command with their process IDs as reported by the `ps` command.
- 3 Eject the software disc.
- 4 Restart the VxVM daemon processes:

```
# /usr/sbin/vxddladm start eventsource  
# /etc/vx/bin/vxcached  
# /etc/vx/bin/vxrelocd
```

[622442]

Supported hardware warning

The following disk arrays, which supported the Storage Mapping feature in the previous release, are not yet confirmed for operation in the 5.0 release. The HCL will be updated when support becomes available.

- EMC 3000,8000, DMX
- IBM F10,F20, ESS800

Host name may need to be entered manually on clustered host

When installing SF Management Server on a clustered host on which the Domain Name Service (DNS) is not configured, the installer will be prompted to manually enter the fully-qualified host name in order to proceed with the installation.

When installing on a clustered host on which the DNS is running slowly, the installer may occasionally be prompted to manually enter the fully-qualified host name in order to proceed with the installation.

[621161]

Veritas Volume Manager known issues

The following incidents were reported for this release of VxVM.

Installation known issues

Upgrading to Veritas Volume Manager 5.0

Refer to the *Veritas Storage Foundation Installation Guide* for instructions on upgrading an existing system on which Volume Manager is installed.

Removing a disk from Volume Manager control

Remove a VM disk from a disk group after evacuating any data on the disk. You can permanently remove this disk from Volume Manager control by removing the VM metadata partition from that disk. Use the low-level command, `vxdiskunsetup`, as follows:

```
# /usr/lib/vxvm/bin/vxdiskunsetup hdisk_N
```

Caution: This command permanently removes a disk from Volume Manager control. It should be used only by a system administrator who is trained and knowledgeable about Volume Manager.

Reinitializing disks previously under Volume Manager control

Make a note of any of the disks that you are planning to initialize if they were previously under Volume Manager control. If the disks were previously under Volume Manager control and were used on the same host system, and if the proper uninstall procedures were *not* followed, the disk groups they represent are imported automatically during the installation process. An attempt during the installation to initialize disks that were previously under Volume Manager control fails. After the installation, if you no longer desire to use those disk groups, use the `destroy` option of the `vxchg(1M)` command to remove those disk groups. Alternately, you can use `vxdiskunsetup(1M)` to remove the disks from Volume Manager control.

Caution: These operations can result in data loss if used incorrectly.

Utility known issues

Global Device Naming

The Global Device Naming (GDN) option to the `vxddladm` command should only be used with the Storage Foundation Volume Server software. [608621]

Current naming scheme

There is no option in the `vxddladm` command to display the current naming scheme. The naming scheme that is in operation can be deduced from the output to the `vxdisk list` command. [611320]

vxdiskadm displays error V-5-1-9764 when excluding devices

The `vxdiskadm` operation displays error V-5-1-9764 if a vendor and product ID combination are specified to exclude devices from multipathing. This error is harmless and can be ignored. The error is not seen if controller or device names are specified instead. [587435]

Specifying an enclosure to the vxmpadm getportids command

The `enclosure` attribute should be used to specify an enclosure name to the `vxmpadm getportids` command, instead of the `enclr` attribute that is shown in the *Veritas Volume Manager Administrator's Guide* and the `vxmpadm(1M)` manual page.

Disk group is disabled if private region sizes differ

A disk group is disabled if the `vxchg init` command is used to create it from a set of disks that have pre-existing private regions that differ in size. This may occur if the disks previously belonged to disk groups in older releases of VxVM.

The workaround is to reinitialize the disks before creating the disk group (for example, by using the `vxdisk -f init` command), or to use the `vxvg adddisk` command to add the disks to the disk group after it has been created. [592180]

Maximum size of a VxVM volume

VxVM supports volume lengths up to 256TB. However, any 32-bit legacy applications that use system calls such as `seek`, `lseek`, `read` and `write` are limited to a maximum offset that is determined by the operating system. This value is usually $2^{31}-1$ bytes (1 byte less than 2 terabytes).

Resizing volumes with detached remote plexes

If a volume in a Remote Mirror configuration has detached plexes at a remote site, you can use the following procedure to resize it:

- 1 Turn off the `allsites` attribute for the volume:


```
# vxvol -g diskgroup set allsites=off volume
```
- 2 Remove the detached plexes:


```
# vxassist -g diskgroup remove mirror volume \
  plexnames=plex1,plex2,...
```
- 3 Use the `vxresize` command to resize the volume.

When the remote site comes back up:

- 1 Replace the removed plexes using storage at the remote site:


```
# vxassist -g diskgroup mirror volume nmirror=N \
  site:remote_site_name
```
- 2 Turn on the `allsites` attribute for the volume:


```
# vxvol -g diskgroup set allsites=on volume
```

Resizing layered volumes during resynchronization

Due to the current implementation to handle the resize of layered volumes, it is recommended that you do not grow or shrink layered volumes (stripe-mirror, concat-mirror, and so on) while resynchronization is ongoing. Note that this limitation does not apply to ISP layered volumes.

Internally, Volume Manager converts the layout of layered volumes and updates the configuration database before it shrinks or grows their sizes. This causes any ongoing operation, such as the resynchronization, to fail.

If the system reboots before the `grow` or `shrink` of a layered volume completes, the volume is left with an intermediate layout. In such a case, use the `vxassist convert` to restore the volume to its original layout.

After a layered volume is resized, the volume names, the plex names and the subdisk names associated with the subvolumes, are changed.

Interpreting output from vxassist snapprint

The output from the `vxassist snapprint` command for Persistent FastResync and Non-Persistent FastResync differs as follows:

- Persistent FastResync maintains separate tracking maps for the original volume and its snapshot volumes. The “%DIRTY” value output by `vxassist snapprint` shows information based only on what has been written to an individual volume.
- Non-Persistent FastResync keeps information about changed regions in the same map for both the original and its snapshot volumes. Even if writes are only made to the snapshot volume, `vxassist snapprint` shows the same “%DIRTY” value for the original volume.

Using vxdbg free with a non-existent disk media name

Using `vxdbg free` with a non-existent disk media name does not print an appropriate error message; it only prints a header.

Simultaneous creation of a mirror and a log using vxassist

The `vxassist` command does not add a mirror and a log when processing a command such as the following:

```
# vxassist mirror volume layout=log ...
```

The mirror is added, but the log is silently omitted. If a log and a mirror are to be added, add the mirror and the log in two separate `vxassist` invocations, as follows:

```
# vxassist mirror volume ...  
# vxassist addlog volume ...
```

This problem will be addressed in a future release.

Resizing a mirrored volume with plexes of different types

Resizing a mirrored volume with plexes of different types is currently unsupported. This is documented in the `vxassist(1M)` and `vxresize(1M)` manual pages.

Relayout of a volume turns it into a layered volume

The `vxassist relayout` process can change a non-layered volume’s layout to layered. For example, you might end up with a stripe-mirror volume instead of a mirror-stripe volume.

If the final layout is not what you intended, there are two solutions:

- If the task is not complete, stop the relayout and reverse it by using the following command:

```
# /usr/sbin/vxrelayout -g dg_name -t task_id reverse vol_name
```

- If the task has completed, you can relayout the volume back to the original layout.

Specifying subdisk alignment when resizing a volume

When relayout is performed on a volume, Volume Manager does not grow subdisks such that they end on cylinder boundaries. If you subsequently increase the size of the volume, its subdisks are not grown using contiguous disk space unless you specify the attribute `layout=nodiskalign` to `vxassist`, as shown here:

```
# vxassist growby volume length layout=nodiskalign
```

Note: Specifying `layout=nodiskalign` permanently enforces this layout policy on the volume.

Relayout fails for a volume with snapshot plexes

The `SNAPATT`, `SNAPDONE`, `SNAPTMP` or `SNAPDIS` plex states are not supported for the relayout of volume configurations such as `stripe-mirror`. Relayout of such volumes fails if any of their plexes are in these states.

Suggested solution: For a plex in the `SNAPDONE` state, change the state of the plex to `ACTIVE` before performing the relayout:

```
# vxplex [-g diskgroup] convert state=ACTIVE plexname
```

For plexes in the `SNAPATT` or `SNAPTMP` states, either allow time for them to be synchronized and placed in the `SNAPDONE` state. You can then use the `vxplex convert` command to convert them to the `ACTIVE` state. Alternatively, you can use the `vxassist snapabort` command to remove the snapshot plexes. For snapshot plexes in the `SNAPDIS` state, dissociate and remove the plex from the volume using this command:

```
# vxplex [-g diskgroup] -o rm dis plexname
```

Using `vxvol` and `vxmend` with layered volumes

The `vxvol` and `vxmend` commands do not handle layered volumes very well. When `vxmend` is executed on the top level volume to change the state of a volume, it is executed only on the top level volume; the change is not propagated to the lower level volumes. As a result, the volume states can become inconsistent and a subsequent `vxvol init` command might fail.

The `vxvol` command also exhibits the same problem. When a `vxvol init` command is executed on the top level volume, the change is not propagated to the volumes corresponding to its subvolumes.

Suggested Solution: When executing the `vxvol` or `vxmend` command on a layered volume, first issue the command to the lower level volumes in a bottom-up fashion, then execute the command on the top-level volume.

In this example, a volume, `vol`, has two subvolumes, `vol-L01` and `vol-L02`. The state of the volumes is first set to `empty`, and then the initialization commands are executed:

```
# vxmend -o force -g mydg fix empty vol-L01
# vxmend -o force -g mydg fix empty vol-L02
# vxmend -o force -g mydg fix empty vol
# vxvol -g mydg init zero vol-L01
# vxvol -g mydg init zero vol-L02
# vxvol -g mydg init zero vol
```

Warning message from vxassist when creating concatenated mirror volumes

You may see the following warning message when creating a concatenated mirror (`concat-mirror`) volume with the maximum size:

```
VxVM vxassist Warning V-5-1-364 dm:volume_name: No disk space
matches specification
```

As long as the volumes have been successfully created, you can safely ignore the message.

Preventing access to a disk by Volume Manager

When Volume Manager starts up, it accesses every disk on the system by reading its disk header and possibly a few blocks from one partition. There is currently no mechanism to prevent this. A disk can be made offline persistently, but the offline state is only recognized *after* the probe of all disks. [8818]

Device and DMP known issues

I/O is not restored on a path

If a path is re-enabled after a failback or a non-disruptive upgrade (NDU) operation, I/O may not be restored on that path. To unblock I/O on the path, run the `vxdisk scandisks` command. [617331]

DMP obtains incorrect serial numbers

DMP cannot obtain the correct serial number for a device if its LUN serial number contains a comma (.). This problem has been seen on EMC Symmetrix arrays with more than 8096 LUNs. [611333]

Package remove does not unload the DMP driver

Various VxVM processes or drivers are not unloaded when the `VRTSvxvm` package is removed. Provided that you stop all volume activity before removing the package, you can ignore any errors that you see about these processes or drivers failing to start. [591547]

Default I/O policy

The default I/O policy for Active/Active (A/A) arrays has been changed from `balanced` to `minimumq`. The default I/O policy for Asymmetric Active/Active (A/A-A) and Active/Passive (A/P) arrays has been changed from `singleactive` to `round-robin`.

Using vpath devices with LVM

VxVM keeps open all non-LVM devices in 5.0. To initialize a disk under LVM, first remove the device from VxVM by using the following command with the disk access name:

```
# vxdisk rm disk_access_name  
[525903]
```

Active I/O is not supported during Non-Disruptive Upgrade

To avoid read and write errors, I/O must be suspended to EMC arrays during a Non-Disruptive Upgrade (NDU) operation.

Using DMP with third-party multipathing drivers

If the appropriate array support library (ASL) for a third-party multipathing driver is installed, the supported devices do not need to be added as foreign devices. For example, if a host is connected to an EMC Symmetrix disk array, DMP can coexist with EMC PowerPath to provide multipathing to the array. If you intend to use EMC PowerPath for multipathing, please refer to “*Third-party driver coexistence*” in the “*Administering disks*” chapter of the *Veritas Volume Manager Administrator’s Guide*.

IBM SDD

If you want to use DMP for multipathing, it is recommended that you remove SDD from the configuration.

Effect of disk errors on Volume Manager startup

Startup of Volume Manager can be severely impacted by disk errors that result in I/O operations taking a long time to fail.

Support for RAM disk devices

RAM disks cannot be used with Volume Manager on AIX systems.

Passthrough ioctl

The only passthrough `ioctl` that is supported on DMP devices is `IOCINFO`. No other passthrough `ioctl` is allowed on DMP nodes.

DMP devices in DISABLED state

If cables to a dual-pathed disk array are swapped on the host, the corresponding DMP devices are placed in the DISABLED state, and I/O errors will occur. To avoid this situation, you must unconfigure the paths and then reconfigure them after the cables have been swapped.

Specifying product IDs to vxdkpadm

When vxdiskadm option 16 is selected, followed by option 7 from the submenu, (Exclude VID:PID from DMP), you should be aware that vxdiskadm does not understand spaces in a product ID string.

Suggested solution: Use the “*” wildcard character to make vxdiskadm accept the string.

DMP failover is slow for a SAN

DMP failover may also take a significant time when a path is disabled from a switch or an array in a SAN environment. This is not a problem if the path is disabled from the host.

Suggested solution: The dynamic tracking and fast fail features of AIX 5.2 ML3 (5200-03) can be used to address this problem.

On an AIX 5.2 ML3 system, where VxVM is already installed and configured:

- 1 Enter the following commands for *each* Fibre Channel adapter or controller:

```
# chdev -l fscsiN -a fc_err_recov=fast_fail -P
# chdev -l fscsiN -a dyntrk=yes -P
```

where *N* is the number of the controller (0, 1, 2 and so on).

- 2 Reboot the system.

- 3 Use the lsattr command to verify that the dyntrk and fast_fail attributes are set to True on each adapter, as shown in this example:

```
# lsattr -El fscsi0
attach      switch      How this adapter is CONNECTED False
dyntrk      yes          Dynamic Tracking of FC Devices True
fc_err_recov fast_fail    FC Fabric Event Error RECOVERY Policy
True
scsi_id      0x10d00     Adapter SCSI ID False
sw_fc_class  3           FC Class for Fabric
```

VxVM and DMP ioctl

The VxVM ioctl (documented on the vxio(7) manual page) does not work if called from a 64-bit user program running on a 32-bit kernel. This is also the case for the DMP ioctl.

Hot-Relocation known issues

Data layout and performance after relocation

Hot-relocation does not guarantee the same layout of data or performance after relocation. It is therefore possible that a single subdisk that existed before relocation may be split into two or more subdisks on separate disks after relocation (if there is not enough contiguous space on a single disk to accommodate that subdisk).

Notification of disk information on disk failure

When a disk failure occurs, the hot-relocation feature notifies the system administrator of the failure and any relocation attempts through electronic mail messages. These messages typically include information about the device offset and disk access name affected by the failure. However, if a disk fails completely or a disk is turned off, the disk access name and device offset information is not included in the mail messages. This is because Volume Manager no longer has access to this information.

Cluster functionality issues

Node rejoin causes I/O failures with A/PF arrays

A cluster node should not be rejoined to a cluster if both the primary and secondary paths are enabled to an A/PF array, but all the other nodes are using only the secondary paths. This is because the joining node does not have any knowledge of the cluster configuration before the join takes place, and it attempts to use the primary path for I/O. As a result, the other cluster nodes can experience I/O failures and leave the cluster.

Workaround:

- 1 Before joining the node to the cluster, disconnect the cable that corresponds to the primary path between the node and the A/PF array.
- 2 Check that the node has joined the cluster by using the following command:

```
# vxclustadm nidmap
```

The output from this command should show an entry for the node.

- 3 Reconnect the cable that corresponds to the primary path between the node and the array.
- 4 Use the following command to trigger cluster-wide failback:

```
# vxdisk scandisks
```

All the nodes should now be using the primary path.

Volume persists in SYNC state

If a node leaves the cluster while a plex is being attached to a volume, the volume can remain in the SYNC state indefinitely. To avoid this, after the plex attach completes, resynchronize the volume manually with the following command:

```
# vxvol -f resync volume
```

RAID-5 volumes

VxVM does not support RAID-5 volumes in cluster-shareable disk groups.

File systems supported in cluster-shareable disk groups

The use of file systems other than Veritas Storage Foundation Cluster File System (SFCFS) on volumes in cluster-shareable disk groups can cause system deadlocks.

Reliability of information about cluster-shareable disk groups

If the `vxconfigd` program is stopped on both the master and slave nodes and then restarted on the slaves first, VxVM output and VEA displays are not reliable until the `vxconfigd` program is started on the master and the slave is reconnected (which can take about 30 seconds). In particular, shared disk groups are marked `disabled` and no information about them is available during this time. The `vxconfigd` program must therefore be started on the master first.

Messages caused by open volume devices

When a node terminates from the cluster, open volume devices in shared disk groups on which I/O is not active are not removed until the volumes are closed. If this node later joins the cluster as the master while these volumes are still open, the presence of these volumes does not cause a problem. However, if the node tries to rejoin the cluster as a slave, this can fail with the following error message:

```
cannot assign minor #
```

This message is accompanied by the console message:

```
WARNING:minor number ### disk group group in use
```

Remote Mirror issues

Volume relayout

Volume relayout is not supported for site-confined volumes or for site-consistent volumes in this release. [528677]

Setting site consistency on a volume

The `vxvol` command cannot be used to set site consistency on a volume unless sites and site consistency have first been set up for the disk group. [530484]

Adding a remote mirror

Adding a remote mirror to a new site for a site-consistent volume does not also create a DRL log plex or a DCO plex at that site. The workaround is to use the `vxassist addlog` command to add a DRL log plex, or the `vxsnap` command to add a version 20 DCO plex at the specified site (`site=sitename`). [533208]

Replacing a failed disk

It is not possible to replace a failed disk while its site is detached. You must first reattach the site and recover the disk group by running these commands:

```
# vxdg -g diskgroup reattachsite sitename  
# vxrecover -g diskgroup
```

The `vxdiskadm` command gives an error when replacing disk on which the `site` tag had been set. Before replacing such a failed disk, use the following commands to set the correct site name on the replacement disk:

```
# vxdisk -f init disk  
# vxdisk settag disk site=sitename
```

[536853, 536881]

Reattaching a site

Reattaching a site when the disks are in the serial-split brain condition gives an error message similar to the following if the `-o overridesb` option is not specified:

```
VxVM vxdg ERROR V-5-1-10127 disassociating sitename: Record not  
in disk group
```

Use the following commands to reattach the site and recover the disk group:

```
# vxdg -g diskgroup -o overridesb reattachsite sitename  
# vxrecover -g diskgroup
```

[540351]

Site records are not propagated during disk group split, move or join

Split, join and move operations fail on a source disk group that has any site-confined volumes. This is because site records cannot be propagated to a target disk group during such operations. The workaround is to specify the `-f` option to the split, join or move operation. This sets `allsites=off` on the target disk group.

[563524]

Restoring site records

The `vxmake` command can be used to recreate a disk group configuration, but not to restore site records. After restoring a disk group configuration, use the following command to recreate the site records manually:

```
# vxdg -g diskgroup addsite site
```

[584200]

Intelligent Storage Provisioning known issues

Number of columns in a RAID-5 ISP volume

If an ISP volume is created with the RAID-5 capability, the parameters `ncols` and `nmaxcols` refer only to the number of data columns, and do not include the parity column. For this reason, the actual number of columns that are created in such a volume is always one more than the number specified.

Creating application volumes

To create application volumes successfully, the appropriate licenses must be present on your system. Vendors of disk arrays may also provide capabilities that require special licenses for certain features of their hardware.

Snapshot known issues

Cache volumes in volume sets

Do not add cache volumes (used by space-optimized instant snapshots) to volume sets. This causes data corruption and system panics.

[614061, 614787]

Mount operation can cause inconsistencies in snapshots

Inconsistencies can arise in point-in-time copies if any of the following snapshot operations are performed on a volume while a file system in the volume is being mounted: `vxassist snapshot`, `vxplex snapshot`, `vxsnap make`, `vxsnap refresh`, or `vxsnap restore`.

Miscellaneous known issues

Auto-import of disk groups

If a disk that failed while a disk group was imported returns to life after the group has been deported, the disk group is auto-imported the next time that the system boots. This contradicts the normal rule that only disk groups that are (non-temporarily) imported at the time of a crash are auto-imported.

If it is important that a disk group *not* be auto-imported when the system is rebooted. It should be imported temporarily when the intention is to deport a disk group (for example, in HA configurations). Use the `-t` flag to `vxchg import`.

Volumes not started following a reboot

During very fast boots on a system with many volumes, `vxconfigd` may not be able to auto-import all of the disk groups by the time `vxrecover -s` is run to start the volumes. As a result, some volumes may not be started when an application starts after reboot.

Suggested Solution: Check the volumes before starting the application or place a sleep (`sleep sec`) before the last invocation of `vxrecover`.

Forcibly starting a volume

The `vxrecover` command starts a volume only if it has at least one plex that is in the ACTIVE or CLEAN state and is not marked STALE, IOFAIL, REMOVED, or NODAREC. If such a plex is not found, Volume Manager assumes that the volume no longer contains valid up-to-date data, so the volume is not started automatically. A plex can be marked STALE or IOFAIL as a result of a disk failure or an I/O failure.

Suggested Solution: Force the volume to start by entering the following command:

```
# vxvol -f start volume
```

Try to determine what caused the problem before you run this command. It is likely that the volume needs to be restored from backup, and it is also possible that the disk needs to be replaced.

Storage expert

Storage Expert rule (`vxse_dg6`) does not provide correct information for non-imported disk groups. [124802]

Instant snapshots of volume sets

The functionality for creating instant snapshots from volume sets is not yet fully supported. This feature should not be used.

Localization of ISP commands

Output and error messages from ISP commands are displayed in English, instead of the locale language.

Entering comments in dialog boxes

Comments may only be entered using the ASCII character set, and not the character set that corresponds to the current locale. [147509]

Disks with write-back caches

Disk drives configured to use a write-back cache, or disk arrays configured with volatile write-back cache, exhibit data integrity problems. The problems occur after a power failure, SCSI bus reset, or other event in which the disk has cached data, but has not yet written it to non-volatile storage. Contact the disk drive or disk array manufacturer to determine whether your system disk drives use a write-back cache, and if the configuration can be changed to disable write-back caching.

Veritas Enterprise Administrator known issues

Note: Refer to the *Veritas Storage Foundation Installation Guide* for information on how to set up and start the VEA server and client.

Controller states

Controller states may be reported as “Not Healthy” when they are actually healthy, and “Healthy” when they are actually not healthy. [599060]

Remote Mirror (campus cluster)

There is no option to create site-based snapshots. [541104]

Action pull-down menu items

No Action pull-down menu items exist for the Layout View, the Disk View or the Volume View. [596284]

Java exception error in the Statistics View

A Java exception error occurs in the Statistics View. [618146]

Out of bounds exception error

When connecting to the central host, an “OutOfBoundException” error occurs. [616661]

Volume tags not displayed

On Microsoft Windows systems, existing volume tags are not displayed when adding a new volume tag. [602953]

Cache volumes shown as available for volume sets

The volume set creation wizard shows cache volumes in the “Available Volumes” list. Cache volumes should not be listed as available. Including cache volumes in volume sets can cause data corruption and system panics. [614761]

Storage Agent dumps core if there are many LUNs

Configurations with more than 10240 LUNs can cause the Storage Agent to dump core in the directory `/var/vx/isis`. [584092]

Workaround

1 Rename the Device Discovery Layer (DDL) library file:

```
# mv /opt/VRTSddlpr/lib/ddl.so /opt/VRTSddlpr/lib/ddl.so.orig
```

This prevents the DDL provider from loading, but has the effect of making enclosure, path and controller objects no longer available in the VEA client GUI.

- 2 Restart the Storage Agent:

```
# /opt/VRTSobc/pal33/bin/vxpal -a StorageAgent
```

Disk group creation failure with duplicate disk ID

VEA fails to create a disk group with a duplicate disk ID, and gives no other options.

Starting a volume in Veritas Enterprise Administrator

Select **Actions > Recover Volume** to start a volume. There is no **Start Volume** action.

Using the Online Help

Selecting a hyperlink from the last item in a list of items may result in the display of text prior to the required text. It may then be necessary to scroll through the Help text to find the text.

Disabling wizards

In VxVM releases prior to VxVM 4.0, you could disable the wizards for certain functions by deselecting the “Enable Wizard Mode.” You can no longer disable wizards.

Adding or deleting a license

If, after installing and starting VEA, you add a new license or delete an existing license, you will not have access to the newly licensed features until you restart the VEA service:

- 1 Stop the VEA backend service:

```
# /opt/VRTS/bin/vxsvcctrl stop
```
- 2 Start the VEA backend service:

```
# /opt/VRTS/bin/vxsvcctrl start
```

vxsvc -k can hang intermittently

Sometimes, when running `vxsvc -k` to shut down `vxsvc`, you might notice intermittent hanging. This happens because the DDL provider is waiting indefinitely for an event, and does not respond to the stop request. To resolve this issue, enter the command:

```
# /opt/VRTS/bin/vxsvcctrl stop
```

Upgrading when the VEA Service is running

Use this procedure whenever you carry out an upgrade and the VEA service is running:

- 1 Stop the Veritas Enterprise Administrator (VEA Service):
`# /opt/VRTS/bin/vxsvcctrl stop`
- 2 Install the patch.
- 3 Restart the VEA service:
`# /opt/VRTS/bin/vxsvcctrl start`
- 4 To display the state of the VEA service, enter the command:
`# /opt/VRTS/bin/vxsvcctrl status`

Veritas Volume Manager Web GUI known issues

Mirroring volumes across targets

Attempting to mirror volumes across targets fails. Such operations are not supported on the AIX operating system platform. [573809]

Data disk and root disk encapsulation

Attempting to encapsulate a data disk or a root disk fail. Such operations are not supported on the AIX operating system platform. [603137]

Creating a file system on a disabled volume

Creating a file system on a disabled volume returns both success and failure messages. In fact, the operation fails. [565072]

Maximum size of a volume

The maximum size of a volume is shown as a rounded-down integer number of gigabytes. If the maximum size is less than 1GB, the maximum size is shown as 0GB. [573897]

Creating a volume without an existing disk group

Attempting to create a volume without an existing disk group produces the following misleading error:

```
Info V-46-1-300 No Volume available to create a file system  
[574410]
```

Disabling paths to SENA storage arrays

Disabling a path to a SENA storage array produces the following dialog:

```
pathname is the last path to its root disk. Are you sure you want  
to disable it?  
Press Next to continue with this operation or press Cancel to  
exit this operation.
```

The message is erroneous, and it is safe to continue the operation. [575262]

Failures when importing disk groups

Messages about failures to import disk groups are not displayed by the Web GUI. [596648]

Failures when creating ISP volumes

Messages about failures to create ISP volumes are not displayed by the Web GUI. [601157]

All Active Alerts View

The All Active Alerts View does not display correct information. [601167]

Deleting an active cache volume

Attempting to delete an active cache volume fails with an error message that is incomplete. [615395]

Corrupted import disk group dialog

If some objects are not present, the import disk group dialog may be displayed as blank or may show the text `<!--td align="center" height="287" valign="midd". For example, this can occur when attempting to import a disk group from a host that is being rebooted. [607096]`

Initializing a disk

At least one object must be selected in the GUI before proceeding to initialize a disk. [607026]

Veritas Storage Foundation Basic soft limitation messages

Messages about exceeding the Storage Foundation Basic soft limitations are not displayed by the Web GUI. [619039]

Create disk group wizard

The create disk group wizard shows internal disks as being available for the creation of shared disk groups. [574717]

Object not found error on creating a volume set

An “object not found error” may be displayed when a volume set is created. [615960]

Java exception when deleting a volume

Deleting a volume that has just been deleted produces a Java exception. This can happen if you do not wait for the Web page to be refreshed after the first delete operation. [608573]

Available controllers not shown

The Scan Disks By Controller View does not list the available controllers. [566619]

Message when forcibly removing a volume from a volume set

Forcibly removing a volume from a volume set displays a message that recommends that the **force** option be selected. [605468]

Java exception when removing a volume from a volume set

Removing a volume from a volume set returns an incorrect Java exception on success. [564455]

Error message when removing a disk from a disk group

Removing a disk from a disk group gives the incorrect error message “no valid disk selected.” [611894]

Disconnecting a disk produces a ghost entry

Ghost entries for disconnected disks in the All Disks View cannot be removed by using the GUI. A command such as `vxdg -g diskgroup rmdisk diskname` must be used instead. [576794]

Adding zero mirrors to a volume set fails

Adding zero mirrors to a volume set gives an error. [603711]

Veritas File System known issues

The following incidents were reported for this release of VxFS.

fsck may abort when applied to unclean file systems from VxFS 4.0

Due to an incompatibility in the VxFS `fsck` utility between the 5.0 and 4.0 releases, `fsck` may abort during intent log replay if it is run on older file systems. This only affects file systems that:

- were previously running under VxFS 4.0
- were CVM shared volumes or multi-volume file systems
- have not been cleanly unmounted prior for use in 5.0 file system

If this situation occurs, you should run a full file system consistency check (`fsck -o full`) to bring the file system to a consistent, clean state that is ready for mounting.

See the `fsck_vxfs(1M)` manual page.

Commands must be large-file aware to operate correctly on file systems larger than one terabyte

For utilities to operate correctly on large-file systems, they must be large file aware. This applies even if commands are invoked on small files in a large file system. See the information regarding disk layout in the *Veritas File System Administrator's Guide*.

Inode limitation on file systems without large file support

For a file system to have more than 8 million inodes, you must create it using the `largefiles` option of `mkfs` (the `fsadm` utility can also be used to set the `largefiles` flag on the file system). See the `mkfs_vxfs(1M)` and `fsadm_vxfs(1M)` manual pages for details. The `largefiles` option is enabled by default on VxFS 4.0 and later releases. In previous VxFS releases, `nolargefiles` was the default mount option.

cp or mv process can hang while copying files from local mount to NFS client

While copying a file using the `cp -p` command or moving a file using the `mv` command from a local VxFS file system to an NFS client file system, there is a possibility that the `cp` or `mv` process can hang. The hang occurs because the basic permissions of the file stored in its mode bits are used to fabricate VxFS ACLs for the file. On AIX, the native ACL type for JFS files causes the return of ACLs for VxFS files to the NFS client, causing the process to hang while NFS validates VxFS ACLs as JFS ACLs.

This problem is not seen on AIX 5.2 at ML03. A recent fix in NFS fails to verify VxFS ACLs returned to NFS, and consequently NFS rejects the ACLs. The rejection of VxFS ACLs is not propagated to the process, and the process continues without errors.

Set ulimit for filesize to unlimited if BSD quotas are used

BSD quota commands insist that the `quotas` and `quotas.grp` files exist. These files can be symbolic links to actual files on a file system other than a VxFS file system. They contain quota records in a non-ASCII format, and are updated when certain quota commands are executed or `sync` is issued. Since these files can grow beyond the maximum file size set in `/etc/security/limits` (see the `ulimit(1)` manual page), the `ulimit` for root must be set to `unlimited` if BSD quotas are used.

Large file systems should be mounted only on systems with sufficient memory

When a file system is mounted, VxFS keeps certain data structures in the kernel. As the size of the file system increases, the amount of data structures stored by VxFS also increases. The file system typically keeps approximately 128 bytes per allocation unit (32,768 file system blocks). This translates to a usage of 512K per 1 TB for an 8K block size file system (4 MB per 1 TB for a 1K block size file system). Therefore, large file systems must be mounted only on systems that have sufficient memory. File systems exceeding 1T are supported only on 64-bit kernels.

The memory requirements for mounting large file systems are shown in the tables below.

Table 1-1 Memory Usage for a File System With a 1K Block Size

File System Size	128 GB	1 TB	8 TB	64 TB
Memory Usage	1 MB	4 MB	32 MB	N/A

Table 1-2 Memory Usage for a File System With a 2K Block Size

File System Size	128 GB	1 TB	8 TB	64 TB
Memory Usage	512K	2 MB	16 MB	128 MB

Table 1-3 Memory Usage for a File System With a 4K Block Size

File System Size	128 GB	1 TB	8 TB	64 TB
Memory Usage	256K	1 MB	8 MB	64 MB

Table 1-4 Memory Usage for a File System With an 8K Block Size

File System Size	128 GB	1 TB	8 TB	64 TB
Memory Usage	128K	512K	4 MB	32 MB

While performing a full `fsck`, the system keeps certain data structures in the core for validating space and inode usage. The space needed depends on the number of inodes and blocks in the file system. The `fsck` command needs approximately 16 MB per 1 TB for an 8K block size file system (128 MB per 1 TB for a 1K block size file system) and 32 MB per million inodes. Sufficient memory and swap space should be configured on the system before running a full `fsck` on a large file-enabled system. If the system is booted through a 32-bit kernel, a full `fsck` of file systems that have a large number of blocks or large number of

inodes may fail, as the total address space available for a 32-bit process is limited.

A replay `fsck` does not need very much memory and does not have these issues.

Virtual address limitation with 32-bit kernel

Installations expected to have a large number of opened files, such as 1 million or more, are recommended to use the 64-bit AIX kernel to avoid memory shortage and performance degradation.

Quick I/O files cannot be sparse files

If you try to convert a sparse file to a Quick I/O file, the Oracle instance can fail if Oracle tries to write into an unallocated block. Specifically, datafiles used by the Oracle8i and Oracle9i temporary tablespace may be sparse files, so do not convert these to Quick I/O files. See the *Veritas Storage Foundation for Oracle Administrator's Guide* for more information.

Some disk quota operations do not function on NFS

When VxFS file systems are exported via NFS, quotas on the file system apply to users when accessing the file system from NFS clients. However, neither the AIX nor the VxFS quota commands on the NFS client can be used to query or edit quotas. The VxFS quota commands can be used on the server to query or edit quotas.

Files and directories

To maximize VxFS performance for file systems with disk layout Version 6 or earlier, do not exceed 100,000 files in the same directory. Use multiple directories instead. This issue does not apply for disk layout Version 7, which supports large directories.

100 percent full file system cannot be resized

In some circumstances, the `fsadm` and `fsvoladm` commands cannot resize a 100 percent full file system due to lack of space for updating structural information. Check VxFS file systems on a regular basis and increase their size if they approach 100 percent capacity. This problem can also occur if the file system is very busy. Free up space or reduce activity on the file system and try the resize again.

About fclear()

The `fclear()` operation fails if the target file system is 100 percent full. Specifically, an `fclear()` system call that targets a file in a file system that is 100 percent full and the execution of `fclear()` will fail due to lack of free space for updating and allocating structural information.

Performance issue with full data clones

Expect a performance degradation of approximately 40 percent with full data clones.

Extent attributes are not preserved when file is copied or moved from VxFS to JFS or JFS2 file systems

When using the `cp`, `mv`, or `cpio` commands to copy or move a file with extent attributes from a VxFS to a JFS or JFS2 file system, the file is copied to the target without preserving the extent attributes of the source file. Extent attributes can be preserved when the source and target files are both on VxFS file systems. On AIX, extent attributes are supported with files only in VxFS file systems. When a file is copied or moved to a non-VxFS file system, the `cp`, `mv`, or `cpio` command displays the following notice:

```
cp: 0653-445 cannot maintain extent attributes for control
```

To avoid this notice, which is not an error message, use the `-E ignore` option with the `cp`, `mv`, and `cpio` commands. The description for using the `-E` option is not available in the manual pages for the `cp`, `mv`, and `cpio` commands. The usage will be added to those manual pages in a future release of AIX. The following is the usage of the `-E` option:

OPTIONS

```
The -E option requires one of the following arguments. If you omit the -E option, warn is the default behavior for the cp, mv, and cpio commands.
```

<code>force</code>	Fails the move or copy operation on a file if the fixed extent size or space reservation of the file cannot be preserved.
<code>ignore</code>	Ignores any errors in preserving extent attributes.
<code>warn</code>	Issues a warning if the space reservation or the fixed extent size of the file cannot be preserved.

Refer to the VxFS manual pages for information on the `gettext`, `setext`, and `vxfsio` commands.

In addition, the AIX `ls` command supports VxFS extent attributes. The `-E` option of `ls` lists the extent attributes of a file.

OPTIONS

```
-El Lists space reservation, fixed extent size, and
```

extent allocation flag information for a file. `-E` and `-l` must be specified together.

Some SMIT options require stanza in file system stanza file

The following SMIT menu options under the “Veritas File System (VxFS)” menu require a file system stanza in the `/etc/filesystems` file to work on a file system:

```
Mount a Veritas File System
Change / Show Characteristics of a Veritas File System
Remove a Veritas File System
Verify a Veritas File System
```

If a Veritas File System is created using the `crfs` command or the “Add a Veritas File System” or “Add a Veritas File System on a Previously Defined Veritas Volume” options, a file system stanza is automatically added to the `/etc/filesystems` file. A stanza is not automatically added if the file system is created with the `mkfs` command.

Memory exhaustion due to small kernel memory heap

Veritas strongly recommends that you use the 64-bit AIX kernel for file server workloads on VxFS to avoid possible memory exhaustion.

`fcl_keeptime` cannot be set to the default value after being modified to a non-default value

After the value for `fcl_keeptime` has been modified to a non-default value through the `vxtunefs` command, you cannot reset the value back to the default value of 0.

ioctls are not supported on the File Change Log file

Ioctls are not supported on the File Change Log file. Commands such as `fsapadm`, `setext`, `fiostat`, and `fsmap` on the FCL file are not supported, since these commands use an internal ioctl to implement their functionality.

Issues with a full volume 0 on a multi-volume file system

Certain file system metadata must be allocated only from volume 0 in a multi-volume file system. If volume 0 is full, operations such as upgrades and checkpoint creations can fail. If this occurs, you can retry these operations after freeing up space from volume 0.

Certain commands fail on file system larger than 32 TB

The `fcldadm`, `fsadm` and `vxupgrade` utilities will not work on file systems that are larger than 32 TB.

[596197]

Possible file system resize failure

Shrinking a file system may fail if certain types of metadata are allocated in the space that is to be shrunk.

[494823]

vxfsconvert cannot convert file systems larger than 2TB

Do not use the `vxconvert` command to convert file systems that are larger than 2 TB. You must manually convert these file systems to VxFS by backing up the file system data and restoring it to a new VxFS file system.

[506461]

check for VX_FCREAT missing in vx_nattr_copen

Calling the `vxfs_nattr_check()` API to check for the existence of named streams of a file, creates a named attribute directory for the file, if the named attribute directory does not exist. For example, a `vxfs_nattr_check()` call on file "foo" results in the creation of "foo/ ." if no named attribute has been set on "foo". Although these directories are not visible in the name space, they require a file system and must be removed. See the following TechNote for instructions on how to remove the name attributes directories.

<http://support.veritas.com/docs/282024.htm>

[623201]

VxFS Web GUI online help known issues

VxFS Web GUI online help known issues

The following known issues were reported for this release:

- For the **Mount Storage Checkpoint** operation, you must select an existing Storage Checkpoint from the drop-down list. You cannot manually enter a Storage Checkpoint name.
- The **Creating a new file system on a volume set** task can only be performed on VxFS file systems.

- For the **Remount Storage Checkpoint** operation, the **More info** link on the second wizard page does not function properly for cluster file systems.
- For the **Unmount Storage Checkpoint** operation, the **More info** link on the second wizard page does not function properly for cluster file systems.

Veritas Storage Foundation for Databases known issues

Veritas Storage Foundation for Oracle software issues

The following are known issues in this release of Veritas Storage Foundation for Oracle:

Removing VRTSodm and VRTSvxfs packages

If you install the product packages using the installation script, but do not reboot, and then remove the packages using the uninstallation script, removal of the `VRTSodm` and `VRTSvxfs` packages may fail due to the device being busy.

Workaround: Exit from the deinstallation script and use the `installp -u` command to uninstall the packages.

Japanese characters may be display incorrectly in VEA GUI

On a Japanese desktop, VEA may incorrectly display system fonts. Japanese characters may not be properly displayed when you select the non-default font for the VEA GUI.

Spaces in container path names

This release does not support spaces in container path names. [31604]

Cannot create checkpoint of database on a mounted checkpoint

You cannot create a Storage Checkpoint of a database located on a mounted Storage Checkpoint. [32726]

Converting a Quick I/O file to a regular file fails due to file size differences

Converting a Quick I/O file to a regular file will fail if you created a Quick I/O file for an Oracle data file that has a smaller size. Oracle generates an error if the size of the regular file is not a multiple of the 2K database block size (`db_block_size`). The error message displayed is similar to the following:

```
*** 2002-08-22 15:11:02.850
*** SESSION ID:(2.1) 2002-08-22 15:11:02.847
ORA-01157: cannot identify/lock data file 51 - see DBWR trace file
ORA-01110: data file 51: '/d05/oradata/rmdb/bill13_data.dbf'
ORA-27046: file size is not a multiple of logical block size
Additional information: 1
```


Workaround: Extend the Quick I/O file so that its size is a multiple of both the file system block size and the database block size (`db_block_size`). For example:

```
$ qiomkfile -r 2147500032 rbstest01.dbf
$ ls .rbstest01.dbf rbstest01.dbf
-rw-r--r-- 1 oracle dba 2147500032 Apr  3 20:27 .rbstest01.dbf
lrwxrwxrwx 1 oracle dba 26 Apr  3 20:27 rbstest01.dbf \
-> .rbstest01.dbf::cdev:vxfs:
$ rm rbstest01.dbf
$ mv .rbstest01.dbf rbstest01.dbf
$ ls rbstest01.dbf
-rw-r--r-- 1 oracle dba 2147500032 Apr  3 20:27 rbstest01.dbf
```

The database will now start as expected. [34106]

VxFS disk layout Version 4 or earlier unsupported with Storage Checkpoints

VxFS disk layouts Version 4 and earlier are not supported with Storage Checkpoints.

If you attempt to retrieve quota information for a Storage Checkpoint in Version 4 or earlier, a message similar to the following displays:

```
Error number: 4646, Error description: DBED4646:ERROR: Unknown error
code -30391108 (getquota) for DBED 46464....
```

[34433]

VEA does not display tablespace information after changing column names

Veritas Enterprise Administrator does not display tablespace information when the `v$table` column names are changed. [34446]

Database FlashSnap unsupported on RAID-5

Database FlashSnap features are not supported on RAID-5 volumes. [34570]

Tuning parameters lost by reverse resynchronization

After running Database FlashSnap reverse resynchronization commands, special tuning parameters such as CQIO and vxtunefs on the primary database will be lost. They will need to be reset manually. [41898]

Connecting to local host can take a few minutes

Connecting to the local host on an AIX machine can take a few minutes. This causes a delay and affects the performance of some functions.

Workaround: In the file `/etc/netsvc.conf` insert the following line:

```
hosts = local,nis,bind
```

[105379]

Internet Explorer security setting required for VEW Web GUI

The security setting in the Internet Explorer browser must be set to medium or lower in order for VEA Web GUI run properly. [223589]

Removing a snapplan

If a snapplan is in a state where `dbed_vmchecksnap -o remove` will not remove it, you can remove it by first forcing a snapshot and then resyncing. After this, use `dbed_vmchecksnap -o remove` to remove the snapplan entry from the repository. [276354]

Snapplans with the same name

If two snapplans are created with the same name but different paths, the error message `snapplan already exists` is displayed. [287057]

Size of checkpoint object in the GUI

The checkpoint object in the GUI does not show the correct size (in blocks) for the checkpoint. This size is not updated even after rescanning checkpoints in the GUI. [412038]

Starting checkpoint policies from the GUI

Checkpoint policies cannot be started from the GUI. [506088]

Removing the SFDB repository database does not remove .odbc.ini

Removing the SFDB repository database using the `sfua_db_config -o dropdb` command does not also remove the `/etc/vx/vxdbed/.odbc.ini` file.

Workaround: After running `sfua_db_config -o dropdb`, you can manually remove `.odbc.ini` with the `rm` command:

```
rm /etc/vx/vxdbed/.odbc.ini
```

[534163, 611943]

Cannot create an Oracle 10gR1 database on raw devices with ODM

An Oracle 10gR1 database cannot be created through ODM on a raw device, producing error message similar to the following:

```
ORA-00200: controlfile could not be created
```

After disabling ODM on the raw device, the database can be successfully created.

This is caused by an Oracle bug. For detailed workaround procedures, refer to the following TechNote on the Symantec Technical Support website:

<http://support.veritas.com/docs/283362.htm>

[540461]

Unmounted checkpoint clone database reappears in the Java GUI

An unmounted checkpoint clone database reappears in the Java GUI tree after rescanning. [567342]

Cloning an instant checkpoint of a database using OMF control files

If an instant checkpoint is created for a database that use Oracle Managed Files (OMF) control files, creating a clone with the `dbed_clonedb` command will fail with following message:

```
SFORA dbed_clonedb ERROR V-81-7052 OMF data or redo files are not supported for Instant Checkpoint clones.
```

Workaround: Either use offline or online checkpoints, or convert OMF controlfiles to ones having non-OMF names. [570250]

SFDB commands may fail due to differing locales

If SFDB commands are executed with a locale that differs from the locale in use when the SFDB server was started, the commands may fail with the following message:

```
([Sybase][ODBC Driver][Adaptive Server Anywhere]Syntax error ).
```

Workaround: Execute the following commands to correct this issue.

```
/opt/VRTSdbcom/bin/sfua_db_config -o stopserver  
/opt/VRTSdbcom/bin/sfua_db_config -o startserver  
/opt/VRTSdbcom/bin/sfua_db_config -o startdb
```

[582069]

Help button in a GUI wizard produces error message

Clicking the **Help** button on a GUI wizard produces the following error message:

```
Error V-39-53246-8 Get EntryPoint failed. Please check the manifest related information
```

Workaround: Press **OK** and ignore the error. [582416]

sfua_db_config does not check if repository disk is local or shared

The `sfua_db_config` command does not check if the disk being used for the repository is a local disk or a shared disk in the case of an HA configuration. [583158]

Archive log destination when creating an online checkpoint

Creating an online checkpoint for a database that has only

```
DB_RECOVERY_FILE_DEST
```

 set as an archive log destination causes a warning message to be printed from the checkpoint creation command. The message states that a clone cannot be created from this checkpoint. If `dbed_clonedb` is subsequently run using this checkpoint, database recovery will fail with an Oracle error.

Workaround: To successfully create a clone of a database from an online checkpoint, define a mandatory archive log destination that is not `DB_RECOVERY_FILE_DEST`. [589288]

Storage Checkpoints not supported with Database FlashSnap clones

Storage Checkpoint operations are currently not supported for databases cloned with Database FlashSnap. [600431]

DBDST class names limited to 29 characters

The `dbdst_admin -o rmclass` command fails when attempting to remove a class name of 30 characters or more. The maximum class name length is 29 characters. [601746]

Must run `dbed_update` before starting an Oracle database from the GUI

The tablespaces folder is empty when starting the Oracle database from the GUI without running `dbed_update` from the command line. Rescanning from the GUI does not solve this issue.

Workaround: Run `dbed_update` from the command line before starting an Oracle database from the GUI. [604848]

In SF Oracle RAC, must run `dbed_vmchecksnap` on VCS master node

For an SF Oracle RAC database, the `dbed_vmchecksnap` command must be run on the Veritas Cluster System master node. Also, only online snapshots are supported, which means the database instance should be up and running on the master node where validation is performed. [604855]

Effect of Storage Checkpoint commands delayed in SFDB GUI

Repository changes resulting from executing SFDB Storage Checkpoint CLIs will not be reflected immediately in the SFDB GUI. The affected CLIs are `dbed_update`, `vxckpt_create`, `vxckpt_mount`, `vxckpt_umount`, and `vxckpt_remove`.

Workaround: Manually refresh from the SFDB GUI or wait for 30 minutes because the SFDB provider will automatically rescan every 30 minutes. [606994]

Web GUI statistic scheduler skips first statistic collection

The Web GUI statistic scheduler uses the client timestamp instead of the server timestamp. This causes the first statistic collection to be skipped. For example, suppose the machine time is 14:00 and the client time is 13:45. If the user wants to have three samples taken starting at 13:45, with 30 minutes between each sample, only two samples will be shown: one at 14:15 and another at 14:45. [608697]

Cannot Refresh View Statistics wizard in Firefox browser

When using the Web GUI with the Mozilla Firefox browser, the Refresh command in the View Statistics wizard does not work. [608697]

Using dbed_vmsnap with a non-existent snapplan

If you specify with `dbed_vmsnap` a snapplan that does not exist, you might see the following error:

```
SFORA dbed_vmsnap ERROR V-81-6518 Could not find snapplan  
'snap_plan' in repository.  
/opt/VRTSdbed/bin/dbed_vmsnap[21]: test: argument expected.
```

Workaround: Correct the name of the snapplan to be one that exists and re-run the `dbed_vmsnap` command. [609682]

Change file permission for admin.properties when changing port number

If you change the communication port number in

`/etc/vx/vxdbed/admin.properties`, you must change the permission of this file to 444 by using the following command:

```
chmod 444 /etc/vx/vxdbed/admin.properties
```

[610437]

sfua_db_config -o startdb does not confirm repository database started

The `sfua_db_config -o startdb` command does not print a message to indicate whether the SFDB repository database was successfully started or not.

Workaround: Check for the success or failure by subsequently running:

```
sfua_db_config -o dbstatus
```

[613681]

Symbolic links to Quick I/O files cause errors

If a database contains a symbolic link to Quick I/O files, Oracle 10g produces the following error:

```
ORA-27094: raw volume can not be used
```

To avoid this error, do not use symbolic links to Quick I/O files.

This issue applies to Oracle version 10.1.0.2. It has been reported to Oracle and will be fixed in a future Oracle release. [614508]

Do not install option 3 (SF Oracle RAC) without proper HA license or setup

When installing Storage Foundation for Oracle, if you do not have the proper HA license or setup, do not choose option 3 (Storage Foundation for Oracle RAC packages) when installing with the Veritas product installer.

This does not cause the installation to fail, but doing this causes VCS/GAB error messages to be written to the system log files, which can be confusing. [614685]

Deep mapping of IBM DS8000 arrays fails under some circumstances

Discovery of IBM DS8000 arrays fails under some circumstances, which results in deep mapping failing for the array. Array discovery fails under either of the following conditions:

- The array has no FB device types
- The array has CKD-alias device types

[615944]

had must be running before unconfiguring SFDB repository

To use `sfua_db_config` to unconfigure the SFDB repository in a VCS environment, make sure the `had` process is running on the system where `sfua_db_config -o unconfig_cluster` is run.

If the `had` process is not running on that system, `sfua_db_config` will not remove the repository VCS service group `Sfua_Base`. [616387]

Some filesets remain after uninstalling SF Oracle RAC

After uninstalling Storage Foundation for Oracle RAC (originally installed using option 3), an error message reports that `gms` failed to stop and the following filesets remain on the system: `VRTSgms`, `VRTSgab.rte`, `VRTSllt.rte`, and `VRTSveki`.

The uninstallation has successfully finished despite these filesets not being removed.

Workaround: After uninstalling, manually remove these filesets with the following command:

```
# installp -u VRTSgms VRTSgab VRTSllt VRTSveki
```

[616446]

Must manually install VRTScsocw package

The `VRTScsocw` package is missing whenever installing Veritas Storage foundation for Oracle HA using option 1 (Required Veritas Storage Foundation for Oracle packages) or option 2 (All Veritas Storage Foundation for Oracle packages). To use the configuration wizard to set up the Oracle agent, this package must be installed manually from the `dvd1` image mount point at: `cluster_server_agents/oracle_agent/pkgs`

Note: Whenever uninstalling this product, in some cases this package may not be removed by the product uninstaller. In this case, the package must be removed manually.

[622316]

Veritas Storage Foundation for DB2 software issues

The following are known issues in this release of Veritas Storage Foundation for DB2:

Cannot convert VxFS files to or from Quick I/O

Converting VxFS files to or from Quick I/O is not currently supported for DB2 8.1.

Do not attempt to convert VxFS files to or from Quick I/O in this release. If you apply FixPak 4 or above, you can use the Concurrent I/O feature instead. [25249]

Reorganizing a database table fails with Quick I/O

Reorganizing a database table fails if tablespaces have been converted to Quick I/O files. See incident 25249. [25271]

Cannot restore if tablespace is converted from Quick I/O to regular file after backup

If you convert a tablespace from a Quick I/O file to a regular file after backing up the database, you will not be able to restore the tablespace from that backup. For example, if you take a backup of a database that has a DMS tablespace with Quick I/O files as containers, and later convert the Quick I/O files to regular files, restoring the database from that backup will fail.

Workaround: Use the `qio_recreate` command to re-create the necessary Quick I/O files before you restore the database. [25272]

Spaces in container path names

This release does not support spaces in container path names. [31604]

Database FlashSnap does not support reverse resynchronization

Database FlashSnap does not support performing a reverse resynchronization across instances. [129793]

Cannot reverse resynchronize offline snapshots

If you try to resynchronize your database to a snapshot (reverse resynchronization) and the snapshot is offline, the process will fail. You must resynchronize the snapshot to your database before attempting the reverse resynchronization again because DB2 no longer sees the disk group as a split image. [217905]

Internet Explorer security setting required for VEW Web GUI

The security setting in the Internet Explorer browser must be set to medium or lower in order for VEA Web GUI run properly. [223589]

Removing a snapplan

If a snapplan is in a state where `dbed_vmchecksnap -o remove` will not remove it, you can remove it by first forcing a snapshot and then resyncing. After this, use `dbed_vmchecksnap -o remove` to remove the snapplan entry from the repository. [276354]

Snapplans with the same name

If two snapplans are created with the same name but different paths, the error message `snapplan already exists` is displayed. [287057]

DPF does not fully support localization

The DB2 Database Partition Feature (DPF) does not fully support localization. As a result, the command output for `db2ed_checkconfig_all`, `db2ed_saveconfig_all`, and `db2ed_ckptcreate_all` may display garbage characters in the Japanese locale. [303712]

Size of checkpoint object in the GUI

The checkpoint object in the GUI does not show the correct size (in blocks) for the checkpoint. This size is not updated even after rescanning checkpoints in the GUI. [412038]

Starting checkpoint policies from the GUI

Checkpoint policies cannot be started from the GUI. [506088]

db2ed_vmchecksnap cannot detect disk slice with no plex

The `db2ed_vmchecksnap` command is unable to detect when a disk slice is enabled but has no associated plex. [524667]

Removing the SFDB repository database does not remove .odbc.ini

Removing the SFDB repository database using the `sfua_db_config -o dropdb` command does not also remove the `/etc/vx/vxdbed/.odbc.ini` file. [534163, 611943]

Workaround: After running `sfua_db_config -o dropdb`, you can manually remove `.odbc.ini` with the `rm` command:

```
rm /etc/vx/vxdbed/.odbc.ini
```

Unmounted checkpoint clone database reappears in the Java GUI

An unmounted checkpoint clone database reappears in the Java GUI tree after rescanning. [567342]

SFDB commands may fail due to differing locales

If SFDB commands are executed with a locale that differs from the locale in use when the SFDB server was started, the commands may fail with the following message:

```
([Sybase][ODBC Driver][Adaptive Server Anywhere]Syntax error ).
```

Workaround: Execute the following commands to correct this issue.

```
/opt/VRTSdbcom/bin/sfua_db_config -o stopserver  
/opt/VRTSdbcom/bin/sfua_db_config -o startserver  
/opt/VRTSdbcom/bin/sfua_db_config -o startdb
```

[582069]

Help button in a GUI wizard produces error message

Clicking the **Help** button on a GUI wizard produces the following error message:

```
Error V-39-53246-8 Get EntryPoint failed. Please check the manifest  
related information
```

Workaround: Press **OK** and ignore the error. [582416]

sfua_db_config does not check if repository disk is local or shared

The `sfua_db_config` command does not check if the disk being used for the repository is a local disk or a shared disk in the case of an HA configuration.

[583158]

Storage Checkpoints not supported with Database FlashSnap clones

Storage Checkpoint operations are currently not supported for databases cloned with Database FlashSnap. [600431]

db2ed_clonedb and db2ed_vmclonedb do not support automatic storage databases

The `db2ed_clonedb` and `db2ed_vmclonedb` commands do not support automatic storage databases. Using either command on an automatic storage database results in the following message:

```
DBT1037N: CONT_PATH entries cannot be specified for an automatic  
storage table space
```

[600490]

DBDST class names limited to 29 characters

The `dbdst_admin -o rmcclass` command fails when attempting to remove a class name of 30 characters or more. The maximum class name length is 29 characters. [601746]

Web GUI statistic scheduler skips first statistic collection

The Web GUI statistic scheduler uses the client timestamp instead of the server timestamp. This causes the first statistic collection to be skipped. For example,

suppose the machine time is 14:00 and the client time is 13:45. If the user wants to have three samples taken starting at 13:45, with 30 minutes between each sample, only two samples will be shown: one at 14:15 and another at 14:45. [608697]

Cannot Refresh View Statistics wizard in Firefox browser

When using the Web GUI with the Mozilla Firefox browser, the Refresh command in the View Statistics wizard does not work. [608697]

db2ed_ckptmount quits silently if checkpoint uses another checkpoint's mount prefix

If a checkpoint uses a mount prefix that was already used for another checkpoint, `db2ed_ckptmount` quits silently with return code 1.

Workaround: Explicitly check the `db2ed_ckptmount` return code. Also, check the output produced by `db2ed_ckptdisplay`. [610283]

Change file permission for admin.properties when changing port number

If you change the communication port number in `/etc/vx/vxdbed/admin.properties`, you must change the permission of this file to 444 by using the following command:

```
chmod 444 /etc/vx/vxdbed/admin.properties
```

[610437]

sfua_db_config -o startdb does not confirm repository database started

The `sfua_db_config -o startdb` command does not print a message to indicate whether the SFDB repository database was successfully started or not.

Workaround: Check for the success or failure by subsequently running:

```
sfua_db_config -o dbstatus
```

[613681]

Unmounting clone database and deleting checkpoint commands seem to hang

The `db2ed_clonedb -o umount` command sometimes seems to hang. When you check the process stack it is executing the command `db2ed_dbprocli`.

Also, when deleting an existing checkpoint, the `vxpal -a DBEDAgent` process starts taking up a lot of processing space and the CLI might appear to hang if you have been running a lot of checkpoint commands.

Workaround: For either issue, stop the `vxpal -a DBEDAgent` process by running the following commands as root:

```
/etc/init.d/vxpal.DBEDAgent stop  
/etc/init.d/vxpal.DBEDAgent start
```

[614055, 614815]

Deep mapping of IBM DS8000 arrays fails under some circumstances

Discovery of IBM DS8000 arrays fails under some circumstances, which results in deep mapping failing for the array. Array discovery fails under either of the following conditions:

- The array has no FB device types
- The array has CKD-alias device types

[615944]

had must be running before unconfiguring SFDB repository

To use `sfua_db_config` to unconfigure the SFDB repository in a VCS environment, make sure the `had` process is running on the system where `sfua_db_config -o unconfig_cluster` is run.

If the `had` process is not running on that system, `sfua_db_config` will not remove the repository VCS service group `Sfua_Base`. [616387]

Software limitations

The following sections describe Veritas Storage Foundation software limitations that exist in this release.

Veritas Storage Foundation software limitations

Advanced POWER Virtualization (APV)

The Cross-platform Data Sharing (CDS) feature is not supported for Virtual SCSI devices. By default, all Virtual SCSI devices are supported as native type devices of type `aixdisk`.

SCSI-3 Persistent Group Reservation (PGR) is not supported for Virtual SCSI devices, which prevents SFRAC functionality being applied to such devices.

Veritas File System software limitations

Quick I/O, ODM, mount -o cio, and the VX_CONCURRENT advisory are mutually exclusive

The `VX_CONCURRENT` advisory cannot be set on a file that is actively open by Quick I/O or ODM, nor can that file be concurrently opened with the `O_CIO` flag. A file opened with the `O_CIO` flag or that has the `VX_CONCURRENT` advisory set may not be concurrently opened by Quick I/O or ODM. Quick I/O and ODM access are not allowed for any files on a file system that is mounted with the `-o cio` mount option.

Veritas Storage Foundation for Oracle software limitations

Cannot remove volume after PL/SQL is run on datafile

You cannot remove a volume after the storage mapping PL/SQL procedure is run on a datafile.

Even though the contents of `map_element` are appropriate, the tablespace is dropped and the file system is unmounted. The database is not using any files residing on this file system. And, the removal of the volume using `vxassist` fails.

After storage mapping, perform the following steps to remove a volume:

- 1 Set `file_mapping` to `false`.

```
# alter system set file_mapping=false
```

- 2 Make sure that the fmon process is not running.
`# ps -fu oracle | grep fmon`
- 3 Run fuser on file system and make sure that no process is attached to the file system.
`# fuser -c /tbs1`
- 4 Unmount the file system.
`# umount /tbs1`
- 5 Remove the volume using vxassist.
`# vxassist -g testdg remove volume tbs1`

Veritas Storage Foundation for DB2 software limitations

CLI database state changes are delayed in GUI

If you use the command line to start or stop the database, the state change is not immediately shown in the GUI. This delay can take up to 60 minutes.

Workaround: Start or stop the database from the GUI, or do a manual rescan from the GUI after starting or stopping with CLI. [604685]

Documentation

Product guides are available on the documentation disc in PDF and HTML formats. We recommend copying pertinent information, such as installation guides and release notes, from the disc to your system directory `/opt/VRTS/docs` for reference.

Veritas documentation disc

The Veritas documentation disc provides searchable, HTML documentation for each product in this release. Printable PDF documents are also included on the disc.

All documentation is organized by product groups.

Release notes and installation guides

Release notes and installation guides are not installed by any filesets. Symantec recommends that you copy them from the software disc to the `/opt/VRTS/docs` directory on your system after product installation so that they are available for future reference.

Release notes for component products in all versions of the Veritas Storage Foundation are located under the `storage_foundation/release_notes`

directory of the Veritas Storage Foundation disc or the `cluster_server/release_notes` directory of the Veritas Cluster Server disc.

Installation guides in all versions of the Veritas Storage Foundation are located under the `storage_foundation/docs` directory of the Veritas Storage Foundation disc or the `cluster_server/docs` directory of the Veritas Cluster Server disc.

It is important that you read the relevant component product release notes before installing any version of Veritas Storage Foundation:

- *Veritas Volume Replicator Release Notes* (`vvr_notes.pdf`)
- *Veritas Cluster Server Release Notes* (`vcs_notes.pdf`)

Veritas Storage Foundation guides

The following manuals, along with the online help, comprise the Veritas Storage Foundation documentation set:

Table 1-5 Guides in Veritas Storage Foundation Documentation Set

Guide Title	Filename
<i>Veritas Storage Foundation and High Availability Getting Started Guide</i>	<code>getting_started.pdf</code>
<i>Veritas Storage Foundation Release Notes</i> (this document)	<code>sf_notes.pdf</code>
<i>Veritas Storage Foundation Installation Guide</i>	<code>sf_install.pdf</code>
<i>Veritas Storage Foundation for DB2 Administrator's Guide</i>	<code>sf_db2_admin.pdf</code>
<i>Veritas Storage Foundation for Oracle Administrator's Guide</i>	<code>sf_ora_admin.pdf</code>
<i>Veritas Array Integration Layer Configuration Guide</i>	<code>vail_config.pdf</code>
<i>Veritas Storage Foundation for DB2 Graphical User Interface Guide</i>	<code>sf_db2_gui.pdf</code>
<i>Veritas Storage Foundation for Oracle Graphical User Interface Guide</i>	<code>sf_ora_gui.pdf</code>
<i>Veritas Volume Manager Administrator's Guide</i>	<code>vxvm_admin.pdf</code>
<i>Veritas Storage Foundation Intelligent Storage Provisioning Administrator's Guide</i>	<code>sf_isp_admin.pdf</code>

Table 1-5 Guides in Veritas Storage Foundation Documentation Set

Guide Title	Filename
<i>Veritas Storage Foundation Intelligent Storage Provisioning Solutions Guide</i>	sf_isp_solutions.pdf
<i>Veritas Storage Foundation Cross-Platform Data Sharing Administrator's Guide</i>	sf_cds_admin.pdf
<i>Veritas Enterprise Administrator User's Guide</i>	vea6x_users.pdf
<i>Veritas Volume Manager Troubleshooting Guide</i>	vxvm_tshoot.pdf
<i>Veritas FlashSnap Point-In-Time Copy Solutions Administrator's Guide</i>	flashsnap_admin.pdf
<i>Veritas File System Administrator's Guide</i>	vxfs_admin.pdf

Veritas Cluster Server Documentation

The following Veritas Cluster Server documentation is available with all Veritas Storage Foundation HA product suites:

Table 1-6 Guides in Veritas Cluster Server Documentation Set

Guide Title	Filename
<i>Veritas Cluster Server Release Notes</i>	vcs_notes.pdf
<i>Veritas Cluster Server Installation Guide</i>	vcs_install.pdf
<i>Veritas Cluster Server User's Guide</i>	vcs_users.pdf
<i>Veritas Cluster Server Agent Developer's Guide</i>	vcs_agent_dev.pdf
<i>Veritas Cluster Server Bundled Agents Reference Guide</i>	vcs_bundled_agents.pdf
VCS Enterprise Agent for Oracle Installation and Configuration Guide	vcs_oracle_install.pdf

Veritas Volume Replicator Documentation

The following Veritas Volume Replicator documentation is available with the Veritas Volume Replicator option:

Table 1-7 Guides in Veritas Volume Replicator Documentation Set

Guide Title	Filename
<i>Veritas Volume Replicator Release Notes</i>	vvr_notes.pdf

Table 1-7 Guides in Veritas Volume Replicator Documentation Set

Guide Title	Filename
<i>Veritas Volume Replicator Installation Guide</i>	vvr_install.pdf
<i>Veritas Volume Replicator Administrator's Guide</i>	vvr_admin.pdf
<i>Veritas Volume Replicator Planning and Tuning Guide</i>	vvr_planning.pdf
<i>Veritas Volume Replicator Web Console Administrator's Guide</i>	vvr_web_admin.pdf
<i>Veritas Volume Replicator Advisor User's Guide</i>	vvr_advisor_users.pdf
<i>Veritas Cluster Server Agents for Veritas Volume Replicator Configuration Guide</i>	vvr_agents_config.pdf

Veritas Storage Foundation for Databases Documentation Changes

The 5.0 release introduces changes to the documentation for Veritas Storage Foundation for Databases. The VRTSordoc and VRTSd2doc packages no longer exist. All database guides are now in one package, VRTSdbdoc. New guides have been created for the GUI documentation and the PDF names have changed for existing guides.

[Table 1-8](#) indicates the PDF and document changes in this release:

Table 1-8 Veritas Storage Foundation for Databases Guides

Guide Title	Previous PDF Name	Current PDF Name
<i>Veritas Storage Foundation for DB2 Administrator's Guide</i>	sf_db2_dbag.pdf	sf_db2_admin.pdf
<i>Veritas Storage Foundation for Oracle Administrator's Guide</i>	sf_ora_dbag.pdf	sf_ora_admin.pdf
<i>Veritas Array Integration Layer Configuration Guide</i>	vail_cg.pdf	vail_config.pdf
<i>Veritas Storage Foundation for DB2 Graphical User Interface Guide (NEW)</i>	N/A	sf_db2_gui.pdf
<i>Veritas Storage Foundation for Oracle Graphical User Interface Guide (NEW)</i>	N/A	sf_ora_gui.pdf

Manual Pages

The Veritas online manual pages are installed in the `/opt/VRTS/man` directory. This directory can be added to the `MANPATH` environment variable.

If the `MANPATH` environment variable does not include `/opt/VRTS/man`, type:

```
# man -M /opt/VRTS/man manual_page_name
```

to view the desired manual page.

Note: Installing documentation and online manual pages is optional.

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ACE (The Adaptive Communication Environment)

TAO

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If you have any suggestions, additions, comments, or questions, please let me know.

Douglas C. Schmidt

Apache Commons-Collections

Apache Commons-dbc

Apache Common Logging

Apache Jakarta Commons

Apache Lucene

Apache Portable Runtime

Apache Snmp4j - The Object Oriented SNMP API for Java

Apache Spring Framework

Apache Struts

Apache Tomcat

Xerces C++

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Digital Encryption Standard (DES) - MIT

MIT and Dennis Ferguson

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Expat XML Parsing Library

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MD5.h

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JavaTip87: Automate the Hourglass Cursor

Kyle Davis

Portions of this code taken from an article available as of 2/02/02 on the JavaWorld Internet site, entitled Javatip87: Automate the HourGlass Cursor" by Kyle Davis.

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Crypt-CBC-2.17

File-Spec-0.90

IO-String-1.06

IO-Tty-1.02

libnet-1.19

List-Compare-0.31

Log dispatch perl module

Logfile rotate perl module

Module-Build-0.2611

MIME-Base64-3.07

HTML-Tagset-3.10

HTML-Parser-3.50

Net-DNS-0.49

Net-DNS-SEC-0.12

Net-Netmask-1.9011

Net-Telnet-3.03

Params validate perl module

Proc-Background-1.08

Test-Plan-0.02

Test-Simple-0.60

Time-Date-1.16

Time zone info

URI-1.35

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Sockets++ library

University of Texas

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