

Veritas™ Volume Replicator Release Notes

HP-UX

5.0



Veritas Volume Replicator Release Notes

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Veritas Volume Replicator 5.0

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Veritas Volume Replicator is a licensed product. See the *Veritas Volume Replicator 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.

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Appendix A Third-party Legal Notices

Veritas Volume Replicator Release Notes

Veritas™ Volume Replicator by Symantec (VVR) is a licensed product and an add-on feature to the Veritas Volume Manager (VxVM). This document provides release information for Veritas Volume Replicator 5.0 on HP-UX and contains information supplemental to the *Veritas Storage Foundation™ Release Notes*.

VVR contains Veritas Enterprise Administrator for VVR (VVR VEA), Veritas Volume Replicator Web Console (VRW), and Veritas Cluster Server (VCS) Agents for Veritas Volume Replicator (VVR). This document provides information about the VVR VEA, VRW, and VCS Agents for VVR. This document also provides information about Veritas Volume Replicator Advisor, which is a tool you can use to plan your VVR environment.

Review this entire document before installing VVR. For additional information about this release, see “[New features](#)” on page 8.

Veritas Volume Replicator is supported on 64-bit versions of the September 2004 HP-UX 11i version 2.0 operating system or later. This release of VVR is not supported on any earlier HP-UX versions.

New features

This release of Veritas Volume Replicator includes the following features:

Replicating volume sets

VVR now supports replicating volume sets by including the volume set itself as a part of the RVG. When a volume set is included in an RVG, VVR also ensures that the replicated volume set configurations are consistent across the Primary and Secondary.

Cross-platform data sharing

Veritas Volume Replicator (VVR) is now CDS compliant. VVR uses CDS format to support the following functionality:

- migrating data between heterogeneous systems (either on the Primary or the Secondary) where each system has direct access to the physical devices used to hold the data. Note that CDS does not support simultaneous use of data from more than one platform.

Caution: Stop all the applications working on that disk group before migrating data between hosts. Failure to do so may result in data loss.

- replicating data between heterogeneous systems. That is, the Primary host is a different platform from the Secondary host, and each host is able to access the data in CDS format.

Bunker replication

Bunker replication enables VVR to achieve complete Recovery Point Objective (RPO) and limited Recovery Time Objective (RTO) without any major impact on the application's performance. Bunker replication uses a bunker site, which maintains a copy of only the Primary SRL without having to maintain additional copies of the data volumes. This feature combines the advantages of synchronous and asynchronous modes of replication.

Enhanced cluster support

VVR supports 4-node cluster applications

VEA features

You can use VVR VEA to replicate to a bunker, which can then be used for disaster recovery.

Managing VVR using the Web GUI

The VVR Web GUI includes the following new features:

- links to volume views enable you to access detailed information about local volumes in the RDS.
- new look and feel provides consistency among Veritas Storage Foundation products.
- new role-based administration model enables you to control access to administrative tasks according to preassigned roles: Storage Administrator, Storage Operator, and Read Only.

Centralized management of VVR

VVR can be centrally managed through the Storage Foundation Management Server. For more information, see the documentation for Storage Foundation Management Server.

Veritas Volume Replicator Advisor

- **Planning the SRL Size for Multiple RVG Configurations**—VRAdvisor now supports SRL size planning for multiple RVGs that share the same network bandwidth within the same configuration. It uses the bandwidth throttling feature to control the maximum network bandwidth to be used by VVR for replication, thus enabling effective usage of the bandwidth by VVR and other applications. The results are displayed in a graphical and summary view.
- **Planning the SRL Size in a Shared Disk Group Environment**—VRAdvisor now supports SRL size planning for a CVM cluster, in a shared disk group environment. For shared disk groups, the data can be collected remotely on each node of the CVM cluster to minimize the write shipping.

Note: For this release VRAdvisor is not supported for a non-CVM clusters.

- **Enhanced Data Collection Capabilities**—The VRAdvisor data collection wizard has been enhanced to collect data for multiple hosts, simultaneously. These hosts are either standalone hosts or nodes in a CVM cluster.

Depending on whether VxVM is present, and the operating system that is being used, the data collection wizard can automatically select the appropriate data format and also convert the native data formats to the CSV (comma separated variables) formats.

- Collecting Network Statistics—VRAdvisor can now provide network analysis information through an additional option on the VRAdvisor wizard. This option provides information such as, the estimated network latency, packet drop rate and the available network bandwidth along with a comparative network performance data for TCP and UDP protocols.

For more information about the Veritas Volume Replicator Advisor, refer to the *Veritas Volume Replicator Advisor User's Guide* (`vvr_advisor_users.pdf`), which is available in the `VRTSvrdoc` package located under the `dvd1/depot` directory.

No longer supported

This release of VVR is not supported on the HP-UX 11i version 1.0 operating system.

This release does not provide VVR Support for HP Serviceguard.

Installation notes

The following information includes guidelines, tips, and other considerations for installing the product. For details on upgrading and installing VVR, refer to the *Veritas Volume Replicator Installation Guide*.

Compatibility considerations

VVR

This release of VVR is available only on the HP-UX 11i version 2.0 operating system.

VVR is not supported with the Internet Protocol (IP) version IPv6. All nodes in a VVR environment must use IPv4.

VVR supports replication between systems running VVR 5.0 and VVR 4.1 and above. That is, you can replicate between a Primary host using VVR 5.0 and a Secondary host using VVR 4.1 or vice versa. This enables you to upgrade VVR on your Primary and Secondary at different times.

VVR enables you to replicate VxVM ISP volumes, provided that all the volumes in an RVG are ISP volumes.

VVR supports replication in a shared disk group environment. VVR also supports the clustering functionality of Veritas File System (VxFS) and Veritas Storage Foundation for Oracle RAC. Veritas File System (VxFS) and Veritas Storage Foundation for Oracle RAC are separately licensed products. Currently, replication support is limited to 4-node cluster applications.

VVR does not support replication in a SAN disk group environment.

VCS Agents for VVR

The Veritas Cluster Server (VCS) Agents for Veritas Volume Replicator 5.0 have been tested to work with VVR running on the 64-bit versions of the HP-UX 11i version 2.0 operating system. These agents are for use with VCS 5.0.

VVR VEA

This release of VVR VEA is available for installation on the HP-UX 11i version 2.0 operating system. VVR VEA can only be installed on hosts on which VVR 5.0 is installed.

VRW

VRW is available for installation on the HP-UX 11i version 2.0 operating system. VRW can only be installed on hosts on which VVR 5.0 is installed. VRW also requires that Web Server for Storage Foundation Host Management is installed.

Web browser requirements

Depending on the platform, one of the following Web browsers is required to run VRW:

Table 1-1 Web browsers and their supported platforms

Operating System	Firefox 1.0.7 (or later)	Internet Explorer 5.5 (or later)	Mozilla 1.6 (or later)	Netscape Navigator 7.0 (or later)
AIX			✓	
HP-UX			✓	
Red Hat	✓		✓	✓
Solaris			✓	
SUSE	✓		✓	✓
Windows	✓	✓		✓

Your browser must support either JScript 5.5 (provided with Microsoft Internet Explorer 6 or later) or JavaScript 1.2 (provided with Netscape Navigator 7.x). Additionally, for Internet Explorer, Secure Sockets Layer (SSL) 3.0 ActiveX scripting must be enabled.

If you are using pop-up blockers (including Yahoo Toolbar or Google Toolbar), either disable them or configure them to accept pop-ups from the Web Server to which you will connect. Note that pop-up blocking is enabled by default in Netscape 7.2.

Note: For Internet Explorer 6.0 on Windows 2003 (Server and Advanced Server), set the default Intranet zone security level to MEDIUM or lower.

VRAdvisor

VRAdvisor does not have a native package for HP-UX. You will need to install the Windows VRAdvisor package and then use the VRAdvisor client to analyze the data that has been collected using either the `vxstat` or `sar` commands.

Note: Although VRAdvisor is supported in a non-English locale, the wizards are still displayed in English.

The VRAdvisor Windows package is supported on:

- Windows XP
- Windows 2000 Professional
- Windows 2000 Server, Advanced Server, Datacenter Server
- Windows Server 2003 (32-bit): Standard Edition, Web Edition, Enterprise Edition, Datacenter Edition

Note: If Windows 2000 is installed on your system, you must have Service Pack (SP) 4 installed on it.

Fixed issues

The following incidents were corrected for the 5.0 release.

The vradadmin issues

Synchronizing volumes and RVG—output may display incorrect volume sizes (306656)

The output of the `vradadmin syncrvg` and the `vradadmin syncvol` commands displayed incorrect volume sizes for data volumes that are large in size. This has been fixed.

Resizing the SRL

The `vradadmin resizesrl` command now enables you to increase the size of the SRL on the Secondary while the application is active and replication is in progress. For instructions on resizing the SRL, see the *Veritas Volume Replicator Administrator's Guide*.

VVR Hangs During SRL Resize

Under certain conditions, VVR would hang while executing the `vradadmin resizesrl` command. This has been fixed. [497131]

Performing migration in an RDS with multiple secondaries

For a Replicated Data Set (RDS) with multiple Secondaries, the `vradadmin migrate` command now automatically reconfigures the new RDS.

SRL issues

Limitations in the SRL resize feature

You can now resize the SRL while automatic synchronization or DCM replay is in progress. Also, the SRL resize operation now preserves checkpoint information. [310204]

Known issues

Before installing any product, read the following Veritas Technical Support TechNote for the latest information on updates, patches, and software issues regarding this release:

<http://support.veritas.com/docs/281875>

The following incidents were reported for this release.

Installation issues

VCS Agents for VVR (42381)

When you try to install VVR on a system that already has a version of VCS Agents for VVR, the `installvvr` script indicates that VVR is already installed on the system. This may be erroneous because the script does not check for the other VVR packages. In this case, some of the packages required by VVR that do not exist on the system may not get installed.

Workaround: Use the `swinstall` command to manually add the VVR packages that are not installed.

Host name may need to be entered manually on clustered HP-UX host (621161)

When installing VVR on a clustered HP-UX host on which the Domain Name Service (DNS) is either slow or not configured, the installer may occasionally need to manually enter the fully-qualified host name when prompted in order to proceed with the installation.

Software disc cannot be ejected during installation

During installation, if any of the products were configured and started, the software disc cannot be ejected. This may prevent installation from continuing in 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]

Support and compatibility issues

Running VxFS commands (135938)

VxFS commands may execute very slowly and appear to be hung when the following conditions exist:

- The RLINK is in synchronous mode
- The network has a low bandwidth
- VxFS has a very large cache

If you encounter this problem, contact Customer Support.

VxVM ISP Stripe-mirror Volumes Cannot be Associated to an RVG

You cannot associate VxVM ISP volumes of the type stripe-mirror to an RVG.

[497136]

The vradmin issues

Multiple vradmin commands (304827)

If a number of `vradmin` commands are started at the same time in the background, some of the commands might fail.

Incorrect configuration (304859)

The `vradmin printrvg` command does not display an error message to indicate an incorrect configuration when the `local_host` and `remote_host` attributes contain the names of the hosts that are not in the RDS.

Invalid license (139302)

The `vradmin` commands that change the configuration may fail before completing if the VVR license has expired. Although an attempt is made to undo the changes, it may not be possible to undo the changes because the license has expired.

Synchronizing volumes and RVG—user cannot specify an offset (306135)

The `vradmin syncrvg` and the `vradmin syncvol` commands do not allow the user to specify an offset for the synchronization operation. They perform the operations on the entire data volume. If the operation is terminated, it must be restarted.

Verifying data (306479)

The `vradmin verifydata` command may hang if certain events occur, for example, if the network disconnects, or a large number of writes on the Primary cause the RLINK to go in to DCM mode after the command is issued and before it completes.

Workaround: Kill the `vradmin verifydata` command using the SIGTERM signal. Press **^C** on the command line, and then perform the following steps on Secondary host:

- 1 Issue the command:

```
# vxibc -g dg_name status rvg_name
```

The output displays one or more application IDs.
- 2 Choose the application ID that begins with `VD` and use this `app-id` in the following steps.
- 3 Issue the command:

```
# vxibc -g dg_name stoprecv app-id rvg_name
```
- 4 Issue the command:

```
# vxibc -g dg_name unregister app-id rvg_name
```

The output of the command `vxibc -g dg_name status rvg_name` should no longer display the `app-id`.

Resizing the SRL

The `vradmin resizesrl` command enables you to increase the size of the SRL while the application is active and replication is in progress. The `vradmin resizesrl` command does not allow you to decrease the size of the SRL. For instructions on resizing the SRL, see the *Veritas Volume Replicator Administrator's Guide*.

Separator display in the vradmin output (306642)

The separator in the output of `vradmin -l printrvg` is not localized; it always displays as a comma (,).

Adding a 5.0 Secondary to an RDS with a 4.1 Primary (423878)

If the RDS has a 4.1 Primary and a 5.0 Secondary, you cannot use the `vradmin addsec` command to add an additional 5.0 Secondary to the RDS. First, upgrade the Primary to 5.0, and then add the Secondary.

RVG and RLINK issues

RVG name size (304979)

If the total number of characters in the name of the RVG name and the name of the remote host exceeds 26 characters, the default RLINK names created by the `vradmin addsec` command are truncated. This may result in a conflict with other RLINK names and cause an error.

To avoid this error, use the `prlink` and `srlink` attributes with the `vradmin addsec` command.

RLINK name (151336)

The `vxmake rlink` command fails if the host name is longer than 31 characters.

Output from the vxrlink stats command (583456)

In some cases, you may see garbled output in the Blocks Sent column of the `vxrlink stats` command. This problem is due to VVR accessing freed memory, and can be safely ignored.

DCM issues

Converting DCM volumes to layered volumes (147490)

Converting a volume with a DCM to a layered layout completes successfully but incorrectly prints the following error messages:

```
vxvm:vxplex: ERROR: Failed to obtain locks:
temp-P05: no such object in the configuration
temp-P06: no such object in the configuration
vxvm:vxassist: ERROR: Could not attach log plex(es) to volume
<volume-name>
```

Error when logging writes to DCM (146293)

When writes are being logged to the DCM, the output of the `vxrlink updates` command is as follows:

```
vxvm:vxrlink: INFO: DCM is in use on rlink <rlinkname>. DCM contains  
<number> Kbytes.
```

The message is confusing because the number could be larger than the physical size of the DCM object. The number of kilobytes indicated is the amount of data that requires resynchronization.

DCM is removed during relayout (156244)

If you perform a relayout that adds a column to a striped volume that has a DCM, the DCM is removed. There is no message indicating this has happened. The DCM can be replaced using the command:

```
# vxassist addlog vol logtype=dcm
```

SRL issues

SRL overflow (152276)

If the SRL overflows on the Primary, any IBC message that exists on the Primary SRL is dropped and therefore not delivered to the Secondary.

Secondary SRL failure during IBC could cause pending writes to be lost (541265)

When an IBC suspends writes to the Secondary data volumes, the writes are stored in the Secondary SRL. These pending writes in the SRL could potentially be lost if all the mirrors of the SRL fail.

Takeover issues

Fast-failback synchronization after an SRL failure on the original Primary may cause data corruption on the new Secondary (284372)

After a takeover if fast-failback synchronization is performed and the new Secondary, which was the original Primary, has recovered from an SRL failure, the synchronization may not synchronize the updates that were lost because of SRL failure. This results in data corruption on the new Secondary. To recover, synchronize the Secondary completely.

Secondary hangs while taking over as failback Primary after receiving in-flight updates from a bunker (598288)

If the bunker SRL write latency is comparable with the Primary SRL write latency, it is possible for the bunker to be ahead of the Primary in terms of the data logged. Such data termed as "in-flight writes" is logged on the Secondary when the Secondary is synchronized using the bunker after a Primary crash.

If such a Secondary which has logged in-flight data writes is promoted to failback Primary, the logged writes are flushed to its data volumes. However,

because of uninitialized log end pointers, this can sometimes result in VxVM hanging on this Secondary node.

Issues related to replication in a shared environment

Secondary checkpoint problem (607703)

In rare situations, when lots of Secondary checkpoints have been created and deleted, VVR can panic when you run the `vxrlink cplist` command.

Using `verifydata` command with the `cachesize` attribute (615728)

The following situation may occur when you use the `vradmin verifydata` command with the `cachesize` attribute while there is I/O on the Primary. If the Secondary receives an IBC while the snapshot is being taken on the Primary, `vxconfigd` may hang on the Secondary.

Workaround: Specify the `cache` attribute instead of the `cachesize` attribute to the `vradmin verifydata` command.

Restoring snapshots when the logowner is the slave node

In rare cases, when the logowner is the slave node, the `vxrvg snaprestore` command may result in data corruption on the Primary volume. After the restore command completes, the data volumes are resynchronized to the snapshot volumes in the background. The problem occurs if the application performs I/O to the data volumes during this resynchronization. To avoid the problem, avoid doing application I/O until the background resynchronization completes.

To view the status of the resynchronization, do the following:

- 1 To display the taskid and the type, use the following command:

```
# vxtask -g dname list
```

- 2 To track the progress of the task, use the following command:

```
# vxtask -g dname monitor taskid
```

See the `vxtask` manual page for more information.

VRW issues

Primary RVG in a private disk group on a master not displayed (615758)

If a CVM master node contains a private disk group, a Primary RVG created in that disk group is not displayed in the VVR Web GUI.

Workaround: use the VVR command line or the VVR VEA GUI to view the RVG.

Volume sizes display incorrectly when replicating between VVR versions on HP-UX (603945)

The VVR Web GUI may display the sizes of the SRL and data volumes incorrectly for an RDS replicating between VVR 4.1 and VVR 5.0 on the HP-UX operating system.

In a CVM cluster, Create Primary wizard does not display private disk groups (615769)

When you create a Primary with the VVR Web GUI while connected to the master node of a CVM cluster, the Create Primary wizard does not display private disk group names in the disk group selection list.

Workaround: To create a Primary RVG in a private disk group on the master node, use the VVR command line or the VVR VEA GUI.

After migration, the Secondaries tab does not show information about the Secondary (575992)

In some cases, after you migrate the Primary role to the Secondary, the Secondaries tab does not show the information about the Secondary RVG. The RVG, SRL and Data Volume information may be blank.

Workaround: To display the information, navigate to the Summary tab and then select the Secondaries tab again.

Associate Volume wizard shows associated volume sets (612927)

The Associate Volume wizard may show volume sets that are already associated to an RVG. A volume set cannot be associated to multiple RVGs.

Secondary disk group view may not display correctly (615834)

In a shared disk group environment, in some cases, clicking on the link for a Secondary disk group may not display the view of the disk group. This may happen if the Secondary cluster contains a deported disk group with the same name as the imported disk group. Clicking on the link may show the view for the deported disk group.

Workaround: If possible, remove the deported disk group with the same name. To avoid the problem, make sure disk group names are unique.

VVR VEA issues

Volume sizes display incorrectly when replicating between VVR versions on HP-UX (612565)

The VVR VEA GUI may display the sizes of the SRL and data volumes incorrectly for an RDS replicating between VVR 4.1 and VVR 5.0 on the HP-UX operating system.

Overview views display incorrect layout and mirror information for certain volume layouts (600485)

For volumes with the layouts concatenated mirrored or mirrored concatenated, the overview views of the Primary and Secondary RVGs show the layout incorrectly as concatenated. The number of mirrors may also be incorrect.

Software limitations

Unsupported Internet protocol versions

VVR does not support IPv6. All nodes in a VVR environment must use IPv4.

RAID-5 volume

VVR does not support Volume Manager RAID-5 volumes as part of RVGs. Hardware RAID-5 is supported.

Disk Group Split and Join

VVR does not support Disk Group Split and Join. This means that you cannot use Disk Group Split and Join on data volumes in an RVG. However, you can take snapshots of data volumes and use DGSJ on the snapshots.

Importing a disk group with VVR objects

If a private disk group containing VVR objects is imported on two nodes, as well as the problems documented for VxVM objects, the SRL is corrupted and a full resynchronization of the Secondary is required.

Volumes in boot disk group

It is not recommended to have replicated volumes in the boot disk group (`bootdg`).

Selecting records using search expressions

The `vxprint -e pattern` command: Selecting RVG and RLINK records using search expressions is not supported.

Adding a Secondary

When adding a Secondary to the RDS, the `vradmin addsec` command cannot be entered from the host being added. If the RDS contains the Primary only, the command must be entered on the Primary.

Issues related to replication in a shared environment

Creating a Primary RVG when the data volumes and SRL are on a shared disk

When creating a Primary whose data volumes and SRL are located on a shared disk group, the `vradmin createpri` command must be issued on the master node of the cluster.

Creating a Secondary RVG when the data volumes and SRL are on a shared disk

When adding a Secondary whose data volumes and SRL are located on a shared disk group to a RDS, the `vradmin addsec` command requires the Secondary host name must be resolvable and up on the master node of the Secondary cluster.

Replication not supported between HP-UX and other platforms for shared disk groups

Replication in a shared disk group is not supported between other platforms (AIX, Solaris or Linux) and HP-UX. (592349)

VRW limitations

Increasing font size

Increasing the font size may cause problems in viewing and navigating the wizards.

IBC messaging support

This release of VRW does not support In-Band Control (IBC) messaging.

VCS Agents for VVR limitations

Onlining and offlining the RVG resources

Currently a problem with Veritas Volume Manager affects the RVG resources. When many RVGs are defined, the number of requests to the Volume Manager to `online` or `offline` can overload the `vxconfigd` process of VxVM, preventing some RVGs from going online or offline.

Workaround: The RVG resources have been set to allow only a single instance of an RVG resource to be brought online or offline. This slows down the onlining and offlining of service groups containing RVGs.

Limitations in the RVGSnapshot agent

Fire drill setup (fdsetup) supports applications using one disk group only. The RVGSnapshot agent does not support volume sets.

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 `/usr/share/doc/vxvm` for reference.

Table 1-2 Veritas Volume Replicator and Veritas Volume Manager documentation sets

Title	File Name
<i>Veritas Volume Replicator Release Notes</i> (this document)	<code>vvr_notes.pdf</code>
<i>Veritas Volume Replicator Installation Guide</i>	<code>vvr_install.pdf</code>
<i>Veritas Volume Replicator Administrator's Guide</i>	<code>vvr_admin.pdf</code>
<i>Veritas Volume Replicator Planning and Tuning Guide</i>	<code>vvr_planning.pdf</code>
<i>Veritas Volume Replicator Advisor User's Guide</i>	<code>vvr_advisor_users.pdf</code>
<i>Veritas Volume Replicator Web Console Administrator's Guide</i>	<code>vvr_web_admin.pdf</code>
<i>Veritas Cluster Server Agents for Veritas Volume Replicator Configuration Guide</i>	<code>vvr_agents_config.pdf</code>
Veritas Storage Foundation	
<i>Veritas Storage Foundation Release Notes</i>	<code>sf_notes.pdf</code>
<i>Veritas Storage Foundation Installation Guide</i>	<code>sf_install.pdf</code>
<i>Veritas Storage Foundation Intelligent Storage Provisioning Administrator's Guide</i>	<code>sf_isp_admin.pdf</code>

Table 1-2 Veritas Volume Replicator and Veritas Volume Manager documentation sets

Title	File Name
<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 FlashSnap Point-In-Time Copy Solutions Administrator's Guide</i>	flashsnap_admin.pdf
<i>Veritas Enterprise Administrator User's Guide</i>	vea6x_users.pdf
Veritas Volume Manager	
<i>Veritas Volume Manager Administrator's Guide</i>	vxvm_admin.pdf
<i>Veritas Volume Manager Troubleshooting Guide</i>	vxvm_tshoot.pdf
<i>Veritas Volume Manager Migration Guide</i>	vxvm_migration.pdf

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ACE (The Adaptive Communication Environment)

TAO

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Digital Encryption Standard (DES) - MIT

MIT and Dennis Ferguson

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MD5.h

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JavaTip87: Automate the Hourglass Cursor

Kyle Davis

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University of Texas

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