



Software Product Description

PRODUCT NAME: VSI Volume Shadowing for OpenVMS

SPD DO-VIBHAA-031

This Software Product Description describes Versions 8.4-1H1, 8.4-2, and 8.4-2L1 of the VSI Volume Shadowing for Integrity servers.

DESCRIPTION

Volume Shadowing for OpenVMS is a System Integrated Product (SIP) that runs on the Integrity server. Volume Shadowing for OpenVMS implements a RAID Level 1 storage strategy that provides high data availability for disk devices by preventing data loss resulting from media deterioration or from controller or device failure. This strategy also prevents storage subsystem component failures from interrupting system or application operations.

Volume shadowing, sometimes referred to as disk mirroring, maintains redundant copies of data on a collection of disk volumes (one copy per disk volume) called a shadow set. The shadow set can support up to six members. This duplication of data provides enhanced data availability. If data is recorded on multiple disk devices, it remains accessible if one device becomes unavailable. Disk read and write operations continue transparently with the remaining members of the shadow set. Note that the terms disk and device are used in this SPD to refer to a disk volume.

Because a shadow set is made up of multiple disks containing the same data, the Volume Shadowing for OpenVMS software can read data from any full member of the shadow set. For each read operation, the Volume Shadowing for OpenVMS software determines which disk to read from using an algorithm that maximizes performance. Volume Shadowing for OpenVMS ensures that disk write operations are duplicated on all shadow set members. For maximum performance, Volume Shadowing for OpenVMS ensures that shadow set write operations are issued in parallel to full shadow set members.

If some data on a full shadow set member becomes unreadable, the shadowing software can read the data from another available full member. Additionally, with DIGITAL Storage Architecture (DSA) disks, the member with unreadable data can be repaired by the controller by rewriting the data to viable, replacement areas provided on each disk. Small Computer Systems Interface (SCSI) devices certified by HP for use with volume shadowing support data repair. For other SCSI devices, replacement and repair algorithms are device specific.

OpenVMS Integrity Files-11 On-Disk Structure 2 (ODS-2), and Files-11 On-Disk Structure 5 (ODS-5) data disks that are certified by HPE can be volume shadowed. For more information, refer to the Hardware Requirements section of this SPD.

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Volume Shadowing for OpenVMS implements a host-based approach to shadowing disk devices.

For the purposes of this document, the term system refers to a single Integrity server-system that contains one or more processors. A system can be a standalone system or a member of an OpenVMS Cluster system. The term OpenVMS Cluster refers to a cluster that may contain Integrity server systems or Integrity server systems and Alpha systems configured together.

Volume Shadowing for OpenVMS supports clusterwide shadowing of SCSI, DSA, Fibre Channel disk storage systems. Specifically, this implementation supports:

- HSC, HSD, HSF, HSG, HSJ, HSV, HSZ, MSA, XP, and K.SCSI controlled disks
- All DSA, Fibre Channel, and Alpha SCSI adapters and controllers that are locally connected to a system
- RF-series controllers and disks connected to the Digital Storage Systems Interconnect (DSSI)

Volume Shadowing also supports OpenVMS MSCP-served DSA, Fibre Channel, and Alpha SCSI disks located within any supported OpenVMS Cluster configuration. DECram virtual disks can be volume shadowed only with other DECram virtual disks.

Volume Shadowing for OpenVMS allows shadowing of disks that are accessible from the system on which the shadowing software is installed. An OpenVMS system parameter enables shadowing at system initialization.

Configuration Overview

Volume Shadowing for OpenVMS requires a minimum of one system, a disk controller, and a disk unit that is DSA-compliant, Fibre Channel compliant, or SCSI compliant. Although only one disk is required for a shadow set, two or more disks are required to maintain multiple copies of the same data. This protects against failure or deterioration of a single device.

Using multiple controllers provides a further guarantee of data availability in the event that a single controller fails. OpenVMS Cluster systems can be configured with multiple systems, interconnects, controllers, and disks; the resulting configurations can provide extremely high data availability.

Shadow Set Membership

A shadow set can have multiple (one to six) members. If one or more members fail, the shadow set can continue operation with the remaining full members.

Shadow set members can be added to or removed from the shadow set without affecting system or user operation, providing that one full member exists. A disk can be removed from the shadow set either by operator command or automatically by the shadowing software. An inoperative disk is removed from the shadow set automatically; operator intervention is not required.

Adding a disk to a shadow set requires an explicit operator command. The shadowing software ensures that data on the newly added disk is made consistent with the other members by means of a copy operation. Full read and write access to the shadow set continues while the copy operation is in progress to the copy member.

Transparency to the End User

To users and application programs, Volume Shadowing for OpenVMS transparently combines the physical members of a given shadow set into a single virtual unit. The shadow set virtual unit acts as a single disk. User or application program modifications are not necessary to propagate write data to shadow set members; Volume Shadowing for OpenVMS software automatically propagates the data to all shadow set members. Similarly, user and application read operations to the virtual disk are transparently routed to the optimal shadow set member.

Volume Shadowing for OpenVMS is invisible to application programs and users. All commands and programming language features that address data on nonshadowed disks can be used unchanged to address data on a virtual unit.

Minicopy and Backup

The minicopy operation is a streamlined copy operation. Minicopy is designed to be used in place of a copy operation when a former shadow set member is returned to a shadow set. When a full member has been removed from a shadow set (for example, to back up that shadow set), a write bitmap tracks the changes that are made to the shadow set in the member's absence. With minicopy, you no longer need to dismount the entire virtual unit (shadow set) to back up the data. Stopping application write I/O, prior to dismounting a full member using certain minicopy qualifiers, is the responsibility of the user. When the member is returned to the shadow set, the write bitmap is used to direct the minicopy operation. While the minicopy operation takes place, the application can continue to read and write to the shadow set.

The minicopy feature and its enabling technology, write bitmaps, are fully implemented for OpenVMS for Integrity servers. In a mixed-version cluster if any systems are running a version of OpenVMS that does not have minicopy capability, no system in the cluster can use the minicopy feature.

Host-Based Minimerge

In a full merge operation, the members of a shadow set are compared with each other to ensure that they contain the same data. This is done by performing a block-by-block comparison of the entire volume. This can be a very lengthy procedure.

A minimerge operation can be significantly faster. By using information about write operations that were logged in volatile controller storage or in a write bitmap on an OpenVMS system, volume shadowing merges only those areas of the shadow set where write activity occurred. This avoids the need for the entire volume scan that is required by full merge operations, thus reducing consumption of system I/O resources. In a mixed-version cluster, every system must support write bitmaps, but it isn't necessary that every system support host-based minimerge (HBMM). Only systems that support HBMM can mount HBMM enabled shadow sets.

Host-based minimerge (HBMM) enables OpenVMS systems to track specific write operations using write bitmaps. HBMM can be used on all storage types, with the exception of those types that have been enabled for controller-based minimerge.

For more information on Host-based minimerge, refer to the HBMM chapter in the *Volume Shadowing for OpenVMS Version 8.4* manual.

Multiuse Bitmaps

HBMM bitmaps keep track of all writes from a known, consistent shadow set state. Therefore these bitmaps can actually be used for multiple purposes. With proper HBMM settings, HBMM bitmaps can be converted for use by Minicopy as well, if a member (or members) is removed automatically by volume shadowing. For example, if an intersite connection is lost to remote storage, volume shadowing will remove those members from the shadow set. With Multiuse bitmaps, once the connection is re-established, those removed members can be re-added to the shadow set using Minicopy. This significantly reduces the time it takes to bring the shadow set back to full membership, thus increasing availability more quickly.

The Multiuse allows all 12 bitmaps to be used for HBMM/Multiuse bitmaps. This creates more redundancy for HBMM bitmaps and also allows the system manager to specify that more than 1 bitmap be converted to Multiuse when a member is removed using the DISMOUNT command.

Multiple-Site Clusters

Qualifiers for the DCL commands DISMOUNT and SET offer support for multiple-site cluster configurations to provide disaster-tolerant support. Designed primarily for multiple-site clusters that use Fibre Channel as a site-to-site interconnect, these command qualifiers can be used in other configurations as well. For more details, refer to the *Volume Shadowing for OpenVMS* manual.

Compatibility

Volume Shadowing for OpenVMS Alpha and Volume Shadowing for Integrity servers are compatible and can operate in an OpenVMS Cluster system, provided that the same features are enabled on both systems. The use of both products in a mixed-architecture OpenVMS Cluster (Alpha and Integrity server machines clustered together) can enable the sharing of data disks.

Configuration Limits

Volume Shadowing for OpenVMS supports a maximum of 500 disks in multiple-member (2- or 3-member or 6- member) Up

to 10,000 shadow sets can be configured by changing a SYSGEN parameter and rebooting the system. These limits are independent of controller and device type.

Configuration Restrictions

Shadow set members cannot have hardware write protection enabled. Hardware write protection stops volume shadowing software from maintaining identical volumes.

Volume Shadowing for OpenVMS does not support shadow sets mounted with the /FOREIGN qualifier.

Volume Shadowing for OpenVMS provides support for SCSI disks and controllers on Alpha systems. Shadowing can also be used with third-party SCSI disks that have READL (read long) and WRITEL (write long) commands implemented and that use the OpenVMS SCSI disk driver. Features are restricted when SCSI disks that do not support READL and WRITEL are shadowed; disk bad-block errors resulting from the use of these disks can cause members to be removed from the shadow set.

HARDWARE REQUIREMENTS

Volume Shadowing for OpenVMS does not depend on specific hardware to operate. Basic shadowing functions can be performed on any supported system. Members of a shadow set can be located on any single system or anywhere in an OpenVMS Cluster system. There are no restrictions on the location of shadow set members beyond the valid disk configurations. Refer to *VSI OpenVMS Operating System Software Product Description* (SPD DO-VIBHA*-005) and the *OpenVMS Cluster Software Product Description* (SPD DO-VIBHAA-032).

Disk Controller Support

Volume Shadowing for OpenVMS supports all disk controllers listed as supported in the *VSI OpenVMS Operating System Software Product Description* (SPD DO-VIBHA*-005) .

Volume Shadowing for OpenVMS can be used with controllers that do not support READL (read long) and WRITEL (write long) subject to the restriction that all OpenVMS devices that are to be used as shadow set members are composed of fault tolerant devices, such as:

- RAID 1—otherwise known as controller-based mirroring, or
- RAID 5—which is striping with a parity device, or
- Advanced Data Guard, which is striping with multiple parity devices
- Any XP Storage Array controller
- Any SmartArray-family of Backplane RAID controller

Disk Drive Support

Volume Shadowing for OpenVMS supports all disk drives listed as supported in the *VSI OpenVMS Operating System Software Product Description* (SPD DO-VIBHA*-005) with the following constraints and exceptions:

- RF35 and RF73 disk devices must use at minimum firmware version T392F.
- RF36 and RF74 disk devices must use at minimum firmware version V427P.
- KDM70 controllers must be at minimum microcode revision 4.3.
- IDE devices.

OpenVMS Cluster Environment

Volume Shadowing for OpenVMS is fully supported in an OpenVMS Cluster when installed on any valid and licensed configuration. Volume Shadowing for OpenVMS allows shadowing of disks that are locally connected to the system on which this software is installed. In addition, Volume Shadowing for OpenVMS allows a user on an OpenVMS system to shadow disks connected to other systems within the same OpenVMS Cluster. In a mixed architecture cluster of Alpha and Integrity server systems, the capability applies to both system architectures.

An OpenVMS Cluster quorum disk cannot be shadowed. For additional information, refer to the *OpenVMS Cluster Software Product Description* (SPD DO-VIBHAA-032).

SOFTWARE REQUIREMENTS

Volume Shadowing for OpenVMS is a System Integrated Product that, as described in this SPD, requires VSI OpenVMS for Integrity servers V8.4-1H1 and higher.

For additional information, and minimum software and firmware revisions for storage subsystems, refer to the *VSI OpenVMS Operating System Software Product Description* (SPD DO-VIBHA*-005).

OPTIONAL SOFTWARE

Optional products that may be useful when running Volume Shadowing for OpenVMS include:

- VSI OpenVMS Cluster Software (SPD DO-VIBHAA-032)
- DECram for OpenVMS Software Product Description (SPD DO-VIBHAB-005)

GROWTH CONSIDERATIONS

The minimum hardware and software requirements for any future version of this product may be different from the requirements for the current version.

DISTRIBUTION AND INSTALLATION

Volume Shadowing for OpenVMS is a System Integrated Product that is included in the High Availability Operating Environment (HA-OE) media kit. Documentation for Volume Shadowing is also included with OpenVMS. Licenses are available separately as follows:

ORDERING INFORMATION

For Volume Shadowing on VSI OpenVMS, per socket licenses are available as electronic licenses (E-LTU) or physical licenses (P-LTU):

- VSI Volume Shadowing PSL 1 Core 1 E-LTU SL-LIVS1E-84V
- VSI Volume Shadowing PSL 1 Core 1 P-LTU SL-LIVS1P-84V
- VSI Volume Shadowing PSL 2 Core 2 E-LTU SL-LIVS2E-84V
- VSI Volume Shadowing PSL 2 Core 2 P-LTU SL-LIVS2P-84V
- VSI Volume Shadowing PSL 4 Core 4 E-LTU SL-LIVS4E-84V
- VSI Volume Shadowing PSL 4 Core 4 P-LTU SL-LIVS4P-84V
- VSI Volume Shadowing PSL 8 Core 8 E-LTU SL-LIVS8E-84V
- VSI Volume Shadowing PSL 8 Core 8 P-LTU SL-LIVS8P-84V

Volume Shadowing is a System Integrated Product (SIP); the product is included on the VSI OpenVMS Operating System media and initial delivery of the product binary is through the purchase of an OE media kit. Volume Shadowing is included in the High Availability Operating Environment (HA-OE) bundle, or can be ordered separately.

Please refer to the *VSI Operating Environments for OpenVMS Version 8.4-2 for Integrity Servers* Software Product Description (DO-VIBHAB-006) for ordering information.

SOFTWARE LICENSING

This software is furnished under the licensing provisions of VMS Software, Inc. Standard Terms and Conditions.

License Management Facility Support

Volume Shadowing for OpenVMS supports the OpenVMS License Management Facility (LMF).

A capacity license allows a varying number of disks to be shadowed on a single system, up to the maximum specified in the Configuration Limits section. When using a capacity licensing scheme in an OpenVMS Cluster, every system in an OpenVMS Cluster that mounts a shadow set must have a properly sized Volume Shadowing for OpenVMS capacity license installed.

For more information about the License Management Facility, refer to the *VSI OpenVMS License Management Utility Manual* in the OpenVMS documentation set.

For more information about OpenVMS licensing terms and policies, contact your local VSI account representative or distributor. Information is also available at the following website:

<http://vmssoftware.com/services>

SOFTWARE PRODUCT SERVICES

A variety of service options are available from VSI. For more information, contact your local VSI account representative or distributor. Information is also available at the following website:

<http://vmssoftware.com/services>

SOFTWARE WARRANTY

This software product is provided by VSI with a 90-day conformance warranty in accordance with the VSI warranty terms applicable to the license purchase.

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