Software Product Description

PRODUCT NAME: HP Volume Shadowing for OpenVMS
SPD 27.29.19

Note:

This is the Software Product Description (SPD) for the following three products running on OpenVMS Version 7.2-2, Version 7.3, Version 7.3–1, Version 7.3–2 or Version 8.2:

- HP Volume Shadowing for OpenVMS Alpha
- HP Volume Shadowing for OpenVMS VAX
- HP Volume Shadowing for OpenVMS I64

Except where specifically noted, the features described in this SPD apply to all 3 products. The license and part number information is architecture specific. Please refer to the section of this SPD for further details.

DESCRIPTION

Volume Shadowing for OpenVMS is a System Integrated Product (SIP) that runs on the Integrity server, Alpha and VAX families of processors. 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. Shadow sets consist of one, two, or three disk volumes or shadow set 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 I64, Alpha and VAX system disks, Files-11 On-Disk Structure 2 (ODS-2), and Files-11 On-Disk Structure 5 (ODS-5) data disks that are certified by HP can be volume shadowed. For more information, refer to the Hardware Requirements section of this SPD.

Volume Shadowing for OpenVMS implements a host-based approach to shadowing disk devices. In previous OpenVMS versions, Volume Shadowing for Open-

VMS VAX implemented a controller-based approach to disk shadowing. Controller-based Volume Shadowing for OpenVMS VAX is no longer available or supported.

For the purposes of this document, the term system refers to a single Integrity server, Alpha or VAX computer 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 a mix of Alpha systems and VAX systems or Integry server systems and Alpha systems configured together.

Volume Shadowing for OpenVMS supports clusterwide shadowing of Alpha SCSI, DSA, and 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. HP 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 one, two, or three members. If one member of a two-member or a three-member shadow set fails, the shadow set can continue operation with the remaining full member(s).

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, introduced in Volume Shadowing on OpenVMS Alpha Versions 7.2-2 and 7.3, 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 Alpha and OpenVMS I64. OpenVMS VAX V7.3 systems can write to shadow sets which use this feature, but they can neither create master write bitmaps nor manage them with DCL commands. 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), introduced in Volume Shadowing on OpenVMS V8.2, 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 *HP OpenVMS Version 8.2 New Features and Documentation Overview* manual.

Multiple-Site Clusters

Starting with OpenVMS Alpha Version 7.2-2 and available on OpenVMS I64 systems, new qualifiers for the DCL commands DISMOUNT and SET were introduced for use in 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 *HP Volume Shadowing for OpenVMS* manual.

Compatibility

HP Volume Shadowing for OpenVMS Alpha and HP Volume Shadowing for I64 are compatible and can operate in an OpenVMS Cluster system, provided that the same features are enabled on both systems. The same is true for HP Volume Shadowing for OpenVMS Alpha and HP Volume Shadowing for OpenVMS VAX. The use of both products in a mixed-architecture OpenVMS Cluster (Alpha and VAX machines clustered together, or 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) shadow sets on a single OpenVMS Cluster. Up to 10,000 single-member shadow sets are allowed on the same OpenVMS Cluster or standalone system. These limits are independent of controller and device type.

Configuration Restrictions

Controller-based Volume Shadowing for OpenVMS VAX is no longer available.

In Volume Shadowing for OpenVMS VAX V7.3 and Volume Shadowing for OpenVMS Alpha Version 7.3-1, and all earlier versions, all members of a shadow set must have the same number of physical blocks. For example, two RA92 disk drives could form a shadow set. An RZ28 and an RZ28B disk drive could also form a shadow set. However, a 6-GB disk and an 8-GB disk could not be members of the same shadow set.

Starting with OpenVMS Alpha Version 7.3–2, different sized devices can be used within a shadow set. This functionality is called dissimilar device shadowing (DDS). To use DDS, all systems must be running OpenVMS Alpha Version 7.3–2 or later.

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 defined in the *HP OpenVMS Operating System for Alpha Version 7.3-1 and 7.3-2, and VAX Version 7.3 Software Product Description* (SPD 25.01.xx) or the *HP OpenVMS for Integrity Servers and HP OpenVMS Alpha Version 8.2 Operating Systems Software Product Description* (SPD 82.35.xx), and the *OpenVMS Cluster Software Software Product Description* (SPD 29.78.xx).

Disk Controller Support

Volume Shadowing for OpenVMS supports all disk controllers listed as supported in the *HP OpenVMS Operating System for Alpha Version 7.3-1 and 7.3-2, and VAX Version 7.3 Software Product Description* (SPD 25.01.xx) or the *HP OpenVMS for Integrity Servers and HP OpenVMS Alpha Version 8.2 Operating Systems Software Product Description* (SPD 82.35.xx), with the exception of VAX SCSI controllers and IDE controllers.

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 *HP OpenVMS Operating System for Alpha Version 7.3-1 and 7.3-2, and VAX Version 7.3 Software Product Description* (SPD 25.01.xx) or the *HP OpenVMS for Integrity Servers and HP OpenVMS Alpha Version 8.2 Operating Systems Software Product Description* (SPD 82.35.xx), 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.
- Disks attached to a local VAX SCSI controller on VAX 4000 and VAX 3000 series systems are not supported.
- 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 I64 systems or Alpha and VAX 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 Software Product Description* (SPD 29.78.xx).

SOFTWARE REQUIREMENTS

Volume Shadowing for OpenVMS is a System Integrated Product that, as described in this SPD, requires OpenVMS Alpha Version 7.2-2, or Version 7.3 and later.

For additional information, and minimum software and firmware revisions for storage subsystems, refer to the *HP OpenVMS Operating System for Alpha Version 7.3-1 and 7.3-2, and VAX Version 7.3 Software Product Description* (SPD 25.01.xx) or the *HP OpenVMS for Integrity Servers and HP OpenVMS Alpha Version 8.2 Operating Systems Software Product Description* (SPD 82.35.xx).

OPTIONAL SOFTWARE

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

- OpenVMS Cluster Software (SPD 29.78.xx)
- DECram for OpenVMS (SPD 34.26.xx)
- RAID Software for OpenVMS (SPD 46.49.xx)

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 distributed and installed with the OpenVMS Alpha operating system Version 7.2-2 or 7.3. On OpenVMS I64, it is included in the Enterprise Operating Environment EOE) media kit. Documentation for Volume Shadowing is also included with OpenVMS. Licenses and services are available separately as follows:

ORDERING INFORMATION

For Volume Shadowing on OpenVMS I64:
Software Licenses:
Per Processor: BA413AC

The Volume Shadowing on OpenVMS I64 license is also included with the Enterprise Operating Environment (EOE) license bundle. Please refer to the *HP Operating Environments for OpenVMS Industry Standard 64 for Integrity servers* Software Product Description (SPD 82.34.xx) for ordering information.

Software Media:
Foundation Operating Environment Media, BA322AA, or
Enterprise Operating Environment Media, BA323AA, or
Mission Critical Operating Environment Media, BA324AA

For Volume Shadowing on OpenVMS Alpha:
Software Capacity Licenses: QL-2A1A*-**
Software Per-Disk Licenses: QL-2A1AA-3B
Software Product Services: QT-2A1A*-**

For Volume Shadowing on OpenVMS VAX:
Software Capacity Licenses: QL-AB2A*-**
Software Per-Disk Licenses: QL-2A1AA-3B
Software Product Services: QT-AB2A*-**

* Denotes variant fields. For additional information about available licenses, services, and media, refer to the appropriate price list.

SOFTWARE LICENSING

This software is furnished under the licensing provisions of Hewlett-Packard's Standard Terms and Conditions.

License Management Facility Support

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

Licenses for Volume Shadowing for OpenVMS are sold on either a capacity or a per-disk basis. On OpenVMS I64, the license for Volume Shadowing for OpenVMS is limited to a per-processor capacity license, and no per-disk licensing is available on that platform.

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.

Alternatively, licenses are available on a per-disk basis using concurrent user licensing. With this type of licensing, one per-disk license is required for every disk that may become a member of a shadow set. The per-disk license is attached to a particular disk during the MOUNT process. That disk can then be included in a shadow set by any OpenVMS Alpha or VAX member of the OpenVMS Cluster with access to that disk.

Both methods of licensing can coexist in a single OpenVMS Cluster.

For more information about the License Management Facility, refer to the *HP OpenVMS Operating System for Alpha Version 7.3-1 and 7.3-2, and VAX Version 7.3 Software Product Description* (SPD 25.01.xx) or the *HP OpenVMS for Integrity Servers and HP OpenVMS Alpha Version 8.2 Operating Systems Software Product Description* (SPD 82.35.xx) or the *HP OpenVMS License Management Utility Manual* in the OpenVMS documentation set.

For more information about OpenVMS licensing terms and policies, contact your local HP sales office, or find HP software licensing information on the World Wide Web at:

http://h18000.www1.hp.com/products/software/info/terms/swl_sld.html

SOFTWARE PRODUCT SERVICES

A variety of service options are available from HP. For more information, contact your local HP account representative or distributor. Information is also available from http://www.hp.com/hps/software.

SOFTWARE WARRANTY

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