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Software Product Description

PRODUCT NAME: Volume Shadowing for OpenVMS, Version 7.0 **SPD 27.29.13**

Note: This is the Software Product Description (SPD) for the following two products:

- Volume Shadowing for OpenVMS VAX
- Volume Shadowing for OpenVMS Alpha

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

DESCRIPTION

Volume Shadowing for OpenVMS is a System Integrated Product (SIP) that runs on the VAX and Alpha 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 controller or device failure. It 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 disks (one copy per disk) called a shadow set. Shadow sets consist of one, two, or three compatible disk volumes or shadow set members. This duplication of data provides enhanced data availability; if data is recorded on multiple disk volumes, it remains accessible if one volume becomes unavailable. Disk read and write operations continue transparently with the remaining members of the shadow set.

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 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 to shadow set members in parallel.

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

OpenVMS VAX and Alpha system disks and any Files–11 On-Disk Structure 2 (ODS-2) data disks that are certified by Digital can be volume shadowed. Spiralog data disks can also be volume shadowed. For more information, refer to the *Hardware Requirements* section of this SPD.

Volume Shadowing for OpenVMS implements a host-based (phase II) approach to shadowing disk devices. Previous versions of Volume Shadowing for OpenVMS VAX also implemented a controller-based (phase I) approach to disk shadowing. Phase I is no longer available or supported.

For the purposes of this document, the term CPU is used to refer to a single VAX or Alpha computer, containing one or more processors. A CPU can be a standalone system or a member of a VMScluster system. The term VMScluster refers to a cluster that may contain a mix of VAX systems and Alpha systems configured together.

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

- HSC, HSD, HSF, HSJ, HSZ, and K.SCSI controlled disks

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- All DSA and Digital SCSI adapters and controllers that are locally connected to a CPU
- RF-series controllers and disks connected to the Digital Storage Systems Interconnect (DSSI)

Volume Shadowing also supports OpenVMS MSCP served DSA and Digital SCSI disks located within any supported VMScluster configuration. Volume Shadowing for OpenVMS allows the shadowing of disks that are accessible from the system on which shadowing is installed. An OpenVMS system parameter enables shadowing at system initialization.

Configuration Overview

Volume Shadowing for OpenVMS requires a minimum of one CPU, a disk controller, and a disk unit that is either DSA compliant or SCSI compliant. Although only one disk is required, there must be two or more disks in a shadow set in order to maintain multiple copies of the same data. This protects against failure or deterioration of a single volume.

Using two controllers provides a further guarantee of data availability in the event that a single controller fails. VMScluster systems can be configured with multiple CPUs, 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. After the failure of one member of a two-member shadow set, the shadow set can continue operation with the remaining member.

Shadow set members can be added to or removed from the shadow set at any time without affecting system or user operation.

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.

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

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

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

Compatibility

Volume Shadowing for OpenVMS Alpha is compatible and can operate with Volume Shadowing for OpenVMS VAX. The use of both products in a mixed-architecture VMScluster (VAX and Alpha machines clustered together) can enable the sharing of data disks between VAX and Alpha systems. System disks can be shared among VAX nodes or Alpha nodes in a VMScluster. A single system disk, however, cannot be shared for booting between VAX and Alpha systems in a VMScluster because booting is architecture specific.

Configuration Limits

Volume Shadowing for OpenVMS supports a maximum of 400 disks in multimember (2 or 3 member) shadow sets on a single VMScluster. An unlimited number of single member shadow sets are allowed on the same VMScluster. These limits are independent of controller and device type.

Configuration Restrictions

Controller-based Volume Shadowing for OpenVMS VAX is no longer available. One member of a former phase I shadow set can be mounted to form a phase II shadow set, and thus allow access to the data.

All members of a given shadow set must have the same disk geometry (same number of sectors, tracks, and cylinders) and have the same LBNs (logical block numbers). For example, two RA92s could form a shadow set. An RZ28 and an RZ28B could also form a shadow set.

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 Digital SCSI disks and controllers. It is also possible to use shadowing 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. By default, the OpenVMS Mount utility does not permit SCSI disks to become members of a shadow set if they do not implement READL and WRITEL. This behavior can be overridden with the MOUNT qualifier /NO_FORCED_ERROR, but to do so places the data on these disks in jeopardy.

HARDWARE REQUIREMENTS

Volume Shadowing for OpenVMS does not depend on specific hardware in order to operate. All shadowing functions can be performed on any supported CPU. Members of a shadow set can be located on any single CPU or anywhere in a VMScluster system. There are no restrictions on the location of shadow set members beyond the valid disk configurations defined in the OpenVMS Operating System Software Product Description (SPD 25.01.xx) and the OpenVMS Cluster Software Product Description (SPD 29.78.xx).

Disk Controller Support

Volume Shadowing for OpenVMS supports all disk controllers listed as supported in the OpenVMS Operating System Software Product Description (SPD 25.01.xx).

Disk Drive Support

Volume Shadowing for OpenVMS supports all disk drives listed as supported in the OpenVMS Operating System Software Product Description (SPD 25.01.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.
- RZ disks attached to a local VAX SCSI controller on VAX 4000 and VAX 3000 series systems have limited error-handling capabilities. Note that these configurations provide full data replication.

VMScluster Environment

Volume Shadowing for OpenVMS is fully supported in a VMScluster when installed on any valid and licensed configuration. Volume Shadowing for OpenVMS allows shadowing of disks that are locally connected to the VAX or Alpha system on which this software is installed. In addition, Volume Shadowing for OpenVMS allows a user on the OpenVMS system to shadow disks connected to other VAX or Alpha systems within the VMScluster.

A VMScluster quorum disk cannot be shadowed.

For additional information, refer to the OpenVMS Cluster Software Product Description (SPD 29.78.xx).

SOFTWARE REQUIREMENTS

Volume Shadowing for OpenVMS Version 7.0 is a System Integrated Product that requires OpenVMS Version 7.0.

For additional information, and minimum software and firmware revisions for storage subsystems, refer to the OpenVMS Operating System Software Product Description (SPD 25.01.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
- VAXsimPLUS
- StorageWorks 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 Version 7.0 is a System Integrated Product that is distributed and installed with the OpenVMS operating system Version 7.0.

ORDERING INFORMATION

For Volume Shadowing on OpenVMS VAX:

- Software Capacity Licenses: QL-AB2A*-**
- Software Per-Disk Licenses: QL-2A1AA-3B
- Software Documentation: QA-AB2AA-GZ
- Software Product Services: QT-AB2A*-**

For Volume Shadowing on OpenVMS Alpha:

- Software Capacity Licenses: QL-2A1A*-**
- Software Per-Disk Licenses: QL-2A1AA-3B
- Software Documentation: QA-AB2AA-GZ
- Software Product Services: QT-2A1A*-**

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

SOFTWARE LICENSING

This software is furnished under the licensing provisions of Digital Equipment Corporation'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.

A capacity license allows a varying number of disks to be shadowed on a single CPU, up to the maximum specified in the Configuration Limits section. When using a capacity licensing scheme in a VMScluster, every CPU in a VMScluster 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 VAX member or OpenVMS Alpha member of the VMScluster with access to that disk.

Both methods of licensing can coexist in a single VMScluster.

For more information about the License Management Facility, refer to the OpenVMS Operating System Software Product Description (SPD 25.01.xx) or the *OpenVMS License Management Utility Manual* in the OpenVMS documentation set.

For more information about Digital's licensing terms and policies, contact your local Digital office.

SOFTWARE PRODUCT SERVICES

A variety of service options are available from Digital. For more information, contact your local Digital office.

SOFTWARE WARRANTY

Warranty for this software product is provided by Digital with the purchase of a license for the product as defined in the Software Warranty Addendum of this SPD.

The previous information is valid at time of release. Please contact your local Digital office for the most up-to-date information.

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