DSM for OpenVMS VAX
DSM for OpenVMS AXP

Reliability and Performance for 21st Century Computing

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DSM (Digital Standard MUMPS®) is Digital's implementation of ANSI Standard M (alternatively known as MUMPS)* for Digital's OpenVMS operating system platform. DSM software is identical on both the VAX platform and Digital's industry-leading 64-bit RISC-based Alpha AXP platform. As a result, the DSM product is fully compatible across both VAX and Alpha AXP systems; applications developed on one platform will run on the other.

The DSM product is a totally integrated package including a high-level interpretive programming language and a multiuser data management system layered on the OpenVMS operating system. It also includes the DSM Application Software Library (DASL) package, an application generation tool that combines a data dictionary, screen and form compiler, report compiler, and SQL-compliant query driver.

Designed for highly available, high-performance production systems, DSM software provides reliable, efficient operations for networked, distributed or standalone environments. DSM software offers the portability of a standard programming language together with enhancements for superior programming power, speed, and flexibility. Because of these features, as well as its ease of use, DSM software is a popular choice for developing applications for finance, manufacturing, health care, and other industries that depend on their computing resources for key services.

Together with the rich resources of the OpenVMS operating system, DSM software can deliver the high availability and reliability demanded for mission-critical production systems. The DSM software environment is ideal for transaction processing or any shared, database-intensive application.

**M is approved by the MUMPS Development Committee (MDC) for use as an alternate name for MUMPS. As such, it has been adopted throughout this document.*

Reliability and Availability

A large credit union was experiencing frequent downtime and problems with their database. Because of the many online services they offer, such as ATM and bank-by-phone, they needed a high-availability solution, as well as one that provides high reliability. By converting their system to DSM software, they were able to enhance availability by running the database across multiple VAX systems in a VMScluster environment. In addition, DSM features such as before- and after-image journaling provided automatic recovery to ensure the reliability of their database information and quick recovery from any system failure.

DSM Highlights

- Provides high-speed, cost-effective transaction processing capabilities.
- Enables advanced networking and multi-CPU database sharing with full VMScluster system support for OpenVMS VAX, and cluster-ready support for OpenVMS AXP.
- Takes advantage of the OpenVMS operating system for either VAX or Alpha AXP, with full access to OpenVMS devices, editors, files, DECnet, system services, and symmetric multiprocessing. Fully compatible across both platforms; applications developed on one platform will run on the other.
- Includes both an external call interface to call out to routines written in other languages, and a callable routines library that allows routines written in non-M programming languages to access a DSM database.
- Permits development of X Window System and OSF/Motif applications through a comprehensive X Window System interface based on OpenVMS DECwindows Motif.
- Provides a complete X Image Extensions (XIE) and DECimage Application Services interface package.
- Provides high-speed Before-Image and After-Image Journaling for enhanced database integrity and automatic failover operations in a standalone, networked, or VMScluster environment.
- Facilitates application development through error-handling capabilities, a powerful symbolic debugger, and adherence to ANSI Standard Specifications for M X11.1-1990, including many ANSI Type A language extensions.
- Promotes system security through user access control and Distributed Data Processing (DDP) circuit connection control facilities.
- Provides, through the DSM Application Software Library, a fourth-generation application-development tool with a query driver that utilizes SQL syntax.

Providing Unprecedented Interoperability

Access to and from other programming environments is an essential capability of software products today. DSM software provides an unprecedented degree of interoperability with external software environments through the callable routines library and the external call interface.

The callable routines library allows programs written in any language supported by the OpenVMS operating system to call the DSM image directly. These programs can have direct read and write access to the DSM database, performing operations — including commit and rollback — on globals and calling DSM routines. (Globals are symbolic references to hierarchical arrays in the DSM database and may be shared by multiple users.) Non-M software such as office automation systems and decision support systems can seamlessly use DSM data or take advantage of the unique features of the DSM interpreter.

Through the external call interface, which supports the proposed ANSI M external calling syntax, DSM programs can call user-developed functions written in languages other than M. This allows M programs to take advantage of the capabilities of non-M software.

X Window System Interface

DSM software provides a complete set of DECwindows Motif function calls, which conform to the proposed ANSI M Standard X Window Binding Specification. Support for Motif UIL (user interface language) is included so that DSM programmers can create sophisticated graphical user interfaces and references to M callbacks using either a text editor or a WYSIWYG tool such as DEC VUIT.

The DSM product provides a complete library of external calls to X Image Extensions (XIE) and DECimage Application Services. Calls to DECimage Application Services can be made directly from a DSM environment, enabling programmers to integrate images into window-based applications.

Designed with Productivity in Mind

Every level of the DSM software, from the interpreter through the database structure to the most advanced language features, has been designed for programmer productivity. Using DSM software, programmers can develop and update applications faster and more easily than in many other programming environments.

The DSM interpreter, oriented toward variable-length strings, is fast and efficient. To optimize the execution of DSM routines, DSM software provides a language precompiler as a component of the interpreter. Performance features, such as memory-resident routines and an in-memory disk-buffer pool, increase system throughput.

Parameter passing, stacking of local variables, block structuring, and extrinsic functions make the DSM product a powerful tool for the most demanding development environments. The DSM product provides extensions to ANSI Standard M commands and functions, including many ANSI Type A language extensions, keeping DSM software current with ANSI standards and facilitating application development. For development efficiency, the DSM product provides a powerful symbolic debugger that allows users to set breakpoints and watchpoints and to monitor the current state of the call stack, as well as a facility that allows programmers to write error-handling routines at every execution level.

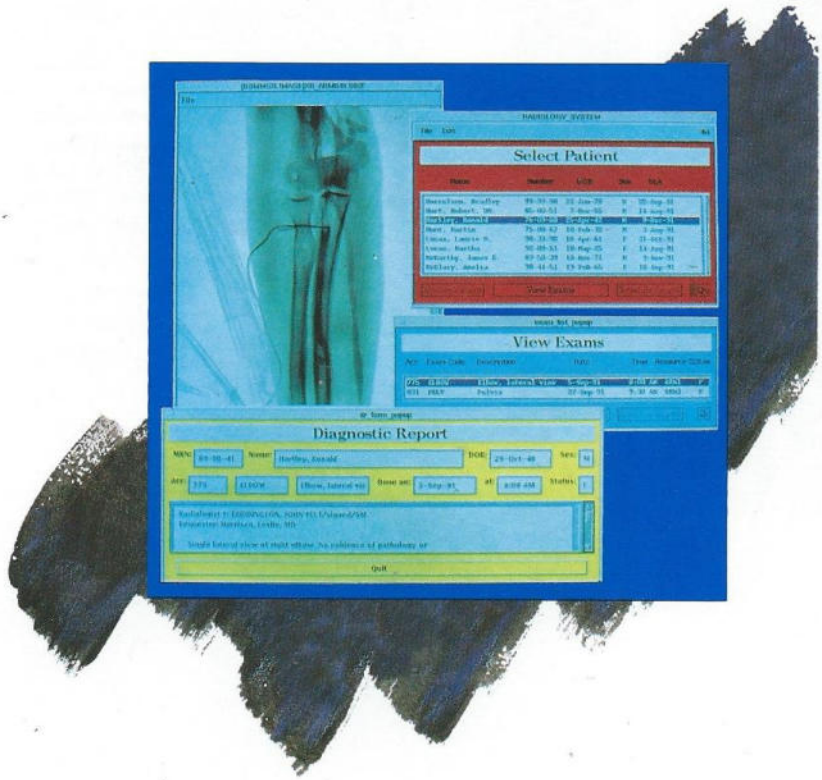
The OpenVMS Advantage

DSM software is layered on the rich environment of the OpenVMS operating system. Through OpenVMS, DSM software provides the powerful DCL command language and a variety of editors. You can integrate into your DSM applications the wide range of OpenVMS layered software products including word processors, spreadsheets, and other office automation tools that operate concurrently with the DSM product. You can access

X Window Interface for DSM

The DSM product includes an interface to the X Window System software, which allows programmers to create state-of-the-art applications having graphical user interfaces (GUIs). These applications can run on DSM for OpenVMS or DSM for ULTRIX, and will support any X protocol device, such as workstations, personal computers and X-terminals.

WYSIWYG ("what you see is what you get") development tools, such as DEC VUIT, generate user interface language (UIL) code, which greatly increases programmer productivity. By incorporating an interface to such tools with language, database, and GUI, DSM software provides a powerful development environment.



OpenVMS services, routines in the OpenVMS Run Time Library, or routines written in other languages.

DSM users can connect to all devices in the OpenVMS system and access OpenVMS RMS sequential, relative, and indexed files.

The DSM product brings users the full OpenVMS advantage. The OpenVMS operating system is one of the most standards-compliant software environments available. With its built-in NAS (Network Application Support) software, OpenVMS is a peerless multivendor environment that integrates all the most popular desktops, datacenters, and databases.

DSM software is fully compatible across the VAX and the Alpha AXP platforms. The same DSM-based applications will run on both systems. Users can develop and run DSM-based applications on today's OpenVMS products knowing that future migration from their current environments to Digital's advanced Alpha AXP systems will be a seamless transition.

DSM Features High Reliability

To help insure the integrity of your data in the event of a system failure, you can use DSM Journaling to record transactions that alter the database. DSM utilities allow you to enable journaling on a global-by-global basis and to preselect a set of journal files, add or remove a file from a set online, and display the status of journaling files.

DSM features exist to provide rapid recovery from CPU failures that cause the loss of in-memory disk buffers. Because the DSM product saves a before-image copy of structural changes to the database, a restarted system can roll back any incomplete structural changes that resulted from the CPU failure.

The DSM product takes full advantage of the VMScluster environment's automatic failover capabilities. If one node fails, operations on other nodes sharing a common database are suspended until before-image and after-image journal files are applied, then resumed once the database is restored to a logically consistent, accurate state.

The DSM product includes incremental backup of a live database in a VMScluster, which significantly increases uptime. Its efficient incremental backup utility allows modifications to the DSM database while applications are running. In addition, the integrity checker and database repair utilities help the system manager preserve the logical integrity of the DSM database.

DSM Is Optimized for Transaction Processing

The DSM product provides simple extensions to the ANSI M language that allow programmers to group global accesses into well-defined sets called transaction recovery units. By designing your transaction processing system around the concept of the transaction recovery unit, you can create highly reliable and efficient applications.

DSM software is the first M product in the industry to possess all the "ACID" properties for transaction processing:

- Atomicity
- Consistency
- Isolation
- Durability

Transactions with these properties can be relied on to maintain the integrity of the database even in such critical situations as system failure, concurrent data access, or transaction interruption.

Compatibility and Investment Protection

A major U.S. developer of health care applications knew that its customers require flexibility in their choice of hardware platforms. By relying on Digital's OpenVMS platform, the developer is now able to offer customers exactly the flexibility of choice they need. Because DSM software is fully compatible across OpenVMS platforms, the developer's DSM-based applications will already run on Digital's new industry-leading RISC-based Alpha AXP technology. Customers are assured a long-range growth path, and as processing requirements grow, enhanced applications can be implemented without disruption.

Windows on the Future with DSM

Windows-based applications are rapidly becoming the norm in many industries, providing a standardized and more intuitive user interface that is easier to learn. Many window applications, such as those used in the patient care areas of hospitals, simply require the user to "point and click" in order to bring an image up on a screen or to modify a record.

For application developers, the X Window System interface provided with the DSM product allows rapid prototyping of graphical user interface-based applications using the high performance DSM database. Applications developed today will conform to tomorrow's MDC and IEEE standards, and will run on any desktop device, from a PC to an X terminal to a workstation.

Because of the efficient organization of data and the reliability of the transaction recovery unit concept, DSM systems have achieved high scores for speed and cost-effectiveness in industry-standard transaction processing benchmark tests.

Database-Sharing Techniques for Growing Applications

As your demand for computing resources grows, the DSM product offers two paths for database sharing to accommodate large, critical applications: installing DSM software across multiple systems in a VMScluster environment or linking single DSM configurations via the high-performance DSM DDP (DSM Distributed Data Processing) networking protocol.

Either type of database sharing increases processing power and makes your applications available to more users. Database availability can be assured through reconfiguration in the event of processor failure. Performance is excellent, and application software is not concerned with the actual physical location of the globals. You can continue to make use of your original system, protecting your computing investment.

If you choose a VMScluster environment, DSM software provides full support for the OpenVMS distributed lock manager, allowing read and write operations to the database from any cluster node. You can take full advantage of VMScluster features including dynamic load balancing, processor redundancy, and distributed batch and print queues.

DSM DDP provides very easy access to your database on a wide variety of platforms. For sharing data between DSM systems connected in a wide area network, you can use DECnet. In a local area network, data can be shared using Ethernet. From your personal computer, DSM DDP-DOS software enables access to the DSM database across Ethernet-based local area networks.

DSM applications can establish network links with non-M systems through DECnet task-to-task networking. To reach UNIX® network systems, the DSM product provides an interface to Wollongong TCP/IP.

Your choice of database-sharing scenario depends on your current configuration, the needs of your application, and other system management considerations. The DSM product includes tools to help system managers achieve maximum throughput in any scenario.

DSM Brings You DASL Tools

Software developers know that an application generator can bring increased efficiency to the development process. By automating many programming tasks, an application generator supports the rapid development of sophisticated software products. The DSM Application Software Library (DASL) is a fourth-generation application generator specifically designed for the DSM programmer.

The DASL main menu offers easy-to-use modules to develop, document, and maintain your application, and to simplify and expedite the handling of complex databases. Modules include a Data Dictionary, a Screen Driver, a Report Driver, a Query Driver, a Development Environment, and an Application Environment. The DASL package also provides a security system, error handling, and a user mail system.

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DASL Highlights

- Provides a set of menu-driven tools for developers of DSM applications.
- Adds structure to an application, improving its supportability.
- Promotes interactive design and rapid prototyping.
- Integrates with DSM environment to provide a single-product, single-vendor solution.
- Automates many of the tasks involved in defining and documenting a DSM database, generating screens, designing reports for data output, and defining queries to the database.
- Provides facilities for porting DSM applications to other types of M systems running on a variety of hardware platforms.
- Provides a consistent screen-oriented user interface with extensive multi-level help.
- Includes the SQL-compliant Query Driver, allowing end users to extract information from the database easily and quickly.
- Designed for M programmers, it follows M conventions and uses M syntax.
- Facilitates the development of applications in languages other than English by allowing redefinition of delimiters, function keys, and day/time formats.
- Uses code generation to transform DASL commands into efficient M code.

Cost-Effective Service Arrangements

The DSM product is available with a full-year product warranty. Once the product warranty has expired, customers may choose to purchase additional service from a variety of options.

For More Information

For more information about the DSM product, contact your local Digital sales representative.

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