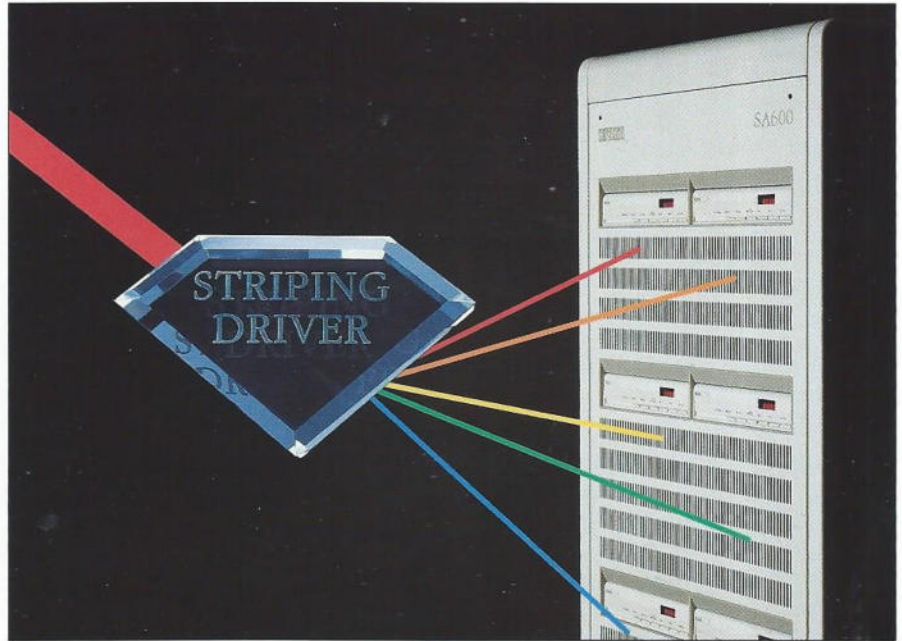# VAX Disk Striping Driver for VMS

Supercomputer-class I/O on Your VAX System

Digital's Disk Striping Driver enables extraordinarily fast I/O with transparent parallel technology.

Parallel I/O Technology Eliminates Bottlenecks

Although disk technology continues to produce faster disks, the processing power of computer systems is increasing even more rapidly. This mismatch has led to a gap in the amount of data a CPU can process and the speed at which the I/O subsystem can deliver data. Digital has overcome this gap by introducing parallel I/O technology in the VAX Disk Striping Driver for VMS. With this innovative software, applications can perform extraordinarily fast I/O using standard Digital Storage Architecture (DSA) controller and disk devices.

Unlike other parallel techniques where applications must be painstakingly rewritten and tuned, Digital's Disk Striping Driver is completely transparent to applications. You simply configure your I/O subsystem to provide the desired throughput by adding devices. With two I/O paths to two disk drives, the resulting device appears as a single drive with roughly twice the throughput and capacity. And the data rate increases linearly as you add more devices—up to 40 times the performance of today's disks on Digital's most powerful systems.

But high throughput and application transparency aren't the only advantages of Digital's Disk Striping Driver. Many applications also benefit from the automatic dynamic load balancing across multiple disk drives. By moving files to a striped disk set, each drive is accessed more evenly, balancing the I/O without manual intervention.

Highlights

- Transparent to applications

- Increases I/O data rate proportionally with the added hardware devices [1]

- Increases I/O request rates by automatically distributing the requests more evenly between drives

- Uses standard DSA disk drives and controllers

- Uses VAXsimPLUS and shadowing for improved reliability

- Works with VAX Performance Advisor (VPA) for performance tuning

[1] See specifications on back page for configurations.
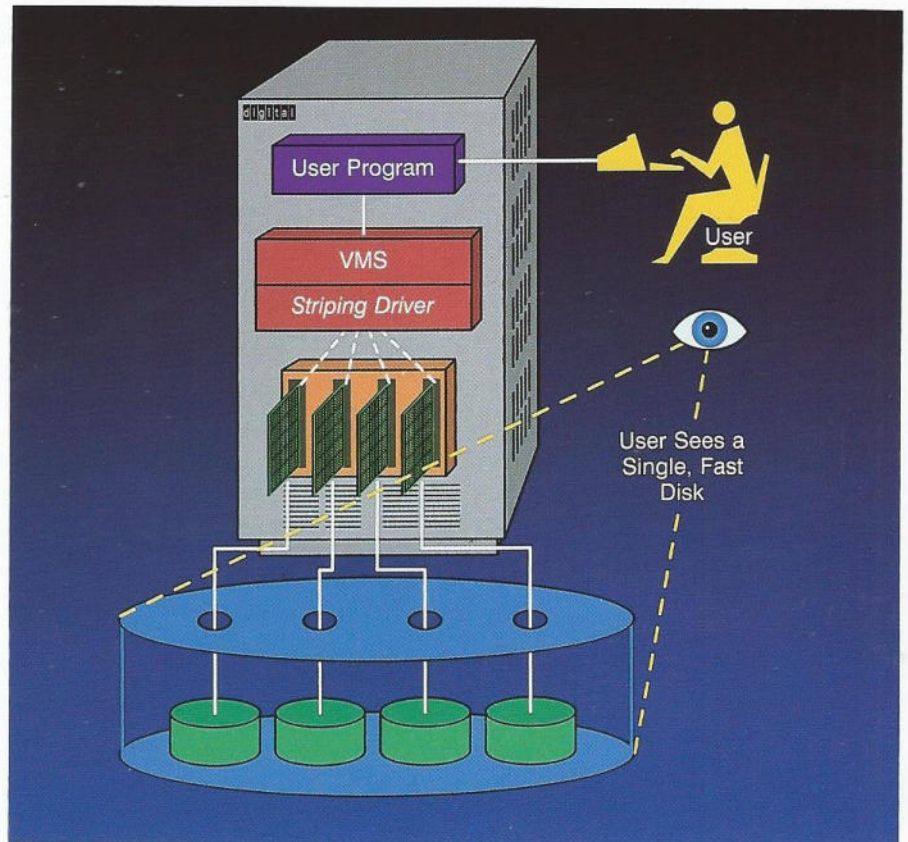
With Digital's Disk Striping Driver, a number of disks appear to the user as one large and fast disk.

Using Software to Create New Disks from Existing Hardware

Striping is a technique that turns a single I/O operation into multiple I/O operations, transferring the data in parallel to and from multiple disks. A system manager creates a stripe set by joining several DSA disks into a single pseudo-device. The resulting stripe set is treated by the user the same as any local DSA disk device, only appearing to the user as larger and faster than each of the individual drives.

Flexibility to Solve I/O Demands

The Disk Striping Driver allows you to configure your DSA I/O subsystem to match needs to system resources. You may choose to configure for high throughput, high request rate, high availability, or some combinations of these. As your application demands change, reconfiguring to meet these needs requires only backup, initialize, and restore—no special hardware is required.

Many applications, such as those listed on the next page, demand high I/O bandwidth in addition to CPU speed. The Disk Striping Driver permits data rate throughput at up to 97% of the maximum sustainable combined transfer rates of the disk drives in a stripe set.

With a separate I/O channel for each disk drive, the limiting factor in I/O bandwidth becomes the type and maximum number of controllers and busses supported by the system platform. Most VAX platforms are supported, and bandwidth performance potential ranges from 1.3 megabytes per second on a Q-bus MicroVAX to a theoretical maximum of almost 80 megabytes per second on the VAX 9000 series. The specifications on the back page show how to configure for maximum bandwidth with different controllers.
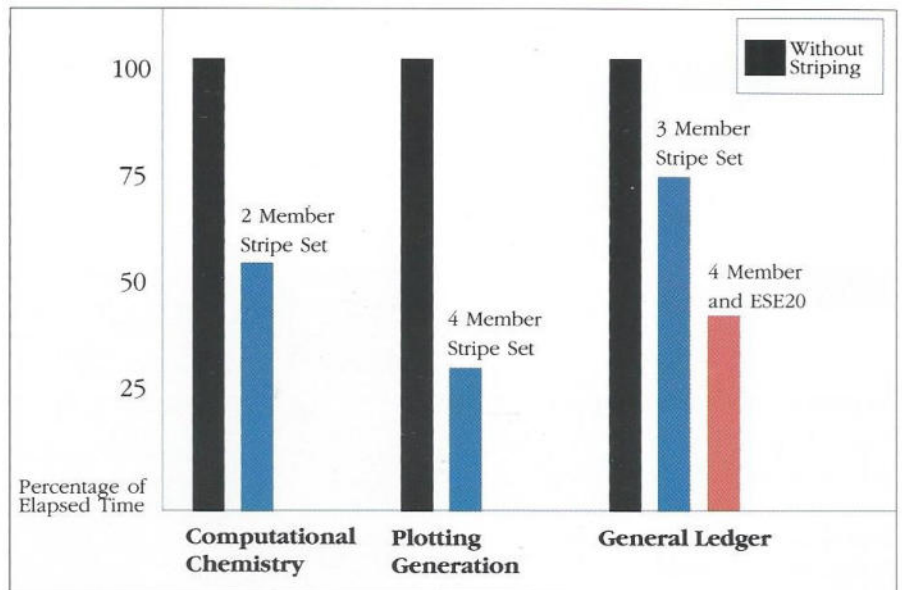
Striped versus unstriped application performance comparisons show the clear benefits of Disk Striping Driver.

Increase I/O Request Rate by Spreading the Load

Applications that require many I/O requests to a large file may also benefit from the Disk Striping Driver. With the file striped across multiple disks, seek time is reduced because the file occupies fewer tracks per drive. Significant performance improvements in I/O request rates are possible by utilizing smaller disk drives to make up the stripe set. By using the ESE20 for small, hot files (files with high I/O request rates) in conjunction with a stripe set for large files, one application exhibited a significant reduction in job turn-around time and increased processor utilization.

Another I/O bound application with many small files can now finish in one-third the time by implementing striping. The RA70 disk drive characteristics are ideally suited to applications that benefit from load balancing. Of course, the Disk Striping Driver may not benefit every application, so the best way to discover how it might increase performance is to talk to your local Digital Professional Software Services representative and perhaps try striping with your application.

Protecting Your Data

Protection against loss of data is always foremost in the design of Digital's DSA storage subsystems. While the stripe set responds to physical, logical, and virtual I/O, the individual controllers and drives implement all the sophisticated data integrity features of DSA. DSA provides for an industry leading error correction code, a unique error detection code, automated bad block replacement, and other

proven techniques to reduce the possibility of data loss. However, the failure of a single drive in the stripe set causes the stripe set to become unavailable, requiring a restore operation.

Another Digital innovation in protection against data loss is VAXsimPLUS, a knowledge-based, predictive maintenance tool. VAXsimPLUS is an on-line service monitor that continuously monitors all system devices to detect problems before they result in downtime. It is available from Digital Customer Services as an integral part of our standard on-site services agreement.

For even more protection, you can configure the Disk Striping Driver with VAX Volume Shadowing so that you have multiple concurrent copies. In conjunction with VAX Volume Shadowing, VAXsimPLUS can dynamically back up a suspect drive online to a pre-designated drive. This provides total uptime throughout the repair and restoration process and eliminates the need for an off-line restoration process. Your Digital Customer Services representative can help you configure your subsystem for maximized availability.

High Bandwidth Applications

- Finite element analysis
- Seismic exploration
- Reservoir modeling
- ECAD and MECAD
- Solids modeling
- Imaging
- Telemetry
- Computational fluid dynamics
- Meteorology
- Genetic engineering
- Data acquisition
- Supercomputer file services
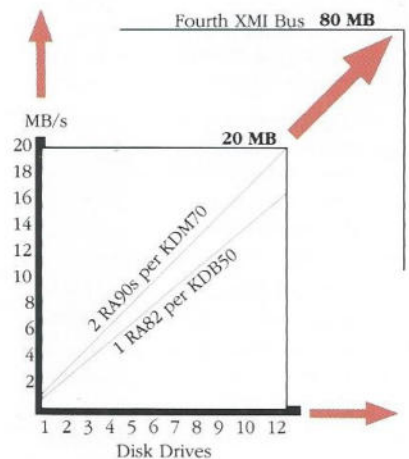
As controllers and drives are added, bandwidth exhibits linear gains.

Digital Service and Support

Digital's service organization can help you decide how to benefit from the Disk Striping Driver. Digital provides one of the most comprehensive portfolios of services in the industry, designed to support customers throughout the computing life-cycle—planning and design, consulting, implementation, and ongoing maintenance. And you can tailor the type and amount of support necessary to meet your individual needs. Whatever the service solution, you benefit from a single point of contact.

For more information, please contact your local Digital Sales representative.

Specifications for VAX Disk Striping Driver for VMS with Recommended Configuration for Maximum Throughput

System	VAX 9000 [1]	VAX 6000 [2]	VAX 3000 [3]
Bus system	XMI	VAXBI	Q-bus DSSI
Standard	1	2	1
Maximum	4	6	1
Controller	KDM70	KDB50	KFQSA
Per bus	6	2	1
Per system	23	12	1
Controller throughput	3.4 [4]	1.4	1.3
Maximum throughput	79.2 [4]	16.8	1.3
Data throughput/disk			
RA82	1.4	1.4	-
RA90	1.7	1.4	-
RF30/71	-	-	.675

VAXcluster configuration

All high-performance, mass-storage servers (HSC40, HSC50, and HSC70) can be used with the Disk Striping Driver. The maximum sustained data throughput depends on the CI adapter to the individual VAX systems. You can connect multiple CI adapters on a VAX 9000 system to improve the data throughput. The new CIXCD adapter provides a much higher bandwidth.

Even when the maximum data throughput might be limited by the available CI adapter, you still can take full advantage of the load balancing in a high availability environment.

The maximum sustained throughput on an HSC40, HSC50, or HSC70 is 4.2 megabytes per second, achieved with a minimum of three data channels.

[1] One XMI bus with VAX 9000 Model 210.

[2] One VAXBI bus with VAX 6000 Model 210 and four with Model 450/460.

[3] Includes only DSSI-based MicroVAX systems with a KFQSA controller.

[4] Theoretical maximum.

VAX 82xx/83xx—two VAXBI and four KDB50 (maximum two KDB50 per VAXBI); VAX 85xx—two VAXBI and four KDB50

(maximum two KDB50 per VAXBI); VAX 88xx—four VAXBI and eight KDB50.

Contact your Digital Sales representative for complete configuration information.

Required hardware: any VAX/VMS system with RA or RF DSA subsystems. Required software: VMS operating system, V5.0 or later. Order number: QL-YELA*-AA (* depends on CPU type).