



# **Veritas Storage Foundation™** *for Windows®*

Dynamic Multi-pathing Option

Competitive Comparisons

# Veritas Storage Foundation *for Windows*

## Dynamic Multi-pathing Option

### Contents

Introduction .....	4
Veritas Storage Foundation Dynamic Multi-pathing Option .....	4
Defining multipathing and load balancing .....	5
Active/Passive .....	5
Active/Active .....	5
Competitive comparisons .....	6
Summary .....	9

## Introduction

Dynamic Multi-pathing software provides the intelligence necessary to manage multiple I/O paths between a server and a storage subsystem. Without multipathing software, the server operating system presents applications with multiple images of a disk or LUN (one for each I/O path discovered), which can result in data corruption.

At its most basic, multipathing software has two main modes of operation. When configured for redundancy, a single path is dedicated to I/O transfer, while other paths are in standby mode. The software manages failover between the I/O paths, thus eliminating the potential for a single point of failure. If connectivity along one path to a storage device is interrupted, the multipathing software dynamically switches I/Os to a surviving path, allowing application access to continue unimpeded. The other mode of operation allows for all paths to be utilized for I/O transfer. This can improve performance by leveraging the presence of these multiple paths, increasing the available bandwidth for I/O traffic.

## Veritas Storage Foundation Dynamic Multi-pathing Option

Most multipathing solutions are developed for a specific brand of storage array by that array vendor and, as such, generally cannot service the various types of storage that exist in many of today's heterogeneous SAN environments. Unlike these proprietary solutions, the Veritas Storage Foundation Dynamic Multi-pathing Option is a heterogeneous solution that covers a wide variety of the most popular array families available today. Dynamic Multi-pathing includes an extensive list of support libraries for the various arrays that it supports. Starting with Storage Foundation 4.2 for Windows, it also integrates with the Microsoft® Multipath I/O (MPIO) architecture for storage devices and includes multiple MPIO Device Specific Modules (DSMs) for leading storage arrays. In addition to the benefits of heterogeneity, Dynamic Multi-pathing offers several advantages over other multipathing solutions, such as:

- GUI/CLI management from a common user interface
- Array visualization from the GUI
- SNMP alerts for path failure and recovery
- Path performance statistics
- Full compliance with Microsoft's MPIO architecture
- Microsoft MPIO management and integration
- 32-bit and 64-bit Windows support (IA-32, IA-64, and x64)
- Microsoft WHQL logo qualification
- Fibre Channel and iSCSI support

## **Defining multipathing and load balancing**

Dynamic Multi-pathing operates in two basic modes: (1) Active/Passive, where a single path is dedicated to data transfer, while other paths act as failover targets to provide fault tolerance should the primary path fail; and (2) Active/Active, where multiple paths are utilized for I/O transfer to provide I/O load balancing.

### **Active/Passive**

In its simplest form, Active/Passive multipathing is just that: one active path for I/O traffic, with other paths being passive. However, through special configuration, environments using Active/Passive multipathing can also be made to concurrently utilize multiple paths. This is known as Active/Passive Concurrent multipathing (aka, Dual-Active multipathing), and is important in cluster environments that use SCSI-2 protocols. This is accomplished through multipathing software that allows for configuring at the device (LUN) level instead of (or in addition to) at the array level. By configuring the preferred path for data transfer at the device level, specific paths can be dedicated to specific LUNs. This allows multiple paths, each configured as the preferred path for its specific LUN, to be used for data transfer. Note that the array also must support this.

### **Active/Active**

Active/Active multipathing has more variations than Active/Passive. There are several load-balancing algorithms available today. Although some of these algorithms may be referred to by different names, their functionality is the same. Table 1 describes these load-balancing algorithms, along with their various names.

# Veritas Storage Foundation *for Windows*

## Dynamic Multi-pathing Option

**Table 1. Load-Balancing Algorithms**

Algorithm	Other Names	Description	Comments
Round Robin		Equally distributes I/O among the paths in round-robin sequence	This policy is designed to optimize the use of caching in disk drives and RAID controllers. The size of the cache depends on the characteristics of the particular hardware.
Dynamic Least Queue Depth	Least I/O, Minimum Queue, Smart	This algorithm schedules I/O through the path that has the least number of I/Os pending.	Useful with JBOD configurations
Balanced Path		Special load balancing of the round robin. It follows a "balanced path policy," where random I/Os are balanced across all available paths.	Good for a wide variety of applications; optimizes built-in cache in the RAID controllers or disk drives
Weighted Paths	Adaptive Priority, Least Bandwidth	Measures the delay on all paths connected to a LUN on a continuous basis. As each I/O is issued, it is sent to the path with the least delay at the time the I/O is sent to a path.	Good for I/O loads that can vary over time; e.g., a database can have both long transfers (table scans) and short transfers (random look-ups).
Round Robin with Subset	Priority	Uses a subset of paths, each in turn, in round-robin fashion. The user specifies the paths for data transfer that make up the subset. The remaining paths are in standby mode.	
Least Blocks		Load balance is based on the number of blocks in pending I/Os. I/O requests are routed to the path with the fewest queued blocks.	
Active/Passive		A mode in which a path designated as the "Preferred Path" or "Primary Path" is always active and the other path or paths act as backups (standby paths) that are called into service if the current operating path fails.	

### Competitive comparisons

In addition to the Veritas Storage Foundation for Windows Dynamic Multi-pathing Option, there are several other multipathing software applications available. Dynamic Multi-pathing is heterogeneous, meaning that it isn't hardware-specific, but rather works with a wide variety of array families (based on the Veritas Dynamic Multi-pathing HCL). Most of the other multipathing applications are provided by hardware vendors and are specific to the arrays manufactured by those vendors. Among the most popular are applications from EMC (PowerPath), HP (SecurePath), Hitachi (HDL), and IBM (SDD and RDAC). These applications enable different features and offer a variety of load-balancing algorithms (some more than others), as defined above.

# Veritas Storage Foundation *for Windows*

## Dynamic Multi-pathing Option

Table 2 gives a side-by-side comparison of the available features and load-balancing options available with these applications.

Table 3 gives a side-by-side comparison of the hardware arrays supported by each of these applications.

**Table 2. Multipathing Feature Comparisons**

Product	Veritas Dynamic Multi-pathing 5.0	EMC PowerPath 4.5.1	HP SecurePath 4.0c	Hitachi HDLM 5.7	IBM SDD 1.6	IBM RDAC
<b>System Management</b>						
100% Microsoft MPIO-based solution	•					
GUI Multipathing Management	•	•	•	•		
CLI Multipathing Management	•	•	•	•	•	•
GUI Visualization of Array	•	•				
SNMP Alerts for Path Failures	•					
Path Performance Statistics	•			•		
Proactive Path Checking	•	•	•	•	•	•
SNMP Alerts for Path Recovery	•					
<b>Multipathing</b>						
Automatic I/O Path Failure Detection	•	•	•	•	•	•
Dynamic Reconfiguration and Recovery	•	•	•	•	•	•
Auto Failback	•	•	•	•	•	•
Dynamic Path Recognition	•					
Maintenance Mode Support	•					
<b>Load Balancing</b>						
Active/Passive	•	•			•	•
Round Robin	•	•	•	•	•	•
Dynamic Least Queue Depth	•	•	•		•	
Least Blocks	•	•				
Weighted Path	•	•				
Balanced Path	•					
Round Robin with Subset	•					
Adaptive Priority (Least Bandwidth)			•			
Extended Round Robin				•		
Active/Active Multipathing with Clustering	•	•			•	
<b>Windows OS Support</b>						
Windows 2000	ASL Only	•	•	•	•	•
Windows Server* 2003 (32-bit)	•	•	•	•	•	•
Windows Server 2003 (64-bit Itanium*)	•			•	•	
Windows Server 2003 (64-bit x64 Opteron or Xeon*)	•					
<b>Standards Support</b>						
Microsoft MPIO-based	•					
Microsoft WHQL logo qualified	•	•	•	•	•	•
Fibre Channel SAN support	•	•	•	•	•	•
iSCSI SAN support	•					
SCSI-3 PGM support	•	•				

# Veritas Storage Foundation for Windows

## Dynamic Multi-pathing Option

**Table 3. Array Support Comparisons**

Product	Veritas Dynamic Multi-pathing 5.0	EMC PowerPath 4.5.1	HP SecurePath 4.0c	Hitachi HDLM 5.7	IBM SDD 1.6	IBM RDAC
<b>Heterogeneous Array Support</b>						
EMC CLARiiON CX/CX-3 Ultrascale Series Arrays	•	•				
EMC Symmetrix 3000 Series	•	•				
EMC Symmetrix 8000 Series	•	•				
EMC Symmetrix DMX Series	•	•				
Hitachi 9200 Freedom Series	•					
Hitachi 9500 V Thunder Series	•			•	•	
Hitachi 9900 Lightning Series (9900 and 9900 V)	•	•		•	•	
Hitachi SANRISE 2000	•			•	•	
Hitachi SANRISE 9900 V	•			•	•	
Hitachi TagmaStore Universal Storage Platform (USP)	•	•		•	•	
Hitachi TagmaStore Network Storage Controller (NSC)	•					
Hitachi TagmaStore Adaptable Modular Storage (AMS)	•					
Hitachi TagmaStore Workgroup Modular Storage (WMS)	•					
HP StorageWorks EVA4000/EVA6000/EVA8000	•					
HP StorageWorks EVA3000/EVA5000	•	•	•			
HP StorageWorks MSA 1000/MSA 1500	•		•			
HP StorageWorks XP12000/XP10000 Disk Arrays	•		•			
HP SureStore E Disk Array XP128/XP1024	•	•	•			
HP SureStore E Disk Array XP48/512	•	•	•			
HP SureStore E Disk Array XP256		•				
IBM® ESS Models E10/E20/F10/F20 (Shark)	•	•				
IBM SAN Volume Controller	•					
IBM System Storage N3000 and N5000 Series						
IBM TotalStorage® ESS 800/ESS 750	•	•				•
IBM TotalStorage DS8000 Series	•					
IBM TotalStorage DS6000 Series	•					
IBM TotalStorage DS4000 Series	•					
Network Appliance FAS200 Series	•					
Network Appliance FAS3000 Series	•					
Network Appliance FAS6000 Series	•					
Network Appliance FAS900 Series	•					
Network Appliance NearStore Series	•					
Sun™ StorageTek FlexLine 300 Series Storage Systems	•					
Sun StorEdge™ 6000 Series Arrays	•					
Sun StorEdge 9900/9900V Series	•			•	•	

## Veritas Storage Foundation *for Windows* Dynamic Multi-pathing Option

### **Summary**

The Veritas Storage Foundation *for Windows* Dynamic Multi-pathing Option is the industry's leading SAN storage multipathing solution for mission critical Windows servers. Veritas Dynamic Multi-pathing is fully compliant with the Microsoft Windows MPIO Framework and is in its third generation of MPIO integration. Veritas Dynamic Multi-pathing offers MPIO Device Specific Module (DSM) support for most leading array families from EMC, HP, HDS, IBM and Network Appliance as well as a feature rich solution unparalleled in the industry. Whether you are looking for an array independent multipathing solution for your Windows 'SAN Builds' or a feature-rich solution to improve SAN storage performance or management, Veritas Dynamic Multi-pathing is the ideal choice for your Windows servers.

## About Symantec

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