



By Barbara Craig

SEAGATE SAS DRIVES PROVIDE OPTIMIZED NEAR-LINE STORAGE FOR DELL SYSTEMS

New Seagate® Barracuda® ES.2 Serial Attached SCSI (SAS) hard drives, available in Dell™ PowerEdge™ servers and Dell PowerVault™ storage, are designed to provide the exceptional performance, efficient operation, robust data integrity, and seamless integration required by near-line ecosystems in enterprise data centers.

Growing data access requirements for users and applications, internal policies on system uptime and reliability, and other challenges have resulted in increasing demand for cost-effective, high-capacity near-line storage (also known as *tier 2* storage). Low-cost storage that must be frequently replaced, however, may force other systems to operate in a degraded mode, failing to deliver the required level of service and even driving up costs by demanding repeated maintenance and additional redundancy at the application or system layer. Although Serial ATA (SATA) hard drives can provide a capable, cost-effective foundation platform for near-line storage, IT organizations are constantly seeking higher levels of performance, efficiency, and reliability than these drives can provide.

The new Seagate Barracuda ES.2 Serial Attached SCSI (SAS) hard drive can help meet these needs, providing significant and comprehensive advantages for virtually every aspect of capacity-intensive enterprise applications (see Figure 1). Available in Dell PowerEdge servers and Dell PowerVault storage (see the “High-performance Seagate SAS drives in Dell systems” sidebar in this article), these drives are designed to maintain high performance even in the presence of rotational and linear vibration commonly encountered in high-density enterprise IT environments, as well as efficient operation, robust data integrity, and seamless integration into existing infrastructures.

EXCEPTIONAL PERFORMANCE AT THE DRIVE AND SYSTEM LEVEL

In April 2008, Seagate engineers tested the performance of the Seagate Barracuda ES.2 SAS hard drive using the Storage Performance Council (SPC) component-level SPC-1C and SPC-2C tests with an on-site SPC auditor present. These SPC benchmarks are designed to measure hard drive performance by simulating real-world workloads: SPC-1C simulates random workloads, while SPC-2C simulates large-scale sequential data movement of near-line storage applications characterized by large I/Os organized into one or more concurrent patterns, such as large file processing (large computer-aided design files or file copy operations), large database queries (scans or joins of large relational tables, or data mining or business intelligence), and video on demand (individualized video entertainment or drawing from a digital film library).

The test system was a server with two Intel® Xeon® processors at 2.8 GHz, 2 GB of RAM, a Super Micro X6DH8-XG2 motherboard, and an LSI SAS3041X-R SAS/SATA host bus adapter running the Microsoft® Windows Server® 2003 Enterprise Edition OS. The test team ran the benchmark tests against five different 1 TB hard drives in this system: a Barracuda ES.2 SAS drive, a Barracuda ES.2 SATA drive, and three third-party SATA drives. In the SPC-1C tests, the Barracuda ES.2 SAS drive provided 8–54 percent higher throughput than the third-party SATA drives.

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In the SPC-2C tests, the Barracuda ES.2 SAS drive provided 38–93 percent higher composite throughput than the third-party SATA drives (see Figure 2).¹

The performance advantages of near-line Barracuda ES.2 SAS drives over SATA drives extend to the system level, where the full-duplex, bidirectional SAS architecture allows systems to transmit data on two data channels simultaneously. This transmission might entail a write command on one channel and a read command on the other, or, for maximum throughput, the two channels can be combined into a single wide port that can concurrently transmit write or read commands.

OPTIMIZED PERFORMANCE PER WATT

A growing emphasis on reducing energy consumption and lowering data center operating costs has made hard drive power consumption and performance per watt key metrics for enterprise IT departments. Near-line SAS drives typically use similar amounts of power as comparable SATA drives—for example, 1 TB and 750 GB Seagate Barracuda ES.2 SATA drives are specified at 8.0 W when idle and 11.6 W when operational, with the addition of an interposer card adding 1.2 W for a total of 9.2 W when idle and 12.8 W when operational. Comparable 1 TB and 750 GB Barracuda ES.2 SAS drives are specified at 9.0 W when idle and 12.5 W when operational, and do not require an interposer card.

To demonstrate the power optimization of near-line SAS drives, in July 2008 Seagate

Exceptional performance	<ul style="list-style-type: none"> 33 percent average I/O performance boost over comparable SATA drive High levels of throughput in sequential read and write commands Full-duplex, bidirectional I/O and 7,200 rpm platter speeds Enhanced rotational vibration tolerance in high-density enclosures
Optimized performance per watt	<ul style="list-style-type: none"> Similar power consumption to a comparable SATA drive, and lower operational power consumption than a comparable SATA drive with an interposer card Seagate PowerTrim™ technology, which helps reduce power consumption, heat, and energy costs without sacrificing performance
Robust data integrity	<ul style="list-style-type: none"> End-to-end initiator-target nexus checking that helps ensure data moving to or from the drive is not misdirected, helping eliminate a key cause of data corruption Dual ports that enable failover and data recovery in multi-host storage environments
Simplicity and continuity in deployment	<ul style="list-style-type: none"> Easy enterprise-level management with support for up to 16 hosts per drive queue rather than one host for SATA drives Seamless SAS connectivity, avoiding the need for SATA interposer cards and helping reduce costs while minimizing servicing complexity Compatibility with existing SCSI software and middleware
Optimization for near-line enterprise storage	<ul style="list-style-type: none"> Support for up to 1 TB of storage for capacity-intensive applications Designed for 24/7 operation and a mean time between failures of 1.2 million hours Hot-swappable drives and four-wire cabling for quick, simple serviceability Increased reliability by eliminating single points of failure imposed by single-ported SATA drives

Figure 1. Seagate Barracuda ES.2 SAS drives can provide significant benefits in enterprise IT environments

engineers used the Iometer benchmark to compare the throughput of a Barracuda ES.2 SAS drive with that of a Barracuda ES.2 SATA drive in a Dell PowerVault MD1000 disk expansion enclosure configured with a Dell SAS 5/E controller. The write cache was disabled for these tests. The results demonstrated that the SAS drive provided a 7 percent improvement in sequential reads, 14 percent improvement in sequential writes, 100 percent improvement in random reads, and 9 percent improvement in random writes over the SATA drive, with an average 33 percent performance boost over the SATA drive.

As these results indicate, the SAS drive provided significantly higher performance

than the SATA drive with only fractionally greater power consumption, resulting in higher performance per watt. Adding an interposer card (frequently used to provide dual-port connectivity to SATA drives) can make the power consumption of a SATA drive equal to or even greater than that of a SAS drive, helping increase the performance-per-watt advantage of the SAS drive even further.

ROBUST DATA INTEGRITY AT THE SYSTEM LEVEL

Physical interconnect malfunctions can cause up to 68 percent of storage subsystem failures.² Lacking inherent dual-port failover capability, SATA systems often report such interconnect failures as a drive-not-found error, which can result in administrators misdiagnosing the problem as a drive failure rather than silent corruption while the data was being transmitted.

Given this limitation, it follows that near-line SATA drives and adapters typically develop silent data corruptions significantly more often than Fibre Channel or SAS drives. RAID storage arrays offer

HIGH-PERFORMANCE SEAGATE SAS DRIVES IN DELL SYSTEMS

High-performance, cost-effective Seagate Barracuda ES.2 Serial Attached SCSI (SAS) drives are currently supported in the following Dell systems:

- Dell PowerEdge server models 840, 860, 6850, 1900, 1950, 2900, 2950, 2970, 6950, 6970, SC440, SC1430, SC1435, R200, R300, R900, T105, T200, and T605
- Dell PowerVault storage models MD1000, MD3000, MD3000i, NF500, and NF600

¹For complete details, visit www.storageperformance.org/results.

²"Are Disks the Dominant Contributor for Storage Failures? A Comprehensive Study of Storage Subsystem Failure Characteristics," by Weihang Jiang, Chongfeng Hu, Yuanyuan Zhou, and Arkady Kanevsky, FAST '08: 6th USENIX Conference on File and Storage Technologies, February 26–28, 2008, San Jose, CA, www.usenix.org/event/fast08/tech/full_papers/jiang/jiang.pdf.

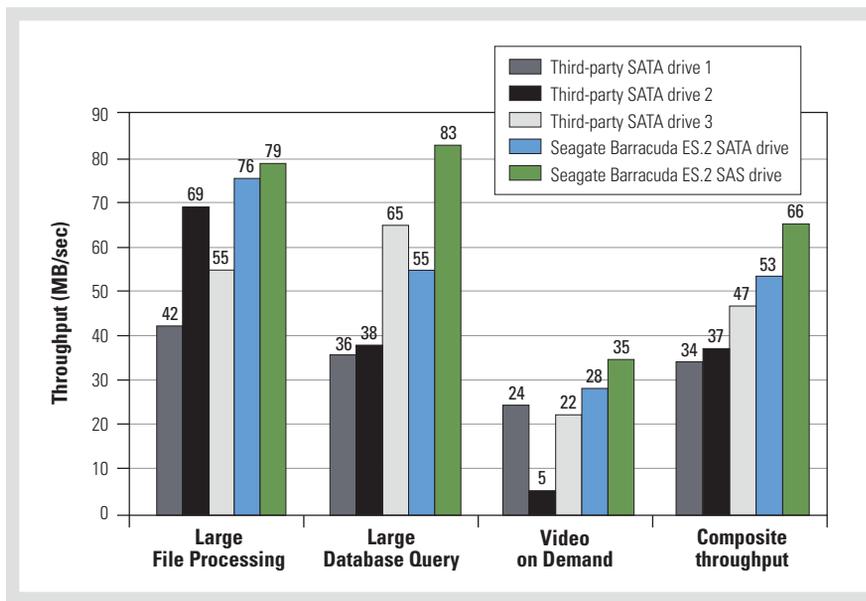


Figure 2. Seagate Barracuda ES.2 SAS drives can provide significantly higher performance than SATA drives

no protection from silent data corruption, because current file systems use checksums to help detect corrupt data when the data is read back, which may not happen until months after the corrupted data was written. Such delays can increase the chances that the uncorrupted data has been lost forever.

The goal of a RAID architecture is to provide data redundancy in the event of a failure, but by definition data corruption is an undetected failure—one that RAID offers no protection against. SAS drives help reduce data corruption with end-to-end initiator-target nexus checking, a key component of data integrity that helps ensure that data traveling to or from the drive is not misdirected. SATA drives cannot achieve this level of enterprise-class data integrity because they lack native addressability (although purchasing and deploying interposer cards can provide that capability, at additional cost).

Furthermore, SAS drives help decrease storage system failure rates by reducing the number of physical interconnects and adding dual-port redundancy (see the “Simplicity and continuity in deployment” section in this article). Administrators also gain enhanced access to advanced error reporting, which can

provide valuable information for effective troubleshooting.

SIMPLICITY AND CONTINUITY IN DEPLOYMENT

IT professionals can be reluctant to deploy storage systems that may disrupt operations. Near-line SAS drives, however, are designed to seamlessly integrate into the same SAS infrastructures that currently support critical tier 1 storage.

In addition, near-line SAS drives not only help eliminate the additional expense and complexity of SATA interposer cards, but also offer enhanced connectivity and failover capabilities. SAS command queuing enables one drive to accommodate up to 16 hosts, compared with the single host that a standard SATA hard drive can accept through native command queuing. Interposer cards can enable command queuing for a second host connection, but this approach is typically still inadequate for enterprise storage environments.

Support for a large number of host connections helps SAS drives avoid the single-point-of-failure risk that characterizes SATA drives. By avoiding the need for a SATA interposer card, SAS drives can also reduce total system parts count—a key consideration when designing for

high reliability. In addition, SAS hard drives can help ensure operational continuity and investment protection because of their compatibility with existing SCSI software and middleware.

OPTIMIZED, COST-EFFECTIVE SAS DRIVES

Enterprise-ready Seagate Barracuda ES.2 SAS hard drives are designed, tested, and optimized to handle the rigors of 24/7 operation in enterprise data centers. Providing exceptional performance, efficient operation, robust data integrity, and seamless integration with existing infrastructures, these drives can help organizations deploy optimized, cost-effective storage in their near-line/tier 2 storage ecosystems. [U](#)

Barbara Craig is a senior product marketing manager at Seagate, where she is responsible for product marketing for Seagate’s Enterprise Compute products, which comprise a broad range of high-capacity, high-performance, low-power hard drives for 24/7, business-critical IT environments. She has held a number of marketing positions over a 30-year career at various high-tech companies, and was most recently outbound product marketing manager at QLogic, where she was responsible for global marketing for original equipment manufacturer accounts. Barbara attended the State University of New York, Pepperdine University, and Vanderbilt University.

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