

Storage Synergies: Adaptec Series 5 Unified Serial Controllers and Seagate Barracuda ES.2 SAS Drives

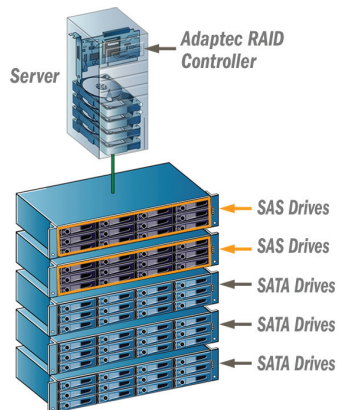
A new generation of storage controllers and disk drives is now available, optimal for a growing class of storage applications that require scalability, performance and reliability. Whether it's video surveillance applications that must retrieve specific data on demand or mushrooming 24/7 hosting infrastructures, the core need for these "Tier 2" or "nearline" applications is data access. Any storage solutions intended for such applications should combine rapid data access with superior reliability to ensure access remains constant. While the increasing complexity and scale of today's storage applications are the driving force behind next-generation controllers and disk drives, these applications also require the flexibility to take advantage of both types of serial disk drives: Serial ATA (SATA) and Serial Attached SCSI (SAS).

SATA hard disk drives (HDD) deliver enormous capacity (up to 1.5TB) at the lowest cost-per-GB, ideal for environments where capacity-per-watt takes precedence over the ability to withstand 100 percent duty cycles. Boasting rotation speeds up to 7200-RPM, the latest SATA drives offer far greater reliability than their predecessors while also incorporating a number of enterprise-class features. That said, all-SATA storage environments (SATA controllers and SATA HDDs) provide limited scalability, flexibility and performance.

By contrast, SAS HDDs are the gold standard in disk drive reliability and performance, albeit typically offering less capacity than SATA drives. This modest capacity, coupled with a primary focus on enterprise-class solutions, has historically limited broad SAS acceptance. Available with either 10K-RPM or 15K-RPM rotation speeds and a choice of 3.5-inch or 2.5-inch form factors, SAS drives are specifically engineered for 24x7 operation and continuous (100 percent) workloads.

Adaptec Series 5 Unified Serial™ RAID Controllers

The award-winning Adaptec Series 5 controller family represents the latest evolution of Unified Serial technology, which makes it possible for both SATA and SAS devices to be connected in the same storage infrastructure. As shown below, this enables companies to employ a single storage system for both mission-critical Tier 1 (online) storage on SAS drives and higher-capacity Tier 2 storage on SATA drives. Changing drive types, adding capacity, or upgrading the system to use only SAS drives is as simple as swapping disks.



Example of tiered storage built on Unified Serial™ Architecture

Figure 1: Unified Serial Architecture Seamlessly Blends Tier 1 and Tier 2 Storage

Adaptec Series 5 controllers also deliver best-in-class performance and scalability. Boasting the highest performance available from any controllers, the Series 5 family maximizes scalability by offering up to 28 ports. In addition, up to 256 devices can be connected to a single controller card using chassis with built-in SAS expanders. Configuration flexibility is further enhanced by the Series 5 controllers' inclusion of both internal and external ports.

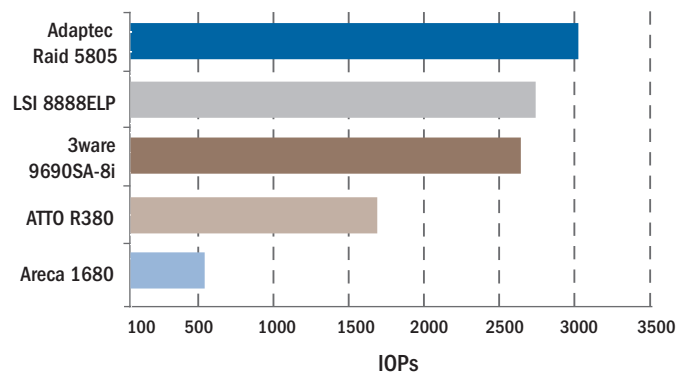


Figure 2: Adaptec Series 5 Controllers Outperform the Competition by up to 5X

Storage Synergies: Adaptec Series 5 Unified Serial Controllers

Adaptec also provides a wide range of RAID choices to ensure the optimal level of data protection. Such choices include RAID 6, which enables a storage system to sustain two disk drive failures without experiencing data loss.

Of course, while the unprecedented capabilities of Adaptec Series 5 controllers are indeed impressive, they don't exist in isolation. To take complete advantage of Series 5 controller performance, scalability and reliability requires disk drives that feature the same remarkable degree of technological innovation and manufacturing precision.

Seagate Barracuda ES.2 Disk Drives

The Seagate Barracuda, ES.2 SAS HDD is the one and only Tier 2 SAS drive available today, augmenting Seagate's renowned family of high-capacity 7200-RPM SATA HDDs. The dual-port failover capability, superior speed and data integrity of the new Seagate Barracuda ES.2 SAS drive, coupled with its enormous capacity, make it the ideal low-cost/GB enterprise-ready drive for business-critical and nearline storage solutions.

Barracuda ES disk drives incorporate a comprehensive suite of features to maximize reliability, including Workload Management, Seagate PowerTrim, technology and Error Recovery Control (ERC). Workload Management ensures that drives do not overheat during workload spikes or when operating outside normal drive conditions. PowerTrim dynamically optimizes power consumption by switching off components in the drive's electronic circuitry that aren't being used for the disk drive's current activity.

In addition, Error Recovery Control ensures that if a drive times out without completing the requested command, the drive stops the command and returns an error status to the host. This enables the host to rebuild the data from other RAID drives without failing the complete RAID set. The result? Fewer system time-outs and less frequent RAID rebuilds, which translates into greater reliability and productivity.

Used in conjunction with Adaptec Series 5 Unified Serial controllers, the new family of Seagate Barracuda ES.2 high-capacity Tier 2 SAS drives enables every business to reap the rich rewards of SAS performance, scalability and reliability.

Performance per Watt is Key

In a data center, power consumption is an increasingly important cost factor, and one key metric for storage system power consumption is performance-per-watt. The Adaptec Series 5 controller family offers up to five times the performance of competitors when carrying out critical storage tasks such as sequential and random reads/writes.

Such impressive performance is delivered via a highly efficient ROC (RAID on Chip) architecture that reduces power consumption on the controller board. For example, the Adaptec RAID 5805 8-port controller consumes only .45A@3.3 volts, less than half the power consumption of its predecessors (which utilized discrete components).

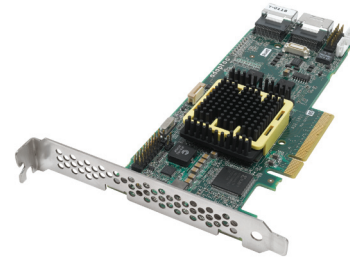


Figure 3: The Adaptec RAID Series 5 family of products reduce power consumption

To press the SAS performance-per-watt advantage still further, the Seagate Barracuda ES.2 SAS drive delivers superior throughput, with an average 135 percent increase over its Barracuda ES.2 SATA siblings.

PERFORMANCE*

135% Average Performance Boost over SATA

- ✓ 110% improvement in sequential reads
- ✓ 390% improvement in sequential writes
- ✓ 20% improvement in random reads
- ✓ 23% improvement in random writes

*Write Cache Off

Figure 4: Seagate Barracuda ES.2 SAS HDD Boosts Performance

Such striking performance benefits are due to the Barracuda ES.2 SAS drive's use of the powerful SCSI command set (including SCSI command queuing), dual core processors (vs. a single core processor on SATA) and hardware sequential streaming support. Support for bi-directional full-duplex mode provides two active channels for concurrent read and write operations as opposed to the single-channel half-duplex mode of SATA (see below).

Full Duplex, Dual Port & 2 Active Channels

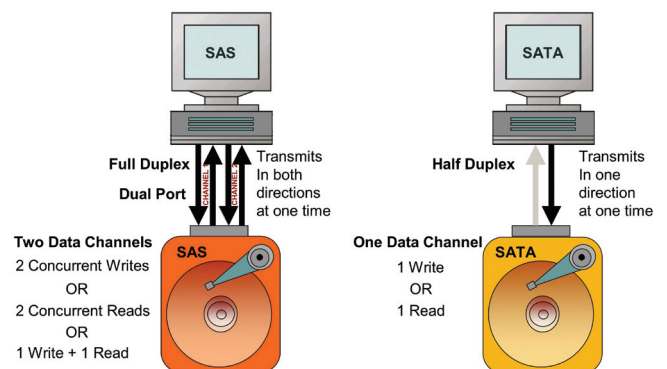


Figure 5: SAS Employs Two Active Data Channels for Superior Performance

Storage Synergies: Adaptec Series 5 Unified Serial Controllers

Performance-per-watt is boosted even higher by Seagate's PowerTrim technology, which is integrated into the Barracuda ES.2 drive family and dynamically manages drive power consumption at all levels of activity. The Barracuda ES.2 drive addresses the IT dilemma facing energy-constrained data centers with a 20 percent reduction in overall drive power consumption, as well as a best-in-class 55 percent reduction in watts-per-GB, compared to previous generations of Barracuda ES drives.

As a result, moving to SAS gives customers an up to 38 percent improvement in performance-per-watt over SATA, in addition to the superior performance and data integrity that distinguish Barracuda ES.2 SAS disk drives.

Redundancy and Reliability Benefits of the SAS Interface

Simply put, SAS offers both superior performance and more sophisticated data integrity and protection. SAS employs I/O Error Detection (IOEDC) to verify both data content and location, compared to SATA which only verifies content. Similarly, SAS I/O Error Correction (IOECC) corrects data errors on both reads and writes, as opposed to SATA which only does so on writes.

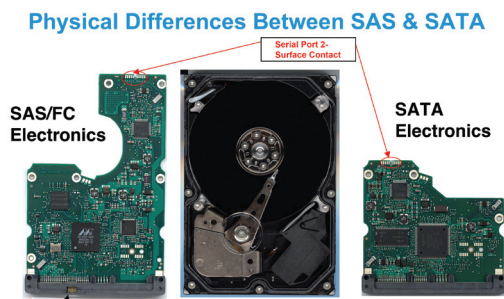


Figure 6: More Sophisticated SAS Circuitry Delivers Better Performance, Data Integrity

Greater performance and reliability are enabled by the dual-port interface of the Seagate Barracuda ES2 SAS drive, which gives it two discrete SAS ports through which data can be transferred. Used in concert with Adaptec Unified Serial RAID controllers, these ports can provide separate, redundant paths to the controllers.

Known as "Dual Path Failover," this feature enables both ports of a drive to be connected to separate ports on a controller via different cables. When both connections are functioning, the controller can use this dual-path configuration to boost performance in high-traffic storage environments. Should a cable or connection fail, the controller can switch over to the remaining connection and preserve access to the SAS disk drive.

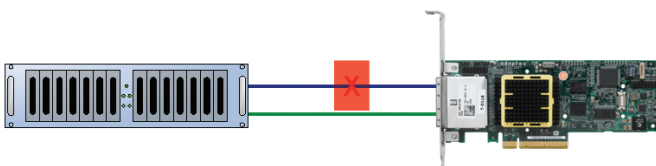


Figure 7: Dual-Path Failover Capability of SAS Ensures Data Availability

By contrast, achieving basic dual-port capability with a SATA drive requires an interposer board that contains a multiplexer switch (known as a "MUX"), necessary to activate the redundant connection when a drive connection fails. Not only does an interposer fail to provide full SAS functionality, it also creates a single point of failure, adds more parts/complexity to the drive and increases disk drive power consumption.

Indeed, the combined power consumption of an interposer board and the SATA version of the Barracuda ES.2 disk drive is higher than the power consumption of the same Barracuda ES.2 drive equipped with the SAS interface!

Adaptec Unified Serial Technology and Seagate Barracuda ES.2 SAS Drives in Server Environments

In Tier 1 (also known as online) server storage environments where absolute reliability and the highest I/O throughput are required, high-performance SAS disk drives such as the Seagate® Savvio™ (2.5-inch form factor) and Seagate® Cheetah™ (3.5-inch form factor) used in conjunction with Adaptec Series 5 High Performance RAID controllers for SATA & SAS drives continue to remain the optimal solution.

However, in less stringent Tier 2 storage environments Seagate Barracuda ES.2 SAS drives and Adaptec Series 5 RAID controllers (supporting both SATA & SAS drives) offer distinct advantages. They enable companies to enjoy the high capacity associated with SATA, along with the performance, reliability, and scalability that distinguish the SAS interface, all at a far more affordable price point than that of mission-critical Tier 1 SAS drives.

SAS drives also benefit from the support and troubleshooting capabilities of the SCSI protocol. For example, the drive can provide critical information about medium error count ("Grown Defects") and error messages (SCSI Sense key). These messages assist analysis of why the drive failed in certain environments (internal hardware defect, power supply issues, data transfer problems, etc.), information that is very useful in finding the root cause of problems and determining the appropriate fixes.

Conversely, in all-SATA storage environments the reason for failure is often unclear and the drive is simply replaced, even though faulty connectors or power supply issues may be at the root of the problem. In such cases replacement of the "defective" drive does not address the underlying issue, and the new drive will appear to fail as well.

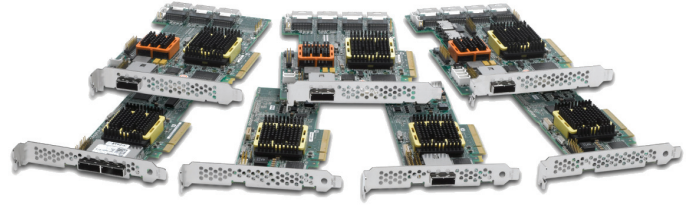
For companies that typically look to SATA HDDs for business-critical Tier 2 storage, the Seagate Barracuda ES.2 SAS drive in conjunction with the Adaptec Series 5 RAID controller deliver a far more powerful storage solution at only a trivial price difference. The many benefits of the SAS interface (including its ability to reduce Total Cost of Ownership via higher performance, more reliable data transfers and better failure analysis capabilities) make this solution the ideal choice for cost-effective Tier 2 storage environments.

Conclusion

For today's storage needs, SATA solutions using Adaptec Series 5 RAID controllers (with proven high performance for most applications) and Seagate's vast array of SATA drives, provide the most cost-effective storage solution for storage applications with web, file, email, video, OLTP and general purpose servers.

In addition, the combination of Adaptec's Series 5 High Performance Unified Serial RAID Controller family, designed to handle both SATA and SAS drives, and Seagate's Barracuda ES.2 SAS disk drives brings unprecedented power and value to business-critical and nearline storage solutions. Together these controllers and drives deliver the key performance, reliability and scalability advantages that make SAS storage so compelling...all for virtually the same price as a SATA-only solution.

Adaptec Series 5 RAID Family



Highest Performance Unified Serial RAID controllers – Seven Models

Adaptec RAID 52445:	28 ports (24 internal / 4 external)
Adaptec RAID 51645:	20 ports (16 internal / 4 external)
Adaptec RAID 51245:	16 ports (12 internal / 4 external)
Adaptec RAID 5805:	8 internal ports
Adaptec RAID 5085:	8 external ports
Adaptec RAID 5445:	8 ports (4 internal / 4 external)
Adaptec RAID 5405:	4 internal ports

Performance

- Up to 5X faster than competitive RAID controllers

Scalability

- 256 device support, double the industry standard; internal and external port connections satisfy the need for capacities of approximately 200TB per system

Total Compatibility with the Storage Ecosystem

- Over 300 disk drives, motherboards, and chassis work seamlessly with Adaptec Series 5 controllers

Ideal Product Deployment

- Web Hosting
- Digital Surveillance
- Medical Imaging
- Communications



Seagate Barracuda ES.2 SAS 1TB Disk Drive



SAS Functionality & Features

Dual Port	Full Duplex (Bidirectional I/O)
Variable Sector Size	Two Concurrent Data Channels
Multiple Host Support	Multi Host Command Queuing
Full SCSI Command Set	Mode Pages
Independent Port Clocking	Low Power

Figure 8: Premium SAS Functionality with Cost-Conscious SATA Pricing

Barracuda ES.2 SAS – Three Models

Seagate ST31000640SS:	1 TB capacity*
Seagate ST3750630SS:	750 GB capacity*
Seagate ST3500620SS:	500 GB capacity*

*One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes

Product Highlights

- Perpendicular recording technology for maximum capacity
- 24x7 operation and 1.2 million hours MTBF
- Dynamic power saving using Seagate PowerTrim™ technology
- Broad spectrum rotational vibration tolerance at 12.5 rads/s²

- Designed to sustain performance in densely-packed multi-drive systems
- Error Recovery Control - quick error resolution to prevent system timeouts
- Workload management to ensure operational reliability
- Quick and robust download with firmware security checks
- Write Same command for efficient RAID initialization
- Idle Read After Write data integrity checking
- Unrecoverable error rate 10 times better than desktop-class drives
- 16 MB cache
- Industry-leading five-year limited warranty

Best-Fit Applications

- Storage-hungry business applications
- Network attached storage (NAS)
- Storage area networks (SAN)
- Maximum capacity servers
- Rich media content storage—audio, video, image
- Reference and compliance data storage
- Enterprise backup and restore—D2D, virtual tape
- Collaboration—email, messaging
- Infrastructure—Web, print, file

adaptec

Adaptec, Inc.

691 South Milpitas Boulevard
Milpitas, California 95035
Tel: (408) 945-8600
Fax: (408) 262-2533

World Wide Web: www.adaptec.com

Pre-Sales Support: US and Canada: 1 (800) 442-7274 or (408) 957-7274

Pre-Sales Support: Europe: Tel: (44) 1276-854-500 or Fax: (44) 1276-854-505



Seagate Technology

920 Disc Drive
Scotts Valley, California 95066
Tel: (831) 438-6550

Copyright 2008 Adaptec, Inc. All rights reserved. Adaptec, the Adaptec logo, Storage Manager, and Storage Manager Pro are trademarks of Adaptec, Inc., which may be registered in some jurisdictions. Microsoft, Windows, Windows NT, and Windows 2000, are registered trademarks of Microsoft Corporation, used under license. All other trademarks used are owned by their respective owners.

Information supplied by Adaptec Inc., is believed to be accurate and reliable at the time of printing, but Adaptec Inc., assumes no responsibility for any errors that may appear in this document. Adaptec, Inc., reserves the right, without notice, to make changes in product design or specifications. Information is subject to change without notice.

Copyright © 2008 Seagate Technology LLC. All rights reserved. Printed in USA. Seagate, Seagate Technology and the Wave logo are registered trademarks of Seagate Technology LLC in the United States and/or other countries. [Mark A], [Mark B] and [Mark C] are either trademarks or registered trademarks of Seagate Technology LLC or one of its affiliated companies in the United States and/or other countries. All other trademarks or registered trademarks are the property of their respective owners. When referring to hard drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Quantitative usage examples for various applications are for illustrative purposes. Actual quantities will vary based on various factors, including file size, file format, features and application software. Seagate reserves the right to change, without notice, product offerings or specifications.

Part Number: 667090-011 Printed in U.S.A. 07/08 6190_1.2