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Technology Paper

High-Capacity RAID Revolution

Introduction

Two powerful forces are shaping today's enterprise storage landscape: the pressure for greater efficiency and cost-effectiveness, and the inexorable demand for more storage capacity. Reconciling these rival imperatives falls to IT managers, who must balance upper management's fiscal goals with a stringent mandate that IT deliver seamless performance, capacity and reliability.

Conceptually, the path to more efficient storage is straightforward: Deploy multiple levels of storage to optimize price/performance based on the specific characteristics (quantity, required availability, and so forth) of the data. Such a specialized approach demands multiple device types, each cost effectively performing its respective storage duties.

Driven by dramatic growth in areal densities, the emergence of affordable disc drives offering vast capacities and high performance was a watershed event in the evolution of enterprise storage. The low cost-per-GB of desktop-class Serial ATA (SATA) drives has spurred development of a new class of RAID-based storage to serve high-capacity applications. High-capacity, SATA-based RAID storage is key to making cost-effective storage for business applications a reality.

But for one glaring problem: most SATA drives are designed for the desktop, not RAID-based applications. While effective in some low-end server environments with usage profiles that resemble those of desktop computers, these drives are incongruous with enterprise storage duties. Lacking the high reliability and RAID-friendly integration features required by capacity-intensive 24x7 applications, desktop drives are clearly not the storage panacea some hoped they might be.

Enter the new genre of high-capacity/RAID-optimized SATA drives—engineered for 24x7 operation and purpose-built to excel in RAID environments.

Evolution of High-Capacity RAID

Born of necessity and fueled by skyrocketing areal densities, the movement towards high-capacity RAID storage quickly gained traction in the enterprise because it held the promise of simultaneously cutting storage costs and improving data accessibility. The burgeoning wave of voluminous, inexpensive ATA drives could serve capacity-intensive applications at significantly lower cost-per-GB than SCSI/SAS drives, while delivering far faster data access than offline tape libraries.

Initial forays into high-capacity RAID storage met with mixed results, largely due to the unavoidable reliance on parallel ATA drives. Hamstrung by the interface's inherent limitations (poor throughput with multiple users, master/slave and termination issues), IT professionals have nevertheless managed to achieve a modicum of success with low-end servers and RAIDs equipped with ATA drives.

But it wasn't until the arrival of SATA disc drives that high-capacity, RAID-based storage galvanized the enterprise market.

SATA at Center Stage

With its modern serial architecture, superior throughput (3 Gbits/sec) and lack of master/slave headaches, SATA has quickly superseded its parallel predecessor both on the desktop and in some low-end server applications. Some IT managers, under growing pressure to reduce costs, contemplated SATA's blend of performance and low cost-per-GB and quickly concluded that SATA drives are ideally suited for high-capacity RAID-based applications.

However, many experienced IT professionals have been more circumspect, troubled by factors less immediately obvious but nevertheless crucial in determining SATA's RAID storage value proposition. Despite myriad technological advancements over their venerable forebearers, typical SATA drives remain at their core desktop-class devices. As such, they are designed for eight-hours-per-day, five-days-per-week deployment with light workloads, rather than the 24x7 demands of enterprise-ready RAID storage.

With this last point in mind, would low initial expenditures on desktop-class SATA drives be counterbalanced by higher rates of drive failure and the attendant costs of RAID volume rebuilds, downtime and diminished productivity? Such a scheme significantly decreases storage efficiency...and demands a better alternative.

RAID-Ready SATA Advantages

The solution is high-capacity SATA drives specifically designed for use in RAID and other multi-drive systems. As one would expect, such drives deliver the exceptional enhanced reliability that 24x7 capacity-intensive applications demand. In addition to RAID multi-drive firmware features that increase system uptime, optimize performance and ease management, these drives offer even more value thanks to their compatibility with Serial Attached SCSI (SAS).

SAS retains the proven strengths of its predecessor (rock-solid reliability, a rich and mature command set) while achieving blazing throughput and remarkable scalability. Equally compelling, SAS/SATA compatibility enables performance (SAS) and capacity (SATA) applications to be addressed within the same SAS domain, even the same enclosure. And unlike SATA cabinets/enclosures, SAS hardware is specifically designed to meet the density requirements (for example, vibration and temperature management) of enterprise environments.

As can be seen, the theoretical benefits of deploying high-capacity SATA solutions are substantial and far-reaching. Seagate® has created the Barracuda ES drives to make those benefits a reality.

Seagate Barracuda ES[1]

Barracuda ES is a new class of enterprise storage developed in response to the growing need for cost-effective multi-drive storage. Purpose-built for the demands of capacity-intensive 24x7 applications, Barracuda ES drives deliver an unprecedented blend of enormous capacity, superior reliability and high performance in tightly packed multi-drive systems.

Barracuda ES drives enable RAID systems that perform more reliably and are easier to build and support. Incorporating industry-leading, multi-drive features, such as Error Recovery Control, One-Step Microcode Download and Write Same, Barracuda ES drives speak the *language* of complex system controllers and hosts, simplifying system integration, improving RAID performance and reducing drive failures.

Barracuda ES drives include additional features to ensure they meet the stringent requirements of 24x7 RAID storage applications:

- The highest capacity, with up to 750GB per drive—50 percent more than other drives of the same class.
- High tolerance to rotational vibration makes NL35 Series drives ideal for closely-packed RAID system designs.
- Protection by the unparalleled Seagate 5-Year Warranty

Available in 250GB, 400GB, 500GB and 750GB capacities, Barracuda ES drives boast the industry's highest capacity, maximizing scalability in dynamic, capacity-intensive RAID systems. Hundreds (even thousands) of Barracuda ES drives can be deployed and managed within a single SAS domain, enabling highly scalable, cost-effective storage solutions for capacity-hungry applications.

[1] Fibre Channel versions available through leading storage system manufacturers

Seagate Barracuda ES SATA[1] (Serial ATA) Overview	
FEATURE	BENEFIT TO ENTERPRISE
250GB, 400GB, 500GB and 750GB Capacities	The industry's highest capacity increases storage density by up to 50 percent and lowers cost-per-gigabyte for capacity-intensive storage applications.
High Reliability in 24x7 Workloads	Operates in RAID and other multi-drive environments without compromising application performance or availability; tougher than standard desktop SATA drives
Workload Management	Seagate proprietary technology that protects drives from extreme workloads to optimize drive reliability
8- and 16-Mbyte Cache	More efficient processing of peak workloads
Native Command Queuing	More efficient processing of peak workloads
Error Recovery Control	Eliminates false drive failures caused by desktop drive error recovery processes
High Rotational Vibration Tolerance	Ready to operate in multiple-drive arrays. 500GB model uses RV Feed Forward for the highest RV tolerance.

[1] Fibre Channel versions available through leading storage system manufacturers

Conclusion

Intended to increase efficiency and reduce storage costs, high-capacity RAID solutions can instead add expense and complexity by relying on desktop-class SATA drives not designed for enterprise duty. Optimized for capacity-intensive 24x7 applications, Seagate Barracuda ES drives have the high capacity, high reliability and multi-drive features needed to make cost-effective RAID storage a reality.

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