



SAS: The New Paradigm

by Seagate & Xyratex

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Introduction

Efficiency is the watchword in today's businesses as they strive to achieve the optimal blend of performance and cost effectiveness. This can be a delicate balance: Investing in unnecessarily powerful and costly solutions is wasteful, yet deploying inexpensive and underpowered solutions can seriously degrade system performance and overall productivity. In either case the bottom line ultimately suffers.

The advent of Serial Attached SCSI (SAS) answers the growing demand for more flexible storage solutions that deliver both higher performance and greater economics. SAS retains the proven strengths of its parallel predecessor (rock-solid reliability, a rich and mature command set) while achieving exceptional throughput and remarkable scalability. But perhaps SAS's most compelling feature is its compatibility with Serial ATA (SATA), which enables unprecedented freedom to select the most appropriate, cost-effective disc drive for a given storage application.

Now savvy IT managers can quickly deploy storage solutions tailored to their specific needs: SAS drives are clearly the best choice for mission-critical use, where transactional/online performance and reliability are crucial, while SATA drives are cost-effective for capacity-oriented applications, such as archive, and disk-to-disk backup. Because SAS and SATA disk drives can be consolidated on a common backplane and housed in a single enclosure, one SAS-based subsystem can economically handle the full gamut of storage duties for a broad variety of businesses.

Four distinct attributes of SAS make such storage efficiency possible: Performance, SAS/SATA Compatibility, Scalability and SAS/SCSI Integration.

Performance

It's clear that explosive growth in transactional business data will continue unabated, posing significant performance challenges for any storage solution. With a transfer rate of 3.0 Gbits/sec (and a clear roadmap to 12.0 Gbits/sec), Serial Attached SCSI utilizes full duplex, point-to-point architecture to ensure superior performance now and in the foreseeable future.

Full duplex operation doubles effective throughput by enabling simultaneous signal transfers in both directions. To provide for high availability and greater uptime, dual data ports ensure that if one SAS host controller fails, the extra data port can maintain uninterrupted communication with a second controller. In addition, these two ports can be combined into a single “wide port” for even higher throughput.

SAS’s point-to-point cabling ensures maximum bandwidth by providing a dedicated signal path for each device, eliminating the shared bus bandwidth slowdowns and bottlenecks of parallel SCSI. This also means the end of daisy-chain address conflicts and termination headaches.

SAS performance is further enhanced by integrating the same SCSI command sets that support today’s small-to-medium business and small-to-medium enterprise (SMB/SME) storage environments, ensuring rapid and reliable throughput under high-demand traffic conditions such as e-commerce applications, which entail frequent, concurrent access by multiple initiators or hosts.

SAS/SATA Compatibility

The freedom to select the most appropriate disc drive for a given task is fundamental to maximizing storage efficiency and cost effectiveness. Yet until now IT managers have had few options in that regard. Serial Attached SCSI provides much needed flexibility by leveraging existing SATA standards to enable compatibility with its serial cousin.

By ensuring its cables/connectors, backplanes, expanders and host bus adapters (HBAs) are fully compatible with SATA drives, SAS enables a single SAS-based storage subsystem to support both online and near-line applications. High performance 15K-RPM SAS drives are optimal for transactional, high availability duties, while high-capacity 7200-RPM SATA drives are best suited to archival, low availability environments. Both drive types can seamlessly share a common SAS enclosure; and when storage priorities shift, adapting the drive mix is simply a matter of plugging additional SAS or SATA drives into the SAS backplane.

As a further benefit, standardizing on a single SAS platform significantly reduces the cost and complexity of the data center by minimizing the number of individual components that must be qualified, purchased, inventoried and maintained. Such component rationalization also results in a smaller data center footprint, and places fewer demands on management resources and support staff.

Scalability

As the volume of SMB/SME data continues its relentless expansion, any viable long-term storage strategy must include simple, cost-effective scalability as an essential component. Scalability was never among parallel SCSI’s strengths, and a key goal of Serial Attached SCSI was to vastly improve the ease with which drives could be added to increase capacity and throughput.

In concert with SAS's point-to-point architecture, inexpensive switches known as expanders enable quick aggregation of many drives, allowing a single SAS domain to contain up to 16,384 devices (128 maximum SAS devices per edge expander x 128 maximum edge expanders per fan-out expander) while preserving performance.

Furthermore, the compact cabling and connectors employed by SAS (and SATA) free up valuable space inside enclosures, improving airflow and cooling while making drive installation and removal simpler. Hot plug capability enables drive swapping without system shutdown to maximize availability, while blind mate connectors ease connection in cramped or inaccessible installations.

SAS/SCSI Integration

While Serial Attached SCSI overcomes many of parallel SCSI's interface limitations through the use of modern serial-based technologies, it also maintains the acclaimed reliability of its predecessor by integrating existing SCSI commands. SCSI's robust, mature command set employs sophisticated features such as Cyclic Redundancy Check (CRC) to ensure rock-solid data integrity, even in the most rigorous SMB/SME environments.

Furthermore, the SCSI commands interface with a broad variety of storage management and application software. By incorporating this command set, SAS also protects a company's current investment in SCSI software, middleware and drivers.

In addition, SAS also preserves the value of SMB/SME's vast SCSI intellectual capital, garnered over many years of configuring, deploying and maintaining SCSI storage solutions. IT professionals can continue to tap this wellspring of SCSI knowledge and experience, helping to drive innovative and effective SAS deployments throughout their businesses.

As IT budgets continue to undergo intense scrutiny, the pressure to rationalize and consolidate storage systems has never been greater. Serial Attached SCSI takes a holistic approach to achieving this goal, delivering a compelling blend of performance, SATA compatibility, scalability and SCSI integration to enable a new class of high-performance, high efficiency storage solutions. SAS gives IT managers unprecedented flexibility to deploy targeted, cost-effective storage systems that can easily adapt and scale as needs change. Simply put, SAS establishes a new paradigm for efficient SMB/SME storage.

Xyratex F5402E FC to SAS/SATA RAID Subsystem

As the above overview illustrates, the theoretical benefits of a SAS-based storage strategy are significant and far-reaching. The Xyratex F5402E RAID Subsystem was specifically designed to make those benefits a practical reality.

By combining high-performance SAS and cost-effective SATA disc storage in one SAS system, the Xyratex F5402E enables businesses to optimize performance and cost effectiveness over a broad range of applications. Now a

single RAID system can efficiently support both rigorous transactional, high availability online applications and capacity-intensive near-line environments.

The Xyratex F5402E provides remarkable scalability, enabling capacity to be seamlessly increased up to 30TB. Furthermore, data management is greatly simplified by the ability to dynamically adjust the mix of SAS and SATA drives as business needs evolve. When growth in critical transactional activity demands expanded SAS storage, it's literally a snap to plug in more SAS drives. And additional SAS capacity can be quickly made available by easily migrating less frequently accessed data to SATA storage.

Complementing this exceptional degree of flexibility, the Xyratex F5402E delivers extraordinary speed. Boasting throughput three times faster than parallel SCSI storage solutions, it excels in even the most bandwidth-intensive applications. The F5402E's remarkable performance relies on its point-to-point architecture, which ensures a dedicated, discrete signal path for every storage device. Further boosting throughput, full duplex operation allows data to be simultaneously transferred in both directions.

Reliability is a fundamental priority for all businesses, and the Xyratex F5402E employs a comprehensive suite of tools to ensure data integrity and availability. The time-tested SCSI command set incorporates robust error checking protocols to safeguard data transfers, while dual ported SAS drives combine with the dual disc I/O interface module's host-based path failover to maintain availability in the event of host controller malfunction. Should a drive failure occur, replacement drives can be hot swapped into service without powering down the system.

Greater storage efficiency continues to be a key goal for companies large and small, and achieving this objective requires the flexibility to deploy the most appropriate, cost-effective storage solution for every application. The Xyratex F5402E provides such flexibility, enabling SME/SMBs to support highperformance online applications (SAS) and capacity-oriented near-line applications (SATA) with a single storage system. In addition, the F5402E's SCSI foundation protects existing investment in SCSI software and eases migration to SAS. In the near future the Xyratex F5402E will be upgradeable to a high availability storage system. In short, the F5402E delivers exceptional return on investment over a broad range of business applications, while preserving the value of current IT environments.

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