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Technology Paper

Rationalizing the Data Center

Executive Summary

Several years ago the enterprise IT infrastructure, already growing at an impressive pace, kicked into high gear. Spurred by the red-hot Internet economy and widespread concern over the Y2K crisis, infrastructure investment leapt to unprecedented levels. In the rush to deployment, little time was allotted to ensure proper integration and coordination of these systems. When the economic bubble burst, many enterprises found themselves awash in expensive, complex systems that were both inefficient and maintenance-intensive.

In today's more thoughtful economic climate, rationalizing the data center is crucial to reducing costs and improving productivity in the short term, while laying the groundwork for more strategic, measured growth in the long term. Reducing the number and size of data centers, consolidating the plethora of systems in those centers into fewer, more efficient configurations, and deploying more targeted, cost-effective storage solutions in those systems are key elements of rationalization.

Four distinct attributes of Serial Attached SCSI (SAS) make it uniquely suitable for achieving optimal enterprise storage rationalization: performance, compatibility, scalability and flexibility. The greater the flexibility in choosing and deploying storage systems, the more likely enterprise IT managers can achieve optimal performance and cost-effectiveness. SAS offers an unparalleled degree of freedom to create high-performance storage solutions that can easily scale and adapt as needs change.

Infrastructure in Overdrive

Just a few short years ago the enterprise was at the forefront of stupendous economic growth, scrambling to keep up with a data explosion unprecedented in the Information Age. The Internet's meteoric rise was continuing unabated, e-business and e-commerce had quickly established themselves as essential business models, and every day seemed to bring another flurry of mergers and acquisitions. Harried IT managers found themselves in reactive mode, adding new data storage solutions at breakneck speed with little time (or fiscal incentive) to calculate the long-term financial consequences. IT budgets were plump and business opportunities apparently unlimited. Woe indeed to any IT department that jeopardized potentially lucrative new ventures by failing to ensure sufficient storage capacity and bandwidth.

And in the midst of this economic euphoria, the specter of catastrophic data loss due to the Y2K bug provided yet another justification for costly infrastructure upgrades. With business revenues running at fever pitch, almost any expenditure necessary to safeguard those revenues was deemed acceptable.

Not surprisingly, enterprise IT investment soared to then-record levels as firms around the globe poured money into state-of-the-art storage solutions (as well as brawny servers and powerful business applications) to accommodate their burgeoning businesses. Of course, it was also necessary to hire legions of additional IT personnel to deploy and maintain those sophisticated assets.

And then the economic bubble burst...

Cost and Complexity

In the aftermath, characterized by rapidly dwindling revenues, the enterprise was forced to critically examine every aspect of operations for possible cost-cutting opportunities, and found itself drowning in a plethora of expensive, complex IT infrastructure. It soon became apparent that in the rush to deploy these cutting-edge solutions, insufficient time had been taken to integrate them into existing infrastructures or even ensure proper coordination between newly-deployed systems. Constant mergers and acquisitions exacerbated the problem by demanding that dissimilar systems, often at widely remote locations, be jury-rigged together.

The result was a hodgepodge of redundant and often incompatible infrastructure, with mediocre efficiency and vexing reliability. When massive budget cuts made the grim reality of IT staff layoffs an almost daily ritual, the ability to effectively monitor and troubleshoot these problematic systems quickly diminished.

Of course technological progress marches on, even in sluggish economies, and soon much of the enterprise's costly infrastructure was rendered obsolete. Beyond the expected advancements (faster and higher-capacity disc drives, speedier processors, improved I/O, and so on), the latest generation of enterprise systems also marked a newfound sensitivity to tightly-constrained IT budgets. A new breed of economical, minimalist systems (for example, ATA-based NAS and blade servers) quickly found favor with cost-conscious IT managers keeping a close eye on new expenditures.

Unfortunately, though many businesses were long overdue for infrastructure upgrades, the stagnant marketplace ensured there were simply no funds available for replacing outdated systems with newer, more efficient ones. And as noted above, razor-thin budgets even precluded adequate IT staff to maintain those obsolete systems. For many companies it was simply a question of making do with the existing infrastructure, of hunkering down and weathering the fiscal storm.

Lessons Learned

Happily the storm has now passed and stoic resolve is gradually being replaced by cautious optimism for sustained growth over the long term. As difficult as the economic downturn was, it provided a valuable lesson on the importance of a fundamental enterprise tenet: IT infrastructure investment must emphasize **long-term goals** rather than **short-term prospects**, must be thoughtfully **proactive** rather than hurriedly **reactive**.

As IT budgets are slowly increased and pent-up demand for new systems is gradually addressed, the first task for savvy IT managers is to evaluate their current infrastructure and determine how today's more targeted solutions can help lower costs and improve efficiency now, while still remaining viable in the long term. The most direct and effective means to achieve this goal is **rationalization of the data center**: simply put, paring down the multitude of decentralized data centers (and servers they house) to fewer, smaller and more centralized centers while simultaneously consolidating the storage systems within to ensure optimal performance and efficiency.

The cost savings that can be realized from data center rationalization are significant: less hardware and smaller physical spaces yield obvious economies, but they also enable fewer IT personnel to administer and maintain the systems, an important factor when considering data center overhead.

How to Rationalize Enterprise Storage With Serial Attached SCSI

Four distinct attributes of Serial Attached SCSI (SAS) make it uniquely suitable for achieving optimal enterprise storage rationalization:

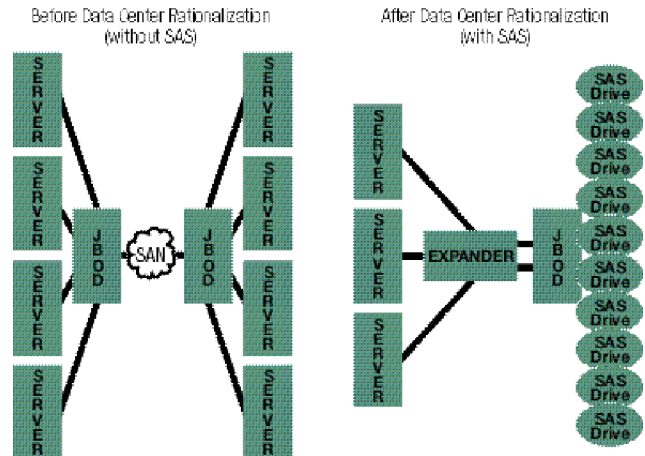
- Performance
- Compatibility
- Scalability
- Flexibility

Storage Rationalization Through SAS Performance

With a transfer rate of 3.0 Gbits/sec (and a clear roadmap to 12.0 Gbits/sec), Serial Attached SCSI accelerates storage to remarkable speeds by utilizing full-duplex, point-to-point architecture. Full-duplex operation enables signal transfers to take place in both directions simultaneously, doubling effective throughput. Dual data ports ensure high availability—in the event one SAS host controller fails, the extra data port maintains uninterrupted communication with a second controller. In addition, these two ports can be combined into a single “wide port” for higher throughput. Point-to-point cabling ensures maximum bandwidth by providing a dedicated signal path for each device, banishing the shared bandwidth slowdowns and bottlenecks of its parallel predecessor. 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 enterprise storage environment, ensuring superior throughput under high-demand enterprise traffic conditions, such as e-commerce applications, which entail frequent, concurrent access by multiple initiators or hosts.

Storage Rationalization Through SAS Performance—Benefit: SAS performance makes it a viable, highly cost-effective alternative to Fibre Channel when remote servers are consolidated in centralized data centers (that is, local-attach environments).



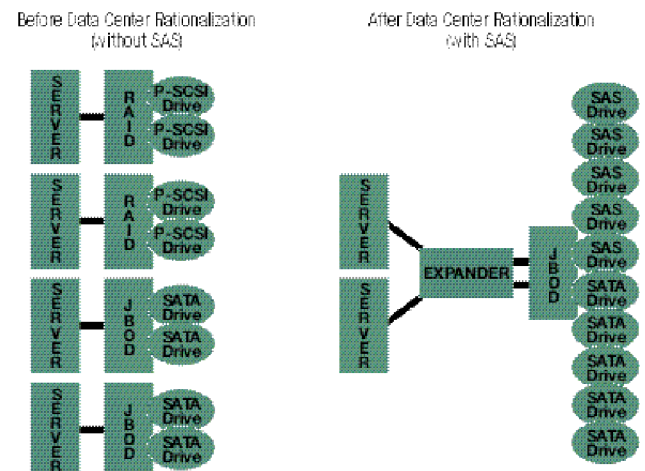
Consolidating multiple remote servers in a centralized data center can yield even greater savings if SAS drives are then deployed in place of Fibre Channel SANs.

Storage Rationalization Through SAS Compatibility

Serial Attached SCSI cables/connectors, backplanes and host bus adapters (HBAs) are fully compatible with Serial ATA (SATA) drives. Furthermore, SAS employs three different protocols to transport information over its serial interface, one of which (Serial ATA Tunneling Protocol, or STP) enables SAS controllers to identify and communicate with Serial ATA devices.

SAS provides the path through which deployment of SATA in the enterprise offers the greatest strategic benefit—the freedom to select the most appropriate disc drive for a given task. SAS disc drives are clearly the best choice for mission-critical enterprise use where transactional/online performance and reliability are crucial, while SATA disc drives are cost-effective for lighter-duty use such as near-line and backup/restore storage.

SAS compatibility also ensures maximum value for your IT investment by enabling a common enclosure to house both SAS and SATA devices on the same SAS backplane. Enterprise users can seamlessly deploy a mix of SAS and SATA drives to most efficiently meet their needs, saving both space and money. Smaller businesses can initially purchase SAS backplanes for use with SATA drives, knowing that as business increases and storage demands grow they can simply add SAS drives without needing to upgrade their enclosures.



SAS drives can be deployed for mission-critical duty in place of parallel SCSI while being housed in a common cabinet with SATA drives used for near-line storage.

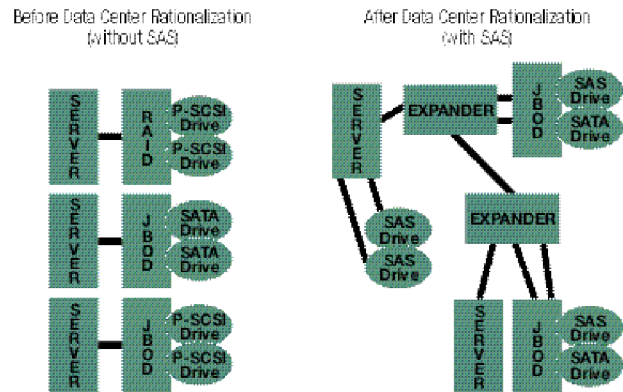
Storage Rationalization Through SAS Compatibility—Benefit: SAS and SATA drives can be consolidated on a common backplane and housed in a single enclosure, enabling one SAS-based subsystem to economically handle the full gamut of enterprise storage duties.

Storage Rationalization Through SAS Scalability

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 specifications for SAS expanders also include the ability to accept both SAS drives and SATA drives as end devices, thus enabling a single SAS domain to contain a hybrid SAS/SATA deployment of enormous scale.

Storage Rationalization Through SAS Scalability—Benefit: SAS expanders enable quick, inexpensive scalability far beyond that of parallel SCSI, and vast heterogeneous SAS/SATA configurations are possible.



SAS expanders enable seamless scalability of both SAS and SATA drives, ensuring both mission-critical and near-line storage can be quickly adjusted as required for the tasks at hand.

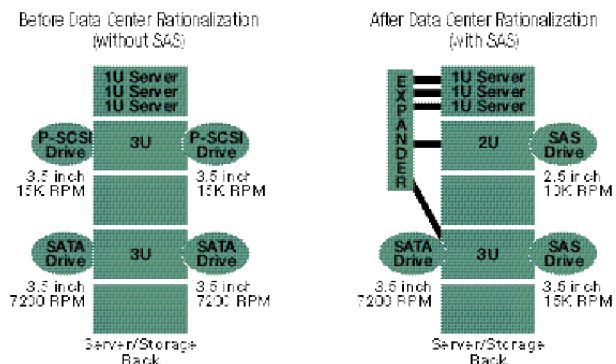
Storage Rationalization Through SAS Flexibility

SAS drives will be available in the industry-standard, 3.5-inch form factor for storage systems utilizing a common backplane. A single storage subsystem will thus be able to house a low-cost, 7200-RPM SATA drive in the same enclosure as the preferred online enterprise solution, the industry-standard, 15,000-RPM SCSI drive.

SAS drives will also be offered in the new 2.5-inch small form factor, an ideal pairing of complementary technologies. SAS's compact connectors and seamless scalability are the perfect match for these slim drives and the space-efficient applications in which they excel. For denser computing environments in which raw capacity takes a back seat to higher throughput (IOPS/U), 2.5-inch SAS drives will play an increasingly prominent role.

Note that choosing 2.5-inch SAS drives for transactional applications (for example, database storage for ERP and CRM software) doesn't preclude use of 3.5-inch SATA drives for periodic backup and restore. For example, servers and storage subsystems of varying sizes (for example, 1U, 2U, 4U) stacked on top of one another in a cabinet can transfer data interchangeably between SAS and SATA drives. Depending on the cabinet's configuration, Serial Tunneling Protocol (STP) could be accomplished at an HBA or expander, thus eliminating the need for SATA and SAS drives to share the same backplane.

Storage Rationalization Through SAS Flexibility—Benefit: SAS offers a choice of standard 3.5-inch form factor drives or new 2.5-inch drives, which boast lower power consumption, easier cooling, 70 percent smaller size and greater IOPS/U in high-density computing environments.



SAS expanders enable seamless scalability of both SAS and SATA drives, ensuring both mission-critical and near-line storage can be quickly adjusted as required for the tasks at hand.

SAS expanders enable 3.5-inch SAS, 3.5-inch SATA and the new 2.5-inch SAS drives to share a single rack. For dense computing environments 2.5-inch SAS drives ensure energy savings and superior IOPS/U.



Conclusion

As IT budgets continue to undergo intense scrutiny, the pressure to rationalize enterprise storage systems has never been greater. That said, the ultimate goal of any IT manager has always been to employ the best, most cost-effective storage solutions for the applications at hand. The greater the flexibility in choosing and deploying those solutions, the more likely optimal performance and cost-effectiveness will be achieved. Serial Attached SCSI offers an unprecedented degree of freedom to create high-performance storage solutions that can easily scale and adapt as needs change. As such, SAS truly heralds an exciting new era in enterprise storage.