Serial Attached SCSI (SAS) Technology Transition

SAS meets HP requirements for enterprise storage with strict quality, reliability standards, and universal compatibility

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Table of contents

Solutions for the adaptive enterprise.

hp invent

SAS builds off of the best features of SCSI and provides a roadmap for innovation and improvement for many years to come.

Introducing SAS technology

Leading vendors and suppliers in the enterprise computing and storage technology industries–HP, Intel, LSI Logic, Adaptec, Hitachi, Fujitsu, Maxtor, and Seagate–were the original advocates of SAS, the next generation storage solution.

The SCSI Trade Association (STA), formed to promote the use and understanding of SCSI technology, includes these same industry leaders, among others. STA believes as the need for more volume and flexible storage usage increases, SAS will be more attractive to the industry. In fact, the STA no longer includes Ultra640 SCSI technology on its 2004 roadmap, which clearly points toward SAS advancements in SAS throughputs over the next generations.[1]

SAS technology encompasses a set of innovations that change the familiar parallel SCSI interconnect between a server and its storage devices. Industry leaders recognize that SAS embraces the best features of other serial storage solutions and provides a roadmap for innovation and improvement for many years to come.

Key advantages of SAS technology

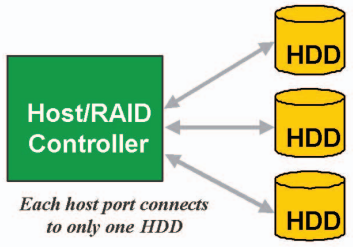
- Improved performance and reliability features
- Configuration flexibility and simplicity
- Scalable I/O with future growth roadmap
- Traditional SCSI software and middleware
- Simplified and thinner cabling

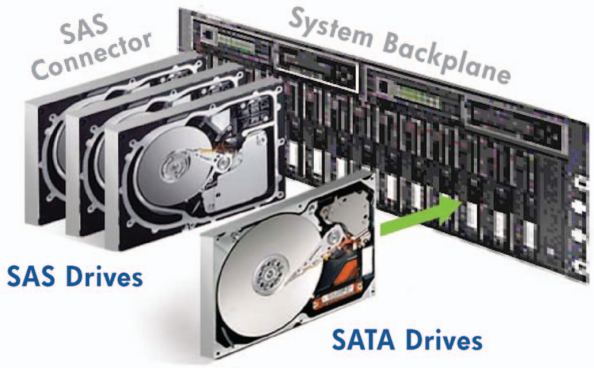
SAS support

SAS initiators support three standard protocols: Serial SCSI Protocol (SSP), Serial Management Protocol (SMP), and Serial ATA Tunneling Protocol (STP). SAS technology also supports hot-swappable SAS and Serial ATA (SATA) disk drives, enabling online replacement of lower cost and lower reliability SATA disk drives in RAID solutions.

[1] http://www.scsita.org/aboutscsi/sas/faq.html

Fig 1. SAS utilizes a point-to-point architecture allowing for dedicated bandwidth between the controller and the hard drive. A SAS backplane allows the flexibility to use SAS and/or SATA drives in the same system.





Point-to-point architecture

As a point-to-point architecture, SAS can connect multiple devices simultaneously, have dedicated bandwidth between the controller and hard drive, and provide greater scalability than with shared access topologies.

Simplified cabling

The SAS interface meets cabling requirements using thinner cables with smaller connectors for improved routing, airflow, and cooling within systems using the serial interface. SAS improves the electrical characteristics and reduces the cross-talk usually associated with the larger parallel cabling.

Universal interconnect

SAS technology makes a significant step toward a universal interconnect for direct attached storage (DAS).

Flexibility

A major SAS benefit is its compatibility with SATA. Both types of disk drives can be installed and controlled in the same SAS system. Smaller form factors and greater addressability will lead to a new level of flexibility when deploying mainstream data center servers and subsystems. Because SAS is based on the foundation of the industry-leading parallel SCSI specification, it will provide universal interconnect by integrating two established technologies, SCSI and SATA, while offering logical SCSI compatibility and combining the proven utility, reliability, and performance of the SCSI protocol with the performance and advantages of serial architecture.

With SAS, HP customers have options that were previously unavailable.

Why SAS?

SAS holds the promise of the future for enterprise users who will eventually need more integer operations per second (IOPS) performance, easier connectivity, and greater scalability as storage requirements continue to escalate. By late 2004, as SAS products start entering the market, customers will appreciate the time and effort that has gone into the definition, development, and standardization of this innovative refinement to long-standing SCSI technology. SCSI is truly ubiquitous and perpetual.[2]

More affordable than Fibre Channel and more robust and reliable than SATA, SAS will be able to fulfill these requirements and provide the necessary performance and scalability to move data at gigabit speeds-speeds that meet or exceed current storage I/O performance found in ATA, SATA, SCSI, or Fibre Channel systems.

Customers will also benefit from the freedom to choose either SAS or SATA drives or both, depending on storage applications because they are both operable on the same backplane. Finally, SAS is the logical evolution that preserves the SCSI advantages while leveraging the SATA electrical and physical connection. SAS will reduce multiple storage system management complexity by enabling system managers to meet a wide range of application requirements with a single storage system.

HP factor enterprise hard drives and SAS

SAS drives are utilized with 3.5-inch hard drives and new 2.5-inch small form factor (SFF) enterprise hard drive technology that decreases the capacity glut. Parallel SCSI hard drive (3.5-inch) technology has been one of the industry-standard hard drive technologies because of its reliability. HP provides unique values for Parallel SCSI hard drive technology such as Universal Architecture, optimized firmware, and superior testing and quality standards. Customers generally choose Parallel SCSI hard drive technology for higher data integrity, performance, reliability, and its hot-plug capability.

Customers generally opt for SFF enterprise technology for low power and higher performance from more spindles in a given space. Other benefits include:

- More drives in a server, using 70% less space and more spindles per U, equaling high performance
- Designed for I/O-intensive environments
- Lowest power consumption, using 30% less energy, which eases the cooling burden
- Designed with Universal SAS hot-plug architecture that rapidly deploys all HP server and storage platforms, allowing a customer to have only one drive across all segments

[2] http://www.lsilogic.com/products/islands/sas/scsi_SAS.pdf

"The industry transition to serial interfaces in all hard disk drive markets may be inevitable and inescapable, but the careful creation of solid and reliable SAS/SATA configurations will remain crucial to widespread enterprise market acceptance.
These STA-sponsored plugfests are helping to accelerate the market readiness of SAS and defuse any doubts regarding the depth of forethought that went into the SAS specification.
Beginning in 2005, SAS will become the heir to parallel SCSI. And Gartner predicts that—despite significant incursions of SATA and further extensions of Fibre Channel—SAS will remain the most widely integrated hard disk drive interface in multi-user environments in 2006, 2007, and 2008."
John Monroe, Gartner Research Vice President

Distinguishing the differences between SAS and SATA interfaces

HP has already transitioned from Parallel ATA (PATA) to SATA technology, the foundation of a new storage interface replacement architecture that is as cost-effective as PATA and has greater performance improvement potential.

A natural question arises from SAS/SATA compatibility: when should customers specify SAS disks, and when should they use SATA disks? The answer is based on the inherent differences between them. SAS hard disk drives are used for supporting many users simultaneously in 24x7 environments and carry a three-year warranty, while SATA hard disk drives are designed for low cost and carry only a one-year warranty.

SAS or SATA?

HP recommends that customers who require performance, reliability, and software consistency choose SAS hard drives because SAS:

- Meets the requirements for enterprise storage by providing strict quality, reliability standards, and universal compatibility
- Is the best choice for transactional data and 24x7 mission-critical operation enterprise server and storage market segments
- Has the best price for performance with full duplex and 3.0 Gb/s at introduction
- Has nearly unlimited connectivity, hosting up to more than 16,000 devices
- Is a multi-initiator and has dual-ported disk drives that provide redundant connections for high availability
- Has a three-year warranty

On the other hand, HP advises that customers who require an inexpensive price for server and storage deployments consider SATA because it:

- Is the best choice for reference data and eight to 10 hours of operation in entry-level server and storage environments, which are not heavily utilized and can sustain lower reliability than typical enterprise environments
- Is the lowest cost per gigabyte
- Has performance with half duplex and 1.5 Gb/s at introduction
- Has a one-year warranty

Why HP?

HP and partners ensure quality systems for reliable, time-to-market SAS solutions

Working closely with its team suppliers far in advance of product availability and qualifying HDD technology, HP can ensure technology feasibility and successful time-to-market integration for its customers. HP and its SAS team members have poured years of combined technical expertise into the selection, qualification, and on-going support of their SAS solution to provide customers with unsurpassed technology.

To bring HP product candidates to market, the products must meet the stringent requirements of the HP Quality System to ensure that the product is reliable, and will meet customers' requirements.

The four steps that HP product candidates must experience assure customers that HP has developed and maintains one of the most disciplined and well-structured processes within the technology industry.

The following steps have been defined and must happen before the product being considered HP Qualified:

1. Selection Evaluation
2. Development Validation
3. Supplier Production Qualification
4. Continuous Improvement/Performance Monitoring

The HP difference

HP offers the broadest range of computing platforms so customers have flexibility, scalability, and attractive cost of ownership for their SAS solutions.

HP continues a long, storied history of innovation by focusing on the next generation technology to improve HP ProLiant server and HP StorageWorks Modular Smart Array (MSA) storage array functionality. HP is a leader in SATA and SAS technology development and was a founding member of the Serial Attached SCSI Working Group in November 2001. All HP technology suppliers have developed strong, long-term working relationships with HP.

Engaging with its partners in researching new technologies, HP devises long-range product roadmaps, new features, and defining requirements for product design. HP also operated with SAS technology team members two to three years in advance of product availability to ensure technology feasibility and successful system integration.

By purchasing HP hard drive products, customers have bought into a tradition of excellence and commitment that consistently produces the highest quality at competitive price points, designed to fully integrate across the HP enterprise-class line of servers and storage.

HP SAS customers enjoy:

- Increased storage connectivity
- Flexibility in server deployment
- SAS disk drive and SATA disk drive compatibility
- Total management of the storage solution
- Embracing the best features of other serial storage solutions
- Storage choices
- The best investment protection
- The best choice for mainstream and 24x7 operation enterprise server and storage market segments
- Strict quality, reliability standards, and universal compatibility
- Evolving from 20 years of SCSI infrastructure-enabling better performance, scalability, and flexibility

For more information

http://www.hp.com/go/serial

To learn more about HP's offering, visit **www.hp.com**.

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