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The Benefits of Serial Attached SCSI (SAS) for External Subsystems

Serial Attached SCSI (SAS), the follow-on to parallel SCSI, is designed for high-performance enterprise requirements and offers both the benefits of backward compatibility with SCSI and interoperability with Serial ATA (SATA), bringing enterprises a flexibility and cost savings previously not possible. SAS provides significant benefits to external storage subsystems and offers users "one-stop-shopping" to satisfy their requirements for the following three main data types;

Throughput Data	Transaction Data	Reference Data
· High MB/s and large data-intensive files · Large block, random read/writes · Video streaming · CAD	· Maximum IOPs for OLTP, calculation intensive files · Small block, random read/writes · Reservation systems · Billing systems	· Fixed content, archival data for secondary/nearline storage · Large block, sequential writes/reads · Imaging · Medical records

Figure 1

An external subsystem with a SAS midplane will support both high performance, reliable SAS drives ideal for transaction data, and cost-effective, high-capacity SATA drives ideal for reference and throughput data. Now customers can use one platform instead of two to support both drive types and satisfy all three application segments (illustrated in Figure 1). SAS-based external storage arrays provide benefits in five areas: performance, availability, flexibility, scalability, and cost of ownership.

Take Advantage of SAS Today

Because of its trusted reliability and stable feature set, the SCSI protocol has been accepted by the market for a remarkable twenty years. SAS leverages this continuing evolution of SCSI with new levels of scalability, flexibility, and cost-effectiveness for connectivity, data transport, and data storage.

The first SAS prototypes were announced in 2003 and were a major step to achieving mass market availability. Those prototypes allowed development of the first generation of technologies and products that bring the benefits of SAS into the enterprise. These products have been developed and tested, and enable a wide variety of integrated solutions.

Interoperability testing was a key component of SAS, because it increases the architecture's flexibility by supporting both SAS and SATA disk drives and components. Interoperability allows one vendor's SAS products to be compatible with another's, and it also ensures products developed today will work with all existing and next-generation SATA products.

Adaptec Unified Serial™ Architecture

This interoperability between SAS and SATA is the foundation of Adaptec Unified Serial Architecture, which integrates Unified Serial SAS-based controllers, the most advanced data protection available today, and a single management interface that works across all the connected storage. Unified Serial Architecture allows you to start taking advantage of the benefits of SAS today, even in SATA environments, and create solutions that can be updated simply by swapping out the disk drives.

Higher Performance

SAS has received extensive market attention due to several performance benefits. For example, a SAS connection can support four SAS wide lanes or 4 x 300MB/s per connection.

A SAS connection on a JBOD system can support a theoretical maximum of 1,200MB/s (see Figure 2). SAS is also used as a high performance, yet cost-effective expansion port to daisy chain to another SAS subsystem.

4 x SAS Lanes
300MBs each + 1,200 MBs

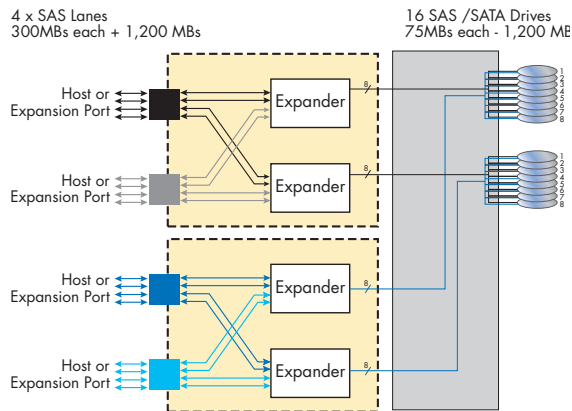16 SAS /SATA Drives
75MBs each - 1,200 MB

Figure 2

In addition, each 3Gb high-performance SAS drive (10K rpm or 15K rpm) is connected to a 3Gb drive connection, providing more then enough bandwidth for the highest performing drives (see Figure 2). Assuming 16 SAS drives in a subsystem and each drive capable of 75MB/s, that would equal 1,200 MB/s performance from 16 drives which far surpasses both 2Gb Fibre Channel loops and U320 Parallel SCSI buses. The roadmap for SAS is robust and provides clear investment protection by starting at 3Gb, doubling to 6Gb in 2007 and then doubling again to 12Gb.

Increased Availability

Another benefit of SAS-based storage subsystems is the native dual port capability of each SAS drive, providing a redundant path to each drive in the event of a controller failover. In addition, since each drive is on a separate point-to-point connection, losing a drive connection only affects a single drive. Compare this to parallel SCSI in which losing a bus affects all the drives on the bus.

SAS drives, like Fibre Channel, are designed for the rigors of enterprise use and heavy loads, have MTBF ratings in excess of 1 million hours, and warranties up to 5 years.

SAS drives are engineered for rugged enterprise duty, and every component (drive motor, spindle, actuator, firmware, etc.) is specifically designed and manufactured for that rigorous use. SAS drives also safeguard data integrity via their comprehensive verification/error correction capabilities.

SAS drive-based subsystems support active-active controllers whose failover and redundant host connections can be SAS, Fibre Channel or iSCSI. These subsystems also support redundant hot swappable power, cooling, and enclosure services and the same RAID and software capabilities found in Fibre Channel and SCSI-based arrays.

Utmost Flexibility

Probably the best known benefit of SAS for external storage is its configuration flexibility on which Adaptec Unified Serial Architecture is built. A SATA drive can be plugged into a SAS midplane without any modifications or changes, and the Unified Serial controller in the array and the software seamlessly support a system with a mix of SATA and SAS. As illustrated in Figure 3, 6 SAS drives could be partitioned in one storage pool or LUN and assigned to a server with a transaction-intensive application, such as a reservation system. The other 6 drives could be SATA and partitioned in a storage pool or LUN and assigned to a different server running a reference application, such as medical imaging. Alternatively, one array could support all SAS drives and a second array connected or daisy chained to the first could support all SATA drives. This flexibility is not possible with Fibre Channel and Parallel SCSI-based subsystems; only SAS provides customers with the best of both worlds.

Common Software, Power, Packaging & Cooling

Fibre Host Interface   iSCSI Host Interface   SAS/Unified Serial Host Interface

OR   OR

High-performance, reliable SAS drives
Mainstream applications
Dual ported, 10K and 15K rpm

High-capacity, cost-effective SATA drives
Nearline applications
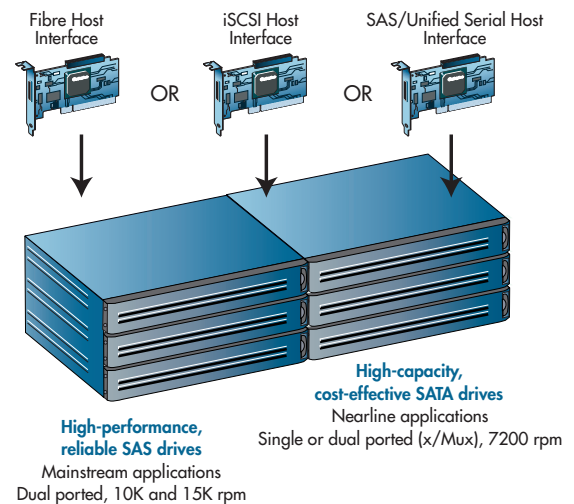Single or dual ported (x/Mux), 7200 rpm

Figure 3

Seamless Scalability & Improved Cost of Ownership

Unlike SCSI, whose architecture limits the scalability of multiple drive enclosures, Unified Serial Architecture provides the capability to scale more than 100 drives, or 36TB with 300GB SAS drives or 48TB with 400GB SATA drives. This provides very large pools of storage and a cost-effective alternative to Fibre Channel-based SANs.

In addition, supporting SAS and SATA drive types in one system reduces cost of ownership, simplifies training and product portfolios, and provides investment protection.

Summary

SAS-based Unified Serial Architecture offers new levels of performance, availability, and customer choice by supporting both enterprise-class SAS drives and SATA drives for cost-sensitive applications. OEMs and IT managers now have the flexibility to configure storage subsystems with either drive technology, or both, enabling high-performance and low-cost storage in the same subsystem thus maximizing customers' return on investment and providing flexibility for future growth.

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