



An Evolutionary Step for SAS Technology

White Paper

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Introduction

First introduced in 2004, Serial Attached SCSI (SAS) was the next logical step in the evolution of SCSI technology. This new serial-based technology leveraged the proven application protocol layer from parallel SCSI, while also providing robust solutions and generational software compatibility for storage systems. With storage requirements rapidly escalating and becoming more complex, factors such as support for much higher drive counts leveraging greater drive density, security, scalability and availability were becoming more and more important. SAS technology has provided a vastly better alternative to parallel SCSI for the direct attachment of storage in server applications.

Initially introduced with an interconnect speed of 3Gb/s, SAS fulfilled the storage industry's need to replace the aging parallel SCSI technology in server-based deployments. SAS systems provided improved performance, dual-port SAS drives, wide ports and additional advanced capabilities that enabled the storage systems to operate with full-duplex data transmissions and aggregated bandwidth.

Storage demands have continued to escalate and now require more and more complex capabilities. Thus, making it necessary for the storage industry to look beyond 3Gb/s SAS and determine what steps need to be taken to incorporate additional improvements into the SAS protocol.

This paper takes a look at the evolution of the SAS protocol and examines the new capabilities that will be provided with the next step along the evolutionary process for the SAS protocol – 6Gb/s SAS.

SAS Roadmap

The figure below (Figure 1) shows the development timeline for the SAS protocol and provides a general indication of when technology transitions are expected to occur. At discrete steps along the timeline, storage industry companies come together to participate in plugfests to test their newest products for interoperability. Currently, the SAS-2 technical specification is nearing the end of its development. The last

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technical input was completed in March, 2008, and ANSI T10 will forward the SAS-2 specification on to INCITS towards the end of 2008 for final review and ratification. Initial 6Gb/s SAS prototype samples of component-level products have started to become available to OEMs for development purposes. The first 6Gb/s SAS plugfest is currently scheduled at UNH-IOL for November 10-14, 2008, which indicates system-level products will be available to end-users by late-2009 or early-2010.

It is expected that a mid-cycle enhancement, called SAS-2.1 will add additional capabilities in the 2011 timeframe.

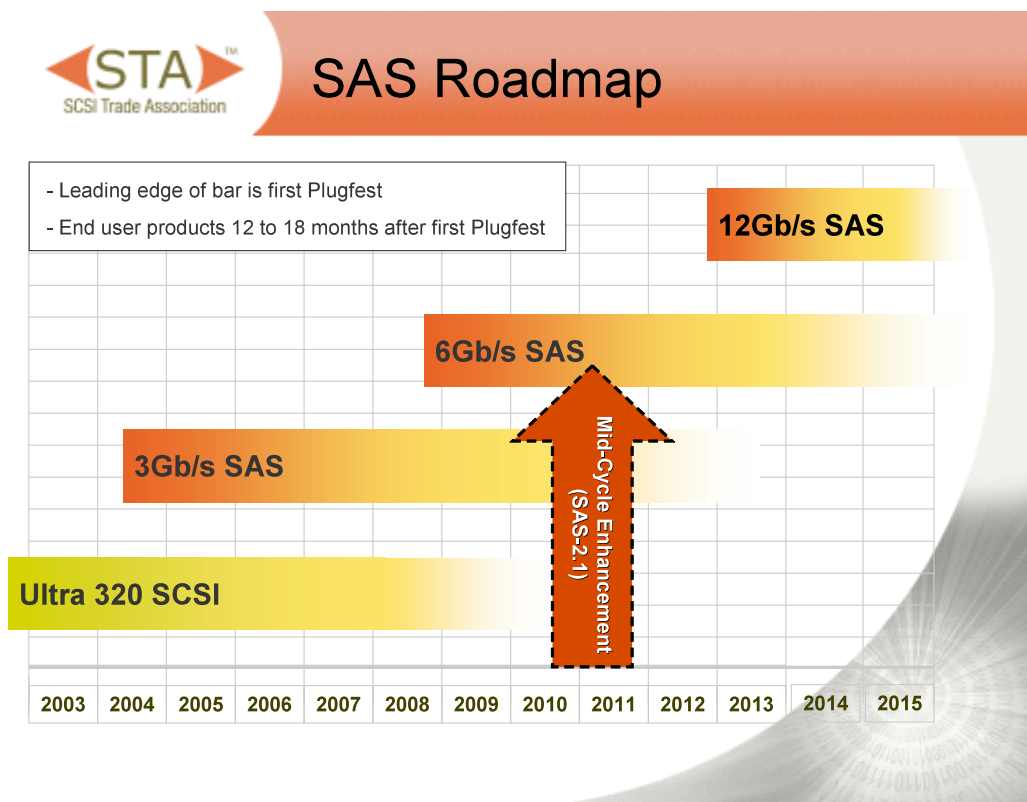


Figure 1 – SAS Roadmap, SCSI Trade Association

What Is 6Gb/s SAS?

6Gb/s SAS is the marketing name that the SCSI Trade Association (STA) has given to the industry standard based on the SAS-2 technical specification. While it is true that 6Gb/s SAS is the successor for 3Gb/s SAS, there is much more to this new industry standard than simply a speed enhancement. In order for any product to be considered 6Gb/s SAS compliant, it must provide the following minimum features:

- Transfer rate to 6Gb/s to double 3Gb/s SAS data rate.
- Standardized (SAS-2) zoning for enhanced multi-host support and security capabilities.
- Spread spectrum clocking (SSC) to reduce system-level Electromagnetic Interference.

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- Connection multiplexing to increase link utilization when 3Gb/s SAS components are used in a 6Gb/s SAS infrastructure.

These enhancements are expected to help SAS expand beyond its initial deployments (shareable DAS and blade storage) and into new applications.

Market Opportunity

The figure below (Figure 2) shows the projected deployment scenarios for SAS solutions. Today, SAS is prevalent in PC/workstations and DAS storage for servers. SAS will need to evolve, through further enhancements, such as 6Gb/s SAS, to meet the specific needs of external storage.

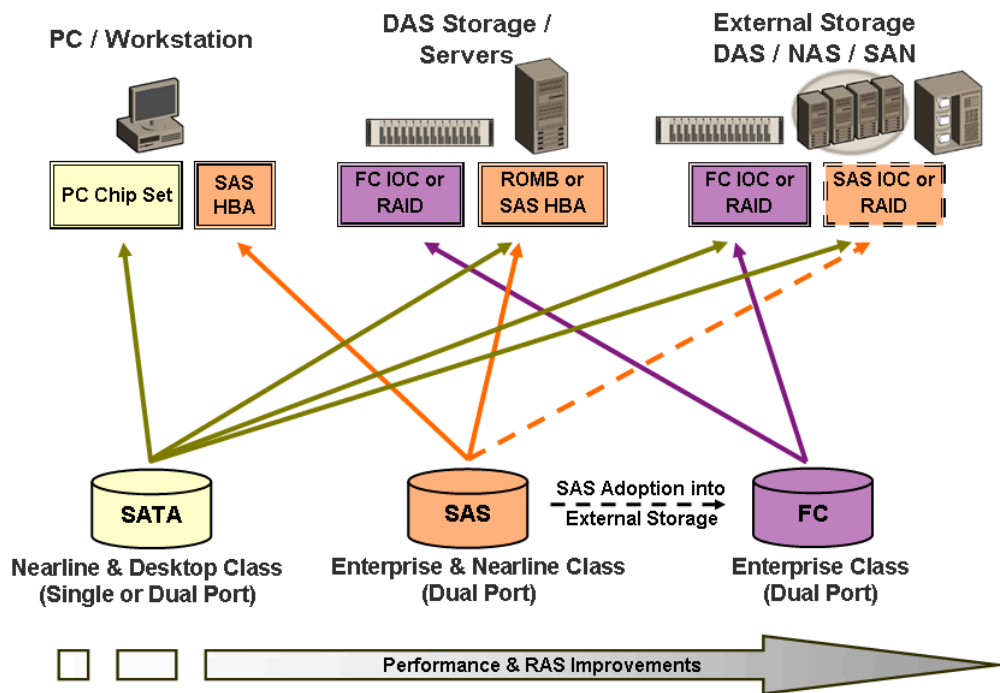


Figure 2 – Projected SAS Market Opportunities

Factors that are critical to the continued adoption of SAS technology include robust system performance, and high reliability, availability and serviceability (RAS).

SAS Deployments in External Storage

Due to the demanding requirements for performance and RAS in external storage, SAS to date has had only limited success in external storage applications. Since Fibre Channel is still the dominant protocol for providing high performance back-end connectivity (from the RAID controllers through the disk enclosures and down to the individual disk drives), initial SAS deployments have been targeted at the entry-level and lower-end of mid-range external storage systems. This is an excellent space for new technology to prove itself, as the performance and reliability demands are not as extreme as those required by the larger mid-range and monolithic enterprise systems.

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In order for SAS to gain entry into the upper bands of external storage, it is essential that the protocol continues to mature to a level that provides performance and RAS which are at least on par with that provided today by Fibre Channel. With the introduction of 6Gb/s SAS, it is expected that SAS will be better able to take the next step in supporting external storage systems.

A hot topic in external storage systems today is tiered storage, or the ability to connect high-capacity disk drives alongside performance drives in a storage system. There are a variety of new options available for connecting high-capacity disk drives into 6Gb/s SAS storage designs. These options include: SAS expanders with SATA Tunneling Protocol (STP)/SATA bridging, drive tailgate cards with Serial SCSI Protocol (SSP)/SATA bridging and high-capacity SAS drives with pure SSP. Each approach has advantages and disadvantages that should be considered during architectural design to optimize solutions that strike the best balance amongst the following attributes:

- Highest Level of RAS Achieved
- Lowest Development Risk
- Best Performance
- Ease of Implementation
- Best Time-to-Market
- Lowest Cost

For more details on tiered storage options, please refer to the prior released STA article on this topic: www.serialstoragewire.net/Articles/2008_03/opinion28.html.

The Next Step

SAS has come a long way. With the introduction of 6Gb/s SAS, storage system providers will be offered enhanced SAS capabilities – double the transfer rate to 6Gb/s, standardized zoning, spread spectrum clocking and connection multiplexing. In order for SAS to keep pace with the ever-increasing needs for more capacity and more complex capabilities, it is essential that the SAS protocol continues to evolve. Some considerations for the next step (beyond the SAS-2 technical specification) along the evolutionary path for the SAS protocol include:

- Data Center Scale-Out Capabilities – providing improved cabling options with greater distances and the potential for optical connections.
- Green Features – providing power management options to improve power and cooling efficiencies.

Conclusion

As SAS technology moves beyond its initial markets in shareable DAS and blade storage into external storage applications, it is essential that improvements be made in performance and RAS to meet the demands of new applications. 6Gb/s SAS offers storage system providers a number of enhancements that:

- Increase Performance



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- Enhance Security
- Improve System-Level EMI

Further, new options are expected to be made available to enhance tiered storage capabilities.

However, the path doesn't stop here, as demands for storage and storage system capabilities continue to increase. As storage system providers respond to these demands we can expect to see SAS play an increasingly important role in providing end-users with the reliability and performance they require.

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