WHITE PAPER

EQUALLOGIC®
SIMPLIFYING NETWORKED STORAGE™

SERIAL ATTACHED SCSI

MANAGEMENT SERIES

A TRIED, TRUE AND TRUSTED FRIEND JUST GOT BETTER – SERIAL ATTACHED SCSI (SAS)

Serial Attached SCSI (SAS) has been added to EqualLogic storage products as a method of connecting high performance disk drives to a PS Series storage array controller delivering significant data rate improvement to an already solid platform. While the name SAS may sound new, the base technology uses SCSI as its foundation. A well established interconnect and protocol standard that has been around for over 25 years. SCSI is not new. It just keeps getting better.

SCSI or Small Computer System Interface has been around a long time. At 25 years of existence, this data transport technology was developed in the 1980's as a way of connecting several storage devices to a controller using a shared bus architecture. To date, over 1 billion SCSI connections have been made between controllers and storage devices. In fact, the SCSI protocol is used over multiple transports including USB, 1394, Parallel SCSI, Fibre Channel, iSCSI and now SAS. All of the SCSI "middleware" remains the same and represents a robust and mature base for essentially all storage infrastructures.

THREE KEY COMPONENTS THAT THE SCSI STANDARD DELIVERS

- Fault connection

  Assurance that data will be transmitted from the storage device to the controller and back with the highest speed and signal integrity possible. As electrical speeds increase, signal integrity becomes more difficult for both cables and especially backplanes. At today's 320 MB/sec SCSI speeds, cable and backplane signal paths between peripheral and controller are at their practical limit for fear of signal loss and integrity. In addition, cross talk between signal lines is a result of cable designs that have reached their physical limits. Cross talk can severely impact signal integrity by causing a wire to transmit a false signal or ghost image to either storage device or controller. Wire shielding and shorter distances overcome this problem in contemporary storage array designs.

- Data Transport

  Parallel SCSI is a shared media, multi drop bus, which means that all devices are physically connected to the same set of wires or backplane. Being a shared bus architecture, the system uses a negotiation process to get a time slot for data transmission across the bus. This is analogous to a single line phone system being used by multiple people to make separate phone calls. One person at a time and the controller (operator) has to give the sender permission to transmit or receive data (speak). During high data traffic periods, connected devices will line up or queue up for data transmission because other peripherals are using the wires. This is especially apparent in applications that require high bandwidth and large numbers of drives. All of this exchange is done using the SCSI transport protocol or language between components. A well understood, highly robust standard.

- Device Connectivity

  Because of the limitations of the device selection mechanism used in parallel SCSI and the negative electrical characteristics generated by adding devices to a multi-drop bus, parallel SCSI is limited to a total of 16 devices per bus. This constrains the physical topology and scalability of systems that utilize parallel SCSI as a device interconnect

The development of Serial Attached SCSI (SAS) was driven by the same set of engineers that were challenged by the Parallel SCSI design limitations. The SAS design addresses all of the aforementioned limitations described for Parallel SCSI and delivers an added feature. The wire connection (phy - physical layer) is virtually identical to the connection scheme designed for Serial ATA (SATA). The SAS interconnect allows either SAS or SATA devices to interoperate on the same infrastructure. The advantage here is that these connection technologies will leverage huge economies of scale in production and deployment. Users can create tiers of storage based on drive type and configure storage systems to any specification they choose then change it if they decide to repurpose a storage array for a different application. Interchangeable hot-pluggable modular parts will revolutionize the storage industry by giving users new choices for data storage.

SAS delivers the latest electrical connection technology to a long standing SCSI protocol. Storage devices use the same SCSI language to speak to each other, but over far more robust electrical lines. This new standard essentially uses a point to point switching technology to overcome design limitations experienced with SCSI and sets a

framework to grow with tomorrow's advancements in storage products.

THE ADVANTAGES OF SAS OVER PARALLEL SCSI: CONNECTION, DATA TRANSPORT, CONNECTIVITY

Engineers developing the SAS standard took all of the learnings from SCSI and improved upon them. In the SAS configuration, all disk drives are connected to the controller using dedicated wire links in a switched architecture format.

- The wire design has been modified from antiquated ribbon cable to point-to-point twisted pairs to allow for longer distance signal travel at much greater line frequencies. The problem with cross talk across multiple signal lines is eliminated. In addition to signal integrity, SAS devices are dual ported, delivering higher availability and eliminating any single point of failure to the disk drive.

- Storage devices no longer share a bus, but instead are connected through an array of expanders, (switches). These expanders provide an efficient means of making connections and provide wide ports for bandwidth aggregation. As soon as the device is ready to transmit or receive, the controller opens a link and transmission occurs. The controller serves as a data aggregator and not a traffic cop at a shared intersection. Problems with negotiation and bus contention are minimized.

- The theoretical limit of SAS connections in a system is well beyond what is realistic. Thousands of storage devices can be interconnected using SAS. SAS is the best interconnect technology for delivering the highest possible performance of aggregated storage devices and efficient scalability to large configurations. Application clients will experience every drop of performance that system designers can squeeze out of the storage arrays. The data rate bottlenecks have been eliminated.

SAS is truly as superior interconnect technology. It takes the best that 25 years of SCSI experience has to offer and makes it better. SAS has a roadmap to take line speeds to 6Gb/sec and then 12Gb/sec. Well beyond what is required by future disk drive technology. Country road, meet super highway.

For more information regarding EqualLogic and the PS Series, please visit www.equallogic.com or contact us at 888-579-9762 ext 7792.

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