Serial Attached SCSI Expanders: Key Components for Powering Storage Growth in the Enterprise

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Introduction

SCSI is the most versatile disk interface used today for mass storage in enterprise environments by virtue of the protocol's advanced features, throughput capabilities, and support for large storage infrastructures. But the growing need for faster, more complex data communications and more scalable storage systems raises the question of whether parallel SCSI can support the increasing capacity scalability requirements and longer cables needed for external storage systems.

Parallel SCSI Bus Expanders

The physical layer of the parallel SCSI bus has continued to limit its ability to widely scale. While standard unassisted Low Voltage Differential (LVD) SCSI supports a maximum of 12 meters between the computer and external device, many of today's larger SCSI systems require cables longer than that; hence, the need for SCSI bus expanders.

SCSI expanders were developed to convert older single-ended, high-voltage SCSI signaling to more versatile low-voltage-differential SCSI signaling and provide a way to attach two or more physical SCSI segments, each with its own signaling capability. SCSI expanders also provided an excellent way to increase the standard distance between SCSI devices by improving SCSI signal integrity. With LVD SCSI now widely used, and the need for greater distances between devices growing, SCSI expanders are now almost exclusively used for expansion rather than signal conversion.

Using Serial Attached SCSI Expanders in the Enterprise

The scalability of parallel buses is limited because they share connection paths, and adding more buses with multiple initiators does little to extend this limited scalability. Serial Attached SCSI (SAS) uses expander hardware as a switch to simplify configuration of large external storage systems that can be easily scaled with minimal latency while preserving bandwidth for increased workloads. Edge expanders can connect up to 127 SAS or Serial ATA (SATA) devices but no more than one other fully configured expander. If the topology requires more than two fully configured edge expanders, a fan-out expander can be used to provide and manage the additional connectivity. A fan-out expander may connect up to 128 edge expanders providing addressability to a maximum of 16,256 (127x128) end devices. The SCSI Management Protocol (SMP) within SAS manages the point-to-point connections in the topology.

SAS expanders are used to attach multiple devices to multiple host initiators in fault tolerant designs. These multiple host initiators and links provide redundant links to other initiators or devices to maintain a connection in case of a system failure. The SAS expander, in combination with dual-port SAS drives and SATA drives with 2-port adapters, makes it easy to design redundant systems for high fault tolerance. New 2.5-inch dual-ported SAS drives enable fully fault tolerant designs for applications requiring higher computing density. This highly scalable and reliable connection scheme enables enterprise-level topologies that support multi-node clustering for automatic failover or load balancing – vital for mission-critical applications.

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SAS expanders also maximize performance in the enterprise environment. First-generation Serial Attached SCSI will deliver throughput of 3Gb/sec per link and succeeding generations up to 12 Gb/sec to keep pace with technology and application advances. SAS expanders allow individual links to be combined to create wide ports, allowing system designers to aggregate the performance of Serial Attached SCSI initiators and expanders to increase total available bandwidth. Grouping four or eight links can produce bandwidth of 12 Gb/sec or 24 Gb/sec, respectively.

Conclusion

Today, most data centers use parallel storage technology like SCSI, but as requirements for increased performance, higher scalability needs and improved reliability grow, IT managers are looking to new serial technologies such as SAS. SAS expanders are an essential component of the SAS infrastructure in the mainstream enterprise storage arena. SAS expanders deliver the highest scalability with support for more than 16,000 devices, the greatest storage configuration flexibility by supporting both SAS and SATA disk drives, the ability to design highly fault tolerant designs with redundant pathways, and the greatest performance scalability by allowing individual links to be combined to create wide bandwidth pipes.

About the author

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