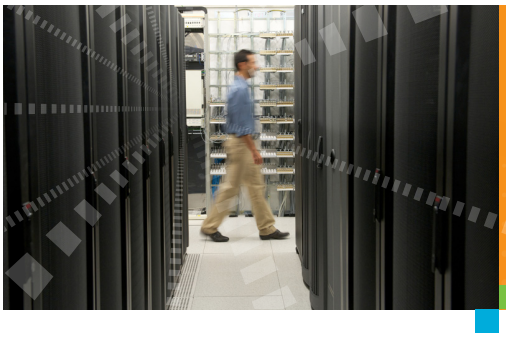
LSI
Storage. Networking. Accelerated.

White Paper



Deciding on a Host Interface Technology

Executive Overview

Solutions providers and data center leaders have a myriad of choices to connect servers and share storage today. Serial Attached SCSI (SAS), Fibre Channel (FC), and iSCSI (Ethernet) predominate. Selection factors include addressability/connectivity, technology comfort level, cost, distance, manageability, and performance. Which is right for you?

Host Interfaces High Level Overview – SAS, FC and iSCSI

A typical shared or networked storage environment consists of application servers, storage systems, external hardware interfaces within the application server, the appropriate cabling, and, in the case of a storage area network (SAN), a switch between the one or more servers and the storage systems.

The external interface technologies, as key components of these environments, are the foundation of the overall storage framework's performance, scalability, reliability, technical complexity, and cost. Several interface options have been developed to support storage environments and includes interfaces such as SAS, FC and iSCSI. With this range of options, each with its own distinct features and characteristics, it is important to examine the strengths and special considerations of each one.

As with any technology, one size will never fit all. Depending on an organizations storage environment, one interface option may be better suited than another based on the needs of the business and its data storage requirements. The following table provides an "at-a-glance" overview of each of these technologies.

Table 1. Host Interface Options "At-a-Glance"

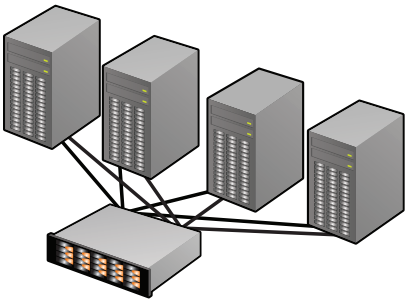
	iSCSI	SAS	FC
Description	Interconnect technology built on SCSI and TCP/IP	Serial protocol for data transfer incorporating SCSI command	A set of related physical layer networking standards to transport SCSI command sets
Architecture	IP-based standard - SCSI commands send in TCP/IP packets over Ethernet	Serial, point-to-point with discrete signal paths	Switched – multiple concurrent transactions
Distance	Unlimited, however, latencies increase as distances increase	10 meters between devices	30 meters (copper) 50,000 meters (optical)
Scalability	No limits to the number of devices	Varies	256 devices 16 million devices with the use of switched fabric

Raw Performance	1 Gb/s for an exclusive network (performance will be less for shared network environments)	6 Gb/s with x4 wide ports for theoretical bandwidth up to 24Gb/s at peak operating times	Up to 8 Gb/s
Investment	Low to Medium – use an existing or separate IP network for higher performance and security	Medium	High
IT Expertise	Medium – Requires some storage and IP cross-training	Low	High

Comparative Cost and Performance Analysis

The investment required to adopt an interface as well as the overall performance are also key attributes when selecting a host interface technology. The below cost and performance analysis is based on LSI partner list pricing based on the CTS2600 storage system where applicable . For throughput, raw MB/s was estimated on the host ports throughput capabilities and based on one port per controller, dual controllers, and two storage systems for each highly available configuration.

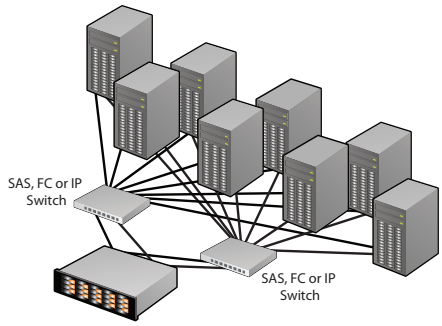
IOPs were not included in this analysis as the IOPs results were constant across all the host interface technologies offered with the CTS2600 storage system. Fortunately, the CTS2600 offers impressive IOPs results making it suitable for a range of transactional applications. These high availability configurations include the acquisition costs for the unique connectivity aspects such as cables, HBAs and switches where applicable. Any common devices, such as the storage system and drives, have been removed. For a more detailed breakdown of pricing, see Addendum A.



Shared Direct Connectivity to Four Servers

	6Gb/SSAS	8Gb/SFC	1Gb/SiSCSI
Total	$5,942	$13,980	$4,555
MB/s Read Performance	9,600MB/s	3,200MB/s	400MB/s
Price per MB/s	$0.62	$4.37	$11.39

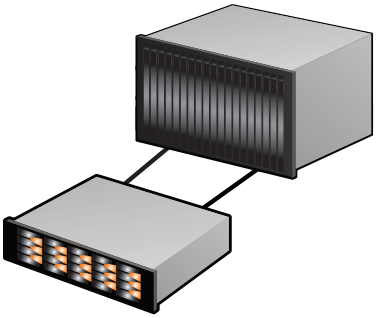
Conclusion: For direct-attached shared storage, when cost is the driving factor in an organizations purchasing decision and performance is not critical, iSCSI is well positioned from a cost perspective. For bandwidth intensive demands, SAS offers high throughput at the lowest price per MB/s and does not add any performance burden to your network.



Networked Connectivity to Eight Non-blade Servers

	6Gb/SSAS	8Gb/SFC	1Gb/SISCSI
Total	$12,794	$23,768	$5,884
MB/s Read Performance	9,600MB/s	3,200MB/s	900MB/s
Price per MB/s	$1.33	$7.43	$14.71

Conclusion: For connectivity to multiple servers, iSCSI again is the low cost alternative when performance is not a factor. For a great price-to-performance solution, SAS is very well positioned. FC is often the selection of choice when an organization has existing FC SAN implementations or requires high switching capabilities.



Networked to Eight Blade Servers

	6Gb/SSAS	8Gb/SFC	1Gb/SISCSI
Total	$5,234	$12,196	$6,397
MB/s Read Performance	9,600MB/s	3,200MB/s	400MB/s
Price per MB/s	$0.55	$3.81	$15.99

Conclusion: For both the lowest priced configuration and superior price-to-performance, SAS host connectivity can meet both of these requirements for server blade consolidation implementations.

Targeted Implementations

Interface	Markets
SAS	▪ One-room storage / integrated rack solutions ▪ "Ultimate" virtual SANs for simple direct connectivity up to four servers ▪ Cost-effective SAN for multiple servers and storage resources using the SAS switch ▪ High performance and shared storage connectivity for clustered virtual server deployments
FC	▪ Existing FC implementations ▪ High Performance servers ▪ High server count (high addressability)
iSCSI	▪ Low-cost/secondary server implementations for low cost connectivity ▪ Departmental and satellite offices

Key Applications

While the simple answer to "what host interface is the best one for my application?" can often be "it depends". With so many variables to consider, below provides some high level guidance based on host interface support and application workload.

	6Gb/SSAS	8Gb/SFC	1Gb/SISCSI
Exchange			
Virtualization			
BC/DR			
Distributed Corporate / Retail			
Mission Critical Database			
Data Warehousing			
Campus Area Replication			
Linux			
Secondary Storage			

Best Fit Adequate Not the Best Fit

Conclusion

While it is very important to look at your current environment to select the optimal host interface technology, it is wise to also consider your company's future growth. Will you be adding remote office sites? Do you expect your performance requirements to grow in the upcoming years? What applications do you plan on introducing? These requirements are just a few of many future considerations to be taken into account when investing in your storage infrastructure.

While a range of interface options is good, making a sound investment in the right interface for your organization is even better. And with storage systems, such as the CTS2600, which has the flexibility to support concurrent SAS and iSCSI or SAS and FC connectivity, all of your data requirements can be met by a single storage system. By choosing the appropriate technology based on the information offered in this document and by understanding your environment's unique requirements, you can ensure that you can meet your organization's data needs today and in the future.

Addendum

Pricing based on a partner's posted list pricing as of December 2010. Storage system and other common components that do not impact this cost comparison have not been included.

Shared Connectivity to Four Servers

	QTY	SAS	FC	1 Gb iSCSI
Interface ports	2	$2,998	$3,198	$3,198
Cable (~1M)	8	$952	$632	$5
HBAs	8	$1,992	$9,352	$1,352
SFPs (if applicable)	2	$0	$798	$0
Total		**$5,942**	**$13,980**	**$4,555**
% compared to SAS			**135%**	**-23%**
Estimated MB/s raw read performance		**9,600**	**3,200**	**400**
Price per MB/s		**$0.62**	**$4.37**	**$11.39**

Networked to Eight Non-blade Servers

	QTY	SAS	FC	1 Gb iSCSI
Interface ports	2	$2,998	$3,198	$3,198
Cable (~1M)	20	$2,380	$1,580	$14
Switch	2	$5,424	$8,840	$1,320
HBAs (if applicable)	8	$1,992	$9,352	$1,352
SFPs (if applicable)	2	$0	$798	$0
Total		**$12,794**	**$23,768**	**$5,884**
% compared to SAS			**86%**	**-54%**
Estimated MB/s raw read performance		**9,600**	**3,200**	**400**
Price per MB/s		**$1.33**	**$7.43**	**$14.71**

Networked to Eight Non-blade Servers

	QTY	SAS	FC	1 Gb iSCSI
Interface ports	2	$2,998	$3,198	$3,198
Cable (~1M)	2	$238	$158	$1
Switch	2	$1,998	$8,840	$3,198
SFPs (if applicable)	2	$0	$0	$0
Total		**$5,234**	**$12,196**	**$6,397**
% compared to SAS			**133%**	**22%**
Estimated MB/s read performance		**9,600**	**3,200**	**400**
Price per MB/s		**$0.55**	**$3.81**	**$15.99**

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