



# Using Fibre Channel to Reduce SCSI Storage Costs

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# Introduction

There are two popular methods for connecting storage arrays to servers for block-level access to storage – Direct Attached Storage (DAS) and Storage Area Networking (SAN). Both use the SCSI protocol and appear as local storage to servers. These two methods present contrasting storage architectures.

The most common architecture or method remains DAS, which uses a direct connection between a server and its dedicated SCSI storage system. These connections typically use parallel SCSI technology, which is used internally for disks as well. DAS is simple to deploy yet becomes increasingly difficult to manage as the numbers of DAS systems grow.

A newer method places fibre channel (FC) technology and FC switches between servers and storage to create a Storage Area Network (SAN). The connectivity the switches provide allows the connection of more than one server to a storage system. This reduces the number of storage systems required but substantially increases complexity and cost due to the switches.

Not surprisingly, both methods provide an almost mutually exclusive set of benefits, but an intermediate solution – DAS supporting multiple servers using FC without switches – becomes a sensible and desired alternative. Fortunately, innovative FC-based DAS solutions are now available to fill the void between traditional SCSI-based DAS and FC-based SAN.

This white paper explores how FC DAS solutions apply the benefits of fibre channel to reduce SCSI storage costs without requiring SAN switches.

## Benefits of Fibre Channel

Fibre Channel is an open-standard technology that provides reliable and fast communications at high speeds. It is most commonly used to network servers and storage using specialized switches into SANs. FC DAS solutions use fibre channel and therefore share many of its benefits, such as:

- € Reduced costs
- € Faster performance
- € Better scalability
- € Improved utilization
- € More dependability

## Reduced Costs

SCSI DAS storage systems are available in a broad range of configurations and prices. Even so, there are two general types based on where their controllers reside. Internal RAID types are DAS systems that require RAID controllers to be installed inside their server. DAS systems with RAID controllers outside the server are external RAID types. In any event, SCSI DAS storage systems can cost up to \$10,000 each or more depending on their configuration.

	<b>SCSI DAS: Internal RAID</b>	<b>SCSI DAS: External RAID</b>	<b>FC DAS Storage Solution</b>
Configuration	One JBOD System  Four Disks (One RAID 5 set plus spare)	One RAID System  Four Disks (One RAID 5 set plus spare)	One RAID System  Seven Disks (Two RAID 5 sets plus spare)
Price per Server	\$6,000	\$10,000	\$30,000
Price for 2 Servers	\$12,000	\$20,000	\$34,000 *
Cost for 4 Servers	\$24,000	\$40,000	\$38,000 *
Cost for 8 Servers	\$48,000	\$80,000	\$46,000 *

\* Includes \$2,000 for FC host adapter per server.

Storage costs are reduced significantly by consolidating the purchase of multiple SCSI DAS storage systems into a FC DAS storage solution. Four external RAID systems can cost the same or more as an FC DAS solution, without the added benefits that fibre channel provides. Moreover, the Total Costs of Ownership (TCO) for the FC DAS solution will be far less than external RAID – and internal RAID in some cases – due to the far greater management and maintenance costs of supporting multiple storage systems instead of a consolidated one.

## Faster Performance

Fibre Channel is a newer and faster technology than SCSI. As such, storage systems utilizing FC technology are generally more advanced and feature rich than those utilizing SCSI. This can result in a FC DAS storage solution providing much faster performance. FC DAS storage solutions often provide performance similar to several SCSI-based storage systems combined. This results in greatly improve performance for every server with FC DAS storage solutions.

	<b>SCSI DAS: Internal RAID</b>	<b>SCSI DAS: External RAID</b>	<b>FC DAS Storage Solution</b>
Typical RAID Cache Memory	128 Mbytes	256 Mbytes	2 Gbytes
Typical Data Transfer Rates	200 Mbytes/sec	200 Mbytes/sec	400 Mbytes/sec or more
Typical Data Transaction Rates (cached)	5,000 IO/sec	15,000 IO/sec	100,000 IO/sec or more

## Better Scalability

Consolidating the storage requirements of several servers will surely increase the storage capacity requirements of the storage system in use. Fortunately, this is another area in which

FC DAS storage solutions are far superior to internal RAID and external RAID alternatives. Each fibre channel disk connection supports a far greater number of disks than SCSI can, so FC DAS storage solutions often scale to extremely large storage capacities. It is unlikely servers connected to a FC DAS storage solution will out-grow the supported storage capacity, unless their requirements are highly unusual.

	<b>SCSI DAS: Internal RAID</b>	<b>SCSI DAS: External RAID</b>	<b>FC DAS Storage Solution</b>
Typical Number of Disk Bays Per Enclosure	12 or 14	12 or 14	12 or 14
Typical Number of Supported Enclosures	1 to 2	1 to 3	1 to 8
Online Enclosures Installation	No	No	Yes
Maximum Capacity Using 146 GB Disks	4 TB	6 TB	16 TB or more

## Improved Utilization

The storage consolidation provided by a FC DAS storage solution provides far superior storage utilization. FC DAS storage solutions allow adding capacity one disk at a time and allocating the new storage capacity to one or multiple servers. Increasing storage capacities when using internal RAID or external RAID requires adding one or more disks per system.

For example, adding storage capacity to four servers would require a minimum of four disks when using internal RAID or external RAID – one for each storage system. FC DAS storage solutions can provision storage to servers as needed, so it could require as little as one disk to increase the storage available to four servers.

An even more basic aspect of storage utilization involves the unusable disk capacity required for RAID protection and spare disks. With internal RAID and external RAID, each includes an independent set of disks configured for RAID protection. Using RAID 5 protection results in one disk lost to parity overhead and potentially one additional disk for use as a spare. If there are four such systems in use, each is 'wasting' two disks each for a total of eight disks.

A FC DAS storage solution would provide storage to all four servers using one set of disks configured for similar RAID 5 protection and one spare disk. The number of disks made unusable for user storage is reduced by 75% in this example. Moreover, storage capacity is more precisely allocated using FC DAS storage solutions since any portion of the added capacity can be allocated to any server. The alternative is to add storage to internal RAID or external RAID in exact increments of one disk per server. The efficiency and advantages of an FC DAS storage solution grows as the number of servers increase.

## More Dependability

The common measure of dependability for storage systems is Reliability, Availability and Serviceability (RAS). Reliability reflects how infrequently the storage system will experience a

component failure, regardless of the effects of that failure. Availability describes the likelihood that the storage system will remain usable over time. Serviceability describes the ability to perform maintenance on the storage system without removing it from service. Together with uptime and downtime ratings, they provide common factors for comparing products.

	<b>SCSI DAS: Internal RAID</b>	<b>SCSI DAS: External RAID</b>	<b>FC DAS Storage Solution</b>
Reliability	Low	Medium	High
Availability	Low	Medium	High
Serviceability	Low	Medium	High
Uptime Rating	99.9%	99.99%	99.999%
Downtime Rating	~8 hours/year	~1 hour/year	~5 min/year

These ratings will differ among systems, particularly the uptime and downtime ratings. Detailed information on RAS and other dependability parameters can be found in product data sheets, users guides and technical documentation. In any event, the dependability of FC DAS storage solutions is superior to internal RAID or external RAID storage systems.

## Comparing FC DAS Storage Solutions

There are many factors that are important to consider when comparing FC DAS storage represent solutions, though there is no perfect criteria list. The following questions and suggestions are a basic set of guidelines, so be sure to add criteria important to each environment. The comparison checklist at the end of this document can help with summarizing comparison ratings of FC DAS storage solutions.

### Number of Host Ports

Identify FC storage systems that provide multiple FC host ports without requiring external FC switches or other hardware options. FC storage systems with at least eight built-in FC host ports enable a transition from SCSI storage to FC storage without increasing costs.

### Supported Platforms

Confirm that the FC storage system under consideration can support multiple operating systems simultaneously and can do so without requiring expensive software options. Also, ensure all features are available for every supported server platform and operating system.

### Sufficient Performance

Sharing an FC storage system among servers will result in sharing its performance as well. Fortunately, FC storage systems are now available where the performance provided is greater than the performance provided by several SCSI storage systems combined. Look for these for best results.

## Dependability

Reliability, availability and serviceability (RAS) become critical with FC storage systems since any disruption can affect multiple servers at once. Ask for documentation to support any RAS claims and avoid products without proof of five 9's (99.999%) uptime or better.

## Management Software

A comprehensive storage management suite greatly simplifies storage set-up, configuration and monitoring. Ideal FC storage systems offer software that supports all popular server operating systems at no cost or low cost. The availability of multi-pathing and load balancing software is a plus.

## Total System Price

Watch out for FC storage solutions requiring expensive service and maintenance agreements. Such contracts can increase the total system price of an FC storage system to levels that make these solutions impractical.

## Scalability

Exactly what is required to scale the FC storage system? Many require substantial hardware and software upgrades as they scale, which creates costly barriers in the future. This is rather common for product families that have many outwardly similar models.

## Conclusion

Technology innovations continue to result in an increasing number of choices for storage systems. Some products are so different that their benefits are uncertain or difficult to attain. Others however, offer genuine improvements while also reducing costs.

The newest FC DAS storage solutions are an excellent choice to sensibly reduce costs. They use popular and field proven technologies – such as external RAID, DAS architectures and fibre channel – to provide consolidated storage for multiple servers at costs lower than SCSI.

## Comparison Checklist

Complete one checklist for each product. Add important categories of your own, if desired. Score as follows: 1 point for good, 2 points for better and 3 points for best. Total the scores for each checklist. Products with the highest scores merit serious consideration.

1. Number of Host Ports	£ Two FC host ports (good)
	£ Four FC host ports (better)
	£ Eight FC host ports or more (best)
2. Supported Platforms	£ Supports one operating system at once (good)
	£ Supports two operating systems at once (better)
	£ Supports multiple operating systems at once (best)
3. Sufficient Performance	£ Similar performance as SCSI storage (good)
	£ Twice as fast as SCSI storage (better)
	£ Four times faster than SCSI storage (best)
4. Dependability	£ All components removable (good)
	£ All components redundant (better)
	£ All components hot-swap (best)
5. Management Software	£ Basic software for set-up and configuration (good)
	£ Above, plus multiple system administration (better)
	£ Above, plus multiple system event reporting (best)
6. Total System Price	£ System price includes all hardware items (good)
	£ Above, plus includes management software (better)
	£ Above, plus includes service and support (best)
7. Scalability	£ Scales, but can require multiple upgrades (good)
	£ Scales, but requires software upgrades only (better)
	£ Scales by adding disks and enclosures alone (best)
8. _____	£ (good) _____
	£ (better) _____
	£ (best) _____
9. _____	£ (good) _____
	£ (better) _____
	£ (best) _____
10. _____	£ (good) _____
	£ (better) _____
	£ (best) _____

Product Name: \_\_\_\_\_ Score: \_\_\_\_\_