



# Easy-attach Storage

## Making SAN Affordable

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## Storage On Overload

Businesses today are facing data storage requirements that are fast exceeding their existing storage capacity. New regulatory and business needs are requiring companies to retain years of data at every level, and multimedia applications, large file transfers via e-mail, and replacement of paper, film and microfiche recording processes are increasing storage requirements even more. Many businesses are also looking to add off-site storage for additional availability and redundancy in situations such as disaster recovery.

The need for storage capacity is increasing so much that in 2004, over 60% of storage managers are increasing their spending on storage, with half of them increasing spending by more than 10%.<sup>1</sup> In choosing storage products to meet these new capacity demands, companies need to consider the versatility, scalability, and total cost of ownership (TCO) of available storage solutions. In the past, high equipment and operations costs associated with proprietary technologies have put Storage Area Networks (SANs) beyond the budget of many small and mid-sized companies. But open architectures based on industry-standard technologies and new management tools are helping to lower the overall cost of SAN systems, making them a practical solution for today's increasing storage requirements.

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1. Storage Magazine's March 2004 Purchasing Intentions Survey.  
<http://storagemagazine.techtarget.com>

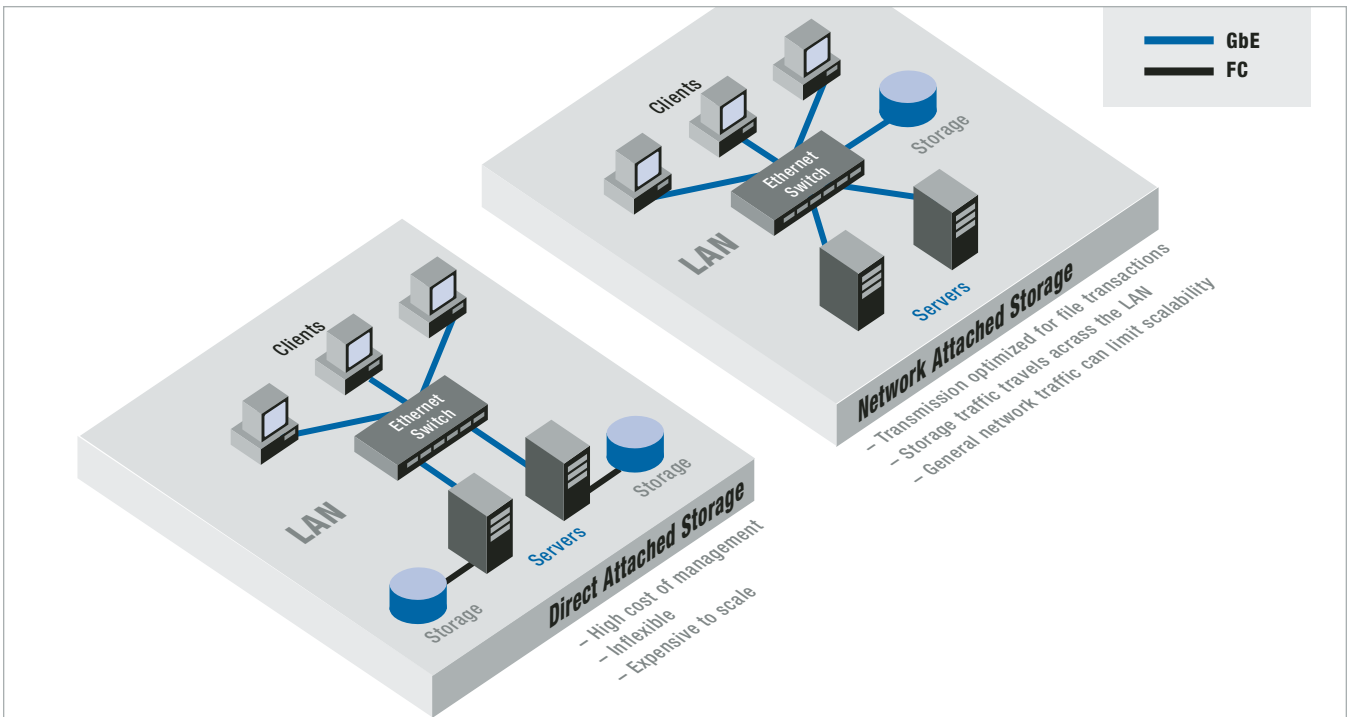


Figure 1: Storage on Overload. Growing enterprise storage requirements are exceeding the limited scalability of DAS and NAS storage technologies.

## Storage Basics

Businesses and other organizations require effective ways to store and maintain growing quantities of data. Today's technology offers three basic storage options: Direct Attached Storage (DAS), Network Attached Storage (NAS) and Storage Area Networks (SANs).

### Direct Attached Storage (DAS)

In its simplest form, DAS consists of a disk drive, or multiple disk drives, attached directly to a server. Data is typically transferred using SCSI (Small Computer System Interface) commands. SCSI commands, used by standard storage transfer data as blocks, low-level, granular units.

DAS is very easy to implement, but there are a number of limitations to the DAS approach including high cost of management, distance limitations and limited scalability. In particular, in order to increase storage capacity, enterprises must purchase more servers. And DAS is a local drive technology, designed to be attached within a few inches or feet of the server. These limitations have driven the need for network storage.

### Network Attached Storage (NAS)

NAS is a file-based storage architecture with resources attached directly to the LAN. Storage traffic is transmitted through files, the most common means of transferring data over LANs.

Since it uses familiar Ethernet technology, NAS resources can be managed by existing IT staff with minimal training in storage management, which may reduce IT costs. Another benefit of NAS is flexibility, since the storage unit(s) can easily be attached to the network. However, this is not a highly scalable option, since storage access is dependent on general network traffic. Traffic can become very heavy due to usage spikes or business growth (e.g., an insurance company processing claims after a hurricane or an online retailer storing orders for a new product line). These spikes may seriously decrease the performance of the LAN, and slow storage access can affect application performance.

## Storage Area Networks (SANs)

SANs are dedicated networks that connect servers to storage devices and transport storage traffic without burdening the enterprise LAN (Figure 2). Switches and other equipment in a SAN have historically communicated via a network protocol suite called Fibre Channel, which allows SCSI commands to be transmitted via serial, rather than parallel, connections. The protocol also allows for relatively high throughput, transmitting data at 1 and 2 Gb/s in current products and 4 and 10 Gb/s in upcoming products<sup>2</sup>.

Several factors help make SANs attractive: not only do they provide very scalable, efficiently accessible storage, they can also offer superior protection for critical business information and the ability to more intelligently and flexibly manage the storage that's available.

Storage architecture may affect the performance of enterprise servers and applications. In the absence of storage management tools, servers with high-demand applications and often-used data may become overloaded while others remain relatively idle. SANs can manage storage to help balance data demands across servers and control storage costs. SANs are also highly scalable. Growing storage demands can be met by simply re-allocating existing storage or by installing more storage and network resources. The centralized data management provided by SANs can also help avoid redundant file copies that rapidly consume disk space and multiple file versions that cause reconciliation problems (which can be serious for companies needing to achieve regulatory compliance).

## Easy-attach, Low-cost SAN

SAN is a versatile, scalable form of storage, but until now, it has been cost-effective only for large companies with massive, complex storage needs because proprietary technology made for a very high Total Cost of Ownership (TCO). Now, Internet SCSI (iSCSI) connectivity and other technology developments are helping to produce a new generation of high-speed, low-cost, long-distance SAN products. iSCSI is a standard protocol for encapsulating SCSI commands into TCP/IP packets, enabling block data transport over IP networks. It helps change the TCO equation by simplifying SAN management, taking advantage of existing ethernet network infrastructure and by extending the operating distance of SAN to the range of the Internet. Fibre Channel vendors are also helping to reduce the cost of SAN connectivity by offering lower cost FC Host Bus Adapters (HBAs), disk drives and switches.

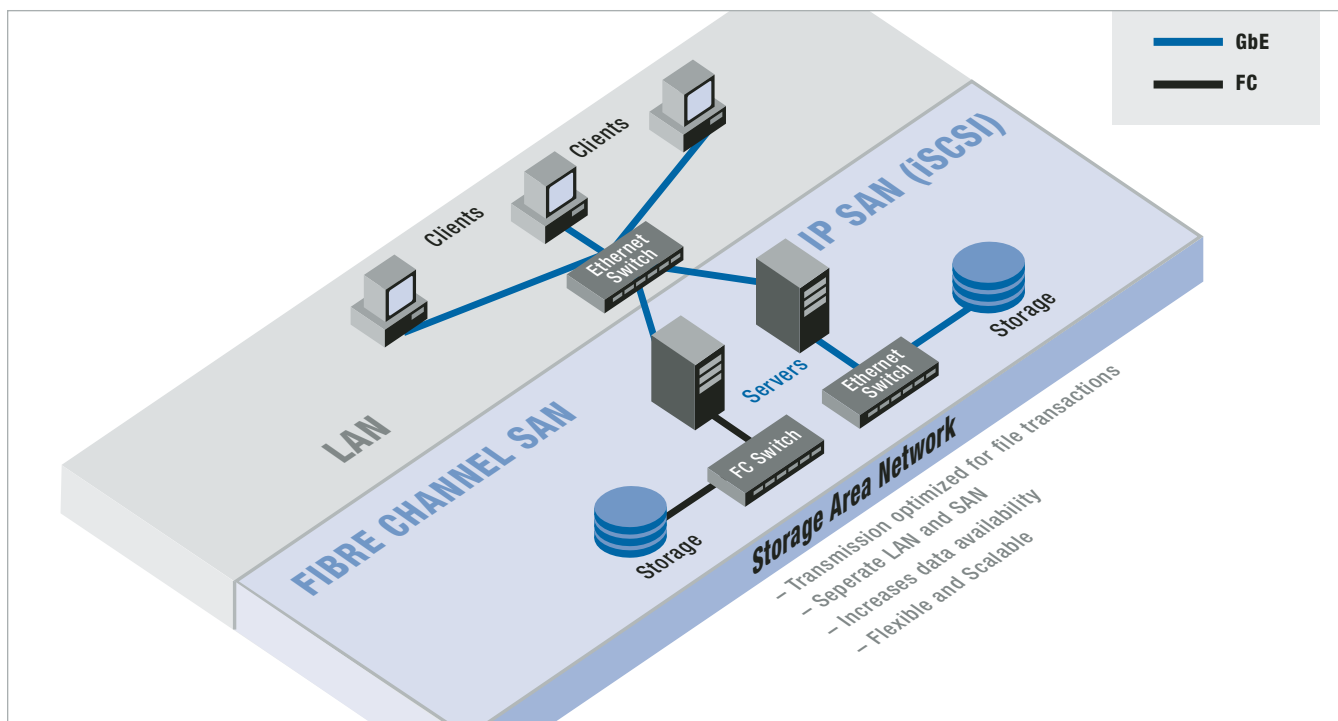
Off-the-shelf disks and servers help to lower equipment and upgrade costs, and new management technology is boosting the ease of use and versatility of SAN, making it a cost-effective option for a widening variety of enterprise storage needs.

## Simpler Deployment and Administration

For many organizations, the largest barrier to SAN storage has been the cost of outsourcing or hiring staff with the specialized skills needed to configure and administer Fibre Channel-only SANs. iSCSI SANs are built on stable SCSI and Ethernet technologies familiar to most IT staffs. SANs become essentially easy-to-deploy components of the IT infrastructure. Companies can further decrease administration costs and utilize existing resources by considering non-proprietary, intuitive SAN management software tools more commonly available with today's SAN systems.

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2. 1 and 2 Gb/s is the industry standard today. The Fibre Channel Industry Association (FCIA) is moving the industry to 4 and 10 Gb/s.



**Figure 2: Storage Area Network showing iSCSI or Fibre Channel connectivity.** New SAN systems use standards-based, lower cost technologies, components and management software making SAN storage simpler to manage and more affordable.

## Low Equipment Costs

Recent developments in SAN systems help to lower purchase and deployment costs because they are built with open, non-proprietary technology. Serial ATA (SATA) is the disk technology of choice for the new-generation SANs. SATA helps to overcome many of the performance limits, cabling issues and other limitations of parallel ATA disk storage with comparable reliability. SATA storage combines software transparency, low cost, and scalability to help lower the purchase and upgrade costs of SAN storage. And SATA disks are hot-pluggable, so storage capacity can be added without taking the storage network off line.

Flexibility in connectivity options is further driving down costs to implement a storage area network. For example, lower cost Fibre Channel Host Bus Adapters (HBAs), disk drives and switches are driving down costs to implement Fibre Channel connectivity. The interoperability of iSCSI connectivity helps to lower deployment and infrastructure costs, reducing disparate networks and cabling by utilizing commodity Ethernet infrastructure. iSCSI is designed to function over standard Gigabit Ethernet (copper or optical cabling) already in place in most buildings today.

## Safer, More Accessible Storage

Although the theoretical limit for Fibre Channel transmission is 10 kilometers, individual multi-mode fiber links used in Fibre Channel SANs may have a practical limitation of 250 to 500 meters. The storage ecosystem is evolving to where organizations often have SANs located far from the LAN, to provide geographical redundancy as part of disaster planning. This means even 10 kilometers may be increasingly inadequate.

Because transmissions can travel over the worldwide standards-based switching infrastructure of the Global IP Network, iSCSI SANs have no practical distance limitations. With support for widely distributed storage networks and for all the RAID levels in use today, low-cost SANs become a practical solution for remote data replication or for geographically distributed organizations that require real-time distributed access to shared data. For example, a high-tech company based in San Jose, California, could use an iSCSI SAN to back up their data to a remote location in case of an earthquake. Or an international architecture firm could enable work team members to share the latest project data without waiting 24 hours for traditional replication, backup, and reconciliation procedures.

## Choosing SANs

There are a number of technologies and ease-of-use features that IT departments should consider in choosing affordable, easy-to-manage SAN technology.

First, consider iSCSI connectivity to help ensure flexibility, scalability, and easy-attach, easy-upgrade management. Having the option of Fibre Channel connectivity is a plus, for compatibility with deployed SAN infrastructure. Look for hot-swappable SATA disks for lower costs and easy upgrades. Finally, consider the management software available with the SAN server. Ideally, the SAN should have a drag-and-drop management interface with easy to use features such as:

- **Snapshot Technology:** Similar to incremental database backups, this feature lets administrators make an instantaneous copy of incremental changes to a storage volume, then back up from the snapshot. Users have continuous access to the data on the original volume.
  - **Hot Spare Support:** The storage pool should be configurable to support a hot spare storage module. If an active module fails, the hot spare should automatically join the cluster, and administrators should be notified of the failure automatically, so they can resolve the issue at their convenience.
  - **Storage Virtualization and Pooling:** Administrators should be able to cluster storage modules into a virtual storage pool that can be configured dynamically from a centralized management console. With this capability, storage capacity can potentially scale to hundreds of terabytes automatically and without system downtime. Individual volumes can then be provisioned to maximize available capacity and/or data protection.
- **Volume Over-provisioning:** This feature would allow IT staff to configure a system as if it had more disk capacity than is actually installed, then add disks as needed. The system would then notify administrators as data approaches current disk capacity so they could add more disks. Over-provisioning would help storage capacity expand to meet business needs without having to disrupt business operations by constantly taking the SAN offline for reconfiguration or taking client servers (such as a Microsoft\* Exchange server) offline to expand partitions and resize databases.
  - **Remote Copy:** This feature would provide the management capability to snapshot and replicate data between multiple data centers, to ensure business continuity in case of natural disasters or outages. Creating remote snapshots in a second location would ensure that database applications such as Microsoft Exchange and Microsoft SQL Server\* have continuous access to data volumes. If the production server or volumes became unavailable, application processing can be failed over to the secondary application server, which could then access data from the remote snapshots.

## Find Your Sanity (Reconsidering SAN)

With the availability of low-cost, easy-to-use SAN technology, SAN storage is becoming cost-effective and suitable for a variety of enterprise storage needs, from increasing storage capacity to remote data replication and providing real-time distributed data access. Even businesses and institutions with limited IT resources, infrastructure and budget can now enjoy the scalability and versatility of SAN for their growing storage needs.

Ideally, virtualization intelligence would be distributed on storage modules across the network. Since no single device would control either management or data traffic, there should be no performance bottleneck, no single point of failure, and no strain on server resources.

## For More Information

*The Storage Networking Industry Association (SNIA)*

[www.snia.org](http://www.snia.org)

*IP Storage Forum – iSCSI subgroup within SNIA*

[www.snia.org/tech\\_activities/ip\\_storage/iscsi](http://www.snia.org/tech_activities/ip_storage/iscsi)

*iSCSI: The Future of Network Storage Whitepaper*

[www.intel.com/network/connectivity/resources/doc\\_library/white\\_papers/iSCSI\\_network\\_storage.pdf](http://www.intel.com/network/connectivity/resources/doc_library/white_papers/iSCSI_network_storage.pdf)

*Fibre Channel Industry Association*

[www.fibrechannel.org](http://www.fibrechannel.org)

*The Internet Engineering Task Force (IETF)*

[www.ietf.org](http://www.ietf.org)

*The Serial ATA Working Group*

[www.serialata.org](http://www.serialata.org)

*More on Serial ATA Technology*

[www.intel.com/technology/serialata/index.htm](http://www.intel.com/technology/serialata/index.htm)

*A Good Overview of Storage Technology*

[www.findarticles.com/cf\\_dls/m0BRZ/9\\_23/109082347/p1/article.jhtml](http://www.findarticles.com/cf_dls/m0BRZ/9_23/109082347/p1/article.jhtml)



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