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# Beyond Storage Consolidation

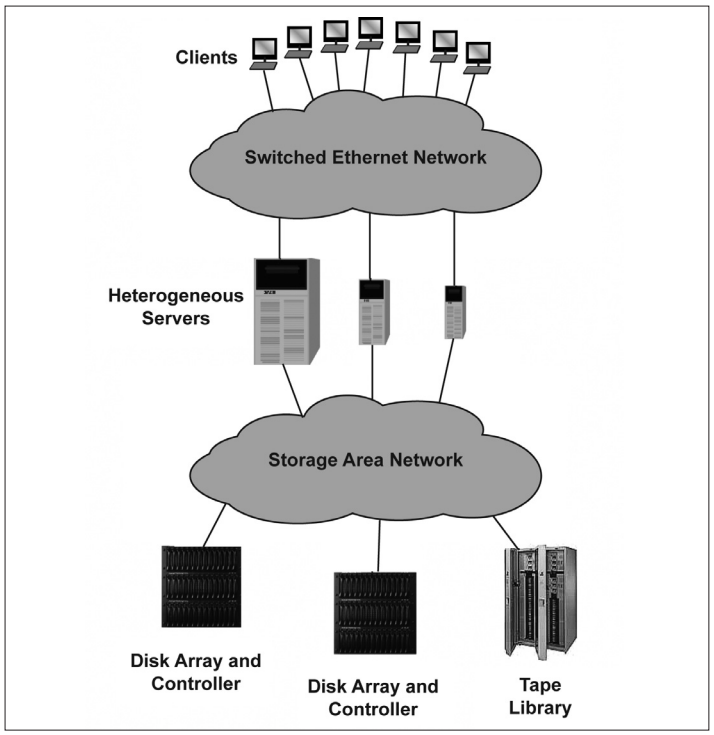
## The benefits of iSCSI SANs

*By Eric R. Schott*

Managing storage and reducing administrative costs are at the center of an increasingly complex problem that challenges small and large businesses alike. Today, most data centers have storage directly connected to individual servers. This method of direct attached storage (DAS) is expensive, difficult to grow, and limited in management capabilities—especially as servers proliferate.

Storage area networks (SANs) provide a solution to many storage management challenges via the ability to consolidate storage for many servers in a centrally managed resource. However, until mid-2003, IT managers had considerable obstacles to contend with since Fibre Channel was the sole means for implementing a SAN. While justifiable for large enterprises, FC-SANs come with significant initial and ongoing costs as well as administrative and management complexities that most enterprises cannot justify. The arrival of Ethernet-based SANs and the iSCSI standard changed the SAN playing field and made the benefits of consolidated storage available to businesses of all sizes.

By combining the simplicity of Ethernet networks with the advanced storage features mission-critical applications require, iSCSI SANs deliver simplified storage management and consolidation at a reasonable price. The key to controlling costs and increasing storage management can be found in a SAN solution that couples best-of-breed consolidation and virtualization methods with iSCSI connectivity. Storage consolidation expands device connectivity and reduces points of management, while virtualization delivers a centralized, flexible method of management that masks the complexity of storage infrastructures and reduces administrative overhead.




### Storage Consolidation

Storage consolidation is an architecture that allows storage devices and servers to be acquired, managed and upgraded independently. In a consolidated storage environment, numerous heterogeneous servers and applications share a single pool of storage on a network. A consolidated infrastructure can lower management costs and results in easy scalability, high availability and efficient storage space utilization. It also simplifies backup and disaster-recovery strategies. An additional benefit of consolidated storage is that costs can be divided between various departments and groups using the storage. Increasingly, businesses are turning to iSCSI SANs to consolidate storage based on the solution's cost effectiveness, ease of use and block-level support. Figure 2 is an example of a consolidated solution.

Today, IT departments need a consolidated storage solution for their critical applications which provides the same functionality as high-end solutions made for mission-critical applications—but at a significantly lower cost and without excessive administrative overhead. To lower the total cost of ownership of the IT infrastructure, organizational storage costs must be parallel to their application and hardware investments. iSCSI SAN vendors are tackling this opportunity by delivering cost-effective solutions for storage and protection of data.

Vendor solutions in this emerging market vary in the level of features and capabilities offered, so IT managers should create a checklist of key capabilities for their iSCSI SAN, including: seamless expandability, automatic load balancing, automatic storage provisioning, disaster tolerance, and replication. iSCSI SANs are an ideal solution for data centers seeking to move away from DAS and realize the advantages of consolidated storage without the complexity and cost of conventional high-end, Fibre Channel SANs.

### Virtualization

Once storage is consolidated, the job is only half done because users still need a way to manage the storage. Enter virtualization. The goal of virtualization is to make a complicated task easy to perform. For example, operating system technologies utilize virtualization in a variety of areas, including the evolution of memory management from a manual process to a virtual memory subsystem that dynamically allocates memory as needed.

| Virtualization Method | Benefits | Deficiencies |
|---|---|---|
| Host-based (volume manager) ★ | Supports multi-vender storage systems | Many points of management<br>Single software vendor<br>Difficult to deploy, especially with mixed platforms<br>Must install and manage software on each host<br>Steals bandwidth from host<br>Slow snapshot capabilities<br>Storage pool limited to a single host |
| In-band appliance (located in I/O path) ★★ | Supports multi-bender storage systems<br>Optimizes performance if a dedicated switch | Additional point of management<br>Single switch vendor (difficult network upgrades)<br>No knowledge of device capacity or status<br>All I/O must flow through appliance<br>Steals bandwidth from host<br>Slow snapshot capabilities |
| Out-of-band appliance (located out of I/O path, except for snapshots) ★★ | Supports multi-vender storage systems<br>Optimizes performance | Additional point of management<br>Single switch vendor (difficult network upgrades)<br>No knowledge of device capacity or status<br>May not support all platforms<br>Must install software on host (or HBA)<br>Steals bandwidth from host<br>Slow snapshot capabilities |
| Storage subsystem ★★★★ | Reduces management complexity<br>Standard network hardware<br>Optimizes performance<br>Integrated RAID management<br>Fast snapshot capabilities<br>Can co-exist with other solutions | Some products limit storage pool to a single array<br>Single storage vendor |

★ Degree to which solution meets next generation virtualization criteria (4 stars is the maximum score).

Similarly, virtualization helped e-mail communication gain mass usage by allowing users to simply type the destination address, eliminating the need to understand network routing schemes.

As with memory management and e-mail, storage virtualization seeks to simplify unwieldy tasks such as setup, storage allocation, load balancing, RAID configuration, backup, replication, and snapshots. True virtualization takes storage administrators away from physical layouts and constraints of the underlying storage hardware. The decoupling of physical storage from logical volumes makes these normally disruptive activities transparent to hosts. By disassociating the physical disks from the logical volumes presented to hosts, administrators are no longer bound by disk capacity and performance, nor are they forced to cable or layout data across devices every time workloads change.

While the goal of virtualization is to simplify storage management, not all solutions achieve this objective effectively. Early-generation storage virtualization products deliver flexibility; however, they do little to reduce complexity. In fact, many of these products require extensive administrator involvement and increase the number of components an IT administrator must manage, load balance, configure, and provision.

Next-generation virtualization solutions address these challenges. They mask the underlying intricacy of the storage environment by creating a single pool of protected storage, not just a set of consolidated disks. Loads are automatically balanced and logical volumes are easily created and expanded on demand with no user impact. RAID configuration and backup, replication, and snapshot capabilities are integrated and transparent to applications. The Table outlines the methods to implement storage virtualization.

**The SAN is Now the Data Center**

The consolidation and virtualization of storage lays the foundation for unprecedented flexibility of a new, more dynamic data center. Going by many titles (on-demand computing, utility computing, grid computing) they all point to the same vision: a virtual pool of data center resources that can respond nimbly to user demands. Industry analysts and companies are working toward this new data center architecture, which would have only three components: servers, network infrastructure and storage. These three attributes of the new data center are virtual pools of scalable resources made up of intelligent, modular equipment that can be deployed or decommissioned as needed, seamlessly and without downtime.

In this new data center, servers can now be connected to a central storage resource. Using boot from SAN capability, the servers can be deployed or decommissioned as needed with no disruption to applications. The emphasis shifts from the server as the central resource to the SAN, which is now consolidated, centrally managed, and protected. The SAN can be expanded as needed without downtime. Data is available to applications, which run on expendable and interchangeable servers.

IP-SANs can serve as the platform for the virtual data center. This platform must offer seamlessly scalable storage that expands transparently as new arrays are added, integrate a full complement of high-end management capabilities including data protection, and operate autonomically with a "set it and forget it" intelligence that can be trusted—all in a fully redundant system that ensures consistent data availability.

There is no question that the data center of the future will be virtual, and that more and more IT managers will demand that their data center systems be completely integrated and automated. This is a positive for customers and vendors alike, as the paradigm shift towards simplicity, integration, and automation has enormous operational benefits to customers and presents a compelling business opportunity for those vendors creative enough to engage with it.

**Conclusion**

An enterprise-quality SAN solution should offer the following:

- Scalable, highly available pool of storage
- Storage allocation and resizing on demand
- Centralized management with easy-to-use interfaces and remote access
- Security that protects logical volumes from unauthorized access
- Automatic load balancing for performance optimization
- Snapshot and replication functionality
- Host platform independence
- High-performance, multi-path host access

IT managers must design a storage strategy that couples cost considerations with overall system management and longer-term objectives. Using an iSCSI SAN can be an effective method for implementing such a storage strategy, but IT managers must recognize that not all storage devices with iSCSI connectivity are created equal. Evaluating the SAN's methods of consolidation and virtualization is critical to finding a solution that delivers the management capabilities needed to lower the total cost of ownership, increase storage utilization, streamline system administration, and lay the groundwork for the virtual data center.

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