Abstract

As storage demands continue to increase and become more complex, businesses are faced with the daunting task of managing these demands amidst tightening IT budgets. iSCSI technology has developed into an easily managed, cost-effective storage solution which promises to overcome these challenges.

This white paper is intended to provide an overview of data storage solutions in use today and how their shortcomings are resolved through the implementation of iSCSI technology.
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Introduction: Storage Technologies

As global economies continue to expand, so do the demands for effective data storage. Small, medium, and enterprise businesses require robust storage solutions to support ever expanding email and e-commerce environments.

Before the benefits of iSCSI can be realized, it’s important to understand the different types of data storage solutions in use today. There are two primary types of storage, DAS (Direct Attached Storage), and networked storage, which consists of NAS (Network Attached Storage) and SAN (Storage Area Networks).

DAS: Direct Attached Storage

- High Performance I/O
- High Security
- Distance Limitation
- Low Scalability

DAS, in its most basic form, is simply a storage device, such as a hard drive, with a dedicated parallel connection to a server. In larger installations, data is stored to DAS RAID disk subsystems. Servers connect to DAS devices via SCSI (Small Computer System Interface) or Fibre Channel ports capable of transmitting data at a rate of up to 320MB/sec. SCSI is a transfer protocol which uses very fast and efficient granular block I/O commands for transferring data to the DAS device. DAS storage has its share of strengths and weaknesses.

Speed and security are two advantages of DAS. With up to 320MB/sec transfer rate, DAS is currently the fastest storage solution available today. DAS is also very secure since it utilizes a direct physical connection to the server, and cannot be spoofed (tricked) into giving access to unauthorized sources.

The major disadvantages of DAS are its distance restriction, high network overhead, and limited scalability. SCSI device connections cannot typically exceed 12 meters, which means data storage is usually confined to a single room, or even within a single system enclosure. Network File-Level access to DAS devices is accomplished by sharing the data through the host operating system. Sharing storage in this manner eats up system resources, burdens the LAN (Local Area Network) with storage traffic, and decreases network bandwidth. Another DAS handicap is limited scalability. Since the storage device connects directly to the server, when additional storage is required, more servers must be added. As a result, storage management becomes increasingly complex and costly as demands for data storage grow.
NAS: Network Attached Storage

Network attached storage (NAS) has become a popular storage solution. NAS appliances are storage devices that connect directly to the LAN via standard Ethernet port and use the familiar TCP/IP protocol to communicate with network peers. TCP/IP works by dividing up actual files into many small fragments, encapsulating into packets, then sending as frames through the LAN or WAN (Wide Area Network). NAS is an attractive storage solution for some businesses, but proves to be inadequate for others.

One advantage of NAS over other storage technologies is its ease of implementation. The plug and play nature of NAS makes it a flexible storage option for small businesses and is easily administered by existing IT staff. In addition, the use of TCP/IP eliminates distance limitations associated with DAS storage solutions. As a result, NAS appliances can be accessed over the network regardless of their physical location.

Among the disadvantages of NAS is its high network overhead and limited scalability. Storage data to and from the NAS must travel across the same network as other servers, which burdens the LAN, and limits bandwidth. NAS scalability is also an issue for many organizations. As data storage demands increase, additional NAS devices must be added to the network, complicating management. As NAS appliances accumulate on the LAN, storage traffic continues to increase, consuming network bandwidth, and decreasing data availability.
SAN: Storage Area Networks

SAN (Storage Area Network) is a network dedicated to providing storage to enterprise servers. SANs are traditionally configured using special switches and storage devices that communicate via Fibre Channel protocol. The Fibre Channel protocol uses block-level SCSI commands which are transmitted over serial, rather than parallel connections, and can span up to 500 meters. Servers connect to the SAN using special Fibre Channel HBAs (Host Bus Adapters) capable of transmitting data at 1Gbps, 2Gbps, and soon even 10Gbps.

SAN configurations are desirable for many reasons. SANs isolate data storage traffic on a dedicated Fibre Channel network which increases bandwidth and data availability on the enterprise LAN. SANs also offer a centrally accessible/manageable data store easing administration. While SAN storage solutions lead the pack when it comes to performance, scalability, and management, they do suffer drawbacks.

The primary disadvantage of SANs is cost. Since it is still a rather new technology, Fibre Channel equipment remains expensive, as is the support required to implement and maintain it. Another drawback of SAN is its distance limitation. Although higher than SCSI DAS, SANs still have a practical distance limitation of 250-500 meters. This limitation has proven inadequate for businesses and government agencies requiring offsite interstate disaster recovery plans. SAN solutions have been adopted by enterprise businesses, but continue to elude small and medium businesses, reluctant to implement due to costly dedicated hardware and IT support expertise.
iSCSI: Internet SCSI  
**Picks up where DAS, NAS and SAN, Left Off**

- High Performance Block Level I/O
- Utilizes Existing Ethernet LAN
- No Distance Restrictions
- Cost Effective
- Centralized Management
- Higher Storage Utilization

As the demands for data storage continue to increase on a global scale, a new technology standard has emerged to address the drawbacks of DAS, NAS, and SAN data storage solutions. Enter iSCSI.

iSCSI (Internet SCSI) or SCSI over IP, was developed by the IETF (Internet Engineering Task Force) and ratified in February 2003. iSCSI transmits data via TCP/IP over existing network infrastructures, but with high performance block-level I/O. Instead of fragmenting and encapsulating actual data files into packets, as with NAS, iSCSI encapsulates much smaller SCSI command blocks. This results in data transmission speeds at nearly the same rate as direct SCSI connections, and relieves the network of bandwidth depleting file level storage traffic. In addition, since block-level I/O is transferred over IP, high performance data storage is no longer held captive to just LAN and MAN (Metropolitan Area Network) environments, but is now applicable in WAN environments as well. Without the distance restrictions associated other storage solutions, iSCSI presents an effective way to accomplish high performance offsite disaster recovery. Use of iSCSI is also a great way to consolidate or “pool” data, making management a snap. This results in higher storage utilization which helps to keep IT costs down.

The advent of iSCSI enables small and medium businesses to reap the benefits of enterprise level Fibre Channel storage solutions, without the expense of implementation and mandatory support expertise. Companies now have a cost effective storage solution that provides high performance, utilization of existing network infrastructures, and centralized storage.