WHITE PAPER

COMPARING STORAGE AREA NETWORKS AND NETWORK ATTACHED STORAGE

Complementary technologies provide unique advantages over traditional storage architectures

BROCADE
The intelligent platform for networking storage

Often seen as competing technologies, Storage Area Networks (SANs) and Network Attached Storage (NAS) actually complement each other very well to provide access to different types of data. SANs are optimized for high-volume block-oriented data transfers while NAS is designed to provide data access at the file level.

Both technologies satisfy the need to remove direct storage-to-server connections to facilitate more flexible storage access. In addition, both SANs and NAS are based on open industry-standard network protocols—Fibre Channel for SANs and networking protocols such as TCP/IP for NAS. While SANs support a broad range of applications—including providing storage for NAS appliances—NAS storage is typically limited to applications that access data at the file level. Regardless of their differences, both SANs and NAS play vital roles in today's enterprises and provide many advantages over traditional server-attached storage implementations.

SAN and NAS Fundamentals

SANs and NAS are increasingly replacing or supplementing traditional server-attached storage implementations in many data centers. As a result, organizations are realizing a wide range of benefits, including increased flexibility, easier storage deployment, and reduced overall storage costs. Although both SAN and NAS technologies can provide a competitive advantage, each is designed for specific types of environments and applications.

Key SAN Characteristics

SANs are networked infrastructures designed to provide a flexible, high-performance, and highly scalable storage environment. SANs accomplish this by enabling many direct connections between servers and storage devices such as disk storage systems and tape libraries.

High-performance Fibre Channel switches and Fibre Channel network protocols ensure that device connections are both reliable and efficient. These connections are based on either native Fibre Channel or SCSI (through a SCSI-to-Fibre Channel converter or gateway). One or more Fibre Channel switches—such as one of the Brocade® SilkWorm® family of switches—provides the interconnectivity for the host servers and storage devices in a meshed topology referred to as a "SAN fabric" (see Figure 1).

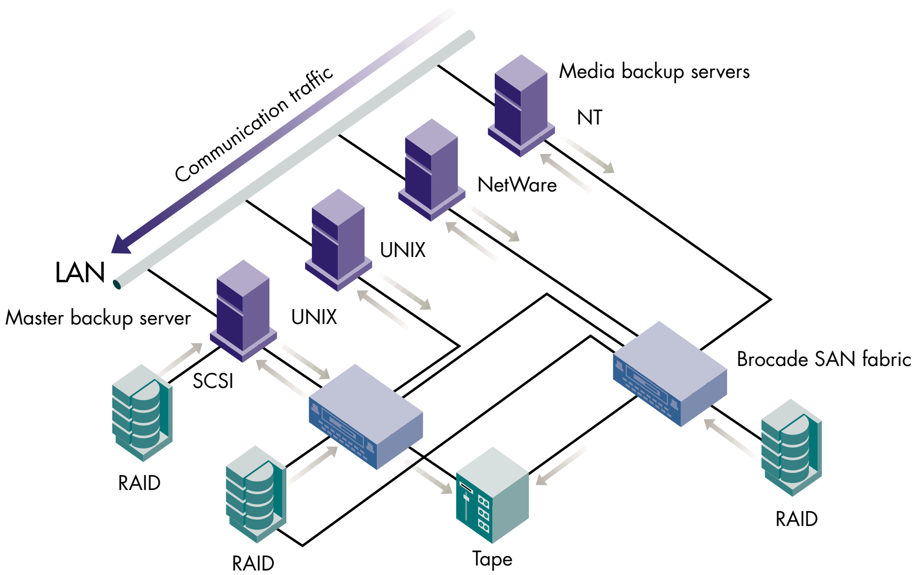

Figure 1.
A basic SAN infrastructure using LAN-free data backup to reduce network traffic

Because SANs are optimized to transfer large blocks of data between servers and storage devices, they are ideal for a wide variety of applications such as:

- Mission-critical database applications where predictable response time, availability, and storage scalability are essential
- Centralized storage backups where performance, data integrity, and reliability ensure that critical enterprise data is secure
- High-availability and application failover environments that ensure very high levels of application availability at reduced costs
- Scalable storage virtualization, which detaches storage from direct host attachments and enables dynamic storage allocation from a centralized pool
- Improved disaster tolerance, which provides high Fibre Channel performance at extended distances (up to 150 km) between host servers and connected devices

Primary SAN Strengths

Because SANs offer excellent scalability, they are increasingly becoming the infrastructure of choice for large enterprises and service providers that face rapidly expanding data storage requirements. In fact, SANs provide many significant advantages over traditional storage architectures. For instance, traditional server-attached storage is often difficult to update or centrally manage. Each server must be shut down to physically add and configure new storage. In contrast, SANs provide a way to add storage without the downtime and disruption associated with server-attached storage upgrades. SANs also help centralize data management, which greatly reduces overall operating costs.

Leveraging Fibre Channel technology, SANs optimize the efficient transfer of block data. By supporting applications that involve high-volume block transfers between storage and servers, SANs provide a way to streamline data backups. As a result, valuable network bandwidth traditionally used for data backup can be used instead for more strategic applications.

Open, industry-standard Fibre Channel technology also makes SANs extremely flexible. By overcoming the cabling restrictions traditionally associated with SCSI, SANs vastly increase the distance between servers and storage while enabling many more connection possibilities. Improved scalability also simplifies server deployments and upgrades to improve the return on the original hardware investment.

Moreover, SANs enable a higher degree of control over the storage network environment—meeting the performance and availability requirements of transaction-based systems. These types of systems require a very high degree of predictability and cannot tolerate wide swings in application performance. SANs address this need by using the highly reliable and high-performance Fibre Channel protocol.

Another key advantage of SANs is the ability to deliver block data to enterprise-level data-intensive applications. During data transfer, SANs impose less processing overhead on communicating nodes (particularly servers), since data is broken into fewer segments during transmission. As a result, Fibre Channel SANs are much more effective at delivering large bursts of block data—which makes Fibre Channel an ideal protocol for storage-intensive environments.

Today, SANs are increasingly implemented in conjunction with NAS environments to provide high-performance, large-capacity storage pools for NAS facilities. In fact, many SANs currently reside behind NAS appliances to address critical storage scalability and backup requirements.

SAN Applications and Benefits

One of the key benefits realized in SAN environments is vastly improved reliability and scalability of enterprise data backup and restore operations. SAN-based operations can significantly lower backup and restore times while reducing the amount of traffic running on the corporate network.

By extending the SAN across Metropolitan Area Network (MAN) infrastructures, SANs also improve disaster tolerance through the seamless connection of remote facilities. SANs employ MAN infrastructures to increase the distance between SAN components by up to 150 km with little or no decrease in performance. Organizations can use this capability to improve disaster tolerance by deploying failover facilities for mission-critical applications and remote data replication for critical application servers. Backup and restore facilities are also an ideal candidate for remote implementations.

In addition, transaction-based database applications benefit greatly from SAN deployments. The ability to seamlessly add storage, improve data backup times, and ensure predictable performance levels goes a long way toward improving the overall reliability, availability, and serviceability of transaction-based applications. Moreover, eliminating direct storage-to-server attachment and deploying a SAN typically decreases the amount of spare storage required for each server.

SANs also provide a more cost-effective way to address high-availability application requirements. Traditional high-availability configurations require a hot standby server for each primary server in a high-availability server pair. By eliminating storage connection constraints, SANs enable a single standby server to support multiple primary servers.

Improved server availability and more effective storage capacity utilization in turn reduce the total cost of ownership for the server complex. In fact, recent Brocade analysis of the financial benefits of SANs reveals that typical return on investment occurs within 6 to 24 months.

Key NAS Characteristics

NAS solutions are typically configured as file-serving appliances accessed by workstations and servers through a network protocol such as TCP/IP and applications such as Network File System (NFS) or Common Internet File System (CIFS) for file access. Most NAS connections reside between workstation clients and the NAS file-sharing facility. These connections rely on the underlying corporate network infrastructure to function properly.

NAS enables organizations to quickly and easily add file storage capacity to their technology infrastructure. Because NAS focuses specifically on serving files while hiding many of the details of the actual file system implementation, NAS appliances are often self-contained and relatively easy to deploy.

Typical interaction between a NAS client and an appliance involves data transfers of relatively short duration and volume. Today's small LAN/WAN network packet sizes force large transfers to be split into many small pieces. Additional processing is required at each end of the connection to break down and reassemble the data stream. As the number of packets involved in the transfer increases, so does the drain on the processor. Applications running on the same server might be adversely affected if packet processing consumes too many processor resources. As a result, a key NAS performance constraint is the ability of the network to deliver the data since network congestion directly affects NAS performance (see Figure 2).

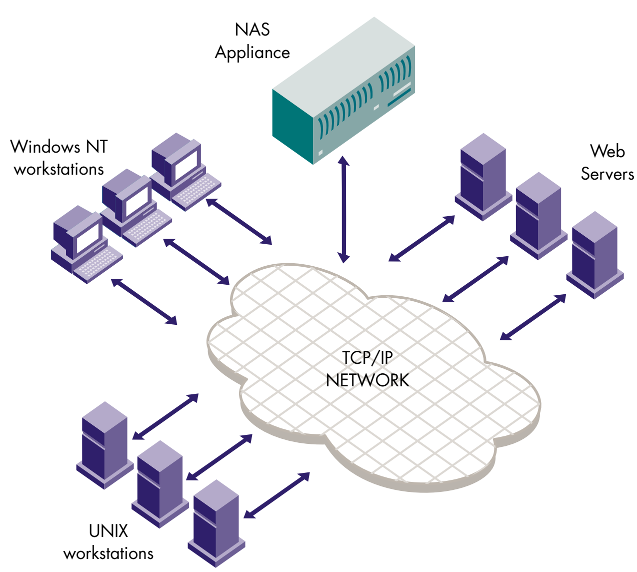

Figure 2.
A basic NAS implementation with all data traffic flowing over the production LAN

NAS storage scalability is often limited to the size of the appliance enclosure. Adding another appliance is relatively easy, but accessing the combined contents as a single entity is not, since appliances typically have unique network identifiers. Because of these constraints, data backups in NAS environments are usually not centralized and therefore might be limited to direct-attached devices (such as dedicated tape drives or libraries) or a network-based strategy where the appliance data is backed up to facilities over a corporate or dedicated LAN.

Primary NAS Strengths

NAS works well for organizations that need to deliver file data to multiple clients over a network. NAS appliances also function well in environments where data must be transferred over very long distances. Because most NAS requests are for smaller amounts of data, distance and network delays are less critical to data transfer.

In addition, NAS appliances are relatively easy to deploy—enabling widespread distribution of NAS hosts, clients, and appliances throughout the enterprise. Properly configured, NAS provides reliable file-level data integrity, because file locking is handled by the appliance itself. Although deployment is fairly straightforward, organizations must be careful to ensure that appropriate levels of file security are provided during NAS appliance configuration.

NAS Applications and Benefits

NAS applications tend to be most efficient for file-sharing tasks—such as NFS in UNIX and CIFS in Windows NT environments—where network-based locking at the file level provides a high level of concurrent access protection. NAS facilities can also be optimized to deliver file information to many clients with file-level protection.

Two common applications that utilize the effectiveness of NAS include hosting home directories and providing a data store for static Web pages that are accessed by many different Web servers.

In certain situations, organizations can deploy NAS solutions in a limited manner for database applications. These situations are usually limited to applications where the majority of data access is typically read-only, the databases are small, access volume is low, and predictable performance is not mandatory. In this type of situation, NAS solutions can help reduce overall storage costs.

Complementary Technologies for Leading-Edge Environments

Despite their many differences, SANs and NAS are actually complementary storage technologies. For example, SANs excel at block data transfers, scale exceedingly well, and manage devices efficiently. Organizations can benefit greatly by employing SANs for mission-critical applications, storage consolidation, backup/restores, and high-availability computing.

In contrast, NAS supports file sharing between multiple peer clients. NAS clients can potentially access file shares from anywhere in the organization. Because file access is typically low volume and less sensitive to response times, predictable performance and distance are less of a concern in NAS implementations. Table 1 highlights some of the key characteristics of both SAN and NAS.

	SAN	NAS
Protocol	• Fibre Channel • Fibre Channel-to-SCSI	• TCP/IP
Applications	• Mission-critical transaction-based database application processing • Centralized data backup • Disaster recovery operations • Storage consolidation	• File sharing in NFS and CIFS • Small-block data transfer over long distances • Limited read-only database access
Advantages	• High availability • Data transfer reliability • Reduced traffic on the primary network • Configuration flexibility • High performance • High scalability • Centralized management • Multiple vendor offerings	• Few distance limitations • Simplified addition of file sharing capacity • Easy deployment and maintenance

Table 1.
SAN and NAS characteristics at a glance

Many of the traditional distinctions between NAS and SANs are starting to disappear. For instance, NAS appliances increasingly use SANs to solve operational problems associated with storage expansion and data backup/restore. Although the two technologies are similar, NAS does not provide the full range of business benefits that SANs do. However, compared to traditional server-attached storage, both SAN and NAS technologies reduce the total cost of ownership and provide a much better overall return on investment.

For more information about the advantages of Brocade Fibre Channel SANs, visit **www.brocade.com.**

BROCADE
The intelligent platform for networking storage

Corporate Headquarters
1745 Technology Drive
San Jose, CA 95110
T: (408) 487-8000
F: (408) 487-8101
info@brocade.com

European Headquarters
29, route de l'Aéroport
Case Postale 105
1211 Geneva 15, Switzerland
T: +41 22 799 56 40
F: +41 22 799 56 41
europe-info@brocade.com

Asia Pacific Headquarters
The Imperial Tower 15th Fl.
1-1-1 Uchisaiwaicho,
Chiyoda-ku, Tokyo 100-0011
Japan
T: +81 3 5219 1510
F: +81 3 3507 5900
apac-info@brocade.com