Storage Area Networks; Unclogging LANs and Improving Data Accessibility

"This important technology is moving into the mainstream in distributed networking and will be the normal, adopted way of attaching and sharing storage in a few short years."

Michael Peterson,
Strategic Research Corporation

Kevin J. Smith

Mylex Corporation

Fremont, CA

White Paper

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References

Copies of this and other white papers may be obtained from the Mylex web site (www.Mylex.com).

RAID Controllers Are Not Created Equal;
Many Will Not Survive on Wolfpack-II Clusters

DAC960PJ/PR Two Node Clustering

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The key challenges facing IS executives are satisfying increasingly diverse networking requirements and reducing network complexity to lower total cost of ownership (TCO). Success depends on efficiently delivering:

- High bandwidth for warehousing and web-based applications, i.e. multimedia,
- Low, predictable latency for time-sensitive applications, e.g. video conferencing,
- Performance and resiliency for mission critical applications, e.g. OLTP.

When computing resources were used only for internal operations, the cost of information bottlenecks and network failures was limited to lost productivity. However, as computing resources are used to engage customers, as well as manage operations, bottlenecks and network failures translate into lost business and lost productivity.

A primary benefit of Storage Area Networks (SAN's) is unclogging network arteries by moving bulk data transfers off client networks and onto specialized sub-networks, often referred to as *the networks behind the servers*.

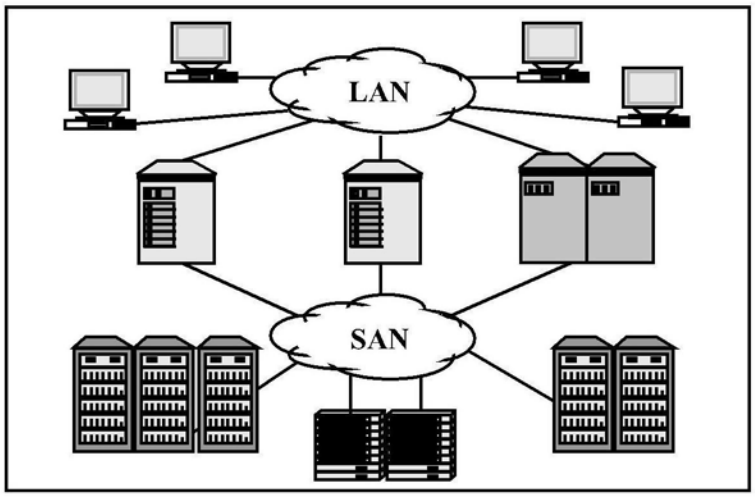

Figure 1. LAN's and SAN's

With SAN's, pools of storage (and related traffic) are removed from the LAN, externalized and shared by mainframes, UNIX and PC servers. In addition to de-congesting client networks, cross-platform data sharing and amortizing storage costs across servers, a SAN topology adds value by providing:

- Flexible, modular expansion by de-coupling server and storage investments,
- Bandwidth and capacity scaling by eliminating SCSI and PCI bottlenecks,
- Increased fault tolerance and availability with redundant paths to data,
- Increased application performance with multiple gigabit links to data,
- Simplified systems integration and enriched storage management,
- Improved data protection and security through centralization, and
- Lower total cost-of-ownership (TCO).

Server-Dependent Storage

A paradigm shift from centralized to distributed storage began in the 1980's driven by peer-to-peer networks, inexpensive UNIX and PC servers and the notion that moving computing and storage resources closer to workgroups would increase productivity. The result was islands of computing and disparate networks tied together by gateways. IS managers were faced with multiple copies of inconsistent data, networks that were expensive to manage and corporate assets (data) that were difficult to access and vulnerable to intrusion. The AberdeenGroup, a respected market research firm, refers to this environment as server-dependent storage (Figure 4).

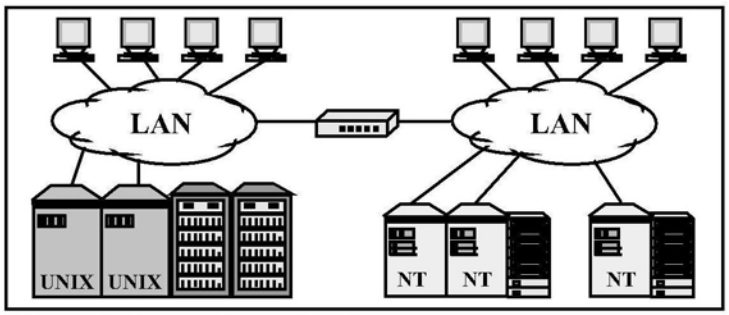

Figure 2. Server-Dependent Storage

Server-Independent Storage

Emerging SAN technologies mirror today's LAN technologies with gigabaud shared and dedicated bandwidth. The AberdeenGroup advises: "Unless enterprises view and implement storage as if it were part of a giant network across the enterprise, they will pay too much for their storage and will face extreme, labor-intensive difficulties in performing vital storage-related functions, such as managing the storage and backing up and moving critical data." While giant SAN's may someday become a reality, local SAN's with server-independent storage are being deployed today.

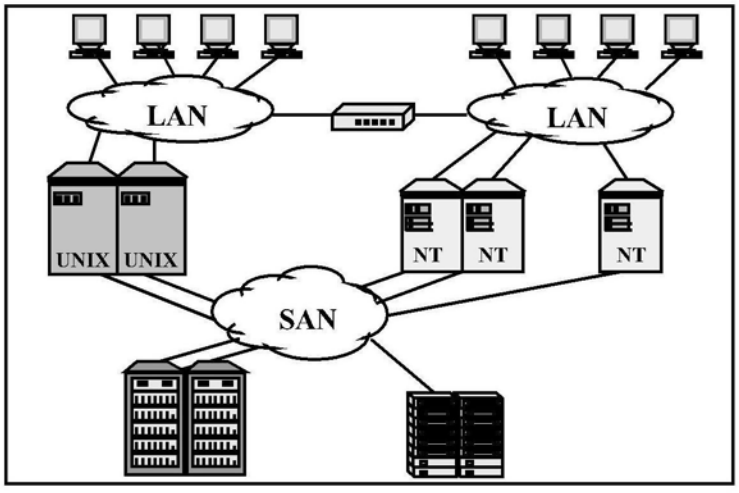

Figure 3. Server-Independent Storage

SAN: Storage Area Network or System Area Network?

SAN is one of the more overloaded acronyms in computer jargon; its meaning is context sensitive. To systems people, SAN means *System Area Network*, and to storage people, SAN means *Storage Area Network*. Some people consider both definitions synonymous. However, while System Area Network and Storage Area Network topologies can be similar or even identical, there is an important distinction between the two technologies.

System Area Network

A System Area Network is a specialized network used in clusters configurations for node-to-node, node-to-device (primarily disk), and device-to-device communications that provides both high bandwidth and low latency. Low latency is the distinguishing characteristic of a System Area Network. Short message latency across a System Area Network is generally less than 10 microseconds, an order of magnitude less than Fibre Channel or Gigabit Ethernet. Low latency is a prerequisite to high performance for applications distributed across cluster nodes, e.g. parallel DBMS's. Instances of a distributed application in a cluster environment frequently exchange messages to synchronize program execution or access to shared resources. Most System Area Networks use proprietary protocols, however, this is expected to change when the VI Architecture is introduced in 1999. The VI Architecture is an interconnect-independent set of protocols and API's that standardize the interface between OS's and cluster interconnects. ServerNet developed by Tandem Corporation, and SCI, an ANSI standard implemented by Dolphin, are examples of System Area Networks. System Area Network technologies can also be used to implement Storage Area Networks.

Storage Area Network

A Storage Area Network can be designed with a specialized or standard networking technology, e.g. Fibre Channel. Its purpose is to provide high bandwidth connections between servers and storage devices, and between storage devices, e.g. storage arrays and tape libraries. The primary objective of Storage Area Networks is high bandwidth for moving large amounts of data; latency is a secondary consideration. Storage Area Networks have been implemented with ESCON and HIPPI interfaces, and more recently with SSA and Fibre Channel. They can be deployed in homogeneous, e.g. all UNIX servers, or heterogeneous environments, e.g. a mix of UNIX and NT servers, and can be local to servers or remote from servers and connected to other (remote) Storage Area Networks. They use standard channel protocols, such as SCSI riding on top of Fibre Channel. In Storage Area Networks, storage is de-coupled from servers and managed as an independent resource.

Storage Area Networks can be configured in fabric topologies with switches to interconnect servers and devices or implemented in loop topologies with hubs to simplify cable management and increase loop resiliency.

In this paper, SAN is used in the Storage Area Network context.

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