



Storage Area Network

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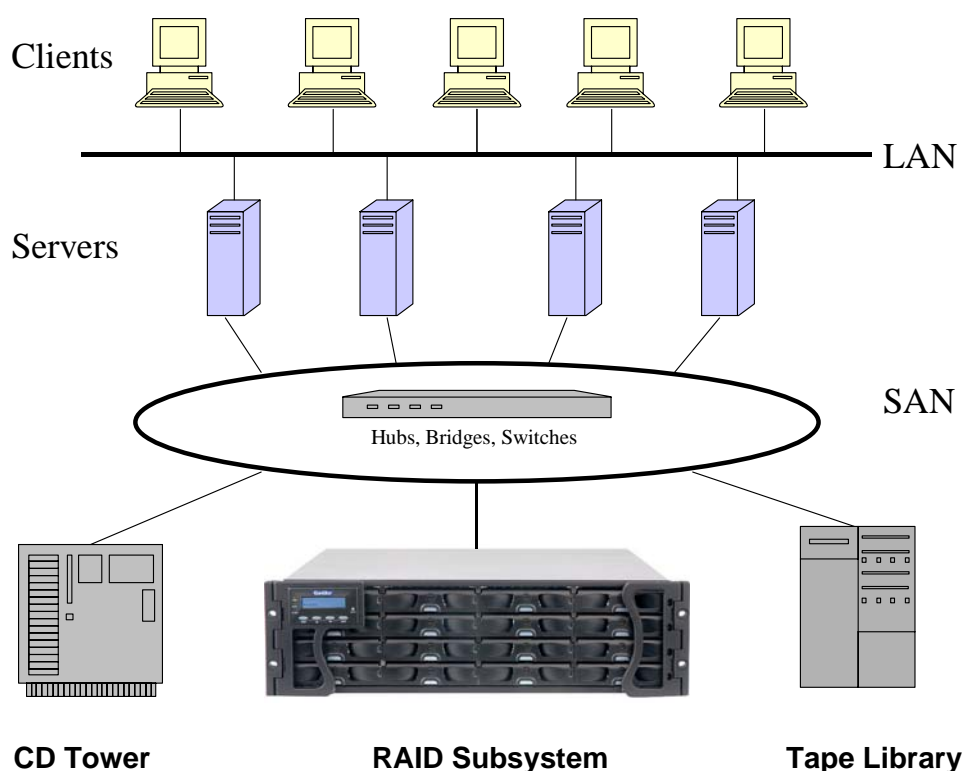
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Introduction

In order to meet the demands of the storage system, enterprises apply SAN to increase the system efficiency and capacity expansion. According to SNIA (Storage Networking Industry Association), SAN is:

1. The purpose of the SAN is transmitting data between storage systems and storage systems or storage systems and client servers. The SAN fabric contains physical connections from storage systems to client, and then storage management devices, servers, and network devices. However, SAN is usually defined as block I/O services provider.
2. The storage system contains storage components, devices, computer equipments, software applications, and network devices.

SAN is able to attach with various kinds of storage devices, such as disk-array subsystems, CD towers, magnetic tape drivers and libraries, and provides data I/O services via hub or switches through network connections.



SAN Fabric

1. Local Area Network (LAN) to connect servers and client computers.
2. Servers.
3. Storage management application software – apply a single console to monitor storage systems.
4. High capacity and efficient storage devices.
5. SAN devices – hubs, switches, servers and storage devices implements a storage resource environment.

Advantages of SAN Solution

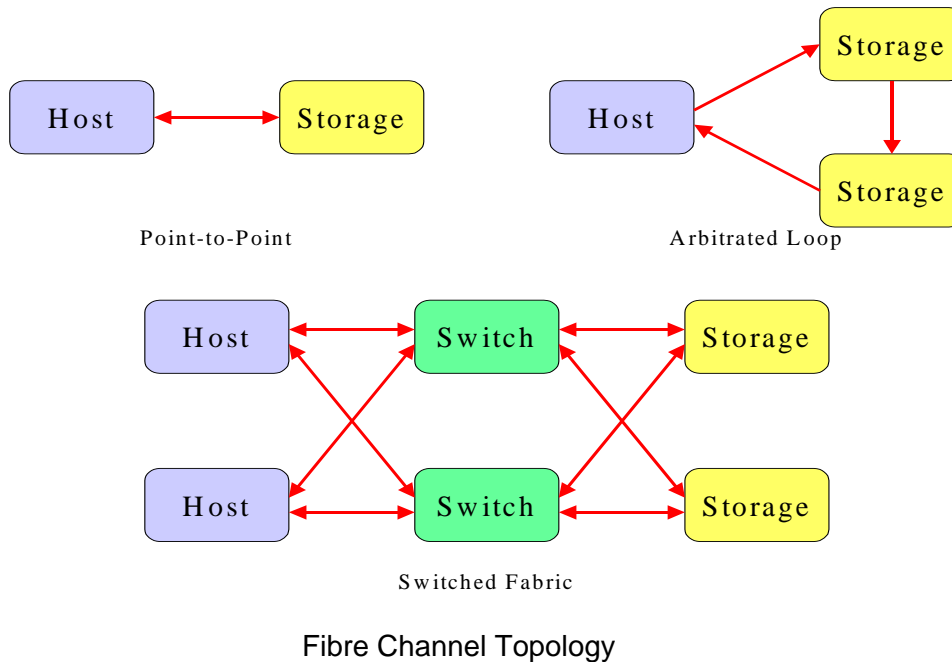
6. By integrating storage devices, SAN increases the storage space usability and cost efficiency.
7. SAN is the high-speed storage sharing system.
8. SAN increases the network bandwidth and reliability of data I/O.
9. SAN is separated from the regular network system, and has an ability to expand the storage capacity.
10. SAN reduces the cost of the storage management since it simplifies the system fabric and devices management.

From the early SAN fabric, fiber optic is the common material used for data transmitting channels; however, SNIA does not define which network techniques would be used for SAN fabric. Therefore, storage network which is based on fiber optics is called Fibre Channel SAN (FC SAN), and IP SAN is the storage network based on Ethernet, such as iSCSI. Besides above two techniques, other interfaces, like SAS or Infiniband, produce different storage systems.

Fibre Channel SAN vs. IP SAN

Fibre Channel SAN (FC SAN)

Fiber optics is usually applied to high-speed storage area network, and the related techniques are defined by T11 technology committee of INCITS. FC SAN has the advantages, like high-speed and long-distance transmission, high reliability, and so on. In addition, fibre channel with 8Gbps would appear to market in 2008.



FC SAN topologies

(1).Point-to-point

This is the simplest topology of the FC SAN, which allows the host and storage to connect directly. With point-to-point topology, the pro is transmitting speed is high, but the con is the limitation of the system expansion. Hence, several HBA cards are involved to connect from the server to storage devices in order to make the system expansion.

(2).Arbitrated Loop

One-way loop fashion enables transmitting events between nodes and nodes; in other words, the transmitter of one node transmits data to the receiver of the next node. However, once one node would do the transmitting event to another node, the permission is required between the transmitter and receiver.

Arbitrated loop topology enables 127 storage devices attached but still has some limitations; for instance, the bandwidth is shared by all devices in the loop, and only two devices can communicate at the same time. The limitation will reduce the system efficiency.

(3).Switched Fabric

Switched fabric is a computer network topology where many storage devices connect with each other via switches. Advantages are:

- Nodes among the devices are allowed to work at the same time to increase the efficiency of the subsystem.
- Switched fabric supports redundant path between multiple devices to increase the system availability.

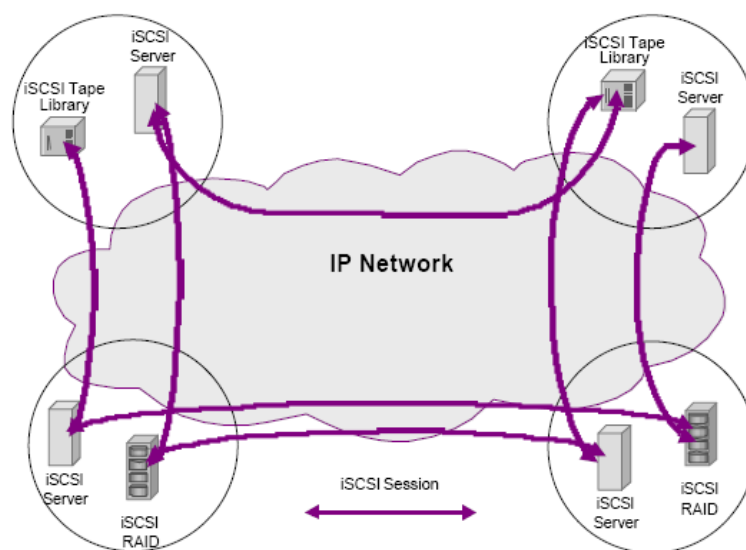
- Zoning functions the data protection.
- The Subsystem is allowed to add more switches to increase the route length.

IP SAN

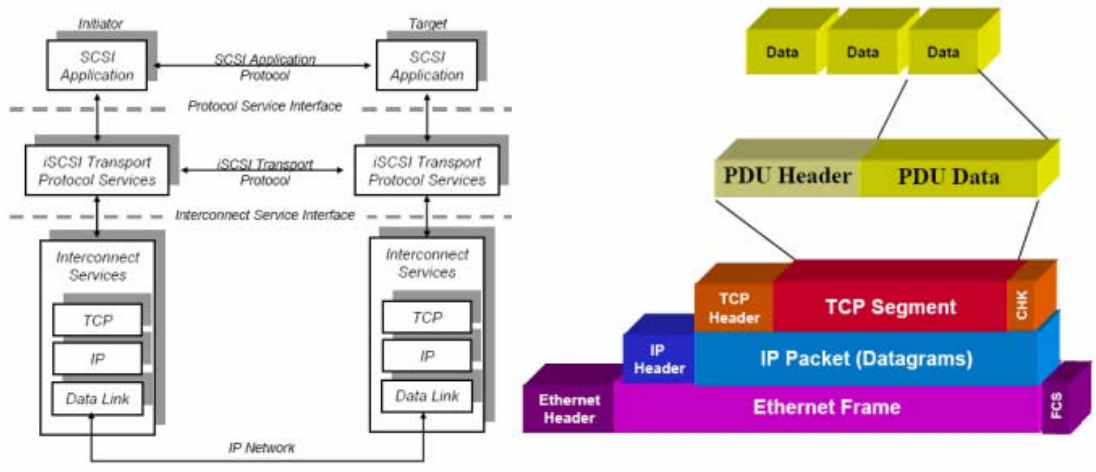
IP SAN is the storage area network doing data transmitting processes through TCP/IP protocols. Since the protocol commands are embedded the IP address where the data is transmitted to, IP SAN is the high-efficient and point-to-point storage solution. There are some ways to implement SAN by TCP/IP, such as FCIP (Fibre Channel over IP), iFCP (Internet Fibre Channel Protocol), and the iSCSI (Internet SCSI), which is more cost-efficient than Fibre SAN.

iSCSI technology

iSCSI is a internet protocol standards are officially ratified by Internet Engineering Task Force, IETF; furthermore, iSCSI technology simplify the storage area network solution, such as setting time, equipments, and techniques, via the Ethernet interface. From the view of the IP SAN topology, hosts are required to receive and process iSCSI IP packages. Two ways to do it; first is installing the application software (initiators) and processing the related commands and data through CPU, or using the TCP/IP Offload Engine (TOE) to process IP packages in order to reduce the CPU loading efforts and increase its operating efficiency. Then, IP SAN is not required to install any additional switches. Contract to FC SAN, IP SAN keeps the original circuits to avoid the additional wiring expanses. Comparing with FC SAN, IP SAN reduces not only the complexity of SAN building, but also the actual costs of equipments and cables.



iSCSI Topology



iSCSI Protocol model

iSCSI and Fibre Channel comparison table

	iSCSI	Fibre Channel
Speed	1G bps	4G bps
Connecting Distance	Up to 10km(same as LAN)	Up to 40km
Material	Cat-5e cables	Fibre optic, copper
Mode	Data block	Data block
Frame	0~1.5KB	0~2KB
Topology	Point-to-Point Hub/Switched	Point-to-Point Arbitrated Loop Switched Fabric
Transport	Ethernet, ATM, Packet-over-SONET, T-1, T-3, DS-3, DWDM	Fibre Channel, DWDM
Host Interface	iSCSI initiator TOE card	FC HBA card
Switch	Ethernet switch	Fibre Channel Switch
Electromagnetic Interference (EMI)	Yes	No
Cost	Low	high
Market	Medium enterprises	Large enterprises
Efficiency	fair	good
Next Generation	10G bps	8G bps

Conclusion

In recent years, the demand of the storage system grows rapidly; furthermore, most enterprises request the SAN system with high capacity and efficiency, more reliable and secure in order to get rid of risks of data lost and service interruption.

ABOUT the AUTHOR

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