

Storage Area Network

Data Centre Virtualisation

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Data Centre Virtualization (ACUA6001_LON)

Introduction

“A Storage Area Network (SAN) is a dedicated high-speed network or subnetwork whose main purpose is to transfer data between shared pools of storage devices and multiple servers [1].”

Identify and explore the hardware components of the SAN

SAN components interconnection

SAN management and monitoring software tools

Scalability and future growth of the SAN

SAN Integrity - Data redundancy and security solutions for unauthorised access

SAN functional concepts - Infrastructure simplification, information lifecycle management, and business continuity management

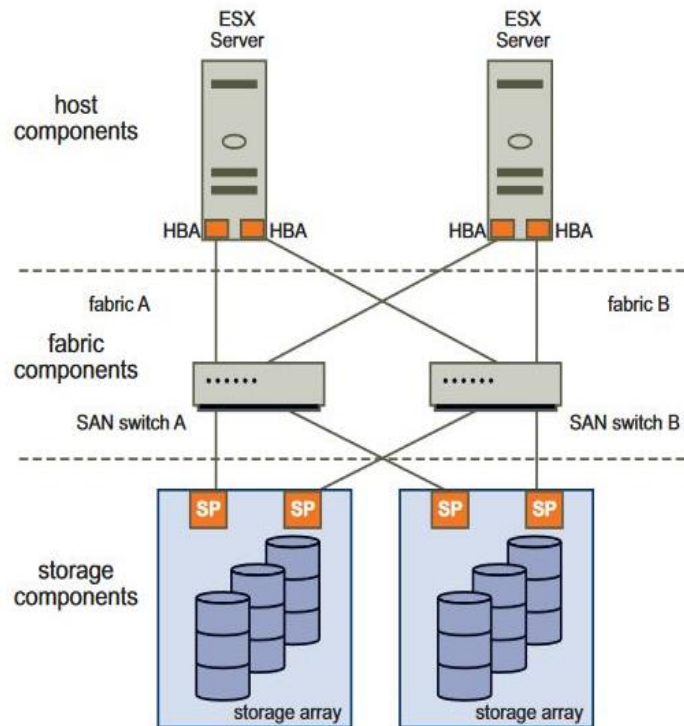
SAN-Hardware components

Host layer-localise the servers attached to the SAN [2].

Fabric layer-representing cabling and network devices who interconnect hosts and storage [2].

Storage layer-representing the storage devices collected into different storage pools or tiers [2].

Basic hardware components [2]



SAN-Hardware components

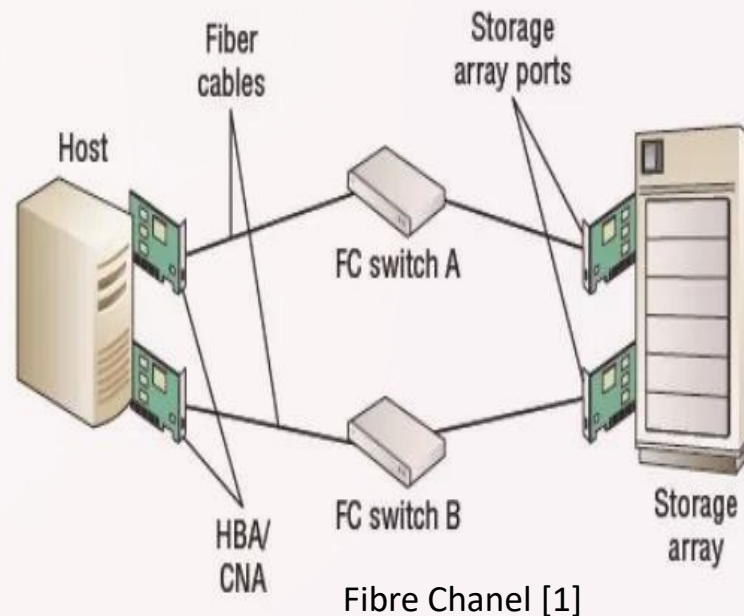
Hosts are simple computer systems, such as a servers and expand to data centre size with hundreds of servers and virtualised environments [1], [3].

Fabric layer technologies and interfaces employed are [3]:

- ❖ Fibre Channel (FC)
- ❖ Small Computer System Interface (SCSI)
- ❖ Host Bus Adapter (HBA) is used to connect FC or iSCSI, via dedicated access.

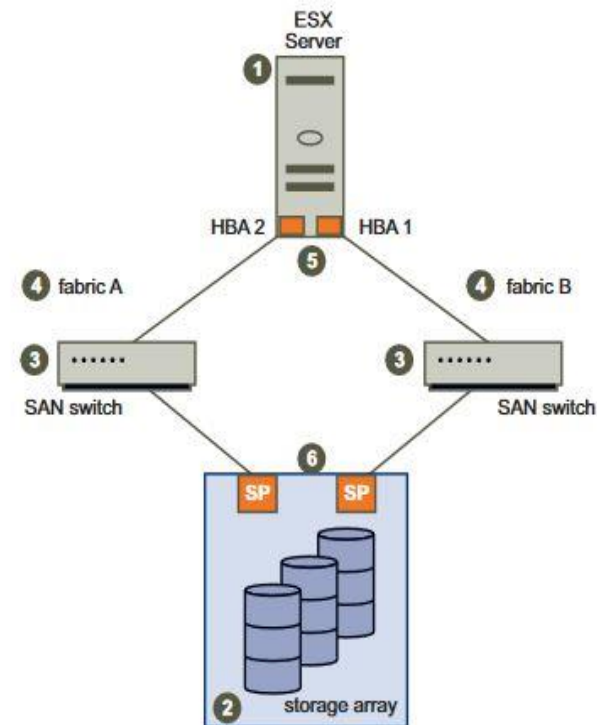
Fabric switches are operating unified as a big single device.

Storage layer incorporate flash arrays technology such as Solid-State Devices (SSD) and more non-volatile memory express (NVMe) storage platforms with NVMe over Fabric protocols [2], [3].



SAN components interconnection

- ❖ The host access a storage device on the SAN by first sending a block-based access request for his target [2].
 - ❖ SCSI command is encapsulated into FC packet and when is accepted by the HBA is converted from its binary data form to the optical form required for transmission on the fibre optic cable [2].
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- ❖ The request is also packaged according to the FC protocol [2]
 - ❖ The HBA transmits the request to the SAN [2].
 - ❖ One of the SAN switches receive the request and sends it to the storage processor, and forward to the storage device [2]



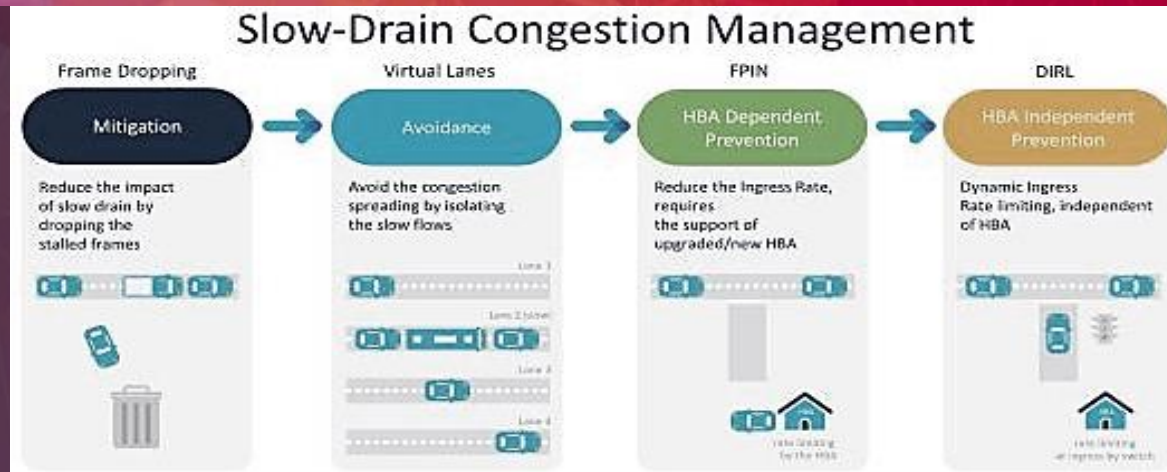
SAN management and monitoring tools

SAN management may refer to[3]:

- ❖ Planning for future expansion
- ❖ Capacity/Usage management
- ❖ Support for virtualization
- ❖ Infrastructure management
- ❖ Creating and managing RAID levels
- ❖ Backup management

Key performance indicators (KPIs) in several areas of the SAN [3].[4]:

- ❖ Related to storage array , such as the read/write throughput
- ❖ Related to the SAN fabric, such as low or no buffer credits for switch or orphaned ports
- ❖ Related to host server, such as I/O throughput, or virtual machine performance when accessing SAN
- ❖ Related to SAN capacity, such as capacity trends or shortages

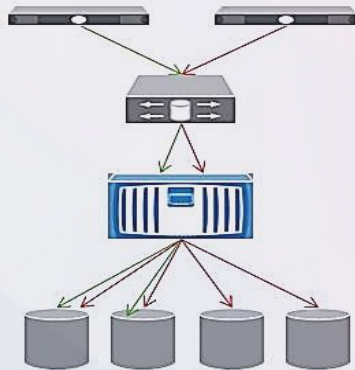


SAN management and monitoring tools

SAN Software components consist of [3], [4]:

- ❖ Fabric Management and Monitoring Software
- ❖ Fabric Security and Access Control Software

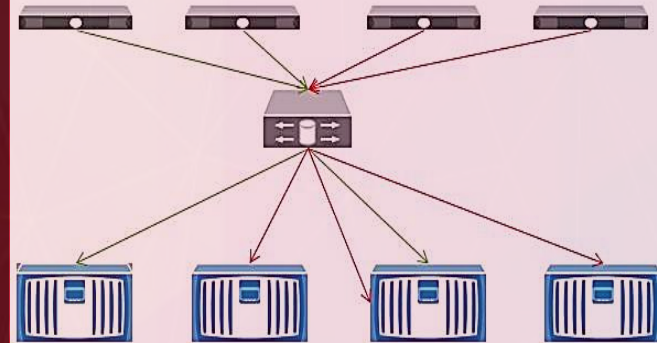
LUN Masking



There are two basic methods for controlling SAN permissions:

- ❖ Masking-creating a list of the Logical Unit Number (LUN) that are unavailable to be accessed by a host [3].
- ❖ Zoning- controlling host access and configuring the fabric, limiting host access to storage LUNs that are in an approved SAN zone [3].

Zoning



SAN tools may include SolarWinds Storage Resource Monitor, IntelliMagic Vision for SAN and EG Innovations Infrastructure Monitoring [5].

Scalability and future growth of the SAN

Vertical Scaling or Scaling Up means the addition of expansion units to storage system while keeping existing number of storage controllers [3],[4].

Horizontal Scaling or Scaling Out means adding more nodes and enables SAN's infrastructure to accomplish more work in less time [3], [4].

Business Challenge[4]:

- Meet new scalability demands associated with growth
- Simplify SAN management
- Prepare to support Fibre Channel over Ethernet in future

Network Solution[4]:

- Cisco MDS 9710 Multilayer Directors
- Cisco MDS 9148 Multilayer Fabric Switches
- Cisco Prime Data Centre Network Manager

Business Results[4]:

- Centralizing SAN infrastructure and reducing cabling costs by 30 percent
- Significantly scaling performance through high-density switch design
- Simplifying management across unified switch fabric

SAN Integrity

Data redundancy and security solutions for unauthorised access

Redundant Array of Independent Disk (RAID) implementation is the required redundancy solution for SAN [6].

RAID system is generally mirrored in two different physical storage devices [2],[6].

Disaster scenarios can be avoided by using two RAID controllers [2].

Redundancy also means power supply engineering, equipped with backup ventilator and cooling elements[6].

SAN's unauthorised accesses vulnerabilities are [2]:

- ❖ Exposed network administration passwords
- ❖ Deliberate changes to zoning information
- ❖ Changes to security and access control policies
- ❖ Simple Network Management Protocol (SNMP) vulnerabilities

Solutions:

- ❖ Passwords must be secured on fabric switches interfaces.
- ❖ Disconnect SNMP devices that are not essential to the operation of the SAN or using ingress filtering to block SNMP traffic [2], [4], [6].
- ❖ Configuring SNMP agents to refuse messages from unauthorized systems, or segregating SNMP traffic onto a separate management network [2], [4], [6].

SAN functional concepts

Infrastructure simplification

Virtual SAN (VSAN) is a form of simplification which use virtualization to create one or more logical partitions or segments within the physical SAN [2], [3].

VSAN provide fault isolation and hight availability with segmentation [3].

VMware (vSAN) introduced advanced features including storage pooling or tiering, detecting and organizing storage and non-disruptive data migration [2].

vSAN can support information lifecycle management in order to automatically move frequently accessed data into a high-performance storage tier and then forward to a lower tier as the data becomes less frequently accessed. In the end data are relegated to an archival storage tier as it falls into disuse [2].

Information lifecycle management

Business continuity management

Business continuity management is integrated in SAN appliances and offered as cloud-based IaaS [6].

StoneFly appliances provides single node and high-availability node configurations, virtual server environments, operating system, centralised management, deduplication, snapshots, volume encryption, thin provisioning [6].

Redundantly distributing data onto multiple physical systems guarantees the high security of saved data[2], [3], [6].

How security of data is managed

References

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