

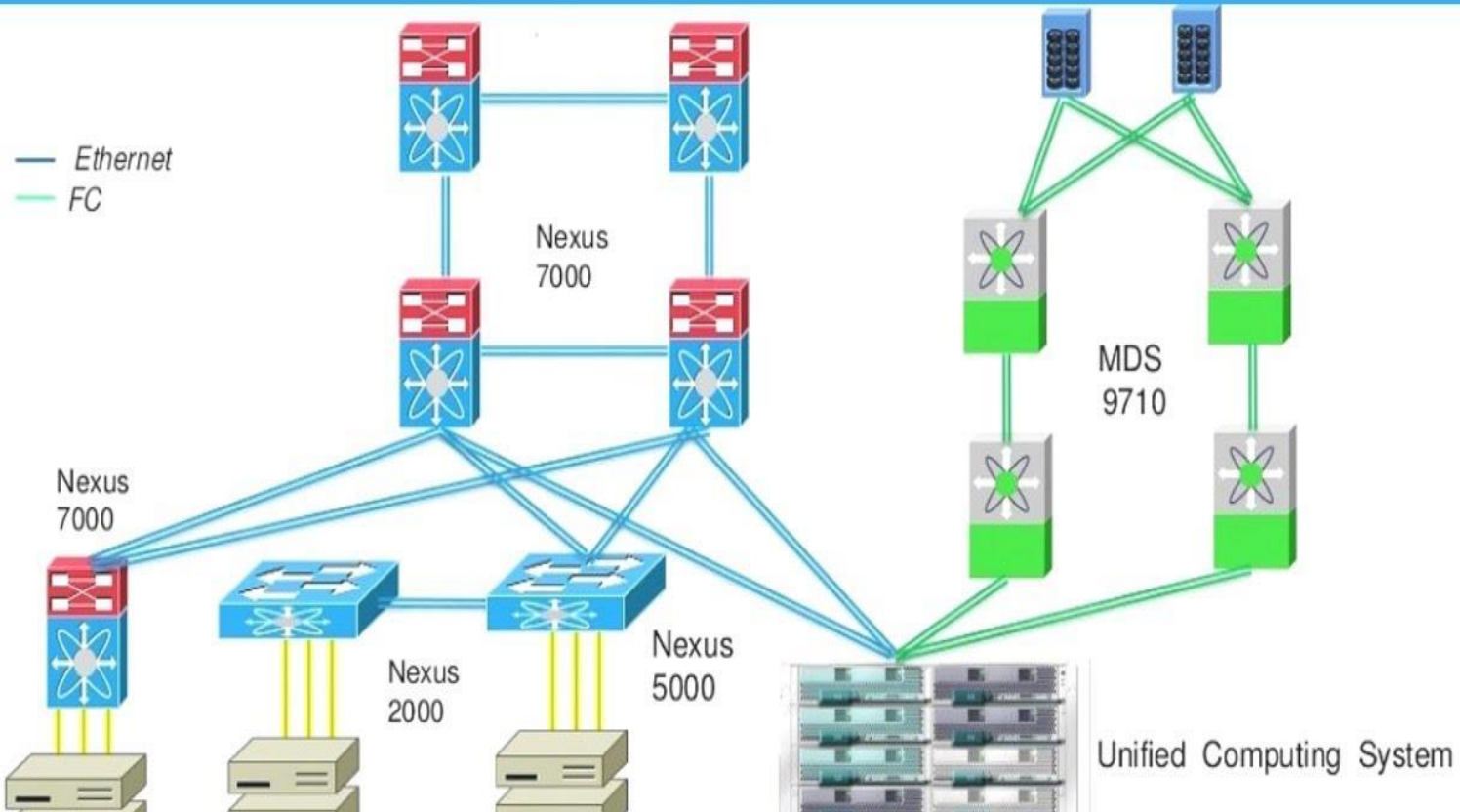
STORAGE AREA NETWORK (ACUA6001_LON)

Student Name: Octavian Cristian Libotean

Student Id: 1815958

Lecturer Name: Koushik Modak

STORAGE AREA NETWORK



WHAT IS A STORAGE AREA NETWORK?

A storage area network (SAN) is a dedicated network tailored to a specific environment, combining servers, storage systems, networking switches, software, and services. [1]



A).BASIC HARDWARE COMPONENTS OF THE SAN

The core components of a SAN are:

- Servers
- Storage
- Network infrastructure

Servers

The server infrastructure is the underlying reason for all SAN solutions, and this infrastructure includes a mix of server platforms. With initiatives, such as server consolidation and Internet commerce, the need for SANs increases, making the importance of network storage greater.



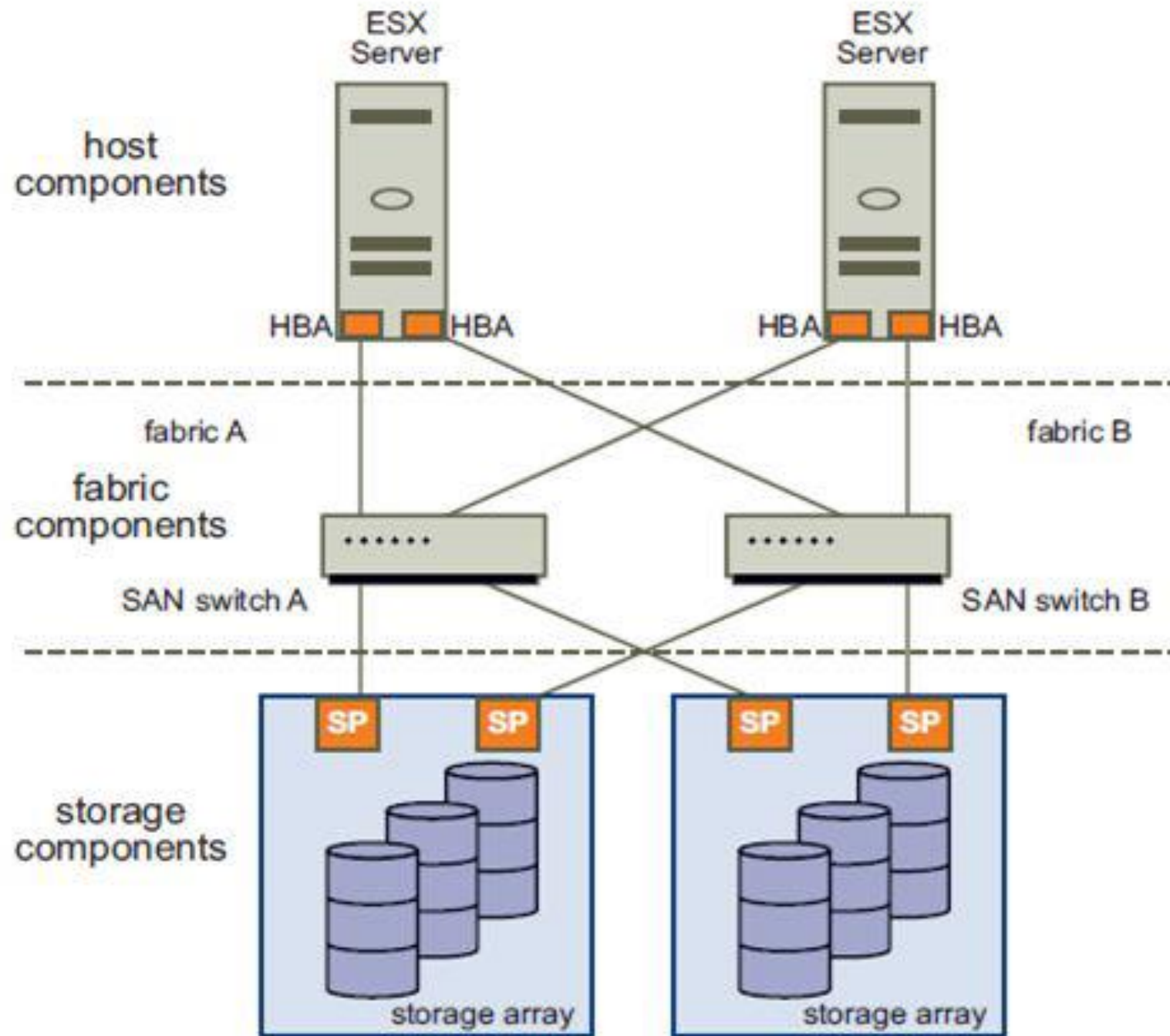
A).BASIC HARDWARE COMPONENTS OF THE SAN

Storage

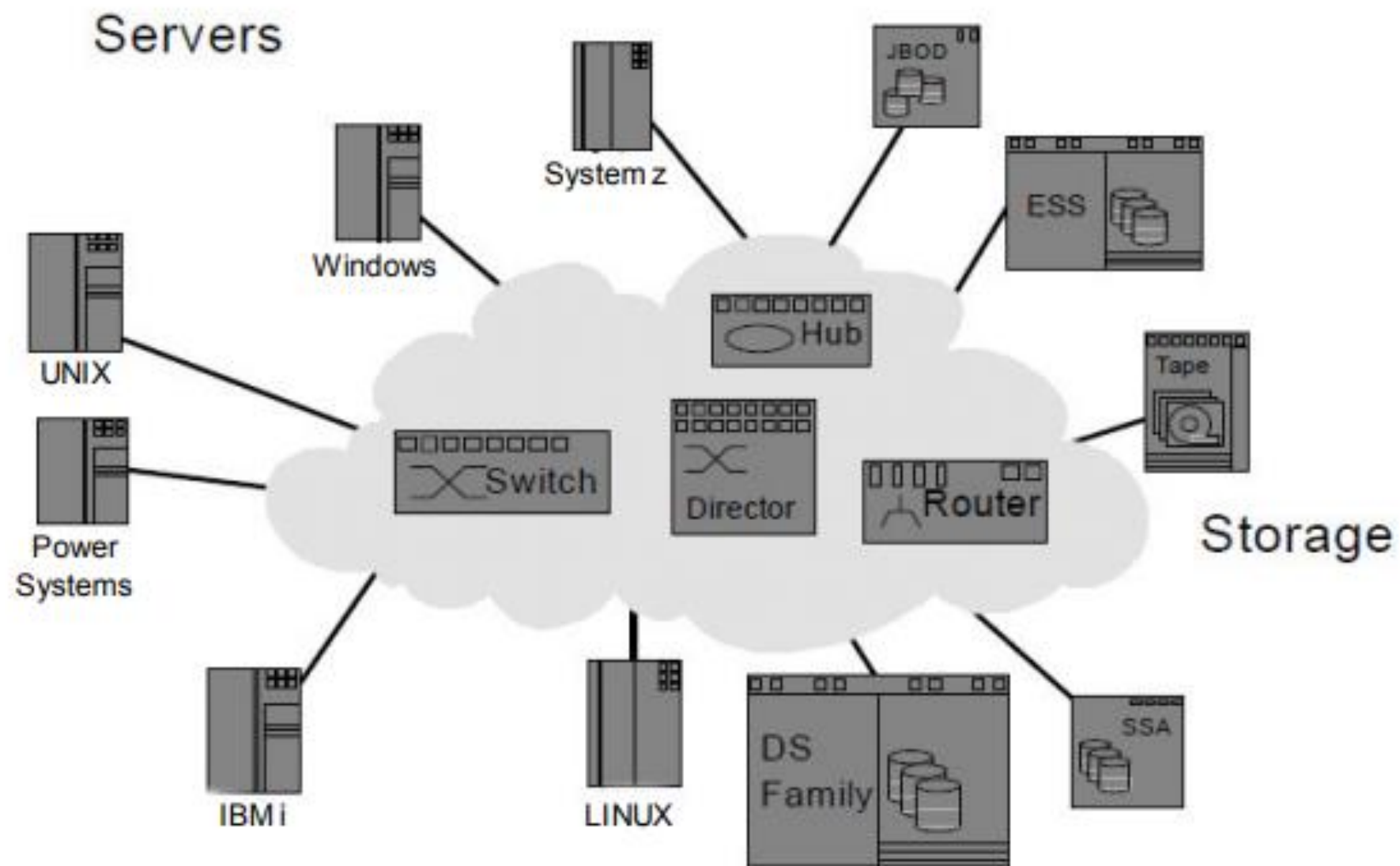
A storage system can consist of disk systems and tape systems. The disk system can include HDDs, SSDs or Flash drives. The tape system can consist of tape drives, tape autoloaders and tape libraries.

Network infrastructure

SAN connectivity consists of hardware and software components that interconnect storage devices and servers, including Fibre Channel. Hardware can include hubs, switches, directors, and routers. The software includes SAN management software.



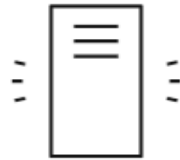
SAN connectivity components



B).HOW IT IS INTERCONNECTED

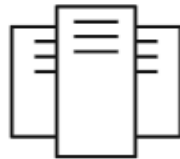
- Sometimes referred to as the network behind the servers, a SAN consists of a communication infrastructure, which provides physical connections, allowing an any-to-any device to bridge across the network using interconnected elements, such as switches and directors.
- SAN can also be viewed as an extension of the storage bus concept. This concept enables storage devices and servers to interconnect by using similar elements, such as local area networks (LANs) and wide-area networks (WANs).
- A SAN also includes a management layer that organizes the connections, storage elements and computer systems. This layer ensures secure and robust data transfers.

Today's SANs create new methods of attaching storage to servers, enabling availability and performance improvements. They connect shared storage arrays and tape libraries to multiple servers used by clustered servers for failover. And they can bypass traditional network traffic bottlenecks, facilitating direct, high-speed data transfers between servers and storage devices in three ways:



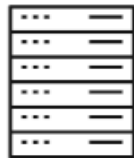
Server to storage

This traditional interaction model's advantage is that the same storage device might be accessed serially or concurrently by multiple servers.



Server to server

A SAN might be used for high-speed, low-latency and high-volume communications between servers.



Storage to storage

The ability to move data without server intervention frees up server processor cycles for other activities, such as application processing. Examples include a disk drive device that backs up its data to a tape device without server intervention or a remote device mirroring across the SAN.

C).THE SOFTWARE THAT IS REQUIRED TO MANAGE AND MONITOR THE OPERATION OF THE SAN

SAN software is used to manage:

- Hardware and software within the SAN (such as storage, switches, and hubs)
- Multiple storage enclosures
- Multiple operating systems
- Multiple vendors
- Resources to be managed in different geographical locations

SAN management functions include:

- Device installation, configuration, and monitoring
- SAN resource inventory
- Report utilities
- Automated component and fabric discovery
- Management of fabric configuration
- Name services
- Security management
- Performance monitoring and load balancing

C).THE SOFTWARE THAT IS REQUIRED TO MANAGE AND MONITOR THE OPERATION OF THE SAN

At the storage level **SAN management** includes the management of:

- Disks and disk arrays
- Tapes and tape libraries
- Cabling
- Hubs, switches, gateways, bridges, and routers
- Interswitch links
- HBAs

SAN software uses:

- SCSI enclosure services that might impact FC-AL bandwidth
- Simple Network Management Protocol (SNMP)
- Web Based Enterprise Management (WBEM)
- Common Interface Model (CIM)
- Desktop Management Interface (DMI)
- Java Application Management Interface (JAMI)

At the enterprise level **SAN software** manages:

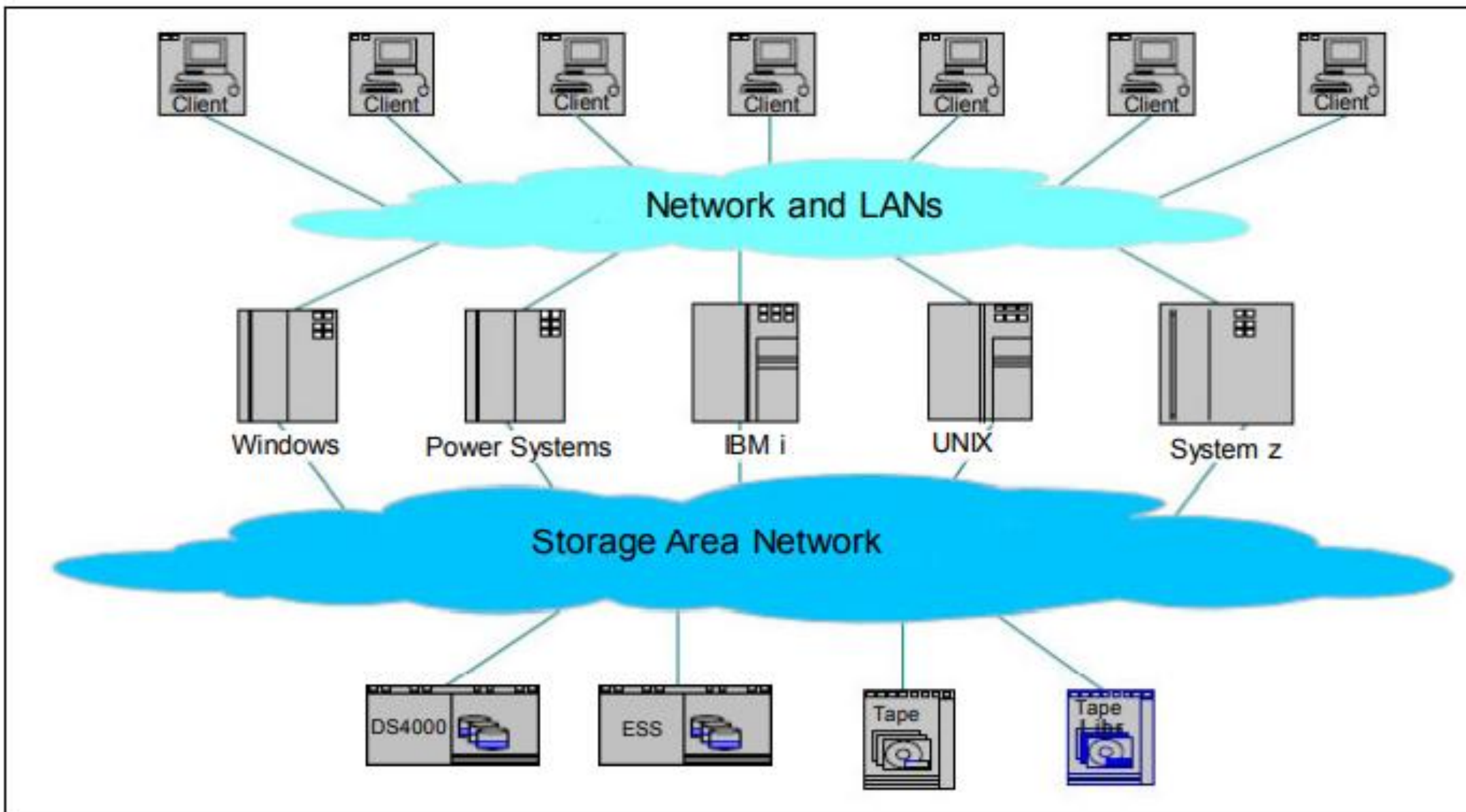
- Storage
- Networks
- Servers
- Desktops

[3]



D).HOW THE SAN CAN BE SCALED TO ALLOW FOR FUTURE GROWTH

- The physical components of a SAN can be grouped in a single rack or data centre or connected over long distances. This makes a SAN a feasible solution for businesses of any size: the SAN can grow easily with the business it supports
- With the Cisco® MDS 9710 Multilayer Director you'll meet the stringent requirements of large virtualized storage environments. As a director-class SAN switch, the MDS 9710 uses the same operating system and management interface as other Cisco data centre switches. It brings intelligent capabilities to a high-performance, protocol-independent switch fabric. You'll gain uncompromising availability, security, and scalability; simplified management; and the capability to flexibly integrate new technologies.
 - ❖ Enable enterprise clouds
 - ❖ Transform large storage networks
 - ❖ Lower operating costs
 - ❖ Deploy Fibre Channel
 - ❖ IBM Fibre Connectivity (FICON)
 - ❖ Fibre Channel over IP (FCIP)
 - ❖ Fibre Channel over Ethernet (FCoE) on a single fabric



Cisco MDS 9710 Multilayer Director



Main benefits(MDS 9710)

- ❑ Reduce total cost of ownership with SAN consolidation
- ❑ Enterprise-class availability
- ❑ Business transformation with enterprise cloud deployment
- ❑ Advanced traffic management
- ❑ Ease of management
- ❑ Comprehensive solution for robust security
- ❑ Advanced diagnostics and troubleshooting tools
- ❑ Convergence with multihop FCoE
- ❑ Integrated mainframe support

E).HOW SECURITY OF DATA IS MANAGED INCLUDING DATA REDUNDANCY AND PROTECTION FROM UNAUTHORIZED ACCESS

Some of the techniques used for securing a SAN infrastructure include:

- Encrypting data at rest when stored on a SAN infrastructure or storage drives
- Isolating users/departments/organizations using a virtual SAN
- Securing network and communication interfaces
- Implementing an access control list (ACL) and digital certificates within the switch to ensure only authenticated switches join a SAN fabric
- Removing and resolving single points of failure
- Mitigating network-based vulnerabilities such as Simple Network Management Protocol (SNMP), which is vulnerable to Denial of Service (DoS) attack

F).EXPLAIN THE CONCEPTS OF INFRASTRUCTURE SIMPLIFICATION, INFORMATION LIFECYCLE MANAGEMENT, AND BUSINESS CONTINUITY IN A STORAGE-AREA NETWORK (SAN)

The key benefits that a SAN might bring to a highly data-dependent business infrastructure can be summarized into three concepts:

- Infrastructure simplification
- Information lifecycle management
- Business continuity

Infrastructure simplification

Four major methods exist by which infrastructure simplification can be achieved

- 1) ***Consolidation***
- 2) ***Virtualization***
- 3) ***Automation***
- 4) ***Integration***

F).EXPLAIN THE CONCEPTS OF INFRASTRUCTURE SIMPLIFICATION, INFORMATION LIFECYCLE MANAGEMENT, AND BUSINESS CONTINUITY IN A STORAGE-AREA NETWORK (SAN)

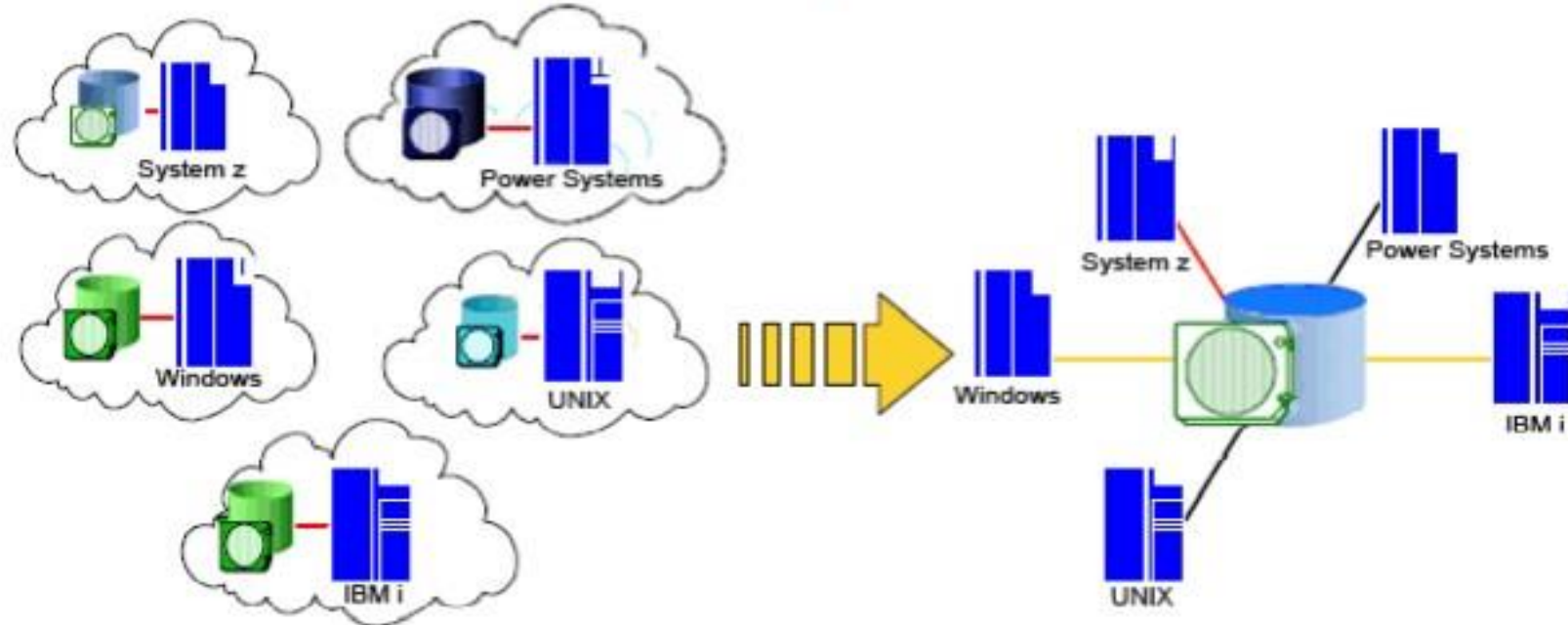
Information lifecycle management

IBM Tivoli Productivity Centre For Data was designed to support ILM.

Business continuity

Implementing the correct SAN solution can help not only in real-time recovery techniques, but it also can reduce the recovery time objective (RTO) for your current DR plan.

Disk and Tape Storage Consolidation



Islands of Information

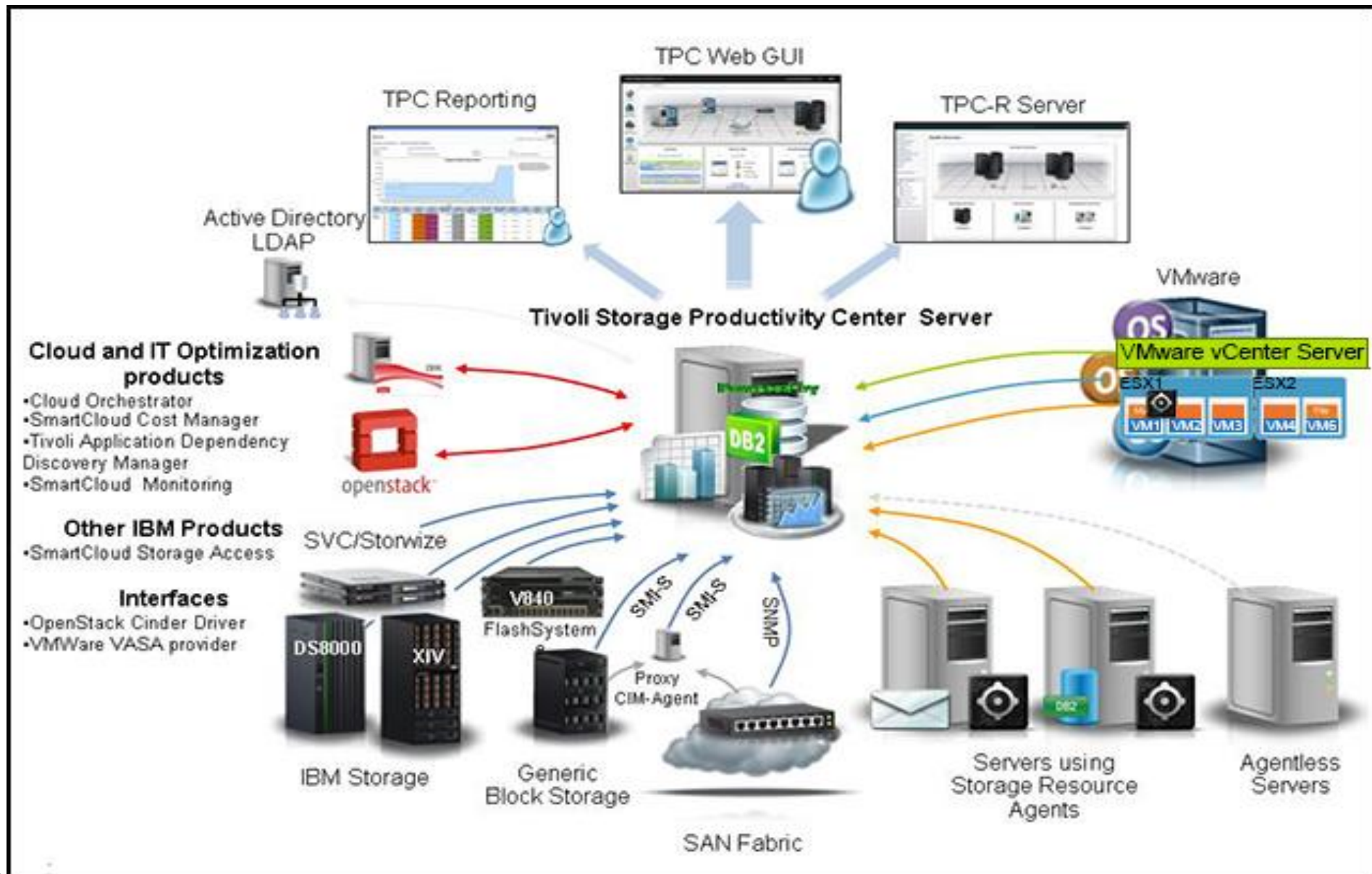
- Distributed servers and storage
- Separate storage management
- Separate islands of information

Consolidated Storage

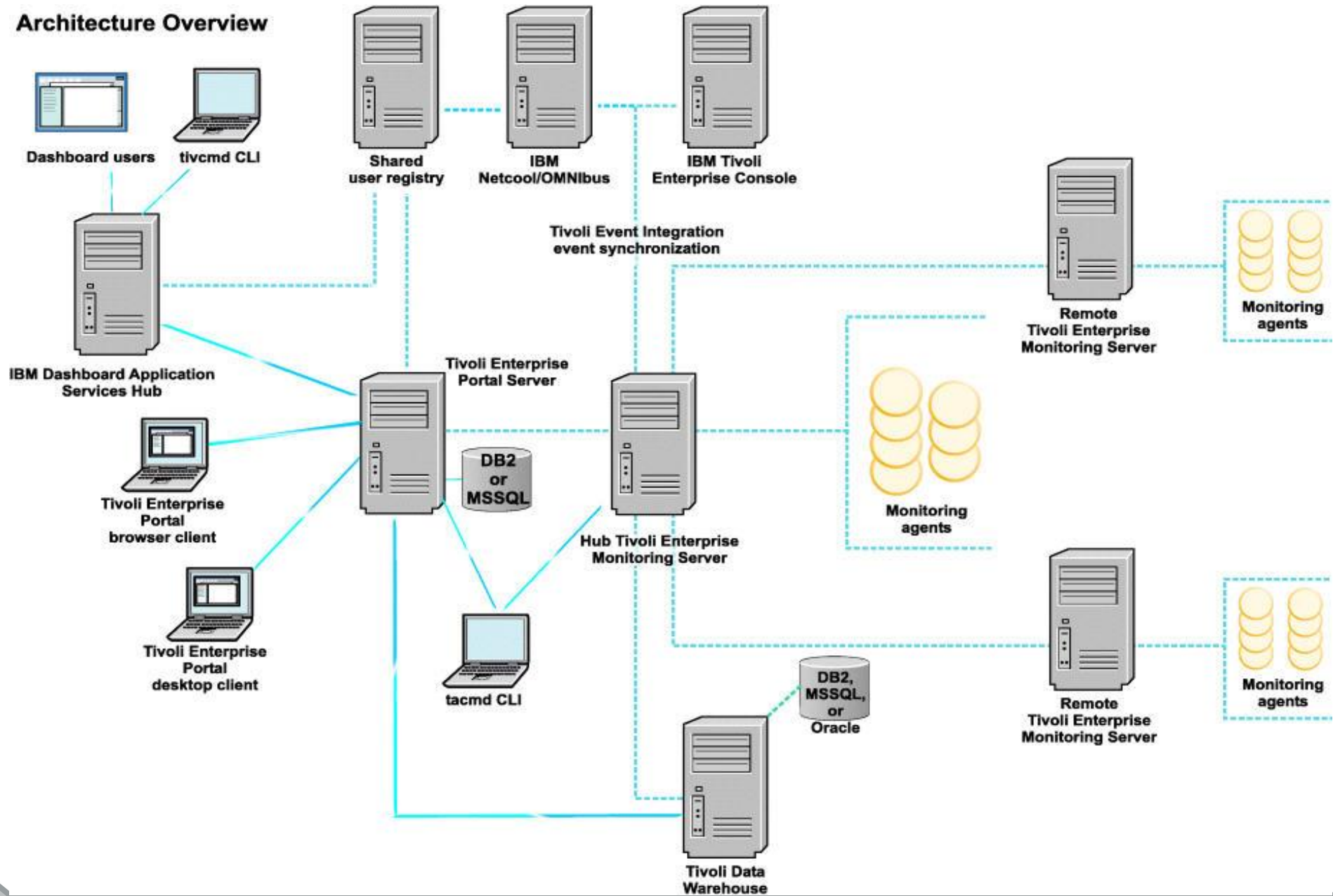
- Consolidated storage systems
- Consolidated storage management
- Consolidated enterprise data

Storage Area Networks can provide consolidation benefits without physical consolidation

IBM Tivoli Productivity Center For Data(ILM)



IBM Tivoli Monitoring



DAS (DIRECTLY ATTACHED STORAGE) VS NAS (NETWORK ATTACHED STORAGE) VS SAN (STORAGE AREA NETWORKS)

Directly Attached Storage (DAS)

- ❖ The storage device is directly attached to the computer
- ❖ A number of cables can be used to connect DAS units
- ❖ DAS is designed to be used only by a single computer, unlike NAS and SAN that are designed to be shared resources

The main advantage of DAS is that it is high-performance, simpler to setup and configure, and typically lower-cost when compared to SAN storage.

The disadvantage is that it cannot be managed over a network, and may not have the same level of redundancy as a NAS or SAN.

Network Attached Storage (NAS)

- ❖ NAS is dedicated 100% to serve files over a network
- ❖ NAS shares storage over a network
- ❖ Multiple user logins can also be created to provide various levels of access
- ❖ NAS is ideal for SMBs because it allows a cost-effective way to gain data access for multiple clients quickly at the file level
- ❖ Easy setup and configuration compared to SAN
- ❖ Maximum storage resources utilization
- ❖ Easy-to-provide RAID redundancy to a large number of users

Disadvantages include latency issues due to network issues.

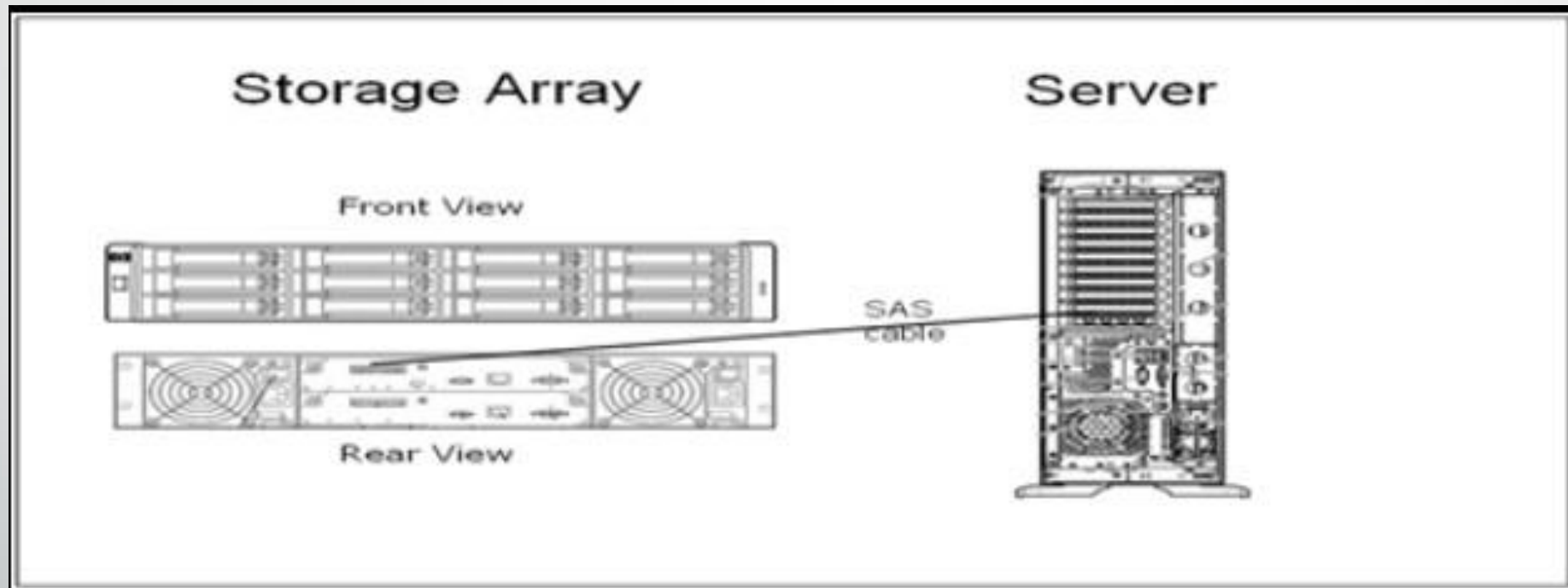
Storage Area Networks (SAN)

- ❖ In SAN infrastructure, fiber channel is used to connect devices such as RAID arrays, DAS or tape libraries to servers
- ❖ Higher levels of performance throughput and data is highly available through redundant disk controllers and drives
- ❖ SAN offers complete reliability and 24/7 availability of data
- ❖ Ability to share the storage arrays to multiple servers

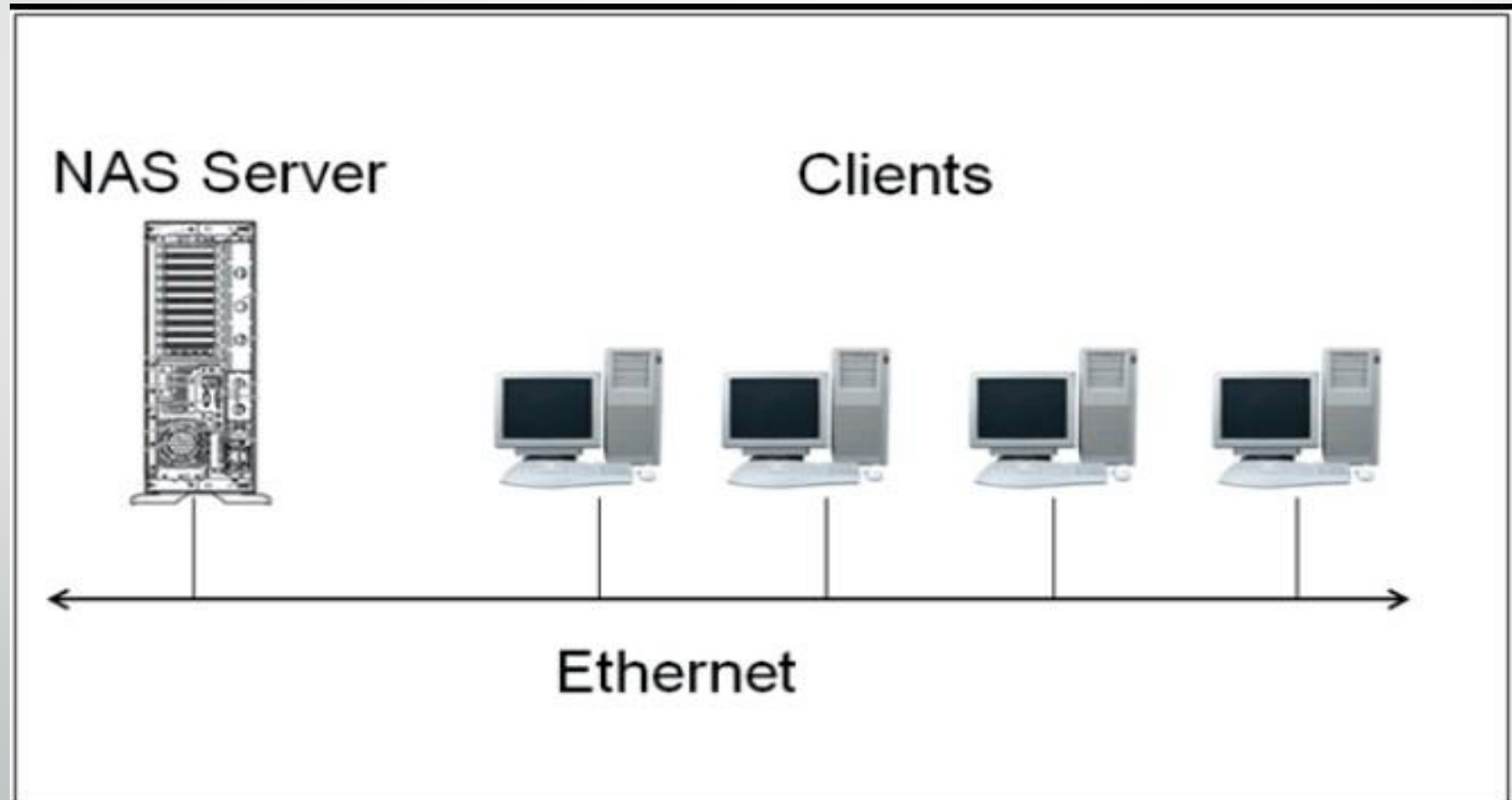
The main advantage of SAN is its ability to transfer large data blocks

The disadvantages include a much higher startup cost for SANs, and they are inherently much more complex to manage. SAN is limited to the enterprise sector since a huge investment is required for its design, development, and deployment

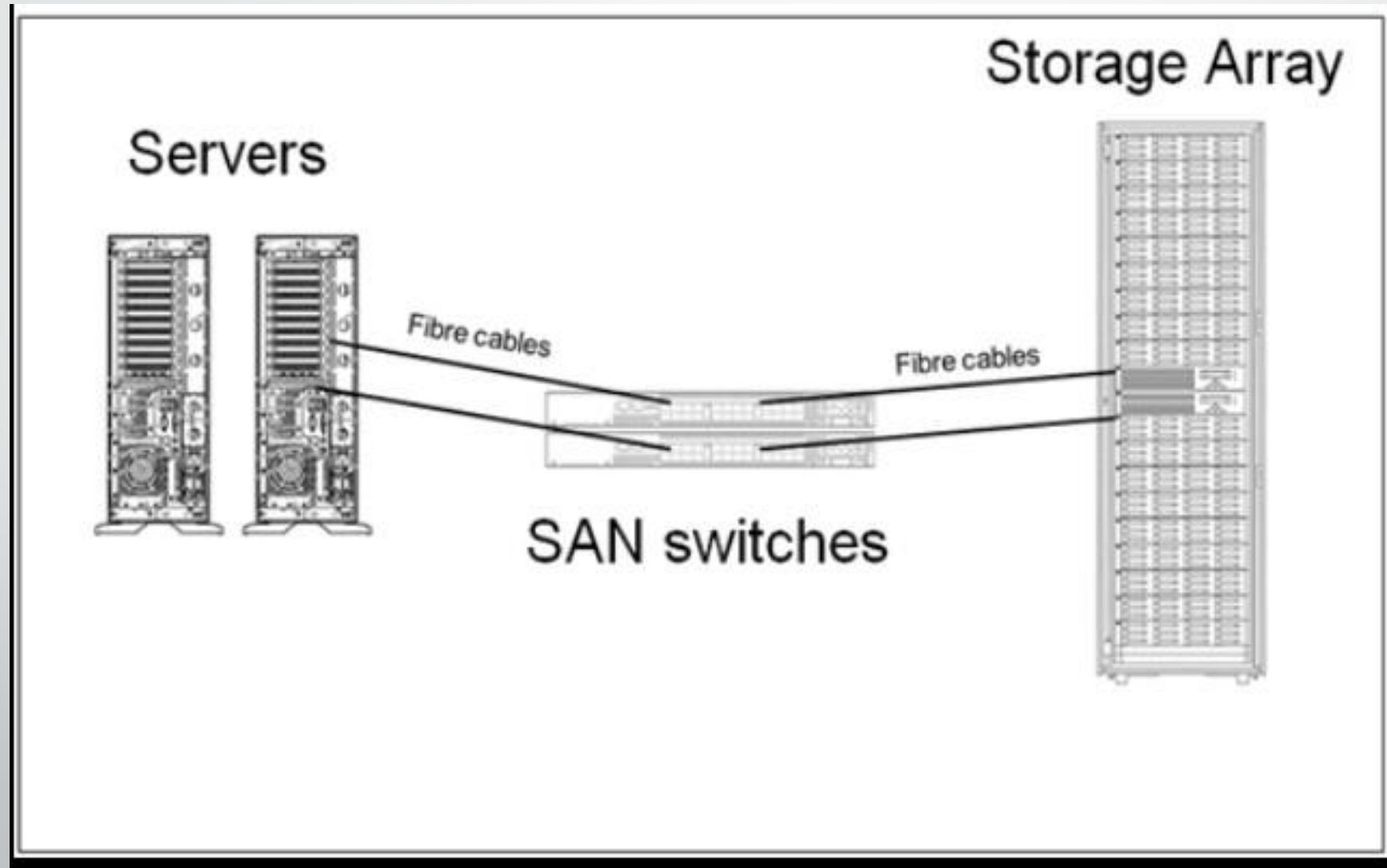
DIRECTLY ATTACHED STORAGE (DAS)



NETWORK ATTACHED STORAGE (NAS)



STORAGE AREA NETWORK (SAS)



REFERENCES

[1]"What is a Storage Area Network (SAN)? SAN Defined | IBM", Ibm.com, 2021. [Online]. Available: <https://www.ibm.com/topics/storage-area-network>. [Accessed: 30- Nov- 2021].

[2]"IBM Redbooks", Redbooks.ibm.com, 2021. [Online]. Available: <https://www.redbooks.ibm.com>. [Accessed: 30- Nov- 2021].

[3]"SAN Software components SAN software is required to manage and troubleshoot a | Course Hero", Coursehero.com, 2021. [Online]. Available: <https://www.coursehero.com/file/p14rteeac/SAN-Software-components-SAN-software-is-required-to-manage-and-troubleshoot-a/>. [Accessed: 01- Dec- 2021].

[4]<https://www.vmware.com>, 2021. [Online]. Available: https://www.vmware.com › pdf › esx_san_cfg_technote.pdf. [Accessed: 01- Dec- 2021].

[5]P. Services, S. Networking, C. Directors and D. Sheets, "Cisco MDS 9710 Multilayer Director - Cisco MDS 9710 Multilayer Director Data Sheet", Cisco, 2021. [Online]. Available: https://www.cisco.com/c/en/us/products/collateral/storage-networking/mds-9700-series-multilayer-directors/data_sheet_c78-727769.html. [Accessed: 01- Dec- 2021].

[6]"What is Storage Area Network Security (SAN Security)? - Definition from Techopedia", Techopedia.com, 2021. [Online]. Available: [https://www.techopedia.com/definition/30210/storage-area-network-security-san-security#:~:text=Storage%20area%20network%20\(SAN\)%20security,is%20protected%20from%20any%20vulnerabilities](https://www.techopedia.com/definition/30210/storage-area-network-security-san-security#:~:text=Storage%20area%20network%20(SAN)%20security,is%20protected%20from%20any%20vulnerabilities). [Accessed: 02- Dec- 2021].