

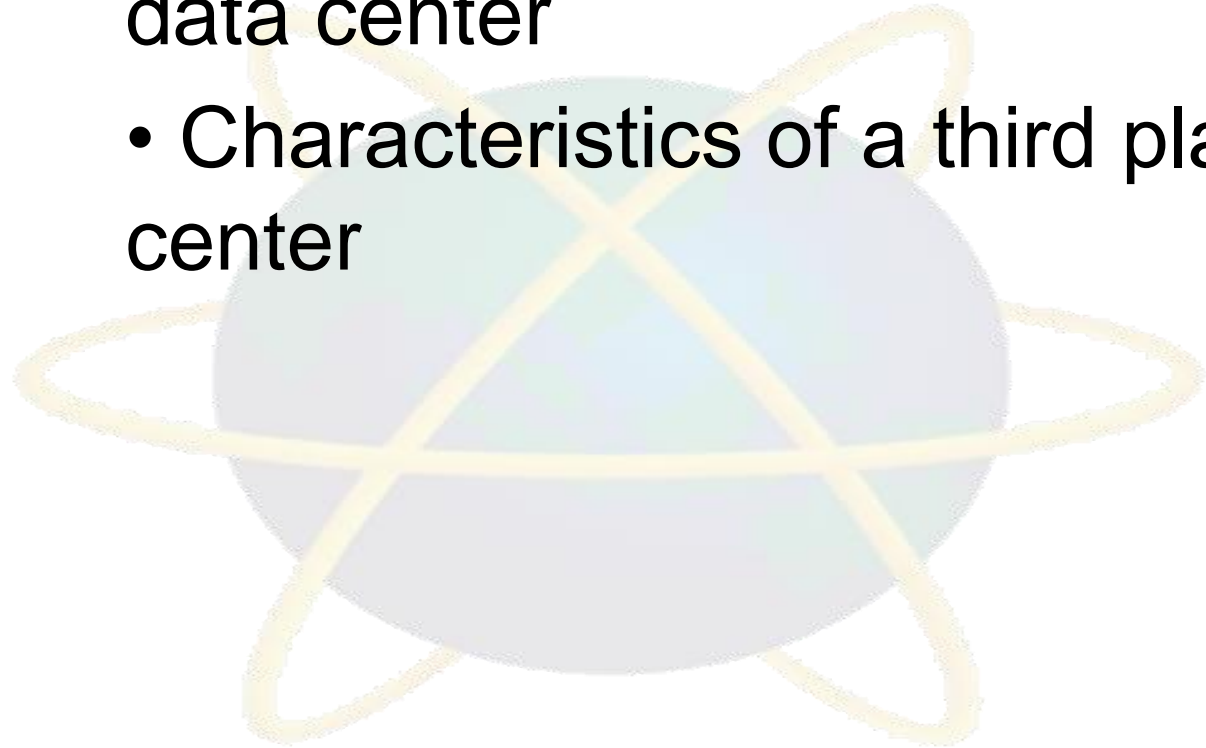


# Data Protection and Management

## Introduction to Data Protection – Data Centers

# Upon completion of session, you should be able to:

- Data center and its components
- Compute, storage, and connectivity elements of a data center
- Characteristics of a third platform-centric data center





# Data Center





# Data Center Introduction

A data center typically comprises:

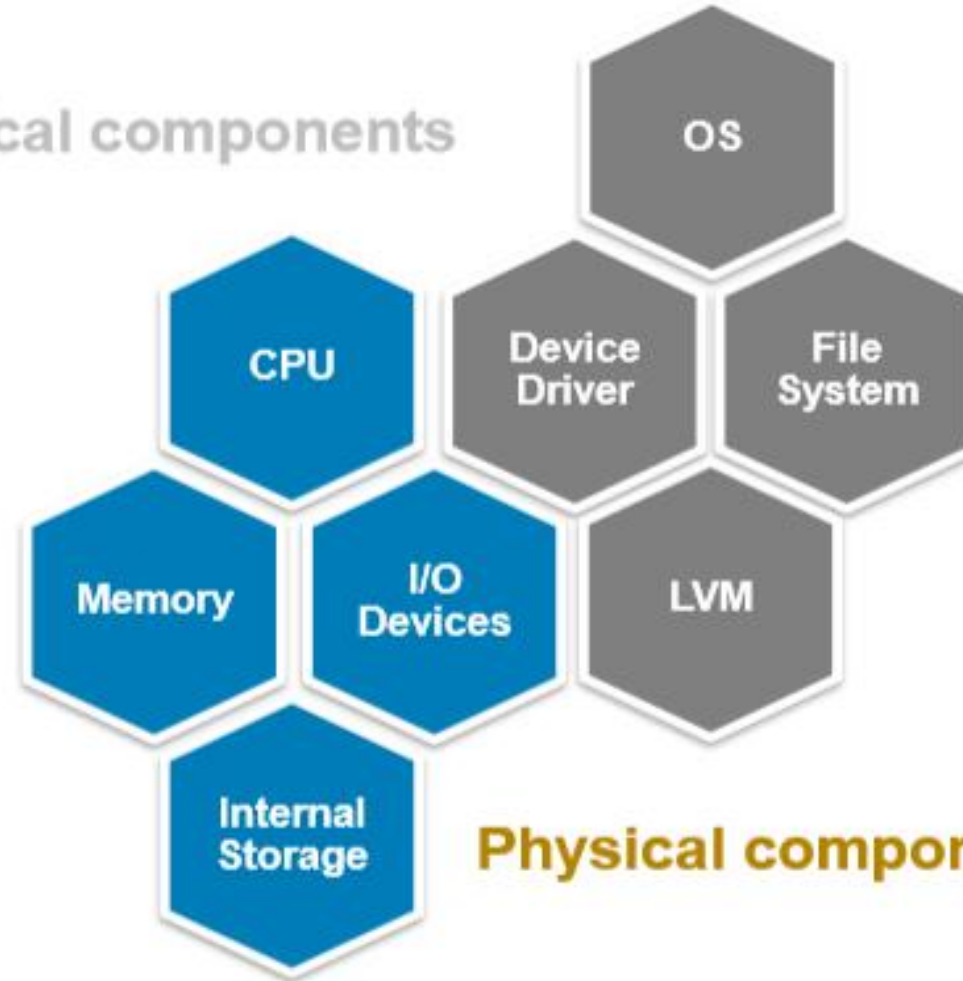
- Facility: The building and floor space where the data center is constructed
- IT equipment: Compute system, storage, and connectivity elements
- Support infrastructure: Power supply, fire detection, HVAC, and security systems

# Data Center IT Equipment – Compute System



A computing device (combination of hardware and system software) that runs applications

Logical components



Physical components

# Compute Cluster

In an enterprise data center, applications are typically deployed on compute clusters for high availability and for balancing computing workloads.

A compute cluster is a group of two or more compute systems that function together, sharing certain network and storage resources, and logically viewed as a single system.

# Types of Compute System



**Tower Compute System**



**Rack-mounted Compute System**



**Blade Compute System**

[https://www.youtube.com/watch?v=AcCkrHfA\\_gU](https://www.youtube.com/watch?v=AcCkrHfA_gU)

# Physical Components of a Compute System

## CPU

An IC that executes software programs by performing arithmetical, logical, and I/O operations

## Random-Access Memory

Volatile data storage that contains the programs for execution and the data used by the CPU

## Read-Only Memory

Semiconductor memory containing boot, power management, and other device-specific firmware

## Motherboard

A PCB that holds the processor, RAM, ROM, network and I/O ports

## Secondary Storage

A persistent storage device such as HDD or SSD



# Logical Components of a Compute System

## OS

Software that controls and manages the hardware and software on a compute system

## Device Driver

Software that enables the OS to recognize a device, and to access and control it

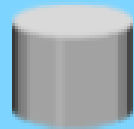
## File System

An OS component that organizes files and manages the storage and retrieval of files

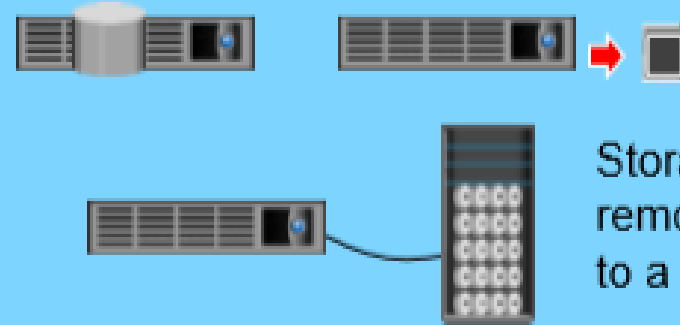
## LVM

Software that creates and controls compute level logical storage

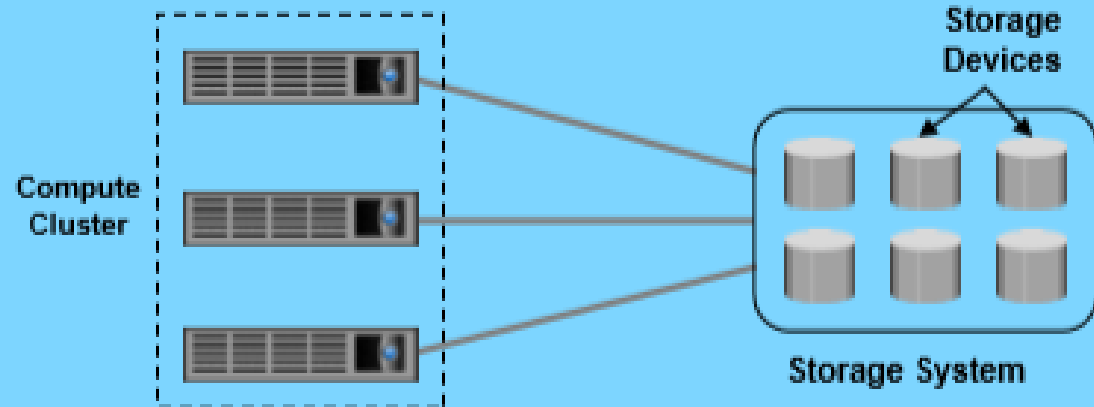
# Data Center IT Equipment – Storage



Digital data is persistently stored on storage devices (or storage) consisting of non-volatile media



Storage may be internal, removable, or external to a compute system

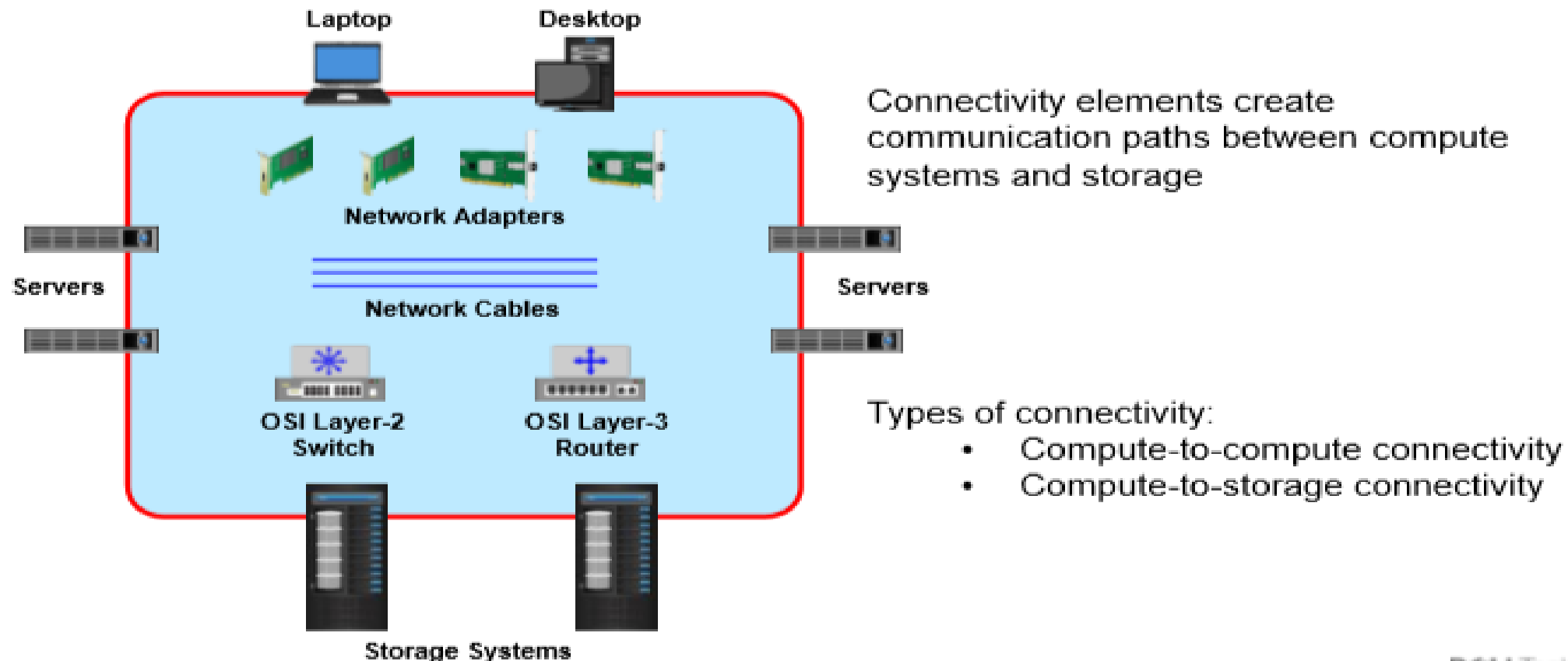


Storage devices are assembled within a storage system/array

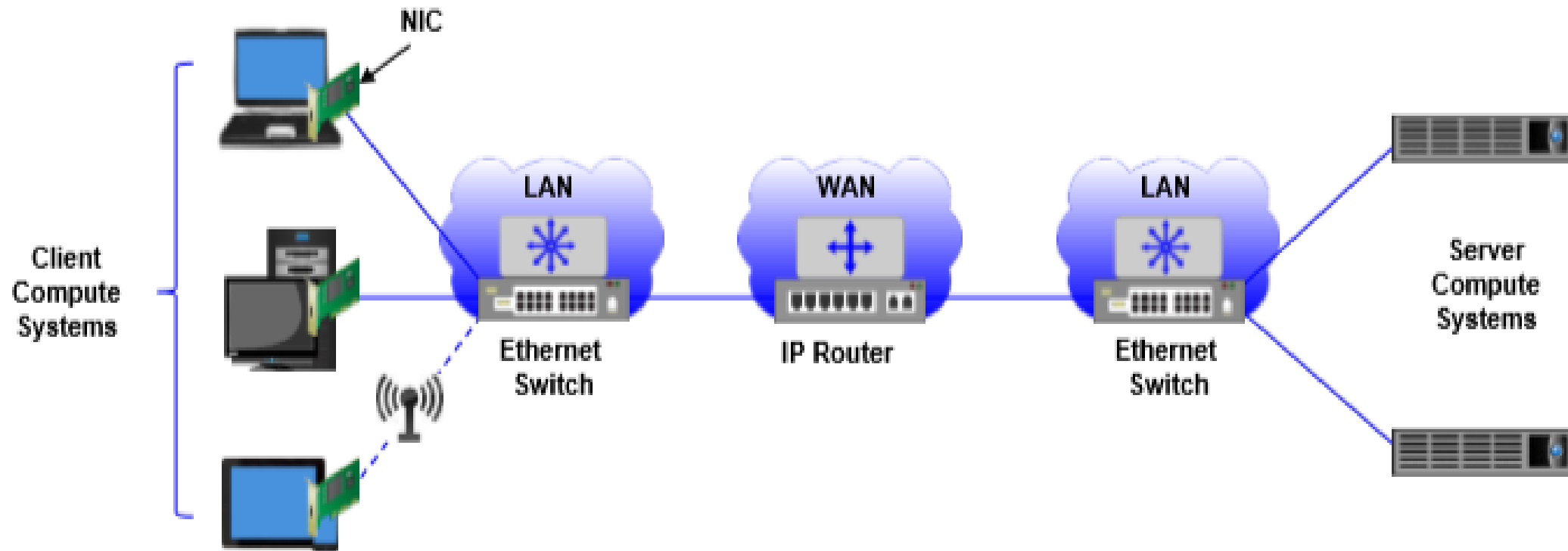
Storage systems are designed for high capacity, scalability, performance, reliability, and security

# Data Center IT Equipment – Connectivity Elements

The connectivity elements help in connecting IT equipment together in a data center.



# Compute-to-compute Connectivity



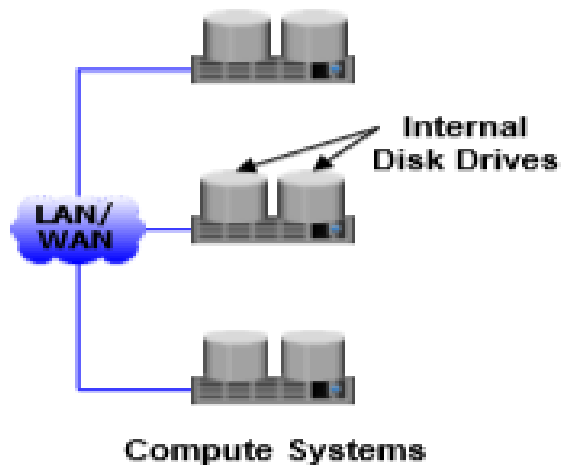


# Compute-to-storage Connectivity

Storage may be connected directly to a compute system or over a network.

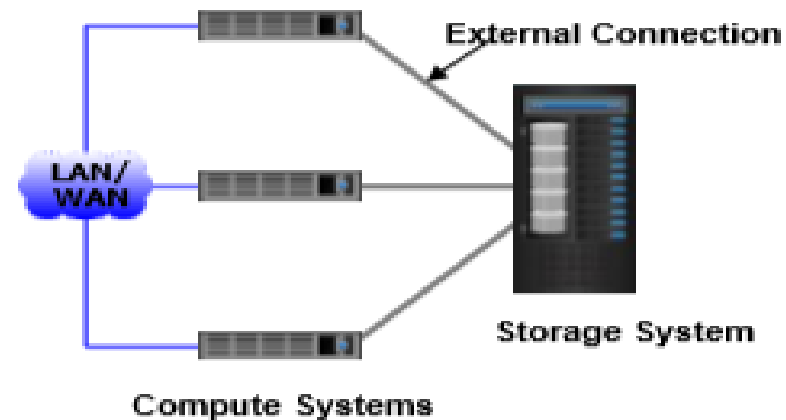
## Direct-attached Storage Connectivity

**Internal DAS**



- Shorter compute-to-storage distance
- Limited number of storage devices
- Storage occupies a large amount of space

**External DAS**

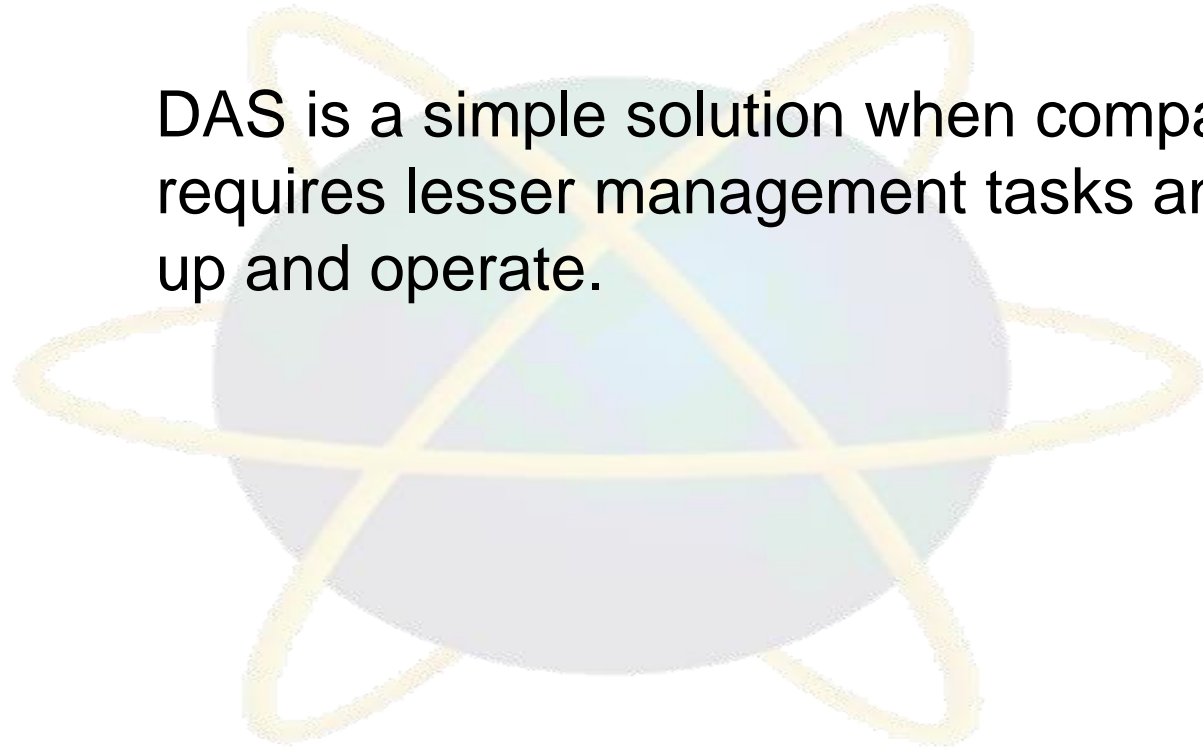


- Greater compute-to-storage distance
- Higher number of storage devices
- Centralized storage management

# DAS Advantages

DAS connectivity is simple and can be deployed easily and rapidly. Setup is managed using compute-based tools, such as the compute system OS, which makes storage management tasks easy for small and medium enterprises.

DAS is a simple solution when compared to networked storage connectivity and requires lesser management tasks and hardware and software elements to set up and operate.



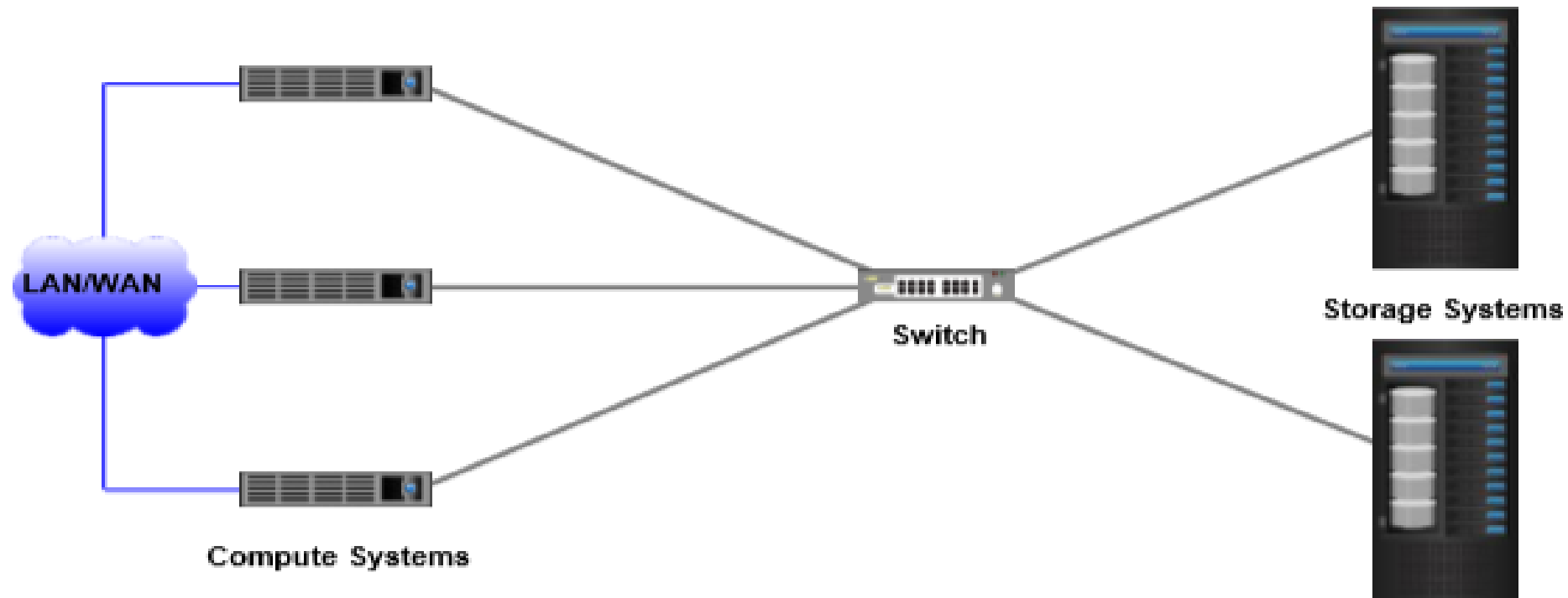
# DAS Disadvantages

DAS does not scale well, and is therefore inadequate to satisfy the growing demand for storage capacity. When storage capacities are being reached, the application or service availability may be compromised.

A storage device has a limited number of ports, which restrict the number of compute systems that can directly connect to the storage device. DAS does not make optimal use of storage resources due to its limited ability to share storage ports. In DAS environments, unused resources cannot be easily re-allocated, resulting in islands of over-utilized and under-utilized storage pools.

# Compute-to-storage Connectivity Networked

## Networked Storage Connectivity



- Improved utilization of storage systems
- Centralized storage management
- Dynamic, non-disruptive scalability of storage capacity



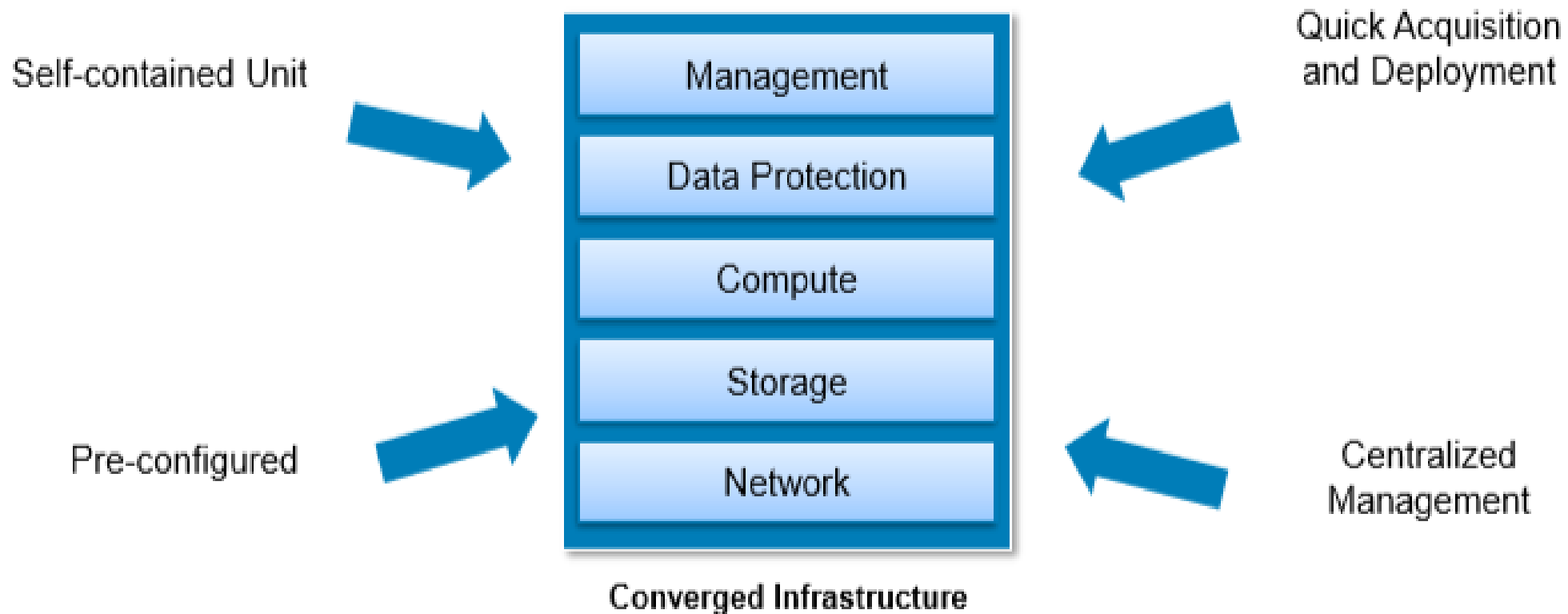
# Storage Connectivity Protocols

Protocol	Description
IDE/ATA	<ul style="list-style-type: none"><li>Used to connect hard disks and optical drives.</li><li>Ultra DMA/133 version of ATA supports a throughput of 133 MB/s</li></ul>
Serial ATA	<ul style="list-style-type: none"><li>Serial version of IDE/ATA protocol</li><li>Provides data transfer rate of up to 16 Gb/s (standard 3.2)</li></ul>
SCSI	<ul style="list-style-type: none"><li>Popular standard for compute-to-storage connectivity</li><li>Supports up to 16 devices on a single bus</li><li>Ultra-640 version provides data transfer speed of up to 640 MB/s</li></ul>
SAS	<ul style="list-style-type: none"><li>Point-to-point serial protocol, alternative to parallel SCSI</li><li>Supports data transfer rate of up to 12 Gb/s (SAS 3.0)</li></ul>
FC	<ul style="list-style-type: none"><li>Widely-used protocol for high speed compute-to-storage communication</li><li>Latest version of the FC standard '16GFC' allows transmission of data up to 16 Gb/s</li></ul>
IP	<ul style="list-style-type: none"><li>Existing IP-based network is used for compute-to-storage communication</li></ul>

# Data Center in a Box – Converged Infrastructure

- IT components that make up a data center can be packaged into a single, standalone computing box, called converged infrastructure.
- The package is a self-contained unit that can be deployed independently, or aggregated with other packages to meet additional capacity and performance requirements

# Data Center in a Box – Converged Infrastructure

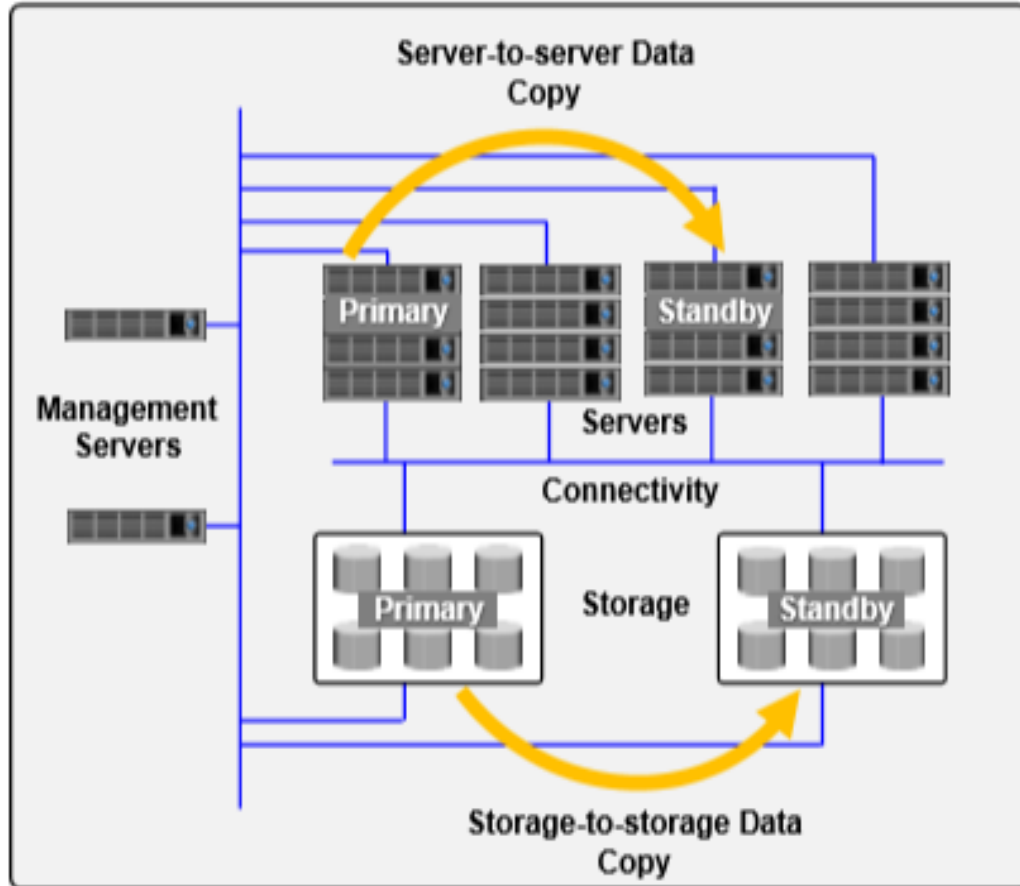


# Data Center Data Protection

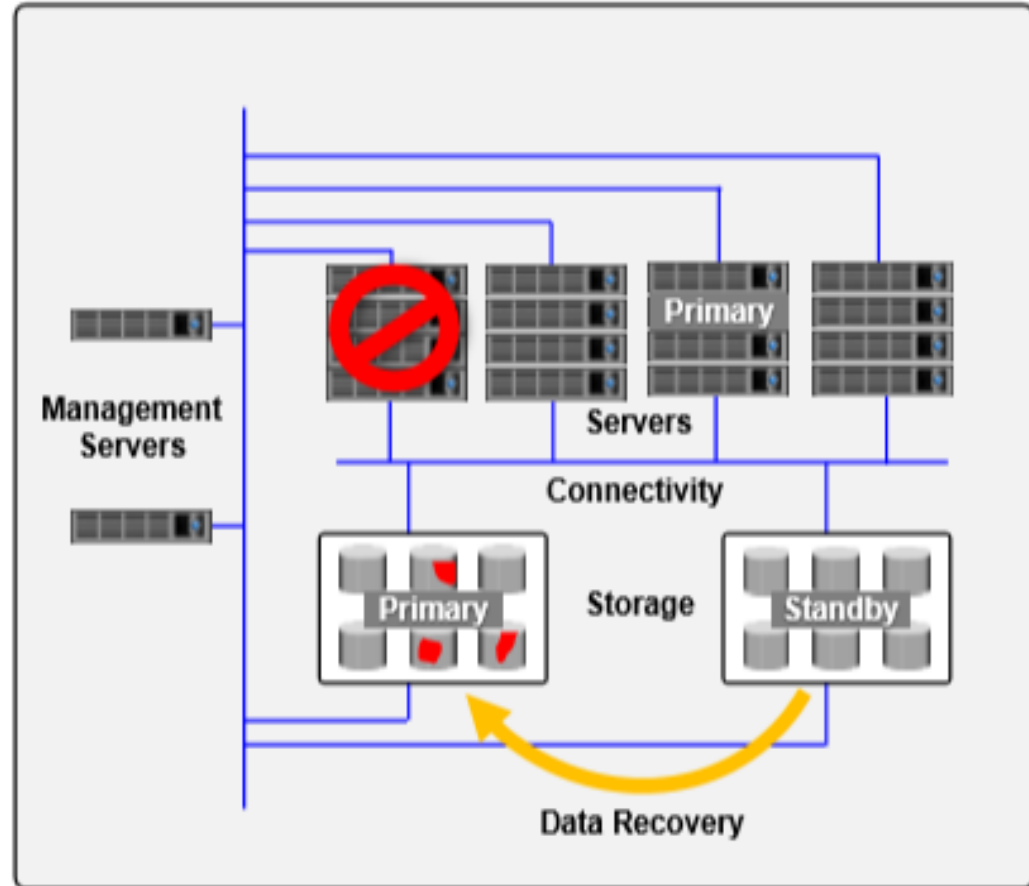
- Primary (production) database server may periodically transfer a copy of transaction data to a standby database server. This method ensures that the standby database is consistent up to a point-in-time with the primary database. In case the primary database server fails, the standby database server may start production operations.
- In another method, data is copied directly from a primary storage to a standby protection storage without involving application servers. The protection storage may be used for data recovery or restarting business operations in the event of primary storage failure.



# Data Protection in a Data Center

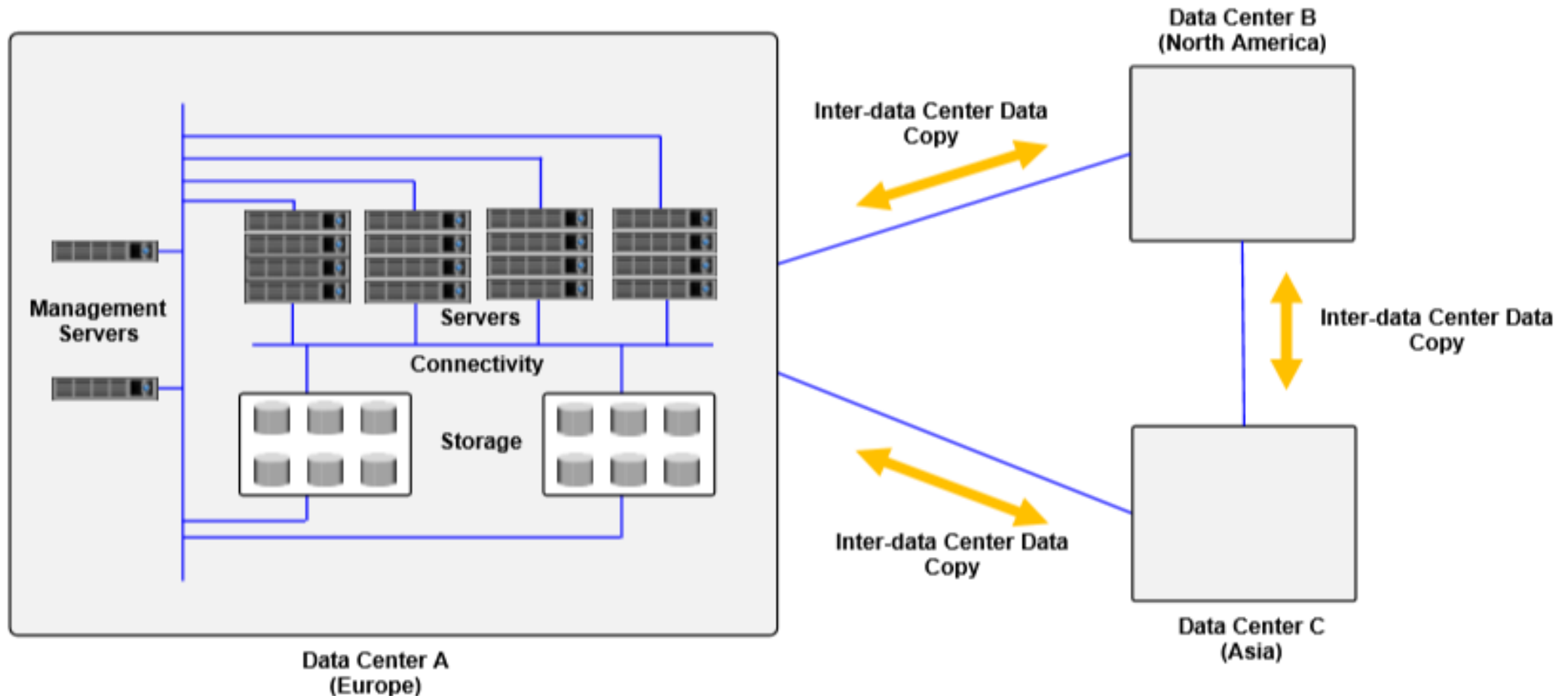


Data Center  
(Normal Condition)



Data Center  
(After Resource Failure)

# Data Protection in a Data Center (contd.)- Remote Protection



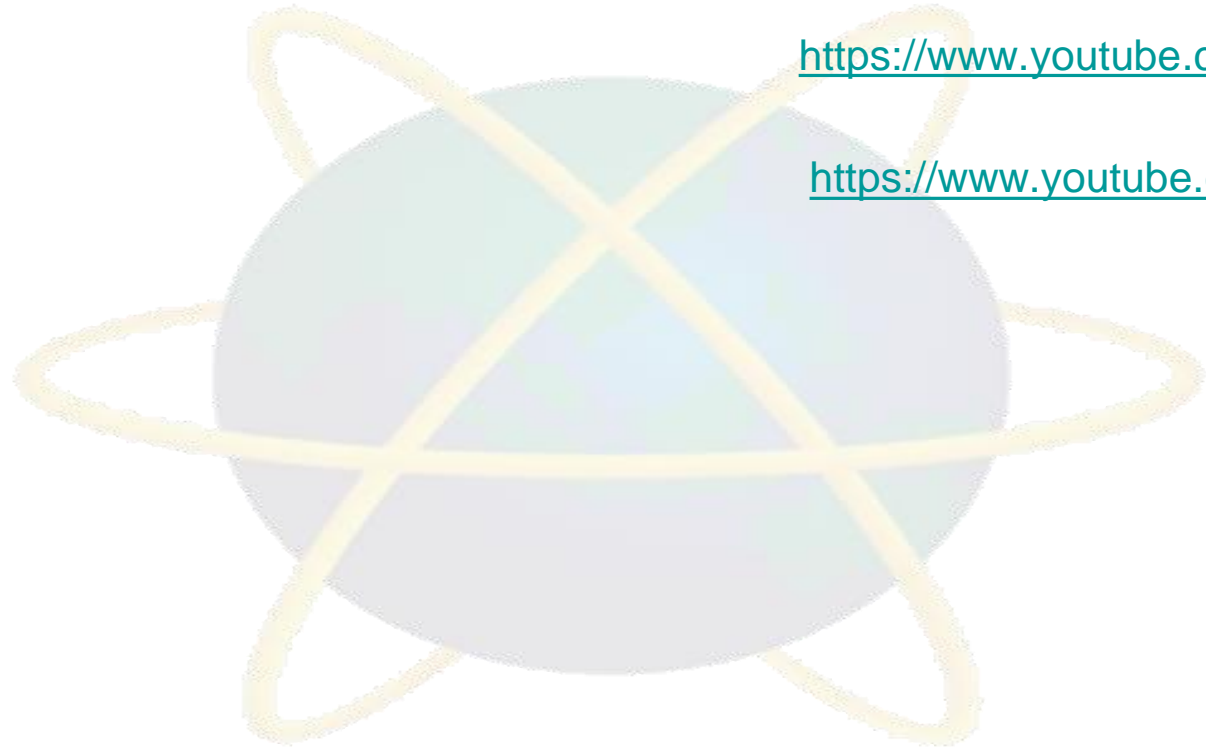
# Remote Protection

- Large organizations often maintain multiple data centers to distribute data-processing workloads and provide remote protection of data.
- Data is copied between data centers to provide remote protection and high availability. If one data center experiences an outage, other data centers continue providing services to the users.

# Q & A

<https://www.youtube.com/watch?v=XZmGGAhHqa0>

[https://www.youtube.com/watch?v=O6p\\_g1PRp1U](https://www.youtube.com/watch?v=O6p_g1PRp1U)





# Next Topic

## Evolution of Computing Platform Data Protection and Availability Solutions

