PC Storage

Overview

Storage devices

- Optical
- Hard disk drives
- Solid state drives
- RAID

Network storage

- NAS
- iSCSI
- SAN
- Cloud storage

Optical Storage Devices

Optical Storage Devices

Use lasers to read and write data from and to spinning disks

Considered removable media

Limited number of writes

CD/DVD/Blu-ray

Optical drives and storage media

Internal (IDE, SATA) or external (USB)

CD-ROM, DVD-ROM, BD-ROM

CD-R, DVD-R, BD-R (recordable)

CD-RW, DVD-RW, BD-RE

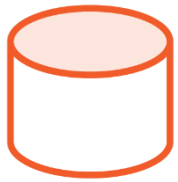
Storage capacity

- CD: 737 MB
- DVD: 47 GB (double sided)
- Blu-ray: 50GB (dual layer)
- Ultra HD Blu-ray: 100 GB

DVD Drive

Hard Disk Drives

Hard Disk Drives



Contain a series of spinning rigid metal platters

Read and write heads must move over spinning platters to read and write

Uses power to drive motors which results in noise and heat

HARD DISK DRIVES

Magnetic drives

Internal interface

- IDE
- SATA
- SCSI

External interface

- USB
- eSATA
- SAS

Magnetic Drive Characteristics

Rotational Speed

5,400 rpm

7,200 rpm

10,000 rpm

15,000 rpm

Physical Sizes

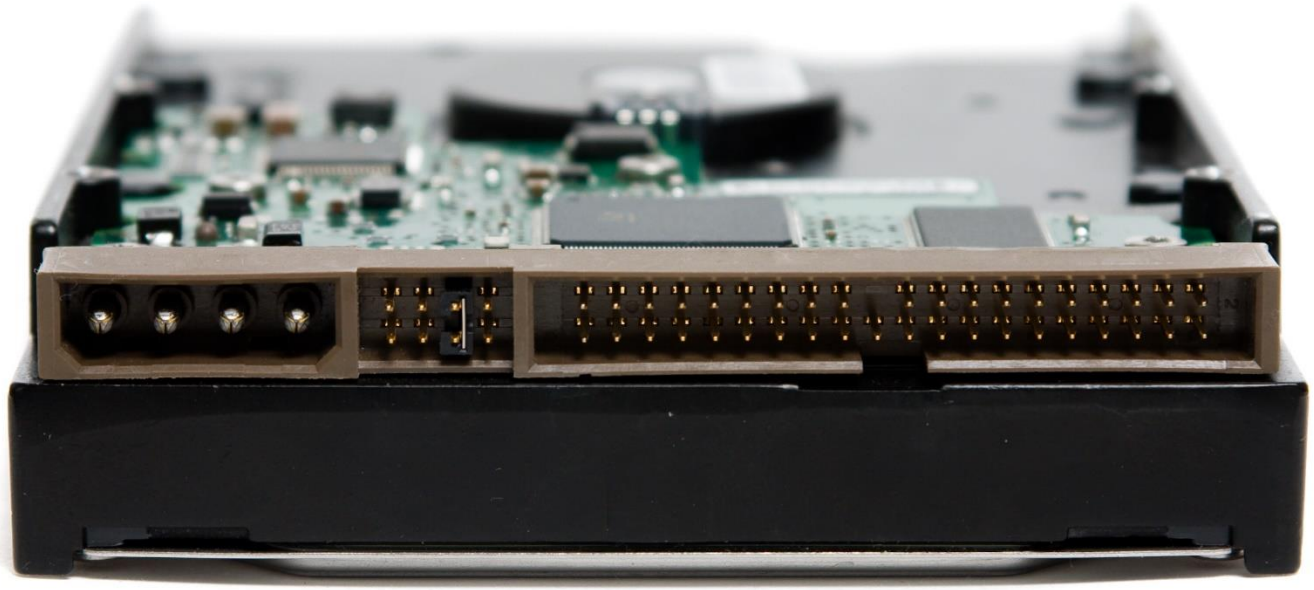
2.5”

3.5”

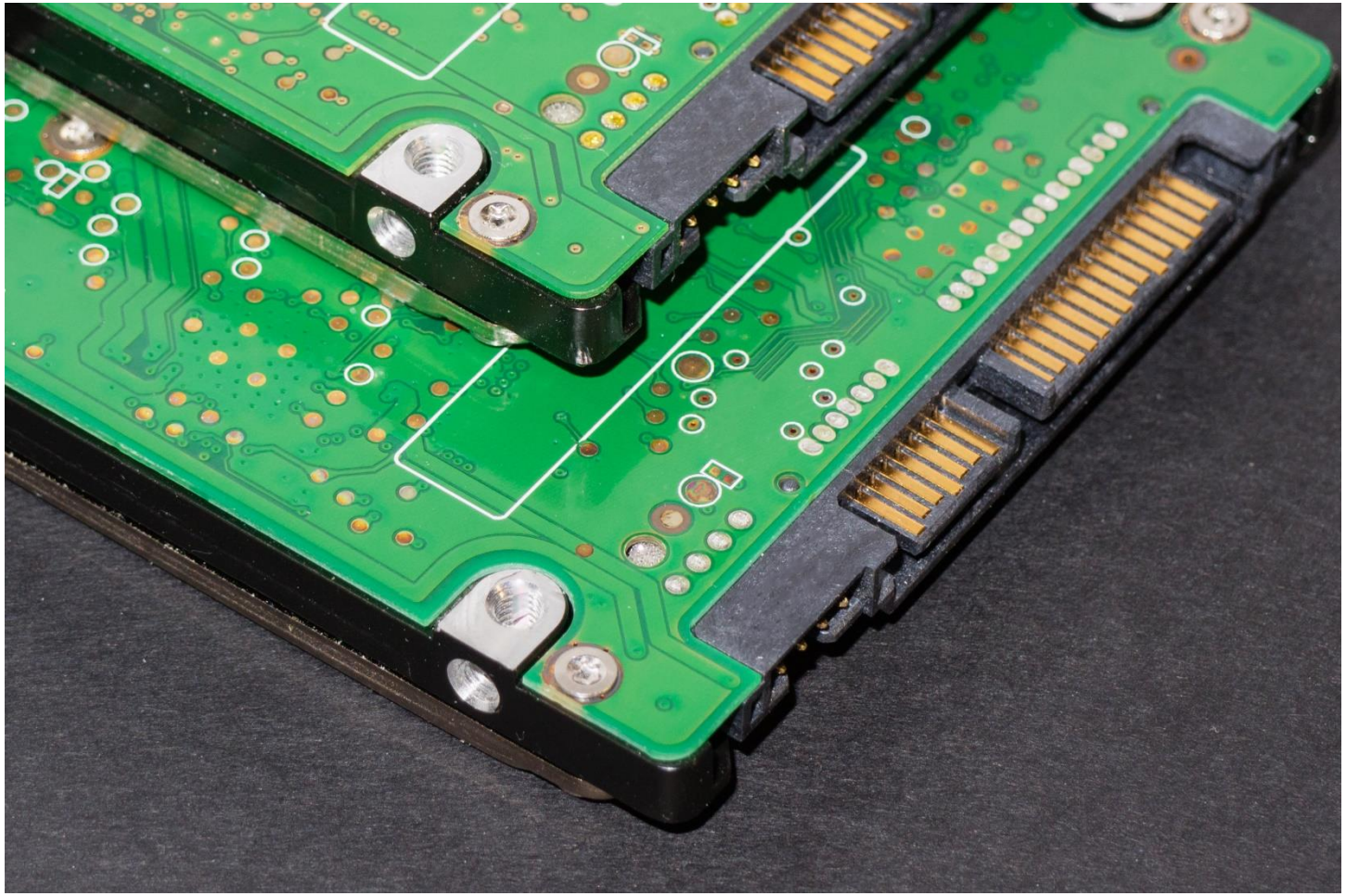
Eg: SATA 2.5, SATA 3.5

Hard Disk Drive

PATA HDD Interface



SATA Interface (HDD or SSD)



Solid State Drives

Solid State Drives

No mechanical moving parts

Based on digital circuits and flash memory

Less power draw and noise compared to HDDs

SOLID STATE DRIVES

USB thumb drives

M.2

- Small form factor SSD drive

Flash memory also used by

- SD cards
  - CompactFlash
  - Mini-SD cards
  - Micro-SD cards
  - xD

USB Thumb Drive

Redundant Array of Independent Disks

RAID

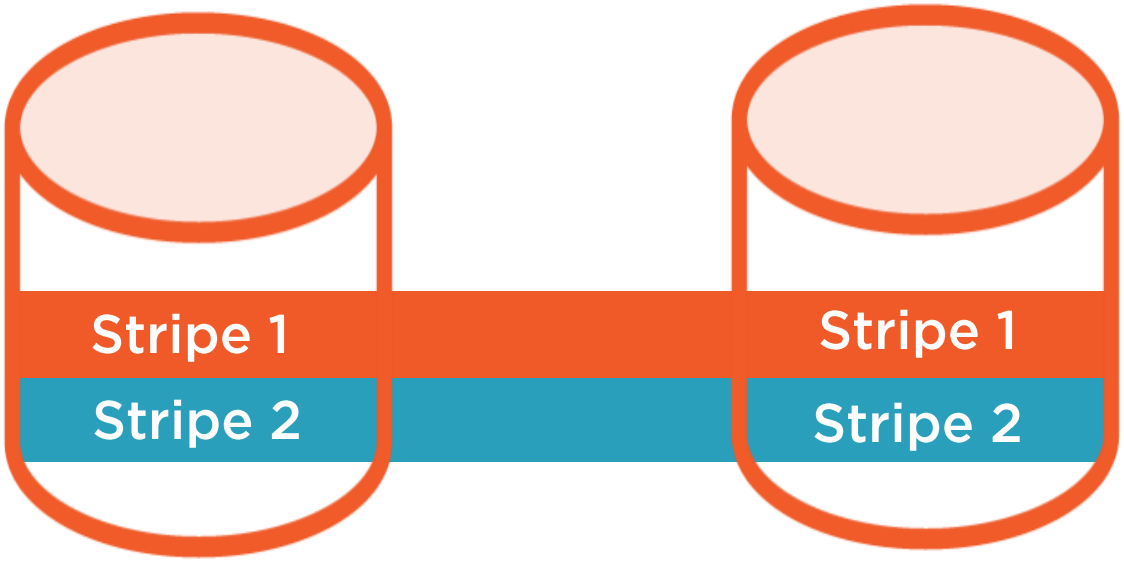
A group of physical or virtual disks working together

- Increased performance and fault tolerance
- Disks should be hot-swappable

Hardware RAID uses a physical RAID controller

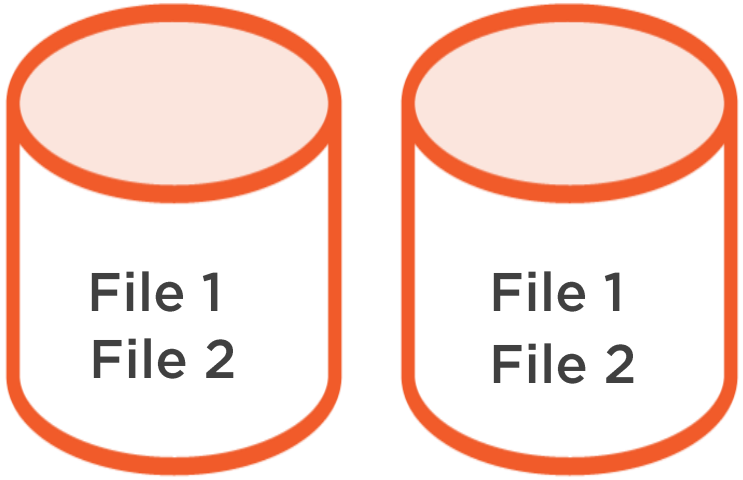
Software RAID manages logical disks using the OS

RAID 0
Striped Volume



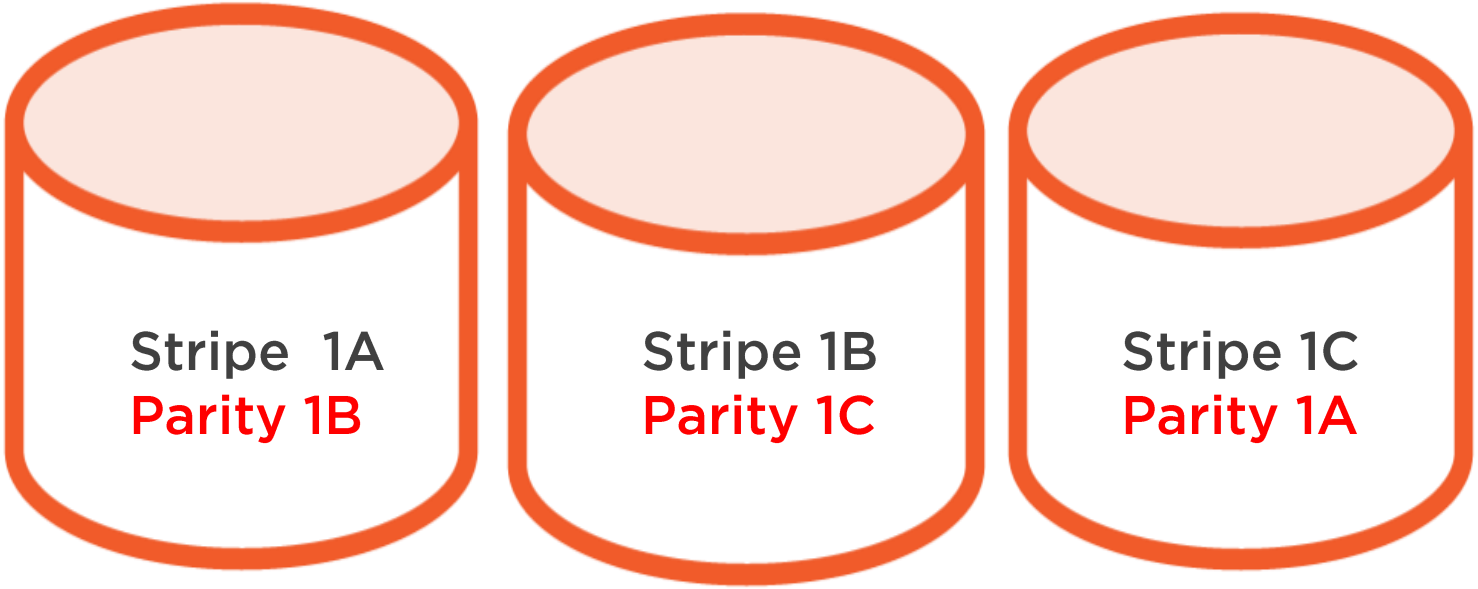
- No fault tolerance
- Increased performance
- Appears as a single disk in the OS

RAID 1
Mirrored Volume



- Provides fault tolerance
- Increased read performance
- Appears as a single disk in the OS

RAID 5
Striping with Distributed Parity



- Commonly used
- Increased performance
- Can tolerate the failure of one disk in the array

Other RAID Levels

RAID 10

- RAID 1 + RAID 0
- Combines mirroring and striping
- Requires four disks

RAID 50

- RAID 5 + RAID 0
- Combines distributed parity and striping
- Requires six disks

Demo

Configure Software RAID 5 using Microsoft Windows Server 2016

Network Attached Storage

Network Attached Storage

NAS

Network storage accessible over a standard IP network

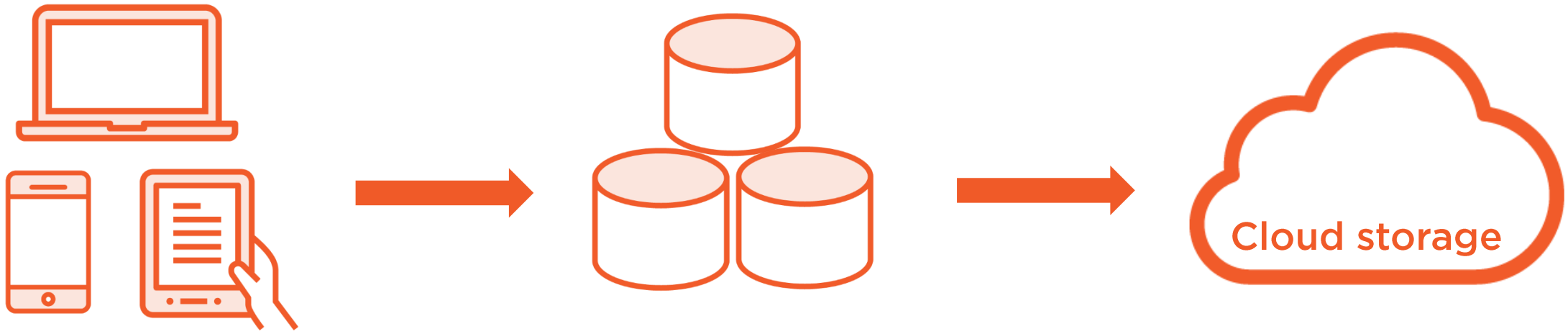
File and folder sync to the NAS device

Backup of NAS data to the cloud

Accessed via file sharing/streaming protocols

- Network file system (NFS)
- Server Message Block (SMB)
- Universal Plug and Play (UPnP)

Network Attached Storage



LAN devices
- Windows
- macOS
- Linux

NAS device
- Expandable capacity
- Wi-Fi or wired
- AES 256-bit encryption
- RAID capabilities

iSCSI

iSCSI

Network storage over a standard IP network

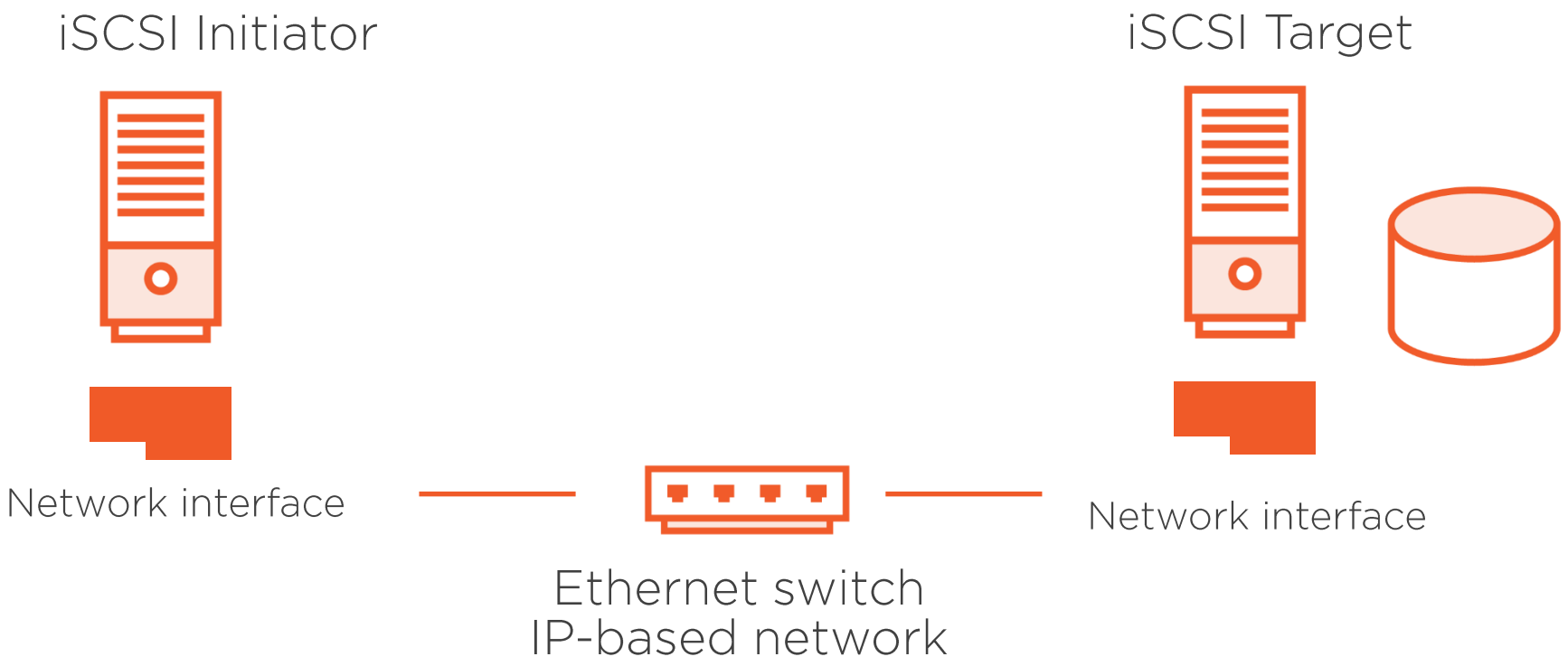
Normally uses TCP port 3260

iSCSI disk I/O commands are embedded within IP packets

Hardware and software solutions

- iSCSI initiator
- iSCSI target

iSCSI Architecture



Storage Area Networks

Storage Area Networks

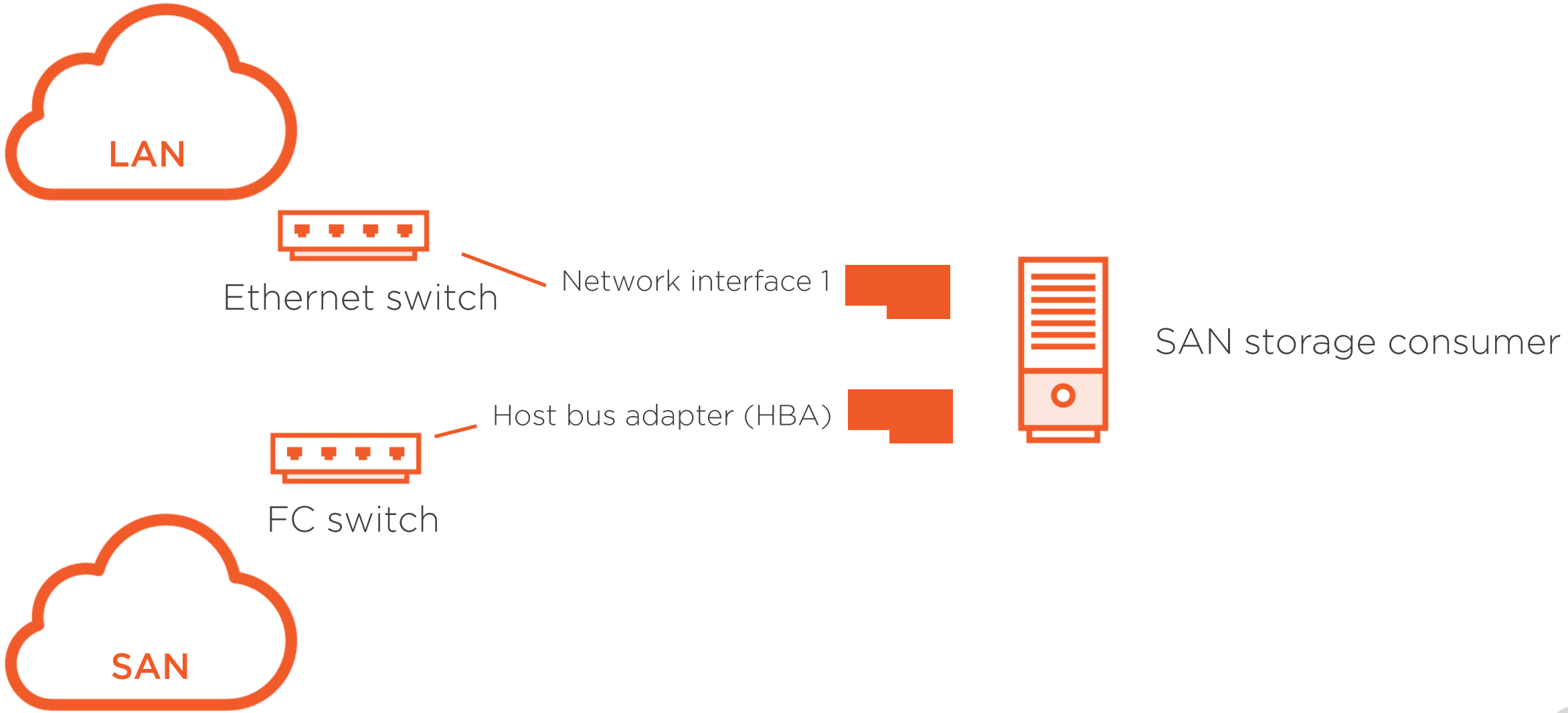
Hosts access remote network storage as opposed to direct attached storage (DAS)

Host boot device can exist on a SAN

Dedicated network for disk I/O traffic over a network

- Fibre Channel (FC)
- Fibre Channel over Ethernet (FCoE)
- iSCSI

Simple SAN Architecture



Cloud Storage

Cloud Storage

On-premises cloud storage consumer

Cloud Storage Considerations

Redundant internet connections

Automatic synchronization

Server-side encryption of data at rest

Data sovereignty

Demo

Configure a Windows 10 station to use cloud storage

Summary

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