

# Module 1

## NetApp ONTAP 9 clusters

# About this module

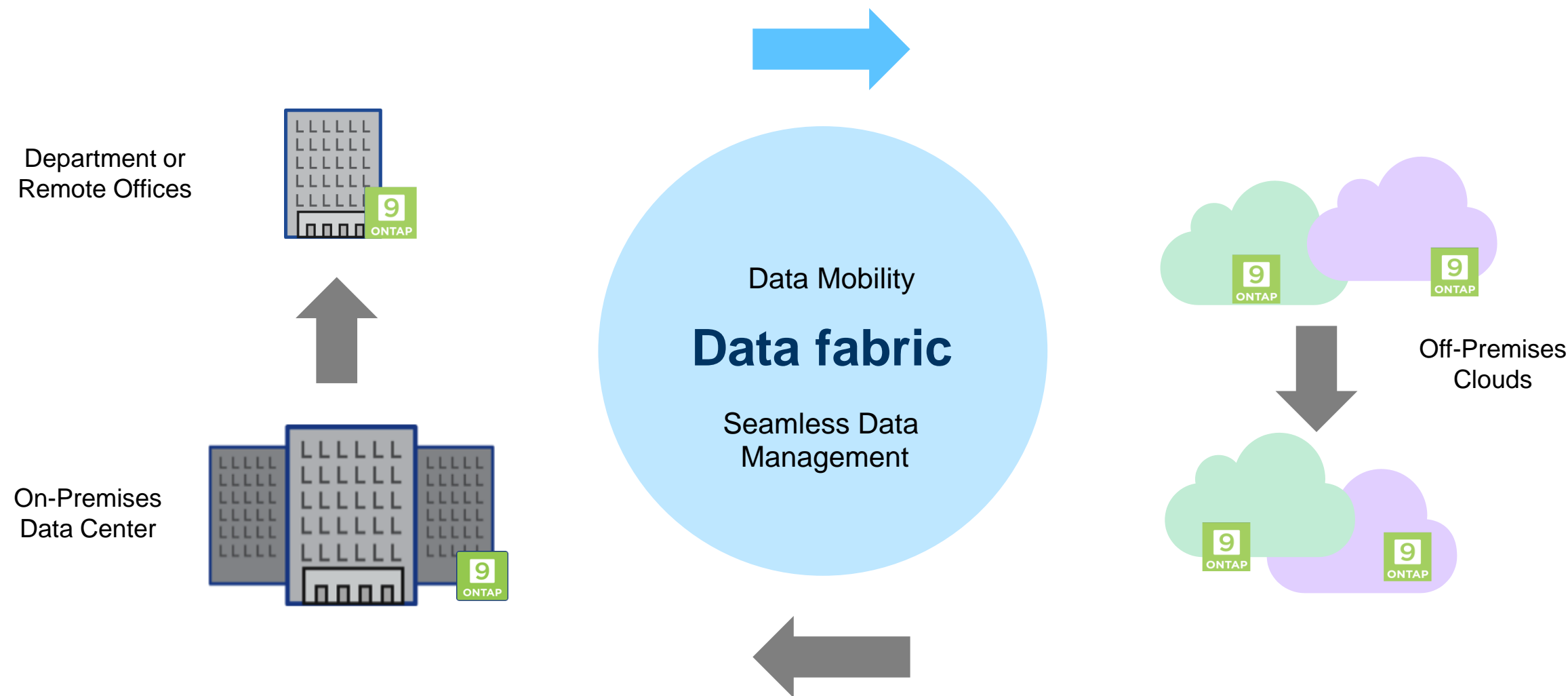
This module focuses on enabling you to do the following:

- Identify NetApp ONTAP deployment options
- Define ONTAP cluster components
- Describe the role of a storage VM (storage virtual machine, also known as SVM) in the NetApp storage architecture

# Lesson 1

## ONTAP deployment options

# NetApp ONTAP is the foundation for your data fabric

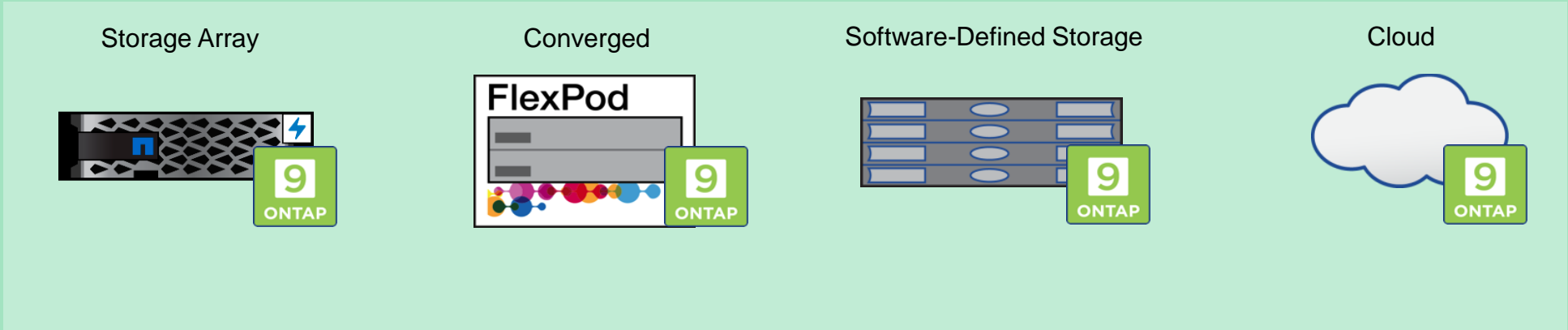


# Standardize data management

ONTAP software: For any application, anywhere



## ONTAP 9 software



Shared data management

# ONTAP 9.8 hardware systems

May 2021



# All SAN Array systems

## ASA



- AFF ASA A700
- AFF ASA A800



- AFF ASA A400



- AFF ASA A220
- AFF ASA A250

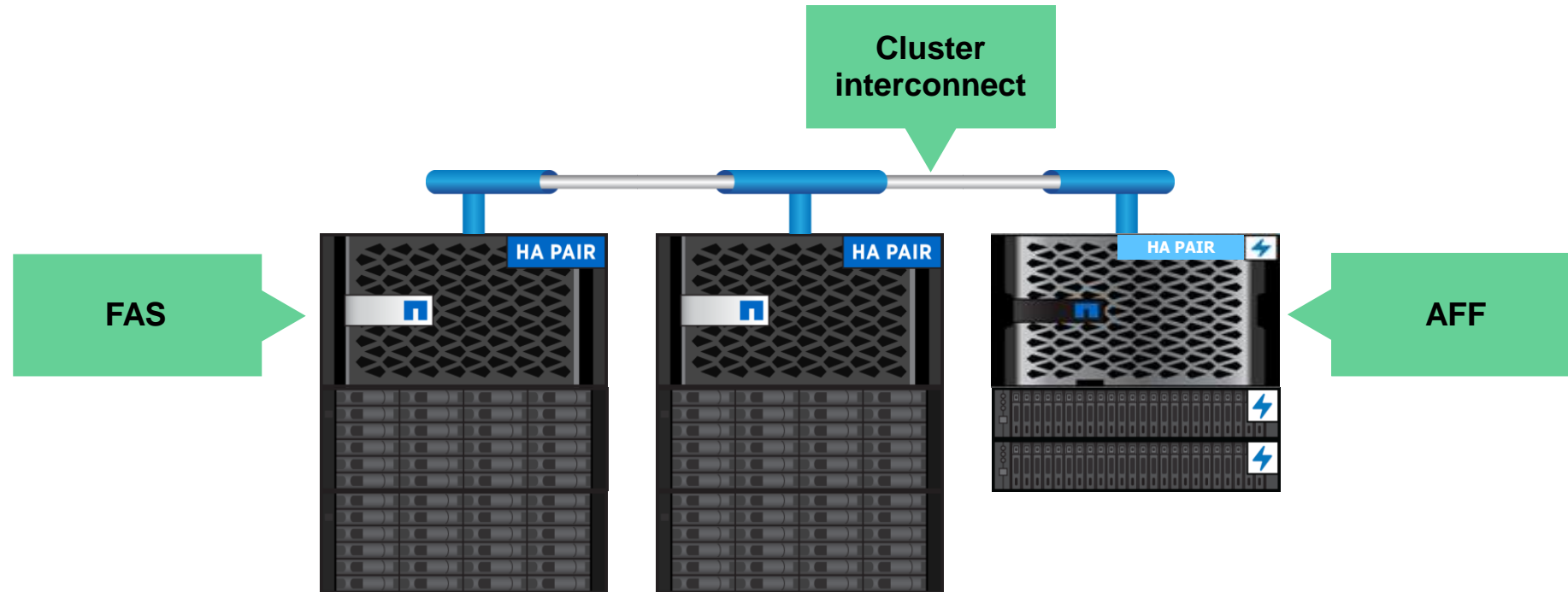
- All SAN Array (ASA) systems are optimized for enterprise tier 1 SAN workloads.
- ASA systems use proven AFF system hardware.
- ASA systems provide uninterrupted access to data during a planned or unplanned storage failover.
- NetApp ONTAP System Manager (formerly OnCommand System Manager) is streamlined for SAN:
  - Implementation
  - Configuration
  - Management

# Lesson 2

## ONTAP cluster



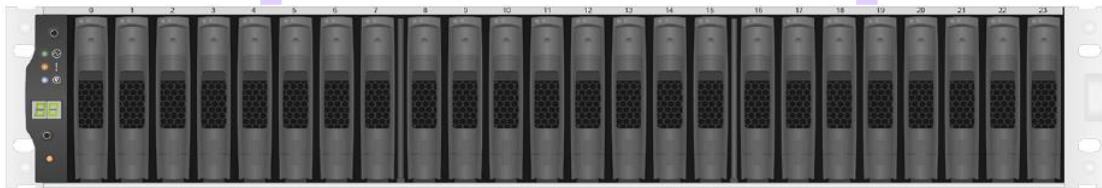
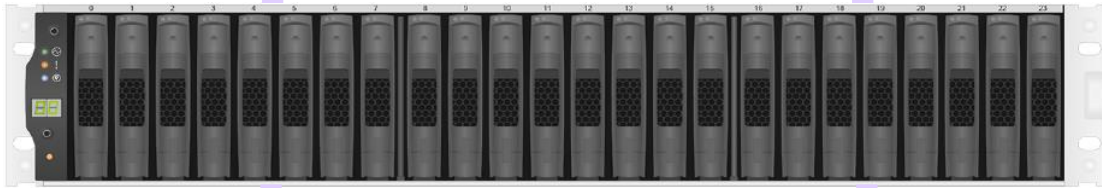
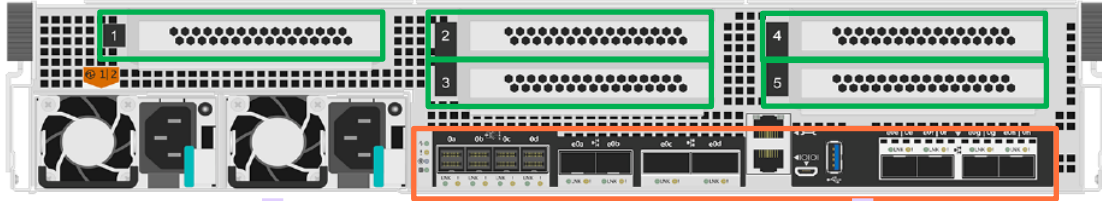
# The cluster



For product specifications, see the Hardware Universe:  
[hww.netapp.com](http://hww.netapp.com).

# Node

Controller rear view

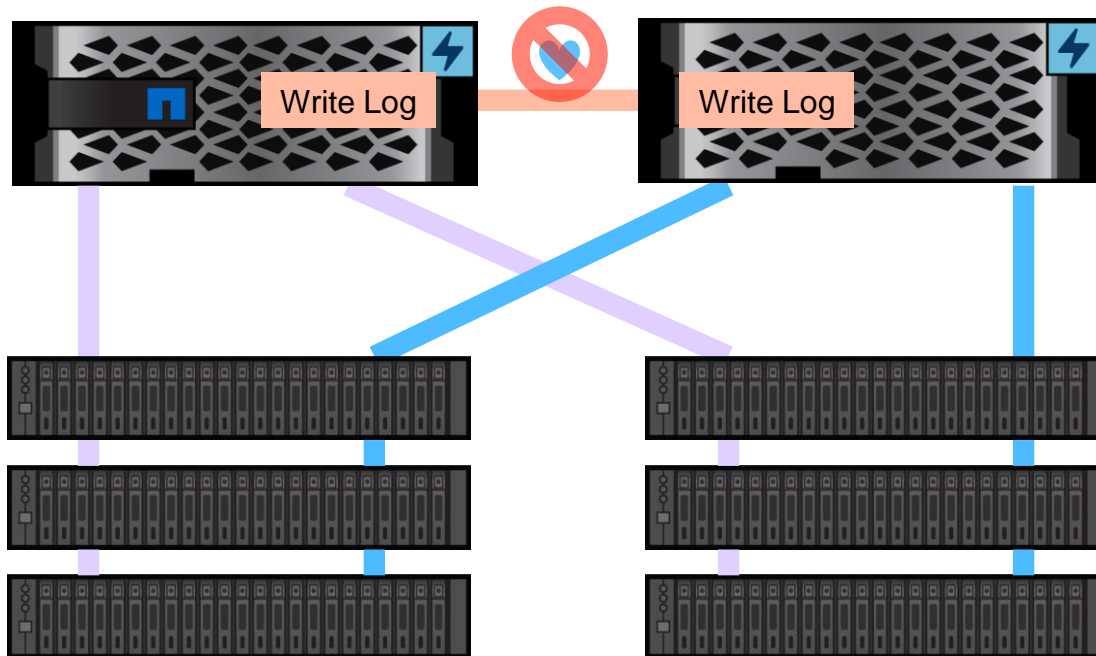


Drive shelves

- A FAS storage controller or AFF storage controller that runs ONTAP software
- Storage and network ports
- Expansion slots  
Not all entry-level systems have expansion slots.
- Nonvolatile write protection that uses NVRAM, NVMEM, or NVDIMMs
- Drive shelves or internal drives or both

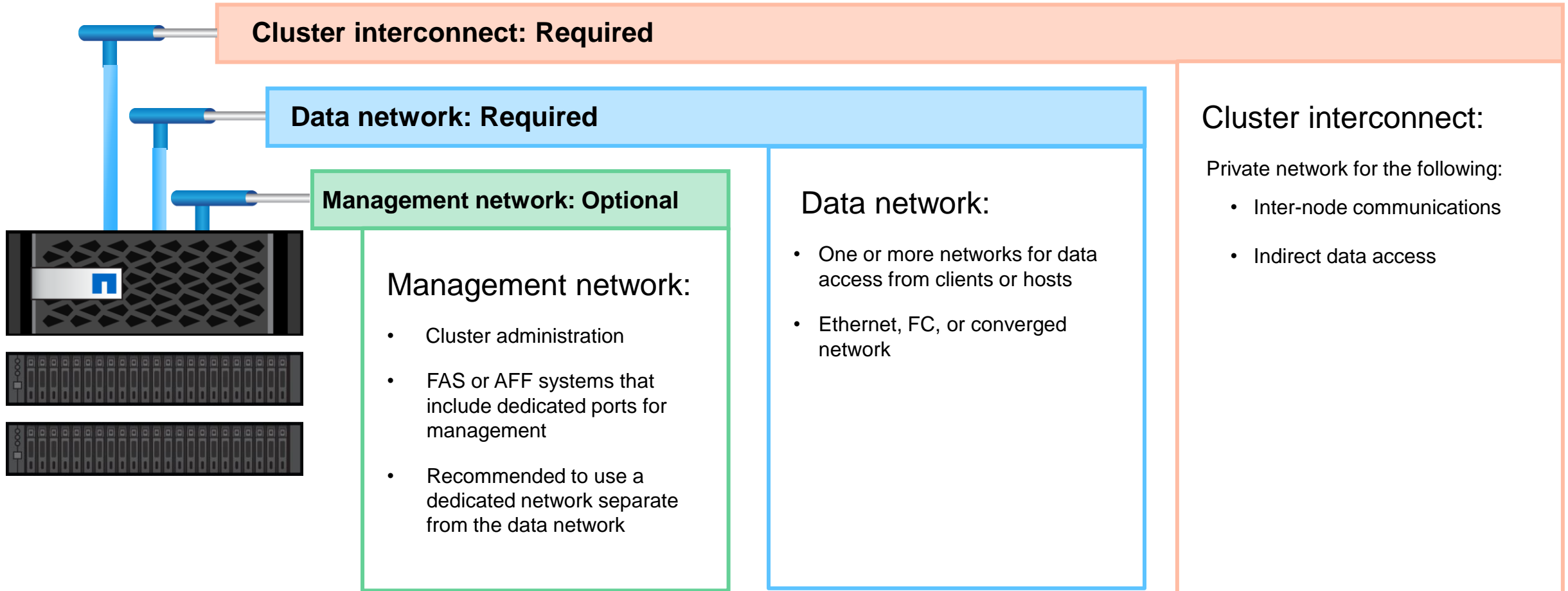
For product specifications, see the Hardware Universe:  
[hww.netapp.com](http://hww.netapp.com).

# High-availability pair



- Characteristics of a high-availability (HA) pair:
  - Two connected nodes are in a partnership.
  - Nodes connect to the same drive shelves.
  - Nodes own some of the drives.
  - If a node fails, the surviving node takes control of the failed partner's drives.
- Components of HA pair connections:
  - HA interconnect
  - Multipath HA shelf connectivity

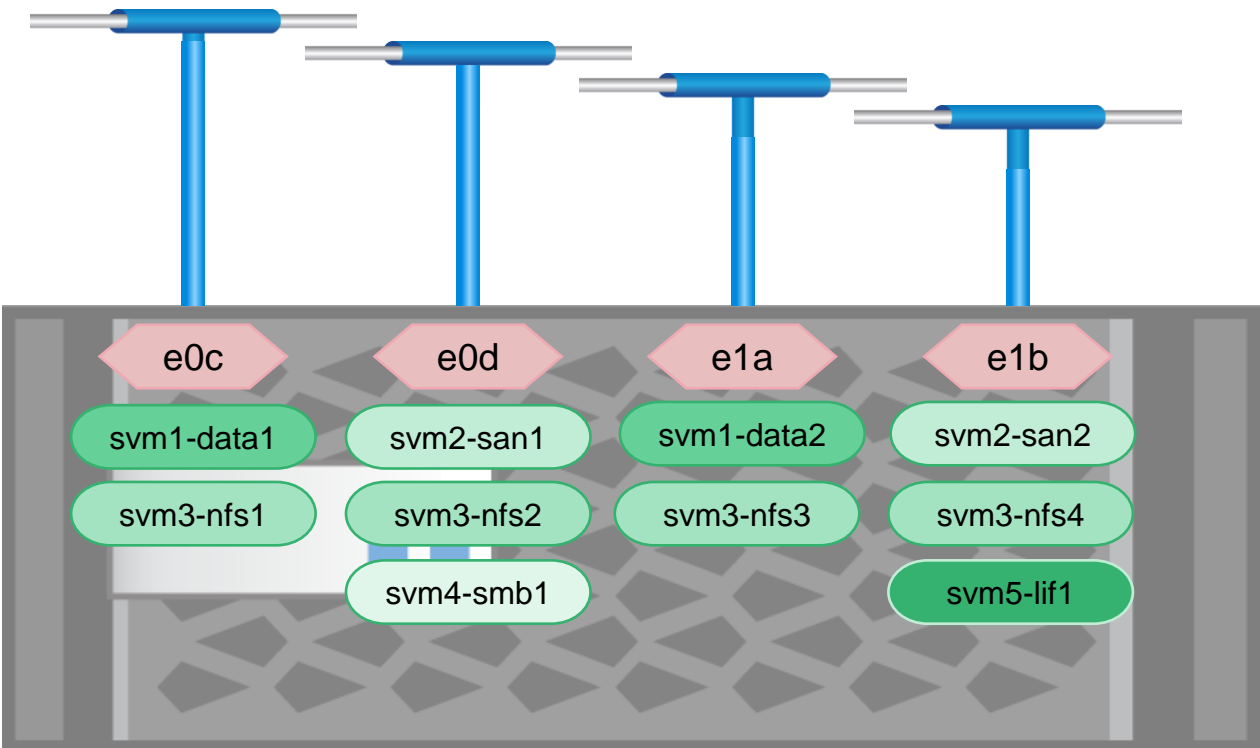
# Network



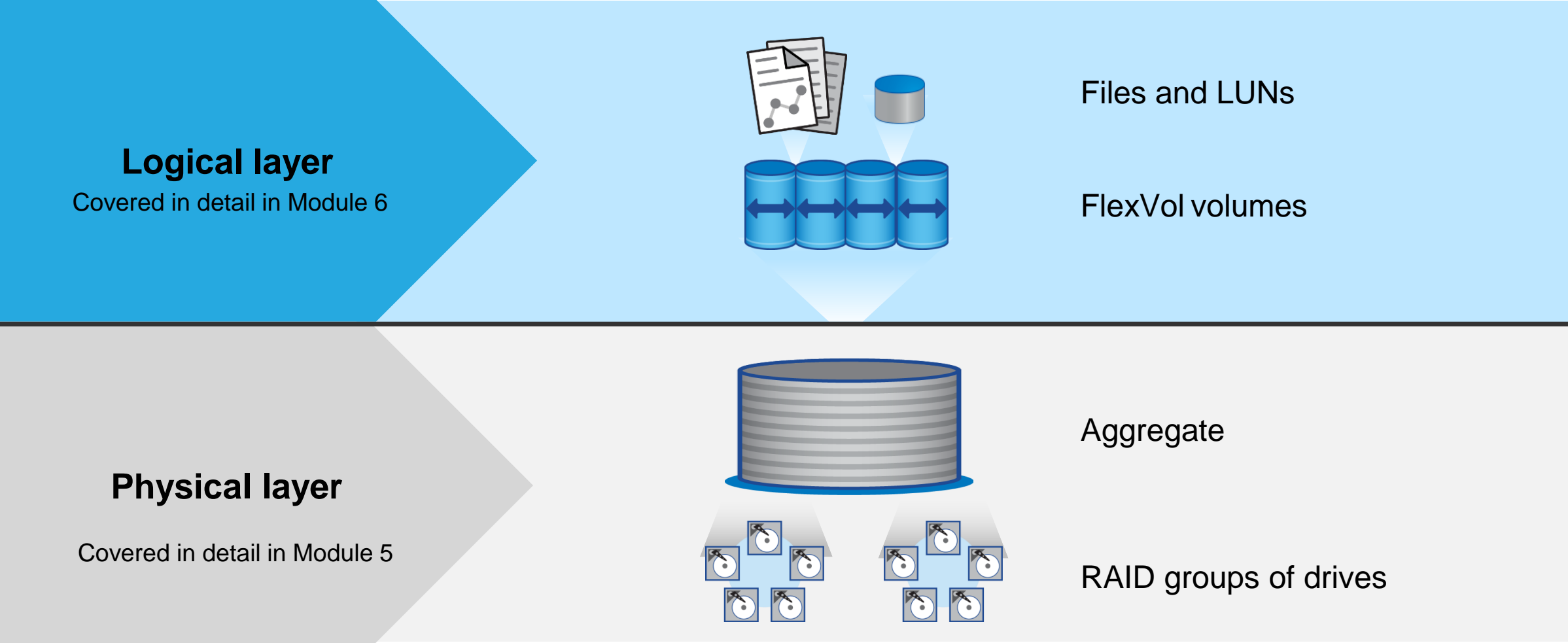
# Ports and LIFs

Physical ports

Logical network interfaces



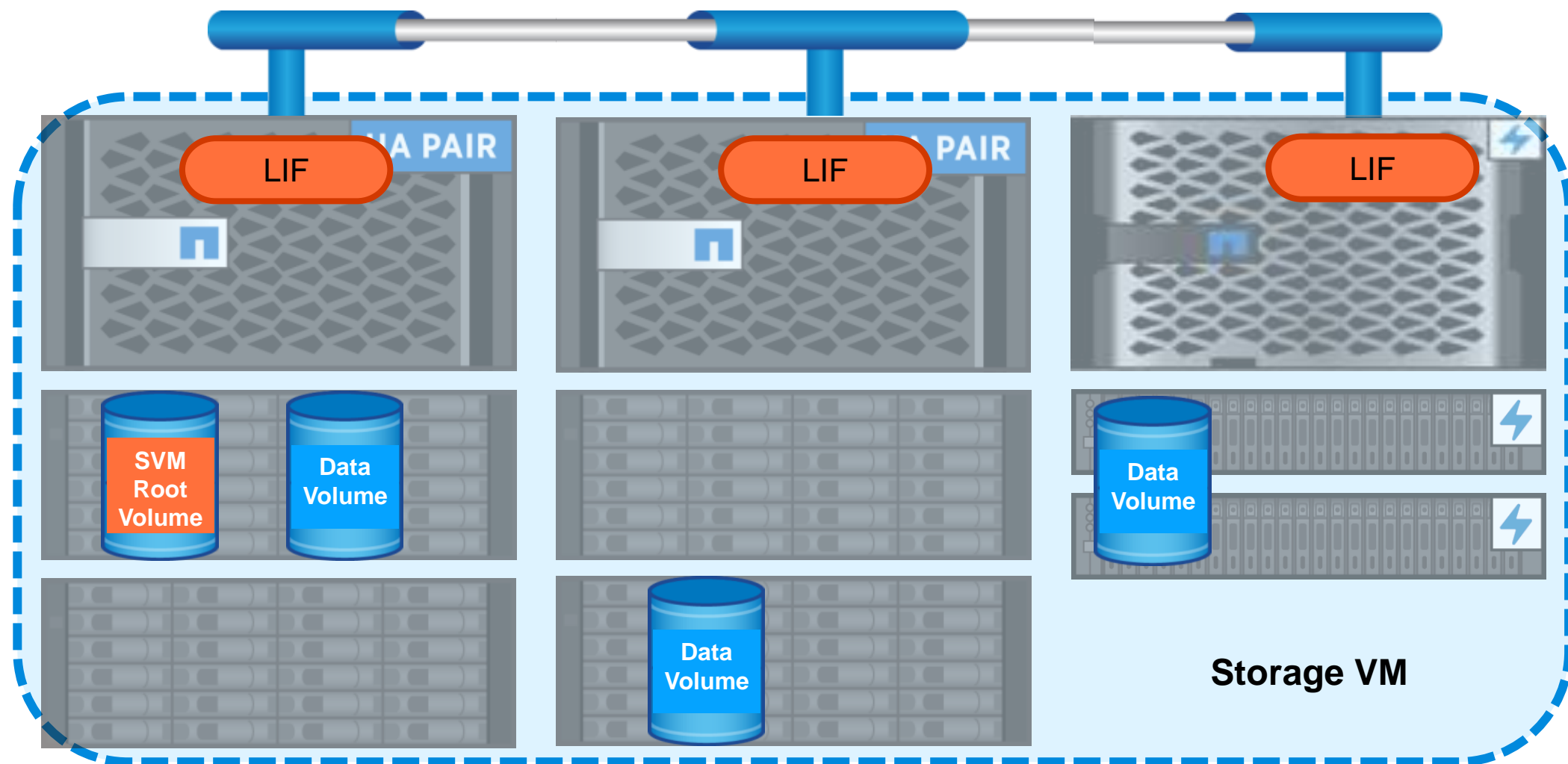
# ONTAP storage architecture



# Lesson 3

## Storage VMs

# Storage virtual machine





# Storage VM types

```
svl-nau::> vservers show
```

Vserver	Type	Subtype	Admin State	Operational State	Root Volume	Aggregate
cluster1	admin	-	-	-	-	-
cluster1-01	node	-	-	-	-	-
cluster1-02	node	-	-	-	-	-
svm_1	data	default	running	running	svm_1_root	n1_data_001
svm_2	data	default	running	running	svm_2_root	n1_data_001
svm_3	data	default	running	running	svm_3_root	n1_data_002

6 entries were displayed.

## Admin SVM:

- Is created during cluster setup
- Represents the cluster
- Exists once per cluster
- Owns cluster-scoped resources

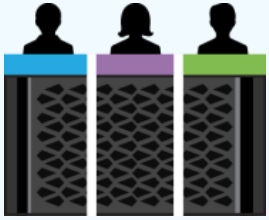
## Node SVM:

- Is created during cluster setup
- Represents an individual node
- Exists once per node in the cluster
- Owns node-scoped resources

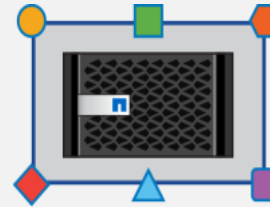
## Data SVM:

- Provides client access to user data
- Includes data volumes, LIFs, protocols, and access control
- Is for multiple use cases:
  - Secure multitenancy
  - Separation of resources and workloads
  - Delegation of management

# SVM benefits



- **Unified storage:**
  - NAS protocols: CIFS and NFS
  - SAN protocols: iSCSI, FC (including FCoE), and NVMe over Fibre Channel (NVMe/FC)
  - Object protocols: Simple Storage Service (S3)



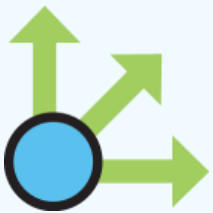
- **Secure multitenancy:**
  - Partitioning of a storage system
  - Isolation of data and management
  - No data flow among SVMs in the cluster



- **Nondisruptive operations (NDO) and nondisruptive upgrade (NDU):**
  - Resource migration
  - Resource availability during hardware and software upgrades

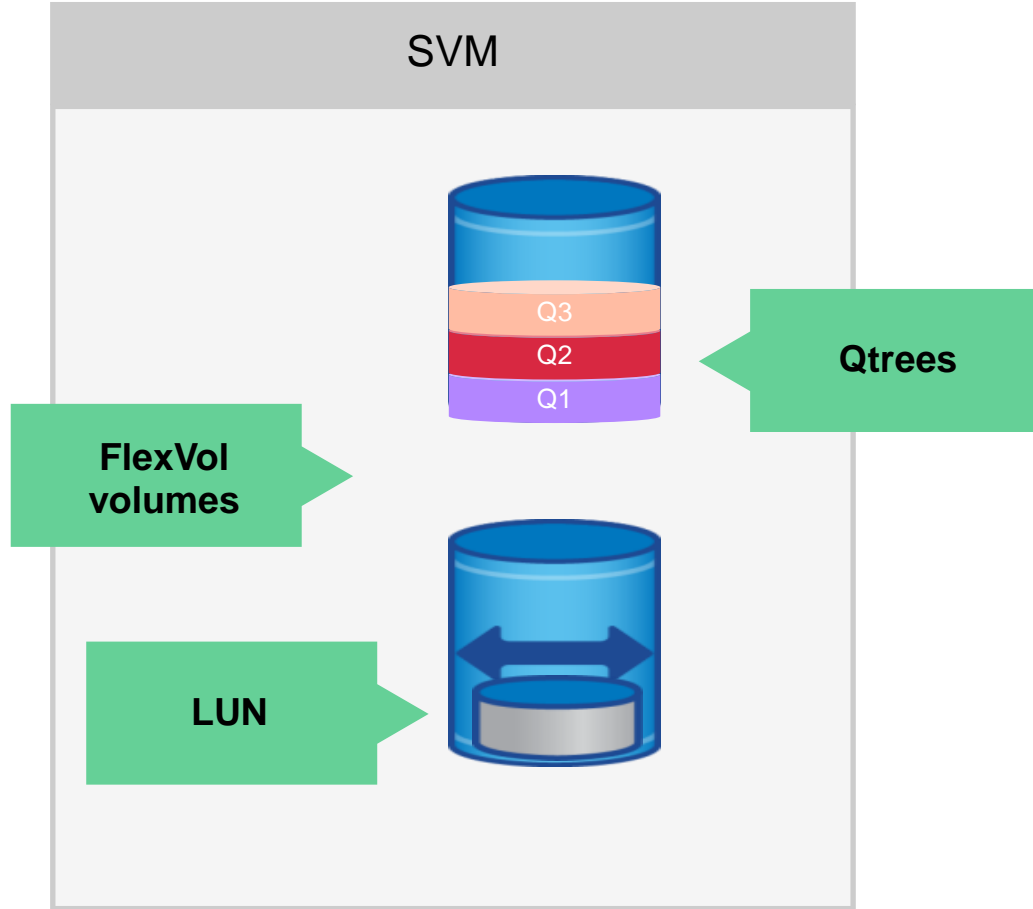


- **Delegation of management:**
  - User authentication and administrator authentication
  - Access assigned by the cluster administrator



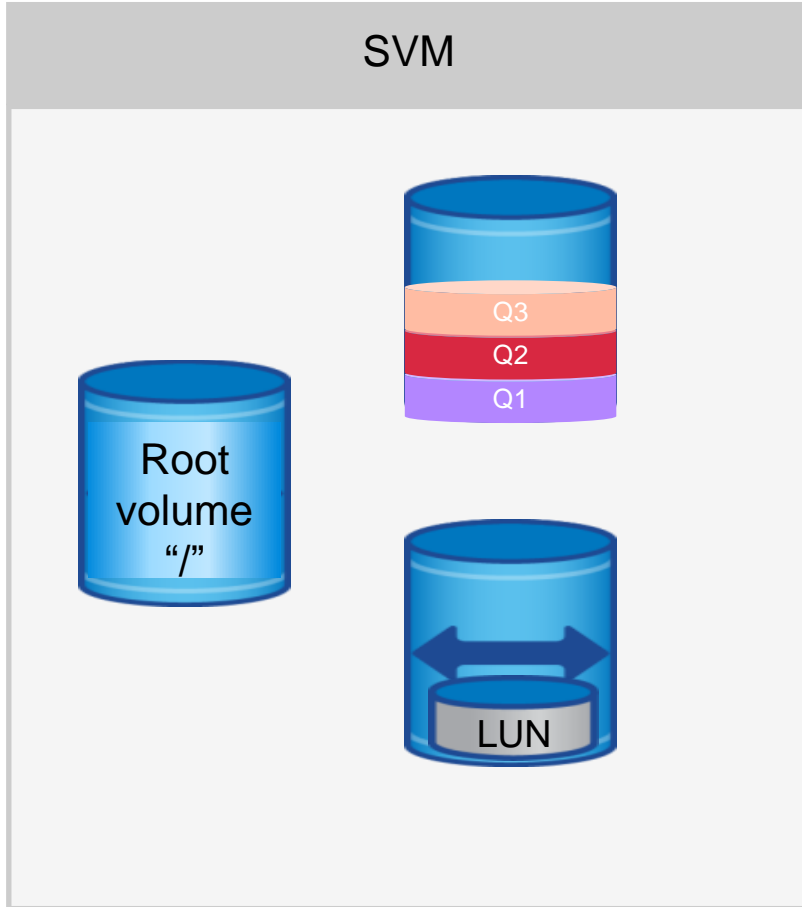
- **Scalability:**
  - Addition and removal
  - Modification on demand to meet data-throughput and storage requirements

# SVM with FlexVol volumes



- **FlexVol volume:**
  - Representation of the file system in a NAS environment
  - Container for LUNs in a SAN environment
- **Quota tree (qtree):**
  - Optional partitioning of FlexVol volumes into smaller segments
  - Separate settings for size limits, security, access, and performance
- **LUN:**
  - Logical unit that represents a SCSI disk
  - One LUN per volume (recommended best practice)

# SVM root volume

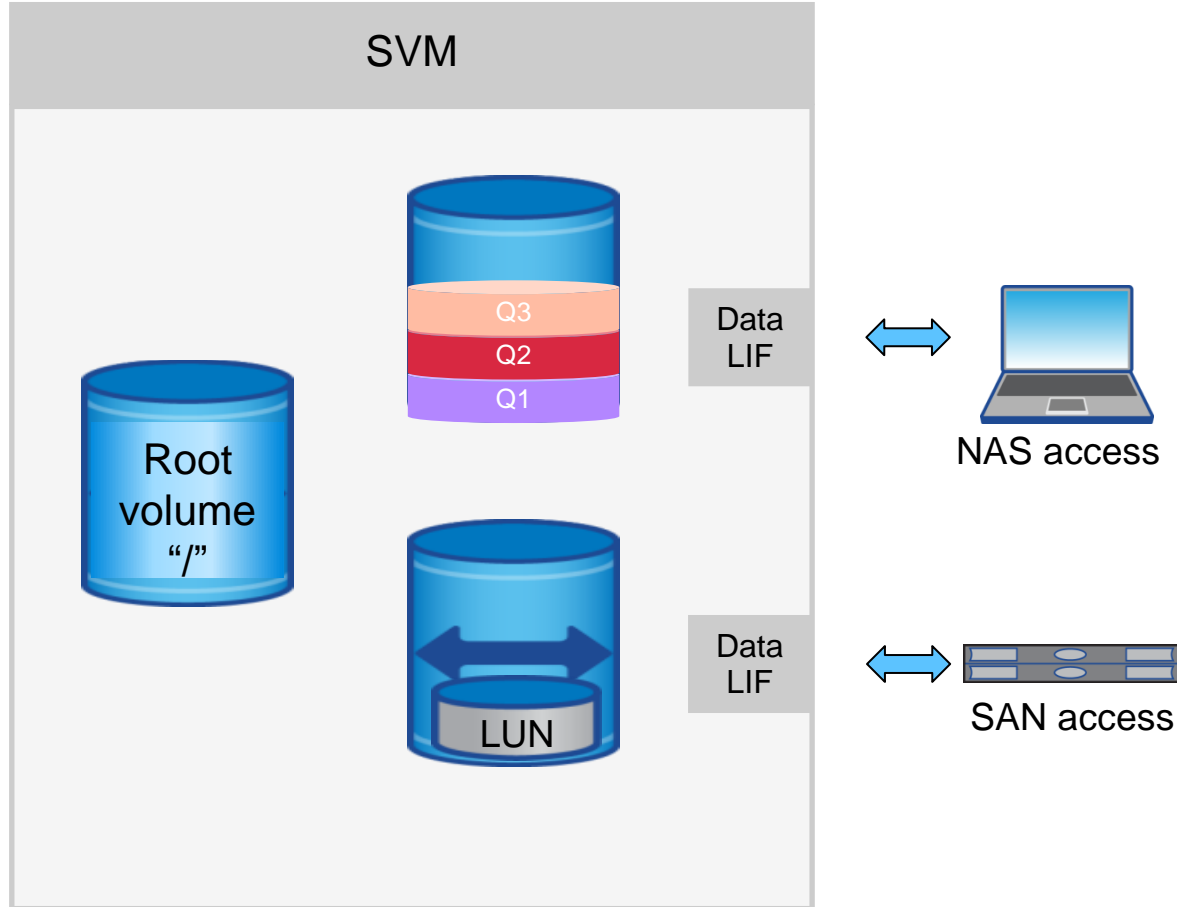


- Is created when the SVM is created
- Serves as the NAS client entry point to the namespace that an SVM provides

Therefore, it should be mirrored on another node to ensure that the namespace is always accessible.

- Should not be used to store user data

# Data LIFs



- **NAS data LIFs:**
  - Multiprotocol (NFS, CIFS, or both)
  - Manually or automatically assigned IP addresses
  - Failover or migration to any node in the cluster
- **SAN data LIFs:**
  - Single protocol (FC or iSCSI):
    - An FC LIF is assigned a worldwide port name (WWPN) when it is created.
    - iSCSI LIF IP addresses can be assigned manually or automatically.
  - No failover
  - Restrictions on migration



# Lesson 4

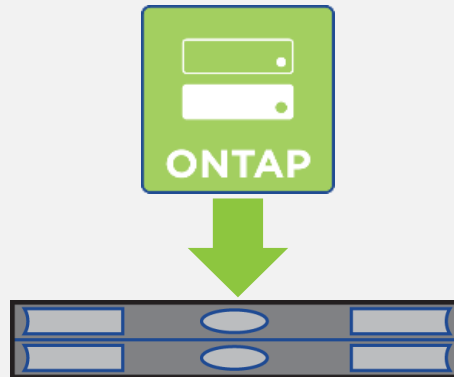
## Software-defined storage

# Software-defined storage

## NetApp ONTAP Select software

### ONTAP Select software

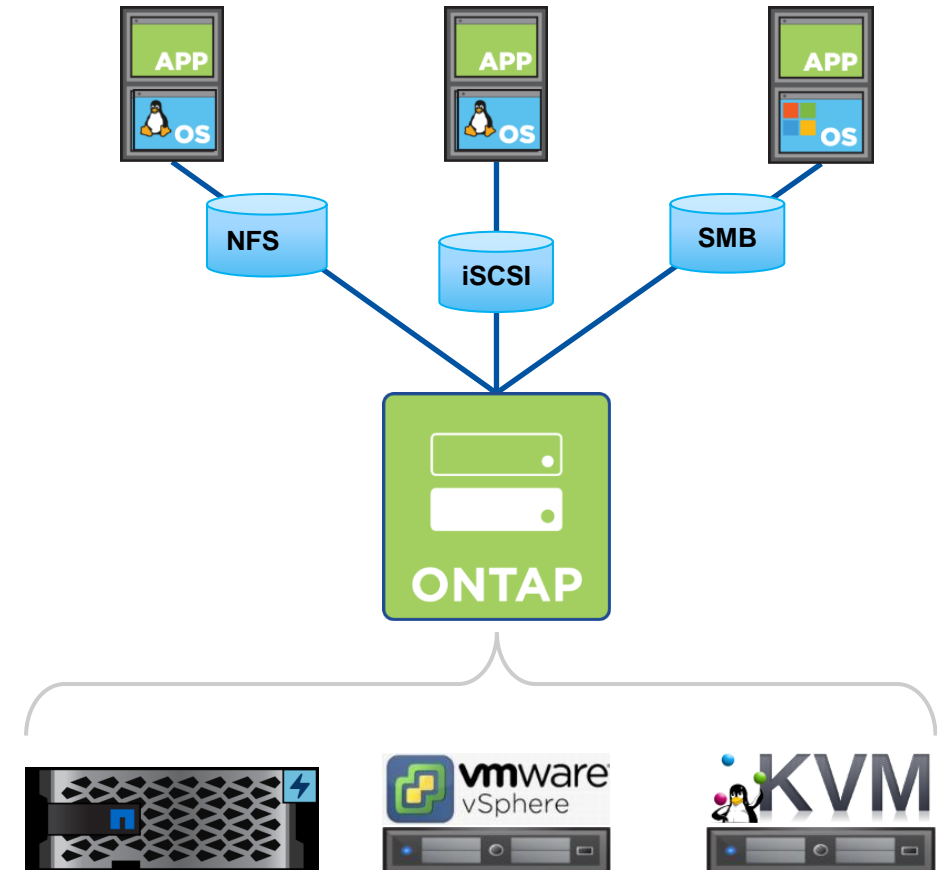
- Software-defined storage on third-party servers that is referred to as hybrid cloud infrastructure
- Suited for data center or remote office
- Flexible, capacity-based license



# ONTAP Select software

## Overview

- ONTAP Select software features the following:
  - ONTAP software that runs on commodity hardware
  - Note:** ONTAP Select clusters cannot be mixed with AFF or FAS nodes in a cluster.
  - Enterprise data management services for server direct-attached storage (DAS), external array, and VMware vSAN
- ONTAP Select software provides a cloudlike experience on premises:
  - Flexibility
  - Agility
  - Simplicity





# Software-defined storage

NetApp Cloud Volumes ONTAP software

## Cloud Volumes ONTAP

- Software-defined storage on public cloud services (like Amazon Web Services [AWS], Microsoft Azure, or Google Cloud)
- Pricing system in which you pay for only what you use, when you use it



# Resources

- ONTAP 9 Documentation Center  
<http://docs.netapp.com/ontap-9/index.jsp>
  - *ONTAP 9 Concepts*
  - *High-Availability Configuration Guide*
  - *System Administration Reference*
- Cloud Central  
<http://cloud.netapp.com>
- Videos
  - *ONTAP Select: Introduction*  
<https://www.youtube.com/watch?v=UyLGV07Q-0U>
  - *Cloud Volumes ONTAP*  
<https://www.youtube.com/watch?v=KewTNwXiaIY>

An abstract graphic in the top right corner consisting of a grid of teal-colored cubes. The cubes are arranged in a way that creates a sense of depth and perspective, with some cubes appearing to be in front of others, casting soft shadows. The overall effect is a modern, architectural design element.

# Knowledge check

## Module 1: NetApp ONTAP 9 clusters

## Knowledge check

# Which two deployment options are software-defined? (Choose two.)

- a. ONTAP software that is deployed on a FAS system
- b. ONTAP software that is deployed on an AFF system
- c. ONTAP software that is deployed on commodity hardware
- d. ONTAP software that is deployed in the cloud
- e. ONTAP software that is deployed by using a heterogeneous enterprise array

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## Knowledge check

# Which set of networks is part of a cluster?

- a. data network, management network, and cluster interconnect
- b. data network, HA interconnect, and cluster interconnect
- c. HA interconnect, cluster interconnect, and backup network
- d. data network, cluster interconnect, and backup network

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## Knowledge check

# Which pair of components is a major part of data SVMs?

- a. aggregates and network ports
- b. disks and nodes
- c. data LIFs and aggregates
- d. volumes and data LIFs



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# Module summary

This module focused on enabling you to do the following:

- Identify ONTAP deployment options
- Define ONTAP cluster components
- Describe the role of an SVM in the ONTAP storage architecture



# **Addendum ONTAP Select learning resources**

# Additional ONTAP Select learning

Learn about advanced topics like supported configurations and deploying the software on VMware ESXi or Kernel-Based Virtual Machine (KVM) hosts:

- *ONTAP Select Installation and Deployment* (web-based course)
- [ONTAP Select Documentation Resources](#)
- Technical Reports:
  - [TR-4669: HCI File Services Powered by ONTAP Select](#)
  - [TR-4517: ONTAP Select on VMware - Product Architecture and Best Practices](#)
  - [TR-4613: ONTAP Select on KVM Product Architecture and Best Practices](#)



# **Addendum NetApp Cloud Volumes learning resources**

# Cloud Volumes learning resources

- [Cloud Fundamentals](#) (online course)
- [Cloud Volumes ONTAP Fundamentals](#) (online course)
- [Cloud Volumes Documentation](#)
- Technical Reports:
  - [TR-4757-SAP Applications on Microsoft Azure Using NetApp Cloud Volumes ONTAP](#)
  - [TR-4816-Performance Characterization of NetApp Cloud Volumes ONTAP in Google Cloud Platform](#)
- Video
  - Cloud Volumes ONTAP for AWS  
<https://www.youtube.com/watch?v=sQKq9iJvD2o&t=7s>
  - Cloud Volumes ONTAP for Azure  
<https://www.youtube.com/watch?v=R2EWE3o6kxs>