

Module 2

Cluster setup

About this module

This module focuses on enabling you to do the following:

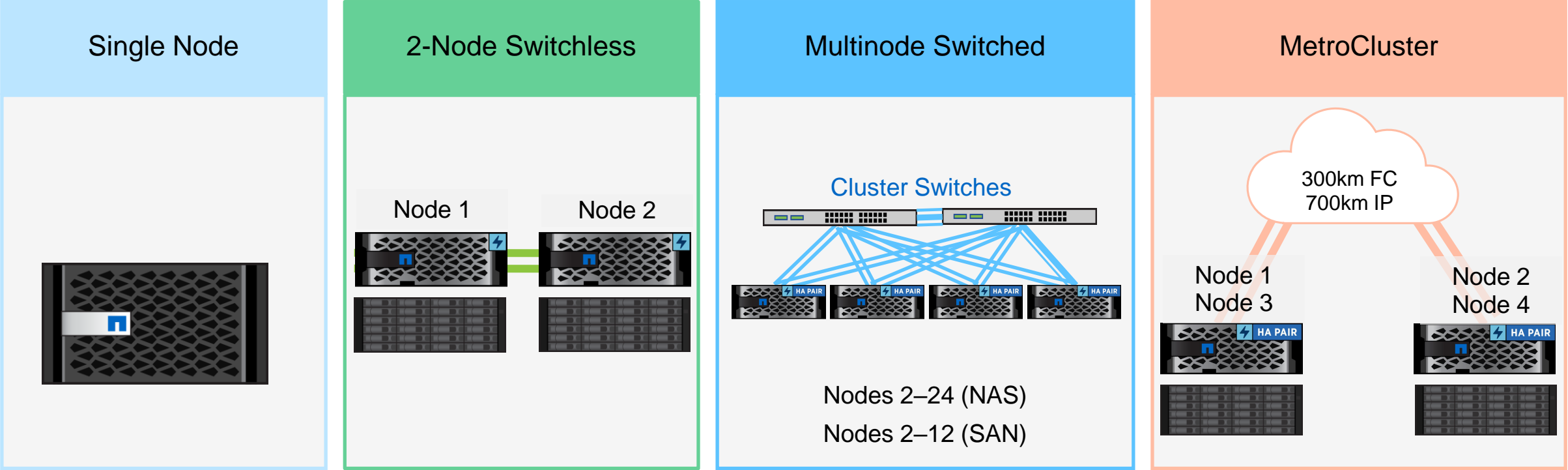
- Identify supported cluster configurations
- List the steps to set up a cluster
- Manage cluster nodes at the hardware level



Lesson 1

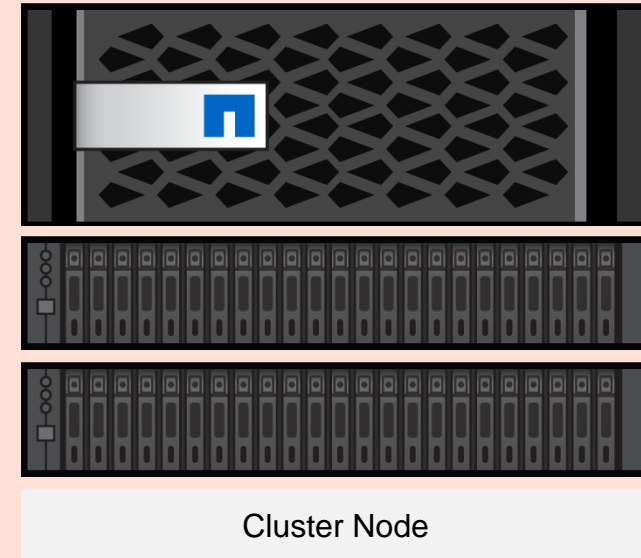
Supported FAS and AFF configurations

Supported cluster configurations



Single-node cluster

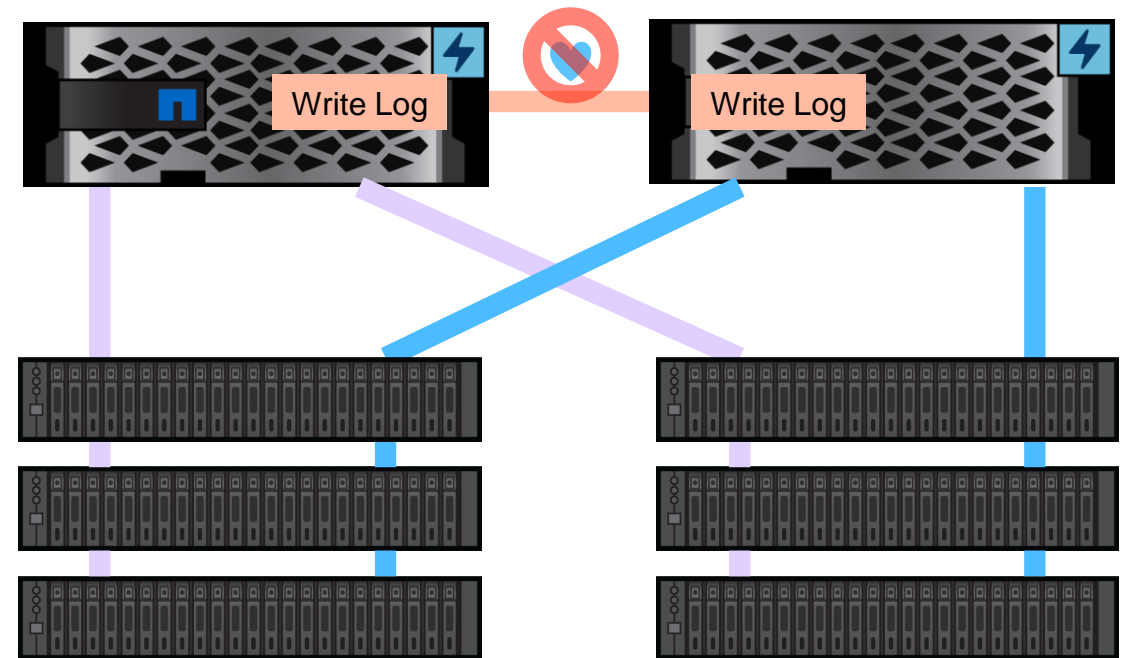
- Features of a single-node cluster:
 - Special implementation of a cluster that runs on a standalone node
 - An implementation for a workload that requires only one node and does not need nondisruptive operations (NDO)
 - Use case: Data protection for a remote office or test and development
- Features and operations that a single-node cluster does not support:
 - Storage failover (SFO) and high availability
 - Operations that affect multiple nodes



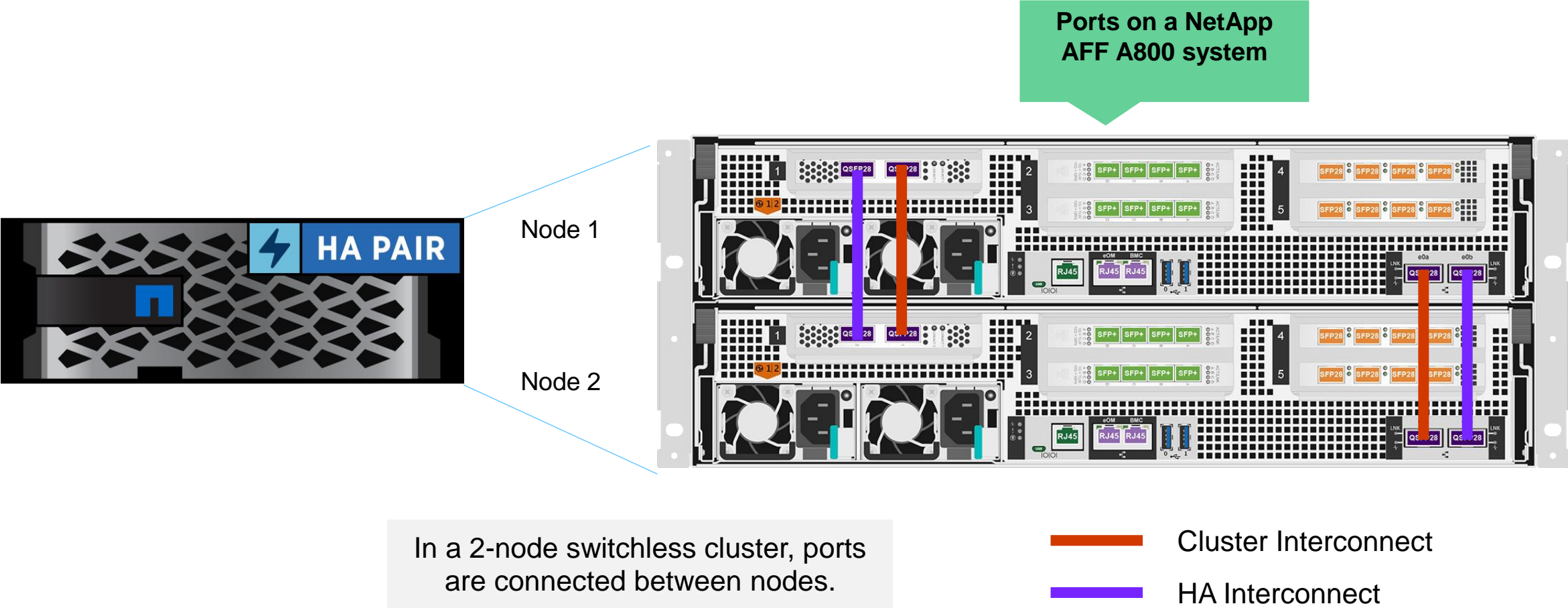
HA pairs

High-availability (HA) pairs provide hardware redundancy that supports the following features:

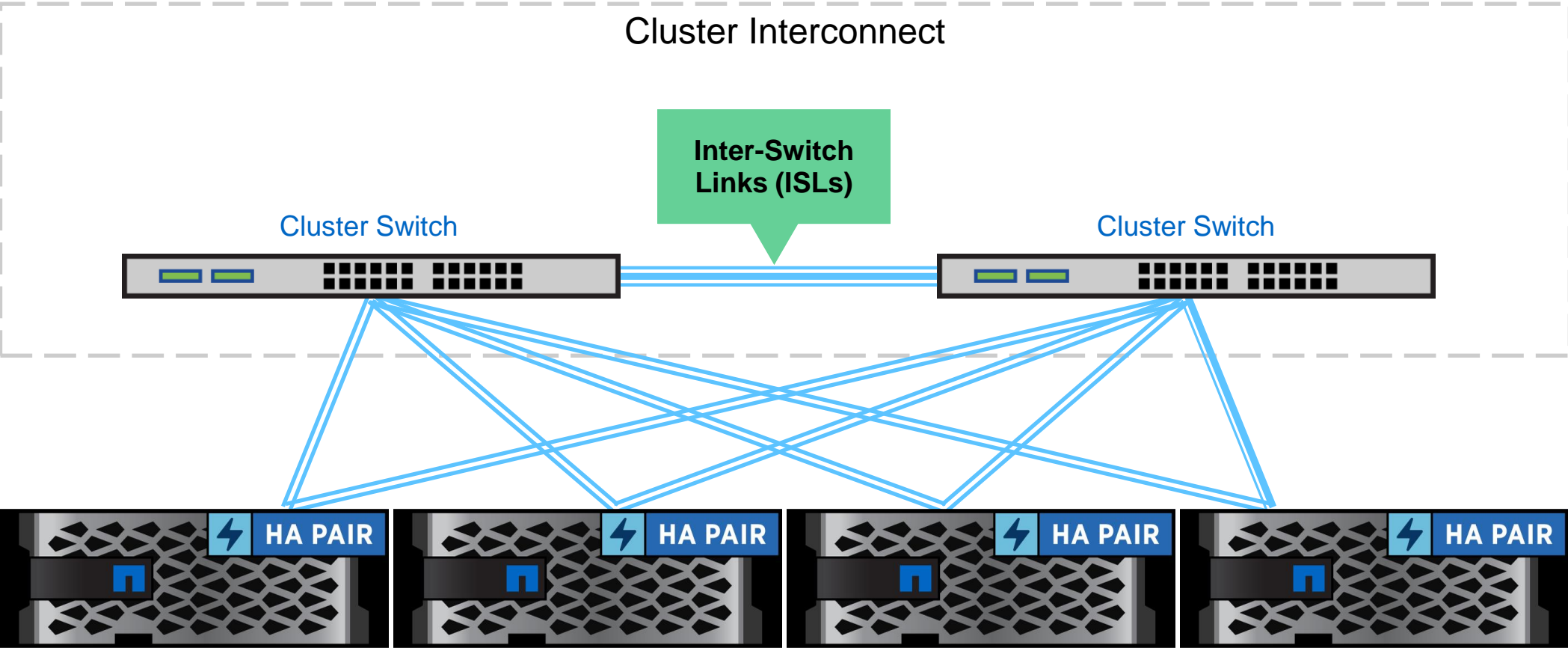
- NDO and nondisruptive upgrade (NDU)
- Fault tolerance
- Takeover and giveback of partner storage
- Elimination of most hardware components and cables as single points of failure
- Improved data availability



2-node switchless cluster



Multinode Switched Clusters



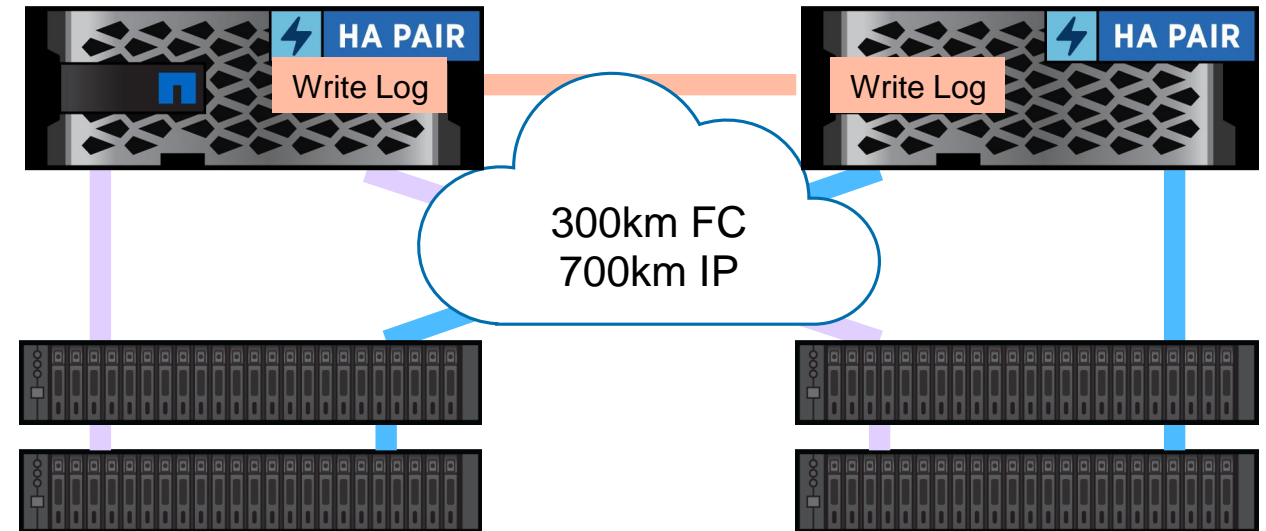
More networking details are discussed in the Network Management module.

MetroCluster software

Benefits of MetroCluster software:

- Geographic separation for business continuity
- Continuous availability and zero data loss
- Set-it-once simplicity
- Zero change management
- Unified solution (support for SAN and NAS)

Learn more about MetroCluster software in
ONTAP Data Protection Administration
– and –
ONTAP MetroCluster Installation
– or –
ONTAP MetroCluster IP Implementation.





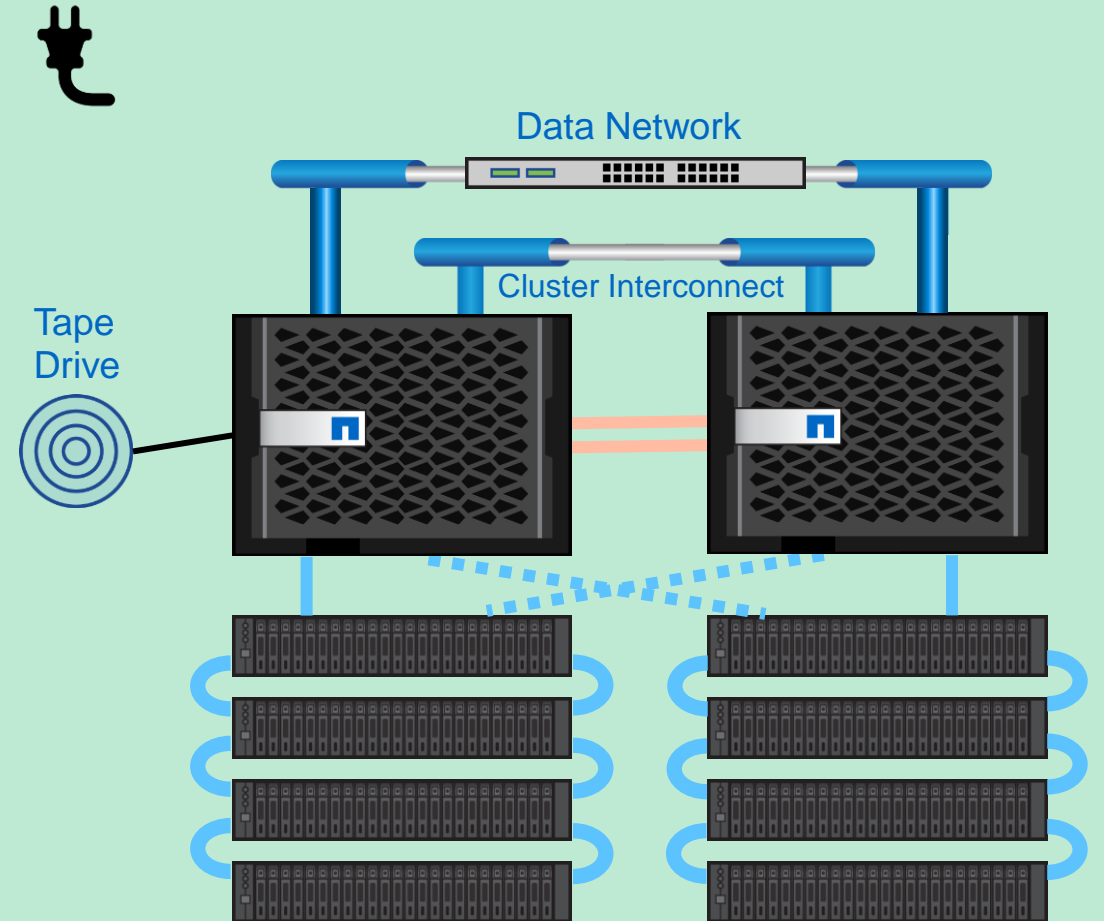
Lesson 2

Setting up a cluster

Basic hardware setup tasks

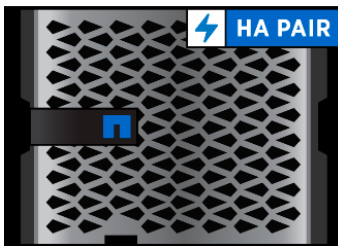
Connect the following hardware:

- HA interconnect
- Drive shelf to drive shelf cabling
- Controllers to drive shelves
- Controllers to cluster interconnect
- Controllers to networks
- Any tape devices
- Controllers and drive shelves to redundant power



HA interconnect links

- Are used primarily to mirror the write log
- Provide a channel for certain types of communication traffic between the nodes in an HA pair:
 - Failover
 - Drive firmware updates
 - Heartbeat
 - Version information



Dual-node chassis

Uses an internal or node-to-node HA interconnect



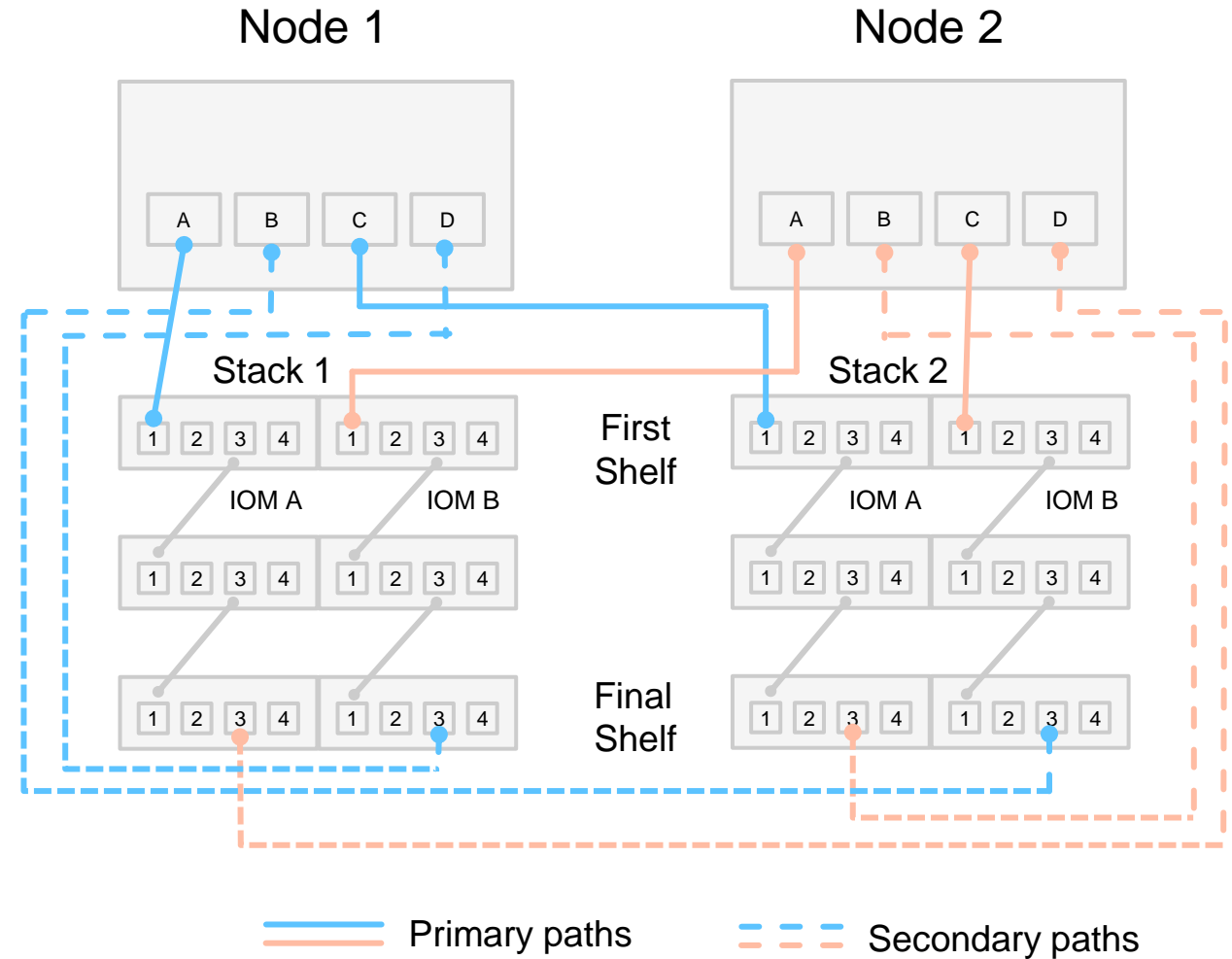
Single-node chassis

Requires external HA interconnect cables

Drive shelf cabling

MPHA configuration

- Multipath high-availability (MPHA) cabling ensures that the storage controllers have redundant paths to all drives in the HA pair.
- MPHA cabling is recommended for HA pair configurations.
- Cabling is mirrored on both nodes to ensure that drive IDs are consistent within the HA pair.



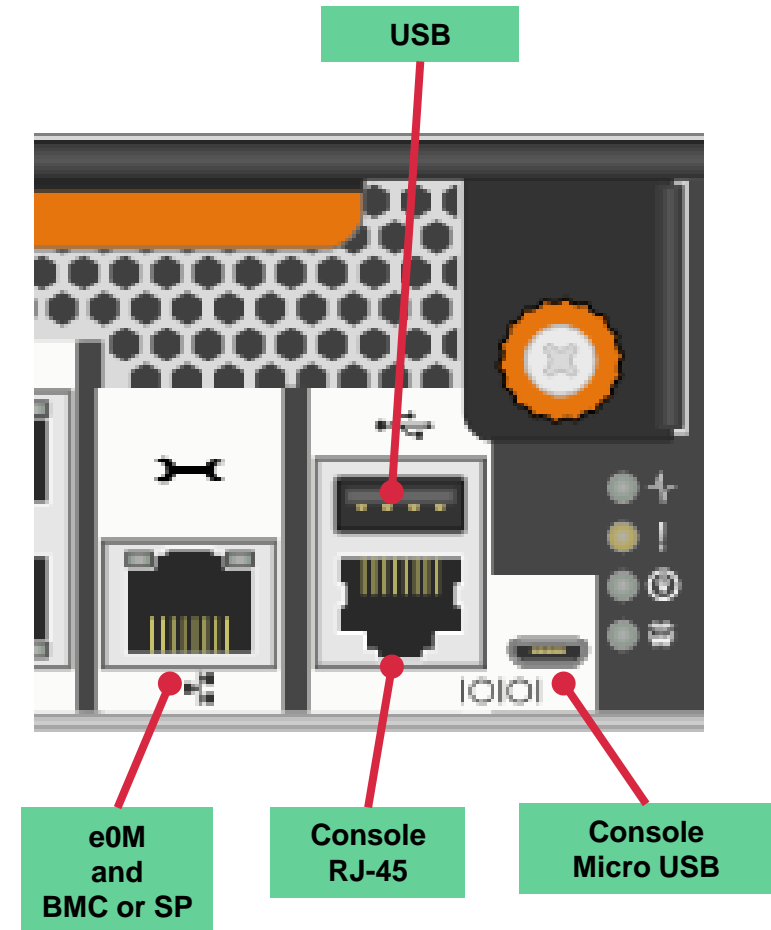
Powering on a system

1. Power on network switches.
2. Power on drive shelves.
3. Power on tape devices (if present).
4. Power on storage controllers.



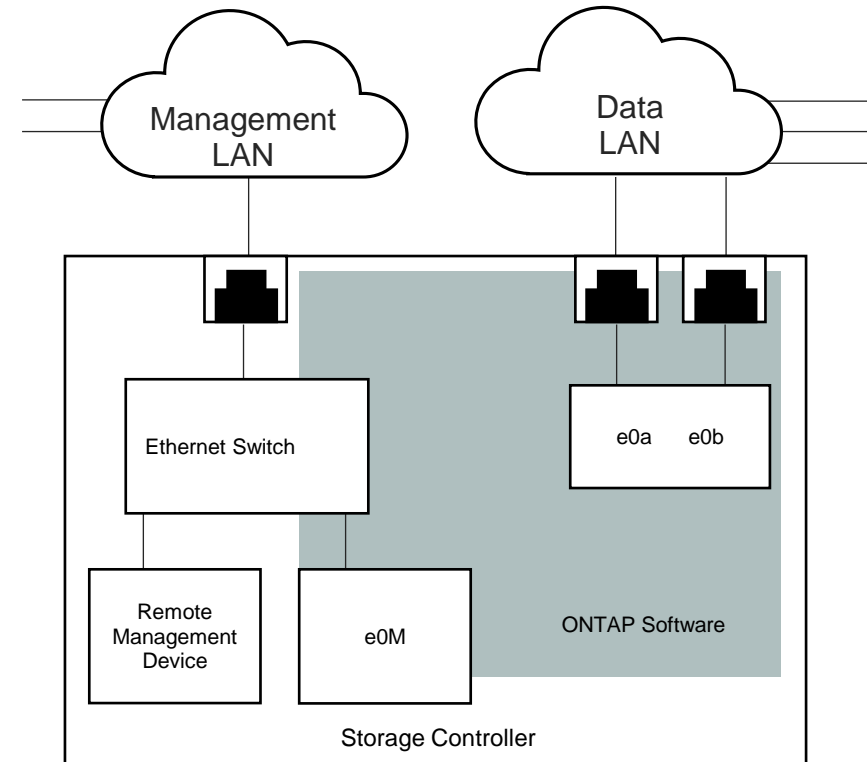
Management connections

- Console connections:
 - RJ-45 that uses RS232C ANSI-115.2K-8-None-1
 - Micro USB that uses RS232C ANSI-115.2K-8-None-1
- Remote management device connection: Baseboard Management Controller (BMC) or Service Processor (SP)
- Management network connections (e0M)



Management interfaces

- e0M interface:
 - Is dedicated for management traffic
 - Is used for ONTAP system administration tasks
- BMC or SP interface:
 - Is used to manage and provide remote management capabilities for the storage system
 - Provides remote access to the console and provides monitoring, troubleshooting, logging, and alerting features
 - Remains operational
 - Uses the following setup command:
system service-processor



Console on boot

```
SP node2> system console
```

```
Type Ctrl-D to exit.
```

```
LOADER> boot_ontap
```

```
. . .
```

```
*****
```

```
*                                           *
```

```
* Press Ctrl-C for Boot Menu. *
```

```
*                                           *
```

```
*****
```

```
. . .
```

Boot menu

^C

Boot Menu will be available.

Please choose one of the following:

- (1) Normal Boot.
- (2) Boot without /etc/rc.
- (3) Change password.
- (4) Clean configuration and initialize all disks.
- (5) Maintenance mode boot.
- (6) Update flash from backup config.
- (7) Install new software first.
- (8) Reboot node.
- (9) Configure Advanced Drive Partitioning
- (10) Set Onboard Key Manager recovery secrets.
- (11) Config node for external key management.

Selection (1-9)? **1**



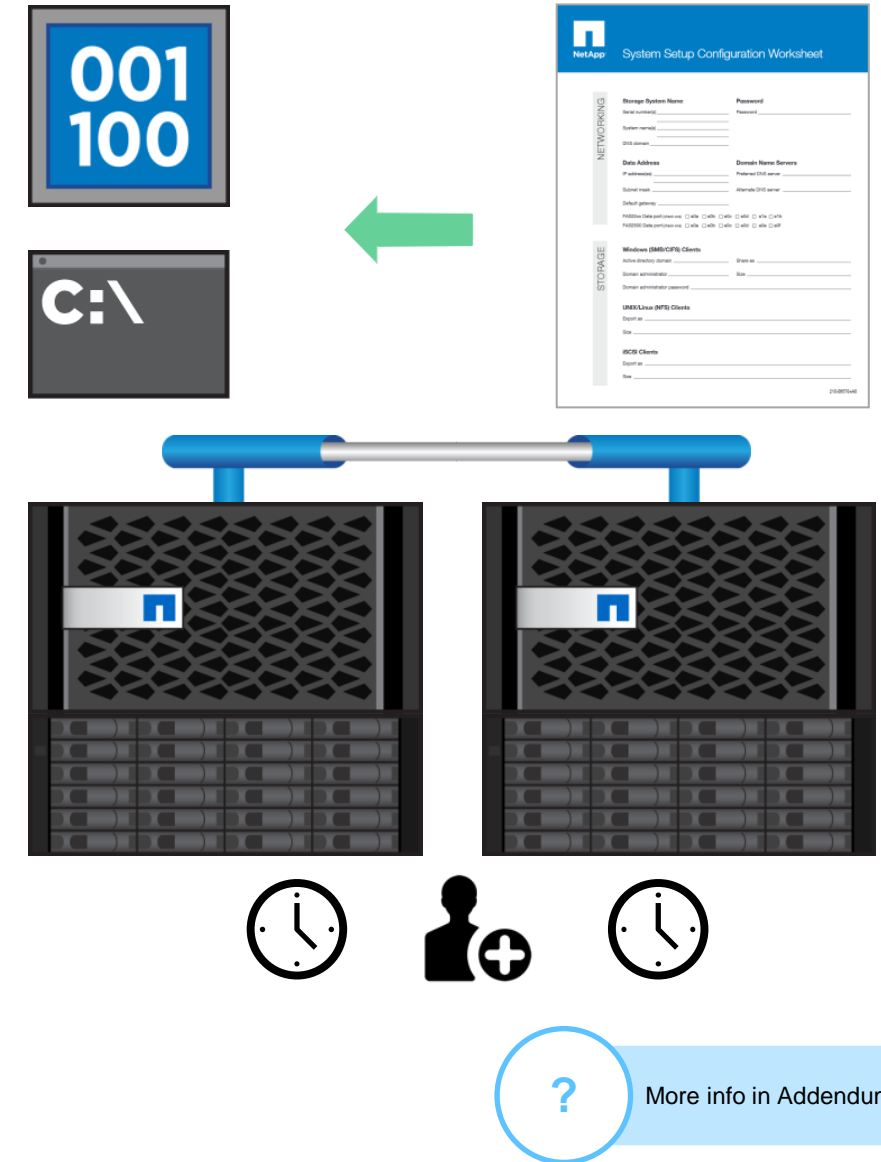
Topic for discussion

Why might you need to access the boot menu?

Creating a cluster

Cluster creation methods:

- Guided Cluster Setup with NetApp ONTAP System Manager:
 - Windows discovers new cluster nodes on the network.
 - Double-click a discovered node to launch ONTAP System Manager.
 - Follow the Guided Cluster Setup to configure all the discovered nodes simultaneously.
- CLI cluster setup wizard:
 - Use a wizard to create the cluster and join all nodes.
 - Configure the cluster time and NetApp Active IQ functionality.



Additional Training



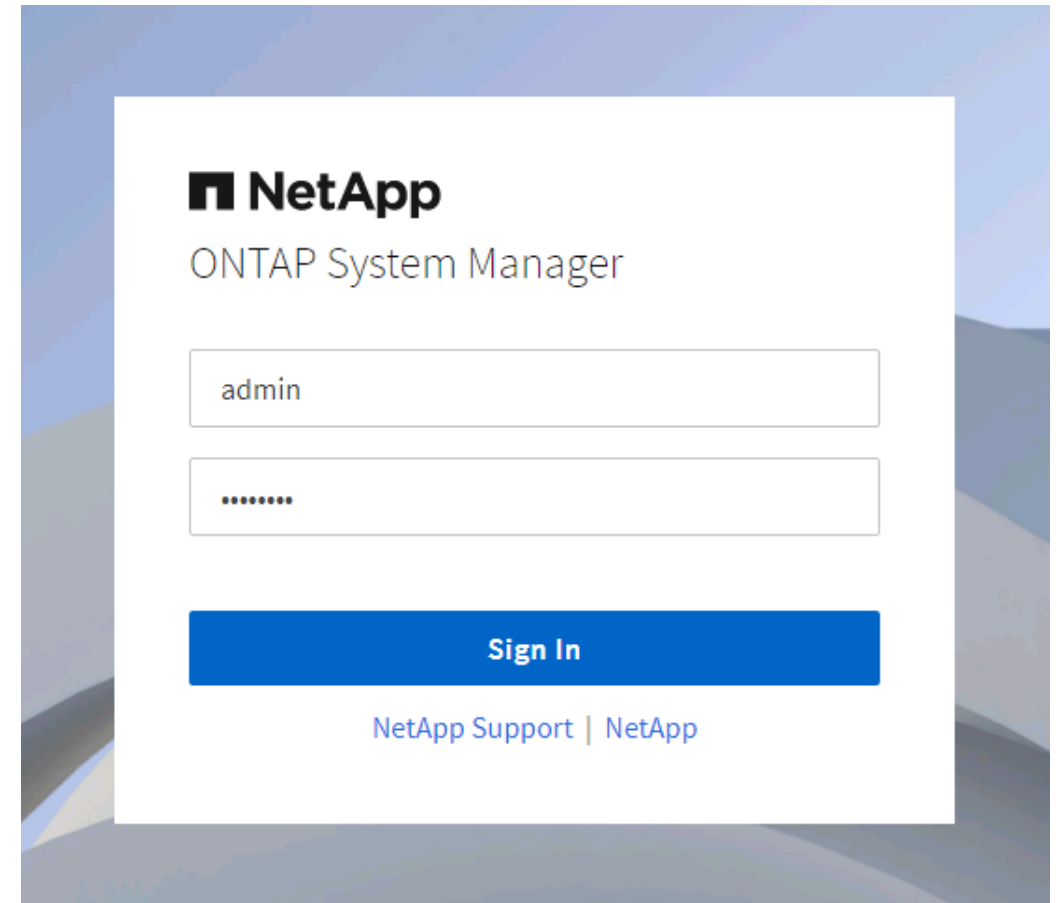
- [Installing Clustered Data ONTAP](#)
(web-based course)
- [Universal NetApp FAS Installation](#)
(web-based course)

Lesson 3

Administration interfaces

Cluster administrators

- Manage the entire cluster:
 - All cluster resources
 - Storage VM (storage virtual machine, also known as SVM) creation and management
 - Access control and roles
 - Resource delegation
- Use login credentials:
 - User name (default): admin
 - Password: password that you created during cluster setup

The image shows the login interface for NetApp ONTAP System Manager. It features a white login card centered on a blue and grey abstract background. The card contains the NetApp logo and the text 'ONTAP System Manager'. Below this are two input fields: the first contains the text 'admin', and the second contains a series of dots representing a password. A blue 'Sign In' button is positioned below the password field. At the bottom of the card, there are links for 'NetApp Support' and 'NetApp' separated by a vertical bar.

NetApp
ONTAP System Manager

admin

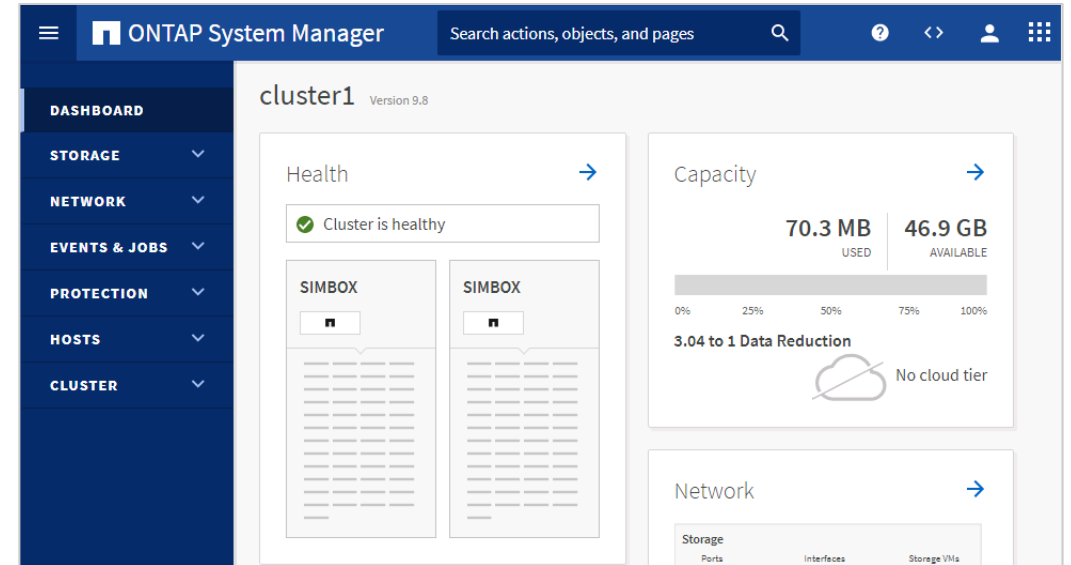
.....

Sign In

[NetApp Support](#) | [NetApp](#)

Managing resources in a cluster

- **ONTAP System Manager:**
 - Visual representation of the available resources
 - Wizard-based resource creation
 - Best practice configurations
 - Limited advanced operations
- **The CLI:**
 - Manual or scripted commands
 - Manual resource creation that might require many steps
 - Ability to focus and switch quickly among specific objects
- **Automation Tools:**
 - OnCommand Workflow Automation (OnCommand WFA)
 - Ansible
 - ONTAP RESTful API



```
login as: admin
```

```
Using keyboard-interactive authentication.
```

```
Password: *****
```

```
cluster1::> cluster show
```

Node	Health	Eligibility
cluster1-01	true	true
cluster1-02	true	true

Clustershell

The default CLI, or shell, in ONTAP software is called the clustershell and has the following features:

- Inline help
- Online manual pages
- Command history
- Ability to reissue a command
- Keyboard shortcuts
- Queries and UNIX-style patterns
- Wildcards

```
login as: admin
```

```
Using keyboard-interactive authentication.
```

```
Password: *****
```

```
cluster1::> cluster show
```

Node	Health	Eligibility
-----	-----	-----
cluster1-01	true	true
cluster1-02	true	true

```
cluster1::>
```

Clustershell

Command scope

```
cluster1::> storage aggregate
```

```
cluster1::storage aggregate> modify
```

Clustershell

Scope return

```
cluster1::storage disk option> ..  
cluster1::storage disk> top  
cluster1::>
```

Clustershell

Use of the question mark wildcard

```
cluster1::> storage aggregate
cluster1::storage aggregate> modify ?
[-aggregate] <aggregate name>           Aggregate
[ -disktype|-T {ATA | BSAS | FCAL | FSAS | LUN | MSATA | SAS | SATA | SSD | VMDISK} ] Disk Type
[ -free-space-realloc {on|off|no_redirect} ] Free Space Reallocation
[ -ha-policy {sfo|cfo} ]                  HA Policy
[ -percent-snapshot-space <percent> ]     Space Reserved for Snapshot Copies
[ -space-nearly-full-threshold-percent <percent> ] Aggregate Nearly Full Threshold Percent
[ -space-full-threshold-percent <percent> ] Aggregate Full Threshold Percent
[ -hybrid-enabled {true|false} ]          Hybrid Enabled
[ -force-hybrid-enabled|-f [true] ]       Force Marking of Aggregate as Hybrid Enabled
[ -maxraidsize|-s <integer> ]             Max RAID Size
...
cluster1::storage aggregate> modify
```

Clustershell

Tab completion

Tab

```
cluster1::storage aggregate> modify
```

```
    aggr0_n1 aggr0_n2 n1_data_001 n1_data_002  
    n1_data_003 n2_data_001
```

Tab

```
cluster1::storage aggregate> modify -aggregate n2_data_001 -state online
```

```
Aggregate online successful on aggregate: n2_data_001
```

```
cluster1::storage aggregate>
```

Clustershell

Privilege levels

```
cluster1::> set -privilege advanced  
Warning: These advanced commands are potentially dangerous;  
use them only when directed to do so by NetApp personnel.  
Do you want to continue? {y|n}: y
```

```
cluster1::*>  
cluster1::*>  
cluster1::*>  
cluster1::*> set admin  
cluster1::>
```

*** In prompt indicates
advanced privilege**

Clustershell

Additional features

The search path enables you to run commands out of scope:

```
cluster1::system node> disk show = storage disk show
```

Abbreviation is permitted (shortest unambiguous sequences of characters):

```
cluster1::> aggr show = storage aggregate show  
cluster1::> net int show = network interface show
```

You can run queries with patterns and wildcards:

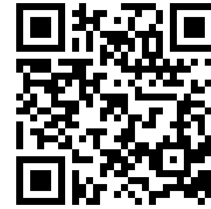
```
cluster1::> storage disk show -physical-size >500gb
```

Use the up-arrow key to review command history.

References

- NetApp Hardware Universe:

<http://hwu.netapp.com>



- ONTAP 9 Documentation Center:

<http://docs.netapp.com/ontap-9/index.jsp>

- *Software Setup Guide*
- *High-Availability Configuration Guide*
- *System Administration Reference*

- ONTAP System Manager Documentation Center:

<https://docs.netapp.com/us-en/ontap/index.htm>



Module summary

This module focused on enabling you to do the following:

- Identify supported cluster configurations
- List the steps to set up a cluster
- Manage cluster nodes at the hardware level

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 2: Cluster setup

Knowledge check

Client data that is passed between cluster nodes travels over which links?

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

Knowledge check

Client data that is passed between cluster nodes travels over which links?

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



Complete an exercise

Module 2: Cluster setup

Exploring ONTAP management UIs

- Access your lab equipment.
- Open your Exercise Guide, Module 2.
- Complete exercise 2-1.
- Share your results.

This exercise requires approximately
15 minutes.




Share your experiences

Roundtable discussion

ONTAP System Manager versus clustershell:

- Which method do you prefer to use for configuring volumes?
- Which method do you prefer to use for configuring LUNs?

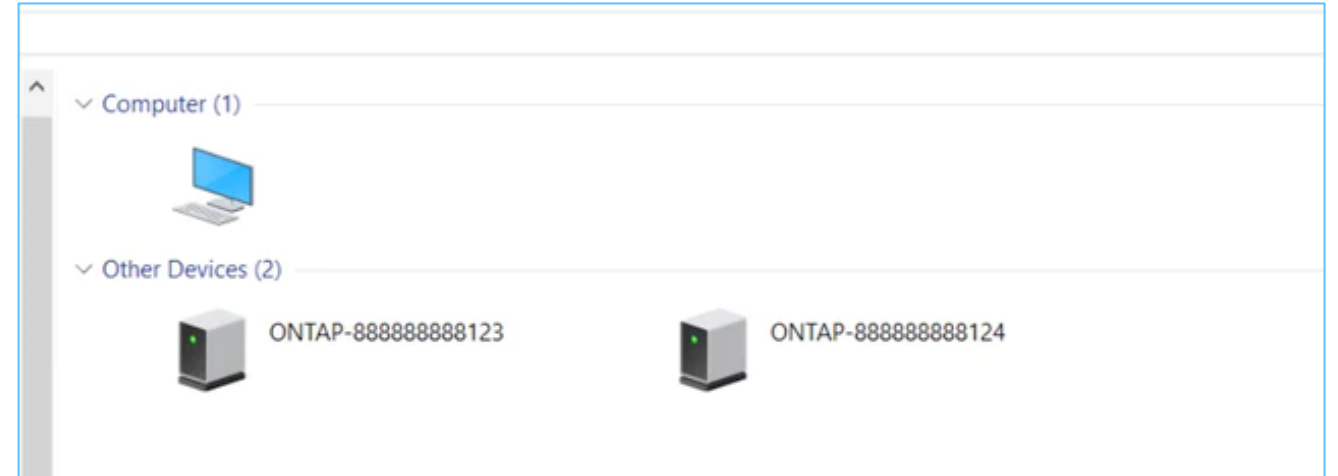


Addendum ONTAP System Manager: Cluster setup

Cluster setup

Connect to ONTAP System Manager

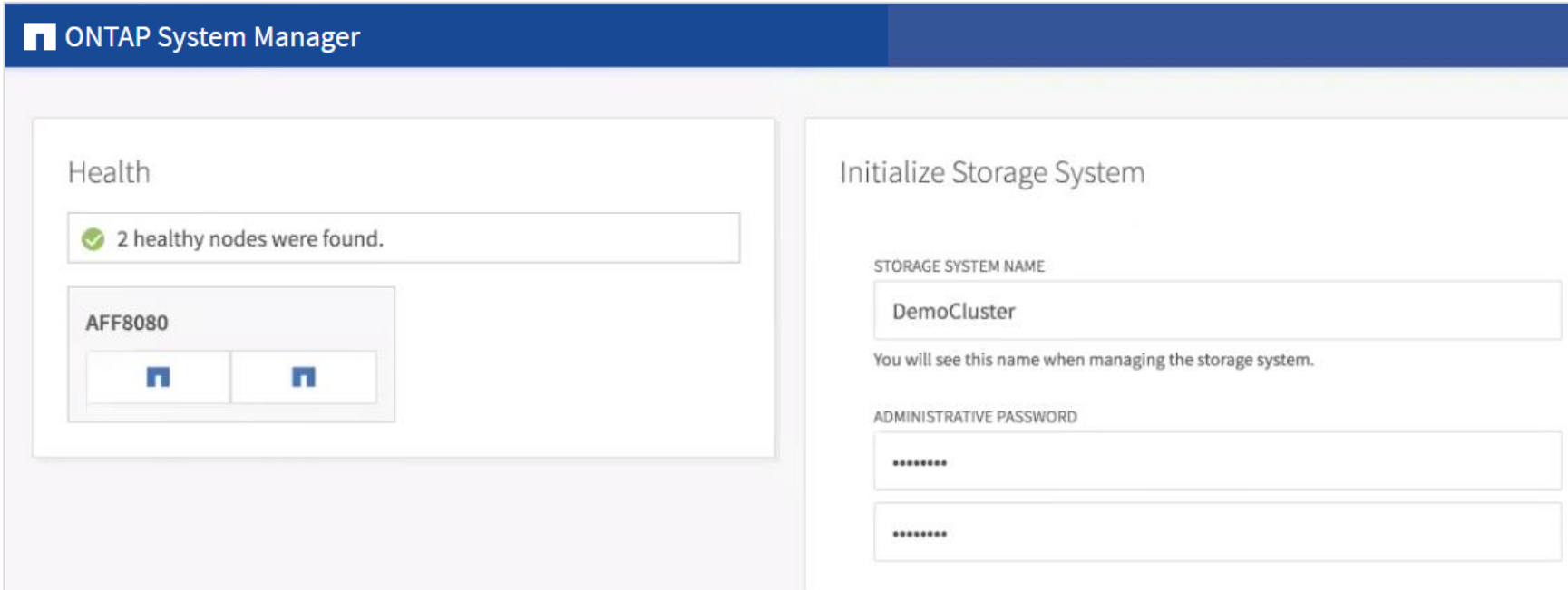
1. Power on the cluster nodes.
2. Connect a Windows host to the same network as the cluster nodes.
3. From the Windows Network page, double-click a cluster node to connect to ONTAP System Manager.



Guided Cluster Setup

System Manager system initialization

- Information about nodes is discovered and displayed.
- Depending on the network configuration, a single-node cluster, a 2-node switchless cluster, or a switched cluster is created.
- Set the cluster name and assign an administrator password.



The screenshot displays the ONTAP System Manager web interface. The top navigation bar is dark blue with the ONTAP logo and the text "ONTAP System Manager". The main content area is divided into two panels. The left panel, titled "Health", shows a green checkmark icon and the text "2 healthy nodes were found." Below this, a box labeled "AFF8080" contains two node icons, each with a blue square and a white 'N'. The right panel, titled "Initialize Storage System", contains two input fields. The first is labeled "STORAGE SYSTEM NAME" and has the text "DemoCluster" entered. Below it is a note: "You will see this name when managing the storage system." The second input field is labeled "ADMINISTRATIVE PASSWORD" and contains two rows of masked characters (asterisks).

Cluster setup

Networking section

Networking

CLUSTER IP ADDRESS

10.232.228.132

SUBNET MASK

255.255.255.128

GATEWAY

10.232.228.129

NODE SERIAL NUMBERS

721639000122

721639000121

NODE IP ADDRESSES

10.232.228.134

10.232.228.131

☒ Use Domain Name Service (DNS)

DNS DOMAINS

ctl.gdl.englab.netapp.com

+ Add

NAME SERVERS

10.224.223.130

+ Add

☒ Use time services (NTP)

NTP SERVERS

10.235.48.111

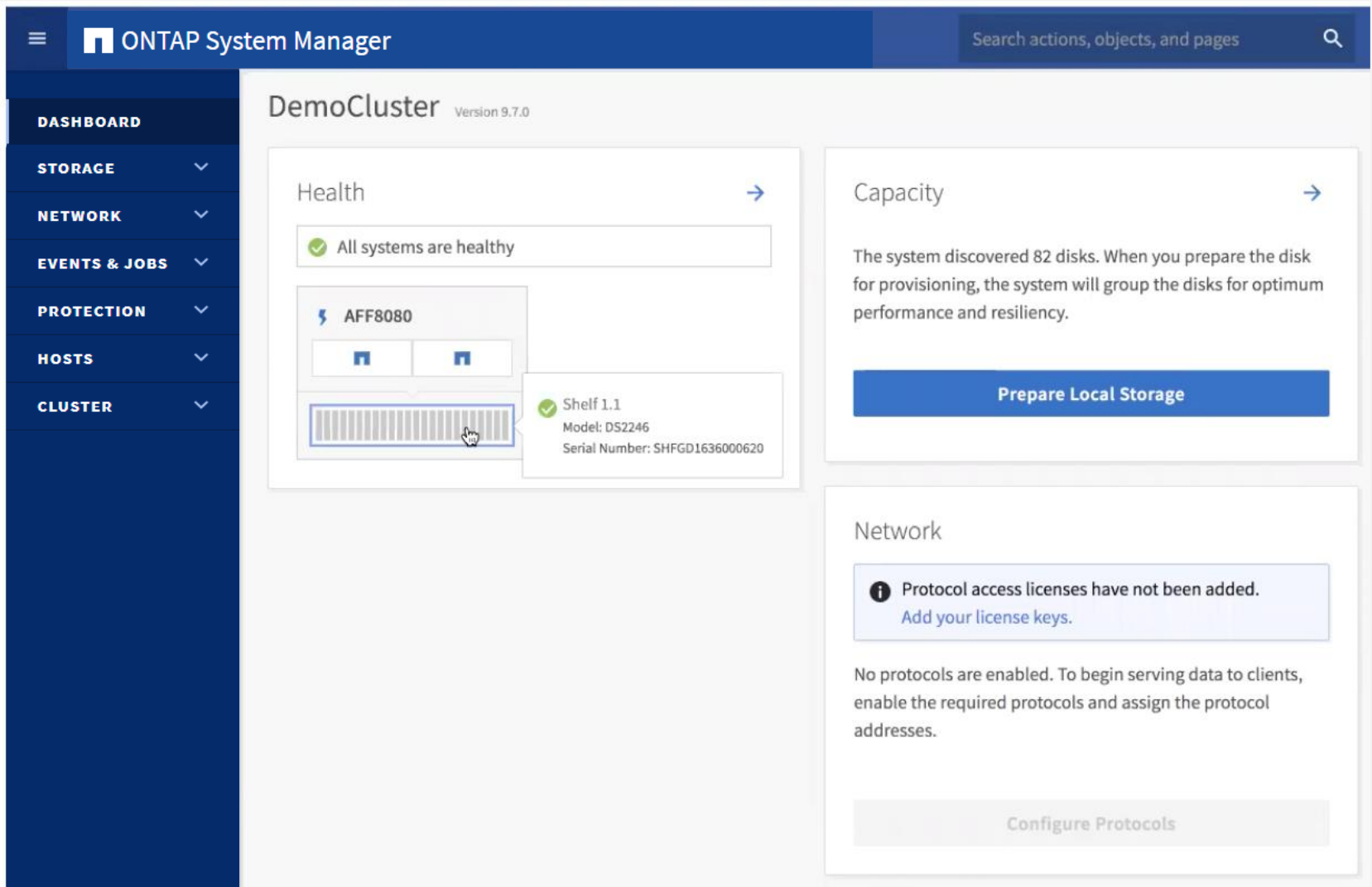
+ Add

- In the Networking section, you configure the cluster management and node management network interfaces.
- In the Networking section, you also configure DNS and Network Time Protocol (NTP).
- When you click Submit, the cluster initialization process starts.

Cluster setup

Prepare storage

Click **Prepare Local Storage** to configure the storage aggregates (local tiers) according to NetApp best practices.



Cluster setup

Configure an SVM for data access

Click **Configure Protocols** to create a storage VM and configure the data access protocols.

Health

✔ All systems are healthy

AFF8080

Capacity

0 Bytes

11.3 TB

USEDAVAILABLE

0%20%40%60%80%100%

1 to 1 Data Reduction

Network

No protocols are enabled. To begin serving data to clients, enable the required protocols and assign the protocol addresses.

Configure Protocols

Configure Protocols

ONTAP exposes protocol services through storage VMs. [More details](#)

STORAGE VM NAME

SANSVM

Network Protocols

iSCSI

✔ FC

✔ Enable FC

CONFIGURE FC PORTS ?

Nodes	0e	0f	0g	0h
DemoCluster-01	✔	✔		
DemoCluster-02	✔	✔		

Save

Cancel

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