Module 2
Cluster setup

About this module

This module focuses on enabling you to do the following:

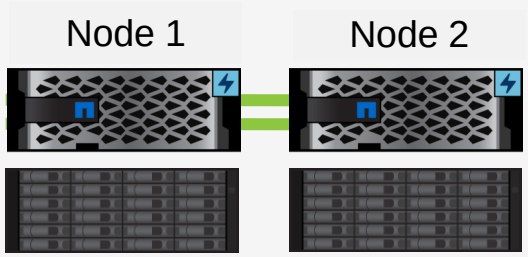
- Identify supported cluster configurations
- List the steps to set up a cluster
- Manage cluster nodes at the hardware level

Lesson 1
Supported FAS and AFF configurations

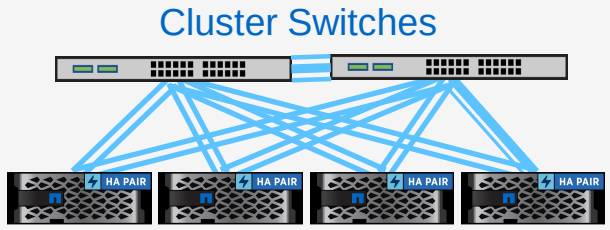
Supported cluster configurations

Single Node

2-Node Switchless



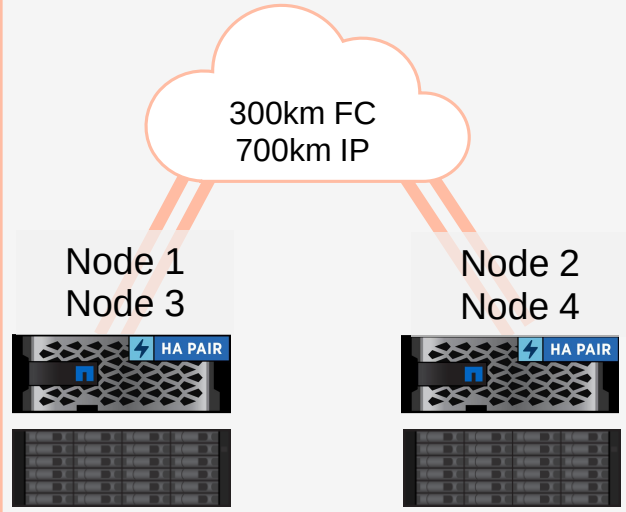
Multinode Switched



Nodes 2–24 (NAS)

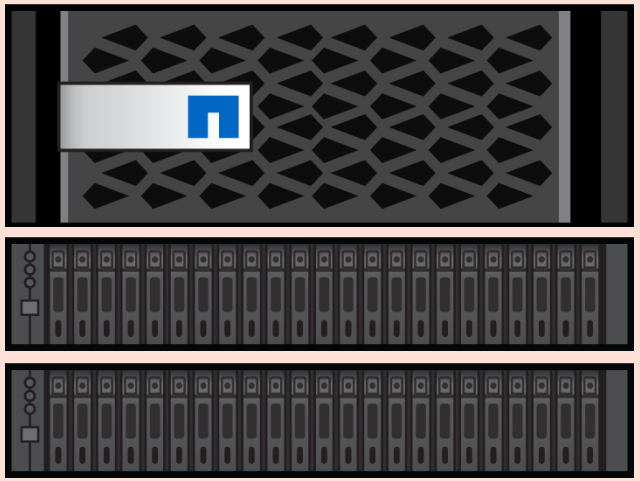
Nodes 2–12 (SAN)

MetroCluster



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

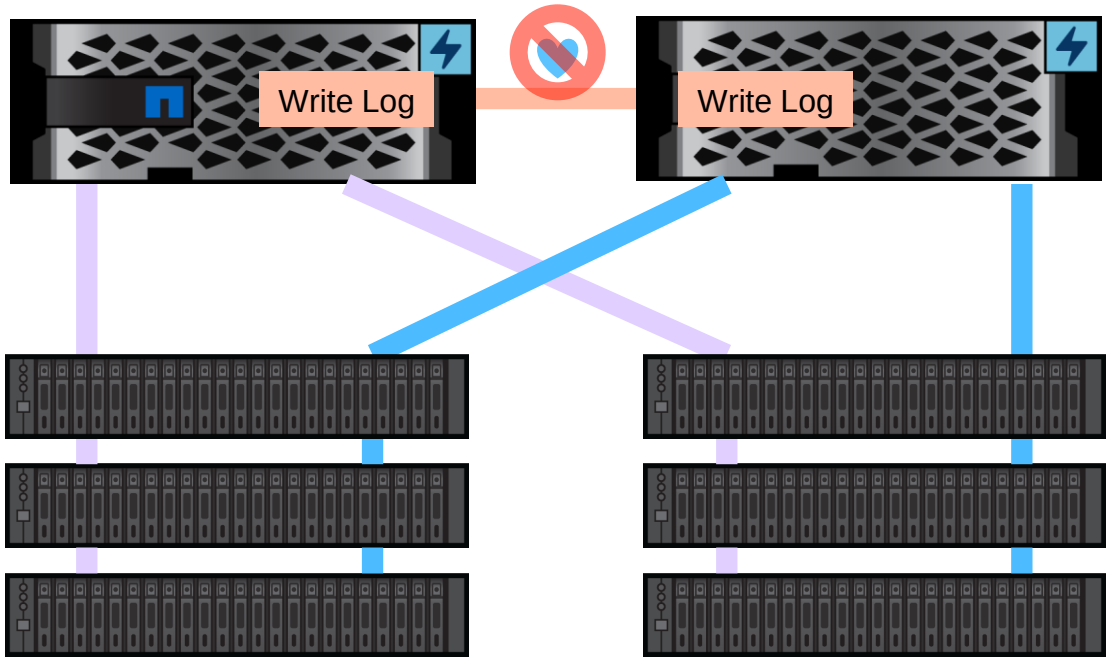


Cluster Node

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

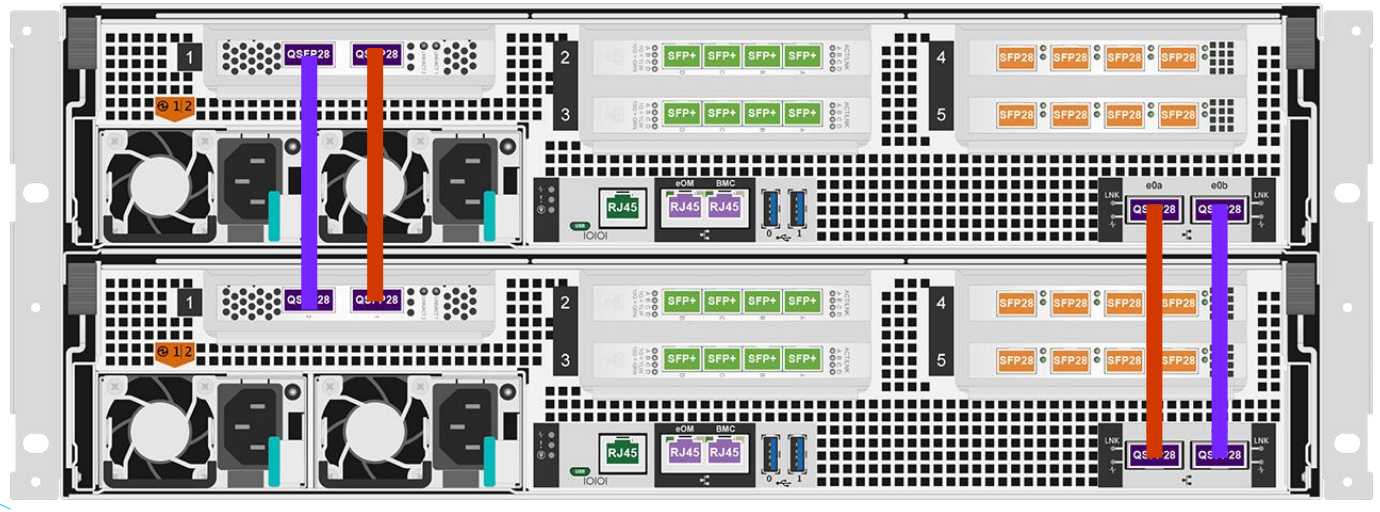


2-node switchless cluster

Node 1

Node 2

Ports on a NetApp AFF A800 system

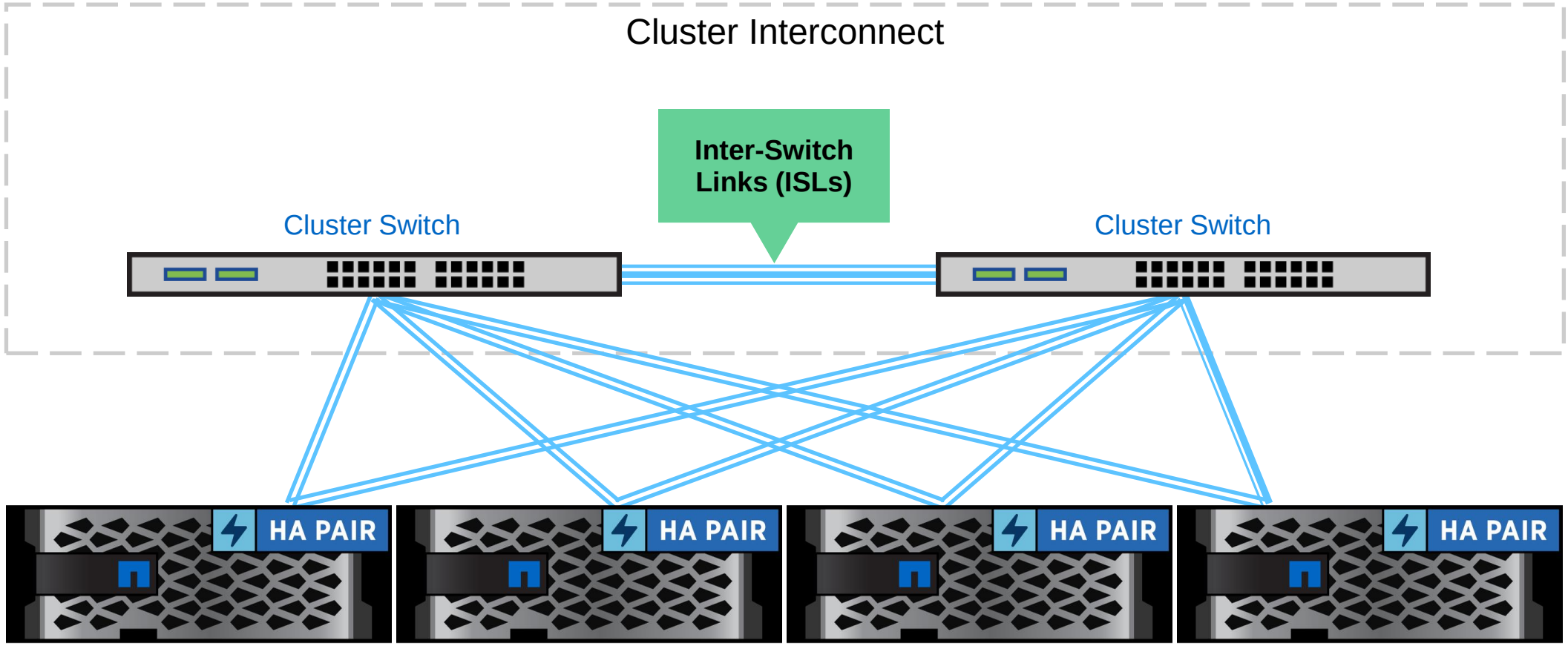


In a 2-node switchless cluster, ports are connected between nodes.

Cluster Interconnect

HA Interconnect

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

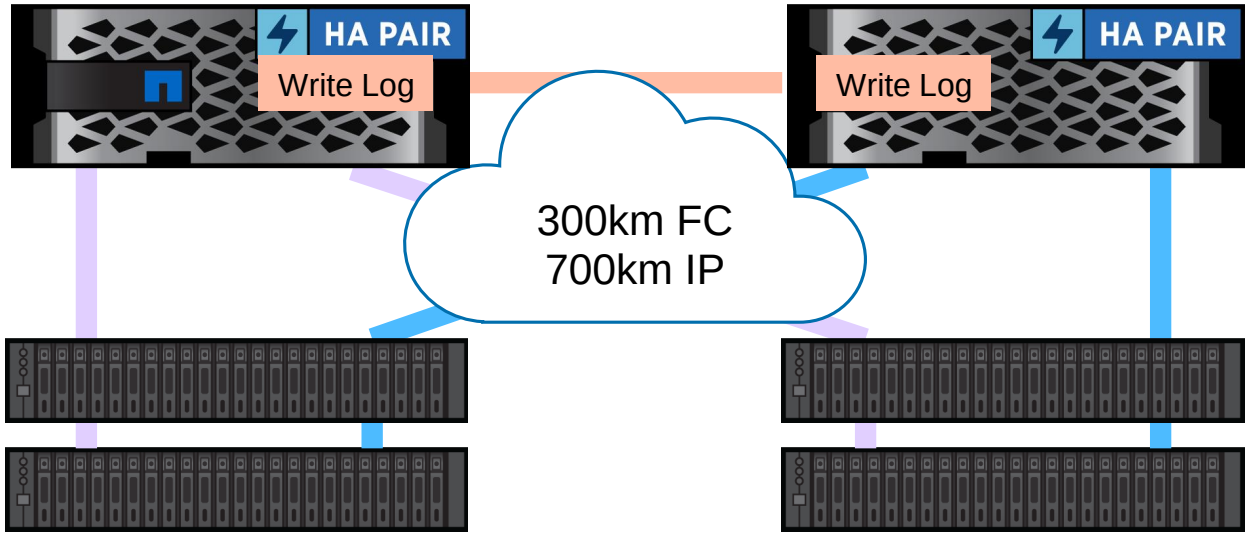
ONTAP Data Protection Administration

– and –

ONTAP MetroCluster Installation

– or –

ONTAP MetroCluster IP Implementation.

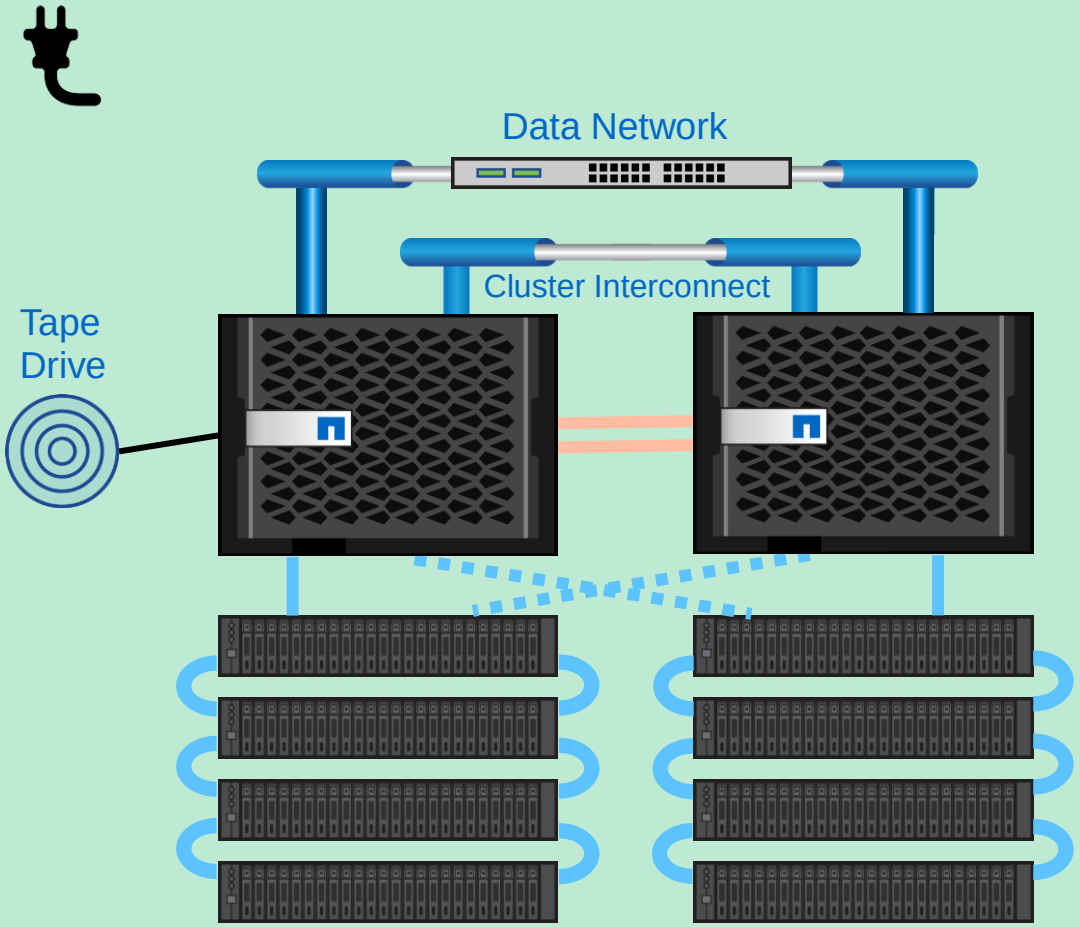


Lesson 2
Setting up a cluster

Basic hardware setup tasks

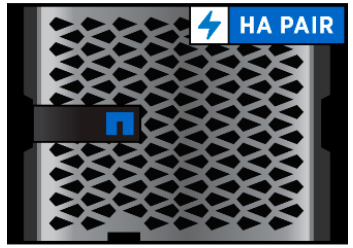
Connect the following hardware:

- 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



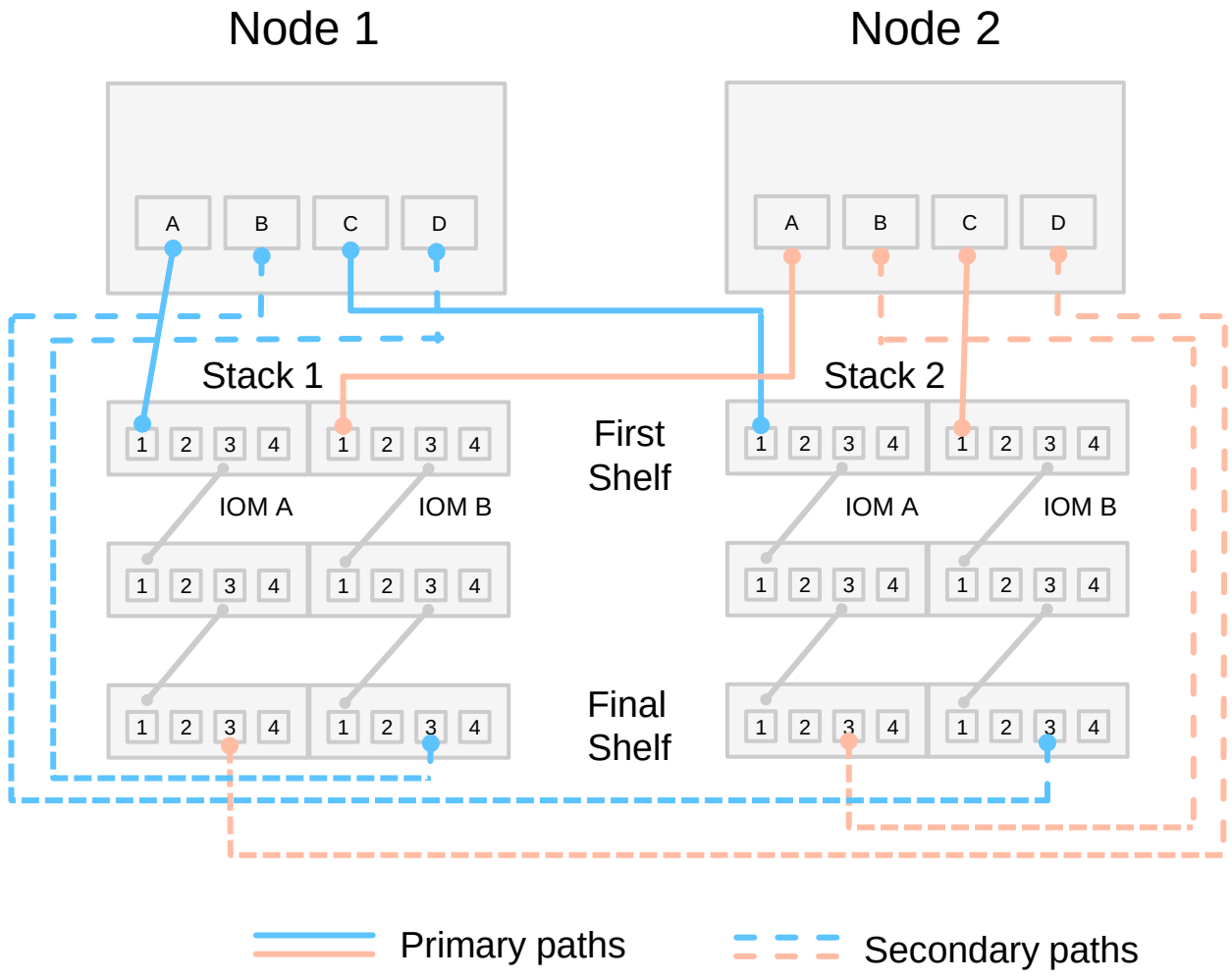
Dual-node chassis
Uses an internal or node-to-node HA interconnect

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.

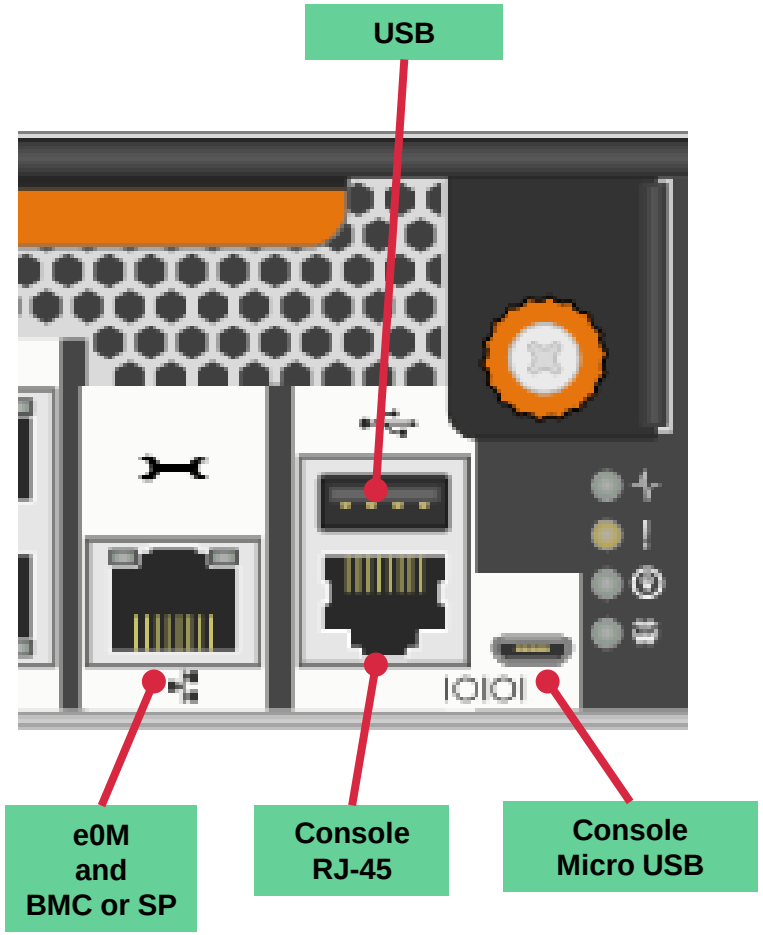


Powering on a system

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

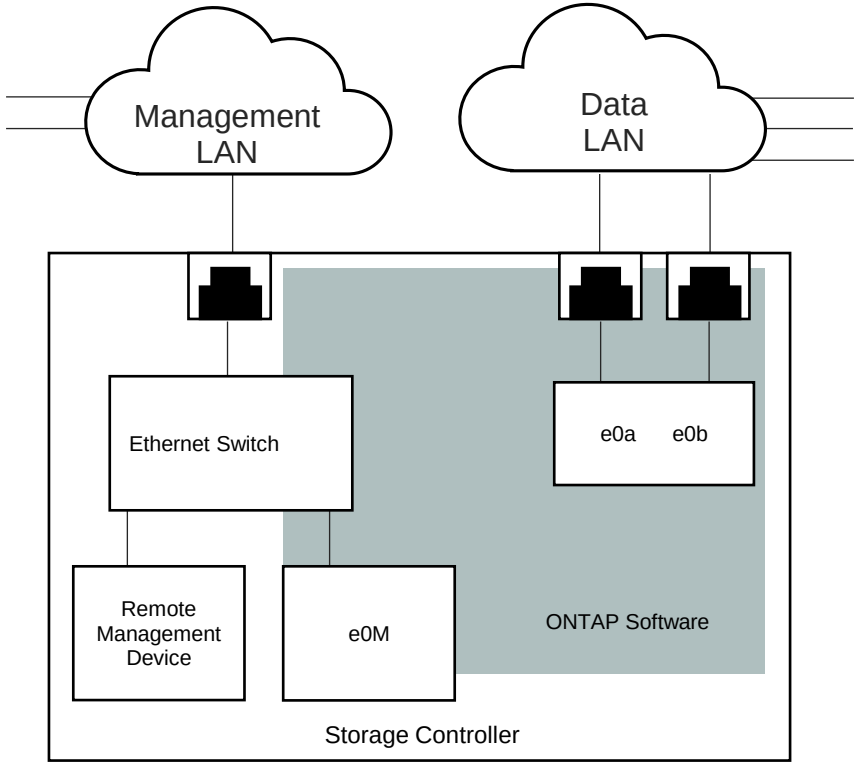
Management connections

- 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
```

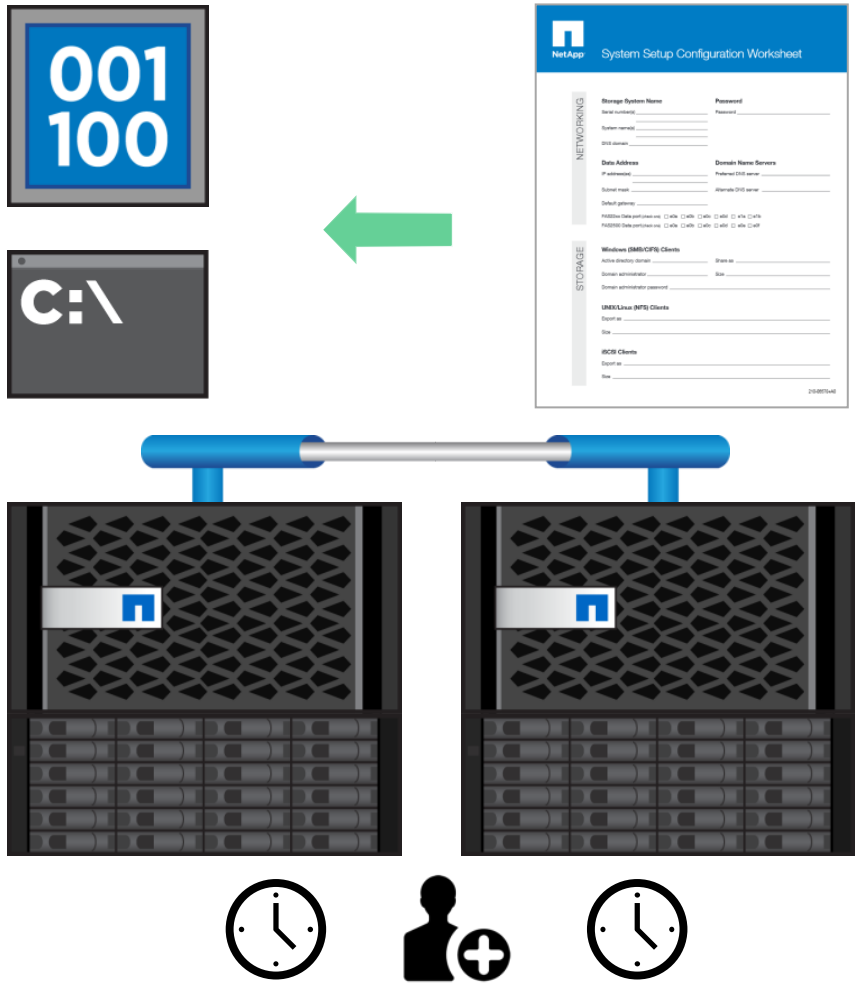
Topic for discussion

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.



? More info in Addendum

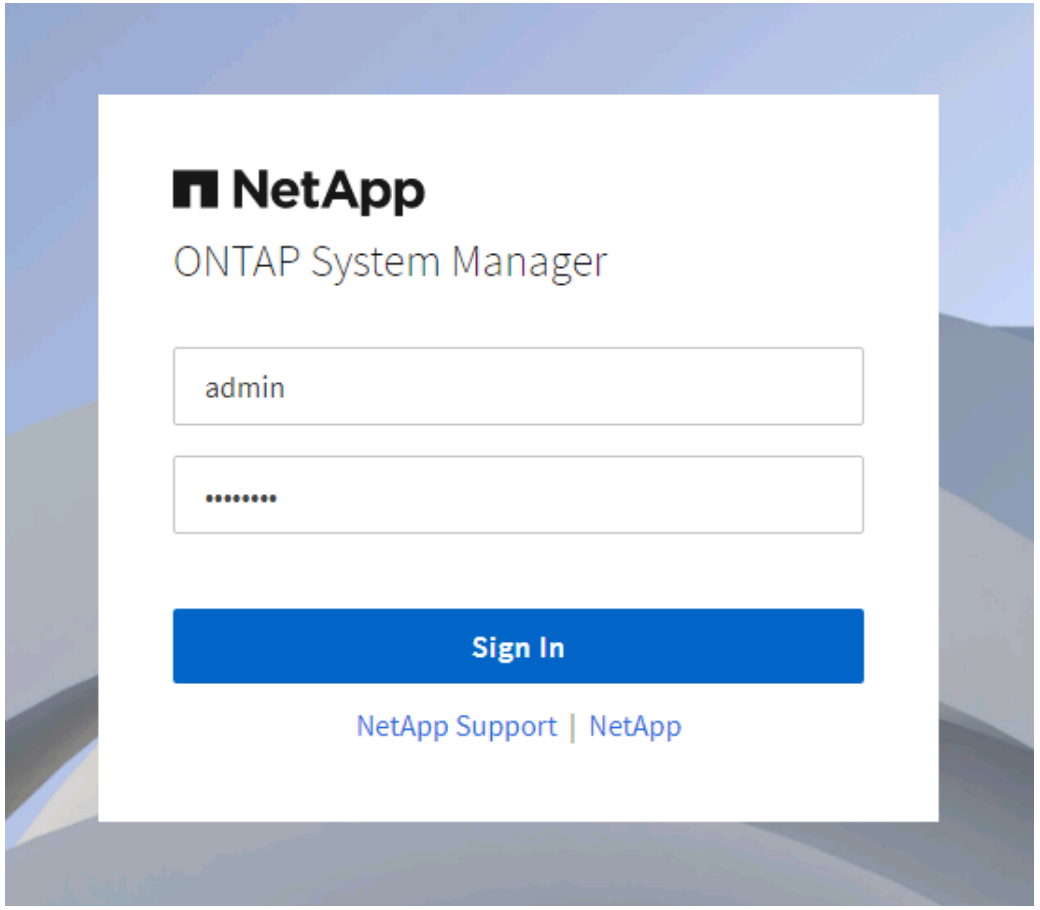
Additional Training

- *Installing Clustered Data ONTAP* (web-based course)
- *Universal NetApp FAS Installation* (web-based course)

Lesson 3
Administration interfaces

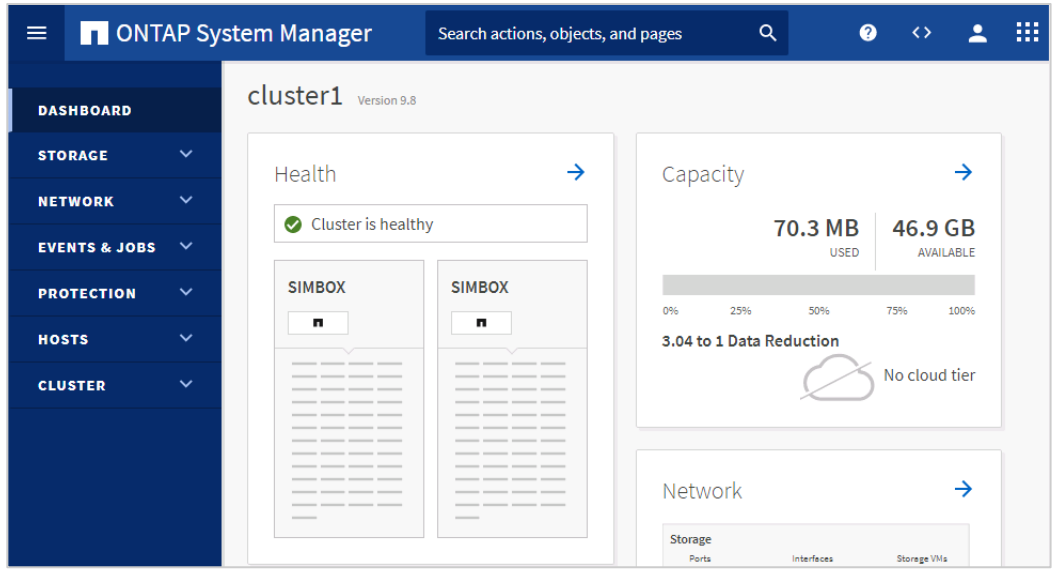
Cluster administrators

- 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



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::>
```

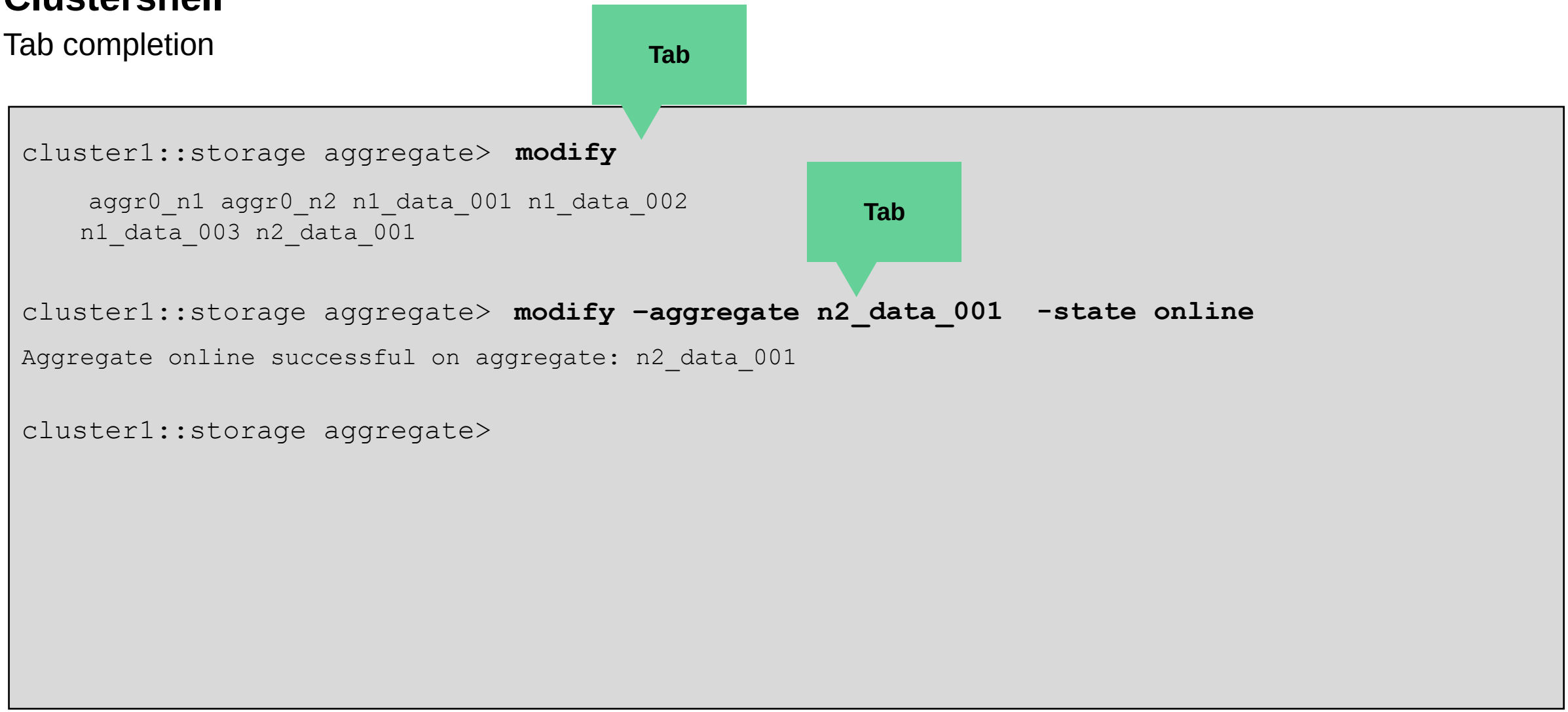

Clustershell

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



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

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:

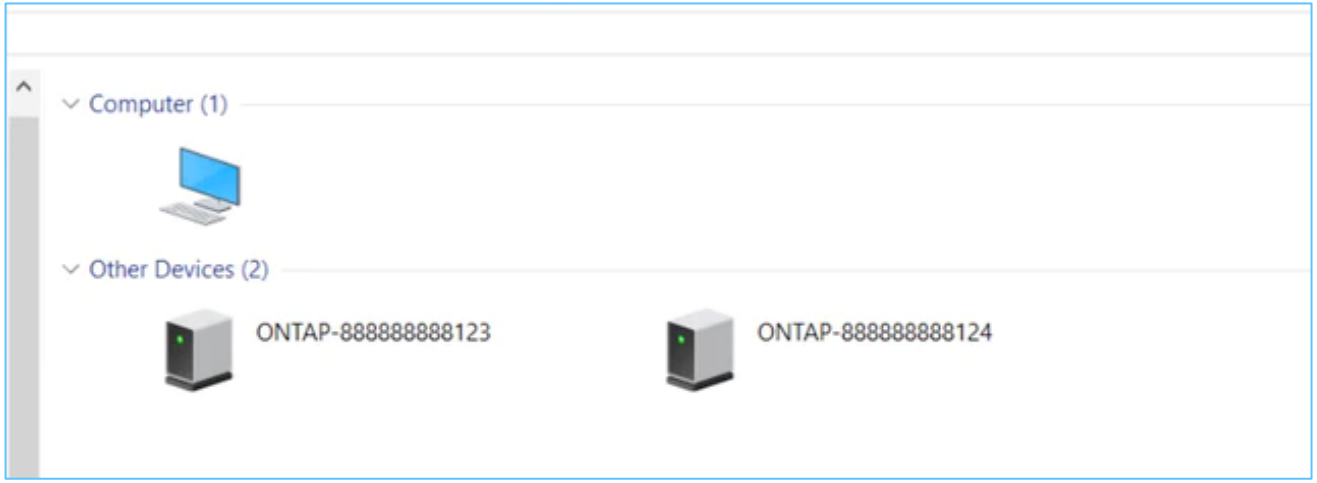
- Which method do you prefer to use for configuring volumes?
- Which method do you prefer to use for configuring LUNs?

Addendum
ONTAP System Manager: Cluster setup

Cluster setup

Connect to ONTAP System Manager

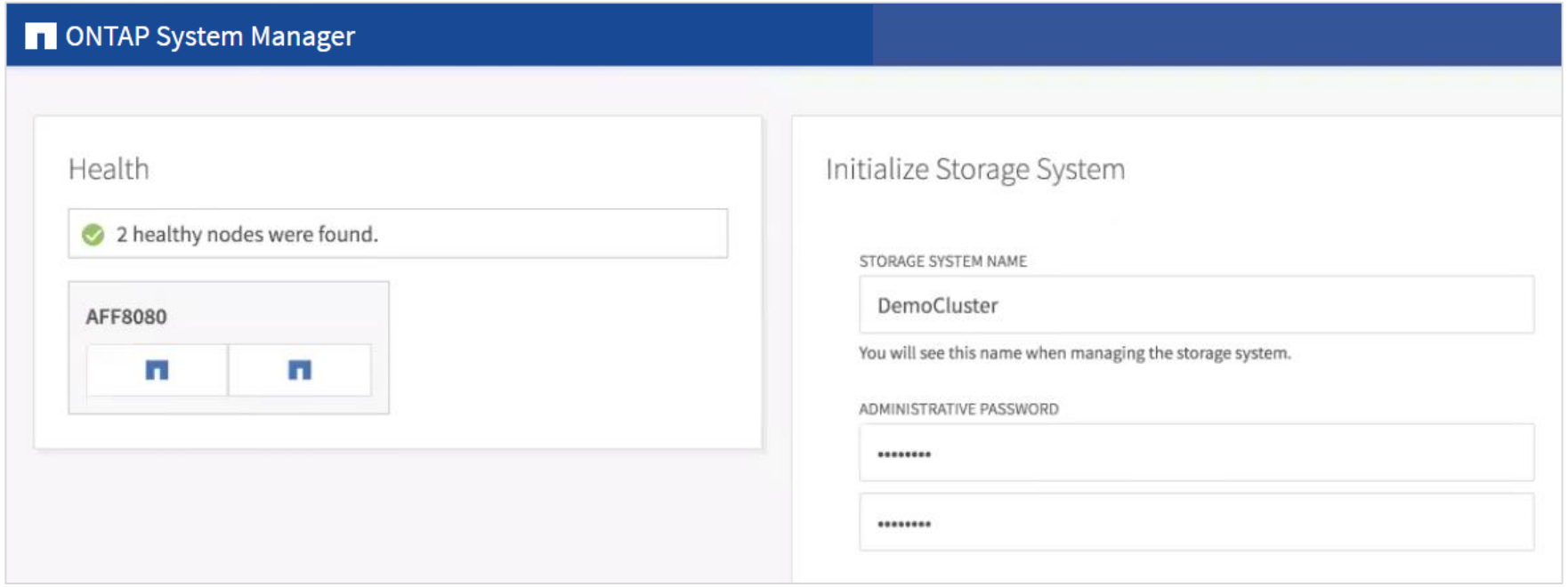
1. Power on the cluster nodes.
2. Connect a Windows host to the same network as the cluster nodes.
3. From the Windows Network page, double-click a cluster node to connect to ONTAP System Manager.



Guided Cluster Setup

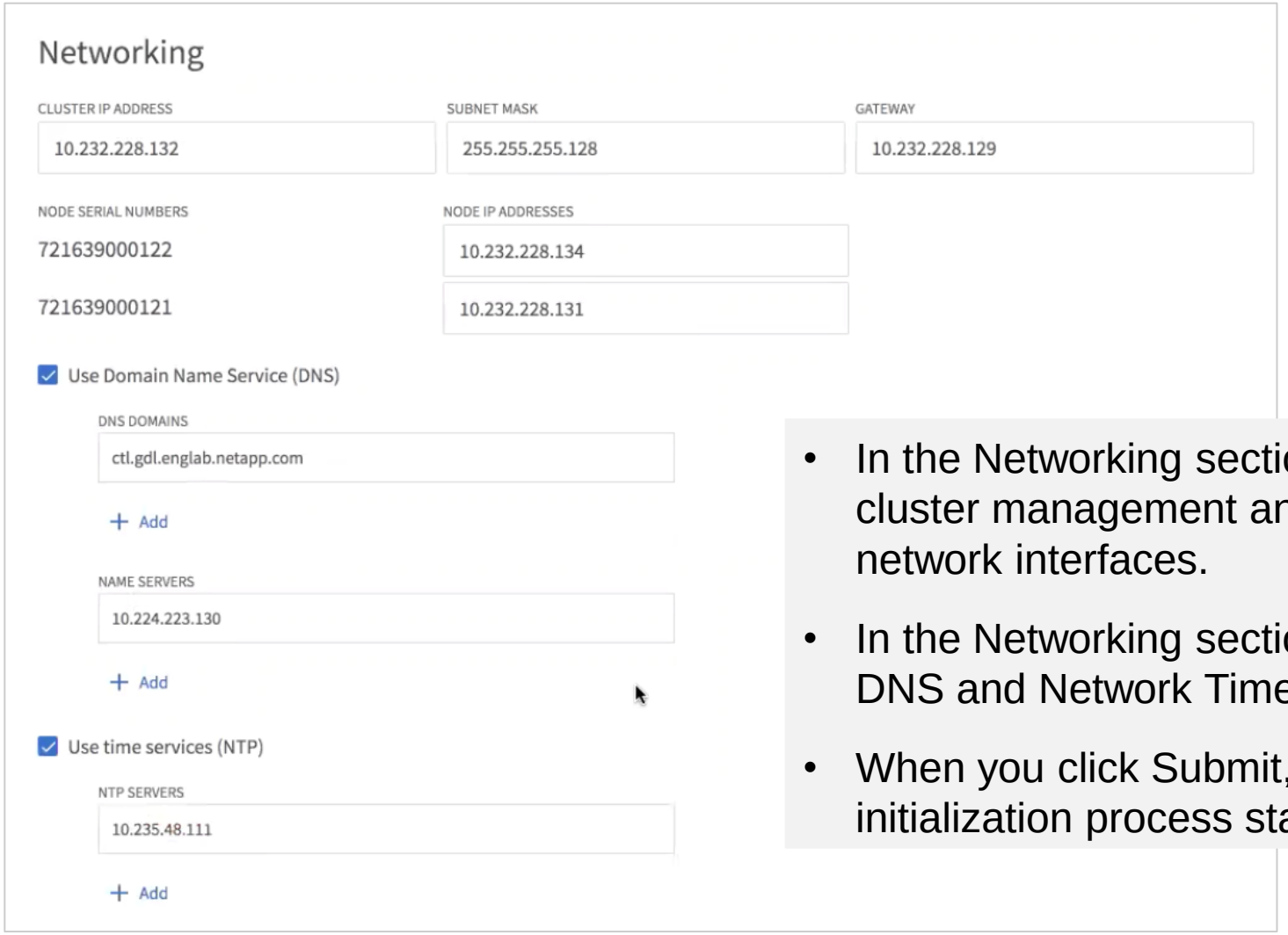
System Manager system initialization

- 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.



Cluster setup

Networking section

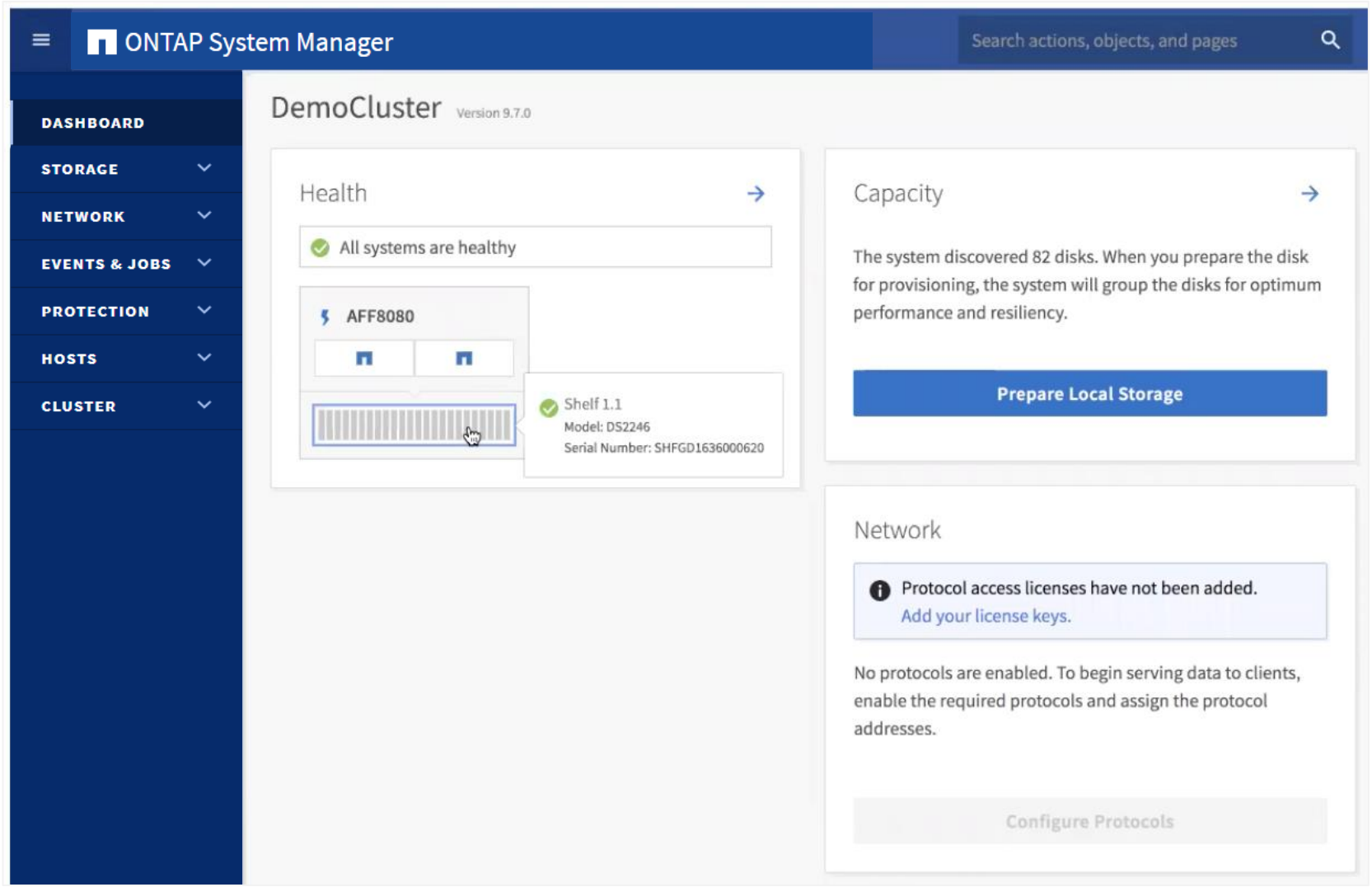


- In the Networking section, you configure the cluster management and node management network interfaces.
- In the Networking section, you also configure DNS and Network Time Protocol (NTP).
- When you click Submit, the cluster initialization process starts.

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.