NetApp HCI 1.4

Deployment Guide

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NetApp®

Contents

NetApp HCI overview

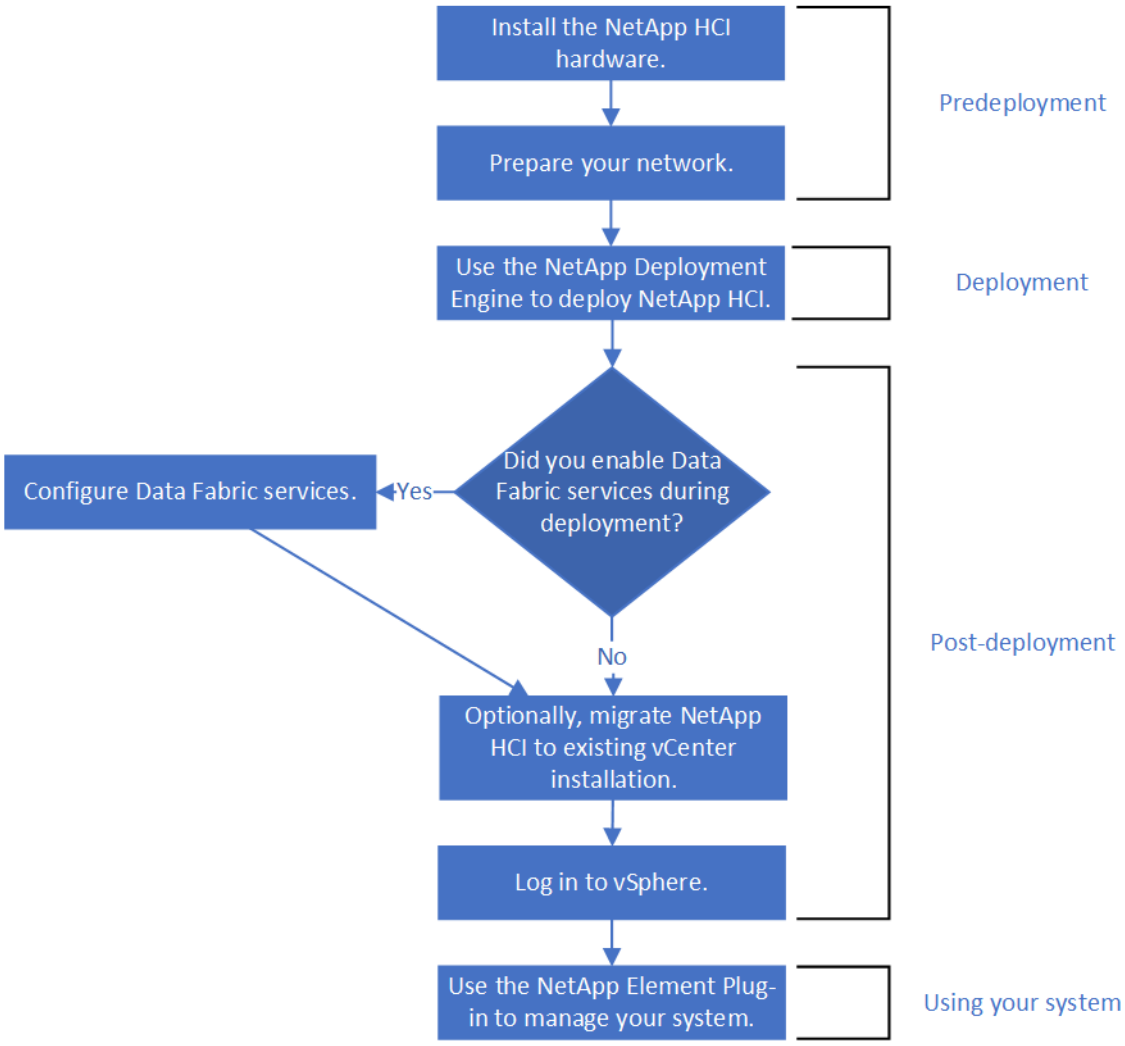
NetApp HCI provides both storage and compute resources, combining them to build a VMware vSphere environment backed by the capabilities of NetApp Element software. You can integrate NetApp HCI seamlessly with other products in the NetApp Data Fabric, creating a complete solution for your datacenter.

After successful deployment of NetApp HCI, you manage the system from the VMware vSphere Web Client. The NetApp Element Plug-in for vCenter Server (also referred to as the vCenter Plug-in, or VCP) is used to manage storage resources, including datastores, volumes, Quality of Service, storage cluster components, and data protection. Compute nodes appear as ESXi hosts and you can manage them in vSphere.

NetApp HCI events and faults are reported in vSphere as system alarms. The management node monitors the compute nodes, and appears as a virtual machine in the cluster after deployment. All storage and compute monitoring data can be collected by NetApp SolidFire Active IQ, which performs real-time monitoring of NetApp HCI.

This guide introduces NetApp HCI and its architecture, and covers the information needed to prepare your environment for a deployment as well as the steps needed to complete deployment. It also gives best practices for network and switch configuration to enable you to get the most out of your system. Using this guide, you can quickly deploy and configure your fully racked and powered NetApp HCI installation using the NetApp Deployment Engine.

The following diagram outlines the basic steps you need to follow to deploy NetApp HCI.



About this guide

This guide introduces NetApp HCI and its architecture, and covers the information needed to prepare your environment for a deployment as well as the steps needed to complete deployment. It also gives best practices for network and switch configuration to enable you to get the most out of your system. Using this guide, you can quickly deploy and configure your fully racked and powered NetApp HCI installation using the NetApp Deployment Engine.

Requirements for NetApp HCI deployment

NetApp HCI has specific physical and network requirements for proper operation in your datacenter. Ensure that you implement the following requirements and recommendations before you begin deployment.

Network and switch requirements

The switches used to carry NetApp HCI traffic require specific configuration to ensure a successful deployment. See your switch documentation for specific instructions on implementing each of the following requirements for your environment.

NetApp HCI deployment requires three network segments, one for each of the following types of traffic:

- Management
- VMware vMotion
- Storage

Depending on the NetApp H-Series compute and storage node models and the planned cabling configuration, you can physically separate these networks using separate switches or logically separate them using VLANs. For most deployments, however, you need to logically separate these networks (and any other additional virtual machine networks) using VLANs.

Ensure that the management networks for storage and compute nodes have network routes between them. These networks must have gateways assigned, and there must be a route between the gateways.

NetApp HCI has the following switch requirements:

- All switch ports connected to NetApp HCI nodes must be configured as spanning tree edge ports.
- NetApp HCI nodes have redundant ports for all network functions except out-of-band management. For the best resiliency, divide these ports across two switches with redundant uplinks to either a traditional hierarchical architecture or a layer 2 spine-and-leaf architecture.
- The switches handling storage, virtual machine, and vMotion traffic must support speeds of at least 10GbE per port (up to 25GbE per port is supported).
- The switches handling management traffic must support speeds of at least 1GbE per port.
- You must configure jumbo frames on the switch ports handling storage and vMotion traffic. Hosts must be able to send 9000 byte packets end-to-end for a successful installation.
- Round-trip network latency between all storage and compute nodes should not exceed 2ms.

All NetApp HCI nodes provide additional out-of-band management capabilities via a dedicated management port. NetApp H300S, H300E, H500S, H500E, H700S, H700E and H410C nodes also allow for shared IPMI access via Port A. As a best practice, you should ease remote management of NetApp HCI by configuring out-of-band management for all nodes in your environment.

Network ports used by NetApp HCI

You might need to allow the following ports through your datacenter's edge firewall so that you can manage the system remotely and allow clients outside of your datacenter to connect to resources.

Some of these ports might not be required, depending on how you use the system. All ports are TCP unless stated otherwise, and should be open bidirectionally.

The following abbreviations are used in the table:

- MIP: Management IP address
- SIP: Storage IP address
- MVIP: Management virtual IP address
- SVIP: Storage virtual IP address

Source	Destination	Port	Description
iSCSI clients	Storage cluster MVIP	443	(Optional) UI and API access
iSCSI clients	Storage cluster SVIP	3260	Client iSCSI communications
iSCSI clients	Storage node SIP	3260	Client iSCSI communications
Management node	sfsupport.solidfire.com	22	Reverse SSH tunnel for support access
Management node	Storage node MIP	22	SSH access for support
Management node	DNS servers	53 TCP/UDP	DNS lookup
Management node	Storage node MIP	442	UI and API access to storage node and Element software upgrades
Management node	monitoring.solidfire.com	443	Storage cluster reporting to Active IQ
Management node	Storage cluster MVIP	443	UI and API access to storage node and Element software upgrades
SNMP server	Storage cluster MVIP	161 UDP	SNMP polling
SNMP server	Storage node MIP	161 UDP	SNMP polling
Storage node MIP	DNS servers	53 TCP/UDP	DNS lookup
Storage node MIP	Management node	80	Element software upgrades
Storage node MIP	S3/Swift endpoint	80	(Optional) HTTP communication to S3/Swift endpoint for backup and recovery
Storage node MIP	NTP server	123 TCP/UDP	NTP
Storage node MIP	Management node	162 UDP	SNMP traps
Storage node MIP	SNMP server	162 UDP	SNMP traps
Storage node MIP	LDAP server	389 TCP/UDP	LDAP lookup
Storage node MIP	Remote storage cluster MVIP	443	Remote replication cluster pairing communication

Source	Destination	Port	Description
Storage node MIP	Remote storage node MIP	443	Remote replication cluster pairing communication
Storage node MIP	S3/Swift endpoint	443	(Optional) HTTPS communication to S3/Swift endpoint for backup and recovery
Storage node MIP	Management node	10514 TCP/UDP 514 TCP/UDP	Syslog forwarding
Storage node MIP	Syslog server	10514 TCP/UDP 514 TCP/UDP	Syslog forwarding
Storage node MIP	LDAPS server	636 TCP/UDP	LDAPS lookup
Storage node MIP	Remote storage node MIP	2181	Intercluster communication for remote replication
Storage node SIP	S3/Swift endpoint	80	(Optional) HTTP communication to S3/Swift endpoint for backup and recovery
Storage node SIP	S3/Swift endpoint	443	(Optional) HTTPS communication to S3/Swift endpoint for backup and recovery
Storage node SIP	Remote storage node SIP	2181	Intercluster communication for remote replication
Storage node SIP	Storage node SIP	3260	Internode iSCSI
Storage node SIP	Remote storage node SIP	4000 through 4020	Remote replication node-to-node data transfer
Storage node SIP	Compute node SIP	442	Compute node API, configuration and validation, and access to software inventory
System administrator PC	Storage node MIP	80	(NetApp HCI only) Landing page of NetApp HCI Deployment Engine
System administrator PC	Management node	442	HTTPS UI access to management node

Source	Destination	Port	Description
System administrator PC	Storage node MIP	442	HTTPS UI and API access to storage node
			(NetApp HCI only) Configuration and deployment monitoring in NetApp Deployment Engine
System administrator PC	Management node	443	HTTPS UI and API access to management node
System administrator PC	Storage cluster MVIP	443	HTTPS UI and API access to storage cluster
System administrator PC	Storage node MIP	443	HTTPS storage cluster creation, post-deployment UI access to storage cluster
vCenter Server	Storage cluster MVIP	443	vCenter Plug-in API access
vCenter Server	Management node	8080/8443	(Optional) vCenter Plug-in QoSSIOC service. 8080 redirects to 8443.
vCenter Server	Storage cluster MVIP	8444	vCenter VASA provider access (VVols only)
vCenter Server	Management node	9443	vCenter Plug-in registration. The port can be closed after registration is complete.

Network cable requirements

You can use the following guidelines to ensure that you have enough of the right type of network cables for the size of your deployment. For ports that require RJ45 cables, you must use Category 5e or Category 6 rated RJ45 cables.

- Two-cable compute node configuration: Each compute node must to be connected to a 10/25GbE network via two SFP+/SFP28 cables (one additional RJ45 cable is optional for out-of-band management).
- Six-cable compute node configuration: Each compute node must to be connected to a 10/25GbE network via four SFP+/SFP28 cables and to a 1/10GbE network via two RJ45 cables (one additional RJ45 cable is optional for out-of-band management).
- Each storage node must be connected to a 10/25GbE network via two SFP+/SFP28 cables and to a 1/10GbE network via two RJ45 cables (one additional RJ45 cable is optional for out-of-band management).
- Ensure the network cables you use to connect the NetApp HCI system to your network are long enough to comfortably reach your switches.

For example, a deployment containing four storage nodes and three compute nodes (using the six-cable configuration) requires the following number of network cables:

- 14 1/10GbE cables (plus seven cables for IPMI traffic, if desired)
- 20 10/25GbE cables

This is due to the following reasons:

- Four storage nodes require eight 1/10GbE cables and eight 10/25GbE cables.
- Three compute nodes using the six-cable configuration require six 1/10GbE cables and twelve 10/25GbE cables.

Network configuration

NetApp HCI can utilize multiple different network cabling and VLAN configurations. It is important to plan your network configuration to ensure a successful deployment.

Required network segments

NetApp HCI requires a minimum of three network segments: management, storage, and virtualization traffic (which includes virtual machines and vMotion traffic). You can also separate virtual machine and vMotion traffic. These network segments usually exist as logically separated VLANs in the NetApp HCI network infrastructure.

How compute and storage nodes connect to these networks depends on how you design the network and cable the nodes. The sample network illustrations in this guide assume the following networks:

Network name	VLAN ID
Management	100
Storage	105
vMotion	107
Virtual machines	200, 201

For the best deployment experience, you should configure a network segment that is available as the native VLAN on all switch ports that are used for NetApp HCI nodes. This enables automatic discovery and configuration. In the network configuration examples in this guide, the management network (VLAN ID 100) is shared for this purpose.

The NetApp Deployment Engine enables you to quickly configure networks for compute and storage nodes during the initial deployment. You can place certain built-in management components such as vCenter and the management node on their own network segment if needed. These network segments require routing to allow vCenter and the management node to communicate with storage and compute management networks. In most deployments those components use the same management network (in this example, VLAN ID 100).

Note: You configure virtual machine networks using vCenter. The default virtual machine network in NetApp HCI deployments uses the same node ports and native VLAN as the vMotion network. If you plan to use multiple tagged virtual machine networks, be sure to include them in the initial network planning.

Network configuration and cabling options

You can use a two-cable network configuration for NetApp HCI compute nodes, simplifying cable routing. This configuration uses two SFP+/SFP28 cables plus an optional (but recommended) RJ45 cable for IPMI communication. Storage nodes support a single network topology that uses four network cables.

All storage nodes support a network topology that uses four network ports; this topology uses ports A through D on H300S, H500S H700S, and 610S nodes. Compute nodes support three network topologies:

Configuration option	Cabling and description
Option A	Two-cable configuration using ports D and E (two SFP28/SFP+ interfaces) on H300E, H500E, H700E and H410C nodes
Option B	Six-cable configuration using ports A through F (two RJ45 and four SFP28/SFP+ interfaces) on H300E, H500E, H700E and H410C nodes
Option C	Cable configuration similar to option B, but using native VLANs for the management, storage, and vMotion networks

Nodes that do not have the correct number of connected cables cannot participate in the deployment. For example, you cannot deploy a compute node in a six-cable configuration if it only has ports D and E connected.

Note: You can adjust the NetApp HCI network configuration after deployment to meet infrastructure needs. However, when you expand NetApp HCI resources, remember that new nodes must have the same cable configuration as the existing compute and storage nodes.

Configuration option A: Two cables for compute nodes

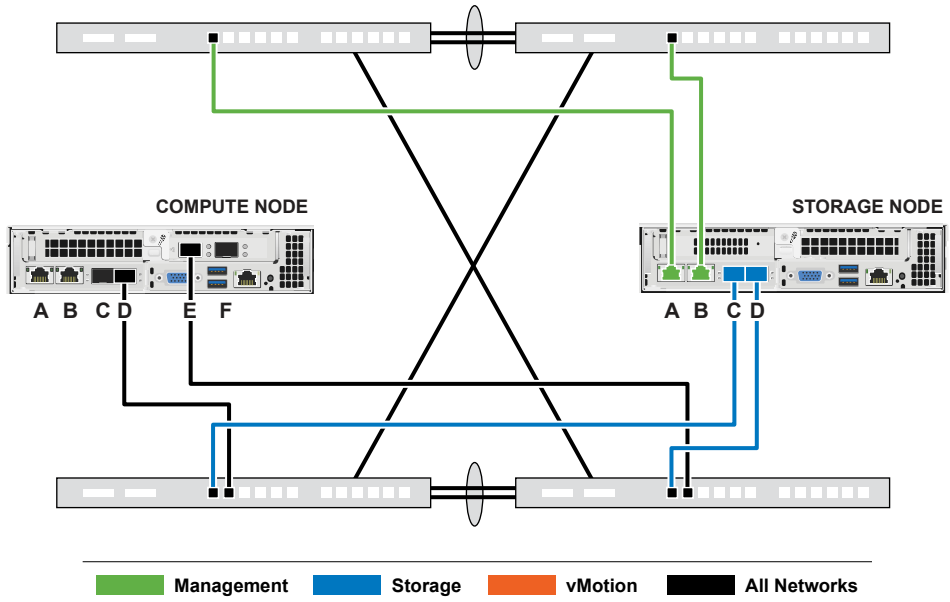
The H300E, H500E, H700E and H410C compute nodes support using two network cables for connectivity to all NetApp HCI networks. This configuration requires that the storage, vMotion and any virtual machine networks use VLAN tagging. All compute and storage nodes must use the same VLAN ID scheme.

VLAN configuration

As a best practice, you should configure the required network segments on all switch ports that the nodes are using. For example:

Network name	VLAN ID	Switch port configuration
Management	100	Native
Storage	105	Tagged
vMotion	107	Tagged
Virtual machines	200, 201	Tagged

The following illustration shows the recommended cabling configuration for two-cable compute nodes and four-cable storage nodes. All switch ports in this example share the same configuration.



Example switch commands

You can use the following example commands to configure all switch ports used for NetApp HCI nodes. These commands are based on a Cisco configuration; see your switch documentation for the specific commands you need to implement this configuration. Replace the interface name, description, and VLANs with the values for your environment.

```
interface {interface name, such as EthernetX/Y or GigabitEthernetX/Y/Z}
description {desired description, such as NetApp-HCI-NodeX-PortY}
mtu 9216
switchport mode trunk
switchport trunk native vlan 100
switchport trunk allowed vlan 105,107,200,201
spanning-tree port type edge trunk
```

Configuration option B: Six cables for compute nodes

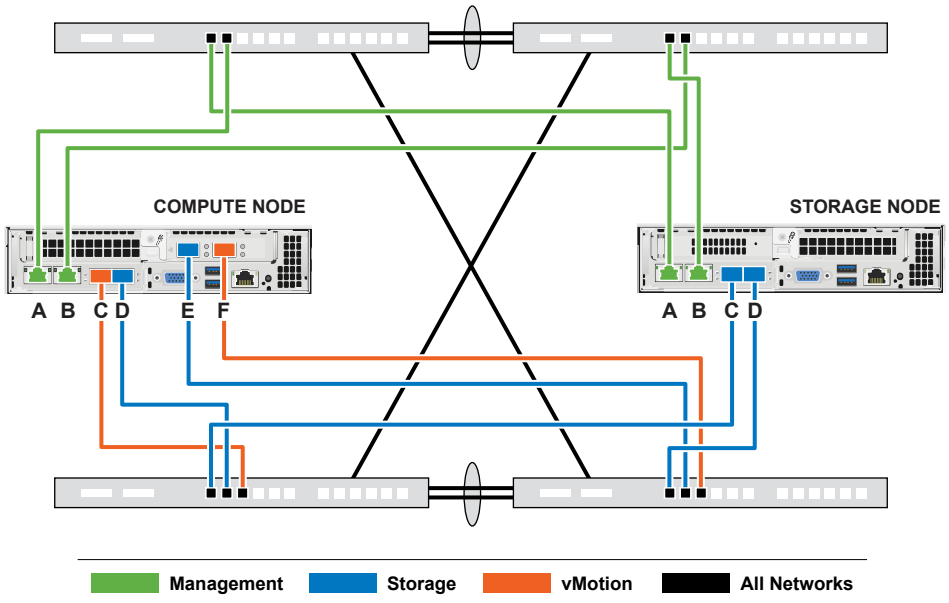
As a secondary network configuration option, the H300E, H500E, H700E and H410C compute nodes support using six network cables for connectivity to all NetApp HCI networks.

VLAN configuration

When you deploy compute nodes using six cables and storage nodes using four cables, as a best practice, you should configure the required network segments on all switch ports that the nodes are using. For example:

Network name	VLAN ID	Switch port configuration
Management	100	Native
Storage	105	Tagged
vMotion	107	Tagged
Virtual machines	200, 201	Tagged

The following illustration shows the recommended cabling configuration for six-cable compute nodes and four-cable storage nodes. All switch ports in this example share the same configuration.



Example switch commands

You can use the following example commands to configure all switch ports used for NetApp HCI nodes. These commands are based on a Cisco configuration; see your switch documentation for the specific commands you need to implement this configuration. Replace the interface name, description, and VLANs with the values for your environment.

```
interface {interface name, such as EthernetX/Y or GigabitEthernetX/Y/Z}
description {desired description, such as NetApp-HCI-NodeX-PortY}
mtu 9216
switchport mode trunk
switchport trunk native vlan 100
switchport trunk allowed vlan 105,107,200,201
spanning-tree port type edge trunk
```

Configuration option C: Six cables for compute nodes with native VLANs

You can deploy NetApp HCI without using tagged VLANs for storage and virtualization traffic, and instead rely on the switch configuration to separate the network segments. This configuration is the most complex deployment option.

VLAN configuration

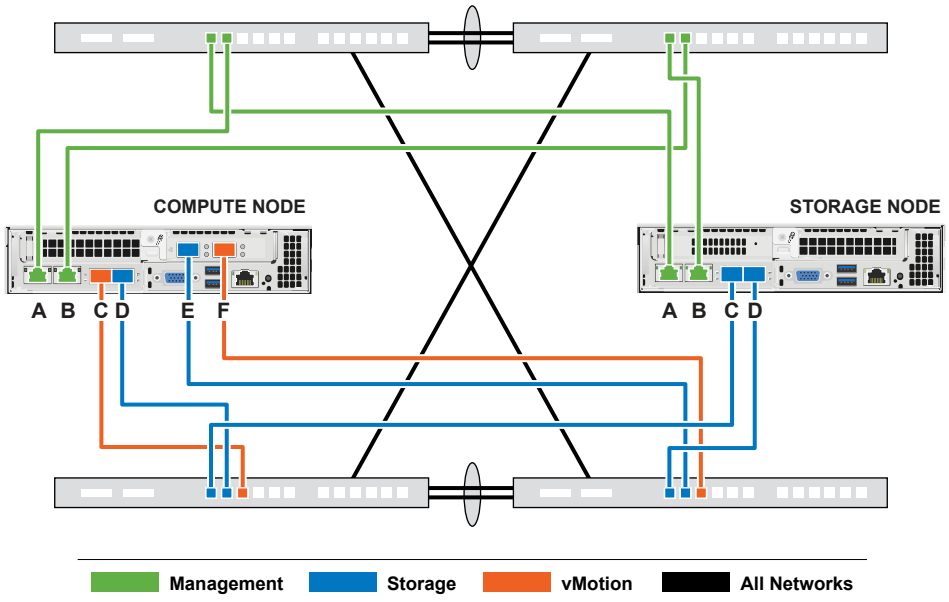
This topology option uses the following VLAN configuration:

Node ports used	Network name	VLAN ID	Connected switch port configuration
Ports A and B on compute and storage nodes	Management	100	Native
Ports D and E on compute nodes	Storage	105	Native
Ports C and D on storage nodes	Storage	105	Native
Ports C and F on compute nodes	vMotion	107	Native

Node ports used	Network name	VLAN ID	Connected switch port configuration
Ports C and F on compute nodes	Virtual machines	200, 201	Tagged

Caution: Deploying this configuration requires careful switch port configuration. Configuration errors in this network topology can result in deployment problems that are difficult to diagnose.

The following illustration shows the network configuration overview for this topology option. In the example, individual switch ports are configured with the appropriate network segment as the native network.



Example switch commands

You can use the following example switch commands to configure switch ports used for the NetApp HCI nodes. These commands are based on a Cisco configuration; see your switch documentation for the specific commands you need to implement this configuration.

You can use the following example commands to configure the switch ports used for the management network. Replace the interface name, description, and VLANs with the values for your configuration.

```
interface {interface name, such as EthernetX/Y or GigabitEthernetX/Y/Z}
description {desired description, such as NetApp-HCI-NodeX-PortA|B}
switchport access vlan 100
spanning-tree port type edge
```

You can use the following example commands to configure the switch ports used for the storage network. Replace the interface name, description, and VLANs with the values for your configuration.

```
interface {interface name, such as EthernetX/Y or GigabitEthernetX/Y/Z}
description {desired description, such as NetApp-HCI-NodeX-PortC|D}
mtu 9216
switchport access vlan 105
spanning-tree port type edge
```

You can use the following example commands to configure the switch ports used for the vMotion and virtual machines network. Replace the interface name, description, and VLANs with the values for your configuration.

```
interface {interface name, such as EthernetX/Y or GigabitEthernetX/Y/Z}
description {desired description, such as NetApp-HCI-NodeX-PortC|F}
mtu 9216
switchport mode trunk
switchport trunk native vlan 107
switchport trunk allowed vlan 200,201
spanning-tree port type edge trunk
```

IP address requirements

NetApp HCI has specific IP address requirements that depend on the size of your deployment. It is important to note that by default the initial IP addresses you assign to each node before using the NetApp Deployment Engine to deploy the system are temporary and cannot be reused. You need to set aside a second permanent set of unused IP addresses that you can assign during final deployment.

It is best if the storage network and the management network each use separate contiguous ranges of IP addresses. Use the following table to determine how many IP addresses you need for your NetApp HCI deployment:

System component	Management network IP addresses needed	Storage network IP addresses needed	vMotion network IP addresses needed	Total IP addresses needed per component
Compute node	1	2	1	4
Storage node	1	1		2
Storage cluster	1	1		2
VMware vCenter	1			1
File services	2			2
Management node	1			1

Configuring LACP for optimal storage performance

For optimal NetApp HCI storage cluster performance, you should configure Link Aggregation Control Protocol (LACP) on the switch ports used for each of the storage nodes.

Before you begin

- You have configured the switch ports connected to the 10/25GbE interfaces of NetApp HCI storage nodes as LACP port channels.
- You have set the LACP timers on the switches handling storage traffic to “fast mode (1s)” for optimal failover detection time. During deployment, the Bond1G interfaces on all storage nodes are automatically configured for active/passive mode.
- You have configured Cisco Virtual PortChannel (vPC) or the equivalent switch stacking technology for the switches handling the storage network. Switch stacking technology eases

configuration of LACP and port channels, and provides a loop-free topology between switches and the 10/25GbE ports on the storage nodes.

Steps

1. Follow your switch vendor recommendations for enabling LACP on the switch ports used for NetApp H-Series storage nodes.
2. Change the bond mode on all storage nodes to LACP in the on-node user interface (also known as the Terminal User Interface, or TUI) before you deploy NetApp HCI.

Configuring the IPMI ports

DHCP is enabled for the IPMI port of each NetApp HCI node. If your IPMI network does not use DHCP, you can manually assign a static IPv4 address to the IPMI port.

Before you begin

You have a KVM or monitor and keyboard you can use to access the BIOS of each node.

About this task

Use the arrow keys to navigate in the BIOS. Select a tab or option by pressing `Enter`. Go back to previous screens by pressing `ESC`.

Steps

1. Power on the node.
2. Upon booting, enter the BIOS by pressing the `Del` key.
3. Select the **IPMI** tab.
4. Select **BMC Network Configuration** and press `Enter`.
5. Choose **Yes** and press `Enter`.
6. Select **Configuration Address Source** and press `Enter`.
7. Choose **Static** and press `Enter`.
8. Select **Station IP address** and enter a new IP address for the IPMI port. Press `Enter` when finished.
9. Select **Subnet mask** and enter a new subnet mask for the IPMI port. Press `Enter` when finished.
10. Select **Gateway IP address** and enter a new gateway IP address for the IPMI port. Press `Enter` when finished.
11. Connect one end of an Ethernet cable to the IPMI port and the other end to a switch.

    The IPMI port for this node is ready to use.
12. Repeat this procedure for any other NetApp HCI nodes with IPMI ports that are not configured.

Related tasks

Changing the IPMI password on page 18

Changing the IPMI password

You should change the password for the default IPMI ADMIN account on each node as soon as you configure the IPMI port.

Before you begin

You have configured the IPMI IP address for each node.

Steps

1. Open a web browser on a computer that can reach the IPMI network and browse to the IPMI IP address for the node.
2. Enter the username ADMIN and password ADMIN in the login prompt.
3. Upon logging in, click the **Configuration** tab.
4. Click **Users**.
5. Select the ADMIN user and click **Modify User**.
6. Select the **Change Password** check box.
7. Enter a new password in the **Password** and **Confirm Password** fields.
8. Click **Modify**, and then click **OK**.
9. Repeat this procedure for any other NetApp HCI nodes with default passwords for the IPMI ADMIN account.

Related tasks

Configuring the IPMI ports on page 17

DNS and timekeeping requirements

Before deployment, you might need to prepare DNS records for your NetApp HCI system and gather NTP server information.

Make the following DNS and timeserver preparations before deploying NetApp HCI:

- Create any needed DNS entries for hosts (such as individual compute or storage nodes) and document how the host entries map to the respective IP addresses. During deployment, you will need to assign a prefix to your storage cluster that will be applied to each host; to avoid confusion, keep your DNS naming plans in mind when choosing a prefix.
- If you are deploying NetApp HCI with a new VMware vCenter Server instance using a fully qualified domain name, you must create one Pointer (PTR) record and one Address (A) record for vCenter Server on the given DNS server before deployment.
- If you are deploying NetApp HCI with a new vCenter Server instance using only IP addresses, you do not need to create new DNS records for vCenter Server.
- NetApp HCI requires a valid NTP server for timekeeping. You can use a publicly available time server if you do not have one in your environment.

Environmental requirements

Ensure that the power for the rack used to install NetApp HCI is supplied by AC power outlets, and that your datacenter provides adequate cooling for the size of your NetApp HCI installation.

For detailed capabilities of each component of NetApp HCI, see the NetApp HCI *datasheet*.

Note: The H410C compute node operates only on high-line voltage (200-240 VAC). You must ensure that the power requirements are met when you add H410C nodes to an existing NetApp HCI system.

Protection Domains

NetApp Element software supports Protection Domains functionality, which optimizes data layout on storage nodes for the best data availability. To use this feature, you should split storage capacity evenly across three or more NetApp H-series chassis for optimal storage reliability. In this scenario, the storage cluster automatically enables Protection Domains.

Related information

Element Software User Guide

Final preparations

You must ensure that you complete the following final items before you deploy NetApp HCI.

- Gather all relevant information about your network, current or planned VMware infrastructure, and planned user credentials.
- Rack, cable, and power on the NetApp HCI installation.
- Ensure that storage capacity is split evenly across all chassis containing storage nodes. This ensures the best storage reliability possible.

Deploying NetApp HCI

The NetApp Deployment Engine enables you to quickly deploy NetApp HCI. During deployment, you can let the NetApp Deployment Engine automatically set many of the networking configuration details for you. After deployment, NetApp HCI will be ready to serve highly available compute and storage resources in a production environment.

Before you begin

You have ensured that all compute and storage nodes that will be part of the initial deployment are running the same versions of Element software (for storage nodes) and Bootstrap OS (for compute nodes).

Steps

1. Accessing the NetApp Deployment Engine on page 20
2. Starting your deployment on page 23
3. Enabling Data Fabric services on page 23
4. VMware vCenter configuration on page 24
5. Configuring credentials on page 25
6. Selecting a network topology on page 25
7. Selecting inventory on page 26
8. Configuring network settings on page 27
9. Reviewing and deploying the configuration on page 29

Accessing the NetApp Deployment Engine

To deploy NetApp HCI, you need to access the NetApp Deployment Engine on one of the NetApp H-Series storage nodes via the IPv4 address assigned to the Bond1G interface, which is the logical interface that combines ports A and B for storage nodes. This storage node becomes the controlling storage node for the deployment process. Depending on your environment, you need to either configure the IPv4 address or retrieve it from one of the storage nodes.

Note: You can only access the NetApp Deployment Engine using the Bond1G interface of a storage node. Using the Bond10G interface, the logical interface that combines ports C and D for storage nodes, is not supported.

Use one of the following methods that best describes your network environment to access the NetApp Deployment Engine.

Scenario	Method
You do not have DHCP in your environment	*Accessing the NetApp Deployment Engine in environments without DHCP*
You have DHCP in your environment	*Accessing the NetApp Deployment Engine in environments with DHCP*
You want to assign all IP addresses manually	*Manually assigning IP addresses to access the NetApp Deployment Engine*

Accessing the NetApp Deployment Engine in environments without DHCP

When DHCP is not in use on the network, you need to set a static IPv4 address on the Bond1G interface of one of the storage nodes (also known as a controlling storage node) that you will use to

access the NetApp Deployment Engine. The NetApp Deployment Engine on the controlling storage node will discover and communicate with other compute and storage nodes using IPv4 addresses that have been auto-configured on the Bond10G interfaces of all nodes. You should use this method unless your network has special requirements.

Before you begin

- You or your network administrator have completed the tasks in the *Installation and Setup Instructions* document.
- You have physical access to the NetApp HCI nodes.
- All of the NetApp HCI nodes are powered on.
- DHCP is not enabled for the NetApp HCI networks and the NetApp HCI nodes have not obtained IP addresses from DHCP servers.
- The NetApp HCI management network is configured as the native VLAN on the Bond10G interfaces of all nodes.

Steps

1. Plug a KVM into the back of one of the NetApp HCI storage nodes (this node will become the controlling storage node).
2. Configure the IP address, subnet mask, and gateway address for Bond1G in the user interface. You can also configure a VLAN ID for the Bond1G network if needed.

   Note: You cannot reuse this IPv4 address later during deployment with the NetApp Deployment Engine.

3. Open a web browser on a computer that can access the NetApp HCI management network.
4. Browse to the IP address you assigned to the controlling storage node. For example:

   ```
   http://<Bond1G IP address>
   ```

   This takes you to the NetApp Deployment Engine user interface.

Related information

H300, H500, and H700 series hardware installation instructions
H600S series hardware installation instructions

Accessing the NetApp Deployment Engine in environments with DHCP

In environments where servers automatically acquire IPv4 configuration from DHCP, you can access the NetApp Deployment Engine using the IPv4 address assigned to the Bond1G interface on one of the storage nodes. You can use a USB stick to retrieve the IPv4 address from one of the storage nodes. The NetApp Deployment Engine will automatically discover other compute and storage nodes that use DHCP-assigned IPv4 addresses. You should not use this method unless your network has special requirements.

Before you begin

- You or your network administrator have completed the tasks in the *Installation and Setup Instructions* document.
- You have physical access to the NetApp HCI nodes.

- All of the NetApp HCI nodes are powered on.
- DHCP is enabled on the NetApp HCI management and storage networks.
- The DHCP address pool is large enough to accommodate two IPv4 addresses per NetApp HCI node.

Note: For the NetApp HCI deployment to succeed, all nodes in the deployment must either have DHCP-acquired or auto-configured IPv4 addresses (you cannot mix IPv4 address assignment methods).

About this task

If DHCP is in use only for the storage network (Bond10G interfaces), you should use the steps outlined in *Accessing the NetApp Deployment Engine in environments without DHCP* on page 20 to access the NetApp Deployment Engine.

Steps

1. Wait several minutes for the nodes to request IP addresses.
2. Choose a storage node and insert a USB stick into the node. Leave it in for at least five seconds.
3. Remove the USB stick, and insert it into your computer.
4. Open the `readme.html` file. This takes you to the NetApp Deployment Engine user interface.

Manually assigning IP addresses to access the NetApp Deployment Engine

You can manually assign static IPv4 addresses to the Bond1G and Bond10G interfaces on all NetApp HCI nodes to access the NetApp Deployment Engine and deploy NetApp HCI. You should not use this method unless your network has special requirements.

Before you begin

Attention: All IP addresses you assign manually before using the NetApp Deployment Engine to deploy the system are temporary and cannot be reused. If you choose to manually assign IP addresses, you need to set aside a second permanent set of unused IP addresses that you can assign during final deployment.

- You or your network administrator have completed the tasks in the *Installation and Setup Instructions* document.
- You have physical access to the NetApp HCI nodes.
- All of the NetApp HCI nodes are powered on.
- DHCP is not enabled for the NetApp HCI networks and the NetApp HCI nodes have not obtained IP addresses from DHCP servers.

About this task

In this configuration, compute and storage nodes will use static IPv4 addresses to discover and communicate with other nodes during deployment. This configuration is not recommended.

Steps

1. Plug a KVM into the back of one of the NetApp HCI storage nodes (this node will become the controlling storage node).

2. Configure the IP address, subnet mask, and gateway address for Bond1G and Bond10G in the user interface. You can also configure a VLAN ID for each network if needed.
3. Repeat step 2 for the remaining storage and compute nodes.
4. Open a web browser on a computer that can access the NetApp HCI management network.
5. Browse to the Bond1G IP address you assigned to the controlling storage node. For example:

   ```
   http://<Bond1G IP address>
   ```

   This takes you to the NetApp Deployment Engine user interface.

Related information

H300, H500, and H700 series hardware installation instructions
H600S series hardware installation instructions

Starting your deployment

Before continuing with your NetApp HCI deployment, you need to read and understand the end user license agreements.

Steps

1. On the **Welcome to NetApp HCI** page, click **Get Started**.
2. On the **Prerequisites** page, perform the following actions:
   a. Ensure each prerequisite is met, and click each associated checkbox to confirm.
   b. Click **Continue**.
3. On the **End User Licenses** page, perform the following actions:
   a. Read the NetApp End User License Agreement.
   b. If you accept the terms, click **I accept** at the bottom of the agreement text.
   c. Read the VMware End User License Agreement.
   d. If you accept the terms, click **I accept** at the bottom of the agreement text.
   e. Click **Continue**.

Enabling Data Fabric services

As part of NetApp HCI deployment, you have the option of installing a single-node ONTAP Select cluster as a virtual machine. This enables you to host file services from NetApp HCI. After deployment, you can view information about the ONTAP Select virtual machine using vCenter and manage the file services using OnCommand System Manager.

Before you begin

Ensure that you have a standard or premium ONTAP Select license file. If you need a license, contact your NetApp sales representative for ONTAP Select licensing information.

Step

1. Choose one of the following options:

Option	Steps
Skip ONTAP Select installation	**a.** Click **Continue**.
Install ONTAP Select	**a.** On the **Data Fabric** page, select the check box titled **Yes, I want to enable File Services powered by ONTAP**. **b.** Click **Browse** and select the ONTAP Select license file in the resulting file chooser. **c.** Click **Open**. **d.** Click **Continue**.

VMware vCenter configuration

NetApp HCI makes use of VMware vCenter Server to manage and monitor the VMware ESXi hypervisor installed on each compute node. During deployment, you can install a new vCenter Server as well as the NetApp Element Plug-in for vCenter Server.

Be aware of the following caveats when you use the NetApp Deployment Engine to install a new vCenter Server:

- The NetApp Deployment Engine installs the new vCenter Server Appliance with the Small deployment size option.
- The vCenter Server license is a temporary evaluation license. For continued operation after the evaluation period, you must obtain a new license key from VMware and add it to the vCenter Server license inventory.

Related tasks

Configuring a new VMware vCenter Server environment on page 24

Related information

vCenter Plug-in User Guide in the NetApp HCI Documentation Center
VMware vSphere documentation

Configuring a new VMware vCenter Server environment

You can deploy a new vCenter Server environment as part of the NetApp HCI installation process by providing some of the network information that vCenter Server should use. Note that if you configure vCenter Server using an IP address, the address cannot be changed after installation.

Before you begin

You have obtained the network information for the planned vCenter Server deployment.

Steps

1. Select which version of vCenter Server the system should install during deployment.
2. Configure the new vCenter Server using one of the following options:

Option	Steps
Use a domain name (recommended).	**a.** Select **Configure Using a Fully Qualified Domain Name**. **b.** Enter the vCenter Server domain name in the **vCenter Server Fully Qualified Domain Name** field. **c.** Enter the DNS server IP address in the **DNS Server IP Address** field. **d.** Click **Continue**.
Use an IP address.	**a.** Select **Configure Using an IP Address**. **b.** Click **Continue**.

Configuring credentials

During deployment, you define a common set of credentials to be used for the newly deployed VMware vSphere environment, the NetApp HCI compute and storage resources, management node, and any Data Fabric services you enabled.

About this task

Remember the following points about the credentials you set in the NetApp HCI Deployment Engine:

- To log in to a vCenter Server environment installed as part of deployment, use the same user name that you enter on this page with the following suffix:

  `@vsphere.local`

- To log in to ESXi after deployment, use `root` as the user name and the same password you enter on this page.
- To log in to the ONTAP Select web interface after deployment, use `admin` as the user name and the same password you enter on this page.

Steps

1. On the **Credentials** page, enter a user name in the **User Name** field.
2. Enter a password in the **Password** field.

   The password must conform to the password criteria visible in the **Password must contain** box. If you enter a password that does not meet the required criteria, error text is displayed with correction information.
3. Confirm the password in the **Re-enter Password** field.
4. Click **Continue**.

Selecting a network topology

When cabling NetApp HCI nodes, you have the option of using different network cable configurations depending on your needs. For each compute node, you can use all six network ports, with different types of traffic assigned to each pair of ports, or you can use two ports with all types of

traffic assigned to the ports. Storage nodes use the standard four-cable configuration. Your choice affects which compute nodes are selectable in the inventory.

Before you begin

If you choose the two-cable network topology for compute nodes, consider the following requirements:

- You have a VMware vSphere Enterprise Plus license ready to apply after deployment is complete.
- You have verified that the configuration of your network and network switches is correct.
- VLAN tagging is required for storage and vMotion networks for all compute and storage nodes.

Steps

1. On the **Network Topology** page, select a compute node topology that fits the way you installed compute nodes for NetApp HCI:
   - **6 Cable Option**: The six-cable option provides dedicated ports for each type of traffic (management, virtual machine, and storage).
   - **2 Cable Option**: The two-cable option combines management, virtual machine, and storage traffic on two bonded ports.
2. Optional: If you selected **6 Cable Option**, you can optionally enable vSphere Distributed Switch (VDS).

   Selecting VDS configures a distributed switch, enabling simplified, centralized management of virtual machine network configuration after NetApp HCI deployment is complete. If you choose this option, you must have a vSphere Enterprise Plus license ready to apply after deployment. The two-cable option requires VDS, and automatically enables it.
3. When finished, click **Continue**.

Related concepts

Network configuration and cabling options on page 11

Selecting inventory

On the **Inventory** page, the NetApp Deployment Engine automatically detects available compute and storage nodes, enabling you to select and add all NetApp HCI resources to the deployment.

About this task

The storage node that is hosting the NetApp Deployment Engine is automatically selected, and cannot be deselected. If a node does not meet the requirements for deployment, it is not selectable and problems are indicated in red. You can position your cursor over the error to see an explanation.

Only compute nodes using the network topology you selected on the **Network Topology** page are selectable in the **Compute Nodes** list.

Note: NetApp HCI requires that the CPU generations in all compute nodes match for proper VMware vMotion functionality. Once you select a compute node from the inventory, you cannot select compute nodes with different CPU generations.

Note: The NetApp Deployment Engine does not support H610S storage nodes, and the **Inventory** page does not display them as available nodes. To add H610S nodes to a NetApp HCI deployment, use the Element web interface. For information about adding nodes using the Element web interface, see the *Element Software User Guide*.

Steps

1. On the **Inventory** page, view the list of available nodes.

   If the system cannot detect any inventory, it displays an error. Correct the error before continuing.

   If your system uses DHCP for IP address assignment, the storage and compute resources might not appear in the inventory immediately.

2. Optional: If a resource does not appear in the inventory immediately, or if you address an error and need to refresh the inventory, click **Refresh Inventory**. You might need to refresh the inventory multiple times.

3. Optional: To filter the inventory on certain node attributes, such as node type or the amount of memory, click **Show** in the header of the **Compute Nodes** or **Storage Nodes** lists.

   The system filters the inventory as soon as you enter text into one of the column filter fields.

4. Select all compute nodes that shipped with your system from the **Compute Nodes** list.

   You must select at least two compute nodes to proceed with deployment.

5. Select all storage nodes that shipped with your system from the **Storage Nodes** list.

   You must select at least four storage nodes to proceed with deployment.

6. Optional: If a storage node selection box is flagged, that storage node exceeds 33% of the total storage cluster capacity. Perform one of the following steps:

   - Clear the selection box for the flagged storage node.
   - Select additional storage nodes to more equally distribute the storage cluster capacity between nodes.

7. Click **Continue**.

Configuring network settings

NetApp HCI provides a network settings page with an easy form to simplify network configuration. When you complete the easy form, NetApp HCI automatically populates much of the rest of the information on the network settings page. You can then enter final network settings and verify that the network configuration is correct before proceeding. You do not need to complete the easy form in its entirety.

Before you begin

- You have obtained the following information:
  - The planned naming prefix for the hosts and storage cluster
  - All planned subnet mask, starting IP address, default gateway, and VLAN IDs for the management, iSCSI, and vMotion networks
  - The IP address, default gateway, VLAN IDs, and subnet mask information for any planned VMware vCenter deployment
  - The Network Time Protocol (NTP) server address for NetApp HCI
  - The DNS server IP address information for NetApp HCI
- If you are deploying a vSphere Distributed Switch, you have a vSphere Enterprise Plus license ready to apply after deployment is complete.

- If you assigned VLAN IDs to node ports during Terminal User Interface (TUI) configuration, you have configured those ports with the same VLAN ID during network configuration. You do not need to configure tagged host ports as access ports or native VLANs on the connected switch ports.
- You have verified that your network switch configuration is correct. Incorrect switch configurations (such as incorrect VLANs or MTU size) will cause deployment errors.

About this task

If you selected the two-cable network topology for compute nodes, you must use VLAN IDs for the vMotion and storage networks for all compute and storage nodes in the deployment (VLAN IDs are optional for the management networks).

Steps

1. Optional: To disable live validation of network information you enter on this page, toggle the **Live network validation for this page is currently** switch to **Off**. If you enter a VLAN ID during configuration (including the easy form), or if you are using the two-cable compute node topology, network validation is automatically disabled.
2. In the **Infrastructure Services** section of the **Network Settings** page, enter the DNS and NTP server information for NetApp HCI in the following fields:

Field	Description
DNS Server IP Address 1	The IP address of the primary DNS server for NetApp HCI. If you specified a DNS server on the **vCenter Configuration** page, this field is populated and read-only.
DNS Server IP Address 2 (Optional)	An optional IP address of a secondary DNS server for NetApp HCI.
NTP Server Address 1	The IP address or fully qualified domain name of the primary NTP server for this infrastructure.
NTP Server Address 2 (Optional)	An optional IP address or fully qualified domain name of the secondary NTP server for this infrastructure.

3. Launch the easy form by clicking **To save time, launch the easy form to enter fewer network settings**.

   The **Network Settings Easy Form** dialog appears.
4. Enter a naming prefix in the **Naming Prefix** field.

   The naming prefix is applied to the hostname of each host and the name of the storage cluster. Prefixes can contain letters, numbers, and hyphens, and cannot exceed 55 characters.
5. Choose one of the following options for assigning VLAN IDs.

   Note: When you assign VLAN IDs, you are configuring VLAN tags that NetApp HCI will apply to the network traffic. You do not need to enter your native VLAN as a VLAN ID; to use the native VLAN for a network, leave the appropriate field empty.

Option	Steps
Assign VLAN IDs	**a.** Select **Yes** for the **Will you assign VLAN IDs** option. **b.** In the **VLAN ID** column, enter a VLAN ID for each type of network traffic you want to assign to a VLAN. Both compute vMotion traffic and iSCSI traffic must use an unshared VLAN ID. **c.** Click **Next**. **d.** Click **Clear** to clear input from a row of fields. **e.** In the **Subnet** column, enter subnet definitions in CIDR format for each type of network traffic in each network; for example, `192.168.1.0/24`. **f.** In the **Default Gateway** column, enter the IP address of the default gateway for each type of network traffic in each network. **g.** In the **Starting IP** column, enter the first useable IP address for each network subnet in each network.
Do not assign VLAN IDs	**a.** Select **No** for the **Will you assign VLAN IDs** radio button. **b.** In the **Subnet** column, enter subnet definitions in CIDR format for each type of network traffic in each network; for example, `192.168.1.0/24`. **c.** In the **Default Gateway** column, enter the IP address of the default gateway for each type of network traffic in each network. **d.** In the **Starting IP** column, enter the first useable IP address for each type of network traffic in each network.

6. Click **Apply to Network Settings**.

   This populates the **Network Settings** page with the settings you entered in the easy form.

7. Verify that the data that was populated from the easy form is correct.

8. Click **Continue**.

Reviewing and deploying the configuration

You can review the information you provided before beginning deployment. You can also correct any incorrect or incomplete information before you proceed.

Steps

1. Optional: Click the  icon to download setup information about the installation in CSV format.

   You can archive this file and refer to it later for configuration information.

2. Expand each section and review the information. To expand all sections at once, click **Expand All**.

3. Optional: To make changes to information in any displayed section:

   a. Click **Edit** in the corresponding section.

b. Make the necessary changes.

c. Click **Continue** until you reach the **Review** page. Your previous settings are saved on each page.

d. Repeat steps 2 and 3 to make any other necessary changes.

4. If you do not want to send cluster statistics and support information to NetApp-hosted SolidFire Active IQ servers, clear the final checkbox.

   This disables real-time health and diagnostic monitoring for NetApp HCI. Disabling this feature removes the ability for NetApp to proactively support and monitor NetApp HCI to detect and resolve problems before production is affected.

5. If all information is correct, click **Start Deployment**.

   A dialog appears. In the event of network connectivity issues or power loss during the final setup process, or if your browser session is lost, you can copy the URL displayed in the dialog and use it to browse to the final setup progress page.

6. Review the information in the dialog and click **Copy to Clipboard** to copy the URL to your clipboard.

7. Save the URL to a text file on your computer.

8. When you are ready to proceed with deployment, click **OK**.

   Deployment begins and a progress page is displayed. Do not close the browser window or navigate away from the progress page until deployment is complete. If your browser session is lost for any reason, you can browse to the URL you copied earlier (and accept any security warnings that appear) to regain access to the final setup progress page.

   Note: If the deployment fails, save any error message text and contact NetApp Support.

9. Optional: During deployment, to download setup information about the installation in CSV format, click **Export all setup information to CSV file**.

10. When deployment is complete, click **Launch vSphere Client** to begin managing your new NetApp HCI installation.

Post-deployment tasks

Depending on your choices during the deployment process, you need to complete some final tasks before your NetApp HCI system is ready for production use, such as configuring file services (if enabled).

Related tasks

Configuring File Services powered by ONTAP on page 34

Migrating to an existing vCenter

After deploying NetApp HCI, you can migrate your installation from the vCenter instance deployed with NetApp HCI to an existing vCenter instance in your environment.

Before you begin

If you chose to install vCenter 6.5u2 during NetApp HCI deployment:

- Your existing ESXi environment is version 6.5u1 build 5969303 or later.
- Your existing vSphere environment is version 6.5u2 build 8307201 or later.

If you chose to install vCenter 6.0u3 during NetApp HCI deployment:

- Your existing ESXi environment is version 6.0u3 build 5050593 or later.
- Your existing vSphere environment is version 6.0u3a build 5202527 or later.

Steps

1. Browse to the IP address of the newly installed vCenter instance you installed during NetApp HCI deployment. For example:

   ```
   https://<IP address>/vsphere-client
   ```

2. Log in to the new vCenter instance.
3. Export the vSphere Distributed Switch (VDS) configuration:
   a. Go to **Home > Networking**.
   b. Right-click **NetApp HCI VDS** and select **Settings > Export Configuration**.
   c. In the resulting dialog box, select the **Distributed switch and all port groups** option.
   d. Click **OK**.
   e. Click **Yes**.
   f. Save the backup file to your computer.
4. Unregister the NetApp Element Plug-in from the new vCenter:
   a. Browse to the IP address of the NetApp HCI management node. For example:

      ```
      https://<management node IP address>:9443
      ```

b. Click **Element Plug-in Registration**.

c. Select **Registration Status**.

d. Provide information about the new vCenter and click **Check Status**.

e. Click the **Unregister Plug-in** tab.

f. Click **Unregister**.

5. Disconnect all connected hosts from the new vCenter instance:

   a. Identify the ESXi host that is running the vCenter virtual machine (disconnect this host last).

   b. Right click on each of the other ESXi hosts and select **Connection > Disconnect**, ending with the host that is running the vCenter virtual machine.

6. Browse to the IP address of the existing vCenter instance.

7. Log in to the existing vCenter instance.

8. Create a new cluster in the existing vCenter instance, using the following settings:

   - **Name**: Duplicate of the existing cluster name from the new vCenter instance
   - **DRS**: Turn ON
   - **Automation Level**: Fully automated (default setting)
   - **Migration Threshold**: 50/50 (default setting)
   - **vSphere HA**: Turn ON
     - **Host Monitoring**: Enabled
     - **Admission Control**: Disabled (unchecked)
     - **VM Monitoring Status**: VM Monitoring Only
     - **Monitoring Sensitivity**: High (default setting)
   - **EVC**:
     - Disabled (for deployments with compute nodes of the same generation)
     - Intel Broadwell Generation (for deployments with compute nodes of mixed generations)
   - **Virtual SAN**: Disabled (default setting)

9. Add existing NetApp HCI hosts to the existing vCenter cluster you created:

   a. Right-click on the newly created cluster and select **Add Host**.

   b. Provide the IP address and credentials of the new ESXi host, and follow the prompts that appear.

   c. Click **Next**.

   d. Click **Finish**.

   e. Repeat these steps for any ESXi hosts that you disconnected from the new vCenter instance.

10. Register the NetApp Element Plug-in to the existing vCenter instance.

a. Browse to the IP address of the management node. For example:

```
https://<management node IP address>:9443
```

b. Click **Element Plug-in Registration**.

c. Click **Register Plug-in**.

d. Provide the IP address and credentials of the existing vCenter instance.

e. Click **Register**.

11. Power off the new vCenter instance.

12. Log out from the existing vCenter instance.

13. Log back in to the existing vCenter instance.

14. Add the NetApp HCI storage cluster in the NetApp Element Plug-in:

a. Select **NetApp Element Plug-in > Clusters > Add Cluster**.

b. Provide the management IP address, hostname, and credentials of the cluster.

c. Click **OK**.

15. Add the management node settings to the configuration:

a. Select **Home > NetApp Element Configuration > mNode Settings**.

b. Click the **Action** menu and select **Configure**.

c. Provide the IP address, hostname, and credentials of the management node.

d. Ensure that the management node status is **UP**.

16. Use the NetApp HCI API interface to reconfigure alert integration settings for NetApp HCI:

a. Browse to the API URL of your NetApp HCI system. For example:

```
https://<IP address>:8443/swagger-ui.html
```

b. Run the following API command using the IP address of the new vCenter instance:

```
vcenter:vcenter > DELETE /vcenter
```

17. Import the saved vSphere Distributed Switch (VDS) configuration into the existing vCenter:

a. Log in to the existing vCenter instance.

b. Go to **Home > Networking**.

c. Check for an existing VDS with the name of **NetApp HCI VDS** and delete it if it exists.

d. Right-click on the **NetApp-HCI-Datacenter** object and select **Distributed Switch > Import Distributed Switch**.

e. Browse to and select to the file that you saved earlier.

f. Enable the **Preserve original distributed switch and port group identifiers** option.

g. Click **Next**.

h. Click **Finish**.

18. Connect to the NetApp HCI management node and do the following:
    a. Remove the new vCenter entry from the `/sf/hci/nma/conf/nma.conf` file.
    b. Restart SIOC by running the following command:

```
sudo service sioc restart
```

Configuring File Services powered by ONTAP

If you enabled File Services powered by ONTAP with your system, the deployment process created and provisioned a single-node ONTAP Select instance with one or more datastores based on the capacity of the ONTAP Select license. ONTAP Select has already been configured with a connection to the datastores, which resides on the NetApp HCI storage cluster. You need to configure ONTAP Select before you can use the file services.

About this task

Note that ONTAP volume encryption is disabled in ONTAP Select when deployed with NetApp HCI.

The iSCSI protocol is not supported in ONTAP Select when deployed with NetApp HCI, and is not needed to access the underlying NetApp HCI storage volume.

See the *NetApp HCI File Services Powered by ONTAP Select Quick Start Guide* and the OnCommand System Manager Help for more information about the steps needed to configure file services for production use.

Steps

1. Browse to the IP address of the ONTAP Select virtual machine.

   You can find the IP address by viewing the properties of the ONTAP Select virtual machine in vCenter.

2. Log in to OnCommand System Manager using

   `admin`
   as the user name and the password you configured during the deployment process.

3. Optional: Modify network adapter configuration, if needed.
4. Create one or more aggregates.
5. Create one or more storage virtual machines (SVMs).
6. Create one or more shares.
7. Configure the desired file protocols for the new shares.

Related information

NetApp HCI File Services Powered by ONTAP Select Quick Start Guide
OnCommand System Manager documentation

Keeping VMware vSphere up to date

After deploying NetApp HCI, you should use VMware vSphere Update Manager to apply the latest security patches for the version of VMware vSphere used with NetApp HCI.

Use the *Interoperability Matrix Tool* to ensure that all versions of software are compatible. See the VMware vSphere Update Manager *documentation* for more information.

Expanding an existing NetApp HCI installation

After deployment, you can expand NetApp HCI storage and compute resources either separately or at the same time. After installing the node in the NetApp HCI chassis, you use the NetApp Deployment Engine to configure NetApp HCI to utilize the new resources. NetApp HCI detects the existing network configuration and offers you configuration options within the existing networks and VLANs, if any.

Note that NetApp HCI uses VMware Enhanced vMotion Compatibility (EVC) to ensure vMotion functionality when there are compute nodes with different CPU generations in the vSphere cluster. When EVC is required for expansion, NetApp HCI enables it automatically whenever possible. In the following situations, you might need to manually change EVC settings in the vSphere client to complete expansion:

- The existing compute nodes have a newer CPU generation than the compute nodes you are trying to add.
- The controlling vCenter instance does not support the required EVC level.
- The compute nodes you are trying to add have an older CPU generation than the EVC setting of the controlling vCenter instance.

Expanding NetApp HCI storage resources

After deployment, you can expand and configure NetApp HCI storage resources using the NetApp Deployment Engine.

Before you begin

- You have free and unused IPv4 addresses on the same network segment as existing nodes (each new node must be installed on the same network as existing nodes of its type).
- You have one of the following types of accounts:
  - The native Administrator account that was created during initial deployment
  - A custom user account with Cluster Admin, Drives, Volumes, and Nodes permissions
- You have performed the following actions with each new node:
  - Installed the new node in the NetApp HCI chassis by following the installation and setup instructions available in the NetApp HCI Documentation Center
  - Cabled and powered on the new node
- You have the management IPv4 address of an already installed storage node. You can find the IP address in the **NetApp Element Management > Cluster > Nodes** tab of the NetApp Element Plug-in for vCenter Server.
- Each new node uses the same network topology and cabling as the existing storage or compute clusters.

About this task

Note: The NetApp Deployment Engine does not support H610S storage nodes. To add H610S nodes to a new or existing NetApp HCI deployment, use the NetApp Element software web interface. For information about adding nodes using the Element web interface, see the *Element Software User Guide*.

Tip: When expanding storage resources, storage capacity should be split evenly across all chassis for best reliability.

Steps

1. Browse to the management IP address of one of the existing storage nodes:

   ```
   http://<storage node management IP address>/
   ```

2. Log in to the NetApp Deployment Engine by providing the NetApp HCI storage cluster administrator credentials.
3. Click **Expand Your Installation**.
4. On the **Welcome** page, select **No**.
5. Click **Continue**.
6. On the **Available Inventory** page, select the storage nodes you want to add to the existing NetApp HCI installation.
7. Click **Continue**.
8. On the **Network Settings** page, perform the following steps:
   a. Verify the information detected from the initial deployment.
   b. Each new storage node is listed by serial number, and you need to assign new network information to it. For each new storage node, perform the following steps:
      - If NetApp HCI detected a naming prefix, copy it from the **Detected Naming Prefix** field, and insert it as the prefix for the new unique hostname you add in the **Hostname** field.
      - In the **Management IP Address** field, enter a management IP address for the new storage node that is within the management network subnet.
      - In the **Storage (iSCSI) IP Address** field, enter an iSCSI IP address for the new storage node that is within the iSCSI network subnet.
   c. Click **Continue**.
9. On the **Review** page in the **Network Settings** section, new nodes are shown in bold text. If you need to make changes to information in any section, perform the following steps:
   a. Click **Edit** for that section.
   b. When finished making changes, click **Continue** on any subsequent pages to return to the **Review** page.
10. Optional: If you do not want to send cluster statistics and support information to NetApp-hosted Active IQ servers, clear the final checkbox.

    This disables real-time health and diagnostic monitoring for NetApp HCI. Disabling this feature removes the ability for NetApp to proactively support and monitor NetApp HCI to detect and resolve problems before production is affected.
11. Click **Add Nodes**.

    You can monitor the progress while NetApp HCI adds and configures the resources.
12. Optional: Verify that any new storage nodes are visible in the VMware vSphere Web Client.

Expanding NetApp HCI compute resources

After deployment, you can expand and configure NetApp HCI compute resources using the NetApp Deployment Engine.

Before you begin

- The vCenter instance NetApp HCI is using has vSphere Enterprise Plus licensing if you are expanding an installation with Virtual Distributed Switches.
- None of the vCenter or vSphere instances in use with NetApp HCI have expired licenses.
- You have free and unused IPv4 addresses on the same network segment as existing nodes (each new node must be installed on the same network as existing nodes of its type).
- You have a vCenter administrator account.
- You have performed the following actions with each new node:
  - Installed the new node in the NetApp HCI chassis by following the installation and setup instructions available in the NetApp HCI Documentation Center
  - Cabled and powered on the new node
- You have the management IPv4 address of an already installed storage node. You can find the IP address in the **NetApp Element Management** > **Cluster** > **Nodes** tab of the NetApp Element Plug-in for vCenter Server.
- Each new node uses the same network topology and cabling as the existing storage or compute clusters.

Steps

1. Browse to the management IP address of one of the existing storage nodes:

   ```
   http://<storage node management IP address>/
   ```

2. Log in to the NetApp Deployment Engine by providing the NetApp HCI storage cluster administrator credentials.
3. Click **Expand Your Installation**.
4. On the **Welcome** page, select **Yes**.
5. On the **End User Licenses** page, perform the following actions:
   a. Read the VMware End User License Agreement.
   b. If you accept the terms, click **I accept** at the end of the agreement text.
   c. Click **Continue**.
6. Click **Continue**.
7. On the **vCenter** page, perform the following steps:
   a. Enter a FQDN or IP address and administrator credentials for the vCenter instance associated with your NetApp HCI installation.
   b. Click **Continue**.

c. Select a vSphere datacenter to which to add the new compute nodes.

d. Select a vSphere cluster with which the new compute nodes should be associated.

Note: If you are adding compute nodes with CPU generations that are different than the CPU generation of the existing compute nodes and Enhanced vMotion Compatibility (EVC) is disabled on the controlling vCenter instance, you must enable EVC before proceeding. This ensures vMotion functionality after expansion is complete.

e. Click **Continue**.

8. On the **ESXi Credentials** page, create ESXi administrator credentials for the compute node or nodes you are adding.

   You should use the same master credentials that were created during the initial NetApp HCI deployment.

9. Click **Continue**.

10. On the **Available Inventory** page, select the nodes you want to add to the existing NetApp HCI installation.

    Important: For some compute nodes, you might need to enable EVC at the highest level your vCenter version supports before you can add them to your installation. You need to use the vSphere client to enable EVC for these compute nodes. After you enable it, refresh the **Inventory** page and try adding the compute nodes again.

11. Click **Continue**.

12. On the **Network Settings** page:

    a. Verify the information detected from the initial deployment.

    b. Each new compute node is listed by serial number, and you need to assign new network information to it. For each new compute node, perform the following actions:

    - If NetApp HCI detected a naming prefix, copy it from the **Detected Naming Prefix** field, and insert it as the prefix for the new unique hostname you add in the **Hostname** field.
    - In the **Management IP Address** field, enter a management IP address for the compute node that is within the management network subnet.
    - In the **vMotion IP Address** field, enter a vMotion IP address for the compute node that is within the vMotion network subnet.
    - In the **iSCSI A - IP Address** field, enter an IP address for the first iSCSI port of the compute node that is within the iSCSI network subnet.
    - In the **iSCSI B - IP Address** field, enter an IP address for the second iSCSI port of the compute node that is within the iSCSI network subnet.

    c. Click **Continue**.

13. On the **Review** page in the **Network Settings** section, new nodes are shown in bold text. If you need to make changes to information in any section, perform the following steps:

    a. Click **Edit** for that section.

    b. When finished making changes, click **Continue** on any subsequent pages to return to the **Review** page.

14. Optional: If you do not want to send cluster statistics and support information to NetApp-hosted SolidFire Active IQ servers, clear the final checkbox.

This disables real-time health and diagnostic monitoring for NetApp HCI. Disabling this feature removes the ability for NetApp to proactively support and monitor NetApp HCI to detect and resolve problems before production is affected.

15. Click **Add Nodes**.

    You can monitor the progress while NetApp HCI adds and configures the resources.

16. Optional: Verify that any new compute nodes are visible in vCenter.

Related information

H300, H500, and H700 series hardware installation instructions
H600S series hardware installation instructions
VMware Knowledge Base: Enhanced vMotion Compatibility (EVC) processor support

Accessing NetApp SolidFire Active IQ

By default, NetApp HCI sends performance and alert statistics to the NetApp SolidFire Active IQ service. As part of your normal support contract, NetApp Support monitors this data and alerts you to any performance bottlenecks or potential system issues. You need to create a NetApp Support account if you do not already have one (even if you have an existing SolidFire Active IQ account) so that you can take advantage of this service.

Steps

1. Open a web browser and browse to *https://activeiq.solidfire.com*.
2. Do one of the following:

Scenario	Steps
You do not have a NetApp Support account (or you currently have an existing SolidFire Active IQ account)	**a.** Click **Sign up now**. The NetApp Support account registration pages appear. **b.** Follow the instructions on these pages to register for a NetApp Support account. **c.** After your account is activated, reopen the *https://activeiq.solidfire.com* login page and proceed with the steps in the following option.
You have an existing NetApp Support account (or have just created an account)	**a.** On the login page that appears, log in with your NetApp Support credentials. **b.** When you are logged in, the Dashboard appears and you can monitor your NetApp HCI installation usage statistics. **c.** See the online help documentation within the Active IQ interface.

NetApp HCI system alerts

You can use the Alert Monitor tab in the web UI on a management node to run a system test and configure settings for a NetApp HCI monitor server.

You can access the Alert Monitor settings by browsing to the NetApp HCI management node IP address using the following notation:

```
https://<IP address>:442
```

VMware vCenter Alert Monitor

The following table details the configuration options for the alert monitor functionality:

Option	Description
Run Alert Monitor Tests	Runs the monitor system tests to check for the following: • NetApp HCI and VMware vCenter connectivity • Pairing of NetApp HCI and VMware vCenter through datastore information supplied by the QoSSIOC service • Current NetApp HCI alarm and vCenter alarm lists
Collect Alerts	Enables or disables the forwarding of NetApp HCI storage alarms to vCenter. You can select the target storage cluster from the drop-down list. The default setting for this option is `Enabled`.
Collect Best Practice Alerts	Enables or disables the forwarding of NetApp HCI storage Best Practice alerts to vCenter. Best Practice alerts are faults that are triggered by a sub-optimal system configuration. The default setting for this option is `Disabled`. When disabled, NetApp HCI storage Best Practice alerts do not appear in vCenter.
Collect ONTAP Alerts	Enables or disables the forwarding of ONTAP Select alarms to vCenter. When disabled, ONTAP Select alarms do not appear in vCenter.
Send Support Data To AIQ	Controls the flow of support and monitoring data from VMware vCenter to SolidFire Active IQ. • `Enabled`: All vCenter alarms, NetApp HCI storage alarms, and support data are sent to SolidFire Active IQ. This enables NetApp to proactively support and monitor the NetApp HCI installation, so that possible problems can be detected and resolved before affecting the system. • `Disabled`: No vCenter alarms, NetApp HCI storage alarms, or support data are sent to SolidFire Active IQ.

Option	Description
Send Compute Node Data To AIQ	Controls the flow of support and monitoring data from the compute nodes to AIQ. • `Enabled`: Support and monitoring data about the compute nodes is transmitted to SolidFire Active IQ to enable proactive support for the compute node hardware. • `Disabled`: Support and monitoring data about the compute nodes is not transmitted to SolidFire Active IQ.

NetApp HCI related documentation

You can find more information about NetApp HCI in the NetApp product documentation library.

Document	Focus	Description
Installation and Setup Instructions	Hardware installation and setup	A quick start guide for hardware installation, including racking and cabling.
Installing Rails for H600S Series Storage Nodes	Hardware installation and setup	Describes how to install rails for NetApp H600S series storage nodes.
Installing Rails for NetApp HCI H-Series Nodes	Hardware installation and setup	A quick start guide for installation of the rails into a four-post rack.
NetApp HCI Deployment Guide	Deployment	Describes the NetApp HCI deployment process and its requirements. It also contains descriptions of system architecture and features, including Active IQ and alert monitoring management.
NetApp HCI File Services Powered by ONTAP Select Quick Start Guide	Advanced storage operations	Describes how to configure NetApp HCI File Services powered by ONTAP Select during the NetApp HCI deployment process.
NetApp Element Plug-In for vCenter Server Release Notes	System management	Describes the latest features and updates to the tool for managing NetApp HCI resources within vCenter.
NetApp Element Plug-In for vCenter Server User Guide	System management	Describes the tool for managing NetApp HCI resources within vCenter.
NetApp Element software User Guide	Advanced storage operations	Describes storage cluster management using the Element software web interface. You can use the Element web UI to perform some advanced operations that you cannot perform with the vCenter Plug-In. This document also describes how to install a management node.

Document	Focus	Description
NetApp Element software API Reference Guide	Advanced storage operations	Describes storage management using Element software APIs. You can use the Element API to perform some advanced operations that you cannot perform with the vCenter Plug-In.
Replacing a Failed Power Supply Unit in an H600S Series Chassis	Hardware maintenance	Describes how to replace a failed power supply unit in an H600S series chassis.
Replacing a Failed H600S Series Node	Hardware maintenance	Describes how to replace a failed H600S series storage node.
Replacing a Failed Storage Node in a NetApp HCI H-Series Chassis	Hardware maintenance	Describes how to replace a failed storage node in an H-Series chassis.
Replacing a Failed Compute Node in a NetApp HCI H-Series Chassis	Hardware maintenance	Describes how to replace a failed compute node in an H-Series chassis.
Replacing a Failed Power Supply Unit in a NetApp HCI H-Series Chassis	Hardware maintenance	Describes how to replace a failed power supply unit in an H-Series chassis.
Replacing a Failed NetApp HCI H-Series Chassis	Hardware maintenance	Describes how to replace a failed H-Series chassis.
Replacing a Solid-State Drive for a NetApp HCI H-Series Storage Node	Hardware maintenance	Describes how to replace a failed solid-state drive for an H-Series storage node.
Replacing Drives for H600S Series Storage Nodes	Hardware maintenance	Describes how to replace SSDs for H600S series storage nodes.
NetApp HCI Datasheet	Hardware specifications	Describes benefits and hardware specifications of NetApp HCI.

Related information

NetApp HCI Product Library

Contacting NetApp Support

If you need help with or have questions or comments about NetApp products, contact NetApp Support.

- Web: *mysupport.netapp.com*
- Phone:
  - 888.4.NETAPP (888.463.8277) (US and Canada)
  - 00.800.44.638277 (EMEA/Europe)
  - +800.800.80.800 (Asia/Pacific)

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doccomments@netapp.com

To help us direct your comments to the correct division, include in the subject line the product name, version, and operating system.

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You can also contact us in the following ways:

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