NetApp HCI Cloud Services and Solutions

HCI

NetApp
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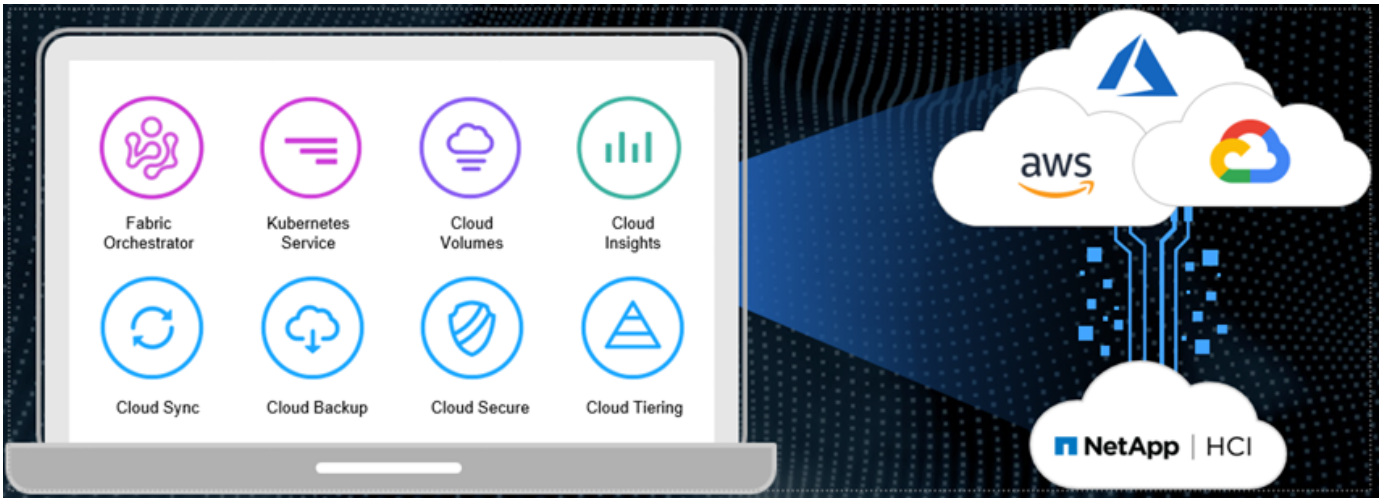
NetApp HCI Cloud Services

With NetApp HCI, a hybrid cloud infrastructure that serves as a deployment engine supporting NetApp Kubernetes Service, you can set up a cloud native development pipeline quickly and easily.

THIS DOCUMENTATION IS PROVIDED AS A TECHNOLOGY PREVIEW.



To use cloud services on NetApp HCI, do the following:

- Review prerequisite information.
- Enable cloud services, such as the NetApp Kubernetes Service and Cloud Volumes on NetApp HCI, using the NetApp Hybrid Cloud Control
- Create and manage Kubernetes clusters using the NetApp Kubernetes Service on NetApp Cloud Central.
- Create and manage Cloud Volumes on NetApp HCI using NetApp Fabric Orchestrator on NetApp Cloud Central.

Find more information

- NetApp Cloud Services and Solutions
- NetApp Cloud Central
- NetApp Cloud Documentation
- NetApp HCI Documentation Center

Concepts

Cloud services on NetApp HCI overview

NetApp HCI installations connect to, register with, and become a deployable region with NetApp Cloud Central.

What you can do with cloud services on NetApp HCI

- Deploy services across cloud providers and your private cloud.
- Interact with NetApp HCI as you would with any other supported cloud provider.
- Port the apps and data across a hybrid cloud architecture regardless of cloud location without compromising service-level agreements.
- Spin up cloud-native applications yourself. See Adding applications to your Kubernetes cluster using the NetApp Kubernetes Service.
- Create cloud volumes on the Kubernetes cluster by using the NetApp Fabric Orchestrator. See Managing Cloud Volumes on NetApp HCI overview information.

Find more information

- NetApp HCI Documentation Center
- NetApp Cloud Central
- NetApp Cloud Documentation
- NetApp Kubernetes Service Documentation

Types of cloud services on NetApp HCI

The following NetApp cloud services are supported on NetApp HCI.

- **NetApp Kubernetes Service**: You must use NetApp Kubernetes Service (NKS), a SaaS platform that enables you to deploy a Kubernetes cluster in the cloud with the major cloud providers and also with NetApp private cloud. This is required to enable cloud services on NetApp HCI. This service is installed as VMs on a NetApp HCI compute node or nodes. *Available in Preview mode*.

  See Managing Kubernetes clusters on NetApp HCI overview information.

- **NetApp Cloud Volumes**: To manage Cloud Volumes on NetApp HCI, select this service. This service offers an on-demand shared file systems feature on your premises. The Cloud Volumes option will enable Data Fabric replication to and from public clouds. Cloud Volumes on NetApp HCI can be deployed only on a vCenter with a single datacenter. *Available in Preview mode*.

See Managing data in Cloud Volumes on NetApp HCI information.

- **NetApp Cloud Insights**: This service will enable you to monitor cloud services on NetApp HCI. *Coming soon*.

NetApp Fabric Orchestrator provides a centralized storage and data management control plane for fabric-wide, multi-cloud visibility, monitoring, policies, administration and workflow orchestration for NetApp storage systems on-premises and in the cloud.
Using NetApp Fabric Orchestrator, you can discover, manage, and govern your storage assets and data estate, anywhere. Use Fabric Orchestrator to create and manage Cloud Volumes on NetApp HCI.

Using Fabric Orchestrator, you can enable these services:

- **Cloud Volumes on NetApp HCI**: NetApp HCI provides the platform for the NetApp Kubernetes Service and Cloud Volumes. This documentation provides information only on this service.
- **Cloud Volumes Service for On Premises**: This option is a fully managed private cloud storage service that is available for customers within their own on-premises data centers. NetApp configures and manages your infrastructure so you don‘t have to. This alternate storage consumption model offers high-performance storage for customers and partners wanting a cloud-like OPEX billing model managed by our NetApp cloud operations experts.

See Managing data in Cloud Volumes on NetApp HCI information.

Notice of functional preview

NetApp Kubernetes Service and Cloud Volumes on NetApp HCI are presently available as a functional preview. While in preview, the services are only for non-production environments and noncommercial use. By participating in the preview, participants agree to be bound by the cloud services terms of service.

Top Links

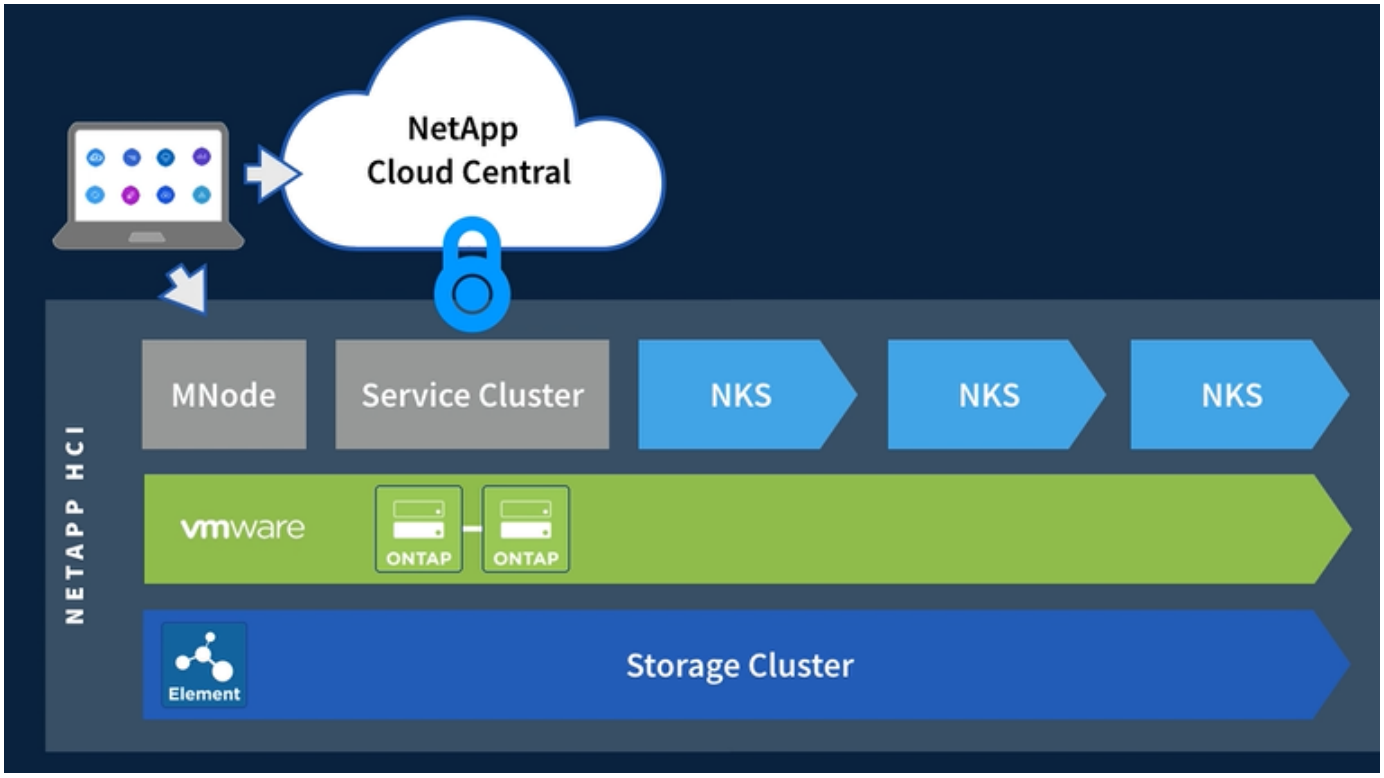
- Deploying cloud services on NetApp HCI overview
- Functional Preview Terms of Service

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation
- NetApp HCI Documentation Center
- NetApp Kubernetes Service Documentation

Architecture overview for cloud services on NetApp HCI

NetApp HCI along with NetApp Kubernetes Service enables you to deploy your applications as you would with a public cloud provider—all in a self-service mode. This enables you to treat your datacenter as a deployable region of your multi-cloud.



Components

The following components are used for cloud services on NetApp HCI:

- **NetApp Deployment Engine**: Deploys NetApp HCI.
- **NetApp HCI management node**: Establishes a connection to NetApp Cloud Central and authenticates and registers the NetApp HCI installation to a Cloud Central account. You can use the management node also to update management service bundles.
- **NetApp Hybrid Cloud Control**: Deploys and configures NetApp HCI Element and enables cloud services on NetApp HCI.
- **NetApp Kubernetes Service agent**: Maintains a communication tunnel between NKS and NetApp HCI, creates user clusters, and maintains deployed cloud services.

Top Links

- Deploying cloud services on NetApp HCI overview

- NetApp HCI Documentation Center

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation

What happens when you enable NetApp Kubernetes Service?

NetApp HCI creates a bootstrap agent that establishes an encrypted communication tunnel to the NetApp Kubernetes Service control plane and creates a *service cluster*.

The service cluster, connected to NetApp Kubernetes Service, acts as a service orchestrator to deploy services and update itself. The NetApp Kubernetes Service agent maintains the tunnel, maintains deployed service clusters, and enables you to create *user clusters* on which you can place applications or solutions.

After a service cluster is deployed on your system, requested software along with updates can be updated on your NetApp HCI systems.

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation

Cluster types in cloud services on NetApp HCI

You'll encounter different types of clusters when using cloud services on NetApp HCI.

- **Service cluster**: Connected to NetApp Kubernetes Service (NKS), a service cluster acts as an orchestrator to deploy services and update itself. The service cluster is a set of compute nodes and storage resources that form a Kubernetes environment. Each cluster has at least one master node, which is responsible for overall management of the cluster, and three worker nodes, on which containers are scheduled to execute. Service clusters are for internal NKS use and are not available for running your applications. Service clusters are not listed in the NKS UI. Service clusters should not be modified or deleted.
- **User cluster**: These are workload clusters on which you add any number of applications. These clusters are maintained in NetApp Kubernetes Service.

Find more information

- NetApp Kubernetes Service documentation
- NetApp Cloud Central
- NetApp Cloud Documentation

Kubernetes terminology

Cloud services on NetApp HCI involves pods, volumes, and projects that you create and manage by using the NetApp Kubernetes Service (NKS). Persistent volumes are managed by Trident software.

- **NKS workspace**: The NKS *workspace* enables you to group together projects, teams, and members. This lets you tailor access to the exact needs of a group of users. For example, you may want to allow a certain team access to build and manage clusters at one particular provider. This can be accomplished by creating a workspace for that team (or teams). Then assign specific Provider Credentials to that workspace.
- **NKS clusters**: NKS enables you to create and manage *clusters* at the provider of your choice. You can customize defaults, such as the region, size, and number of nodes. And, you can add packaged Helm charts.
- **NKS pod**: A *pod* is the NKS atomic unit. It is the smallest unit that can be deployed. A pod consists of one or more containers that share the same namespace, IP addresses, and volume. It can exist only on a single node.
- **NKS project**: An NKS *project* is a construct for grouping applications, for example, Wordspace or MySQL. A project is a namespace with RBAC on the Kubernetes cluster. Projects are the heart of application lifecycle management. Clusters can have many projects, and each project can have many solutions, including applications and packages. Clusters can represent different environments, like a test, staging, and production environment. In this case, each cluster environment will be running a similar version of the same project.
- **Solutions on NKS**: With NKS, you can move workloads with predesigned solutions or applications to the cloud platform that suits your needs, with any of the major hyperscalers or an on-premises environment. This list of open-source technologies includes:
  - fabric8
  - GitLab
  - Helm
  - Istio
  - Linkerd
  - Prometheus
  - Trident is another solution that's preinstalled with the NetApp Kubernetes Service. With

Trident, NetApp solutions such as Cloud Volumes Service can meet persistent volume claims that are made by Kubernetes clusters.

- **NKS volume**: An NKS *volume* is storage provisioned directly to a pod. NKS supports a wide variety of volume types, including Amazon EBS, Azure Disk Storage, volumes managed by NetApp Element, NFS, and many more. Volumes enable the containers within a pod to share information and are destroyed when their parent pod is deleted.

Trident software and persistent storage

- **Persistent storage**: With NKS, you can use a *persistent volume*, one that exists independently of any specific pod and with its own lifetime. Persistent volumes can be used to support stateful applications, such as database services, enabling all components of an enterprise solution to be deployed and managed by NKS. Using Trident to manage persistent volume claims (PVCs) insulates the developers creating pods from the lower-level implementation details of the storage that they are accessing.
- **Trident software with NKS**: The NetApp Kubernetes Service on NetApp HCI employs Trident software to provision storage automatically to containerized applications. Trident is automatically deployed and configured when new NKS clusters are created. When a containerized application issues a PVC request, Trident dynamically provisions storage per the parameters requested against the NetApp Element software storage layer in NetApp HCI.

Trident, itself a Kubernetes-native application, runs directly within a Kubernetes cluster. With Trident, Kubernetes users (such as developers, data scientists, and Kubernetes administrators) can create, manage, and interact with persistent storage volumes in the standard Kubernetes format that they are already familiar with.

With Trident, NetApp solutions such as Cloud Volumes Service can meet persistent volume claims that are made by Kubernetes clusters

For details, visit the Trident website.

Find more information

- NetApp Kubernetes Service documentation
- NetApp Cloud Central
- NetApp Cloud Documentation

Prerequisites for cloud services on NetApp HCI

Prerequisites overview

Before you begin with cloud services on NetApp HCI, you should review the following items:

- Review your NetApp Cloud Central account information or sign up, if you don't already have an account.
- Review requirements for your system, port, networking, and browser.
- Check out licensing requirements.
- Get a NetApp Kubernetes Service API token.

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation

Cloud Central accounts

Each NetApp HCI system that has cloud services enabled is associated with a NetApp Cloud Central account. A Cloud Central account is the *workspace* in which you deploy cloud services on NetApp HCI.

The account is maintained in Cloud Central, so any changes that you make to it are available to other NetApp cloud data services.

A Cloud Central account enables multi-tenancy:

- A single Cloud Central account can include multiple NetApp HCI systems that serve different business needs. Because users are associated with the Cloud Central account, there's no need to configure users for each individual NetApp HCI system.
- Within each NetApp HCI system, multiple users can deploy and manage NetApp HCI systems in isolated environments called *workspaces*. These workspaces are invisible to other users, unless they are shared.

When you deploy NetApp HCI and enable cloud services, you select the Cloud Central account to associate with the system. Account admins can then modify the settings for this account by managing users, workspaces, and service connectors.

Using Cloud Central, you can set up accounts as individual accounts or as Federated accounts:

- You can make a new account with name, email, and password and then you are logged in. This is the simplest type of account.
- If you are part of a Cloud Central Federated organization, you enter your email and are then routed to the organization login.

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation

Sign up for a Cloud Central account

Before you enable cloud services on NetApp HCI, you must have a Cloud Central account.

Steps

1. Go to NetApp Cloud Central.
2. Click **Sign Up**.
3. Enter a valid business email address and choose a password.
4. Enter your company name and your full name.
5. Accept the terms and conditions and click **Sign Up**.

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation

Requirements before you begin with cloud services

Before you use cloud services on NetApp HCI, you should have completed networking and other requirements.

System requirements

- A NetApp HCI 1.6 or later system deployed by the NetApp Deployment Engine (NDE)
- Upgraded NetApp HCI management services. See management services information in the NetApp Element User Guide.

- NetApp Hybrid Cloud Control available on the management node of your system
- NetApp HCI management node 2.2 or later (requires updates from the 2.0 version)
- Your version of VMware vCenter supported by the NetApp HCI Deployment Engine
- All nodes must have IP addresses assigned to them by Dynamic DHCP. A DHCP server must be able to run on all NKS networks.
- The “NetApp-HCI-Datastore-02” datastore must exist in vSphere. It is a requirement for enabling NKS. If the datastore does not exist, the cloud services installation will not be successful. Before enabling cloud services, check vSphere to see that the datastore is there. If you are creating the datastore, it must meet the following conditions: 2 TiB in size, formatted as a VMware Virtual Machine File System (VMFS), shared with all compute hosts, and with the default QoS (or higher).
- Ports must be opened in the firewall as specified in NKS information. https://docs.netapp.com/us-en/kubernetes-service/whitelist-ports-and-ip-addresses.html

Running NKS services through a proxy server is not supported.

Networking requirements

- You must have already configured the required vSphere distributed switches (VDS). VMware standard switches (VSS) are not supported.
- You must have already configured the recommended vSphere distributed switch (VDS) port groups:
  - NetApp HCI VDS 01-HCI_Internal_NKS_Management
  - NetApp HCI VDS 01-HCI_Internal_NKS_Workload
  - NetApp HCI VDS 01-HCI_Internal_NKS_Data
- Using VDS requires a vSphere Enterprise Plus license. You must have this license.

System size requirements

- 2x4 systems are not supported for production use. However, you can use these for demo work.
- 3x4 systems are the minimum production system size we support.
- 4x4 systems are the recommended minimum size.

NetApp Kubernetes Service requirements

- A NetApp Kubernetes Service (NKS) account
- A NetApp Kubernetes Service API token, which authorizes the installer to access the NKS organization. You can create this before or during the process of enabling cloud services on NetApp HCI.

Requirements for Cloud Volumes on NetApp HCI and NetApp Fabric Orchestrator

- An NKS account. NetApp HCI installs the service cluster on NKS, which in turn installs the Kubernetes pods, which is a set of one or more containers used for Cloud Volumes on NetApp HCI.
- All requirements needed for NKS, such as the NKS API token, which authorizes the installer to access the NKS organization.
- Access to the NKS storage system
- A Cloud Central account

Browser requirements

- Any modern browser

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation
- NetApp HCI Documentation Center

Licensing requirements

Before you begin using Cloud Volumes on NetApp HCI, you will need to obtain licenses. You can obtain the licenses before or during the use of the Cloud Services wizard.

The Cloud Services wizard provides a link to obtain the licenses; however, you will need your software license serial numbers. You can get the serial numbers from the NetApp Support Site at mysupport.netapp.com.

Licensing requirements for Cloud Volumes on NetApp HCI

Because Cloud Volumes on NetApp HCI is supported by NetApp ONTAP HA clusters and each requires a license, Cloud Volumes on NetApp HCI requires two “ONTAP Select Premium” licenses.

The NetApp licensing files use the following format:

NLF<serialnumber>.txt

Fabric Orchestrator is in Preview mode. When you enable Cloud Volumes on NetApp HCI, you automatically have access to the Preview environment.

Licensing requirements for NetApp Kubernetes Service

NetApp Kubernetes Service does not require an additional license.

NetApp Kubernetes Service is metered and billed by the number of worker nodes in the managed Kubernetes clusters. While these Kubernetes worker nodes are virtual machines that are running on a cluster and NetApp HCI compute nodes, the number of physical compute nodes in the NetApp HCI environment are an unrelated entity for metering and billing purposes.

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation

Get a NetApp Kubernetes Service API token

Enabling cloud services for NetApp HCI requires a NetApp Kubernetes Service API token that is associated with your NetApp Cloud Central account.

You can complete these steps before enabling cloud services or during the process, when a wizard displays a link to get the API token.

Steps

1. Open a web browser and browse to NetApp Cloud Central for NetApp Kubernetes Service. https://nks.netapp.io
2. Log in by providing the NetApp HCI storage cluster administrator credentials.

   If you do not have an account, click **Sign Up** and provide the account information.

3. Click **Go to Cloud Data Services** and select **NetApp HCI**.
4. Click the user icon at the top right of the screen and select **Edit Profile**.
5. In the API Tokens section, click **Add Token**, enter a token name, and click **Create**.
6. Copy the token and save it in a file so that you can later paste it when needed.

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation
- NetApp Kubernetes Service
- NetApp Kubernetes Service Documentation

Enable cloud services on NetApp HCI

Deploy cloud services on NetApp HCI overview

NetApp HCI installations connect to, register with, and become a deployable region with NetApp Cloud Central. With this, you can centrally manage cloud services for NetApp HCI on-premise systems in the same way that you do in public clouds.

Deployment overview

Deploying and configuring a NetApp HCI solution in the cloud involves these steps. Our user interfaces help you every step of the way:

- Deploy and configure NetApp HCI using the quick and easy NetApp Deployment Engine that you've used previously. See the NetApp HCI Deployment Guide in the NetApp HCI Documentation Center.
- Enable cloud services using the management node along with a NetApp Hybrid Cloud Control wizard. You establish a connection to NetApp Cloud Central and authenticate and register your NetApp HCI installation to your Cloud Central account.
- Create a Kubernetes cluster using the NetApp Kubernetes Service, one of many services located on NetApp Cloud Central.
- Create a Kubernetes project.
- Add applications to your Kubernetes cluster.
- Create cloud volumes using NetApp Fabric Orchestrator.

Find more information

- NetApp HCI Documentation Center
- NetApp Cloud Central
- NetApp Cloud Documentation

Enable cloud services

Enabling NetApp cloud services adds your local NetApp HCI system as a region to NetApp Cloud Central.

Enabling cloud services is performed using the NetApp Hybrid Cloud Control.

About this task

This lets you use NetApp Kubernetes Service and Cloud Volumes on NetApp HCI on your on-premises private cloud. With the NetApp Kubernetes Service, you can deploy and manage

Kubernetes clusters.

A NetApp Hybrid Cloud Control wizard takes you through the following tasks:

- Select the cloud services you want to enable.
- Obtain a Kubernetes API token and register your installation with NetApp Cloud Central.
- Select the vCenter resources.
- If you enabled Cloud Volumes on NetApp HCI, enable licenses using a link to the NetApp License Generator.
- Configure networking.

Sign in to or register with NetApp Cloud Central

1. Access NetApp Hybrid Cloud Control (HCC) by opening a web browser and browsing to the IP address of the management node:
   "https://<_ManagementNodeIP_>"

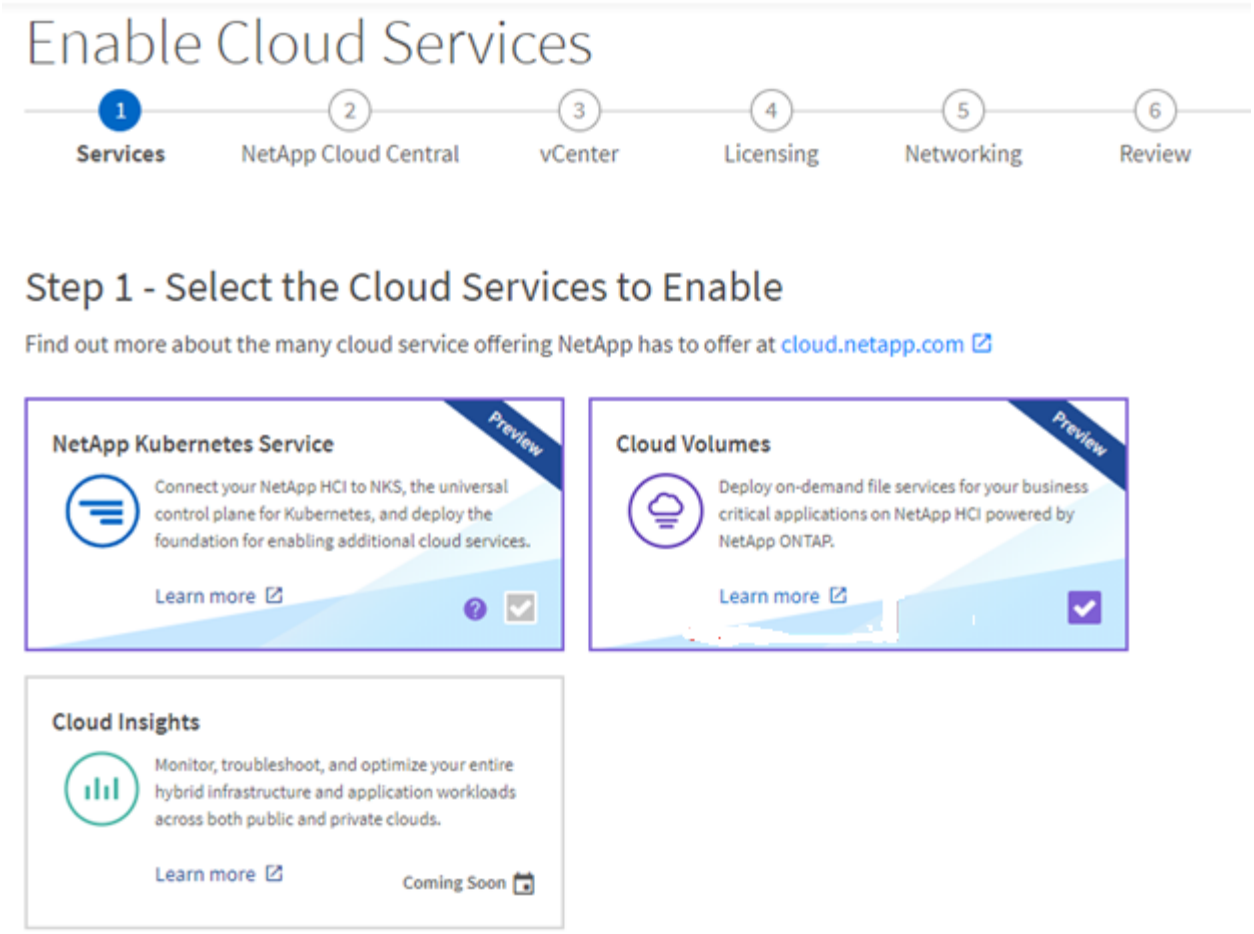
   

   For details, see Accessing NetApp Hybrid Cloud Control.

2. Click the **Cloud** icon.

   An outline of a cloud indicates that no services have been enabled. A filled in cloud indicates that some services have been enabled.

3. In the Cloud Services popup, review the services that are available and click **Enable Cloud Services**.



Select the Cloud Services you want to enable

SERVICES and INFORMATION ARE PROVIDED as a TECHNOLOGY PREVIEW. You might see a different set of services than those listed here.

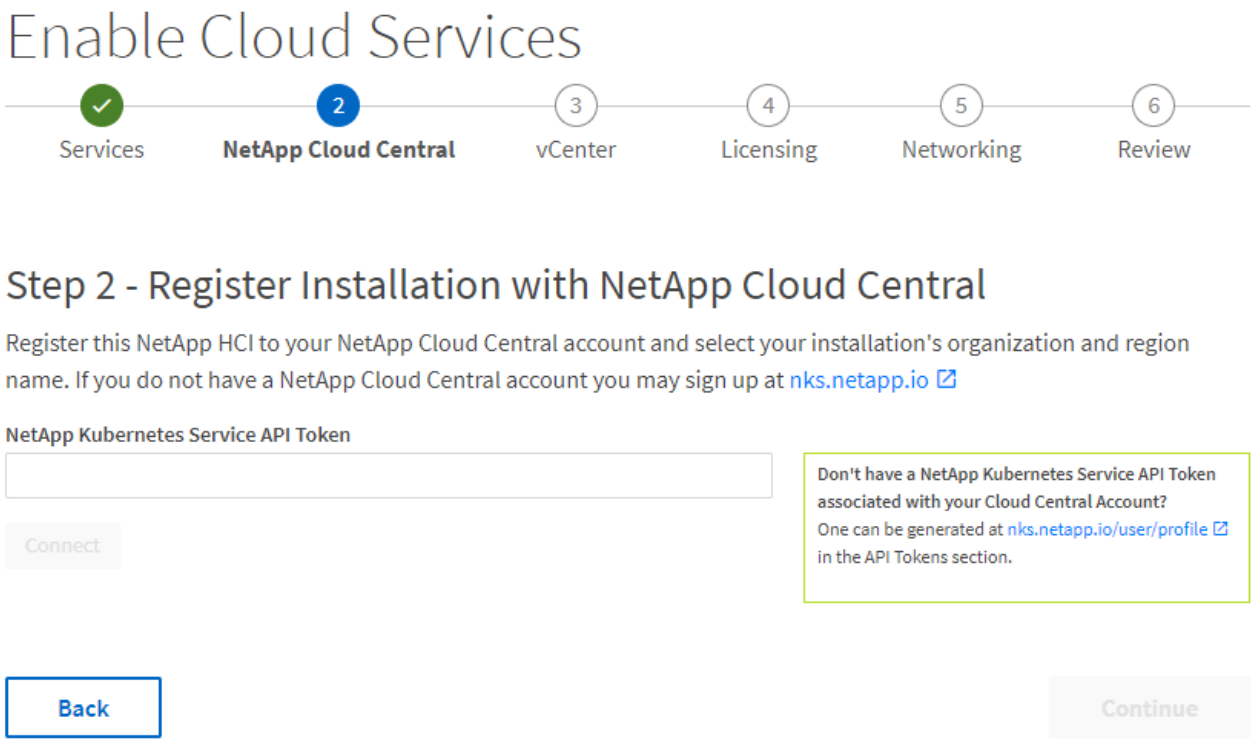
1. On the Services page, select the services that you want to enable.
   - **NetApp Kubernetes Service**: You must use NetApp Kubernetes Service, a SaaS platform that enables you to deploy a Kubernetes cluster in the cloud with the major cloud providers and also with a NetApp private cloud. This is required to enable cloud services on NetApp HCI. This service is installed as a VM on a NetApp HCI compute node.
   - **Cloud Volumes**: To install Cloud Volumes on NetApp HCI, select this service. This service offers an on-demand shared file systems feature on your premises. The Cloud Volumes option will enable Data Fabric replication to and from public clouds.
   - **Cloud Insights**: This option will enable you to monitor cloud services on NetApp HCI. *Coming soon.*
2. Click **Continue**.

Get a Kubernetes API token

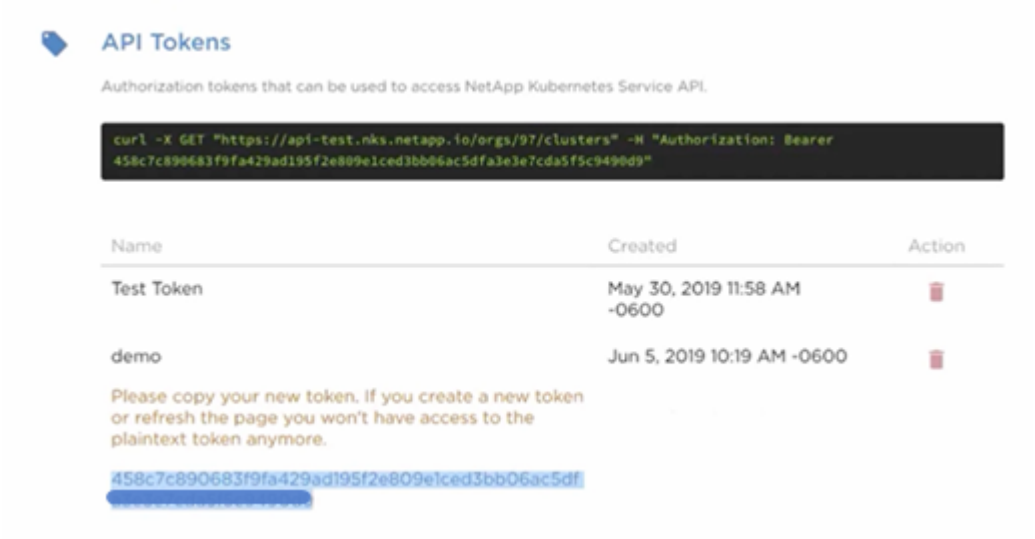
Enabling cloud services on NetApp HCI requires a NetApp Kubernetes Service API token that is associated with your Cloud Central account. You can complete these steps prior to enabling cloud services or during the process.

If you already have a NetApp Kubernetes Service API token, you can skip this procedure.

1. On the Enable Cloud Services > NetApp Cloud Central page, click the **API token** link to get a Kubernetes Service API token if you do not already have one.

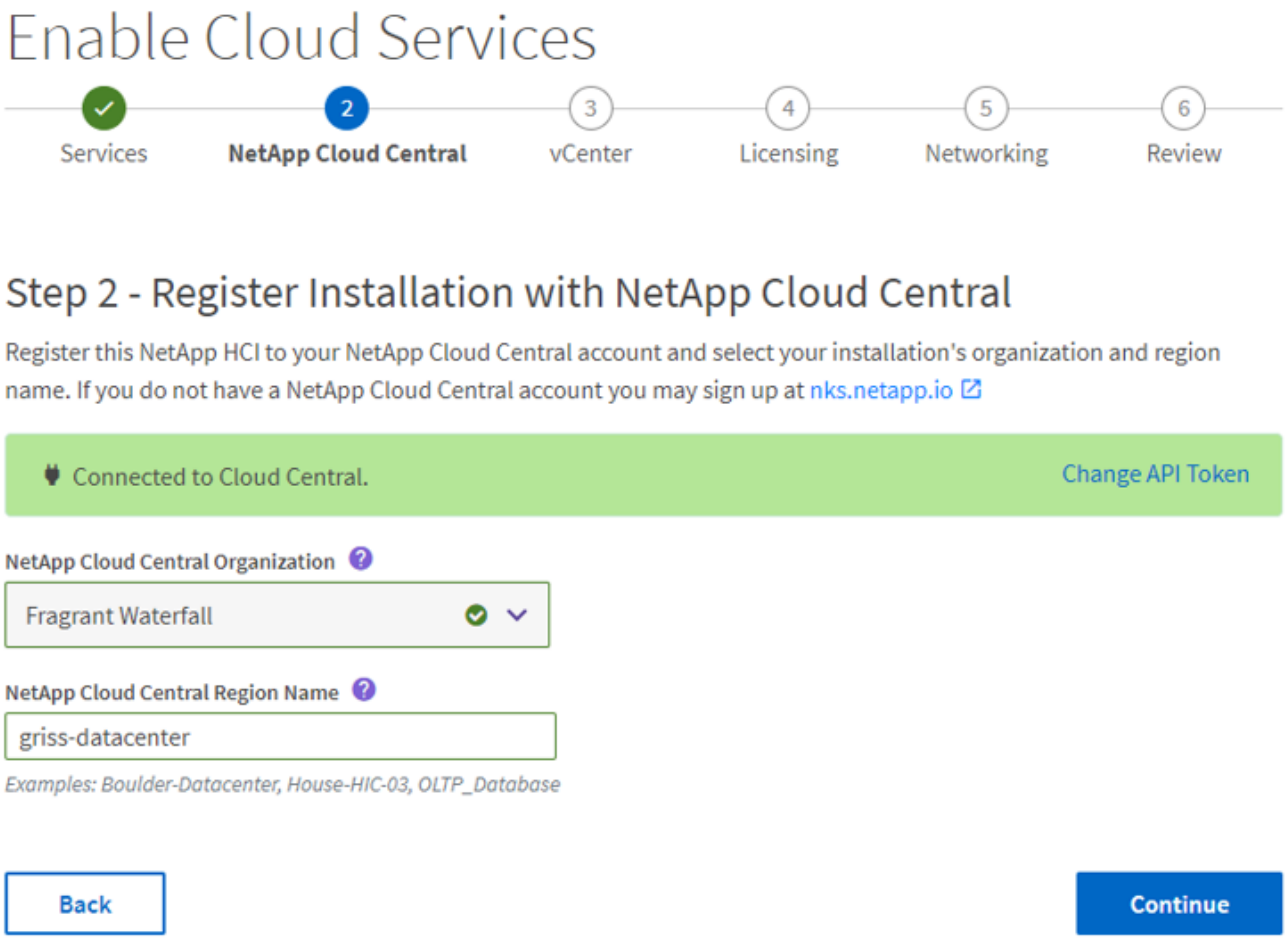


2. Enter a token name and click **Create**.



3. Copy the token.
4. Return to NetApp Hybrid Cloud Control and paste it into the NetApp Kubernetes Service API Token field.
5. Click **Connect**.

   The registration is now established and you are connected to Cloud Central. The Organization and Region Name fields appear listing the datacenters and regions available for this Cloud Central connection.



Register your installation with NetApp Cloud Central

1. On the NetApp Cloud Central page, select your Cloud Central organization and region name.

   This region name is used to identify this NetApp HCI installation and is used as the site name for any NetApp Kubernetes clusters created on this installation.

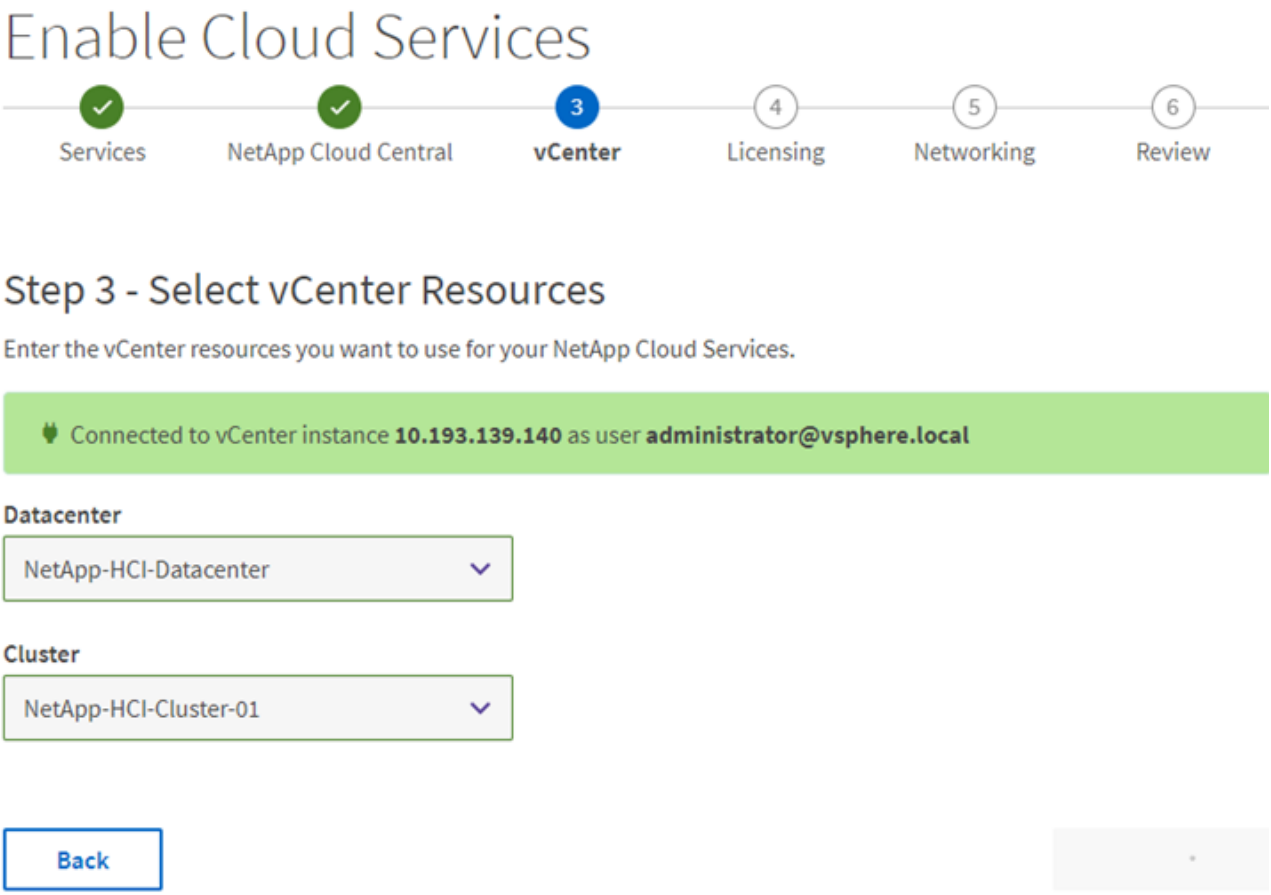
2. Click **Continue** to go to the vCenter Resources page.

Select the vCenter resources

Because the management node is connected to the vCenter, the vCenter used for deployment is displayed.

1. On the vCenter page, enter or select the following:
   a. **Datacenter**: Select a datacenter from those configured on the NetApp HCI system.
   b. **Cluster**: Select a cluster from those configured on the NetApp HCI system.
   c. **Switch**: Select a switch. Only switches that meet the redundant management and storage uplinks are displayed.

   The vCenter instance and admin user connected to it are displayed.



2. Click **Continue**.

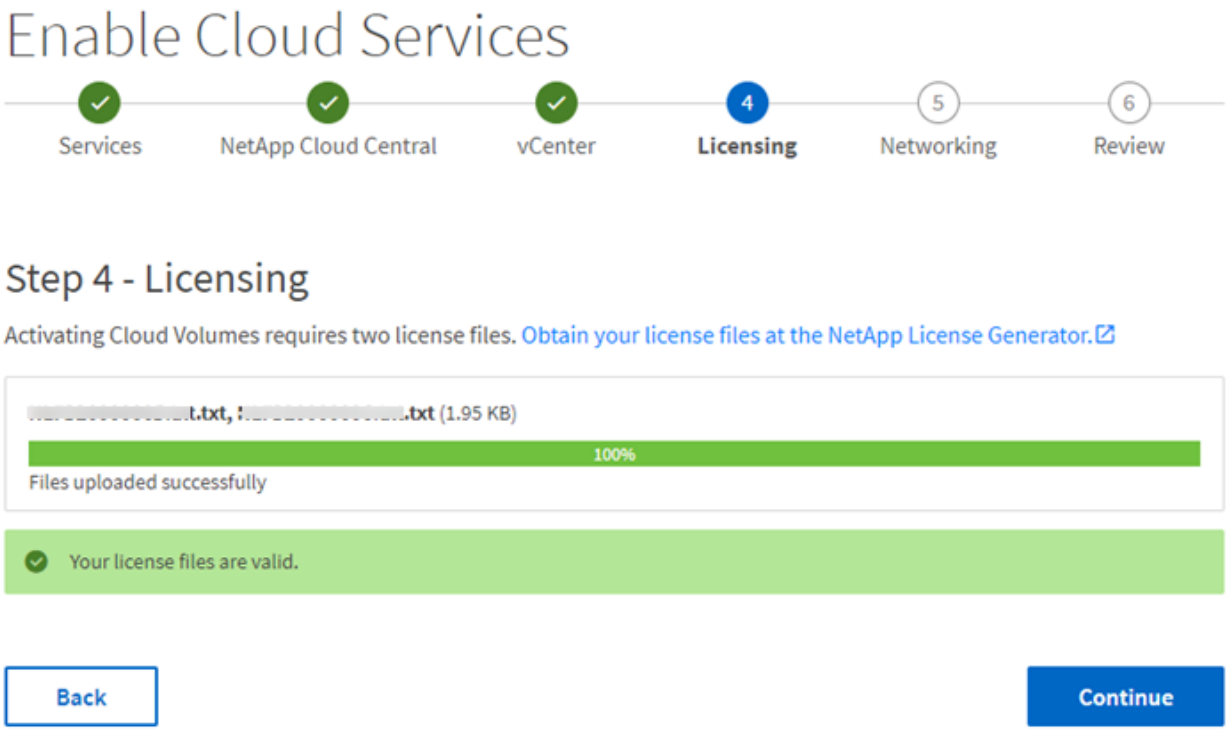
Enter license information

If you enabled Cloud Volumes, a Licensing page appears. If not, the Licensing page does not appear and you should skip the Licensing steps and enter networking information on the Networking page instead.

The NetApp license files use the following format:

NLF<serialnumber>.txt

1. If you already have obtained license files, click **Browse** to locate them.
   Select both licenses and click **Choose** so they can be uploaded.
2. If you have not obtained license files, complete the following to obtain or retrieve them:
   a. Serial number information is provided in an email after ordering software. Go to the NetApp Support Site, click **Products** > **Software Licenses**, and
   enter product and serial number.
   b. Return to the Hybrid Cloud Control Licensing page, click the link to the NetApp License File Generator, supply your password, select “ONTAP Select-Premium” as the product line, and supply the product serial number that you obtained from the NetApp Support Site.



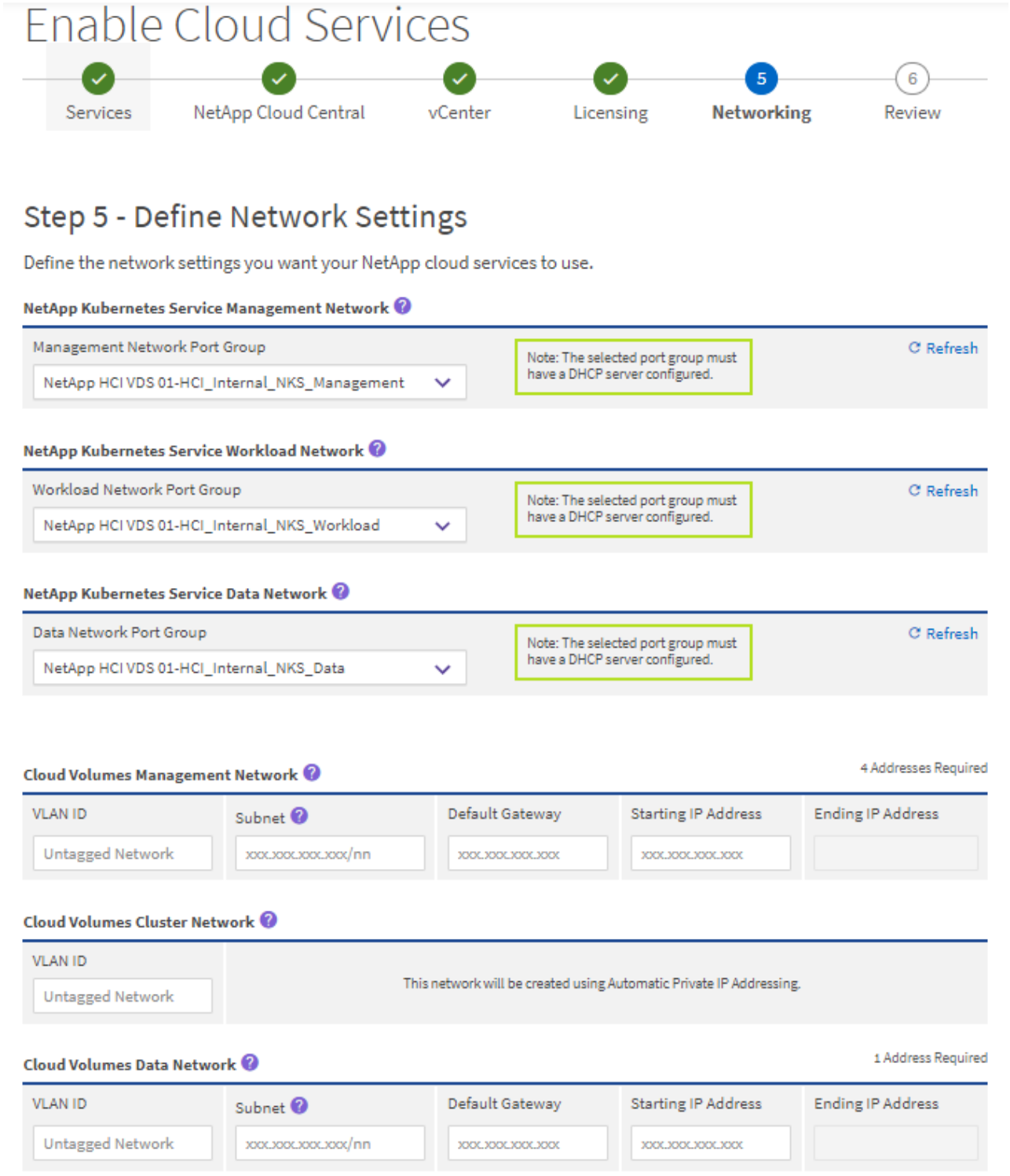
   c. Acknowledge the Global Data Privacy Policy and click **Submit**.
   d. Download the license files either directly from the NetApp License File Generator or from the email.
   e. Do this twice for the two licenses, one for each of the HA clusters.
   f. You can now upload the license files. In the Licensing page, click **Browse** to locate both license files that you downloaded. Select both licenses and click **Choose** to upload them.
3. Click **Continue**.

Select networking options

1. On the Networking page, review the hover text for each of the following and configure networking information:

- **NetApp Kubernetes Service Management Network**: Select the vSphere distributed port group to use for management traffic for the NetApp Kubernetes Service service cluster. This network requires outbound Internet access.
- **NetApp Kubernetes Service Workload Network**: Select the vSphere distributed port group to use for management traffic for the NetApp Kubernetes Service user clusters, on which you place your applications. This network requires outbound Internet access.
- **NetApp Kubernetes Service Data Network**: Select the vSphere distributed port group to use for persistent volume data traffic for the NetApp Kubernetes Service user clusters.

2. If you enabled Cloud Volumes on the Services page, the following additional fields appear:
   - **Cloud Volumes Management Network**: Enter the IP addresses for managing the Cloud Volumes deployment VM and its deployed nodes. These IP addresses are used during the installation to configure Cloud Volumes enablement.
   - **Cloud Volumes Cluster Network**: Enter network information used by the cluster nodes used by Cloud Volumes deployment to communicate with each other.
   - **Cloud Volumes Storage Network**: Enter network information to serve data from Cloud Volumes on NetApp HCI. This will become the network from which you access provisioned cloud volumes.



3. Click **Continue**.
4. On the Review page, review your choices by expanding each option. and click **Continue**.

Result

NetApp HCI cloud services are enabled and the NetApp Hybrid Cloud Control opening page reappears.

Click the cloud icon to see the number of services enabled.
The process can take up to 30 minutes for NKS and 60 minutes for NKS along with Cloud Volumes on

NetApp HCI.

NetApp HCI uses the NetApp Kubernetes Service to create a service cluster, which is a Kubernetes cluster that consists of four VMs (one Kubernetes master node and three Kubernetes worker compute nodes).

After you finish

Next, continue with Creating Kubernetes clusters on your NetApp HCI system by using the NetApp Kubernetes Service.

Or, to create cloud volumes, create custom data management workflows, and manage data across volumes, use NetApp Fabric Orchestrator. See Managing data in NetApp Cloud Volumes.

Top Link

- Deploying cloud services on NetApp HCI overview

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation

Enable Cloud Volumes on NetApp HCI after NKS is already enabled

After you enable NetApp Kubernetes Service (NKS) on NetApp HCI, you might want to later enable the Cloud Volumes on NetApp HCI.

Enabling cloud services is performed using the NetApp Hybrid Cloud Control.

About this task

This lets you use Cloud Volumes on NetApp HCI on your on-premises private cloud.

A NetApp Hybrid Cloud Control wizard takes you through the following tasks:

- Select the Cloud Volumes service you want to enable.
- Enable licenses using a link to the NetApp License Generator.
- Configure networking.

Sign in to NetApp Cloud Central

1. Access NetApp Hybrid Cloud Control (HCC) by opening a web browser and browsing to the IP address of the management node:

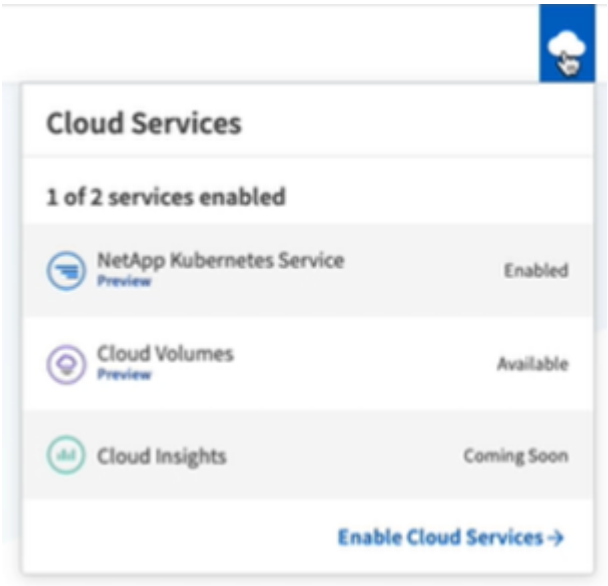
"https://<_ManagementNodeIP_>"

For details, see Accessing NetApp Hybrid Cloud Control.

2. Click the **Cloud** icon.

   An outline of a cloud indicates that no services have been enabled. A filled in cloud indicates that some services have been enabled. This image shows that NKS has already been enabled, but Cloud Volumes has not yet been enabled.

3. In the Cloud Services popup, review the services that are available.



4. Click **Enable cloud services**.

Select the Cloud Services you want to enable

SERVICES and INFORMATION ARE PROVIDED as a TECHNOLOGY PREVIEW. You might see a different set of services than those listed here.

1. On the Services page, select the services that you want to enable.
   - **NetApp Kubernetes Service**: This is enabled already. You must use NetApp Kubernetes Service, a SaaS platform that enables you to deploy a Kubernetes cluster in the cloud with the major cloud providers and also with a NetApp private cloud. This is required to enable cloud services on NetApp HCI. This service is installed as a VM on a NetApp HCI compute node.
   - **Cloud Volumes**: To install Cloud Volumes on NetApp HCI, select this service. This service offers an on-demand shared file systems feature on your premises. The Cloud Volumes option will enable Data Fabric replication to and from public clouds.

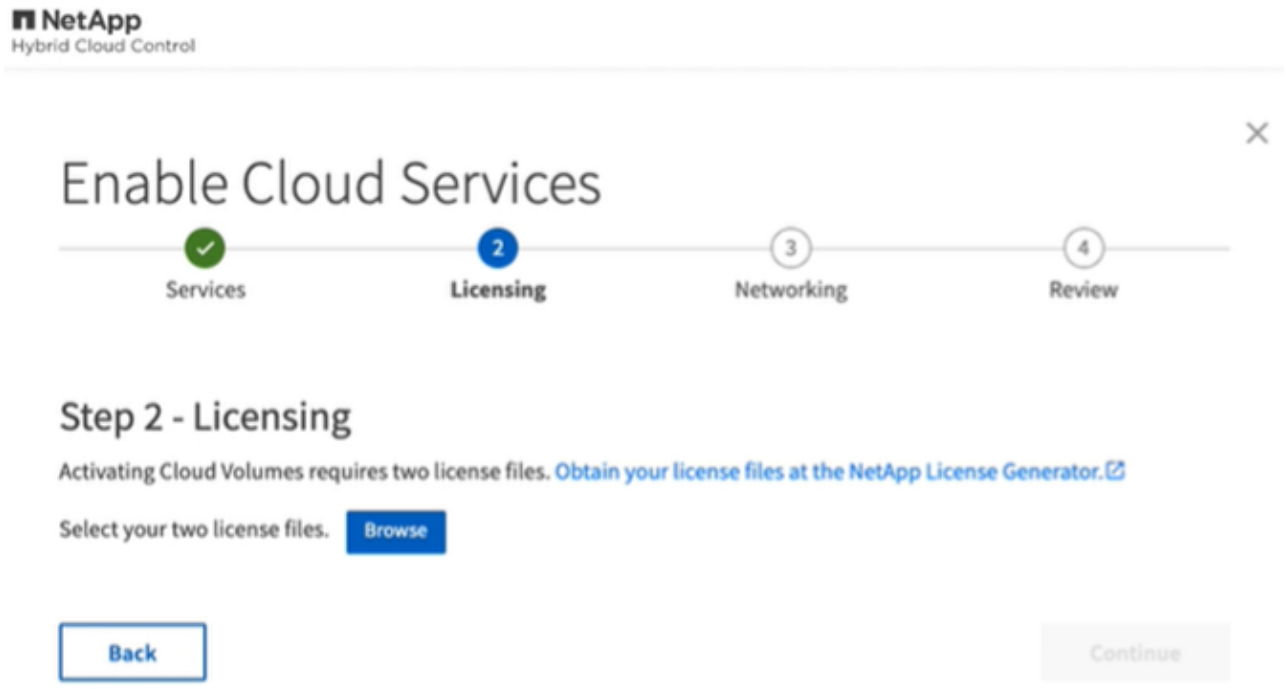
- **Cloud Insights**: This option will enable you to monitor cloud services on NetApp HCI. *Coming soon.*

2. Click **Continue**.

Enter license information

If you enabled Cloud Volumes, a Licensing page appears.
The NetApp license files use the following format:
NLF<serialnumber>.txt

1. If you already have obtained license files, click **Browse** to locate them.
   Select both licenses and click **Choose** so they can be uploaded.
2. If you have not obtained license files, complete the following to obtain or retrieve them:
   a. Serial number information is provided in an email after ordering software. Go to the NetApp Support Site, click **Products** > **Software Licenses**, and
   enter product and serial number.
   b. Return to the Hybrid Cloud Control Licensing page, click the link to the NetApp License File Generator, supply your password, select “ONTAP Select-Premium” as the product line, and supply the product serial number that you obtained from the NetApp Support Site.



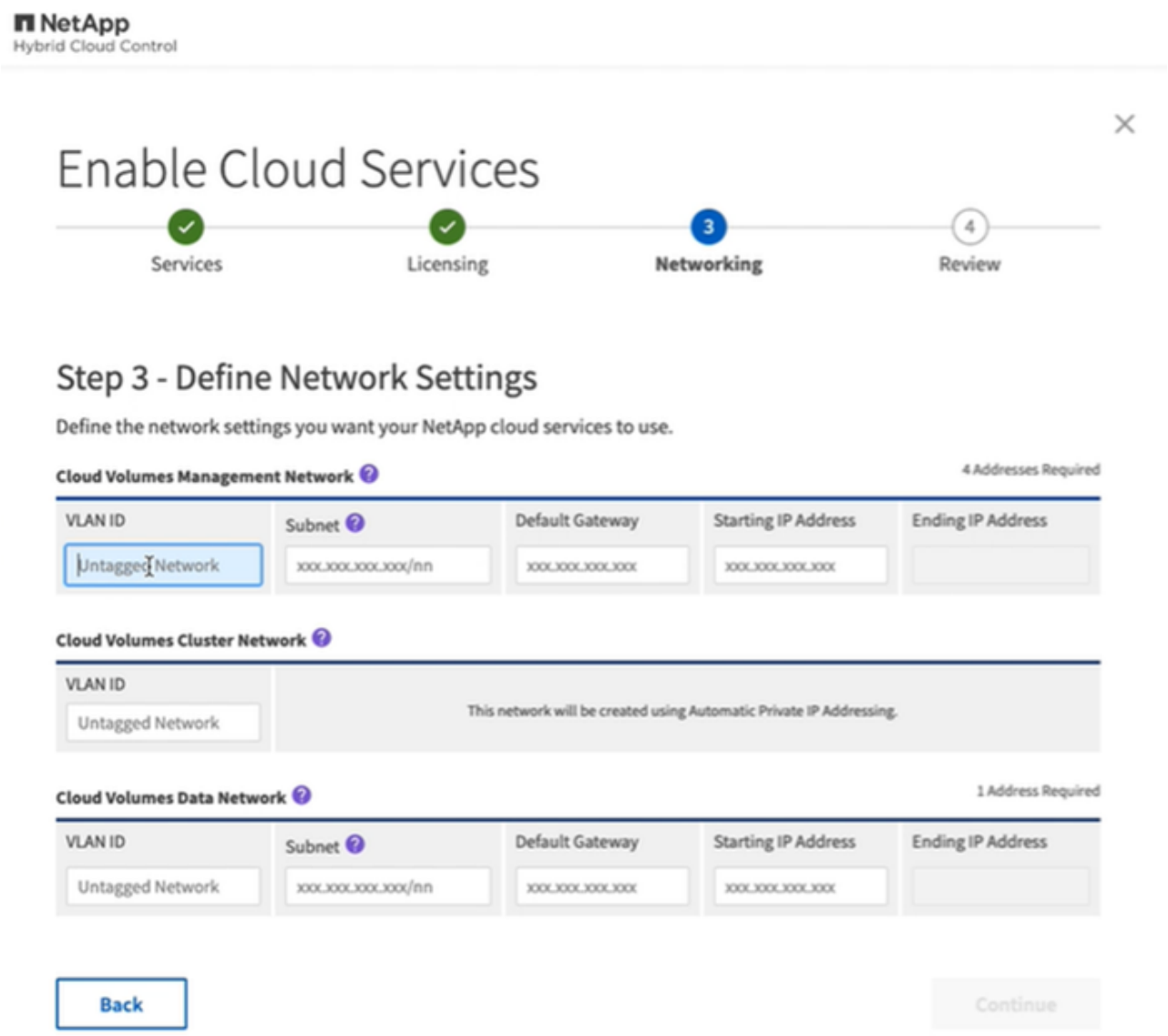
   c. Acknowledge the Global Data Privacy Policy and click **Submit**.
   d. Download the license files either directly from the NetApp License File Generator or from the email.
   e. Do this twice for the two licenses, one for each of the HA clusters.

f. You can now upload the license files. In the Licensing page, click **Browse** to locate both license files that you downloaded. Select both licenses and click **Choose** to upload them.

3. Click **Continue**.

Select networking options

1. If you enabled Cloud Volumes on the Services page, the following additional fields appear:
   - **Cloud Volumes Management Network**: Enter the IP addresses for managing the Cloud Volumes deployment VM and its deployed nodes. These IP addresses are used during the installation to configure Cloud Volumes enablement.
   - **Cloud Volumes Cluster Network**: Enter network information used by the cluster nodes used by Cloud Volumes deployment to communicate with each other.
   - **Cloud Volumes Storage Network**: Enter network information to serve data from Cloud Volumes on NetApp HCI. This will become the network from which you access provisioned cloud volumes.



2. Click **Continue**.
3. On the Review page, review your choices by expanding each option. and click **Continue**.

Result

Cloud Volumes on NetApp HCI are enabled and the NetApp Hybrid Cloud Control opening page reappears.

Click the cloud icon to see the number of services enabled.
The process can take up to 30 minutes for Cloud Volumes on NetApp HCI.

After you finish

To create cloud volumes, create custom data management workflows, and manage data across volumes, use NetApp Fabric Orchestrator. See Managing data in NetApp Cloud Volumes.

Top Link

- Deploying cloud services on NetApp HCI overview

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation

Enable Kubernetes clusters on NetApp HCI

Manage Kubernetes clusters on NetApp HCI overview

Using the NetApp Kubernetes Service (NKS) on Cloud Central, you can create and manage Kubernetes clusters anywhere using a single interface, whether you need them to reside on a private cloud or many public clouds.

Prerequisites

Before you use the NetApp Kubernetes Service, you must enable it using the NetApp Hybrid Cloud Control.
See information on deploying cloud services on NetApp HCI.

Workflow overview

To create and manage clusters using the NetApp Kubernetes Service, do the following:
* Access the NetApp Kubernetes Service on NetApp Cloud Central.
* Create a cluster on NetApp HCI using the NetApp Kubernetes Service.
* Create a project within a workspace in the NetApp Kubernetes Service.
* Add applications or solutions to your clusters in the NetApp Kubernetes Service.

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation
- NetApp Kubernetes Service Documentation

Access NetApp Kubernetes Service

You can access NetApp Kubernetes Service directly with its own address or by selecting the product option from the Cloud Central product list.

Steps

1. Go to the NetApp Kubernetes Service Login page.
2. Enter your Cloud Central login credentials and click **Login**.

If you do not see any systems listed, make sure that the NetApp HCI administrator is added to your NetApp Cloud Central account.

3. If you do not have a Cloud Central account, on the Cloud Central Login page, click **Sign Up**.
4. Using Cloud Central, you can set up accounts either as individual accounts or as Federated accounts:
    a. You can make a new account with name, email, and password and then you will be logged in. This is the simplest type of account.
    b. If you are part of a Cloud Central Federated organization, you enter your email and are then routed to the organization login.
5. From other Cloud Central products, select **Products** > **NetApp Kubernetes Service**.

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation
- NetApp Kubernetes Service Documentation

Creating a Kubernetes cluster using the NetApp Kubernetes Service

After you enable cloud services, you can create Kubernetes user clusters on a NetApp HCI on-premise system using the NetApp Kubernetes Service.

Prerequisites

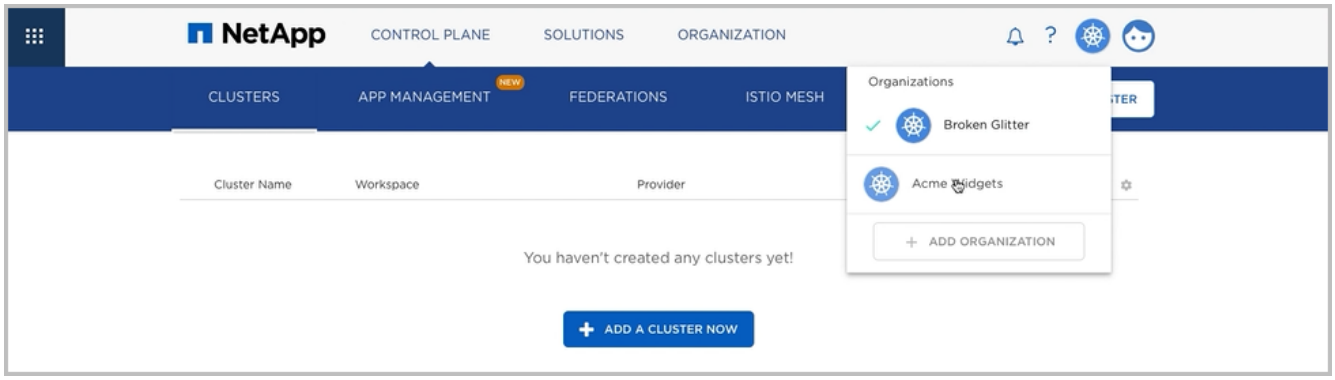
Before you use NetApp Kubernetes Service with NetApp HCI, you must enable the service using the NetApp Hybrid Cloud Control.
See information on deploying cloud services on NetApp HCI.

About this task

You create Kubernetes clusters, add them to a workspace, create a project within that workspace, and later add a solution to the project. After you create the clusters, those clusters are ready to accept application workloads, including predesigned or your own applications.

Logging in to NetApp Cloud Central

1. From NetApp Cloud Central, select **Products** > **NetApp Kubernetes Service**.
2. Log in using your Cloud Central credentials.



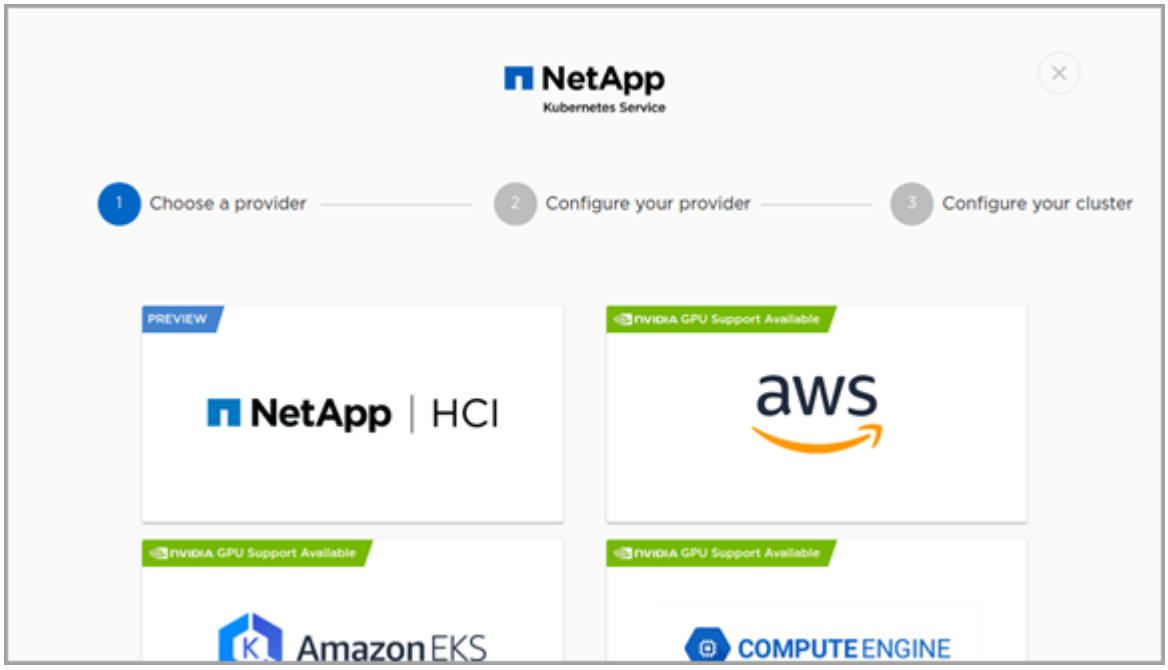
Choosing a provider

1. Click **Organizations** and choose your organization.

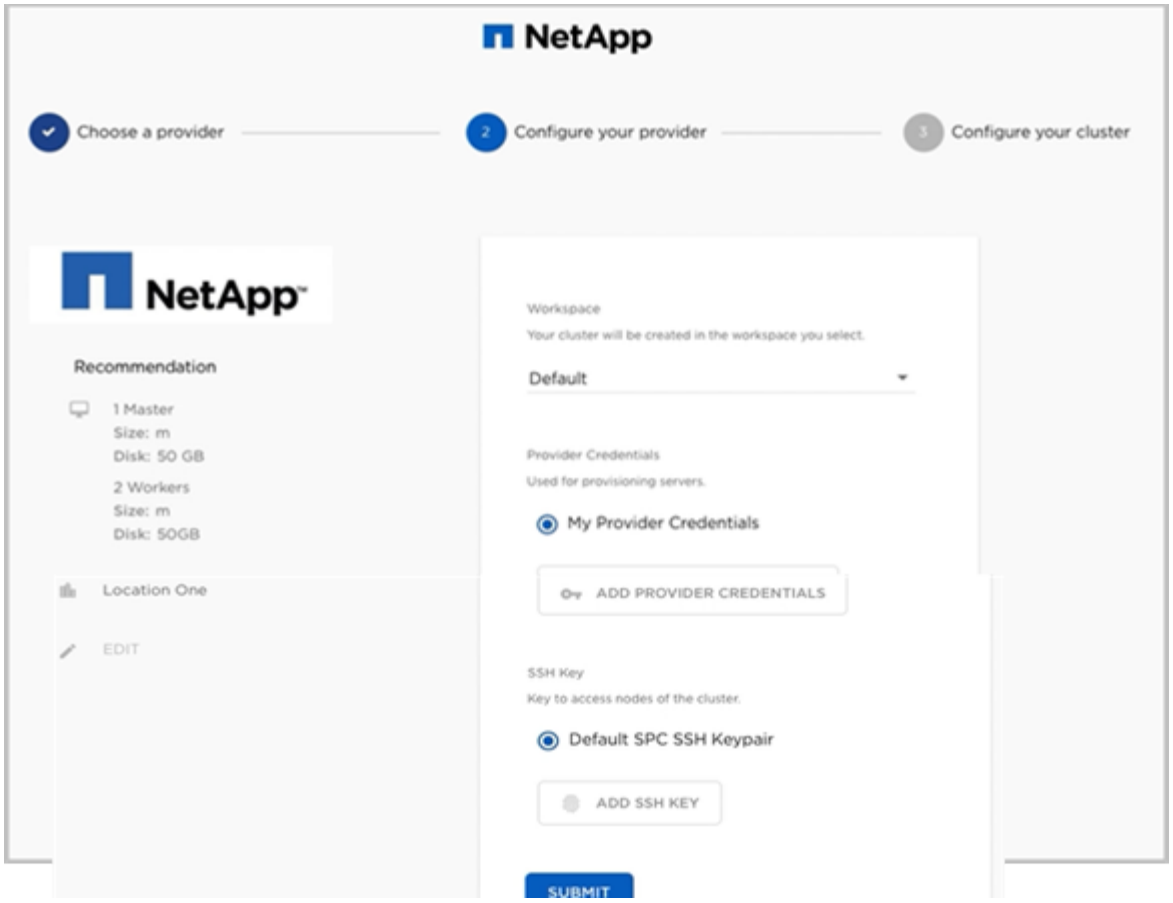
   

2. Click **Control Plane**.
3. Click **Add Cluster**.

   A list of providers appears, including NetApp HCI.



4. Choose **NetApp HCI** as the provider.



Configuring your provider

1. Select the region, the workspace in which the cluster will be located, and SSH key pair for the cluster.

   In most cases you can just accept the defaults.

2. To edit any of the default values for the cluster nodes, click **Edit** and customize the number, size, and disk space allotted to the cluster nodes. If there is more than one NetApp HCI installation in the organization, you can select additional systems.
3. Click **Submit**.

Configuring your cluster

1. Configure your Kubernetes cluster by entering the cluster name.
2. Typically, use the default settings.
3. Click **Submit**.

Result

The NetApp Kubernetes Service creates the cluster and displays it on the Clusters page.

Deleting a Kubernetes cluster

In the NKS preview environment, if you want to delete a Kubernetes cluster, contact NetApp Technical Support for assistance.
The NKS preview environment will be removed.

After you finish

Continue with Creating a project within a NetApp Kubernetes Service workspace you specified so that you can later add applications or solutions to the project.

Find more information

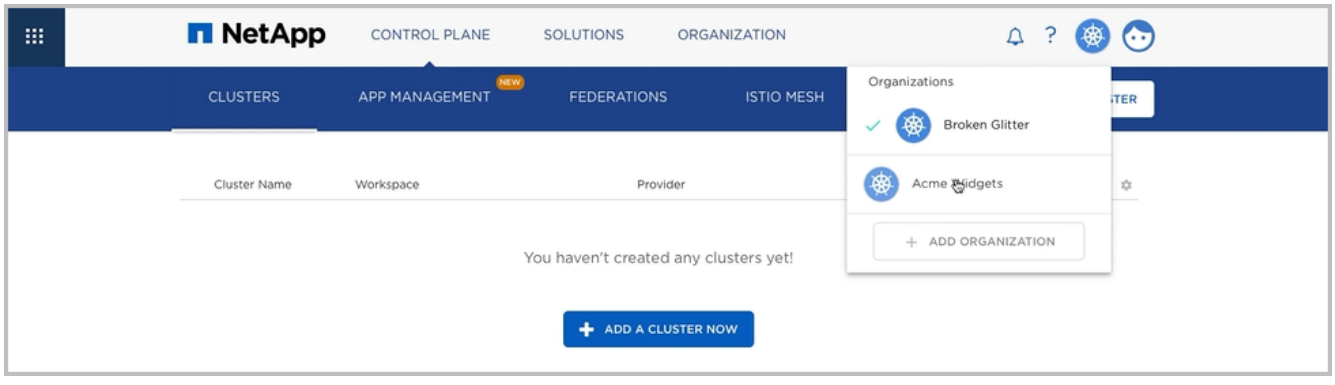
- NetApp Cloud Central
- NetApp Cloud Documentation
- NetApp Kubernetes Service Documentation

Create a project within a NetApp Kubernetes Service workspace

When you create Kubernetes user clusters, you select a workspace in the NetApp Kubernetes Service. You can create a project within that workspace and later add a solution to the project.

Steps

1. From NetApp Cloud Central, select **Products** > **NetApp Kubernetes Service**.
2. Log in using your Cloud Central credentials.



3. Click **Organization**.

4. To add a team, to which you can later add to your workspace, click **Teams**, click **Add Team**, add a

team name, select members, and click **Submit**.

5. To add a workspace, to which you can later add projects, click **Workspaces**, click **Add Workspace**, add a workspace name, select teams, and click **Submit**.

After you finish

Continue with Adding applications to your Kubernetes cluster.

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation
- NetApp Kubernetes Service Documentation

Storage classes with NetApp Kubernetes Service on NetApp HCI

After you enable cloud services on NetApp HCI and enable NetApp Kubernetes Service (NKS), Kubernetes storage classes are created.

When you add applications in NKS, you need to know the storage class and its provisioner.

Storage classes with NKS

The following table lists the storage classes and the associated provisioners and IOPS values.

Storage class	Provisioner	IOPS minimum	IOPS maximum	IOPS burst
solidfire-bronze	netapp.io/trident	1000	4000	6000
solidfire-silver	netapp.io/trident	5000	25,000	40,000
solidfire-gold	netapp.io/trident	15,000	180,000	200,000
vsphere (default)	kubernetes.io/vsphere-volume	NA	NA	NA

Storage class impact

Storage classes affect storage pools, QoS values, and persistent volume claims in the following ways:

- Each NetApp Element storage class uses a unique storage pool.
- Storage pools are identified by a set of unique QoS (IOPS) values.
- When a Persistent Volume Claim (PVC) uses one of the "solidfire" storage classes, a volume within

the referred storage pool is created on Element.

- Trident creates the PV with the storage class and the storage pool attributes.
- Kubernetes mounts the volume to the pod.

Example of PVC using a storage class

This example shows a volume created with the *solidfire-gold* storage class IOPS values on Element. When a pod uses this PVC, the new volume with the *solidfire-gold* IOPS values is mounted to the pod.

```
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
      name: pvcclaim-gold
spec:
  accessModes:
  - ReadWriteOnce
  resources:
    requests:
      storage: 10Gi
  storageClassName: solidfire-gold
```

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation
- NetApp HCI Documentation Center

Add applications to a Kubernetes cluster

After you create your Kubernetes user cluster, you can easily add any number of applications to the cluster. Using this feature, you gain tremendous efficiency of spinning up or down applications as needed.

About this task

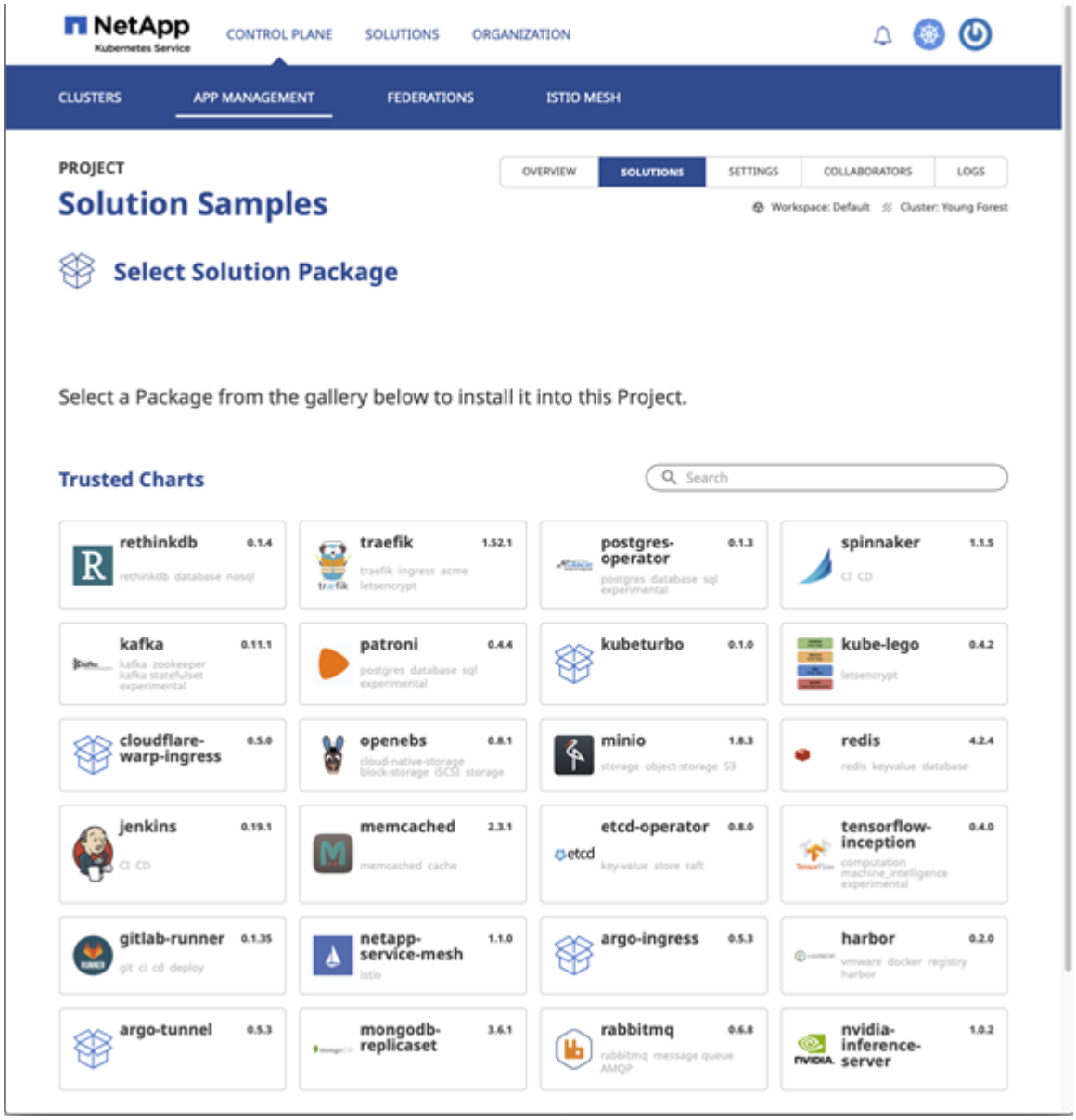
You can deploy applications on the cluster that resides on NetApp HCI by using the NetApp Kubernetes Service.

When you add applications to your Kubernetes cluster, you need to know about storage classes.
See Storage classes with NKS on NetApp HCI.

Steps

1. From NetApp Cloud Central, select **Products** > **NetApp Kubernetes Service**.

2. To add an application to your existing Kubernetes cluster, click **Solutions**.



Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation
- NetApp Kubernetes Service Documentation

Manage data in Cloud Volumes with NetApp Fabric Orchestrator

Manage data with Cloud Volumes on NetApp HCI overview

Using Fabric Orchestrator, you can create and manage cloud volumes anywhere using a single interface, whether you need them to reside on a private cloud or many public clouds.

Fabric Orchestrator is in Preview mode. When you enable Cloud Volumes on NetApp HCI, you automatically have access to the Preview environment.

Prerequisites

Before you use Cloud Volumes on NetApp HCI, you must enable the service using the NetApp Hybrid Cloud Control.
See information on deploying cloud services on NetApp HCI.

Workflow overview

To create and manage cloud volumes using Fabric Orchestrator, do the following:
* Access Fabric Orchestrator on NetApp Cloud Central.
* Create Cloud Volumes on NetApp HCI using Fabric Orchestrator.

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation

What happens when you enable Cloud Volumes on NetApp HCI?

When you enable Cloud Volumes on NetApp HCI using Hybrid Cloud Control, several events occur in NetApp Fabric Orchestrator, the interface you use to create and manage cloud volumes.

- NetApp HCI initiates an API call that creates a new organization (workspace) in Fabric Orchestrator. The organization is the same organization used in NetApp Kubernetes Service.

Cloud Volumes is a Kubernetes application that runs in the NetApp Kubernetes Service service cluster.

- The Cloud Central account used during installation in NetApp Hybrid Cloud Control becomes the owner assigned to the Fabric Orchestrator organization.
- The region in NetApp Kubernetes Service becomes the same region in the Fabric Orchestrator organization.
- Within the datacenter in vCenter, a new folder called "NetApp-HCI-CloudVolumeFoundation" is created. This folder contains the cluster and deployment VMs.
- Cloud Volumes installs the port groups required in vCenter. The following three networks are created:
  - NetApp-HCI-CVF-Cluster
  - NetApp-HCI-CVF-Mgmt
  - NetApp-HCI-CVF-Storage
- Cloud Volumes creates the following datastores, which should not be modified:
  - NetApp-HCI-CVF-Deploy-DS
  - NetApp-HCI-CVF-Cluster-DS-01
  - NetApp-HCI-CVF-Cluster-DS-02

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation

Access NetApp Fabric Orchestrator

You can access NetApp Fabric Orchestrator directly with its own address or by selecting the product option from the Cloud Central product list.

Steps

1. Go to the NetApp Fabric Orchestrator Login page.
2. Enter your Cloud Central login credentials and click **Login**.

   If you do not see any systems listed, make sure that the NetApp HCI administrator is added to your NetApp Cloud Central account.

3. If you do not have a Cloud Central account, on the Cloud Central Login page, click **Sign Up**.

   Using Cloud Central, you can set up accounts either as individual accounts or as Federated

accounts:

a. You can make a new account with name, email, and password and then you will be logged in. This is the simplest type of account.

b. If you are part of a Cloud Central Federated organization, you enter your email and are then routed to the organization login.

4. From other Cloud Central products, select **Products** > **NetApp Fabric Orchestrator**.

Find more information

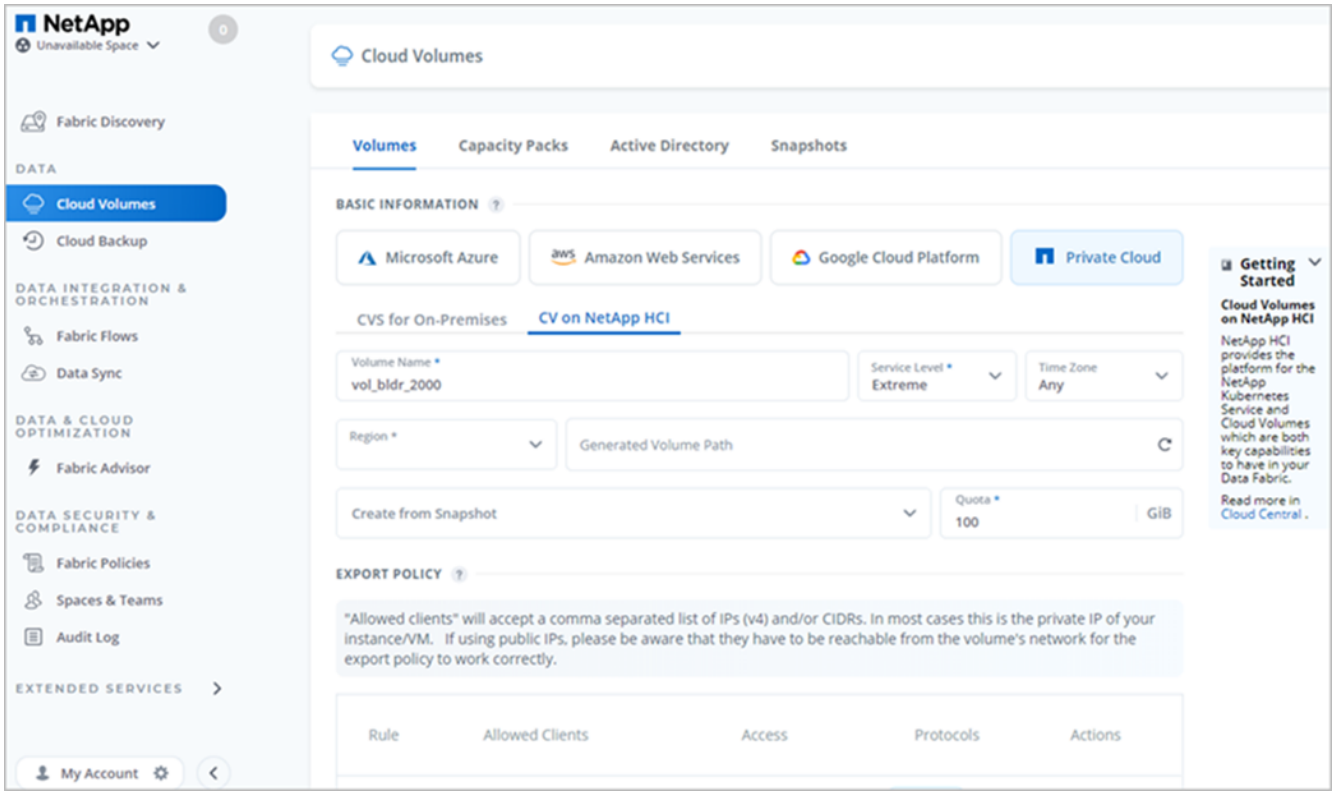
- NetApp Cloud Central
- NetApp Cloud Documentation

Create cloud volumes with NetApp Fabric Orchestrator

You can create cloud volumes on the Kubernetes cluster by using another cloud service, the NetApp Fabric Orchestrator.

Steps

1. From NetApp Cloud Central, select **Products** > **NetApp Fabric Orchestrator**.
2. Click **Create Cloud Volumes**.



3. On the Create Cloud volumes page, enter or select the following:

a. Choose **NetApp Private Cloud** as the provider.
b. On the NetApp HCI tab, select the cloud volume.
c. Select the service level and region.
d. Enter any tags or labels.
e. Edit the export policy and protection policy.

4. Click **Create Cloud Volumes**.

Find more information

- NetApp Cloud Central
- NetApp Cloud Documentation