



# **Advanced Cluster Management for Kubernetes on Red Hat OpenShift with NetApp**

NetApp Solutions

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# Advanced Cluster Management for Kubernetes on Red Hat OpenShift with NetApp

## Advanced Cluster Management for Kubernetes: Red Hat OpenShift with NetApp

As a containerized application transitions from development to production, many organizations require multiple Red Hat OpenShift clusters to support the testing and deployment of that application. In conjunction with this, organizations usually host multiple applications or workloads on OpenShift clusters. Therefore, each organization ends up managing a set of clusters, and OpenShift administrators must thus face the added challenge of managing and maintaining multiple clusters across a range of environments that span multiple on-premises data centers and public clouds. To address these challenges, Red Hat introduced Advanced Cluster Management for Kubernetes.

Red Hat Advanced Cluster Management for Kubernetes enables you to perform the following tasks:

1. Create, import, and manage multiple clusters across data centers and public clouds
2. Deploy and manage applications or workloads on multiple clusters from a single console
3. Monitor and analyze health and status of different cluster resources
4. Monitor and enforce security compliance across multiple clusters

Red Hat Advanced Cluster Management for Kubernetes is installed as an add-on to a Red Hat OpenShift cluster, and it uses this cluster as a central controller for all its operations. This cluster is known as hub cluster, and it exposes a management plane for the users to connect to Advanced Cluster Management. All the other OpenShift clusters that are either imported or created via the Advanced Cluster Management console are managed by the hub cluster and are called managed clusters. It installs an agent called Klusterlet on the managed clusters to connect them to the hub cluster and serve the requests for different activities related to cluster lifecycle management, application lifecycle management, observability, and security compliance.



For more information, see the documentation [here](#).

[Next: Deployment Prerequisites.](#)

# Deployment

## Deploy Advanced Cluster Management for Kubernetes

### Prerequisites

1. A Red Hat OpenShift cluster (greater than version 4.5) for the hub cluster
2. Red Hat OpenShift clusters (greater than version 4.4.3) for managed clusters
3. Cluster-admin access to the Red Hat OpenShift cluster
4. A Red Hat subscription for Advanced Cluster Management for Kubernetes

Advanced Cluster Management is an add-on on for the OpenShift cluster, so there are certain requirements and restrictions on the hardware resources based on the features used across the hub and managed clusters. You need to take these issues into account when sizing the clusters. See the documentation [here](#) for more details.

Optionally, if the hub cluster has dedicated nodes for hosting infrastructure components and you would like to install Advanced Cluster Management resources only on those nodes, you need to add tolerations and selectors to those nodes accordingly. For more details, see the documentation [here](#).

[Next: Installation.](#)

## Deploy Advanced Cluster Management for Kubernetes

To install Advanced Cluster Management for Kubernetes on an OpenShift cluster, complete the following steps:

1. Choose an OpenShift cluster as the hub cluster and log into it with cluster-admin privileges.
2. Navigate to Operators > Operators Hub and search for Advanced Cluster Management for Kubernetes.



3. Select Advanced Cluster Management for Kubernetes and click Install.



# Advanced Cluster Management for Kubernetes

2.2.3 provided by Red Hat



Install

## Latest version

2.2.3

## Capability level

- ☒ Basic Install
- ☒ Seamless Upgrades
- ☐ Full Lifecycle
- ☐ Deep Insights
- ☐ Auto Pilot

## Provider type

Red Hat

## Provider

Red Hat

## Infrastructure features

Disconnected

Red Hat Advanced Cluster Management for Kubernetes provides the multicluster hub, a central management console for managing multiple Kubernetes-based clusters across data centers, public clouds, and private clouds. You can use the hub to create Red Hat OpenShift Container Platform clusters on selected providers, or import existing Kubernetes-based clusters. After the clusters are managed, you can set compliance requirements to ensure that the clusters maintain the specified security requirements. You can also deploy business applications across your clusters.

Red Hat Advanced Cluster Management for Kubernetes also provides the following operators:

- Multicluster subscriptions: An operator that provides application management capabilities including subscribing to resources from a channel and deploying those resources on MCH-managed Kubernetes clusters based on placement rules.
- Hive for Red Hat OpenShift: An operator that provides APIs for provisioning and performing initial configuration of OpenShift clusters. These operators are used by the multicluster hub to provide its provisioning and application-management capabilities.

## How to Install

Use of this Red Hat product requires a licensing and subscription agreement.

4. On the Install Operator screen, provide the necessary details (NetApp recommends retaining the default parameters) and click Install.

## Install Operator

Install your Operator by subscribing to one of the update channels to keep the Operator up to date. The strategy determines either manual or automatic updates.

### Update channel \*

- ☐ release-2.0
- ☐ release-2.1
- ☒ release-2.2

### Installation mode \*

- ☐ All namespaces on the cluster (default)  
This mode is not supported by this Operator
- ☒ A specific namespace on the cluster  
Operator will be available in a single Namespace only.

### Installed Namespace \*

- ☒ Operator recommended Namespace: **PR** open-cluster-management

#### Namespace creation

Namespace **open-cluster-management** does not exist and will be created.

- ☐ Select a Namespace

### Approval strategy \*

- ☒ Automatic
- ☐ Manual

**Install**

Cancel

5. Wait for the operator installation to complete.



**Advanced Cluster Management for Kubernetes**  
2.2.3 provided by Red Hat

### Installing Operator

The Operator is being installed. This may take a few minutes.

[View installed Operators in Namespace open-cluster-management](#)

6. After the operator is installed, click Create MultiClusterHub.



## Advanced Cluster Management for Kubernetes

2.2.3 provided by Red Hat



### Installed operator - operand required

The Operator has installed successfully. Create the required custom resource to be able to use this Operator.

**MCH** MultiClusterHub **Required**

Advanced provisioning and management of OpenShift and Kubernetes clusters

Create MultiClusterHub

[View installed Operators in Namespace open-cluster-management](#)

- On the Create MultiClusterHub screen, click Create after furnishing the details. This initiates the installation of a multi-cluster hub.

Project: open-cluster-management

Advanced Cluster Management for Kubernetes > Create MultiClusterHub

#### Create MultiClusterHub

Create by completing the form. Default values may be provided by the Operator authors.

Configure via: ☒ Form view ☐ YAML view

**Note:** Some fields may not be represented in this form view. Please select "YAML view" for full control.



MultiClusterHub

provided by Red Hat

MultiClusterHub defines the configuration for an instance of the MultiCluster Hub

Name \*

multiclusterhub

Labels

app=frontend

> Advanced configuration

Create

Cancel

- After all the pods move to the Running state in the open-cluster-management namespace and the operator moves to the Succeeded state, Advanced Cluster Management for Kubernetes is installed.

## Installed Operators

Installed Operators are represented by ClusterServiceVersions within this Namespace. For more information, see the [Understanding Operators documentation](#). Or create an Operator and ClusterServiceVersion using the [Operator SDK](#).

Name ▾

Search by name...

/

Name ↑	Managed Namespaces ↓	Status	Provided APIs
<div><div></div><div><div>Advanced Cluster Management for Kubernetes</div><div>2.2.3 provided by Red Hat</div></div></div>	<div><div>NS</div>open-cluster-management</div>	<div><div>✓ Succeeded</div><div>Up to date</div></div>	<div><div>MultiClusterHub</div><div>ClusterManager</div><div>ClusterDeployment</div><div>ClusterState</div><div>View 25 more...</div></div>

9. It takes some time to complete the hub installation, and, after it is done, the MultiCluster hub moves to Running state.

Installed Operators > Operator details

 **Advanced Cluster Management for Kubernetes**  
2.2.3 provided by Red Hat

Actions ▾

Details | **YAML** | Subscription | Events | All instances | **MultiClusterHub** | ClusterManager | ClusterDeployment | ClusterSt...

**MultiClusterHubs** [Create MultiClusterHub](#)

Name ▾

Search by name...

Name ↑	Kind ↓	Status ↓	Labels ↓
 multiclusterhub	MultiClusterHub	Phase: ✓ Running	No labels

10. It creates a route in the open-cluster-management namespace. Connect to the URL in the route to access the Advanced Cluster Management console.

## Routes

[Create Route](#)

Filter ▾

Name ▾ mul

Name mul ✕

[Clear all filters](#)

Next: [Features - Cluster Lifecycle Management](#).



# Features

## Features: Advanced Cluster Management for Kubernetes on Red Hat OpenShift with NetApp

### Cluster Lifecycle Management

To manage different OpenShift clusters, you can either create or import them into Advanced Cluster Management.

1. First navigate to Automate Infrastructures > Clusters.
2. To create a new OpenShift cluster, complete the following steps:
  - a. Create a provider connection: Navigate to Provider Connections and click Add a Connection, provide all the details corresponding to the selected provider type and click Add.

#### Select a provider and enter basic information

Provider \* ⓘ

aws Amazon Web Services ▼

Connection name \* ⓘ

nik-hcl-aws

Namespace \* ⓘ

default ▼

#### Configure your provider connection

Base DNS domain ⓘ

cie.netapp.com

AWS access key ID \* ⓘ

AKIATCFBZDOIASDSA

AWS secret access key \* ⓘ

.....

Red Hat OpenShift pull secret \* ⓘ

```
FuS3pNbktVaHplNFc2MkZsbmtBVGN6TktmUIZXcHcxOW9teEZwQ0lYZld3cjJobGxJeDBON0xiZE0yeGM5Q0QZwZk5RR2JUanlxNnNUM2lRb0FJb
UFjNCIBYlpEWVZEOHItNkxTMDZPUVpoWFRhcGwtRElDQ2RSYlJRaTlxblDLT2oyQ3pVeUJfNllwcENSa2YyOUUyLWZGSFVfNA==", "email": "Nikhil.k
ulkarni@netapp.com"}, "registry.redhat.io":
```

SSH private key \* ⓘ

```
-----BEGIN OPENSSH PRIVATE KEY-----
b3BlbnNzaC1rZXktdjEAAAABG5vbmUAAAAEbasdadssadm9uZQAAAAAAAAABAAAAAMwAAAAAtzc2gtZW
QyNTUxOQAAACCLcwLgAvSlHAeP+DevlRNzaG2zkNreMlZ/UHyfOUWwAAAAAJhy/wa6xf8Gu
```

SSH public key \* ⓘ

ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIltzAuAC746agdh2lcB4/4N6/VE3NobbOQ2t4zVn9QfJ/RRa8A root@nik-rhel8

- b. To create a new cluster, navigate to Clusters and click Add a Cluster > Create a Cluster. Provide the details for the cluster and the corresponding provider and click Create.

^ Configuration

Cluster name \* ?

rh-aws

^ Distribution

Select the type of Kubernetes distribution to use for your cluster.


Red Hat OpenShift

Select an infrastructure provider to host your Red Hat OpenShift cluster.


Amazon Web Services


Google Cloud


Microsoft Azure


VMware vSphere


Bare Metal

Release image \* ?

quay.io/openshift-release-dev/ocp-release:4.7.12-x86\_64

Provider connection \* ?

nik-hcl-aws

Add a connection

- c. After the cluster is created, it appears in the cluster list with the status Ready.
3. To import an existing cluster, complete the following steps:
    - a. Navigate to Clusters and click Add a Cluster > Import an Existing Cluster.
    - b. Enter the name of the cluster and click Save Import and Generate Code. A command to add the existing cluster is displayed.
    - c. Click Copy Command and run the command on the cluster to be added to the hub cluster. This initiates the installation of the necessary agents on the cluster, and, after this process is complete, the cluster appears in the cluster list with status Ready.

**Name \***

ocp-vmw1

**Additional labels**

Once you click on "Save import and generate code", the information you entered will be used to generate the code and cannot be modified anymore. If you wish to change any information, you will have to delete and re-import this cluster.

Code generated successfully Import saved

**Run a command**

**1. Copy this command**

Click the button to have the command automatically copied to your clipboard.

Copy command

**2. Run this command with kubectl configured for your targeted cluster to start the import**

Log in to the existing cluster in your terminal and run the command.

View cluster Import another

4. After you create and import multiple clusters, you can monitor and manage them from a single console.

[Next: Features - Application Lifecycle Management.](#)

## Features: Advanced Cluster Management for Kubernetes on Red Hat OpenShift with NetApp

### Application lifecycle management

To create an application and manage it across a set of clusters,

1. Navigate to Manage Applications from the sidebar and click Create Application. Provide the details of the application you would like to create and click Save.

Create an application YAML: Off

Cancel

Save


**Name\*** ⓘ  
demo-app

**Namespace\*** ⓘ  
default

^ **Repository location for resources**

^ **Repository types**

Select the type of repository where resources that you want to deploy are located

 Git ☒

**URL\*** ⓘ  
https://github.com/open-cluster-management/acm-hive-openshift-releases.git

**Branch** ⓘ  
main

**Path** ⓘ  
clusterImageSets/fast/4.7

- After the application components are installed, the application appears in the list.

## Applications

Refresh every 15s

Last update: 7:36:23 PM

Overview

Advanced configuration

Create application

Q Search						
Name	Namespace	Clusters	Resource	Time window	Created	
demo-app	default	Local	Git		8 days ago	

1 - 1 of 1 << < 1 of 1 > >>

- The application can now be monitored and managed from the console.

[Next: Features - governance and risk.](#)

## **Features: Advanced Cluster Management for Kubernetes on Red Hat OpenShift with NetApp**

### **Governance and risk**

This feature allows you to define the compliance policies for different clusters and make sure that the clusters adhere to it. You can configure the policies to either inform or remediate any deviations or violations of the rules.

1. Navigate to Governance and Risk from the sidebar.
2. To create compliance policies, click Create Policy, enter the details of the policy standards, and select the clusters that should adhere to this policy. If you want to automatically remediate the violations of this policy, select the checkbox Enforce if Supported and click Create.

# Create policy YAML: Off

**Name \***

policy-complianceoperator

**Namespace \*** 

default

**Specifications \***  ComplianceOperator**Cluster selector**  local-cluster: "true"**Standards**  NIST-CSF**Categories**  PR.IP Information Protection Processes and Procedures**Controls**  PR.IP-1 Baseline Configuration☐ **Enforce if supported** ☐ **Disable policy** 

- After all the required policies are configured, any policy or cluster violations can be monitored and remediated from Advanced Cluster Management.

## Governance and risk ⓘ

Filter

Refresh every 10s

Last update: 12:54:01 PM

Create policy

Summary 1

Standards

NIST-CSF



No violations found

Based on the industry standards, there are no cluster or policy violations.

Policies

Cluster violations

Find policies

Policy name	Namespace	Remediation	Cluster violations	Standards	Categories	Controls	Created
policy-complianceoperator	default	inform	0/1	NIST-CSF	PR.IP Information Protection Processes and Procedures	PR.IP-1 Baseline Configuration	32 minutes ago

1 - 1 of 1

<< <

1

of 1

> >>

Next: Features - Observability.

### Features: Advanced Cluster Management for Kubernetes on Red Hat OpenShift with NetApp

#### Observability

Advanced Cluster Management for Kubernetes provides a way to monitor the nodes, pods, and applications, and workloads across all the clusters.

1. Navigate to Observe Environments > Overview.



- All pods and workloads across all clusters are monitored and sorted based on a variety of filters. Click Pods to view the corresponding data.



- All nodes across the clusters are monitored and analyzed based on a variety of data points. Click Nodes to get more insight into the corresponding details.



## Search

Saved searches [Open new search tab](#)

3 Related cluster

1k Related pod

12 Related service

Show all (3)

### Node (20)

Name	Cluster	Role	Architecture	OS image	CPU	Created	Labels
ocp-master-1.ocp-bare-metal.cie.netapp.com	ocp-bare-metal	master; worker	amd64	Red Hat Enterprise Linux CoreOS 47.83.202103292105-0 (Ootpa)	48	a month ago	beta.kubernetes.io/arch=amd64 beta.kubernetes.io/os=linux kubernetes.io/arch=amd64 5 more
ocp-master-2.ocp-bare-metal.cie.netapp.com	ocp-bare-metal	master; worker	amd64	Red Hat Enterprise Linux CoreOS 47.83.202103292105-0 (Ootpa)	48	a month ago	beta.kubernetes.io/arch=amd64 beta.kubernetes.io/os=linux kubernetes.io/arch=amd64 5 more
ocp-master-3.ocp-bare-metal.cie.netapp.com	ocp-bare-metal	master; worker	amd64	Red Hat Enterprise Linux CoreOS 47.83.202103292105-0 (Ootpa)	48	a month ago	beta.kubernetes.io/arch=amd64 beta.kubernetes.io/os=linux kubernetes.io/arch=amd64 5 more

4. All clusters are monitored and organized based on different cluster resources and parameters. Click Clusters to view cluster details.

## Search

Saved searches [Open new search tab](#)

3k Related secret

787 Related pod

15 Related persistentvolumeclaim

17 Related node

1 Related application

15 Related persistentvolume

1 Related searchcollector

8 Related clusterclaim

3 Related resourcequota

5 Related identity

Show all (159)

### Cluster (2)

Name	Available	Hub accepted	Joined	Nodes	Kubernetes version	CPU	Memory	Console URL	Labels
local-cluster	True	True	True	8	v1.20.0+c8905da	84	418501Mi	<a href="#">Launch</a>	cloud=VSphere clusterID=148632d9-69d5-4ae4-98ee-8df886463c3 installer.name=multiclusterhub 4 more
ocp-vmw	True	True	True	9	v1.20.0+df9c838	28	111981Mi	<a href="#">Launch</a>	cloud=VSphere clusterID=9d76ac4e-4aae-4d45-a2e8-11b6b54282fe name=ocp-vmw 1 more

Next: Features - Create Resources.

## Features: Advanced Cluster Management for Kubernetes on Red Hat OpenShift with NetApp

### Create resources on multiple clusters

Advanced Cluster Management for Kubernetes allows users to create resources on one or more managed clusters simultaneously from the console. As an example, if you have OpenShift clusters at different sites backed with different NetApp ONTAP clusters and want to provision PVC's at both sites, you can click the (+) sign on the top bar. Then select the clusters on which you want to create the PVC, paste the resource YAML, and click Create.

Clusters | Select the clusters where the resource(s) will be deployed.

2 x local-cluster,  
ocp-vmw

Resource configuration | Enter the configuration manifest for the resource(s).

YAML

```
1 kind: PersistentVolumeClaim
2 apiVersion: v1
3 metadata:
4   name: demo-pvc
5 spec:
6   accessModes:
7     - ReadWriteOnce
8   resources:
9     requests:
10      storage: 1Gi
11   storageClassName: ocp-trident
```

## Videos and Demos: Red Hat OpenShift with NetApp

The following video demonstrate some of the capabilities documented in this document:

- [Video: Accelerate Software Development with Astra Control and NetApp FlexClone Technology](#)
- [Video: Leverage NetApp Astra Control to Perform Post-mortem Analysis and Restore Your Application](#)
- [Video: Data Protection in CI/CD pipeline with Astra Control](#)
- [Video: Workload Migration using Astra Control Center - Red Hat OpenShift with NetApp](#)
- [Video: Workload Migration using Astra Trident and SnapMirror - Red Hat OpenShift with NetApp](#)
- [Video: Installing OpenShift Virtualization - Red Hat OpenShift with NetApp](#)
- [Video: Deploying a Virtual Machine with OpenShift Virtualization - Red Hat OpenShift with NetApp](#)
- [Video: NetApp HCI for Red Hat OpenShift on Red Hat Virtualization Deployment](#)

Next: Additional Information: Red Hat OpenShift with NetApp.

## Additional Information: Red Hat OpenShift with NetApp

To learn more about the information described in this document, review the following websites:

- NetApp Documentation

<https://docs.netapp.com/>

- Astra Trident Documentation

<https://docs.netapp.com/us-en/trident/index.html>

- NetApp Astra Control Center Documentation

<https://docs.netapp.com/us-en/astra-control-center/>

- Red Hat OpenShift Documentation

[https://access.redhat.com/documentation/en-us/openshift\\_container\\_platform/4.7/](https://access.redhat.com/documentation/en-us/openshift_container_platform/4.7/)

- Red Hat OpenStack Platform Documentation

[https://access.redhat.com/documentation/en-us/red\\_hat\\_opensstack\\_platform/16.1/](https://access.redhat.com/documentation/en-us/red_hat_opensstack_platform/16.1/)

- Red Hat Virtualization Documentation

[https://access.redhat.com/documentation/en-us/red\\_hat\\_virtualization/4.4/](https://access.redhat.com/documentation/en-us/red_hat_virtualization/4.4/)

- VMware vSphere Documentation

<https://docs.vmware.com/>

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