



# Red Hat OpenShift Container Storage 4.6

## Deploying OpenShift Container Storage using Microsoft Azure and Azure Red Hat OpenShift

How to install



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## Abstract

Read this document for instructions on installing and managing Red Hat OpenShift Container Storage on Microsoft Azure.

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## PREFACE

Red Hat OpenShift Container Storage 4.6 supports deployment on existing Red Hat OpenShift Container Platform (RHOCP) Azure clusters.



### NOTE

Only internal OpenShift Container Storage clusters are supported on Microsoft Azure. See [Planning your deployment](#) for more information about deployment requirements.

To deploy OpenShift Container Storage in internal mode, follow the deployment process [Deploying OpenShift Container Storage on Microsoft Azure](#)

# CHAPTER 1. DEPLOYING OPENSIFT CONTAINER STORAGE ON MICROSOFT AZURE

Deploying OpenShift Container Storage on OpenShift Container Platform using dynamic storage devices provided by Microsoft Azure installer-provisioned infrastructure (IPI) (type: **managed-premium**) enables you to create internal cluster resources. This results in internal provisioning of the base services, which helps to make additional storage classes available to applications.



## NOTE

Only internal OpenShift Container Storage clusters are supported on Microsoft Azure. See [Planning your deployment](#) for more information about deployment requirements.

1. [Install the Red Hat OpenShift Container Storage Operator](#) .
2. [Create the OpenShift Container Storage Cluster Service](#)

## 1.1. INSTALLING RED HAT OPENSIFT CONTAINER STORAGE OPERATOR

You can install Red Hat OpenShift Container Storage Operator using the Red Hat OpenShift Container Platform Operator Hub. For information about the hardware and software requirements, see [Planning your deployment](#).

### Prerequisites

- You must be logged into the OpenShift Container Platform (RHOC) cluster.
- You must have at least three worker nodes in the RHOC cluster.



## NOTE

- When you need to override the cluster-wide default node selector for OpenShift Container Storage, you can use the following command in command line interface to specify a blank node selector for the **openshift-storage** namespace:

```
$ oc annotate namespace openshift-storage openshift.io/node-selector=
```

- Taint a node as **infra** to ensure only Red Hat OpenShift Container Storage resources are scheduled on that node. This helps you save on subscription costs. For more information, see [How to use dedicated worker nodes for Red Hat OpenShift Container Storage](#) chapter in *Managing and Allocating Storage Resources* guide.

### Procedure

1. Click **Operators** → **OperatorHub** in the left pane of the OpenShift Web Console.
2. Use **Filter by keyword** text box or the filter list to search for OpenShift Container Storage from the list of operators.
3. Click **OpenShift Container Storage**.



4. On the **OpenShift Container Storage operator** page, click **Install**.
5. On the **Install Operator** page, ensure the following options are selected by default::
  - a. Update Channel as **stable-4.6**
  - b. Installation Mode as **A specific namespace on the cluster**
  - c. Installed Namespace as **Operator recommended namespace openshift-storage**. If Namespace **openshift-storage** does not exist, it will be created during the operator installation.
  - d. Select **Enable operator recommended cluster monitoring on this namespace** checkbox as this is required for cluster monitoring.
  - e. Select **Approval Strategy** as **Automatic** or **Manual**. Approval Strategy is set to **Automatic** by default.
    - **Approval Strategy as Automatic.**

**NOTE**

When you select the Approval Strategy as **Automatic**, approval is not required either during fresh installation or when updating to the latest version of OpenShift Container Storage.

- i. Click **Install**
  - ii. Wait for the install to initiate. This may take up to 20 minutes.
  - iii. Click **Operators → Installed Operators**
  - iv. Ensure the **Project** is **openshift-storage**. By default, the **Project** is **openshift-storage**.
  - v. Wait for the **Status** of **OpenShift Container Storage** to change to **Succeeded**.
- **Approval Strategy as Manual.**

**NOTE**

When you select the Approval Strategy as **Manual**, approval is required during fresh installation or when updating to the latest version of OpenShift Container Storage.

- i. Click **Install**
- ii. On the **Manual approval required** page, you can either click **Approve** or **View Installed Operators in namespace openshift-storage** to install the operator.

**IMPORTANT**

Before you click either of the options, wait for a few minutes on the **Manual approval required** page until the install plan gets loaded in the window.



## IMPORTANT

If you choose to click **Approve**, you must review the install plan before you proceed.

- If you click **Approve**.
  - Wait for a few minutes while the OpenShift Container Storage Operator is getting installed.
  - On the **Installed operator - ready for use** page, click **View Operator**.
  - Ensure the **Project** is **openshift-storage**. By default, the **Project** is **openshift-storage**.
  - Click **Operators → Installed Operators**
  - Wait for the **Status** of **OpenShift Container Storage** to change to **Succeeded**.
- If you click **View Installed Operators in namespace openshift-storage**.
  - On the **Installed Operators** page, click **ocs-operator**.
  - On the **Subscription Details** page, click the **Install Plan** link.
  - On the **InstallPlan Details** page, click **Preview Install Plan**.
  - Review the install plan and click **Approve**.
  - Wait for the **Status** of the **Components** to change from **Unknown** to either **Created** or **Present**.
  - Click **Operators → Installed Operators**
  - Ensure the **Project** is **openshift-storage**. By default, the **Project** is **openshift-storage**.
  - Wait for the **Status** of **OpenShift Container Storage** to change to **Succeeded**.

### Verification steps

- Verify that **OpenShift Container Storage** Operator shows a green tick indicating successful installation.
- Click **View Installed Operators in namespace openshift-storage** link to verify that OpenShift Container Storage Operator shows the **Status** as **Succeeded** on the Installed Operators dashboard.

## 1.2. CREATING AN OPENSIFT CONTAINER STORAGE CLUSTER SERVICE IN INTERNAL MODE

Use this procedure to create an OpenShift Container Storage Cluster Service after you install the OpenShift Container Storage operator.

## Prerequisites

- The OpenShift Container Storage operator must be installed from the Operator Hub. For more information, see [Installing OpenShift Container Storage Operator using the Operator Hub](#).



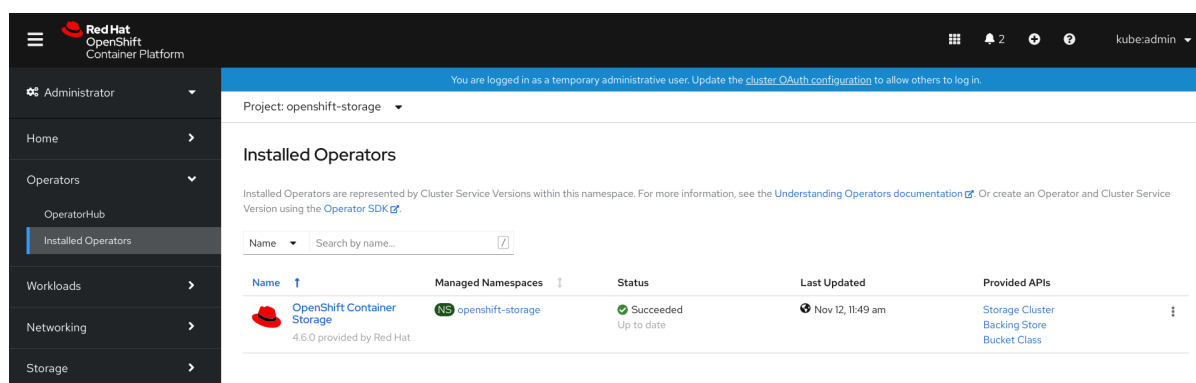
### IMPORTANT

You must not change the host caching policy of the disks from the Azure side after the OpenShift Container Storage cluster is deployed. Changing the host caching policy results in data unavailability due to the **CrashLoopBackOff** state of the object storage device (OSD) pods.

## Procedure

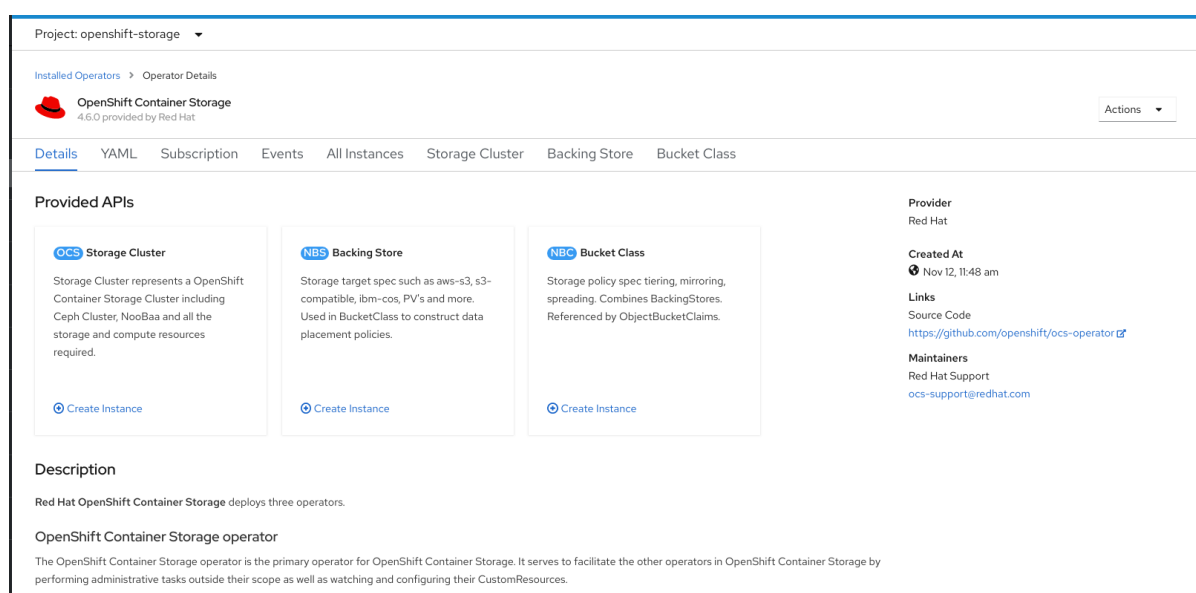
1. Click **Operators** → **Installed Operators** to view all the installed operators. Ensure that the **Project** selected is **openshift-storage**.

Figure 1.1. OpenShift Container Storage Operator page



2. Click **OpenShift Container Storage**.

Figure 1.2. Details tab of OpenShift Container Storage



3. Click **Create Instance** link of Storage Cluster.

Figure 1.3. Create Storage Cluster page

You are logged in as a temporary administrative user. Update the cluster OLM configuration to allow others to log in.

OpenShift Container Storage > Create Storage Cluster

## Create Storage Cluster

OCS runs as a cloud-native service for optimal integration with applications in need of storage, and handles the scenes such as provisioning and management.

Select Mode:  Internal  Internal - Attached Devices  External

**Capacity**

Storage Class:

OCS Service Capacity:

**Encryption**

Enable data encryption for the OCS storage cluster

Disabled

**Nodes**

Select at least 3 nodes, preferably in 3 different zones. It is recommended to start with at least 14 CPUs and 34 GiB per node. The selected nodes will be labeled with `cluster.ocs.openshift.io/openshift-storage` (unless they are already labeled). 3 of the selected nodes will be used for initial deployment. The remaining nodes will be used by OpenShift as scheduling targets for OCS scaling.

Name:

<input checked="" type="checkbox"/>	Name	Role	Zone	CPU	Memory
<input checked="" type="checkbox"/>	mb-2021-02-01a-8v4bl-worker-eastus-1-7f9w	worker	eastus-1	16	61.81 GiB
<input checked="" type="checkbox"/>	mb-2021-02-01a-8v4bl-worker-eastus-1-dhkdq	worker	eastus-1	16	61.81 GiB
<input checked="" type="checkbox"/>	mb-2021-02-01a-8v4bl-worker-eastus-1-tmgzb	worker	eastus-1	16	61.81 GiB

3 nodes selected

4. On the **Create Storage Cluster** page, ensure that the following options are selected:
  - a. In the **Select Mode** section, **Internal** mode is selected by default.
  - b. **Storage Class** is set by default to **managed-premium** for Microsoft Azure.
  - c. Select **OpenShift Container Storage Service Capacity** from drop down list.



### NOTE

Once you select the initial storage capacity, cluster expansion will only be performed using the selected usable capacity (times 3 of raw storage).

- d. **(Optional)** In the **Encryption** section, set the toggle to **Enabled** to enable data encryption on the cluster.
- e. In the **Nodes** section, select at least three worker nodes from the available list for the use of OpenShift Container Storage service.  
For cloud platforms with multiple availability zones, ensure that the Nodes are spread across different Locations/availability zones.



### NOTE

To find specific worker nodes in the cluster, you can filter nodes on the basis of Name or Label.

- Name allows you to search by name of the node
- Label allows you to search by selecting the predefined label

If the nodes selected do not match the OpenShift Container Storage cluster requirement of an aggregated 30 CPUs and 72 GiB of RAM, a minimal cluster will be deployed. For minimum starting node requirements, see [Resource requirements](#) section in Planning guide.

5. Click **Create**.

The **Create** button is enabled only after you select three nodes. A new storage cluster with three storage devices will be created, one per selected node. The default configuration uses a replication factor of 3.

### Verification steps

1. Verify that the final **Status** of the installed storage cluster shows as **Phase: Ready** with a green tick mark.
  - Click **Operators → Installed Operators → Storage Cluster** link to view the storage cluster installation status.
  - Alternatively, when you are on the Operator **Details** tab, you can click on the **Storage Cluster** tab to view the status.
2. To verify that all components for OpenShift Container Storage are successfully installed, see [Verifying your OpenShift Container Storage installation](#).

## CHAPTER 2. DEPLOYING OPENSIFT CONTAINER STORAGE ON AZURE RED HAT OPENSIFT

The Azure Red Hat OpenShift service enables you to deploy fully managed OpenShift clusters. Red Hat OpenShift Container Storage can be deployed on Azure Red Hat OpenShift service.



### IMPORTANT

OpenShift Container storage on Azure Red Hat OpenShift is not a managed service offering. Red Hat OpenShift Container Storage subscriptions are required to have the installation supported by the Red Hat support team. Open support cases by choosing the product as **Red Hat OpenShift Container Storage** with the [Red Hat support](#) team (and not Microsoft) if you need any assistance for OpenShift Container Storage on Azure Red Hat OpenShift.

To install OpenShift Container Storage on Azure Red Hat OpenShift, follow sections:

1. [Getting a Red Hat pull secret for new deployment of Azure Red Hat OpenShift](#)
2. [Preparing a Red Hat pull secret for existing Azure Red Hat OpenShift clusters](#)
3. [Adding the pull secret to the cluster](#)
4. [Validating your Red Hat pull secret is working](#)
5. [Install the Red Hat OpenShift Container Storage Operator](#) .
6. [Create the OpenShift Container Storage Cluster Service](#)

### 2.1. GETTING A RED HAT PULL SECRET FOR NEW DEPLOYMENT OF AZURE RED HAT OPENSIFT

A Red Hat pull secret enables the cluster to access Red Hat container registries along with additional content.

#### Prerequisites

- A Red Hat portal account.
- OpenShift Container Storage subscription.

#### Procedure

To get a Red Hat pull secret for a new deployment of Azure Red Hat OpenShift, follow the steps in the section [Get a Red Hat pull secret](#) in the official Microsoft Azure documentation.

Note that while creating the [Azure Red Hat OpenShift cluster](#), you may need larger worker nodes, controlled by `--worker-vm-size` or more worker nodes, controlled by `--worker-count`. The recommended `worker-vm-size` is **Standard\_D16s\_v3**. You can also use dedicated worker nodes, for more information, see [How to use dedicated worker nodes for Red Hat OpenShift Container Storage](#) in the *Managing and allocating storage resources* guide.

## 2.2. PREPARING A RED HAT PULL SECRET FOR EXISTING AZURE RED HAT OPENSIFT CLUSTERS

When you create an Azure Red Hat OpenShift cluster without adding a Red Hat pull secret, a pull secret is still created on the cluster automatically. However, this pull secret is not fully populated.

Use this section to update the automatically created pull secret with the additional values from the Red Hat pull secret.

### Prerequisites

- Existing Azure Red Hat OpenShift cluster without a Red Hat pull secret.

### Procedure

To prepare a Red Hat pull secret for existing an existing Azure Red Hat OpenShift clusters, follow the steps in the section [Prepare your pull secret](#) in the official Microsoft Azure documentation.

## 2.3. ADDING THE PULL SECRET TO THE CLUSTER

### Prerequisites

- A Red Hat pull secret.

### Procedure

- Run the following command to update your pull secret.



### NOTE

Running this command causes the cluster nodes to restart one by one as they are updated.

```
oc set data secret/pull-secret -n openshift-config --from-file=.dockerconfigjson=./pull-secret.json
```

After the secret is set, you can enable the Red Hat Certified Operators.

### 2.3.1. Modifying the configuration files to enable Red Hat operators

To modify the configuration files to enable Red Hat operators, follow the steps in the section [Modify the configuration files](#) in the official Microsoft Azure documentation.

## 2.4. VALIDATING YOUR RED HAT PULL SECRET IS WORKING

After you add the pull secret and modify the configuration files, the cluster can take several minutes to get updated.

To check if the cluster has been updated, run the following command to show the **Certified Operators** and **Red Hat Operators** sources available:

```
$ oc get catalogsource -A
```

NAMESPACE	NAME	DISPLAY
openshift-marketplace	redhat-operators	Red Hat Operators
TYPE	PUBLISHER	AGE
grpc	Red Hat	11s

If you do not see the Red Hat Operators, wait a few minutes and try again.

To ensure that your pull secret has been updated and is working correctly, open **Operator Hub** and check for any Red Hat verified Operator. For example, check if the OpenShift Container Storage Operator is available, and see if you have permissions to install it.

## 2.5. INSTALLING RED HAT OPENSIFT CONTAINER STORAGE OPERATOR

You can install Red Hat OpenShift Container Storage Operator using the Red Hat OpenShift Container Platform Operator Hub. For information about the hardware and software requirements, see [Planning your deployment](#).

### Prerequisites

- You must be logged into the OpenShift Container Platform (RHOC) cluster.
- You must have at least three worker nodes in the RHOC cluster.



### NOTE

- When you need to override the cluster-wide default node selector for OpenShift Container Storage, you can use the following command in command line interface to specify a blank node selector for the **openshift-storage** namespace:
 

```
$ oc annotate namespace openshift-storage openshift.io/node-selector=
```
- Taint a node as **infra** to ensure only Red Hat OpenShift Container Storage resources are scheduled on that node. This helps you save on subscription costs. For more information, see [How to use dedicated worker nodes for Red Hat OpenShift Container Storage](#) chapter in *Managing and Allocating Storage Resources* guide.

### Procedure

1. Click **Operators** → **OperatorHub** in the left pane of the OpenShift Web Console.
2. Use **Filter by keyword** text box or the filter list to search for OpenShift Container Storage from the list of operators.
3. Click **OpenShift Container Storage**.
4. On the **OpenShift Container Storage operator** page, click **Install**.
5. On the **Install Operator** page, ensure the following options are selected by default:
  - a. Update Channel as **stable-4.6**
  - b. Installation Mode as **A specific namespace on the cluster**



- c. Installed Namespace as **Operator recommended namespace openshift-storage**. If Namespace **openshift-storage** does not exist, it will be created during the operator installation.
- d. Select **Enable operator recommended cluster monitoring on this namespace** checkbox as this is required for cluster monitoring.
- e. Select **Approval Strategy** as **Automatic** or **Manual**. Approval Strategy is set to **Automatic** by default.
  - **Approval Strategy as Automatic.**

**NOTE**

When you select the Approval Strategy as **Automatic**, approval is not required either during fresh installation or when updating to the latest version of OpenShift Container Storage.

- i. Click **Install**
  - ii. Wait for the install to initiate. This may take up to 20 minutes.
  - iii. Click **Operators → Installed Operators**
  - iv. Ensure the **Project** is **openshift-storage**. By default, the **Project** is **openshift-storage**.
  - v. Wait for the **Status** of **OpenShift Container Storage** to change to **Succeeded**.
- **Approval Strategy as Manual.**

**NOTE**

When you select the Approval Strategy as **Manual**, approval is required during fresh installation or when updating to the latest version of OpenShift Container Storage.

- i. Click **Install**
- ii. On the **Manual approval required** page, you can either click **Approve** or **View Installed Operators in namespace openshift-storage** to install the operator.

**IMPORTANT**

Before you click either of the options, wait for a few minutes on the **Manual approval required** page until the install plan gets loaded in the window.

**IMPORTANT**

If you choose to click **Approve**, you must review the install plan before you proceed.

- If you click **Approve**.

- Wait for a few minutes while the OpenShift Container Storage Operator is getting installed.
- On the **Installed operator - ready for use** page, click **View Operator**.
- Ensure the **Project** is **openshift-storage**. By default, the **Project** is **openshift-storage**.
- Click **Operators → Installed Operators**
- Wait for the **Status** of **OpenShift Container Storage** to change to **Succeeded**.
- If you click **View Installed Operators** in namespace **openshift-storage**.
  - On the **Installed Operators** page, click **ocs-operator**.
  - On the **Subscription Details** page, click the **Install Plan** link.
  - On the **InstallPlan Details** page, click **Preview Install Plan**.
  - Review the install plan and click **Approve**.
  - Wait for the **Status** of the **Components** to change from **Unknown** to either **Created** or **Present**.
  - Click **Operators → Installed Operators**
  - Ensure the **Project** is **openshift-storage**. By default, the **Project** is **openshift-storage**.
  - Wait for the **Status** of **OpenShift Container Storage** to change to **Succeeded**.

### Verification steps

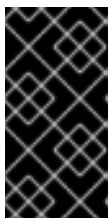
- Verify that **OpenShift Container Storage** Operator shows a green tick indicating successful installation.
- Click **View Installed Operators** in namespace **openshift-storage** link to verify that OpenShift Container Storage Operator shows the **Status** as **Succeeded** on the Installed Operators dashboard.

## 2.6. CREATING AN OPENSIFT CONTAINER STORAGE CLUSTER SERVICE IN INTERNAL MODE

Use this procedure to create an OpenShift Container Storage Cluster Service after you install the OpenShift Container Storage operator.

### Prerequisites

- The OpenShift Container Storage operator must be installed from the Operator Hub. For more information, see [Installing OpenShift Container Storage Operator using the Operator Hub](#) .



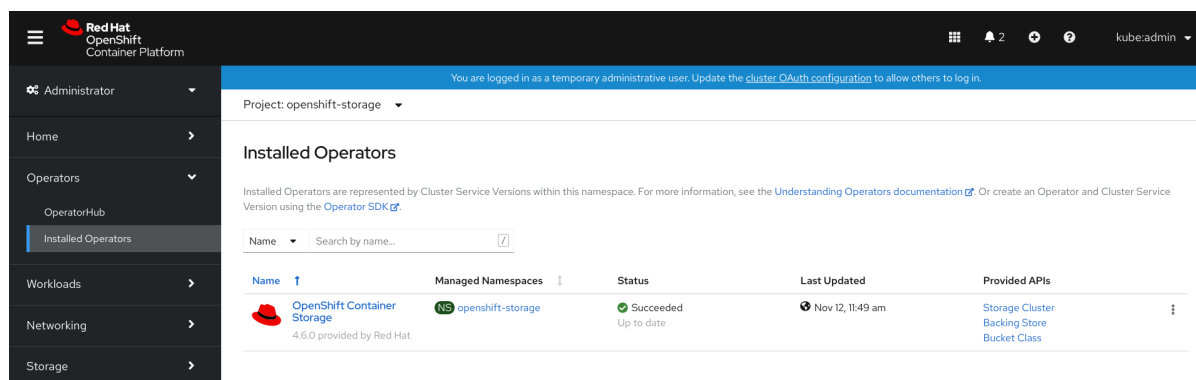
## IMPORTANT

You must not change the host caching policy of the disks from the Azure side after the OpenShift Container Storage cluster is deployed. Changing the host caching policy results in data unavailability due to the **CrashLoopBackOff** state of the object storage device (OSD) pods.

## Procedure

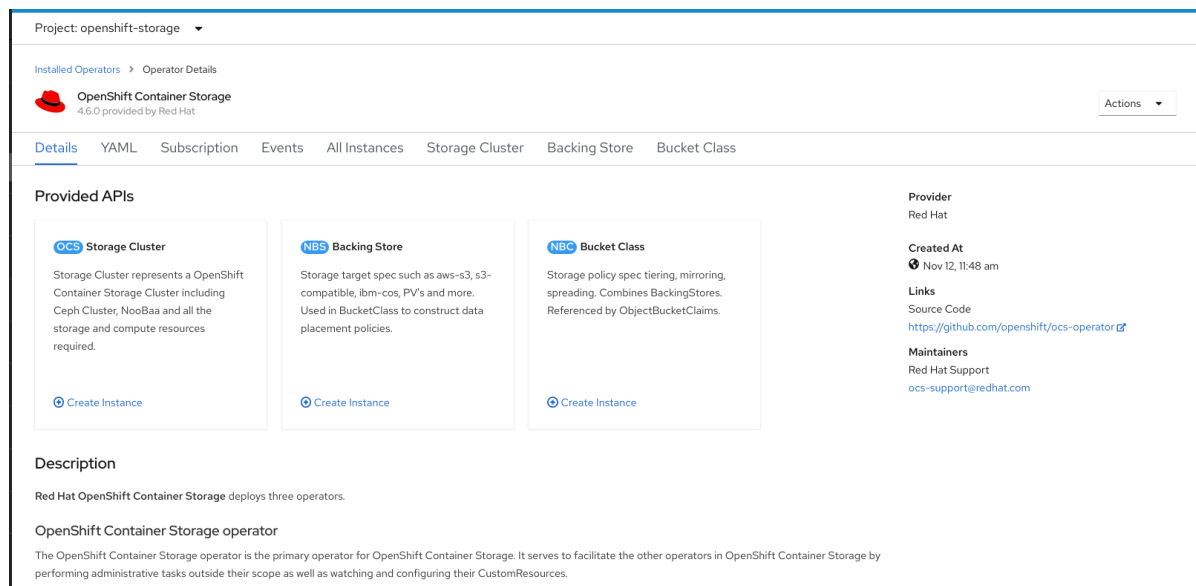
1. Click **Operators** → **Installed Operators** to view all the installed operators. Ensure that the **Project** selected is **openshift-storage**.

Figure 2.1. OpenShift Container Storage Operator page



2. Click **OpenShift Container Storage**.

Figure 2.2. Details tab of OpenShift Container Storage



3. Click **Create Instance** link of Storage Cluster.

Figure 2.3. Create Storage Cluster page

You are logged in as a temporary administrator. [View the cluster OCS configuration to allow others to log in.](#)

OpenShift Container Storage > Create Storage Cluster

## Create Storage Cluster

OCS runs as a cloud-native service for optimal integration with applications in need of storage, and handles the scenes such as provisioning and management.

Select Mode:  Internal  Internal - Attached Devices  External

**Capacity**

Storage Class:

OCS Service Capacity:

**Encryption**

Enable data encryption for the OCS storage cluster

Disabled

**Nodes**

Select at least 3 nodes, preferably in 3 different zones. It is recommended to start with at least 14 CPUs and 34 GiB per node. The selected nodes will be labeled with `cluster.ocs.openshift.io/openshift-storage` (unless they are already labeled). 3 of the selected nodes will be used for initial deployment. The remaining nodes will be used by OpenShift as scheduling targets for OCS scaling.

Name

<input checked="" type="checkbox"/>	Name	Role	Zone	CPU	Memory
<input checked="" type="checkbox"/>	<a href="#">mib-2021-02-01a-8v4bl-worker-eastus-1-7f9pw</a>	worker	eastus-1	16	61.81 GiB
<input checked="" type="checkbox"/>	<a href="#">mib-2021-02-01a-8v4bl-worker-eastus-1-dhkdq</a>	worker	eastus-1	16	61.81 GiB
<input checked="" type="checkbox"/>	<a href="#">mib-2021-02-01a-8v4bl-worker-eastus-1-tmgsb</a>	worker	eastus-1	16	61.81 GiB

3 nodes selected

4. On the **Create Storage Cluster** page, ensure that the following options are selected:
  - a. In the **Select Mode** section, **Internal** mode is selected by default.
  - b. **Storage Class** is set by default to **managed-premium** for Microsoft Azure.
  - c. Select **OpenShift Container Storage Service Capacity** from drop down list.



### NOTE

Once you select the initial storage capacity, cluster expansion will only be performed using the selected usable capacity (times 3 of raw storage).

- d. **(Optional)** In the **Encryption** section, set the toggle to **Enabled** to enable data encryption on the cluster.
- e. In the **Nodes** section, select at least three worker nodes from the available list for the use of OpenShift Container Storage service.  
For cloud platforms with multiple availability zones, ensure that the Nodes are spread across different Locations/availability zones.



### NOTE

To find specific worker nodes in the cluster, you can filter nodes on the basis of Name or Label.

- Name allows you to search by name of the node
- Label allows you to search by selecting the predefined label

If the nodes selected do not match the OpenShift Container Storage cluster requirement of an aggregated 30 CPUs and 72 GiB of RAM, a minimal cluster will be deployed. For minimum starting node requirements, see [Resource requirements](#) section in Planning guide.

5. Click **Create**.

The **Create** button is enabled only after you select three nodes. A new storage cluster with three storage devices will be created, one per selected node. The default configuration uses a replication factor of 3.

### Verification steps

1. Verify that the final **Status** of the installed storage cluster shows as **Phase: Ready** with a green tick mark.
  - Click **Operators → Installed Operators → Storage Cluster** link to view the storage cluster installation status.
  - Alternatively, when you are on the Operator **Details** tab, you can click on the **Storage Cluster** tab to view the status.
2. To verify that all components for OpenShift Container Storage are successfully installed, see [Verifying your OpenShift Container Storage installation](#).

## CHAPTER 3. VERIFYING OPENSIFT CONTAINER STORAGE DEPLOYMENT

Use this section to verify that OpenShift Container Storage is deployed correctly.

### 3.1. VERIFYING THE STATE OF THE PODS

To determine if OpenShift Container storage is deployed successfully, you can verify that the pods are in **Running** state.

#### Procedure

1. Click **Workloads** → **Pods** from the left pane of the OpenShift Web Console.
2. Select **openshift-storage** from the **Project** drop down list.  
For more information on the expected number of pods for each component and how it varies depending on the number of nodes, see [Table 3.1, "Pods corresponding to OpenShift Container storage cluster"](#).
3. Verify that the following pods are in running and completed state by clicking on the **Running** and the **Completed** tabs:

**Table 3.1. Pods corresponding to OpenShift Container storage cluster**

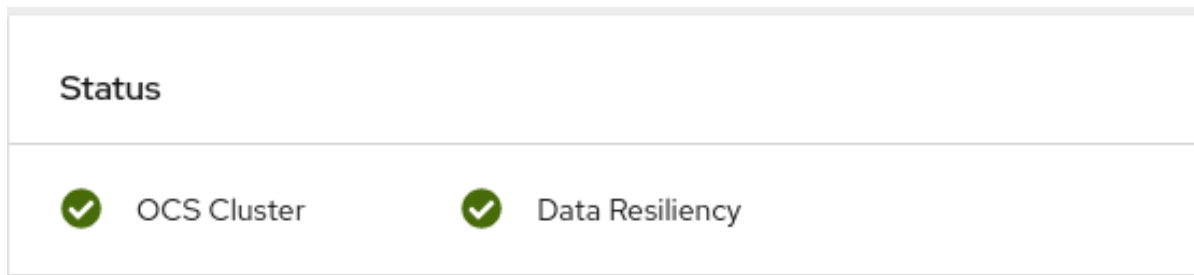
Component	Corresponding pods
OpenShift Container Storage Operator	<ul style="list-style-type: none"> <li>● <b>ocs-operator-*</b> (1 pod on any worker node)</li> <li>● <b>ocs-metrics-exporter-*</b></li> </ul>
Rook-ceph Operator	<b>rook-ceph-operator-*</b> (1 pod on any worker node)
Multicloud Object Gateway	<ul style="list-style-type: none"> <li>● <b>noobaa-operator-*</b> (1 pod on any worker node)</li> <li>● <b>noobaa-core-*</b> (1 pod on any storage node)</li> <li>● <b>noobaa-db-*</b> (1 pod on any storage node)</li> <li>● <b>noobaa-endpoint-*</b> (1 pod on any storage node)</li> </ul>
MON	<b>rook-ceph-mon-*</b> (3 pods distributed across storage nodes)

Component	Corresponding pods
MGR	<b>rook-ceph-mgr-*</b> (1 pod on any storage node)
MDS	<b>rook-ceph-mds-ocs-storagecluster-cephfilesystem-*</b> (2 pods distributed across storage nodes)
CSI	<ul style="list-style-type: none"> <li>● <b>cephfs</b> <ul style="list-style-type: none"> <li>○ <b>csi-cephfsplugin-*</b> (1 pod on each worker node)</li> <li>○ <b>csi-cephfsplugin-provisioner-*</b> (2 pods distributed across worker nodes)</li> </ul> </li> <li>● <b>rbd</b> <ul style="list-style-type: none"> <li>○ <b>csi-rbdplugin-*</b> (1 pod on each worker node)</li> <li>○ <b>csi-rbdplugin-provisioner-*</b> (2 pods distributed across worker nodes)</li> </ul> </li> </ul>
rook-ceph-crashcollector	<b>rook-ceph-crashcollector-*</b> (1 pod on each storage node)
OSD	<ul style="list-style-type: none"> <li>● <b>rook-ceph-osd-*</b> (1 pod for each device)</li> <li>● <b>rook-ceph-osd-prepare-ocs-deviceset-*</b> (1 pod for each device)</li> </ul>

### 3.2. VERIFYING THE OPENSIFT CONTAINER STORAGE CLUSTER IS HEALTHY

- Click **Home** → **Overview** from the left pane of the OpenShift Web Console and click **Persistent Storage** tab.
- In the **Status card**, verify that *OCS Cluster* and *Data Resiliency* has a green tick mark as shown in the following image:

Figure 3.1. Health status card in Persistent Storage Overview Dashboard



- In the **Details card**, verify that the cluster information is displayed as follows:

**Service Name**

OpenShift Container Storage

**Cluster Name**

ocs-storagecluster

**Provider**

Azure

**Mode**

Internal

**Version**

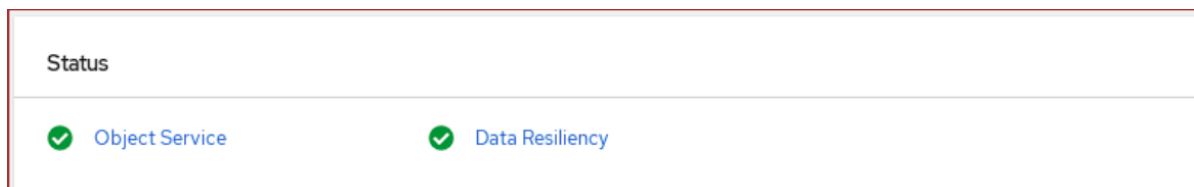
ocs-operator-4.6.0

For more information on the health of OpenShift Container Storage cluster using the persistent storage dashboard, see [Monitoring OpenShift Container Storage](#).

### 3.3. VERIFYING THE MULTICLOUD OBJECT GATEWAY IS HEALTHY

- Click **Home** → **Overview** from the left pane of the OpenShift Web Console and click the **Object Service** tab.
- In the **Status card**, verify that both *Object Service* and *Data Resiliency* are in **Ready** state (green tick).

Figure 3.2. Health status card in Object Service Overview Dashboard



- In the **Details card**, verify that the MCG information is displayed as follows:

**Service Name**

OpenShift Container Storage

**System Name**

Multicloud Object Gateway

**Provider**

Azure

**Version**



ocs-operator-4.6.0

For more information on the health of the OpenShift Container Storage cluster using the object service dashboard, see [Monitoring OpenShift Container Storage](#).

### 3.4. VERIFYING THAT THE OPENSIFT CONTAINER STORAGE SPECIFIC STORAGE CLASSES EXIST

To verify the storage classes exists in the cluster:

- Click **Storage** → **Storage Classes** from the left pane of the OpenShift Web Console.
- Verify that the following storage classes are created with the OpenShift Container Storage cluster creation:
  - **ocs-storagecluster-ceph-rbd**
  - **ocs-storagecluster-cephfs**
  - **openshift-storage.noobaa.io**

## CHAPTER 4. UNINSTALLING OPENSIFT CONTAINER STORAGE

### 4.1. UNINSTALLING OPENSIFT CONTAINER STORAGE IN INTERNAL MODE

Use the steps in this section to uninstall OpenShift Container Storage.

#### Uninstall Annotations

Annotations on the Storage Cluster are used to change the behavior of the uninstall process. To define the uninstall behavior, the following two annotations have been introduced in the storage cluster:

- **uninstall.ocs.openshift.io/cleanup-policy: delete**
- **uninstall.ocs.openshift.io/mode: graceful**

The below table provides information on the different values that can be used with these annotations:

**Table 4.1. uninstall.ocs.openshift.io uninstall annotations descriptions**

Annotation	Value	Default	Behavior
cleanup-policy	delete	Yes	Rook cleans up the physical drives and the <b>DataDirHostPath</b>
cleanup-policy	retain	No	Rook does <b>not</b> clean up the physical drives and the <b>DataDirHostPath</b>
mode	graceful	Yes	Rook and NooBaa <b>pauses</b> the uninstall process until the PVCs and the OBCs are removed by the administrator/user
mode	forced	No	Rook and NooBaa proceeds with uninstall even if PVCs/OBCs provisioned using Rook and NooBaa exist respectively.

You can change the cleanup policy or the uninstall mode by editing the value of the annotation by using the following commands:

```
$ oc annotate storagecluster -n openshift-storage ocs-storagecluster
uninstall.ocs.openshift.io/cleanup-policy="retain" --overwrite
storagecluster.ocs.openshift.io/ocs-storagecluster annotated
```

```
$ oc annotate storagecluster -n openshift-storage ocs-storagecluster
uninstall.ocs.openshift.io/mode="forced" --overwrite
storagecluster.ocs.openshift.io/ocs-storagecluster annotated
```

## Prerequisites

- Ensure that the OpenShift Container Storage cluster is in a healthy state. The uninstall process can fail when some of the pods are not terminated successfully due to insufficient resources or nodes. In case the cluster is in an unhealthy state, contact Red Hat Customer Support before uninstalling OpenShift Container Storage.
- Ensure that applications are not consuming persistent volume claims (PVCs) or object bucket claims (OBCs) using the storage classes provided by OpenShift Container Storage.
- If any custom resources (such as custom storage classes, cephblockpools) were created by the admin, they must be deleted by the admin after removing the resources which consumed them.

## Procedure

1. Delete the volume snapshots that are using OpenShift Container Storage.

- a. List the volume snapshots from all the namespaces.

```
$ oc get volumesnapshot --all-namespaces
```

- b. From the output of the previous command, identify and delete the volume snapshots that are using OpenShift Container Storage.

```
$ oc delete volumesnapshot <VOLUME-SNAPSHOT-NAME> -n <NAMESPACE>
```

2. Delete PVCs and OBCs that are using OpenShift Container Storage.

In the default uninstall mode (graceful), the uninstaller waits till all the PVCs and OBCs that use OpenShift Container Storage are deleted.

If you wish to delete the Storage Cluster without deleting the PVCs beforehand, you may set the uninstall mode annotation to "forced" and skip this step. Doing so will result in orphan PVCs and OBCs in the system.

- a. Delete OpenShift Container Platform monitoring stack PVCs using OpenShift Container Storage.  
See [Section 4.2, "Removing monitoring stack from OpenShift Container Storage"](#)
- b. Delete OpenShift Container Platform Registry PVCs using OpenShift Container Storage.  
See [Section 4.3, "Removing OpenShift Container Platform registry from OpenShift Container Storage"](#)
- c. Delete OpenShift Container Platform logging PVCs using OpenShift Container Storage.  
See [Section 4.4, "Removing the cluster logging operator from OpenShift Container Storage"](#)
- d. Delete other PVCs and OBCs provisioned using OpenShift Container Storage.
  - Given below is a sample script to identify the PVCs and OBCs provisioned using OpenShift Container Storage. The script ignores the PVCs that are used internally by OpenShift Container Storage.

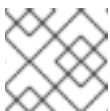
```
#!/bin/bash

RBD_PROVISIONER="openshift-storage.rbd.csi.ceph.com"
CEPHFS_PROVISIONER="openshift-storage.cephfs.csi.ceph.com"
NOOBAA_PROVISIONER="openshift-storage.noobaa.io/obc"
RGW_PROVISIONER="openshift-storage.ceph.rook.io/bucket"

NOOBAA_DB_PVC="noobaa-db"
NOOBAA_BACKINGSTORE_PVC="noobaa-default-backing-store-noobaa-pvc"

# Find all the OCS StorageClasses
OCS_STORAGECLASSES=$(oc get storageclasses | grep -e
"$RBD_PROVISIONER" -e "$CEPHFS_PROVISIONER" -e
"$NOOBAA_PROVISIONER" -e "$RGW_PROVISIONER" | awk '{print $1}')

# List PVCs in each of the StorageClasses
for SC in $OCS_STORAGECLASSES
do
    echo
    "=====
=="
    echo "$SC StorageClass PVCs and OBCs"
    echo
    "=====
=="
    oc get pvc --all-namespaces --no-headers 2>/dev/null | grep $SC | grep -v -e
"$NOOBAA_DB_PVC" -e "$NOOBAA_BACKINGSTORE_PVC"
    oc get obc --all-namespaces --no-headers 2>/dev/null | grep $SC
    echo
done
```

**NOTE**

Omit **RGW\_PROVISIONER** for cloud platforms.

- Delete the OBCs.

```
$ oc delete obc <obc name> -n <project name>
```

- Delete the PVCs.

```
$ oc delete pvc <pvc name> -n <project-name>
```

**NOTE**

Ensure that you have removed any custom backing stores, bucket classes, etc., created in the cluster.

3. Delete the Storage Cluster object and wait for the removal of the associated resources.

```
$ oc delete -n openshift-storage storagecluster --all --wait=true
```

4. Check for cleanup pods if the **uninstall.ocs.openshift.io/cleanup-policy** was set to **delete**(default) and ensure that their status is **Completed**.

```
$ oc get pods -n openshift-storage | grep -i cleanup
NAME                READY STATUS  RESTARTS AGE
cluster-cleanup-job-<xx> 0/1   Completed 0      8m35s
cluster-cleanup-job-<yy> 0/1   Completed 0      8m35s
cluster-cleanup-job-<zz> 0/1   Completed 0      8m35s
```

5. Confirm that the directory **/var/lib/rook** is now empty. This directory will be empty only if the **uninstall.ocs.openshift.io/cleanup-policy** annotation was set to **delete**(default).

```
$ for i in $(oc get node -l cluster.ocs.openshift.io/openshift-storage= -o jsonpath='{.items[*].metadata.name}'); do oc debug node/${i} -- chroot /host ls -l /var/lib/rook; done
```

6. If encryption was enabled at the time of install, remove **dm-crypt** managed **device-mapper** mapping from OSD devices on all the OpenShift Container Storage nodes.
  - a. Create a **debug** pod and **chroot** to the host on the storage node.

```
$ oc debug node/<node name>
$ chroot /host
```

- b. Get Device names and make note of the OpenShift Container Storage devices.

```
$ dmsetup ls
ocs-deviceset-0-data-0-57snx-block-dmccrypt (253:1)
```

- c. Remove the mapped device.

```
$ cryptsetup luksClose --debug --verbose ocs-deviceset-0-data-0-57snx-block-dmccrypt
```

If the above command gets stuck due to insufficient privileges, run the following commands:

- Press **CTRL+Z** to exit the above command.
- Find PID of the **cryptsetup** process which was stuck.

```
$ ps
```

Example output:

```
PID  TTY  TIME  CMD
778825  ?    00:00:00 cryptsetup
```

Take a note of the **PID** number to kill. In this example, **PID** is **778825**.

- Terminate the process using **kill** command.

```
$ kill -9 <PID>
```

- Verify that the device name is removed.

```
$ dmsetup ls
```

7. Delete the namespace and wait till the deletion is complete. You will need to switch to another project if **openshift-storage** is the active project.

For example:

```
$ oc project default
$ oc delete project openshift-storage --wait=true --timeout=5m
```

The project is deleted if the following command returns a **NotFound** error.

```
$ oc get project openshift-storage
```



#### NOTE

While uninstalling OpenShift Container Storage, if namespace is not deleted completely and remains in **Terminating** state, perform the steps in [Troubleshooting and deleting remaining resources during Uninstall](#) to identify objects that are blocking the namespace from being terminated.

8. Unlabel the storage nodes.

```
$ oc label nodes --all cluster.ocs.openshift.io/openshift-storage-
$ oc label nodes --all topology.rook.io/rack-
```

9. Remove the OpenShift Container Storage taint if the nodes were tainted.

```
$ oc adm taint nodes --all node.ocs.openshift.io/storage-
```

10. Confirm all PVs provisioned using OpenShift Container Storage are deleted. If there is any PV left in the **Released** state, delete it.

```
$ oc get pv
$ oc delete pv <pv name>
```

11. Delete the Multicloud Object Gateway storageclass.

```
$ oc delete storageclass openshift-storage.noobaa.io --wait=true --timeout=5m
```

12. Remove **CustomResourceDefinitions**.

```
$ oc delete crd backingstores.noobaa.io bucketclasses.noobaa.io
cephblockpools.ceph.rook.io cephclusters.ceph.rook.io cephfilesystems.ceph.rook.io
cephnfses.ceph.rook.io cephobjectstores.ceph.rook.io cephobjectstoreusers.ceph.rook.io
noobaas.noobaa.io ocsinitializations.ocs.openshift.io storageclusters.ocs.openshift.io
cephclients.ceph.rook.io cephobjectrealms.ceph.rook.io cephobjectzonegroups.ceph.rook.io
cephobjectzones.ceph.rook.io cephrbdmirrors.ceph.rook.io --wait=true --timeout=5m
```

13. To ensure that OpenShift Container Storage is uninstalled completely, on the OpenShift Container Platform Web Console,

- a. Click **Home** → **Overview** to access the dashboard.

- b. Verify that the Persistent Storage and Object Service tabs no longer appear next to the **Cluster** tab.

## 4.2. REMOVING MONITORING STACK FROM OPENSIFT CONTAINER STORAGE

Use this section to clean up the monitoring stack from OpenShift Container Storage.

The PVCs that are created as a part of configuring the monitoring stack are in the **openshift-monitoring** namespace.

### Prerequisites

- PVCs are configured to use OpenShift Container Platform monitoring stack. For information, see [configuring monitoring stack](#).

### Procedure

1. List the pods and PVCs that are currently running in the **openshift-monitoring** namespace.

```
$ oc get pod,pvc -n openshift-monitoring
```

NAME	READY	STATUS	RESTARTS	AGE
pod/alertmanager-main-0	3/3	Running	0	8d
pod/alertmanager-main-1	3/3	Running	0	8d
pod/alertmanager-main-2	3/3	Running	0	8d
pod/cluster-monitoring-operator-84457656d-pkrxm	1/1	Running	0	8d
pod/grafana-79ccf6689f-2ll28	2/2	Running	0	8d
pod/kube-state-metrics-7d86fb966-rvd9w	3/3	Running	0	8d
pod/node-exporter-25894	2/2	Running	0	8d
pod/node-exporter-4dsd7	2/2	Running	0	8d
pod/node-exporter-6p4zc	2/2	Running	0	8d
pod/node-exporter-jbjvg	2/2	Running	0	8d
pod/node-exporter-jj4t5	2/2	Running	0	6d18h
pod/node-exporter-k856s	2/2	Running	0	6d18h
pod/node-exporter-rf8gn	2/2	Running	0	8d
pod/node-exporter-rmb5m	2/2	Running	0	6d18h
pod/node-exporter-zj7kx	2/2	Running	0	8d
pod/openshift-state-metrics-59dbd4f654-4clng	3/3	Running	0	8d
pod/prometheus-adapter-5df5865596-k8dzn	1/1	Running	0	7d23h
pod/prometheus-adapter-5df5865596-n2gj9	1/1	Running	0	7d23h
pod/prometheus-k8s-0	6/6	Running	1	8d
pod/prometheus-k8s-1	6/6	Running	1	8d
pod/prometheus-operator-55cfb858c9-c4zd9	1/1	Running	0	6d21h
pod/telemeter-client-78fc8fc97d-2rgfp	3/3	Running	0	8d

NAME	STATUS	VOLUME
CAPACITY	ACCESS MODES	STORAGECLASS
		AGE
persistentvolumeclaim/my-alertmanager-claim-alertmanager-main-0	Bound	pvc-0d519c4f-

```

15a5-11ea-baa0-026d231574aa 40Gi RWO ocs-storagecluster-ceph-rbd 8d
persistentvolumeclaim/my-alertmanager-claim-alertmanager-main-1 Bound pvc-
0d5a9825-15a5-11ea-baa0-026d231574aa 40Gi RWO ocs-storagecluster-ceph-
rbd 8d
persistentvolumeclaim/my-alertmanager-claim-alertmanager-main-2 Bound pvc-
0d6413dc-15a5-11ea-baa0-026d231574aa 40Gi RWO ocs-storagecluster-ceph-
rbd 8d
persistentvolumeclaim/my-prometheus-claim-prometheus-k8s-0 Bound pvc-0b7c19b0-
15a5-11ea-baa0-026d231574aa 40Gi RWO ocs-storagecluster-ceph-rbd 8d
persistentvolumeclaim/my-prometheus-claim-prometheus-k8s-1 Bound pvc-0b8aed3f-
15a5-11ea-baa0-026d231574aa 40Gi RWO ocs-storagecluster-ceph-rbd 8d

```

2. Edit the monitoring **configmap**.

```
$ oc -n openshift-monitoring edit configmap cluster-monitoring-config
```

3. Remove any **config** sections that reference the OpenShift Container Storage storage classes as shown in the following example and save it.

**Before editing**



```
.  
.   
.   
apiVersion: v1  
data:  
  config.yaml: |  
    alertmanagerMain:  
      volumeClaimTemplate:  
        metadata:  
          name: my-alertmanager-claim  
        spec:  
          resources:  
            requests:  
              storage: 40Gi  
          storageClassName: ocs-storagecluster-ceph-rbd  
  prometheusK8s:  
    volumeClaimTemplate:  
      metadata:  
        name: my-prometheus-claim  
      spec:  
        resources:  
          requests:  
            storage: 40Gi  
        storageClassName: ocs-storagecluster-ceph-rbd  
kind: ConfigMap  
metadata:  
  creationTimestamp: "2019-12-02T07:47:29Z"  
  name: cluster-monitoring-config  
  namespace: openshift-monitoring  
  resourceVersion: "22110"  
  selfLink: /api/v1/namespaces/openshift-monitoring/configmaps/cluster-monitoring-config  
  uid: fd6d988b-14d7-11ea-84ff-066035b9efa8  
.   
.   
.   

```

After editing

```

.
.
.
apiVersion: v1
data:
  config.yaml: |
kind: ConfigMap
metadata:
  creationTimestamp: "2019-11-21T13:07:05Z"
  name: cluster-monitoring-config
  namespace: openshift-monitoring
  resourceVersion: "404352"
  selfLink: /api/v1/namespaces/openshift-monitoring/configmaps/cluster-monitoring-config
  uid: d12c796a-0c5f-11ea-9832-063cd735b81c
.
.
.

```

In this example, **alertmanagerMain** and **prometheusK8s** monitoring components are using the OpenShift Container Storage PVCs.

4. Delete relevant PVCs. Make sure you delete all the PVCs that are consuming the storage classes.

```
$ oc delete -n openshift-monitoring pvc <pvc-name> --wait=true --timeout=5m
```

### 4.3. REMOVING OPENSIFT CONTAINER PLATFORM REGISTRY FROM OPENSIFT CONTAINER STORAGE

Use this section to clean up OpenShift Container Platform registry from OpenShift Container Storage. If you want to configure an alternative storage, see [image registry](#)

The PVCs that are created as a part of configuring OpenShift Container Platform registry are in the **openshift-image-registry** namespace.

#### Prerequisites

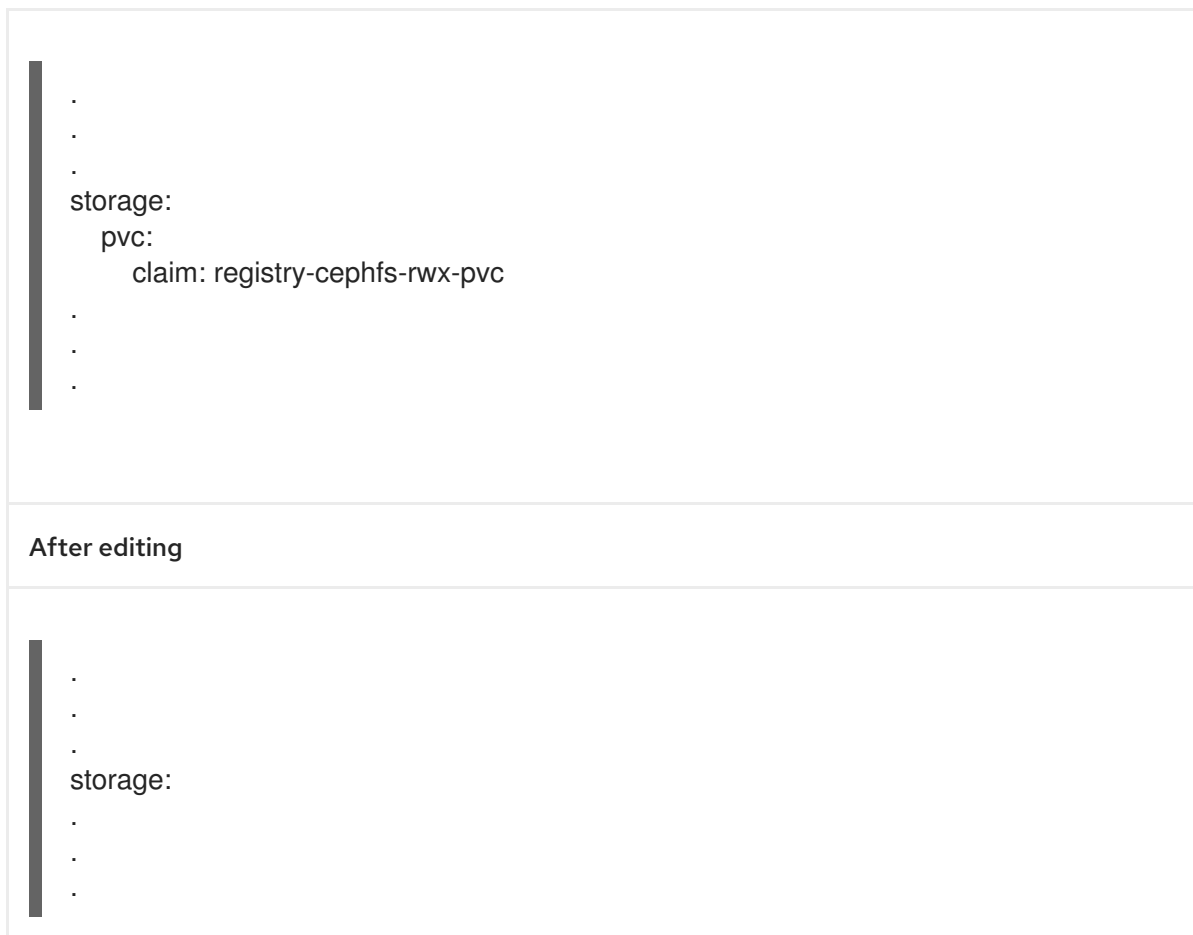
- The image registry should have been configured to use an OpenShift Container Storage PVC.

#### Procedure

1. Edit the **configs.imageregistry.operator.openshift.io** object and remove the content in the **storage** section.

```
$ oc edit configs.imageregistry.operator.openshift.io
```

Before editing



In this example, the PVC is called **registry-cephfs-rwx-pvc**, which is now safe to delete.

2. Delete the PVC.

```
$ oc delete pvc <pvc-name> -n openshift-image-registry --wait=true --timeout=5m
```

## 4.4. REMOVING THE CLUSTER LOGGING OPERATOR FROM OPENSIFT CONTAINER STORAGE

Use this section to clean up the cluster logging operator from OpenShift Container Storage.

The PVCs that are created as a part of configuring cluster logging operator are in the **openshift-logging** namespace.

### Prerequisites

- The cluster logging instance should have been configured to use OpenShift Container Storage PVCs.

### Procedure

1. Remove the **ClusterLogging** instance in the namespace.

```
$ oc delete clusterlogging instance -n openshift-logging --wait=true --timeout=5m
```

The PVCs in the **openshift-logging** namespace are now safe to delete.

2. Delete PVCs.

```
┆ $ oc delete pvc <pvc-name> -n openshift-logging --wait=true --timeout=5m
```