# Red Hat OpenShift Container Storage 4.4

## Managing OpenShift Container Storage

Instructions for cluster and storage administrators

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# Red Hat OpenShift Container Storage 4.4 Managing OpenShift Container Storage

Instructions for cluster and storage administrators

## Abstract

This document covers instructions for managing an OpenShift Container Storage cluster.

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# CHAPTER 1. OVERVIEW

*Managing OpenShift Container Storage* is written to help administrators understand how to manage and administer their Red Hat OpenShift Container Storage cluster.

Most management tasks focus on a single resource. This document is divided into chapters based on the resource that an administrator is trying to modify:

- Chapter 2, *Configure storage for OpenShift Container Platform services* shows you how to use OpenShift Container Storage for core OpenShift Container Platform services.
- Chapter 3, *Backing OpenShift Container Platform applications with OpenShift Container Storage* provides information about how to configure OpenShift Container Platform applications to use OpenShift Container Storage.
- Chapter 4, *Scaling storage nodes* provides information about scaling storage capacity of OpenShift Container Storage nodes.
- Chapter 5, *Managing persistent volume claims* provides information about managing Persistent Volume Claim requests, and automating the fulfillment of those requests.
- Chapter 6, *Managing container storage interface (CSI) component placements* provides information about setting tolerations to bring up container storage interface component on the nodes.
- Chapter 7, *Multicloud Object Gateway* provides information about the Multicloud Object Gateway.
- Chapter 9, *Replacing storage nodes* shows you how to replace an operational or failed node on AWS UPI, AWS IPI, and VMware UPI for OpenShift Container Storage.
- Chapter 10, *Replacing storage devices* provides instructions for replacing a device for OpenShift Container Storage deployed dynamically on VMware and bare metal infrastructures and OpenShift Container Storage deployed using local storage devices.
- Chapter 11, *Updating OpenShift Container Storage* provides instructions for upgrading your OpenShift Container Storage cluster.

# CHAPTER 2. CONFIGURE STORAGE FOR OPENSHIFT CONTAINER PLATFORM SERVICES

You can use OpenShift Container Storage to provide storage for OpenShift Container Platform services such as image registry, monitoring, and logging.

The process for configuring storage for these services depends on the infrastructure used in your OpenShift Container Storage deployment.

> **WARNING**
>
> Always ensure that you have plenty of storage capacity for these services. If the storage for these critical services runs out of space, the cluster becomes inoperable and very difficult to recover.
>
> Red Hat recommends configuring shorter curation and retention intervals for these services. See Configuring Curator and Modifying retention time for Prometheus metrics data in the OpenShift Container Platform documentation for details.
>
> If you do run out of storage space for these services, contact Red Hat Customer Support.

## 2.1. CONFIGURING IMAGE REGISTRY TO USE OPENSHIFT CONTAINER STORAGE

OpenShift Container Platform provides a built in Container Image Registry which runs as a standard workload on the cluster. A registry is typically used as a publication target for images built on the cluster as well as a source of images for workloads running on the cluster.

Follow the instructions in this section to configure OpenShift Container Storage as storage for the Container Image Registry. On AWS, it is not required to change the storage for the registry. However, it is recommended to change the storage to OpenShift Container Storage persistent volume for vSphere and Baremetal platforms.

> **WARNING**
>
> This process does not migrate data from an existing image registry to the new image registry. If you already have container images in your existing registry, back up your registry before you complete this process, and re-register your images when this process is complete.

**Prerequisites**

- You have administrative access to OpenShift Web Console.

- OpenShift Container Storage Operator is installed and running in the **openshift-storage** namespace. In OpenShift Web Console, click **Operators → Installed Operators** to view installed operators.
- Image Registry Operator is installed and running in the **openshift-image-registry** namespace. In OpenShift Web Console, click **Administration → Cluster Settings → Cluster Operators** to view cluster operators.
- The **ocs-storagecluster-cephfs** storage class is available. In OpenShift Web Console, click **Storage → Storage Classes** to view available storage classes.

Procedure

1. **Create a Persistent Volume Claim for the Image Registry to use.**
   a. In OpenShift Web Console, click **Storage → Persistent Volume Claims**.
   b. Set the **Project** to **openshift-image-registry**.
   c. Click **Create Persistent Volume Claim**
      i. Specify a **Storage Class** of **ocs-storagecluster-cephfs**.
      ii. Specify the Persistent Volume Claim **Name**, for example, **ocs4registry**.
      iii. Specify an **Access Mode** of **Shared Access (RWX)**.
      iv. Specify a **Size** of at least 100 GB.
      v. Click **Create**.
      Wait until the status of the new Persistent Volume Claim is listed as **Bound**.
2. **Configure the cluster's Image Registry to use the new Persistent Volume Claim.**
   a. Click **Administration →Custom Resource Definitions**.
   b. Click the **Config** custom resource definition associated with the **imageregistry.operator.openshift.io** group.
   c. Click the **Instances** tab.
   d. Beside the cluster instance, click the **Action Menu ( ⋮ ) → Edit Config**.
   e. Add the new Persistent Volume Claim as persistent storage for the Image Registry.
      i. Add the following under **spec:**, replacing the existing **storage:** section if necessary.

```
storage:
  pvc:
    claim: <new-pvc-name>
```

For example:

```
storage:
  pvc:
    claim: ocs4registry
```

ii. Click **Save**.

3. **Verify that the new configuration is being used.**

    a. Click **Workloads → Pods**.

    b. Set the **Project** to **openshift-image-registry**.

    c. Verify that the new **image-registry-*** pod appears with a status of **Running**, and that the previous **image-registry-*** pod terminates.

    d. Click the new **image-registry-*** pod to view pod details.

    e. Scroll down to **Volumes** and verify that the **registry-storage** volume has a **Type** that matches your new Persistent Volume Claim, for example, **ocs4registry**.

## 2.2. CONFIGURING MONITORING TO USE OPENSHIFT CONTAINER STORAGE

OpenShift Container Storage provides a monitoring stack that is comprised of Prometheus and AlertManager.

Follow the instructions in this section to configure OpenShift Container Storage as storage for the monitoring stack.

### IMPORTANT

Monitoring will not function if it runs out of storage space. Always ensure that you have plenty of storage capacity for monitoring.

Red Hat recommends configuring a short retention intervals for this service. See the *Modifying retention time for Prometheus metrics data* sub section of Configuring persistent storage in the OpenShift Container Platform documentation for details.

### Prerequisites

- You have administrative access to OpenShift Web Console.

- OpenShift Container Storage Operator is installed and running in the **openshift-storage** namespace. In OpenShift Web Console, click **Operators → Installed Operators** to view installed operators.

- Monitoring Operator is installed and running in the **openshift-monitoring** namespace. In OpenShift Web Console, click **Administration → Cluster Settings → Cluster Operators** to view cluster operators.

- The **ocs-storagecluster-ceph-rbd** storage class is available. In OpenShift Web Console, click **Storage → Storage Classes** to view available storage classes.

### Procedure

1. In OpenShift Web Console, go to **Workloads → Config Maps**.

2. Set the **Project** dropdown to **openshift-monitoring**.

3. Click **Create Config Map**.

4. Define a new **cluster-monitoring-config** Config Map using the following example.
   Replace the content in angle brackets (**<**, **>**) with your own values, for example, **retention: 24h** or **storage: 40Gi**.

   ### Example cluster-monitoring-config Config Map

   ```
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: cluster-monitoring-config
     namespace: openshift-monitoring
   data:
     config.yaml: |
         prometheusK8s:
           retention: <time to retain monitoring files, e.g. 24h>
           volumeClaimTemplate:
             metadata:
               name: ocs-prometheus-claim
             spec:
               storageClassName: ocs-storagecluster-ceph-rbd
               resources:
                 requests:
                   storage: <size of claim, e.g. 40Gi>
         alertmanagerMain:
           volumeClaimTemplate:
             metadata:
               name: ocs-alertmanager-claim
             spec:
               storageClassName: ocs-storagecluster-ceph-rbd
               resources:
                 requests:
                   storage: <size of claim, e.g. 40Gi>
   ```

5. Click **Create** to save and create the Config Map.

### Verification steps

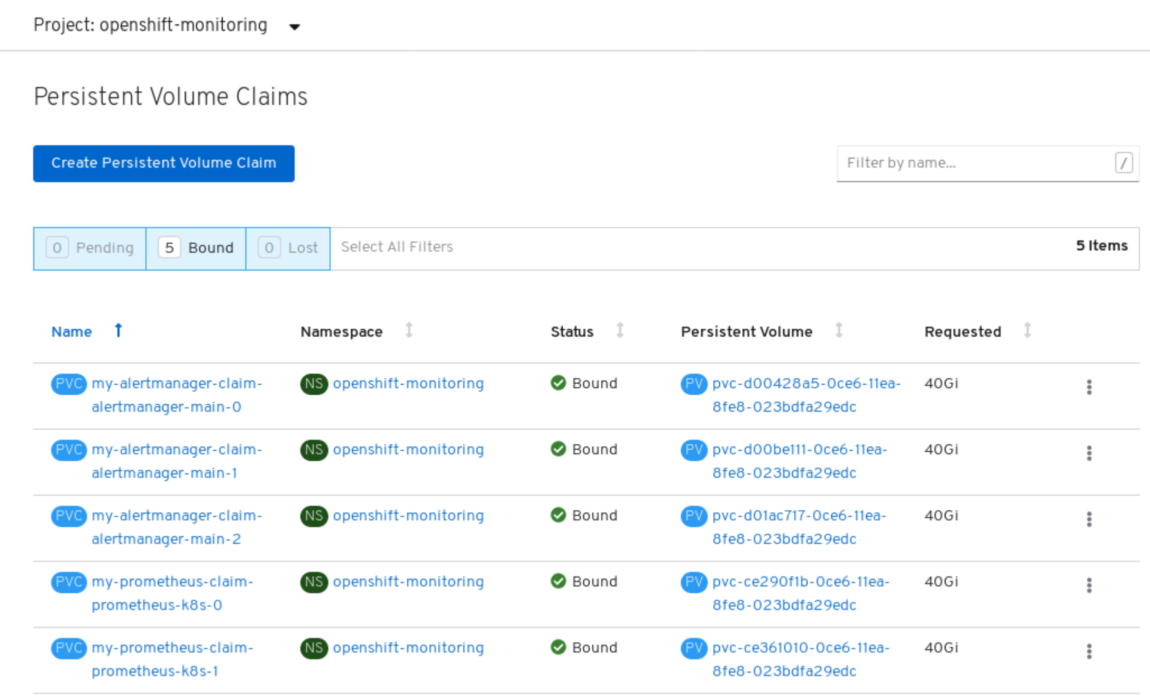
1. Verify that the Persistent Volume claims are bound to the pods.

   a. Go to **Storage → Persistent Volume Claims**.

   b. Set the **Project** dropdown to **openshift-monitoring**.

   c. Verify that 5 Persistent Volume Claims are visible with a state of **Bound**, attached to three **alertmanager-main-*** pods, and two **prometheus-k8s-*** pods.

   ### Monitoring storage created and bound



Persistent Volume Claims

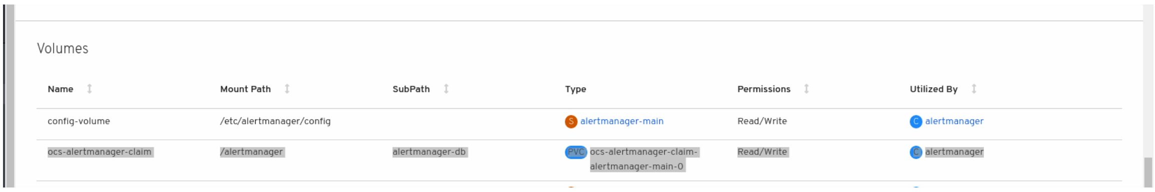
| Name | Namespace | Status | Persistent Volume | Requested |
|---|---|---|---|---|
| PVC my-alertmanager-claim-alertmanager-main-0 | NS openshift-monitoring | ✓ Bound | PV pvc-d00428a5-0ce6-11ea-8fe8-023bdfa29edc | 40Gi |
| PVC my-alertmanager-claim-alertmanager-main-1 | NS openshift-monitoring | ✓ Bound | PV pvc-d00be111-0ce6-11ea-8fe8-023bdfa29edc | 40Gi |
| PVC my-alertmanager-claim-alertmanager-main-2 | NS openshift-monitoring | ✓ Bound | PV pvc-d01ac717-0ce6-11ea-8fe8-023bdfa29edc | 40Gi |
| PVC my-prometheus-claim-prometheus-k8s-0 | NS openshift-monitoring | ✓ Bound | PV pvc-ce290f1b-0ce6-11ea-8fe8-023bdfa29edc | 40Gi |
| PVC my-prometheus-claim-prometheus-k8s-1 | NS openshift-monitoring | ✓ Bound | PV pvc-ce361010-0ce6-11ea-8fe8-023bdfa29edc | 40Gi |

2. Verify that the new **alertmanager-main-*** pods appear with a state of **Running**.

    a. Click the new **alertmanager-main-*** pods to view the pod details.

    b. Scroll down to **Volumes** and verify that the volume has a **Type**, **ocs-alertmanager-claim** that matches one of your new Persistent Volume Claims, for example, **ocs-alertmanager-claim-alertmanager-main-0**.

    Persistent Volume Claims attached to **alertmanager-main-*** pod



Volumes

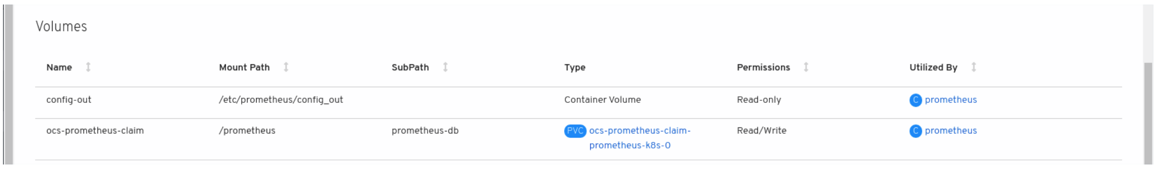
| Name | Mount Path | SubPath | Type | Permissions | Utilized By |
|---|---|---|---|---|---|
| config-volume | /etc/alertmanager/config | | S alertmanager-main | Read/Write | C alertmanager |
| ocs-alertmanager-claim | /alertmanager | alertmanager-db | PVC ocs-alertmanager-claim-alertmanager-main-0 | Read/Write | C alertmanager |

3. Verify that the new **prometheus-k8s-*** pods appear with a state of **Running**.

    a. Click the new **prometheus-k8s-*** pods to view the pod details.

    b. Scroll down to **Volumes** and verify that the volume has a **Type**, **ocs-prometheus-claim** that matches one of your new Persistent Volume Claims, for example, **ocs-prometheus-claim-prometheus-k8s-0**.

    Persistent Volume Claims attached to **prometheus-k8s-*** pod



Volumes

| Name | Mount Path | SubPath | Type | Permissions | Utilized By |
|---|---|---|---|---|---|
| config-out | /etc/prometheus/config_out | | Container Volume | Read-only | C prometheus |
| ocs-prometheus-claim | /prometheus | prometheus-db | PVC ocs-prometheus-claim-prometheus-k8s-0 | Read/Write | C prometheus |

## 2.3. CLUSTER LOGGING FOR OPENSHIFT CONTAINER STORAGE

You can deploy cluster logging to aggregate logs for a range of OpenShift Container Platform services. For information about how to deploy cluster logging, see Deploying cluster logging.

Upon initial OpenShift Container Platform deployment, OpenShift Container Storage is not configured by default and the OpenShift Container Platform cluster will solely rely on default storage available from the nodes. You can edit the default configuration of OpenShift logging (ElasticSearch) to be backed by OpenShift Container Storage to have OpenShift Container Storage backed logging (Elasticsearch).

IMPORTANT

Always ensure that you have plenty of storage capacity for these services. If you run out of storage space for these critical services, the logging application becomes inoperable and very difficult to recover.

Red Hat recommends configuring shorter curation and retention intervals for these services. See Configuring Curator in the OpenShift Container Platform documentation for details.

If you run out of storage space for these services, contact Red Hat Customer Support.

### 2.3.1. Configuring persistent storage

You can configure a persistent storage class and size for the Elasticsearch cluster using the storage class name and size parameters. The Cluster Logging Operator creates a Persistent Volume Claim for each data node in the Elasticsearch cluster based on these parameters. For example:

```
spec:
  logStore:
   type: "elasticsearch"
   elasticsearch:
    nodeCount: 3
    storage:
     storageClassName: "ocs-storagecluster-ceph-rbd”
     size: "200G"
```

This example specifies that each data node in the cluster will be bound to a Persistent Volume Claim that requests **200GiB** of **ocs-storagecluster-ceph-rbd** storage. Each primary shard will be backed by a single replica. A copy of the shard is replicated across all the nodes and are always available and the copy can be recovered if at least two nodes exist due to the single redundancy policy. For information about Elasticsearch replication policies, see Elasticsearch replication policy in About deploying and configuring cluster logging.

NOTE

Omission of the storage block will result in a deployment backed by default storage. For example:

```
spec:
  logStore:
   type: "elasticsearch"
   elasticsearch:
    nodeCount: 3
    storage: {}
```

For more information, see Configuring cluster logging.

### 2.3.2. Configuring cluster logging to use OpenShift Container Storage

Follow the instructions in this section to configure OpenShift Container Storage as storage for the OpenShift cluster logging.

> NOTE
>
> You can obtain all the logs when you configure logging for the first time in OpenShift Container Storage. However, after you uninstall and reinstall logging, the old logs are removed and only the new logs are processed.

**Prerequisites**

- You have administrative access to OpenShift Web Console.
- OpenShift Container Storage Operator is installed and running in the **openshift-storage** namespace.
- Cluster logging Operator is installed and running in the **openshift-logging** namespace.

**Procedure**

1. Click **Administration → Custom Resource Definitions**from the left pane of the OpenShift Web Console.
2. On the Custom Resource Definitions page, click **ClusterLogging**.
3. On the Custom Resource Definition Overview page, select **View Instances** from the Actions menu or click the **Instances** Tab.
4. On the Cluster Logging page, click **Create Cluster Logging**.
   You might have to refresh the page to load the data.
5. In the YAML, replace the code with the following:

```
apiVersion: "logging.openshift.io/v1"
kind: "ClusterLogging"
metadata:
  name: "instance"
  namespace: "openshift-logging"
spec:
  managementState: "Managed"
  logStore:
    type: "elasticsearch"
    elasticsearch:
      nodeCount: 3
      storage:
        storageClassName: ocs-storagecluster-ceph-rbd
        size: 200G
      redundancyPolicy: "SingleRedundancy"
  visualization:
    type: "kibana"
    kibana:
      replicas: 1
  curation:
    type: "curator"
  curator:
    schedule: "30 3 * * *"
collection:
  logs:
    type: "fluentd"
    fluentd: {}
```

6. Click **Save**.

### Verification steps

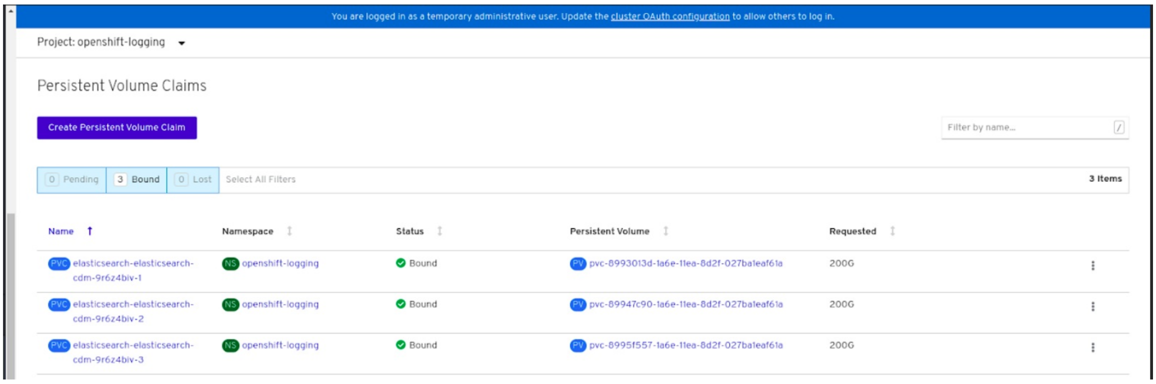
1. Verify that the Persistent Volume Claims are bound to the **elasticsearch** pods.

    a. Go to **Storage → Persistent Volume Claims**.

    b. Set the **Project** dropdown to **openshift-logging**.

    c. Verify that Persistent Volume Claims are visible with a state of **Bound**, attached to **elasticsearch-*** pods.

    **Figure 2.1. Cluster logging created and bound**



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

Project: openshift-logging

Persistent Volume Claims

| Name | Namespace | Status | Persistent Volume | Requested |
|---|---|---|---|---|
| PVC elasticsearch-elasticsearch-cdm-9r6z4biv-1 | NS openshift-logging | Bound | PV pvc-8993013d-1a6e-11ea-8d2f-027ba1eaf61a | 200G |
| PVC elasticsearch-elasticsearch-cdm-9r6z4biv-2 | NS openshift-logging | Bound | PV pvc-89947c90-1a6e-11ea-8d2f-027ba1eaf61a | 200G |
| PVC elasticsearch-elasticsearch-cdm-9r6z4biv-3 | NS openshift-logging | Bound | PV pvc-8995f557-1a6e-11ea-8d2f-027ba1eaf61a | 200G |

2. Verify that the new cluster logging is being used.

    a. Click **Workload → Pods**.

    b. Set the Project to **openshift-logging**.

    c. Verify that the new **elasticsearch-*** pods appear with a state of **Running**.

    d. Click the new **elasticsearch-*** pod to view pod details.

    e. Scroll down to **Volumes** and verify that the elasticsearch volume has a **Type** that matches your new Persistent Volume Claim, for example, **elasticsearch-elasticsearch-cdm-9r624biv-3**.

    f. Click the Persistent Volume Claim name and verify the storage class name in the PersistenVolumeClaim Overview page.

NOTE

Make sure to use a shorter curator time to avoid PV full scenario on PVs attached to Elasticsearch pods.

You can configure Curator to delete Elasticsearch data based on retention settings. It is recommended that you set the following default index data retention of 5 days as a default.

```
config.yaml: |
    openshift-storage:
      delete:
        days: 5
```

For more details, see Curation of Elasticsearch Data .

NOTE

To uninstall cluster logging backed by Persistent Volume Claim, use the steps in Removing the cluster logging operator from OpenShift Container Storage .

# CHAPTER 3. BACKING OPENSHIFT CONTAINER PLATFORM APPLICATIONS WITH OPENSHIFT CONTAINER STORAGE

You cannot directly install OpenShift Container Storage during the OpenShift Container Platform installation. However, you can install OpenShift Container Storage on an existing OpenShift Container Platform by using the Operator Hub and then configure the OpenShift Container Platform applications to be backed by OpenShift Container Storage.

### Prerequisites

- OpenShift Container Platform is installed and you have administrative access to OpenShift Web Console.
- OpenShift Container Storage is installed and running in the **openshift-storage** namespace.

### Procedure

1. In the OpenShift Web Console, perform one of the following:
   - Click **Workloads → Deployments**.
     In the Deployments page, you can do one of the following:
     - Select any existing deployment and click **Add Storage** option from the **Action** menu (⋮).
     - Create a new deployment and then add storage.
       i. Click **Create Deployment** to create a new deployment.
       ii. Edit the **YAML** based on your requirement to create a deployment.
       iii. Click **Create**.
       iv. Select **Add Storage** from the **Actions** drop down menu on the top right of the page.
   - Click **Workloads → Deployment Configs**
     In the Deployment Configs page, you can do one of the following:
     - Select any existing deployment and click **Add Storage** option from the **Action** menu (⋮).
     - Create a new deployment and then add storage.
       i. Click **Create Deployment Config** to create a new deployment.
       ii. Edit the **YAML** based on your requirement to create a deployment.
       iii. Click **Create**.
       iv. Select **Add Storage** from the **Actions** drop down menu on the top right of the page.
2. In the Add Storage page, you can choose one of the following options:
   - Click the **Use existing claim** option and select a suitable PVC from the drop down list.

- Click the **Create new claim** option.

    a. Select **ocs-storagecluster-ceph-rbd** or **ocs-storagecluster-cephfs** storage class from the **Storage Class** drop down list.

    b. Provide a name for the Persistent Volume Claim.

    c. Select ReadWriteOnce (RWO) or ReadWriteMany (RWX) access mode.

    > NOTE
    >
    > ReadOnlyMany (ROX) is deactivated as it is not supported.

    d. Select the size of the desired storage capacity.

    > NOTE
    >
    > You cannot resize the storage capacity after the creation of Persistent Volume Claim.

3. Specify the mount path and subpath (if required) for the mount path volume inside the container.

4. Click **Save**.

**Verification steps**

1. Depending on your configuration, perform one of the following:

    - Click **Workloads → Deployments**.

    - Click **Workloads → Deployment Configs**

2. Set the Project as required.

3. Click the deployment for you which you added storage to view the deployment details.

4. Scroll down to **Volumes** and verify that your deployment has a **Type** that matches the Persistent Volume Claim that you assigned.

5. Click the Persistent Volume Claim name and verify the storage class name in the PersistenVolumeClaim Overview page.

# CHAPTER 4. SCALING STORAGE NODES

To scale the storage capacity of OpenShift Container Storage, you can do either of the following:

- **Scale up storage nodes** - Add storage capacity to the existing Red Hat OpenShift Container Storage worker nodes
- **Scale out storage nodes** - Add new worker nodes containing storage capacity

## 4.1. REQUIREMENTS FOR SCALING STORAGE NODES

Before you proceed to scale the storage nodes, refer to the following sections to understand the node requirements for your specific Red Hat OpenShift Container Storage instance:

- Supported Infrastructure and Platforms
- Supported configurations
  - For dynamically created storage
  - For local storage devices

> **WARNING**
>
> Always ensure that you have plenty of storage capacity.
>
> If storage ever fills completely, it is not possible to add capacity or delete or migrate content away from the storage to free up space. Completely full storage is very difficult to recover.
>
> Capacity alerts are issued when cluster storage capacity reaches 75% (near-full) and 85% (full) of total capacity. Always address capacity warnings promptly, and review your storage regularly to ensure that you do not run out of storage space.
>
> If you do run out of storage space completely, contact Red Hat Customer Support.

### 4.1.1. Supported Deployments for Red Hat OpenShift Container Storage

- User-provisioned infrastructure:
  - Amazon Web Services (AWS)
  - VMware
  - Bare metal
- Installer-provisioned infrastructure:
  - Amazon Web Services (AWS)

## 4.2. SCALING UP STORAGE CAPACITY

Depending on the type of your deployment, you can choose one of the following procedures to scale up storage capacity.

- For AWS or VMware infrastructures using dynamic or automated provisioning of storage devices, see Section 4.2.1, “Scaling up storage by adding capacity to your OpenShift Container Storage nodes on AWS or VMware infrastructure”
- For bare metal, Amazon EC2 I3, or VMware infrastructures using local storage devices, see Section 4.2.2, “Scaling up storage by adding capacity to your OpenShift Container Storage nodes using local storage devices”

### 4.2.1. Scaling up storage by adding capacity to your OpenShift Container Storage nodes on AWS or VMware infrastructure

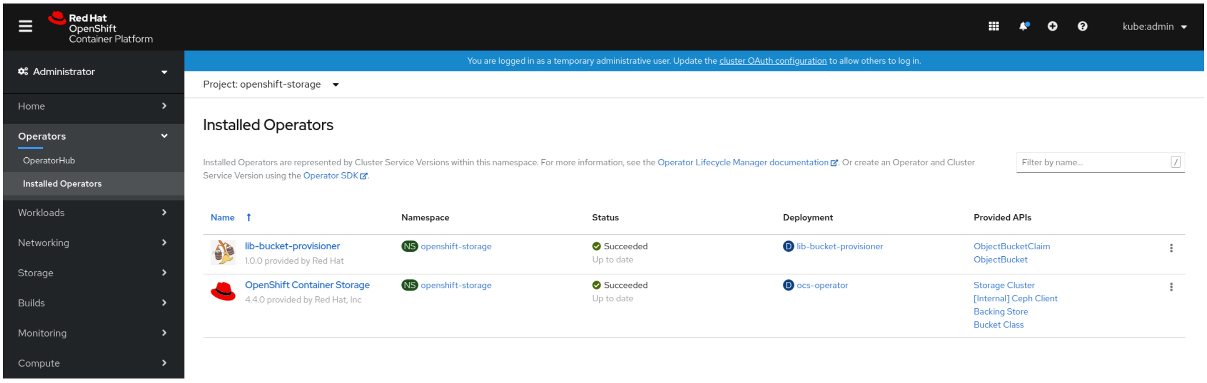
Use this procedure to add storage capacity and performance to your configured Red Hat OpenShift Container Storage worker nodes.

#### Prerequisites

- A running OpenShift Container Storage Platform
- Administrative privileges on the OpenShift Web Console

#### Procedure

1. Navigate to the OpenShift Web Console.
2. Click on **Operators** on the left navigation bar.
3. Select **Installed Operators**.
4. In the window, click **OpenShift Container Storage** Operator:



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

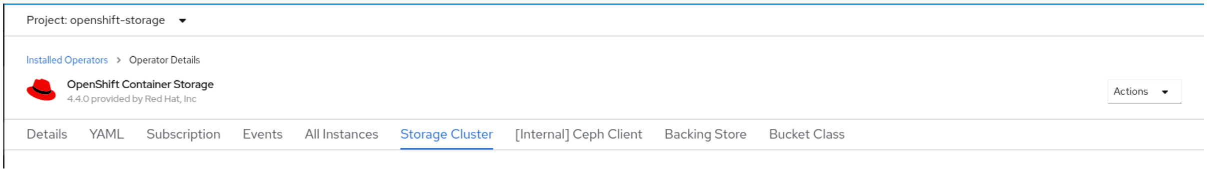
Project: openshift-storage

Installed Operators

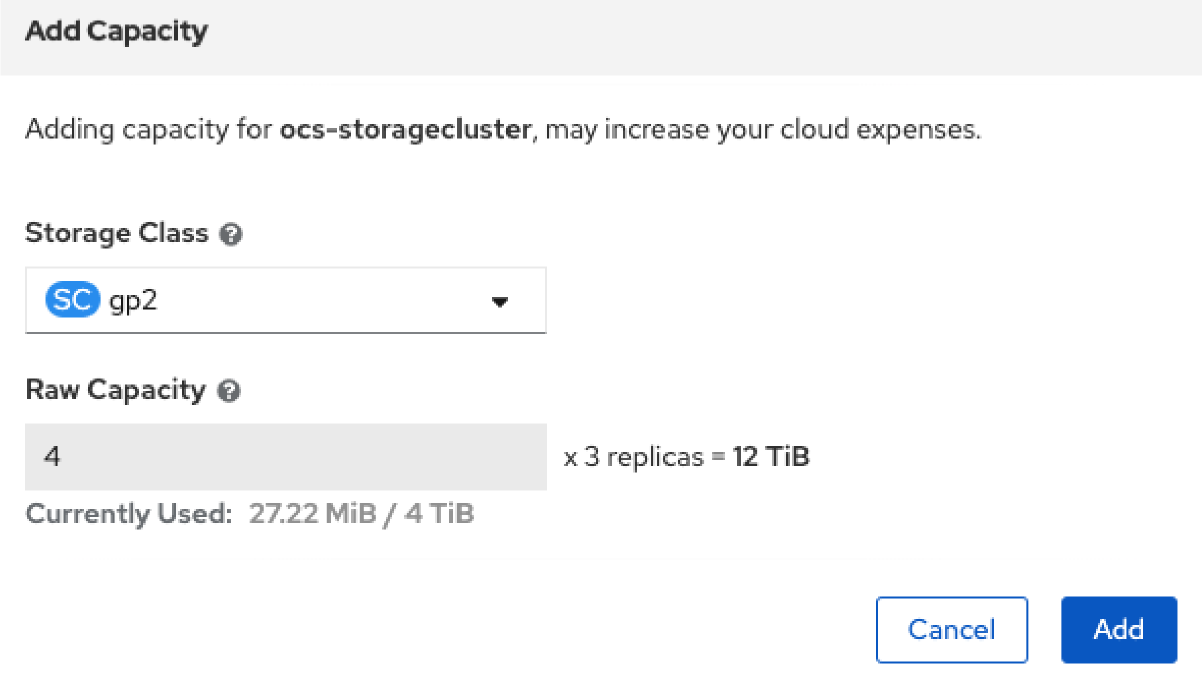
Installed Operators are represented by Cluster Service Versions within this namespace. For more information, see the Operator Lifecycle Manager documentation. Or create an Operator and Cluster Service Version using the Operator SDK.

| Name ↑ | Namespace | Status | Deployment | Provided APIs |
|---|---|---|---|---|
| lib-bucket-provisioner<br>1.0.0 provided by Red Hat | NS openshift-storage | Succeeded<br>Up to date | D lib-bucket-provisioner | ObjectBucketClaim<br>ObjectBucket |
| OpenShift Container Storage<br>4.4.0 provided by Red Hat, Inc | NS openshift-storage | Succeeded<br>Up to date | D ocs-operator | Storage Cluster<br>[Internal] Ceph Client<br>Backing Store<br>Bucket Class |

5. In the top navigation bar, scroll right and click **Storage Cluster** tab.


Project: openshift-storage
Installed Operators > Operator Details
OpenShift Container Storage
4.4.0 provided by Red Hat, Inc
Actions
Details
YAML
Subscription
Events
All Instances
Storage Cluster
[Internal] Ceph Client
Backing Store
Bucket Class

6. The visible list should have only one item. Click ( ⋮ ) on the far right to extend the options menu.
7. Select **Add Capacity** from the options menu.



Add Capacity

Adding capacity for **ocs-storagecluster**, may increase your cloud expenses.

Storage Class

SC gp2

Raw Capacity

4 x 3 replicas = 12 TiB

Currently Used: 27.22 MiB / 4 TiB

From this dialog box, you can set the requested additional capacity and the storage class. **Add capacity** shows the capacity selected at the time of installation and allows to add the capacity only in this increment. On AWS, the storage class should be set to **gp2**. On VMWare, the storage class should be set to **thin**.

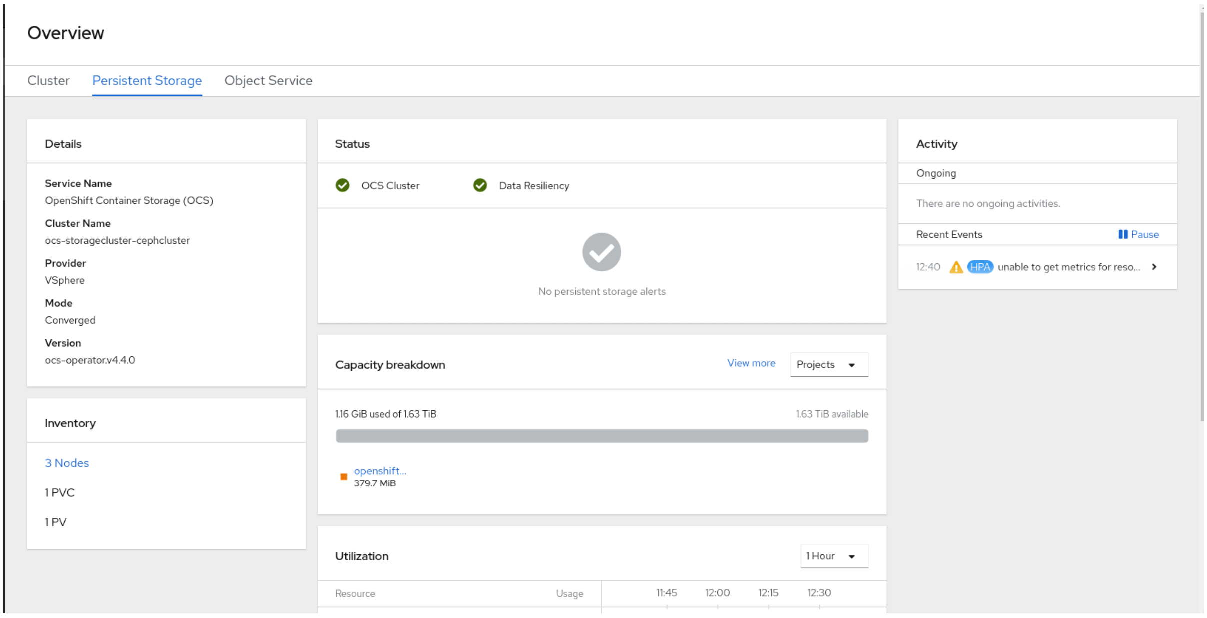
NOTE

The effectively provisioned capacity will be three times as much as what you see in the **Raw Capacity** field because OpenShift Container Storage uses a replica count of 3.

8. Click **Add**. You can see the status of the storage cluster after it reaches the **Ready** state. You might need to wait a couple of minutes after you see the **Ready** state.

## Verification steps

1. Navigate to **Overview → Persistent Storage** tab, then check the **Capacity breakdown** card.



Overview

Details

Service Name
OpenShift Container Storage (OCS)

Cluster Name
ocs-storagecluster-cephcluster

Provider
VSphere

Mode
Converged

Version
ocs-operator.v4.4.0

Inventory

3 Nodes

1 PVC

1 PV

Status

✓ OCS Cluster ✓ Data Resiliency

No persistent storage alerts

Capacity breakdown

1.16 GiB used of 1.63 TiB 1.63 TiB available

openshift...
379.7 MiB

Utilization

Activity

Ongoing

There are no ongoing activities.

Recent Events

12:40 HPA unable to get metrics for reso...

2. Note that the capacity increases based on your selections.

IMPORTANT

OpenShift Container Storage does not support cluster reduction either by reducing OSDs or reducing nodes.

### 4.2.2. Scaling up storage by adding capacity to your OpenShift Container Storage nodes using local storage devices

Use this procedure to add storage capacity (additional storage devices) to your configured local storage based OpenShift Container Storage worker nodes on bare metal, Amazon EC2 I3, and VMware infrastructures.

IMPORTANT

Scaling up storage on Amazon EC2 I3 is a Technology Preview feature. Technology Preview features are not supported with Red Hat production service level agreements (SLAs) and might not be functionally complete. Red Hat does not recommend using them in production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process.

NOTE

For Amazon EC2 I3 infrastructure, adding nodes is the only option for adding capacity, as deployment is done using both the available NVMe devices.

#### Prerequisites

- You must be logged into OpenShift Container Platform (OCP) cluster.
- You must have installed local storage operator. For information, see Installing Local Storage Operator.
- You must have three OpenShift Container Platform worker nodes with the same storage type and size attached to each node (for example, 2TB NVMe drive) as the original OCS StorageCluster was created with.

#### Procedure

1. To add storage capacity to OpenShift Container Platform nodes with OpenShift Container Storage installed, you need to
   a. Find the unique **by-id** identifier for available devices that you want to add, that is, a minimum of one device per worker node. Follow procedure finding available storage devices.

      NOTE

      Make sure you perform this process for all the existing nodes (minimum of 3) for which you want to add storage.

   b. Add unique device **by-id**.

```
$ oc edit -n local-storage localvolume local-block
```

Example output:

```
spec:
  logLevel: Normal
  managementState: Managed
  nodeSelector:
    nodeSelectorTerms:
    - matchExpressions:
      - key: cluster.ocs.openshift.io/openshift-storage
        operator: In
        values:
        - ""
  storageClassDevices:
  - devicePaths:
    - /dev/disk/by-id/nvme-INTEL_SSDPE2KX010T7_PHLF733402P51P0GGN
    - /dev/disk/by-id/nvme-INTEL_SSDPE2KX010T7_PHLF733402LM1P0GGN
    - /dev/disk/by-id/nvme-INTEL_SSDPE2KX010T7_PHLF733402M21P0GGN
    - /dev/disk/by-id/nvme-INTEL_SSDPE2KX010T7_PHLF733402B71P0GGN    # newly
added device by-id
    - /dev/disk/by-id/nvme-INTEL_SSDPE2KX010T7_PHLF733402A31P0GGN    # newly
added device by-id
    - /dev/disk/by-id/nvme-INTEL_SSDPE2KX010T7_PHLF733402Q71P0GGN    # newly
added device by-id
    storageClassName: localblock
    volumeMode: Block
```

Make sure to save the changes after editing the CR.

```
localvolume.local.storage.openshift.io/local-block edited
```

You can see that in this CR new devices using **by-id** have been added. Each device maps to **nvme1n1** on one of the three worker nodes.

- **nvme-INTEL_SSDPE2KX010T7_PHLF733402B71P0GGN**
- **nvme-INTEL_SSDPE2KX010T7_PHLF733402A31P0GGN**
- **nvme-INTEL_SSDPE2KX010T7_PHLF733402Q71P0GGN**

2. Display PVs with **storageclass** name used in **localVolume** CR.

```
$ oc get pv | grep localblock | grep Available
```

Example output:

```
local-pv-5ee61dcc   894Gi   RWO    Delete  Available   localblock     2m35s
local-pv-b1fa607a   894Gi   RWO    Delete  Available   localblock     2m27s
local-pv-e971c51d   894Gi   RWO    Delete  Available   localblock     2m22s
...
```

There are three more available PVs of same size which will be used for new OSDs.

3. To expand storage capacity, increase the **count** by 1 for **StorageDeviceSets** in **StorageCluster** CR.

```
$ oc edit storageclusters.ocs.openshift.io -n openshift-storage
```

Example output:

```
spec:
  monDataDirHostPath: /var/lib/rook
  storageDeviceSets:
  - config: {}
    count: 2    # <-- increase this count by 1
    dataPVCTemplate:
      metadata:
        creationTimestamp: null
      spec:
        accessModes:
        - ReadWriteOnce
        resources:
          requests:
            storage: 894Gi
        storageClassName: localblock
        volumeMode: Block
      status: {}
    name: ocs-deviceset
    placement: {}
    replica: 3
    resources: {}
  version: 4.4.0
```

Make sure to save the changes after editing the CR.

```
storagecluster.ocs.openshift.io/ocs-storagecluster edited
```

### IMPORTANT

To ensure that the OSDs have a guaranteed size across the nodes, the storage size for **storageDeviceSets** must be specified as less than or equal to the size of the desired PVs created on the nodes.

4. Verify that there are three new OSDs running and their corresponding new PVCs are created.

```
$ oc get -n openshift-storage pods -l app=rook-ceph-osd
```

Example output:

```
NAME                               READY   STATUS    RESTARTS   AGE
rook-ceph-osd-0-77c4fdb758-qshw4   1/1     Running   0          1h
rook-ceph-osd-1-8645c5fbb6-656ks   1/1     Running   0          1h
rook-ceph-osd-2-86895b854f-r4gt6   1/1     Running   0          1h
rook-ceph-osd-3-dc7f787dd-gdnsz    1/1     Running   0          10m
rook-ceph-osd-4-554b5c46dd-hbf9t   1/1     Running   0          10m
rook-ceph-osd-5-5cf94c4448-k94j6   1/1     Running   0          10m
```

In the above example, osd-3, osd-4, and osd-5 are the newly added pods to the OpenShift Container Storage cluster.

```
$ oc get pvc -n openshift-storage |grep localblock
```

Example output:

```
ocs-deviceset-0-0-qc29m   Bound   local-pv-fc5562d3   894Gi   RWO  localblock  1h
ocs-deviceset-0-1-qdmrl   Bound   local-pv-b1fa607a   894Gi   RWO  localblock  10m
ocs-deviceset-1-0-mpwmk   Bound   local-pv-58cdd0bc   894Gi   RWO  localblock  1h
ocs-deviceset-1-1-85892   Bound   local-pv-e971c51d   894Gi   RWO  localblock  10m
ocs-deviceset-2-0-rll47   Bound   local-pv-29d8ad8d   894Gi   RWO  localblock  1h
ocs-deviceset-2-1-cgth2   Bound   local-pv-5ee61dcc   894Gi   RWO  localblock  10m
```

In the above example, we see three new PVCs are created.

### Verification steps

See Verifying OpenShift Container Storage deployment .

## 4.3. SCALING OUT STORAGE CAPACITY

To scale out storage capacity, you need to perform the following:

- Add a new node to increase the storage capacity when existing worker nodes are already running at their maximum supported OSDs, which is the increment of 3 OSDs of the capacity selected during initial configuration.
- Verify that the new node is added successfully
- Scale up the storage capacity after the node is added

Depending on the type of your deployment, you can choose one of the following procedures to add a storage node:

- For AWS installer-provisioned infrastructure, see Section 4.3.1, “Adding a node on an AWS installer-provisioned infrastructure”
- For AWS or VMware user-provisioned infrastructure, see Section 4.3.2, “Adding a node on an AWS or a VMware user-provisioned infrastructure”
- For bare metal, Amazon EC2 I3, or VMware infrastructures, see Section 4.3.3, “Adding a node using a local storage device”

### 4.3.1. Adding a node on an AWS installer-provisioned infrastructure

#### Prerequisites

- You must be logged into OpenShift Container Platform (OCP) cluster.

#### Procedure

1. Navigate to **Compute → Machine Sets**.
2. On the machine set where you want to add nodes, select **Edit Count**.

3. Add the amount of nodes, and click **Save**.

4. Click **Compute → Nodes** and confirm if the new node is in **Ready** state.

5. Apply the OpenShift Container Storage label to the new node.

   a. For the new node, **Action menu ( ⋮ ) → Edit Labels**.

   b. Add **cluster.ocs.openshift.io/openshift-storage** and click **Save**.

> **NOTE**
>
> It is recommended to add 3 nodes each in different zones. You must add 3 nodes and perform this procedure for all of them.

### Verification steps

To verify that the new node is added, see Section 4.3.4, “Verifying the addition of a new node” .

## 4.3.2. Adding a node on an AWS or a VMware user-provisioned infrastructure

### Prerequisites

- You must be logged into OpenShift Container Platform (OCP) cluster.

### Procedure

1. Depending on whether you are adding a node on an AWS user provisioned infrastructure or a VMware user-provisioned infrastructure, perform the following steps:

   - For AWS

     a. Create a new AWS machine instance with the required infrastructure. See Supported Infrastructure and Platforms.

     b. Create a new OpenShift Container Platform node using the new AWS machine instance.

   - For VMware:

     a. Create a new VM on vSphere with the required infrastructure. See Supported Infrastructure and Platforms.

     b. Create a new OpenShift Container Platform worker node using the new VM.

2. Check for certificate signing requests (CSRs) related to OpenShift Container Storage that are in **Pending** state:

```
$ oc get csr
```

3. Approve all required OpenShift Container Storage CSRs for the new node:

```
$ oc adm certificate approve <Certificate_Name>
```

4. Click **Compute → Nodes**, confirm if the new node is in **Ready** state.

5. Apply the OpenShift Container Storage label to the new node using any one of the following:

   **From User interface**

   a. For the new node, click **Action Menu ( ⋮ ) → Edit Labels**

   b. Add **cluster.ocs.openshift.io/openshift-storage** and click **Save**.

   **From Command line interface**

   - Execute the following command to apply the OpenShift Container Storage label to the new node:

     ```
     $ oc label node <new_node_name> cluster.ocs.openshift.io/openshift-storage=""
     ```

     NOTE

     It is recommended to add 3 nodes each in different zones. You must add 3 nodes and perform this procedure for all of them.

### Verification steps

To verify that the new node is added, see Section 4.3.4, "Verifying the addition of a new node" .

## 4.3.3. Adding a node using a local storage device

Use this procedure to add a node on bare metal, Amazon EC2, and VMware infrastructures.

IMPORTANT

Scaling storage nodes for Amazon EC2 infrastructure is a Technology Preview feature. Technology Preview features are not supported with Red Hat production service level agreements (SLAs) and might not be functionally complete. Red Hat does not recommend using them in production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process.

### Prerequisites

- You must be logged into OpenShift Container Platform (OCP) cluster.

- You must have three OpenShift Container Platform worker nodes with the same storage type and size attached to each node (for example, 2TB NVMe drive) as the original OCS StorageCluster was created with.

### Procedure

1. Depending on whether you are adding a node on bare metal, Amazon EC2, or VMware infrastructure, perform the following steps:

   - For Amazon EC2

     a. Create a new Amazon EC2 I3 machine instance with the required infrastructure. See Creating a MachineSet in AWS and Supported Infrastructure and Platforms.

   b. Create a new OpenShift Container Platform node using the new Amazon EC2 I3 machine instance.

- For VMware:

   a. Create a new VM on vSphere with the required infrastructure. See Supported Infrastructure and Platforms.

   b. Create a new OpenShift Container Platform worker node using the new VM.

- For bare metal:

   a. Get a new bare metal machine with the required infrastructure. See Supported Infrastructure and Platforms.

   b. Create a new OpenShift Container Platform node using the new bare metal machine.

2. Check for certificate signing requests (CSRs) related to OpenShift Container Storage that are in **Pending** state:

```
$ oc get csr
```

3. Approve all required OpenShift Container Storage CSRs for the new node:

```
$ oc adm certificate approve <Certificate_Name>
```

4. Click **Compute → Nodes**, confirm if the new node is in **Ready** state.

5. Apply the OpenShift Container Storage label to the new node using any one of the following:

   **From User interface**

   a. For the new node, click **Action Menu ( ⋮ ) → Edit Labels**

   b. Add **cluster.ocs.openshift.io/openshift-storage** and click **Save**.

   **From Command line interface**

   - Execute the following command to apply the OpenShift Container Storage label to the new node:

```
$ oc label node <new_node_name> cluster.ocs.openshift.io/openshift-storage=""
```

NOTE

It is recommended to add 3 nodes each in different zones. You must add 3 nodes and perform this procedure for all of them.

### Verification steps

To verify that the new node is added, see Section 4.3.4, “Verifying the addition of a new node” .

### 4.3.4. Verifying the addition of a new node

1. Execute the following command and verify that the new node is present in the output:

   ```
   $ oc get nodes --show-labels | grep cluster.ocs.openshift.io/openshift-storage= |cut -d' ' -f1
   ```

2. Click **Workloads → Pods**, confirm that at least the following pods on the new node are in **Running** state:

   - **csi-cephfsplugin-***
   - **csi-rbdplugin-***

### 4.3.5. Scaling up storage capacity

To scale up storage capacity, see Scaling up storage by adding capacity .

# CHAPTER 5. MANAGING PERSISTENT VOLUME CLAIMS

IMPORTANT

Expanding PVCs is not supported for PVCs backed by OpenShift Container Storage.

## 5.1. CONFIGURING APPLICATION PODS TO USE OPENSHIFT CONTAINER STORAGE

Follow the instructions in this section to configure OpenShift Container Storage as storage for an application pod.

### Prerequisites

- You have administrative access to OpenShift Web Console.
- OpenShift Container Storage Operator is installed and running in the **openshift-storage** namespace. In OpenShift Web Console, click **Operators → Installed Operators** to view installed operators.
- The default storage classes provided by OpenShift Container Storage are available. In OpenShift Web Console, click **Storage → Storage Classes** to view default storage classes.

### Procedure

1. **Create a Persistent Volume Claim (PVC) for the application to use.**
   a. In OpenShift Web Console, click **Storage → Persistent Volume Claims**.
   b. Set the **Project** for the application pod.
   c. Click **Create Persistent Volume Claim**
      i. Specify a **Storage Class** provided by OpenShift Container Storage.
      ii. Specify the PVC **Name**, for example, **myclaim**.
      iii. Select the required **Access Mode**.
      iv. Specify a **Size** as per application requirement.
      v. Click **Create** and wait until the PVC is in **Bound** status.
2. **Configure a new or existing application pod to use the new PVC.**
   - For a new application pod, perform the following steps:
      i. Click **Workloads →Pods**.
      ii. Create a new application pod.
      iii. Under the **spec:** section, add **volume:** section to add the new PVC as a volume for the application pod.

```
volumes:
  - name: <volume_name>
    persistentVolumeClaim:
      claimName: <pvc_name>
```

For example:

```
volumes:
  - name: mypd
    persistentVolumeClaim:
      claimName: myclaim
```

- For an existing application pod, perform the following steps:

   i. Click **Workloads →Deployment Configs**.

   ii. Search for the required deployment config associated with the application pod.

   iii. Click on its **Action menu ( ⋮ ) → Edit Deployment Config**.

   iv. Under the **spec:** section, add **volume:** section to add the new PVC as a volume for the application pod and click **Save**.

```
volumes:
  - name: <volume_name>
    persistentVolumeClaim:
      claimName: <pvc_name>
```

For example:

```
volumes:
  - name: mypd
    persistentVolumeClaim:
      claimName: myclaim
```

3. **Verify that the new configuration is being used.**

   a. Click **Workloads → Pods**.

   b. Set the **Project** for the application pod.

   c. Verify that the application pod appears with a status of **Running**.

   d. Click the application pod name to view pod details.

   e. Scroll down to **Volumes** section and verify that the volume has a **Type** that matches your new Persistent Volume Claim, for example, **myclaim**.

## 5.2. VIEWING PERSISTENT VOLUME CLAIM REQUEST STATUS

WARNING

Expanding Persistent Volume Claims (PVCs) is not supported for PVCs backed by OpenShift Container Storage.

Use this procedure to view the status of a PVC request.

### Prerequisites

- Administrator access to OpenShift Container Storage.

### Procedure

1. Log in to OpenShift Web Console.
2. Click **Storage → Persistent Volume Claims**
3. Search for the required PVC name by using the **Filter** textbox.
4. Check the **Status** column corresponding to the required PVC.
5. Click the required **Name** to view the PVC details.

## 5.3. REVIEWING PERSISTENT VOLUME CLAIM REQUEST EVENTS

Use this procedure to review and address Persistent Volume Claim (PVC) request events.

### Prerequisites

- Administrator access to OpenShift Web Console.

### Procedure

1. Log in to OpenShift Web Console.
2. Click **Home → Overview → Persistent Storage**
3. Locate the **Inventory** card to see the number of PVCs with errors.
4. Click **Storage → Persistent Volume Claims**
5. Search for the required PVC using the **Filter** textbox.
6. Click on the PVC name and navigate to **Events**
7. Address the events as required or as directed.

## 5.4. DYNAMIC PROVISIONING

### 5.4.1. About dynamic provisioning

The StorageClass resource object describes and classifies storage that can be requested, as well as provides a means for passing parameters for dynamically provisioned storage on demand. StorageClass objects can also serve as a management mechanism for controlling different levels of storage and access to the storage. Cluster Administrators (**cluster-admin**) or Storage Administrators ( **storage-admin**) define and create the StorageClass objects that users can request without needing any intimate knowledge about the underlying storage volume sources.

The OpenShift Container Platform persistent volume framework enables this functionality and allows administrators to provision a cluster with persistent storage. The framework also gives users a way to request those resources without having any knowledge of the underlying infrastructure.

Many storage types are available for use as persistent volumes in OpenShift Container Platform. While all of them can be statically provisioned by an administrator, some types of storage are created dynamically using the built-in provider and plug-in APIs.

### 5.4.2. Dynamic provisioning in OpenShift Container Storage

Red Hat OpenShift Container Storage is software-defined storage that is optimised for container environments. It runs as an operator on OpenShift Container Platform to provide highly integrated and simplified persistent storage management for containers.

OpenShift Container Storage supports a variety of storage types, including:

- Block storage for databases
- Shared file storage for continuous integration, messaging, and data aggregation
- Object storage for archival, backup, and media storage

Version 4.4 uses Red Hat Ceph Storage to provide the file, block, and object storage that backs persistent volumes, and Rook.io to manage and orchestrate provisioning of persistent volumes and claims. NooBaa provides object storage, and its Multicloud Gateway allows object federation across multiple cloud environments (available as a Technology Preview).

In OpenShift Container Storage 4.4, the Red Hat Ceph Storage Container Storage Interface (CSI) driver for RADOS Block Device (RBD) and Ceph File System (CephFS) handles the dynamic provisioning requests. When a PVC request comes in dynamically, the CSI driver has the following options:

- Create a PVC with ReadWriteOnce (RWO) and ReadWriteMany (RWX) access that is based on Ceph RBDs with volume mode **Block**
- Create a PVC with ReadWriteOnce (RWO) access that is based on Ceph RBDs with volume mode **Filesystem**
- Create a PVC with ReadWriteOnce (RWO) and ReadWriteMany (RWX) access that is based on CephFS for volume mode **Filesystem**

The judgement of which driver (RBD or CephFS) to use is based on the entry in the **storageclass.yaml** file.

### 5.4.3. Available dynamic provisioning plug-ins

OpenShift Container Platform provides the following provisioner plug-ins, which have generic implementations for dynamic provisioning that use the cluster's configured provider's API to create new storage resources:

| Storage type | Provisioner plug-in name | Notes |
|---|---|---|
| AWS Elastic Block Store (EBS) | **kubernetes.io/aws-ebs** | For dynamic provisioning when using multiple clusters in different zones, tag each node with **Key=kubernetes.io/cluster/<cluster_name>,Value=<cluster_id>** where **<cluster_name>** and **<cluster_id>** are unique per cluster. |
| AWS Elastic File System (EFS) | | Dynamic provisioning is accomplished through the EFS provisioner pod and not through a provisioner plug-in. |
| Azure Disk | **kubernetes.io/azure-disk** | |
| Azure File | **kubernetes.io/azure-file** | The **persistent-volume-binder** ServiceAccount requires permissions to create and get Secrets to store the Azure storage account and keys. |
| Ceph File System (POSIX Compliant filesystem) | **openshift-storage.cephfs.csi.ceph.com** | Provisions a volume for ReadWriteMany (RWX) or ReadWriteOnce (RWO) access modes using the Ceph Filesytem configured in a Ceph cluster. |
| Ceph RBD (Block Device) | **openshift-storage.rbd.csi.ceph.com** | Provisions a volume for RWO access mode for Ceph RBD, RWO and RWX access mode for block PVC, and RWO access mode for Filesystem PVC. |
| GCE Persistent Disk (gcePD) | **kubernetes.io/gce-pd** | In multi-zone configurations, it is advisable to run one OpenShift Container Platform cluster per GCE project to avoid PVs from being created in zones where no node in the current cluster exists. |

| Storage type | Provisioner plug-in name | Notes |
|---|---|---|
| S3 Bucket (MCG Object Bucket Claim) | **openshift-storage.noobaa.io/obc** | Provisions an object bucket claim to support S3 API calls through the Multicloud Object Gateway (MCG). The exact storage backing the S3 bucket is dependent on the MCG configuration and the type of deployment. |
| VMware vSphere | **kubernetes.io/vsphere-volume** | |

IMPORTANT

Any chosen provisioner plug-in also requires configuration for the relevant cloud, host, or third-party provider as per the relevant documentation.

# CHAPTER 6. MANAGING CONTAINER STORAGE INTERFACE (CSI) COMPONENT PLACEMENTS

Each cluster consists of a number of dedicated nodes such as **infra** and **storage** nodes. However, a **infra** node will not be able to use OpenShift Container Storage persistent volume claims (PVCs) on the node. So, if you want to use such nodes, you can set tolerations to bring up **csi-plugins** on the nodes. For more information, see https://access.redhat.com/solutions/4827161.

### Procedure

1. Create a **configmap rook-ceph-operator-config**.

```
$ oc create -f rook-ceph-operator-config.yaml
configmap/rook-ceph-operator-config created
```

2. Display **configmap**.

```
$ oc get configmap rook-ceph-operator-config -n openshift-storage -o yaml
```

Example output of **configmap** with **key** set to **nodetype** and **value** set to **infra**:

```
apiVersion: v1
data:
  CSI_PLUGIN_TOLERATIONS: |
    - effect: NoSchedule
      key: nodetype
      operator: Equal
      value: infra
    - effect: NoSchedule
      key: node.ocs.openshift.io/storage
      operator: Exists
kind: ConfigMap
metadata:
  creationTimestamp: "2020-03-23T11:49:27Z"
  name: rook-ceph-operator-config
  namespace: openshift-storage
  resourceVersion: "114879"
  selfLink: /api/v1/namespaces/openshift-storage/configmaps/rook-ceph-operator-config
  uid: ac22e63a-8df1-4650-a57f-89bf7a2ce06a
```

3. Restart the **rook-ceph-operator**.

## Verification step

Verify that the **csi-cephfsplugin-*** and **csi-rbdplugin-*** pods are running on the **infra** nodes.

# CHAPTER 7. MULTICLOUD OBJECT GATEWAY

## 7.1. ABOUT THE MULTICLOUD OBJECT GATEWAY

The Multicloud Object Gateway (MCG) is a lightweight object storage service for OpenShift, allowing users to start small and then scale as needed on-premise, in multiple clusters, and with cloud-native storage.

## 7.2. ACCESSING THE MULTICLOUD OBJECT GATEWAY WITH YOUR APPLICATIONS

You can access the object service with any application targeting AWS S3 or code that uses AWS S3 Software Development Kit (SDK). Applications need to specify the MCG endpoint, an access key, and a secret access key. You can use your terminal or the MCG CLI to retrieve this information.

#### Prerequisites

- A running OpenShift Container Storage Platform
- Download the MCG command-line interface for easier management:

  ```
  # subscription-manager repos --enable=rh-ocs-4-for-rhel-8-x86_64-rpms
  # yum install mcg
  ```

- Alternatively, you can install the **mcg** package from the OpenShift Container Storage RPMs found here https://access.redhat.com/downloads/content/547/ver=4/rhel---8/4/x86_64/packages

You can access the relevant endpoint, access key, and secret access key two ways:

- Section 7.2.1, “Accessing the Multicloud Object Gateway from the terminal”
- Section 7.2.2, “Accessing the Multicloud Object Gateway from the MCG command-line interface”

### 7.2.1. Accessing the Multicloud Object Gateway from the terminal

#### Procedure

Run the **describe** command to view information about the MCG endpoint, including its access key (**AWS_ACCESS_KEY_ID** value) and secret access key ( **AWS_SECRET_ACCESS_KEY** value):

```
# oc describe noobaa -n openshift-storage
```

The output will look similar to the following:

```
Name:         noobaa
Namespace:    openshift-storage
Labels:       <none>
Annotations:  <none>
API Version:  noobaa.io/v1alpha1
Kind:         NooBaa
Metadata:
```

```
  Creation Timestamp:  2019-07-29T16:22:06Z
  Generation:          1
  Resource Version:    6718822
  Self Link:           /apis/noobaa.io/v1alpha1/namespaces/openshift-storage/noobaas/noobaa
  UID:                 019cfb4a-b21d-11e9-9a02-06c8de012f9e
Spec:
Status:
  Accounts:
    Admin:
      Secret Ref:
        Name:           noobaa-admin
        Namespace:      openshift-storage
  Actual Image:         noobaa/noobaa-core:4.0
  Observed Generation:  1
  Phase:                Ready
  Readme:

  Welcome to NooBaa!
  -----------------

  Welcome to NooBaa!
    -----------------
    NooBaa Core Version:
    NooBaa Operator Version:

    Lets get started:

    1. Connect to Management console:

      Read your mgmt console login information (email & password) from secret: "noobaa-admin".

        kubectl get secret noobaa-admin -n openshift-storage -o json | jq '.data|map_values(@base64d)'

      Open the management console service - take External IP/DNS or Node Port or use port
forwarding:

        kubectl port-forward -n openshift-storage service/noobaa-mgmt 11443:443 &
        open https://localhost:11443

    2. Test S3 client:

      kubectl port-forward -n openshift-storage service/s3 10443:443 &
1
      NOOBAA_ACCESS_KEY=$(kubectl get secret noobaa-admin -n openshift-storage -o json | jq -r
'.data.AWS_ACCESS_KEY_ID|@base64d')
2
      NOOBAA_SECRET_KEY=$(kubectl get secret noobaa-admin -n openshift-storage -o json | jq -r
'.data.AWS_SECRET_ACCESS_KEY|@base64d')
      alias s3='AWS_ACCESS_KEY_ID=$NOOBAA_ACCESS_KEY
AWS_SECRET_ACCESS_KEY=$NOOBAA_SECRET_KEY aws --endpoint https://localhost:10443 --
no-verify-ssl s3'
      s3 ls


    Services:
      Service Mgmt:
```

```
    External DNS:
     https://noobaa-mgmt-openshift-storage.apps.mycluster-cluster.qe.rh-ocs.com
     https://a3406079515be11eaa3b70683061451e-1194613580.us-east-
2.elb.amazonaws.com:443
    Internal DNS:
     https://noobaa-mgmt.openshift-storage.svc:443
    Internal IP:
     https://172.30.235.12:443
    Node Ports:
     https://10.0.142.103:31385
    Pod Ports:
     https://10.131.0.19:8443
   serviceS3:
    External DNS: 3
     https://s3-openshift-storage.apps.mycluster-cluster.qe.rh-ocs.com
     https://a340f4e1315be11eaa3b70683061451e-943168195.us-east-2.elb.amazonaws.com:443
    Internal DNS:
     https://s3.openshift-storage.svc:443
    Internal IP:
     https://172.30.86.41:443
    Node Ports:
     https://10.0.142.103:31011
    Pod Ports:
     https://10.131.0.19:6443
```

1 access key (**AWS_ACCESS_KEY_ID** value)

2 secret access key (**AWS_SECRET_ACCESS_KEY** value)

3 MCG endpoint

**NOTE**

The output from the **oc describe noobaa** command lists the internal and external DNS names that are available. When using the internal DNS, the traffic is free. The external DNS uses Load Balancing to process the traffic, and therefore has a cost per hour.

### 7.2.2. Accessing the Multicloud Object Gateway from the MCG command-line interface

#### Prerequisites

- Download the MCG command-line interface:

```
# subscription-manager repos --enable=rh-ocs-4-for-rhel-8-x86_64-rpms
# yum install mcg
```

#### Procedure

Run the **status** command to access the endpoint, access key, and secret access key:

```
noobaa status -n openshift-storage
```

The output will look similar to the following:

```
INFO[0000] Namespace: openshift-storage
INFO[0000]
INFO[0000] CRD Status:
INFO[0003]   Exists: CustomResourceDefinition "noobaas.noobaa.io"
INFO[0003]   Exists: CustomResourceDefinition "backingstores.noobaa.io"
INFO[0003]   Exists: CustomResourceDefinition "bucketclasses.noobaa.io"
INFO[0004]   Exists: CustomResourceDefinition "objectbucketclaims.objectbucket.io"
INFO[0004]   Exists: CustomResourceDefinition "objectbuckets.objectbucket.io"
INFO[0004]
INFO[0004] Operator Status:
INFO[0004]   Exists: Namespace "openshift-storage"
INFO[0004]   Exists: ServiceAccount "noobaa"
INFO[0005]   Exists: Role "ocs-operator.v0.0.271-6g45f"
INFO[0005]   Exists: RoleBinding "ocs-operator.v0.0.271-6g45f-noobaa-f9vpj"
INFO[0006]   Exists: ClusterRole "ocs-operator.v0.0.271-fjhgh"
INFO[0006]   Exists: ClusterRoleBinding "ocs-operator.v0.0.271-fjhgh-noobaa-pdxn5"
INFO[0006]   Exists: Deployment "noobaa-operator"
INFO[0006]
INFO[0006] System Status:
INFO[0007]   Exists: NooBaa "noobaa"
INFO[0007]   Exists: StatefulSet "noobaa-core"
INFO[0007]   Exists: Service "noobaa-mgmt"
INFO[0008]   Exists: Service "s3"
INFO[0008]   Exists: Secret "noobaa-server"
INFO[0008]   Exists: Secret "noobaa-operator"
INFO[0008]   Exists: Secret "noobaa-admin"
INFO[0009]   Exists: StorageClass "openshift-storage.noobaa.io"
INFO[0009]   Exists: BucketClass "noobaa-default-bucket-class"
INFO[0009]   (Optional) Exists: BackingStore "noobaa-default-backing-store"
INFO[0010]   (Optional) Exists: CredentialsRequest "noobaa-cloud-creds"
INFO[0010]   (Optional) Exists: PrometheusRule "noobaa-prometheus-rules"
INFO[0010]   (Optional) Exists: ServiceMonitor "noobaa-service-monitor"
INFO[0011]   (Optional) Exists: Route "noobaa-mgmt"
INFO[0011]   (Optional) Exists: Route "s3"
INFO[0011]   Exists: PersistentVolumeClaim "db-noobaa-core-0"
INFO[0011]   System Phase is "Ready"
INFO[0011]   Exists:  "noobaa-admin"

#------------------#
#- Mgmt Addresses -#
#------------------#

ExternalDNS : [https://noobaa-mgmt-openshift-storage.apps.mycluster-cluster.qe.rh-ocs.com
https://a3406079515be11eaa3b70683061451e-1194613580.us-east-2.elb.amazonaws.com:443]
ExternalIP  : []
NodePorts   : [https://10.0.142.103:31385]
InternalDNS : [https://noobaa-mgmt.openshift-storage.svc:443]
InternalIP  : [https://172.30.235.12:443]
PodPorts    : [https://10.131.0.19:8443]

#--------------------#
#- Mgmt Credentials -#
#--------------------#
```

```
email    : admin@noobaa.io
password : HKLbH1rSuVU0I/souIkSiA==

#----------------#
#- S3 Addresses -#
#----------------#

1
ExternalDNS : [https://s3-openshift-storage.apps.mycluster-cluster.qe.rh-ocs.com
https://a340f4e1315be11eaa3b70683061451e-943168195.us-east-2.elb.amazonaws.com:443]
ExternalIP  : []
NodePorts   : [https://10.0.142.103:31011]
InternalDNS : [https://s3.openshift-storage.svc:443]
InternalIP  : [https://172.30.86.41:443]
PodPorts    : [https://10.131.0.19:6443]

#------------------#
#- S3 Credentials -#
#------------------#

2
AWS_ACCESS_KEY_ID     : jVmAsu9FsvRHYmfjTiHV
3
AWS_SECRET_ACCESS_KEY : E//420VNedJfATvVSmDz6FMtsSAzuBv6z180PT5c

#------------------#
#- Backing Stores -#
#------------------#

NAME                         TYPE     TARGET-BUCKET                                            PHASE   AGE
noobaa-default-backing-store   aws-s3   noobaa-backing-store-15dc896d-7fe0-4bed-9349-
5942211b93c9   Ready   141h35m32s

#------------------#
#- Bucket Classes -#
#------------------#

NAME                        PLACEMENT                                                   PHASE   AGE
noobaa-default-bucket-class   {Tiers:[{Placement: BackingStores:[noobaa-default-backing-store]}]}
Ready   141h35m33s

#-----------------#
#- Bucket Claims -#
#-----------------#

No OBC's found.
```

1. endpoint
2. access key
3. secret access key

You now have the relevant endpoint, access key, and secret access key in order to connect to your applications.

**Example 7.1. Example**

If AWS S3 CLI is the application, the following command will list buckets in OCS:

```
AWS_ACCESS_KEY_ID=<AWS_ACCESS_KEY_ID>
AWS_SECRET_ACCESS_KEY=<AWS_SECRET_ACCESS_KEY>
aws --endpoint <ENDPOINT> --no-verify-ssl s3 ls
```

## 7.3. ADDING STORAGE RESOURCES FOR HYBRID OR MULTICLOUD

### 7.3.1. Creating a new backing store

Use this procedure to create a new backing store in OpenShift Container Storage.

**Prerequisites**

- Administrator access to OpenShift.

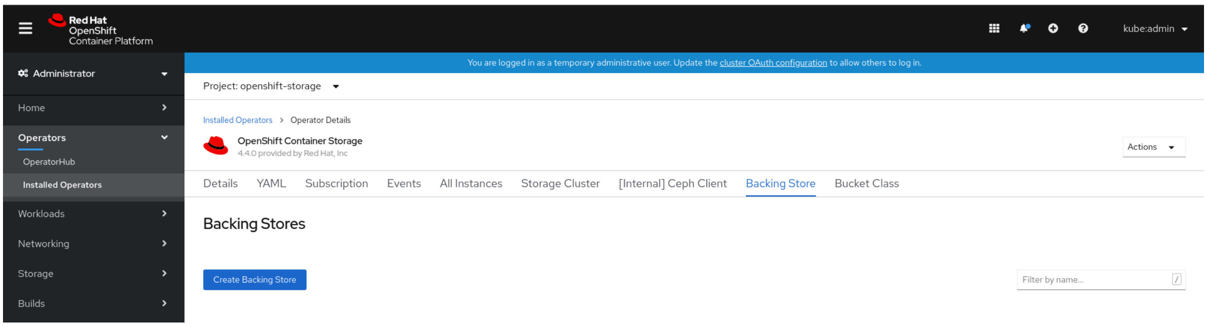
**Procedure**

1. Click **Operators → Installed Operators** from the left pane of the OpenShift Web Console to view the installed operators.

2. Click **OpenShift Container Storage** Operator.

3. On the OpenShift Container Storage Operator page, scroll right and click the **Backing Store** tab.

**Figure 7.1. OpenShift Container Storage Operator page with backing store tab**

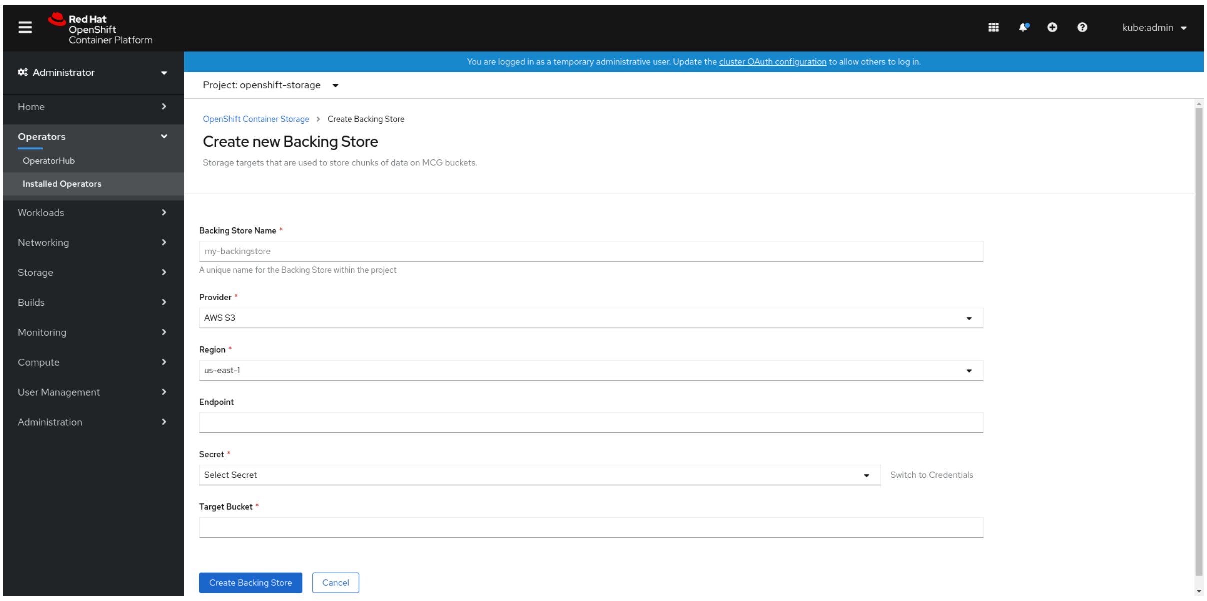


You are logged in as a temporary administrative user. Update the cluster OAuth configuration to allow others to log in.

Project: openshift-storage

4. Click **Create Backing Store**.

Figure 7.2. Create Backing Store page



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

Project: openshift-storage

OpenShift Container Storage > Create Backing Store

Create new Backing Store

Storage targets that are used to store chunks of data on MCG buckets.

Backing Store Name *
my-backingstore
A unique name for the Backing Store within the project

Provider *
AWS S3

Region *
us-east-1

Endpoint

Secret *
Select Secret
Switch to Credentials

Target Bucket *

Create Backing Store
Cancel

5. On the Create New Backing Store page, perform the following:

   a. Enter a **Backing Store Name**.

   b. Select a **Provider**.

   c. Select a **Region**.

   d. Enter an **Endpoint**. This is optional.

   e. Select a **Secret** from drop down list, or create your own secret. Optionally, you can **Switch to Credentials** view which lets you fill in the required secrets.
   For more information on creating an OCP secret, see the section Creating the secret in the Openshift Container Platform documentation.

      Each backingstore requires a different secret. For more information on creating the secret for a particular backingstore, see the Section 7.3.2, "Adding storage resources for hybrid or Multicloud using the MCG command line interface" and follow the procedure for the addition of storage resources using a YAML.

      NOTE

      This menu is relevant for all providers except Google Cloud and local PVC.

   f. Enter **Target bucket**. The target bucket is a container storage that is hosted on the remote cloud service. It allows you to create a connection that tells MCG that it can use this bucket for the system.

6. Click **Create Backing Store**.

### Verification steps

1. Click **Operators → Installed Operators**.

2. Click **OpenShift Container Storage** Operator.

3. Search for the new backing store or click **Backing Store** tab to view all the backing stores.

### 7.3.2. Adding storage resources for hybrid or Multicloud using the MCG command line interface

The Multicloud Object Gateway (MCG) simplifies the process of spanning data across cloud provider and clusters.

You must add a backing storage that can be used by the MCG.

Depending on the type of your deployment, you can choose one of the following procedures to create a backing storage:

- For creating an AWS-backed backingstore, see Section 7.3.2.1, “Creating an AWS-backed backingstore”
- For creating an IBM COS-backed backingstore, see Section 7.3.2.2, “Creating an IBM COS-backed backingstore”
- For creating an Azure-backed backingstore, see Section 7.3.2.3, “Creating an Azure-backed backingstore”

For VMWare deployments, skip to Section 7.3.3, “Creating an s3 compatible Multicloud Object Gateway backingstore” for further instructions.

#### 7.3.2.1. Creating an AWS-backed backingstore

**Prerequisites**

- Download the Multicloud Object Gateway (MCG) command-line interface:

  ```
  # subscription-manager repos --enable=rh-ocs-4-for-rhel-8-x86_64-rpms
  # yum install mcg
  ```

- Alternatively, you can install the **mcg** package from the OpenShift Container Storage RPMs found here https://access.redhat.com/downloads/content/547/ver=4/rhel---8/4/x86_64/packages

**Procedure**

1. From the MCG command-line interface, run the following command:

   ```
   noobaa backingstore create <backingstore_name> --access-key=<AWS ACCESS KEY> --
   secret-key=<AWS SECRET ACCESS KEY> --target-bucket <bucket-name>
   ```

   a. Replace **<backingstore_name>** with the name of the backingstore.

   b. Replace **<AWS ACCESS KEY>** and **<AWS SECRET ACCESS KEY>** with an AWS access key ID and secret access key you created for this purpose.

   c. Replace **<bucket-name>** with an existing AWS bucket name. This argument tells Multicloud Object Gateway which bucket to use as a target bucket for its backing store, and subsequently, data storage and administration.
   The output will be similar to the following:

```
INFO[0001]    Exists: NooBaa "noobaa"
INFO[0002]    Created: BackingStore "aws-resource"
INFO[0002]    Created: Secret "backing-store-secret-aws-resource"
```

You can also add storage resources using a YAML:

1. Create a secret with the credentials:

    ```
    apiVersion: v1
    kind: Secret
    metadata:
      name: <backingstore-secret-name>
    type: Opaque
    data:
      AWS_ACCESS_KEY_ID: <AWS ACCESS KEY ID ENCODED IN BASE64>
      AWS_SECRET_ACCESS_KEY: <AWS SECRET ACCESS KEY ENCODED IN BASE64>
    ```

    a. You must supply and encode your own AWS access key ID and secret access key using Base64, and use the results in place of **<AWS ACCESS KEY ID ENCODED IN BASE64>** and **<AWS SECRET ACCESS KEY ENCODED IN BASE64>**.

    b. Replace **<backingstore-secret-name>** with a unique name.

2. Apply the following YAML for a specific backing store:

    ```
    apiVersion: noobaa.io/v1alpha1
    kind: BackingStore
    metadata:
      finalizers:
      - noobaa.io/finalizer
      labels:
        app: noobaa
      name: bs
      namespace: openshift-storage
    spec:
      awsS3:
        secret:
          name: <backingstore-secret-name>
          namespace: noobaa
        targetBucket: <bucket-name>
      type: aws-s3
    ```

    a. Replace **<bucket-name>** with an existing AWS bucket name. This argument tells Multicloud Object Gateway which bucket to use as a target bucket for its backing store, and subsequently, data storage and administration.

    b. Replace **<backingstore-secret-name>** with the name of the secret created in the previous step.

#### 7.3.2.2. Creating an IBM COS-backed backingstore

##### Prerequisites

- Download the Multicloud Object Gateway (MCG) command-line interface:

    ▪

```
# subscription-manager repos --enable=rh-ocs-4-for-rhel-8-x86_64-rpms
# yum install mcg
```

- Alternatively, you can install the **mcg** package from the OpenShift Container Storage RPMs found here https://access.redhat.com/downloads/content/547/ver=4/rhel---8/4/x86_64/packages

### Procedure

1. From the MCG command-line interface, run the following command:

```
noobaa backingstore create ibm-cos <backingstore_name> --access-key=<IBM ACCESS
KEY> --secret-key=<IBM SECRET ACCESS KEY> --endpoint=<IBM COS ENDPOINT> --
target-bucket <bucket-name>
```

   a. Replace **<backingstore_name>** with the name of the backingstore.

   b. Replace **<IBM ACCESS KEY>**, **<IBM SECRET ACCESS KEY>**, **<IBM COS ENDPOINT>** with an IBM access key ID, secret access key and the appropriate regional endpoint that corresponds to the location of the existing IBM bucket.
   To generate the above keys on IBM cloud, you must include HMAC credentials while creating the service credentials for your target bucket.

   c. Replace **<bucket-name>** with an existing IBM bucket name. This argument tells Multicloud Object Gateway which bucket to use as a target bucket for its backing store, and subsequently, data storage and administration.
   The output will be similar to the following:

```
INFO[0001]   Exists: NooBaa "noobaa"
INFO[0002]   Created: BackingStore "ibm-resource"
INFO[0002]   Created: Secret "backing-store-secret-ibm-resource"
```

You can also add storage resources using a YAML:

1. Create a secret with the credentials:

```
apiVersion: v1
kind: Secret
metadata:
  name: <backingstore-secret-name>
type: Opaque
data:
  IBM_COS_ACCESS_KEY_ID: <IBM COS ACCESS KEY ID ENCODED IN BASE64>
  IBM_COS_SECRET_ACCESS_KEY: <IBM COS SECRET ACCESS KEY ENCODED IN
BASE64>
```

   a. You must supply and encode your own IBM COS access key ID and secret access key using Base64, and use the results in place of **<IBM COS ACCESS KEY ID ENCODED IN BASE64>** and **<IBM COS SECRET ACCESS KEY ENCODED IN BASE64>**.

   b. Replace **<backingstore-secret-name>** with a unique name.

2. Apply the following YAML for a specific backing store:

```
apiVersion: noobaa.io/v1alpha1
```

```
kind: BackingStore
metadata:
  finalizers:
  - noobaa.io/finalizer
  labels:
    app: noobaa
  name: bs
  namespace: openshift-storage
spec:
  ibmCos:
    endpoint: <endpoint>
    secret:
      name: <backingstore-secret-name>
      namespace: openshift-storage
    targetBucket: <bucket-name>
  type: ibm-cos
```

a. Replace **<bucket-name>** with an existing IBM COS bucket name. This argument tells Multicloud Object Gateway which bucket to use as a target bucket for its backing store, and subsequently, data storage and administration.

b. Replace **<endpoint>** with a regional endpoint that corresponds to the location of the existing IBM bucket name. This argument tells Multicloud Object Gateway which endpoint to use for its backing store, and subsequently, data storage and administration.

c. Replace **<backingstore-secret-name>** with the name of the secret created in the previous step.

### 7.3.2.3. Creating an Azure-backed backingstore

#### Prerequisites

- Download the Multicloud Object Gateway (MCG) command-line interface:

```
# subscription-manager repos --enable=rh-ocs-4-for-rhel-8-x86_64-rpms
# yum install mcg
```

- Alternatively, you can install the **mcg** package from the OpenShift Container Storage RPMs found here https://access.redhat.com/downloads/content/547/ver=4/rhel---8/4/x86_64/packages

#### Procedure

1. From the MCG command-line interface, run the following command:

```
noobaa backingstore create azure-blob <backingstore_name> --account-key=<AZURE
ACCOUNT KEY> --account-name=<AZURE ACCOUNT NAME> --target-blob-container
<blob container name>
```

a. Replace **<backingstore_name>** with the name of the backingstore.

b. Replace **<AZURE ACCOUNT KEY>** and **<AZURE ACCOUNT NAME>** with an AZURE account key and account name you created for this purpose.

c. Replace **<blob container name>** with an existing Azure blob container name. This argument tells Multicloud Object Gateway which bucket to use as a target bucket for its backing store, and subsequently, data storage and administration.
   The output will be similar to the following:

```
INFO[0001]  Exists: NooBaa "noobaa"
INFO[0002]  Created: BackingStore "azure-resource"
INFO[0002]  Created: Secret "backing-store-secret-azure-resource"
```

You can also add storage resources using a YAML:

1. Create a secret with the credentials:

```
apiVersion: v1
kind: Secret
metadata:
  name: <backingstore-secret-name>
type: Opaque
data:
  AccountName: <AZURE ACCOUNT NAME ENCODED IN BASE64>
  AccountKey: <AZURE ACCOUNT KEY ENCODED IN BASE64>
```

   a. You must supply and encode your own Azure Account Name and Account Key using Base64, and use the results in place of **<AZURE ACCOUNT NAME ENCODED IN BASE64>** and **<AZURE ACCOUNT KEY ENCODED IN BASE64>**.

   b. Replace **<backingstore-secret-name>** with a unique name.

2. Apply the following YAML for a specific backing store:

```
apiVersion: noobaa.io/v1alpha1
kind: BackingStore
metadata:
  finalizers:
  - noobaa.io/finalizer
  labels:
    app: noobaa
  name: bs
  namespace: openshift-storage
spec:
  azureBlob:
    secret:
      name: <backingstore-secret-name>
      namespace: openshift-storage
    targetBlobContainer: <blob-container-name>
  type: azure-blob
```

   a. Replace **<blob-container-name>** with an existing Azure blob container name. This argument tells Multicloud Object Gateway which bucket to use as a target bucket for its backing store, and subsequently, data storage and administration.

   b. Replace **<backingstore-secret-name>** with the name of the secret created in the previous step.

### 7.3.3. Creating an s3 compatible Multicloud Object Gateway backingstore

The Multicloud Object Gateway can use any S3 compatible object storage as a backing store, for example, Red Hat Ceph Storage's RADOS Gateway (RGW). The following procedure shows how to create an S3 compatible Multicloud Object Gateway backing store for Red Hat Ceph Storage's RADOS Gateway. Note that when RGW is deployed, Openshift Container Storage operator creates an S3 compatible backingstore for Multicloud Object Gateway automatically.

### Procedure

1. From the Multicloud Object Gateway (MCG) command-line interface, run the following NooBaa command:

```
noobaa backingstore create s3-compatible rgw-resource --access-key=<RGW ACCESS
KEY> --secret-key=<RGW SECRET KEY> --target-bucket=<bucket-name> --
endpoint=http://rook-ceph-rgw-ocs-storagecluster-cephobjectstore.openshift-
storage.svc.cluster.local:80
```

   a. To get the **<RGW ACCESS KEY>** and **<RGW SECRET KEY>**, run the following command using your RGW user secret name:

```
oc get secret <RGW USER SECRET NAME> -o yaml
```

   b. Decode the access key ID and the access key from Base64 and keep them.

   c. Replace **<RGW USER ACCESS KEY>** and **<RGW USER SECRET ACCESS KEY>** with the appropriate, decoded data from the previous step.

   d. Replace **<bucket-name>** with an existing RGW bucket name. This argument tells Multicloud Object Gateway which bucket to use as a target bucket for its backing store, and subsequently, data storage and administration.
   The output will be similar to the following:

```
INFO[0001]  Exists: NooBaa "noobaa"
INFO[0002]  Created: BackingStore "rgw-resource"
INFO[0002]  Created: Secret "backing-store-secret-rgw-resource"
```

You can also create the backingstore using a YAML:

1. Create a **CephObjectStore** user. This also creates a secret containing the RGW credentials:

```
apiVersion: ceph.rook.io/v1
kind: CephObjectStoreUser
metadata:
  name: <RGW-Username>
  namespace: openshift-storage
spec:
  store: ocs-storagecluster-cephobjectstore
  displayName: "<Display-name>"
```

   a. Replace **<RGW-Username>** and **<Display-name>** with a unique username and display name.

2. Apply the following YAML for an S3-Compatible backing store:

```
apiVersion: noobaa.io/v1alpha1
```

```
kind: BackingStore
metadata:
  finalizers:
  - noobaa.io/finalizer
  labels:
    app: noobaa
  name: <backingstore-name>
  namespace: openshift-storage
spec:
  s3Compatible:
    endpoint: http://rook-ceph-rgw-ocs-storagecluster-cephobjectstore.openshift-storage.svc.cluster.local:80
    secret:
      name: <backingstore-secret-name>
      namespace: openshift-storage
    signatureVersion: v4
    targetBucket: <RGW-bucket-name>
  type: s3-compatible
```

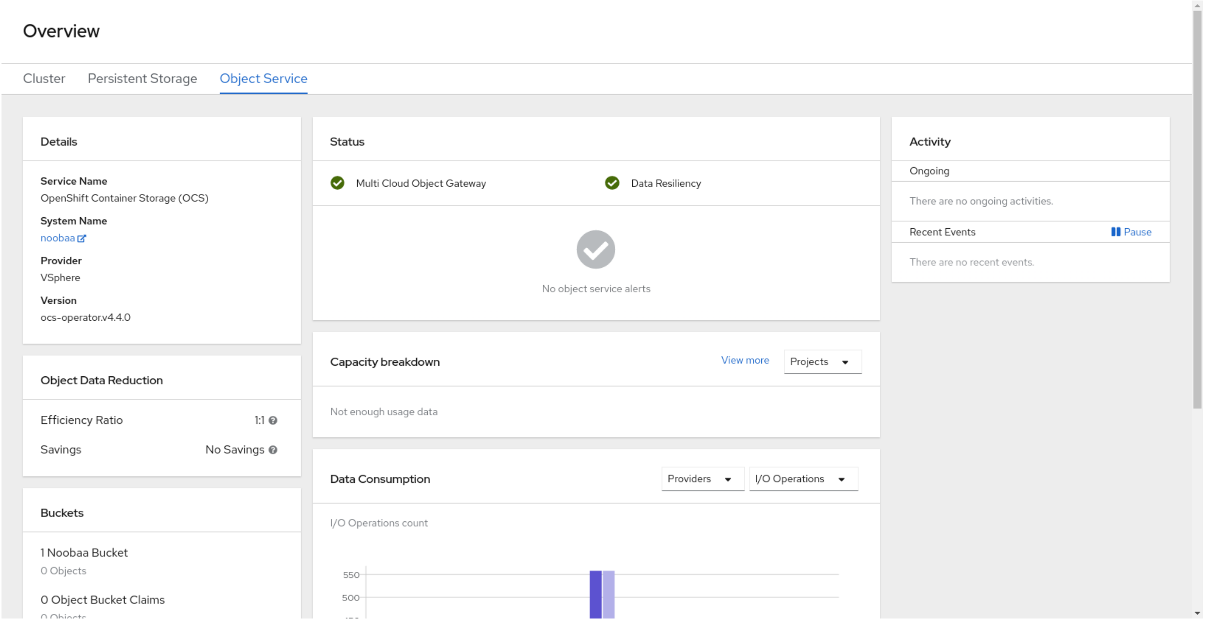
a. Replace **<backingstore-secret-name>** with the name of the secret that was created with **CephObjectStore** in the previous step.

b. Replace **<bucket-name>** with an existing RGW bucket name. This argument tells Multicloud Object Gateway which bucket to use as a target bucket for its backing store, and subsequently, data storage and administration.

### 7.3.4. Adding storage resources for hybrid and Multicloud using the user interface

#### Procedure

1. In your OpenShift Storage console, navigate to **Overview → Object Service** → select the **noobaa** link:



Overview

Cluster  Persistent Storage  Object Service

Details

Service Name
OpenShift Container Storage (OCS)

System Name
noobaa

Provider
VSphere

Version
ocs-operator.v4.4.0

Status

✓ Multi Cloud Object Gateway  ✓ Data Resiliency

No object service alerts

Activity

Ongoing

There are no ongoing activities.

Recent Events  Pause

There are no recent events.

Object Data Reduction

Efficiency Ratio 1:1

Savings No Savings

Capacity breakdown  View more  Projects

Not enough usage data

Data Consumption  Providers  I/O Operations

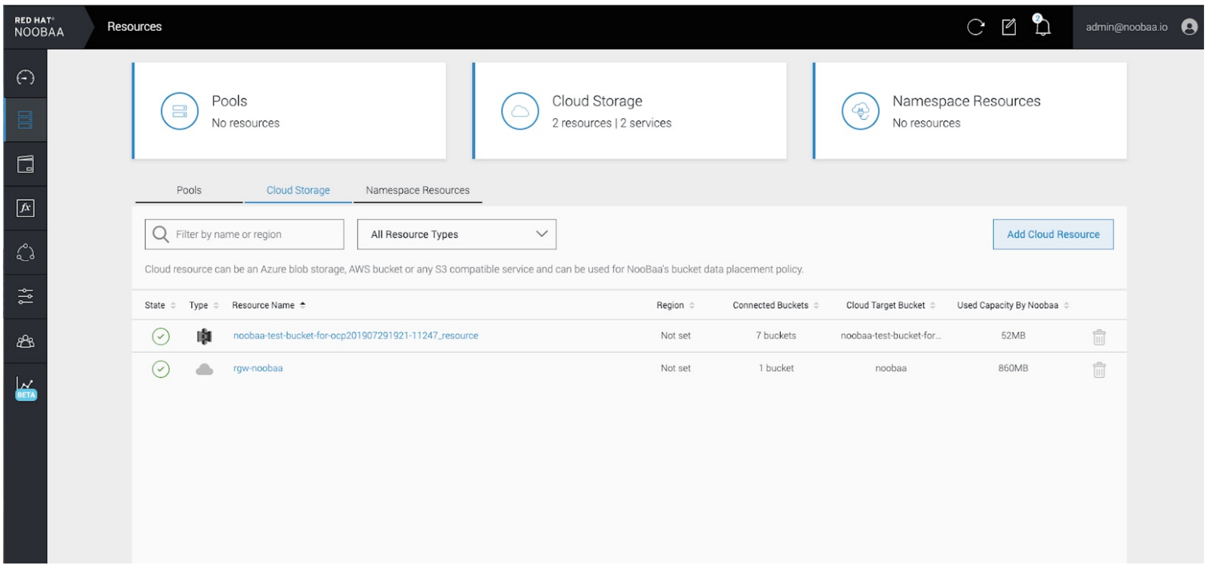
I/O Operations count

Buckets

1 Noobaa Bucket
0 Objects

0 Object Bucket Claims

2. Select the **Resources** tab in the left, highlighted below. From the list that populates, select **Add Cloud Resource**:



Pools
No resources

Cloud Storage
2 resources | 2 services

Namespace Resources
No resources

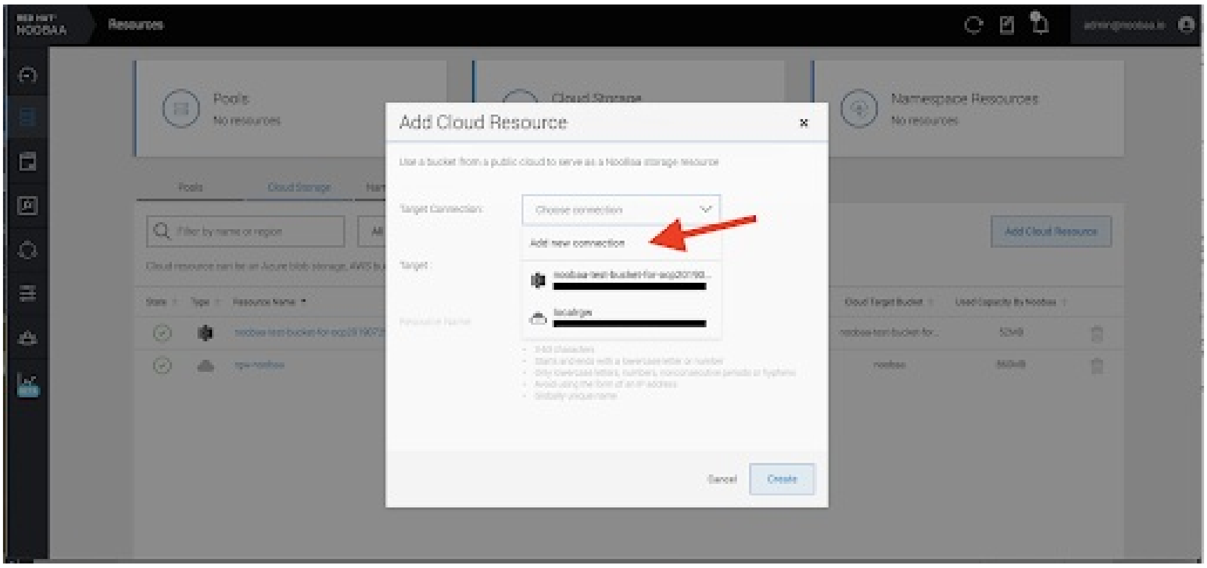
Pools | Cloud Storage | Namespace Resources

Filter by name or region | All Resource Types | Add Cloud Resource

Cloud resource can be an Azure blob storage, AWS bucket or any S3 compatible service and can be used for NooBaa's bucket data placement policy.

| State | Type | Resource Name | Region | Connected Buckets | Cloud Target Bucket | Used Capacity By Noobaa |
|---|---|---|---|---|---|---|
| ✓ | | noobaa-test-bucket-for-ocp201907291921-11247_resource | Not set | 7 buckets | noobaa-test-bucket-for... | 52MB |
| ✓ | | rgw-noobaa | Not set | 1 bucket | noobaa | 860MB |

3. Select **Add new connection**:



Add Cloud Resource

Use a bucket from a public cloud to serve as a NooBaa storage resource

Target Connection: Choose connection

Add new connection

noobaa-test-bucket-for-ocp20190...
[redacted]

localrgw
[redacted]

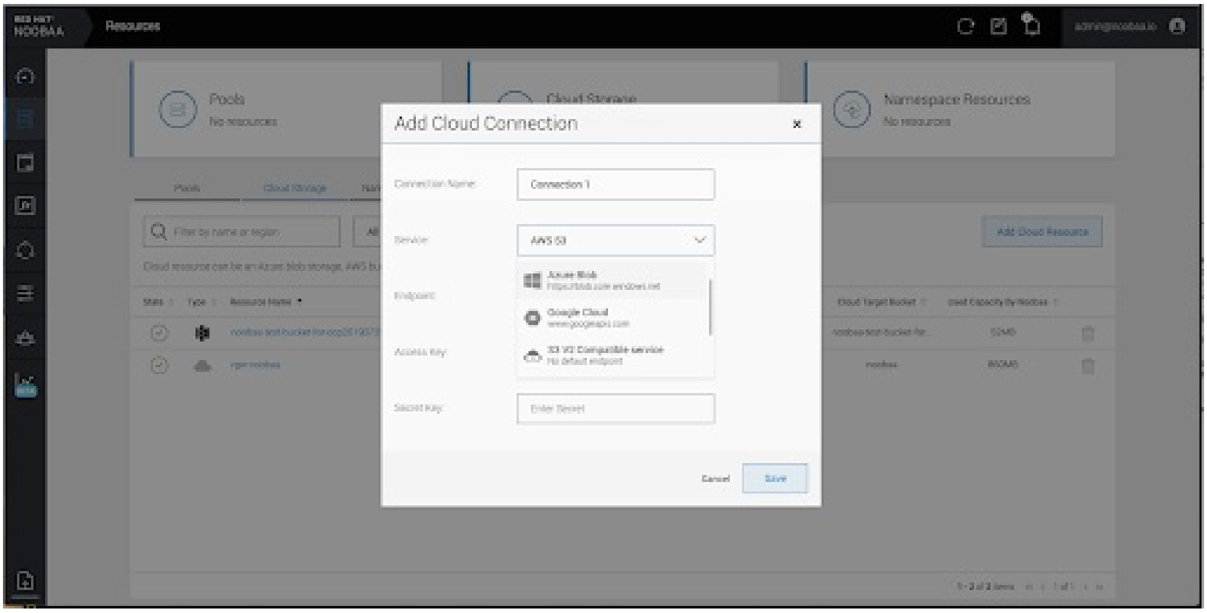
Target:

Resource Name:

- 3-63 characters
- Starts and ends with a lowercase letter or number
- Only lowercase letters, numbers, nonconsecutive periods or hyphens
- Avoid using the form of an IP address
- Globally unique name

Cancel | Create

4. Select the relevant native cloud provider or S3 compatible option and fill in the details:



Add Cloud Connection

Connection Name: Connection 1

Service: AWS S3

Azure Blob
https://blob.core.windows.net

Google Cloud
www.googleapis.com

S3 V2 Compatible service
No default endpoint

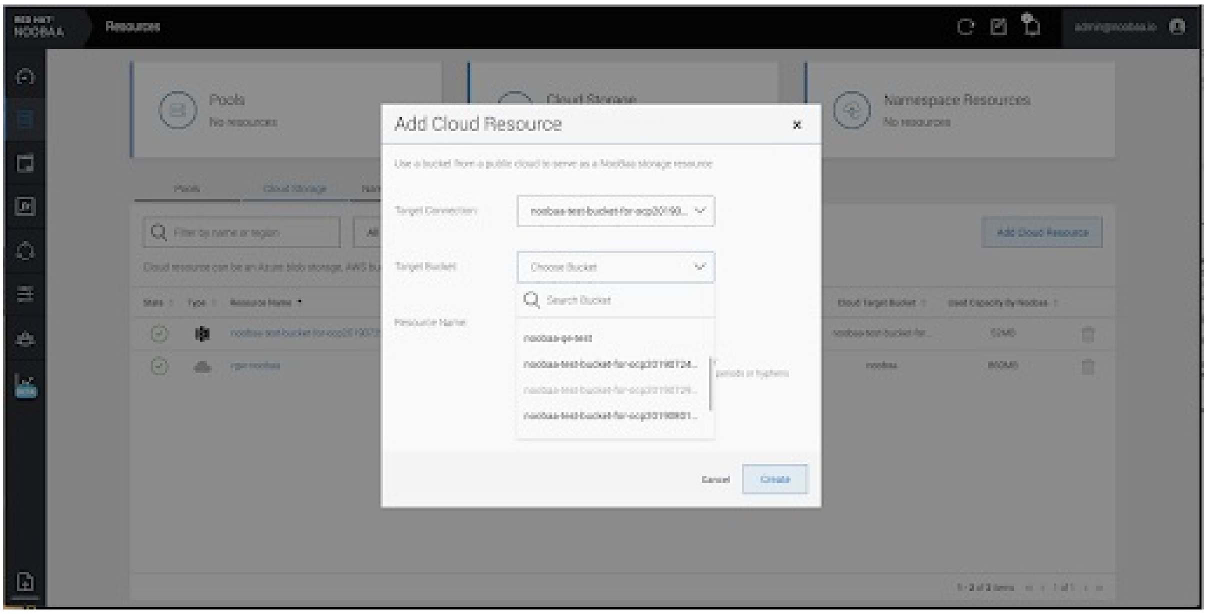
Endpoint:

Access Key:

Secret Key: Enter Secret

Cancel | Save

5. Select the newly created connection and map it to the existing bucket:



Add Cloud Resource

Use a bucket from a public cloud to serve as a NooBaa storage resource

Target Connection: noobaa-test-bucket-for-ocp20190...

Target Bucket: Choose Bucket

Search Bucket

noobaa-qe-test

noobaa-test-bucket-for-ocp20190724...

noobaa-test-bucket-for-ocp20190729...

noobaa-test-bucket-for-ocp20190801...

Resource Name:

6. Repeat these steps to create as many backing stores as needed.

## NOTE

Resources created in NooBaa UI cannot be used by OpenShift UI or MCG CLI.

## 7.3.5. Creating a new bucket class

Bucket class is a CRD representing a class of buckets that defines tiering policies and data placements for an Object Bucket Class (OBC).

Use this procedure to create a bucket class in OpenShift Container Storage.

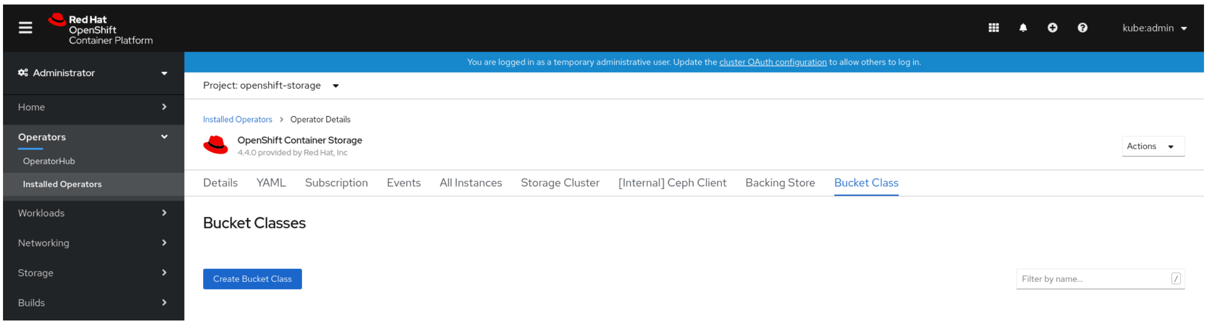
### Procedure

1. Click **Operators → Installed Operators** from the left pane of the OpenShift Web Console to view the installed operators.

2. Click **OpenShift Container Storage** Operator.

3. On the OpenShift Container Storage Operator page, scroll right and click the **Bucket Class** tab.

**Figure 7.3. OpenShift Container Storage Operator page with Bucket Class tab**



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

Project: openshift-storage

OpenShift Container Storage
4.4.0 provided by Red Hat, Inc

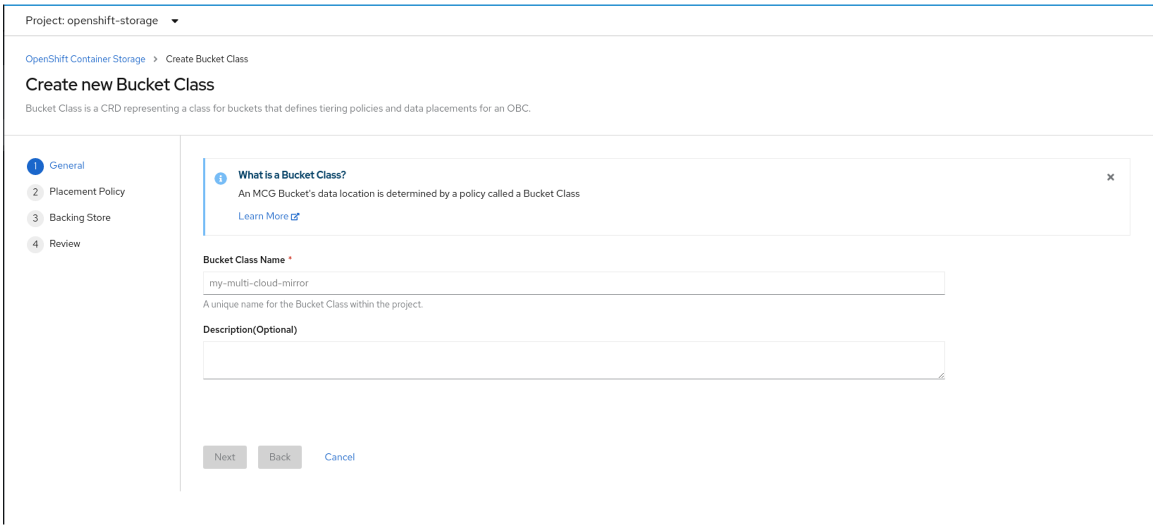
Bucket Classes

4. Click **Create Bucket Class**.

5. On the Create new Bucket Class page, perform the following:

a. Enter a **Bucket Class Name** and click **Next**.

**Figure 7.4. Create Bucket Class page**


Project: openshift-storage
OpenShift Container Storage > Create Bucket Class
1 General
2 Placement Policy
3 Backing Store
4 Review
Learn More
Next
Back
Cancel

Create new Bucket Class

Bucket Class is a CRD representing a class for buckets that defines tiering policies and data placements for an OBC.

What is a Bucket Class?

An MCG Bucket's data location is determined by a policy called a Bucket Class

Bucket Class Name *

my-multi-cloud-mirror

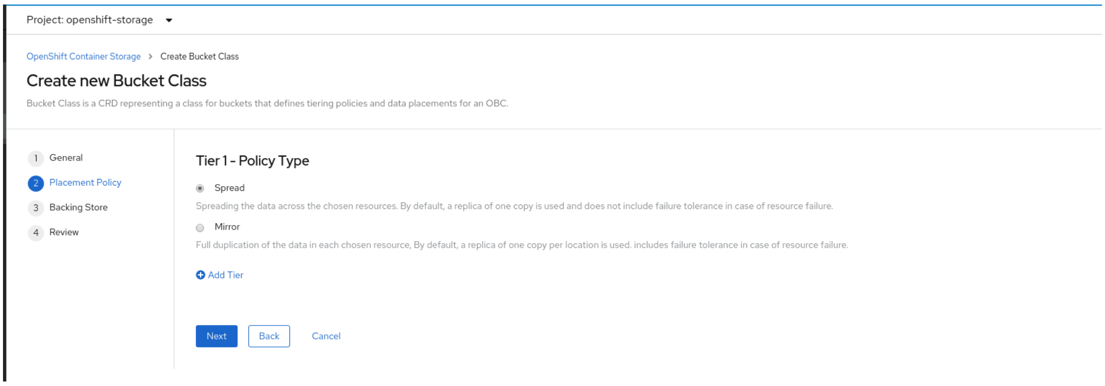
A unique name for the Bucket Class within the project.

Description(Optional)

b. In Placement Policy, select **Tier 1 - Policy Type**and click **Next**. You can choose either one of the options as per your requirements.

- **Spread** allows spreading of the data across the chosen resources.
- **Mirror** allows full duplication of the data across the chosen resources.
- Click **Add Tier** to add another policy tier.

**Figure 7.5. Tier 1 - Policy Type selection page**


Project: openshift-storage
OpenShift Container Storage > Create Bucket Class
1 General
2 Placement Policy
3 Backing Store
4 Review
Add Tier
Next
Back
Cancel

Create new Bucket Class

Bucket Class is a CRD representing a class for buckets that defines tiering policies and data placements for an OBC.

Tier 1 - Policy Type

● Spread

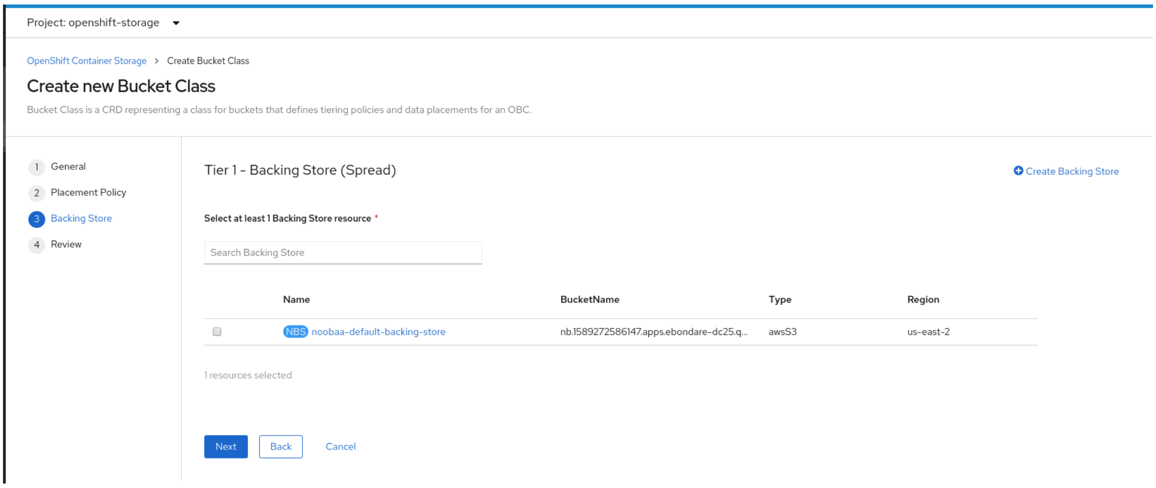
Spreading the data across the chosen resources. By default, a replica of one copy is used and does not include failure tolerance in case of resource failure.

○ Mirror

Full duplication of the data in each chosen resource, By default, a replica of one copy per location is used. includes failure tolerance in case of resource failure.

c. Select atleast one **Backing Store** resource from the available list if you have selected Tier 1 - Policy Type as Spread and click **Next**. Alternatively, you can also create a new backing store.

Figure 7.6. Tier 1 - Backing Store selection page



Project: openshift-storage

OpenShift Container Storage > Create Bucket Class

Create new Bucket Class

Bucket Class is a CRD representing a class for buckets that defines tiering policies and data placements for an OBC.

1 General
2 Placement Policy
3 Backing Store
4 Review

Tier 1 - Backing Store (Spread)

Create Backing Store

Select at least 1 Backing Store resource *

Search Backing Store

| | Name | BucketName | Type | Region |
|---|---|---|---|---|
| □ | NBS noobaa-default-backing-store | nb.1589272586147.apps.ebondare-dc25.q... | awsS3 | us-east-2 |

1 resources selected

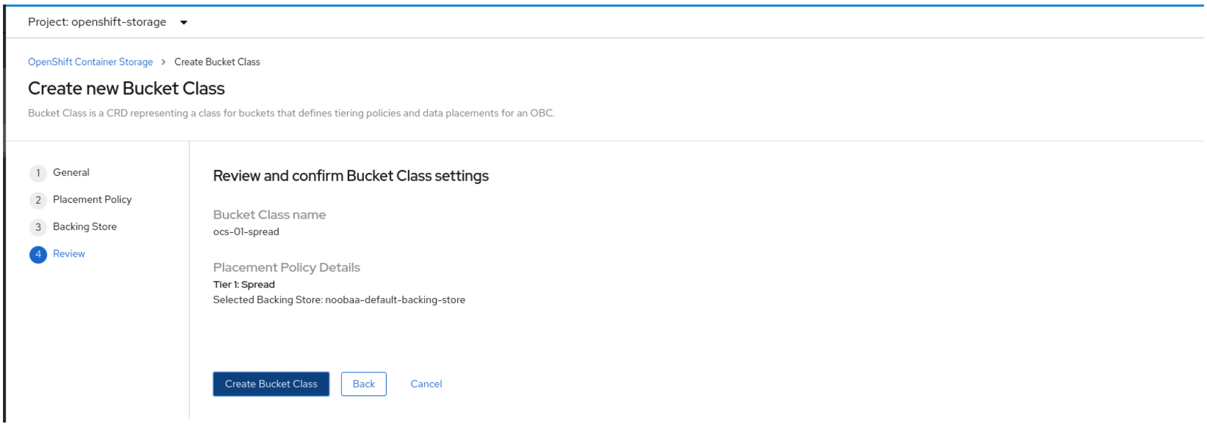
Next | Back | Cancel

## NOTE

You need to select atleast 2 backing stores when you select Policy Type as Mirror in previous step.

a. Review and confirm Bucket Class settings.

Figure 7.7. Bucket class settings review page



Project: openshift-storage

OpenShift Container Storage > Create Bucket Class

Create new Bucket Class

Bucket Class is a CRD representing a class for buckets that defines tiering policies and data placements for an OBC.

1 General
2 Placement Policy
3 Backing Store
4 Review

Review and confirm Bucket Class settings

Bucket Class name
ocs-01-spread

Placement Policy Details
Tier 1: Spread
Selected Backing Store: noobaa-default-backing-store

Create Bucket Class | Back | Cancel

b. Click **Create Bucket Class**.

### Verification steps

1. Click **Operators → Installed Operators**.
2. Click **OpenShift Container Storage** Operator.
3. Search for the new Bucket Class or click **Bucket Class** tab to view all the Bucket Classes.

## 7.4. MIRRORING DATA FOR HYBRID AND MULTICLOUD BUCKETS

The Multicloud Object Gateway (MCG) simplifies the process of spanning data across cloud provider and clusters.

### Prerequisites

- You must first add a backing storage that can be used by the MCG, see Section 7.3, "Adding storage resources for hybrid or Multicloud".

Then you create a bucket class that reflects the data management policy, mirroring.

### Procedure

You can set up mirroring data three ways:

- Section 7.4.1, "Creating bucket classes to mirror data using the MCG command-line-interface"
- Section 7.4.2, "Creating bucket classes to mirror data using a YAML"
- Section 7.4.3, "Configuring buckets to mirror data using the user interface"

## 7.4.1. Creating bucket classes to mirror data using the MCG command-line-interface

1. From the MCG command-line interface, run the following command to create a bucket class with a mirroring policy:

```
$ noobaa bucketclass create mirror-to-aws --backingstores=azure-resource,aws-resource --
placement Mirror
```

2. Set the newly created bucket class to a new bucket claim, generating a new bucket that will be mirrored between two locations:

```
$ noobaa obc create  mirrored-bucket --bucketclass=mirror-to-aws
```

## 7.4.2. Creating bucket classes to mirror data using a YAML

1. Apply the following YAML. This YAML is a hybrid example that mirrors data between local Ceph storage and AWS:

```
apiVersion: noobaa.io/v1alpha1
kind: BucketClass
metadata:
  name: hybrid-class
  labels:
    app: noobaa
spec:
  placementPolicy:
    tiers:
      - tier:
          mirrors:
            - mirror:
                spread:
                  - cos-east-us
            - mirror:
                spread:
                  - noobaa-test-bucket-for-ocp201907291921-11247_resource
```

2. Add the following lines to your standard Object Bucket Claim (OBC):

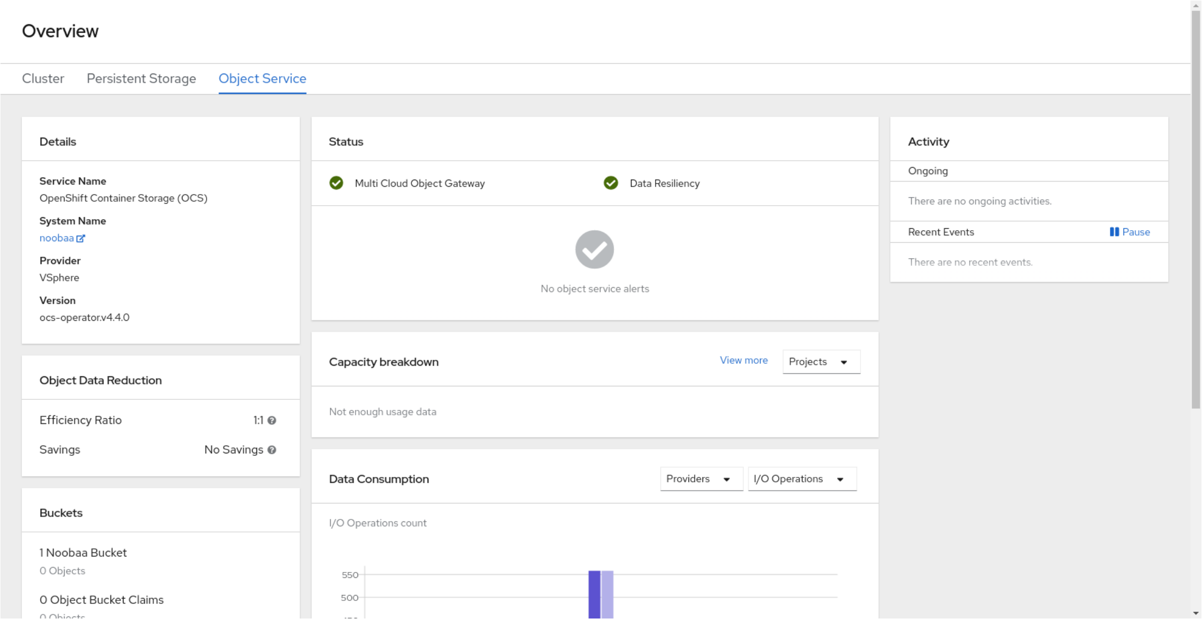
```
additionalConfig:
  bucketclass: mirror-to-aws
```

–

For more information about OBCs, see Section 7.6, “Object Bucket Claim” .

### 7.4.3. Configuring buckets to mirror data using the user interface

1. In your OpenShift Storage console, navigate to **Overview** → **Object Service** → select the **noobaa** link:



Overview

Details

Service Name
OpenShift Container Storage (OCS)

System Name
noobaa

Provider
VSphere

Version
ocs-operator.v4.4.0

Object Data Reduction

Efficiency Ratio 1:1

Savings No Savings

Buckets

1 Noobaa Bucket
0 Objects

0 Object Bucket Claims
0 Objects

Status

Multi Cloud Object Gateway

Data Resiliency

No object service alerts

Capacity breakdown

Not enough usage data

Data Consumption

I/O Operations count

Activity

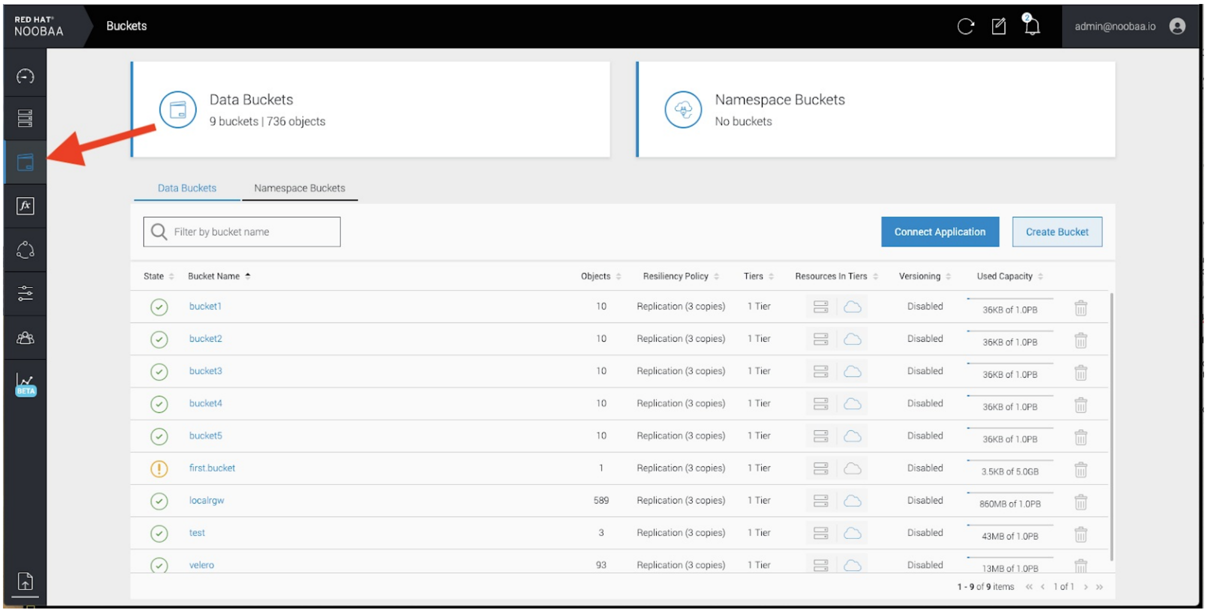
Ongoing

There are no ongoing activities.

Recent Events

There are no recent events.

2. Click the **buckets** icon on the left side. You will see a list of your buckets:



Data Buckets
9 buckets | 736 objects

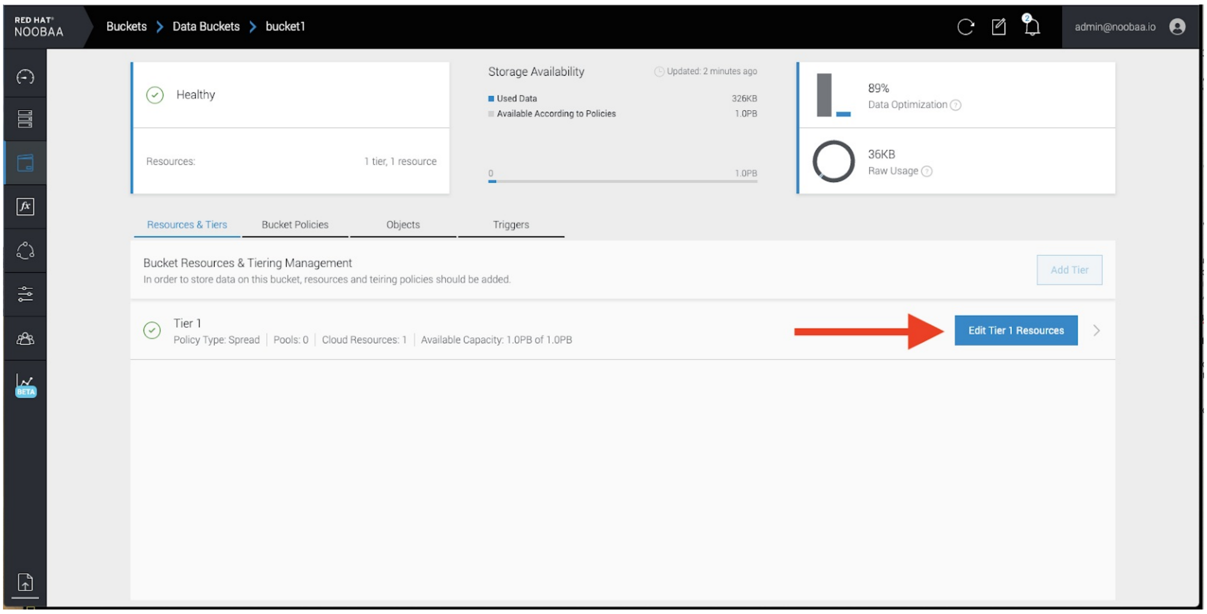
Namespace Buckets
No buckets

| State | Bucket Name | Objects | Resiliency Policy | Tiers | Resources In Tiers | Versioning | Used Capacity |
|---|---|---|---|---|---|---|---|
| ✓ | bucket1 | 10 | Replication (3 copies) | 1 Tier | | Disabled | 36KB of 1.0PB |
| ✓ | bucket2 | 10 | Replication (3 copies) | 1 Tier | | Disabled | 36KB of 1.0PB |
| ✓ | bucket3 | 10 | Replication (3 copies) | 1 Tier | | Disabled | 36KB of 1.0PB |
| ✓ | bucket4 | 10 | Replication (3 copies) | 1 Tier | | Disabled | 36KB of 1.0PB |
| ✓ | bucket5 | 10 | Replication (3 copies) | 1 Tier | | Disabled | 36KB of 1.0PB |
| ! | first.bucket | 1 | Replication (3 copies) | 1 Tier | | Disabled | 3.5KB of 5.0GB |
| ✓ | localrgw | 589 | Replication (3 copies) | 1 Tier | | Disabled | 860MB of 1.0PB |
| ✓ | test | 3 | Replication (3 copies) | 1 Tier | | Disabled | 43MB of 1.0PB |
| ✓ | velero | 93 | Replication (3 copies) | 1 Tier | | Disabled | 13MB of 1.0PB |

1 - 9 of 9 items « ‹ 1 of 1 › »

3. Click the bucket you want to update.

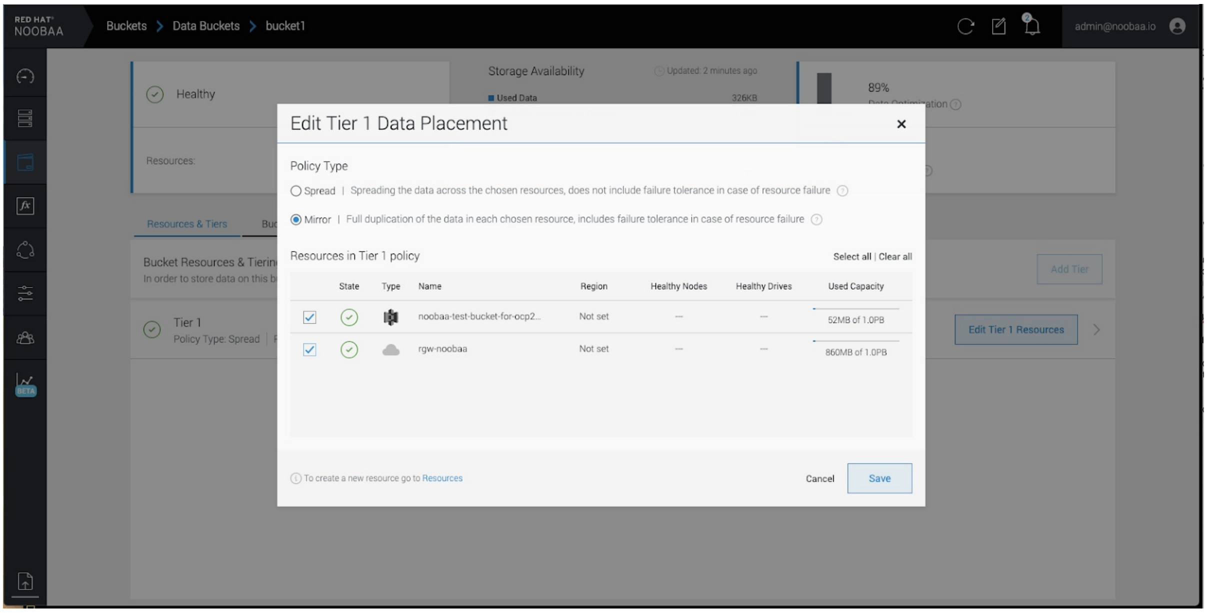
4. Click **Edit Tier 1 Resources**:



Bucket Resources & Tiering Management
In order to store data on this bucket, resources and teiring policies should be added.

Tier 1
Policy Type: Spread | Pools: 0 | Cloud Resources: 1 | Available Capacity: 1.0PB of 1.0PB

5. Select **Mirror** and check the relevant resources you want to use for this bucket. In the following example, we mirror data between on prem Ceph RGW to AWS:



Edit Tier 1 Data Placement

Policy Type

○ Spread | Spreading the data across the chosen resources, does not include failure tolerance in case of resource failure

● Mirror | Full duplication of the data in each chosen resource, includes failure tolerance in case of resource failure

Resources in Tier 1 policy

| | State | Type | Name | Region | Healthy Nodes | Healthy Drives | Used Capacity |
|---|---|---|---|---|---|---|---|
| ☑ | ✓ | | noobaa-test-bucket-for-ocp2... | Not set | — | — | 52MB of 1.0PB |
| ☑ | ✓ | | rgw-noobaa | Not set | — | — | 860MB of 1.0PB |

To create a new resource go to Resources

6. Click **Save**.

NOTE

Resources created in NooBaa UI cannot be used by OpenShift UI or MCG CLI.

## 7.5. BUCKET POLICIES IN THE MULTICLOUD OBJECT GATEWAY

OpenShift Container Storage supports AWS S3 bucket policies. Bucket policies allow you to grant users access permissions for buckets and the objects in them.

### 7.5.1. About bucket policies

Bucket policies are an access policy option available for you to grant permission to your AWS S3 buckets and objects. Bucket policies use JSON-based access policy language. For more information about access policy language, see AWS Access Policy Language Overview .

### 7.5.2. Using bucket policies

#### Prerequisites

- A running OpenShift Container Storage Platform
- Access to the Multicloud Object Gateway, see Section 7.2, “Accessing the Multicloud Object Gateway with your applications”

#### Procedure

To use bucket policies in the Multicloud Object Gateway:

1. Create the bucket policy in JSON format. See the following example:

```
{
    "Version": "NewVersion",
    "Statement": [
        {
            "Sid": "Example",
            "Effect": "Allow",
            "Principal": [
                    "john.doe@example.com"
            ],
            "Action": [
                "s3:GetObject"
            ],
            "Resource": [
                "arn:aws:s3:::john_bucket"
            ]
        }
    ]
}
```

   There are many available elements for bucket policies. For details on these elements and examples of how they can be used, see AWS Access Policy Language Overview .

   For more examples of bucket policies, see AWS Bucket Policy Examples .

   Instructions for creating S3 users can be found in Section 7.5.3, “Creating an AWS S3 user in the Multicloud Object Gateway”.

2. Using AWS S3 client, use the **put-bucket-policy** command to apply the bucket policy to your S3 bucket:

```
# aws --endpoint ENDPOINT --no-verify-ssl s3api put-bucket-policy --bucket MyBucket --
policy BucketPolicy
```

   Replace ***ENDPOINT*** with the S3 endpoint

   Replace ***MyBucket*** with the bucket to set the policy on

   Replace ***BucketPolicy*** with the bucket policy JSON file

   Add **--no-verify-ssl** if you are using the default self signed certificates

For example:

```
# aws --endpoint https://s3-openshift-storage.apps.gogo44.noobaa.org --no-verify-ssl s3api
put-bucket-policy -bucket MyBucket --policy file://BucketPolicy
```

For more information on the **put-bucket-policy** command, see the AWS CLI Command Reference for put-bucket-policy.

NOTE

The principal element specifies the user that is allowed or denied access to a resource, such as a bucket. Currently, Only NooBaa accounts can be used as principals. In the case of object bucket claims, NooBaa automatically create an account **obc-account.<generated bucket name>@noobaa.io**.

NOTE

Bucket policy conditions are not supported.

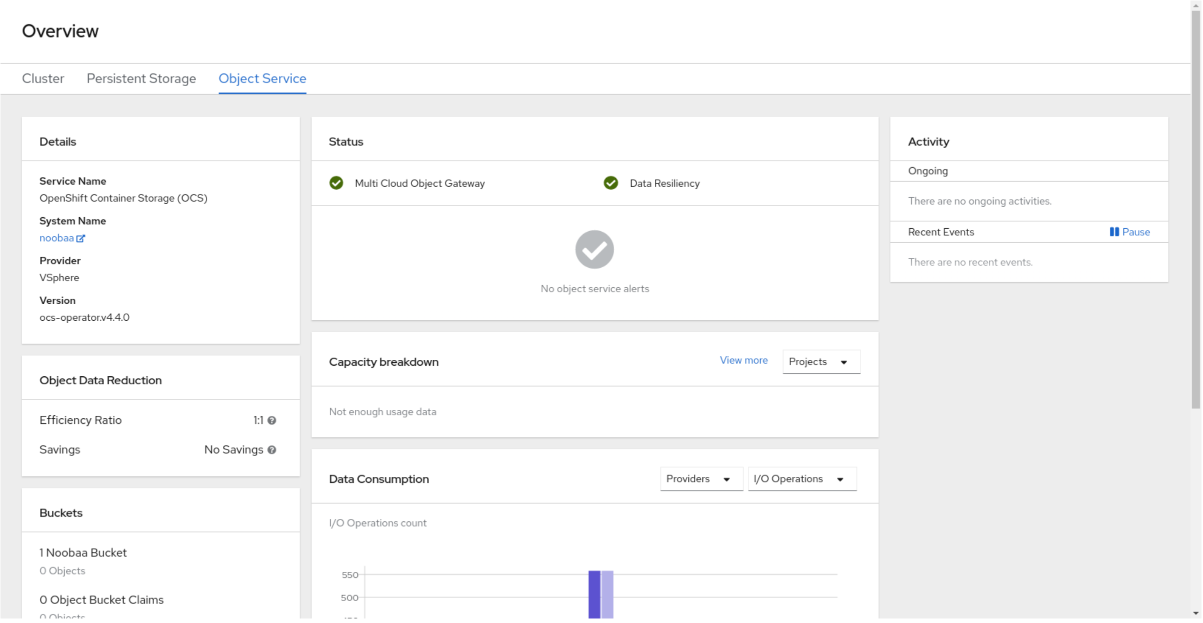
### 7.5.3. Creating an AWS S3 user in the Multicloud Object Gateway

#### Prerequisites

- A running OpenShift Container Storage Platform
- Access to the Multicloud Object Gateway, see Section 7.2, “Accessing the Multicloud Object Gateway with your applications”

#### Procedure

1. In your OpenShift Storage console, navigate to **Overview** → **Object Service** → select the **noobaa** link:



Overview

Cluster Persistent Storage Object Service

Details

Service Name
OpenShift Container Storage (OCS)

System Name
noobaa

Provider
VSphere

Version
ocs-operator.v4.4.0

Object Data Reduction

Efficiency Ratio 1:1

Savings No Savings

Buckets

1 Noobaa Bucket
0 Objects

0 Object Bucket Claims
0 Objects

Status

Multi Cloud Object Gateway Data Resiliency

No object service alerts

Capacity breakdown View more Projects

Not enough usage data

Data Consumption Providers I/O Operations

I/O Operations count

Activity

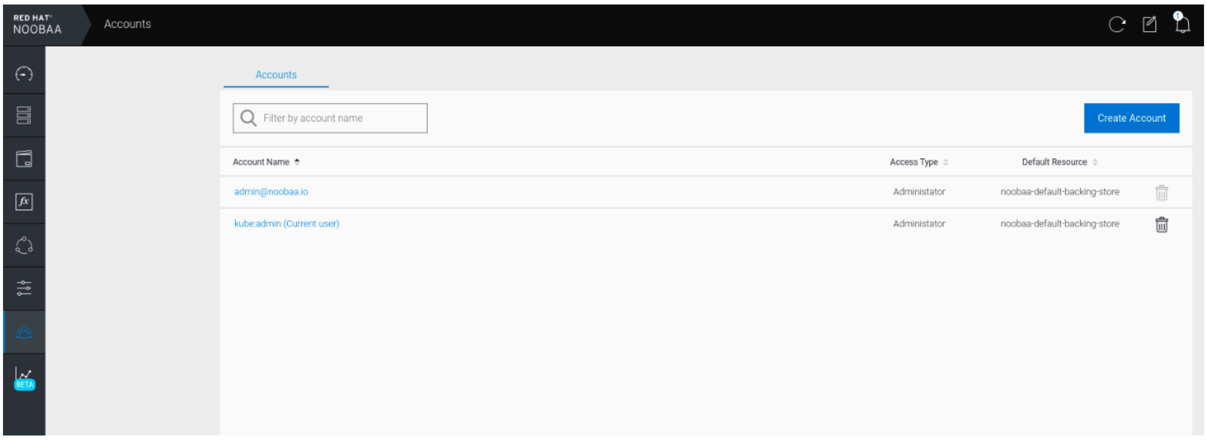
Ongoing

There are no ongoing activities.

Recent Events Pause

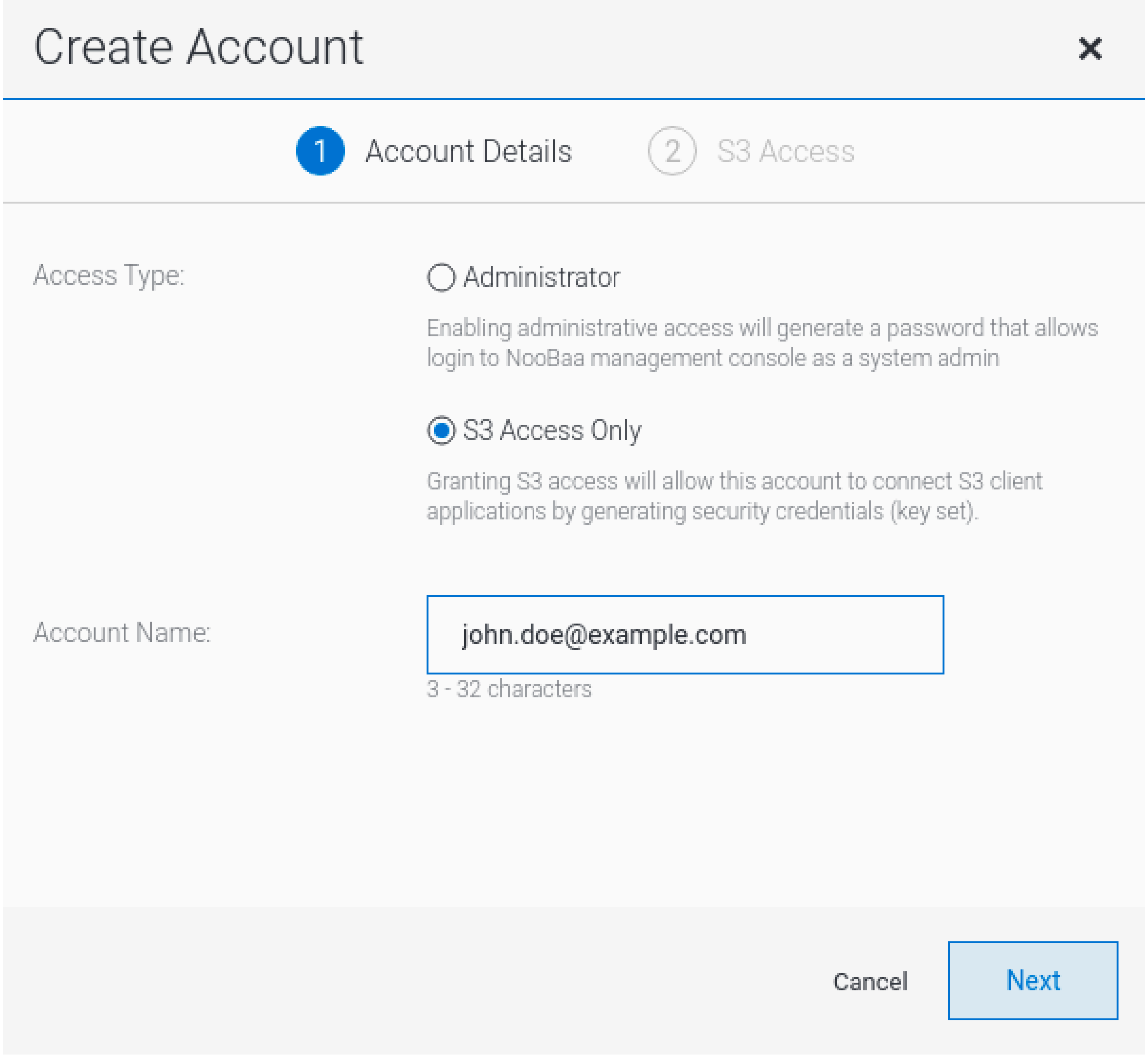
There are no recent events.

2. Under the **Accounts** tab, click **Create Account**



| Account Name | Access Type | Default Resource |
|---|---|---|
| admin@noobaa.io | Administator | noobaa-default-backing-store |
| kube:admin (Current user) | Administator | noobaa-default-backing-store |

3. Select **S3 Access Only**, provide the **Account Name**, for example, john.doe@example.com. Click Next:



Access Type:

○ Administrator

Enabling administrative access will generate a password that allows login to NooBaa management console as a system admin

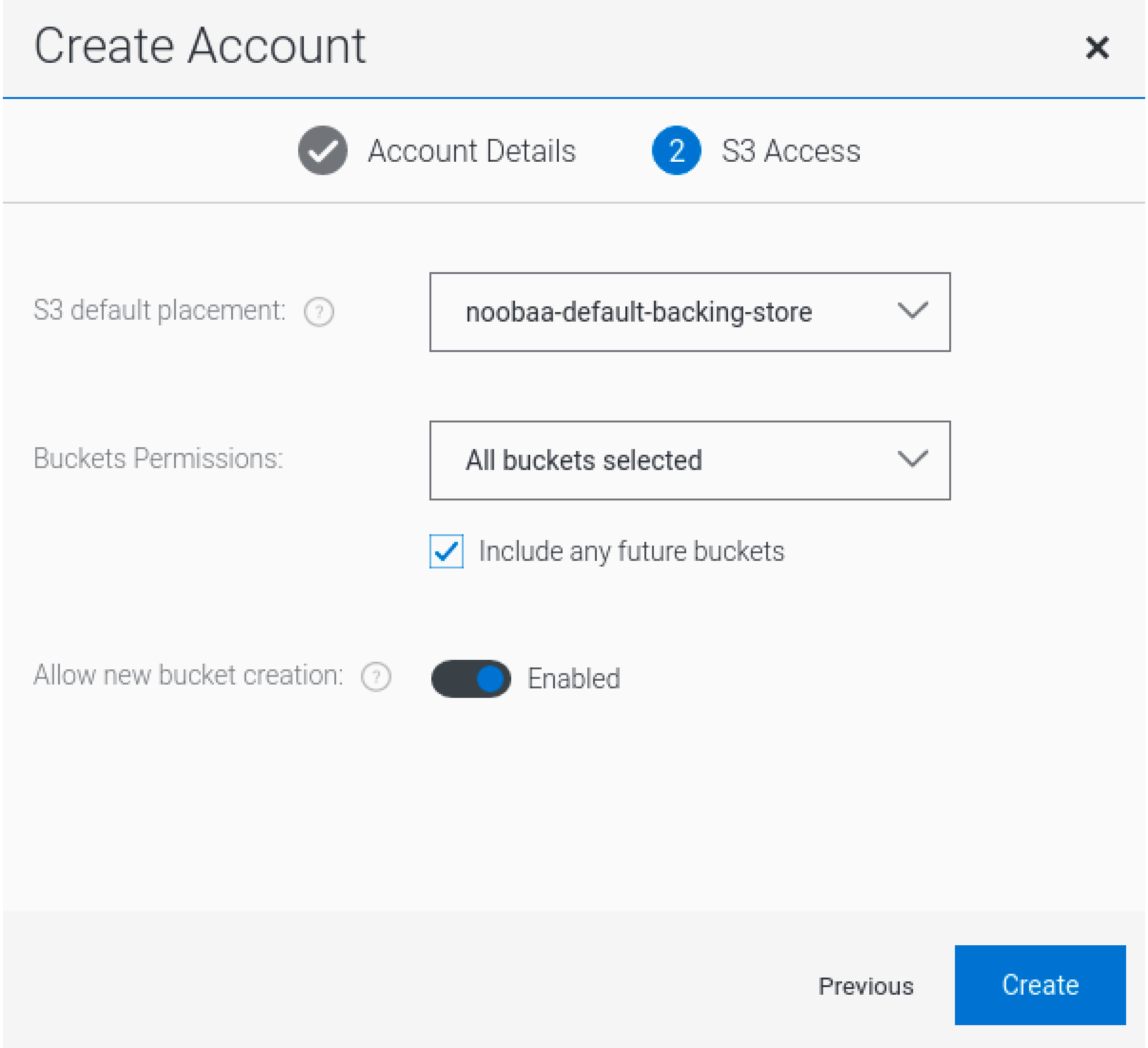
● S3 Access Only

Granting S3 access will allow this account to connect S3 client applications by generating security credentials (key set).

Account Name: john.doe@example.com

3 - 32 characters

4. Select **S3 default placement**, for example, noobaa-default-backing-store. Select **Buckets Permissions**. A specific bucket or all buckets can be selected. Click **Create**:



Create Account

✓ Account Details  2 S3 Access

S3 default placement: noobaa-default-backing-store

Buckets Permissions: All buckets selected

☑ Include any future buckets

Allow new bucket creation: Enabled

## 7.6. OBJECT BUCKET CLAIM

An Object Bucket Claim can be used to request an S3 compatible bucket backend for your workloads.

You can create an Object Bucket Claim three ways:

- Section 7.6.1, “Dynamic Object Bucket Claim”
- Section 7.6.2, “Creating an Object Bucket Claim using the command line interface”
- Section 7.6.3, “Creating an Object Bucket Claim using the OpenShift Web Console”

An object bucket claim creates a new bucket and an application account in NooBaa with permissions to the bucket, including a new access key and secret access key. The application account is allowed to access only a single bucket and can’t create new buckets by default.

### 7.6.1. Dynamic Object Bucket Claim

Similar to persistent volumes, you can add the details of the Object Bucket claim to your application’s YAML, and get the object service endpoint, access key, and secret access key available in a configuration map and secret. It is easy to read this information dynamically into environment variables of your application.

### Procedure

1. Add the following lines to your application YAML:

```
apiVersion: objectbucket.io/v1alpha1
kind: ObjectBucketClaim
metadata:
  name: <obc-name>
spec:
  generateBucketName: <obc-bucket-name>
  storageClassName: noobaa
```

   These lines are the Object Bucket Claim itself.

   a. Replace **<obc-name>** with the a unique Object Bucket Claim name.

   b. Replace **<obc-bucket-name>** with a unique bucket name for your Object Bucket Claim.

2. You can add more lines to the YAML file to automate the use of the Object Bucket Claim. The example below is the mapping between the bucket claim result, which is a configuration map with data and a secret with the credentials. This specific job will claim the Object Bucket from NooBaa, which will create a bucket and an account.

```
apiVersion: batch/v1
kind: Job
metadata:
  name: testjob
spec:
  template:
    spec:
      restartPolicy: OnFailure
      containers:
        - image: <your application image>
          name: test
          env:
            - name: BUCKET_NAME
              valueFrom:
                configMapKeyRef:
                  name: <obc-name>
                  key: BUCKET_NAME
            - name: BUCKET_HOST
              valueFrom:
                configMapKeyRef:
                  name: <obc-name>
                  key: BUCKET_HOST
            - name: BUCKET_PORT
              valueFrom:
                configMapKeyRef:
                  name: <obc-name>
                  key: BUCKET_PORT
            - name: AWS_ACCESS_KEY_ID
              valueFrom:
                secretKeyRef:
                  name: <obc-name>
                  key: AWS_ACCESS_KEY_ID
            - name: AWS_SECRET_ACCESS_KEY
```

```
              valueFrom:
                secretKeyRef:
                  name: <obc-name>
                  key: AWS_SECRET_ACCESS_KEY
```

a. Replace all instances of <obc-name> with your Object Bucket Claim name.

b. Replace <your application image> with your application image.

3. Apply the updated YAML file:

```
# oc apply -f <yaml.file>
```

a. Replace **<yaml.file>** with the name of your YAML file.

4. To view the new configuration map, run the following:

```
# oc get cm <obc-name>
```

a. Replace **obc-name** with the name of your Object Bucket Claim.
You can expect the following environment variables in the output:

- **BUCKET_HOST** - Endpoint to use in the application
- **BUCKET_PORT** - The port available for the application
    - The port is related to the **BUCKET_HOST**. For example, if the **BUCKET_HOST** is https://my.example.com, and the **BUCKET_PORT** is 443, the endpoint for the object service would be https://my.example.com:443.
- **BUCKET_NAME** - Requested or generated bucket name
- **AWS_ACCESS_KEY_ID** - Access key that is part of the credentials
- **AWS_SECRET_ACCESS_KEY** - Secret access key that is part of the credentials

### 7.6.2. Creating an Object Bucket Claim using the command line interface

When creating an Object Bucket Claim using the command-line interface, you get a configuration map and a Secret that together contain all the information your application needs to use the object storage service.

#### Prerequisites

- Download the MCG command-line interface:

```
# subscription-manager repos --enable=rh-ocs-4-for-rhel-8-x86_64-rpms
# yum install mcg
```

#### Procedure

1. Use the command-line interface to generate the details of a new bucket and credentials. Run the following command:

```
# noobaa obc create <obc-name> -n openshift-storage
```

–

Replace **<obc-name>** with a unique Object Bucket Claim name, for example, **myappobc**.

Additionally, you can use the **--app-namespace** option to specify the namespace where the Object Bucket Claim configuration map and secret will be created, for example, **myapp-namespace**.

Example output:

```
INFO[0001]   Created: ObjectBucketClaim "test21obc"
```

The MCG command-line-interface has created the necessary configuration and has informed OpenShift about the new OBC.

2. Run the following command to view the Object Bucket Claim:

```
# oc get obc -n openshift-storage
```

Example output:

```
NAME        STORAGE-CLASS                 PHASE   AGE
test21obc   openshift-storage.noobaa.io   Bound   38s
```

3. Run the following command to view the YAML file for the new Object Bucket Claim:

```
# oc get obc test21obc -o yaml -n openshift-storage
```

Example output:

```
apiVersion: objectbucket.io/v1alpha1
kind: ObjectBucketClaim
metadata:
  creationTimestamp: "2019-10-24T13:30:07Z"
  finalizers:
  - objectbucket.io/finalizer
  generation: 2
  labels:
    app: noobaa
    bucket-provisioner: openshift-storage.noobaa.io-obc
    noobaa-domain: openshift-storage.noobaa.io
  name: test21obc
  namespace: openshift-storage
  resourceVersion: "40756"
  selfLink: /apis/objectbucket.io/v1alpha1/namespaces/openshift-storage/objectbucketclaims/test21obc
  uid: 64f04cba-f662-11e9-bc3c-0295250841af
spec:
  ObjectBucketName: obc-openshift-storage-test21obc
  bucketName: test21obc-933348a6-e267-4f82-82f1-e59bf4fe3bb4
  generateBucketName: test21obc
  storageClassName: openshift-storage.noobaa.io
status:
  phase: Bound
```

4. Inside of your **openshift-storage** namespace, you can find the configuration map and the secret to use this Object Bucket Claim. The CM and the secret have the same name as the Object Bucket Claim. To view the secret:

   ```
   # oc get -n openshift-storage secret test21obc -o yaml
   ```

   Example output:

   ```
   Example output:
   apiVersion: v1
   data:
     AWS_ACCESS_KEY_ID: c0M0R2xVanF3ODR3bHBkVW94cmY=
     AWS_SECRET_ACCESS_KEY:
   Wi9kcFluSWxHRzlWaFlzNk1hc0xma2JXcjM1MVhqa051SlBleXpmOQ==
   kind: Secret
   metadata:
     creationTimestamp: "2019-10-24T13:30:07Z"
     finalizers:
     - objectbucket.io/finalizer
     labels:
       app: noobaa
       bucket-provisioner: openshift-storage.noobaa.io-obc
       noobaa-domain: openshift-storage.noobaa.io
     name: test21obc
     namespace: openshift-storage
     ownerReferences:
     - apiVersion: objectbucket.io/v1alpha1
       blockOwnerDeletion: true
       controller: true
       kind: ObjectBucketClaim
       name: test21obc
       uid: 64f04cba-f662-11e9-bc3c-0295250841af
     resourceVersion: "40751"
     selfLink: /api/v1/namespaces/openshift-storage/secrets/test21obc
     uid: 65117c1c-f662-11e9-9094-0a5305de57bb
   type: Opaque
   ```

   The secret gives you the S3 access credentials.

5. To view the configuration map:

   ```
   # oc get -n openshift-storage cm test21obc -o yaml
   ```

   Example output:

   ```
   apiVersion: v1
   data:
     BUCKET_HOST: 10.0.171.35
     BUCKET_NAME: test21obc-933348a6-e267-4f82-82f1-e59bf4fe3bb4
     BUCKET_PORT: "31242"
     BUCKET_REGION: ""
     BUCKET_SUBREGION: ""
   kind: ConfigMap
   metadata:
     creationTimestamp: "2019-10-24T13:30:07Z"
   ```

```
finalizers:
- objectbucket.io/finalizer
labels:
  app: noobaa
  bucket-provisioner: openshift-storage.noobaa.io-obc
  noobaa-domain: openshift-storage.noobaa.io
name: test21obc
namespace: openshift-storage
ownerReferences:
- apiVersion: objectbucket.io/v1alpha1
  blockOwnerDeletion: true
  controller: true
  kind: ObjectBucketClaim
  name: test21obc
  uid: 64f04cba-f662-11e9-bc3c-0295250841af
resourceVersion: "40752"
selfLink: /api/v1/namespaces/openshift-storage/configmaps/test21obc
uid: 651c6501-f662-11e9-9094-0a5305de57bb
```

The configuration map contains the S3 endpoint information for your application.

### 7.6.3. Creating an Object Bucket Claim using the OpenShift Web Console

You can create an Object Bucket Claim (OBC) using the OpenShift Web Console.

#### Prerequisites

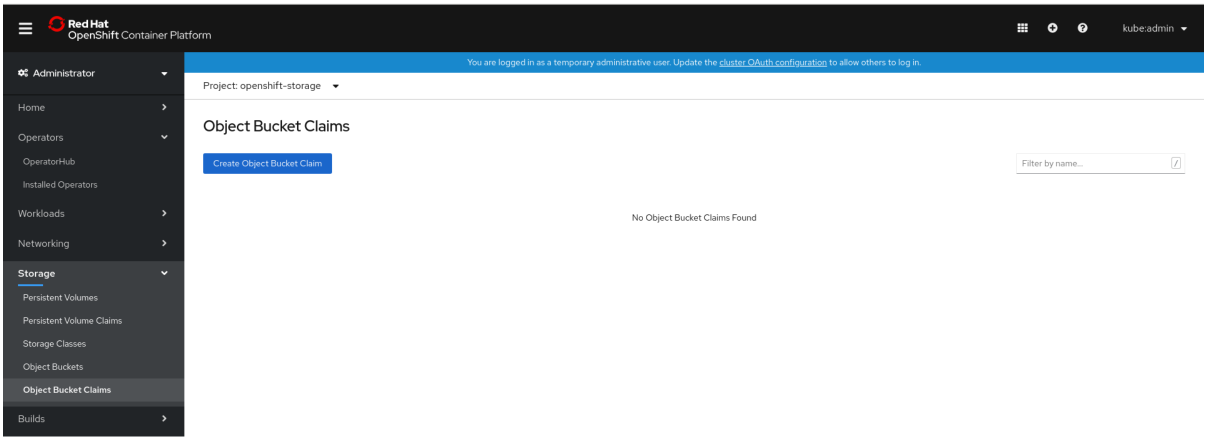
- Administrative access to the OpenShift Web Console.

#### Procedure

1. Log into the OpenShift Web Console.

2. On the left navigation bar, click **Storage → Object Bucket Claims**.

3. In the following window, click **Create Object Bucket Claim**:



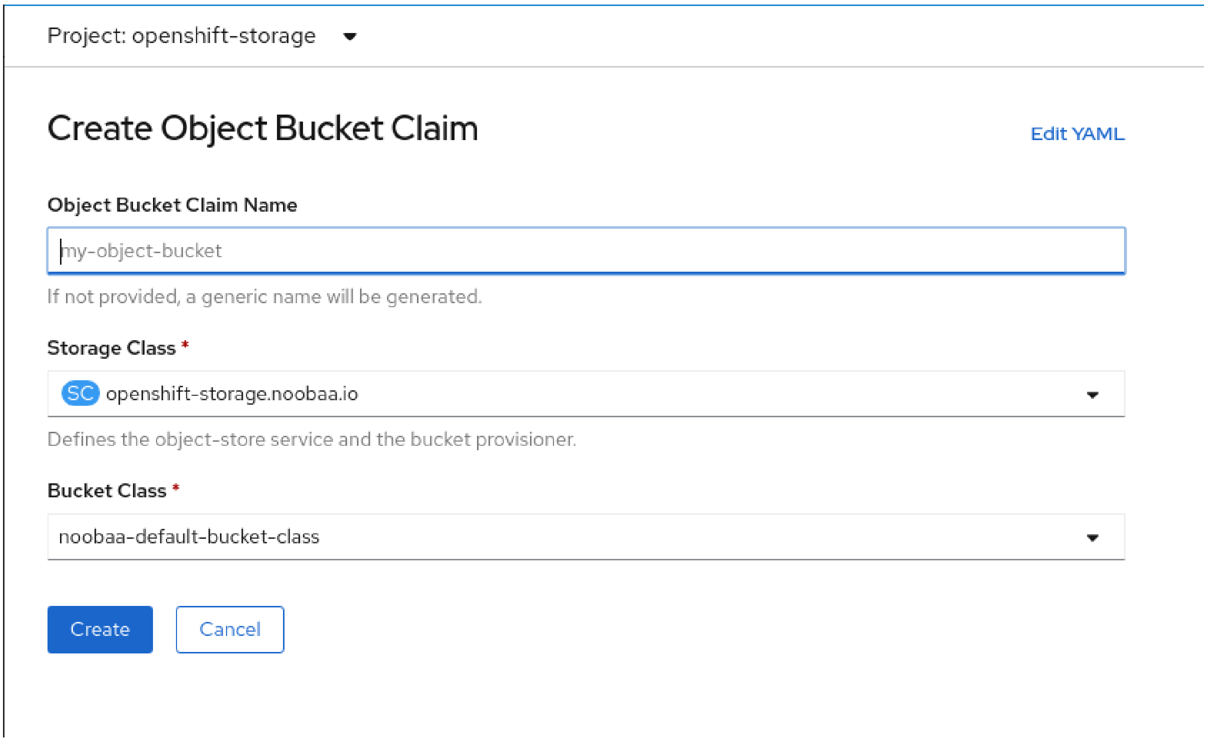
You are logged in as a temporary administrative user. Update the cluster OAuth configuration to allow others to log in.

Project: openshift-storage

Object Bucket Claims

No Object Bucket Claims Found

4. In the following window, enter a name for your object bucket claim, and select the appropriate storage class and bucket class from the dropdown menus:



Create Object Bucket Claim

Object Bucket Claim Name

my-object-bucket

If not provided, a generic name will be generated.

Storage Class *

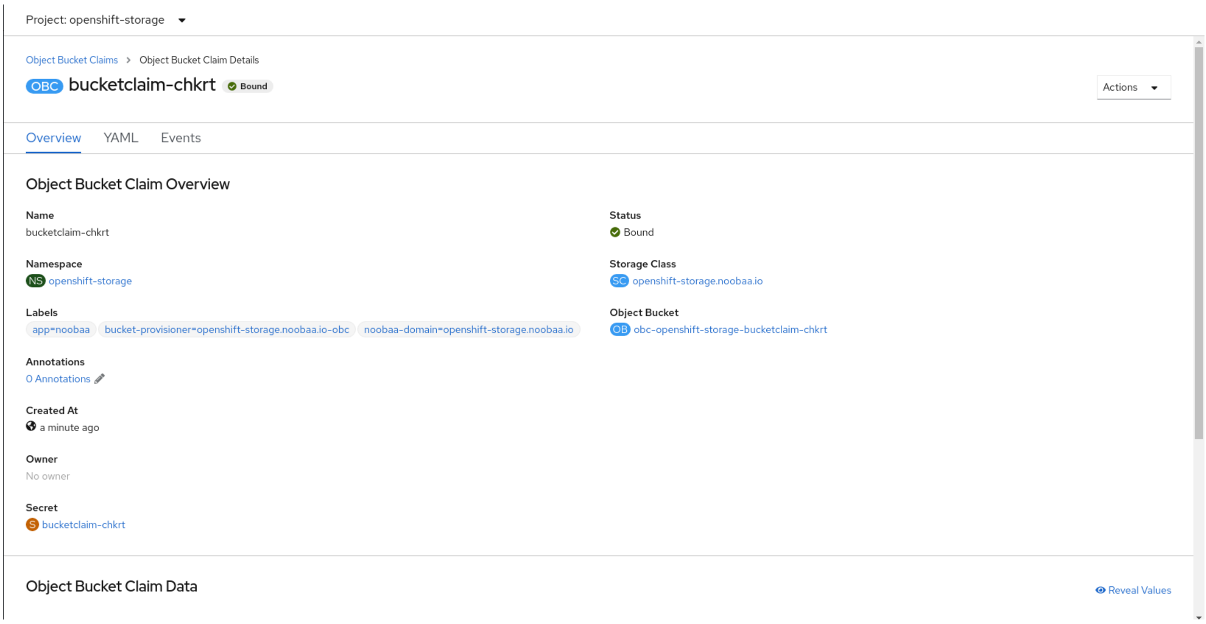
SC openshift-storage.noobaa.io

Defines the object-store service and the bucket provisioner.

Bucket Class *

noobaa-default-bucket-class

5. Click **Create**.
   Once the OBC is created, you will be redirected to its detail page:


Project: openshift-storage
Object Bucket Claims > Object Bucket Claim Details
Actions
Overview
YAML
Events
Reveal Values

OBC bucketclaim-chkrt Bound

Object Bucket Claim Overview

Name
bucketclaim-chkrt

Status
Bound

Namespace
NS openshift-storage

Storage Class
SC openshift-storage.noobaa.io

Labels
app=noobaa bucket-provisioner=openshift-storage.noobaa.io-obc noobaa-domain=openshift-storage.noobaa.io

Object Bucket
OB obc-openshift-storage-bucketclaim-chkrt

Annotations
0 Annotations

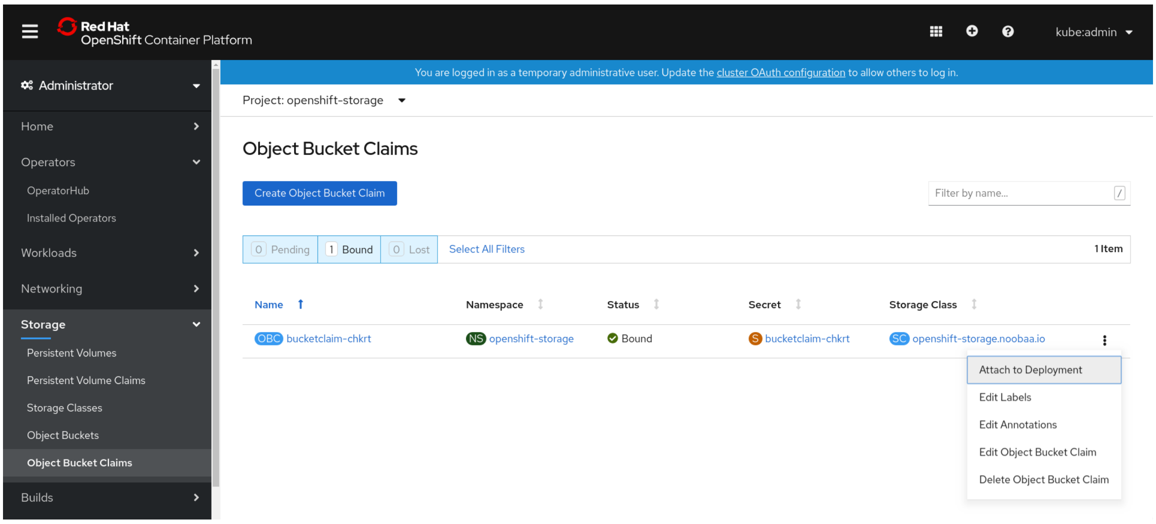
Created At
a minute ago

Owner
No owner

Secret
S bucketclaim-chkrt

Object Bucket Claim Data

6. Once you’ve created the OBC, you can attach it to a deployment.
   a. On the left navigation bar, click **Storage → Object Bucket Claims**.
   b. Click the action menu ( ⋮ ) next to the OBC you created.
   c. From the drop down menu, select **Attach to Deployment**.



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

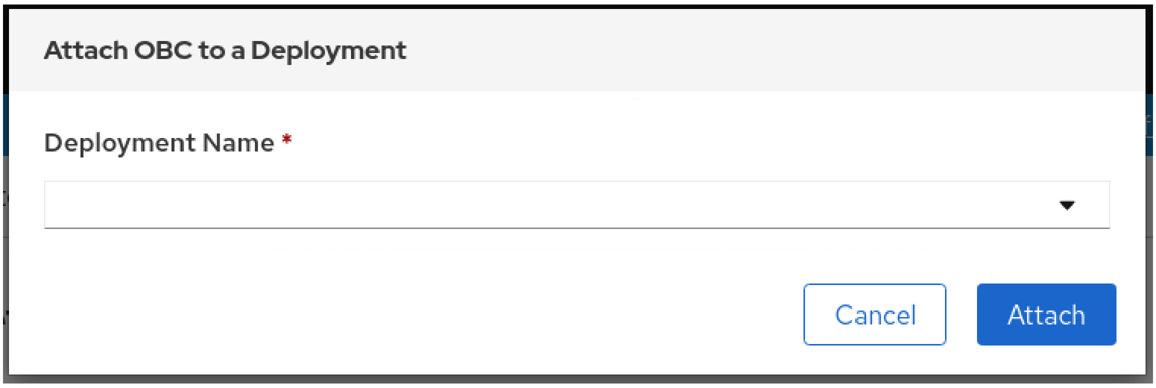
Project: openshift-storage

Object Bucket Claims

0 Pending | 1 Bound | 0 Lost | 1 Item

| Name | Namespace | Status | Secret | Storage Class |
|---|---|---|---|---|
| OBC bucketclaim-chkrt | NS openshift-storage | ✓ Bound | S bucketclaim-chkrt | SC openshift-storage.noobaa.io |

d. In the following window, select the desired deployment from the drop down menu, then click **Attach**:

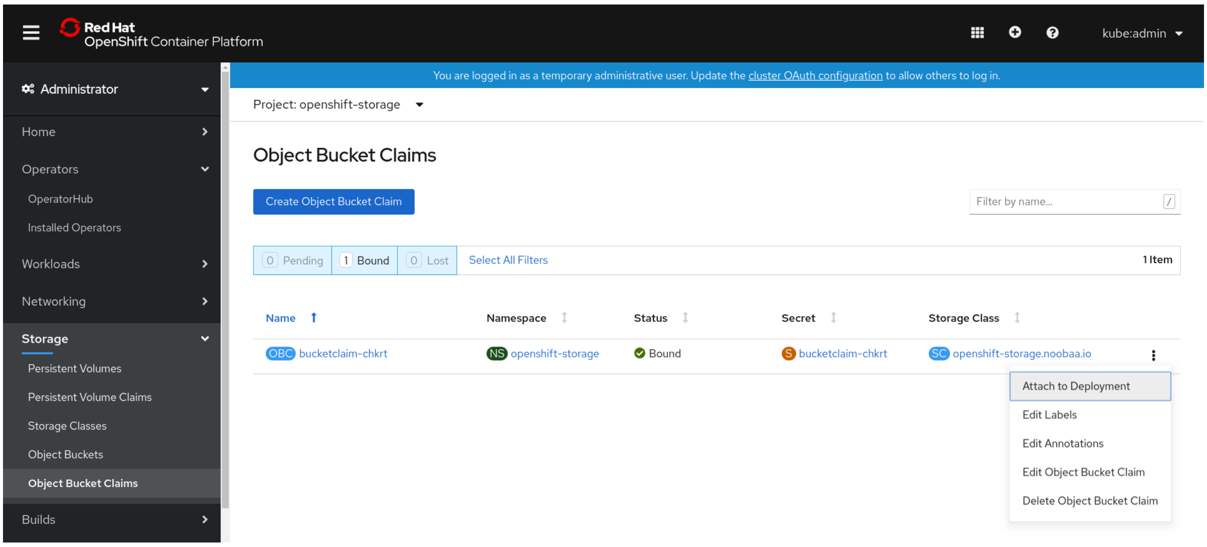


## NOTE

In order for your applications to communicate with the OBC, you need to use the configmap and secret. For more information about this, see Section 7.6.1, “Dynamic Object Bucket Claim”.

### 7.6.3.1. Delete an Object Bucket Claim

1. On the **Object Bucket Claims** page, click on the action menu ( ⋮ ) next to the OBC that you want to delete.



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

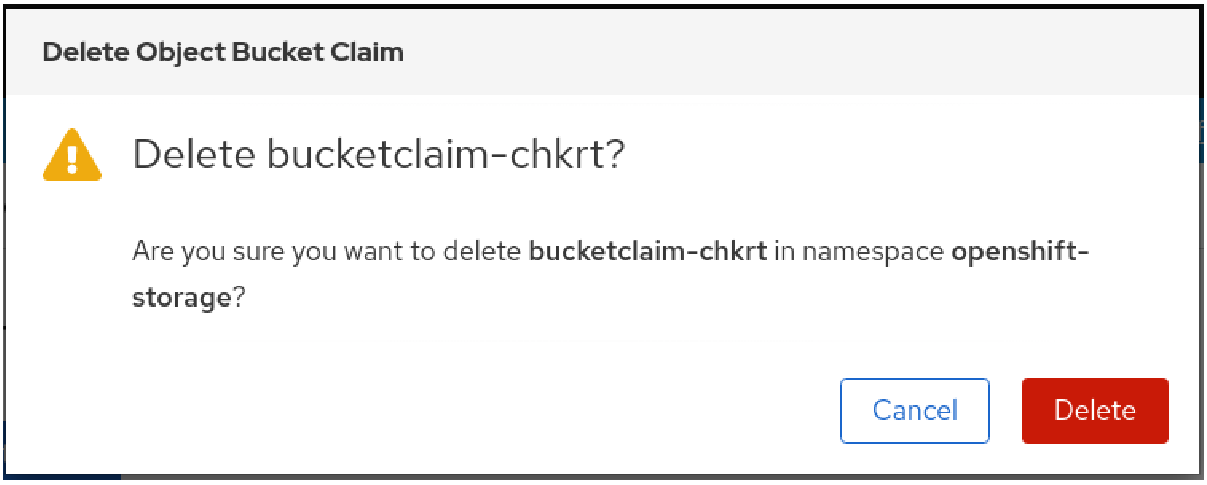
Project: openshift-storage

Object Bucket Claims

0 Pending | 1 Bound | 0 Lost | 1 Item

| Name | Namespace | Status | Secret | Storage Class |
|---|---|---|---|---|
| OBC bucketclaim-chkrt | NS openshift-storage | ✓ Bound | S bucketclaim-chkrt | SC openshift-storage.noobaa.io |

2. Select **Delete Object Bucket Claim** from menu.



**Delete Object Bucket Claim**

Delete bucketclaim-chkrt?

Are you sure you want to delete **bucketclaim-chkrt** in namespace **openshift-storage**?

3. Click **Delete**.

### 7.6.3.2. Viewing object buckets using the Multicloud Object Gateway user interface

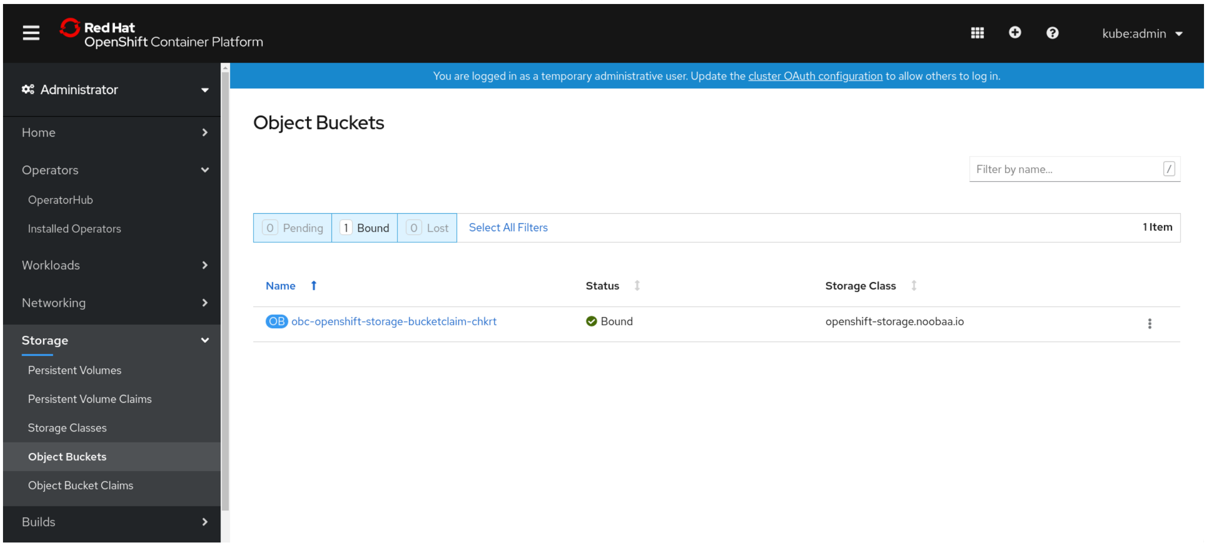
You can view the details of object buckets created for Object Bucket Claims (OBCs).

## Procedure

To view the object bucket details:

1. Log into the OpenShift Web Console.

2. On the left navigation bar, click **Storage → Object Buckets**:



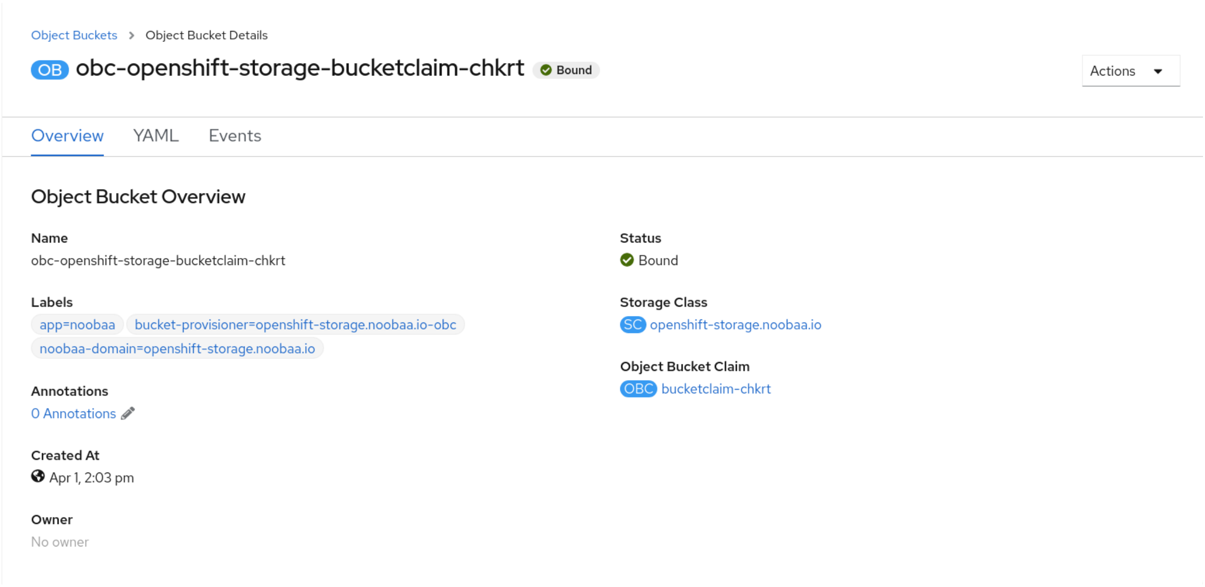
You are logged in as a temporary administrative user. Update the cluster OAuth configuration to allow others to log in.

Object Buckets

| Name | Status | Storage Class |
|---|---|---|
| OB obc-openshift-storage-bucketclaim-chkrt | Bound | openshift-storage.noobaa.io |

You can also navigate to the details page of a specific OBC and click the **Resource** link to view the object buckets for that OBC.

3. Select the object bucket you want to see details for. You will be navigated to the object bucket's details page:



Object Buckets > Object Bucket Details

OB obc-openshift-storage-bucketclaim-chkrt ✓ Bound

Object Bucket Overview

Name
obc-openshift-storage-bucketclaim-chkrt

Labels
app=noobaa bucket-provisioner=openshift-storage.noobaa.io-obc noobaa-domain=openshift-storage.noobaa.io

Annotations
0 Annotations

Created At
Apr 1, 2:03 pm

Owner
No owner

Status
✓ Bound

Storage Class
SC openshift-storage.noobaa.io

Object Bucket Claim
OBC bucketclaim-chkrt

## 7.7. SCALING MULTICLOUD OBJECT GATEWAY PERFORMANCE BY ADDING ENDPOINTS

The Multicloud Object Gateway performance may vary from one environment to another. In some cases, specific applications require faster performance which can be easily addressed by scaling S3 endpoints.

The Multicloud Object Gateway resource pool is a group of NooBaa daemon containers that provide two types of services enabled by default:

- Storage service
- S3 endpoint service

IMPORTANT

Scaling Multicloud Object Gateway performance by adding endpoints is a Technology Preview feature. Technology Preview features are not supported with Red Hat production service level agreements (SLAs) and might not be functionally complete. Red Hat does not recommend using them in production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process.

For more information, see Technology Preview Features Support Scope .

### 7.7.1. S3 endpoints in the Multicloud Object Gateway

The S3 endpoint is a service that every Multicloud Object Gateway provides by default that handles the heavy lifting data digestion in the Multicloud Object Gateway. The endpoint service handles the data chunking, deduplication, compression, and encryption, and it accepts data placement instructions from the Multicloud Object Gateway.

### 7.7.2. Scaling with storage nodes

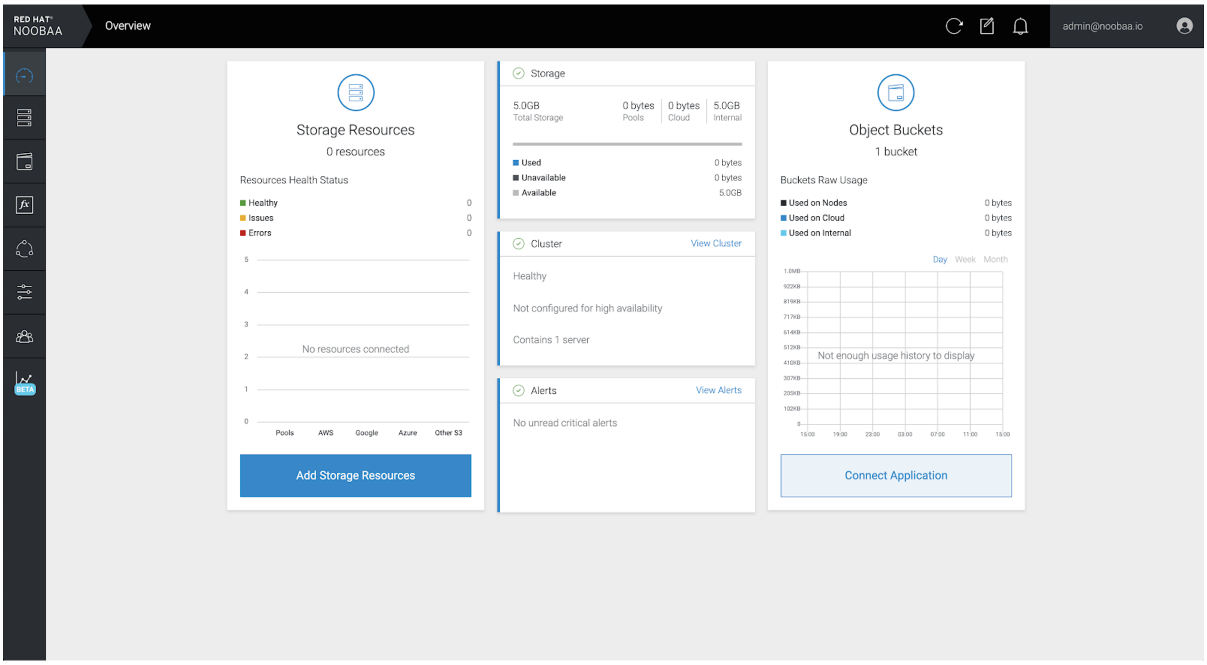
#### Prerequisites

- A running OpenShift Container Storage cluster on OpenShift Container Platform with access to the Multicloud Object Gateway.

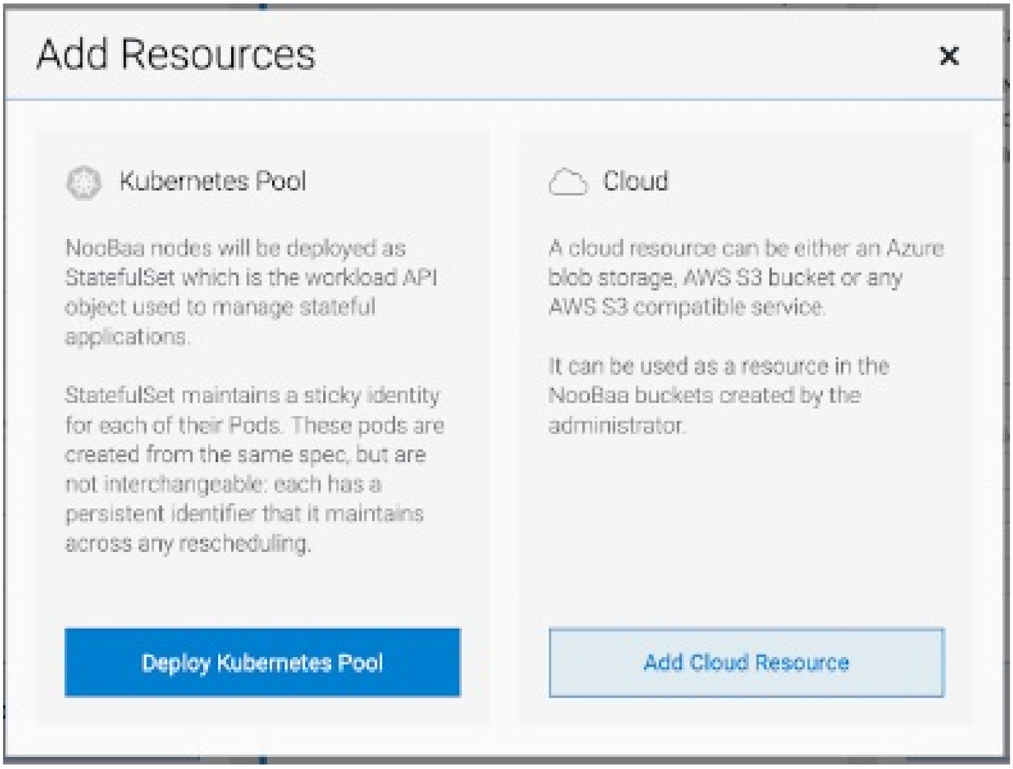
A storage node in the Multicloud Object Gateway is a NooBaa daemon container attached to one or more persistent volumes and used for local object service data storage. NooBaa daemons can be deployed on Kubernetes nodes. This can be done by creating a Kubernetes pool consisting of StatefulSet pods.

## Procedure

1. In the Mult-Cloud Object Gateway user interface, from the **Overview** page, click **Add Storage Resources**:



2. In the window, click **Deploy Kubernetes Pool**



Add Resources

Kubernetes Pool

NooBaa nodes will be deployed as StatefulSet which is the workload API object used to manage stateful applications.

StatefulSet maintains a sticky identity for each of their Pods. These pods are created from the same spec, but are not interchangeable: each has a persistent identifier that it maintains across any rescheduling.

Deploy Kubernetes Pool

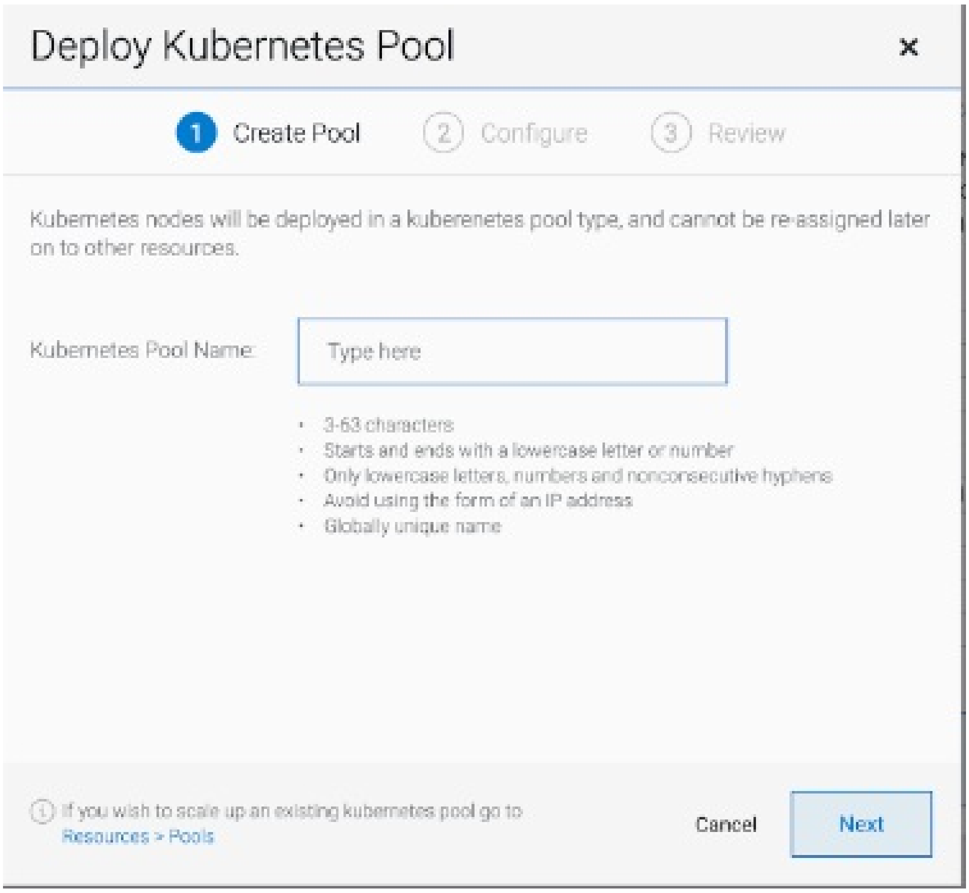
Cloud

A cloud resource can be either an Azure blob storage, AWS S3 bucket or any AWS S3 compatible service.

It can be used as a resource in the NooBaa buckets created by the administrator.

Add Cloud Resource

3. In the **Create Pool** step create the target pool for the future installed nodes.



Deploy Kubernetes Pool

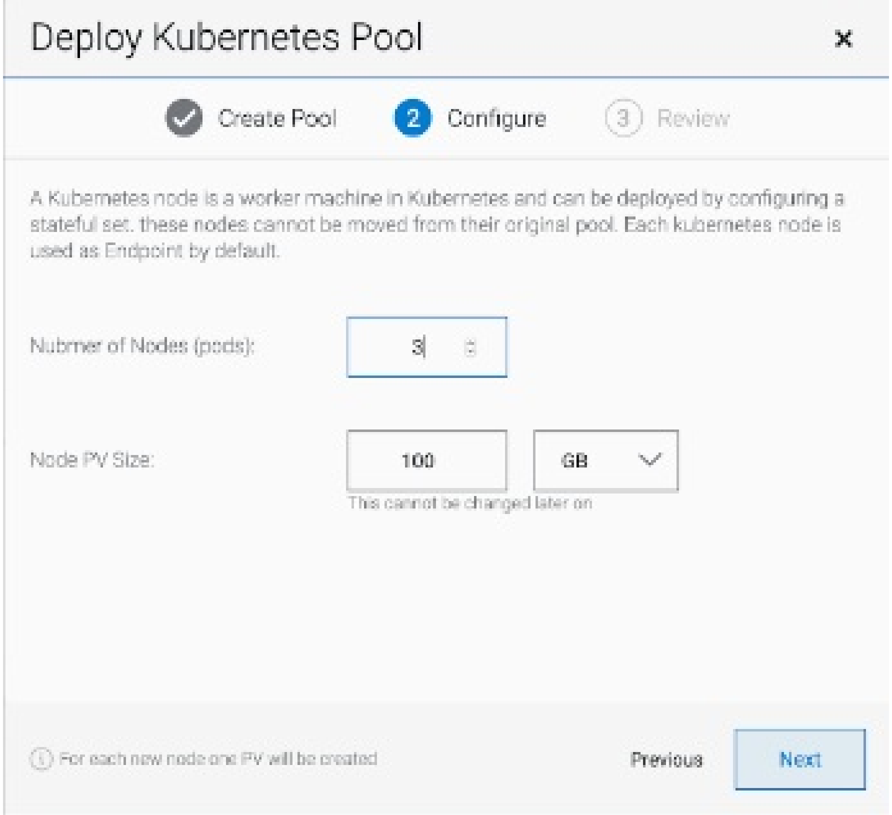
Kubernetes nodes will be deployed in a kuberenetes pool type, and cannot be re-assigned later on to other resources.

Kubernetes Pool Name: Type here

- 3-63 characters
- Starts and ends with a lowercase letter or number
- Only lowercase letters, numbers and nonconsecutive hyphens
- Avoid using the form of an IP address
- Globally unique name

If you wish to scale up an existing kubernetes pool go to Resources > Pools

4. In the **Configure** step, configure the number of requested pods and the size of each PV. For each new pod, one PV is be created.



Deploy Kubernetes Pool

A Kubernetes node is a worker machine in Kubernetes and can be deployed by configuring a stateful set. these nodes cannot be moved from their original pool. Each kubernetes node is used as Endpoint by default.

Nubmer of Nodes (pods): 3

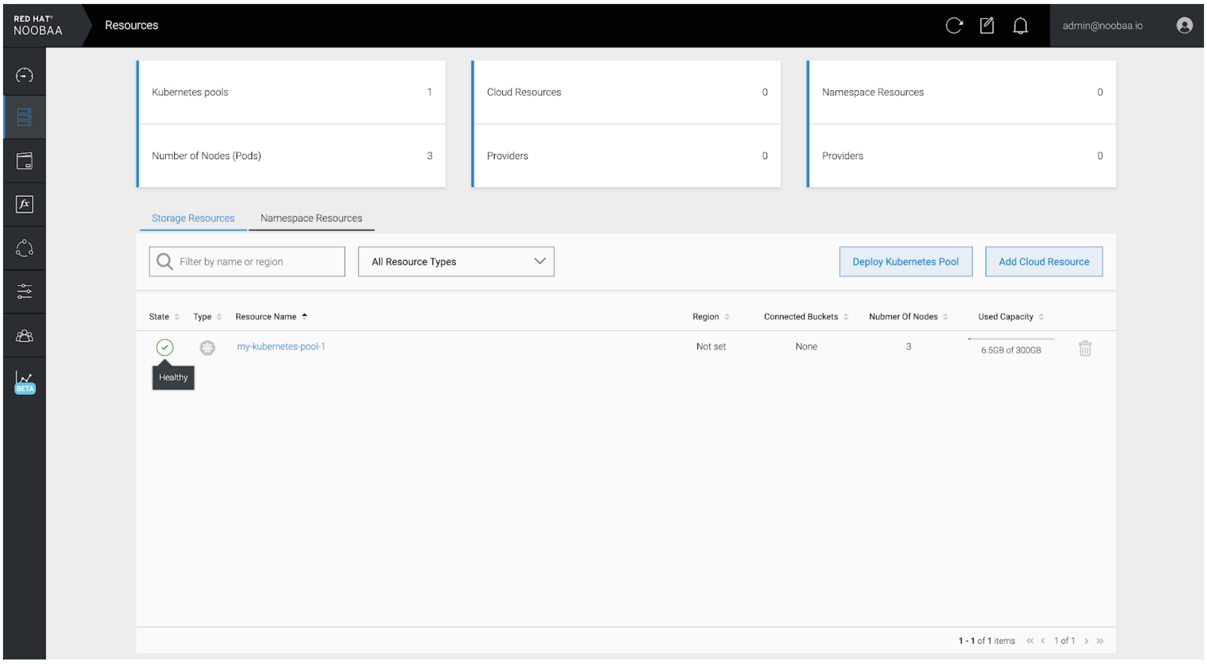
Node PV Size: 100 GB

This cannot be changed later on

For each new node one PV will be created

5. In the **Review** step, you can find the details of the new pool and select the deployment method you wish to use: local or external deployment. If local deployment is selected, the Kubernetes nodes will deploy within the cluster. If external deployment is selected, you will be provided with a YAML file to run externally.

6. All nodes will be assigned to the pool you chose in the first step, and can be found under **Resources → Storage resources→ Resource name**:



| | |
|---|---|
| Kubernetes pools | 1 |
| Number of Nodes (Pods) | 3 |
| Cloud Resources | 0 |
| Providers | 0 |
| Namespace Resources | 0 |
| Providers | 0 |

| State | Type | Resource Name | Region | Connected Buckets | Nubmer Of Nodes | Used Capacity |
|---|---|---|---|---|---|---|
| ✓ | | my-kubernetes-pool-1 | Not set | None | 3 | 6.5GB of 300GB |

# CHAPTER 8. ACCESSING THE RADOS OBJECT GATEWAY S3 ENDPOINT

Users can access the RADOS Object Gateway (RGW) endpoint directly.

### Prerequisites

- A running OpenShift Container Storage Platform

### Procedure

1. Run **oc get service** command to get the RGW service name.

```
$ oc get service

NAME                                      TYPE
rook-ceph-rgw-ocs-storagecluster-cephobjectstore   ClusterIP

CLUSTER-IP      EXTERNAL-IP   PORT(S)    AGE
172.30.99.207    <none>        80/TCP     4d15h
```

2. Run **oc expose** command to expose the RGW service.

```
$ oc expose svc/<RGW service name> --hostname=<route name>
```

Replace **<RGW-service name>** with the RGW service name from the previous step.

Replace **<route name>** with a route you want to create for the RGW service.

For example:

```
$ oc expose svc/rook-ceph-rgw-ocs-storagecluster-cephobjectstore --hostname=rook-ceph-rgw-ocs.ocp.host.example.com
```

3. Run **oc get route** command to confirm **oc expose** is successful and there is an RGW route.

```
$ oc get route

NAME                                      HOST/PORT                         PATH
rook-ceph-rgw-ocs-storagecluster-cephobjectstore   rook-ceph-rgw-
ocsocp.host.example.com

SERVICES                                  PORT        TERMINATION   WILDCARD
rook-ceph-rgw-ocs-storagecluster-cephobjectstore   http         <none>
```

### Verify

- To verify the **ENDPOINT**, run the following command:

```
aws s3 --no-verify-ssl --endpoint <ENDPOINT> ls
```

Replace **<ENDPOINT>** with the route that you get from the command in the above step 3.

For example:

```
$ aws s3 --no-verify-ssl --endpoint http://rook-ceph-rgw-ocs.ocp.host.example.com ls
```

NOTE

To get the access key and secret of the default user **ocs-storagecluster-cephobjectstoreuser**, run the following commands:

- Access key:

  ```
  $ oc get secret rook-ceph-object-user-ocs-storagecluster-cephobjectstore-ocs-
  storagecluster-cephobjectstoreuser  -o yaml | grep -w "AccessKey:" | head -n1
  | awk '{print $2}' | base64 --decode
  ```

- Secret key:

  ```
  $ oc get secret rook-ceph-object-user-ocs-storagecluster-cephobjectstore-ocs-
  storagecluster-cephobjectstoreuser  -o yaml | grep -w "SecretKey:" | head -n1
  | awk '{print $2}' | base64 --decode
  ```

# CHAPTER 9. REPLACING STORAGE NODES

Depending on the type of your deployment, you can choose one of the following procedures to replace storage nodes:

- For dynamically provisioned storage nodes deployed on AWS, see:
  - Section 9.1.1, “Replacing operational nodes on AWS user-provisioned infrastructures”
  - Section 9.1.2, “Replacing failed nodes on AWS user-provisioned infrastructures”
  - Section 9.1.3, “Replacing operational nodes on AWS installer-provisioned infrastructures”
  - Section 9.1.4, “Replacing failed nodes on AWS installer-provisioned infrastructures”
- For dynamically created storage nodes deployed on VMware, see:
  - Section 9.2.1, “Replacing operational nodes on VMware user-provisioned infrastructures”
  - Section 9.2.2, “Replacing failed nodes on VMware user-provisioned infrastructures”
- For storage nodes deployed using local storage devices, see:
  - Section 9.3.1, “Replacing failed storage nodes on Amazon EC2 infrastructure”
  - Section 9.3.2, “Replacing failed storage nodes on VMware infrastructure”
  - Section 9.3.3, “Replacing failed storage nodes on bare metal infrastructure”

## 9.1. DYNAMICALLY PROVISIONED OPENSHIFT CONTAINER STORAGE DEPLOYED ON AWS INFRASTRUCTURES

### 9.1.1. Replacing operational nodes on AWS user-provisioned infrastructures

Perform this procedure to replace an operational node on AWS user-provisioned infrastructure.

**Procedure**

1. Identify the node that needs to be replaced.
2. Mark the node as unschedulable using the following command:

```
$ oc adm cordon <node_name>
```

3. Drain the node using the following command:

```
$ oc adm drain <node_name> --force --delete-local-data --ignore-daemonsets
```

**IMPORTANT**

This activity may take at least 5-10 minutes or more. Ceph errors generated during this period are temporary and are automatically resolved when the new node is labeled and functional.

4. Delete the node using the following command:

   ```
   $ oc delete nodes <node_name>
   ```

5. Create a new AWS machine instance with the required infrastructure. See Supported Infrastructure and Platforms.

6. Create a new OpenShift Container Platform node using the new AWS machine instance.

7. Check for certificate signing requests (CSRs) related to OpenShift Container Platform that are in **Pending** state:

   ```
   $ oc get csr
   ```

8. Approve all required OpenShift Container Platform CSRs for the new node:

   ```
   $ oc adm certificate approve <Certificate_Name>
   ```

9. Click **Compute → Nodes**, confirm if the new node is in **Ready** state.

10. Apply the OpenShift Container Storage label to the new node using any one of the following:

    **From User interface**

    a. For the new node, click **Action Menu ( ⋮ ) → Edit Labels**

    b. Add **cluster.ocs.openshift.io/openshift-storage** and click **Save**.

    **From Command line interface**

    - Execute the following command to apply the OpenShift Container Storage label to the new node:

      ```
      $ oc label node <new_node_name> cluster.ocs.openshift.io/openshift-storage=""
      ```

**Verification steps**

1. Execute the following command and verify that the new node is present in the output:

   ```
   $ oc get nodes --show-labels | grep cluster.ocs.openshift.io/openshift-storage= |cut -d' ' -f1
   ```

2. Click **Workloads → Pods**, confirm that at least the following pods on the new node are in **Running** state:

   - **csi-cephfsplugin-***
   - **csi-rbdplugin-***

3. Verify that all other required OpenShift Container Storage pods are in **Running** state.

4. If verification steps fail, kindly contact Red Hat Support .

### 9.1.2. Replacing failed nodes on AWS user-provisioned infrastructures

Perform this procedure to replace a failed node which is not operational on AWS user-provisioned infrastructure (UPI) for OpenShift Container Storage.

### Procedure

1. Identify the AWS machine instance of the node that needs to be replaced.

2. Log in to AWS and terminate the identified AWS machine instance.

3. Create a new AWS machine instance with the required infrastructure. See Supported Infrastructure and Platforms.

4. Create a new OpenShift Container Platform node using the new AWS machine instance.

5. Check for certificate signing requests (CSRs) related to OpenShift Container Platform that are in **Pending** state:

   ```
   $ oc get csr
   ```

6. Approve all required OpenShift Container Platform CSRs for the new node:

   ```
   $ oc adm certificate approve <Certificate_Name>
   ```

7. Click **Compute → Nodes**, confirm if the new node is in **Ready** state.

8. Apply the OpenShift Container Storage label to the new node using any one of the following:

   **From User interface**

   a. For the new node, click **Action Menu ( ⋮ ) → Edit Labels**

   b. Add **cluster.ocs.openshift.io/openshift-storage** and click **Save**.

   **From Command line interface**

   - Execute the following command to apply the OpenShift Container Storage label to the new node:

     ```
     $ oc label node <new_node_name> cluster.ocs.openshift.io/openshift-storage=""
     ```

### Verification steps

1. Execute the following command and verify that the new node is present in the output:

   ```
   $ oc get nodes --show-labels | grep cluster.ocs.openshift.io/openshift-storage= |cut -d' ' -f1
   ```

2. Click **Workloads → Pods**, confirm that at least the following pods on the new node are in **Running** state:

   - **csi-cephfsplugin-***
   - **csi-rbdplugin-***

3. Verify that all other required OpenShift Container Storage pods are in **Running** state.

4. If verification steps fail, contact Red Hat Support .

### 9.1.3. Replacing operational nodes on AWS installer-provisioned infrastructures

Use this procedure to replace an operational node on AWS installer-provisioned infrastructure (IPI).

**Procedure**

1. Log in to OpenShift Web Console and click **Compute → Nodes**.
2. Identify the node that needs to be replaced. Take a note of its **Machine Name**.
3. Mark the node as unschedulable using the following command:

   ```
   $ oc adm cordon <node_name>
   ```

4. Drain the node using the following command:

   ```
   $ oc adm drain <node_name> --force --delete-local-data --ignore-daemonsets
   ```

   **IMPORTANT**

   This activity may take at least 5-10 minutes or more. Ceph errors generated during this period are temporary and are automatically resolved when the new node is labeled and functional.

5. Click **Compute → Machines**. Search for the required machine.
6. Besides the required machine, click the **Action menu ( ⋮ ) → Delete Machine**.
7. Click **Delete** to confirm the machine deletion. A new machine is automatically created.
8. Wait for new machine to start and transition into **Running** state.

   **IMPORTANT**

   This activity may take at least 5-10 minutes or more.

9. Click **Compute → Nodes**, confirm if the new node is in **Ready** state.
10. Apply the OpenShift Container Storage label to the new node using any one of the following:

    **From User interface**

    a. For the new node, click **Action Menu ( ⋮ ) → Edit Labels**

    b. Add **cluster.ocs.openshift.io/openshift-storage** and click **Save**.

    **From Command line interface**

    - Execute the following command to apply the OpenShift Container Storage label to the new node:

      ```
      $ oc label node <new_node_name> cluster.ocs.openshift.io/openshift-storage=""
      ```

–

### Verification steps

1. Execute the following command and verify that the new node is present in the output:

   ```
   $ oc get nodes --show-labels | grep cluster.ocs.openshift.io/openshift-storage= |cut -d' ' -f1
   ```

2. Click **Workloads → Pods**, confirm that at least the following pods on the new node are in **Running** state:
   - **csi-cephfsplugin-***
   - **csi-rbdplugin-***
3. Verify that all other required OpenShift Container Storage pods are in **Running** state.
4. If verification steps fail, kindly contact Red Hat Support .

## 9.1.4. Replacing failed nodes on AWS installer-provisioned infrastructures

Perform this procedure to replace a failed node which is not operational on AWS installer-provisioned infrastructure (IPI) for OpenShift Container Storage.

### Procedure

1. Log in to OpenShift Web Console and click **Compute → Nodes**.
2. Identify the faulty node and click on its **Machine Name**.
3. Click **Actions → Edit Annotations**, and click **Add More**.
4. Add **machine.openshift.io/exclude-node-draining** and click **Save**.
5. Click **Actions → Delete Machine**, and click **Delete**.
6. A new machine is automatically created, wait for new machine to start.

   **IMPORTANT**

   This activity may take at least 5-10 minutes or more. Ceph errors generated during this period are temporary and are automatically resolved when the new node is labeled and functional.

7. Click **Compute → Nodes**, confirm if the new node is in **Ready** state.
8. Apply the OpenShift Container Storage label to the new node using any one of the following:

   **From User interface**

   a. For the new node, click **Action Menu ( ⋮ ) → Edit Labels**

   b. Add **cluster.ocs.openshift.io/openshift-storage** and click **Save**.

   **From Command line interface**

- Execute the following command to apply the OpenShift Container Storage label to the new node:

  ```
  $ oc label node <new_node_name> cluster.ocs.openshift.io/openshift-storage=""
  ```

9. [Optional]: If the failed AWS instance is not removed automatically, terminate the instance from AWS console.

**Verification steps**

1. Execute the following command and verify that the new node is present in the output:

   ```
   $ oc get nodes --show-labels | grep cluster.ocs.openshift.io/openshift-storage= |cut -d' ' -f1
   ```

2. Click **Workloads → Pods**, confirm that at least the following pods on the new node are in **Running** state:
   - **csi-cephfsplugin-***
   - **csi-rbdplugin-***
3. Verify that all other required OpenShift Container Storage pods are in **Running** state.
4. If verification steps fail, kindly contact Red Hat Support .

## 9.2. DYNAMICALLY PROVISIONED OPENSHIFT CONTAINER STORAGE DEPLOYED ON VMWARE INFRASTRUCTURES

### 9.2.1. Replacing operational nodes on VMware user-provisioned infrastructures

Perform this procedure to replace an operational node on VMware user-provisioned infrastructure (UPI).

**Procedure**

1. Identify the node and its VM that needs to be replaced.
2. Mark the node as unschedulable using the following command:

   ```
   $ oc adm cordon <node_name>
   ```

3. Drain the node using the following command:

   ```
   $ oc adm drain <node_name> --force --delete-local-data --ignore-daemonsets
   ```

   **IMPORTANT**

   This activity may take at least 5-10 minutes or more. Ceph errors generated during this period are temporary and are automatically resolved when the new node is labeled and functional.

4. Delete the node using the following command:

   ```
   $ oc delete nodes <node_name>
   ```

5. Log in to vSphere and terminate the identified VM.

   > **IMPORTANT**
   >
   > VM should be deleted only from the inventory and not from the disk.

6. Create a new VM on vSphere with the required infrastructure. See Supported Infrastructure and Platforms.

7. Create a new OpenShift Container Platform worker node using the new VM.

8. Check for certificate signing requests (CSRs) related to OpenShift Container Platform that are in **Pending** state:

   ```
   $ oc get csr
   ```

9. Approve all required OpenShift Container Platform CSRs for the new node:

   ```
   $ oc adm certificate approve <Certificate_Name>
   ```

10. Click **Compute → Nodes**, confirm if the new node is in **Ready** state.

11. Apply the OpenShift Container Storage label to the new node using any one of the following:

    **From User interface**

    a. For the new node, click **Action Menu ( ⋮ ) → Edit Labels**

    b. Add **cluster.ocs.openshift.io/openshift-storage** and click **Save**.

    **From Command line interface**

    - Execute the following command to apply the OpenShift Container Storage label to the new node:

      ```
      $ oc label node <new_node_name> cluster.ocs.openshift.io/openshift-storage=""
      ```

### Verification steps

1. Execute the following command and verify that the new node is present in the output:

   ```
   $ oc get nodes --show-labels | grep cluster.ocs.openshift.io/openshift-storage= |cut -d' ' -f1
   ```

2. Click **Workloads → Pods**, confirm that at least the following pods on the new node are in **Running** state:

   - **csi-cephfsplugin-***
   - **csi-rbdplugin-***

3. Verify that all other required OpenShift Container Storage pods are in **Running** state.

4. If verification steps fail, kindly contact Red Hat Support .

### 9.2.2. Replacing failed nodes on VMware user-provisioned infrastructures

Perform this procedure to replace a failed node on VMware user-provisioned infrastructure (UPI).

**Procedure**

1. Identify the node and its VM that needs to be replaced.

2. Delete the node using the following command:

   ```
   $ oc delete nodes <node_name>
   ```

3. Log in to vSphere and terminate the identified VM.

   **IMPORTANT**

   VM should be deleted only from the inventory and not from the disk.

4. Create a new VM on vSphere with the required infrastructure. See Supported Infrastructure and Platforms.

5. Create a new OpenShift Container Platform worker node using the new VM.

6. Check for certificate signing requests (CSRs) related to OpenShift Container Platform that are in **Pending** state:

   ```
   $ oc get csr
   ```

7. Approve all required OpenShift Container Platform CSRs for the new node:

   ```
   $ oc adm certificate approve <Certificate_Name>
   ```

8. Click **Compute → Nodes**, confirm if the new node is in **Ready** state.

9. Apply the OpenShift Container Storage label to the new node using any one of the following:

   **From User interface**

   a. For the new node, click **Action Menu ( ⋮ ) → Edit Labels**

   b. Add **cluster.ocs.openshift.io/openshift-storage** and click **Save**.

   **From Command line interface**

   - Execute the following command to apply the OpenShift Container Storage label to the new node:

     ```
     $ oc label node <new_node_name> cluster.ocs.openshift.io/openshift-storage=""
     ```

**Verification steps**

1. Execute the following command and verify that the new node is present in the output:

   ```
   $ oc get nodes --show-labels | grep cluster.ocs.openshift.io/openshift-storage= |cut -d' ' -f1
   ```

2. Click **Workloads → Pods**, confirm that at least the following pods on the new node are in **Running** state:

   - **csi-cephfsplugin-***
   - **csi-rbdplugin-***

3. Verify that all other required OpenShift Container Storage pods are in **Running** state.

4. If verification steps fail, kindly contact Red Hat Support .

## 9.3. OPENSHIFT CONTAINER STORAGE DEPLOYED USING LOCAL STORAGE DEVICES

> **IMPORTANT**
>
> While replacing a node, the hostname of the new Openshift Container Storage node should not be the same as the hostname of any decommissioned Openshift Container Storage node due to a known issue. As a workaround, we recommend to use a new hostname for adding the replaced node back into the cluster.

### 9.3.1. Replacing failed storage nodes on Amazon EC2 infrastructure

The ephemeral storage of Amazon EC2 I3 for OpenShift Container Storage might cause data loss when there is an instance power off. Use this procedure to recover from such an instance power off on Amazon EC2 infrastructure.

> **IMPORTANT**
>
> Replacing storage nodes in Amazon EC2 I3 infrastructure is a Technology Preview feature. Technology Preview features are not supported with Red Hat production service level agreements (SLAs) and might not be functionally complete. Red Hat does not recommend using them in production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process.

**Prerequisites**

- You must be logged into OpenShift Container Platform (OCP) cluster.

**Procedure**

1. Identify the node and get labels on the node to be replaced.

   ```
   $ oc get nodes --show-labels | grep <node_name>
   ```

2. Identify the mon (if any) and OSDs that are running in the node to be replaced.

```
$ oc get pods -n openshift-storage -o wide | grep -i <node_name>
```

3. Scale down the deployments of the pods identified in the previous step.
   For example:

```
$ oc scale deployment rook-ceph-mon-c --replicas=0 -n openshift-storage
$ oc scale deployment rook-ceph-osd-0 --replicas=0 -n openshift-storage
$ oc scale deployment --selector=app=rook-ceph-crashcollector,node_name=<node_name>
--replicas=0 -n openshift-storage
```

4. Mark the nodes as unschedulable.

```
$ oc adm cordon <node_name>
```

5. Drain the node.

```
$ oc adm drain <node_name> --force --delete-local-data --ignore-daemonsets
```

NOTE

If the failed node is not connected to the network, remove the pods running on it by using the command:

```
$ oc get pods -A -o wide | grep -i <node_name> |  awk '{if ($4 ==
"Terminating") system ("oc -n " $1 " delete pods " $2  " --grace-period=0 " " --
force ")}'
$ oc adm drain <node_name> --force --delete-local-data --ignore-daemonsets
```

6. Remove the failed node.

   a. For Installer provisioned infrastructure, delete the machine corresponding to the failed node. A new node is automatically added.

      i. Click **Compute → Machines**. Search for the required machine.

      ii. Besides the required machine, click the Action menu **( ⋮ ) → Delete Machine**

      iii. Click **Delete** to confirm the machine deletion. A new machine is automatically created.

      iv. Wait for the new machine to start and transition into Running state.

      IMPORTANT

      This activity may take at least 5-10 minutes or more.

   b. For User provisioned infrastructure, follow the below mentioned steps

      i. Delete the node.

```
$ oc delete node <node_name>
```

ii. Create a new Amazon EC2 I3 machine instance with the required infrastructure. See Supported Infrastructure and Platforms.

iii. Create a new OpenShift Container Platform node using the new Amazon EC2 I3 machine instance.

iv. Check for certificate signing requests (CSRs) related to OpenShift Container Platform that are in Pending state:

```
$ oc get csr
```

v. Approve all required OpenShift Container Platform CSRs for the new node:

```
$ oc adm certificate approve <Certificate_Name>
```

c. [Optional]: If the failed AWS instance is not removed automatically, terminate the instance from AWS console.

7. Click **Compute → Nodes** in OpenShift web console. Confirm if the new node is in **Ready** state.

8. Apply the OpenShift Container Storage label to the new node using any one of the following:

**From User interface**

a. For the new node, click **Action Menu ( ⋮ ) → Edit Labels**.

b. Add **cluster.ocs.openshift.io/openshift-storage** and click **Save**.

**From Command line interface**

- Execute the following command to apply the OpenShift Container Storage label to the new node:

```
$ oc label node <new_node_name> cluster.ocs.openshift.io/openshift-storage=""
```

9. Add the local storage devices available in the new worker node to the OpenShift Container Storage StorageCluster.

a. Add the new disk entries to LocalVolume CR.
Edit **LocalVolume** CR. You can either remove or comment out the failed device **/dev/disk/by-id/{id}** and add the new **/dev/disk/by-id/{id}**.

```
$ oc get -n local-storage localvolume
NAME          AGE
local-block   25h
```

```
$ oc edit -n local-storage localvolume local-block
```

Example output:

```
[...]
    storageClassDevices:
    - devicePaths:
      - /dev/disk/by-id/nvme-
```

```
Amazon_EC2_NVMe_Instance_Storage_AWS10382E5D7441494EC
      - /dev/disk/by-id/nvme-
Amazon_EC2_NVMe_Instance_Storage_AWS1F45C01D7E84FE3E9
      - /dev/disk/by-id/nvme-
Amazon_EC2_NVMe_Instance_Storage_AWS136BC945B4ECB9AE4
      - /dev/disk/by-id/nvme-
Amazon_EC2_NVMe_Instance_Storage_AWS10382E5D7441464EP
  #   - /dev/disk/by-id/nvme-
Amazon_EC2_NVMe_Instance_Storage_AWS1F45C01D7E84F43E7
  #   - /dev/disk/by-id/nvme-
Amazon_EC2_NVMe_Instance_Storage_AWS136BC945B4ECB9AE8
      - /dev/disk/by-id/nvme-
Amazon_EC2_NVMe_Instance_Storage_AWS6F45C01D7E84FE3E9
      - /dev/disk/by-id/nvme-
Amazon_EC2_NVMe_Instance_Storage_AWS636BC945B4ECB9AE4
      storageClassName: localblock
      volumeMode: Block
[...]
```

Make sure to save the changes after editing the CR.

You can see that in this CR the below two new devices using by-id have been added.

- **nvme-Amazon_EC2_NVMe_Instance_Storage_AWS6F45C01D7E84FE3E9**
- **nvme-Amazon_EC2_NVMe_Instance_Storage_AWS636BC945B4ECB9AE4**

b. Display PVs with **localblock**.

```
$ oc get pv | grep localblock
```

Example output:

```
local-pv-3646185e   2328Gi  RWO     Delete      Available
localblock  9s
local-pv-3933e86    2328Gi  RWO     Delete      Bound       openshift-storage/ocs-
deviceset-2-1-v9jp4   localblock  5h1m
local-pv-8176b2bf   2328Gi  RWO     Delete      Bound       openshift-storage/ocs-
deviceset-0-0-nvs68   localblock  5h1m
local-pv-ab7cabb3   2328Gi  RWO     Delete      Available
localblock  9s
local-pv-ac52e8a    2328Gi  RWO     Delete      Bound       openshift-storage/ocs-
deviceset-1-0-knrgr   localblock  5h1m
local-pv-b7e6fd37   2328Gi  RWO     Delete      Bound       openshift-storage/ocs-
deviceset-2-0-rdm7m   localblock  5h1m
local-pv-cb454338   2328Gi  RWO     Delete      Bound       openshift-storage/ocs-
deviceset-0-1-h9hfm   localblock  5h1m
local-pv-da5e3175   2328Gi  RWO     Delete      Bound       openshift-storage/ocs-
deviceset-1-1-g97lq   localblock  5h
...
```

10. Delete each PV and OSD associated with failed node using the following steps.

    a. Identify the DeviceSet associated with the OSD to be replaced.

```
$ osd_id_to_remove=0
$ oc get -n openshift-storage -o yaml deployment rook-ceph-osd-${osd_id_to_remove} |
grep ceph.rook.io/pvc
```

where, **osd_id_to_remove** is the integer in the pod name immediately after the **rook-ceph-osd** prefix. In this example, the deployment name is **rook-ceph-osd-0**.

Example output:

```
ceph.rook.io/pvc: ocs-deviceset-0-0-nvs68
    ceph.rook.io/pvc: ocs-deviceset-0-0-nvs68
```

b. Identify the PV associated with the PVC.

```
$ oc get -n openshift-storage pvc ocs-deviceset-<x>-<y>-<pvc-suffix>
```

where, x, y, and pvc-suffix are the values in the DeviceSet identified in an earlier step.

Example output:

```
NAME                      STATUS     VOLUME             CAPACITY   ACCESS MODES
STORAGECLASS   AGE
ocs-deviceset-0-0-nvs68   Bound   local-pv-8176b2bf   2328Gi      RWO            localblock
4h49m
```

In this example, the associated PV is **local-pv-8176b2bf**.

c. Delete the PVC which was identified in earlier steps. In this example, the PVC name is ocs-deviceset-0-0-nvs68.

```
$ oc delete pvc ocs-deviceset-0-0-nvs68 -n openshift-storage
```

Example output:

```
persistentvolumeclaim "ocs-deviceset-0-0-nvs68" deleted
```

d. Delete the PV which was identified in earlier steps. In this example, the PV name is local-pv-8176b2bf.

```
$ oc delete pv local-pv-8176b2bf
```

Example output:

```
persistentvolume "local-pv-8176b2bf" deleted
```

e. Remove the failed OSD from the cluster.

```
$ oc process -n openshift-storage ocs-osd-removal -p
FAILED_OSD_ID=${osd_id_to_remove} | oc create -f -
```

f. Verify that the OSD is removed successfully by checking the status of the **ocs-osd-removal** pod. A status of **Completed** confirms that the OSD removal job succeeded.

```
# oc get pod -l job-name=ocs-osd-removal-${osd_id_to_remove} -n openshift-storage
```

NOTE

If **ocs-osd-removal** fails and the pod is not in the expected **Completed** state, check the pod logs for further debugging. For example:

```
# oc logs -l job-name=ocs-osd-removal-${osd_id_to_remove} -n openshift-
storage --tail=-1
```

g. Delete the OSD pod deployment.

```
$ oc delete deployment rook-ceph-osd-${osd_id_to_remove} -n openshift-storage
```

11. Delete **crashcollector** pod deployment identified in an earlier step.

```
$ oc delete deployment --selector=app=rook-ceph-crashcollector,node_name=
<old_node_name> -n openshift-storage
```

12. Deploy the new OSD by restarting the **rook-ceph-operator** to force operator reconciliation.

```
$ oc get -n openshift-storage pod -l app=rook-ceph-operator
```

Example output:

```
NAME                                  READY   STATUS    RESTARTS   AGE
rook-ceph-operator-6f74fb5bff-2d982   1/1     Running   0          5h3m
```

a. Delete the **rook-ceph-operator**.

```
$ oc delete -n openshift-storage pod rook-ceph-operator-6f74fb5bff-2d982
```

Example output:

```
pod "rook-ceph-operator-6f74fb5bff-2d982" deleted
```

b. Verify that the **rook-ceph-operator** pod is restarted.

```
$ oc get -n openshift-storage pod -l app=rook-ceph-operator
```

Example output:

```
NAME                                  READY   STATUS    RESTARTS   AGE
rook-ceph-operator-6f74fb5bff-7mvrq   1/1     Running   0          66s
```

Creation of the new OSD may take several minutes after the operator starts.

13. Delete the **ocs-osd-removal** job(s).

```
$ oc delete job ocs-osd-removal-${osd_id_to_remove}
```

Example output:

```
job.batch "ocs-osd-removal-0" deleted
```

### Verification steps

1. Execute the following command and verify that the new node is present in the output:

   ```
   $ oc get nodes --show-labels | grep cluster.ocs.openshift.io/openshift-storage= |cut -d' ' -f1
   ```

2. Click **Workloads → Pods**, confirm that at least the following pods on the new node are in **Running** state:

   - **csi-cephfsplugin-***
   - **csi-rbdplugin-***

3. Verify that all other required OpenShift Container Storage pods are in **Running** state. Also, ensure that the new incremental **mon** is created and is in the **Running** state.

   ```
   $ oc get pod -n openshift-storage | grep mon
   ```

   Example output:

   ```
   rook-ceph-mon-a-64556f7659-c2ngc    1/1     Running     0   5h1m
   rook-ceph-mon-b-7c8b74dc4d-tt6hd    1/1     Running     0   5h1m
   rook-ceph-mon-d-57fb8c657-wg5f2     1/1     Running     0   27m
   ```

   OSDs and mon's might take several minutes to get to the **Running** state.

4. If verification steps fail, contact Red Hat Support .

## 9.3.2. Replacing failed storage nodes on VMware infrastructure

### Prerequisites

- You must be logged into OpenShift Container Platform (OCP) cluster.

### Procedure

1. Identify the node and get labels on the node to be replaced.

   ```
   $ oc get nodes --show-labels | grep <node_name>
   ```

2. Identify the **mon** (if any) and OSDs that are running in the node to be replaced.

   ```
   $ oc get pods -n openshift-storage -o wide | grep -i <node_name>
   ```

3. Scale down the deployments of the pods identified in the previous step.
   For example:

   ```
   $ oc scale deployment rook-ceph-mon-c --replicas=0 -n openshift-storage
   ```

```
$ oc scale deployment rook-ceph-osd-0 --replicas=0 -n openshift-storage
$ oc scale deployment --selector=app=rook-ceph-crashcollector,node_name=<node_name>
--replicas=0 -n openshift-storage
```

4. Mark the node as unschedulable.

```
$ oc adm cordon <node_name>
```

5. Drain the node.

```
$ oc adm drain <node_name> --force --delete-local-data --ignore-daemonsets
```

NOTE

If the failed node is not connected to the network, remove the pods running on it by using the command:

```
$ oc get pods -A -o wide | grep -i <node_name> |  awk '{if ($4 ==
"Terminating") system ("oc -n " $1 " delete pods " $2  " --grace-period=0 " " --
force ")}'
$ oc adm drain <node_name> --force --delete-local-data --ignore-daemonsets
```

6. Delete the node.

```
$ oc delete node <node_name>
```

7. Create a new VM on VMware with the required infrastructure. See Supported Infrastructure and Platforms.

8. Create a new OpenShift Container Platform worker node using the new VM.

9. Check for certificate signing requests (CSRs) related to OpenShift Container Platform that are in **Pending** state:

```
$ oc get csr
```

10. Approve all required OpenShift Container Platform CSRs for the new node:

```
$ oc adm certificate approve <Certificate_Name>
```

11. Click **Compute → Nodes** in OpenShift Web Console, confirm if the new node is in **Ready** state.

12. Apply the OpenShift Container Storage label to the new node using any one of the following:

    **From User interface**

    a. For the new node, click **Action Menu ( ⋮ ) → Edit Labels**.

    b. Add **cluster.ocs.openshift.io/openshift-storage** and click **Save**.

    **From Command line interface**

- Execute the following command to apply the OpenShift Container Storage label to the new node:

  ```
  $ oc label node <new_node_name> cluster.ocs.openshift.io/openshift-storage=""
  ```

13. Add the local storage devices available in these worker nodes to the OpenShift Container Storage StorageCluster.

    a. Add a new disk entry to **LocalVolume** CR.
    Edit **LocalVolume** CR and remove or comment out failed device **/dev/disk/by-id/{id}** and add the new **/dev/disk/by-id/{id}**. In this example, the new device is **/dev/disk/by-id/scsi-36000c29f5c9638dec9f19b220fbe36b1**.

    ```
    # oc get -n local-storage localvolume
    NAME          AGE
    local-block   25h
    ```

    ```
    # oc edit -n local-storage localvolume local-block
    ```

    Example output:

    ```
    [...]
      storageClassDevices:
      - devicePaths:
        - /dev/disk/by-id/scsi-36000c29346bca85f723c4c1f268b5630
        - /dev/disk/by-id/scsi-36000c29134dfcfaf2dfeeb9f98622786
     #   - /dev/disk/by-id/scsi-36000c2962b2f613ba1f8f4c5cf952237
        - /dev/disk/by-id/scsi-36000c29f5c9638dec9f19b220fbe36b1
        storageClassName: localblock
        volumeMode: Block
    [...]
    ```

    Make sure to save the changes after editing the CR.

    b. Display PVs with **localblock**.

    ```
    $ oc get pv | grep localblock
    ```

    Example output:

    ```
    local-pv-3e8964d3                         100Gi      RWO         Delete          Bound
    openshift-storage/ocs-deviceset-2-0-79j94   localblock                             25h
    local-pv-414755e0                         100Gi      RWO         Delete          Bound
    openshift-storage/ocs-deviceset-1-0-959rp   localblock                             25h
    local-pv-b481410                          100Gi      RWO         Delete          Available
    localblock                           3m24s
    local-pv-d9c5cbd6                         100Gi      RWO         Delete          Bound
    openshift-storage/ocs-deviceset-0-0-nvs68   localblock
    ```

14. Delete the PV associated with the failed node.

    a. Identify the **DeviceSet** associated with the OSD to be replaced.

```
# osd_id_to_remove=0
# oc get -n openshift-storage -o yaml deployment rook-ceph-osd-${osd_id_to_remove} |
grep ceph.rook.io/pvc
```

where, **osd_id_to_remove** is the integer in the pod name immediately after the **rook-ceph-osd prefix**. In this example, the deployment name is **rook-ceph-osd-0**.

Example output:

```
ceph.rook.io/pvc: ocs-deviceset-0-0-nvs68
    ceph.rook.io/pvc: ocs-deviceset-0-0-nvs68
```

In this example, the PVC name is **ocs-deviceset-0-0-nvs68**.

b. Identify the PV associated with the PVC.

```
# oc get -n openshift-storage pvc ocs-deviceset-<x>-<y>-<pvc-suffix>
```

where, **x**, **y**, and **pvc-suffix** are the values in the **DeviceSet** identified in the previous step.

Example output:

```
NAME                  STATUS      VOLUME       CAPACITY   ACCESS MODES
STORAGECLASS   AGE
ocs-deviceset-0-0-nvs68   Bound   local-pv-d9c5cbd6   100Gi     RWO          localblock
24h
```

In this example, the associated PV is **local-pv-d9c5cbd6**.

c. Delete the PVC.

```
oc delete pvc <pvc-name> -n openshift-storage
```

d. Delete the PV.

```
# oc delete pv local-pv-d9c5cbd6
```

Example output:

```
persistentvolume "local-pv-d9c5cbd6" deleted
```

15. Remove the failed OSD from the cluster.

```
# oc process -n openshift-storage ocs-osd-removal -p
FAILED_OSD_ID=${osd_id_to_remove} | oc create -f -
```

16. Verify that the OSD is removed successfully by checking the status of the **ocs-osd-removal** pod. A status of **Completed** confirms that the OSD removal job succeeded.

```
# oc get pod -l job-name=ocs-osd-removal-${osd_id_to_remove} -n openshift-storage
```

NOTE

If **ocs-osd-removal** fails and the pod is not in the expected **Completed** state, check the pod logs for further debugging. For example:

```
# oc logs -l job-name=ocs-osd-removal-${osd_id_to_remove} -n openshift-
storage --tail=-1
```

17. Delete OSD pod deployment and crashcollector pod deployment.

```
$ oc delete deployment rook-ceph-osd-${osd_id_to_remove} -n openshift-storage
$ oc delete deployment --selector=app=rook-ceph-crashcollector,node_name=
<old_node_name> -n openshift-storage
```

18. Deploy the new OSD by restarting the **rook-ceph-operator** to force operator reconciliation.

```
# oc get -n openshift-storage pod -l app=rook-ceph-operator
```

Example output:

```
NAME                                  READY   STATUS    RESTARTS   AGE
rook-ceph-operator-6f74fb5bff-2d982   1/1     Running   0          1d20h
```

a. Delete the **rook-ceph-operator**.

```
# oc delete -n openshift-storage pod rook-ceph-operator-6f74fb5bff-2d982
```

Example output:

```
pod "rook-ceph-operator-6f74fb5bff-2d982" deleted
```

b. Verify that the **rook-ceph-operator** pod is restarted.

```
# oc get -n openshift-storage pod -l app=rook-ceph-operator
```

Example output:

```
NAME                                  READY   STATUS    RESTARTS   AGE
rook-ceph-operator-6f74fb5bff-7mvrq   1/1     Running   0          66s
```

Creation of the new OSD and **mon** might take several minutes after the operator restarts.

19. Delete the **ocs-osd-removal** job.

```
# oc delete job ocs-osd-removal-${osd_id_to_remove}
```

Example output:

```
job.batch "ocs-osd-removal-0" deleted
```

### Verification steps

- Execute the following command and verify that the new node is present in the output:

  ```
  $ oc get nodes --show-labels | grep cluster.ocs.openshift.io/openshift-storage= |cut -d' ' -f1
  ```

- Click **Workloads → Pods**, confirm that at least the following pods on the new node are in **Running** state:
  - **csi-cephfsplugin-***
  - **csi-rbdplugin-***
- Verify that all other required OpenShift Container Storage pods are in **Running** state.
  - Make sure that the new incremental **mon** is created and is in the **Running** state.

    ```
    $ oc get pod -n openshift-storage | grep mon
    ```

    Example output:

    ```
    rook-ceph-mon-c-64556f7659-c2ngc                    1/1     Running     0
    6h14m
    rook-ceph-mon-d-7c8b74dc4d-tt6hd                   1/1     Running     0       4h24m
    rook-ceph-mon-e-57fb8c657-wg5f2                    1/1     Running     0       162m
    ```

    OSD and Mon might take several minutes to get to the **Running** state.
- If verification steps fail, contact Red Hat Support .

### 9.3.3. Replacing failed storage nodes on bare metal infrastructure

#### Prerequisites

- You must be logged into OpenShift Container Platform (OCP) cluster.

#### Procedure

1. Identify the node and get labels on the node to be replaced. Make a note of the rack label.

   ```
   $ oc get nodes --show-labels | grep <node_name>
   ```

2. Identify the mon (if any) and object storage device (OSD) pods that are running in the node to be replaced.

   ```
   $ oc get pods -n openshift-storage -o wide | grep -i <node_name>
   ```

3. Scale down the deployments of the pods identified in the previous step.
   For example:

   ```
   $ oc scale deployment rook-ceph-mon-c --replicas=0 -n openshift-storage
   $ oc scale deployment rook-ceph-osd-0 --replicas=0 -n openshift-storage
   $ oc scale deployment --selector=app=rook-ceph-crashcollector,node_name=<node_name>
   --replicas=0 -n openshift-storage
   ```

4. Mark the node as unschedulable.

```
$ oc adm cordon <node_name>
```

5. Drain the node.

```
$ oc adm drain <node_name> --force --delete-local-data --ignore-daemonsets
```

NOTE

If the failed node is not connected to the network, remove the pods running on it by using the command:

```
$ oc get pods -A -o wide | grep -i <node_name> |  awk '{if ($4 ==
"Terminating") system ("oc -n " $1 " delete pods " $2  " --grace-period=0 " " --
force ")}'
$ oc adm drain <node_name> --force --delete-local-data --ignore-daemonsets
```

6. Delete the node.

```
$ oc delete node <node_name>
```

7. Get a new bare metal machine with required infrastructure. See Installing a cluster on bare metal.

8. Create a new OpenShift Container Platform node using the new bare metal machine.

9. Check for certificate signing requests (CSRs) related to OpenShift Container Storage that are in **Pending** state:

```
$ oc get csr
```

10. Approve all required OpenShift Container Storage CSRs for the new node:

```
$ oc adm certificate approve <Certificate_Name>
```

11. Click **Compute → Nodes** in OpenShift Web Console, confirm if the new node is in **Ready** state.

12. Apply the OpenShift Container Storage label to the new node using any one of the following:

    **From User interface**

    a. For the new node, click **Action Menu ( ⋮ ) → Edit Labels**.

    b. Add **cluster.ocs.openshift.io/openshift-storage** and click **Save**.

    **From Command line interface**

    - Execute the following command to apply the OpenShift Container Storage label to the new node:

```
$ oc label node <new_node_name> cluster.ocs.openshift.io/openshift-storage=""
```

13. Add the local storage devices available in these worker nodes to the OpenShift Container Storage StorageCluster.

    a. Add a new disk entry to **LocalVolume** CR.
    Edit **LocalVolume** CR and remove or comment out failed device **/dev/disk/by-id/{id}** and add the new **/dev/disk/by-id/{id}**. In this example, the new device is **/dev/disk/by-id/scsi-36000c29f5c9638dec9f19b220fbe36b1**.

    ```
    # oc get -n local-storage localvolume
    NAME          AGE
    local-block   25h
    ```

    ```
    # oc edit -n local-storage localvolume local-block
    ```

    Example output:

    ```
    [...]
      storageClassDevices:
      - devicePaths:
        - /dev/disk/by-id/scsi-36000c29346bca85f723c4c1f268b5630
        - /dev/disk/by-id/scsi-36000c29134dfcfaf2dfeeb9f98622786
     #   - /dev/disk/by-id/scsi-36000c2962b2f613ba1f8f4c5cf952237
        - /dev/disk/by-id/scsi-36000c29f5c9638dec9f19b220fbe36b1
        storageClassName: localblock
        volumeMode: Block
    [...]
    ```

    Make sure to save the changes after editing the CR.

    b. Display PVs with **localblock**.

    ```
    $ oc get pv | grep localblock
    ```

    Example output:

    ```
    local-pv-3e8964d3                        100Gi      RWO          Delete          Bound
    openshift-storage/ocs-deviceset-2-0-79j94   localblock                              25h
    local-pv-414755e0                        100Gi      RWO          Delete          Bound
    openshift-storage/ocs-deviceset-1-0-959rp   localblock                              25h
    local-pv-b481410                        100Gi      RWO          Delete          Available
    localblock                          3m24s
    local-pv-d9c5cbd6                        100Gi      RWO          Delete          Bound
    openshift-storage/ocs-deviceset-0-0-nvs68   localblock
    ```

14. Delete the PV associated with the failed node.

    a. Identify the **DeviceSet** associated with the OSD to be replaced.

    ```
    # osd_id_to_remove=0
    # oc get -n openshift-storage -o yaml deployment rook-ceph-osd-${osd_id_to_remove} |
    grep ceph.rook.io/pvc
    ```

    where, **osd_id_to_remove** is the integer in the pod name immediately after the **rook-ceph-osd prefix**. In this example, the deployment name is **rook-ceph-osd-0**.

Example output:

```
ceph.rook.io/pvc: ocs-deviceset-0-0-nvs68
    ceph.rook.io/pvc: ocs-deviceset-0-0-nvs68
```

In this example, the PVC name is **ocs-deviceset-0-0-nvs68**.

b. Identify the PV associated with the PVC.

```
# oc get -n openshift-storage pvc ocs-deviceset-<x>-<y>-<pvc-suffix>
```

where, **x**, **y**, and **pvc-suffix** are the values in the **DeviceSet** identified in the previous step.

Example output:

```
NAME                    STATUS      VOLUME        CAPACITY   ACCESS MODES
STORAGECLASS   AGE
ocs-deviceset-0-0-nvs68   Bound   local-pv-d9c5cbd6   100Gi      RWO            localblock
24h
```

In this example, the associated PV is **local-pv-d9c5cbd6**.

c. Delete the PVC.

```
oc delete pvc <pvc-name> -n openshift-storage
```

d. Delete the PV.

```
# oc delete pv local-pv-d9c5cbd6
```

Example output:

```
persistentvolume "local-pv-d9c5cbd6" deleted
```

15. Remove the failed OSD from the cluster.

```
# oc process -n openshift-storage ocs-osd-removal -p
FAILED_OSD_ID=${osd_id_to_remove} | oc create -f -
```

16. Verify that the OSD is removed successfully by checking the status of the **ocs-osd-removal** pod. A status of **Completed** confirms that the OSD removal job succeeded.

```
# oc get pod -l job-name=ocs-osd-removal-${osd_id_to_remove} -n openshift-storage
```

NOTE

If **ocs-osd-removal** fails and the pod is not in the expected **Completed** state, check the pod logs for further debugging. For example:

```
# oc logs -l job-name=ocs-osd-removal-${osd_id_to_remove} -n openshift-
storage --tail=-1
```

17. Delete OSD pod deployment and crashcollector pod deployment.

```
$ oc delete deployment rook-ceph-osd-${osd_id_to_remove} -n openshift-storage
$ oc delete deployment --selector=app=rook-ceph-crashcollector,node_name=
<old_node_name> -n openshift-storage
```

18. Deploy the new OSD by restarting the **rook-ceph-operator** to force operator reconciliation.

```
# oc get -n openshift-storage pod -l app=rook-ceph-operator
```

Example output:

```
NAME                                  READY   STATUS    RESTARTS   AGE
rook-ceph-operator-6f74fb5bff-2d982   1/1     Running   0          1d20h
```

a. Delete the **rook-ceph-operator**.

```
# oc delete -n openshift-storage pod rook-ceph-operator-6f74fb5bff-2d982
```

Example output:

```
pod "rook-ceph-operator-6f74fb5bff-2d982" deleted
```

b. Verify that the **rook-ceph-operator** pod is restarted.

```
# oc get -n openshift-storage pod -l app=rook-ceph-operator
```

Example output:

```
NAME                                  READY   STATUS    RESTARTS   AGE
rook-ceph-operator-6f74fb5bff-7mvrq   1/1     Running   0          66s
```

Creation of the new OSD and **mon** might take several minutes after the operator restarts.

19. Delete the **ocs-osd-removal** job.

```
# oc delete job ocs-osd-removal-${osd_id_to_remove}
```

Example output:

```
job.batch "ocs-osd-removal-0" deleted
```

### Verification steps

- Execute the following command and verify that the new node is present in the output:

```
$ oc get nodes --show-labels | grep cluster.ocs.openshift.io/openshift-storage= |cut -d' ' -f1
```

- Click **Workloads → Pods**, confirm that at least the following pods on the new node are in **Running** state:
  - **csi-cephfsplugin-***

  - **csi-rbdplugin-***

- Verify that all other required OpenShift Container Storage pods are in **Running** state.

  - Make sure that the new incremental **mon** is created and is in the **Running** state.

    ```
    $ oc get pod -n openshift-storage | grep mon
    ```

    Example output:

    ```
    rook-ceph-mon-c-64556f7659-c2ngc                    1/1     Running     0
    6h14m
    rook-ceph-mon-d-7c8b74dc4d-tt6hd                   1/1     Running     0        4h24m
    rook-ceph-mon-e-57fb8c657-wg5f2                    1/1     Running     0        162m
    ```

    OSD and Mon might take several minutes to get to the **Running** state.

- If verification steps fail, contact Red Hat Support.

# CHAPTER 10. REPLACING STORAGE DEVICES

Depending on the type of your deployment, you can choose one of the following procedures to replace a storage device:

- For dynamically created storage clusters deployed on AWS, see:
  - Section 10.1.1, “Replacing operational or failed storage devices on AWS user-provisioned infrastructure”
  - Section 10.1.2, “Replacing operational or failed storage devices on AWS installer-provisioned infrastructure”
- For dynamically created storage clusters deployed on VMware, see Section 10.2.1, “Replacing operational or failed storage devices on VMware user-provisioned infrastructure”
- For storage clusters deployed using local storage devices, see:
  - Section 10.3.1, “Replacing failed storage devices on Amazon EC2 infrastructure”
  - Section 10.3.2, “Replacing operational or failed storage devices on VMware and bare metal infrastructures”

## 10.1. DYNAMICALLY PROVISIONED OPENSHIFT CONTAINER STORAGE DEPLOYED ON AWS

### 10.1.1. Replacing operational or failed storage devices on AWS user-provisioned infrastructure

When you need to replace a device in a dynamically created storage cluster on an AWS user-provisioned infrastructure, you must replace the storage node. For information about how to replace nodes, see:

- Replacing operational nodes on AWS user-provisioned infrastructures
- Replacing failed nodes on AWS user-provisioned infrastructures .

### 10.1.2. Replacing operational or failed storage devices on AWS installer-provisioned infrastructure

When you need to replace a device in a dynamically created storage cluster on an AWS installer-provisioned infrastructure, you must replace the storage node. For information about how to replace nodes, see:

- Replacing operational nodes on AWS installer-provisioned infrastructures
- Replacing failed nodes on AWS installer-provisioned infrastructures .

## 10.2. DYNAMICALLY PROVISIONED OPENSHIFT CONTAINER STORAGE DEPLOYED ON VMWARE

### 10.2.1. Replacing operational or failed storage devices on VMware user-provisioned infrastructure

Use this procedure when a virtual machine disk (VMDK) needs to be replaced in OpenShift Container Storage which is deployed dynamically on VMware infrastructure. This procedure helps to create a new persistent volume claim (PVC) on a new volume and remove the old object storage device (OSD).

### Procedure

1. Identify the OSD that needs to be replaced.

   ```
   # oc get -n openshift-storage pods -l app=rook-ceph-osd -o wide
   ```

   Example output:

   ```
   rook-ceph-osd-0-6d77d6c7c6-m8xj6    0/1    CrashLoopBackOff    0    24h   10.129.0.16
   compute-2   <none>           <none>
   rook-ceph-osd-1-85d99fb95f-2svc7    1/1    Running    0    24h   10.128.2.24   compute-0
   <none>           <none>
   rook-ceph-osd-2-6c66cdb977-jp542    1/1    Running    0    24h   10.131.2.32   compute-1
   <none>           <none>
   ```

   In this example, **rook-ceph-osd-0-6d77d6c7c6-m8xj6** needs to be replaced.

   NOTE

   If the OSD to be replaced is healthy, the status of the pod will be Running.

2. Scale down the OSD deployment for the OSD to be replaced

   ```
   # osd_id_to_remove=0
   # oc scale -n openshift-storage deployment rook-ceph-osd-${osd_id_to_remove} --replicas=0
   ```

   where, **osd_id_to_remove** is the integer in the pod name immediately after the **rook-ceph-osd** prefix. In this example, the deployment name is **rook-ceph-osd-0**.

   Example output:

   ```
   deployment.extensions/rook-ceph-osd-0 scaled
   ```

3. Verify that the **rook-ceph-osd** pod is terminated.

   ```
   # oc get -n openshift-storage pods -l ceph-osd-id=${osd_id_to_remove}
   ```

   Example output:

   ```
   No resources found.
   ```

NOTE

If the **rook-ceph-osd** pod is in **terminating** state, use the **force** option to delete the pod.

```
# oc delete pod rook-ceph-osd-0-6d77d6c7c6-m8xj6 --force --grace-period=0
```

Example output:

```
warning: Immediate deletion does not wait for confirmation that the running
resource has been terminated. The resource may continue to run on the
cluster indefinitely.
  pod "rook-ceph-osd-0-6d77d6c7c6-m8xj6" force deleted
```

4. Remove the old OSD from the cluster so that a new OSD can be added.

```
# oc process -n openshift-storage ocs-osd-removal -p
FAILED_OSD_ID=${osd_id_to_remove} | oc create -f -
```

WARNING

This step results in OSD being completely removed from the cluster. Make sure that the correct value of **osd_id_to_remove** is provided.

5. Verify that the OSD is removed successfully by checking the status of the **ocs-osd-removal** pod. A status of **Completed** confirms that the OSD removal job succeeded.

```
# oc get pod -l job-name=ocs-osd-removal-${osd_id_to_remove} -n openshift-storage
```

NOTE

If **ocs-osd-removal** fails and the pod is not in the expected **Completed** state, check the pod logs for further debugging. For example:

```
# oc logs -l job-name=ocs-osd-removal-${osd_id_to_remove} -n openshift-
storage --tail=-1
```

6. Delete the PVC resources associated with the OSD to be replaced.

   a. Identify the **DeviceSet** associated with the OSD to be replaced.

   ```
   # oc get -n openshift-storage -o yaml deployment rook-ceph-osd-${osd_id_to_remove} |
   grep ceph.rook.io/pvc
   ```

   Example output:

```
ceph.rook.io/pvc: ocs-deviceset-0-0-nvs68
   ceph.rook.io/pvc: ocs-deviceset-0-0-nvs68
```

In this example, the PVC name is **ocs-deviceset-0-0-nvs68**.

b. Identify the PV associated with the PVC.

```
# oc get -n openshift-storage pvc ocs-deviceset-<x>-<y>-<pvc-suffix>
```

where, **x**, **y**, and **pvc-suffix** are the values in the **DeviceSet** identified in the previous step.

Example output:

```
NAME                    STATUS   VOLUME                                     CAPACITY   ACCESS
MODES   STORAGECLASS   AGE
ocs-deviceset-0-0-nvs68   Bound    pvc-0e621d45-7d18-4d35-a282-9700c3cc8524
512Gi      RWO            thin           24h
```

In this example, the PVC is **ocs-deviceset-0-0-nvs68** that is identified in the previous step and associated PV is **pvc-0e621d45-7d18-4d35-a282-9700c3cc8524**.

c. Identify the **prepare-pod** associated with the OSD to be replaced. Use the PVC name obtained in an earlier step.

```
# oc describe -n openshift-storage pvc ocs-deviceset-<x>-<y>-<pvc-suffix> | grep
Mounted
```

where, **x**, **y**, and **pvc-suffix** are the values in the **DeviceSet** identified in an earlier step.

Example output:

```
Mounted By:    rook-ceph-osd-prepare-ocs-deviceset-0-0-nvs68-zblp7
```

d. Delete the **osd-prepare** pod before removing the associated PVC.

```
# oc delete -n openshift-storage pod rook-ceph-osd-prepare-ocs-deviceset-<x>-<y>-
<pvc-suffix>-<pod-suffix>
```

where, **x**, **y**, **pvc-suffix**, and **pod-suffix** are the values in the **osd-prepare** pod name identified in the previous step.

Example output:

```
pod "rook-ceph-osd-prepare-ocs-deviceset-0-0-nvs68-zblp7" deleted
```

e. Delete the PVC associated with the device.

```
# oc delete -n openshift-storage pvc ocs-deviceset-<x>-<y>-<pvc-suffix>
```

where, **x**, **y**, and **pvc-suffix** are the values in the **DeviceSet** identified in an earlier step.

Example output:

```
persistentvolumeclaim "ocs-deviceset-0-0-nvs68" deleted
```

7. Create new OSD for new device.

   a. Delete the deployment for the OSD to be replaced.

   ```
   # oc delete -n openshift-storage deployment rook-ceph-osd-${osd_id_to_remove}
   ```

   Example output:

   ```
   deployment.extensions/rook-ceph-osd-0 deleted
   ```

   b. Verify that the PV for the device identified in an earlier step is deleted.

   ```
   # oc get -n openshift-storage pv pvc-0e621d45-7d18-4d35-a282-9700c3cc8524
   ```

   Example output:

   ```
   Error from server (NotFound): persistentvolumes "pvc-0e621d45-7d18-4d35-a282-
   9700c3cc8524" not found
   ```

   In this example, the PV name is **pvc-0e621d45-7d18-4d35-a282-9700c3cc8524**.

   - If the PV still exists, delete the PV associated with the device.

     ```
     # oc delete pv pvc-0e621d45-7d18-4d35-a282-9700c3cc8524
     ```

     Example output:

     ```
     persistentvolume "pvc-0e621d45-7d18-4d35-a282-9700c3cc8524" deleted
     ```

     In this example, the PV name is **pvc-0e621d45-7d18-4d35-a282-9700c3cc8524**.

   c. Deploy the new OSD by restarting the **rook-ceph-operator** to force operator reconciliation.

      i. Identify the name of the **rook-ceph-operator**.

      ```
      # oc get -n openshift-storage pod -l app=rook-ceph-operator
      ```

      Example output:

      ```
      NAME                               READY   STATUS    RESTARTS   AGE
      rook-ceph-operator-6f74fb5bff-2d982   1/1     Running   0          1d20h
      ```

      ii. Delete the **rook-ceph-operator**.

      ```
      # oc delete -n openshift-storage pod rook-ceph-operator-6f74fb5bff-2d982
      ```

      Example output:

      ```
      pod "rook-ceph-operator-6f74fb5bff-2d982" deleted
      ```

In this example, the rook-ceph-operator pod name is **rook-ceph-operator-6f74fb5bff-2d982**.

iii. Verify that the **rook-ceph-operator** pod is restarted.

```
# oc get -n openshift-storage pod -l app=rook-ceph-operator
```

Example output:

```
NAME                                READY   STATUS    RESTARTS   AGE
rook-ceph-operator-6f74fb5bff-7mvrq   1/1     Running   0          66s
```

Creation of the new OSD may take several minutes after the operator restarts.

8. Delete the **ocs-osd-removal** job.

```
# oc delete job ocs-osd-removal-${osd_id_to_remove}
```

Example output:

```
job.batch "ocs-osd-removal-0" deleted
```

### Verfication steps

- Verify that there is a new OSD running and a new PVC created.

```
# oc get -n openshift-storage pods -l app=rook-ceph-osd
```

Example output:

```
rook-ceph-osd-0-5f7f4747d4-snshw                    1/1     Running     0          4m47s
rook-ceph-osd-1-85d99fb95f-2svc7                    1/1     Running     0          1d20h
rook-ceph-osd-2-6c66cdb977-jp542                    1/1     Running     0          1d20h
```

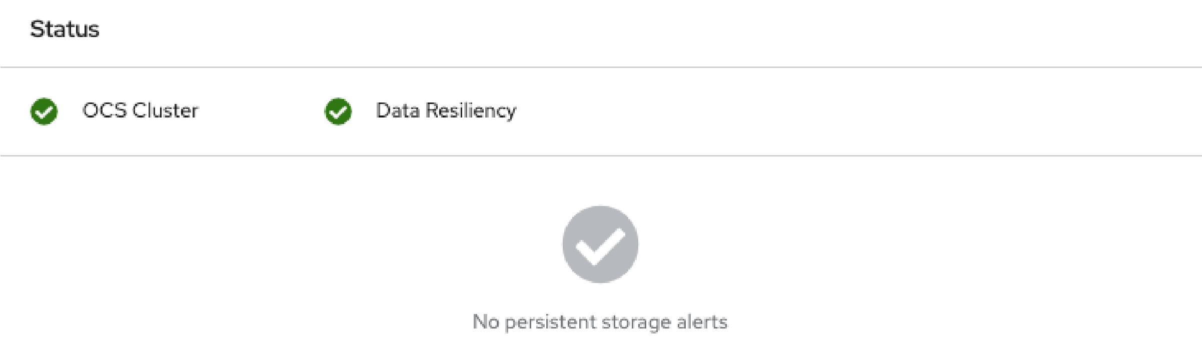
```
# oc get -n openshift-storage pvc
```

Example output:

```
NAME                      STATUS   VOLUME                                     CAPACITY   ACCESS
MODES   STORAGECLASS   AGE
ocs-deviceset-0-0-2s6w4   Bound    pvc-7c9bcaf7-de68-40e1-95f9-0b0d7c0ae2fc   512Gi
RWO            thin           5m
ocs-deviceset-1-0-q8fwh   Bound    pvc-9e7e00cb-6b33-402e-9dc5-b8df4fd9010f   512Gi
RWO            thin           1d20h
ocs-deviceset-2-0-9v8lq   Bound    pvc-38cdfcee-ea7e-42a5-a6e1-aaa6d4924291   512Gi
RWO            thin           1d20h
```

- Log in to OpenShift Web Console and view the storage dashboard.

Figure 10.1. OSD status in OpenShift Container Platform storage dashboard after device replacement



Status

✓ OCS Cluster ✓ Data Resiliency

No persistent storage alerts

## 10.3. OPENSHIFT CONTAINER STORAGE DEPLOYED USING LOCAL STORAGE DEVICES

### 10.3.1. Replacing failed storage devices on Amazon EC2 infrastructure

When you need to replace a storage device on an Amazon EC2 (storage-optimized I3) infrastructure, you must replace the storage node. For information about how to replace nodes, see Replacing failed storage nodes on Amazon EC2 infrastructure.

### 10.3.2. Replacing operational or failed storage devices on VMware and bare metal infrastructures

You can replace an object storage device (OSD) in OpenShift Container Storage deployed using local storage devices on bare metal and VMware infrastructures. Use this procedure when an underlying storage device needs to be replaced.

**Procedure**

1. Identify the OSD that needs to be replaced and the OpenShift Container Platform node that has the OSD scheduled on it.

```
# oc get -n openshift-storage pods -l app=rook-ceph-osd -o wide
```

Example output:

```
rook-ceph-osd-0-6d77d6c7c6-m8xj6   0/1   CrashLoopBackOff   0   24h   10.129.0.16
compute-2  <none>          <none>
rook-ceph-osd-1-85d99fb95f-2svc7   1/1   Running   0   24h   10.128.2.24   compute-0
<none>          <none>
rook-ceph-osd-2-6c66cdb977-jp542   1/1   Running   0   24h   10.130.0.18   compute-1
<none>          <none>
```

In this example, **rook-ceph-osd-0-6d77d6c7c6-m8xj6** needs to be replaced and **compute-2** is the OCP node on which the OSD is scheduled.

> NOTE
>
> If the OSD to be replaced is healthy, the status of the pod will be **Running**.

2. Scale down the OSD deployment for the OSD to be replaced.

```
# osd_id_to_remove=0
# oc scale -n openshift-storage deployment rook-ceph-osd-${osd_id_to_remove} --replicas=0
```

where **osd_id_to_remove** is the integer in the pod name immediately after the **rook-ceph-osd** prefix. In this example, the deployment name is **rook-ceph-osd-0**.

Example output:

```
deployment.extensions/rook-ceph-osd-0 scaled
```

3. Verify that the **rook-ceph-osd** pod is terminated.

```
# oc get -n openshift-storage pods -l ceph-osd-id=${osd_id_to_remove}
```

Example output:

```
No resources found in openshift-storage namespace.
```

NOTE

If the **rook-ceph-osd** pod is in **terminating** state, use the **force** option to delete the pod.

```
# oc delete pod rook-ceph-osd-0-6d77d6c7c6-m8xj6 --grace-period=0 --force
```

Example output:

```
warning: Immediate deletion does not wait for confirmation that the running
resource has been terminated. The resource may continue to run on the
cluster indefinitely.
  pod "rook-ceph-osd-0-6d77d6c7c6-m8xj6" force deleted
```

4. Remove the old OSD from the cluster so that a new OSD can be added.

   a. Delete any old **ocs-osd-removal** jobs.

```
# oc delete job ocs-osd-removal-${osd_id_to_remove}
```

   Example output:

```
job.batch "ocs-osd-removal-0" deleted
```

   b. Remove the old OSD from the cluster

```
# oc process -n openshift-storage ocs-osd-removal -p
FAILED_OSD_ID=${osd_id_to_remove} | oc create -f -
```

> **WARNING**
>
> This step results in OSD being completely removed from the cluster. Make sure that the correct value of **osd_id_to_remove** is provided.

5. Verify that the OSD is removed successfully by checking the status of the **ocs-osd-removal** pod. A status of **Completed** confirms that the OSD removal job succeeded.

```
# oc get pod -l job-name=ocs-osd-removal-${osd_id_to_remove} -n openshift-storage
```

> **NOTE**
>
> If **ocs-osd-removal** fails and the pod is not in the expected **Completed** state, check the pod logs for further debugging. For example:
>
> ```
> # oc logs -l job-name=ocs-osd-removal-${osd_id_to_remove} -n openshift-storage --tail=-1
> ```

6. Delete the persistent volume claim (PVC) resources associated with the OSD to be replaced.

   a. Identify the **DeviceSet** associated with the OSD to be replaced.

   ```
   # oc get -n openshift-storage -o yaml deployment rook-ceph-osd-${osd_id_to_remove} | grep ceph.rook.io/pvc
   ```

   Example output:

   ```
   ceph.rook.io/pvc: ocs-deviceset-0-0-nvs68
       ceph.rook.io/pvc: ocs-deviceset-0-0-nvs68
   ```

   In this example, the PVC name is **ocs-deviceset-0-0-nvs68**.

   b. Identify the PV associated with the PVC.

   ```
   # oc get -n openshift-storage pvc ocs-deviceset-<x>-<y>-<pvc-suffix>
   ```

   where, **x**, **y**, and **pvc-suffix** are the values in the **DeviceSet** identified in an earlier step.

   Example output:

   ```
   NAME                    STATUS    VOLUME             CAPACITY   ACCESS MODES   STORAGECLASS   AGE
   ocs-deviceset-0-0-nvs68   Bound   local-pv-d9c5cbd6   100Gi      RWO            localblock     24h
   ```

   In this example, the associated PV is **local-pv-d9c5cbd6**.

   c. Identify the name of the device to be replaced.

```
# oc get pv local-pv-<pv-suffix> -o yaml | grep path
```

where, **pv-suffix** is the value in the PV name identified in an earlier step.

Example output:

```
path: /mnt/local-storage/localblock/sdb
```

In this example, the device name is **sdb**.

d. Identify the **prepare-pod** associated with the OSD to be replaced.

```
# oc describe -n openshift-storage pvc ocs-deviceset-<x>-<y>-<pvc-suffix> | grep
Mounted
```

where, **x**, **y**, and **pvc-suffix** are the values in the **DeviceSet** identified in an earlier step.

Example output:

```
Mounted By:    rook-ceph-osd-prepare-ocs-deviceset-0-0-nvs68-zblp7
```

In this example the **prepare-pod** name is **rook-ceph-osd-prepare-ocs-deviceset-0-0-nvs68-zblp7**.

e. Delete the **osd-prepare** pod before removing the associated PVC.

```
# oc delete -n openshift-storage pod rook-ceph-osd-prepare-ocs-deviceset-<x>-<y>-
<pvc-suffix>-<pod-suffix>
```

where, **x**, **y**, **pvc-suffix**, and **pod-suffix** are the values in the **osd-prepare** pod name identified in an earlier step.

Example output:

```
pod "rook-ceph-osd-prepare-ocs-deviceset-0-0-nvs68-zblp7" deleted
```

f. Delete the PVC associated with the OSD to be replaced.

```
# oc delete -n openshift-storage pvc ocs-deviceset-<x>-<y>-<pvc-suffix>
```

where, **x**, **y**, and **pvc-suffix** are the values in the **DeviceSet** identified in an earlier step.

Example output:

```
persistentvolumeclaim "ocs-deviceset-0-0-nvs68" deleted
```

7. Replace the old device and use the new device to create a new OpenShift Container Platform PV.

a. Log in to OpenShift Container Platform node with the device to be replaced. In this example, the OpenShift Container Platform node is **compute-2**.

```
# oc debug node/compute-2
```

Example output:

```
Starting pod/compute-2-debug ...
To use host binaries, run `chroot /host`
Pod IP: 10.70.56.66
If you don't see a command prompt, try pressing enter.
# chroot /host
```

b. Record the **/dev/disk/by-id/{id}** that is to be replaced using the device name, **sdb**, identified earlier.

```
# ls -alh /mnt/local-storage/localblock
```

Example output:

```
total 0
drwxr-xr-x. 2 root root 17 Apr  8 23:03 .
drwxr-xr-x. 3 root root 24 Apr  8 23:03 ..
lrwxrwxrwx. 1 root root 54 Apr  8 23:03 sdb -> /dev/disk/by-id/scsi-
36000c2962b2f613ba1f8f4c5cf952237
```

c. Find the name of the **LocalVolume** CR, and remove or comment out the device **/dev/disk/by-id/{id}** that is to be replaced.

```
# oc get -n local-storage localvolume
NAME          AGE
local-block   25h
```

```
# oc edit -n local-storage localvolume local-block
```

Example output:

```
[...]
  storageClassDevices:
  - devicePaths:
    - /dev/disk/by-id/scsi-36000c29346bca85f723c4c1f268b5630
    - /dev/disk/by-id/scsi-36000c29134dfcfaf2dfeeb9f98622786
#   - /dev/disk/by-id/scsi-36000c2962b2f613ba1f8f4c5cf952237
    storageClassName: localblock
    volumeMode: Block
[...]
```

Make sure to save the changes after editing the CR.

8. Log in to OpenShift Container Platform node with the device to be replaced and remove the old **symlink**.

```
# oc debug node/compute-2
```

Example output:

```
Starting pod/compute-2-debug ...
To use host binaries, run `chroot /host`
```

```
Pod IP: 10.70.56.66
If you don't see a command prompt, try pressing enter.
# chroot /host
```

a. Identify the old **symlink** for the device name to be replaced. In this example, the device name is **sdb**.

```
# ls -alh /mnt/local-storage/localblock
```

Example output:

```
total 0
drwxr-xr-x. 2 root root 28 Apr 10 00:42 .
drwxr-xr-x. 3 root root 24 Apr  8 23:03 ..
lrwxrwxrwx. 1 root root 54 Apr  8 23:03 sdb -> /dev/disk/by-id/scsi-
36000c2962b2f613ba1f8f4c5cf952237
```

b. Remove the **symlink**.

```
# rm /mnt/local-storage/localblock/sdb
```

c. Verify that the **symlink** is removed.

```
# ls -alh /mnt/local-storage/localblock
```

Example output:

```
total 0
drwxr-xr-x. 2 root root 17 Apr 10 00:56 .
drwxr-xr-x. 3 root root 24 Apr  8 23:03 ..
```

IMPORTANT

Both **/dev/mapper** and **/dev/** should be checked to see if there are orphans related to **ceph** before moving on. Use the results of **vgdisplay** to find these orphans. If there is anything in **/dev/mapper** or **/dev/ceph-*** with **ceph** in the name that is not from the list of VG Names, use **dmsetup** to remove it.

9. Delete the PV associated with the device to be replaced, which was identified in earlier steps. In this example, the PV name is **local-pv-d9c5cbd6**.

```
# oc delete pv local-pv-d9c5cbd6
```

Example output:

```
persistentvolume "local-pv-d9c5cbd6" deleted
```

10. Replace the device with the new device.

11. Log back into the correct OpenShift Cotainer Platform node and identify the device name for the new drive. The device name can be the same as the old device, but the **by-id** must change unless you are reseating the same device.

```
# lsblk
```

Example output:

```
NAME                       MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda                          8:0    0   60G  0 disk
|-sda1                       8:1    0  384M  0 part /boot
|-sda2                       8:2    0  127M  0 part /boot/efi
|-sda3                       8:3    0    1M  0 part
`-sda4                       8:4    0 59.5G  0 part
  `-coreos-luks-root-nocrypt 253:0    0 59.5G  0 dm   /sysroot
sdb                          8:16   0  100G  0 disk
```

In this example, the new device name is **sdb**.

a. Identify the **/dev/disk/by-id/{id}** for the new device and record it.

```
# ls -alh /dev/disk/by-id | grep sdb
```

Example output:

```
lrwxrwxrwx. 1 root root   9 Apr  9 20:45 scsi-36000c29f5c9638dec9f19b220fbe36b1 ->
../../sdb
```

12. After the new **/dev/disk/by-id/{id}** is available a new disk entry can be added to the **LocalVolume** CR.

a. Find the name of the **LocalVolume** CR.

```
# oc get -n local-storage localvolume
NAME          AGE
local-block   25h
```

b. Edit **LocalVolume** CR and add the new **/dev/disk/by-id/{id}**. In this example the new device is **/dev/disk/by-id/scsi-36000c29f5c9638dec9f19b220fbe36b1**.

```
# oc edit -n local-storage localvolume local-block
```

Example output:

```
[...]
  storageClassDevices:
  - devicePaths:
    - /dev/disk/by-id/scsi-36000c29346bca85f723c4c1f268b5630
    - /dev/disk/by-id/scsi-36000c29134dfcfaf2dfeeb9f98622786
#   - /dev/disk/by-id/scsi-36000c2962b2f613ba1f8f4c5cf952237
    - /dev/disk/by-id/scsi-36000c29f5c9638dec9f19b220fbe36b1
    storageClassName: localblock
    volumeMode: Block
[...]
```

Make sure to save the changes after editing the CR.

13. Verify that there is a new PV in **Available** state and of the correct size.

```
# oc get pv | grep 100Gi
```

Example output:

```
local-pv-3e8964d3                    100Gi      RWO            Delete           Bound        openshift-
storage/ocs-deviceset-2-0-79j94   localblock                          25h
local-pv-414755e0                    100Gi      RWO            Delete           Bound        openshift-
storage/ocs-deviceset-1-0-959rp   localblock                          25h
local-pv-b481410                    100Gi      RWO            Delete           Available
```

14. Create new OSD for new device.

    a. Delete the deployment for the OSD to be replaced.

    ```
    # osd_id_to_remove=0
    # oc delete -n openshift-storage deployment rook-ceph-osd-${osd_id_to_remove}
    ```

    Example output:

    ```
    deployment.extensions/rook-ceph-osd-0 deleted
    ```

    b. Deploy the new OSD by restarting the **rook-ceph-operator** to force operator reconciliation.

        i. Identify the name of the **rook-ceph-operator**.

        ```
        # oc get -n openshift-storage pod -l app=rook-ceph-operator
        ```

        Example output:

        ```
        NAME                                  READY   STATUS    RESTARTS   AGE
        rook-ceph-operator-6f74fb5bff-2d982   1/1     Running   0          1d20h
        ```

        ii. Delete the **rook-ceph-operator**.

        ```
        # oc delete -n openshift-storage pod rook-ceph-operator-6f74fb5bff-2d982
        ```

        Example output:

        ```
        pod "rook-ceph-operator-6f74fb5bff-2d982" deleted
        ```

        In this example, the rook-ceph-operator pod name is **rook-ceph-operator-6f74fb5bff-2d982**.

        iii. Verify that the **rook-ceph-operator** pod is restarted.

        ```
        # oc get -n openshift-storage pod -l app=rook-ceph-operator
        ```

        Example output:

        ```
        NAME                                  READY   STATUS    RESTARTS   AGE
        rook-ceph-operator-6f74fb5bff-7mvrq   1/1     Running   0          66s
        ```

Creation of the new OSD may take several minutes after the operator restarts.

### Verfication steps

- Verify that there is a new OSD running and a new PVC created.

  ```
  # oc get -n openshift-storage pods -l app=rook-ceph-osd
  ```

  Example output:

  ```
  rook-ceph-osd-0-5f7f4747d4-snshw                    1/1     Running     0        4m47s
  rook-ceph-osd-1-85d99fb95f-2svc7                    1/1     Running     0        1d20h
  rook-ceph-osd-2-6c66cdb977-jp542                    1/1     Running     0        1d20h
  ```

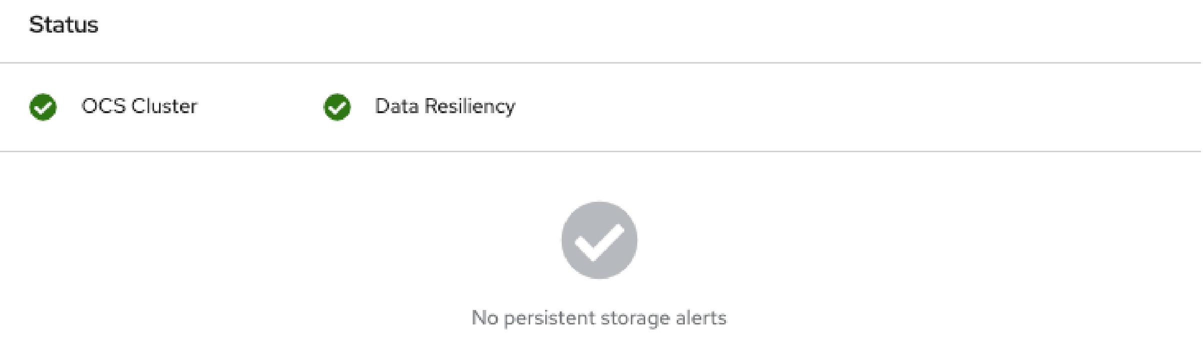
  ```
  # oc get -n openshift-storage pvc | grep localblock
  ```

  Example output:

  ```
  ocs-deviceset-0-0-c2mqb   Bound    local-pv-b481410                  100Gi     RWO
  localblock                5m
  ocs-deviceset-1-0-959rp   Bound    local-pv-414755e0                 100Gi     RWO
  localblock                1d20h
  ocs-deviceset-2-0-79j94   Bound    local-pv-3e8964d3                 100Gi     RWO
  localblock                1d20h
  ```

- Log in to OpenShift Web Console and view the storage dashboard.

  **Figure 10.2. OSD status in OpenShift Container Platform storage dashboard after device replacement**



# CHAPTER 11. UPDATING OPENSHIFT CONTAINER STORAGE

It is recommended to use the same version of Red Hat OpenShift Container Platform with Red Hat OpenShift Container Storage. Refer to this Red Hat Knowledgebase article for a complete OpenShift Container Platform and OpenShift Container Storage supportability and compatibility matrix.

First, you must update Red Hat OpenShift Container Platform ,and then, update Red Hat OpenShift Container Storage. If using Local Storage Operator, Local Storage Operator version must match with the Red Hat OpenShift Container Platform version in order to have the Local Storage Operator fully supported with Red Hat OpenShift Container Storage. Local Storage Operator does not get updated when Red Hat OpenShift Container Platform is updated. To check if your OpenShift Container Storage cluster uses the Local Storage Operator, see the Checking for Local Storage Operator deployments section of the Troubleshooting Guide.

IMPORTANT

If your cluster was deployed using local storage devices and uses the Local Storage Operator in Openshift Container Storage version 4.3, you must re-install the cluster and not update to version 4.4. For details on installation, see Installing OpenShift Container Storage using local storage devices.

## 11.1. ENABLING AUTOMATIC UPDATES FOR OPENSHIFT CONTAINER STORAGE OPERATOR

Use this procedure to enable automatic update approval for updating OpenShift Container Storage operator in OpenShift Container Platform.

### Prerequisites

- Update the OpenShift Container Platform cluster to the latest stable release of version 4.3.X or 4.4.Y, see Updating Clusters.
- Switch the Red Hat OpenShift Container Storage channel channel from **stable-4.3** to **stable-4.4**. For details about channels, see OpenShift Container Platform upgrade channels and releases.

  NOTE

  You are required to switch channels only when you are updating minor versions (for example, updating from 4.3 to 4.4) and not when updating between batch updates of 4.4 (for example, updating from 4.4.0 to 4.4.1).

- Ensure that all OpenShift Container Storage nodes are in **Ready** status.
- Under **Persistent Storage** in **Status** card, confirm that the Ceph cluster is healthy and data is resilient.
- Ensure that you have sufficient time to complete the Openshift Container Storage (OCS) update process, as the update time varies depending on the number of OSDs that run in the cluster.

### Procedure

1. Log in to OpenShift Web Console.

2. Click **Operators → Installed Operators**

3. Select the **openshift-storage** project.

4. Click on the OpenShift Container Storage operator name.

5. Click **Subscription** tab and click the link under **Approval**.

6. Select **Automatic (default)** and click **Save**.

7. Perform one of the following depending on the **Upgrade Status**:

    - **Upgrade Status** *shows* **requires approval**.

        a. Click on the **Install Plan** link.

        b. On the **InstallPlan Details** page, click **Preview Install Plan**.

        c. Review the install plan and click **Approve**.

        d. Wait for the **Status** to change from **Unknown** to **Created**.

        e. Click **Operators → Installed Operators**

        f. Select the **openshift-storage** project.

        g. Wait for the **Status** to change to **Up to date**

    - **Upgrade Status** *does not show* **requires approval**:

        a. Wait for the update to initiate. This may take up to 20 minutes.

        b. Click **Operators → Installed Operators**

        c. Select the **openshift-storage** project.

        d. Wait for the **Status** to change to **Up to date**

### Verification steps

1. Click **Overview → Persistent Storage** tab and in **Status** card confirm that the OpenShift Container Storage cluster has a green tick mark indicating it is healthy.

2. Click **Operators → Installed Operators → OpenShift Container Storage Operator**.

3. Under **Storage Cluster**, verify that the cluster service status in **Ready**.

    > NOTE
    >
    > Once updated from OpenShift Container Storage version 4.3 to 4.4, the **Version** field here will still display 4.3. This is because the **ocs-operator** does not update the string represented in this field.

4. If verification steps fail, kindly contact Red Hat Support .

## 11.2. MANUALLY UPDATING OPENSHIFT CONTAINER STORAGE OPERATOR

Use this procedure to update OpenShift Container Storage operator by providing manual approval to the install plan.

### Prerequisites

- Update the OpenShift Container Platform cluster to the latest stable release of version 4.3.X or 4.4.Y, see Updating Clusters.
- Switch the Red Hat OpenShift Container Storage channel channel from **stable-4.3** to **stable-4.4**. For details about channels, see OpenShift Container Platform upgrade channels and releases.

  > NOTE
  >
  > You are required to switch channels only when you are updating minor versions (for example, updating from 4.3 to 4.4) and not when updating between batch updates of 4.4 (for example, updating from 4.4.0 to 4.4.1).

- Ensure that all OpenShift Container Storage nodes are in **Ready** status.
- Under **Persistent Storage** in **Status** card, confirm that the Ceph cluster is healthy and data is resilient.
- Ensure that you have sufficient time to complete the Openshift Container Storage (OCS) update process, as the update time varies depending on the number of OSDs that run in the cluster.

### Procedure

1. Log in to OpenShift Web Console.
2. Click **Operators → Installed Operators**
3. Select the **openshift-storage** project.
4. Click **Subscription** tab and click the link under **Approval**.
5. Select **Manual** and click **Save**.
6. Wait for the **Upgrade Status** to change to **Upgrading**.
7. If the **Upgrade Status** shows **requires approval**, click on **requires approval**.
8. On the **InstallPlan Details** page, click **Preview Install Plan**.
9. Review the install plan and click **Approve**.
10. Wait for the **Status** to change from **Unknown** to **Created**.
11. Click **Operators → Installed Operators**
12. Select the **openshift-storage** project.

13. Wait for the **Status** to change to **Up to date**

### Verification steps

1. Click **Overview → Persistent Storage** tab and in **Status** card confirm that the Ceph cluster has a green tick mark indicating it is healthy.

2. Click **Operators** → **Installed Operators** → **OpenShift Container Storage Operator**.

3. Under **Storage Cluster**, verify that the cluster service status in **Ready**.

NOTE

Once updated from OpenShift Container Storage version 4.3 to 4.4, the **Version** field here will still display 4.3. This is because the **ocs-operator** does not update the string represented in this field.

4. If verification steps fail, kindly contact Red Hat Support .