# Red Hat OpenShift Container Storage 4.8

## Deploying OpenShift Container Storage using Amazon Web Services

How to install and set up OpenShift Container Storage on OpenShift Container Platform AWS Clusters

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## Legal Notice



## Abstract

Read this document for instructions on installing Red Hat OpenShift Container Storage 4.8 using Amazon Web Services for cloud storage.

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# MAKING OPEN SOURCE MORE INCLUSIVE

Red Hat is committed to replacing problematic language in our code, documentation, and web properties. We are beginning with these four terms: master, slave, blacklist, and whitelist. Because of the enormity of this endeavor, these changes will be implemented gradually over several upcoming releases. For more details, see our CTO Chris Wright's message.

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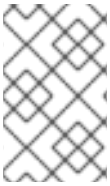
# PREFACE

Red Hat OpenShift Container Storage 4.8 supports deployment on existing Red Hat OpenShift Container Platform (RHOCP) AWS clusters in connected or disconnected environments along with out-of-the-box support for proxy environments.



**NOTE**

Only internal Openshift Container Storage clusters are supported on AWS. See Planning your deployment and Preparing to deploy OpenShift Container Storage for more information about deployment requirements.

To deploy OpenShift Container Storage, start with the requirements in Preparing to deploy OpenShift Container Storage chapter and then follow the deployment process for your environment:

- Deploy using dynamic storage devices

# CHAPTER 1. PREPARING TO DEPLOY OPENSHIFT CONTAINER STORAGE

Deploying OpenShift Container Storage on OpenShift Container Platform using dynamic storage devices provides you with the option to create internal cluster resources. This will result in the internal provisioning of the base services, which helps to make additional storage classes available to applications.

Before you begin the deployment of Red Hat OpenShift Container Storage, follow these steps:

1. For Red Hat Enterprise Linux based hosts for worker nodes, enable file system access for containers on Red Hat Enterprise Linux based nodes.

**NOTE**

Skip this step for Red Hat Enterprise Linux CoreOS (RHCOS).

2. Optional: If you want to enable cluster-wide encryption using an external Key Management System (KMS):
   - Ensure that a policy with a token exists and the key value backend path in Vault is enabled. See Enabling the key value backend path and policy in Vault .
   - Ensure that you are using signed certificates on your Vault servers.
3. Minimum starting node requirements [Technology Preview]
   An OpenShift Container Storage cluster will be deployed with minimum configuration when the standard deployment resource requirement is not met. See Resource requirements section in Planning guide.

## 1.1. ENABLING FILE SYSTEM ACCESS FOR CONTAINERS ON RED HAT ENTERPRISE LINUX BASED NODES

Deploying OpenShift Container Storage on an OpenShift Container Platform with worker nodes on a Red Hat Enterprise Linux base in a user provisioned infrastructure (UPI) does not automatically provide container access to the underlying Ceph file system.

**NOTE**

Skip this section for hosts based on Red Hat Enterprise Linux CoreOS (RHCOS).

**Procedure**

1. Log in to the Red Hat Enterprise Linux based node and open a terminal.
2. For each node in your cluster:
   a. Verify that the node has access to the rhel-7-server-extras-rpms repository.

```
# subscription-manager repos --list-enabled | grep rhel-7-server
```

   If you do not see both **rhel-7-server-rpms** and **rhel-7-server-extras-rpms** in the output, or if there is no output, run the following commands to enable each repository.

```
# subscription-manager repos --enable=rhel-7-server-rpms
# subscription-manager repos --enable=rhel-7-server-extras-rpms
```

b. Install the required packages.

```
# yum install -y policycoreutils container-selinux
```

c. Persistently enable container use of the Ceph file system in SELinux.

```
# setsebool -P container_use_cephfs on
```

## 1.2. ENABLING KEY VALUE BACKEND PATH AND POLICY IN VAULT

**Prerequisites**

- Administrator access to Vault.
- Choose a unique path name as the backend **path** that follows the naming convention since it cannot be changed later.

**Procedure**

1. Enable the Key/Value (KV) backend path in Vault.
   For Vault KV secret engine API, version 1:

   ```
   $ vault secrets enable -path=ocs kv
   ```

   For Vault KV secret engine API, version 2:

   ```
   $ vault secrets enable -path=ocs kv-v2
   ```

2. Create a policy to restrict users to perform a write or delete operation on the secret using the following commands:

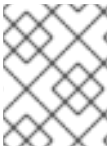
   ```
   echo '
   path "ocs/*" {
     capabilities = ["create", "read", "update", "delete", "list"]
   }
   path "sys/mounts" {
   capabilities = ["read"]
   }'| vault policy write ocs -
   ```

3. Create a token matching the above policy:

   ```
   $ vault token create -policy=ocs -format json
   ```

# CHAPTER 2. DEPLOY USING DYNAMIC STORAGE DEVICES

Deploying OpenShift Container Storage on OpenShift Container Platform using dynamic storage devices provided by AWS EBS (type: gp2) provides you with the option to create internal cluster resources. This will result in the internal provisioning of the base services, which helps to make additional storage classes available to applications.



**NOTE**

Only internal Openshift Container Storage clusters are supported on AWS. See Planning your deployment for more information about deployment requirements.

Also, ensure that you have addressed the requirements in Preparing to deploy OpenShift Container Storage chapter before proceeding with the below steps for deploying using dynamic storage devices:

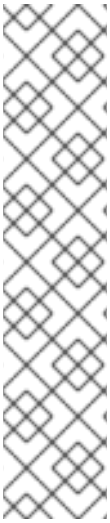
1. Install the Red Hat OpenShift Container Storage Operator .
2. Create the OpenShift Container Storage Cluster Service .

## 2.1. INSTALLING RED HAT OPENSHIFT CONTAINER STORAGE OPERATOR

You can install Red Hat OpenShift Container Storage Operator using the Red Hat OpenShift Container Platform Operator Hub.

**Prerequisites**

- Access to an OpenShift Container Platform cluster using an account with cluster-admin and operator installation permissions.
- You have at least three worker nodes in the Red Hat OpenShift Container Platform cluster.
- You have satisfied any additional requirements required. For more information, see Planning your deployment.



**NOTE**

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

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

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

**Procedure**

1. Log in to OpenShift Web Console.

2. Click **Operators → OperatorHub**.
3. Search for **OpenShift Container Storage** from the list of operators and click on it.
4. Click **Install**.
5. Set the following options on the **Install Operator** page:
    a. Channel as **stable-4.8**.
    b. Installation Mode as **A specific namespace on the cluster**
    c. Installed Namespace as **Operator recommended namespace openshift-storage**. If Namespace **openshift-storage** does not exist, it will be created during the operator installation.
    d. **Approval Strategy** as **Automatic** or **Manual**.
    e. Click **Install**.
    If you select **Automatic** updates, the Operator Lifecycle Manager (OLM) automatically upgrades the running instance of your operator without any intervention.

    If you select **Manual** updates, the OLM creates an update request. As a cluster administrator, you must then manually approve that update request to have the operator updated to the new version.

**Verification step**

- Verify that the **OpenShift Container Storage** Operator shows a green tick indicating successful installation.

## 2.2. CREATING AN OPENSHIFT CONTAINER STORAGE CLUSTER SERVICE IN INTERNAL MODE

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

**Prerequisites**

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

**Procedure**

1. Log into the OpenShift Web Console.
2. Click **Operators → Installed Operators** to view all the installed operators.
Ensure that the **Project** selected is **openshift-storage**.
3. Click **OpenShift Container Storage** > **Create Instance** link of Storage Cluster.
4. **Select Mode** is set to **Internal** by default.
5. Select **Capacity and nodes**
    a. Select **Storage Class**. By default, it is set to **gp2**.

b. Select **Requested Capacity** from the drop down list. It is set to **2 TiB** by default. You can use the drop down to modify the capacity value.

**NOTE**

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

c. In the **Select Nodes** section, select at least three available nodes.
For cloud platforms with multiple availability zones, ensure that the Nodes are spread across different Locations/availability zones.

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

d. Click **Next**.

6. (Optional) Set **Security and network** configuration

a. Select the **Enable encryption** checkbox to encrypt block and file storage.

b. Choose any one or both **Encryption level**:

- **Cluster-wide encryption** to encrypt the entire cluster (block and file).
- **Storage class encryption** to create encrypted persistent volume (block only) using encryption enabled storage class.

c. Select the **Connect to an external key management service** checkbox. This is optional for cluster-wide encryption.

i. **Key Management Service Provider** is set to **Vault** by default.

ii. Enter Vault **Service Name**, host **Address** of Vault server ('https://<hostname or ip>'), **Port number** and **Token**.

iii. Expand **Advanced Settings** to enter additional settings and certificate details based on your Vault configuration:

A. Enter the Key Value secret path in **Backend Path** that is dedicated and unique to OpenShift Container Storage.

B. (Optional) Enter **TLS Server Name** and **Vault Enterprise Namespace**.

C. Provide **CA Certificate**, **Client Certificate** and **Client Private Key** by uploading the respective PEM encoded certificate file.

D. Click **Save**.

7. Select **Default** (SDN) if you are using a single network or **Custom** (Multus) Network if you plan on using multiple network interfaces.

a. Select a **Public Network Interface** from drop down.

b. Select a **Cluster Network Interface** from drop down.

**NOTE**

If only using one additional network interface select the single NetworkAttachementDefinition (i.e. ocs-public-cluster) for the Public Network Interface and leave the Cluster Network Interface blank.

8. Click **Next**.
9. Review the configuration details. To modify any configuration settings, click **Back** to go back to the previous configuration page.
10. Click **Create**.
11. Edit the configmap if Vault Key/Value (KV) secret engine API, version 2 is used for cluster-wide encryption with Key Management System (KMS).
    a. On the OpenShift Web Console, navigate to **Workloads → ConfigMaps**.
    b. To view the KMS connection details, click **ocs-kms-connection-details**.
    c. Edit the configmap.
        i. Click **Action menu ( ⋮ ) → Edit ConfigMap**
        ii. Set the **VAULT_BACKEND** parameter to **v2**.

```
kind: ConfigMap
apiVersion: v1
metadata:
  name: ocs-kms-connection-details
[...]
data:
  KMS_PROVIDER: vault
  KMS_SERVICE_NAME: vault
[...]
  VAULT_BACKEND: v2
[...]
```

        iii. Click **Save**.

**Verification steps**

1. On the storage cluster details page, the storage cluster name displays a green tick next to it to indicate that the cluster was created successfully.
2. Verify that the final **Status** of the installed storage cluster shows as **Phase: Ready** with a green tick mark.
    - Click **Operators → Installed Operators → Storage Cluster**link to view the storage cluster installation status.
    - Alternatively, when you are on the Operator **Details** tab, you can click on the **Storage Cluster** tab to view the status.
3. To verify that all components for OpenShift Container Storage are successfully installed, see Verifying your OpenShift Container Storage installation .

# CHAPTER 3. VERIFYING OPENSHIFT CONTAINER STORAGE DEPLOYMENT

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

## 3.1. VERIFYING THE STATE OF THE PODS

To verify that the pods of OpenShift Containers Storage are in running state, follow the below procedure:

**Procedure**

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

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

| Component | Corresponding pods |
|---|---|
| OpenShift Container Storage Operator | • **ocs-operator-*** (1 pod on any worker node)<br>• **ocs-metrics-exporter-*** |
| Rook-ceph Operator | **rook-ceph-operator-***<br>(1 pod on any worker node) |
| Multicloud Object Gateway | • **noobaa-operator-*** (1 pod on any worker node)<br>• **noobaa-core-*** (1 pod on any storage node)<br>• **noobaa-db-pg-*** (1 pod on any storage node)<br>• **noobaa-endpoint-*** (1 pod on any storage node) |
| MON | **rook-ceph-mon-***<br>(3 pods distributed across storage nodes) |

| Component | Corresponding pods |
|---|---|
| MGR | **rook-ceph-mgr-***<br><br>(1 pod on any storage node) |
| MDS | **rook-ceph-mds-ocs-storagecluster-cephfilesystem-***<br><br>(2 pods distributed across storage nodes) |
| CSI | • **cephfs**<br>  ◦ **csi-cephfsplugin-*** (1 pod on each worker node)<br>  ◦ **csi-cephfsplugin-provisioner-*** (2 pods distributed across worker nodes)<br>• **rbd**<br>  ◦ **csi-rbdplugin-*** (1 pod on each worker node)<br>  ◦ **csi-rbdplugin-provisioner-*** (2 pods distributed across worker nodes) |
| rook-ceph-crashcollector | **rook-ceph-crashcollector-***<br><br>(1 pod on each storage node) |
| OSD | • **rook-ceph-osd-*** (1 pod for each device)<br>• **rook-ceph-osd-prepare-ocs-deviceset-*** (1 pod for each device) |

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

To verify that the cluster of OpenShift Container Storage is healthy, follow the steps in the procedure.

**Procedure**

1. Click **Storage → Overview** and click the **Block and File** tab.
2. In the **Status card**, verify that *Storage Cluster* and *Data Resiliency* has a green tick mark.
3. In the **Details card**, verify that the cluster information is displayed.

For more information on the health of the OpenShift Container Storage clusters using the Block and File dashboard, see Monitoring OpenShift Container Storage .

## 3.3. VERIFYING THE MULTICLOUD OBJECT GATEWAY IS HEALTHY

To verify that the OpenShift Container Storage Multicloud Object Gateway is healthy, follow the steps in the procedure.

**Procedure**

1. Click **Storage → Overview** from the OpenShift Web Console and click the **Object** tab.
2. In the **Status card**, verify that both *Object Service* and *Data Resiliency* are in **Ready** state (green tick).
3. In the **Details card**, verify that the Multicloud Object Gateway information is displayed.

For more information on the health of the OpenShift Container Storage cluster using the object service dashboard, see Monitoring OpenShift Container Storage .

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

To verify the storage classes exists in the cluster, follow the steps in the procedure.

**Procedure**

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

# CHAPTER 4. UNINSTALLING OPENSHIFT CONTAINER STORAGE

## 4.1. UNINSTALLING OPENSHIFT CONTAINER STORAGE IN INTERNAL MODE

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

### Uninstall Annotations

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

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

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

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

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

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

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

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

**Prerequisites**

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

**Procedure**

1. Delete the volume snapshots that are using OpenShift Container Storage.
   a. List the volume snapshots from all the namespaces.

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

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

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

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

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

   a. Delete OpenShift Container Platform monitoring stack PVCs using OpenShift Container Storage.
      For more information, see Section 4.2, “Removing monitoring stack from OpenShift Container Storage”.

   b. Delete OpenShift Container Platform Registry PVCs using OpenShift Container Storage.
      For more information, see Section 4.3, “Removing OpenShift Container Platform registry from OpenShift Container Storage”.

   c. Delete OpenShift Container Platform logging PVCs using OpenShift Container Storage.
      For more information, see Section 4.4, “Removing the cluster logging operator from OpenShift Container Storage”.

   d. Delete other PVCs and OBCs provisioned using OpenShift Container Storage.

      - Following script is sample script to identify the PVCs and OBCs provisioned using OpenShift Container Storage. The script ignores the PVCs that are used internally by

Openshift Container Storage.

```
#!/bin/bash

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

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

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

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

**NOTE**

Omit **RGW_PROVISIONER** for cloud platforms.

- Delete the OBCs.

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

- Delete the PVCs.

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

**NOTE**

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

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

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

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

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

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

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

6. If encryption was enabled at the time of install, remove **dm-crypt** managed **device-mapper** mapping from OSD devices on all the OpenShift Container Storage nodes.

   a. Create a **debug** pod and **chroot** to the host on the storage node.

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

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

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

   c. Remove the mapped device.

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

NOTE

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

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

```
$ ps -ef | grep crypt
```

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

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

- Verify that the device name is removed.

```
$ dmsetup ls
```

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

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

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

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

NOTE

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

8. Unlabel the storage nodes.

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

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

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

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

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

11. Delete the Multicloud Object Gateway storageclass.

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

12. Remove **CustomResourceDefinitions**.

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

13. Optional: To ensure that the vault keys are deleted permanently you need to manually delete the metadata associated with the vault key.

NOTE

Execute this step only if Vault Key/Value (KV) secret engine API, version 2 is used for cluster-wide encryption with Key Management System (KMS) since the vault keys are marked as deleted and not permanently deleted during the uninstallation of OpenShift Container Storage. You can always restore it later if required.

a. List the keys in the vault.

```
$ vault kv list <backend_path>
```

***<backend_path>***

Is the path in the vault where the encryption keys are stored.
For example:

```
$ vault kv list kv-v2
```

Example output:

```
Keys
-----
NOOBAA_ROOT_SECRET_PATH/
rook-ceph-osd-encryption-key-ocs-deviceset-thin-0-data-0m27q8
rook-ceph-osd-encryption-key-ocs-deviceset-thin-1-data-0sq227
rook-ceph-osd-encryption-key-ocs-deviceset-thin-2-data-0xzszb
```

b. List the metadata associated with the vault key.

```
$ vault kv get kv-v2/<key>
```

For the Multicloud Object Gateway (MCG) key:

```
$ vault kv get kv-v2/NOOBAA_ROOT_SECRET_PATH/<key>
```

***<key>***

Is the encryption key.
For Example:

```
$ vault kv get kv-v2/rook-ceph-osd-encryption-key-ocs-deviceset-thin-0-data-0m27q8
```

Example output:

```
====== Metadata ======
Key              Value
---              -----
created_time     2021-06-23T10:06:30.650103555Z
deletion_time    2021-06-23T11:46:35.045328495Z
destroyed        false
version          1
```

c. Delete the metadata.

```
$ vault kv metadata delete kv-v2/<key>
```

For the MCG key:

```
$ vault kv metadata delete kv-v2/NOOBAA_ROOT_SECRET_PATH/<key>
```

***<key>***

Is the encryption key.
For Example:

```
$ vault kv metadata delete kv-v2/rook-ceph-osd-encryption-key-ocs-deviceset-thin-0-data-0m27q8
```

Example output:

```
Success! Data deleted (if it existed) at: kv-v2/metadata/rook-ceph-osd-encryption-key-ocs-deviceset-thin-0-data-0m27q8
```

d. Repeat these steps to delete the metadata associated with all the vault keys.

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

a. Click **Storage**.

b. Verify that **Overview** no longer appears under Storage.

## 4.2. REMOVING MONITORING STACK FROM OPENSHIFT CONTAINER STORAGE

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

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

### Prerequisites

- PVCs are configured to use OpenShift Container Platform monitoring stack.
  For information, see configuring monitoring stack.

### Procedure

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

```
$ oc get pod,pvc -n openshift-monitoring
NAME                        READY   STATUS    RESTARTS   AGE
pod/alertmanager-main-0     3/3     Running   0          8d
pod/alertmanager-main-1     3/3     Running   0          8d
pod/alertmanager-main-2     3/3     Running   0          8d
pod/cluster-monitoring-
```

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

NAME                                                STATUS   VOLUME
CAPACITY   ACCESS MODES   STORAGECLASS                AGE
persistentvolumeclaim/my-alertmanager-claim-alertmanager-main-0   Bound    pvc-0d519c4f-
15a5-11ea-baa0-026d231574aa   40Gi       RWO            ocs-storagecluster-ceph-rbd   8d
persistentvolumeclaim/my-alertmanager-claim-alertmanager-main-1   Bound    pvc-
0d5a9825-15a5-11ea-baa0-026d231574aa   40Gi       RWO            ocs-storagecluster-ceph-
rbd   8d
persistentvolumeclaim/my-alertmanager-claim-alertmanager-main-2   Bound    pvc-
0d6413dc-15a5-11ea-baa0-026d231574aa   40Gi       RWO            ocs-storagecluster-ceph-
rbd   8d
persistentvolumeclaim/my-prometheus-claim-prometheus-k8s-0        Bound    pvc-0b7c19b0-
15a5-11ea-baa0-026d231574aa   40Gi       RWO            ocs-storagecluster-ceph-rbd   8d
persistentvolumeclaim/my-prometheus-claim-prometheus-k8s-1        Bound    pvc-0b8aed3f-
15a5-11ea-baa0-026d231574aa   40Gi       RWO            ocs-storagecluster-ceph-rbd   8d
```

2. Edit the monitoring **configmap**.

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

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

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

**After editing**

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

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

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

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

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

To clean the OpenShift Container Platform registry from OpenShift Container Storage, follow the steps in the procedure.

If you want to configure an alternative storage, see image registry

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

### Prerequisites

- The image registry must be configured to use an OpenShift Container Storage PVC.

### Procedure

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

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

**Before editing**

```
.
.
.
storage:
   pvc:
      claim: registry-cephfs-rwx-pvc
.
.
.
```

**After editing**

```
.
.
.
storage:
.
.
.
```

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

2. Delete the PVC.

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

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

To clean the cluster logging operator from the OpenShift Container Storage, follow the steps in the procedure.

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

### Prerequisites

- The cluster logging instance must be configured to use OpenShift Container Storage PVCs.

### Procedure

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

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

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

2. Delete PVCs.

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