Red Hat OpenShift Container Storage 4.5

Deploying OpenShift Container Storage on VMware vSphere

How to install OpenShift Container Storage on Red Hat OpenShift Container Platform VMware vSphere clusters

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Legal Notice

Abstract

Read this document for instructions on installing Red Hat OpenShift Container Storage 4.5 on Red Hat OpenShift Container Platform VMware vSphere clusters.

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PREFACE

Red Hat OpenShift Container Storage 4.5 supports deployment on existing Red Hat OpenShift Container Platform (OCP) vSphere clusters in connected or disconnected environments along with out-of-the-box support for proxy environments.

NOTE

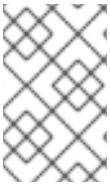
Both internal and external Openshift Container Storage clusters are supported on VMware vSphere. See Planning your deployment for more information about deployment requirements.

To deploy OpenShift Container Storage, follow the appropriate deployment process for your environment:

- Internal mode
  - Deploy using dynamic storage devices
  - Deploy using local storage devices
- External mode

CHAPTER 1. DEPLOY USING DYNAMIC STORAGE DEVICES

Deploying OpenShift Container Storage on OpenShift Container Platform using dynamic storage devices provided by VMware vSphere (disk format: thin) 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

Both internal and external Openshift Container Storage clusters are supported on VMware vSphere. See Planning your deployment for more information about deployment requirements.

Follow the below steps for deployment:

1. For Red Hat Enterprise Linux based hosts in a user provisioned infrastructure (UPI), enable the container access to the underlying file system. Follow the instructions on enabling file system access for containers on Red Hat Enterprise Linux based nodes.

   NOTE

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

2. Install the Red Hat OpenShift Container Storage Operator .

3. Create the OpenShift Container Storage Cluster Service .

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

Deploying OpenShift Container Platform 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

This process is not necessary for hosts based on Red Hat Enterprise Linux CoreOS.

Procedure

Perform the following steps on each node in your cluster.

1. Log in to the Red Hat Enterprise Linux based node and open a terminal.

2. 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
   ```

3. Install the required packages.

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

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

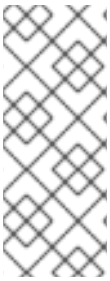
```
# setsebool -P container_use_cephfs on
```

1.2. 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. For information about the hardware and software requirements, see Planning your deployment.

Prerequisites

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



NOTE

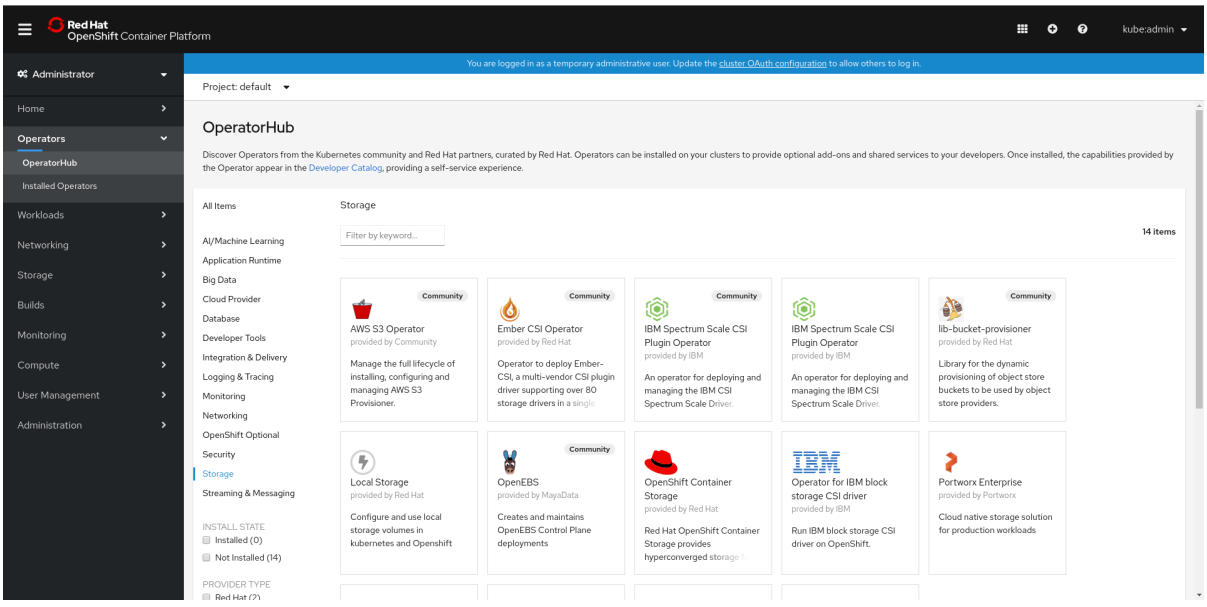
When you need to override the cluster-wide default node selector for OpenShift Container Storage, you can use the following command in command line interface to specify a blank node selector for the **openshift-storage** namespace:

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

Procedure

1. Click **Operators → OperatorHub** in the left pane of the OpenShift Web Console.

Figure 1.1. List of operators in the Operator Hub



2. Click on **OpenShift Container Storage**.

You can use the **Filter by keyword** text box or the filter list to search for OpenShift Container Storage from the list of operators.

3. On the OpenShift Container Storage operator page, click **Install**.

4. On the **Install Operator** page, ensure the following options are selected:

   a. Update Channel as **stable-4.5**

   b. Installation Mode as **A specific namespace on the cluster**

   c. Installed Namespace as **Operator recommended namespace PR openshift-storage**. If Namespace **openshift-storage** does not exist, it will be created during the operator installation.

   d. Select **Approval Strategy** as **Automatic** or **Manual**. Approval Strategy is set to **Automatic** by default.

   - **Approval Strategy** as **Automatic**.

NOTE

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

     i. Click **Install**

     ii. Wait for the install to initiate. This may take up to 20 minutes.

     iii. Click **Operators → Installed Operators**

     iv. Ensure the **Project** is **openshift-storage**. By default, the **Project** is **openshift-storage**.

     v. Wait for the **Status** of **OpenShift Container Storage** to change to **Succeeded**.

   - **Approval Strategy** as **Manual**.

NOTE

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

     i. Click **Install**.

     ii. On the **Installed Operators** page, click **ocs-operator**.

     iii. On the **Subscription Details** page, click the **Install Plan** link.

     iv. On the **InstallPlan Details** page, click **Preview Install Plan**.

     v. Review the install plan and click **Approve**.

vi. Wait for the **Status** of the **Components** to change from **Unknown** to either **Created** or **Present**.

vii. Click **Operators → Installed Operators**

viii. Ensure the **Project** is **openshift-storage**. By default, the **Project** is **openshift-storage**.

ix. Wait for the **Status** of **OpenShift Container Storage** to change to **Succeeded**.

Verification steps

- Verify that OpenShift Container Storage Operator shows the Status as **Succeeded** on the Installed Operators dashboard.

1.3. 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.

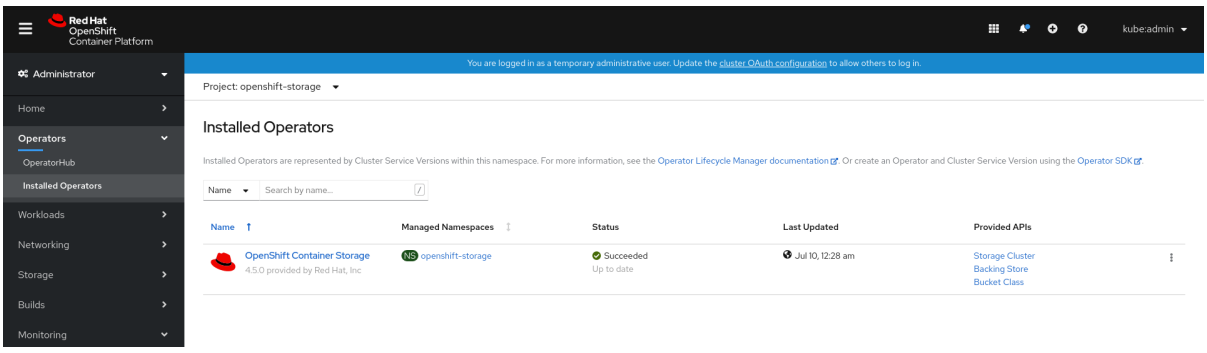
Prerequisites

- 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 .
- For VMs on VMware, ensure the **disk.EnableUUID** option is set to **TRUE**. You need to have vCenter account privileges to configure the VMs. For more information, see Required vCenter account privileges. To set the **disk.EnableUUID** option, use the **Advanced** option of the **VM Options** in the **Customize hardware tab**. For more information, see Creating Red Hat Enterprise Linux CoreOS (RHCOS) machines in vSphere.

Procedure

1. Click **Operators → Installed Operators** from the OpenShift Web Console to view the installed operators. Ensure that the **Project** selected is **openshift-storage**.
2. On the **Installed Operators** page, click **Openshift Container Storage**.

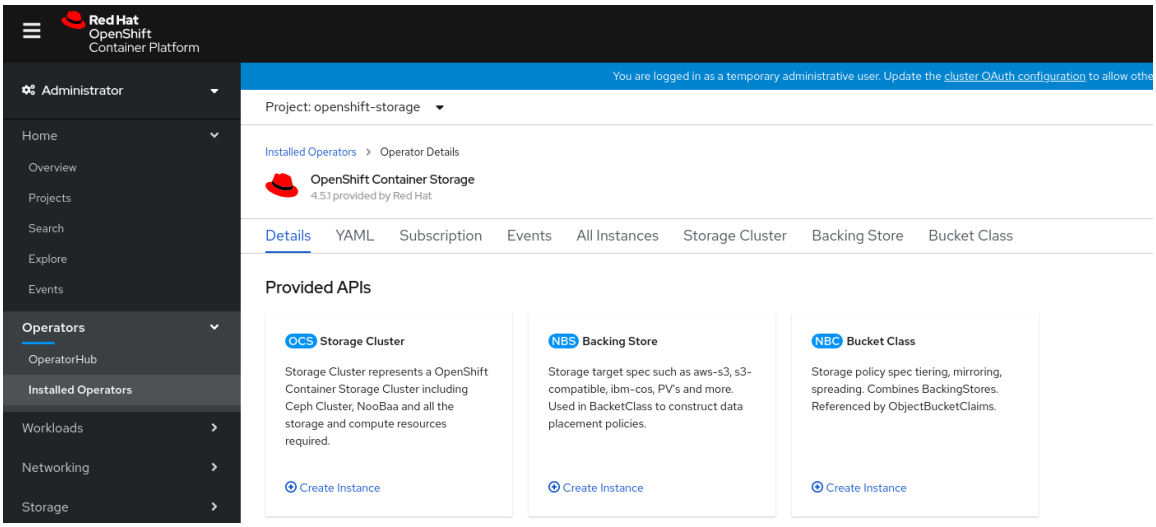
   Figure 1.2. OpenShift Container Storage Operator page



3. On the **Installed Operators → Operator Details** page, perform either of the following to create a Storage Cluster Service.

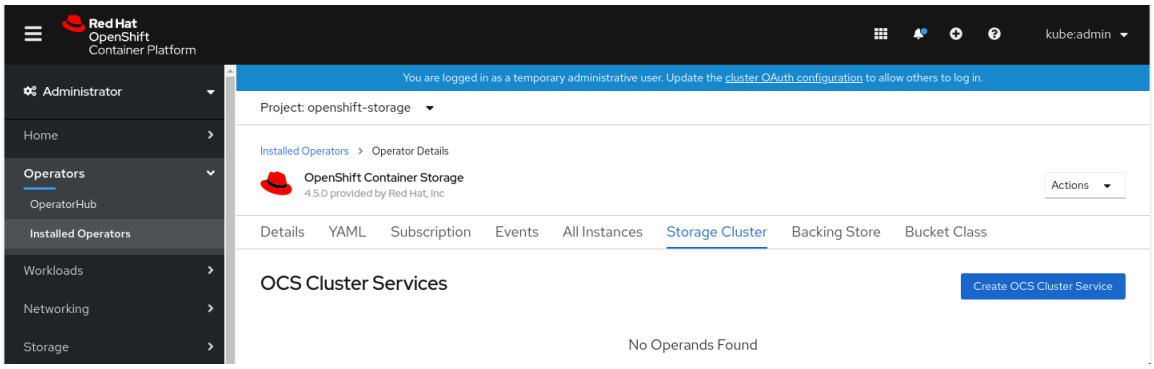
   a. On the **Details tab → Provided APIs → OCS Storage Cluster** click **Create Instance**.

Figure 1.3. Operator Details Page



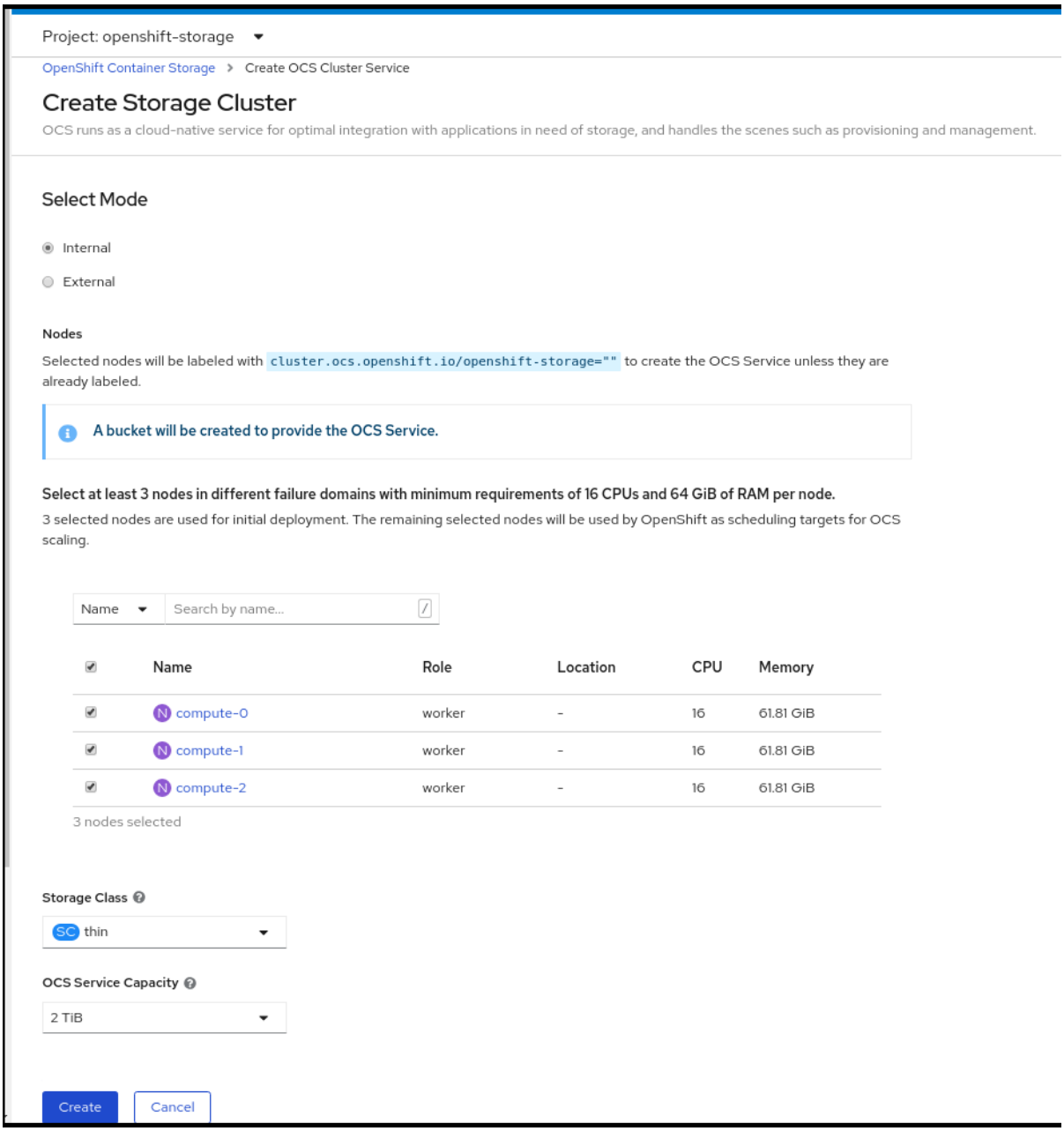
b. Alternatively, select the **Storage cluster** tab and click **Create OCS Cluster Service**.

Figure 1.4. Storage Cluster tab



4. On the **Create Storage Cluster** page, ensure that the following options are selected:

Figure 1.5. Create Storage Cluster page



a. By default, Select Mode has **Internal** selected.

b. In the **Nodes** section, for the use of OpenShift Container Storage service, select a minimum of three or a multiple of three worker nodes from the available list.
It is recommended that the worker nodes are spread across three different physical nodes, racks or failure domains for high availability.

NOTE

- To find specific worker nodes in the cluster, you can filter nodes on the basis of Name or Label.
  - Name allows you to search by name of the node
  - Label allows you to search by selecting the predefined label
- Use vCenter anti-affinity to align OpenShift Container Storage rack labels with physical nodes and racks in the data center to avoid scheduling two worker nodes on the same physical chassis.

For minimum starting node requirements, see Resource requirements section in Planning guide.

c. **Storage Class** is set by default to **thin** for VMware.

d. Select **OCS Service Capacity** from drop down list.

NOTE

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

5. Click **Create**.

NOTE

The **Create** button is enabled only after selecting a minimum of three worker nodes.

Upon successful deployment, a storage cluster with three storage devices gets created. These devices get distributed across three of the selected nodes. The configuration uses a replication factor of 3. To scale the initial cluster, see Scaling storage nodes .

Verification steps

- To verify that OpenShift Container Storage is successfully installed, see Verifying your OpenShift Container Storage installation.

CHAPTER 2. DEPLOYING USING LOCAL STORAGE DEVICES

Deploying OpenShift Container Storage on OpenShift Container Platform using local 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.

Use this section to deploy OpenShift Container Storage on VMware where OpenShift Container Platform is already installed.

2.1. OVERVIEW OF DEPLOYING WITH INTERNAL LOCAL STORAGE

To deploy Red Hat OpenShift Container Storage using local storage, follow these steps:

1. Understand the requirements for installing OpenShift Container Storage using local storage devices.
2. For Red Hat Enterprise Linux based hosts, enabling file system access for containers on Red Hat Enterprise Linux based nodes.

NOTE

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

3. Install the Red Hat OpenShift Container Storage Operator .
4. Install Local Storage Operator .
5. Find the available storage devices .
6. Creating OpenShift Container Storage cluster service on VMware .

2.2. REQUIREMENTS FOR INSTALLING OPENSHIFT CONTAINER STORAGE USING LOCAL STORAGE DEVICES

- You must have at least three OpenShift Container Platform worker nodes in the cluster with locally attached storage devices on each of them.
  - Each of the three selected nodes must have at least one raw block device available to be used by OpenShift Container Storage.
  - For minimum starting node requirements, see Resource requirements section in Planning guide.
  - The devices to be used must be empty, that is, there should be no PVs, VGs, or LVs remaining on the disks.
- You must have a minimum of three labeled nodes.
  - It is recommended that the worker nodes are spread across three different physical nodes, racks or failure domains for high availability.
  - Each node that has local storage devices to be used by OpenShift Container Storage must have a specific label to deploy OpenShift Container Storage pods. To label the nodes, use the following command:

```
$ oc label nodes <NodeNames> cluster.ocs.openshift.io/openshift-storage=''
```

- There should not be any storage providers managing locally mounted storage on the storage nodes that would conflict with the use of Local Storage Operator for Red Hat OpenShift Container Storage.
- The Local Storage Operator version must match the Red Hat OpenShift Container Platform version in order to have the Local Storage Operator fully supported with Red Hat OpenShift Container Storage. The Local Storage Operator does not get upgraded when Red Hat OpenShift Container Platform is upgraded.

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

Deploying OpenShift Container Platform 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

This process is not necessary for hosts based on Red Hat Enterprise Linux CoreOS.

Procedure

Perform the following steps on each node in your cluster.

1. Log in to the Red Hat Enterprise Linux based node and open a terminal.
2. 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
   ```

3. Install the required packages.

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

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

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

2.4. 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. For information about the hardware and software requirements, see Planning your deployment.

Prerequisites

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

NOTE

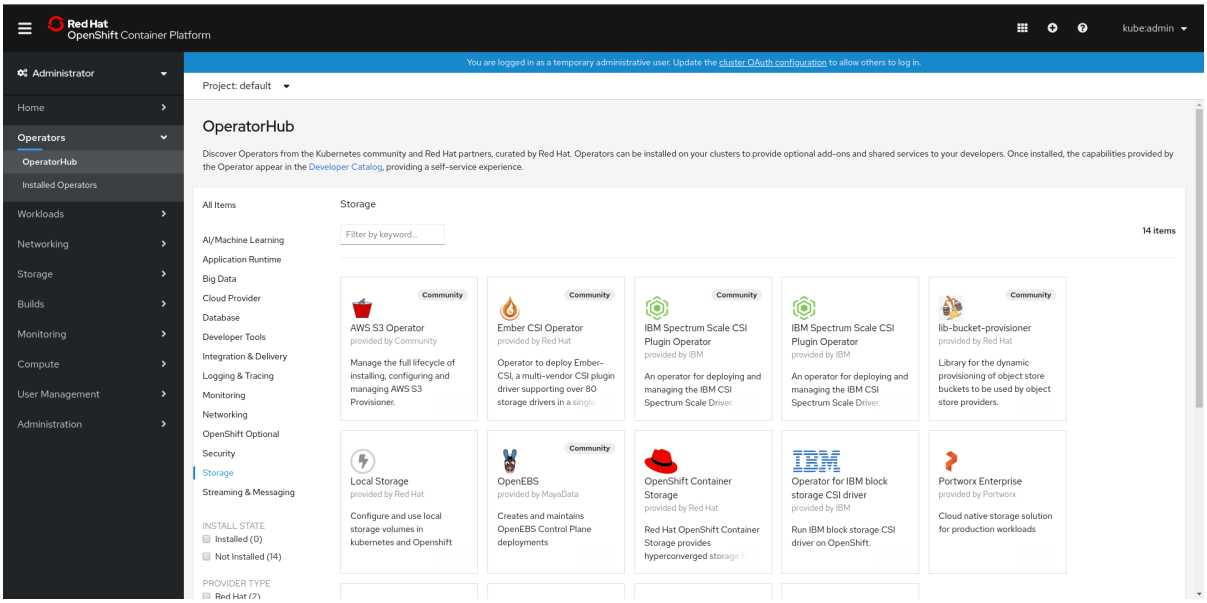
When you need to override the cluster-wide default node selector for OpenShift Container Storage, you can use the following command in command line interface to specify a blank node selector for the **openshift-storage** namespace:

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

Procedure

1. Click **Operators → OperatorHub** in the left pane of the OpenShift Web Console.

   Figure 2.1. List of operators in the Operator Hub



2. Click on **OpenShift Container Storage**.
   You can use the **Filter by keyword** text box or the filter list to search for OpenShift Container Storage from the list of operators.

3. On the OpenShift Container Storage operator page, click **Install**.

4. On the **Install Operator** page, ensure the following options are selected:

   a. Update Channel as **stable-4.5**

   b. Installation Mode as **A specific namespace on the cluster**

   c. Installed Namespace as **Operator recommended namespace PR openshift-storage**. If Namespace **openshift-storage** does not exist, it will be created during the operator installation.

   d. Select **Approval Strategy** as **Automatic** or **Manual**. Approval Strategy is set to **Automatic** by default.

- **Approval Strategy** as **Automatic**.

NOTE

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

i. Click **Install**

ii. Wait for the install to initiate. This may take up to 20 minutes.

iii. Click **Operators → Installed Operators**

iv. Ensure the **Project** is **openshift-storage**. By default, the **Project** is **openshift-storage**.

v. Wait for the **Status** of **OpenShift Container Storage** to change to **Succeeded**.

- **Approval Strategy** as **Manual**.

NOTE

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

i. Click **Install**.

ii. On the **Installed Operators** page, click **ocs-operator**.

iii. On the **Subscription Details** page, click the **Install Plan** link.

iv. On the **InstallPlan Details** page, click **Preview Install Plan**.

v. Review the install plan and click **Approve**.

vi. Wait for the **Status** of the **Components** to change from **Unknown** to either **Created** or **Present**.

vii. Click **Operators → Installed Operators**

viii. Ensure the **Project** is **openshift-storage**. By default, the **Project** is **openshift-storage**.

ix. Wait for the **Status** of **OpenShift Container Storage** to change to **Succeeded**.

Verification steps

- Verify that OpenShift Container Storage Operator shows the Status as **Succeeded** on the Installed Operators dashboard.

2.5. INSTALLING LOCAL STORAGE OPERATOR

Use this procedure to install the Local Storage Operator from the Operator Hub before creating OpenShift Container Storage clusters on local storage devices.

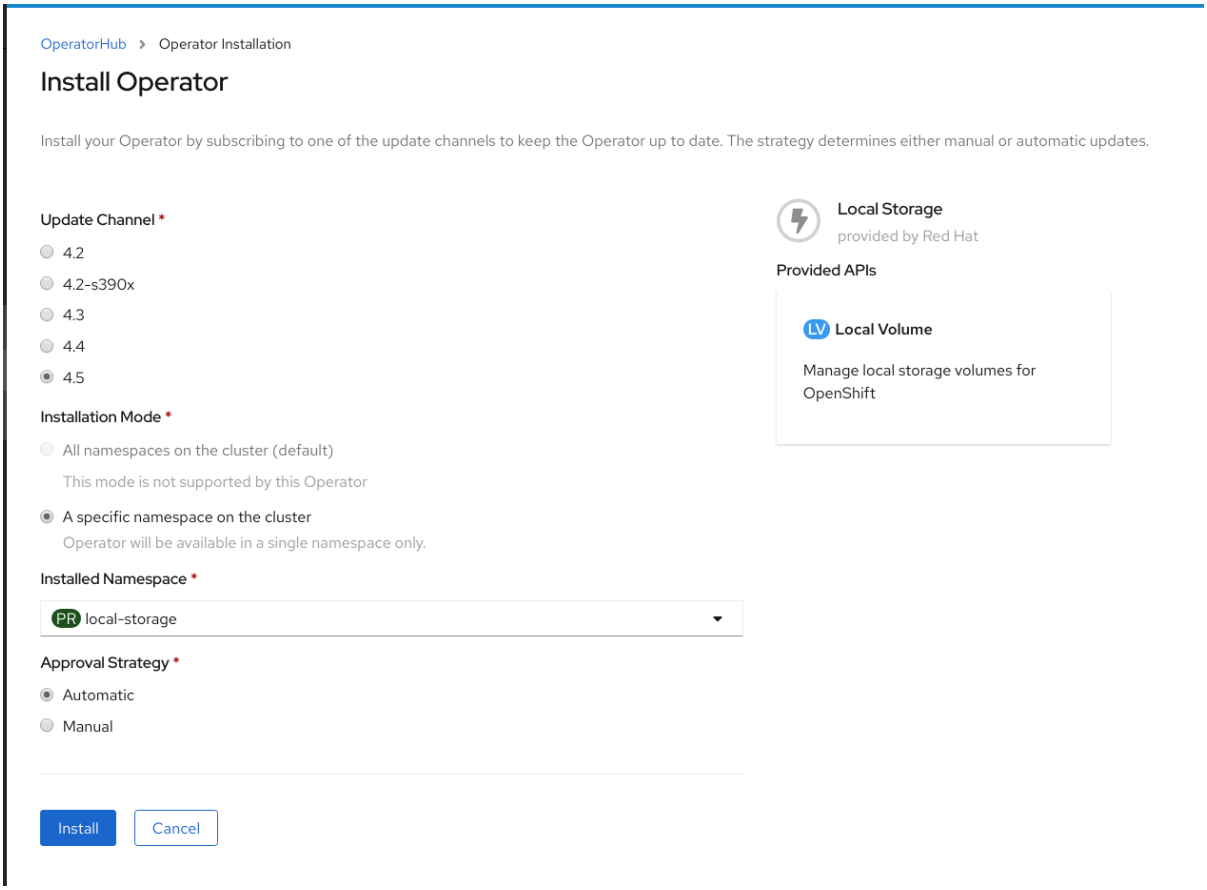
Prerequisites

- Create a namespace called **local-storage** as follows:
  a. Click **Administration → Namespaces** in the left pane of the OpenShift Web Console.
  b. Click **Create Namespace**.
  c. In the Create Namespace dialog box, enter **local-storage** for Name.
  d. Select **No restrictions** option for **Default Network Policy**.
  e. Click **Create**.

Procedure

1. Click **Operators → OperatorHub** in the left pane of the OpenShift Web Console.
2. Search for **Local Storage Operator** from the list of operators and click on it.
3. Click **Install**.

Figure 2.2. Install Operator page



4. On the **Install Operator** page, ensure the following options are selected
   a. Update Channel as **stable-4.5**
   b. Installation Mode as **A specific namespace on the cluster**

c. Installed Namespace as **local-storage**.

d. Approval Strategy as **Automatic**

5. Click **Install**.

6. Verify that the Local Storage Operator shows the Status as **Succeeded**.

2.6. FINDING AVAILABLE STORAGE DEVICES

Use this procedure to identify the device names for each of the three or more nodes that you have labeled with the OpenShift Container Storage label **cluster.ocs.openshift.io/openshift-storage="** before creating PVs.

Procedure

1. List and verify the name of the nodes with the OpenShift Container Storage label.

```
$ oc get nodes -l cluster.ocs.openshift.io/openshift-storage=
```

Example output:

```
NAME       STATUS   ROLES    AGE    VERSION
compute-0   Ready    worker   106m   v1.18.3+2cf11e2
compute-1   Ready    worker   106m   v1.18.3+2cf11e2
compute-2   Ready    worker   106m   v1.18.3+2cf11e2
```

2. Log in to each node that is used for OpenShift Container Storage resources and find the unique **by-id** device name for each available raw block device.

```
$ oc debug node/<Nodename>
```

Example output:

```
$ oc debug node/compute-0
Starting pod/compute-0-debug ...
To use host binaries, run `chroot /host`
Pod IP: 10.1.50.36
If you don't see a command prompt, try pressing enter.
sh-4.2# chroot /host
sh-4.4# lsblk
NAME                         MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
sda                            8:0    0   120G  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    0 119.5G  0 part
  `-coreos-luks-root-nocrypt 253:0    0 119.5G  0 dm   /sysroot
nvme0n1                      259:0    0   1.5T  0 disk
```

In this example, for **compute-0**, the available local device is **nvme0n1**.

3. Identify the unique ID for each of the devices selected in Step 2.

```
sh-4.4#
ls -l /dev/disk/by-id/ | grep nvme0n1
lrwxrwxrwx. 1 root root 13 Aug 19 06:41 nvme-
Dell_Express_Flash_NVMe_P4610_1.6TB_SFF_PHLN951601QF1P6AGN -> ../../nvme0n1
lrwxrwxrwx. 1 root root 13 Aug 19 06:41 nvme-eui.01000000010000005cd2e4895e0e5251 -
> ../../nvme0n1
```

In the above example, the ID for the local device 'nvme0n1` is

```
nvme-eui.01000000010000005cd2e4895e0e5251
```

4. Repeat the above step to identify the device ID for all the other nodes that have the storage devices to be used by OpenShift Container Storage. See this Knowledge Base article for more details.

2.7. CREATING OPENSHIFT CONTAINER STORAGE CLUSTER ON VMWARE

Use this procedure to create storage cluster on VMware infrastructure.

VMware supports the following three types of local storage:

- Virtual machine disk (VMDK)
- Raw device mapping (RDM)
- VMDirectPath I/O

Prerequisites

- Ensure that all the requirements in the Requirements for installing OpenShift Container Storage using local storage devices section are met.
- You must have three worker nodes with the same storage type and size attached to each node to use local storage devices on VMware.
- For VMs on VMware, ensure the **disk.EnableUUID** option is set to **TRUE**. You need to have vCenter account privileges to configure the VMs. For more information, see Required vCenter account privileges. To set the **disk.EnableUUID** option, use the **Advanced** option of the **VM Options** in the **Customize hardware** tab. For more information, see Creating Red Hat Enterprise Linux CoreOS (RHCOS) machines in vSphere.
- Verify your OpenShift Container Platform worker nodes are labeled for OpenShift Container Storage:

```
$ oc get nodes -l cluster.ocs.openshift.io/openshift-storage -o jsonpath='{range .items[*]}
{.metadata.name}{"\n"}'
```

To identify storage devices on each node, refer to Finding available storage devices.

Procedure

1. Create the LocalVolume CR for block PVs.

Example of **LocalVolume** CR **local-storage-block.yaml** using OpenShift Container Storage label as node selector:

```
apiVersion: local.storage.openshift.io/v1
kind: LocalVolume
metadata:
  name: local-block
  namespace: local-storage
  labels:
    app: ocs-storagecluster
spec:
  nodeSelector:
    nodeSelectorTerms:
    - matchExpressions:
        - key: cluster.ocs.openshift.io/openshift-storage
          operator: In
          values:
          - ""
  storageClassDevices:
    - storageClassName: localblock
      volumeMode: Block
      devicePaths:
        - /dev/disk/by-id/nvme-eui.01000000010000005cd2e4895e0e5251   # <-- modify this
line
        - /dev/disk/by-id/nvme-eui.01000000010000005cd2e4ea2f0f5251   # <-- modify this line
        - /dev/disk/by-id/nvme-eui.01000000010000005cd2e4de2f0f5251   # <-- modify this line
```

2. Create **LocalVolume** CR for block PVs.

```
$ oc create -f local-storage-block.yaml
```

Example output:

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

3. Check if the pods are created.

```
$ oc -n local-storage get pods
```

Example output:

```
NAME                                  READY   STATUS    RESTARTS   AGE
local-block-local-diskmaker-5brzv         1/1     Running   0          31s
local-block-local-diskmaker-8sxcs         1/1     Running   0          31s
local-block-local-diskmaker-s7s9p         1/1     Running   0          31s
local-block-local-provisioner-9cbw8       1/1     Running   0          31s
local-block-local-provisioner-cpddv       1/1     Running   0          31s
local-block-local-provisioner-f6h7h       1/1     Running   0          31s
local-storage-operator-75b9776b75-vwdzh   1/1     Running   0          12m
```

4. Check the new **localblock** StorageClass.

```
$ oc get sc | grep localblock
```

Example output:

```
localblock      kubernetes.io/no-provisioner   Delete          WaitForFirstConsumer   false
96s
```

5. Check the PVs that are created with the **Available** status.

```
$ oc get pv
```

Example output:

```
NAME                CAPACITY   ACCESS MODES   RECLAIM POLICY   STATUS      CLAIM
STORAGECLASS   REASON   AGE
local-pv-264b0256   1490Gi     RWO            Delete           Available           localblock
108s
local-pv-8b0e9b53   1490Gi     RWO            Delete           Available           localblock
99s
local-pv-8dcc8c60   1490Gi     RWO            Delete           Available           localblock
98s
```

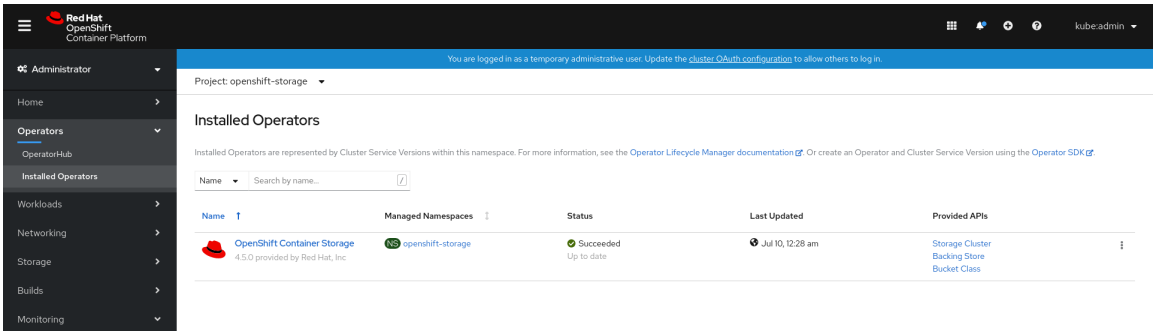
6. Create the OpenShift Container Storage Cluster Service that uses the **localblock** Storage Class.

   a. Log into the OpenShift Web Console.

   b. Click **Operators → Installed Operators** from the OpenShift Web Console to view the installed operators. Ensure that the **Project** selected is **openshift-storage**.

   c. On the **Installed Operators** page, click **Openshift Container Storage**.

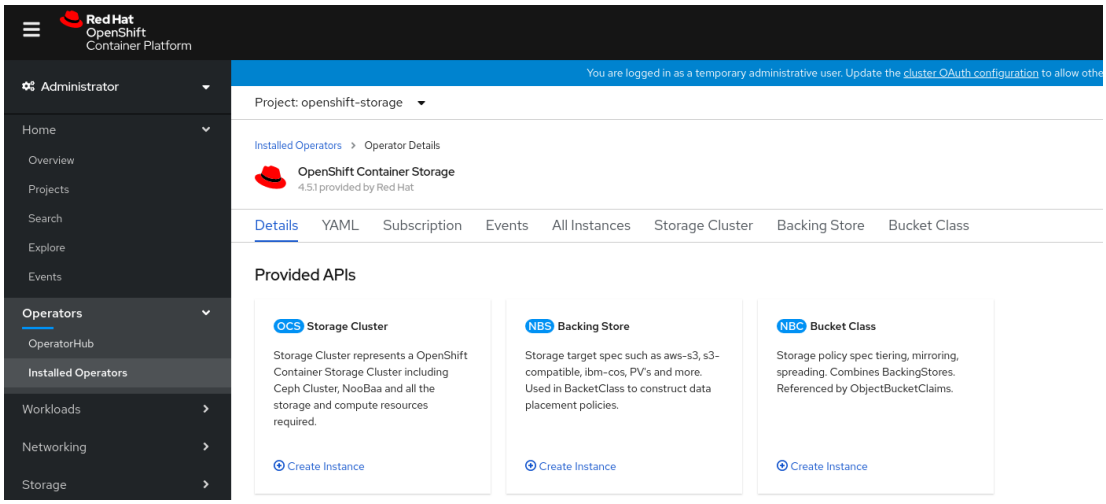
   Figure 2.3. OpenShift Container Storage Operator page



   d. On the **Installed Operators → Operator Details** page, perform either of the following to create a Storage Cluster Service.

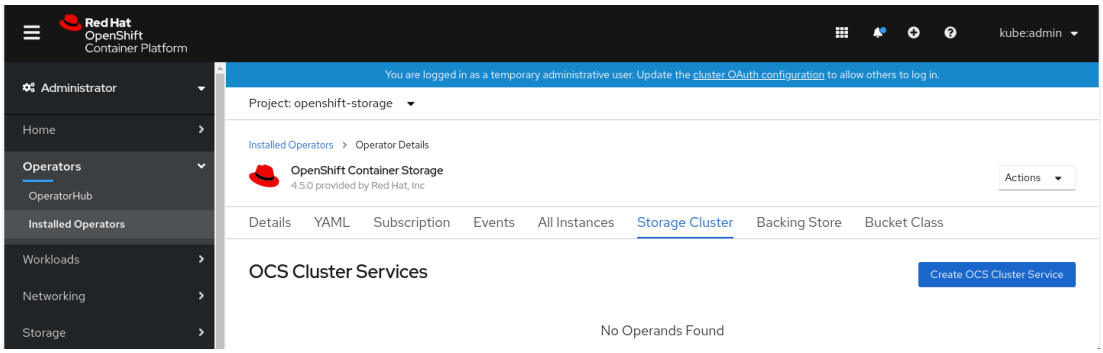
   - On the **Details tab → Provided APIs → OCS Storage Cluster**, click **Create Instance**.

Figure 2.4. Operator Details Page

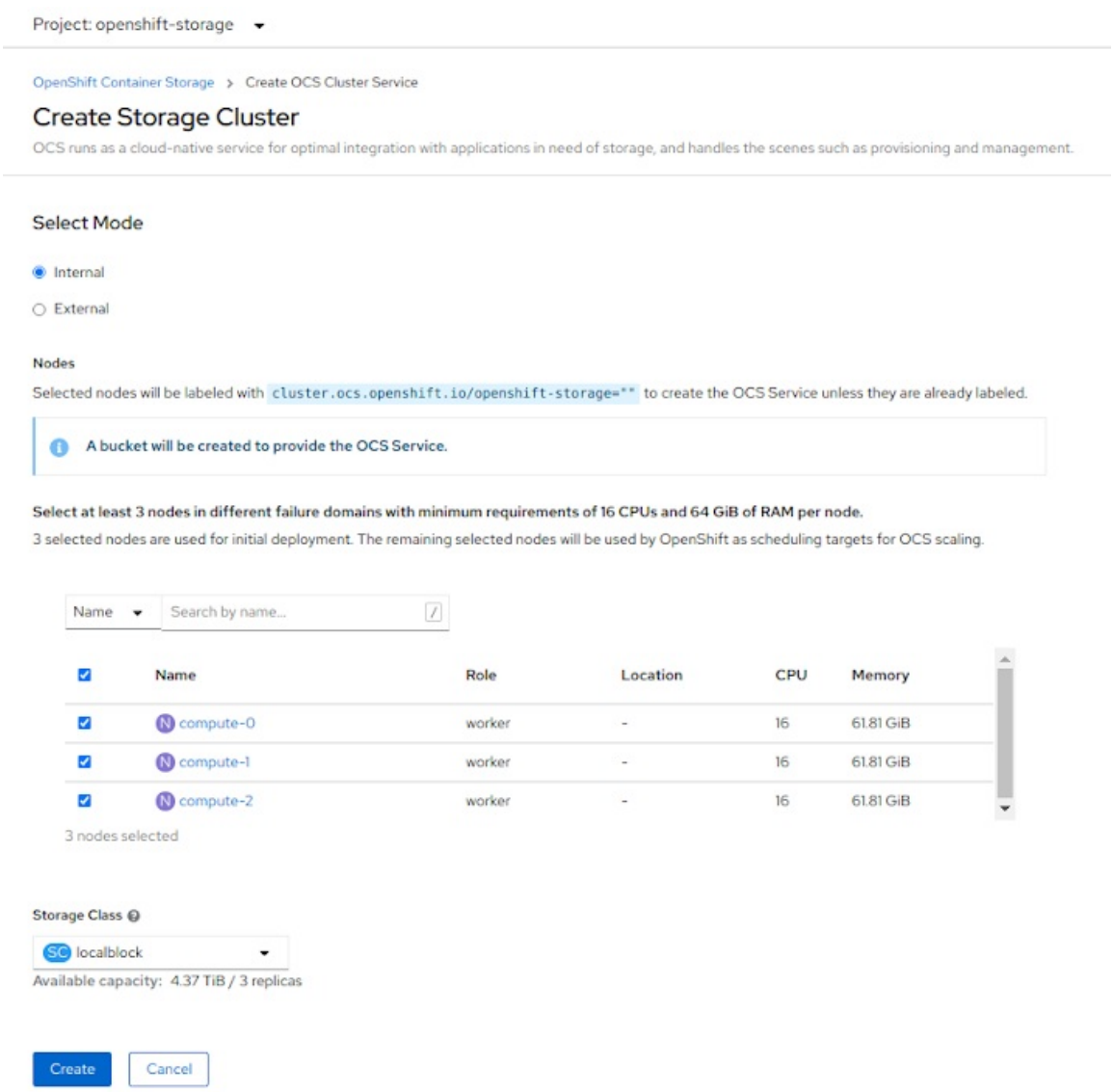


- Alternatively, select the **Storage cluster** tab and click **Create OCS Cluster Service**.

Figure 2.5. Storage Cluster tab



e. On the **Create Storage Cluster** page, ensure that the following options are selected:



- Leave **Select Mode** as **Internal**.
- In the **Nodes** section, for the use of OpenShift Container Storage service, select a minimum of three or a multiple of three worker nodes from the available list.
  It is recommended that the worker nodes are spread across three different physical nodes, racks or failure domains for high availability.

NOTE

  - To find specific worker nodes in the cluster, you can filter nodes on the basis of Name or Label.
    - Name allows you to search by name of the node
    - Label allows you to search by selecting the predefined label
  - Use vCenter anti-affinity to align OpenShift Container Storage rack labels with physical nodes and racks in the data center to avoid scheduling two worker nodes on the same physical chassis.

For minimum starting node requirements, see Resource requirements section in Planning guide.

- Select **localblock** from the **Storage Class** dropdown list.

f. Click **Create**.

NOTE

The **Create** button is enabled only after selecting a minimum of three worker nodes.

Upon successful deployment, a storage cluster with three storage devices gets created. These devices get distributed across three of the selected nodes. The configuration uses a replication factor of 3. To scale the initial cluster, see Scaling storage nodes .

Verification steps

See Verifying your OpenShift Container Storage installation .

CHAPTER 3. VERIFYING OPENSHIFT CONTAINER STORAGE DEPLOYMENT FOR INTERNAL MODE

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

3.1. VERIFYING THE STATE OF THE PODS

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

Procedure

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

Table 3.1. Pods corresponding to OpenShift Container storage cluster

Component	Corresponding pods
OpenShift Container Storage Operator	**ocs-operator-*** (1 pod on any worker node)
Rook-ceph Operator	**rook-ceph-operator-*** (1 pod on any worker node)
Multicloud Object Gateway	• **noobaa-operator-*** (1 pod on any worker node) • **noobaa-core-*** (1 pod on any storage node) • **nooba-db-*** (1 pod on any storage node) • **noobaa-endpoint-*** (1 pod on any storage node)
MON	**rook-ceph-mon-*** (3 pods distributed across storage nodes)
MGR	**rook-ceph-mgr-*** (1 pod on any storage node)

Component	Corresponding pods
MDS	**rook-ceph-mds-ocs-storagecluster-cephfilesystem-*** (2 pods distributed across storage nodes)
RGW	**rook-ceph-rgw-ocs-storagecluster-cephobjectstore-*** (2 pods distributed across storage nodes)

CSI	• **cephfs**
	  ◦ **csi-cephfsplugin-*** (1 pod on each worker node)
	  ◦ **csi-cephfsplugin-provisioner-*** (2 pods distributed across storage nodes)
	• **rbd**
	  ◦ **csi-rbdplugin-*** (1 pod on each worker node)
	  ◦ **csi-rbdplugin-provisioner-*** (2 pods distributed across storage nodes)

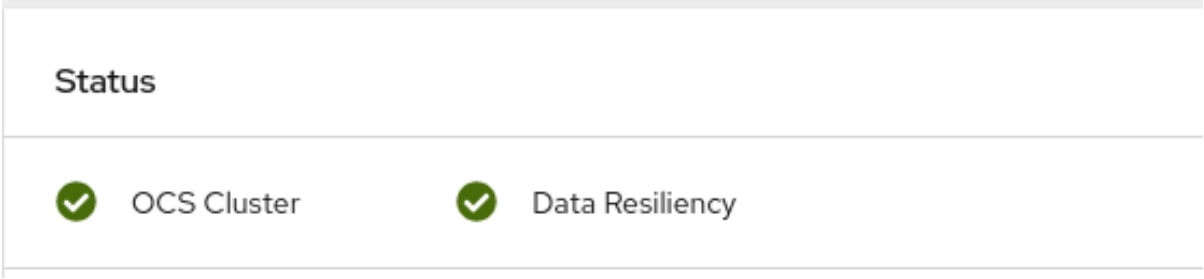
rook-ceph-drain-canary	**rook-ceph-drain-canary-*** (1 pod on each storage node)
rook-ceph-crashcollector	**rook-ceph-crashcollector-*** (1 pod on each storage node)
OSD	• **rook-ceph-osd-*** (1 pod for each device) • **rook-ceph-osd-prepare-ocs-deviceset-*** (1 pod for each device)

3.2. VERIFYING THE OPENSHIFT CONTAINER STORAGE CLUSTER IS HEALTHY

You can verify health of OpenShift Container Storage cluster using the persistent storage dashboard. For more information, see Monitoring OpenShift Container Storage .

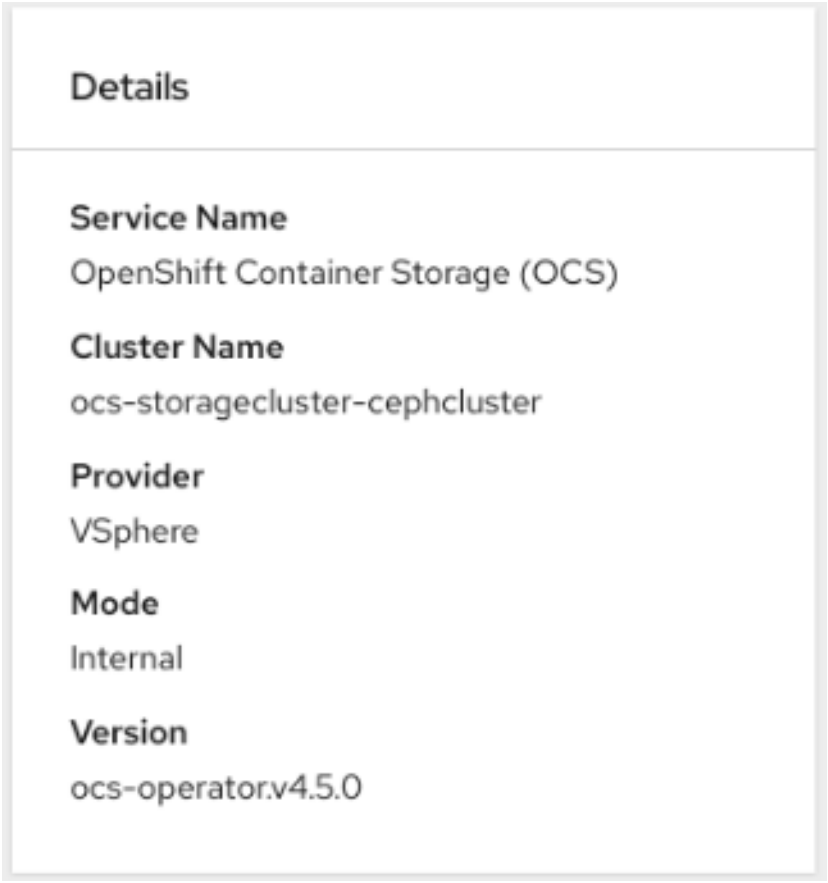
- Click **Home → Overview** from the left pane of the OpenShift Web Console and click **Persistent Storage** tab.
- In the **Status card**, verify that *OCS Cluster* has a green tick mark as shown in the following image:

Figure 3.1. Health status card in Persistent Storage Overview Dashboard



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

Figure 3.2. Details card in Persistent Storage Overview Dashboard

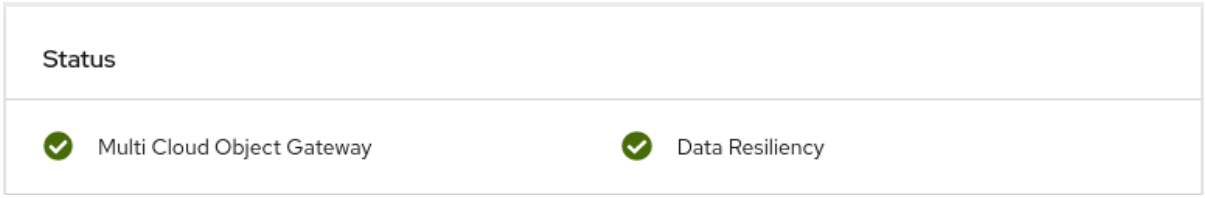


3.3. VERIFYING THE MULTICLOUD OBJECT GATEWAY IS HEALTHY

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

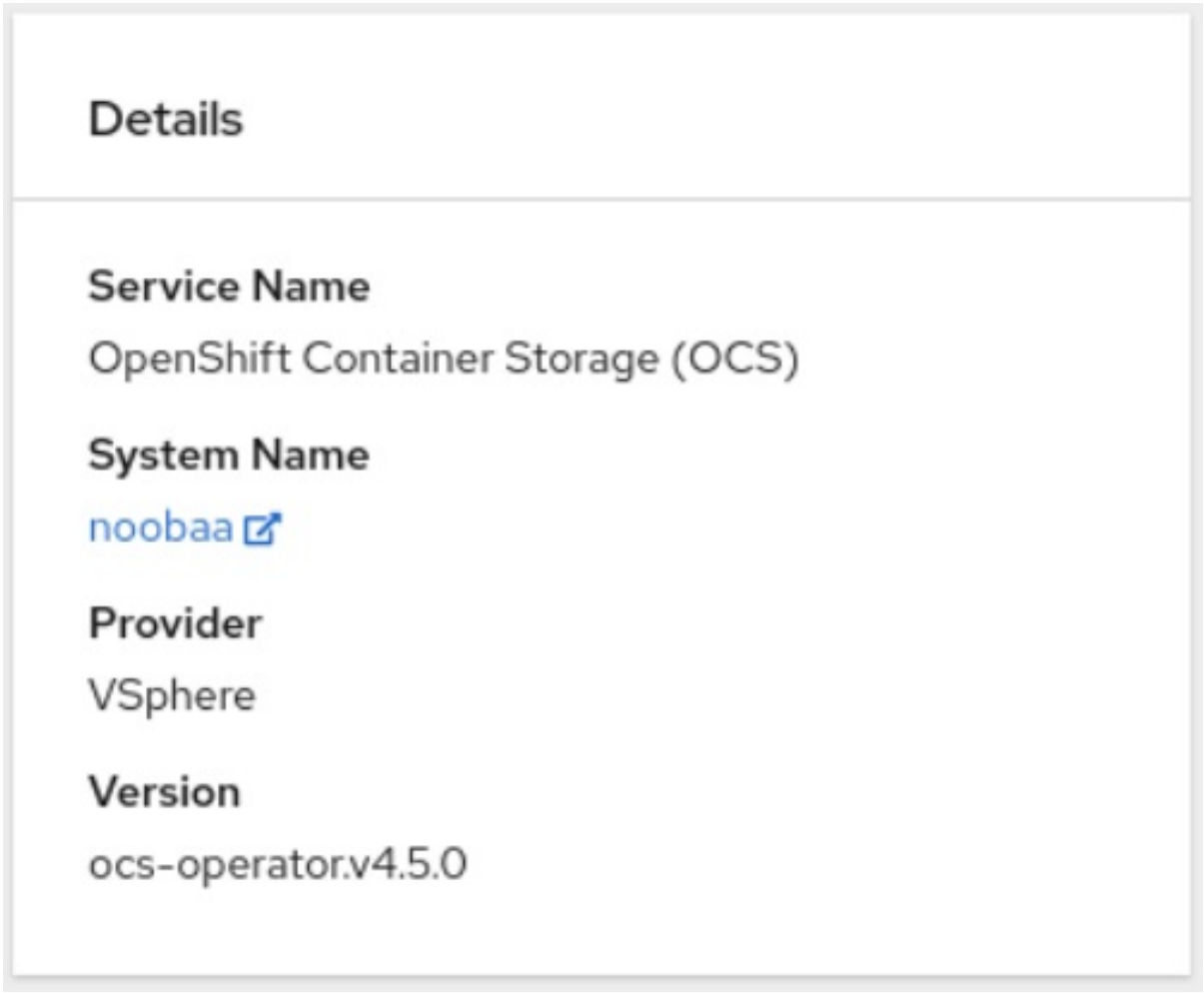
- Click **Home → Overview** from the left pane of the OpenShift Web Console and click the **Object Service** tab.
- In the **Status card**, verify that the Multicloud Object Gateway (MCG) storage displays a green tick icon as shown in following image:

Figure 3.3. Health status card in Object Service Overview Dashboard



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

Figure 3.4. Details card in Object Service Overview Dashboard



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

To verify the storage classes exists in the cluster:

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

- **ocs-storagecluster-ceph-rgw**

CHAPTER 4. UNINSTALLING OPENSHIFT CONTAINER STORAGE

4.1. UNINSTALLING OPENSHIFT CONTAINER STORAGE ON INTERNAL MODE

Use the steps in this section to uninstall OpenShift Container Storage instead of the Uninstall option from the user interface.

Prerequisites

- Make sure that the OpenShift Container Storage cluster is in a healthy state. The deletion might fail if some of the pods are not terminated successfully due to insufficient resources or nodes. In case the cluster is in an unhealthy state, you should contact Red Hat Customer Support before uninstalling OpenShift Container Storage.
- Make sure that applications are not consuming persistent volume claims (PVCs) or object bucket claims (OBCs) using the storage classes provided by OpenShift Container Storage. PVCs and OBCs will be deleted during the uninstall process.

Procedure

1. Query for PVCs and OBCs that use the OpenShift Container Storage based storage class provisioners.
   For example :

   ```
   $ oc get pvc -o=jsonpath='{range .items[?(@.spec.storageClassName=="ocs-storagecluster-ceph-rbd")]}{"Name: "}{@.metadata.name}{" Namespace: "}{@.metadata.namespace}{" Labels: "}{@.metadata.labels}{"\n"}{end}' --all-namespaces|awk '! ( /Namespace: openshift-storage/ && /app:noobaa/ )' | grep -v noobaa-default-backing-store-noobaa-pvc
   ```

   ```
   $ oc get pvc -o=jsonpath='{range .items[?(@.spec.storageClassName=="ocs-storagecluster-cephfs")]}{"Name: "}{@.metadata.name}{" Namespace: "}{@.metadata.namespace}{"\n"}{end}' --all-namespaces
   ```

   ```
   $ oc get obc -o=jsonpath='{range .items[?(@.spec.storageClassName=="ocs-storagecluster-ceph-rgw")]}{"Name: "}{@.metadata.name}{" Namespace: "}{@.metadata.namespace}{"\n"}{end}' --all-namespaces
   ```

   ```
   $ oc get obc -o=jsonpath='{range .items[?(@.spec.storageClassName=="openshift-storage.noobaa.io")]}{"Name: "}{@.metadata.name}{" Namespace: "}{@.metadata.namespace}{"\n"}{end}' --all-namespaces
   ```

2. Follow these instructions to ensure that the PVCs and OBCs listed in the previous step are deleted.
   If you have created PVCs as a part of configuring the monitoring stack, cluster logging operator, or image registry, then you must perform the clean up steps provided in the following sections as required:

   - Section 4.2, “Removing monitoring stack from OpenShift Container Storage”

- Section 4.3, “Removing OpenShift Container Platform registry from OpenShift Container Storage”
- Section 4.4, “Removing the cluster logging operator from OpenShift Container Storage”

For each of the remaining PVCs or OBCs, follow the steps mentioned below :

a. Determine the pod that is consuming the PVC or OBC.

b. Identify the controlling API object such as a **Deployment**, **StatefulSet**, **DaemonSet** , **Job**, or a custom controller.
Each API object has a metadata field known as **OwnerReference**. This is a list of associated objects. The **OwnerReference** with the **controller** field set to true will point to controlling objects such as **ReplicaSet**, **StatefulSet**,**DaemonSet** and so on.

c. Ensure that the API object is not consuming PVC or OBC provided by OpenShift Container Storage. Either the object should be deleted or the storage should be replaced. Ask the owner of the project to make sure that it is safe to delete or modify the object.

NOTE

You can ignore the **noobaa** pods.

d. Delete the OBCs.

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

e. Delete any custom Bucket Class you have created.

```
$ oc get bucketclass -A  | grep -v noobaa-default-bucket-class
```

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

f. If you have created any custom Multi Cloud Gateway backingstores, delete them.

- List and note the backingstores.

```
for bs in $(oc get backingstore -o name -n openshift-storage | grep -v noobaa-default-backing-store); do echo "Found backingstore $bs"; echo "Its has the following pods running :"; echo "$(oc get pods -o name -n openshift-storage | grep $(echo ${bs} | cut -f2 -d/))"; done
```

- Delete each of the backingstores listed above and confirm that the dependent resources also get deleted.

```
for bs in $(oc get backingstore -o name -n openshift-storage | grep -v noobaa-default-backing-store); do echo "Deleting Backingstore $bs"; oc delete -n openshift-storage $bs; done
```

- If any of the backingstores listed above were based on the pv-pool, ensure that the corresponding pod and PVC are also deleted.

```
$ oc get pods -n openshift-storage | grep noobaa-pod | grep -v noobaa-default-backing-store-noobaa-pod
```

```
$ oc get pvc -n openshift-storage --no-headers | grep -v noobaa-db | grep noobaa-pvc | grep -v noobaa-default-backing-store-noobaa-pvc
```

g. Delete the remaining PVCs listed in Step 1.

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

3. List and note the backing local volume objects. If there are no results, skip steps 7 and 8.

```
$ for sc in $(oc get storageclass|grep 'kubernetes.io/no-provisioner' |grep -E $(oc get storagecluster -n openshift-storage -o jsonpath='{ .items[*].spec.storageDeviceSets[*].dataPVCTemplate.spec.storageClassName}' | sed 's/ /|/g')| awk '{ print $1 }');
do
   echo -n "StorageClass: $sc ";
   oc get storageclass $sc -o jsonpath=" { 'LocalVolume: ' }{ .metadata.labels['local\.storage\.openshift\.io/owner-name'] } { '\n' }";
done
```

Example output:

```
StorageClass: localblock  LocalVolume: local-block
```

4. Delete the **StorageCluster** object and wait for the removal of the associated resources.

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

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

a. Switch to another namespace if openshift-storage is the active namespace.
For example :

```
$ oc project default
```

b. Delete the openshift-storage namespace.

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

c. Wait for approximately five minutes and confirm if the project is deleted successfully.

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

Output:

```
Error from server (NotFound): namespaces "openshift-storage" not found
```

NOTE

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

6. Clean up the storage operator artifacts on each node.

```
$ 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 rm -rfv /var/lib/rook; done
```

Ensure you can see removed directory **/var/lib/rook** in the output.

Confirm that the directory no longer exists

```
$ 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
```

7. Delete the local volume created during the deployment and repeat for each of the local volumes listed in step 3.
For each of the local volumes, do the following:

   a. Set the variable **LV** to the name of the LocalVolume and variable **SC** to the name of the StorageClass listed in Step 3.
   For example:

   ```
   $ LV=local-block
   ```

   ```
   $ SC=localblock
   ```

   b. List and note the devices to be cleaned up later.

   ```
   $ oc get localvolume -n local-storage $LV -o jsonpath='{
   .spec.storageClassDevices[*].devicePaths[*] }'
   ```

   Example output:

   ```
   /dev/disk/by-id/nvme-xxxxxx
   /dev/disk/by-id/nvme-yyyyyy
   /dev/disk/by-id/nvme-zzzzzz
   ```

   c. Delete the local volume resource.

   ```
   $ oc delete localvolume -n local-storage --wait=true $LV
   ```

   d. Delete the remaining PVs and StorageClasses if they exist.

   ```
   $ oc delete pv -l storage.openshift.com/local-volume-owner-name=${LV} --wait --
   timeout=5m
   ```

   ```
   $ oc delete storageclass $SC --wait --timeout=5m
   ```

e. Clean up the artifacts from the storage nodes for that resource.

```
$ [[ ! -z $SC ]] && 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 rm -rfv
/mnt/local-storage/${SC}/; done
```

Example output :

```
Starting pod/node-xxx-debug ...
To use host binaries, run `chroot /host`
removed '/mnt/local-storage/localblock/nvme2n1'
removed directory '/mnt/local-storage/localblock'

Removing debug pod ...
Starting pod/node-yyy-debug ...
To use host binaries, run `chroot /host`
removed '/mnt/local-storage/localblock/nvme2n1'
removed directory '/mnt/local-storage/localblock'

Removing debug pod ...
Starting pod/node-zzz-debug ...
To use host binaries, run `chroot /host`
removed '/mnt/local-storage/localblock/nvme2n1'
removed directory '/mnt/local-storage/localblock'

Removing debug pod ...
```

8. Wipe the disks for each of the local volumes listed in step 3 so that they can be reused.

a. List the storage nodes.

```
$ oc get nodes -l cluster.ocs.openshift.io/openshift-storage=
```

Example output:

```
NAME      STATUS   ROLES    AGE     VERSION
node-xxx  Ready    worker   4h45m  v1.18.3+6c42de8
node-yyy  Ready    worker   4h46m  v1.18.3+6c42de8
node-zzz  Ready    worker   4h45m  v1.18.3+6c42de8
```

b. Obtain the node console and execute **chroot /host** command when the prompt appears.

```
$ oc debug node/node-xxx
Starting pod/node-xxx-debug ...
To use host binaries, run `chroot /host`
Pod IP: w.x.y.z
If you don't see a command prompt, try pressing enter.
sh-4.2# chroot /host
```

c. Store the disk paths gathered in step 7(ii) in the **DISKS** variable within quotes.

```
sh-4.2# DISKS="/dev/disk/by-id/nvme-xxxxxx
/dev/disk/by-id/nvme-yyyyyy /dev/disk/by-id/nvme-zzzzzz"
```

d. Run **sgdisk --zap-all** on all the disks.

```
sh-4.4# for disk in $DISKS; do sgdisk --zap-all $disk;done
```

Example output:

```
Problem opening /dev/disk/by-id/nvme-xxxxxx for reading! Error is 2.
The specified file does not exist!
Problem opening '' for writing! Program will now terminate.
Warning! MBR not overwritten! Error is 2!
Problem opening /dev/disk/by-id/nvme-yyyyy for reading! Error is 2.
The specified file does not exist!
Problem opening '' for writing! Program will now terminate.
Warning! MBR not overwritten! Error is 2!
Creating new GPT entries.
GPT data structures destroyed! You may now partition the disk using fdisk or
other utilities.
NOTE
Ignore file-not-found warnings as they refer to disks that are on other machines.
```

e. Exit the shell and repeat for the other nodes.

```
sh-4.4# exit
exit
sh-4.2# exit
exit

Removing debug pod ...
```

9. Delete the **openshift-storage.noobaa.io** storage class.

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

10. Unlabel the storage nodes.

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

```
$ oc label nodes  --all topology.rook.io/rack-
```

NOTE

You can ignore the warnings displayed for the unlabeled nodes such as label <label> not found.

11. Confirm all PVs are deleted. If there is any PV left in the Released state, delete it.

```
# oc get pv | egrep 'ocs-storagecluster-ceph-rbd|ocs-storagecluster-cephfs'
```

```
# oc delete pv <pv name>
```

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
storageclusterinitializations.ocs.openshift.io storageclusters.ocs.openshift.io
cephclients.ceph.rook.io --wait=true --timeout=5m
```

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

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

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

4.2. REMOVING MONITORING STACK FROM OPENSHIFT CONTAINER STORAGE

Use this section to clean up 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

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

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

Prerequisites

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

Procedure

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

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

Before editing

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

After editing

```
.
.
.
storage:
  emptyDir: {}
.
.
.
```

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

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

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

Prerequisites

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

Procedure

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

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

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

2. Delete PVCs.

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