Red Hat OpenShift Container Storage 4.5

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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Abstract

Read this document for instructions on installing Red Hat OpenShift Container Storage 4.5 using Amazon Web Services for local or cloud storage.

Table of Contents

PREFACE

Red Hat OpenShift Container Storage 4.5 supports deployment on existing Red Hat OpenShift Container Platform (OCP) 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 for more information about deployment requirements.

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

- Deploy using dynamic storage devices
- Deploy using local storage devices [Technology Preview]

CHAPTER 1. 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.

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

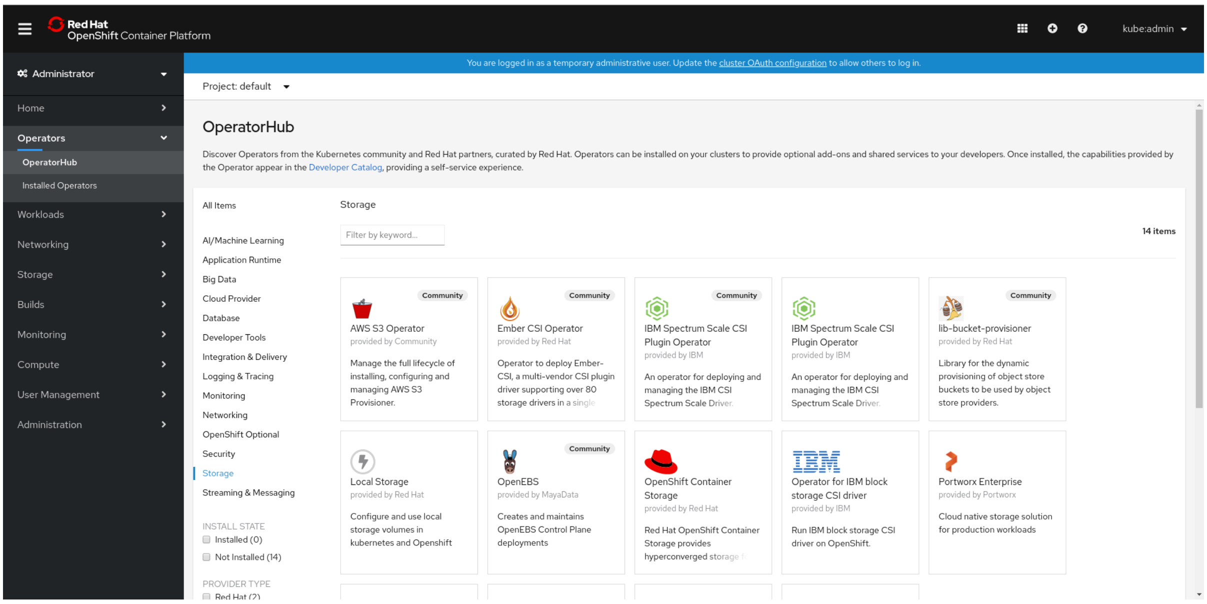
- You must be logged into the OpenShift Container Platform cluster.
- You must have at least three worker nodes in the OpenShift Container Platform cluster.

> **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



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

OperatorHub

Discover Operators from the Kubernetes community and Red Hat partners, curated by Red Hat. Operators can be installed on your clusters to provide optional add-ons and shared services to your developers. Once installed, the capabilities provided by the Operator appear in the Developer Catalog, providing a self-service experience.

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provided by Community
Manage the full lifecycle of installing, configuring and managing AWS S3 Provisioner.

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provided by IBM
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lib-bucket-provisioner
provided by Red Hat
Library for the dynamic provisioning of object store buckets to be used by object store providers.

Local Storage
provided by Red Hat
Configure and use local storage volumes in kubernetes and Openshift

OpenEBS
provided by MayaData
Creates and maintains OpenEBS Control Plane deployments

OpenShift Container Storage
provided by Red Hat
Red Hat OpenShift Container Storage provides hyperconverged storage f

Operator for IBM block storage CSI driver
provided by IBM
Run IBM block storage CSI driver on OpenShift.

Portworx Enterprise
provided by Portworx
Cloud native storage solution for production workloads

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

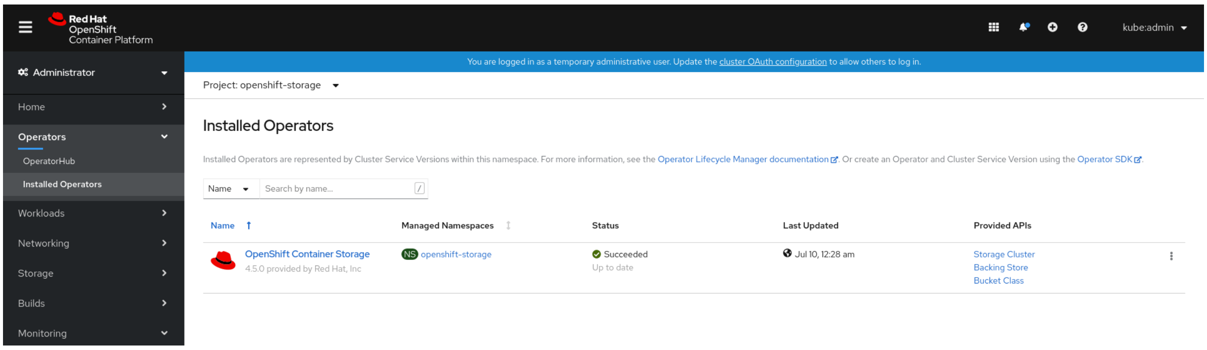
- The OpenShift Container Storage operator must be installed from the Operator Hub. For more information, see Installing OpenShift Container Storage Operator using the Operator Hub .

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



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

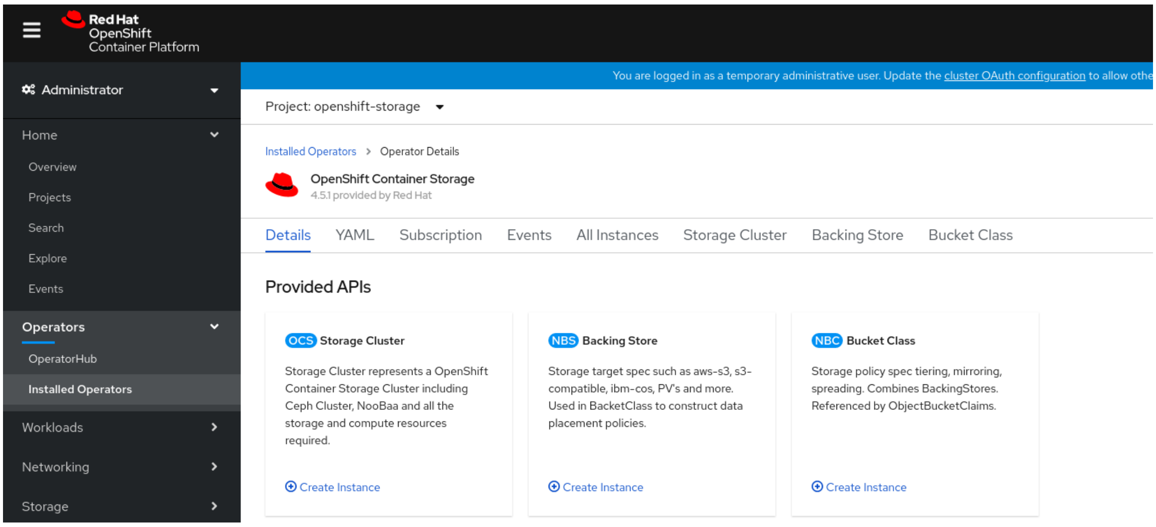
Installed Operators are represented by Cluster Service Versions within this namespace. For more information, see the Operator Lifecycle Manager documentation. Or create an Operator and Cluster Service Version using the Operator SDK.

Name	Managed Namespaces	Status	Last Updated	Provided APIs
OpenShift Container Storage 4.5.0 provided by Red Hat, Inc	NS openshift-storage	Succeeded Up to date	Jul 10, 12:28 am	Storage Cluster Backing Store Bucket Class

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



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

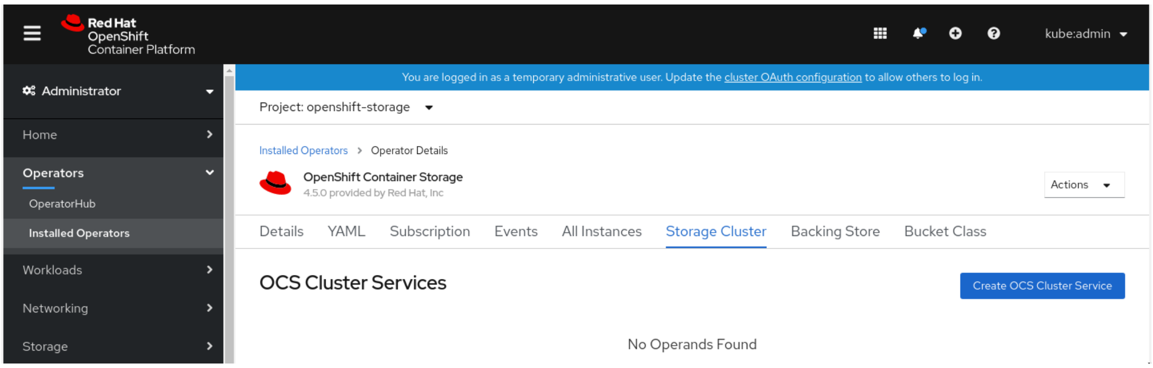
Storage Cluster represents a OpenShift Container Storage Cluster including Ceph Cluster, NooBaa and all the storage and compute resources required.

Storage target spec such as aws-s3, s3-compatible, ibm-cos, PV's and more. Used in BacketClass to construct data placement policies.

Storage policy spec tiering, mirroring, spreading. Combines BackingStores. Referenced by ObjectBucketClaims.

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

Figure 1.4. Storage Cluster tab

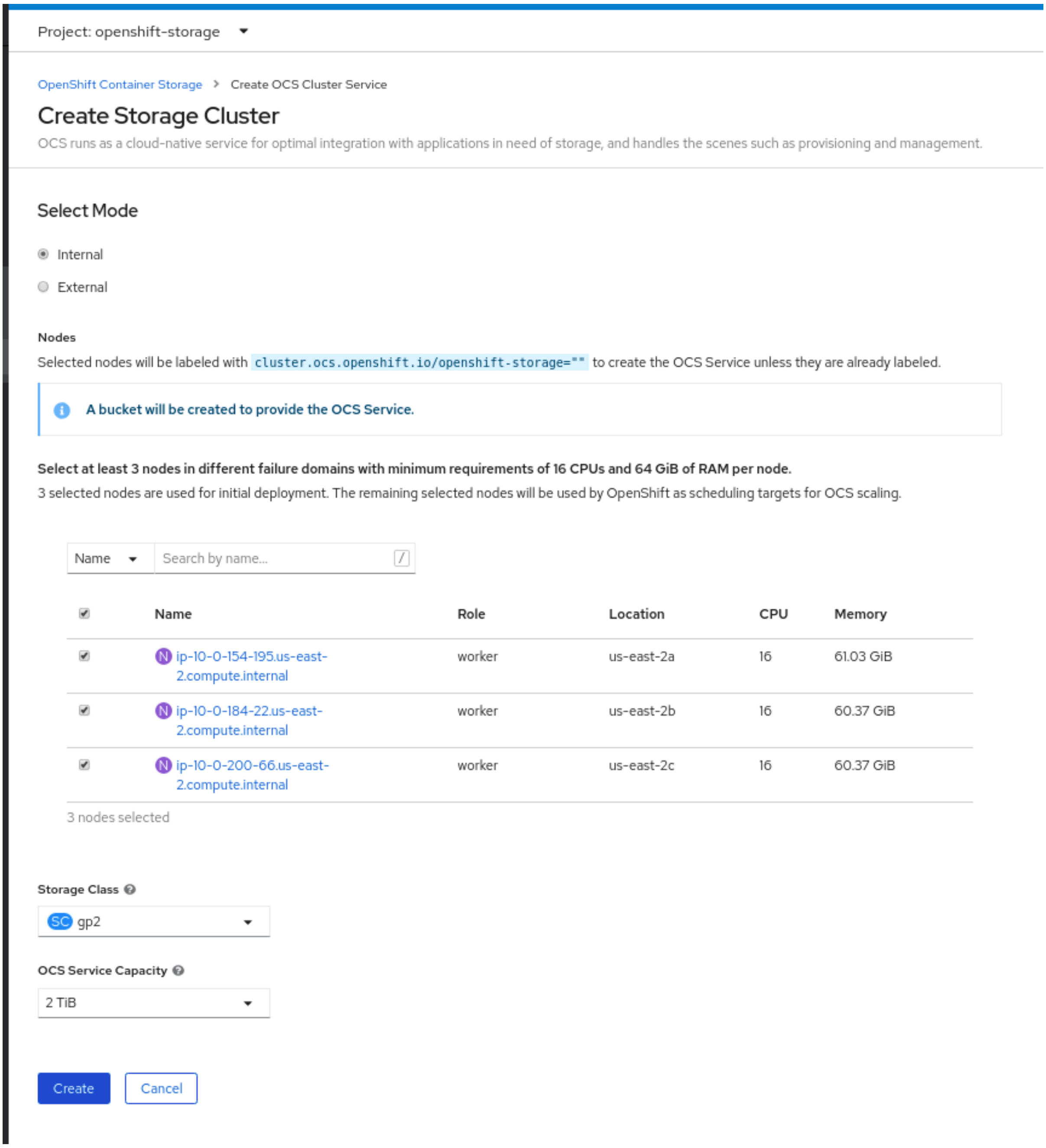


You are logged in as a temporary administrative user. Update the cluster OAuth configuration to allow others to log in.

No Operands Found

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

Figure 1.5. Create Storage Cluster page



Project: openshift-storage ▾

OpenShift Container Storage > Create OCS Cluster Service

Create Storage Cluster

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

Select Mode

● Internal

○ External

Nodes

Selected nodes will be labeled with `cluster.ocs.openshift.io/openshift-storage=""` to create the OCS Service unless they are already labeled.

A bucket will be created to provide the OCS Service.

Select at least 3 nodes in different failure domains with minimum requirements of 16 CPUs and 64 GiB of RAM per node.

3 selected nodes are used for initial deployment. The remaining selected nodes will be used by OpenShift as scheduling targets for OCS scaling.

Name ▾ Search by name...

☑	Name	Role	Location	CPU	Memory
☑	N ip-10-0-154-195.us-east-2.compute.internal	worker	us-east-2a	16	61.03 GiB
☑	N ip-10-0-184-22.us-east-2.compute.internal	worker	us-east-2b	16	60.37 GiB
☑	N ip-10-0-200-66.us-east-2.compute.internal	worker	us-east-2c	16	60.37 GiB

3 nodes selected

Storage Class

SC gp2 ▾

OCS Service Capacity

2 TiB ▾

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.
For cloud platforms with multiple availability zones, ensure that the Nodes are spread across different Locations/availability zones.

NOTE

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

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

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

c. **Storage Class** is set by default to **gp2** for AWS.

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 Amazon EC2 storage optimized I3 where OpenShift Container Platform is already installed.

IMPORTANT

Installing OpenShift Container Storage on Amazon EC2 storage optimized I3 instances using the Local Storage Operator 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. Red Hat OpenShift Container Storage deployment assumes a new cluster, without any application or other workload running on the 3 worker nodes. Applications should run on additional worker nodes.

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 Amazon EC2 storage optimized - i3en.2xlarge instance type.

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.

    - Ensure that the Nodes are spread across different Locations/Availability Zones for a multiple availability zones platform.

    - 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

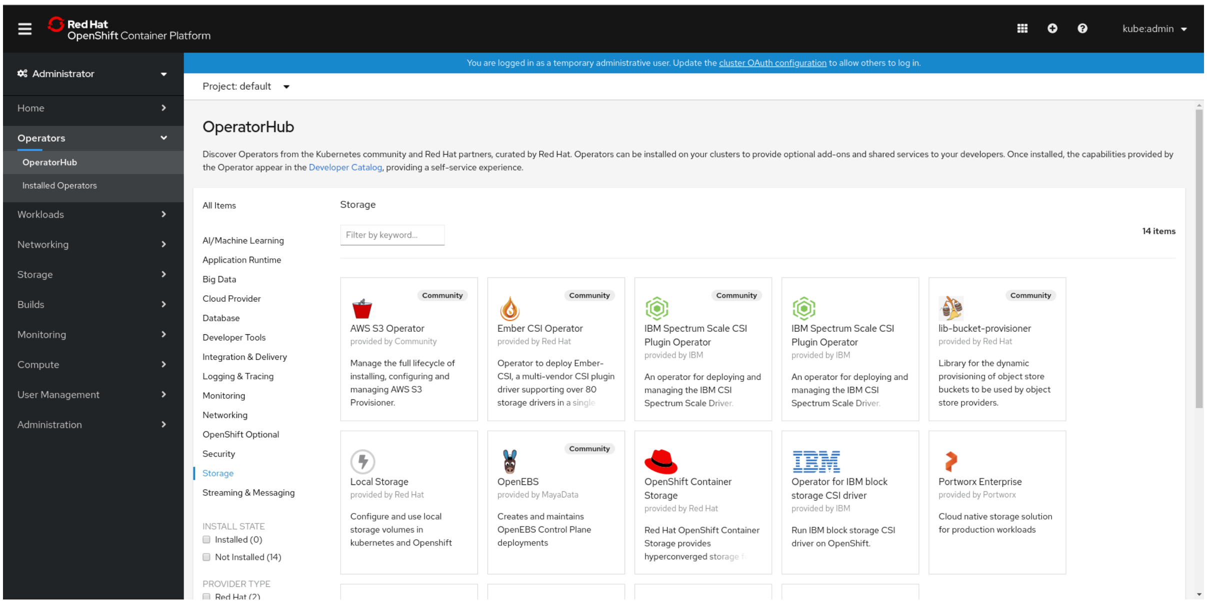
- You must be logged into the OpenShift Container Platform cluster.
- You must have at least three worker nodes in the OpenShift Container Platform cluster.

> **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



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Red Hat OpenShift Container Storage provides hyperconverged storage f

Operator for IBM block storage CSI driver
provided by IBM
Run IBM block storage CSI driver on OpenShift.

Portworx Enterprise
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Cloud native storage solution for production workloads

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.

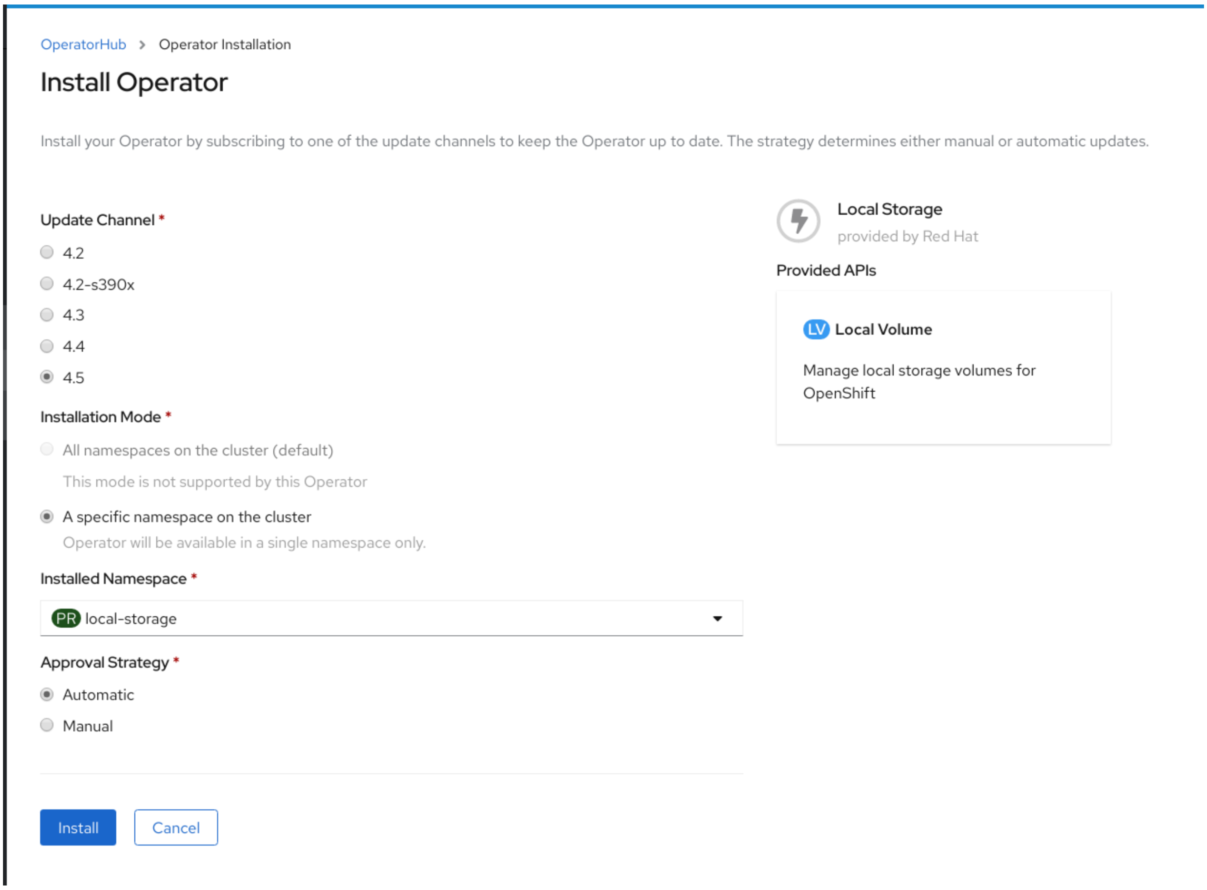
    d. Select **No restrictions** option for **Default Network Policy**.

    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



OperatorHub > Operator Installation

Install Operator

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

Update Channel *

○ 4.2
○ 4.2-s390x
○ 4.3
○ 4.4
● 4.5

Installation Mode *

○ All namespaces on the cluster (default)
This mode is not supported by this Operator

● A specific namespace on the cluster
Operator will be available in a single namespace only.

Installed Namespace *

PR local-storage

Approval Strategy *

● Automatic
○ Manual

Install Cancel

Local Storage
provided by Red Hat

Provided APIs

LV Local Volume

Manage local storage volumes for OpenShift

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
ip-10-0-135-71.us-east-2.compute.internal    Ready    worker   6h45m   v1.16.2
ip-10-0-145-125.us-east-2.compute.internal   Ready    worker   6h45m   v1.16.2
ip-10-0-160-91.us-east-2.compute.internal    Ready    worker   6h45m   v1.16.2
```

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/ip-10-0-135-71.us-east-2.compute.internal
Starting pod/ip-10-0-135-71us-east-2computeinternal-debug ...
To use host binaries, run `chroot /host`
Pod IP: 10.0.135.71
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
xvda                        202:0    0   120G  0 disk
|-xvda1                     202:1    0   384M  0 part /boot
|-xvda2                     202:2    0   127M  0 part /boot/efi
|-xvda3                     202:3    0     1M  0 part
`-xvda4                     202:4    0 119.5G  0 part
  `-coreos-luks-root-nocrypt 253:0    0 119.5G  0 dm   /sysroot
nvme0n1                     259:0    0   2.3T  0 disk
nvme1n1                     259:1    0   2.3T  0 disk
```

In this example, for the selected node, the local devices available are **nvme0n1** and **nvme1n1**.

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

```
sh-4.4#  ls -l /dev/disk/by-id/ | grep Storage
lrwxrwxrwx. 1 root root 13 Mar 17 16:24 nvme-
Amazon_EC2_NVMe_Instance_Storage_AWS10382E5D7441494EC -> ../../nvme0n1
lrwxrwxrwx. 1 root root 13 Mar 17 16:24 nvme-
Amazon_EC2_NVMe_Instance_Storage_AWS60382E5D7441494EC -> ../../nvme1n1
```

In the example above, the IDs for the two local devices are

- nvme0n1: nvme-Amazon_EC2_NVMe_Instance_Storage_AWS10382E5D7441494EC
- nvme1n1: nvme-Amazon_EC2_NVMe_Instance_Storage_AWS60382E5D7441494EC

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 AMAZON EC2 STORAGE OPTIMIZED - I3EN.2XLARGE INSTANCE TYPE

Use this procedure to create OpenShift Container Storage cluster on Amazon EC2 (storage optimized - i3en.2xlarge instance type) infrastructure, which will:

1. Create PVs by using the **LocalVolume** CR
2. Create a new **StorageClass**

The Amazon EC2 storage optimized - i3en.2xlarge instance type includes two non-volatile memory express (NVMe) disks. The example in this procedure illustrates the use of both the disks that the instance type comes with.

When you are using the ephemeral storage of Amazon EC2 I3

- Use three availability zones to decrease the risk of losing all the data.
- Limit the number of users with ec2:StopInstances permissions to avoid instance shutdown by mistake.

WARNING

It is not recommended to use ephemeral storage of Amazon EC2 I3 for OpenShift Container Storage persistent data, because stopping all the three nodes can cause data loss.

It is recommended to use ephemeral storage of Amazon EC2 I3 only in following scenarios:

- Cloud burst where data is copied from another location for a specific data crunching, which is limited in time
- Development or testing environment

IMPORTANT

Installing OpenShift Container Storage on Amazon EC2 storage optimized - i3en.2xlarge instance using local storage operator 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

- Ensure that all the requirements in the Requirements for installing OpenShift Container Storage using local storage devices section are met.
- Verify your OpenShift Container Platform worker nodes are labeled for OpenShift Container Storage, which is used as the **nodeSelector**.

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

  Example output:

  -

```
ip-10-0-135-71.us-east-2.compute.internal
ip-10-0-145-125.us-east-2.compute.internal
ip-10-0-160-91.us-east-2.compute.internal
```

Procedure

1. Create local persistent volumes (PVs) on the storage nodes using **LocalVolume** custom resource (CR).
   Example of **LocalVolume** CR **local-storage-block.yaml** using OpenShift Storage Container label as node selector and **by-id** device identifier:

   ```
   apiVersion: local.storage.openshift.io/v1
   kind: LocalVolume
   metadata:
     name: local-block
     namespace: local-storage
     labels:
       app: ocs-storagecluster
   spec:
     tolerations:
     - key: "node.ocs.openshift.io/storage"
       value: "true"
       effect: NoSchedule
     nodeSelector:
       nodeSelectorTerms:
         - matchExpressions:
             - key: cluster.ocs.openshift.io/openshift-storage
               operator: In
               values:
                 - ''
     storageClassDevices:
       - storageClassName: localblock
         volumeMode: Block
         devicePaths:
           - /dev/disk/by-id/nvme-
   Amazon_EC2_NVMe_Instance_Storage_AWS10382E5D7441494EC   # <-- modify this line
           - /dev/disk/by-id/nvme-
   Amazon_EC2_NVMe_Instance_Storage_AWS1F45C01D7E84FE3E9   # <-- modify this line
           - /dev/disk/by-id/nvme-
   Amazon_EC2_NVMe_Instance_Storage_AWS136BC945B4ECB9AE4   # <-- modify this line
           - /dev/disk/by-id/nvme-
   Amazon_EC2_NVMe_Instance_Storage_AWS10382E5D7441464EP   # <-- modify this line
           - /dev/disk/by-id/nvme-
   Amazon_EC2_NVMe_Instance_Storage_AWS1F45C01D7E84F43E7   # <-- modify this line
           - /dev/disk/by-id/nvme-
   Amazon_EC2_NVMe_Instance_Storage_AWS136BC945B4ECB9AE8   # <-- modify this line
   ```

   Each Amazon EC2 I3 instance has two disks and this example uses both disks on each node.

2. Create the **LocalVolume** CR.

   ```
   $ 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-59rmn        1/1     Running   0          15m
   local-block-local-diskmaker-6n7ct        1/1     Running   0          15m
   local-block-local-diskmaker-jwtsn        1/1     Running   0          15m
   local-block-local-provisioner-6ssxc      1/1     Running   0          15m
   local-block-local-provisioner-swwvx      1/1     Running   0          15m
   local-block-local-provisioner-zmv5j      1/1     Running   0          15m
   local-storage-operator-7848bbd595-686dg  1/1     Running   0          15m
   ```

4. Check if the PVs are created.
   You must see a new PV for each of the local storage devices on the three worker nodes. Refer to the example in the Finding available storage devices section that shows two available storage devices per worker node with a size 2.3 TiB for each node.

   ```
   $ oc get pv
   ```

   Example output:

   ```
   NAME              CAPACITY ACCESS MODES  RECLAIM POLICY STATUS       CLAIM
   STORAGECLASS  REASON   AGE
   local-pv-1a46bc79  2328Gi   RWO          Delete         Available          localblock          14m
   local-pv-429d90ee  2328Gi   RWO          Delete         Available          localblock
   14m
   local-pv-4d0a62e3  2328Gi   RWO          Delete         Available          localblock
   14m
   local-pv-55c05d76  2328Gi   RWO          Delete         Available          localblock          14m
   local-pv-5c7b0990  2328Gi   RWO          Delete         Available          localblock          14m
   local-pv-a6b283b   2328Gi   RWO          Delete         Available          localblock          14m
   ```

5. Check for the new **StorageClass** that is now present when the **LocalVolume** CR is created. This **StorageClass** is used to provide the **StorageCluster** PVCs in the following steps.

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

   Example output:

   ```
   NAME          PROVISIONER                    RECLAIMPOLICY
   VOLUMEBINDINGMODE ALLOWVOLUMEEXPANSION     AGE
   localblock    kubernetes.io/no-provisioner   Delete
   WaitForFirstConsumer  false                 15m
   ```

6. Create the **StorageCluster** CR that uses the **localblock** StorageClass to consume the PVs created by the Local Storage Operator.
   Example of **StorageCluster** CR **ocs-cluster-service.yaml** using **monDataDirHostPath** and **localblock** StorageClass.

```
apiVersion: ocs.openshift.io/v1
kind: StorageCluster
metadata:
  name: ocs-storagecluster
  namespace: openshift-storage
spec:
  manageNodes: false
  resources:
    mds:
      limits:
        cpu: 3
        memory: 8Gi
      requests:
        cpu: 1
        memory: 8Gi
  monDataDirHostPath: /var/lib/rook
  storageDeviceSets:
    - count: 2
      dataPVCTemplate:
        spec:
          accessModes:
            - ReadWriteOnce
          resources:
            requests:
              storage: 2328Gi
          storageClassName: localblock
          volumeMode: Block
      name: ocs-deviceset
      placement: {}
      portable: false
      replica: 3
      resources:
        limits:
          cpu: 2
          memory: 5Gi
        requests:
          cpu: 1
          memory: 5Gi
```

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 PVs created on the nodes.

7. Create **StorageCluster** CR.

```
$ oc create -f ocs-cluster-service.yaml
```

Example output

```
storagecluster.ocs.openshift.io/ocs-cluster-service created
```

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)

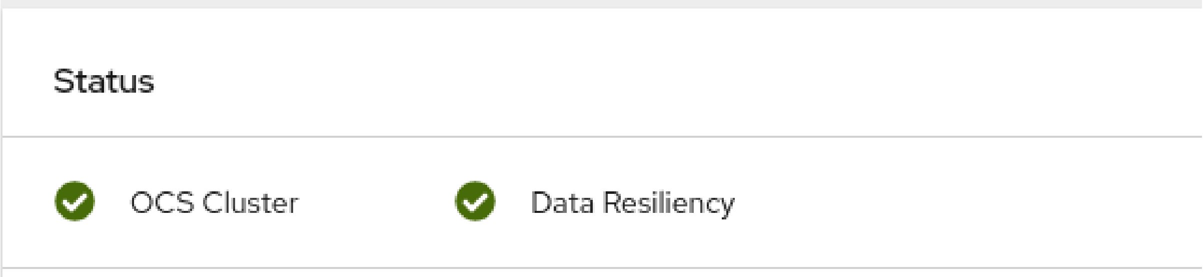
Component	Corresponding pods
MDS	**rook-ceph-mds-ocs-storagecluster-cephfilesystem-*** (2 pods distributed across storage nodes)
CSI	- **cephfs** - **csi-cephfsplugin-*** (1 pod on each worker node) - **csi-cephfsplugin-provisioner-*** (2 pods distributed across storage nodes) - **rbd** - **csi-rbdplugin-*** (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

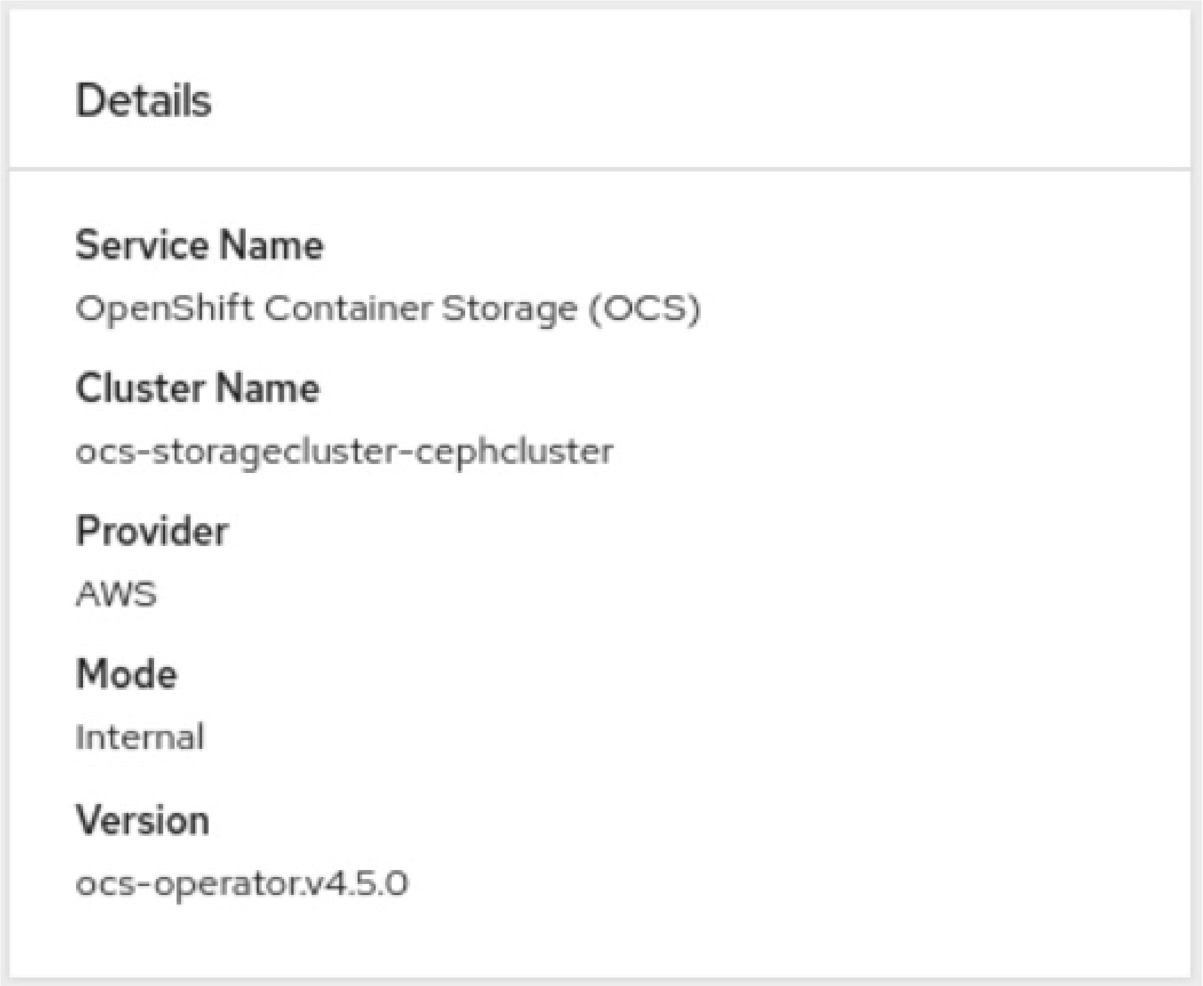


Status

✓ OCS Cluster ✓ Data Resiliency

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

Figure 3.2. Details card in Persistent Storage Overview Dashboard



Details

Service Name

OpenShift Container Storage (OCS)

Cluster Name

ocs-storagecluster-cephcluster

Provider

AWS

Mode

Internal

Version

ocs-operator.v4.5.0

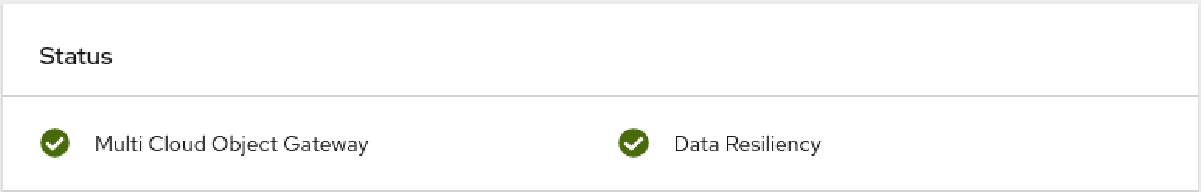
3.3. VERIFYING THE MULTICLOUD OBJECT GATEWAY IS HEALTHY

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



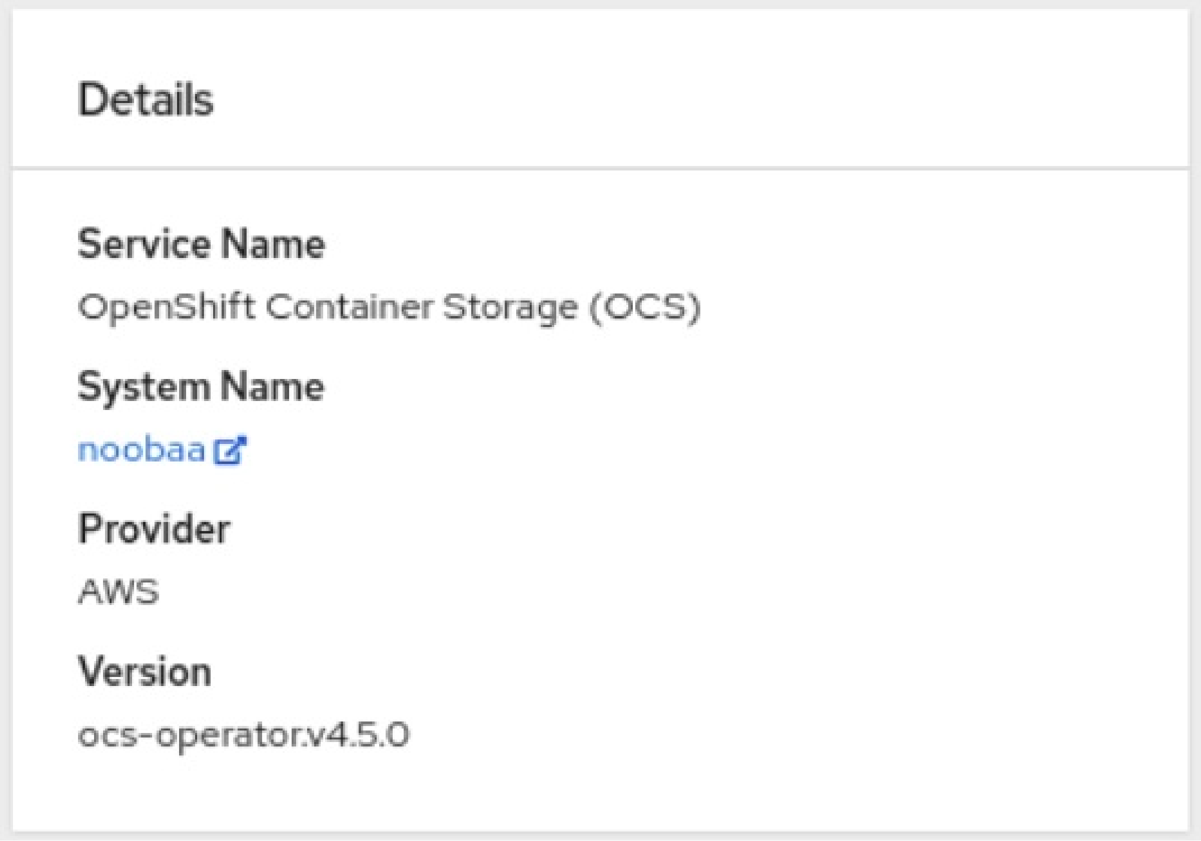
Status

✓ Multi Cloud Object Gateway

✓ Data Resiliency

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

Figure 3.4. Details card in Object Service Overview Dashboard



Details

Service Name

OpenShift Container Storage (OCS)

System Name

noobaa

Provider

AWS

Version

ocs-operator.v4.5.0

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**

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=="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
```

NOTE

Uninstalling OpenShift Container Storage clusters on AWS deletes all the OpenShift Container Storage data stored on the target buckets, however, neither the target buckets created by the user nor the ones that were automatically created during the OpenShift Container Storage installation gets deleted and the data that does not belong to OpenShift Container Storage remains on these target buckets.

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:
.
.
.
```

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
   ```