

Red Hat OpenShift Container Storage 4.6

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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Abstract

Read this document for instructions on installing Red Hat OpenShift Container Storage 4.6 on Red Hat OpenShift Container Platform VMware vSphere clusters.

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PREFACE

Red Hat OpenShift Container Storage 4.6 supports deployment on existing Red Hat OpenShift Container Platform (RHOCP) 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:

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



NOTE

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

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



NOTE

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 (RHOCP) cluster.
- You must have at least three worker nodes in the RHOCP cluster.

NOTE

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

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

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

Procedure

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

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



NOTE

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

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



NOTE

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

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



IMPORTANT

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



IMPORTANT

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

• If you click **Approve**.

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

Verification steps

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

1.3. 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

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

Figure 1.1. OpenShift Container Storage Operator page

Red Hat OpenShift Container Pla	latform						4 2	0 0	kube:admin 👻
📽 Administrator	I		You are logged in as a tempo	rary administrative user. Update th	ne <u>cluster OAuth configuration</u> to allow othe	ers to log in	n.		
Administrator		Project: openshift-storage	•						
Home	>								
		Installed Operato	rs						
Operators									
operators	~	Installed Operators are represe	ented by Cluster Service Versions within this	namespace. For more information.	see the Understanding Operators docume	ntation 🛪	Or create	n Operato	r and Cluster Service
OperatorHub	Ý	Installed Operators are represe Version using the Operator SD	ented by Cluster Service Versions within this i K 🖉	namespace. For more information,	see the Understanding Operators docume	ntation 🗗	Or create	in Operator	r and Cluster Service
	Ť		Kø.	namespace. For more information,	see the Understanding Operators document	ntation 🖪.	Or create	in Operato	r and Cluster Service
OperatorHub	Ť	Version using the Operator SD Name Search by name	К а . 1е			ntation 🖪.			r and Cluster Service
OperatorHub	` 、	Version using the Operator SD	ж а .	namespace. For more information, Status	see the Understanding Operators document	ntation 🗗	Or create		r and Cluster Service
OperatorHub Installed Operators Workloads	,	Version using the Operator SD Name Search by name	Kg. ne // Managed Namespaces	Status		ntation 🗗	Provided Storage (APIs	r and Cluster Service
OperatorHub		Version using the Operator SD Name Search by nam Name OpenShift Contai	Kr . Managed Namespaces I ner Copenshift-storage	Status	Last Updated	ntation 🗗	Provided	APIs Cluster tore	r and Cluster Service

2. Click OpenShift Container Storage.

Figure 1.2. Details tab of OpenShift Container Storage

Project: openshift-storage 🛛 👻			
Installed Operators > Operator Details OpenShift Container Storage 4.6.0 provided by Red Hat			Actions -
Details YAML Subscription Ev	vents All Instances Storage Cluste	r Backing Store Bucket Class	
Provided APIs			Provider Red Hat
CCS Storage Cluster 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 BucketClass to construct data placement policies.	Storage policy spec tiering, mirroring, spreading, combines BackingStores. Referenced by ObjectBucketClaims.	Created At ♥ Nov 12, 11:48 am Links Source Code https://github.com/openshift/ocs-operator ₫* Maintainers Red Hat Support
	• Create Instance	● Create Instance	ocs-support@redhat.com
	r	t serves to facilitate the other operators in OpenShift Co lesources.	ontainer Storage by

3. Click Create Instance link of Storage Cluster.

Figure 1.3. Create Storage Cluster page

Project: openshift-storage 🔹

OpenShift Container Storage > Create Storage Cluster

Create Storage Cluster

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

Select Mode: OInternal OInternal - Attached Devices External

A bucket will be created to provide the OCS Service.

Capacity

Storage Class 🚱	
SC thin	•
OCS Service Capacity 🚱	
4 TiB	-

Encryption

Enable data encryption for the OCS storage cluster

 Enabled

Nodes

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

lame	 Search by name 	e /			
4	Name	Role	Location	CPU	Memory
•	N compute-0	worker	-	16	61.81 GiB
•	N compute-1	worker	-	16	61.81 GiB
*	N compute-2	worker	-	16	61.81 GiB



- 4. On the Create Storage Cluster page, ensure that the following options are selected:
 - a. In the Select Mode section, Internal mode is selected by default.

- b. Storage Class is set by default to thin for VMware.
- c. Select **OpenShift Container Storage Service Capacity** from drop down list.



NOTE

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

- d. **(Optional)** In the **Encryption** section, set the toggle to **Enabled** to enable data encryption on the cluster.
- e. In the **Nodes** section, select at least three worker nodes from the available list for the use of OpenShift Container Storage service.

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.

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

5. Click Create.

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

Verification steps

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

CHAPTER 2. DEPLOYING 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, enable 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. Create OpenShift Container Storage cluster on VMware .

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

- You must upgrade to a latest version of OpenShift Container Platform 4.6 before deploying OpenShift Container Storage 4.6. For information, see Updating OpenShift Container Platform clusters guide.
- 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.
- 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.
 - The devices you use must be empty; the disks must not include physical volumes (PVs), volume groups (VGs), or logical volumes (LVs) remaining on the disk.
- For minimum starting node requirements, see Resource requirements section in Planning guide.

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

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



NOTE

× ·

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 (RHOCP) cluster.
- You must have at least three worker nodes in the RHOCP cluster.

NOTE

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

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

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

Procedure

- 1. Click **Operators** \rightarrow **OperatorHub** in the left pane of the OpenShift Web Console.
- 2. Use **Filter by keyword** text box or the filter list to search for OpenShift Container Storage from the list of operators.
- 3. Click OpenShift Container Storage.
- 4. On the **OpenShift Container Storage operator** page, click Install.
- 5. On the Install Operator page, ensure the following options are selected by default::
 - a. Update Channel as stable-4.6
 - b. Installation Mode as A specific namespace on the cluster
 - c. Installed Namespace as Operator recommended namespace openshift-storage. If Namespace openshift-storage does not exist, it will be created during the operator installation.
 - d. Select **Enable operator recommended cluster monitoring on this namespace**checkbox as this is required for cluster monitoring.
 - e. Select **Approval Strategy** as **Automatic** or **Manual**. Approval Strategy is set to **Automatic** by default.
 - Approval Strategy as Automatic.



NOTE

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

- i. Click Install
- ii. Wait for the install to initiate. This may take up to 20 minutes.
- iii. Click Operators → Installed Operators

- iv. Ensure the **Project** is **openshift-storage**. By default, the **Project** is **openshift-storage**.
- v. Wait for the Status of OpenShift Container Storage to change to Succeeded.
- Approval Strategy as Manual.



NOTE

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

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



IMPORTANT

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



IMPORTANT

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

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

- Click Operators → Installed Operators
- Ensure the Project is openshift-storage. By default, the Project is openshift-storage.
- Wait for the Status of OpenShift Container Storage to change to Succeeded.

Verification steps

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

2.5. 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.

Procedure

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

Figure 2.1. Install Operator page

You are logged in as a temporary administrative user. U	Jpdate the <u>cluster OAuth configuration</u> to allow others t	to log in.					
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 determin	es either manual or automatic updates.						
Update Channel *	Local Storage						
4.6	Provided APIs						
Installation Mode *							
 All namespaces on the cluster (default) 	LV Local Volume	Local Volume Set					
This mode is not supported by this Operator	Manage local storage volumes for	A Local Volume set allows you to filter a					
 A specific namespace on the cluster 	OpenShift	set of storage volumes, group them and					
Operator will be available in a single namespace only.		create a dedicated storage class to consume storage from the set of					
Installed Namespace *		volumes.					
Operator recommended namespace: () openshift-local-storage							
Namespace creation							
Namespace openshift-local-storage does not exist and will be created.	Local Volume Discovery	LVDR Local Volume Discovery Result					
 Pick an existing namespace 	Discover list of potentially usable disks	Disc inventory of available disks from					
	on the chosen set of nodes	selected nodes					
Approval Strategy * Approval Strategy * Approval Strategy *							
Automatic Manual							
Install Cancel							

5. Set the following options on the Install Operator page:

- a. Update Channel as 4.6
- b. Installation Mode as A specific namespace on the cluster
- c. Installed Namespace as **Operator recommended namespace openshift-local-storage**.
- d. Approval Strategy as Automatic
- 6. Click Install.
- 7. Verify that the Local Storage Operator shows the Status as **Succeeded**.

2.6. CREATING OPENSHIFT CONTAINER STORAGE CLUSTER ON VMWARE

Use this procedure to create storage cluster on VMware infrastructure when a storage class does not exist.

If you already have a storage class created, you can directly create a storage cluster as described in Creating a storage cluster on VMware when a storage class exists section.

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 a minimum of 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.

Procedure

- 1. Log into the OpenShift Web Console.
- Click Operators → Installed Operators to view all the installed operators. Ensure that the Project selected is openshift-storage.

Figure 2.2. OpenShift Container Storage Operator page

Red Hat OpenShift Container Pla	tform						4 2	Ð	Ø	kube:admin 👻
🏶 Administrator	-		You are logged in as a tempora	ry administrative user. Update th	e <u>cluster OAuth configuration</u> to allow other	s to log i	n.			
Administrator	Ť	Project: openshift-storage 🔹								
Home	>	Installed Operators								
Operators	~									
OperatorHub		Installed Operators are represented I Version using the Operator SDK 🗗.	by Cluster Service Versions within this na	mespace. For more information,	see the Understanding Operators documen	tation 🗹	. Or creat	e an Op	erator and	d Cluster Service
Installed Operators		Name Search by name	7							
Workloads	>	Name 1	Managed Namespaces	Status	Last Updated		Provide	ed APIs		
Workloads		OpenShift Container	NS openshift-storage	Succeeded	Nov 12, 11:49 am		Storage	Cluste	r	
Networking	>	4.6.0 provided by Red Hat		Up to date			Backing Bucket	g Store		:
Storage	>									

3. Click OpenShift Container Storage.

Figure 2.3. Details tab of OpenShift Container Storage

OpenShift Container Storage 4.6.0 provided by Red Hat			Actions
tails YAML Subscription E	vents All Instances Storage Cluste	er Backing Store Bucket Class	
ovided APIs			Provider Red Hat
OCS Storage Cluster Storage Cluster represents a OpenShift Container Storage Cluster including Ceph Cluster, NooBaa and all the storage and compute resources required.	NBS Backing Store Storage target spec such as aws-s3, s3- compatible, ibm-cos, PV's and more. Used in BucketClass to construct data placement policies.	NEO Bucket Class Storage policy spec tiering, mirroring, spreading. Combines BackingStores. Referenced by ObjectBucketClaims.	Created At Nov 12, 11:48 am Links Source Code https://github.com/openshift/ocs-operator @ Maintainers
Oreate Instance	 Create Instance 	• Create Instance	Red Hat Support ocs-support@redhat.com
scription			
Hat OpenShift Container Storage deploys t	hree operators.		
enShift Container Storage operato			

4. Click Create Instance link of Storage Cluster.

Figure 2.4. Create Storage Cluster page

You an	e logged in as a temporary administrative user. Update the <u>cluster OAuth configuration</u> to allow others to log in.
Project: openshift-storage 📼	
Create Storage Cluster OCS runs as a cloud-native service for optimal integration with applications	in need of storage, and handles the scenes such as provisioning and management.
Select Mode: 🔿 Internal 💿 Internal - Attached Devices 💿 External	

- 5. Select Internal-Attached devices for the Select Mode. By default, Internal is selected.
- 6. Create a storage cluster using the wizard that includes disk discovery, storage class creation, and storage cluster creation.

You are prompted to install the Local Storage Operator if it is not already installed. Click **Install** and install the operator as described in Installing Local Storage Operator.

Discover Disks

You can discover a list of potentially usable disks on the selected nodes. Block disks and partitions that are not in use and available for provisioning persistent volumes (PVs) are discovered.

Figure 2.5. Discovery Disks wizard page

	You are logged in as a temporary administrative user. Up	date the <u>cluster OAuth confi</u> g	<u>guration</u> to allow of	thers to log in.			
Project: openshift-storage 🔹							
Create Storage Cluste	OpenSMIt Container Storage Create Storage Cluster Create Storage Cluster OCS runs as a cloud-native service for optimal integration with applications in need of storage, and handles the scenes such as provisioning and management.						
Select Mode: O Internal Internal	al - Attached Devices 🔘 External						
Missing storage class The storage cluster needs to use a	storage class to consume the local storage. In order to create one you need to discover the available disks and	create a storage class using the	filters to select the	disks you wish to u	ise.		
Discover Disks Create Storage Class Greate Storage Cluster	Auto Detect Volume Allows you to discover the available disks on all available nodes Node Selector All nodes Selecting all nodes will discover for available disks storage on all nodes. Selecting nodes allow you to limit the discovery for available disks to specific nodes.						
	Name Search by name						
	Name 1	Role	Zone	CPU	Memory		
	C 🚯 compute-0	worker	-	16	61.81 GIB		
	O compute-1 O compute-2	worker	-	16	61.81 GiB		
	3 nodes selected	worker	-	10	0.01010		
	Next Back Cancel						

- a. Choose one of the following:
 - All nodes to discover disks in all the nodes.
 - Select nodes to discover disks from a subset of the listed nodes. 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 and Label allows you to search by selecting the predefined label.

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



NOTE

If the nodes to be selected are tainted and not discovered in the wizard, follow the steps provided in the Red Hat Knowledgebase Solution as a workaround.

b. Click Next.

Create Storage Class

You can create a dedicated storage class to consume storage by filtering a set of storage volumes.

	You are logged in as a temporary administrative user. Update the <u>cluster OAuth configuration</u> to allow others to log in.	
Project: openshift-storage 🔹		
The storage cluster needs to use	a storage class to consume the local storage. In order to create one you need to discover the available disks and create a storage class using the filters to select the disks you wish to use.	
1 Discover Disks		
	Local Volume Set A Local Volume Set allows you to filter a set of storage volumes, group them and create a dedicated storage class to consume storage for them.	
2 Create Storage Class		
3 Create Storage Cluster	Volume Set Name *	Selected Capacity
	localblock	3 Nodes 3 Disks
	Storage Class Name	
	localblock	
	Filter Disks	
	Node Selector	2.7 TiB
	All nodes (3 nodes) Selecting all nodes will use the available disks that match the selected filters on all nodes selected on previous step.	Out of 2.7 TiB
	⊖ Select nodes	
	Selecting all nodes will use the available disks that match the selected filters only on selected nodes.	
	Disk Type	
	All	
	V Advanced	
	Disk Mode	
	Block	
	Disk Size	
	Min Max	
	0 . THE 🕶	
	Max Disk Limit Disk limit will set the maximum number of PVs to create on a node. If the field is empty, will create PVs for all available disks on the matching nodes.	
	Disk limit will set the maximum number of PVs to create on a node. If the field is empty, will create PVs for all available disks on the matching nodes. All	
	Next Back Cancel	

Figure 2.6. Create Storage Class wizard page

- a. Enter the Volume Set Name.
- b. Enter the **Storage Class Name** By default, the volume set name appears for the storage class name.
- c. The nodes selected for disk discovery in the earlier step are displayed in the **Filter Disks** section. Choose one of the following:
 - All nodes to select all the nodes for which you discovered the available disks.
 - Select nodes to choose a subset of the nodes for which you discovered the available disks.

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 and Label allows you to search by selecting the predefined label.

It is recommended that the worker nodes are spread across three different physical nodes, racks or failure domains for high availability.



NOTE

Ensure OpenShift Container Storage rack labels are aligned with physical racks in the datacenter to prevent a double node failure at the failure domain level.

d. Select the required **Disk Type**. The following options are available:

All	Selects all types of disks present on the nodes. By default, this option is selected.
SSD/NVM E	Selects only SSD or NVME type of disks.

HDD

Selects only HDD type of disks.



NOTE

If the SSD/NVME disks are detected as HDD due to the underlying abstraction of storage, select the disk type as **All** or **HDD**. For example, local storage device as VMDK.

e. In the Advanced section, you can set the following:

Disk Mode	Block is selected by default.				
Disk Size	Minimum and maximum avaialable size of the device that needs to be included. NOTE You must set a minimum size of 100GB for the device.				
Max Disk Limit	This indicates the maximum number of PVs that can be created on a node. If this field is left empty, then PVs are created for all the available disks on the matching nodes.				

f. (Optional) You can view the selected capacity of the disks on the selected nodes using the *Select Capacity* chart.

This chart might take a few minutes to reflect the disks that are discovered in the previous step.

You can click on the *Nodes* and *Disks* links on the chart to bring up the list of nodes and disks to view more details.

Figure 2.7. List of selected nodes

lame	Role	Zone	CPU	Memory	
compute-0	worker	-	16	61.81 GiB	
compute-1	worker	-	16	61.81 GiB	
compute-2	worker	-	16	61.81 GiB	

Name 🏌	Node 1	Туре 🄱	Model 1	Capacity 🗍
/dev/nvme1n1	compute-0	disk	Dell Express Flash NVMe P4610 1.6TB SFF	1.46 TiB
/dev/nvmeOn 1	compute-1	disk	Dell Express Flash NVMe P4610 1.6TB SFF	1.46 TiB
/dev/nvme0n1	compute-2	disk	Dell Express Flash NVMe P4610 1.6TB SFF	1.46 TiB

Figure 2.8. List of selected disks

- g. Click Next.
- h. Click Yes in the message alert to confirm the creation of the storage class. After the local volume set and storage class are created, it is not possible to go back to the step.

Create Storage Cluster

Figure 2.9. Create Storage Cluster wizard page

^		You are logged in as a temporary acm	instrative user. Update the	cluster OAuth co	<u>enfiguration</u> to allo	w others to log in	
	Project: openshift-storage 🔹						
	Create Storage Cluster OCS runs as a cloud native service for optimal integration with applications in need of storage, and handles the scenes such as provisioning and management.						
	Select Mode: 🔘 Internal 🛎 Internal	- Attached Devices O External					
	1 Discover Disks 2 Create Storage Class	A bucket will be created to provide the OCS Service.					
	3 Create Storage Cluster	Capacity					
		Storage Class @ Control Storage Class @ Available capacity: 437 TIB / 3 repicae					
		Encryption Enable data encryption for the OCS storage cluster Enabled					
		Nodes					
		Selected nodes are based on the selected storage class. It is recommended to The selected nodes will be labeled with <u>duster.vcs.openalifi.id/openalifiestorag</u> scheduling targets for OCS scaling				s will be used for in	nitial deployment. The remaining rodes will be used by OpenShift as
		Name					
		Name	Role	Zone	CPU	Memory	*
		S compute O	worker		16	6181 GiB	_
		Compute-1	worker	-	16	6181 GiB	_
		Scompute-2	worker	-	16	618I GiB	*
÷		Create					

a. Select the required storage class.

You might need to wait a couple of minutes for the storage nodes corresponding to the selected storage class to get populated.

- b. (Optional) In the Encryption section, set the toggle to Enabled to enable data encryption on the cluster.
- c. The nodes corresponding to the storage class are displayed based on the storage class that you selected from the drop down list.
- d. Click Create.

The **Create** button is enabled only when a minimum of three nodes are selected. A new storage cluster of three volumes will be created with one volume per worker node. The default configuration uses a replication factor of 3.

To expand the capacity of the initial cluster, see Scaling Storage guide.

Verification steps

See Verifying your OpenShift Container Storage installation .

2.7. CREATING A STORAGE CLUSTER ON VMWARE WHEN A STORAGE CLASS EXISTS

You can create a Openshift Container Storage Cluster using the existing storage class that is created through the Local Storage Operator page.

Prerequisites

- Ensure that all the requirements in the Requirements for installing OpenShift Container Storage using local storage devices section are met.
- You must have a minimum of three worker nodes with the same storage type and size attached to each node (for example, 2TB NVMe hard drive) to use local storage devices on bare metal.
- You must have created a storage class that consists of a minimum of three nodes and volume attached to it.

Procedure

- 1. Log into the OpenShift Web Console.
- Click Operators → Installed Operators to view all the installed operators. Ensure that the Project selected is openshift-storage.

Figure 2.10 (OpenShift	Container	Storage	Operator page
1 igure 2.10. 0	Spensinit	Container	Storage	operator page

Bed Hat OpenShift Container Pla	atform						4 2	÷	0	kube:admin 👻
📽 Administrator	Ţ		You are logged in as a tempora	ry administrative user. Update th	e <u>cluster OAuth configuration</u> to allow other	rs to log	in.			
Auministrator		Project: openshift-storage 👻								
Home	>	Installed Operators								
Operators OperatorHub	~		by Cluster Service Versions within this na	mespace. For more information,	see the Understanding Operators documer	ntation 🖪	. Or crea	te an Op	erator an	d Cluster Service
Installed Operators		Name Search by name								
Workloads	>	Name †	Managed Namespaces 1	Status	Last Updated		Provid	led APIs		
Networking	>	4.6.0 provided by Red Ha	NS openshift-storage	Succeeded Up to date				je Cluste ig Store t Class		1
Storage	>									

3. Click OpenShift Container Storage.

Project: openshift-storage 🔹						
Installed Operators > Operator Details OpenShift Container Storage 4.6.0 provided by Red Hat			Actions •			
Details YAML Subscription E	vents All Instances Storage Cluste	r Backing Store Bucket Class				
Provided APIs			Provider Red Hat			
Storage Cluster 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-53, s3- compatible, ibm-cos, PV's and more. Used in BucketClass to construct data placement policies.	Storage policy spec tiering, mirroring, spreading, Combines BackingStores. Referenced by ObjectBucketClaims.	Created At			
Ocreate Instance	• Create Instance	● Create Instance				
			ift Container Storage by			

Figure 2.11. Details tab of OpenShift Container Storage

4. Click Create Instance link of Storage Cluster.

Figure 2.12. Create Storage Cluster page

	You are logged in as a temporary administrative user. Update the <u>cluster OAuth configuration</u> to allow others to log in.
Project: openshift-storage 🛛 👻	
Create Storage Cluster OCS runs as a cloud-native service for optimal integration with appl	lications in need of storage, and handles the scenes such as provisioning and management.
Select Mode: O Internal Internal Internal - Attached Devices O Ext	ternal

5. Select Internal-Attached devices for the Select Mode. By default, Internal is selected.

Figure 2.13. Create Storage Cluster page

•	You are logged in as a temporary administrative user. Update the <u>cluster OAuth configuration</u> to allow others to log in.					
Project: openshift-storage 🔻						
OpenShift Container Storage > Create Storage Cluster						
Create Storage Cluster						
OCS runs as a cloud-native service for optimal integration with applications	in need of storage, and handles the scenes such as pr	ovisioning and manag	gement.			
Select Mode: 🔿 Internal 🔹 Internal - Attached Devices 🔿 External						
A bucket will be created to provide the OCS Service.						
Capacity						
Storage Class @						
SG localblock -						
Available capacity: 2.73 TiB / 3 replicas						
Frenchien						
Encryption						
Enable data encryption for the OCS storage cluster						
Disabled						
Nodes						
Selected nodes are based on the selected storage class. It is recommended						
The selected nodes will be labeled with cluster.ocs.openshift.io/openshift.sto	rage="" (unless they are already labeled). 3 of the sel	ected nodes will be u	ised for initial deployn	nent. The remaining nodes	will be used by OpenShift as scheduling targets for OCS scaling.	
Name Vame Search by name						
Name	Role	Zone	CPU	Memory		
🚯 worker-01	worker	-	40	61.69 GiB		
🔇 worker-02	worker	-	40	61.69 GiB		
🔇 worker-03	worker	-	40	61.69 GiB		
Create Cancel						

6. (Optional) In the Encryption section, set the toggle to Enabled to enable data encryption on the cluster.

- 7. The nodes corresponding to the selected storage class are displayed. The selected nodes are labeled with **cluster.ocs.openshift.io/openshift-storage=**" if they are not already labeled. Three of the selected nodes are used for initial deployment and the remaining nodes are used as the scheduling targets for OpenShift Container Storage scaling.
- 8. Click Create.

The **Create** button is enabled only when a minimum of three nodes are selected.

A new storage cluster of three volumes will be created with one volume per worker node. The default configuration uses a replication factor of 3.

To expand the capacity of the initial cluster, see Scaling Storage guide.

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** \rightarrow **Pods** from the left pane of the OpenShift Web Console.
- 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

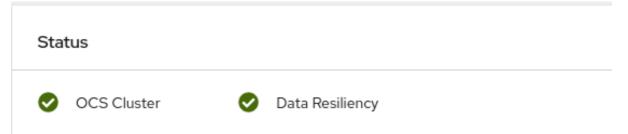
Component	Corresponding pods
OpenShift Container Storage Operator	 ocs-operator-* (1 pod on any worker node) ocs-metrics-exporter-*
Rook-ceph Operator	rook-ceph-operator-* (1 pod on any worker node)
Multicloud Object Gateway	 noobaa-operator-* (1 pod on any worker node) noobaa-core-* (1 pod on any storage node) noobaa-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)

Component	Corresponding pods
MGR	rook-ceph-mgr-* (1 pod on any storage node)
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 worker nodes) rbd csi-rbdplugin-* (1 pod on each worker node) csi-rbdplugin-provisioner-* (2 pods distributed across worker nodes)
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

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

Figure 3.1. Health status card in Persistent Storage Overview Dashboard



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

Service Name	
OpenShift Container Storage	
Cluster Name	
ocs-storagecluster	
Provider	
VSphere	
Mode	
Internal	
Version	
ocs-operator-4.6.0	

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

3.3. VERIFYING THE MULTICLOUD OBJECT GATEWAY IS HEALTHY

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

Figure 3.2. Health status card in Object Service Overview Dashboard

Status		
Object Service	Data Resiliency	

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

Service Name

OpenShift Container Storage

System Name

Multicloud Object Gateway RADOS Object Gateway

Provider

VSphere

Version

ocs-operator-4.6.0

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

3.4. VERIFYING THAT THE 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 IN INTERNAL MODE

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

Uninstall Annotations

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

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

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

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

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

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

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

Prerequisites

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

Procedure

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

\$ oc get volumesnapshot --all-namespaces

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

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

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

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

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

#!/bin/bash				
RBD_PROVISIONER="openshift-storage.rbd.csi.ceph.com" CEPHFS_PROVISIONER="openshift-storage.cephfs.csi.ceph.com" NOOBAA_PROVISIONER="openshift-storage.noobaa.io/obc" RGW_PROVISIONER="openshift-storage.ceph.rook.io/bucket"				
NOOBAA_DB_PVC="noobaa-db" NOOBAA_BACKINGSTORE_PVC="noobaa-default-backing-store-noobaa-pvc"				
# Find all the OCS StorageClasses OCS_STORAGECLASSES=\$(oc get storageclasses grep -e "\$RBD_PROVISIONER" -e "\$CEPHFS_PROVISIONER" -e "\$NOOBAA_PROVISIONER" -e "\$RGW_PROVISIONER" awk '{print \$1}')				
# List PVCs in each of the StorageClasses for SC in \$OCS_STORAGECLASSES do echo				
==" echo "\$SC StorageClass PVCs and OBCs" echo				
==" oc get pvcall-namespacesno-headers 2>/dev/null grep \$SC grep -v -e "\$NOOBAA_DB_PVC" -e "\$NOOBAA_BACKINGSTORE_PVC" oc get obcall-namespacesno-headers 2>/dev/null grep \$SC echo done				



NOTE

Omit RGW_PROVISIONER for cloud platforms.

• Delete the OBCs.



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

• Delete the PVCs.

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



NOTE

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

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

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

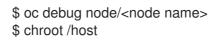
4. Check for cleanup pods if the **uninstall.ocs.openshift.io/cleanup-policy** was set to **delete**(default) and ensure that their status is **Completed**.

\$ oc get pods -n openshift-storage | grep -i cleanupNAMEREADYSTATUSRESTARTSAGEcluster-cleanup-job-<xx>0/1Completed08m35scluster-cleanup-job-<yy>0/1Completed08m35scluster-cleanup-job-<zz>0/1Completed08m35s

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

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

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



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

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

c. Remove the mapped device.

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

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

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

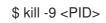
\$ ps

Example output:

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

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

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



• Verify that the device name is removed.



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

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

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

\$ oc get project openshift-storage



NOTE

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

- 8. Delete the local storage operator configurations if you have deployed OpenShift Container Storage using local storage devices. See Removing local storage operator configurations .
- 9. Unlabel the storage nodes.

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

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

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

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

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

12. Delete the Multicloud Object Gateway storageclass.

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

13. Remove CustomResourceDefinitions.

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

- 14. To ensure that OpenShift Container Storage is uninstalled completely, on the OpenShift Container Platform Web Console,
 - a. Click **Home** \rightarrow **Overview** to access the dashboard.
 - b. Verify that the Persistent Storage and Object Service tabs no longer appear next to the **Cluster** tab.

4.1.1. Removing local storage operator configurations

Use the instructions in this section only if you have deployed OpenShift Container Storage using local storage devices.



NOTE

For OpenShift Container Storage deployments only using **localvolume** resources, go directly to step 8.

Procedure

- 1. Identify the **LocalVolumeSet** and the corresponding **StorageClassName** being used by OpenShift Container Storage.
- 2. Set the variable SC to the **StorageClass** providing the **LocalVolumeSet**.

\$ export SC="<StorageClassName>"

3. Delete the **LocalVolumeSet**.

\$ oc delete localvolumesets.local.storage.openshift.io <name-of-volumeset> -n openshiftlocal-storage

4. Delete the local storage PVs for the given **StorageClassName**.

\$ oc get pv | grep \$SC | awk '{print \$1}'| xargs oc delete pv

5. Delete the StorageClassName.



6. Delete the symlinks created by the **LocalVolumeSet**.

[[! -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

7. Delete LocalVolumeDiscovery.

\$ oc delete localvolumediscovery.local.storage.openshift.io/auto-discover-devices -n openshift-local-storage

8. Removing **LocalVolume** resources (if any).

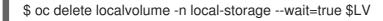
Use the following steps to remove the **LocalVolume** resources that were used to provision PVs in the current or previous OpenShift Container Storage version. Also, ensure that these resources are not being used by other tenants on the cluster.

For each of the local volumes, do the following:

- a. Identify the **LocalVolume** and the corresponding **StorageClassName** being used by OpenShift Container Storage.
- b. Set the variable LV to the name of the LocalVolume and variable SC to the name of the StorageClass
 For example:

\$ LV=local-block \$ SC=localblock

c. Delete the local volume resource.



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

\$ oc delete pv -I 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 ...

4.2. REMOVING MONITORING STACK FROM OPENSHIFT CONTAINER STORAGE

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

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

Prerequisites

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

Procedure

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

\$ oc get pod,pvc -n openshift-monitoring
NAME READY STATUS RESTARTS AGE
pod/alertmanager-main-0 3/3 Running 0 8d
pod/alertmanager-main-1 3/3 Running 0 8d
pod/alertmanager-main-2 3/3 Running 0 8d
pod/cluster-monitoring-
operator-84457656d-pkrxm 1/1 Running 0 8d
pod/grafana-79ccf6689f-2ll28 2/2 Running 0 8d
pod/kube-state-metrics-
7d86fb966-rvd9w 3/3 Running 0 8d
pod/node-exporter-4dsd72/2Running08dpod/node-exporter-6p4zc2/2Running08d
pod/node-exporter-jbjvg 2/2 Running 0 8d
pod/node-exporter-jpjvg 2/2 Running 0 6d18h
pod/node-exporter-Jj4t5 2/2 Running 0 6d18h
pod/node-exporter-rf8gn 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

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-cephrbd 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

 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

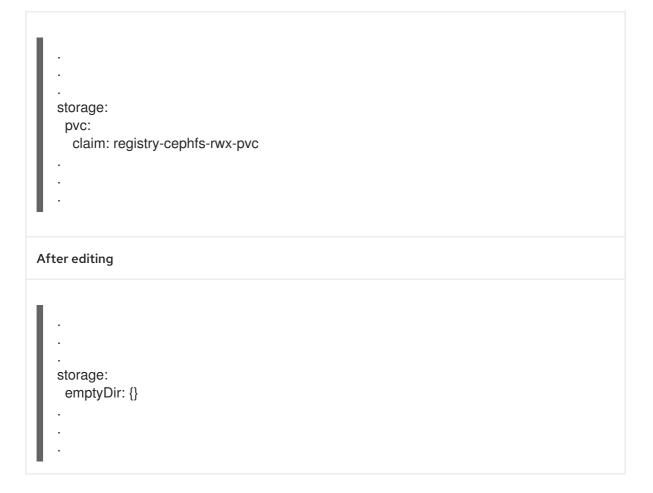
• The image registry should have been configured to use an OpenShift Container Storage PVC.

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



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 the **openshiftlogging** 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