

Red Hat OpenShift Container Storage 4.5

Deploying OpenShift Container Storage on VMware vSphere

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

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Abstract

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

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PREFACE

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



NOTE

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

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

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

CHAPTER 1. DEPLOY USING DYNAMIC STORAGE DEVICES

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



NOTE

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

Follow the below steps for deployment:

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



NOTE

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

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

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

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



NOTE

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

Procedure

Perform the following steps on each node in your cluster.

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

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

If you do not see both **rhel-7-server-rpms** and **rhel-7-server-extras-rpms** in the output, or if

there is no output, run the following commands to enable each repository.

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

3. Install the required packages.

yum install -y policycoreutils container-selinux

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

setsebool -P container_use_cephfs on

1.2. INSTALLING RED HAT OPENSHIFT CONTAINER STORAGE OPERATOR

You can install Red Hat OpenShift Container Storage Operator using the Red Hat OpenShift Container Platform Operator Hub. For information about the hardware and software requirements, see Planning your deployment.

Prerequisites

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



NOTE

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

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

Procedure

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

Figure 1.1. List of operators in the Operator Hub

■ C Red Hat OpenShift Co	ntainer Platform							Ð	0	kube:admin 👻
📽 Administrator	- Proj	oject: default 👻	You	are logged in as a temporary administ	rative user. Update the <u>cluster OAuth</u>	configuration to allow others to log in.				
Home	, Ob	peratorHub								
Operators OperatorHub			netes community and Red Hat partne per Catalog, providing a self-service e	ers, curated by Red Hat. Operators can experience.	be installed on your clusters to provic	le optional add-ons and shared service	es to your developers. Once	installed,	the capabi	lities provided by
Installed Operators Workloads	> All Its	Items	Storage							
Networking	· · · ·	Machine Learning	Filter by keyword							14 items
Storage Builds	> Big D	Data oud Provider	Community	Community	Community		Come	nunity		
Monitoring	Data	tabase veloper Tools	AWS S3 Operator provided by Community	Ember CSI Operator provided by Red Hat	IBM Spectrum Scale CSI Plugin Operator	IBM Spectrum Scale CSI Plugin Operator	lib-bucket-provisioner			
Compute	· ·	egration & Delivery gging & Tracing	Manage the full lifecycle of installing, configuring and	Operator to deploy Ember- CSI, a multi-vendor CSI plugin	provided by IBM An operator for deploying and	provided by IBM An operator for deploying and	Library for the dynamic provisioning of object st			
User Management Administration		nitoring tworking	managing AWS S3 Provisioner.	driver supporting over 80 storage drivers in a single	managing the IBM CSI Spectrum Scale Driver.	managing the IBM CSI Spectrum Scale Driver.	buckets to be used by o store providers.	bject		
	Secu Stor Strea INST In In N N N PRO		Local Storage provided by Red Hat Configure and use local storage volumes in kubernetes and Openshift	Community 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 1	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 so for production workload			

2. Click on OpenShift Container Storage.

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

- 3. On the OpenShift Container Storage operator page, click Install.
- 4. On the Install Operator page, ensure the following options are selected:
 - a. Update Channel as stable-4.5
 - b. Installation Mode as A specific namespace on the cluster
 - c. Installed Namespace as **Operator recommended namespace PR openshift-storage**. If Namespace **openshift-storage** does not exist, it will be created during the operator installation.
 - d. Select **Approval Strategy** as **Automatic** or **Manual**. Approval Strategy is set to **Automatic** by default.
 - Approval Strategy as Automatic.



NOTE

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

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



NOTE

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

- i. Click Install.
- ii. On the Installed Operators page, click ocs-operator.
- iii. On the Subscription Details page, click the Install Plan link.
- iv. On the InstallPlan Details page, click Preview Install Plan.
- v. Review the install plan and click Approve.

- vi. Wait for the **Status** of the **Components** to change from **Unknown** to either **Created** or **Present**.
- vii. Click Operators -> Installed Operators
- viii. Ensure the **Project** is **openshift-storage**. By default, the **Project** is **openshift-storage**.
- ix. Wait for the Status of OpenShift Container Storage to change to Succeeded.

Verification steps

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

1.3. CREATING AN OPENSHIFT CONTAINER STORAGE CLUSTER SERVICE IN INTERNAL MODE

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

Prerequisites

- The OpenShift Container Storage operator must be installed from the Operator Hub. For more information, see Installing OpenShift Container Storage Operator using the Operator Hub .
- For VMs on VMware, ensure the disk.EnableUUID option is set to TRUE. You need to have vCenter account privileges to configure the VMs. For more information, see Required vCenter account privileges. To set the disk.EnableUUID option, use the Advanced option of the VM Options in the Customize hardware tab. For more information, see Creating Red Hat Enterprise Linux CoreOS (RHCOS) machines in vSphere.

Procedure

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

Figure 1.2. OpenShift Container Storage Operator page

Red Hat OpenShift Container Platfor					≡ ≉ ⊙	😧 kube:admin 👻
S Administrator		You are logged in as a	temporary administrative user. Update th	he <u>cluster OAuth configuration</u> to allow others to log		
 Administrator 	Project: openshift-storage 👻					
	>					
Operators	Installed Operators					
OperatorHub	Installed Operators are represented by Clu	ster Service Versions within this namespace. Fo	more information, see the Operator Life	ecycle Manager documentation 🖉. Or create an Oper	ator and Cluster Service Version using th	e Operator SDK 🖉.
Installed Operators	Name Search by name	7				
Workloads	> Name 1	Managed Namespaces	Status	Last Updated	Provided APIs	
	> OpenShift Container Storage	NS openshift-storage	Succeeded	Jul 10, 12:28 am	Storage Cluster	:
	4.5.0 provided by Red Hat, Inc		Up to date		Backing Store Bucket Class	*
Builds	>					
Monitoring	~					

- 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

e Red Hat OpenShift Container Platform				
📽 Administrator 🚽		You are logged in as a temporary	administrative user. Update the <u>cluster OAuth con</u>	figuration to allow othe
🐱 Administrator 🛛 👻	Project: openshift-storage 🔹			
Home 🗸	Installed Operators > Operator Details			
Overview	OpenShift Container Storage			
Projects	4.5.1 provided by Red Hat			
Search	Details YAML Subscription Ev	vents All Instances Storage Cluste	r Backing Store Bucket Class	
Explore				
Events	Provided APIs			
Operators 🗸 🗸	OCS Storage Cluster	NBS Backing Store	NBC Bucket Class	
OperatorHub			_	
Installed Operators	Storage Cluster represents a OpenShift Container Storage Cluster including Ceph Cluster, NooBaa and all the	Storage target spec such as aws-s3, s3- compatible, ibm-cos, PV's and more. Used in BacketClass to construct data	Storage policy spec tiering, mirroring, spreading. Combines BackingStores. Referenced by ObjectBucketClaims.	
Workloads >	storage and compute resources required.	placement policies.		
Networking >		O Create Instance	• Create Instance	
Storage >				

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

Figure 1.4. Storage Cluster tab

Red Hat OpenShift Container Platform	₩ ° 0	kube:admin 👻
🕫 Administrator 🗸 🔒		
	Project: openshift-storage 💌	
Home >	Installed Operators > Operator Details	
Operators 🗸	OpenShift Container Storage	Actions 👻
OperatorHub	4.5.0 provided by Red Hat, Inc	
Installed Operators	Details YAML Subscription Events All Instances Storage Cluster Backing Store Bucket Class	
Workloads >	OCS Cluster Services	
Networking >	OCS Cluster Services	CS Cluster Service
Storage	No Operands Found	

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

Figure 1.5. Create Storage Cluster page

	ci openion	nift-storage 🔻					
OpenSh	nift Contain	er Storage > Create OCS Clus	ter Service				
		orage Cluster					
OCS rui	ins as a clo	ud-native service for optimal i	ntegration with applications	s in need of storage, an	d handles the	e scenes such as provisi	oning and management.
Colori	t Mode						
Select	t wode						
Inter	rnal						
Exte	ernal						
Nodes							
		ill be labeled with cluster.oc	s.openshift.io/openshi	ft-storage="" to cre	eate the OCS	Service unless they are	2
already	labeled.						
8	A bucket	will be created to provide the	OCS Service.				
Select a	at least 3 i	nodes in different failure don	ains with minimum requir	ements of 16 CPUs an	d 64 GiB of	RAM per node.	
		are used for initial deployment				-	CS
scaling.				, -,			
	lame 🔻	Search by name					
N	vanie +	o con or o y name					
		Name	Role	Location	CPU	Memory	
e	2		Role	Location	CPU 16	Memory 61.81 GiB	
	2 2	Name		Location -		-	
	2 2 2	Name © compute-0	worker	Location - -	16	61.81 GiB	
	2 2 2	Name Compute-0 Compute-1 Compute-2	worker	-	16 16	61.81 GIB	
	2	Name Compute-0 Compute-1 Compute-2	worker	-	16 16	61.81 GIB	
9 9 3 n	2 III	Name Compute-0 Compute-1 Compute-2	worker	-	16 16	61.81 GIB	
3 n Storage	2 IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	Name Compute-0 Compute-1 Compute-2	worker	-	16 16	61.81 GIB	
3 n Storage	2 III	Name Compute-0 Compute-1 Compute-2	worker	-	16 16	61.81 GIB	
3 n Storage	2 IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	Name Compute-0 Compute-1 Compute-2 Cted	worker	-	16 16	61.81 GIB	
3 n Storage	Class China	Name Compute-0 Compute-1 Compute-2 Cted	worker	-	16 16	61.81 GIB	
Storage OCS Ser	Class China	Name Compute-0 Compute-1 Compute-2 Cted Cted Cted	worker	-	16 16	61.81 GIB	
Storage OCS Ser	Class China	Name Compute-0 Compute-1 Compute-2 Cted Cted Cted	worker	-	16 16	61.81 GIB	

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



NOTE

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

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

- c. Storage Class is set by default to thin for VMware.
- d. Select OCS Service Capacity from drop down list.



NOTE

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

5. Click Create.



NOTE

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

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

Verification steps

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

CHAPTER 2. DEPLOYING USING LOCAL STORAGE DEVICES

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

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

2.1. OVERVIEW OF DEPLOYING WITH INTERNAL LOCAL STORAGE

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

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



NOTE

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

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

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

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

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

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

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

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



NOTE

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

Procedure

Perform the following steps on each node in your cluster.

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

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

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

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

3. Install the required packages.

yum install -y policycoreutils container-selinux

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

setsebool -P container_use_cephfs on

2.4. INSTALLING RED HAT OPENSHIFT CONTAINER STORAGE OPERATOR

You can install Red Hat OpenShift Container Storage Operator using the Red Hat OpenShift Container Platform Operator Hub. For information about the hardware and software requirements, see Planning your deployment.

Prerequisites

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



NOTE

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

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

Procedure

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

Center Center

Figure 2.1. List of operators in the Operator Hub

- 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 \rightarrow 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** \rightarrow **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

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 update Update Channel • 4.2 4.2-2-390x 4.3 4.4 4.5 Installation Mode • All namespaces on the cluster (default) This mode is not supported by this Operator 4. Aspecific namespace on the cluster Operator will be available in a single namespace only. Installed Namespace • (c) Local Volume Manage local storage volumes for OpenShift All namespace • (c) Local Volume Manage local storage volumes for OpenShift (c) Local Volume Manage local storage volumes for OpenShift (c) Local Volume Manage local storage volumes for OpenShift (c) Local Volume (c) Local V	Install Operator	
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 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* Installed Namespace * Approval Strategy* I Automatic	Jpdate Channel *	
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 4.4 4.5 Manage local storage volumes for OpenShift 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 • Approval Strategy • Automatic 	4.3	
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Installed Namespace • Installed Namespace • Approval Strategy • Automatic	A specific namespace on the cluster	
PR local-storage Approval Strategy Automatic	Operator will be available in a single namespace only.	
Approval Strategy * Automatic	nstalled Namespace *	
Automatic	PR local-storage	•
	Approval Strategy *	
Manual	Automatic	
	Manual	

- 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 -I cluster.ocs.openshift.io/openshift-storage=

Example output:

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

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

\$ oc debug node/<Nodename>

Example output:

```
$ oc debug node/compute-0
Starting pod/compute-0-debug ...
To use host binaries, run `chroot /host`
Pod IP: 10.1.50.36
If you don't see a command prompt, try pressing enter.
sh-4.2# chroot /host
sh-4.4# Isblk
NAME
                   MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
                  8:0 0 120G 0 disk
sda
-sda1
                   8:1 0 384M 0 part /boot
                   8:2 0 127M 0 part /boot/efi
-sda2
-sda3
                   8:3 0
                           1M 0 part
-sda4
                   8:4 0 119.5G 0 part
 -coreos-luks-root-nocrypt 253:0 0 119.5G 0 dm /sysroot
nvme0n1
                    259:0 0 1.5T 0 disk
```

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

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

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

In the above example, the ID for the local device 'nvmeOn1` is



- nvme-eui.010000001000005cd2e4895e0e5251
- 4. Repeat the above step to identify the device ID for all the other nodes that have the storage devices to be used by OpenShift Container Storage. See this Knowledge Base article for more details.

2.7. CREATING OPENSHIFT CONTAINER STORAGE CLUSTER ON VMWARE

Use this procedure to create storage cluster on VMware infrastructure.

VMware supports the following three types of local storage:

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

Prerequisites

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

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

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

Procedure

1. Create the LocalVolume CR for block PVs.

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

apiVersion: local.storage.openshift.io/v1 kind: LocalVolume metadata: name: local-block namespace: local-storage labels: app: ocs-storagecluster spec: nodeSelector: nodeSelectorTerms: - matchExpressions: - key: cluster.ocs.openshift.io/openshift-storage operator: In values: _ "" storageClassDevices: - storageClassName: localblock volumeMode: Block devicePaths: - /dev/disk/by-id/nvme-eui.0100000010000005cd2e4895e0e5251 # <-- modify this line - /dev/disk/by-id/nvme-eui.0100000010000005cd2e4ea2f0f5251 # <-- modify this line

- /dev/disk/by-id/nvme-eui.010000001000005cd2e4de2f0f5251 # <-- modify this line
- 2. Create LocalVolume CR for block PVs.

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

Example output:

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

3. Check if the pods are created.



\$ oc -n local-storage get pods

Example output:

NAME	READY	STA	TUS R	ESTAF	RTS AG	λE
local-block-local-diskmaker-5	brzv	1/1	Running	ј О	31s	
local-block-local-diskmaker-8	SXCS	1/1	Running	g 0	31s	
local-block-local-diskmaker-s	7s9p	1/1	Runnin	g 0	31s	
local-block-local-provisioner-	9cbw8	1/1	Runnin	g 0	31s	
local-block-local-provisioner-	cpddv	1/1	Running	у О	31s	
local-block-local-provisioner-	f6h7h	1/1	Running	0	31s	
local-storage-operator-75b97	'76b75-vw	/dzh	1/1 Ru	Inning	0	12m

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

\$ oc get sc | grep localblock

Example output:

96s

localblock kubernetes.io/no-provisioner Delete WaitForFirstConsumer false

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

\$ oc get pv

Example output:

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

- 6. Create the OpenShift Container Storage Cluster Service that uses the localblock Storage Class.
 - a. Log into the OpenShift Web Console.
 - b. Click **Operators** → **Installed Operators** from the OpenShift Web Console to view the installed operators. Ensure that the Project selected is openshift-storage.
 - c. On the Installed Operators page, click Openshift Container Storage.

Figure 2.3. OpenShift Container Storage Operator page

Red Hat OpenShift Container Pla	atform					₩ ♥ ♥ Ø	kube:admin 👻
S Administrator			You are logged in as a	a temporary administrative user. Update th	ne <u>cluster OAuth configuration</u> to allow others to log i	n.	
Administration		Project: openshift-storage 📼					
	>						
Operators	~	Installed Operators					
OperatorHub		Installed Operators are represented by Cluster	Service Versions within this namespace. Fo	r more information, see the Operator Life	cycle Manager documentation 🖉. Or create an Opera	ator and Cluster Service Version using the Operato	r SDK 🖉.
Installed Operators		Name 👻 Search by name	Z				
Workloads	>						
Networking	>	Name 1	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	1
	>	 4.5.0 provided by Red Hat, Inc 		op to date		Bucket Class	
	>						
	ŕ						

- d. On the **Installed Operators** \rightarrow **Operator Details** page, perform either of the following to create a Storage Cluster Service.
 - On the **Details tab** \rightarrow **Provided APIs** \rightarrow **OCS Storage Cluster** click **Create Instance**.

Red Hat OpenShift Container Pl	atform			
📽 Administrator			You are logged in as a temporary	y administrative user. Update the <u>cluster OAuth configuration</u> to a
vo / tarrin oct a con		Project: openshift-storage 🛛 🕶		
Home	~	Installed Operators > Operator Details		
		OpenShift Container Storage		
		4.5.1 provided by Red Hat		
		Details YAML Subscription Ev	vents All Instances Storage Cluste	er Backing Store Bucket Class
			5	
		Provided APIs		
Operators	~	OCS Storage Cluster	(NBS) Backing Store	NBC Bucket Class
OperatorHub		Storage Cluster represents a OpenShift	Storage target spec such as aws-s3, s3-	Storage policy spec tiering, mirroring,
		Container Storage Cluster including	compatible, ibm-cos, PV's and more.	spreading. Combines BackingStores.
Installed Operators		Ceph Cluster, NooBaa and all the	Used in BacketClass to construct data placement policies.	Referenced by ObjectBucketClaims.
	>	storage and compute resources required.	placement policies.	
Installed Operators Workloads Networking	> >		Create Instance	Create Instance

Figure 2.4. Operator Details Page

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

Red Hat OpenShift Container Platform	₩ ¢ ¢	kube:admin 👻
📽 Administrator 🗸		
	Project: openshift-storage 🔻	
Home >	Installed Operators > Operator Details	
Operators 🗸	OpenShift Container Storage	Actions 👻
OperatorHub	4.5.0 provided by Red Hat, Inc	Actions •
Installed Operators	Details YAML Subscription Events All Instances Storage Cluster Backing Store Bucket Class	
Workloads >	OCS Cluster Services	CS Cluster Service
Networking >		C3 Cluster Service
Storage >	No Operands Found	

Figure 2.5. Storage Cluster tab

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

OpenShift Cont	tainer Storage > Create OCS Cluster	Service				
Create S	storage Cluster					
OCS runs as a	cloud-native service for optimal inte	gration with applications in ne	ed of storage, and handle	es the scenes s	uch as provisioning	and manaç
Select Mod	le					
Internal						
 External 						
Nodes						
Selected node	s will be labeled with cluster.ocs.	openshift.io/openshift-s	torage="" to create the	OCS Service u	nless they are alrea	dy labeled
- (200 Lauren)						
1 A buck	et will be created to provide the O	CS Service.				
1 A buck	xet will be created to provide the O	CS Service.				
	et will be created to provide the O		ts of 16 CPUs and 64 Gi	B of RAM per i	node.	
Select at least		ns with minimum requiremen				aling.
Select at least	3 nodes in different failure domain	ns with minimum requiremen				ling.
Select at least 3 selected nod	3 nodes in different failure domain les are used for initial deployment. Th	ns with minimum requiremen he remaining selected nodes				aling.
Select at least 3 selected nod	3 nodes in different failure domain	ns with minimum requiremen				ling.
Select at least 3 selected nod Name	3 nodes in different failure domain les are used for initial deployment. The Search by name	ns with minimum requirement he remaining selected nodes 7	ill be used by OpenShift	as scheduling	targets for OCS sca	aling.
Select at least 3 selected nod Name	3 nodes in different failure domain les are used for initial deployment. The Search by name	ns with minimum requirement he remaining selected nodes to Role		as scheduling	targets for OCS sca Memory	aling.
Select at least 3 selected nod Name	3 nodes in different failure domain les are used for initial deployment. The Search by name Name Compute-0	ns with minimum requirement he remaining selected nodes in 7 Role worker	ill be used by OpenShift	CPU	Memory 61.81 GiB	aling.
Select at least 3 selected nod Name	3 nodes in different failure domain les are used for initial deployment. The Search by name Name compute-0 compute-1	ns with minimum requirement he remaining selected nodes to	ill be used by OpenShift	cPU 16 16	Memory 61.81 GiB 61.81 GiB	aling.
Select at least 3 selected nod Name 2 2 2 2 2	3 nodes in different failure domain les are used for initial deployment. The Search by name Name Compute-0 Compute-1 Compute-2	ns with minimum requirement he remaining selected nodes in 7 Role worker	ill be used by OpenShift	CPU	Memory 61.81 GiB	aling.
Select at least 3 selected nod Name	3 nodes in different failure domain les are used for initial deployment. The Search by name Name Compute-0 Compute-1 Compute-2	ns with minimum requirement he remaining selected nodes to	ill be used by OpenShift	cPU 16 16	Memory 61.81 GiB 61.81 GiB	aling.
Select at least 3 selected nod Name 2 2 2 2 2	3 nodes in different failure domain les are used for initial deployment. The Search by name Name Compute-0 Compute-1 Compute-2	ns with minimum requirement he remaining selected nodes to	ill be used by OpenShift	cPU 16 16	Memory 61.81 GiB 61.81 GiB	aling.
Select at least 3 selected nod Name 2 2 2 2 2	3 nodes in different failure domain les are used for initial deployment. The Search by name Name Compute-0 Compute-1 Compute-2	ns with minimum requirement he remaining selected nodes to	ill be used by OpenShift	cPU 16 16	Memory 61.81 GiB 61.81 GiB	aling.
Select at least 3 selected nod Name 2 2 2 3 nodes se	3 nodes in different failure domain les are used for initial deployment. The Search by name Name © compute-0 © compute-1 © compute-2 elected	ns with minimum requirement he remaining selected nodes to	ill be used by OpenShift	cPU 16 16	Memory 61.81 GiB 61.81 GiB	aling.
Select at least 3 selected nod Name 2 2 2 2 2	a 3 nodes in different failure domain les are used for initial deployment. The Search by name Name (i) compute-0 (i) compute-1 (ii) compute-2 elected	ns with minimum requirement he remaining selected nodes to	ill be used by OpenShift	cPU 16 16	Memory 61.81 GiB 61.81 GiB	aling.

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



NOTE

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

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

- Select localblock from the Storage Class dropdown list.
- f. Click Create.



NOTE

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

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

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)
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)

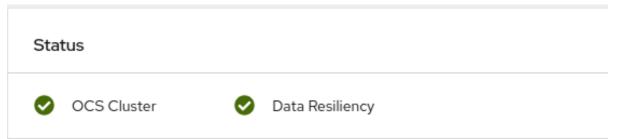
Component	Corresponding pods
MDS	rook-ceph-mds-ocs-storagecluster- cephfilesystem-*
RGW	(2 pods distributed across storage nodes) rook-ceph-rgw-ocs-storagecluster- cephobjectstore-* (2 pods distributed across storage nodes)
CSI	 cephfs csi-cephfsplugin-* (1 pod on each worker node) csi-cephfsplugin-provisioner-* (2 pods distributed across storage nodes) rbd csi-rbdplugin-* (1 pod on each worker node) csi-rbdplugin-provisioner-* (2 pods distributed across storage nodes)
rook-ceph-drain-canary	rook-ceph-drain-canary-* (1 pod on each storage node)
rook-ceph-crashcollector	rook-ceph-crashcollector-* (1 pod on each storage node)
OSD	 rook-ceph-osd-* (1 pod for each device) rook-ceph-osd-prepare-ocs- deviceset-* (1 pod for each device)

3.2. VERIFYING THE OPENSHIFT CONTAINER STORAGE CLUSTER IS HEALTHY

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

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





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

Figure 3.2. Details card in Persistent Storage Overview Dashboard

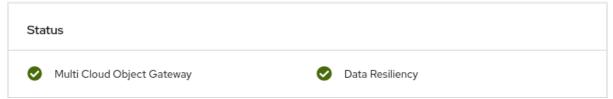
Details
Service Name OpenShift Container Storage (OCS) Cluster Name ocs-storagecluster-cephcluster
Provider VSphere
Mode Internal
Version ocs-operator.v4.5.0

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:





• 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 Con	tainer Stora	ge (OCS)	
System Name noobaa 🗹			
Provider VSphere			
Version ocs-operator.v-	4.5.0		
	4.5.0		

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

• ocs-storagecluster-ceph-rgw

CHAPTER 4. UNINSTALLING OPENSHIFT CONTAINER STORAGE

4.1. UNINSTALLING OPENSHIFT CONTAINER STORAGE ON INTERNAL MODE

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

Prerequisites

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

Procedure

 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-storageclusterceph-rbd")]]{"Name: "}{@.metadata.name}{" Namespace: "}{@.metadata.namespace}{" Labels: "}{@.metadata.labels}{"\n"}{end}' --all-namespaces|awk '! (/Namespace: openshiftstorage/ && /app:noobaa/)' | grep -v noobaa-default-backing-store-noobaa-pvc

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

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

\$ oc get obc -o=jsonpath='{range .items[?(@.spec.storageClassName=="openshiftstorage.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 noobaadefault-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.

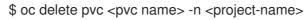
for bs in \$(oc get backingstore -o name -n openshift-storage | grep -v noobaadefault-backing-store); do echo "Deleting Backingstore \$bs"; oc delete -n openshift-storage \$bs; done

• 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-defaultbacking-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.



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

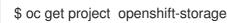
- 5. Delete the namespace and wait till the deletion is complete. You will need to switch to another project if openshift-storage is the active project.
 - a. Switch to another namespace if openshift-storage is the active namespace. For example :



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.



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.

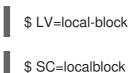
Confirm that the directory no longer exists

\$ 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

 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:



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-xxxxx /dev/disk/by-id/nvme-yyyyyy /dev/disk/by-id/nvme-zzzzz

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-xxxxx 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 ...

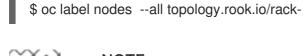
9. Delete the **openshift-storage.noobaa.io** storage class.

\$ 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-



NOTE

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

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

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

oc delete pv <pv name>

12. Remove **CustomResourceDefinitions**.

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

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

4.2. 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 REST.	ARTS 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-	00
powpromotileus-adapter-	

5df5865596-k8dzn pod/prometheus-adapter-	1/1 Running 0	7d23h	
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-	3/3 Running 0	8d	
78fc8fc97d-2rgfp	3/3 hutining U	ou	
NAME	STA	ATUS VOLUME	
CAPACITY ACCESS MC	DES STORAGECLAS	SS AGE	
persistentvolumeclaim/my	-alertmanager-claim-ale	ertmanager-main-0 Bound pvc-0d51	9c4f-
15a5-11ea-baa0-026d231			d
	•	ertmanager-main-1 Bound pvc-	
0d5a9825-15a5-11ea-baa	.0-026d231574aa 40G	i RWO ocs-storagecluster-c	eph-
rbd 8d	alortmanagor claim alo	ertmanager-main-2 Bound pvc-	
0d6413dc-15a5-11ea-baa	•	. .	enh-
rbd 8d	0 020020107400 400		opn
persistentvolumeclaim/my	-prometheus-claim-pror	metheus-k8s-0 Bound pvc-0b7c ⁻	9b0-
15a5-11ea-baa0-026d231	• •	•	d
persistentvolumeclaim/my	-prometheus-claim-pror	metheus-k8s-1 Bound pvc-0b8ae	ed3f-
15a5-11ea-baa0-026d231	574aa 40Gi RWO	ocs-storagecluster-ceph-rbd 8	d
1			

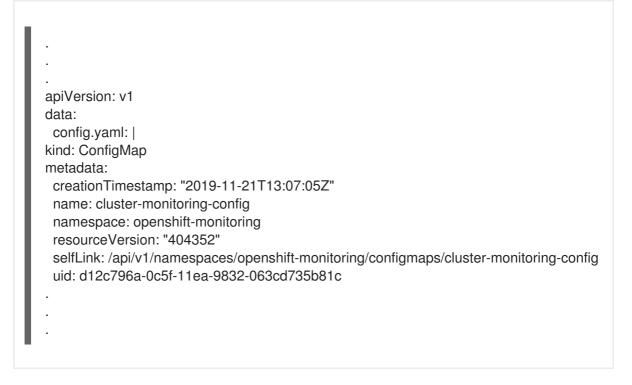
2. Edit the monitoring **configmap**.

\$ 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



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

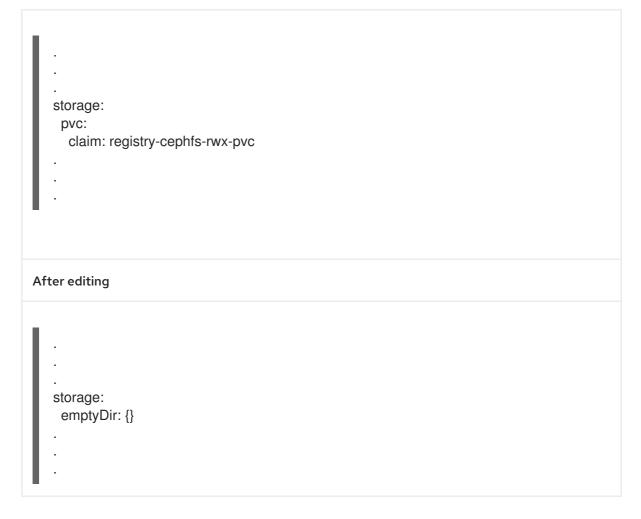
• The image registry should have been configured to use an OpenShift Container Storage PVC.

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 **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