



# Red Hat OpenShift Data Foundation 4.10

## Deploying OpenShift Data Foundation using Microsoft Azure and Azure Red Hat OpenShift

Instructions on deploying OpenShift Data Foundation using Microsoft Azure and  
Azure Red Hat OpenShift



## Red Hat OpenShift Data Foundation 4.10 Deploying OpenShift Data Foundation using Microsoft Azure and Azure Red Hat OpenShift

---

Instructions on deploying OpenShift Data Foundation using Microsoft Azure and Azure Red Hat OpenShift

## Legal Notice

Copyright © 2023 Red Hat, Inc.

The text of and illustrations in this document are licensed by Red Hat under a Creative Commons Attribution–Share Alike 3.0 Unported license ("CC-BY-SA"). An explanation of CC-BY-SA is available at

<http://creativecommons.org/licenses/by-sa/3.0/>

. In accordance with CC-BY-SA, if you distribute this document or an adaptation of it, you must provide the URL for the original version.

Red Hat, as the licensor of this document, waives the right to enforce, and agrees not to assert, Section 4d of CC-BY-SA to the fullest extent permitted by applicable law.

Red Hat, Red Hat Enterprise Linux, the Shadowman logo, the Red Hat logo, JBoss, OpenShift, Fedora, the Infinity logo, and RHCE are trademarks of Red Hat, Inc., registered in the United States and other countries.

Linux<sup>®</sup> is the registered trademark of Linus Torvalds in the United States and other countries.

Java<sup>®</sup> is a registered trademark of Oracle and/or its affiliates.

XFS<sup>®</sup> is a trademark of Silicon Graphics International Corp. or its subsidiaries in the United States and/or other countries.

MySQL<sup>®</sup> is a registered trademark of MySQL AB in the United States, the European Union and other countries.

Node.js<sup>®</sup> is an official trademark of Joyent. Red Hat is not formally related to or endorsed by the official Joyent Node.js open source or commercial project.

The OpenStack<sup>®</sup> Word Mark and OpenStack logo are either registered trademarks/service marks or trademarks/service marks of the OpenStack Foundation, in the United States and other countries and are used with the OpenStack Foundation's permission. We are not affiliated with, endorsed or sponsored by the OpenStack Foundation, or the OpenStack community.

All other trademarks are the property of their respective owners.

## Abstract

Read this document for instructions about how to install and manage Red Hat OpenShift Data Foundation using Red Hat OpenShift Container Platform on Microsoft Azure.

## Table of Contents

<b>MAKING OPEN SOURCE MORE INCLUSIVE .....</b>	<b>3</b>
<b>PROVIDING FEEDBACK ON RED HAT DOCUMENTATION .....</b>	<b>4</b>
<b>PREFACE .....</b>	<b>5</b>
<b>CHAPTER 1. PREPARING TO DEPLOY OPENSIFT DATA FOUNDATION .....</b>	<b>6</b>
<b>CHAPTER 2. DEPLOYING OPENSIFT DATA FOUNDATION ON MICROSOFT AZURE .....</b>	<b>7</b>
2.1. INSTALLING RED HAT OPENSIFT DATA FOUNDATION OPERATOR	7
2.2. ENABLING CLUSTER-WIDE ENCRYPTION WITH KMS USING THE TOKEN AUTHENTICATION METHOD	8
2.3. ENABLING CLUSTER-WIDE ENCRYPTION WITH KMS USING THE KUBERNETES AUTHENTICATION METHOD	9
2.4. CREATING AN OPENSIFT DATA FOUNDATION CLUSTER	12
<b>CHAPTER 3. DEPLOYING OPENSIFT DATA FOUNDATION ON AZURE RED HAT OPENSIFT .....</b>	<b>15</b>
3.1. GETTING A RED HAT PULL SECRET FOR NEW DEPLOYMENT OF AZURE RED HAT OPENSIFT	15
3.2. PREPARING A RED HAT PULL SECRET FOR EXISTING AZURE RED HAT OPENSIFT CLUSTERS	16
3.3. ADDING THE PULL SECRET TO THE CLUSTER	16
3.3.1. Modifying the configuration files to enable Red Hat operators	16
3.4. VALIDATING YOUR RED HAT PULL SECRET IS WORKING	16
3.5. INSTALLING RED HAT OPENSIFT DATA FOUNDATION OPERATOR	17
3.6. CREATING AN OPENSIFT DATA FOUNDATION CLUSTER	18
<b>CHAPTER 4. VERIFYING OPENSIFT DATA FOUNDATION DEPLOYMENT .....</b>	<b>21</b>
4.1. VERIFYING THE STATE OF THE PODS	21
4.2. VERIFYING THE OPENSIFT DATA FOUNDATION CLUSTER IS HEALTHY	23
4.3. VERIFYING THE MULTICLOUD OBJECT GATEWAY IS HEALTHY	23
4.4. VERIFYING THAT THE OPENSIFT DATA FOUNDATION SPECIFIC STORAGE CLASSES EXIST	23
<b>CHAPTER 5. DEPLOY STANDALONE MULTICLOUD OBJECT GATEWAY .....</b>	<b>24</b>
5.1. INSTALLING RED HAT OPENSIFT DATA FOUNDATION OPERATOR	24
5.2. CREATING A STANDALONE MULTICLOUD OBJECT GATEWAY	25
<b>CHAPTER 6. UNINSTALLING OPENSIFT DATA FOUNDATION .....</b>	<b>28</b>
6.1. UNINSTALLING OPENSIFT DATA FOUNDATION IN INTERNAL MODE	28



## MAKING OPEN SOURCE MORE INCLUSIVE

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

## PROVIDING FEEDBACK ON RED HAT DOCUMENTATION

We appreciate your input on our documentation. Do let us know how we can make it better.

To give feedback, create a Bugzilla ticket:

1. Go to the [Bugzilla](#) website.
2. In the **Component** section, choose **documentation**.
3. Fill in the **Description** field with your suggestion for improvement. Include a link to the relevant part(s) of documentation.
4. Click **Submit Bug**.



# PREFACE

Red Hat OpenShift Data Foundation supports deployment on existing Red Hat OpenShift Container Platform (RHOCP) Azure clusters.



## NOTE

Only internal OpenShift Data Foundation clusters are supported on Microsoft Azure. See [Planning your deployment](#) for more information about deployment requirements.

To deploy OpenShift Data Foundation, start with the requirements in [Preparing to deploy OpenShift Data Foundation](#) chapter and then follow the appropriate deployment process based on your requirement:

- [Deploy OpenShift Data Foundation on Microsoft Azure](#)
- [Deploy standalone Multicloud Object Gateway component](#)

# CHAPTER 1. PREPARING TO DEPLOY OPENSIFT DATA FOUNDATION

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

Before you begin the deployment of OpenShift Data Foundation, follow these steps:

1. Setup a chrony server. See [Configuring chrony time service](#) and use [knowledgebase solution](#) to create rules allowing all traffic.
2. Optional: If you want to enable cluster-wide encryption using an external Key Management System (KMS) then follow the steps:
  - Ensure that you have a valid Red Hat OpenShift Data Foundation Advanced subscription. To know how subscriptions for OpenShift Data Foundation work, see [knowledgebase article on OpenShift Data Foundation subscriptions](#).
  - When the Token authentication method is selected for encryption then refer to [Enabling cluster-wide encryption with the Token authentication using KMS](#).
  - When the Kubernetes authentication method is selected for encryption then refer to [Enabling cluster-wide encryption with the Kubernetes authentication using KMS](#).
  - Ensure that you are using signed certificates on your Vault servers.
3. Minimum starting node requirements  
An OpenShift Data Foundation cluster is deployed with minimum configuration when the standard deployment resource requirement is not met. See [Resource requirements](#) section in Planning guide.
4. Regional-DR requirements [Developer preview]  
Disaster Recovery features supported by Red Hat OpenShift Data Foundation require all of the following prerequisites in order to successfully implement a Disaster Recovery solution:
  - A valid Red Hat OpenShift Data Foundation Advanced subscription
  - A valid Red Hat Advanced Cluster Management for Kubernetes subscription  
To know how subscriptions for OpenShift Data Foundation work, see [knowledgebase article on OpenShift Data Foundation subscriptions](#).

For detailed requirements, see [Regional-DR requirements](#) and [RHACM requirements](#).

## CHAPTER 2. DEPLOYING OPENSIFT DATA FOUNDATION ON MICROSOFT AZURE

You can deploy OpenShift Data Foundation on OpenShift Container Platform using dynamic storage devices provided by Microsoft Azure installer-provisioned infrastructure (IPI) (type: **managed-premium**) that enables you to create internal cluster resources. This results in internal provisioning of the base services, which helps to make additional storage classes available to applications.

Also, it is possible to deploy only the Multicloud Object Gateway (MCG) component with OpenShift Data Foundation. For more information, see [Deploy standalone Multicloud Object Gateway](#).



### NOTE

Only internal OpenShift Data Foundation clusters are supported on Microsoft Azure. See [Planning your deployment](#) for more information about deployment requirements.

Ensure that you have addressed the requirements in [Preparing to deploy OpenShift Data Foundation](#) chapter before proceeding with the below steps for deploying using dynamic storage devices:

1. [Install the Red Hat OpenShift Data Foundation Operator](#).
2. [Create the OpenShift Data Foundation Cluster](#)

### 2.1. INSTALLING RED HAT OPENSIFT DATA FOUNDATION OPERATOR

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

#### Prerequisites

- Access to an OpenShift Container Platform cluster using an account with **cluster-admin** and Operator installation permissions.
- You must have at least three worker nodes in the Red Hat OpenShift Container Platform cluster.
- For additional resource requirements, see the [Planning your deployment](#) guide.



### IMPORTANT

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

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

- Taint a node as **infra** to ensure only Red Hat OpenShift Data Foundation 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 Data Foundation](#) chapter in the *Managing and Allocating Storage Resources* guide.

## Procedure

1. Log in to the OpenShift Web Console.
2. Click **Operators → OperatorHub**.
3. Scroll or type **OpenShift Data Foundation** into the **Filter by keyword** box to find the **OpenShift Data Foundation** Operator.
4. Click **Install**.
5. Set the following options on the **Install Operator** page:
  - a. Update Channel as **stable-4.10**.
  - 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 is created during the operator installation.
  - d. Select Approval Strategy as **Automatic** or **Manual**.

If you select **Automatic** updates, then the Operator Lifecycle Manager (OLM) automatically upgrades the running instance of your Operator without any intervention.

If you select **Manual** updates, then the OLM creates an update request. As a cluster administrator, you must then manually approve that update request to update the Operator to a newer version.
  - e. Ensure that the **Enable** option is selected for the **Console plugin**.
  - f. Click **Install**.

## Verification steps

- After the operator is successfully installed, a pop-up with a message, **Web console update is available** appears on the user interface. Click **Refresh web console** from this pop-up for the console changes to reflect.
- In the Web Console:
  - Navigate to Installed Operators and verify that the **OpenShift Data Foundation** Operator shows a green tick indicating successful installation.
  - Navigate to **Storage** and verify if **Data Foundation** dashboard is available.

## 2.2. ENABLING CLUSTER-WIDE ENCRYPTION WITH KMS USING THE TOKEN AUTHENTICATION METHOD

To enable the key value backend path and policy in Vault for the Token authentication, follow the procedure:

### Prerequisites

- Administrator access to Vault.

- A valid Red Hat OpenShift Data Foundation Advanced subscription. For more information, see the [knowledgebase article on OpenShift Data Foundation subscriptions](#).
- Carefully, select a unique path name as the backend **path** that follows the naming convention since it cannot be changed later.

### Procedure

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

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

For Vault KV secret engine API, version 2:

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

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

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

3. Create a token matching the above policy.

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

## 2.3. ENABLING CLUSTER-WIDE ENCRYPTION WITH KMS USING THE KUBERNETES AUTHENTICATION METHOD

You can enable the Kubernetes authentication method for cluster-wide encryption using the Key Management System (KMS).

### Prerequisites

- Administrator access to Vault.
- A valid Red Hat OpenShift Data Foundation Advanced subscription. For more information, see the [knowledgebase article on OpenShift Data Foundation subscriptions](#).
- The OpenShift Data Foundation operator must be installed from the Operator Hub.
- Select a unique path name as the backend **path** that follows the naming convention since it cannot be changed later.

**NOTE**

Use of Vault Namespaces is not supported with the Kubernetes authentication method in OpenShift Data Foundation 4.10

**Procedure**

1. Create a service account:

```
$ oc -n openshift-storage create serviceaccount <serviceaccount_name>
```

where, **<serviceaccount\_name>** specifies the name of the service account.

For example:

```
$ oc -n openshift-storage create serviceaccount odf-vault-auth
```

2. Create **clusterrolebindings** and **clusterroles**:

```
$ oc -n openshift-storage create clusterrolebinding vault-tokenreview-binding --
clusterrole=system:auth-delegator --serviceaccount=openshift-
storage:<serviceaccount_name>_
```

For example:

```
$ oc -n openshift-storage create clusterrolebinding vault-tokenreview-binding --
clusterrole=system:auth-delegator --serviceaccount=openshift-storage:odf-vault-auth
```

3. Depending on the OpenShift Container Platform version, perform one of the following:

- For OpenShift Container Platform 4.10:
  - Identify the secret name associated with the serviceaccount (SA) created above.

```
$ VAULT_SA_SECRET_NAME=$(oc -n openshift-storage get sa <SA_NAME> -o
jsonpath="{.secrets[*]['name']}") | grep -o "[^[:space:]]*-token-[^[:space:]]*"
```

For example:

```
$ VAULT_SA_SECRET_NAME=$(oc -n openshift-storage get sa odf-vault-auth -o
jsonpath="{.secrets[*]['name']}") | grep -o "[^[:space:]]*-token-[^[:space:]]*"
```

- For OpenShift Container Platform 4.11:
  - Create a secret for the **serviceaccount** token and CA certificate.

```
$ cat <<EOF | oc create -f -
apiVersion: v1
kind: Secret
metadata:
  name: odf-vault-auth-token
  namespace: openshift-storage
annotations:
  kubernetes.io/service-account.name: <serviceaccount_name>
```

```
type: kubernetes.io/service-account-token
data: {}
EOF
```

where, **<serviceaccount\_name>** is the service account created in the earlier step.

```
$ VAULT_SA_SECRET_NAME=odf-vault-auth-token
```

4. Get the token and the CA certificate from the secret.

```
$ SA_JWT_TOKEN=$(oc -n openshift-storage get secret "$VAULT_SA_SECRET_NAME" -o
jsonpath="{.data.token}" | base64 --decode; echo)
$ SA_CA_CERT=$(oc -n openshift-storage get secret "$VAULT_SA_SECRET_NAME" -o
jsonpath="{.data['ca.crt']}" | base64 --decode; echo)
```

5. Retrieve the OCP cluster endpoint.

```
$ OCP_HOST=$(oc config view --minify --flatten -o jsonpath="{.clusters[0].cluster.server}")
```

6. Fetch the service account issuer.

```
$ oc proxy &
$ proxy_pid=$!
$ issuer="$( curl --silent http://127.0.0.1:8001/.well-known/openid-configuration | jq -r
.issuer)"
$ kill $proxy_pid
```

7. Use the information collected in the steps above to setup the Kubernetes authentication method in Vault as shown below.

```
$ vault auth enable kubernetes
$ vault write auth/kubernetes/config \
  token_reviewer_jwt="$SA_JWT_TOKEN" \
  kubernetes_host="$OCP_HOST" \
  kubernetes_ca_cert="$SA_CA_CERT" \
  issuer="$issuer"
```

## IMPORTANT

To configure Kubernetes authentication method in Vault when the issuer is empty.

```
$ vault write auth/kubernetes/config \
  token_reviewer_jwt="$SA_JWT_TOKEN" \
  kubernetes_host="$OCP_HOST" \
  kubernetes_ca_cert="$SA_CA_CERT"
```

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

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

For Vault KV secret engine API, version 2.

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

9. Create a policy to restrict users to perform a write or delete operation on the secret:

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

10. Generate the roles:

```
$ vault write auth/kubernetes/role/odf-rook-ceph-op \
  bound_service_account_names=rook-ceph-system,rook-ceph-osd,noobaa \
  bound_service_account_namespaces=openshift-storage \
  policies=odf \
  ttl=1440h
```

The role **odf-rook-ceph-op** is later used while you configure the KMS connection details during the creation of the storage system.

```
$ vault write auth/kubernetes/role/odf-rook-ceph-osd \
  bound_service_account_names=rook-ceph-osd \
  bound_service_account_namespaces=openshift-storage \
  policies=odf \
  ttl=1440h
```

## 2.4. CREATING AN OPENSIFT DATA FOUNDATION CLUSTER

Create an OpenShift Data Foundation cluster after you install the OpenShift Data Foundation operator.

### Prerequisites

- The OpenShift Data Foundation operator must be installed from the Operator Hub. For more information, see [Installing OpenShift Data Foundation Operator using the Operator Hub](#).

### Procedure

1. In the OpenShift Web Console, click **Operators → Installed Operators** to view all the installed operators.  
Ensure that the **Project** selected is **openshift-storage**.
2. Click on the **OpenShift Data Foundation** operator, and then click **Create StorageSystem**.
3. In the **Backing storage** page, select the following:
  - a. Select **Full Deployment** for the **Deployment type** option.
  - b. Select the **Use an existing StorageClass** option.



- c. Select the **Storage Class**.  
By default, it is set to **managed-premium**.
  - d. Click **Next**.
4. In the **Capacity and nodes** page, provide the necessary information:
    - a. Select a value for **Requested Capacity** from the dropdown list. It is set to **2 TiB** by default.

**NOTE**

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

- b. In the **Select Nodes** section, select at least three available nodes.
  - c. Optional: Select the **Taint nodes** checkbox to dedicate the selected nodes for OpenShift Data Foundation.  
For cloud platforms with multiple availability zones, ensure that the Nodes are spread across different Locations/availability zones.  
  
If the nodes selected do not match the OpenShift Data Foundation cluster requirements of an aggregated 30 CPUs and 72 GiB of RAM, a minimal cluster is deployed. For minimum starting node requirements, see the [Resource requirements](#) section in the *Planning* guide.
  - d. Click **Next**.
5. Optional: In the **Security and network** page, configure the following based on your requirements:
    - a. To enable encryption, select **Enable data encryption for block and file storage**
    - b. Select either one or both the encryption levels:
      - **Cluster-wide encryption**  
Encrypts the entire cluster (block and file).
      - **StorageClass encryption**  
Creates encrypted persistent volume (block only) using encryption enabled storage class.
    - c. Select the **Connect to an external key management service** checkbox. This is optional for cluster-wide encryption.
      - i. **Key Management Service Provider** is set to **Vault** by default.
      - ii. Select an **Authentication Method**.  
  
**Using Token authentication method**
        - Enter a unique **Connection Name**, host **Address** of the Vault server ('https://<hostname or ip>'), **Port** number and **Token**.
        - Expand **Advanced Settings** to enter additional settings and certificate details based on your **Vault** configuration:

- Enter the Key Value secret path in **Backend Path** that is dedicated and unique to OpenShift Data Foundation.
- Optional: Enter **TLS Server Name** and **Vault Enterprise Namespace**
- Upload the respective PEM encoded certificate file to provide the **CA Certificate**, **Client Certificate** and **Client Private Key**.
- Click **Save**.

#### Using Kubernetes authentication method

- Enter a unique Vault **Connection Name**, host **Address** of the Vault server ('https://<hostname or ip>'), **Port** number and **Role** name.
- Expand **Advanced Settings** to enter additional settings and certificate details based on your **Vault** configuration:
  - Enter the Key Value secret path in **Backend Path** that is dedicated and unique to OpenShift Data Foundation.
  - Optional: Enter **TLS Server Name** and **Authentication Path** if applicable.
  - Upload the respective PEM encoded certificate file to provide the **CA Certificate**, **Client Certificate** and **Client Private Key**.
  - Click **Save**.

d. Click **Next**.

6. In the **Review and create** page, review the configuration details.  
To modify any configuration settings, click **Back**.

7. Click **Create StorageSystem**.

#### Verification steps

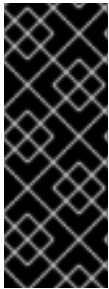
- To verify the final Status of the installed storage cluster:
  - a. In the OpenShift Web Console, navigate to **Installed Operators → OpenShift Data Foundation → Storage System → ocs-storagecluster-storagesystem → Resources**.
  - b. Verify that **Status** of **StorageCluster** is **Ready** and has a green tick mark next to it.
- To verify that all components for OpenShift Data Foundation are successfully installed, see [Verifying your OpenShift Data Foundation deployment](#).

#### Additional resources

To enable Overprovision Control alerts, refer to [Alerts](#) in Monitoring guide.

## CHAPTER 3. DEPLOYING OPENSIFT DATA FOUNDATION ON AZURE RED HAT OPENSIFT

The Azure Red Hat OpenShift service enables you to deploy fully managed OpenShift clusters. Red Hat OpenShift Data Foundation can be deployed on Azure Red Hat OpenShift service.



### IMPORTANT

OpenShift Data Foundation on Azure Red Hat OpenShift is not a managed service offering. Red Hat OpenShift Data Foundation subscriptions are required to have the installation supported by the Red Hat support team. Open support cases by choosing the product as **Red Hat OpenShift Data Foundation** with the [Red Hat support](#) team (and not Microsoft) if you need any assistance for Red Hat OpenShift Data Foundation on Azure Red Hat OpenShift.

To install OpenShift Data Foundation on Azure Red Hat OpenShift, follow sections:

1. [Getting a Red Hat pull secret for new deployment of Azure Red Hat OpenShift](#) .
2. [Preparing a Red Hat pull secret for existing Azure Red Hat OpenShift clusters](#) .
3. [Adding the pull secret to the cluster](#) .
4. [Validating your Red Hat pull secret is working](#) .
5. [Install the Red Hat OpenShift Data Foundation Operator](#) .
6. [Create the OpenShift Data Foundation Cluster Service](#) .

### 3.1. GETTING A RED HAT PULL SECRET FOR NEW DEPLOYMENT OF AZURE RED HAT OPENSIFT

A Red Hat pull secret enables the cluster to access Red Hat container registries along with additional content.

#### Prerequisites

- A Red Hat portal account.
- OpenShift Data Foundation subscription.

#### Procedure

To get a Red Hat pull secret for a new deployment of Azure Red Hat OpenShift, follow the steps in the section [Get a Red Hat pull secret](#) in the official Microsoft Azure documentation.

Note that while creating the [Azure Red Hat OpenShift cluster](#), you may need larger worker nodes, controlled by `--worker-vm-size` or more worker nodes, controlled by `--worker-count`. The recommended `worker-vm-size` is **Standard\_D16s\_v3**. You can also use dedicated worker nodes, for more information, see [How to use dedicated worker nodes for Red Hat OpenShift Data Foundation](#) in the *Managing and allocating storage resources* guide.

## 3.2. PREPARING A RED HAT PULL SECRET FOR EXISTING AZURE RED HAT OPENSIFT CLUSTERS

When you create an Azure Red Hat OpenShift cluster without adding a Red Hat pull secret, a pull secret is still created on the cluster automatically. However, this pull secret is not fully populated.

Use this section to update the automatically created pull secret with the additional values from the Red Hat pull secret.

### Prerequisites

- Existing Azure Red Hat OpenShift cluster without a Red Hat pull secret.

### Procedure

To prepare a Red Hat pull secret for existing an existing Azure Red Hat OpenShift clusters, follow the steps in the section [Prepare your pull secret](#) in the official Microsoft Azure documentation.

## 3.3. ADDING THE PULL SECRET TO THE CLUSTER

### Prerequisites

- A Red Hat pull secret.

### Procedure

- Run the following command to update your pull secret.



#### NOTE

Running this command causes the cluster nodes to restart one by one as they are updated.

```
oc set data secret/pull-secret -n openshift-config --from-file=.dockerconfigjson=./pull-secret.json
```

After the secret is set, you can enable the Red Hat Certified Operators.

### 3.3.1. Modifying the configuration files to enable Red Hat operators

To modify the configuration files to enable Red Hat operators, follow the steps in the section [Modify the configuration files](#) in the official Microsoft Azure documentation.

## 3.4. VALIDATING YOUR RED HAT PULL SECRET IS WORKING

After you add the pull secret and modify the configuration files, the cluster can take several minutes to get updated.

To check if the cluster has been updated, run the following command to show the **Certified Operators** and **Red Hat Operators** sources available:

```
$ oc get catalogsource -A
```

NAMESPACE	NAME	DISPLAY
openshift-marketplace	redhat-operators	Red Hat Operators
TYPE	PUBLISHER	AGE
grpc	Red Hat	11s

If you do not see the Red Hat Operators, wait a few minutes and try again.

To ensure that your pull secret has been updated and is working correctly, open **Operator Hub** and check for any Red Hat verified Operator. For example, check if the OpenShift Data Foundation Operator is available, and see if you have permissions to install it.

## 3.5. INSTALLING RED HAT OPENSIFT DATA FOUNDATION OPERATOR

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

### Prerequisites

- Access to an OpenShift Container Platform cluster using an account with **cluster-admin** and Operator installation permissions.
- You must have at least three worker nodes in the Red Hat OpenShift Container Platform cluster.
- For additional resource requirements, see the [Planning your deployment](#) guide.

### IMPORTANT

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

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

- Taint a node as **infra** to ensure only Red Hat OpenShift Data Foundation 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 Data Foundation](#) chapter in the *Managing and Allocating Storage Resources* guide.

### Procedure

1. Log in to the OpenShift Web Console.
2. Click **Operators → OperatorHub**.
3. Scroll or type **OpenShift Data Foundation** into the **Filter by keyword** box to find the **OpenShift Data Foundation** Operator.
4. Click **Install**.

5. Set the following options on the **Install Operator** page:
  - a. Update Channel as **stable-4.10**.
  - 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 is created during the operator installation.
  - d. Select Approval Strategy as **Automatic** or **Manual**.  
 If you select **Automatic** updates, then the Operator Lifecycle Manager (OLM) automatically upgrades the running instance of your Operator without any intervention.  
  
 If you select **Manual** updates, then the OLM creates an update request. As a cluster administrator, you must then manually approve that update request to update the Operator to a newer version.
  - e. Ensure that the **Enable** option is selected for the **Console plugin**.
  - f. Click **Install**.

### Verification steps

- After the operator is successfully installed, a pop-up with a message, **Web console update is available** appears on the user interface. Click **Refresh web console** from this pop-up for the console changes to reflect.
- In the Web Console:
  - Navigate to Installed Operators and verify that the **OpenShift Data Foundation Operator** shows a green tick indicating successful installation.
  - Navigate to **Storage** and verify if **Data Foundation** dashboard is available.

## 3.6. CREATING AN OPENSIFT DATA FOUNDATION CLUSTER

Create an OpenShift Data Foundation cluster after you install the OpenShift Data Foundation operator.

### Prerequisites

- The OpenShift Data Foundation operator must be installed from the Operator Hub. For more information, see [Installing OpenShift Data Foundation Operator using the Operator Hub](#).

### Procedure

1. In the OpenShift Web Console, click **Operators → Installed Operators** to view all the installed operators.  
Ensure that the **Project** selected is **openshift-storage**.
2. Click on the **OpenShift Data Foundation** operator, and then click **Create StorageSystem**.
3. In the **Backing storage** page, select the following:
  - a. Select **Full Deployment** for the **Deployment type** option.
  - b. Select the **Use an existing StorageClass** option.

- c. Select the **Storage Class**.  
By default, it is set to **managed-premium**.
  - d. Click **Next**.
4. In the **Capacity and nodes** page, provide the necessary information:
    - a. Select a value for **Requested Capacity** from the dropdown list. It is set to **2 TiB** by default.

**NOTE**

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

- b. In the **Select Nodes** section, select at least three available nodes.
  - c. Optional: Select the **Taint nodes** checkbox to dedicate the selected nodes for OpenShift Data Foundation.  
For cloud platforms with multiple availability zones, ensure that the Nodes are spread across different Locations/availability zones.  
  
If the nodes selected do not match the OpenShift Data Foundation cluster requirements of an aggregated 30 CPUs and 72 GiB of RAM, a minimal cluster is deployed. For minimum starting node requirements, see the [Resource requirements](#) section in the *Planning* guide.
  - d. Click **Next**.
5. Optional: In the **Security and network** page, configure the following based on your requirements:
    - a. To enable encryption, select **Enable data encryption for block and file storage**
    - b. Select either one or both the encryption levels:
      - **Cluster-wide encryption**  
Encrypts the entire cluster (block and file).
      - **StorageClass encryption**  
Creates encrypted persistent volume (block only) using encryption enabled storage class.
    - c. Select the **Connect to an external key management service** checkbox. This is optional for cluster-wide encryption.
      - i. **Key Management Service Provider** is set to **Vault** by default.
      - ii. Select an **Authentication Method**.  
  
**Using Token authentication method**
        - Enter a unique **Connection Name**, host **Address** of the Vault server ('https://<hostname or ip>'), **Port** number and **Token**.
        - Expand **Advanced Settings** to enter additional settings and certificate details based on your **Vault** configuration:

- Enter the Key Value secret path in **Backend Path** that is dedicated and unique to OpenShift Data Foundation.
- Optional: Enter **TLS Server Name** and **Vault Enterprise Namespace**
- Upload the respective PEM encoded certificate file to provide the **CA Certificate**, **Client Certificate** and **Client Private Key**.
- Click **Save**.

### Using Kubernetes authentication method

- Enter a unique Vault **Connection Name**, host **Address** of the Vault server ('https://<hostname or ip>'), **Port** number and **Role** name.
- Expand **Advanced Settings** to enter additional settings and certificate details based on your **Vault** configuration:
  - Enter the Key Value secret path in **Backend Path** that is dedicated and unique to OpenShift Data Foundation.
  - Optional: Enter **TLS Server Name** and **Authentication Path** if applicable.
  - Upload the respective PEM encoded certificate file to provide the **CA Certificate**, **Client Certificate** and **Client Private Key**.
  - Click **Save**.

d. Click **Next**.

6. In the **Review and create** page, review the configuration details.  
To modify any configuration settings, click **Back**.

7. Click **Create StorageSystem**.

### Verification steps

- To verify the final Status of the installed storage cluster:
  - a. In the OpenShift Web Console, navigate to **Installed Operators → OpenShift Data Foundation → Storage System → ocs-storagecluster-storagesystem → Resources**.
  - b. Verify that **Status** of **StorageCluster** is **Ready** and has a green tick mark next to it.
- To verify that all components for OpenShift Data Foundation are successfully installed, see [Verifying your OpenShift Data Foundation deployment](#).

### Additional resources

To enable Overprovision Control alerts, refer to [Alerts](#) in Monitoring guide.



## CHAPTER 4. VERIFYING OPENSIFT DATA FOUNDATION DEPLOYMENT

Use this section to verify that OpenShift Data Foundation is deployed correctly.

### 4.1. VERIFYING THE STATE OF THE PODS

#### Procedure

1. Click **Workloads** → **Pods** from the OpenShift Web Console.
2. Select **openshift-storage** from the **Project** drop-down list.



#### NOTE

If the **Show default projects** option is disabled, use the toggle button to list all the default projects.

For more information on the expected number of pods for each component and how it varies depending on the number of nodes, see [Table 4.1, "Pods corresponding to OpenShift Data Foundation cluster"](#).

3. Click the **Running** and **Completed** tabs to verify that the following pods are in **Running** and **Completed** state:

**Table 4.1. Pods corresponding to OpenShift Data Foundation cluster**

Component	Corresponding pods
OpenShift Data Foundation Operator	<ul style="list-style-type: none"> <li>● <b>ocs-operator-*</b> (1 pod on any worker node)</li> <li>● <b>ocs-metrics-exporter-*</b> (1 pod on any worker node)</li> <li>● <b>odf-operator-controller-manager-*</b> (1 pod on any worker node)</li> <li>● <b>odf-console-*</b> (1 pod on any worker node)</li> <li>● <b>csi-addons-controller-manager-*</b> (1 pod on any worker node)</li> </ul>
Rook-ceph Operator	<b>rook-ceph-operator-*</b> (1 pod on any worker node)

Component	Corresponding pods
Multicloud Object Gateway	<ul style="list-style-type: none"> <li>● <b>noobaa-operator-*</b> (1 pod on any worker node)</li> <li>● <b>noobaa-core-*</b> (1 pod on any storage node)</li> <li>● <b>noobaa-db-pg-*</b> (1 pod on any storage node)</li> <li>● <b>noobaa-endpoint-*</b> (1 pod on any storage node)</li> </ul>
MON	<b>rook-ceph-mon-*</b> (3 pods distributed across storage nodes)
MGR	<b>rook-ceph-mgr-*</b> (1 pod on any storage node)
MDS	<b>rook-ceph-mds-ocs-storagecluster-cephfilesystem-*</b> (2 pods distributed across storage nodes)
CSI	<ul style="list-style-type: none"> <li>● <b>cephfs</b> <ul style="list-style-type: none"> <li>○ <b>csi-cephfsplugin-*</b> (1 pod on each worker node)</li> <li>○ <b>csi-cephfsplugin-provisioner-*</b> (2 pods distributed across worker nodes)</li> </ul> </li> <li>● <b>rbd</b> <ul style="list-style-type: none"> <li>○ <b>csi-rbdplugin-*</b> (1 pod on each worker node)</li> <li>○ <b>csi-rbdplugin-provisioner-*</b> (2 pods distributed across worker nodes)</li> </ul> </li> </ul>
rook-ceph-crashcollector	<b>rook-ceph-crashcollector-*</b> (1 pod on each storage node)
OSD	<ul style="list-style-type: none"> <li>● <b>rook-ceph-osd-*</b> (1 pod for each device)</li> <li>● <b>rook-ceph-osd-prepare-ocs-device-*</b> (1 pod for each device)</li> </ul>

## 4.2. VERIFYING THE OPENSIFT DATA FOUNDATION CLUSTER IS HEALTHY

### Procedure

1. In the OpenShift Web Console, click **Storage → Data Foundation**.
2. In the **Status** card of the **Overview** tab, click **Storage System** and then click the storage system link from the pop up that appears.
3. In the **Status** card of the **Block and File** tab, verify that *Storage Cluster* has a green tick.
4. In the **Details** card, verify that the cluster information is displayed.

For more information on the health of the OpenShift Data Foundation cluster using the **Block and File** dashboard, see [Monitoring OpenShift Data Foundation](#).

## 4.3. VERIFYING THE MULTICLOUD OBJECT GATEWAY IS HEALTHY

### Procedure

1. In the OpenShift Web Console, click **Storage → Data Foundation**.
2. In the **Status** card of the **Overview** tab, click **Storage System** and then click the storage system link from the pop up that appears.
  - a. In the **Status** card of the **Object** tab, verify that both *Object Service* and *Data Resiliency* have a green tick.
  - b. In the **Details** card, verify that the MCG information is displayed.

For more information on the health of the OpenShift Data Foundation cluster using the object service dashboard, see [Monitoring OpenShift Data Foundation](#).

## 4.4. VERIFYING THAT THE OPENSIFT DATA FOUNDATION SPECIFIC STORAGE CLASSES EXIST

### Procedure

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

## CHAPTER 5. DEPLOY STANDALONE MULTICLOUD OBJECT GATEWAY

Deploying only the Multicloud Object Gateway component with OpenShift Data Foundation provides the flexibility in deployment and helps to reduce the resource consumption. Use this section to deploy only the standalone Multicloud Object Gateway component, which involves the following steps:

- Installing Red Hat OpenShift Data Foundation Operator
- Creating standalone Multicloud Object Gateway

### 5.1. INSTALLING RED HAT OPENSIFT DATA FOUNDATION OPERATOR

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

#### Prerequisites

- Access to an OpenShift Container Platform cluster using an account with **cluster-admin** and Operator installation permissions.
- You must have at least three worker nodes in the Red Hat OpenShift Container Platform cluster.
- For additional resource requirements, see the [Planning your deployment](#) guide.



#### IMPORTANT

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

```
$ oc annotate namespace openshift-storage openshift.io/node-selector=
```
- Taint a node as **infra** to ensure only Red Hat OpenShift Data Foundation 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 Data Foundation](#) chapter in the *Managing and Allocating Storage Resources* guide.

#### Procedure

1. Log in to the OpenShift Web Console.
2. Click **Operators → OperatorHub**.
3. Scroll or type **OpenShift Data Foundation** into the **Filter by keyword** box to find the **OpenShift Data Foundation Operator**.
4. Click **Install**.
5. Set the following options on the **Install Operator** page:

- a. Update Channel as **stable-4.10**.
- 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 is created during the operator installation.
- d. Select Approval Strategy as **Automatic** or **Manual**.  
If you select **Automatic** updates, then the Operator Lifecycle Manager (OLM) automatically upgrades the running instance of your Operator without any intervention.  
  
If you select **Manual** updates, then the OLM creates an update request. As a cluster administrator, you must then manually approve that update request to update the Operator to a newer version.
- e. Ensure that the **Enable** option is selected for the **Console plugin**.
- f. Click **Install**.

### Verification steps

- After the operator is successfully installed, a pop-up with a message, **Web console update is available** appears on the user interface. Click **Refresh web console** from this pop-up for the console changes to reflect.
- In the Web Console:
  - Navigate to Installed Operators and verify that the **OpenShift Data Foundation** Operator shows a green tick indicating successful installation.
  - Navigate to **Storage** and verify if **Data Foundation** dashboard is available.

## 5.2. CREATING A STANDALONE MULTICLOUD OBJECT GATEWAY

You can create only the standalone Multicloud Object Gateway component while deploying OpenShift Data Foundation.

### Prerequisites

- Ensure that the OpenShift Data Foundation Operator is installed.

### Procedure

1. In the OpenShift Web Console, click **Operators → Installed Operators** to view all the installed operators.  
Ensure that the **Project** selected is **openshift-storage**.
2. Click **OpenShift Data Foundation** operator and then click **Create StorageSystem**.
3. In the **Backing storage** page, select the following:
  - a. Select **Multicloud Object Gateway** for **Deployment type**.
  - b. Select the **Use an existing StorageClass** option.
  - c. Click **Next**.

4. Optional: In the **Security** page, select **Connect to an external key management service**
  - a. **Key Management Service Provider** is set to **Vault** by default.
  - b. Enter Vault **Service Name**, host Address of Vault server ('https:// <hostname or ip>'), **Port number**, and **Token**.
  - c. Expand **Advanced Settings** to enter additional settings and certificate details based on your **Vault** configuration:
    - i. Enter the Key Value secret path in the **Backend Path** that is dedicated and unique to OpenShift Data Foundation.
    - ii. Optional: Enter **TLS Server Name** and **Vault Enterprise Namespace**
    - iii. Upload the respective PEM encoded certificate file to provide the **CA Certificate**, **Client Certificate**, and **Client Private Key**.
    - iv. Click **Save**.
  - d. Click **Next**.
5. In the **Review and create** page, review the configuration details:  
To modify any configuration settings, click **Back**.
6. Click **Create StorageSystem**.

## Verification steps

### Verifying that the OpenShift Data Foundation cluster is healthy

1. In the OpenShift Web Console, click **Storage → Data Foundation**.
2. In the **Status** card of the **Overview** tab, click **Storage System** and then click the storage system link from the pop up that appears.
  - a. In the **Status card** of the **Object** tab, verify that both *Object Service* and *Data Resiliency* have a green tick.
  - b. In the **Details** card, verify that the MCG information is displayed.

### Verifying the state of the pods

1. Click **Workloads → Pods** from the OpenShift Web Console.
2. Select **openshift-storage** from the **Project** drop-down list and verify that the following pods are in **Running** state.



#### NOTE

If the **Show default projects** option is disabled, use the toggle button to list all the default projects.

Component	Corresponding pods
OpenShift Data Foundation Operator	<ul style="list-style-type: none"> <li>● <b>ocs-operator-*</b> (1 pod on any worker node)</li> <li>● <b>ocs-metrics-exporter-*</b> (1 pod on any worker node)</li> <li>● <b>odf-operator-controller-manager-*</b> (1 pod on any worker node)</li> <li>● <b>odf-console-*</b> (1 pod on any worker node)</li> <li>● <b>csi-addons-controller-manager-*</b> (1 pod on any worker node)</li> </ul>
Rook-ceph Operator	<b>rook-ceph-operator-*</b> (1 pod on any worker node)
Multicloud Object Gateway	<ul style="list-style-type: none"> <li>● <b>noobaa-operator-*</b> (1 pod on any worker node)</li> <li>● <b>noobaa-core-*</b> (1 pod on any worker node)</li> <li>● <b>noobaa-db-pg-*</b> (1 pod on any worker node)</li> <li>● <b>noobaa-endpoint-*</b> (1 pod on any worker node)</li> </ul>

## CHAPTER 6. UNINSTALLING OPENSIFT DATA FOUNDATION

### 6.1. UNINSTALLING OPENSIFT DATA FOUNDATION IN INTERNAL MODE

To uninstall OpenShift Data Foundation in Internal mode, refer to the [knowledge base article on Uninstalling OpenShift Data Foundation](#).