Red Hat Ceph Storage 4

Installation Guide

Installing Red Hat Ceph Storage on Red Hat Enterprise Linux

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Legal Notice

Abstract

This document provides instructions on installing Red Hat Ceph Storage on Red Hat Enterprise Linux 8 running on AMD64 and Intel 64 architectures.

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CHAPTER 1. WHAT IS RED HAT CEPH STORAGE?

Red Hat Ceph Storage is a scalable, open, software-defined storage platform that combines an enterprise hardened version of the Ceph storage system with a Ceph management platform, deployment utilities, and support services.

Red Hat Ceph Storage is designed for cloud infrastructure and web-scale object storage. Red Hat Ceph Storage clusters consist of the following types of nodes:

Red Hat Ceph Storage Ansible administration node

This type of node acts as the traditional Ceph Administration node did for previous versions of Red Hat Ceph Storage. This type of node provides the following functions:

- Centralized storage cluster management
- The Ceph configuration files and keys
- Optionally, local repositories for installing Ceph on nodes that cannot access the Internet for security reasons

Monitor nodes

Each monitor node runs the monitor daemon (**ceph-mon**), which maintains a master copy of the cluster map. The cluster map includes the cluster topology. A client connecting to the Ceph cluster retrieves the current copy of the cluster map from the monitor which enables the client to read from and write data to the cluster.

IMPORTANT

Ceph can run with one monitor; however, to ensure high availability in a production cluster, Red Hat will only support deployments with at least three monitor nodes. Red Hat recommends deploying a total of 5 Ceph Monitors for storage clusters exceeding 750 OSDs.

OSD nodes

Each Object Storage Device (OSD) node runs the Ceph OSD daemon (**ceph-osd**), which interacts with logical disks attached to the node. Ceph stores data on these OSD nodes.
Ceph can run with very few OSD nodes, which the default is three, but production clusters realize better performance beginning at modest scales, for example 50 OSDs in a storage cluster. Ideally, a Ceph cluster has multiple OSD nodes, allowing isolated failure domains by creating the CRUSH map.

MDS nodes

Each Metadata Server (MDS) node runs the MDS daemon (**ceph-mds**), which manages metadata related to files stored on the Ceph File System (CephFS). The MDS daemon also coordinates access to the shared cluster.

Object Gateway node

Ceph Object Gateway node runs the Ceph RADOS Gateway daemon (**ceph-radosgw**), and is an object storage interface built on top of **librados** to provide applications with a RESTful gateway to Ceph Storage Clusters. The Ceph Object Gateway supports two interfaces:

S3

Provides object storage functionality with an interface that is compatible with a large subset of the Amazon S3 RESTful API.

Swift

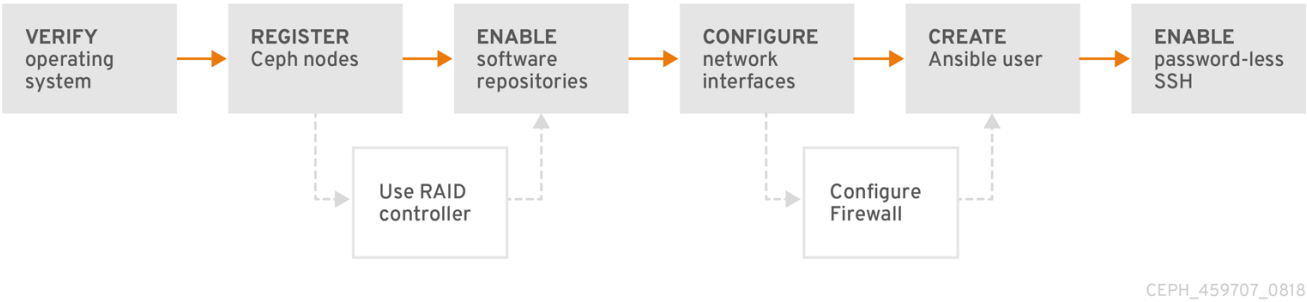
Provides object storage functionality with an interface that is compatible with a large subset of the OpenStack Swift API.

For details on the Ceph architecture, see the *Architecture Guide* for Red Hat Ceph Storage 4.

For minimum recommended hardware, see the Red Hat Ceph Storage Hardware Selection Guide 4.

CHAPTER 2. REQUIREMENTS FOR INSTALLING RED HAT CEPH STORAGE

Figure 2.1. Prerequisite Workflow



NOTE

RHCS 4.0 Beta support is provided through Engineering. Contact customer support to open a BZ.

Before installing Red Hat Ceph Storage, review the following requirements and prepare each Monitor, OSD, Metadata Server, and client nodes accordingly.

2.1. PREREQUISITES

- Verify the hardware meets the minimum requirements for Red Hat Ceph Storage 4.

NOTE

For the Red Hat Ceph Storage 4 Beta release, only Red Hat Enterprise Linux 8 in a lab environment is supported.

2.2. REQUIREMENTS CHECKLIST FOR INSTALLING RED HAT CEPH STORAGE

Task	Required	Section	Recommendation
Verifying the operating system version	Yes	Section 2.3, “Operating system requirements for Red Hat Ceph Storage”	
Registering Ceph nodes	Yes	Section 2.4, “Registering Red Hat Ceph Storage nodes to the CDN and attaching subscriptions”	

Task	Required	Section	Recommendation
Enabling Ceph software repositories	Yes	Section 2.5, "Enabling the Red Hat Ceph Storage repositories"	
Using a RAID controller with OSD nodes	No	Section 2.6, "Considerations for using a RAID controller with OSD nodes"	Enabling write-back caches on a RAID controller might result in increased small I/O write throughput for OSD nodes.
Configuring the network	Yes	Section 2.8, "Verifying the network configuration for Red Hat Ceph Storage"	At minimum, a public network is required. However, a private network for cluster communication is recommended.
Configuring a firewall	No	Section 2.9, "Configuring a firewall for Red Hat Ceph Storage"	A firewall can increase the level of trust for a network.
Creating an Ansible user	Yes	Section 2.10, "Creating an Ansible user with **sudo** access"	Creating the Ansible user is required on all Ceph nodes.
Enabling password-less SSH	Yes	Section 2.11, "Enabling password-less SSH for Ansible"	Required for Ansible.

NOTE

By default, **ceph-ansible** installs NTP/chronyd as a requirement. If NTP/chronyd is customized, refer to *Configuring the Network Time Protocol for Red Hat Ceph Storage* in Manually Installing Red Hat Ceph Storage section to understand how NTP/chronyd must be configured to function properly with Ceph.

2.3. OPERATING SYSTEM REQUIREMENTS FOR RED HAT CEPH STORAGE

Red Hat Ceph Storage 4 is supported on Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux 8. If using Red Hat Enterprise Linux 7, use 7.7 or higher. If using Red Hat Enterprise Linux 8, use 8.1 or higher.

Container based deployments are only supported on Red Hat Enterprise Linux 8. RPM based deployments are supported on both Red Hat Enterprise Linux 7 and Red Hat Enterprise Linux 8.

Use the same operating system version and architecture across all nodes. For example, do not use a mixture of nodes with both AMD64 and Intel 64 architectures, or a mixture of nodes with both Red Hat Enterprise Linux 7 and Red Hat Enterprise Linux 8 operating systems.

IMPORTANT

Red Hat does not support clusters with heterogeneous architectures or operating system versions.

Additional Resources

- The documentation set for Red Hat Enterprise Linux 8 is available at https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/8/
- The documentation set for Red Hat Enterprise Linux 7 is available at https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/7/.

Return to requirements checklist

2.4. REGISTERING RED HAT CEPH STORAGE NODES TO THE CDN AND ATTACHING SUBSCRIPTIONS

Register each Red Hat Ceph Storage node to the Content Delivery Network (CDN) and attach the appropriate subscription so that the node has access to software repositories. Each Red Hat Ceph Storage node must be able to access the full Red Hat Enterprise Linux 8 base content and the extras repository content. Perform the following steps on all bare-metal and container nodes in the storage cluster, unless otherwise noted.

NOTE

For bare-metal Red Hat Ceph Storage nodes that cannot access the Internet during the installation, provide the software content by using the Red Hat Satellite server. Alternatively, mount a local Red Hat Enterprise Linux 8 Server ISO image and point the Red Hat Ceph Storage nodes to the ISO image. For additional details, contact Red Hat Support.

For more information on registering Ceph nodes with the Red Hat Satellite server, see the How to Register Ceph with Satellite 6 and How to Register Ceph with Satellite 5 articles on the Red Hat Customer Portal.

Prerequisites

- A valid Red Hat subscription.
- Red Hat Ceph Storage nodes must be able to connect to the Internet.
- Root-level access to the Red Hat Ceph Storage nodes.

Procedure

1. For **container** deployments only, when the Red Hat Ceph Storage nodes do **NOT** have access to the Internet during deployment. You must follow these steps first on a node with Internet access:

   a. Start a local Docker registry:

   Red Hat Enterprise Linux 7

   ```
   # docker run -d -p 5000:5000 --restart=always --name registry registry:2
   ```

Red Hat Enterprise Linux 8

```
# podman run -d -p 5000:5000 --restart=always --name registry registry:2
```

b. Pull the Red Hat Ceph Storage 4 image from the Red Hat Customer Portal:

Red Hat Enterprise Linux 7

```
# docker pull registry.redhat.io/rhceph/rhceph-4-rhel8
```

Red Hat Enterprise Linux 8

```
# podman pull registry.redhat.io/rhceph/rhceph-4-rhel8
```

NOTE

Red Hat Enterprise Linux 7 and 8 both use the same container image, based on Red Hat Enterprise Linux 8.

c. Tag the image:

Red Hat Enterprise Linux 7

```
# docker tag registry.redhat.io/rhceph/rhceph-4-rhel8
LOCAL_NODE_FQDN:5000/cephimageinlocalreg
```

Red Hat Enterprise Linux 8

```
# podman tag registry.redhat.io/rhceph/rhceph-4-rhel8
LOCAL_NODE_FQDN:5000/cephimageinlocalreg
```

Replace

- *LOCAL_NODE_FQDN* with your local host FQDN.

d. Push the image to the local Docker registry you started:

Red Hat Enterprise Linux 7

```
# docker push LOCAL_NODE_FQDN:5000/cephimageinlocalreg
```

Red Hat Enterprise Linux 8

```
# podman push LOCAL_NODE_FQDN:5000/cephimageinlocalreg
```

Replace

- *LOCAL_NODE_FQDN* with your local host FQDN.

2. For all deployments, **bare-metal** or in **containers**:

   a. Register the node, and when prompted, enter the appropriate Red Hat Customer Portal credentials:

   ```
   # subscription-manager register
   ```

   b. Pull the latest subscription data from the CDN:

   ```
   # subscription-manager refresh
   ```

   c. List all available subscriptions for Red Hat Ceph Storage:

   ```
   # subscription-manager list --available --all --matches="*Ceph*"
   ```

   Identify the appropriate subscription and retrieve its Pool ID.

   d. Attach the subscription:

   ```
   # subscription-manager attach --pool=POOL_ID
   ```

   Replace

   - *POOL_ID* with the Pool ID identified in the previous step.

   e. Disable the default software repositories, and enable the Red Hat Enterprise Linux 8 Server and Red Hat Enterprise Linux 8 Server Extras repositories:

   Red Hat Enterprise Linux 7

   ```
   # subscription-manager repos --disable=*
   # subscription-manager repos --enable=rhel-7-server-rpms
   # subscription-manager repos --enable=rhel-7-server-extras-rpms
   ```

   Red Hat Enterprise Linux 8

   ```
   # subscription-manager repos --disable=*
   # subscription-manager repos --enable=rhel-8-for-x86_64-baseos-rpms
   # subscription-manager repos --enable=rhel-8-for-x86_64-appstream-rpms
   ```

3. Update the system to receive the latest packages.

   a. For Red Hat Enterprise Linux 7:

   ```
   # yum update
   ```

   b. For Red Hat Enterprise Linux 8:

   ```
   # dnf update
   ```

Additional Resources

- See the *Using and Configuring Red Hat Subscription Manager* guide for Red Hat Subscription Management.
- See the *Enabling the Red Hat Ceph Storage repositories*.

Return to requirements checklist

2.5. ENABLING THE RED HAT CEPH STORAGE REPOSITORIES

Before you can install Red Hat Ceph Storage, you must choose an installation method. Red Hat Ceph Storage supports two installation methods:

- Content Delivery Network (CDN)
  For Ceph Storage clusters with Ceph nodes that can connect directly to the internet, use Red Hat Subscription Manager to enable the required Ceph repository.
- Local Repository
  For Ceph Storage clusters where security measures preclude nodes from accessing the internet, install Red Hat Ceph Storage 4 from a single software build delivered as an ISO image, which will allow you to install local repositories.

Prerequisites

- Valid customer subscription.
- For CDN installations:
  - Red Hat Ceph Storage nodes must be able to connect to the internet.
  - Register the cluster nodes with CDN.
- If enabled, then disable the Extra Packages for Enterprise Linux (EPEL) software repository:

```
[root@monitor ~]# yum install yum-utils vim -y
[root@monitor ~]# yum-config-manager --disable epel
```

Procedure

- For CDN installations:
  On the **Ansible administration node**, enable the Red Hat Ceph Storage 4 Tools repository and Ansible repository:

  Red Hat Enterprise Linux 7

```
[root@admin ~]# subscription-manager repos --enable=rhel-7-server-rhceph-4-tools-rpms --
enable=rhel-7-server-ansible-2.8-rpms
```

  Red Hat Enterprise Linux 8

```
[root@admin ~]# subscription-manager repos --enable=rhceph-4-tools-for-rhel-8-x86_64-
rpms --enable=ansible-2.8-for-rhel-8-x86_64-rpms
```

- Red Hat Enterprise Linux 7 **ONLY**
  On the **Monitor nodes**, enable the Red Hat Ceph Storage 4 Monitor repository:

```
[root@monitor ~]# subscription-manager repos --enable=rhel-7-server-rhceph-4-mon-rpms
```

On the **OSD nodes**, enable the Red Hat Ceph Storage 4 OSD repository:

```
[root@osd ~]# subscription-manager repos --enable=rhel-7-server-rhceph-4-osd-rpms
```

Enable the Red Hat Ceph Storage 4 Tools repository on any RBD mirroring node or any other **Client nodes**, any **Object Gateway nodes**, any **Metadata Server nodes**, and any **NFS nodes**.

```
# subscription-manager repos --enable=rhel-7-server-rhceph-4-tools-rpms
```

- For ISO installations:
  1. Log in to the Red Hat Customer Portal.
  2. Click **Downloads** to visit the **Software & Download** center.
  3. In the Red Hat Ceph Storage area, click **Download Software** to download the latest version of the software.

Additional Resources

- The Using and Configuring Red Hat Subscription Manager guide for Red Hat Subscription Management 1

Return to requirements checklist

2.6. CONSIDERATIONS FOR USING A RAID CONTROLLER WITH OSD NODES

Optionally, you can consider using a RAID controller on the OSD nodes. Here are some things to consider:

- If an OSD node has a RAID controller with 1-2GB of cache installed, enabling the write-back cache might result in increased small I/O write throughput. However, the cache must be non-volatile.
- Most modern RAID controllers have super capacitors that provide enough power to drain volatile memory to non-volatile NAND memory during a power-loss event. It is important to understand how a particular controller and its firmware behave after power is restored.
- Some RAID controllers require manual intervention. Hard drives typically advertise to the operating system whether their disk caches should be enabled or disabled by default. However, certain RAID controllers and some firmware do not provide such information. Verify that disk level caches are disabled to avoid file system corruption.
- Create a single RAID 0 volume with write-back for each Ceph OSD data drive with write-back cache enabled.
- If Serial Attached SCSI (SAS) or SATA connected Solid-state Drive (SSD) disks are also present on the RAID controller, then investigate whether the controller and firmware support *pass-through* mode. Enabling *pass-through* mode helps avoid caching logic, and generally results in much lower latency for fast media.

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2.7. CONSIDERATIONS FOR USING NVME WITH OBJECT GATEWAY

Optionally, you can consider using NVMe for the Ceph Object Gateway.

If you plan to use the object gateway feature of Red Hat Ceph Storage and the OSD nodes are using NVMe-based SSDs, then consider following the procedures found in the *Using NVMe with LVM optimally* section of the *Ceph Object Gateway for Production Guide*. These procedures explain how to use specially designed Ansible playbooks which will place journals and bucket indexes together on SSDs, which can increase performance compared to having all journals on one device.

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2.8. VERIFYING THE NETWORK CONFIGURATION FOR RED HAT CEPH STORAGE

All Red Hat Ceph Storage nodes require a public network. You must have a network interface card configured to a public network where Ceph clients can reach Ceph monitors and Ceph OSD nodes.

You might have a network interface card for a cluster network so that Ceph can conduct heart-beating, peering, replication, and recovery on a network separate from the public network.

Configure the network interface settings and ensure to make the changes persistent.

IMPORTANT

Red Hat does not recommend using a single network interface card for both a public and private network.

Prerequisites

- Network interface card connected to the network.

Procedure

Do the following steps on all Red Hat Ceph Storage nodes in the storage cluster, as the **root** user.

1. Verify the following settings are in the **/etc/sysconfig/network-scripts/ifcfg-*** file corresponding the public-facing network interface card:

   a. The **BOOTPROTO** parameter is set to **none** for static IP addresses.

   b. The **ONBOOT** parameter must be set to **yes**.
   If it is set to **no**, the Ceph storage cluster might fail to peer on reboot.

   c. If you intend to use IPv6 addressing, you must set the IPv6 parameters such as **IPV6INIT** to **yes**, except the **IPV6_FAILURE_FATAL** parameter.
   Also, edit the Ceph configuration file, **/etc/ceph/ceph.conf**, to instruct Ceph to use IPv6, otherwise, Ceph uses IPv4.

Additional Resources

- For details on configuring network interface scripts for Red Hat Enterprise Linux 8, see the *Configuring ip networking with ifcfg files* chapter in the *Configuring and managing networking* guide for Red Hat Enterprise Linux 8.
- For more information on network configuration see the *Network Configuration Reference* chapter in the *Configuration Guide* for Red Hat Ceph Storage 4.

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2.9. CONFIGURING A FIREWALL FOR RED HAT CEPH STORAGE

Red Hat Ceph Storage uses the **firewalld** service.

The Monitor daemons use port **6789** for communication within the Ceph storage cluster.

On each Ceph OSD node, the OSD daemons use several ports in the range **6800-7300**:

- One for communicating with clients and monitors over the public network
- One for sending data to other OSDs over a cluster network, if available; otherwise, over the public network
- One for exchanging heartbeat packets over a cluster network, if available; otherwise, over the public network

The Ceph Manager (**ceph-mgr**) daemons use ports in range **6800-7300**. Consider colocating the **ceph-mgr** daemons with Ceph Monitors on same nodes.

The Ceph Metadata Server nodes (**ceph-mds**) use port range **6800-7300**.

The Ceph Object Gateway nodes are configured by Ansible to use port **8080** by default. However, you can change the default port, for example to port **80**.

To use the SSL/TLS service, open port **443**.

The following steps are optional if **firewalld** is enabled. By default, **ceph-ansible** includes the below setting in **group_vars/all.yml**, which automatically opens the appropriate ports:

```
configure_firewall: True
```

Prerequisite

- Network hardware is connected.
- Having **root** or **sudo** access to all nodes in the storage cluster.

Procedure

1. On all nodes in the storage cluster, start the **firewalld** service. Enable it to run on boot, and ensure that it is running:

```
# systemctl enable firewalld
# systemctl start firewalld
# systemctl status firewalld
```

2. On all monitor nodes, open port **6789** on the public network:

```
[root@monitor ~]# firewall-cmd --zone=public --add-port=6789/tcp
[root@monitor ~]# firewall-cmd --zone=public --add-port=6789/tcp --permanent
```

To limit access based on the source address:

```
firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="IP_ADDRESS/NETMASK_PREFIX" port protocol="tcp" \
port="6789" accept"
```

```
firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="IP_ADDRESS/NETMASK_PREFIX" port protocol="tcp" \
port="6789" accept" --permanent
```

Replace

- *IP_ADDRESS* with the network address of the Monitor node.
- *NETMASK_PREFIX* with the netmask in CIDR notation.

Example

```
[root@monitor ~]# firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="192.168.0.11/24" port protocol="tcp" \
port="6789" accept"
```

```
[root@monitor ~]# firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="192.168.0.11/24" port protocol="tcp" \
port="6789" accept" --permanent
```

3. On all OSD nodes, open ports **6800-7300** on the public network:

```
[root@osd ~]# firewall-cmd --zone=public --add-port=6800-7300/tcp
[root@osd ~]# firewall-cmd --zone=public --add-port=6800-7300/tcp --permanent
```

If you have a separate cluster network, repeat the commands with the appropriate zone.

4. On all Ceph Manager (**ceph-mgr**) nodes, open ports **6800-7300** on the public network:

```
[root@monitor ~]# firewall-cmd --zone=public --add-port=6800-7300/tcp
[root@monitor ~]# firewall-cmd --zone=public --add-port=6800-7300/tcp --permanent
```

If you have a separate cluster network, repeat the commands with the appropriate zone.

5. On all Ceph Metadata Server (**ceph-mds**) nodes, open ports **6800-7300** on the public network:

```
[root@monitor ~]# firewall-cmd --zone=public --add-port=6800-7300/tcp
[root@monitor ~]# firewall-cmd --zone=public --add-port=6800-7300/tcp --permanent
```

If you have a separate cluster network, repeat the commands with the appropriate zone.

6. On all Ceph Object Gateway nodes, open the relevant port or ports on the public network.

   a. To open the default Ansible configured port of **8080**:

```
[root@gateway ~]# firewall-cmd --zone=public --add-port=8080/tcp
[root@gateway ~]# firewall-cmd --zone=public --add-port=8080/tcp --permanent
```

   To limit access based on the source address:

```
firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="IP_ADDRESS/NETMASK_PREFIX" port protocol="tcp" \
port="8080" accept"
```

```
firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="IP_ADDRESS/NETMASK_PREFIX" port protocol="tcp" \
port="8080" accept" --permanent
```

   Replace

   - *IP_ADDRESS* with the network address of the Monitor node.
   - *NETMASK_PREFIX* with the netmask in CIDR notation.

   Example

```
[root@gateway ~]# firewall-cmd --zone=public --add-rich-rule="rule family="ipv4"
\
source address="192.168.0.31/24" port protocol="tcp" \
port="8080" accept"
```

```
[root@gateway ~]# firewall-cmd --zone=public --add-rich-rule="rule family="ipv4"
\
source address="192.168.0.31/24" port protocol="tcp" \
port="8080" accept" --permanent
```

   b. Optionally, if you installed Ceph Object Gateway using Ansible and changed the default port that Ansible configures the Ceph Object Gateway to use from **8080**, for example, to port **80**, then open this port:

```
[root@gateway ~]# firewall-cmd --zone=public --add-port=80/tcp
[root@gateway ~]# firewall-cmd --zone=public --add-port=80/tcp --permanent
```

   To limit access based on the source address, run the following commands:

```
firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="IP_ADDRESS/NETMASK_PREFIX" port protocol="tcp" \
port="80" accept"
```

```
firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="IP_ADDRESS/NETMASK_PREFIX" port protocol="tcp" \
port="80" accept" --permanent
```

Replace

- *IP_ADDRESS* with the network address of the Monitor node.
- *NETMASK_PREFIX* with the netmask in CIDR notation.

Example

```
[root@gateway ~]# firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="192.168.0.31/24" port protocol="tcp" \
port="80" accept"
```

```
[root@gateway ~]# firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="192.168.0.31/24" port protocol="tcp" \
port="80" accept" --permanent
```

c. Optional. To use SSL/TLS, open port **443**:

```
[root@gateway ~]# firewall-cmd --zone=public --add-port=443/tcp
[root@gateway ~]# firewall-cmd --zone=public --add-port=443/tcp --permanent
```

To limit access based on the source address, run the following commands:

```
firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="IP_ADDRESS/NETMASK_PREFIX" port protocol="tcp" \
port="443" accept"
```

```
firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="IP_ADDRESS/NETMASK_PREFIX" port protocol="tcp" \
port="443" accept" --permanent
```

Replace

- *IP_ADDRESS* with the network address of the Monitor node.
- *NETMASK_PREFIX* with the netmask in CIDR notation.

Example

```
[root@gateway ~]# firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="192.168.0.31/24" port protocol="tcp" \
port="443" accept"
[root@gateway ~]# firewall-cmd --zone=public --add-rich-rule="rule family="ipv4" \
source address="192.168.0.31/24" port protocol="tcp" \
port="443" accept" --permanent
```

Additional Resources

- For more information about public and cluster network, see Verifying the Network Configuration for Red Hat Ceph Storage.

- For additional details on **firewalld**, see the Using and configuring firewalls chapter in the *Securing networks* guide for Red Hat Enterprise Linux 8.

Return to requirements checklist

2.10. CREATING AN ANSIBLE USER WITH SUDO ACCESS

Ansible must be able to log into all the Red Hat Ceph Storage (RHCS) nodes as a user that has **root** privileges to install software and create configuration files without prompting for a password. You must create an Ansible user with password-less **root** access on all nodes in the storage cluster when deploying and configuring a Red Hat Ceph Storage cluster with Ansible.

Prerequisite

- Having **root** or **sudo** access to all nodes in the storage cluster.

Procedure

1. Log into the node as the **root** user:

```
ssh root@HOST_NAME
```

Replace

- *HOST_NAME* with the host name of the Ceph node.

Example

```
# ssh root@mon01
```

Enter the **root** password when prompted.

2. Create a new Ansible user:

```
adduser USER_NAME
```

Replace

- *USER_NAME* with the new user name for the Ansible user.

Example

```
# adduser admin
```

IMPORTANT

Do not use **ceph** as the user name. The **ceph** user name is reserved for the Ceph daemons. A uniform user name across the cluster can improve ease of use, but avoid using obvious user names, because intruders typically use them for brute-force attacks.

3. Set a new password for this user:

```
# passwd USER_NAME
```

Replace

- *USER_NAME* with the new user name for the Ansible user.

  Example

  ```
  # passwd admin
  ```

  Enter the new password twice when prompted.

4. Configure **sudo** access for the newly created user:

```
cat << EOF >/etc/sudoers.d/USER_NAME
$USER_NAME ALL = (root) NOPASSWD:ALL
EOF
```

Replace

- *USER_NAME* with the new user name for the Ansible user.

  Example

  ```
  # cat << EOF >/etc/sudoers.d/admin
  admin ALL = (root) NOPASSWD:ALL
  EOF
  ```

5. Assign the correct file permissions to the new file:

```
chmod 0440 /etc/sudoers.d/USER_NAME
```

Replace

- *USER_NAME* with the new user name for the Ansible user.

  Example

  ```
  # chmod 0440 /etc/sudoers.d/admin
  ```

Additional Resources

- The Managing user accounts section in the *Configuring basic system settings* guide Red Hat Enterprise Linux 8

Return to requirements checklist

2.11. ENABLING PASSWORD-LESS SSH FOR ANSIBLE

Generate an SSH key pair on the Ansible administration node and distribute the public key to each node in the storage cluster so that Ansible can access the nodes without being prompted for a password.

NOTE

This procedure is not required if installing Red Hat Ceph Storage using the Cockpit web-based interface. This is because the Cockpit Ceph Installer generates its own SSH key. Instructions for copying the Cockpit SSH key to all nodes in the cluster are in the chapter Installing Red Hat Ceph Storage using the Cockpit web interface .

Prerequisites

- Access to the Ansible administration node.
- *Creating an Ansible user with* ***sudo*** *access*.

Procedure

1. Generate the SSH key pair, accept the default file name and leave the passphrase empty:

```
[ansible@admin ~]$ ssh-keygen
```

2. Copy the public key to all nodes in the storage cluster:

```
ssh-copy-id USER_NAME@HOST_NAME
```

Replace

- *USER_NAME* with the new user name for the Ansible user.
- *HOST_NAME* with the host name of the Ceph node.

Example

```
[ansible@admin ~]$ ssh-copy-id ceph-admin@ceph-mon01
```

3. Create the user's SSH **config** file:

```
[ansible@admin ~]$ touch ~/.ssh/config
```

4. Open for editing the **config** file. Set values for the **Hostname** and **User** options for each node in the storage cluster:

```
Host node1
  Hostname HOST_NAME
  User USER_NAME
Host node2
  Hostname HOST_NAME
  User USER_NAME
...
```

Replace

- *HOST_NAME* with the host name of the Ceph node.

- *HOST_NAME* with the host name of the Ceph node.
- *USER_NAME* with the new user name for the Ansible user.

Example

```
Host node1
  Hostname monitor
  User admin
Host node2
  Hostname osd
  User admin
Host node3
  Hostname gateway
  User admin
```

IMPORTANT

By configuring the ~/**.ssh**/**config** file you do not have to specify the **-u** ***USER_NAME*** option each time you execute the **ansible-playbook** command.

5. Set the correct file permissions for the ~/**.ssh**/**config** file:

```
[admin@admin ~]$ chmod 600 ~/.ssh/config
```

Additional Resources

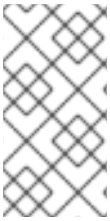
- The **ssh_config(5)** manual page.
- See the Using secure communications between two systems with OpenSSH chapter in the *Securing networks* for Red Hat Enterprise Linux 8.

Return to requirements checklist

CHAPTER 3. INSTALLING RED HAT CEPH STORAGE USING THE COCKPIT WEB INTERFACE

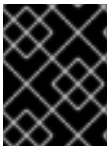
This chapter describes how to use the Cockpit web-based interface to install a Red Hat Ceph Storage cluster and other components, such as Metadata Servers, the Ceph client, or the Ceph Object Gateway.

The process consists of installing the Cockpit Ceph Installer, logging into Cockpit, and configuring and starting the cluster install using different pages within the installer.



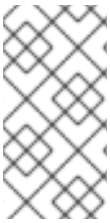
NOTE

The Cockpit Ceph Installer uses Ansible and the Ansible playbooks provided by the **ceph-ansible** RPM to perform the actual install. It is still possible to use these playbooks to install Ceph without Cockpit. That process is relevant to this chapter and is referred to as a *direct Ansible install*, or *using the Ansible playbooks directly*.



IMPORTANT

The Cockpit Ceph installer does not currently support IPv6 networking. If you require IPv6 networking, install Ceph using the Ansible playbooks directly.



NOTE

The dashboard web interface, used for administration and monitoring of Ceph, is installed by default by the Ansible playbooks in the **ceph-ansible** RPM, which Cockpit uses on the back-end. Therefore, whether you use Ansible playbooks directly, or use Cockpit to install Ceph, the dashboard web interface will be installed as well.

3.1. PREREQUISITES

- Complete the general prerequisites required for direct Ansible Red Hat Ceph Storage installs.
- A recent version of Firefox or Chrome.
- If using multiple networks to segment intra-cluster traffic, client-to-cluster traffic, RADOS Gateway traffic, or iSCSI traffic, ensure the relevant networks are already configured on the hosts. For more information, see network considerations in the Hardware Guide and the section in this chapter on completing the Network page of the Cockpit Ceph Installer

3.2. INSTALLATION REQUIREMENTS

- One node to act as the Ansible administration node.
- One node to provide the performance metrics and alerting platform. This may be colocated with the Ansible administration node.
- One or more nodes to form the Ceph cluster. The installer supports an all-in-one installation called *Development/POC*. In this mode all Ceph services can run from the same node, and data replication defaults to disk rather than host level protection.

3.3. INSTALL AND CONFIGURE THE COCKPIT CEPH INSTALLER

Before you can use the Cockpit Ceph Installer to install a Red Hat Ceph Storage cluster, you must install the Cockpit Ceph Installer itself.

Prerequisites

- Root-level access to the Ansible administration node.
- The **ansible** user account for use with the Ansible application.

Procedure

1. Verify Cockpit is installed.

```
$ rpm -q cockpit
```

Example:

```
[admin@jb-ceph4-admin ~]$ rpm -q cockpit
cockpit-196.3-1.el8.x86_64
```

If you see similar output to the example above, skip to the step *Verify Cockpit is running*. If the output is **package cockpit is not installed**, continue to the step *Install Cockpit*.

2. Optional: Install Cockpit.

   a. For Red Hat Enterprise Linux 8:

```
# dnf install cockpit
```

   b. For Red Hat Enterprise Linux 7:

```
# yum install cockpit
```

3. Verify Cockpit is running.

```
# systemctl status cockpit.socket
```

If you see **Active: active (listening)** in the output, skip to the step *Install the Cockpit plugin for Red Hat Ceph Storage*. If instead you see **Active: inactive (dead)**, continue to the step *Enable Cockpit*.

4. Optional: Enable Cockpit.

   a. Use the **systemctl** command to enable Cockpit:

```
# systemctl enable --now cockpit.socket
```

You will see a line like the following:

```
Created symlink /etc/systemd/system/sockets.target.wants/cockpit.socket →
/usr/lib/systemd/system/cockpit.socket.
```

   b. Verify Cockpit is running:

```
# systemctl status cockpit.socket
```

You will see a line like the following:

```
Active: active (listening) since Tue 2020-01-07 18:49:07 EST; 7min ago
```

5. Install the Cockpit Ceph Installer for Red Hat Ceph Storage.

   a. For Red Hat Enterprise Linux 8:

   ```
   # dnf install cockpit-ceph-installer
   ```

   b. For Red Hat Enterprise Linux 7:

   ```
   # yum install cockpit-ceph-installer
   ```

6. As the Ansible user, log in to the container catalog using sudo:

   NOTE

   By default, the Cockpit Ceph Installer uses the **root** user to install Ceph. To use the Ansible user created as a part of the prerequisites to install Ceph, run the rest of the commands in this procedure with **sudo** as the Ansible user.

   Red Hat Enterprise Linux 7

   ```
   $ sudo docker login -u CUSTOMER_PORTAL_USERNAME https://registry.redhat.io
   ```

   Example

   ```
   [admin@jb-ceph4-admin ~]$ sudo docker login -u myusername https://registry.redhat.io
   Password:
   Login Succeeded!
   ```

   Red Hat Enterprise Linux 8

   ```
   $ sudo podman login -u CUSTOMER_PORTAL_USERNAME https://registry.redhat.io
   ```

   Example

   ```
   [admin@jb-ceph4-admin ~]$ sudo podman login -u myusername https://registry.redhat.io
   Password:
   Login Succeeded!
   ```

7. As the Ansible user, start the **ansible-runner-service** using sudo.

   ```
   $ sudo ansible-runner-service.sh -s
   ```

   Example

```
[admin@jb-ceph4-admin ~]$ sudo ansible-runner-service.sh -s
Checking environment is ready
Checking/creating directories
Checking SSL certificate configuration
Generating RSA private key, 4096 bit long modulus (2 primes)
.....................................................................................................................
.....................................................................+++++
.....................................................+++++
e is 65537 (0x010001)
Generating RSA private key, 4096 bit long modulus (2 primes)
.......................................+++++
.....................................................................................................................
.......................+++++
e is 65537 (0x010001)
writing RSA key
Signature ok
subject=C = US, ST = North Carolina, L = Raleigh, O = Red Hat, OU = RunnerServer, CN =
jb-ceph4-admin
Getting CA Private Key
Generating RSA private key, 4096 bit long modulus (2 primes)
.........................................................................................+++++
..+++++
e is 65537 (0x010001)
writing RSA key
Signature ok
subject=C = US, ST = North Carolina, L = Raleigh, O = Red Hat, OU = RunnerClient, CN = jb-
ceph4-admin
Getting CA Private Key
Setting ownership of the certs to your user account(admin)
Setting target user for ansible connections to admin
Applying SELINUX container_file_t context to '/etc/ansible-runner-service'
Applying SELINUX container_file_t context to '/usr/share/ceph-ansible'
Ansible API (runner-service) container set to rhceph/ansible-runner-rhel8:latest
Fetching Ansible API container (runner-service). Please wait...
Trying to pull registry.redhat.io/rhceph/ansible-runner-rhel8:latest...Getting image source
signatures
Copying blob c585fd5093c6 done
Copying blob 217d30c36265 done
Copying blob e61d8721e62e done
Copying config b96067ea93 done
Writing manifest to image destination
Storing signatures
b96067ea93c8d6769eaea86854617c63c61ea10c4ff01ecf71d488d5727cb577
Starting Ansible API container (runner-service)
Started runner-service container
Waiting for Ansible API container (runner-service) to respond
The Ansible API container (runner-service) is available and responding to requests

Login to the cockpit UI at https://jb-ceph4-admin:9090/cockpit-ceph-installer to start the install
```

The last line of output includes the URL to the Cockpit Ceph Installer. In the example above the URL is **https://jb-ceph4-admin:9090/cockpit-ceph-installer**. Take note of the URL printed in your environment.

3.4. COPY THE COCKPIT CEPH INSTALLER SSH KEY TO ALL NODES IN THE CLUSTER

The Cockpit Ceph Installer uses SSH to connect to and configure the nodes in the cluster. In order for it to do this automatically the installer generates an SSH key pair so it can access the nodes without being prompted for a password. The SSH public key must be transferred to all nodes in the cluster.

Prerequisites

- An Ansible user with sudo access has been created.
- The Cockpit Ceph Installer is installed and configured.

Procedure

1. Log in to the Ansible administration node as the Ansible user.

   ```
   ssh ANSIBLE_USER@HOST_NAME
   ```

   Example:

   ```
   $ ssh admin@jb-ceph4-admin
   ```

2. Copy the SSH public key to the first node:

   ```
   sudo ssh-copy-id -f -i /usr/share/ansible-runner-service/env/ssh_key.pub
   _ANSIBLE_USER_@_HOST_NAME_
   ```

   Example:

   ```
   $ sudo ssh-copy-id -f -i /usr/share/ansible-runner-service/env/ssh_key.pub admin@jb-ceph4-
   mon
   /bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/usr/share/ansible-runner-
   service/env/ssh_key.pub"
   admin@192.168.122.182's password:

   Number of key(s) added: 1

   Now try logging into the machine, with:   "ssh 'admin@jb-ceph4-mon'"
   and check to make sure that only the key(s) you wanted were added.
   ```

   Repeat this step for all nodes in the cluster

3.5. LOG IN TO COCKPIT

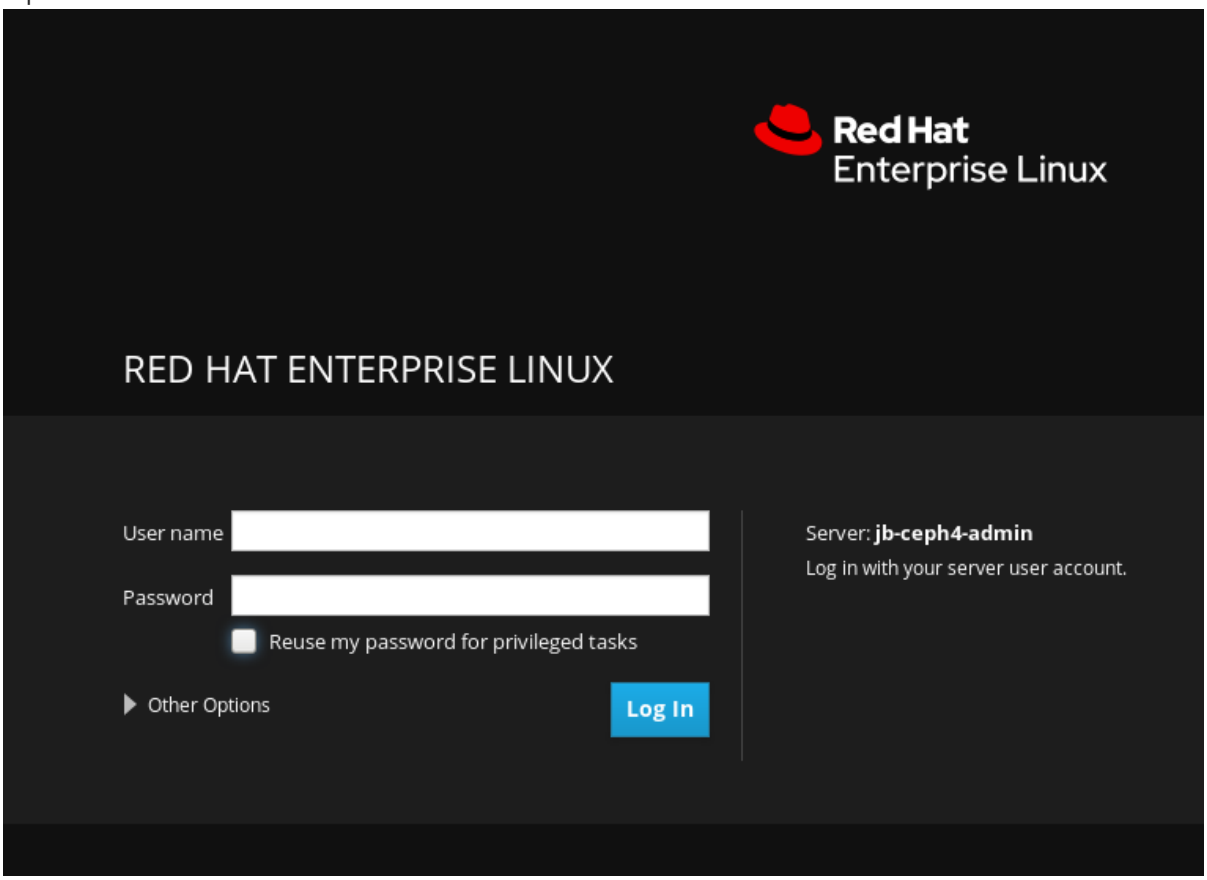
You can view the Cockpit Ceph Installer web interface by logging into Cockpit.

Prerequisites

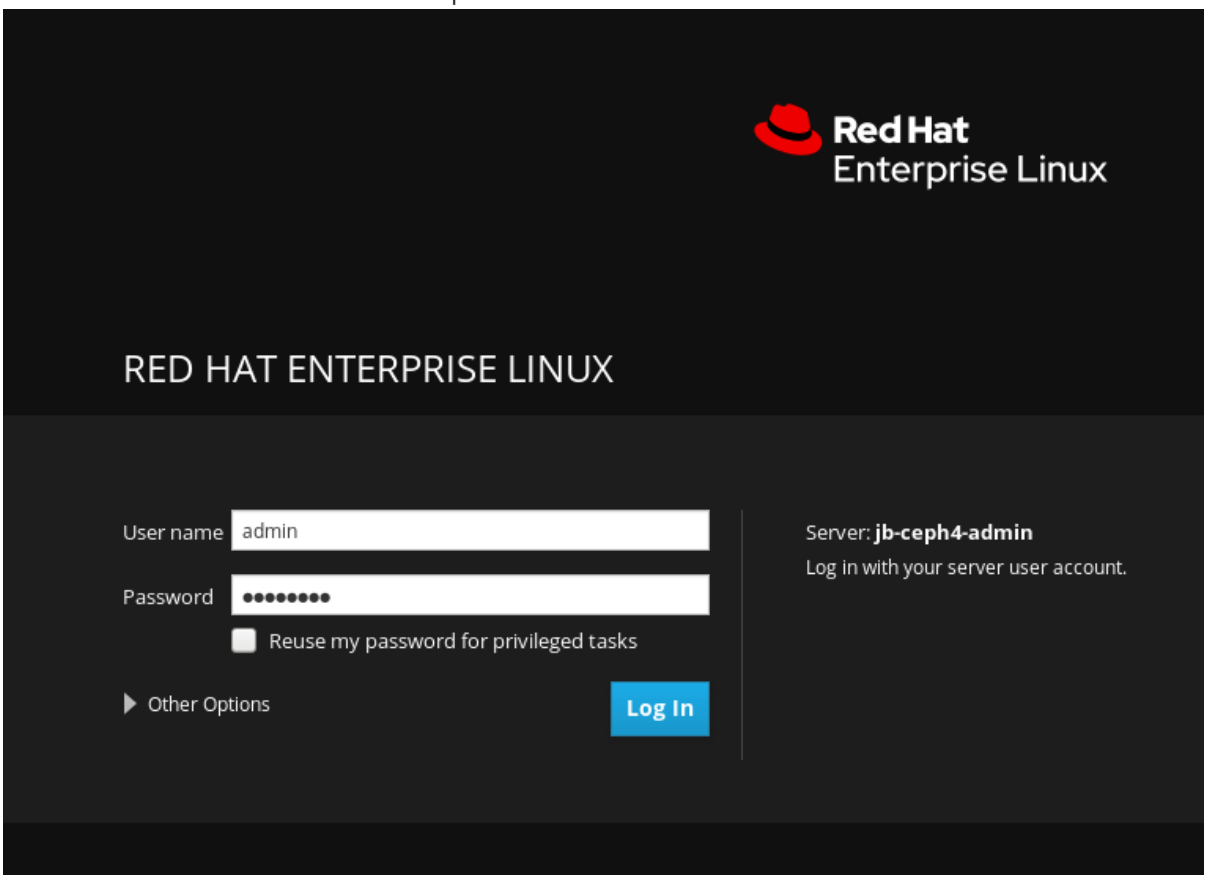
- The Cockpit Ceph Installer is installed and configured.
- You have the URL printed as a part of configuring the Cockpit Ceph Installer

Procedure

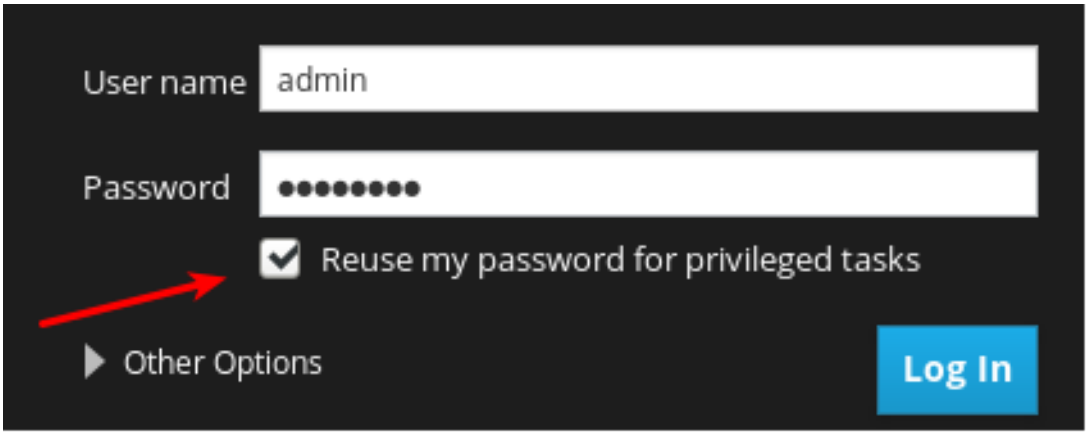
1. Open the URL in a web browser.



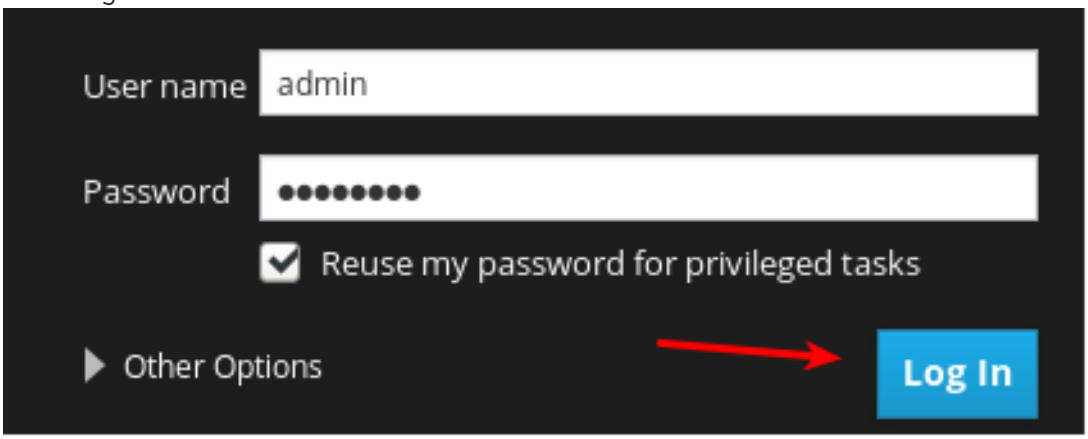
2. Enter the Ansible user name and its password.



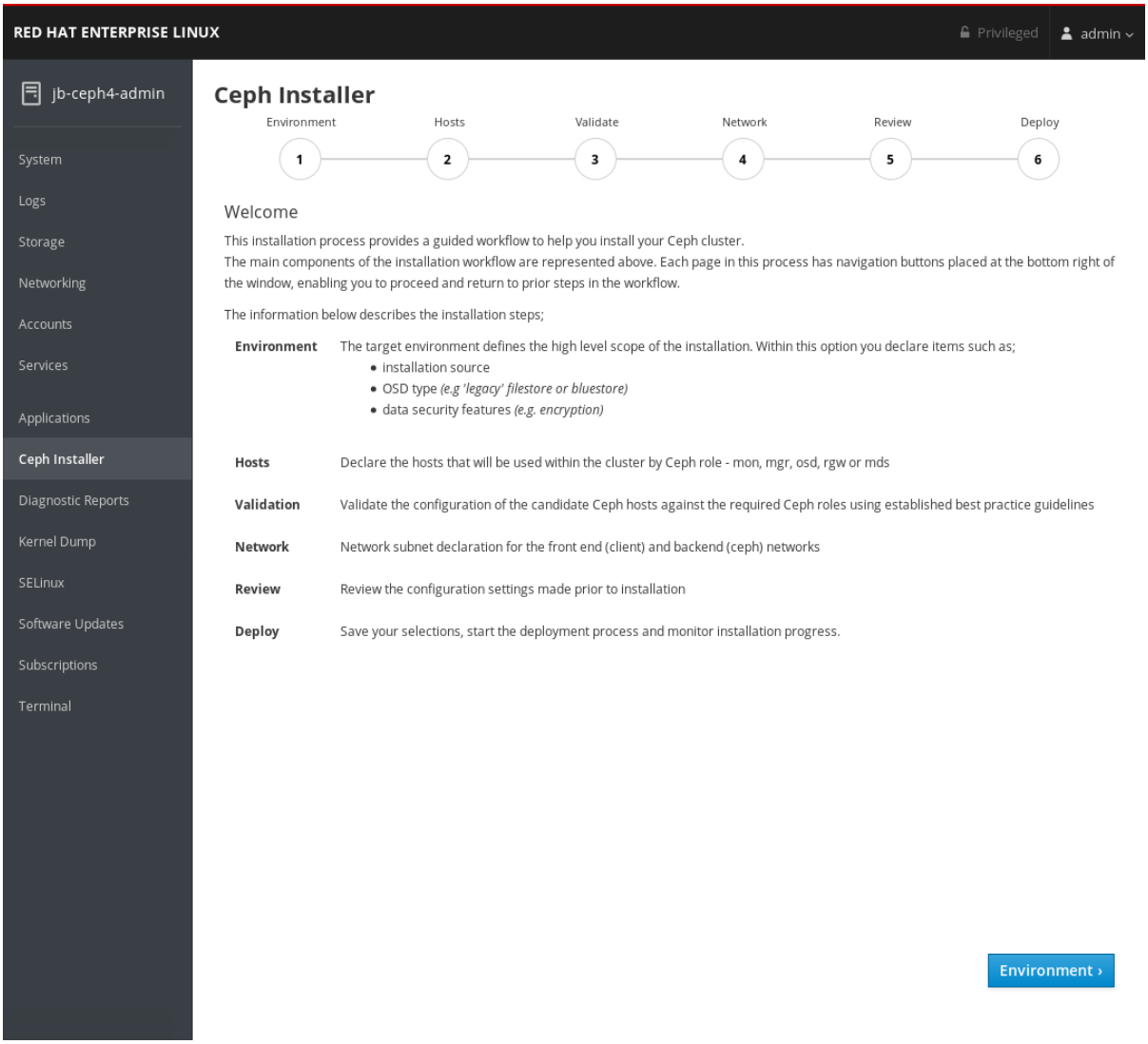
3. Click the radio button for *Reuse my password for privileged tasks*.



4. Click *Log In*.



5. Review the welcome page to understand how the installer works and the overall flow of the installation process.



Click the *Environment* button at the bottom right corner of the web page after you have reviewed the information in the welcome page.

3.6. COMPLETE THE ENVIRONMENT PAGE OF THE COCKPIT CEPH INSTALLER

The *Environment* page allows you to configure overall aspects of the cluster, like what installation source to use and how to use Hard Disk Drives (HDDs) and Solid State Drives (SSDs) for storage.

Prerequisites

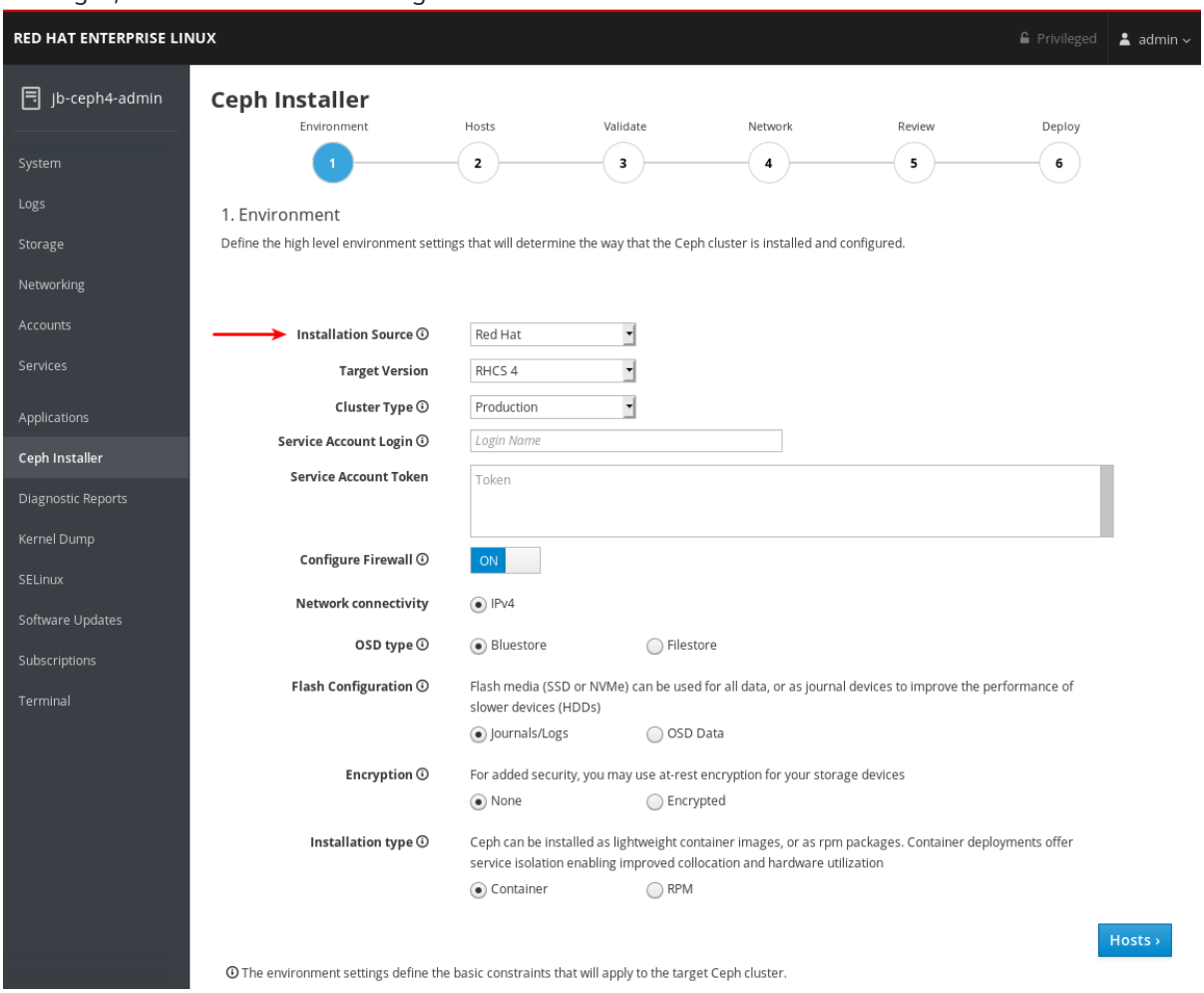
- The Cockpit Ceph Installer is installed and configured.
- You have the URL printed as a part of configuring the Cockpit Ceph Installer.
- You have created a registry service account.

NOTE

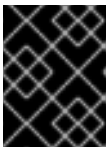
In the dialogs to follow, there are tooltips to the right of some of the settings. To view them, hover the mouse cursor over the icon that looks like an *i* with a circle around it.

Procedure

1. Select the *Installation Source*. Choose *Red Hat* to use repositories from Red Hat Subscription Manager, or ISO to use a CD image downloaded from the Red Hat Customer Portal.

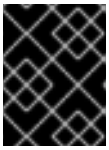


If you choose *Red Hat*, *Target Version* will be set to *RHCS 4* without any other options. If you choose *ISO*, *Target Version* will be set to the ISO image file.



IMPORTANT

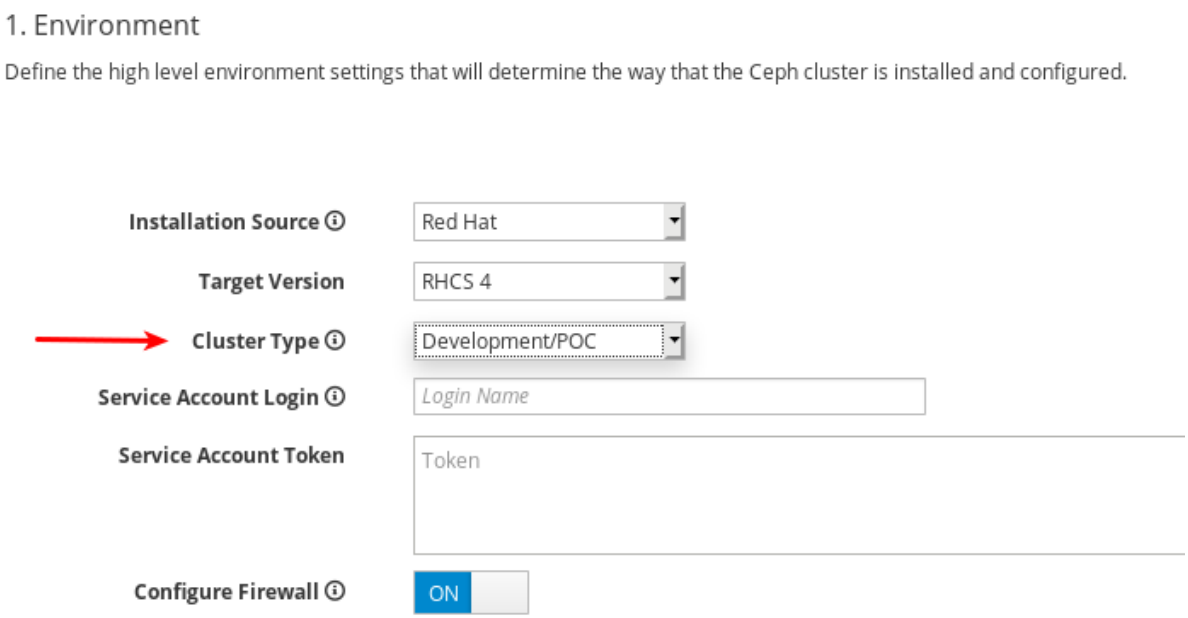
If you choose ISO, the image file must be in the **/usr/share/ansible-runner-service/iso** directory and its SELinux context must be set to **container_file_t**.



IMPORTANT

The *Community* and *Distribution* options for *Installation Source* are not supported.

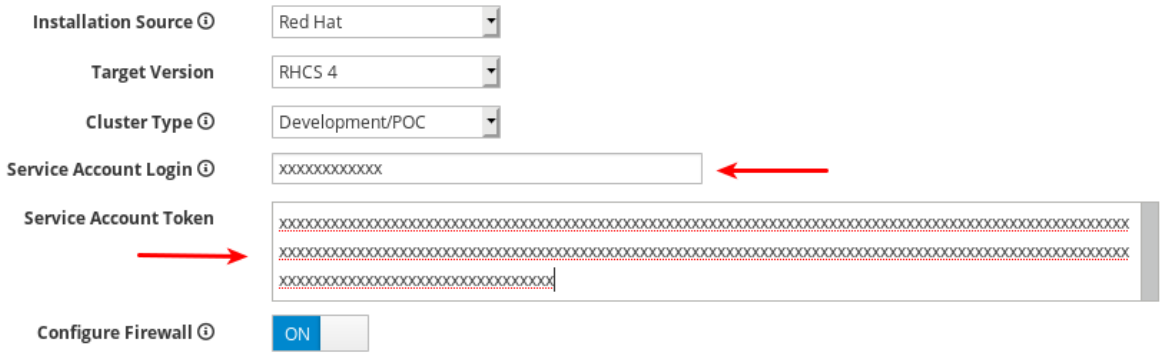
2. Select the *Cluster Type*. The *Production* selection prohibits the install from proceeding if certain resource requirements like CPU number and memory size are not met. To allow the cluster installation to proceed even if the resource requirements are not met, select *Development/POC*.



IMPORTANT

Do not use *Development/POC* mode to install a Ceph cluster that will be used in production.

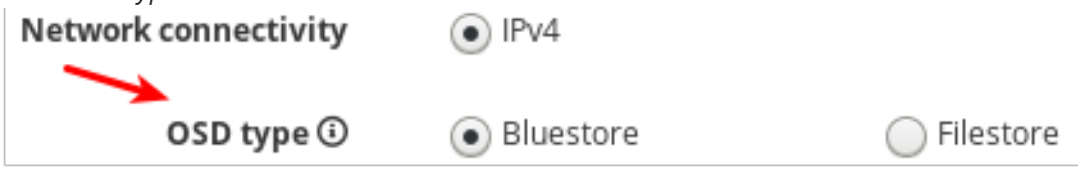
3. Set the *Service Account Login* and *Service Account Token*. If you do not have a Red Hat Registry Service Account, create one using the Registry Service Account webpage.



4. Set *Configure Firewall* to *ON* to apply rules to **firewalld** to open ports for Ceph services. Use the *OFF* setting if you are not using **firewalld**.

5. Currently, the Cockpit Ceph Installer only supports IPv4. If you require IPv6 support, discountinue use of the Cockpit Ceph Installer and proceed with installing Ceph using the Ansible scripts directly.

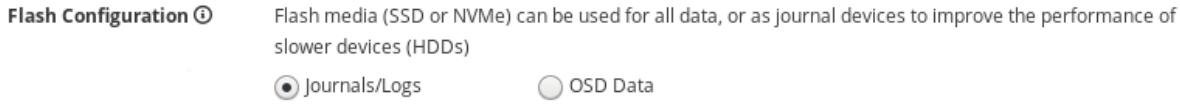
6. Set *OSD Type* to *BlueStore* or *FileStore*.



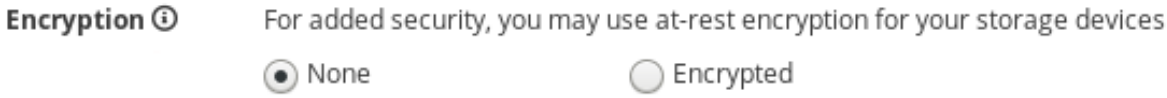
IMPORTANT

BlueStore is the default OSD type. Previously, Ceph used FileStore as the object store. This format is deprecated for new Red Hat Ceph Storage 4.0 installs because BlueStore offers more features and improved performance. It is still possible to use FileStore, but using it requires a support exception. For more information on BlueStore, see Ceph BlueStore in the Architecture Guide.

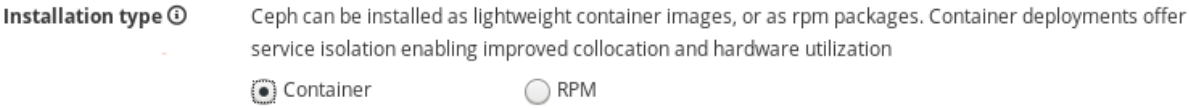
7. Set *Flash Configuration* to *Journal/Logs* or *OSD data*. If you have Solid State Drives (SSDs), whether they use NVMe or a traditional SATA/SAS interface, you can choose to use them just for write journaling and logs while the actual data goes on Hard Disk Drives (HDDs), or you can use the SSDs for journaling, logs, and data, and not use HDDs for any Ceph OSD functions.



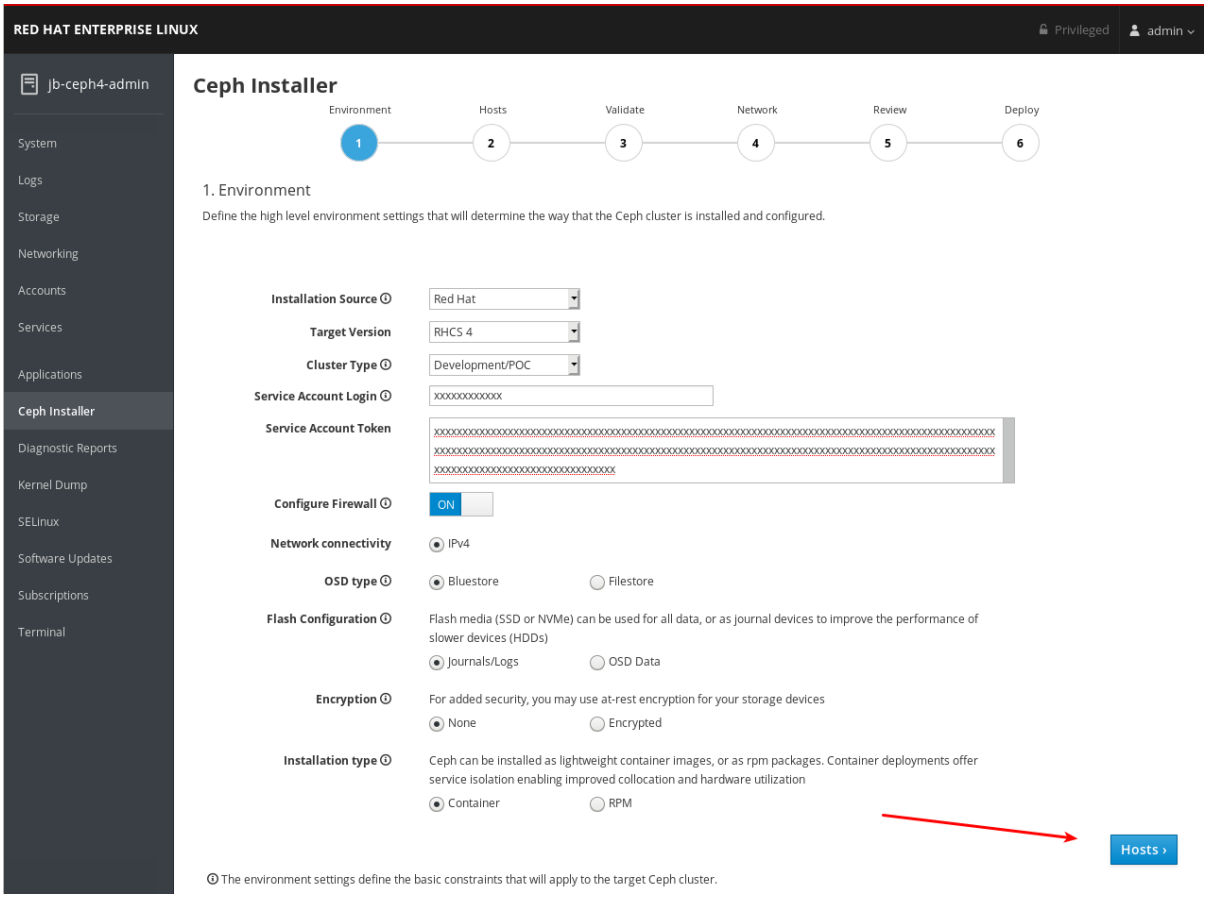
8. Set *Encryption* to *None* or *Encrypted*. This refers to at rest encryption of storage devices using the LUKS1 format.



9. Set *Installation type* to *Container* or *RPM*. Traditionally, Red Hat Package Manager (RPM) was used to install software on Red Hat Enterprise Linux. Now, you can install Ceph using RPM or containers. Installing Ceph using containers can provide improved hardware utilization since services can be isolated and collocated.



10. Review all the Environment settings and click the *Hosts* button at the bottom right corner of the webpage.



3.7. COMPLETE THE HOSTS PAGE OF THE COCKPIT CEPH INSTALLER

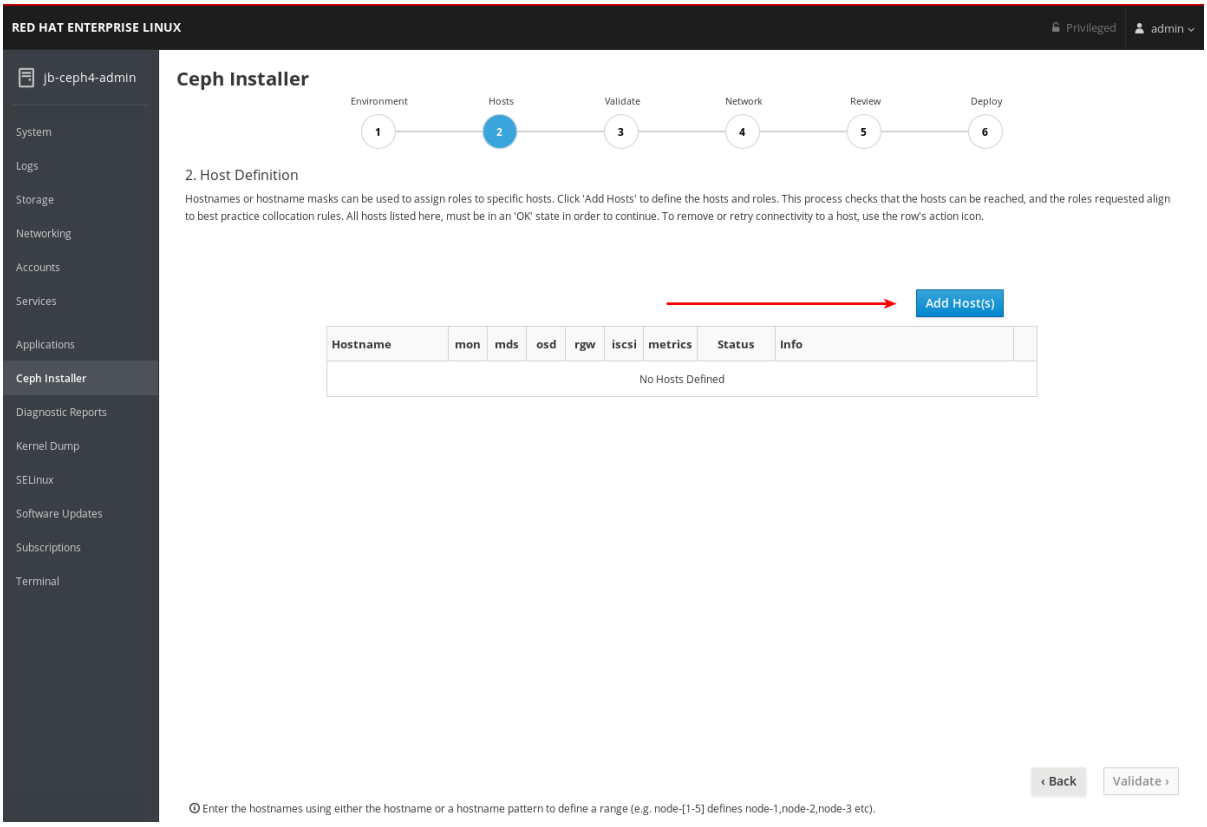
The *Hosts* page allows you inform the Cockpit Ceph Installer what hosts to install Ceph on, and what roles each host will be used for. As you add the hosts, the installer will check them for SSH and DNS connectivity.

Prerequisites

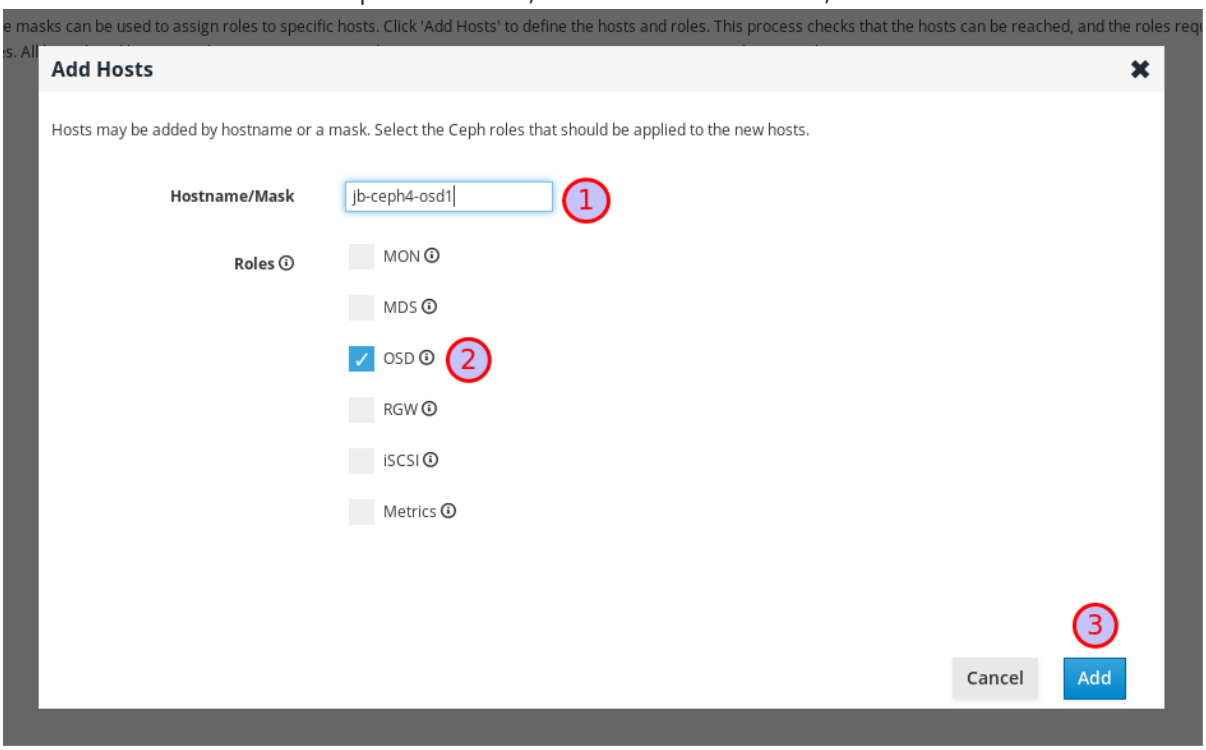
- The Environment page of the Cockpit Ceph Installer has been completed.
- The Cockpit Ceph Installer SSH key has been copied to all nodes in the cluster .

Procedure

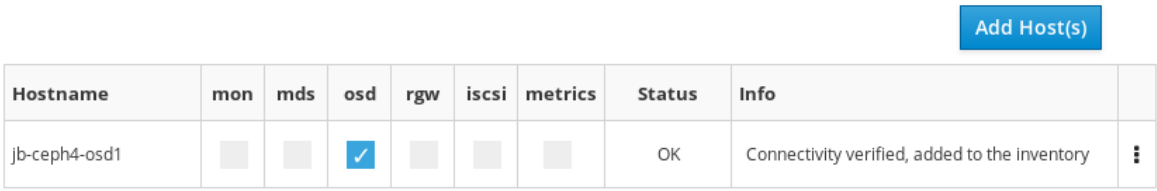
1. Click the *Add Host(s)* button.



2. Enter the hostname for a Ceph OSD node, check the box for *OSD*, and click the *Add* button.

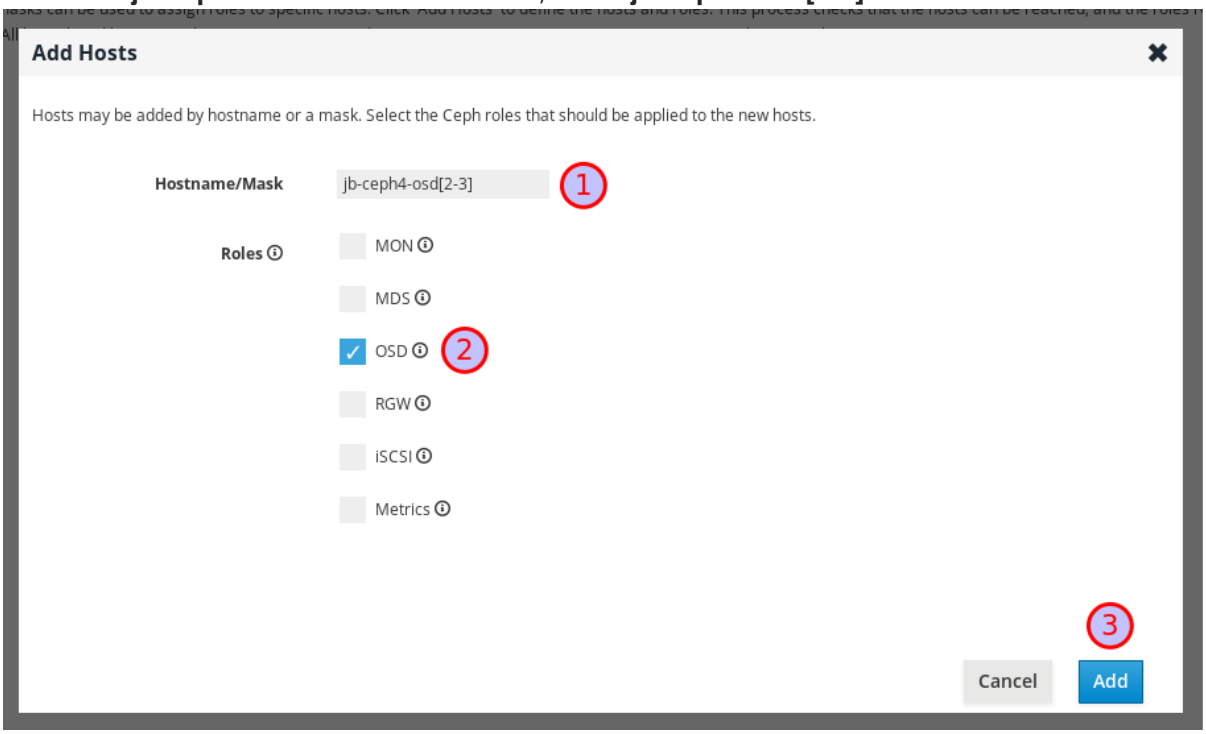


The first Ceph OSD node is added.

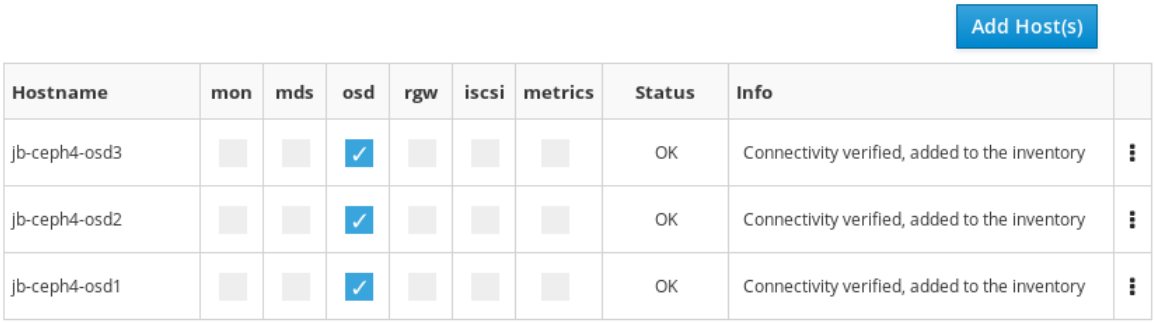


For production clusters, repeat this step until you have added at least three Ceph OSD nodes.

3. Optional: Use a host name pattern to define a range of nodes. For example, to add **jb-ceph4-osd2** and **jb-ceph4-osd3** at the same time, enter **jb-ceph4-osd[2-3]**.



Both **jb-ceph4-osd2** and **jb-ceph4-ods3** are added.



4. Repeat the above steps for the other nodes in your cluster.

   a. For production clusters, add at least three Ceph Monitor nodes. In the dialog, the role is listed as **MON**.

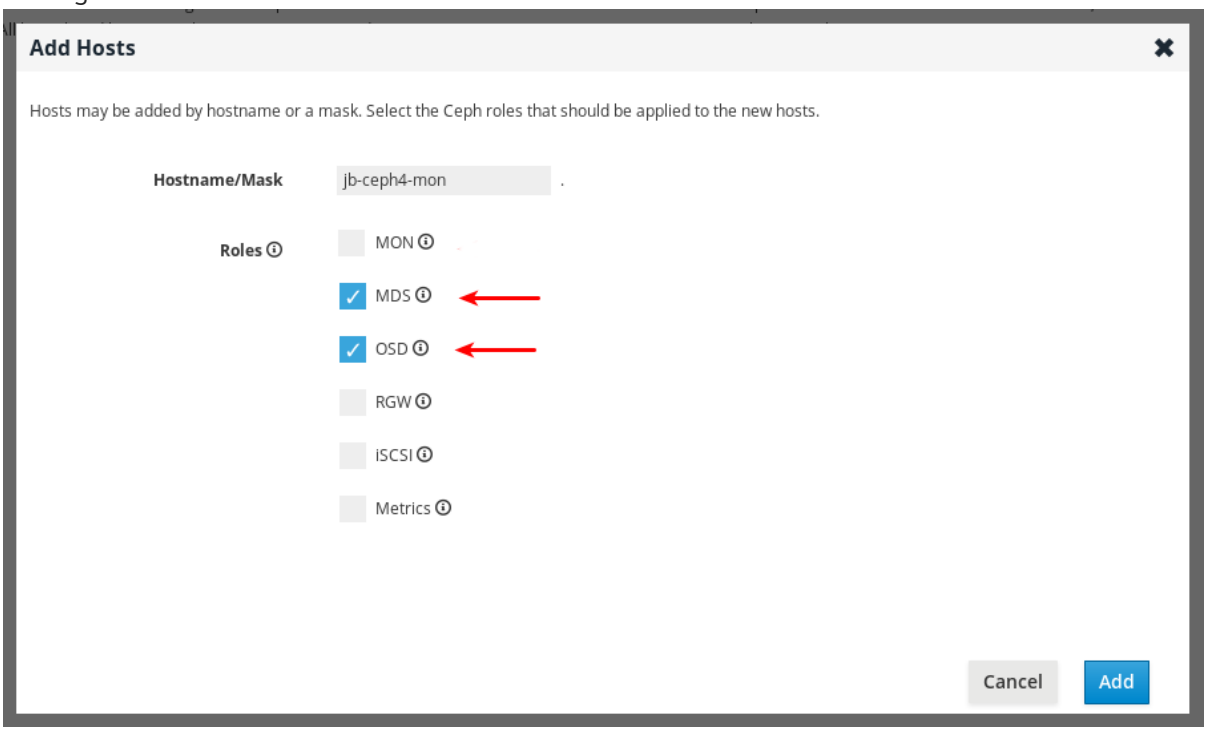
   b. Add a node with the **Metrics** role. The **Metrics** role installs Grafana and Prometheus to provide real-time insights into the performance of the Ceph cluster. These metrics are presented in the Ceph Dashboard, which allows you to monitor and manage the cluster. The installation of the dashboard, Grafana, and Prometheus are required. You can colocate the metrics functions on the Ansible Administration node. If you do, ensure the system resources of the node are greater than what is required for a stand alone metrics node .

   c. Optional: Add a node with the **MDS** role. The **MDS** role installs the Ceph Metadata Server (MDS). Metadata Server daemons are necessary for deploying a Ceph File System.

   d. Optional: Add a node with the **RGW** role. The **RGW** role installs the Ceph Object Gateway, also know as the RADOS gateway, which is an object storage interface built on top of the librados API to provide applications with a RESTful gateway to Ceph storage clusters. It supports the Amazon S3 and OpenStack Swift APIs.

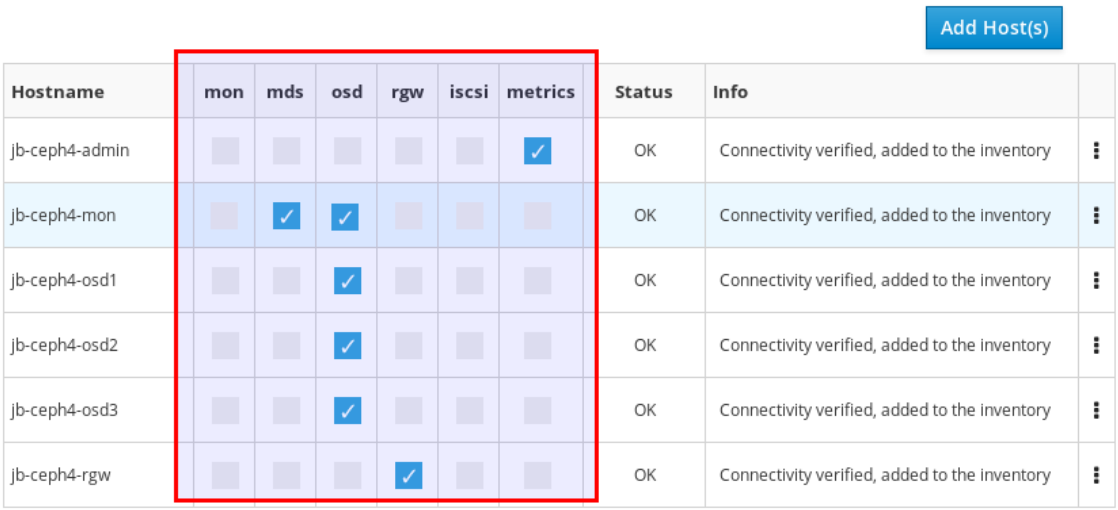
e. Optional: Add a node with the **iSCSI** role. The **iSCSI** role installs an iSCSI gateway so you can share Ceph Block Devices over iSCSI. To use iSCSI with Ceph, you must install the iSCSI gateway on at least two nodes for multipath I/O.

5. Optional: Colocate more than one service on the same node by selecting multiple roles when adding the node.

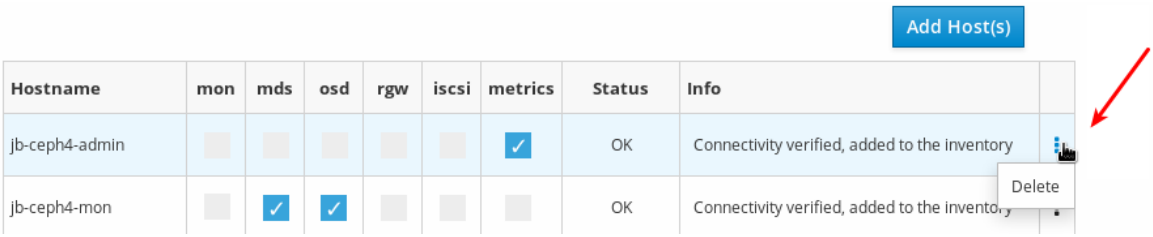


For more information on colocating daemons, see Colocation of containerized Ceph daemons in the Installation Guide.

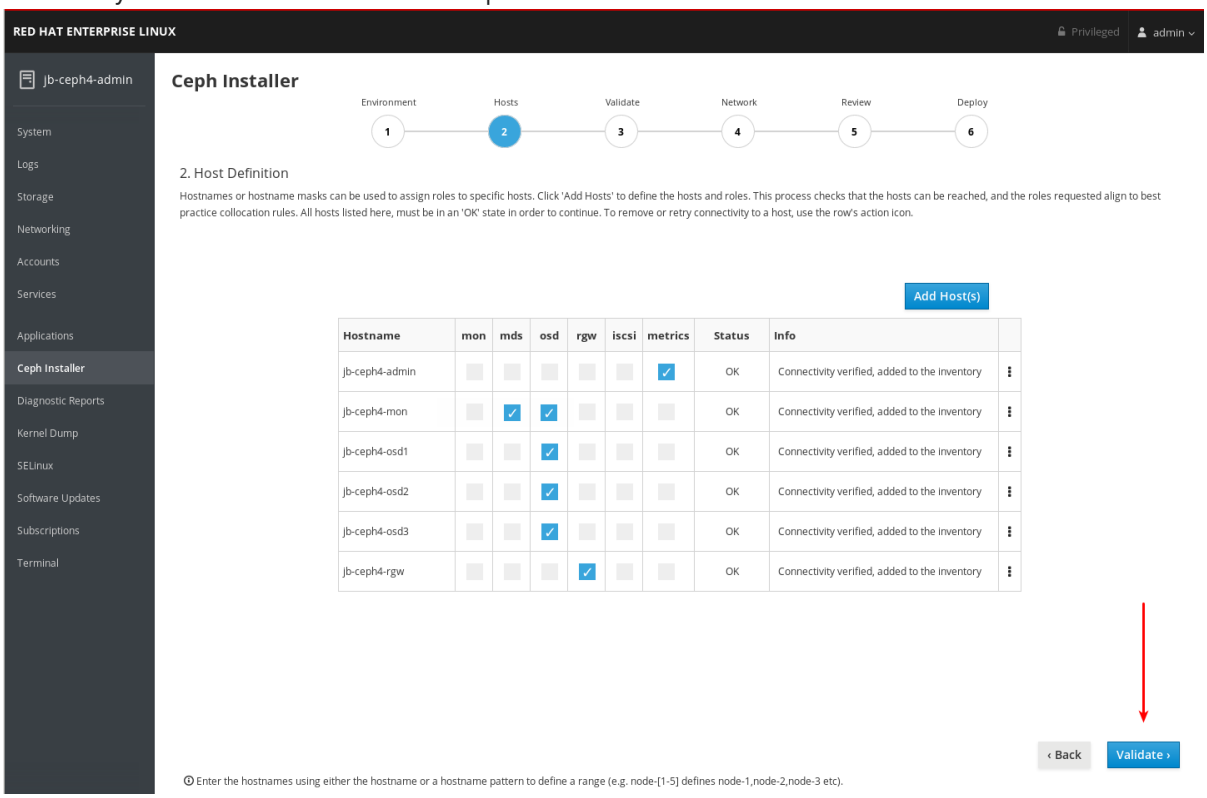
6. Optional: Modify the roles assigned to a node by checking or unchecking roles in the table.



7. Optional: To delete a node, on the far right side of the row of the node you want to delete, click the kebab icon and then click *Delete*.



8. Click the *Validate* button at the bottom right corner of the page after you have added all the nodes in your cluster and set all the required roles.



NOTE

For production clusters, the Cockpit Ceph installer will not proceed unless you have three or five monitors. In these examples *Cluster Type* is set to *Development/POC* so the install can proceed with only one monitor.

3.8. COMPLETE THE VALIDATE PAGE OF THE COCKPIT CEPH INSTALLER

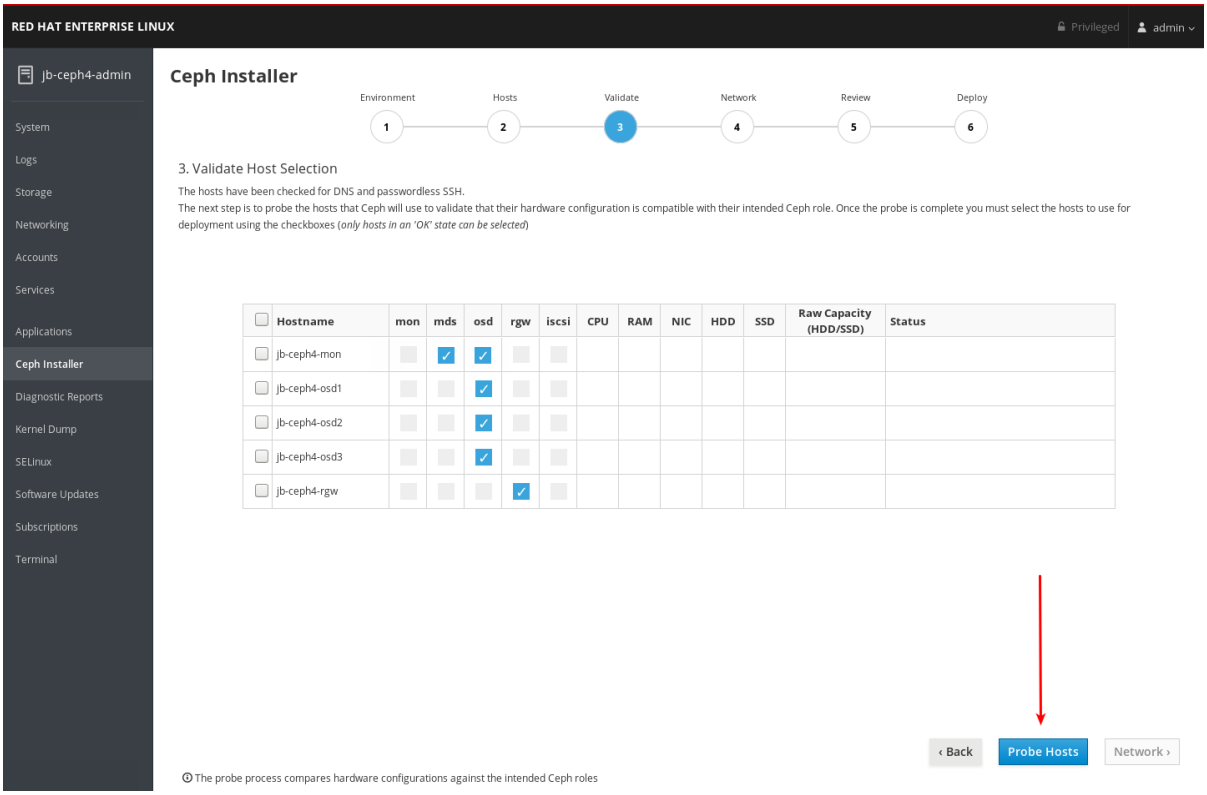
The *Validate* page allows you to probe the nodes you provided on the *Hosts* page to verify they meet the hardware requirements for the roles you intend to use them for.

Prerequisites

- The Hosts page of the Cockpit Ceph Installer has been completed.

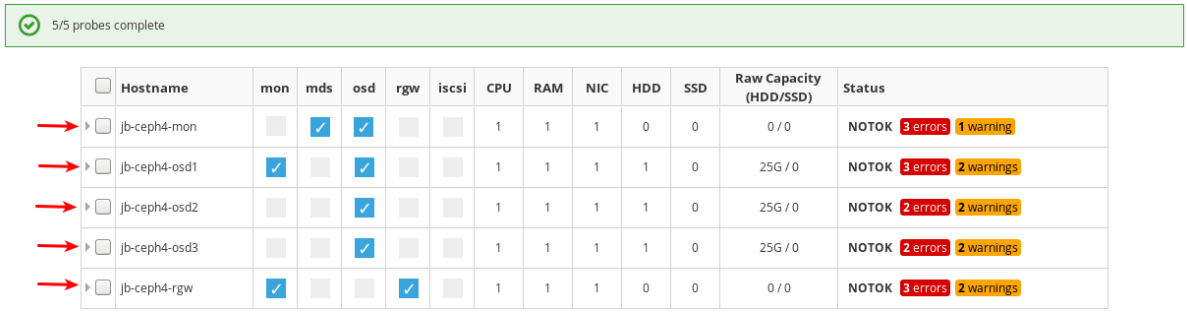
Procedure

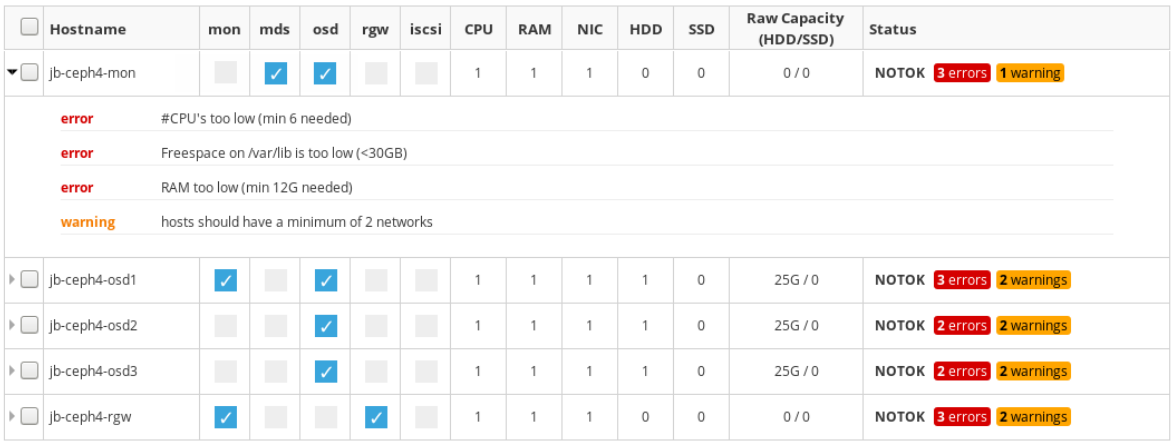
1. Click the *Probe Hosts* button.

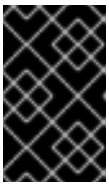


To continue you must select at least three hosts which have an *OK Status*.

2. Optional: If warnings or errors were generated for hosts, click the arrow to the left of the check mark for the host to view the issues.







IMPORTANT

If you set *Cluster Type* to *Production*, any errors generated will cause *Status* to be *NOTOK* and you will not be able to select them for installation. Read the next step for information on how to resolve errors.

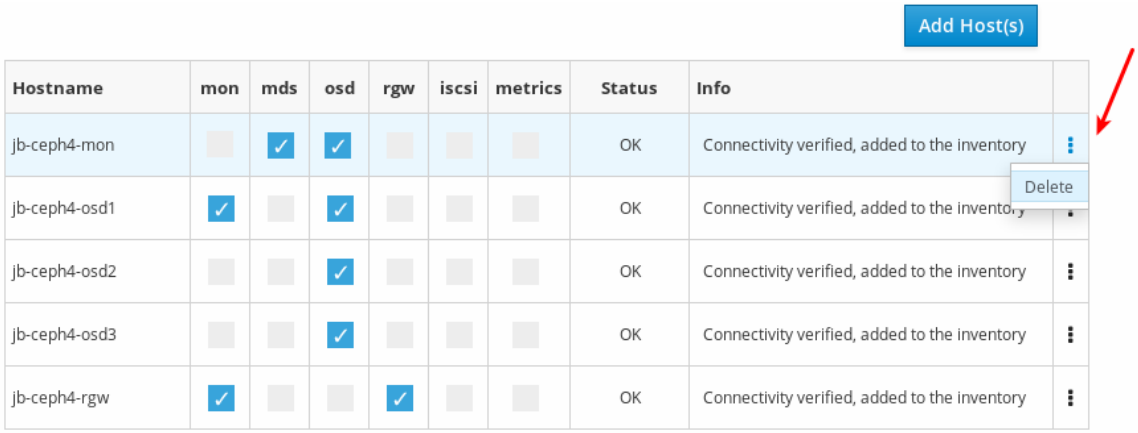
IMPORTANT

If you set *Cluster Type* to *Development/POC*, any errors generated will be listed as warnings so *Status* is always *OK*. This allows you to select the hosts and install Ceph on them regardless of whether the hosts meet the requirements or suggestions. You can still resolve warnings if you want to. Read the next step for information on how to resolve warnings.

3. Optional: To resolve errors and warnings use one or more of the following methods.

   a. The easiest way to resolve errors or warnings is to disable certain roles completely or to disable a role on one host and enable it on another host which has the required resources. Experiment with enabling or disabling roles until you find a combination where, if you are installing a *Development/POC* cluster, you are comfortable proceeding with any remaining warnings, or if you are installing a *Production* cluster, at least three hosts have all the resources required for the roles assigned to them and you are comfortable proceeding with any remaining warnings.

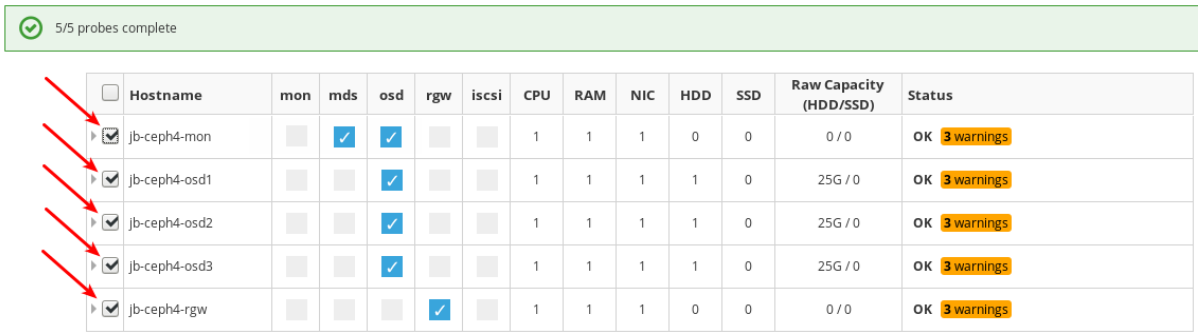
   b. You can also use a new host which meets the requirements for the roles required. First go back to the *Hosts* page and delete the hosts with issues.



   Then, add the new hosts .

   c. If you want to upgrade the hardware on a host or modify it in some other way so it will meet the requirements or suggestions, first make the desired changes to the host, and then click *Probe Hosts* again. If you have to reinstall the operating system you will have to copy the SSH key again.

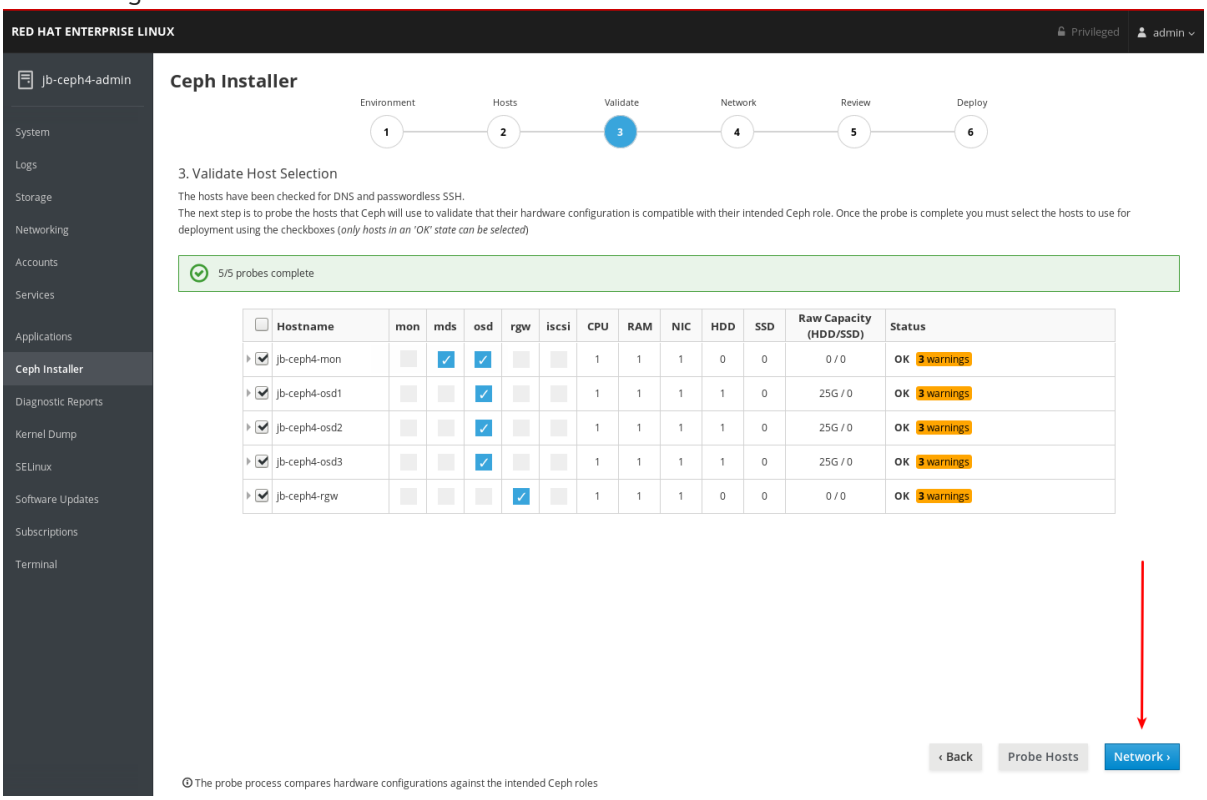
4. Select the hosts to install Red Hat Ceph Storage on by checking the box next to the host.



IMPORTANT

If installing a production cluster, you must resolve any errors before you can select them for installation.

5. Click the *Network* button at the bottom right corner of the page to review and configure networking for the cluster.



3.9. COMPLETE THE NETWORK PAGE OF THE COCKPIT CEPH INSTALLER

The *Network* page allows you to isolate certain cluster communication types to specific networks. This requires multiple different networks configured across the hosts in the cluster.

IMPORTANT

The *Network* page uses information gathered from the probes done on the *Validate* page to display the networks your hosts have access to. Currently, if you have already proceeded to the *Network* page, you cannot add new networks to hosts, go back to the *Validate* page, reprobe the hosts, and proceed to the *Network* page again and use the new networks. They will not be displayed for selection. To use networks added to the hosts after already going to the *Network* page you must refresh the web page completely and restart the install from the beginning.

IMPORTANT

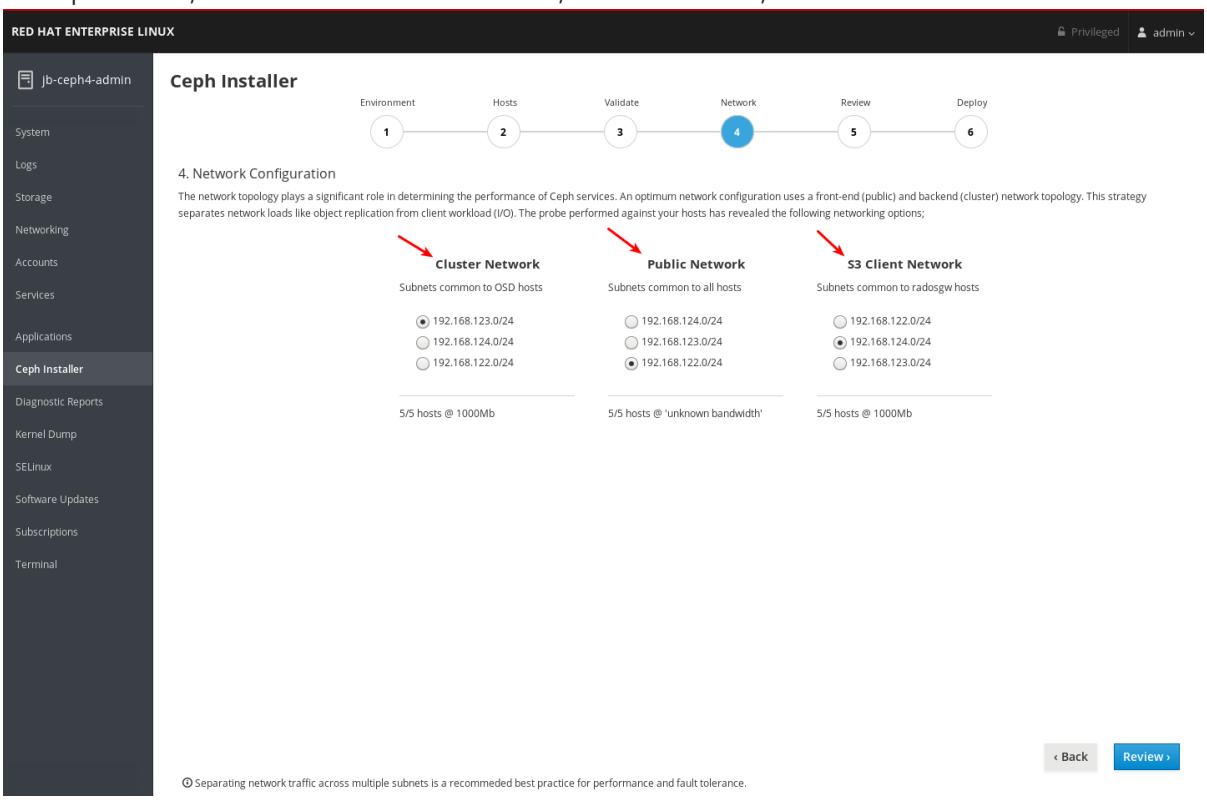
For production clusters you must segregate intra-cluster-traffic from client-to-cluster traffic on separate NICs. In addition to segregating cluster traffic types, there are other networking considerations to take into account when setting up a Ceph cluster. For more information, see Network considerations in the Hardware Guide.

Prerequisites

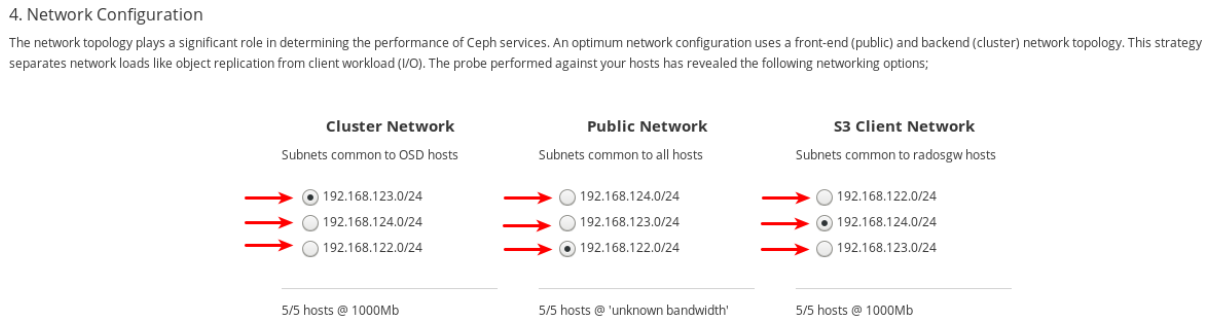
- The Validate page of the Cockpit Ceph Installer has been completed.

Procedure

1. Take note of the network types you can configure on the Network page. Each type has its own column. Columns for *Cluster Network* and *Public Network* are always displayed. If you are installing hosts with the RADOS Gateway role, the *S3 Network* column will be displayed. If you are installing hosts with the iSCSI role, the *iSCSI Network* column will be displayed. In the example below, columns for *Cluster Network*, *Public Network*, and *S3 Network* are shown.

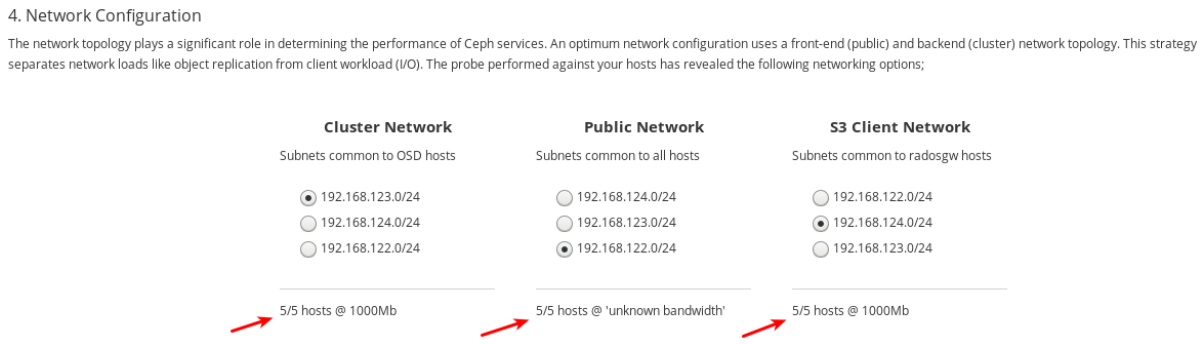


2. Take note of the networks you can select for each network type. Only the networks which are available on all hosts that make up a particular network type are shown. In the example below, there are three networks which are available on all hosts in the cluster. Because all three networks are available on every set of hosts which make up a network type, each network type lists the same three networks.

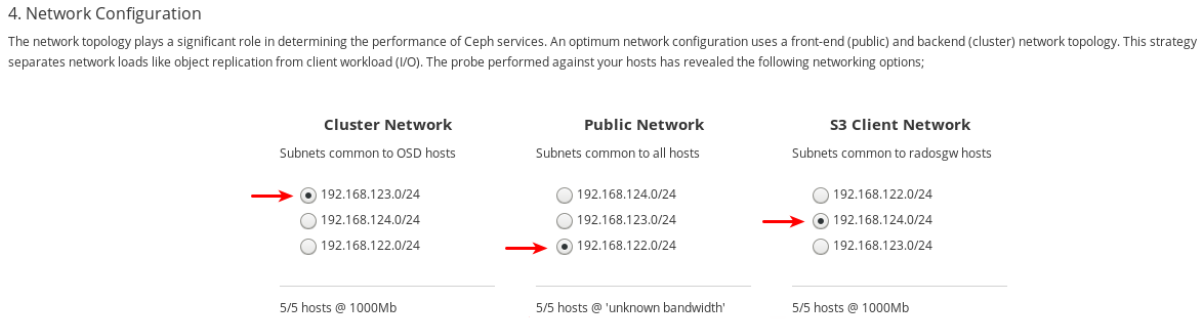


The three networks available are **192.168.122.0/24**, **192.168.123.0/24**, and **192.168.124.0/24**.

3. Take note of the speed each network operates at. This is the speed of the NICs used for the particular network. In the example below, **192.168.123.0/24**, and **192.168.124.0/24** are at 1,000 mbps. The Cockpit Ceph Installer could not determine the speed for the **192.168.122.0/24** network.

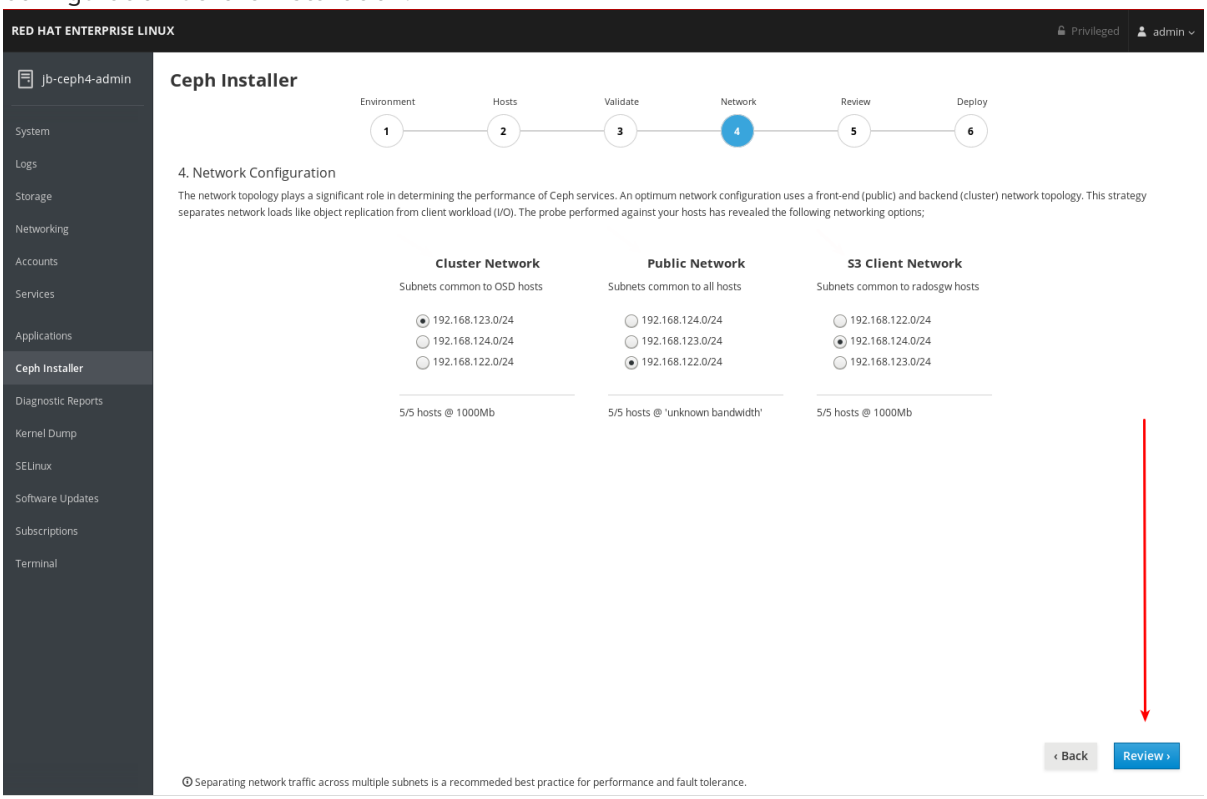


4. Select the networks you want to use for each network type. For production clusters, you must select separate networks for *Cluster Network* and *Public Network*. For development/POC clusters, you can select the same network for both types, or if you only have one network configured on all hosts, only that network will be displayed and you will not be able to select other networks.



The **192.168.122.0/24** network will be used for the *Public Network*, the **192.168.123.0/24** network will be used for the *Cluster Network*, and the **192.168.124.0/24** network will be used for the *S3 Network*.

5. Click the *Review* button at the bottom right corner of the page to review the entire cluster configuration before installation.



3.10. REVIEW THE INSTALLATION CONFIGURATION

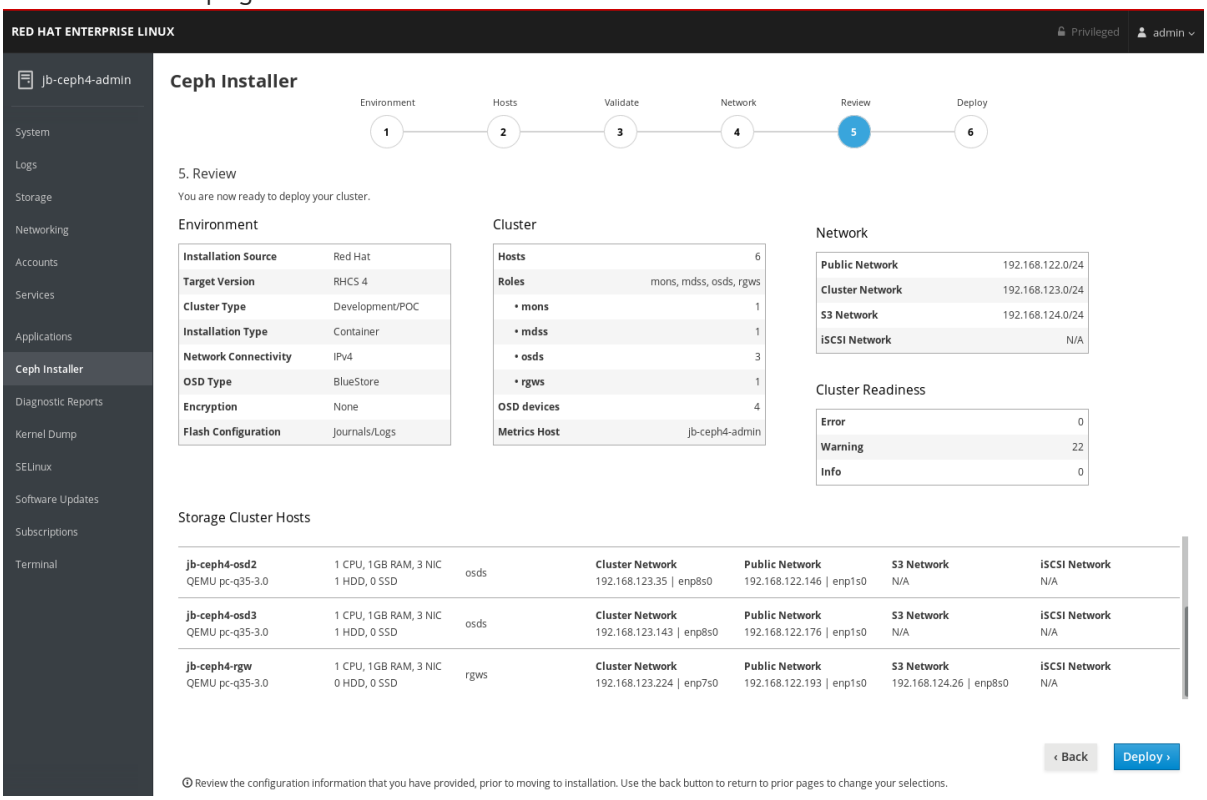
The *Review* page allows you to view all the details of the Ceph cluster installation configuration that you set on the previous pages, and details about the hosts, some of which were not included in previous pages.

Prerequisites

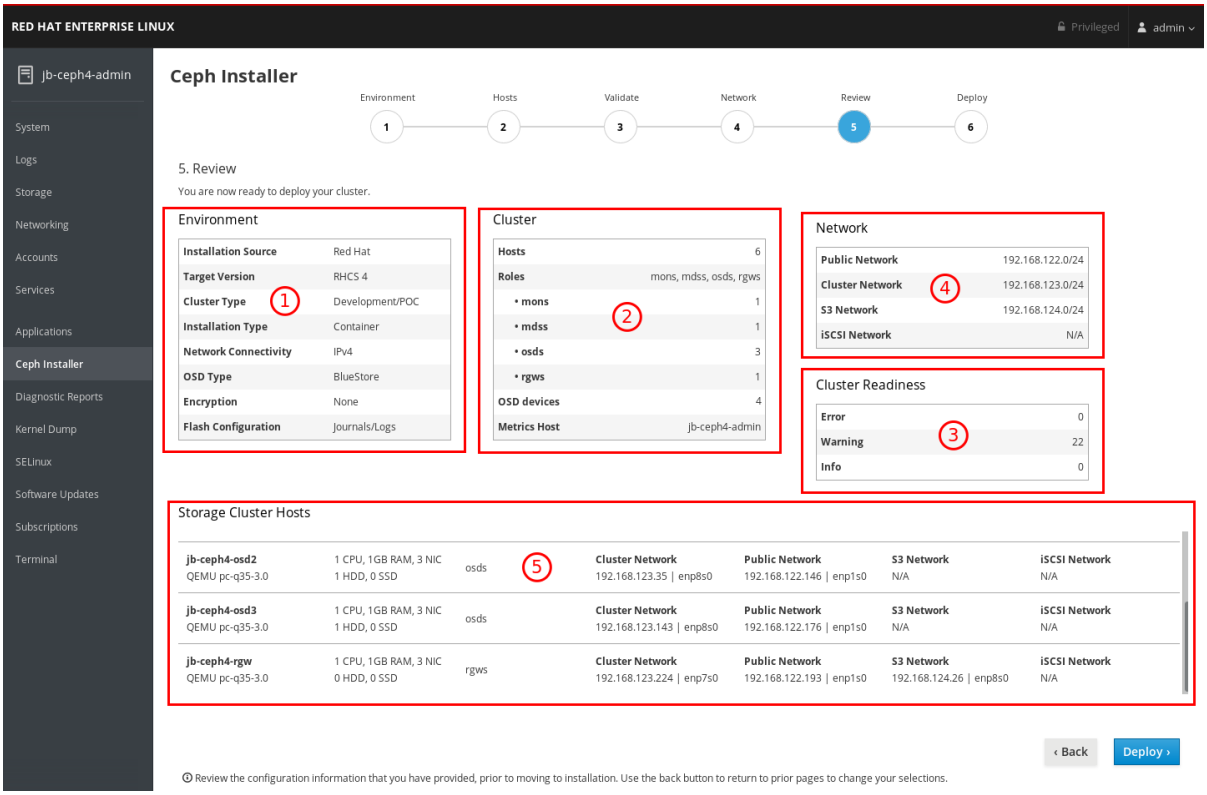
- The Network page of the Cockpit Ceph Installer has been completed.

Procedure

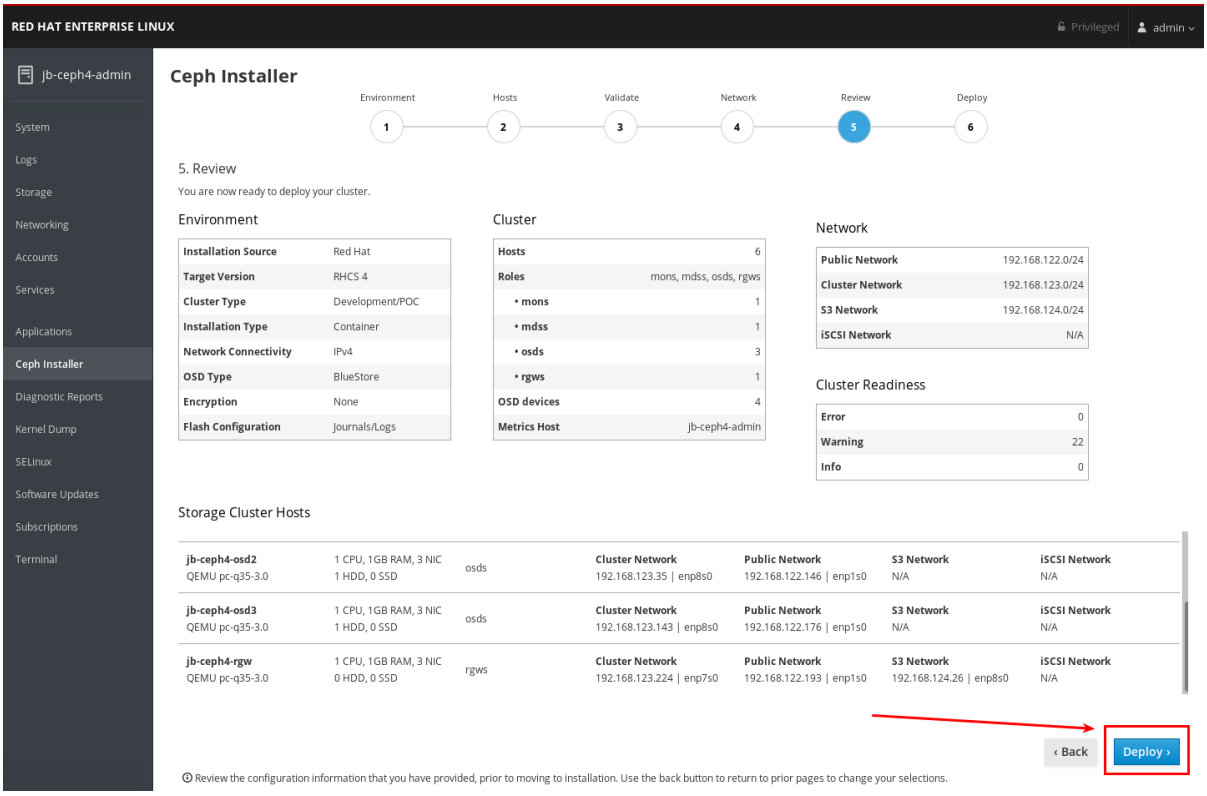
1. View the review page.



2. Verify the information from each previous page is as you expect it as shown on the *Review* page. A summary of information from the *Environment* page is at **1**, followed by the *Hosts* page at **2**, the *Validate* page at **3**, the *Network* page at **4**, and details about the hosts, including some additional details which were not included in previous pages, are at **5**.



3. Click the *Deploy* button at the bottom right corner of the page to go to the *Deploy* page where you can finalize and start the actual installation process.



3.11. DEPLOY THE CEPH CLUSTER

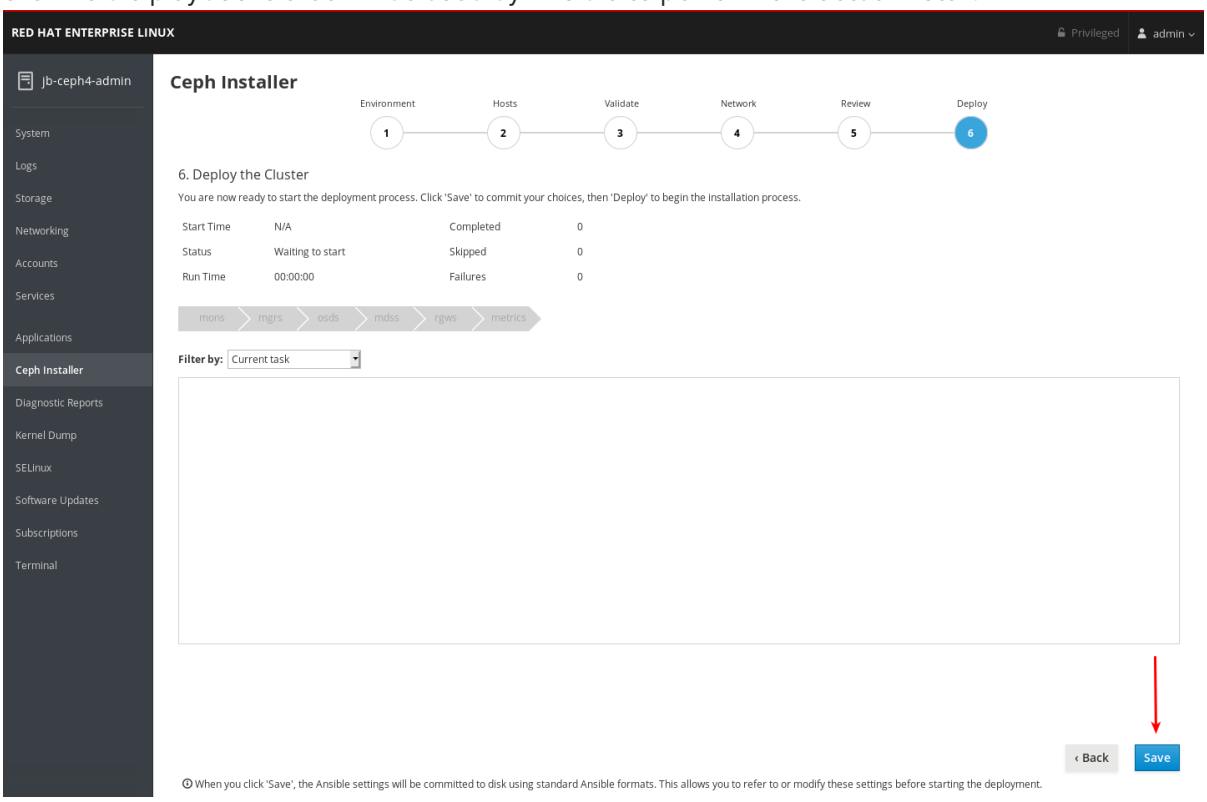
The *Deploy* page allows you save the installation settings in their native Ansible format, review or modify them if required, start the install, monitor its progress, and view the status of the cluster after the install finishes successfully.

Prerequisites

- Installation configuration settings on the Review page have been verified.

Procedure

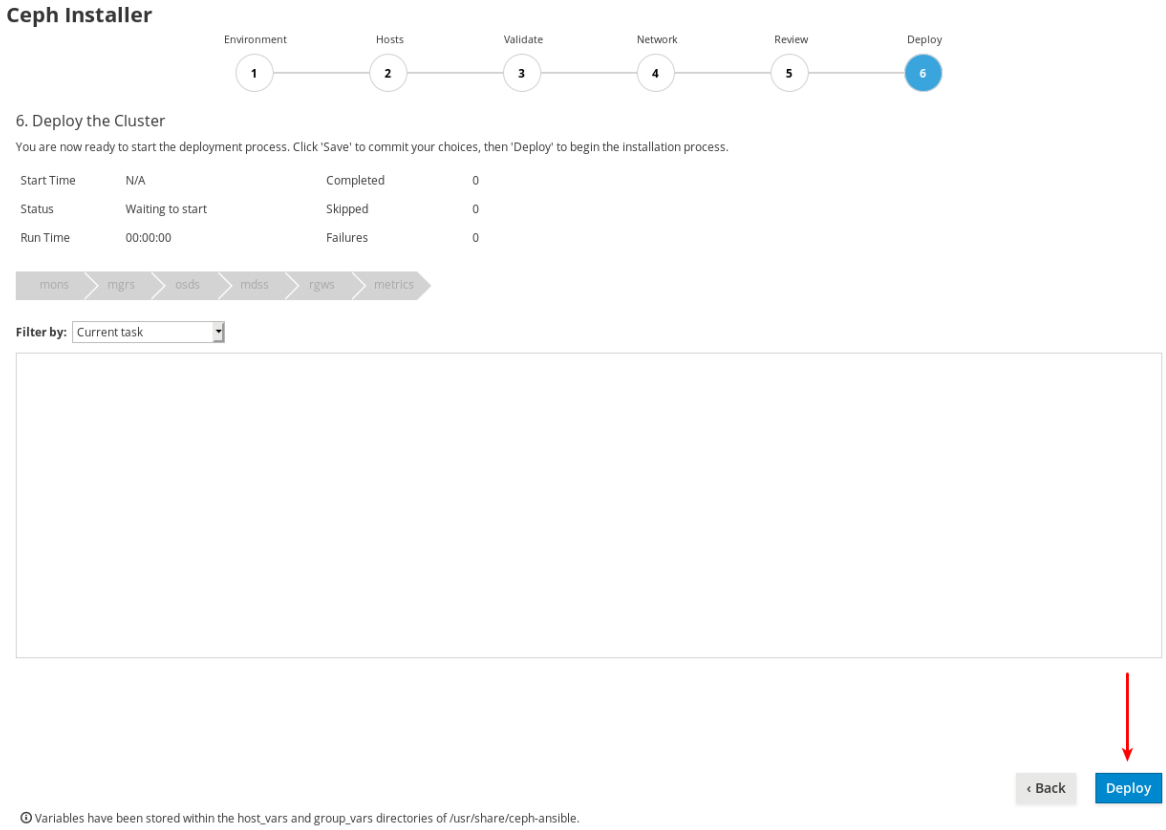
1. Click the *Save* button at the bottom right corner of the page to save the installation settings to the Ansible playbooks that will be used by Ansible to perform the actual install.



2. Optional: View or further customize the settings in the Ansible playbooks located on the Ansible administration node. The playbooks are located in **/usr/share/ceph-ansible**. For more information about the Ansible playbooks and how to use them to customize the install, see Installing a Red Hat Ceph Storage cluster .

3. Change the default dashboard password. By default the dashboard password is **p@ssw0rd**, which is insecure. Change the password using the **/usr/share/ceph-ansible/group_vars/all.yml** Ansible playbook. Add a line like **dashboard_admin_password: *MY_NEW_PASSWORD*** where *MY_NEW_PASSWORD* is a secure password. For more information see Changing the dashboard password using the dashboard, or Changing the dashboard password using Ansible in the Dashboard Guide.

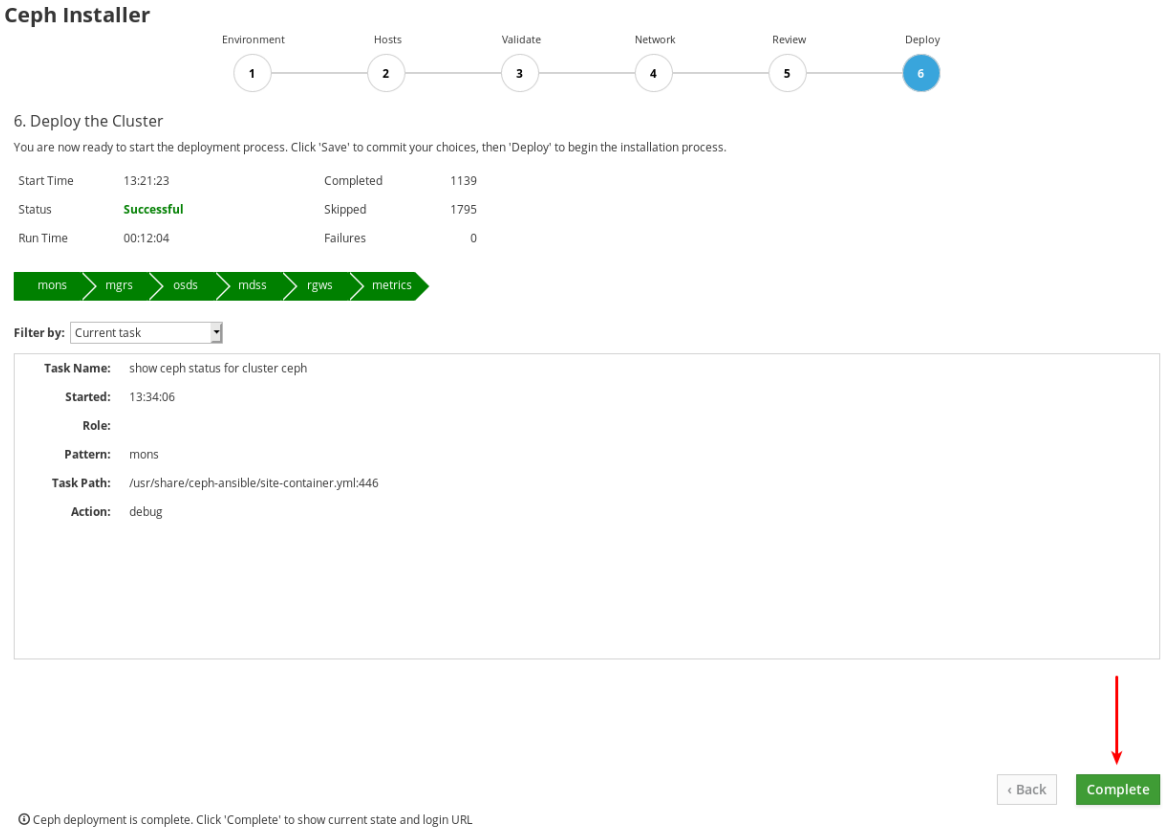
4. Click the *Deploy* button at the bottom right corner of the page to start the install.



5. Observe the installation progress while it is running.
   The information at **1** shows whether the install is running or not, the start time, and elapsed time. The information at **2** shows a summary of the Ansible tasks that have been attempted. The information at **3** shows which roles have been installed or are installing. Green represents a role where all hosts that were assigned that role have had that role installed on them. Blue represents a role where hosts that have that role assigned to them are still being installed. At **4** you can view details about the current task or view failed tasks. Use the *Filter by* menu to switch between current task and failed tasks.

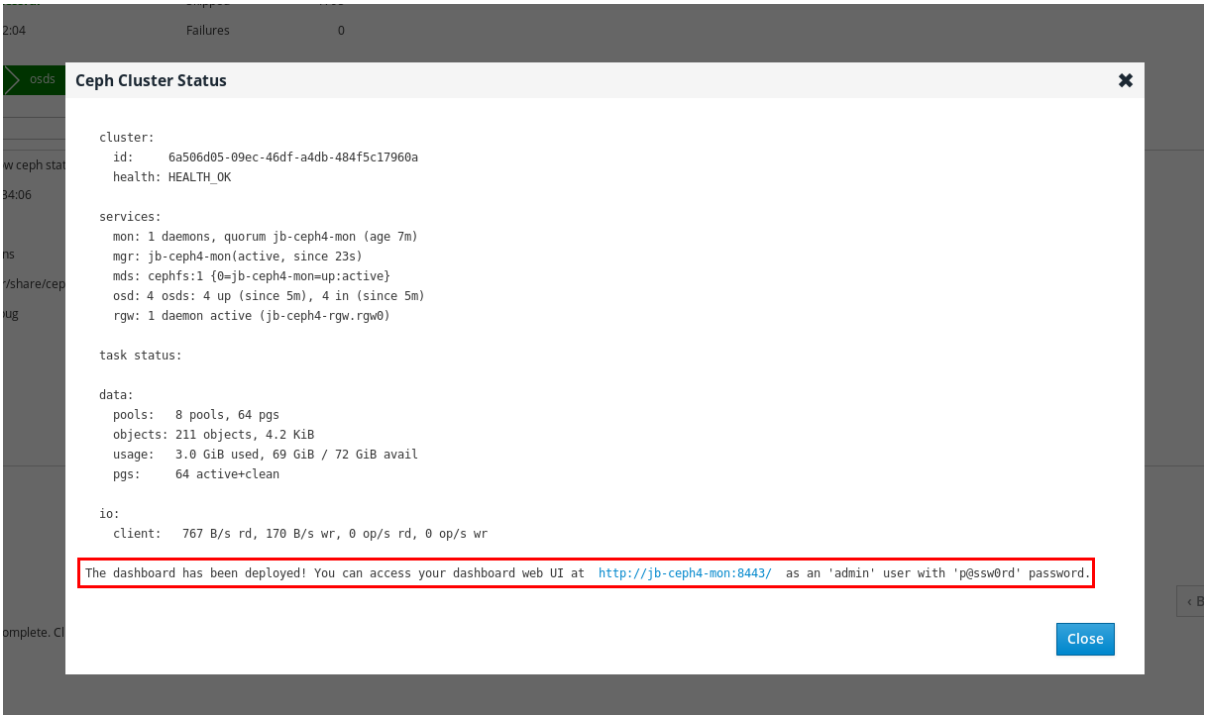
The role names come from the Ansible inventory file. The equivalency is: **mons** are Monitors, **mgrs** are Managers, note the Manager role is installed alongside the Monitor role, **osds** are Object Storage Devices, **mdss** are Metadata Servers, **rgws** are RADOS Gateways, **metrics** are Grafana and Prometheus services for dashboard metrics. Not shown in the example screenshot: **iscsigws** are iSCSI Gateways.

6. After the installation finishes, click the *Complete* button at the bottom right corner of the page. This opens a window which displays the output of the command **ceph status**, as well as dashboard access information.

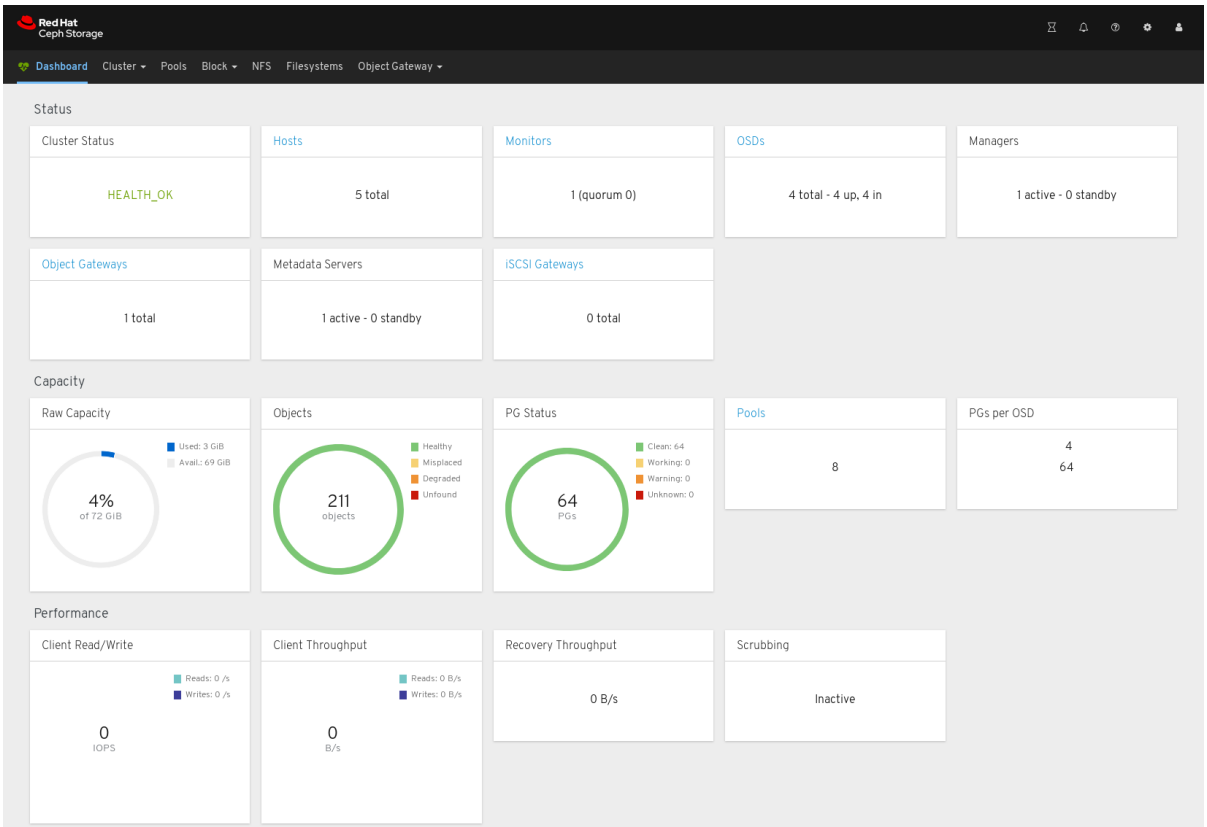


7. Compare cluster status information in the example below with the cluster status information on your cluster. The example shows a healthy cluster, with all OSDs up and in, and all services active. PGs are in the **active+clean** state. If some aspects of your cluster are not the same, refer to the Troubleshoting Guide for information on how to resolve the issues.

8. At the bottom of the Ceph Cluster Status window, the dashboard access information is displayed, including the URL, user name, and password. Take note of this information.



9. Use the information from the previous step along with the Dashboard Guide to access the dashboard.



The dashboard provides a web interface so you can administer and monitor the Red Hat Ceph Storage cluster. For more information, see the Dashboard Guide.

10. Optional: View the **cockpit-ceph-installer.log** file. This file records a log of the selections made and any associated warnings the probe process generated. It is located in the home directory of the user that ran the installer script, **ansible-runner-service.sh**.

CHAPTER 4. DEPLOYING RED HAT CEPH STORAGE

This chapter describes how to use the Ansible application to deploy a Red Hat Ceph Storage cluster and other components, such as Metadata Servers or the Ceph Object Gateway.

- To install a Red Hat Ceph Storage cluster, see Section 4.2, "Installing a Red Hat Ceph Storage cluster".
- To install Metadata Servers, see Section 4.4, "Installing Metadata servers" .
- To install the **ceph-client** role, see Section 4.5, "Installing the Ceph Client Role" .
- To install the Ceph Object Gateway, see Section 4.6, "Installing the Ceph Object Gateway" .
- To configure a multisite Ceph Object Gateway, see Section 4.6.1, "Configuring a multisite Ceph Object Gateway".
- To learn about the Ansible **--limit** option, see Section 4.8, "Understanding the **limit** option".

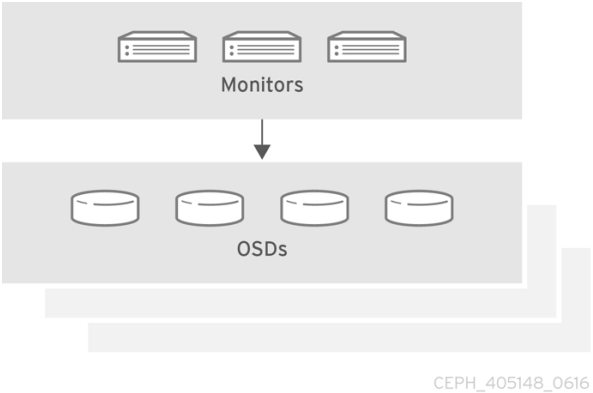
4.1. PREREQUISITES

- Obtain a valid customer subscription.
- Prepare the cluster nodes, by doing the following on each node:
  - Register the node to the Content Delivery Network (CDN) and attach subscriptions .
  - Enable the appropriate software repositories .
  - Create an Ansible user .
  - Enable passwordless SSH access .
  - Optionally, configure a firewall .
- Before installing with ceph-ansible, edit the inventory file and specify a node by its hostname or IP address under the **[grafana-server]** group where the Grafana and Prometheus instance for the Dashboard will be installed.

4.2. INSTALLING A RED HAT CEPH STORAGE CLUSTER

Use the Ansible application with the **ceph-ansible** playbook to install Red Hat Ceph Storage on bare-metal or in containers. Using a Ceph storage clusters in production must have a minimum of three monitor nodes and three OSD nodes containing multiple OSD daemons. A typical Ceph storage cluster running in production usually consists of ten or more nodes.

In the following procedure, run the commands from the Ansible administration node, unless instructed otherwise. This procedure applies to both bare-metal and container deployments, unless specified.



IMPORTANT

Ceph can run with one monitor; however, to ensure high availability in a production cluster, Red Hat will only support deployments with at least three monitor nodes.

IMPORTANT

Deploying Red Hat Ceph Storage 4 in containers on Red Hat Enterprise Linux 7.7 will deploy Red Hat Ceph Storage 4 on a Red Hat Enterprise Linux 8 container image.

Prerequisites

- A valid customer subscription.
- Root-level access to the Ansible administration node.
- The **ansible** user account for use with the Ansible application.
- Enable Red Hat Ceph Storage Tools and Ansible repositories

Procedure

1. Log in as the **root** user account on the Ansible administration node.
2. For all deployments, **bare-metal** or in **containers**:
   a. Install the **ceph-ansible** package:

   ```
   [root@admin ~]# yum install ceph-ansible
   ```

   b. Create a symbolic link to the **/usr/share/ceph-ansible/group_vars** directory in the **/etc/ansible/** directory:

   ```
   [root@admin ~]# ln -s /usr/share/ceph-ansible/group_vars /etc/ansible/group_vars
   ```

   c. Navigate to the **/usr/share/ceph-ansible/** directory:

   ```
   [root@admin ~]$ cd /usr/share/ceph-ansible
   ```

3. Create new **yml.sample** files:

```
[root@admin ceph-ansible]# cp group_vars/all.yml.sample group_vars/all.yml
[root@admin ceph-ansible]# cp group_vars/osds.yml.sample group_vars/osds.yml
```

a. **Bare-metal** deployments:

```
[root@admin ceph-ansible]# cp site.yml.sample site.yml
```

b. **Container** deployments:

```
[root@admin ceph-ansible]# cp site-docker.yml.sample site-docker.yml
```

4. Edit the new files.

a. Open for editing the **group_vars/all.yml** file.

IMPORTANT

Do not set the **cluster: ceph** parameter to any value other than **ceph**, because using custom storage cluster names is not supported.

WARNING

By default, Ansible attempts to restart an installed, but masked **firewalld** service, which can cause the Red Hat Ceph Storage deployment to fail. To work around this issue, set the **configure_firewall** option to **false** in the **all.yml** file. If you are running the **firewalld** service, then there is no requirement to use the **configure_firewall** option in the **all.yml** file.

NOTE

Having the **ceph_rhcs_version** option set to **4** will pull in the latest version of Red Hat Ceph Storage 4.

i. **Bare-metal** example of the **all.yml** file:

```
ceph_origin: repository
ceph_repository: rhcs
ceph_repository_type: cdn
ceph_rhcs_version: 4
monitor_interface: eth0
public_network: 192.168.0.0/24
ceph_docker_registry_username:
ceph_docker_registry_password:
```

IMPORTANT

On Red Hat Enterprise Linux 7, the Ansible playbooks currently do not enable the Ceph repositories automatically. In enabling the Red Hat Ceph Storage repositories, for Red Hat Enterprise Linux 7, you were instructed to manually enable the Ceph repositories. Additionally, you need to configure the Ansible playbooks to use the distro configured repositories intstead of the CDN repositories. Use the **ceph_origin** configuration option below to use the correct repositories.

- Red Hat Enterprise Linux 7 **ONLY**

```
ceph_origin: distro
```

ii. **Containers** example of the **all.yml** file:

```
monitor_interface: eth0
journal_size: 5120
public_network: 192.168.0.0/24
ceph_docker_image: rhceph/rhceph-4-rhel8
containerized_deployment: true
ceph_docker_registry: registry.redhat.io
ceph_docker_registry_username:
ceph_docker_registry_password:
ceph_origin: repository
ceph_repository: rhcs
ceph_repository_type: cdn
ceph_rhcs_version: 4
```

NOTE

journal_size is required for filestore only

IMPORTANT

By default the dashboard password is **p@ssw0rd**, which is insecure. Change the password using the **/usr/share/ceph-ansible/group_vars/all.yml** Ansible playbook. Add a line like **dashboard_admin_password: *MY_NEW_PASSWORD*** where *MY_NEW_PASSWORD* is a secure password. For more information see Changing the dashboard password using the dashboard, or Changing the dashboard password using Ansible in the Dashboard Guide.

b. For all deployments, **bare-metal** or in **containers**, open for editing the **group_vars/osds.yml** file.

IMPORTANT

Do not install an OSD on the device the operating system is installed on. Sharing the same device between the operating system and OSDs causes performance issues.

Ceph-ansible uses the **ceph-volume** tool to prepare storage devices for Ceph usage. You can configure **osds.yml** to use your storage devices in different ways to optimize performance for your particular workload.

IMPORTANT

All the examples below use the BlueStore object store, which is the format Ceph uses to store data on devices. Previously, Ceph used FileStore as the object store. This format is deprecated for new Red Hat Ceph Storage 4.0 installs because BlueStore offers more features and improved performance. It is still possible to use FileStore, but using it requires a support exception. For more information on BlueStore, see Ceph BlueStore in the Architecture Guide.

i. **Auto discovery**

```
osd_auto_discovery: true
```

The above example uses all empty storage devices on the system to create the OSDs, so you do not have to specify them explicitly. The **ceph-volume** tool checks for empty devices, so devices which are not empty will not be used.

ii. **Simple configuration**

```
devices:
  - /dev/sda
  - /dev/sdb
```

or

```
devices:
  - /dev/sda
  - /dev/sdb
  - /dev/nvme0n1
```

In the first example, if the **devices** are traditional hard drives or SSDs, then a complete OSD is configured on each device, which includes the data, database, and write-ahead log, also known as WAL or **block.wal**.

In the second scenario, when there is a mix of traditional hard drives and SSDs, the data is placed on the traditional hard drives, **sda** and **sdb**, and the database is created as large as possible on the **nvme0n1** SSD.

When using the **devices** option alone, **ceph-volume lvm batch** mode automatically optimizes OSD configuration.

iii. **Advanced configuration**

```
devices:
  - /dev/sda
  - /dev/sdb
dedicated_devices:
  - /dev/sdx
  - /dev/sdy
```

or

```
devices:
  - /dev/sda
  - /dev/sdb
dedicated_devices:
  - /dev/sdx
  - /dev/sdy
bluestore_wal_devices:
  - /dev/nvme0n1
  - /dev/nvme0n2
```

In the first example, there are two OSDs. The **sda** and **sdb** devices each have their own data segments and write-ahead logs. The additional dictionary **dedicated_devices** is used to isolate their databases, also known as **block.db**, on **sdx** and **sdy**, respectively.

In the second example, another additional dictionary, **bluestore_wal_devices**, is used to isolate the write-ahead log on NVMe devices **nvme0n1** and **nvme0n2**. Using **devices**, **dedicated_devices**, and **bluestore_wal_devices,** together, allows you to isolate all components of an OSD onto separate devices, which can increase performance.

iv. Pre-created logical volumes

```
lvm_volumes:
  - data: data-lv1
    data_vg: data-vg1
    db: db-lv1
    db_vg: db-vg1
    wal: wal-lv1
    wal_vg: wal-vg1
  - data: data-lv2
    data_vg: data-vg2
    db: db-lv2
    db_vg: db-vg2
    wal: wal-lv2
    wal_vg: wal-vg2
```

By default, Ceph uses Logical Volume Manager to create logical volumes on the OSD devices. In the *Simple configuration* and *Advanced configuration* examples above, Ceph creates logical volumes on the devices automatically. You can use previously created logical volumes with Ceph by specifying the **lvm_volumes** dictionary.

The above example specifies dedicated logical volumes for the data, database, and WAL. You can also specify just data, data and WAL, or data and database.

The **data:** line must specify the logical volume name where data is to be stored, and **data-vg:** must specify the name of the volume group the data logical volume is contained in. Similarly, **db:** is used to specify the logical volume the database is stored on and **db_vg:** is used to specify the volume group its logical volume is in. The **wal:** line specifies the logical volume the WAL is stored on and the **wal_vg:** line specifies the volume group that contains it.

IMPORTANT

With **lvm_volumes:**, the volume groups and logical volumes must be created beforehand. They will not be created by **ceph-ansible**.

NOTE

If using all NVMe SSDs, then set **osds_per_device: 4**. For more information, see *Configuring OSD Ansible settings for all NVMe Storage* the Red Hat Ceph Storage 4 *Installation Guide*.

5. For all deployments, **bare-metal** or in **containers**, open for editing the Ansible inventory file, by default the **/etc/ansible/hosts** file. Comment out the example hosts.

   a. Add a node under **[grafana-server]**. This role installs Grafana and Prometheus to provide real-time insights into the performance of the Ceph cluster. These metrics are presented in the Ceph Dashboard, which allows you to monitor and manage the cluster. The installation of the dashboard, Grafana, and Prometheus are required. You can colocate the metrics functions on the Ansible Administration node. If you do, ensure the system resources of the node are greater than than what is required for a stand alone metrics node .

   ```
   [grafana-server]
   GRAFANA-SERVER_NODE_NAME
   ```

   b. Add the monitor nodes under the **[mons]** section:

   ```
   [mons]
   MONITOR_NODE_NAME_1
   MONITOR_NODE_NAME_2
   MONITOR_NODE_NAME_3
   ```

   c. Add OSD nodes under the **[osds]** section:

   ```
   [osds]
   OSD_NODE_NAME_1
   OSD_NODE_NAME_2
   OSD_NODE_NAME_3
   ```

   NOTE

   You can add a range specifier (**[1:10]**) to the end of the node name, if the node names are numerically sequential. For example:

   ```
   [osds]
   example-node[1:10]
   ```

   NOTE

   For OSDs in a new installation, the default object store format is BlueStore.

   i. **Bare-metal** deployments:

Optionally, you can use the **devices** parameter to specify devices that the OSD nodes will use. Use a comma-separated list to list multiple devices:

> **NOTE**
>
> When specifying no devices, set the **osd_auto_discovery** parameter to **true** in the **osds.yml** file.

```
[osds]
CEPH_NODE_NAME devices="[ 'DEVICE', 'DEVICE' ]"
```

Example

```
[osds]
ceph-osd-01 devices="[ '/dev/sdb', '/dev/sdc' ]"
ceph-osd-02 devices="[ '/dev/sdb', '/dev/sdc', '/dev/sdd' ]"
```

> **NOTE**
>
> Using the **devices** parameter is useful when OSDs use devices with different names or when one of the devices failed on one of the OSDs.

ii. **Container** deployments:
You can colocate the Ceph Monitor daemons with the Ceph OSD daemons on one node by adding the same node under the **[mons]** and **[osds]** sections. See the link on colocating Ceph daemons in the *Additional Resources* section below for more information.

d. Optionally, if you want Ansible to create a custom CRUSH hierarchy, specify where you want the OSD hosts to be in the CRUSH map's hierarchy by using the **osd_crush_location** parameter. You must specify at least two CRUSH bucket types to specify the location of the OSD, and one bucket **type** must be **host**. By default, these include **root**, **datacenter**, **room**, **row**, **pod**, **pdu**, **rack**, **chassis** and **host**.

```
[osds]
CEPH_NODE_NAME osd_crush_location="{ 'root': 'ROOT_BUCKET', 'rack':
'RACK_BUCKET', 'pod': 'POD_BUCKET', 'host': 'CEPH_NODE_NAME' }"
```

Example

```
[osds]
ceph-osd-01 osd_crush_location="{ 'root': 'mon-root', 'rack': 'mon-rack', 'pod': 'monpod',
'host': 'ceph-osd-01' }"
```

e. Add the Ceph Manager (**ceph-mgr**) nodes under the **[mgrs]** section. This is colocating the Ceph Manager daemon with Ceph Monitor daemon.

```
[mgrs]
MONITOR_NODE_NAME_1
MONITOR_NODE_NAME_2
MONITOR_NODE_NAME_3
```

6. For all deployments, **bare-metal** or in **containers**, log in in with or switch to the **ansible** user.

   a. Create the **ceph-ansible-keys** directory where Ansible stores temporary values generated by the **ceph-ansible** playbook:

   ```
   [ansible@admin ~]$ mkdir ~/ceph-ansible-keys
   ```

   b. Verify that Ansible can reach the Ceph nodes:

   ```
   [ansible@admin ~]$ ansible all -m ping
   ```

   c. Change to the **/usr/share/ceph-ansible/** directory:

   ```
   [ansible@admin ~]$ cd /usr/share/ceph-ansible/
   ```

7. Run the **ceph-ansible** playbook.

   a. **Bare-metal** deployments:

   ```
   [ansible@admin ceph-ansible]$ ansible-playbook site.yml
   ```

   b. **Container** deployments:

   ```
   [ansible@admin ceph-ansible]$ ansible-playbook site-docker.yml
   ```

   NOTE

   If you deploy Red Hat Ceph Storage to Red Hat Enterprise Linux Atomic Host hosts, use the **--skip-tags=with_pkg** option:

   ```
   [user@admin ceph-ansible]$ ansible-playbook site-docker.yml --skip-tags=with_pkg
   ```

   NOTE

   To increase the deployment speed, use the **--forks** option to **ansible-playbook**. By default, **ceph-ansible** sets forks to **20**. With this setting, up to twenty nodes will be installed at the same time. To install up to thirty nodes at a time, run **ansible-playbook --forks 30 *PLAYBOOK FILE***. The resources on the admin node must be monitored to ensure they are not overused. If they are, lower the number passed to **--forks**.

8. Wait for the Ceph deployment to finish.

9. Verify the status of the Ceph storeage cluster.

   a. **Bare-metal** deployments:

   ```
   [root@monitor ~]# ceph health
   HEALTH_OK
   ```

   b. **Container** deployments:

Red Hat Enterprise Linux 7

```
[root@ocp ~]# docker exec ceph-mon-ID ceph health
```

Red Hat Enterprise Linux 8

```
[root@ocp ~]# podman exec ceph-mon-ID ceph health
```

Replace

- ***ID*** with the host name of the Ceph Monitor node:

  Example

  ```
  [root@ocp ~]# podman exec ceph-mon-mon0 ceph health
  HEALTH_OK
  ```

10. For all deployments, **bare-metal** or in **containers**, verify the storage cluster is functioning using **rados**.

    a. From a Ceph Monitor node, create a test pool with eight placement groups (PG):

    Syntax

    ```
    [root@mon ~]# ceph osd pool create POOL_NAME PG_NUMBER
    ```

    Example

    ```
    [root@mon ~]# ceph osd pool create test 8
    ```

    b. Create a file called **hello-world.txt**:

    Syntax

    ```
    [root@monitor ~]# vim FILE_NAME
    ```

    Example

    ```
    [root@monitor ~]# vim hello-world.txt
    ```

    c. Upload **hello-world.txt** to the test pool using the object name **hello-world**:

    Syntax

    ```
    [root@monitor ~]# rados --pool POOL_NAME put OBJECT_NAME
    OBJECT_FILE_NAME
    ```

    Example

    ```
    [root@monitor ~]# rados --pool test put hello-world hello-world.txt
    ```

d. Download **hello-world** from the test pool as file name **fetch.txt**:

Syntax

```
[root@monitor ~]# rados --pool POOL_NAME get OBJECT_NAME
OBJECT_FILE_NAME
```

Example

```
[root@monitor ~]# rados --pool test get hello-world fetch.txt
```

e. Check the contents of **fetch.txt**:

```
[root@monitor ~]# cat fetch.txt
"Hello World!"
```

NOTE

In addition to verifying the storage cluster status, you can use the **ceph-medic** utility to overall diagnose the Ceph Storage cluster. See the *Installing and Using **ceph-medic** to Diagnose a Ceph Storage Cluster* chapter in the Red Hat Ceph Storage 4 *Troubleshooting Guide*.

Additional Resources

- List of the common Ansible settings.
- List of the common OSD settings.
- See *Colocation of containerized Ceph daemons* for details.

4.3. CONFIGURING OSD ANSIBLE SETTINGS FOR ALL NVME STORAGE

To optimize performance when using only non-volatile memory express (NVMe) devices for storage, configure four OSDs on each NVMe device. Normally only one OSD is configured per device, which will underutilize the throughput of an NVMe device.

NOTE

If you mix SSDs and HDDs, then SSDs will be used for the database, or **block.db**, not for data in OSDs.

NOTE

In testing, configuring four OSDs on each NVMe device was found to provide optimal performance. It is recommended to set **osds_per_device: 4**, but it is not required. Other values may provide better performance in your environment.

Prerequisites

- Satisfying all software and hardware requirements for a Ceph storage cluster.

Procedure

1. Set **osds_per_device: 4** in **group_vars/osds.yml**:

```
osds_per_device: 4
```

2. List the NVMe devices under **devices**:

```
devices:
  - /dev/nvme0n1
  - /dev/nvme1n1
  - /dev/nvme2n1
  - /dev/nvme3n1
```

3. The settings in **group_vars/osds.yml** will look similar to this example:

```
osds_per_device: 4
devices:
  - /dev/nvme0n1
  - /dev/nvme1n1
  - /dev/nvme2n1
  - /dev/nvme3n1
```

NOTE

You must use **devices** with this configuration, not **lvm_volumes**. This is because **lvm_volumes** is generally used with pre-created logical volumes and **osds_per_device** implies automatic logical volume creation by Ceph.

Additional Resources

- See the *Installing a Red Hat Ceph Storage Cluster* in the *Red Hat Ceph Storage Installation Guide* for more details.

4.4. INSTALLING METADATA SERVERS

Use the Ansible automation application to install a Ceph Metadata Server (MDS). Metadata Server daemons are necessary for deploying a Ceph File System.

Prerequisites

- A working Red Hat Ceph Storage cluster.

Procedure

Perform the following steps on the Ansible administration node.

1. Add a new section **[mdss]** to the **/etc/ansible/hosts** file:

```
[mdss]
NODE_NAME
NODE_NAME
NODE_NAME
```

Replace *NODE_NAME* with the host names of the nodes where you want to install the Ceph Metadata servers.

Alternatively, you can colocate the Metadata server with the OSD daemon on one node by adding the same node under the **[osds]** and **[mdss]** sections.

2. Navigate to the **/usr/share/ceph-ansible** directory:

```
[root@admin ~]# cd /usr/share/ceph-ansible
```

3. Optionally, you can change the default variables.

   a. Create a copy of the **group_vars/mdss.yml.sample** file named **mdss.yml**:

```
[root@admin ceph-ansible]# cp group_vars/mdss.yml.sample group_vars/mdss.yml
```

   b. Optionally, edit the parameters in **mdss.yml**. See **mdss.yml** for details.

4. As the **ansible** user, run the Ansible playbook:

   - **Bare-metal** deployments:

```
[user@admin ceph-ansible]$ ansible-playbook site.yml --limit mdss
```

   - **Container** deployments:

```
[ansible@admin ceph-ansible]$ ansible-playbook site-docker.yml --limit mdss
```

5. After installing the Metadata servers, you can now configure them. For details, see the *Configuring Metadata Server Daemons* chapter in the Ceph File System Guide.

Additional Resources

- The *Ceph File System Guide* for Red Hat Ceph Storage 4
- See *Colocation of containerized Ceph daemons* for details.
- See *Understanding the **limit** option* for details.

4.5. INSTALLING THE CEPH CLIENT ROLE

The **ceph-ansible** utility provides the **ceph-client** role that copies the Ceph configuration file and the administration keyring to nodes. In addition, you can use this role to create custom pools and clients.

Prerequisites

- A running Ceph storage cluster, preferably in the **active + clean** state.
- Perform the tasks listed in requirements.

Procedure

Perform the following tasks on the Ansible administration node.

1. Add a new section **[clients]** to the **/etc/ansible/hosts** file:

```
[clients]
CLIENT_NODE_NAME
```

Replace *CLIENT_NODE_NAME* with the host name of the node where you want to install the **ceph-client** role.

2. Navigate to the **/usr/share/ceph-ansible** directory:

```
[root@admin ~]# cd /usr/share/ceph-ansible
```

3. Create a new copy of the **clients.yml.sample** file named **clients.yml**:

```
[root@admin ceph-ansible ~]# cp group_vars/clients.yml.sample group_vars/clients.yml
```

4. Open the **group_vars/clients.yml** file, and uncomment the following lines:

```
keys:
  - { name: client.test, caps: { mon: "allow r", osd: "allow class-read object_prefix
rbd_children, allow rwx pool=test" },  mode: "{{ ceph_keyring_permissions }}" }
```

   a. Replace **client.test** with the real client name, and add the client key to the client definition line, for example:

```
key: "ADD-KEYRING-HERE=="
```

   Now the whole line example would look similar to this:

```
- { name: client.test, key: "AQAin8tUMICVFBAALRHNrV0Z4MXupRw4v9JQ6Q==", caps:
{ mon: "allow r", osd: "allow class-read object_prefix rbd_children, allow rwx pool=test" },
mode: "{{ ceph_keyring_permissions }}" }
```

   NOTE

   The **ceph-authtool --gen-print-key** command can generate a new client key.

5. Optionally, instruct **ceph-client** to create pools and clients.

   a. Update **clients.yml**.

      - Uncomment the **user_config** setting and set it to **true**.
      - Uncomment the **pools** and **keys** sections and update them as required. You can define custom pools and client names altogether with the **cephx** capabilities.

   b. Add the **osd_pool_default_pg_num** setting to the **ceph_conf_overrides** section in the **all.yml** file:

```
ceph_conf_overrides:
  global:
    osd_pool_default_pg_num: NUMBER
```

   Replace *NUMBER* with the default number of placement groups.

6. As the **ansible** user, run the Ansible playbook:

   a. **Bare-metal** deployments:

   ```
   [ansible@admin ceph-ansible]$ ansible-playbook site.yml --limit clients
   ```

   b. **Container** deployments:

   ```
   [ansible@admin ceph-ansible]$ ansible-playbook site-docker.yml --limit clients
   ```

Additional Resources

- See *Understanding the **limit** option* for details.

4.6. INSTALLING THE CEPH OBJECT GATEWAY

The Ceph Object Gateway, also know as the RADOS gateway, is an object storage interface built on top of the **librados** API to provide applications with a RESTful gateway to Ceph storage clusters.

Prerequisites

- A running Red Hat Ceph Storage cluster, preferably in the **active + clean** state.
- On the Ceph Object Gateway node, perform the tasks listed in Chapter 2, *Requirements for Installing Red Hat Ceph Storage*.

Procedure

Perform the following tasks on the Ansible administration node.

1. Add gateway hosts to the **/etc/ansible/hosts** file under the **[rgws]** section to identify their roles to Ansible. If the hosts have sequential naming, use a range, for example:

   ```
   [rgws]
   <rgw_host_name_1>
   <rgw_host_name_2>
   <rgw_host_name[3..10]>
   ```

2. Navigate to the Ansible configuration directory:

   ```
   [root@ansible ~]# cd /usr/share/ceph-ansible
   ```

3. Create the **rgws.yml** file from the sample file:

   ```
   [root@ansible ~]# cp group_vars/rgws.yml.sample group_vars/rgws.yml
   ```

4. Open and edit the **group_vars/rgws.yml** file. To copy the administrator key to the Ceph Object Gateway node, uncomment the **copy_admin_key** option:

   ```
   copy_admin_key: true
   ```

5. The **rgws.yml** file may specify a different default port than the default port **8080**. For example:

```
ceph_rgw_civetweb_port: 80
```

6. In the **all.yml** file, you **MUST** specify a **radosgw_interface**.

```
radosgw_interface: <interface>
```

Replace:

- **<interface>** with the interface that the Ceph Object Gateway nodes listen to

For example:

```
radosgw_interface: eth0
```

Specifying the interface prevents Civetweb from binding to the same IP address as another Civetweb instance when running multiple instances on the same host.

For additional details, see the **all.yml** file.

7. Generally, to change default settings, uncomment the settings in the **rgw.yml** file, and make changes accordingly. To make additional changes to settings that are not in the **rgw.yml** file, use **ceph_conf_overrides:** in the **all.yml** file. For example, set the **rgw_dns_name:** with the host of the DNS server and ensure the cluster's DNS server to configure it for wild cards to enable S3 subdomains.

```
ceph_conf_overrides:
  client.rgw.rgw1:
    rgw_dns_name: <host_name>
    rgw_override_bucket_index_max_shards: 16
    rgw_bucket_default_quota_max_objects: 1638400
```

For advanced configuration details, see the Red Hat Ceph Storage 4 *Ceph Object Gateway for Production* guide. Advanced topics include:

- *Configuring Ansible Groups*
- *Developing Storage Strategies*. See the *Creating the Root Pool*, *Creating System Pools*, and *Creating Data Placement Strategies* sections for additional details on how create and configure the pools.
  See Bucket Sharding for configuration details on bucket sharding.

8. Run the Ansible playbook:

   a. **Bare-metal** deployments:

```
[user@admin ceph-ansible]$ ansible-playbook site.yml --limit rgws
```

   b. **Container** deployments:

```
[user@admin ceph-ansible]$ ansible-playbook site-docker.yml --limit rgws
```

NOTE

Ansible ensures that each Ceph Object Gateway is running.

For a single site configuration, add Ceph Object Gateways to the Ansible configuration.

For multi-site deployments, you should have an Ansible configuration for each zone. That is, Ansible will create a Ceph storage cluster and gateway instances for that zone.

After installation for a multi-site cluster is complete, proceed to the Multi-site chapter in the Red Hat Ceph Storage 4 *Object Gateway Guide* for details on configuring a cluster for multi-site.

Additional Resources

- Section 4.8, "Understanding the **limit** option"
- The Red Hat Ceph Storage 4 *Object Gateway Guide*

4.6.1. Configuring a multisite Ceph Object Gateway

Ansible will configure the realm, zonegroup, along with the master and secondary zones for a Ceph Object Gateway in a multisite environment.

Prerequisites

- Two running Red Hat Ceph Storage clusters.
- On the Ceph Object Gateway node, perform the tasks listed in the *Requirements for Installing Red Hat Ceph Storage* found in the *Red Hat Ceph Storage Installation Guide*.
- Install and configure one Ceph Object Gateway per storage cluster.

Procedure

1. Do the following steps on Ansible node for the primary storage cluster:

   a. Generate the system keys and capture their output in the **multi-site-keys.txt** file:

   ```
   [root@ansible ~]# echo system_access_key: $(cat /dev/urandom | tr -dc 'a-zA-Z0-9' | fold -w 20 | head -n 1) > multi-site-keys.txt
   [root@ansible ~]# echo system_secret_key: $(cat /dev/urandom | tr -dc 'a-zA-Z0-9' | fold -w 40 | head -n 1) >> multi-site-keys.txt
   ```

   b. Navigate to the Ansible configuration directory, **/usr/share/ceph-ansible**:

   ```
   [root@ansible ~]# cd /usr/share/ceph-ansible
   ```

   c. Open and edit the **group_vars/all.yml** file. Enable multisite support by adding the following options, along with updating the *ZONE_NAME*, *ZONE_GROUP_NAME*, *REALM_NAME*, *ACCESS_KEY*, and *SECRET_KEY* options accordingly:
   When more than one Ceph Object Gateway is in the master zone, then the **rgw_multisite_endpoints** option needs to be set. The value for the **rgw_multisite_endpoints** option is a comma separated list, with no spaces.

   ```
   rgw_multisite: true
   rgw_zone: ZONE_NAME
   rgw_zonemaster: true
   rgw_zonesecondary: false
   ```

```
rgw_multisite_endpoint_addr: "{{ ansible_fqdn }}"
rgw_multisite_endpoints:
http://foo.example.com:8080,http://bar.example.com:8080,http://baz.example.com:8080
rgw_zonegroup: ZONE_GROUP_NAME
rgw_zone_user: zone.user
rgw_realm: REALM_NAME
system_access_key: ACCESS_KEY
system_secret_key: SECRET_KEY
```

NOTE

The **ansible_fqdn** domain name must be resolvable from the secondary storage cluster.

d. Run the Ansible playbook:

```
[ansible@ansible ceph-ansible]$ ansible-playbook site.yml --limit rgws
```

e. Restart the Ceph Object Gateway daemon:

```
[root@rgw ~]# systemctl restart ceph-radosgw@rgw.`hostname -s`
```

2. Do the following steps on the Ansible node for the secondary storage cluster:

a. Navigate to the Ansible configuration directory, **/usr/share/ceph-ansible**:

```
[root@ansible ~]# cd /usr/share/ceph-ansible
```

b. Open and edit the **group_vars/all.yml** file. Enable multisite support by adding the following options, along with updating the *ZONE_NAME*, *ZONE_GROUP_NAME*, *REALM_NAME*, *ACCESS_KEY*, and *SECRET_KEY* options accordingly: The **rgw_zone_user**, **system_access_key**, and **system_secret_key** values must be the same values as used in the master zone configuration. The **rgw_pullhost** value (*MASTER_RGW_NODE_NAME*) must be the Ceph Object Gateway for the master zone:

```
rgw_multisite: true
rgw_zone: ZONE_NAME
rgw_zonemaster: false
rgw_zonesecondary: true
rgw_multisite_endpoint_addr: "{{ ansible_fqdn }}"
rgw_zonegroup: ZONE_GROUP_NAME
rgw_zone_user: zone.user
rgw_realm: REALM_NAME
system_access_key: ACCESS_KEY
system_secret_key: SECRET_KEY
rgw_pull_proto: http
rgw_pull_port: 8080
rgw_pullhost: MASTER_RGW_NODE_NAME
```

NOTE

The **ansible_fqdn** domain name must be resolvable from the primary storage cluster.

c. Run the Ansible playbook:

d. **Bare-metal** deployments:

```
[user@ansible ceph-ansible]$ ansible-playbook site.yml --limit rgws
```

e. **Container** deployments:

```
[user@ansible ceph-ansible]$ ansible-playbook site-docker.yml --limit rgws
```

3. After running the Ansible playbook on the master and secondary storage clusters, you will have a running active-active Ceph Object Gateway configuration.

4. Verify the multisite Ceph Object Gateway configuration:

   a. From the Ceph Monitor and Object Gateway nodes at each site, primary and secondary, must be able to **curl** the other site.

   b. Run the **radosgw-admin sync status** command on both sites.

4.7. INSTALLING THE NFS-GANESHA GATEWAY

The Ceph NFS Ganesha Gateway is an NFS interface built on top of the Ceph Object Gateway to provide applications with a POSIX filesystem interface to the Ceph Object Gateway for migrating files within filesystems to Ceph Object Storage.

Prerequisites

- A running Ceph storage cluster, preferably in the **active + clean** state.
- At least one node running a Ceph Object Gateway.
- Disable any running kernel NFS service instances on any host that will run NFS-Ganesha before attempting to run NFS-Ganesha. NFS-Ganesha will not start if another NFS instance is running.
- Ensure the rpcbind service is running:

```
# systemctl start rpcbind
```

> **NOTE**
>
> The rpcbind package that provides rpcbind is usually installed by default. If that is not the case, install the package first.

- If the nfs-service service is running, stop and disable it:

```
# systemctl stop nfs-server.service
# systemctl disable nfs-server.service
```

Procedure

Perform the following tasks on the Ansible administration node.

1. Create the **nfss.yml** file from the sample file:

```
[root@ansible ~]# cd /etc/ansible/group_vars
[root@ansible ~]# cp nfss.yml.sample nfss.yml
```

2. Add gateway hosts to the **/etc/ansible/hosts** file under an **[nfss]** group to identify their group membership to Ansible.

```
[nfss]
NFS_HOST_NAME_1
NFS_HOST_NAME_2
NFS_HOST_NAME[3..10]
```

If the hosts have sequential naming, then you can use a range specifier, for example: **[3..10]**.

3. Navigate to the Ansible configuration directory:

```
[root@ansible ~]# cd /usr/share/ceph-ansible
```

4. To copy the administrator key to the Ceph Object Gateway node, uncomment the **copy_admin_key** setting in the **/usr/share/ceph-ansible/group_vars/nfss.yml** file:

```
copy_admin_key: true
```

5. Configure the FSAL (File System Abstraction Layer) sections of the **/usr/share/ceph-ansible/group_vars/nfss.yml** file. Provide an export ID (*NUMERIC_EXPORT_ID*), S3 user ID (*S3_USER*), S3 access key (*ACCESS_KEY*) and secret key (*SECRET_KEY*):

```
# FSAL RGW Config #

ceph_nfs_rgw_export_id: NUMERIC_EXPORT_ID
#ceph_nfs_rgw_pseudo_path: "/"
#ceph_nfs_rgw_protocols: "3,4"
#ceph_nfs_rgw_access_type: "RW"
ceph_nfs_rgw_user: "S3_USER"
ceph_nfs_rgw_access_key: "ACCESS_KEY"
ceph_nfs_rgw_secret_key: "SECRET_KEY"
```

WARNING

Access and secret keys are optional, and can be generated.

6. Run the Ansible playbook:

   a. **Bare-metal** deployments:

```
[ansible@admin ceph-ansible]$ ansible-playbook site.yml --limit nfss
```

   b. **Container** deployments:

```
[ansible@admin ceph-ansible]$ ansible-playbook site-docker.yml --limit nfss
```

Additional Resources

- *Understanding the limit option*
- *Object Gateway Configuration and Administration Guide*

4.8. UNDERSTANDING THE LIMIT OPTION

This section contains information about the Ansible **--limit** option.

Ansible supports the **--limit** option that enables you to use the **site**, **site-docker**, and **rolling_upgrade** Ansible playbooks for a particular section of the inventory file.

```
ansible-playbook site.yml|site-docker.yml|infrastructure-playbooks/rolling_upgrade.yml --limit
osds|rgws|clients|mdss|nfss|iscsigws
```

Bare-metal

For example, to redeploy only OSDs on bare-metal, run the following command as the Ansible user:

```
[ansible@ansible ceph-ansible]$ ansible-playbook site.yml --limit osds
```

Containers

For example, to redeploy only OSDs on containers, run the following command as the Ansible user:

```
[ansible@ansible ceph-ansible]$ ansible-playbook site-docker.yml --limit osds
```

Upgrades

For example, to upgrade to the latest version of Red Hat Ceph Storage, run the following command as the Ansible user:

```
[ansible@ansible ceph-ansible]$ ansible-playbook infrastructure-playbooks/rolling_upgrade.yml --
limit clients
```

IMPORTANT

If you colocate Ceph components on one node, Ansible applies a playbook to **all components** on the node despite that only one component type was specified with the **limit** option. For example, if you run the **rolling_update** playbook with the **--limit osds** option on a node that contains OSDs and Metadata Servers (MDS), Ansible will upgrade both components, OSDs and MDSs.

4.9. ADDITIONAL RESOURCES

- The Ansible Documentation

CHAPTER 5. COLOCATION OF CONTAINERIZED CEPH DAEMONS

This section describes:

- How colocation works and its advantages
- How to set dedicated resources for colocated daemons

5.1. HOW COLOCATION WORKS AND ITS ADVANTAGES

You can colocate containerized Ceph daemons on the same node. Here are the advantages of colocating some of Ceph's services:

- Significant improvement in total cost of ownership (TCO) at small scale
- Reduction from six nodes to three for the minimum configuration
- Easier upgrade
- Better resource isolation

How Colocation Works

You can colocate one daemon from the following list with an OSD daemon by adding the same node to appropriate sections in the Ansible inventory file.

- Ceph Object Gateway (**radosgw**)
- Ceph Metadata Server (MDS)
- RBD mirror (**rbd-mirror**)
- Ceph Monitor and the Ceph Manager daemon (**ceph-mgr**)
- NFS Ganesha

The following example shows how the inventory file with colocated daemons can look like:

Ansible inventory file with colocated daemons

```
[mons]
MONITOR_NODE_NAME_1
MONITOR_NODE_NAME_2
MONITOR_NODE_NAME_3

[mgrs]
MONITOR_NODE_NAME_1
MONITOR_NODE_NAME_2
MONITOR_NODE_NAME_3

[osds]
OSD_NODE_NAME_1
OSD_NODE_NAME_2
OSD_NODE_NAME_3
```

```
[rgws]
RGW_NODE_NAME_1
RGW_NODE_NAME_2
```

The Figure 5.1, "Colocated Daemons" and Figure 5.2, "Non-colocated Daemons" images shows the difference between clusters with colocated and non-colocated daemons.

Figure 5.1. Colocated Daemons

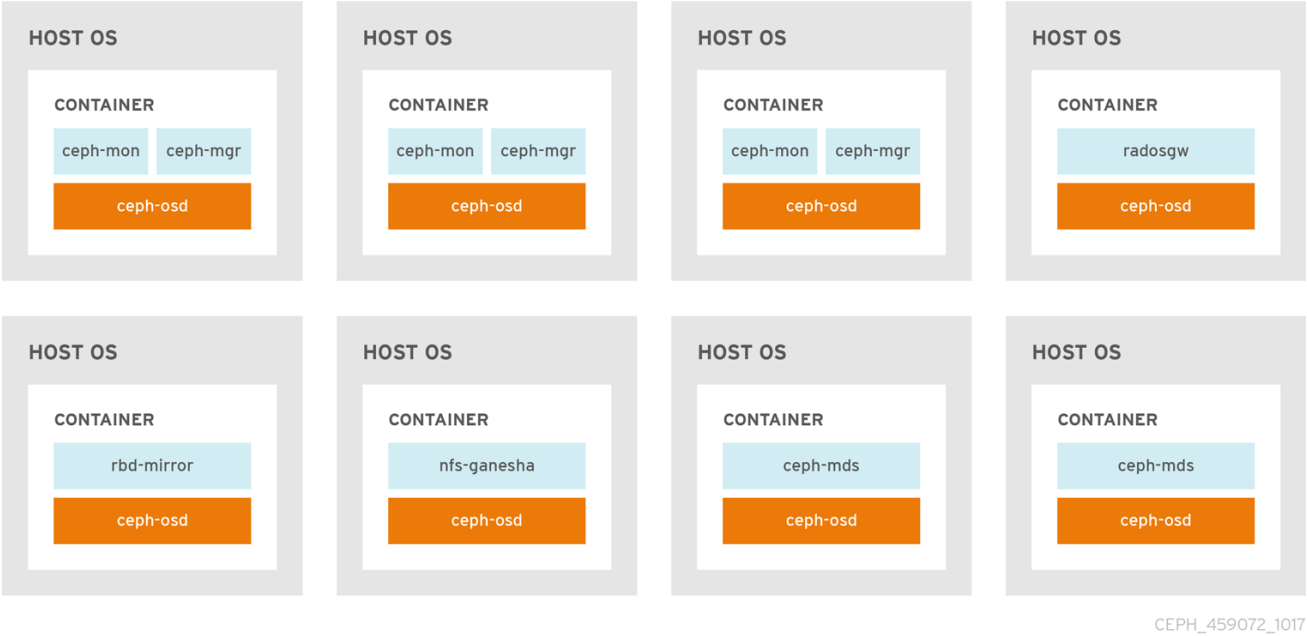
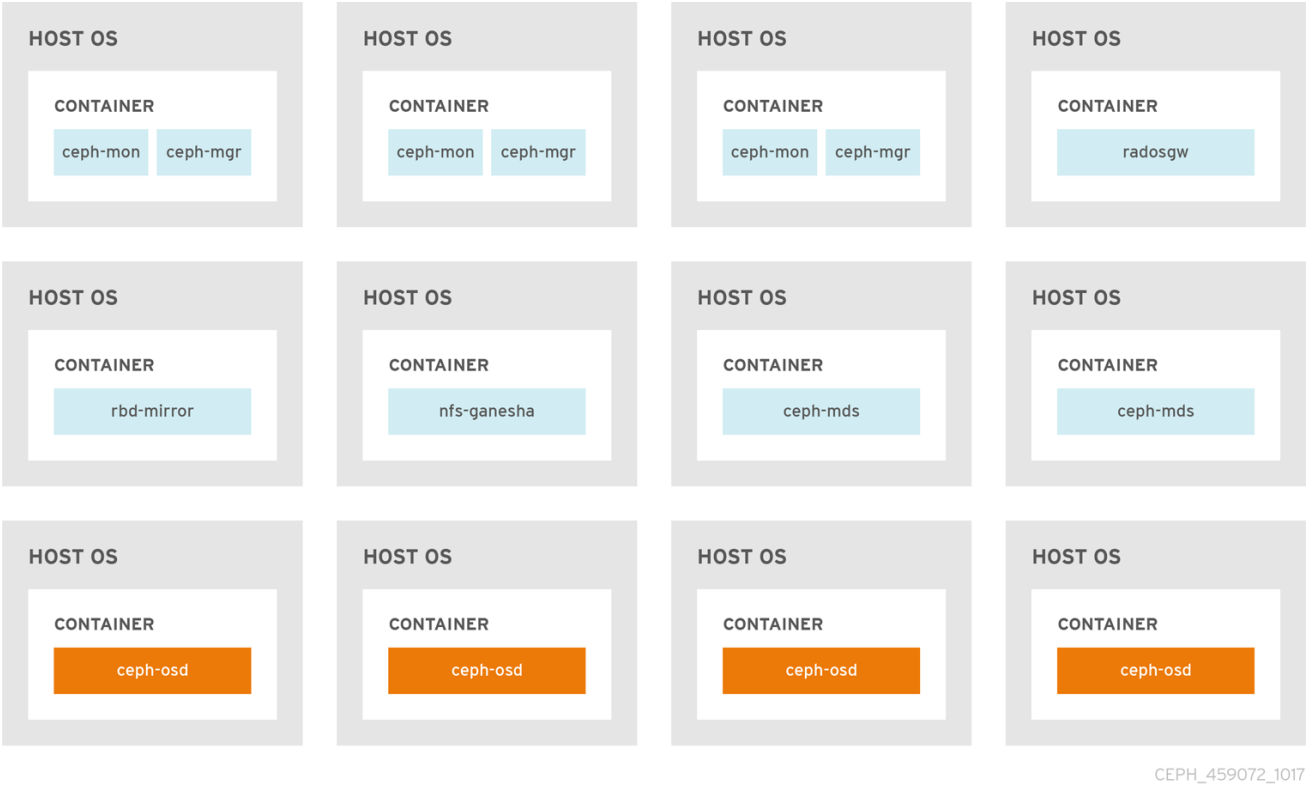


Figure 5.2. Non-colocated Daemons



When you colocate two containerized Ceph daemons on a same node, the **ceph-ansible** playbook reserves dedicated CPU and RAM resources to each. By default, **ceph-ansible** uses values listed in the Recommended Minimum Hardware chapter in the *Red Hat Ceph Storage Hardware Guide*. To learn how to change the default values, see the Setting Dedicated Resources for Colocated Daemons section.

5.2. SETTING DEDICATED RESOURCES FOR COLOCATED DAEMONS

When colocating two Ceph daemon on the same node, the **ceph-ansible** playbook reserves CPU and RAM resources for each daemon. The default values that **ceph-ansible** uses are listed in the Recommended Minimum Hardware chapter in the Red Hat Ceph Storage Hardware Selection Guide. To change the default values, set the needed parameters when deploying Ceph daemons.

Procedure

1. To change the default CPU limit for a daemon, set the **ceph_*daemon-type*_docker_cpu_limit** parameter in the appropriate **.yml** configuration file when deploying the daemon. See the following table for details.

Daemon	Parameter	Configuration file
OSD	**ceph_osd_docker_cpu_limit**	**osds.yml**
MDS	**ceph_mds_docker_cpu_limit**	**mdss.yml**
RGW	**ceph_rgw_docker_cpu_limit**	**rgws.yml**

   For example, to change the default CPU limit to 2 for the Ceph Object Gateway, edit the **/usr/share/ceph-ansible/group_vars/rgws.yml** file as follows:

```
ceph_rgw_docker_cpu_limit: 2
```

2. To change the default RAM for OSD daemons, set the **osd_memory_target** in the **/usr/share/ceph-ansible/group_vars/all.yml** file when deploying the daemon. For example, to limit the OSD RAM to 6 GB:

```
ceph_conf_overrides:
  osd:
    osd_memory_target=6000000000
```

> **IMPORTANT**
>
> In an hyperconverged infrastructure (HCI) configuration, you can also use the **ceph_osd_docker_memory_limit** parameter in the **osds.yml** configuration file to change the Docker memory CGroup limit. In this case, set **ceph_osd_docker_memory_limit** to 50% higher than **osd_memory_target**, so that the CGroup limit is more constraining than it is by default for an HCI configuration. For example, if **osd_memory_target** is set to 6 GB, set **ceph_osd_docker_memory_limit** to 9 GB:
>
> ```
> ceph_osd_docker_memory_limit: 9g
> ```

Additional Resources

- The sample configuration files in the **/usr/share/ceph-ansible/group_vars/** directory

5.3. ADDITIONAL RESOURCES

- The *Red Hat Ceph Storage Hardware Selection Guide*

CHAPTER 6. UPGRADING A RED HAT CEPH STORAGE CLUSTER

As a storage administrator, you can upgrade a Red Hat Ceph Storage cluster to a new major version or to a new minor version or to just apply asynchronous updates to the current version. The **rolling_update.yml** Ansible playbook performs upgrades for bare-metal or containerized deployments of Red Hat Ceph Storage. Ansible upgrades the Ceph nodes in the following order:

- Monitor nodes
- MGR nodes
- OSD nodes
- MDS nodes
- Ceph Object Gateway nodes
- All other Ceph client nodes

NOTE

Starting with Red Hat Ceph Storage 3.1 new Ansible playbooks were added to optimize storage for performance when using Object Gateway and high speed NVMe based SSDs (and SATA SSDs). The playbooks do this by placing journals and bucket indexes together on SSDs, this increases performance compared to having all journals on one device. These playbooks are designed to be used when installing Ceph. Existing OSDs continue to work and need no extra steps during an upgrade. There is no way to upgrade a Ceph cluster while simultaneously reconfiguring OSDs to optimize storage in this way. To use different devices for journals or bucket indexes requires reprovisioning OSDs. For more information see *Using NVMe with LVM optimally* in *Ceph Object Gateway for Production Guide*.

IMPORTANT

The **rolling_update.yml** playbook includes the **serial** variable that adjusts the number of nodes to be updated simultaneously. Red Hat strongly recommends to use the default value (**1**), which ensures that Ansible will upgrade cluster nodes one by one.

IMPORTANT

When upgrading a Red Hat Ceph Storage cluster from a previous version to version 4, the Ceph Ansible configuration will default the object store type to BlueStore. If you still want to use FileStore as the OSD object store, then explicitly set the Ceph Ansible configuration to FileStore. This ensures newly deployed and replaced OSDs are using FileStore.

IMPORTANT

When using the **rolling_update.yml** playbook to upgrade to any Red Hat Ceph Storage 4.x version, and if you are using a multisite Ceph Object Gateway configuration, then you do not have to manually update the **all.yml** file to specify the multisite configuration.

6.1. PREPARING FOR AN UPGRADE

There are a few things to complete before you can start an upgrade of a Red Hat Ceph Storage cluster from version 3 to version 4. These steps apply to both bare-metal and container deployments of a Red Hat Ceph Storage cluster, unless specified for one or the other.

Prerequisites

- Root-level access to all nodes in the storage cluster.

Procedure

1. Log in as the **root** user on all nodes in the storage cluster.
2. On all nodes in the storage cluster, enable the **rhel-7-server-extras-rpms** repository:

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

3. If the Ceph nodes are not connected to the Red Hat Content Delivery Network (CDN), you can use an ISO image to upgrade Red Hat Ceph Storage by updating the local repository with the latest version of Red Hat Ceph Storage.
4. On the Ansible administration node, change to the **cephmetrics-ansible** directory:

```
[root@admin ~]# cd /usr/share/cephmetrics-ansible
```

5. Run the **purge.yml** playbook to remove an existing Ceph dashboard installation:

```
[root@admin cephmetrics-ansible]# ansible-playbook -v purge.yml
```

6. Enable the Red Hat Ceph Storage 4 Tools repository on the Ansible administration node, any RBD mirroring node or any other client nodes, any Ceph Object Gateway nodes, any Ceph Metadata Server nodes, and any NFS nodes.

```
# subscription-manager repos --enable=rhel-7-server-rhceph-4-tools-rpms
```

7. On the Ansible administration node, enable the Ansible repository:

```
[root@admin ~]# subscription-manager repos --enable=rhel-7-server-ansible-2.8-rpms
```

8. On the Monitor nodes, enable the Monitor repository:

```
[root@mon ~]# subscription-manager repos --enable=rhel-7-server-rhceph-4-mon-rpms
```

9. On the OSD nodes, enable the OSD repository:

```
[root@osd ~]# subscription-manager repos --enable=rhel-7-server-rhceph-4-osd-rpms
```

10. On the Ansible administration node, ensure the latest version of the **ansible** and **ceph-ansible** packages are installed.

```
[root@admin ~]# yum update ansible ceph-ansible
```

11. Edit the **infrastructure-playbooks/rolling_update.yml** playbook and change the **health_osd_check_retries** and **health_osd_check_delay** values to **50** and **30** respectively:

```
health_osd_check_retries: 50
health_osd_check_delay: 30
```

For each OSD node, these values cause Ansible to wait for up to 25 minutes, and will check the storage cluster health every 30 seconds, waiting before continuing the upgrade process.

NOTE

Adjust the **health_osd_check_retries** option value up or down based on the used storage capacity of the storage cluster. For example, if you are using 218 TB out of 436 TB, basically using 50% of the storage capacity, then set the **health_osd_check_retries** option to **50**.

12. If the storage cluster you want to upgrade contains Ceph Block Device images that use the **exclusive-lock** feature, ensure that all Ceph Block Device users have permissions to blacklist clients:

```
ceph auth caps client.ID mon 'allow r, allow command "osd blacklist"' osd
'EXISTING_OSD_USER_CAPS'
```

Additional Resources

- See *Enabling the Red Hat Ceph Storage repositories* for details.

6.2. UPGRADING THE STORAGE CLUSTER USING ANSIBLE

Using the Ansible deployment tool, you can upgrade a Red Hat Ceph Storage cluster to the latest version by doing a rolling upgrade. These steps apply to both bare-metal and container deployment, unless otherwise noted.

Prerequisites

- Root-level access to the Ansible administration node.
- An **ansible** user account.

Procedure

1. Navigate to the **/usr/share/ceph-ansible/** directory:

```
[root@admin ~]# cd /usr/share/ceph-ansible/
```

2. As a precaution, make backup copies of the **group_vars/all.yml** and **group_vars/osds.yml** files:

```
[root@admin ceph-ansible]# cp group_vars/all.yml group_vars/all_old.yml
[root@admin ceph-ansible]# cp group_vars/osds.yml group_vars/osds_old.yml
[root@admin ceph-ansible]# cp group_vars/clients.yml group_vars/clients_old.yml
```

3. Copy the latest **site.yml** or **site-docker.yml** file from the sample files:

a. For **bare-metal** deployments:

```
[root@admin ceph-ansible]# cp site.yml.sample site.yml
```

b. For **container** deployments:

```
[root@admin ceph-ansible]# cp site-docker.yml.sample site-docker.yml
```

4. Open the **group_vars/all.yml** file and edit the following options.

a. Add the **fetch_directory** option:

```
fetch_directory: FULL_DIRECTORY_PATH
```

Replace

- *FULL_DIRECTORY_PATH* with a writable location, such as the Ansible user's home directory.

b. If the cluster you want to upgrade contains any Ceph Object Gateway nodes, add the **radosgw_interface** option:

```
radosgw_interface: INTERFACE
```

Replace

- *INTERFACE* with the interface that the Ceph Object Gateway nodes listen to.

c. Set **ceph_origin** to **distro**. For new Ceph installs on Red Hat Enterprise Linux 8, **ceph-ansible** enables the Ceph repositories automatically. For Red Hat Enterprise Linux 7, you enabled them manually earlier. Instruct **ceph-ansible** to use the operating system distribution configured repositories with the following setting:

```
ceph_origin: distro
```

d. The default OSD object store is BlueStore. To keep the traditional OSD object store, you must explicitly set the **osd_objectstore** option to **filestore**:

```
osd_objectstore: filestore
```

NOTE

With the **osd_objectstore** option set to **filestore**, replacing an OSD will use FileStore, instead of BlueStore.

IMPORTANT

Starting with Red Hat Ceph Storage 4, FileStore is a deprecated feature. Red Hat recommends migrating the FileStore OSDs to BlueStore OSDs.

e. For **bare-metal** deployments:

i. Uncomment the **upgrade_ceph_packages** option and set it to **True**:

```
upgrade_ceph_packages: True
```

ii. Set the **ceph_rhcs_version** option to **4**:

```
ceph_rhcs_version: 4
```

> **NOTE**
>
> Having the **ceph_rhcs_version** option set to **4** will pull in the latest version of Red Hat Ceph Storage 4.

f. For **containers** deployments:

i. Change the **ceph_docker_image** option to point to the Ceph 4 container version:

```
ceph_docker_image: rhceph/rhceph-4-rhel8
```

5. Open the Ansible inventory file for editing, **/etc/ansible/hosts** by default, and add the Ceph dashboard node name or IP address under the **[grafana-server]** section. If this section does not exist, then also add this section along with the node name or IP address.

6. Switch to or log on as the **ansible** user, then run the **rolling_update.yml** playbook:

```
[ansible@admin ceph-ansible]$ ansible-playbook infrastructure-playbooks/rolling_update.yml
```

To use the playbook only for a particular group of nodes on the Ansible inventory file, you can use the **--limit** option.

7. Because of a known issue, after the **rolling_update.yml** playbook finishes you need to unset the **norebalance** flag:

```
[root@mon ~]# ceph osd set norebalance
```

> **NOTE**
>
> See Bugzilla 1793564 for more information on this known issue.

8. As the **root** user on the RBD mirroring daemon node, upgrade the **rbd-mirror** package manually:

```
[root@rbd ~]# yum upgrade rbd-mirror
```

9. Restart the **rbd-mirror** daemon:

```
systemctl restart ceph-rbd-mirror@CLIENT_ID
```

10. Verify the health status of the storage cluster.

a. For **bare-metal** deployments, log into a monitor node as the **root** user and run the Ceph status command:

```
[root@mon ~]# ceph -s
```

b. For **container** deployments, log into a Ceph Monitor node as the **root** user.

i. List all running containers:

```
[root@mon ~]# docker ps
```

ii. Check health status:

```
[root@mon ~]# docker exec ceph-mon-MONITOR_NAME ceph -s
```

Replace

- *MONITOR_NAME* with the name of the Ceph Monitor container found in the previous step.

Example

```
[root@mon ~]# docker exec ceph-mon-mon01 ceph -s
```

11. If using FileStore OSDs, then once the upgrade finishes, run the Ansible playbook to migrate the FileStore OSDs to BlueStore OSDs:

Syntax

```
ansible-playbook infrastructure-playbooks/filestore-to-bluestore.yml --limit
OSD_NODE_TO_MIGRATE
```

Example

```
[ansible@admin ceph-ansible]$ ansible-playbook infrastructure-playbooks/filestore-to-
bluestore.yml --limit osd01
```

12. If working in an OpenStack environment, update all the **cephx** users to use the RBD profile for pools. The following commands must be run as the **root** user:

a. Glance users:

Syntax

```
ceph auth caps client.glance mon 'profile rbd' osd 'profile rbd
pool=GLANCE_POOL_NAME'
```

Example

```
[root@mon ~]# ceph auth caps client.glance mon 'profile rbd' osd 'profile rbd
pool=images'
```

b. Cinder users:

Syntax

```
ceph auth caps client.cinder mon 'profile rbd' osd 'profile rbd
pool=CINDER_VOLUME_POOL_NAME, profile rbd pool=NOVA_POOL_NAME, profile
rbd-read-only pool=GLANCE_POOL_NAME'
```

Example

```
[root@mon ~]# ceph auth caps client.cinder mon 'profile rbd' osd 'profile rbd
pool=volumes, profile rbd pool=vms, profile rbd-read-only pool=images'
```

c. OpenStack general users:

Syntax

```
ceph auth caps client.openstack mon 'profile rbd' osd 'profile rbd-read-only
pool=CINDER_VOLUME_POOL_NAME, profile rbd pool=NOVA_POOL_NAME, profile
rbd-read-only pool=GLANCE_POOL_NAME'
```

Example

```
[root@mon ~]# ceph auth caps client.openstack mon 'profile rbd' osd 'profile rbd-read-
only pool=volumes, profile rbd pool=vms, profile rbd-read-only pool=images'
```

IMPORTANT

Do these CAPS updates before performing any live client migrations. This allows clients to use the new libraries running in memory, causing the old CAPS settings to drop from cache and applying the new RBD profile settings.

Additional Resources

- See *Understanding the limit option* for more details.
- See *How to migrate the object store from FileStore to BlueStore* in the *Red Hat Ceph Storage Administration Guide* for more details.

6.3. UPGRADING THE STORAGE CLUSTER USING THE COMMAND-LINE INTERFACE

You can upgrade from Red Hat Ceph Storage 3.3 to Red Hat Ceph Storage 4 while the storage cluster is running. An important difference between these versions is that Red Hat Ceph Storage 4 uses the **msgr2** protocol by default, which uses port **3300**. If it is not open, the cluster will issue a **HEALTH_WARN** error.

Here are the constraints to consider when upgrading the storage cluster:

- Red Hat Ceph Storage 4 uses **msgr2** protocol by default. Ensure port **3300** is open on Ceph Monitor nodes
- Once you upgrade the **ceph-monitor** daemons from Red Hat Ceph Storage 3 to Red Hat Ceph Storage 4, the Red Hat Ceph Storage 3 **ceph-osd** daemons **cannot** create new OSDs until you upgrade them to Red Hat Ceph Storage 4.

- **Do not** create any pools while the upgrade is in progress.

Prerequisites

- Root-level access to the Ceph Monitor, OSD, and Object Gateway nodes.

Procedure

1. Ensure that the cluster has completed at least one full scrub of all PGs while running Red Hat Ceph Storage 3. Failure to do so can cause your monitor daemons to refuse to join the quorum on start, leaving them non-functional. To ensure the cluster has completed at least one full scrub of all PGs, execute the following:

   ```
   # ceph osd dump | grep ^flags
   ```

   To proceed with an upgrade from Red Hat Ceph Storage 3 to Red Hat Ceph Storage 4, the OSD map must include the **recovery_deletes** and **purged_snapdirs** flags.

2. Ensure the cluster is in a healthy and clean state.

   ```
   # ceph health
   HEALTH_OK
   ```

3. For nodes running **ceph-mon** and **ceph-manager**, execute:

   ```
   # subscription-manager repos --enable=rhel-7-server-rhceph-4-mon-rpms
   ```

   Once the Red Hat Ceph Storage 4 package is enabled, execute the following on each of the **ceph-mon** and **ceph-manager** nodes:

   ```
   # firewall-cmd --add-port=3300/tcp
   # firewall-cmd --add-port=3300/tcp --permanent
   # yum update -y
   # systemctl restart ceph-mon@<mon-hostname>
   # systemctl restart ceph-mgr@<mgr-hostname>
   ```

   Replace **<mon-hostname>** and **<mgr-hostname>** with the hostname of the target host.

4. Before upgrading OSDs, set the **noout** flag on a Ceph Monitor node to prevent OSDs from rebalancing during upgrade.

   ```
   # ceph osd set noout
   ```

5. On each OSD node, execute:

   ```
   # subscription-manager repos --enable=rhel-7-server-rhceph-4-osd-rpms
   ```

   Once the Red Hat Ceph Storage 4 package is enabled, update the OSD node:

   ```
   # yum update -y
   ```

   For each OSD daemon running on the node, execute:

```
# systemctl restart ceph-osd@<osd-num>
```

Replace **<osd-num>** with the osd number to restart. Ensure all OSDs on the node have restarted before proceeding to the next OSD node.

6. After upgrading all OSD nodes, unset the **noout** flag on a Ceph Monitor node.

```
# ceph osd unset noout
```

7. On Ceph Object Gateway nodes, execute:

```
# subscription-manager repos --enable=rhel-7-server-rhceph-4-tools-rpms
```

Once the Red Hat Ceph Storage 4 package is enabled, update the node and restart the **ceph-rgw** daemon:

```
# yum update -y
# systemctl restart ceph-rgw@<rgw-target>
```

Replace **<rgw-target>** with the rgw target to restart.

8. For the administration node, execute:

```
# subscription-manager repos --enable=rhel-7-server-rhceph-4-tools-rpms
# yum update -y
```

9. Ensure the cluster is in a healthy and clean state.

```
# ceph health
HEALTH_OK
```

CHAPTER 7. WHAT TO DO NEXT?

This is only the beginning of what Red Hat Ceph Storage can do to help you meet the challenging storage demands of the modern data center. Here are links to more information on a variety of topics:

- Benchmarking performance and accessing performance counters, see the Benchmarking Performance chapter in the Administration Guide for Red Hat Ceph Storage 4.
- Creating and managing snapshots, see the Snapshots chapter in the Block Device Guide for Red Hat Ceph Storage 4.
- Expanding the Red Hat Ceph Storage cluster, see the Managing Cluster Size chapter in the Administration Guide for Red Hat Ceph Storage 4.
- Mirroring Ceph Block Devices, see the Block Device Mirroring chapter in the Block Device Guide for Red Hat Ceph Storage 4.
- Process management, see the Process Management chapter in the Administration Guide for Red Hat Ceph Storage 4.
- Tunable parameters, see the Configuration Guide for Red Hat Ceph Storage 4.
- Using Ceph as the back end storage for OpenStack, see the Back-ends section in the Storage Guide for Red Hat OpenStack Platform.

APPENDIX A. TROUBLESHOOTING

A.1. ANSIBLE STOPS INSTALLATION BECAUSE IT DETECTS LESS DEVICES THAN EXPECTED

The Ansible automation application stops the installation process and returns the following error:

```
- name: fix partitions gpt header or labels of the osd disks (autodiscover disks)
  shell: "sgdisk --zap-all --clear --mbrtogpt -- '/dev/{{ item.0.item.key }}' || sgdisk --zap-all --clear --
mbrtogpt -- '/dev/{{ item.0.item.key }}'"
  with_together:
    - "{{ osd_partition_status_results.results }}"
    - "{{ ansible_devices }}"
  changed_when: false
  when:
    - ansible_devices is defined
    - item.0.item.value.removable == "0"
    - item.0.item.value.partitions|count == 0
    - item.0.rc != 0
```

What this means:

When the **osd_auto_discovery** parameter is set to **true** in the **/etc/ansible/group_vars/osds.yml** file, Ansible automatically detects and configures all the available devices. During this process, Ansible expects that all OSDs use the same devices. The devices get their names in the same order in which Ansible detects them. If one of the devices fails on one of the OSDs, Ansible fails to detect the failed device and stops the whole installation process.

Example situation:

1. Three OSD nodes (**host1**, **host2**, **host3**) use the **/dev/sdb**, **/dev/sdc**, and **dev/sdd** disks.
2. On **host2**, the **/dev/sdc** disk fails and is removed.
3. Upon the next reboot, Ansible fails to detect the removed **/dev/sdc** disk and expects that only two disks will be used for **host2**, **/dev/sdb** and **/dev/sdc** (formerly **/dev/sdd**).
4. Ansible stops the installation process and returns the above error message.

To fix the problem:

In the **/etc/ansible/hosts** file, specify the devices used by the OSD node with the failed disk (**host2** in the Example situation above):

```
[osds]
host1
host2 devices="[ '/dev/sdb', '/dev/sdc' ]"
host3
```

See Chapter 4, *Deploying Red Hat Ceph Storage* for details.

APPENDIX B. USING THE COMMAND-LINE INTERFACE TO INSTALL THE CEPH SOFTWARE

As a storage administrator, you can choose to manually install various components of the Red Hat Ceph Storage software.

B.1. INSTALLING THE CEPH COMMAND LINE INTERFACE

The Ceph command-line interface (CLI) enables administrators to execute Ceph administrative commands. The CLI is provided by the **ceph-common** package and includes the following utilities:

- **ceph**
- **ceph-authtool**
- **ceph-dencoder**
- **rados**

Prerequisites

- A running Ceph storage cluster, preferably in the **active + clean** state.

Procedure

1. On the client node, enable the Red Hat Ceph Storage 4 Tools repository:

```
[root@gateway ~]# subscription-manager repos --enable=rhceph-4-tools-for-rhel-8-x86_64-rpms
```

2. On the client node, install the **ceph-common** package:

```
# yum install ceph-common
```

3. From the initial monitor node, copy the Ceph configuration file, in this case **ceph.conf**, and the administration keyring to the client node:

   Syntax

```
# scp /etc/ceph/<cluster_name>.conf <user_name>@<client_host_name>:/etc/ceph/
# scp /etc/ceph/<cluster_name>.client.admin.keyring
<user_name>@<client_host_name:/etc/ceph/
```

   Example

```
# scp /etc/ceph/ceph.conf root@node1:/etc/ceph/
# scp /etc/ceph/ceph.client.admin.keyring root@node1:/etc/ceph/
```

   Replace **<client_host_name>** with the host name of the client node.

B.2. MANUALLY INSTALLING RED HAT CEPH STORAGE

IMPORTANT

Red Hat does not support or test upgrading manually deployed clusters. Therefore, Red Hat recommends to use Ansible to deploy a new cluster with Red Hat Ceph Storage 4. See Chapter 4, *Deploying Red Hat Ceph Storage* for details.

You can use command-line utilities, such as Yum, to upgrade manually deployed clusters, but Red Hat does not support or test this approach.

All Ceph clusters require at least one monitor, and at least as many OSDs as copies of an object stored on the cluster. Red Hat recommends using three monitors for production environments and a minimum of three Object Storage Devices (OSD).

Bootstrapping the initial monitor is the first step in deploying a Ceph storage cluster. Ceph monitor deployment also sets important criteria for the entire cluster, such as:

- The number of replicas for pools
- The number of placement groups per OSD
- The heartbeat intervals
- Any authentication requirement

Most of these values are set by default, so it is useful to know about them when setting up the cluster for production.

Installing a Ceph storage cluster by using the command line interface involves these steps:

- Bootstrapping the initial Monitor node
- Adding an Object Storage Device (OSD) node

Monitor Bootstrapping

Bootstrapping a Monitor and by extension a Ceph storage cluster, requires the following data:

Unique Identifier

The File System Identifier (**fsid**) is a unique identifier for the cluster. The **fsid** was originally used when the Ceph storage cluster was principally used for the Ceph file system. Ceph now supports native interfaces, block devices, and object storage gateway interfaces too, so **fsid** is a bit of a misnomer.

Cluster Name

Ceph clusters have a cluster name, which is a simple string without spaces. The default cluster name is **ceph**, but you can specify a different cluster name. Overriding the default cluster name is especially useful when you work with multiple clusters.
When you run multiple clusters in a multi-site architecture, the cluster name for example, **us-west**, **us-east** identifies the cluster for the current command-line session.

NOTE

To identify the cluster name on the command-line interface, specify the Ceph configuration file with the cluster name, for example, **ceph.conf**, **us-west.conf**, **us-east.conf**, and so on.

Example:

```
# ceph --cluster us-west.conf ...
```

Monitor Name

Each Monitor instance within a cluster has a unique name. In common practice, the Ceph Monitor name is the node name. Red Hat recommend one Ceph Monitor per node, and no co-locating the Ceph OSD daemons with the Ceph Monitor daemon. To retrieve the short node name, use the **hostname -s** command.

Monitor Map

Bootstrapping the initial Monitor requires you to generate a Monitor map. The Monitor map requires:

- The File System Identifier (**fsid**)
- The cluster name, or the default cluster name of **ceph** is used
- At least one host name and its IP address.

Monitor Keyring

Monitors communicate with each other by using a secret key. You must generate a keyring with a Monitor secret key and provide it when bootstrapping the initial Monitor.

Administrator Keyring

To use the **ceph** command-line interface utilities, create the **client.admin** user and generate its keyring. Also, you must add the **client.admin** user to the Monitor keyring.

The foregoing requirements do not imply the creation of a Ceph configuration file. However, as a best practice, Red Hat recommends creating a Ceph configuration file and populating it with the **fsid**, the **mon initial members** and the **mon host** settings at a minimum.

You can get and set all of the Monitor settings at runtime as well. However, the Ceph configuration file might contain only those settings which overrides the default values. When you add settings to a Ceph configuration file, these settings override the default settings. Maintaining those settings in a Ceph configuration file makes it easier to maintain the cluster.

To bootstrap the initial Monitor, perform the following steps:

1. Enable the Red Hat Ceph Storage 4 Monitor repository:

```
[root@monitor ~]# subscription-manager repos --enable=rhceph-4-mon-for-rhel-8-x86_64-rpms
```

2. On your initial Monitor node, install the **ceph-mon** package as **root**:

```
# yum install ceph-mon
```

3. As **root**, create a Ceph configuration file in the **/etc/ceph/** directory. By default, Ceph uses **ceph.conf**, where **ceph** reflects the cluster name:

   Syntax

   ```
   # touch /etc/ceph/<cluster_name>.conf
   ```

   Example

   ```
   # touch /etc/ceph/ceph.conf
   ```

4. As **root**, generate the unique identifier for your cluster and add the unique identifier to the **[global]** section of the Ceph configuration file:

   Syntax

   ```
   # echo "[global]" > /etc/ceph/<cluster_name>.conf
   # echo "fsid = `uuidgen`" >> /etc/ceph/<cluster_name>.conf
   ```

   Example

   ```
   # echo "[global]" > /etc/ceph/ceph.conf
   # echo "fsid = `uuidgen`" >> /etc/ceph/ceph.conf
   ```

5. View the current Ceph configuration file:

   ```
   $ cat /etc/ceph/ceph.conf
   [global]
   fsid = a7f64266-0894-4f1e-a635-d0aeaca0e993
   ```

6. As **root**, add the initial Monitor to the Ceph configuration file:

   Syntax

   ```
   # echo "mon initial members = <monitor_host_name>[,<monitor_host_name>]" >>
   /etc/ceph/<cluster_name>.conf
   ```

   Example

   ```
   # echo "mon initial members = node1" >> /etc/ceph/ceph.conf
   ```

7. As **root**, add the IP address of the initial Monitor to the Ceph configuration file:

   Syntax

   ```
   # echo "mon host = <ip-address>[,<ip-address>]" >> /etc/ceph/<cluster_name>.conf
   ```

   Example

   ```
   # echo "mon host = 192.168.0.120" >> /etc/ceph/ceph.conf
   ```

NOTE

To use IPv6 addresses, you set the **ms bind ipv6** option to **true**. For details, see the Bind section in the Configuration Guide for Red Hat Ceph Storage 4.

8. As **root**, create the keyring for the cluster and generate the Monitor secret key:

   Syntax

   ```
   # ceph-authtool --create-keyring /tmp/<cluster_name>.mon.keyring --gen-key -n mon. --cap
   mon '<capabilites>'
   ```

   Example

   ```
   # ceph-authtool --create-keyring /tmp/ceph.mon.keyring --gen-key -n mon. --cap mon 'allow *'
   creating /tmp/ceph.mon.keyring
   ```

9. As **root**, generate an administrator keyring, generate a **<cluster_name>.client.admin.keyring** user and add the user to the keyring:

   Syntax

   ```
   # ceph-authtool --create-keyring /etc/ceph/<cluster_name>.client.admin.keyring --gen-key -n
   client.admin --set-uid=0 --cap mon '<capabilites>' --cap osd '<capabilites>' --cap mds
   '<capabilites>'
   ```

   Example

   ```
   # ceph-authtool --create-keyring /etc/ceph/ceph.client.admin.keyring --gen-key -n
   client.admin --set-uid=0 --cap mon 'allow *' --cap osd 'allow *' --cap mds 'allow'
   creating /etc/ceph/ceph.client.admin.keyring
   ```

10. As **root**, add the **<cluster_name>.client.admin.keyring** key to the **<cluster_name>.mon.keyring**:

    Syntax

    ```
    # ceph-authtool /tmp/<cluster_name>.mon.keyring --import-keyring
    /etc/ceph/<cluster_name>.client.admin.keyring
    ```

    Example

    ```
    # ceph-authtool /tmp/ceph.mon.keyring --import-keyring /etc/ceph/ceph.client.admin.keyring
    importing contents of /etc/ceph/ceph.client.admin.keyring into /tmp/ceph.mon.keyring
    ```

11. Generate the Monitor map. Specify using the node name, IP address and the **fsid**, of the initial Monitor and save it as **/tmp/monmap**:

    Syntax

    ```
    $ monmaptool --create --add <monitor_host_name> <ip-address> --fsid <uuid>
    /tmp/monmap
    ```

Example

```
$ monmaptool --create --add node1 192.168.0.120 --fsid a7f64266-0894-4f1e-a635-
d0aeaca0e993 /tmp/monmap
monmaptool: monmap file /tmp/monmap
monmaptool: set fsid to a7f64266-0894-4f1e-a635-d0aeaca0e993
monmaptool: writing epoch 0 to /tmp/monmap (1 monitors)
```

12. As **root** on the initial Monitor node, create a default data directory:

Syntax

```
# mkdir /var/lib/ceph/mon/<cluster_name>-<monitor_host_name>
```

Example

```
# mkdir /var/lib/ceph/mon/ceph-node1
```

13. As **root**, populate the initial Monitor daemon with the Monitor map and keyring:

Syntax

```
# ceph-mon [--cluster <cluster_name>] --mkfs -i <monitor_host_name> --monmap
/tmp/monmap --keyring /tmp/<cluster_name>.mon.keyring
```

Example

```
# ceph-mon --mkfs -i node1 --monmap /tmp/monmap --keyring /tmp/ceph.mon.keyring
ceph-mon: set fsid to a7f64266-0894-4f1e-a635-d0aeaca0e993
ceph-mon: created monfs at /var/lib/ceph/mon/ceph-node1 for mon.node1
```

14. View the current Ceph configuration file:

```
# cat /etc/ceph/ceph.conf
[global]
fsid = a7f64266-0894-4f1e-a635-d0aeaca0e993
mon_initial_members = node1
mon_host = 192.168.0.120
```

For more details on the various Ceph configuration settings, see the Configuration Guide for Red Hat Ceph Storage 4. The following example of a Ceph configuration file lists some of the most common configuration settings:

Example

```
[global]
fsid = <cluster-id>
mon initial members = <monitor_host_name>[, <monitor_host_name>]
mon host = <ip-address>[, <ip-address>]
public network = <network>[, <network>]
cluster network = <network>[, <network>]
auth cluster required = cephx
```

```
auth service required = cephx
auth client required = cephx
osd journal size = <n>
osd pool default size = <n>  # Write an object n times.
osd pool default min size = <n> # Allow writing n copy in a degraded state.
osd pool default pg num = <n>
osd pool default pgp num = <n>
osd crush chooseleaf type = <n>
```

15. As **root**, create the **done** file:

    Syntax

    ```
    # touch /var/lib/ceph/mon/<cluster_name>-<monitor_host_name>/done
    ```

    Example

    ```
    # touch /var/lib/ceph/mon/ceph-node1/done
    ```

16. As **root**, update the owner and group permissions on the newly created directory and files:

    Syntax

    ```
    # chown -R <owner>:<group> <path_to_directory>
    ```

    Example

    ```
    # chown -R ceph:ceph /var/lib/ceph/mon
    # chown -R ceph:ceph /var/log/ceph
    # chown -R ceph:ceph /var/run/ceph
    # chown ceph:ceph /etc/ceph/ceph.client.admin.keyring
    # chown ceph:ceph /etc/ceph/ceph.conf
    # chown ceph:ceph /etc/ceph/rbdmap
    ```

    NOTE

    If the Ceph Monitor node is co-located with an OpenStack Controller node, then the Glance and Cinder keyring files must be owned by **glance** and **cinder** respectively. For example:

    ```
    # ls -l /etc/ceph/
    ...
    -rw-------.  1 glance glance      64 <date> ceph.client.glance.keyring
    -rw-------.  1 cinder cinder      64 <date> ceph.client.cinder.keyring
    ...
    ```

17. For storage clusters with custom names, as **root**, add the following line:

    Syntax

    ```
    # echo "CLUSTER=<custom_cluster_name>" >> /etc/sysconfig/ceph
    ```

Example

```
# echo "CLUSTER=test123" >> /etc/sysconfig/ceph
```

18. As **root**, start and enable the **ceph-mon** process on the initial Monitor node:

Syntax

```
# systemctl enable ceph-mon.target
# systemctl enable ceph-mon@<monitor_host_name>
# systemctl start ceph-mon@<monitor_host_name>
```

Example

```
# systemctl enable ceph-mon.target
# systemctl enable ceph-mon@node1
# systemctl start ceph-mon@node1
```

19. As **root**, verify the monitor daemon is running:

Syntax

```
# systemctl status ceph-mon@<monitor_host_name>
```

Example

```
# systemctl status ceph-mon@node1
● ceph-mon@node1.service - Ceph cluster monitor daemon
   Loaded: loaded (/usr/lib/systemd/system/ceph-mon@.service; enabled; vendor preset:
disabled)
   Active: active (running) since Wed 2018-06-27 11:31:30 PDT; 5min ago
 Main PID: 1017 (ceph-mon)
   CGroup: /system.slice/system-ceph\x2dmon.slice/ceph-mon@node1.service
           └─1017 /usr/bin/ceph-mon -f --cluster ceph --id node1 --setuser ceph --setgroup ceph

Jun 27 11:31:30 node1 systemd[1]: Started Ceph cluster monitor daemon.
Jun 27 11:31:30 node1 systemd[1]: Starting Ceph cluster monitor daemon...
```

To add more Red Hat Ceph Storage Monitors to the storage cluster, see the Adding a Monitor section in the Administration Guide for Red Hat Ceph Storage 4.

OSD Bootstrapping

Once you have your initial monitor running, you can start adding the Object Storage Devices (OSDs). Your cluster cannot reach an **active + clean** state until you have enough OSDs to handle the number of copies of an object.

The default number of copies for an object is three. You will need three OSD nodes at minimum. However, if you only want two copies of an object, therefore only adding two OSD nodes, then update the **osd pool default size** and **osd pool default min size** settings in the Ceph configuration file.

For more details, see the *OSD Configuration Reference* section in the *Configuration Guide* for Red Hat Ceph Storage 4.

After bootstrapping the initial monitor, the cluster has a default CRUSH map. However, the CRUSH map does not have any Ceph OSD daemons mapped to a Ceph node.

To add an OSD to the cluster and updating the default CRUSH map, execute the following on each OSD node:

1. Enable the Red Hat Ceph Storage 4 OSD repository:

```
[root@osd ~]# subscription-manager repos --enable=rhceph-4-osd-for-rhel-8-x86_64-rpms
```

2. As **root**, install the **ceph-osd** package on the Ceph OSD node:

```
# yum install ceph-osd
```

3. Copy the Ceph configuration file and administration keyring file from the initial Monitor node to the OSD node:

Syntax

```
# scp <user_name>@<monitor_host_name>:<path_on_remote_system>
<path_to_local_file>
```

Example

```
# scp root@node1:/etc/ceph/ceph.conf /etc/ceph
# scp root@node1:/etc/ceph/ceph.client.admin.keyring /etc/ceph
```

4. Generate the Universally Unique Identifier (UUID) for the OSD:

```
$ uuidgen
b367c360-b364-4b1d-8fc6-09408a9cda7a
```

5. As **root**, create the OSD instance:

Syntax

```
# ceph osd create <uuid> [<osd_id>]
```

Example

```
# ceph osd create b367c360-b364-4b1d-8fc6-09408a9cda7a
0
```

NOTE

This command outputs the OSD number identifier needed for subsequent steps.

6. As **root**, create the default directory for the new OSD:

Syntax

```
# mkdir /var/lib/ceph/osd/<cluster_name>-<osd_id>
```

Example

```
# mkdir /var/lib/ceph/osd/ceph-0
```

7. As **root**, prepare the drive for use as an OSD, and mount it to the directory you just created. Create a partition for the Ceph data and journal. The journal and the data partitions can be located on the same disk. This example is using a 15 GB disk:

Syntax

```
# parted <path_to_disk> mklabel gpt
# parted <path_to_disk> mkpart primary 1 10000
# mkfs -t <fstype> <path_to_partition>
# mount -o noatime <path_to_partition> /var/lib/ceph/osd/<cluster_name>-<osd_id>
# echo "<path_to_partition>  /var/lib/ceph/osd/<cluster_name>-<osd_id>   xfs
defaults,noatime 1 2" >> /etc/fstab
```

Example

```
# parted /dev/sdb mklabel gpt
# parted /dev/sdb mkpart primary 1 10000
# parted /dev/sdb mkpart primary 10001 15000
# mkfs -t xfs /dev/sdb1
# mount -o noatime /dev/sdb1 /var/lib/ceph/osd/ceph-0
# echo "/dev/sdb1 /var/lib/ceph/osd/ceph-0  xfs defaults,noatime 1 2" >> /etc/fstab
```

8. As **root**, initialize the OSD data directory:

Syntax

```
# ceph-osd -i <osd_id> --mkfs --mkkey --osd-uuid <uuid>
```

Example

```
# ceph-osd -i 0 --mkfs --mkkey --osd-uuid b367c360-b364-4b1d-8fc6-09408a9cda7a
... auth: error reading file: /var/lib/ceph/osd/ceph-0/keyring: can't open /var/lib/ceph/osd/ceph-
0/keyring: (2) No such file or directory
... created new key in keyring /var/lib/ceph/osd/ceph-0/keyring
```

NOTE

The directory must be empty before you run **ceph-osd** with the **--mkkey** option. If you have a custom cluster name, the **ceph-osd** utility requires the **--cluster** option.

9. As **root**, register the OSD authentication key. If your cluster name differs from **ceph**, insert your cluster name instead:

Syntax

-

```
# ceph auth add osd.<osd_id> osd 'allow *' mon 'allow profile osd' -i
/var/lib/ceph/osd/<cluster_name>-<osd_id>/keyring
```

Example

```
# ceph auth add osd.0 osd 'allow *' mon 'allow profile osd' -i /var/lib/ceph/osd/ceph-0/keyring
added key for osd.0
```

10. As **root**, add the OSD node to the CRUSH map:

Syntax

```
# ceph [--cluster <cluster_name>] osd crush add-bucket <host_name> host
```

Example

```
# ceph osd crush add-bucket node2 host
```

11. As **root**, place the OSD node under the **default** CRUSH tree:

Syntax

```
# ceph [--cluster <cluster_name>] osd crush move <host_name> root=default
```

Example

```
# ceph osd crush move node2 root=default
```

12. As **root**, add the OSD disk to the CRUSH map

Syntax

```
# ceph [--cluster <cluster_name>] osd crush add osd.<osd_id> <weight> [<bucket_type>=
<bucket-name> ...]
```

Example

```
# ceph osd crush add osd.0 1.0 host=node2
add item id 0 name 'osd.0' weight 1 at location {host=node2} to crush map
```

NOTE

You can also decompile the CRUSH map, and add the OSD to the device list. Add the OSD node as a bucket, then add the device as an item in the OSD node, assign the OSD a weight, recompile the CRUSH map and set the CRUSH map. For more details, see the Editing a CRUSH map section in the *Storage Strategies Guide* for Red Hat Ceph Storage 4 for more details.

13. As **root**, update the owner and group permissions on the newly created directory and files:

Syntax

```
# chown -R <owner>:<group> <path_to_directory>
```

Example

```
# chown -R ceph:ceph /var/lib/ceph/osd
# chown -R ceph:ceph /var/log/ceph
# chown -R ceph:ceph /var/run/ceph
# chown -R ceph:ceph /etc/ceph
```

14. For storage clusters with custom names, as **root**, add the following line to the **/etc/sysconfig/ceph** file:

Syntax

```
# echo "CLUSTER=<custom_cluster_name>" >> /etc/sysconfig/ceph
```

Example

```
# echo "CLUSTER=test123" >> /etc/sysconfig/ceph
```

15. The OSD node is in your Ceph storage cluster configuration. However, the OSD daemon is **down** and **in**. The new OSD must be **up** before it can begin receiving data. As **root**, enable and start the OSD process:

Syntax

```
# systemctl enable ceph-osd.target
# systemctl enable ceph-osd@<osd_id>
# systemctl start ceph-osd@<osd_id>
```

Example

```
# systemctl enable ceph-osd.target
# systemctl enable ceph-osd@0
# systemctl start ceph-osd@0
```

Once you start the OSD daemon, it is **up** and **in**.

Now you have the monitors and some OSDs up and running. You can watch the placement groups peer by executing the following command:

```
$ ceph -w
```

To view the OSD tree, execute the following command:

```
$ ceph osd tree
```

Example

```
ID  WEIGHT    TYPE NAME        UP/DOWN  REWEIGHT  PRIMARY-AFFINITY
-1       2    root default
```

```
-2     2      host node2
 0     1         osd.0      up      1            1
-3     1      host node3
 1     1         osd.1      up      1            1
```

To expand the storage capacity by adding new OSDs to the storage cluster, see the Adding an OSD section in the *Administration Guide* for Red Hat Ceph Storage 4.

B.3. MANUALLY INSTALLING CEPH MANAGER

Usually, the Ansible automation utility installs the Ceph Manager daemon (**ceph-mgr**) when you deploy the Red Hat Ceph Storage cluster. However, if you do not use Ansible to manage Red Hat Ceph Storage, you can install Ceph Manager manually. Red Hat recommends to colocate the Ceph Manager and Ceph Monitor daemons on a same node.

Prerequisites

- A working Red Hat Ceph Storage cluster
- **root** or **sudo** access
- The **rhceph-4-mon-for-rhel-8-x86_64-rpms** repository enabled
- Open ports **6800-7300** on the public network if firewall is used

Procedure

Use the following commands on the node where **ceph-mgr** will be deployed and as the **root** user or with the **sudo** utility.

1. Install the **ceph-mgr** package:

```
[root@node1 ~]# yum install ceph-mgr
```

2. Create the **/var/lib/ceph/mgr/ceph-*hostname*/** directory:

```
mkdir /var/lib/ceph/mgr/ceph-hostname
```

Replace *hostname* with the host name of the node where the **ceph-mgr** daemon will be deployed, for example:

```
[root@node1 ~]# mkdir /var/lib/ceph/mgr/ceph-node1
```

3. In the newly created directory, create an authentication key for the **ceph-mgr** daemon:

```
[root@node1 ~]# ceph auth get-or-create mgr.`hostname -s` mon 'allow profile mgr' osd
'allow *' mds 'allow *' -o /var/lib/ceph/mgr/ceph-node1/keyring
```

4. Change the owner and group of the **/var/lib/ceph/mgr/** directory to **ceph:ceph**:

```
[root@node1 ~]# chown -R ceph:ceph /var/lib/ceph/mgr
```

5. Enable the **ceph-mgr** target:

```
[root@node1 ~]# systemctl enable ceph-mgr.target
```

6. Enable and start the **ceph-mgr** instance:

```
systemctl enable ceph-mgr@hostname
systemctl start ceph-mgr@hostname
```

Replace *hostname* with the host name of the node where the **ceph-mgr** will be deployed, for example:

```
[root@node1 ~]# systemctl enable ceph-mgr@node1
[root@node1 ~]# systemctl start ceph-mgr@node1
```

7. Verify that the **ceph-mgr** daemon started successfully:

```
ceph -s
```

The output will include a line similar to the following one under the **services:** section:

```
    mgr: node1(active)
```

8. Install more **ceph-mgr** daemons to serve as standby daemons that become active if the current active daemon fails.

Additional resources

- *Requirements for Installing Red Hat Ceph Storage*

B.4. MANUALLY INSTALLING CEPH BLOCK DEVICE

The following procedure shows how to install and mount a thin-provisioned, resizable Ceph Block Device.

IMPORTANT

Ceph Block Devices must be deployed on separate nodes from the Ceph Monitor and OSD nodes. Running kernel clients and kernel server daemons on the same node can lead to kernel deadlocks.

Prerequisites

- Ensure to perform the tasks listed in the Section B.1, “Installing the Ceph Command Line Interface” section.
- If you use Ceph Block Devices as a back end for virtual machines (VMs) that use QEMU, increase the default file descriptor. See the Ceph - VM hangs when transferring large amounts of data to RBD disk Knowledgebase article for details.

Procedure

1. Create a Ceph Block Device user, with permissions of read-write access to the pool

```
ceph auth get-or-create client.<user_name> mon 'profile rbd' osd 'profile rbd pool=
<pool_name>' \
-o /etc/ceph/<keyring_file>
```

For example, to create a user named **rbd** and to manipulate and use block device images in a pool named **rbd**, replace **<user_name>** and **<pool_name>** with **rbd**:

```
# ceph auth get-or-create \
client.rbd mon 'profile rbd' osd 'profile rbd pool=rbd' \
-o /etc/ceph/rbd.keyring
```

See the *User Management* section in the Red Hat Ceph Storage 4 *Administration Guide* for more information about creating users.

2. Create a block device image:

```
rbd create <image_name> --size <image_size> --pool <pool_name> \
--name client.rbd --keyring /etc/ceph/rbd.keyring
```

Specify **<image_name>**, **<image_size>**, and **<pool_name>**, for example:

```
$ rbd create image1 --size 4G --pool rbd \
--name client.rbd --keyring /etc/ceph/rbd.keyring
```

WARNING

The default Ceph configuration includes the following Ceph Block Device features:

- **layering**
- **exclusive-lock**
- **object-map**
- **deep-flatten**
- **fast-diff**

If you use the kernel RBD (**krbd**) client, you may not be able to map the block device image.

To work around this problem, disable the unsupported features. Use one of the following options to do so:

- Disable the unsupported features dynamically:

  ```
  rbd feature disable <image_name> <feature_name>
  ```

  For example:

  ```
  # rbd feature disable image1 object-map deep-flatten fast-diff
  ```

- Use the **--image-feature layering** option with the **rbd create** command to enable only **layering** on newly created block device images.
- Disable the features be default in the Ceph configuration file:

  ```
  rbd_default_features = 1
  ```

This is a known issue, for details see the *Known Issues* chapter in the *Release Notes* for Red Hat Ceph Storage 4.

All these features work for users that use the user-space RBD client to access the block device images.

3. Map the newly created image to the block device:

   ```
   rbd map <image_name> --pool <pool_name>\
   --name client.rbd --keyring /etc/ceph/rbd.keyring
   ```

   For example:

```
# rbd map image1 --pool rbd --name client.rbd \
--keyring /etc/ceph/rbd.keyring
```

4. Use the block device by creating a file system:

```
mkfs.ext4 /dev/rbd/<pool_name>/<image_name>
```

Specify the pool name and the image name, for example:

```
# mkfs.ext4 /dev/rbd/rbd/image1
```

This action can take a few moments.

5. Mount the newly created file system:

```
mkdir <mount_directory>
mount /dev/rbd/<pool_name>/<image_name> <mount_directory>
```

For example:

```
# mkdir /mnt/ceph-block-device
# mount /dev/rbd/rbd/image1 /mnt/ceph-block-device
```

Additional Resources

- The *Block Device Guide* for Red Hat Ceph Storage 4.

B.5. MANUALLY INSTALLING CEPH OBJECT GATEWAY

The Ceph object gateway, also know as the RADOS gateway, is an object storage interface built on top of the **librados** API to provide applications with a RESTful gateway to Ceph storage clusters.

Prerequisites

- A running Ceph storage cluster, preferably in the **active + clean** state.
- Perform the tasks listed in Chapter 2, *Requirements for Installing Red Hat Ceph Storage* .

Procedure

1. Enable the Red Hat Ceph Storage 4 Tools repository:

```
[root@gateway ~]# subscription-manager repos --enable=rhceph-4-tools-for-rhel-8-x86_64-debug-rpms
```

2. On the Object Gateway node, install the **ceph-radosgw** package:

```
# yum install ceph-radosgw
```

3. On the initial Monitor node, do the following steps.

   a. Update the Ceph configuration file as follows:

```
[client.rgw.<obj_gw_hostname>]
host = <obj_gw_hostname>
rgw frontends = "civetweb port=80"
rgw dns name = <obj_gw_hostname>.example.com
```

Where **<obj_gw_hostname>** is a short host name of the gateway node. To view the short host name, use the **hostname -s** command.

b. Copy the updated configuration file to the new Object Gateway node and all other nodes in the Ceph storage cluster:

Syntax

```
# scp /etc/ceph/<cluster_name>.conf <user_name>@<target_host_name>:/etc/ceph
```

Example

```
# scp /etc/ceph/ceph.conf root@node1:/etc/ceph/
```

c. Copy the **<cluster_name>.client.admin.keyring** file to the new Object Gateway node:

Syntax

```
# scp /etc/ceph/<cluster_name>.client.admin.keyring
<user_name>@<target_host_name>:/etc/ceph/
```

Example

```
# scp /etc/ceph/ceph.client.admin.keyring root@node1:/etc/ceph/
```

4. On the Object Gateway node, create the data directory:

Syntax

```
# mkdir -p /var/lib/ceph/radosgw/<cluster_name>-rgw.`hostname -s`
```

Example

```
# mkdir -p /var/lib/ceph/radosgw/ceph-rgw.`hostname -s`
```

5. On the Object Gateway node, add a user and keyring to bootstrap the object gateway:

Syntax

```
# ceph auth get-or-create client.rgw.`hostname -s` osd 'allow rwx' mon 'allow rw' -o
/var/lib/ceph/radosgw/<cluster_name>-rgw.`hostname -s`/keyring
```

Example

```
# ceph auth get-or-create client.rgw.`hostname -s` osd 'allow rwx' mon 'allow rw' -o
/var/lib/ceph/radosgw/ceph-rgw.`hostname -s`/keyring
```

IMPORTANT

When you provide capabilities to the gateway key you must provide the read capability. However, providing the Monitor write capability is optional; if you provide it, the Ceph Object Gateway will be able to create pools automatically.

In such a case, ensure to specify a reasonable number of placement groups in a pool. Otherwise, the gateway uses the default number, which is most likely **not** suitable for your needs. See Ceph Placement Groups (PGs) per Pool Calculator for details.

6. On the Object Gateway node, create the **done** file:

   Syntax

   ```
   # touch /var/lib/ceph/radosgw/<cluster_name>-rgw.`hostname -s`/done
   ```

   Example

   ```
   # touch /var/lib/ceph/radosgw/ceph-rgw.`hostname -s`/done
   ```

7. On the Object Gateway node, change the owner and group permissions:

   ```
   # chown -R ceph:ceph /var/lib/ceph/radosgw
   # chown -R ceph:ceph /var/log/ceph
   # chown -R ceph:ceph /var/run/ceph
   # chown -R ceph:ceph /etc/ceph
   ```

8. For storage clusters with custom names, as **root**, add the following line:

   Syntax

   ```
   # echo "CLUSTER=<custom_cluster_name>" >> /etc/sysconfig/ceph
   ```

   Example

   ```
   # echo "CLUSTER=test123" >> /etc/sysconfig/ceph
   ```

9. On the Object Gateway node, open TCP port 80:

   ```
   # firewall-cmd --zone=public --add-port=80/tcp
   # firewall-cmd --zone=public --add-port=80/tcp --permanent
   ```

10. On the Object Gateway node, start and enable the **ceph-radosgw** process:

    Syntax

    ```
    # systemctl enable ceph-radosgw.target
    # systemctl enable ceph-radosgw@rgw.<rgw_hostname>
    # systemctl start ceph-radosgw@rgw.<rgw_hostname>
    ```

    Example

```
# systemctl enable ceph-radosgw.target
# systemctl enable ceph-radosgw@rgw.node1
# systemctl start ceph-radosgw@rgw.node1
```

Once installed, the Ceph Object Gateway automatically creates pools if the write capability is set on the Monitor. See the Pools chapter in the Storage Strategies Guide for details on creating pools manually.

Additional Resources

- The Red Hat Ceph Storage 4 *Object Gateway Configuration and Administration Guide*

APPENDIX C. OVERRIDING CEPH DEFAULT SETTINGS

Unless otherwise specified in the Ansible configuration files, Ceph uses its default settings.

Because Ansible manages the Ceph configuration file, edit the **/etc/ansible/group_vars/all.yml** file to change the Ceph configuration. Use the **ceph_conf_overrides** setting to override the default Ceph configuration.

Ansible supports the same sections as the Ceph configuration file; **[global]**, **[mon]**, **[osd]**, **[mds]**, **[rgw]**, and so on. You can also override particular instances, such as a particular Ceph Object Gateway instance. For example:

```
###################
# CONFIG OVERRIDE #
###################

ceph_conf_overrides:
  client.rgw.rgw1:
    log_file: /var/log/ceph/ceph-rgw-rgw1.log
```

NOTE

Ansible does not include braces when referring to a particular section of the Ceph configuration file. Sections and settings names are terminated with a colon.

IMPORTANT

Do not set the cluster network with the **cluster_network** parameter in the **CONFIG OVERRIDE** section because this can cause two conflicting cluster networks being set in the Ceph configuration file.

To set the cluster network, use the **cluster_network** parameter in the **CEPH CONFIGURATION** section. For details, see *Installing a Red Hat Ceph Storage cluster* in the *Red Hat Ceph Storage Installation Guide*.

APPENDIX D. IMPORTING AN EXISTING CEPH CLUSTER TO ANSIBLE

You can configure Ansible to use a cluster deployed without Ansible. For example, if you upgraded Red Hat Ceph Storage 1.3 clusters to version 2 manually, configure them to use Ansible by following this procedure:

1. After manually upgrading from version 1.3 to version 2, install and configure Ansible on the administration node.

2. Ensure that the Ansible administration node has passwordless **ssh** access to all Ceph nodes in the cluster. See Section 2.11, "Enabling password-less SSH for Ansible" for more details.

3. As **root**, create a symbolic link to the Ansible **group_vars** directory in the **/etc/ansible/** directory:

```
# ln -s /usr/share/ceph-ansible/group_vars /etc/ansible/group_vars
```

4. As **root**, create an **all.yml** file from the **all.yml.sample** file and open it for editing:

```
# cd /etc/ansible/group_vars
# cp all.yml.sample all.yml
# vim all.yml
```

5. Set the **generate_fsid** setting to **false** in **group_vars/all.yml**.

6. Get the current cluster **fsid** by executing **ceph fsid**.

7. Set the retrieved **fsid** in **group_vars/all.yml**.

8. Modify the Ansible inventory in **/etc/ansible/hosts** to include Ceph hosts. Add monitors under a **[mons]** section, OSDs under an **[osds]** section and gateways under an **[rgws]** section to identify their roles to Ansible.

9. Make sure **ceph_conf_overrides** is updated with the original **ceph.conf** options used for **[global]**, **[osd]**, **[mon]**, and **[client]** sections in the **all.yml** file.
   Options like **osd journal**, **public_network** and **cluster_network** should not be added in **ceph_conf_overrides** because they are already part of **all.yml**. Only the options that are not part of **all.yml** and are in the original **ceph.conf** should be added to **ceph_conf_overrides**.

10. From the **/usr/share/ceph-ansible/** directory run the playbook.

```
# cd /usr/share/ceph-ansible/
# ansible-playbook infrastructure-playbooks/take-over-existing-cluster.yml -u <username>
```

APPENDIX E. PURGING STORAGE CLUSTERS DEPLOYED BY ANSIBLE

If you no longer want to use a Ceph storage cluster, then use the **purge-docker-cluster.yml** playbook to remove the cluster. Purging a storage cluster is also useful when the installation process failed and you want to start over.

> **WARNING**
>
> After purging a Ceph storage cluster, all data on the OSDs is permanently lost.

Prerequisites

- Root-level access to the Ansible administration node.
- Access to the **ansible** user account.
- For **bare-metal** deployments:
  - If the **osd_auto_discovery** option in the **/usr/share/ansible/group-vars/osds.yml** file is set to **true**, then Ansible will fail to purge the storage cluster. Therefore, comment out **osd_auto_discovery** and declare the OSD devices in the **osds.yml** file.
- Ensure that the **/var/log/ansible.log** file is writable.

Procedure

1. Navigate to the **/usr/share/ceph-ansible/** directory:

```
[root@admin ~]# cd /usr/share/ceph-ansible
```

2. As the **ansible** user, run the purge playbook.
   a. For **bare-metal** deployments, use the **purge-cluster.yml** playbook to purge the Ceph storage cluster:

```
[ansible@admin ceph-ansible]$ ansible-playbook infrastructure-playbooks/purge-cluster.yml
```

   b. For **container** deployments:
      i. Use the **purge-docker-cluster.yml** playbook to purge the Ceph storage cluster:

```
[ansible@admin ceph-ansible]$ ansible-playbook infrastructure-playbooks/purge-docker-cluster.yml
```

NOTE

This playbook removes all packages, containers, configuration files, and all the data created by the Ceph Ansible playbook.

ii. To specify a different inventory file other than the default (**/etc/ansible/hosts**), use **-i** parameter:

Syntax

```
[ansible@admin ceph-ansible]$ ansible-playbook infrastructure-playbooks/purge-docker-cluster.yml -i INVENTORY_FILE
```

Replace

INVENTORY_FILE with the path to the inventory file.

Example

```
[ansible@admin ceph-ansible]$ ansible-playbook infrastructure-playbooks/purge-docker-cluster.yml -i ~/ansible/hosts
```

iii. To skip the removal of the Ceph container image, use the **--skip-tags="remove_img"** option:

```
[ansible@admin ceph-ansible]$ ansible-playbook --skip-tags="remove_img" infrastructure-playbooks/purge-docker-cluster.yml
```

iv. To skip the removal of the packages that were installed during the installation, use the **--skip-tags="with_pkg"** option:

```
[ansible@admin ceph-ansible]$ ansible-playbook --skip-tags="with_pkg" infrastructure-playbooks/purge-docker-cluster.yml
```

Additional Resources

- See the *OSD Ansbile settings* for more details.

APPENDIX F. GENERAL ANSIBLE SETTINGS

These are the most common configurable Ansible parameters. There are two sets of parameters depending on the deployment method, either bare-metal or containers.

> **NOTE**
>
> This is not an exhaustive list of all the available Ansible parameters.

Bare-metal and Containers Settings

monitor_interface

The interface that the Ceph Monitor nodes listen on.

Value

User-defined

Required

Yes

Notes

Assigning a value to at least one of the **monitor_*** parameters is required.

monitor_address

The address that the Ceph Monitor nodes listen too.

Value

User-defined

Required

Yes

Notes

Assigning a value to at least one of the **monitor_*** parameters is required.

monitor_address_block

The subnet of the Ceph public network.

Value

User-defined

Required

Yes

Notes

Use when the IP addresses of the nodes are unknown, but the subnet is known. Assigning a value to at least one of the **monitor_*** parameters is required.

ip_version

Value

ipv6

Required

Yes, if using IPv6 addressing.

public_network

The IP address and netmask of the Ceph public network, or the corresponding IPv6 address, if using IPv6.

Value

User-defined

Required

Yes

Notes

For more information, see *Verifying the Network Configuration for Red Hat Ceph Storage* .

cluster_network

The IP address and netmask of the Ceph cluster network, or the corresponding IPv6 address, if using IPv6.

Value

User-defined

Required

No

Notes

For more information, see *Verifying the Network Configuration for Red Hat Ceph Storage* .

configure_firewall

Ansible will try to configure the appropriate firewall rules.

Value

true or **false**

Required

No

journal_size

The required size of the journal in MB.

Value

User-defined

Required

No

Bare-metal-specific Settings

ceph_origin

Value

repository or **distro** or **local**

Required

Yes

Notes

The **repository** value means Ceph will be installed through a new repository. The **distro** value

means that no separate repository file will be added, and you will get whatever version of Ceph that is included with the Linux distribution. The **local** value means the Ceph binaries will be copied from the local machine.

ceph_repository_type

Value

cdn or **iso**

Required

Yes

ceph_rhcs_version

Value

4

Required

Yes

ceph_rhcs_iso_path

The full path to the ISO image.

Value

User-defined

Required

Yes, if using an ISO image.

Container-specific Settings

ceph_docker_image

Value

rhceph/rhceph-4-rhel8, or **cephimageinlocalreg**, if using a local Docker registry.

Required

Yes

containerized_deployment

Value

true

Required

Yes

ceph_docker_registry

Value

registry.redhat.io, or ***LOCAL_FQDN_NODE_NAME***, if using a local Docker registry.

Required

Yes

APPENDIX G. OSD ANSIBLE SETTINGS

These are the most common configurable OSD Ansible parameters.

devices

List of devices where Ceph's data is stored.

Value

User-defined

Required

Yes, if specifying a list of devices.

Notes

Cannot be used when **osd_auto_discovery** setting is used. When using the **devices** option, **ceph-volume lvm batch** mode creates the optimized OSD configuration.

dmcrypt

To encrypt the OSDs.

Value

true

Required

No

Notes

The default value is **false**.

lvm_volumes

A list of FileStore or BlueStore dictionaries.

Value

User-defined

Required

Yes, if storage devices are not defined using the **devices** parameter.

Notes

Each dictionary must contain a **data**, **journal** and **data_vg** keys. Any logical volume or volume group must be the name and not the full path. The **data**, and **journal** keys can be a logical volume (LV) or partition, but do not use one journal for multiple **data** LVs. The **data_vg** key must be the volume group containing the **data** LV. Optionally, the **journal_vg** key can be used to specify the volume group containing the journal LV, if applicable.

osds_per_device

The number of OSDs to create per device.

Value

User-defined

Required

No

Notes

The default value is **1**.

osd_objectstore

The Ceph object store type for the OSDs.

Value

bluestore or **filestore**

Required

No

Notes

The default value is **bluestore**. Required for upgrades.