Red Hat Ceph Storage 6

Operations Guide

Operational tasks for Red Hat Ceph Storage

Last Updated: 2024-03-29

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Abstract

This document describes how to do operational tasks for Red Hat Ceph Storage. Red Hat is committed to replacing problematic language in our code, documentation, and web properties. We are beginning with these four terms: master, slave, blacklist, and whitelist. Because of the enormity of this endeavor, these changes will be implemented gradually over several upcoming releases. For more details, see our CTO Chris Wright's message

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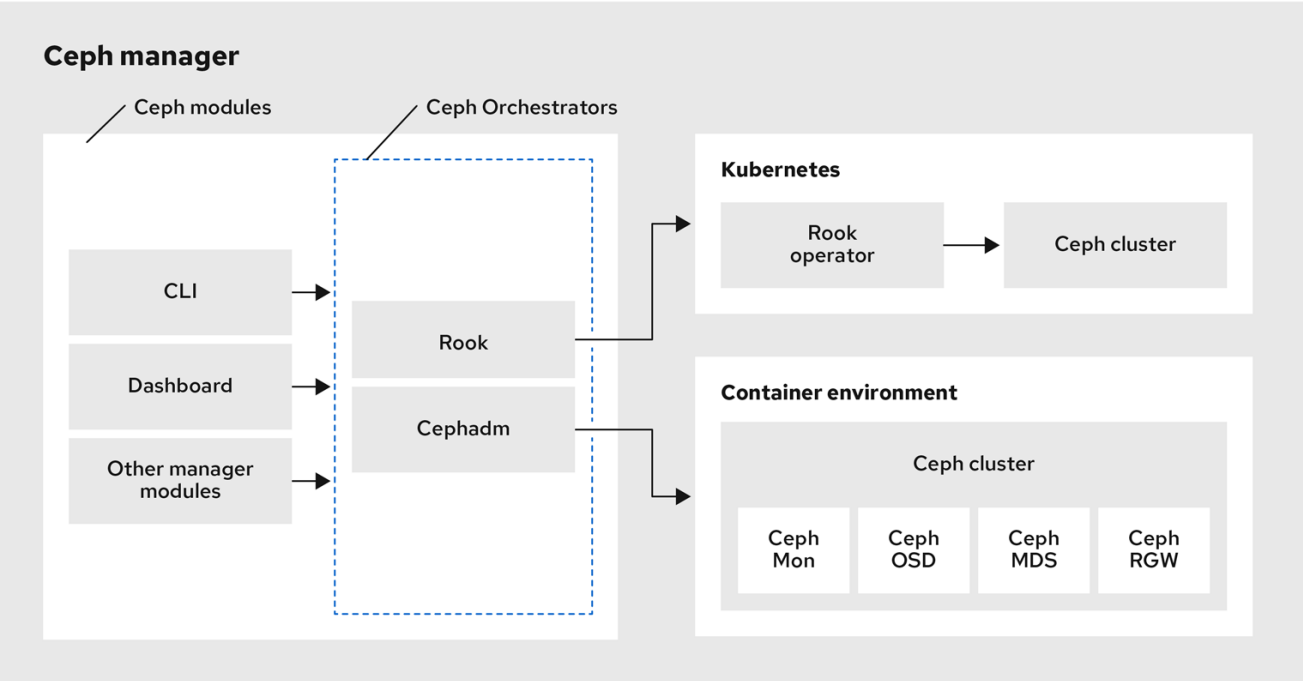
CHAPTER 1. INTRODUCTION TO THE CEPH ORCHESTRATOR

As a storage administrator, you can use the Ceph Orchestrator with Cephadm utility that provides the ability to discover devices and create services in a Red Hat Ceph Storage cluster.

1.1. USE OF THE CEPH ORCHESTRATOR

Red Hat Ceph Storage Orchestrators are manager modules that primarily act as a bridge between a Red Hat Ceph Storage cluster and deployment tools like Rook and Cephadm for a unified experience. They also integrate with the Ceph command line interface and Ceph Dashboard.

The following is a workflow diagram of Ceph Orchestrator:



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Types of Red Hat Ceph Storage Orchestrators

There are three main types of Red Hat Ceph Storage Orchestrators:

- **Orchestrator CLI** : These are common APIs used in Orchestrators and include a set of commands that can be implemented. These APIs also provide a common command line interface (CLI) to orchestrate **ceph-mgr** modules with external orchestration services. The following are the nomenclature used with the Ceph Orchestrator:
  - Host : This is the host name of the physical host and not the pod name, DNS name, container name, or host name inside the container.
  - Service type : This is the type of the service, such as nfs, mds, osd, mon, rgw, and mgr.
  - Service : A functional service provided by a Ceph storage cluster such as monitors service, managers service, OSD services, Ceph Object Gateway service, and NFS service.
  - Daemon : A specific instance of a service deployed by one or more hosts such as Ceph Object Gateway services can have different Ceph Object Gateway daemons running in three different hosts.

- **Cephadm Orchestrator** - This is a Ceph Orchestrator module that does not rely on an external tool such as Rook or Ansible, but rather manages nodes in a cluster by establishing an SSH connection and issuing explicit management commands. This module is intended for day-one and day-two operations.
  Using the Cephadm Orchestrator is the recommended way of installing a Ceph storage cluster without leveraging any deployment frameworks like Ansible. The idea is to provide the manager daemon with access to an SSH configuration and key that is able to connect to all nodes in a cluster to perform any management operations, like creating an inventory of storage devices, deploying and replacing OSDs, or starting and stopping Ceph daemons. In addition, the Cephadm Orchestrator will deploy container images managed by **systemd** in order to allow independent upgrades of co-located services.

  This orchestrator will also likely highlight a tool that encapsulates all necessary operations to manage the deployment of container image based services on the current host, including a command that bootstraps a minimal cluster running a Ceph Monitor and a Ceph Manager.

- **Rook Orchestrator** - Rook is an orchestration tool that uses the Kubernetes Rook operator to manage a Ceph storage cluster running inside a Kubernetes cluster. The rook module provides integration between Ceph's Orchestrator framework and Rook. Rook is an open source cloud-native storage operator for Kubernetes.
  Rook follows the "operator" model, in which a custom resource definition (CRD) object is defined in Kubernetes to describe a Ceph storage cluster and its desired state, and a rook operator daemon is running in a control loop that compares the current cluster state to desired state and takes steps to make them converge. The main object describing Ceph's desired state is the Ceph storage cluster CRD, which includes information about which devices should be consumed by OSDs, how many monitors should be running, and what version of Ceph should be used. Rook defines several other CRDs to describe RBD pools, CephFS file systems, and so on.

  The Rook Orchestrator module is the glue that runs in the **ceph-mgr** daemon and implements the Ceph orchestration API by making changes to the Ceph storage cluster in Kubernetes that describe desired cluster state. A Rook cluster's **ceph-mgr** daemon is running as a Kubernetes pod, and hence, the rook module can connect to the Kubernetes API without any explicit configuration.

CHAPTER 2. MANAGEMENT OF SERVICES USING THE CEPH ORCHESTRATOR

As a storage administrator, after installing the Red Hat Ceph Storage cluster, you can monitor and manage the services in a storage cluster using the Ceph Orchestrator. A service is a group of daemons that are configured together.

This section covers the following administrative information:

- *Placement specification of the Ceph Orchestrator .*
- *Deploying the Ceph daemons using the command line interface .*
- *Deploying the Ceph daemons on a subset of hosts using the command line interface .*
- *Service specification of the Ceph Orchestrator .*
- *Deploying the Ceph daemons using the service specification .*
- *Deploying the Ceph File System mirroring daemon using the service specification .*

2.1. PLACEMENT SPECIFICATION OF THE CEPH ORCHESTRATOR

You can use the Ceph Orchestrator to deploy **osds**, **mons**, **mgrs**, **mds**, and **rgw** services. Red Hat recommends deploying services using placement specifications. You need to know where and how many daemons have to be deployed to deploy a service using the Ceph Orchestrator. Placement specifications can either be passed as command line arguments or as a service specification in a **yaml** file.

There are two ways of deploying the services using the placement specification:

- Using the placement specification directly in the command line interface. For example, if you want to deploy three monitors on the hosts, running the following command deploys three monitors on **host01**, **host02**, and **host03**.

  Example

  ```
  [ceph: root@host01 /]# ceph orch apply mon --placement="3 host01 host02 host03"
  ```

- Using the placement specification in the YAML file. For example, if you want to deploy **node-exporter** on all the hosts, then you can specify the following in the **yaml** file.

  Example

  ```
  service_type: node-exporter
  placement:
  host_pattern: '*'
  extra_entrypoint_args:
    - "--collector.textfile.directory=/var/lib/node_exporter/textfile_collector2"
  ```

2.2. DEPLOYING THE CEPH DAEMONS USING THE COMMAND LINE INTERFACE

Using the Ceph Orchestrator, you can deploy the daemons such as Ceph Manager, Ceph Monitors, Ceph OSDs, monitoring stack, and others using the **ceph orch** command. Placement specification is passed as **--placement** argument with the Orchestrator commands.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the storage cluster.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Use one of the following methods to deploy the daemons on the hosts:

   - **Method 1**: Specify the number of daemons and the host names:

     Syntax

     ```
     ceph orch apply SERVICE_NAME --placement="NUMBER_OF_DAEMONS HOST_NAME_1 HOST_NAME_2 HOST_NAME_3"
     ```

     Example

     ```
     [ceph: root@host01 /]# ceph orch apply mon --placement="3 host01 host02 host03"
     ```

   - **Method 2**: Add the labels to the hosts and then deploy the daemons using the labels:

     a. Add the labels to the hosts:

        Syntax

        ```
        ceph orch host label add HOSTNAME_1 LABEL
        ```

        Example

        ```
        [ceph: root@host01 /]# ceph orch host label add host01 mon
        ```

     b. Deploy the daemons with labels:

        Syntax

        ```
        ceph orch apply DAEMON_NAME label:LABEL
        ```

        Example

        ```
        ceph orch apply mon label:mon
        ```

- **Method 3**: Add the labels to the hosts and deploy using the **--placement** argument:

  a. Add the labels to the hosts:

  Syntax

  ```
  ceph orch host label add HOSTNAME_1 LABEL
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch host label add host01 mon
  ```

  b. Deploy the daemons using the label placement specification:

  Syntax

  ```
  ceph orch apply DAEMON_NAME --placement="label:LABEL"
  ```

  Example

  ```
  ceph orch apply mon --placement="label:mon"
  ```

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ceph orch ps --service_name=SERVICE_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=mon
  [ceph: root@host01 /]# ceph orch ps --service_name=mon
  ```

Additional Resources

- See the *Adding hosts using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide*.

2.3. DEPLOYING THE CEPH DAEMONS ON A SUBSET OF HOSTS USING THE COMMAND LINE INTERFACE

You can use the **--placement** option to deploy daemons on a subset of hosts. You can specify the number of daemons in the placement specification with the name of the hosts to deploy the daemons.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. List the hosts on which you want to deploy the Ceph daemons:

   Example

   ```
   [ceph: root@host01 /]# ceph orch host ls
   ```

3. Deploy the daemons:

   Syntax

   ```
   ceph orch apply SERVICE_NAME --placement="NUMBER_OF_DAEMONS HOST_NAME_1 _HOST_NAME_2 HOST_NAME_3"
   ```

   Example

   ```
   ceph orch apply mgr --placement="2 host01 host02 host03"
   ```

   In this example, the **mgr** daemons are deployed only on two hosts.

Verification

- List the hosts:

  Example

  ```
  [ceph: root@host01 /]# ceph orch host ls
  ```

Additional Resources

- See the *Listing hosts using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide*.

2.4. SERVICE SPECIFICATION OF THE CEPH ORCHESTRATOR

A service specification is a data structure to specify the service attributes and configuration settings that is used to deploy the Ceph service. The following is an example of the multi-document YAML file, **cluster.yaml**, for specifying service specifications:

Example

```
service_type: mon
placement:
  host_pattern: "mon*"
---
service_type: mgr
placement:
  host_pattern: "mgr*"
---
service_type: osd
service_id: default_drive_group
placement:
  host_pattern: "osd*"
data_devices:
  all: true
```

The following list are the parameters where the properties of a service specification are defined as follows:

- **service_type**: The type of service:
  - Ceph services like mon, crash, mds, mgr, osd, rbd, or rbd-mirror.
  - Ceph gateway like nfs or rgw.
  - Monitoring stack like Alertmanager, Prometheus, Grafana or Node-exporter.
  - Container for custom containers.
- **service_id**: A unique name of the service.
- **placement**: This is used to define where and how to deploy the daemons.
- **unmanaged**: If set to **true**, the Orchestrator will neither deploy nor remove any daemon associated with this service.

Stateless service of Orchestrators

A stateless service is a service that does not need information of the state to be available. For example, to start an **rgw** service, additional information is not needed to start or run the service. The **rgw** service does not create information about this state in order to provide the functionality. Regardless of when the **rgw** service starts, the state is the same.

2.5. DEPLOYING THE CEPH DAEMONS USING THE SERVICE SPECIFICATION

Using the Ceph Orchestrator, you can deploy daemons such as ceph Manager, Ceph Monitors, Ceph OSDs, monitoring stack, and others using the service specification in a YAML file.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.

Procedure

1. Create the **yaml** file:

   Example

   ```
   [root@host01 ~]# touch mon.yaml
   ```

2. This file can be configured in two different ways:

   - Edit the file to include the host details in placement specification:

     Syntax

     ```
     service_type: SERVICE_NAME
     placement:
       hosts:
         - HOST_NAME_1
         - HOST_NAME_2
     ```

     Example

     ```
     service_type: mon
     placement:
       hosts:
         - host01
         - host02
         - host03
     ```

   - Edit the file to include the label details in placement specification:

     Syntax

     ```
     service_type: SERVICE_NAME
     placement:
       label: "LABEL_1"
     ```

     Example

     ```
     service_type: mon
     placement:
       label: "mon"
     ```

3. Optional: You can also use extra container arguments in the service specification files such as CPUs, CA certificates, and other files while deploying services:

   Example

   ```
   extra_container_args:
   ```

```
    - "-v"
    - "/etc/pki/ca-trust/extracted:/etc/pki/ca-trust/extracted:ro"
    - "--security-opt"
    - "label=disable"
    - "cpus=2"
    - "--collector.textfile.directory=/var/lib/node_exporter/textfile_collector2"
```

NOTE

Red Hat Ceph Storage 6.1 and later releases support the use of extra arguments to enable additional metrics in node-exporter deployed by Cephadm.

4. Mount the YAML file under a directory in the container:

   Example

   ```
   [root@host01 ~]# cephadm shell --mount mon.yaml:/var/lib/ceph/mon/mon.yaml
   ```

5. Navigate to the directory:

   Example

   ```
   [ceph: root@host01 /]# cd /var/lib/ceph/mon/
   ```

6. Deploy the Ceph daemons using service specification:

   Syntax

   ```
   ceph orch apply -i FILE_NAME.yaml
   ```

   Example

   ```
   [ceph: root@host01 mon]# ceph orch apply -i mon.yaml
   ```

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=mon
  ```

Additional Resources

- See the *Listing hosts using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide*.

2.6. DEPLOYING THE CEPH FILE SYSTEM MIRRORING DAEMON USING THE SERVICE SPECIFICATION

Ceph File System (CephFS) supports asynchronous replication of snapshots to a remote CephFS file system using the CephFS mirroring daemon (**cephfs-mirror**). Snapshot synchronization copies snapshot data to a remote CephFS, and creates a new snapshot on the remote target with the same name. Using the Ceph Orchestrator, you can deploy **cephfs-mirror** using the service specification in a YAML file.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.
- A CephFS created.

Procedure

1. Create the **yaml** file:

   #### Example

   ```
   [root@host01 ~]# touch mirror.yaml
   ```

2. Edit the file to include the following:

   #### Syntax

   ```
   service_type: cephfs-mirror
   service_name: SERVICE_NAME
   placement:
     hosts:
       - HOST_NAME_1
       - HOST_NAME_2
       - HOST_NAME_3
   ```

   #### Example

   ```
   service_type: cephfs-mirror
   service_name: cephfs-mirror
   placement:
     hosts:
       - host01
       - host02
       - host03
   ```

3. Mount the YAML file under a directory in the container:

Example

```
[root@host01 ~]# cephadm shell --mount mirror.yaml:/var/lib/ceph/mirror.yaml
```

4. Navigate to the directory:

   Example

   ```
   [ceph: root@host01 /]# cd /var/lib/ceph/
   ```

5. Deploy the **cephfs-mirror** daemon using the service specification:

   Example

   ```
   [ceph: root@host01 /]# ceph orch apply -i mirror.yaml
   ```

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- List the hosts, daemons, and processes:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=cephfs-mirror
  ```

Additional Resources

- See *Ceph File System mirrors* for more information about the **cephfs-mirror** daemon.

CHAPTER 3. MANAGEMENT OF HOSTS USING THE CEPH ORCHESTRATOR

As a storage administrator, you can use the Ceph Orchestrator with Cephadm in the backend to add, list, and remove hosts in an existing Red Hat Ceph Storage cluster.

You can also add labels to hosts. Labels are free-form and have no specific meanings. Each host can have multiple labels. For example, apply the **mon** label to all hosts that have monitor daemons deployed, **mgr** for all hosts with manager daemons deployed, **rgw** for Ceph object gateways, and so on.

Labeling all the hosts in the storage cluster helps to simplify system management tasks by allowing you to quickly identify the daemons running on each host. In addition, you can use the Ceph Orchestrator or a YAML file to deploy or remove daemons on hosts that have specific host labels.

This section covers the following administrative tasks:

- *Adding hosts using the Ceph Orchestrator*.
- *Adding multiple hosts using the Ceph Orchestrator*.
- *Listing hosts using the Ceph Orchestrator*.
- *Adding a label to a host*.
- *Removing a label from a host*.
- *Removing hosts using the Ceph Orchestrator*.
- *Placing hosts in the maintenance mode using the Ceph Orchestrator*.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.
- The IP addresses of the new hosts should be updated in **/etc/hosts** file.

3.1. ADDING HOSTS USING THE CEPH ORCHESTRATOR

You can use the Ceph Orchestrator with Cephadm in the backend to add hosts to an existing Red Hat Ceph Storage cluster.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all nodes in the storage cluster.
- Register the nodes to the CDN and attach subscriptions.
- Ansible user with sudo and passwordless **ssh** access to all nodes in the storage cluster.

Procedure

1. From the Ceph administration node, log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Extract the cluster's public SSH keys to a folder:

   Syntax

   ```
   ceph cephadm get-pub-key > ~/PATH
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph cephadm get-pub-key > ~/ceph.pub
   ```

3. Copy Ceph cluster's public SSH keys to the root user's **authorized_keys** file on the new host:

   Syntax

   ```
   ssh-copy-id -f -i ~/PATH root@HOST_NAME_2
   ```

   Example

   ```
   [ceph: root@host01 /]# ssh-copy-id -f -i ~/ceph.pub root@host02
   ```

4. From the Ansible administration node, add the new host to the Ansible inventory file. The default location for the file is **/usr/share/cephadm-ansible/hosts**. The following example shows the structure of a typical inventory file:

   Example

   ```
   host01
   host02
   host03

   [admin]
   host00
   ```

   NOTE

   If you have previously added the new host to the Ansible inventory file and run the preflight playbook on the host, skip to step 6.

5. Run the preflight playbook with the **--limit** option:

   Syntax

   ```
   ansible-playbook -i INVENTORY_FILE cephadm-preflight.yml --extra-vars
   "ceph_origin=rhcs,ceph_rhcs_version=6" --limit NEWHOST
   ```

Example

```
[ceph-admin@admin cephadm-ansible]$ ansible-playbook -i hosts cephadm-preflight.yml --extra-vars "ceph_origin=rhcs,ceph_rhcs_version=6" --limit host02
```

The preflight playbook installs **podman**, **lvm2**, **chronyd**, and **cephadm** on the new host. After installation is complete, **cephadm** resides in the **/usr/sbin/** directory.

6. From the Ceph administration node, log into the Cephadm shell:

Example

```
[root@host01 ~]# cephadm shell
```

7. Use the **cephadm** orchestrator to add hosts to the storage cluster:

Syntax

```
ceph orch host add HOST_NAME IP_ADDRESS_OF_HOST [--label=LABEL_NAME_1,LABEL_NAME_2]
```

The **--label** option is optional and this adds the labels when adding the hosts. You can add multiple labels to the host.

Example

```
[ceph: root@host01 /]# ceph orch host add host02 10.10.128.70 --labels=mon,mgr
```

Verification

- List the hosts:

Example

```
[ceph: root@host01 /]# ceph orch host ls
```

Additional Resources

- See the *Listing hosts using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide*.
- For more information about the **cephadm-preflight** playbook, see *Running the preflight playbook* section in the *Red Hat Ceph Storage Installation Guide*.
- See the *Registering Red Hat Ceph Storage nodes to the CDN and attaching subscriptions* section in the *Red Hat Ceph Storage Installation Guide*.
- See the *Creating an Ansible user with sudo access* section in the *Red Hat Ceph Storage Installation Guide*.

3.2. ADDING MULTIPLE HOSTS USING THE CEPH ORCHESTRATOR

You can use the Ceph Orchestrator to add multiple hosts to a Red Hat Ceph Storage cluster at the same time using the service specification in YAML file format.

Prerequisites

- A running Red Hat Ceph Storage cluster.

Procedure

1. Create the **hosts.yaml** file:

   #### Example

   ```
   [root@host01 ~]# touch hosts.yaml
   ```

2. Edit the **hosts.yaml** file to include the following details:

   #### Example

   ```
   service_type: host
   addr: host01
   hostname: host01
   labels:
   - mon
   - osd
   - mgr
   ---
   service_type: host
   addr: host02
   hostname: host02
   labels:
   - mon
   - osd
   - mgr
   ---
   service_type: host
   addr: host03
   hostname: host03
   labels:
   - mon
   - osd
   ```

3. Mount the YAML file under a directory in the container:

   #### Example

   ```
   [root@host01 ~]# cephadm shell --mount hosts.yaml:/var/lib/ceph/hosts.yaml
   ```

4. Navigate to the directory:

   #### Example

   ```
   [ceph: root@host01 /]# cd /var/lib/ceph/
   ```

5. Deploy the hosts using service specification:

   Syntax

   ```
   ceph orch apply -i FILE_NAME.yaml
   ```

   Example

   ```
   [ceph: root@host01 hosts]# ceph orch apply -i hosts.yaml
   ```

Verification

- List the hosts:

  Example

  ```
  [ceph: root@host01 /]# ceph orch host ls
  ```

Additional Resources

- See the *Listing hosts using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide*.

3.3. LISTING HOSTS USING THE CEPH ORCHESTRATOR

You can list hosts of a Ceph cluster with Ceph Orchestrators.

NOTE

The *STATUS* of the hosts is blank, in the output of the **ceph orch host ls** command.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the storage cluster.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. List the hosts of the cluster:

   Example

   ```
   [ceph: root@host01 /]# ceph orch host ls
   ```

You will see that the *STATUS* of the hosts is blank which is expected.

3.4. ADDING A LABEL TO A HOST

Use the Ceph Orchestrator to add a label to a host. Labels can be used to specify placement of daemons.

A few examples of labels are **mgr**, **mon**, and **osd** based on the service deployed on the hosts. Each host can have multiple labels.

You can also add the following host labels that have special meaning to **cephadm** and they begin with **_**:

- **_no_schedule**: This label prevents **cephadm** from scheduling or deploying daemons on the host. If it is added to an existing host that already contains Ceph daemons, it causes **cephadm** to move those daemons elsewhere, except OSDs which are not removed automatically. When a host is added with the **_no_schedule** label, no daemons are deployed on it. When the daemons are drained before the host is removed, the **_no_schedule** label is set on that host.
- **_no_autotune_memory**: This label does not autotune memory on the host. It prevents the daemon memory from being tuned even when the **osd_memory_target_autotune** option or other similar options are enabled for one or more daemons on that host.
- **_admin**: By default, the **_admin** label is applied to the bootstrapped host in the storage cluster and the **client.admin** key is set to be distributed to that host with the **ceph orch client-keyring {ls|set|rm}** function. Adding this label to additional hosts normally causes **cephadm** to deploy configuration and keyring files in the **/etc/ceph** directory.

Prerequisites

- A storage cluster that has been installed and bootstrapped.
- Root-level access to all nodes in the storage cluster.
- Hosts are added to the storage cluster.

Procedure

1. Log in to the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Add a label to a host:

   Syntax

   ```
   ceph orch host label add HOSTNAME LABEL
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph orch host label add host02 mon
   ```

Verification

- List the hosts:

  Example

  ```
  [ceph: root@host01 /]# ceph orch host ls
  ```

3.5. REMOVING A LABEL FROM A HOST

You can use the Ceph orchestrator to remove a label from a host.

Prerequisites

- A storage cluster that has been installed and bootstrapped.
- Root-level access to all nodes in the storage cluster.

Procedure

1. Launch the **cephadm** shell:

   ```
   [root@host01 ~]# cephadm shell
   [ceph: root@host01 /]#
   ```

2. Remove the label.

   Syntax

   ```
   ceph orch host label rm HOSTNAME LABEL
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph orch host label rm host02 mon
   ```

Verification

- List the hosts:

  Example

  ```
  [ceph: root@host01 /]# ceph orch host ls
  ```

3.6. REMOVING HOSTS USING THE CEPH ORCHESTRATOR

You can remove hosts of a Ceph cluster with the Ceph Orchestrators. All the daemons are removed with the **drain** option which adds the **_no_schedule** label to ensure that you cannot deploy any daemons or a cluster till the operation is complete.

IMPORTANT

If you are removing the bootstrap host, be sure to copy the admin keyring and the configuration file to another host in the storage cluster before you remove the host.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.
- Hosts are added to the storage cluster.
- All the services are deployed.
- Cephadm is deployed on the nodes where the services have to be removed.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Fetch the host details:

   Example

   ```
   [ceph: root@host01 /]# ceph orch host ls
   ```

3. Drain all the daemons from the host:

   Syntax

   ```
   ceph orch host drain HOSTNAME
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph orch host drain host02
   ```

   The **_no_schedule** label is automatically applied to the host which blocks deployment.

4. Check the status of OSD removal:

   Example

   ```
   [ceph: root@host01 /]# ceph orch osd rm status
   ```

   When no placement groups (PG) are left on the OSD, the OSD is decommissioned and removed from the storage cluster.

5. Check if all the daemons are removed from the storage cluster:

Syntax

```
ceph orch ps HOSTNAME
```

Example

```
[ceph: root@host01 /]# ceph orch ps host02
```

6. Remove the host:

Syntax

```
ceph orch host rm HOSTNAME
```

Example

```
[ceph: root@host01 /]# ceph orch host rm host02
```

Additional Resources

- See the *Adding hosts using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide* for more information.
- See the *Listing hosts using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide* for more information.

3.7. PLACING HOSTS IN THE MAINTENANCE MODE USING THE CEPH ORCHESTRATOR

You can use the Ceph Orchestrator to place the hosts in and out of the maintenance mode. The **ceph orch host maintenance enter** command stops the **systemd target** which causes all the Ceph daemons to stop on the host. Similarly, the **ceph orch host maintenance exit** command restarts the **systemd target** and the Ceph daemons restart on their own.

The orchestrator adopts the following workflow when the host is placed in maintenance:

1. Confirms the removal of hosts does not impact data availability by running the **orch host ok-to-stop** command.
2. If the host has Ceph OSD daemons, it applies **noout** to the host subtree to prevent data migration from triggering during the planned maintenance slot.
3. Stops the Ceph target, thereby, stopping all the daemons.
4. Disables the **ceph target** on the host, to prevent a reboot from automatically starting Ceph services.

Exiting maintenance reverses the above sequence.

Prerequisites

- A running Red Hat Ceph Storage cluster.

- Root-level access to all the nodes.
- Hosts added to the cluster.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. You can either place the host in maintenance mode or place it out of the maintenance mode:

   - Place the host in maintenance mode:

     Syntax

     ```
     ceph orch host maintenance enter HOST_NAME [--force]
     ```

     Example

     ```
     [ceph: root@host01 /]# ceph orch host maintenance enter host02 --force
     ```

     The **--force** flag allows the user to bypass warnings, but not alerts.

   - Place the host out of the maintenance mode:

     Syntax

     ```
     ceph orch host maintenance exit HOST_NAME
     ```

     Example

     ```
     [ceph: root@host01 /]# ceph orch host maintenance exit host02
     ```

Verification

- List the hosts:

  Example

  ```
  [ceph: root@host01 /]# ceph orch host ls
  ```

CHAPTER 4. MANAGEMENT OF MONITORS USING THE CEPH ORCHESTRATOR

As a storage administrator, you can deploy additional monitors using placement specification, add monitors using service specification, add monitors to a subnet configuration, and add monitors to specific hosts. Apart from this, you can remove the monitors using the Ceph Orchestrator.

By default, a typical Red Hat Ceph Storage cluster has three or five monitor daemons deployed on different hosts.

Red Hat recommends deploying five monitors if there are five or more nodes in a cluster.

NOTE

Red Hat recommends deploying three monitors when Ceph is deployed with the OSP director.

Ceph deploys monitor daemons automatically as the cluster grows, and scales back monitor daemons automatically as the cluster shrinks. The smooth execution of this automatic growing and shrinking depends upon proper subnet configuration.

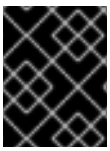
If your monitor nodes or your entire cluster are located on a single subnet, then Cephadm automatically adds up to five monitor daemons as you add new hosts to the cluster. Cephadm automatically configures the monitor daemons on the new hosts. The new hosts reside on the same subnet as the bootstrapped host in the storage cluster.

Cephadm can also deploy and scale monitors to correspond to changes in the size of the storage cluster.

4.1. CEPH MONITORS

Ceph Monitors are lightweight processes that maintain a master copy of the storage cluster map. All Ceph clients contact a Ceph monitor and retrieve the current copy of the storage cluster map, enabling clients to bind to a pool and read and write data.

Ceph Monitors use a variation of the Paxos protocol to establish consensus about maps and other critical information across the storage cluster. Due to the nature of Paxos, Ceph requires a majority of monitors running to establish a quorum, thus establishing consensus.



IMPORTANT

Red Hat requires at least three monitors on separate hosts to receive support for a production cluster.

Red Hat recommends deploying an odd number of monitors. An odd number of Ceph Monitors has a higher resilience to failures than an even number of monitors. For example, to maintain a quorum on a two-monitor deployment, Ceph cannot tolerate any failures; with three monitors, one failure; with four monitors, one failure; with five monitors, two failures. This is why an odd number is advisable. Summarizing, Ceph needs a majority of monitors to be running and to be able to communicate with each other, two out of three, three out of four, and so on.

For an initial deployment of a multi-node Ceph storage cluster, Red Hat requires three monitors, increasing the number two at a time if a valid need for more than three monitors exists.

Since Ceph Monitors are lightweight, it is possible to run them on the same host as OpenStack nodes. However, Red Hat recommends running monitors on separate hosts.

IMPORTANT

Red Hat ONLY supports collocating Ceph services in containerized environments.

When you remove monitors from a storage cluster, consider that Ceph Monitors use the Paxos protocol to establish a consensus about the master storage cluster map. You must have a sufficient number of Ceph Monitors to establish a quorum.

Additional Resources

- See the Red Hat Ceph Storage *Supported configurations* Knowledgebase article for all the supported Ceph configurations.

4.2. CONFIGURING MONITOR ELECTION STRATEGY

The monitor election strategy identifies the net splits and handles failures. You can configure the election monitor strategy in three different modes:

1. **classic** - This is the default mode in which the lowest ranked monitor is voted based on the elector module between the two sites.

2. **disallow** - This mode lets you mark monitors as disallowed, in which case they will participate in the quorum and serve clients, but cannot be an elected leader. This lets you add monitors to a list of disallowed leaders. If a monitor is in the disallowed list, it will always defer to another monitor.

3. **connectivity** - This mode is mainly used to resolve network discrepancies. It evaluates connection scores, based on pings that check liveness, provided by each monitor for its peers and elects the most connected and reliable monitor to be the leader. This mode is designed to handle net splits, which may happen if your cluster is stretched across multiple data centers or otherwise susceptible. This mode incorporates connection score ratings and elects the monitor with the best score. If a specific monitor is desired to be the leader, configure the election strategy so that the specific monitor is the first monitor in the list with a rank of **0**.

Red Hat recommends you to stay in the **classic** mode unless you require features in the other modes.

Before constructing the cluster, change the **election_strategy** to **classic**, **disallow**, or **connectivity** in the following command:

Syntax

```
ceph mon set election_strategy {classic|disallow|connectivity}
```

4.3. DEPLOYING THE CEPH MONITOR DAEMONS USING THE COMMAND LINE INTERFACE

The Ceph Orchestrator deploys one monitor daemon by default. You can deploy additional monitor daemons by using the **placement** specification in the command line interface. To deploy a different number of monitor daemons, specify a different number. If you do not specify the hosts where the

monitor daemons should be deployed, the Ceph Orchestrator randomly selects the hosts and deploys the monitor daemons to them.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. There are four different ways of deploying Ceph monitor daemons:

Method 1

- Use placement specification to deploy monitors on hosts:

NOTE

Red Hat recommends that you use the **--placement** option to deploy on specific hosts.

Syntax

```
ceph orch apply mon --placement="HOST_NAME_1 HOST_NAME_2 HOST_NAME_3"
```

Example

```
[ceph: root@host01 /]# ceph orch apply mon --placement="host01 host02 host03"
```

NOTE

Be sure to include the bootstrap node as the first node in the command.

IMPORTANT

Do not add the monitors individually as **ceph orch apply mon** supersedes and will not add the monitors to all the hosts. For example, if you run the following commands, then the first command creates a monitor on **host01**. Then the second command supersedes the monitor on host1 and creates a monitor on **host02**. Then the third command supersedes the monitor on **host02** and creates a monitor on **host03**. Eventually, there is a monitor only on the third host.

```
# ceph orch apply mon host01
# ceph orch apply mon host02
# ceph orch apply mon host03
```

Method 2

- Use placement specification to deploy specific number of monitors on specific hosts with labels:

  a. Add the labels to the hosts:

  Syntax

  ```
  ceph orch host label add HOSTNAME_1 LABEL
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch host label add host01 mon
  ```

  b. Deploy the daemons:

  Syntax

  ```
  ceph orch apply mon --placement="HOST_NAME_1:mon HOST_NAME_2:mon HOST_NAME_3:mon"
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch apply mon --placement="host01:mon host02:mon host03:mon"
  ```

Method 3

- Use placement specification to deploy specific number of monitors on specific hosts:

  Syntax

  ```
  ceph orch apply mon --placement="NUMBER_OF_DAEMONS HOST_NAME_1 HOST_NAME_2 HOST_NAME_3"
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch apply mon --placement="3 host01 host02 host03"
  ```

Method 4

- Deploy monitor daemons randomly on the hosts in the storage cluster:

  Syntax

  ```
  ceph orch apply mon NUMBER_OF_DAEMONS
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch apply mon 3
  ```

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=mon
  ```

4.4. DEPLOYING THE CEPH MONITOR DAEMONS USING THE SERVICE SPECIFICATION

The Ceph Orchestrator deploys one monitor daemon by default. You can deploy additional monitor daemons by using the service specification, like a YAML format file.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.

Procedure

1. Create the **mon.yaml** file:

   Example

   ```
   [root@host01 ~]# touch mon.yaml
   ```

2. Edit the **mon.yaml** file to include the following details:

   Syntax

   ```
   service_type: mon
   placement:
     hosts:
       - HOST_NAME_1
       - HOST_NAME_2
   ```

   Example

   ```
   service_type: mon
   placement:
   ```

```
hosts:
  - host01
  - host02
```

3. Mount the YAML file under a directory in the container:

   Example

   ```
   [root@host01 ~]# cephadm shell --mount mon.yaml:/var/lib/ceph/mon/mon.yaml
   ```

4. Navigate to the directory:

   Example

   ```
   [ceph: root@host01 /]# cd /var/lib/ceph/mon/
   ```

5. Deploy the monitor daemons:

   Syntax

   ```
   ceph orch apply -i FILE_NAME.yaml
   ```

   Example

   ```
   [ceph: root@host01 mon]# ceph orch apply -i mon.yaml
   ```

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=mon
  ```

4.5. DEPLOYING THE MONITOR DAEMONS ON SPECIFIC NETWORK USING THE CEPH ORCHESTRATOR

The Ceph Orchestrator deploys one monitor daemon by default. You can explicitly specify the IP address or CIDR network for each monitor and control where each monitor is placed.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Disable automated monitor deployment:

   Example

   ```
   [ceph: root@host01 /]# ceph orch apply mon --unmanaged
   ```

3. Deploy monitors on hosts on specific network:

   Syntax

   ```
   ceph orch daemon add mon HOST_NAME_1:IP_OR_NETWORK
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph orch daemon add mon host03:10.1.2.123
   ```

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=mon
  ```

4.6. REMOVING THE MONITOR DAEMONS USING THE CEPH ORCHESTRATOR

To remove the monitor daemons from the host, you can just redeploy the monitor daemons on other hosts.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- At least one monitor daemon deployed on the hosts.

Procedure

1. Log into the Cephadm shell:

   #### Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Run the **ceph orch apply** command to deploy the required monitor daemons:

   #### Syntax

   ```
   ceph orch apply mon "NUMBER_OF_DAEMONS HOST_NAME_1 HOST_NAME_3"
   ```

   If you want to remove monitor daemons from **host02**, then you can redeploy the monitors on other hosts.

   #### Example

   ```
   [ceph: root@host01 /]# ceph orch apply mon "2 host01 host03"
   ```

Verification

- List the hosts,daemons, and processes:

  #### Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

  #### Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=mon
  ```

Additional Resources

- See *Deploying the Ceph monitor daemons using the command line interface* section in the *Red Hat Ceph Storage Operations Guide* for more information.
- See *Deploying the Ceph monitor daemons using the service specification* section in the *Red Hat Ceph Storage Operations Guide* for more information.

4.7. REMOVING A CEPH MONITOR FROM AN UNHEALTHY STORAGE CLUSTER

You can remove a **ceph-mon** daemon from an unhealthy storage cluster. An unhealthy storage cluster is one that has placement groups persistently in not **active + clean** state.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to the Ceph Monitor node.
- At least one running Ceph Monitor node.

Procedure

1. Identify a surviving monitor and log into the host:

   Syntax

   ```
   ssh root@MONITOR_ID
   ```

   Example

   ```
   [root@admin ~]# ssh root@host00
   ```

2. Log in to each Ceph Monitor host and stop all the Ceph Monitors:

   Syntax

   ```
   cephadm unit --name DAEMON_NAME.HOSTNAME stop
   ```

   Example

   ```
   [root@host00 ~]# cephadm unit --name mon.host00 stop
   ```

3. Set up the environment suitable for extended daemon maintenance and to run the daemon interactively:

   Syntax

   ```
   cephadm shell --name DAEMON_NAME.HOSTNAME
   ```

   Example

   ```
   [root@host00 ~]# cephadm shell --name mon.host00
   ```

4. Extract a copy of the **monmap** file:

   Syntax

```
ceph-mon -i HOSTNAME --extract-monmap TEMP_PATH
```

Example

```
[ceph: root@host00 /]# ceph-mon -i host01 --extract-monmap /tmp/monmap

2022-01-05T11:13:24.440+0000 7f7603bd1700 -1 wrote monmap to /tmp/monmap
```

5. Remove the non-surviving Ceph Monitor(s):

Syntax

```
monmaptool TEMPORARY_PATH --rm HOSTNAME
```

Example

```
[ceph: root@host00 /]# monmaptool /tmp/monmap --rm host01
```

6. Inject the surviving monitor map with the removed monitor(s) into the surviving Ceph Monitor:

Syntax

```
ceph-mon -i HOSTNAME --inject-monmap TEMP_PATH
```

Example

```
[ceph: root@host00 /]# ceph-mon -i host00 --inject-monmap /tmp/monmap
```

7. Start only the surviving monitors:

Syntax

```
cephadm unit --name DAEMON_NAME.HOSTNAME start
```

Example

```
[root@host00 ~]# cephadm unit --name mon.host00 start
```

8. Verify the monitors form a quorum:

Example

```
[ceph: root@host00 /]# ceph -s
```

9. Optional: Archive the removed Ceph Monitor's data directory in **/var/lib/ceph/*CLUSTER_FSID*/mon.*HOSTNAME*** directory.

CHAPTER 5. MANAGEMENT OF MANAGERS USING THE CEPH ORCHESTRATOR

As a storage administrator, you can use the Ceph Orchestrator to deploy additional manager daemons. Cephadm automatically installs a manager daemon on the bootstrap node during the bootstrapping process.

In general, you should set up a Ceph Manager on each of the hosts running the Ceph Monitor daemon to achieve same level of availability.

By default, whichever **ceph-mgr** instance comes up first is made active by the Ceph Monitors, and others are standby managers. There is no requirement that there should be a quorum among the **ceph-mgr** daemons.

If the active daemon fails to send a beacon to the monitors for more than the **mon mgr beacon grace**, then it is replaced by a standby.

If you want to pre-empt failover, you can explicitly mark a **ceph-mgr** daemon as failed with **ceph mgr fail MANAGER_NAME** command.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.
- Hosts are added to the cluster.

5.1. DEPLOYING THE MANAGER DAEMONS USING THE CEPH ORCHESTRATOR

The Ceph Orchestrator deploys two Manager daemons by default. You can deploy additional manager daemons using the **placement** specification in the command line interface. To deploy a different number of Manager daemons, specify a different number. If you do not specify the hosts where the Manager daemons should be deployed, the Ceph Orchestrator randomly selects the hosts and deploys the Manager daemons to them.

NOTE

Ensure your deployment has at least three Ceph Managers in each deployment.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.

Procedure

1. Log into the Cephadm shell:

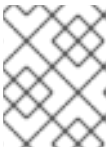
   Example

```
[root@host01 ~]# cephadm shell
```

2. You can deploy manager daemons in two different ways:

Method 1

- Deploy manager daemons using placement specification on specific set of hosts:



NOTE

Red Hat recommends that you use the **--placement** option to deploy on specific hosts.

Syntax

```
ceph orch apply mgr --placement=" HOST_NAME_1 HOST_NAME_2 HOST_NAME_3"
```

Example

```
[ceph: root@host01 /]# ceph orch apply mgr --placement="host01 host02 host03"
```

Method 2

- Deploy manager daemons randomly on the hosts in the storage cluster:

Syntax

```
ceph orch apply mgr NUMBER_OF_DAEMONS
```

Example

```
[ceph: root@host01 /]# ceph orch apply mgr 3
```

Verification

- List the service:

Example

```
[ceph: root@host01 /]# ceph orch ls
```

- List the hosts, daemons, and processes:

Syntax

```
ceph orch ps --daemon_type=DAEMON_NAME
```

Example

```
[ceph: root@host01 /]# ceph orch ps --daemon_type=mgr
```

5.2. REMOVING THE MANAGER DAEMONS USING THE CEPH ORCHESTRATOR

To remove the manager daemons from the host, you can just redeploy the daemons on other hosts.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.
- Hosts are added to the cluster.
- At least one manager daemon deployed on the hosts.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Run the **ceph orch apply** command to redeploy the required manager daemons:

   Syntax

   ```
   ceph orch apply mgr "NUMBER_OF_DAEMONS HOST_NAME_1 HOST_NAME_3"
   ```

   If you want to remove manager daemons from **host02**, then you can redeploy the manager daemons on other hosts.

   Example

   ```
   [ceph: root@host01 /]# ceph orch apply mgr "2 host01 host03"
   ```

Verification

- List the hosts,daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=mgr
  ```

Additional Resources

- See *Deploying the manager daemons using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide* for more information.

5.3. USING THE CEPH MANAGER MODULES

Use the **ceph mgr module ls** command to see the available modules and the modules that are presently enabled.

Enable or disable modules with **ceph mgr module enable MODULE** command or **ceph mgr module disable MODULE** command respectively.

If a module is enabled, then the active **ceph-mgr** daemon loads and executes it. In the case of modules that provide a service, such as an HTTP server, the module might publish its address when it is loaded. To see the addresses of such modules, run the **ceph mgr services** command.

Some modules might also implement a special standby mode which runs on standby **ceph-mgr** daemon as well as the active daemon. This enables modules that provide services to redirect their clients to the active daemon, if the client tries to connect to a standby.

Following is an example to enable the dashboard module:

```
[ceph: root@host01 /]# ceph mgr module enable dashboard

[ceph: root@host01 /]# ceph mgr module ls

MODULE
balancer              on (always on)
crash                 on (always on)
devicehealth          on (always on)
orchestrator          on (always on)
pg_autoscaler         on (always on)
progress              on (always on)
rbd_support           on (always on)
status                on (always on)
telemetry             on (always on)
volumes               on (always on)
cephadm               on
dashboard             on
iostat                on
nfs                   on
prometheus            on
restful               on
alerts                -
diskprediction_local  -
influx                -
insights              -
k8sevents             -
localpool             -
mds_autoscaler        -
mirroring             -
osd_perf_query        -
osd_support           -
rgw                   -
rook                  -
selftest              -
snap_schedule         -
stats                 -
telegraf              -
test_orchestrator     -
```

```
zabbix                -

[ceph: root@host01 /]# ceph mgr services
{
        "dashboard": "http://myserver.com:7789/",
        "restful": "https://myserver.com:8789/"
}
```

The first time the cluster starts, it uses the **mgr_initial_modules** setting to override which modules to enable. However, this setting is ignored through the rest of the lifetime of the cluster: only use it for bootstrapping. For example, before starting your monitor daemons for the first time, you might add a section like this to your **ceph.conf** file:

```
[mon]
    mgr initial modules = dashboard balancer
```

Where a module implements comment line hooks, the commands are accessible as ordinary Ceph commands and Ceph automatically incorporates module commands into the standard CLI interface and route them appropriately to the module:

```
[ceph: root@host01 /]# ceph <command | help>
```

You can use the following configuration parameters with the above command:

Table 5.1. Configuration parameters

Configuration	Description	Type	Default
mgr module path	Path to load modules from.	String	**"<library dir>/mgr"**
mgr data	Path to load daemon data (such as keyring)	String	**"/var/lib/ceph/mgr/$cluster-$id"**
mgr tick period	How many seconds between manager beacons to monitors, and other periodic checks.	Integer	**5**
mon mgr beacon grace	How long after last beacon should a manager be considered failed.	Integer	**30**

5.4. USING THE CEPH MANAGER BALANCER MODULE

The balancer is a module for Ceph Manager (**ceph-mgr**) that optimizes the placement of placement groups (PGs) across OSDs in order to achieve a balanced distribution, either automatically or in a supervised fashion.

Currently the balancer module cannot be disabled. It can only be turned off to customize the configuration.

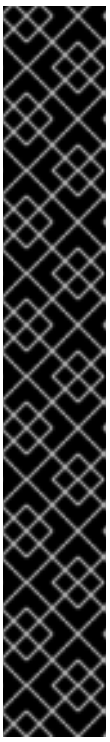
Modes

There are currently two supported balancer modes:

- **crush-compat**: The CRUSH compat mode uses the compat **weight-set** feature, introduced in Ceph Luminous, to manage an alternative set of weights for devices in the CRUSH hierarchy. The normal weights should remain set to the size of the device to reflect the target amount of data that you want to store on the device. The balancer then optimizes the **weight-set** values, adjusting them up or down in small increments in order to achieve a distribution that matches the target distribution as closely as possible. Because PG placement is a pseudorandom process, there is a natural amount of variation in the placement; by optimizing the weights, the balancer counter-acts that natural variation.
  This mode is fully backwards compatible with older clients. When an OSDMap and CRUSH map are shared with older clients, the balancer presents the optimized weightsff as the real weights.

  The primary restriction of this mode is that the balancer cannot handle multiple CRUSH hierarchies with different placement rules if the subtrees of the hierarchy share any OSDs. Because this configuration makes managing space utilization on the shared OSDs difficult, it is generally not recommended. As such, this restriction is normally not an issue.

- **upmap**: Starting with Luminous, the OSDMap can store explicit mappings for individual OSDs as exceptions to the normal CRUSH placement calculation. These **upmap** entries provide fine-grained control over the PG mapping. This CRUSH mode will optimize the placement of individual PGs in order to achieve a balanced distribution. In most cases, this distribution is "perfect", with an equal number of PGs on each OSD +/-1 PG, as they might not divide evenly.



IMPORTANT

To allow use of this feature, you must tell the cluster that it only needs to support luminous or later clients with the following command:

```
[ceph: root@host01 /]# ceph osd set-require-min-compat-client luminous
```

This command fails if any pre-luminous clients or daemons are connected to the monitors.

Due to a known issue, kernel CephFS clients report themselves as jewel clients. To work around this issue, use the **--yes-i-really-mean-it** flag:

```
[ceph: root@host01 /]# ceph osd set-require-min-compat-client luminous --
yes-i-really-mean-it
```

You can check what client versions are in use with:

```
[ceph: root@host01 /]# ceph features
```

Prerequisites

- A running Red Hat Ceph Storage cluster.

Procedure

1. Ensure the balancer module is enabled:

   Example

   ```
   [ceph: root@host01 /]# ceph mgr module enable balancer
   ```

2. Turn on the balancer module:

   Example

   ```
   [ceph: root@host01 /]# ceph balancer on
   ```

3. The default mode is **upmap**. The mode can be changed with:

   Example

   ```
   [ceph: root@host01 /]# ceph balancer mode crush-compat
   ```

   or

   Example

   ```
   [ceph: root@host01 /]# ceph balancer mode upmap
   ```

Status

The current status of the balancer can be checked at any time with:

Example

```
[ceph: root@host01 /]# ceph balancer status
```

Automatic balancing

By default, when turning on the balancer module, automatic balancing is used:

Example

```
[ceph: root@host01 /]# ceph balancer on
```

The balancer can be turned back off again with:

Example

```
[ceph: root@host01 /]# ceph balancer off
```

This will use the **crush-compat** mode, which is backward compatible with older clients and will make small changes to the data distribution over time to ensure that OSDs are equally utilized.

Throttling

No adjustments will be made to the PG distribution if the cluster is degraded, for example, if an OSD has failed and the system has not yet healed itself.

When the cluster is healthy, the balancer throttles its changes such that the percentage of PGs that are misplaced, or need to be moved, is below a threshold of 5% by default. This percentage can be adjusted using the **target_max_misplaced_ratio** setting. For example, to increase the threshold to 7%:

Example

```
[ceph: root@host01 /]# ceph config-key set mgr target_max_misplaced_ratio .07
```

Automatic balancing

By default, when turning on the balancer module, automatic balancing is used:

Example

```
[ceph: root@host01 /]# ceph balancer on
```

The balancer can be turned back off again with:

Example

```
[ceph: root@host01 /]# ceph balancer off
```

This will use the **crush-compat** mode, which is backward compatible with older clients and will make small changes to the data distribution over time to ensure that OSDs are equally utilized.

Throttling

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Example

```
[ceph: root@host01 /]# ceph config-key set mgr target_max_misplaced_ratio .07
```

For automatic balancing:

- Set the number of seconds to sleep in between runs of the automatic balancer:

Example

```
[ceph: root@host01 /]# ceph config set mgr mgr/balancer/sleep_interval 60
```

- Set the time of day to begin automatic balancing in HHMM format:

Example

```
[ceph: root@host01 /]# ceph config set mgr mgr/balancer/begin_time 0000
```

- Set the time of day to finish automatic balancing in HHMM format:

Example

```
[ceph: root@host01 /]# ceph config set mgr mgr/balancer/end_time 2359
```

- Restrict automatic balancing to this day of the week or later. Uses the same conventions as crontab, **0** is Sunday, **1** is Monday, and so on:

Example

```
[ceph: root@host01 /]# ceph config set mgr mgr/balancer/begin_weekday 0
```

- Restrict automatic balancing to this day of the week or earlier. This uses the same conventions as crontab, **0** is Sunday, **1** is Monday, and so on:

Example

```
[ceph: root@host01 /]# ceph config set mgr mgr/balancer/end_weekday 6
```

- Define the pool IDs to which the automatic balancing is limited. The default for this is an empty string, meaning all pools are balanced. The numeric pool IDs can be gotten with the **ceph osd pool ls detail** command:

Example

```
[ceph: root@host01 /]# ceph config set mgr mgr/balancer/pool_ids 1,2,3
```

Supervised optimization

The balancer operation is broken into a few distinct phases:

1. Building a **plan**.
2. Evaluating the quality of the data distribution, either for the current PG distribution, or the PG distribution that would result after executing a **plan**.
3. Executing the **plan**.
   - To evaluate and score the current distribution:

     Example

     ```
     [ceph: root@host01 /]# ceph balancer eval
     ```

   - To evaluate the distribution for a single pool:

     Syntax

     ```
     ceph balancer eval POOL_NAME
     ```

     Example

     ```
     [ceph: root@host01 /]# ceph balancer eval rbd
     ```

- To see greater detail for the evaluation:

  Example

  ```
  [ceph: root@host01 /]# ceph balancer eval-verbose ...
  ```

- To generate a plan using the currently configured mode:

  Syntax

  ```
  ceph balancer optimize PLAN_NAME
  ```

  Replace *PLAN_NAME* with a custom plan name.

  Example

  ```
  [ceph: root@host01 /]# ceph balancer optimize rbd_123
  ```

- To see the contents of a plan:

  Syntax

  ```
  ceph balancer show PLAN_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph balancer show rbd_123
  ```

- To discard old plans:

  Syntax

  ```
  ceph balancer rm PLAN_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph balancer rm rbd_123
  ```

- To see currently recorded plans use the status command:

  ```
  [ceph: root@host01 /]# ceph balancer status
  ```

- To calculate the quality of the distribution that would result after executing a plan:

  Syntax

  ```
  ceph balancer eval PLAN_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph balancer eval rbd_123
  ```

- To execute the plan:

  Syntax

  ```
  ceph balancer execute PLAN_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph balancer execute rbd_123
  ```

  NOTE

  Only execute the plan if it is expected to improve the distribution. After execution, the plan will be discarded.

5.5. USING THE CEPH MANAGER ALERTS MODULE

You can use the Ceph Manager alerts module to send simple alert messages about the Red Hat Ceph Storage cluster's health by email.

NOTE

This module is not intended to be a robust monitoring solution. The fact that it is run as part of the Ceph cluster itself is fundamentally limiting in that a failure of the **ceph-mgr** daemon prevents alerts from being sent. This module can, however, be useful for standalone clusters that exist in environments where existing monitoring infrastructure does not exist.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to the Ceph Monitor node.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Enable the alerts module:

   Example

   ```
   [ceph: root@host01 /]# ceph mgr module enable alerts
   ```

3. Ensure the alerts module is enabled:

   Example

```
[ceph: root@host01 /]# ceph mgr module ls | more
{
    "always_on_modules": [
        "balancer",
        "crash",
        "devicehealth",
        "orchestrator",
        "pg_autoscaler",
        "progress",
        "rbd_support",
        "status",
        "telemetry",
        "volumes"
    ],
    "enabled_modules": [
        "alerts",
        "cephadm",
        "dashboard",
        "iostat",
        "nfs",
        "prometheus",
        "restful"
    ]
```

4. Configure the Simple Mail Transfer Protocol (SMTP):

Syntax

```
ceph config set mgr mgr/alerts/smtp_host SMTP_SERVER
ceph config set mgr mgr/alerts/smtp_destination RECEIVER_EMAIL_ADDRESS
ceph config set mgr mgr/alerts/smtp_sender SENDER_EMAIL_ADDRESS
```

Example

```
[ceph: root@host01 /]# ceph config set mgr mgr/alerts/smtp_host smtp.example.com
[ceph: root@host01 /]# ceph config set mgr mgr/alerts/smtp_destination
example@example.com
[ceph: root@host01 /]# ceph config set mgr mgr/alerts/smtp_sender
example2@example.com
```

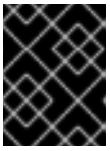
5. Optional: By default, the alerts module uses SSL and port 465.

Syntax

```
ceph config set mgr mgr/alerts/smtp_port PORT_NUMBER
```

Example

```
[ceph: root@host01 /]# ceph config set mgr mgr/alerts/smtp_port 587
```



IMPORTANT

SSL is not supported in Red Hat Ceph Storage 6 cluster. Do not set the **smtp_ssl** parameter while configuring alerts.

6. Authenticate to the SMTP server:

   Syntax

   ```
   ceph config set mgr mgr/alerts/smtp_user USERNAME
   ceph config set mgr mgr/alerts/smtp_password PASSWORD
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph config set mgr mgr/alerts/smtp_user admin1234
   [ceph: root@host01 /]# ceph config set mgr mgr/alerts/smtp_password admin1234
   ```

7. Optional: By default, SMTP **From** name is **Ceph**. To change that, set the **smtp_from_name** parameter:

   Syntax

   ```
   ceph config set mgr mgr/alerts/smtp_from_name CLUSTER_NAME
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph config set mgr mgr/alerts/smtp_from_name 'Ceph Cluster Test'
   ```

8. Optional: By default, the alerts module checks the storage cluster's health every minute, and sends a message when there is a change in the cluster health status. To change the frequency, set the **interval** parameter:

   Syntax

   ```
   ceph config set mgr mgr/alerts/interval INTERVAL
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph config set mgr mgr/alerts/interval "5m"
   ```

   In this example, the interval is set to 5 minutes.

9. Optional: Send an alert immediately:

   Example

   ```
   [ceph: root@host01 /]# ceph alerts send
   ```

Additional Resources

- See the *Health messages of a Ceph cluster* section in the *Red Hat Ceph Storage Troubleshooting Guide* for more information on Ceph health messages.

5.6. USING THE CEPH MANAGER CRASH MODULE

Using the Ceph manager crash module, you can collect information about daemon crashdumps and store it in the Red Hat Ceph Storage cluster for further analysis.

By default, daemon crashdumps are dumped in **/var/lib/ceph/crash**. You can configure it with the option **crash dir**. Crash directories are named by time, date, and a randomly-generated UUID, and contain a metadata file **meta** and a recent log file, with a **crash_id** that is the same.

You can use **ceph-crash.service** to submit these crashes automatically and persist in the Ceph Monitors. The **ceph-crash.service** watches the **crashdump** directory and uploads them with **ceph crash post**.

The *RECENT_CRASH* heath message is one of the most common health messages in a Ceph cluster. This health message means that one or more Ceph daemons has crashed recently, and the crash has not yet been archived or acknowledged by the administrator. This might indicate a software bug, a hardware problem like a failing disk, or some other problem. The option **mgr/crash/warn_recent_interval** controls the time period of what recent means, which is two weeks by default. You can disable the warnings by running the following command:

Example

```
[ceph: root@host01 /]# ceph config set mgr/crash/warn_recent_interval 0
```

The option **mgr/crash/retain_interval** controls the period for which you want to retain the crash reports before they are automatically purged. The default for this option is one year.

Prerequisites

- A running Red Hat Ceph Storage cluster.

Procedure

1. Ensure the crash module is enabled:

   #### Example

   ```
   [ceph: root@host01 /]# ceph mgr module ls | more
   {
       "always_on_modules": [
           "balancer",
           "crash",
           "devicehealth",
           "orchestrator_cli",
           "progress",
           "rbd_support",
           "status",
           "volumes"
       ],
       "enabled_modules": [
           "dashboard",
   ```

```
        "pg_autoscaler",
        "prometheus"
    ]
```

2. Save a crash dump: The metadata file is a JSON blob stored in the crash dir as **meta**. You can invoke the ceph command **-i -** option, which reads from stdin.

   Example

   ```
   [ceph: root@host01 /]# ceph crash post -i meta
   ```

3. List the timestamp or the UUID crash IDs for all the new and archived crash info:

   Example

   ```
   [ceph: root@host01 /]# ceph crash ls
   ```

4. List the timestamp or the UUID crash IDs for all the new crash information:

   Example

   ```
   [ceph: root@host01 /]# ceph crash ls-new
   ```

5. List the timestamp or the UUID crash IDs for all the new crash information:

   Example

   ```
   [ceph: root@host01 /]# ceph crash ls-new
   ```

6. List the summary of saved crash information grouped by age:

   Example

   ```
   [ceph: root@host01 /]# ceph crash stat
   8 crashes recorded
   8 older than 1 days old:
   2022-05-20T08:30:14.533316Z_4ea88673-8db6-4959-a8c6-0eea22d305c2
   2022-05-20T08:30:14.590789Z_30a8bb92-2147-4e0f-a58b-a12c2c73d4f5
   2022-05-20T08:34:42.278648Z_6a91a778-bce6-4ef3-a3fb-84c4276c8297
   2022-05-20T08:34:42.801268Z_e5f25c74-c381-46b1-bee3-63d891f9fc2d
   2022-05-20T08:34:42.803141Z_96adfc59-be3a-4a38-9981-e71ad3d55e47
   2022-05-20T08:34:42.830416Z_e45ed474-550c-44b3-b9bb-283e3f4cc1fe
   2022-05-24T19:58:42.549073Z_b2382865-ea89-4be2-b46f-9a59af7b7a2d
   2022-05-24T19:58:44.315282Z_1847afbc-f8a9-45da-94e8-5aef0738954e
   ```

7. View the details of the saved crash:

   Syntax

   ```
   ceph crash info CRASH_ID
   ```

   Example

```
[ceph: root@host01 /]# ceph crash info 2022-05-24T19:58:42.549073Z_b2382865-ea89-
4be2-b46f-9a59af7b7a2d
{
    "assert_condition": "session_map.sessions.empty()",
    "assert_file": "/builddir/build/BUILD/ceph-16.1.0-486-g324d7073/src/mon/Monitor.cc",
    "assert_func": "virtual Monitor::~Monitor()",
    "assert_line": 287,
    "assert_msg": "/builddir/build/BUILD/ceph-16.1.0-486-g324d7073/src/mon/Monitor.cc: In
function 'virtual Monitor::~Monitor()' thread 7f67a1aeb700 time 2022-05-
24T19:58:42.545485+0000\n/builddir/build/BUILD/ceph-16.1.0-486-
g324d7073/src/mon/Monitor.cc: 287: FAILED
ceph_assert(session_map.sessions.empty())\n",
    "assert_thread_name": "ceph-mon",
    "backtrace": [
        "/lib64/libpthread.so.0(+0x12b30) [0x7f679678bb30]",
        "gsignal()",
        "abort()",
        "(ceph::__ceph_assert_fail(char const*, char const*, int, char const*)+0x1a9)
[0x7f6798c8d37b]",
        "/usr/lib64/ceph/libceph-common.so.2(+0x276544) [0x7f6798c8d544]",
        "(Monitor::~Monitor()+0xe30) [0x561152ed3c80]",
        "(Monitor::~Monitor()+0xd) [0x561152ed3cdd]",
        "main()",
        "__libc_start_main()",
        "_start()"
    ],
    "ceph_version": "16.2.8-65.el8cp",
    "crash_id": "2022-07-06T19:58:42.549073Z_b2382865-ea89-4be2-b46f-9a59af7b7a2d",
    "entity_name": "mon.ceph-adm4",
    "os_id": "rhel",
    "os_name": "Red Hat Enterprise Linux",
    "os_version": "8.5 (Ootpa)",
    "os_version_id": "8.5",
    "process_name": "ceph-mon",
    "stack_sig":
"957c21d558d0cba4cee9e8aaf9227b3b1b09738b8a4d2c9f4dc26d9233b0d511",
    "timestamp": "2022-07-06T19:58:42.549073Z",
    "utsname_hostname": "host02",
    "utsname_machine": "x86_64",
    "utsname_release": "4.18.0-240.15.1.el8_3.x86_64",
    "utsname_sysname": "Linux",
    "utsname_version": "#1 SMP Wed Jul 06 03:12:15 EDT 2022"
}
```

8. Remove saved crashes older than *KEEP* days: Here, *KEEP* must be an integer.

Syntax

```
ceph crash prune KEEP
```

Example

```
[ceph: root@host01 /]# ceph crash prune 60
```

9. Archive a crash report so that it is no longer considered for the **RECENT_CRASH** health check and does not appear in the **crash ls-new** output. It appears in the **crash ls**.

   Syntax

   ```
   ceph crash archive CRASH_ID
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph crash archive 2022-05-24T19:58:42.549073Z_b2382865-ea89-4be2-b46f-9a59af7b7a2d
   ```

10. Archive all crash reports:

    Example

    ```
    [ceph: root@host01 /]# ceph crash archive-all
    ```

11. Remove the crash dump:

    Syntax

    ```
    ceph crash rm CRASH_ID
    ```

    Example

    ```
    [ceph: root@host01 /]# ceph crash rm 2022-05-24T19:58:42.549073Z_b2382865-ea89-4be2-b46f-9a59af7b7a2d
    ```

Additional Resources

- See the *Health messages of a Ceph cluster* section in the *Red Hat Ceph Storage Troubleshooting Guide* for more information on Ceph health messages.

5.7. TELEMETRY MODULE

The telemetry module sends data about the storage cluster to help understand how Ceph is used and what problems are encountered during operations. The data is visualized on the public dashboard to view the summary statistics on how many clusters are reporting, their total capacity and OSD count, and version distribution trends.

Channels

The telemetry report is broken down into different channels, each with a different type of information. After the telemetry is enabled, you can turn on or turn off the individual channels.

The following are the four different channels:

- **basic** - The default is **on**. This channel provides the basic information about the clusters, which includes the following information:
  - The capacity of the cluster.

    - The number of monitors, managers, OSDs, MDSs, object gateways, or other daemons.
    - The software version that is currently being used.
    - The number and types of RADOS pools and Ceph File Systems.
    - The names of configuration options that are changed from their default (but not their values).

- **crash** - The default is **on**. This channel provides information about the daemon crashes, which includes the following information:
    - The type of daemon.
    - The version of the daemon.
    - The operating system, the OS distribution, and the kernel version.
    - The stack trace that identifies where in the Ceph code the crash occurred.
- **device** - The default is **on**. This channel provides information about the device metrics, which includes anonymized SMART metrics.
- **ident** - The default is **off**. This channel provides the user-provided identifying information about the cluster such as cluster description, and contact email address.
- **perf** - The default is **off**. This channel provides the various performance metrics of the cluster, which can be used for the following:
    - Reveal overall cluster health.
    - Identify workload patterns.
    - Troubleshoot issues with latency, throttling, memory management, and other similar issues.
    - Monitor cluster performance by daemon.

The data that is reported does not contain any sensitive data such as pool names, object names, object contents, hostnames, or device serial numbers.

It contains counters and statistics on how the cluster is deployed, Ceph version, host distribution, and other parameters that help the project to gain a better understanding of the way Ceph is used.

Data is secure and is sent to https://telemetry.ceph.com.

Enable telemetry

Before enabling channels, ensure that the telemetry is **on**.

- Enable telemetry:

```
ceph telemetry on
```

Enable and disable channels

- Enable or disable individual channels:

```
ceph telemetry enable channel basic
ceph telemetry enable channel crash
ceph telemetry enable channel device
ceph telemetry enable channel ident
ceph telemetry enable channel perf

ceph telemetry disable channel basic
ceph telemetry disable channel crash
ceph telemetry disable channel device
ceph telemetry disable channel ident
ceph telemetry disable channel perf
```

- Enable or disable multiple channels:

```
ceph telemetry enable channel basic crash device ident perf
ceph telemetry disable channel basic crash device ident perf
```

- Enable or disable all channels together:

```
ceph telemetry enable channel all
ceph telemetry disable channel all
```

Sample report

- To review the data reported at any time, generate a sample report:

```
ceph telemetry show
```

- If telemetry is **off**, preview the sample report:

```
ceph telemetry preview
```

  It takes longer to generate a sample report for storage clusters with hundreds of OSDs or more.

- To protect your privacy, device reports are generated separately, and data such as hostname and device serial number are anonymized. The device telemetry is sent to a different endpoint and does not associate the device data with a particular cluster. To see the device report, run the following command:

```
ceph telemetry show-device
```

- If telemetry is **off**, preview the sample device report:

```
ceph telemetry preview-device
```

- Get a single output of both the reports with telemetry **on**:

```
ceph telemetry show-all
```

- Get a single output of both the reports with telemetry **off**:

```
ceph telemetry preview-all
```

- Generate a sample report by channel:

  Syntax

  ```
  ceph telemetry show CHANNEL_NAME
  ```

- Generate a preview of the sample report by channel:

  Syntax

  ```
  ceph telemetry preview CHANNEL_NAME
  ```

Collections

Collections are different aspects of data that is collected within a channel.

- List the collections:

  ```
  ceph telemetry collection ls
  ```

- See the difference between the collections that you are enrolled in, and the new, available collections:

  ```
  ceph telemetry diff
  ```

- Enroll to the most recent collections:

  Syntax

  ```
  ceph telemetry on
  ceph telemetry enable channel CHANNEL_NAME
  ```

Interval

The module compiles and sends a new report every 24 hours by default.

- Adjust the interval:

  Syntax

  ```
  ceph config set mgr mgr/telemetry/interval INTERVAL
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph config set mgr mgr/telemetry/interval 72
  ```

  In the example, the report is generated every three days (72 hours).

Status

- View the current configuration:

  ```
  ceph telemetry status
  ```

Manually sending telemetry

- Send telemetry data on an ad hoc basis:

```
ceph telemetry send
```

If telemetry is disabled, add **--license sharing-1-0** to the **ceph telemetry send** command.

Sending telemetry through a proxy

- If the cluster cannot connect directly to the configured telemetry endpoint, you can configure a HTTP/HTTPs proxy server:

Syntax

```
ceph config set mgr mgr/telemetry/proxy PROXY_URL
```

Example

```
[ceph: root@host01 /]# ceph config set mgr mgr/telemetry/proxy https://10.0.0.1:8080
```

You can include the user pass in the command:

Example

```
[ceph: root@host01 /]# ceph config set mgr mgr/telemetry/proxy https://10.0.0.1:8080
```

Contact and description

- Optional: Add a contact and description to the report:

Syntax

```
ceph config set mgr mgr/telemetry/contact '_CONTACT_NAME_'
ceph config set mgr mgr/telemetry/description '_DESCRIPTION_'
ceph config set mgr mgr/telemetry/channel_ident true
```

Example

```
[ceph: root@host01 /]# ceph config set mgr mgr/telemetry/contact 'John Doe
<john.doe@example.com>'
[ceph: root@host01 /]# ceph config set mgr mgr/telemetry/description 'My first Ceph cluster'
[ceph: root@host01 /]# ceph config set mgr mgr/telemetry/channel_ident true
```

If **ident** flag is enabled, its details are not displayed in the leaderboard.

Leaderboard

- Participate in a leaderboard on the public dashboard:

Example

```
[ceph: root@host01 /]# ceph config set mgr mgr/telemetry/leaderboard true
```

The leaderboard displays basic information about the storage cluster. This board includes the total storage capacity and the number of OSDs.

Disable telemetry

- Disable telemetry any time:

  Example

```
ceph telemetry off
```

CHAPTER 6. MANAGEMENT OF OSDS USING THE CEPH ORCHESTRATOR

As a storage administrator, you can use the Ceph Orchestrators to manage OSDs of a Red Hat Ceph Storage cluster.

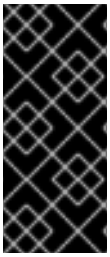
6.1. CEPH OSDS

When a Red Hat Ceph Storage cluster is up and running, you can add OSDs to the storage cluster at runtime.

A Ceph OSD generally consists of one **ceph-osd** daemon for one storage drive and its associated journal within a node. If a node has multiple storage drives, then map one **ceph-osd** daemon for each drive.

Red Hat recommends checking the capacity of a cluster regularly to see if it is reaching the upper end of its storage capacity. As a storage cluster reaches its **near full** ratio, add one or more OSDs to expand the storage cluster's capacity.

When you want to reduce the size of a Red Hat Ceph Storage cluster or replace the hardware, you can also remove an OSD at runtime. If the node has multiple storage drives, you might also need to remove one of the **ceph-osd** daemon for that drive. Generally, it's a good idea to check the capacity of the storage cluster to see if you are reaching the upper end of its capacity. Ensure that when you remove an OSD that the storage cluster is not at its **near full** ratio.



IMPORTANT

Do not let a storage cluster reach the **full** ratio before adding an OSD. OSD failures that occur after the storage cluster reaches the **near full** ratio can cause the storage cluster to exceed the **full** ratio. Ceph blocks write access to protect the data until you resolve the storage capacity issues. Do not remove OSDs without considering the impact on the **full** ratio first.

6.2. CEPH OSD NODE CONFIGURATION

Configure Ceph OSDs and their supporting hardware similarly as a storage strategy for the pool(s) that will use the OSDs. Ceph prefers uniform hardware across pools for a consistent performance profile. For best performance, consider a CRUSH hierarchy with drives of the same type or size.

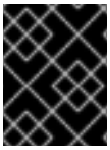
If you add drives of dissimilar size, adjust their weights accordingly. When you add the OSD to the CRUSH map, consider the weight for the new OSD. Hard drive capacity grows approximately 40% per year, so newer OSD nodes might have larger hard drives than older nodes in the storage cluster, that is, they might have a greater weight.

Before doing a new installation, review the *Requirements for Installing Red Hat Ceph Storage* chapter in the *Installation Guide*.

6.3. AUTOMATICALLY TUNING OSD MEMORY

The OSD daemons adjust the memory consumption based on the **osd_memory_target** configuration option. The option **osd_memory_target** sets OSD memory based upon the available RAM in the system.

If Red Hat Ceph Storage is deployed on dedicated nodes that do not share memory with other services, **cephadm** automatically adjusts the per-OSD consumption based on the total amount of RAM and the number of deployed OSDs.



IMPORTANT

By default, the **osd_memory_target_autotune** parameter is set to **true** in Red Hat Ceph Storage 6.0.

Syntax

```
ceph config set osd osd_memory_target_autotune true
```

Once the storage cluster is upgraded to Red Hat Ceph Storage 6.0, for cluster maintenance such as addition of OSDs or replacement of OSDs, Red Hat recommends setting **osd_memory_target_autotune** parameter to **true** to autotune osd memory as per system memory.

Cephadm starts with a fraction **mgr/cephadm/autotune_memory_target_ratio**, which defaults to **0.7** of the total RAM in the system, subtract off any memory consumed by non-autotuned daemons such as non-OSDS and for OSDs for which **osd_memory_target_autotune** is false, and then divide by the remaining OSDs.

The **osd_memory_target** parameter is calculated as follows:

Syntax

```
osd_memory_target = TOTAL_RAM_OF_THE_OSD * (1048576) * (autotune_memory_target_ratio) / NUMBER_OF_OSDS_IN_THE_OSD_NODE - (SPACE_ALLOCATED_FOR_OTHER_DAEMONS)
```

SPACE_ALLOCATED_FOR_OTHER_DAEMONS may optionally include the following daemon space allocations:

- Alertmanager: 1 GB
- Grafana: 1 GB
- Ceph Manager: 4 GB
- Ceph Monitor: 2 GB
- Node-exporter: 1 GB
- Prometheus: 1 GB

For example, if a node has 24 OSDs and has 251 GB RAM space, then **osd_memory_target** is **7860684936**.

The final targets are reflected in the configuration database with options. You can view the limits and the current memory consumed by each daemon from the **ceph orch ps** output under **MEM LIMIT** column.

NOTE

In Red Hat Ceph Storage 6.0, the default setting of **osd_memory_target_autotune true** is unsuitable for hyperconverged infrastructures where compute and Ceph storage services are colocated. In a hyperconverged infrastructure, the **autotune_memory_target_ratio** can be set to **0.2** to reduce the memory consumption of Ceph.

Example

```
[ceph: root@host01 /]# ceph config set mgr
mgr/cephadm/autotune_memory_target_ratio 0.2
```

You can manually set a specific memory target for an OSD in the storage cluster.

Example

```
[ceph: root@host01 /]# ceph config set osd.123 osd_memory_target 7860684936
```

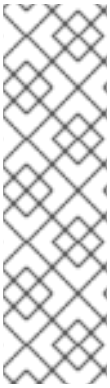
You can manually set a specific memory target for an OSD host in the storage cluster.

Syntax

```
ceph config set osd/host:HOSTNAME osd_memory_target TARGET_BYTES
```

Example

```
[ceph: root@host01 /]# ceph config set osd/host:host01 osd_memory_target 1000000000
```



NOTE

Enabling **osd_memory_target_autotune** overwrites existing manual OSD memory target settings. To prevent daemon memory from being tuned even when the **osd_memory_target_autotune** option or other similar options are enabled, set the **_no_autotune_memory** label on the host.

Syntax

```
ceph orch host label add HOSTNAME _no_autotune_memory
```

You can exclude an OSD from memory autotuning by disabling the autotune option and setting a specific memory target.

Example

```
[ceph: root@host01 /]# ceph config set osd.123 osd_memory_target_autotune false
[ceph: root@host01 /]# ceph config set osd.123 osd_memory_target 16G
```

6.4. LISTING DEVICES FOR CEPH OSD DEPLOYMENT

You can check the list of available devices before deploying OSDs using the Ceph Orchestrator. The commands are used to print a list of devices discoverable by Cephadm. A storage device is considered available if all of the following conditions are met:

- The device must have no partitions.
- The device must not have any LVM state.
- The device must not be mounted.
- The device must not contain a file system.
- The device must not contain a Ceph BlueStore OSD.
- The device must be larger than 5 GB.

NOTE

Ceph will not provision an OSD on a device that is not available.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager and monitor daemons are deployed.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. List the available devices to deploy OSDs:

   Syntax

   ```
   ceph orch device ls [--hostname=HOSTNAME_1 HOSTNAME_2] [--wide] [--refresh]
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph orch device ls --wide --refresh
   ```

   Using the **--wide** option provides all details relating to the device, including any reasons that the device might not be eligible for use as an OSD. This option does not support NVMe devices.

3. Optional: To enable *Health*, *Ident*, and *Fault* fields in the output of **ceph orch device ls**, run the following commands:

NOTE

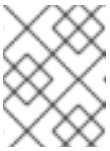
These fields are supported by **libstoragemgmt** library and currently supports SCSI, SAS, and SATA devices.

a. As root user outside the Cephadm shell, check your hardware's compatibility with **libstoragemgmt** library to avoid unplanned interruption to services:

Example

```
[root@host01 ~]# cephadm shell lsmcli ldl
```

In the output, you see the *Health Status* as *Good* with the respective *SCSI VPD 0x83* ID.



NOTE

If you do not get this information, then enabling the fields might cause erratic behavior of devices.

b. Log back into the Cephadm shell and enable **libstoragemgmt** support:

Example

```
[root@host01 ~]# cephadm shell
[ceph: root@host01 /]# ceph config set mgr mgr/cephadm/device_enhanced_scan true
```

Once this is enabled, **ceph orch device ls** gives the output of *Health* field as *Good*.

Verification

- List the devices:

  Example

  ```
  [ceph: root@host01 /]# ceph orch device ls
  ```

6.5. ZAPPING DEVICES FOR CEPH OSD DEPLOYMENT

You need to check the list of available devices before deploying OSDs. If there is no space available on the devices, you can clear the data on the devices by zapping them.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager and monitor daemons are deployed.

Procedure

1. Log into the Cephadm shell:

Example

```
[root@host01 ~]# cephadm shell
```

2. List the available devices to deploy OSDs:

Syntax

```
ceph orch device ls [--hostname=HOSTNAME_1 HOSTNAME_2] [--wide] [--refresh]
```

Example

```
[ceph: root@host01 /]# ceph orch device ls --wide --refresh
```

3. Clear the data of a device:

Syntax

```
ceph orch device zap HOSTNAME FILE_PATH --force
```

Example

```
[ceph: root@host01 /]# ceph orch device zap host02 /dev/sdb --force
```

Verification

- Verify the space is available on the device:

Example

```
[ceph: root@host01 /]# ceph orch device ls
```

You will see that the field under *Available* is *Yes*.

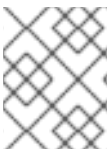
Additional Resources

- See the *Listing devices for Ceph OSD deployment* section in the *Red Hat Ceph Storage Operations Guide* for more information.

6.6. DEPLOYING CEPH OSDS ON ALL AVAILABLE DEVICES

You can deploy all OSDS on all the available devices. Cephadm allows the Ceph Orchestrator to discover and deploy the OSDs on any available and unused storage device.

To deploy OSDs all available devices, run the command without the **unmanaged** parameter and then re-run the command with the parameter to prevent from creating future OSDs.



NOTE

The deployment of OSDs with **--all-available-devices** is generally used for smaller clusters. For larger clusters, use the OSD specification file.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager and monitor daemons are deployed.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. List the available devices to deploy OSDs:

   Syntax

   ```
   ceph orch device ls [--hostname=HOSTNAME_1 HOSTNAME_2] [--wide] [--refresh]
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph orch device ls --wide --refresh
   ```

3. Deploy OSDs on all available devices:

   Example

   ```
   [ceph: root@host01 /]# ceph orch apply osd --all-available-devices
   ```

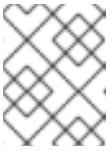
   The effect of **ceph orch apply** is persistent which means that the Orchestrator automatically finds the device, adds it to the cluster, and creates new OSDs. This occurs under the following conditions:

   - New disks or drives are added to the system.
   - Existing disks or drives are zapped.
   - An OSD is removed and the devices are zapped.
     You can disable automatic creation of OSDs on all the available devices by using the **--unmanaged** parameter.

     Example

     ```
     [ceph: root@host01 /]# ceph orch apply osd --all-available-devices --unmanaged=true
     ```

     Setting the parameter **--unmanaged** to **true** disables the creation of OSDs and also there is no change if you apply a new OSD service.



NOTE

The command **ceph orch daemon add** creates new OSDs, but does not add an OSD service.

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- View the details of the node and devices:

  Example

  ```
  [ceph: root@host01 /]# ceph osd tree
  ```

Additional Resources

- See the *Listing devices for Ceph OSD deployment* section in the *Red Hat Ceph Storage Operations Guide*.

6.7. DEPLOYING CEPH OSDS ON SPECIFIC DEVICES AND HOSTS

You can deploy all the Ceph OSDs on specific devices and hosts using the Ceph Orchestrator.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager and monitor daemons are deployed.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. List the available devices to deploy OSDs:

   Syntax

   ```
   ceph orch device ls [--hostname=HOSTNAME_1 HOSTNAME_2] [--wide] [--refresh]
   ```

   Example

```
[ceph: root@host01 /]# ceph orch device ls --wide --refresh
```

3. Deploy OSDs on specific devices and hosts:

Syntax

```
ceph orch daemon add osd HOSTNAME:DEVICE_PATH
```

Example

```
[ceph: root@host01 /]# ceph orch daemon add osd host02:/dev/sdb
```

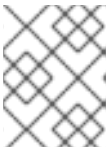
To deploy ODSs on a raw physical device, without an LVM layer, use the **--method raw** option.

Syntax

```
ceph orch daemon add osd --method raw HOSTNAME:DEVICE_PATH
```

Example

```
[ceph: root@host01 /]# ceph orch daemon add osd --method raw host02:/dev/sdb
```



NOTE

If you have separate DB or WAL devices, the ratio of block to DB or WAL devices **MUST** be 1:1.

Verification

- List the service:

Example

```
[ceph: root@host01 /]# ceph orch ls osd
```

- View the details of the node and devices:

Example

```
[ceph: root@host01 /]# ceph osd tree
```

- List the hosts, daemons, and processes:

Syntax

```
ceph orch ps --service_name=SERVICE_NAME
```

Example

```
[ceph: root@host01 /]# ceph orch ps --service_name=osd
```

Additional Resources

- See the *Listing devices for Ceph OSD deployment* section in the *Red Hat Ceph Storage Operations Guide*.

6.8. ADVANCED SERVICE SPECIFICATIONS AND FILTERS FOR DEPLOYING OSDS

Service Specification of type OSD is a way to describe a cluster layout using the properties of disks. It gives the user an abstract way to tell Ceph which disks should turn into an OSD with the required configuration without knowing the specifics of device names and paths. For each device and each host, define a **yaml** file or a **json** file.

General settings for OSD specifications

- **service_type**: 'osd': This is mandatory to create OSDS
- **service_id**: Use the service name or identification you prefer. A set of OSDs is created using the specification file. This name is used to manage all the OSDs together and represent an Orchestrator service.
- **placement**: This is used to define the hosts on which the OSDs need to be deployed.
  You can use on the following options:
  - **host_pattern**: '*' - A host name pattern used to select hosts.
  - **label**: 'osd_host' - A label used in the hosts where OSD need to be deployed.
  - **hosts**: 'host01', 'host02' - An explicit list of host names where OSDs needs to be deployed.
- **selection of devices**: The devices where OSDs are created. This allows us to separate an OSD from different devices. You can create only BlueStore OSDs which have three components:
  - OSD data: contains all the OSD data
  - WAL: BlueStore internal journal or write-ahead Log
  - DB: BlueStore internal metadata
- **data_devices**: Define the devices to deploy OSD. In this case, OSDs are created in a collocated schema. You can use filters to select devices and folders.
- **wal_devices**: Define the devices used for WAL OSDs. You can use filters to select devices and folders.
- **db_devices**: Define the devices for DB OSDs. You can use the filters to select devices and folders.
- **encrypted**: An optional parameter to encrypt information on the OSD which can set to either **True** or **False**
- **unmanaged**: An optional parameter, set to False by default. You can set it to True if you do not want the Orchestrator to manage the OSD service.
- **block_wal_size**: User-defined value, in bytes.

- **block_db_size**: User-defined value, in bytes.
- **osds_per_device**: User-defined value for deploying more than one OSD per device.
- **method**: An optional parameter to specify if an OSD is created with an LVM layer or not. Set to **raw** if you want to create OSDs on raw physical devices that do not include an LVM layer. If you have separate DB or WAL devices, the ratio of block to DB or WAL devices **MUST** be 1:1.

Filters for specifying devices

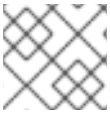
Filters are used in conjunction with the **data_devices**, **wal_devices** and **db_devices** parameters.

Name of the filter	Description	Syntax	Example
Model	Target specific disks. You can get details of the model by running **lsblk -o NAME,FSTYPE,LABEL,MOUNTPOINT,SIZE,MODEL** command or **smartctl -i /*DEVIVE_PATH***	Model: *DISK_MODEL_NAME*	Model: MC-55-44-XZ
Vendor	Target specific disks	Vendor: *DISK_VENDOR_NAME*	Vendor: Vendor Cs
Size Specification	Includes disks of an exact size	size: *EXACT*	size: '10G'
Size Specification	Includes disks size of which is within the range	size: *LOW:HIGH*	size: '10G:40G'
Size Specification	Includes disks less than or equal to in size	size: *:HIGH*	size: ':10G'
Size Specification	Includes disks equal to or greater than in size	size: *LOW:*	size: '40G:'
Rotational	Rotational attribute of the disk. 1 matches all disks that are rotational and 0 matches all the disks that are non-rotational. If rotational =0, then OSD is configured with SSD or NVME. If rotational=1 then the OSD is configured with HDD.	rotational: 0 or 1	rotational: 0
All	Considers all the available disks	all: true	all: true

Limiter	When you have specified valid filters but want to limit the amount of matching disks you can use the 'limit' directive. It should be used only as a last resort.	limit: *NUMBER*	limit: 2

NOTE

To create an OSD with non-collocated components in the same host, you have to specify the different types of devices used and the devices should be on the same host.



NOTE

The devices used for deploying OSDs must be supported by **libstoragemgmt**.

Additional Resources

- See the *Deploying Ceph OSDs using the advanced specifications* section in the *Red Hat Ceph Storage Operations Guide*.
- For more information on **libstoragemgmt**, see the *Listing devices for Ceph OSD deployment* section in the *Red Hat Ceph Storage Operations Guide*.

6.9. DEPLOYING CEPH OSDS USING ADVANCED SERVICE SPECIFICATIONS

The service specification of type OSD is a way to describe a cluster layout using the properties of disks. It gives the user an abstract way to tell Ceph which disks should turn into an OSD with the required configuration without knowing the specifics of device names and paths.

You can deploy the OSD for each device and each host by defining a **yaml** file or a **json** file.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager and monitor daemons are deployed.

Procedure

1. On the monitor node, create the **osd_spec.yaml** file:

   Example

   ```
   [root@host01 ~]# touch osd_spec.yaml
   ```

2. Edit the **osd_spec.yaml** file to include the following details:

Syntax

```
service_type: osd
service_id: SERVICE_ID
placement:
  host_pattern: '*' # optional
data_devices: # optional
  model: DISK_MODEL_NAME # optional
  paths:
  - /DEVICE_PATH
osds_per_device: NUMBER_OF_DEVICES # optional
db_devices: # optional
  size: # optional
  all: true # optional
  paths:
   - /DEVICE_PATH
encrypted: true
```

a. Simple scenarios: In these cases, all the nodes have the same set-up.

Example

```
service_type: osd
service_id: osd_spec_default
placement:
  host_pattern: '*'
data_devices:
  all: true
  paths:
  - /dev/sdb
encrypted: true
```

Example

```
service_type: osd
service_id: osd_spec_default
placement:
  host_pattern: '*'
data_devices:
  size: '80G'
db_devices:
  size: '40G:'
  paths:
   - /dev/sdc
```

b. Simple scenario: In this case, all the nodes have the same setup with OSD devices created in raw mode, without an LVM layer.

Example

```
service_type: osd
service_id: all-available-devices
```

```
encrypted: "true"
method: raw
placement:
  host_pattern: "*"
data_devices:
  all: "true"
```

c. Advanced scenario: This would create the desired layout by using all HDDs as **data_devices** with two SSD assigned as dedicated DB or WAL devices. The remaining SSDs are **data_devices** that have the NVMEs vendors assigned as dedicated DB or WAL devices.

Example

```
service_type: osd
service_id: osd_spec_hdd
placement:
  host_pattern: '*'
data_devices:
  rotational: 0
db_devices:
  model: Model-name
  limit: 2
---
service_type: osd
service_id: osd_spec_ssd
placement:
  host_pattern: '*'
data_devices:
  model: Model-name
db_devices:
  vendor: Vendor-name
```

d. Advanced scenario with non-uniform nodes: This applies different OSD specs to different hosts depending on the host_pattern key.

Example

```
service_type: osd
service_id: osd_spec_node_one_to_five
placement:
  host_pattern: 'node[1-5]'
data_devices:
  rotational: 1
db_devices:
  rotational: 0
---
service_type: osd
service_id: osd_spec_six_to_ten
placement:
  host_pattern: 'node[6-10]'
data_devices:
  model: Model-name
db_devices:
  model: Model-name
```

e. Advanced scenario with dedicated WAL and DB devices:

Example

```
service_type: osd
service_id: osd_using_paths
placement:
  hosts:
    - host01
    - host02
data_devices:
  paths:
    - /dev/sdb
db_devices:
  paths:
    - /dev/sdc
wal_devices:
  paths:
    - /dev/sdd
```

f. Advanced scenario with multiple OSDs per device:

Example

```
service_type: osd
service_id: multiple_osds
placement:
  hosts:
    - host01
    - host02
osds_per_device: 4
data_devices:
  paths:
    - /dev/sdb
```

g. For pre-created volumes, edit the **osd_spec.yaml** file to include the following details:

Syntax

```
service_type: osd
service_id: SERVICE_ID
placement:
  hosts:
    - HOSTNAME
data_devices: # optional
  model: DISK_MODEL_NAME # optional
  paths:
  - /DEVICE_PATH
db_devices: # optional
  size: # optional
  all: true # optional
  paths:
   - /DEVICE_PATH
```

Example

```
service_type: osd
service_id: osd_spec
placement:
  hosts:
    - machine1
data_devices:
  paths:
    - /dev/vg_hdd/lv_hdd
db_devices:
  paths:
    - /dev/vg_nvme/lv_nvme
```

h. For OSDs by ID, edit the **osd_spec.yaml** file to include the following details:

NOTE

This configuration is applicable for Red Hat Ceph Storage 5.3z1 and later releases. For earlier releases, use pre-created lvm.

Syntax

```
service_type: osd
service_id: OSD_BY_ID_HOSTNAME
placement:
  hosts:
    - HOSTNAME
data_devices: # optional
  model: DISK_MODEL_NAME # optional
  paths:
  - /DEVICE_PATH
db_devices: # optional
  size: # optional
  all: true # optional
  paths:
   - /DEVICE_PATH
```

Example

```
service_type: osd
service_id: osd_by_id_host01
placement:
  hosts:
    - host01
data_devices:
  paths:
    - /dev/disk/by-id/scsi-0QEMU_QEMU_HARDDISK_drive-scsi0-0-0-5
db_devices:
  paths:
    - /dev/disk/by-id/nvme-nvme.1b36-31323334-51454d55204e564d65204374726c-
00000001
```

i. For OSDs by path, edit the **osd_spec.yaml** file to include the following details:

NOTE

This configuration is applicable for Red Hat Ceph Storage 5.3z1 and later releases. For earlier releases, use pre-created lvm.

Syntax

```
service_type: osd
service_id: OSD_BY_PATH_HOSTNAME
placement:
  hosts:
    - HOSTNAME
data_devices: # optional
  model: DISK_MODEL_NAME # optional
  paths:
  - /DEVICE_PATH
db_devices: # optional
  size: # optional
  all: true # optional
  paths:
   - /DEVICE_PATH
```

Example

```
service_type: osd
service_id: osd_by_path_host01
placement:
  hosts:
    - host01
data_devices:
  paths:
    - /dev/disk/by-path/pci-0000:0d:00.0-scsi-0:0:0:4
db_devices:
  paths:
    - /dev/disk/by-path/pci-0000:00:02.0-nvme-1
```

3. Mount the YAML file under a directory in the container:

Example

```
[root@host01 ~]# cephadm shell --mount osd_spec.yaml:/var/lib/ceph/osd/osd_spec.yaml
```

4. Navigate to the directory:

Example

```
[ceph: root@host01 /]# cd /var/lib/ceph/osd/
```

5. Before deploying OSDs, do a dry run:

NOTE

This step gives a preview of the deployment, without deploying the daemons.

Example

```
[ceph: root@host01 osd]# ceph orch apply -i osd_spec.yaml --dry-run
```

6. Deploy OSDs using service specification:

Syntax

```
ceph orch apply -i FILE_NAME.yml
```

Example

```
[ceph: root@host01 osd]# ceph orch apply -i osd_spec.yaml
```

Verification

- List the service:

Example

```
[ceph: root@host01 /]# ceph orch ls osd
```

- View the details of the node and devices:

Example

```
[ceph: root@host01 /]# ceph osd tree
```

Additional Resources

- See the *Advanced service specifications and filters for deploying OSDs* section in the *Red Hat Ceph Storage Operations Guide*.

6.10. REMOVING THE OSD DAEMONS USING THE CEPH ORCHESTRATOR

You can remove the OSD from a cluster by using Cephadm.

Removing an OSD from a cluster involves two steps:

1. Evacuates all placement groups (PGs) from the cluster.
2. Removes the PG-free OSDs from the cluster.

The **--zap** option removed the volume groups, logical volumes, and the LVM metadata.

NOTE

After removing OSDs, if the drives the OSDs were deployed on once again become available, **cephadm`** might automatically try to deploy more OSDs on these drives if they match an existing drivegroup specification. If you deployed the OSDs you are removing with a spec and do not want any new OSDs deployed on the drives after removal, modify the drivegroup specification before removal. While deploying OSDs, if you have used **--all-available-devices** option, set **unmanaged: true** to stop it from picking up new drives at all. For other deployments, modify the specification. See the *Deploying Ceph OSDs using advanced service specifications* for more details.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- Ceph Monitor, Ceph Manager and Ceph OSD daemons are deployed on the storage cluster.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Check the device and the node from which the OSD has to be removed:

   Example

   ```
   [ceph: root@host01 /]# ceph osd tree
   ```

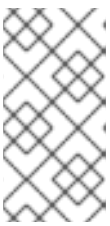
3. Remove the OSD:

   Syntax

   ```
   ceph orch osd rm OSD_ID [--replace] [--force] --zap
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph orch osd rm 0 --zap
   ```

   NOTE

   If you remove the OSD from the storage cluster without an option, such as **--replace**, the device is removed from the storage cluster completely. If you want to use the same device for deploying OSDs, you have to first zap the device before adding it to the storage cluster.

4. Optional: To remove multiple OSDs from a specific node, run the following command:

   Syntax

```
ceph orch osd rm OSD_ID OSD_ID --zap
```

Example

```
[ceph: root@host01 /]# ceph orch osd rm 2 5 --zap
```

5. Check the status of the OSD removal:

Example

```
[ceph: root@host01 /]# ceph orch osd rm status
OSD  HOST   STATE                    PGS  REPLACE  FORCE  ZAP   DRAIN STARTED AT
9    host01 done, waiting for purge    0  False    False  True  2023-06-06 17:50:50.525690
10   host03 done, waiting for purge    0  False    False  True  2023-06-06 17:49:38.731533
11   host02 done, waiting for purge    0  False    False  True  2023-06-06 17:48:36.641105
```

When no PGs are left on the OSD, it is decommissioned and removed from the cluster.

Verification

- Verify the details of the devices and the nodes from which the Ceph OSDs are removed:

Example

```
[ceph: root@host01 /]# ceph osd tree
```

Additional Resources

- See the *Deploying Ceph OSDs on all available devices* section in the *Red Hat Ceph Storage Operations Guide* for more information.
- See the *Deploying Ceph OSDs on specific devices and hosts* section in the *Red Hat Ceph Storage Operations Guide* for more information.
- See the *Zapping devices for Ceph OSD deployment* section in the *Red Hat Ceph Storage Operations Guide* for more information on clearing space on devices.

6.11. REPLACING THE OSDS USING THE CEPH ORCHESTRATOR

When disks fail, you can replace the physical storage device and reuse the same OSD ID to avoid having to reconfigure the CRUSH map.

You can replace the OSDs from the cluster using the **--replace** option.

NOTE

If you want to replace a single OSD, see *Deploying Ceph OSDs on specific devices and hosts*. If you want to deploy OSDs on all available devices, see *Deploying Ceph OSDs on all available devices*.

This option preserves the OSD ID using the **ceph orch rm** command. The OSD is not permanently removed from the CRUSH hierarchy, but is assigned the **destroyed** flag. This flag is used to determine

the OSD IDs that can be reused in the next OSD deployment. The **destroyed** flag is used to determine which OSD id is reused in the next OSD deployment.

Similar to **rm** command, replacing an OSD from a cluster involves two steps:

- Evacuating all placement groups (PGs) from the cluster.
- Removing the PG-free OSD from the cluster.

If you use OSD specification for deployment, the OSD ID of the disk being replaced is automatically assigned to the newly added disk as soon as it is inserted.

NOTE

After removing OSDs, if the drives the OSDs were deployed on once again become available, **cephadm** might automatically try to deploy more OSDs on these drives if they match an existing drivegroup specification. If you deployed the OSDs you are removing with a spec and do not want any new OSDs deployed on the drives after removal, modify the drivegroup specification before removal. While deploying OSDs, if you have used **--all-available-devices** option, set **unmanaged: true** to stop it from picking up new drives at all. For other deployments, modify the specification. See the *Deploying Ceph OSDs using advanced service specifications* for more details.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- Monitor, Manager, and OSD daemons are deployed on the storage cluster.
- A new OSD that replaces the removed OSD must be created on the same host from which the OSD was removed.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Ensure to dump and save a mapping of your OSD configurations for future references:

   Example

   ```
   [ceph: root@node /]# ceph osd metadata -f plain | grep device_paths
   "device_paths": "sde=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:0:0:1,sdi=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:1:0:1",
   "device_paths": "sde=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:0:0:1,sdf=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:1:0:1",
   "device_paths": "sdd=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:0:0:2,sdg=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:1:0:2",
   "device_paths": "sdd=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:0:0:2,sdh=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:1:0:2",
   ```

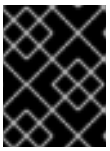
```
"device_paths": "sdd=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:0:0:2,sdk=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:1:0:2",
"device_paths": "sdc=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:0:0:3,sdl=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:1:0:3",
"device_paths": "sdc=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:0:0:3,sdj=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:1:0:3",
"device_paths": "sdc=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:0:0:3,sdm=/dev/disk/by-path/pci-0000:03:00.0-scsi-0:1:0:3",
[.. output omitted ..]
```

3. Check the device and the node from which the OSD has to be replaced:

   Example

   ```
   [ceph: root@host01 /]# ceph osd tree
   ```

4. Remove the OSD from the **cephadm** managed cluster:

   IMPORTANT

   If the storage cluster has **health_warn** or other errors associated with it, check and try to fix any errors before replacing the OSD to avoid data loss.

   Syntax

   ```
   ceph orch osd rm OSD_ID --replace [--force]
   ```

   The **--force** option can be used when there are ongoing operations on the storage cluster.

   Example

   ```
   [ceph: root@host01 /]# ceph orch osd rm 0 --replace
   ```

5. Recreate the new OSD by applying the following OSD specification:

   Example

   ```
   service_type: osd
   service_id: osd
   placement:
     hosts:
     - myhost
   data_devices:
     paths:
     - /path/to/the/device
   ```

6. Check the status of the OSD replacement:

   Example

   ```
   [ceph: root@host01 /]# ceph orch osd rm status
   ```

7. Stop the orchestrator to apply any existing OSD specification:

   Example

   ```
   [ceph: root@node /]# ceph orch pause
   [ceph: root@node /]# ceph orch status
   Backend: cephadm
   Available: Yes
   Paused: Yes
   ```

8. Zap the OSD devices that have been removed:

   Example

   ```
   [ceph: root@node /]# ceph orch device zap node.example.com /dev/sdi --force
   zap successful for /dev/sdi on node.example.com

   [ceph: root@node /]# ceph orch device zap node.example.com /dev/sdf --force
   zap successful for /dev/sdf on node.example.com
   ```

9. Resume the Orcestrator from pause mode

   Example

   ```
   [ceph: root@node /]# ceph orch resume
   ```

10. Check the status of the OSD replacement:

    Example

    ```
    [ceph: root@node /]# ceph osd tree
    ID  CLASS  WEIGHT   TYPE NAME     STATUS  REWEIGHT  PRI-AFF
    -1         0.77112  root default
    -3         0.77112      host node
     0    hdd  0.09639          osd.0     up   1.00000  1.00000
     1    hdd  0.09639          osd.1     up   1.00000  1.00000
     2    hdd  0.09639          osd.2     up   1.00000  1.00000
     3    hdd  0.09639          osd.3     up   1.00000  1.00000
     4    hdd  0.09639          osd.4     up   1.00000  1.00000
     5    hdd  0.09639          osd.5     up   1.00000  1.00000
     6    hdd  0.09639          osd.6     up   1.00000  1.00000
     7    hdd  0.09639          osd.7     up   1.00000  1.00000
     [.. output omitted ..]
    ```

Verification

- Verify the details of the devices and the nodes from which the Ceph OSDs are replaced:

  Example

  ```
  [ceph: root@host01 /]# ceph osd tree
  ```

  You can see an OSD with the same id as the one you replaced running on the same host.

- Verify that the **db_device** for the new deployed OSDs is the replaced **db_device**:

  Example

```
[ceph: root@host01 /]# ceph osd metadata 0 | grep bluefs_db_devices
"bluefs_db_devices": "nvme0n1",

[ceph: root@host01 /]# ceph osd metadata 1 | grep bluefs_db_devices
"bluefs_db_devices": "nvme0n1",
```

Additional Resources

- See the *Deploying Ceph OSDs on all available devices* section in the *Red Hat Ceph Storage Operations Guide* for more information.
- See the *Deploying Ceph OSDs on specific devices and hosts* section in the *Red Hat Ceph Storage Operations Guide* for more information.

6.12. REPLACING THE OSDS WITH PRE-CREATED LVM

After purging the OSD with the **ceph-volume lvm zap** command, if the directory is not present, then you can replace the OSDs with the OSd service specification file with the pre-created LVM.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Failed OSD

Procedure

1. Log into the Cephadm shell:

   Example

```
[root@host01 ~]# cephadm shell
```

2. Remove the OSD:

   Syntax

```
ceph orch osd rm OSD_ID [--replace]
```

   Example

```
[ceph: root@host01 /]# ceph orch osd rm 8 --replace
Scheduled OSD(s) for removal
```

3. Verify the OSD is destroyed:

   Example

```
[ceph: root@host01 /]# ceph osd tree

ID   CLASS  WEIGHT   TYPE NAME       STATUS     REWEIGHT  PRI-AFF
 -1         0.32297  root default
 -9         0.05177      host host10
  3    hdd  0.01520          osd.3          up   1.00000  1.00000
 13    hdd  0.02489          osd.13         up   1.00000  1.00000
 17    hdd  0.01169          osd.17         up   1.00000  1.00000
-13         0.05177      host host11
  2    hdd  0.01520          osd.2          up   1.00000  1.00000
 15    hdd  0.02489          osd.15         up   1.00000  1.00000
 19    hdd  0.01169          osd.19         up   1.00000  1.00000
 -7         0.05835      host host12
 20    hdd  0.01459          osd.20         up   1.00000  1.00000
 21    hdd  0.01459          osd.21         up   1.00000  1.00000
 22    hdd  0.01459          osd.22         up   1.00000  1.00000
 23    hdd  0.01459          osd.23         up   1.00000  1.00000
 -5         0.03827      host host04
  1    hdd  0.01169          osd.1          up   1.00000  1.00000
  6    hdd  0.01129          osd.6          up   1.00000  1.00000
  7    hdd  0.00749          osd.7          up   1.00000  1.00000
  9    hdd  0.00780          osd.9          up   1.00000  1.00000
 -3         0.03816      host host05
  0    hdd  0.01169          osd.0          up   1.00000  1.00000
  8    hdd  0.01129          osd.8    destroyed        0  1.00000
 12    hdd  0.00749          osd.12         up   1.00000  1.00000
 16    hdd  0.00769          osd.16         up   1.00000  1.00000
-15         0.04237      host host06
  5    hdd  0.01239          osd.5          up   1.00000  1.00000
 10    hdd  0.01540          osd.10         up   1.00000  1.00000
 11    hdd  0.01459          osd.11         up   1.00000  1.00000
-11         0.04227      host host07
  4    hdd  0.01239          osd.4          up   1.00000  1.00000
 14    hdd  0.01529          osd.14         up   1.00000  1.00000
 18    hdd  0.01459          osd.18         up   1.00000  1.00000
```

4. Zap and remove the OSD using the **ceph-volume** command:

Syntax

```
ceph-volume lvm zap --osd-id OSD_ID
```

Example

```
[ceph: root@host01 /]# ceph-volume lvm zap --osd-id 8

Zapping: /dev/vg1/data-lv2
Closing encrypted path /dev/mapper/l4D6ql-Prji-IzH4-dfhF-xzuf-5ETl-jNRcXC
Running command: /usr/sbin/cryptsetup remove /dev/mapper/l4D6ql-Prji-IzH4-dfhF-xzuf-
5ETl-jNRcXC
Running command: /usr/bin/dd if=/dev/zero of=/dev/vg1/data-lv2 bs=1M count=10
conv=fsync
 stderr: 10+0 records in
```

```
10+0 records out
 stderr: 10485760 bytes (10 MB, 10 MiB) copied, 0.034742 s, 302 MB/s
Zapping successful for OSD: 8
```

5. Check the OSD topology:

   Example

```
[ceph: root@host01 /]# ceph-volume lvm list
```

6. Recreate the OSD with a specification file corresponding to that specific OSD topology:

   Example

```
[ceph: root@host01 /]# cat osd.yml
service_type: osd
service_id: osd_service
placement:
  hosts:
  - host03
data_devices:
  paths:
  - /dev/vg1/data-lv2
db_devices:
  paths:
   - /dev/vg1/db-lv1
```

7. Apply the updated specification file:

   Example

```
[ceph: root@host01 /]# ceph orch apply -i osd.yml
Scheduled osd.osd_service update...
```

8. Verify the OSD is back:

   Example

```
[ceph: root@host01 /]# ceph -s
[ceph: root@host01 /]# ceph osd tree
```

6.13. REPLACING THE OSDS IN A NON-COLOCATED SCENARIO

When the an OSD fails in a non-colocated scenario, you can replace the WAL/DB devices. The procedure is the same for DB and WAL devices. You need to edit the **paths** under **db_devices** for DB devices and **paths** under **wal_devices** for WAL devices.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Daemons are non-colocated.

- Failed OSD

Procedure

1. Identify the devices in the cluster:

   Example

```
[root@host01 ~]# lsblk

NAME                                                                  MAJ:MIN RM  SIZE RO
TYPE MOUNTPOINT
sda                                                                     8:0    0   20G  0 disk
├─sda1                                                                  8:1    0    1G  0 part
/boot
└─sda2                                                                  8:2    0   19G  0 part
  ├─rhel-root                                                         253:0    0   17G  0 lvm  /
  └─rhel-swap                                                         253:1    0    2G  0 lvm
[SWAP]
sdb                                                                     8:16   0   10G  0 disk
└─ceph--5726d3e9--4fdb--4eda--b56a--3e0df88d663f-osd--block--3ceb89ec--87ef--46b4--
99c6--2a56bac09ff0 253:2    0   10G  0 lvm
sdc                                                                     8:32   0   10G  0 disk
└─ceph--d7c9ab50--f5c0--4be0--a8fd--e0313115f65c-osd--block--37c370df--1263--487f--
a476--08e28bdbcd3c 253:4    0   10G  0 lvm
sdd                                                                     8:48   0   10G  0 disk
├─ceph--1774f992--44f9--4e78--be7b--b403057cf5c3-osd--db--31b20150--4cbc--4c2c--
9c8f--6f624f3bfd89    253:7    0  2.5G  0 lvm
└─ceph--1774f992--44f9--4e78--be7b--b403057cf5c3-osd--db--1bee5101--dbab--4155--
a02c--e5a747d38a56    253:9    0  2.5G  0 lvm
sde                                                                     8:64   0   10G  0 disk
sdf                                                                     8:80   0   10G  0 disk
└─ceph--412ee99b--4303--4199--930a--0d976e1599a2-osd--block--3a99af02--7c73--4236--
9879--1fad1fe6203d 253:6    0   10G  0 lvm
sdg                                                                     8:96   0   10G  0 disk
└─ceph--316ca066--aeb6--46e1--8c57--f12f279467b4-osd--block--58475365--51e7--42f2--
9681--e0c921947ae6 253:8    0   10G  0 lvm
sdh                                                                     8:112  0   10G  0 disk
├─ceph--d7064874--66cb--4a77--a7c2--8aa0b0125c3c-osd--db--0dfe6eca--ba58--438a--
9510--d96e6814d853    253:3    0    5G  0 lvm
└─ceph--d7064874--66cb--4a77--a7c2--8aa0b0125c3c-osd--db--26b70c30--8817--45de--
8843--4c0932ad2429    253:5    0    5G  0 lvm
sr0
```

2. Log into the Cephadm shell:

   Example

```
[root@host01 ~]# cephadm shell
```

3. Identify the OSDs and their DB device:

   Example

```
[ceph: root@host01 /]# ceph-volume lvm list /dev/sdh


====== osd.2 =======

  [db]          /dev/ceph-d7064874-66cb-4a77-a7c2-8aa0b0125c3c/osd-db-0dfe6eca-ba58-
438a-9510-d96e6814d853

      block device              /dev/ceph-5726d3e9-4fdb-4eda-b56a-3e0df88d663f/osd-block-
3ceb89ec-87ef-46b4-99c6-2a56bac09ff0
      block uuid                GkWLoo-f0jd-Apj2-Zmwj-ce0h-OY6J-UuW8aD
      cephx lockbox secret
      cluster fsid              fa0bd9dc-e4c4-11ed-8db4-001a4a00046e
      cluster name              ceph
      crush device class
      db device                 /dev/ceph-d7064874-66cb-4a77-a7c2-8aa0b0125c3c/osd-db-
0dfe6eca-ba58-438a-9510-d96e6814d853
      db uuid                   6gSPoc-L39h-afN3-rDl6-kozT-AX9S-XR20xM
      encrypted                 0
      osd fsid                  3ceb89ec-87ef-46b4-99c6-2a56bac09ff0
      osd id                    2
      osdspec affinity          non-colocated
      type                      db
      vdo                       0
      devices                   /dev/sdh

====== osd.5 =======

  [db]          /dev/ceph-d7064874-66cb-4a77-a7c2-8aa0b0125c3c/osd-db-26b70c30-8817-
45de-8843-4c0932ad2429

      block device              /dev/ceph-d7c9ab50-f5c0-4be0-a8fd-e0313115f65c/osd-block-
37c370df-1263-487f-a476-08e28bdbcd3c
      block uuid                Eay3I7-fcz5-AWvp-kRcI-mJaH-n03V-Zr0wmJ
      cephx lockbox secret
      cluster fsid              fa0bd9dc-e4c4-11ed-8db4-001a4a00046e
      cluster name              ceph
      crush device class
      db device                 /dev/ceph-d7064874-66cb-4a77-a7c2-8aa0b0125c3c/osd-db-
26b70c30-8817-45de-8843-4c0932ad2429
      db uuid                   mwSohP-u72r-DHcT-BPka-piwA-lSwx-w24N0M
      encrypted                 0
      osd fsid                  37c370df-1263-487f-a476-08e28bdbcd3c
      osd id                    5
      osdspec affinity          non-colocated
      type                      db
      vdo                       0
      devices                   /dev/sdh
```

4. In the **osds.yaml** file, set **unmanaged** parameter to **true**, else **cephadm** redeploys the OSDs:

Example

```
[ceph: root@host01 /]# cat osds.yml
service_type: osd
```

```
service_id: non-colocated
unmanaged: true
placement:
  host_pattern: 'ceph*'
data_devices:
  paths:
   - /dev/sdb
   - /dev/sdc
   - /dev/sdf
   - /dev/sdg
db_devices:
  paths:
   - /dev/sdd
   - /dev/sdh
```

5. Apply the updated specification file:

   Example

```
[ceph: root@host01 /]# ceph orch apply -i osds.yml

Scheduled osd.non-colocated update...
```

6. Check the status:

   Example

```
[ceph: root@host01 /]# ceph orch ls

NAME           PORTS        RUNNING  REFRESHED  AGE  PLACEMENT
alertmanager   ?:9093,9094      1/1  9m ago     4d   count:1
crash                           3/4  4d ago     4d   *
grafana        ?:3000           1/1  9m ago     4d   count:1
mgr                             1/2  4d ago     4d   count:2
mon                             3/5  4d ago     4d   count:5
node-exporter  ?:9100           3/4  4d ago     4d   *
osd.non-colocated               8  4d ago     5s   <unmanaged>
prometheus     ?:9095           1/1  9m ago     4d   count:1
```

7. Remove the OSDs. Ensure to use the **--zap** option to remove hte backend services and the **--replace** option to retain the OSD IDs:

   Example

```
[ceph: root@host01 /]# ceph orch osd rm 2 5 --zap --replace
Scheduled OSD(s) for removal
```

8. Check the status:

   Example

```
[ceph: root@host01 /]# ceph osd df tree | egrep -i "ID|host02|osd.2|osd.5"

ID  CLASS  WEIGHT   REWEIGHT  SIZE     RAW USE  DATA     OMAP  META     AVAIL
```

```
%USE  VAR   PGS  STATUS     TYPE NAME
-5        0.04877        -   55 GiB   15 GiB  4.1 MiB   0 B   60 MiB  40 GiB  27.27  1.17    -
host02
 2    hdd  0.01219   1.00000   15 GiB  5.0 GiB  996 KiB   0 B   15 MiB  10 GiB  33.33  1.43    0
destroyed          osd.2
 5    hdd  0.01219   1.00000   15 GiB  5.0 GiB  1.0 MiB   0 B   15 MiB  10 GiB  33.33  1.43    0
destroyed          osd.5
```

9. Edit the **osds.yaml** specification file to change **unmanaged** parameter to **false** and replace the path to the DB device if it has changed after the device got physically replaced:

   Example

```
[ceph: root@host01 /]# cat osds.yml
service_type: osd
service_id: non-colocated
unmanaged: false
placement:
  host_pattern: 'ceph01*'
data_devices:
  paths:
   - /dev/sdb
   - /dev/sdc
   - /dev/sdf
   - /dev/sdg
db_devices:
  paths:
   - /dev/sdd
   - /dev/sde
```

   In the above example, **/dev/sdh** is replaced with **/dev/sde**.

IMPORTANT

If you use the same host specification file to replace the faulty DB device on a single OSD node, modify the **host_pattern** option to specify only the OSD node, else the deployment fails and you cannot find the new DB device on other hosts.

10. Reapply the specification file with the **--dry-run** option to ensure the OSDs shall be deployed with the new DB device:

    Example

```
[ceph: root@host01 /]# ceph orch apply -i osds.yml --dry-run
WARNING! Dry-Runs are snapshots of a certain point in time and are bound
to the current inventory setup. If any of these conditions change, the
preview will be invalid. Please make sure to have a minimal
timeframe between planning and applying the specs.
####################
SERVICESPEC PREVIEWS
####################
+---------+------+--------+-------------+
|SERVICE  |NAME  |ADD_TO  |REMOVE_FROM  |
+---------+------+--------+-------------+
```

```
+---------+------+--------+-------------+
################
OSDSPEC PREVIEWS
################
+---------+-------+-------+----------+----------+-----+
|SERVICE  |NAME   |HOST   |DATA      |DB        |WAL  |
+---------+-------+-------+----------+----------+-----+
|osd      |non-colocated  |host02  |/dev/sdb  |/dev/sde  |-    |
|osd      |non-colocated  |host02  |/dev/sdc  |/dev/sde  |-    |
+---------+-------+-------+----------+----------+-----+
```

11. Apply the specification file:

    Example

    ```
    [ceph: root@host01 /]# ceph orch apply -i osds.yml
    Scheduled osd.non-colocated update...
    ```

12. Check the OSDs are redeployed:

    Example

    ```
    [ceph: root@host01 /]# ceph osd df tree | egrep -i "ID|host02|osd.2|osd.5"

    ID  CLASS  WEIGHT   REWEIGHT  SIZE     RAW USE  DATA     OMAP  META     AVAIL
    %USE   VAR   PGS  STATUS  TYPE NAME
    -5         0.04877         -   55 GiB   15 GiB  4.5 MiB   0 B   60 MiB  40 GiB  27.27  1.17    -
    host host02
     2    hdd  0.01219   1.00000   15 GiB  5.0 GiB  1.1 MiB   0 B   15 MiB  10 GiB  33.33  1.43    0
    up          osd.2
     5    hdd  0.01219   1.00000   15 GiB  5.0 GiB  1.1 MiB   0 B   15 MiB  10 GiB  33.33  1.43    0
    up          osd.5
    ```

Verification

1. From the OSD host where the OSDS are redeployed, verify if they are on the new DB device:

   Example

   ```
   [ceph: root@host01 /]# ceph-volume lvm list /dev/sde

   ====== osd.2 =======

     [db]          /dev/ceph-15ce813a-8a4c-46d9-ad99-7e0845baf15e/osd-db-1998a02e-5e67-
   42a9-b057-e02c22bbf461

         block device              /dev/ceph-a4afcb78-c804-4daf-b78f-3c7ad1ed0379/osd-block-
   564b3d2f-0f85-4289-899a-9f98a2641979
         block uuid                ITPVPa-CCQ5-BbFa-FZCn-FeYt-c5N4-ssdU41
         cephx lockbox secret
         cluster fsid              fa0bd9dc-e4c4-11ed-8db4-001a4a00046e
         cluster name              ceph
         crush device class
         db device                 /dev/ceph-15ce813a-8a4c-46d9-ad99-7e0845baf15e/osd-db-
   ```

```
1998a02e-5e67-42a9-b057-e02c22bbf461
    db uuid               HF1bYb-fTK7-0dcB-CHzW-xvNn-dCym-KKdU5e
    encrypted             0
    osd fsid              564b3d2f-0f85-4289-899a-9f98a2641979
    osd id                2
    osdspec affinity      non-colocated
    type                  db
    vdo                   0
    devices               /dev/sde

====== osd.5 =======

  [db]      /dev/ceph-15ce813a-8a4c-46d9-ad99-7e0845baf15e/osd-db-6c154191-846d-
4e63-8c57-fc4b99e182bd

    block device          /dev/ceph-b37c8310-77f9-4163-964b-f17b4c29c537/osd-block-
b42a4f1f-8e19-4416-a874-6ff5d305d97f
    block uuid            0LuPoz-ao7S-UL2t-BDIs-C9pl-ct8J-xh5ep4
    cephx lockbox secret
    cluster fsid          fa0bd9dc-e4c4-11ed-8db4-001a4a00046e
    cluster name          ceph
    crush device class
    db device             /dev/ceph-15ce813a-8a4c-46d9-ad99-7e0845baf15e/osd-db-
6c154191-846d-4e63-8c57-fc4b99e182bd
    db uuid               SvmXms-iWkj-MTG7-VnJj-r5Mo-Moiw-MsbqVD
    encrypted             0
    osd fsid              b42a4f1f-8e19-4416-a874-6ff5d305d97f
    osd id                5
    osdspec affinity      non-colocated
    type                  db
    vdo                   0
    devices               /dev/sde
```

6.14. STOPPING THE REMOVAL OF THE OSDS USING THE CEPH ORCHESTRATOR

You can stop the removal of only the OSDs that are queued for removal. This resets the initial state of the OSD and takes it off the removal queue.

If the OSD is in the process of removal, then you cannot stop the process.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- Monitor, Manager and OSD daemons are deployed on the cluster.
- Remove OSD process initiated.

Procedure

1. Log into the Cephadm shell:

Example

```
[root@host01 ~]# cephadm shell
```

2. Check the device and the node from which the OSD was initiated to be removed:

Example

```
[ceph: root@host01 /]# ceph osd tree
```

3. Stop the removal of the queued OSD:

Syntax

```
ceph orch osd rm stop OSD_ID
```

Example

```
[ceph: root@host01 /]# ceph orch osd rm stop 0
```

4. Check the status of the OSD removal:

Example

```
[ceph: root@host01 /]# ceph orch osd rm status
```

Verification

- Verify the details of the devices and the nodes from which the Ceph OSDs were queued for removal:

Example

```
[ceph: root@host01 /]# ceph osd tree
```

Additional Resources

- See *Removing the OSD daemons using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide* for more information.

6.15. ACTIVATING THE OSDS USING THE CEPH ORCHESTRATOR

You can activate the OSDs in the cluster in cases where the operating system of the host was reinstalled.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.

- Monitor, Manager and OSD daemons are deployed on the storage cluster.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. After the operating system of the host is reinstalled, activate the OSDs:

   Syntax

   ```
   ceph cephadm osd activate HOSTNAME
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph cephadm osd activate host03
   ```

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --service_name=SERVICE_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --service_name=osd
  ```

6.16. OBSERVING THE DATA MIGRATION

When you add or remove an OSD to the CRUSH map, Ceph begins rebalancing the data by migrating placement groups to the new or existing OSD(s). You can observe the data migration using **ceph-w** command.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Recently added or removed an OSD.

Procedure

1. To observe the data migration:

   Example

   ```
   [ceph: root@host01 /]# ceph -w
   ```

2. Watch as the placement group states change from **active+clean** to **active, some degraded objects**, and finally **active+clean** when migration completes.

3. To exit the utility, press **Ctrl + C**.

6.17. RECALCULATING THE PLACEMENT GROUPS

Placement groups (PGs) define the spread of any pool data across the available OSDs. A placement group is built upon the given redundancy algorithm to be used. For a 3-way replication, the redundancy is defined to use three different OSDs. For erasure-coded pools, the number of OSDs to use is defined by the number of chunks.

When defining a pool the number of placement groups defines the grade of granularity the data is spread with across all available OSDs. The higher the number the better the equalization of capacity load can be. However, since handling the placement groups is also important in case of reconstruction of data, the number is significant to be carefully chosen upfront. To support calculation a tool is available to produce agile environments.

During the lifetime of a storage cluster a pool may grow above the initially anticipated limits. With the growing number of drives a recalculation is recommended. The number of placement groups per OSD should be around 100. When adding more OSDs to the storage cluster the number of PGs per OSD will lower over time. Starting with 120 drives initially in the storage cluster and setting the **pg_num** of the pool to 4000 will end up in 100 PGs per OSD, given with the replication factor of three. Over time, when growing to ten times the number of OSDs, the number of PGs per OSD will go down to ten only. Because a small number of PGs per OSD will tend to an unevenly distributed capacity, consider adjusting the PGs per pool.

Adjusting the number of placement groups can be done online. Recalculating is not only a recalculation of the PG numbers, but will involve data relocation, which will be a lengthy process. However, the data availability will be maintained at any time.

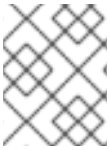
Very high numbers of PGs per OSD should be avoided, because reconstruction of all PGs on a failed OSD will start at once. A high number of IOPS is required to perform reconstruction in a timely manner, which might not be available. This would lead to deep I/O queues and high latency rendering the storage cluster unusable or will result in long healing times.

Additional Resources

- See the *PG calculator* for calculating the values by a given use case.
- See the *Erasure Code Pools* chapter in the *Red Hat Ceph Storage Strategies Guide* for more information.

CHAPTER 7. MANAGEMENT OF MONITORING STACK USING THE CEPH ORCHESTRATOR

As a storage administrator, you can use the Ceph Orchestrator with Cephadm in the backend to deploy monitoring and alerting stack. The monitoring stack consists of Prometheus, Prometheus exporters, Prometheus Alertmanager, and Grafana. Users need to either define these services with Cephadm in a YAML configuration file, or they can use the command line interface to deploy them. When multiple services of the same type are deployed, a highly-available setup is deployed. The node exporter is an exception to this rule.



NOTE

Red Hat Ceph Storage 6.0 does not support custom images for deploying monitoring services such as Prometheus, Grafana, Alertmanager, and node-exporter.

The following monitoring services can be deployed with Cephadm:

- Prometheus is the monitoring and alerting toolkit. It collects the data provided by Prometheus exporters and fires preconfigured alerts if predefined thresholds have been reached. The Prometheus manager module provides a Prometheus exporter to pass on Ceph performance counters from the collection point in **ceph-mgr**.
  The Prometheus configuration, including scrape targets, such as metrics providing daemons, is set up automatically by Cephadm. Cephadm also deploys a list of default alerts, for example, health error, 10% OSDs down, or pgs inactive.

- Alertmanager handles alerts sent by the Prometheus server. It deduplicates, groups, and routes the alerts to the correct receiver. By default, the Ceph dashboard is automatically configured as the receiver. The Alertmanager handles alerts sent by the Prometheus server. Alerts can be silenced using the Alertmanager, but silences can also be managed using the Ceph Dashboard.

- Grafana is a visualization and alerting software. The alerting functionality of Grafana is not used by this monitoring stack. For alerting, the Alertmanager is used.
  By default, traffic to Grafana is encrypted with TLS. You can either supply your own TLS certificate or use a self-signed one. If no custom certificate has been configured before Grafana has been deployed, then a self-signed certificate is automatically created and configured for Grafana. Custom certificates for Grafana can be configured using the following commands:

  Syntax

  ```
  ceph config-key set mgr/cephadm/grafana_key -i
  PRESENT_WORKING_DIRECTORY/key.pem
  ceph config-key set mgr/cephadm/grafana_crt -i
  PRESENT_WORKING_DIRECTORY/certificate.pem
  ```

Node exporter is an exporter for Prometheus which provides data about the node on which it is installed. It is recommended to install the node exporter on all nodes. This can be done using the **monitoring.yml** file with the node-exporter service type.

7.1. DEPLOYING THE MONITORING STACK USING THE CEPH ORCHESTRATOR

The monitoring stack consists of Prometheus, Prometheus exporters, Prometheus Alertmanager, Grafana, and Ceph Exporter. Ceph Dashboard makes use of these components to store and visualize detailed metrics on cluster usage and performance.

You can deploy the monitoring stack using the service specification in YAML file format. All the monitoring services can have the network and port they bind to configured in the **yml** file.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to the nodes.

Procedure

1. Enable the prometheus module in the Ceph Manager daemon. This exposes the internal Ceph metrics so that Prometheus can read them:

   Example

   ```
   [ceph: root@host01 /]# ceph mgr module enable prometheus
   ```

   IMPORTANT

   Ensure this command is run before Prometheus is deployed. If the command was not run before the deployment, you must redeploy Prometheus to update the configuration:

   ```
   ceph orch redeploy prometheus
   ```

2. Navigate to the following directory:

   Syntax

   ```
   cd /var/lib/ceph/DAEMON_PATH/
   ```

   Example

   ```
   [ceph: root@host01 mds/]# cd /var/lib/ceph/monitoring/
   ```

   NOTE

   If the directory **monitoring** does not exist, create it.

3. Create the **monitoring.yml** file:

   Example

   ```
   [ceph: root@host01 monitoring]# touch monitoring.yml
   ```

4. Edit the specification file with a content similar to the following example:

Example

```
service_type: prometheus
service_name: prometheus
placement:
  hosts:
  - host01
networks:
- 192.169.142.0/24
---
service_type: node-exporter
---
service_type: alertmanager
service_name: alertmanager
placement:
  hosts:
  - host01
networks:
- 192.169.142.0/24
---
service_type: grafana
service_name: grafana
placement:
  hosts:
  - host01
networks:
- 192.169.142.0/24
---
service_type: ceph-exporter
```

NOTE

Ensure the monitoring stack components **alertmanager**, **prometheus**, and **grafana** are deployed on the same host. The **node-exporter** and **ceph-exporter** components should be deployed on all the hosts.

5. Apply monitoring services:

Example

```
[ceph: root@host01 monitoring]# ceph orch apply -i monitoring.yml
```

Verification

- List the service:

Example

```
[ceph: root@host01 /]# ceph orch ls
```

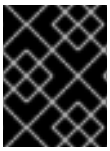
- List the hosts, daemons, and processes:

Syntax

```
ceph orch ps --service_name=SERVICE_NAME
```

Example

```
[ceph: root@host01 /]# ceph orch ps --service_name=prometheus
```



IMPORTANT

Prometheus, Grafana, and the Ceph dashboard are all automatically configured to talk to each other, resulting in a fully functional Grafana integration in the Ceph dashboard.

7.2. REMOVING THE MONITORING STACK USING THE CEPH ORCHESTRATOR

You can remove the monitoring stack using the **ceph orch rm** command.

Prerequisites

- A running Red Hat Ceph Storage cluster.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Use the **ceph orch rm** command to remove the monitoring stack:

   Syntax

   ```
   ceph orch rm SERVICE_NAME --force
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph orch rm grafana
   [ceph: root@host01 /]# ceph orch rm prometheus
   [ceph: root@host01 /]# ceph orch rm node-exporter
   [ceph: root@host01 /]# ceph orch rm ceph-exporter
   [ceph: root@host01 /]# ceph orch rm alertmanager
   [ceph: root@host01 /]# ceph mgr module disable prometheus
   ```

3. Check the status of the process:

   Example

   ```
   [ceph: root@host01 /]# ceph orch status
   ```

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps
  ```

Additional Resources

- See *Deploying the monitoring stack using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide* for more information.

CHAPTER 8. BASIC RED HAT CEPH STORAGE CLIENT SETUP

As a storage administrator, you have to set up client machines with basic configuration to interact with the storage cluster. Most client machines only need the **ceph-common package** and its dependencies installed. It will supply the basic **ceph** and **rados** commands, as well as other commands like **mount.ceph** and **rbd**.

8.1. CONFIGURING FILE SETUP ON CLIENT MACHINES

Client machines generally need a smaller configuration file than a full-fledged storage cluster member. You can generate a minimal configuration file which can give details to clients to reach the Ceph monitors.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root access to the nodes.

Procedure

1. On the node where you want to set up the files, create a directory **ceph** in the **/etc** folder:

   #### Example

   ```
   [root@host01 ~]# mkdir /etc/ceph/
   ```

2. Navigate to **/etc/ceph** directory:

   #### Example

   ```
   [root@host01 ~]# cd /etc/ceph/
   ```

3. Generate the configuration file in the **ceph** directory:

   #### Example

   ```
   [root@host01 ceph]# ceph config generate-minimal-conf

   # minimal ceph.conf for 417b1d7a-a0e6-11eb-b940-001a4a000740
   [global]
    fsid = 417b1d7a-a0e6-11eb-b940-001a4a000740
    mon_host = [v2:10.74.249.41:3300/0,v1:10.74.249.41:6789/0]
   ```

   The contents of this file should be installed in **/etc/ceph/ceph.conf** path. You can use this configuration file to reach the Ceph monitors.

8.2. SETTING-UP KEYRING ON CLIENT MACHINES

Most Ceph clusters are run with the authentication enabled, and the client needs the keys in order to communicate with cluster machines. You can generate the keyring which can give details to clients to reach the Ceph monitors.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root access to the nodes.

Procedure

1. On the node where you want to set up the keyring, create a directory **ceph** in the **/etc** folder:

   Example

   ```
   [root@host01 ~]# mkdir /etc/ceph/
   ```

2. Navigate to **/etc/ceph** directory in the **ceph** directory:

   Example

   ```
   [root@host01 ~]# cd /etc/ceph/
   ```

3. Generate the keyring for the client:

   Syntax

   ```
   ceph auth get-or-create client.CLIENT_NAME -o /etc/ceph/NAME_OF_THE_FILE
   ```

   Example

   ```
   [root@host01 ceph]# ceph auth get-or-create client.fs -o /etc/ceph/ceph.keyring
   ```

4. Verify the output in the **ceph.keyring** file:

   Example

   ```
   [root@host01 ceph]# cat ceph.keyring

   [client.fs]
    key = AQAvoH5gkUCsExAATz3xCBLd4n6B6jRv+Z7CVQ==
   ```

   The resulting output should be put into a keyring file, for example **/etc/ceph/ceph.keyring**.

CHAPTER 9. MANAGEMENT OF MDS SERVICE USING THE CEPH ORCHESTRATOR

As a storage administrator, you can use Ceph Orchestrator with Cephadm in the backend to deploy the MDS service. By default, a Ceph File System (CephFS) uses only one active MDS daemon. However, systems with many clients benefit from multiple active MDS daemons.

This section covers the following administrative tasks:

- *Deploying the MDS service using the command line interface .*
- *Deploying the MDS service using the service specification .*
- *Removing the MDS service using the Ceph Orchestrator .*

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.
- Hosts are added to the cluster.
- All manager, monitor and OSD daemons are deployed.

9.1. DEPLOYING THE MDS SERVICE USING THE COMMAND LINE INTERFACE

Using the Ceph Orchestrator, you can deploy the Metadata Server (MDS) service using the **placement** specification in the command line interface. Ceph File System (CephFS) requires one or more MDS.

NOTE

Ensure you have at least two pools, one for Ceph file system (CephFS) data and one for CephFS metadata.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager, monitor, and OSD daemons are deployed.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. There are two ways of deploying MDS daemons using placement specification:

Method 1

- Use **ceph fs volume** to create the MDS daemons. This creates the CephFS volume and pools associated with the CephFS, and also starts the MDS service on the hosts.

  Syntax

  ```
  ceph fs volume create FILESYSTEM_NAME --placement="NUMBER_OF_DAEMONS HOST_NAME_1 HOST_NAME_2 HOST_NAME_3"
  ```

  NOTE

  By default, replicated pools are created for this command.

  Example

  ```
  [ceph: root@host01 /]# ceph fs volume create test --placement="2 host01 host02"
  ```

Method 2

- Create the pools, CephFS, and then deploy MDS service using placement specification:

  a. Create the pools for CephFS:

  Syntax

  ```
  ceph osd pool create DATA_POOL [PG_NUM]
  ceph osd pool create METADATA_POOL [PG_NUM]
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph osd pool create cephfs_data 64
  [ceph: root@host01 /]# ceph osd pool create cephfs_metadata 64
  ```

  Typically, the metadata pool can start with a conservative number of Placement Groups (PGs) as it generally has far fewer objects than the data pool. It is possible to increase the number of PGs if needed. The pool sizes range from 64 PGs to 512 PGs. Size the data pool is proportional to the number and sizes of files you expect in the file system.

  IMPORTANT

  For the metadata pool, consider to use:

  - A higher replication level because any data loss to this pool can make the whole file system inaccessible.
  - Storage with lower latency such as Solid-State Drive (SSD) disks because this directly affects the observed latency of file system operations on clients.

  b. Create the file system for the data pools and metadata pools:

Syntax

```
ceph fs new FILESYSTEM_NAME METADATA_POOL DATA_POOL
```

Example

```
[ceph: root@host01 /]# ceph fs new test cephfs_metadata cephfs_data
```

c. Deploy MDS service using the **ceph orch apply** command:

Syntax

```
ceph orch apply mds FILESYSTEM_NAME --placement="NUMBER_OF_DAEMONS
HOST_NAME_1 HOST_NAME_2 HOST_NAME_3"
```

Example

```
[ceph: root@host01 /]# ceph orch apply mds test --placement="2 host01 host02"
```

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- Check the CephFS status:

  Example

  ```
  [ceph: root@host01 /]# ceph fs ls
  [ceph: root@host01 /]# ceph fs status
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=mds
  ```

Additional Resources

- See the *Red Hat Ceph Storage File System Guide* for more information about creating the Ceph File System (CephFS).
- For information on setting the pool values, see Setting number of placement groups in a pool .

9.2. DEPLOYING THE MDS SERVICE USING THE SERVICE SPECIFICATION

Using the Ceph Orchestrator, you can deploy the MDS service using the service specification.

NOTE

Ensure you have at least two pools, one for the Ceph File System (CephFS) data and one for the CephFS metadata.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager, monitor, and OSD daemons are deployed.

Procedure

1. Create the **mds.yaml** file:

   Example

   ```
   [root@host01 ~]# touch mds.yaml
   ```

2. Edit the **mds.yaml** file to include the following details:

   Syntax

   ```
   service_type: mds
   service_id: FILESYSTEM_NAME
   placement:
     hosts:
     - HOST_NAME_1
     - HOST_NAME_2
     - HOST_NAME_3
   ```

   Example

   ```
   service_type: mds
   service_id: fs_name
   placement:
     hosts:
     - host01
     - host02
   ```

3. Mount the YAML file under a directory in the container:

   Example

   ```
   [root@host01 ~]# cephadm shell --mount mds.yaml:/var/lib/ceph/mds/mds.yaml
   ```

4. Navigate to the directory:

   Example

   ```
   [ceph: root@host01 /]# cd /var/lib/ceph/mds/
   ```

5. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

6. Navigate to the following directory:

   Example

   ```
   [ceph: root@host01 /]# cd /var/lib/ceph/mds/
   ```

7. Deploy MDS service using service specification:

   Syntax

   ```
   ceph orch apply -i FILE_NAME.yaml
   ```

   Example

   ```
   [ceph: root@host01 mds]# ceph orch apply -i mds.yaml
   ```

8. Once the MDS services is deployed and functional, create the CephFS:

   Syntax

   ```
   ceph fs new CEPHFS_NAME METADATA_POOL DATA_POOL
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph fs new test metadata_pool data_pool
   ```

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

Example

```
[ceph: root@host01 /]# ceph orch ps --daemon_type=mds
```

Additional Resources

- See the *Red Hat Ceph Storage File System Guide* for more information about creating the Ceph File System (CephFS).

9.3. REMOVING THE MDS SERVICE USING THE CEPH ORCHESTRATOR

You can remove the service using the **ceph orch rm** command. Alternatively, you can remove the file system and the associated pools.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.
- Hosts are added to the cluster.
- At least one MDS daemon deployed on the hosts.

Procedure

- There are two ways of removing MDS daemons from the cluster:

Method 1

- Remove the CephFS volume, associated pools, and the services:
  a. Log into the Cephadm shell:

     Example

     ```
     [root@host01 ~]# cephadm shell
     ```

  b. Set the configuration parameter **mon_allow_pool_delete** to **true**:

     Example

     ```
     [ceph: root@host01 /]# ceph config set mon mon_allow_pool_delete true
     ```

  c. Remove the file system:

     Syntax

     ```
     ceph fs volume rm FILESYSTEM_NAME --yes-i-really-mean-it
     ```

     Example

```
[ceph: root@host01 /]# ceph fs volume rm cephfs-new --yes-i-really-mean-it
```

This command will remove the file system, its data, and metadata pools. It also tries to remove the MDS using the enabled **ceph-mgr** Orchestrator module.

Method 2

- Use the **ceph orch rm** command to remove the MDS service from the entire cluster:

  a. List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

  b. Remove the service

  Syntax

  ```
  ceph orch rm SERVICE_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch rm mds.test
  ```

Verification

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps
  ```

Additional Resources

- See *Deploying the MDS service using the command line interface* section in the *Red Hat Ceph Storage Operations Guide* for more information.
- See *Deploying the MDS service using the service specification* section in the *Red Hat Ceph Storage Operations Guide* for more information.

CHAPTER 10. MANAGEMENT OF CEPH OBJECT GATEWAY USING THE CEPH ORCHESTRATOR

As a storage administrator, you can deploy Ceph object gateway using the command line interface or by using the service specification.

You can also configure multi-site object gateways, and remove the Ceph object gateway using the Ceph Orchestrator.

Cephadm deploys Ceph object gateway as a collection of daemons that manages a single-cluster deployment or a particular realm and zone in a multi-site deployment.

NOTE

With Cephadm, the object gateway daemons are configured using the monitor configuration database instead of a **ceph.conf** or the command line. If that configuration is not already in the **client.rgw** section, then the object gateway daemons will start up with default settings and bind to the port **80**.

NOTE

The **.default.rgw.buckets.index** pool is created only after the bucket is created in Ceph Object Gateway, while the **.default.rgw.buckets.data** pool is created after the data is uploaded to the bucket.

This section covers the following administrative tasks:

- *Deploying the Ceph object gateway using the command line interface .*
- *Deploying the Ceph object gateway using the service specification .*
- *Deploying a multi-site Ceph object gateway using the Ceph Orchestrator .*
- *Removing the Ceph object gateway using the Ceph Orchestrator .*

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.
- Hosts are added to the cluster.
- All the managers, monitors, and OSDs are deployed in the storage cluster.

10.1. DEPLOYING THE CEPH OBJECT GATEWAY USING THE COMMAND LINE INTERFACE

Using the Ceph Orchestrator, you can deploy the Ceph Object Gateway with the **ceph orch** command in the command line interface.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.
- Hosts are added to the cluster.
- All manager, monitor and OSD daemons are deployed.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. You can deploy the Ceph object gateway daemons in three different ways:

Method 1

- Create realm, zone group, zone, and then use the placement specification with the host name:

  a. Create a realm:

     Syntax

     ```
     radosgw-admin realm create --rgw-realm=REALM_NAME --default
     ```

     Example

     ```
     [ceph: root@host01 /]# radosgw-admin realm create --rgw-realm=test_realm --default
     ```

  b. Create a zone group:

     Syntax

     ```
     radosgw-admin zonegroup create --rgw-zonegroup=ZONE_GROUP_NAME  --master --default
     ```

     Example

     ```
     [ceph: root@host01 /]# radosgw-admin zonegroup create --rgw-zonegroup=default  --master --default
     ```

  c. Create a zone:

     Syntax

     ```
     radosgw-admin zone create --rgw-zonegroup=ZONE_GROUP_NAME --rgw-zone=ZONE_NAME --master --default
     ```

     Example

     ```
     -
     ```

```
[ceph: root@host01 /]# radosgw-admin zone create --rgw-zonegroup=default --rgw-
zone=test_zone --master --default
```

d. Commit the changes:

Syntax

```
radosgw-admin period update --rgw-realm=REALM_NAME --commit
```

Example

```
[ceph: root@host01 /]# radosgw-admin period update --rgw-realm=test_realm --commit
```

e. Run the **ceph orch apply** command:

Syntax

```
ceph orch apply rgw NAME [--realm=REALM_NAME] [--zone=ZONE_NAME] --
placement="NUMBER_OF_DAEMONS [HOST_NAME_1 HOST_NAME_2]"
```

Example

```
[ceph: root@host01 /]# ceph orch apply rgw test --realm=test_realm --zone=test_zone --
placement="2 host01 host02"
```

Method 2

- Use an arbitrary service name to deploy two Ceph Object Gateway daemons for a single cluster deployment:

Syntax

```
ceph orch apply rgw SERVICE_NAME
```

Example

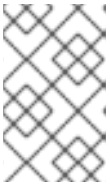
```
[ceph: root@host01 /]# ceph orch apply rgw foo
```

Method 3

- Use an arbitrary service name on a labeled set of hosts:

Syntax

```
ceph orch host label add HOST_NAME_1 LABEL_NAME
ceph orch host label add HOSTNAME_2 LABEL_NAME
ceph orch apply rgw SERVICE_NAME --placement="label:LABEL_NAME count-per-
host:NUMBER_OF_DAEMONS" --port=8000
```



NOTE

NUMBER_OF_DAEMONS controls the number of Ceph object gateways deployed on each host. To achieve the highest performance without incurring an additional cost, set this value to 2.

Example

```
[ceph: root@host01 /]# ceph orch host label add host01 rgw  # the 'rgw' label can be anything
[ceph: root@host01 /]# ceph orch host label add host02 rgw
[ceph: root@host01 /]# ceph orch apply rgw foo --placement="2 label:rgw" --port=8000
```

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=rgw
  ```

10.2. DEPLOYING THE CEPH OBJECT GATEWAY USING THE SERVICE SPECIFICATION

You can deploy the Ceph Object Gateway using the service specification with either the default or the custom realms, zones, and zone groups.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to the bootstrapped host.
- Hosts are added to the cluster.
- All manager, monitor, and OSD daemons are deployed.

Procedure

1. As a root user, create a specification file:

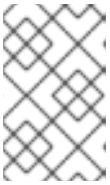
   Example

```
[root@host01 ~]# touch radosgw.yml
```

2. Edit the **radosgw.yml** file to include the following details for the default realm, zone, and zone group:

Syntax

```
service_type: rgw
service_id: REALM_NAME.ZONE_NAME
placement:
  hosts:
  - HOST_NAME_1
  - HOST_NAME_2
  count_per_host: NUMBER_OF_DAEMONS
spec:
  rgw_realm: REALM_NAME
  rgw_zone: ZONE_NAME
  rgw_frontend_port: FRONT_END_PORT
networks:
  -  NETWORK_CIDR # Ceph Object Gateway service binds to a specific network
```



NOTE

NUMBER_OF_DAEMONS controls the number of Ceph Object Gateways deployed on each host. To achieve the highest performance without incurring an additional cost, set this value to 2.

Example

```
service_type: rgw
service_id: default
placement:
  hosts:
  - host01
  - host02
  - host03
  count_per_host: 2
spec:
  rgw_realm: default
  rgw_zone: default
  rgw_frontend_port: 1234
networks:
  - 192.169.142.0/24
```

3. Optional: For custom realm, zone, and zone group, create the resources and then create the **radosgw.yml** file:

   a. Create the custom realm, zone, and zone group:

   ### Example

   ```
   [root@host01 ~]# radosgw-admin realm create --rgw-realm=test_realm
   [root@host01 ~]# radosgw-admin zonegroup create --rgw-zonegroup=test_zonegroup
   ```

```
[root@host01 ~]# radosgw-admin zone create --rgw-zonegroup=test_zonegroup --rgw-zone=test_zone
[root@host01 ~]# radosgw-admin period update --rgw-realm=test_realm --commit
```

b. Create the **radosgw.yml** file with the following details:

Example

```
service_type: rgw
service_id: test_realm.test_zone
placement:
  hosts:
  - host01
  - host02
  - host03
  count_per_host: 2
spec:
  rgw_realm: test_realm
  rgw_zone: test_zone
  rgw_frontend_port: 1234
networks:
  - 192.169.142.0/24
```

4. Mount the **radosgw.yml** file under a directory in the container:

Example

```
[root@host01 ~]# cephadm shell --mount radosgw.yml:/var/lib/ceph/radosgw/radosgw.yml
```

NOTE

Every time you exit the shell, you have to mount the file in the container before deploying the daemon.

5. Deploy the Ceph Object Gateway using the service specification:

Syntax

```
ceph orch apply -i FILE_NAME.yml
```

Example

```
[ceph: root@host01 /]# ceph orch apply -i radosgw.yml
```

Verification

- List the service:

Example

```
[ceph: root@host01 /]# ceph orch ls
```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=rgw
  ```

10.3. DEPLOYING A MULTI-SITE CEPH OBJECT GATEWAY USING THE CEPH ORCHESTRATOR

Ceph Orchestrator supports multi-site configuration options for the Ceph Object Gateway.

You can configure each object gateway to work in an active-active zone configuration allowing writes to a non-primary zone. The multi-site configuration is stored within a container called a realm.

The realm stores zone groups, zones, and a time period. The **rgw** daemons handle the synchronization eliminating the need for a separate synchronization agent, thereby operating with an active-active configuration.

You can also deploy multi-site zones using the command line interface (CLI).

NOTE

The following configuration assumes at least two Red Hat Ceph Storage clusters are in geographically separate locations. However, the configuration also works on the same site.

Prerequisites

- At least two running Red Hat Ceph Storage clusters.
- At least two Ceph Object Gateway instances, one for each Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.
- Nodes or containers are added to the storage cluster.
- All Ceph Manager, Monitor and OSD daemons are deployed.

Procedure

1. In the **cephadm** shell, configure the primary zone:
   a. Create a realm:

      Syntax

      ```
      radosgw-admin realm create --rgw-realm=REALM_NAME --default
      ```

      Example

```
[ceph: root@host01 /]# radosgw-admin realm create --rgw-realm=test_realm --default
```

If the storage cluster has a single realm, then specify the **--default** flag.

b. Create a primary zone group:

Syntax

```
radosgw-admin zonegroup create --rgw-zonegroup=ZONE_GROUP_NAME --
endpoints=http://RGW_PRIMARY_HOSTNAME:RGW_PRIMARY_PORT_NUMBER_1 --
master --default
```

Example

```
[ceph: root@host01 /]# radosgw-admin zonegroup create --rgw-zonegroup=us --
endpoints=http://rgw1:80 --master --default
```

c. Create a primary zone:

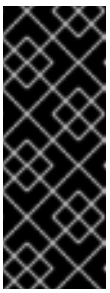
Syntax

```
radosgw-admin zone create --rgw-zonegroup=PRIMARY_ZONE_GROUP_NAME --rgw-
zone=PRIMARY_ZONE_NAME --
endpoints=http://RGW_PRIMARY_HOSTNAME:RGW_PRIMARY_PORT_NUMBER_1 --
access-key=SYSTEM_ACCESS_KEY --secret=SYSTEM_SECRET_KEY
```

Example

```
[ceph: root@host01 /]# radosgw-admin zone create --rgw-zonegroup=us --rgw-zone=us-
east-1 --endpoints=http://rgw1:80 --access-key=LIPEYZJLTWXRKXS9LPJC --secret-
key=IsAje0AVDNXNw48LjMAimpCpI7VaxJYSnfD0FFKQ
```

d. Optional: Delete the default zone, zone group, and the associated pools.



IMPORTANT

Do not delete the default zone and its pools if you are using the default zone and zone group to store data. Also, removing the default zone group deletes the system user.

To access old data in the **default** zone and zonegroup, use **--rgw-zone default** and **--rgw-zonegroup default** in **radosgw-admin** commands.

Example

```
[ceph: root@host01 /]# radosgw-admin zonegroup delete --rgw-zonegroup=default
[ceph: root@host01 /]# ceph osd pool rm default.rgw.log default.rgw.log --yes-i-really-
really-mean-it
[ceph: root@host01 /]# ceph osd pool rm default.rgw.meta default.rgw.meta --yes-i-
really-really-mean-it
[ceph: root@host01 /]# ceph osd pool rm default.rgw.control default.rgw.control --yes-i-
really-really-mean-it
```

```
[ceph: root@host01 /]# ceph osd pool rm default.rgw.data.root default.rgw.data.root --
yes-i-really-really-mean-it
[ceph: root@host01 /]# ceph osd pool rm default.rgw.gc default.rgw.gc --yes-i-really-
really-mean-it
```

e. Create a system user:

Syntax

```
radosgw-admin user create --uid=USER_NAME --display-name="USER_NAME" --
access-key=SYSTEM_ACCESS_KEY --secret=SYSTEM_SECRET_KEY --system
```

Example

```
[ceph: root@host01 /]# radosgw-admin user create --uid=zone.user --display-
name="Zone user" --system
```

Make a note of the **access_key** and **secret_key**.

f. Add the access key and system key to the primary zone:

Syntax

```
radosgw-admin zone modify --rgw-zone=PRIMARY_ZONE_NAME --access-
key=ACCESS_KEY --secret=SECRET_KEY
```

Example

```
[ceph: root@host01 /]# radosgw-admin zone modify --rgw-zone=us-east-1 --access-
key=NE48APYCAODEPLKBCZVQ--
secret=u24GHQWRE3yxxNBnFBzjM4jn14mFIckQ4EKL6LoW
```

g. Commit the changes:

Syntax

```
radosgw-admin period update --commit
```

Example

```
[ceph: root@host01 /]# radosgw-admin period update --commit
```

h. Outside the **cephadm** shell, fetch the **FSID** of the storage cluster and the processes:

Example

```
[root@host01 ~]#  systemctl list-units | grep ceph
```

i. Start the Ceph Object Gateway daemon:

Syntax

```
systemctl start ceph-FSID@DAEMON_NAME
systemctl enable ceph-FSID@DAEMON_NAME
```

Example

```
[root@host01 ~]# systemctl start ceph-62a081a6-88aa-11eb-a367-
001a4a000672@rgw.test_realm.us-east-1.host01.ahdtsw.service
[root@host01 ~]# systemctl enable ceph-62a081a6-88aa-11eb-a367-
001a4a000672@rgw.test_realm.us-east-1.host01.ahdtsw.service
```

2. In the Cephadm shell, configure the secondary zone.

   a. Pull the primary realm configuration from the host:

   Syntax

   ```
   radosgw-admin realm pull --url=URL_TO_PRIMARY_ZONE_GATEWAY --access-
   key=ACCESS_KEY --secret-key=SECRET_KEY
   ```

   Example

   ```
   [ceph: root@host04 /]# radosgw-admin realm pull --url=http://10.74.249.26:80 --access-
   key=LIPEYZJLTWXRKXS9LPJC --secret-
   key=IsAje0AVDNXNw48LjMAimpCpI7VaxJYSnfD0FFKQ
   ```

   b. Pull the primary period configuration from the host:

   Syntax

   ```
   radosgw-admin period pull --url=URL_TO_PRIMARY_ZONE_GATEWAY --access-
   key=ACCESS_KEY --secret-key=SECRET_KEY
   ```

   Example

   ```
   [ceph: root@host04 /]# radosgw-admin period pull --url=http://10.74.249.26:80 --access-
   key=LIPEYZJLTWXRKXS9LPJC --secret-
   key=IsAje0AVDNXNw48LjMAimpCpI7VaxJYSnfD0FFKQ
   ```

   c. Configure a secondary zone:

   Syntax

   ```
   radosgw-admin zone create --rgw-zonegroup=ZONE_GROUP_NAME \
            --rgw-zone=SECONDARY_ZONE_NAME --
   endpoints=http://RGW_SECONDARY_HOSTNAME:RGW_PRIMARY_PORT_NUMBER
   _1 \
            --access-key=SYSTEM_ACCESS_KEY --secret=SYSTEM_SECRET_KEY \
            --endpoints=http://FQDN:80 \
            [--read-only]
   ```

   Example

```
[ceph: root@host04 /]# radosgw-admin zone create --rgw-zonegroup=us --rgw-zone=us-east-2 --endpoints=http://rgw2:80 --access-key=LIPEYZJLTWXRKXS9LPJC --secret-key=IsAje0AVDNXNw48LjMAimpCpI7VaxJYSnfD0FFKQ --endpoints=http://rgw.example.com:80
```

d. Optional: Delete the default zone.

IMPORTANT

Do not delete the default zone and its pools if you are using the default zone and zone group to store data.

To access old data in the **default** zone and zonegroup, use **--rgw-zone default** and **--rgw-zonegroup default** in **radosgw-admin** commands.

Example

```
[ceph: root@host04 /]# radosgw-admin zone rm --rgw-zone=default
[ceph: root@host04 /]# ceph osd pool rm default.rgw.log default.rgw.log --yes-i-really-really-mean-it
[ceph: root@host04 /]# ceph osd pool rm default.rgw.meta default.rgw.meta --yes-i-really-really-mean-it
[ceph: root@host04 /]# ceph osd pool rm default.rgw.control default.rgw.control --yes-i-really-really-mean-it
[ceph: root@host04 /]# ceph osd pool rm default.rgw.data.root default.rgw.data.root --yes-i-really-really-mean-it
[ceph: root@host04 /]# ceph osd pool rm default.rgw.gc default.rgw.gc --yes-i-really-really-mean-it
```

e. Update the Ceph configuration database:

Syntax

```
ceph config set SERVICE_NAME rgw_zone SECONDARY_ZONE_NAME
```

Example

```
[ceph: root@host04 /]# ceph config set rgw rgw_zone us-east-2
```

f. Commit the changes:

Syntax

```
radosgw-admin period update --commit
```

Example

```
[ceph: root@host04 /]# radosgw-admin period update --commit
```

g. Outside the Cephadm shell, fetch the FSID of the storage cluster and the processes:

Example

```
[root@host04 ~]#  systemctl list-units | grep ceph
```

h. Start the Ceph Object Gateway daemon:

Syntax

```
systemctl start ceph-FSID@DAEMON_NAME
systemctl enable ceph-FSID@DAEMON_NAME
```

Example

```
[root@host04 ~]# systemctl start ceph-62a081a6-88aa-11eb-a367-
001a4a000672@rgw.test_realm.us-east-2.host04.ahdtsw.service
[root@host04 ~]# systemctl enable ceph-62a081a6-88aa-11eb-a367-
001a4a000672@rgw.test_realm.us-east-2.host04.ahdtsw.service
```

3. Optional: Deploy multi-site Ceph Object Gateways using the placement specification:

Syntax

```
ceph orch apply rgw NAME --realm=REALM_NAME --zone=PRIMARY_ZONE_NAME --
placement="NUMBER_OF_DAEMONS HOST_NAME_1 HOST_NAME_2"
```

Example

```
[ceph: root@host04 /]# ceph orch apply rgw east --realm=test_realm --zone=us-east-1 --
placement="2 host01 host02"
```

Verification

- Check the synchronization status to verify the deployment:

Example

```
[ceph: root@host04 /]# radosgw-admin sync status
```

10.4. REMOVING THE CEPH OBJECT GATEWAY USING THE CEPH ORCHESTRATOR

You can remove the Ceph object gateway daemons using the **ceph orch rm** command.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.
- Hosts are added to the cluster.
- At least one Ceph object gateway daemon deployed on the hosts.

Procedure

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. List the service:

   Example

   ```
   [ceph: root@host01 /]# ceph orch ls
   ```

3. Remove the service:

   Syntax

   ```
   ceph orch rm SERVICE_NAME
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph orch rm rgw.test_realm.test_zone_bb
   ```

Verification

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps
  ```

  Example

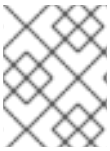
  ```
  [ceph: root@host01 /]# ceph orch ps
  ```

Additional Resources

- See *Deploying the Ceph object gateway using the command line interface* section in the *Red Hat Ceph Storage Operations Guide* for more information.
- See *Deploying the Ceph object gateway using the service specification* section in the *Red Hat Ceph Storage Operations Guide* for more information.

CHAPTER 11. MANAGEMENT OF NFS-GANESHA GATEWAY USING THE CEPH ORCHESTRATOR (LIMITED AVAILABILITY)

As a storage administrator, you can use the Orchestrator with Cephadm in the backend to deploy the NFS-Ganesha gateway. Cephadm deploys NFS Ganesha using a predefined RADOS pool and optional namespace.



NOTE

This technology is Limited Availability. See the *Deprecated functionality* chapter for additional information.

NOTE

Red Hat supports CephFS exports only over the NFS v4.0+ protocol.

This section covers the following administrative tasks:

- *Creating the NFS-Ganesha cluster using the Ceph Orchestrator .*
- *Deploying the NFS-Ganesha gateway using the command line interface .*
- *Deploying the NFS-Ganesha gateway using the service specification .*
- *Implementing HA for CephFS/NFS service .*
- *Updating the NFS-Ganesha cluster using the Ceph Orchestrator .*
- *Viewing the NFS-Ganesha cluster information using the Ceph Orchestrator .*
- *Fetching the NFS-Ganesha cluster logs using the Ceph Orchestrator .*
- *Setting custom NFS-Ganesha configuration using the Ceph Orchestrator .*
- *Resetting custom NFS-Ganesha configuration using the Ceph Orchestrator .*
- *Deleting the NFS-Ganesha cluster using the Ceph Orchestrator .*
- *Removing the NFS Ganesha gateway using the Ceph Orchestrator .*

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.
- Hosts are added to the cluster.
- All manager, monitor and OSD daemons are deployed.

11.1. CREATING THE NFS-GANESHA CLUSTER USING THE CEPH ORCHESTRATOR

You can create an NFS-Ganesha cluster using the **mgr/nfs** module of the Ceph Orchestrator. This module deploys the NFS cluster using Cephadm in the backend.

This creates a common recovery pool for all NFS-Ganesha daemons, new user based on **clusterid**, and a common NFS-Ganesha config RADOS object.

For each daemon, a new user and a common configuration is created in the pool. Although all the clusters have different namespaces with respect to the cluster names, they use the same recovery pool.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager, monitor and OSD daemons are deployed.

Procedure

1. Log into the Cephadm shell:

   #### Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Enable the **mgr/nfs** module:

   #### Example

   ```
   [ceph: root@host01 /]# ceph mgr module enable nfs
   ```

3. Create the cluster:

   #### Syntax

   ```
   ceph nfs cluster create CLUSTER_NAME ["HOST_NAME_1 HOST_NAME_2 HOST_NAME_3"]
   ```

   The *CLUSTER_NAME* is an arbitrary string and *HOST_NAME_1* is an optional string signifying the hosts to deploy NFS-Ganesha daemons.

   #### Example

   ```
   [ceph: root@host01 /]# ceph nfs cluster create nfsganesha "host01 host02"
   NFS Cluster Created Successful
   ```

   This creates an NFS_Ganesha cluster **nfsganesha** with one daemon on **host01** and **host02**.

Verification

- List the cluster details:

  #### Example

```
[ceph: root@host01 /]# ceph nfs cluster ls
```

- Show NFS-Ganesha cluster information:

  Syntax

  ```
  ceph nfs cluster info CLUSTER_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph nfs cluster info nfsganesha
  ```

Additional Resources

- See *Exporting Ceph File System namespaces over the NFS protocol* section in the *Red Hat Ceph Storage File System Guide* for more information.
- See *Deploying the Ceph daemons using the service specification* section in the *Red Hat Ceph Storage Operations Guide* for more information.

11.2. DEPLOYING THE NFS-GANESHA GATEWAY USING THE COMMAND LINE INTERFACE

You can use the Ceph Orchestrator with Cephadm in the backend to deploy the NFS-Ganesha gateway using the placement specification. In this case, you have to create a RADOS pool and create a namespace before deploying the gateway.

NOTE

Red Hat supports CephFS exports only over the NFS v4.0+ protocol.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager, monitor and OSD daemons are deployed.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Create the RADOS pool namespace, and enable the application. For RBD pools, enable RBD.

   Syntax

```
ceph osd pool create POOL_NAME
ceph osd pool application enable POOL_NAME freeform/rgw/rbd/cephfs/nfs
rbd pool init -p POOL_NAME
```

Example

```
[ceph: root@host01 /]# ceph osd pool create nfs-ganesha
[ceph: root@host01 /]# ceph osd pool application enable nfs-ganesha nfs
[ceph: root@host01 /]# rbd pool init -p nfs-ganesha
```

3. Deploy NFS-Ganesha gateway using placement specification in the command line interface:

Syntax

```
ceph orch apply nfs SERVICE_ID --placement="NUMBER_OF_DAEMONS HOST_NAME_1
HOST_NAME_2 HOST_NAME_3"
```

Example

```
[ceph: root@host01 /]# ceph orch apply nfs foo --placement="2 host01 host02"
```

This deploys an NFS-Ganesha cluster **nfsganesha** with one daemon on **host01** and **host02**.

Verification

- List the service:

Example

```
[ceph: root@host01 /]# ceph orch ls
```

- List the hosts, daemons, and processes:

Syntax

```
ceph orch ps --daemon_type=DAEMON_NAME
```

Example

```
[ceph: root@host01 /]# ceph orch ps --daemon_type=nfs
```

Additional Resources

- See *Deploying the Ceph daemons using the command line interface* section in the *Red Hat Ceph Storage Operations Guide* for more information.
- See the *Creating a block device pool* section in the *Red Hat Ceph Storage Block Device Guide* for more information.

11.3. DEPLOYING THE NFS-GANESHA GATEWAY USING THE SERVICE SPECIFICATION

You can use the Ceph Orchestrator with Cephadm in the backend to deploy the NFS-Ganesha gateway using the service specification. In this case, you have to create a RADOS pool and create a namespace before deploying the gateway.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.

Procedure

1. Create the **nfs.yaml** file:

   Example

   ```
   [root@host01 ~]# touch nfs.yaml
   ```

2. Edit the **nfs.yaml** file to include the following details:

   Syntax

   ```
   service_type: nfs
   service_id: SERVICE_ID
   placement:
     hosts:
       - HOST_NAME_1
       - HOST_NAME_2
   ```

   Example

   ```
   service_type: nfs
   service_id: foo
   placement:
     hosts:
       - host01
       - host02
   ```

3. Mount the YAML file under a directory in the container:

   Example

   ```
   [root@host01 ~]# cephadm shell --mount nfs.yaml:/var/lib/ceph/nfs.yaml
   ```

4. Create the RADOS pool, namespace, and enable RBD:

   Syntax

```
ceph osd pool create POOL_NAME
ceph osd pool application enable POOL_NAME rbd
rbd pool init -p POOL_NAME
```

Example

```
[ceph: root@host01 /]# ceph osd pool create nfs-ganesha
[ceph: root@host01 /]# ceph osd pool application enable nfs-ganesha rbd
[ceph: root@host01 /]# rbd pool init -p nfs-ganesha
```

5. Navigate to the directory:

   Example

   ```
   [ceph: root@host01 /]# cd /var/lib/ceph/
   ```

6. Deploy NFS-Ganesha gateway using service specification:

   Syntax

   ```
   ceph orch apply -i FILE_NAME.yaml
   ```

   Example

   ```
   [ceph: root@host01 ceph]# ceph orch apply -i nfs.yaml
   ```

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=nfs
  ```

Additional Resources

- See the *Creating a block device pool* section in the *Red Hat Ceph Storage Block Device Guide* for more information.

11.4. IMPLEMENTING HA FOR CEPHFS/NFS SERVICE (TECHNOLOGY PREVIEW)

You can deploy NFS with a high-availability (HA) front-end, virtual IP, and load balancer, by using the **--ingress** flag and by specifying a virtual IP address. This deploys a combination of **keepalived** and **haproxy** and provides a high-availability NFS frontend for the NFS service.

When a cluster is created with **--ingress** flag, an ingress service is additionally deployed to provide load balancing and high-availability for the NFS servers. A virtual IP is used to provide a known, stable NFS endpoint that all NFS clients can use to mount. Ceph handles the details of redirecting NFS traffic on the virtual IP to the appropriate backend NFS servers and redeploys NFS servers when they fail.

Deploying an ingress service for an existing service provides:

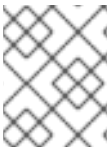
- A stable, virtual IP that can be used to access the NFS server.
- Load distribution across multiple NFS gateways.
- Failover between hosts in the event of a host failure.

IMPORTANT

HA for CephFS/NFS is a Technology Preview feature only. Technology Preview features are not supported with Red Hat production service level agreements (SLAs), might not be functionally complete, and Red Hat does not recommend using them for production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process. See the support scope for Red Hat Technology Preview features for more details.

IMPORTANT

When an **ingress** service is deployed in front of the NFS cluster, the backend NFS-ganesha servers will see the haproxy's IP address and not the client's IP address. As a result, if you are restricting client access based on IP address, access restrictions for NFS exports will not work as expected.



NOTE

If the active NFS server serving a client goes down, the client's I/Os are interrupted until the replacement for the active NFS server is online and the NFS cluster is active again.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All the manager, monitor, and OSD daemons are deployed.
- Ensure the NFS module is enabled.

Procedure

1. Log into the Cephadm shell:

Example

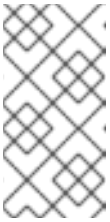
```
[root@host01 ~]# cephadm shell
```

2. Create the NFS cluster with the **--ingress** flag:

Syntax

```
ceph nfs cluster create CLUSTER_ID [PLACEMENT] [--port PORT_NUMBER] [--ingress --virtual-ip IP_ADDRESS/CIDR_PREFIX]
```

- Replace *CLUSTER_ID* with a unique string to name the NFS Ganesha cluster.
- Replace *PLACEMENT* with the number of NFS servers to deploy and the host or hosts that you want to deploy the NFS Ganesha daemon containers on.
- Use the **--port** *PORT_NUMBER* flag to deploy NFS on a port other than the default port of 2049.
- The **--ingress** flag combined with the **--virtual-ip** flag, deploys NFS with a high-availability front-end (virtual IP and load balancer).
- Replace **--virtual-ip** *IP_ADDRESS* with an IP address to provide a known, stable NFS endpoint that all clients can use to mount NFS exports. The **--virtual-ip** must include a CIDR prefix length. The virtual IP will normally be configured on the first identified network interface that has an existing IP in the same subnet.

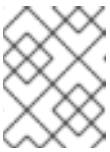


NOTE

The number of hosts you allocate for the NFS service must be greater than the number of active NFS servers you request to deploy, specified by the **placement: count** parameter. In the below example, one active NFS server is requested and two hosts are allocated.

Example

```
[ceph: root@host01 /]# ceph nfs cluster create mycephnfs "1 host02 host03" --ingress --virtual-ip 10.10.128.75/22
```



NOTE

Deployment of NFS daemons and the ingress service is asynchronous and the command might return before the services have completely started.

3. Check that the services have successfully started:

Syntax

```
ceph orch ls --service_name=nfs.CLUSTER_ID
ceph orch ls --service_name=ingress.nfs.CLUSTER_ID
```

Example

```
[ceph: root@host01 /]# ceph orch ls --service_name=nfs.mycephnfs

NAME          PORTS    RUNNING  REFRESHED  AGE  PLACEMENT
nfs.mycephnfs  ?:12049      1/2  0s ago     20s  host02;host03

[ceph: root@host01 /]# ceph orch ls --service_name=ingress.nfs.mycephnfs

NAME                 PORTS                 RUNNING  REFRESHED  AGE  PLACEMENT
ingress.nfs.mycephnfs  10.10.128.75:2049,9049      4/4   46s ago    73s  count:2
```

Verification

- View the IP endpoints, IPs for the individual NFS daemons, and the virtual IP for the **ingress** service:

  #### Syntax

  ```
  ceph nfs cluster info CLUSTER_ID
  ```

  #### Example

  ```
  [ceph: root@host01 /]# ceph nfs cluster info mycephnfs

  {
     "mycephnfs": {
        "virtual_ip": "10.10.128.75",
        "backend": [
           {
              "hostname": "host02",
              "ip": "10.10.128.69",
              "port": 12049
           },
           {
              "hostname": "host03",
              "ip": "10.10.128.70",
              "port": 12049
           }
        ],
        "port": 2049,
        "monitor_port": 9049
     }
  }
  ```

- List the hosts and processes:

  #### Example

  ```
  [ceph: root@host01 /]# ceph orch ps | grep nfs

  haproxy.nfs.cephnfs.host01.rftylv     host01  *:2049,9000  running (11m)    10m ago  11m
  23.2M        -  2.2.19-7ea3822   5e6a41d77b38  f8cc61dc827e
  haproxy.nfs.cephnfs.host02.zhtded     host02  *:2049,9000  running (11m)    53s ago  11m
  21.3M        -  2.2.19-7ea3822   5e6a41d77b38  4cad324e0e23
  keepalived.nfs.cephnfs.host01.zktmsk  host01               running (11m)    10m ago  11m
  ```

```
2349k   -  2.1.5   18fa163ab18f  66bf39784993
keepalived.nfs.cephnfs.host02.vyycvp  host02          running (11m)    53s ago  11m
2349k   -  2.1.5   18fa163ab18f  1ecc95a568b4
nfs.cephnfs.0.0.host02.fescmw         host02  *:12049  running (14m)     3m ago  14m
76.9M   -  3.5     cef6e7959b0a  bb0e4ee9484e
nfs.cephnfs.1.0.host03.avaddf         host03  *:12049  running (14m)     3m ago  14m
74.3M   -  3.5     cef6e7959b0a  ea02c0c50749
```

Additional resources

- For information about mounting NFS exports on client hosts, see the *Exporting Ceph File System namespaces over the NFS protocol* section in the *Red Hat Ceph Storage File System Guide*.

11.5. UPGRADING A STANDALONE CEPHFS/NFS CLUSTER FOR HA

As a storage administrator, you can upgrade a standalone storage cluster to a high-availability (HA) cluster by deploying the **ingress** service on an existing NFS service.

Prerequisites

- A running Red Hat Ceph Storage cluster with an existing NFS service.
- Hosts are added to the cluster.
- All the manager, monitor, and OSD daemons are deployed.
- Ensure the NFS module is enabled.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. List existing NFS clusters:

   Example

   ```
   [ceph: root@host01 /]# ceph nfs cluster ls

   mynfs
   ```

NOTE

If a standalone NFS cluster is created on one node, you need to increase it to two or more nodes for HA. To increase the NFS service, edit the **nfs.yaml** file and increase the placements with the same port number.

The number of hosts you allocate for the NFS service must be greater than the number of active NFS servers you request to deploy, specified by the **placement: count** parameter.

Syntax

```
service_type: nfs
service_id: SERVICE_ID
placement:
  hosts:
    - HOST_NAME_1
    - HOST_NAME_2
  count: COUNT
spec:
  port: PORT_NUMBER
```

Example

```
service_type: nfs
service_id: mynfs
placement:
  hosts:
    - host02
    - host03
  count: 1
spec:
  port: 12345
```

In this example, the existing NFS service is running on port **12345** and an additional node is added to the NFS cluster with the same port.

Apply the **nfs.yaml** service specification changes to upgrade to a two node NFS service:

Example

```
[ceph: root@host01 ceph]# ceph orch apply -i nfs.yaml
```

3. Edit the **ingress.yaml** specification file with the existing NFS cluster ID:

Syntax

```
service_type: SERVICE_TYPE
service_id: SERVICE_ID
placement:
  count: PLACEMENT
spec:
  backend_service: SERVICE_ID_BACKEND (1)
```

```
frontend_port: FRONTEND_PORT
monitor_port: MONITOR_PORT 2
virtual_ip: VIRTUAL_IP_WITH_CIDR
```

1 *SERVICE_ID_BACKEND* should include a *PORT* property that is not **2049** to avoid conflicting with the ingress service, which could be placed on the same host.

2 *MONITOR_PORT* is used to access the haproxy load status page.

Example

```
service_type: ingress
service_id: nfs.mynfs
placement:
  count: 2
spec:
  backend_service: nfs.mynfs
  frontend_port: 2049
  monitor_port: 9000
  virtual_ip: 10.10.128.75/22
```

4. Deploy the ingress service:

Example

```
[ceph: root@host01 /]# ceph orch apply -i ingress.yaml
```

NOTE

Deployment of NFS daemons and the ingress service is asynchronous and the command might return before the services have completely started.

5. Check that the ingress services have successfully started:

Syntax

```
ceph orch ls --service_name=ingress.nfs.CLUSTER_ID
```

Example

```
[ceph: root@host01 /]# ceph orch ls --service_name=ingress.nfs.mynfs

NAME                 PORTS                 RUNNING  REFRESHED  AGE  PLACEMENT
ingress.nfs.mynfs  10.10.128.75:2049,9000      4/4   4m ago     22m  count:2
```

Verification

- View the IP endpoints, IPs for the individual NFS daemons, and the virtual IP for the **ingress** service:

Syntax

```
ceph nfs cluster info CLUSTER_ID
```

Example

```
[ceph: root@host01 /]# ceph nfs cluster info mynfs

{
    "mynfs": {
        "virtual_ip": "10.10.128.75",
        "backend": [
            {
                "hostname": "host02",
                "ip": "10.10.128.69",
                "port": 12049
            },
            {
                "hostname": "host03",
                "ip": "10.10.128.70",
                "port": 12049
            }
        ],
        "port": 2049,
        "monitor_port": 9049
    }
}
```

- List the hosts and processes:

Example

```
[ceph: root@host01 /]# ceph orch ps | grep nfs

haproxy.nfs.mynfs.host01.ruyyhq     host01  *:2049,9000  running (27m)     6m ago  34m
9.85M        -  2.2.19-7ea3822   5e6a41d77b38  328d27b3f706
haproxy.nfs.mynfs.host02.ctrhha     host02  *:2049,9000  running (34m)     6m ago  34m
4944k        -  2.2.19-7ea3822   5e6a41d77b38  4f4440dbfde9
keepalived.nfs.mynfs.host01.fqgjxd  host01               running (27m)     6m ago  34m    31.2M
-  2.1.5            18fa163ab18f  0e22b2b101df
keepalived.nfs.mynfs.host02.fqzkxb  host02               running (34m)     6m ago  34m    17.5M
-  2.1.5            18fa163ab18f  c1e3cc074cf8
nfs.mynfs.0.0.host02.emoaut         host02  *:12345      running (37m)     6m ago  37m    82.7M
-  3.5              91322de4f795  2d00faaa2ae5
nfs.mynfs.1.0.host03.nsxcfd         host03  *:12345      running (37m)     6m ago  37m    81.1M
-  3.5              91322de4f795  d4bda4074f17
```

Additional resources

- For information about mounting NFS exports on client hosts, see the *Exporting Ceph File System namespaces over the NFS protocol* section in the *Red Hat Ceph Storage File System Guide*.

11.6. DEPLOYING HA FOR CEPHFS/NFS USING A SPECIFICATION FILE

You can deploy HA for CephFS/NFS using a specification file by first deploying an NFS service and then deploying **ingress** to the same NFS service.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All the manager, monitor, and OSD daemons are deployed.
- Ensure the NFS module is enabled.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Ensure the NFS module is enabled:

   Example

   ```
   [ceph: root@host01 /]# ceph mgr module ls | more
   ```

3. Exit out of the Cephadm shell and create the **nfs.yaml** file:

   Example

   ```
   [root@host01 ~]# touch nfs.yaml
   ```

4. Edit the **nfs.yaml** file to include the following details:

   Syntax

   ```
   service_type: nfs
   service_id: SERVICE_ID
   placement:
     hosts:
       - HOST_NAME_1
       - HOST_NAME_2
     count: COUNT
   spec:
     port: PORT_NUMBER
   ```

NOTE

The number of hosts you allocate for the NFS service must be greater than the number of active NFS servers you request to deploy, specified by the **placement: count** parameter.

Example

```
service_type: nfs
service_id: cephfsnfs
placement:
  hosts:
    - host02
    - host03
  count: 1
spec:
  port: 12345
```

In this example, the server is run on the non-default port of **12345**, instead of the default port of **2049**, on host02 and host03.

5. Mount the YAML file under a directory in the container:

Example

```
[root@host01 ~]# cephadm shell --mount nfs.yaml:/var/lib/ceph/nfs.yaml
```

6. Log into the Cephadm shell and navigate to the directory:

Example

```
[ceph: root@host01 /]# cd /var/lib/ceph/
```

7. Deploy the NFS service using service specification:

Syntax

```
ceph orch apply -i FILE_NAME.yaml
```

Example

```
[ceph: root@host01 ceph]# ceph orch apply -i nfs.yaml
```

NOTE

Deployment of the NFS service is asynchronous and the command might return before the services have completely started.

8. Check that the NFS services have successfully started:

Syntax

```
ceph orch ls --service_name=nfs.CLUSTER_ID
```

Example

```
[ceph: root@host01 /]# ceph orch ls --service_name=nfs.cephfsnfs
```

```
NAME          PORTS    RUNNING  REFRESHED  AGE  PLACEMENT
nfs.cephfsnfs  ?:12345      2/2  3m ago     13m  host02;host03
```

9. Exit out of the Cephadm shell and create the **ingress.yaml** file:

   Example

   ```
   [root@host01 ~]# touch ingress.yaml
   ```

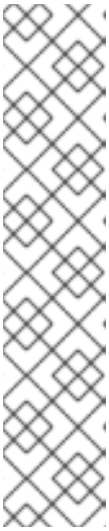
10. Edit the **ingress.yaml** file to include the following details:

    Syntax

    ```
    service_type: SERVICE_TYPE
    service_id: SERVICE_ID
    placement:
      count: PLACEMENT
    spec:
      backend_service: SERVICE_ID_BACKEND
      frontend_port: FRONTEND_PORT
      monitor_port: MONITOR_PORT
      virtual_ip: VIRTUAL_IP_WITH_CIDR
    ```

    Example

    ```
    service_type: ingress
    service_id: nfs.cephfsnfs
    placement:
      count: 2
    spec:
      backend_service: nfs.cephfsnfs
      frontend_port: 2049
      monitor_port: 9000
      virtual_ip: 10.10.128.75/22
    ```

    NOTE

    In this example, **placement: count: 2** deploys the **keepalived** and **haproxy** service on random nodes. To specify the nodes to deploy **keepalived** and **haproxy** on, use the **placement: hosts** option:

    Example

    ```
    service_type: ingress
    service_id: nfs.cephfsnfs
    placement:
      hosts:
        - host02
        - host03
    ```

11. Mount the YAML file under a directory in the container:

Example

```
[root@host01 ~]# cephadm shell --mount ingress.yaml:/var/lib/ceph/ingress.yaml
```

12. Log into the Cephadm shell and navigate to the directory:

Example

```
[ceph: root@host01 /]# cd /var/lib/ceph/
```

13. Deploy the **ingress** service using service specification:

Syntax

```
ceph orch apply -i FILE_NAME.yaml
```

Example

```
[ceph: root@host01 ceph]# ceph orch apply -i ingress.yaml
```

14. Check that the ingress services have successfully started:

Syntax

```
ceph orch ls --service_name=ingress.nfs.CLUSTER_ID
```

Example

```
[ceph: root@host01 /]# ceph orch ls --service_name=ingress.nfs.cephfsnfs

NAME                  PORTS                RUNNING  REFRESHED  AGE  PLACEMENT
ingress.nfs.cephfsnfs  10.10.128.75:2049,9000      4/4   4m ago     22m  count:2
```

Verification

- View the IP endpoints, IPs for the individual NFS daemons, and the virtual IP for the **ingress** service:

Syntax

```
ceph nfs cluster info CLUSTER_ID
```

Example

```
[ceph: root@host01 /]# ceph nfs cluster info cephfsnfs

{
   "cephfsnfs": {
      "virtual_ip": "10.10.128.75",
      "backend": [
         {
```

```
            "hostname": "host02",
            "ip": "10.10.128.69",
            "port": 12345
        },
        {
            "hostname": "host03",
            "ip": "10.10.128.70",
            "port": 12345
        }
    ],
    "port": 2049,
    "monitor_port": 9049
  }
}
```

- List the hosts and processes:

  Example

```
[ceph: root@host01 /]# ceph orch ps | grep nfs

haproxy.nfs.cephfsnfs.host01.ruyyhq     host01  *:2049,9000  running (27m)     6m ago  34m
9.85M        -  2.2.19-7ea3822   5e6a41d77b38  328d27b3f706
haproxy.nfs.cephfsnfs.host02.ctrhha     host02  *:2049,9000  running (34m)     6m ago  34m
4944k        -  2.2.19-7ea3822   5e6a41d77b38  4f4440dbfde9
keepalived.nfs.cephfsnfs.host01.fqgjxd  host01               running (27m)     6m ago  34m
31.2M        -  2.1.5            18fa163ab18f  0e22b2b101df
keepalived.nfs.cephfsnfs.host02.fqzkxb  host02               running (34m)     6m ago  34m
17.5M        -  2.1.5            18fa163ab18f  c1e3cc074cf8
nfs.cephfsnfs.0.0.host02.emoaut         host02  *:12345      running (37m)     6m ago  37m
82.7M        -  3.5              91322de4f795  2d00faaa2ae5
nfs.cephfsnfs.1.0.host03.nsxcfd         host03  *:12345      running (37m)     6m ago  37m
81.1M        -  3.5              91322de4f795  d4bda4074f17
```

Additional resources

- For information about mounting NFS exports on client hosts, see the *Exporting Ceph File System namespaces over the NFS protocol* section in the *Red Hat Ceph Storage File System Guide*.

11.7. UPDATING THE NFS-GANESHA CLUSTER USING THE CEPH ORCHESTRATOR

You can update the NFS-Ganesha cluster by changing the placement of the daemons on the hosts using the Ceph Orchestrator with Cephadm in the backend.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager, monitor and OSD daemons are deployed.

- NFS-Ganesha cluster created using the **mgr/nfs** module.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Update the cluster:

   Syntax

   ```
   ceph orch apply nfs CLUSTER_NAME ["HOST_NAME_1,HOST_NAME_2,HOST_NAME_3"]
   ```

   The *CLUSTER_NAME* is an arbitrary string, *HOST_NAME_1* is an optional string signifying the hosts to update the deployed NFS-Ganesha daemons.

   Example

   ```
   [ceph: root@host01 /]# ceph orch apply nfs nfsganesha "host02"
   ```

   This updates the **nfsganesha** cluster on **host02**.

Verification

- List the cluster details:

  Example

  ```
  [ceph: root@host01 /]# ceph nfs cluster ls
  ```

- Show NFS-Ganesha cluster information:

  Syntax

  ```
  ceph nfs cluster info CLUSTER_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph nfs cluster info nfsganesha
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

  Example

```
[ceph: root@host01 /]# ceph orch ps --daemon_type=nfs
```

Additional Resources

- See *Creating the NFS-Ganesha cluster using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide* for more information.

11.8. VIEWING THE NFS-GANESHA CLUSTER INFORMATION USING THE CEPH ORCHESTRATOR

You can view the information of the NFS-Ganesha cluster using the Ceph Orchestrator. You can get the information about all the NFS Ganesha clusters or specific clusters with their port, IP address and the name of the hosts on which the cluster is created.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager, monitor and OSD daemons are deployed.
- NFS-Ganesha cluster created using the **mgr/nfs** module.

Procedure

1. Log into the Cephadm shell:

   #### Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. View the NFS-Ganesha cluster information:

   #### Syntax

   ```
   ceph nfs cluster info CLUSTER_NAME
   ```

   #### Example

   ```
   [ceph: root@host01 /]# ceph nfs cluster info nfsganesha

   {
       "nfsganesha": [
           {
               "hostname": "host02",
               "ip": [
                   "10.10.128.70"
               ],
               "port": 2049
           }
       ]
   }
   ```

-

Additional Resources

- See *Creating the NFS-Ganesha cluster using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide* for more information.

11.9. FETCHING THE NFS-GANESHA CLUSTER LOGS USING THE CEPH ORCHESTRATOR

With the Ceph Orchestrator, you can fetch the NFS-Ganesha cluster logs. You need to be on the node where the service is deployed.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Cephadm installed on the nodes where NFS is deployed.
- Root-level access to all the nodes.
- Hosts are added to the cluster.
- NFS-Ganesha cluster created using the **mgr/nfs** module.

Procedure

1. As a root user, fetch the *FSID* of the storage cluster:

   Example

   ```
   [root@host03 ~]# cephadm ls
   ```

   Copy the *FSID* and the name of the service.

2. Fetch the logs:

   Syntax

   ```
   cephadm logs --fsid FSID --name SERVICE_NAME
   ```

   Example

   ```
   [root@host03 ~]# cephadm logs --fsid 499829b4-832f-11eb-8d6d-001a4a000635 --name
   nfs.foo.host03
   ```

Additional Resources

- See *Deploying the Ceph daemons using the placement specification* section in the *Red Hat Ceph Storage Operations Guide* for more information.

11.10. SETTING CUSTOM NFS-GANESHA CONFIGURATION USING THE CEPH ORCHESTRATOR

The NFS-Ganesha cluster is defined in default configuration blocks. Using Ceph Orchestrator you can customize the configuration and that will have precedence over the default configuration blocks.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager, monitor and OSD daemons are deployed.
- NFS-Ganesha cluster created using the **mgr/nfs** module.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. The following is an example of the default configuration of NFS-Ganesha cluster:

   Example

   ```
   # {{ cephadm_managed }}
   NFS_CORE_PARAM {
           Enable_NLM = false;
           Enable_RQUOTA = false;
           Protocols = 4;
   }

   MDCACHE {
           Dir_Chunk = 0;
   }

   EXPORT_DEFAULTS {
           Attr_Expiration_Time = 0;
   }

   NFSv4 {
           Delegations = false;
           RecoveryBackend = 'rados_cluster';
           Minor_Versions = 1, 2;
   }

   RADOS_KV {
           UserId = "{{ user }}";
           nodeid = "{{ nodeid}}";
           pool = "{{ pool }}";
           namespace = "{{ namespace }}";
   }

   RADOS_URLS {
           UserId = "{{ user }}";
   ```

```
        watch_url = "{{ url }}";
}

RGW {
        cluster = "ceph";
        name = "client.{{ rgw_user }}";
}

%url    {{ url }}
```

3. Customize the NFS-Ganesha cluster configuration. The following are two examples for customizing the configuration:

   - Change the log level:

     Example

     ```
     LOG {
      COMPONENTS {
          ALL = FULL_DEBUG;
       }
      }
     ```

   - Add custom export block:

     a. Create the user.

     NOTE

     User specified in FSAL blocks should have proper caps for NFS-Ganesha daemons to access the Ceph cluster.

     Syntax

     ```
     ceph auth get-or-create client.USER_ID mon 'allow r' osd 'allow rw pool=.nfs namespace=NFS_CLUSTER_NAME, allow rw tag cephfs data=FS_NAME' mds 'allow rw path=EXPORT_PATH'
     ```

     Example

     ```
     [ceph: root@host01 /]# ceph auth get-or-create client.f64f341c-655d-11eb-8778-fa163e914bcc mon 'allow r' osd 'allow rw pool=.nfs namespace=nfs_cluster_name, allow rw tag cephfs data=fs_name' mds 'allow rw path=export_path'
     ```

     b. Navigate to the following directory:

     Syntax

     ```
     cd /var/lib/ceph/DAEMON_PATH/
     ```

     Example

     ```
     [ceph: root@host01 /]# cd /var/lib/ceph/nfs/
     ```

-

If the **nfs** directory does not exist, create a directory in the path.

c. Create a new configuration file:

Syntax

```
touch PATH_TO_CONFIG_FILE
```

Example

```
[ceph: root@host01 nfs]#  touch nfs-ganesha.conf
```

d. Edit the configuration file by adding the custom export block. It creates a single export and that is managed by the Ceph NFS export interface.

Syntax

```
EXPORT {
  Export_Id = NUMERICAL_ID;
  Transports = TCP;
  Path = PATH_WITHIN_CEPHFS;
  Pseudo = BINDING;
  Protocols = 4;
  Access_Type = PERMISSIONS;
  Attr_Expiration_Time = 0;
  Squash = None;
  FSAL {
    Name = CEPH;
    Filesystem = "FILE_SYSTEM_NAME";
    User_Id = "USER_NAME";
    Secret_Access_Key = "USER_SECRET_KEY";
  }
}
```

Example

```
EXPORT {
  Export_Id = 100;
  Transports = TCP;
  Path = /;
  Pseudo = /ceph/;
  Protocols = 4;
  Access_Type = RW;
  Attr_Expiration_Time = 0;
  Squash = None;
  FSAL {
    Name = CEPH;
    Filesystem = "filesystem name";
    User_Id = "user id";
    Secret_Access_Key = "secret key";
  }
}
```

4. Apply the new configuration the cluster:

   Syntax

   ```
   ceph nfs cluster config set CLUSTER_NAME -i PATH_TO_CONFIG_FILE
   ```

   Example

   ```
   [ceph: root@host01 nfs]# ceph nfs cluster config set nfs-ganesha -i /var/lib/ceph/nfs/nfs-ganesha.conf
   ```

   This also restarts the service for the custom configuration.

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=nfs
  ```

- Verify the custom configuration:

  Syntax

  ```
  /bin/rados -p POOL_NAME -N CLUSTER_NAME get userconf-nfs.CLUSTER_NAME -
  ```

  Example

  ```
  [ceph: root@host01 /]# /bin/rados -p nfs-ganesha -N nfsganesha get userconf-nfs.nfsganesha -
  ```

Additional Resources

- See the *Resetting custom NFS-Ganesha configuration using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide* for more information.

11.11. RESETTING CUSTOM NFS-GANESHA CONFIGURATION USING THE CEPH ORCHESTRATOR

Using the Ceph Orchestrator, you can reset the user-defined configuration to the default configuration.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager, monitor and OSD daemons are deployed.
- NFS-Ganesha deployed using the **mgr/nfs** module.
- Custom NFS cluster configuration is set-up

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Reset the NFS-Ganesha configuration:

   Syntax

   ```
   ceph nfs cluster config reset CLUSTER_NAME
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph nfs cluster config reset  nfs-cephfs
   ```

Verification

- List the service:

  Example

  ```
  [ceph: root@host01 /]# ceph orch ls
  ```

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps --daemon_type=DAEMON_NAME
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps --daemon_type=nfs
  ```

- Verify the custom configuration is deleted:

Syntax

```
/bin/rados -p POOL_NAME -N CLUSTER_NAME get userconf-nfs.CLUSTER_NAME -
```

Example

```
[ceph: root@host01 /]# /bin/rados -p nfs-ganesha -N nfsganesha get userconf-
nfs.nfsganesha -
```

Additional Resources

- See *Creating the NFS-Ganesha cluster using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide* for more information.
- See the *Setting custom NFS-Ganesha configuration using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide* for more information..

11.12. DELETING THE NFS-GANESHA CLUSTER USING THE CEPH ORCHESTRATOR

You can use the Ceph Orchestrator with Cephadm in the backend to delete the NFS-Ganesha cluster.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Hosts are added to the cluster.
- All manager, monitor and OSD daemons are deployed.
- NFS-Ganesha cluster created using the **mgr/nfs** module.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Delete the cluster:

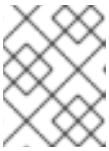
   Syntax

   ```
   ceph nfs cluster rm CLUSTER_NAME
   ```

   The *CLUSTER_NAME* is an arbitrary string.

   Example

   ```
   [ceph: root@host01 /]# ceph nfs cluster rm nfsganesha
   NFS Cluster Deleted Successfully
   ```



NOTE

The **delete** option is deprecated and you need to use **rm** to delete an NFS cluster.

Verification

- List the cluster details:

  Example

```
[ceph: root@host01 /]# ceph nfs cluster ls
```

Additional Resources

- See *Exporting Ceph File System namespaces over the NFS protocol* section in the *Red Hat Ceph Storage File System guide* for more information.
- See *Creating the NFS-Ganesha cluster using the Ceph Orchestrator* section in the *Red Hat Ceph Storage Operations Guide* for more information.

11.13. REMOVING THE NFS-GANESHA GATEWAY USING THE CEPH ORCHESTRATOR

You can remove the NFS-Ganesha gateway using the **ceph orch rm** command.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all the nodes.
- Hosts are added to the cluster.
- At least one NFS-Ganesha gateway deployed on the hosts.

Procedure

1. Log into the Cephadm shell:

   Example

```
[root@host01 ~]# cephadm shell
```

2. List the service:

   Example

```
[ceph: root@host01 /]# ceph orch ls
```

3. Remove the service:

   Syntax

```
ceph orch rm SERVICE_NAME
```

Example

```
[ceph: root@host01 /]# ceph orch rm nfs.foo
```

Verification

- List the hosts, daemons, and processes:

  Syntax

  ```
  ceph orch ps
  ```

  Example

  ```
  [ceph: root@host01 /]# ceph orch ps
  ```

Additional Resources

- See *Deploying the Ceph daemons using the service specification* section in the *Red Hat Ceph Storage Operations Guide* for more information.
- See *Deploying the NFS-Ganesha gateway using the service specification* section in the *Red Hat Ceph Storage Operations Guide* for more information.

CHAPTER 12. CONFIGURATION OF SNMP TRAPS

As a storage administrator, you can deploy and configure the simple network management protocol (SNMP) gateway in a Red Hat Ceph Storage cluster to receive alerts from the Prometheus Alertmanager and route them as SNMP traps to the cluster.

12.1. SIMPLE NETWORK MANAGEMENT PROTOCOL

Simple network management protocol (SNMP) is one of the most widely used open protocols, to monitor distributed systems and devices across a variety of hardware and software platforms. Ceph's SNMP integration focuses on forwarding alerts from its Prometheus Alertmanager cluster to a gateway daemon. The gateway daemon transforms the alert into an SNMP Notification and sends it on to a designated SNMP management platform. The gateway daemon is from the **snmp_notifier_project**, which provides SNMP V2c and V3 support with authentication and encryption.

The Red Hat Ceph Storage SNMP gateway service deploys one instance of the gateway by default. You can increase this by providing placement information. However, if you enable multiple SNMP gateway daemons, your SNMP management platform receives multiple notifications for the same event.

The SNMP traps are alert messages and the Prometheus Alertmanager sends these alerts to the SNMP notifier which then looks for object identifier (OID) in the given alerts' labels. Each SNMP trap has a unique ID which allows it to send additional traps with updated status to a given SNMP poller. SNMP hooks into the Ceph health checks so that every health warning generates a specific SNMP trap.

In order to work correctly and transfer information on device status to the user to monitor, SNMP relies on several components. There are four main components that makeup SNMP:

- **SNMP Manager**- The SNMP manager, also called a management station, is a computer that runs network monitoring platforms. A platform that has the job of polling SNMP-enabled devices and retrieving data from them. An SNMP Manager queries agents, receives responses from agents and acknowledges asynchronous events from agents.

- **SNMP Agent** - An SNMP agent is a program that runs on a system to be managed and contains the MIB database for the system. These collect data like bandwidth and disk space, aggregates it, and sends it to the management information base (MIB).

- **Management information base (MIB)**- These are components contained within the SNMP agents. The SNMP manager uses this as a database and asks the agent for access to particular information. This information is needed for the network management systems (NMS). The NMS polls the agent to take information from these files and then proceeds to translate it into graphs and displays that can be viewed by the user. MIBs contain statistical and control values that are determined by the network device.

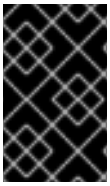
- **SNMP Devices**

The following versions of SNMP are compatible and supported for gateway implementation:

- **V2c** - Uses a community string without any authentication and is vulnerable to outside attacks.

- **V3 authNoPriv** - Uses the username and password authentication without encryption.

- **V3 authPriv** - Uses the username and password authentication with encryption to the SNMP management platform.



IMPORTANT

When using SNMP traps, ensure that you have the correct security configuration for your version number to minimize the vulnerabilities that are inherent to SNMP and keep your network protected from unauthorized users.

12.2. CONFIGURING SNMPTRAPD

It is important to configure the simple network management protocol (SNMP) target before deploying the **snmp-gateway** because the **snmptrapd** daemon contains the auth settings that you need to specify when creating the **snmp-gateway** service.

The SNMP gateway feature provides a means of exposing the alerts that are generated in the Prometheus stack to an SNMP management platform. You can configure the SNMP traps to the destination based on the **snmptrapd** tool. This tool allows you to establish one or more SNMP trap listeners.

The following parameters are important for configuration:

- The **engine-id** is a unique identifier for the device, in hex, and required for SNMPV3 gateway. Red Hat recommends using `8000C53F_CLUSTER_FSID_WITHOUT_DASHES_`for this parameter.
- The **snmp-community**, which is the *SNMP_COMMUNITY_FOR_SNMPV2* parameter, is **public** for SNMPV2c gateway.
- The **auth-protocol** which is the *AUTH_PROTOCOL*, is mandatory for SNMPV3 gateway and is **SHA** by default.
- The **privacy-protocol**, which is the *PRIVACY_PROTOCOL*, is mandatory for SNMPV3 gateway.
- The *PRIVACY_PASSWORD* is mandatory for SNMPV3 gateway with encryption.
- The *SNMP_V3_AUTH_USER_NAME* is the user name and is mandatory for SNMPV3 gateway.
- The *SNMP_V3_AUTH_PASSWORD* is the password and is mandatory for SNMPV3 gateway.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to the nodes.
- Install **firewalld** on Red Hat Enterprise Linux system.

Procedure

1. On the SNMP management host, install the SNMP packages:

   #### Example

   ```
   [root@host01 ~]# dnf install -y net-snmp-utils net-snmp
   ```

2. Open the port 162 for SNMP to receive alerts:

Example

```
[root@host01 ~]# firewall-cmd --zone=public --add-port=162/udp
[root@host01 ~]# firewall-cmd --zone=public --add-port=162/udp --permanent
```

3. Implement the management information base (MIB) to make sense of the SNMP notification and enhance SNMP support on the destination host. Copy the raw file from the main repository: https://github.com/ceph/ceph/blob/master/monitoring/snmp/CEPH-MIB.txt

   Example

   ```
   [root@host01 ~]# curl -o CEPH_MIB.txt -L
   https://raw.githubusercontent.com/ceph/ceph/master/monitoring/snmp/CEPH-MIB.txt
   [root@host01 ~]# scp CEPH_MIB.txt root@host02:/usr/share/snmp/mibs
   ```

4. Create the **snmptrapd** directory.

   Example

   ```
   [root@host01 ~]# mkdir /root/snmptrapd/
   ```

5. Create the configuration files in **snmptrapd** directory for each protocol based on the SNMP version:

   Syntax

   ```
   format2 %V\n% Agent Address: %A \n Agent Hostname: %B \n Date: %H - %J - %K - %L -
   %M - %Y \n Enterprise OID: %N \n Trap Type: %W \n Trap Sub-Type: %q \n
   Community/Infosec Context: %P \n Uptime: %T \n Description: %W \n PDU Attribute/Value
   Pair Array:\n%v \n ---------- \n
   createuser -e 0x_ENGINE_ID_ SNMPV3_AUTH_USER_NAME AUTH_PROTOCOL
   SNMP_V3_AUTH_PASSWORD PRIVACY_PROTOCOL PRIVACY_PASSWORD
   authuser log,execute SNMP_V3_AUTH_USER_NAME
   authCommunity   log,execute,net SNMP_COMMUNITY_FOR_SNMPV2
   ```

   - For SNMPV2c, create the **snmptrapd_public.conf** file as follows:

     Example

     ```
     format2 %V\n% Agent Address: %A \n Agent Hostname: %B \n Date: %H - %J - %K -
     %L - %M - %Y \n Enterprise OID: %N \n Trap Type: %W \n Trap Sub-Type: %q \n
     Community/Infosec Context: %P \n Uptime: %T \n Description: %W \n PDU
     Attribute/Value Pair Array:\n%v \n ---------- \n

     authCommunity   log,execute,net public
     ```

     The **public** setting here must match the **snmp_community** setting used when deploying the **snmp-gateway** service.

   - For SNMPV3 with authentication only, create the **snmptrapd_auth.conf** file as follows:

     Example

```
format2 %V\n% Agent Address: %A \n Agent Hostname: %B \n Date: %H - %J - %K - %L - %M - %Y \n Enterprise OID: %N \n Trap Type: %W \n Trap Sub-Type: %q \n Community/Infosec Context: %P \n Uptime: %T \n Description: %W \n PDU Attribute/Value Pair Array:\n%v \n ---------- \n
createuser -e 0x8000C53Ff64f341c655d11eb8778fa163e914bcc myuser SHA mypassword
authuser log,execute myuser
```

The **0x8000C53Ff64f341c655d11eb8778fa163e914bcc** string is the **engine_id**, and **myuser** and **mypassword** are the credentials. The password security is defined by the **SHA** algorithm.

This corresponds to the settings for deploying the **snmp-gateway** daemon.

Example

```
snmp_v3_auth_username: myuser
snmp_v3_auth_password: mypassword
```

- For SNMPV3 with authentication and encryption, create the **snmptrapd_authpriv.conf** file as follows:

Example

```
format2 %V\n% Agent Address: %A \n Agent Hostname: %B \n Date: %H - %J - %K - %L - %M - %Y \n Enterprise OID: %N \n Trap Type: %W \n Trap Sub-Type: %q \n Community/Infosec Context: %P \n Uptime: %T \n Description: %W \n PDU Attribute/Value Pair Array:\n%v \n ---------- \n
createuser -e 0x8000C53Ff64f341c655d11eb8778fa163e914bcc myuser SHA mypassword DES mysecret
authuser log,execute myuser
```

The **0x8000C53Ff64f341c655d11eb8778fa163e914bcc** string is the **engine_id**, and **myuser** and **mypassword** are the credentials. The password security is defined by the **SHA** algorithm and **DES** is the type of privacy encryption.

This corresponds to the settings for deploying the **snmp-gateway** daemon.

Example

```
snmp_v3_auth_username: myuser
snmp_v3_auth_password: mypassword
snmp_v3_priv_password: mysecret
```

6. Run the daemon on the SNMP management host:

Syntax

```
/usr/sbin/snmptrapd -M /usr/share/snmp/mibs -m CEPH-MIB.txt -f -C -c /root/snmptrapd/CONFIGURATION_FILE -Of -Lo :162
```

Example

```
[root@host01 ~]# /usr/sbin/snmptrapd -M /usr/share/snmp/mibs -m CEPH-MIB.txt -f -C -c
/root/snmptrapd/snmptrapd_auth.conf -Of -Lo :162
```

7. If any alert is triggered on the storage cluster, you can monitor the output on the SNMP management host. Verify the SNMP traps and also the traps decoded by MIB.

Example

```
NET-SNMP version 5.8
 Agent Address: 0.0.0.0
 Agent Hostname: <UNKNOWN>
 Date: 15 - 5 - 12 - 8 - 10 - 4461391
 Enterprise OID: .
 Trap Type: Cold Start
 Trap Sub-Type: 0
 Community/Infosec Context: TRAP2, SNMP v3, user myuser, context
 Uptime: 0
 Description: Cold Start
 PDU Attribute/Value Pair Array:
.iso.org.dod.internet.mgmt.mib-2.1.3.0 = Timeticks: (292276100) 3 days, 19:52:41.00
.iso.org.dod.internet.snmpV2.snmpModules.1.1.4.1.0 = OID:
.iso.org.dod.internet.private.enterprises.ceph.cephCluster.cephNotifications.prometheus.promM
gr.promMgrPrometheusInactive
.iso.org.dod.internet.private.enterprises.ceph.cephCluster.cephNotifications.prometheus.promM
gr.promMgrPrometheusInactive.1 = STRING:
"1.3.6.1.4.1.50495.1.2.1.6.2[alertname=CephMgrPrometheusModuleInactive]"
.iso.org.dod.internet.private.enterprises.ceph.cephCluster.cephNotifications.prometheus.promM
gr.promMgrPrometheusInactive.2 = STRING: "critical"
.iso.org.dod.internet.private.enterprises.ceph.cephCluster.cephNotifications.prometheus.promM
gr.promMgrPrometheusInactive.3 = STRING: "Status: critical
- Alert: CephMgrPrometheusModuleInactive
  Summary: Ceph's mgr/prometheus module is not available
  Description: The mgr/prometheus module at 10.70.39.243:9283 is unreachable. This could
mean that the module has been disabled or the mgr itself is down.
Without the mgr/prometheus module metrics and alerts will no longer function. Open a shell
to ceph and use 'ceph -s' to determine whether the mgr is active. If the mgr is not active,
restart it, otherwise you can check the mgr/prometheus module is loaded with 'ceph mgr
module ls'  and if it's not listed as enabled, enable it with 'ceph mgr module enable
prometheus'"
```

In the above example, an alert is generated after the Prometheus module is disabled.

Additional Resources

- See the *Deploying the SNMP gateway* section in the *Red Hat Ceph Storage Operations Guide*.

12.3. DEPLOYING THE SNMP GATEWAY

You can deploy the simple network management protocol (SNMP) gateway using either SNMPV2c or SNMPV3. There are two methods to deploy the SNMP gateway:

1. By creating a credentials file.
2. By creating one service configuration yaml file with all the details.

You can use the following parameters to deploy the SNMP gateway based on the versions:

- The **service_type** is the **snmp-gateway**.
- The **service_name** is any user-defined string.
- The **count** is the number of SNMP gateways to be deployed in a storage cluster.
- The **snmp_destination** parameter must be of the format hostname:port.
- The **engine-id** is a unique identifier for the device, in hex, and required for SNMPV3 gateway. Red Hat recommends to use `8000C53F_CLUSTER_FSID_WITHOUT_DASHES_` for this parameter.
- The **snmp_community** parameter is **public** for SNMPV2c gateway.
- The **auth-protocol** is mandatory for SNMPV3 gateway and is **SHA** by default.
- The **privacy-protocol** is mandatory for SNMPV3 gateway with authentication and encryption.
- The port is **9464** by default.
- You must provide a **-i *FILENAME*** to pass the secrets and passwords to the orchestrator.

Once the SNMP gateway service is deployed or updated, the Prometheus Alertmanager configuration is automatically updated to forward any alert that has an objectidentifier to the SNMP gateway daemon for further processing.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to the nodes.
- Configuring **snmptrapd** on the destination host, which is the SNMP management host.

Procedure

1. Log into the Cephadm shell:

   Example

   ```
   [root@host01 ~]# cephadm shell
   ```

2. Create a label for the host on which SNMP gateway needs to be deployed:

   Syntax

   ```
   ceph orch host label add HOSTNAME snmp-gateway
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph orch host label add host02 snmp-gateway
   ```

3. Create a credentials file or a service configuration file based on the SNMP version:

- For SNMPV2c, create the file as follows:

  Example

  ```
  [ceph: root@host01 /]# cat snmp_creds.yml

  snmp_community: public
  ```

  OR

  Example

  ```
  [ceph: root@host01 /]# cat snmp-gateway.yml

  service_type: snmp-gateway
  service_name: snmp-gateway
  placement:
    count: 1
  spec:
    credentials:
      snmp_community: public
    port: 9464
    snmp_destination: 192.168.122.73:162
    snmp_version: V2c
  ```

- For SNMPV3 with authentication only, create the file as follows:

  Example

  ```
  [ceph: root@host01 /]# cat snmp_creds.yml

  snmp_v3_auth_username: myuser
  snmp_v3_auth_password: mypassword
  ```

  OR

  Example

  ```
  [ceph: root@host01 /]# cat snmp-gateway.yml

  service_type: snmp-gateway
  service_name: snmp-gateway
  placement:
    count: 1
  spec:
    credentials:
      snmp_v3_auth_password: mypassword
      snmp_v3_auth_username: myuser
    engine_id: 8000C53Ff64f341c655d11eb8778fa163e914bcc
    port: 9464
    snmp_destination: 192.168.122.1:162
    snmp_version: V3
  ```

- For SNMPV3 with authentication and encryption, create the file as follows:

Example

```
[ceph: root@host01 /]# cat snmp_creds.yml

snmp_v3_auth_username: myuser
snmp_v3_auth_password: mypassword
snmp_v3_priv_password: mysecret
```

OR

Example

```
[ceph: root@host01 /]# cat snmp-gateway.yml

service_type: snmp-gateway
service_name: snmp-gateway
placement:
  count: 1
spec:
  credentials:
    snmp_v3_auth_password: mypassword
    snmp_v3_auth_username: myuser
    snmp_v3_priv_password: mysecret
  engine_id: 8000C53Ff64f341c655d11eb8778fa163e914bcc
  port: 9464
  snmp_destination: 192.168.122.1:162
  snmp_version: V3
```

4. Run the **ceph orch** command:

Syntax

```
ceph orch apply snmp-gateway --snmp_version=V2c_OR_V3 --
destination=SNMP_DESTINATION [--port=PORT_NUMBER]\
[--engine-id=8000C53F_CLUSTER_FSID_WITHOUT_DASHES_] [--auth-
protocol=MDS_OR_SHA] [--privacy_protocol=DES_OR_AES] -i FILENAME
```

OR

Syntax

```
ceph orch apply -i FILENAME.yml
```

- For SNMPV2c, with the **snmp_creds** file, run the **ceph orch** command with the **snmp-version** as **V2c**:

  Example

  ```
  [ceph: root@host01 /]# ceph orch apply snmp-gateway --snmp-version=V2c --
  destination=192.168.122.73:162 --port=9464 -i snmp_creds.yml
  ```

- For SNMPV3 with authentication only, with the **snmp_creds** file, run the **ceph orch** command with the **snmp-version** as **V3** and **engine-id**:

Example

```
[ceph: root@host01 /]# ceph orch apply snmp-gateway --snmp-version=V3 --engine-id=8000C53Ff64f341c655d11eb8778fa163e914bcc--destination=192.168.122.73:162 -i snmp_creds.yml
```

- For SNMPV3 with authentication and encryption, with the **snmp_creds** file, run the **ceph orch** command with the **snmp-version** as **V3**, **privacy-protocol**, and **engine-id**:

Example

```
[ceph: root@host01 /]# ceph orch apply snmp-gateway --snmp-version=V3 --engine-id=8000C53Ff64f341c655d11eb8778fa163e914bcc--destination=192.168.122.73:162 --privacy-protocol=AES -i snmp_creds.yml
```

OR

- For all the SNMP versions, with the **snmp-gateway** file, run the following command:

Example

```
[ceph: root@host01 /]# ceph orch apply -i snmp-gateway.yml
```

Additional Resources

- See the *Configuring `snmptrapd`* section in the *Red Hat Ceph Storage Operations Guide*.

CHAPTER 13. HANDLING A NODE FAILURE

As a storage administrator, you can experience a whole node failing within the storage cluster, and handling a node failure is similar to handling a disk failure. With a node failure, instead of Ceph recovering placement groups (PGs) for only one disk, all PGs on the disks within that node must be recovered. Ceph will detect that the OSDs are all down and automatically start the recovery process, known as self-healing.

There are three node failure scenarios.

- Replacing the node by using the root and Ceph OSD disks from the failed node.
- Replacing the node by reinstalling the operating system and using the Ceph OSD disks from the failed node.
- Replacing the node by reinstalling the operating system and using all new Ceph OSD disks.

For a high-level workflow for each node replacement scenario, see link:https://access.redhat.com/documentation/en-us/red_hat_ceph_storage/6/html-single/operations_guide/#ops_workflow-for replacing-a-node[*Workflow for replacing a node*].

Prerequisites

- A running Red Hat Ceph Storage cluster.
- A failed node.

13.1. CONSIDERATIONS BEFORE ADDING OR REMOVING A NODE

One of the outstanding features of Ceph is the ability to add or remove Ceph OSD nodes at run time. This means that you can resize the storage cluster capacity or replace hardware without taking down the storage cluster.

The ability to serve Ceph clients while the storage cluster is in a **degraded** state also has operational benefits. For example, you can add or remove or replace hardware during regular business hours, rather than working overtime or on weekends. However, adding and removing Ceph OSD nodes can have a significant impact on performance.

Before you add or remove Ceph OSD nodes, consider the effects on storage cluster performance:

- Whether you are expanding or reducing the storage cluster capacity, adding or removing Ceph OSD nodes induces backfilling as the storage cluster rebalances. During that rebalancing time period, Ceph uses additional resources, which can impact storage cluster performance.
- In a production Ceph storage cluster, a Ceph OSD node has a particular hardware configuration that facilitates a particular type of storage strategy.
- Since a Ceph OSD node is part of a CRUSH hierarchy, the performance impact of adding or removing a node typically affects the performance of pools that use the CRUSH ruleset.

Additional Resources

- See the *Red Hat Ceph Storage Storage Strategies Guide* for more details.

13.2. WORKFLOW FOR REPLACING A NODE

There are three node failure scenarios. Use these high-level workflows for each scenario when replacing a node.

- *Replacing the node by using the root and Ceph OSD disks from the failed node*
- *Replacing the node by reinstalling the operating system and using the Ceph OSD disks from the failed node*
- *Replacing the node by reinstalling the operating system and using all new Ceph OSD disks*

Prerequisites

- A running Red Hat Ceph Storage cluster.
- A failed node.

13.2.1. Replacing the node by using the root and Ceph OSD disks from the failed node

Use the root and Ceph OSD disks from the failed node to replace the node.

Procedure

1. Disable backfilling.

   Syntax

   ```
   ceph osd set noout
   ceph osd set noscrub
   ceph osd set nodeep-scrub
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph osd set noout
   [ceph: root@host01 /]# ceph osd set noscrub
   [ceph: root@host01 /]# ceph osd set nodeep-scrub
   ```

2. Replace the node, taking the disks from the old node, and adding them to the new node.

3. Enable backfilling.

   Syntax

   ```
   ceph osd unset noout
   ceph osd unset noscrub
   ceph osd unset nodeep-scrub
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph osd unset noout
   [ceph: root@host01 /]# ceph osd unset noscrub
   [ceph: root@host01 /]# ceph osd unset nodeep-scrub
   ```

13.2.2. Replacing the node by reinstalling the operating system and using the Ceph OSD disks from the failed node

Reinstall the operating system and use the Ceph OSD disks from the failed node to replace the node.

Procedure

1. Disable backfilling.

   Syntax

   ```
   ceph osd set noout
   ceph osd set noscrub
   ceph osd set nodeep-scrub
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph osd set noout
   [ceph: root@host01 /]# ceph osd set noscrub
   [ceph: root@host01 /]# ceph osd set nodeep-scrub
   ```

2. Create a backup of the Ceph configuration.

   Syntax

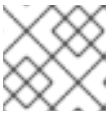
   ```
   cp /etc/ceph/ceph.conf /PATH_TO_BACKUP_LOCATION/ceph.conf
   ```

   Example

   ```
   [ceph: root@host01 /]# cp /etc/ceph/ceph.conf /some/backup/location/ceph.conf
   ```

3. Replace the node and add the Ceph OSD disks from the failed node.

4. Configure disks as JBOD.

   NOTE

   This should be done by the storage administrator.

5. Install the operating system. For more information about operating system requirements, see *Operating system requirements for Red Hat Ceph Storage* . For more information about installing the operating system, see the Red Hat Enterprise Linux product documentation .

   NOTE

   This should be done by the system administrator.

6. Restore the Ceph configuration.

   Syntax

   ```
   cp /PATH_TO_BACKUP_LOCATION/ceph.conf /etc/ceph/ceph.conf
   ```

-

Example

```
[ceph: root@host01 /]# cp /some/backup/location/ceph.conf /etc/ceph/ceph.conf
```

7. Add the new node to the storage cluster using the Ceph Orchestrator commands. Ceph daemons are placed automatically on the respective node. For more information, see *Adding a Ceph OSD node*.

8. Enable backfilling.

Syntax

```
ceph osd unset noout
ceph osd unset noscrub
ceph osd unset nodeep-scrub
```

Example

```
[ceph: root@host01 /]# ceph osd unset noout
[ceph: root@host01 /]# ceph osd unset noscrub
[ceph: root@host01 /]# ceph osd unset nodeep-scrub
```

13.2.3. Replacing the node by reinstalling the operating system and using all new Ceph OSD disks

Reinstall the operating system and use all new Ceph OSD disks to replace the node.

Procedure

1. Disable backfilling.

Syntax

```
ceph osd set noout
ceph osd set noscrub
ceph osd set nodeep-scrub
```

Example

```
[ceph: root@host01 /]# ceph osd set noout
[ceph: root@host01 /]# ceph osd set noscrub
[ceph: root@host01 /]# ceph osd set nodeep-scrub
```

2. Remove all OSDs on the failed node from the storage cluster. For more information, see *Removing a Ceph OSD node*.

3. Create a backup of the Ceph configuration.

Syntax

```
cp /etc/ceph/ceph.conf /PATH_TO_BACKUP_LOCATION/ceph.conf
```

Example

```
[ceph: root@host01 /]# cp /etc/ceph/ceph.conf /some/backup/location/ceph.conf
```

4. Replace the node and add the Ceph OSD disks from the failed node.
5. Configure disks as JBOD.

NOTE

This should be done by the storage administrator.

6. Install the operating system. For more information about operating system requirements, see *Operating system requirements for Red Hat Ceph Storage* . For more information about installing the operating system, see the Red Hat Enterprise Linux product documentation .

NOTE

This should be done by the system administrator.

7. Add the new node to the storage cluster using the Ceph Orchestrator commands. Ceph daemons are placed automatically on the respective node. For more information, see *Adding a Ceph OSD node*.
8. Enable backfilling.

Syntax

```
ceph osd unset noout
ceph osd unset noscrub
ceph osd unset nodeep-scrub
```

Example

```
[ceph: root@host01 /]# ceph osd unset noout
[ceph: root@host01 /]# ceph osd unset noscrub
[ceph: root@host01 /]# ceph osd unset nodeep-scrub
```

13.3. PERFORMANCE CONSIDERATIONS

The following factors typically affect a storage cluster's performance when adding or removing Ceph OSD nodes:

- Ceph clients place load on the I/O interface to Ceph; that is, the clients place load on a pool. A pool maps to a CRUSH ruleset. The underlying CRUSH hierarchy allows Ceph to place data across failure domains. If the underlying Ceph OSD node involves a pool that is experiencing high client load, the client load could significantly affect recovery time and reduce performance. Because write operations require data replication for durability, write-intensive client loads in particular can increase the time for the storage cluster to recover.

- Generally, the capacity you are adding or removing affects the storage cluster's time to recover. In addition, the storage density of the node you add or remove might also affect recovery times. For example, a node with 36 OSDs typically takes longer to recover than a node with 12 OSDs.

- When removing nodes, you MUST ensure that you have sufficient spare capacity so that you will not reach **full ratio** or **near full ratio**. If the storage cluster reaches **full ratio**, Ceph will suspend write operations to prevent data loss.

- A Ceph OSD node maps to at least one Ceph CRUSH hierarchy, and the hierarchy maps to at least one pool. Each pool that uses a CRUSH ruleset experiences a performance impact when Ceph OSD nodes are added or removed.

- Replication pools tend to use more network bandwidth to replicate deep copies of the data, whereas erasure coded pools tend to use more CPU to calculate **k+m** coding chunks. The more copies that exist of the data, the longer it takes for the storage cluster to recover. For example, a larger pool or one that has a greater number of **k+m** chunks will take longer to recover than a replication pool with fewer copies of the same data.

- Drives, controllers and network interface cards all have throughput characteristics that might impact the recovery time. Generally, nodes with higher throughput characteristics, such as 10 Gbps and SSDs, recover more quickly than nodes with lower throughput characteristics, such as 1 Gbps and SATA drives.

13.4. RECOMMENDATIONS FOR ADDING OR REMOVING NODES

Red Hat recommends adding or removing one OSD at a time within a node and allowing the storage cluster to recover before proceeding to the next OSD. This helps to minimize the impact on storage cluster performance. Note that if a node fails, you might need to change the entire node at once, rather than one OSD at a time.

To remove an OSD:

- Using *Removing the OSD daemons using the Ceph Orchestrator* .

To add an OSD:

- Using *Deploying Ceph OSDs on all available devices* .

- Using *Deploying Ceph OSDs using advanced service specification* .

- Using *Deploying Ceph OSDs on specific devices and hosts* .

When adding or removing Ceph OSD nodes, consider that other ongoing processes also affect storage cluster performance. To reduce the impact on client I/O, Red Hat recommends the following:

Calculate capacity

Before removing a Ceph OSD node, ensure that the storage cluster can backfill the contents of all its OSDs without reaching the **full ratio**. Reaching the **full ratio** will cause the storage cluster to refuse write operations.

Temporarily disable scrubbing

Scrubbing is essential to ensuring the durability of the storage cluster's data; however, it is resource intensive. Before adding or removing a Ceph OSD node, disable scrubbing and deep-scrubbing and let the current scrubbing operations complete before proceeding.

```
ceph osd set noscrub
ceph osd set nodeep-scrub
```

Once you have added or removed a Ceph OSD node and the storage cluster has returned to an **active+clean** state, unset the **noscrub** and **nodeep-scrub** settings.

```
ceph osd unset noscrub
ceph osd unset nodeep-scrub
```

Limit backfill and recovery

If you have reasonable data durability, there is nothing wrong with operating in a **degraded** state. For example, you can operate the storage cluster with **osd_pool_default_size = 3** and **osd_pool_default_min_size = 2**. You can tune the storage cluster for the fastest possible recovery time, but doing so significantly affects Ceph client I/O performance. To maintain the highest Ceph client I/O performance, limit the backfill and recovery operations and allow them to take longer.

```
osd_max_backfills = 1
osd_recovery_max_active = 1
osd_recovery_op_priority = 1
```

You can also consider setting the sleep and delay parameters such as, **osd_recovery_sleep**.

Increase the number of placement groups

Finally, if you are expanding the size of the storage cluster, you may need to increase the number of placement groups. If you determine that you need to expand the number of placement groups, Red Hat recommends making incremental increases in the number of placement groups. Increasing the number of placement groups by a significant amount will cause a considerable degradation in performance.

13.5. ADDING A CEPH OSD NODE

To expand the capacity of the Red Hat Ceph Storage cluster, you can add an OSD node.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- A provisioned node with a network connection.

Procedure

1. Verify that other nodes in the storage cluster can reach the new node by its short host name.
2. Temporarily disable scrubbing:

   #### Example

   ```
   [ceph: root@host01 /]# ceph osd set noscrub
   [ceph: root@host01 /]# ceph osd set nodeep-scrub
   ```

3. Limit the backfill and recovery features:

   #### Syntax

```
ceph tell DAEMON_TYPE.* injectargs --OPTION_NAME VALUE [--OPTION_NAME VALUE]
```

Example

```
[ceph: root@host01 /]# ceph tell osd.* injectargs --osd-max-backfills 1 --osd-recovery-max-active 1 --osd-recovery-op-priority 1
```

4. Extract the cluster's public SSH keys to a folder:

   Syntax

   ```
   ceph cephadm get-pub-key > ~/PATH
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph cephadm get-pub-key > ~/ceph.pub
   ```

5. Copy ceph cluster's public SSH keys to the root user's **authorized_keys** file on the new host:

   Syntax

   ```
   ssh-copy-id -f -i ~/PATH root@HOST_NAME_2
   ```

   Example

   ```
   [ceph: root@host01 /]# ssh-copy-id -f -i ~/ceph.pub root@host02
   ```

6. Add the new node to the CRUSH map:

   Syntax

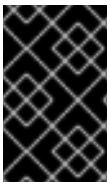
   ```
   ceph orch host add NODE_NAME IP_ADDRESS
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph orch host add host02 10.10.128.70
   ```

7. Add an OSD for each disk on the node to the storage cluster.

   - Using *Deploying Ceph OSDs on all available devices* .
   - Using *Deploying Ceph OSDs using advanced service specification* .
   - Using *Deploying Ceph OSDs on specific devices and hosts* .



IMPORTANT

When adding an OSD node to a Red Hat Ceph Storage cluster, Red Hat recommends adding one OSD daemon at a time and allowing the cluster to recover to an **active+clean** state before proceeding to the next OSD.

Additional Resources

- See the *Setting a Specific Configuration Setting at Runtime* section in the *Red Hat Ceph Storage Configuration Guide* for more details.
- See *Adding a Bucket* and *Moving a Bucket* sections in the *Red Hat Ceph Storage Storage Strategies Guide* for details on placing the node at an appropriate location in the CRUSH hierarchy.

13.6. REMOVING A CEPH OSD NODE

To reduce the capacity of a storage cluster, remove an OSD node.

WARNING

Before removing a Ceph OSD node, ensure that the storage cluster can backfill the contents of all OSDs without reaching the **full ratio**. Reaching the **full ratio** will cause the storage cluster to refuse write operations.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all nodes in the storage cluster.

Procedure

1. Check the storage cluster's capacity:

   Syntax

   ```
   ceph df
   rados df
   ceph osd df
   ```

2. Temporarily disable scrubbing:

   Syntax

   ```
   ceph osd set noscrub
   ceph osd set nodeep-scrub
   ```

3. Limit the backfill and recovery features:

   Syntax

   ```
   ceph tell DAEMON_TYPE.* injectargs --OPTION_NAME VALUE [--OPTION_NAME VALUE]
   ```

   Example

```
[ceph: root@host01 /]# ceph tell osd.* injectargs --osd-max-backfills 1 --osd-recovery-max-active 1 --osd-recovery-op-priority 1
```

4. Remove each OSD on the node from the storage cluster:

   - Using *Removing the OSD daemons using the Ceph Orchestrator*.

IMPORTANT

When removing an OSD node from the storage cluster, Red Hat recommends removing one OSD at a time within the node and allowing the cluster to recover to an **active+clean** state before proceeding to remove the next OSD.

   a. After you remove an OSD, check to verify that the storage cluster is not getting to the **near-full ratio**:

      Syntax

      ```
      ceph -s
      ceph df
      ```

   b. Repeat this step until all OSDs on the node are removed from the storage cluster.

5. Once all OSDs are removed, remove the host:

   - Using *Removing hosts using the Ceph Orchestrator*.

Additional Resources

- See the *Setting a specific configuration at runtime* section in the *Red Hat Ceph Storage Configuration Guide* for more details.

13.7. SIMULATING A NODE FAILURE

To simulate a hard node failure, power off the node and reinstall the operating system.

Prerequisites

- A healthy running Red Hat Ceph Storage cluster.
- Root-level access to all nodes on the storage cluster.

Procedure

1. Check the storage cluster's capacity to understand the impact of removing the node:

   Example

   ```
   [ceph: root@host01 /]# ceph df
   [ceph: root@host01 /]# rados df
   [ceph: root@host01 /]# ceph osd df
   ```

2. Optionally, disable recovery and backfilling:

   Example

   ```
   [ceph: root@host01 /]# ceph osd set noout
   [ceph: root@host01 /]# ceph osd set noscrub
   [ceph: root@host01 /]# ceph osd set nodeep-scrub
   ```

3. Shut down the node.

4. If you are changing the host name, remove the node from CRUSH map:

   Example

   ```
   [ceph: root@host01 /]# ceph osd crush rm host03
   ```

5. Check the status of the storage cluster:

   Example

   ```
   [ceph: root@host01 /]# ceph -s
   ```

6. Reinstall the operating system on the node.

7. Add the new node:

   - Using the *Adding hosts using the Ceph Orchestrator*.

8. Optionally, enable recovery and backfilling:

   Example

   ```
   [ceph: root@host01 /]# ceph osd unset noout
   [ceph: root@host01 /]# ceph osd unset noscrub
   [ceph: root@host01 /]# ceph osd unset nodeep-scrub
   ```

9. Check Ceph's health:

   Example

   ```
   [ceph: root@host01 /]# ceph -s
   ```

Additional Resources

- See the *Red Hat Ceph Storage Installation Guide* for more details.

CHAPTER 14. HANDLING A DATA CENTER FAILURE

As a storage administrator, you can take preventive measures to avoid a data center failure. These preventive measures include:

- Configuring the data center infrastructure.
- Setting up failure domains within the CRUSH map hierarchy.
- Designating failure nodes within the domains.

Prerequisites

- A healthy running Red Hat Ceph Storage cluster.
- Root-level access to all nodes in the storage cluster.

14.1. AVOIDING A DATA CENTER FAILURE

Configuring the data center infrastructure

Each data center within a stretch cluster can have a different storage cluster configuration to reflect local capabilities and dependencies. Set up replication between the data centers to help preserve the data. If one data center fails, the other data centers in the storage cluster contain copies of the data.

Setting up failure domains within the CRUSH map hierarchy

Failure, or failover, domains are redundant copies of domains within the storage cluster. If an active domain fails, the failure domain becomes the active domain.

By default, the CRUSH map lists all nodes in a storage cluster within a flat hierarchy. However, for best results, create a logical hierarchical structure within the CRUSH map. The hierarchy designates the domains to which each node belongs and the relationships among those domains within the storage cluster, including the failure domains. Defining the failure domains for each domain within the hierarchy improves the reliability of the storage cluster.

When planning a storage cluster that contains multiple data centers, place the nodes within the CRUSH map hierarchy so that if one data center goes down, the rest of the storage cluster stays up and running.

Designating failure nodes within the domains

If you plan to use three-way replication for data within the storage cluster, consider the location of the nodes within the failure domain. If an outage occurs within a data center, it is possible that some data might reside in only one copy. When this scenario happens, there are two options:

- Leave the data in read-only status with the standard settings.
- Live with only one copy for the duration of the outage.

With the standard settings, and because of the randomness of data placement across the nodes, not all the data will be affected, but some data can have only one copy and the storage cluster would revert to read-only mode. However, if some data exist in only one copy, the storage cluster reverts to read-only mode.

14.2. HANDLING A DATA CENTER FAILURE

Red Hat Ceph Storage can withstand catastrophic failures to the infrastructure, such as losing one of the data centers in a stretch cluster. For the standard object store use case, configuring all three data centers can be done independently with replication set up between them. In this scenario, the storage cluster configuration in each of the data centers might be different, reflecting the local capabilities and dependencies.

A logical structure of the placement hierarchy should be considered. A proper CRUSH map can be used, reflecting the hierarchical structure of the failure domains within the infrastructure. Using logical hierarchical definitions improves the reliability of the storage cluster, versus using the standard hierarchical definitions. Failure domains are defined in the CRUSH map. The default CRUSH map contains all nodes in a flat hierarchy. In a three data center environment, such as a stretch cluster, the placement of nodes should be managed in a way that one data center can go down, but the storage cluster stays up and running. Consider which failure domain a node resides in when using 3-way replication for the data.

In the example below, the resulting map is derived from the initial setup of the storage cluster with 6 OSD nodes. In this example, all nodes have only one disk and hence one OSD. All of the nodes are arranged under the default *root*, that is the standard *root* of the hierarchy tree. Because there is a weight assigned to two of the OSDs, these OSDs receive fewer chunks of data than the other OSDs. These nodes were introduced later with bigger disks than the initial OSD disks. This does not affect the data placement to withstand a failure of a group of nodes.

Example

```
[ceph: root@host01 /]# ceph osd tree
ID WEIGHT  TYPE NAME          UP/DOWN REWEIGHT PRIMARY-AFFINITY
-1 0.33554 root default
-2 0.04779     host host03
 0 0.04779         osd.0          up  1.00000          1.00000
-3 0.04779     host host02
 1 0.04779         osd.1          up  1.00000          1.00000
-4 0.04779     host host01
 2 0.04779         osd.2          up  1.00000          1.00000
-5 0.04779     host host04
 3 0.04779         osd.3          up  1.00000          1.00000
-6 0.07219     host host06
 4 0.07219         osd.4          up  0.79999          1.00000
-7 0.07219     host host05
 5 0.07219         osd.5          up  0.79999          1.00000
```

Using logical hierarchical definitions to group the nodes into same data center can achieve data placement maturity. Possible definition types of *root*, *datacenter*, *rack*, *row* and *host* allow the reflection of the failure domains for the three data center stretch cluster:

- Nodes host01 and host02 reside in data center 1 (DC1)
- Nodes host03 and host05 reside in data center 2 (DC2)
- Nodes host04 and host06 reside in data center 3 (DC3)
- All data centers belong to the same structure (allDC)

Since all OSDs in a host belong to the host definition there is no change needed. All the other assignments can be adjusted during runtime of the storage cluster by:

- Defining the *bucket* structure with the following commands:

```
ceph osd crush add-bucket allDC root
ceph osd crush add-bucket DC1 datacenter
ceph osd crush add-bucket DC2 datacenter
ceph osd crush add-bucket DC3 datacenter
```

- Moving the nodes into the appropriate place within this structure by modifying the CRUSH map:

```
ceph osd crush move DC1 root=allDC
ceph osd crush move DC2 root=allDC
ceph osd crush move DC3 root=allDC
ceph osd crush move host01 datacenter=DC1
ceph osd crush move host02 datacenter=DC1
ceph osd crush move host03 datacenter=DC2
ceph osd crush move host05 datacenter=DC2
ceph osd crush move host04 datacenter=DC3
ceph osd crush move host06 datacenter=DC3
```

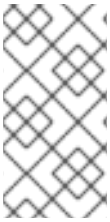
Within this structure any new hosts can be added too, as well as new disks. By placing the OSDs at the right place in the hierarchy the CRUSH algorithm is changed to place redundant pieces into different failure domains within the structure.

The above example results in the following:

Example

```
[ceph: root@host01 /]# ceph osd tree
ID  WEIGHT  TYPE NAME             UP/DOWN REWEIGHT PRIMARY-AFFINITY
 -8 6.00000 root allDC
 -9 2.00000     datacenter DC1
 -4 1.00000         host host01
  2 1.00000             osd.2         up  1.00000          1.00000
 -3 1.00000         host host02
  1 1.00000             osd.1         up  1.00000          1.00000
-10 2.00000     datacenter DC2
 -2 1.00000         host host03
  0 1.00000             osd.0         up  1.00000          1.00000
 -7 1.00000         host host05
  5 1.00000             osd.5         up  0.79999          1.00000
-11 2.00000     datacenter DC3
 -6 1.00000         host host06
  4 1.00000             osd.4         up  0.79999          1.00000
 -5 1.00000         host host04
  3 1.00000             osd.3         up  1.00000          1.00000
 -1       0 root default
```

The listing from above shows the resulting CRUSH map by displaying the osd tree. Easy to see is now how the hosts belong to a data center and all data centers belong to the same top level structure but clearly distinguishing between locations.



NOTE

Placing the data in the proper locations according to the map works only properly within the healthy cluster. Misplacement might happen under circumstances, when some OSDs are not available. Those misplacements will be corrected automatically once it is possible to do so.

Additional Resources

- See the CRUSH administration chapter in the Red Hat Ceph Storage Storage Strategies Guide for more information.