Red Hat Ceph Storage 6

Installation Guide

Installing Red Hat Ceph Storage on Red Hat Enterprise Linux
Installing Red Hat Ceph Storage on Red Hat Enterprise Linux
Abstract

This document provides instructions on installing Red Hat Ceph Storage on Red Hat Enterprise Linux running on AMD64 and Intel 64 architectures. 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.
3.19. RUNNING THE CEPHADM-CLIENTS PLAYBOOK  .......................................................... 78
3.20. MANAGING OPERATING SYSTEM TUNING PROFILES WITH CEPHADM  ............... 79
  3.20.1. Creating tuning profiles  ..................................................................................... 80
  3.20.2. Viewing tuning profiles  ..................................................................................... 82
  3.20.3. Modifying tuning profiles  .................................................................................. 83
  3.20.4. Removing tuning profiles  .................................................................................. 85
3.21. PURGING THE CEPH STORAGE CLUSTER  ............................................................ 86

CHAPTER 4. MANAGING A RED HAT CEPH STORAGE CLUSTER USING CEPHADM-ANSIBLE MODULES  .................................................................................. 88
  4.1. THE CEPHADM-ANSIBLE MODULES  .................................................................. 88
  4.2. THE CEPHADM-ANSIBLE MODULES OPTIONS  ............................................... 88
  4.3. BOOTSTRAPPING A STORAGE CLUSTER USING THE CEPHADM_BOOTSTRAP AND CEPHADM_REGISTRY_LOGIN MODULES  ..................... 92
  4.4. ADDING OR REMOVING HOSTS USING THE CEPH_ORCH_HOST MODULE ........... 95
  4.5. SETTING CONFIGURATION OPTIONS USING THE CEPH_CONFIG MODULE ......... 100
  4.6. APPLYING A SERVICE SPECIFICATION USING THE CEPH_ORCH_APPLY MODULE 102
  4.7. MANAGING CEPH DAEMON STATES USING THE CEPH_ORCH_DAEMON MODULE 104

CHAPTER 5. WHAT TO DO NEXT? DAY 2 ......................................................................... 106

APPENDIX A. COMPARISON BETWEEN CEPH ANSIBLE AND CEPHADM  ..................... 107
APPENDIX B. THE CEPHADM COMMANDS ................................................................. 109
CHAPTER 1. RED HAT CEPH STORAGE

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

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

**Ceph Monitor**

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

**IMPORTANT**

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

**Ceph Manager**

The Ceph Manager daemon, `ceph-mgr`, co-exists with the Ceph Monitor daemons running on Ceph Monitor nodes to provide additional services. The Ceph Manager provides an interface for other monitoring and management systems using Ceph Manager modules. Running the Ceph Manager daemons is a requirement for normal storage cluster operations.

**Ceph OSD**

Each Ceph Object Storage Device (OSD) node runs the `ceph-osd` daemon, which interacts with logical disks attached to the node. The storage cluster stores data on these Ceph OSD nodes.

Ceph can run with very few OSD nodes, of which the default is three, but production storage clusters realize better performance beginning at modest scales. For example, 50 Ceph OSDs in a storage cluster. Ideally, a Ceph storage cluster has multiple OSD nodes, allowing for the possibility to isolate failure domains by configuring the CRUSH map accordingly.

**Ceph MDS**

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

**Ceph Object Gateway**

Ceph Object Gateway node runs the `ceph-radosgw` daemon, and is an object storage interface built on top of `librados` to provide applications with a RESTful access point to the Ceph storage cluster. The Ceph Object Gateway supports two interfaces:

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

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

Additional Resources

- For details on the Ceph architecture, see the *Red Hat Ceph Storage Architecture Guide*.
- For the minimum hardware recommendations, see the *Red Hat Ceph Storage Hardware Selection Guide*.
CHAPTER 2. RED HAT CEPH STORAGE CONSIDERATIONS AND RECOMMENDATIONS

As a storage administrator, you can have a basic understanding about what things to consider before running a Red Hat Ceph Storage cluster. Understanding such things as, the hardware and network requirements, understanding what type of workloads work well with a Red Hat Ceph Storage cluster, along with Red Hat’s recommendations. Red Hat Ceph Storage can be used for different workloads based on a particular business need or set of requirements. Doing the necessary planning before installing a Red Hat Ceph Storage is critical to the success of running a Ceph storage cluster efficiently and achieving the business requirements.

NOTE

Want help with planning a Red Hat Ceph Storage cluster for a specific use case? Contact your Red Hat representative for assistance.

2.1. BASIC RED HAT CEPH STORAGE CONSIDERATIONS

The first consideration for using Red Hat Ceph Storage is developing a storage strategy for the data. A storage strategy is a method of storing data that serves a particular use case. If you need to store volumes and images for a cloud platform like OpenStack, you can choose to store data on faster Serial Attached SCSI (SAS) drives with Solid State Drives (SSD) for journals. By contrast, if you need to store object data for an S3- or Swift-compliant gateway, you can choose to use something more economical, like traditional Serial Advanced Technology Attachment (SATA) drives. Red Hat Ceph Storage can accommodate both scenarios in the same storage cluster, but you need a means of providing the fast storage strategy to the cloud platform, and a means of providing more traditional storage for your object store.

One of the most important steps in a successful Ceph deployment is identifying a price-to-performance profile suitable for the storage cluster’s use case and workload. It is important to choose the right hardware for the use case. For example, choosing IOPS-optimized hardware for a cold storage application increases hardware costs unnecessarily. Whereas, choosing capacity-optimized hardware for its more attractive price point in an IOPS-intensive workload will likely lead to unhappy users complaining about slow performance.

Red Hat Ceph Storage can support multiple storage strategies. Use cases, cost versus benefit performance tradeoffs, and data durability are the primary considerations that help develop a sound storage strategy.

Use Cases

Ceph provides massive storage capacity, and it supports numerous use cases, such as:

- The Ceph Block Device client is a leading storage backend for cloud platforms that provides limitless storage for volumes and images with high performance features like copy-on-write cloning.

- The Ceph Object Gateway client is a leading storage backend for cloud platforms that provides a RESTful S3-compliant and Swift-compliant object storage for objects like audio, bitmap, video, and other data.

- The Ceph File System for traditional file storage.

Cost vs. Benefit of Performance
Faster is better. Bigger is better. High durability is better. However, there is a price for each superlative quality, and a corresponding cost versus benefit tradeoff. Consider the following use cases from a performance perspective: SSDs can provide very fast storage for relatively small amounts of data and journaling. Storing a database or object index can benefit from a pool of very fast SSDs, but proves too expensive for other data. SAS drives with SSD journaling provide fast performance at an economical price for volumes and images. SATA drives without SSD journaling provide cheap storage with lower overall performance. When you create a CRUSH hierarchy of OSDs, you need to consider the use case and an acceptable cost versus performance tradeoff.

Data Durability

In large scale storage clusters, hardware failure is an expectation, not an exception. However, data loss and service interruption remain unacceptable. For this reason, data durability is very important. Ceph addresses data durability with multiple replica copies of an object or with erasure coding and multiple coding chunks. Multiple copies or multiple coding chunks present an additional cost versus benefit tradeoff: it is cheaper to store fewer copies or coding chunks, but it can lead to the inability to service write requests in a degraded state. Generally, one object with two additional copies, or two coding chunks can allow a storage cluster to service writes in a degraded state while the storage cluster recovers.

Replication stores one or more redundant copies of the data across failure domains in case of a hardware failure. However, redundant copies of data can become expensive at scale. For example, to store 1 petabyte of data with triple replication would require a cluster with at least 3 petabytes of storage capacity.

Erasure coding stores data as data chunks and coding chunks. In the event of a lost data chunk, erasure coding can recover the lost data chunk with the remaining data chunks and coding chunks. Erasure coding is substantially more economical than replication. For example, using erasure coding with 8 data chunks and 3 coding chunks provides the same redundancy as 3 copies of the data. However, such an encoding scheme uses approximately 1.5x the initial data stored compared to 3x with replication.

The CRUSH algorithm aids this process by ensuring that Ceph stores additional copies or coding chunks in different locations within the storage cluster. This ensures that the failure of a single storage device or host does not lead to a loss of all of the copies or coding chunks necessary to preclude data loss. You can plan a storage strategy with cost versus benefit tradeoffs, and data durability in mind, then present it to a Ceph client as a storage pool.

**IMPORTANT**

ONLY the data storage pool can use erasure coding. Pools storing service data and bucket indexes use replication.

**IMPORTANT**

Ceph’s object copies or coding chunks make RAID solutions obsolete. Do not use RAID, because Ceph already handles data durability, a degraded RAID has a negative impact on performance, and recovering data using RAID is substantially slower than using deep copies or erasure coding chunks.

Additional Resources

- See the *Minimum hardware considerations for Red Hat Ceph Storage* section of the *Red Hat Ceph Storage Installation Guide* for more details.

### 2.2. RED HAT CEPH STORAGE WORKLOAD CONSIDERATIONS
One of the key benefits of a Ceph storage cluster is the ability to support different types of workloads within the same storage cluster using performance domains. Different hardware configurations can be associated with each performance domain. Storage administrators can deploy storage pools on the appropriate performance domain, providing applications with storage tailored to specific performance and cost profiles. Selecting appropriately sized and optimized servers for these performance domains is an essential aspect of designing a Red Hat Ceph Storage cluster.

To the Ceph client interface that reads and writes data, a Ceph storage cluster appears as a simple pool where the client stores data. However, the storage cluster performs many complex operations in a manner that is completely transparent to the client interface. Ceph clients and Ceph object storage daemons, referred to as Ceph OSDs, or simply OSDs, both use the Controlled Replication Under Scalable Hashing (CRUSH) algorithm for the storage and retrieval of objects. Ceph OSDs can run in containers within the storage cluster.

A CRUSH map describes a topography of cluster resources, and the map exists both on client hosts as well as Ceph Monitor hosts within the cluster. Ceph clients and Ceph OSDs both use the CRUSH map and the CRUSH algorithm. Ceph clients communicate directly with OSDs, eliminating a centralized object lookup and a potential performance bottleneck. With awareness of the CRUSH map and communication with their peers, OSDs can handle replication, backfilling, and recovery—allowing for dynamic failure recovery.

Ceph uses the CRUSH map to implement failure domains. Ceph also uses the CRUSH map to implement performance domains, which simply take the performance profile of the underlying hardware into consideration. The CRUSH map describes how Ceph stores data, and it is implemented as a simple hierarchy, specifically an acyclic graph, and a ruleset. The CRUSH map can support multiple hierarchies to separate one type of hardware performance profile from another. Ceph implements performance domains with device "classes".

For example, you can have these performance domains coexisting in the same Red Hat Ceph Storage cluster:

- Hard disk drives (HDDs) are typically appropriate for cost and capacity-focused workloads.
- Throughput-sensitive workloads typically use HDDs with Ceph write journals on solid state drives (SSDs).
- IOPS-intensive workloads, such as MySQL and MariaDB, often use SSDs.
Workloads

Red Hat Ceph Storage is optimized for three primary workloads.

**IMPORTANT**

Carefully consider the workload being run by Red Hat Ceph Storage clusters **BEFORE** considering what hardware to purchase, because it can significantly impact the price and performance of the storage cluster. For example, if the workload is capacity-optimized and the hardware is better suited to a throughput-optimized workload, then hardware will be more expensive than necessary. Conversely, if the workload is throughput-optimized and the hardware is better suited to a capacity-optimized workload, then the storage cluster can suffer from poor performance.

- **IOPS optimized**: Input, output per second (IOPS) optimization deployments are suitable for cloud computing operations, such as running MYSQL or MariaDB instances as virtual machines on OpenStack. IOPS optimized deployments require higher performance storage such as 15k RPM SAS drives and separate SSD journals to handle frequent write operations. Some high IOPS scenarios use all flash storage to improve IOPS and total throughput. An IOPS-optimized storage cluster has the following properties:
  - Lowest cost per IOPS.
- Highest IOPS per GB.
- 99th percentile latency consistency.

Uses for an IOPS-optimized storage cluster are:

- Typically block storage.
- 3x replication for hard disk drives (HDDs) or 2x replication for solid state drives (SSDs).
- MySQL on OpenStack clouds.

- **Throughput optimized:** Throughput-optimized deployments are suitable for serving up significant amounts of data, such as graphic, audio, and video content. Throughput-optimized deployments require high bandwidth networking hardware, controllers, and hard disk drives with fast sequential read and write characteristics. If fast data access is a requirement, then use a throughput-optimized storage strategy. Also, if fast write performance is a requirement, using Solid State Disks (SSD) for journals will substantially improve write performance.
A throughput-optimized storage cluster has the following properties:

- Lowest cost per MBps (throughput).
- Highest MBps per TB.
- Highest MBps per BTU.
- Highest MBps per Watt.
- 97th percentile latency consistency.

Uses for a throughput-optimized storage cluster are:

- Block or object storage.
- 3x replication.
- Active performance storage for video, audio, and images.
- Streaming media, such as 4k video.

- **Capacity optimized:** Capacity-optimized deployments are suitable for storing significant amounts of data as inexpensively as possible. Capacity-optimized deployments typically trade performance for a more attractive price point. For example, capacity-optimized deployments often use slower and less expensive SATA drives and co-locate journals rather than using SSDs for journaling.
A cost and capacity-optimized storage cluster has the following properties:

- Lowest cost per TB.
- Lowest BTU per TB.
- Lowest Watts required per TB.

Uses for a cost and capacity-optimized storage cluster are:

- Typically object storage.
- Erasure coding for maximizing usable capacity
Object archive.

Video, audio, and image object repositories.

2.3. NETWORK CONSIDERATIONS FOR RED HAT CEPH STORAGE

An important aspect of a cloud storage solution is that storage clusters can run out of IOPS due to network latency, and other factors. Also, the storage cluster can run out of throughput due to bandwidth constraints long before the storage clusters run out of storage capacity. This means that the network hardware configuration must support the chosen workloads to meet price versus performance requirements.

Storage administrators prefer that a storage cluster recovers as quickly as possible. Carefully consider bandwidth requirements for the storage cluster network, be mindful of network link oversubscription, and segregate the intra-cluster traffic from the client-to-cluster traffic. Also consider that network performance is increasingly important when considering the use of Solid State Disks (SSD), flash, NVMe, and other high performing storage devices.

Ceph supports a public network and a storage cluster network. The public network handles client traffic and communication with Ceph Monitors. The storage cluster network handles Ceph OSD heartbeats, replication, backfilling, and recovery traffic. At a minimum, a single 10 GB Ethernet link should be used for storage hardware, and you can add additional 10 GB Ethernet links for connectivity and throughput.

### IMPORTANT

Red Hat recommends allocating bandwidth to the storage cluster network, such that it is a multiple of the public network using the `osd_pool_default_size` as the basis for the multiple on replicated pools. Red Hat also recommends running the public and storage cluster networks on separate network cards.

### IMPORTANT

Red Hat recommends using 10 GB Ethernet for Red Hat Ceph Storage deployments in production. A 1 GB Ethernet network is not suitable for production storage clusters.

In the case of a drive failure, replicating 1 TB of data across a 1 GB Ethernet network takes 3 hours, and 3 TB takes 9 hours. Using 3 TB is the typical drive configuration. By contrast, with a 10 GB Ethernet network, the replication times would be 20 minutes and 1 hour. Remember that when a Ceph OSD fails, the storage cluster will recover by replicating the data it contained to other Ceph OSDs within the pool.

The failure of a larger domain such as a rack means that the storage cluster utilizes considerably more bandwidth. When building a storage cluster consisting of multiple racks, which is common for large storage implementations, consider utilizing as much network bandwidth between switches in a “fat tree” design for optimal performance. A typical 10 GB Ethernet switch has 48 10 GB ports and four 40 GB ports. Use the 40 GB ports on the spine for maximum throughput. Alternatively, consider aggregating unused 10 GB ports with QSFP+ and SFP+ cables into more 40 GB ports to connect to other rack and spine routers. Also, consider using LACP mode 4 to bond network interfaces. Additionally, use jumbo frames, with a maximum transmission unit (MTU) of 9000, especially on the backend or cluster network.

Before installing and testing a Red Hat Ceph Storage cluster, verify the network throughput. Most performance-related problems in Ceph usually begin with a networking issue. Simple network issues like a kinked or bent Cat-6 cable could result in degraded bandwidth. Use a minimum of 10 GB ethernet for the front side network. For large clusters, consider using 40 GB ethernet for the backend or cluster network.

### IMPORTANT

Before installing and testing a Red Hat Ceph Storage cluster, verify the network throughput. Most performance-related problems in Ceph usually begin with a networking issue. Simple network issues like a kinked or bent Cat-6 cable could result in degraded bandwidth. Use a minimum of 10 GB ethernet for the front side network. For large clusters, consider using 40 GB ethernet for the backend or cluster network.
IMPORTANT

For network optimization, Red Hat recommends using jumbo frames for a better CPU per bandwidth ratio, and a non-blocking network switch back-plane. Red Hat Ceph Storage requires the same MTU value throughout all networking devices in the communication path, end-to-end for both public and cluster networks. Verify that the MTU value is the same on all hosts and networking equipment in the environment before using a Red Hat Ceph Storage cluster in production.

Additional Resources

- See the Configuring a private network section in the Red Hat Ceph Storage Configuration Guide for more details.
- See the Configuring a public network section in the Red Hat Ceph Storage Configuration Guide for more details.
- See the Configuring multiple public networks to the cluster section in the Red Hat Ceph Storage Configuration Guide for more details.

2.4. CONSIDERATIONS FOR USING A RAID CONTROLLER WITH OSD HOSTS

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

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

2.5. TUNING CONSIDERATIONS FOR THE LINUX KERNEL WHEN RUNNING CEPH

Production Red Hat Ceph Storage clusters generally benefit from tuning the operating system, specifically around limits and memory allocation. Ensure that adjustments are set for all hosts within the storage cluster. You can also open a case with Red Hat support asking for additional guidance.

Increase the File Descriptors
The Ceph Object Gateway can hang if it runs out of file descriptors. You can modify the 
/etc/security/limits.conf file on Ceph Object Gateway hosts to increase the file descriptors for the 
Ceph Object Gateway.

```plaintext
ceph       soft    nofile     unlimited
```

**Adjusting the ulimit value for Large Storage Clusters**

When running Ceph administrative commands on large storage clusters, for example, with 1024 Ceph 
OSDs or more, create an /etc/security/limits.d/50-ceph.conf file on each host that runs administrative 
commands with the following contents:

```plaintext
USER_NAME   soft    nproc     unlimited
```

Replace `USER_NAME` with the name of the non-root user account that runs the Ceph administrative 
commands.

**NOTE**

The root user’s `ulimit` value is already set to `unlimited` by default on Red Hat Enterprise Linux.

### 2.6. HOW COLOCATION WORKS AND ITS ADVANTAGES

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

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

**How Colocation Works**

With the help of the Cephadm orchestrator, you can colocate one daemon from the following list with 
one or more OSD daemons (ceph-osd):

- Ceph Monitor (`ceph-mon`) and Ceph Manager (`ceph-mgr`) daemons
- NFS Ganesha (`nfs-ganesha`) for Ceph Object Gateway (`nfs-ganesha`)
- RBD Mirror (`rbd-mirror`)
- Observability Stack (Grafana)

Additionally, for Ceph Object Gateway (`radosgw`) (RGW) and Ceph File System (`ceph-mds`), you can 
colocate either with an OSD daemon plus a daemon from the above list, excluding RBD mirror.

**NOTE**

Collocating two of the same kind of daemons on a given node is not supported.
NOTE

Because `ceph-mon` and `ceph-mgr` work together closely they do not count as two separate daemons for the purposes of colocation.

NOTE

Red Hat recommends colocating the Ceph Object Gateway with Ceph OSD containers to increase performance.

With the colocation rules shared above, we have the following minimum clusters sizes that comply with these rules:

Example 1

1. Media: Full flash systems (SSDs)
2. Use case: Block (RBD) and File (CephFS), or Object (Ceph Object Gateway)
3. Number of nodes: 3
4. Replication scheme: 2

<table>
<thead>
<tr>
<th>Host</th>
<th>Daemon</th>
<th>Daemon</th>
<th>Daemon</th>
</tr>
</thead>
<tbody>
<tr>
<td>host1</td>
<td>OSD</td>
<td>Monitor/Manager</td>
<td>Grafana</td>
</tr>
<tr>
<td>host2</td>
<td>OSD</td>
<td>Monitor/Manager</td>
<td>RGW or CephFS</td>
</tr>
<tr>
<td>host3</td>
<td>OSD</td>
<td>Monitor/Manager</td>
<td>RGW or CephFS</td>
</tr>
</tbody>
</table>

NOTE

The minimum size for a storage cluster with three replicas is four nodes. Similarly, the size of a storage cluster with two replicas is a three node cluster. It is a requirement to have a certain number of nodes for the replication factor with an extra node in the cluster to avoid extended periods with the cluster in a degraded state.
Figure 2.2. Colocated Daemons Example 1

Example 2

1. Media: Full flash systems (SSDs) or spinning devices (HDDs)

2. Use case: Block (RBD), File (CephFS), and Object (Ceph Object Gateway)

3. Number of nodes: 4

4. Replication scheme: 3

<table>
<thead>
<tr>
<th>Host</th>
<th>Daemon</th>
<th>Daemon</th>
<th>Daemon</th>
</tr>
</thead>
<tbody>
<tr>
<td>host1</td>
<td>OSD</td>
<td>Grafana</td>
<td>CephFS</td>
</tr>
<tr>
<td>host2</td>
<td>OSD</td>
<td>Monitor/Manager</td>
<td>RGW</td>
</tr>
<tr>
<td>host3</td>
<td>OSD</td>
<td>Monitor/Manager</td>
<td>RGW</td>
</tr>
<tr>
<td>host4</td>
<td>OSD</td>
<td>Monitor/Manager</td>
<td>CephFS</td>
</tr>
</tbody>
</table>
Figure 2.3. Colocated Daemons Example 2

Example 3

1. Media: Full flash systems (SSDs) or spinning devices (HDDs)

2. Use case: Block (RBD), Object (Ceph Object Gateway), and NFS for Ceph Object Gateway

3. Number of nodes: 4

4. Replication scheme: 3

<table>
<thead>
<tr>
<th>Host</th>
<th>Daemon</th>
<th>Daemon</th>
<th>Daemon</th>
</tr>
</thead>
<tbody>
<tr>
<td>host1</td>
<td>OSD</td>
<td>Grafana</td>
<td></td>
</tr>
<tr>
<td>host2</td>
<td>OSD</td>
<td>Monitor/Manager</td>
<td>RGW</td>
</tr>
<tr>
<td>host3</td>
<td>OSD</td>
<td>Monitor/Manager</td>
<td>RGW</td>
</tr>
<tr>
<td>host4</td>
<td>OSD</td>
<td>Monitor/Manager</td>
<td>NFS (RGW)</td>
</tr>
</tbody>
</table>
Figure 2.4. Colocated Daemons Example 3

The diagrams below show the differences between storage clusters with colocated and non-colocated daemons.
Figure 2.5. Colocated Daemons

**Host OS**

- Container
  - ceph-mds
  - Grafana
  - ceph-osd (xN)

**Host OS**

- Container
  - ceph-mon, ceph-mgr
  - radosgw
  - ceph-osd (xN)

**Host OS**

- Container
  - ceph-mon, ceph-mgr
  - ceph-mds
  - ceph-osd (xN)

**Host OS**

- Container
  - ceph-mon, ceph-mgr
  - radosgw
  - ceph-osd (xN)
2.7. OPERATING SYSTEM REQUIREMENTS FOR RED HAT CEPH STORAGE

Red Hat Enterprise Linux entitlements are included in the Red Hat Ceph Storage subscription. The release of Red Hat Ceph Storage 6 is supported on Red Hat Enterprise Linux 9.0 and later

NOTE

Red Hat Ceph Storage 6.0 supports Red Hat Enterprise Linux 8.7 and 8.8 with bootstrap node in supported Red Hat Enterprise Linux 9.0 or later Red Hat Ceph Storage 6.1 supports Red Hat Enterprise Linux 8.8 with bootstrap node in supported Red Hat Enterprise Linux 9.2.

Red Hat Ceph Storage 6 is supported on container-based deployments only.
Use the same operating system version, architecture, and deployment type across all nodes. For example, do not use a mixture of nodes with both AMD64 and Intel 64 architectures, a mixture of nodes with Red Hat Enterprise Linux 8.7 operating systems, or a mixture of nodes with container-based deployments.

**IMPORTANT**

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

**SELinux**

By default, SELinux is set to **Enforcing** mode and the **ceph-selinux** packages are installed. For additional information on SELinux, see the *Data Security and Hardening Guide*, and *Red Hat Enterprise Linux 9 Using SELinux Guide*.

**Additional Resources**

- Red Hat Enterprise Linux

### 2.8. MINIMUM HARDWARE CONSIDERATIONS FOR RED HAT CEPH STORAGE

Red Hat Ceph Storage can run on non-proprietary commodity hardware. Small production clusters and development clusters can run without performance optimization with modest hardware.

**NOTE**

Disk space requirements are based on the Ceph daemons’ default path under `/var/lib/ceph/` directory.

**Table 2.1. Containers**

<table>
<thead>
<tr>
<th>Process</th>
<th>Criteria</th>
<th>Minimum Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ceph-osd-container</strong></td>
<td>Processor</td>
<td>1x AMD64 or Intel 64 CPU CORE per OSD container.</td>
</tr>
<tr>
<td></td>
<td>RAM</td>
<td>Minimum of 5 GB of RAM per OSD container.</td>
</tr>
<tr>
<td></td>
<td>Number of nodes</td>
<td>Minimum of 3 nodes required.</td>
</tr>
<tr>
<td></td>
<td>OS Disk</td>
<td>1x OS disk per host.</td>
</tr>
<tr>
<td></td>
<td>OSD Storage</td>
<td>1x storage drive per OSD container. Cannot be shared with OS Disk.</td>
</tr>
<tr>
<td><strong>block.db</strong></td>
<td>Optional, but Red Hat recommended, 1x SSD or NVMe or Optane partition or lvm per daemon. Sizing is 4% of <strong>block.data</strong> for BlueStore for object, file and mixed workloads and 1% of <strong>block.data</strong> for the BlueStore for Block Device, Openstack cinder, and Openstack cinder workloads.</td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>Criteria</td>
<td>Minimum Recommended</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>block.wal</td>
<td>Optionally, 1x SSD or NVMe or Optane partition or logical volume per daemon. Use a small size, for example 10 GB, and only if it’s faster than the block.db device.</td>
<td></td>
</tr>
<tr>
<td>Network</td>
<td>2x 10 GB Ethernet NICs</td>
<td>ceph-mon-container</td>
</tr>
<tr>
<td>Processor</td>
<td>1x AMD64 or Intel 64 CPU CORE per mon-container</td>
<td></td>
</tr>
<tr>
<td>RAM</td>
<td>3 GB per mon-container</td>
<td></td>
</tr>
<tr>
<td>Disk Space</td>
<td>10 GB per mon-container, 50 GB Recommended</td>
<td></td>
</tr>
<tr>
<td>Monitor Disk</td>
<td>Optionally, 1x SSD disk for Monitor rocksdb data</td>
<td></td>
</tr>
<tr>
<td>Network</td>
<td>2x1 GB Ethernet NICs, 10 GB Recommended</td>
<td></td>
</tr>
<tr>
<td>Prometheus</td>
<td>20 GB to 50 GB under /var/lib/ceph/ directory created as a separate file system to protect the contents under /var/ directory.</td>
<td>ceph-mgr-container</td>
</tr>
<tr>
<td>Processor</td>
<td>1x AMD64 or Intel 64 CPU CORE per mgr-container</td>
<td></td>
</tr>
<tr>
<td>RAM</td>
<td>3 GB per mgr-container</td>
<td></td>
</tr>
<tr>
<td>Network</td>
<td>2x1 GB Ethernet NICs, 10 GB Recommended</td>
<td>ceph-radosgw-container</td>
</tr>
<tr>
<td>Processor</td>
<td>1x AMD64 or Intel 64 CPU CORE per radosgw-container</td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>Criteria</td>
<td>Minimum Recommended</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>RAM</td>
<td>1 GB per daemon</td>
<td></td>
</tr>
<tr>
<td>Disk Space</td>
<td>5 GB per daemon</td>
<td></td>
</tr>
<tr>
<td>Network</td>
<td>1x 1 GB Ethernet NICs</td>
<td>ceph-mds-container</td>
</tr>
<tr>
<td>Processor</td>
<td>1x AMD64 or Intel 64 CPU CORE per mds-container</td>
<td></td>
</tr>
<tr>
<td>RAM</td>
<td>3 GB per mds-container</td>
<td></td>
</tr>
<tr>
<td></td>
<td>This number is highly dependent on the configurable MDS cache size. The RAM requirement is typically twice as much as the amount set in the mds_cache_memory_limit configuration setting. Note also that this is the memory for your daemon, not the overall system memory.</td>
<td></td>
</tr>
<tr>
<td>Disk Space</td>
<td>2 GB per mds-container, plus taking into consideration any additional space required for possible debug logging, 20GB is a good start.</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 3. RED HAT CEPH STORAGE INSTALLATION

As a storage administrator, you can use the `cephadm` utility to deploy new Red Hat Ceph Storage clusters.

The `cephadm` utility manages the entire life cycle of a Ceph cluster. Installation and management tasks comprise two types of operations:

- Day One operations involve installing and bootstrapping a bare-minimum, containerized Ceph storage cluster, running on a single node. Day One also includes deploying the Monitor and Manager daemons and adding Ceph OSDs.

- Day Two operations use the Ceph orchestration interface, `cephadm orch`, or the Red Hat Ceph Storage Dashboard to expand the storage cluster by adding other Ceph services to the storage cluster.

**Prerequisites**

- At least one running virtual machine (VM) or bare-metal server with an active internet connection.

- Red Hat Enterprise Linux 9.0 or later with `ansible-core` bundled into AppStream.

    **IMPORTANT**

    Red Hat Ceph Storage 6 supports Red Hat Enterprise Linux 8.x with bootstrap node within Red Hat Enterprise Linux 9.x.

- A valid Red Hat subscription with the appropriate entitlements.

- Root-level access to all nodes.

- An active Red Hat Network (RHN) or service account to access the Red Hat Registry.

- Remove troubling configurations in iptables so that refresh of iptables services does not cause issues to the cluster. For an example, refer to the Verifying firewall rules are configured for default Ceph ports section of the Red Hat Ceph Storage Configuration Guide.

### 3.1. THE CEPHADM UTILITY

The `cephadm` utility deploys and manages a Ceph storage cluster. It is tightly integrated with both the command-line interface (CLI) and the Red Hat Ceph Storage Dashboard web interface, so that you can manage storage clusters from either environment. `cephadm` uses SSH to connect to hosts from the manager daemon to add, remove, or update Ceph daemon containers. It does not rely on external configuration or orchestration tools such as Ansible or Rook.

**NOTE**

The `cephadm` utility is available after running the preflight playbook on a host.

The `cephadm` utility consists of two main components:

- The `cephadm` shell.
• The cephadm orchestrator.

The cephadm shell

The cephadm shell launches a bash shell within a container. This enables you to perform “Day One” cluster setup tasks, such as installation and bootstrapping, and to invoke ceph commands.

There are two ways to invoke the cephadm shell:

• Enter cephadm shell at the system prompt:

  Example

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

• At the system prompt, type cephadm shell and the command you want to execute:

  Example

  [root@host01 ~ ]# cephadm shell ceph - s

NOTE

If the node contains configuration and keyring files in /etc/ceph/, the container environment uses the values in those files as defaults for the cephadm shell. However, if you execute the cephadm shell on a Ceph Monitor node, the cephadm shell inherits its default configuration from the Ceph Monitor container, instead of using the default configuration.

The cephadm orchestrator

The cephadm orchestrator enables you to perform “Day Two” Ceph functions, such as expanding the storage cluster and provisioning Ceph daemons and services. You can use the cephadm orchestrator through either the command-line interface (CLI) or the web-based Red Hat Ceph Storage Dashboard. Orchestrator commands take the form ceph orch.

The cephadm script interacts with the Ceph orchestration module used by the Ceph Manager.

3.2. HOW CEPHADM WORKS

The cephadm command manages the full lifecycle of a Red Hat Ceph Storage cluster. The cephadm command can perform the following operations:

• Bootstrap a new Red Hat Ceph Storage cluster.

• Launch a containerized shell that works with the Red Hat Ceph Storage command-line interface (CLI).

• Aid in debugging containerized daemons.

The cephadm command uses ssh to communicate with the nodes in the storage cluster. This allows you to add, remove, or update Red Hat Ceph Storage containers without using external tools. Generate the ssh key pair during the bootstrapping process, or use your own ssh key.
The **cephadm** bootstrapping process creates a small storage cluster on a single node, consisting of one Ceph Monitor and one Ceph Manager, as well as any required dependencies. You then use the orchestrator CLI or the Red Hat Ceph Storage Dashboard to expand the storage cluster to include nodes, and to provision all of the Red Hat Ceph Storage daemons and services. You can perform management functions through the CLI or from the Red Hat Ceph Storage Dashboard web interface.

**NOTE**

The **cephadm** utility is a new feature in Red Hat Ceph Storage 6. It does not support older versions of Red Hat Ceph Storage.

### 3.3. THE CEPHADM-ANSIBLE PLAYBOOKS

The **cephadm-ansible** package is a collection of Ansible playbooks to simplify workflows that are not covered by **cephadm**. After installation, the playbooks are located in `/usr/share/cephadm-ansible/`.

The **cephadm-ansible** package includes the following playbooks:

- `cephadm-preflight.yml`
- `cephadm-clients.yml`
- `cephadm-purge-cluster.yml`

The **cephadm-preflight playbook**
Use the `cephadm-preflight` playbook to initially setup hosts before bootstrapping the storage cluster and before adding new nodes or clients to your storage cluster. This playbook configures the Ceph repository and installs some prerequisites such as `podman`, `lvm2`, `chronyd`, and `cephadm`.

The `cephadm-clients` playbook

Use the `cephadm-clients` playbook to set up client hosts. This playbook handles the distribution of configuration and keyring files to a group of Ceph clients.

The `cephadm-purge-cluster` playbook

Use the `cephadm-purge-cluster` playbook to remove a Ceph cluster. This playbook purges a Ceph cluster managed with cephadm.

Additional Resources

- For more information about the `cephadm-preflight` playbook, see Running the preflight playbook.
- For more information about the `cephadm-clients` playbook, see Running the cephadm-clients playbook.
- For more information about the `cephadm-purge-cluster` playbook, see Purging the Ceph storage cluster.

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

- Red Hat Ceph Storage 6.0 is supported on Red Hat Enterprise Linux 8.7, 8.8, 9.0, 9.1, and 9.2.
- Red Hat Ceph Storage 6.1 is supported on Red Hat Enterprise Linux 8.8 and 9.2.

**IMPORTANT**

When using Red Hat Enterprise Linux 8.x, the Admin node must be running a supported Red Hat Enterprise Linux 9.x version for your Red Hat Ceph Storage.

For full compatibility information, see Compatibility Guide.

Prerequisites

- At least one running virtual machine (VM) or bare-metal server with an active internet connection.
- Red Hat Enterprise Linux 9.0 or later with `ansible-core` bundled into AppStream.
- A valid Red Hat subscription with the appropriate entitlements.
- Root-level access to all nodes.

Procedure

1. Register the node, and when prompted, enter your Red Hat Customer Portal credentials:

   **Syntax**

   ```text
   ```
subscription-manager register

2. Pull the latest subscription data from the CDN:

Syntax

subscription-manager refresh

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

Syntax

subscription-manager list --available --matches 'Red Hat Ceph Storage'

4. Identify the appropriate subscription and retrieve its Pool ID.

5. Attach a pool ID to gain access to the software entitlements. Use the Pool ID you identified in the previous step.

Syntax

subscription-manager attach --pool=POOL_ID

6. Disable the default software repositories, and then enable the server and the extras repositories on the respective version of Red Hat Enterprise Linux:

Red Hat Enterprise Linux 9

subscription-manager repos --disable=*  
subscription-manager repos --enable=rhel-9-for-x86_64-baseos-rpms  
subscription-manager repos --enable=rhel-9-for-x86_64-appstream-rpms

7. Update the system to receive the latest packages for Red Hat Enterprise Linux:

Syntax

# dnf update

8. Subscribe to Red Hat Ceph Storage 6 content. Follow the instructions in How to Register Ceph with Red Hat Satellite 6.

9. Enable the ceph-tools repository:

Red Hat Enterprise Linux 9

subscription-manager repos --enable=rhceph-6-tools-for-rhel-9-x86_64-rpms

10. Repeat the above steps on all nodes you are adding to the cluster.

11. Install cephadm-ansible:

Syntax
3.5. CONFIGURING ANSIBLE INVENTORY LOCATION

You can configure inventory location files for the `cephadm-ansible` staging and production environments. The Ansible inventory hosts file contains all the hosts that are part of the storage cluster. You can list nodes individually in the inventory hosts file or you can create groups such as `[mons]`, `[osds]`, and `[rgws]` to provide clarity to your inventory and ease the usage of the `--limit` option to target a group or node when running a playbook.

**NOTE**

If deploying clients, client nodes must be defined in a dedicated `[clients]` group.

**Prerequisites**

- An Ansible administration node.
- Root-level access to the Ansible administration node.
- The `cephadm-ansible` package is installed on the node.

**Procedure**

1. Navigate to the `/usr/share/cephadm-ansible/` directory:

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

2. Optional: Create subdirectories for staging and production:

   ```
   [root@admin cephadm-ansible]# mkdir -p inventory/staging inventory/production
   ```

3. Optional: Edit the `ansible.cfg` file and add the following line to assign a default inventory location:

   ```
   [defaults]
   inventory = ./inventory/staging
   ```

4. Optional: Create an inventory `hosts` file for each environment:

   ```
   [root@admin cephadm-ansible]# touch inventory/staging/hosts
   [root@admin cephadm-ansible]# touch inventory/production/hosts
   ```

5. Open and edit each `hosts` file and add the nodes and `[admin]` group:

   ```
   NODE_NAME_1
   NODE_NAME_2
   [admin]
   ADMIN_NODE_NAME_1
   ```
3.6. ENABLING SSH LOGIN AS ROOT USER ON RED HAT ENTERPRISE LINUX 9

Red Hat Enterprise Linux 9 does not support SSH login as a root user even if the `PermitRootLogin` parameter is set to `yes` in the `/etc/ssh/sshd_config` file. You get the following error:

Example

```bash
[root@host01 ~]# ssh root@myhostname
root@myhostname password:
Permission denied, please try again.
```

You can run one of the following methods to enable login as a root user:

- Use "Allow root SSH login with password" flag while setting the root password during installation of Red Hat Enterprise Linux 9.

- Manually set the `PermitRootLogin` parameter after Red Hat Enterprise Linux 9 installation.

This section describes manual setting of the `PermitRootLogin` parameter.

Prerequisites
Root-level access to all nodes.

Procedure

1. Open the `etc/ssh/sshd_config` file and set the `PermitRootLogin` to `yes`:
   
   **Example**
   
   ```bash
   [root@admin ~]# echo 'PermitRootLogin yes' >> /etc/ssh/sshd_config.d/01-permitrootlogin.conf
   ```

2. Restart the SSH service:

   **Example**
   
   ```bash
   [root@admin ~]# systemctl restart sshd.service
   ```

3. Login to the node as the root user:

   **Syntax**
   
   ```bash
   ssh root@HOST_NAME
   ```

   Replace `HOST_NAME` with the host name of the Ceph node.

   **Example**
   
   ```bash
   [root@admin ~]# ssh root@host01
   ```

   Enter the root password when prompted.

Additional Resources

- For more information, see the Not able to login as root user via ssh in RHEL 9 server Knowledgebase solution.

### 3.7. CREATING AN ANSIBLE USER WITH sudo ACCESS

You can create an Ansible user with password-less root access on all nodes in the storage cluster to run the `cephadm-ansible` playbooks. The Ansible user must be able to log into all the Red Hat Ceph Storage nodes as a user that has root privileges to install software and create configuration files without prompting for a password.

**Prerequisites**

- Root-level access to all nodes.

- For Red Hat Enterprise Linux 9, to log in as a root user, see Enabling SSH log in as root user on Red Hat Enterprise Linux 9

**Procedure**
1. Log in to the node as the root user:

**Syntax**

```bash
ssh root@HOST_NAME
```

Replace `HOST_NAME` with the host name of the Ceph node.

**Example**

```bash
[root@admin ~]# ssh root@host01
```

Enter the root password when prompted.

2. Create a new Ansible user:

**Syntax**

```bash
adduser USER_NAME
```

Replace `USER_NAME` with the new user name for the Ansible user.

**Example**

```bash
[root@host01 ~]# adduser ceph-admin
```

**IMPORTANT**

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

3. Set a new password for this user:

**Syntax**

```bash
passwd USER_NAME
```

Replace `USER_NAME` with the new user name for the Ansible user.

**Example**

```bash
[root@host01 ~]# passwd ceph-admin
```

Enter the new password twice when prompted.

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

**Syntax**

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

Replace `USER_NAME` with the new user name for the Ansible user.

**Example**

```bash
[root@host01 ~]# cat << EOF >/etc/sudoers.d/ceph-admin
ceph-admin ALL = (root) NOPASSWD:ALL
EOF
```

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

**Syntax**

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

Replace `USER_NAME` with the new user name for the Ansible user.

**Example**

```bash
[root@host01 ~]# chmod 0440 /etc/sudoers.d/ceph-admin
```

6. Repeat the above steps on all nodes in the storage cluster.

**Additional Resources**

- For more information about creating user accounts, see the [Getting started with managing user accounts](https://docs.redhat.com/docs/Red_Hat_Enterprise_Linux/9/html/Configuring_Basic_System_Settings/getting-started-with-managing-user-accounts.html) section in the Configuring basic system settings chapter of the Red Hat Enterprise Linux 9 guide.

### 3.8. ENABLING PASSWORD-LESS SSH FOR ANSIBLE

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

**Prerequisites**

- Access to the Ansible administration node.
- Ansible user with sudo access to all nodes in the storage cluster.
- For Red Hat Enterprise Linux 9, to log in as a root user, see [Enabling SSH log in as root user on Red Hat Enterprise Linux 9](https://docs.redhat.com/docs/Red_Hat_Enterprise_Linux/9/html/Enabling_SSH_log_in_as_root_user.html)

**Procedure**

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

```bash
[ceph-admin@admin ~]$ ssh-keygen
```
2. Copy the public key to all nodes in the storage cluster:

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

Replace `USER_NAME` with the new user name for the Ansible user. Replace `HOST_NAME` with the host name of the Ceph node.

**Example**

```
[ceph-admin@admin ~]$ ssh-copy-id ceph-admin@host01
```

3. Create the user’s SSH config file:

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

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

```
Host host01
  Hostname HOST_NAME
  User USER_NAME
Host host02
  Hostname HOST_NAME
  User USER_NAME
...
```

Replace `HOST_NAME` with the host name of the Ceph node. Replace `USER_NAME` with the new user name for the Ansible user.

**Example**

```
Host host01
  Hostname host01
  User ceph-admin
Host host02
  Hostname host02
  User ceph-admin
Host host03
  Hostname host03
  User ceph-admin
```

**IMPORTANT**

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

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

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

**Additional Resources**
3.9. RUNNING THE PREFLIGHT PLAYBOOK

This Ansible playbook configures the Ceph repository and prepares the storage cluster for bootstrapping. It also installs some prerequisites, such as podman, lvm2, chronyd, and cephadm. The default location for cephadm-ansible and cephadm-preflight.yml is /usr/share/cephadm-ansible.

The preflight playbook uses the cephadm-ansible inventory file to identify all the admin and nodes in the storage cluster.

The default location for the inventory file is /usr/share/cephadm-ansible/hosts. The following example shows the structure of a typical inventory file:

```
Example

host02
host03
host04
[admin]
host01
```

The [admin] group in the inventory file contains the name of the node where the admin keyring is stored. On a new storage cluster, the node in the [admin] group will be the bootstrap node. To add additional admin hosts after bootstrapping the cluster see Setting up the admin node in the Installation Guide for more information.

NOTE

Run the preflight playbook before you bootstrap the initial host.

IMPORTANT

If you are performing a disconnected installation, see Running the preflight playbook for a disconnected installation.

Prerequisites

- Root-level access to the Ansible administration node.
- Ansible user with sudo and passwordless ssh access to all nodes in the storage cluster.

NOTE

In the below example, host01 is the bootstrap node.

Procedure

1. Navigate to the the /usr/share/cephadm-ansible directory.
2. Open and edit the hosts file and add your nodes:
Example

```
host02
host03
host04
[admin]
host01
```

3. Run the preflight playbook:

**Syntax**

```
ansible-playbook -i INVENTORY_FILE cephadm-preflight.yml --extra-vars "ceph_origin=rhcs"
```

**Example**

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

After installation is complete, **cephadm** resides in the `/usr/sbin/` directory.

- Use the `--limit` option to run the preflight playbook on a selected set of hosts in the storage cluster:

**Syntax**

```
ansible-playbook -i INVENTORY_FILE cephadm-preflight.yml --extra-vars "ceph_origin=rhcs" --limit GROUP_NAME|NODE_NAME
```

Replace `GROUP_NAME` with a group name from your inventory file. Replace `NODE_NAME` with a specific node name from your inventory file.

**NOTE**

Optionally, you can group your nodes in your inventory file by group name such as `[mons]`, `[osds]`, and `[mgrs]`. However, admin nodes must be added to the `[admin]` group and clients must be added to the `[clients]` group.

**Example**

```
[ceph-admin@admin cephadm-ansible]$ ansible-playbook -i hosts cephadm-preflight.yml --extra-vars "ceph_origin=rhcs" --limit clients
[ceph-admin@admin cephadm-ansible]$ ansible-playbook -i hosts cephadm-preflight.yml --extra-vars "ceph_origin=rhcs" --limit host01
```

- When you run the preflight playbook, **cephadm-ansible** automatically installs **chronyd** and **ceph-common** on the client nodes.

### 3.10. BOOTSTRAPPING A NEW STORAGE CLUSTER

The **cephadm** utility performs the following tasks during the bootstrap process:
• Installs and starts a Ceph Monitor daemon and a Ceph Manager daemon for a new Red Hat Ceph Storage cluster on the local node as containers.

• Creates the /etc/ceph directory.

• Writes a copy of the public key to /etc/ceph/ceph.pub for the Red Hat Ceph Storage cluster and adds the SSH key to the root user’s/root/.ssh/authorized_keys file.

• Applies the _admin label to the bootstrap node.

• Writes a minimal configuration file needed to communicate with the new cluster to /etc/ceph/ceph.conf.

• Writes a copy of the client.admin administrative secret key to /etc/ceph/ceph.client.admin.keyring.

• Deploys a basic monitoring stack with prometheus, grafana, and other tools such as node-exporter and alert-manager.

IMPORTANT

If you are performing a disconnected installation, see Performing a disconnected installation.

NOTE

If you have existing prometheus services that you want to run with the new storage cluster, or if you are running Ceph with Rook, use the --skip-monitoring-stack option with the cephadm bootstrap command. This option bypasses the basic monitoring stack so that you can manually configure it later.

IMPORTANT

If you are deploying a monitoring stack, see Deploying the monitoring stack using the Ceph Orchestrator in the Red Hat Ceph Storage Operations Guide.

IMPORTANT

Bootstrapping provides the default user name and password for the initial login to the Dashboard. Bootstrap requires you to change the password after you log in.

IMPORTANT

Before you begin the bootstrapping process, make sure that the container image that you want to use has the same version of Red Hat Ceph Storage as cephadm. If the two versions do not match, bootstrapping fails at the Creating initial admin user stage.

NOTE

Before you begin the bootstrapping process, you must create a username and password for the registry.redhat.io container registry. For more information about Red Hat container registry authentication, see the knowledge base article Red Hat Container Registry Authentication.
Prerequisites

- An IP address for the first Ceph Monitor container, which is also the IP address for the first node in the storage cluster.
- Login access to registry.redhat.io.
- A minimum of 10 GB of free space for /var/lib/containers/.
- Root-level access to all nodes.

NOTE

If the storage cluster includes multiple networks and interfaces, be sure to choose a network that is accessible by any node that uses the storage cluster.

NOTE

If the local node uses fully-qualified domain names (FQDN), then add the --allow-fqdn-hostname option to cephadm bootstrap on the command line.

IMPORTANT

Run cephadm bootstrap on the node that you want to be the initial Monitor node in the cluster. The IP_ADDRESS option should be the IP address of the node you are using to run cephadm bootstrap.

NOTE

If you want to deploy a storage cluster using IPV6 addresses, then use the IPV6 address format for the --mon-ip IP_ADDRESS option. For example: cephadm bootstrap --mon-ip 2620:52:0:880:225:90ff:fefc:2536 --registry-json /etc/mylogin.json

Procedure

1. Bootstrap a storage cluster:

   Syntax

   cephadm bootstrap --cluster-network NETWORK_CIDR --mon-ip IP_ADDRESS --registry-url registry.redhat.io --registry-username USER_NAME --registry-password PASSWORD --yes-i-know

   Example

   [root@host01 ~]# cephadm bootstrap --cluster-network 10.10.128.0/24 --mon-ip 10.10.128.68 --registry-url registry.redhat.io --registry-username myuser1 --registry-password mypassword1 --yes-i-know

   NOTE

   If you want internal cluster traffic routed over the public network, you can omit the --cluster-network NETWORK_CIDR option.
The script takes a few minutes to complete. Once the script completes, it provides the credentials to the Red Hat Ceph Storage Dashboard URL, a command to access the Ceph command-line interface (CLI), and a request to enable telemetry.

Ceph Dashboard is now available at:

- URL: https://host01:8443/
- User: admin
- Password: i8nhu7zham

Enabling client.admin keyring and conf on hosts with "admin" label
You can access the Ceph CLI with:

```
sudo /usr/sbin/cephadm shell --fsid 266ee7a8-2a05-11eb-b846-5254002d4916 -c /etc/ceph/ceph.conf -k /etc/ceph/ceph.client.admin.keyring
```

Please consider enabling telemetry to help improve Ceph:

```
ceph telemetry on
```

For more information see:

```
https://docs.ceph.com/docs/master/mgr/telemetry/
```

Bootstrap complete.

Additional Resources

- For more information about the recommended bootstrap command options, see Recommended cephadm bootstrap command options.

- For more information about the options available for the bootstrap command, see Bootstrap command options.

- For information about using a JSON file to contain login credentials for the bootstrap process, see Using a JSON file to protect login information.

3.10.1. Recommended cephadm bootstrap command options

The cephadm bootstrap command has multiple options that allow you to specify file locations, configure ssh settings, set passwords, and perform other initial configuration tasks.

Red Hat recommends that you use a basic set of command options for cephadm bootstrap. You can configure additional options after your initial cluster is up and running.

The following examples show how to specify the recommended options.

**Syntax**

```
cephadm bootstrap --ssh-user USER_NAME --mon-ip IP_ADDRESS --allow-fqdn-hostname --registry-json REGISTRY_JSON
```

**Example**
Additional Resources

- For more information about the --registry-json option, see Using a JSON file to protect login information.
- For more information about all available cephadm bootstrap options, see Bootstrap command options.
- For more information about bootstrapping the storage cluster as a non-root user, see Bootstrapping the storage cluster as a non-root user.

3.10.2. Using a JSON file to protect login information

As a storage administrator, you might choose to add login and password information to a JSON file, and then refer to the JSON file for bootstrapping. This protects the login credentials from exposure.

```plaintext
NOTE
You can also use a JSON file with the cephadm --registry-login command.
```

Prerequisites

- An IP address for the first Ceph Monitor container, which is also the IP address for the first node in the storage cluster.
- Login access to registry.redhat.io.
- A minimum of 10 GB of free space for /var/lib/containers/.
- Root-level access to all nodes.

Procedure

1. Create the JSON file. In this example, the file is named mylogin.json.

Syntax

```plaintext
{
  "url":"REGISTRY_URL",
  "username":"USER_NAME",
  "password":"PASSWORD"
}
```

Example

```plaintext
{
  "url":"registry.redhat.io",
  "username":"myuser1",
  "password":"mypassword1"
}
```
2. Bootstrap a storage cluster:

Syntax

```
cephadm bootstrap --mon-ip IP_ADDRESS --registry-json /etc/mylogin.json
```

Example

```
[root@host01 ~]# cephadm bootstrap --mon-ip 10.10.128.68 --registry-json /etc/mylogin.json
```

3.10.3. Bootstrapping a storage cluster using a service configuration file

To bootstrap the storage cluster and configure additional hosts and daemons using a service configuration file, use the `--apply-spec` option with the `cephadm bootstrap` command. The configuration file is a `.yaml` file that contains the service type, placement, and designated nodes for services that you want to deploy.

**NOTE**

If you want to use a non-default realm or zone for applications such as multi-site, configure your Ceph Object Gateway daemons after you bootstrap the storage cluster, instead of adding them to the configuration file and using the `--apply-spec` option. This gives you the opportunity to create the realm or zone you need for the Ceph Object Gateway daemons before deploying them. See the Red Hat Ceph Storage Operations Guide for more information.

**NOTE**

If deploying a NFS-Ganesha gateway, or Metadata Server (MDS) service, configure them after bootstrapping the storage cluster.

- To deploy a Ceph NFS-Ganesha gateway, you must create a RADOS pool first.
- To deploy the MDS service, you must create a CephFS volume first.

See the Red Hat Ceph Storage Operations Guide for more information.

**NOTE**

With Red Hat Ceph Storage 6.0, if you run the bootstrap command with `--apply-spec` option, ensure to include the IP address of the bootstrap host in the specification file. This prevents resolving the IP address to loopback address while re-adding the bootstrap host where active Ceph Manager is already running.

If you do not use the `--apply-spec` option during bootstrap and instead use `ceph orch apply` command with another specification file which includes re-adding the host and contains an active Ceph Manager running, then ensure to explicitly provide the `addr` field. This is applicable for applying any specification file after bootstrapping.

Prerequisites

- At least one running virtual machine (VM) or server.
- Red Hat Enterprise Linux 9.0 or later with `ansible-core` bundled into AppStream.
• Root-level access to all nodes.
• Login access to `registry.redhat.io`.
• Passwordless `ssh` is set up on all hosts in the storage cluster.
• `cephadm` is installed on the node that you want to be the initial Monitor node in the storage cluster.

**NOTE**

Red Hat Ceph Storage 6.0 supports Red Hat Enterprise Linux 8.7 and 8.8 with bootstrap node in supported Red Hat Enterprise Linux 9.0 or later. Red Hat Ceph Storage 6.1 supports Red Hat Enterprise Linux 8.8 with bootstrap node in supported Red Hat Enterprise Linux 9.2.

**Procedure**

1. Log in to the bootstrap host.

2. Create the service configuration `.yaml` file for your storage cluster. The example file directs `cephadm bootstrap` to configure the initial host and two additional hosts, and it specifies that OSDs be created on all available disks.

**Example**

```yaml
service_type: host
addr: host01
hostname: host01
---
 service_type: host
addr: host02
hostname: host02
---
 service_type: host
addr: host03
hostname: host03
---
 service_type: host
addr: host04
hostname: host04
---
 service_type: mon
placement:
  host_pattern: "host[0-2]"
---
 service_type: osd
service_id: my_osds
placement:
  host_pattern: "host[1-3]"
data_devices:
  all: true
```

3. Bootstrap the storage cluster with the `--apply-spec` option:

**Syntax**
```bash
cephadm bootstrap --apply-spec CONFIGURATION_FILE_NAME --mon-ip MONITOR_IP_ADDRESS --registry-url registry.redhat.io --registry-username USER_NAME --registry-password PASSWORD
```

**Example**

```
[root@host01 ~]# cephadm bootstrap --apply-spec initial-config.yaml --mon-ip 10.10.128.68 -registry-url registry.redhat.io --registry-username myuser1 --registry-password mypassword1
```

The script takes a few minutes to complete. Once the script completes, it provides the credentials to the Red Hat Ceph Storage Dashboard URL, a command to access the Ceph command-line interface (CLI), and a request to enable telemetry.

4. Once your storage cluster is up and running, see the [Red Hat Ceph Storage Operations Guide](https://docs.redhat.com/docs/en-us/red-hat-ceph-storage/6/html/operations-guide/) for more information about configuring additional daemons and services.

**Additional Resources**

- For more information about the options available for the bootstrap command, see the Bootstrap command options.

### 3.10.4. Bootstrapping the storage cluster as a non-root user

To bootstrap the Red Hat Ceph Storage cluster as a non-root user on the bootstrap node, use the `--ssh-user` option with the `cephadm bootstrap` command. `--ssh-user` specifies a user for SSH connections to cluster nodes.

Non-root users must have passwordless `sudo` access.

**Prerequisites**

- An IP address for the first Ceph Monitor container, which is also the IP address for the initial Monitor node in the storage cluster.
- Login access to `registry.redhat.io`.
- A minimum of 10 GB of free space for `/var/lib/containers/`.
- SSH public and private keys.
- Passwordless `sudo` access to the bootstrap node.

**Procedure**

1. Change to `sudo` on the bootstrap node:

   **Syntax**

   ```bash
   su - SSH_USER_NAME
   ```

   **Example**
   ```bash
   ```
2. Establish the SSH connection to the bootstrap node:

   **Example**

   `[ceph@host01 ~]# ssh host01
   Last login: Tue Sep 14 12:03:29 EST 2021 on pts/0`

3. Optional: Invoke the `cephadm bootstrap` command.

   **NOTE**

   Using private and public keys is optional. If SSH keys have not previously been created, these can be created during this step.

   Include the `--ssh-private-key` and `--ssh-public-key` options:

   **Syntax**

   cephadm bootstrap --ssh-user USER_NAME --mon-ip IP_ADDRESS --ssh-private-key PRIVATE_KEY --ssh-public-key PUBLIC_KEY --registry-url registry.redhat.io --registry-username USER_NAME --registry-password PASSWORD

   **Example**

   cephadm bootstrap --ssh-user ceph --mon-ip 10.10.128.68 --ssh-private-key /home/ceph/.ssh/id_rsa --ssh-public-key /home/ceph/.ssh/id_rsa.pub --registry-url registry.redhat.io --registry-username myuser1 --registry-password mypassword1

   **Additional Resources**

   - For more information about all available `cephadm bootstrap` options, see *Bootstrap command options*.
   - For more information about utilizing Ansible to automate bootstrapping a rootless cluster, see the knowledge base article *Red Hat Ceph Storage 6 rootless deployment utilizing ansible ad-hoc commands*.

3.10.5. Bootstrap command options

The `cephadm bootstrap` command bootstraps a Ceph storage cluster on the local host. It deploys a MON daemon and a MGR daemon on the bootstrap node, automatically deploys the monitoring stack on the local host, and calls `ceph orch host add HOSTNAME`.

The following table lists the available options for `cephadm bootstrap`.

<table>
<thead>
<tr>
<th><code>cephadm bootstrap</code> option</th>
<th>Description</th>
</tr>
</thead>
</table>

43
<table>
<thead>
<tr>
<th>cephadm bootstrap option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--config CONFIG_FILE, -c CONFIG_FILE</td>
<td>CONFIG_FILE is the ceph.conf file to use with the bootstrap command</td>
</tr>
<tr>
<td>--cluster-network NETWORK_CIDR</td>
<td>Use the subnet defined by NETWORK_CIDR for internal cluster traffic. This is specified in CIDR notation. For example: 10.10.128.0/24.</td>
</tr>
<tr>
<td>--mon-id MON_ID</td>
<td>Bootstraps on the host named MON_ID. Default value is the local host.</td>
</tr>
<tr>
<td>--mon-addrv MON_ADDRV</td>
<td>mon IPs (e.g., [v2:localipaddr:3300,v1:localipaddr:6789])</td>
</tr>
<tr>
<td>--mon-ip IP_ADDRESS</td>
<td>IP address of the node you are using to run cephadm bootstrap.</td>
</tr>
<tr>
<td>--mgr-id MGR_ID</td>
<td>Host ID where a MGR node should be installed. Default: randomly generated.</td>
</tr>
<tr>
<td>--fsid FSID</td>
<td>Cluster FSID.</td>
</tr>
<tr>
<td>--output-dir OUTPUT_DIR</td>
<td>Use this directory to write config, keyring, and pub key files.</td>
</tr>
<tr>
<td>--output-keyring OUTPUT_KEYRING</td>
<td>Use this location to write the keyring file with the new cluster admin and mon keys.</td>
</tr>
<tr>
<td>--output-config OUTPUT_CONFIG</td>
<td>Use this location to write the configuration file to connect to the new cluster.</td>
</tr>
<tr>
<td>--output-pub-ssh-key OUTPUT_PUB_SSH_KEY</td>
<td>Use this location to write the public SSH key for the cluster.</td>
</tr>
<tr>
<td>--skip-ssh</td>
<td>Skip the setup of the ssh key on the local host.</td>
</tr>
<tr>
<td>--initial-dashboard-user INITIAL_DASHBOARD_USER</td>
<td>Initial user for the dashboard.</td>
</tr>
<tr>
<td>--initial-dashboard-password INITIAL_DASHBOARD_PASSWORD</td>
<td>Initial password for the initial dashboard user.</td>
</tr>
<tr>
<td>--ssl-dashboard-port SSL_DASHBOARD_PORT</td>
<td>Port number used to connect with the dashboard using SSL.</td>
</tr>
<tr>
<td>--dashboard-key DASHBOARD_KEY</td>
<td>Dashboard key.</td>
</tr>
<tr>
<td>--dashboard-crt DASHBOARD_CRT</td>
<td>Dashboard certificate.</td>
</tr>
<tr>
<td>cephadm bootstrap option</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>--ssh-config SSH_CONFIG</td>
<td>SSH config.</td>
</tr>
<tr>
<td>--ssh-private-key SSH_PRIVATE_KEY</td>
<td>SSH private key.</td>
</tr>
<tr>
<td>--ssh-public-key SSH_PUBLIC_KEY</td>
<td>SSH public key.</td>
</tr>
<tr>
<td>--ssh-user SSH_USER</td>
<td>Sets the user for SSH connections to cluster hosts. Passwordless sudo is needed for non-root users.</td>
</tr>
<tr>
<td>--skip-mon-network</td>
<td>Sets mon public_network based on the bootstrap mon ip.</td>
</tr>
<tr>
<td>--skip-dashboard</td>
<td>Do not enable the Ceph Dashboard.</td>
</tr>
<tr>
<td>--dashboard-password-noupdate</td>
<td>Disable forced dashboard password change.</td>
</tr>
<tr>
<td>--no-minimize-config</td>
<td>Do not assimilate and minimize the configuration file.</td>
</tr>
<tr>
<td>--skip-ping-check</td>
<td>Do not verify that the mon IP is pingable.</td>
</tr>
<tr>
<td>--skip-pull</td>
<td>Do not pull the latest image before bootstrapping.</td>
</tr>
<tr>
<td>--skip-firewalld</td>
<td>Do not configure firewalld.</td>
</tr>
<tr>
<td>--allow-overwrite</td>
<td>Allow the overwrite of existing –output-* config/keyring/ssh files.</td>
</tr>
<tr>
<td>--allow-fqdn-hostname</td>
<td>Allow fully qualified host name.</td>
</tr>
<tr>
<td>--skip-prepare-host</td>
<td>Do not prepare host.</td>
</tr>
<tr>
<td>--orphan-initial-daemons</td>
<td>Do not create initial mon, mgr, and crash service specs.</td>
</tr>
<tr>
<td>--skip-monitoring-stack</td>
<td>Do not automatically provision the monitoring stack] (prometheus, grafana, alertmanager, node-exporter).</td>
</tr>
<tr>
<td>--apply-spec APPLY_SPEC</td>
<td>Apply cluster spec file after bootstrap (copy ssh key, add hosts and apply services).</td>
</tr>
<tr>
<td>--registry-url REGISTRY_URL</td>
<td>Specifies the URL of the custom registry to log into. For example: registry.redhat.io.</td>
</tr>
<tr>
<td>--registry-username REGISTRY_USERNAME</td>
<td>User name of the login account to the custom registry.</td>
</tr>
</tbody>
</table>
### cephadm bootstrap option | Description
--- | ---
--registry-password REGISTRY_PASSWORD | Password of the login account to the custom registry.
--registry-json REGISTRY_JSON | JSON file containing registry login information.

**Additional Resources**

- For more information about the `--skip-monitoring-stack` option, see *Adding hosts*.
- For more information about logging into the registry with the `registry-json` option, see help for the `registry-login` command.
- For more information about cephadm options, see help for *cephadm*.

### 3.10.6. Configuring a private registry for a disconnected installation

You can use a disconnected installation procedure to install cephadm and bootstrap your storage cluster on a private network. A disconnected installation uses a private registry for installation. Use this procedure when the Red Hat Ceph Storage nodes do NOT have access to the Internet during deployment.

Follow this procedure to set up a secure private registry using authentication and a self-signed certificate. Perform these steps on a node that has both Internet access and access to the local cluster.

**NOTE**

Using an insecure registry for production is not recommended.

**Prerequisites**

- At least one running virtual machine (VM) or server with an active internet connection.
- Red Hat Enterprise Linux 9.0 or later with *ansible-core* bundled into AppStream.
- Login access to *registry.redhat.io*.
- Root-level access to all nodes.

**NOTE**

Red Hat Ceph Storage 6.0 supports Red Hat Enterprise Linux 8.7 and 8.8 with bootstrap node in supported Red Hat Enterprise Linux 9.0 or later Red Hat Ceph Storage 6.1 supports Red Hat Enterprise Linux 8.8 with bootstrap node in supported Red Hat Enterprise Linux 9.2.

**Procedure**

1. Log in to the node that has access to both the public network and the cluster nodes.
2. Register the node, and when prompted, enter the appropriate Red Hat Customer Portal credentials:

   **Example**

   ```shell
   [root@admin ~]# subscription-manager register
   ```

3. Pull the latest subscription data:

   **Example**

   ```shell
   [root@admin ~]# subscription-manager refresh
   ```

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

   **Example**

   ```shell
   [root@admin ~]# subscription-manager list --available --all --matches="*Ceph*"
   ```

   Copy the Pool ID from the list of available subscriptions for Red Hat Ceph Storage.

5. Attach the subscription to get access to the software entitlements:

   **Syntax**

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

   Replace `POOL_ID` with the Pool ID identified in the previous step.

6. Disable the default software repositories, and enable the server and the extras repositories:

   **Red Hat Enterprise Linux 9**

   ```shell
   [root@admin ~]# subscription-manager repos --disable=* 
   [root@admin ~]# subscription-manager repos --enable=rhel-9-for-x86_64-baseos-rpms
   [root@admin ~]# subscription-manager repos --enable=rhel-9-for-x86_64-appstream-rpms
   ```

7. Install the **podman** and **httpd-tools** packages:

   **Example**

   ```shell
   [root@admin ~]# dnf install -y podman httpd-tools
   ```

8. Create folders for the private registry:

   **Example**

   ```shell
   [root@admin ~]# mkdir -p /opt/registry/{auth,certs,data}
   ```

   The registry will be stored in `/opt/registry` and the directories are mounted in the container running the registry.
- The **auth** directory stores the **htpasswd** file the registry uses for authentication.
- The **certs** directory stores the certificates the registry uses for authentication.
- The **data** directory stores the registry images.

9. Create credentials for accessing the private registry:

**Syntax**

```
htpasswd -bBc /opt/registry/auth/htpasswd PRIVATE_REGISTRY_USERNAME
PRIVATE_REGISTRY_PASSWORD
```

- The **b** option provides the password from the command line.
- The **B** option stores the password using **Bcrypt** encryption.
- The **c** option creates the **htpasswd** file.
- Replace **PRIVATE_REGISTRY_USERNAME** with the username to create for the private registry.
- Replace **PRIVATE_REGISTRY_PASSWORD** with the password to create for the private registry username.

**Example**

```
[root@admin ~]# htpasswd -bBc /opt/registry/auth/htpasswd myregistryusername
myregistrypassword1
```

10. Create a self-signed certificate:

**Syntax**

```
openssl req -newkey rsa:4096 -nodes -sha256 -keyout /opt/registry/certs/domain.key -x509 -days 365 -out /opt/registry/certs/domain.crt -addext "subjectAltName = DNS:LOCAL_NODE_FQDN"
```

- Replace **LOCAL_NODE_FQDN** with the fully qualified host name of the private registry node.

**NOTE**

You will be prompted for the respective options for your certificate. The **CN** value is the host name of your node and should be resolvable by DNS or the **/etc/hosts** file.

**Example**

```
[root@admin ~]# openssl req -newkey rsa:4096 -nodes -sha256 -keyout
/opt/registry/certs/domain.key -x509 -days 365 -out /opt/registry/certs/domain.crt -addext
"subjectAltName = DNS:admin.lab.redhat.com"
```
When creating a self-signed certificate, be sure to create a certificate with a proper Subject Alternative Name (SAN). Podman commands that require TLS verification for certificates that do not include a proper SAN, return the following error: \texttt{x509: certificate relies on legacy Common Name field, use SANs or temporarily enable Common Name matching with GODEBUG=x509ignoreCN=0}.

11. Create a symbolic link to \texttt{domain.cert} to allow \texttt{skopeo} to locate the certificate with the file extension \texttt{.cert}:

   \textbf{Example}

   \begin{verbatim}
   [root@admin ~]# ln -s /opt/registry/certs/domain.crt /opt/registry/certs/domain.cert
   \end{verbatim}

12. Add the certificate to the trusted list on the private registry node:

   \textbf{Syntax}

   \begin{verbatim}
   cp /opt/registry/certs/domain.crt /etc/pki/ca-trust/source/anchors/
   update-ca-trust
   trust list | grep -i "LOCAL\_NODE\_FQDN"
   \end{verbatim}

   Replace \texttt{LOCAL\_NODE\_FQDN} with the FQDN of the private registry node.

   \textbf{Example}

   \begin{verbatim}
   [root@admin ~]# cp /opt/registry/certs/domain.crt /etc/pki/ca-trust/source/anchors/
   [root@admin ~]# update-ca-trust
   [root@admin ~]# trust list | grep -i "admin.lab.redhat.com"
   \end{verbatim}

   label: admin.lab.redhat.com

13. Copy the certificate to any nodes that will access the private registry for installation and update the trusted list:

   \textbf{Example}

   \begin{verbatim}
   [root@admin ~]# scp /opt/registry/certs/domain.crt root@host01:/etc/pki/ca-trust/source/anchors/
   [root@admin ~]# ssh root@host01
   [root@host01 ~]# update-ca-trust
   [root@host01 ~]# trust list | grep -i "admin.lab.redhat.com"
   \end{verbatim}

   label: admin.lab.redhat.com

14. Start the local secure private registry:

   \textbf{Syntax}

   \begin{verbatim}
   podman run --restart=always --name NAME\_OF\_CONTAINER \-p 5000:5000 -v /opt/registry/data:/var/lib/registry:z
   \end{verbatim}
-v /opt/registry/auth:/auth:z \
-v /opt/registry/certs:/certs:z \
-e "REGISTRY_AUTH=htpasswd" \
-e "REGISTRY_AUTH_HTPASSWD_REALM=Registry Realm" \
-e REGISTRY_AUTH_HTPASSWD_PATH=/auth/htpasswd \
-e "REGISTRY_HTTP_TLS_CERTIFICATE=/certs/domain.crt" \
-e "REGISTRY_HTTP_TLS_KEY=/certs/domain.key" \
-e REGISTRY_COMPATIBILITY_SCHEMA1_ENABLED=true \
-d registry:2

Replace NAME_OF_CONTAINER with a name to assign to the container.

Example

```
[root@admin ~]# podman run --restart=always --name myprivateregistry \
  -p 5000:5000 -v /opt/registry/data:/var/lib/registry:z \
  -v /opt/registry/auth:/auth:z \
  -v /opt/registry/certs:/certs:z \
  -e "REGISTRY_AUTH=htpasswd" \
  -e "REGISTRY_AUTH_HTPASSWD_REALM=Registry Realm" \
  -e REGISTRY_AUTH_HTPASSWD_PATH=/auth/htpasswd \
  -e "REGISTRY_HTTP_TLS_CERTIFICATE=/certs/domain.crt" \
  -e "REGISTRY_HTTP_TLS_KEY=/certs/domain.key" \
  -e REGISTRY_COMPATIBILITY_SCHEMA1_ENABLED=true \
  -d registry:2
```

This starts the private registry on port 5000 and mounts the volumes of the registry directories in the container running the registry.

15. On the local registry node, verify that `registry.redhat.io` is in the container registry search path.

   a. Open for editing the `/etc/containers/registries.conf` file, and add `registry.redhat.io` to the `unqualified-search-registries` list, if it does not exist:

      Example

```
unqualified-search-registries = ["registry.redhat.io", "registry.access.redhat.com", "registry.fedoraproject.org", "registry.centos.org", "docker.io"]
```

16. Login to `registry.redhat.io` with your Red Hat Customer Portal credentials:

   Syntax

```
podman login registry.redhat.io
```

17. Copy the following Red Hat Ceph Storage 6 image, Prometheus images, and Dashboard image from the Red Hat Customer Portal to the private registry:

   **Table 3.1. Custom image details for monitoring stack**

<table>
<thead>
<tr>
<th>Monitoring stack component</th>
<th>Image details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prometheus</td>
<td>registry.redhat.io/openshift4/ose-prometheus:v4.10</td>
</tr>
<tr>
<td>Monitoring stack component</td>
<td>Image details</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>Grafana</td>
<td>registry.redhat.io/rhceph-6-dashboard-rhel9:latest</td>
</tr>
<tr>
<td>Node-exporter</td>
<td>registry.redhat.io/openshift4/ose-prometheus-node-exporter:v4.10</td>
</tr>
<tr>
<td>AlertManager</td>
<td>registry.redhat.io/openshift4/ose-prometheus-alertmanager:v4.10</td>
</tr>
<tr>
<td>HAProxy</td>
<td>registry.redhat.io/rhceph/haproxy-rhel9:latest</td>
</tr>
<tr>
<td>Keepalived</td>
<td>registry.redhat.io/rhceph/keepalived-rhel9:latest</td>
</tr>
<tr>
<td>SNMP Gateway</td>
<td>registry.redhat.io/rhceph/snmp-notifier-rhel9:latest</td>
</tr>
</tbody>
</table>

**Syntax**

```bash
```

- Replace `CERTIFICATE_DIRECTORY_PATH` with the directory path to the self-signed certificates.
- Replace `RED_HAT_CUSTOMER_PORTAL_LOGIN` and `RED_HAT_CUSTOMER_PORTAL_PASSWORD` with your Red Hat Customer Portal credentials.
- Replace `PRIVATE_REGISTRY_USERNAME` and `PRIVATE_REGISTRY_PASSWORD` with the private registry credentials.
- Replace `SRC_IMAGE` and `SRC_TAG` with the name and tag of the image to copy from registry.redhat.io.
- Replace `DST_IMAGE` and `DST_TAG` with the name and tag of the image to copy to the private registry.
- Replace `LOCAL_NODE_FQDN` with the FQDN of the private registry.

**Example**

```
[root@admin ~]# podman run -v /opt/registry/certs:/certs:Z -v /opt/registry/certs:/certs:Z --rm registry.redhat.io/rhel8/skopeo:8.5-8 skopeo copy --remove-signatures --src-creds myusername:mypassword1 --dest-cert-dir=/certs/ --dest-creds myregistryusername:myregistrypassword1 docker://registry.redhat.io/rhceph/rhceph-6-
```
rhel9:latest docker://admin.lab.redhat.com:5000/rhceph/rhceph-6-rhel9:latest

```
```

```
```

```
```

18. Using the `curl` command, verify the images reside in the local registry:

**Syntax**

```
curl -u PRIVATE_REGISTRY_USERNAME:PRIVATE_REGISTRY_PASSWORD https://LOCAL_NODE_FQDN:5000/v2/_catalog
```

**Example**

```
[root@admin ~]# curl -u myregistryusername:myregistrypassword1 https://admin.lab.redhat.com:5000/v2/_catalog
```

```json
{"repositories":["openshift4/ose-prometheus","openshift4/ose-prometheus-alertmanager","openshift4/ose-prometheus-node-exporter","rhceph/rhceph-6-dashboard-rhel9","rhceph/rhceph-6-rhel9"]}
```

**Additional Resources**

- For more information on different image Ceph package versions, see the knowledge base solution for details on *What are the Red Hat Ceph Storage releases and corresponding Ceph package versions?*
3.10.7. Running the preflight playbook for a disconnected installation

You use the `cephadm-preflight.yml` Ansible playbook to configure the Ceph repository and prepare the storage cluster for bootstrapping. It also installs some prerequisites, such as `podman`, `lvm2`, `chronyd`, and `cephadm`.

The preflight playbook uses the `cephadm-ansible` inventory `hosts` file to identify all the nodes in the storage cluster. The default location for `cephadm-ansible`, `cephadm-preflight.yml`, and the inventory `hosts` file is `/usr/share/cephadm-ansible/`

The following example shows the structure of a typical inventory file:

```
Example

host02
host03
host04

[admin]
host01
```

The `[admin]` group in the inventory file contains the name of the node where the admin keyring is stored.

**NOTE**

Run the preflight playbook before you bootstrap the initial host.

**Prerequisites**

- The `cephadm-ansible` package is installed on the Ansible administration node.
- Root-level access to all nodes in the storage cluster.
- Passwordless `ssh` is set up on all hosts in the storage cluster.
- Nodes configured to access a local YUM repository server with the following repositories enabled:
  - `rhel-9-for-x86_64-baseos-rpms`
  - `rhel-9-for-x86_64-appstream-rpms`
  - `rhceph-6-tools-for-rhel-9-x86_64-rpms`

**IMPORTANT**

When using Red Hat Enterprise Linux 8.x, the Admin node must be running a supported Red Hat Enterprise Linux 9.x version for your Red Hat Ceph Storage.

**NOTE**

For more information about setting up a local YUM repository, see the knowledge base article *Creating a Local Repository and Sharing with Disconnected/Offline/Air-gapped Systems*
Procedure

1. Navigate to the `/usr/share/cephadm-ansible` directory on the Ansible administration node.

2. Open and edit the `hosts` file and add your nodes.

3. Run the preflight playbook with the `ceph_origin` parameter set to `custom` to use a local YUM repository:

   **Syntax**

   ```bash
   ansible-playbook -i INVENTORY_FILE cephadm-preflight.yml --extra-vars "ceph_origin=custom" -e "custom_repo_url=CUSTOM_REPO_URL"
   ```

   **Example**

   ```bash
   [ceph-admin@admin cephadm-ansible]$ ansible-playbook -i hosts cephadm-preflight.yml --extra-vars "ceph_origin=custom" -e "custom_repo_url=http://mycustomrepo.lab.redhat.com/x86_64/os/"
   ```

   After installation is complete, `cephadm` resides in the `/usr/sbin/` directory.

4. Alternatively, you can use the `--limit` option to run the preflight playbook on a selected set of hosts in the storage cluster:

   **Syntax**

   ```bash
   ansible-playbook -i INVENTORY_FILE cephadm-preflight.yml --extra-vars "ceph_origin=custom" -e "custom_repo_url=CUSTOM_REPO_URL" --limit GROUP_NAME|NODE_NAME
   ```

   Replace `GROUP_NAME` with a group name from your inventory file. Replace `NODE_NAME` with a specific node name from your inventory file.

   **Example**

   ```bash
   [ceph-admin@admin cephadm-ansible]$ ansible-playbook -i hosts cephadm-preflight.yml --extra-vars "ceph_origin=custom" -e
   ```
"custom_repo_url=http://mycustomrepo.lab.redhat.com/x86_64/os/" --limit clients
[ceph-admin@admin cephadm-ansible]$ ansible-playbook -i hosts cephadm-preflight.yml --extra-vars "ceph_origin=custom" -e
"custom_repo_url=http://mycustomrepo.lab.redhat.com/x86_64/os/" --limit host02

**NOTE**
When you run the preflight playbook, **cephadm-ansible** automatically installs **chronyd** and **ceph-common** on the client nodes.

### 3.10.8. Performing a disconnected installation

Before you can perform the installation, you must obtain a Red Hat Ceph Storage container image, either from a proxy host that has access to the Red Hat registry or by copying the image to your local registry.

**NOTE**
If your local registry uses a self-signed certificate with a local registry, ensure you have added the trusted root certificate to the bootstrap host. For more information, see [Configuring a private registry for a disconnected installation](#).

**NOTE**
Red Hat Ceph Storage 6.0 supports Red Hat Enterprise Linux 8.7 and 8.8 with bootstrap node in supported Red Hat Enterprise Linux 9.0 or later Red Hat Ceph Storage 6.1 supports Red Hat Enterprise Linux 8.8 with bootstrap node in supported Red Hat Enterprise Linux 9.2.

**IMPORTANT**
Before you begin the bootstrapping process, make sure that the container image that you want to use has the same version of Red Hat Ceph Storage as **cephadm**. If the two versions do not match, bootstrapping fails at the **Creating initial admin user** stage.

**Prerequisites**

- At least one running virtual machine (VM) or server.

- Root-level access to all nodes.

- Passwordless **ssh** is set up on all hosts in the storage cluster.

- The preflight playbook has been run on the bootstrap host in the storage cluster. For more information, see [Running the preflight playbook for a disconnected installation](#).

- A private registry has been configured and the bootstrap node has access to it. For more information, see [Configuring a private registry for a disconnected installation](#).

- A Red Hat Ceph Storage container image resides in the custom registry.

**Procedure**

1. Log in to the bootstrap host.
2. Bootstrap the storage cluster:

**Syntax**

```bash
cephadm --image PRIVATE_REGISTRY_NODE_FQDN:5000/CUSTOM_IMAGE_NAME:IMAGE_TAG
bootstrap --mon-ip IP_ADDRESS --registry-url PRIVATE_REGISTRY_NODE_FQDN:5000 --
registry-username PRIVATE_REGISTRY_USERNAME --registry-password PRIVATE_REGISTRY_PASSWORD
```

- Replace `PRIVATE_REGISTRY_NODE_FQDN` with the fully qualified domain name of your private registry.
- Replace `CUSTOM_IMAGE_NAME` and `IMAGE_TAG` with the name and tag of the Red Hat Ceph Storage container image that resides in the private registry.
- Replace `IP_ADDRESS` with the IP address of the node you are using to run `cephadm bootstrap`.
- Replace `PRIVATE_REGISTRY_USERNAME` with the username to create for the private registry.
- Replace `PRIVATE_REGISTRY_PASSWORD` with the password to create for the private registry username.

**Example**

```
[root@host01 ~]# cephadm --image admin.lab.redhat.com:5000/rhceph-6-rhel9:latest
bootstrap --mon-ip 10.10.128.68 --registry-url admin.lab.redhat.com:5000 --registry-
username myregistryusername --registry-password myregistrypassword1
```

The script takes a few minutes to complete. Once the script completes, it provides the credentials to the Red Hat Ceph Storage Dashboard URL, a command to access the Ceph command-line interface (CLI), and a request to enable telemetry.

Ceph Dashboard is now available at:

- **URL**: https://host01:8443/
- **User**: admin
- **Password**: i8nhu7zham

Enabling client.admin keyring and conf on hosts with "admin" label

You can access the Ceph CLI with:

```
sudo /usr/sbin/cephadm shell --fsid 266ee7a8-2a05-11eb-b846-5254002d4916 -c /etc/ceph/ceph.conf -k /etc/ceph/ceph.client.admin.keyring
```

Please consider enabling telemetry to help improve Ceph:

```
ceph telemetry on
```

For more information see:
After the bootstrap process is complete, see Changing configurations of custom container images for disconnected installations to configure the container images.

Additional Resources

- Once your storage cluster is up and running, see the Red Hat Ceph Storage Operations Guide for more information about configuring additional daemons and services.

3.10.9. Changing configurations of custom container images for disconnected installations

After you perform the initial bootstrap for disconnected nodes, you must specify custom container images for monitoring stack daemons. You can override the default container images for monitoring stack daemons, since the nodes do not have access to the default container registry.

**NOTE**

Make sure that the bootstrap process on the initial host is complete before making any configuration changes.

By default, the monitoring stack components are deployed based on the primary Ceph image. For disconnected environment of the storage cluster, you can use the latest available monitoring stack component images.

**Prerequisites**

- At least one running virtual machine (VM) or server.
- Red Hat Enterprise Linux 9.0 or later with ansible-core bundled into AppStream.
- Root-level access to all nodes.
- Passwordless ssh is set up on all hosts in the storage cluster.

**NOTE**

Red Hat Ceph Storage 6.0 supports Red Hat Enterprise Linux 8.7 and 8.8 with bootstrap node in supported Red Hat Enterprise Linux 9.0 or later Red Hat Ceph Storage 6.1 supports Red Hat Enterprise Linux 8.8 with bootstrap node in supported Red Hat Enterprise Linux 9.2.

**Procedure**

1. Set the custom container images with the ceph config command:

**Syntax**

    ceph config set mgr mgr/cephadm/OPTION_NAME
    CUSTOM_REGISTRY_NAME/CONTAINER_NAME
Use the following options for `OPTION_NAME`:

- `container_image_prometheus`
- `container_image_grafana`
- `container_image_alertmanager`
- `container_image_node_exporter`

**Example**

```bash
[root@host01 ~]# ceph config set mgr mgr/cephadm/container_image_prometheus myregistry/mycontainer
[root@host01 ~]# ceph config set mgr mgr/cephadm/container_image_grafana myregistry/mycontainer
[root@host01 ~]# ceph config set mgr mgr/cephadm/container_image_alertmanager myregistry/mycontainer
[root@host01 ~]# ceph config set mgr mgr/cephadm/container_image_node_exporter myregistry/mycontainer
```

2. **Redeploy node-exporter**:

**Syntax**

```
ceph orch redeploy node-exporter
```

**NOTE**

If any of the services do not deploy, you can redeploy them with the `ceph orch redeploy` command.

**NOTE**

By setting a custom image, the default values for the configuration image name and tag will be overridden, but not overwritten. The default values change when updates become available. By setting a custom image, you will not be able to configure the component for which you have set the custom image for automatic updates. You will need to manually update the configuration image name and tag to be able to install updates.

- If you choose to revert to using the default configuration, you can reset the custom container image. Use `ceph config rm` to reset the configuration option:

**Syntax**

```
ceph config rm mgr mgr/cephadm/OPTION_NAME
```

**Example**

```
ceph config rm mgr mgr/cephadm/container_image_prometheus
```

**Additional Resources**

- For more information about performing a disconnected installation, see *Performing a disconnected installation*. 

3.11. LAUNCHING THE CEPHADM SHELL

The cephadm shell command launches a bash shell in a container with all of the Ceph packages installed. This enables you to perform “Day One” cluster setup tasks, such as installation and bootstrapping, and to invoke ceph commands.

Prerequisites

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

Procedure

There are two ways to launch the cephadm shell:

- Enter cephadm shell at the system prompt. This example invokes the ceph -s command from within the shell.

  **Example**

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

- At the system prompt, type cephadm shell and the command you want to execute:

  **Example**

  ```
  [root@host01 ~]# cephadm shell ceph -s
  ```

  **NOTE**

  If the node contains configuration and keyring files in /etc/ceph/, the container environment uses the values in those files as defaults for the cephadm shell. If you execute the cephadm shell on a MON node, the cephadm shell inherits its default configuration from the MON container, instead of using the default configuration.

3.12. VERIFYING THE CLUSTER INSTALLATION

Once the cluster installation is complete, you can verify that the Red Hat Ceph Storage 6 installation is running properly.

There are two ways of verifying the storage cluster installation as a root user:

- Run the podman ps command.
- Run the cephadm shell ceph -s.

Prerequisites

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

Procedure
- Run the `podman ps` command:

  **Example**
  
  ```bash
  [root@host01 ~]# podman ps
  ```

  **NOTE**
  
  In Red Hat Ceph Storage 6, the format of the `systemd` units has changed. In the `NAMES` column, the unit files now include the `FSID`.

- Run the `cephadm shell ceph -s` command:

  **Example**
  
  ```bash
  [root@host01 ~]# cephadm shell ceph -s
  ```

  ```bash
  cluster:
  id:     f64f341c-655d-11eb-8778-fa163e914bcc
  health: HEALTH_OK

  services:
  mon: 3 daemons, quorum host01,host02,host03 (age 94m)
  mgr: host01.lbnhug(active, since 59m), standbys: host02.rofgay, host03.ohipra
  mds: 1/1 daemons up, 1 standby
  osd: 18 osds: 18 up (since 10m), 18 in (since 10m)
  rgw: 4 daemons active (2 hosts, 1 zones)

  data:
  volumes: 1/1 healthy
  pools: 8 pools, 225 pgs
  objects: 230 objects, 9.9 KiB
  usage: 271 MiB used, 269 GiB / 270 GiB avail
  pgs: 225 active+clean

  io:
  client: 85 B/s rd, 0 op/s rd, 0 op/s wr
  ```

  **NOTE**
  
  The health of the storage cluster is in `HEALTH_WARN` status as the hosts and the daemons are not added.

### 3.13. ADDING HOSTS

Bootstrapping the Red Hat Ceph Storage installation creates a working storage cluster, consisting of one Monitor daemon and one Manager daemon within the same container. As a storage administrator, you can add additional hosts to the storage cluster and configure them.

**NOTE**

Running the preflight playbook installs `podman`, `lvm2`, `chronyd`, and `cephadm` on all hosts listed in the Ansible inventory file.
Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level or user with sudo 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

**NOTE**

In the following procedure, use either `root`, as indicated, or the username with which the user is bootstrapped.

1. From the node that contains the admin keyring, install the storage cluster’s public SSH key in the root user’s `authorized_keys` file on the new host:

   **Syntax**
   ```bash
   ssh-copy-id -f -i /etc/ceph/ceph.pub user@NEWHOST
   ```

   **Example**
   ```bash
   [root@host01 ~]# ssh-copy-id -f -i /etc/ceph/ceph.pub root@host02
   [root@host01 ~]# ssh-copy-id -f -i /etc/ceph/ceph.pub root@host03
   ```

2. Navigate to the `/usr/share/cephadm-ansible` directory on the Ansible administration node.

   **Example**
   ```bash
   [ceph-admin@admin ~]$ cd /usr/share/cephadm-ansible
   ```

3. 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**
   ```bash
   [ceph-admin@admin ~]$ cat hosts
   host02
   host03
   host04
   [admin]
   host01
   ```
4. Run the preflight playbook with the `--limit` option:

**Syntax**

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

**Example**

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

5. From the bootstrap node, use the `cephadm` orchestrator to add the new host to the storage cluster:

**Syntax**

```bash
ceph orch host add NEWHOST
```

**Example**

```
[ceph: root@host01 /]# ceph orch host add host02
Added host 'host02' with addr '10.10.128.69'
[ceph: root@host01 /]# ceph orch host add host03
Added host 'host03' with addr '10.10.128.70'
```

6. Optional: You can also add nodes by IP address, before and after you run the preflight playbook. If you do not have DNS configured in your storage cluster environment, you can add the hosts by IP address, along with the host names.

**Syntax**

```bash
ceph orch host add HOSTNAME IP_ADDRESS
```

**Example**

```
[ceph: root@host01 /]# ceph orch host add host02 10.10.128.69
Added host 'host02' with addr '10.10.128.69'
```

**Verification**

- View the status of the storage cluster and verify that the new host has been added. The `STATUS` of the hosts is blank, in the output of the `ceph orch host ls` command.

  **Example**

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

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

Additional Resources

- 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.

3.13.1. Using the addr option to identify hosts

The addr option offers an additional way to contact a host. Add the IP address of the host to the addr option. If ssh cannot connect to the host by its hostname, then it uses the value stored in addr to reach the host by its IP address.

Prerequisites

- A storage cluster that has been installed and bootstrapped.

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

Procedure

Run this procedure from inside the cephadm shell.

1. Add the IP address:

   Syntax

   ceph orch host add HOSTNAME IP_ADDR

   Example

   [ceph: root@host01 /]# ceph orch host add host01 10.10.128.68

   NOTE

   If adding a host by hostname results in that host being added with an IPv6 address instead of an IPv4 address, use ceph orch host to specify the IP address of that host:

   ceph orch host set-addr HOSTNAME IP_ADDR

   To convert the IP address from IPv6 format to IPv4 format for a host you have added, use the following command:

   ceph orch host set-addr HOSTNAME IPV4_ADDRESS

3.13.2. Adding multiple hosts

Use a YAML file to add multiple hosts to the storage cluster at the same time.
NOTE

Be sure to create the `hosts.yaml` file within a host container, or create the file on the local host and then use the `cephadm` shell to mount the file within the container. The `cephadm` shell automatically places mounted files in `/mnt`. If you create the file directly on the local host and then apply the `hosts.yaml` file instead of mounting it, you might see a `File does not exist` error.

Prerequisites

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

Procedure

1. Copy over the public `ssh` key to each of the hosts that you want to add.

2. Use a text editor to create a `hosts.yaml` file.

3. Add the host descriptions to the `hosts.yaml` file, as shown in the following example. Include the labels to identify placements for the daemons that you want to deploy on each host. Separate each host description with three dashes (---).

   Example

   ```
   service_type: host
   addr:
   hostname: host02
   labels:
   - mon
   - osd
   - mgr
   ---
   service_type: host
   addr:
   hostname: host03
   labels:
   - mon
   - osd
   - mgr
   ---
   service_type: host
   addr:
   hostname: host04
   labels:
   - mon
   - osd
   ```

4. If you created the `hosts.yaml` file within the host container, invoke the `ceph orch apply` command:

   Example

   ```
   [root@host01 ~]# ceph orch apply -i hosts.yaml
   ```
5. If you created the `hosts.yaml` file directly on the local host, use the `cephadm` shell to mount the file:

   **Example**

   ```bash
   [root@host01 ~]# cephadm shell --mount hosts.yaml -- ceph orch apply -i /mnt/hosts.yaml
   ```

6. View the list of hosts and their labels:

   **Example**

   ```bash
   [root@host01 ~]# ceph orch host ls
   HOST      ADDR      LABELS          STATUS
   host02    host02    mon osd mgr
   host03    host03    mon osd mgr
   host04    host04    mon osd
   ```

   **NOTE**

   If a host is online and operating normally, its status is blank. An offline host shows a status of OFFLINE, and a host in maintenance mode shows a status of MAINTENANCE.

### 3.13.3. Adding hosts in disconnected deployments

If you are running a storage cluster on a private network and your host domain name server (DNS) cannot be reached through private IP, you must include both the host name and the IP address for each host you want to add to the storage cluster.

#### Prerequisites

- A running storage cluster.
- Root-level access to all hosts in the storage cluster.

#### Procedure

1. Invoke the `cephadm` shell.

   **Syntax**

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

2. Add the host:

   **Syntax**

   ```bash
   ceph orch host add HOST_NAME HOST_ADDRESS
   ```
Example

[ceph: root@host01 ~]# ceph orch host add host03 10.10.128.70

3.13.4. Removing hosts

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

```bash
[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

```bash
ceph orch ps HOSTNAME
```

Example

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

6. Remove the host:

Syntax

```bash
ceph orch rm HOSTNAME
```

Example

```bash
[ceph: root@host01 /]# ceph orch 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.

### 3.14. LABELING HOSTS

The Ceph orchestrator supports assigning labels to hosts. Labels are free-form and have no specific meanings. This means that you can use `mon`, `monitor`, `mycluster_monitor`, or any other text string. Each host can have multiple labels.

For example, apply the `mon` label to all hosts on which you want to deploy Ceph Monitor daemons, `mgr` for all hosts on which you want to deploy Ceph Manager daemons, `rgw` for Ceph Object Gateway daemons, 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.

#### 3.14.1. Adding a label to a host
You can use the Ceph orchestrator to add a label to a host. Each host can have multiple labels. Labels can be used to specify placement of daemons.

**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. Launch the `cephadm` shell:
   ```bash
   [root@host01 ~]# cephadm shell
   [ceph: root@host01 /]#
   ```

2. Add a label to a host:

   **Syntax**
   ```bash
   ceph orch host label add HOSTNAME LABEL
   ```

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

**Verification**

- List the hosts:

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

3.14.2. 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:
   ```bash
   [root@host01 ~]# cephadm shell
   [ceph: root@host01 /]#
   ```
2. Use the ceph orchestrator to remove a label from a host:

Syntax

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

Example

```bash
[ceph: root@host01 /]
```

```
# ceph orch host label rm host02 mon
```

Verification

- List the hosts:

  Example

  ```bash
  [ceph: root@host01 /]
  ```

```
# ceph orch host ls
```

### 3.14.3. Using host labels to deploy daemons on specific hosts

You can use host labels to deploy daemons to specific hosts. There are two ways to use host labels to deploy daemons on specific hosts:

- By using the `--placement` option from the command line.
- By using a YAML file.

**Prerequisites**

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

**Procedure**

1. Log into the Cephadm shell:

   Example

   ```bash
   [root@host01 ~]
   ```

```
# cephadm shell
```

2. List current hosts and labels:

   Example

   ```bash
   [ceph: root@host01 /]
   ```

```
# ceph orch host ls
```

- **Method 1**: Use the `--placement` option to deploy a daemon from the command line:
Syntax

```bash
ceph orch apply DAEMON --placement="label:LABEL"
```

Example

```bash
[ceph: root@host01 /]# ceph orch apply prometheus --placement="label:mylabel"
```

- **Method 2** To assign the daemon to a specific host label in a YAML file, specify the service type and label in the YAML file:

  a. Create the `placement.yml` file:

     ```
     [ceph: root@host01 /]# vi placement.yml
     ```

  b. Specify the service type and label in the `placement.yml` file:

     ```
     service_type: prometheus
     placement:
       label: "mylabel"
     ```

  c. Apply the daemon placement file:

     ```bash
     ceph orch apply -i FILENAME
     ```

     ```bash
     [ceph: root@host01 /]# ceph orch apply -i placement.yml
     Scheduled prometheus update…
     ```

**Verification**

- List the status of the daemons:

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

  ```bash
  [ceph: root@host01 /]# ceph orch ps --daemon_type=prometheus
  NAME               HOST   PORTS   STATUS        REFRESHED  AGE  MEM USE  MEM LIM
  VERSION  IMAGE ID      CONTAINER ID
  prometheus.host02  host02  *:9095  running (2h)     8m ago   2h    85.3M        -  2.22.2
  ac25aac5d567  ad8c7593d7c0
  ```
3.15. ADDING MONITOR SERVICE

A typical Red Hat Ceph Storage storage cluster has three or five monitor daemons deployed on different hosts. If your storage cluster has five or more hosts, Red Hat recommends that you deploy five Monitor nodes.

NOTE

In the case of a firewall, see the Firewall settings for Ceph Monitor node section of the Red Hat Ceph Storage Configuration Guide for details.

NOTE

The bootstrap node is the initial monitor of the storage cluster. Be sure to include the bootstrap node in the list of hosts to which you want to deploy.

NOTE

If you want to apply Monitor service to more than one specific host, be sure to specify all of the host names within the same ceph orch apply command. If you specify ceph orch apply mon --placement host1 and then specify ceph orch apply mon --placement host2, the second command removes the Monitor service on host1 and applies a Monitor service to host2.

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 first (bootstrap) host in the storage cluster. cephadm can also deploy and scale monitors to correspond to changes in the size of the storage cluster.

Prerequisites

- Root-level access to all hosts in the storage cluster.
- A running storage cluster.

Procedure

1. Apply the five Monitor daemons to five random hosts in the storage cluster:
   
   ceph orch apply mon 5

2. Disable automatic Monitor deployment:
   
   ceph orch apply mon --unmanaged

3.15.1. Adding Monitor nodes to specific hosts

Use host labels to identify the hosts that contain Monitor nodes.

Prerequisites

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

Procedure

1. Assign the `mon` label to the host:

   **Syntax**
   ```
   ceph orch host label add HOSTNAME mon
   ```

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

2. View the current hosts and labels:

   **Syntax**
   ```
   ceph orch host ls
   ```

   **Example**
   ```
   [ceph: root@host01 /]# ceph orch host label add host02 mon
   [ceph: root@host01 /]# ceph orch host label add host03 mon
   [ceph: root@host01 /]# ceph orch host ls
   HOST ADDR LABELS STATUS
   host01 mon
   host02 mon
   host03 mon
   host04
   host05
   host06
   ```

3. Deploy monitors based on the host label:

   **Syntax**
   ```
   ceph orch apply mon label:mon
   ```

4. Deploy monitors on a specific set of hosts:

   **Syntax**
   ```
   ceph orch apply mon HOSTNAME1,HOSTNAME2,HOSTNAME3
   ```

   **Example**
   ```
   [root@host01 ~]# ceph orch apply mon host01,host02,host03
   ```
3.16. SETTING UP THE ADMIN NODE

Use an admin node to administer the storage cluster.

An admin node contains both the cluster configuration file and the admin keyring. Both of these files are stored in the directory `/etc/ceph` and use the name of the storage cluster as a prefix.

For example, the default ceph cluster name is `ceph`. In a cluster using the default name, the admin keyring is named `/etc/ceph/ceph.client.admin.keyring`. The corresponding cluster configuration file is named `/etc/ceph/ceph.conf`.

To set up additional hosts in the storage cluster as admin nodes, apply the `_admin` label to the host you want to designate as an administrator node.

**NOTE**

By default, after applying the `_admin` label to a node, `cephadm` copies the `ceph.conf` and `client.admin` keyring files to that node. The `_admin` label is automatically applied to the bootstrap node unless the `--skip-admin-label` option was specified with the `cephadm bootstrap` command.

**Prerequisites**

- A running storage cluster with `cephadm` installed.
- The storage cluster has running Monitor and Manager nodes.
- Root-level access to all nodes in the cluster.

**Procedure**

1. Use `ceph orch host ls` to view the hosts in your storage cluster:

   ```bash
   [root@host01 ~]# ceph orch host ls
   HOST   ADDR   LABELS  STATUS
   host01        mon,mgr,_admin
   host02        mon
   host03        mon,mgr
   host04
   host05
   host06
   ```

2. Use the `_admin` label to designate the admin host in your storage cluster. For best results, this host should have both Monitor and Manager daemons running.

**Syntax**
3. Verify that the admin host has the \_admin label.

Example

[root@host01 ~]# ceph orch host ls
HOST   ADDR   LABELS  STATUS
host01        mon,mgr,\_admin
host02        mon
host03        mon,mgr,\_admin
host04
host05
host06

4. Log in to the admin node to manage the storage cluster.

### 3.16.1. Deploying Ceph monitor nodes using host labels

A typical Red Hat Ceph Storage storage cluster has three or five Ceph Monitor daemons deployed on different hosts. If your storage cluster has five or more hosts, Red Hat recommends that you deploy five Ceph Monitor nodes.

If your Ceph Monitor nodes or your entire cluster are located on a single subnet, then cephadm automatically adds up to five Ceph Monitor daemons as you add new nodes to the cluster. cephadm automatically configures the Ceph Monitor daemons on the new nodes. The new nodes reside on the same subnet as the first (bootstrap) node in the storage cluster. cephadm can also deploy and scale monitors to correspond to changes in the size of the storage cluster.

**NOTE**

Use host labels to identify the hosts that contain Ceph Monitor nodes.

**Prerequisites**

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

**Procedure**

1. Assign the mon label to the host:

Syntax

```
ceph orch host label add HOSTNAME mon
```

Example
2. View the current hosts and labels:

**Syntax**

```
ceph orch host ls
```

**Example**

```
[ceph: root@host01 /]
HOST   ADDR   LABELS  STATUS
host01        mon,mgr,_admin
host02        mon
host03        mon
host04
host05
host06
```

- Deploy Ceph Monitor daemons based on the host label:

  **Syntax**

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

- Deploy Ceph Monitor daemons on a specific set of hosts:

  **Syntax**

  ```
  ceph orch apply mon HOSTNAME1,HOSTNAME2,HOSTNAME3
  ```

  **Example**

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

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

  **NOTE**

  Be sure to include the bootstrap node in the list of hosts to which you want to deploy.

3.16.2. Adding Ceph Monitor nodes by IP address or network name

A typical Red Hat Ceph Storage storage cluster has three or five monitor daemons deployed on different hosts. If your storage cluster has five or more hosts, Red Hat recommends that you deploy five Monitor nodes.

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 nodes to the cluster. You do not need to configure the Monitor daemons on the new nodes. The new nodes reside on the same subnet as the first node in the storage cluster. The first node in the storage cluster is the bootstrap node. cephadm can also deploy and scale monitors to correspond to changes in the size of the storage cluster.
Prerequisites

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

Procedure

1. To deploy each additional Ceph Monitor node:

   Syntax

   ```
   ceph orch apply mon NODE:IP_ADDRESS_OR_NETWORK_NAME 
   [NODE:IP_ADDRESS_OR_NETWORK_NAME...]
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph orch apply mon host02:10.10.128.69 host03:mynetwork
   ```

3.17. ADDING MANAGER SERVICE

*cephadm* automatically installs a Manager daemon on the bootstrap node during the bootstrapping process. Use the Ceph orchestrator to deploy additional Manager daemons.

The Ceph orchestrator deploys two Manager daemons by default. 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**

If you want to apply Manager daemons to more than one specific host, be sure to specify all of the host names within the same *ceph orch apply* command. If you specify *ceph orch apply mgr --placement host1* and then specify *ceph orch apply mgr --placement host2*, the second command removes the Manager daemon on host1 and applies a Manager daemon to host2.

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

Prerequisites

- A running storage cluster.

Procedure

- To specify that you want to apply a certain number of Manager daemons to randomly selected hosts:

  Syntax

  ```
  ceph orch apply mgr NUMBER_OF_DAEMONS
  ```

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

- To add Manager daemons to specific hosts in your storage cluster:

**Syntax**

```bash
ceph orch apply mgr --placement "HOSTNAME1 HOSTNAME2 HOSTNAME3"
```

**Example**

```bash
[ceph: root@host01 /]# ceph orch apply mgr --placement "host02 host03 host04"
```

### 3.18. ADDING OSDS

Cephadm will not provision an OSD on a device that is not available. A storage device is considered available if it meets all of the following conditions:

- The device must have no partitions.
- 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.

**IMPORTANT**

By default, the `osd_memory_target_autotune` parameter is set to `true` in Red Hat Ceph Storage 6.0. For more information about tuning OSD memory, see the [Automatically tuning OSD memory](https://access.redhat.com/documentation/en-us/red_hat_ceph_storage/6.0/rhcs/operations_guide) section in the *Red Hat Ceph Storage Operations Guide*.

**Prerequisites**

- A running Red Hat Ceph Storage cluster.

**Procedure**

1. List the available devices to deploy OSDs:

   **Syntax**

   ```bash
   ceph orch device ls [--hostname=HOSTNAME1 HOSTNAME2] [--wide] [--refresh]
   ```

   **Example**

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

2. You can either deploy the OSDs on specific hosts or on all the available devices:
To create an OSD from a specific device on a specific host:

Syntax

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

Example

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

To deploy OSDs on any available and unused devices, use the `--all-available-devices` option.

Example

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

**NOTE**

This command creates colocated WAL and DB daemons. If you want to create non-colocated daemons, do not use this command.

**Additional Resources**

- For more information about drive specifications for OSDs, see the *Advanced service specifications and filters for deploying OSDs* section in the *Red Hat Ceph Storage Operations Guide*.

- For more information about zapping devices to clear data on devices, see the *Zapping devices for Ceph OSD deployment* section in the *Red Hat Ceph Storage Operations Guide*.

### 3.19. RUNNING THE CEPHDAM-CLIENTS PLAYBOOK

The `cephadm-clients.yml` playbook handles the distribution of configuration and admin keyring files to a group of Ceph clients.

**NOTE**

If you do not specify a configuration file when you run the playbook, the playbook will generate and distribute a minimal configuration file. By default, the generated file is located at `/etc/ceph/ceph.conf`.

**NOTE**

If you are not using the `cephadm-ansible` playbooks, after upgrading your Ceph cluster, you must upgrade the `ceph-common` package and client libraries on your client nodes. For more information, see *Upgrading the Red Hat Ceph Storage cluster* section in the *Red Hat Ceph Storage Upgrade Guide*.

**Prerequisites**

- Root-level access to the Ansible administration node.
Ansible user with sudo and passwordless `ssh` access to all nodes in the storage cluster.

The `cephadm-ansible` package is installed.

The preflight playbook has been run on the initial host in the storage cluster. For more information, see `Running the preflight playbook`.

The `client_group` variable must be specified in the Ansible inventory file.

The `[admin]` group is defined in the inventory file with a node where the admin keyring is present at `/etc/ceph/ceph.client.admin.keyring`.

Procedure

1. Navigate to the `/usr/share/cephadm-ansible` directory.

2. Run the `cephadm-clients.yml` playbook on the initial host in the group of clients. Use the full path name to the admin keyring on the admin host for `PATH_TO_KEYRING`. Optional: If you want to specify an existing configuration file to use, specify the full path to the configuration file for `CONFIG_FILE`. Use the Ansible group name for the group of clients for `ANSIBLE_GROUP_NAME`. Use the FSID of the cluster where the admin keyring and configuration files are stored for `FSID`. The default path for the FSID is `/var/lib/ceph/`.

Syntax

```
ansible-playbook -i hosts cephadm-clients.yml -extra-vars '{"fsid":"FSID", "client_group":"ANSIBLE_GROUP_NAME", "keyring":"PATH_TO_KEYRING", "conf":"CONFIG_FILE"}'
```

Example

```
[ceph-admin@admin cephadm-ansible]$ ansible-playbook -i hosts cephadm-clients.yml --extra-vars '{"fsid":"be3ca2b2-27db-11ec-892b-005056833d58","client_group":"fs_clients","keyring": "/etc/ceph/fs.keyring", "conf": "/etc/ceph/ceph.conf"}’
```

After installation is complete, the specified clients in the group have the admin keyring. If you did not specify a configuration file, `cephadm-ansible` creates a minimal default configuration file on each client.

Additional Resources

- For more information about admin keys, see the `Ceph User Management` section in the `Red Hat Ceph Storage Administration Guide`.

### 3.20. MANAGING OPERATING SYSTEM TUNING PROFILES WITH `CEPHADM`

As a storage administrator, you can use `cephadm` to create and manage operating system tuning profiles that apply a set of `sysctl` settings to a given set of hosts in your Red Hat Ceph Storage cluster. Tuning the operating system gives you extra opportunities for better performance of your Red Hat Ceph Storage cluster.

Additional Resources
For more information about configuring kernel parameters, see the `sysctl(8)` man page.

For more information about tuned profiles, see Customizing TuneD profiles.

### 3.20.1. Creating tuning profiles

You can create a tuning profile by creating a YAML specification file with kernel parameters or by defining kernel parameter settings using the orchestrator CLI.

**Prerequisites**

- A running Red Hat Ceph Storage cluster.
- Root-level access to an admin host.
- Installation of the tuned package.

**Method 1:**

- Create a tuning profile by creating and applying a YAML specification:
  
  a. From a Ceph admin host, create a YAML specification file:

  **Syntax**

  ```bash
  touch TUNED_PROFILE_NAME.yaml
  ```

  **Example**

  ```bash
  [root@host01 ~]# touch mon_hosts_profile.yaml
  ```

  b. Edit the YAML file to include the tuning parameters:

  **Syntax**

  ```yaml
  profile_name: PROFILE_NAME
  placement:
    hosts:
      - HOST1
      - HOST2
  settings:
    SYSCTL_PARAMETER: SYSCTL_PARAMETER_VALUE
  ```

  **Example**

  ```yaml
  profile_name: mon_hosts_profile
  placement:
    hosts:
      - host01
      - host02
  settings:
    fs.file-max: 1000000
    vm.swappiness: 13
  ```
c. Apply the tuning profile:

Syntax

```bash
ceph orch tuned-profile apply -i TUNED_PROFILE_NAME.yaml
```

Example

```bash
[root@host01 ~]# ceph orch tuned-profile apply -i mon_hosts_profile.yaml
Saved tuned profile mon_hosts_profile
```

This example writes the profile to `/etc/sysctl.d/` on `host01` and `host02` and runs `sysctl --system` on each host to reload sysctl variables without rebooting.

**NOTE**

Cephadm writes the profile file name under `/etc/sysctl.d/` as `TUNED_PROFILE_NAME-cephadm-tuned-profile.conf` where `TUNED_PROFILE_NAME` is the `profile_name` you specify in the provided YAML specification. The `sysctl` command applies settings in lexicographical order by the file name the setting occurs in. If multiple files contain the same setting, the entry in the file with the lexicographically latest name will take precedence. To ensure you apply settings before or after other configuration files that may exist, set the `profile_name` in your specification file accordingly.

**NOTE**

Cephadm applies `sysctl` settings only at the host level and not to any certain daemon or container.

Method 2:

- Create a tuning profile by using the orchestrator CLI:
  a. From a Ceph admin host, specify the tuning profile name, placement, and settings:

  **Syntax**

  ```bash
  ceph orch tuned-profile apply PROFILE_NAME --placement='HOST1,HOST2' --settings='SETTING_NAME1=VALUE1,SETTING_NAME2=VALUE2
  ```

  **Example**

  ```bash
  [root@host01 ~]# ceph orch tuned-profile apply osd_hosts_profile --placement='host04,host05' --settings='fs.file-max=200000,vm.swappiness=19'
  Saved tuned profile osd_hosts_profile
  ```

  **Verification**

  - List the tuning profiles that `cephadm` is managing:
Example

```
[root@host01 /]# ceph orch tuned-profile ls

profile_name: osd_hosts_profile
placement: host04;host05
settings:
  fs.file-max: 200000
  vm.swappiness: 19
``` 

3.20.2. Viewing tuning profiles

You can view all the tuning profiles that `cephadm` manages by running the `tuned-profile ls` command.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to an admin host.
- Installation of the `tuned` package.

Procedure

- From a Ceph admin host, list the tuning profiles:

Syntax

```
ceph orch tuned-profile ls
```

Example

```
[root@host01 /]# ceph orch tuned-profile ls

profile_name: osd_hosts_profile
placement: host04;host05
settings:
  fs.file-max: 200000
  vm.swappiness: 19
---
profile_name: mon_hosts_profile
placement: host01;host02
settings:
  fs.file-max: 1000000
  vm.swappiness: 13
```
NOTE

If you need to make modifications and re-apply a profile, passing the `--format yaml` parameter to the `tuned-profile ls` command will present the profiles in a format that you can copy and re-apply.

Example

```
[root@host01 ~]# ceph orch tuned-profile ls --format yaml
placement:
    hosts:
    - host01
    - host02
profile_name: mon_hosts_profile
settings:
    vm.swappiness: '13'
    fs.file-max: 1000000
```

### 3.20.3. Modifying tuning profiles

After you create tuning profiles, you can modify the exiting tuning profiles to adjust `sysctl` settings when needed.

You can modify existing tuning profiles in two ways:

- Re-apply a YAML specification with the same profile name.
- Use the `tuned-profile add-setting` and `rm-setting` parameters to adjust a setting.

**Prerequisites**

- A running Red Hat Ceph Storage cluster.
- Root-level access to an admin host.
- Installation of the `tuned` package.

**Method 1:**

- Modify a setting using the `tuned-profile add-setting` and `rm-setting` parameters:
  
  a. From a Ceph admin host, add or modify a setting for an existing profile:

  **Syntax**

  ```
  ceph orch tuned-profile add-setting PROFILE_NAME SETTING_NAME VALUE
  ```

  **Example**

  ```
  [root@host01 ~]# ceph orch tuned-profile add-setting mon_hosts_profile
  vm.vfs_cache_pressure 110
  ```

  Added setting `vm.vfs_cache_pressure` with value 110 to tuned profile `mon_hosts_profile`
b. To remove a setting from an existing profile:

Syntax

```
ceph orch tuned-profile rm-setting PROFILE_NAME SETTING_NAME
```

Example

```
[root@host01 ~]# ceph orch tuned-profile rm-setting mon_hosts_profile
vm.vfs_cache_pressure

Removed setting vm.vfs_cache_pressure from tuned profile mon_hosts_profile
```

Method 2:

- Modify a setting by re-applying a YAML specification with the same profile name:

  a. From a Ceph admin host, create the YAML specification file or modify an existing specification file:

```
Syntax

vi TUNED_PROFILE_NAME.yaml
```

Example

```
[root@host01 ~]# vi mon_hosts_profile.yaml
```

b. Edit the YAML file to include the tuned parameters you want to modify:

```
Syntax

profile_name: PROFILE_NAME
placement:
  hosts:
    - HOST1
    - HOST2
settings:
  SYSCTL_PARAMETER: SYSCTL_PARAMETER_VALUE
```

Example

```
profile_name: mon_hosts_profile
placement:
  hosts:
    - host01
    - host02
settings:
  fs.file-max: 2000000
  vm.swappiness: 15
```

c. Apply the tuning profile:
Syntax

```bash
ceph orch tuned-profile apply -i TUNED_PROFILE_NAME.yaml
```

Example

```bash
[root@host01 ~]# ceph orch tuned-profile apply -i mon_hosts_profile.yaml
Saved tuned profile mon_hosts_profile
```

**NOTE**

Modifying the placement will require re-applying a profile with the same name. Cephadm tracks profiles by their name, therefore applying a profile with the same name as an existing profile, results in the old profile being overwritten.

### 3.20.4. Removing tuning profiles

As a storage administrator, you can remove tuning profiles that you no longer want *cephadm* to manage, with the `tuned-profile rm` command.

**Prerequisites**

- A running Red Hat Ceph Storage cluster.
- Root-level access to an admin host.
- Installation of the *tuned* package.

**Procedure**

1. From a Ceph admin host, view the tuning profiles that *cephadm* is managing:

   **Example**

   ```bash
   [root@host01 ~]# ceph orch tuned-profile ls
   ```

2. Remove the tuning profile:

   **Syntax**

   ```bash
   ceph orch tuned-profile rm TUNED_PROFILE_NAME
   ```

   **Example**

   ```bash
   [root@host01 ~]# ceph orch tuned-profile rm mon_hosts_profile
   Removed tuned profile mon_hosts_profile
   ```

   When *cephadm* removes a tuning profile, it will remove the profile file previously written to the `/etc/sysctl.d` directory on the corresponding host.
3.21. PURGING THE CEPH STORAGE CLUSTER

Purging the Ceph storage cluster clears any data or connections that remain from previous deployments on your server. For Red Hat Enterprise Linux 8, this Ansible script removes all daemons, logs, and data that belong to the FSID passed to the script from all hosts in the storage cluster. For Red Hat Enterprise Linux 9, use the `cephadm rm-cluster` command since Ansible is not supported.

For Red Hat Enterprise Linux 8

The Ansible inventory file lists all the hosts in your cluster and what roles each host plays in your Ceph storage cluster. The default location for an inventory file is `/usr/share/cephadm-ansible/hosts`, but this file can be placed anywhere.

**IMPORTANT**

This process works only if the `cephadm` binary is installed on all hosts in the storage cluster.

The following example shows the structure of an inventory file:

**Example**

```
host02
host03
host04
[admin]
host01
[clients]
client01
client02
client03
```

**Prerequisites**

- A running Red Hat Ceph Storage cluster.
- Ansible 2.9 or later is installed on the bootstrap node.
- Root-level access to the Ansible administration node.
- Ansible user with sudo and passwordless `ssh` access to all nodes in the storage cluster.
- The `[admin]` group is defined in the inventory file with a node where the admin keyring is present at `/etc/ceph/ceph.client.admin.keyring`.

**Procedure**

- As an Ansible user on the bootstrap node, run the purge script:

  **Syntax**

  ```bash
  ansible-playbook -i hosts cephadm-purge-cluster.yml -e fsid=FSID -vvv
  ```
Example

```
[ceph-admin@host01 cephadm-ansible]$ ansible-playbook -i hosts cephadm-purge-cluster.yml -e fsid=a6ca415a-cde7-11eb-a41a-002590fc2544 -vvv
```

When the script has completed, the entire storage cluster, including all OSD disks, will have been removed from all hosts in the cluster.

For Red Hat Enterprise Linux 9

Prerequisites

- A running Red Hat Ceph Storage cluster.

Procedure

1. Disable `cephadm` to stop all the orchestration operations to avoid deploying new daemons:

   **Example**

   ```
   [ceph: root#host01 /]# ceph mgr module disable cephadm
   ```

2. Get the FSID of the cluster:

   **Example**

   ```
   [ceph: root#host01 /]# ceph fsid
   ```

3. Purge the Ceph daemons from all hosts in the cluster:

   **Syntax**

   `cephadm rm-cluster --force --zap-osds --fsid FSID`

   **Example**

   ```
   [ceph: root#host01 /]# cephadm rm-cluster --force --zap-osds --fsid a6ca415a-cde7-11eb-a41a-002590fc2544
   ```
CHAPTER 4. MANAGING A RED HAT CEPH STORAGE CLUSTER USING CEPHADM-ANSIBLE MODULES

As a storage administrator, you can use cephadm-ansible modules in Ansible playbooks to administer your Red Hat Ceph Storage cluster. The cephadm-ansible package provides several modules that wrap cephadm calls to let you write your own unique Ansible playbooks to administer your cluster.

NOTE

At this time, cephadm-ansible modules only support the most important tasks. Any operation not covered by cephadm-ansible modules must be completed using either the command or shell Ansible modules in your playbooks.

4.1. THE CEPHADM-ANSIBLE MODULES

The cephadm-ansible modules are a collection of modules that simplify writing Ansible playbooks by providing a wrapper around cephadm and ceph orch commands. You can use the modules to write your own unique Ansible playbooks to administer your cluster using one or more of the modules.

The cephadm-ansible package includes the following modules:

- cephadm_bootstrap
- ceph_orch_host
- ceph_config
- ceph_orch_apply
- ceph_orch_daemon
- cephadm_registry_login

4.2. THE CEPHADM-ANSIBLE MODULES OPTIONS

The following tables list the available options for the cephadm-ansible modules. Options listed as required need to be set when using the modules in your Ansible playbooks. Options listed with a default value of true indicate that the option is automatically set when using the modules and you do not need to specify it in your playbook. For example, for the cephadm_bootstrap module, the Ceph Dashboard is installed unless you set dashboard: false.

Table 4.1. Available options for the cephadm_bootstrap module.

<table>
<thead>
<tr>
<th>cephadm_bootstrap</th>
<th>Description</th>
<th>Required</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>mon_ip</td>
<td>Ceph Monitor IP address.</td>
<td>true</td>
<td></td>
</tr>
<tr>
<td>image</td>
<td>Ceph container image.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>docker</td>
<td>Use docker instead of podman.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td><code>cephadm_bootstrap</code></td>
<td>Description</td>
<td>Required</td>
<td>Default</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>fsid</td>
<td>Define the Ceph FSID.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>pull</td>
<td>Pull the Ceph container image.</td>
<td>false</td>
<td>true</td>
</tr>
<tr>
<td>dashboard</td>
<td>Deploy the Ceph Dashboard.</td>
<td>false</td>
<td>true</td>
</tr>
<tr>
<td>dashboard_user</td>
<td>Specify a specific Ceph Dashboard user.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>dashboard_password</td>
<td>Ceph Dashboard password.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>monitoring</td>
<td>Deploy the monitoring stack.</td>
<td>false</td>
<td>true</td>
</tr>
<tr>
<td>firewallld</td>
<td>Manage firewall rules with firewalld.</td>
<td>false</td>
<td>true</td>
</tr>
<tr>
<td>allow_overwrite</td>
<td>Allow overwrite of existing --output-config, --output-keyring, or --output-pub-ssh-key files.</td>
<td>false</td>
<td>false</td>
</tr>
<tr>
<td>registry_url</td>
<td>URL for custom registry.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>registry_username</td>
<td>Username for custom registry.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>registry_password</td>
<td>Password for custom registry.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>registry_json</td>
<td>JSON file with custom registry login information.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>ssh_user</td>
<td>SSH user to use for <code>cephadm</code> ssh to hosts.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>ssh_config</td>
<td>SSH config file path for <code>cephadm</code> SSH client.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>allow_fqdn_hostname</td>
<td>Allow hostname that is a fully-qualified domain name (FQDN).</td>
<td>false</td>
<td>false</td>
</tr>
<tr>
<td>cephadm_bootstrap</td>
<td>Description</td>
<td>Required</td>
<td>Default</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>cluster_network</td>
<td>Subnet to use for cluster replication, recovery and heartbeats.</td>
<td>false</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.2. Available options for the `ceph_orch_host` module.

<table>
<thead>
<tr>
<th>ceph_orch_host</th>
<th>Description</th>
<th>Required</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>fsid</td>
<td>The FSID of the Ceph cluster to interact with.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>image</td>
<td>The Ceph container image to use.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>name</td>
<td>Name of the host to add, remove, or update.</td>
<td>true</td>
<td></td>
</tr>
<tr>
<td>address</td>
<td>IP address of the host.</td>
<td>true when <code>state</code> is <code>present</code>.</td>
<td></td>
</tr>
<tr>
<td>set_admin_label</td>
<td>Set the _admin label on the specified host.</td>
<td>false</td>
<td>false</td>
</tr>
<tr>
<td>labels</td>
<td>The list of labels to apply to the host.</td>
<td>false</td>
<td>[]</td>
</tr>
<tr>
<td>state</td>
<td>If set to <code>present</code>, it ensures the name specified in <code>name</code> is present. If set to <code>absent</code>, it removes the host specified in <code>name</code>. If set to <code>drain</code>, it schedules to remove all daemons from the host specified in <code>name</code>.</td>
<td>false</td>
<td>present</td>
</tr>
</tbody>
</table>

Table 4.3. Available options for the `ceph_config` module

<table>
<thead>
<tr>
<th>ceph_config</th>
<th>Description</th>
<th>Required</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>fsid</td>
<td>The FSID of the Ceph cluster to interact with.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td>image</td>
<td>The Ceph container image to use.</td>
<td>false</td>
<td></td>
</tr>
</tbody>
</table>
Table 4.4. Available options for the `ceph_orch_apply` module.

<table>
<thead>
<tr>
<th>ceph_orch_apply</th>
<th>Description</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>fsid</td>
<td>The FSID of the Ceph cluster to interact with.</td>
<td>false</td>
</tr>
<tr>
<td>image</td>
<td>The Ceph container image to use.</td>
<td>false</td>
</tr>
<tr>
<td>spec</td>
<td>The service specification to apply.</td>
<td>true</td>
</tr>
</tbody>
</table>

Table 4.5. Available options for the `ceph_orch_daemon` module.

<table>
<thead>
<tr>
<th>ceph_orch_daemon</th>
<th>Description</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>fsid</td>
<td>The FSID of the Ceph cluster to interact with.</td>
<td>false</td>
</tr>
<tr>
<td>image</td>
<td>The Ceph container image to use.</td>
<td>false</td>
</tr>
<tr>
<td>state</td>
<td>The desired state of the service specified in <code>name</code>.</td>
<td>true</td>
</tr>
<tr>
<td></td>
<td>If started, it ensures the service is started.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If stopped, it ensures the service is stopped.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If restarted, it will restart the service.</td>
<td></td>
</tr>
<tr>
<td>daemon_id</td>
<td>The ID of the service.</td>
<td>true</td>
</tr>
</tbody>
</table>
### 4.3. Bootstrapping a Storage Cluster Using the cephadm_bootstrap and cephadm_registry_login Modules

As a storage administrator, you can bootstrap a storage cluster using Ansible by using the **cephadm_bootstrap** and **cephadm_registry_login** modules in your Ansible playbook.

**Prerequisites**

- An IP address for the first Ceph Monitor container, which is also the IP address for the first node in the storage cluster.
- Login access to **registry.redhat.io**.
- A minimum of 10 GB of free space for `/var/lib/containers/`.
- Red Hat Enterprise Linux 9.0 or later with **ansible-core** bundled into AppStream.
- Installation of the **cephadm-ansible** package on the Ansible administration node.

---

#### Table 4.6. Available options for the cephadm_registry_login module

<table>
<thead>
<tr>
<th><strong>cephadm_registry_login</strong></th>
<th>Description</th>
<th>Required</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>state</strong></td>
<td>Login or logout of a registry.</td>
<td>false</td>
<td>login</td>
</tr>
<tr>
<td><strong>docker</strong></td>
<td>Use <strong>docker</strong> instead of <strong>podman</strong>.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td><strong>registry_url</strong></td>
<td>The URL for custom registry.</td>
<td>false</td>
<td></td>
</tr>
<tr>
<td><strong>registry_username</strong></td>
<td>Username for custom registry.</td>
<td>true when <strong>state</strong> is <strong>login</strong>.</td>
<td></td>
</tr>
<tr>
<td><strong>registry_password</strong></td>
<td>Password for custom registry.</td>
<td>true when <strong>state</strong> is <strong>login</strong>.</td>
<td></td>
</tr>
<tr>
<td><strong>registry_json</strong></td>
<td>The path to a JSON file. This file must be present on remote hosts prior to running this task. This option is currently not supported.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
- Passwordless SSH is set up on all hosts in the storage cluster.
- Hosts are registered with CDN.

**NOTE**

Red Hat Ceph Storage 6.0 supports Red Hat Enterprise Linux 8.7 and 8.8 with bootstrap node in supported Red Hat Enterprise Linux 9.0 or later Red Hat Ceph Storage 6.1 supports Red Hat Enterprise Linux 8.8 with bootstrap node in supported Red Hat Enterprise Linux 9.2.

**Procedure**

1. Log in to the Ansible administration node.
2. Navigate to the `/usr/share/cephadm-ansible` directory on the Ansible administration node:
   
   **Example**
   
   ```bash
   [ceph-admin@admin ~]$ cd /usr/share/cephadm-ansible
   ```

3. Create the `hosts` file and add hosts, labels, and monitor IP address of the first host in the storage cluster:

   **Syntax**
   
   ```bash
   sudo vi INVENTORY_FILE
   ```

   ```bash
   HOST1 labels="['LABEL1', 'LABEL2']"
   HOST2 labels="['LABEL1', 'LABEL2']"
   HOST3 labels="['LABEL1']"
   ```

   ```bash
   [admin]
   ADMIN_HOST monitor_address=MONITOR_IP_ADDRESS labels="['ADMIN_LABEL', 'LABEL1', 'LABEL2']"
   ```

   **Example**
   
   ```bash
   [ceph-admin@admin cephadm-ansible]$ sudo vi hosts
   ```

   ```bash
   host02 labels="['mon', 'mgr']"
   host03 labels="['mon', 'mgr']"
   host04 labels="['osd']"
   host05 labels="['osd']"
   host06 labels="['osd']"
   ```

   ```bash
   [admin]
   host01 monitor_address=10.10.128.68 labels="['_admin', 'mon', 'mgr']"
   ```

4. Run the preflight playbook:

   **Syntax**
   
   ```bash
   ansible-playbook -i INVENTORY_FILE cephadm-preflight.yml --extra-vars "ceph_origin=rhcs"
   ```
Example

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

5. Create a playbook to bootstrap your cluster:

Syntax

```
sudo vi PLAYBOOK_FILENAME.yml

---
- name: NAME_OF_PLAY
  hosts: BOOTSTRAP_HOST
  become: USE_ELEVATED_PRIVILEGES
  gather_facts: GATHER_FACTS_ABOUT_REMOTE_HOSTS
  tasks:
  - name: NAME_OF_TASK
    cephadm_registry_login:
      state: STATE
      registry_url: REGISTRY_URL
      registry_username: REGISTRY_USER_NAME
      registry_password: REGISTRY_PASSWORD

  - name: NAME_OF_TASK
    cephadm_bootstrap:
      mon_ip: "{{ monitor_address }}"
      dashboard_user: DASHBOARD_USER
      dashboard_password: DASHBOARD_PASSWORD
      allow_fqdn_hostname: ALLOW_FQDN_HOSTNAME
      cluster_network: NETWORK_CIDR
```

Example

```
[ceph-admin@admin cephadm-ansible]$ sudo vi bootstrap.yml

---
- name: bootstrap the cluster
  hosts: host01
  become: true
  gather_facts: false
  tasks:
  - name: login to registry
    cephadm_registry_login:
      state: login
      registry_url: registry.redhat.io
      registry_username: user1
      registry_password: mypassword1

  - name: bootstrap initial cluster
    cephadm_bootstrap:
      mon_ip: "{{ monitor_address }}"
      dashboard_user: mydashboarduser
```
6. Run the playbook:

**Syntax**

```
ansible-playbook -i INVENTORY_FILE PLAYBOOK_FILENAME.yml -vvv
```

**Example**

```
[ceph-admin@admin cephadm-ansible]$ ansible-playbook -i hosts bootstrap.yml -vvv
```

**Verification**

- Review the Ansible output after running the playbook.

### 4.4. ADDING OR REMOVING HOSTS USING THE `ceph_orch_host` MODULE

As a storage administrator, you can add and remove hosts in your storage cluster by using the `ceph_orch_host` module in your Ansible playbook.

**Prerequisites**

- A running Red Hat Ceph 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.
- Installation of the `cephadm-ansible` package on the Ansible administration node.
- New hosts have the storage cluster’s public SSH key. For more information about copying the storage cluster’s public SSH keys to new hosts, see *Adding hosts*.

**Procedure**

1. Use the following procedure to add new hosts to the cluster:
   a. Log in to the Ansible administration node.
   b. Navigate to the `/usr/share/cephadm-ansible` directory on the Ansible administration node:
      ```bash
      [ceph-admin@admin ~]$ cd /usr/share/cephadm-ansible
      ```
   c. Add the new hosts and labels to the Ansible inventory file.

   **Syntax**

   ```bash
   dashboard_password: mydashboardpassword
   allow_fqdn_hostname: true
   cluster_network: 10.10.128.0/28
   ```
sudo vi $INVENTORY_FILE

$NEW_HOST1 labels=['LABEL1', 'LABEL2']
$NEW_HOST2 labels=['LABEL1', 'LABEL2']
$NEW_HOST3 labels=['LABEL1']

[admin]
$ADMIN_HOST monitor_address=$MONITOR_IP_ADDRESS labels=['ADMIN_LABEL', 'LABEL1', 'LABEL2']

Example

[ceph-admin@admin cephadm-ansible]$ sudo vi hosts

host02 labels=['mon', 'mgr']
host03 labels=['mon', 'mgr']
host04 labels=['osd']
host05 labels=['osd']
host06 labels=['osd']

[admin]
host01 monitor_address= 10.10.128.68 labels=['_admin', 'mon', 'mgr']

NOTE

If you have previously added the new hosts to the Ansible inventory file and ran the preflight playbook on the hosts, skip to step 3.

d. Run the preflight playbook with the --limit option:

Syntax

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

Example

[ceph-admin@admin cephadm-ansible]$ ansible-playbook -i hosts cephadm-preflight.yml --extra-vars "ceph_origin=rhcs" --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.

e. Create a playbook to add the new hosts to the cluster:

Syntax

```
sudo vi $PLAYBOOK_FILENAME.yml
```
gather_facts: GATHER_FACTS_ABOUT_REMOTE_HOSTS

tasks:
- name: NAME_OF_TASK
  ceph_orch_host:
    name: "{{ ansible_facts['hostname'] }}"
    address: "{{ ansible_facts['default_ipv4'] ['address'] }}"
    labels: "{{ labels }}"
  delegate_to: HOST_TO_DELEGATE_TASK_TO

- name: NAME_OF_TASK
  when: inventory_hostname in groups['admin']
  ansible.builtin.shell:
    cmd: CEPH_COMMAND_TO_RUN
  register: REGISTER_NAME

- name: NAME_OF_TASK
  when: inventory_hostname in groups['admin']
  debug:
    msg: "{{ REGISTER_NAME.stdout }}"

NOTE

By default, Ansible executes all tasks on the host that matches the hosts line of your playbook. The ceph orch commands must run on the host that contains the admin keyring and the Ceph configuration file. Use the delegate_to keyword to specify the admin host in your cluster.

Example

[ceph-admin@admin cephadm-ansible]$ sudo vi add-hosts.yml

---
- name: add additional hosts to the cluster
  hosts: all
  become: true
  gather_facts: true
  tasks:
  - name: add hosts to the cluster
    ceph_orch_host:
      name: "{{ ansible_facts['hostname'] }}"
      address: "{{ ansible_facts['default_ipv4']['address'] }}"
      labels: "{{ labels }}"
    delegate_to: host01

  - name: list hosts in the cluster
    when: inventory_hostname in groups['admin']
    ansible.builtin.shell:
      cmd: ceph orch host ls
    register: host_list

  - name: print current list of hosts
    when: inventory_hostname in groups['admin']
    debug:
      msg: "{{ host_list.stdout }}"
In this example, the playbook adds the new hosts to the cluster and displays a current list of hosts.

f. Run the playbook to add additional hosts to the cluster:

**Syntax**

```bash
ansible-playbook -i INVENTORY_FILE PLAYBOOK_FILENAME.yml
```

**Example**

```
[ceph-admin@admin cephadm-ansible]$ ansible-playbook -i hosts add-hosts.yml
```

2. Use the following procedure to remove hosts from the cluster:

   a. Log in to the Ansible administration node.

   b. Navigate to the `/usr/share/cephadm-ansible` directory on the Ansible administration node:

   **Example**

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

   c. Create a playbook to remove a host or hosts from the cluster:

   **Syntax**

   ```bash
   sudo vi PLAYBOOK_FILENAME.yml
   ```

   ```yaml
   ---
   - name: NAME_OF_PLAY
     hosts: ADMIN_HOST
     become: USE_ELEVATED_PRIVILEGES
     gather_facts: GATHER_FACTS_ABOUT_REMOTE_HOSTS
     tasks:
       - name: NAME_OF_TASK
         ceph_orch_host:
           name: HOST_TO_REMOVE
           state: STATE

       - name: NAME_OF_TASK
         ceph_orch_host:
           name: HOST_TO_REMOVE
           state: STATE
           retries: NUMBER_OF_RETRIES
           delay: DELAY
           until: CONTINUE_UNTIL
           register: REGISTER_NAME

       - name: NAME_OF_TASK
         ansible.builtin.shell:
           cmd: ceph orch host ls
           register: REGISTER_NAME
   ```
- name: \textit{NAME_OF_TASK}
  debug:
    msg: "\texttt{\{\ REGISTER_NAME.stdout \}}"

\textbf{Example}

```
[ceph-admin@admin cephadm-ansible]$ sudo vi remove-hosts.yml
...
- name: remove host
  hosts: host01
  become: true
  gather_facts: true
  tasks:
    - name: drain host07
      ceph_orch_host:
        name: host07
        state: drain

    - name: remove host from the cluster
      ceph_orch_host:
        name: host07
        state: absent
        retries: 20
        delay: 1
        until: result is succeeded
        register: result

    - name: list hosts in the cluster
      ansible.builtin.shell:
        cmd: ceph orch host ls
        register: host_list

    - name: print current list of hosts
      debug:
        msg: "\texttt{\{\ host_list.stdout \}}"
```

In this example, the playbook tasks drain all daemons on \texttt{host07}, removes the host from the cluster, and displays a current list of hosts.

d. Run the playbook to remove host from the cluster:

\textbf{Syntax}

```
ansible-playbook -i \textit{INV\O\SER\Y\T\Y\E\R\_F\I\L\E} \textit{P\L\A\Y\B\O\O\K\_F\I\L\E\N\A\M\E}.yml
```

\textbf{Example}

```
[ceph-admin@admin cephadm-ansible]$ ansible-playbook -i hosts remove-hosts.yml
```

\textbf{Verification}

- Review the Ansible task output displaying the current list of hosts in the cluster:
4.5. SETTING CONFIGURATION OPTIONS USING THE CEPH_CONFIG MODULE

As a storage administrator, you can set or get Red Hat Ceph Storage configuration options using the `ceph_config` module.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Ansible user with sudo and passwordless SSH access to all nodes in the storage cluster.
- Installation of the `cephadm-ansible` package on the Ansible administration node.
- The Ansible inventory file contains the cluster and admin hosts. For more information about adding hosts to your storage cluster, see Adding or removing hosts using the ceph_orch_host module.

Procedure

1. Log in to the Ansible administration node.
2. Navigate to the `/usr/share/cephadm-ansible` directory on the Ansible administration node:

   ```bash
   [ceph-admin@admin ~]$ cd /usr/share/cephadm-ansible
   ```
3. Create a playbook with configuration changes:

   ```yaml
   sudo vi PLAYBOOK_FILENAME.yml
   ```

   ```yaml
   ---
   - name: PLAY_NAME
     hosts: ADMIN_HOST
     become: USE_ELEVATED_PRIVILEGES
     gather_facts: GATHER_FACTS_ABOUT_REMOTE_HOSTS
   ```
Example

[ceph-admin@admin cephadm-ansible]$ sudo vi change_configuration.yml

---
- name: set pool delete
  hosts: host01
  become: true
  gather_facts: false
  tasks:
    - name: set the allow pool delete option
      ceph_config:
        action: set
        who: mon
        option: mon_allow_pool_delete
        value: true

    - name: get the allow pool delete setting
      ceph_config:
        action: get
        who: mon
        option: mon_allow_pool_delete
        register: verify_mon_allow_pool_delete

    - name: print current mon_allow_pool_delete setting
      debug:
        msg: "the value of 'mon_allow_pool_delete' is {{ verify_mon_allow_pool_delete.stdout }}"

In this example, the playbook first sets the mon_allow_pool_delete option to false. The playbook then gets the current mon_allow_pool_delete setting and displays the value in the Ansible output.

4. Run the playbook:

Syntax
ansible-playbook -i INVENTORY_FILE.PLAYBOOK_FILENAME.yml

Example

[ceph-admin@admin cephadm-ansible]$ ansible-playbook -i hosts change_configuration.yml

Verification

- Review the output from the playbook tasks.

Example

TASK [print current mon_allow_pool_delete setting]
*****************************************************************************
Wednesday 29 June 2022 13:51:41 -0400 (0:00:05.523) 0:00:17.953 ********
ok: [host01] =>
  msg: the value of 'mon_allow_pool_delete' is true

Additional Resources

- See the Red Hat Ceph Storage Configuration Guide for more details on configuration options.

4.6. APPLYING A SERVICE SPECIFICATION USING THE CEPH_ORCH_APPLY MODULE

As a storage administrator, you can apply service specifications to your storage cluster using the ceph_orch_apply module in your Ansible playbooks. A service specification is a data structure to specify the service attributes and configuration settings that is used to deploy the Ceph service. You can use a service specification to deploy Ceph service types like **mon**, **crash**, **mds**, **mgr**, **osd**, **rdb**, or **rbd-mirror**.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Ansible user with sudo and passwordless SSH access to all nodes in the storage cluster.
- Installation of the cephadm-ansible package on the Ansible administration node.
- The Ansible inventory file contains the cluster and admin hosts. For more information about adding hosts to your storage cluster, see Adding or removing hosts using the ceph_orch_host module.

Procedure

1. Log in to the Ansible administration node.
2. Navigate to the /usr/share/cephadm-ansible directory on the Ansible administration node:

Example

[ceph-admin@admin ~]$ cd /usr/share/cephadm-ansible
3. Create a playbook with the service specifications:

Syntax

```bash
sudo vi PLAYBOOK_FILENAME.yml
---
- name: PLAY_NAME
  hosts: HOSTS_OR_HOST_GROUPS
  become: USE_ELEVATED_PRIVILEGES
  gather_facts: GATHER_FACTS_ABOUT_REMOTE_HOSTS
  tasks:
    - name: NAME_OF_TASK
      ceph_orch_apply:
        spec: |
          service_type: SERVICE_TYPE
          service_id: UNIQUE_NAME_OF_SERVICE
          placement:
            host_pattern: *HOST_PATTERN_TO_SELECT_HOSTS*
            label: LABEL
          spec:
            SPECIFICATION_OPTIONS:
```

Example

```bash
[ceph-admin@admin cephadm-ansible]$ sudo vi deploy_osd_service.yml
---
- name: deploy osd service
  hosts: host01
  become: true
  gather_facts: true
  tasks:
    - name: apply osd spec
      ceph_orch_apply:
        spec: |
          service_type: osd
          service_id: osd
          placement:
            host_pattern: **
            label: osd
          spec:
            data_devices:
              all: true
```

In this example, the playbook deploys the Ceph OSD service on all hosts with the label `osd`.

4. Run the playbook:

Syntax

```bash
ansible-playbook -i INVENTORY_FILE PLAYBOOK_FILENAME.yml
```

Example
Verifications

- Review the output from the playbook tasks.

Additional Resources

- See the *Red Hat Ceph Storage Operations Guide* for more details on service specification options.

### 4.7. MANAGING CEPH DAEMON STATES USING THE `CEPH_ORCH_DAEMON` MODULE

As a storage administrator, you can start, stop, and restart Ceph daemons on hosts using the `ceph_orch_daemon` module in your Ansible playbooks.

**Prerequisites**

- A running Red Hat Ceph Storage cluster.
- Ansible user with sudo and passwordless SSH access to all nodes in the storage cluster.
- Installation of the `cephadm-ansible` package on the Ansible administration node.
- The Ansible inventory file contains the cluster and admin hosts. For more information about adding hosts to your storage cluster, see *Adding or removing hosts using the ceph_orch_host module*.

**Procedure**

1. Log in to the Ansible administration node.

2. Navigate to the `/usr/share/cephadm-ansible` directory on the Ansible administration node:

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

3. Create a playbook with daemon state changes:

   **Syntax**

   ```
   sudo vi PLAYBOOK_FILENAME.yml
   ```

   ```yaml
   ---
   - name: PLAY_NAME
     hosts: ADMIN_HOST
     become: USE_ELEVATED_PRIVILEGES
     gather_facts: GATHER_FACTS_ABOUT_REMOTE_HOSTS
     tasks:
       - name: NAME_OF_TASK
         ceph_orch_daemon:
   ```

   ```
   ```
Example

```yaml
[ceph-admin@admin cephadm-ansible]$ sudo vi restart_services.yml
---
- name: start and stop services
  hosts: host01
  become: true
  gather_facts: false
  tasks:
    - name: start osd.0
      ceph_orch_daemon:
        state: started
        daemon_id: 0
        daemon_type: osd

    - name: stop mon.host02
      ceph_orch_daemon:
        state: stopped
        daemon_id: host02
        daemon_type: mon
```

In this example, the playbook starts the OSD with an ID of 0 and stops a Ceph Monitor with an id of host02.

4. Run the playbook:

Syntax

```
ansible-playbook -i INVENTORY_FILE_PLAYBOOK_FILENAME.yml
```

Example

```
[ceph-admin@admin cephadm-ansible]$ ansible-playbook -i hosts restart_services.yml
```

Verification

- Review the output from the playbook tasks.
CHAPTER 5. WHAT TO DO NEXT? DAY 2

As a storage administrator, once you have installed and configured Red Hat Ceph Storage 6, you are ready to perform "Day Two" operations for your storage cluster. These operations include adding metadata servers (MDS) and object gateways (RGW), and configuring services such as NFS.

For more information about how to use the cephadm orchestrator to perform "Day Two" operations, refer to the Red Hat Ceph Storage 6 Operations Guide.

To deploy, configure, and administer the Ceph Object Gateway on "Day Two" operations, refer to the Red Hat Ceph Storage 6 Object Gateway Guide.
APPENDIX A. COMPARISON BETWEEN CEPH ANSIBLE AND CEPHADM

The Red Hat Ceph Storage 6 introduces a new deployment tool, Cephadm, for the containerized deployment of the storage cluster.

The tables compare Cephadm with Ceph-Ansible playbooks for managing the containerized deployment of a Ceph cluster for day one and day two operations.

Table A.1. Day one operations

<table>
<thead>
<tr>
<th>Description</th>
<th>Ceph-Ansible</th>
<th>Cephadm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation of the Red Hat Ceph Storage cluster</td>
<td>Run the <code>site-container.yml</code> playbook.</td>
<td>Run <code>cephadm bootstrap</code> command to bootstrap the cluster on the admin node.</td>
</tr>
<tr>
<td>Addition of hosts</td>
<td>Use the Ceph Ansible inventory.</td>
<td>Run <code>ceph orch add host HOST_NAME</code> to add hosts to the cluster.</td>
</tr>
<tr>
<td>Addition of monitors</td>
<td>Run the <code>add-mon.yml</code> playbook.</td>
<td>Run the <code>ceph orch apply mon</code> command.</td>
</tr>
<tr>
<td>Addition of managers</td>
<td>Run the <code>site-container.yml</code> playbook.</td>
<td>Run the <code>ceph orch apply mgr</code> command.</td>
</tr>
<tr>
<td>Addition of OSDs</td>
<td>Run the <code>add-osd.yml</code> playbook.</td>
<td>Run the <code>ceph orch apply osd</code> command to add OSDs on all available devices or on specific hosts.</td>
</tr>
<tr>
<td>Addition of OSDs on specific devices</td>
<td>Select the <code>devices</code> in the <code>osd.yml</code> file and then run the <code>add-osd.yml</code> playbook.</td>
<td>Select the <code>paths</code> filter under the <code>data_devices</code> in the <code>osd.yml</code> file and then run <code>ceph orch apply -i FILE_NAME.yml</code> command.</td>
</tr>
<tr>
<td>Addition of MDS</td>
<td>Run the <code>site-container.yml</code> playbook.</td>
<td>Run the <code>ceph orch apply filesystem_NAME</code> command to add MDS.</td>
</tr>
<tr>
<td>Addition of Ceph Object Gateway</td>
<td>Run the <code>site-container.yml</code> playbook.</td>
<td>Run the <code>ceph orch apply rgw</code> commands to add Ceph Object Gateway.</td>
</tr>
</tbody>
</table>

Table A.2. Day two operations
<table>
<thead>
<tr>
<th>Description</th>
<th>Ceph–Ansible</th>
<th>Cephadm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removing hosts</td>
<td>Use the Ansible inventory.</td>
<td>Run <code>ceph orch host rm HOST_NAME</code> to remove the hosts.</td>
</tr>
<tr>
<td>Removing monitors</td>
<td>Run the <code>shrink-mon.yml</code> playbook.</td>
<td>Run <code>ceph orch apply mon</code> to redeploy other monitors.</td>
</tr>
<tr>
<td>Removing managers</td>
<td>Run the <code>shrink-mon.yml</code> playbook.</td>
<td>Run <code>ceph orch apply mgr</code> to redeploy other managers.</td>
</tr>
<tr>
<td>Removing OSDs</td>
<td>Run the <code>shrink-osd.yml</code> playbook.</td>
<td>Run <code>ceph orch osd rm OSD_ID</code> to remove the OSDs.</td>
</tr>
<tr>
<td>Removing MDS</td>
<td>Run the <code>shrink-mds.yml</code> playbook.</td>
<td>Run <code>ceph orch rm SERVICE_NAME</code> to remove the specific service.</td>
</tr>
<tr>
<td>Deployment of Ceph Object Gateway</td>
<td>Run the <code>site-container.yml</code> playbook.</td>
<td>Run <code>ceph orch apply rgw SERVICE_NAME</code> to deploy Ceph Object Gateway service.</td>
</tr>
<tr>
<td>Removing Ceph Object Gateway</td>
<td>Run the <code>shrink-rgw.yml</code> playbook.</td>
<td>Run <code>ceph orch rm SERVICE_NAME</code> to remove the specific service.</td>
</tr>
<tr>
<td>Block device mirroring</td>
<td>Run the <code>site-container.yml</code> playbook.</td>
<td>Run <code>ceph orch apply rbd-mirror</code> command.</td>
</tr>
<tr>
<td>Minor version upgrade of Red Hat Ceph Storage</td>
<td>Run the <code>infrastructure-playbooks/rolling_update.yml</code> playbook.</td>
<td>Run <code>ceph orch upgrade start</code> command.</td>
</tr>
<tr>
<td>Upgrading from Red Hat Ceph Storage 4 to Red Hat Ceph Storage 6</td>
<td>Run <code>infrastructure-playbooks/rolling_update.yml</code> playbook.</td>
<td>Upgrade using Cephadm is not supported.</td>
</tr>
<tr>
<td>Deployment of monitoring stack</td>
<td>Edit the <code>all.yml</code> file during installation.</td>
<td>Run the <code>ceph orch apply -i FILE.yml</code> after specifying the services.</td>
</tr>
</tbody>
</table>

**Additional Resources**

- For more details on using the Ceph Orchestrator, see the [Red Hat Ceph Storage Operations Guide](#).
APPENDIX B. THE CEPHADM COMMANDS

The cephadm is a command line tool to manage the local host for the Cephadm Orchestrator. It provides commands to investigate and modify the state of the current host.

Some of the commands are generally used for debugging.

**NOTE**

cephadm is not required on all hosts, however, it is useful when investigating a particular daemon. The cephadm-ansible-preflight playbook installs cephadm on all hosts and the cephadm-ansible purge playbook requires cephadm be installed on all hosts to work properly.

---

**add-repo**

**Description**

Configure the local package repository to also include the Ceph repository. This is mainly used for the disconnected installation of Red Hat Ceph Storage.

**Syntax**

```
cephadm add-repo [--release RELEASE] [--version VERSION] [--repo-url REPO_URL]
```

**Example**

```
[root@host01 ~]# ./cephadm add-repo --version 15.2.1
[root@host01 ~]# ./cephadm add-repo --release pacific
```

---

**adopt**

**Description**

Convert an upgraded storage cluster daemon to run cephadm.

**Syntax**

```
cephadm adopt [-h] --name DAEMON_NAME --style STYLE [--cluster CLUSTER] --legacy-dir
[LEGACY_DIR] --config-json CONFIG_JSON [--skip-firewalld] [--skip-pull]
```

**Example**

```
[root@host01 ~]# cephadm adopt --style=legacy --name prometheus.host02
```

---

**ceph-volume**

**Description**

This command is used to list all the devices on the particular host. Run the ceph-volume command inside a container Deploys OSDs with different device technologies like lvm or physical disks using pluggable tools and follows a predictable, and robust way of preparing, activating, and starting OSDs.

**Syntax**

Example

[root@nhost01 ~]# cephadm ceph-volume inventory --fsid f64f341c-655d-11eb-8778-fa163e914bcc

check-host
Description
Check the host configuration that is suitable for a Ceph cluster.
Syntax

cephadm check-host [--expect-hostname HOSTNAME]

Example

[root@host01 ~]# cephadm check-host --expect-hostname host02

deploy
Description
Deploys a daemon on the local host.
Syntax


Example

[root@host01 ~]# cephadm shell deploy mon --fsid f64f341c-655d-11eb-8778-fa163e914bcc

enter
Description
Run an interactive shell inside a running daemon container.
Syntax

cephadm enter [-h] [--fsid FSID] --name NAME [command [command ...]]

Example

[root@host01 ~]# cephadm enter --name 52c611f2b1d9
**help**

**Description**
View all the commands supported by **cephadm**.

**Syntax**

```
cephadm help
```

**Example**

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

**install**

**Description**
Install the packages.

**Syntax**

```
cephadm install PACKAGES
```

**Example**

```
[root@host01 ~]# cephadm install ceph-common ceph-osd
```

**inspect-image**

**Description**
Inspect the local Ceph container image.

**Syntax**

```
cephadm --image IMAGE_ID inspect-image
```

**Example**

```
[root@host01 ~]# cephadm --image 13ea90216d0be03003d12d7869f72ad9de5cec9e54a27fd308e01e467c0d4a0a inspect-image
```

**list-networks**

**Description**
List the IP networks.

**Syntax**

```
cephadm list-networks
```

**Example**

```
[root@host01 ~]# cephadm list-networks
```
ls

Description
List daemon instances known to cephadm on the hosts. You can use --no-detail for the command to run faster, which gives details of the daemon name, fsid, style, and systemd unit per daemon. You can use --legacy-dir option to specify a legacy base directory to search for daemons.

Syntax

```
cephadm ls [--no-detail] [--legacy-dir LEGACY_DIR]
```

Example

```
[root@host01 ~]# cephadm ls --no-detail
```

logs

Description
Print journald logs for a daemon container. This is similar to the journalctl command.

Syntax

```
cephadm logs [--fsid FSID] --name DAEMON_NAME
cephadm logs [--fsid FSID] --name DAEMON_NAME -- n NUMBER # Last N lines
cephadm logs [--fsid FSID] --name DAEMON_NAME -- f # Follow the logs
```

Example

```
[root@host01 ~]# cephadm logs --fsid 57bddb48-ee04-11eb-9962-001a4a000672 --name osd.8
[root@host01 ~]# cephadm logs --fsid 57bddb48-ee04-11eb-9962-001a4a000672 --name osd.8 -- n 20
[root@host01 ~]# cephadm logs --fsid 57bddb48-ee04-11eb-9962-001a4a000672 --name osd.8 -- f
```

prepare-host

Description
Prepare a host for cephadm.

Syntax

```
cephadm prepare-host [--expect-hostname HOSTNAME]
```

Example

```
[root@host01 ~]# cephadm prepare-host
[root@host01 ~]# cephadm prepare-host --expect-hostname host01
```

pull

Description
Pull the Ceph image.

Syntax

```bash
cephadm [-h] [--image IMAGE_ID] pull
```

Example

```bash
[root@host01 ~]# cephadm --image 13ea90216d0be03003d12d7869f72ad9de5cec9e54a27fd308e01e467c0d4a0a pull
```

registry-login

Description

Give cephadm login information for an authenticated registry. Cephadm attempts to log the calling host into that registry.

Syntax

```bash
```

Example

```bash
[root@host01 ~]# cephadm registry-login --registry-url registry.redhat.io --registry-username myuser1 --registry-password mypassword1
```

You can also use a JSON registry file containing the login info formatted as:

Syntax

```bash
cat REGISTRY_FILE

{
  "url":"REGISTRY_URL",
  "username":"REGISTRY_USERNAME",
  "password":"REGISTRY_PASSWORD"
}
```

Example

```bash
[root@host01 ~]# cat registry_file

{
  "url":"registry.redhat.io",
  "username":"myuser",
  "password":"mypass"
}
[root@host01 ~]# cephadm registry-login -i registry_file
```

rm-daemon
Description

Remove a specific daemon instance. If you run the `cephadm rm-daemon` command on the host directly, although the command removes the daemon, the `cephadm mgr` module notices that the daemon is missing and redeploys it. This command is problematic and should be used only for experimental purposes and debugging.

Syntax

```bash
```

Example

```bash
[root@host01 ~]# cephadm rm-daemon --fsid f64f341c-655d-11eb-8778-fa163e914bcc --name osd.8
```

**rm-cluster**

Description

Remove all the daemons from a storage cluster on that specific host where it is run. Similar to `rm-daemon`, if you remove a few daemons this way and the Ceph Orchestrator is not paused and some of those daemons belong to services that are not unmanaged, the `cephadm` orchestrator just redeploys them there.

Syntax

```bash
cephadm rm-cluster [-fsid FSID] [--force]
```

Example

```bash
[root@host01 ~]# cephadm rm-cluster --fsid f64f341c-655d-11eb-8778-fa163e914bcc
```

**IMPORTANT**

To better clean up the node as part of performing the cluster removal, cluster logs under `/var/log/ceph` directory are deleted when `cephadm rm-cluster` command is run. The cluster logs are removed as long as `--keep-logs` is not passed to the `rm-cluster` command.

**NOTE**

If the `cephadm rm-cluster` command is run on a host that is part of an existing cluster where the host is managed by Cephadm and the Cephadm Manager module is still enabled and running, then Cephadm might immediately start deploying new daemons, and more logs could appear. To avoid this, disable the cephadm mgr module before purging the cluster.

```bash
# ceph mgr module disable cephadm
```

**rm-repo**

Description
Remove a package repository configuration. This is mainly used for the disconnected installation of Red Hat Ceph Storage.

**Syntax**

```
cephadm rm-repo [-h]
```

**Example**

```
[root@host01 ~]# cephadm rm-repo
```

**run**

**Description**

Run a Ceph daemon, in a container, in the foreground.

**Syntax**

```
cephadm run [--fsid FSID] --name DAEMON_NAME
```

**Example**

```
[root@host01 ~]# cephadm run --fsid f64f341c-655d-11eb-8778-fa163e914bcc --name osd.8
```

**shell**

**Description**

Run an interactive shell with access to Ceph commands over the inferred or specified Ceph cluster. You can enter the shell using the `cephadm shell` command and run all the orchestrator commands within the shell.

**Syntax**

```
cephadm shell  [--fsid FSID] [--name DAEMON_NAME, -n DAEMON_NAME] [--config CONFIG, -c CONFIG] [--mount MOUNT, -m MOUNT] [--keyring KEYRING, -k KEYRING] [--env ENV, -e ENV]
```

**Example**

```
[root@host01 ~]# cephadm shell -- ceph orch ls
[root@host01 ~]# cephadm shell
```

**unit**

**Description**

Start, stop, restart, enable, and disable the daemons with this operation. This operates on the daemon's `systemd` unit.

**Syntax**

```
cephadm unit [--fsid FSID] --name DAEMON_NAME start/stop/restart/enable/disable
```
Example

```
[root@host01 ~]# cephadm unit --fsid f64f341c-655d-11eb-8778-fa163e914bcc --name osd.8 start
```

**version**

**Description**

Provides the version of the storage cluster.

**Syntax**

```
cephadm version
```

**Example**

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