Red Hat Ceph Storage 4

Installation Guide

Installing Red Hat Ceph Storage on Red Hat Enterprise Linux

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Legal Notice

Abstract

This document provides instructions on installing Red Hat Ceph Storage on Red Hat Enterprise Linux 7 and Red Hat Enterprise Linux 8 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 .

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CHAPTER 1. WHAT IS RED HAT CEPH STORAGE?

Red Hat Ceph Storage is a scalable, open, software-defined storage platform that combines an enterprise-hardened version of the Ceph storage system with a Ceph management platform, deployment utilities, and support services. Red Hat Ceph Storage is designed for cloud infrastructure and web-scale object storage. Red Hat Ceph Storage clusters consist of the following types of nodes:

Red Hat Ceph Storage Ansible administration

The Ansible administration node replaces the traditional Ceph administration node used in previous versions of Red Hat Ceph Storage. The Ansible administration node provides the following functions:

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

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 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, 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, achieving the business requirements.

NOTE

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

2.1. PREREQUISITES

- Time to understand, consider, and plan a storage solution.

2.2. 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 trade off. 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 trade off.

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 of 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 node 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.

2.3. 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 storage and retrieval of objects. Ceph OSDs can run on bare-metal servers or virtual machines within the storage cluster, using containers or RPM based deployments.

A CRUSH map describes a topography of cluster resources, and the map exists both on client nodes as well as Ceph Monitor nodes 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 a 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:

- **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 an 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 an cost- and capacity-optimized storage cluster are:

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

- Object archive.
- Video, audio, and image object repositories.

IMPORTANT

Carefully consider the workload being ran by a 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 storage cluster can suffer from poor performance.

2.4. 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 in order 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 **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 respectively. 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 will utilize 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, 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

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 nodes and networking equipment in the environment before using a Red Hat Ceph Storage cluster in production.

Additional Resources

- See the *Verifying and configuring the MTU value* section in the *Red Hat Ceph Storage Configuration Guide* for more details.

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 nodes within the storage cluster. You can also open a case with Red Hat support asking for additional guidance.

Reserving Free Memory for Ceph OSDs

To help prevent insufficient memory-related errors during Ceph OSD memory allocation requests, set the specific amount of physical memory to keep in reserve. Red Hat recommends the following settings based on the amount of system RAM.

- For 64 GB, reserve 1 GB:

  ```
  vm.min_free_kbytes = 1048576
  ```

- For 128 GB, reserve 2 GB:

  ```
  vm.min_free_kbytes = 2097152
  ```

- For 256 GB, reserve 3 GB:

  ```
  vm.min_free_kbytes = 3145728
  ```

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 nodes to increase the file descriptors for the Ceph Object Gateway.

```
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 node that runs administrative commands with the following contents:

```
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. CONSIDERATIONS FOR USING A RAID CONTROLLER WITH OSD NODES

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

- If an OSD node has a RAID controller with 1-2GB of cache installed, enabling the write-back cache might result in increased small I/O write throughput. However, the cache must be non-volatile.

- Most modern RAID controllers have super capacitors that provide enough power to drain volatile memory to non-volatile NAND memory during a power-loss event. It is important to understand how a particular controller and its firmware behave after power is restored.

- Some RAID controllers require manual intervention. Hard drives typically advertise to the operating system whether their disk caches should be enabled or disabled by default. However, certain RAID controllers and some firmware do not provide such information. Verify that disk level caches are disabled to avoid file system corruption.

- Create a single RAID 0 volume with write-back for each Ceph OSD data drive with write-back cache enabled.

- If Serial Attached SCSI (SAS) or SATA connected Solid-state Drive (SSD) disks are also present on the RAID controller, then investigate whether the controller and firmware support *pass-through* mode. Enabling *pass-through* mode helps avoid caching logic, and generally results in much lower latency for fast media.

2.7. CONSIDERATIONS FOR USING NVME WITH OBJECT GATEWAY

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

If you plan to use the object gateway feature of Red Hat Ceph Storage and the OSD nodes are using

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

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.

Red Hat Ceph Storage has slightly different requirements depending on a bare-metal or containerized deployment.

NOTE

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

Table 2.1. Bare-metal

Process	Criteria	Minimum Recommended
ceph-osd	Processor	1x AMD64 or Intel 64
	RAM	For **BlueStore** OSDs, Red Hat typically recommends a baseline of 16 GB of RAM per OSD host, with an additional 5 GB of RAM per daemon.
	OS Disk	1x OS disk per host
	Volume Storage	1x storage drive per daemon
	block.db	Optional, but Red Hat recommended, 1x SSD or NVMe or Optane partition or logical volume per daemon. Sizing is 4% of **block.data** for BlueStore for object, file and mixed workloads and 1% of **block.data** for the BlueStore for Block Device, Openstack cinder, and Openstack cinder workloads.
	block.wal	Optional, 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.
	Network	2x 10 GB Ethernet NICs
ceph-mon	Processor	1x AMD64 or Intel 64
	RAM	1 GB per daemon
	Disk Space	15 GB per daemon

Process	Criteria	Minimum Recommended
	Monitor Disk	Optionally,1x SSD disk for **leveldb** monitor data.
	Network	2x 1 GB Ethernet NICs
ceph-mgr	Processor	1x AMD64 or Intel 64
	RAM	1 GB per daemon
	Network	2x 1 GB Ethernet NICs
ceph-radosgw	Processor	1x AMD64 or Intel 64
	RAM	1 GB per daemon
	Disk Space	5 GB per daemon
	Network	1x 1 GB Ethernet NICs
ceph-mds	Processor	1x AMD64 or Intel 64
	RAM	2 GB per daemon 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.
	Disk Space	2 MB per daemon, plus any space required for logging, which might vary depending on the configured log levels.
	Network	2x 1 GB Ethernet NICs Note that this is the same network as the OSDs. If you have a 10 GB network on your OSDs you should use the same on your MDS so that the MDS is not disadvantaged when it comes to latency.

Table 2.2. Containers

Process	Criteria	Minimum Recommended
ceph-osd-container	Processor	1x AMD64 or Intel 64 CPU CORE per OSD container
	RAM	Minimum of 5 GB of RAM per OSD container

Process	Criteria	Minimum Recommended
	OS Disk	1x OS disk per host
	OSD Storage	1x storage drive per OSD container. Cannot be shared with OS Disk.
	block.db	Optional, but Red Hat recommended, 1x SSD or NVMe or Optane partition or lvm per daemon. Sizing is 4% of **block.data** for BlueStore for object, file and mixed workloads and 1% of **block.data** for the BlueStore for Block Device, Openstack cinder, and Openstack cinder workloads.
	block.wal	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.
	Network	2x 10 GB Ethernet NICs, 10 GB Recommended
ceph-mon-container	Processor	1x AMD64 or Intel 64 CPU CORE per mon-container
	RAM	3 GB per **mon-container**
	Disk Space	10 GB per **mon-container**, 50 GB Recommended
	Monitor Disk	Optionally, 1x SSD disk for **Monitor rocksdb** data
	Network	2x 1 GB Ethernet NICs, 10 GB Recommended
ceph-mgr-container	Processor	1x AMD64 or Intel 64 CPU CORE per **mgr-container**
	RAM	3 GB per **mgr-container**
	Network	2x 1 GB Ethernet NICs, 10 GB Recommended
ceph-radosgw-container	Processor	1x AMD64 or Intel 64 CPU CORE per radosgw-container
	RAM	1 GB per daemon
	Disk Space	5 GB per daemon
	Network	1x 1 GB Ethernet NICs
ceph-mds-container	Processor	1x AMD64 or Intel 64 CPU CORE per mds-container

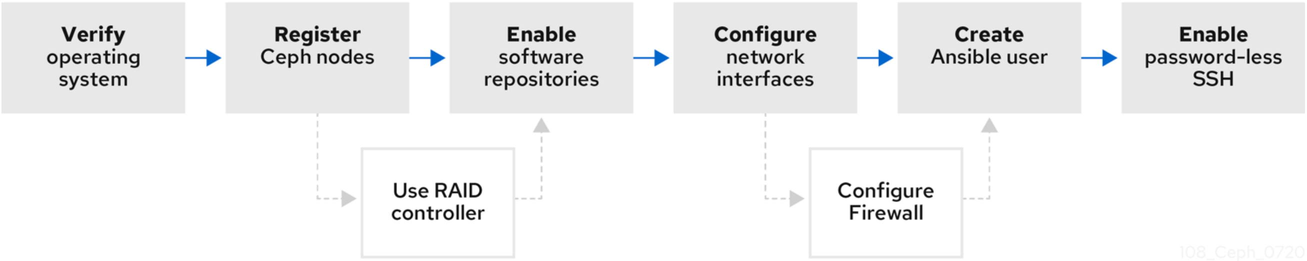
Process	Criteria	Minimum Recommended
	RAM	3 GB per **mds-container** This number is highly dependent on the configurable MDS cache size. The RAM requirement is typically twice as much as the amount set in the **mds_cache_memory_limit** configuration setting. Note also that this is the memory for your daemon, not the overall system memory.
	Disk Space	2 GB per **mds-container**, plus taking into consideration any additional space required for possible debug logging, 20GB is a good start.
	Network	2x 1 GB Ethernet NICs, 10 GB Recommended Note that this is the same network as the OSD containers. If you have a 10 GB network on your OSDs you should use the same on your MDS so that the MDS is not disadvantaged when it comes to latency.

2.9. ADDITIONAL RESOURCES

- If you want to take a deeper look into Ceph's various internal components, and the strategies around those components, see the *Red Hat Ceph Storage Storage Strategies Guide* for more details.

CHAPTER 3. REQUIREMENTS FOR INSTALLING RED HAT CEPH STORAGE

Figure 3.1. Prerequisite Workflow



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

NOTE

To know about Red Hat Ceph Storage releases and corresponding Red Hat Ceph Storage package versions, see What are the Red Hat Ceph Storage releases and corresponding Ceph package versions article on the Red Hat Customer Portal.

3.1. PREREQUISITES

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

3.2. REQUIREMENTS CHECKLIST FOR INSTALLING RED HAT CEPH STORAGE

Task	Required	Section	Recommendation
Verifying the operating system version	Yes	Section 3.3, “Operating system requirements for Red Hat Ceph Storage”	
Registering Ceph nodes	Yes	Section 3.4, “Registering Red Hat Ceph Storage nodes to the CDN and attaching subscriptions”	
Enabling Ceph software repositories	Yes	Section 3.5, “Enabling the Red Hat Ceph Storage repositories”	

Task	Required	Section	Recommendation
Using a RAID controller with OSD nodes	No	Section 2.6, "Considerations for using a RAID controller with OSD nodes"	Enabling write-back caches on a RAID controller might result in increased small I/O write throughput for OSD nodes.
Configuring the network	Yes	Section 3.6, "Verifying the network configuration for Red Hat Ceph Storage"	At minimum, a public network is required. However, a private network for cluster communication is recommended.
Configuring a firewall	No	Section 3.7, "Configuring a firewall for Red Hat Ceph Storage"	A firewall can increase the level of trust for a network.
Creating an Ansible user	Yes	Section 3.8, "Creating an Ansible user with **sudo** access"	Creating the Ansible user is required on all Ceph nodes.
Enabling password-less SSH	Yes	Section 3.9, "Enabling password-less SSH for Ansible"	Required for Ansible.

NOTE

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

3.3. OPERATING SYSTEM REQUIREMENTS FOR RED HAT CEPH STORAGE

Red Hat Enterprise Linux entitlements are included in the Red Hat Ceph Storage subscription.

The initial release of Red Hat Ceph Storage 4 is supported on Red Hat Enterprise Linux 7.7 or Red Hat Enterprise Linux 8.1. The current version of Red Hat Ceph Storage 4.3 is supported on Red Hat Enterprise Linux 7.9, 8.2 EUS, 8.4 EUS, 8.5, 8.6, 8.7, 8.8.

Red Hat Ceph Storage 4 is supported on RPM-based deployments or container-based deployments.

IMPORTANT

Deploying Red Hat Ceph Storage 4 in containers running on Red Hat Enterprise Linux 7, deploys Red Hat Ceph Storage 4 running on Red Hat Enterprise Linux 8 container image.

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 both Red Hat Enterprise Linux 7 and Red Hat Enterprise Linux 8 operating systems, or a mixture of nodes with both RPM-based deployments and 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 please see the *Data Security and Hardening Guide* , *Red Hat Enterprise Linux 7 SELinux User's and Administrator's Guide*, and *Red Hat Enterprise Linux 8 Using SELinux Guide* .

Additional Resources

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

Return to requirements checklist

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

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

NOTE

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

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

Prerequisites

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

Procedure

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

   a. Start a local container registry:

      #### Red Hat Enterprise Linux 7

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

      #### Red Hat Enterprise Linux 8

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

   b. Verify **registry.redhat.io** is in the container registry search path.
      Open for editing the **/etc/containers/registries.conf** file:

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

      If **registry.redhat.io** is not included in the file, add it:

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

   c. Pull the Red Hat Ceph Storage 4 image, Prometheus image, and Dashboard image from the Red Hat Customer Portal:

      #### Red Hat Enterprise Linux 7

      ```
      # docker pull registry.redhat.io/rhceph/rhceph-4-rhel8:latest
      # docker pull registry.redhat.io/openshift4/ose-prometheus-node-exporter:v4.6
      # docker pull registry.redhat.io/rhceph/rhceph-4-dashboard-rhel8:latest
      # docker pull registry.redhat.io/openshift4/ose-prometheus:v4.6
      # docker pull registry.redhat.io/openshift4/ose-prometheus-alertmanager:v4.6
      ```

      #### Red Hat Enterprise Linux 8

      ```
      # podman pull registry.redhat.io/rhceph/rhceph-4-rhel8:latest
      # podman pull registry.redhat.io/openshift4/ose-prometheus-node-exporter:v4.6
      # podman pull registry.redhat.io/rhceph/rhceph-4-dashboard-rhel8:latest
      # podman pull registry.redhat.io/openshift4/ose-prometheus:v4.6
      # podman pull registry.redhat.io/openshift4/ose-prometheus-alertmanager:v4.6
      ```

      #### NOTE

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

d. Tag the image:
The Prometheus image tag version is v4.6 for Red Hat Ceph Storage 4.2.

Red Hat Enterprise Linux 7

```
 # docker tag registry.redhat.io/rhceph/rhceph-4-rhel8:latest
LOCAL_NODE_FQDN:5000/rhceph/rhceph-4-rhel8:latest
 # docker tag registry.redhat.io/openshift4/ose-prometheus-node-exporter:v4.6
LOCAL_NODE_FQDN:5000/openshift4/ose-prometheus-node-exporter:v4.6
 # docker tag registry.redhat.io/rhceph/rhceph-4-dashboard-rhel8:latest
LOCAL_NODE_FQDN:5000/rhceph/rhceph-4-dashboard-rhel8:latest
 # docker tag registry.redhat.io/openshift4/ose-prometheus-alertmanager:v4.6
LOCAL_NODE_FQDN:5000/openshift4/ose-prometheus-alertmanager:v4.6
 # docker tag registry.redhat.io/openshift4/ose-prometheus:v4.6
LOCAL_NODE_FQDN:5000/openshift4/ose-prometheus:v4.6
```

Replace

- *LOCAL_NODE_FQDN* with your local host FQDN.

Red Hat Enterprise Linux 8

```
 # podman tag registry.redhat.io/rhceph/rhceph-4-rhel8:latest
LOCAL_NODE_FQDN:5000/rhceph/rhceph-4-rhel8:latest
 # podman tag registry.redhat.io/openshift4/ose-prometheus-node-exporter:v4.6
LOCAL_NODE_FQDN:5000/openshift4/ose-prometheus-node-exporter:v4.6
 # podman tag registry.redhat.io/rhceph/rhceph-4-dashboard-rhel8:latest
LOCAL_NODE_FQDN:5000/rhceph/rhceph-4-dashboard-rhel8:latest
 # podman tag registry.redhat.io/openshift4/ose-prometheus-alertmanager:v4.6
LOCAL_NODE_FQDN:5000/openshift4/ose-prometheus-alertmanager:v4.6
 # podman tag registry.redhat.io/openshift4/ose-prometheus:v4.6
LOCAL_NODE_FQDN:5000/openshift4/ose-prometheus:v4.6
```

Replace

- *LOCAL_NODE_FQDN* with your local host FQDN.

e. Edit the **/etc/containers/registries.conf** file and add the node’s FQDN with the port in the file, and save:

```
[registries.insecure]
registries = ['LOCAL_NODE_FQDN:5000']
```

NOTE

This step must be done on all storage cluster nodes that access the local Docker registry.

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

Red Hat Enterprise Linux 7

```
# docker push --remove-signatures LOCAL_NODE_FQDN:5000/rhceph/rhceph-4-rhel8
# docker push --remove-signatures LOCAL_NODE_FQDN:5000/openshift4/ose-prometheus-node-exporter:v4.6
# docker push --remove-signatures LOCAL_NODE_FQDN:5000/rhceph/rhceph-4-dashboard-rhel8
# docker push --remove-signatures LOCAL_NODE_FQDN:5000/openshift4/ose-prometheus-alertmanager:v4.6
# docker push --remove-signatures LOCAL_NODE_FQDN:5000/openshift4/ose-prometheus:v4.6
```

Replace

- *LOCAL_NODE_FQDN* with your local host FQDN.

Red Hat Enterprise Linux 8

```
# podman push --remove-signatures LOCAL_NODE_FQDN:5000/rhceph/rhceph-4-rhel8
# podman push --remove-signatures LOCAL_NODE_FQDN:5000/openshift4/ose-prometheus-node-exporter:v4.6
# podman push --remove-signatures LOCAL_NODE_FQDN:5000/rhceph/rhceph-4-dashboard-rhel8
# podman push --remove-signatures LOCAL_NODE_FQDN:5000/openshift4/ose-prometheus-alertmanager:v4.6
# podman push --remove-signatures LOCAL_NODE_FQDN:5000/openshift4/ose-prometheus:v4.6
```

Replace

- *LOCAL_NODE_FQDN* with your local host FQDN.

g. For Red Hat Enterprise Linux 7, restart the **docker** service:

```
# systemctl restart docker
```

NOTE

See the *Installing a Red Hat Ceph Storage cluster* for an example of the **all.yml** file when the Red Hat Ceph Storage nodes do NOT have access to the Internet during deployment.

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

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

```
# subscription-manager register
```

b. Pull the latest subscription data from the CDN:

```
# subscription-manager refresh
```

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

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

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

d. Attach the subscription:

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

Replace

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

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

Red Hat Enterprise Linux 7

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

Red Hat Enterprise Linux 8

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

3. Update the system to receive the latest packages.

a. For Red Hat Enterprise Linux 7:

```
# yum update
```

b. For Red Hat Enterprise Linux 8:

```
# dnf update
```

Additional Resources

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

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3.5. ENABLING THE RED HAT CEPH STORAGE REPOSITORIES

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

- Content Delivery Network (CDN)

For Ceph Storage clusters with Ceph nodes that can connect directly to the internet, use Red Hat Subscription Manager to enable the required Ceph repository.

- Local Repository
  For Ceph Storage clusters where security measures preclude nodes from accessing the internet, install Red Hat Ceph Storage 4 from a single software build delivered as an ISO image, which will allow you to install local repositories.

Prerequisites

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

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

Procedure

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

Red Hat Enterprise Linux 7

```
[root@admin ~]# subscription-manager repos --enable=rhel-7-server-rhceph-4-tools-rpms --enable=rhel-7-server-ansible-2.9-rpms
```

Red Hat Enterprise Linux 8

```
[root@admin ~]# subscription-manager repos --enable=rhceph-4-tools-for-rhel-8-x86_64-rpms --enable=ansible-2.9-for-rhel-8-x86_64-rpms
```

- By default, Red Hat Ceph Storage repositories are enabled by **ceph-ansible** on the respective nodes. To manually enable the repositories:

NOTE

Do not enable these repositories on containerized deployments as they are not needed.

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

Red Hat Enterprise Linux 7

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

Red Hat Enterprise Linux 8

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

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

Red Hat Enterprise Linux 7

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

Red Hat Enterprise Linux 8

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

Enable the Red Hat Ceph Storage 4 Tools repository on the following node types: **RBD mirroring**, **Ceph clients**, **Ceph Object Gateways**, **Metadata Servers**, **NFS**, **iSCSI gateways**, and **Dashboard servers**.

Red Hat Enterprise Linux 7

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

Red Hat Enterprise Linux 8

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

- For ISO installations:

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

Additional Resources

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

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3.6. VERIFYING THE NETWORK CONFIGURATION FOR RED HAT CEPH STORAGE

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

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

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

IMPORTANT

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

Prerequisites

- Network interface card connected to the network.

Procedure

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

1. Verify the following settings are in the **/etc/sysconfig/network-scripts/ifcfg-*** file corresponding the public-facing network interface card:
    a. The **BOOTPROTO** parameter is set to **none** for static IP addresses.
    b. The **ONBOOT** parameter must be set to **yes**.
       If it is set to **no**, the Ceph storage cluster might fail to peer on reboot.
    c. If you intend to use IPv6 addressing, you must set the IPv6 parameters such as **IPV6INIT** to **yes**, except the **IPV6_FAILURE_FATAL** parameter.
       Also, edit the Ceph configuration file, **/etc/ceph/ceph.conf**, to instruct Ceph to use IPv6, otherwise, Ceph uses IPv4.

Additional Resources

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

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3.7. CONFIGURING A FIREWALL FOR RED HAT CEPH STORAGE

Red Hat Ceph Storage uses the **firewalld** service. The **firewalld** service contains the list of ports for each daemon.

The Ceph Monitor daemons use ports **3300** and **6789** for communication within the Ceph storage cluster.

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

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

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

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

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

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

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

```
configure_firewall: True
```

Prerequisite

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

Procedure

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

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

2. On all monitor nodes, open port **3300** and **6789** on the public network:

   ```
   [root@monitor ~]# firewall-cmd --zone=public --add-port=3300/tcp
   [root@monitor ~]# firewall-cmd --zone=public --add-port=3300/tcp --permanent
   [root@monitor ~]# firewall-cmd --zone=public --add-port=6789/tcp
   [root@monitor ~]# firewall-cmd --zone=public --add-port=6789/tcp --permanent
   [root@monitor ~]# firewall-cmd --permanent --add-service=ceph-mon
   [root@monitor ~]# firewall-cmd --add-service=ceph-mon
   ```

   To limit access based on the source address:

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

   #### Replace

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

     #### Example

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

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

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

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

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

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

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

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

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

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

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

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

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

      To limit access based on the source address:

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

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

      Replace

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

        Example

        ```
        [root@gateway ~]# firewall-cmd --zone=public --add-rich-rule="rule family="ipv4"
        ```

```
\
source address="192.168.0.31/24" port protocol="tcp" \
port="8080" accept"
```

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

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

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

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

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

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

Replace

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

Example

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

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

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

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

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

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

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

Replace

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

Example

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

Additional Resources

- For more information about public and cluster network, see Verifying the Network Configuration for Red Hat Ceph Storage.
- For additional details on **firewalld**, see the Using and configuring firewalls chapter in the *Securing networks* guide for Red Hat Enterprise Linux 8.

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3.8. CREATING AN ANSIBLE USER WITH SUDO ACCESS

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

Prerequisite

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

Procedure

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

   ```
   ssh root@HOST_NAME
   ```

   Replace

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

Example

```
# ssh root@mon01
```

Enter the **root** password when prompted.

2. Create a new Ansible user:

   ```
   adduser USER_NAME
   ```

   Replace

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

     Example

     ```
     # adduser admin
     ```

     IMPORTANT

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

3. Set a new password for this user:

   ```
   # passwd USER_NAME
   ```

   Replace

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

     Example

     ```
     # passwd admin
     ```

     Enter the new password twice when prompted.

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

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

   Replace

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

     Example

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

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

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

Replace

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

Example

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

Additional Resources

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

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3.9. ENABLING PASSWORD-LESS SSH FOR ANSIBLE

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

NOTE

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

Prerequisites

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

Procedure

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

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

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

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

Replace

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

Example

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

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

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

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

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

Replace

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

Example

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

IMPORTANT

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

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

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

Additional Resources

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

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CHAPTER 4. INSTALLING RED HAT CEPH STORAGE USING THE COCKPIT WEB INTERFACE

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

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

NOTE

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

IMPORTANT

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

NOTE

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

4.1. PREREQUISITES

- Complete the general prerequisites required for direct Ansible Red Hat Ceph Storage installs.
- A recent version of Firefox or Chrome.
- If using multiple networks to segment intra-cluster traffic, client-to-cluster traffic, RADOS Gateway traffic, or iSCSI traffic, ensure the relevant networks are already configured on the hosts. For more information, see network considerations in the Hardware Guide and the section in this chapter on completing the Network page of the Cockpit Ceph Installer
- Ensure the default port for Cockpit web-based interface, **9090**, is accessible.

4.2. INSTALLATION REQUIREMENTS

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

4.3. INSTALL AND CONFIGURE THE COCKPIT CEPH INSTALLER

Before you can use the Cockpit Ceph Installer to install a Red Hat Ceph Storage cluster, you must install the Cockpit Ceph Installer on the Ansible administration node.

Prerequisites

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

Procedure

1. Verify Cockpit is installed.

   ```
   $ rpm -q cockpit
   ```

   Example:

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

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

2. Optional: Install Cockpit.

   a. For Red Hat Enterprise Linux 8:

   ```
   # dnf install cockpit
   ```

   b. For Red Hat Enterprise Linux 7:

   ```
   # yum install cockpit
   ```

3. Verify Cockpit is running.

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

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

4. Optional: Enable Cockpit.

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

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

   You will see a line like the following:

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

   b. Verify Cockpit is running:

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

You will see a line like the following:

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

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

   a. For Red Hat Enterprise Linux 8:

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

   b. For Red Hat Enterprise Linux 7:

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

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

   NOTE

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

   ### Red Hat Enterprise Linux 7

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

   ### Example

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

   ### Red Hat Enterprise Linux 8

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

   ### Example

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

7. Verify **registry.redhat.io** is in the container registry search path.

   a. Open for editing the **/etc/containers/registries.conf** file:

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

If **registry.redhat.io** is not included in the file, add it:

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

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

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

Example

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

```
Starting Ansible API container (runner-service)
Started runner-service container
Waiting for Ansible API container (runner-service) to respond
The Ansible API container (runner-service) is available and responding to requests

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

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

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

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

Prerequisites

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

Procedure

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

```
ssh ANSIBLE_USER@HOST_NAME
```

Example:

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

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

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

Example:

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

Number of key(s) added: 1

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

Repeat this step for all nodes in the cluster

4.5. LOG IN TO COCKPIT

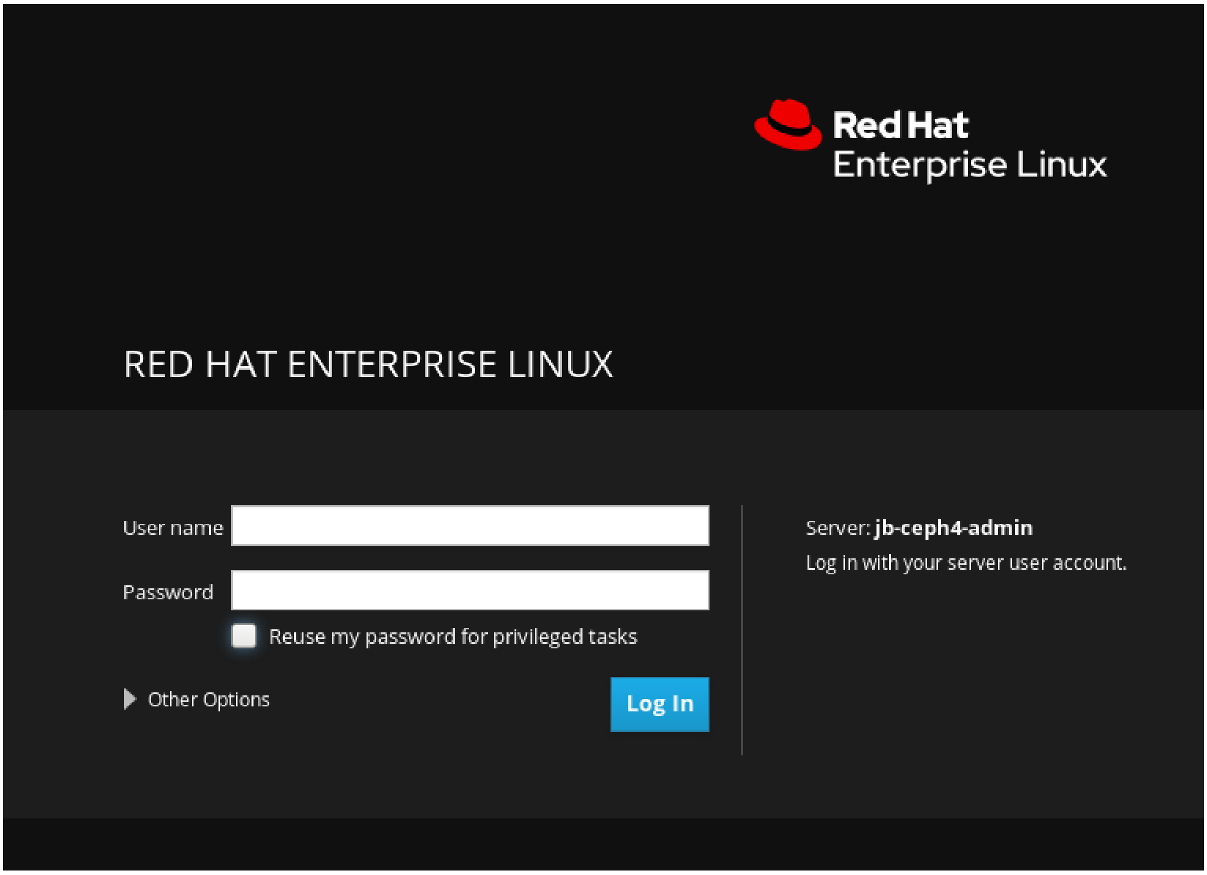
You can view the Cockpit Ceph Installer web interface by logging into Cockpit.

Prerequisites

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

Procedure

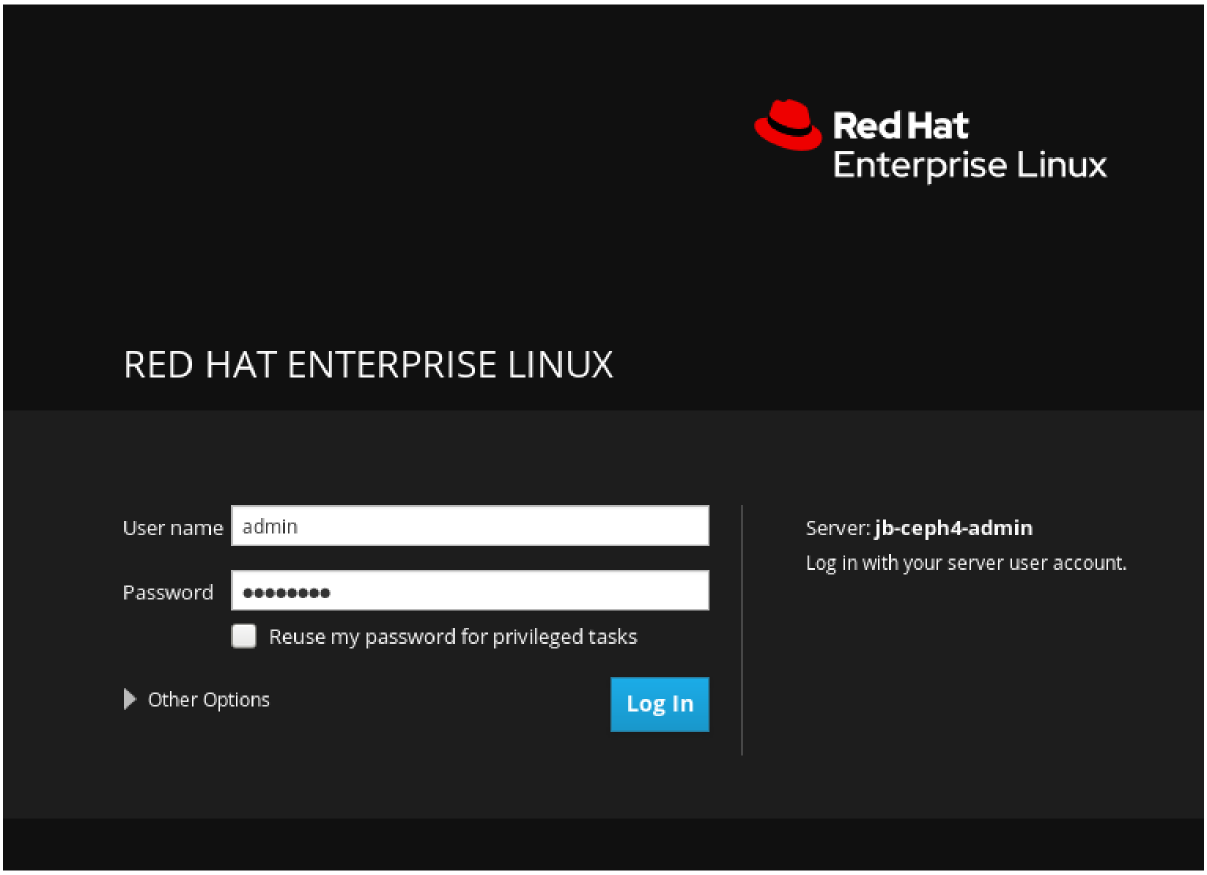
1. Open the URL in a web browser.



Server: **jb-ceph4-admin**

Log in with your server user account.

2. Enter the Ansible user name and its password.



Red Hat Enterprise Linux

RED HAT ENTERPRISE LINUX

User name admin

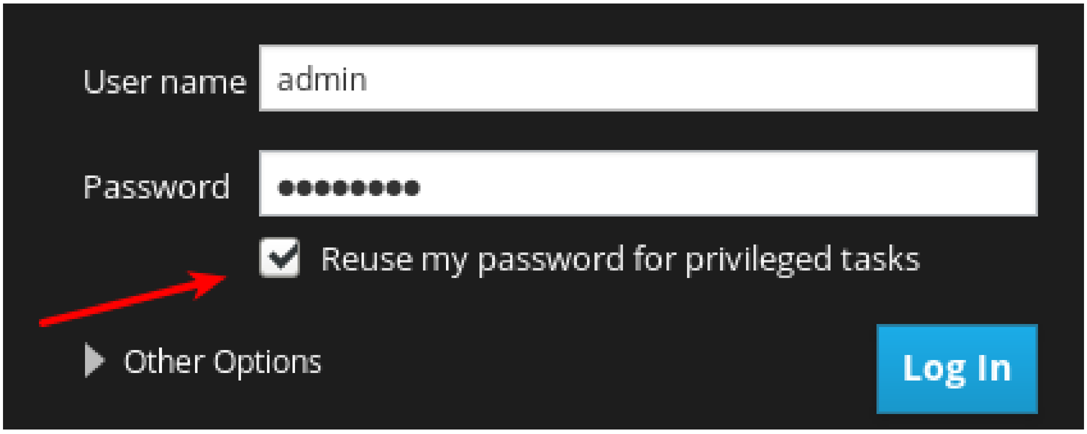
Password ●●●●●●●●

□ Reuse my password for privileged tasks

Server: **jb-ceph4-admin**

Log in with your server user account.

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

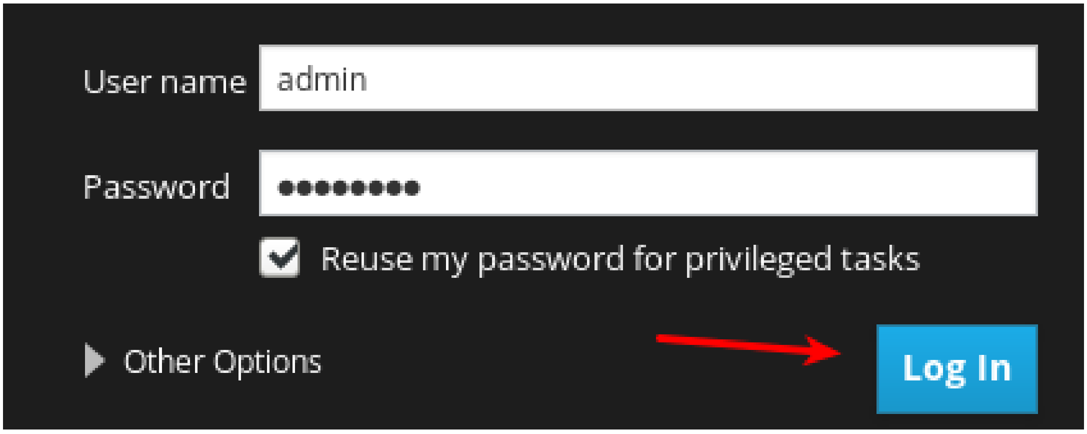


User name admin

Password ●●●●●●●●●

☑ Reuse my password for privileged tasks

4. Click *Log In*.

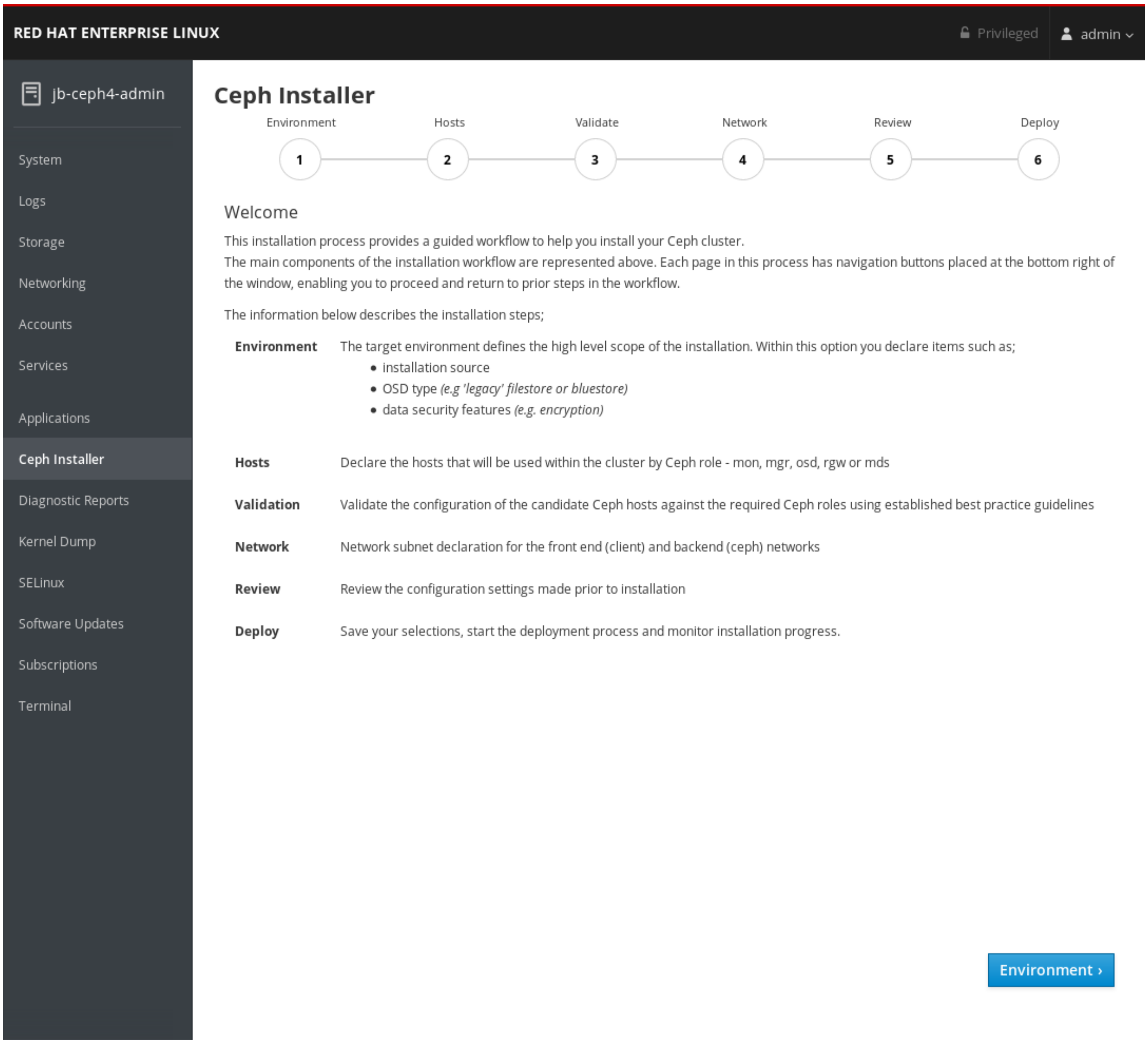


User name admin

Password ●●●●●●●●●

☑ Reuse my password for privileged tasks

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



Ceph Installer

Welcome

This installation process provides a guided workflow to help you install your Ceph cluster.
The main components of the installation workflow are represented above. Each page in this process has navigation buttons placed at the bottom right of the window, enabling you to proceed and return to prior steps in the workflow.

The information below describes the installation steps;

Environment The target environment defines the high level scope of the installation. Within this option you declare items such as;

- installation source
- OSD type *(e.g 'legacy' filestore or bluestore)*
- data security features *(e.g. encryption)*

Hosts Declare the hosts that will be used within the cluster by Ceph role - mon, mgr, osd, rgw or mds

Validation Validate the configuration of the candidate Ceph hosts against the required Ceph roles using established best practice guidelines

Network Network subnet declaration for the front end (client) and backend (ceph) networks

Review Review the configuration settings made prior to installation

Deploy Save your selections, start the deployment process and monitor installation progress.

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

4.6. COMPLETE THE ENVIRONMENT PAGE OF THE COCKPIT CEPH INSTALLER

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

Prerequisites

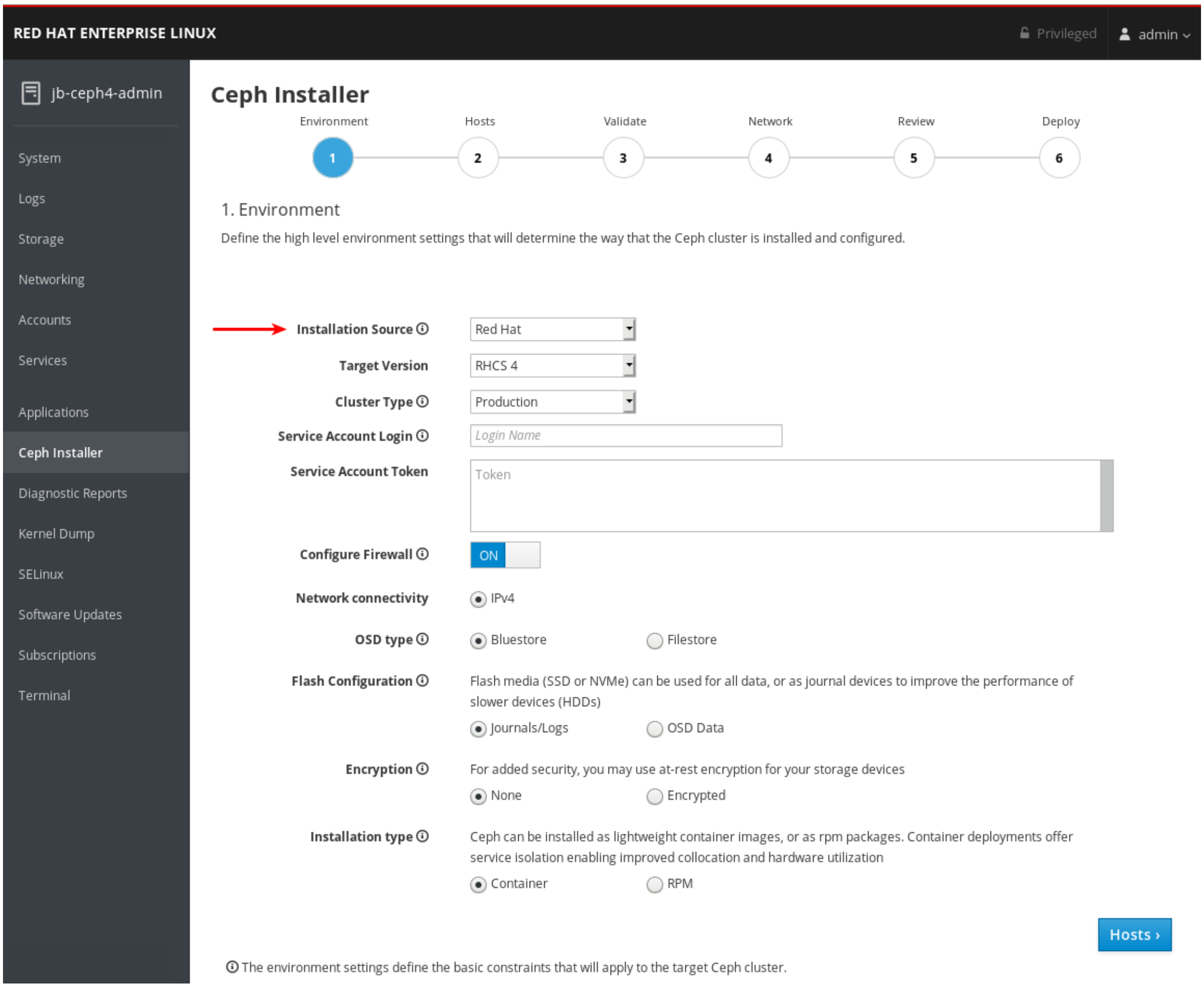
- The Cockpit Ceph Installer is installed and configured.
- You have the URL printed as a part of configuring the Cockpit Ceph Installer.
- You have created a registry service account.

NOTE

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

Procedure

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



Ceph Installer

1. Environment

Define the high level environment settings that will determine the way that the Ceph cluster is installed and configured.

Installation Source ⓘ: Red Hat

Target Version: RHCS 4

Cluster Type ⓘ: Production

Service Account Login ⓘ: Login Name

Service Account Token: Token

Configure Firewall ⓘ: ON

Network connectivity: ● IPv4

OSD type ⓘ: ● Bluestore ○ Filestore

Flash Configuration ⓘ: Flash media (SSD or NVMe) can be used for all data, or as journal devices to improve the performance of slower devices (HDDs)
● Journals/Logs ○ OSD Data

Encryption ⓘ: For added security, you may use at-rest encryption for your storage devices
● None ○ Encrypted

Installation type ⓘ: Ceph can be installed as lightweight container images, or as rpm packages. Container deployments offer service isolation enabling improved collocation and hardware utilization
● Container ○ RPM

ⓘ The environment settings define the basic constraints that will apply to the target Ceph cluster.

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

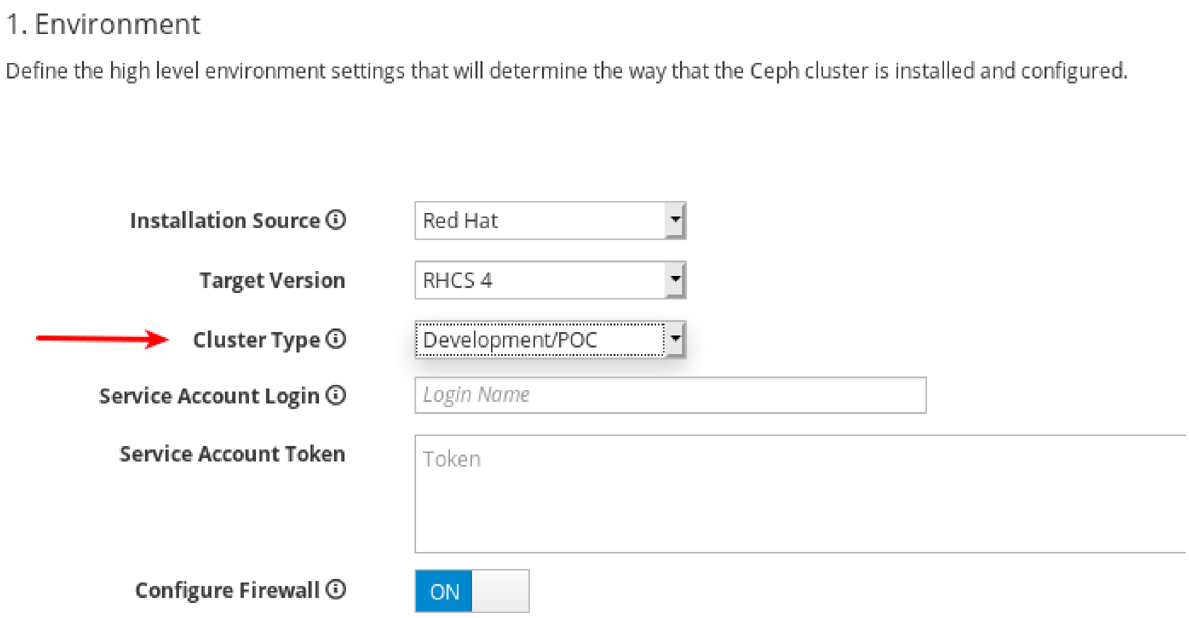
IMPORTANT

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

IMPORTANT

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

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



1. Environment

Define the high level environment settings that will determine the way that the Ceph cluster is installed and configured.

Installation Source ⓘ: Red Hat

Target Version: RHCS 4

Cluster Type ⓘ: Development/POC

Service Account Login ⓘ: Login Name

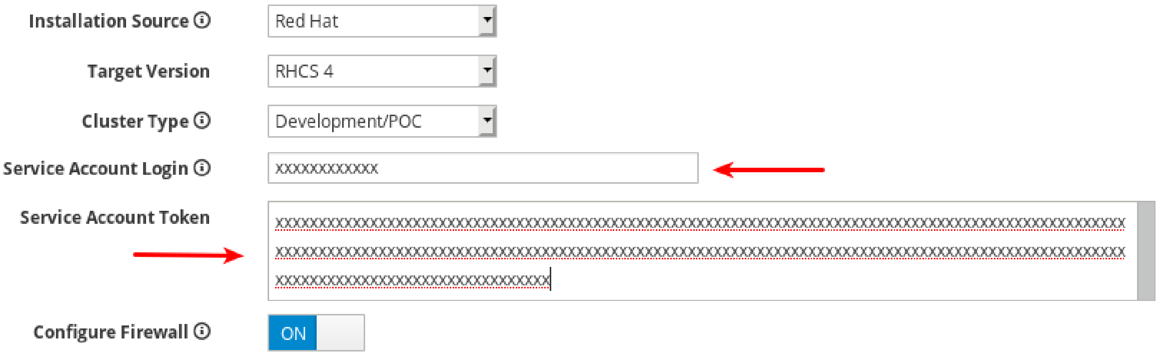
Service Account Token: Token

Configure Firewall ⓘ: ON

IMPORTANT

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

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



Installation Source ⓘ: Red Hat

Target Version: RHCS 4

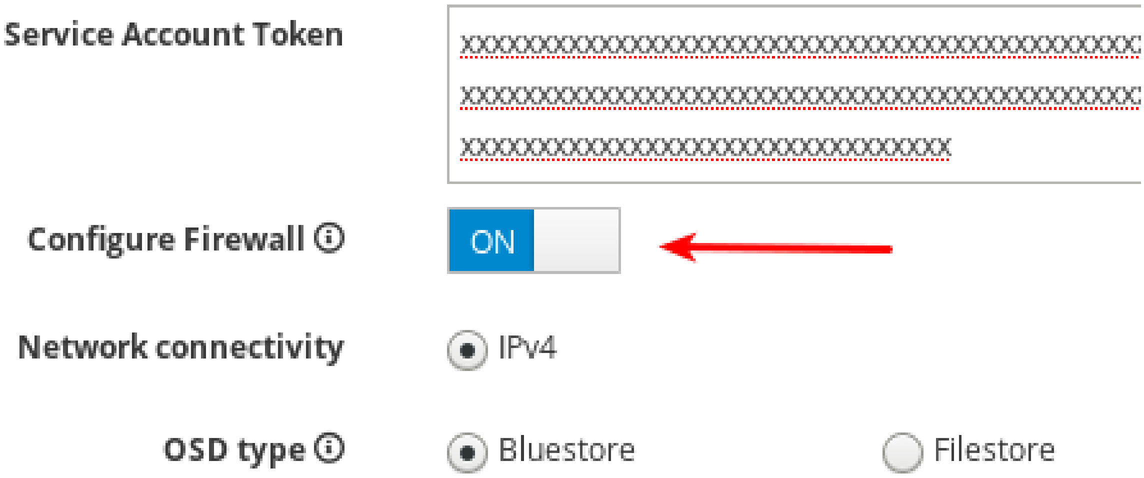
Cluster Type ⓘ: Development/POC

Service Account Login ⓘ: xxxxxxxxxxxx

Service Account Token: xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Configure Firewall ⓘ: ON

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



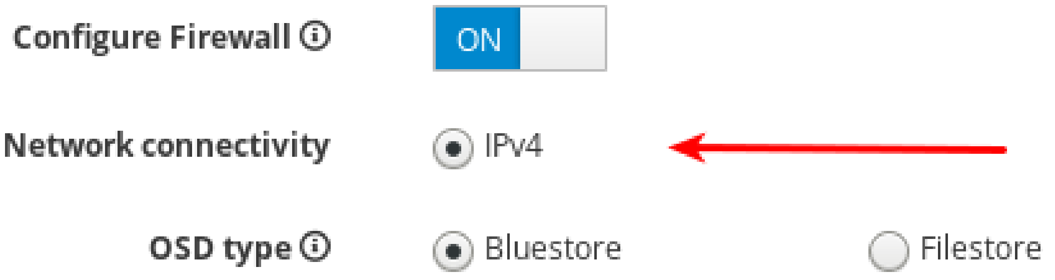
Service Account Token: xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Configure Firewall ⓘ: ON

Network connectivity: ● IPv4

OSD type ⓘ: ● Bluestore ○ Filestore

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

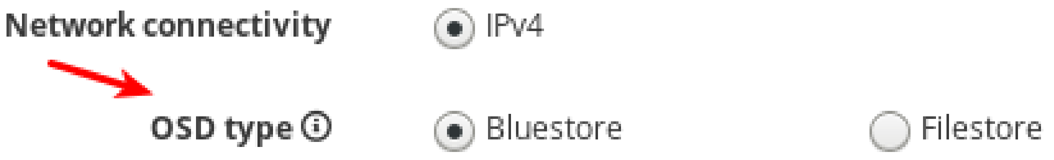


Configure Firewall ⓘ ON

Network connectivity ● IPv4

OSD type ⓘ ● Bluestore ○ Filestore

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



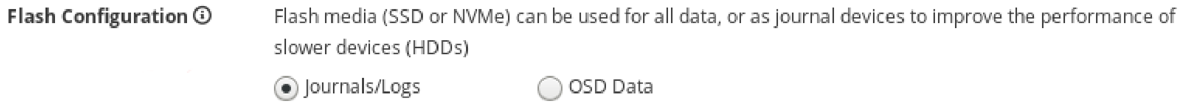
Network connectivity ● IPv4

OSD type ⓘ ● Bluestore ○ Filestore

IMPORTANT

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

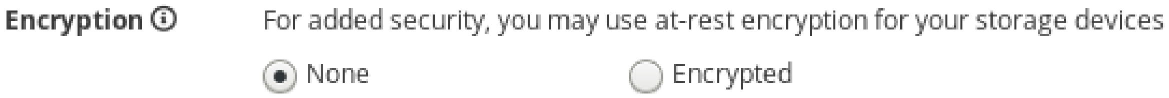
7. Set *Flash Configuration* to *Journal/Logs* or *OSD data*. If you have Solid State Drives (SSDs), whether they use NVMe or a traditional SATA/SAS interface, you can choose to use them just for write journaling and logs while the actual data goes on Hard Disk Drives (HDDs), or you can use the SSDs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



Flash Configuration ⓘ Flash media (SSD or NVMe) can be used for all data, or as journal devices to improve the performance of slower devices (HDDs)

● Journals/Logs ○ OSD Data

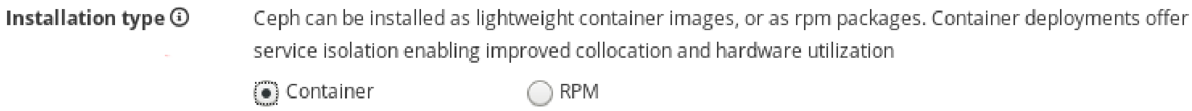
8. Set *Encryption* to *None* or *Encrypted*. This refers to at rest encryption of storage devices using the LUKS1 format.



Encryption ⓘ For added security, you may use at-rest encryption for your storage devices

● None ○ Encrypted

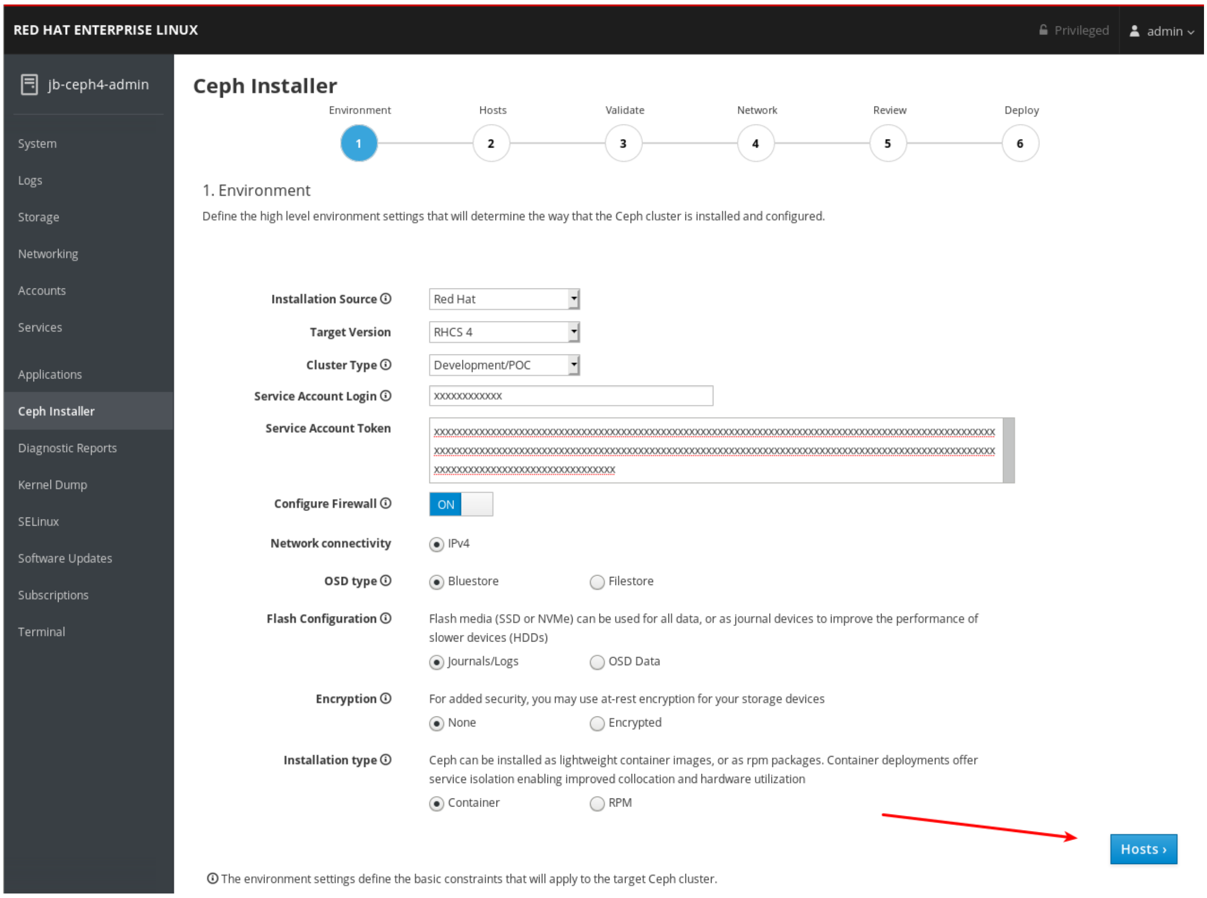
9. Set *Installation type* to *Container* or *RPM*. Traditionally, Red Hat Package Manager (RPM) was used to install software on Red Hat Enterprise Linux. Now, you can install Ceph using RPM or containers. Installing Ceph using containers can provide improved hardware utilization since services can be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



Installation type ⓘ Ceph can be installed as lightweight container images, or as rpm packages. Container deployments offer service isolation enabling improved collocation and hardware utilization

● Container ○ RPM

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



Ceph Installer

1. Environment

Define the high level environment settings that will determine the way that the Ceph cluster is installed and configured.

Installation Source ⓘ Red Hat

Target Version RHCS 4

Cluster Type ⓘ Development/POC

Service Account Login ⓘ xxxxxxxxxxxx

Service Account Token xx

Configure Firewall ⓘ ON

Network connectivity ● IPv4

OSD type ⓘ ● Bluestore ○ Filestore

Flash Configuration ⓘ Flash media (SSD or NVMe) can be used for all data, or as journal devices to improve the performance of slower devices (HDDs)

● Journals/Logs ○ OSD Data

Encryption ⓘ For added security, you may use at-rest encryption for your storage devices

● None ○ Encrypted

Installation type ⓘ Ceph can be installed as lightweight container images, or as rpm packages. Container deployments offer service isolation enabling improved collocation and hardware utilization

● Container ○ RPM

ⓘ The environment settings define the basic constraints that will apply to the target Ceph cluster.

4.7. COMPLETE THE HOSTS PAGE OF THE COCKPIT CEPH INSTALLER

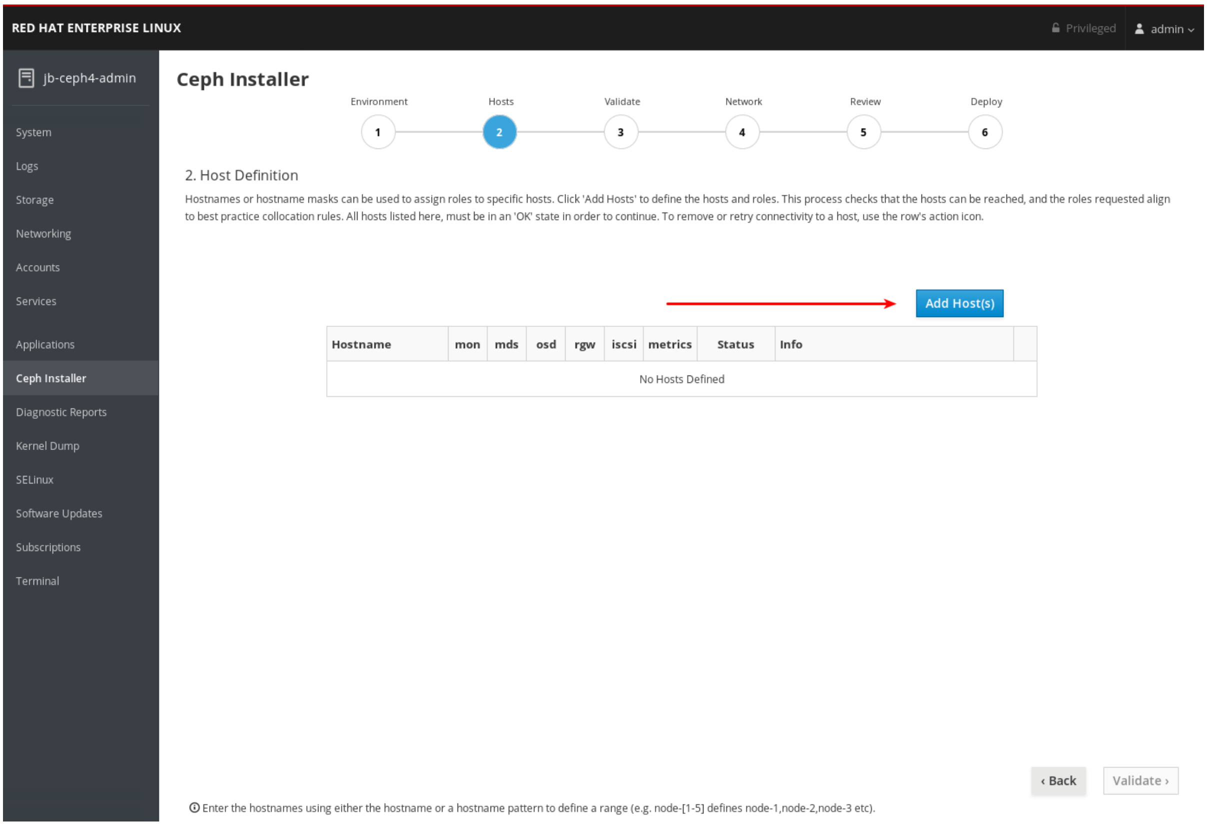
The *Hosts* page allows you inform the Cockpit Ceph Installer what hosts to install Ceph on, and what roles each host will be used for. As you add the hosts, the installer will check them for SSH and DNS connectivity.

Prerequisites

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

Procedure

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



Ceph Installer

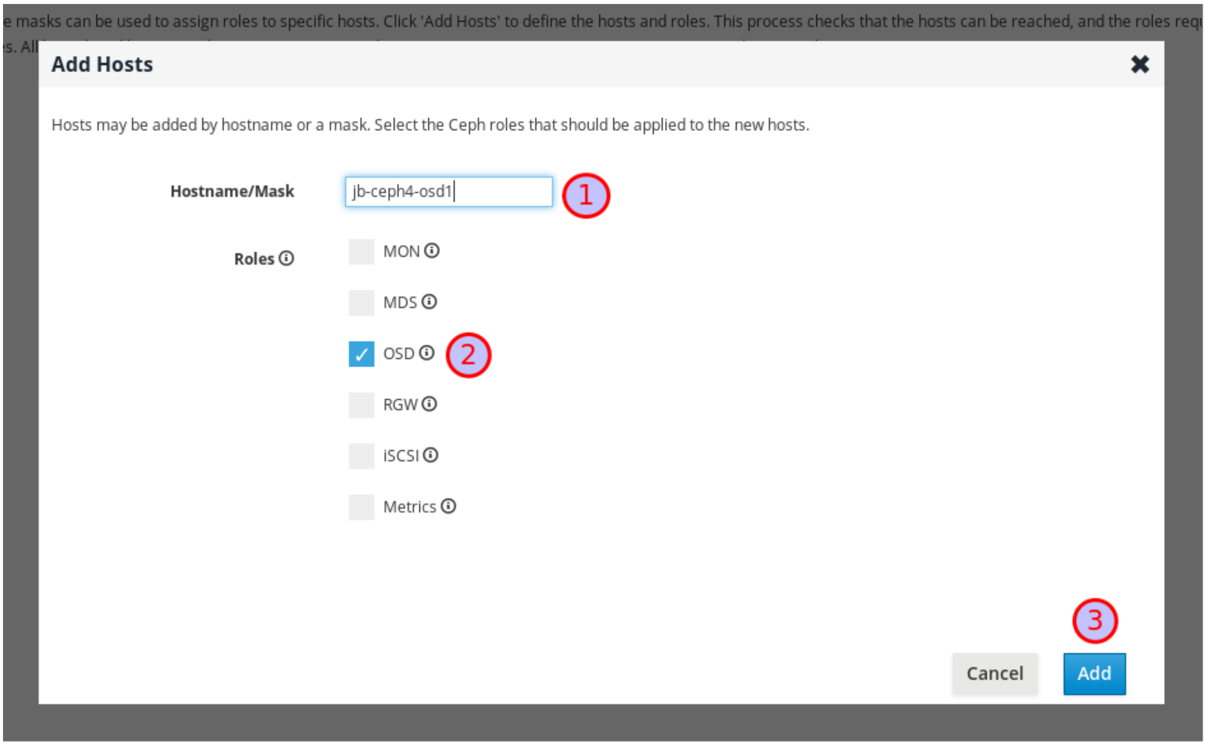
2. Host Definition

Hostnames or hostname masks can be used to assign roles to specific hosts. Click 'Add Hosts' to define the hosts and roles. This process checks that the hosts can be reached, and the roles requested align to best practice collocation rules. All hosts listed here, must be in an 'OK' state in order to continue. To remove or retry connectivity to a host, use the row's action icon.

Hostname	mon	mds	osd	rgw	iscsi	metrics	Status	Info	
No Hosts Defined									

ⓘ Enter the hostnames using either the hostname or a hostname pattern to define a range (e.g. node-[1-5] defines node-1,node-2,node-3 etc).

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


e masks can be used to assign roles to specific hosts. Click 'Add Hosts' to define the hosts and roles. This process checks that the hosts can be reached, and the roles reque
s. All
✖
1
2
3
Cancel
Add

Add Hosts

Hosts may be added by hostname or a mask. Select the Ceph roles that should be applied to the new hosts.

Hostname/Mask: jb-ceph4-osd1

Roles ⓘ

□ MON ⓘ

□ MDS ⓘ

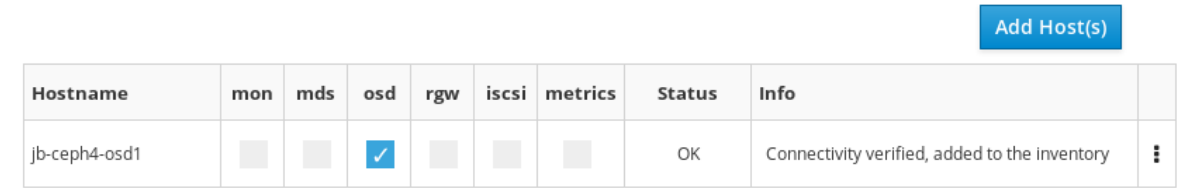
☑ OSD ⓘ

□ RGW ⓘ

□ iSCSI ⓘ

□ Metrics ⓘ

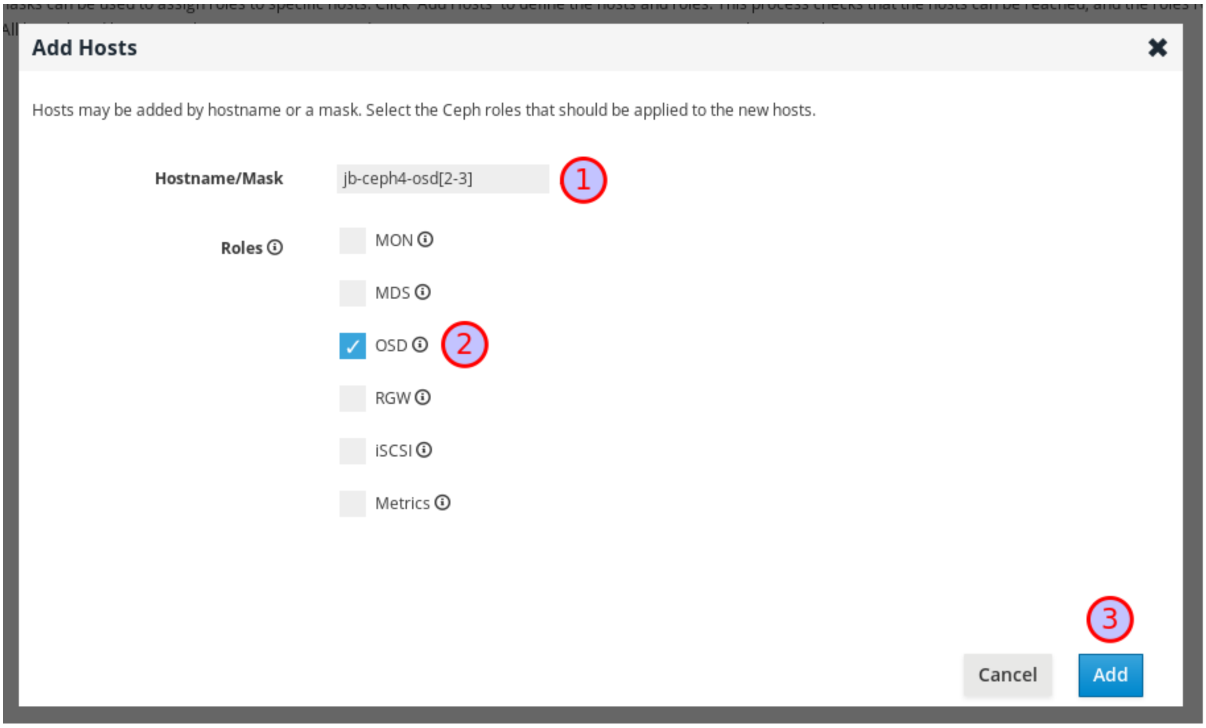
The first Ceph OSD node is added.



Hostname	mon	mds	osd	rgw	iscsi	metrics	Status	Info	
jb-ceph4-osd1	□	□	☑	□	□	□	OK	Connectivity verified, added to the inventory	⋮

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

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



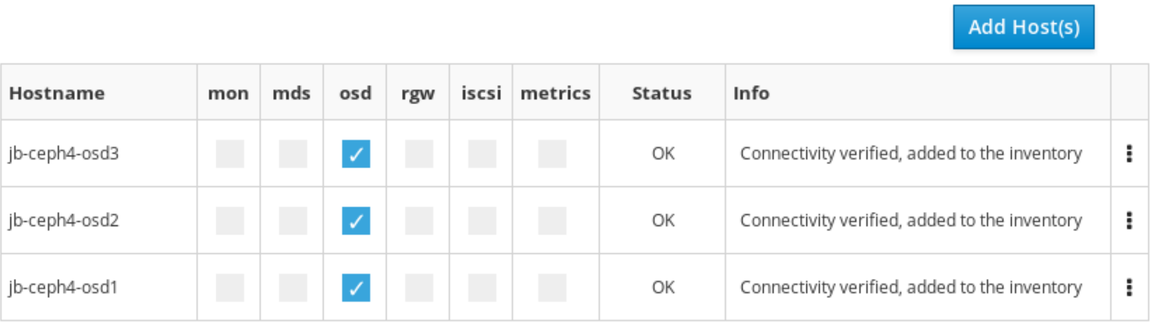
Add Hosts

Hosts may be added by hostname or a mask. Select the Ceph roles that should be applied to the new hosts.

Hostname/Mask: jb-ceph4-osd[2-3]

Roles:
- ☐ MON
- ☐ MDS
- ☑ OSD
- ☐ RGW
- ☐ iSCSI
- ☐ Metrics

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



Hostname	mon	mds	osd	rgw	iscsi	metrics	Status	Info	
jb-ceph4-osd3	☐	☐	☑	☐	☐	☐	OK	Connectivity verified, added to the inventory	⋮
jb-ceph4-osd2	☐	☐	☑	☐	☐	☐	OK	Connectivity verified, added to the inventory	⋮
jb-ceph4-osd1	☐	☐	☑	☐	☐	☐	OK	Connectivity verified, added to the inventory	⋮

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

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

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

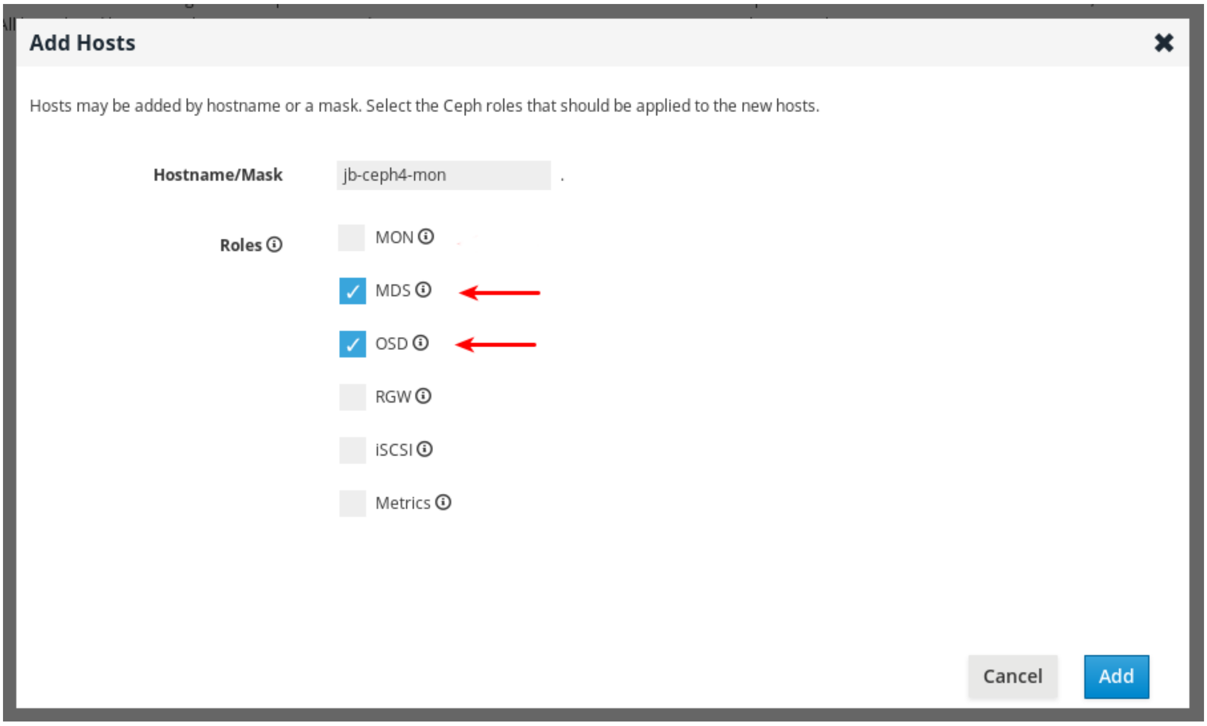
    c. Optional: Add a node with the **MDS** role. The **MDS** role installs the Ceph Metadata Server (MDS). Metadata Server daemons are necessary for deploying a Ceph File System.

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

    Optional: Add a node with the **iSCSI** role. The **iSCSI** role installs an iSCSI gat

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

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



Add Hosts

Hosts may be added by hostname or a mask. Select the Ceph roles that should be applied to the new hosts.

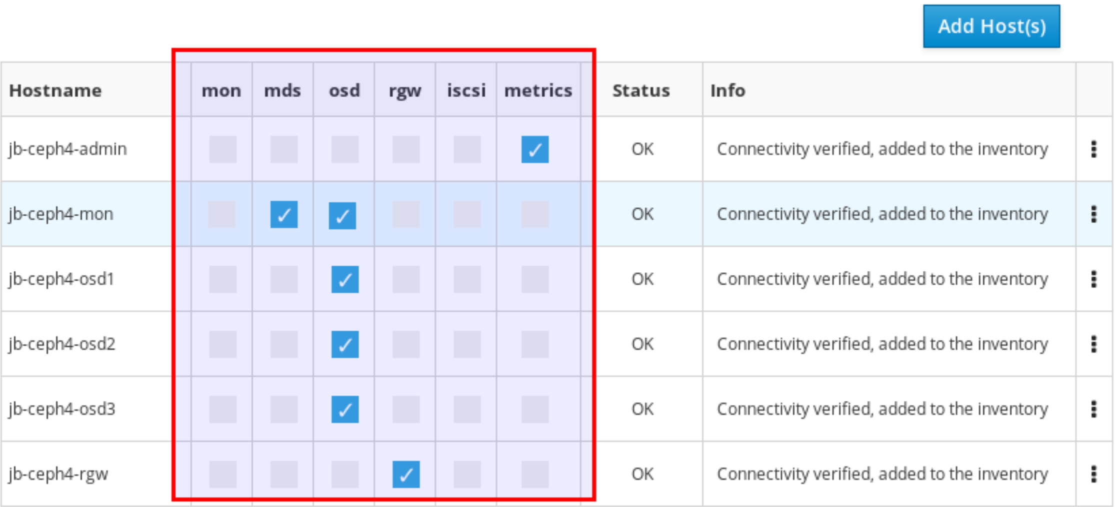
Hostname/Mask: jb-ceph4-mon

Roles:

- □ MON
- ☑ MDS
- ☑ OSD
- □ RGW
- □ iSCSI
- □ Metrics

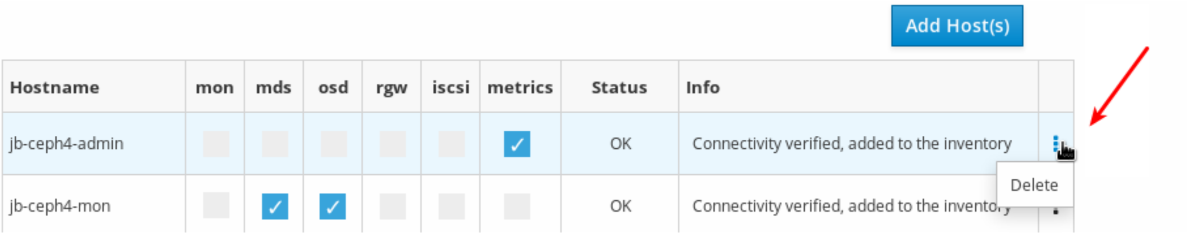
For more information on colocating daemons, see Colocation of containerized Ceph daemons in the Installation Guide.

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



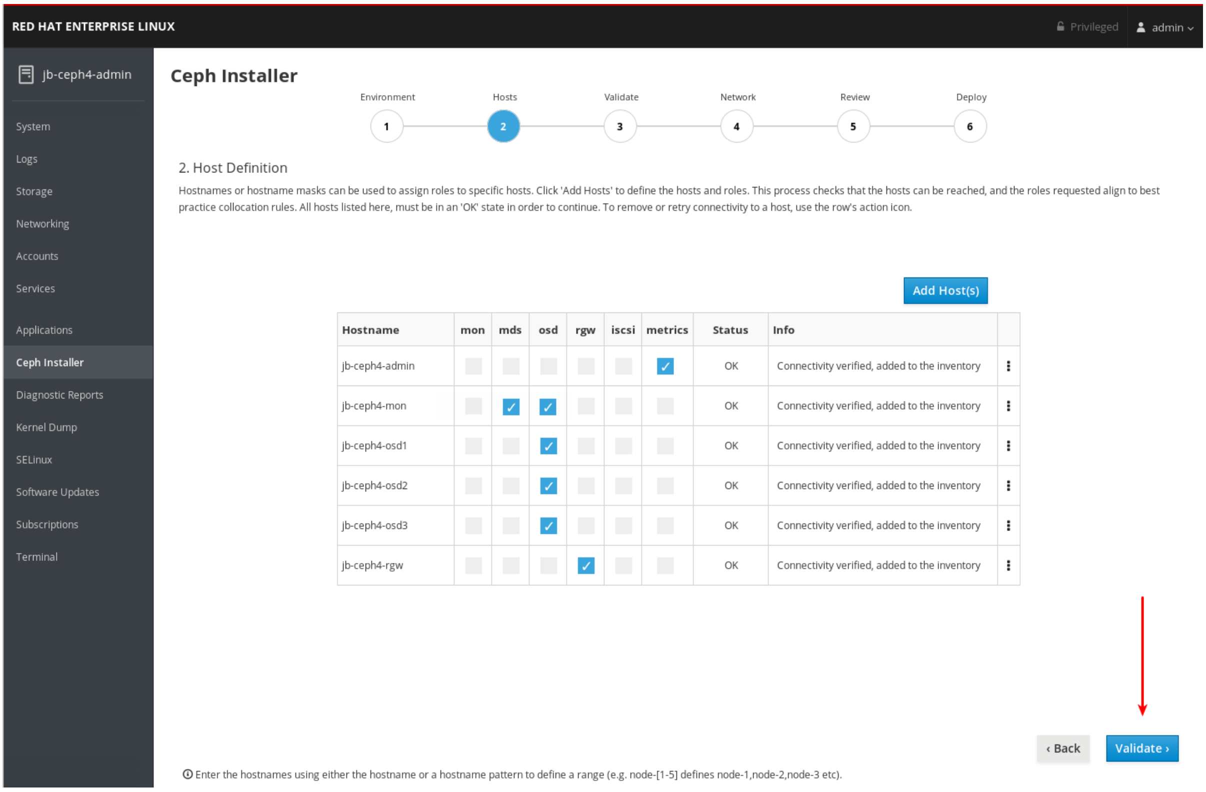
Hostname	mon	mds	osd	rgw	iscsi	metrics	Status	Info
jb-ceph4-admin	□	□	□	□	□	☑	OK	Connectivity verified, added to the inventory
jb-ceph4-mon	□	☑	☑	□	□	□	OK	Connectivity verified, added to the inventory
jb-ceph4-osd1	□	□	☑	□	□	□	OK	Connectivity verified, added to the inventory
jb-ceph4-osd2	□	□	☑	□	□	□	OK	Connectivity verified, added to the inventory
jb-ceph4-osd3	□	□	☑	□	□	□	OK	Connectivity verified, added to the inventory
jb-ceph4-rgw	□	□	□	☑	□	□	OK	Connectivity verified, added to the inventory

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



Hostname	mon	mds	osd	rgw	iscsi	metrics	Status	Info
jb-ceph4-admin	□	□	□	□	□	☑	OK	Connectivity verified, added to the inventory
jb-ceph4-mon	□	☑	☑	□	□	□	OK	Connectivity verified, added to the inventory

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



Ceph Installer

2. Host Definition

Hostnames or hostname masks can be used to assign roles to specific hosts. Click 'Add Hosts' to define the hosts and roles. This process checks that the hosts can be reached, and the roles requested align to best practice collocation rules. All hosts listed here, must be in an 'OK' state in order to continue. To remove or retry connectivity to a host, use the row's action icon.

Hostname	mon	mds	osd	rgw	iscsi	metrics	Status	Info	
jb-ceph4-admin	□	□	□	□	□	☑	OK	Connectivity verified, added to the inventory	⋮
jb-ceph4-mon	□	☑	☑	□	□	□	OK	Connectivity verified, added to the inventory	⋮
jb-ceph4-osd1	□	□	☑	□	□	□	OK	Connectivity verified, added to the inventory	⋮
jb-ceph4-osd2	□	□	☑	□	□	□	OK	Connectivity verified, added to the inventory	⋮
jb-ceph4-osd3	□	□	☑	□	□	□	OK	Connectivity verified, added to the inventory	⋮
jb-ceph4-rgw	□	□	□	☑	□	□	OK	Connectivity verified, added to the inventory	⋮

Enter the hostnames using either the hostname or a hostname pattern to define a range (e.g. node-[1-5] defines node-1,node-2,node-3 etc).

NOTE

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

4.8. COMPLETE THE VALIDATE PAGE OF THE COCKPIT CEPH INSTALLER

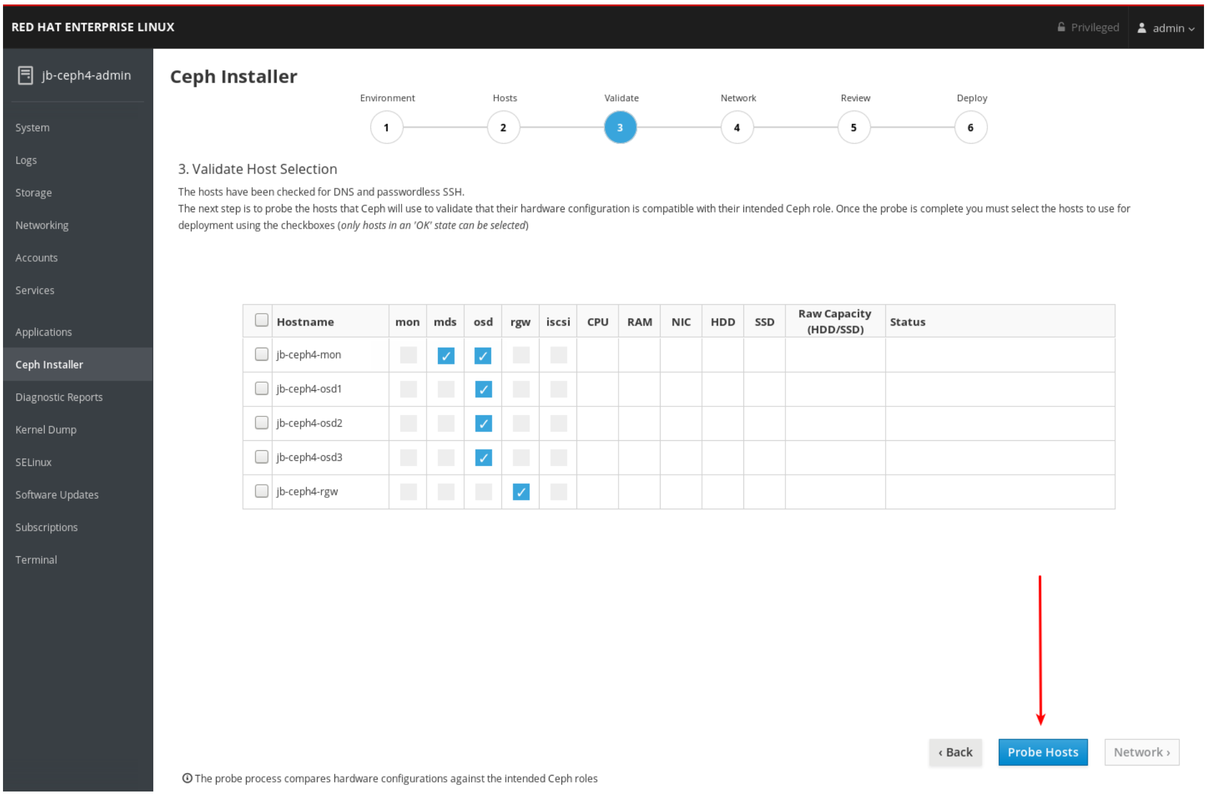
The *Validate* page allows you to probe the nodes you provided on the *Hosts* page to verify they meet the hardware requirements for the roles you intend to use them for.

Prerequisites

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

Procedure

1. Click the *Probe Hosts* button.



Ceph Installer

3. Validate Host Selection

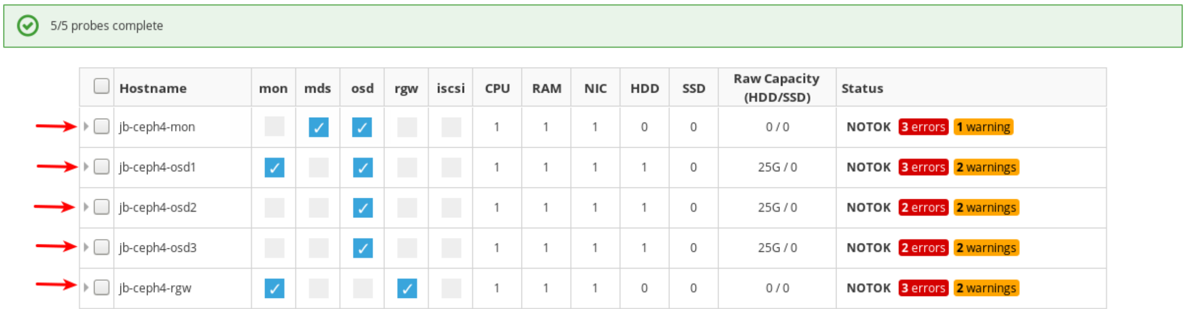
The hosts have been checked for DNS and passwordless SSH.
The next step is to probe the hosts that Ceph will use to validate that their hardware configuration is compatible with their intended Ceph role. Once the probe is complete you must select the hosts to use for deployment using the checkboxes (*only hosts in an 'OK' state can be selected*)

☐ Hostname	mon	mds	osd	rgw	iscsi	CPU	RAM	NIC	HDD	SSD	Raw Capacity (HDD/SSD)	Status
☐ jb-ceph4-mon	☐	☑	☑	☐	☐							
☐ jb-ceph4-osd1	☐	☐	☑	☐	☐							
☐ jb-ceph4-osd2	☐	☐	☑	☐	☐							
☐ jb-ceph4-osd3	☐	☐	☑	☐	☐							
☐ jb-ceph4-rgw	☐	☐	☐	☑	☐							

ⓘ The probe process compares hardware configurations against the intended Ceph roles

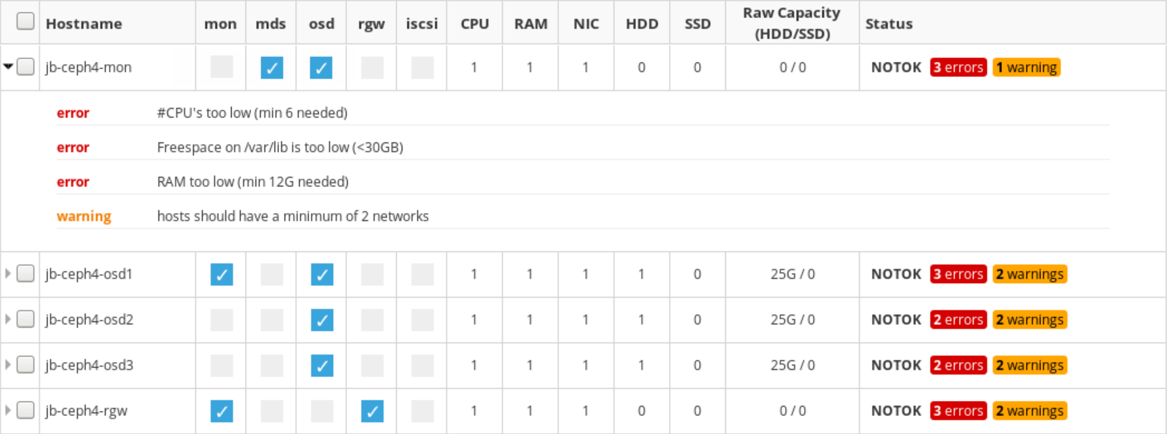
To continue you must select at least three hosts which have an *OK Status*.

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



5/5 probes complete

☐ Hostname	mon	mds	osd	rgw	iscsi	CPU	RAM	NIC	HDD	SSD	Raw Capacity (HDD/SSD)	Status
☐ jb-ceph4-mon	☐	☑	☑	☐	☐	1	1	1	0	0	0 / 0	NOTOK 3 errors 1 warning
☐ jb-ceph4-osd1	☑	☐	☑	☐	☐	1	1	1	1	0	25G / 0	NOTOK 3 errors 2 warnings
☐ jb-ceph4-osd2	☐	☐	☑	☐	☐	1	1	1	1	0	25G / 0	NOTOK 2 errors 2 warnings
☐ jb-ceph4-osd3	☐	☐	☑	☐	☐	1	1	1	1	0	25G / 0	NOTOK 2 errors 2 warnings
☐ jb-ceph4-rgw	☑	☐	☐	☑	☐	1	1	1	0	0	0 / 0	NOTOK 3 errors 2 warnings



☐ Hostname	mon	mds	osd	rgw	iscsi	CPU	RAM	NIC	HDD	SSD	Raw Capacity (HDD/SSD)	Status
☐ jb-ceph4-mon	☐	☑	☑	☐	☐	1	1	1	0	0	0 / 0	NOTOK 3 errors 1 warning

error	#CPU's too low (min 6 needed)
error	Freespace on /var/lib is too low (<30GB)
error	RAM too low (min 12G needed)
warning	hosts should have a minimum of 2 networks

☐ Hostname	mon	mds	osd	rgw	iscsi	CPU	RAM	NIC	HDD	SSD	Raw Capacity (HDD/SSD)	Status
☐ jb-ceph4-osd1	☑	☐	☑	☐	☐	1	1	1	1	0	25G / 0	NOTOK 3 errors 2 warnings
☐ jb-ceph4-osd2	☐	☐	☑	☐	☐	1	1	1	1	0	25G / 0	NOTOK 2 errors 2 warnings
☐ jb-ceph4-osd3	☐	☐	☑	☐	☐	1	1	1	1	0	25G / 0	NOTOK 2 errors 2 warnings
☐ jb-ceph4-rgw	☑	☐	☐	☑	☐	1	1	1	0	0	0 / 0	NOTOK 3 errors 2 warnings

IMPORTANT

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

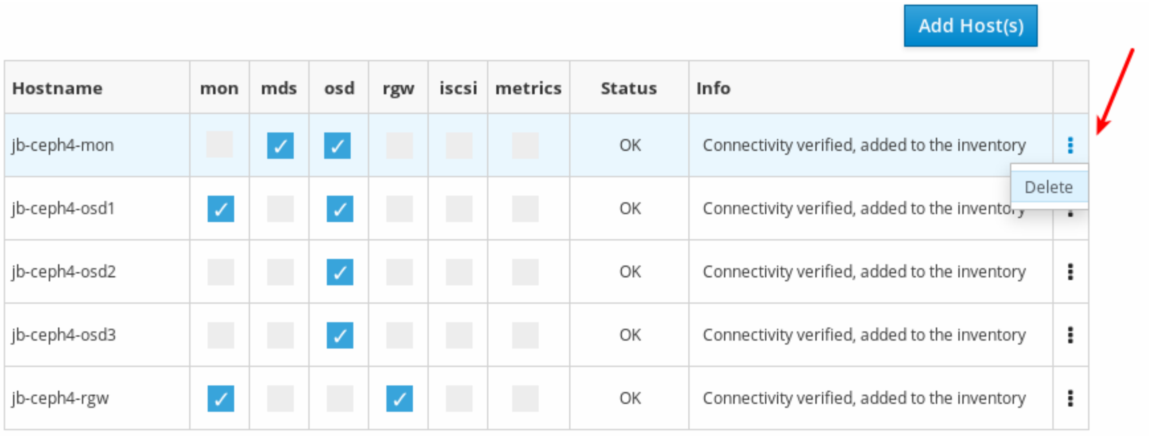
IMPORTANT

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

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

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

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

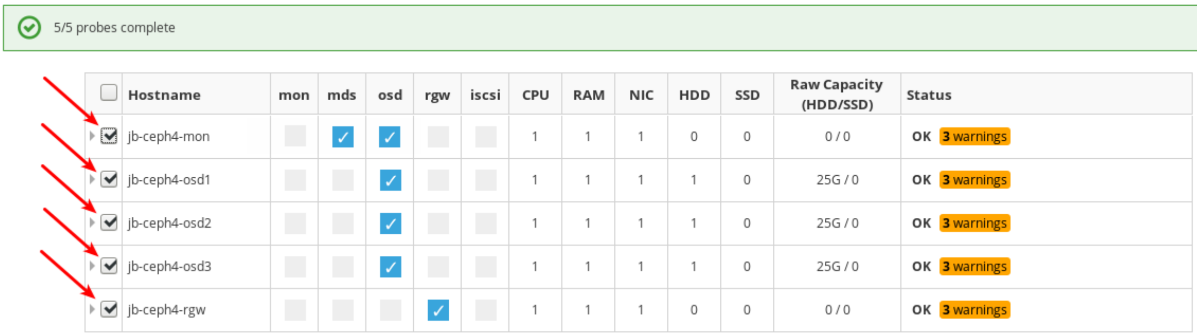


Hostname	mon	mds	osd	rgw	iscsi	metrics	Status	Info	
jb-ceph4-mon	☐	☑	☑	☐	☐	☐	OK	Connectivity verified, added to the inventory	⋮
jb-ceph4-osd1	☑	☐	☑	☐	☐	☐	OK	Connectivity verified, added to the inventory	⋮
jb-ceph4-osd2	☐	☐	☑	☐	☐	☐	OK	Connectivity verified, added to the inventory	⋮
jb-ceph4-osd3	☐	☐	☑	☐	☐	☐	OK	Connectivity verified, added to the inventory	⋮
jb-ceph4-rgw	☑	☐	☐	☑	☐	☐	OK	Connectivity verified, added to the inventory	⋮

   Then, add the new hosts .

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

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

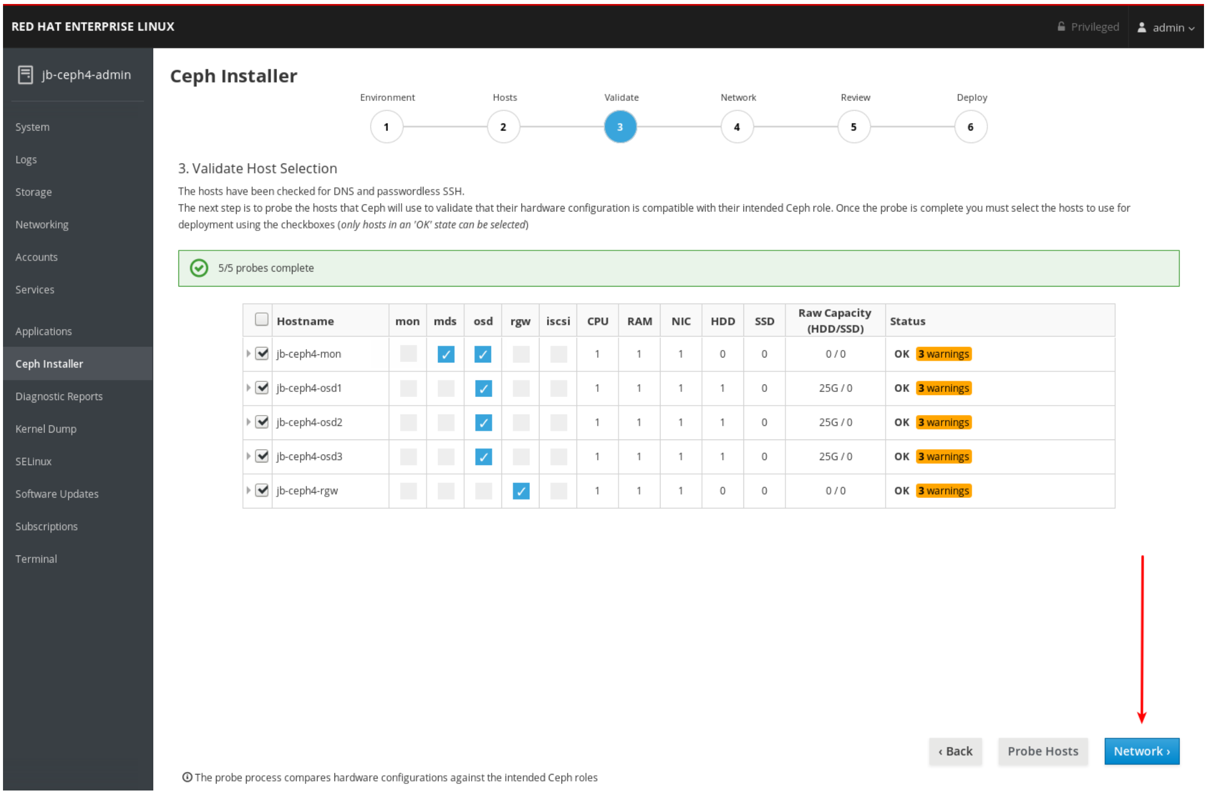

5/5 probes complete

☐ Hostname	mon	mds	osd	rgw	iscsi	CPU	RAM	NIC	HDD	SSD	Raw Capacity (HDD/SSD)	Status
☑ jb-ceph4-mon	☐	☑	☑	☐	☐	1	1	1	0	0	0 / 0	OK 3 warnings
☑ jb-ceph4-osd1	☐	☐	☑	☐	☐	1	1	1	1	0	25G / 0	OK 3 warnings
☑ jb-ceph4-osd2	☐	☐	☑	☐	☐	1	1	1	1	0	25G / 0	OK 3 warnings
☑ jb-ceph4-osd3	☐	☐	☑	☐	☐	1	1	1	1	0	25G / 0	OK 3 warnings
☑ jb-ceph4-rgw	☐	☐	☐	☑	☐	1	1	1	0	0	0 / 0	OK 3 warnings

IMPORTANT

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

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



3. Validate Host Selection

The hosts have been checked for DNS and passwordless SSH.
The next step is to probe the hosts that Ceph will use to validate that their hardware configuration is compatible with their intended Ceph role. Once the probe is complete you must select the hosts to use for deployment using the checkboxes (*only hosts in an 'OK' state can be selected*)

5/5 probes complete

☐	Hostname	mon	mds	osd	rgw	iscsi	CPU	RAM	NIC	HDD	SSD	Raw Capacity (HDD/SSD)	Status
☑	jb-ceph4-mon	☐	☑	☑	☐	☐	1	1	1	0	0	0 / 0	OK 3 warnings
☑	jb-ceph4-osd1	☐	☐	☑	☐	☐	1	1	1	1	0	25G / 0	OK 3 warnings
☑	jb-ceph4-osd2	☐	☐	☑	☐	☐	1	1	1	1	0	25G / 0	OK 3 warnings
☑	jb-ceph4-osd3	☐	☐	☑	☐	☐	1	1	1	1	0	25G / 0	OK 3 warnings
☑	jb-ceph4-rgw	☐	☐	☐	☑	☐	1	1	1	0	0	0 / 0	OK 3 warnings

The probe process compares hardware configurations against the intended Ceph roles

4.9. COMPLETE THE NETWORK PAGE OF THE COCKPIT CEPH INSTALLER

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

IMPORTANT

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

IMPORTANT

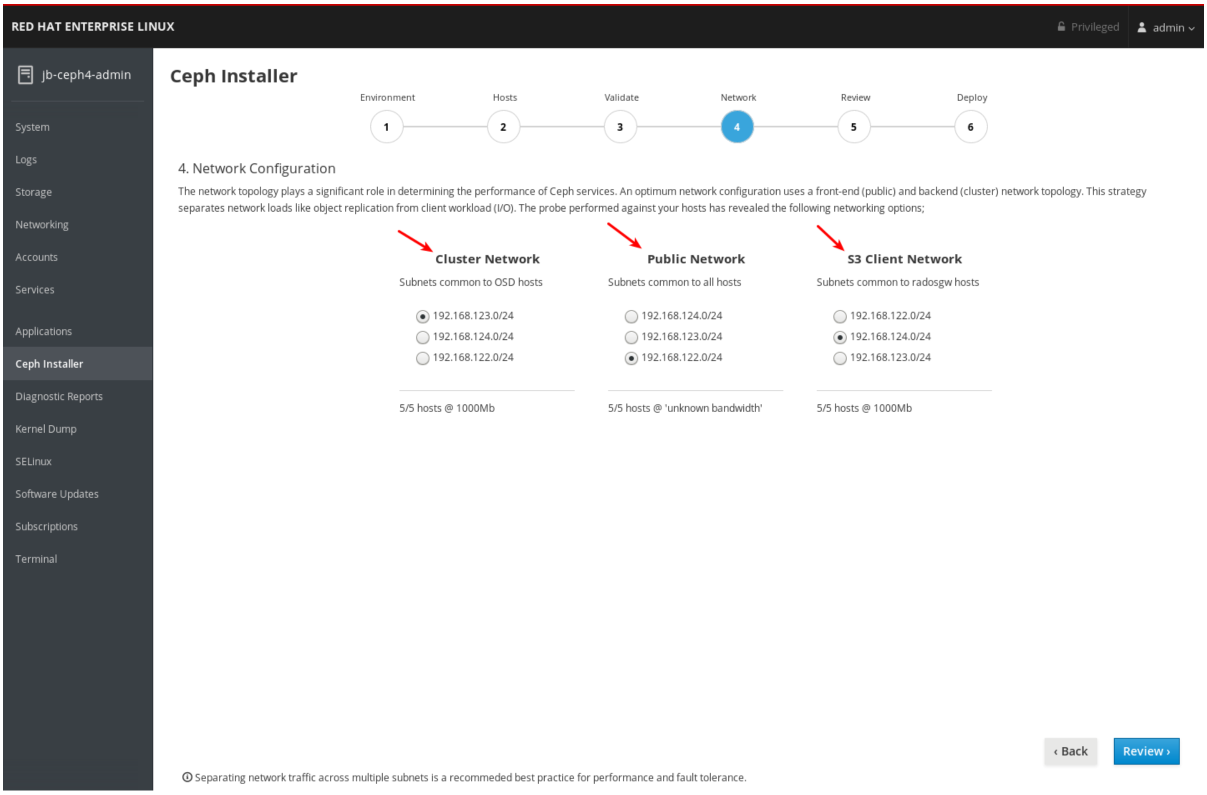
For production clusters you must segregate intra-cluster-traffic from client-to-cluster traffic on separate NICs. In addition to segregating cluster traffic types, there are other networking considerations to take into account when setting up a Ceph cluster. For more information, see Network considerations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

Prerequisites

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

Procedure

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



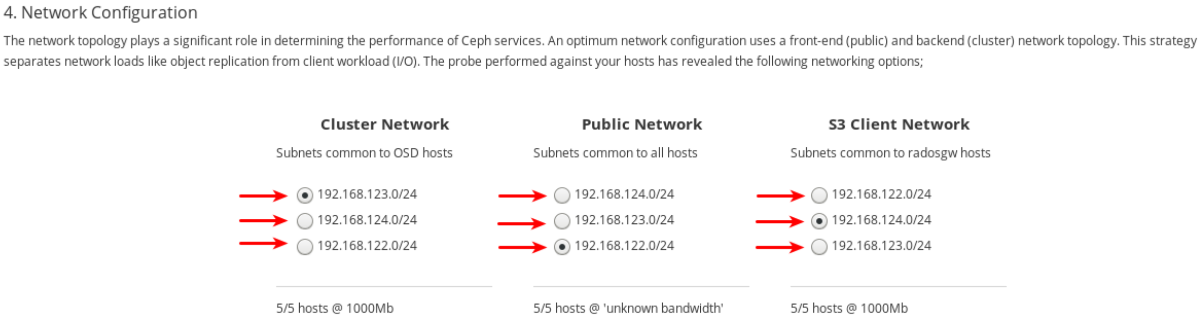
4. Network Configuration

The network topology plays a significant role in determining the performance of Ceph services. An optimum network configuration uses a front-end (public) and backend (cluster) network topology. This strategy separates network loads like object replication from client workload (I/O). The probe performed against your hosts has revealed the following networking options;

Cluster Network	Public Network	S3 Client Network
Subnets common to OSD hosts	Subnets common to all hosts	Subnets common to radosgw hosts
● 192.168.123.0/24	○ 192.168.124.0/24	○ 192.168.122.0/24
○ 192.168.124.0/24	○ 192.168.123.0/24	● 192.168.124.0/24
○ 192.168.122.0/24	● 192.168.122.0/24	○ 192.168.123.0/24
5/5 hosts @ 1000Mb	5/5 hosts @ 'unknown bandwidth'	5/5 hosts @ 1000Mb

Separating network traffic across multiple subnets is a recommeded best practice for performance and fault tolerance.

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



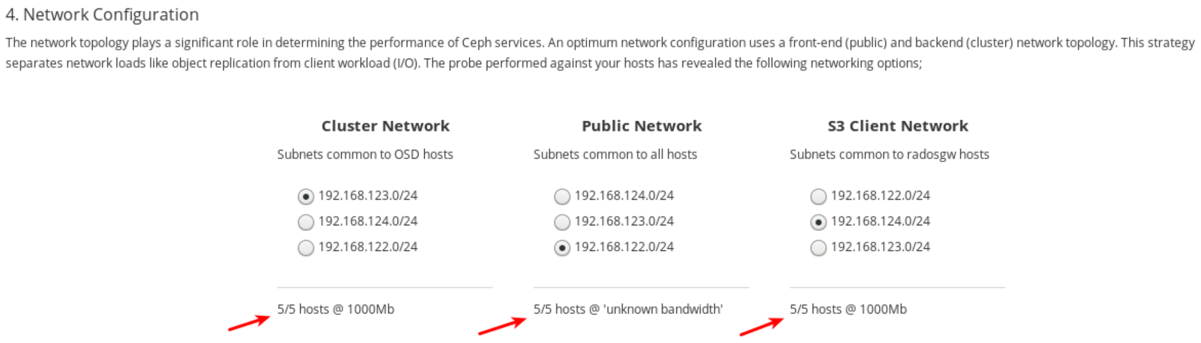
4. Network Configuration

The network topology plays a significant role in determining the performance of Ceph services. An optimum network configuration uses a front-end (public) and backend (cluster) network topology. This strategy separates network loads like object replication from client workload (I/O). The probe performed against your hosts has revealed the following networking options;

Cluster Network	Public Network	S3 Client Network
Subnets common to OSD hosts	Subnets common to all hosts	Subnets common to radosgw hosts
● 192.168.123.0/24	○ 192.168.124.0/24	○ 192.168.122.0/24
○ 192.168.124.0/24	○ 192.168.123.0/24	● 192.168.124.0/24
○ 192.168.122.0/24	● 192.168.122.0/24	○ 192.168.123.0/24
5/5 hosts @ 1000Mb	5/5 hosts @ 'unknown bandwidth'	5/5 hosts @ 1000Mb

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

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

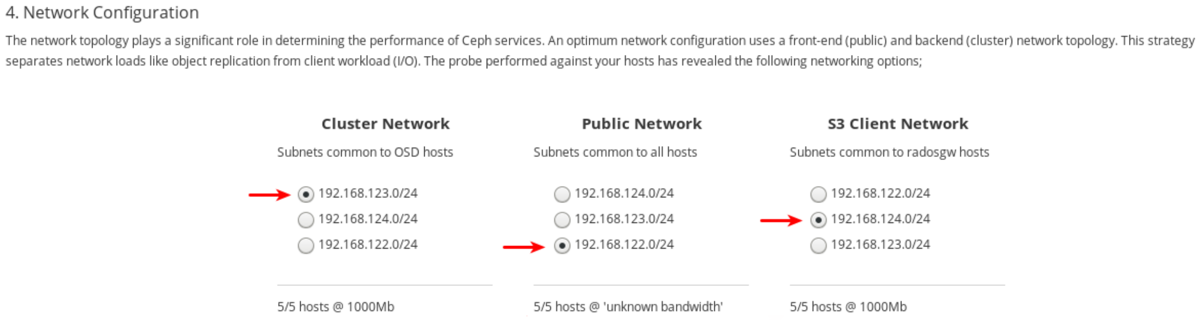


4. Network Configuration

The network topology plays a significant role in determining the performance of Ceph services. An optimum network configuration uses a front-end (public) and backend (cluster) network topology. This strategy separates network loads like object replication from client workload (I/O). The probe performed against your hosts has revealed the following networking options;

Cluster Network	Public Network	S3 Client Network
Subnets common to OSD hosts	Subnets common to all hosts	Subnets common to radosgw hosts
● 192.168.123.0/24	○ 192.168.124.0/24	○ 192.168.122.0/24
○ 192.168.124.0/24	○ 192.168.123.0/24	● 192.168.124.0/24
○ 192.168.122.0/24	● 192.168.122.0/24	○ 192.168.123.0/24
5/5 hosts @ 1000Mb	5/5 hosts @ 'unknown bandwidth'	5/5 hosts @ 1000Mb

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



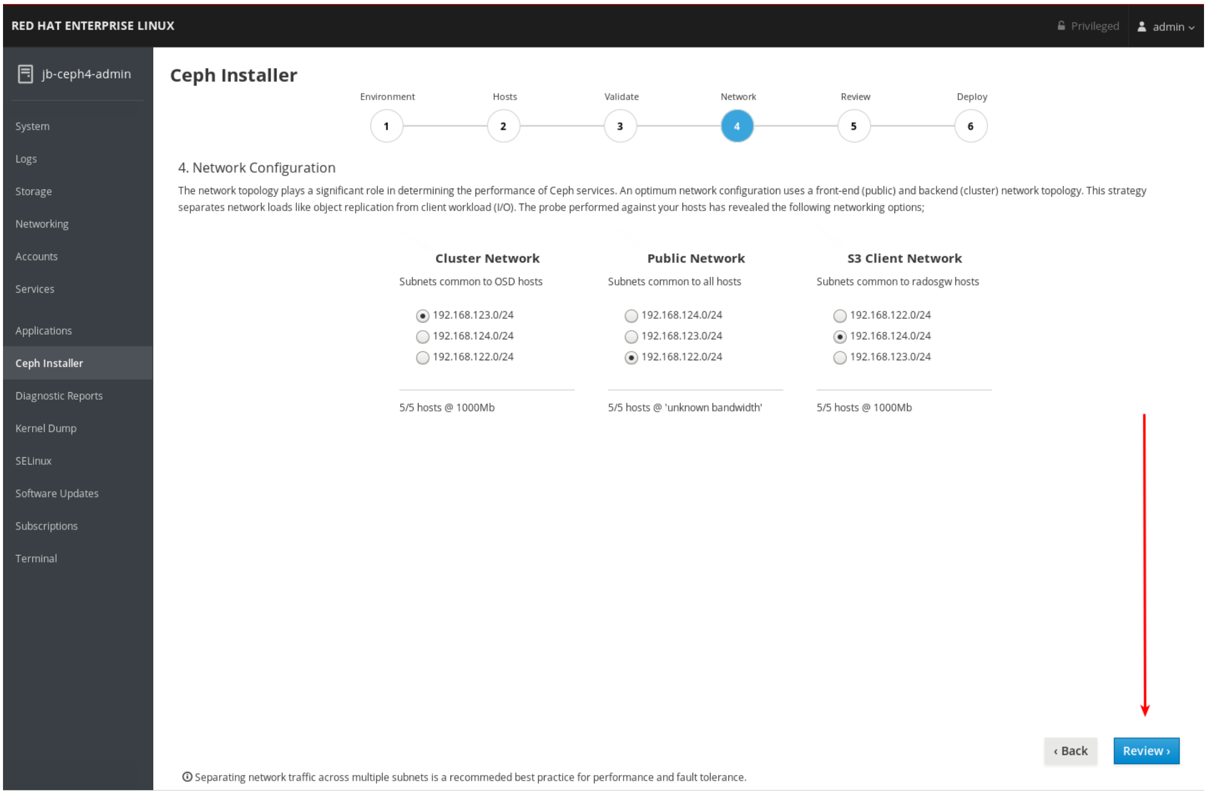
4. Network Configuration

The network topology plays a significant role in determining the performance of Ceph services. An optimum network configuration uses a front-end (public) and backend (cluster) network topology. This strategy separates network loads like object replication from client workload (I/O). The probe performed against your hosts has revealed the following networking options;

Cluster Network	Public Network	S3 Client Network
Subnets common to OSD hosts	Subnets common to all hosts	Subnets common to radosgw hosts
● 192.168.123.0/24	○ 192.168.124.0/24	○ 192.168.122.0/24
○ 192.168.124.0/24	○ 192.168.123.0/24	● 192.168.124.0/24
○ 192.168.122.0/24	● 192.168.122.0/24	○ 192.168.123.0/24
5/5 hosts @ 1000Mb	5/5 hosts @ 'unknown bandwidth'	5/5 hosts @ 1000Mb

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

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



4. Network Configuration

The network topology plays a significant role in determining the performance of Ceph services. An optimum network configuration uses a front-end (public) and backend (cluster) network topology. This strategy separates network loads like object replication from client workload (I/O). The probe performed against your hosts has revealed the following networking options;

Cluster Network	Public Network	S3 Client Network
Subnets common to OSD hosts	Subnets common to all hosts	Subnets common to radosgw hosts
● 192.168.123.0/24	○ 192.168.124.0/24	○ 192.168.122.0/24
○ 192.168.124.0/24	○ 192.168.123.0/24	● 192.168.124.0/24
○ 192.168.122.0/24	● 192.168.122.0/24	○ 192.168.123.0/24
5/5 hosts @ 1000Mb	5/5 hosts @ 'unknown bandwidth'	5/5 hosts @ 1000Mb

Separating network traffic across multiple subnets is a recommeded best practice for performance and fault tolerance.

4.10. REVIEW THE INSTALLATION CONFIGURATION

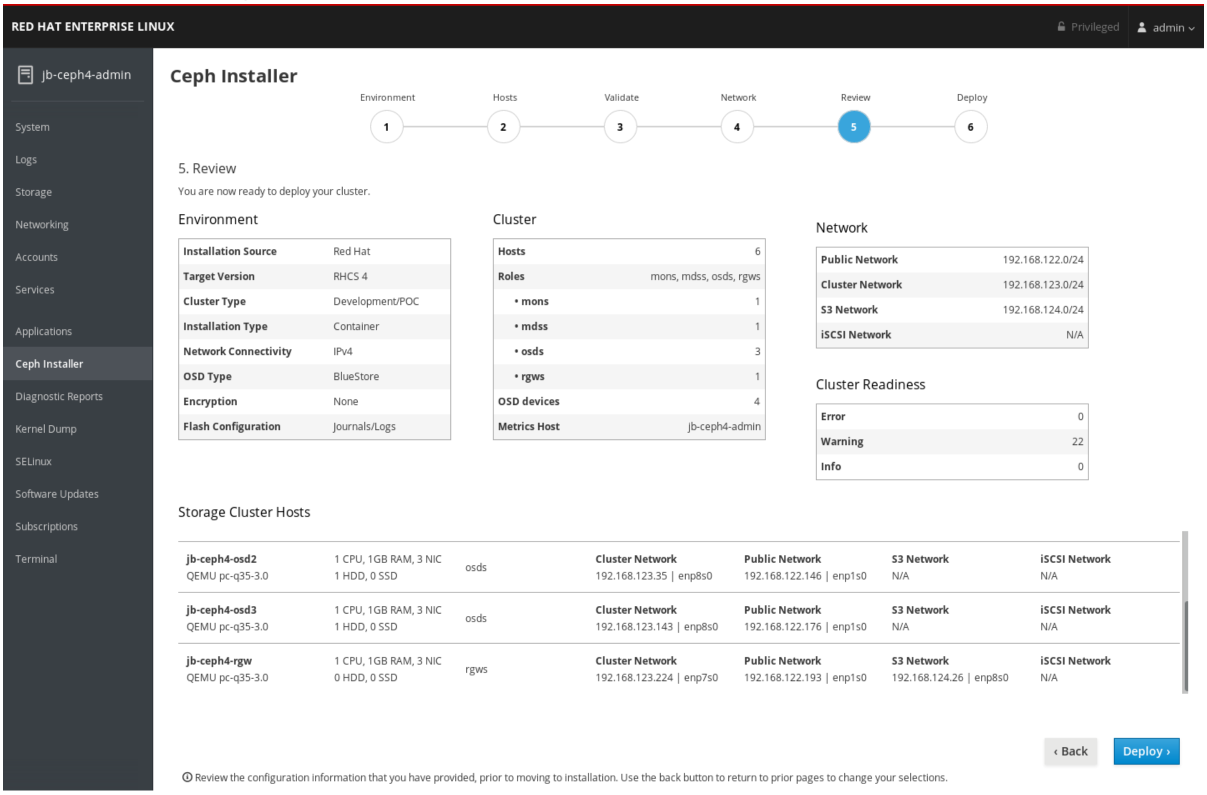
The *Review* page allows you to view all the details of the Ceph cluster installation configuration that you set on the previous pages, and details about the hosts, some of which were not included in previous pages.

Prerequisites

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

Procedure

1. View the review page.



5. Review

You are now ready to deploy your cluster.

Environment

Installation Source	Red Hat
Target Version	RHCS 4
Cluster Type	Development/POC
Installation Type	Container
Network Connectivity	IPv4
OSD Type	BlueStore
Encryption	None
Flash Configuration	Journals/Logs

Cluster

Hosts	6
Roles	mons, mdss, osds, rgws
• mons	1
• mdss	1
• osds	3
• rgws	1
OSD devices	4
Metrics Host	jb-ceph4-admin

Network

Public Network	192.168.122.0/24
Cluster Network	192.168.123.0/24
S3 Network	192.168.124.0/24
iSCSI Network	N/A

Cluster Readiness

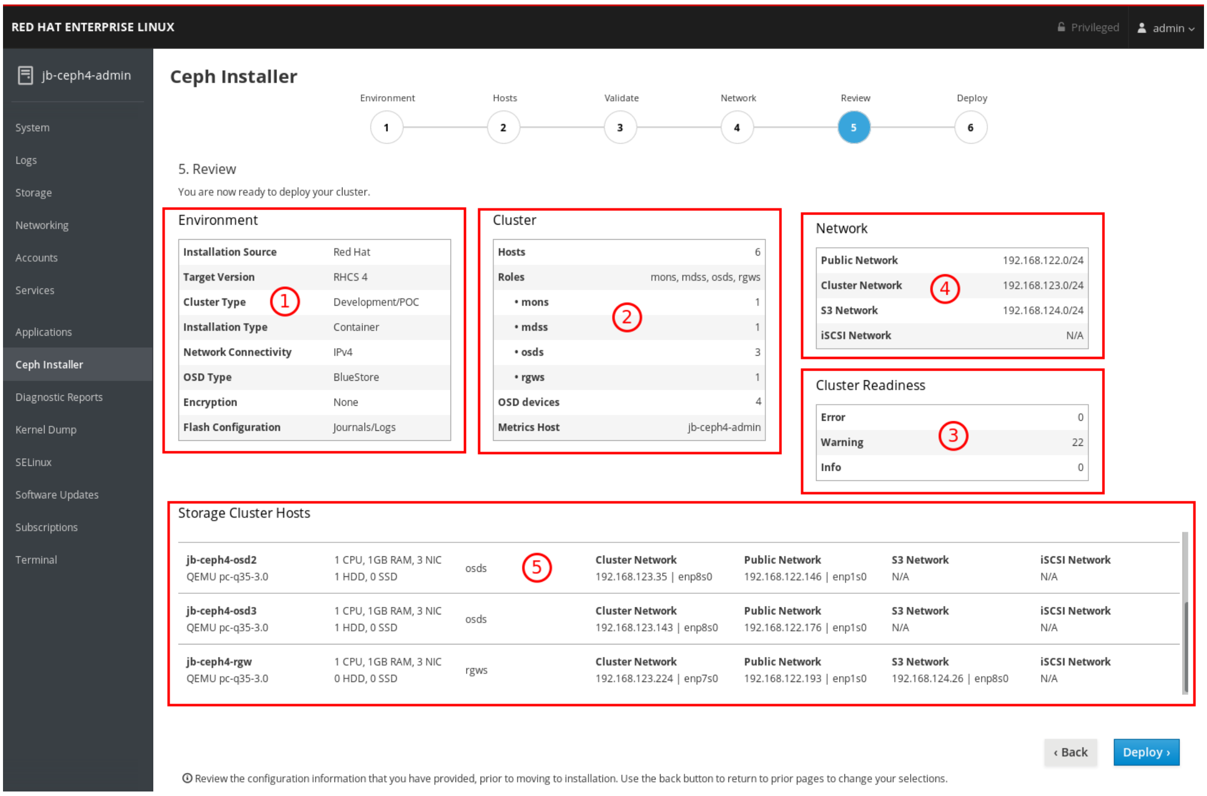
Error	0
Warning	22
Info	0

Storage Cluster Hosts

jb-ceph4-osd2 QEMU pc-q35-3.0	1 CPU, 1GB RAM, 3 NIC 1 HDD, 0 SSD	osds	**Cluster Network** 192.168.123.35 | enp8s0	**Public Network** 192.168.122.146 | enp1s0	**S3 Network** N/A	**iSCSI Network** N/A
jb-ceph4-osd3 QEMU pc-q35-3.0	1 CPU, 1GB RAM, 3 NIC 1 HDD, 0 SSD	osds	**Cluster Network** 192.168.123.143 | enp8s0	**Public Network** 192.168.122.176 | enp1s0	**S3 Network** N/A	**iSCSI Network** N/A
jb-ceph4-rgw QEMU pc-q35-3.0	1 CPU, 1GB RAM, 3 NIC 0 HDD, 0 SSD	rgws	**Cluster Network** 192.168.123.224 | enp7s0	**Public Network** 192.168.122.193 | enp1s0	**S3 Network** 192.168.124.26 | enp8s0	**iSCSI Network** N/A

ⓘ Review the configuration information that you have provided, prior to moving to installation. Use the back button to return to prior pages to change your selections.

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



Ceph Installer

5. Review

You are now ready to deploy your cluster.

Environment

Installation Source	Red Hat
Target Version	RHCS 4
Cluster Type	Development/POC
Installation Type	Container
Network Connectivity	IPv4
OSD Type	BlueStore
Encryption	None
Flash Configuration	Journals/Logs

Cluster

Hosts	6
Roles	mons, mdss, osds, rgws
• mons	1
• mdss	1
• osds	3
• rgws	1
OSD devices	4
Metrics Host	jb-ceph4-admin

Network

Public Network	192.168.122.0/24
Cluster Network	192.168.123.0/24
S3 Network	192.168.124.0/24
iSCSI Network	N/A

Cluster Readiness

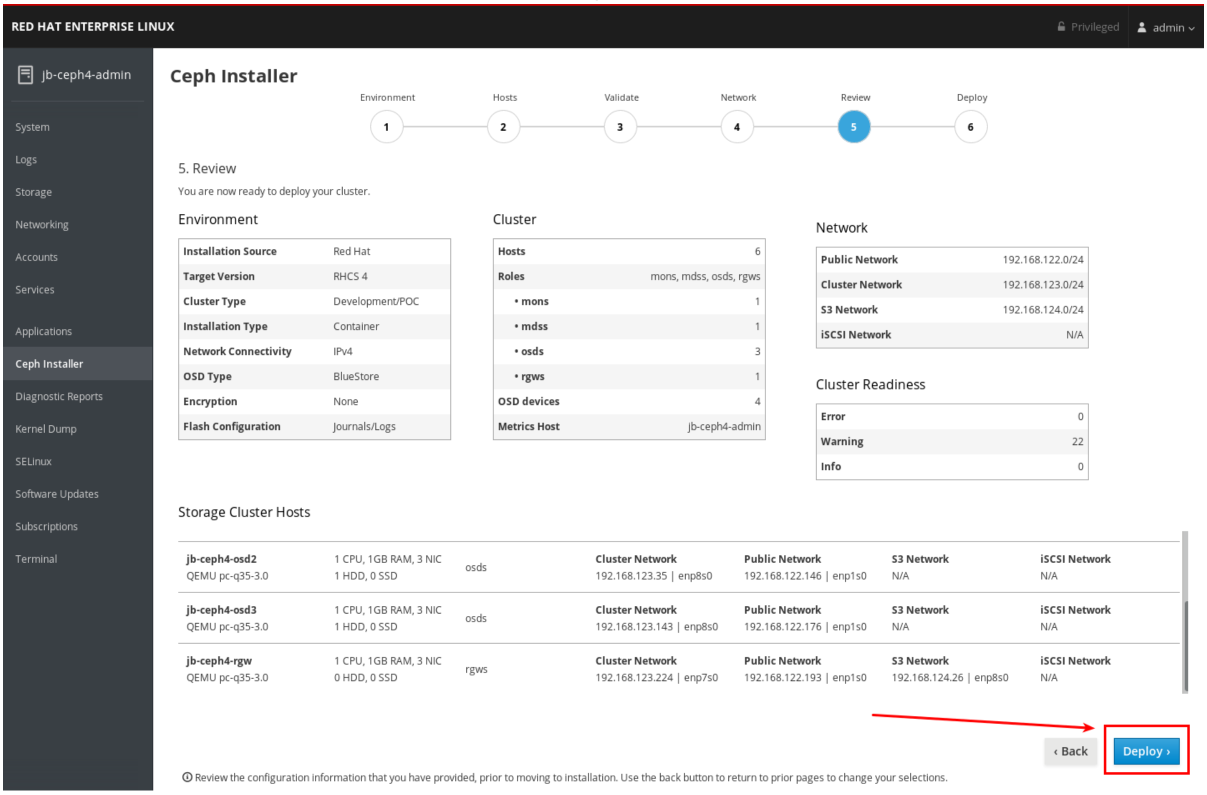
Error	0
Warning	22
Info	0

Storage Cluster Hosts

jb-ceph4-osd2 QEMU pc-q35-3.0	1 CPU, 1GB RAM, 3 NIC 1 HDD, 0 SSD	osds	Cluster Network 192.168.123.35 | enp8s0	Public Network 192.168.122.146 | enp1s0	S3 Network N/A	iSCSI Network N/A
jb-ceph4-osd3 QEMU pc-q35-3.0	1 CPU, 1GB RAM, 3 NIC 1 HDD, 0 SSD	osds	Cluster Network 192.168.123.143 | enp8s0	Public Network 192.168.122.176 | enp1s0	S3 Network N/A	iSCSI Network N/A
jb-ceph4-rgw QEMU pc-q35-3.0	1 CPU, 1GB RAM, 3 NIC 0 HDD, 0 SSD	rgws	Cluster Network 192.168.123.224 | enp7s0	Public Network 192.168.122.193 | enp1s0	S3 Network 192.168.124.26 | enp8s0	iSCSI Network N/A

ⓘ Review the configuration information that you have provided, prior to moving to installation. Use the back button to return to prior pages to change your selections.

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



Ceph Installer

5. Review

You are now ready to deploy your cluster.

Environment

Installation Source	Red Hat
Target Version	RHCS 4
Cluster Type	Development/POC
Installation Type	Container
Network Connectivity	IPv4
OSD Type	BlueStore
Encryption	None
Flash Configuration	Journals/Logs

Cluster

Hosts	6
Roles	mons, mdss, osds, rgws
• mons	1
• mdss	1
• osds	3
• rgws	1
OSD devices	4
Metrics Host	jb-ceph4-admin

Network

Public Network	192.168.122.0/24
Cluster Network	192.168.123.0/24
S3 Network	192.168.124.0/24
iSCSI Network	N/A

Cluster Readiness

Error	0
Warning	22
Info	0

Storage Cluster Hosts

jb-ceph4-osd2 QEMU pc-q35-3.0	1 CPU, 1GB RAM, 3 NIC 1 HDD, 0 SSD	osds	Cluster Network 192.168.123.35 | enp8s0	Public Network 192.168.122.146 | enp1s0	S3 Network N/A	iSCSI Network N/A
jb-ceph4-osd3 QEMU pc-q35-3.0	1 CPU, 1GB RAM, 3 NIC 1 HDD, 0 SSD	osds	Cluster Network 192.168.123.143 | enp8s0	Public Network 192.168.122.176 | enp1s0	S3 Network N/A	iSCSI Network N/A
jb-ceph4-rgw QEMU pc-q35-3.0	1 CPU, 1GB RAM, 3 NIC 0 HDD, 0 SSD	rgws	Cluster Network 192.168.123.224 | enp7s0	Public Network 192.168.122.193 | enp1s0	S3 Network 192.168.124.26 | enp8s0	iSCSI Network N/A

ⓘ Review the configuration information that you have provided, prior to moving to installation. Use the back button to return to prior pages to change your selections.

4.11. DEPLOY THE CEPH CLUSTER

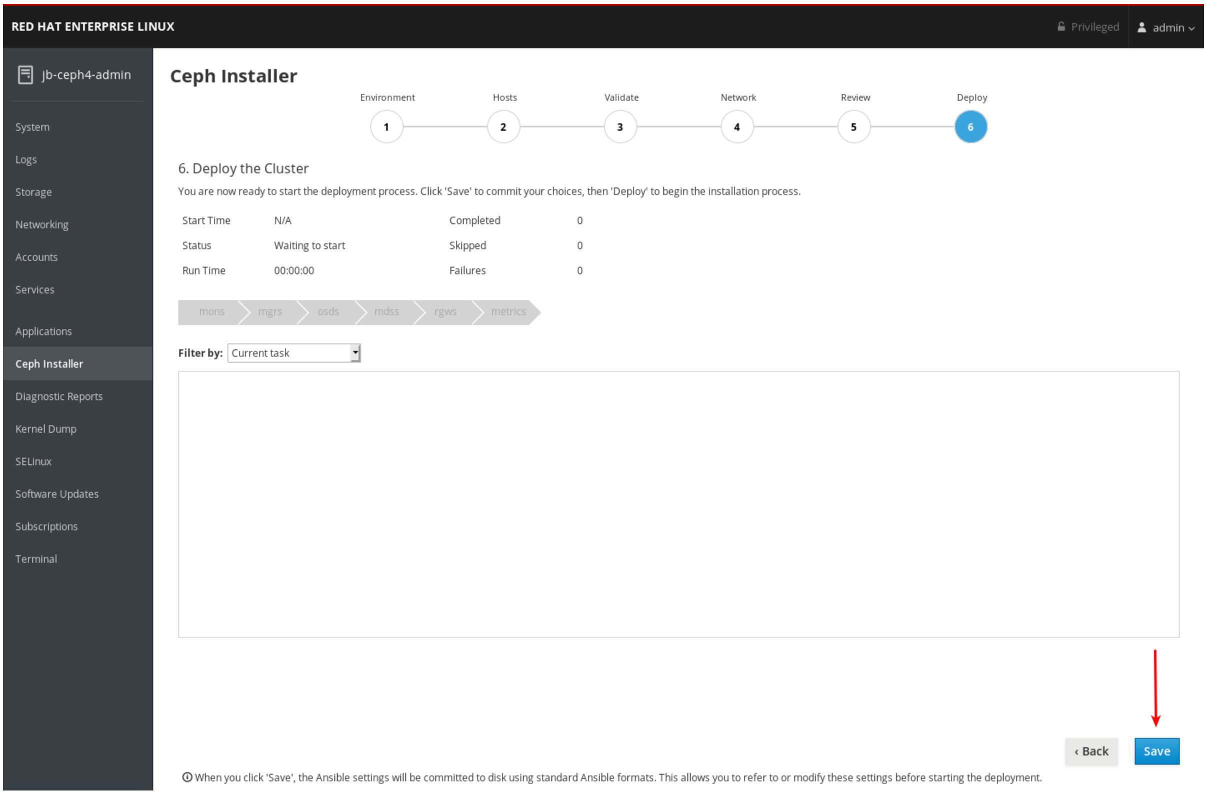
The *Deploy* page allows you save the installation settings in their native Ansible format, review or modify them if required, start the install, monitor its progress, and view the status of the cluster after the install finishes successfully.

Prerequisites

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

Procedure

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



6. Deploy the Cluster

You are now ready to start the deployment process. Click 'Save' to commit your choices, then 'Deploy' to begin the installation process.

Start Time	N/A	Completed	0
Status	Waiting to start	Skipped	0
Run Time	00:00:00	Failures	0

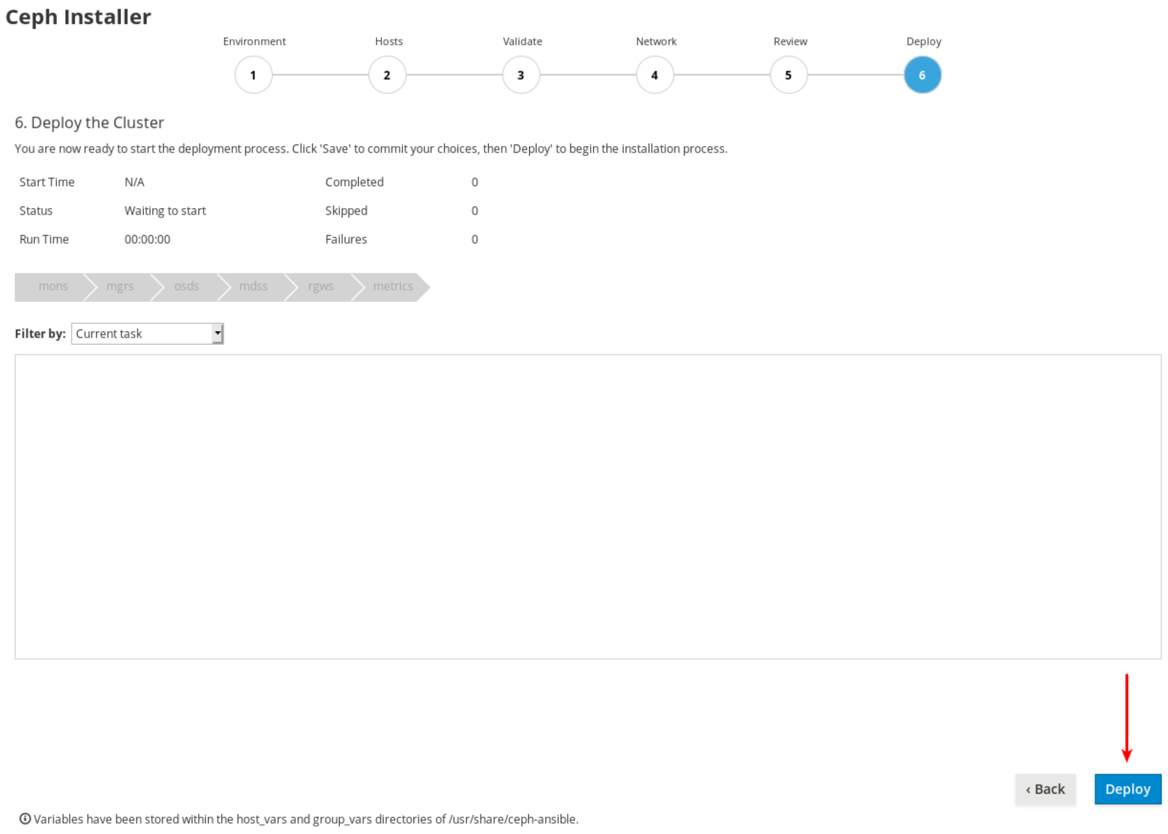
Filter by: Current task

When you click 'Save', the Ansible settings will be committed to disk using standard Ansible formats. This allows you to refer to or modify these settings before starting the deployment.

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

3. Secure the default user names and passwords for Grafana and dashboard. Starting with Red Hat Ceph Storage 4.1, you must uncomment or set **dashboard_admin_password** and **grafana_admin_password** in **/usr/share/ceph-ansible/group_vars/all.yml**. Set secure passwords for each. Also set custom user names for **dashboard_admin_user** and **grafana_admin_user**.

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



Ceph Installer

6. Deploy the Cluster

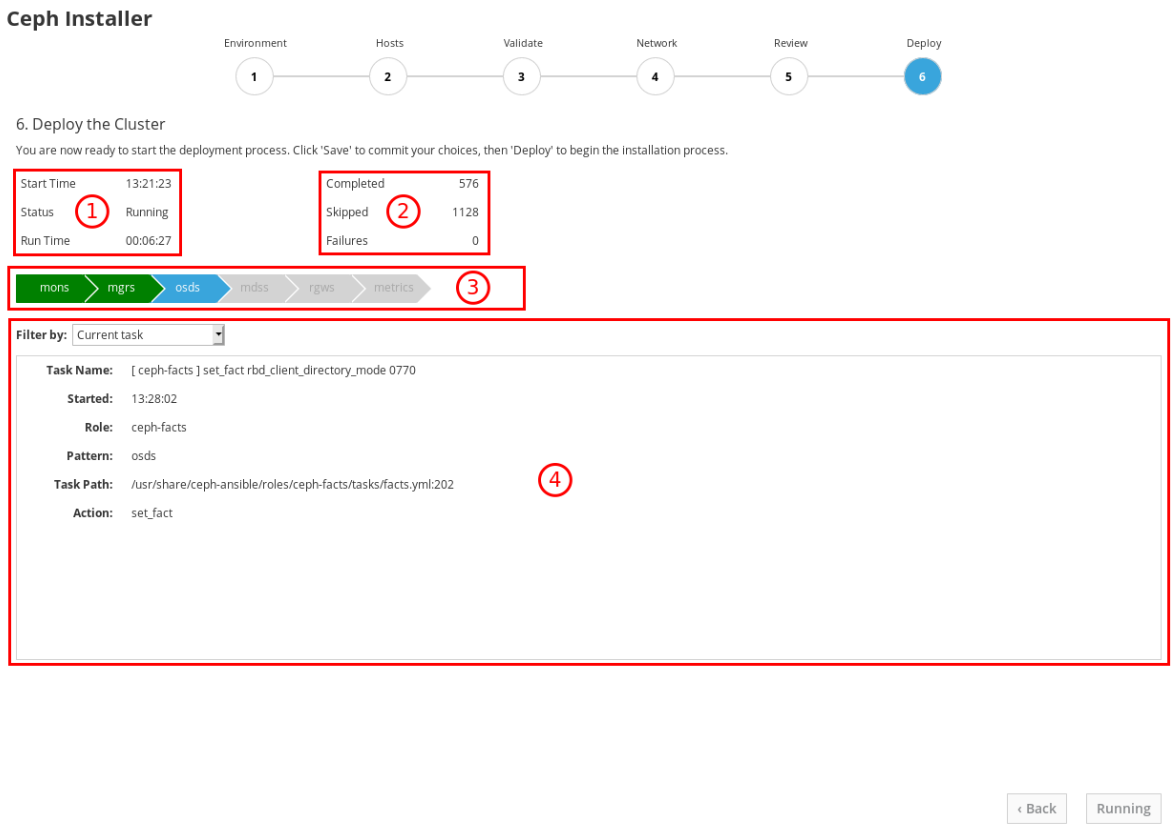
You are now ready to start the deployment process. Click 'Save' to commit your choices, then 'Deploy' to begin the installation process.

Start Time	N/A	Completed	0
Status	Waiting to start	Skipped	0
Run Time	00:00:00	Failures	0

Filter by: Current task

Variables have been stored within the host_vars and group_vars directories of /usr/share/ceph-ansible.

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



6. Deploy the Cluster

You are now ready to start the deployment process. Click 'Save' to commit your choices, then 'Deploy' to begin the installation process.

Start Time	13:21:23
Status	Running
Run Time	00:06:27

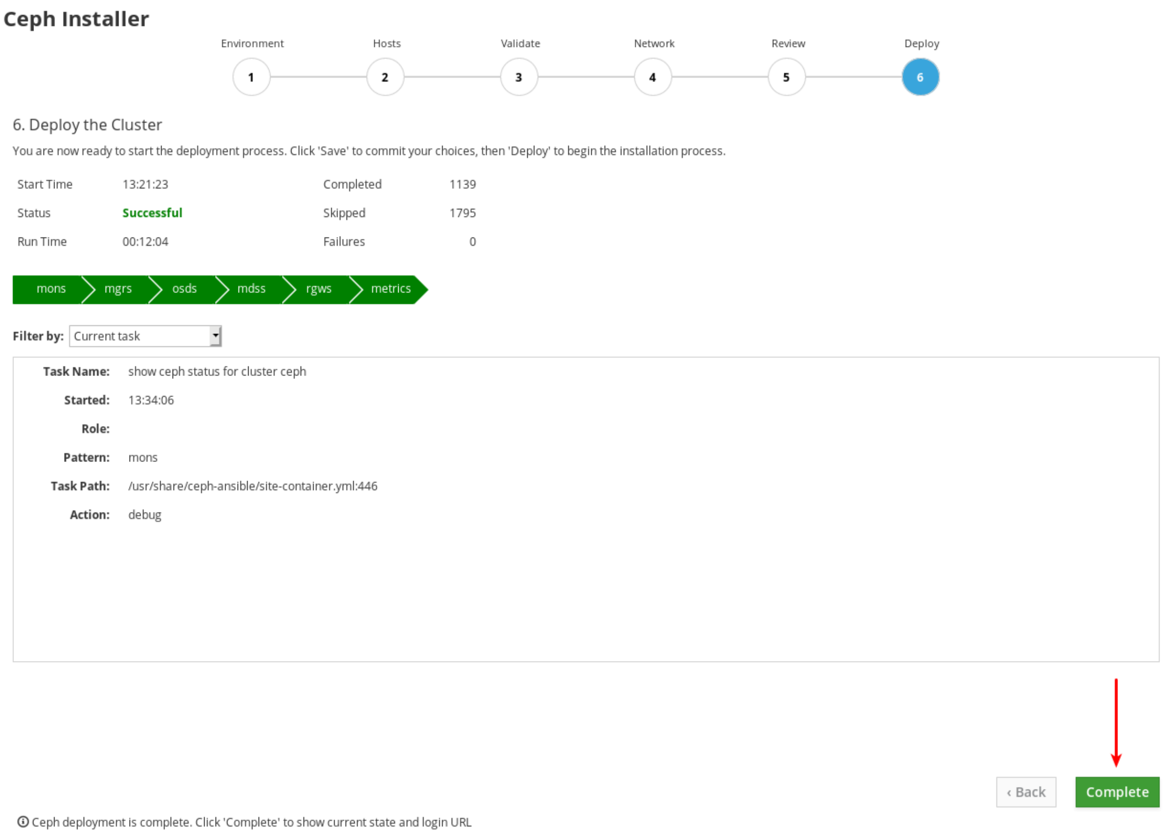
Completed	576
Skipped	1128
Failures	0

Filter by: Current task

Task Name:	[ceph-facts] set_fact rbd_client_directory_mode 0770
Started:	13:28:02
Role:	ceph-facts
Pattern:	osds
Task Path:	/usr/share/ceph-ansible/roles/ceph-facts/tasks/facts.yml:202
Action:	set_fact

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

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



6. Deploy the Cluster

You are now ready to start the deployment process. Click 'Save' to commit your choices, then 'Deploy' to begin the installation process.

Start Time	13:21:23	Completed	1139
Status	**Successful**	Skipped	1795
Run Time	00:12:04	Failures	0

Filter by: Current task

Task Name: show ceph status for cluster ceph

Started: 13:34:06

Role:

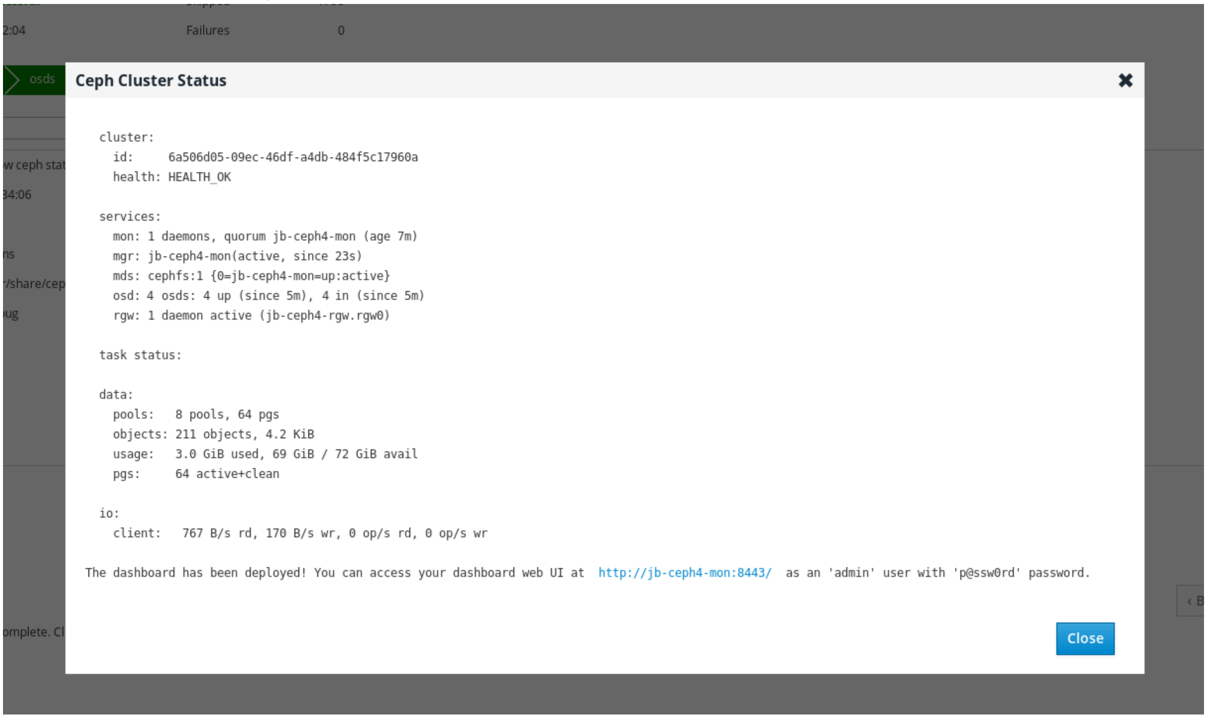
Pattern: mons

Task Path: /usr/share/ceph-ansible/site-container.yml:446

Action: debug

Ceph deployment is complete. Click 'Complete' to show current state and login URL

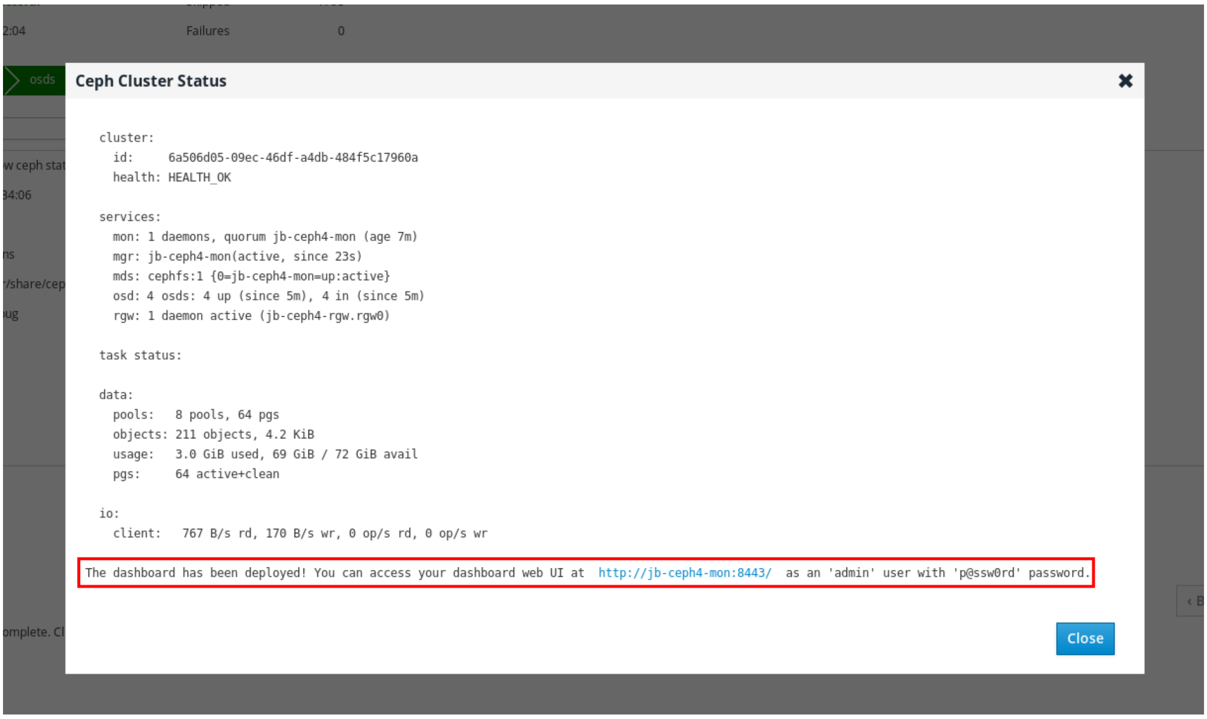
7. Compare cluster status information in the example below with the cluster status information on your cluster. The example shows a healthy cluster, with all OSDs up and in, and all services active. PGs are in the **active+clean** state. If some aspects of your cluster are not the same, refer to the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



Ceph Cluster Status

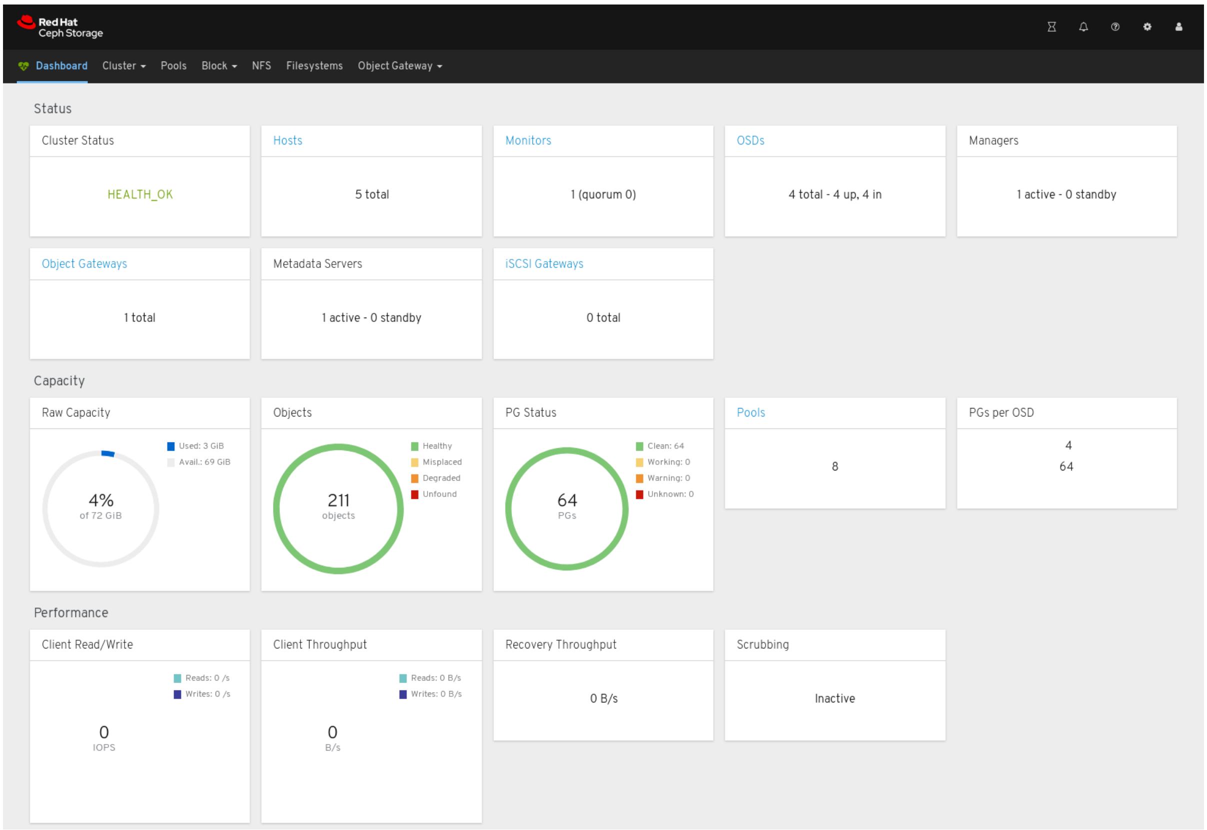
```
cluster:
  id:     6a506d05-09ec-46df-a4db-484f5c17960a
  health: HEALTH_OK

services:
  mon: 1 daemons, quorum jb-ceph4-mon (age 7m)
  mgr: jb-ceph4-mon(active, since 23s)
  mds: cephfs:1 {0=jb-ceph4-mon=up:active}
  osd: 4 osds: 4 up (since 5m), 4 in (since 5m)
  rgw: 1 daemon active (jb-ceph4-rgw.rgw0)

task status:

data:
  pools:   8 pools, 64 pgs
  objects: 211 objects, 4.2 KiB
  usage:   3.0 GiB used, 69 GiB / 72 GiB avail
  pgs:     64 active+clean

io:
  client:   767 B/s rd, 170 B/s wr, 0 op/s rd, 0 op/s wr

The dashboard has been deployed! You can access your dashboard web UI at  http://jb-ceph4-mon:8443/  as an 'admin' user with 'p@ssw0rd' password.
```

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



```
cluster:
  id:     6a506d05-09ec-46df-a4db-484f5c17960a
  health: HEALTH_OK

services:
  mon: 1 daemons, quorum jb-ceph4-mon (age 7m)
  mgr: jb-ceph4-mon(active, since 23s)
  mds: cephfs:1 {0=jb-ceph4-mon=up:active}
  osd: 4 osds: 4 up (since 5m), 4 in (since 5m)
  rgw: 1 daemon active (jb-ceph4-rgw.rgw0)

task status:

data:
  pools:   8 pools, 64 pgs
  objects: 211 objects, 4.2 KiB
  usage:   3.0 GiB used, 69 GiB / 72 GiB avail
  pgs:     64 active+clean

io:
  client:   767 B/s rd, 170 B/s wr, 0 op/s rd, 0 op/s wr

The dashboard has been deployed! You can access your dashboard web UI at  http://jb-ceph4-mon:8443/  as an 'admin' user with 'p@ssw0rd' password.
```

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



Status

Cluster Status: HEALTH_OK
Hosts: 5 total
Monitors: 1 (quorum 0)
OSDs: 4 total - 4 up, 4 in
Managers: 1 active - 0 standby
Object Gateways: 1 total
Metadata Servers: 1 active - 0 standby
iSCSI Gateways: 0 total

Capacity

Raw Capacity: 4% of 72 GiB (Used: 3 GiB, Avail.: 69 GiB)
Objects: 211 objects (Healthy, Misplaced, Degraded, Unfound)
PG Status: 64 PGs (Clean: 64, Working: 0, Warning: 0, Unknown: 0)
Pools: 8
PGs per OSD: 4 64

Performance

Client Read/Write: 0 IOPS (Reads: 0 /s, Writes: 0 /s)
Client Throughput: 0 B/s (Reads: 0 B/s, Writes: 0 B/s)
Recovery Throughput: 0 B/s
Scrubbing: Inactive

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

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

CHAPTER 5. INSTALLING RED HAT CEPH STORAGE USING ANSIBLE

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

- To install a Red Hat Ceph Storage cluster, see Section 5.2, "Installing a Red Hat Ceph Storage cluster".
- To install Metadata Servers, see Section 5.4, "Installing Metadata servers" .
- To install the **ceph-client** role, see Section 5.5, "Installing the Ceph Client Role" .
- To install the Ceph Object Gateway, see Section 5.6, "Installing the Ceph Object Gateway" .
- To configure a multisite Ceph Object Gateway, see Section 5.7, "Configuring multisite Ceph Object Gateways".
- To learn about the Ansible **--limit** option, see Section 5.10, "Understanding the **limit** option".

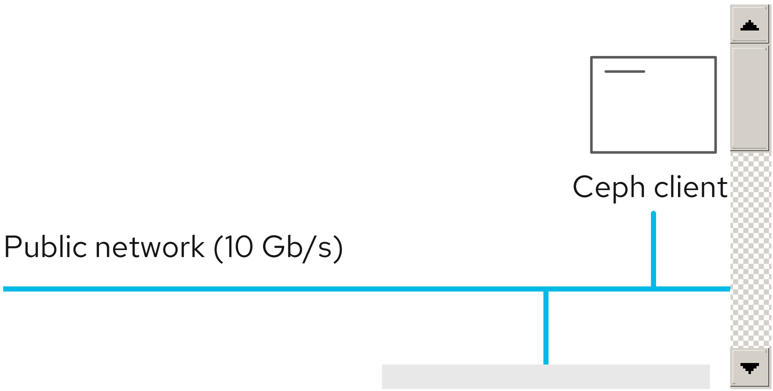
5.1. PREREQUISITES

- Obtain a valid customer subscription.
- Prepare the cluster nodes, by doing the following on each node:
  - Register the node to the Content Delivery Network (CDN) and attach subscriptions .
  - Enable the appropriate software repositories .
  - Create an Ansible user .
  - Enable passwordless SSH access .
  - Optionally, configure a firewall .

5.2. INSTALLING A RED HAT CEPH STORAGE CLUSTER

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

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



IMPORTANT

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

IMPORTANT

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

Prerequisites

- A valid customer subscription.
- Root-level access to the Ansible administration node.
- The **ansible** user account for use with the Ansible application.
- Enable Red Hat Ceph Storage Tools and Ansible repositories
- For **ISO** installation, download the latest ISO image on the Ansible node. See the section *For ISO Installations* in *Enabling the Red Hat Ceph Storage repositories* chapter in the *Red Hat Ceph Storage Installation Guide*.

Procedure

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

   Red Hat Enterprise Linux 7

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

   Red Hat Enterprise Linux 8

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

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

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

4. Create new **yml** files:

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

   a. **Bare-metal** deployments:

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

   b. **Container** deployments:

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

5. Edit the new files.

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

IMPORTANT

Using a custom storage cluster name is not supported. Do not set the **cluster** parameter to any value other than **ceph**. Using a custom storage cluster name is only supported with Ceph clients, such as: **librados**, the Ceph Object Gateway, and RADOS block device mirroring.

WARNING

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

NOTE

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

NOTE

Red Hat recommends leaving the **dashboard_enabled** option set to **True** in the **group_vars/all.yml** file, and not changing it to **False**. If you want to disable the dashboard, see Disabling the Ceph Dashboard.

NOTE

Dashboard related components are containerized. Therefore, for **Bare-metal** or **Container** deployment, **ceph_docker_registry_username** and **ceph_docker_registry_password** parameters have to be included so that ceph-ansible can fetch container images required for the dashboard.

NOTE

If you do not have a Red Hat Registry Service Account, create one using the Registry Service Account webpage. See the *Red Hat Container Registry Authentication* Knowledgebase article for details on how to create and manage tokens.

NOTE

In addition to using a Service Account for the **ceph_docker_registry_username** and **ceph_docker_registry_password** parameters, you can also use your Customer Portal credentials, but to ensure security, encrypt the **ceph_docker_registry_password** parameter. For more information, see Encrypting Ansible password variables with ansible-vault.

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

```
fetch_directory: ~/ceph-ansible-keys
ceph_origin: repository
ceph_repository: rhcs
ceph_repository_type: cdn
ceph_rhcs_version: 4
monitor_interface: eth0 ❶
public_network: 192.168.0.0/24
ceph_docker_registry: registry.redhat.io
ceph_docker_registry_auth: true
ceph_docker_registry_username: SERVICE_ACCOUNT_USER_NAME
ceph_docker_registry_password: TOKEN
dashboard_admin_user:
dashboard_admin_password:
node_exporter_container_image: registry.redhat.io/openshift4/ose-prometheus-node-exporter:v4.6
grafana_admin_user:
grafana_admin_password:
grafana_container_image: registry.redhat.io/rhceph/rhceph-4-dashboard-rhel8
prometheus_container_image: registry.redhat.io/openshift4/ose-prometheus:v4.6
alertmanager_container_image: registry.redhat.io/openshift4/ose-prometheus-alertmanager:v4.6
```

❶ This is the interface on the public network.

IMPORTANT

Starting with Red Hat Ceph Storage 4.1, you must uncomment or set **dashboard_admin_password** and **grafana_admin_password** in **/usr/share/ceph-ansible/group_vars/all.yml**. Set secure passwords for each. Also set custom user names for **dashboard_admin_user** and **grafana_admin_user**.

NOTE

For Red Hat Ceph Storage 4.2, if you have used local registry for installation, use 4.6 for Prometheus image tags.

ii. **Bare-metal** example of the **all.yml** file for **ISO** installation:

```
fetch_directory: ~/ceph-ansible-keys
ceph_origin: repository
ceph_repository: rhcs
ceph_repository_type: iso
ceph_rhcs_iso_path: /home/rhceph-4-rhel-8-x86_64.iso
ceph_rhcs_version: 4
monitor_interface: eth0 1
public_network: 192.168.0.0/24
ceph_docker_registry: registry.redhat.io
ceph_docker_registry_auth: true
ceph_docker_registry_username: SERVICE_ACCOUNT_USER_NAME
ceph_docker_registry_password: TOKEN
dashboard_admin_user:
dashboard_admin_password:
node_exporter_container_image: registry.redhat.io/openshift4/ose-prometheus-
node-exporter:v4.6
grafana_admin_user:
grafana_admin_password:
grafana_container_image: registry.redhat.io/rhceph/rhceph-4-dashboard-rhel8
prometheus_container_image: registry.redhat.io/openshift4/ose-prometheus:v4.6
alertmanager_container_image: registry.redhat.io/openshift4/ose-prometheus-
alertmanager:v4.6
```

1 This is the interface on the public network.

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

```
fetch_directory: ~/ceph-ansible-keys
monitor_interface: eth0 1
public_network: 192.168.0.0/24
ceph_docker_image: rhceph/rhceph-4-rhel8
ceph_docker_image_tag: latest
containerized_deployment: true
ceph_docker_registry: registry.redhat.io
ceph_docker_registry_auth: true
ceph_docker_registry_username: SERVICE_ACCOUNT_USER_NAME
ceph_docker_registry_password: TOKEN
ceph_origin: repository
ceph_repository: rhcs
```

```
ceph_repository_type: cdn
ceph_rhcs_version: 4
dashboard_admin_user:
dashboard_admin_password:
node_exporter_container_image: registry.redhat.io/openshift4/ose-prometheus-
node-exporter:v4.6
grafana_admin_user:
grafana_admin_password:
grafana_container_image: registry.redhat.io/rhceph/rhceph-4-dashboard-rhel8
prometheus_container_image: registry.redhat.io/openshift4/ose-prometheus:v4.6
alertmanager_container_image: registry.redhat.io/openshift4/ose-prometheus-
alertmanager:v4.6
```

1 This is the interface on the public network.

IMPORTANT

Look up the latest container images tags on the *Red Hat Ecosystem Catalog* to install the latest container images with all the latest patches applied.

iv. **Containers** example of the **all.yml** file, when the Red Hat Ceph Storage nodes do NOT have access to the Internet during deployment:

```
fetch_directory: ~/ceph-ansible-keys
monitor_interface: eth0 1
public_network: 192.168.0.0/24
ceph_docker_image: rhceph/rhceph-4-rhel8
ceph_docker_image_tag: latest
containerized_deployment: true
ceph_docker_registry: LOCAL_NODE_FQDN:5000
ceph_docker_registry_auth: false
ceph_origin: repository
ceph_repository: rhcs
ceph_repository_type: cdn
ceph_rhcs_version: 4
dashboard_admin_user:
dashboard_admin_password:
node_exporter_container_image: LOCAL_NODE_FQDN:5000/openshift4/ose-
prometheus-node-exporter:v4.6
grafana_admin_user:
grafana_admin_password:
grafana_container_image: LOCAL_NODE_FQDN:5000/rhceph/rhceph-4-dashboard-
rhel8
prometheus_container_image: LOCAL_NODE_FQDN:5000/openshift4/ose-
prometheus:4.6
alertmanager_container_image: LOCAL_NODE_FQDN:5000/openshift4/ose-
prometheus-alertmanager:4.6
```

1 This is the interface on the public network.

Replace

- *LOCAL_NODE_FQDN* with your local host FQDN.

v. From Red Hat Ceph Storage 4.2, **dashboard_protocol** is set to **https** and Ansible generates the dashboard and grafana keys and certificates. For custom certificates, in the **all.yml** file, update the path at Ansible installer host for **dashboard_crt**, **dashboard_key**, **grafana_crt**, and **grafana_key** for **bare-metal** or **container** deployment.

Syntax

```
dashboard_protocol: https
dashboard_port: 8443
dashboard_crt: 'DASHBOARD_CERTIFICATE_PATH'
dashboard_key: 'DASHBOARD_KEY_PATH'
dashboard_tls_external: false
dashboard_grafana_api_no_ssl_verify: "{{ True if dashboard_protocol == 'https' and
not grafana_crt and not grafana_key else False }}"
grafana_crt: 'GRAFANA_CERTIFICATE_PATH'
grafana_key: 'GRAFANA_KEY_PATH'
```

b. To install Red Hat Ceph Storage using a container registry reachable with a http or https proxy, set the **ceph_docker_http_proxy** or **ceph_docker_https_proxy** variables in the **group_vars/all.yml** file.

Example

```
ceph_docker_http_proxy: http://192.168.42.100:8080
ceph_docker_https_proxy: https://192.168.42.100:8080
```

If you need to exclude some host for the proxy configuration, use the **ceph_docker_no_proxy** variable in the **group_vars/all.yml** file.

Example

```
ceph_docker_no_proxy: "localhost,127.0.0.1"
```

c. In addition to editing the **all.yml** file for proxy installation of Red Hat Ceph Storage, edit the **/etc/environment** file:

Example

```
HTTP_PROXY: http://192.168.42.100:8080
HTTPS_PROXY: https://192.168.42.100:8080
NO_PROXY: "localhost,127.0.0.1"
```

This triggers the podman to start the containerized services such as prometheus, grafana-server, alertmanager, and node-exporter, and download the required images.

d. For all deployments, **bare-metal** or in **containers**, edit the **group_vars/osds.yml** file.

IMPORTANT

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

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

IMPORTANT

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

i. **Auto discovery**

```
osd_auto_discovery: true
```

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

NOTE

If you later decide to remove the cluster using **purge-docker-cluster.yml** or **purge-cluster.yml**, you must comment out **osd_auto_discovery** and declare the OSD devices in the **osds.yml** file. For more information, see Purging storage clusters deployed by Ansible .

ii. **Simple configuration**

First Scenario

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

or

Second Scenario

```
devices:
  - /dev/sda
  - /dev/sdb
  - /dev/nvme0n1
  - /dev/sdc
  - /dev/sdd
  - /dev/nvme1n1
```

or

Third Scenario

```
lvm_volumes:
  - data: /dev/sdb
  - data: /dev/sdc
```

or

Fourth Scenario

```
lvm_volumes:
   - data: /dev/sdb
   - data:/dev/nvme0n1
```

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

In the first scenario, if the **devices** are traditional hard drives or SSDs, then one OSD per device is created.

In the second scenario, when there is a mix of traditional hard drives and SSDs, the data is placed on the traditional hard drives (**sda**, **sdb**) and the BlueStore database is created as large as possible on the SSD (**nvme0n1**). Similarly, the data is placed on the traditional hard drives (**sdc**, **sdd**), and the BlueStore database is created on the SSD **nvme1n1** irrespective of the order of devices mentioned.

NOTE

By default **ceph-ansible** does not override the default values of **bluestore_block_db_size** and **bluestore_block_wal_size**. You can set **bluestore_block_db_size** using **ceph_conf_overrides** in the **group_vars/all.yml** file. The value of **bluestore_block_db_size** should be greater than 2 GB.

In the third scenario, data is placed on the traditional hard drives (**sdb**, **sdc**), and the BlueStore database is collocated on the same devices.

In the fourth scenario, data is placed on the traditional hard drive (**sdb**) and on the SSD (**nvme1n1**), and the BlueStore database is collocated on the same devices. This is different from using the **devices** directive, where the BlueStore database is placed on the SSD.

IMPORTANT

The **ceph-volume lvm batch mode** command creates the optimized OSD configuration by placing data on the traditional hard drives and the BlueStore database on the SSD. If you want to specify the logical volumes and volume groups to use, you can create them directly by following the *Advanced configuration* scenarios below.

iii. **Advanced configuration**

First Scenario

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

or

Second Scenario

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

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

In the second scenario, another additional dictionary, **bluestore_wal_devices**, is used to isolate the write-ahead log on NVMe devices **nvme0n1** and **nvme0n2**. Using the **devices**, **dedicated_devices**, and **bluestore_wal_devices,** options together, this allows you to isolate all components of an OSD onto separate devices. Laying out the OSDs like this can increase overall performance.

iv. **Pre-created logical volumes**

First Scenario

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

or

Second Scenario

```
lvm_volumes:
  - data: /dev/sdb
    db:    db-lv1
```

```
db_vg: db-vg1
wal: wal-lv1
wal_vg: wal-vg1
```

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

In the first scenario, the data is placed on dedicated logical volumes, database, and WAL. You can also specify just data, data and WAL, or data and database. The **data:** line must specify the logical volume name where data is to be stored, and **data_vg:** must specify the name of the volume group the data logical volume is contained in. Similarly, **db:** is used to specify the logical volume the database is stored on and **db_vg:** is used to specify the volume group its logical volume is in. The **wal:** line specifies the logical volume the WAL is stored on and the **wal_vg:** line specifies the volume group that contains it.

In the second scenario, the actual device name is set for the **data:** option, and doing so, does not require specifying the **data_vg:** option. You must specify the logical volume name and the volume group details for the BlueStore database and WAL devices.

IMPORTANT

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

NOTE

If using all NVMe SSDs, then set **osds_per_device: 2**. For more information, see *Configuring OSD Ansible settings for all NVMe Storage* in the *Red Hat Ceph Storage Installation Guide*.

NOTE

After rebooting a Ceph OSD node, there is a possibility that the block device assignments will change. For example, **sdc** might become **sdd**. You can use persistent naming devices, such as the **/dev/disk/by-path/** device path, instead of the traditional block device name.

6. For all deployments, **bare-metal** or in **containers**, create the Ansible inventory file and then open it for editing:

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

Edit the **hosts** file accordingly.

NOTE

For information about editing the Ansible inventory location, see *Configuring Ansible inventory location*.

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

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

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

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

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

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

NOTE

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

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

NOTE

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

d. Optionally, in **container** deployments, colocate Ceph Monitor daemons with the Ceph OSD daemons on one node by adding the same node under the **[mon]** and **[osd]** sections. In the *Additional Resources* section below, see the link on colocating Ceph daemons for more information.

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

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

7. Optionally, if you want to use host specific parameters, for all deployments, **bare-metal** or in **containers**, create the **host_vars** directory with host files to include any parameters specific to hosts.

Create the **host_vars** directory

a. Create the **host_vars** directory:

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

b. Change to the **host_vars** directory:

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

c. Create the host files. Use the *host-name-short-name* format for the name of the files, for example:

```
[ansible@admin host_vars]$ touch tower-osd6
```

d. Update the file with any host specific parameters, for example:

i. In **bare-metal** deployments use the **devices** parameter to specify devices that the OSD nodes will use. Using **devices** is useful when OSDs use devices with different names or when one of the devices failed on one of the OSDs.

```
devices:
  DEVICE_1
  DEVICE_2
```

Example

```
devices:
  /dev/sdb
  /dev/sdc
```

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

8. Optionally, for all deployments, **bare-metal** or in **containers**, you can create a custom CRUSH hierarchy using Ceph Ansible:

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

Syntax

```
[osds]
CEPH_OSD_NAME osd_crush_location="{ 'root': ROOT_BUCKET_', 'rack':
'RACK_BUCKET', 'pod': 'POD_BUCKET', 'host': 'CEPH_HOST_NAME' }"
```

Example

```
[osds]
ceph-osd-01 osd_crush_location="{ 'root': 'default', 'rack': 'rack1', 'pod': 'monpod', 'host':
'ceph-osd-01' }"
```

b. Edit the **group_vars/osds.yml** file, and set the **crush_rule_config** and **create_crush_tree** parameters to **True**. Create at least one CRUSH rule if you do not want to use the default CRUSH rules, for example:

```
crush_rule_config: True
crush_rule_hdd:
    name: replicated_hdd_rule
    root: root-hdd
    type: host
    class: hdd
    default: True
crush_rules:
  - "{{ crush_rule_hdd }}"
create_crush_tree: True
```

If you are using faster SSD devices, then edit the parameters as follows:

```
crush_rule_config: True
crush_rule_ssd:
    name: replicated_ssd_rule
    root: root-ssd
    type: host
    class: ssd
    default: True
crush_rules:
  - "{{ crush_rule_ssd }}"
create_crush_tree: True
```

NOTE

The default CRUSH rules fail if both **ssd** and **hdd** OSDs are not deployed because the default rules now include the **class** parameter, which must be defined.

c. Create **pools**, with created **crush_rules** in **group_vars/clients.yml** file:

Example

```
copy_admin_key: True
user_config: True
pool1:
  name: "pool1"
  pg_num: 128
  pgp_num: 128
  rule_name: "HDD"
  type: "replicated"
  device_class: "hdd"
pools:
  - "{{ pool1 }}"
```

d. View the tree:

```
[root@mon ~]# ceph osd tree
```

e. Validate the pools:

```
[root@mon ~]# for i in $(rados lspools); do echo "pool: $i"; ceph osd pool get $i
crush_rule; done

pool: pool1
crush_rule: HDD
```

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

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

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

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

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

c. Verify that Ansible can reach the Ceph nodes:

```
[ansible@admin ceph-ansible]$ ansible all -m ping -i hosts
```

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

a. **Bare-metal** deployments:

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

b. **Container** deployments:

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

NOTE

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

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

NOTE

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

11. Wait for the Ceph deployment to finish.
    Example output

```
INSTALLER STATUS *******************************
Install Ceph Monitor           : Complete (0:00:30)
Install Ceph Manager           : Complete (0:00:47)
Install Ceph OSD               : Complete (0:00:58)
Install Ceph RGW               : Complete (0:00:34)
Install Ceph Dashboard         : Complete (0:00:58)
Install Ceph Grafana           : Complete (0:00:50)
Install Ceph Node Exporter     : Complete (0:01:14)
```

12. Verify the status of the Ceph storage cluster.

    a. **Bare-metal** deployments:

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

    b. **Container** deployments:

Red Hat Enterprise Linux 7

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

Red Hat Enterprise Linux 8

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

Replace

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

Example

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

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

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

Syntax

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

Example

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

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

Syntax

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

Example

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

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

Syntax

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

Example

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

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

Syntax

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

Example

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

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

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

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

Additional Resources

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

5.3. CONFIGURING OSD ANSIBLE SETTINGS FOR ALL NVME STORAGE

To increase overall performance, you can configure Ansible to use only non-volatile memory express (NVMe) devices for storage. Normally only one OSD is configured per device, which underutilizes the throughput potential of an NVMe device.

NOTE

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

NOTE

In testing, configuring two OSDs on each NVMe device was found to provide optimal performance. Red Hat recommends setting the **osds_per_device** option to **2**, but it is not required. Other values might provide better performance in your environment.

Prerequisites

- Access to an Ansible administration node.
- Installation of the **ceph-ansible** package.

Procedure

1. Set **osds_per_device: 2** in **group_vars/osds.yml**:

```
osds_per_device: 2
```

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

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

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

```
osds_per_device: 2
devices:
  - /dev/nvme0n1
  - /dev/nvme1n1
  - /dev/nvme2n1
  - /dev/nvme3n1
```

NOTE

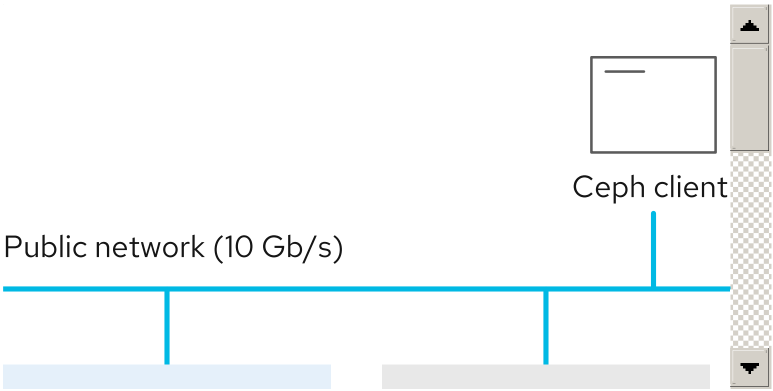
You must use **devices** with this configuration, not **lvm_volumes**. This is because **lvm_volumes** is generally used with pre-created logical volumes and **osds_per_device** implies automatic logical volume creation by Ceph.

Additional Resources

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

5.4. INSTALLING METADATA SERVERS

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



Prerequisites

- A working Red Hat Ceph Storage cluster.
- Enable passwordless SSH access .

Procedure

Perform the following steps on the Ansible administration node.

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

   ```
   [mdss]
   MDS_NODE_NAME1
   MDS_NODE_NAME2
   MDS_NODE_NAME3
   ```

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

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

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

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

3. Optionally, you can change the default variables.

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

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

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

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

   - **Bare-metal** deployments:

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

   - **Container** deployments:

     ```
     [ansible@admin ceph-ansible]$ ansible-playbook site-container.yml --limit mdss -i hosts
     ```

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

Additional Resources

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

5.5. INSTALLING THE CEPH CLIENT ROLE

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

Prerequisites

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

Procedure

Perform the following tasks on the Ansible administration node.

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

   ```
   [clients]
   CLIENT_NODE_NAME
   ```

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

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

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

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

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

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

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

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

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

   Now the whole line example would look similar to this:

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

   NOTE

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

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

   a. Update **clients.yml**.

      - Uncomment the **user_config** setting and set it to **true**.

      - Uncomment the **pools** and **keys** sections and update them as required. You can define custom pools and client names altogether with the **cephx** capabilities.

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

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

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

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

   a. **Bare-metal** deployments:

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

   b. **Container** deployments:

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

Additional Resources

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

5.6. INSTALLING THE CEPH OBJECT GATEWAY

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

Prerequisites

- A running Red Hat Ceph Storage cluster, preferably in the **active + clean** state.
- Enable passwordless SSH access .
- On the Ceph Object Gateway node, perform the tasks listed in Chapter 3, *Requirements for Installing Red Hat Ceph Storage*.

> **WARNING**
>
> If you intend to use Ceph Object Gateway in a multisite configuration, only complete steps 1 - 6. Do not run the Ansible playbook before configuring multisite as this will start the Object Gateway in a single site configuration. Ansible cannot reconfigure the gateway to a multisite setup after it has already been started in a single site configuration. After you complete steps 1 - 6, proceed to the Configuring multisite Ceph Object Gateways section to set up multisite.

Procedure

Perform the following tasks on the Ansible administration node.

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

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

2. Navigate to the Ansible configuration directory:

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

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

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

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

```
copy_admin_key: true
```

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

```
radosgw_interface: <interface>
```

   Replace:

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

   For example:

```
radosgw_interface: eth0
```

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

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

6. Generally, to change default settings, uncomment the settings in the **rgws.yml** file, and make changes accordingly. To make additional changes to settings that are not in the **rgws.yml** file, use **ceph_conf_overrides:** in the **all.yml** file.

```
ceph_conf_overrides:
  client.rgw.rgw1:
   rgw_override_bucket_index_max_shards: 16
   rgw_bucket_default_quota_max_objects: 1638400
```

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

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

7. Run the Ansible playbook:

   WARNING

   Do not run the Ansible playbook if you intend to set up multisite. Proceed to the Configuring multisite Ceph Object Gateways section to set up multisite.

   a. **Bare-metal** deployments:

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

b. **Container** deployments:

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

> NOTE
>
> Ansible ensures that each Ceph Object Gateway is running.

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

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

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

Additional Resources

- See *Understanding the **limit** option* for details.
- The Red Hat Ceph Storage 4 *Object Gateway Guide*

5.7. CONFIGURING MULTISITE CEPH OBJECT GATEWAYS

As a system administrator, you can configure multisite Ceph Object Gateways to mirror data across clusters for disaster recovery purposes.

You can configure multisite with one or more RGW realms. A realm allows the RGWs inside of it to be independent and isolated from RGWs outside of the realm. This way, data written to an RGW in one realm cannot be accessed by an RGW in another realm.

> WARNING
>
> Ceph-ansible cannot reconfigure gateways to a multisite setup after they have already been used in single site configurations. You can deploy this configuration manually. Contact *Red hat Support* for assistance.

> NOTE
>
> From Red Hat Ceph Storage 4.1, you do not need to set the value of **rgw_multisite_endpoints_list** in **group_vars/all.yml** file.

See the *Multisite* section in the *Red Hat Ceph Storage Object Gateway Configuration and Administration Guide* for more information.

5.7.1. Prerequisites

- Two Red Hat Ceph Storage clusters.
- On the Ceph Object Gateway nodes, perform the tasks listed in the *Requirements for Installing Red Hat Ceph Storage* section in the *Red Hat Ceph Storage Installation Guide*.
- For each Object Gateway node, perform steps 1 - 6 in *Installing the Ceph Object Gateway* section in the *Red Hat Ceph Storage Installation Guide*.

5.7.2. Configuring a multi-site Ceph Object Gateway with one realm

Ceph-ansible configures Ceph Object Gateways to mirror data in one realm across multiple storage clusters with multiple Ceph Object Gateway instances.

> **WARNING**
>
> Ceph-ansible cannot reconfigure gateways to a multisite setup after they have already been used in single site configurations. You can deploy this configuration manually. Contact *Red hat Support* for assistance.

Prerequisites

- Two running Red Hat Ceph Storage clusters.
- On the Ceph Object Gateway nodes, perform the tasks listed in the *Requirements for Installing Red Hat Ceph Storage* section in the *Red Hat Ceph Storage Installation Guide*.
- For each Object Gateway node, perform steps 1 - 6 in *Installing the Ceph Object Gateway* . section in the *Red Hat Ceph Storage Installation Guide*.

Procedure

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

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

Primary storage cluster

a. Navigate to the Ceph-ansible configuration directory:

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

b. Open and edit the **group_vars/all.yml** file. Uncomment the **rgw_multisite** line and set it to **true**. Uncomment the **rgw_multisite_proto** parameter.

```
rgw_multisite: true
rgw_multisite_proto: "http"
```

c. Create a **host_vars** directory in **/usr/share/ceph-ansible**:

```
[root@ansible ceph-ansible]# mkdir host_vars
```

d. Create a file in **host_vars** for each of the Object Gateway nodes on the primary storage cluster. The file name should be the same name as used in the Ansible inventory file. For example, if the Object Gateway node is named **rgw-primary**, create the file **host_vars/rgw-primary**.

Syntax

```
touch host_vars/NODE_NAME
```

Example

```
[root@ansible ceph-ansible]# touch host_vars/rgw-primary
```

> **NOTE**
>
> If there are multiple Ceph Object Gateway nodes in the cluster used for the multi-site configuration, then create separate files for each of the nodes.

e. Edit the files and add the configuration details for all the instances on the respective Object Gateway nodes. Configure the following settings, along with updating the *ZONE_NAME*, *ZONE_GROUP_NAME*, *ZONE_USER_NAME*, *ZONE_DISPLAY_NAME*, and *REALM_NAME* accordingly. Use the random strings saved in the **multi-site-keys.txt** file for *ACCESS_KEY* and *SECRET_KEY*.

Syntax

```
rgw_instances:
  - instance_name: 'INSTANCE_NAME'
    rgw_multisite: true
    rgw_zonemaster: true
    rgw_zonesecondary: false
    rgw_zonegroupmaster: true
    rgw_zone: ZONE_NAME_1
    rgw_zonegroup: ZONE_GROUP_NAME_1
    rgw_realm: REALM_NAME_1
    rgw_zone_user: ZONE_USER_NAME_1
    rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_1"
    system_access_key: ACCESS_KEY_1
    system_secret_key: SECRET_KEY_1
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: RGW_PRIMARY_PORT_NUMBER_1
```

Example

```
rgw_instances:
  - instance_name: 'rgw0'
    rgw_multisite: true
    rgw_zonemaster: true
    rgw_zonesecondary: false
    rgw_zonegroupmaster: true
    rgw_zone: paris
    rgw_zonegroup: idf
    rgw_realm: france
    rgw_zone_user: jacques.chirac
    rgw_zone_user_display_name: "Jacques Chirac"
    system_access_key: P9Eb6S8XNyo4dtZZUUMy
    system_secret_key: qqHCUtfdNnpHq3PZRHW5un9l0bEBM812Uhow0XfB
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: 8080
```

f. Optional: For creating multiple instances, edit the files and add the configuration details to all the instances on the respective Object Gateway nodes. Configure the following settings along with updating the items under **rgw_instances**. Use the random strings saved in the **multi-site-keys-realm-1.txt** file for *ACCESS_KEY_1* and *SECRET_KEY_1*.

Syntax

```
rgw_instances:
  - instance_name: 'INSTANCE_NAME_1'
    rgw_multisite: true
    rgw_zonemaster: true
    rgw_zonesecondary: false
    rgw_zonegroupmaster: true
    rgw_zone: ZONE_NAME_1
    rgw_zonegroup: ZONE_GROUP_NAME_1
    rgw_realm: REALM_NAME_1
    rgw_zone_user: ZONE_USER_NAME_1
    rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_1"
    system_access_key: ACCESS_KEY_1
    system_secret_key: SECRET_KEY_1
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: PORT_NUMBER_1
  - instance_name: 'INSTANCE_NAME_2'
    rgw_multisite: true
    rgw_zonemaster: true
    rgw_zonesecondary: false
    rgw_zonegroupmaster: true
    rgw_zone: ZONE_NAME_1
    rgw_zonegroup: ZONE_GROUP_NAME_1
    rgw_realm: REALM_NAME_1
    rgw_zone_user: ZONE_USER_NAME_1
    rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_1"
    system_access_key: ACCESS_KEY_1
    system_secret_key: SECRET_KEY_1
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: PORT_NUMBER_2
```

Example

```
rgw_instances:
  - instance_name: 'rgw0'
    rgw_multisite: true
    rgw_zonemaster: true
    rgw_zonesecondary: false
    rgw_zonegroupmaster: true
    rgw_zone: paris
    rgw_zonegroup: idf
    rgw_realm: france
    rgw_zone_user: jacques.chirac
    rgw_zone_user_display_name: "Jacques Chirac"
    system_access_key: P9Eb6S8XNyo4dtZZUUMy
    system_secret_key: qqHCUtfdNnpHq3PZRHW5un9l0bEBM812Uhow0XfB
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: 8080
  - instance_name: 'rgw1'
    rgw_multisite: true
    rgw_zonemaster: true
    rgw_zonesecondary: false
    rgw_zonegroupmaster: true
    rgw_zone: paris
    rgw_zonegroup: idf
    rgw_realm: france
    rgw_zone_user: jacques.chirac
    rgw_zone_user_display_name: "Jacques Chirac"
    system_access_key: P9Eb6S8XNyo4dtZZUUMy
    system_secret_key: qqHCUtfdNnpHq3PZRHW5un9l0bEBM812Uhow0XfB
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: 8081
```

Secondary storage cluster

a. Navigate to the Ceph-ansible configuration directory:

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

b. Open and edit the **group_vars/all.yml** file. Uncomment the **rgw_multisite** line and set it to **true**. Uncomment the **rgw_multisite_proto** parameter.

```
rgw_multisite: true
rgw_multisite_proto: "http"
```

c. Create a **host_vars** directory in **/usr/share/ceph-ansible**:

```
[root@ansible ceph-ansible]# mkdir host_vars
```

d. Create a file in **host_vars** for each of the Object Gateway nodes on the secondary storage cluster. The file name should be the same name as used in the Ansible inventory file. For example, if the Object Gateway node is named **rgw-secondary**, create the file **host_vars/rgw-secondary**.

Syntax

```
touch host_vars/NODE_NAME
```

Example

```
[root@ansible ceph-ansible]# touch host_vars/rgw-secondary
```

> NOTE
>
> If there are multiple Ceph Object Gateway nodes in the cluster used for the multi-site configuration, then create files for each of the nodes.

e. Configure the following settings. Use the same values as used on the first cluster for *ZONE_USER_NAME*, *ZONE_DISPLAY_NAME*, *ACCESS_KEY*, *SECRET_KEY*, *REALM_NAME*, and *ZONE_GROUP_NAME*. Use a different value for *ZONE_NAME* from the primary storage cluster. Set *MASTER_RGW_NODE_NAME* to the Ceph Object Gateway node for the master zone. Note that, compared to the primary storage cluster, the settings for **rgw_zonemaster**, **rgw_zonesecondary**, and **rgw_zonegroupmaster** are reversed.

Syntax

```
rgw_instances:
  - instance_name: 'INSTANCE_NAME_1'
    rgw_multisite: true
    rgw_zonemaster: false
    rgw_zonesecondary: true
    rgw_zonegroupmaster: false
    rgw_zone: ZONE_NAME_2
    rgw_zonegroup: ZONE_GROUP_NAME_1
    rgw_realm: REALM_NAME_1
    rgw_zone_user: ZONE_USER_NAME_1
    rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_1"
    system_access_key: ACCESS_KEY_1
    system_secret_key: SECRET_KEY_1
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: PORT_NUMBER_1
    endpoint:
RGW_PRIMARY_HOSTNAME_ENDPOINT:RGW_PRIMARY_PORT_NUMBER_1
```

Example

```
rgw_instances:
  - instance_name: 'rgw0'
    rgw_multisite: true
    rgw_zonemaster: false
    rgw_zonesecondary: true
    rgw_zonegroupmaster: false
    rgw_zone: lyon
    rgw_zonegroup: idf
    rgw_realm: france
    rgw_zone_user: jacques.chirac
    rgw_zone_user_display_name: "Jacques Chirac"
    system_access_key: P9Eb6S8XNyo4dtZZUUMy
    system_secret_key: qqHCUtfdNnpHq3PZRHW5un9l0bEBM812Uhow0XfB
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: 8080
    endpoint: http://rgw-primary:8081
```

f. Optional: For creating multiple instances, edit the files and add the configuration details to all the instances on the respective Object Gateway nodes. Configure the following settings along with updating the items under **rgw_instances**. Use the random strings saved in the **multi-site-**

keys-realm-1.txt file for *ACCESS_KEY_1* and *SECRET_KEY_1*. Set *RGW_PRIMARY_HOSTNAME* to the Object Gateway node in the primary storage cluster.

Syntax

```
rgw_instances:
  - instance_name: 'INSTANCE_NAME_1'
     rgw_multisite: true
     rgw_zonemaster: false
     rgw_zonesecondary: true
     rgw_zonegroupmaster: false
     rgw_zone: ZONE_NAME_2
     rgw_zonegroup: ZONE_GROUP_NAME_1
     rgw_realm: REALM_NAME_1
     rgw_zone_user: ZONE_USER_NAME_1
     rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_1"
     system_access_key: ACCESS_KEY_1
     system_secret_key: SECRET_KEY_1
     radosgw_address: "{{ _radosgw_address }}"
     radosgw_frontend_port: PORT_NUMBER_1
     endpoint: RGW_PRIMARY_HOSTNAME:RGW_PRIMARY_PORT_NUMBER_1
  - instance_name: '_INSTANCE_NAME_2_'
     rgw_multisite: true
     rgw_zonemaster: false
     rgw_zonesecondary: true
     rgw_zonegroupmaster: false
     rgw_zone: ZONE_NAME_2
     rgw_zonegroup: ZONE_GROUP_NAME_1
     rgw_realm: REALM_NAME_1
     rgw_zone_user: ZONE_USER_NAME_1
     rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_1"
     system_access_key: ACCESS_KEY_1
     system_secret_key: SECRET_KEY_1
     radosgw_address: "{{ _radosgw_address }}"
     radosgw_frontend_port:  PORT_NUMBER_1
     endpoint: RGW_PRIMARY_HOSTNAME:RGW_PRIMARY_PORT_NUMBER_2
```

Example

```
rgw_instances:
  - instance_name: 'rgw0'
     rgw_multisite: true
     rgw_zonemaster: false
     rgw_zonesecondary: true
     rgw_zonegroupmaster: false
     rgw_zone: lyon
     rgw_zonegroup: idf
     rgw_realm: france
     rgw_zone_user: jacques.chirac
     rgw_zone_user_display_name: "Jacques Chirac"
     system_access_key: P9Eb6S8XNyo4dtZZUUMy
     system_secret_key: qqHCUtfdNnpHq3PZRHW5un9l0bEBM812Uhow0XfB
     radosgw_address: "{{ _radosgw_address }}"
     radosgw_frontend_port: 8080
     endpoint: http://rgw-primary:8080
```

```
- instance_name: 'rgw1'
  rgw_multisite: true
  rgw_zonemaster: false
  rgw_zonesecondary: true
  rgw_zonegroupmaster: false
  rgw_zone: lyon
  rgw_zonegroup: idf
  rgw_realm: france
  rgw_zone_user: jacques.chirac
  rgw_zone_user_display_name: "Jacques Chirac"
  system_access_key: P9Eb6S8XNyo4dtZZUUMy
  system_secret_key: qqHCUtfdNnpHq3PZRHW5un9l0bEBM812Uhow0XfB
  radosgw_address: "{{ _radosgw_address }}"
  radosgw_frontend_port: 8081
  endpoint: http://rgw-primary:8081
```

On both sites, run the following steps:

1. Run the Ansible playbook on the primary storage cluster:

   - **Bare-metal** deployments:

     ```
     [user@ansible ceph-ansible]$ ansible-playbook site.yml -i hosts
     ```

   - **Container** deployments:

     ```
     [user@ansible ceph-ansible]$ ansible-playbook site-container.yml -i hosts
     ```

2. Verify the secondary storage cluster can access the API on the primary storage cluster.
   From the Object Gateway nodes on the secondary storage cluster, use **curl** or another HTTP client to connect to the API on the primary cluster. Compose the URL using the information used to configure **rgw_pull_proto**, **rgw_pullhost**, and **rgw_pull_port** in **all.yml**. Following the example above, the URL is **http://cluster0-rgw-000:8080**. If you cannot access the API, verify the URL is right and update **all.yml** if required. Once the URL works and any network issues are resolved, continue with the next step to run the Ansible playbook on the secondary storage cluster.

3. Run the Ansible playbook on the secondary storage cluster:

   NOTE

   If the cluster is deployed and you are making changes to the Ceph Object Gateway, then use the **--limit rgws** option.

   - **Bare-metal** deployments:

     ```
     [user@ansible ceph-ansible]$ ansible-playbook site.yml -i hosts
     ```

   - **Container** deployments:

     ```
     [user@ansible ceph-ansible]$ ansible-playbook site-container.yml -i hosts
     ```

After running the Ansible playbook on the primary and secondary storage clusters, the Ceph Object Gateways run in an active-active state.

4. Verify the multisite Ceph Object Gateway configuration on both the sites:

   Syntax

   ```
   radosgw-admin sync status
   ```

5.7.3. Configuring a multi-site Ceph Object Gateway with multiple realms and multiple instances

Ceph-ansible configures Ceph Object Gateways to mirror data in multiple realms across multiple storage clusters with multiple Ceph Object Gateway instances.

> **WARNING**
>
> Ceph-ansible cannot reconfigure gateways to a multi-site setup after they have already been used in single site configurations. You can deploy this configuration manually. Contact *Red hat Support* for assistance.

Prerequisites

- Two running Red Hat Ceph Storage clusters.
- At least two Object Gateway nodes in each storage cluster.
- On the Ceph Object Gateway nodes, perform the tasks listed in the *Requirements for Installing Red Hat Ceph Storage* section in the *Red Hat Ceph Storage Installation Guide*.
- For each Object Gateway node, perform steps 1 - 6 in *Installing the Ceph Object Gateway* section in the *Red Hat Ceph Storage Installation Guide*.

Procedure

1. On any node, generate the system access keys and secret keys for realm one and two, and save them in files named **multi-site-keys-realm-1.txt** and **multi-site-keys-realm-2.txt**, respectively:

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

   # echo system_access_key: $(cat /dev/urandom | tr -dc 'a-zA-Z0-9' | fold -w 20 | head -n 1) > multi-site-keys-realm-2.txt
   [root@ansible ~]# echo system_secret_key: $(cat /dev/urandom | tr -dc 'a-zA-Z0-9' | fold -w 40 | head -n 1) >> multi-site-keys-realm-2.txt
   ```

Site-A storage cluster

a. Navigate to the Ansible configuration directory:

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

b. Open and edit the **group_vars/all.yml** file. Uncomment the **rgw_multisite** line and set it to **true**. Uncomment the **rgw_multisite_proto** parameter.

```
rgw_multisite: true
rgw_multisite_proto: "http"
```

c. Create a **host_vars** directory in **/usr/share/ceph-ansible**:

```
[root@ansible ceph-ansible]# mkdir host_vars
```

d. Create a file in **host_vars** for each of the Object Gateway nodes on the site-A storage cluster. The file name should be the same name as used in the Ansible inventory file. For example, if the Object Gateway node is named **rgw-site-a**, create the file **host_vars/rgw-site-a**.

Syntax

```
touch host_vars/NODE_NAME
```

Example

```
[root@ansible ceph-ansible]# touch host_vars/rgw-site-a
```

NOTE

If there are multiple Ceph Object Gateway nodes in the cluster used for the multi-site configuration, then create separate files for each of the nodes.

e. For creating multiple instances for the first realm, edit the files and add the configuration details to all the instances on the respective Object Gateway nodes. Configure the following settings along with updating the items under **rgw_instances** for the first realm. Use the random strings saved in the **multi-site-keys-realm-1.txt** file for *ACCESS_KEY_1* and *SECRET_KEY_1*.

Syntax

```
rgw_instances:
  - instance_name: '_INSTANCE_NAME_1_'
    rgw_multisite: true
    rgw_zonemaster: true
    rgw_zonesecondary: false
    rgw_zonegroupmaster: true
    rgw_zone: ZONE_NAME_1
    rgw_zonegroup: ZONE_GROUP_NAME_1
    rgw_realm: REALM_NAME_1
    rgw_zone_user: ZONE_USER_NAME_1
    rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_1"
    system_access_key: ACCESS_KEY_1
    system_secret_key: SECRET_KEY_1
    radosgw_address: "{{ _radosgw_address }}"
```

```
      radosgw_frontend_port: PORT_NUMBER_1
    - instance_name: '_INSTANCE_NAME_2_'
      rgw_multisite: true
      rgw_zonemaster: true
      rgw_zonesecondary: false
      rgw_zonegroupmaster: true
      rgw_zone: ZONE_NAME_1
      rgw_zonegroup: ZONE_GROUP_NAME_1
      rgw_realm: REALM_NAME_1
      rgw_zone_user: ZONE_USER_NAME_1
      rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_1"
      system_access_key: ACCESS_KEY_1
      system_secret_key: SECRET_KEY_1
      radosgw_address: "{{ _radosgw_address }}"
      radosgw_frontend_port: PORT_NUMBER_1
```

Example

```
rgw_instances:
  - instance_name: 'rgw0'
      rgw_multisite: true
      rgw_zonemaster: true
      rgw_zonesecondary: false
      rgw_zonegroupmaster: true
      rgw_zone: paris
      rgw_zonegroup: idf
      rgw_realm: france
      rgw_zone_user: jacques.chirac
      rgw_zone_user_display_name: "Jacques Chirac"
      system_access_key: P9Eb6S8XNyo4dtZZUUMy
      system_secret_key: qqHCUtfdNnpHq3PZRHW5un9l0bEBM812Uhow0XfB
      radosgw_address: "{{ _radosgw_address }}"
      radosgw_frontend_port: 8080
 - instance_name: 'rgw1'
      rgw_multisite: true
      rgw_zonemaster: true
      rgw_zonesecondary: false
      rgw_zonegroupmaster: true
      rgw_zone: paris
      rgw_zonegroup: idf
      rgw_realm: france
      rgw_zone_user: jacques.chirac
      rgw_zone_user_display_name: "Jacques Chirac"
      system_access_key: P9Eb6S8XNyo4dtZZUUMy
      system_secret_key: qqHCUtfdNnpHq3PZRHW5un9l0bEBM812Uhow0XfB
      radosgw_address: "{{ _radosgw_address }}"
      radosgw_frontend_port: 8080
```

NOTE

Skip next step and run it, followed by running Ansible playbook, after configuring all realms on site-B as site-A is secondary to those realms.

f. For multiple instances for other realms, configure the following settings along with updating the

f. For multiple instances for other realms, configure the following settings along with updating the items under **rgw_instances**. Use the random strings saved in the **multi-site-keys-realm-2.txt** file for *ACCESS_KEY_2* and *SECRET_KEY_2*.

Syntax

```
rgw_instances:
  - instance_name: 'INSTANCE_NAME_1'
      rgw_multisite: true
      rgw_zonemaster: false
      rgw_zonesecondary: true
      rgw_zonegroupmaster: false
      rgw_zone: ZONE_NAME_2
      rgw_zonegroup: ZONE_GROUP_NAME_2
      rgw_realm: REALM_NAME_2
      rgw_zone_user: ZONE_USER_NAME_2
      rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_2"
      system_access_key: ACCESS_KEY_2
      system_secret_key: SECRET_KEY_2
      radosgw_address: "{{ _radosgw_address }}"
      radosgw_frontend_port: PORT_NUMBER_1
      endpoint:
RGW_SITE_B_PRIMARY_HOSTNAME_ENDPOINT:RGW_SITE_B_PORT_NUMBER_1
  - instance_name: 'INSTANCE_NAME_2'
      rgw_multisite: true
      rgw_zonemaster: false
      rgw_zonesecondary: true
      rgw_zonegroupmaster: false
      rgw_zone: ZONE_NAME_2
      rgw_zonegroup: ZONE_GROUP_NAME_2
      rgw_realm: REALM_NAME_2
      rgw_zone_user: ZONE_USER_NAME_2
      rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_2"
      system_access_key: ACCESS_KEY_2
      system_secret_key: SECRET_KEY_2
      radosgw_address: "{{ _radosgw_address }}"
      radosgw_frontend_port: PORT_NUMBER_1
      endpoint:
RGW_SITE_B_PRIMARY_HOSTNAME_ENDPOINT:RGW_SITE_B_PORT_NUMBER_1
```

Example

```
rgw_instances:
  - instance_name: 'rgw0'
      rgw_multisite: true
      rgw_zonemaster: false
      rgw_zonesecondary: true
      rgw_zonegroupmaster: false
      rgw_zone: fairbanks
      rgw_zonegroup: alaska
      rgw_realm: usa
      rgw_zone_user: edward.lewis
      rgw_zone_user_display_name: "Edward Lewis"
      system_access_key: yu17wkvAx3B8Wyn08XoF
      system_secret_key: 5YZfaSUPqxSNIkZQQA3lBZ495hnIV6k2HAz710BY
      radosgw_address: "{{ _radosgw_address }}"
```

```
    radosgw_frontend_port: 8080
    endpoint: http://rgw-site-b:8081
  - instance_name: 'rgw1'
    rgw_multisite: true
    rgw_zonemaster: false
    rgw_zonesecondary: true
    rgw_zonegroupmaster: false
    rgw_zone: fairbanks
    rgw_zonegroup: alaska
    rgw_realm: usa
    rgw_zone_user: edward.lewis
    rgw_zone_user_display_name: "Edward Lewis"
    system_access_key: yu17wkvAx3B8Wyn08XoF
    system_secret_key: 5YZfaSUPqxSNIkZQQA3lBZ495hnIV6k2HAz710BY
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: 8081
    endpoint: http://rgw-site-b:8081
```

g. Run the Ansible playbook on the site-A storage cluster:

- **Bare-metal** deployments:

  ```
  [user@ansible ceph-ansible]$ ansible-playbook site.yml -i hosts
  ```

- **Container** deployments:

  ```
  [user@ansible ceph-ansible]$ ansible-playbook site-container.yml -i hosts
  ```

Site-B Storage Cluster

a. Navigate to the Ceph-ansible configuration directory:

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

b. Open and edit the **group_vars/all.yml** file. Uncomment the **rgw_multisite** line and set it to **true**. Uncomment the **rgw_multisite_proto** parameter.

```
rgw_multisite: true
rgw_multisite_proto: "http"
```

c. Create a **host_vars** directory in **/usr/share/ceph-ansible**:

```
[root@ansible ceph-ansible]# mkdir host_vars
```

d. Create a file in **host_vars** for each of the Object Gateway nodes on the site-B storage cluster. The file name should be the same name as used in the Ansible inventory file. For example, if the Object Gateway node is named **rgw-site-b**, create the file **host_vars/rgw-site-b**.

Syntax

```
touch host_vars/NODE_NAME
```

Example

```
[root@ansible ceph-ansible]# touch host_vars/rgw-site-b
```

NOTE

If there are multiple Ceph Object Gateway nodes in the cluster used for the multi-site configuration, then create files for each of the nodes.

e. For creating multiple instances for the first realm, edit the files and add the configuration details to all the instances on the respective Object Gateway nodes. Configure the following settings along with updating the items under **rgw_instances** for the first realm. Use the random strings saved in the **multi-site-keys-realm-1.txt** file for *ACCESS_KEY_1* and *SECRET_KEY_1*. Set *RGW_SITE_A_PRIMARY_HOSTNAME_ENDPOINT* to the Object Gateway node in the site-A storage cluster.

Syntax

```
rgw_instances:
  - instance_name: 'INSTANCE_NAME_1'
    rgw_multisite: true
    rgw_zonemaster: false
    rgw_zonesecondary: true
    rgw_zonegroupmaster: false
    rgw_zone: ZONE_NAME_1
    rgw_zonegroup: ZONE_GROUP_NAME_1
    rgw_realm: REALM_NAME_1
    rgw_zone_user: ZONE_USER_NAME_1
    rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_1"
    system_access_key: ACCESS_KEY_1
    system_secret_key: SECRET_KEY_1
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: PORT_NUMBER_1
    endpoint: RGW_SITE_A_HOSTNAME_ENDPOINT:RGW_SITE_A_PORT_NUMBER_1
  - instance_name: '_INSTANCE_NAME_2_'
    rgw_multisite: true
    rgw_zonemaster: false
    rgw_zonesecondary: true
    rgw_zonegroupmaster: false
    rgw_zone: ZONE_NAME_1
    rgw_zonegroup: ZONE_GROUP_NAME_1
    rgw_realm: REALM_NAME_1
    rgw_zone_user: ZONE_USER_NAME_1
    rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_1"
    system_access_key: ACCESS_KEY_1
    system_secret_key: SECRET_KEY_1
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port:  PORT_NUMBER_1
    endpoint:
RGW_SITE_A_PRIMARY_HOSTNAME_ENDPOINT:RGW_SITE_A_PORT_NUMBER_1
```

Example

```
rgw_instances:
  - instance_name: 'rgw0'
    rgw_multisite: true
    rgw_zonemaster: false
    rgw_zonesecondary: true
    rgw_zonegroupmaster: false
    rgw_zone: paris
    rgw_zonegroup: idf
    rgw_realm: france
    rgw_zone_user: jacques.chirac
    rgw_zone_user_display_name: "Jacques Chirac"
    system_access_key: P9Eb6S8XNyo4dtZZUUMy
    system_secret_key: qqHCUtfdNnpHq3PZRHW5un9l0bEBM812Uhow0XfB
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: 8080
    endpoint: http://rgw-site-a:8080
  - instance_name: 'rgw1'
    rgw_multisite: true
    rgw_zonemaster: false
    rgw_zonesecondary: true
    rgw_zonegroupmaster: false
    rgw_zone: paris
    rgw_zonegroup: idf
    rgw_realm: france
    rgw_zone_user: jacques.chirac
    rgw_zone_user_display_name: "Jacques Chirac"
    system_access_key: P9Eb6S8XNyo4dtZZUUMy
    system_secret_key: qqHCUtfdNnpHq3PZRHW5un9l0bEBM812Uhow0XfB
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: 8081
    endpoint: http://rgw-site-a:8081
```

f. For multiple instances for the other realms, configure the following settings along with updating the items under **rgw_instances**. Use the random strings saved in the **multi-site-keys-realm-2.txt** file for *ACCESS_KEY_2* and *SECRET_KEY_2*. Set *RGW_SITE_A_PRIMARY_HOSTNAME_ENDPOINT* to the Object Gateway node in the site-A storage cluster.

Syntax

```
rgw_instances:
  - instance_name: 'INSTANCE_NAME_1'
    rgw_multisite: true
    rgw_zonemaster: true
    rgw_zonesecondary: false
    rgw_zonegroupmaster: true
    rgw_zone: ZONE_NAME_2
    rgw_zonegroup: ZONE_GROUP_NAME_2
    rgw_realm: REALM_NAME_2
    rgw_zone_user: ZONE_USER_NAME_2
    rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_2"
    system_access_key: ACCESS_KEY_2
    system_secret_key: SECRET_KEY_2
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: PORT_NUMBER_1
  - instance_name: '_INSTANCE_NAME_2_'
    rgw_multisite: true
    rgw_zonemaster: true
    rgw_zonesecondary: false
    rgw_zonegroupmaster: true
    rgw_zone: ZONE_NAME_2
    rgw_zonegroup: ZONE_GROUP_NAME_2
    rgw_realm: REALM_NAME_2
    rgw_zone_user: ZONE_USER_NAME_2
    rgw_zone_user_display_name: "ZONE_DISPLAY_NAME_2"
    system_access_key: ACCESS_KEY_2
    system_secret_key: SECRET_KEY_2
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: PORT_NUMBER_1
```

Example

```
rgw_instances:
  - instance_name: 'rgw0'
    rgw_multisite: true
    rgw_zonemaster: true
    rgw_zonesecondary: false
    rgw_zonegroupmaster: true
    rgw_zone: fairbanks
    rgw_zonegroup: alaska
    rgw_realm: usa
    rgw_zone_user: edward.lewis
    rgw_zone_user_display_name: "Edward Lewis"
    system_access_key: yu17wkvAx3B8Wyn08XoF
    system_secret_key: 5YZfaSUPqxSNIkZQQA3lBZ495hnIV6k2HAz710BY
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: 8080
  - instance_name: 'rgw1'
    rgw_multisite: true
    rgw_zonemaster: true
    rgw_zonesecondary: false
    rgw_zonegroupmaster: true
    rgw_zone: fairbanks
    rgw_zonegroup: alaska
    rgw_realm: usa
    rgw_zone_user: edward.lewis
    rgw_zone_user_display_name: "Edward Lewis"
    system_access_key: yu17wkvAx3B8Wyn08XoF
    system_secret_key: 5YZfaSUPqxSNIkZQQA3lBZ495hnIV6k2HAz710BY
    radosgw_address: "{{ _radosgw_address }}"
    radosgw_frontend_port: 8081
```

g. Run the Ansible playbook on the site-B storage cluster:

- **Bare-metal** deployments:

  ```
  [user@ansible ceph-ansible]$ ansible-playbook site.yml -i hosts
  ```

- **Container** deployments:

  ```
  [user@ansible ceph-ansible]$ ansible-playbook site-container.yml -i hosts
  ```

  Run the Ansible playbook again on the **site-A** storage cluster for **other** realms of **site-A**.

After running the Ansible playbook on the **site-A** and **site-B** storage clusters, the Ceph Object Gateways run in an active-active state.

Verification

1. Verify the multisite Ceph Object Gateway configuration:

    a. From the Ceph Monitor and Object Gateway nodes at each site, site-A and site-B, use **curl** or another HTTP client to verify the APIs are accessible from the other site.

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

    #### Syntax

    ```
    radosgw-admin sync status
    radosgw-admin sync status --rgw -realm REALM_NAME 1
    ```

    1 Use this option for multiple realms on the respective nodes of the storage cluster.

    #### Example

    ```
    [user@ansible ceph-ansible]$ radosgw-admin sync status

    [user@ansible ceph-ansible]$ radosgw-admin sync status --rgw -realm usa
    ```

5.8. DEPLOYING OSDS WITH DIFFERENT HARDWARE ON THE SAME HOST

You can deploy mixed OSDs, for example, HDDs and SSDs, on the same host, with the **device_class** feature in Ansible.

Prerequisites

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

Procedure

1. Create **crush_rules** in the **group_vars/mons.yml** file:

    #### Example

    ```
    crush_rule_config: true
    crush_rule_hdd:
        name: HDD
        root: default
    ```

```
    type: host
    class: hdd
    default: true
crush_rule_ssd:
    name: SSD
    root: default
    type: host
    class: ssd
    default: true
crush_rules:
      - "{{ crush_rule_hdd }}"
      - "{{ crush_rule_ssd }}"
create_crush_tree: true
```

NOTE

If you are not using SSD or HDD devices in the cluster, do not define the **crush_rules** for that device.

2. Create **pools**, with created **crush_rules** in **group_vars/clients.yml** file.

Example

```
copy_admin_key: True
user_config: True
pool1:
  name: "pool1"
  pg_num: 128
  pgp_num: 128
  rule_name: "HDD"
  type: "replicated"
  device_class: "hdd"
pools:
  - "{{ pool1 }}"
```

3. Sample the inventory file to assign roots to OSDs:

Example

```
[mons]
mon1

[osds]
osd1 osd_crush_location="{ 'root': 'default', 'rack': 'rack1', 'host': 'osd1' }"
osd2 osd_crush_location="{ 'root': 'default', 'rack': 'rack1', 'host': 'osd2' }"
osd3 osd_crush_location="{ 'root': 'default', 'rack': 'rack2', 'host': 'osd3' }"
osd4 osd_crush_location="{ 'root': 'default', 'rack': 'rack2', 'host': 'osd4' }"
osd5 devices="['/dev/sda', '/dev/sdb']" osd_crush_location="{ 'root': 'default', 'rack': 'rack3',
'host': 'osd5' }"
osd6 devices="['/dev/sda', '/dev/sdb']" osd_crush_location="{ 'root': 'default', 'rack': 'rack3',
'host': 'osd6' }"

[mgrs]
mgr1
```

```
[clients]
client1
```

4. View the tree.

Syntax

```
[root@mon ~]# ceph osd tree
```

Example

```
TYPE NAME

root default
   rack rack1
     host osd1
        osd.0
        osd.10
     host osd2
        osd.3
        osd.7
        osd.12
   rack rack2
     host osd3
        osd.1
        osd.6
        osd.11
     host osd4
        osd.4
        osd.9
        osd.13
   rack rack3
      host osd5
        osd.2
        osd.8
      host osd6
        osd.14
        osd.15
```

5. Validate the pools.

Example

```
# for i in $(rados lspools);do echo "pool: $i"; ceph osd pool get $i crush_rule;done

pool: pool1
crush_rule: HDD
```

Additional Resources

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

- See *Device Classes* in *Red Hat Ceph Storage Storage Strategies Guide* for more details.

5.9. INSTALLING THE NFS-GANESHA GATEWAY

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

Prerequisites

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

*Enable passwordless SSH access .

- Ensure the rpcbind service is running:

  ```
  # systemctl start rpcbind
  ```

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

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

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

Procedure

Perform the following tasks on the Ansible administration node.

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

   ```
   [root@ansible ~]# cd /usr/share/ceph-ansible/group_vars
   [root@ansible ~]# cp nfss.yml.sample nfss.yml
   ```

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

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

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

3. Navigate to the Ansible configuration directory:

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

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

```
copy_admin_key: true
```

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

```
# FSAL RGW Config #

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

> **WARNING**
>
> Access and secret keys are optional, and can be generated.

6. Run the Ansible playbook:

   a. **Bare-metal** deployments:

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

   b. **Container** deployments:

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

Additional Resources

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

5.10. UNDERSTANDING THE LIMIT OPTION

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

Ansible supports the **--limit** option that enables you to use the **site** and **site-container** Ansible playbooks for a particular role of the inventory file.

```
ansible-playbook site.yml|site-container.yml --limit osds|rgws|clients|mdss|nfss|iscsigws -i hosts
```

Bare-metal

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

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

Containers

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

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

5.11. THE PLACEMENT GROUP AUTOSCALER

Placement group (PG) tuning use to be a manual process of plugging in numbers for **pg_num** by using the PG calculator. Starting with Red Hat Ceph Storage 4.1, PG tuning can be done automatically by enabling the **pg_autoscaler** Ceph manager module. The PG autoscaler is configured on a per-pool basis, and scales the **pg_num** by a power of two. The PG autoscaler only proposes a change to **pg_num**, if the suggested value is more than three times the actual value.

The PG autoscaler has three modes:

warn

The default mode for new and existing pools. A health warning is generated if the suggested **pg_num** value varies too much from the current **pg_num** value.

on

The pool's **pg_num** is adjusted automatically.

off

The autoscaler can be turned off for any pool, but storage administrators will need to manually set the **pg_num** value for the pool.

Once the PG autoscaler in enabled for a pool, you can view the value adjustments by running the **ceph osd pool autoscale-status** command. The **autoscale-status** command displays the current state of the pools. Here are the **autoscale-status** column descriptions:

SIZE

Reports the total amount of data, in bytes, that are stored in the pool. This size includes object data and OMAP data.

TARGET SIZE

Reports the expected size of the pool as provided by the storage administrator. This value is used to calculate the pool's ideal number of PGs.

RATE

The replication factor for replicated buckets or the ratio for erasure-coded pools.

RAW CAPACITY

The raw storage capacity of a storage device that a pool is mapped to based on CRUSH.

RATIO

The ratio of total storage being consumed by the pool.

TARGET RATIO

A ratio specifying what fraction of the total storage cluster's space is consumed by the pool as provided by the storage administrator.

PG_NUM

The current number of placement groups for the pool.

NEW PG_NUM

The proposed value. This value might not be set.

AUTOSCALE

The PG autoscaler mode set for the pool.

Additional Resources

- The Placement group pool calculator.

5.11.1. Configuring the placement group autoscaler

You can configure Ceph Ansible to enable and configure the PG autoscaler for new pools in the Red Hat Ceph Storage cluster. By default, the placement group (PG) autoscaler is off.

> **IMPORTANT**
>
> Currently, you can only configure the placement group autoscaler on new Red Hat Ceph Storage deployments, and not existing Red Hat Ceph Storage installations.

Prerequisites

- Access to the Ansible administration node.
- Access to a Ceph Monitor node.

Procedure

1. On the Ansible administration node, open the **group_vars/all.yml** file for editing.
2. Set the **pg_autoscale_mode** option to **True**, and set the **target_size_ratio** value for a new or existing pool:

   Example

   ```
   openstack_pools:
       - {"name": backups, "target_size_ratio": 0.1, "pg_autoscale_mode": True, "application": rbd}
       - {"name": volumes, "target_size_ratio": 0.5, "pg_autoscale_mode": True, "application": rbd}
       - {"name": vms,      "target_size_ratio": 0.2, "pg_autoscale_mode": True, "application": rbd}
       - {"name": images,  "target_size_ratio": 0.2, "pg_autoscale_mode": True, "application": rbd}
   ```

   > **NOTE**
   >
   > The **target_size_ratio** value is the weight percentage relative to other pools in the storage cluster.

3. Save the changes to the **group_vars/all.yml** file.

4. Run the appropriate Ansible playbook:

   Bare-metal deployments

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

   Containers deployments

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

5. Once the Ansible playbook finishes, check the autoscaler status from a Ceph Monitor node:

   ```
   [user@mon ~]$ ceph osd pool autoscale-status
   ```

5.12. ADDITIONAL RESOURCES

- The Ansible Documentation

CHAPTER 6. COLOCATION OF CONTAINERIZED CEPH DAEMONS

This section describes:

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

6.1. HOW COLOCATION WORKS AND ITS ADVANTAGES

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

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

See the Knowledgebase article *Red Hat Ceph Storage: Supported Configurations* for more information on collocation of daemons in the Red Hat Ceph Storage cluster.

How Colocation Works

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

- Ceph Metadata Server (**ceph-mds**)
- Ceph Monitor (**ceph-mon**) and Ceph Manager (**ceph-mgr**) daemons
- NFS Ganesha (**nfs-ganesha**)
- RBD Mirror (**rbd-mirror**)
- iSCSI Gateway (**iscsigw**)

Starting with Red Hat Ceph Storage 4.2, Metadata Server (MDS) can be co-located with one additional scale-out daemon.

Additionally, for Ceph Object Gateway (**radosgw**) or Grafana, you can colocate either with an OSD daemon plus a daemon from the above list, excluding RBD mirror.z For example, the following is a valid five node colocated configuration:

Node	Daemon	Daemon	Daemon
node1	OSD	Monitor	Grafana
node2	OSD	Monitor	RADOS Gateway
node3	OSD	Monitor	RADOS Gateway

Node	Daemon	Daemon	Daemon
node4	OSD	Metadata Server	
node5	OSD	Metadata Server	

To deploy a five node cluster like the above setup, configure the Ansible inventory file like so:

Ansible inventory file with colocated daemons

```
[grafana-server]
node1

[mons]
node[1:3]

[mgrs]
node[1:3]

[osds]
node[1:5]

[rgws]
node[2:3]

[mdss]
node[4:5]
```

NOTE

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

NOTE

Colocating Grafana with any other daemon is not supported with Cockpit based installation. Use **ceph-ansible** to configure the storage cluster.

NOTE

Red Hat recommends colocating the Ceph Object Gateway with OSD containers to increase performance. To achieve the highest performance without incurring an additional cost, use two gateways by setting **radosgw_num_instances: 2** in **group_vars/all.yml**. For more information, see Red Hat Ceph Storage RGW deployment strategies and sizing guidance.

NOTE

Adequate CPU and network resources are required to colocate Grafana with two other containers. If resource exhaustion occurs, colocate Grafana with a Monitor only, and if resource exhaustion still occurs, run Grafana on a dedicated node.

The Figure 6.1, "Colocated Daemons" and Figure 6.2, "Non-colocated Daemons" images shows the difference between clusters with colocated and non-colocated daemons.

Figure 6.1. Colocated Daemons

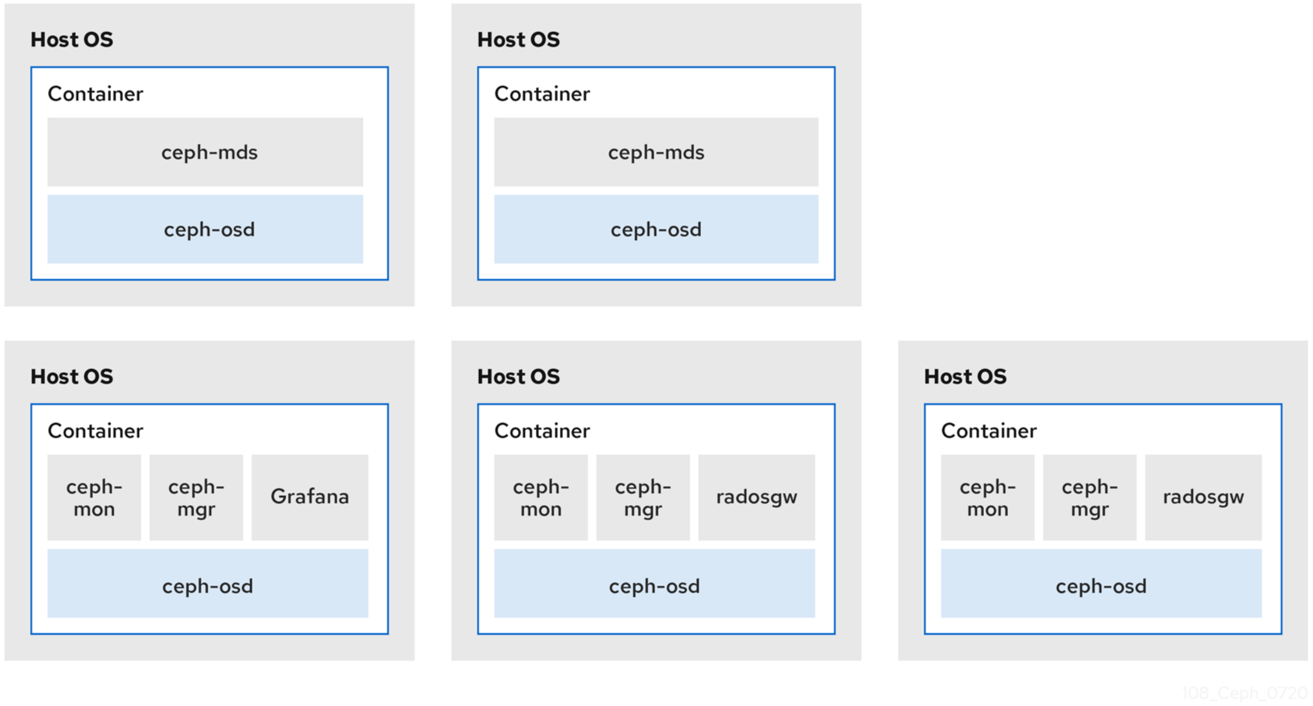
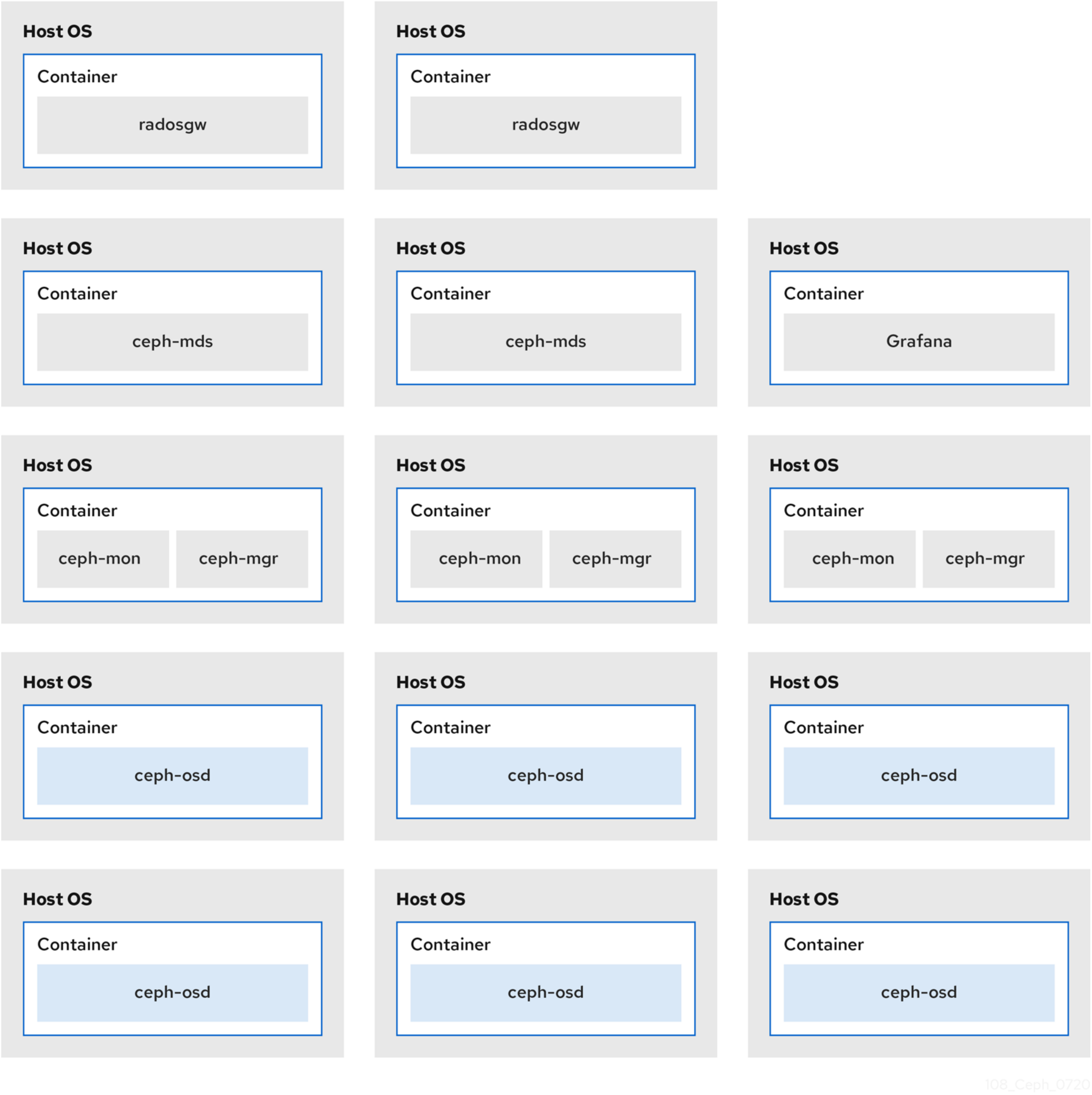


Figure 6.2. Non-colocated Daemons



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

6.2. SETTING DEDICATED RESOURCES FOR COLOCATED DAEMONS

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

Procedure

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

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

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

```
ceph_rgw_docker_cpu_limit: 2
```

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

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

IMPORTANT

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

```
ceph_osd_docker_memory_limit: 9g
```

Additional Resources

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

6.3. ADDITIONAL RESOURCES

- The *Red Hat Ceph Storage Hardware Selection Guide*

CHAPTER 7. UPGRADING A RED HAT CEPH STORAGE CLUSTER

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

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

NOTE

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

IMPORTANT

When upgrading a Red Hat Ceph Storage cluster from a previous supported version to version 4.2z2, the upgrade completes with the storage cluster in a HEALTH_WARN state stating that monitors are allowing insecure **global_id** reclaim. This is due to a patched CVE, the details of which are available in the *CVE-2021-20288*. This issue is fixed by CVE for Red Hat Ceph Storage 4.2z2.

Recommendations to mute health warnings:

1. Identify clients that are not updated by checking the **ceph health detail** output for the **AUTH_INSECURE_GLOBAL_ID_RECLAIM** alert.

2. Upgrade all clients to Red Hat Ceph Storage 4.2z2 release.

3. After validating all clients have been updated and the *AUTH_INSECURE_GLOBAL_ID_RECLAIM* alert is no longer present for a client, set **auth_allow_insecure_global_id_reclaim** to **false**. When this option is set to **false**, then an unpatched client cannot reconnect to the storage cluster after an intermittent network disruption breaking its connection to a monitor, or be able to renew its authentication ticket when it times out, which is 72 hours by default.

   #### Syntax

   ```
   ceph config set mon auth_allow_insecure_global_id_reclaim false
   ```

4. Ensure that no clients are listed with the **AUTH_INSECURE_GLOBAL_ID_RECLAIM** alert.

IMPORTANT

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

IMPORTANT

If the upgrade fails at any point, check the cluster status with the **ceph status** command to understand the upgrade failure reason. If you are not sure of the failure reason and how to resolve , please contact *Red hat Support* for assistance.

WARNING

If upgrading a multisite setup from Red Hat Ceph Storage 3 to Red Hat Ceph Storage 4, heed the following recommendations or else replication may break. Set **rgw_multisite: false** in **all.yml** before running **rolling_update.yml**. Do not re-enable **rgw_multisite** after upgrade. Use it only if you need to add new gateways after upgrade. Only upgrade a Red Hat Ceph Storage 3 cluster at version 3.3z5 or higher to Red Hat Ceph Storage 4. If you cannot update to 3.3z5 or a higher, disable synchronization between sites before upgrading the clusters. To disable synchronization, set **rgw_run_sync_thread = false** and restart the RADOS Gateway daemon. Upgrade the primary cluster first. Upgrade to Red Hat Ceph Storage 4.1 or later. To see the package versions that correlate to 3.3z5 see What are the Red Hat Ceph Storage releases and corresponding Ceph package versions? For instructions on how to disable synchronization, see How to disable RGW Multisite sync temporarily?

WARNING

When using Ceph Object Gateway and upgrading from Red Hat Ceph Storage 3.x to Red Hat Ceph Storage 4.x, the front end is automatically changed from CivetWeb to Beast, which is the new default. For more information, see Configuration in the Object Gateway Configuration and Administration Guide .

WARNING

If using RADOS Gateway, Ansible will switch the front end from CivetWeb to Beast. In the process of this the RGW instance names are changed from rgw.*HOSTNAME* to rgw.*HOSTNAME*.rgw0. Due to the name change Ansible does not update the existing RGW configuration in **ceph.conf** and instead appends a default configuration, leaving intact the old CivetWeb based RGW setup, however it is not used. Custom RGW configuration changes would then be lost, which could cause an RGW service interruption. To avoid this, before upgrade, add the existing RGW configuration in the **ceph_conf_overrides** section of **all.yml**, but change the RGW instance names by appending **.rgw0**, then restart the RGW service. This will preserve non-default RGW configuration changes after upgrade. For information on **ceph_conf_overrides**, see Overriding Ceph Default Settings .

7.1. SUPPORTED RED HAT CEPH STORAGE UPGRADE SCENARIOS

Red Hat supports the following upgrade scenarios.

Read the tables for *bare-metal*, and *containerized* to understand what pre-upgrade state your cluster must be in to move to certain post-upgrade states.

Use **ceph-ansible** to perform bare-metal and containerized upgrades where the bare-metal or host operating system does not change major versions. Upgrading from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8 is not supported with **ceph-ansible**. To upgrade the bare-metal operating system from Red Hat Enterprise Linux 7.9 to Red Hat Enterprise Linux 8.4 as a part of upgrading Red Hat Ceph Storage, see the *Manually upgrading a Red Hat Ceph Storage cluster and operating system* section in the *Red Hat Ceph Storage Installation Guide*.

NOTE

To upgrade your cluster to Red Hat Ceph Storage 4, Red Hat recommends your cluster to be on the latest version of the Red Hat Ceph Storage 3. To know the latest version of Red Hat Ceph Storage, see the *What are the Red Hat Ceph Storage releases?* Knowledgebase article for more information.

Table 7.1. Supported upgrade scenarios for Bare-metal deployments

Pre-upgrade state		Post-upgrade state	
Red Hat Enterprise Linux version	Red Hat Ceph Storage version	Red Hat Enterprise Linux version	Red Hat Ceph Storage version
7.6	3.3	7.9	4.2
7.6	3.3	8.4	4.2
7.7	3.3	7.9	4.2
7.7	4.0	7.9	4.2
7.8	3.3	7.9	4.2
7.8	3.3	8.4	4.2
7.9	3.3	8.4	4.2
8.1	4.0	8.4	4.2
8.2	4.1	8.4	4.2
8.2	4.1	8.4	4.2
8.3	4.1	8.4	4.2

Table 7.2. Supported upgrade scenarios for Containerized deployments

Pre-upgrade state			Post-upgrade state		
Host Red Hat Enterprise Linux version	Container Red Hat Enterprise Linux version	Red Hat Ceph Storage version	Host Red Hat Enterprise Linux version	Container Red Hat Enterprise Linux version	Red Hat Ceph Storage version
7.6	7.8	3.3	7.9	8.4	4.2
7.7	7.8	3.3	7.9	8.4	4.2
7.7	8.1	4.0	7.9	8.4	4.2
7.8	7.8	3.3	7.9	8.4	4.2
8.1	8.1	4.0	8.4	8.4	4.2
8.2	8.2	4.1	8.4	8.4	4.2
8.3	8.3	4.1	8.4	8.4	4.2

7.2. PREPARING FOR AN UPGRADE

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

IMPORTANT

You can only upgrade to the latest version of Red Hat Ceph Storage 4. For example, if version 4.1 is available, you cannot upgrade from 3 to 4.0; you must go directly to 4.1.

IMPORTANT

If using the FileStore object store, after upgrading from Red Hat Ceph Storage 3 to Red Hat Ceph Storage 4, you must migrate to BlueStore.

IMPORTANT

You cannot use **ceph-ansible** to upgrade Red Hat Ceph Storage while also upgrading Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8. You must stay on Red Hat Enterprise Linux 7. To upgrade the operating system as well, see Manually upgrading a Red Hat Ceph Storage cluster and operating system.

IMPORTANT

The option **bluefs_buffered_io** is set to **True** by default for Red Hat Ceph Storage 4.2z2 and later versions. This option enables BlueFS to perform buffered reads in some cases and enables the kernel page cache to act as a secondary cache for reads like RocksDB block reads. For example, if the RocksDB block cache is not large enough to hold all blocks during the OMAP iteration, it may be possible to read them from the page cache instead of the disk. This can dramatically improve performance when **osd_memory_target** is too small to hold all entries in the block cache. Currently enabling **bluefs_buffered_io** and disabling the system level swap prevents performance degradation.

Prerequisites

- Root-level access to all nodes in the storage cluster.
- The system clocks on all nodes in the storage cluster are synchronized. If the Monitor nodes are out of sync, the upgrade process might not complete properly.
- If upgrading from version 3, the version 3 cluster is upgraded to the latest version of Red Hat Ceph Storage 3.
- Before upgrading to version 4, if the Prometheus node exporter service is running, then stop the service:

  #### Example

  ```
  [root@mon ~]# systemctl stop prometheus-node-exporter.service
  ```

  ### IMPORTANT

  This is a known issue, that will be fixed in an upcoming Red Hat Ceph Storage release. See the Red Hat Knowledgebase article for more details regarding this issue.

  ### NOTE

  For **Bare-metal** or **Container** Red Hat Ceph Storage cluster nodes that cannot access the internet during an upgrade, follow the procedure provided in the section *Registering Red Hat Ceph Storage nodes to the CDN and attaching subscriptions* in the *Red Hat Ceph Storage Installation Guide*.

Procedure

1. Log in as the **root** user on all nodes in the storage cluster.
2. If the Ceph nodes are not connected to the Red Hat Content Delivery Network (CDN), you can use an ISO image to upgrade Red Hat Ceph Storage by updating the local repository with the latest version of Red Hat Ceph Storage.
3. If upgrading Red Hat Ceph Storage from version 3 to version 4, remove an existing Ceph dashboard installation.
   a. On the Ansible administration node, change to the **cephmetrics-ansible** directory:

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

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

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

4. If upgrading Red Hat Ceph Storage from version 3 to version 4, enable the Ceph and Ansible repositories on the Ansible administration node:

   Red Hat Enterprise Linux 7

   ```
   [root@admin ~]# subscription-manager repos --enable=rhel-7-server-rhceph-4-tools-rpms --
   enable=rhel-7-server-ansible-2.9-rpms
   ```

   Red Hat Enterprise Linux 8

   ```
   [root@admin ~]# subscription-manager repos --enable=rhceph-4-tools-for-rhel-8-x86_64-
   rpms --enable=ansible-2.9-for-rhel-8-x86_64-rpms
   ```

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

   Red Hat Enterprise Linux 7

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

   Red Hat Enterprise Linux 8

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

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

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

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

   NOTE

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

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

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

8. If the storage cluster was originally installed using Cockpit, create a symbolic link in the **/usr/share/ceph-ansible** directory to the inventory file where Cockpit created it, at **/usr/share/ansible-runner-service/inventory/hosts**:

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

    ```
    # cd /usr/share/ceph-ansible
    ```

    b. Create the symbolic link:

    ```
    # ln -s /usr/share/ansible-runner-service/inventory/hosts hosts
    ```

9. To upgrade the cluster using **ceph-ansible**, create the symbolic link in the **etc/ansible/hosts** directory to the **hosts** inventory file:

    ```
    # ln -s /etc/ansible/hosts hosts
    ```

10. If the storage cluster was originally installed using Cockpit, copy the Cockpit generated SSH keys to the Ansible user's **~/.ssh** directory:

    a. Copy the keys:

    ```
    # cp /usr/share/ansible-runner-service/env/ssh_key.pub
    /home/ANSIBLE_USERNAME/.ssh/id_rsa.pub
    # cp /usr/share/ansible-runner-service/env/ssh_key
    /home/ANSIBLE_USERNAME/.ssh/id_rsa
    ```

    Replace *ANSIBLE_USERNAME* with the username for Ansible, usually **admin**.

    ### Example

    ```
    # cp /usr/share/ansible-runner-service/env/ssh_key.pub /home/admin/.ssh/id_rsa.pub
    # cp /usr/share/ansible-runner-service/env/ssh_key /home/admin/.ssh/id_rsa
    ```

    b. Set the appropriate owner, group, and permissions on the key files:

    ```
    # chown ANSIBLE_USERNAME:_ANSIBLE_USERNAME_
    /home/ANSIBLE_USERNAME/.ssh/id_rsa.pub
    # chown ANSIBLE_USERNAME:_ANSIBLE_USERNAME_
    /home/ANSIBLE_USERNAME/.ssh/id_rsa
    # chmod 644 /home/ANSIBLE_USERNAME/.ssh/id_rsa.pub
    # chmod 600 /home/ANSIBLE_USERNAME/.ssh/id_rsa
    ```

    Replace *ANSIBLE_USERNAME* with the username for Ansible, usually **admin**.

    ### Example

    ```
    # chown admin:admin /home/admin/.ssh/id_rsa.pub
    # chown admin:admin /home/admin/.ssh/id_rsa
    # chmod 644 /home/admin/.ssh/id_rsa.pub
    ```

```
# chmod 600 /home/admin/.ssh/id_rsa
```

Additional Resources

- See *Enabling the Red Hat Ceph Storage repositories* for details.
- For more information about clock synchronization and clock skew, see the *Clock Skew* section in the *Red Hat Ceph Storage Troubleshooting Guide*.

7.3. UPGRADING THE STORAGE CLUSTER USING ANSIBLE

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

Prerequisites

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

Procedure

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

   Example

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

2. If upgrading from Red Hat Ceph Storage 3 to Red Hat Ceph Storage 4, make backup copies of the **group_vars/all.yml**, **group_vars/osds.yml**, and **group_vars/clients.yml** files:

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

3. If upgrading from Red Hat Ceph Storage 3 to Red Hat Ceph Storage 4, create new copies of the **group_vars/all.yml.sample**, **group_vars/osds.yml.sample** and **group_vars/clients.yml.sample** files, and rename them to **group_vars/all.yml**, **group_vars/osds.yml**, and **group_vars/clients.yml** respectively. Open and edit them accordingly, basing the changes on your previously backed up copies.

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

4. Edit the **group_vars/osds.yml** file. Add and set the following options:

   ```
   nb_retry_wait_osd_up: 60
   delay_wait_osd_up: 10
   ```

> NOTE
>
> These are the default values; you can modify the values as per your use case.

5. If upgrading to a new minor version of Red Hat Ceph Storage 4, verify the value for **grafana_container_image** in **group_vars/all.yml** is the same as in **group_vars/all.yml.sample**. If it is not the same, edit it so it is.

   Example

   ```
   grafana_container_image: registry.redhat.io/rhceph/rhceph-4-dashboard-rhel8:4
   ```

   > NOTE
   >
   > The image path shown is included in **ceph-ansible** version 4.0.23-1.

6. Copy the latest **site.yml** or **site-container.yml** file from the sample files:

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

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

   b. For **container** deployments:

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

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

   a. Add the **fetch_directory** option:

   ```
   fetch_directory: FULL_DIRECTORY_PATH
   ```

   Replace

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

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

   ```
   radosgw_interface: INTERFACE
   ```

   Replace

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

   c. If your current setup has SSL certificates configured, you need to edit the following:

   ```
   radosgw_frontend_ssl_certificate: /etc/pki/ca-trust/extracted/CERTIFICATE_NAME
   radosgw_frontend_port: 443
   ```

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

```
osd_objectstore: filestore
```

NOTE

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

IMPORTANT

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

e. Starting with Red Hat Ceph Storage 4.1, you must uncomment or set **dashboard_admin_password** and **grafana_admin_password** in **/usr/share/ceph-ansible/group_vars/all.yml**. Set secure passwords for each. Also set custom user names for **dashboard_admin_user** and **grafana_admin_user**.

f. For both **bare-metal** and **containers** deployments:

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

   ```
   upgrade_ceph_packages: True
   ```

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

   ```
   ceph_rhcs_version: 4
   ```

   NOTE

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

   iii. Add the **ceph_docker_registry** information to **all.yml**:

   Syntax

   ```
   ceph_docker_registry: registry.redhat.io
   ceph_docker_registry_username: SERVICE_ACCOUNT_USER_NAME
   ceph_docker_registry_password: TOKEN
   ```

   NOTE

   If you do not have a Red Hat Registry Service Account, create one using the *Registry Service Account webpage* . See the *Red Hat Container Registry Authentication* Knowledgebase article for more details.

NOTE

In addition to using a Service Account for the **ceph_docker_registry_username** and **ceph_docker_registry_password** parameters, you can also use your Customer Portal credentials, but to ensure security, encrypt the **ceph_docker_registry_password** parameter. For more information, see Encrypting Ansible password variables with ansible-vault.

g. For **containers** deployments:

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

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

   ii. Change the **ceph_docker_image_tag** option to point to the latest version of **rhceph/rhceph-4-rhel8**:

   ```
   ceph_docker_image_tag: latest
   ```

8. If upgrading from Red Hat Ceph Storage 3 to Red Hat Ceph Storage 4, open the Ansible inventory file for editing, **/etc/ansible/hosts** by default, and add the Ceph dashboard node name or IP address under the **[grafana-server]** section. If this section does not exist, then also add this section along with the node name or IP address.

9. Switch to or log in as the Ansible user, then run the **rolling_update.yml** playbook:

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

   IMPORTANT

   Using the **--limit** Ansible option with the **rolling_update.yml** playbook is not supported.

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

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

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

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

12. Verify the health status of the storage cluster.

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

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

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

       i. List all running containers:

Red Hat Enterprise Linux 7

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

Red Hat Enterprise Linux 8

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

ii. Check health status:

Red Hat Enterprise Linux 7

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

Red Hat Enterprise Linux 8

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

Replace

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

  Example

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

13. Optional: If upgrading from Red Hat Ceph Storage 3.x to Red Hat Ceph Storage 4.x, you might see this health warning: *Legacy BlueStore stats reporting detected on 336 OSD(s).* This is caused by newer code calculating pool stats differently. You can resolve this by setting the **bluestore_fsck_quick_fix_on_mount** parameter.

    a. Set **bluestore_fsck_quick_fix_on_mount** to **true**:

    Example

    ```
    [root@mon ~]# ceph config set osd bluestore_fsck_quick_fix_on_mount true
    ```

    b. Set the **noout** and **norebalance** flags to prevent data movement while OSDs are down:

    Example

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

    c. For **bare-metal** deployment, restart **ceph-osd.target** on every OSD node of the storage cluster:

    Example

    ```
    [root@osd ~]# systemctl restart ceph-osd.target
    ```

d. For **containerized** deployment, restart the individual OSDs one after the other and wait for all the placement groups to be in **active+clean** state.

Syntax

```
systemctl restart ceph-osd@OSD_ID.service
```

Example

```
[root@osd ~]# systemctl restart ceph-osd@0.service
```

e. When all the OSDs are repaired, unset the **nout** and **norebalance** flags:

Example

```
[root@mon ~]# ceph osd unset noout
[root@mon ~]# ceph osd unset norebalance
```

f. Set the **bluestore_fsck_quick_fix_on_mount** to **false** once all the OSDs are repaired:

Example

```
[root@mon ~]# ceph config set osd bluestore_fsck_quick_fix_on_mount false
```

g. Optional: An alternate method for **bare-metal** deployment is to stop the OSD service, run the repair function on the OSD using the **ceph-bluestore-tool** command, and then start the OSD service:

i. Stop the OSD service:

```
[root@osd ~]# systemctl stop ceph-osd.target
```

ii. Run the repair function on the OSD, specifying its actual OSD ID:

Syntax

```
ceph-bluestore-tool --path /var/lib/ceph/osd/ceph-OSDID repair
```

Example

```
[root@osd ~]# ceph-bluestore-tool --path /var/lib/ceph/osd/ceph-2 repair
```

iii. Start the OSD service:

```
[root@osd ~]# systemctl start ceph-osd.target
```

14. Once the upgrade finishes, you can migrate the FileStore OSDs to BlueStore OSDs, by running the Ansible playbook:

Syntax

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

Example

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

Once the migration completes do the following sub steps.

a. Open for editing the **group_vars/osds.yml** file, and set the **osd_objectstore** option to **bluestore**, for example:

```
osd_objectstore: bluestore
```

b. If you are using the **lvm_volumes** variable, then change the **journal** and **journal_vg** options to **db** and **db_vg** respectively, for example:

Before

```
lvm_volumes:
  - data: /dev/sdb
    journal: /dev/sdc1
  - data: /dev/sdd
    journal: journal1
    journal_vg: journals
```

After converting to Bluestore

```
lvm_volumes:
  - data: /dev/sdb
    db: /dev/sdc1
  - data: /dev/sdd
    db: journal1
    db_vg: journals
```

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

a. Glance users:

Syntax

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

Example

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

b. Cinder users:

Syntax

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

Example

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

c. OpenStack general users:

Syntax

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

Example

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

IMPORTANT

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

16. Optional: On client nodes, restart any applications that depend on the Ceph client-side libraries.

NOTE

If you are upgrading OpenStack Nova compute nodes that have running QEMU or KVM instances or use a dedicated QEMU or KVM client, stop and start the QEMU or KVM instance because restarting the instance does not work in this case.

Additional Resources

- See *Understanding the limit option* for more details.
- See *How to migrate the object store from FileStore to BlueStore* in the *Red Hat Ceph Storage Administration Guide* for more details.
- See the Knowledgebase article *After a ceph-upgrade the cluster status reports `Legacy BlueStore stats reporting detected`* for additional details.

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

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

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

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

Prerequisites

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

Procedure

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

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

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

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

```
ceph health
HEALTH_OK
```

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

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

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

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

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

4. Before upgrading OSDs, set the **noout** and **nodeep-scrub** flags on a Ceph Monitor node to prevent OSDs from rebalancing during upgrade.

```
# ceph osd set noout
# ceph osd det nodeep-scrub
```

5. On each OSD node, execute:

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

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

   ```
   # yum update -y
   ```

   For each OSD daemon running on the node, execute:

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

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

6. If there are any OSDs in the storage cluster deployed with **ceph-disk**, instruct **ceph-volume** to start the daemons.

   ```
   # ceph-volume simple scan
   # ceph-volume simple activate --all
   ```

7. Enable the Nautilus only functionality:

   ```
   # ceph osd require-osd-release nautilus
   ```

   IMPORTANT

   Failure to execute this step will make it impossible for OSDs to communicate after **msgr2** is enabled.

8. After upgrading all OSD nodes, unset the **noout** and **nodeep-scrub** flags on a Ceph Monitor node.

   ```
   # ceph osd unset noout
   # ceph osd unset nodeep-scrub
   ```

9. Switch any existing CRUSH buckets to the latest bucket type **straw2**.

   ```
   # ceph osd getcrushmap -o backup-crushmap
   # ceph osd crush set-all-straw-buckets-to-straw2
   ```

10. Once all the daemons are updated after upgrading from Red Hat Ceph Storage 3 to Red Hat Ceph Storage 4, run the following steps:

    a. Enable the messenger v2 protocol, **msgr2**:

       ```
       ceph mon enable-msgr2
       ```

This instructs all Ceph Monitors that bind to the old default port of 6789, to also bind to the new port of 3300.

b. Verify the status of the monitor:

```
ceph mon dump
```

NOTE

Running nautilus OSDs does not bind to their v2 address automatically. They must be restarted.

11. For each host upgraded from Red Hat Ceph Storage 3 to Red Hat Ceph Storage 4, update the **ceph.conf** file to either not specify any monitor port or reference both the v2 and v1 addresses and ports.

12. Import any configuration options in **ceph.conf** file into the storage cluster’s configuration database.

Example

```
[root@mon ~]# ceph config assimilate-conf -i /etc/ceph/ceph.conf
```

a. Check the storage cluster’s configuration database.

Example

```
[root@mon ~]# ceph config dump
```

b. Optional: After upgrading to Red Hat Ceph Storage 4, create a minimal **ceph.conf** file for each host:

Example

```
[root@mon ~]# ceph config generate-minimal-conf > /etc/ceph/ceph.conf.new
[root@mon ~]# mv /etc/ceph/ceph.conf.new /etc/ceph/ceph.conf
```

13. On Ceph Object Gateway nodes, execute:

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

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

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

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

14. For the administration node, execute:

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

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

```
# ceph health
HEALTH_OK
```

16. Optional: On client nodes, restart any applications that depend on the Ceph client-side libraries.

NOTE

If you are upgrading OpenStack Nova compute nodes that have running QEMU or KVM instances or use a dedicated QEMU or KVM client, stop and start the QEMU or KVM instance because restarting the instance does not work in this case.

7.5. MANUALLY UPGRADING THE CEPH FILE SYSTEM METADATA SERVER NODES

You can manually upgrade the Ceph File System (CephFS) Metadata Server (MDS) software on a Red Hat Ceph Storage cluster running either Red Hat Enterprise Linux 7 or 8.

IMPORTANT

Before you upgrade the storage cluster, reduce the number of active MDS ranks to one per file system. This eliminates any possible version conflicts between multiple MDS. In addition, take all standby nodes offline before upgrading.

This is because the MDS cluster does not possess built-in versioning or file system flags. Without these features, multiple MDS might communicate using different versions of the MDS software, and could cause assertions or other faults to occur.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- The nodes are using Red Hat Ceph Storage version 3.3z64 or 4.1.
- Root-level access to all nodes in the storage cluster.

IMPORTANT

The underlying XFS filesystem must be formatted with **ftype=1** or with **d_type** support. Run the command **xfs_info /var** to ensure the **ftype** is set to **1**. If the value of **ftype** is not **1**, attach a new disk or create a volume. On top of this new device, create a new XFS filesystem and mount it on **/var/lib/containers**.

Starting with Red Hat Enterprise Linux 8.0, **mkfs.xfs** enables **ftype=1** by default.

Procedure

1. Reduce the number of active MDS ranks to 1:

Syntax

```
ceph fs set FILE_SYSTEM_NAME max_mds 1
```

Example

```
[root@mds ~]# ceph fs set fs1 max_mds 1
```

2. Wait for the cluster to stop all of the MDS ranks. When all of the MDS have stopped, only rank 0 should be active. The rest should be in standby mode. Check the status of the file system:

   ```
   [root@mds ~]# ceph status
   ```

3. Use **systemctl** to take all standby MDS offline:

   ```
   [root@mds ~]# systemctl stop ceph-mds.target
   ```

4. Confirm that only one MDS is online, and that it has rank 0 for your file system:

   ```
   [root@mds ~]# ceph status
   ```

5. If you are upgrading from Red Hat Ceph Storage 3 on RHEL 7, disable the Red Hat Ceph Storage 3 tools repository and enable the Red Hat Ceph Storage 4 tools repository:

   ```
   [root@mds ~]# subscription-manager repos --disable=rhel-7-server-rhceph-3-tools-rpms
   [root@mds ~]# subscription-manager repos --enable=rhel-7-server-rhceph-4-tools-rpms
   ```

6. Update the node and restart the ceph-mds daemon:

   ```
   [root@mds ~]# yum update -y
   [root@mds ~]# systemctl restart ceph-mds.target
   ```

7. Follow the same processes for the standby daemons. Disable and enable the tools repositories, and then upgrade and restart each standby MDS:

   ```
   [root@mds ~]# subscription-manager repos --disable=rhel-7-server-rhceph-3-tools-rpms
   [root@mds ~]# subscription-manager repos --enable=rhel-7-server-rhceph-4-tools-rpms
   [root@mds ~]# yum update -y
   [root@mds ~]# systemctl restart ceph-mds.target
   ```

8. When you have finished restarting all of the MDS in standby, restore the previous value of **max_mds** for the storage cluster:

   Syntax

   ```
   ceph fs set FILE_SYSTEM_NAME max_mds ORIGINAL_VALUE
   ```

   Example

   ```
   [root@mds ~]# ceph fs set fs1 max_mds 5
   ```

7.6. ADDITIONAL RESOURCES

- To see the package versions that correlate to 3.3z5 see What are the Red Hat Ceph Storage releases and corresponding Ceph package versions?

CHAPTER 8. MANUALLY UPGRADING A RED HAT CEPH STORAGE CLUSTER AND OPERATING SYSTEM

Normally, using **ceph-ansible**, it is not possible to upgrade Red Hat Ceph Storage and Red Hat Enterprise Linux to a new major release at the same time. For example, if you are on Red Hat Enterprise Linux 7, using **ceph-ansible**, you must stay on that version. As a system administrator, you can do this manually, however.

Use this chapter to manually upgrade a Red Hat Ceph Storage cluster at version 4.1 or 3.3z6 running on Red Hat Enterprise Linux 7.9, to a Red Hat Ceph Storage cluster at version 4.2 running on Red Hat Enterprise Linux 8.4.

IMPORTANT

To upgrade a containerized Red Hat Ceph Storage cluster at version 3.x or 4.x to a version 4.2, see the following three sections, *Supported Red Hat Ceph Storage upgrade scenarios*, *Preparing for an upgrade* , and *Upgrading the storage cluster using Ansible* in the *Red Hat Ceph Storage Installation Guide*.

To migrate existing systemd templates, run **docker-to-podman** playbook:

```
[user@admin ceph-ansible]$ ansible-playbook infrastructure-playbooks/docker-to-podman.yml -i hosts
```

Where **user** is the Ansible user.

IMPORTANT

If a node is collocated with more than one daemon, follow the specific section in this chapter , for the daemons collocated in the node. For example a node collocated with the Ceph Monitor daemon and the OSD daemon:

see *Manually upgrading Ceph Monitor nodes and their operating systems* and *Manually upgrading Ceph OSD nodes and their operating systems*.

IMPORTANT

Manually upgrading Ceph OSD nodes and their operating systems will not work with encrypted OSD partitions as the Leapp upgrade utility does not support upgrading with OSD encryption.

8.1. PREREQUISITES

- A running Red Hat Ceph Storage cluster.
- The nodes are running Red Hat Enterprise Linux 7.9.
- The nodes are using Red Hat Ceph Storage version 3.3z6 or 4.1
- Access to the installation source for Red Hat Enterprise Linux 8.3.

8.2. MANUALLY UPGRADING CEPH MONITOR NODES AND THEIR OPERATING SYSTEMS

As a system administrator, you can manually upgrade the Ceph Monitor software on a Red Hat Ceph Storage cluster node and the Red Hat Enterprise Linux operating system to a new major release at the same time.

> **IMPORTANT**
>
> Perform the procedure on only one Monitor node at a time. To prevent cluster access issues, ensure the current upgraded Monitor node has returned to normal operation *prior* to proceeding to the next node.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- The nodes are running Red Hat Enterprise Linux 7.9.
- The nodes are using Red Hat Ceph Storage version 3.3z6 or 4.1
- Access to the installation source for Red Hat Enterprise Linux 8.3.

Procedure

1. Stop the monitor service:

   Syntax

   ```
   systemctl stop ceph-mon@MONITOR_ID
   ```

   Replace *MONITOR_ID* with the Monitor's ID number.

2. If using Red Hat Ceph Storage 3, disable the Red Hat Ceph Storage 3 repositories.

   a. Disable the tools repository:

   ```
   [root@mon ~]# subscription-manager repos --disable=rhel-7-server-rhceph-3-tools-rpms
   ```

   b. Disable the mon repository:

   ```
   [root@mon ~]# subscription-manager repos --disable=rhel-7-server-rhceph-3-mon-rpms
   ```

3. If using Red Hat Ceph Storage 4, disable the Red Hat Ceph Storage 4 repositories.

   a. Disable the tools repository:

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

   b. Disable the mon repository:

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

4. Install the **leapp** utility. See Upgrading from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8.

5. Run through the leapp preupgrade checks. See Assessing upgradability from the command line .

6. Set **PermitRootLogin yes** in **/etc/ssh/sshd_config**.

7. Restart the OpenSSH SSH daemon:

   ```
   [root@mon ~]# systemctl restart sshd.service
   ```

8. Remove the iSCSI module from the Linux kernel:

   ```
   [root@mon ~]# modprobe -r iscsi
   ```

9. Perform the upgrade by following Performing the upgrade from RHEL 7 to RHEL 8 .

10. Reboot the node.

11. Enable the repositories for Red Hat Ceph Storage 4 for Red Hat Enterprise Linux 8.

    a. Enable the tools repository:

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

    b. Enable the mon repository:

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

12. Install the **ceph-mon** package:

    ```
    [root@mon ~]# dnf install ceph-mon
    ```

13. If the manager service is colocated with the monitor service, install the **ceph-mgr** package:

    ```
    [root@mon ~]# dnf install ceph-mgr
    ```

14. Restore the **ceph-client-admin.keyring** and **ceph.conf** files from a Monitor node which has not been upgraded yet or from a node that has already had those files restored.

15. Switch any existing CRUSH buckets to the latest bucket type **straw2**.

    ```
    # ceph osd getcrushmap -o backup-crushmap
    # ceph osd crush set-all-straw-buckets-to-straw2
    ```

16. Once all the daemons are updated after upgrading from Red Hat Ceph Storage 3 to Red Hat Ceph Storage 4, run the following steps:

    a. Enable the messenger v2 protocol, **msgr2**:

    ```
    ceph mon enable-msgr2
    ```

This instructs all Ceph Monitors that bind to the old default port of 6789, to also bind to the new port of 3300.

> **IMPORTANT**
>
> Ensure all the Ceph Monitors are upgraded from Red Hat Ceph Storage 3 to Red Hat Ceph Storage 4 before performing any further Ceph Monitor configuration.

b. Verify the status of the monitor:

```
ceph mon dump
```

> **NOTE**
>
> Running nautilus OSDs does not bind to their v2 address automatically. They must be restarted.

17. For each host upgraded from Red Hat Ceph Storage 3 to Red Hat Ceph Storage 4, update the **ceph.conf** file to either not specify any monitor port or reference both the v2 and v1 addresses and ports. Import any configuration options in **ceph.conf** file into the storage cluster's configuration database.

Example

```
[root@mon ~]# ceph config assimilate-conf -i /etc/ceph/ceph.conf
```

a. Check the storage cluster's configuration database.

Example

```
[root@mon ~]# ceph config dump
```

b. Optional: After upgrading to Red Hat Ceph Storage 4, create a minimal **ceph.conf** file for each host:

Example

```
[root@mon ~]# ceph config generate-minimal-conf > /etc/ceph/ceph.conf.new
[root@mon ~]# mv /etc/ceph/ceph.conf.new /etc/ceph/ceph.conf
```

18. Install the **leveldb** package:

```
[root@mon ~]# dnf install leveldb
```

19. Start the monitor service:

```
[root@mon ~]# systemctl start ceph-mon.target
```

20. If the manager service is colocated with the monitor service, start the manager service too:

```
[root@mon ~]# systemctl start ceph-mgr.target
```

21. Verify the monitor service came back up and is in quorum.

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

    On the *mon:* line under *services:*, ensure the node is listed as in *quorum* and not as *out of quorum*.

    Example

    ```
    mon: 3 daemons, quorum ceph4-mon,ceph4-mon2,ceph4-mon3 (age 2h)
    ```

22. If the manager service is colocated with the monitor service, verify it is up too:

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

    Look for the manager's node name on the *mgr:* line under *services*.

    Example

    ```
    mgr: ceph4-mon(active, since 2h), standbys: ceph4-mon3, ceph4-mon2
    ```

23. Repeat the above steps on all Monitor nodes until they have all been upgraded.

Additional Resources

- See Manually upgrading a Red Hat Ceph Storage cluster and operating system in the Installation Guide for more information.
- See Upgrading from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8 for more information.

8.3. MANUALLY UPGRADING CEPH OSD NODES AND THEIR OPERATING SYSTEMS

As a system administrator, you can manually upgrade the Ceph OSD software on a Red Hat Ceph Storage cluster node and the Red Hat Enterprise Linux operating system to a new major release at the same time.

IMPORTANT

This procedure should be performed for each OSD node in the Ceph cluster, but typically only for one OSD node at a time. A maximum of one failure domains worth of OSD nodes may be performed in parallel. For example, if per-rack replication is in use, one entire rack's OSD nodes can be upgraded in parallel. To prevent data access issues, ensure the current OSD node's OSDs have returned to normal operation and all of the cluster's PGs are in the **active+clean** state **prior** to proceeding to the next OSD.

IMPORTANT

This procedure will not work with encrypted OSD partitions as the Leapp upgrade utility does not support upgrading with OSD encryption.

IMPORTANT

If the OSDs were created using **ceph-disk**, and are still managed by **ceph-disk**, you must use **ceph-volume** to take over management of them. This is covered in an optional step below.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- The nodes are running Red Hat Enterprise Linux 7.9.
- The nodes are using Red Hat Ceph Storage version 3.3z6 or 4.0
- Access to the installation source for Red Hat Enterprise Linux 8.3.

Procedure

1. Set the OSD **noout** flag to prevent OSDs from getting marked down during the migration:

   ```
   ceph osd set noout
   ```

2. Set the OSD **nobackfill**, **norecover**, **norrebalance**, **noscrub** and **nodeep-scrub** flags to avoid unnecessary load on the cluster and to avoid any data reshuffling when the node goes down for migration:

   ```
   ceph osd set nobackfill
   ceph osd set norecover
   ceph osd set norebalance
   ceph osd set noscrub
   ceph osd set nodeep-scrub
   ```

3. Gracefully shut down all the OSD processes on the node:

   ```
   [root@mon ~]# systemctl stop ceph-osd.target
   ```

4. If using Red Hat Ceph Storage 3, disable the Red Hat Ceph Storage 3 repositories.

   a. Disable the tools repository:

      ```
      [root@mon ~]# subscription-manager repos --disable=rhel-7-server-rhceph-3-tools-rpms
      ```

   b. Disable the osd repository:

      ```
      [root@mon ~]# subscription-manager repos --disable=rhel-7-server-rhceph-3-osd-rpms
      ```

5. If using Red Hat Ceph Storage 4, disable the Red Hat Ceph Storage 4 repositories.

   a. Disable the tools repository:

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

b. Disable the osd repository:

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

6. Install the **leapp** utility. See Upgrading from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8.

7. Run through the leapp preupgrade checks. See Assessing upgradability from the command line .

8. Set **PermitRootLogin yes** in **/etc/ssh/sshd_config**.

9. Restart the OpenSSH SSH daemon:

   ```
   [root@mon ~]# systemctl restart sshd.service
   ```

10. Remove the iSCSI module from the Linux kernel:

    ```
    [root@mon ~]# modprobe -r iscsi
    ```

11. Perform the upgrade by following Performing the upgrade from RHEL 7 to RHEL 8 .

12. Reboot the node.

13. Enable the repositories for Red Hat Ceph Storage 4 for Red Hat Enterprise Linux 8.

    a. Enable the tools repository:

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

    b. Enable the osd repository:

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

14. Install the **ceph-osd** package:

    ```
    [root@mon ~]# dnf install ceph-osd
    ```

15. Install the **leveldb** package:

    ```
    [root@mon ~]# dnf install leveldb
    ```

16. Restore the **ceph.conf** file from a node which has not been upgraded yet or from a node that has already had those files restored.

17. Unset the **noout**, **nobackfill**, **norecover**, **norrebalance**, **noscrub** and **nodeep-scrub** flags:

    ```
    # ceph osd unset noout
    # ceph osd unset nobackfill
    # ceph osd unset norecover
    ```

```
# ceph osd unset norebalance
# ceph osd unset noscrub
# ceph osd unset nodeep-scrub
```

18. Switch any existing CRUSH buckets to the latest bucket type **straw2**.

```
# ceph osd getcrushmap -o backup-crushmap
# ceph osd crush set-all-straw-buckets-to-straw2
```

19. Optional: If the OSDs were created using **ceph-disk**, and are still managed by **ceph-disk**, you must use **ceph-volume** to take over management of them.

    a. Mount each object storage device:

    Syntax

    ```
    /dev/DRIVE /var/lib/ceph/osd/ceph-OSD_ID
    ```

    Replace *DRIVE* with the storage device name and partition number.

    Replace *OSD_ID* with the OSD ID.

    Example

    ```
    [root@mon ~]# mount /dev/sdb1 /var/lib/ceph/osd/ceph-0
    ```

    Verify the *ID_NUMBER* is correct.

    Syntax

    ```
    cat /var/lib/ceph/osd/ceph-OSD_ID/whoami
    ```

    Replace *OSD_ID* with the OSD ID.

    Example

    ```
    [root@mon ~]# cat /var/lib/ceph/osd/ceph-0/whoami
    0
    ```

    Repeat the above steps for any additional object store devices.

    b. Scan the newly mounted devices:

    Syntax

    ```
    ceph-volume simple scan /var/lib/ceph/osd/ceph-OSD_ID
    ```

    Replace *OSD_ID* with the OSD ID.

    Example

    ```
    [root@mon ~]# ceph-volume simple scan /var/lib/ceph/osd/ceph-0
     stderr: lsblk: /var/lib/ceph/osd/ceph-0: not a block device
    ```

```
 stderr: lsblk: /var/lib/ceph/osd/ceph-0: not a block device
 stderr: Unknown device, --name=, --path=, or absolute path in /dev/ or /sys expected.
Running command: /usr/sbin/cryptsetup status /dev/sdb1
--> OSD 0 got scanned and metadata persisted to file: /etc/ceph/osd/0-0c9917f7-fce8-42aa-bdec-8c2cf2d536ba.json
--> To take over management of this scanned OSD, and disable ceph-disk and udev, run:
-->     ceph-volume simple activate 0 0c9917f7-fce8-42aa-bdec-8c2cf2d536ba
```

Repeat the above step for any additional object store devices.

c. Activate the device:

Syntax

```
ceph-volume simple activate OSD_ID UUID
```

Replace *OSD_ID* with the OSD ID and *UUID* with the UUID printed in the scan output from earlier.

Example

```
[root@mon ~]# ceph-volume simple activate 0 0c9917f7-fce8-42aa-bdec-8c2cf2d536ba
Running command: /usr/bin/ln -snf /dev/sdb2 /var/lib/ceph/osd/ceph-0/journal
Running command: /usr/bin/chown -R ceph:ceph /dev/sdb2
Running command: /usr/bin/systemctl enable ceph-volume@simple-0-0c9917f7-fce8-42aa-bdec-8c2cf2d536ba
 stderr: Created symlink /etc/systemd/system/multi-user.target.wants/ceph-volume@simple-0-0c9917f7-fce8-42aa-bdec-8c2cf2d536ba.service →
/usr/lib/systemd/system/ceph-volume@.service.
Running command: /usr/bin/ln -sf /dev/null /etc/systemd/system/ceph-disk@.service
--> All ceph-disk systemd units have been disabled to prevent OSDs getting triggered by UDEV events
Running command: /usr/bin/systemctl enable --runtime ceph-osd@0
 stderr: Created symlink /run/systemd/system/ceph-osd.target.wants/ceph-osd@0.service → /usr/lib/systemd/system/ceph-osd@.service.
Running command: /usr/bin/systemctl start ceph-osd@0
--> Successfully activated OSD 0 with FSID 0c9917f7-fce8-42aa-bdec-8c2cf2d536ba
```

Repeat the above step for any additional object store devices.

20. Optional: If your OSDs were created with **ceph-volume** and you did not complete the previous step, start the OSD service now:

```
[root@mon ~]# systemctl start ceph-osd.target
```

21. Activate the OSDs:

BlueStore

```
[root@mon ~]# ceph-volume lvm activate --all
```

22. Verify that the OSDs are **up** and **in**, and that they are in the **active+clean** state.

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

On the *osd:* line under *services:*, ensure that all OSDs are **up** and **in**:

Example

```
osd: 3 osds: 3 up (since 8s), 3 in (since 3M)
```

23. Repeat the above steps on all OSD nodes until they have all been upgraded.

24. If upgrading from Red Hat Ceph Storage 3, disallow pre-Nautilus OSDs and enable the Nautilus-only functionality:

```
[root@mon ~]# ceph osd require-osd-release nautilus
```

NOTE

Failure to execute this step makes it impossible for OSDs to communicate after **msgrv2** is enabled.

25. Once all the daemons are updated after upgrading from Red Hat Ceph Storage 3 to Red Hat Ceph Storage 4, run the following steps:

a. Enable the messenger v2 protocol, **msgr2**:

```
[root@mon ~]# ceph mon enable-msgr2
```

This instructs all Ceph Monitors that bind to the old default port of 6789, to also bind to the new port of 3300.

b. On every node, import any configuration options in **ceph.conf** file into the storage cluster’s configuration database:

Example

```
[root@mon ~]# ceph config assimilate-conf -i /etc/ceph/ceph.conf
```

NOTE

When you assimilate a config into your monitors, for example, if you have different config values set for the same set of options, the end result depends on the order in which the files are assimilated.

c. Check the storage cluster’s configuration database:

Example

```
[root@mon ~]# ceph config dump
```

Additional Resources

- See Manually upgrading a Red Hat Ceph Storage cluster and operating system in the Installation Guide for more information.

- See Upgrading from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8 for more information.

8.4. MANUALLY UPGRADING CEPH OBJECT GATEWAY NODES AND THEIR OPERATING SYSTEMS

As a system administrator, you can manually upgrade the Ceph Object Gateway (RGW) software on a Red Hat Ceph Storage cluster node and the Red Hat Enterprise Linux operating system to a new major release at the same time.

IMPORTANT

This procedure should be performed for each RGW node in the Ceph cluster, but only for one RGW node at a time. Ensure the current upgraded RGW has returned to normal operation **prior** to proceeding to the next node to prevent any client access issues.

Prerequisites

- A running Red Hat Ceph Storage cluster.

- The nodes are running Red Hat Enterprise Linux 7.9.

- The nodes are using Red Hat Ceph Storage version 3.3z6 or 4.1

- Access to the installation source for Red Hat Enterprise Linux 8.3.

Procedure

1. Stop the Ceph Object Gateway service:

```
# systemctl stop ceph-radosgw.target
```

2. If using Red Hat Ceph Storage 3, disable the Red Hat Ceph Storage 3 tool repository:

```
# subscription-manager repos --disable=rhel-7-server-rhceph-3-tools-rpms
```

3. If using Red Hat Ceph Storage 4, disable the Red Hat Ceph Storage 4 tools repository:

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

4. Install the **leapp** utility. See Upgrading from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8.

5. Run through the leapp preupgrade checks. See Assessing upgradability from the command line .

6. Set **PermitRootLogin yes** in **/etc/ssh/sshd_config**.

7. Restart the OpenSSH SSH daemon:

```
# systemctl restart sshd.service
```

8. Remove the iSCSI module from the Linux kernel:

   ```
   # modprobe -r iscsi
   ```

9. Perform the upgrade by following Performing the upgrade from RHEL 7 to RHEL 8 .

10. Reboot the node.

11. Enable the tools repositories for Red Hat Ceph Storage 4 for Red Hat Enterprise Linux 8.

    ```
    # subscription-manager repos --enable=rhceph-4-tools-for-rhel-8-x86_64-rpms
    ```

12. Install the **ceph-radosgw** package:

    ```
    # dnf install ceph-radosgw
    ```

13. Optional: Install the packages for any Ceph services that are colocated on this node. Enable additional Ceph repositories if needed.

14. Optional: Install the **leveldb** package which is needed by other Ceph services.

    ```
    # dnf install leveldb
    ```

15. Restore the **ceph-client-admin.keyring** and **ceph.conf** files from a node which has not been upgraded yet or from a node that has already had those files restored.

16. Start the RGW service:

    ```
    # systemctl start ceph-radosgw.target
    ```

17. Switch any existing CRUSH buckets to the latest bucket type **straw2**.

    ```
    # ceph osd getcrushmap -o backup-crushmap
    # ceph osd crush set-all-straw-buckets-to-straw2
    ```

18. Verify the daemon is active:

    ```
    # ceph -s
    ```

    There is an *rgw:* line under *services:*.

    ### Example

    ```
    rgw: 1 daemon active (jb-ceph4-rgw.rgw0)
    ```

19. Repeat the above steps on all Ceph Object Gateway nodes until they have all been upgraded.

Additional Resources

- See Manually upgrading a Red Hat Ceph Storage cluster and operating system in the Installation Guide for more information.

- See Upgrading from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8 for more information.

8.5. MANUALLY UPGRADING THE CEPH DASHBOARD NODE AND ITS OPERATING SYSTEM

As a system administrator, you can manually upgrade the Ceph Dashboard software on a Red Hat Ceph Storage cluster node and the Red Hat Enterprise Linux operating system to a new major release at the same time.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- The node is running Red Hat Enterprise Linux 7.9.
- The node is running Red Hat Ceph Storage version 3.3z6 or 4.1
- Access to the installation source for Red Hat Enterprise Linux 8.3.

Procedure

1. Uninstall the existing dashboard from the cluster.
   a. Change to the **/usr/share/cephmetrics-ansible** directory:
      ```
      # cd /usr/share/cephmetrics-ansible
      ```
   b. Run the **purge.yml** Ansible playbook:
      ```
      # ansible-playbook -v purge.yml
      ```
2. If using Red Hat Ceph Storage 3, disable the Red Hat Ceph Storage 3 tools repository:
   ```
   # subscription-manager repos --disable=rhel-7-server-rhceph-3-tools-rpms
   ```
3. If using Red Hat Ceph Storage 4, disable the Red Hat Ceph Storage 4 tools repository:
   ```
   # subscription-manager repos --disable=rhel-7-server-rhceph-4-tools-rpms
   ```
4. Install the **leapp** utility. See Upgrading from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8.
5. Run through the **leapp** preupgrade checks. See Assessing upgradability from the command line .
6. Set **PermitRootLogin yes** in **/etc/ssh/sshd_config**.
7. Restart the OpenSSH SSH daemon:
   ```
   # systemctl restart sshd.service
   ```
8. Remove the iSCSI module from the Linux kernel:

```
# modprobe -r iscsi
```

9. Perform the upgrade by following Performing the upgrade from RHEL 7 to RHEL 8 .

10. Reboot the node.

11. Enable the tools repository for Red Hat Ceph Storage 4 for Red Hat Enterprise Linux 8:

    ```
    # subscription-manager repos --enable=rhceph-4-tools-for-rhel-8-x86_64-rpms
    ```

12. Enable the Ansible repository:

    ```
    # subscription-manager repos --enable=ansible-2.9-for-rhel-8-x86_64-rpms
    ```

13. Configure **ceph-ansible** to manage the cluster. It will install the dashboard. Follow the instructions in Installing Red Hat Ceph Storage using Ansible , including the prerequisites.

14. After you run **ansible-playbook site.yml** as a part of the above procedures, the URL for the dashboard will be printed. See Installing dashboard using Ansible in the Dashboard guide for more information on locating the URL and accessing the dashboard.

Additional Resources

- See Manually upgrading a Red Hat Ceph Storage cluster and operating system in the Installation Guide for more information.

- See Upgrading from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8 for more information.

- See Installing dashboard using Ansible in the Dashboard guide for more information.

8.6. MANUALLY UPGRADING CEPH ANSIBLE NODES AND RECONFIGURING SETTINGS

Manually upgrade the Ceph Ansible software on a Red Hat Ceph Storage cluster node and the Red Hat Enterprise Linux operating system to a new major release at the same time. This procedure applies to both bare-metal and container deployments, unless specified.

> **IMPORTANT**
>
> Before upgrading hostOS on the Ceph Ansible node, take a backup of **group_vars** and **hosts** file. Use the created backup before re-configuring the Ceph Ansible node.

Prerequisites

- A running Red Hat Ceph Storage cluster.

- The node is running Red Hat Enterprise Linux 7.9.

- The node is running Red Hat Ceph Storage version 3.3z6 or 4.1

- Access to the installation source for Red Hat Enterprise Linux 8.3.

Procedure

1. Enable the tools repository for Red Hat Ceph Storage 4 for Red Hat Enterprise Linux 8:

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

2. Enable the Ansible repository:

```
[root@dashboard ~]# subscription-manager repos --enable=ansible-2.9-for-rhel-8-x86_64-rpms
```

3. Configure **ceph-ansible** to manage the storage cluster. It will install the dashboard. Follow the instructions in Installing Red Hat Ceph Storage using Ansible , including the prerequisites.

4. After you run **ansible-playbook site.yml** as a part of the above procedures, the URL for the dashboard will be printed. See Installing dashboard using Ansible in the Dashboard guide for more information on locating the URL and accessing the dashboard.

Additional Resources

- See Manually upgrading a Red Hat Ceph Storage cluster and operating system in the Installation Guide for more information.
- See Upgrading from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8 for more information.
- See Installing dashboard using Ansible in the Dashboard guide for more information.

8.7. MANUALLY UPGRADING THE CEPH FILE SYSTEM METADATA SERVER NODES AND THEIR OPERATING SYSTEMS

You can manually upgrade the Ceph File System (CephFS) Metadata Server (MDS) software on a Red Hat Ceph Storage cluster and the Red Hat Enterprise Linux operating system to a new major release at the same time.

IMPORTANT

Before you upgrade the storage cluster, reduce the number of active MDS ranks to one per file system. This eliminates any possible version conflicts between multiple MDS. In addition, take all standby nodes offline before upgrading.

This is because the MDS cluster does not possess built-in versioning or file system flags. Without these features, multiple MDS might communicate using different versions of the MDS software, and could cause assertions or other faults to occur.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- The nodes are running Red Hat Enterprise Linux 7.9.
- The nodes are using Red Hat Ceph Storage version 3.3z6 or 4.1.

- Access to the installation source for Red Hat Enterprise Linux 8.3.
- Root-level access to all nodes in the storage cluster.

IMPORTANT

The underlying XFS filesystem must be formatted with **ftype=1** or with **d_type** support. Run the command **xfs_info /var** to ensure the **ftype** is set to **1**. If the value of **ftype** is not **1**, attach a new disk or create a volume. On top of this new device, create a new XFS filesystem and mount it on **/var/lib/containers**.

Starting with Red Hat Enterprise Linux 8, **mkfs.xfs** enables **ftype=1** by default.

Procedure

1. Reduce the number of active MDS ranks to 1:

   Syntax

   ```
   ceph fs set FILE_SYSTEM_NAME max_mds 1
   ```

   Example

   ```
   [root@mds ~]# ceph fs set fs1 max_mds 1
   ```

2. Wait for the cluster to stop all of the MDS ranks. When all of the MDS have stopped, only rank 0 should be active. The rest should be in standby mode. Check the status of the file system:

   ```
   [root@mds ~]# ceph status
   ```

3. Use **systemctl** to take all standby MDS offline:

   ```
   [root@mds ~]# systemctl stop ceph-mds.target
   ```

4. Confirm that only one MDS is online, and that it has rank 0 for the file system:

   ```
   [root@mds ~]# ceph status
   ```

5. Disable the tools repository for the operating system version:

   a. If you are upgrading from Red Hat Ceph Storage 3 on RHEL 7, disable the Red Hat Ceph Storage 3 tools repository:

   ```
   [root@mds ~]# subscription-manager repos --disable=rhel-7-server-rhceph-3-tools-rpms
   ```

   b. If you are using Red Hat Ceph Storage 4, disable the Red Hat Ceph Storage 4 tools repository:

   ```
   [root@mds ~]# subscription-manager repos --disable=rhel-7-server-rhceph-4-tools-rpms
   ```

6. Install the **leapp** utility. For more information about **leapp**, refer to Upgrading from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8.

7. Run through the **leapp** preupgrade checks. For more information, refer to Assessing upgradability from the command line.

8. Edit **/etc/ssh/sshd_config** and set **PermitRootLogin** to **yes**.

9. Restart the OpenSSH SSH daemon:

   ```
   [root@mds ~]# systemctl restart sshd.service
   ```

10. Remove the iSCSI module from the Linux kernel:

    ```
    [root@mds ~]# modprobe -r iscsi
    ```

11. Perform the upgrade. See Performing the upgrade from RHEL 7 to RHEL 8 .

12. Reboot the MDS node.

13. Enable the tools repositories for Red Hat Ceph Storage 4 for Red Hat Enterprise Linux 8:

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

14. Install the **ceph-mds** package:

    ```
    [root@mds ~]# dnf install ceph-mds -y
    ```

15. Optional: Install the packages for any Ceph services that are colocated on this node. Enable additional Ceph repositories, if needed.

16. Optional: Install the **leveldb** package, which is needed by other Ceph services:

    ```
    [root@mds ~]# dnf install leveldb
    ```

17. Restore the **ceph-client-admin.keyring** and **ceph.conf** files from a node that has not been upgraded yet, or from a node that has already had those files restored.

18. Switch any existing CRUSH buckets to the latest bucket type **straw2**.

    ```
    # ceph osd getcrushmap -o backup-crushmap
    # ceph osd crush set-all-straw-buckets-to-straw2
    ```

19. Start the MDS service:

    ```
    [root@mds ~]# systemctl restart ceph-mds.target
    ```

20. Verify that the daemon is active:

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

21. Follow the same processes for the standby daemons.

22. When you have finished restarting all of the MDS in standby, restore the previous value of **max_mds** for your cluster:

Syntax

```
ceph fs set FILE_SYSTEM_NAME max_mds ORIGINAL_VALUE
```

Example

```
[root@mds ~]# ceph fs set fs1 max_mds 5
```

8.8. RECOVERING FROM AN OPERATING SYSTEM UPGRADE FAILURE ON AN OSD NODE

As a system administrator, if you have a failure when using the procedure Manually upgrading Ceph OSD nodes and their operating systems, you can recover from the failure using the following procedure. In the procedure you will do a fresh install of Red Hat Enterprise Linux 8.4 on the node and still be able to recover the OSDs without any major backfilling of data besides the writes to the OSDs that were down while they were out.

IMPORTANT

DO NOT touch the media backing the OSDs or their respective **wal.db** or **block.db** databases.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- An OSD node that failed to upgrade.
- Access to the installation source for Red Hat Enterprise Linux 8.4.

Procedure

1. Perform a standard installation of Red Hat Enterprise Linux 8.4 on the failed node and enable the Red Hat Enterprise Linux repositories.
   - Performing a standard RHEL installation
2. Enable the repositories for Red Hat Ceph Storage 4 for Red Hat Enterprise Linux 8.
   a. Enable the tools repository:

      ```
      # subscription-manager repos --enable=rhceph-4-tools-for-rhel-8-x86_64-rpms
      ```

   b. Enable the osd repository:

      ```
      # subscription-manager repos --enable=rhceph-4-osd-for-rhel-8-x86_64-rpms
      ```

3. Install the **ceph-osd** package:

   ```
   # dnf install ceph-osd
   ```

4. Restore the **ceph.conf** file to **/etc/ceph** from a node which has not been upgraded yet or from a node that has already had those files restored.

5. Start the OSD service:

   ```
   # systemctl start ceph-osd.target
   ```

6. Activate the object store devices:

   ```
   ceph-volume lvm activate --all
   ```

7. Watch the recovery of the OSDs and cluster backfill writes to recovered OSDs:

   ```
   # ceph -w
   ```

   Monitor the output until all PGs are in state **active+clean**.

Additional Resources

- See Manually upgrading a Red Hat Ceph Storage cluster and operating system in the Installation Guide for more information.

- See Upgrading from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8 for more information.

8.9. ADDITIONAL RESOURCES

- If you do not need to upgrade the operating system to a new major release, see Upgrading a Red Hat Ceph Storage cluster.

CHAPTER 9. WHAT TO DO NEXT?

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

- Benchmarking performance and accessing performance counters, see the *Benchmarking Performance* chapter in the Administration Guide for Red Hat Ceph Storage 4.
- Creating and managing snapshots, see the *Snapshots* chapter in the Block Device Guide for Red Hat Ceph Storage 4.
- Expanding the Red Hat Ceph Storage cluster, see the *Managing the storage cluster size* chapter in the Operations Guide for Red Hat Ceph Storage 4.
- Mirroring Ceph Block Devices, see the *Block Device Mirroring* chapter in the Block Device Guide for Red Hat Ceph Storage 4.
- Process management, see the *Process Management* chapter in the Administration Guide for Red Hat Ceph Storage 4.
- Tunable parameters, see the *Configuration Guide* for Red Hat Ceph Storage 4.
- Using Ceph as the back end storage for OpenStack, see the Back-ends section in the Storage Guide for Red Hat OpenStack Platform.
- Monitor the health and capacity of the Red Hat Ceph Storage cluster with the Ceph Dashboard. See the *Dashboard Guide* for additional details.

APPENDIX A. TROUBLESHOOTING

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

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

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

What this means:

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

Example situation:

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

To fix the problem:

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

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

See Chapter 5, *Installing Red Hat Ceph Storage using Ansible* for details.

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

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

B.1. INSTALLING THE CEPH COMMAND LINE INTERFACE

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

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

Prerequisites

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

Procedure

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

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

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

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

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

Syntax

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

Example

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

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

B.2. MANUALLY INSTALLING RED HAT CEPH STORAGE

IMPORTANT

Red Hat does not support or test upgrading manually deployed clusters. Therefore, Red Hat recommends to use Ansible to deploy a new cluster with Red Hat Ceph Storage 4. See Chapter 5, *Installing Red Hat Ceph Storage using Ansible* for details.

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

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

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

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

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

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

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

Monitor Bootstrapping

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

Unique Identifier

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

Monitor Name

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

Monitor Map

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

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

Monitor Keyring

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

Administrator Keyring

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

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

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

To bootstrap the initial Monitor, perform the following steps:

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

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

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

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

3. As **root**, create a Ceph configuration file in the **/etc/ceph/** directory.

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

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

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

5. View the current Ceph configuration file:

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

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

Syntax

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

Example

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

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

   Syntax

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

   Example

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

   NOTE

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

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

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

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

   Syntax

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

   Example

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

10. As **root**, add the **ceph.client.admin.keyring** key to the **ceph.mon.keyring**:

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

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

    Syntax

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

    Example

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

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

Syntax

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

Example

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

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

Syntax

```
# ceph-mon --mkfs -i <monitor_host_name> --monmap /tmp/monmap --keyring
/tmp/ceph.mon.keyring
```

Example

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

14. View the current Ceph configuration file:

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

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

Example

```
[global]
fsid = <cluster-id>
mon initial members = <monitor_host_name>[, <monitor_host_name>]
mon host = <ip-address>[, <ip-address>]
public network = <network>[, <network>]
cluster network = <network>[, <network>]
auth cluster required = cephx
auth service required = cephx
auth client required = cephx
osd journal size = <n>
osd pool default size = <n>  # Write an object n times.
osd pool default min size = <n> # Allow writing n copy in a degraded state.
osd pool default pg num = <n>
osd pool default pgp num = <n>
osd crush chooseleaf type = <n>
```

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

    Syntax

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

    Example

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

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

    Syntax

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

    Example

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

    NOTE

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

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

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

    Syntax

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

Example

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

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

Syntax

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

Example

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

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

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

OSD Bootstrapping

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

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

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

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

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

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

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

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

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

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

   Syntax

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

   Example

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

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

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

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

   Syntax

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

   Example

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

   NOTE

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

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

   Syntax

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

   Example

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

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

   Syntax

   ```
   # parted <path_to_disk> mklabel gpt
   # parted <path_to_disk> mkpart primary 1 10000
   ```

```
# mkfs -t <fstype> <path_to_partition>
# mount -o noatime <path_to_partition> /var/lib/ceph/osd/ceph-<osd_id>
# echo "<path_to_partition>  /var/lib/ceph/osd/ceph-<osd_id>   xfs defaults,noatime 1 2" >>
/etc/fstab
```

Example

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

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

Syntax

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

Example

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

9. As **root**, register the OSD authentication key.

Syntax

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

Example

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

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

Syntax

```
# ceph osd crush add-bucket <host_name> host
```

Example

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

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

Syntax

```
# ceph osd crush move <host_name> root=default
```

Example

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

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

    Syntax

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

    Example

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

    NOTE

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

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

    Syntax

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

    Example

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

14. The OSD node is in your Ceph storage cluster configuration. However, the OSD daemon is **down** and **in**. The new OSD must be **up** before it can begin receiving data. As **root**, enable and start the OSD process:

    Syntax

    ```
    # systemctl enable ceph-osd.target
    # systemctl enable ceph-osd@<osd_id>
    # systemctl start ceph-osd@<osd_id>
    ```

    Example

```
# systemctl enable ceph-osd.target
# systemctl enable ceph-osd@0
# systemctl start ceph-osd@0
```

Once you start the OSD daemon, it is **up** and **in**.

Now you have the monitors and some OSDs up and running. You can watch the placement groups peer by executing the following command:

```
$ ceph -w
```

To view the OSD tree, execute the following command:

```
$ ceph osd tree
```

Example

```
ID  WEIGHT    TYPE NAME        UP/DOWN  REWEIGHT  PRIMARY-AFFINITY
-1       2    root default
-2       2        host node2
 0       1            osd.0         up         1            1
-3       1        host node3
 1       1            osd.1         up         1            1
```

To expand the storage capacity by adding new OSDs to the storage cluster, see the Adding an OSD section in the *Administration Guide* for Red Hat Ceph Storage 4.

B.3. MANUALLY INSTALLING CEPH MANAGER

Usually, the Ansible automation utility installs the Ceph Manager daemon (**ceph-mgr**) when you deploy the Red Hat Ceph Storage cluster. However, if you do not use Ansible to manage Red Hat Ceph Storage, you can install Ceph Manager manually. Red Hat recommends to colocate the Ceph Manager and Ceph Monitor daemons on a same node.

Prerequisites

- A working Red Hat Ceph Storage cluster
- **root** or **sudo** access
- The **rhceph-4-mon-for-rhel-8-x86_64-rpms** repository enabled
- Open ports **6800-7300** on the public network if firewall is used

Procedure

Use the following commands on the node where **ceph-mgr** will be deployed and as the **root** user or with the **sudo** utility.

1. Install the **ceph-mgr** package:

```
[root@node1 ~]# yum install ceph-mgr
```

2. Create the **/var/lib/ceph/mgr/ceph-*hostname*/** directory:

   ```
   mkdir /var/lib/ceph/mgr/ceph-hostname
   ```

   Replace *hostname* with the host name of the node where the **ceph-mgr** daemon will be deployed, for example:

   ```
   [root@node1 ~]# mkdir /var/lib/ceph/mgr/ceph-node1
   ```

3. In the newly created directory, create an authentication key for the **ceph-mgr** daemon:

   ```
   [root@node1 ~]# ceph auth get-or-create mgr.`hostname -s` mon 'allow profile mgr' osd
   'allow *' mds 'allow *' -o /var/lib/ceph/mgr/ceph-node1/keyring
   ```

4. Change the owner and group of the **/var/lib/ceph/mgr/** directory to **ceph:ceph**:

   ```
   [root@node1 ~]# chown -R ceph:ceph /var/lib/ceph/mgr
   ```

5. Enable the **ceph-mgr** target:

   ```
   [root@node1 ~]# systemctl enable ceph-mgr.target
   ```

6. Enable and start the **ceph-mgr** instance:

   ```
   systemctl enable ceph-mgr@hostname
   systemctl start ceph-mgr@hostname
   ```

   Replace *hostname* with the host name of the node where the **ceph-mgr** will be deployed, for example:

   ```
   [root@node1 ~]# systemctl enable ceph-mgr@node1
   [root@node1 ~]# systemctl start ceph-mgr@node1
   ```

7. Verify that the **ceph-mgr** daemon started successfully:

   ```
   ceph -s
   ```

   The output will include a line similar to the following one under the **services:** section:

   ```
       mgr: node1(active)
   ```

8. Install more **ceph-mgr** daemons to serve as standby daemons that become active if the current active daemon fails.

Additional resources

- *Requirements for Installing Red Hat Ceph Storage*

B.4. MANUALLY INSTALLING CEPH BLOCK DEVICE

The following procedure shows how to install and mount a thin-provisioned, resizable Ceph Block Device.

IMPORTANT

Ceph Block Devices must be deployed on separate nodes from the Ceph Monitor and OSD nodes. Running kernel clients and kernel server daemons on the same node can lead to kernel deadlocks.

Prerequisites

- Ensure to perform the tasks listed in the Section B.1, "Installing the Ceph Command Line Interface" section.
- If you use Ceph Block Devices as a back end for virtual machines (VMs) that use QEMU, increase the default file descriptor. See the Ceph - VM hangs when transferring large amounts of data to RBD disk Knowledgebase article for details.

Procedure

1. Create a Ceph Block Device user named **client.rbd** with full permissions to files on OSD nodes (**osd 'allow rwx'**) and output the result to a keyring file:

```
ceph auth get-or-create client.rbd mon 'profile rbd' osd 'profile rbd pool=<pool_name>' \
-o /etc/ceph/rbd.keyring
```

   Replace **<pool_name>** with the name of the pool that you want to allow **client.rbd** to have access to, for example **rbd**:

```
# ceph auth get-or-create \
client.rbd mon 'allow r' osd 'allow rwx pool=rbd' \
-o /etc/ceph/rbd.keyring
```

   See the *User Management* section in the Red Hat Ceph Storage 4 *Administration Guide* for more information about creating users.

2. Create a block device image:

```
rbd create <image_name> --size <image_size> --pool <pool_name> \
--name client.rbd --keyring /etc/ceph/rbd.keyring
```

   Specify **<image_name>**, **<image_size>**, and **<pool_name>**, for example:

```
$ rbd create image1 --size 4G --pool rbd \
--name client.rbd --keyring /etc/ceph/rbd.keyring
```

WARNING

The default Ceph configuration includes the following Ceph Block Device features:

- **layering**
- **exclusive-lock**
- **object-map**
- **deep-flatten**
- **fast-diff**

If you use the kernel RBD (**krbd**) client, you may not be able to map the block device image.

To work around this problem, disable the unsupported features. Use one of the following options to do so:

- Disable the unsupported features dynamically:

  ```
  rbd feature disable <image_name> <feature_name>
  ```

  For example:

  ```
  # rbd feature disable image1 object-map deep-flatten fast-diff
  ```

- Use the **--image-feature layering** option with the **rbd create** command to enable only **layering** on newly created block device images.
- Disable the features be default in the Ceph configuration file:

  ```
  rbd_default_features = 1
  ```

This is a known issue, for details see the *Known Issues* chapter in the *Release Notes* for Red Hat Ceph Storage 4.

All these features work for users that use the user-space RBD client to access the block device images.

3. Map the newly created image to the block device:

```
rbd map <image_name> --pool <pool_name>\
--name client.rbd --keyring /etc/ceph/rbd.keyring
```

For example:

```
# rbd map image1 --pool rbd --name client.rbd \
--keyring /etc/ceph/rbd.keyring
```

4. Use the block device by creating a file system:

   ```
   mkfs.ext4 /dev/rbd/<pool_name>/<image_name>
   ```

   Specify the pool name and the image name, for example:

   ```
   # mkfs.ext4 /dev/rbd/rbd/image1
   ```

   This action can take a few moments.

5. Mount the newly created file system:

   ```
   mkdir <mount_directory>
   mount /dev/rbd/<pool_name>/<image_name> <mount_directory>
   ```

   For example:

   ```
   # mkdir /mnt/ceph-block-device
   # mount /dev/rbd/rbd/image1 /mnt/ceph-block-device
   ```

Additional Resources

- The *Block Device Guide* for Red Hat Ceph Storage 4.

B.5. MANUALLY INSTALLING CEPH OBJECT GATEWAY

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

Prerequisites

- A running Ceph storage cluster, preferably in the **active + clean** state.
- Perform the tasks listed in Chapter 3, *Requirements for Installing Red Hat Ceph Storage* .

Procedure

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

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

2. On the Object Gateway node, install the **ceph-radosgw** package:

   ```
   # yum install ceph-radosgw
   ```

3. On the initial Monitor node, do the following steps.

   a. Update the Ceph configuration file as follows:

```
[client.rgw.<obj_gw_hostname>]
host = <obj_gw_hostname>
rgw frontends = "civetweb port=80"
rgw dns name = <obj_gw_hostname>.example.com
```

Where **<obj_gw_hostname>** is a short host name of the gateway node. To view the short host name, use the **hostname -s** command.

b. Copy the updated configuration file to the new Object Gateway node and all other nodes in the Ceph storage cluster:

Syntax

```
# scp /etc/ceph/ceph.conf <user_name>@<target_host_name>:/etc/ceph
```

Example

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

c. Copy the **ceph.client.admin.keyring** file to the new Object Gateway node:

Syntax

```
# scp /etc/ceph/ceph.client.admin.keyring
<user_name>@<target_host_name>:/etc/ceph/
```

Example

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

4. On the Object Gateway node, create the data directory:

```
# mkdir -p /var/lib/ceph/radosgw/ceph-rgw.`hostname -s`
```

5. On the Object Gateway node, add a user and keyring to bootstrap the object gateway:

Syntax

```
# ceph auth get-or-create client.rgw.`hostname -s` osd 'allow rwx' mon 'allow rw' -o
/var/lib/ceph/radosgw/ceph-rgw.`hostname -s`/keyring
```

Example

```
# ceph auth get-or-create client.rgw.`hostname -s` osd 'allow rwx' mon 'allow rw' -o
/var/lib/ceph/radosgw/ceph-rgw.`hostname -s`/keyring
```

IMPORTANT

When you provide capabilities to the gateway key you must provide the read capability. However, providing the Monitor write capability is optional; if you provide it, the Ceph Object Gateway will be able to create pools automatically.

In such a case, ensure to specify a reasonable number of placement groups in a pool. Otherwise, the gateway uses the default number, which is most likely **not** suitable for your needs. See Ceph Placement Groups (PGs) per Pool Calculator for details.

6. On the Object Gateway node, create the **done** file:

   ```
   # touch /var/lib/ceph/radosgw/ceph-rgw.`hostname -s`/done
   ```

7. On the Object Gateway node, change the owner and group permissions:

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

8. On the Object Gateway node, open TCP port 8080:

   ```
   # firewall-cmd --zone=public --add-port=8080/tcp
   # firewall-cmd --zone=public --add-port=8080/tcp --permanent
   ```

9. On the Object Gateway node, start and enable the **ceph-radosgw** process:

   #### Syntax

   ```
   # systemctl enable ceph-radosgw.target
   # systemctl enable ceph-radosgw@rgw.<rgw_hostname>
   # systemctl start ceph-radosgw@rgw.<rgw_hostname>
   ```

   #### Example

   ```
   # systemctl enable ceph-radosgw.target
   # systemctl enable ceph-radosgw@rgw.node1
   # systemctl start ceph-radosgw@rgw.node1
   ```

Once installed, the Ceph Object Gateway automatically creates pools if the write capability is set on the Monitor. See the Pools chapter in the Storage Strategies Guide for details on creating pools manually.

Additional Resources

- The Red Hat Ceph Storage 4 *Object Gateway Configuration and Administration Guide*

APPENDIX C. CONFIGURING ANSIBLE INVENTORY LOCATION

As an option, you can configure inventory location files for the **ceph-ansible** staging and production environments.

Prerequisites

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

Procedure

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

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

2. Create subdirectories for staging and production:

   ```
   [ansible@admin ceph-ansible]$ mkdir -p inventory/staging inventory/production
   ```

3. Edit the **ansible.cfg** file and add the following lines:

   ```
   [defaults]
   inventory = ./inventory/staging # Assign a default inventory directory
   ```

4. Create an inventory 'hosts' file for each environment:

   ```
   [ansible@admin ceph-ansible]$ touch inventory/staging/hosts
   [ansible@admin ceph-ansible]$ touch inventory/production/hosts
   ```

   a. Open and edit each **hosts** file and add the Ceph Monitor nodes under the **[mons]** section:

      ```
      [mons]
      MONITOR_NODE_NAME_1
      MONITOR_NODE_NAME_1
      MONITOR_NODE_NAME_1
      ```

      #### Example

      ```
      [mons]
      mon-stage-node1
      mon-stage-node2
      mon-stage-node3
      ```

NOTE

By default, playbooks run in the staging environment. To run the playbook in the production environment:

```
[ansible@admin ceph-ansible]$ ansible-playbook -i inventory/production
playbook.yml
```

Additional Resources

- For more information about installing the **ceph-ansible** package, see Installing a Red Hat Storage Cluster.

APPENDIX D. OVERRIDING CEPH DEFAULT SETTINGS

Unless otherwise specified in the Ansible configuration files, Ceph uses its default settings.

Because Ansible manages the Ceph configuration file, edit the **/usr/share/ceph-ansible/group_vars/all.yml** file to change the Ceph configuration. Use the **ceph_conf_overrides** setting to override the default Ceph configuration.

Ansible supports the same sections as the Ceph configuration file; **[global]**, **[mon]**, **[osd]**, **[mds]**, **[rgw]**, and so on. You can also override particular instances, such as a particular Ceph Object Gateway instance. For example:

```
###################
# CONFIG OVERRIDE #
###################

ceph_conf_overrides:
  client.rgw.server601.rgw1:
    rgw_enable_ops_log: true
    log_file: /var/log/ceph/ceph-rgw-rgw1.log
```

NOTE

Do not use a variable as a key in the **ceph_conf_overrides** setting. You must pass the absolute label for the host for the section(s) for which you want to override particular configuration value.

NOTE

Ansible does not include braces when referring to a particular section of the Ceph configuration file. Sections and settings names are terminated with a colon.

IMPORTANT

Do not set the cluster network with the **cluster_network** parameter in the **CONFIG OVERRIDE** section because this can cause two conflicting cluster networks being set in the Ceph configuration file.

To set the cluster network, use the **cluster_network** parameter in the **CEPH CONFIGURATION** section. For details, see *Installing a Red Hat Ceph Storage cluster* in the *Red Hat Ceph Storage Installation Guide*.

APPENDIX E. IMPORTING AN EXISTING CEPH CLUSTER TO ANSIBLE

You can configure Ansible to use a cluster deployed without Ansible. For example, if you upgraded Red Hat Ceph Storage 1.3 clusters to version 2 manually, configure them to use Ansible by following this procedure:

1. After manually upgrading from version 1.3 to version 2, install and configure Ansible on the administration node.

2. Ensure that the Ansible administration node has passwordless **ssh** access to all Ceph nodes in the cluster. See Section 3.9, "Enabling password-less SSH for Ansible" for more details.

3. As **root**, create a symbolic link to the Ansible **group_vars** directory in the **/etc/ansible/** directory:

   ```
   # ln -s /usr/share/ceph-ansible/group_vars /etc/ansible/group_vars
   ```

4. As **root**, create an **all.yml** file from the **all.yml.sample** file and open it for editing:

   ```
   # cd /etc/ansible/group_vars
   # cp all.yml.sample all.yml
   # vim all.yml
   ```

5. Set the **generate_fsid** setting to **false** in **group_vars/all.yml**.

6. Get the current cluster **fsid** by executing **ceph fsid**.

7. Set the retrieved **fsid** in **group_vars/all.yml**.

8. Modify the Ansible inventory in **/etc/ansible/hosts** to include Ceph hosts. Add monitors under a **[mons]** section, OSDs under an **[osds]** section and gateways under an **[rgws]** section to identify their roles to Ansible.

9. Make sure **ceph_conf_overrides** is updated with the original **ceph.conf** options used for **[global]**, **[osd]**, **[mon]**, and **[client]** sections in the **all.yml** file.
   Options like **osd journal**, **public_network** and **cluster_network** should not be added in **ceph_conf_overrides** because they are already part of **all.yml**. Only the options that are not part of **all.yml** and are in the original **ceph.conf** should be added to **ceph_conf_overrides**.

10. From the **/usr/share/ceph-ansible/** directory run the playbook.

    ```
    # cd /usr/share/ceph-ansible/
    # ansible-playbook infrastructure-playbooks/take-over-existing-cluster.yml -u <username> -i hosts
    ```

APPENDIX F. PURGING STORAGE CLUSTERS DEPLOYED BY ANSIBLE

If you no longer want to use a Ceph storage cluster, then use the **purge-docker-cluster.yml** playbook to remove the cluster. Purging a storage cluster is also useful when the installation process failed and you want to start over.

> ⚠ **WARNING**
>
> After purging a Ceph storage cluster, all data on the OSDs is permanently lost.

Prerequisites

- Root-level access to the Ansible administration node.
- Access to the **ansible** user account.
- For **bare-metal** deployments:
  - If the **osd_auto_discovery** option in the **/usr/share/ceph-ansible/group-vars/osds.yml** file is set to **true**, then Ansible will fail to purge the storage cluster. Therefore, comment out **osd_auto_discovery** and declare the OSD devices in the **osds.yml** file.
- Ensure that the **/var/log/ansible/ansible.log** file is writable by the **ansible** user account.

Procedure

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

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

2. As the **ansible** user, run the purge playbook.

   a. For **bare-metal** deployments, use the **purge-cluster.yml** playbook to purge the Ceph storage cluster:

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

   b. For **container** deployments:

   i. Use the **purge-docker-cluster.yml** playbook to purge the Ceph storage cluster:

   ```
   [ansible@admin ceph-ansible]$ ansible-playbook infrastructure-playbooks/purge-docker-cluster.yml
   ```

NOTE

This playbook removes all packages, containers, configuration files, and all the data created by the Ceph Ansible playbook.

ii. To specify a different inventory file other than the default (**/etc/ansible/hosts**), use **-i** parameter:

Syntax

```
[ansible@admin ceph-ansible]$ ansible-playbook infrastructure-playbooks/purge-docker-cluster.yml -i INVENTORY_FILE
```

Replace

INVENTORY_FILE with the path to the inventory file.

Example

```
[ansible@admin ceph-ansible]$ ansible-playbook infrastructure-playbooks/purge-docker-cluster.yml -i ~/ansible/hosts
```

iii. To skip the removal of the Ceph container image, use the **--skip-tags=”remove_img”** option:

```
[ansible@admin ceph-ansible]$ ansible-playbook --skip-tags="remove_img"
infrastructure-playbooks/purge-docker-cluster.yml
```

iv. To skip the removal of the packages that were installed during the installation, use the **--skip-tags=”with_pkg”** option:

```
[ansible@admin ceph-ansible]$ ansible-playbook --skip-tags="with_pkg"
infrastructure-playbooks/purge-docker-cluster.yml
```

Additional Resources

- See the *OSD Ansible settings* for more details.

APPENDIX G. PURGING THE CEPH DASHBOARD USING ANSIBLE

If you no longer want the dashboard installed, use the **purge-dashboard.yml** playbook to remove the dashboard. You might also want to purge the dashboard when troubleshooting an issue with the dashboard or its components.

Prerequisites

- Red Hat Ceph Storage 4.3 or later.
- Ceph-ansible shipped with the latest version of Red Hat Ceph Storage.
- Sudo-level access to all nodes in the storage cluster.

Procedure

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

   Example

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

3. Run the Ansible **purge-dashboard.yml** playbook, and when prompted, type **yes** to confirm purging of the dashboard:

   Example

   ```
   [ansible@admin ceph-ansible]$ ansible-playbook infrastructure-playbooks/purge-dashboard.yml -i hosts -vvvv
   ```

Verification

- Run the **ceph mgr services** command to verify dashboard is no longer running:

  Syntax

  ```
  ceph mgr services
  ```

  The dashboard URL is not displayed.

Additional Resources

- To install the dashboard, see *Installing dashboard using Ansbile* in the *Red Hat Ceph Storage Dashboard Guide*.

APPENDIX H. ENCRYPTING ANSIBLE PASSWORD VARIABLES WITH ANSIBLE-VAULT

You can use **ansible-vault** to encrypt Ansible variables used to store passwords so they are not readable as plaintext. For example, in **group_vars/all.yml** the **ceph_docker_registry_username** and **ceph_docker_registry_password** variables can be set to Service Account credentials, or Customer Portal credentials. The Service Account is designed to be shared, but the Customer Portal password should be secured. In addition to encrypting **ceph_docker_registry_password**, you may also want to encrypt **dashboard_admin_password** and **grafana_admin_password**.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Access to the Ansible administration node.

Procedure

1. Log in to the Ansible administration node.
2. Change to the **/usr/share/ceph-ansible/** directory:

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

3. Run **ansible-vault** and create a new vault password:

   Example

   ```
   [admin@admin ceph-ansible]$ ansible-vault encrypt_string --stdin-name
   'ceph_docker_registry_password_vault'
   New Vault password:
   ```

4. Re-enter the vault password to confirm it:

   Example

   ```
   [admin@admin ceph-ansible]$ ansible-vault encrypt_string --stdin-name
   'ceph_docker_registry_password_vault'
   New Vault password:
   Confirm New Vault password:
   ```

5. Enter the password to encrypt, then enter CTRL+D twice to complete the entry:

   Syntax

   ```
   ansible-vault encrypt_string --stdin-name 'ceph_docker_registry_password_vault'
   New Vault password:
   Confirm New Vault password:
   Reading plaintext input from stdin. (ctrl-d to end input)
   PASSWORD
   ```

   Replace *PASSWORD* with the password:

Example

```
[admin@admin ceph-ansible]$ ansible-vault encrypt_string --stdin-name
'ceph_docker_registry_password_vault'
New Vault password:
Confirm New Vault password:
Reading plaintext input from stdin. (ctrl-d to end input)
SecurePassword
```

Do not hit enter after typing the password or it will include a new-line as a part of the password in the encrypted string.

6. Take note of the output that begins with **ceph_docker_registry_password_vault: !vault |** and ends with a few lines of numbers, as it will be used in the next step:

Example

```
[admin@admin ceph-ansible]$ ansible-vault encrypt_string --stdin-name
'ceph_docker_registry_password_vault'
New Vault password:
Confirm New Vault password:
Reading plaintext input from stdin. (ctrl-d to end input)
SecurePasswordceph_docker_registry_password_vault: !vault |
        $ANSIBLE_VAULT;1.1;AES256

383836396461666561303266666332626438363439303738363763313264373530323761653
06234

3161386334616632653530383231316631636462363761660a3733383733346634343638653
56633

663839633230333036623337653839383536306234333465653635346364346436343364306
43438

6134306662646365370a3431353166333038306535656337363034666362613263613337666
13462
        39353365343137323163343937636464663534383234326531666139376561663532
Encryption successful
```

The output you need begins immediately after the password, without spaces or new lines.

7. Open for editing **group_vars/all.yml** and paste the output from above into the file:

Example

```
ceph_docker_registry_password_vault: !vault |
        $ANSIBLE_VAULT;1.1;AES256

383836396461666561303266666332626438363439303738363763313264373530323761653
06234

3161386334616632653530383231316631636462363761660a3733383733346634343638653
56633

663839633230333036623337653839383536306234333465653635346364346436343364306
```

```
43438

6134306662646365370a3431353166333038306535656337363034666362613263613337666
13462
          39353365343137323163343937636464663534383234326531666139376561663532
```

8. Add a line below the encrypted password with the following:

   Example

   ```
   ceph_docker_registry_password: "{{ ceph_docker_registry_password_vault }}"
   ```

   NOTE

   Using two variables as seen above is required due to a bug in Ansible that breaks the string type when assigning the vault value directly to the Ansible variable.

9. Configure Ansible to ask for the vault password when running **ansible-playbook**.

   a. Open for editing **/usr/share/ceph-ansible/ansible.cfg** and add the following line in the **[defaults]** section:

      ```
      ask_vault_pass = True
      ```

   b. Optionally, you can pass **--ask-vault-pass** every time you run ansible-playbook:

      Example

      ```
      [admin@admin ceph-ansible]$ ansible-playbook -v site.yml --ask-vault-pass
      ```

10. Re-run **site.yml** or **site-container.yml** to ensure there are no errors related to the encrypted password.

    Example

    ```
    [admin@admin ceph-ansible]$ ansible-playbook -v site.yml -i hosts --ask-vault-pass
    ```

    The **-i hosts** option is only needed if you are not using the default Ansible inventory location of **/etc/ansible/hosts**.

Additional Resources

- See Service Account information in Red Hat Container Registry Authentication

APPENDIX I. GENERAL ANSIBLE SETTINGS

These are the most common configurable Ansible parameters. There are two sets of parameters depending on the deployment method, either bare-metal or containers.

NOTE

This is not an exhaustive list of all the available Ansible parameters.

Bare-metal and Containers Settings

monitor_interface

The interface that the Ceph Monitor nodes listen on.

Value

User-defined

Required

Yes

Notes

Assigning a value to at least one of the **monitor_*** parameters is required.

monitor_address

The address that the Ceph Monitor nodes listen too.

Value

User-defined

Required

Yes

Notes

Assigning a value to at least one of the **monitor_*** parameters is required.

monitor_address_block

The subnet of the Ceph public network.

Value

User-defined

Required

Yes

Notes

Use when the IP addresses of the nodes are unknown, but the subnet is known. Assigning a value to at least one of the **monitor_*** parameters is required.

ip_version

Value

ipv6

Required

Yes, if using IPv6 addressing.

public_network

The IP address and netmask of the Ceph public network, or the corresponding IPv6 address, if using IPv6.

Value

User-defined

Required

Yes

Notes

For more information, see *Verifying the Network Configuration for Red Hat Ceph Storage* .

cluster_network

The IP address and netmask of the Ceph cluster network, or the corresponding IPv6 address, if using IPv6.

Value

User-defined

Required

No

Notes

For more information, see *Verifying the Network Configuration for Red Hat Ceph Storage* .

configure_firewall

Ansible will try to configure the appropriate firewall rules.

Value

true or **false**

Required

No

Bare-metal-specific Settings

ceph_origin

Value

repository or **distro** or **local**

Required

Yes

Notes

The **repository** value means Ceph will be installed through a new repository. The **distro** value means that no separate repository file will be added, and you will get whatever version of Ceph that is included with the Linux distribution. The **local** value means the Ceph binaries will be copied from the local machine.

ceph_repository_type

Value

cdn or **iso**

Required

Yes

ceph_rhcs_version

Value

4

Required

Yes

ceph_rhcs_iso_path

The full path to the ISO image.

Value

User-defined

Required

Yes, if **ceph_repository_type** is set to **iso**.

Container-specific Settings

ceph_docker_image

Value

rhceph/rhceph-4-rhel8, or **cephimageinlocalreg**, if using a local Docker registry.

Required

Yes

ceph_docker_image_tag

Value

The **latest** version of **rhceph/rhceph-4-rhel8** or the **customtag** given during the local registry configuration.

Required

Yes

containerized_deployment

Value

true

Required

Yes

ceph_docker_registry

Value

registry.redhat.io, or ***LOCAL_FQDN_NODE_NAME***, if using a local Docker registry.

Required

Yes

APPENDIX J. OSD ANSIBLE SETTINGS

These are the most common configurable OSD Ansible parameters.

osd_auto_discovery

Automatically find empty devices to use as OSDs.

Value

false

Required

No

Notes

Cannot be used with **devices**. Cannot be used with **purge-docker-cluster.yml** or **purge-cluster.yml**. To use those playbooks, comment out **osd_auto_discovery** and declare the OSD devices using **devices**.

devices

List of devices where Ceph's data is stored.

Value

User-defined

Required

Yes, if specifying a list of devices.

Notes

Cannot be used when **osd_auto_discovery** setting is used. When using the **devices** option, **ceph-volume lvm batch** mode creates the optimized OSD configuration.

dmcrypt

To encrypt the OSDs.

Value

true

Required

No

Notes

The default value is **false**.

lvm_volumes

A list of FileStore or BlueStore dictionaries.

Value

User-defined

Required

Yes, if storage devices are not defined using the **devices** parameter.

Notes

Each dictionary must contain a **data**, **journal** and **data_vg** keys. Any logical volume or volume group must be the name and not the full path. The **data**, and **journal** keys can be a logical volume (LV) or partition, but do not use one journal for multiple **data** LVs. The **data_vg** key must be the volume group containing the **data** LV. Optionally, the **journal_vg** key can be used to specify the volume group containing the journal LV, if applicable.

osds_per_device

The number of OSDs to create per device.

Value

User-defined

Required

No

Notes

The default value is **1**.

osd_objectstore

The Ceph object store type for the OSDs.

Value

bluestore or **filestore**

Required

No

Notes

The default value is **bluestore**. Required for upgrades.