Red Hat Ceph Storage 6

Configuration Guide

Configuration settings for Red Hat Ceph Storage

Last Updated: 2024-03-29

Red Hat Ceph Storage 6 Configuration Guide

Configuration settings for Red Hat Ceph Storage

Legal Notice

Abstract

This document provides instructions for configuring Red Hat Ceph Storage at boot time and run time. It also provides configuration reference information. 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.

Table of Contents

CHAPTER 1. THE BASICS OF CEPH CONFIGURATION

As a storage administrator, you need to have a basic understanding of how to view the Ceph configuration, and how to set the Ceph configuration options for the Red Hat Ceph Storage cluster. You can view and set the Ceph configuration options at runtime.

Prerequisites

- Installation of the Red Hat Ceph Storage software.

1.1. CEPH CONFIGURATION

All Red Hat Ceph Storage clusters have a configuration, which defines:

- Cluster Identity
- Authentication settings
- Ceph daemons
- Network configuration
- Node names and addresses
- Paths to keyrings
- Paths to OSD log files
- Other runtime options

A deployment tool, such as **cephadm**, will typically create an initial Ceph configuration file for you. However, you can create one yourself if you prefer to bootstrap a Red Hat Ceph Storage cluster without using a deployment tool.

Additional Resources

- For more information about **cephadm** and the Ceph orchestrator, see the *Red Hat Ceph Storage Operations Guide*.

1.2. THE CEPH CONFIGURATION DATABASE

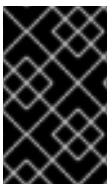
The Ceph Monitor manages a configuration database of Ceph options that centralize configuration management by storing configuration options for the entire storage cluster. By centralizing the Ceph configuration in a database, this simplifies storage cluster administration.

The priority order that Ceph uses to set options is:

- Compiled-in default values
- Ceph cluster configuration database
- Local **ceph.conf** file
- Runtime override, using the **ceph daemon *DAEMON-NAME* config set** or **ceph tell *DAEMON-NAME* injectargs** commands

There are still a few Ceph options that can be defined in the local Ceph configuration file, which is **/etc/ceph/ceph.conf** by default. However, **ceph.conf** has been deprecated for Red Hat Ceph Storage 6.

cephadm uses a basic **ceph.conf** file that only contains a minimal set of options for connecting to Ceph Monitors, authenticating, and fetching configuration information. In most cases, **cephadm** uses only the **mon_host** option. To avoid using **ceph.conf** only for the **mon_host** option, use DNS SRV records to perform operations with Monitors.



IMPORTANT

Red Hat recommends that you use the **assimilate-conf** administrative command to move valid options into the configuration database from the **ceph.conf** file. For more information about **assimilate-conf**, see Administrative Commands.

Ceph allows you to make changes to the configuration of a daemon at runtime. This capability can be useful for increasing or decreasing the logging output, by enabling or disabling debug settings, and can even be used for runtime optimization.

NOTE

When the same option exists in the configuration database and the Ceph configuration file, the configuration database option has a lower priority than what is set in the Ceph configuration file.

Sections and Masks

Just as you can configure Ceph options globally, per daemon type, or by a specific daemon in the Ceph configuration file, you can also configure the Ceph options in the configuration database according to these sections:

Section	Description
global	Affects all daemons and clients.
mon	Affects all Ceph Monitors.
mgr	Affects all Ceph Managers.
osd	Affects all Ceph OSDs.
mds	Affects all Ceph Metadata Servers.
client	Affects all Ceph Clients, including mounted file systems, block devices, and RADOS Gateways.

Ceph configuration options can have a mask associated with them. These masks can further restrict which daemons or clients the options apply to.

Masks have two forms:

type:location

The **type** is a CRUSH property, for example, **rack** or **host**. The **location** is a value for the property type. For example, **host:foo** limits the option only to daemons or clients running on the **foo** host.

Example

```
ceph config set osd/host:magna045 debug_osd 20
```

class:device-class

The **device-class** is the name of the CRUSH device class, such as **hdd** or **ssd**. For example, **class:ssd** limits the option only to Ceph OSDs backed by solid state drives (SSD). This mask has no effect on non-OSD daemons of clients.

Example

```
ceph config set osd/class:hdd osd_max_backfills 8
```

Administrative Commands

The Ceph configuration database can be administered with the subcommand **ceph config *ACTION***. These are the actions you can do:

ls

Lists the available configuration options.

dump

Dumps the entire configuration database of options for the storage cluster.

get *WHO*

Dumps the configuration for a specific daemon or client. For example, *WHO* can be a daemon, like **mds.a**.

set *WHO OPTION VALUE*

Sets a configuration option in the Ceph configuration database, where *WHO* is the target daemon, *OPTION* is the option to set, and *VALUE* is the desired value.

show *WHO*

Shows the reported running configuration for a running daemon. These options might be different from those stored by the Ceph Monitors if there is a local configuration file in use or options have been overridden on the command line or at run time. Also, the source of the option values is reported as part of the output.

assimilate-conf -i *INPUT_FILE* -o *OUTPUT_FILE*

Assimilate a configuration file from the *INPUT_FILE* and move any valid options into the Ceph Monitors' configuration database. Any options that are unrecognized, invalid, or cannot be controlled by the Ceph Monitor return in an abbreviated configuration file stored in the *OUTPUT_FILE*. This command can be useful for transitioning from legacy configuration files to a centralized configuration database. Note that when you assimilate a configuration and the Monitors or other daemons have different configuration values set for the same set of options, the end result depends on the order in which the files are assimilated.

help *OPTION* -f json-pretty

Displays help for a particular *OPTION* using a JSON-formatted output.

Additional Resources

- For more information about the command, see *Setting a specific configuration at runtime* .

1.3. USING THE CEPH METAVARIABLES

Metavariables simplify Ceph storage cluster configuration dramatically. When a metavariable is set in a configuration value, Ceph expands the metavariable into a concrete value.

Metavariables are very powerful when used within the **[global]**, **[osd]**, **[mon]**, or **[client]** sections of the Ceph configuration file. However, you can also use them with the administration socket. Ceph metavariables are similar to Bash shell expansion.

Ceph supports the following metavariables:

$cluster

Description

Expands to the Ceph storage cluster name. Useful when running multiple Ceph storage clusters on the same hardware.

Example

/etc/ceph/$cluster.keyring

Default

ceph

$type

Description

Expands to one of **osd** or **mon**, depending on the type of the instant daemon.

Example

/var/lib/ceph/$type

$id

Description

Expands to the daemon identifier. For **osd.0**, this would be **0**.

Example

/var/lib/ceph/$type/$cluster-$id

$host

Description

Expands to the host name of the instant daemon.

$name

Description

Expands to **$type.$id**.

Example

/var/run/ceph/$cluster-$name.asok

1.4. VIEWING THE CEPH CONFIGURATION AT RUNTIME

The Ceph configuration files can be viewed at boot time and run time.

Prerequisites

- Root-level access to the Ceph node.
- Access to admin keyring.

Procedure

1. To view a runtime configuration, log in to a Ceph node running the daemon and execute:

   Syntax

   ```
   ceph daemon DAEMON_TYPE.ID config show
   ```

   To see the configuration for **osd.0**, you can log into the node containing **osd.0** and execute this command:

   Example

   ```
   [root@osd ~]# ceph daemon osd.0 config show
   ```

2. For additional options, specify a daemon and **help**.

   Example

   ```
   [root@osd ~]# ceph daemon osd.0 help
   ```

1.5. VIEWING A SPECIFIC CONFIGURATION AT RUNTIME

Configuration settings for Red Hat Ceph Storage can be viewed at runtime from the Ceph Monitor node.

Prerequisites

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

Procedure

1. Log into a Ceph node and execute:

   Syntax

   ```
   ceph daemon DAEMON_TYPE.ID config get PARAMETER
   ```

   Example

   ```
   [root@mon ~]# ceph daemon osd.0 config get public_addr
   ```

1.6. SETTING A SPECIFIC CONFIGURATION AT RUNTIME

To set a specific Ceph configuration at runtime, use the **ceph config set** command.

Prerequisites

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

Procedure

1. Set the configuration on all Monitor or OSD daemons :

   Syntax

   ```
   ceph config set DAEMON CONFIG-OPTION VALUE
   ```

   Example

   ```
   [root@mon ~]# ceph config set osd debug_osd 10
   ```

2. Validate that the option and value are set:

   Example

   ```
   [root@mon ~]# ceph config dump
   osd      advanced debug_osd  10/10
   ```

   - To remove the configuration option from all daemons:

     Syntax

     ```
     ceph config rm DAEMON CONFIG-OPTION VALUE
     ```

     Example

     ```
     [root@mon ~]# ceph config rm osd debug_osd
     ```

   - To set the configuration for a specific daemon:

     Syntax

     ```
     ceph config set DAEMON.DAEMON-NUMBER CONFIG-OPTION VALUE
     ```

     Example

     ```
     [root@mon ~]# ceph config set osd.0 debug_osd 10
     ```

   - To validate that the configuration is set for the specified daemon:

Example

```
[root@mon ~]# ceph config dump
osd.0      advanced debug_osd     10/10
```

- To remove the configuration for a specific daemon:

  Syntax

  ```
  ceph config rm DAEMON.DAEMON-NUMBER CONFIG-OPTION
  ```

  Example

  ```
  [root@mon ~]# ceph config rm osd.0 debug_osd
  ```

NOTE

If you use a client that does not support reading options from the configuration database, or if you still need to use **ceph.conf** to change your cluster configuration for other reasons, run the following command:

```
ceph config set mgr mgr/cephadm/manage_etc_ceph_ceph_conf false
```

You must maintain and distribute the **ceph.conf** file across the storage cluster.

1.7. OSD MEMORY TARGET

BlueStore keeps OSD heap memory usage under a designated target size with the **osd_memory_target** configuration option.

The option **osd_memory_target** sets OSD memory based upon the available RAM in the system. Use this option when TCMalloc is configured as the memory allocator, and when the **bluestore_cache_autotune** option in BlueStore is set to **true**.

Ceph OSD memory caching is more important when the block device is slow; for example, traditional hard drives, because the benefit of a cache hit is much higher than it would be with a solid state drive. However, this must be weighed into a decision to colocate OSDs with other services, such as in a hyper-converged infrastructure (HCI) or other applications.

1.7.1. Setting the OSD memory target

Use the **osd_memory_target** option to set the maximum memory threshold for all OSDs in the storage cluster, or for specific OSDs. An OSD with an **osd_memory_target** option set to 16 GB might use up to 16 GB of memory.

NOTE

Configuration options for individual OSDs take precedence over the settings for all OSDs.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to all hosts in the storage cluster.

Procedure

- To set **osd_memory_target** for all OSDs in the storage cluster:

  Syntax

  ```
  ceph config set osd osd_memory_target VALUE
  ```

  VALUE is the number of GBytes of memory to be allocated to each OSD in the storage cluster.

- To set **osd_memory_target** for a specific OSD in the storage cluster:

  Syntax

  ```
  ceph config set osd.id osd_memory_target VALUE
  ```

  .id is the ID of the OSD and *VALUE* is the number of GB of memory to be allocated to the specified OSD. For example, to configure the OSD with ID 8 to use up to 16 GBytes of memory:

  Example

  ```
  [ceph: root@host01 /]# ceph config set osd.8 osd_memory_target 16G
  ```

- To set an individual OSD to use one maximum amount of memory and configure the rest of the OSDs to use another amount, specify the individual OSD first:

  Example

  ```
  [ceph: root@host01 /]# ceph config set osd osd_memory_target 16G
  [ceph: root@host01 /]# ceph config set osd.8 osd_memory_target 8G
  ```

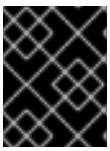
Additional resources

- To configure Red Hat Ceph Storage to autotune OSD memory usage, see *Automatically tuning OSD memory* in the *Operations Guide*.

1.8. AUTOMATICALLY TUNING OSD MEMORY

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

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



IMPORTANT

By default, the **osd_memory_target_autotune** parameter is set to **true** in Red Hat Ceph Storage 5.1.

Syntax

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

Once the storage cluster is upgraded to Red Hat Ceph Storage 5.0, for cluster maintenance such as addition of OSDs or replacement of OSDs, Red Hat recommends setting **osd_memory_target_autotune** parameter to **true** to autotune osd memory as per system memory.

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

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

Syntax

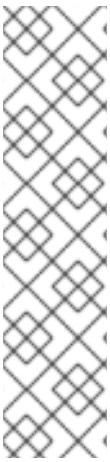
```
osd_memory_target = TOTAL_RAM_OF_THE_OSD * (1048576) * (autotune_memory_target_ratio) / NUMBER_OF_OSDS_IN_THE_OSD_NODE - (SPACE_ALLOCATED_FOR_OTHER_DAEMONS)
```

SPACE_ALLOCATED_FOR_OTHER_DAEMONS may optionally include the following daemon space allocations:

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

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

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



NOTE

In Red Hat Ceph Storage 5.1, the default setting of **osd_memory_target_autotune true** is unsuitable for hyperconverged infrastructures where compute and Ceph storage services are colocated. In a hyperconverged infrastructure, the **autotune_memory_target_ratio** can be set to **0.2** to reduce the memory consumption of Ceph.

Example

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

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

Example

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

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

Syntax

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

Example

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

NOTE

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

Syntax

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

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

Example

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

1.9. MDS MEMORY CACHE LIMIT

MDS servers keep their metadata in a separate storage pool, named **cephfs_metadata**, and are the users of Ceph OSDs. For Ceph File Systems, MDS servers have to support an entire Red Hat Ceph Storage cluster, not just a single storage device within the storage cluster, so their memory requirements can be significant, particularly if the workload consists of small-to-medium-size files, where the ratio of metadata to data is much higher.

Example: Set the **mds_cache_memory_limit** to 2000000000 bytes

```
ceph_conf_overrides:
  mds:
    mds_cache_memory_limit=2000000000
```

NOTE

For a large Red Hat Ceph Storage cluster with a metadata-intensive workload, do not put an MDS server on the same node as other memory-intensive services, doing so gives you the option to allocate more memory to MDS, for example, sizes greater than 100 GB.

Additional Resources

- See *Metadata Server cache size limits* in *Red Hat Ceph Storage File System Guide*.
- See the general Ceph configuration options in *Configuration options* for specific option descriptions and usage.

CHAPTER 2. CEPH NETWORK CONFIGURATION

As a storage administrator, you must understand the network environment that the Red Hat Ceph Storage cluster will operate in, and configure the Red Hat Ceph Storage accordingly. Understanding and configuring the Ceph network options will ensure optimal performance and reliability of the overall storage cluster.

Prerequisites

- Network connectivity.
- Installation of the Red Hat Ceph Storage software.

2.1. NETWORK CONFIGURATION FOR CEPH

Network configuration is critical for building a high performance Red Hat Ceph Storage cluster. The Ceph storage cluster does not perform request routing or dispatching on behalf of the Ceph client. Instead, Ceph clients make requests directly to Ceph OSD daemons. Ceph OSDs perform data replication on behalf of Ceph clients, which means replication and other factors impose additional loads on the networks of Ceph storage clusters.

Ceph has one network configuration requirement that applies to all daemons. The Ceph configuration file must specify the **host** for each daemon.

Some deployment utilities, such as **cephadm** creates a configuration file for you. Do not set these values if the deployment utility does it for you.

IMPORTANT

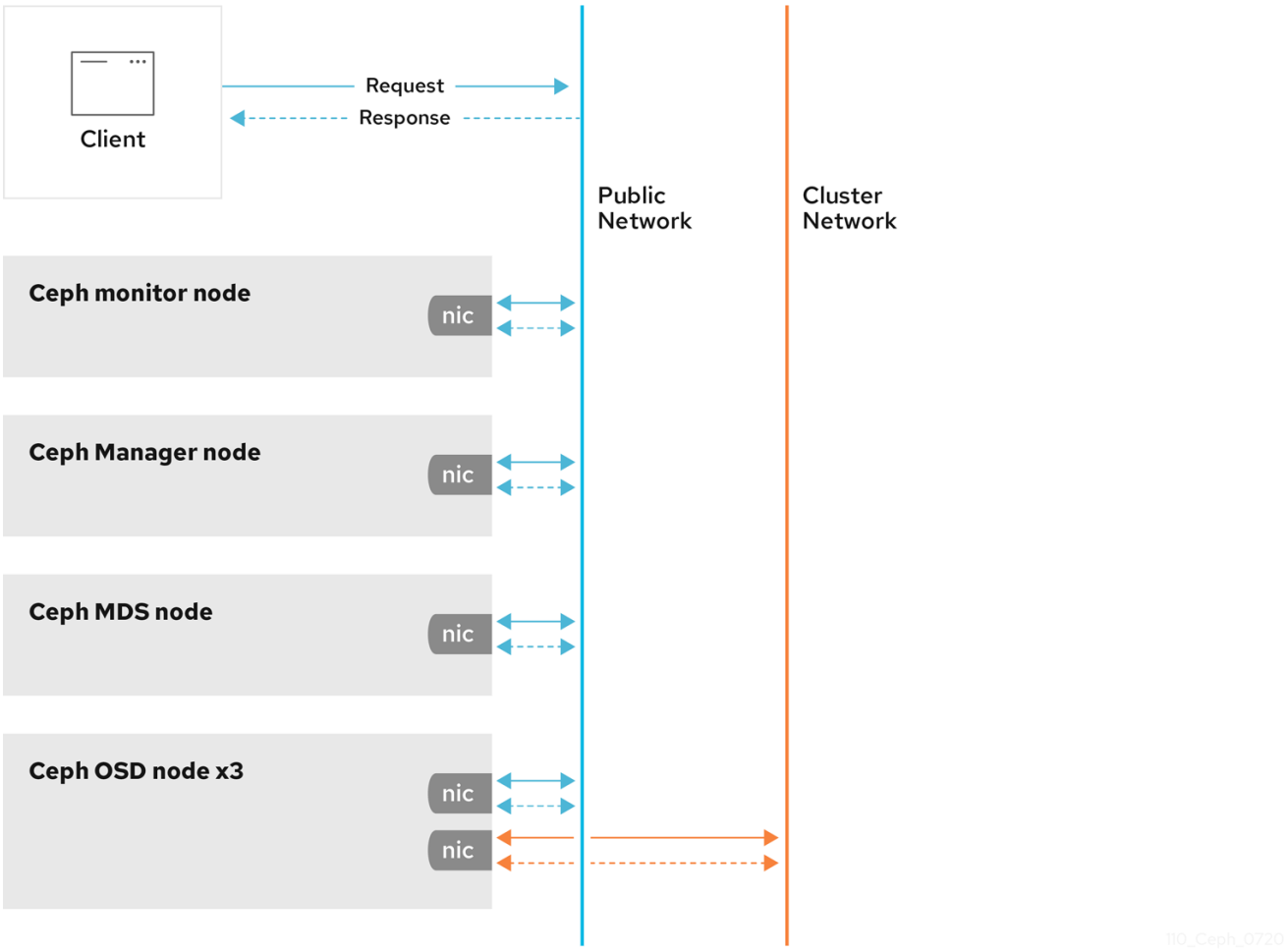
The **host** option is the short name of the node, not its FQDN. It is not an IP address.

All Ceph clusters must use a public network. However, unless you specify an internal cluster network, Ceph assumes a single public network. Ceph can function with a public network only, but for large storage clusters, you will see significant performance improvement with a second private network for carrying only cluster-related traffic.

IMPORTANT

Red Hat recommends running a Ceph storage cluster with two networks. One public network and one private network.

To support two networks, each Ceph Node will need to have more than one network interface card (NIC).



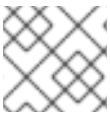
There are several reasons to consider operating two separate networks:

- **Performance:** Ceph OSDs handle data replication for the Ceph clients. When Ceph OSDs replicate data more than once, the network load between Ceph OSDs easily dwarfs the network load between Ceph clients and the Ceph storage cluster. This can introduce latency and create a performance problem. Recovery and rebalancing can also introduce significant latency on the public network.

- **Security**: While most people are generally civil, some actors will engage in what is known as a Denial of Service (DoS) attack. When traffic between Ceph OSDs gets disrupted, peering may fail and placement groups may no longer reflect an **active + clean** state, which may prevent users from reading and writing data. A great way to defeat this type of attack is to maintain a completely separate cluster network that does not connect directly to the internet.

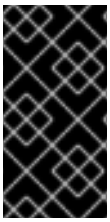
Network configuration settings are not required. Ceph can function with a public network only, assuming a public network is configured on all hosts running a Ceph daemon. However, Ceph allows you to establish much more specific criteria, including multiple IP networks and subnet masks for your public network. You can also establish a separate cluster network to handle OSD heartbeat, object replication, and recovery traffic.

Do not confuse the IP addresses you set in the configuration with the public-facing IP addresses network clients might use to access your service. Typical internal IP networks are often **192.168.0.0** or **10.0.0.0**.



NOTE

Ceph uses CIDR notation for subnets, for example, **10.0.0.0/24**.



IMPORTANT

If you specify more than one IP address and subnet mask for either the public or the private network, the subnets within the network must be capable of routing to each other. Additionally, make sure you include each IP address and subnet in your IP tables and open ports for them as necessary.

When you configured the networks, you can restart the cluster or restart each daemon. Ceph daemons bind dynamically, so you do not have to restart the entire cluster at once if you change the network configuration.

Additional Resources

- See the common options in *Red Hat Ceph Storage Configuration Guide*, *Appendix B* for specific option descriptions and usage.

2.2. CEPH NETWORK MESSENGER

Messenger is the Ceph network layer implementation. Red Hat supports two messenger types:

- **simple**
- **async**

In Red Hat Ceph Storage 5 and higher, **async** is the default messenger type. To change the messenger type, specify the **ms_type** configuration setting in the **[global]** section of the Ceph configuration file.

NOTE

For the **async** messenger, Red Hat supports the **posix** transport type, but does not currently support **rdma** or **dpdk**. By default, the **ms_type** setting in Red Hat Ceph Storage 5 or higher reflects **async+posix**, where **async** is the messenger type and **posix** is the transport type.

SimpleMessenger

The **SimpleMessenger** implementation uses TCP sockets with two threads per socket. Ceph associates each logical session with a connection. A pipe handles the connection, including the input and output of each message. While **SimpleMessenger** is effective for the **posix** transport type, it is not effective for other transport types such as **rdma** or **dpdk**.

AsyncMessenger

Consequently, **AsyncMessenger** is the default messenger type for Red Hat Ceph Storage 5 or higher. For Red Hat Ceph Storage 5 or higher, the **AsyncMessenger** implementation uses TCP sockets with a fixed-size thread pool for connections, which should be equal to the highest number of replicas or erasure-code chunks. The thread count can be set to a lower value if performance degrades due to a low CPU count or a high number of OSDs per server.

NOTE

Red Hat does not support other transport types such as **rdma** or **dpdk** at this time.

Additional Resources

- See the AsyncMmessenger options in *Red Hat Ceph Storage Configuration Guide*, *Appendix B* for specific option descriptions and usage.
- See the *Red Hat Ceph Storage Architecture Guide* for details about using *on-wire encryption* with the Ceph messenger version 2 protocol.

2.3. CONFIGURING A PUBLIC NETWORK

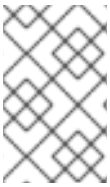
To configure Ceph networks, use the **config set** command within the **cephadm** shell. Note that the IP addresses you set in your network configuration are different from the public-facing IP addresses that network clients might use to access your service.

Ceph functions perfectly well with only a public network. However, Ceph allows you to establish much more specific criteria, including multiple IP networks for your public network.

You can also establish a separate, private cluster network to handle OSD heartbeat, object replication, and recovery traffic. For more information about the private network, see *Configuring a private network* .

NOTE

Ceph uses CIDR notation for subnets, for example, 10.0.0.0/24. Typical internal IP networks are often 192.168.0.0/24 or 10.0.0.0/24.



NOTE

If you specify more than one IP address for either the public or the cluster network, the subnets within the network must be capable of routing to each other. In addition, make sure you include each IP address in your IP tables, and open ports for them as necessary.

The public network configuration allows you specifically define IP addresses and subnets for the public network.

Prerequisites

- Installation of the Red Hat Ceph Storage software.

Procedure

1. Log in to the **cephadm** shell:

   Example

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

2. Configure the public network with the subnet:

   Syntax

   ```
   ceph config set mon public_network IP_ADDRESS_WITH_SUBNET
   ```

   Example

   ```
   [ceph: root@host01 /]# ceph config set mon public_network 192.168.0.0/24
   ```

3. Get the list of services in the storage cluster:

   Example

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

4. Restart the daemons. Ceph daemons bind dynamically, so you do not have to restart the entire cluster at once if you change the network configuration for a specific daemon.

   Example

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

5. Optional: If you want to restart the cluster, on the admin node as a root user, run **systemctl** command:

   Syntax

   ```
   systemctl restart ceph-FSID_OF_CLUSTER.target
   ```

   Example

   ```
   [root@host01 ~]# systemctl restart ceph-1ca9f6a8-d036-11ec-8263-fa163ee967ad.target
   ```

Additional Resources

- See the common options in *Red Hat Ceph Storage Configuration Guide*, *Appendix B* for specific option descriptions and usage.

2.4. CONFIGURING A PRIVATE NETWORK

Network configuration settings are not required. Ceph assumes a public network with all hosts operating on it, unless you specifically configure a cluster network, also known as a *private network*.

If you create a cluster network, OSDs routes heartbeat, object replication, and recovery traffic over the cluster network. This can improve performance, compared to using a single network.

IMPORTANT

For added security, the cluster network should not be reachable from the public network or the Internet.

To assign a cluster network, use the **--cluster-network** option with the **cephadm bootstrap** command. The cluster network that you specify must define a subnet in CIDR notation (for example, 10.90.90.0/24 or fe80::/64).

You can also configure the **cluster_network** after boostrap.

Prerequisites

- Access to the Ceph software repository.

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

Procedure

- Run the **cephadm bootstrap command** from the initial node that you want to use as the Monitor node in the storage cluster. Include the **--cluster-network** option in the command.

  Syntax

  ```
  cephadm bootstrap --mon-ip IP-ADDRESS --registry-url registry.redhat.io --registry-username USER_NAME --registry-password PASSWORD --cluster-network NETWORK-IP-ADDRESS
  ```

  Example

  ```
  [root@host01 ~]# cephadm bootstrap --mon-ip 10.10.128.68 --registry-url registry.redhat.io --registry-username myuser1 --registry-password mypassword1 --cluster-network 10.10.0.0/24
  ```

- To configure the **cluster_network** after bootstrap, run the **config set** command and redeploy the daemons:

  1. Log in to the **cephadm** shell:

     Example

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

  2. Configure the cluster network with the subnet:

     Syntax

     ```
     ceph config set global cluster_network IP_ADDRESS_WITH_SUBNET
     ```

     Example

     ```
     [ceph: root@host01 /]# ceph config set global cluster_network 10.10.0.0/24
     ```

  3. Get the list of services in the storage cluster:

     Example

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

  4. Restart the daemons. Ceph daemons bind dynamically, so you do not have to restart the entire cluster at once if you change the network configuration for a specific daemon.

     Example

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

  5. Optional: If you want to restart the cluster, on the admin node as a root user, run **systemctl** command:

Syntax

```
systemctl restart ceph-FSID_OF_CLUSTER.target
```

Example

```
[root@host01 ~]# systemctl restart ceph-1ca9f6a8-d036-11ec-8263-fa163ee967ad.target
```

Additional Resources

- For more information about invoking **cephadm bootstrap**, see the *Bootstrapping a new storage cluster* section in the *Red Hat Ceph Storage Installation Guide*.

2.5. CONFIGURING MULTIPLE PUBLIC NETWORKS TO THE CLUSTER

When the user wants to place the Ceph Monitor daemons on hosts belonging to multiple network subnets, configuring multiple public networks to the cluster is necessary. An example of usage is a stretch cluster mode used for Advanced Cluster Management (ACM) in Metro DR for OpenShift Data Foundation.

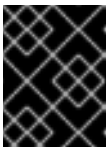
You can configure multiple public networks to the cluster during bootstrap and once bootstrap is complete.

Prerequisites

- Before adding a host be sure that you have a running Red Hat Ceph Storage cluster.

Procedure

1. Bootstrap a Ceph cluster configured with multiple public networks.
   a. Prepare a **ceph.conf** file containing a **mon** public network section:



IMPORTANT

At least one of the provided public networks must be configured on the current host used for bootstrap.

Syntax

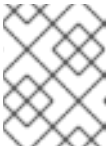
```
[mon]
public_network = PUBLIC_NETWORK1, PUBLIC_NETWORK2
```

Example

```
[mon]
public_network = 10.40.0.0/24, 10.41.0.0/24, 10.42.0.0/24
```

This is an example with three public networks to be provided for bootstrap.

   b. Bootstrap the cluster by providing the **ceph.conf** file as input:

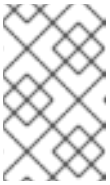


NOTE

During the bootstrap you can include any other arguments that you want to provide.

Syntax

```
cephadm --image IMAGE_URL bootstrap --mon-ip MONITOR_IP -c
PATH_TO_CEPH_CONF
```



NOTE

Alternatively, an ***IMAGE_ID*** (such as, **13ea90216d0be03003d12d7869f72ad9de5cec9e54a27fd308e01e467c0d4a0a**) can be used instead of ***IMAGE_URL***.

Example

```
[root@host01 ~]# cephadm –image cp.icr.io/cp/ibm-ceph/ceph-5-rhel8:latest bootstrap –
mon-ip 10.40.0.0/24 -c /etc/ceph/ceph.conf
```

2. Add new hosts to the subnets:

NOTE

The host being added must be reachable from the host that the active manager is running on.

a. Install the cluster's public SSH key in the new host's root user's **authorized_keys** file:

Syntax

```
ssh-copy-id -f -i /etc/ceph/ceph.pub root@NEW_HOST
```

Example

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

b. Log into **cephadm** shell:

Example

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

c. Add the new host to the Ceph cluster:

Syntax

```
ceph orch host add NEW_HOST IP [LABEL1 ...]
```

Example

```
[root@host01 ~]# ceph orch host add host02 10.10.0.102 label1
[root@host01 ~]# ceph orch host add host03 10.10.0.103 label2
```

NOTE

- It is best to explicitly provide the host IP address. If an IP is not provided, then the host name is immediately resolved via DNS and that IP is used.
- One or more labels can also be included to immediately label the new host. For example, by default the **_admin** label makes cephadm maintain a copy of the **ceph.conf** file and a **client.admin** keyring file in **/etc/ceph** directory.

3. Add the networks configurations for the public network parameters to a running cluster. Be sure that the subnets are separated by commas and that the subnets are listed in subnet/mask format.

   Syntax

   ```
   ceph config set mon public_network "SUBNET_1,SUBNET_2, ..."
   ```

   Example

   ```
   [root@host01 ~]# ceph config set mon public_network "192.168.0.0/24, 10.42.0.0/24, ..."
   ```

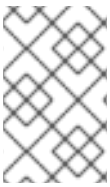
   If necessary, update the **mon** specifications to place the **mon** daemons on hosts within the specified subnets.

Additional Resources

- See *Adding hosts* for more details about adding hosts in the *Red Hat Ceph Storage Installation Guide*.
- See *Stretch clusters for Ceph storage* for more details about stretch clusters in the *Red Hat Ceph Storage Administration Guide*.

2.6. VERIFYING FIREWALL RULES ARE CONFIGURED FOR DEFAULT CEPH PORTS

By default, Red Hat Ceph Storage daemons use TCP ports 6800–7100 to communicate with other hosts in the cluster. You can verify that the host's firewall allows connection on these ports.



NOTE

If your network has a dedicated firewall, you might need to verify its configuration in addition to following this procedure. See the firewall's documentation for more information.

See the firewall's documentation for more information.

Prerequisites

- Root-level access to the host.

Procedure

1. Verify the host's **iptables** configuration:
   a. List active rules:

```
[root@host1 ~]# iptables -L
```

   b. Verify the absence of rules that restrict connectivity on TCP ports 6800–7100.

   Example

```
REJECT all -- anywhere anywhere reject-with icmp-host-prohibited
```

2. Verify the host's **firewalld** configuration:
   a. List ports open on the host:

   Syntax

```
firewall-cmd --zone ZONE --list-ports
```

   Example

```
[root@host1 ~]# firewall-cmd --zone default --list-ports
```

   b. Verify the range is inclusive of TCP ports 6800–7100.

2.7. FIREWALL SETTINGS FOR CEPH MONITOR NODE

You can enable encryption for all Ceph traffic over the network with the introduction of the messenger version 2 protocol. The **secure** mode setting for messenger v2 encrypts communication between Ceph daemons and Ceph clients, giving you end-to-end encryption.

Messenger v2 Protocol

The second version of Ceph's on-wire protocol, **msgr2**, includes several new features:

- A secure mode encrypts all data moving through the network.
- Encapsulation improvement of authentication payloads.
- Improvements to feature advertisement and negotiation.

The Ceph daemons bind to multiple ports allowing both the legacy, v1-compatible, and the new, v2-compatible, Ceph clients to connect to the same storage cluster. Ceph clients or other Ceph daemons connecting to the Ceph Monitor daemon will try to use the **v2** protocol first, if possible, but if not, then the legacy **v1** protocol will be used. By default, both messenger protocols, **v1** and **v2**, are enabled. The new v2 port is 3300, and the legacy v1 port is 6789, by default.

Prerequisites

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

Procedure

1. Add rules using the following example:

```
[root@mon ~]# sudo iptables -A INPUT -i IFACE -p tcp -s IP-ADDRESS/NETMASK --dport 6789 -j ACCEPT
[root@mon ~]# sudo iptables -A INPUT -i IFACE -p tcp -s IP-ADDRESS/NETMASK --dport 3300 -j ACCEPT
```

   a. Replace ***IFACE*** with the public network interface (for example, **eth0**, **eth1**, and so on).

   b. Replace ***IP-ADDRESS*** with the IP address of the public network and ***NETMASK*** with the netmask for the public network.

2. For the **firewalld** daemon, execute the following commands:

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

Additional resources

- See the *Red Hat Ceph Storage network configuration options* in *Ceph network configuration options* for specific option descriptions and usage.
- See the *Red Hat Ceph Storage Architecture Guide* for details about using *Ceph on-wire encryption* with the Ceph messenger version 2 protocol.

CHAPTER 3. CEPH MONITOR CONFIGURATION

As a storage administrator, you can use the default configuration values for the Ceph Monitor or customize them according to the intended workload.

Prerequisites

- Installation of the Red Hat Ceph Storage software.

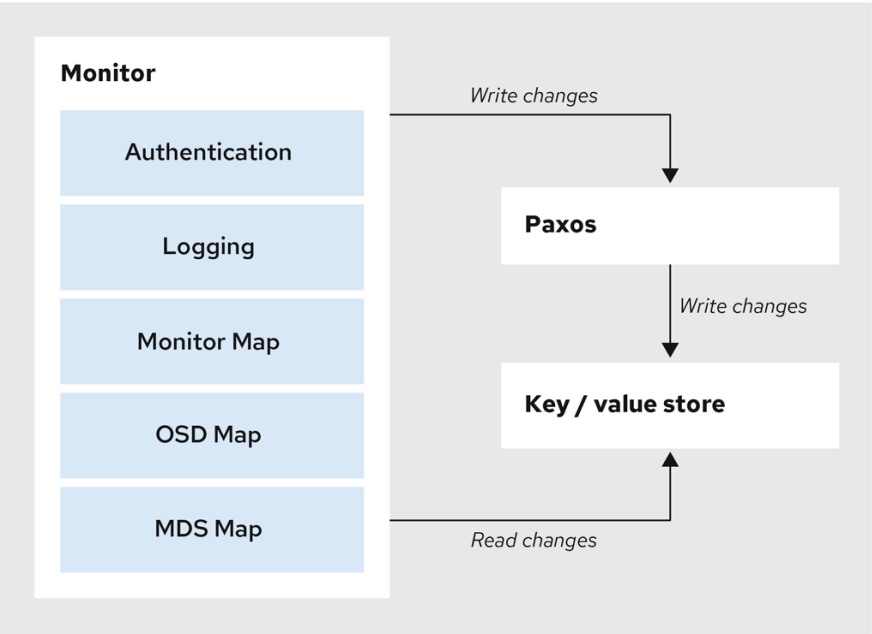
3.1. CEPH MONITOR CONFIGURATION

Understanding how to configure a Ceph Monitor is an important part of building a reliable Red Hat Ceph Storage cluster. All storage clusters have at least one monitor. A Ceph Monitor configuration usually remains fairly consistent, but you can add, remove or replace a Ceph Monitor in a storage cluster.

Ceph monitors maintain a "master copy" of the cluster map. That means a Ceph client can determine the location of all Ceph monitors and Ceph OSDs just by connecting to one Ceph monitor and retrieving a current cluster map.

Before Ceph clients can read from or write to Ceph OSDs, they must connect to a Ceph Monitor first. With a current copy of the cluster map and the CRUSH algorithm, a Ceph client can compute the location for any object. The abilityto compute object locations allows a Ceph client to talk directly to Ceph OSDs, which is a very important aspect of Ceph's high scalability and performance.

The primary role of the Ceph Monitor is to maintain a master copy of the cluster map. Ceph Monitors also provide authentication and logging services. Ceph Monitors write all changes in the monitor services to a single Paxos instance, and Paxos writes the changes to a key-value store for strong consistency. Ceph Monitors can query the most recent version of the cluster map during synchronization operations. Ceph Monitors leverage the key-value store's snapshots and iterators, using the **rocksdb** database, to perform store-wide synchronization.



3.2. VIEWING THE CEPH MONITOR CONFIGURATION DATABASE

You can view Ceph Monitor configuration in the configuration database.

NOTE

Previous releases of Red Hat Ceph Storage centralize Ceph Monitor configuration in **/etc/ceph/ceph.conf**. This configuration file has been deprecated as of Red Hat Ceph Storage 5.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Root-level access to a Ceph Monitor host.

Procedure

1. Log into the **cephadm** shell.

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

2. Use the **ceph config** command to view the configuration database:

Example

```
[ceph: root@host01 /]# ceph config get mon
```

Additional Resources

- For more information about the options available for the **ceph config** command, use **ceph config -h**.

3.3. CEPH CLUSTER MAPS

The cluster map is a composite of maps, including the monitor map, the OSD map, and the placement group map. The cluster map tracks a number of important events:

- Which processes are **in** the Red Hat Ceph Storage cluster.
- Which processes that are **in** the Red Hat Ceph Storage cluster are **up** and running or **down**.
- Whether, the placement groups are **active** or **inactive**, and **clean** or in some other state.
- other details that reflect the current state of the cluster such as:
  - the total amount of storage space or
  - the amount of storage used.

When there is a significant change in the state of the cluster, for example, a Ceph OSD goes down, a placement group falls into a degraded state, and so on. The cluster map gets updated to reflect the current state of the cluster. Additionally, the Ceph monitor also maintains a history of the prior states of the cluster. The monitor map, OSD map, and placement group map each maintain a history of their map versions. Each version is called an **epoch**.

When operating the Red Hat Ceph Storage cluster, keeping track of these states is an important part of the cluster administration.

3.4. CEPH MONITOR QUORUM

A cluster will run sufficiently with a single monitor. However, a single monitor is a single-point-of-failure. To ensure high availability in a production Ceph storage cluster, run Ceph with multiple monitors so that the failure of a single monitor will not cause a failure of the entire storage cluster.

When a Ceph storage cluster runs multiple Ceph Monitors for high availability, Ceph Monitors use the Paxos algorithm to establish consensus about the master cluster map. A consensus requires a majority of monitors running to establish a quorum for consensus about the cluster map. For example, 1; 2 out of 3; 3 out of 5; 4 out of 6; and so on.

Red Hat recommends running a production Red Hat Ceph Storage cluster with at least three Ceph Monitors to ensure high availability. When you run multiple monitors, you can specify the initial monitors that must be members of the storage cluster to establish a quorum. This may reduce the time it takes for the storage cluster to come online.

```
[mon]
mon_initial_members = a,b,c
```

NOTE

A *majority* of the monitors in the storage cluster must be able to reach each other in to establish a quorum. You can decrease the initial number of monitors to establish a quorum with the **mon_initial_members** option.

3.5. CEPH MONITOR CONSISTENCY

When you add monitor settings to the Ceph configuration file, you need to be aware of some of the architectural aspects of Ceph Monitors. Ceph imposes strict consistency requirements for a Ceph Monitor when discovering another Ceph Monitor within the cluster. Whereas Ceph clients and other Ceph daemons use the Ceph configuration file to discover monitors, monitors discover each other using the monitor map (**monmap**), not the Ceph configuration file.

A Ceph Monitor always refers to the local copy of the monitor map when discovering other Ceph Monitors in the Red Hat Ceph Storage cluster. Using the monitor map instead of the Ceph configuration file avoids errors that could break the cluster. For example, typos in the Ceph configuration file when specifying a monitor address or port. Since monitors use monitor maps for discovery and they share monitor maps with clients and other Ceph daemons, the monitor map provides monitors with a strict guarantee that their consensus is valid.

Strict consistency when applying updates to the monitor maps

As with any other updates on the Ceph Monitor, changes to the monitor map always run through a distributed consensus algorithm called Paxos. The Ceph Monitors must agree on each update to the monitor map, such as adding or removing a Ceph Monitor, to ensure that each monitor in the quorum has the same version of the monitor map. Updates to the monitor map are incremental so that Ceph Monitors have the latest agreed-upon version and a set of previous versions.

Maintaining history

Maintaining a history enables a Ceph Monitor that has an older version of the monitor map to catch up with the current state of the Red Hat Ceph Storage cluster.

If Ceph Monitors discovered each other through the Ceph configuration file instead of through the monitor map, it would introduce additional risks because the Ceph configuration files are not updated and distributed automatically. Ceph Monitors might inadvertently use an older Ceph configuration file,

fail to recognize a Ceph Monitor, fall out of a quorum, or develop a situation where Paxos is not able to determine the current state of the system accurately.

3.6. BOOTSTRAP THE CEPH MONITOR

In most configuration and deployment cases, tools that deploy Ceph, such as **cephadm**, might help bootstrap the Ceph monitors by generating a monitor map for you.

A Ceph monitor requires a few explicit settings:

- **File System ID**: The **fsid** is the unique identifier for your object store. Since you can run multiple storage clusters on the same hardware, you must specify the unique ID of the object store when bootstrapping a monitor. Using deployment tools, such as **cephadm**, will generate a file system identifier, but you can also specify the **fsid** manually.
- **Monitor ID**: A monitor ID is a unique ID assigned to each monitor within the cluster. By convention, the ID is set to the monitor's hostname. This option can be set using a deployment tool, using the **ceph** command, or in the Ceph configuration file. In the Ceph configuration file, sections are formed as follows:

  Example

  ```
  [mon.host1]

  [mon.host2]
  ```

- **Keys**: The monitor must have secret keys.

Additional Resources

- For more information about **cephadm** and the Ceph orchestrator, see the *Red Hat Ceph Storage Operations Guide*.

3.7. MINIMUM CONFIGURATION FOR A CEPH MONITOR

The bare minimum monitor settings for a Ceph Monitor in the Ceph configuration file includes a host name for each monitor if it is not configured for DNS and the monitor address. The Ceph Monitors run on port **6789** and **3300** by default.

IMPORTANT

Do not edit the Ceph configuration file.

NOTE

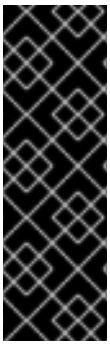
This minimum configuration for monitors assumes that a deployment tool generates the **fsid** and the **mon.** key for you.

You can use the following commands to set or read the storage cluster configuration options.

- **ceph config dump** - Dumps the entire configuration database for the whole storage cluster.
- **ceph config generate-minimal-conf** - Generates a minimal **ceph.conf** file.

- **ceph config get *WHO*** – Dumps the configuration for a specific daemon or a client, as stored in the Ceph Monitor's configuration database.
- **ceph config set *WHO OPTION VALUE*** – Sets the configuration option in the Ceph Monitor's configuration database.
- **ceph config show *WHO*** – Shows the reported running configuration for a running daemon.
- **ceph config assimilate-conf -i *INPUT_FILE* -o *OUTPUT_FILE*** – Ingests a configuration file from the input file and moves any valid options into the Ceph Monitors' configuration database.

Here, *WHO* parameter might be name of the section or a Ceph daemon, *OPTION* is a configuration file, and *VALUE* can be either **true** or **false**.



IMPORTANT

When a Ceph daemon needs a config option prior to getting the option from the config store, you can set the configuration by running the following command:

```
ceph cephadm set-extra-ceph-conf
```

This command adds text to all the daemon's **ceph.conf** files. It is a workaround and is NOT a recommended operation.

3.8. UNIQUE IDENTIFIER FOR CEPH

Each Red Hat Ceph Storage cluster has a unique identifier (**fsid**). If specified, it usually appears under the **[global]** section of the configuration file. Deployment tools usually generate the **fsid** and store it in the monitor map, so the value may not appear in a configuration file. The **fsid** makes it possible to run daemons for multiple clusters on the same hardware.

NOTE

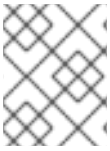
Do not set this value if you use a deployment tool that does it for you.

3.9. CEPH MONITOR DATA STORE

Ceph provides a default path where Ceph monitors store data.

IMPORTANT

Red Hat recommends running Ceph monitors on separate drives from Ceph OSDs for optimal performance in a production Red Hat Ceph Storage cluster.

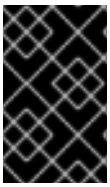


NOTE

A dedicated **/var/lib/ceph** partition should be used for the MON database with a size between 50 and 100 GB.

Ceph monitors call the **fsync()** function often, which can interfere with Ceph OSD workloads.

Ceph monitors store their data as key-value pairs. Using a data store prevents recovering Ceph monitors from running corrupted versions through Paxos, and it enables multiple modification operations in one single atomic batch, among other advantages.



IMPORTANT

Red Hat does not recommend changing the default data location. If you modify the default location, make it uniform across Ceph monitors by setting it in the **[mon]** section of the configuration file.

3.10. CEPH STORAGE CAPACITY

When a Red Hat Ceph Storage cluster gets close to its maximum capacity (specifies by the **mon_osd_full_ratio** parameter), Ceph prevents you from writing to or reading from Ceph OSDs as a safety measure to prevent data loss. Therefore, letting a production Red Hat Ceph Storage cluster approach its full ratio is not a good practice, because it sacrifices high availability. The default full ratio is **.95**, or 95% of capacity. This a very aggressive setting for a test cluster with a small number of OSDs.

TIP

When monitoring a cluster, be alert to warnings related to the **nearfull** ratio. This means that a failure of some OSDs could result in a temporary service disruption if one or more OSDs fails. Consider adding more OSDs to increase storage capacity.

A common scenario for test clusters involves a system administrator removing a Ceph OSD from the Red Hat Ceph Storage cluster to watch the cluster re-balance. Then, removing another Ceph OSD, and so on until the Red Hat Ceph Storage cluster eventually reaches the full ratio and locks up.

IMPORTANT

Red Hat recommends a bit of capacity planning even with a test cluster. Planning enables you to gauge how much spare capacity you will need in to maintain high availability.

Ideally, you want to plan for a series of Ceph OSD failures where the cluster can recover to an **active + clean** state without replacing those Ceph OSDs immediately. You can run a cluster in an **active + degraded** state, but this is not ideal for normal operating conditions.

The following diagram depicts a simplistic Red Hat Ceph Storage cluster containing 33 Ceph Nodes with one Ceph OSD per host, each Ceph OSD Daemon reading from and writing to a 3TB drive. So this exemplary Red Hat Ceph Storage cluster has a maximum actual capacity of 99TB. With a **mon osd full ratio** of **0.95**, if the Red Hat Ceph Storage cluster falls to 5 TB of remaining capacity, the cluster will not allow Ceph clients to read and write data. So the Red Hat Ceph Storage cluster's operating capacity is 95 TB, not 99 TB.

It is normal in such a cluster for one or two OSDs to fail. A less frequent but reasonable scenario involves a rack's router or power supply failing, which brings down multiple OSDs simultaneously, for example, OSDs 7-12. In such a scenario, you should still strive for a cluster that can remain operational and achieve an **active + clean** state, even if that means adding a few hosts with additional OSDs in short order. If your capacity utilization is too high, you might not lose data, but you could still sacrifice data availability while resolving an outage within a failure domain if capacity utilization of the cluster exceeds the full ratio. For this reason, Red Hat recommends at least some rough capacity planning.

Identify two numbers for your cluster:

- the number of OSDs
- the total capacity of the cluster

To determine the mean average capacity of an OSD within a cluster, divide the total capacity of the cluster by the number of OSDs in the cluster. Consider multiplying that number by the number of OSDs you expect to fail simultaneously during normal operations (a relatively small number). Finally, multiply the capacity of the cluster by the full ratio to arrive at a maximum operating capacity. Then, subtract the amount of data from the OSDs you expect to fail to arrive at a reasonable full ratio. Repeat the foregoing process with a higher number of OSD failures (for example, a rack of OSDs) to arrive at a reasonable number for a near full ratio.

3.11. CEPH HEARTBEAT

Ceph monitors know about the cluster by requiring reports from each OSD, and by receiving reports from OSDs about the status of their neighboring OSDs. Ceph provides reasonable default settings for interaction between monitor and OSD, however, you can modify them as needed.

3.12. CEPH MONITOR SYNCHRONIZATION ROLE

When you run a production cluster with multiple monitors which is recommended, each monitor checks to see if a neighboring monitor has a more recent version of the cluster map. For example, a map in a neighboring monitor with one or more epoch numbers higher than the most current epoch in the map of

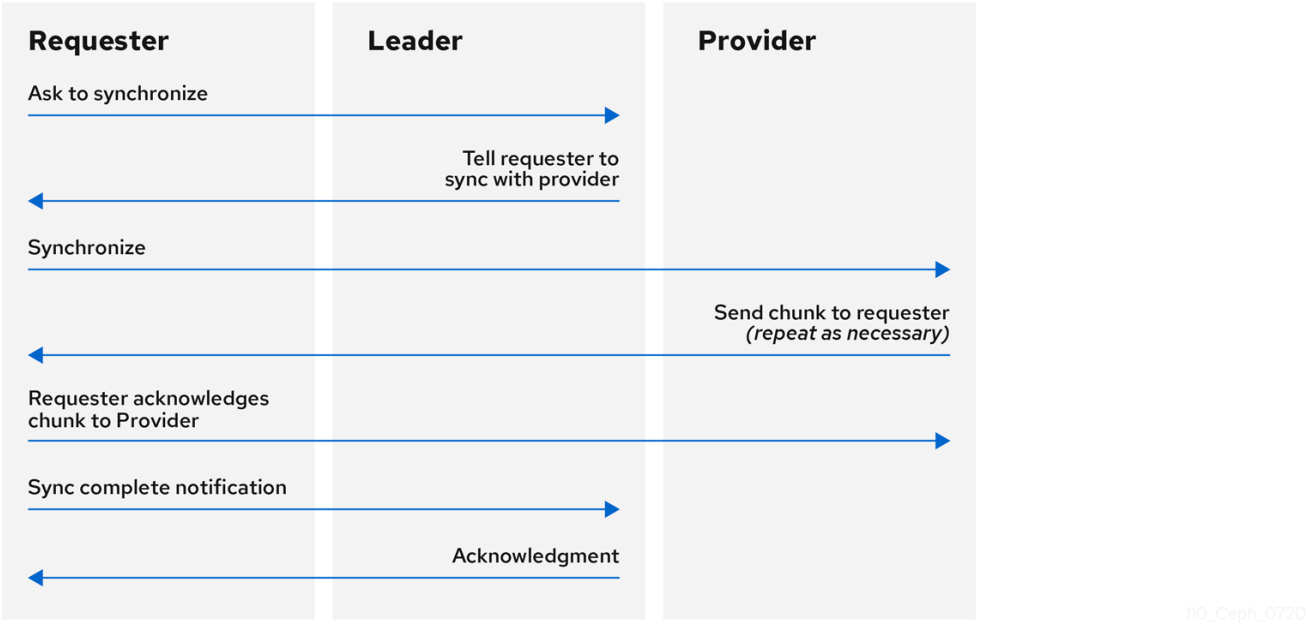
the instant monitor. Periodically, one monitor in the cluster might fall behind the other monitors to the point where it must leave the quorum, synchronize to retrieve the most current information about the cluster, and then rejoin the quorum.

Synchronization roles

For the purposes of synchronization, monitors can assume one of three roles:

- **Leader**: The Leader is the first monitor to achieve the most recent Paxos version of the cluster map.
- **Provider**: The Provider is a monitor that has the most recent version of the cluster map, but was not the first to achieve the most recent version.
- **Requester:** The Requester is a monitor that has fallen behind the leader and must synchronize to retrieve the most recent information about the cluster before it can rejoin the quorum.

These roles enable a leader to delegate synchronization duties to a provider, which prevents synchronization requests from overloading the leader and improving performance. In the following diagram, the requester has learned that it has fallen behind the other monitors. The requester asks the leader to synchronize, and the leader tells the requester to synchronize with a provider.



Monitor synchronization

Synchronization always occurs when a new monitor joins the cluster. During runtime operations, monitors can receive updates to the cluster map at different times. This means the leader and provider roles may migrate from one monitor to another. If this happens while synchronizing, for example, a provider falls behind the leader, the provider can terminate synchronization with a requester.

Once synchronization is complete, Ceph requires trimming across the cluster. Trimming requires that the placement groups are **active + clean**.

3.13. CEPH TIME SYNCHRONIZATION

Ceph daemons pass critical messages to each other, which must be processed before daemons reach a timeout threshold. If the clocks in Ceph monitors are not synchronized, it can lead to a number of anomalies.

For example:

- Daemons ignoring received messages such as outdated timestamps.
- Timeouts triggered too soon or late when a message was not received in time.

TIP

Install NTP on the Ceph monitor hosts to ensure that the monitor cluster operates with synchronized clocks.

Clock drift may still be noticeable with NTP even though the discrepancy is not yet harmful. Ceph clock drift and clock skew warnings can get triggered even though NTP maintains a reasonable level of synchronization. Increasing your clock drift may be tolerable under such circumstances. However, a number of factors such as workload, network latency, configuring overrides to default timeouts, and other synchronization options can influence the level of acceptable clock drift without compromising Paxos guarantees.

Additional Resources

- See the section on *Ceph time synchronization* for more details.
- See all the Red Hat Ceph Storage Monitor configuration options in *Ceph Monitor configuration options* for specific option descriptions and usage.

CHAPTER 4. CEPH AUTHENTICATION CONFIGURATION

As a storage administrator, authenticating users and services is important to the security of the Red Hat Ceph Storage cluster. Red Hat Ceph Storage includes the Cephx protocol, as the default, for cryptographic authentication, and the tools to manage authentication in the storage cluster.

Red Hat Ceph Storage includes the Cephx protocol, as the default, for cryptographic authentication, and the tools to manage authentication in the storage cluster.

As part of the Ceph authentication configuration, consider key rotation for your Ceph and gateway daemons for increased security. Key rotation is done through the command-line, with **cephadm**. See *Enabling key rotation* for more details.

Prerequisites

- Installation of the Red Hat Ceph Storage software.

4.1. CEPHX AUTHENTICATION

The **cephx** protocol is enabled by default. Cryptographic authentication has some computational costs, though they are generally quite low. If the network environment connecting clients and hosts is considered safe and you cannot afford authentication computational costs, you can disable it. When deploying a Ceph storage cluster, the deployment tool will create the **client.admin** user and keyring.

IMPORTANT

Red Hat recommends using authentication.

NOTE

If you disable authentication, you are at risk of a man-in-the-middle attack altering client and server messages, which could lead to significant security issues.

Enabling and disabling Cephx

Enabling Cephx requires that you have deployed keys for the Ceph Monitors and OSDs. When toggling Cephx authentication on or off, you do not have to repeat the deployment procedures.

4.2. ENABLING CEPHX

When **cephx** is enabled, Ceph will look for the keyring in the default search path, which includes **/etc/ceph/$cluster.$name.keyring**. You can override this location by adding a **keyring** option in the **[global]** section of the Ceph configuration file, but this is not recommended.

Execute the following procedures to enable **cephx** on a cluster with authentication disabled. If you or your deployment utility have already generated the keys, you may skip the steps related to generating keys.

Prerequisites

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

Procedure

1. Create a **client.admin** key, and save a copy of the key for your client host:

```
[root@mon ~]# ceph auth get-or-create client.admin mon 'allow *' osd 'allow *' -o
/etc/ceph/ceph.client.admin.keyring
```

WARNING

This will erase the contents of any existing **/etc/ceph/client.admin.keyring** file. Do not perform this step if a deployment tool has already done it for you.

2. Create a keyring for the monitor cluster and generate a monitor secret key:

```
[root@mon ~]# ceph-authtool --create-keyring /tmp/ceph.mon.keyring --gen-key -n mon. --
cap mon 'allow *'
```

3. Copy the monitor keyring into a **ceph.mon.keyring** file in every monitor **mon data** directory. For example, to copy it to **mon.a** in cluster **ceph**, use the following:

```
[root@mon ~]# cp /tmp/ceph.mon.keyring /var/lib/ceph/mon/ceph-a/keyring
```

4. Generate a secret key for every OSD, where ***ID*** is the OSD number:

```
ceph auth get-or-create osd.ID mon 'allow rwx' osd 'allow *' -o
/var/lib/ceph/osd/ceph-ID/keyring
```

5. By default the **cephx** authentication protocol is enabled.

NOTE

If the **cephx** authentication protocol was disabled previously by setting the authentication options to **none**, then by removing the following lines under the **[global]** section in the Ceph configuration file (**/etc/ceph/ceph.conf**) will reenable the **cephx** authentication protocol:

```
auth_cluster_required = none
auth_service_required = none
auth_client_required = none
```

6. Start or restart the Ceph storage cluster.

IMPORTANT

Enabling **cephx** requires downtime because the cluster needs to be completely restarted, or it needs to be shut down and then started while client I/O is disabled.

These flags need to be set before restarting or shutting down the storage cluster:

```
[root@mon ~]# ceph osd set noout
[root@mon ~]# ceph osd set norecover
[root@mon ~]# ceph osd set norebalance
[root@mon ~]# ceph osd set nobackfill
[root@mon ~]# ceph osd set nodown
[root@mon ~]# ceph osd set pause
```

Once **cephx** is enabled and all PGs are active and clean, unset the flags:

```
[root@mon ~]# ceph osd unset noout
[root@mon ~]# ceph osd unset norecover
[root@mon ~]# ceph osd unset norebalance
[root@mon ~]# ceph osd unset nobackfill
[root@mon ~]# ceph osd unset nodown
[root@mon ~]# ceph osd unset pause
```

4.3. DISABLING CEPHX

The following procedure describes how to disable Cephx. If your cluster environment is relatively safe, you can offset the computation expense of running authentication.

IMPORTANT

Red Hat recommends enabling authentication.

However, it may be easier during setup or troubleshooting to temporarily disable authentication.

Prerequisites

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

Procedure

1. Disable **cephx** authentication by setting the following options in the **[global]** section of the Ceph configuration file:

   Example

   ```
   auth_cluster_required = none
   auth_service_required = none
   auth_client_required = none
   ```

2. Start or restart the Ceph storage cluster.

4.4. CEPHX USER KEYRINGS

When you run Ceph with authentication enabled, the **ceph** administrative commands and Ceph clients require authentication keys to access the Ceph storage cluster.

The most common way to provide these keys to the **ceph** administrative commands and clients is to include a Ceph keyring under the **/etc/ceph/** directory. The file name is usually **ceph.client.admin.keyring** or **$cluster.client.admin.keyring**. If you include the keyring under the **/etc/ceph/** directory, you do not need to specify a **keyring** entry in the Ceph configuration file.

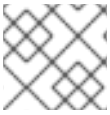
IMPORTANT

Red Hat recommends copying the Red Hat Ceph Storage cluster keyring file to nodes where you will run administrative commands, because it contains the **client.admin** key.

To do so, execute the following command:

```
# scp USER@HOSTNAME:/etc/ceph/ceph.client.admin.keyring /etc/ceph/ceph.client.admin.keyring
```

Replace ***USER*** with the user name used on the host with the **client.admin** key and ***HOSTNAME*** with the host name of that host.



NOTE

Ensure the **ceph.keyring** file has appropriate permissions set on the client machine.

You can specify the key itself in the Ceph configuration file using the **key** setting, which is not recommended, or a path to a key file using the **keyfile** setting.

4.5. CEPHX DAEMON KEYRINGS

Administrative users or deployment tools might generate daemon keyrings in the same way as generating user keyrings. By default, Ceph stores daemons keyrings inside their data directory. The default keyring locations, and the capabilities necessary for the daemon to function.

NOTE

The monitor keyring contains a key but no capabilities, and is not part of the Ceph storage cluster **auth** database.

The daemon data directory locations default to directories of the form:

```
/var/lib/ceph/$type/CLUSTER-ID
```

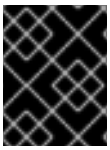
Example

```
/var/lib/ceph/osd/ceph-12
```

You can override these locations, but it is not recommended.

4.6. CEPHX MESSAGE SIGNATURES

Ceph provides fine-grained control so you can enable or disable signatures for service messages between the client and Ceph. You can enable or disable signatures for messages between Ceph daemons.



IMPORTANT

Red Hat recommends that Ceph authenticate all ongoing messages between the entities using the session key set up for that initial authentication.

NOTE

Ceph kernel modules do not support signatures yet.

CHAPTER 5. POOLS, PLACEMENT GROUPS, AND CRUSH CONFIGURATION

As a storage administrator, you can choose to use the Red Hat Ceph Storage default options for pools, placement groups, and the CRUSH algorithm or customize them for the intended workload.

Prerequisites

- Installation of the Red Hat Ceph Storage software.

5.1. POOLS PLACEMENT GROUPS AND CRUSH

When you create pools and set the number of placement groups for the pool, Ceph uses default values when you do not specifically override the defaults.

IMPORTANT

Red Hat recommends overriding some of the defaults. Specifically, set a pool's replica size and override the default number of placement groups.

You can set these values when running pool commands.

By default, Ceph makes 3 replicas of objects. If you want to set 4 copies of an object as the default value, a primary copy and three replica copies, reset the default values as shown in **osd_pool_default_size**. If you want to allow Ceph to write a lesser number of copies in a degraded state, set **osd_pool_default_min_size** to a number less than the **osd_pool_default_size** value.

Example

```
[ceph: root@host01 /]# ceph config set global osd_pool_default_size 4  # Write an object 4 times.
[ceph: root@host01 /]# ceph config set global osd_pool_default_min_size 1  # Allow writing one copy in a degraded state.
```

Ensure you have a realistic number of placement groups. Red Hat recommends approximately 100 per OSD. For example, total number of OSDs multiplied by 100 divided by the number of replicas, that is, **osd_pool_default_size**. For 10 OSDs and **osd_pool_default_size** = 4, we would recommend approximately (100 * 10) / 4 = 250.

Example

```
[ceph: root@host01 /]# ceph config set global osd_pool_default_pg_num 250
[ceph: root@host01 /]# ceph config set global osd_pool_default_pgp_num 250
```

Additional resources

- See all the Red Hat Ceph Storage pool, placement group, and CRUSH configuration options in l*Appendix E* for specific option descriptions and usage.

CHAPTER 6. CEPH OBJECT STORAGE DAEMON (OSD) CONFIGURATION

As a storage administrator, you can configure the Ceph Object Storage Daemon (OSD) to be redundant and optimized based on the intended workload.

Prerequisites

- Installation of the Red Hat Ceph Storage software.

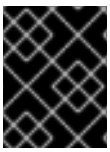
6.1. CEPH OSD CONFIGURATION

All Ceph clusters have a configuration, which defines:

- Cluster identity
- Authentication settings
- Ceph daemon membership in the cluster
- Network configuration
- Host names and addresses
- Paths to keyrings
- Paths to OSD log files
- Other runtime options

A deployment tool, such as **cephadm**, will typically create an initial Ceph configuration file for you. However, you can create one yourself if you prefer to bootstrap a cluster without using a deployment tool.

For your convenience, each daemon has a series of default values. Many are set by the **ceph/src/common/config_opts.h** script. You can override these settings with a Ceph configuration file or at runtime by using the monitor **tell** command or connecting directly to a daemon socket on a Ceph node.



IMPORTANT

Red Hat does not recommend changing the default paths, as it makes it more difficult to troubleshoot Ceph later.

Additional Resources

- For more information about **cephadm** and the Ceph orchestrator, see the *Red Hat Ceph Storage Operations Guide*.

6.2. SCRUBBING THE OSD

In addition to making multiple copies of objects, Ceph ensures data integrity by scrubbing placement groups. Ceph scrubbing is analogous to the **fsck** command on the object storage layer.

For each placement group, Ceph generates a catalog of all objects and compares each primary object and its replicas to ensure that no objects are missing or mismatched.

Light scrubbing (daily) checks the object size and attributes. Deep scrubbing (weekly) reads the data and uses checksums to ensure data integrity.

Scrubbing is important for maintaining data integrity, but it can reduce performance. Adjust the following settings to increase or decrease scrubbing operations.

Additional resources

- See *Ceph scrubbing options* in the appendix of the *Red Hat Ceph Storage Configuration Guide* for more details.

6.3. BACKFILLING AN OSD

When you add Ceph OSDs to a cluster or remove them from the cluster, the CRUSH algorithm rebalances the cluster by moving placement groups to or from Ceph OSDs to restore the balance. The process of migrating placement groups and the objects they contain can reduce the cluster operational performance considerably. To maintain operational performance, Ceph performs this migration with the 'backfill' process, which allows Ceph to set backfill operations to a lower priority than requests to read or write data.

6.4. OSD RECOVERY

When the cluster starts or when a Ceph OSD terminates unexpectedly and restarts, the OSD begins peering with other Ceph OSDs before a write operation can occur.

If a Ceph OSD crashes and comes back online, usually it will be out of sync with other Ceph OSDs containing more recent versions of objects in the placement groups. When this happens, the Ceph OSD goes into recovery mode and seeks to get the latest copy of the data and bring its map back up to date. Depending upon how long the Ceph OSD was down, the OSD's objects and placement groups may be significantly out of date. Also, if a failure domain went down, for example, a rack, more than one Ceph OSD might come back online at the same time. This can make the recovery process time consuming and resource intensive.

To maintain operational performance, Ceph performs recovery with limitations on the number of recovery requests, threads, and object chunk sizes which allows Ceph to perform well in a degraded state.

Additional resources

- See all the Red Hat Ceph Storage Ceph OSD configuration options in *OSD object daemon storage configuration options* for specific option descriptions and usage.

CHAPTER 7. CEPH MONITOR AND OSD INTERACTION CONFIGURATION

As a storage administrator, you must properly configure the interactions between the Ceph Monitors and OSDs to ensure a stable working environment.

Prerequisites

- Installation of the Red Hat Ceph Storage software.

7.1. CEPH MONITOR AND OSD INTERACTION

After you have completed your initial Ceph configuration, you can deploy and run Ceph. When you execute a command such as **ceph health** or **ceph -s**, the Ceph Monitor reports on the current state of the Ceph storage cluster. The Ceph Monitor knows about the Ceph storage cluster by requiring reports from each Ceph OSD daemon, and by receiving reports from Ceph OSD daemons about the status of their neighboring Ceph OSD daemons. If the Ceph Monitor does not receive reports, or if it receives reports of changes in the Ceph storage cluster, the Ceph Monitor updates the status of the Ceph cluster map.

Ceph provides reasonable default settings for Ceph Monitor and OSD interaction. However, you can override the defaults. The following sections describe how Ceph Monitors and Ceph OSD daemons interact for the purposes of monitoring the Ceph storage cluster.

7.2. OSD HEARTBEAT

Each Ceph OSD daemon checks the heartbeat of other Ceph OSD daemons every 6 seconds. To change the heartbeat interval, change the value at runtime:

Syntax

```
ceph config set osd osd_heartbeat_interval TIME_IN_SECONDS
```

Example

```
[ceph: root@host01 /]# ceph config set osd osd_heartbeat_interval 60
```

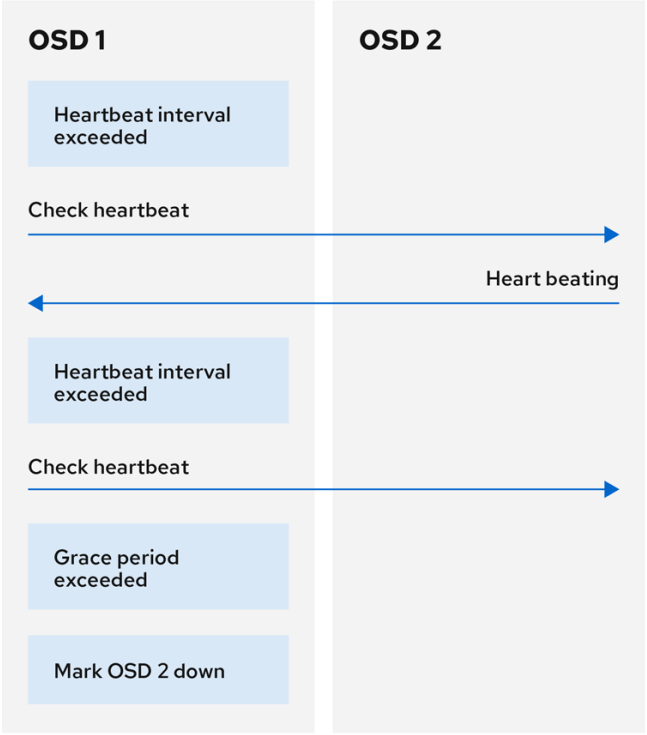
If a neighboring Ceph OSD daemon does not send heartbeat packets within a 20 second grace period, the Ceph OSD daemon might consider the neighboring Ceph OSD daemon **down**. It can report it back to a Ceph Monitor, which updates the Ceph cluster map. To change the grace period, set the value at runtime:

Syntax

```
ceph config set osd osd_heartbeat_grace TIME_IN_SECONDS
```

Example

```
[ceph: root@host01 /]# ceph config set osd osd_heartbeat_grace 30
```



7.3. REPORTING AN OSD AS DOWN

By default, two Ceph OSD Daemons **from different hosts** must report to the Ceph Monitors that another Ceph OSD Daemon is **down** before the Ceph Monitors acknowledge that the reported Ceph OSD Daemon is **down**.

However, there is the chance that all the OSDs reporting the failure are in different hosts in a rack with a bad switch that causes connection problems between OSDs.

To avoid a "false alarm," Ceph considers the peers reporting the failure as a proxy for a "subcluster" that is similarly laggy. While this is not always the case, it may help administrators localize the grace correction to a subset of the system that is performing poorly.

Ceph uses the **mon_osd_reporter_subtree_level** setting to group the peers into the "subcluster" by their common ancestor type in the CRUSH map.

By default, only two reports from **a different subtree** are required to report another Ceph OSD Daemon **down**. Administrators can change the number of reporters from unique subtrees and the common ancestor type required to report a Ceph OSD Daemon **down** to a Ceph Monitor by setting the **mon_osd_min_down_reporters** and **mon_osd_reporter_subtree_level** values at runtime:

Syntax

```
ceph config set mon mon_osd_min_down_reporters NUMBER
```

Example

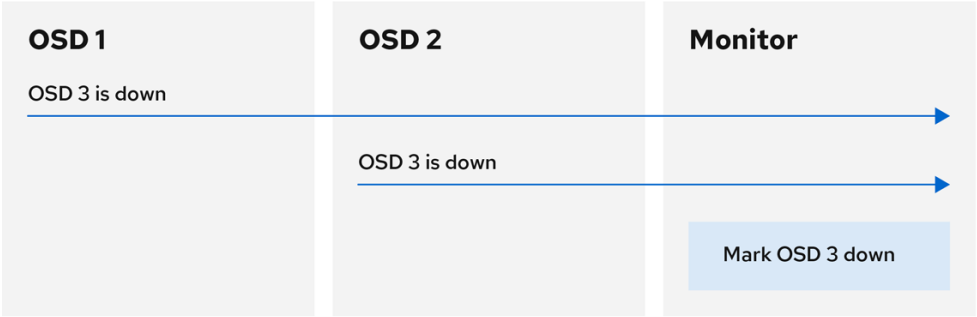
```
[ceph: root@host01 /]# ceph config set mon mon_osd_min_down_reporters 4
```

Syntax

```
ceph config set mon mon_osd_reporter_subtree_level CRUSH_ITEM
```

Example

```
[ceph: root@host01 /]# ceph config set mon mon_osd_reporter_subtree_level host
[ceph: root@host01 /]# ceph config set mon mon_osd_reporter_subtree_level rack
[ceph: root@host01 /]# ceph config set mon mon_osd_reporter_subtree_level osd
```



7.4. REPORTING A PEERING FAILURE

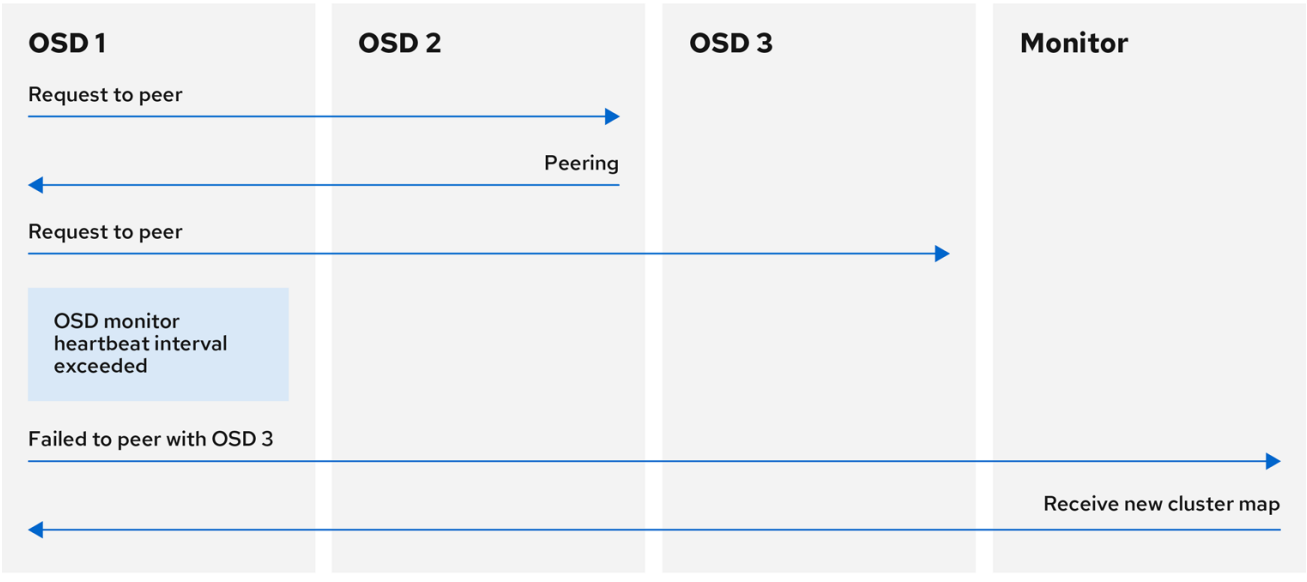
If a Ceph OSD daemon cannot peer with any of the Ceph OSD daemons defined in its Ceph configuration file or the cluster map, it pings a Ceph Monitor for the most recent copy of the cluster map every 30 seconds. You can change the Ceph Monitor heartbeat interval by setting the value at runtime:

Syntax

```
ceph config set osd osd_mon_heartbeat_interval TIME_IN_SECONDS
```

Example

```
[ceph: root@host01 /]# ceph config set osd osd_mon_heartbeat_interval 60
```



7.5. OSD REPORTING STATUS

If a Ceph OSD Daemon does not report to a Ceph Monitor, the Ceph Monitor marks the Ceph OSD Daemon **down** after the **mon_osd_report_timeout**, which is 900 seconds, elapses. A Ceph OSD Daemon sends a report to a Ceph Monitor when a reportable event such as a failure, a change in placement group stats, a change in **up_thru** or when it boots within 5 seconds.

You can change the Ceph OSD Daemon minimum report interval by setting the **osd_mon_report_interval** value at runtime:

Syntax

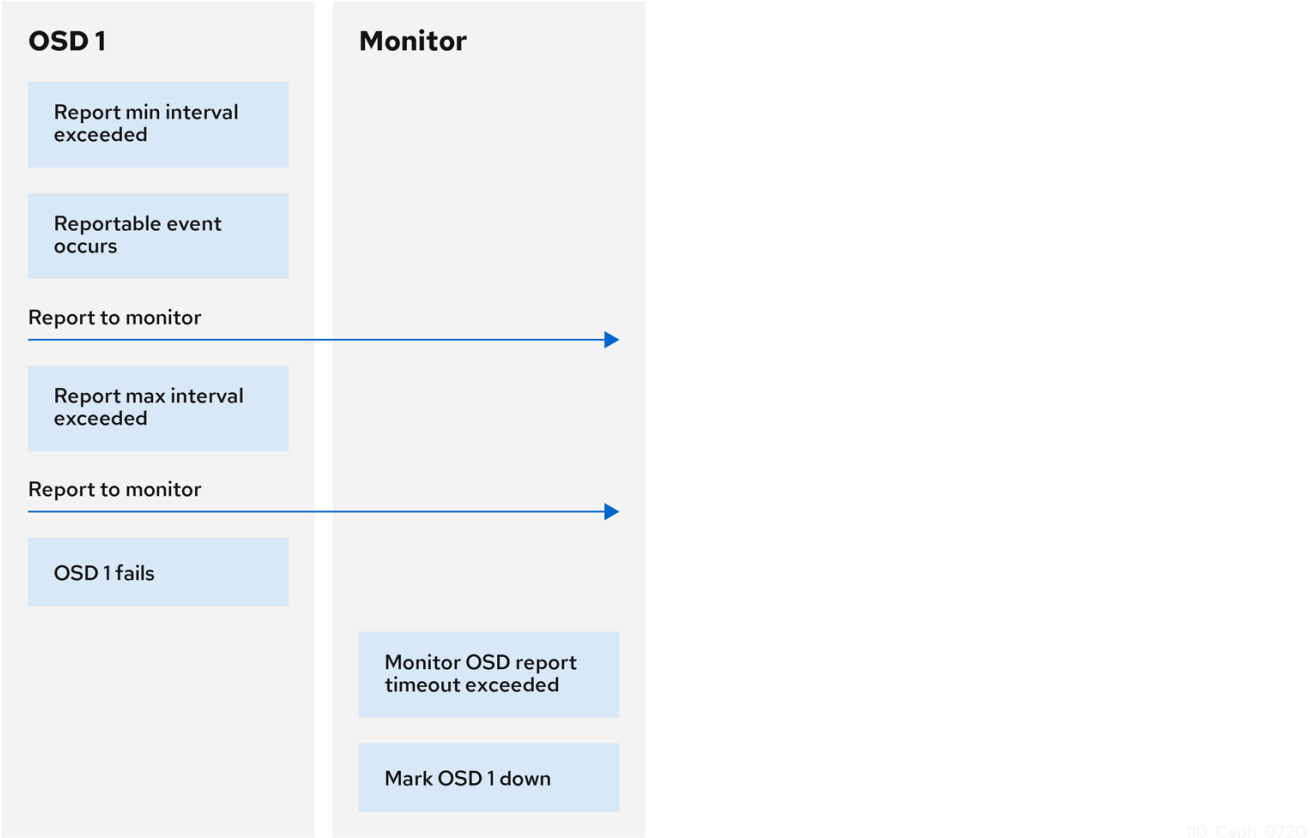
```
ceph config set osd osd_mon_report_interval TIME_IN_SECONDS
```

To get, set, and verify the config you can use the following example:

Example

```
[ceph: root@host01 /]# ceph config get osd osd_mon_report_interval
5
[ceph: root@host01 /]# ceph config set osd osd_mon_report_interval 20
[ceph: root@host01 /]# ceph config dump | grep osd

global                 advanced  osd_pool_default_crush_rule              -1
  osd                  basic     osd_memory_target                        4294967296
  osd                  advanced  osd_mon_report_interval                  20
```



Additional resources

- See all the Red Hat Ceph Storage Ceph Monitor and OSD configuration options in *Ceph Monitor and OSD configuration options* for specific option descriptions and usage.

CHAPTER 8. CEPH DEBUGGING AND LOGGING CONFIGURATION

As a storage administrator, you can increase the amount of debugging and logging information in **cephadm** to help diagnose problems with Red Hat Ceph Storage.

Prerequisites

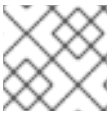
- Red Hat Ceph Storage software is installed.

Additional resources

- See all the Red Hat Ceph Storage Ceph debugging and logging configuration options in *Ceph debugging and loggin configuration options* for specific option descriptions and usage.
- For more information about troubleshooting **cephadm**, see *Cephadm troubleshooting* in the *Red Hat Ceph Storage Administration Guide*.
- For more information about **cephadm** logging, see *Cephadm operations* in the *Red Hat Ceph Storage Administration Guide*.

APPENDIX A. GENERAL CONFIGURATION OPTIONS

These are the general configuration options for Ceph.



NOTE

Typically, these will be set automatically by deployment tools, such as **cephadm**.

fsid

Description

The file system ID. One per cluster.

Type

UUID

Required

No.

Default

N/A. Usually generated by deployment tools.

admin_socket

Description

The socket for executing administrative commands on a daemon, irrespective of whether Ceph monitors have established a quorum.

Type

String

Required

No

Default

/var/run/ceph/$cluster-$name.asok

pid_file

Description

The file in which the monitor or OSD will write its PID. For instance, **/var/run/$cluster/$type.$id.pid** will create /var/run/ceph/mon.a.pid for the **mon** with id **a** running in the **ceph** cluster. The **pid file** is removed when the daemon stops gracefully. If the process is not daemonized (meaning it runs with the **-f** or **-d** option), the **pid file** is not created.

Type

String

Required

No

Default

No

chdir

Description

The directory Ceph daemons change to once they are up and running. Default / directory recommended.

Type

String

Required

No

Default

/

max_open_files

Description

If set, when the Red Hat Ceph Storage cluster starts, Ceph sets the **max_open_fds** at the OS level (that is, the max # of file descriptors). It helps prevent Ceph OSDs from running out of file descriptors.

Type

64-bit Integer

Required

No

Default

0

fatal_signal_handlers

Description

If set, we will install signal handlers for SEGV, ABRT, BUS, ILL, FPE, XCPU, XFSZ, SYS signals to generate a useful log message.

Type

Boolean

Default

true

APPENDIX B. CEPH NETWORK CONFIGURATION OPTIONS

These are the common network configuration options for Ceph.

public_network

Description

The IP address and netmask of the public (front-side) network (for example, **192.168.0.0/24**). Set in **[global]**. You can specify comma-delimited subnets.

Type

<ip-address>/<netmask> [, <ip-address>/<netmask>]

Required

No

Default

N/A

public_addr

Description

The IP address for the public (front-side) network. Set for each daemon.

Type

IP Address

Required

No

Default

N/A

cluster_network

Description

The IP address and netmask of the cluster network (for example, **10.0.0.0/24**). Set in **[global]**. You can specify comma-delimited subnets.

Type

<ip-address>/<netmask> [, <ip-address>/<netmask>]

Required

No

Default

N/A

cluster_addr

Description

The IP address for the cluster network. Set for each daemon.

Type

Address

Required

No

Default

N/A

ms_type

Description

The messenger type for the network transport layer. Red Hat supports the **simple** and the **async** messenger type using **posix** semantics.

Type

String.

Required

No.

Default

async+posix

ms_public_type

Description

The messenger type for the network transport layer of the public network. It operates identically to **ms_type**, but is applicable only to the public or front-side network. This setting enables Ceph to use a different messenger type for the public or front-side and cluster or back-side networks.

Type

String.

Required

No.

Default

None.

ms_cluster_type

Description

The messenger type for the network transport layer of the cluster network. It operates identically to **ms_type**, but is applicable only to the cluster or back-side network. This setting enables Ceph to use a different messenger type for the public or front-side and cluster or back-side networks.

Type

String.

Required

No.

Default

None.

Host options

You must declare at least one Ceph Monitor in the Ceph configuration file, with a **mon addr** setting under each declared monitor. Ceph expects a **host** setting under each declared monitor, metadata server and OSD in the Ceph configuration file.

IMPORTANT

Do not use **localhost**. Use the short name of the node, not the fully-qualified domain name (FQDN). Do not specify any value for **host** when using a third party deployment system that retrieves the node name for you.

mon_addr

Description

A list of **<hostname>:<port>** entries that clients can use to connect to a Ceph monitor. If not set, Ceph searches **[mon.*]** sections.

Type

String

Required

No

Default

N/A

host

Description

The host name. Use this setting for specific daemon instances (for example, **[osd.0]**).

Type

String

Required

Yes, for daemon instances.

Default

localhost

TCP options

Ceph disables TCP buffering by default.

ms_tcp_nodelay

Description

Ceph enables **ms_tcp_nodelay** so that each request is sent immediately (no buffering). Disabling Nagle's algorithm increases network traffic, which can introduce congestion. If you experience large numbers of small packets, you may try disabling **ms_tcp_nodelay**, but be aware that disabling it will generally increase latency.

Type

Boolean

Required

No

Default

true

ms_tcp_rcvbuf

Description

The size of the socket buffer on the receiving end of a network connection. Disabled by default.

Type

32-bit Integer

Required

No

Default

0

ms_tcp_read_timeout

Description

If a client or daemon makes a request to another Ceph daemon and does not drop an unused connection, the **tcp read timeout** defines the connection as idle after the specified number of seconds.

Type

Unsigned 64-bit Integer

Required

No

Default

900 15 minutes.

Bind options

The bind options configure the default port ranges for the Ceph OSD daemons. The default range is **6800:7100**. You can also enable Ceph daemons to bind to IPv6 addresses.

IMPORTANT

Verify that the firewall configuration allows you to use the configured port range.

ms_bind_port_min

Description

The minimum port number to which an OSD daemon will bind.

Type

32-bit Integer

Default

6800

Required

No

ms_bind_port_max

Description

The maximum port number to which an OSD daemon will bind.

Type

32-bit Integer

Default

7300

Required

No.

ms_bind_ipv6

Description

Enables Ceph daemons to bind to IPv6 addresses.

Type

Boolean

Default

false

Required

No

Asynchronous messenger options

These Ceph messenger options configure the behavior of **AsyncMessenger**.

ms_async_transport_type

Description

Transport type used by the **AsyncMessenger**. Red Hat supports the **posix** setting, but does not support the **dpdk** or **rdma** settings at this time. POSIX uses standard TCP/IP networking and is the default value. Other transport types are experimental and are **NOT** supported.

Type

String

Required

No

Default

posix

ms_async_op_threads

Description

Initial number of worker threads used by each **AsyncMessenger** instance. This configuration setting **SHOULD** equal the number of replicas or erasure code chunks, but it may be set lower if the CPU core count is low or the number of OSDs on a single server is high.

Type

64-bit Unsigned Integer

Required

No

Default

3

ms_async_max_op_threads

Description

The maximum number of worker threads used by each **AsyncMessenger** instance. Set to lower values if the OSD host has limited CPU count, and increase if Ceph is underutilizing CPUs are underutilized.

Type

64-bit Unsigned Integer

Required

No

Default

5

ms_async_set_affinity

Description

Set to **true** to bind **AsyncMessenger** workers to particular CPU cores.

Type

Boolean

Required

No

Default

true

ms_async_affinity_cores

Description

When **ms_async_set_affinity** is **true**, this string specifies how **AsyncMessenger** workers are bound to CPU cores. For example, **0,2** will bind workers #1 and #2 to CPU cores #0 and #2, respectively. **NOTE:** When manually setting affinity, make sure to not assign workers to virtual CPUs created as an effect of hyper threading or similar technology, because they are slower than physical CPU cores.

Type

String

Required

No

Default

(empty)

ms_async_send_inline

Description

Send messages directly from the thread that generated them instead of queuing and sending from the **AsyncMessenger** thread. This option is known to decrease performance on systems with a lot of CPU cores, so it's disabled by default.

Type

Boolean

Required

No

Default

false

Connection mode configuration options

Starting with Red Hat Ceph Storage 6 and later, for most connections, there are options that control the modes that are used for encryption and compression.

ms_cluster_mode

Description

Connection mode used for intra-cluster communication between Ceph daemons. If multiple modes are listed, the modes listed first are preferred.

Type

String

Default

crc secure

ms_service_mode

Description

A list of permitted modes for clients to use when connecting to the storage cluster.

Type

String

Default

crc secure

ms_client_mode

Description

A list of connection modes, in order of preference, for clients to use when interacting with a Ceph cluster.

Type

String

Default

crc secure

ms_mon_cluster_mode

Description

The connection mode to use between Ceph monitors.

Type

String

Default

secure crc

ms_mon_service_mode

Description

A list of permitted modes for clients or other Ceph daemons to use when connecting to monitors.

Type

String

Default

secure crc

ms_mon_client_mode

Description

A list of connection modes, in order of preference, for clients or non-monitor daemons to use when connecting to Ceph monitors.

Type

String

Default

secure crc

Compression mode configuration options

Starting with Red Hat Ceph Storage 6 and later, with the messenger v2 protocol, you can use the configuration options for the compression modes.

ms_compress_secure

Description

Combining encryption with compression reduces the level of security of messages between peers. In case, both the encryption and compression are enabled, compression setting is ignored and message is not compressed. Override this setting with option. Send messages directly from the thread that generated them instead of queuing and sending from the **AsyncMessenger** thread. This option is known to decrease performance on systems with a lot of CPU cores, so it's disabled by default.

Type

Boolean

Default

false

ms_osd_compress_mode

Description

Compression policy to use in messenger for communication with Ceph OSDs.

Type

String

Default

none

Valid choices

none or **force**

ms_osd_compress_min_size

Description

Minimal message size eligible for on-wire compression.

Type

Integer

Default

1 Ki

ms_osd_compression_algorithm

Description

Compression algorithm for connections with OSD in order of preference

Type

String

Default

snappy

Valid choices

snappy, **zstd**, **zlib**, or **lz4**

APPENDIX C. CEPH FIREWALL PORTS

These are the general firewall ports used by various components in Red Hat Ceph Storage.

Port	Port type	Components
6800-7300	TCP	Ceph OSDs.
3300	TCP	Ceph clients and Ceph daemons connecting to the Ceph Monitor daemon. This port is preferred over 6789.
6789	TCP	Ceph clients and Ceph daemons connecting to the Ceph Monitor daemon. This port is considered if port 3300 fails.

APPENDIX D. CEPH MONITOR CONFIGURATION OPTIONS

The following are Ceph monitor configuration options that can be set up during deployment.

You can set these configuration options with the **ceph config set mon *CONFIGURATION_OPTION VALUE*** command.

mon_initial_members

Description

The IDs of initial monitors in a cluster during startup. If specified, Ceph requires an odd number of monitors to form an initial quorum (for example, 3).

Type

String

Default

None

mon_force_quorum_join

Description

Force monitor to join quorum even if it has been previously removed from the map

Type

Boolean

Default

False

mon_dns_srv_name

Description

The service name used for querying the DNS for the monitor hosts/addresses.

Type

String

Default

ceph-mon

fsid

Description

The cluster ID. One per cluster.

Type

UUID

Required

Yes.

Default

N/A. May be generated by a deployment tool if not specified.

mon_data

Description

The monitor’s data location.

Type

String

Default

/var/lib/ceph/mon/$cluster-$id

mon_data_size_warn

Description

Ceph issues a **HEALTH_WARN** status in the cluster log when the monitor's data store reaches this threshold. The default value is 15GB.

Type

Integer

Default

15*1024*1024*1024*

mon_data_avail_warn

Description

Ceph issues a **HEALTH_WARN** status in the cluster log when the available disk space of the monitor's data store is lower than or equal to this percentage.

Type

Integer

Default

30

mon_data_avail_crit

Description

Ceph issues a **HEALTH_ERR** status in the cluster log when the available disk space of the monitor's data store is lower or equal to this percentage.

Type

Integer

Default

5

mon_warn_on_cache_pools_without_hit_sets

Description

Ceph issues a **HEALTH_WARN** status in the cluster log if a cache pool does not have the **hit_set_type** parameter set.

Type

Boolean

Default

True

mon_warn_on_crush_straw_calc_version_zero

Description

Ceph issues a **HEALTH_WARN** status in the cluster log if the CRUSH's **straw_calc_version** is zero. See CRUSH tunables for details.

Type

Boolean

Default

True

mon_warn_on_legacy_crush_tunables

Description

Ceph issues a **HEALTH_WARN** status in the cluster log if CRUSH tunables are too old (older than **mon_min_crush_required_version**).

Type

Boolean

Default

True

mon_crush_min_required_version

Description

This setting defines the minimum tunable profile version required by the cluster.

Type

String

Default

hammer

mon_warn_on_osd_down_out_interval_zero

Description

Ceph issues a **HEALTH_WARN** status in the cluster log if the **mon_osd_down_out_interval** setting is zero, because the Leader behaves in a similar manner when the **noout** flag is set. Administrators find it easier to troubleshoot a cluster by setting the **noout** flag. Ceph issues the warning to ensure administrators know that the setting is zero.

Type

Boolean

Default

True

mon_cache_target_full_warn_ratio

Description

Ceph issues a warning when between the ratio of **cache_target_full** and **target_max_object**.

Type

Float

Default

0.66

mon_health_data_update_interval

Description

How often (in seconds) a monitor in the quorum shares its health status with its peers. A negative number disables health updates.

Type

Float

Default

60

mon_health_to_clog

Description

This setting enables Ceph to send a health summary to the cluster log periodically.

Type

Boolean

Default

True

mon_health_detail_to_clog

Description

This setting enable Ceph to send a health details to the cluster log periodically.

Type

Boolean

Default

True

mon_op_complaint_time

Description

Number of seconds after which the Ceph Monitor operation is considered blocked after no updates.

Type

Integer

Default

30

mon_health_to_clog_tick_interval

Description

How often (in seconds) the monitor sends a health summary to the cluster log. A non-positive number disables it. If the current health summary is empty or identical to the last time, the monitor will not send the status to the cluster log.

Type

Integer

Default

60.000000

mon_health_to_clog_interval

Description

How often (in seconds) the monitor sends a health summary to the cluster log. A non-positive number disables it. The monitor will always send the summary to the cluster log.

Type

Integer

Default

600

mon_osd_full_ratio

Description

The percentage of disk space used before an OSD is considered **full**.

Type

Float:

Default

.95

mon_osd_nearfull_ratio

Description

The percentage of disk space used before an OSD is considered **nearfull**.

Type

Float

Default

.85

mon_sync_trim_timeout

Description, Type

Double

Default

30.0

mon_sync_heartbeat_timeout

Description, Type

Double

Default

30.0

mon_sync_heartbeat_interval

Description, Type

Double

Default

5.0

mon_sync_backoff_timeout

Description, Type

Double

Default

30.0

mon_sync_timeout

Description

The number of seconds the monitor will wait for the next update message from its sync provider before it gives up and bootstraps again.

Type

Double

Default

60.000000

mon_sync_max_retries

Description, Type

Integer

Default

5

mon_sync_max_payload_size

Description

The maximum size for a sync payload (in bytes).

Type

32-bit Integer

Default

1045676

paxos_max_join_drift

Description

The maximum Paxos iterations before we must first sync the monitor data stores. When a monitor finds that its peer is too far ahead of it, it will first sync with data stores before moving on.

Type

Integer

Default

10

paxos_stash_full_interval

Description

How often (in commits) to stash a full copy of the PaxosService state. Currently this setting only affects **mds**, **mon**, **auth** and **mgr** PaxosServices.

Type

Integer

Default

25

paxos_propose_interval

Description

Gather updates for this time interval before proposing a map update.

Type

Double

Default

1.0

paxos_min

Description

The minimum number of paxos states to keep around

Type

Integer

Default

500

paxos_min_wait

Description

The minimum amount of time to gather updates after a period of inactivity.

Type

Double

Default

0.05

paxos_trim_min

Description

Number of extra proposals tolerated before trimming

Type

Integer

Default

250

paxos_trim_max

Description

The maximum number of extra proposals to trim at a time

Type

Integer

Default

500

paxos_service_trim_min

Description

The minimum amount of versions to trigger a trim (0 disables it)

Type

Integer

Default

250

paxos_service_trim_max

Description

The maximum amount of versions to trim during a single proposal (0 disables it)

Type

Integer

Default

500

mon_max_log_epochs

Description

The maximum amount of log epochs to trim during a single proposal

Type

Integer

Default

500

mon_max_pgmap_epochs

Description

The maximum amount of pgmap epochs to trim during a single proposal

Type

Integer

Default

500

mon_mds_force_trim_to

Description

Force monitor to trim mdsmaps to this point (0 disables it. dangerous, use with care)

Type

Integer

Default

0

mon_osd_force_trim_to

Description

Force monitor to trim osdmaps to this point, even if there is PGs not clean at the specified epoch (0 disables it. dangerous, use with care)

Type

Integer

Default

0

mon_osd_cache_size

Description

The size of osdmaps cache, not to rely on underlying store's cache

Type

Integer

Default

500

mon_election_timeout

Description

On election proposer, maximum waiting time for all ACKs in seconds.

Type

Float

Default

5

mon_lease

Description

The length (in seconds) of the lease on the monitor's versions.

Type

Float

Default

5

mon_lease_renew_interval_factor

Description

mon lease * **mon lease renew interval factor** will be the interval for the Leader to renew the other monitor's leases. The factor should be less than **1.0**.

Type

Float

Default

0.6

mon_lease_ack_timeout_factor

Description

The Leader will wait **mon lease** * **mon lease ack timeout factor** for the Providers to acknowledge the lease extension.

Type

Float

Default

2.0

mon_accept_timeout_factor

Description

The Leader will wait **mon lease** * **mon accept timeout factor** for the Requesters to accept a Paxos update. It is also used during the Paxos recovery phase for similar purposes.

Type

Float

Default

2.0

mon_min_osdmap_epochs

Description

Minimum number of OSD map epochs to keep at all times.

Type

32-bit Integer

Default

500

mon_max_pgmap_epochs

Description

Maximum number of PG map epochs the monitor should keep.

Type

32-bit Integer

Default

500

mon_max_log_epochs

Description

Maximum number of Log epochs the monitor should keep.

Type

32-bit Integer

Default

500

clock_offset

Description

How much to offset the system clock. See **Clock.cc** for details.

Type

Double

Default

0

mon_tick_interval

Description

A monitor's tick interval in seconds.

Type

32-bit Integer

Default

5

mon_clock_drift_allowed

Description

The clock drift in seconds allowed between monitors.

Type

Float

Default

.050

mon_clock_drift_warn_backoff

Description

Exponential backoff for clock drift warnings.

Type

Float

Default

5

mon_timecheck_interval

Description

The time check interval (clock drift check) in seconds for the leader.

Type

Float

Default

300.0

mon_timecheck_skew_interval

Description

The time check interval (clock drift check) in seconds when in the presence of a skew in seconds for the Leader.

Type

Float

Default

30.0

mon_max_osd

Description

The maximum number of OSDs allowed in the cluster.

Type

32-bit Integer

Default

10000

mon_globalid_prealloc

Description

The number of global IDs to pre-allocate for clients and daemons in the cluster.

Type

32-bit Integer

Default

10000

mon_sync_fs_threshold

Description

Synchronize with the filesystem when writing the specified number of objects. Set it to **0** to disable it.

Type

32-bit Integer

Default

5

mon_subscribe_interval

Description

The refresh interval, in seconds, for subscriptions. The subscription mechanism enables obtaining the cluster maps and log information.

Type

Double

Default

86400.000000

mon_stat_smooth_intervals

Description

Ceph will smooth statistics over the last **N** PG maps.

Type

Integer

Default

6

mon_probe_timeout

Description

Number of seconds the monitor will wait to find peers before bootstrapping.

Type

Double

Default

2.0

mon_daemon_bytes

Description

The message memory cap for metadata server and OSD messages (in bytes).

Type

64-bit Integer Unsigned

Default

400ul << 20

mon_max_log_entries_per_event

Description

The maximum number of log entries per event.

Type

Integer

Default

4096

mon_osd_prime_pg_temp

Description

Enables or disable priming the PGMap with the previous OSDs when an out OSD comes back into the cluster. With the **true** setting, the clients will continue to use the previous OSDs until the newly in OSDs as that PG peered.

Type

Boolean

Default

true

mon_osd_prime_pg_temp_max_time

Description

How much time in seconds the monitor should spend trying to prime the PGMap when an out OSD comes back into the cluster.

Type

Float

Default

0.5

mon_osd_prime_pg_temp_max_time_estimate

Description

Maximum estimate of time spent on each PG before we prime all PGs in parallel.

Type

Float

Default

0.25

mon_osd_allow_primary_affinity

Description

Allow **primary_affinity** to be set in the osdmap.

Type

Boolean

Default

False

mon_osd_pool_ec_fast_read

Description

Whether turn on fast read on the pool or not. It will be used as the default setting of newly created erasure pools if **fast_read** is not specified at create time.

Type

Boolean

Default

False

mon_mds_skip_sanity

Description

Skip safety assertions on FSMap, in case of bugs where we want to continue anyway. Monitor terminates if the FSMap sanity check fails, but we can disable it by enabling this option.

Type

Boolean

Default

False

mon_max_mdsmap_epochs

Description

The maximum amount of mdsmap epochs to trim during a single proposal.

Type

Integer

Default

500

mon_config_key_max_entry_size

Description

The maximum size of config-key entry (in bytes).

Type

Integer

Default

65536

mon_warn_pg_not_scrubbed_ratio

Description

The percentage of the scrub max interval past the scrub max interval to warn.

Type

float

Default

0.5

mon_warn_pg_not_deep_scrubbed_ratio

Description

The percentage of the deep scrub interval past the deep scrub interval to warn

Type

float

Default

0.75

mon_scrub_interval

Description

How often, in seconds, the monitor scrub its store by comparing the stored checksums with the computed ones of all the stored keys.

Type

Integer

Default

3600*24

mon_scrub_timeout

Description

The timeout to restart scrub of mon quorum participant does not respond for the latest chunk.

Type

Integer

Default

5 min

mon_scrub_max_keys

Description

The maximum number of keys to scrub each time.

Type

Integer

Default

100

mon_scrub_inject_crc_mismatch

Description

The probability of injecting CRC mismatches into Ceph Monitor scrub.

Type

Integer

Default

3600*24

mon_scrub_inject_missing_keys

Description

The probability of injecting missing keys into mon scrub.

Type

float

Default

0

mon_compact_on_start

Description

Compact the database used as Ceph Monitor store on **ceph-mon** start. A manual compaction helps to shrink the monitor database and improve its performance if the regular compaction fails to work.

Type

Boolean

Default

False

mon_compact_on_bootstrap

Description

Compact the database used as Ceph Monitor store on bootstrap. The monitor starts probing each other for creating a quorum after bootstrap. If it times out before joining the quorum, it will start over and bootstrap itself again.

Type

Boolean

Default

False

mon_compact_on_trim

Description

Compact a certain prefix (including paxos) when we trim its old states.

Type

Boolean

Default

True

mon_cpu_threads

Description

Number of threads for performing CPU intensive work on monitor.

Type

Boolean

Default

True

mon_osd_mapping_pgs_per_chunk

Description

We calculate the mapping from the placement group to OSDs in chunks. This option specifies the number of placement groups per chunk.

Type

Integer

Default

4096

mon_osd_max_split_count

Description

Largest number of PGs per "involved" OSD to let split create. When we increase the **pg_num** of a pool, the placement groups will be split on all OSDs serving that pool. We want to avoid extreme multipliers on PG splits.

Type

Integer

Default

300

rados_mon_op_timeout

Description

Number of seconds to wait for a response from the monitor before returning an error from a rados operation. 0 means at limit, or no wait time.

Type

Double

Default

0

Additional Resources

- Pool Values
- CRUSH tunables

APPENDIX E. CEPHX CONFIGURATION OPTIONS

The following are Cephx configuration options that can be set up during deployment.

auth_cluster_required

Description

If enabled, the Red Hat Ceph Storage cluster daemons, **ceph-mon** and **ceph-osd**, must authenticate with each other. Valid settings are **cephx** or **none**.

Type

String

Required

No

Default

cephx.

auth_service_required

Description

If enabled, the Red Hat Ceph Storage cluster daemons require Ceph clients to authenticate with the Red Hat Ceph Storage cluster in order to access Ceph services. Valid settings are **cephx** or **none**.

Type

String

Required

No

Default

cephx.

auth_client_required

Description

If enabled, the Ceph client requires the Red Hat Ceph Storage cluster to authenticate with the Ceph client. Valid settings are **cephx** or **none**.

Type

String

Required

No

Default

cephx.

keyring

Description

The path to the keyring file.

Type

String

Required

No

Default

/etc/ceph/$cluster.$name.keyring,/etc/ceph/$cluster.keyring,/etc/ceph/keyring,/etc/ceph/keyring.bin

keyfile

Description

The path to a key file (that is. a file containing only the key).

Type

String

Required

No

Default

None

key

Description

The key (that is, the text string of the key itself). Not recommended.

Type

String

Required

No

Default

None

ceph-mon

Location

$mon_data/keyring

Capabilities

mon 'allow *'

ceph-osd

Location

$osd_data/keyring

Capabilities

mon 'allow profile osd' osd 'allow *'

radosgw

Location

$rgw_data/keyring

Capabilities

mon 'allow rwx' osd 'allow rwx'

cephx_require_signatures

Description

If set to **true**, Ceph requires signatures on all message traffic between the Ceph client and the Red Hat Ceph Storage cluster, and between daemons comprising the Red Hat Ceph Storage cluster.

Type

Boolean

Required

No

Default

false

cephx_cluster_require_signatures

Description

If set to **true**, Ceph requires signatures on all message traffic between Ceph daemons comprising the Red Hat Ceph Storage cluster.

Type

Boolean

Required

No

Default

false

cephx_service_require_signatures

Description

If set to **true**, Ceph requires signatures on all message traffic between Ceph clients and the Red Hat Ceph Storage cluster.

Type

Boolean

Required

No

Default

false

cephx_sign_messages

Description

If the Ceph version supports message signing, Ceph will sign all messages so they cannot be spoofed.

Type

Boolean

Default

true

auth_service_ticket_ttl

Description

When the Red Hat Ceph Storage cluster sends a Ceph client a ticket for authentication, the cluster assigns the ticket a time to live.

Type

Double

Default

60*60

APPENDIX F. POOLS, PLACEMENT GROUPS, AND CRUSH CONFIGURATION OPTIONS

The Ceph options that govern pools, placement groups, and the CRUSH algorithm.

mon_allow_pool_delete

Description

Allows a monitor to delete a pool. In RHCS 3 and later releases, the monitor cannot delete the pool by default as an added measure to protect data.

Type

Boolean

Default

false

mon_max_pool_pg_num

Description

The maximum number of placement groups per pool.

Type

Integer

Default

65536

mon_pg_create_interval

Description

Number of seconds between PG creation in the same Ceph OSD Daemon.

Type

Float

Default

30.0

mon_pg_stuck_threshold

Description

Number of seconds after which PGs can be considered as being stuck.

Type

32-bit Integer

Default

300

mon_pg_min_inactive

Description

Ceph issues a **HEALTH_ERR** status in the cluster log if the number of PGs that remain inactive longer than the **mon_pg_stuck_threshold** exceeds this setting. The default setting is one PG. A non-positive number disables this setting.

Type

Integer

Default

1

mon_pg_warn_min_per_osd

Description

Ceph issues a **HEALTH_WARN** status in the cluster log if the average number of PGs per OSD in the cluster is less than this setting. A non-positive number disables this setting.

Type

Integer

Default

30

mon_pg_warn_max_per_osd

Description

Ceph issues a **HEALTH_WARN** status in the cluster log if the average number of PGs per OSD in the cluster is greater than this setting. A non-positive number disables this setting.

Type

Integer

Default

300

mon_pg_warn_min_objects

Description

Do not warn if the total number of objects in the cluster is below this number.

Type

Integer

Default

1000

mon_pg_warn_min_pool_objects

Description

Do not warn on pools whose object number is below this number.

Type

Integer

Default

1000

mon_pg_check_down_all_threshold

Description

The threshold of **down** OSDs by percentage after which Ceph checks all PGs to ensure they are not stuck or stale.

Type

Float

Default

0.5

mon_pg_warn_max_object_skew

Description

Ceph issue a **HEALTH_WARN** status in the cluster log if the average number of objects in a pool is greater than **mon pg warn max object skew** times the average number of objects for all pools. A non-positive number disables this setting.

Type

Float

Default

10

mon_delta_reset_interval

Description

The number of seconds of inactivity before Ceph resets the PG delta to zero. Ceph keeps track of the delta of the used space for each pool to aid administrators in evaluating the progress of recovery and performance.

Type

Integer

Default

10

mon_osd_max_op_age

Description

The maximum age in seconds for an operation to complete before issuing a **HEALTH_WARN** status.

Type

Float

Default

32.0

osd_pg_bits

Description

Placement group bits per Ceph OSD Daemon.

Type

32-bit Integer

Default

6

osd_pgp_bits

Description

The number of bits per Ceph OSD Daemon for Placement Groups for Placement purpose (PGPs).

Type

32-bit Integer

Default

6

osd_crush_chooseleaf_type

Description

The bucket type to use for **chooseleaf** in a CRUSH rule. Uses ordinal rank rather than name.

Type

32-bit Integer

Default

1. Typically a host containing one or more Ceph OSD Daemons.

osd_pool_default_crush_replicated_ruleset

Description

The default CRUSH ruleset to use when creating a replicated pool.

Type

8-bit Integer

Default

0

osd_pool_erasure_code_stripe_unit

Description

Sets the default size, in bytes, of a chunk of an object stripe for erasure coded pools. Every object of size S will be stored as N stripes, with each data chunk receiving **stripe unit** bytes. Each stripe of **N * stripe unit** bytes will be encoded/decoded individually. This option can be overridden by the **stripe_unit** setting in an erasure code profile.

Type

Unsigned 32-bit Integer

Default

4096

osd_pool_default_size

Description

Sets the number of replicas for objects in the pool. The default value is the same as **ceph osd pool set {pool-name} size {size}**.

Type

32-bit Integer

Default

3

osd_pool_default_min_size

Description

Sets the minimum number of written replicas for objects in the pool in order to acknowledge a write operation to the client. If the minimum is not met, Ceph will not acknowledge the write to the client. This setting ensures a minimum number of replicas when operating in **degraded** mode.

Type

32-bit Integer

Default

0, which means no particular minimum. If **0**, minimum is **size - (size / 2)**.

osd_pool_default_pg_num

Description

The default number of placement groups for a pool. The default value is the same as **pg_num** with **mkpool**.

Type

32-bit Integer

Default

32

osd_pool_default_pgp_num

Description

The default number of placement groups for placement for a pool. The default value is the same as **pgp_num** with **mkpool**. PG and PGP should be equal.

Type

32-bit Integer

Default

0

osd_pool_default_flags

Description

The default flags for new pools.

Type

32-bit Integer

Default

0

osd_max_pgls

Description

The maximum number of placement groups to list. A client requesting a large number can tie up the Ceph OSD Daemon.

Type

Unsigned 64-bit Integer

Default

1024

Note

Default should be fine.

osd_min_pg_log_entries

Description

The minimum number of placement group logs to maintain when trimming log files.

Type

32-bit Int Unsigned

Default

250

osd_default_data_pool_replay_window

Description

The time, in seconds, for an OSD to wait for a client to replay a request.

Type

32-bit Integer

Default

45

APPENDIX G. OBJECT STORAGE DAEMON (OSD) CONFIGURATION OPTIONS

The following are Ceph Object Storage Daemon (OSD) configuration options that can be set during deployment.

You can set these configuration options with the **ceph config set osd *CONFIGURATION_OPTION VALUE*** command.

osd_uuid

Description

The universally unique identifier (UUID) for the Ceph OSD.

Type

UUID

Default

The UUID.

Note

The **osd uuid** applies to a single Ceph OSD. The **fsid** applies to the entire cluster.

osd_data

Description

The path to the OSD's data. You must create the directory when deploying Ceph. Mount a drive for OSD data at this mount point.

> IMPORTANT: Red Hat does not recommend changing the default.

Type

String

Default

/var/lib/ceph/osd/$cluster-$id

osd_max_write_size

Description

The maximum size of a write in megabytes.

Type

32-bit Integer

Default

90

osd_client_message_size_cap

Description

The largest client data message allowed in memory.

Type

64-bit Integer Unsigned

Default

500MB default. **500*1024L*1024L**

osd_class_dir

Description

The class path for RADOS class plug-ins.

Type

String

Default

$libdir/rados-classes

osd_max_scrubs

Description

The maximum number of simultaneous scrub operations for a Ceph OSD.

Type

32-bit Int

Default

1

osd_scrub_thread_timeout

Description

The maximum time in seconds before timing out a scrub thread.

Type

32-bit Integer

Default

60

osd_scrub_finalize_thread_timeout

Description

The maximum time in seconds before timing out a scrub finalize thread.

Type

32-bit Integer

Default

60*10

osd_scrub_begin_hour

Description

This restricts scrubbing to this hour of the day or later. Use **osd_scrub_begin_hour = 0** and **osd_scrub_end_hour = 0** to allow scrubbing the entire day. Along with **osd_scrub_end_hour**, they define a time window, in which the scrubs can happen. But a scrub is performed no matter whether the time window allows or not, as long as the placement group's scrub interval exceeds **osd_scrub_max_interval**.

Type

Integer

Default

0

Allowed range

[0,23]

osd_scrub_end_hour

Description

This restricts scrubbing to the hour earlier than this. Use **osd_scrub_begin_hour = 0** and **osd_scrub_end_hour = 0** to allow scrubbing for the entire day. Along with **osd_scrub_begin_hour**, they define a time window, in which the scrubs can happen. But a scrub is performed no matter whether the time window allows or not, as long as the placement group's scrub interval exceeds **osd_scrub_max_interval**.

Type

Integer

Default

0

Allowed range

[0,23]

osd_scrub_load_threshold

Description

The maximum load. Ceph will not scrub when the system load (as defined by the **getloadavg()** function) is higher than this number. Default is **0.5**.

Type

Float

Default

0.5

osd_scrub_min_interval

Description

The minimum interval in seconds for scrubbing the Ceph OSD when the Red Hat Ceph Storage cluster load is low.

Type

Float

Default

Once per day. **60*60*24**

osd_scrub_max_interval

Description

The maximum interval in seconds for scrubbing the Ceph OSD irrespective of cluster load.

Type

Float

Default

Once per week. **7*60*60*24**

osd_scrub_interval_randomize_ratio

Description

Takes the ratio and randomizes the scheduled scrub between **osd scrub min interval** and **osd scrub max interval**.

Type

Float

Default

0.5.

mon_warn_not_scrubbed

Description

Number of seconds after **osd_scrub_interval** to warn about any PGs that were not scrubbed.

Type

Integer

Default

0 (no warning).

osd_scrub_chunk_min

Description

The object store is partitioned into chunks which end on hash boundaries. For chunky scrubs, Ceph scrubs objects one chunk at a time with writes blocked for that chunk. The **osd scrub chunk min** setting represents the minimum number of chunks to scrub.

Type

32-bit Integer

Default

5

osd_scrub_chunk_max

Description

The maximum number of chunks to scrub.

Type

32-bit Integer

Default

25

osd_scrub_sleep

Description

The time to sleep between deep scrub operations.

Type

Float

Default

0 (or off).

osd_scrub_during_recovery

Description

Allows scrubbing during recovery.

Type

Bool

Default

false

osd_scrub_invalid_stats

Description

Forces extra scrub to fix stats marked as invalid.

Type

Bool

Default

true

osd_scrub_priority

Description

Controls queue priority of scrub operations versus client I/O.

Type

Unsigned 32-bit Integer

Default

5

osd_requested_scrub_priority

Description

The priority set for user requested scrub on the work queue. If this value were to be smaller than **osd_client_op_priority**, it can be boosted to the value of **osd_client_op_priority** when scrub is blocking client operations.

Type

Unsigned 32-bit Integer

Default

120

osd_scrub_cost

Description

Cost of scrub operations in megabytes for queue scheduling purposes.

Type

Unsigned 32-bit Integer

Default

52428800

osd_deep_scrub_interval

Description

The interval for deep scrubbing, that is fully reading all data. The **osd scrub load threshold** parameter does not affect this setting.

Type

Float

Default

Once per week. **60*60*24*7**

osd_deep_scrub_stride

Description

Read size when doing a deep scrub.

Type

32-bit Integer

Default

512 KB. **524288**

mon_warn_not_deep_scrubbed

Description

Number of seconds after **osd_deep_scrub_interval** to warn about any PGs that were not scrubbed.

Type

Integer

Default

0 (no warning)

osd_deep_scrub_randomize_ratio

Description

The rate at which scrubs will randomly become deep scrubs (even before **osd_deep_scrub_interval** has passed).

Type

Float

Default

0.15 or 15%

osd_deep_scrub_update_digest_min_age

Description

How many seconds old objects must be before scrub updates the whole-object digest.

Type

Integer

Default

7200 (120 hours)

osd_deep_scrub_large_omap_object_key_threshold

Description

Warning when you encounter an object with more OMAP keys than this.

Type

Integer

Default

200000

osd_deep_scrub_large_omap_object_value_sum_threshold

Description

Warning when you encounter an object with more OMAP key bytes than this.

Type

Integer

Default

1 G

osd_delete_sleep

Description

Time in seconds to sleep before the next removal transaction. This throttles the placement group deletion process.

Type

Float

Default

0.0

osd_delete_sleep_hdd

Description

Time in seconds to sleep before the next removal transaction for HDDs.

Type

Float

Default

5.0

osd_delete_sleep_ssd

Description

Time in seconds to sleep before the next removal transaction for SSDs.

Type

Float

Default

1.0

osd_delete_sleep_hybrid

Description

Time in seconds to sleep before the next removal transaction when Ceph OSD data is on HDD and OSD journal or WAL and DB is on SSD.

Type

Float

Default

1.0

osd_op_num_shards

Description

The number of shards for client operations.

Type

32-bit Integer

Default

0

osd_op_num_threads_per_shard

Description

The number of threads per shard for client operations.

Type

32-bit Integer

Default

0

osd_op_num_shards_hdd

Description

The number of shards for HDD operations.

Type

32-bit Integer

Default

5

osd_op_num_threads_per_shard_hdd

Description

The number of threads per shard for HDD operations.

Type

32-bit Integer

Default

1

osd_op_num_shards_ssd

Description

The number of shards for SSD operations.

Type

32-bit Integer

Default

8

osd_op_num_threads_per_shard_ssd

Description

The number of threads per shard for SSD operations.

Type

32-bit Integer

Default

2

osd_op_queue

Description

Sets the type of queue to be used for operation prioritizing within Ceph OSDs. Requires a restart of the OSD daemons.

Type

String

Default

wpq

Valid choices

wpq, **mclock_scheduler**, **debug_random**

IMPORTANT

The mClock OSD scheduler is a Technology Preview feature only. Technology Preview features are not supported with Red Hat production service level agreements (SLAs), might not be functionally complete, and Red Hat does not recommend using them for production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process. See the support scope for Red Hat Technology Preview features for more details.

osd_op_queue_cut_off

Description

Selects which priority operations are sent to the strict queue and which are sent to the normal queue. Requires a restart of the OSD daemons.
The low setting sends all replication and higher operations to the strict queue, while the high option sends only replication acknowledgment operations and higher to the strict queue.

The high setting helps when some Ceph OSDs in the cluster are very busy, especially when combined with the **wpq** option in the **osd_op_queue** setting. Ceph OSDs that are very busy handling replication traffic can deplete primary client traffic on these OSDs without these settings.

Type

String

Default

high

Valid choices

low, **high**, **debug_random**

osd_client_op_priority

Description

The priority set for client operations. It is relative to **osd recovery op priority**.

Type

32-bit Integer

Default

63

Valid Range

1-63

osd_recovery_op_priority

Description

The priority set for recovery operations. It is relative to **osd client op priority**.

Type

32-bit Integer

Default

3

Valid Range

1-63

osd_op_thread_timeout

Description

The Ceph OSD operation thread timeout in seconds.

Type

32-bit Integer

Default

15

osd_op_complaint_time

Description

An operation becomes complaint worthy after the specified number of seconds have elapsed.

Type

Float

Default

30

osd_disk_threads

Description

The number of disk threads, which are used to perform background disk intensive OSD operations such as scrubbing and snap trimming.

Type

32-bit Integer

Default

1

osd_op_history_size

Description

The maximum number of completed operations to track.

Type

32-bit Unsigned Integer

Default

20

osd_op_history_duration

Description

The oldest completed operation to track.

Type

32-bit Unsigned Integer

Default

600

osd_op_log_threshold

Description

How many operations logs to display at once.

Type

32-bit Integer

Default

5

osd_op_timeout

Description

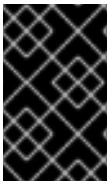
The time in seconds after which running OSD operations time out.

Type

Integer

Default

0



IMPORTANT

Do not set the **osd op timeout** option unless your clients can handle the consequences. For example, setting this parameter on clients running in virtual machines can lead to data corruption because the virtual machines interpret this timeout as a hardware failure.

osd_max_backfills

Description

The maximum number of backfill operations allowed to or from a single OSD.

Type

64-bit Unsigned Integer

Default

1

osd_backfill_scan_min

Description

The minimum number of objects per backfill scan.

Type

32-bit Integer

Default

64

osd_backfill_scan_max

Description

The maximum number of objects per backfill scan.

Type

32-bit Integer

Default

512

osd_backfill_full_ratio

Description

Refuse to accept backfill requests when the Ceph OSD's full ratio is above this value.

Type

Float

Default

0.85

osd_backfill_retry_interval

Description

The number of seconds to wait before retrying backfill requests.

Type

Double

Default

30.000000

osd_map_dedup

Description

Enable removing duplicates in the OSD map.

Type

Boolean

Default

true

osd_map_cache_size

Description

The size of the OSD map cache in megabytes.

Type

32-bit Integer

Default

50

osd_map_cache_bl_size

Description

The size of the in-memory OSD map cache in OSD daemons.

Type

32-bit Integer

Default

50

osd_map_cache_bl_inc_size

Description

The size of the in-memory OSD map cache incrementals in OSD daemons.

Type

32-bit Integer

Default

100

osd_map_message_max

Description

The maximum map entries allowed per MOSDMap message.

Type

32-bit Integer

Default

40

osd_snap_trim_thread_timeout

Description

The maximum time in seconds before timing out a snap trim thread.

Type

32-bit Integer

Default

60*60*1

osd_pg_max_concurrent_snap_trims

Description

The max number of parallel snap trims/PG. This controls how many objects per PG to trim at once.

Type

32-bit Integer

Default

2

osd_snap_trim_sleep

Description

Insert a sleep between every trim operation a PG issues.

Type

32-bit Integer

Default

0

osd_snap_trim_sleep_hdd

Description

Time in seconds to sleep before the next snapshot trimming for HDDs.

Type

Float

Default

5.0

osd_snap_trim_sleep_ssd

Description

Time in seconds to sleep before the next snapshot trimming operation for SSD OSDs, including NVMe.

Type

Float

Default

0.0

osd_snap_trim_sleep_hybrid

Description

Time in seconds to sleep before the next snapshot trimming operation when OSD data is on an HDD and the OSD journal or WAL and DB is on an SSD.

Type

Float

Default

2.0

osd_max_trimming_pgs

Description

The max number of trimming PGs

Type

32-bit Integer

Default

2

osd_backlog_thread_timeout

Description

The maximum time in seconds before timing out a backlog thread.

Type

32-bit Integer

Default

60*60*1

osd_default_notify_timeout

Description

The OSD default notification timeout (in seconds).

Type

32-bit Integer Unsigned

Default

30

osd_check_for_log_corruption

Description

Check log files for corruption. Can be computationally expensive.

Type

Boolean

Default

false

osd_remove_thread_timeout

Description

The maximum time in seconds before timing out a remove OSD thread.

Type

32-bit Integer

Default

60*60

osd_command_thread_timeout

Description

The maximum time in seconds before timing out a command thread.

Type

32-bit Integer

Default

10*60

osd_command_max_records

Description

Limits the number of lost objects to return.

Type

32-bit Integer

Default

256

osd_auto_upgrade_tmap

Description

Uses **tmap** for **omap** on old objects.

Type

Boolean

Default

true

osd_tmapput_sets_users_tmap

Description

Uses **tmap** for debugging only.

Type

Boolean

Default

false

osd_preserve_trimmed_log

Description

Preserves trimmed log files, but uses more disk space.

Type

Boolean

Default

false

osd_recovery_delay_start

Description

After peering completes, Ceph delays for the specified number of seconds before starting to recover objects.

Type

Float

Default

0

osd_recovery_max_active

Description

The number of active recovery requests per OSD at one time. More requests will accelerate recovery, but the requests place an increased load on the cluster.

Type

32-bit Integer

Default

0

osd_recovery_max_active_hdd

Description

The number of active recovery requests per Ceph OSD at one time, if the primary device is HDD.

Type

Integer

Default

3

osd_recovery_max_active_ssd

Description

The number of active recovery requests per Ceph OSD at one time, if the primary device is SSD.

Type

Integer

Default

10

osd_recovery_sleep

Description

Time in seconds to sleep before the next recovery or backfill operation. Increasing this value slows down recovery operation while client operations are less impacted.

Type

Float

Default

0.0

osd_recovery_sleep_hdd

Description

Time in seconds to sleep before the next recovery or backfill operation for HDDs.

Type

Float

Default

0.1

osd_recovery_sleep_ssd

Description

Time in seconds to sleep before the next recovery or backfill operation for SSDs.

Type

Float

Default

0.0

osd_recovery_sleep_hybrid

Description

Time in seconds to sleep before the next recovery or backfill operation when Ceph OSD data is on HDD and OSD journal or WAL and DB is on SSD.

Type

Float

Default

0.025

osd_recovery_max_chunk

Description

The maximum size of a recovered chunk of data to push.

Type

64-bit Integer Unsigned

Default

8388608

osd_recovery_threads

Description

The number of threads for recovering data.

Type

32-bit Integer

Default

1

osd_recovery_thread_timeout

Description

The maximum time in seconds before timing out a recovery thread.

Type

32-bit Integer

Default

30

osd_recover_clone_overlap

Description

Preserves clone overlap during recovery. Should always be set to **true**.

Type

Boolean

Default

true

rados_osd_op_timeout

Description

Number of seconds that RADOS waits for a response from the OSD before returning an error from a RADOS operation. A value of 0 means no limit.

Type

Double

Default

0

APPENDIX H. CEPH MONITOR AND OSD CONFIGURATION OPTIONS

When modifying heartbeat settings, include them in the **[global]** section of the Ceph configuration file.

mon_osd_min_up_ratio

Description

The minimum ratio of **up** Ceph OSD Daemons before Ceph will mark Ceph OSD Daemons **down**.

Type

Double

Default

.3

mon_osd_min_in_ratio

Description

The minimum ratio of **in** Ceph OSD Daemons before Ceph will mark Ceph OSD Daemons **out**.

Type

Double

Default

0.750000

mon_osd_laggy_halflife

Description

The number of seconds **laggy** estimates will decay.

Type

Integer

Default

60*60

mon_osd_laggy_weight

Description

The weight for new samples in **laggy** estimation decay.

Type

Double

Default

0.3

mon_osd_laggy_max_interval

Description

Maximum value of **laggy_interval** in laggy estimations (in seconds). The monitor uses an adaptive approach to evaluate the **laggy_interval** of a certain OSD. This value will be used to calculate the grace time for that OSD.

Type

Integer

Default

300

mon_osd_adjust_heartbeat_grace

Description

If set to **true**, Ceph will scale based on **laggy** estimations.

Type

Boolean

Default

true

mon_osd_adjust_down_out_interval

Description

If set to **true**, Ceph will scaled based on **laggy** estimations.

Type

Boolean

Default

true

mon_osd_auto_mark_in

Description

Ceph will mark any booting Ceph OSD Daemons as **in** the Ceph Storage Cluster.

Type

Boolean

Default

false

mon_osd_auto_mark_auto_out_in

Description

Ceph will mark booting Ceph OSD Daemons auto marked **out** of the Ceph Storage Cluster as **in** the cluster.

Type

Boolean

Default

true

mon_osd_auto_mark_new_in

Description

Ceph will mark booting new Ceph OSD Daemons as **in** the Ceph Storage Cluster.

Type

Boolean

Default

true

mon_osd_down_out_interval

Description

The number of seconds Ceph waits before marking a Ceph OSD Daemon **down** and **out** if it does not respond.

Type

32-bit Integer

Default

600

mon_osd_downout_subtree_limit

Description

The largest CRUSH unit type that Ceph will automatically mark **out**.

Type

String

Default

rack

mon_osd_reporter_subtree_level

Description

This setting defines the parent CRUSH unit type for the reporting OSDs. The OSDs send failure reports to the monitor if they find an unresponsive peer. The monitor may mark the reported OSD **down** and then **out** after a grace period.

Type

String

Default

host

mon_osd_report_timeout

Description

The grace period in seconds before declaring unresponsive Ceph OSD Daemons **down**.

Type

32-bit Integer

Default

900

mon_osd_min_down_reporters

Description

The minimum number of Ceph OSD Daemons required to report a **down** Ceph OSD Daemon.

Type

32-bit Integer

Default

2

osd_heartbeat_address

Description

A Ceph OSD Daemon's network address for heartbeats.

Type

Address

Default

The host address.

osd_heartbeat_interval

Description

How often a Ceph OSD Daemon pings its peers (in seconds).

Type

32-bit Integer

Default

6

osd_heartbeat_grace

Description

The elapsed time when a Ceph OSD Daemon has not shown a heartbeat that the Ceph Storage Cluster considers it **down**.

Type

32-bit Integer

Default

20

osd_mon_heartbeat_interval

Description

How often the Ceph OSD Daemon pings a Ceph Monitor if it has no Ceph OSD Daemon peers.

Type

32-bit Integer

Default

30

osd_mon_report_interval_max

Description

The maximum time in seconds that a Ceph OSD Daemon can wait before it must report to a Ceph Monitor.

Type

32-bit Integer

Default

120

osd_mon_report_interval_min

Description

The minimum number of seconds a Ceph OSD Daemon may wait from startup or another reportable event before reporting to a Ceph Monitor.

Type

32-bit Integer

Default

5

Valid Range

Should be less than **osd mon report interval max**

osd_mon_ack_timeout

Description

The number of seconds to wait for a Ceph Monitor to acknowledge a request for statistics.

Type

32-bit Integer

Default

30

APPENDIX I. CEPH SCRUBBING OPTIONS

Ceph ensures data integrity by scrubbing placement groups. The following are the Ceph scrubbing options that you can adjust to increase or decrease scrubbing operations.

You can set these configuration options with the **ceph config set global *CONFIGURATION_OPTION VALUE*** command.

mds_max_scrub_ops_in_progress

Description

The maximum number of scrub operations performed in parallel. You can set this value with **ceph config set mds_max_scrub_ops_in_progress *VALUE*** command.

Type

integer

Default

5

osd_max_scrubs

Description

The maximum number of simultaneous scrub operations for a Ceph OSD Daemon.

Type

integer

Default

1

osd_scrub_begin_hour

Description

The specific hour at which the scrubbing begins. Along with **osd_scrub_end_hour**, you can define a time window in which the scrubs can happen. Use **osd_scrub_begin_hour = 0** and **osd_scrub_end_hour = 0** to allow scrubbing the entire day.

Type

integer

Default

0

Allowed range

[0, 23]

osd_scrub_end_hour

Description

The specific hour at which the scrubbing ends. Along with **osd_scrub_begin_hour**, you can define a time window, in which the scrubs can happen. Use **osd_scrub_begin_hour = 0** and **osd_scrub_end_hour = 0** to allow scrubbing for the entire day.

Type

integer

Default

0

Allowed range

[0, 23]

osd_scrub_begin_week_day

Description

The specific day on which the scrubbing begins. 0 = Sunday, 1 = Monday, etc. Along with "osd_scrub_end_week_day", you can define a time window in which scrubs can happen. Use **osd_scrub_begin_week_day = 0** and **osd_scrub_end_week_day = 0** to allow scrubbing for the entire week.

Type

integer

Default

0

Allowed range

[0, 6]

osd_scrub_end_week_day

Description

This defines the day on which the scrubbing ends. 0 = Sunday, 1 = Monday, etc. Along with **osd_scrub_begin_week_day**, they define a time window, in which the scrubs can happen. Use **osd_scrub_begin_week_day = 0** and **osd_scrub_end_week_day = 0** to allow scrubbing for the entire week.

Type

integer

Default

0

Allowed range

[0, 6]

osd_scrub_during_recovery

Description

Allow scrub during recovery. Setting this to **false** disables scheduling new scrub, and deep-scrub, while there is an active recovery. The already running scrubs continue which is useful to reduce load on busy storage clusters.

Type

boolean

Default

false

osd_scrub_load_threshold

Description

The normalized maximum load. Scrubbing does not happen when the system load, as defined by getloadavg() / number of online CPUs, is higher than this defined number.

Type

float

Default

0.5

osd_scrub_min_interval

Description

The minimal interval in seconds for scrubbing the Ceph OSD daemon when the Ceph storage Cluster load is low.

Type

float

Default

1 day

osd_scrub_max_interval

Description

The maximum interval in seconds for scrubbing the Ceph OSD daemon irrespective of cluster load.

Type

float

Default

7 days

osd_scrub_chunk_min

Description

The minimal number of object store chunks to scrub during a single operation. Ceph blocks writes to a single chunk during scrub.

type

integer

Default

5

osd_scrub_chunk_max

Description

The maximum number of object store chunks to scrub during a single operation.

type

integer

Default

25

osd_scrub_sleep

Description

Time to sleep before scrubbing the next group of chunks. Increasing this value slows down the overall rate of scrubbing, so that client operations are less impacted.

type

float

Default

0.0

osd_scrub_extended_sleep

Description

Duration to inject a delay during scrubbing out of scrubbing hours or seconds.

type

float

Default

0.0

osd_scrub_backoff_ratio

Description

Backoff ratio for scheduling scrubs. This is the percentage of ticks that do NOT schedule scrubs, 66% means that 1 out of 3 ticks schedules scrubs.

type

float

Default

0.66

osd_deep_scrub_interval

Description

The interval for **deep** scrubbing, fully reading all data. The **osd_scrub_load_threshold** does not affect this setting.

type

float

Default

7 days

osd_debug_deep_scrub_sleep

Description

Inject an expensive sleep during deep scrub IO to make it easier to induce preemption.

type

float

Default

0

osd_scrub_interval_randomize_ratio

Description

Add a random delay to **osd_scrub_min_interval** when scheduling the next scrub job for a placement group. The delay is a random value less than **osd_scrub_min_interval** * **osd_scrub_interval_randomized_ratio**. The default setting spreads scrubs throughout the allowed time window of **[1, 1.5]** * **osd_scrub_min_interval**.

type

float

Default

0.5

osd_deep_scrub_stride

Description

Read size when doing a deep scrub.

type

size

Default

512 KB

osd_scrub_auto_repair_num_errors

Description

Auto repair does not occur if more than this many errors are found.

type

integer

Default

5

osd_scrub_auto_repair

Description

Setting this to **true** enables automatic Placement Group (PG) repair when errors are found by scrubs or deep-scrubs. However, if more than **osd_scrub_auto_repair_num_errors** errors are found, a repair is NOT performed.

type

boolean

Default

false

osd_scrub_max_preemptions

Description

Set the maximum number of times you need to preempt a deep scrub due to a client operation before blocking client IO to complete the scrub.

type

integer

Default

5

osd_deep_scrub_keys

Description

Number of keys to read from an object at a time during deep scrub.

type

integer

Default

1024

APPENDIX J. BLUESTORE CONFIGURATION OPTIONS

The following are Ceph BlueStore configuration options that can be configured during deployment.

NOTE

This list is not complete.

rocksdb_cache_size

Description

The size of the RocksDB cache in MB.

Type

32-bit Integer

Default

512

bluestore_throttle_bytes

Description

Maximum bytes available before the user throttles the input or output (I/O) submission.

Type

Size

Default

64 MB

bluestore_throttle_deferred_bytes

Description

Maximum bytes for deferred writes before the user throttles the I/O submission.

Type

Size

Default

128 MB

bluestore_throttle_cost_per_io

Description

Overhead added to the transaction cost in bytes for each I/O.

Type

Size

Default

0 B

bluestore_throttle_cost_per_io_hdd

Description

The default **bluestore_throttle_cost_per_io** value for HDDs.

Type

Unsigned integer

Default

67 000

bluestore_throttle_cost_per_io_ssd

Description

The default **bluestore_throttle_cost_per_io** value for SSDs.

Type

Unsigned integer

Default

4 000