Red Hat Ceph Storage 4

File System Guide

Configuring and Mounting Ceph File Systems

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Configuring and Mounting Ceph File Systems

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Abstract

This guide describes how to configure the Ceph Metadata Server (MDS) and how to create, mount and work the Ceph File System (CephFS). Red Hat is committed to replacing problematic language in our code, documentation, and web properties. We are beginning with these four terms: master, slave, blacklist, and whitelist. Because of the enormity of this endeavor, these changes will be implemented gradually over several upcoming releases. For more details, see our CTO Chris Wright's message.

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CHAPTER 1. INTRODUCTION TO THE CEPH FILE SYSTEM

As a storage administrator, you can gain an understanding of the features, system components, and limitations to manage a Ceph File System (CephFS) environment.

1.1. CEPH FILE SYSTEM FEATURES AND ENHANCEMENTS

The Ceph File System (CephFS) is a file system compatible with POSIX standards that is built on top of Ceph's distributed object store, called RADOS (Reliable Autonomic Distributed Object Storage). CephFS provides file access to a Red Hat Ceph Storage cluster, and uses the POSIX semantics wherever possible. For example, in contrast to many other common network file systems like NFS, CephFS maintains strong cache coherency across clients. The goal is for processes using the file system to behave the same when they are on different hosts as when they are on the same host. However, in some cases, CephFS diverges from the strict POSIX semantics.

The Ceph File System has the following features and enhancements:

Scalability

The Ceph File System is highly scalable due to horizontal scaling of metadata servers and direct client reads and writes with individual OSD nodes.

Shared File System

The Ceph File System is a shared file system so multiple clients can work on the same file system at once.

High Availability

The Ceph File System provides a cluster of Ceph Metadata Servers (MDS). One is active and others are in standby mode. If the active MDS terminates unexpectedly, one of the standby MDS becomes active. As a result, client mounts continue working through a server failure. This behavior makes the Ceph File System highly available. In addition, you can configure multiple active metadata servers.

Configurable File and Directory Layouts

The Ceph File System allows users to configure file and directory layouts to use multiple pools, pool namespaces, and file striping modes across objects.

POSIX Access Control Lists (ACL)

The Ceph File System supports the POSIX Access Control Lists (ACL). ACL are enabled by default with the Ceph File Systems mounted as kernel clients with kernel version **kernel-3.10.0-327.18.2.el7** or newer. To use an ACL with the Ceph File Systems mounted as FUSE clients, you must enable them.

Client Quotas

The Ceph File System supports setting quotas on any directory in a system. The quota can restrict the number of bytes or the number of files stored beneath that point in the directory hierarchy. CephFS client quotas are enabled by default.

Resizing

The Ceph File System size is only bound by the capacity of the OSDs servicing its data pool. To increase the capacity, add more OSDs to the CephFS data pool. To decrease the capacity, use either client quotas or pool quotas.

Snapshots

The Ceph File System supports read-only snapshots but not writable clones.

POSIX file system operations

The Ceph File System supports standard and consistent POSIX file system operations including the following access patterns:

- Buffered write operations via the Linux page cache.
- Cached read operations via the Linux page cache.
- Direct I/O asynchronous or synchronous read/write operations, bypassing the page cache.
- Memory mapped I/O.

Additional Resources

- See the *Installing Metadata servers* section in the *Installation Guide* to install Ceph Metadata servers.
- See the *Deploying Ceph File Systems* section in the *File System Guide* to create Ceph File Systems.

1.2. CEPH FILE SYSTEM COMPONENTS

The Ceph File System has two primary components:

Clients

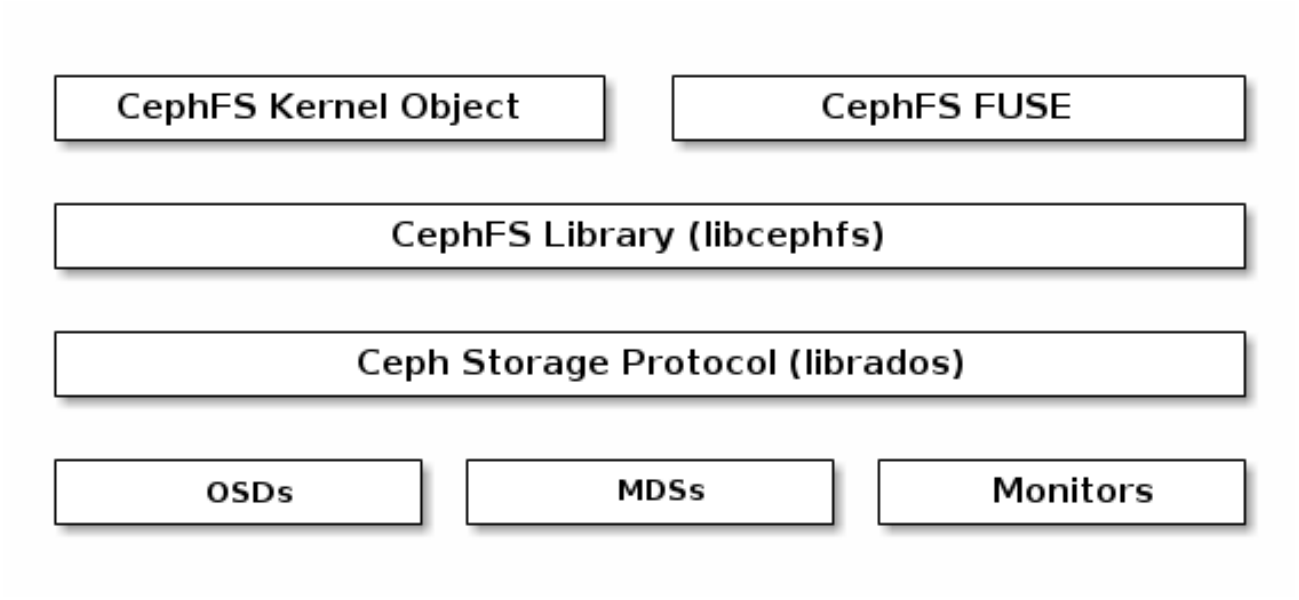
The CephFS clients perform I/O operations on behalf of applications using CephFS, such as, **ceph-fuse** for FUSE clients and **kcephfs** for kernel clients. CephFS clients send metadata requests to an active Metadata Server. In return, the CephFS client learns of the file metadata, and can begin safely caching both metadata and file data.

Metadata Servers (MDS)

The MDS does the following:

- Provides metadata to CephFS clients.
- Manages metadata related to files stored on the Ceph File System.
- Coordinates access to the shared Red Hat Ceph Storage cluster.
- Caches hot metadata to reduce requests to the backing metadata pool store.
- Manages the CephFS clients' caches to maintain cache coherence.
- Replicates hot metadata between active MDS.
- Coalesces metadata mutations to a compact journal with regular flushes to the backing metadata pool.
- CephFS requires at least one Metadata Server daemon (**ceph-mds**) to run.

The diagram below shows the component layers of the Ceph File System.



The bottom layer represents the underlying core storage cluster components:

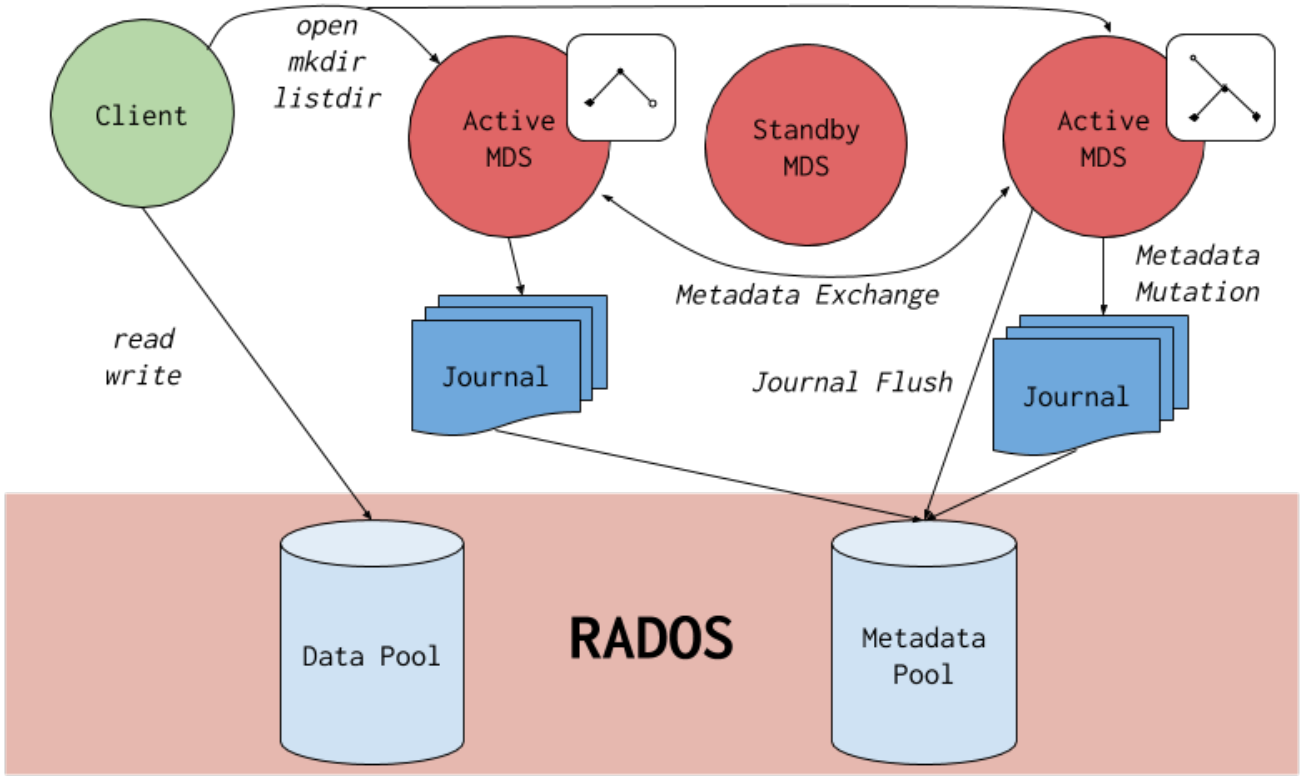
- Ceph OSDs (**ceph-osd**) where the Ceph File System data and metadata are stored.
- Ceph Metadata Servers (**ceph-mds**) that manages Ceph File System metadata.
- Ceph Monitors (**ceph-mon**) that manages the master copy of the cluster map.

The Ceph Storage protocol layer represents the Ceph native **librados** library for interacting with the core storage cluster.

The CephFS library layer includes the CephFS **libcephfs** library that works on top of **librados** and represents the Ceph File System.

The top layer represents two types of Ceph clients that can access the Ceph File Systems.

The diagram below shows more details on how the Ceph File System components interact with each other.



Additional Resources

- See the *Installing Metadata servers* section in the *Red Hat Ceph Storage Installation Guide* to install Ceph Metadata servers.
- See the *Deploying Ceph File Systems* section in the *Red Hat Ceph Storage File System Guide* to create Ceph File Systems.

1.3. CEPH FILE SYSTEM AND SELINUX

Starting with Red Hat Enterprise Linux 8.3 and Red Hat Ceph Storage 4.2, support for using Security-Enhanced Linux (SELinux) on Ceph File Systems (CephFS) environments is available. You can now set any SELinux file type with CephFS, along with assigning a particular SELinux type on individual files. This support applies to the Ceph File System Metadata Server (MDS), the CephFS File System in User Space (FUSE) clients, and the CephFS kernel clients.

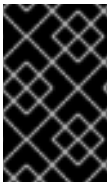
Additional Resources

- See the *Using SELinux Guide* on Red Hat Enterprise Linux 8 for more information on SELinux.

1.4. CEPH FILE SYSTEM LIMITATIONS AND THE POSIX STANDARDS

Creation of multiple Ceph File Systems on one Red Hat Ceph Storage cluster is disabled by default. An attempt to create an additional Ceph File System fails with the following error message:

```
Error EINVAL: Creation of multiple filesystems is disabled.
```



IMPORTANT

While technically possible, Red Hat does not support having multiple Ceph File Systems on one Red Hat Ceph Storage cluster. Doing so can cause the MDS or CephFS client nodes to terminate unexpectedly.

The Ceph File System diverges from the strict POSIX semantics in the following ways:

- If a client's attempt to write a file fails, the write operations are not necessarily atomic. That is, the client might call the **write()** system call on a file opened with the **O_SYNC** flag with an 8MB buffer and then terminates unexpectedly and the write operation can be only partially applied. Almost all file systems, even local file systems, have this behavior.

- In situations when the write operations occur simultaneously, a write operation that exceeds object boundaries is not necessarily atomic. For example, writer *A* writes **"aa|aa"** and writer *B* writes **"bb|bb"** simultaneously, where **"|"** is the object boundary, and **"aa|bb"** is written rather than the proper **"aa|aa"** or **"bb|bb"**.

- POSIX includes the **telldir()** and **seekdir()** system calls that allow you to obtain the current directory offset and seek back to it. Because CephFS can fragment directories at any time, it is difficult to return a stable integer offset for a directory. As such, calling the **seekdir()** system call to a non-zero offset might often work but is not guaranteed to do so. Calling **seekdir()** to offset 0 will always work. This is an equivalent to the **rewinddir()** system call.

- Sparse files propagate incorrectly to the **st_blocks** field of the **stat()** system call. CephFS does not explicitly track parts of a file that are allocated or written to, because the **st_blocks** field is always populated by the quotient of file size divided by block size. This behavior causes utilities, such as **du**, to overestimate used space.

- When the **mmap()** system call maps a file into memory on multiple hosts, write operations are not coherently propagated to caches of other hosts. That is, if a page is cached on host A, and then updated on host B, host A page is not coherently invalidated.

- CephFS clients present a hidden **.snap** directory that is used to access, create, delete, and rename snapshots. Although this directory is excluded from the **readdir()** system call, any process that tries to create a file or directory with the same name returns an error. The name of this hidden directory can be changed at mount time with the **-o snapdirname=.<new_name>** option or by using the **client_snapdir** configuration option.

Additional Resources

- See the *Installing Metadata servers* section in the *Red Hat Ceph Storage Installation Guide* to install Ceph Metadata servers.

- See the *Deploying Ceph File Systems* section in the *Red Hat Ceph Storage File System Guide* to create Ceph File Systems.

1.5. ADDITIONAL RESOURCES

- See the *Installing Metadata Servers* section in the *Red Hat Ceph Storage Installation Guide* for more details.

- If you want to use NFS Ganesha as an interface to the Ceph File System with Red Hat OpenStack Platform, see the CephFS with NFS-Ganesha deployment section in the *Deploying the Shared File Systems service with CephFS through NFS* guide for instructions on how to deploy such an environment.

CHAPTER 2. THE CEPH FILE SYSTEM METADATA SERVER

As a storage administrator, you can learn about the different states of the Ceph File System (CephFS) Metadata Server (MDS), along with learning about CephFS MDS ranking mechanic, configuring the MDS standby daemon, and cache size limits. Knowing these concepts can enable you to configure the MDS daemons for a storage environment.

2.1. PREREQUISITES

- A running, and healthy Red Hat Ceph Storage cluster.
- Installation of the Ceph Metadata Server daemons (**ceph-mds**).

2.2. METADATA SERVER DAEMON STATES

The Metadata Server (MDS) daemons operate in two states:

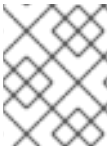
- Active – manages metadata for files and directories stores on the Ceph File System.
- Standby – serves as a backup, and becomes active when an active MDS daemon becomes unresponsive.

By default, a Ceph File System uses only one active MDS daemon. However, systems with many clients benefit from multiple active MDS daemons.

You can configure the file system to use multiple active MDS daemons so that you can scale metadata performance for larger workloads. The active MDS daemons dynamically share the metadata workload when metadata load patterns change. Note that systems with multiple active MDS daemons still require standby MDS daemons to remain highly available.

What Happens When the Active MDS Daemon Fails

When the active MDS becomes unresponsive, a Ceph Monitor daemon waits a number of seconds equal to the value specified in the **mds_beacon_grace** option. If the active MDS is still unresponsive after the specified time period has passed, the Ceph Monitor marks the MDS daemon as **laggy**. One of the standby daemons becomes active, depending on the configuration.



NOTE

To change the value of **mds_beacon_grace**, add this option to the Ceph configuration file and specify the new value.

2.3. METADATA SERVER RANKS

Each Ceph File System (CephFS) has a number of ranks, one by default, which starts at zero.

Ranks define the way how the metadata workload is shared between multiple Metadata Server (MDS) daemons. The number of ranks is the maximum number of MDS daemons that can be active at one time. Each MDS daemon handles a subset of the CephFS metadata that is assigned to that rank.

Each MDS daemon initially starts without a rank. The Ceph Monitor assigns a rank to the daemon. The MDS daemon can only hold one rank at a time. Daemons only lose ranks when they are stopped.

The **max_mds** setting controls how many ranks will be created.

The actual number of ranks in the CephFS is only increased if a spare daemon is available to accept the new rank.

Rank States

Ranks can be:

- **Up** - A rank that is assigned to the MDS daemon.
- **Failed** - A rank that is not associated with any MDS daemon.
- **Damaged** - A rank that is damaged; its metadata is corrupted or missing. Damaged ranks are not assigned to any MDS daemons until the operator fixes the problem, and uses the **ceph mds repaired** command on the damaged rank.

2.4. METADATA SERVER CACHE SIZE LIMITS

You can limit the size of the Ceph File System (CephFS) Metadata Server (MDS) cache by:

- **A memory limit** Use the **mds_cache_memory_limit** option. Red Hat recommends a value between 8 GB and 64 GB for **mds_cache_memory_limit**. Setting more cache can cause issues with recovery. This limit is approximately 66% of the desired maximum memory use of the MDS.

IMPORTANT

Red Hat recommends to use memory limits instead of inode count limits.

- **Inode count**: Use the **mds_cache_size** option. By default, limiting the MDS cache by inode count is disabled.

In addition, you can specify a cache reservation by using the **mds_cache_reservation** option for MDS operations. The cache reservation is limited as a percentage of the memory or inode limit and is set to 5% by default. The intent of this parameter is to have the MDS maintain an extra reserve of memory for its cache for new metadata operations to use. As a consequence, the MDS should in general operate below its memory limit because it will recall old state from clients in order to drop unused metadata in its cache.

The **mds_cache_reservation** option replaces the **mds_health_cache_threshold** option in all situations, except when MDS nodes sends a health alert to the Ceph Monitors indicating the cache is too large. By default, **mds_health_cache_threshold** is 150% of the maximum cache size.

Be aware that the cache limit is not a hard limit. Potential bugs in the CephFS client or MDS or misbehaving applications might cause the MDS to exceed its cache size. The **mds_health_cache_threshold** option configures the storage cluster health warning message, so that operators can investigate why the MDS cannot shrink its cache.

Additional Resources

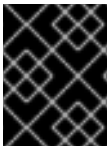
- See the *Metadata Server daemon configuration reference* section in the *Red Hat Ceph Storage File System Guide* for more information.

2.5. CONFIGURING MULTIPLE ACTIVE METADATA SERVER DAEMONS

Configure multiple active Metadata Server (MDS) daemons to scale metadata performance for large systems.

IMPORTANT

Do not convert all standby MDS daemons to active ones. A Ceph File System (CephFS)requires at least one standby MDS daemon to remain highly available.



IMPORTANT

The scrubbing process is not currently supported when multiple active MDS daemons are configured.

Prerequisites

- Ceph administration capabilities on the MDS node.

Procedure

1. Set the **max_mds** parameter to the desired number of active MDS daemons:

   Syntax

   ```
   ceph fs set NAME max_mds NUMBER
   ```

   Example

   ```
   [root@mon ~]# ceph fs set cephfs max_mds 2
   ```

   This example increases the number of active MDS daemons to two in the CephFS called **cephfs**

   NOTE

   Ceph only increases the actual number of ranks in the CephFS if a spare MDS daemon is available to take the new rank.

2. Verify the number of active MDS daemons:

   Syntax

   ```
   ceph fs status NAME
   ```

   Example

   ```
   [root@mon ~]# ceph fs status cephfs
   cephfs - 0 clients
   ======
   +------+--------+-------+---------------+-------+-------+
   | Rank | State  |  MDS  |    Activity   |  dns  |  inos |
   +------+--------+-------+---------------+-------+-------+
   |  0   | active | node1 | Reqs:    0 /s |   10  |   12  |
   |  1   | active | node2 | Reqs:    0 /s |   10  |   12  |
   +------+--------+-------+---------------+-------+-------+
   +-----------------+----------+-------+-------+
   |       Pool      |   type   | used | avail |
   ```

```
+-----------------+----------+-------+-------+
| cephfs_metadata | metadata | 4638  | 26.7G |
|   cephfs_data   |   data   |    0  | 26.7G |
+-----------------+----------+-------+-------+

+-------------+
| Standby MDS |
+-------------+
|    node3    |
+-------------+
```

Additional Resources

- See the *Metadata Server daemons states* section in the *Red Hat Ceph Storage File System Guide* for more details.
- See the *Decreasing the Number of Active MDS Daemons* section in the *Red Hat Ceph Storage File System Guide* for more details.
- See the *Managing Ceph users* section in the *Red Hat Ceph Storage Administration Guide* for more details.

2.6. CONFIGURING THE NUMBER OF STANDBY DAEMONS

Each Ceph File System (CephFS) can specify the required number of standby daemons to be considered healthy. This number also includes the standby-replay daemon waiting for a rank failure.

Prerequisites

- User access to the Ceph Monitor node.

Procedure

1. Set the expected number of standby daemons for a particular CephFS:

   Syntax

   ```
   ceph fs set FS_NAME standby_count_wanted NUMBER
   ```

   NOTE

   Setting the *NUMBER* to zero disables the daemon health check.

   Example

   ```
   [root@mon]# ceph fs set cephfs standby_count_wanted 2
   ```

   This example sets the expected standby daemon count to two.

2.7. CONFIGURING THE STANDBY-REPLAY METADATA SERVER

Configure each Ceph File System (CephFS) by adding a standby-replay Metadata Server (MDS) daemon. Doing this reduces failover time if the active MDS becomes unavailable.

This specific standby-replay daemon follows the active MDS's metadata journal. The standby-replay daemon is only used by the active MDS of the same rank, and is not available to other ranks.

IMPORTANT

If using standby-replay, then every active MDS must have a standby-replay daemon.

Prerequisites

- User access to the Ceph Monitor node.

Procedure

1. Set the standby-replay for a particular CephFS:

   Syntax

   ```
   ceph fs set FS_NAME allow_standby_replay 1
   ```

   Example

   ```
   [root@mon]# ceph fs set cephfs allow_standby_replay 1
   ```

   In this example, the Boolean value is **1**, which enables the standby-replay daemons to be assigned to the active Ceph MDS daemons.

NOTE

Setting the **allow_standby_replay** Boolean value back to **0** only prevents new standby-replay daemons from being assigned. To also stop the running daemons, mark them as **failed** with the **ceph mds fail** command.

Additional Resources

- See the *Using the ceph mds fail command* section in the *Red Hat Ceph Storage File System Guide* for details.

2.8. DECREASING THE NUMBER OF ACTIVE METADATA SERVER DAEMONS

How to decrease the number of active Ceph File System (CephFS) Metadata Server (MDS) daemons.

Prerequisites

- The rank that you will remove must be active first, meaning that you must have the same number of MDS daemons as specified by the **max_mds** parameter.

Procedure

1. Set the same number of MDS daemons as specified by the **max_mds** parameter:

   Syntax

   ```
   ceph fs status NAME
   ```

   Example

   ```
   [root@mon ~]# ceph fs status cephfs
   cephfs - 0 clients

   +------+--------+-------+---------------+-------+-------+
   | Rank | State  |  MDS  |    Activity   |  dns  |  inos |
   +------+--------+-------+---------------+-------+-------+
   |  0   | active | node1 | Reqs:    0 /s |   10  |   12  |
   |  1   | active | node2 | Reqs:    0 /s |   10  |   12  |
   +------+--------+-------+---------------+-------+-------+
   +-----------------+----------+-------+-------+
   |       Pool      |   type   |  used | avail |
   +-----------------+----------+-------+-------+
   | cephfs_metadata | metadata | 4638  | 26.7G |
   |   cephfs_data   |   data   |    0  | 26.7G |
   +-----------------+----------+-------+-------+

   +-------------+
   | Standby MDS |
   +-------------+
   |    node3    |
   +-------------+
   ```

2. On a node with administration capabilities, change the **max_mds** parameter to the desired number of active MDS daemons:

   Syntax

   ```
   ceph fs set NAME max_mds NUMBER
   ```

   Example

   ```
   [root@mon ~]# ceph fs set cephfs max_mds 1
   ```

3. Wait for the storage cluster to stabilize to the new **max_mds** value by watching the Ceph File System status.

4. Verify the number of active MDS daemons:

   Syntax

   ```
   ceph fs status NAME
   ```

   Example

   ```
   [root@mon ~]# ceph fs status cephfs
   ```

```
cephfs - 0 clients

+------+--------+-------+---------------+-------+-------+
| Rank | State  |  MDS  |    Activity   |  dns  |  inos |
+------+--------+-------+---------------+-------+-------+
|  0   | active | node1 | Reqs:    0 /s |   10  |   12  |
+------+--------+-------+---------------+-------+-------+
+-----------------+----------+-------+-------+
|       Pool      |   type   | used  | avail |
+-----------------+----------+-------+-------+
| cephfs_metadata | metadata | 4638  | 26.7G |
|   cephfs_data   |   data   |    0  | 26.7G |
+-----------------+----------+-------+-------+

+-------------+
| Standby MDS |
+-------------+
|    node3    |
|    node2    |
+-------------+
```

Additional Resources

- See the *Metadata Server daemons states* section in the *Red Hat Ceph Storage File System Guide*.
- See the *Configuring multiple active Metadata Server daemons* section in the *Red Hat Ceph Storage File System Guide*.

2.9. ADDITIONAL RESOURCES

- See the *Installing Metadata servers* section of the *Red Hat Ceph Storage Installation Guide* for details.
- See the *Red Hat Ceph Storage Installation Guide* for details on installing a Red Hat Ceph Storage cluster.

CHAPTER 3. DEPLOYMENT OF THE CEPH FILE SYSTEM

As a storage administrator, you can deploy Ceph File Systems (CephFS) in a storage environment and have clients mount those Ceph File Systems to meet the storage needs.

Basically, the deployment workflow is three steps:

1. Create a Ceph File System on a Ceph Monitor node.
2. Create a Ceph client user with the appropriate capabilities, and make the client key available on the node where the Ceph File System will be mounted.
3. Mount CephFS on a dedicated node, using either a kernel client or a File System in User Space (FUSE) client.

3.1. PREREQUISITES

- A running, and healthy Red Hat Ceph Storage cluster.
- Installation and configuration of the Ceph Metadata Server daemon (**ceph-mds**).

3.2. LAYOUT, QUOTA, SNAPSHOT, AND NETWORK RESTRICTIONS

These user capabilities can help you restrict access to a Ceph File System (CephFS) based on the needed requirements.

IMPORTANT

All user capability flags, except **rw**, must be specified in alphabetical order.

Layouts and Quotas

When using layouts or quotas, clients require the **p** flag, in addition to **rw** capabilities. Setting the **p** flag restricts all the attributes being set by special extended attributes, those with a **ceph.** prefix. Also, this restricts other means of setting these fields, such as **openc** operations with layouts.

Example

```
client.0
    key: AQAz7EVWygILFRAAdIcuJ10opU/JKyfFmxhuaw==
    caps: [mds] allow rwp
    caps: [mon] allow r
    caps: [osd] allow rw tag cephfs data=cephfs_a

client.1
    key: AQAz7EVWygILFRAAdIcuJ11opU/JKyfFmxhuaw==
    caps: [mds] allow rw
    caps: [mon] allow r
    caps: [osd] allow rw tag cephfs data=cephfs_a
```

In this example, **client.0** can modify layouts and quotas on the file system **cephfs_a**, but **client.1** cannot.

Snapshots

When creating or deleting snapshots, clients require the **s** flag, in addition to **rw** capabilities. When the capability string also contains the **p** flag, the **s** flag must appear after it.

Example

```
client.0
  key: AQAz7EVWygILFRAAdIcuJ10opU/JKyfFmxhuaw==
  caps: [mds] allow rw, allow rws path=/temp
  caps: [mon] allow r
  caps: [osd] allow rw tag cephfs data=cephfs_a
```

In this example, **client.0** can create or delete snapshots in the **temp** directory of file system **cephfs_a**.

Network

Restricting clients connecting from a particular network.

Example

```
client.0
  key: AQAz7EVWygILFRAAdIcuJ10opU/JKyfFmxhuaw==
  caps: [mds] allow r network 10.0.0.0/8, allow rw path=/bar network 10.0.0.0/8
  caps: [mon] allow r network 10.0.0.0/8
  caps: [osd] allow rw tag cephfs data=cephfs_a network 10.0.0.0/8
```

The optional network and prefix length is in CIDR notation, for example, **10.3.0.0/16**.

Additional Resources

- See the *Creating client users for a Ceph File System* section in the *Red Hat Ceph Storage File System Guide* for details on setting the Ceph user capabilities.

3.3. CREATING A CEPH FILE SYSTEM

You can create a Ceph File System (CephFS) on a Ceph Monitor node.

IMPORTANT

By default, you can create only one CephFS per Ceph Storage cluster.

Prerequisites

- A running, and healthy Red Hat Ceph Storage cluster.
- Installation and configuration of the Ceph Metadata Server daemon (**ceph-mds**).
- Root-level access to a Ceph monitor node.

Procedure

1. Create two pools, one for storing data and one for storing metadata:

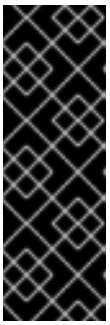
   #### Syntax

```
ceph osd pool create NAME _PG_NUM
```

Example

```
[root@mon ~]# ceph osd pool create cephfs_data 64
[root@mon ~]# ceph osd pool create cephfs_metadata 64
```

Typically, the metadata pool can start with a conservative number of Placement Groups (PGs) as it will generally have far fewer objects than the data pool. It is possible to increase the number of PGs if needed. Recommended metadata pool sizes range from 64 PGs to 512 PGs. Size the data pool is proportional to the number and sizes of files you expect in the file system.



IMPORTANT

For the metadata pool, consider to use:

- A higher replication level because any data loss to this pool can make the whole file system inaccessible.
- Storage with lower latency such as Solid-State Drive (SSD) disks because this directly affects the observed latency of file system operations on clients.

2. Create the CephFS:

Syntax

```
ceph fs new NAME METADATA_POOL DATA_POOL
```

Example

```
[root@mon ~]# ceph fs new cephfs cephfs_metadata cephfs_data
```

3. Verify that one or more MDSs enter to the active state based on you configuration.

Syntax

```
ceph fs status NAME
```

Example

```
[root@mon ~]# ceph fs status cephfs
cephfs - 0 clients
======
+------+--------+-------+---------------+-------+-------+
| Rank | State  |  MDS  |    Activity   |  dns  |  inos |
+------+--------+-------+---------------+-------+-------+
|  0   | active | node1 | Reqs:    0 /s |   10  |   12  |
+------+--------+-------+---------------+-------+-------+
+-----------------+----------+-------+-------+
|       Pool      |   type   |  used | avail |
+-----------------+----------+-------+-------+
| cephfs_metadata | metadata | 4638  | 26.7G |
```

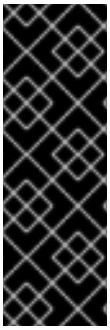
```
|  cephfs_data  |  data  |   0  | 26.7G |
+----------------+----------+-------+-------+

+-------------+
| Standby MDS |
+-------------+
|   node3   |
|   node2   |
+-------------+----
```

Additional Resources

- See the *Enabling the Red Hat Ceph Storage Repositories* section in *Red Hat Ceph Storage Installation Guide* for more details.
- See the *Pools* chapter in the *Red Hat Ceph Storage Storage Strategies Guide* for more details.
- See the *The Ceph File System* section in the *Red Hat Ceph Storage File System Guide* for more details on the Ceph File System limitations.
- See the *Red Hat Ceph Storage Installation Guide* for details on installing Red Hat Ceph Storage.
- See the *Installing Metadata Servers* in the *Red Hat Ceph Storage Installation Guide* for details.

3.4. CREATING CEPH FILE SYSTEMS WITH ERASURE CODING (TECHNOLOGY PREVIEW)

By default, Ceph uses replicated pools for data pools. You can also add an additional erasure-coded data pool, if needed. Ceph File Systems (CephFS) backed by erasure-coded pools use less overall storage compared to Ceph File Systems backed by replicated pools. While erasure-coded pools use less overall storage, they also use more memory and processor resources than replicated pools.



IMPORTANT

The Ceph File System using erasure-coded pools is a Technology Preview feature. 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 to use them for production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process. See the support scope for Red Hat Technology Preview features for more details.

IMPORTANT

For production environments, Red Hat recommends using a replicated pool as the default data pool.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- A running CephFS environment.
- Pools using BlueStore OSDs.

- User-level access to a Ceph Monitor node.

Procedure

1. Create a replicated metadata pool for CephFS metadata:

   Syntax

   ```
   ceph osd pool create METADATA_POOL PG_NUM
   ```

   Example

   ```
   [root@mon ~]# ceph osd pool create cephfs-metadata 64
   ```

   This example creates a pool named **cephfs-metadata** with 64 placement groups.

2. Create a default replicated data pool for CephFS:

   Syntax

   ```
   ceph osd pool create DATA_POOL PG_NUM
   ```

   Example

   ```
   [root@mon ~]# ceph osd pool create cephfs-data 64
   ```

   This example creates a replicated pool named **cephfs-data** with 64 placement groups.

3. Create an erasure-coded data pool for CephFS:

   Syntax

   ```
   ceph osd pool create DATA_POOL PG_NUM erasure
   ```

   Example

   ```
   [root@mon ~]# ceph osd pool create cephfs-data-ec 64 erasure
   ```

   This example creates an erasure-coded pool named **cephfs-data-ec** with 64 placement groups.

4. Enable overwrites on the erasure-coded pool:

   Syntax

   ```
   ceph osd pool set DATA_POOL allow_ec_overwrites true
   ```

   Example

   ```
   [root@mon ~]# ceph osd pool set cephfs-data-ec allow_ec_overwrites true
   ```

   This example enables overwrites on an erasure-coded pool named **cephfs-data-ec**.

5. Add the erasure-coded data pool to the CephFS Metadata Server (MDS):

   Syntax

   ```
   ceph fs add_data_pool cephfs-ec DATA_POOL
   ```

   Example

   ```
   [root@mon ~]# ceph fs add_data_pool cephfs-ec cephfs-data-ec
   ```

   a. Optionally, verify the data pool was added:

      ```
      [root@mon ~]# ceph fs ls
      ```

6. Create the CephFS:

   Syntax

   ```
   ceph fs new cephfs METADATA_POOL DATA_POOL
   ```

   Example

   ```
   [root@mon ~]# ceph fs new cephfs cephfs-metadata cephfs-data
   ```

   IMPORTANT

   Using an erasure-coded pool for the default data pool is not recommended.

7. Create the CephFS using erasure coding:

   Syntax

   ```
   ceph fs new cephfs-ec METADATA_POOL DATA_POOL
   ```

   Example

   ```
   [root@mon ~]# ceph fs new cephfs-ec cephfs-metadata cephfs-data-ec
   ```

8. Verify that one or more Ceph FS Metadata Servers (MDS) enters the active state:

   Syntax

   ```
   ceph fs status FS_EC
   ```

   Example

   ```
   [root@mon ~]# ceph fs status cephfs-ec
   cephfs-ec - 0 clients
   ======
   +------+--------+-------+---------------+-------+-------+
   ```

```
| Rank | State  |  MDS  |    Activity   |  dns  |  inos |
+------+--------+-------+---------------+-------+-------+
|  0   | active | node1 | Reqs:    0 /s |   10  |   12  |
+------+--------+-------+---------------+-------+-------+
+-----------------+----------+-------+-------+
|       Pool      |   type   |  used | avail |
+-----------------+----------+-------+-------+
| cephfs-metadata | metadata | 4638  | 26.7G |
|  cephfs-data    |   data   |    0  | 26.7G |
|  cephfs-data-ec |   data   |    0  | 26.7G |
+-----------------+----------+-------+-------+

+-------------+
| Standby MDS |
+-------------+
|    node3    |
|    node2    |
+-------------+
```

9. To add a new erasure-coded data pool to an existing file system.

   a. Create an erasure-coded data pool for CephFS:

      Syntax

      ```
      ceph osd pool create DATA_POOL PG_NUM erasure
      ```

      Example

      ```
      [root@mon ~]# ceph osd pool create cephfs-data-ec1 64 erasure
      ```

   b. Enable overwrites on the erasure-coded pool:

      Syntax

      ```
      ceph osd pool set DATA_POOL allow_ec_overwrites true
      ```

      Example

      ```
      [root@mon ~]# ceph osd pool set cephfs-data-ec1 allow_ec_overwrites true
      ```

   c. Add the erasure-coded data pool to the CephFS Metadata Server (MDS):

      Syntax

      ```
      ceph fs add_data_pool cephfs-ec DATA_POOL
      ```

      Example

      ```
      [root@mon ~]# ceph fs add_data_pool cephfs-ec cephfs-data-ec1
      ```

10. Create the CephFS using erasure coding:

Syntax

```
ceph fs new cephfs-ec METADATA_POOL DATA_POOL
```

Example

```
[root@mon ~]# ceph fs new cephfs-ec cephfs-metadata cephfs-data-ec1
```

Additional Resources

- See the *The Ceph File System Metadata Server* chapter in the *Red Hat Ceph Storage File System Guide* for more information on the CephFS MDS.
- See the *Installing Metadata Servers* section of the *Red Hat Ceph Storage Installation Guide* for details on installing CephFS.
- See the *Erasure-Coded Pools* section in the *Red Hat Ceph Storage Storage Strategies Guide* for more information.
- See the *Erasure Coding with Overwrites* section in the *Red Hat Ceph Storage Storage Strategies Guide* for more information.

3.5. CREATING CLIENT USERS FOR A CEPH FILE SYSTEM

Red Hat Ceph Storage uses **cephx** for authentication, which is enabled by default. To use **cephx** with the Ceph File System, create a user with the correct authorization capabilities on a Ceph Monitor node and make its key available on the node where the Ceph File System will be mounted.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- Installation and configuration of the Ceph Metadata Server daemon (ceph-mds).
- Root-level access to a Ceph monitor node.
- Root-level access to a Ceph client node.

Procedure

1. On a Ceph Monitor node, create a client user:

   #### Syntax

   ```
   ceph fs authorize FILE_SYSTEM_NAME client.CLIENT_NAME /DIRECTORY CAPABILITY [/DIRECTORY CAPABILITY] ...
   ```

   - To restrict the client to only writing in the **temp** directory of filesystem **cephfs_a**:

     #### Example

     ```
     [root@mon ~]# ceph fs authorize cephfs_a client.1 / r /temp rw
     ```

```
client.1
  key: AQBSdFhcGZFUDRAAcKhG9Cl2HPiDMMRv4DC43A==
  caps: [mds] allow r, allow rw path=/temp
  caps: [mon] allow r
  caps: [osd] allow rw tag cephfs data=cephfs_a
```

- To completely restrict the client to the **temp** directory, remove the root (/) directory:

  Example

  ```
  [root@mon ~]# ceph fs authorize cephfs_a client.1 /temp rw
  ```

NOTE

Supplying **all** or asterisk as the file system name grants access to every file system. Typically, it is necessary to quote the asterisk to protect it from the shell.

2. Verify the created key:

   Syntax

   ```
   ceph auth get client.ID
   ```

   Example

   ```
   [root@mon ~]# ceph auth get client.1
   ```

3. Copy the keyring to the client.

   a. On the Ceph Monitor node, export the keyring to a file:

      Syntax

      ```
      ceph auth get client.ID -o ceph.client.ID.keyring
      ```

      Example

      ```
      [root@mon ~]# ceph auth get client.1 -o ceph.client.1.keyring
      exported keyring for client.1
      ```

   b. Copy the client keyring from the Ceph Monitor node to the **/etc/ceph/** directory on the client node:

      Syntax

      ```
      scp root@MONITOR_NODE_NAME:/root/ceph.client.1.keyring /etc/ceph/
      ```

      Replace_MONITOR_NODE_NAME_with the Ceph Monitor node name or IP.

      Example

```
[root@client ~]# scp root@mon:/root/ceph.client.1.keyring /etc/ceph/ceph.client.1.keyring
```

4. Set the appropriate permissions for the keyring file:

   Syntax

   ```
   chmod 644 KEYRING
   ```

   Example

   ```
   [root@client ~]# chmod 644 /etc/ceph/ceph.client.1.keyring
   ```

Additional Resources

- See the *User Management* chapter in the *Red Hat Ceph Storage Administration Guide* for more details.

3.6. MOUNTING THE CEPH FILE SYSTEM AS A KERNEL CLIENT

You can mount the Ceph File System (CephFS) as a kernel client, either manually or automatically on system boot.

IMPORTANT

Clients running on other Linux distributions, aside from Red Hat Enterprise Linux, are permitted but not supported. If issues are found in the CephFS Metadata Server or other parts of the storage cluster when using these clients, Red Hat will address them. If the cause is found to be on the client side, then the issue will have to be addressed by the kernel vendor of the Linux distribution.

Prerequisites

- Root-level access to a Linux-based client node.
- User-level access to a Ceph Monitor node.
- An existing Ceph File System.

Procedure

1. Configure the client node to use the Ceph storage cluster.
   a. Enable the Red Hat Ceph Storage 4 Tools repository:

      Red Hat Enterprise Linux 7

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

      Red Hat Enterprise Linux 8

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

b. Install the **ceph-common** package:

Red Hat Enterprise Linux 7

```
[root@client ~]# yum install ceph-common
```

Red Hat Enterprise Linux 8

```
[root@client ~]# dnf install ceph-common
```

c. Copy the Ceph client keyring from the Ceph Monitor node to the client node:

Syntax

```
scp root@MONITOR_NODE_NAME:/etc/ceph/KEYRING_FILE /etc/ceph/
```

Replace *MONITOR_NODE_NAME* with the Ceph Monitor host name or IP address.

Example

```
[root@client ~]# scp root@192.168.0.1:/etc/ceph/ceph.client.1.keyring /etc/ceph/
```

d. Copy the Ceph configuration file from a Ceph Monitor node to the client node:

Syntax

```
scp root@MONITOR_NODE_NAME:/etc/ceph/ceph.conf /etc/ceph/ceph.conf
```

Replace *MONITOR_NODE_NAME* with the Ceph Monitor host name or IP address.

Example

```
[root@client ~]# scp root@192.168.0.1:/etc/ceph/ceph.conf /etc/ceph/ceph.conf
```

e. Set the appropriate permissions for the configuration file:

```
[root@client ~]# chmod 644 /etc/ceph/ceph.conf
```

f. Choose either automatically or manually mounting.

Manually Mounting

2. Create a mount directory on the client node:

Syntax

```
mkdir -p MOUNT_POINT
```

Example

```
[root@client]# mkdir -p /mnt/cephfs
```

3. Mount the Ceph File System. To specify multiple Ceph Monitor addresses, separate them with commas in the **mount** command, specify the mount point, and set the client name:

NOTE

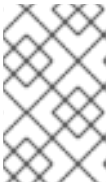
As of Red Hat Ceph Storage 4.1, **mount.ceph** can read keyring files directly. As such, a secret file is no longer necessary. Just specify the client ID with **name=*CLIENT_ID***, and **mount.ceph** will find the right keyring file.

Syntax

```
mount -t ceph MONITOR-1_NAME:6789,MONITOR-2_NAME:6789,MONITOR-3_NAME:6789:/ MOUNT_POINT -o name=CLIENT_ID
```

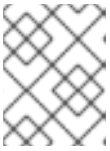
Example

```
[root@client ~]# mount -t ceph mon1:6789,mon2:6789,mon3:6789:/ /mnt/cephfs -o name=1
```



NOTE

You can configure a DNS server so that a single host name resolves to multiple IP addresses. Then you can use that single host name with the **mount** command, instead of supplying a comma-separated list.



NOTE

You can also replace the Monitor host names with the string **:/** and **mount.ceph** will read the Ceph configuration file to determine which Monitors to connect to.

4. Verify that the file system is successfully mounted:

Syntax

```
stat -f MOUNT_POINT
```

Example

```
[root@client ~]# stat -f /mnt/cephfs
```

Automatically Mounting

2. On the client host, create a new directory for mounting the Ceph File System.

Syntax

```
mkdir -p MOUNT_POINT
```

Example

```
[root@client ~]# mkdir -p /mnt/cephfs
```

3. Edit the **/etc/fstab** file as follows:

Syntax

```
#DEVICE              PATH        TYPE    OPTIONS              DUMP  FSCK
HOST_NAME:_PORT_,    MOUNT_POINT ceph    name=CLIENT_ID,      0     0
HOST_NAME:_PORT_,
ceph.client_mountpoint=/VOL/SUB_VOL_GROUP/SUB_VOL/UID_SUB_VOL,
HOST_NAME:_PORT_:/                       [ADDITIONAL_OPTIONS]
```

The **first column** sets the Ceph Monitor host names and the port number.

The **second column** sets the mount point

The **third column** sets the file system type, in this case, **ceph**, for CephFS.

The **fourth column** sets the various options, such as, the user name and the secret file using the **name** and **secretfile** options, respectively. You can also set specific volumes, sub-volume groups, and sub-volumes using the **ceph.client_mountpoint** option.

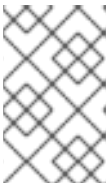
Set the **_netdev** option to ensure that the file system is mounted after the networking subsystem starts to prevent hanging and networking issues. If you do not need access time information, then setting the **noatime** option can increase performance.

Set the **fifth and sixth columns** to zero.

Example

```
#DEVICE       PATH              TYPE   OPTIONS       DUMP  FSCK
mon1:6789,    /mnt/cephfs       ceph   name=1,       0     0
mon2:6789,
ceph.client_mountpoint=/my_vol/my_sub_vol_group/my_sub_vol/0,
mon3:6789:/                           _netdev,noatime
```

The Ceph File System will be mounted on the next system boot.



NOTE

As of Red Hat Ceph Storage 4.1, **mount.ceph** can read keyring files directly. As such, a secret file is no longer necessary. Just specify the client ID with **name=*CLIENT_ID***, and **mount.ceph** will find the right keyring file.

NOTE

You can also replace the Monitor host names with the string **:/** and **mount.ceph** will read the Ceph configuration file to determine which Monitors to connect to.

Additional Resources

- See the **mount(8)** manual page.
- See the *Ceph user management* chapter in the *Red Hat Ceph Storage Administration Guide* for more details on creating a Ceph user.

- See the *Creating a Ceph File System* section of the *Red Hat Ceph Storage File System Guide* for details.

3.7. MOUNTING THE CEPH FILE SYSTEM AS A FUSE CLIENT

You can mount the Ceph File System (CephFS) as a File System in User Space (FUSE) client, either manually or automatically on system boot.

Prerequisites

- Root-level access to a Linux-based client node.
- User-level access to a Ceph Monitor node.
- An existing Ceph File System.

Procedure

1. Configure the client node to use the Ceph storage cluster.
   a. Enable the Red Hat Ceph Storage 4 Tools repository:

      Red Hat Enterprise Linux 7

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

      Red Hat Enterprise Linux 8

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

   b. Install the **ceph-fuse** package:

      Red Hat Enterprise Linux 7

      ```
      [root@client ~]# yum install ceph-fuse
      ```

      Red Hat Enterprise Linux 8

      ```
      [root@client ~]# dnf install ceph-fuse
      ```

   c. Copy the Ceph client keyring from the Ceph Monitor node to the client node:

      Syntax

      ```
      scp root@MONITOR_NODE_NAME:/etc/ceph/KEYRING_FILE /etc/ceph/
      ```

      Replace *MONITOR_NODE_NAME* with the Ceph Monitor host name or IP address.

      Example

      ```
      [root@client ~]# scp root@192.168.0.1:/etc/ceph/ceph.client.1.keyring /etc/ceph/
      ```

d. Copy the Ceph configuration file from a Ceph Monitor node to the client node:

Syntax

```
scp root@MONITOR_NODE_NAME:/etc/ceph/ceph.conf /etc/ceph/ceph.conf
```

Replace *MONITOR_NODE_NAME* with the Ceph Monitor host name or IP address.

Example

```
[root@client ~]# scp root@192.168.0.1:/etc/ceph/ceph.conf /etc/ceph/ceph.conf
```

e. Set the appropriate permissions for the configuration file:

```
[root@client ~]# chmod 644 /etc/ceph/ceph.conf
```

f. Choose either automatically or manually mounting.

Manually Mounting

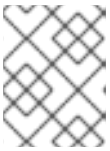
2. On the client node, create a directory for the mount point:

Syntax

```
mkdir PATH_TO_MOUNT_POINT
```

Example

```
[root@client ~]# mkdir /mnt/mycephfs
```



NOTE

If you used the **path** option with MDS capabilities, then the mount point must be within what is specified by **path**.

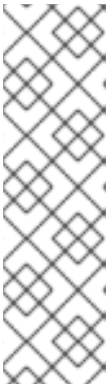
3. Use the **ceph-fuse** utility to mount the Ceph File System.

Syntax

```
ceph-fuse -n client.CLIENT_ID MOUNT_POINT
```

Example

```
[root@client ~]# ceph-fuse -n client.1 /mnt/mycephfs
```



NOTE

If you do not use the default name and location of the user keyring, that is **/etc/ceph/ceph.client.*CLIENT_ID*.keyring**, then use the **--keyring** option to specify the path to the user keyring, for example:

Example

```
[root@client ~]# ceph-fuse -n client.1 --keyring=/etc/ceph/client.1.keyring
/mnt/mycephfs
```

NOTE

Use the **-r** option to instruct the client to treat that path as its root:

Syntax

```
ceph-fuse -n client.CLIENT_ID MOUNT_POINT -r PATH
```

Example

```
[root@client ~]# ceph-fuse -n client.1 /mnt/cephfs -r /home/cephfs
```

4. Verify that the file system is successfully mounted:

Syntax

```
stat -f MOUNT_POINT
```

Example

```
[user@client ~]$ stat -f /mnt/cephfs
```

Automatically Mounting

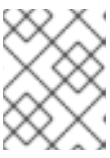
2. On the client node, create a directory for the mount point:

Syntax

```
mkdir PATH_TO_MOUNT_POINT
```

Example

```
[root@client ~]# mkdir /mnt/mycephfs
```



NOTE

If you used the **path** option with MDS capabilities, then the mount point must be within what is specified by **path**.

3. Edit the **/etc/fstab** file as follows:

Syntax

```
#DEVICE                PATH          TYPE          OPTIONS                DUMP  FSCK
HOST_NAME:_PORT_,      MOUNT_POINT   fuse.ceph     ceph.id=CLIENT_ID,     0     0
HOST_NAME:_PORT_,
ceph.client_mountpoint=/VOL/SUB_VOL_GROUP/SUB_VOL/UID_SUB_VOL,
HOST_NAME:_PORT_:/                                [ADDITIONAL_OPTIONS]
```

The **first column** sets the Ceph Monitor host names and the port number.

The **second column** sets the mount point

The **third column** sets the file system type, in this case, **fuse.ceph**, for CephFS.

The **fourth column** sets the various options, such as, the user name and the secret file using the **name** and **secretfile** options, respectively. You can also set specific volumes, sub-volume groups, and sub-volumes using the **ceph.client_mountpoint** option. Set the **_netdev** option to ensure that the file system is mounted after the networking subsystem starts to prevent hanging and networking issues. If you do not need access time information, then setting the **noatime** option can increase performance.

Set the **fifth and sixth columns** to zero.

Example

```
#DEVICE        PATH            TYPE         OPTIONS          DUMP  FSCK
mon1:6789,     /mnt/cephfs     fuse.ceph    ceph.id=1,       0     0
mon2:6789,
ceph.client_mountpoint=/my_vol/my_sub_vol_group/my_sub_vol/0,
mon3:6789:/                                 _netdev,defaults
```

The Ceph File System will be mounted on the next system boot.

Additional Resources

- The **ceph-fuse(8)** manual page.
- See the *Ceph user management* chapter in the *Red Hat Ceph Storage Administration Guide* for more details on creating a Ceph user.
- See the *Creating a Ceph File System* section of the *Red Hat Ceph Storage File System Guide* for details.

3.8. ADDITIONAL RESOURCES

- See the Section 3.3, “Creating a Ceph File System” for details.
- See the Section 3.5, “Creating client users for a Ceph File System” for details.
- See the Section 3.6, “Mounting the Ceph File System as a kernel client” for details.
- See the Section 3.7, “Mounting the Ceph File System as a FUSE client” for details.

- See the *Red Hat Ceph Storage Installation Guide* for details on installing the CephFS Metadata Server.
- See the Chapter 2, *The Ceph File System Metadata Server* for details on configuring the CephFS Metadata Server daemon.

CHAPTER 4. CEPH FILE SYSTEM ADMINISTRATION

As a storage administrator, you can perform common Ceph File System (CephFS) administrative tasks, such as:

- To map a directory to a particular MDS rank, see Section 4.4, “Mapping directory trees to Metadata Server daemon ranks”.
- To disassociate a directory from a MDS rank, see Section 4.5, “Disassociating directory trees from Metadata Server daemon ranks”.
- To work with files and directory layouts, see Section 4.8, “Working with File and Directory Layouts”.
- To add a new data pool, see Section 4.6, “Adding data pools” .
- To work with quotas, see Section 4.7, “Working with Ceph File System quotas” .
- To remove a Ceph File System using the command-line interface, see Section 4.12, “Removing a Ceph File System using the command-line interface”.
- To remove a Ceph File System using Ansible, see Section 4.13, “Removing a Ceph File System using Ansible”.
- To set a minimum client version, see Section 4.14, “Setting a minimum client version” .
- To use the **ceph mds fail** command, see Section 4.15, “Using the **ceph mds fail** command”.

4.1. PREREQUISITES

- A running, and healthy Red Hat Ceph Storage cluster.
- Installation and configuration of the Ceph Metadata Server daemons (**ceph-mds**).
- Create and mount the Ceph File System.

4.2. UNMOUNTING CEPH FILE SYSTEMS MOUNTED AS KERNEL CLIENTS

How to unmount a Ceph File System that is mounted as a kernel client.

Prerequisites

- Root-level access to the node doing the mounting.

Procedure

1. To unmount a Ceph File System mounted as a kernel client:

   Syntax

   ```
   umount MOUNT_POINT
   ```

   Example

```
[root@client ~]# umount /mnt/cephfs
```

Additional Resources

- The **umount(8)** manual page

4.3. UNMOUNTING CEPH FILE SYSTEMS MOUNTED AS FUSE CLIENTS

Unmounting a Ceph File System that is mounted as a File System in User Space (FUSE) client.

Prerequisites

- Root-level access to the FUSE client node.

Procedure

1. To unmount a Ceph File System mounted in FUSE:

   Syntax

   ```
   fusermount -u MOUNT_POINT
   ```

   Example

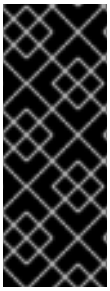
   ```
   [root@client ~]# fusermount -u /mnt/cephfs
   ```

Additional Resources

- The **ceph-fuse(8)** manual page

4.4. MAPPING DIRECTORY TREES TO METADATA SERVER DAEMON RANKS

To map a directory and its subdirectories to a particular active Metadata Server (MDS) rank so that its metadata is only managed by the MDS daemon holding that rank. This approach enables you to evenly spread application load or limit impact of users' metadata requests to the entire storage cluster.



IMPORTANT

An internal balancer already dynamically spreads the application load. Therefore, only map directory trees to ranks for certain carefully chosen applications.

In addition, when a directory is mapped to a rank, the balancer cannot split it. Consequently, a large number of operations within the mapped directory can overload the rank and the MDS daemon that manages it.

Prerequisites

- At least two active MDS daemons.
- User access to the CephFS client node.

- Verify that the **attr** package is installed on the CephFS client node with a mounted Ceph File System.

Procedure

1. Add the **p** flag to the Ceph user's capabilities:

   Syntax

   ```
   ceph fs authorize FILE_SYSTEM_NAME client.CLIENT_NAME /DIRECTORY CAPABILITY
   [/DIRECTORY CAPABILITY] ...
   ```

   Example

   ```
   [user@client ~]$ ceph fs authorize cephfs_a client.1 /temp rwp

   client.1
     key: AQBSdFhcGZFUDRAAcKhG9Cl2HPiDMMRv4DC43A==
     caps: [mds] allow r, allow rwp path=/temp
     caps: [mon] allow r
     caps: [osd] allow rw tag cephfs data=cephfs_a
   ```

2. Set the **ceph.dir.pin** extended attribute on a directory:

   Syntax

   ```
   setfattr -n ceph.dir.pin -v RANK DIRECTORY
   ```

   Example

   ```
   [user@client ~]$ setfattr -n ceph.dir.pin -v 2 /temp
   ```

   This example assigns the **/temp** directory and all of its subdirectories to rank 2.

Additional Resources

- See the *Layout, quota, snapshot, and network restrictions* section in the *Red Hat Ceph Storage File System Guide* for more details about the **p** flag.
- See the *Disassociating directory trees from Metadata Server daemon ranks* section in the *Red Hat Ceph Storage File System Guide* for more details.
- See the *Configuring multiple active Metadata Server daemons* section in the *Red Hat Ceph Storage File System Guide* for more details.

4.5. DISASSOCIATING DIRECTORY TREES FROM METADATA SERVER DAEMON RANKS

Disassociate a directory from a particular active Metadata Server (MDS) rank.

Prerequisites

- User access to the Ceph File System (CephFS) client node.
- Ensure that the **attr** package is installed on the client node with a mounted CephFS.

Procedure

1. Set the **ceph.dir.pin** extended attribute to -1 on a directory:

   Syntax

   ```
   setfattr -n ceph.dir.pin -v -1 DIRECTORY
   ```

   Example

   ```
   [user@client ~]$ serfattr -n ceph.dir.pin -v -1 /home/ceph-user
   ```

   NOTE

   Any separately mapped subdirectories of **/home/ceph-user/** are not affected.

Additional Resources

- See the *Mapping Directory Trees to MDS Ranks* section in *Red Hat Ceph Storage File System Guide* for more details.

4.6. ADDING DATA POOLS

The Ceph File System (CephFS) supports adding more than one pool to be used for storing data. This can be useful for:

- Storing log data on reduced redundancy pools
- Storing user home directories on an SSD or NVMe pool
- Basic data segregation.

Before using another data pool in the Ceph File System, you must add it as described in this section.

By default, for storing file data, CephFS uses the initial data pool that was specified during its creation. To use a secondary data pool, you must also configure a part of the file system hierarchy to store file data in that pool or optionally within a namespace of that pool, using file and directory layouts.

Prerequisites

- Root-level access to the Ceph Monitor node.

Procedure

1. Create a new data pool:

   Syntax

   ```
   ceph osd pool create POOL_NAME PG_NUMBER
   ```

Replace:

- ***POOL_NAME*** with the name of the pool.
- ***PG_NUMBER*** with the number of placement groups (PGs).

Example

```
[root@mon ~]# ceph osd pool create cephfs_data_ssd 64
pool 'cephfs_data_ssd' created
```

2. Add the newly created pool under the control of the Metadata Servers:

Syntax

```
ceph fs add_data_pool FS_NAME POOL_NAME
```

Replace:

- ***FS_NAME*** with the name of the file system.
- ***POOL_NAME*** with the name of the pool.

Example:

```
[root@mon ~]# ceph fs add_data_pool cephfs cephfs_data_ssd
added data pool 6 to fsmap
```

3. Verify that the pool was successfully added:

Example

```
[root@mon ~]# ceph fs ls
name: cephfs, metadata pool: cephfs_metadata, data pools: [cephfs_data cephfs_data_ssd]
```

4. If you use the **cephx** authentication, make sure that clients can access the new pool.

Additional Resources

- See the *Working with File and Directory Layouts* for details.
- See the *Creating Ceph File System Client Users* for details.

4.7. WORKING WITH CEPH FILE SYSTEM QUOTAS

As a storage administrator, you can view, set, and remove quotas on any directory in the file system. You can place quota restrictions on the number of bytes or the number of files within the directory.

4.7.1. Prerequisites

- Make sure that the **attr** package is installed.

4.7.2. Ceph File System quotas

The Ceph File System (CephFS) quotas allow you to restrict the number of bytes or the number of files stored in the directory structure.

Limitations

- CephFS quotas rely on the cooperation of the client mounting the file system to stop writing data when it reaches the configured limit. However, quotas alone cannot prevent an adversarial, untrusted client from filling the file system.
- Once processes that write data to the file system reach the configured limit, a short period of time elapses between when the amount of data reaches the quota limit, and when the processes stop writing data. The time period generally measures in the tenths of seconds. However, processes continue to write data during that time. The amount of additional data that the processes write depends on the amount of time elapsed before they stop.
- Previously, quotas were only supported with the userspace FUSE client. With Linux kernel version 4.17 or newer, the CephFS kernel client supports quotas against Ceph mimic or newer clusters. Those version requirements are met by Red Hat Enterprise Linux 8 and Red Hat Ceph Storage 4, respectively. The userspace FUSE client can be used on older and newer OS and cluster versions. The FUSE client is provided by the **ceph-fuse** package.
- When using path-based access restrictions, be sure to configure the quota on the directory to which the client is restricted, or to a directory nested beneath it. If the client has restricted access to a specific path based on the MDS capability, and the quota is configured on an ancestor directory that the client cannot access, the client will not enforce the quota. For example, if the client cannot access the /**home**/ directory and the quota is configured on /**home**/, the client cannot enforce that quota on the directory /**home**/**user**/.
- Snapshot file data that has been deleted or changed does not count towards the quota.

4.7.3. Viewing quotas

Use the **getfattr** command and the **ceph.quota** extended attributes to view the quota settings for a directory.

NOTE

If the attributes appear on a directory inode, then that directory has a configured quota. If the attributes do not appear on the inode, then the directory does not have a quota set, although its parent directory might have a quota configured. If the value of the extended attribute is 0, the quota is not set.

Prerequisites

- Make sure that the **attr** package is installed.

Procedure

1. To view CephFS quotas.
   a. Using a byte-limit quota:

      Syntax

```
getfattr -n ceph.quota.max_bytes DIRECTORY
```

Example

```
[root@fs ~]# getfattr -n ceph.quota.max_bytes /cephfs/
```

b. Using a file-limit quota:

Syntax

```
getfattr -n ceph.quota.max_files DIRECTORY
```

Example

```
[root@fs ~]# getfattr -n ceph.quota.max_files /cephfs/
```

Additional Resources

- See the **getfattr(1)** manual page for more information.

4.7.4. Setting quotas

This section describes how to use the **setfattr** command and the **ceph.quota** extended attributes to set the quota for a directory.

Prerequisites

- Make sure that the **attr** package is installed.

Procedure

1. To set CephFS quotas.

   a. Using a byte-limit quota:

   Syntax

   ```
   setfattr -n ceph.quota.max_bytes -v 100000000 /some/dir
   ```

   Example

   ```
   [root@fs ~]# setfattr -n ceph.quota.max_bytes -v 100000000 /cephfs/
   ```

   In this example, 100000000 bytes equals 100 MB.

   b. Using a file-limit quota:

   Syntax

   ```
   setfattr -n ceph.quota.max_files -v 10000 /some/dir
   ```

Example

```
[root@fs ~]# setfattr -n ceph.quota.max_files -v 10000 /cephfs/
```

In this example, 10000 equals 10,000 files.

Additional Resources

- See the **setfattr(1)** manual page for more information.

4.7.5. Removing quotas

This section describes how to use the **setfattr** command and the **ceph.quota** extended attributes to remove a quota from a directory.

Prerequisites

- Make sure that the **attr** package is installed.

Procedure

1. To remove CephFS quotas.
   a. Using a byte-limit quota:

Syntax

```
setfattr -n ceph.quota.max_bytes -v 0 DIRECTORY
```

Example

```
[root@fs ~]# setfattr -n ceph.quota.max_bytes -v 0 /cephfs/
```

   b. Using a file-limit quota:

Syntax

```
setfattr -n ceph.quota.max_files -v 0 DIRECTORY
```

Example

```
[root@fs ~]# setfattr -n ceph.quota.max_files -v 0 /cephfs/
```

Additional Resources

- See the **setfattr(1)** manual page for more information.

4.7.6. Additional Resources

- See the **getfattr(1)** manual page for more information.
- See the **setfattr(1)** manual page for more information.

4.8. WORKING WITH FILE AND DIRECTORY LAYOUTS

As a storage administrator, you can control how file or directory data is mapped to objects.

This section describes how to:

- Understand file and directory layouts
- Set file and directory layouts
- View file and directory layout fields
- View individual layout fields
- Remove the directory layouts

4.8.1. Prerequisites

- The installation of the **attr** package.

4.8.2. Overview of file and directory layouts

This section explains what file and directory layouts are in the context for the Ceph File System.

A layout of a file or directory controls how its content is mapped to Ceph RADOS objects. The directory layouts serves primarily for setting an inherited layout for new files in that directory.

To view and set a file or directory layout, use virtual extended attributes or extended file attributes (**xattrs**). The name of the layout attributes depends on whether a file is a regular file or a directory:

- Regular files layout attributes are called **ceph.file.layout**.
- Directories layout attributes are called **ceph.dir.layout**.

The *File and Directory Layout Fields* table lists available layout fields that you can set on files and directories.

Layouts Inheritance

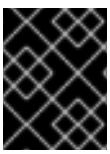
Files inherit the layout of their parent directory when you create them. However, subsequent changes to the parent directory layout do not affect children. If a directory does not have any layouts set, files inherit the layout from the closest directory with layout in the directory structure.

Additional Resources

- See the *Layouts Inheritance* for more details.

4.8.3. Setting file and directory layout fields

Use the **setfattr** command to set layout fields on a file or directory.



IMPORTANT

When you modify the layout fields of a file, the file must be empty, otherwise an error occurs.

Prerequisites

- Root-level access to the node.

Procedure

1. To modify layout fields on a file or directory:

   Syntax

   ```
   setfattr -n ceph.TYPE.layout.FIELD -v VALUE PATH
   ```

   Replace:

   - *TYPE* with **file** or **dir**.
   - *FIELD* with the name of the field.
   - *VALUE* with the new value of the field.
   - *PATH* with the path to the file or directory.

   Example

   ```
   [root@fs ~]# setfattr -n ceph.file.layout.stripe_unit -v 1048576 test
   ```

Additional Resources

- See the table in the *Overview of the file and directory layouts* section of the *Red Hat Ceph Storage File System Guide* for more details.
- See the **setfattr(1)** manual page.

4.8.4. Viewing file and directory layout fields

To use the **getfattr** command to view layout fields on a file or directory.

Prerequisites

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

Procedure

1. To view layout fields on a file or directory as a single string:

   Syntax

   ```
   getfattr -n ceph.TYPE.layout PATH
   ```

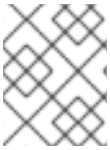
   Replace

   - *PATH* with the path to the file or directory.

- *TYPE* with **file** or **dir**.

Example

```
[root@mon ~] getfattr -n ceph.dir.layout /home/test
ceph.dir.layout="stripe_unit=4194304 stripe_count=2 object_size=4194304
pool=cephfs_data"
```



NOTE

A directory does not have an explicit layout until you set it. Consequently, attempting to view the layout without first setting it fails because there are no changes to display.

Additional Resources

- The **getfattr(1)** manual page.
- For more information, see *Setting file and directory layouts* section in the *Red Hat Ceph Storage File System Guide*.

4.8.5. Viewing individual layout fields

Use the **getfattr** command to view individual layout fields for a file or directory.

Prerequisites

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

Procedure

1. To view individual layout fields on a file or directory:

Syntax

```
getfattr -n ceph.TYPE.layout.FIELD _PATH
```

Replace

- *TYPE* with **file** or **dir**.
- *FIELD* with the name of the field.
- *PATH* with the path to the file or directory.

Example

```
[root@mon ~] getfattr -n ceph.file.layout.pool test
ceph.file.layout.pool="cephfs_data"
```

NOTE

Pools in the **pool** field are indicated by name. However, newly created pools can be indicated by ID.

Additional Resources

- The **getfattr(1)** manual page.
- For more information, see File and directory layout fields.

4.8.6. Removing directory layouts

Use the **setfattr** command to remove layouts from a directory.

NOTE

When you set a file layout, you cannot change or remove it.

Prerequisites

- A directory with a layout.

Procedure

1. To remove a layout from a directory:

   Syntax

   ```
   setfattr -x ceph.dir.layout DIRECTORY_PATH
   ```

   Example

   ```
   [user@client ~]$ setfattr -x ceph.dir.layout /home/cephfs
   ```

2. To remove the **pool_namespace** field:

   Syntax

   ```
   setfattr -x ceph.dir.layout.pool_namespace DIRECTORY_PATH
   ```

   Example

   ```
   [user@client ~]$ setfattr -x ceph.dir.layout.pool_namespace /home/cephfs
   ```

NOTE

The **pool_namespace** field is the only field you can remove separately.

Additional Resources

- The **setfattr(1)** manual page

4.9. CEPH FILE SYSTEM SNAPSHOT CONSIDERATIONS

As a storage administrator, you can gain an understanding of the data structures, system components, and considerations to manage Ceph File System (CephFS) snapshots.

Snapshots create an immutable view of a file system at the point in time of creation. You can create a snapshot within any directory, and all data in the file system under that directory is covered.

4.9.1. Storing snapshot metadata for a Ceph File System

Storage of snapshot directory entries and their inodes occurs in-line as part of the directory they were in at the time of the snapshot. All directory entries include a first and last **snapid** for which they are valid.

4.9.2. Ceph File System snapshot writeback

Ceph snapshots rely on clients to help determine which operations apply to a snapshot and flush snapshot data and metadata back to the OSD and MDS clusters. Handling snapshot writeback is an involved process because snapshots apply to subtrees of the file hierarchy, and the creation of snapshots can occur anytime.

Parts of the file hierarchy that belong to the same set of snapshots are referred to by a single **SnapRealm**. Each snapshot applies to the subdirectory nested beneath a directory and divides the file hierarchy into multiple "realms" where all of the files contained by a realm share the same set of snapshots.

The Ceph Metadata Server (MDS) controls client access to inode metadata and file data by issuing capabilities (caps) for each inode. During snapshot creation, clients acquire dirty metadata on inodes with capabilities to describe the file state at that time. When a client receives a **ClientSnap** message, it updates the local **SnapRealm** and its links to specific inodes and generates a **CapSnap** for the inode. Capability writeback flushes out the **CapSnap** and, if dirty data exists, the **CapSnap** is used to block new data writes until the snapshot flushes to the OSDs.

The MDS generates snapshot-representing directory entries as part of the routine process for flushing them. The MDS keeps directory entries with outstanding **CapSnap** data pinned in memory and the journal until the writeback process flushes them.

Additional Resources

- See the *Creating client users for a Ceph File System* section in the *Red Hat Ceph Storage File System Guide* for details on setting the Ceph user capabilities.

4.9.3. Ceph File System snapshots and hard links

Ceph moves an inode with multiple hard links to a dummy global **SnapRealm**. This dummy **SnapRealm** covers all snapshots in the filesystem. Any new snapshots preserve the inode's data. This preserved data covers snapshots on any linkage of the inode.

4.9.4. Updating a snapshot for a Ceph File System

The process of updating a snapshot is similar to the process of deleting a snapshot.

If you remove an inode out of its parent **SnapRealm**, Ceph generates a new **SnapRealm** for the renamed inode if the **SnapRealm** does not already exist. Ceph saves the IDs of snapshots that are effective on the original parent **SnapRealm** into the **past_parent_snaps** data structure of the new **SnapRealm** and then follows a process similar to creating a snapshot.

Additional Resources

- For details about snapshot data structures, see *Ceph File System snapshot data structures* in *Red Hat Ceph Storage File System Guide*.

4.9.5. Ceph File System snapshots and multiple file systems

Snapshots are known to not function properly with multiple file systems.

If you have multiple file systems sharing a single Ceph pool with namespaces, their snapshots will collide, and deleting one snapshot results in missing file data for other snapshots sharing the same Ceph pool.

4.9.6. Ceph File System snapshot data structures

The Ceph File System (CephFS) uses the following snapshot data structures to store data efficiently:

SnapRealm

A **SnapRealm** is created whenever you create a snapshot at a new point in the file hierarchy or when you move a snapshotted inode outside its parent snapshot. A single **SnapRealm** represents the parts of the file hierarchy that belong to the same set of snapshots. A **SnapRealm** contains a **sr_t_srnode** and **inodes_with_caps** that are part of the snapshot.

sr_t

An **sr_t** is the on-disk snapshot metadata. It contains sequence counters, time-stamps, and a list of associated snapshot IDs and the **past_parent_snaps**.

SnapServer

A **SnapServer** manages snapshot ID allocation, snapshot deletion, and maintaining a list of cumulative snapshots in the file system. A file system only has one instance of a **SnapServer**.

SnapContext

A **SnapContext** consists of a snapshot sequence ID (snapid) and all the snapshot IDs currently defined for an object. When a write operation occurs, a Ceph client provides a **SnapContext** to specify the set of snapshots that exist for an object. To generate a **SnapContext** list, Ceph combines snapids associated with the **SnapRealm** and all valid snapids in the **past_parent_snaps** data structure.
File data is stored using RADOS self-managed snapshots. In a self-managed snapshot, the client must provide the current **SnapContext** on each write. Clients are careful to use the correct **SnapContext** when writing file data to the Ceph OSDs.

SnapClient cached effective snapshots filter out stale snapids.

SnapClient

A **SnapClient** is used to communicate with a **SnapServer** and cache cumulative snapshots locally. Each Metadata Server (MDS) rank has a **SnapClient** instance.

4.10. MANAGING CEPH FILE SYSTEM SNAPSHOTS

As a storage administrator, you can take a point-in-time snapshot of a Ceph File System (CephFS) directory. CephFS snapshots are asynchronous, and you can choose which directory snapshot creation occurs in.

4.10.1. Prerequisites

- A running and healthy Red Hat Ceph Storage cluster.

- Deployment of a Ceph File System.

4.10.2. Ceph File System snapshots

A Ceph File System (CephFS) snapshot creates an immutable, point-in-time view of a Ceph File System. CephFS snapshots are asynchronous and are kept in a special hidden directory in the CephFS directory, named **.snap**. You can specify snapshot creation for any directory within a Ceph File System. When specifying a directory, the snapshot also includes all the subdirectories beneath it.

WARNING

Each Ceph Metadata Server (MDS) cluster allocates the snap identifiers independently. Using snapshots for multiple Ceph File Systems that are sharing a single pool causes snapshot collisions and results in missing file data.

Additional Resources

- See the *Creating a snapshot for a Ceph File System* section in the *Red Hat Ceph Storage File System Guide* for more details.

4.10.3. Enabling a snapshot for a Ceph File System

New Ceph File Systems enable the snapshotting feature by default, but you must manually enable the feature on existing Ceph File Systems.

Prerequisites

- A running and healthy Red Hat Ceph Storage cluster.
- Deployment of a Ceph File System.
- Root-level access to a Ceph Metadata Server (MDS) node.

Procedure

- For existing Ceph File Systems, enable the snapshotting feature:

  Syntax

  ```
  ceph fs set FILE_SYSTEM_NAME allow_new_snaps true
  ```

  Example

  ```
  [root@mds ~]# ceph fs set cephfs allow_new_snaps true
  enabled new snapshots
  ```

Additional Resources

- See the *Creating a snapshot for a Ceph File System* section in the *Red Hat Ceph Storage File System Guide* for details on creating a snapshot.
- See the *Deleting a snapshot for a Ceph File System* section in the *Red Hat Ceph Storage File System Guide* for details on deleting a snapshot.
- See the *Restoring a snapshot for a Ceph File System* section in the *Red Hat Ceph Storage File System Guide* for details on restoring a snapshot.

4.10.4. Creating a snapshot for a Ceph File System

You can create an immutable, point-in-time view of a Ceph File System by creating a snapshot. A snapshot uses a hidden directory located in the directory to snapshot. The name of this directory is **.snap** by default.

Prerequisites

- A running and healthy Red Hat Ceph Storage cluster.
- Deployment of a Ceph File System.
- Root-level access to a Ceph Metadata Server (MDS) node.

Procedure

- To create a snapshot, create a new subdirectory inside the **.snap** directory. The snapshot name is the new subdirectory name.

  Syntax

  ```
  mkdir NEW_DIRECTORY_PATH
  ```

  Example

  ```
  [root@mds cephfs]# mkdir .snap/new-snaps
  ```

  This example creates the **new-snaps** subdirectory on a Ceph File System that is mounted on **/mnt/cephfs** and informs the Ceph Metadata Server (MDS) to start making snapshots.

Verification

- List the new snapshot directory:

  Syntax

  ```
  ls -l .snap/
  ```

  The **new-snaps** subdirectory displays under the **.snap** directory.

Additional Resources

- See the *Deleting a snapshot for a Ceph File System* section in the *Red Hat Ceph Storage File System Guide* for details on deleting a snapshot.

- See the *Restoring a snapshot for a Ceph File System* section in the *Red Hat Ceph Storage File System Guide* for details on restoring a snapshot.

4.10.5. Deleting a snapshot for a Ceph File System

You can delete a snapshot by removing the corresponding directory in a **.snap** directory.

Prerequisites

- A running and healthy Red Hat Ceph Storage cluster.
- Deployment of a Ceph File System.
- Creation of snapshots on a Ceph File System.
- Root-level access to a Ceph Metadata Server (MDS) node.

Procedure

- To delete a snapshot, remove the corresponding directory:

  Syntax

  ```
  rmdir DIRECTORY_PATH
  ```

  Example

  ```
  [root@mds cephfs]# rmdir .snap/new-snaps
  ```

  This example deletes the **new-snaps** subdirectory on a Ceph File System that is mounted on **/mnt/cephfs**.

NOTE

Contrary to a regular directory, a **rmdir** command succeeds even if the directory is not empty, so you do not need to use a recursive **rm** command.

IMPORTANT

Attempting to delete root-level snapshots, which might contain underlying snapshots, will fail.

Additional Resources

- See the *Restoring a snapshot for a Ceph File System* section in the *Red Hat Ceph Storage File System Guide* for details on restoring a snapshot.
- See the *Creating a snapshot for a Ceph File System* section in the *Red Hat Ceph Storage File System Guide* for details on creating a snapshot.

4.10.6. Restoring a snapshot for a Ceph File System

You can restore a file from a snapshot or fully restore a complete snapshot for a Ceph File System (CephFS).

Prerequisites

- A running, and healthy Red Hat Ceph Storage cluster.
- Deployment of a Ceph File System.
- Root-level access to a Ceph Metadata Server (MDS) node.

Procedure

- To restore a file from a snapshot, copy it from the snapshot directory to the regular tree:

  Syntax

  ```
  cp -a .snap/SNAP_DIRECTORY/FILENAME
  ```

  Example

  ```
  [root@mds dir1]# cp .snap/new-snaps/file1 .
  ```

  This example restores **file1** to the current directory.

- You can also fully restore a snapshot from the **.snap** directory tree. Replace the current entries with copies from the desired snapshot:

  Syntax

  ```
  [root@mds dir1]# rm -rf *
  [root@mds dir1]# cp -a .snap/SNAP_DIRECTORY/* .
  ```

  Example

  ```
  [root@mds dir1]# rm -rf *
  [root@mds dir1]# cp -a .snap/new-snaps/* .
  ```

  This example removes all files and directories under **dir1** and restores the files from the **new-snaps** snapshot to the current directory, **dir1**.

4.10.7. Additional Resources

- See the *Deployment of the Ceph File System* section in the *Red Hat Ceph Storage File System Guide*.

4.11. TAKING DOWN A CEPH FILE SYSTEM CLUSTER

You can take down Ceph File System (CephFS) cluster by simply setting the **down** flag **true**. Doing this gracefully shuts down the Metadata Server (MDS) daemons by flushing journals to the metadata pool and all client I/O is stopped.

You can also take the CephFS cluster down quickly for testing the deletion of a file system and bring the Metadata Server (MDS) daemons down, for example, practicing a disaster recovery scenario. Doing this sets the **jointable** flag to prevent the MDS standby daemons from activating the file system.

Prerequisites

- User access to the Ceph Monitor node.

Procedure

1. To mark the CephFS cluster down:

   Syntax

   ```
   ceph fs set FS_NAME down true
   ```

   Exmaple

   ```
   [root@mon]# ceph fs set cephfs down true
   ```

   a. To bring the CephFS cluster back up:

      Syntax

      ```
      ceph fs set FS_NAME down false
      ```

      Exmaple

      ```
      [root@mon]# ceph fs set cephfs down false
      ```

or

1. To quickly take down a CephFS cluster:

   Syntax

   ```
   ceph fs fail FS_NAME
   ```

   Exmaple

   ```
   [root@mon]# ceph fs fail cephfs
   ```

4.12. REMOVING A CEPH FILE SYSTEM USING THE COMMAND-LINE INTERFACE

You can remove a Ceph File System (CephFS) using the command-line interface. Before doing so, consider backing up all the data and verifying that all clients have unmounted the file system locally.

WARNING

This operation is destructive and will make the data stored on the Ceph File System permanently inaccessible.

Prerequisites

- Back-up the data.
- All clients have unmounted the Ceph File System (CephFS).
- Root-level access to a Ceph Monitor node.

Procedure

1. Display the CephFS status to determine the MDS ranks.

   Syntax

   ```
   ceph fs status
   ```

   Example

   ```
   [root@mon ~]# ceph fs status
   cephfs - 0 clients
   ======
   +------+--------+---------------+--------------+-------+-------+
   | Rank | State  |      MDS      |    Activity  |  dns  |  inos |
   +------+--------+---------------+--------------+-------+-------+
   |  0   | active | cluster1-node6 | Reqs:    0 /s |   10  |   13  |
   +------+--------+---------------+--------------+-------+-------+
   +-----------------+----------+-------+-------+
   |       Pool      |   type   | used | avail |
   +-----------------+----------+-------+-------+
   | cephfs_metadata | metadata | 2688k | 15.0G |
   |   cephfs_data   |   data   |    0  | 15.0G |
   +-----------------+----------+-------+-------+
   +----------------+
   |  Standby MDS   |
   +----------------+
   | cluster1-node5 |
   +----------------+
   ```

   In the example above, the rank is *0*.

2. Mark the CephFS as down:

   Syntax

   ```
   ceph fs set FS_NAME down true
   ```

Replace *FS_NAME* with the name of the CephFS you want to remove.

Example

```
[root@mon]# ceph fs set cephfs down true
marked down
```

3. Display the status of the CephFS to determine it has stopped:

Syntax

```
ceph fs status
```

Example

```
[root@mon ~]# ceph fs status
cephfs - 0 clients
======
+------+----------+---------------+----------+-------+-------+
| Rank |  State   |      MDS      | Activity |  dns  |  inos |
+------+----------+---------------+----------+-------+-------+
|  0   | stopping | cluster1-node6 |          |   10  |   12  |
+------+----------+---------------+----------+-------+-------+
+-----------------+----------+-------+-------+
|       Pool      |   type   |  used | avail |
+-----------------+----------+-------+-------+
| cephfs_metadata | metadata | 2688k | 15.0G |
|   cephfs_data   |   data   |    0  | 15.0G |
+-----------------+----------+-------+-------+
+----------------+
|  Standby MDS   |
+----------------+
| cluster1-node5 |
+----------------+
```

After some time, the MDS is no longer listed:

Example

```
[root@mon ~]# ceph fs status
cephfs - 0 clients
======
+------+-------+-----+----------+-----+------+
| Rank | State | MDS | Activity | dns | inos |
+------+-------+-----+----------+-----+------+
+------+-------+-----+----------+-----+------+
+-----------------+----------+-------+-------+
|       Pool      |   type   |  used | avail |
+-----------------+----------+-------+-------+
| cephfs_metadata | metadata | 2688k | 15.0G |
|   cephfs_data   |   data   |    0  | 15.0G |
+-----------------+----------+-------+-------+
+----------------+
|  Standby MDS   |
```

```
+----------------+
| cluster1-node5 |
+----------------+
```

4. Fail all MDS ranks shown in the status of step one:

   Syntax

   ```
   ceph mds fail RANK
   ```

   Replace *RANK* with the rank of the MDS daemons to fail.

   Example

   ```
   [root@mon]# ceph mds fail 0
   ```

5. Remove the CephFS:

   Syntax

   ```
   ceph fs rm FS_NAME --yes-i-really-mean-it
   ```

   Replace *FS_NAME* with the name of the Ceph File System you want to remove.

   Example

   ```
   [root@mon]# ceph fs rm cephfs --yes-i-really-mean-it
   ```

6. Verify that the file system is removed:

   Syntax

   ```
   ceph fs ls
   ```

   Example

   ```
   [root@mon ~]# ceph fs ls
   No filesystems enabled
   ```

7. Optional: Remove the pools that were used by CephFS.

   a. On a Ceph Monitor node, list the pools:

      Syntax

      ```
      ceph osd pool ls
      ```

      Example

      ```
      [root@mon ~]# ceph osd pool ls
      rbd
      cephfs_data
      ```

```
cephfs_metadata
```

In the example output, **cephfs_metadata** and **cephfs_data** are the pools that were used by CephFS.

b. Remove the metadata pool:

Syntax

```
ceph osd pool delete CEPH_METADATA_POOL CEPH_METADATA_POOL --yes-i-really-really-mean-it
```

Replace *CEPH_METADATA_POOL* with the pool CephFS used for metadata storage by including the pool name twice.

Example

```
[root@mon ~]# ceph osd pool delete cephfs_metadata cephfs_metadata --yes-i-really-really-mean-it
pool 'cephfs_metadata' removed
```

c. Remove the data pool:

Syntax

```
ceph osd pool delete CEPH_DATA_POOL CEPH_DATA_POOL --yes-i-really-really-mean-it
```

Replace *CEPH_DATA_POOL* with the pool CephFS used for data storage by including the pool name twice.

Example

```
[root@mon ~]# ceph osd pool delete cephfs_data cephfs_data --yes-i-really-really-mean-it
pool 'cephfs_data' removed
```

Additional Resources

- See *Removing a Ceph File System Using Ansible* in the *Red Hat Ceph Storage File System Guide*.
- See the *Delete a pool* section in the *Red Hat Ceph Storage Storage Strategies Guide*.

4.13. REMOVING A CEPH FILE SYSTEM USING ANSIBLE

You can remove a Ceph File System (CephFS) using **ceph-ansible**. Before doing so, consider backing up all the data and verifying that all clients have unmounted the file system locally.

WARNING

This operation is destructive and will make the data stored on the Ceph File System permanently inaccessible.

Prerequisites

- A running Red Hat Ceph Storage cluster.
- A good backup of the data.
- All clients have unmounted the Ceph File System.
- Access to the Ansible administration node.
- Root-level access to a Ceph Monitor node.

Procedure

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

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

2. Identify the Ceph Metadata Server (MDS) nodes by reviewing the **[mdss]** section in the Ansible inventory file. On the Ansible administration node, open **/usr/share/ceph-ansible/hosts**:

   Example

```
[mdss]
cluster1-node5
cluster1-node6
```

   In the example, **cluster1-node5** and **cluster1-node6** are the MDS nodes.

3. Set the **max_mds** parameter to **1**:

   Syntax

```
ceph fs set NAME max_mds NUMBER
```

   Example

```
[root@mon ~]# ceph fs set cephfs max_mds 1
```

4. Run the **shrink-mds.yml** playbook, specifying the Metadata Server (MDS) to remove:

   Syntax

```
ansible-playbook infrastructure-playbooks/shrink-mds.yml -e mds_to_kill=MDS_NODE -i
hosts
```

Replace *MDS_NODE* with the Metadata Server node you want to remove. The Ansible playbook will ask you if you want to shrink the cluster. Type **yes** and press the enter key.

Example

```
[admin@admin ceph-ansible]$ ansible-playbook infrastructure-playbooks/shrink-mds.yml -e
mds_to_kill=cluster1-node6 -i hosts
```

5. Optional: Repeat the process for any additional MDS nodes:

Syntax

```
ansible-playbook infrastructure-playbooks/shrink-mds.yml -e mds_to_kill=MDS_NODE -i
hosts
```

Replace *MDS_NODE* with the Metadata Server node you want to remove. The Ansible playbook will ask you if you want to shrink the cluster. Type **yes** and press the enter key.

Example

```
[admin@admin ceph-ansible]$ ansible-playbook infrastructure-playbooks/shrink-mds.yml -e
mds_to_kill=cluster1-node5 -i hosts
```

6. Check the status of the CephFS:

Syntax

```
ceph fs status
```

Example

```
[root@mon ~]# ceph fs status
cephfs - 0 clients
======
+------+--------+---------------+---------------+-------+-------+
| Rank | State  |      MDS      |    Activity   |  dns  |  inos |
+------+--------+---------------+---------------+-------+-------+
|  0   | failed | cluster1-node6 | Reqs:    0 /s |   10  |   13  |
+------+--------+---------------+---------------+-------+-------+
+-----------------+----------+-------+-------+
|       Pool      |   type   |  used | avail |
+-----------------+----------+-------+-------+
| cephfs_metadata | metadata | 2688k | 15.0G |
|   cephfs_data   |   data   |    0  | 15.0G |
+-----------------+----------+-------+-------+
+----------------+
|  Standby MDS   |
+----------------+
| cluster1-node5 |
+----------------+
```

7. Remove the **[mdss]** section and the nodes in it from the Ansible inventory file so they will not be reprovisioned as metadata servers on future runs of the **site.yml** or **site-container.yml** playbooks. Open for editing the Ansible inventory file, **/usr/share/ceph-ansible/hosts**:

   Example

   ```
   [mdss]
   cluster1-node5
   cluster1-node6
   ```

   Remove the **[mdss]** section and all nodes under it.

8. Remove the CephFS:

   Syntax

   ```
   ceph fs rm FS_NAME --yes-i-really-mean-it
   ```

   Replace *FS_NAME* with the name of the Ceph File System you want to remove.

   Example

   ```
   [root@mon]# ceph fs rm cephfs --yes-i-really-mean-it
   ```

9. Optional: Remove the pools that were used by CephFS.

   a. On a Ceph Monitor node, list the pools:

      Syntax

      ```
      ceph osd pool ls
      ```

      Find the pools that were used by CephFS.

      Example

      ```
      [root@mon ~]# ceph osd pool ls
      rbd
      cephfs_data
      cephfs_metadata
      ```

      In the example output, **cephfs_metadata** and **cephfs_data** are the pools that were used by CephFS.

   b. Remove the metadata pool:

      Syntax

      ```
      ceph osd pool delete CEPH_METADATA_POOL CEPH_METADATA_POOL --yes-i-really-really-mean-it
      ```

      Replace *CEPH_METADATA_POOL* with the pool CephFS used for metadata storage by including the pool name twice.

Example

```
[root@mon ~]# ceph osd pool delete cephfs_metadata cephfs_metadata --yes-i-really-really-mean-it
pool 'cephfs_metadata' removed
```

c. Remove the data pool:

Syntax

```
ceph osd pool delete CEPH_DATA_POOL CEPH_DATA_POOL --yes-i-really-really-mean-it
```

Replace *CEPH_METADATA_POOL* with the pool CephFS used for metadata storage by including the pool name twice.

Example

```
[root@mon ~]# ceph osd pool delete cephfs_data cephfs_data --yes-i-really-really-mean-it
pool 'cephfs_data' removed
```

d. Verify the pools no longer exist:

Example

```
[root@mon ~]# ceph osd pool ls
rbd
```

The **cephfs_metadata** and **cephfs_data** pools are no longer listed.

Additional Resources

- See Removing a Ceph File System Manually in the *Red Hat Ceph Storage File System Guide*.
- See the *Delete a pool* section in the *Red Hat Ceph Storage Storage Strategies Guide*.

4.14. SETTING A MINIMUM CLIENT VERSION

You can set a minimum version of Ceph that a third-party client must be running to connect to a Red Hat Ceph Storage Ceph File System (CephFS). Set the **min_compat_client** parameter to prevent older clients from mounting the file system. CephFS will also automatically evict currently connected clients that use an older version than the version set with **min_compat_client**.

The rationale for this setting is to prevent older clients which might include bugs or have incomplete feature compatibility from connecting to the cluster and disrupting other clients. For example, some older versions of CephFS clients might not release capabilities properly and cause other client requests to be handled slowly.

The values of **min_compat_client** are based on the upstream Ceph versions. Red Hat recommends that the third-party clients use the same major upstream version as the Red Hat Ceph Storage cluster is based on. See the following table to see the upstream versions and corresponding Red Hat Ceph Storage versions.

Table 4.1. min_compat_client values

Value	Upstream Ceph version	Red Hat Ceph Storage version
luminous	12.2	Red Hat Ceph Storage 3
mimic	13.2	not applicable
nautilus	14.2	Red Hat Ceph Storage 4

IMPORTANT

If you use Red Hat Enterprise Linux 7, do not set **min_compat_client** to a later version than **luminous** because Red Hat Enterprise Linux 7 is considered a luminous client and if you use a later version, CephFS does not allow it to access the mount point.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed

Procedure

1. Set the minimum client version:

```
ceph fs set name min_compat_client release
```

Replace *name* with the name of the Ceph File System and *release* with the minimum client version. For example to restrict clients to use the **nautilus** upstream version at minimum on the **cephfs** Ceph File System:

```
$ ceph fs set cephfs min_compat_client nautilus
```

See Table 4.1, "**min_compat_client** values" for the full list of available values and how they correspond with Red Hat Ceph Storage versions.

4.15. USING THE CEPH MDS FAIL COMMAND

Use the **ceph mds fail** command to:

- Mark an MDS daemon as failed. If the daemon was active and a suitable standby daemon was available, and if the standby daemon was active after disabling the **standby-replay** configuration, using this command forces a failover to the standby daemon. By disabling the **standby-replay** daemon, this prevents new **standby-replay** daemons from being assigned.
- Restart a running MDS daemon. If the daemon was active and a suitable standby daemon was available, the "failed" daemon becomes a standby daemon.

Prerequisites

- Installation and configuration of the Ceph MDS daemons.

Procedure

1. To fail a daemon:

   Syntax

   ```
   ceph mds fail MDS_NAME
   ```

   Where *MDS_NAME* is the name of the **standby-replay** MDS node.

   Example

   ```
   [root@mds ~]# ceph mds fail example01
   ```

   NOTE

   You can find the Ceph MDS name from the **ceph fs status** command.

Additional Resources

- See the *Decreasing the Number of Active MDS Daemons* in the *Red Hat Ceph Storage File System Guide*.
- See the *Configuring Standby Metadata Server Daemons* in the *Red Hat Ceph Storage File System Guide*.
- See the *Explanation of Ranks in Metadata Server Configuration* in the *Red Hat Ceph Storage File System Guide*.

4.16. CEPH FILE SYSTEM CLIENT EVICTIONS

When a Ceph File System (CephFS) client is unresponsive or misbehaving, it might be necessary to forcibly terminate, or evict it from accessing the CephFS. Evicting a CephFS client prevents it from communicating further with Metadata Server (MDS) daemons and Ceph OSD daemons. If a CephFS client is buffering I/O to the CephFS at the time of eviction, then any un-flushed data will be lost. The CephFS client eviction process applies to all client types: FUSE mounts, kernel mounts, NFS gateways, and any process using **libcephfs** API library.

You can evict CephFS clients automatically, if they fail to communicate promptly with the MDS daemon, or manually.

Automatic Client Eviction

These scenarios cause an automatic CephFS client eviction:

- If a CephFS client has not communicated with the active MDS daemon for over the default 300 seconds, or as set by the **session_autoclose** option.
- If the **mds_cap_revoke_eviction_timeout** option is set, and a CephFS client has not responded to the cap revoke messages for over the set amount of seconds. The **mds_cap_revoke_eviction_timeout** option is disabled by default.
- During MDS startup or failover, the MDS daemon goes through a reconnect phase waiting for all the CephFS clients to connect to the new MDS daemon. If any CephFS clients fails to reconnect within the default time window of 45 seconds, or as set by the

mds_reconnect_timeout option.

Additional Resources

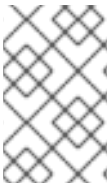
- See the *Manually evicting a Ceph File System client* section in the *Red Hat Ceph Storage File System Guide* for more details.

4.17. BLACKLIST CEPH FILE SYSTEM CLIENTS

Ceph File System client blacklisting is enabled by default. When you send an eviction command to a single Metadata Server (MDS) daemon, it propagates the blacklist to the other MDS daemons. This is to prevent the CephFS client from accessing any data objects, so it is necessary to update the other CephFS clients, and MDS daemons with the latest Ceph OSD map, which includes the blacklisted client entries.

An internal "osdmap epoch barrier" mechanism is used when updating the Ceph OSD map. The purpose of the barrier is to verify the CephFS clients receiving the capabilities have a sufficiently recent Ceph OSD map, before any capabilities are assigned that might allow access to the same RADOS objects, as to not race with cancelled operations, such as, from ENOSPC or blacklisted clients from evictions.

If you are experiencing frequent CephFS client evictions due to slow nodes or an unreliable network, and you cannot fix the underlying issue, then you can ask the MDS to be less strict. It is possible to respond to slow CephFS clients by simply dropping their MDS sessions, but permit the CephFS client to re-open sessions and to continue talking to Ceph OSDs. By setting the **mds_session_blacklist_on_timeout** and **mds_session_blacklist_on_evict** options to **false** enables this mode.



NOTE

When blacklisting is disabled, the evicted CephFS client has only an effect on the MDS daemon you send the command to. On a system with multiple active MDS daemons, you would need to send an eviction command to each active daemon.

4.18. MANUALLY EVICTING A CEPH FILE SYSTEM CLIENT

You might want to manually evict a Ceph File System (CephFS) client, if the client is misbehaving and you do not have access to the client node, or if a client dies, and you do not want to wait for the client session to time out.

Prerequisites

- User access to the Ceph Monitor node.

Procedure

1. Review the client list:

   Syntax

   ```
   ceph tell DAEMON_NAME client ls
   ```

   Exmaple

   ```
   [root@mon]# ceph tell mds.0 client ls
   ```

```
[
    {
        "id": 4305,
        "num_leases": 0,
        "num_caps": 3,
        "state": "open",
        "replay_requests": 0,
        "completed_requests": 0,
        "reconnecting": false,
        "inst": "client.4305 172.21.9.34:0/422650892",
        "client_metadata": {
            "ceph_sha1": "ae81e49d369875ac8b569ff3e3c456a31b8f3af5",
            "ceph_version": "ceph version 12.0.0-1934-gae81e49
(ae81e49d369875ac8b569ff3e3c456a31b8f3af5)",
            "entity_id": "0",
            "hostname": "senta04",
            "mount_point": "/tmp/tmpcMpF1b/mnt.0",
            "pid": "29377",
            "root": "/"
        }
    }
]
```

2. Evict the specified CephFS client:

Syntax

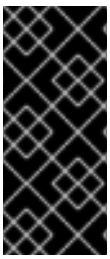
```
ceph tell DAEMON_NAME client evict id=ID_NUMBER
```

Exmaple

```
[root@mon]# ceph tell mds.0 client evict id=4305
```

4.19. REMOVING A CEPH FILE SYSTEM CLIENT FROM THE BLACKLIST

In some situations, it can be useful to allow a previous blacklisted Ceph File System (CephFS) client to reconnect to the storage cluster.



IMPORTANT

Removing a CephFS client from the blacklist puts data integrity at risk, and does not guarantee a fully healthy, and functional CephFS client as a result. The best way to get a fully healthy CephFS client back after an eviction, is to unmount the CephFS client and do a fresh mount. If other CephFS clients are accessing files that the blacklisted CephFS client was doing buffered I/O to can result in data corruption.

Prerequisites

- User access to the Ceph Monitor node.

Procedure

1. Review the blacklist:

Exmaple

```
[root@mon]# ceph osd blacklist ls
listed 1 entries
127.0.0.1:0/3710147553 2020-03-19 11:32:24.716146
```

2. Remove the CephFS client from the blacklist:

Syntax

```
ceph osd blacklist rm CLIENT_NAME_OR_IP_ADDR
```

Exmaple

```
[root@mon]# ceph osd blacklist rm 127.0.0.1:0/3710147553
un-blacklisting 127.0.0.1:0/3710147553
```

3. Optionally, to have FUSE-based CephFS clients trying automatically to reconnect when removing them from the blacklist. On the FUSE client, set the following option to **true**:

```
client_reconnect_stale = true
```

4.20. ADDITIONAL RESOURCES

- For details, see Chapter 3, *Deployment of the Ceph File System*.
- For details, see the *Red Hat Ceph Storage Installation Guide*.
- For details, see the *Configuring Metadata Server Daemons* in the *Red Hat Ceph Storage File System Guide*.

CHAPTER 5. MANAGEMENT OF CEPH FILE SYSTEM VOLUMES, SUB-VOLUMES, AND SUB-VOLUME GROUPS

As a storage administrator, you can use Red Hat's Ceph Container Storage Interface (CSI) to manage Ceph File System (CephFS) exports. This also allows you to use other services, such as OpenStack's file system service (Manila) by having a common command-line interface to interact with. The **volumes** module for the Ceph Manager daemon (**ceph-mgr**) implements the ability to export Ceph File Systems (CephFS).

The Ceph Manager volumes module implements the following file system export abstractions:

- CephFS volumes
- CephFS subvolume groups
- CephFS subvolumes

This chapter describes how to work with:

- Ceph File System volumes
- Ceph File System subvolume groups
- Ceph File System subvolumes

5.1. CEPH FILE SYSTEM VOLUMES

As a storage administrator, you can create, list, and remove Ceph File System (CephFS) volumes. CephFS volumes are an abstraction for Ceph File Systems.

This section describes how to:

- Create a file system volume.
- List file system volume.
- Remove a file system volume.

5.1.1. Creating a file system volume

Ceph Manager's orchestrator module creates a Meta Data Server (MDS) for the Ceph File System (CephFS). This section describes how to create CephFS volume.

NOTE

This creates the Ceph File System, along with the data and metadata pools.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.

Procedure

1. Create a CephFS volume:

   Syntax

   ```
   ceph fs volume create VOLUME_NAME
   ```

   Example

   ```
   [root@mon ~]# ceph fs volume create cephfs
   ```

5.1.2. Listing file system volume

This section describes the step to list the Ceph File system (CephFS) volumes.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS volume.

Procedure

1. List the CephFS volume:

   Example

   ```
   [root@mon ~]# ceph fs volume ls
   ```

5.1.3. Removing a file system volume

Ceph Manager's orchestrator module removes the Meta Data Server (MDS) for the Ceph File System (CephFS). This section shows how to remove the Ceph File system (CephFS) volume.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS volume.

Procedure

1. Remove the CephFS volume:

Syntax

```
ceph fs volume rm VOLUME_NAME [--yes-i-really-mean-it]
```

Example

```
[root@mon ~]# ceph fs volume rm cephfs --yes-i-really-mean-it
```

5.2. CEPH FILE SYSTEM SUBVOLUMES

As a storage administrator, you can create, list, fetch absolute path, fetch metadata, and remove Ceph File System (CephFS) subvolumes.

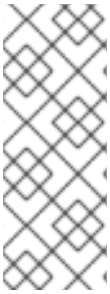
You can also authorize Ceph client users for CephFS subvolumes. Additionally, you can also create, list and remove snapshots of these subvolumes. CephFS subvolumes are an abstraction for independent Ceph File Systems directory trees.

This section describes how to:

- Create a file system subvolume.
- List file system subvolume.
- Authorizing Ceph client users for File System subvolumes.
- Deauthorizing Ceph client users for File System subvolumes.
- Listing Ceph client users for File System subvolumes.
- Evicting Ceph client users from File System subvolumes.
- Resizing a file system subvolume.
- Fetch absolute path of a file system subvolume.
- Fetch metadata of a file system subvolume.
- Create snapshot of a file system subvolume.
- List snapshots of a file system subvolume.
- Fetching metadata of the snapshots of a file system subvolume.
- Remove a file system subvolume.
- Remove snapshot of a file system subvolume.

5.2.1. Creating a file system subvolume

This section describes how to create Ceph File system (CephFS) subvolume.



NOTE

When creating a subvolume you can specify its subvolume group, data pool layout, uid, gid, file mode in octal numerals, and size in bytes. The subvolume can be created in a separate RADOS namespace by specifying `--namespace-isolated` option. By default a subvolume is created within the default subvolume group, and with an octal file mode '755', uid of its subvolume group, gid of its subvolume group, data pool layout of its parent directory and no size limit.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.

Procedure

1. Create a CephFS subvolume:

   Syntax

   ```
   ceph fs subvolume create VOLUME_NAME SUBVOLUME_NAME [--size SIZE_IN_BYTES --group_name SUBVOLUME_GROUP_NAME --pool_layout DATA_POOL_NAME --uid _UID --gid GID --mode OCTAL_MODE] [--namespace-isolated]
   ```

   Example

   ```
   [root@mon ~]# ceph fs subvolume create cephfs sub0 --group_name subgroup0 --namespace-isolated
   ```

   The command succeeds even if the subvolume already exists.

5.2.2. Listing file system subvolume

This section describes the step to list the Ceph File system (CephFS) subvolume.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS subvolume.

Procedure

1. List the CephFS subvolume:

   Syntax

```
ceph fs subvolume ls VOLUME_NAME [--group_name SUBVOLUME_GROUP_NAME]
```

Example

```
[root@mon ~]# ceph fs subvolume ls cephfs --group_name subgroup0
```

5.2.3. Authorizing Ceph client users for File System subvolumes

Red Hat Ceph Storage cluster uses **cephx** for authentication, which is enabled by default. To use **cephx** with the Ceph File System (CephFS) subvolumes, create a user with the correct authorization capabilities on a Ceph Monitor node and make its key available on the node where the Ceph File System is mounted. You can authorize the user to access the CephFS subvolumes using the **authorize** command.

Prerequisites

- A working Red Hat Ceph Storage cluster with CephFS deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS volume created.

Procedure

1. Create a CephFS subvolume:

   Syntax

   ```
   ceph fs subvolume create VOLUME_NAME SUBVOLUME_NAME [--size SIZE_IN_BYTES --group_name SUBVOLUME_GROUP_NAME --pool_layout DATA_POOL_NAME --uid _UID --gid GID --mode OCTAL_MODE] [--namespace-isolated]
   ```

   Example

   ```
   [root@mon ~]# ceph fs subvolume create cephfs sub0 --group_name subgroup0 --namespace-isolated
   ```

   The command succeeds even if the subvolume already exists.

2. Authorize the Ceph client user,with either read or write access to CephFS subvolumes:

   Syntax

   ```
   ceph fs subvolume authorize VOLUME_NAME SUBVOLUME_NAME AUTH_ID [--group_name=GROUP_NAME] [--access_level=ACCESS_LEVEL]
   ```

   The ***ACCESS_LEVEL*** can be either **r** or **rw** and ***AUTH_ID*** is the Ceph client user, which is a string.

   Example

```
[root@mon ~]# ceph fs subvolume authorize cephfs sub0 guest --group_name=subgroup0 --
access_level=rw
```

In this example, the 'client.guest' is authorized to access subvolume **sub0** in the subvolume group **subgroup0**.

Additional Resources

- See the *Ceph authentication configuration* section in the *Red Hat Ceph Storage Configuration Guide*.
- See the *Creating a file system volume* section in the *Red Hat Ceph Storage Ceph File System Guide*.

5.2.4. Deauthorizing Ceph client users for File System subvolumes

You can deauthorize the user to access the Ceph File System (CephFS) subvolumes using the **deauthorize** command.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS volume and subvolume created.
- Ceph client users authorized to access CephFS subvolumes.

Procedure

- Deauthorize the Ceph client user's access to CephFS subvolumes:

  Syntax

  ```
  ceph fs subvolume deauthorize VOLUME_NAME SUBVOLUME_NAME AUTH_ID [--
  group_name=GROUP_NAME]
  ```

  The ***AUTH_ID*** is the Ceph client user, which is a string.

  Example

  ```
  [root@mon ~]# ceph fs subvolume deauthorize cephfs sub0 guest --group_name=subgroup0
  ```

  In this example, the 'client.guest' is deauthorized to access subvolume **sub0** in the subvolume group **subgroup0**.

Additional Resources

- See the *Authorizing Ceph client users for File System subvolumes* section in the *Red Hat Ceph Storage Ceph File System Guide*.

5.2.5. Listing Ceph client users for File System subvolumes

You can list the user's access to the Ceph File System (CephFS) subvolumes using the **authorized_list** command.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS volume and subvolume created.
- Ceph client users authorized to access CephFS subvolumes.

Procedure

- List the Ceph client user's access to CephFS subvolumes:

  Syntax

  ```
  ceph fs subvolume authorized_list VOLUME_NAME SUBVOLUME_NAME [--group_name=GROUP_NAME]
  ```

  Example

  ```
  [root@mon ~]# ceph fs subvolume authorized_list cephfs sub0 --group_name=subgroup0
  [
      {
          "guest": "rw"
      }
  ]
  ```

Additional Resources

- See the *Authorizing Ceph client users for File System subvolumes* section in the *Red Hat Ceph Storage Ceph File System Guide*.

5.2.6. Evicting Ceph client users from File System subvolumes

You can evict the Ceph client user from the Ceph File System (CephFS) subvolumes using the **evict** command based on the **_AUTH_ID** and the subvolume mounted.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS volume and subvolume created.

- Ceph client users authorized to access CephFS subvolumes.

Procedure

- Evict the Ceph client user from the CephFS subvolumes:

  Syntax

  ```
  ceph fs subvolume evict VOLUME_NAME SUBVOLUME_NAME AUTH_ID [--group_name=GROUP_NAME]
  ```

  The ***AUTH_ID*** is the Ceph client user, which is a string.

  Example

  ```
  [root@mon ~]# ceph fs subvolume evict cephfs sub0 guest --group_name=subgroup0
  ```

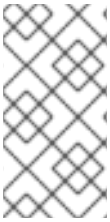
  In this example, the 'client.guest' is evicted from the subvolumegroup **subgroup0**.

Additional Resources

- See the *Authorizing Ceph client users for File System subvolumes* section in the *Red Hat Ceph Storage Ceph File System Guide*.

5.2.7. Resizing a file system subvolume

This section describes the step to resize the Ceph File system (CephFS) subvolume.



NOTE

The **ceph fs subvolume resize** command resizes the subvolume quota using the size specified by **new_size**. The **--no_shrink** flag prevents the subvolume to shrink below the current used size of the subvolume. The subvolume can be resized to an infinite size by passing **inf** or **infinite** as the **new_size**.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS subvolume.

Procedure

1. Resize a CephFS subvolume:

   Syntax

   ```
   ceph fs subvolume resize VOLUME_NAME SUBVOLUME_NAME_ NEW_SIZE [--group_name SUBVOLUME_GROUP_NAME] [--no_shrink]
   ```

Example

```
[root@mon ~]# ceph fs subvolume resize cephfs sub0 1024000000 --group_name
subgroup0 --no_shrink
```

5.2.8. Fetching absolute path of a file system subvolume

This section shows how to fetch the absolute path of a Ceph File system (CephFS) subvolume.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS subvolume.

Procedure

1. Fetch the absolute path of the CephFS subvolume:

Syntax

```
ceph fs subvolume getpath VOLUME_NAME SUBVOLUME_NAME [--group_name
SUBVOLUME_GROUP_NAME]
```

Example

```
[root@mon ~]# ceph fs subvolume getpath cephfs sub0 --group_name subgroup0

/volumes/subgroup0/sub0/c10cc8b8-851d-477f-99f2-1139d944f691
```

5.2.9. Fetching metadata of a file system subvolume

This section shows how to fetch metadata of a Ceph File system (CephFS) subvolume.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS subvolume.

Procedure

1. Fetch the metadata of a CephFS subvolume:

Syntax

```
ceph fs subvolume info VOLUME_NAME SUBVOLUME_NAME [--group_name
SUBVOLUME_GROUP_NAME]
```

Example

```
[root@mon ~]# ceph fs subvolume info cephfs sub0 --group_name subgroup0
```

Example output

```
{
    "atime": "2020-09-08 09:27:15",
    "bytes_pcent": "undefined",
    "bytes_quota": "infinite",
    "bytes_used": 0,
    "created_at": "2020-09-08 09:27:15",
    "ctime": "2020-09-08 09:27:15",
    "data_pool": "cephfs_data",
    "features": [
        "snapshot-clone",
        "snapshot-autoprotect",
        "snapshot-retention"
    ],
    "gid": 0,
    "mode": 16877,
    "mon_addrs": [
        "10.8.128.22:6789",
        "10.8.128.23:6789",
        "10.8.128.24:6789"
    ],
    "mtime": "2020-09-08 09:27:15",
    "path": "/volumes/subgroup0/sub0/6d01a68a-e981-4ebe-84ca-96b660879173",
    "pool_namespace": "",
    "state": "complete",
    "type": "subvolume",
    "uid": 0
}
```

The output format is a json and contains the following fields:

- **atime**: access time of subvolume path in the format "YYYY-MM-DD HH:MM:SS".
- **mtime**: modification time of subvolume path in the format "YYYY-MM-DD HH:MM:SS".
- **ctime**: change time of subvolume path in the format "YYYY-MM-DD HH:MM:SS".
- **uid**: uid of subvolume path.
- **gid**: gid of subvolume path.
- **mode**: mode of subvolume path.
- **mon_addrs**: list of monitor addresses.
- **bytes_pcent**: quota used in percentage if quota is set, else displays "undefined".

- **bytes_quota**: quota size in bytes if quota is set, else displays "infinite".
- **bytes_used**: current used size of the subvolume in bytes.
- **created_at**: time of creation of subvolume in the format "YYYY-MM-DD HH:MM:SS".
- **data_pool**: data pool the subvolume belongs to.
- **path**: absolute path of a subvolume.
- **type**: subvolume type indicating whether it's clone or subvolume.
- **pool_namespace**: RADOS namespace of the subvolume.
- **features**: features supported by the subvolume, such as , "snapshot-clone", "snapshot-autoprotect", or "snapshot-retention".
- **state**: current state of the subvolume, such as, "complete" or "snapshot-retained"

5.2.10. Creating snapshot of a file system subvolume

This section shows how to create snapshots of Ceph File System (CephFS) subvolume.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS subvolume.
- In addition to read (**r**) and write (**w**) capabilities, clients also require **s** flag on a directory path within the file system.

Procedure

1. Verify that the **s** flag is set on the directory:

   Syntax

   ```
   ceph auth get CLIENT_NAME
   ```

   Example

   ```
   client.0
     key: AQAz7EVWygILFRAAdIcuJ12opU/JKyfFmxhuaw==
     caps: [mds] allow rw, allow rws path=/bar 1
     caps: [mon] allow r
     caps: [osd] allow rw tag cephfs data=cephfs_a 2
   ```

   1 2 In the example, **client.0** can create or delete snapshots in the **bar** directory of file system **cephfs_a**.

2. Create a snapshot of the Ceph File System subvolume:

Syntax

```
ceph fs subvolume snapshot create VOLUME_NAME _SUBVOLUME_NAME
_SNAP_NAME [--group_name GROUP_NAME]
```

Example

```
[root@mon ~]# ceph fs subvolume snapshot create cephfs sub0 snap0 --group_name
subgroup0
```

5.2.11. Cloning subvolumes from snapshots

Subvolumes can be created by cloning subvolume snapshots. It is an asynchronous operation involving copying data from a snapshot to a subvolume.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- To create or delete snapshots, in addition to read and write capability, clients require **s** flag on a directory path within the filesystem.

Syntax

```
CLIENT_NAME
   key: AQAz7EVWygILFRAAdIcuJ12opU/JKyfFmxhuaw==
   caps: [mds] allow rw, allow rws path=DIRECTORY_PATH
   caps: [mon] allow r
   caps: [osd] allow rw tag cephfs data=DIRECTORY_NAME
```

In the following example, **client.0** can create or delete snapshots in the **bar** directory of filesystem **cephfs_a**.

Example

```
client.0
   key: AQAz7EVWygILFRAAdIcuJ12opU/JKyfFmxhuaw==
   caps: [mds] allow rw, allow rws path=/bar
   caps: [mon] allow r
   caps: [osd] allow rw tag cephfs data=cephfs_a
```

Procedure

1. Create a Ceph File System (CephFS) volume:

Syntax

```
ceph fs volume create VOLUME_NAME
```

Example

```
[root@mon ~]# ceph fs volume create cephfs
```

This creates the CephFS file system, its data and metadata pools.

2. Create a subvolume group. By default, the subvolume group is created with an octal file mode '755', and data pool layout of its parent directory.

Syntax

```
ceph fs subvolumegroup create VOLUME_NAME GROUP_NAME [--pool_layout
DATA_POOL_NAME --uid UID --gid GID --mode OCTAL_MODE]
```

Example

```
[root@mon ~]# ceph fs subvolumegroup create cephfs subgroup0
```

3. Create a subvolume. By default, a subvolume is created within the default subvolume group, and with an octal file mode '755', uid of its subvolume group, gid of its subvolume group, data pool layout of its parent directory and no size limit.

Syntax

```
ceph fs subvolume create VOLUME_NAME SUBVOLUME_NAME [--size SIZE_IN_BYTES -
-group_name SUBVOLUME_GROUP_NAME --pool_layout DATA_POOL_NAME --uid _UID
--gid GID --mode OCTAL_MODE]
```

Example

```
[root@mon ~]# ceph fs subvolume create cephfs sub0 --group_name subgroup0
```

4. Create a snapshot of a subvolume:

Syntax

```
ceph fs subvolume snapshot create VOLUME_NAME _SUBVOLUME_NAME SNAP_NAME
[--group_name SUBVOLUME_GROUP_NAME]
```

Example

```
[root@mon ~]# ceph fs subvolume snapshot create cephfs sub0 snap0  --group_name
subgroup0
```

5. Initiate a clone operation:

NOTE

By default, cloned subvolumes are created in the default group.

a. If the source subvolume and the target clone are in the default group, run the following command:

Syntax

```
ceph fs subvolume snapshot clone VOLUME_NAME SUBVOLUME_NAME SNAP_NAME TARGET_SUBVOLUME_NAME
```

Example

```
[root@mon ~]# ceph fs subvolume snapshot clone cephfs sub0 snap0 clone0
```

b. If the source subvolume is in the non-default group, then specify the source subvolume group in the following command:

Syntax

```
ceph fs subvolume snapshot clone VOLUME_NAME SUBVOLUME_NAME SNAP_NAME TARGET_SUBVOLUME_NAME --group_name SUBVOLUME_GROUP_NAME
```

Example

```
[root@mon ~]# ceph fs subvolume snapshot clone cephfs sub0 snap0 clone0 --group_name subgroup0
```

c. If the target clone is to a non-default group, then specify the target group in the following command:

Syntax

```
ceph fs subvolume snapshot clone VOLUME_NAME SUBVOLUME_NAME SNAP_NAME TARGET_SUBVOLUME_NAME --target_group_name _SUBVOLUME_GROUP_NAME
```

Example

```
[root@mon ~]# ceph fs subvolume snapshot clone cephfs sub0 snap0 clone0 --target_group_name subgroup1
```

6. Check the status of the clone operation:

Syntax

```
ceph fs clone status VOLUME_NAME CLONE_NAME [--group_name TARGET_GROUP_NAME]
```

Example

```
[root@mon ~]# ceph fs clone status cephfs clone0 --group_name subgroup1

{
```

```
  "status": {
    "state": "complete"
  }
}
```

Additional Resources

- See the *Managing Ceph Users* section in the *Red Hat Ceph Storage Administration Guide*.

5.2.12. Listing snapshots of a file system subvolume

This section provides the step to list the snapshots of a Ceph File system (CephFS) subvolume.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS subvolume.
- Snapshots of the subvolume.

Procedure

1. List the snapshots of a CephFS subvolume:

   Syntax

   ```
   ceph fs subvolume snapshot ls VOLUME_NAME SUBVOLUME_NAME [--group_name SUBVOLUME_GROUP_NAME]
   ```

   Example

   ```
   [root@mon ~]# ceph fs subvolume snapshot ls cephfs sub0 --group_name subgroup0
   ```

5.2.13. Fetching metadata of the snapshots of a file system subvolume

This section provides the step to fetch the metadata of the snapshots of a Ceph File system (CephFS) subvolume.

Prerequisites

- A working Red Hat Ceph Storage cluster with CephFS deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS subvolume.
- Snapshots of the subvolume.

Procedure

1. Fetch the metadata of the snapshots of a CephFS subvolume:

   Syntax

   ```
   ceph fs subvolume snapshot info VOLUME_NAME SUBVOLUME_NAME SNAP_NAME [--group_name SUBVOLUME_GROUP_NAME]
   ```

   Example

   ```
   [root@mon ~]# ceph fs subvolume snapshot info cephfs sub0 snap0 --group_name subgroup0
   ```

   Example output

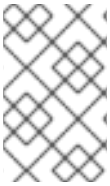
   ```
   {
       "created_at": "2021-09-08 06:18:47.330682",
       "data_pool": "cephfs_data",
       "has_pending_clones": "no",
       "size": 0
   }
   ```

The output format is json and contains the following fields:

- **created_at**: time of creation of snapshot in the format "YYYY-MM-DD HH:MM:SS:ffffff".
- **data_pool**: data pool the snapshot belongs to.
- **has_pending_clones**: "yes" if snapshot clone is in progress otherwise "no".
- **size**: snapshot size in bytes.

5.2.14. Removing a file system subvolume

This section describes the step to remove the Ceph File system (CephFS) subvolume.



NOTE

The **ceph fs subvolume rm** command removes the subvolume and its contents in two steps. First, it moves the subvolume to a trash folder, and then asynchronously purges its contents.

A subvolume can be removed retaining existing snapshots of the subvolume using the **--retain-snapshots** option. If snapshots are retained, the subvolume is considered empty for all operations not involving the retained snapshots. Retained snapshots can be used as a clone source to recreate the subvolume, or cloned to a newer subvolume.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.

- Read and write capability on the Ceph Manager nodes.
- A CephFS subvolume.

Procedure

1. Remove a CephFS subvolume:

   Syntax

   ```
   ceph fs subvolume rm VOLUME_NAME SUBVOLUME_NAME [--group_name SUBVOLUME_GROUP_NAME] [--force] [--retain-snapshots]
   ```

   Example

   ```
   [root@mon ~]# ceph fs subvolume rm cephfs sub0 --group_name subgroup0 --retain snapshots
   ```

2. To recreate a subvolume from a retained snapshot:

   Syntax

   ```
   ceph fs subvolume snapshot clone VOLUME_NAME DELETED_SUBVOLUME RETAINED_SNAPSHOT NEW_SUBVOLUME --group_name SUBVOLUME_GROUP_NAME --target_group_name SUBVOLUME_TARGET_GROUP_NAME
   ```

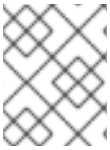
   **NEW_SUBVOLUME* - can either be the same subvolume which was deleted earlier or clone it to a new subvolume.

   Example

   ```
   ceph fs subvolume snapshot clone cephfs sub0 snap0 sub1 --group_name subgroup0 --target_group_name subgroup0
   ```

5.2.15. Removing snapshot of a file system subvolume

This section provides the step to remove snapshots of a Ceph File system (CephFS) subvolume group.



NOTE

Using the **--force** flag allows the command to succeed that would otherwise fail if the snapshot did not exist.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A Ceph File System volume.

- A snapshot of the subvolume group.

Procedure

1. Remove the snapshot of the CephFS subvolume:

   Syntax

   ceph fs subvolume snapshot rm *VOLUME_NAME SUBVOLUME_NAME _SNAP_NAME* [--group_name *GROUP_NAME* --force]

   Example

   [root@mon ~]# ceph fs subvolume snapshot rm cephfs sub0 snap0 --group_name subgroup0 --force

5.3. CEPH FILE SYSTEM SUBVOLUME GROUPS

As a storage administrator, you can create, list, fetch absolute path, and remove Ceph File System (CephFS) subvolume groups. Additionally, you can also create, list and remove snapshots of these subvolume groups. CephFS subvolume groups are abstractions at a directory level which effects policies, for example, file layouts, across a set of subvolumes.

This section describes how to:

- Create a file system subvolume group.
- List file system subvolume groups.
- Fetch absolute path of a file system subvolume group.
- Create snapshot of a file system subvolume group.
- List snapshots of a file system subvolume group.
- Remove snapshot of a file system subvolume group.
- Remove a file system subvolume group.

5.3.1. Creating a file system subvolume group

This section describes how to create Ceph File system (CephFS) subvolume group.

NOTE

When creating a subvolume group you can specify its data pool layout, uid, gid, and file mode in octal numerals. By default, the subvolume group is created with an octal file mode '755', uid '0', gid '0' and data pool layout of its parent directory.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.

- Read and write capability on the Ceph Manager nodes.

Procedure

1. Create a CephFS subvolume group:

   Syntax

   ```
   ceph fs subvolumegroup create VOLUME_NAME GROUP_NAME [--pool_layout
   DATA_POOL_NAME --uid UID --gid GID --mode OCTAL_MODE]
   ```

   Example

   ```
   [root@mon ~]# ceph fs subvolumegroup create cephfs subgroup0
   ```

   The command succeeds even if the subvolume group already exists.

5.3.2. Listing file system subvolume groups

This section describes the step to list the Ceph File system (CephFS) subvolume groups.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS subvolume group.

Procedure

1. List the CephFS subvolume groups:

   Syntax

   ```
   ceph fs subvolumegroup ls VOLUME_NAME
   ```

   Example

   ```
   [root@mon ~]# ceph fs subvolumegroup ls cephfs
   ```

5.3.3. Fetching absolute path of a file system subvolume group

This section shows how to fetch the absolute path of a Ceph File system (CephFS) subvolume group.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.

- Read and write capability on the Ceph Manager nodes.
- A CephFS subvolume group.

Procedure

1. Fetch the absolute path of the CephFS subvolume group:

   Syntax

   ```
   ceph fs subvolumegroup getpath VOLUME_NAME GROUP_NAME
   ```

   Example

   ```
   [root@mon ~]# ceph fs subvolumegroup getpath cephfs subgroup0

   /volumes/subgroup0
   ```

5.3.4. Creating snapshot of a file system subvolume group

This section shows how to create snapshots of Ceph File system (CephFS) subvolume group.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- CephFS subvolume group.
- In addition to read (**r**) and write (**w**) capabilities, clients also require **s** flag on a directory path within the file system.

Procedure

1. Verify that the **s** flag is set on the directory:

   Syntax

   ```
   ceph auth get CLIENT_NAME
   ```

   Example

   ```
   client.0
     key: AQAz7EVWygILFRAAdIcuJ12opU/JKyfFmxhuaw==
     caps: [mds] allow rw, allow rws path=/bar 1
     caps: [mon] allow r
     caps: [osd] allow rw tag cephfs data=cephfs_a 2
   ```

   1 2 In the example, **client.0** can create or delete snapshots in the **bar** directory of file system **cephfs_a**.

2. Create a snapshot of the CephFS subvolume group:

   Syntax

   ```
   ceph fs subvolumegroup snapshot create VOLUME_NAME _GROUP_NAME SNAP_NAME
   ```

   Example

   ```
   [root@mon ~]# ceph fs subvolumegroup snapshot create cephfs subgroup0 snap0
   ```

   The command implicitly snapshots all the subvolumes under the subvolume group.

5.3.5. Listing snapshots of a file system subvolume group

This section provides the steps to list the snapshots of a Ceph File system (CephFS) subvolume group.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS subvolume group.
- Snapshots of the subvolume group.

Procedure

1. List the snapshots of a CephFS subvolume group:

   Syntax

   ```
   ceph fs subvolumegroup snapshot ls VOLUME_NAME GROUP_NAME
   ```

   Example

   ```
   [root@mon ~]# ceph fs subvolumegroup snapshot ls cephfs subgroup0
   ```

5.3.6. Removing snapshot of a file system subvolume group

This section provides the step to remove snapshots of a Ceph File system (CephFS) subvolume group.

NOTE

Using the **--force** flag allows the command to succeed that would otherwise fail if the snapshot did not exist.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.

- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A Ceph File System volume.
- A snapshot of the subvolume group.

Procedure

1. Remove the snapshot of the CephFS subvolume group:

   Syntax

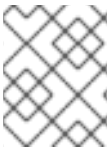
   ```
   ceph fs subvolumegroup snapshot rm VOLUME_NAME GROUP_NAME SNAP_NAME [--force]
   ```

   Example

   ```
   [root@mon ~]# ceph fs subvolumegroup snapshot rm cephfs subgroup0 snap0 --force
   ```

5.3.7. Removing a file system subvolume group

This section shows how to remove the Ceph File system (CephFS) subvolume group.



NOTE

The removal of a subvolume group fails if it is not empty or non-existent. The **--force** flag allows the non-existent subvolume group to be removed.

Prerequisites

- A working Red Hat Ceph Storage cluster with Ceph File System deployed.
- At least read access on the Ceph Monitor.
- Read and write capability on the Ceph Manager nodes.
- A CephFS subvolume group.

Procedure

1. Remove the CephFS subvolume group:

   Syntax

   ```
   ceph fs subvolumegroup rm VOLUME_NAME GROUP_NAME [--force]
   ```

   Example

   ```
   [root@mon ~]# ceph fs subvolumegroup rm cephfs subgroup0 --force
   ```

5.4. ADDITIONAL RESOURCES

- See the *Managing Ceph Users* section in the *Red Hat Ceph Storage Administration Guide*.

APPENDIX A. HEALTH MESSAGES FOR THE CEPH FILE SYSTEM

Cluster health checks

The Ceph Monitor daemons generate health messages in response to certain states of the Metadata Server (MDS). Below is the list of the health messages and their explanation:

mds rank(s) <ranks> have failed

One or more MDS ranks are not currently assigned to any MDS daemon. The storage cluster will not recover until a suitable replacement daemon starts.

mds rank(s) <ranks> are damaged

One or more MDS ranks has encountered severe damage to its stored metadata, and cannot start again until the metadata is repaired.

mds cluster is degraded

One or more MDS ranks are not currently up and running, clients might pause metadata I/O until this situation is resolved. This includes ranks being failed or damaged, and includes ranks which are running on an MDS but are not in the **active** state yet – for example, ranks in the **replay** state.

mds <names> are laggy

The MDS daemons are supposed to send beacon messages to the monitor in an interval specified by the **mds_beacon_interval** option, the default is 4 seconds. If an MDS daemon fails to send a message within the time specified by the **mds_beacon_grace** option, the default is 15 seconds. The Ceph Monitor marks the MDS daemon as **laggy** and automatically replaces it with a standby daemon if any is available.

Daemon-reported health checks

The MDS daemons can identify a variety of unwanted conditions, and return them in the output of the **ceph status** command. These conditions have human readable messages, and also have a unique code starting **MDS_HEALTH**, which appears in JSON output. Below is the list of the daemon messages, their codes, and explanation.

"Behind on trimming..."

Code: MDS_HEALTH_TRIM
CephFS maintains a metadata journal that is divided into log segments. The length of journal (in number of segments) is controlled by the **mds_log_max_segments** setting. When the number of segments exceeds that setting, the MDS starts writing back metadata so that it can remove (trim) the oldest segments. If this process is too slow, or a software bug is preventing trimming, then this health message appears. The threshold for this message to appear is for the number of segments to be double **mds_log_max_segments**.

"Client <name> failing to respond to capability release"

Code: MDS_HEALTH_CLIENT_LATE_RELEASE, MDS_HEALTH_CLIENT_LATE_RELEASE_MANY
CephFS clients are issued capabilities by the MDS. The capabilities work like locks. Sometimes, for example when another client needs access, the MDS requests clients to release their capabilities. If the client is unresponsive, it might fail to do so promptly, or fail to do so at all. This message appears if a client has taken a longer time to comply than the time specified by the **mds_revoke_cap_timeout** option (default is 60 seconds).

"Client <name> failing to respond to cache pressure"

Code: MDS_HEALTH_CLIENT_RECALL, MDS_HEALTH_CLIENT_RECALL_MANY
Clients maintain a metadata cache. Items, such as inodes, in the client cache are also pinned in the

MDS cache. When the MDS needs to shrink its cache to stay within its own cache size limits, the MDS sends messages to clients to shrink their caches too. If a client is unresponsive, it can prevent the MDS from properly staying within its cache size, and the MDS might eventually run out of memory and terminate unexpectedly. This message appears if a client has taken more time to comply than the time specified by the **mds_recall_state_timeout** option (default is 60 seconds). See Understanding MDS Cache Size Limits for details.

"Client name failing to advance its oldest client/flush tid"

Code: MDS_HEALTH_CLIENT_OLDEST_TID, MDS_HEALTH_CLIENT_OLDEST_TID_MANY
The CephFS protocol for communicating between clients and MDS servers uses a field called **oldest tid** to inform the MDS of which client requests are fully complete so that the MDS can forget about them. If an unresponsive client is failing to advance this field, the MDS might be prevented from properly cleaning up resources used by client requests. This message appears if a client has more requests than the number specified by the **max_completed_requests** option (default is 100000) that are complete on the MDS side but have not yet been accounted for in the client's **oldest tid** value.

"Metadata damage detected"

Code: MDS_HEALTH_DAMAGE
Corrupt or missing metadata was encountered when reading from the metadata pool. This message indicates that the damage was sufficiently isolated for the MDS to continue operating, although client accesses to the damaged subtree return I/O errors. Use the **damage ls** administration socket command to view details on the damage. This message appears as soon as any damage is encountered.

"MDS in read-only mode"

Code: MDS_HEALTH_READ_ONLY
The MDS has entered into read-only mode and will return the **EROFS** error codes to client operations that attempt to modify any metadata. The MDS enters into read-only mode:

- If it encounters a write error while writing to the metadata pool.
- If the administrator forces the MDS to enter into read-only mode by using the **force_readonly** administration socket command.

"<N> slow requests are blocked"

Code: MDS_HEALTH_SLOW_REQUEST
One or more client requests have not been completed promptly, indicating that the MDS is either running very slowly, or encountering a bug. Use the **ops** administration socket command to list outstanding metadata operations. This message appears if any client requests have taken more time than the value specified by the **mds_op_complaint_time** option (default is 30 seconds).

"Too many inodes in cache"

Code: MDS_HEALTH_CACHE_OVERSIZED

The MDS has failed to trim its cache to comply with the limit set by the administrator. If the MDS cache becomes too large, the daemon might exhaust available memory and terminate unexpectedly. By default, this message appears if the MDS cache size is 50% greater than its limit.

Additional Resources

- See the *Metadata Server cache size limits* section in the *Red Hat Ceph Storage File System Guide* for details.

APPENDIX B. METADATA SERVER DAEMON CONFIGURATION REFERENCE

Refer the list commands that can be used for Metadata Server (MDS) daemon configuration.

mon_force_standby_active

Description

If set to **true**, monitors force MDS in standby replay mode to be active. Set under the **[mon]** or **[global]** section in the Ceph configuration file.

Type

Boolean

Default

true

max_mds

Description

The number of active MDS daemons during cluster creation. Set under the **[mon]** or **[global]** section in the Ceph configuration file.

Type

32-bit Integer

Default

1

mds_cache_memory_limit

Description

The memory limit the MDS enforces for its cache. Red Hat recommends to use this parameter instead of the **mds cache size** parameter.

Type

64-bit Integer Unsigned

Default

1073741824

mds_cache_reservation

Description

The cache reservation, memory or inodes, for the MDS cache to maintain. The value is a percentage of the maximum cache configured. Once the MDS begins dipping into its reservation, it recalls client state until its cache size shrinks to restore the reservation.

Type

Float

Default

0.05

mds_cache_size

Description

The number of inodes to cache. A value of 0 indicates an unlimited number. Red Hat recommends to use the **mds_cache_memory_limit** to limit the amount of memory the MDS cache uses.

Type

32-bit Integer

Default

0

mds_cache_mid

Description

The insertion point for new items in the cache LRU, from the top.

Type

Float

Default

0.7

mds_dir_commit_ratio

Description

The fraction of directory contains erroneous information before Ceph commits using a full update, instead of partial update.

Type

Float

Default

0.5

mds_dir_max_commit_size

Description

The maximum size of a directory update before Ceph breaks the directory into smaller transactions, in MB.

Type

32-bit Integer

Default

90

mds_decay_halflife

Description

The half-life of MDS cache temperature.

Type

Float

Default

5

mds_beacon_interval

Description

The frequency, in seconds, of beacon messages sent to the monitor.

Type

Float

Default

4

mds_beacon_grace

Description

The interval without beacons before Ceph declares an MDS **laggy**, and possibly replace it.

Type

Float

Default

15

mds_blacklist_interval

Description

The blacklist duration for failed MDS daemons in the OSD map.

Type

Float

Default

24.0*60.0

mds_session_timeout

Description

The interval, in seconds, of client inactivity before Ceph times out capabilities and leases.

Type

Float

Default

60

mds_session_autoclose

Description

The interval, in seconds, before Ceph closes a **laggy** client's session.

Type

Float

Default

300

mds_reconnect_timeout

Description

The interval, in seconds, to wait for clients to reconnect during MDS restart.

Type

Float

Default

45

mds_tick_interval

Description

How frequently the MDS performs internal periodic tasks.

Type

Float

Default

5

mds_dirstat_min_interval

Description

The minimum interval, in seconds, to try to avoid propagating recursive statistics up the tree.

Type

Float

Default

1

mds_scatter_nudge_interval

Description

How quickly changes in directory statistics propagate up.

Type

Float

Default

5

mds_client_prealloc_inos

Description

The number of inode numbers to preallocate per client session.

Type

32-bit Integer

Default

1000

mds_early_reply

Description

Determines whether the MDS allows clients to see request results before they commit to the journal.

Type

Boolean

Default

true

mds_use_tmap

Description

Use **trivialmap** for directory updates.

Type

Boolean

Default

true

mds_default_dir_hash

Description

The function to use for hashing files across directory fragments.

Type

32-bit Integer

Default

2,that is, **rjenkins**

mds_log

Description

Set to **true** if the MDS should journal metadata updates. Disable for benchmarking only.

Type

Boolean

Default

true

mds_log_skip_corrupt_events

Description

Determines whether the MDS tries to skip corrupt journal events during journal replay.

Type

Boolean

Default

false

mds_log_max_events

Description

The maximum events in the journal before Ceph initiates trimming. Set to **-1** to disable limits.

Type

32-bit Integer

Default

-1

mds_log_max_segments

Description

The maximum number of segments or objects, in the journal before Ceph initiates trimming. Set to **-1** to disable limits.

Type

32-bit Integer

Default

30

mds_log_max_expiring

Description

The maximum number of segments to expire in parallels.

Type

32-bit Integer

Default

20

mds_log_eopen_size

Description

The maximum number of inodes in an **EOpen** event.

Type

32-bit Integer

Default

100

mds_bal_sample_interval

Description

Determines how frequently to sample directory temperature, when making fragmentation decisions.

Type

Float

Default

3

mds_bal_replicate_threshold

Description

The maximum temperature before Ceph attempts to replicate metadata to other nodes.

Type

Float

Default

8000

mds_bal_unreplicate_threshold

Description

The minimum temperature before Ceph stops replicating metadata to other nodes.

Type

Float

Default

0

mds_bal_frag

Description

Determines whether the MDS fragments directories.

Type

Boolean

Default

false

mds_bal_split_size

Description

The maximum directory size before the MDS splits a directory fragment into smaller bits. The root directory has a default fragment size limit of 10000.

Type

32-bit Integer

Default

10000

mds_bal_split_rd

Description

The maximum directory read temperature before Ceph splits a directory fragment.

Type

Float

Default

25000

mds_bal_split_wr

Description

The maximum directory write temperature before Ceph splits a directory fragment.

Type

Float

Default

10000

mds_bal_split_bits

Description

The number of bits by which to split a directory fragment.

Type

32-bit Integer

Default

3

mds_bal_merge_size

Description

The minimum directory size before Ceph tries to merge adjacent directory fragments.

Type

32-bit Integer

Default

50

mds_bal_merge_rd

Description

The minimum read temperature before Ceph merges adjacent directory fragments.

Type

Float

Default

1000

mds_bal_merge_wr

Description

The minimum write temperature before Ceph merges adjacent directory fragments.

Type

Float

Default

1000

mds_bal_interval

Description

The frequency, in seconds, of workload exchanges between MDS nodes.

Type

32-bit Integer

Default

10

mds_bal_fragment_interval

Description

The frequency, in seconds, of adjusting directory fragmentation.

Type

32-bit Integer

Default

5

mds_bal_idle_threshold

Description

The minimum temperature before Ceph migrates a subtree back to its parent.

Type

Float

Default

0

mds_bal_max

Description

The number of iterations to run balancer before Ceph stops. For testing purposes only.

Type

32-bit Integer

Default

-1

mds_bal_max_until

Description

The number of seconds to run balancer before Ceph stops. For testing purposes only.

Type

32-bit Integer

Default

-1

mds_bal_mode

Description

The method for calculating MDS load:

- **1** = Hybrid.
- **2** = Request rate and latency.
- **3** = CPU load.

Type

32-bit Integer

Default

0

mds_bal_min_rebalance

Description

The minimum subtree temperature before Ceph migrates.

Type

Float

Default

0.1

mds_bal_min_start

Description

The minimum subtree temperature before Ceph searches a subtree.

Type

Float

Default

0.2

mds_bal_need_min

Description

The minimum fraction of target subtree size to accept.

Type

Float

Default

0.8

mds_bal_need_max

Description

The maximum fraction of target subtree size to accept.

Type

Float

Default

1.2

mds_bal_midchunk

Description

Ceph migrates any subtree that is larger than this fraction of the target subtree size.

Type

Float

Default

0.3

mds_bal_minchunk

Description

Ceph ignores any subtree that is smaller than this fraction of the target subtree size.

Type

Float

Default

0.001

mds_bal_target_removal_min

Description

The minimum number of balancer iterations before Ceph removes an old MDS target from the MDS map.

Type

32-bit Integer

Default

5

mds_bal_target_removal_max

Description

The maximum number of balancer iterations before Ceph removes an old MDS target from the MDS map.

Type

32-bit Integer

Default

10

mds_replay_interval

Description

The journal poll interval when in **standby-replay** mode for a **hot standby**.

Type

Float

Default

1

mds_shutdown_check

Description

The interval for polling the cache during MDS shutdown.

Type

32-bit Integer

Default

0

mds_thrash_exports

Description

Ceph randomly exports subtrees between nodes. For testing purposes only.

Type

32-bit Integer

Default

0

mds_thrash_fragments

Description

Ceph randomly fragments or merges directories.

Type

32-bit Integer

Default

0

mds_dump_cache_on_map

Description

Ceph dumps the MDS cache contents to a file on each MDS map.

Type

Boolean

Default

false

mds_dump_cache_after_rejoin

Description

Ceph dumps MDS cache contents to a file after rejoining the cache during recovery.

Type

Boolean

Default

false

mds_verify_scatter

Description

Ceph asserts that various scatter/gather invariants are **true**. For developer use only.

Type

Boolean

Default

false

mds_debug_scatterstat

Description

Ceph asserts that various recursive statistics invariants are **true**. For developer use only.

Type

Boolean

Default

false

mds_debug_frag

Description

Ceph verifies directory fragmentation invariants when convenient. For developer use only.

Type

Boolean

Default

false

mds_debug_auth_pins

Description

The debug authentication pin invariants. For developer use only.

Type

Boolean

Default

false

mds_debug_subtrees

Description

Debugging subtree invariants. For developer use only.

Type

Boolean

Default

false

mds_kill_mdstable_at

Description

Ceph injects MDS failure in MDS Table code. For developer use only.

Type

32-bit Integer

Default

0

mds_kill_export_at

Description

Ceph injects MDS failure in the subtree export code. For developer use only.

Type

32-bit Integer

Default

0

mds_kill_import_at

Description

Ceph injects MDS failure in the subtree import code. For developer use only.

Type

32-bit Integer

Default

0

mds_kill_link_at

Description

Ceph injects MDS failure in hard link code. For developer use only.

Type

32-bit Integer

Default

0

mds_kill_rename_at

Description

Ceph injects MDS failure in the rename code. For developer use only.

Type

32-bit Integer

Default

0

mds_wipe_sessions

Description

Ceph deletes all client sessions on startup. For testing purposes only.

Type

Boolean

Default

0

mds_wipe_ino_prealloc

Description

Ceph deletea inode preallocation metadata on startup. For testing purposes only.

Type

Boolean

Default

0

mds_skip_ino

Description

The number of inode numbers to skip on startup. For testing purposes only.

Type

32-bit Integer

Default

0

mds_standby_for_name

Description

The MDS daemon is a standby for another MDS daemon of the name specified in this setting.

Type

String

Default

N/A

mds_standby_for_rank

Description

An instance of the MDS daemon is a standby for another MDS daemon instance of this rank.

Type

32-bit Integer

Default

-1

mds_standby_replay

Description

Determines whether the MDS daemon polls and replays the log of an active MDS when used as a **hot standby**.

Type

Boolean

Default

false

APPENDIX C. JOURNALER CONFIGURATION REFERENCE

Reference of the list commands that can be used for journaler configuration.

journaler_write_head_interval

Description

How frequently to update the journal head object.

Type

Integer

Required

No

Default

15

journaler_prefetch_periods

Description

How many stripe periods to read ahead on journal replay.

Type

Integer

Required

No

Default

10

journal_prezero_periods

Description

How many stripe periods to zero ahead of write position.

Type

Integer

Required

No

Default

10

journaler_batch_interval

Description

Maximum additional latency in seconds to incur artificially.

Type

Double

Required

No

Default

.001

journaler_batch_max

Description

Maximum bytes that will be delayed flushing.

Type

64-bit Unsigned Integer

Required

No

Default

0

APPENDIX D. CEPH FILE SYSTEM CLIENT CONFIGURATION REFERENCE

This section lists configuration options for Ceph File System (CephFS) FUSE clients. Set them in the Ceph configuration file under the **[client]** section.

client_acl_type

Description

Set the ACL type. Currently, only possible value is **posix_acl** to enable POSIX ACL, or an empty string. This option only takes effect when the **fuse_default_permissions** is set to **false**.

Type

String

Default

"" (no ACL enforcement)

client_cache_mid

Description

Set the client cache midpoint. The midpoint splits the least recently used lists into a hot and warm list.

Type

Float

Default

0.75

client_cache size

Description

Set the number of inodes that the client keeps in the metadata cache.

Type

Integer

Default

16384 (16 MB)

client_caps_release_delay

Description

Set the delay between capability releases in seconds. The delay sets how many seconds a client waits to release capabilities that it no longer needs in case the capabilities are needed for another user space operation.

Type

Integer

Default

5 (seconds)

client_debug_force_sync_read

Description

If set to **true**, clients read data directly from OSDs instead of using a local page cache.

Type

Boolean

Default

false

client_dirsize_rbytes

Description

If set to **true**, use the recursive size of a directory (that is, total of all descendants).

Type

Boolean

Default

true

client_max_inline_size

Description

Set the maximum size of inlined data stored in a file inode rather than in a separate data object in RADOS. This setting only applies if the **inline_data** flag is set on the MDS map.

Type

Integer

Default

4096

client_metadata

Description

Comma-delimited strings for client metadata sent to each MDS, in addition to the automatically generated version, host name, and other metadata.

Type

String

Default

"" (no additional metadata)

client_mount_gid

Description

Set the group ID of CephFS mount.

Type

Integer

Default

-1

client_mount_timeout

Description

Set the timeout for CephFS mount in seconds.

Type

Float

Default

300.0

client_mount_uid

Description

Set the user ID of CephFS mount.

Type

Integer

Default

-1

client_mountpoint

Description

An alternative to the **-r** option of the **ceph-fuse** command.

Type

String

Default

/

client_oc

Description

Enable object caching.

Type

Boolean

Default

true

client_oc_max_dirty

Description

Set the maximum number of dirty bytes in the object cache.

Type

Integer

Default

104857600 (100MB)

client_oc_max_dirty_age

Description

Set the maximum age in seconds of dirty data in the object cache before writeback.

Type

Float

Default

5.0 (seconds)

client_oc_max_objects

Description

Set the maximum number of objects in the object cache.

Type

Integer

Default

1000

client_oc_size

Description

Set how many bytes of data will the client cache.

Type

Integer

Default

209715200 (200 MB)

client_oc_target_dirty

Description

Set the target size of dirty data. Red Hat recommends to keep this number low.

Type

Integer

Default

8388608 (8MB)

client_permissions

Description

Check client permissions on all I/O operations.

Type

Boolean

Default

true

client_quota_df

Description

Report root directory quota for the **statfs** operation.

Type

Boolean

Default

true

client_readahead_max_bytes

Description

Set the maximum number of bytes that the kernel reads ahead for future read operations. Overridden by the **client_readahead_max_periods** setting.

Type

Integer

Default

0 (unlimited)

client_readahead_max_periods

Description

Set the number of file layout periods (object size * number of stripes) that the kernel reads ahead. Overrides the **client_readahead_max_bytes** setting.

Type

Integer

Default

4

client_readahead_min

Description

Set the minimum number bytes that the kernel reads ahead.

Type

Integer

Default

131072 (128KB)

client_snapdir

Description

Set the snapshot directory name.

Type

String

Default

".snap"

client_tick_interval

Description

Set the interval in seconds between capability renewal and other upkeep.

Type

Float

Default

1.0

client_use_random_mds

Description

Choose random MDS for each request.

Type

Boolean

Default

false

fuse_default_permissions

Description

When set to **false**, the **ceph-fuse** utility checks does its own permissions checking, instead of relying on the permissions enforcement in FUSE. Set to false together with the **client acl type=posix_acl** option to enable POSIX ACL.

Type

Boolean

Default

true

DEVELOPER OPTIONS

These options are internal. They are listed here only to complete the list of options.

client_debug_getattr_caps

Description

Check if the reply from the MDS contains required capabilities.

Type

Boolean

Default

false

client_debug_inject_tick_delay

Description

Add artificial delay between client ticks.

Type

Integer

Default

0

client_inject_fixed_oldest_tid

Description, Type

Boolean

Default

false

client_inject_release_failure

Description, Type

Boolean

Default

false

client_trace

Description

The path to the trace file for all file operations. The output is designed to be used by the Ceph synthetic client. See the **ceph-syn(8)** manual page for details.

Type

String

Default

"" (disabled)