Use qtrees to partition your FlexVol volumes

ONTAP 9

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Use qtrees to partition your FlexVol volumes

Qtrees and ONTAP FlexVol volume partitioning

Qtrees enable you to partition FlexVol volumes into smaller segments that can be managed individually. The volume partitioning enabled by qtrees provides a finer level of control when administering storage by project, user, or group. You can use qtrees to better manage quotas, security style, and CIFS oplocks.

ONTAP creates a default qtree for each volume named **qtree0**. If you do not put data in a specific qtree, it's placed in qtree0.

General limitations

You should be aware of the limitations of qtrees before using them in a production environment. Also review the Operation and limitations when using the extended qtree performance monitoring feature.

- Qtree names can be no more than 64 characters.
- Certain special characters used in the qtree names, such as commas and spaces, can cause problems with other ONTAP capabilities and should be avoided.
- You cannot move directories between different qtrees. Only files can be moved between qtrees.
- If you create qtree-level and volume-level shares on the same FlexVol or SCVMM pool, the qtrees appear as directories on the FlexVol share. You should be careful not to accidentally delete them.

Commands for managing and configuring qtrees

You can manage and configure qtrees using the ONTAP CLI. Depending on what you want to do, you should use the following commands to administer qtrees.

The command `volume rehost` can cause other concurrent administrative operations targeted at the same volume to fail.

If you want to…	Use this command…
Create a qtree	`volume qtree create`
Display a filtered list of qtrees	`volume qtree show`
Delete a qtree	`volume qtree delete` This command will fail unless the qtree is empty or the `-force true` flag is used.
Modify a qtree's UNIX permissions	`volume qtree modify -unix-permissions`

Modify a qtree's CIFS oplocks setting	`volume qtree oplocks`
Modify a qtree's security setting	`volume qtree security`
Rename a qtree	`volume qtree rename`
Display a qtree's statistics	`volume qtree statistics`
Reset a qtree's statistics	`volume qtree statistics -reset`

Extended qtree performance monitoring

Beginning with ONTAP 9.16.1, you can use the ONTAP REST API to access the extended qtree monitoring capabilities which includes latency metrics and historical statistics.

The ONTAP REST API includes several endpoints related to qtrees. Prior to ONTAP 9.16.1, customers could access real-time statistics for qtrees, including IO operations per second (IOPs) as well as throughput for read, write, and other operations.

The extended qtree performance monitoring available beginning with ONTAP 9.16.1 gives you the ability to monitor real-time latency statistics as well as IOPs and throughput for NFSv3, NFSv4.0, NFSv4.1, NFSv4.2, pNFS (technically a part of NFSv4.1 and NFSv4.2), and CIFS. It also collects and archives statistics to allow viewing of historical performance data.

This extended monitoring provides storage administrators with greater insight into system performance. You can use this data to identify high-use qtrees, potential bottlenecks, and other areas when working to improve quality of service. Being able to analyze these metrics, including trends over a longer period of time, enables you to make more informed data-driven decisions.

Operation and limitations

There are several operational characteristics, including limitations, you should consider before using the extended qtree performance monitoring feature in a production environment.

Remount required

After enabling qtree extended monitoring, you need to remount the affected volume to activate the feature.

Availability of statistics

After enabling extended performance monitoring, the statistical data is not immediately available. This includes IOPS, throughput, and latency statistics. It can take up to five minutes before this data is displayed for a qtree.

Qtrees per cluster

You can enable extended performance monitoring for a maximum of 50,000 qtrees in an ONTAP cluster.

Access extended metrics using the ONTAP REST API

Beginning with ONTAP 9.16.1, you can access the extended qtree performance monitoring feature through the ONTAP REST API. The basic capabilities fall into several categories as described below.

Enable and disable extended performance monitoring

You can access the property `ext_performance_monitoring.enabled` at the endpoint `/api/storage/qtrees` to enable or disable the extended monitoring feature. The POST and PATCH methods are available depending on whether you are creating a new qtree or configuring an existing qtree.

Retrieve global monitoring metrics and settings

Several new global properties have been added to the `/api/storage/qtrees` endpoint. You can retrieve these fields using the GET method.

Retrieve metrics for a specific qtree

You can use the GET method at the endpoint `/api/storage/qtrees/{volume.uuid}/{id}/metrics` to retrieve the new statistics and metrics properties for a specific qtree as defined at a specific volume.

Upgrading and reverting

If you enable the feature in ONTAP 9.16.1, you can upgrade to a subsequent ONTAP release without restrictions. However, there are two scenarios to consider.

Upgrade to 9.16.1 and handling mixed version clusters

The extended performance monitoring feature cannot be used (that is, `ext_performance_monitoring.enabled` cannot be set to `true`) until the effective cluster version (ECV) of the cluster is at 9.16.1.

Revert from 9.16.1

If any qtrees have the property `ext_performance_monitoring.enabled` set to `true`, reverting to 9.15.1 from 9.16.1 is not allowed. The revert operation is blocked. The best practice is to set `ext_performance_monitoring.enabled` to `false` for all qtrees prior to reverting to an earlier ONTAP release.

Learn more

Learn more about the ONTAP REST API, including what's new with the ONTAP REST API, from the ONTAP automation documentation. You should also review the ONTAP automation documentation for details about the ONTAP REST API qtree endpoints.

Obtain a qtree junction path

You can mount an individual qtree by obtaining the junction path or namespace path of the qtree. The qtree path displayed by the CLI command `qtree show -instance` is of the format `/vol/<volume_name>/<qtree_name>`. However, this path does not refer to the junction path or namespace path of the qtree.

Learn more about `qtree show` in the ONTAP command reference.

About this task

You need to know the junction path of the volume to obtain the junction path or namespace path of the qtree.

Steps

1. Use the `vserver volume junction-path` command to obtain the junction path of a volume.

   The following example displays the junction path of the volume named vol1 located on the storage virtual machine (SVM) named vs0:

```
cluster1::> volume show -volume vol1 -vserver vs0 -fields junction-path

------- ------ -------------

vs0 vol1 /vol1
```

From the above output, the volume's junction path is `/vol1`. Since qtrees are always rooted at the volume, the junction path or namespace path of the qtree will be `/vol1/qtree1`.

Learn more about `vserver volume junction-path` in the ONTAP command reference.

Directory to qtree conversions

Convert a directory to a qtree

If you have a directory at the root of a FlexVol volume that you want to convert to a qtree, you need to migrate the data contained in the directory to a new qtree with the same name, using your client application.

About this task

The steps you take to convert a directory to a qtree depend on what client you use. The following process outlines the general tasks you need to complete.

Before you begin

You cannot delete a directory if it is associated with an existing CIFS share.

Steps

1. Rename the directory to be made into a qtree.
2. Create a new qtree with the original directory name.
3. Use the client application to move the contents of the directory into the new qtree.
4. Delete the now-empty directory.

Convert a directory to a qtree using a Windows client

To convert a directory to a qtree using a Windows client, you rename the directory, create a qtree on the storage system, and move the contents of the directory to the qtree.

About this task

You must use Windows Explorer for this procedure. You cannot use the Windows command-line interface or the DOS prompt environment.

Steps

1. Open Windows Explorer.
2. Click the folder representation of the directory you want to change.

The directory must reside at the root of its containing volume.

3. From the **File** menu, select **Rename** to give this directory a different name.
4. On the storage system, use the `volume qtree create` command to create a new qtree with the original name of the directory. Learn more about `volume qtree create` in the ONTAP command reference.
5. In Windows Explorer, open the renamed directory folder and select the files inside it.
6. Drag these files into the folder representation of the new qtree.

The more subfolders contained in the folder that you are moving, the longer the move operation takes.

7. From the **File** menu, select **Delete** to delete the renamed, now-empty directory folder.

Convert a directory to a qtree using a UNIX client

To convert a directory to a qtree in UNIX, you rename the directory, create a qtree on the storage system, and move the directory's contents to the qtree.

Steps

1. Open a UNIX client window.
2. Use the `mv` command to rename the directory.

```
client: mv /n/user1/vol1/dir1 /n/user1/vol1/olddir
```

3. From the storage system, use the `volume qtree create` command to create a qtree with the original name.

```
system1: volume qtree create /n/user1/vol1/dir1
```

Learn more about `volume qtree create` in the ONTAP command reference.

4. From the client, use the `mv` command to move the contents of the old directory into the qtree.

The more subdirectories contained in a directory that you are moving, the longer the move operation will take.

```
client: mv /n/user1/vol1/olddir/* /n/user1/vol1/dir1
```

5. Use the `rmdir` command to delete the old, now-empty directory.

```
client: rmdir /n/user1/vol1/olddir
```

After you finish

Depending on how your UNIX client implements the `mv` command, file ownership and permissions might not be preserved. If this occurs, update file owners and permissions to their previous values.

Learn more about the commands described in this procedure in the ONTAP command reference.

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