



# **Manage local Snapshot copies**

## **ONTAP 9**

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# Manage local Snapshot copies

## Manage local Snapshot copies overview

A *Snapshot copy* is a read-only, point-in-time image of a volume. The image consumes minimal storage space and incurs negligible performance overhead because it records only changes to files since the last Snapshot copy.

You can use a Snapshot copy to restore the entire contents of a volume, or to recover individual files or LUNs. Snapshot copies are stored in the directory `.snapshot` on the volume.

In ONTAP 9.3 and earlier, a volume can contain up to 255 Snapshot copies. In ONTAP 9.4 and later, a FlexVol volume can contain up to 1023 Snapshot copies.



Beginning with ONTAP 9.8, FlexGroup volumes can contain 1023 Snapshot copies. For more information, see [Protect FlexGroup volumes using Snapshot copies](#).

## Configure custom Snapshot policies

### Configure custom Snapshot policies overview

A *Snapshot policy* defines how the system creates Snapshot copies. The policy specifies when to create Snapshot copies, how many copies to retain, and how to name them. For example, a system might create one Snapshot copy every day at 12:10 a.m., retain the two most recent copies, and name the copies “daily.*timestamp*.”

The default policy for a volume automatically creates Snapshot copies on the following schedule, with the oldest Snapshot copies deleted to make room for newer copies:

- A maximum of six hourly Snapshot copies taken five minutes past the hour.
- A maximum of two daily Snapshot copies taken Monday through Saturday at 10 minutes after midnight.
- A maximum of two weekly Snapshot copies taken every Sunday at 15 minutes after midnight.

Unless you specify a Snapshot policy when you create a volume, the volume inherits the Snapshot policy associated with its containing storage virtual machine (SVM).

### When to configure a custom Snapshot policy

If the default Snapshot policy is not appropriate for a volume, you can configure a custom policy that modifies the frequency, retention, and name of Snapshot copies. The schedule will be dictated mainly by the rate of change of the active file system.

You might back up a heavily used file system like a database every hour, while you back up rarely used files once a day. Even for a database, you will typically run a full backup once or twice a day, while backing up transaction logs every hour.

Other factors are the importance of the files to your organization, your Service Level Agreement (SLA), your Recovery Point Objective (RPO), and your Recovery Time Objective (RTO). Generally speaking, you should

retain only as many Snapshot copies as necessary.

## Create a Snapshot job schedule

A Snapshot policy requires at least one Snapshot copy job schedule. You can use the `job schedule cron create` command to create a job schedule.

### About this task

By default, ONTAP forms the names of Snapshot copies by appending a timestamp to the job schedule name.

If you specify values for both day of the month and day of the week, the values are considered independently. For example, a cron schedule with the day specification `Friday` and the day of the month specification `13` runs every Friday and on the 13th day of each month, not just on every Friday the 13th.

### Step

1. Create a job schedule:

```
job schedule cron create -name job_name -month month -dayofweek day_of_week  
-day day_of_month -hour hour -minute minute
```

For `-month`, `-dayofweek`, and `-hour`, you can specify `all` to run the job every month, day of the week, and hour, respectively.

Beginning with ONTAP 9.10.1, you can include the Vserver for your job schedule:

```
job schedule cron create -name job_name -vserver Vserver_name -month month  
-dayofweek day_of_week -day day_of_month -hour hour -minute minute
```

The following example creates a job schedule named `myweekly` that runs on Saturdays at 3:00 a.m.:

```
cluster1::> job schedule cron create -name myweekly -dayofweek  
"Saturday" -hour 3 -minute 0
```

The following example creates a schedule named `myweeklymulti` that specifies multiple days, hours and minutes:

```
job schedule cron create -name myweeklymulti -dayofweek  
"Monday,Wednesday,Sunday" -hour 3,9,12 -minute 0,20,50
```

## Create a Snapshot policy

A Snapshot policy specifies when to create Snapshot copies, how many copies to retain, and how to name them. For example, a system might create one Snapshot copy every day at 12:10 a.m., retain the two most recent copies, and name them “`daily.timestamp`.” A Snapshot policy can contain up to five job schedules.

### About this task

By default, ONTAP forms the names of Snapshot copies by appending a timestamp to the job schedule name:

```
daily.2017-05-14_0013/      hourly.2017-05-15_1106/
daily.2017-05-15_0012/      hourly.2017-05-15_1206/
hourly.2017-05-15_1006/      hourly.2017-05-15_1306/
```

You can substitute a prefix for the job schedule name if you prefer.

The `snapmirror-label` option is for SnapMirror replication. For more information, see [Defining a rule for a policy](#).

### Step

1. Create a Snapshot policy:

```
volume snapshot policy create -vserver SVM -policy policy_name -enabled
true|false -schedule1 schedule1_name -count1 copies_to_retain -prefix1
snapshot_prefix -snapmirror-label1 snapshot_label ... -schedule1 schedule5_name
-count5 copies_to_retain-prefix5 snapshot_prefix -snapmirror-label5
snapshot_label
```

The following example creates a Snapshot policy named `snap_policy_daily` that runs on a daily schedule. The policy has a maximum of five Snapshot copies, each with the name `daily.timestamp` and the SnapMirror label `daily`:

```
cluster1::> volume snapshot policy create -vserver vs0 -policy
snap_policy_daily -schedule1 daily -count1 5 -snapmirror-label1 daily
```

## Manage the Snapshot copy reserve

### Manage the Snapshot copy reserve overview

The *Snapshot copy reserve* sets aside a percentage of disk space for Snapshot copies, five percent by default. Because Snapshot copies use space in the active file system when the Snapshot copy reserve is exhausted, you might want to increase the Snapshot copy reserve as needed. Alternatively, you can autodelete Snapshot copies when the reserve is full.

### When to increase the Snapshot copy reserve

In deciding whether to increase the Snapshot reserve, it's important to remember that a Snapshot copy records only changes to files since the last Snapshot copy was made. It consumes disk space only when blocks in the active file system are modified or deleted.

This means that the rate of change of the file system is the key factor in determining the amount of disk space used by Snapshot copies. No matter how many Snapshot copies you create, they will not consume disk space if the active file system has not changed.

A FlexVol volume containing database transaction logs, for example, might have a Snapshot copy reserve as large as 20% to account for its greater rate of change. Not only will you want to create more Snapshot copies to capture the more frequent updates to the database, you will also want to have a larger Snapshot copy reserve to handle the additional disk space the Snapshot copies consume.



A Snapshot copy consists of pointers to blocks rather than copies of blocks. You can think of a pointer as a “claim” on a block: ONTAP “holds” the block until the Snapshot copy is deleted.



T2

File 1

File 2

File 3

A	B	C
D	E	F
G	H	I

File 3 is added

›A	›B	›C
›D	›E	›F
›G	›H	›I

Snapshot 2

A	B	C
D	E	F
G	H	I

Blocks on disk

T3

File 1

File 3

A	B	C1
G	H	I

File 1 is modified,  
File 2 is deleted

›A	›B	›C1
›G	›H	›I

Snapshot 3

A	B	C
C1	D	E
F	G	H
I		

Blocks on disk

*A Snapshot copy consumes disk space only when blocks in the active file system are modified or deleted.*

How deleting protected files can lead to less file space than expected

A Snapshot copy points to a block even after you delete the file that used the block. This explains why an exhausted Snapshot copy reserve might lead to the counter-intuitive result in which deleting an entire file system results in less space being available than the file system occupied.

Consider the following example. Before deleting any files, the `df` command output is as follows:

Filesystem	kbytes	used	avail	capacity
/vol/vol0/	3000000	3000000	0	100%
/vol/vol0/.snapshot	1000000	500000	500000	50%

After deleting the entire file system and making a Snapshot copy of the volume, the `df` command generates the following output:

Filesystem	kbytes	used	avail	capacity
/vol/vol0/	3000000	2500000	500000	83%
/vol/vol0/.snapshot	1000000	3500000	0	350%

As the output shows, the entire 3 GB formerly used by the active file system is now being used by Snapshot copies, in addition to the 0.5 GB used before the deletion.

Because the disk space used by the Snapshot copies now exceeds the Snapshot copy reserve, the overflow of 2.5 GB “spills” into the space reserved for active files, leaving you with 0.5 GB free space for files where you might reasonably have expected 3 GB.

## Monitor Snapshot copy disk consumption

You can monitor Snapshot copy disk consumption using the `df` command. The command displays the amount of free space in the active file system and the Snapshot copy reserve.

### Step

1. Display Snapshot copy disk consumption: `df`

The following example shows Snapshot copy disk consumption:

```
cluster1::> df
Filesystem      kbytes  used   avail  capacity
/vol/vol0/      3000000 3000000 0        100%
/vol/vol0/.snapshot 1000000 500000 500000   50%
```

## Check available Snapshot copy reserve on a volume

You might want to check how much Snapshot copy reserve is available on a volume by using the `snapshot-reserve-available` parameter with the `volume show` command.

### Step

1. Check the Snapshot copy reserve available on a volume:

```
vol show -vserver SVM -volume volume -fields snapshot-reserve-available
```

For complete command syntax, see the man page.

The following example displays the available Snapshot copy reserve for `vol1`:

```
cluster1::> vol show -vserver vs0 -volume vol1 -fields snapshot-reserve-
available

vserver volume snapshot-reserve-available
-----
vs0      vol1      4.84GB
```

## Modify the Snapshot copy reserve

You might want to configure a larger Snapshot copy reserve to prevent Snapshot copies from using space reserved for the active file system. You can decrease the Snapshot copy reserve when you no longer need as much space for Snapshot copies.

### Step

1. Modify the Snapshot copy reserve:

```
volume modify -vserver SVM -volume volume -percent-snapshot-space snap_reserve
```

For complete command syntax, see the man page.

The following example sets the Snapshot copy reserve for `vol1` to 10 percent:

```
cluster1::> volume modify -vserver vs0 -volume vol1 -percent-snapshot
-space 10
```

## Autodelete Snapshot copies

You can use the `volume snapshot autodelete modify` command to trigger automatic deletion of Snapshot copies when the Snapshot reserve is exceeded. By default, the oldest Snapshot copies are deleted first.

### About this task

LUN and file clones are deleted when there are no more Snapshot copies to be deleted.

### Step

1. Autodelete Snapshot copies:

```
volume snapshot autodelete modify -vserver SVM -volume volume -enabled
true|false -trigger volume|snap_reserve
```

For complete command syntax, see the man page.



The following example autodeletes Snapshot copies for `vol1` when the Snapshot copy reserve is exhausted:

```
cluster1::> volume snapshot autodelete modify -vserver vs0 -volume vol1
-enabled true -trigger snap_reserve
```

## Restore files from Snapshot copies

### Restore a file from a Snapshot copy on an NFS or SMB client

A user on an NFS or SMB client can restore a file directly from a Snapshot copy without the intervention of a storage system administrator.

Every directory in the file system contains a subdirectory named `.snapshot` accessible to NFS and SMB users. The `.snapshot` subdirectory contains subdirectories corresponding to the Snapshot copies of the volume:

```
$ ls .snapshot
daily.2017-05-14_0013/      hourly.2017-05-15_1106/
daily.2017-05-15_0012/      hourly.2017-05-15_1206/
hourly.2017-05-15_1006/      hourly.2017-05-15_1306/
```

Each subdirectory contains the files referenced by the Snapshot copy. If users accidentally delete or overwrite a file, they can restore the file to the parent read-write directory by copying the file from the Snapshot subdirectory to the read-write directory:

```
$ ls my.txt
ls: my.txt: No such file or directory
$ ls .snapshot
daily.2017-05-14_0013/      hourly.2017-05-15_1106/
daily.2017-05-15_0012/      hourly.2017-05-15_1206/
hourly.2017-05-15_1006/      hourly.2017-05-15_1306/
$ ls .snapshot/hourly.2017-05-15_1306/my.txt
my.txt
$ cp .snapshot/hourly.2017-05-15_1306/my.txt .
$ ls my.txt
my.txt
```

### Enable and disable NFS and SMB client access to Snapshot copy directory

To determine whether the Snapshot copy directory is visible to NFS and SMB clients to restore a file or LUN from a Snapshot copy, you can enable and disable access to the Snapshot copy directory using the `-snapdir-access` option of the `volume modify`

command.

### Steps

1. Check the Snapshot directory access status:

```
volume show -vserver SVM_name -volume vol_name -fields snapdir-access
```

Example:

```
clus1::> volume show -vserver vs0 -volume vol1 -fields snapdir-access
vserver volume snapdir-access
-----
vs0      vol1    false
```

2. Enable or disable the Snapshot copy directory access:

```
volume modify -vserver SVM_name -volume vol_name -snapdir-access true|false
```

The following example enables Snapshot copy directory access on vol1:

```
clus1::> volume modify -vserver vs0 -volume vol1 -snapdir-access true
Volume modify successful on volume vol1 of Vserver vs0.
```

## Restore a single file from a Snapshot copy

You can use the `volume snapshot restore-file` command to restore a single file or LUN from a Snapshot copy. You can restore the file to a different location in the parent read-write volume if you do not want to replace an existing file.

### About this task

If you are restoring an existing LUN, a LUN clone is created and backed up in the form of a Snapshot copy. During the restore operation, you can read to and write from the LUN.

Files with streams are restored by default.

### Steps

1. List the Snapshot copies in a volume:

```
volume snapshot show -vserver SVM -volume volume
```

For complete command syntax, see the man page.

The following example shows the Snapshot copies in `vol1`:

```
clus1::> volume snapshot show -vserver vs1 -volume vol1
```

Vserver	Volume	Snapshot	State	Size	Total%	Used%
vs1	vol1	hourly.2013-01-25_0005	valid	224KB	0%	0%
		daily.2013-01-25_0010	valid	92KB	0%	0%
		hourly.2013-01-25_0105	valid	228KB	0%	0%
		hourly.2013-01-25_0205	valid	236KB	0%	0%
		hourly.2013-01-25_0305	valid	244KB	0%	0%
		hourly.2013-01-25_0405	valid	244KB	0%	0%
		hourly.2013-01-25_0505	valid	244KB	0%	0%

7 entries were displayed.

## 2. Restore a file from a Snapshot copy:

```
volume snapshot restore-file -vserver SVM -volume volume -snapshot snapshot  
-path file_path -restore-path destination_path
```

For complete command syntax, see the man page.

The following example restores the file `myfile.txt`:

```
cluster1::> volume snapshot restore-file -vserver vs0 -volume vol1  
-snapshot daily.2013-01-25_0010 -path /myfile.txt
```

## Restore part of a file from a Snapshot copy

You can use the `volume snapshot partial-restore-file` command to restore a range of data from a Snapshot copy to a LUN or to an NFS or SMB container file, assuming you know the starting byte offset of the data and the byte count. You might use this command to restore one of the databases on a host that stores multiple databases in the same LUN.

Beginning in ONTAP 9.12.1, partial restore is available for volumes in an SM-BC relationship.

### Steps

1. List the Snapshot copies in a volume:

```
volume snapshot show -vserver SVM -volume volume
```

For complete command syntax, see the man page.

The following example shows the Snapshot copies in `vol1`:

```
clus1::> volume snapshot show -vserver vs1 -volume vol1
```

Vserver	Volume	Snapshot	State	Size	Total%	Used%
vs1	vol1	hourly.2013-01-25_0005	valid	224KB	0%	0%
		daily.2013-01-25_0010	valid	92KB	0%	0%
		hourly.2013-01-25_0105	valid	228KB	0%	0%
		hourly.2013-01-25_0205	valid	236KB	0%	0%
		hourly.2013-01-25_0305	valid	244KB	0%	0%
		hourly.2013-01-25_0405	valid	244KB	0%	0%
		hourly.2013-01-25_0505	valid	244KB	0%	0%

7 entries were displayed.

## 2. Restore part of a file from a Snapshot copy:

```
volume snapshot partial-restore-file -vserver SVM -volume volume -snapshot  
snapshot -path file_path -start-byte starting_byte -byte-count byte_count
```

The starting byte offset and byte count must be multiples of 4,096.

The following example restores the first 4,096 bytes of the file `myfile.txt`:

```
cluster1::> volume snapshot partial-restore-file -vserver vs0 -volume  
vol1 -snapshot daily.2013-01-25_0010 -path /myfile.txt -start-byte 0  
-byte-count 4096
```

## Restore the contents of a volume from a Snapshot copy

You can use the `volume snapshot restore` command to restore the contents of a volume from a Snapshot copy.

### About this task

If the volume has SnapMirror relationships, manually replicate all mirror copies of the volume immediately after you restore from a Snapshot copy. Not doing so can result in unusable mirror copies that must be deleted and recreated.

## 1. List the Snapshot copies in a volume:

```
volume snapshot show -vserver SVM -volume volume
```

The following example shows the Snapshot copies in `vol1`:

```
clus1::> volume snapshot show -vserver vs1 -volume vol1
```

Vserver	Volume	Snapshot	State	Size	Total%	Used%
vs1	vol1	hourly.2013-01-25_0005	valid	224KB	0%	0%
		daily.2013-01-25_0010	valid	92KB	0%	0%
		hourly.2013-01-25_0105	valid	228KB	0%	0%
		hourly.2013-01-25_0205	valid	236KB	0%	0%
		hourly.2013-01-25_0305	valid	244KB	0%	0%
		hourly.2013-01-25_0405	valid	244KB	0%	0%
		hourly.2013-01-25_0505	valid	244KB	0%	0%

7 entries were displayed.

## 2. Restore the contents of a volume from a Snapshot copy:

```
volume snapshot restore -vserver SVM -volume volume -snapshot snapshot
```

The following example restores the contents of vol1:

```
cluster1::> volume snapshot restore -vserver vs0 -volume vol1 -snapshot  
daily.2013-01-25_0010
```

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