NetApp

FlexClone volumes in SnapDrive for UNIX

Snapdrive for Unix

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SnapDrive for UNIX supports FlexClone volumes, which are based on Data ONTAP FlexClone technology. A FlexClone volume is a point-in-time copy of a parent flexible volume. FlexClone volumes are faster than LUN clones, and they give you the flexibility to create multiple copies of data.

What FlexClone volumes are

A flexible volume clone, FlexClone, is a point-in-time copy of a parent flexible volume. The FlexClone volume does not inherit the changes made to the parent flexible volume after the clone is created.

Data ONTAP FlexClone technology enables instant replication of data volumes without requiring additional storage space at the time of creation. Each clone volume is a transparent, virtual copy that you can use for a wide range of operations such as product or system development testing, bug fixing, upgrade checks, and so on.

FlexClone technology provides substantial space savings with minimal overhead. Using this technology you can manage many more dataset combinations in lesser time and with less risk. FlexClone volumes do not have write reservation by default. SnapDrive 4.1 for UNIX uses FlexClone technology in NFS and SAN environments.

> (i) FlexClone volumes are supported on Data ONTAP 7.0.x and later, but they are not supported with vFiler units on storage systems running Data ONTAP 7.2 or earlier.

Benefits of FlexClone volumes

FlexClone volumes provide data management and performance benefits.

- Simplified data management and reduced risk.
- Flexibility and greater utilization.

  You can use FlexClone volumes to create multiple copies of data for additional users without giving them access to the original data.

- Faster than a LUN clone.

Types of FlexClone volumes

FlexClone volumes can be classified as temporary or all-purpose depending on how SnapDrive for UNIX uses them.

- **Restricted or temporary FlexClone volume**: This FlexClone volume (created during `snap connect`) is primarily used to verify data. Provisioning and Snapshot operations (except `snap disconnect`) through SnapDrive for UNIX are not allowed on this FlexClone volume.
- **Unrestricted or all-purpose FlexClone volume**: This FlexClone volume (created during `snap connect`) can be used also as a back end for provisioning and Snapshot operations, just like normal flexible

volumes. You can perform all regular SnapDrive operations on this FlexClone volume.

SnapDrive for UNIX operations on FlexClone volumes

You can carry out various operations on FlexClone volumes using SnapDrive for UNIX.

Role-based access control for FlexClone volume operations

If Operations Manager is configured with the system, the Operations Manager administrator must grant you the required capabilities to carry out storage operations on FlexClone volumes.

Unrestricted FlexClone volume: You must have the following capabilities to perform storage operations on an unrestricted FlexClone volume:

- For `snap connect`, you must have `SD.SnapShot.UnrestrictedClone` capability on the parent volume.
- For `snap disconnect`, you must have `SD.SnapShot.DestroyUnrestrictedClone` capability on the FlexClone volume.

Restricted FlexClone volumes: You must have the following capabilities for storage operations on a restricted FlexClone volume:

- For `snap connect` you must have `SD.SnapShot.Clone` capability on the parent volume.
- For `snap disconnect` you must have `SD.SnapShot.Clone` capability on the parent volume.

To split the FlexClone volume during the `snap connect` operation, `SD.Storage.Write` access capability on the parent volume.

To perform storage operations on split FlexClone volumes during the `snap disconnect`, for split FlexClone volumes, you must have `SD.Storage.Delete` capability on the split volume clone.

Snap connect procedure

The snap connect procedure is valid for Data ONTAP 7.2 or later and explain the steps for snap connect operation.

The following steps depict the snap connect procedure:

Steps
1. SnapDrive for UNIX obtains the file spec name and the Snapshot name from the snap connect CLI. It then finds out the original storage system volume(s) where the snapshot(s) resides.
2. SnapDrive for UNIX chooses an appropriate cloning method for storage system entities based on CLI configuration options.

   (i) If the CLI option is specified, it always overrides the `snapdrive.conf` file option.

   a. If `-clone lunclone` option is specified in the CLI or the `san-clone-method=lunclone` option in the `snapdrive.conf` file, then SnapDrive for UNIX creates a LUN clone in the same volume from the

given snapshot.

b. If `-clone unrestricted` option is specified in the CLI or the `san-clone-method=unrestricted` option in the `snapdrive.conf` file, then SnapDrive for UNIX creates or reuses all-purpose FlexClone from the given Snapshot.

c. If `-clone optimal` option is specified in the CLI or the `san-clone-method=optimal` option in the `snapdrive.conf` file, then SnapDrive for UNIX automatically chooses between restricted FlexClone and LUN clone, based on storage system configuration.

> ⓘ By default, clones created by SnapDrive for UNIX are backup clones.

Snap disconnect procedure

This section explains the procedure followed for snap disconnect.

The following steps depict the snap disconnect procedure:

Steps

1. SnapDrive for UNIX obtains host file specs from `snap disconnect` CLI and finds out the storage system volume.

2. After deleting host file specs and un-mapping the LUNs, SnapDrive for UNIX checks if the current volume is a clone created by SnapDrive.

3. If the FlexClone is created by SnapDrive, then SnapDrive for UNIX checks whether:

   a. There are any mapped LUNs in the clone volume

   b. There are any new LUNs in the cloned volume

   c. There are any new Snapshot copies

If all the conditions are satisfied, SnapDrive for UNIX deletes the cloned volume. For an unrestricted FlexClone, if RBAC is configured, then SnapDrive for UNIX does not perform substep 1 and substep 2 checks.

On storage systems with Data ONTAP version earlier than 7.2, restricted FlexClone volumes does not gets deleted by SnapDrive for UNIX. Storage system commands should be used to delete them. However, Unrestricted FlexClone volumes are deleted when the appropriate RBAC capability is provided to the user.

Related information

Role-based access control in SnapDrive for UNIX

Connecting to a single filespec in a LUN

You can connect to a single filespec which resides in a LUN. The following example describes how you can complete this operation.

> ⓘ Filespec can be any one of file system, host volume, disk group, or a LUN.

For creating restricted FlexClone, you need to set the option `san-clone-method =optimal` in `snapdrive.conf` file or give `-clone optimal` before you can connect the filespec. This example displays the results when you want to connect a filespec `/mnt/fs1` which resides in a LUN `homer:/vol/vol1/lun1`

The layout of the source file system `/mnt/fs1` is given below:

```
# snapdrive storage show -fs /mnt/fs_1 -capabilities
raw device: /dev/sdc1 mount point: /mnt/fs_1 (persistent) fstype jfs2

allowed operations: all

device filename adapter path size proto state clone lun path backing
snapshot
-------------- ------- ---- ---- ----- ----- ----- --------
----------------
/dev/sdc -  P 100m iscsi online No homer:/vol/vol1/lun1  -
```

```
# snapdrive snap connect -fs /mnt/fs_1 -snapname homer:/vol/vol1:snap1
-autorename

 connecting /mnt/fs_1:
        creating restricted volume clone
homer:/vol/Snapdrive_vol1_volume_clone_from_snap1_snapshot ... success

        mapping new lun(s) ... done
        discovering new lun(s) ... done
Successfully connected to snapshot homer:/vol/vol1:snap1
        file system: /mnt/fs_1_0
```

Here, SnapDrive for UNIX automatically chose to create a restricted FlexClone
`Snapdrive_vol1_0_volume_clone_from_snap1_snapshot` from snapshot snap1 and connected it to
the LUN testlun1 in this FlexClone to create a cloned host file system /mnt/fs_1_0.

```
# snapdrive storage show -fs /mnt/fs_1_0 -capabilities

raw device: /dev/sde1   mount point: /mnt/fs_1_0 (persistent) fstype jfs2
allowed operations: snap disconnect; snap list; snap show; storage show;
storage list

device filename adapter path size  proto  state  clone  lun path backing
snapshot
-------------- ------- ---- ----- ------ ------ ------ --------
----------------
/dev/sde  -  P  100m iscsi online flex-clone
homer:/vol/Snapdrive_vol1_volume_clone_from_snap1_snapshot/lun1 vol1:snap1
```

SnapDrive for UNIX names the destination FlexClone with the prefix mentioned in the CLI.

If the generated FlexClone name (with prefix) is already in use, SnapDrive for UNIX gives an error message. In
this case, you can use -autorename option along with -prefixfv to auto generate clone volume names.

-prefixfv CLI option is applicable only for SAN based filespecs. The -destfv CLI option is ignored by SnapDrive for UNIX for SAN based filespecs during FlexClone operation.

> ⓘ SnapDrive for UNIX displays a warning when a Snapshot copy is locked due to LUN clones. However, SnapDrive for UNIX proceeds with the `snap connect` operation.

Connecting to multiple filespecs

You can connect to multiple filespecs that reside in a volume. The following example describes how you can complete this operation.

For creating restricted FlexClone, you need to set the `san-clone-method=unrestricted` in the `snapdrive.conf` file or give `-clone unrestricted` before you can connect to multiple filespec. This example displays the results when you want to connect to multiple filespec `/mnt/fs_1` and `/mnt/fs_2` in snap1 which reside in volume vol1.

The layout of /mnt/fs_1 and /mnt/fs_2 is given in the following:

```
 # snapdrive storage show -fs /mnt/fs_1 /mnt/fs_2 -capabilities
raw device: /dev/sdc1   mount point: /mnt/fs_1 (persistent) fstype jfs2
allowed operations: all

device filename       adapter      path     size     proto    state      clone
lun path            backing snapshot
----------------      -------      ----     ------    -----    -----      -------
----------------      ----------------
/dev/sdc                  -          P       100m    iscsi    online      No
homer:/vol/vol1/lun1        -

raw device: /dev/sdo1   mount point: /mnt/fs_2 (persistent) fstype jfs2
allowed operations: all

device filename       adapter path     size      proto    state    clone     lun
path                backing snapshot
----------------      ------- ----     ----      -------   -----    -----
--------             ----------------
/dev/sdo                  -      P       100m     iscsi    online   No
homer:/vol/vol1/lun2        -
```

Here the user used Snapshot snap2 which contains application consistent Snapshots of `/mnt/fs1` and `/mnt/fs2` for snap connect.

```
 # snapdrive snap connect -fs /mnt/fs_1 -fs /mnt/fs_2 -snapname
homer:/vol/vol1:snap2 -autorename -clone unrestricted

 connecting /mnt/fs_1:
        creating unrestricted volume clone
homer:/vol/Snapdrive_vol1_volume_clone_from_snap2_snapshot ... success

        mapping new lun(s) ... done

 connecting /mnt/fs_2:

        mapping new lun(s) ... done
        discovering new lun(s) ... done
Successfully connected to snapshot homer:/vol/vol1:snap2
        file system: /mnt/fs_1_0
        file system: /mnt/fs_2_0
```

Here, SnapDrive for UNIX has created a single unrestricted FlexClone
`Snapdrive_vol1_0_volume_clone_from_snap2_Snapshot` from Snapshot snap2. This is then
connected to LUN testlun1 and testlun2 to create a cloned host file system `/mnt/fs1_0` and `/mnt/fs2_0`
respectively.

```
# snapdrive storage show -fs /mnt/fs_1_0 /mnt/fs_2_0 -capabilities
raw device: /dev/sde1   mount point: /mnt/fs_1_0 (persistent) fstype jfs2
allowed operations: all

device filename      adapter   path  size    proto   state   clone
lun path                                                backing
snapshot
----------------     -------   ----  ----    -----   -----   -----
--------
----------------
/dev/sde               -       P     100m    iscsi   online  flex-clone
homer:/vol/Snapdrive_vol1_volume_clone_from_snap2_snapshot/lun1
vol1:snap2

raw device: /dev/sdac1  mount point: /mnt/fs_2_0 (persistent) fstype jfs2
allowed operations: all

device filename      adapter   path    size    proto    state   clone
lun path
backing snapshot
----------------     -------   ----    ----    -----    -----   -----
--------
----------------
/dev/sdac              -       P       100m    iscsi    online  flex-clone
homer:/vol/Snapdrive_vol1_volume_clone_from_snap2_snapshot/lun2
vol1:snap2
```

Disconnecting a file specification

You can disconnect a file specification. The following example describes how you can complete this operation.

The layout of `/mnt/fs1_0` is given in the following.

```
# snapdrive storage show -fs /mnt/fs_1_0 -capabilities
raw device: /dev/sde1    mount point: /mnt/fs_1_0 (persistent) fstype jfs2
allowed operations: all

device filename    adapter  path    size    proto    state    clone
lun path                                                      backing
snapshot
---------------    -------  ----    ----    -----    -----    -----
--------
---------------
/dev/sde              -       P      100m    iscsi    online   flex-clone
homer:/vol/Snapdrive_vol1_volume_clone_from_snap2_snapshot/lun1
vol1:snap2
```

The following output shows how to disconnect the file system /mnt/fs_1_0:

```
#snapdrive snap disconnect -fs /mnt/fs_1_0
 delete file system /mnt/fs_1_0
- fs /mnt/fs_1_0 ... deleted
        - LUN
homer:/vol/Snapdrive_vol1_volume_clone_from_snap2_snapshot/lun1 ...
disconnected
        - deleting volume clone ...
homer:/vol/Snapdrive_vol1_volume_clone_from_snap2_snapshot  done
```

After disconnecting the file system /mnt/fs_1_0, SnapDrive for UNIX also deletes the cloned volume
Snapdrive_vol1_0_volume_clone_from_snap2_snapshot, if the following conditions are met:

- No mapped LUNs are present in the volume
- No new LUNs are present
- No new Snapshot copies are present

Deleting a FlexClone not created by SnapDrive for UNIX: SnapDrive for UNIX does not allow deletion of
FlexClone not created by it.

Splitting the FlexClone volume

You can split the existing FlexClone volume using the SnapDrive for UNIX commands.

To split the FlexClone volume you need to additionally specify the -split CLI option with the snap connect
command. To disconnect, you should provide the -split option with the disconnect command to
disconnect the split FlexClone volume. The blocking and non-blocking modes of initiating a -split operation
are valid here.

Related information

Space reservation with a FlexClone volume

You can carry out space reservation operation on both restricted and unrestricted type of FlexClone volumes. By default FlexClone volumes do not have write reservations.

Following are the space reservation settings for the FlexClone for unrestricted and restricted FlexClone volumes:

Unrestricted FlexClone volumes: If `-reserve` option is given in the CLI or `flexclone-writereserve-enabled = on` in `snapdrive.conf`, the space reservation would be set to volume on the FlexClone, otherwise it is none. SnapDrive for UNIX shows an error message if the space available on the aggregate is not sufficient to adhere to this setting.

Restricted FlexClone volumes:

- The space reservation setting at volume-level is always disabled; that is, space reservation is set to NONE.
- If `-reserve` or `-noreserve` option is given in the CLI, then space reservation is enabled or disabled respectively on the LUNs which belong to the host file spec. Otherwise, the host file spec related LUNs in FlexClone inherit the space reservation from the parent volume LUNs.