ONTAP® 9

Data Protection Power Guide

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NetApp®

Contents

Deciding whether to use the Data Protection Power Guide

This guide describes how to manage Snapshot copies on a local ONTAP system, and how to replicate Snapshot copies to a remote system using SnapMirror. You can replicate Snapshot copies for disaster recovery or long-term retention.

Note: The *Data Protection Power Guide* replaces the *Data Protection Using SnapMirror and SnapVault Guide*.

You should use this guide under the following circumstances:

- You want to understand the range of ONTAP backup and recovery capabilities.
- You want to use the command-line interface (CLI), not OnCommand System Manager, an automated scripting tool, or a SnapCenter product.
  If you are using System Manager, see *Cluster Management Using OnCommand System Manager*.
  Cluster management using System Manager
  If you are using SnapCenter, see the documentation for your SnapCenter product.
- You have already created peer relationships between the source and destination clusters and the source and destination SVMs.
  Cluster and SVM peering
- You are backing up volumes or SVMs from AFF or FAS storage systems to AFF or FAS storage systems.
  - If you are replicating Element volumes to ONTAP, or ONTAP LUNs to an Element system, see the NetApp Element software documentation.
    Replication between NetApp element software and ONTAP
- You want to provide data protection using online methods, not tape.

If you want to quickly perform volume backup and recovery using best practices, you should choose among the following documentation:

- Volume disaster recovery preparation
  Volume disaster recovery express preparation
- Volume disaster recovery
  Volume disaster express recovery
- Volume backup using SnapVault
  Volume express backup using SnapVault
- Volume restore using SnapVault
  Volume restore express management using SnapVault

If you require additional configuration or conceptual information, you should choose among the following documentation:

- ONTAP conceptual background
  ONTAP concepts
- Synchronous disaster recovery in a MetroCluster configuration
  MetroCluster management and disaster recovery
- Data protection for WORM files in SnapLock volumes
  Archive and compliance using SnapLock technology
- Data protection using tape technology
  - *NDMP express configuration*
  - *Data protection using tape backup*
- Command reference
  ONTAP 9 commands

- Automation of management tasks
  NetApp Documentation: OnCommand Workflow Automation (current releases)
- Technical Reports (TRs), which include additional information about ONTAP technology and interaction with external services.
  - *NetApp Technical Report 4015: SnapMirror Configuration and Best Practices Guide for ONTAP 9.1, 9.2*
  - *NetApp Technical Report 4183: SnapVault Best Practices Guide*

Managing local Snapshot copies

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 volume can contain up to 1023 Snapshot copies.

Configuring custom Snapshot policies

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.

Creating 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.

Example

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
```

Creating 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* on page 36.

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*

Example

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
```

Managing the Snapshot copy reserve

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.

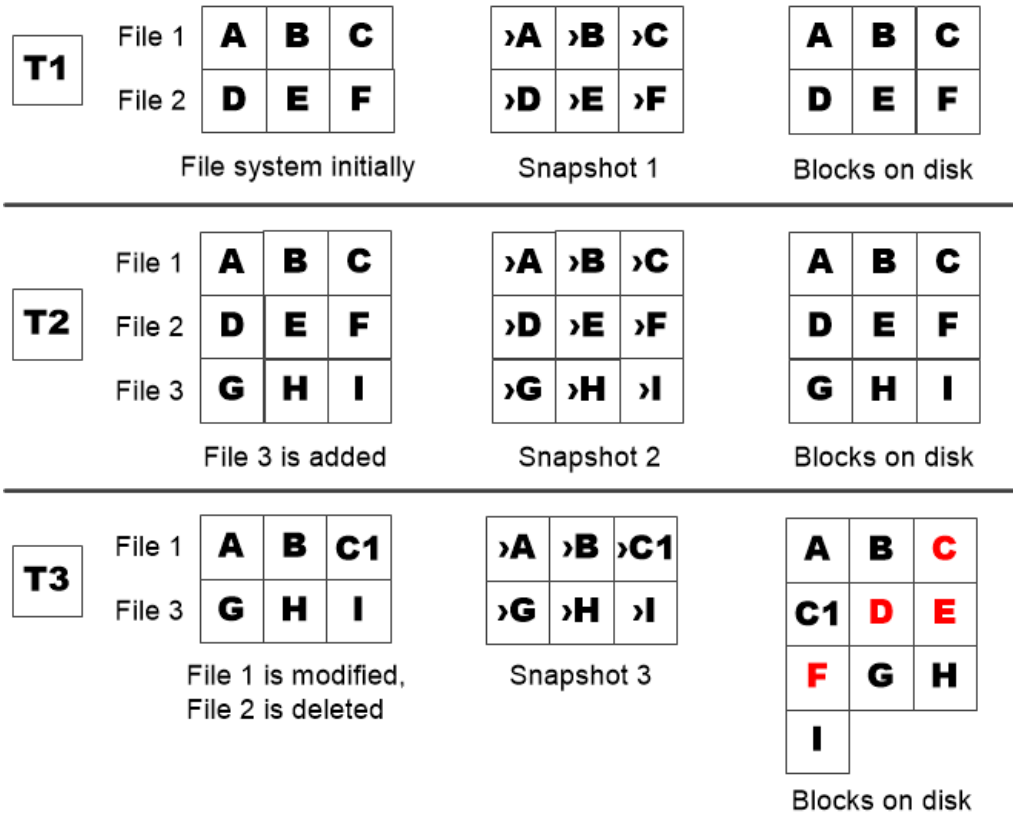
When to increase the Snapshot copy reserve

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.

Tip: 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.



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.

Monitoring 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`

   #### Example

   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%
   ```

Modifying 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.

Example

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

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

Autodeleting 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.

Example

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

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

Restoring files from Snapshot copies

You can use a Snapshot copy to recover individual files or LUNs, or to restore the entire contents of a volume. You can restore files from an NFS or CIFS client as well as from the storage system.

Restoring a file from a Snapshot copy on an NFS or CIFS client

A user on an NFS or CIFS 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 CIFS 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
```

Restoring 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.

   #### Example

   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.

   #### Example

   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
   ```

Restoring 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 CIFS 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.

Steps

1. List the Snapshot copies in a volume:

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

   For complete command syntax, see the man page.

   #### Example

   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.

   #### Example

   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
   ```

Restoring 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.

Steps

1. List the Snapshot copies in a volume:

   volume snapshot show -vserver *SVM* -volume *volume*

   For complete command syntax, see the man page.

   #### Example

   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*

   For complete command syntax, see the man page.

   #### Example

   The following example restores the contents of **vol1**:

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

Understanding SnapMirror volume replication

Traditionally, ONTAP replication technologies served the need for disaster recovery (DR) and data archiving. In ONTAP 9.3, these technologies were combined in a way that allows you to configure disaster recovery and archiving on the same destination volume.

Related concepts

Asynchronous SnapMirror disaster recovery basics on page 16
SnapVault archiving basics on page 20
SnapMirror unified replication basics on page 21
XDP replaces DP as the SnapMirror default in ONTAP 9.3 on page 23
Fan-out and cascade data protection deployments on page 24

Asynchronous SnapMirror disaster recovery basics

SnapMirror is disaster recovery technology, designed for failover from primary storage to secondary storage at a geographically remote site. As its name implies, SnapMirror creates a replica, or *mirror,* of your working data in secondary storage from which you can continue to serve data in the event of a catastrophe at the primary site.

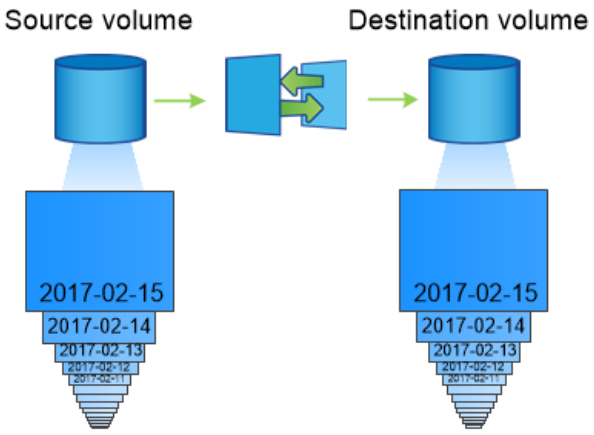
If the primary site is still available to serve data, you can simply transfer any needed data back to it, and not serve clients from the mirror at all. As the failover use case implies, the controllers on the secondary system should be equivalent or nearly equivalent to the controllers on the primary system to serve data efficiently from mirrored storage.

Data protection relationships

Data is mirrored at the volume level. The relationship between the source volume in primary storage and the destination volume in secondary storage is called a *data protection relationship.* The clusters in which the volumes reside and the SVMs that serve data from the volumes must be *peered.* A peer relationship enables clusters and SVMs to exchange data securely.

Cluster and SVM peering express configuration

The figure below illustrates SnapMirror data protection relationships.



A SnapMirror data protection relationship typically mirrors the Snapshot copies available on the source volume.

Scope of data protection relationships

You can create a data protection relationship directly between volumes or between the SVMs that own the volumes. In an *SVM data protection relationship,* all or part of the SVM configuration, from NFS exports and SMB shares to RBAC, is replicated, as well as the data in the volumes that the SVM owns.

You can also use SnapMirror for two special data protection applications:

- A *load-sharing mirror* copy of the SVM root volume ensures that data remains accessible in the event of a node outage or failover.
- A data protection relationship between *SnapLock volumes* lets you replicate WORM files to secondary storage.
  Archive and compliance using SnapLock technology

How SnapMirror data protection relationships are initialized

The first time you invoke SnapMirror, it performs a *baseline transfer* from the source volume to the destination volume. The *SnapMirror policy* for the relationship defines the contents of the baseline and any updates.

A baseline transfer under the default SnapMirror policy `MirrorAllSnapshots` involves the following steps:

- Make a Snapshot copy of the source volume.
- Transfer the Snapshot copy and all the data blocks it references to the destination volume.
- Transfer the remaining, less recent Snapshot copies on the source volume to the destination volume for use in case the “active” mirror is corrupted.

How SnapMirror data protection relationships are updated

Updates are asynchronous, following the schedule you configure. Retention mirrors the Snapshot policy on the source.

At each update under the `MirrorAllSnapshots` policy, SnapMirror creates a Snapshot copy of the source volume and transfers that Snapshot copy and any Snapshot copies that have been made since the last update. In the following output from the `snapmirror policy show` command for the `MirrorAllSnapshots` policy, note the following:

- `Create Snapshot` is “true”, indicating that `MirrorAllSnapshots` creates a Snapshot copy when SnapMirror updates the relationship.
- `MirrorAllSnapshots` has rules “sm_created” and “all_source_snapshots”, indicating that both the Snapshot copy created by SnapMirror and any Snapshot copies that have been made since the last update are transferred when SnapMirror updates the relationship.

```
cluster_dst::> snapmirror policy show -policy MirrorAllSnapshots -instance

                    Vserver: vs0
     SnapMirror Policy Name: MirrorAllSnapshots
     SnapMirror Policy Type: async-mirror
               Policy Owner: cluster-admin
                Tries Limit: 8
           Transfer Priority: normal
   Ignore accesstime Enabled: false
     Transfer Restartability: always
 Network Compression Enabled: false
             Create Snapshot: true
                     Comment: Asynchronous SnapMirror policy for mirroring all snapshots
                              and the latest active file system.
      Total Number of Rules: 2
                 Total Keep: 2
                      Rules: SnapMirror Label     Keep  Preserve Warn Schedule Prefix
                             ----------------     ----  -------- ---- -------- ------
                             sm_created              1  false       0 -        -
                             all_source_snapshots    1  false       0 -        -
```

MirrorLatest policy

The preconfigured `MirrorLatest` policy works exactly the same way as `MirrorAllSnapshots`, except that only the Snapshot copy created by SnapMirror is transferred at initialization and update.

```
                    Rules: SnapMirror Label     Keep  Preserve Warn Schedule Prefix
                           ----------------     ----  -------- ---- -------- ------
                           sm_created              1  false       0 -        -
```

SnapMirror Synchronous disaster recovery basics

Beginning with ONTAP 9.5, SnapMirror Synchronous (SM-S) technology is supported on all FAS and AFF platforms that have at least 16 GB of memory and on all ONTAP Select platforms. SnapMirror Synchronous technology is a capacity based, per-node, licensed feature that provides synchronous data replication at the volume level.

This functionality addresses the regulatory and national mandates for synchronous replication in financial, healthcare, and other regulated industries where zero data loss is required.

The following number of SnapMirror Synchronous operations are allowed per node depending on the platform:

- AFF: 40
- FAS: 20
- ONTAP Select: 10

Supported features

SnapMirror Synchronous technology supports the NFSv3, FC, and iSCSI protocols over all networks for which the latency does not exceed 10ms.

Unsupported features

The following features are not supported with Synchronous SnapMirror relationships in ONTAP 9.5:

- CIFS/SMB
- NFSv4
- Mixed protocol volumes (for example, CIFS/NFSv3)
- User created, scheduled, and application Snapshot copies are not replicated.
- DP_Optimized (DPO)
- SnapLock volumes
- FlexGroup volumes
- FlexCache volumes
- NVMe protocol
- SnapRestore
- DP_Optimized (DPO) systems
- Tape backup or restore using dump and SMTape on the destination volume
- Tape based restore to the source volume

- Throughput floor (QoS Min) for source volumes
- Hard and soft quotas
- FPolicy
- SnapMirror Synchronous cascade
- In a fan-out configuration, only one relationship can be a SnapMirror Synchronous relationship; all the other relationships from the source volume must be asynchronous SnapMirror relationships.
- Global throttling

Modes of operation

SnapMirror Synchronous has two modes of operation based on the type of the SnapMirror policy used:

Sync mode

In Sync mode, an I/O to primary storage is first replicated to secondary storage. Then the I/O is written to primary storage, and acknowledgment is sent to the application that issued the I/O. If the write to the secondary storage is not completed for any reason, the application is allowed to continue writing to the primary storage. When the error condition is corrected, SnapMirror Synchronous technology automatically resynchronizes with the secondary storage and resumes replicating from primary storage to secondary storage in Synchronous mode.

In Sync mode, RPO=0 and RTO is very low until a secondary replication failure occurs at which time RPO and RTO become indeterminate, but equal the time to repair the issue that caused secondary replication to fail and for the resync to complete.

StrictSync mode

SnapMirror Synchronous can optionally operate in StrictSync mode. If the write to the secondary storage is not completed for any reason, the application I/O fails, thereby ensuring that the primary and secondary storage are identical. Application I/O to the primary resumes only after the SnapMirror relationship returns to the **`InSync`** status. If the primary storage fails, application I/O can be resumed on the secondary storage, after failover, with no loss of data.

In StrictSync mode RPO is always zero, and RTO is very low.

Relationship status

The status of a SnapMirror Synchronous relationship is always in the **`InSync`** status during normal operation. If the SnapMirror transfer fails for any reason, the destination is not in sync with the source and can go to the **`OutofSync`** status.

For SnapMirror Synchronous relationships, the system automatically checks the relationship status (**`InSync`** or **`OutofSync`**) at a fixed interval. If the relationship status is **`OutofSync`**, ONTAP automatically triggers the auto resync process to bring back the relationship to the **`InSync`** status. Auto resync is triggered only if the transfer fails due to any operation, such as unplanned storage failover at source or destination or a network outage. User-initiated operations such as `snapmirror quiesce` and `snapmirror break` do not trigger auto resync.

If the relationship status becomes **`OutofSync`** for a SnapMirror Synchronous relationship in the StrictSync mode, all I/O operations to the primary volume are stopped. The **`OutofSync`** state for SnapMirror Synchronous relationship in the Sync mode is not disruptive to the primary and I/O operations are allowed on the primary volume.

Understanding workloads supported by StrictSync and Sync policies

StrictSync and Sync policies support all LUN based applications with FC and iSCSI protocols, as well as NFSv3 protocol for enterprise applications such as databases, VMWare, and so on.

For a Sync policy, you need to consider a few important aspects while selecting the NFSv3 workloads. The amount of data read or write operations by workloads is not a consideration, as Sync policy can handle high read or write IO workloads. However, workloads that have excessive file creation, directory creation, file permission changes, or directory permission changes may not be suitable (these are referred to as high-metadata workloads). A typical example of a high-metadata workload is a DevOps workload in which you create multiple test files, run automation, and delete the files. Another example is parallel build workload that generate multiple temporary files during compilation. The impact of a high rate of write metadata activity is that it can cause synchronization between mirrors to temporarily break which stalls the read and write IOs from the client.

For information about best practices and sizing of StrictSync policy and Sync policy, see NetApp ONTAP Resources page.

Related information

NetApp ONTAP Resources

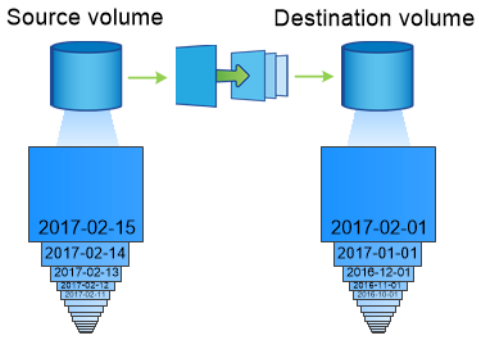
SnapVault archiving basics

SnapVault is archiving technology, designed for disk-to-disk Snapshot copy replication for standards compliance and other governance-related purposes. In contrast to a SnapMirror relationship, in which the destination usually contains only the Snapshot copies currently in the source volume, a SnapVault destination typically retains point-in-time Snapshot copies created over a much longer period.

You might want to keep monthly Snapshot copies of your data over a 20-year span, for example, to comply with government accounting regulations for your business. Since there is no requirement to serve data from vault storage, you can use slower, less expensive disks on the destination system.

SnapMirror and SnapVault share the same command infrastructure. You specify which method you want to use when you create a SnapMirror policy. Both methods require peered clusters and peered SVMs.

The figure below illustrates SnapVault data protection relationships.



A SnapVault data protection relationship typically retains point-in-time Snapshot copies created over a longer period than the Snapshot copies on the source volume.

How SnapVault data protection relationships are initialized

As with SnapMirror, SnapVault performs a baseline transfer the first time you invoke it. The SnapMirror policy for the relationship defines the contents of the baseline and any updates.

A baseline transfer under the default SnapVault policy `XDPDefault` makes a Snapshot copy of the source volume, then transfers that copy and the data blocks it references to the destination volume. Unlike SnapMirror, SnapVault does not include older Snapshot copies in the baseline.

How SnapVault data protection relationships are updated

Updates are asynchronous, following the schedule you configure. The rules you define in the policy for the relationship identify which new Snapshot copies to include in updates and how many copies to retain. The labels defined in the policy ("monthly," for example) must match one or more labels defined in the Snapshot policy on the source. Otherwise, replication fails.

At each update under the `XDPDefault` policy, SnapMirror transfers Snapshot copies that have been made since the last update, provided they have labels matching the labels defined in the policy rules. In the following output from the `snapmirror policy show` command for the `XDPDefault` policy, note the following:

- `Create Snapshot` is "false", indicating that `XDPDefault` does not create a Snapshot copy when SnapMirror updates the relationship.
- `XDPDefault` has rules "daily" and "weekly", indicating that all Snapshot copies with matching labels on the source are transferred when SnapMirror updates the relationship.

```
cluster_dst::> snapmirror policy show -policy XDPDefault -instance

                     Vserver: vs0
      SnapMirror Policy Name: XDPDefault
      SnapMirror Policy Type: vault
                Policy Owner: cluster-admin
                 Tries Limit: 8
            Transfer Priority: normal
   Ignore accesstime Enabled: false
      Transfer Restartability: always
 Network Compression Enabled: false
             Create Snapshot: false
                     Comment: Default policy for XDP relationships with daily and weekly
                              rules.
       Total Number of Rules: 2
                  Total Keep: 59
                       Rules: SnapMirror Label     Keep  Preserve Warn Schedule Prefix
                              ----------------     ----  -------- ---- -------- ------
                              daily                   7  false       0 -        -
                              weekly                 52  false       0 -        -
```

SnapMirror unified replication basics

SnapMirror *unified replication* allows you to configure disaster recovery and archiving on the same destination volume. When unified replication is appropriate, it offers benefits in reducing the amount of secondary storage you need, limiting the number of baseline transfers, and decreasing network traffic.

How unified data protection relationships are initialized

As with SnapMirror, unified data protection performs a baseline transfer the first time you invoke it. The SnapMirror policy for the relationship defines the contents of the baseline and any updates.

A baseline transfer under the default unified data protection policy `MirrorAndVault` makes a Snapshot copy of the source volume, then transfers that copy and the data blocks it references to the destination volume. Like SnapVault, unified data protection does not include older Snapshot copies in the baseline.

How unified data protection relationships are updated

At each update under the `MirrorAndVault` policy, SnapMirror creates a Snapshot copy of the source volume and transfers that Snapshot copy and any Snapshot copies that have been made since the last update, provided they have labels matching the labels defined in the Snapshot policy rules. In the following output from the `snapmirror policy show` command for the `MirrorAndVault` policy, note the following:

- `Create Snapshot` is "true", indicating that `MirrorAndVault` creates a Snapshot copy when SnapMirror updates the relationship.
- `MirrorAndVault` has rules "sm_created", "daily", and "weekly", indicating that both the Snapshot copy created by SnapMirror and the Snapshot copies with matching labels on the source are transferred when SnapMirror updates the relationship.

```
cluster_dst::> snapmirror policy show -policy MirrorAndVault -instance

                    Vserver: vs0
      SnapMirror Policy Name: MirrorAndVault
      SnapMirror Policy Type: mirror-vault
                Policy Owner: cluster-admin
                 Tries Limit: 8
            Transfer Priority: normal
   Ignore accesstime Enabled: false
     Transfer Restartability: always
 Network Compression Enabled: false
             Create Snapshot: true
                     Comment: A unified Synchronous SnapMirror and SnapVault policy for
                              mirroring the latest file system and daily and weekly snapshots.
       Total Number of Rules: 3
                  Total Keep: 59
                       Rules: SnapMirror Label     Keep  Preserve Warn Schedule Prefix
                              ----------------     ----  -------- ---- -------- ------
                              sm_created              1  false       0 -        -
                              daily                   7  false       0 -        -
                              weekly                 52  false       0 -        -
```

Unified7year policy

The preconfigured `Unified7year` policy works exactly the same way as `MirrorAndVault`, except that a fourth rule transfers monthly Snapshot copies and retains them for seven years.

```
                       Rules: SnapMirror Label     Keep  Preserve Warn Schedule Prefix
                              ----------------     ----  -------- ---- -------- ------
                              sm_created              1  false       0 -        -
                              daily                   7  false       0 -        -
                              weekly                 52  false       0 -        -
                              monthly                84  false       0 -        -
```

How to protect against possible data corruption

Unified replication limits the contents of the baseline transfer to the Snapshot copy created by SnapMirror at initialization. At each update, SnapMirror creates another Snapshot copy of the source and transfers that Snapshot copy and any new Snapshot copies that have labels matching the labels defined in the Snapshot policy rules.

You can protect against the possibility that an updated Snapshot copy is corrupted by creating a copy of the last transferred Snapshot copy on the destination. This "local copy" is retained regardless of the retention rules on the source, so that even if the Snapshot originally transferred by SnapMirror is no longer available on the source, a copy of it will be available on the destination.

When to use unified data replication

You need to weigh the benefit of maintaining a full mirror against the advantages that unified replication offers in reducing the amount of secondary storage, limiting the number of baseline transfers, and decreasing network traffic.

The key factor in determining the appropriateness of unified replication is the rate of change of the active file system. A traditional mirror might be better suited to a volume holding hourly Snapshot copies of database transaction logs, for example.

XDP replaces DP as the SnapMirror default in ONTAP 9.3

Starting with ONTAP 9.3, SnapMirror extended data protection (XDP) mode replaces SnapMirror data protection (DP) mode as the SnapMirror default.

Until ONTAP 9.3, SnapMirror invoked in DP mode and SnapMirror invoked in XDP mode used different replication engines, with different approaches to version-dependence:

- SnapMirror invoked in DP mode used a *version-dependent* replication engine in which the ONTAP version was required to be the same on primary and secondary storage:

```
cluster_dst::>  snapmirror create -type DP -source-path ... -
destination-path ...
```

- SnapMirror invoked in XDP mode used a *version-flexible* replication engine that supported different ONTAP versions on primary and secondary storage:

```
cluster_dst::>  snapmirror create -type XDP -source-path ... -
destination-path ...
```

With improvements in performance, the significant benefits of version-flexible SnapMirror outweigh the slight advantage in replication throughput obtained with version-dependent mode. For this reason, starting with ONTAP 9.3, XDP mode has been made the new default, and any invocations of DP mode on the command line or in new or existing scripts are automatically converted to XDP mode.

Existing relationships are not affected. If a relationship is already of type DP, it will continue to be of type DP. Starting with ONTAP 9.5, MirrorAndVault is the new default policy when no data protection mode is specified or when XDP mode is specified as the relationship type. The table below shows the behavior you can expect.

If you specify...	The type is...	The default policy (if you do not specify a policy) is...
DP	XDP	MirrorAllSnapshots (SnapMirror DR)
Nothing	XDP	MirrorAndVault (unified replication)
XDP	XDP	MirrorAndVault (unified replication)

As the table shows, the default policies assigned to XDP in different circumstances ensure that the conversion maintains the functional equivalence of the old types. Of course, you can use different policies as needed, including policies for unified replication:

If you specify...	And the policy is ...	The result is...
DP	MirrorAllSnapshots	SnapMirror DR
DP	XDPDefault	SnapVault
DP	MirrorAndVault	Unified replication
XDP	MirrorAllSnapshots	SnapMirror DR
XDP	XDPDefault	SnapVault
XDP	MirrorAndVault	Unified replication

The only exceptions to conversion are as follows:

- SVM data protection relationships continue to default to DP mode in ONTAP 9.3 and earlier. Starting with ONTAP 9.4, SVM data protection relationships default to XDP mode.
- Root volume load-sharing data protection relationships continue to default to DP mode.
- SnapLock data protection relationships continue to default to DP mode.
- Explicit invocations of DP continue to default to DP mode if you set the following cluster-wide option:

  ```
  options replication.create_data_protection_rels.enable on
  ```

  This option is ignored if you do not explicitly invoke DP.

When a destination volume grows automatically

During a data protection mirror transfer, the destination volume grows automatically in size if the source volume has grown, provided there is available space in the aggregate that contains the volume.

This behavior occurs irrespective of any automatic growth setting on the destination. You cannot limit the volume's growth or prevent ONTAP from growing it.

By default, data protection volumes are set to the `grow_shrink` autosize mode, which enables the volume to grow or shrink in response to the amount of used space, and max-autosize is set to 16 TB for data protection volumes.

Fan-out and cascade data protection deployments

You can use a *fan-out* deployment to extend data protection to multiple secondary systems. You can use a *cascade* deployment to extend data protection to tertiary systems.

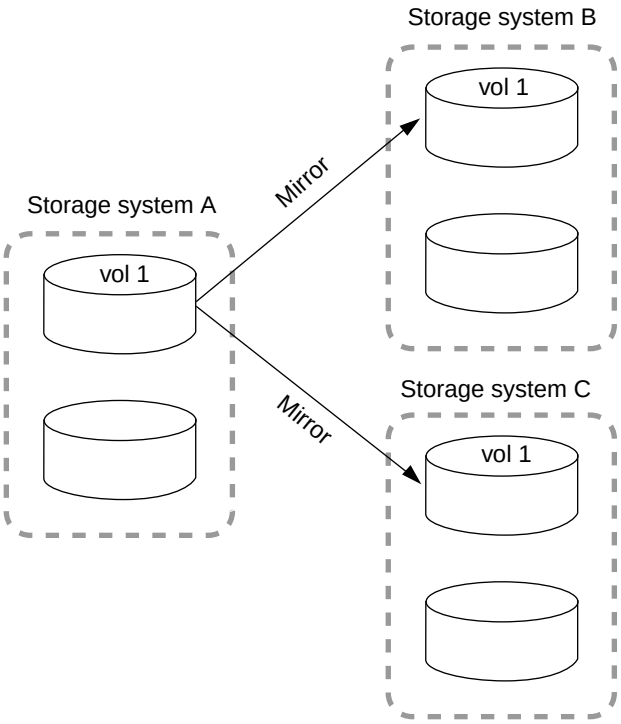
Both fan-out and cascade deployments support any combination of SnapMirror DR, SnapVault, or unified replication; however, SnapMirror Synchronous relationships (supported starting with ONTAP 9.5) support only fan-out deployments with one or more asynchronous SnapMirror relationships and do not support cascade deployments. Only one relationship in the fan-out configuration can be a SnapMirror Synchronous relationship, all the other relationships from the source volume must be asynchronous SnapMirror relationships.

Note: You can use a *fan-in* deployment to create data protection relationships between multiple primary systems and a single secondary system. Each relationship must use a different volume on the secondary system.

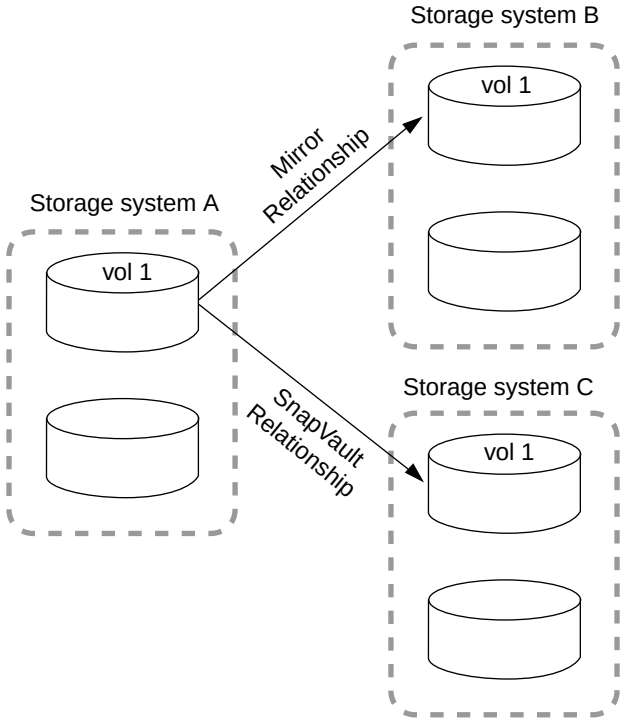
How fan-out deployments work

SnapMirror supports *multiple-mirrors* and *mirror-vault* fan-out deployments.

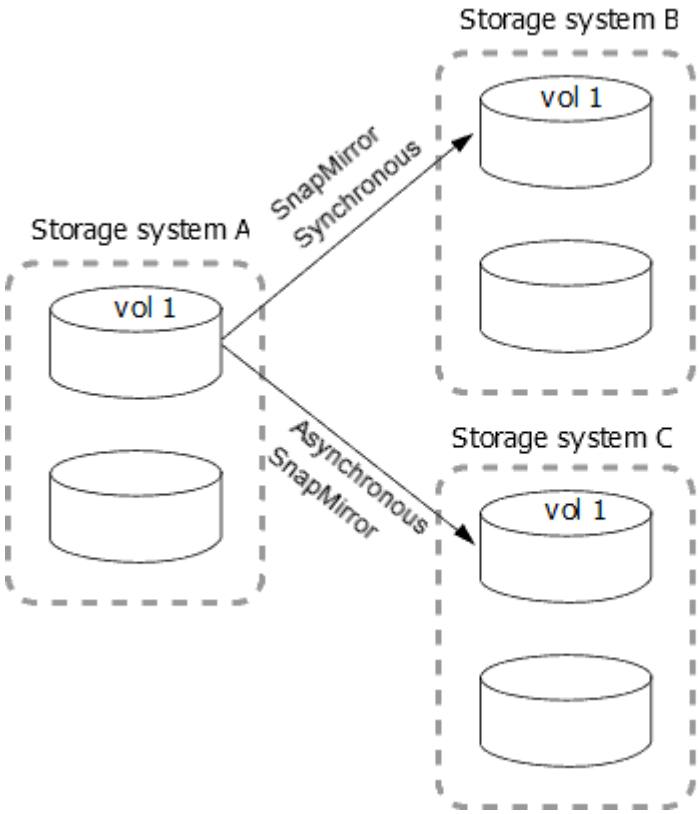
A multiple-mirrors fan-out deployment consists of a source volume that has a mirror relationship to multiple secondary volumes.



A mirror-vault fan-out deployment consists of a source volume that has a mirror relationship to a secondary volume and a SnapVault relationship to a different secondary volume.



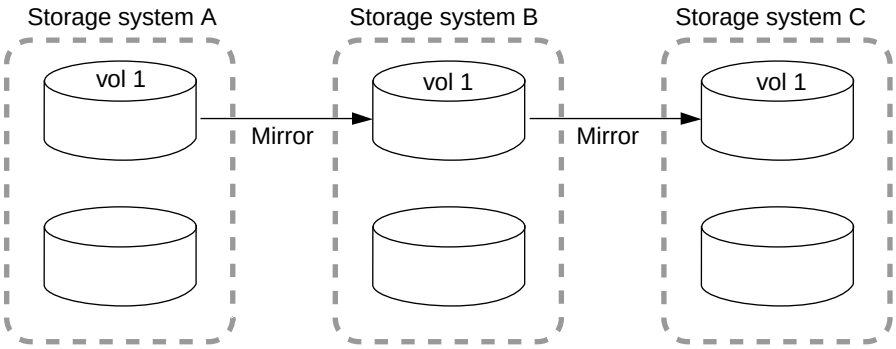
Starting with ONTAP 9.5, you can have fan-out deployments with SnapMirror Synchronous relationships; however, only one relationship in the fan-out configuration can be a SnapMirror Synchronous relationship, all the other relationships from the source volume must be asynchronous SnapMirror relationships.



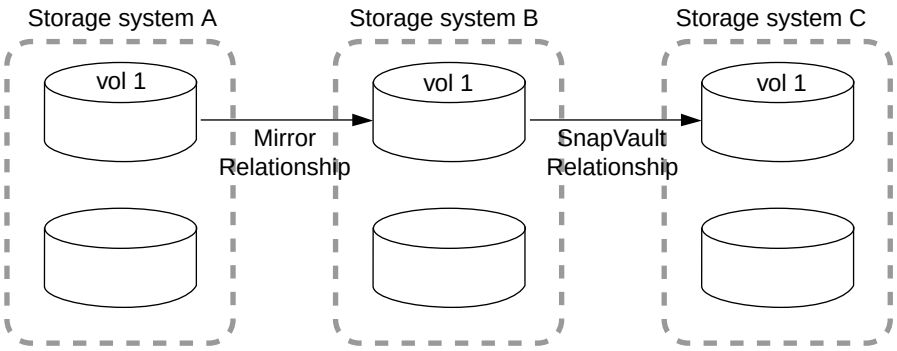
How cascade deployments work

SnapMirror supports *mirror-mirror*, *mirror-vault*, *vault-mirror*, and *vault-vault* cascade deployments.

A mirror-mirror cascade deployment consists of a chain of relationships in which a source volume is mirrored to a secondary volume, and the secondary volume is mirrored to a tertiary volume. If the secondary volume becomes unavailable, you can synchronize the relationship between the primary and tertiary volumes without performing a new baseline transfer.



A mirror-vault cascade deployment consists of a chain of relationships in which a source volume is mirrored to a secondary volume, and the secondary volume is vaulted to a tertiary volume.



Vault-mirror and, starting with ONTAP 9.2, vault-vault cascade deployments are also supported:

- A vault-mirror cascade deployment consists of a chain of relationships in which a source volume is vaulted to a secondary volume, and the secondary volume is mirrored to a tertiary volume.
- A vault-vault cascade deployment consists of a chain of relationships in which a source volume is vaulted to a secondary volume, and the secondary volume is vaulted to a tertiary volume.

SnapMirror Synchronous relationships are not supported in cascade deployments.

SnapMirror licensing

A SnapMirror license is required on both the source and destination clusters, with limited exceptions as defined below. A SnapVault license is not required if a SnapMirror license is already installed.

DP_Optimized (DPO) license

Starting with ONTAP 9.3, a new DP_Optimized (DPO) license is available that supports an increased number of volumes and peer relationships. A SnapMirror license is still required on both the source and destination.

On the following platforms, a DPO license is required only on the destination cluster. Otherwise, it is required on both the source and destination:

- FAS22xx
- FAS25xx
- FAS26xx
- FAS62xx
- FAS80xx
- FAS82xx
- FAS9000

SnapMirror license exceptions for DPO destinations

Starting with ONTAP 9.3, the following platforms do not need a SnapMirror license on the source when the destination has a DPO license:

- AFF80xx : 8020, 8040, 8060, 8080
- FAS80xx : 8020, 8040, 8060, 8080
- FAS22xx : 2220, 2240
- FAS25xx : 2520, 2552, 2554
- FAS62xx : 6210, 6220, 6240, 6250, 6280, 6290
- V32xx : 3220, 3240, 3250, 3270
- V62xx : 6210, 6220, 6240, 6250, 6280, 6290

SnapMirror Synchronous license

Starting with ONTAP 9.5, SnapMirror Synchronous relationships are supported. You require the following licenses for creating a SnapMirror Synchronous relationship:

- The SnapMirror Synchronous license is required on the source cluster.
- The SnapMirror license is required on both the source cluster and the destination cluster.

Managing SnapMirror volume replication

SnapMirror offers three types of data protection relationship: SnapMirror DR, SnapVault, and unified replication. You can follow the same basic workflow to configure each type of relationship.

Related concepts

Understanding SnapMirror volume replication on page 16

Deciding whether to use the Data Protection Power Guide

This guide describes how to manage Snapshot copies on a local ONTAP system, and how to replicate Snapshot copies to a remote system using SnapMirror. You can replicate Snapshot copies for disaster recovery or long-term retention.

Note: The *Data Protection Power Guide* replaces the *Data Protection Using SnapMirror and SnapVault Guide*.

You should use this guide under the following circumstances:

- You want to understand the range of ONTAP backup and recovery capabilities.
- You want to use the command-line interface (CLI), not OnCommand System Manager, an automated scripting tool, or a SnapCenter product.
  If you are using System Manager, see *Cluster Management Using OnCommand System Manager.*
  Cluster management using System Manager
  If you are using SnapCenter, see the documentation for your SnapCenter product.
- You have already created peer relationships between the source and destination clusters and the source and destination SVMs.
  Cluster and SVM peering
- You are backing up volumes or SVMs from AFF or FAS storage systems to AFF or FAS storage systems.
  - If you are replicating Element volumes to ONTAP, or ONTAP LUNs to an Element system, see the NetApp Element software documentation.
    Replication between NetApp element software and ONTAP
- You want to provide data protection using online methods, not tape.

If you want to quickly perform volume backup and recovery using best practices, you should choose among the following documentation:

- Volume disaster recovery preparation
  Volume disaster recovery express preparation
- Volume disaster recovery
  Volume disaster express recovery
- Volume backup using SnapVault
  Volume express backup using SnapVault
- Volume restore using SnapVault
  Volume restore express management using SnapVault

If you require additional configuration or conceptual information, you should choose among the following documentation:

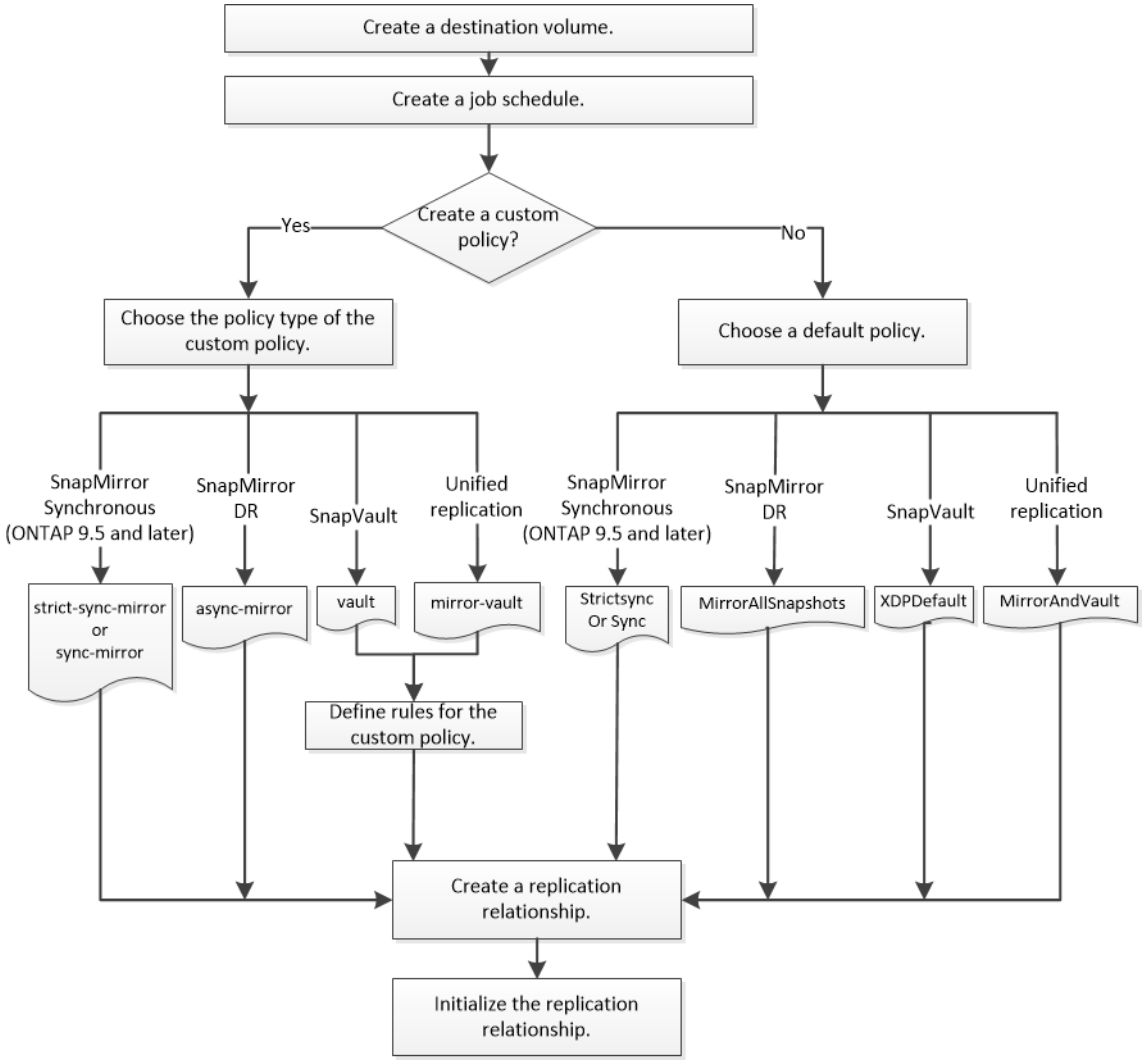
- ONTAP conceptual background
  ONTAP concepts
- Synchronous disaster recovery in a MetroCluster configuration
  MetroCluster management and disaster recovery

- Data protection for WORM files in SnapLock volumes
  Archive and compliance using SnapLock technology
- Data protection using tape technology
  - *NDMP express configuration*
  - *Data protection using tape backup*
- Command reference
  ONTAP 9 commands
- Automation of management tasks
  NetApp Documentation: OnCommand Workflow Automation (current releases)
- Technical Reports (TRs), which include additional information about ONTAP technology and interaction with external services.
  - *NetApp Technical Report 4015: SnapMirror Configuration and Best Practices Guide for ONTAP 9.1, 9.2*
  - *NetApp Technical Report 4183: SnapVault Best Practices Guide*

SnapMirror replication workflow

For each type of SnapMirror data protection relationship, the workflow is the same: create a destination volume, create a job schedule, specify a policy, create and initialize the relationship.

Starting in ONTAP 9.3, you can use the `snapmirror protect` command to configure a data protection relationship in a single step. Even if you use `snapmirror protect`, you need to understand each step in the workflow.



Configuring a replication relationship in one step

Starting in ONTAP 9.3, you can use the `snapmirror protect` command to configure a data protection relationship in a single step. You specify a list of volumes to be replicated, an SVM on the destination cluster, a job schedule, and a SnapMirror policy. `snapmirror protect` does the rest.

Before you begin

- The source and destination clusters and SVMs must be peered.
  Cluster and SVM peering express configuration
- The language on the destination volume must be the same as the language on the source volume.

About this task

The `snapmirror protect` command chooses an aggregate associated with the specified SVM. If no aggregate is associated with the SVM, it chooses from all the aggregates in the cluster. The choice of aggregate is based on the amount of free space and the number of volumes on the aggregate.

The `snapmirror protect` command then performs the following steps:

- Creates a destination volume with an appropriate type and amount of reserved space for each volume in the list of volumes to be replicated.
- Configures a replication relationship appropriate for the policy you specify.
- Initializes the relationship.

The name of the destination volume is of the form *source_volume_name*_dst. In case of a conflict with an existing name, the command appends a number to the volume name. You can specify a prefix and/or suffix in the command options. The suffix replaces the system-supplied dst suffix.

In ONTAP 9.3 and earlier, a destination volume can contain up to 251 Snapshot copies. In ONTAP 9.4 and later, a destination volume can contain up to 1019 Snapshot copies.

Note: Initialization can be time-consuming. `snapmirror protect` does not wait for initialization to complete before the job finishes. For this reason, you should use the `snapmirror show` command rather than the `job show` command to determine when initialization is complete.

Starting with ONTAP 9.5, SnapMirror Synchronous relationships can be created by using the `snapmirror protect` command.

Step

1. Create and initialize a replication relationship in one step:

   snapmirror protect -path-list *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-vserver *destination_SVM* -policy *policy* -schedule *schedule* -auto-initialize true|false -destination-volume-prefix *prefix* -destination-volume-suffix *suffix*

   Note: You must run this command from the destination SVM or the destination cluster. The `-auto-initialize` option defaults to “true”.

   #### Example

   The following example creates and initializes a SnapMirror DR relationship using the default **`MirrorAllSnapshots`** policy:

   ```
   cluster_dst::> snapmirror protect -path-list svm1:volA, svm1:volB -
   destination-vserver svm_backup -policy MirrorAllSnapshots -schedule
   replication_daily
   ```

   Note: You can use a custom policy if you prefer. For more information, see *Creating a custom replication policy* on page 34.

   #### Example

   The following example creates and initializes a SnapVault relationship using the default **`XDPDefault`** policy:

   ```
   cluster_dst::> snapmirror protect -path-list svm1:volA, svm1:volB -
   destination-vserver svm_backup -policy XDPDefault -schedule
   replication_daily
   ```

   #### Example

   The following example creates and initializes a unified replication relationship using the default **`MirrorAndVault`** policy:

   ```
   cluster_dst::> snapmirror protect -path-list svm1:volA, svm1:volB -
   destination-vserver svm_backup -policy MirrorAndVault
   ```

Example

The following example creates and initializes a SnapMirror Synchronous relationship using the default **Sync** policy:

```
cluster_dst::> snapmirror protect -path-list svm1:volA, svm1:volB -
destination-vserver svm_sync -policy Sync
```

Note: For SnapVault and unified replication policies, you might find it useful to define a schedule for creating a copy of the last transferred Snapshot copy on the destination. For more information, see *Defining a schedule for creating a local copy on the destination* on page 37.

After you finish

Use the `snapmirror show` command to verify that the SnapMirror relationship was created. For complete command syntax, see the man page.

Configuring a replication relationship one step at a time

For each type of data protection relationship, you need to create a destination volume, configure a job schedule, specify a policy, and create and initialize the relationship. You can use a default or custom policy.

Steps

1. Creating a destination volume on page 33
2. Creating a replication job schedule on page 34
3. Customizing a replication policy on page 34
4. Creating a replication relationship on page 38
5. Initializing a replication relationship on page 40
6. Example: Configuring a vault-vault cascade on page 41

Creating a destination volume

You can use the `volume create` command on the destination to create a destination volume. The destination volume should be the same or greater in size than the source volume.

Step

1. Create a destination volume:

   volume create -vserver *SVM* -volume *volume* -aggregate *aggregate* -type DP -size *size*

   For complete command syntax, see the man page.

Example

The following example creates a 2-GB destination volume named **volA_dst**:

```
cluster_dst::> volume create -vserver SVM_backup -volume volA_dst -
aggregate node01_aggr -type DP -size 2GB
```

Creating a replication job schedule

You can use the `job schedule cron create` command to create a replication job schedule. The job schedule determines when SnapMirror automatically updates the data protection relationship to which the schedule is assigned.

About this task

You assign a job schedule when you create a data protection relationship. If you do not assign a job schedule, you must update the relationship manually.

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.

Example

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

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

Customizing a replication policy

You can use a default or custom policy when you create a replication relationship. For a custom SnapVault or unified replication policy, you must define one or more *rules* that determine which Snapshot copies are transferred during initialization and update. You might also want to define a schedule for creating local Snapshot copies on the destination.

Related concepts

SnapMirror Synchronous disaster recovery basics on page 18

Related tasks

Creating a custom replication policy on page 34
Defining a rule for a policy on page 36
Defining a schedule for creating a local copy on the destination on page 37

Creating a custom replication policy

You can create a custom replication policy if the default policy for a relationship is not suitable. You might want to compress data in a network transfer, for example, or modify the number of attempts SnapMirror makes to transfer Snapshot copies.

About this task

The *policy type* of the replication policy determines the type of relationship it supports. The table below shows the available policy types.

Policy type	Relationship type
async-mirror	SnapMirror DR
vault	SnapVault
mirror-vault	Unified replication
strict-sync-mirror	SnapMirror Synchronous in the StrictSync mode (supported starting with ONTAP 9.5)
sync-mirror	SnapMirror Synchronous in the Sync mode (supported starting with ONTAP 9.5)

Tip: When you create a custom replication policy, it is a good idea to model the policy after a default policy.

Step

1. Create a custom replication policy:

   `snapmirror policy create -vserver` *`SVM`* `-policy` *`policy`* `-type async-mirror|vault|mirror-vault|strict-sync-mirror|sync-mirror -comment` *`comment`* `-tries` *`transfer_tries`* `-transfer-priority low|normal -is-network-compression-enabled true|false`

   For complete command syntax, see the man page.

   Starting with ONTAP 9.5, you can specify the schedule for creating a common Snapshot copy schedule for SnapMirror Synchronous relationships by using the `-common-snapshot-schedule` parameter. By default, the common Snapshot copy schedule for SnapMirror Synchronous relationships is one hour. You can specify a value from 30 minutes to two hours for the Snapshot copy schedule for SnapMirror Synchronous relationships.

Example

The following example creates a custom replication policy for SnapMirror DR that enables network compression for data transfers:

```
cluster_dst::> snapmirror policy create -vserver svm1 -policy
DR_compressed -type async-mirror -comment “DR with network
compression enabled” -is-network-compression-enabled true
```

Example

The following example creates a custom replication policy for SnapVault:

```
cluster_dst::> snapmirror policy create -vserver svm1 -policy
my_snapvault -type vault
```

Example

The following example creates a custom replication policy for unified replication:

```
cluster_dst::> snapmirror policy create -vserver svm1 -policy
my_unified -type mirror-vault
```

Example

The following example creates a custom replication policy for SnapMirror Synchronous relationship in the StrictSync mode:

```
cluster_dst::> snapmirror policy create -vserver svm1 -policy
my_strictsync -type strict-sync-mirror -common-snapshot-schedule
my_sync_schedule
```

After you finish

For “vault” and “mirror-vault” policy types, you must define rules that determine which Snapshot copies are transferred during initialization and update.

Use the `snapmirror policy show` command to verify that the SnapMirror policy was created. For complete command syntax, see the man page.

Defining a rule for a policy

For custom policies with the “vault” or “mirror-vault” policy type, you must define at least one rule that determines which Snapshot copies are transferred during initialization and update. You can also define rules for default policies with the “vault” or “mirror-vault” policy type.

About this task

Every policy with the “vault” or “mirror-vault” policy type must have a rule that specifies which Snapshot copies to replicate. The rule “bi-monthly”, for example, indicates that only Snapshot copies assigned the SnapMirror label “bi-monthly” should be replicated. You specify the SnapMirror label when you configure the Snapshot policy on the source.

Each policy type is associated with one or more system-defined rules. These rules are automatically assigned to a policy when you specify its policy type. The table below shows the system-defined rules.

System-defined rule	Used in policy types	Result
sm_created	async-mirror, mirror-vault	A Snapshot copy created by SnapMirror is transferred on initialization and update.
all_source_snapshots	async-mirror	New Snapshot copies on the source are transferred on initialization and update.
daily	vault, mirror-vault	New Snapshot copies on the source with the SnapMirror label “daily” are transferred on initialization and update.
weekly	vault, mirror-vault	New Snapshot copies on the source with the SnapMirror label “weekly” are transferred on initialization and update.
monthly	mirror-vault	New Snapshot copies on the source with the SnapMirror label “monthly” are transferred on initialization and update.

Except for the “async-mirror” policy type, you can specify additional rules as needed, for default or custom policies. For example:

- For the default `MirrorAndVault` policy, you might create a rule called “bi-monthly” to match Snapshot copies on the source with the “bi-monthly” SnapMirror label.
- For a custom policy with the “mirror-vault” policy type, you might create a rule called “bi-weekly” to match Snapshot copies on the source with the “bi-weekly” SnapMirror label.

Step

1. Define a rule for a policy:

snapmirror policy add-rule -vserver *SVM* -policy *policy_for_rule* -snapmirror-label *snapmirror-label* -keep *retention_count*

For complete command syntax, see the man page.

Example

The following example adds a rule with the SnapMirror label **bi-monthly** to the default **MirrorAndVault** policy:

```
cluster_dst::> snapmirror policy add-rule -vserver svm1 -policy
MirrorAndVault -snapmirror-label bi-monthly -keep 6
```

Example

The following example adds a rule with the SnapMirror label **bi-weekly** to the custom **my_snapvault** policy:

```
cluster_dst::> snapmirror policy add-rule -vserver svm1 -policy
my_snapvault -snapmirror-label bi-weekly -keep 26
```

Defining a schedule for creating a local copy on the destination

For SnapVault and unified replication relationships, you can protect against the possibility that an updated Snapshot copy is corrupted by creating a copy of the last transferred Snapshot copy on the destination. This "local copy" is retained regardless of the retention rules on the source, so that even if the Snapshot originally transferred by SnapMirror is no longer available on the source, a copy of it will be available on the destination.

About this task

You specify the schedule for creating a local copy in the `-schedule` option of the `snapmirror policy add-rule` command.

Step

1. Define a schedule for creating a local copy on the destination:

   snapmirror policy add-rule -vserver *SVM* -policy *policy_for_rule* -snapmirror-label *snapmirror-label* -schedule *schedule*

   For complete command syntax, see the man page. For an example of how to create a job schedule, see *Creating a replication job schedule* on page 34.

Example

The following example adds a schedule for creating a local copy to the default **MirrorAndVault** policy:

```
cluster_dst::> snapmirror policy add-rule -vserver svm1 -policy
MirrorAndVault -snapmirror-label my_monthly -schedule my_monthly
```

Example

The following example adds a schedule for creating a local copy to the custom **my_unified** policy:

```
cluster_dst::> snapmirror policy add-rule -vserver svm1 -policy
my_unified -snapmirror-label my_monthly -schedule my_monthly
```

Creating a replication relationship

The relationship between the source volume in primary storage and the destination volume in secondary storage is called a *data protection relationship.* You can use the `snapmirror create` command to create SnapMirror DR, SnapVault, or unified replication data protection relationships.

Before you begin

- The source and destination clusters and SVMs must be peered.
  Cluster and SVM peering express configuration
- The language on the destination volume must be the same as the language on the source volume.

About this task

Until ONTAP 9.3, SnapMirror invoked in DP mode and SnapMirror invoked in XDP mode used different replication engines, with different approaches to version-dependence:

- SnapMirror invoked in DP mode used a *version-dependent* replication engine in which the ONTAP version was required to be the same on primary and secondary storage:

```
cluster_dst::>  snapmirror create -type DP -source-path ... -
destination-path ...
```

- SnapMirror invoked in XDP mode used a *version-flexible* replication engine that supported different ONTAP versions on primary and secondary storage:

```
cluster_dst::>  snapmirror create -type XDP -source-path ... -
destination-path ...
```

With improvements in performance, the significant benefits of version-flexible SnapMirror outweigh the slight advantage in replication throughput obtained with version-dependent mode. For this reason, starting with ONTAP 9.3, XDP mode has been made the new default, and any invocations of DP mode on the command line or in new or existing scripts are automatically converted to XDP mode.

Existing relationships are not affected. If a relationship is already of type DP, it will continue to be of type DP. The table below shows the behavior you can expect.

If you specify...	The type is...	The default policy (if you do not specify a policy) is...
DP	XDP	MirrorAllSnapshots (SnapMirror DR)
Nothing	XDP	MirrorAllSnapshots (SnapMirror DR)
XDP	XDP	XDPDefault (SnapVault)

See also the examples in the procedure below.

The only exceptions to conversion are as follows:

- SVM data protection relationships continue to default to DP mode.
  Specify XDP explicitly to obtain XDP mode with the default `MirrorAllSnapshots` policy.
- Load-sharing data protection relationships continue to default to DP mode.
- SnapLock data protection relationships continue to default to DP mode.
- Explicit invocations of DP continue to default to DP mode if you set the following cluster-wide option:

```
options replication.create_data_protection_rels.enable on
```

  This option is ignored if you do not explicitly invoke DP.

In ONTAP 9.3 and earlier, a destination volume can contain up to 251 Snapshot copies. In ONTAP 9.4 and later, a destination volume can contain up to 1019 Snapshot copies.

Starting with ONTAP 9.5, SnapMirror Synchronous relationships are supported.

Step

1. From the destination cluster, create a replication relationship:

   snapmirror create -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -type DP|XDP -schedule *schedule* -policy *policy*

   For complete command syntax, see the man page.

   Note: The `schedule` parameter is not applicable when creating SnapMirror Synchronous relationships.

Example

The following example creates a SnapMirror DR relationship using the default **`MirrorLatest`** policy:

```
cluster_dst::> snapmirror create -source-path svm1:volA -destination-
path svm_backup:volA_dst -type XDP -schedule my_daily -policy
MirrorLatest
```

Example

The following example creates a SnapVault relationship using the default **`XDPDefault`** policy:

```
cluster_dst::> snapmirror create -source-path svm1:volA -destination-
path svm_backup:volA_dst -type XDP -schedule my_daily -policy
XDPDefault
```

Example

The following example creates a unified replication relationship using the default **`MirrorAndVault`** policy:

```
cluster_dst:> snapmirror create -source-path svm1:volA -destination-
path svm_backup:volA_dst -type XDP -schedule my_daily -policy
MirrorAndVault
```

Example

The following example creates a unified replication relationship using the custom **`my_unified`** policy:

```
cluster_dst::> snapmirror create -source-path svm1:volA -destination-
path svm_backup:volA_dst -type XDP -schedule my_daily -policy
my_unified
```

Example

The following example creates a SnapMirror Synchronous relationship using the default **`Sync`** policy:

```
cluster_dst::> snapmirror create -source-path svm1:volA -destination-
path svm_backup:volA_dst -type XDP -policy Sync
```

Example

The following example creates a SnapMirror Synchronous relationship using the default **StrictSync** policy:

```
cluster_dst::> snapmirror create -source-path svm1:volA -destination-
path svm_backup:volA_dst -type XDP -policy StrictSync
```

Example

The following example creates a SnapMirror DR relationship. With the DP type automatically converted to XDP and with no policy specified, the policy defaults to the **MirrorAllSnapshots** policy:

```
cluster_dst::> snapmirror create -source-path svm1:volA -destination-
path svm_backup:volA_dst -type DP -schedule my_daily
```

Example

The following example creates a SnapMirror DR relationship. With no type or policy specified, the policy defaults to the **MirrorAllSnapshots** policy:

```
cluster_dst::> snapmirror create -source-path svm1:volA -destination-
path svm_backup:volA_dst -schedule my_daily
```

Example

The following example creates a SnapMirror DR relationship. With no policy specified, the policy defaults to the **XDPDefault** policy:

```
cluster_dst::> snapmirror create -source-path svm1:volA -destination-
path svm_backup:volA_dst -type XDP -schedule my_daily
```

After you finish

Use the `snapmirror show` command to verify that the SnapMirror relationship was created. For complete command syntax, see the man page.

Initializing a replication relationship

For all relationship types, initialization performs a *baseline transfer*: it makes a Snapshot copy of the source volume, then transfers that copy and all the data blocks it references to the destination volume. Otherwise, the contents of the transfer depend on the policy.

Before you begin

The source and destination clusters and SVMs must be peered.

Cluster and SVM peering express configuration

About this task

Initialization can be time-consuming. You might want to run the baseline transfer in off-peak hours.

Starting with ONTAP 9.5, SnapMirror Synchronous relationships are supported.

Step

1. Initialize a replication relationship:

snapmirror initialize -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

For complete command syntax, see the man page.

Note: You must run this command from the destination SVM or the destination cluster.

Example

The following example initializes the relationship between the source volume **volA** on **svm1** and the destination volume **volA_dst** on **svm_backup**:

```
cluster_dst::> snapmirror initialize -source-path svm1:volA -
destination-path svm_backup:volA_dst
```

Example: Configuring a vault-vault cascade

An example will show in concrete terms how you can configure replication relationships one step at a time. You can use the vault-vault cascade deployment configured in the example to retain more than 251 Snapshot copies labeled “my-weekly”.

Before you begin

- The source and destination clusters and SVMs must be peered.
- You must be running ONTAP 9.2 or later. Vault-vault cascades are not supported in earlier ONTAP releases.

About this task

The example assumes the following:

- You have configured Snapshot copies on the source cluster with the SnapMirror labels “my-daily”, “my-weekly”, and “my-monthly”.
- You have configured destination volumes named “volA” on the secondary and tertiary destination clusters.
- You have configured replication job schedules named “my_snapvault” on the secondary and tertiary destination clusters.

The example shows how to create replication relationships based on two custom policies:

- The “snapvault_secondary” policy retains 7 daily, 52 weekly, and 180 monthly Snapshot copies on the secondary destination cluster.
- The “snapvault_tertiary policy” retains 250 weekly Snapshot copies on the tertiary destination cluster.

Steps

1. On the secondary destination cluster, create the “snapvault_secondary” policy:

   cluster_secondary::> snapmirror policy create -policy snapvault_secondary -type vault -comment “Policy on secondary for vault to vault cascade” -vserver svm_secondary

2. On the secondary destination cluster, define the “my-daily” rule for the policy:

   cluster_secondary::> snapmirror policy add-rule -policy snapvault_secondary -snapmirror-label my-daily -keep 7 -vserver svm_secondary

3. On the secondary destination cluster, define the “my-weekly” rule for the policy:

```
cluster_secondary::> snapmirror policy add-rule -policy
snapvault_secondary -snapmirror-label my-weekly -keep 52 -vserver
svm_secondary
```

4. On the secondary destination cluster, define the “my-monthly” rule for the policy:

```
cluster_secondary::> snapmirror policy add-rule -policy
snapvault_secondary -snapmirror-label my-monthly -keep 180 -vserver
svm_secondary
```

5. On the secondary destination cluster, verify the policy:

```
cluster_secondary::> snapmirror policy show snapvault_secondary -
instance
```

```
                    Vserver: svm_secondary
      SnapMirror Policy Name: snapvault_secondary
      SnapMirror Policy Type: vault
                Policy Owner: cluster-admin
                 Tries Limit: 8
           Transfer Priority: normal
   Ignore accesstime Enabled: false
     Transfer Restartability: always
Network Compression Enabled: false
             Create Snapshot: false
                     Comment: Policy on secondary for vault to vault cascade
       Total Number of Rules: 3
                  Total Keep: 239
                       Rules: SnapMirror Label     Keep  Preserve Warn Schedule Prefix
                              ----------------     ----  -------- ---- -------- ------
                              my-daily               7  false       0 -        -
                              my-weekly             52  false       0 -        -
                              my-monthly           180  false       0 -        -
```

6. On the secondary destination cluster, create the relationship with the source cluster:

```
cluster_secondary::> snapmirror create -source-path svm_primary:volA -
destination-path svm_secondary:volA -type XDP -schedule my_snapvault -
policy snapvault_secondary
```

7. On the secondary destination cluster, initialize the relationship with the source cluster:

```
cluster_secondary::> snapmirror initialize -source-path svm_primary:volA
-destination-path svm_secondary:volA
```

8. On the tertiary destination cluster, create the “snapvault_tertiary” policy:

```
cluster_tertiary::> snapmirror policy create -policy snapvault_tertiary
-type vault -comment “Policy on tertiary for vault to vault cascade” -
vserver svm_tertiary
```

9. On the tertiary destination cluster, define the “my-weekly” rule for the policy:

```
cluster_tertiary::> snapmirror policy add-rule -policy
snapvault_tertiary -snapmirror-label my-weekly -keep 250 -vserver
svm_tertiary
```

10. On the tertiary destination cluster, verify the policy:

```
cluster_tertiary::> snapmirror policy show snapvault_tertiary -instance
```

```
                    Vserver: svm_tertiary
      SnapMirror Policy Name: snapvault_tertiary
      SnapMirror Policy Type: vault
                Policy Owner: cluster-admin
                 Tries Limit: 8
           Transfer Priority: normal
   Ignore accesstime Enabled: false
     Transfer Restartability: always
Network Compression Enabled: false
             Create Snapshot: false
                     Comment: Policy on tertiary for vault to vault cascade
       Total Number of Rules: 1
```

```
                    Total Keep: 250
                         Rules: SnapMirror Label     Keep  Preserve Warn Schedule Prefix
                                ----------------     ----  -------- ---- -------- ------
                                my-weekly             250  false       0 -        -
```

11. On the tertiary destination cluster, create the relationship with the secondary cluster:

    cluster_tertiary::> snapmirror create -source-path svm_secondary:volA -destination-path svm_tertiary:volA -type XDP -schedule my_snapvault -policy snapvault_tertiary

12. On the tertiary destination cluster, initialize the relationship with the secondary cluster:

    cluster_tertiary::> snapmirror initialize -source-path svm_secondary:volA -destination-path svm_tertiary:volA

Converting an existing DP-type relationship to XDP

You can easily convert an existing DP-type relationship to XDP to take advantage of version-flexible SnapMirror.

About this task

SnapMirror does not automatically convert existing DP-type relationships to XDP. To convert the relationship, you need to break and delete the existing relationship, create a new XDP relationship, and resync the relationship. For background information, see *XDP replaces DP as the SnapMirror default in ONTAP 9.3* on page 23.

Steps

1. Quiesce the existing DP-type relationship:

   snapmirror quiesce -source-path *SVM*:*volume*|*cluster*://*SVM*/*volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM*/*volume*, ...

   For complete command syntax, see the man page.

   Note: You must run this command from the destination SVM or the destination cluster.

   #### Example

   The following example quiesces the relationship between the source volume **volA** on **svm1** and the destination volume **volA_dst** on **svm_backup**:

   ```
   cluster_dst::> snapmirror quiesce -source-path svm1:volA -destination-
   path svm_backup:volA_dst
   ```

2. Break the existing DP-type relationship:

   snapmirror break -source-path *SVM*:*volume*|*cluster*://*SVM*/*volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM*/*volume*, ...

   For complete command syntax, see the man page.

   Note: You must run this command from the destination SVM or the destination cluster.

   #### Example

   The following example breaks the relationship between the source volume **volA** on **svm1** and the destination volume **volA_dst** on **svm_backup**:

   ```
   cluster_dst::> snapmirror break -source-path svm1:volA -destination-
   path svm_backup:volA_dst
   ```

3. Disable automatic deletion of Snapshot copies on the destination volume:

   volume snapshot autodelete modify -vserver *SVM* -volume *volume* -enabled false

   Example

   The following example disables Snapshot copy autodelete on the destination volume **volA_dst**:

   ```
   cluster_dst::> volume snapshot autodelete modify -vserver svm_backup -
   volume volA_dst -enabled false
   ```

4. Delete the existing DP-type relationship:

   snapmirror delete -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

   For complete command syntax, see the man page.

   Example

   Note: You must run this command from the destination SVM or the destination cluster.

   The following example deletes the relationship between the source volume **volA** on **svm1** and the destination volume **volA_dst** on **svm_backup**:

   ```
   cluster_dst::> snapmirror delete -source-path svm1:volA -destination-
   path svm_backup:volA_dst
   ```

5. Create the new XDP-type relationship:

   snapmirror create -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -type XDP -schedule *schedule* -policy *policy*

   The new relationship must use the same source and destination volume. For complete command syntax, see the man page.

   Note: You must run this command from the destination SVM or the destination cluster.

   Example

   The following example creates a SnapMirror DR relationship between the source volume **volA** on **svm1** and the destination volume **volA_dst** on **svm_backup** using the default **MirrorAllSnapshots** policy:

   ```
   cluster_dst::> snapmirror create -source-path svm1:volA -destination-
   path svm_backup:volA_dst -type XDP -schedule my_daily -policy
   MirrorAllSnapshots
   ```

6. Resync the source and destination volumes:

   snapmirror resync -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -type DP|XDP -schedule *schedule* -policy *policy*

   For complete command syntax, see the man page.

   Note: You must run this command from the destination SVM or the destination cluster. Although resync does not require a baseline transfer, it can be time-consuming. You might want to run the resync in off-peak hours.

Example

The following example resyncs the relationship between the source volume **volA** on **svm1** and the destination volume **volA_dst** on **svm_backup**:

```
cluster_dst::> snapmirror resync -source-path svm1:volA -destination-
path svm_backup:volA_dst
```

After you finish

Use the `snapmirror show` command to verify that the SnapMirror relationship was created. For complete command syntax, see the man page.

Converting the type of a SnapMirror relationship

Starting with ONTAP 9.5, SnapMirror Synchronous is supported. You can convert an asynchronous SnapMirror relationship to a SnapMirror Synchronous relationship or vice versa without performing a baseline transfer.

About this task

You cannot convert an asynchronous SnapMirror relationship to a SnapMirror Synchronous relationship or vice versa by changing the SnapMirror policy

Choices

- **Converting an asynchronous SnapMirror relationship to a SnapMirror Synchronous relationship**

  1. From the destination cluster, delete the asynchronous SnapMirror relationship:

     snapmirror delete -destination-path *SVM*:*volume*

     Example

     ```
     cluster2::>snapmirror delete -destination-path vs1_dr:vol1
     ```

  2. From the source cluster, release the SnapMirror relationship without deleting the common Snapshot copies:

     snapmirror release -relationship-info-only true -destination-path *dest_SVM*:*dest_volume*

     Example

     ```
     cluster1::>snapmirror release -relationship-info-only true -
     destination-path vs1_dr:vol1
     ```

  3. From the destination cluster, create a SnapMirror Synchronous relationship:

     snapmirror create -source-path *src_SVM*:*src_volume* -destination-path *dest_SVM*:*dest_volume* -policy sync-mirror

     Example

     ```
     cluster2::>snapmirror create -source-path vs1:vol1 -destination-
     path vs1_dr:vol1 -policy sync
     ```

4. Resynchronize the SnapMirror Synchronous relationship:

   snapmirror resync -destination-path *dest_SVM*:*dest_volume*

   Example

   ```
   cluster2::>snapmirror resync -destination-path vs1_dr:vol1
   ```

- **Converting a SnapMirror Synchronous relationship to an asynchronous SnapMirror relationship**

  1. From the destination cluster, quiesce the existing SnapMirror Synchronous relationship:

     snapmirror quiesce -destination-path dest_SVM:dest_volume

     Example

     ```
     cluster2::> snapmirror quiesce -destination-path vs1_dr:vol1
     ```

  2. From the destination cluster, delete the asynchronous SnapMirror relationship:

     snapmirror delete -destination-path *SVM*:*volume*

     Example

     ```
     cluster2::>snapmirror delete -destination-path vs1_dr:vol1
     ```

  3. From the source cluster, release the SnapMirror relationship without deleting the common Snapshot copies:

     snapmirror release -relationship-info-only true -destination-path *dest_SVM*:*dest_volume*

     Example

     ```
     cluster1::>snapmirror release -relationship-info-only true -
     destination-path vs1_dr:vol1
     ```

  4. From the destination cluster, create an asynchronous SnapMirror relationship:

     snapmirror create -source-path *src_SVM*:*src_volume* -destination-path *dest_SVM*:*dest_volume* -policy MirrorAllSnapshots

     Example

     ```
     cluster2::>snapmirror create -source-path vs1:vol1 -destination-
     path vs1_dr:vol1 -policy sync
     ```

  5. Resynchronize the SnapMirror Synchronous relationship:

     snapmirror resync -destination-path *dest_SVM*:*dest_volume*

     Example

     ```
     cluster2::>snapmirror resync -destination-path vs1_dr:vol1
     ```

Converting the mode of a SnapMirror Synchronous relationship

Starting with ONTAP 9.5, SnapMirror Synchronous relationships are supported. You can convert the mode of a SnapMirror Synchronous relationship from StrictSync to Sync or vice versa.

About this task

You cannot modify the policy of a Snapmirror Synchronous relationship to convert its mode.

Steps

1. From the destination cluster, quiesce the existing SnapMirror Synchronous relationship:

   snapmirror quiesce -destination-path *dest_SVM*:*dest_volume*

   Example

   ```
   cluster2::> snapmirror quiesce -destination-path vs1_dr:vol1
   ```

2. From the destination cluster, delete the existing SnapMirror Synchronous relationship:

   snapmirror delete -destination-path *dest_SVM*:*dest_volume*

   Example

   ```
   cluster2::> snapmirror delete -destination-path vs1_dr:vol1
   ```

3. From the source cluster, release the SnapMirror relationship without deleting the common Snapshot copies:

   snapmirror release -relationship-info-only true -destination-path *dest_SVM*:*dest_volume*

   Example

   ```
   cluster1::> snapmirror release -relationship-info-only true -
   destination-path vs1_dr:vol1
   ```

4. From the destination cluster, create a SnapMirror Synchronous relationship by specifying the mode to which you want to convert the SnapMirror Synchronous relationship:

   snapmirror create -source-path vs1:vol1 -destination-path *dest_SVM*:*dest_volume* -policy Sync|StrictSync

   Example

   ```
   cluster2::> snapmirror create -source-path vs1:vol1 -destination-path
   vs1_dr:vol1 -policy Sync
   ```

5. From the destination cluster, resynchronize the SnapMirror relationship:

   snapmirror resync -destination-path *dest_SVM*:*dest_volume*

Example

```
cluster2::> snapmirror resync -destination-path vs1_dr:vol1
```

Serving data from a SnapMirror DR destination volume

When disaster disables the primary site for a SnapMirror DR relationship, you can serve data from the destination volume with minimal disruption. You can reactivate the source volume when service is restored at the primary site.

Steps

1. Making the destination volume writeable on page 48
2. Configuring the destination volume for data access on page 49
3. Reactivating the original source volume on page 49

Making the destination volume writeable

You need to make the destination volume writeable before you can serve data from the volume to clients. You can use the `snapmirror quiesce` command to stop scheduled transfers to the destination, the `snapmirror abort` command to stop ongoing transfers, and the `snapmirror break` command to make the destination writeable.

About this task

You must perform this task from the destination SVM or the destination cluster.

Steps

1. Stop scheduled transfers to the destination:

   snapmirror quiesce -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

   For complete command syntax, see the man page.

   #### Example

   The following example stops scheduled transfers between the source volume **volA** on **svm1** and the destination volume **volA_dst** on **svm_backup**:

   ```
   cluster_dst::> snapmirror quiesce -source-path svm1:volA -destination-
   path svm_backup:volA_dst
   ```

2. Stop ongoing transfers to the destination:

   snapmirror abort -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

   For complete command syntax, see the man page.

   Note: This step is not required for SnapMirror Synchronous relationships (supported starting with ONTAP 9.5).

   #### Example

   The following example stops ongoing transfers between the source volume **volA** on **svm1** and the destination volume **volA_dst** on **svm_backup**:

```
cluster_dst::> snapmirror abort -source-path svm1:volA -destination-
path svm_backup:volA_dst
```

3. Break the SnapMirror DR relationship:

   snapmirror break -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

   For complete command syntax, see the man page.

   #### Example

   The following example breaks the relationship between the source volume **volA** on **svm1** and the destination volume **volA_dst** on **svm_backup** and the destination volume **volA_dst** on **svm_backup**:

```
cluster_dst::> snapmirror break -source-path svm1:volA -destination-
path svm_backup:volA_dst
```

Configuring the destination volume for data access

After making the destination volume writeable, you must configure the volume for data access. NAS clients and SAN hosts can access the data from the destination volume until the source volume is reactivated.

NAS environment:

1. Mount the NAS volume to the namespace using the same junction path that the source volume was mounted to in the source SVM.
2. Apply the appropriate ACLs to the CIFS shares at the destination volume.
3. Assign the NFS export policies to the destination volume.
4. Apply the quota rules to the destination volume.
5. Redirect clients to the destination volume.
6. Remount the NFS and CIFS shares on the clients.

SAN environment:

1. Map the LUNs in the volume to the appropriate initiator group.
2. For iSCSI, create iSCSI sessions from the SAN host initiators to the SAN LIFs.
3. On the SAN client, perform a storage re-scan to detect the connected LUNs.

Reactivating the original source volume

You can reestablish the original data protection relationship between the source and destination volumes when you no longer need to serve data from the destination.

About this task

The procedure below assumes that the baseline in the original source volume is intact. If the baseline is not intact, you must create and initialize the relationship between the volume you are serving data from and the original source volume before performing the procedure.

Steps

1. Delete the original data protection relationship:

   snapmirror delete -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

   For complete command syntax, see the man page.

   You must run this command from the source SVM or the source cluster.

Example

The following example deletes the relationship between the original source volume, **volA** on **svm1**, and the volume you are serving data from, **volA_dst** on **svm_backup**:

```
cluster_src::> snapmirror delete -source-path svm1:volA -destination-
path svm_backup:volA_dst
```

2. Reverse the original data protection relationship:

   snapmirror resync -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

   For complete command syntax, see the man page.

   You must run this command from the destination SVM or the destination cluster. Although resync does not require a baseline transfer, it can be time-consuming. You might want to run the resync in off-peak hours.

Example

The following example reverses the relationship between the original source volume, **volA** on **svm1**, and the volume you are serving data from, **volA_dst** on **svm_backup**:

```
cluster_src::> snapmirror resync -source-path svm_backup:volA_dst -
destination-path svm1:volA
```

3. Stop the source SVM for the reversed relationship:

   vserver stop -vserver *SVM*

   For complete command syntax, see the man page.

Example

The following example stops the source SVM for the reversed relationship:

```
cluster_src::> vserver stop svm_backup
```

4. Update the reversed relationship:

   snapmirror update -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

   For complete command syntax, see the man page.

   Note: You must run this command from the destination SVM or the destination cluster. The command fails if a common Snapshot copy does not exist on the source and destination. Use `snapmirror initialize` to re-initialize the relationship.

Example

The following example updates the relationship between the volume you are serving data from, **volA_dst** on **svm_backup**, and the original source volume, **volA** on **svm1**:

```
cluster_src::> snapmirror update -source-path svm_backup:volA_dst -
destination-path svm1:volA
```

5. Stop scheduled transfers for the reversed relationship:

   snapmirror quiesce -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

   For complete command syntax, see the man page.

Note: You must run this command from the destination SVM or the destination cluster.

Example

The following example stops scheduled transfers between the volume you are serving data from, **volA_dst** on **svm_backup**, and the original source volume, **volA** on **svm1**:

```
cluster_src::> snapmirror quiesce -source-path svm_backup:volA_dst -
destination-path svm1:volA
```

6. Stop ongoing transfers for the reversed relationship:

   snapmirror abort -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

   For complete command syntax, see the man page.

   Note: You must run this command from the destination SVM or the destination cluster.

Example

The following example stops ongoing transfers between the volume you are serving data from, **volA_dst** on **svm_backup**, and the original source volume, **volA** on **svm1**:

```
cluster_src::> snapmirror abort -source-path svm_backup:volA_dst -
destination-path svm1:volA
```

7. Break the reversed relationship:

   snapmirror break -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

   For complete command syntax, see the man page.

   Note: You must run this command from the destination SVM or the destination cluster.

Example

The following example breaks the relationship between the volume you are serving data from, **volA_dst** on **svm_backup**, and the original source volume, **volA** on **svm1**:

```
cluster_src::> snapmirror break -source-path svm_backup:volA_dst -
destination-path svm1:volA
```

8. Start the original source SVM:

   vserver start -vserver *SVM*

   For complete command syntax, see the man page.

Example

The following example starts the original source SVM:

```
cluster_dst::> vserver start svm1
```

9. Delete the reversed data protection relationship:

   snapmirror delete -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

   For complete command syntax, see the man page.

You must run this command from the source SVM or the source cluster for the reversed relationship.

Example

The following example deletes the reversed relationship between the original source volume, **volA** on **svm1**, and the volume you are serving data from, **volA_dst** on **svm_backup**:

```
cluster_src::> snapmirror delete -source-path svm_backup:volA_dst -
destination-path svm1:volA
```

10. Reestablish the original data protection relationship:

    snapmirror resync -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

    For complete command syntax, see the man page.

Example

The following example reestablishes the relationship between the original source volume, **volA** on **svm1**, and the original destination volume, **volA_dst** on **svm_backup**:

```
cluster_dst::> snapmirror resync -source-path svm1:volA -destination-
path svm_backup:volA_dst
```

After you finish

Use the `snapmirror show` command to verify that the SnapMirror relationship was created. For complete command syntax, see the man page.

Restoring files from a SnapMirror destination volume

You can use a Snapshot copy in a SnapMirror destination volume to recover individual files or LUNs, or to restore the entire contents of a volume. You can restore files to the original source volume or to a different volume.

Restoring a single file or LUN from a SnapMirror destination

You can restore a single file or LUN or a set of files or LUNs from a Snapshot copy in a SnapMirror destination volume. You can restore files to the original source volume or to a different volume.

Before you begin

To restore a file or LUN from a SnapMirror Synchronous destination (supported starting with ONTAP 9.5), you must first delete and release the relationship.

About this task

The volume to which you are restoring files or LUNs (the destination volume) must be a read-write volume:

- SnapMirror performs an *incremental restore* if the source and destination volumes have a common Snapshot copy (as is typically the case when you are restoring to the original source volume).
- Otherwise, SnapMirror performs a *baseline restore*, in which the specified Snapshot copy and all the data blocks it references are transferred to the destination volume.

Steps

1. List the Snapshot copies in the destination volume:

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

   For complete command syntax, see the man page.

   #### Example

   The following example shows the Snapshot copies on the **`vserverB:secondary1`** destination:

```
cluster_dst::> volume snapshot show -vserver vserverB -volume secondary1

Vserver     Volume      Snapshot                State    Size  Total% Used%
-------     ------      ----------- ----------- ------   -----  ------ -----
vserverB    secondary1  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 single file or LUN or a set of files or LUNs from a Snapshot copy in a SnapMirror destination volume:

   `snapmirror restore -source-path` *`SVM`*`:`*`volume`*`|`*`cluster`*`://`*`SVM/volume`*`, ... -destination-path` *`SVM`*`:`*`volume`*`|`*`cluster`*`://`*`SVM/volume`*`, ... -source-snapshot` *`snapshot`* `-file-list` *`source_file_path`*`,@`*`destination_file_path`*

   For complete command syntax, see the man page.

   Note: You must run this command from the destination SVM or the destination cluster.

   #### Example

   The following command restores the files `file1` and `file2` from the Snapshot copy `daily.2013-01-25_0010` in the original destination volume `secondary1`, to the same location in the active file system of the original source volume `primary1`:

```
cluster_dst::> snapmirror restore -source-path vserverB:secondary1 -
destination-path vserverA:primary1 -source-snapshot daily.
2013-01-25_0010 -file-list /dir1/file1,/dir2/file2

[Job 3479] Job is queued: snapmirror restore for the relationship
with destination vserverA:primary1
```

   #### Example

   The following command restores the files `file1` and `file2` from the Snapshot copy `daily.2013-01-25_0010` in the original destination volume `secondary1`, to a different location in the active file system of the original source volume `primary1`.

   The destination file path begins with the @ symbol followed by the path of the file from the root of the original source volume. In this example, `file1` is restored to `/dir1/file1.new` and file2 is restored to `/dir2.new/file2` on `primary1`:

```
cluster_dst::> snapmirror restore -source-path vserverB:secondary1 -
destination-path vserverA:primary1 -source-snapshot daily.
2013-01-25_0010 -file-list /dir/file1,@/dir1/file1.new,/dir2/file2,@/
```

```
dir2.new/file2

[Job 3479] Job is queued: snapmirror restore for the relationship
with destination vserverA:primary1
```

Example

The following command restores the files `file1` and `file3` from the Snapshot copy `daily.2013-01-25_0010` in the original destination volume `secondary1`, to different locations in the active file system of the original source volume `primary1`, and restores `file2` from `snap1` to the same location in the active file system of `primary1`.

In this example, the file `file1` is restored to `/dir1/file1.new` and `file3` is restored to `/dir3.new/file3`:

```
cluster_dst::> snapmirror restore -source-path vserverB:secondary1 -
destination-path vserverA:primary1 -source-snapshot daily.
2013-01-25_0010 -file-list /dir/file1,@/dir1/file1.new,/dir2/file2,/
dir3/file3,@/dir3.new/file3

[Job 3479] Job is queued: snapmirror restore for the relationship
with destination vserverA:primary1
```

Restoring the contents of a volume from a SnapMirror destination

You can restore the contents of an entire volume from a Snapshot copy in a SnapMirror destination volume. You can restore the volume's contents to the original source volume or to a different volume.

Before you begin

To restore a volume from a SnapMirror Synchronous destination (supported starting with ONTAP 9.5), you must first delete and release the relationship.

About this task

The destination volume for the restore operation must be one of the following:

- A read-write volume, in which case SnapMirror performs an *incremental restore*, provided that the source and destination volumes have a common Snapshot copy (as is typically the case when you are restoring to the original source volume).

  Note: The command fails if there is not a common Snapshot copy. You cannot restore the contents of a volume to an empty read-write volume.

- An empty data protection volume, in which case SnapMirror performs a *baseline restore*, in which the specified Snapshot copy and all the data blocks it references are transferred to the source volume.

Restoring the contents of a volume is a disruptive operation. CIFS traffic must not be running on the SnapVault primary volume when a restore operation is running.

If the destination volume for the restore operation has compression enabled, and the source volume does not have compression enabled, disable compression on the destination volume. You need to re-enable compression after the restore operation is complete.

Any quota rules defined for the destination volume are deactivated before the restore is performed. You can use the `volume quota modify` command to reactivate quota rules after the restore operation is complete.

Steps

1. List the Snapshot copies in the destination volume:

volume snapshot show -vserver *SVM* -volume *volume*

For complete command syntax, see the man page.

Example

The following example shows the Snapshot copies on the **vserverB:secondary1** destination:

```
cluster_dst::> volume snapshot show -vserver vserverB -volume secondary1

Vserver     Volume      Snapshot                State    Size  Total% Used%
-------     ------      ---------- ----------- ------   -----  ------ -----
vserverB    secondary1  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 in a SnapMirror destination volume:

   snapmirror restore -source-path *SVM*:*volume*|*cluster*://*SVM*/*volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM*/*volume*, ... -source-snapshot *snapshot*

   For complete command syntax, see the man page.

   Note: You must run this command from the destination SVM or the destination cluster.

Example

The following command restores the contents of the original source volume `primary1` from the Snapshot copy `daily.2013-01-25_0010` in the original destination volume `secondary1`:

```
cluster_dst::> snapmirror restore -source-path vserverB:secondary1 -
destination-path vserverA:primary1 -source-snapshot daily.
2013-01-25_0010

Warning: All data newer than Snapshot copy daily.2013-01-25_0010 on
volume vserverA:primary1 will be deleted.

Do you want to continue? {y|n}: y

[Job 34] Job is queued: snapmirror restore from source
vserverB:secondary1 for the snapshot daily.2013-01-25_0010.
```

3. Remount the restored volume and restart all applications that use the volume.

Updating a replication relationship manually

You might need to update a replication relationship manually if an update fails because the source volume has been moved.

About this task

SnapMirror aborts any transfers from a moved source volume until you update the replication relationship manually.

Starting with ONTAP 9.5, SnapMirror Synchronous relationships are supported. Although the source and destination volumes are in sync at all times in these relationships, the view from the secondary cluster is synchronized with the primary only on an hourly basis. If you want to view the point-in-

time data at the destination, you should perform a manual update by running the `snapmirror update` command.

Step

1. Update a replication relationship manually:

   snapmirror update -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ...

   For complete command syntax, see the man page.

   Note: You must run this command from the destination SVM or the destination cluster. The command fails if a common Snapshot copy does not exist on the source and destination. Use `snapmirror initialize` to re-initialize the relationship.

Example

The following example updates the relationship between the source volume **volA** on **svm1** and the destination volume **volA_dst** on **svm_backup**:

```
cluster_src::> snapmirror update -source-path svm1:volA -destination-
path svm_backup:volA_dst
```

Resynchronizing a replication relationship

You need to resynchronize a replication relationship after you make a destination volume writeable, after an update fails because a common Snapshot copy does not exist on the source and destination volumes, or if you want to change the replication policy for the relationship.

About this task

Although resync does not require a baseline transfer, it can be time-consuming. You might want to run the resync in off-peak hours.

Step

1. Resync the source and destination volumes:

   snapmirror resync -source-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM/volume*, ... -type DP|XDP -schedule *schedule* -policy *policy*

   For complete command syntax, see the man page.

   Note: You must run this command from the destination SVM or the destination cluster.

Example

The following example resyncs the relationship between the source volume **volA** on **svm1** and the destination volume **volA_dst** on **svm_backup**:

```
cluster_dst::> snapmirror resync -source-path svm1:volA -destination-
path svm_backup:volA_dst
```

Deleting a volume replication relationship

You can use the `snapmirror delete` and `snapmirror release` commands to delete a volume replication relationship. You can then delete unneeded destination volumes manually.

About this task

The `snapmirror release` command deletes any SnapMirror-created Snapshot copies from the source. You can use the `-relationship-info-only` option to preserve the Snapshot copies.

Steps

1. If you have SnapMirror Synchronous relationships (supported starting with ONTAP 9.5), quiesce the replication relationship:

   snapmirror quiesce -destination-path *SVM*:*volume*|*cluster*://*SVM*/*volume*

   #### Example

   ```
   cluster_src::> snapmirror quiesce -destination-path
   svm_backup:volA_dst
   ```

2. Delete the replication relationship:

   snapmirror delete -source-path *SVM*:*volume*|*cluster*://*SVM*/*volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM*/*volume*, ...

   For complete command syntax, see the man page.

   Note: You must run this command from the source cluster or source SVM.

   #### Example

   The following example deletes the relationship between the source volume **volA** on **svm1** and the destination volume **volA_dst** on **svm_backup**:

   ```
   cluster_src::> snapmirror delete -source-path svm1:volA -destination-
   path svm_backup:volA_dst
   ```

3. Release replication relationship information from the source SVM:

   snapmirror release -source-path *SVM*:*volume*|*cluster*://*SVM*/*volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM*/*volume*, ...

   For complete command syntax, see the man page.

   Note: You must run this command from the source cluster or source SVM.

   #### Example

   The following example releases information for the specified replication relationship from the source SVM **svm1**:

   ```
   cluster_src::> snapmirror release -source-path svm1:volA -destination-
   path svm_backup:volA_dst
   ```

Managing storage efficiency

SnapMirror preserves storage efficiency on the source and destination volumes, with one exception, when postprocess data compression is enabled on the destination. In that case, all storage efficiency is lost on the destination. To correct this issue, you need to disable postprocess compression on the destination, update the relationship manually, and re-enable storage efficiency.

Before you begin

- The source and destination clusters and SVMs must be peered.
  Cluster and SVM peering express configuration
- You must disable postprocess compression on the destination.

About this task

Starting with ONTAP 9.3, manual update is no longer required to re-enable storage efficiency. If SnapMirror detects that postprocess compression has been disabled, it automatically re-enables storage efficiency at the next scheduled update. Both the source and the destination must be running ONTAP 9.3.

Starting with ONTAP 9.3, AFF systems manage storage efficiency settings differently from FAS systems after a destination volume is made writeable:

- After you make a destination volume writeable using the `snapmirror break` command, the caching policy on the volume is automatically set to “auto” (the default). If deduplication and/or inline compression are not enabled, they are automatically enabled.
- On resync, the caching policy is automatically set to “none”, and deduplication and inline compression are automatically disabled, regardless of your original settings. You must modify the settings manually as needed.

Note: Manual updates with storage efficiency enabled can be time-consuming. You might want to run the operation in off-peak hours.

Step

1. Update a replication relationship and re-enable storage efficiency:

   `snapmirror update -source-path` *`SVM:volume|cluster://SVM/volume`*`, ... -destination-path` *`SVM:volume|cluster://SVM/volume`*`, ... -enable-storage-efficiency true`

   For complete command syntax, see the man page.

   Note: You must run this command from the destination SVM or the destination cluster. The command fails if a common Snapshot copy does not exist on the source and destination. Use `snapmirror initialize` to re-initialize the relationship.

Example

The following example updates the relationship between the source volume **`volA`** on **`svm1`** and the destination volume **`volA_dst`** on **`svm_backup`**, and re-enables storage efficiency:

```
cluster_dst::> snapmirror update -source-path svm1:volA -destination-
path svm_backup:volA_dst -enable-storage-efficiency true
```

Using SnapMirror global throttling

Starting with ONTAP 9.0, global network throttling is available for all SnapMirror and SnapVault transfers at a per-node level.

About this task

SnapMirror global throttling restricts the bandwidth used by incoming and/or outgoing SnapMirror and SnapVault transfers. The restriction is enforced cluster wide on all nodes in the cluster.

For example, if the outgoing throttle is set to 100 Mbps, each node in the cluster will have the outgoing bandwidth set to 100 Mbps. If global throttling is disabled, it is disabled on all nodes.

Note: The throttle has no effect on `volume move` transfers or load-sharing mirror transfers. Although data transfer rates are often expressed in bits per second (bps), the throttle values must be entered in kilobytes per second (KBps).

Global throttling works with the per-relationship throttle feature for SnapMirror and SnapVault transfers. The per-relationship throttle is enforced until the combined bandwidth of per-relationship transfers exceeds the value of the global throttle, after which the global throttle is enforced. A throttle value **`0`** implies that global throttling is disabled.

Important: Global throttling should not be enabled on clusters that have SnapMirror Synchronous relationships.

Steps

1. Enable global throttling:

   `options -option-name replication.throttle.enable on|off`

   #### Example

   The following example shows how to enable SnapMirror global throttling on **`cluster_dst`**:

   ```
   cluster_dst::> options -option-name replication.throttle.enable on
   ```

2. Specify the maximum total bandwidth used by incoming transfers:

   `options -option-name replication.throttle.incoming.max_kbs` ***`KBps`***

   KBps is the maximum transfer rate in kilobytes per second. Valid transfer rate values are 1 to 125000. The default value for this option is `unlimited`, which means there is no limit on total bandwidth used.

   #### Example

   The following example shows how to set the maximum total bandwidth used by incoming transfers to 100 Mbps:

   ```
   cluster_dst::> options -option-name
   replication.throttle.incoming.max_kbs 12500
   ```

   Note: 100 Mbps = 12500 KBps

3. Specify the maximum total bandwidth used by outgoing transfers:

   `options -option-name replication.throttle.outgoing.max_kbs` ***`KBps`***

KBps is the maximum transfer rate in kilobytes per second. Valid transfer rate values are 1 to 125000. The default value for this option is `unlimited`, which means there is no limit on total bandwidth used.

Example

The following example shows how to set the maximum total bandwidth used by outgoing transfers to 100 Mbps:

```
cluster_dst::> options -option-name
replication.throttle.outgoing.max_kbs 12500
```

Understanding SnapMirror SVM replication

You can use SnapMirror to create a data protection relationship between SVMs. In this type of data protection relationship, all or part of the SVM's configuration, from NFS exports and SMB shares to RBAC, is replicated, as well as the data in the volumes that the SVM owns.

Supported relationship types

Only data-serving SVM can be replicated. The following data protection relationship types are supported:

- *SnapMirror DR,* in which the destination typically contains only the Snapshot copies currently on the source SVM.
- Starting with ONTAP 9.2, *SnapMirror unified replication,* in which the destination is configured for both DR and long-term retention.

Details about these relationship types can be found here: *Understanding SnapMirror volume replication* on page 16.

The *policy type* of the replication policy determines the type of relationship it supports. The following table shows the available policy types.

Policy type	Relationship type
async-mirror	SnapMirror DR
mirror-vault	Unified replication

XDP replaces DP as the SVM replication default in ONTAP 9.4

Starting with ONTAP 9.4, SVM data protection relationships default to XDP mode. SVM data protection relationships continue to default to DP mode in ONTAP 9.3 and earlier.

Existing relationships are not affected by the new default. If a relationship is already of type DP, it will continue to be of type DP. The following table shows the behavior you can expect.

If you specify...	The type is...	The default policy (if you do not specify a policy) is...
DP	XDP	MirrorAllSnapshots (SnapMirror DR)
Nothing	XDP	MirrorAllSnapshots (SnapMirror DR)
XDP	XDP	MirrorAndVault (Unified replication)

Details about the changes in the default can be found here: *XDP replaces DP as the SnapMirror default in ONTAP 9.3* on page 23.

Note: Version-independence is not supported for SVM replication.

How SVM configurations are replicated

The content of an SVM replication relationship is determined by the interaction of the following fields:

- The `-identity-preserve true` option of the `snapmirror create` command replicates the entire SVM configuration.

  The `-identity-preserve false` option replicates only the volumes and authentication and authorization configurations of the SVM, and the protocol and name service settings listed in *Configurations replicated in SVM DR relationships* on page 63.

- The `-discard-configs network` option of the `snapmirror policy create` command excludes LIFs and related network settings from SVM replication, for use in cases where the source and destination SVMs are in different subnets.
- The `-vserver-dr-protection unprotected` option of the `volume modify` command excludes the specified volume from SVM replication.

Otherwise, SVM replication is almost identical to volume replication. You can use virtually the same workflow for SVM replication as you use for volume replication.

Support details

The following table shows support details for SnapMirror SVM replication.

Resource or feature	Support details
Relationship types	• SnapMirror DR • Starting with ONTAP 9.2, SnapMirror unified replication
Replication scope	Intercluster only. You cannot replicate SVMs in the same cluster.
Version-independence	Not supported.
Deployment types	• Single source to single destination • Starting with ONTAP 9.4, fan-out. You can fan-out to two destinations only.
Volume encryption	• Encrypted volumes on the source are encrypted on the destination. • Onboard Key Manager or KMIP servers must be configured on the destination. • New encryption keys are generated at the destination. • If the destination does not contain a node that supports volume .encryption, replication succeeds, but the destination volumes are not encrypted.
FabricPool	Not supported.
MetroCluster	Starting with ONTAP 9.5, SnapMirror SVM replication is supported on MetroCluster configurations. • Only an active SVM within a MetroCluster configuration can be the source of an SVM disaster recovery relationship. A source can be a sync-source SVM before switchover or a sync-destination SVM after switchover. • When a MetroCluster configuration is in a steady state, the MetroCluster sync-destination SVM cannot be the source of an SVM disaster relationship, since the volumes are not online. • When the sync-source SVM is the source of an SVM DR relationship, the source SVM DR relationship information is replicated to the MetroCluster partner. • During the switchover and switchback processes, replication to the SVM DR destination might fail. However, after the switchover or switchback process completes, the next SVM DR scheduled updates will succeed.

Configurations replicated in SVM DR relationships

The following table shows the interaction of the `snapmirror create -identity-preserve` option and the `snapmirror policy create -discard-configs network` option:

Configuration replicated		**`-identity-preserve true`**		**`-identity-preserve false`**
		Policy without `-discard-configs network` set	**Policy with `-discard-configs network` set**	
Network	NAS LIFs	Yes	No	No
	LIF Kerberos configuration	Yes	No	No
	SAN LIFs	No	No	No
	Firewall policies	Yes	Yes	No
	Routes	Yes	No	No
	Broadcast domain	No	No	No
	Subnet	No	No	No
	IPspace	No	No	No
CIFS	CIFS server	Yes	Yes	No
	Local groups and local user	Yes	Yes	Yes
	Privilege	Yes	Yes	Yes
	Shadow copy	Yes	Yes	Yes
	BranchCache	Yes	Yes	Yes
	Server options	Yes	Yes	Yes
	Server security	Yes	Yes	No
	Home directory, share	Yes	Yes	Yes
	Symlink	Yes	Yes	Yes
	Fpolicy policy, Fsecurity policy, and Fsecurity NTFS	Yes	Yes	Yes
	Name mapping and group mapping	Yes	Yes	Yes
	Audit information	Yes	Yes	Yes

Configuration replicated		**`-identity-preserve true`**		**`-identity-preserve false`**
		Policy without `-discard-configs network` set	**Policy with `-discard-configs network` set**	
NFS	Export policies	Yes	Yes	No
	Export policy rules	Yes	Yes	No
	NFS server	Yes	Yes	No
RBAC	Security certificates	Yes	Yes	No
	Login user, public key, role, and role configuration	Yes	Yes	Yes
	SSL	Yes	Yes	No
Name services	DNS and DNS hosts	Yes	Yes	No
	UNIX user and UNIX group	Yes	Yes	Yes
	Kerberos realm and Kerberos keyblocks	Yes	Yes	No
	LDAP and LDAP client	Yes	Yes	No
	Netgroup	Yes	Yes	No
	NIS	Yes	Yes	No
	Web and web access	Yes	Yes	No
Volume	Object	Yes	Yes	Yes
	Snapshot copies, Snapshot policy, and autodelete policy	Yes	Yes	Yes
	Efficiency policy	Yes	Yes	Yes
	Quota policy and quota policy rule	Yes	Yes	Yes
	Recovery queue	Yes	Yes	Yes

Configuration replicated		**`-identity-preserve true`**		**`-identity-preserve false`**
		Policy without `-discard-configs network` set	**Policy with `-discard-configs network` set**	
Root volume	Namespace	Yes	Yes	Yes
	User data	No	No	No
	Qtrees	No	No	No
	Quotas	No	No	No
	File-level QoS	No	No	No
	Attributes: state of the root volume, space guarantee, size, autosize, and total number of files	No	No	No
Storage QoS	QoS policy group	Yes	Yes	Yes
Fibre Channel (FC)		No	No	No
iSCSI		No	No	No
LUNs	Object	Yes	Yes	Yes
	igroups	No	No	No
	portsets	No	No	No
SNMP	v3 users	Yes	Yes	No

Managing SnapMirror SVM replication

You can use SnapMirror to replicate all or part of an SVM's configuration, as well as the volumes the SVM owns. That means you can quickly activate the destination SVM in the event of a disaster at the primary site, and just as quickly reactivate the source SVM when service is restored.

Replicating SVM configurations

SVM replication is almost identical to volume replication. Except for specifying how much of the SVM configuration you want to replicate, you can use virtually the same workflow to replicate an SVM as you use to replicate a volume.

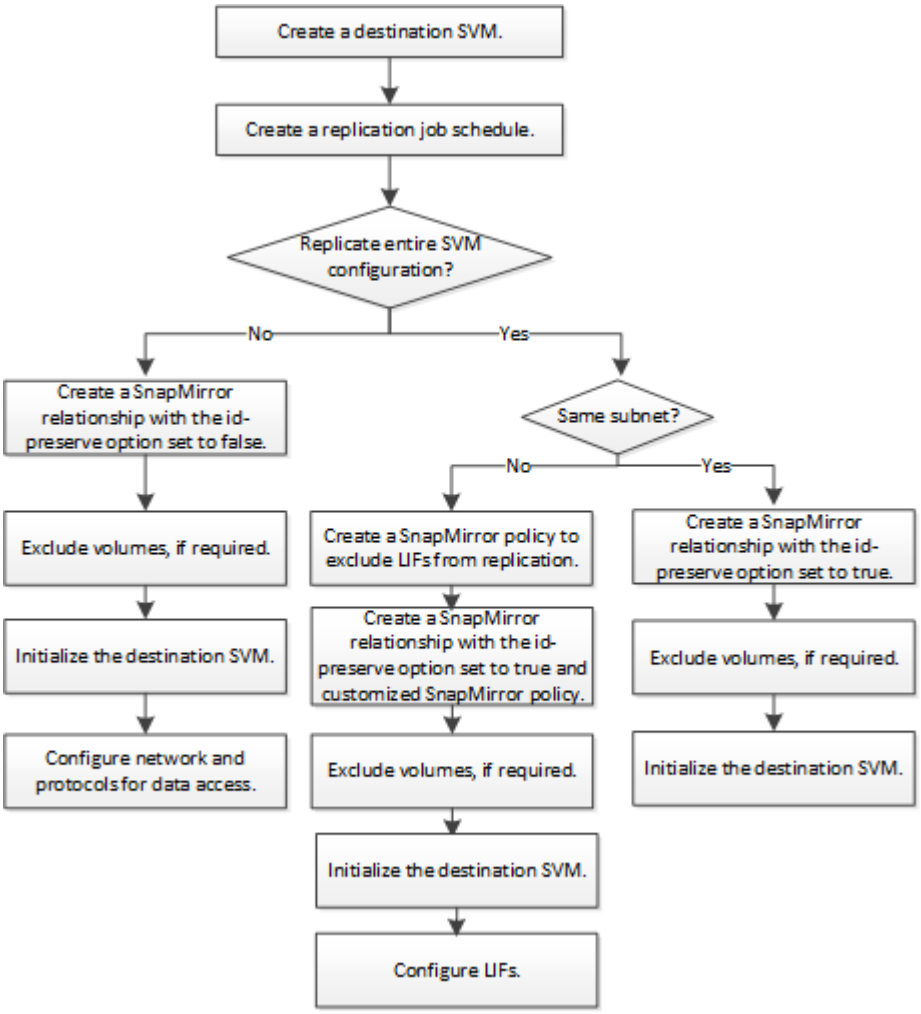
SnapMirror replication workflow on page 30

Choices

SnapMirror SVM replication workflow

SnapMirror SVM replication involves creating the destination SVM, creating a replication job schedule, and creating and initializing a SnapMirror relationship.

Note: This workflow assumes that you are already using a default policy or a custom replication policy.



Replicating an entire SVM configuration

You can use the `-identity-preserve true` option of the `snapmirror create` command to replicate an entire SVM configuration.

Before you begin

The source and destination clusters and SVMs must be peered.

For complete command syntax, see the man page.

About this task

This workflow assumes that you are already using a default policy or a custom replication policy.

Steps

1. Create a destination SVM:

   `vserver create -vserver` ***`SVM_name`*** **`-subtype dp-destination`**

   The SVM name must be unique across the source and destination clusters.

   #### Example

   The following example creates a destination SVM named **`svm_backup`**:

```
cluster_dst:> vserver create -vserver svm_backup -subtype dp-
destination
```

2. Create a replication 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.

   Example

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

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

3. From the destination SVM or the destination cluster, create a replication relationship:

   snapmirror create -source-path *SVM_name*: -destination-path *SVM_name*: -type DP|XDP -schedule *schedule* -policy *policy* -identity-preserve true

   Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options.

   Example

   The following example creates a SnapMirror DR relationship using the default **`MirrorAllSnapshots`** policy:

   ```
   cluster_dst::> snapmirror create -source-path svm1: -destination-path
   svm_backup: -type XDP -schedule my_daily -policy MirrorAllSnapshots -
   identity-preserve true
   ```

   Example

   The following example creates a unified replication relationship using the default **`MirrorAndVault`** policy:

   ```
   cluster_dst:> snapmirror create -source-path svm1: -destination-path
   svm_backup: -type XDP -schedule my_daily -policy MirrorAndVault -
   identity-preserve true
   ```

   Example

   Assuming you have created a custom policy with the policy type **`async-mirror`**, the following example creates a SnapMirror DR relationship:

   ```
   cluster_dst::> snapmirror create -source-path svm1: -destination-path
   svm_backup: -type XDP -schedule my_daily -policy my_mirrored -
   identity-preserve true
   ```

   Example

   Assuming you have created a custom policy with the policy type **`mirror-vault`**, the following example creates a unified replication relationship:

```
cluster_dst::> snapmirror create -source-path svm1: -destination-path
svm_backup: -type XDP -schedule my_daily -policy my_unified -identity-
preserve true
```

4. From the destination SVM or the destination cluster, initialize the SVM replication relationship:

   snapmirror initialize -source-path *SVM_name*: -destination-path *SVM_name*:

   Example

   The following example initializes the relationship between the source SVM, **svm1**, and the destination SVM, **svm_backup**:

   ```
   cluster_dst::> snapmirror initialize -source-path svm1: -destination-
   path svm_backup:
   ```

Excluding LIFs and related network settings from SVM replication

If the source and destination SVMs are in different subnets, you can use the `-discard-configs network` option of the `snapmirror policy create` command to exclude LIFs and related network settings from SVM replication.

Before you begin

The source and destination clusters and SVMs must be peered.

About this task

The `-identity-preserve` option of the `snapmirror create` command must be set to `true` when you create the SVM replication relationship.

For complete command syntax, see the man page.

Steps

1. Create a destination SVM:

   vserver create -vserver *SVM* -subtype dp-destination

   The SVM name must be unique across the source and destination clusters.

   Example

   The following example creates a destination SVM named **svm_backup**:

   ```
   cluster_dst:> vserver create -vserver svm_backup -subtype dp-
   destination
   ```

2. 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.

   Example

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

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

3. Create a custom replication policy:

   snapmirror policy create -vserver *SVM* -policy *policy* -type async-mirror|vault|mirror-vault -comment *comment* -tries *transfer_tries* -transfer-priority low|normal -is-network-compression-enabled true|false -discard-configs network

   For complete command syntax, see the man page.

   Example

   The following example creates a custom replication policy for SnapMirror DR that excludes LIFs:

   ```
   cluster_dst::> snapmirror policy create -vserver svm1 -policy
   DR_exclude_LIFs -type async-mirror -discard-configs network
   ```

   Example

   The following example creates a custom replication policy for unified replication that excludes LIFs:

   ```
   cluster_dst::> snapmirror policy create -vserver svm1 -policy
   unified_exclude_LIFs -type mirror-vault -discard-configs network
   ```

4. From the destination SVM or the destination cluster, run the following command to create a replication relationship:

   snapmirror create -source-path *SVM*: -destination-path *SVM*: -type DP|XDP -schedule *schedule* -policy *policy* -identity-preserve true|false

   Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the examples below.

   Example

   The following example creates a SnapMirror DR relationship that excludes LIFs:

   ```
   cluster_dst::> snapmirror create -source-path svm1: -destination-path
   svm_backup: -type XDP -schedule my_daily -policy DR_exclude_LIFs -
   identity-preserve true
   ```

   Example

   The following example creates a SnapMirror unified replication relationship that excludes LIFs:

   ```
   cluster_dst::> snapmirror create -source-path svm1: -destination-path
   svm_backup: -type XDP -schedule my_daily -policy unified_exclude_LIFs
   -identity-preserve true
   ```

5. From the destination SVM or the destination cluster, initialize a replication relationship:

   snapmirror initialize -source-path *SVM*: -destination-path *SVM*:

   For complete command syntax, see the man page.

Example

The following example initializes the relationship between the source, **svm1** and the destination, **svm_backup**:

```
cluster_dst::> snapmirror initialize -source-path svm1: -destination-
path svm_backup:
```

After you finish

You must configure the network and protocols on the destination SVM for data access in the event a disaster occurs.

Excluding network, name service, and other settings from SVM replication

You can use the `-identity-preserve false` option of the `snapmirror create` command to replicate only the volumes and security configurations of an SVM. Some protocol and name service settings are also preserved.

Before you begin

The source and destination clusters and SVMs must be peered.

About this task

For a list of preserved protocol and name service settings, see *Configurations replicated in SVM DR relationships* on page 63.

For complete command syntax, see the man page.

Steps

1. Create a destination SVM:

   vserver create -vserver *SVM* -subtype dp-destination

   The SVM name must be unique across the source and destination clusters.

   #### Example

   The following example creates a destination SVM named **svm_backup**:

   ```
   cluster_dst:> vserver create -vserver svm_backup -subtype dp-
   destination
   ```

2. Create a replication 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.

   #### Example

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

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

3. Create a replication relationship that excludes network, name service, and other configuration settings:

   snapmirror create -source-path *SVM*: -destination-path *SVM*: -type DP|XDP -schedule *schedule* -policy *policy* -identity-preserve false

   Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the examples below.

   You must run this command from the destination SVM or the destination cluster.

   Example

   The following example creates a SnapMirror DR relationship using the default **MirrorAllSnapshots** policy. The relationship excludes network, name service, and other configuration settings from SVM replication:

   ```
   cluster_dst::> snapmirror create -source-path svm1: -destination-path
   svm_backup: -type XDP -schedule my_daily -policy MirrorAllSnapshots -
   identity-preserve false
   ```

   Example

   The following example creates a unified replication relationship using the default **MirrorAndVault** policy. The relationship excludes network, name service, and other configuration settings:

   ```
   cluster_dst:> snapmirror create svm1: -destination-path svm_backup: -
   type XDP -schedule my_daily -policy MirrorAndVault -identity-preserve
   false
   ```

   Example

   Assuming you have created a custom policy with the policy type **async-mirror**, the following example creates a SnapMirror DR relationship. The relationship excludes network, name service, and other configuration settings from SVM replication:

   ```
   cluster_dst::> snapmirror create -source-path svm1: -destination-path
   svm_backup: -type XDP -schedule my_daily -policy my_mirrored -
   identity-preserve false
   ```

   Example

   Assuming you have created a custom policy with the policy type **mirror-vault**, the following example creates a unified replication relationship. The relationship excludes network, name service, and other configuration settings from SVM replication:

   ```
   cluster_dst::> snapmirror create -source-path svm1: -destination-path
   svm_backup: -type XDP -schedule my_daily -policy my_unified -identity-
   preserve false
   ```

4. From the destination SVM or the destination cluster, initialize the SVM replication relationship:

   snapmirror initialize -source-path *SVM_name*: -destination-path *SVM_name*:

After you finish

You must configure the network and protocols on the destination SVM for data access in the event a disaster occurs. If you are using SMB, you must also configure a CIFS server.

Excluding volumes from SVM replication

By default, all RW data volumes of the source SVM are replicated. If you do not want to protect all the volumes on the source SVM, you can use the `-vserver-dr-protection unprotected` option of the `volume modify` command to exclude volumes from SVM replication.

Steps

1. Exclude a volume from SVM replication:

   `volume modify -vserver` *`SVM`* `-volume` *`volume`* `-vserver-dr-protection unprotected`

   For complete command syntax, see the man page.

   #### Example

   The following example excludes the volume **`volA_src`** from SVM replication:

   ```
   cluster_dst::> volume modify -vserver SVM1 -volume volA_src -vserver-
   dr-protection unprotected
   ```

   If you later want to include a volume in the SVM replication that you originally excluded, run the following command:

   `volume modify -vserver` *`SVM`* `-volume` *`volume`* `-vserver-dr-protection protected`

   #### Example

   The following example includes the volume **`volA_src`** in the SVM replication:

   ```
   cluster_dst::> volume modify -vserver SVM1 -volume volA_src -vserver-
   dr-protection protected
   ```

2. Create and initialize the SVM replication relationship as described in *Replicating an entire SVM configuration* on page 67,

Updating junction paths configured after initialization

The `snapmirror update` command will not replicate junction path information added after you create and initialize an SVM replication relationship. You must run `snapmirror resync` to update the junction path information.

Resynchronizing a replication relationship on page 56

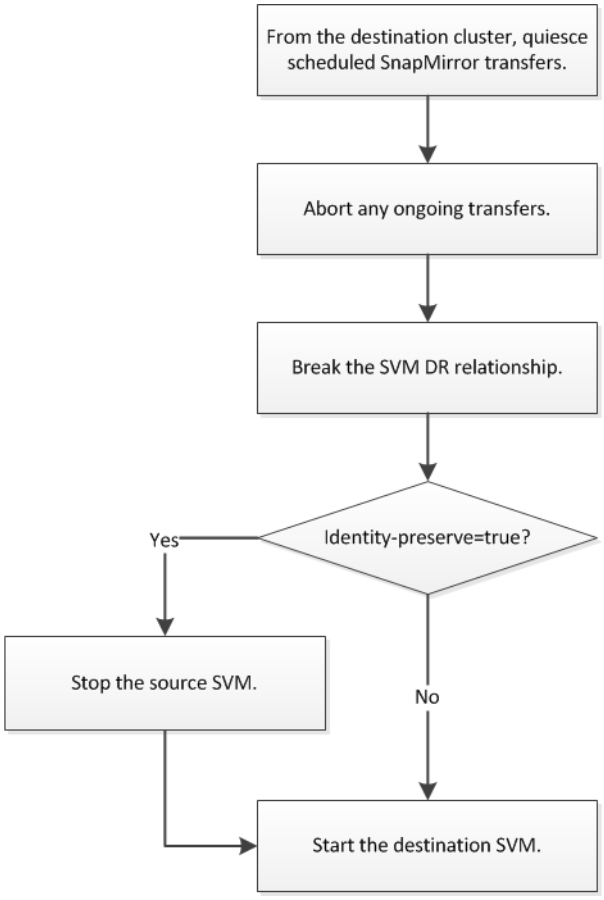
Serving data from an SVM DR destination

When disaster disables the primary site for an SVM DR relationship, you can serve data from the destination SVM with minimal disruption. You can reactivate the source SVM when service is restored at the primary site.

SVM disaster recovery workflow

To recover from a disaster and serve data from the destination SVM, you must activate the destination SVM. Activating the destination SVM involves stopping scheduled SnapMirror transfers,

aborting ongoing SnapMirror transfers, breaking the replication relationship, stopping the source SVM, and starting the destination SVM.



Making SVM destination volumes writeable

You need to make SVM destination volumes writeable before you can serve data to clients. The procedure is largely identical to the procedure for volume replication, with one exception. If you set `-identity-preserve true` when you created the SVM replication relationship, you must stop the source SVM before activating the destination SVM.

About this task

For complete command syntax, see the man page.

Steps

1. From the destination SVM or the destination cluster, stop scheduled transfers to the destination:

   `snapmirror quiesce -source-path` *`SVM`*`: -destination-path` *`SVM`*`:`

   Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

Example

The following example stops scheduled transfers between the source SVM **`svm1`** and the destination SVM **`svm_backup`**:

```
cluster_dst::> snapmirror quiesce -source-path svm1: -destination-
path svm_backup:
```

2. From the destination SVM or the destination cluster, stop ongoing transfers to the destination:

   `snapmirror abort -source-path SVM: -destination-path SVM:`

   Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

   Example

   The following example stops ongoing transfers between the source SVM **`svm1`** and the destination SVM **`svm_backup`**:

   ```
   cluster_dst::> snapmirror abort -source-path svm1: -destination-path
   svm_backup:
   ```

3. From the destination SVM or the destination cluster, break the replication relationship:

   `snapmirror break -source-path SVM: -destination-path SVM:`

   Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

   Example

   The following example breaks the relationship between the source SVM **`svm1`** and the destination SVM **`svm_backup`**:

   ```
   cluster_dst::> snapmirror break -source-path svm1: -destination-path
   svm_backup:
   ```

4. If you set `-identity-preserve true` when you created the SVM replication relationship, stop the source SVM:

   `vserver stop -vserver SVM`

   Example

   The following example stops the source SVM **`svm1`**:

   ```
   cluster_src::> vserver stop svm1
   ```

5. Start the destination SVM:

   `vserver start -vserver SVM`

   Example

   The following example starts the destination SVM **`svm_backup`**:

   ```
   cluster_dst::> vserver start svm_backup
   ```

After you finish

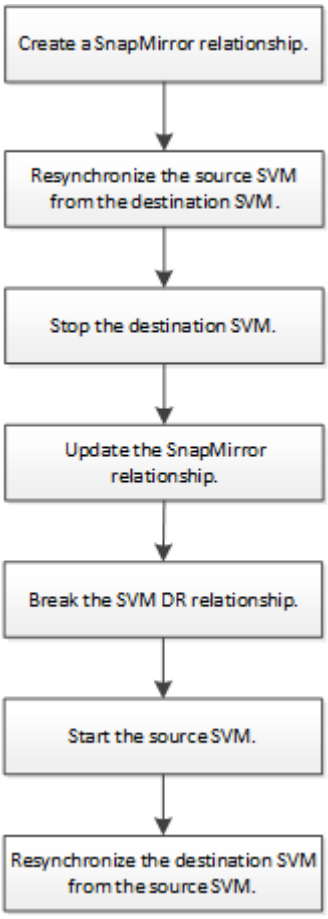
Configure SVM destination volumes for data access, as described in *Configuring the destination volume for data access* on page 49.

Reactivating the source SVM

If the source SVM exists after a disaster, you can reactivate the source SVM when service is restored at your primary site.

Source SVM reactivation workflow

If the source SVM exists after a disaster, you can reactivate it and protect it by recreating the SVM disaster recovery relationship.



Reactivating the original source SVM

You can reestablish the original data protection relationship between the source and destination SVM when you no longer need to serve data from the destination. The procedure is largely identical to the procedure for volume replication, with one exception. If you set `-identity-preserve true` when you created the original SVM replication relationship, you must stop the destination SVM before reactivating the source SVM.

Before you begin

If you have increased the size of destination volume while serving data from it, before you reactivate the source volume, you should manually increase max-autosize on the original source volume to ensure it can grow sufficiently.

When a destination volume grows automatically on page 24

About this task

This procedure assumes that the baseline in the original source volume is intact. If the baseline is not intact, you must create and initialize the relationship between the volume you are serving data from and the original source volume before performing the procedure.

For complete command syntax on commands, see the man page.

Steps

1. From the source SVM or the source cluster, run the following command to delete the original data protection relationship:

   `snapmirror delete -source-path SVM: -destination-path SVM:`

   You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

   #### Example

   The following example deletes the relationship between the original source SVM, **`svm1`**, and the SVM you are serving data from, **`svm_backup`**:

   ```
   cluster_src::> snapmirror delete -source-path svm1: -destination-path
   svm_backup:
   ```

2. From the destination SVM or the destination cluster for the reversed relationship, run the following command to reverse the original data protection relationship:

   `snapmirror resync -source-path SVM: -destination-path SVM:`

   You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

   Although resync does not require a baseline transfer, it can be time-consuming. You might want to run the resync in off-peak hours.

   #### Example

   The following example reverses the relationship between the original source SVM, **`svm1`**, and the SVM you are serving data from, **`svm_backup`**:

   ```
   cluster_src::> snapmirror resync -source-path svm_backup: -
   destination-path svm1:
   ```

3. If you set `-identity-preserve true` when you created the SVM replication relationship, stop the source SVM for the reversed relationship:

   `vserver stop -vserver SVM`

   It is a good idea to stop the destination SVM whether or not you set `-identity-preserve true`.

   #### Example

   The following example stops the source SVM for the reversed relationship:

   ```
   cluster_src::> vserver stop svm_backup
   ```

4. From the destination SVM or the destination cluster, run the following command to update the reversed relationship:

`snapmirror update -source-path SVM: -destination-path SVM:`

Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

The command fails if a common Snapshot copy does not exist on the source and destination. Use `snapmirror initialize` to re-initialize the relationship.

Example

The following example updates the relationship between the SVM you are serving data from,**`svm_backup`**, and the original SVM, **`svm1`**:

```
cluster_src::> snapmirror update -source-path svm_backup: -
destination-path svm1:
```

5. From the destination SVM or the destination cluster, run the following command to stop scheduled transfers for the reversed relationship:

   `snapmirror quiesce -source-path SVM: -destination-path SVM:`

   Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

Example

The following example stops scheduled transfers between the SVM you are serving data from, **`svm_backup`**, and the original SVM, **`svm1`**:

```
cluster_src::> snapmirror quiesce -source-path svm_backup: -
destination-path svm1:
```

6. From the destination SVM or the destination cluster, run the following command to stop ongoing transfers for the reversed relationship:

   `snapmirror abort -source-path SVM: -destination-path SVM:`

   Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

Example

The following example stops ongoing transfers between the SVM you are serving data from, **`svm_backup`**, and the original SVM, **`svm1`**:

```
cluster_src::> snapmirror abort -source-path svm_backup: -destination-
path svm1:
```

7. From the destination SVM or the destination cluster, run the following command to break the reversed relationship:

   `snapmirror break -source-path SVM: -destination-path SVM:`

   Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

Example

The following example breaks the relationship between the SVM you are serving data from, **`svm_backup`**, and the original SVM, **`svm1`**:

```
cluster_src::> snapmirror break -source-path svm_backup: -destination-
path svm1:
```

8. Start the original source SVM:

   vserver start -vserver *SVM*

   Example

   The following example starts the original source SVM:

   ```
   cluster_dst::> vserver start svm1
   ```

9. From the source SVM or the source cluster for the reversed relationship, run the following command to delete the reversed data protection relationship:

   snapmirror delete -source-path *SVM*: -destination-path *SVM*:

   You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

   Example

   The following example deletes the reversed relationship between the original source SVM, **svm1**, and the SVM you are serving data from, **svm_backup**:

   ```
   cluster_src::> snapmirror delete -source-path svm_backup: -
   destination-path svm1:
   ```

10. Reestablish the original data protection relationship:

    snapmirror resync -source-path *SVM*: -destination-path *SVM*:

    Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

    Example

    The following example reestablishes the relationship between the original SVM, **svm1**, and the original destination SVM, **svm_backup**:

    ```
    cluster_dst::> snapmirror resync -source-path svm1: -destination-path
    svm_backup:
    ```

After you finish

Use the `snapmirror show` command to verify that the SnapMirror relationship was created. For complete command syntax, see the man page.

Converting volume replication relationships to an SVM replication relationship

You can convert replication relationships between volumes to a replication relationship between the storage virtual machines (SVMs) that own the volumes, provided that each volume on the source

(except the root volume) is being replicated, and each volume on the source (including the root volume) has the same name as the volume on the destination.

About this task

Use the `volume rename` command to rename destination volumes if necessary.

Steps

1. From the destination SVM or the destination cluster, run the following command to resync the source and destination volumes:

   `snapmirror resync -source-path SVM:volume -destination-path SVM:volume -type DP|XDP -schedule schedule -policy policy`

   For complete command syntax, see the man page.

   Note: Although resync does not require a baseline transfer, it can be time-consuming. You might want to run the resync in off-peak hours.

   #### Example

   The following example resyncs the relationship between the source volume **`volA`** on **`svm1`** and the destination volume **`volA`** on **`svm_backup`**:

   ```
   cluster_dst::> snapmirror resync -source-path svm1:volA -destination-
   path svm_backup:volA
   ```

2. Create an SVM replication relationship between the source and destination SVMs, as described in *Replicating SVM configurations* on page 66.

3. Stop the destination SVM:

   `vserver stop -vserver SVM`

   For complete command syntax, see the man page.

   #### Example

   The following example stops the destination SVM **`svm_backup`**:

   ```
   cluster_src::> vserver stop svm_backup
   ```

4. From the destination SVM or the destination cluster, run the following command to resync the source and destination SVMs:

   `snapmirror resync -source-path SVM: -destination-path SVM: -type DP|XDP -schedule schedule -policy policy`

   For complete command syntax, see the man page.

   Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

   Although resync does not require a baseline transfer, it can be time-consuming. You might want to run the resync in off-peak hours.

   #### Example

   The following example resyncs the relationship between the source SVM **`svm1`** and the destination SVM **`svm_backup`**:

```
cluster_dst::> snapmirror resync -source-path svm1: -destination-path
svm_backup:
```

Deleting an SVM replication relationship

You can use the `snapmirror delete` and `snapmirror release` commands to delete an SVM replication relationship. You can then delete unneeded destination volumes manually.

About this task

The `snapmirror release` command deletes any SnapMirror-created Snapshot copies from the source. You can use the `-relationship-info-only` option to preserve the Snapshot copies.

For complete command syntax on commands, see the man page.

Steps

1. Run the following command from the destination SVM or the destination cluster to break the replication relationship:

   `snapmirror break -source-path` *`SVM`*`: -destination-path` *`SVM`*`:`

   Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

   #### Example

   The following example breaks the relationship between the source SVM **`svm1`** and the destination SVM **`svm_backup`**:

   ```
   cluster_dst::> snapmirror break -source-path svm1: -destination-path
   svm_backup:
   ```

2. Run the following command from the destination SVM or the destination cluster to delete the replication relationship:

   `snapmirror delete -source-path` *`SVM`*`: -destination-path` *`SVM`*`:`

   Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

   #### Example

   The following example deletes the relationship between the source SVM **`svm1`** and the destination SVM **`svm_backup`**:

   ```
   cluster_dst::> snapmirror delete -source-path svm1: -destination-path
   svm_backup:
   ```

3. Run the following command from the source cluster or source SVM to release the replication relationship information from the source SVM:

   `snapmirror release -source-path` *`SVM`*`: -destination-path` *`SVM`*`:`

   Note: You must enter a colon (:) after the SVM name in the `-source-path` and `-destination-path` options. See the example below.

Example

The following example releases information for the specified replication relationship from the source SVM **svm1**:

```
cluster_src::> snapmirror release -source-path svm1: -destination-
path svm_backup:
```

Managing SnapMirror root volume replication

Every SVM in a NAS environment has a unique namespace. The SVM *root volume,* containing operating system and related information, is the entry point to the namespace hierarchy. To ensure that data remains accessible to clients in the event of a node outage or failover, you should create a load-sharing mirror copy of the SVM root volume.

- If the root volume is temporarily unavailable, the load-sharing mirror automatically provides read-only access to root volume data.
- If the root volume is permanently unavailable, you can promote one of the load-sharing volumes to provide write access to root volume data.

Creating and initializing load-sharing mirror relationships

You must create a load-sharing mirror (LSM) for each root volume in the cluster. You can create the LSM on any node other than the one containing the root volume, preferably in a different HA pair. For a two-node cluster, you can create the LSM on the partner of the node with the root volume.

About this task

For example, in a four-node cluster with a root volume on three nodes:

- For the root volume on HA 1 node 1, create the LSM on HA 2 node 1 or HA 2 node 2.
- For the root volume on HA 1 node 2, create the LSM on HA 2 node 1 or HA 2 node 2.
- For the root volume on HA 2 node 1, create the LSM on HA 1 node 1 or HA 1 node 2.

Steps

1. Create a destination volume for the LSM:

   `volume create -vserver` *`SVM`* `-volume` *`volume`* `-aggregate` *`aggregate`* `-type DP -size` *`size`*

   The destination volume should be the same or greater in size than the root volume.

   It is a best practice to name the root and destination volume with suffixes, such as `_root` and `_m1`.

   For complete command syntax, see the man page.

   #### Example

   The following example creates a load-sharing mirror volume for the root volume **`svm1_root`** in **`cluster_src`**:

   ```
   cluster_src:> volume create -vserver svm1 -volume svm1_m1 -aggregate
   aggr_1 -size 1gb -state online -type DP
   ```

2. Create a replication job schedule, as described in *Creating a replication job schedule* on page 34.

3. Create a load-sharing mirror relationship between the SVM root volume and the destination volume for the LSM:

   `snapmirror create -source-path` *`SVM`*`:`*`volume`*`|`*`cluster`*`://`*`SVM/volume`* `-destination-path` *`SVM`*`:`*`volume`*`|`*`cluster`*`://`*`SVM/volume`* `-type LS -schedule` *`schedule`*

   For complete command syntax, see the man page.

Example

The following example creates a load-sharing mirror relationship between the root volume **svm1_root** and the load-sharing mirror volume **svm1_m1**:

```
cluster_src::> snapmirror create -source-path svm1:svm1_root -
destination-path svm1:svm1_m1 -type LS -schedule hourly
```

The type attribute of the load-sharing mirror changes from **DP** to **LS**.

4. Initialize the load-sharing mirror:

   snapmirror initialize-ls-set -source-path *SVM*:*volume*|*cluster*://*SVM*/*volume*

   Initialization can be time-consuming. You might want to run the baseline transfer in off-peak hours.

   For complete command syntax, see the man page.

Example

The following example initializes the load-sharing mirror for the root volume **svm1_root**:

```
cluster_src::> snapmirror initialize-ls-set -source-path
svm1:svm1_root
```

Updating a load-sharing mirror relationship

You should manually update a load-sharing mirror (LSM) relationship if you want changes on the root volume to be visible before the next scheduled update. For example, when a new volume is mounted on the root volume of the SVM, you should update the LSM relationship.

Step

1. Update a load-sharing mirror relationship manually:

   snapmirror update-ls-set -source-path *SVM*:*volume*|*cluster*://*SVM*/*volume*

Example

The following example updates the load-sharing mirror relationship for the root volume **svm1_root**:

```
cluster_src::> snapmirror update-ls-set -source-path svm1:svm1_root
```

Promoting a load-sharing mirror

If a root volume is permanently unavailable, you can promote the load-sharing mirror (LSM) volume to provide write access to root volume data.

Before you begin

You must use advanced privilege level commands for this task.

Steps

1. Change to advanced privilege level:

```
set -privilege advanced
```

2. Promote an LSM volume:

   snapmirror promote -destination-path *SVM*:*volume*|*cluster*://*SVM*/*volume*

   For complete command syntax, see the man page.

   Example

   The following example promotes the volume **svm1_m2** as the new SVM root volume:

```
cluster_src::*> snapmirror promote -destination-path svm1:svm1_m2

Warning: Promote will delete the offline read-write volume
         cluster_src://svm1/svm1_root and replace it with
         cluster_src://svm1/svm1_m2. Because the volume is offline,
         it is not possible to determine whether this promote will
         affect other relationships associated with this source.
Do you want to continue? {y|n}: y
```

   Enter `y`. ONTAP makes the LSM volume a read/write volume, and deletes the original root volume if it is accessible.

   Attention: The promoted root volume might not have all of the data that was in the original root volume if the last update did not occur recently.

3. Return to admin privilege level:

   ```
   set -privilege admin
   ```

4. Rename the promoted volume following the naming convention you used for the root volume:

   volume rename -vserver *SVM* -volume *volume* -newname *new_name*

   Example

   The following example renames the promoted volume **svm1_m2** with the name **svm1_root**:

```
cluster_src::> volume rename -vserver svm11 -volume svm1_m2 -newname
svm1_root
```

5. Protect the renamed root volume, as described in step *3* on page 83 through step *4* on page 84 in *Creating and initializing load-sharing mirror relationships* on page 83.

SnapMirror technical details

There are some convenient features you should be familiar with before creating a SnapMirror data protection relationship. You also need to be aware of compatible ONTAP versions for SnapMirror relationships and basic SnapMirror limitations.

Using path name pattern matching

You can use pattern matching to specify the source and destination paths in `snapmirror` commands.

`snapmirror` commands use fully qualified path names in the following format: *`vserver`*`:`*`volume`*. You can abbreviate the path name by not entering the SVM name. If you do this, the `snapmirror` command assumes the local SVM context of the user.

Assuming that the SVM is called “vserver1” and the volume is called “vol1”, the fully qualified path name is `vserver1:vol1`.

You can use the asterisk (*) in paths as a wildcard to select matching, fully qualified path names. The following table provides examples of using the wildcard to select a range of volumes.

`*`	Matches all paths.
`vs*`	Matches all SVMs and volumes with SVM names beginning with `vs`.
`*:*src*`	Matches all SVMs with volume names containing the `src` text.
`*:vol*`	Matches all SVMs with volume names beginning with `vol`.

```
vs1::> snapmirror show -destination-path *:*dest*
                                                                       Progress
Source              Destination  Mirror        Relationship  Total     Last
Path          Type  Path         State         Status        Progress  Healthy Updated
------------- ---- ------------ ------------- -------------- ---------- ------- --------
vs1:sm_src2
              DP   vs2:sm_dest1
                                 Snapmirrored  Idle           -         true    -
```

Using extended queries to act on many SnapMirror relationships

You can use *extended queries* to perform SnapMirror operations on many SnapMirror relationships at one time. For example, you might have multiple uninitialized SnapMirror relationships that you want to initialize using one command.

About this task

You can apply extended queries to the following SnapMirror operations:

- Initializing uninitialized relationships
- Resuming quiesced relationships
- Resynchronizing broken relationships
- Updating idle relationships
- Aborting relationship data transfers

Step

1. Perform a SnapMirror operation on many relationships:

   ***snapmirror command* {-state *state* } ***

   #### Example

   The following command initializes SnapMirror relationships that are in an **Uninitialized** state:

   ```
   vs1::> snapmirror initialize {-state Uninitialized} *
   ```

Ensuring a common Snapshot copy in a mirror-vault deployment

You can use the `snapmirror snapshot-owner create` command to preserve a labeled Snapshot copy on the secondary in a mirror-vault deployment. Doing so ensures that a common Snapshot copy exists for the update of the vault relationship.

About this task

If you use a combination mirror-vault fan-out or cascade deployment, you should keep in mind that updates will fail if a common Snapshot copy does not exist on the source and destination volumes.

This is never an issue for the mirror relationship in a mirror-vault fan-out or cascade deployment, since SnapMirror always creates a Snapshot copy of the source volume before it performs the update.

It might be an issue for the vault relationship, however, since SnapMirror does not create a Snapshot copy of the source volume when it updates a vault relationship. You need to use the `snapmirror snapshot-owner create` to ensure that there is at least one common Snapshot copy on both the source and destination of the vault relationship.

Steps

1. On the source volume, assign an owner to the labeled Snapshot copy you want to preserve:

   snapmirror snapshot-owner create -vserver *SVM* -volume *volume* -snapshot *snapshot* -owner *owner*

   #### Example

   The following example assigns **ApplicationA** as the owner of the **snap1** Snapshot copy:

   ```
   clust1::> snapmirror snapshot-owner create -vserver vs1 -volume vol1
   -snapshot snap1 -owner ApplicationA
   ```

2. Update the mirror relationship, as described in *Updating a replication relationship manually* on page 55.

   Alternatively, you can wait for the scheduled update of the mirror relationship.

3. Transfer the labeled Snapshot copy to the vault destination:

   snapmirror update -source-path *SVM*:*volume*|*cluster*://*SVM*/*volume*, ... -destination-path *SVM*:*volume*|*cluster*://*SVM*/*volume*, ... -source-snapshot *snapshot*

   For complete command syntax, see the man page.

Example

The following example transfers the **snap1** Snapshot copy::

```
clust1::> snapmirror update -vserver vs1 -volume vol1
-source-snapshot snap1
```

The labeled Snapshot copy will be preserved when the vault relationship is updated.

4. On the source volume, remove the owner from the labeled Snapshot copy:

   snapmirror snapshot-owner delete -vserver *SVM* -volume *volume* -snapshot *snapshot* -owner *owner*

Example

The following examples removes **ApplicationA** as the owner of the **snap1** Snapshot copy:

```
clust1::> snapmirror snapshot-owner delete -vserver vs1 -volume vol1
-snapshot snap1 -owner ApplicationA
```

Compatible ONTAP versions for SnapMirror relationships

You should verify that the source and destination volumes are running compatible ONTAP versions before creating a SnapMirror data protection relationship.

SnapMirror DR relationships

For SnapMirror relationships of type “DP” and policy type “async-mirror”:

A source volume in ONTAP version…	**Can have a destination volume in ONTAP versions…**							
	8.2	8.3	9.0	9.1	9.2	9.3	9.4	9.5
8.2	Yes	Yes	Yes	No	No	No	No	No
8.3	No	Yes	Yes	Yes	No	No	No	No
9.0	No	No	Yes	Yes	Yes	No	No	No
9.1	No	No	No	Yes	Yes	Yes	No	No
9.2	No	No	No	No	Yes	Yes	Yes	No
9.3	No	No	No	No	No	Yes	Yes	Yes
9.4	No	No	No	No	No	No	Yes	Yes
9.5	No	No	No	No	No	No	No	Yes

Note: Interoperability is not bidirectional.

Unified replication relationships

For SnapMirror relationships of type “XDP” (available in ONTAP 8.3 and later):

ONTAP version…	**Interoperates with previous ONTAP versions…**							
	8.3.x	8.3.2 P4	9.0	9.1	9.2	9.3	9.4	9.5
8.3.x	Yes	-	-	-	-	-	-	-
8.3.2 P4	Yes	Yes	-	-	-	-	-	-
9.0	Yes	Yes	Yes	-	-	-	-	-
9.1	Yes	Yes	Yes	Yes	-	-	-	-
9.2	No	Yes	Yes	Yes	Yes	-	-	-
9.3	No	No	Yes	Yes	Yes	Yes	-	-
9.4	No	No	Yes	Yes	No	Yes	Yes	-
9.5	No	No	No	Yes	No	Yes	Yes	Yes

Note: Locate the higher ONTAP version in the left column, and in the right column locate the lower ONTAP version to determine interoperability. Interoperability is bidirectional.

SnapMirror limitations

You should be aware of basic SnapMirror limitations before creating a data protection relationship.

- A destination volume can have only one source volume.

  Note: A source volume can have multiple destination volumes. The destination volume can be the source volume for any type of SnapMirror replication relationship.
- You can fan out a maximum of eight destination volumes from a single source volume.
- You cannot restore files to the destination of a SnapMirror DR relationship.
- Source or destination SnapVault volumes cannot be 32-bit.
- The source volume for a SnapVault relationship should not be a FlexClone volume.

  Note: The relationship will work, but the efficiency offered by FlexClone volumes will not be preserved.

Where to find additional information

You can learn more about tasks related to Snapshot copies and SnapMirror replication in NetApp's extensive documentation library.

- *ONTAP concepts*
  Describes the concepts that inform ONTAP data management software, including data protection and transfer.
- *NetApp Technical Report 4015: SnapMirror Configuration and Best Practices Guide for ONTAP 9.1, 9.2*
  Describes SnapMirror best practices.
- *NetApp Technical Report 4183: SnapVault Best Practices Guide*
  Describes SnapVault best practices.
- *Cluster and SVM peering*
  Describes how to create peer relationships between source and destination clusters and between source and destination SVMs.
- *Cluster management using System Manager*
  Describes how to use OnCommand System Manager to perform SnapMirror replication.
- *Archive and compliance using SnapLock technology*
  Describes how to replicate WORM files in a SnapLock volume.
- *Replication between NetApp element software and ONTAP*
  Describes how to replicate data between Element and ONTAP, including how to back up Element Snapshot copies to an ONTAP system, and how to migrate ONTAP LUNs to an Element system.
- *NDMP express configuration*
  Describes how to use NDMP to back up data directly to tape using a third-party backup application.
- *Data protection using tape backup*
  Describes how to back up and recover data using tape backup and recovery features.

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