SAN data protection

ONTAP 9

NetApp
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SAN data protection

Learn about ONTAP data protection methods for SAN environments

You can protect your data by making copies of it so that it is available for restoration in the event of accidental deletion, application crashes, data corruption, or disaster. Depending on your data protection and backup needs, ONTAP offers a variety of methods that enable you to protect your data.

SnapMirror active sync

Beginning with general availability in ONTAP 9.9.1, provides Zero Recovery Time Objective (Zero RTO) or Transparent Application Failover (TAF) to enable automatic failover of business-critical applications in SAN environments. SnapMirror active sync requires the installation of ONTAP Mediator 1.2 in a configuration with either two AFF clusters or two All-Flash SAN Array (ASA) clusters.

SnapMirror active sync

Snapshot

Enables you to manually or automatically create, schedule, and maintain multiple backups of your LUNs. snapshots use only a minimal amount of additional volume space and do not have a performance cost. If your LUN data is accidentally modified or deleted, that data can easily and quickly be restored from one of the latest snapshots.

FlexClone LUNs (FlexClone license required)

Provides point-in-time, writable copies of another LUN in an active volume or in a snapshot. A clone and its parent can be modified independently without affecting each other.

SnapRestore (license required)

Enables you to perform fast, space-efficient, on-request data recovery from snapshots on an entire volume. You can use SnapRestore to restore a LUN to an earlier preserved state without rebooting the storage system.

Data protection mirror copies (SnapMirror license required)

Provides asynchronous disaster recovery by enabling you to periodically create snapshots of data on your volume; copy those snapshots over a local or wide area network to a partner volume, usually on another cluster; and retain those snapshots. The mirror copy on the partner volume provides quick availability and restoration of data from the time of the last snapshot, if the data on the source volume is corrupted or lost.

SnapVault backups (SnapMirror license required)

Provides storage efficient and long-term retention of backups. SnapVault relationships enable you to back up selected snapshots of volumes to a destination volume and retain the backups.

If you conduct tape backups and archival operations, you can perform them on the data that is already backed up on the SnapVault secondary volume.

Native tape backup and recovery

Support for most existing tape drives are included in ONTAP, as well as a method for tape vendors to dynamically add support for new devices. ONTAP also supports the Remote Magnetic Tape (RMT) protocol, enabling backup and recovery to any capable system.

Related information

Data protection using tape backup

Restore a single LUN from an ONTAP snapshot

You can restore a single LUN from a snapshot without restoring the entire volume that contains the single LUN. You can restore the LUN in place or to a new path in the volume. The operation restores only the single LUN without impacting other files or LUNs in the volume. You can also restore files with streams.

Before you begin

- You must have enough space on your volume to complete the restore operation:
  - If you are restoring a space-reserved LUN where the fractional reserve is 0%, you require one times the size of the restored LUN.
  - If you are restoring a space-reserved LUN where the fractional reserve is 100%, you require two times the size of the restored LUN.
  - If you are restoring a non-space-reserved LUN, you only require the actual space used for the restored LUN.
- A snapshot of the destination LUN must have been created.

  If the restore operation fails, the destination LUN might be truncated. In such cases, you can use the snapshot to prevent data loss.

- A snapshot of the source LUN must have been created.

  In rare cases, the LUN restore can fail, leaving the source LUN unusable. If this occurs, you can use the snapshot to return the LUN to the state just before the restore attempt.

- The destination LUN and source LUN must have the same OS type.

  If your destination LUN has a different OS type from your source LUN, your host can lose data access to the destination LUN after the restore operation.

Steps

1. From the host, stop all host access to the LUN.
2. Unmount the LUN on its host so that the host cannot access the LUN.
3. Unmap the LUN:

```
lun mapping delete -vserver <SVM_name> -volume <volume_name> -lun
<lun_name> -igroup <igroup_name>
```

4. Determine the snapshot you want to restore your LUN to:

```
volume snapshot show -vserver <SVM_name> -volume <volume_name>
```

5. Create a snapshot of the LUN prior to restoring the LUN:

```
volume snapshot create -vserver <SVM_name> -volume <volume_name>
-snapshot <snapshot_name>
```

6. Restore the specified LUN in a volume:

```
volume snapshot restore-file -vserver <SVM_name> -volume <volume_name>
-snapshot <snapshot_name> -path <lun_path>
```

7. Follow the steps on the screen.
8. If necessary, bring the LUN online:

```
lun modify -vserver <SVM_name> -path <lun_path> -state online
```

9. If necessary, remap the LUN:

```
lun mapping create -vserver <SVM_name> -volume <volume_name> -lun
<lun_name> -igroup <igroup_name>
```

10. From the host, remount the LUN.
11. From the host, restart access to the LUN.

Restore all LUNs in a volume from an ONTAP snapshot

You can use `volume snapshot restore` command to restore all the LUNs in a specified volume from a snapshot.

Steps

1. From the host, stop all host access to the LUNs.

   Using SnapRestore without stopping all host access to LUNs in the volume can cause data corruption and system errors.

2. Unmount the LUNs on that host so that the host cannot access the LUNs.
3. Unmap your LUNs:

```
lun mapping delete -vserver <SVM_name> -volume <volume_name> -lun
<lun_name> -igroup <igroup_name>
```

4. Determine the snapshot to which you want to restore your volume:

```
volume snapshot show -vserver <SVM_name> -volume <volume_name>
```

5. Change your privilege setting to advanced:

```
set -privilege advanced
```

6. Restore your data:

```
volume snapshot restore -vserver <SVM_name> -volume <volume_name>
-snapshot <snapshot_name>
```

7. Follow the instructions on the screen.
8. Remap your LUNs:

```
lun mapping create -vserver <SVM_name> -volume <volume_name> -lun
<lun_name> -igroup <igroup_name>
```

9. Verify that your LUNs are online:

```
lun show -vserver <SVM_name> -path <lun_path> -fields state
```

10. If your LUNs are not online, bring them online:

```
lun modify -vserver <SVM_name> -path <lun_path> -state online
```

11. Change your privilege setting to admin:

```
set -privilege admin
```

12. From the host, remount your LUNs.
13. From the host, restart access to your LUNs.

Protect your data with ONTAP FlexClone LUNs

A FlexClone LUN is a point-in-time, writeable copy of another LUN in an active volume or in a snapshot. The clone and its parent can be modified independently without affecting each other.

You can use FlexClone LUNs to create multiple read/write copies of a LUN.

Reasons to create FlexClone LUNs

- You need to create a temporary copy of a LUN for testing purposes.
- You need to make a copy of your data available to additional users without giving them access to the production data.
- You want to create a clone of a database for manipulation and projection operations, while preserving the original data in an unaltered form.
- You want to access a specific subset of a LUN's data (a specific logical volume or file system in a volume group, or a specific file or set of files in a file system) and copy it to the original LUN, without restoring the rest of the data in the original LUN. This works on operating systems that support mounting a LUN and a clone of the LUN at the same time.
- You need multiple SAN boot hosts with the same operating system.

A FlexClone LUN shares space initially with its parent LUN. By default, the FlexClone LUN inherits the space-reserved attribute of the parent LUN. For example, if the parent LUN is non-space-reserved, the FlexClone LUN is also non-space-reserved by default. However, you can create a non-space-reserved FlexClone LUN from a parent that is a space-reserved LUN.

When you clone a LUN, block sharing occurs in the background and you cannot create a volume snapshot until the block sharing is finished.

You must configure the volume to enable the FlexClone LUN automatic deletion function with the `volume snapshot autodelete modify` command. Otherwise, if you want FlexClone LUNs to be deleted automatically but the volume is not configured for FlexClone auto delete, none of the FlexClone LUNs are deleted.

When you create a FlexClone LUN, the FlexClone LUN automatic deletion function is disabled by default. You must manually enable it on every FlexClone LUN before that FlexClone LUN can be automatically deleted. If you are using semi-thick volume provisioning and you want the "best effort" write guarantee provided by this option, you must make *all* FlexClone LUNs available for automatic deletion.

When you create a FlexClone LUN from a snapshot, the LUN is automatically split from the snapshot by using a space-efficient background process so that the LUN does not continue to depend on the snapshot or consume any additional space. If this background split has not been completed and this snapshot is automatically deleted, that FlexClone LUN is deleted even if you have disabled the FlexClone auto delete function for that FlexClone LUN. After the background split is complete, the FlexClone LUN is not deleted even if that snapshot is deleted.

Related information

- Create a FlexClone LUN
- Configure a FlexVol volume to automatically delete FlexClone LUNs
- Prevent a FlexClone LUN from being automatically deleted

Configure and use SnapVault backups in a SAN environment

Learn about ONTAP SnapVault backups in a SAN environment

SnapVault configuration and use in a SAN environment is very similar to configuration and use in a NAS environment, but restoring LUNs in a SAN environment requires some special procedures.

SnapVault backups contain a set of read-only copies of a source volume. In a SAN environment you always back up entire volumes to the SnapVault secondary volume, not individual LUNs.

The procedure for creating and initializing the SnapVault relationship between a primary volume containing LUNs and a secondary volume acting as a SnapVault backup is identical to the procedure used with FlexVol volumes used for file protocols. This procedure is described in detail in Data Protection.

It is important to ensure that LUNs being backed up are in a consistent state before the snapshots are created and copied to the SnapVault secondary volume. Automating the snapshot creation with SnapCenter ensures that backed up LUNs are complete and usable by the original application.

There are three basic choices for restoring LUNs from a SnapVault secondary volume:

- You can map a LUN directly from the SnapVault secondary volume and connect a host to the LUN to access the contents of the LUN.

  The LUN is read-only and you can map only from the most recent snapshot in the SnapVault backup. Persistent reservations and other LUN metadata are lost. If desired, you can use a copy program on the host to copy the LUN contents back to the original LUN if it is still accessible.

  The LUN has a different serial number from the source LUN.

- You can clone any snapshot in the SnapVault secondary volume to a new read-write volume.

  You can then map any of the LUNs in the volume and connect a host to the LUN to access the contents of the LUN. If desired, you can use a copy program on the host to copy the LUN contents back to the original LUN if it is still accessible.

- You can restore the entire volume containing the LUN from any snapshot in the SnapVault secondary volume.

  Restoring the entire volume replaces all of the LUNs, and any files, in the volume. Any new LUNs created since the snapshot was created are lost.

  The LUNs retain their mapping, serial numbers, UUIDs, and persistent reservations.

Access a read-only LUN copy from an ONTAP SnapVault backup

You can access a read-only copy of a LUN from the latest snapshot in a SnapVault backup. The LUN ID, path, and serial number are different from the source LUN and must first be mapped. Persistent reservations, LUN mappings, and igroups are not replicated to the SnapVault secondary volume.

Before you begin

- The SnapVault relationship must be initialized and the latest snapshot in the SnapVault secondary volume must contain the desired LUN.
- The storage virtual machine (SVM) containing the SnapVault backup must have one or more LIFs with the desired SAN protocol accessible from the host used to access the LUN copy.
- If you plan to access LUN copies directly from the SnapVault secondary volume, you must create your igroups on the SnapVault SVM in advance.

  You can access a LUN directly from the SnapVault secondary volume without having to first restore or clone the volume containing the LUN.

About this task

If a new snapshot is added to the SnapVault secondary volume while you have a LUN mapped from a previous snapshot, the contents of the mapped LUN changes. The LUN is still mapped with the same identifiers, but the data is taken from the new snapshot. If the LUN size changes, some hosts automatically detect the size change; Windows hosts require a disk rescan to pick up any size change.

Steps

1. List the available LUNs in the SnapVault secondary volume.

   ```
   lun show
   ```

   In this example, you can see both the original LUNs in the primary volume srcvolA and the copies in the SnapVault secondary volume dstvolB:

   ```
   cluster::> lun show

   Vserver   Path                State   Mapped   Type          Size
   --------  ------------------  ------  -------  --------      -------
   vserverA  /vol/srcvolA/lun_A  online  mapped   windows  300.0GB
   vserverA  /vol/srcvolA/lun_B  online  mapped   windows  300.0GB
   vserverA  /vol/srcvolA/lun_C  online  mapped   windows  300.0GB
   vserverB  /vol/dstvolB/lun_A  online  unmapped windows  300.0GB
   vserverB  /vol/dstvolB/lun_B  online  unmapped windows  300.0GB
   vserverB  /vol/dstvolB/lun_C  online  unmapped windows  300.0GB

   6 entries were displayed.
   ```

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

2. If the igroup for the desired host does not already exist on the SVM containing the SnapVault secondary volume, create an igroup.

   ```
   igroup create -vserver <SVM_name> -igroup <igroup_name> -protocol
   <protocol> -ostype <ostype> -initiator <initiator_name>
   ```

This command creates an igroup for a Windows host that uses the iSCSI protocol:

```
cluster::> igroup create -vserver vserverB -igroup temp_igroup
  -protocol iscsi -ostype windows
  -initiator iqn.1991-05.com.microsoft:hostA
```

3. Map the desired LUN copy to the igroup.

```
lun mapping create -vserver <SVM_name> -path <LUN_path> -igroup
<igroup_name>
```

```
cluster::> lun mapping create -vserver vserverB -path /vol/dstvolB/lun_A
  -igroup temp_igroup
```

Learn more about `lun mapping create` in the ONTAP command reference.

4. Connect the host to the LUN and access the contents of the LUN as desired.

Restore a single LUN from an ONTAP SnapVault backup

You can restore a single LUN to a new location or to the original location. You can restore from any snapshot in the SnapVault secondary volume. To restore the LUN to the original location, you first restore it to a new location and then copy it.

Before you begin

- The SnapVault relationship must be initialized and the SnapVault secondary volume must contain an appropriate snapshot to restore.
- The storage virtual machine (SVM) containing the SnapVault secondary volume must have one or more LIFs with the desired SAN protocol that are accessible from the host used to access the LUN copy.
- The igroups must already exist on the SnapVault SVM.

About this task

The process includes creating a read-write volume clone from a snapshot in the SnapVault secondary volume. You can use the LUN directly from the clone, or you can optionally copy the LUN contents back to the original LUN location.

The LUN in the clone has a different path and serial number from the original LUN. Persistent reservations are not retained.

Steps

1. Verify the secondary volume that contains the SnapVault backup.

```
snapmirror show
```

```
cluster::> snapmirror show

Source          Dest     Mirror  Relation  Total             Last
Path     Type   Path     State   Status    Progress  Healthy Updated
-------- ---- --------- ------- --------- --------- ------- -------
vserverA:srcvolA
         XDP  vserverB:dstvolB
                        Snapmirrored
                                Idle       -         true    -
```

2. Identify the snapshot that you want to restore the LUN from.

```
volume snapshot show
```

```
cluster::> volume snapshot show

Vserver  Volume  Snapshot                State Size   Total% Used%
-------- ------- ---------------------- ----- ------ ------ -----
vserverB
         dstvolB
                 snap2.2013-02-10_0010  valid  124KB     0%    0%
                 snap1.2013-02-10_0015 valid  112KB     0%    0%
                 snap2.2013-02-11_0010  valid  164KB     0%    0%
```

3. Create a read-write clone from the desired snapshot

```
volume clone create -vserver <SVM_name> -flexclone <flexclone_name>
-type <type> -parent-volume <parent_volume_name> -parent-snapshot
<snapshot_name>
```

The volume clone is created in the same aggregate as the SnapVault backup. There must be enough space in the aggregate to store the clone.

```
cluster::> volume clone create -vserver vserverB
  -flexclone dstvolB_clone -type RW -parent-volume dstvolB
  -parent-snapshot daily.2013-02-10_0010
[Job 108] Job succeeded: Successful
```

4. List the LUNs in the volume clone.

```
lun show -vserver <SVM_name> -volume <flexclone_volume_name>
```

```
cluster::> lun show -vserver vserverB -volume dstvolB_clone

Vserver   Path                      State   Mapped   Type
--------- ------------------------  ------- -------- --------
vserverB  /vol/dstvolB_clone/lun_A  online  unmapped windows
vserverB  /vol/dstvolB_clone/lun_B  online  unmapped windows
vserverB  /vol/dstvolB_clone/lun_C  online  unmapped windows

3 entries were displayed.
```

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

5. If the igroup for the desired host does not already exist on the SVM containing the SnapVault backup, create an igroup.

```
igroup create -vserver <SVM_name> -igroup <igroup_name> -protocol
<protocol> -ostype <os_type> -initiator <initiator_name>
```

This example creates an igroup for a Windows host that uses the iSCSI protocol:

```
cluster::> igroup create -vserver vserverB -igroup temp_igroup
  -protocol iscsi -ostype windows
  -initiator iqn.1991-05.com.microsoft:hostA
```

6. Map the desired LUN copy to the igroup.

```
lun mapping create -vserver <SVM_name> -path <lun_path> -igroup
<igroup_name>
```

```
cluster::> lun mapping create -vserver vserverB
  -path /vol/dstvolB_clone/lun_C -igroup temp_igroup
```

Learn more about `lun mapping create` in the ONTAP command reference.

7. Connect the host to the LUN and access the contents of the LUN, as desired.

The LUN is read-write and can be used in place of the original LUN. Because the LUN serial number is different, the host interprets it as a different LUN from the original.

8. Use a copy program on the host to copy the LUN contents back to the original LUN.

Related information

- snapmirror show

Restore all LUNs in a volume from an ONTAP SnapVault backup

If one or more LUNs in a volume need to be restored from a SnapVault backup, you can restore the entire volume. Restoring the volume affects all LUNs in the volume.

Before you begin

The SnapVault relationship must be initialized and the SnapVault secondary volume must contain an appropriate snapshot to restore.

About this task

Restoring an entire volume returns the volume to the state it was in when the snapshot was made. If a LUN was added to the volume after the snapshot, that LUN is removed during the restore process.

After restoring the volume, the LUNs remain mapped to the igroups they were mapped to just before the restore. The LUN mapping might be different from the mapping at the time of the snapshot. Persistent reservations on the LUNs from host clusters are retained.

Steps

1. Stop I/O to all LUNs in the volume.
2. Verify the secondary volume that contains the SnapVault secondary volume.

```
snapmirror show
```

```
cluster::> snapmirror show

Source          Dest     Mirror  Relation  Total             Last
Path     Type   Path     State   Status    Progress  Healthy Updated
-------- ---- --------- ------- --------- --------- ------- -------
vserverA:srcvolA
         XDP  vserverB:dstvolB
                         Snapmirrored
                                 Idle       -         true    -
```

3. Identify the snapshot that you want to restore from.

```
volume snapshot show
```

```
cluster::> volume snapshot show

Vserver  Volume  Snapshot                State Size   Total% Used%
-------- ------- ---------------------- ----- ------ ------ -----
vserverB
         dstvolB
                 snap2.2013-02-10_0010  valid  124KB     0%    0%
                 snap1.2013-02-10_0015 valid  112KB     0%    0%
                 snap2.2013-02-11_0010  valid  164KB     0%    0%
```

4. Specify the snapshot to use.

```
snapmirror restore -destination-path <destination_path> -source-path
<source_path> -source-snapshot <snapshot_name>
```

The destination you specify for the restore is the original volume you are restoring to.

```
cluster::> snapmirror restore -destination-path vserverA:srcvolA
  -source-path vserverB:dstvolB -source-snapshot daily.2013-02-10_0010

Warning: All data newer than Snapshot copy hourly.2013-02-11_1205 on
volume vserverA:src_volA will be deleted.
Do you want to continue? {y|n}: y
[Job 98] Job is queued: snapmirror restore from source
"vserverB:dstvolB" for the snapshot daily.2013-02-10_0010.
```

5. If you are sharing LUNs across a host cluster, restore the persistent reservations on the LUNs from the affected hosts.

Restoring a volume from a SnapVault backup

In the following example, the LUN named lun_D was added to the volume after the snapshot was created. After restoring the entire volume from the snapshot, lun_D no longer appears.

In the `lun show` command output, you can see the LUNs in the primary volume srcvolA and the read-only copies of those LUNs in the SnapVault secondary volume dstvolB. There is no copy of lun_D in the SnapVault backup.

```
cluster::> lun show
Vserver   Path                 State   Mapped   Type          Size
--------- ------------------   ------- -------- --------      -------
vserverA  /vol/srcvolA/lun_A  online  mapped   windows  300.0GB
vserverA  /vol/srcvolA/lun_B  online  mapped   windows  300.0GB
vserverA  /vol/srcvolA/lun_C  online  mapped   windows  300.0GB
vserverA  /vol/srcvolA/lun_D  online  mapped   windows  250.0GB
vserverB  /vol/dstvolB/lun_A  online  unmapped windows  300.0GB
vserverB  /vol/dstvolB/lun_B  online  unmapped windows  300.0GB
vserverB  /vol/dstvolB/lun_C  online  unmapped windows  300.0GB

7 entries were displayed.

cluster::>snapmirror restore -destination-path vserverA:srcvolA
  -source-path vserverB:dstvolB
  -source-snapshot daily.2013-02-10_0010

Warning: All data newer than snapshot hourly.2013-02-11_1205
on volume vserverA:src_volA will be deleted.
Do you want to continue? {y|n}: y
[Job 98] Job is queued: snapmirror restore from source
"vserverB:dstvolB" for the snapshot daily.2013-02-10_0010.

cluster::> lun show
Vserver   Path                 State   Mapped   Type          Size
--------- ------------------   ------- -------- --------      -------
vserverA  /vol/srcvolA/lun_A  online  mapped   windows  300.0GB
vserverA  /vol/srcvolA/lun_B  online  mapped   windows  300.0GB
vserverA  /vol/srcvolA/lun_C  online  mapped   windows  300.0GB
vserverB  /vol/dstvolB/lun_A  online  unmapped windows  300.0GB
vserverB  /vol/dstvolB/lun_B  online  unmapped windows  300.0GB
vserverB  /vol/dstvolB/lun_C  online  unmapped windows  300.0GB

6 entries were displayed.
```

After the volume is restored from the SnapVault secondary volume, the source volume no longer contains lun_D. You do not need to remap the LUNs in the source volume after the restore because they are still mapped.

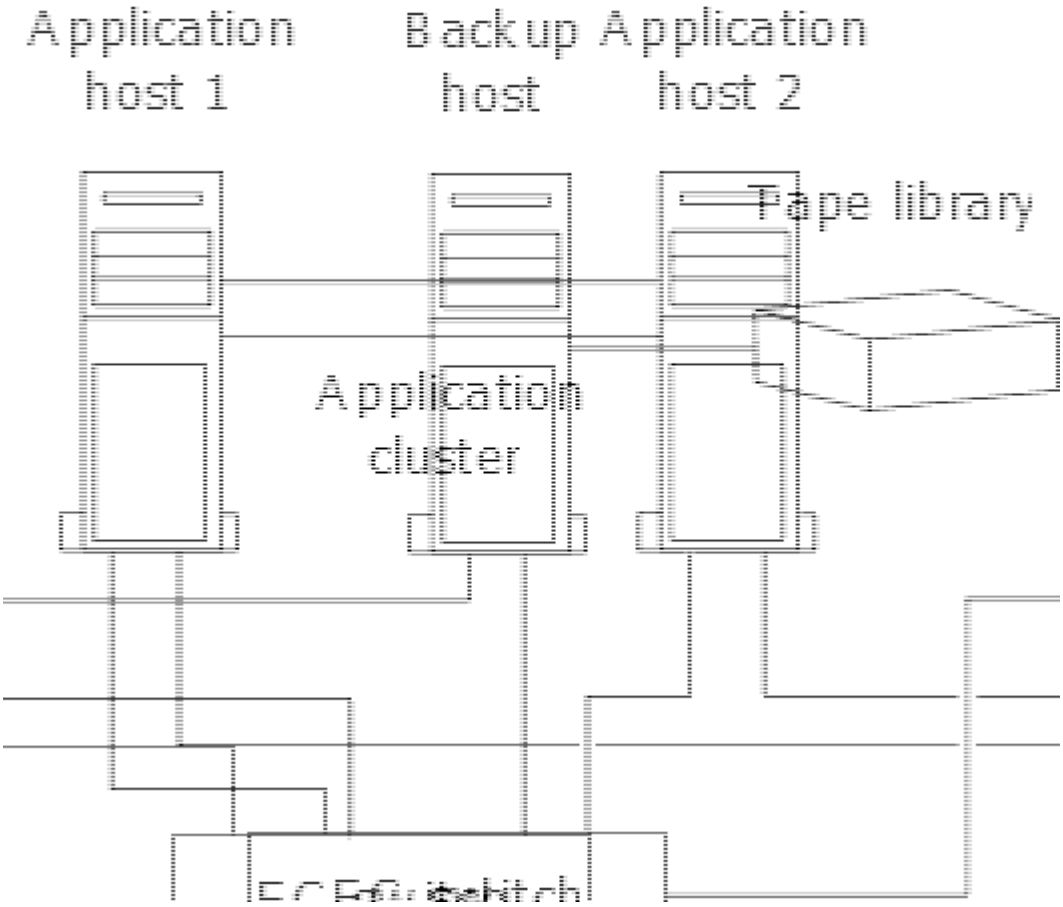
Related information

- snapmirror restore
- snapmirror show

Recommended configuration to connect a host backup system to ONTAP

You can back up SAN systems to tape through a separate backup host to avoid performance degradation on the application host.

It is imperative that you keep SAN and NAS data separated for backup purposes. The figure below shows the recommended physical configuration for a host backup system to the primary storage system. You must configure volumes as SAN-only. LUNs can be confined to a single volume or the LUNs can be spread across multiple volumes or storage systems.



Volumes on a host can consist of a single LUN mapped from the storage system or multiple LUNs using a volume manager, such as VxVM on HP-UX systems.

Use a host backup system to protect a LUN on your ONTAP storage system

You can use a cloned LUN from a snapshot as source data for the host backup system.

Before you begin

A production LUN must exist and be mapped to an igroup that includes the WWPN or initiator node name of the application server. The LUN must also be formatted and accessible to the host.

Steps

1. Save the contents of the host file system buffers to disk.

   You can use the command provided by your host operating system. You can also opt to make this step part of your SAN backup pre-processing script.

2. Create a snapshot of the production LUN.

```
volume snapshot create -vserver <SVM_name> -volume <volume_name>
-snapshot <snapshot> -comment <comment> -foreground false
```

3. Create a clone of the production LUN.

```
volume file clone create -vserver <SMV_name> -volume <volume> -source
-path <path> -snapshot-name <snapshot> -destination-path
<destination_path>
```

4. Create an igroup that includes the WWPN of the backup server.

```
lun igroup create -vserver <SVM_name> -igroup <igroup> -protocol
<protocol> -ostype <os_type> -initiator <initiator>
```

5. Map the LUN clone you created in Step 3 to the backup host.

```
lun mapping create -vserver <SVM_name> -volume <volume_name> -lun
<lun_name> -igroup <igroup>
```

   You can opt to make this step part of your SAN backup application's post-processing script.

6. From the host, discover the new LUN and make the file system available to the host.

   You can opt to make this step part of your SAN backup application's post-processing script.

7. Back up the data in the LUN clone from the backup host to tape by using your SAN backup application.
8. Take the LUN clone offline.

```
lun modify -vserver <SVM_name> -path <path> -state offline
```

9. Remove the LUN clone.

```
lun delete -vserver <SVM_name> -volume <volume> -lun <lun_name>
```

10. Remove the snapshot.

```
volume snapshot delete -vserver <SVM_name> -volume <volume> -snapshot
<snapshot>
```

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