

Module 3

SnapMirror operation

About this module

This module focuses on enabling you to do the following:

- Describe SnapMirror Asynchronous and SnapMirror Synchronous (SM-S)
- Configure SnapMirror relationships to replicate data
- Demonstrate a SnapMirror baseline transfer
- Perform a manual SnapMirror update
- Configure regularly scheduled SnapMirror updates
- Describe data recovery methods that use SnapMirror technology

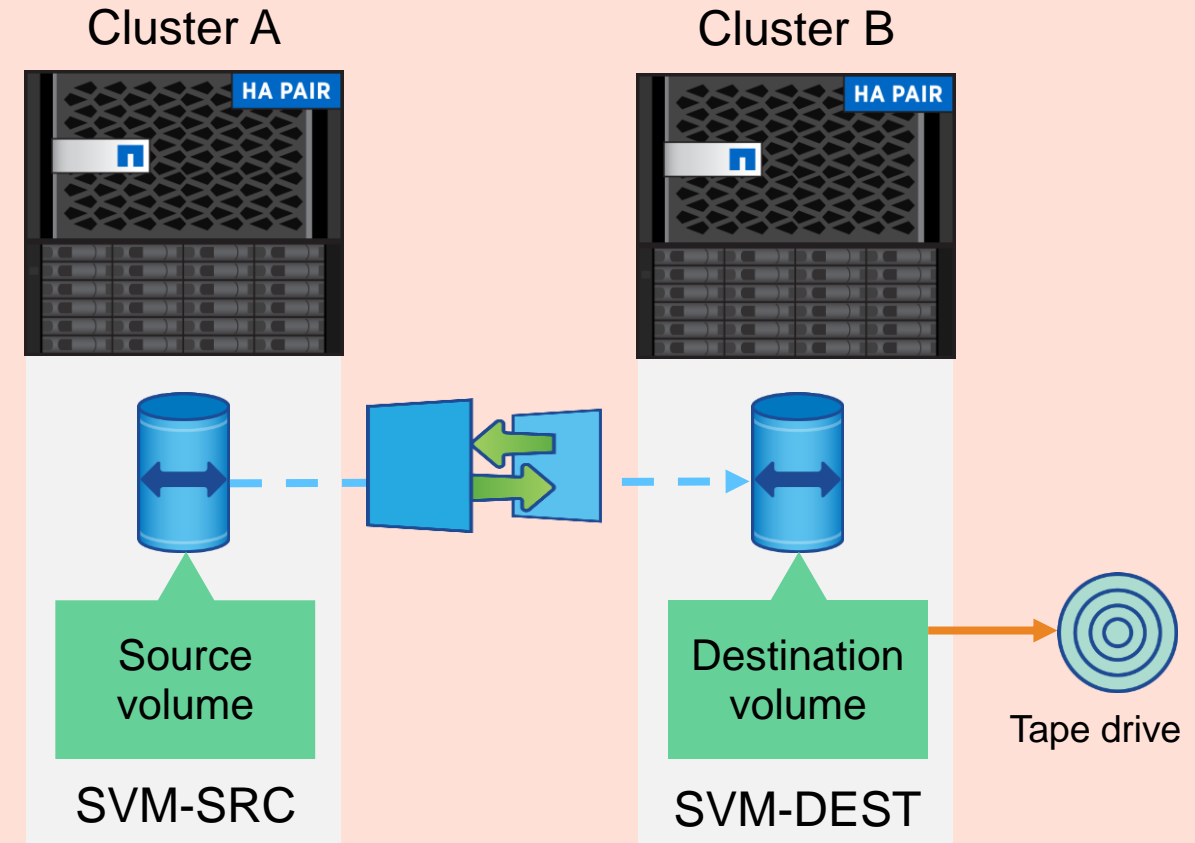


Lesson 1

SnapMirror Asynchronous

SnapMirror Asynchronous

- Data protection mirror relationships provide asynchronous disaster recovery.
- You can use data protection mirror relationships to protect volumes in the following ways:
 - Within a storage VM (storage virtual machine, also known as SVM)
 - To another SVM in the cluster
 - To an SVM in another cluster



SnapMirror policy types

Protection type	Policy name	Policy type	Description
Mirror	MirrorAllSnapshots	async-mirror	The default policy for a disaster-recovery relationship
	MirrorLatest	async-mirror	A policy that mirrors the latest active file system
Vault	XDPDefault	vault	The default policy for a vault relationship
Mirror and vault (unified replication)	MirrorAndVault	mirror-vault	A unified mirror and vault replication policy

SnapMirror policy configuration

Configuration attributes

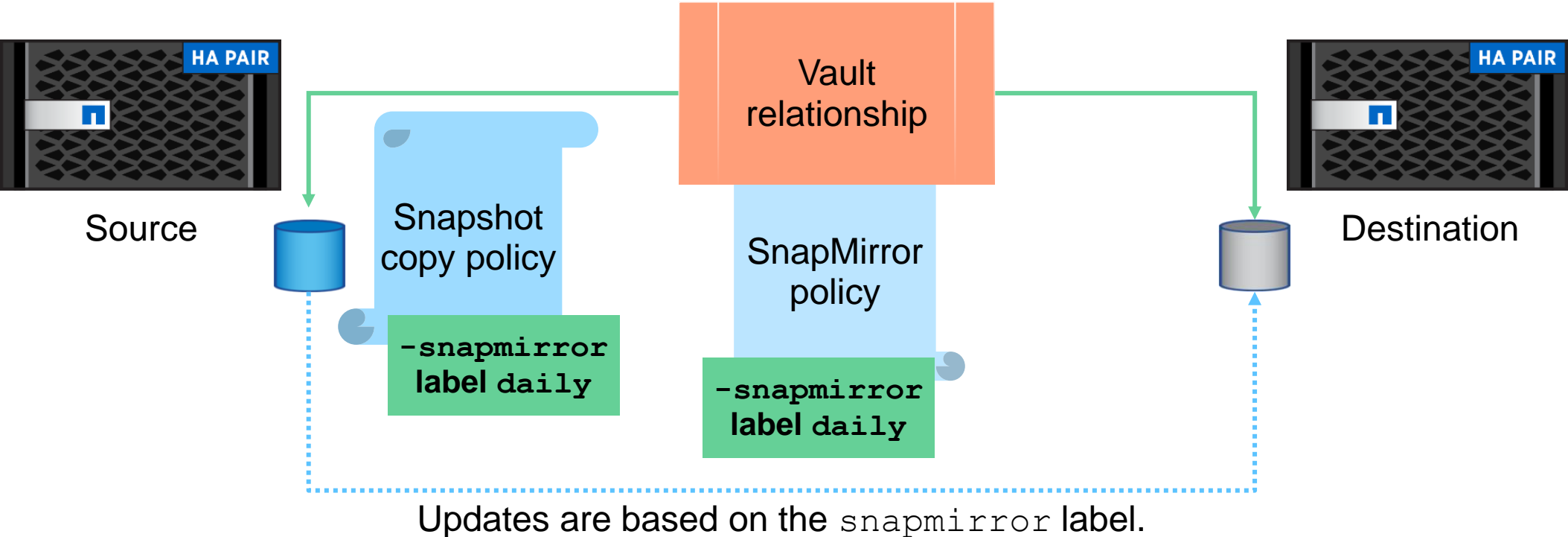
Attribute	Description
<code>-type</code>	<ul style="list-style-type: none">▪ <code>async-mirror</code> (data protection, disaster recovery)▪ <code>vault</code> (extended data protection, backup, and archive)▪ <code>mirror-vault</code> (extended data protection, and unified data protection)
<code>-tries</code>	The maximum number of times to attempt each manual or scheduled transfer
<code>-transfer-priority</code>	<code>Normal</code> or <code>low</code> ; normal-priority transfers are scheduled before low-priority transfers

SnapMirror policy configuration

Configuration rules

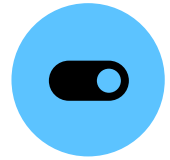
Rule	Description
-keep	Specifies the maximum number of Snapshot copies that are retained on the destination volume for a rule.
-preserve	<p>Specifies the behavior when the Snapshot copy retention count is reached on the destination volume. If the number specified is reached, the update fails.</p> <p>The value can be <code>true</code> or <code>false</code>. The default value is <code>false</code>.</p>
-snapmirror-label	Specifies the rule to modify in a SnapMirror policy. The parameter is used for Snapshot copy selection for extended data protection relationships.
-schedule	Specifies the name of the Snapshot copy schedule that is associated with a rule.

Components of a vault relationship

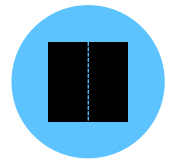


The Snapshot copy policy

Requirements



In the policy, the `snapmirror-label` attribute must be enabled.



The `snapmirror-label` attribute must match the attribute in the SnapMirror policy.



You must decide whether to use a preconfigured Snapshot copy policy or to create a policy.

Verifying the Snapshot copy policy

Check for the `snapmirror-label` attribute on the source SVM

- Use the `volume snapshot policy show` command to verify whether a Snapshot copy policy has the `snapmirror-label` attribute.
- Sample output:

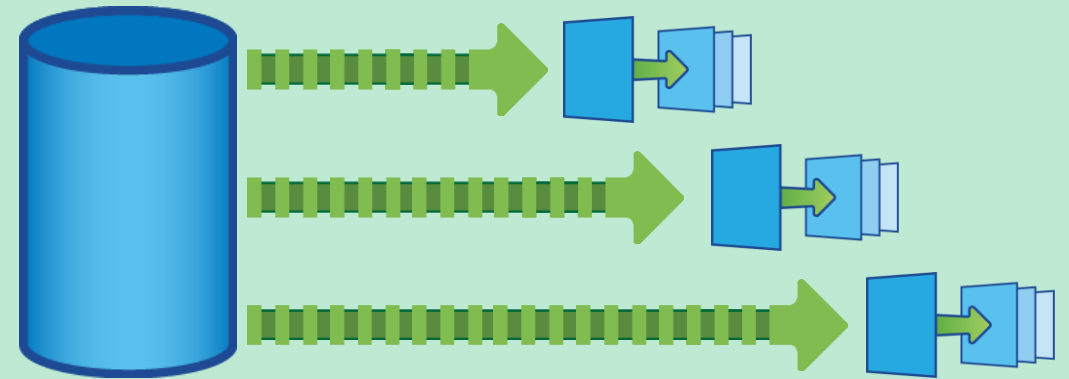
```
cluster1::> volume snapshot policy show
Vserver: cluster1
```

Policy Name	Number of Schedules	Is Enabled	Comment
default	3	true	Default policy with hourly, daily & weekly schedules.
Schedule	Count	Prefix	SnapMirror Label
hourly	6	hourly	-
daily	2	daily	daily
weekly	2	weekly	weekly
default-1weekly	3	true	Default policy with 6 hourly, 2 daily & 1 weekly schedule.
Schedule	Count	Prefix	SnapMirror Label
hourly	6	hourly	-
daily	2	daily	-
weekly	1	weekly	-

The default-1weekly policy does not have a SnapMirror label.

Creating a tiered backup policy

In a tiered backup strategy, a protection policy can have several rules. Each rule identifies a different set of Snapshot copies.



Sample Snapshot copy schedules and retention

For vault relationships

snapmirror-label attribute value	Source volume: Snapshot copy schedule	Source volume: Snapshot copies retained	Destination volume: Snapshot copies retained
weekly	Every Sunday at 20:00	10	20
daily	Every Monday through Friday at 22:00	8	16
hourly	Every hour from 07:00 through 18:00	12	24
Total	Not applicable	30	60

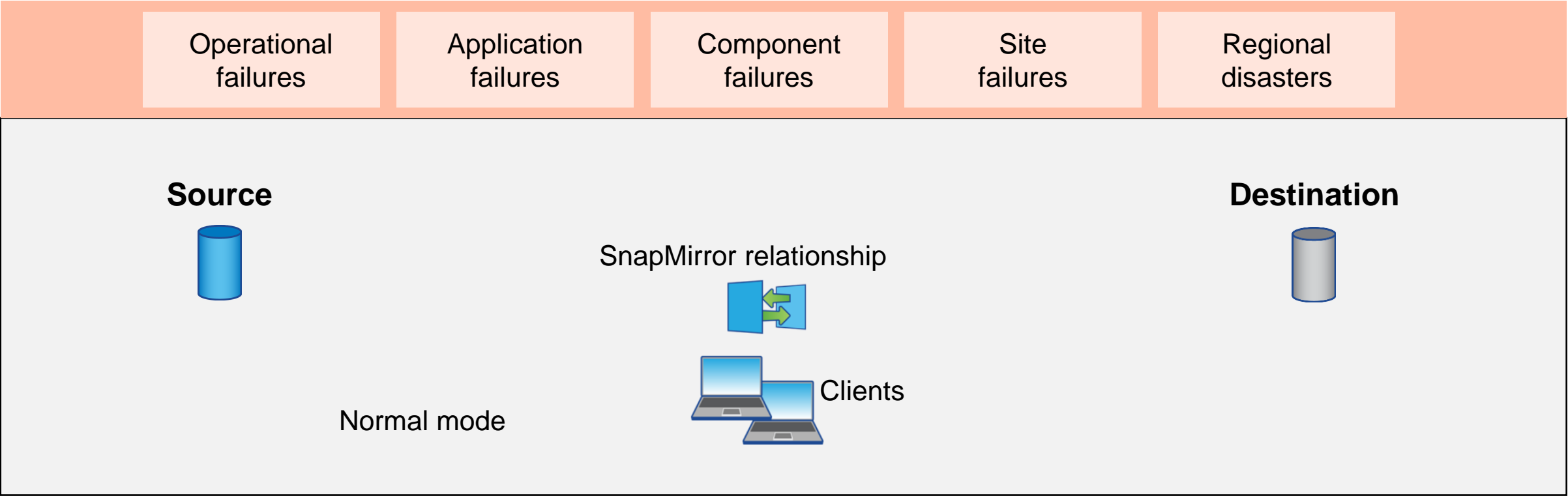
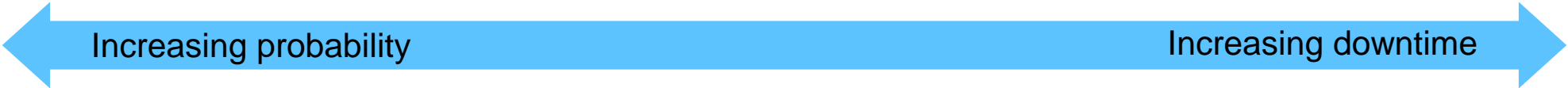


Lesson 2

Using SnapMirror for disaster recovery

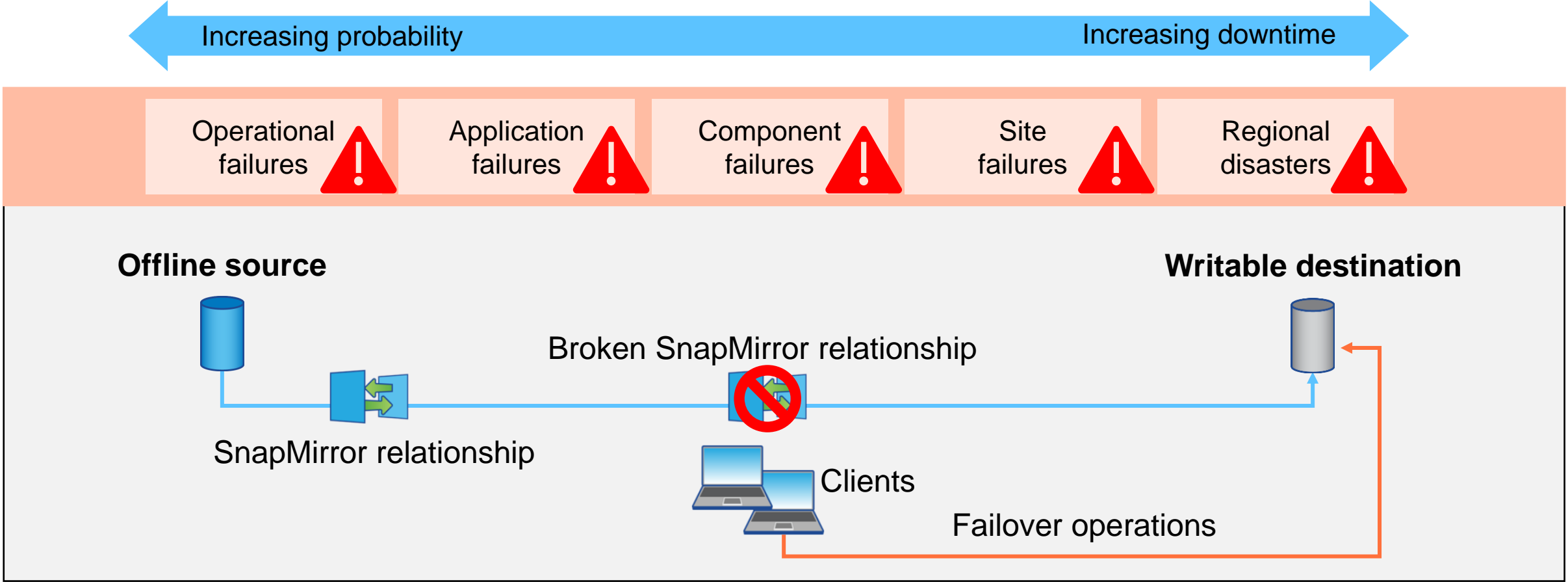
SnapMirror working during normal operation

Clients have normal read/write permission to the source volume.



SnapMirror working in failover mode

Clients have normal read/write permission to the destination volume.

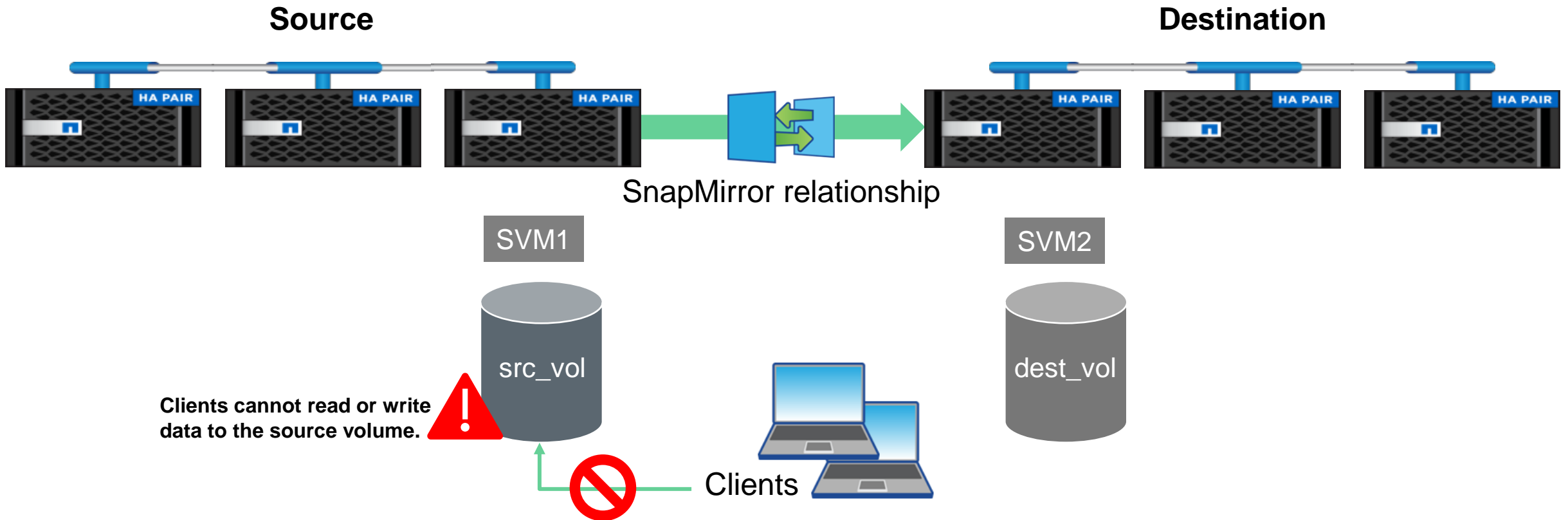


Disaster-recovery operations

Disaster mode

The source volume becomes unavailable

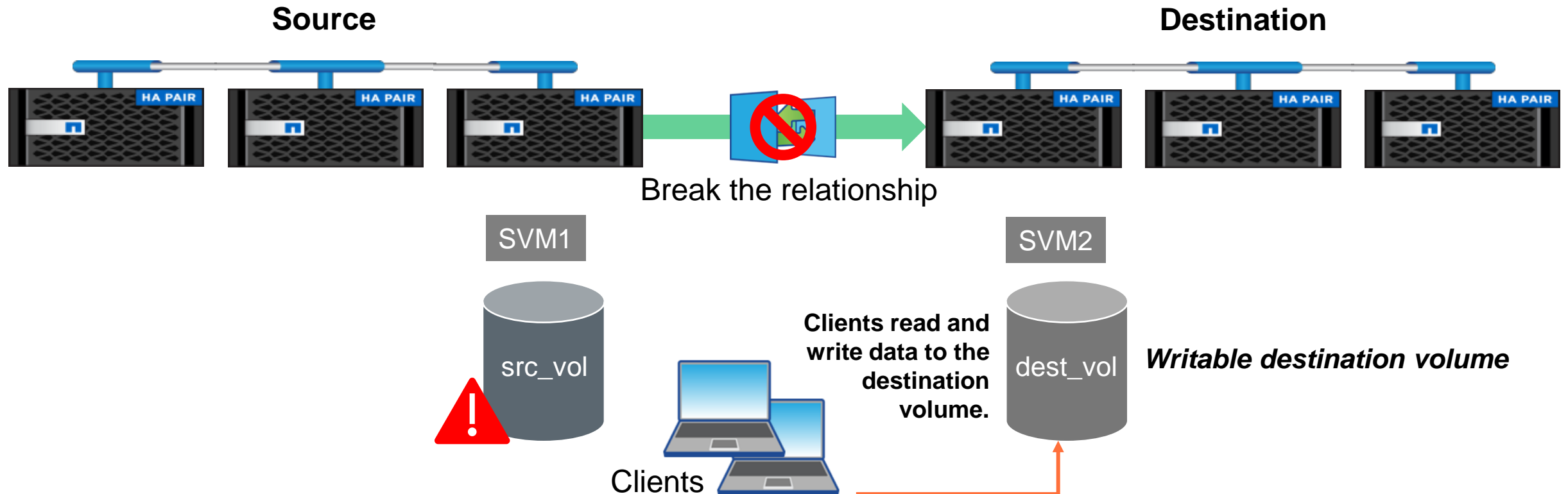
Disaster strikes.



Disaster mode

Clients fail over to the destination volume

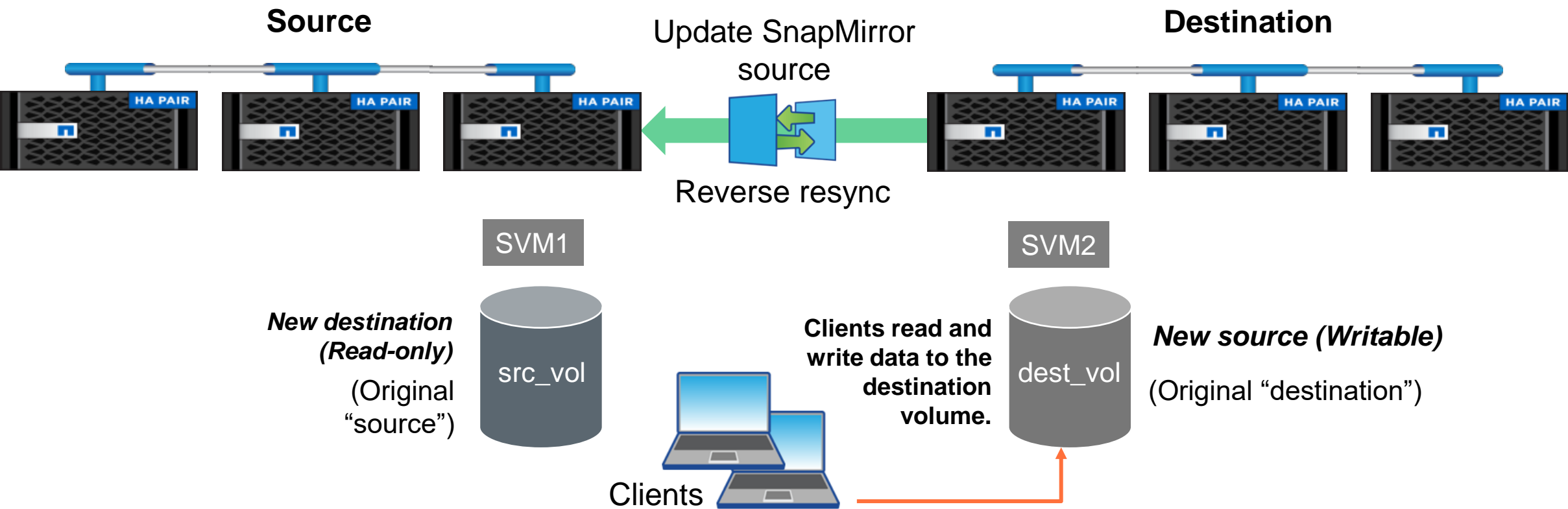
From the destination node, break the SnapMirror relationship and direct clients to the destination volume.



Resumption of normal operations

Part 1: You write new data from the destination to the source

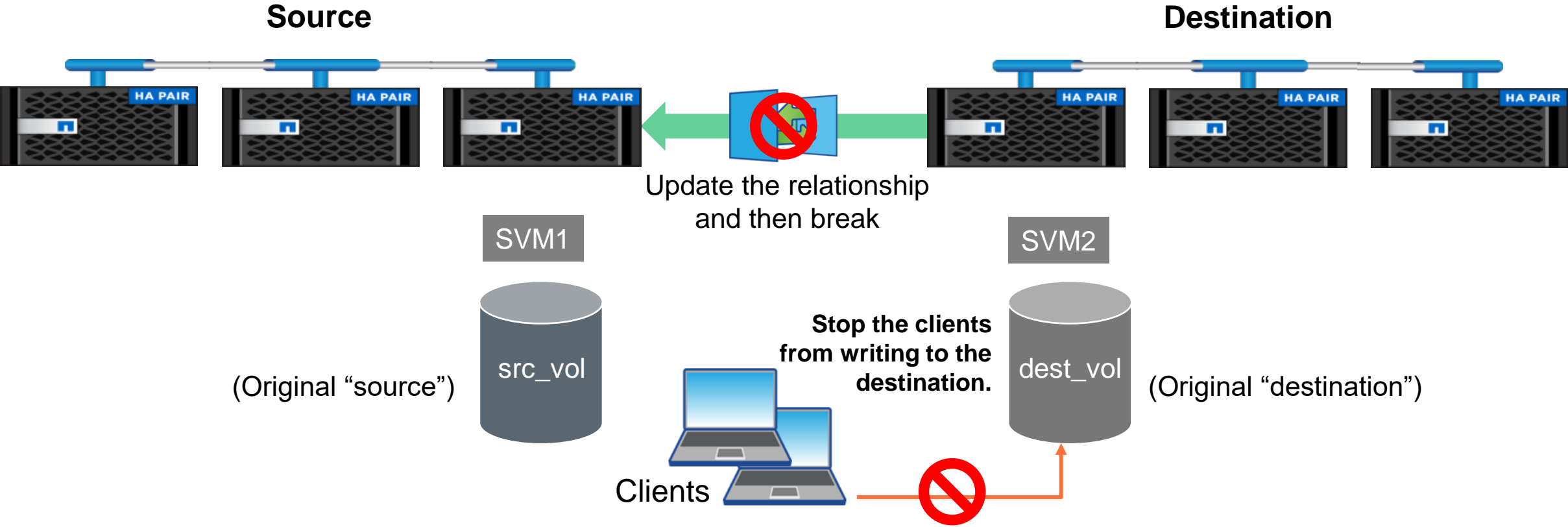
To update the source from the destination, run the `snapmirror resync` command from the original source SVM.



Resumption of normal operations

Part 2: You break the temporary mirror relationship

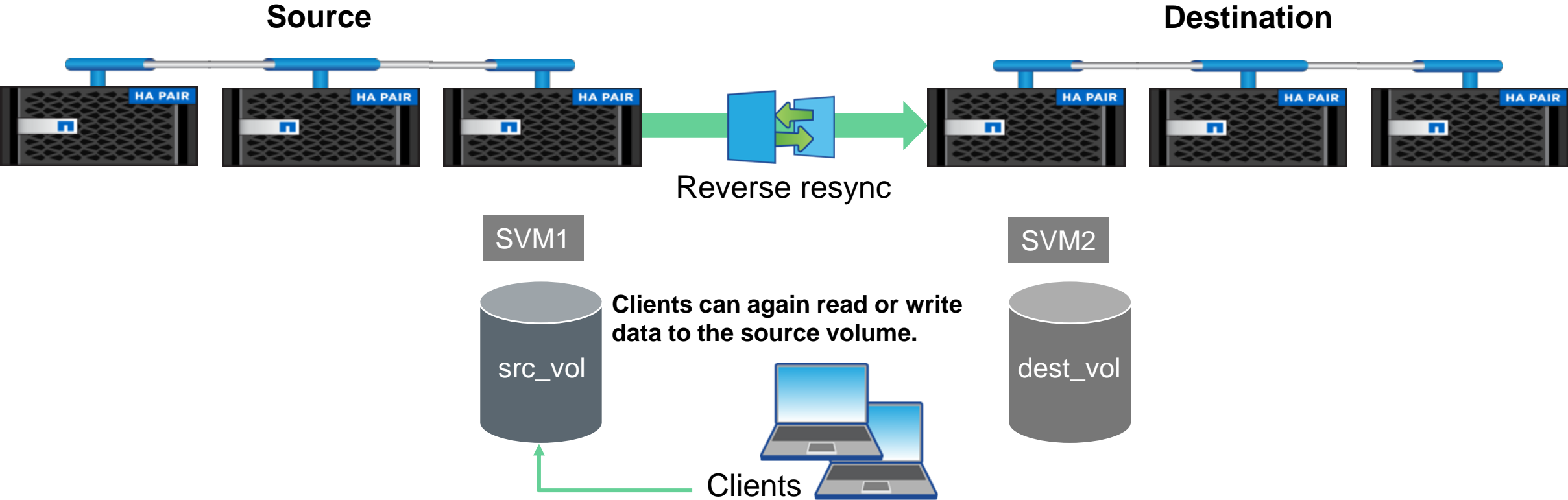
To reverse the direction of the SnapMirror relationship, break the SnapMirror relationship from the original source system.



Resumption of normal operations

Part 3: You resynchronize the mirror relationship

Redirect the clients to the original source volume and then resynchronize the SnapMirror relationship in the original direction.





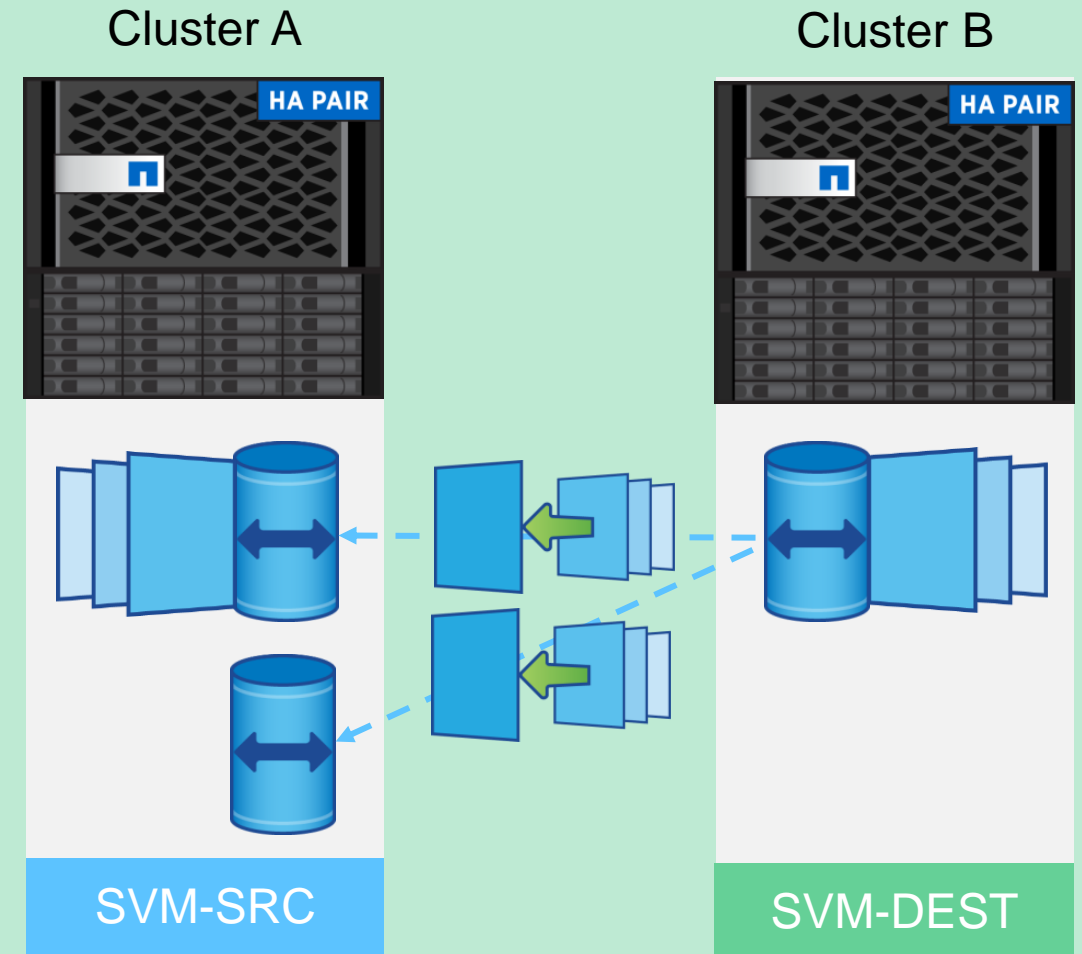
Lesson 3

Using SnapMirror for data restoration

Restoring data from a SnapMirror destination

Guideline

- When data in a volume is lost or corrupted, you can restore data from the following:
 - The most recent Snapshot copy
 - An earlier Snapshot copy
- You can restore data to the following:
 - The source volume
 - A volume other than the source
- You can restore the following:
 - The contents of an entire volume
 - A single file, LUN, a set of files, or LUNs



Restoring a volume

NetApp ONTAP CLI

- To restore a volume, use the `snapmirror restore` command.

```
cluster_dst:> snapmirror restore -source-path SVM:volume|cluster://SVM/volume, ...  
-destination- path SVM:volume|cluster://SVM/volume, ... -source-snapshot snapshot
```

- Sample output:

```
cluster2:> snapmirror restore  
-source-path cluster2://svm1_clust1/smb1_vol1_dest  
-destination-path cluster1://svm1/smb1_vol1  
-source-snapshot daily.2021-05-12_2120
```

Select exactly which Snapshot copy to use to restore the contents of the original source volume.

Restoring a volume

ONTAP System Manager (formerly OnCommand System Manager)

DASHBOARD

STORAGE

NETWORK

EVENTS & JOBS

PROTECTION

Overview

Relationships

HOSTS

CLUSTER

Relationships

Protect

Source	Destination
svm3:smb3_share_CIFS_volume	svm1_clust2:vol_...
svm1:smb1_share_CIFS_volume	svm1_clust2:vol_...

Edit

Delete

Update

Pause

Restore

Break

Restore Relationship

Restores the backed up data from the destination volume to the source volume or to another volume. The restore operation deletes new Snapshot copies that were not backed up and turns off quotas on the volume. You can activate quotas on the volume after this operation is completed.

Source

Volume Restore To

Source Volume

CLUSTER

cluster1

STORAGE VM

svm1

VOLUME

smb1_share_CIFS_volume

Other Volume

Destination

Volume Restored From

CLUSTER

cluster2

STORAGE VM

svm1_clust2

VOLUME

vol_smb1_share_CIFS_volume_dest

USED SPACE

243 MB

snapmirror.b0d636da-12b9-11e8-a7...

Save

Cancel

Restoring a single file or a LUN


- To restore a single file or LUN or a set of files or LUNs, use the `snapmirror restore` command.

```
cluster_dst:> 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
```

- Sample output:

```
cluster2:> snapmirror restore  
-source-path cluster2://svm1_clust1/smb1_vol1_dest  
-destination-path cluster1://svm1/smb1_vol1  
-source-snapshot daily.2021-05-12_2120  
-file-list /dir1/file1,/dir2/file2
```

Select the Snapshot copy to use and the files to restore to the same location in the active file system of the original source volume.

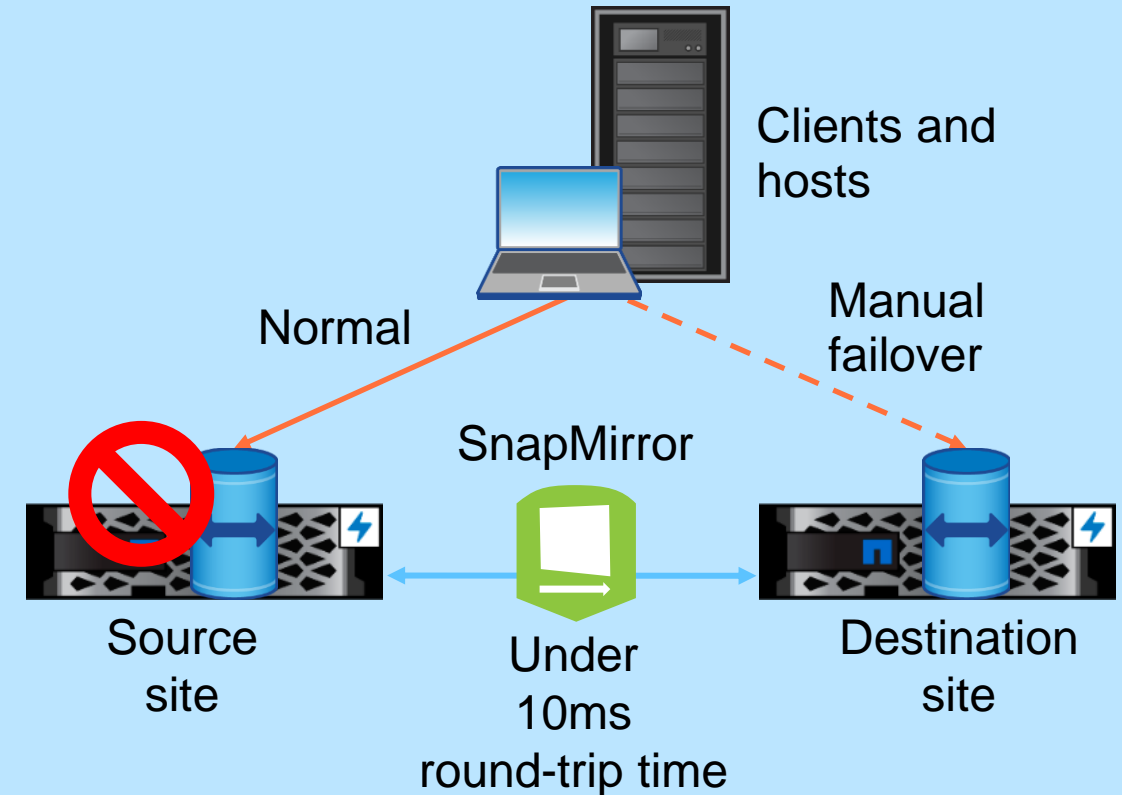


Lesson 4

SnapMirror Synchronous

SM-S overview

- Provides volume-granular, synchronous data replication
- Native data format of destination data copies enables the following:
 - Site-to-site high availability
 - Rapid application recovery
 - Disaster recovery
 - Fulfillment of compliance requirements
 - Zero data loss
- Simple management



SM-S prerequisites

- NetApp FAS, AFF, and ONTAP Select systems
 - These systems must have at least 16GB of memory.
 - The source and destination systems must support ONTAP 9.5 software or later.
- SnapMirror must be licensed on the source and destination storage systems through the Premium Bundle license.
- A functional network must exist between the source and destination systems, with a round-trip latency under 10ms or LAN and MAN distances of up to 150km.
- The cluster and SVM peer relationships must be configured.
- The storage system names should be resolved by DNS.



SM-S considerations

- A source volume cannot have SM-S relationships to multiple destination volumes.

A source volume can have one synchronous and one asynchronous relationship to two different destination volumes.

- The disk technology with the lowest performance determines the I/O characteristics.
- The type of system and the disk configuration on the destination system affects the performance of the source system.
- NetApp recommends a dedicated, high-bandwidth, low-latency network between the source and destination systems.



SM-S features

Feature	Description
Protocol support	<ul style="list-style-type: none">• FC, FC-NVMe, and iSCSI• SMB 2.0 and later, NFSv3, NFSv4.0, and NFSv4.1• Volumes with mixed ONTAP volume security style (for example, SMB and NFSv3)
Scale	<p>Number of concurrent, synchronously replicated volumes per HA pair:</p> <ul style="list-style-type: none">• AFF – 80 volumes• FAS – 40 volumes• ONTAP Select – 20 volumes
Failover	<ul style="list-style-type: none">• Manual or scripted application failover to destination copy• Manual or scripted resync from the destination storage back to the new (or different) primary storage after primary storage failure• No automatic, semiautomatic, or managed failover
Data protection	<ul style="list-style-type: none">• Disaster recovery• Zero data loss• Rapid application recovery• Compliance

SM-S modes



Synchronous (Sync)

- Incoming write I/O is executed simultaneously on source and destination storage.
- A replication failure does not disrupt the application.
- The application can continue writing to the source storage without zero data loss protection.



Strict Synchronous (StrictSync)

- Incoming write I/O is executed simultaneously on source and destination storage.
- A replication failure disrupts the application to ensure zero data loss.
- The application must be manually restarted.

Understanding the workloads for SM-S

Workloads that are supported by both Sync and StrictSync policies:

- FC, FC-NVMe, iSCSI, SMB, and NFS applications
- VMware
- Databases
- Electronic design automation (EDA)
- Home directories
- Software build workloads

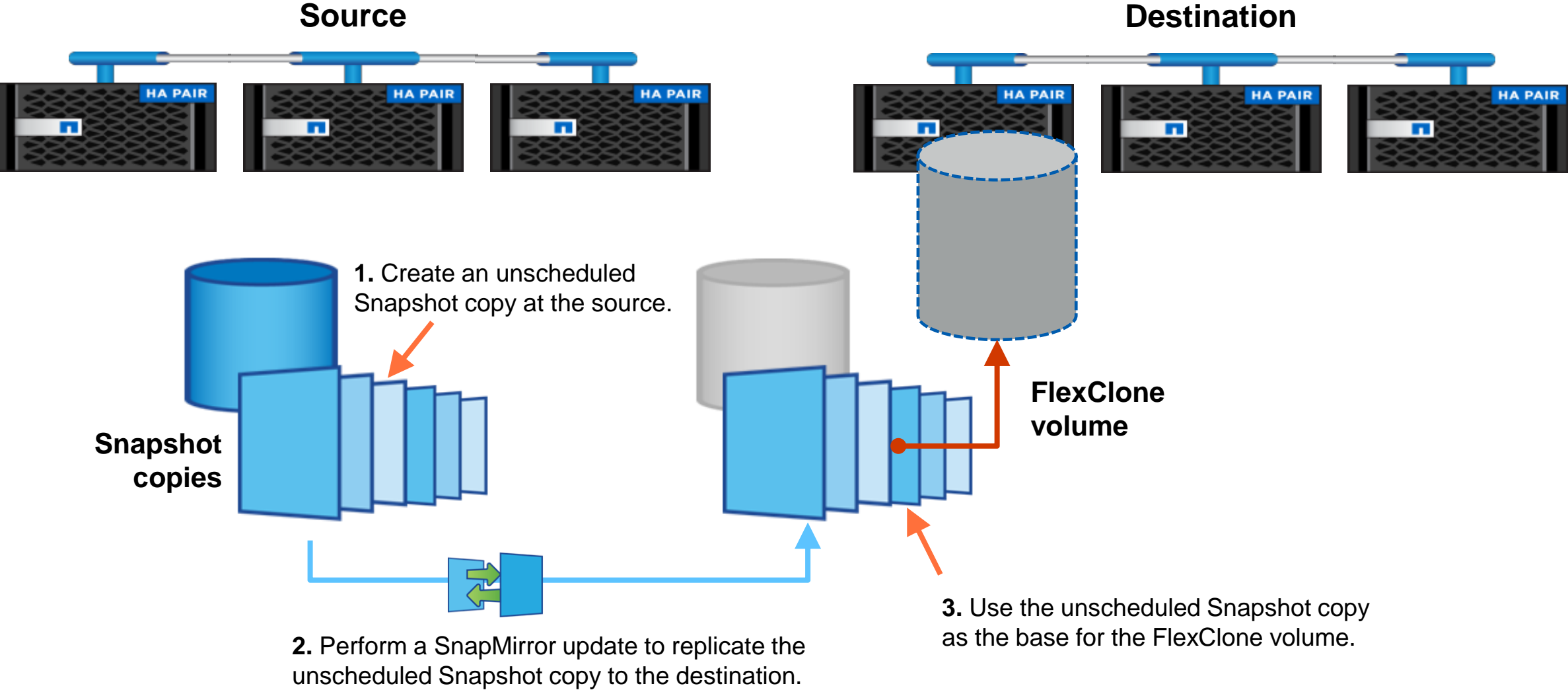




Lesson 5

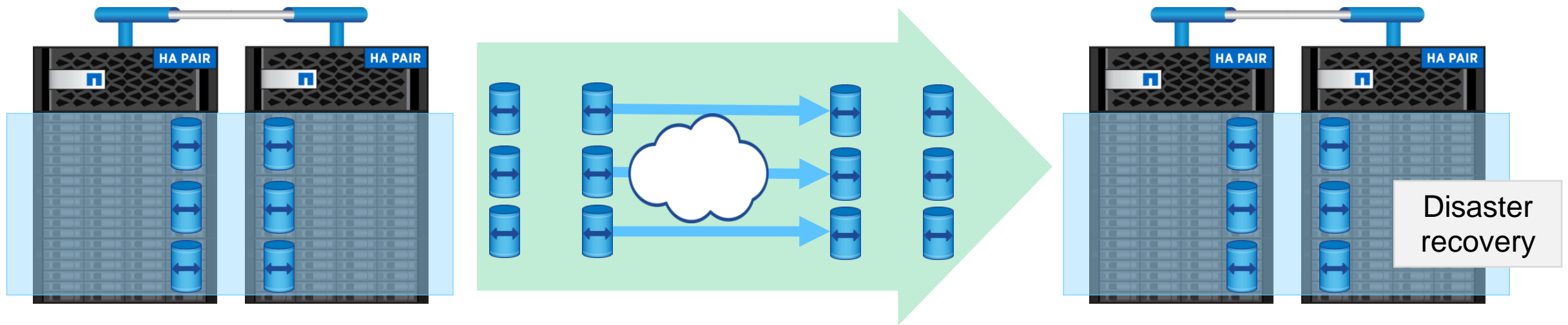
SnapMirror and ONTAP feature interaction

SnapMirror and FlexClone technology



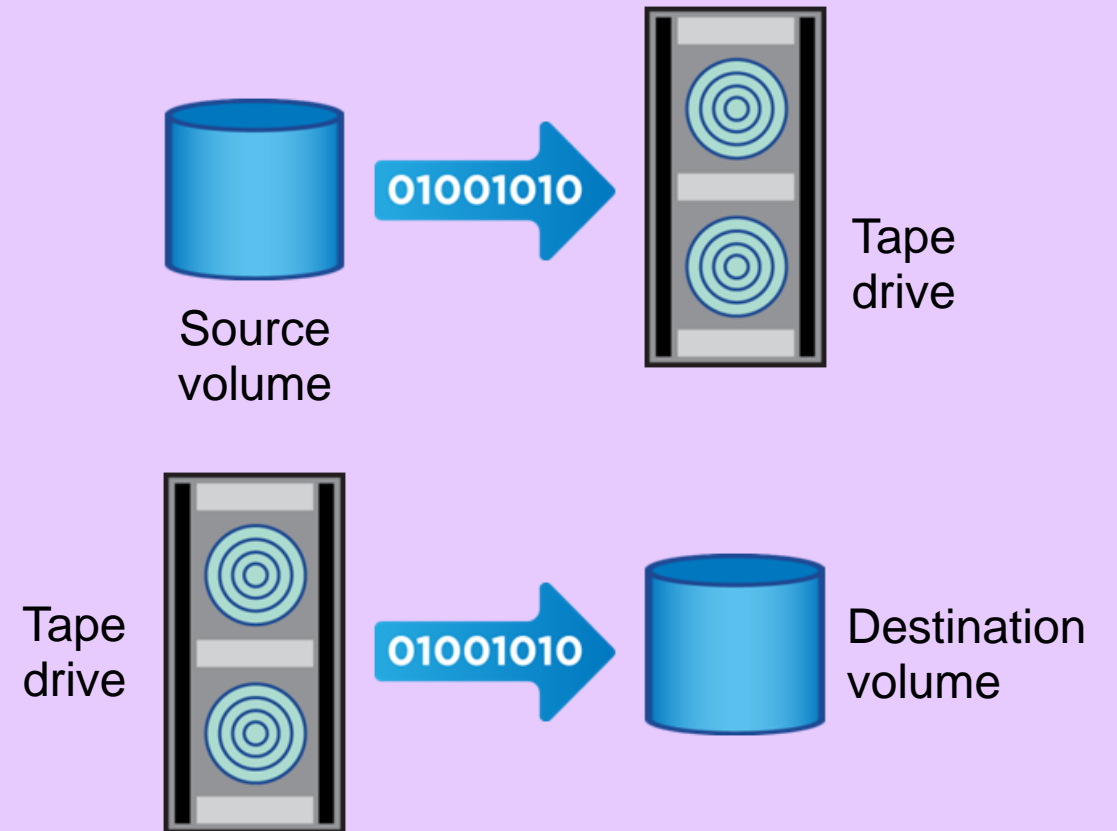
SnapMirror and ONTAP FlexGroup volumes

- FlexGroup volumes that are also SnapMirror volumes are replicated at the FlexGroup level.
 - The same Snapshot rules apply.
 - All member Snapshot copies must succeed for Snapshot copies to be considered successful.
- All FlexGroup members are replicated concurrently across the WAN as a whole.



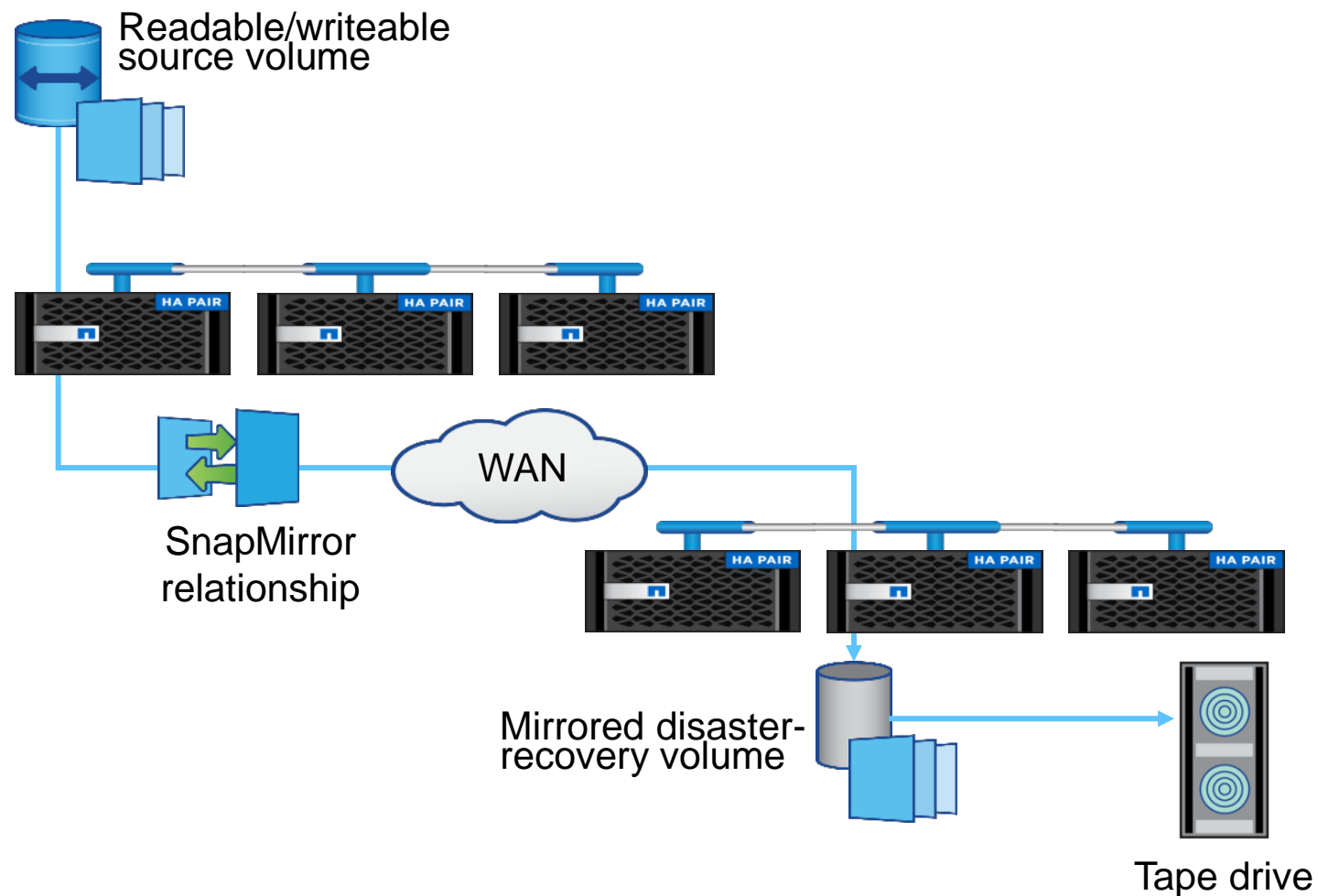
SnapMirror to tape backup

Typically, you create a populated destination volume when you use tape to copy a source volume to a destination volume. The process is called tape seeding.



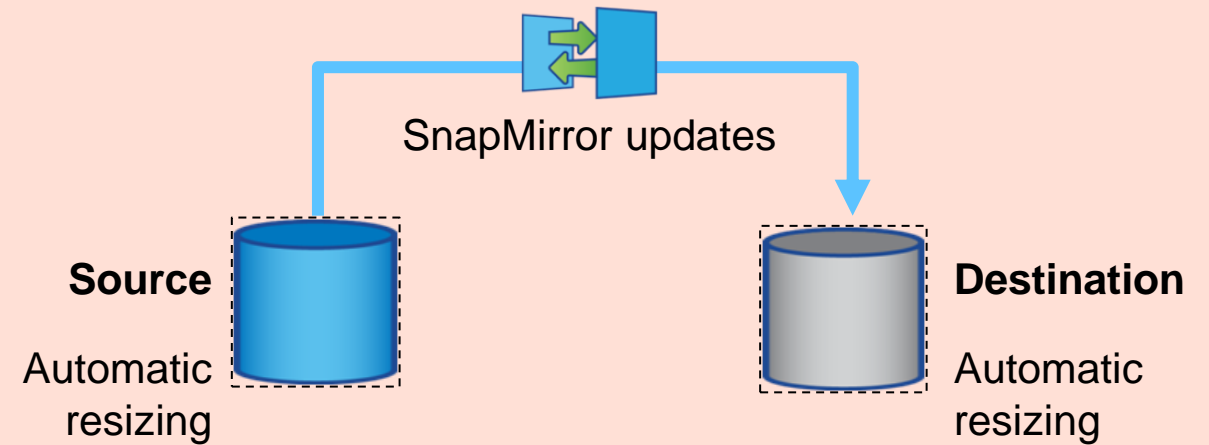
SnapMirror and NDMP

NDMP backups can be performed from the source or destination volumes.

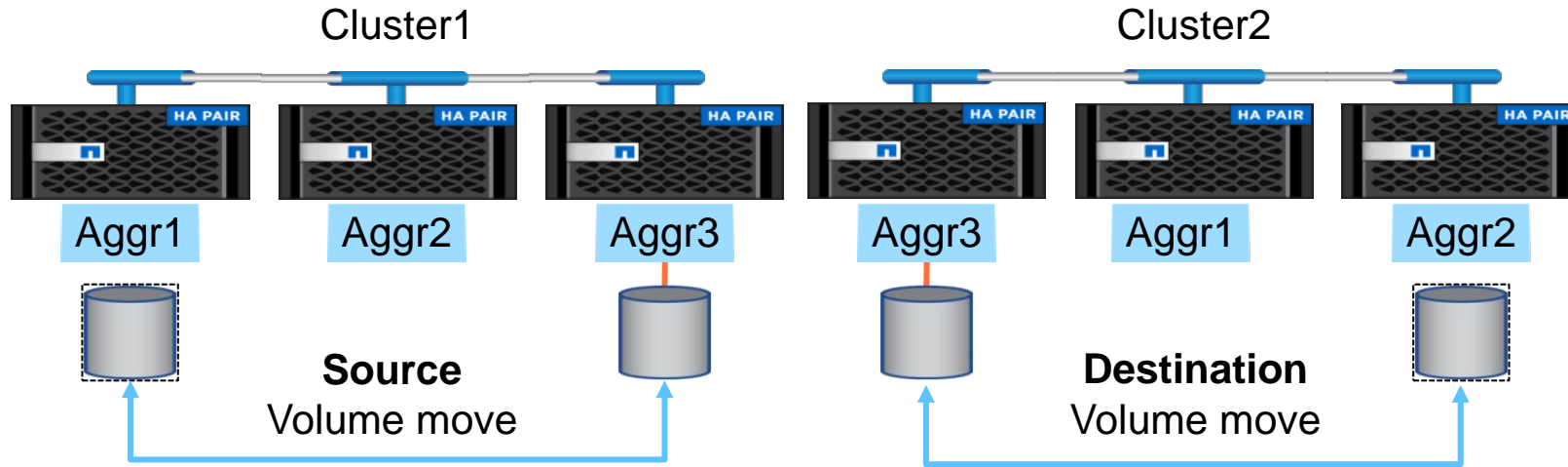


SnapMirror and automatic volume resizing

When the source volume automatically grows, the destination volume also grows.



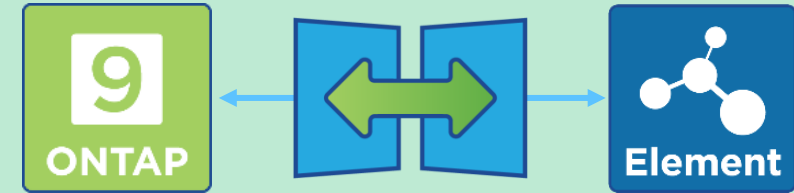
SnapMirror and volume move



A data protection source or destination volume can be moved nondisruptively to another node in the cluster without the need to reconfigure the SnapMirror relationship.

Replication between NetApp Element Software and ONTAP software

- SnapMirror replicates Snapshot copies of an Element volume to an ONTAP destination:
 - If there is a disaster at the Element site, clients access data from the ONTAP system until the Element source volume comes back online
- You can replicate Snapshot copies of a LUN that was created on an ONTAP node back to an Element system:
 - Copy data from an ONTAP LUN created during an outage at the Element site
 - Migrate data from an ONTAP system to an Element system



- You use the following software to manage the relationship:
 - Element UI
 - ONTAP clustershell and NetApp Manageability SDK
 - NetApp SnapCenter software for mirroring a virtual machine (VM) datastore to ONTAP software

Resources

- **ONTAP release notes**
https://library.netapp.com/ecm/ecm_download_file/ECMLP2492508
- ***ONTAP Data Protection Power Guide***
<https://docs.netapp.com/ontap-9/topic/com.netapp.doc.pow-dap/Data%20protection.pdf>
- ***ONTAP Volume Disaster Recovery Preparation Express Guide***
<http://docs.netapp.com/ontap-9/topic/com.netapp.doc.exp-sm-ic-cg/Volume%20disaster%20recovery%20express%20preparation.pdf>
- ***ONTAP Volume Disaster Recovery Express Guide***
<http://docs.netapp.com/ontap-9/topic/com.netapp.doc.exp-sm-ic-fr/Volume%20disaster%20express%20recovery.pdf>
- **NetApp Technical Report TR-4015: SnapMirror Configuration and Best Practices Guide**
- ***NetApp Technical Report TR-4476: NetApp Data Compression and Deduplication – Data ONTAP 8.3.1 and Later***
- ***Replication between NetApp Element Software and ONTAP***
<http://docs.netapp.com/ontap-9/topic/com.netapp.doc.pow-sdbak/Replication%20between%20NetApp%20Element%20software%20and%20ONTAP.pdf>

Module summary

This module focused on enabling you to do the following:

- Describe SnapMirror Asynchronous and SM-S
- Configure SnapMirror relationships to replicate data
- Demonstrate a SnapMirror baseline transfer
- Perform a manual SnapMirror update
- Configure regularly scheduled SnapMirror updates
- Describe data recovery methods that use SnapMirror technology



Knowledge check

Module 3: SnapMirror operation

Knowledge check

A SnapMirror relationship is created between which two storage objects?

- a. volumes
- b. aggregates
- c. SVMs
- d. LUNs

Knowledge check

A SnapMirror relationship is created between which two storage objects?

- a. volumes
- b. aggregates
- c. SVMs
- d. LUNs

Knowledge check

Which three statements about SnapMirror are true? (Choose three.)

- a. It provides synchronous data replication.
- b. It provides asynchronous data replication.
- c. It provides aggregate-level data replication.
- d. SnapMirror relationships do not need to be re-established when a source volume is moved.
- e. SnapMirror relationships must be reconfigured when a source volume is moved.

Knowledge check

Which three statements about SnapMirror are true? (Choose three.)

- a. It provides synchronous data replication.
- b. It provides asynchronous data replication.
- c. It provides aggregate-level data replication.
- d. SnapMirror relationships do not need to be re-established when a source volume is moved.
- e. SnapMirror relationships must be reconfigured when a source volume is moved.

Knowledge check

True or false. When a vault relationship is automatically updated, a new Snapshot copy is created on the source volume and is transferred along with the data blocks that the copy references to the destination volume.

- a. true
- b. false

Knowledge check

True or false. When a vault relationship is automatically updated, a new Snapshot copy is created on the source volume and is transferred along with the data blocks that the copy references to the destination volume.

a. true

b. false



Complete exercises

Module 3: SnapMirror operation

Exercise 1:

Using SnapMirror Asynchronous to Mirror FlexVol Volumes

Exercise 2:

Performing SnapMirror Disaster Recovery

Exercise 3:

Configuring SnapMirror Unified Replication for Vaulting

Exercise 4:

Restoring Data From a Snapshot Copy

Exercise 5:

Configuring a SnapMirror Synchronous Relationship

Exercise 6:

Using FlexClone Technology to Clone a SnapMirror Volume

Duration: 120 minutes



Share your experiences

Roundtable questions for the
equipment-based exercises

Exercise 1

- In Task 1, what is the name of the destination volume that is created automatically?
- How did you verify data transfer on the destination volume after you performed the initial transfer?

Exercise 2

- Before you performed the SnapMirror break operation, what did you check for?
- What happens when you quiesce a SnapMirror relationship?
- When the SnapMirror relationship was broken, what happened to the SVM peer relationship?

Exercise 6

- Why should you delete the Snapshot copy that you created manually on the SnapMirror source volume?