

Module 2

SnapMirror fundamentals

About this module

This module focuses on enabling you to do the following:

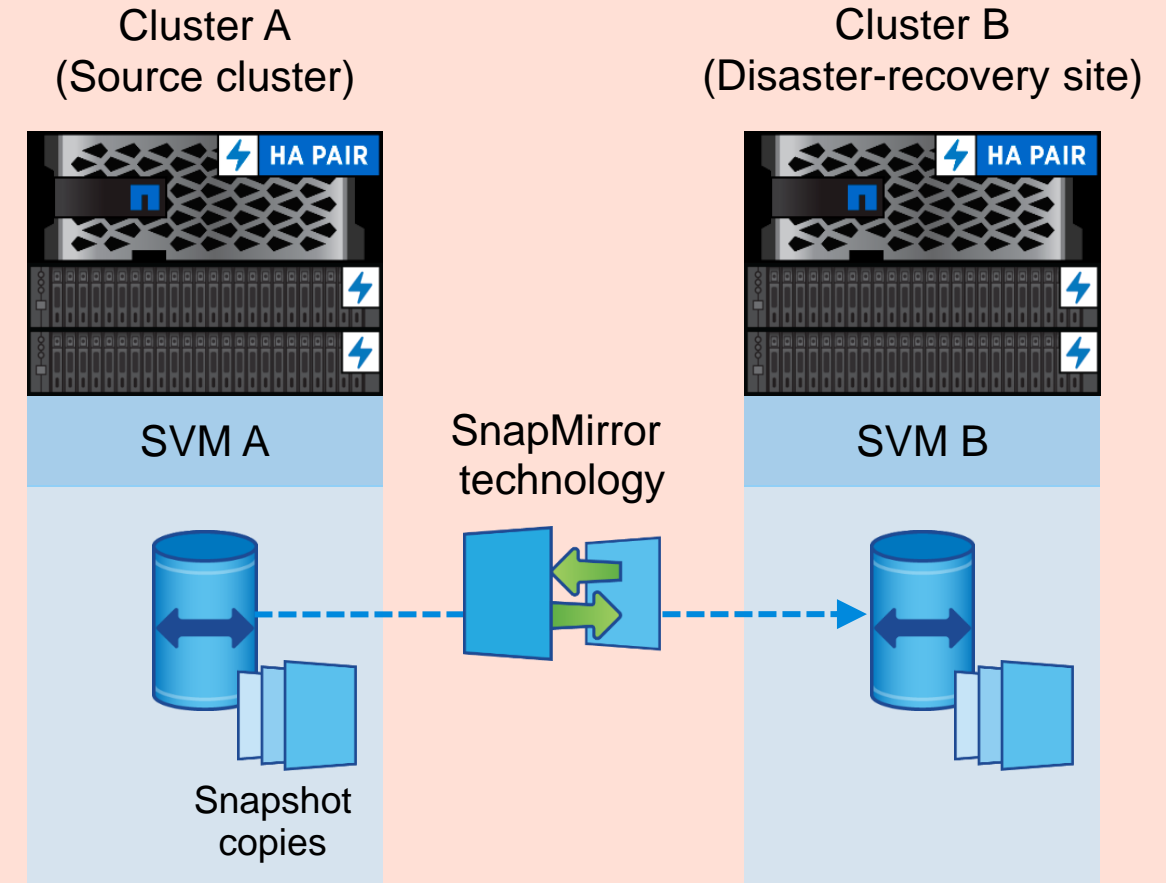
- Explain the types of mirroring relationships in NetApp ONTAP software
- Describe the required components for each type of mirroring relationship
- Identify the differences between replication topologies
- Explain the steps to configure SnapMirror relationships
- List the ONTAP features that SnapMirror supports
- Design a network configuration for intercluster mirroring
- Construct the peer relationships that are required for intercluster mirroring and SVM mirroring

Lesson 1

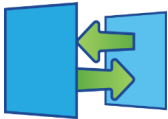
SnapMirror overview

SnapMirror technology

- SnapMirror technology protects the volumes in an SVM.
- Data protection relationships:
 - Mirror relationships between FlexVol volumes
 - Vault relationships between FlexVol volumes
 - Mirror relationships between the SVMs that own the volumes



Asynchronous versus synchronous mirroring



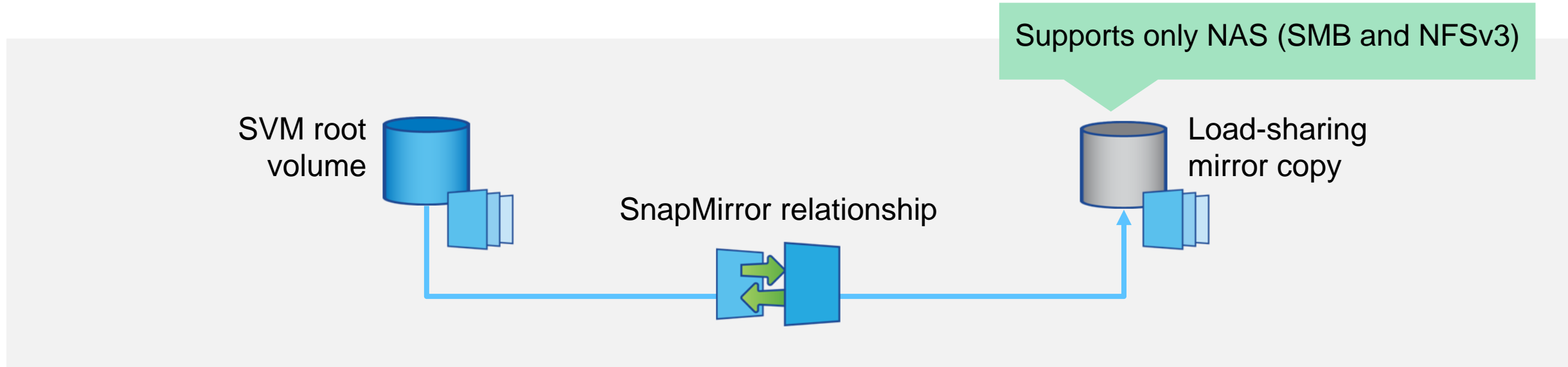
Asynchronous



Synchronous

Solution (based on granularity)	SnapMirror Asynchronous (volume- and SVM-level)	SnapMirror Synchronous (SM-S) (volume-level)
Replication method	Point-in-time	Continuous
Synchronization	Writes only changed data	Writes all data

Load-sharing mirror relationships

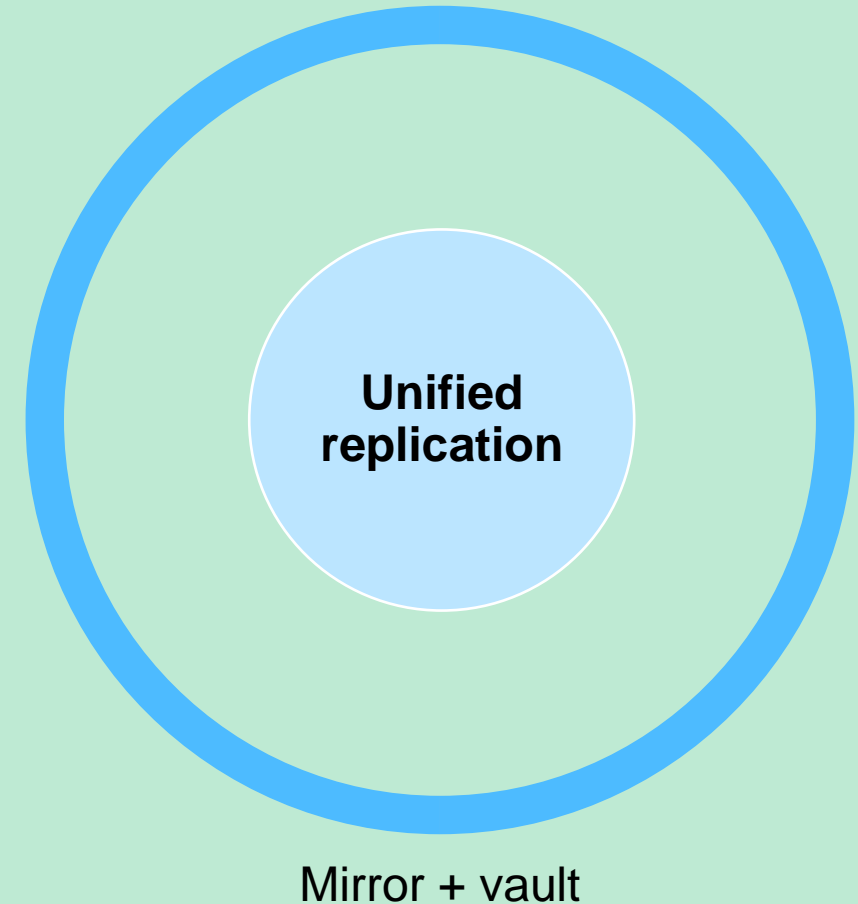


- Create a load-sharing mirror copy of each NAS SVM root volume in a cluster.
- If the root volume is temporarily unavailable, the load-sharing mirror automatically provides read-only access to root volume data.
- If the root volume is permanently unavailable, you can promote one of the load-sharing volumes to provide write access to root volume data.

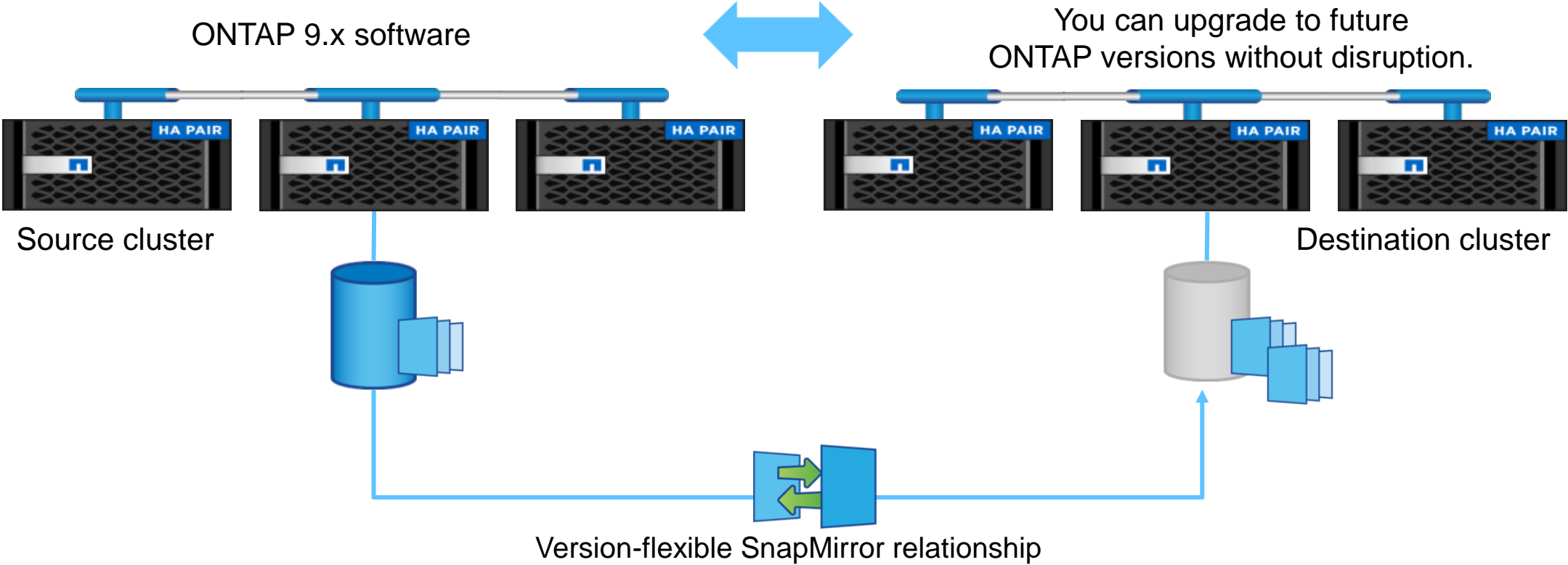
Unified replication relationship

Protect data by using simple, efficient replication

- Reduces destination storage space with one baseline for mirror and vault
- Reduces network traffic with a single baseline and lesser replication traffic
- Simplifies ONTAP software upgrades
 - Higher release to lower release and low to high
 - Version-flexible replication
- Provides better data recovery options with the ability to restore directly from any Snapshot copy
- Works across the data fabric



Version-flexible SnapMirror technology

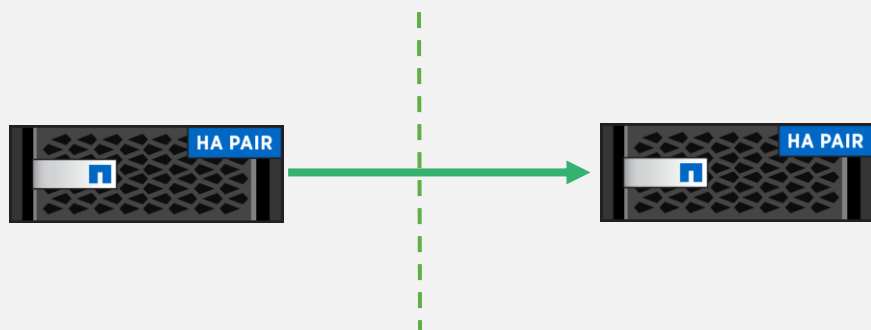


Lesson 2

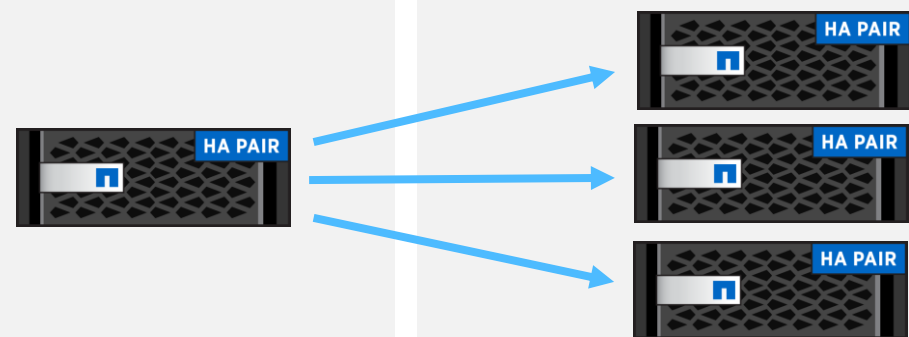
SnapMirror topologies

SnapMirror topologies

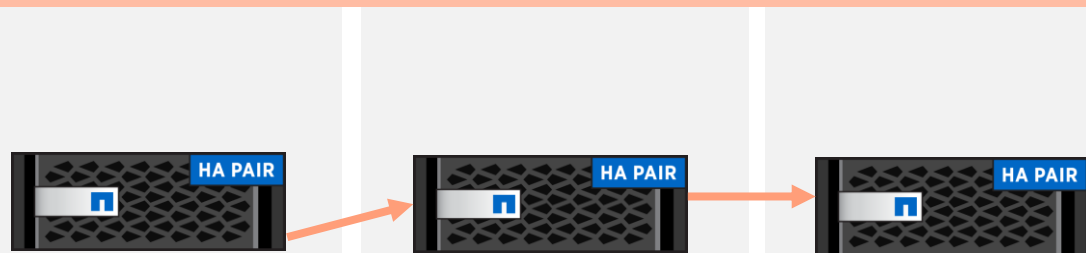
One or more data centers (local or remote copy)



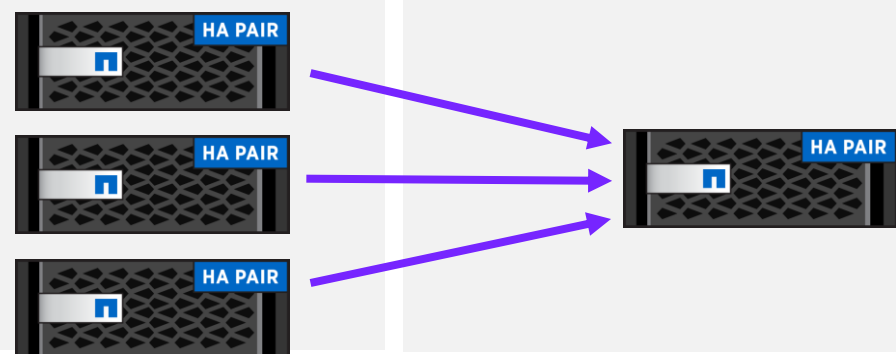
Multiple data centers (fan-out copies)



Multiple data centers (cascades)



Multiple data centers (fan-in copies)



SnapMirror deployment configurations

Basic

Single one-to-one relationship

FlexVol volumes

Cascade

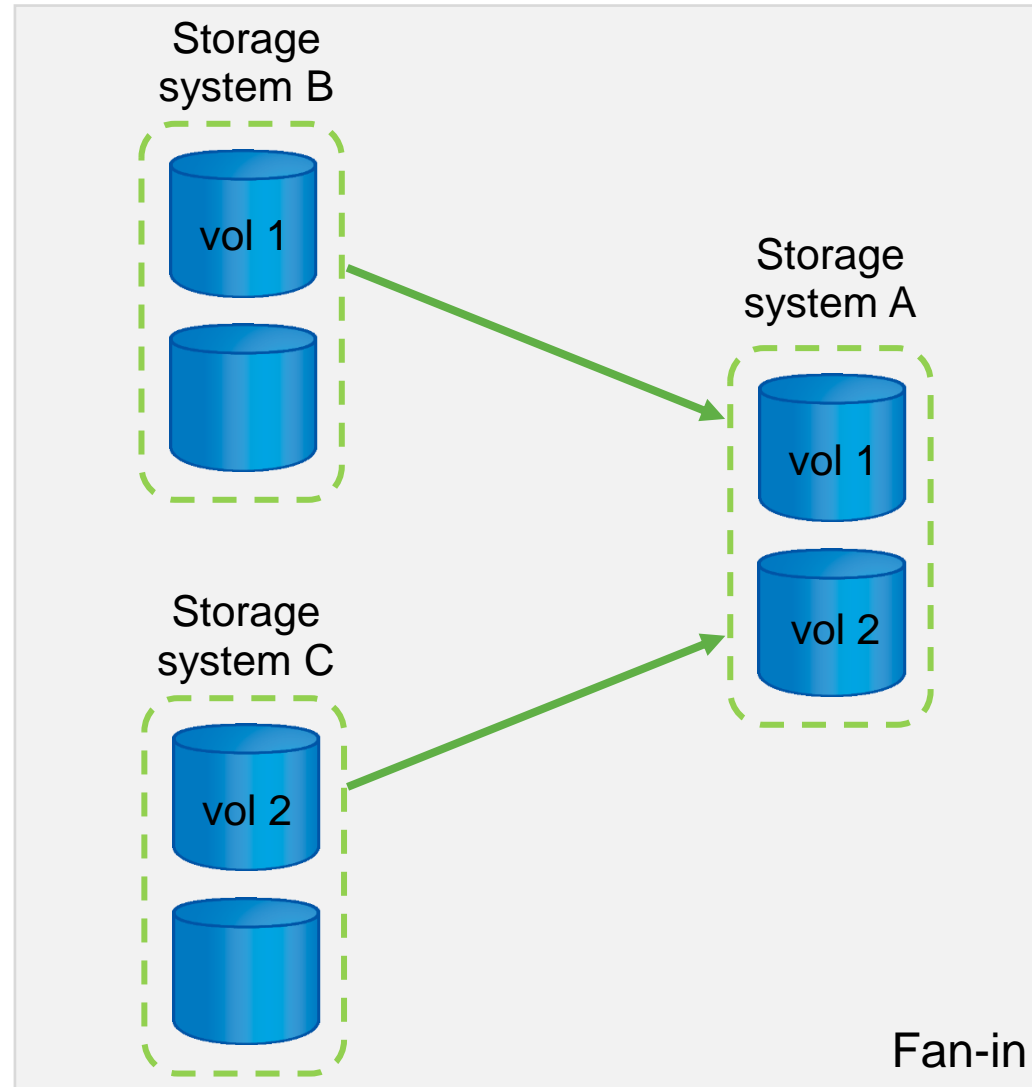
Mirror-mirror

Mirror-vault

Vault-mirror

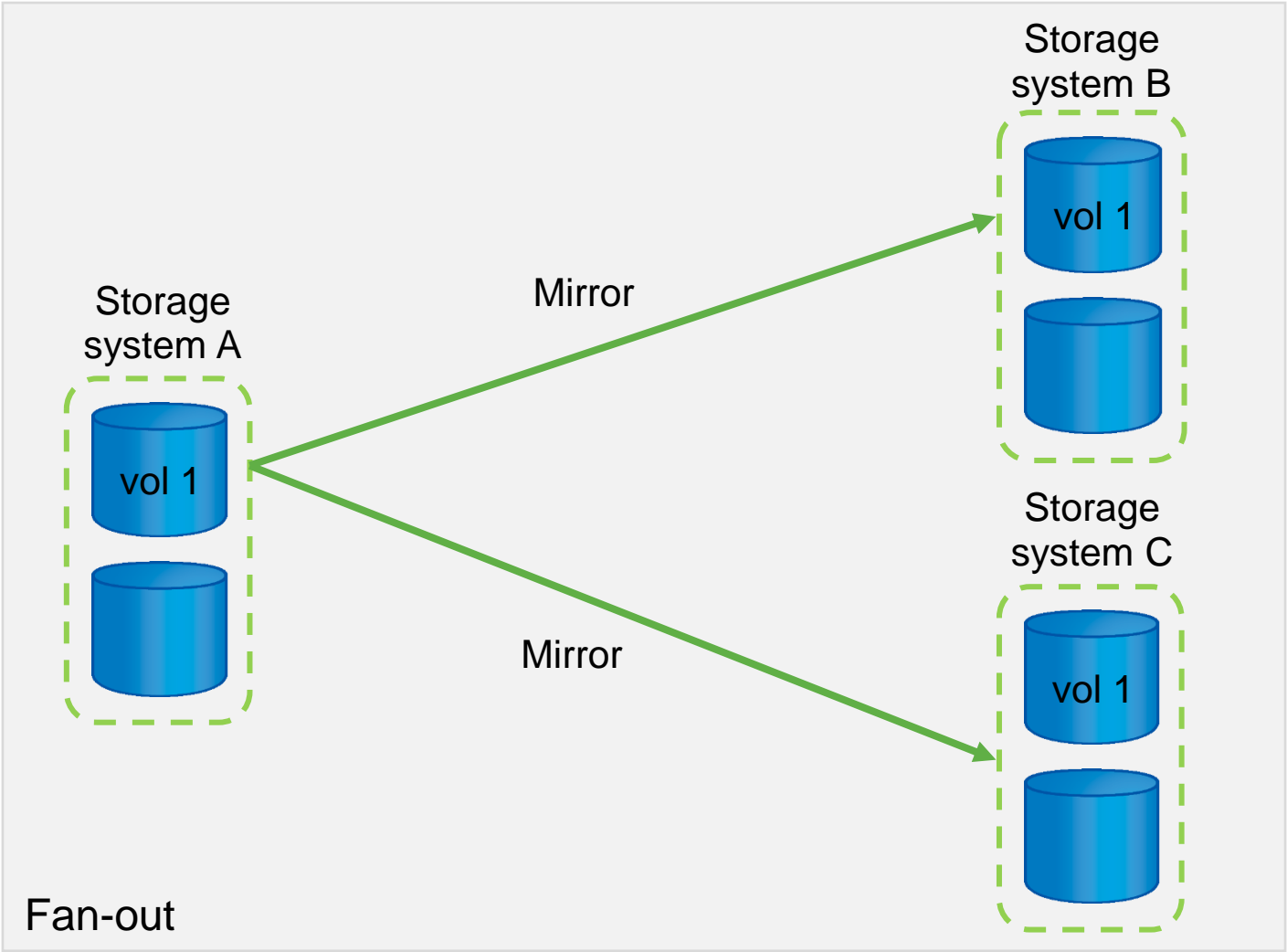
Vault-vault

Replication topologies: Fan-in model



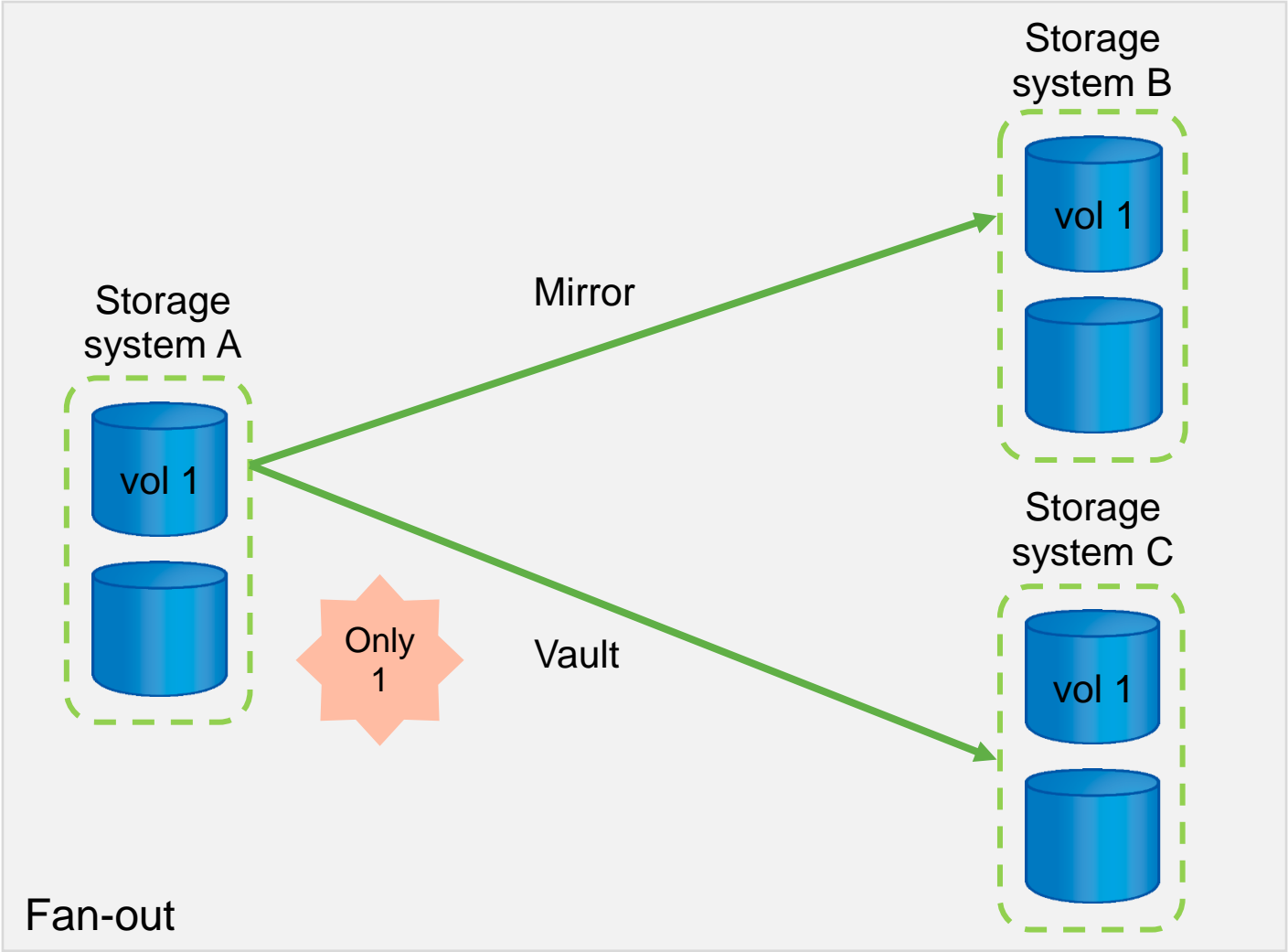
Replication topologies: Fan-out model

Multiple-mirror deployment



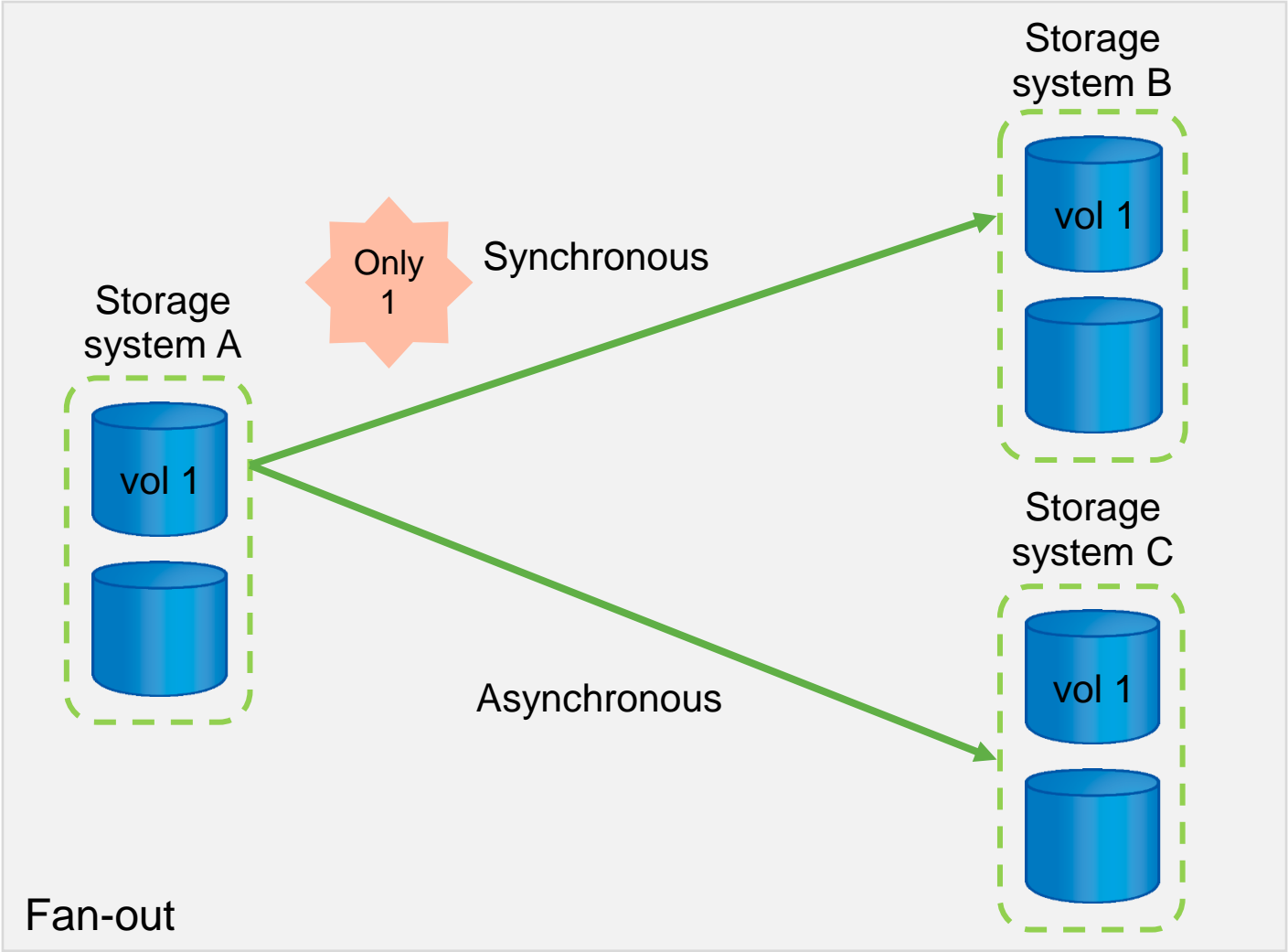
Replication topologies: Fan-out model

Multiple-vault deployment



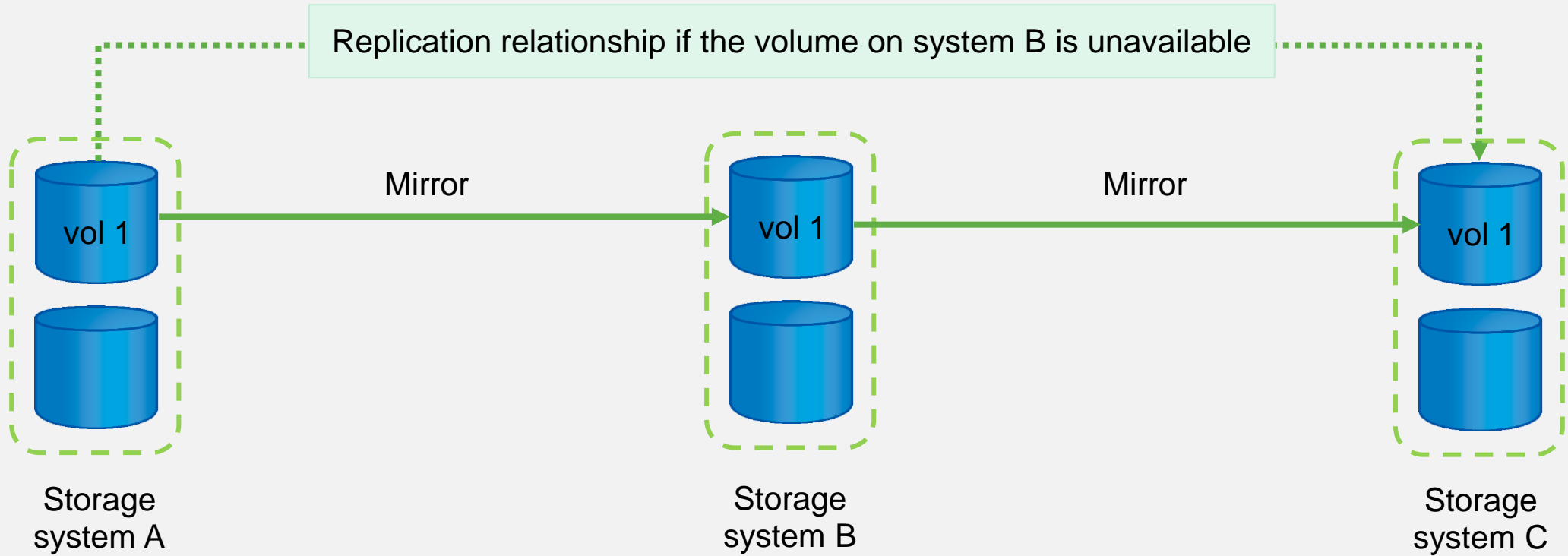
Replication topologies: Fan-out model

SM-S deployment



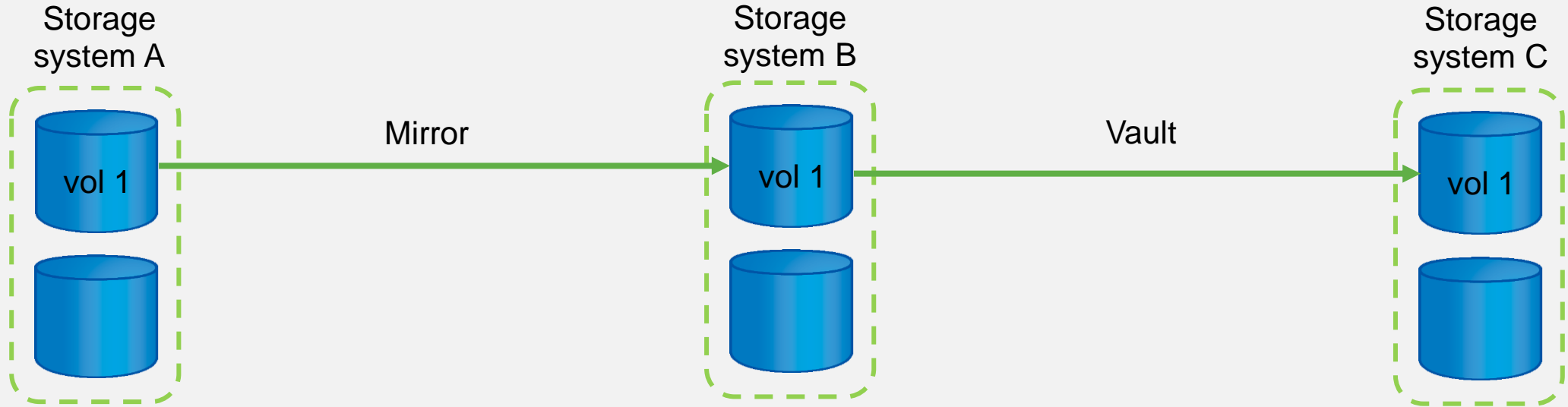
Replication topologies: Cascading model

Mirror-mirror deployment



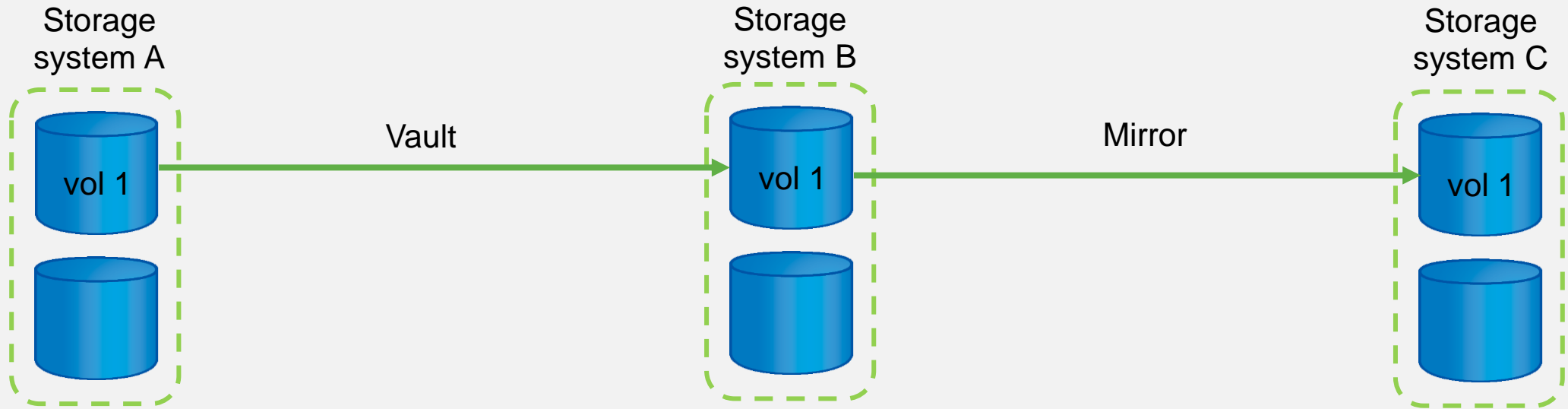
Replication topologies: Cascading model

Mirror-vault deployment



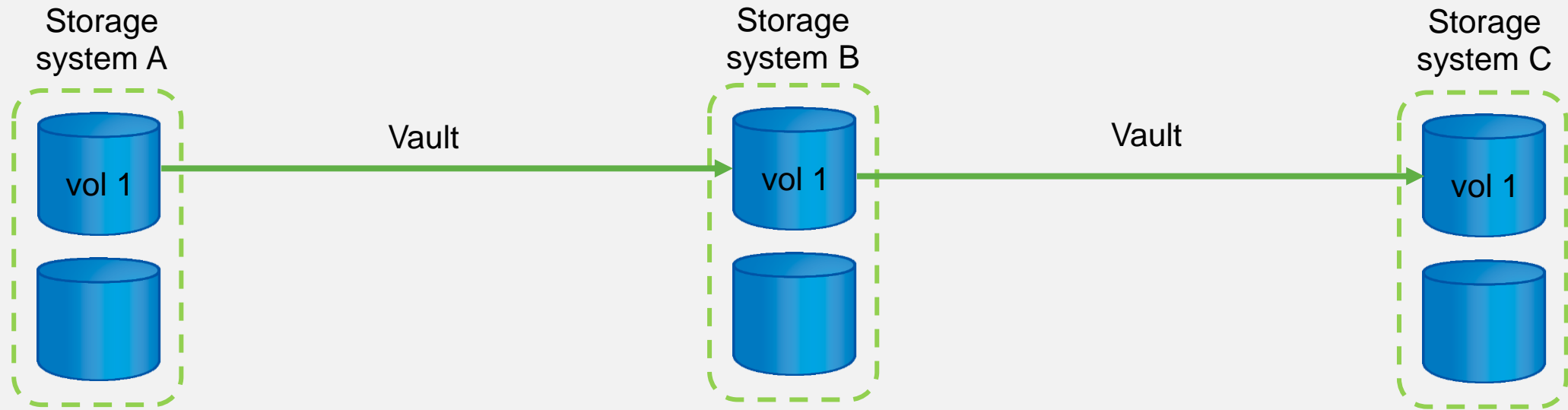
Replication topologies: Cascading model

Vault-mirror deployment



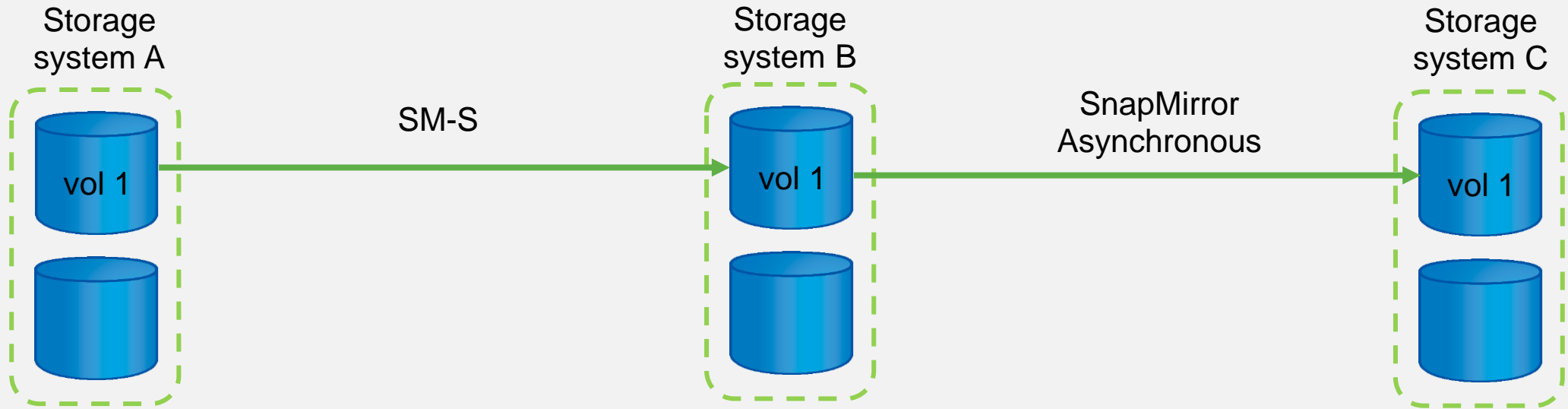
Replication topologies: Cascading model

Vault-vault deployment



Replication topologies: Cascading model

SM-S deployment





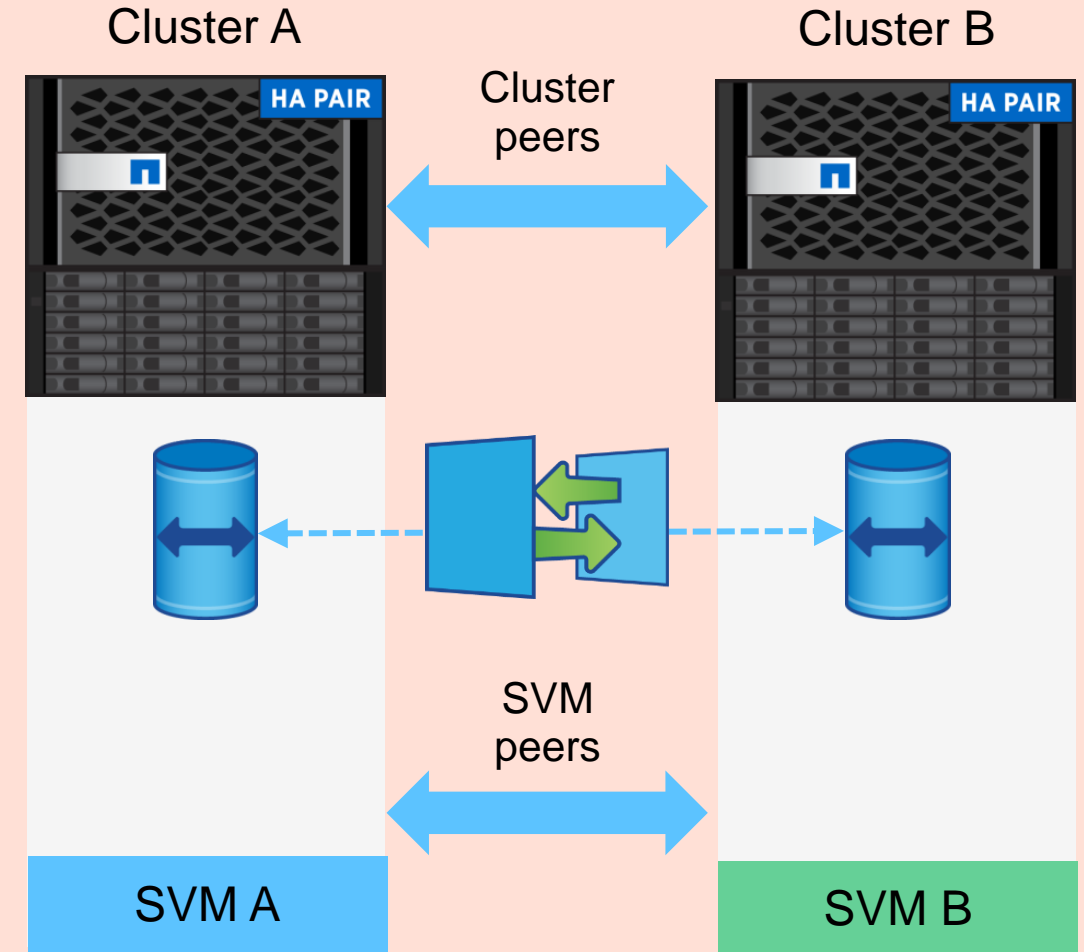
Lesson 3

Configuring SnapMirror relationships

Steps to configure SnapMirror relationships

To create a protection relationship that uses the SnapMirror feature, follow these steps:

- Verify that SnapMirror licenses have been applied on both the primary and the secondary clusters.
- Select the secondary cluster and SVM.
- Establish cluster and SVM peering.
- Create a data protection volume on the secondary.
- Select or create a mirror policy.
- Select or create a schedule.
- Create the relationship.
- Initialize the relationship.

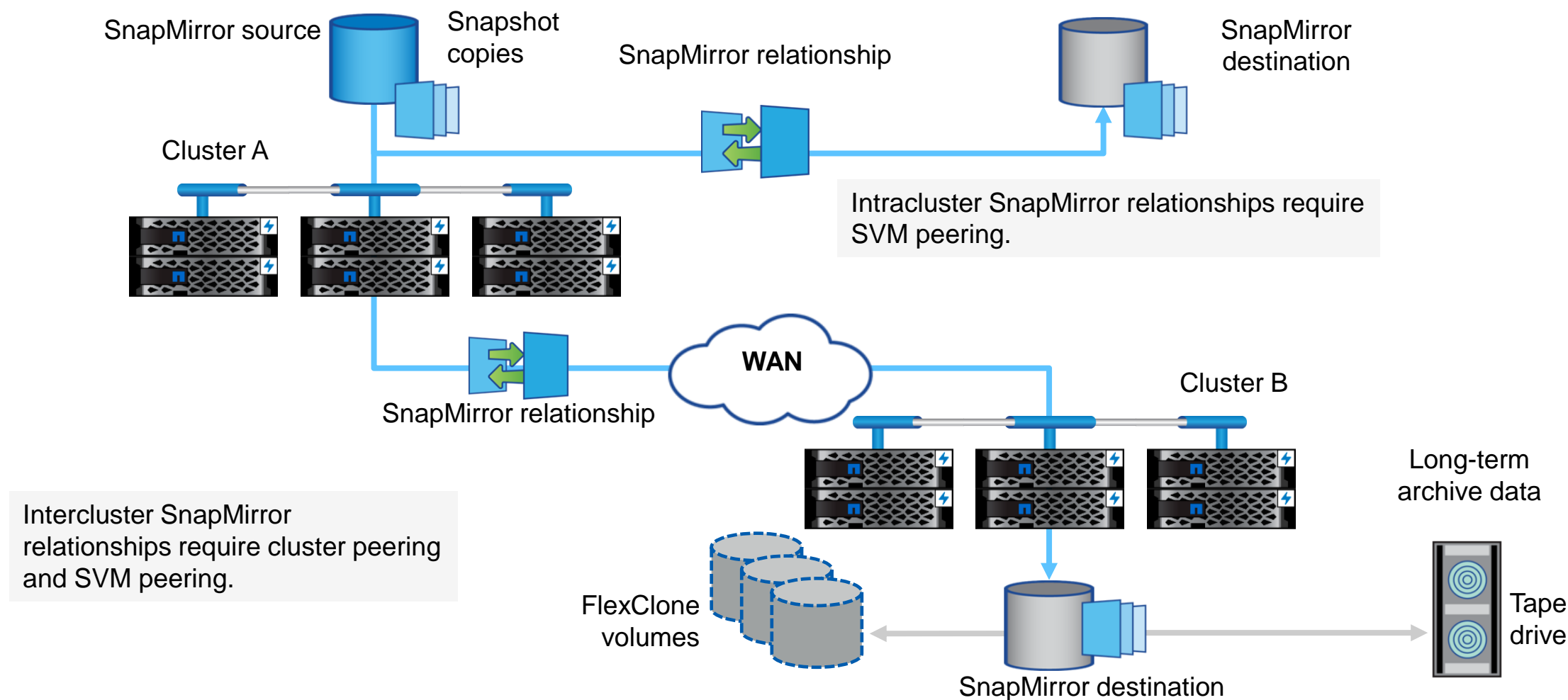


SnapMirror licensing

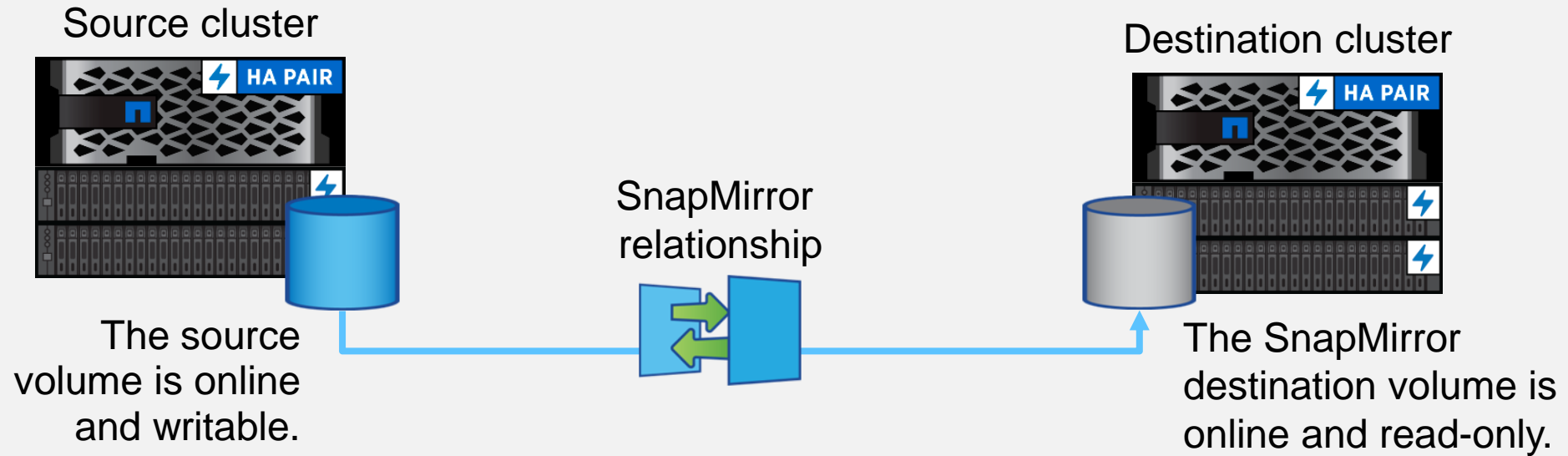
- A SnapMirror license is required for asynchronous replication.
- The license supports both mirror and vault relationships.
- A SnapMirror license and SM-S license are required for synchronous replication.

Licenses Cluster Settings			
+ Add			
<input type="checkbox"/>	Name	State	Scope
<input checked="" type="checkbox"/>	Base License	Compliant	Cluster
<input checked="" type="checkbox"/>	SnapMirror Synchronous License	Compliant	Node
<input checked="" type="checkbox"/>	SMB/CIFS License	Noncompliant	Node
<input checked="" type="checkbox"/>	FC License	Noncompliant	Node
<input checked="" type="checkbox"/>	FlexClone License	Noncompliant	Node
<input checked="" type="checkbox"/>	OnCommand Balance License	Noncompliant	Node
<input checked="" type="checkbox"/>	iSCSI License	Noncompliant	Node
<input checked="" type="checkbox"/>	NFS License	Noncompliant	Node
<input checked="" type="checkbox"/>	SnapLock License	Noncompliant	Node
<input checked="" type="checkbox"/>	SnapManagerSuite License	Noncompliant	Node
<input checked="" type="checkbox"/>	SnapMirror License	Noncompliant	Node
<input checked="" type="checkbox"/>	SnapProtectApps License	Noncompliant	Node

Peering requirements



Creating a destination volume



Language settings

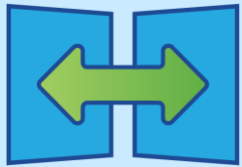
The source and destination FlexVol volumes of a mirror relationship must have the same language setting. If the settings differ, NFS or SMB clients might be unable to access data.



```
cluster1::> volume show -volume svm3_thinvol -fields language
vserver      volume      language
-----
svm3         svm3_thinvol C.UTF-8
```

SnapMirror policy

A SnapMirror relationship must be assigned a policy and an optional schedule.



SnapMirror relationship



SnapMirror policy



Schedule

Scheduling automatic transfers

To automate data protection for a SnapMirror relationship, you must assign a schedule to the relationship.

Schedule



5min @:00,:05,:10,:15,,,,,:55

8hour @2:15,10:15,18:15

daily @0:10

hourly @:05

weekly Sun@0:15

Selecting a job schedule

- Select or modify an existing job schedule.
- Create a job schedule.

```
cluster1::> job schedule show
```

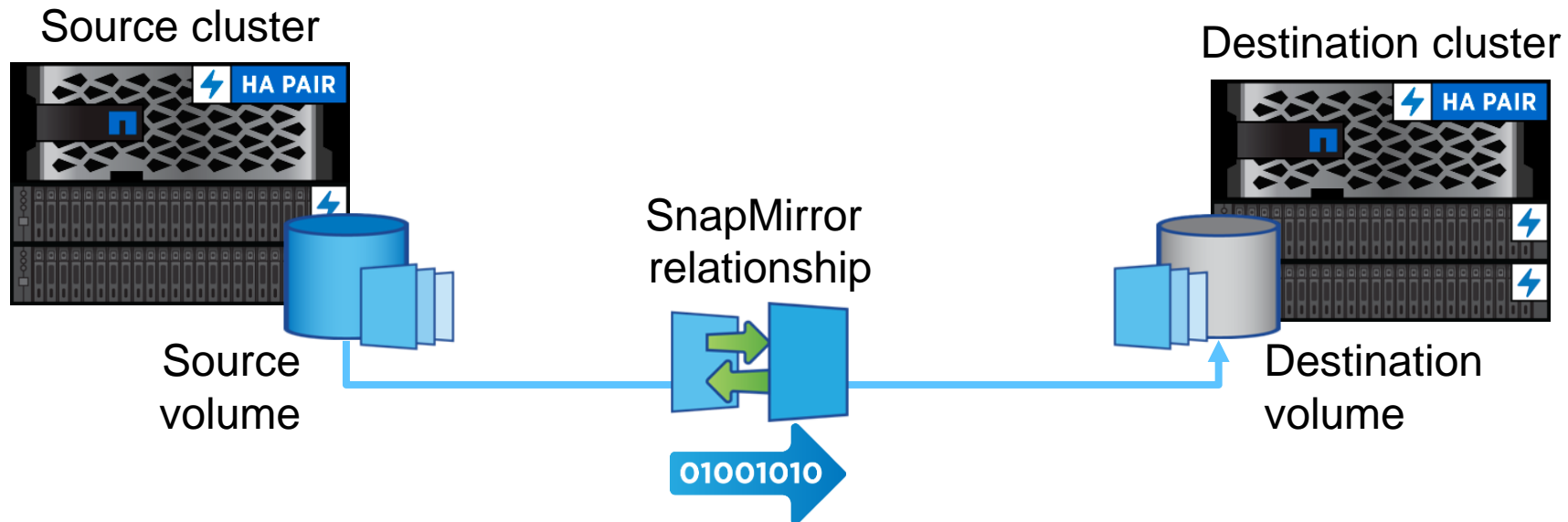
Name	Type	Description
-----	-----	-----
5min	cron	@:00,:05,:10,:15,:20,:25,:30,:35,:40,:45,:50,:55
8hour	cron	@2:15,10:15,18:15
daily	cron	@0:10
Hourly	cron	@:05
weekly	cron	Sun@0:15

Creating the SnapMirror relationship

- You use the `snapmirror create` command to create a SnapMirror relationship.
- SnapMirror in XDP mode uses a version-flexible replication engine.
This engine supports different ONTAP versions on primary and secondary storage.

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

Performing the initial transfer



To initialize the data protection mirror copy, use the
`snapmirror initialize` command.

Monitoring the relationship

ONTAP System Manager

DASHBOARD

STORAGE

NETWORK

EVENTS & JOBS

PROTECTION

Overview

Relationships

HOSTS

Relationships

Protect


Search

	Source	Destination	Protection Policy	Relationship Health	State	Lag
	svm3:smb3_share_CIFS_volume	svm1_clust2:vol_...	svm3_share_async_mirror	Healthy	Mirrored	2 minutes, 51 seconds
<div><div>SOURCE CLUSTER</div>cluster1<div>EXPORTED SNAPSHOT COPY</div>snpmirror.b0d636da-12b9-11e8-a7af-005056b0090c_2148080981.2021-05-03_061119<div>DESTINATION CLUSTER</div>cluster2<div>POLICY TYPE</div>Asynchronous<div>TRANSFER SCHEDULE</div>daily<div>TRANSFER STATUS</div>-</div>						

Monitoring the relationship

ONTAP CLI

Command	Action
See the SnapMirror relationship status	<code>snapmirror show</code>
Manually update a relationship	<code>snapmirror update</code>
Modify relationship properties	<code>snapmirror modify</code>
Modify a policy	<code>snapmirror policy modify</code>
Modify a rule in a policy	<code>snapmirror policy modify-rule</code>
Remove a rule from a policy	<code>snapmirror policy remove-rule</code>
Delete a policy	<code>snapmirror policy delete</code>



Lesson 4

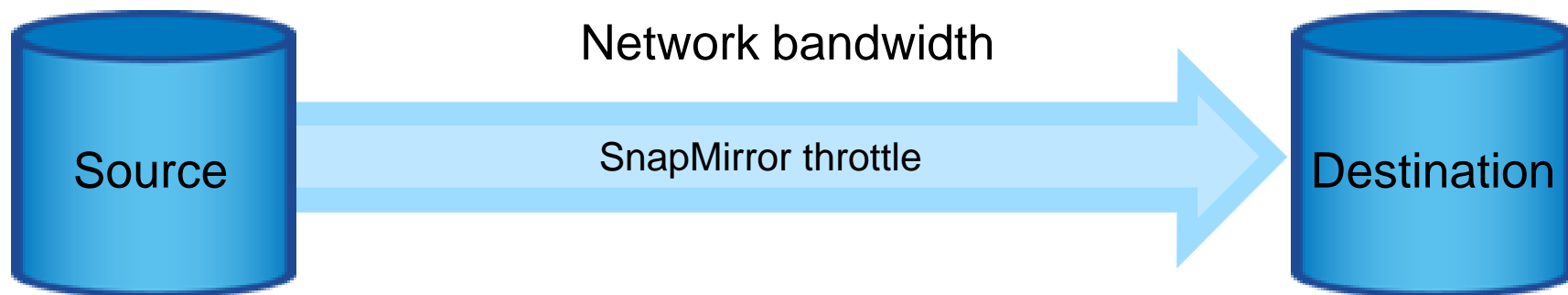
Additional SnapMirror configuration considerations

Intercluster SnapMirror throttle

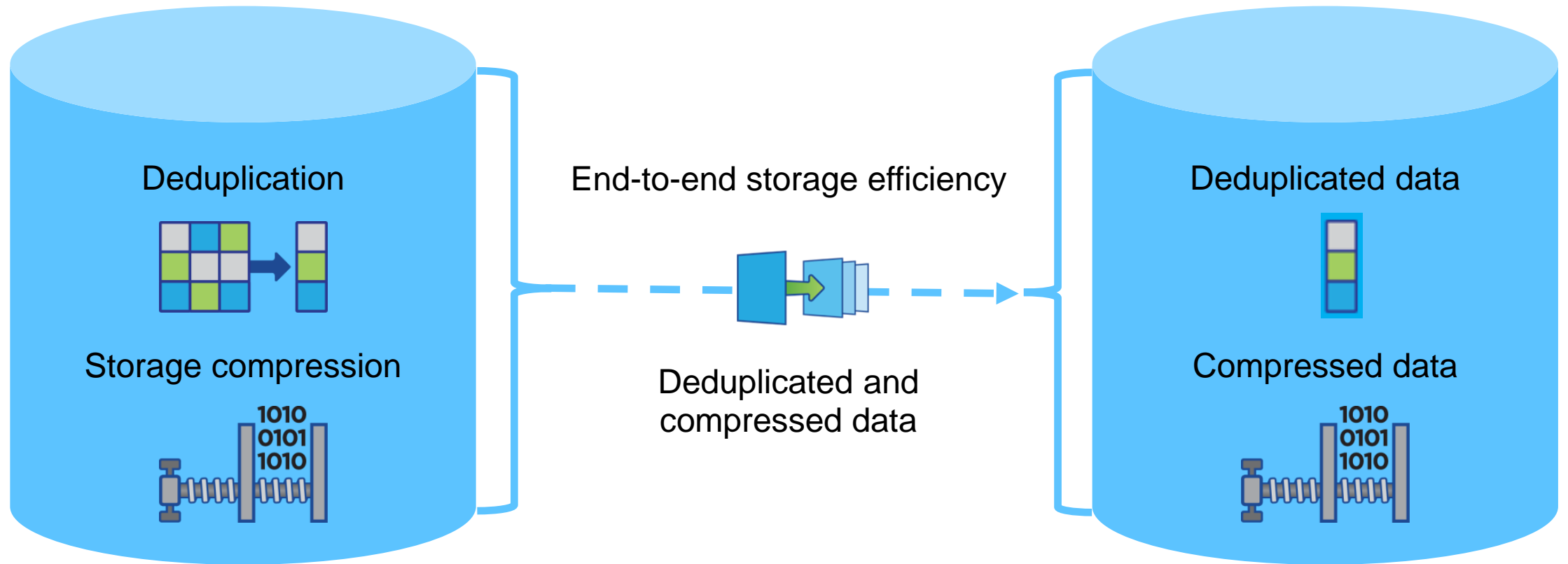
Conserving network bandwidth

- To limit the amount of bandwidth that is used by intercluster SnapMirror transfers, apply a throttle to intercluster SnapMirror relationships.
- Example: Apply a 10-MB throttle to a relationship.

```
cluster02::> snapmirror modify -destination-path cluster02://vs1/vol1 -throttle 10240
```



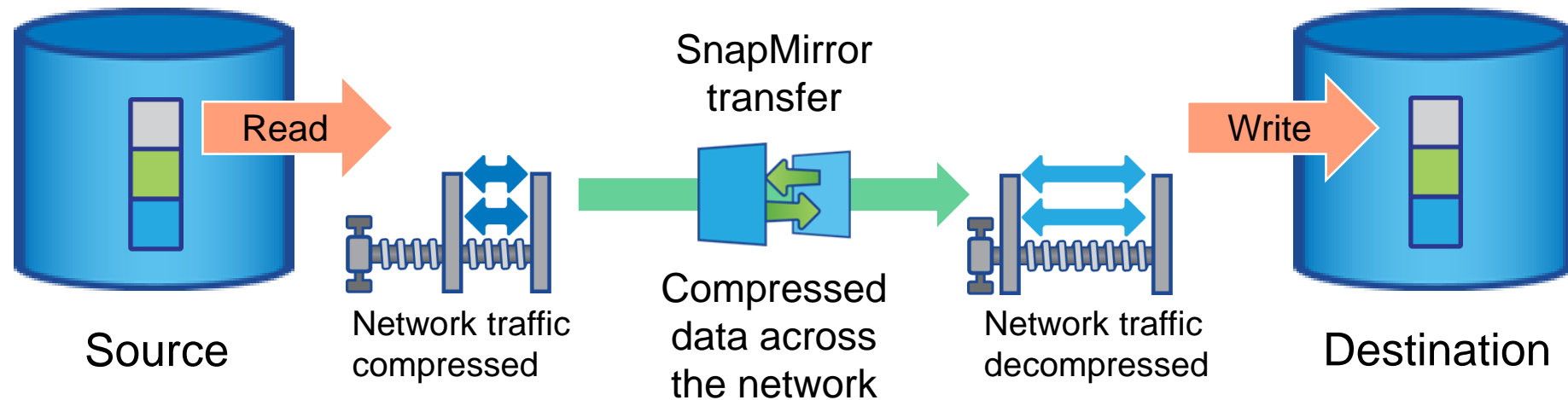
End-to-end storage efficiency



SnapMirror network compression

Conserving network bandwidth

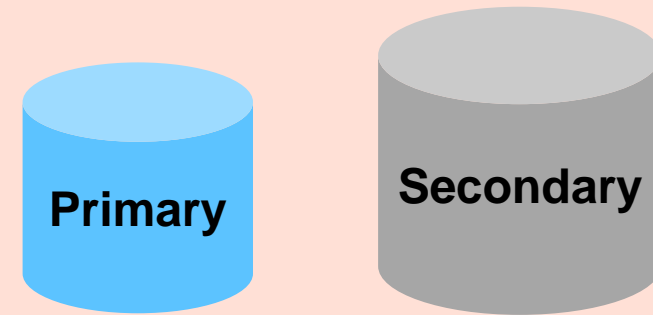
- SnapMirror network compression enables data compression over the network for SnapMirror transfers.
- To enable or disable SnapMirror network compression, in the SnapMirror policy, use the `-is-network-compression-enabled` option.



Determining space requirements for vault relationships

On the destination cluster, determine the amount of space that is required for your backup plans:

- Size of the primary volume
- Rate of increase of the data on the primary volume
- Number of Snapshot copies to retain on the destination volume



12 hourly Snapshot copies
8 daily Snapshot copies
8 weekly Snapshot copies

Cluster and firewall requirements



Cluster requirements

- Any time difference between clusters must be less than 300 seconds (5 minutes).
- Clusters can be in different time zones.
- A cluster cannot be in a peer relationship with more than 255 clusters.

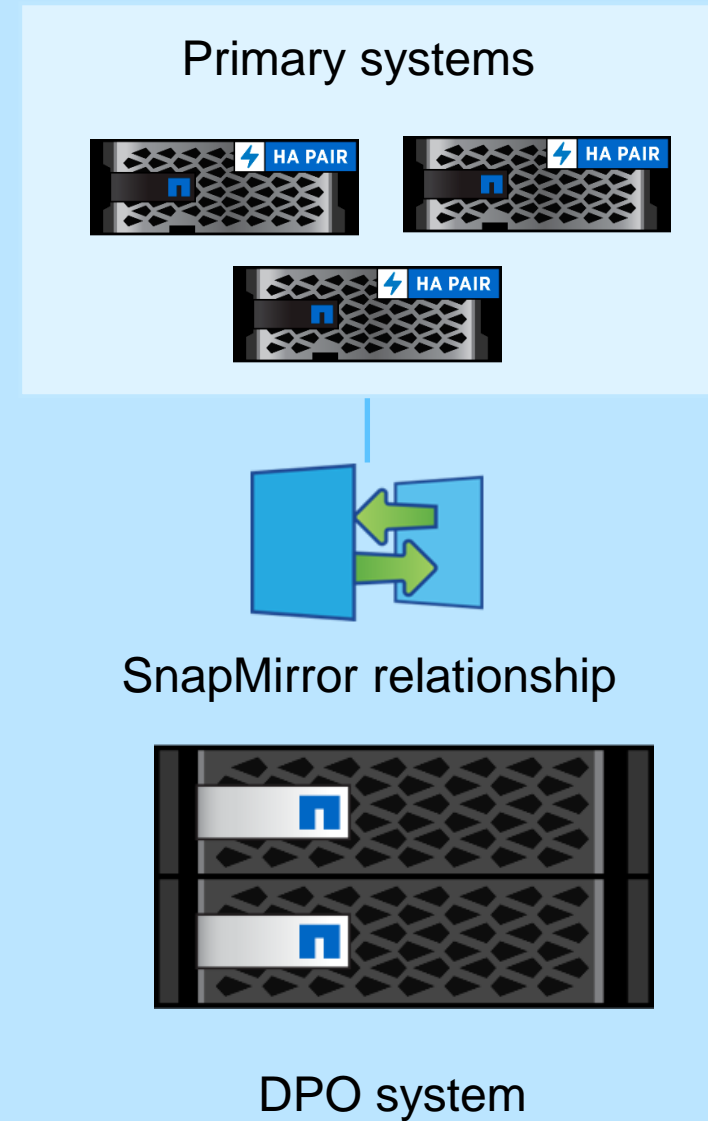


Firewall requirements

- Internet Control Message Protocol (ICMP) service
- TCP to the IP addresses of all intercluster LIFs over ports 10000, 11104, and 11105
- HTTPS

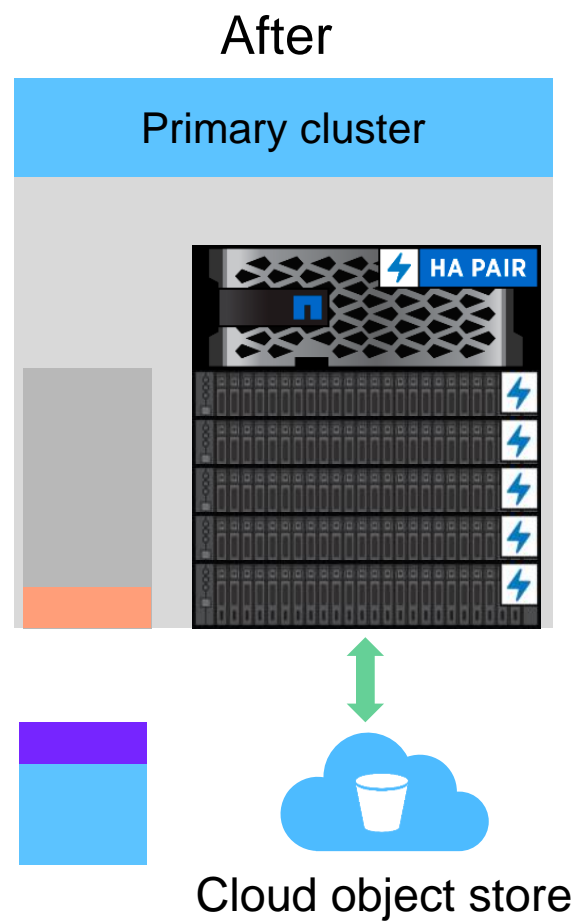
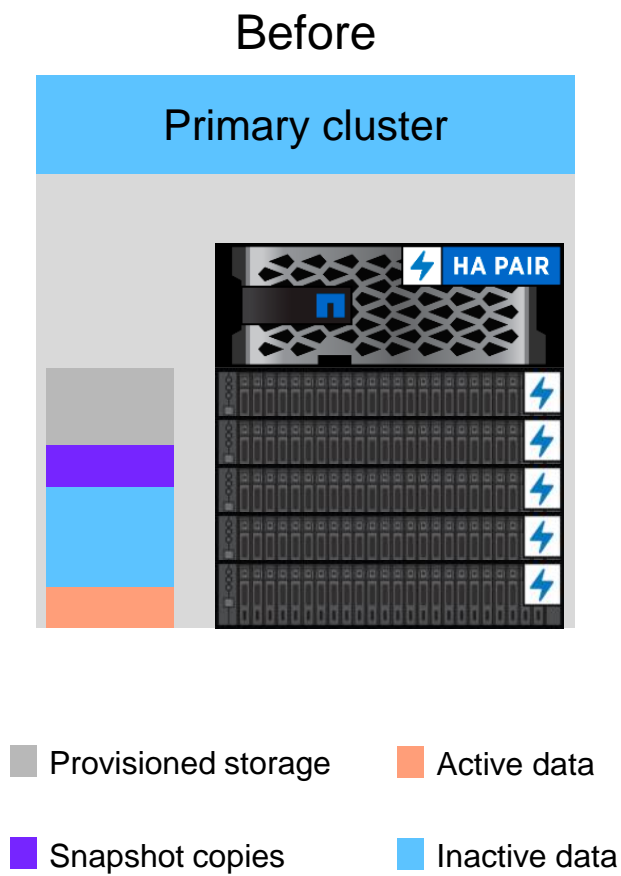
DPO systems

- Data Protection Optimized (DPO) systems are preconfigured systems that serve as target storage for data protection.
- DPO systems are FAS two-node switchless clusters.



FabricPool

Data tiering to cloud object store



FabricPool

Tiering policies

None

Keeps volume data in the performance tier, preventing the data from being moved to the cloud tier

Snapshot-only (default)

Moves cold Snapshot blocks in the volume that are not shared with the active file system to the cloud tier

Auto

Moves cold user data blocks in both the Snapshot copies and the active file system to the cloud tier

All

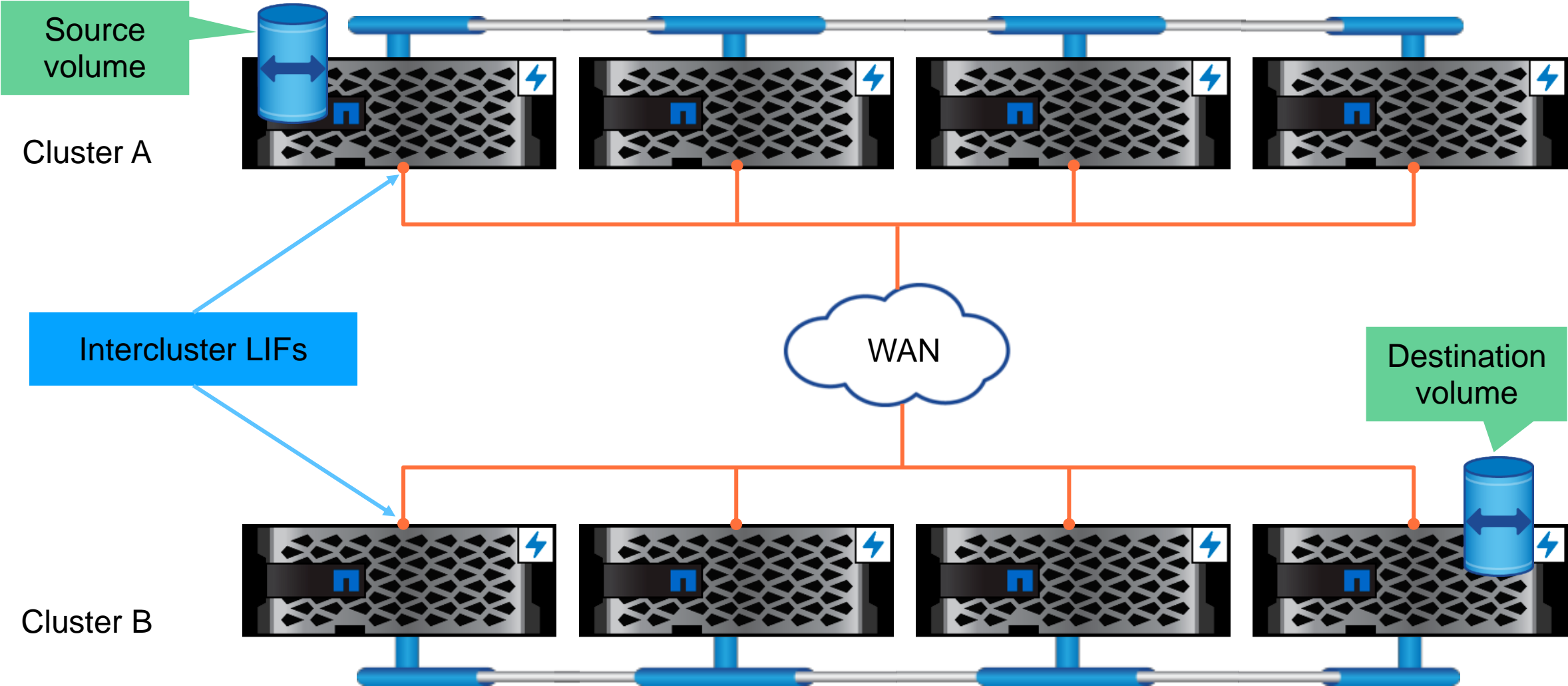
Enables newly transferred data for a data-protection volume to start in the cloud tier



Lesson 5

Guidelines for intercluster networking

The intercluster network



Intercluster network connectivity

IP address and subnet setup

Before cluster peering can be established, network connectivity between the clusters must be set up correctly.

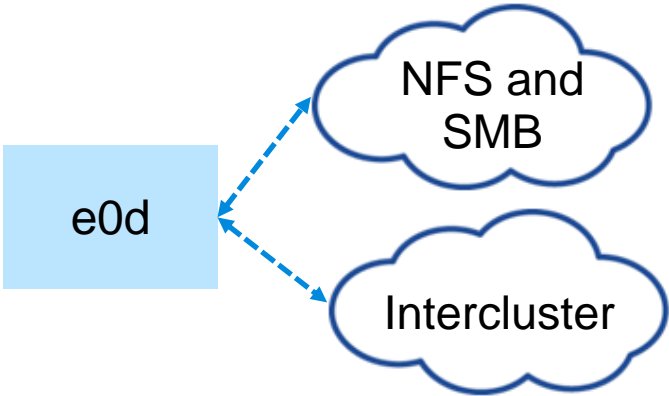
- The subnet must belong to the broadcast domain that contains the ports that are used for intercluster communication.
- IP addresses that are used for intercluster LIFs do not need to be in the same subnet, but having them in the same subnet is a simpler configuration.
- The subnet must have enough IP addresses for one intercluster LIF per node in the cluster.
- The intercluster network must have full-mesh connectivity.
- Intercluster LIFs can use either IPv4 or IPv6 addresses.

Intercluster network connectivity

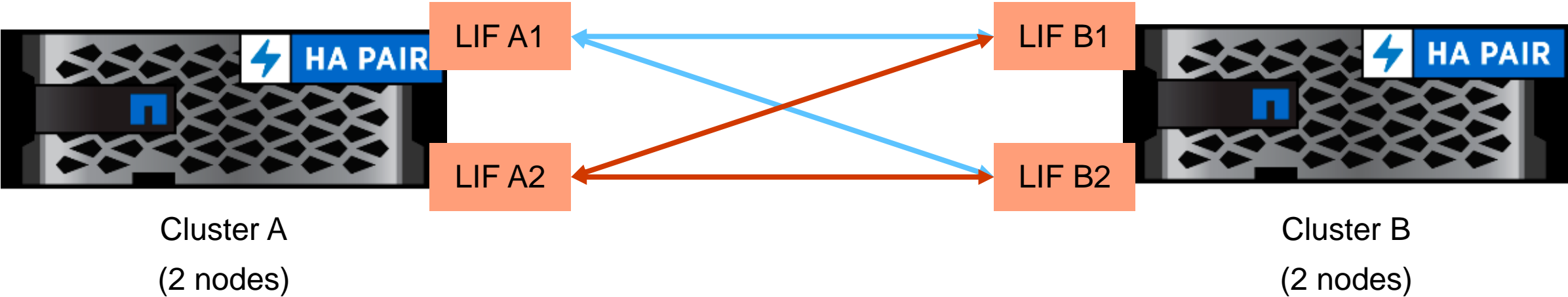
Port setup for intercluster communication

- The ports do not need to be in the default IPspace.
- Ports that are added to a broadcast domain can be physical ports, virtual LANs (VLANs), or interface groups.
- The maximum transmission unit (MTU) settings of all ports must be identical.
- The ports can be used (shared) with data communications.

Node: cluster1-02						
Port	IPspace	Broadcast Domain	Link	MTU	Speed (Mbps) Admin/Oper	Health Status
e0a	Cluster	Cluster	up	9000	auto/1000	healthy
e0b	Cluster	Cluster	up	9000	auto/1000	healthy
e0c	Default	Default	up	9000	auto/1000	healthy
e0d	Default	Default	up	9000	auto/1000	healthy
e0e	Default	Default	up	9000	auto/1000	healthy
e0f	Default	Default	up	9000	auto/1000	healthy

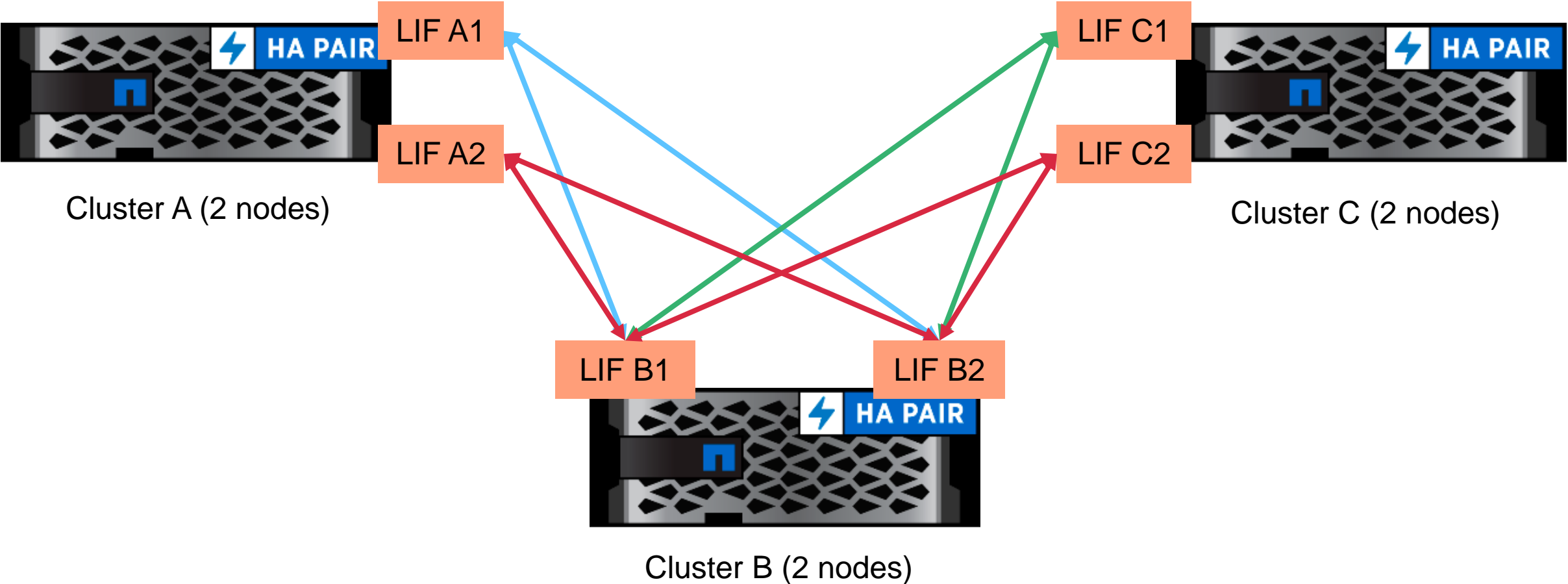


Intercluster networking between two clusters



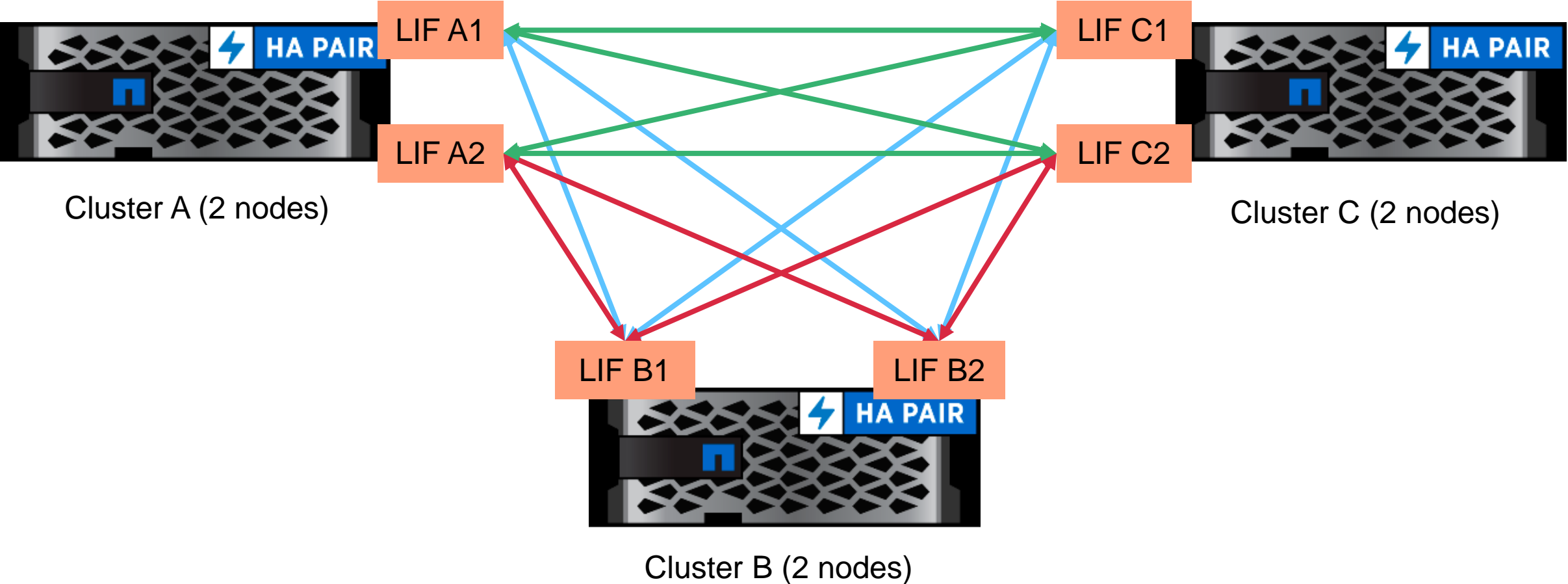
Intercluster networking in a cluster cascade

Part 1 of 2

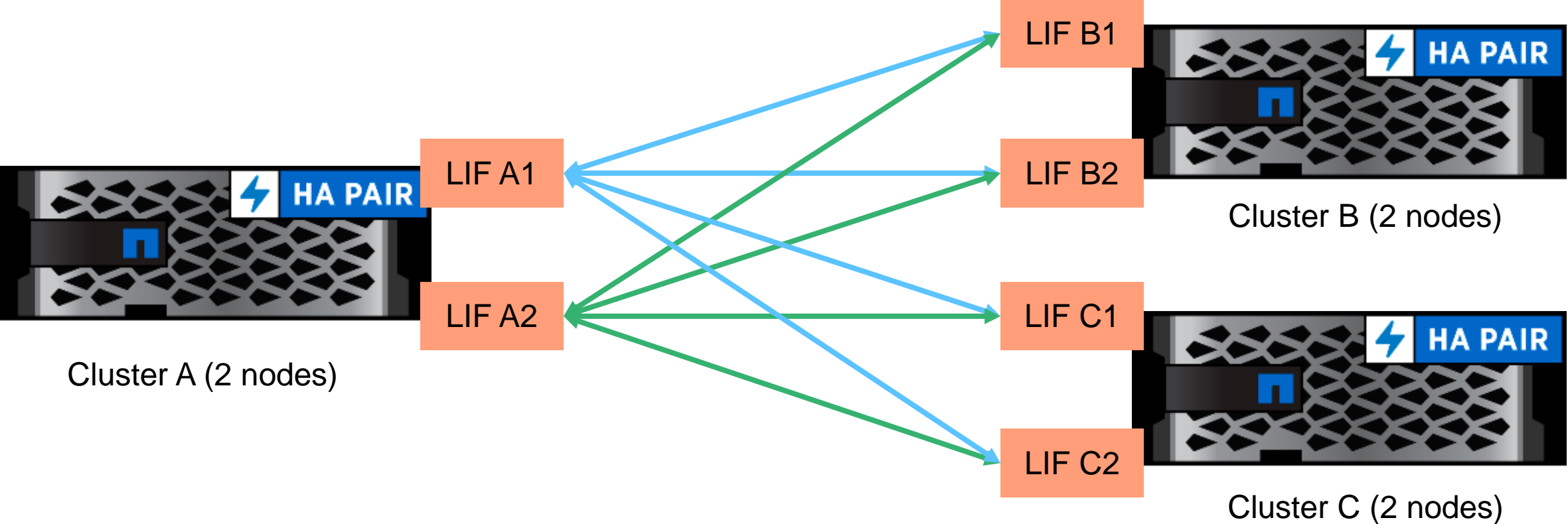



Intercluster networking in a cluster cascade

Part 2 of 2



Intercluster networking in a cluster fan-out or fan-in

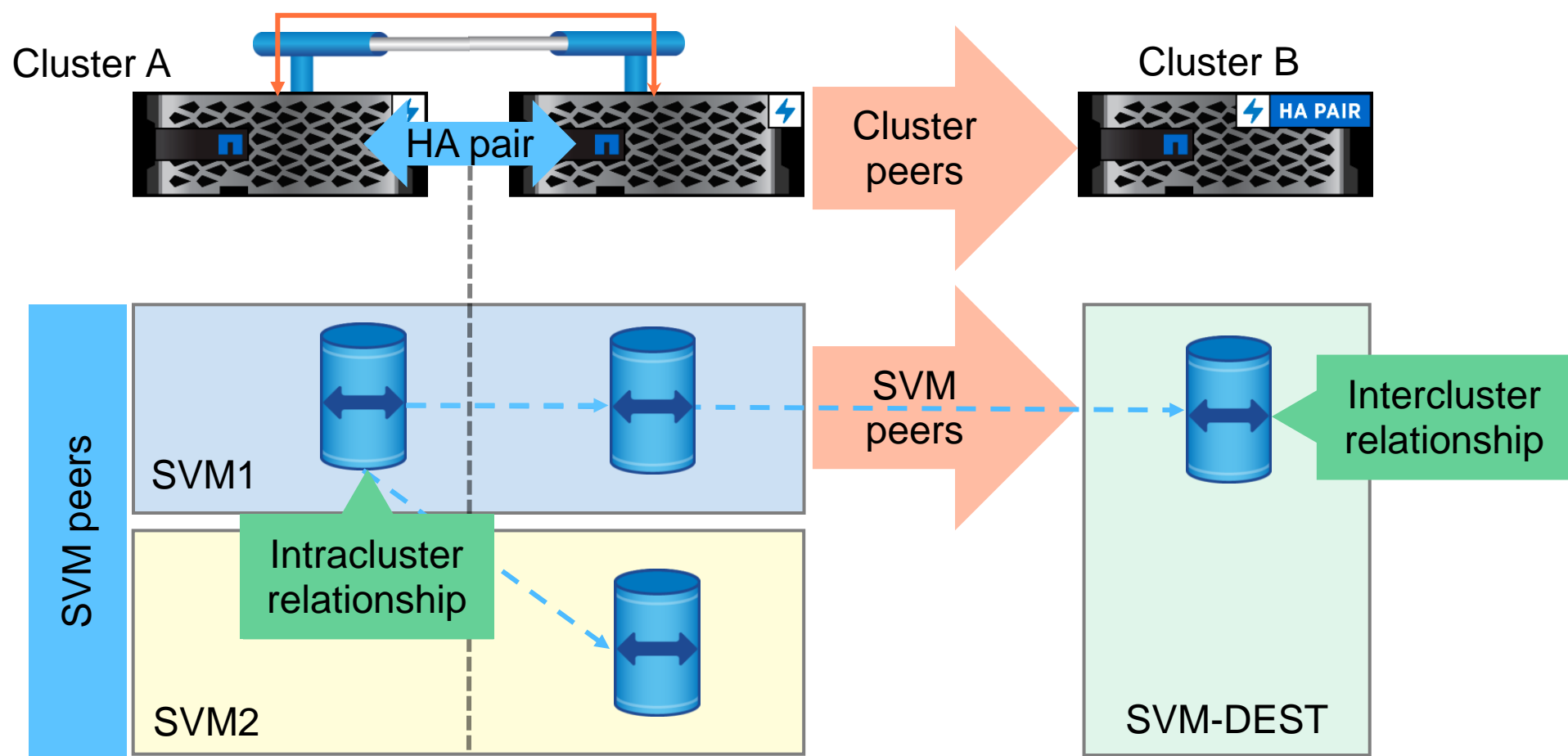




Lesson 6

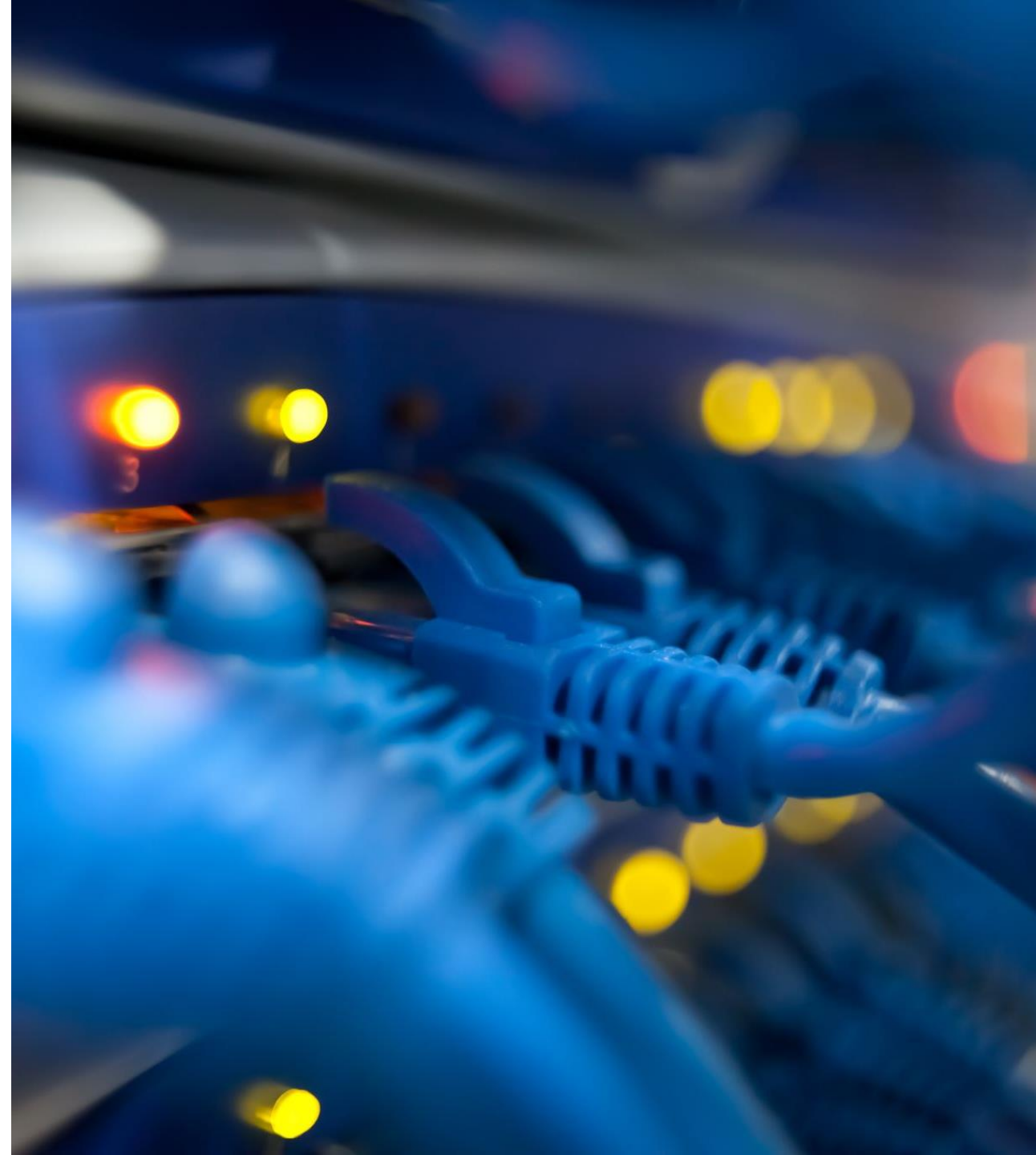
Cluster and SVM peering

Peer relationships



Create cluster peer relationships

- Peer relationships can be authenticated or unauthenticated.
- A passphrase can be used to complete the cluster peering.
- A cluster peer offer can be extended beyond the default of one hour.
- Cluster peers can use the default IPspace or a custom IPspace.



Manage cluster peer relationships

Command	Action
<code>cluster peer create</code>	Create an authenticated cluster peer relationship
<code>cluster peer ping</code>	Initiate an intercluster connectivity test
<code>cluster peer show</code>	Display information about the cluster peer relationship
<code>cluster peer connection show</code>	Display TCP connection information for a cluster peer
<code>cluster peer health show</code>	Display health information for the nodes in a cluster peer
<code>cluster peer offer show</code>	Display information about outstanding authentication offers
<code>cluster peer offer modify</code>	Modify the expiration time of an outstanding offer
<code>cluster peer offer cancel</code>	Cancel an outstanding authentication offer to a peer cluster
<code>cluster peer modify</code>	Modify a cluster peer relationship
<code>cluster peer delete</code>	Delete a cluster peer relationship

SVM peer relationships

Enable volume- and SVM-level SnapMirror relationships to exist between SVMs.

- One SVM can be peered with multiple SVMs within a cluster or across clusters.
- Both clusters must be peered with each other before you create the SVM peer relationship.
- The intercluster network must have full-mesh connectivity.
- The SVM names in any peered clusters must be unique within the clusters.
- System Manager automatically peers SVMs when the protection relationship is created.

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 Cluster and SVM Peering Power Guide*
<http://docs.netapp.com/ontap-9/topic/com.netapp.doc.pow-csp/Cluster%20and%20SVM%20peering.pdf>
- *ONTAP Commands: Manual Page Reference*
<http://docs.netapp.com/ontap-9/topic/com.netapp.doc.dot-cm-cmpr-980/ONTAP%209.8%20commands.pdf>
- *NetApp Technical Report TR-4015: SnapMirror Configuration and Best Practices Guide*
<https://www.netapp.com/media/17229-tr4015.pdf?v=127202175503P>
- *NetApp Technical Report TR-4598: FabricPool Best Practices*
<https://www.netapp.com/pdf.html?item=/media/17239-tr4598pdf.pdf>

Module summary

This module focused on enabling you to do the following:

- Explain the types of mirroring relationships in ONTAP software
- Describe the required components for each type of mirroring relationship
- Identify the differences between replication topologies
- Explain the steps to configure SnapMirror relationships
- List the ONTAP features that SnapMirror supports
- Design a network configuration for intercluster mirroring
- Construct the peer relationships that are required for intercluster mirroring and SVM mirroring

An abstract graphic in the top right corner consisting of a grid of teal-colored cubes. The cubes are arranged in a way that creates a sense of depth and perspective, with some cubes appearing to be in front of others, casting soft shadows. The overall effect is a modern, architectural design element.

Knowledge check

Module 2: SnapMirror fundamentals

Knowledge check

You recently set up a SnapMirror relationship that has a daily update schedule. You want to verify that the updates are being performed daily. Which two things do you do? (Choose two.)

- a. On the System Manager Relationships page, ensure that the amount of lag time is less than the most recent scheduled transfer time.
- b. Use System Manager to check the Relationships page and verify that the Relationship State is Acceptable.
- c. Reboot the secondary cluster so that a new SnapMirror transfer begins.
- d. Use System Manager to check the Relationships page and verify that the Relationship State is Mirrored.

Knowledge check

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Knowledge check

You want to establish a peer relationship between two ONTAP clusters. You are concerned about network connectivity. Which three things do you do? (Choose three.)

- a. Use or create a subnet that has one intercluster LIF per node.
- b. Verify that the subnet belongs to the broadcast domain that contains the ports that are used for intercluster communication.
- c. Verify that the intercluster network has full-mesh connectivity between cluster peer nodes.
- d. Confirm that all network ports are using the default IPspace.

Knowledge check

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- c. Verify that the intercluster network has full-mesh connectivity between cluster peer nodes.
- d. Confirm that all network ports are using the default IPspace.

Knowledge check

You must establish a peer relationship with another cluster. You need to configure the cluster peer offer now, but the other cluster's administrator cannot complete the peer authentication for several hours. What two things do you do? (Choose two.)

- a. Run multiple `cluster peer create` commands from your cluster.
- b. Extend the cluster peer offer beyond the default time.
- c. Use the `cluster peer create -offer-expiration` command.
- d. Wait until the other cluster administrator is available, and then proceed to establish the peer relationship.

Knowledge check

You must establish a peer relationship with another cluster. You need to configure the cluster peer offer now, but the other cluster's administrator cannot complete the peer authentication for several hours. What two things do you do? (Choose two.)

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- d. Wait until the other cluster administrator is available, and then proceed to establish the peer relationship.



Complete exercises

Module 2: SnapMirror fundamentals

Exercise 1: Configuring a Load-sharing Mirror Relationship

Exercise 2: Configuring Cluster Peering and SVM Peering

Duration: 30 minutes