

# Module 6: Logical Storage Management

## Exercise 1: Managing Data Volumes

In this exercise, you manage logical storage resources.

### Objectives

This exercise focuses on enabling you to do the following:

- Create FlexVol volumes
- Expand a FlexVol volume
- Move a FlexVol volume

### Case Study

Because the employees of Dwurgle Enterprises need to be migrated to Zarrot Industries, it was decided to create a second FlexVol volume to store the new users' home directories.


The users who are moving from Dwurgle Enterprises have more data than anticipated. The new volume containing the home directories for the employees from Dwurgle Enterprises was too small when it was created. You need to expand the size of the volume to accommodate the additional data to transfer.

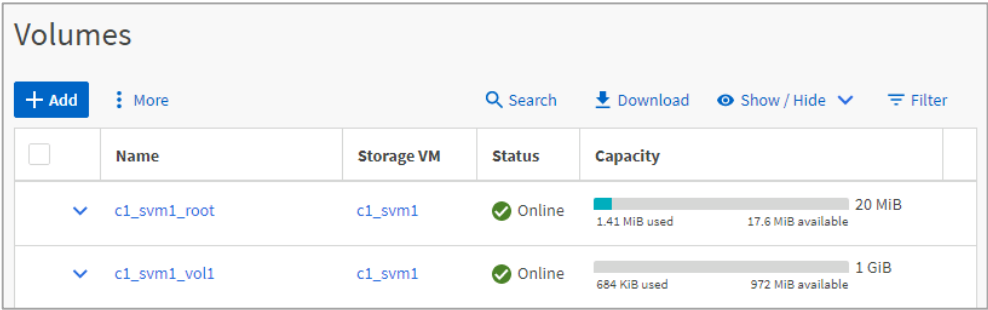
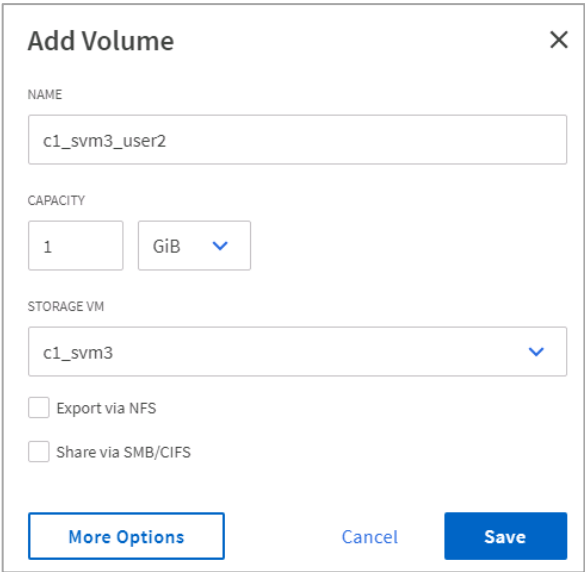
### Lab Equipment

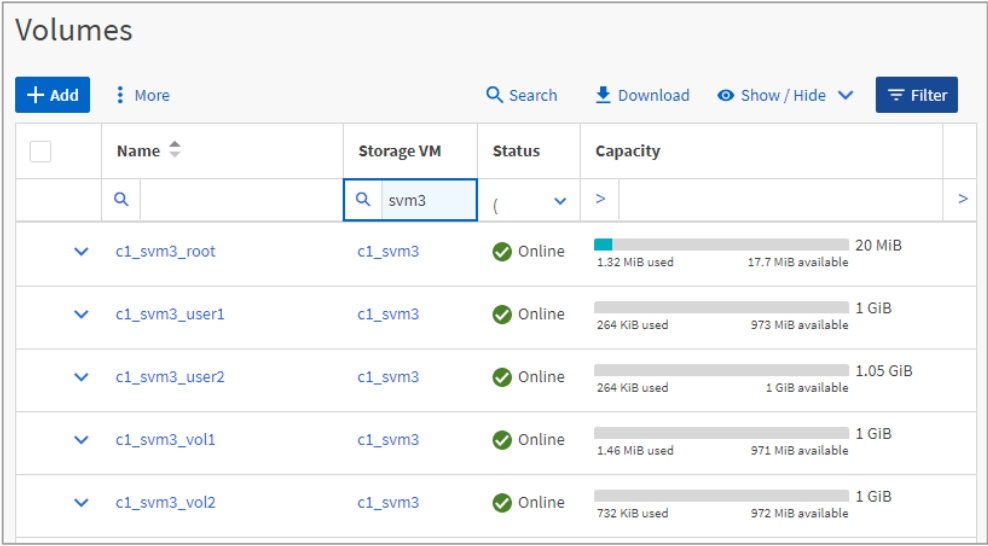
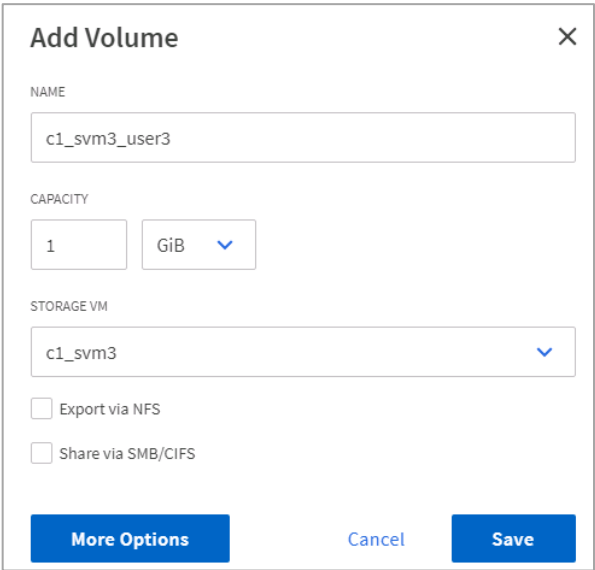
Use the following equipment to complete the exercise:

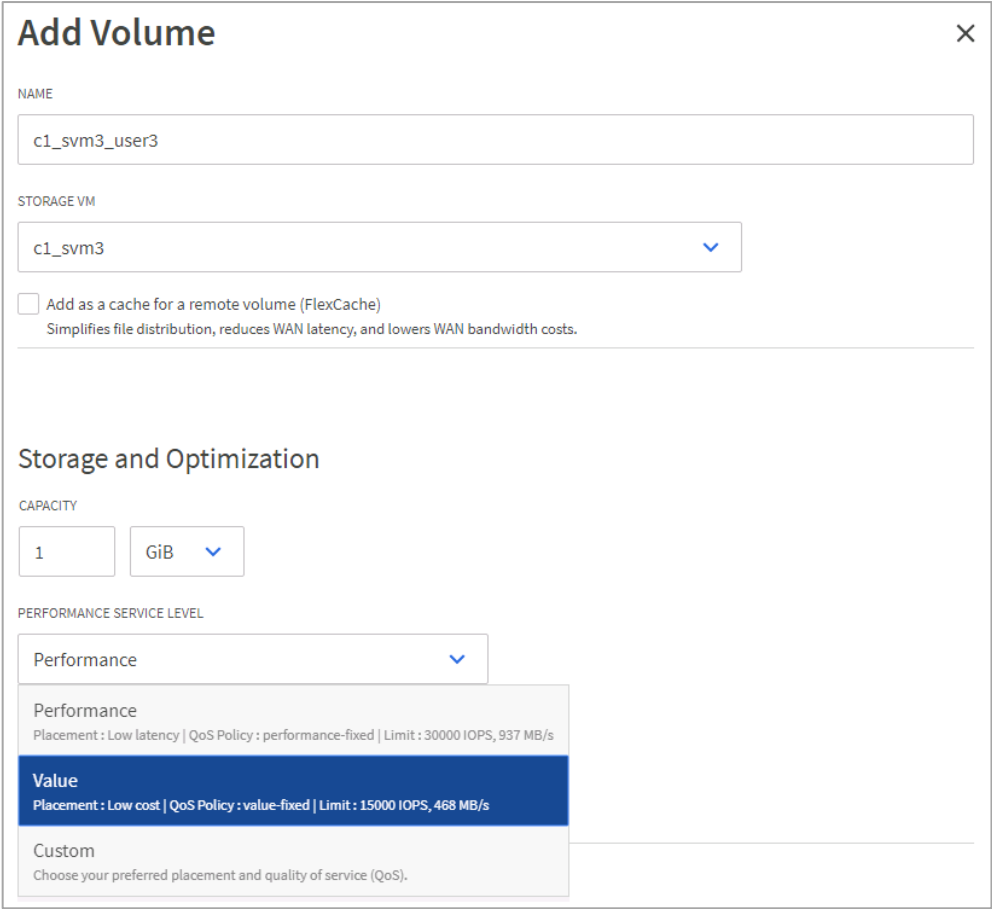
System	Host Name	IP Addresses	User Name	Password
Windows Server	jumphost	192.168.0.5	DEMO\Administrator	Netapp1!
ONTAP cluster-management LIF (cluster1)	cluster1	192.168.0.101	admin (case-sensitive)	Netapp1!

### Task 1: Create FlexVol Volumes

Step	Action
1-1	Start a PuTTY session with <b>cluster1</b> .
1-2	In c1_svm3 on the aggregate n1_hdd_1, create a volume: <pre>volume create -vservers c1_svm3 -volume c1_svm3_user1 -aggregate n1_hdd_1 -size 1gb</pre>
1-3	 You should see a console message stating that the job has been queued. When the job is complete, you see a status of Successful.
1-4	View the volumes: <pre>vol show</pre>
1-5	View detailed information about the new volume: <pre>vol show -vservers c1_svm3 -volume c1_svm3_user1</pre>

Step	Action
1-6	Return to NetApp ONTAP System Manager on <b>cluster1</b> .
1-7	Navigate to the <b>Volumes</b> page.
1-8	<p>On the Volumes page, click <b>Add</b>.</p> 
1-9	<p>In the Add Volume dialog box, specify the following settings:</p> <ul style="list-style-type: none"> <li>• Name: <b>c1_svm3_user2</b></li> <li>• Capacity: <b>1 GiB</b></li> <li>• Storage VM: <b>c1_svm3</b></li> </ul> 
1-10	Click <b>Save</b> .

Step	Action
1-11	<p>Click <b>Filter</b> and enter <b>svm3</b> into the Storage VM textbox.</p> 
1-12	Confirm the successful creation of volume <b>c1_svm3_user2</b> .
1-13	<p>Click <b>c1_svm3_user2</b>, and answer the following question:</p> <p>In which aggregate was the c1_svm3_user2 volume created?</p> <p>_____</p>
1-14	On the Volumes page, click <b>Add</b> .
1-15	<p>In the Add Volume dialog box, specify the following settings:</p> <ul style="list-style-type: none"> <li>• Name: <b>c1_svm3_user3</b></li> <li>• Capacity: <b>1 GiB</b></li> <li>• Storage VM: <b>c1_svm3</b></li> </ul> 
1-16	Click <b>More Options</b> .

Step	Action
1-17	<p>In the Add Volume dialog box, set the Performance Service Level to <b>Value</b>. For the other parameters, accept the default values.</p> 
1-18	Click <b>Save</b> .
1-19	Confirm the successful creation of volume c1_svm3_user3.
1-20	Click <b>c1_svm3_user3</b> .
1-21	<p>Answer the following questions:</p> <ul style="list-style-type: none"> <li>In which aggregate was the c1_svm3_user3 volume created?</li> <li>Why?</li> </ul>

## Task 2: Expand a FlexVol Volume

Step	Action
2-1	Remain in the ONTAP System Manager session on cluster1.
2-2	Go to the <b>Tiers</b> page.
2-3	Observe the amount of space that is available on each aggregate.

Step	Action																																																
2-4	<div><div><div></div><div>i</div></div><div>Your capacity can vary depending on your lab equipment configuration.</div></div>																																																
2-5	<div><div>Navigate to the list of volumes on c1_svm3.</div><div><div><div>Volumes</div><div><div><div>+ Add</div><div>More</div></div><div><div>Search</div><div>Download</div><div>Show / Hide</div><div>Filter</div></div></div><table><thead><tr><th><input type="checkbox"/></th><th>Name</th><th>Storage VM</th><th>Status</th><th>Capacity</th><th></th></tr></thead><tbody><tr><td></td><td><input type="text"/></td><td><input type="text"/></td><td><input type="text"/></td><td><input type="text"/></td><td><input type="text"/></td></tr><tr><td><input checked="" type="checkbox"/></td><td>c1_svm3_root</td><td>c1_svm3</td><td>Online</td><td>20 MiB 1.35 MiB used 17.6 MiB available</td><td></td></tr><tr><td><input checked="" type="checkbox"/></td><td>c1_svm3_user1</td><td>c1_svm3</td><td>Online</td><td>1 GiB 264 KiB used 973 MiB available</td><td></td></tr><tr><td><input checked="" type="checkbox"/></td><td>c1_svm3_user2</td><td>c1_svm3</td><td>Online</td><td>1.05 GiB 264 KiB used 1 GiB available</td><td></td></tr><tr><td><input checked="" type="checkbox"/></td><td>c1_svm3_user3</td><td>c1_svm3</td><td>Online</td><td>1.05 GiB 264 KiB used 1 GiB available</td><td></td></tr><tr><td><input checked="" type="checkbox"/></td><td>c1_svm3_vol1</td><td>c1_svm3</td><td>Online</td><td>1 GiB 1.47 MiB used 971 MiB available</td><td></td></tr><tr><td><input checked="" type="checkbox"/></td><td>c1_svm3_vol2</td><td>c1_svm3</td><td>Online</td><td>1 GiB 740 KiB used 972 MiB available</td><td></td></tr></tbody></table></div></div></div>	<input type="checkbox"/>	Name	Storage VM	Status	Capacity			<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input checked="" type="checkbox"/>	c1_svm3_root	c1_svm3	Online	20 MiB 1.35 MiB used 17.6 MiB available		<input checked="" type="checkbox"/>	c1_svm3_user1	c1_svm3	Online	1 GiB 264 KiB used 973 MiB available		<input checked="" type="checkbox"/>	c1_svm3_user2	c1_svm3	Online	1.05 GiB 264 KiB used 1 GiB available		<input checked="" type="checkbox"/>	c1_svm3_user3	c1_svm3	Online	1.05 GiB 264 KiB used 1 GiB available		<input checked="" type="checkbox"/>	c1_svm3_vol1	c1_svm3	Online	1 GiB 1.47 MiB used 971 MiB available		<input checked="" type="checkbox"/>	c1_svm3_vol2	c1_svm3	Online	1 GiB 740 KiB used 972 MiB available	
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2-6	<div><div>Click Search.</div><div><div><div>Volumes</div><div><div><div>+ Add</div><div>More</div></div><div><div>Search</div><div>Download</div><div>Show / Hide</div><div>Filter</div></div></div><table><thead><tr><th><input type="checkbox"/></th><th>Name</th><th>Storage VM</th><th>Status</th><th>Capacity</th><th></th></tr></thead><tbody><tr><td></td><td><input type="text"/></td><td><input type="text"/></td><td><input type="text"/></td><td><input type="text"/></td><td><input type="text"/></td></tr><tr><td><input checked="" type="checkbox"/></td><td>c1_svm3_root</td><td>c1_svm3</td><td>Online</td><td>20 MiB 1.35 MiB used 17.6 MiB available</td><td></td></tr><tr><td><input checked="" type="checkbox"/></td><td>c1_svm3_user1</td><td>c1_svm3</td><td>Online</td><td>1 GiB 264 KiB used 973 MiB available</td><td></td></tr></tbody></table></div></div></div>	<input type="checkbox"/>	Name	Storage VM	Status	Capacity			<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input checked="" type="checkbox"/>	c1_svm3_root	c1_svm3	Online	20 MiB 1.35 MiB used 17.6 MiB available		<input checked="" type="checkbox"/>	c1_svm3_user1	c1_svm3	Online	1 GiB 264 KiB used 973 MiB available																									
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2-7	<div><div>Enter vol2 into the search textbox.</div><div><div><div>Volumes</div><div><div><div>+ Add</div><div>More</div></div><div><div>vol2</div><div>Download</div><div>Show / Hide</div><div>Filter</div></div></div><table><thead><tr><th><input type="checkbox"/></th><th>Name</th><th>Storage VM</th><th>Status</th><th>Capacity</th><th></th></tr></thead><tbody><tr><td></td><td><input type="text"/></td><td><input type="text"/></td><td><input type="text"/></td><td><input type="text"/></td><td><input type="text"/></td></tr><tr><td><input checked="" type="checkbox"/></td><td>c1_svm3_vol2</td><td>c1_svm3</td><td>Online</td><td>1 GiB 740 KiB used 972 MiB available</td><td></td></tr></tbody></table></div></div></div>	<input type="checkbox"/>	Name	Storage VM	Status	Capacity			<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input checked="" type="checkbox"/>	c1_svm3_vol2	c1_svm3	Online	1 GiB 740 KiB used 972 MiB available																															
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2-8	<div><div>Position your cursor over the c1_svm3_vol2 volume name until the More menu button appears.</div></div>																																																

Step

Action

2-9

Click **More**, and then select **Edit**.

Volumes

+ Add

More

vol2

Download

Show / Hide

Filter

<input type="checkbox"/>	Name	Storage VM	Status	Capacity	IOPS	Latency (ms)	Throughput (M)
<input type="checkbox"/>	<div><div>Q</div><div></div></div>	<div><div>Q</div><div>svm3</div></div>	(All) <div>▼</div>	>	>	>	>
<div><div>▼</div><div>c1_svm3_vol2</div><div><div><div>Edit</div><div>Resize</div><div>Delete</div><div>Clone</div><div>Take Offline</div></div><div><div>Volume</div><div>Cloud Tier Settings</div><div>Export Policy</div><div>Mount Path</div></div></div></div>	c1_svm3	<div><div>✔ Online</div><div><div>496 KiB used</div><div>972 MiB available</div><div>1 GiB</div></div></div>	0	0			

2-10

In the Edit Volume dialog box, increase the volume capacity to **3 GB**.

Edit Volume

×

NAME

c1\_svm3\_vol2

Storage and Optimization

CAPACITY

3

GiB

EXISTING DATA SPACE

972.8 MiB

☐ Enable thin provisioning

☐ Resize automatically

☒ Enable fractional reserve (100%)

☐ Enable quota

☐ Enforce performance limits


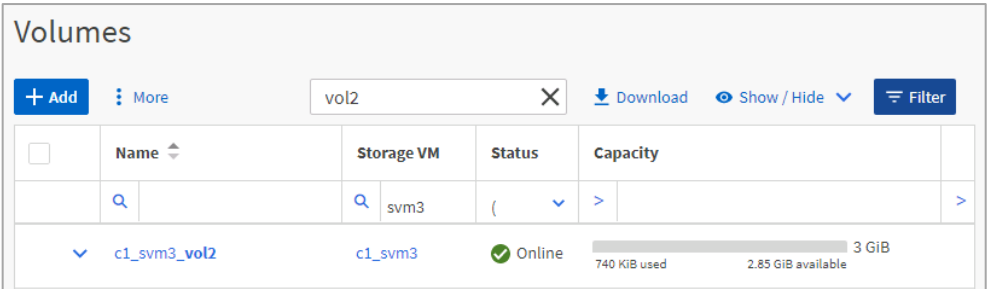
SECURITY TYPE

UNIX

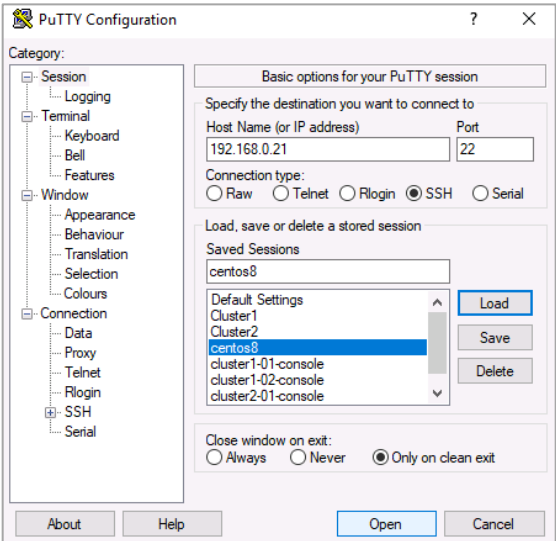
▼




UNIX PERMISSIONS

	<input checked="" type="checkbox"/> Read	<input type="checkbox"/> Write	<input checked="" type="checkbox"/> Execute
OWNER	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
GROUP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
OTHERS	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

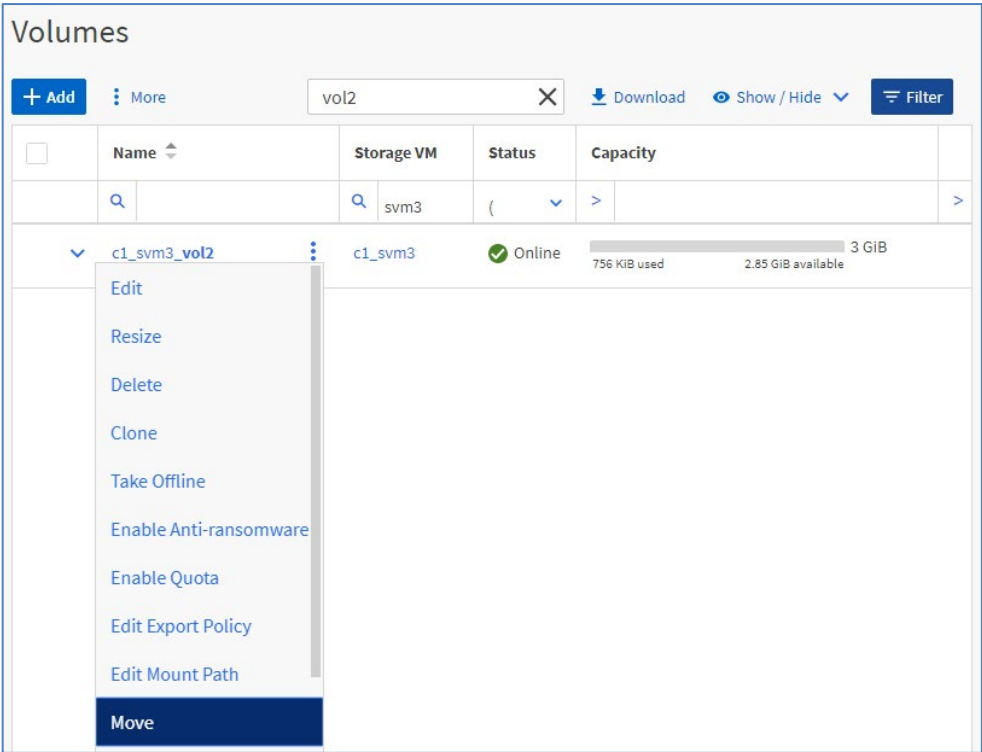

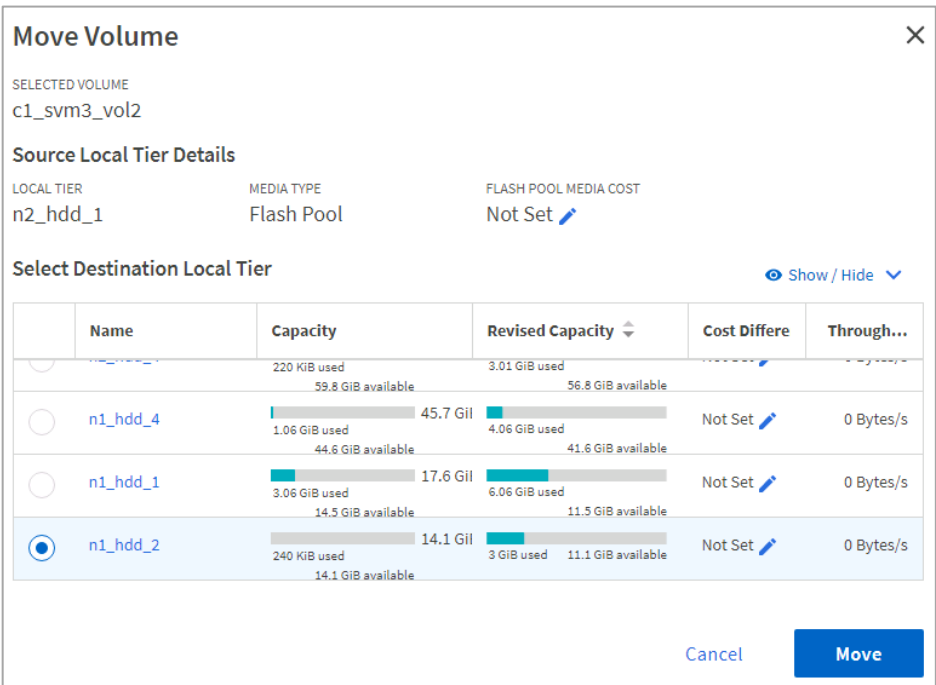
Step	Action
2-11	<p>Set the Unix permissions on the volume so that all users can read and write data.</p> 
2-12	<p>Leave all the other parameters set to their default values and click <b>Save</b>.</p>
2-13	<p>Verify that the new capacity of the volume is 3GB.</p> 

## Task 3: Move a FlexVol Volume

Step	Action
3-1	<p>Open a PuTTY session with your Linux host, which is named <b>centos8</b>.</p> 

Step	Action
3-2	<p>From PuTTY, log in to your Linux system:</p> <ul style="list-style-type: none"> <li>User name: <b>root</b></li> <li>Password: <b>Netapp1!</b></li> </ul>
3-3	 You might experience a delay of about 15 seconds. You can open multiple sessions of PuTTY by right-clicking the PuTTY icon in the taskbar.
3-4	<p>Mount the c1_svm3 namespace to a mount point directory on the Linux client:</p> <pre>mkdir /mnt/svm3</pre> <pre>mount 192.168.0.62:/ /mnt/svm3</pre>
3-5	 You learn about export policies and NFS mounts in Module 7.
3-6	<p>Navigate to the c1_svm3_vol2 volume:</p> <pre>cd /mnt/svm3/vol2</pre>
3-7	<p>Confirm the available space in the exported volume:</p> <pre>df -h .</pre> <p>Sample output:</p> <pre>[root@centos8 vol2]# df -h . Filesystem      Size  Used Avail Use% Mounted on 192.168.0.62:/vol2  2.9G  512K  2.9G   1% /mnt/svm3/vol2</pre> <p><b>Note:</b> The period tells the Linux disk free command to display information about only the directory in which you are currently located.</p>
3-8	<p>Write a 2GB file into the c1_svm3_vol2:</p> <pre>dd if=/dev/zero of=hugefile bs=4K count=500000</pre>  You type a 5 followed by five zeroes. Because the operation can take several minutes, you should continue the next step while the operation runs.



Step	Action
3-9	<p>In System Manager, on the c1_svm3 volume list, position your cursor over the <b>c1_svm3_vol2</b> volume name, click <b>More</b>, and then select <b>Move</b>. The Move Volume dialog box appears.</p> 
3-10	<p> In subsequent steps, you move the volume to another aggregate across the cluster interconnect. Moving the volume while the file hugefile is being written does not interrupt the write operation.</p>
3-11	<p>In the Destination Local Tier section, select <b>n1_hdd_2</b>, and then click <b>Move</b>.</p> 

Step

Action

3-12

Confirm your decision by clicking **Move** again.

Move Volume

SELECTED VOLUME

c1\_svm3\_vol2

Source Local Tier Details

LOCAL TIER

n2\_hdd\_1

MEDIA TYPE

Flash Pool

FLASH POOL MEDIA COST

Not Set

Name	Issue
c1_svm3_vol2	<div><div></div><div>The caching policy associated with the volume being moved into the local tier cannot be preserved. The destination is not a Flash Pool. The caching policy will be disabled in the destination.</div></div>

Select Destination Local Tier

Show / Hide

	Name	Capacity	Revised Capacity	Cost Differe	Through...
<div></div>	n1_hdd_2	<div><div>220 KiB used</div><div>59.8 GiB available</div></div>	<div><div>3.01 GiB used</div><div>56.8 GiB available</div></div>	<div>Not Set</div>	0 Bytes/s
<div></div>	n1_hdd_4	<div><div>1.06 GiB used</div><div>44.6 GiB available</div></div>	<div><div>4.06 GiB used</div><div>41.6 GiB available</div></div>	<div>Not Set</div>	0 Bytes/s
<div></div>	n1_hdd_1	<div><div>3.06 GiB used</div><div>14.5 GiB available</div></div>	<div><div>6.06 GiB used</div><div>11.5 GiB available</div></div>	<div>Not Set</div>	0 Bytes/s
<div></div>	n1_hdd_2	<div><div>240 KiB used</div><div>14.1 GiB available</div></div>	<div><div>3 GiB used</div><div>11.1 GiB available</div></div>	<div>Not Set</div>	0 Bytes/s

Cancel

Move

3-13

In the Volumes page, expand the **c1\_svm3\_vol2** entry and observe the status.

Volumes

+ Add

More

vol2

Download

Show / Hide

Filter

<div></div>	Name	Storage VM	Status	Capacity
<div></div>	<div>Q</div>	<div>Q</div> svm3	<div>(</div>	<div>&gt;</div>
<div></div>	c1_svm3_vol2	c1_svm3	<div><div></div>Online</div>	<div>3 GiB</div> <div><div>1.04 GiB used</div><div>1.81 GiB available</div></div>

The volume is being moved.

14%

STATUS

Online

EXPORT POLICY

default

TYPE

Read/Write

STORAGE EFFICIENCY

Disabled

STYLE

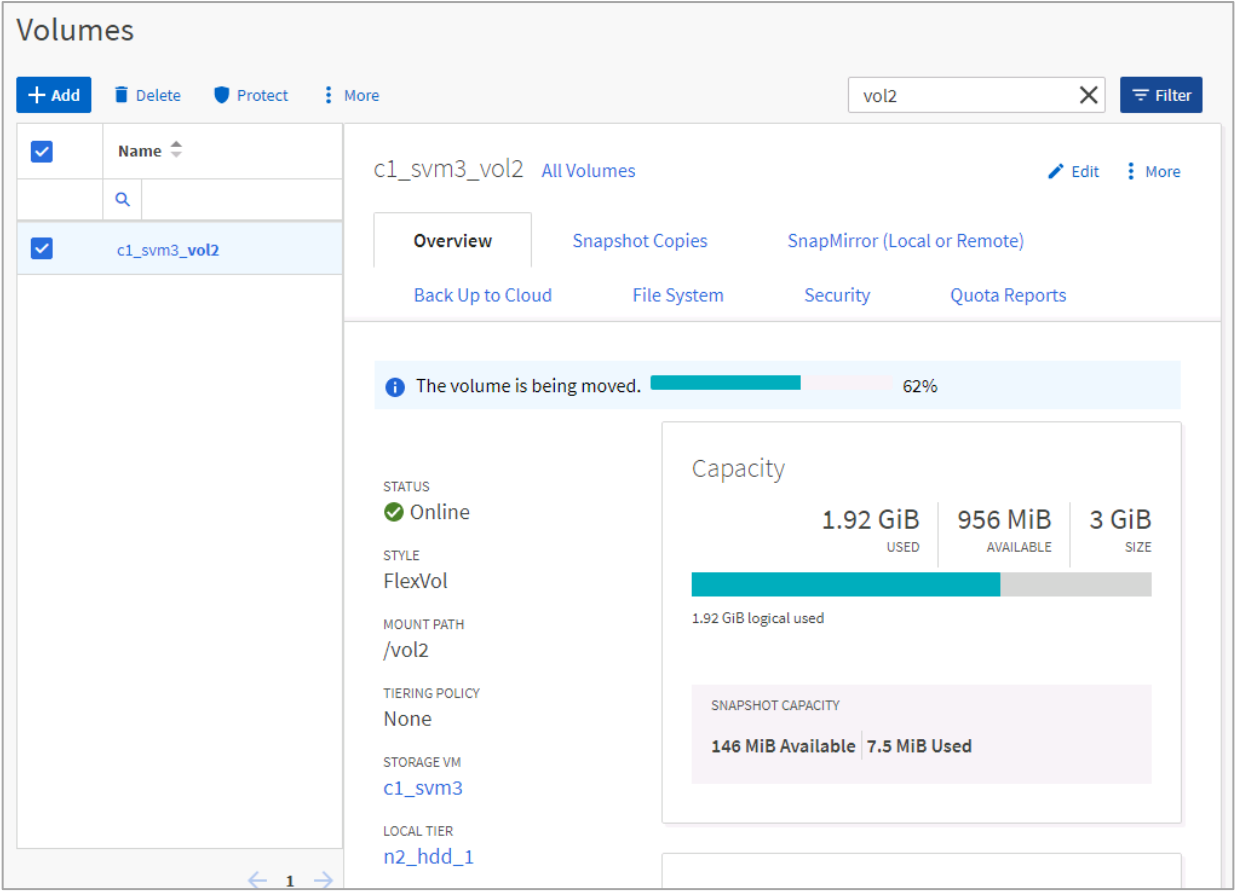
FlexVol

QUOTA

Off

MOUNT PATH

/vol2

Step	Action
3-14	<p>Click <b>c1_svm3_vol2</b> to display the volume details and monitor the progress of the volume move operation.</p> 
3-15	<p>Go back to PuTTY and check the Linux system to confirm the completion of the write operation and the space that is used in the volume:</p> <pre>df -h /mnt/svm3/vol2</pre> <p>Sample output:</p> <pre>[root@centos8 vol2]# df -h /mnt/svm3/vol2 Filesystem      Size  Used Avail Use% Mounted on 192.168.0.62:/vol2  2.9G  2.0G  957M  68% /mnt/svm3/vol2</pre>
3-16	<p>Periodically monitor the progress of the move operation until it finishes. The instructor might start teaching the next module while the volume move runs.</p>

Step	Action						
3-17	<div>When the move is complete (in approximately 5 minutes), verify that the volume is now on n1_hdd_2.</div> <div><div><div><div>c1_svm3_vol2All VolumesEditMore</div><div>OverviewSnapshot CopiesSnapMirror (Local or Remote)Back Up to CloudFile SystemSecurityQuota Reports</div><div><div><div>STATUS Online</div><div>STYLE FlexVol</div><div>MOUNT PATH /vol2</div><div>TIERING POLICY None</div><div>STORAGE VM c1_svm3</div><div>LOCAL TIER n1_hdd_2</div></div><div><div>Capacity</div><table><tr><td>1.92 GiB</td><td>955 MiB</td><td>3 GiB</td></tr><tr><td>USED</td><td>AVAILABLE</td><td>SIZE</td></tr></table><div>1.92 GiB logical used</div><div><div>SNAPSHOT CAPACITY</div><div>146 MiB Available7.35 MiB Used</div></div></div></div></div></div></div>	1.92 GiB	955 MiB	3 GiB	USED	AVAILABLE	SIZE
1.92 GiB	955 MiB	3 GiB					
USED	AVAILABLE	SIZE					

End of exercise