

Basics of ONTAP 9 Cluster Mode administration

LAB GUIDE V3.3 (ONTAP 9.4)

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Lab Objectives

This lab shows how to do basic tasks to quickly and easily set up a FAS controller to allow quick start with NetApp disk array to hosting a CIFS share, NFS export, and iSCSI LUN. The lab also demonstrates the unique advantage of NetApp disk arrays – snapshots and theirs integration with server operating system and/or applications.

This lab's environment includes Windows and Linux hosts suitable for establishing CIFS, NFS, and iSCSI client connections but this lab guide does not include any instructions for configuring those clients to work with the FAS disk array.

Usernames and passwords

System	Username	Password
Windows 2008 (DC)	Administrator	passW0rd
CentOS	root	passW0rd
NetApp Simbox	root	passW0rd
Domain user NetApp	netapp	Netap123





What is not possible to do on this environment.

Simulate ONTAP 9 supports most ONTAP functionality and the majority of its features. However, Simulate ONTAP has some functional limitations and does not support some Data ONTAP features because of the virtualization architecture.

Simulate ONTAP has the following limitations:

- Non-Volatile RAM (NVRAM) is simulated and is not persistent.
- Data loss might occur after power cycles. You must shut down the simulator properly to avoid data loss.
- You can have a maximum of four simulated disk shelves with 14 disk drives per shelf, for a total of 56 drives per simulator.
- Each simulated drive is limited to 9 GB. Note: The simulator image is preconfigured with 28 x 1 GB disks; 14 each on simulated disk shelves 0 and 1 and 14 simulated 520 MB SSD drives in shelve 2.
- You can create 64-bit aggregates, but they are limited to a maximum of 9 GB per simulated disk drive.
- Simulate ONTAP is not suitable for applications that require high performance or heavy I/O.

Simulate ONTAP does not support the following features:

- High Availability (CFO/SFO)
- Fibre channel and SAN connectivity
- CFE, BIOS, shelf FW, and so on





LAB 1: Overview

TASK1: Put a "P" or "L" beside each item in the following list of Data ONTAP cluster-mode concepts to indicate whether it is physical or logical.

- ____ node
- ____ disk
- _____ aggregate
- _____ virtual server (Vserver)
- ____ cluster
- ____ network port
- _____ flexible volume
- _____ Snapshot copy
- ____ SnapMirror copy
- _____ host bus adapter (HBA)
- ____ LIF

TASK2: Put an "N," "A," or "D" (or a combination of those letters) beside each item to indicate whether it has a node Vserver, administration Vserver, or data Vserver scope.

- _____ disk
- ____ namespace
- ____ data LIF
- ____ network port
- _____ cluster management LIF
- flexible volume
- _____ aggregate
- ____ Snapshot copy
- _____ host bus adapter (HBA)

LUN

END OF EXERCISE



LAB 2: Installation and configuration

TASK 1: Creating a two-node cluster

Aim of this exercise is to create a cluster, configure the first node in the cluster, and then add a second node to the cluster.

Step 1.

From the Windows machine in your lab kit, use PuTTY to open a telnet session to "Console node1" to the first storage controller in your lab kit and verify that the preconfigured entry is correct. (We have not configured IP addresses yet so we cannot use IP address).

RuTTY Configuration	×
Category:	
 Session Logging Terminal Keyboard Bell Features Window Appearance Behaviour Translation Selection Colours Connection Proxy Telnet Rlogin SSH Serial 	Basic options for your PuTTY session Specify the destination you want to connect to Host Name (or IP address) Port 22 Connection type: Raw Ielnet Raw Ielnet Raw Ielnet Raw Ielnet Host Segial Load, save or delete a stored session Saved Sessions Default Settings Linux Node1 console Node2 console Delete Close window on exit: Always Never Only on clean exit
About	<u>O</u> pen <u>C</u> ancel

Step 2.

When node boots, then the Cluster Setup wizard starts on the console.

Welcome to the cluster setup wizard. You can enter the following commands at any time: "help" or "?" - if you want to have a question clarified, "back" - if you want to change previously answered questions, and "exit" or "quit" - if you want to quit the cluster setup wizard.



Any changes you made before quitting will be saved.

You can return to cluster setup at any time by typing "cluster setup". To accept a default or omit a question, do not enter a value.

This system will send event messages and periodic reports to NetApp Technical Support. To disable this feature, enter autosupport modify -support disable within 24 hours.

Enabling AutoSupport can significantly speed problem determination and resolution should a problem occur on your system. For further information on AutoSupport, see: http://support.netapp.com/autosupport/

Type yes to confirm and continue {yes}:yes

Enter the node management interface port [e0c]: e0c Enter the node management interface IP address: 10.34.x1.31 Enter the node management interface netmask: 255.255.255.0 Enter the node management interface default gateway: 10.34.x1.1 A node management interface on port e0c with IP address 10.34.x1.31 has been created.

Use your web browser to complete cluster setup by accessing https://10.34.x1.31

Otherwise, press Enter to complete cluster setup using the command line interface: <Enter>

Step 3.

Do you want to create a new cluster or join an existing cluster? {create, join}: **NOTE**: If you make a mistake during cluster setup, press **Ctrl-C** to interrupt the wizard. Log on with admin username and restart the wizard by re-entering *cluster setup* at the cluster shell prompt.

Step 4.

At the prompt, enter create to create a new cluster.

Do you want to create a new cluster or join an existing cluster? {create, join}: create

Step 5.

When prompted about using the node as a single node cluster, reply no because this will be a multi-node cluster.

Do you intend for this node to be used as a single node cluster? {yes, no} [no]: no

Step 6.

Enter yes to accept the default values for cluster network configuration.

System Defaults:

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Private cluster network ports [e0a, e0b].

Cluster port MTU values will be set to 1500.

Cluster interface IP addresses will be automatically generated.

Do you want to use these defaults? {yes, no} [yes]: yes

Step 7.

Enter the cluster administrator's (username "admin") password: **passW0rd** Retype the password: **passW0rd**

It can take several minutes to create cluster interfaces...

Step 8.

Name the cluster **cluster1**.

Step 1 of 5: Create a Cluster

You can type "back", "exit", or "help" at any question.

Enter the cluster name: cluster1

Step 9.

Creating cluster cluster1

Starting cluster support services.....

Cluster cluster1 has been created.

Step 10.

Do not add additional license keys at this time but press Enter to continue.

Step 2 of 5: Add Feature License Keys

You can type "back", "exit", or "help" at any question.

Enter an additional license key []:

Step 11.

Configure the cluster management resources:

a. Type e0c as the port to host the cluster management interface.

b. Enter the IP address, netmask, and default gateway.

Insert the IP addresses depend on your POD number.

Step 3 of 5: Set Up a Vserver for Cluster Administration

You can type "back", "exit", or "help" at any question.

Enter the cluster management interface port [e0d]: e0c

Enter the cluster management interface IP address: 10.34.x1.21

Enter the cluster management interface netmask: 255.255.255.0



Enter the cluster management interface default gateway: **10.34.x1.1**

A cluster management interface on port e0c with IP address 10.34.x1.21 has been created. You can use this address to connect to and manage the cluster.

Step 12.

Enter the domain name and IP address of the DNS server.

Enter the DNS domain names: ntap.lab1

Enter the name server IP addresses: 10.34.x1.10

DNS lookup for the admin Vserver will use the ntap.lab1 domain.

Step 4 of 5: Configure Storage Failover (SFO)

You can type "back", "exit", or "help" at any question.

SFO will not be enabled on a non-HA system.

Step 5 of 5: Set Up the Node

You can type "back", "exit", or "help" at any question.

Where is the controller located []: Bratislava/Slovakia

Step 13.

Cluster "cluster1" has been created.

To complete cluster setup, you must join each additional node to the cluster by running "system node show-discovered" and "cluster add-node" from a node in the cluster.

To complete system configuration, you can use either OnCommand System Manager or the Data ONTAP command-line interface.

To access OnCommand System Manager, point your web browser to the cluster management IP address (https://10.34.x1.21).

To access the command-line interface, connect to the cluster management *IP* address (for example, ssh admin@10.34.x1.21).

Step 14.

If the completion of the cluster setup wizard logs your management session off, log back in as *admin*.

Step 15.

To check the status of your new cluster, enter the cluster show command at the console.

cluster1::> cluster show

Node Health Eligibility



Trust the Strong

cluster1-01 true true

Step 16.

Disable autosupport

cluster1::> autosupport modify -support disable

Step 17.

Log off from terminal (telnet) session and log on trough SSH session to cluster management.



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TASK 2: Add a second node to cluster

Step 1.

From the Windows machine in your lab kit, use PuTTY to open a telnet session to the second storage controller in your lab kit. It is preconfigured in PuTTY as Console node2.

Step 2.

Follow the cluster setup wizard.

Welcome to the cluster setup wizard.

You can enter the following commands at any time: "help" or "?" - if you want to have a question clarified, "back" - if you want to change previously answered questions, and "exit" or "quit" - if you want to quit the cluster setup wizard. Any changes you made before quitting will be saved.

You can return to cluster setup at any time by typing "cluster setup". To accept a default or omit a question, do not enter a value.

This system will send event messages and periodic reports to NetApp Technical Support. To disable this feature, enter autosupport modify -support disable within 24 hours.

Enabling AutoSupport can significantly speed problem determination and resolution should a problem occur on your system. For further information on AutoSupport, see: http://support.netapp.com/autosupport/

Type yes to confirm and continue {yes}: yes

Step 3.

Configure node management:

a. Type **e0c** as the default port to host the node management interface.

b. Enter the IP address, netmask, and default gateway.

c. Press Enter to leave AutoSupport enabled.

Enter the node management interface port [e0c]: e0c

Enter the node management interface IP address: 10.34.x1.32

Enter the node management interface netmask: 255.255.255.0

Enter the node management interface default gateway: 10.34.x1.1

A node management interface on port eOc with IP address 10.34.x1.32 has been created.



Use your web browser to complete cluster setup by accessing https://10.34.x1.32 Otherwise, press Enter to complete cluster setup using the command line interface: <Enter> Step 4. Do you want to create a new cluster or join an existing cluster? {create, join}: join System Defaults: Private cluster network ports [e0a,e0b]. Cluster port MTU values will be set to 1500. Cluster interface IP addresses will be automatically generated. Do you want to use these defaults? {yes, no} [yes]: yes It can take several minutes to create cluster interfaces... Step 1 of 3: Join an Existing Cluster You can type "back", "exit", or "help" at any question. Step 5. Enter the IP address of an interface on the private cluster network from the cluster you want to join: Step 6. First we need to identify private cluster network from the cluster we created. Switch to window with SSH session to cluster management. Enter command: cluster1::> network interface show Logical Status Network Current Current Is Vserver Interface Admin/Oper Address/Mask Node Port Home _____ Cluster cluster1-01_clus1 up/up 169.254.yyy.yy/16 cluster1-01 e0a true cluster1-01_clus2 up/up 169.254.zzz.zz/16 cluster1-01 e0b true cluster1 cluster1-01_mgmt1 up/up 10.34.x1.31/24 cluster1-01 e0c true cluster_mgmt up/up 10.34.x1.21/24 cluster1-01 e0c true

4 entries were displayed.





Step 7.

Enter cluster1-01_clus1 ip address to join the existing cluster. Enter the IP address of an interface on the private cluster network from the cluster you want to join: 169.254.yyy.yy Joining cluster at address 169.254.yyy.yy Starting cluster support services This node has joined the cluster cluster1. Step 2 of 3: Configure Storage Failover (SFO) You can type "back", "exit", or "help" at any question. SFO will not be enabled on a non-HA system. Step 3 of 3: Set Up the Node You can type "back", "exit", or "help" at any question. This node has been joined to cluster "cluster1". To complete cluster setup, you must join each additional node to the cluster by running "system node show-discovered" and "cluster add-node" from a node in the cluster. To complete system configuration, you can use either OnCommand System Manager or the Data ONTAP command-line interface. To access OnCommand System Manager, point your web browser to the cluster management IP address (https://10.34.x1.21). To access the command-line interface, connect to the cluster management IP address (for example, ssh admin@10.34.x1.21). login: Step 8. Log off from terminal (telnet) session.

Step 9.

To check the status of your new cluster, enter the cluster show command at the CLI. *cluster1::> cluster show*

Health	Eligibility
true	true
true	true
	Health true true



2 entries were displayed.

Step 9.

Type **network interface show** and observe the cluster interfaces on both nodes and their associated IPs, noticing that the IP addresses are in a private network range.

cluster1::> network interface show

TASK 3: Preserve free space on vol0 volumes

Step 1.

This step is necessary only when running a virtualized cluster. The virtual disks attached to each node are small compared to real hard disks, resulting in unrealistic sizes for aggr0 and vol0.

Step 2.

Turn off snapshots on vol0 on both nodes.

cluster1::> system node run -node cluster1-01 vol options vol0 nosnap on

cluster1::> system node run -node cluster1-02 vol options vol0 nosnap on

Step 3.

Set snap reserve on vol0 to 0%.

cluster1::> system node run -node cluster1-01 snap reserve vol0 0

cluster1::> system node run -node cluster1-02 snap reserve vol0 0

Step 4.

From the command line, show the aggregates:

cluster1::> stor aggr show

You should see only two aggregates, an aggr0 owned by each of the two nodes in the cluster.

NOTE: The #Vols column shows that each aggregate contains one volume. Those are the vol0 volumes for each node. You cannot move them from their respective aggregates as you will be able to move the volumes that you will create later.

Step 5.

Rename the aggr0 aggregates so that they are more easily identifiable.

cluster1::> aggr rename -aggregate aggr0_cluster1_01 -newname aggr0_n1

cluster1::> aggr rename -aggregate aggr0_cluster1_02 -newname aggr0_n2

Step 6.

Verify the new names.

cluster1::> stor aggr show



The aggr0 aggregates have only one data disk each. The size of the data disk is 1GB.

Step 7.

Next steps till end of the exercise are specific only for the simulator environment. Add 3 data disks to each aggr0 aggregate.

cluster1::> aggr add-disk -aggregate aggr0_n1 -diskcount 3 cluster1::> aggr add-disk -aggregate aggr0_n2 -diskcount 3

Step 8.

Increase the size of vol0 to 3GB.

cluster1::> system node run -node cluster1-01 vol size vol0 +2g

cluster1::> system node run -node cluster1-02 vol size vol0 +2g

Step 9.

Verify the vol0 settings.

cluster1::> volume show -vserver cluster1-01 -volume vol0
cluster1::> volume show -vserver cluster1-02 -volume vol0

Step 10.

Assign all unassigned disk drives cluster1::> storage disk show -container-type unassigned

•••

cluster1::> storage disk assign -all -node cluster1-01 cluster1::> storage disk assign -all -node cluster1-02 cluster1::> storage disk show -container-type unassigned There are no entries matching your query.





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LAB 3: Cluster administration basics

In this exercise, you use the CLI and NetApp OnCommand GUI to explore how to manage a cluster. You also familiarize yourself with NetApp licensing.

Objectives of this exercise

By the end of this exercise, you should be able to:

- Connect to the command shell and explore the command hierarchy
- Review command options
- Compare privilege levels
- Use partial commands and complete commands with the Tab key
- Install NetApp OnCommand GUI
- Configure NetApp OnCommand GUI for your cluster
- Manage feature licenses

TASK 1. Connect to the command shell and explore the command hierarchy

Step 1.

From one of your node management sessions, enter *network interface show* and find the IP address of your cluster management interface.

cluster1::>	network	interface	show
		./	

	Logical	Status	Network	Current	Current	Is
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port	Home
clusterl						
	cluster_mgm	nt up/up	10.34.x1.21/24	cluster1-01	eOc	true
cluster1-01						
	clus1	up/up	169.254.12.222/16	cluster1-01	e0a	true
	clus2	up/up	169.254.131.174/16	cluster1-01	e0b	true
	mgmt1	up/up	10.34.x1.31/24	cluster1-01	e0d	true
cluster1-02						
	clus1	up/up	169.254.245.33/16	cluster1-02	e0a	true
	clus2	up/up	169.254.95.73/16	cluster1-02	e0b	true
	mgmt1	up/up	10.34.x1.32/24	cluster1-02	e0d	true
7 entries	were displ	ayed.				



Step 2.

In PuTTY, configure a new Secure Shell (SSH) session for the cluster management interface that you created in the previous exercise, and click Save to preserve the entry.

RuTTY Configuration	×
Putty Configuration Category: Generation Category: Generation Cogging Generation Cogging Generation Cogging Generation Cogging Generation Generation Generation Generation Generation	Basic options for your PuTTY session Specify the destination you want to connect to Host Name (or IP address) Port 10.34.11.21 22
 → Features → Window → Appearance → Behaviour → Translation → Selection → Colours → Connection → Data → Proxy → Telnet → Rlogin ➡ SSH → Serial 	Connection type: Image: Connection type: Image: Stression Cad, save or delete a stored session Saved Sessions Cluster1-mgmt Image: Cluster1-mgmt Default Settings Image: Cluster1-mgmt Default Settings Image: Cluster1-mgmt Console node1 Save Console node2 Image: Cluster1-mgmt Cluster1-02-mgmt Image: Cluster1-mgmt Close window on exit: Image: Close window on exit: Close window on exit: Image: Cluster
About	<u>O</u> pen <u>C</u> ancel

Step 3.

Using PuTTY, log in to the cluster management interface as admin, and compare the interface and the output of some command shell commands on both the cluster management session and a node management session. Are there any differences?

Step 4.

Close any open node management sessions by typing **exit** then pressing **Enter**, but leave the cluster management session open.

Step 5.

Type ? to review the commands and command directories at the top level of the command

hierarchy.

cluster1::>?

NOTE: You don't need to press Enter after typing a question mark.



Step 6.

Review the objects in the storage command directory.

cluster1::> storage ?

Step 7.

From the command shell, review the top-level command directories.

cluster1::>?

NOTE: An entry that ends with a "right angle bracket" (>) symbol is a command directory rather than a command. The structure resembles a UNIX or a DOS shell, in that you cannot execute command directory names as you do commands, but you can navigate to them. Command directories can contain subdirectories, commands, or both. Command directories provide contextual and hierarchical grouping of commands, so the command structure is not flat.

Step 8.

Go into the cluster directory.

cluster1::> cluster <Enter>

cluster1::cluster>

NOTE: The question mark can be used at any level of the command hierarchy to see what commands and directories are available within that context. Notice that the command shell prompt changes to indicate which context you're in.

Step 9.

Look at the available commands and directories at this level.

cluster1::cluster>?

Step 10.

Go into the **statistics** directory.

cluster1::cluster> statistics

cluster1::cluster statistics>

You're now in the cluster statistics context.

Step 11.

See what's available at this level.

cluster1::cluster statistics>?

Step 12.

Go back (up) one level by typing two periods and then pressing the Enter key.

cluster1::cluster statistics>...

cluster1::cluster>





Step 13.

Notice that you're back at the cluster level.

NOTE: From any level, you can enter *top* to go directly to the top of the entire command hierarchy.

Step 14.

Examine the manual page for the cluster command directory.

cluster1::cluster> man cluster

Step 15.

Enter **q** to exit the manual page.

Step 16.

Examine the manual page for the cluster modify directory and compare the output with the output of the man cluster command in the previous step.

cluster1::cluster> man cluster modify

TASK 2: Review command options

Step 1.

Go to the storage aggregate level within the command shell.

cluster1::> storage aggr

Step 2.

From the storage aggregate level, run this command:

cluster1::storage aggregate> modify ?

NOTE: Square brackets ([]) indicate optional command elements. The output of this command shows the parameter –aggregate with brackets around the parameter name, but not around the parameter value. This means that the parameter name is optional, but the value is required. You can enter the aggregate name as a positional parameter rather than a named parameter, to save keystrokes. All other parameters and values are optional, but brackets surround both parameter and value because, if you provide one, you must provide the other (the value cannot be specified based on positional).

In this case, the aggregate name is required to determine which aggregate will be modified. Although the other parameters are technically optional, at least one of them should be specified for this command to be meaningful (that is, to actually modify an attribute of this aggregate).

Step 3.

Review the options for the storage aggregate scrub command.

cluster1::storage aggregate> scrub ?



NOTE: As with the modify command, the aggregate name is required, but the parameter name is optional. In addition, the action value is required, but the parameter name (–action) is optional. Two possible forms of the command are:

- storage aggregate scrub –aggregate aggr0 –action start
- storage aggregate scrub aggr0 start

Step 4.

Review the possible keyword values for the -state parameter.

cluster1::storage aggregate> modify -state ?

TASK 3: Compare privilege levels

Step 1.

Look at the volume directory.

cluster1::> volume ?

The default privilege level is admin.

Step 2.

Note the commands that are available in this directory context at this privilege level.

Step 3.

Switch to the *advanced* privilege level.

cluster1::> set -privilege advanced

NOTE: Because *-privilege* is an optional positional parameter of the *set* command, you can also specify the desired privilege level as a positional parameter: *set advanced*.

Step 4.

While you are in the *advanced* privilege level, look again at the *volume* directory.

cluster1::> volume ?

Step 5.

Notice the additional commands that are available.

Each command and directory that is available for non-admin privilege levels has an asterisk (*) in front of its description.

Step 6.

Switch back to the *admin* privilege level.

cluster1::> set admin

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TASK 4: Use partial commands and complete commands with the TAB key

Step 1.

Display the logical interfaces.

cluster1::> network interface show

Step 2.

Try the following command:

cluster1::> net int sho

The command fails because this form of the command is ambiguous. Multiple verbs in this command hierarchy begin with the letters "sho."

Step 3.

Retype the command using the full verb, show.

cluster1::> ne in show

Step 4.

Type the first two letters of the *network* command directory (ne) and press Tab.

If the substring that you type is unambiguous, when you press Tab, the command shell completes the substring.

Step 5.

Continue the command by typing *in* and **Tab** and then *sho* and **Tab**.

The network and interface substrings are completed, but because *sho* is ambiguous within the context, the command shell displays the options for *sho*.

Step 6.

This time, enter ne, Tab, in, Tab, show.

TASK 5: GUI management using web browser

You can directly use supported browsers to access GUI. Just enter cluster management interface IP address to your browser. Open browser and access GUI. Use https://10.34.x1.21

TASK 6: Explore package licensing

Open browser window and enter cluster management ip address (https://10.34.x1.21)

Step 1.

Within the NetApp OnCommand System Manager page, select **Configurations > Licenses**.

Step 2.

Verify that the Base package is licensed.

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15	OnCommand System Manager						
					Тур		
		≡	Licenses				
H	Dashboard		Packages Details				
-	Applications & Tiers 🔸	olications & Tiers 🕨	😹 Add 🗙 Delete 😋 Refresh				
			Package	Entitlement Risk 🔺	r Description		
19	Storage	+	(DEPRECATED)-Cluster Base License	-NA-	Installed on a cluster		
	Network		Trusted Platform Module License	-NA-	No License Available		
	inclusion.	,	FabricPool License	-NA-	No License Available		
	Protection	•	NFS License		No License Available		
	Events & Jobs	•	CIPS License		No License Available		
20	Configuration		ISCSI License		No License Available		
-0			FCP License		No License Available		

Step 3.

Click Add to begin adding new licenses for the SnapVault feature.

Step 4.

Verify that the Add License Packages dialog appears.

Add License Packages	×
Enter comma separated license keys	
License Files	
Browse to select a file CLicense files are required for features the	choose Files at use capacity based licenses. Know more
	Add

Step 5.

To follow best practices, you should add feature keys for each node in the cluster, so type the SnapVault key for each node.

```
INIIBQKBFDUFZGABGAAAAAAAAAA
SUOYOUNFXMSMUCEZFAAAAAAAAAA
```

Step 6.

Click Add.

Step 7.

Verify that the SnapVault package was correctly identified. These codes are node locked within the cluster.



Add licenses status				×
Status of the newly adde	d licenses	packages is shown l	below.	
Package/License Code	Status	Туре	Cluster/Node	
SnapVault License	× -	Node Locked	cluster1-02	
SnapVault License	× -	Node Locked	cluster1-01	
			Clos	e

Step 8.

Click Close.

Step 9.

To verify that the new package is licensed in the list, click the package to see licensing details in the lower pane.

		Licenses		
Dashboard		Packages Details		
Applications & Tiers		+ Add × Delete C Refresh		
		Package	Entitlement Risk 🔺 🗍 🐺	Description
Storage 🕨	•	(DEPRECATED)-Cluster Base License	-NA-	Installed on a cluster
Network	•	Trusted Platform Module License	-NA-	No License Available
Protection +		FabricPool License	-NA-	No License Available
Franks & John A		SnapVault License	0	No risk
Events & Jobs 🔹		NFS License		No License Available
Configuration	•	CIFS License		No License Available

Step 10.

Switch back to the cluster management SSH PuTTY session and, if necessary, authenticate as *admin*.

Step 11.

Enter this command to view the cluster's serial id:

```
cluster1::> cluster identity show
    Cluster UUID: 4d0c7e7f-8b4a-11e8-a189-0050569fec97
    Cluster Name: cluster1
    Cluster Serial Number: 1-80-000011
    Cluster Location: Bratislava/Slovakia
    Cluster Contact:
```



For this sample output, the serial number is 1-80-000011.

Step 12.

Identify the serial numbers for each system within the cluster.

cluster1::> system node show -fields node, serialnumber

node serialnumber

cluster1-01 4082368511

cluster1-02 4034389062

2 entries were displayed.

Step 13.

Navigate to the license hierarchy.

cluster1::> license

cluster1::system license>

The prompt takes you to the system license command hierarchy.

Step 14.

List the available commands.

```
cluster1::system license> ?
```

add	Add one or more licenses
clean-up	Remove unnecessary licenses
delete	Delete a license
entitlement-risk>	The entitlement-risk directory
show	Display licenses
status>	Display license status

Step 15.

View the currently licensed packages.

cluster1::system license> show

Step 16.

List details about the available license packages.

cluster1::system license> status show

Step 17.

Add the CIFS licenses for both nodes.

```
cluster1::system license> add -license-code
CAYHXPKBFDUFZGABGAAAAAAAAAAAA,MHEYKUNFXMSMUCEZFAAAAAAAAAAAA
```

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License for package "CIFS" and serial number "1-81-00000000000000004082368511" installed successfully.

License for package "CIFS" and serial number "1-81-0000000000000004034389062" installed successfully.

(2 of 2 added successfully)

Step 18.

Verify the new CIFS licenses.

cluster1::system license> show

Step 19.

Add the FC license for a node that is not currently in the cluster.

NOTE: You can add license codes for nodes that do not exist in the cluster. This is often done to "preload" the license for nodes that are going to be added.

```
cluster1::system license> add -license-code
KOBYNDUCCLPKICAAAAAAAAAAAAA
License for package "FCP" and serial number "1-81-
0000000000000000033333" installed successfully.
(1 of 1 added successfully)
Step 20.
```

View the currently licensed packages.

cluster1::system license> show

Step 21.

Type the following command and then press the TAB key:

cluster1::system license> clean-up -<TAB>

-unused -expired -simulate

NOTE: You can select expired or unused licenses to be removed. An unused license is a license that is associated with nodes that don't belong to the cluster.

Step 22.

Verify what will be cleaned up with the *unused* command.

```
Step 23.
```



Clean up unused licenses cluster1::system license> clean-up -unused 1 unused license deleted.

Step 24.

Verify that the FCP license was removed. cluster1::system license> show

Step 25.

Use GUI or the command shell to enter the other licenses required on cluster1.

cluster1_01

FlexClone	WSK'I'AQKBE'DUE'ZGABGAAAAAAAAAAA
iscsi	OUVWXPKBFDUFZGABGAAAAAAAAAA
NFS	QFATWPKBFDUFZGABGAAAAAAAAAA
SnapMirror	KYMEAQKBFDUFZGABGAAAAAAAAAA
SnapRestore	YDPPZPKBFDUFZGABGAAAAAAAAAAA
cluster1_02	
FlexClone	GARJOUNFXMSMUCEZFAAAAAAAAAAA
iscsi	YBCNLUNFXMSMUCEZFAAAAAAAAAAA
NFS	ANGJKUNFXMSMUCEZFAAAAAAAAAAA
SnapMirror	UFTUNUNFXMSMUCEZFAAAAAAAAAAA
SnapRestore	ILVFNUNFXMSMUCEZFAAAAAAAAAAA

END OF EXERCISE



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LAB 4: Architecture

In this exercise, you identify kernel and user-space processes, answer questions about replicated database (RDB) and quorum concepts, and answer questions about vol0 volumes and limitations.

Objectives of this exercise

- By the end of this exercise, you should be able to:
- Identify kernel and user-space processes
- Explain RDB and quorum concepts
- Explain vol0 volumes uses and limitations

TASK 1: Identify kernel and user-space processes

Step 1.

Using the following list of cluster components, show the path of a network-attached storage (NAS) write request by labeling each component with a number, starting with 1 for the initiator of a write request and proceeding in order to the destination of the request.

__Cluster session manager (CSM)

____D-blade

- ____Data network port
- ____NFS or CIFS client
- ____N-blade
- ____Disks
- ____Nonvolatile RAM (NVRAM)

TASK 2: Explain RDB and quorum concepts

Step 1. List the names of the RDB units.

Step 2. Which RDB unit keeps track of the data that is used to operate the clustershell?

Step 3. Which RDB unit keeps track of the volumes and aggregates and which volumes are on which aggregates?

Step 4. How many healthy nodes are needed in a 16-node cluster to maintain a quorum?





TASK 3: vol0 and Vserver root volumes uses and limitations

Step 1. What is the minimum number of vol0 volumes in a 20-node cluster? What is the maximum?

Step 2. What is stored on a vol0 volume?

Step 3. For the following characteristics, write **vol0**, **vsroot**, or **both** to match the volumes with their characteristics.

- a) Is a flexible volume _____
- b) Can have Snapshot copies _____
- c) Can have mirrors _____
- d) Can be accessed by NFS or CIFS clients _____
- e) Can be backed up to tape _____
- f) Can be copied ____
- g) Can be accessed by the systemshell _____
- h) Can have junctions to other volumes _____
- i) Cannot be moved to another aggregate _____

END OF EXERCISE.





LAB 5: Physical data storage

In this exercise, you use the CLI and NetApp OnCommand GUI to create and add disks to an aggregate.

Objectives of this exercise

- Create an aggregate
- Add disks to an aggregate
- Create a flash pool

TASK1: Create a new aggregate

Step 1.

From the command line, show the aggregates:

cluster1::> stor aggr show

Step 2.

Show the volumes

cluster1::> volume show

Step 3.

View the disks attached to each node, noticing the disks that belong to aggregates and the spare disks that are available to create additional aggregates.

cluster1::> storage disk show -owner cluster1-01

cluster1::> storage disk show -owner cluster1-02

Step 4.

Display disks by type.

cluster1::> storage disk show -type?

cluster1::> storage disk show -type ssd

cluster1::> storage disk show -type fcal -owner cluster1-01

cluster1::> storage disk show -type fcal -owner cluster1-02

cluster1::> storage disk show -type ssd -owner cluster1-01

cluster1::> storage disk show -type ssd -owner cluster1-02

Step 5.

Look at the usage information of the storage aggregate create command.

cluster1::> stor aggr create ?



NOTE: To help familiarize yourself with a command, you can type the command without parameters, followed by a question mark (?).

Step 6.

Create an aggregate with the unique name n01_aggr1 (as an abbreviation of aggregate 1 on the cluster1_01 node).

cluster1::> stor aggr create -aggr n01_aggr1 -node cluster1-01 -disktype fcal -diskcount 5

NOTE: The aggregate will have the storage capacity of three disks. (Two of the disks are used for parity for RAID-DP, which is the default RAID type.) This is only an example. In a production environment, a RAID-DP aggregate of this size is a very inefficient use of disks. Also, note that the –diskcount parameter cannot exceed the available number of spare disks.

Step 7.

Review the list of aggregates again.

cluster1::> stor aggr show

Step 8.

Review the details for the new aggregate, noticing that the new aggregate has an HA policy of sfo.

cluster1::> stor aggr show -aggr n01_aggr1

TASK 2: Add disks to aggregate

Step 1.

cluster1::> aggr add-disks -aggr n01_aggr1 -diskcount 2

The aggregate now has two parity disks and five data disks.

Step 2.

Verify the number of disks in the aggregate and the expanded disk capacity.

cluster1::> aggr show -aggr n01_aggr1

TASK 3: Use GUI to create an aggregate

Step 1.

In GUI select Storage> Aggregates&Disks > Aggregates.

You can see aggr0 for each of the nodes in your cluster, as well as the aggregate that you created by using the CLI:



	Î	Agg	gregates																	
Dashboard	L	+	+ Create 🖌 Edit X Delete : More Actions 🤁 Refresh																	
Applications &	L		Status \Xi	Name		Ŧ	Туре	Ŧ	Used (%)	Ŧ	Available Space $=$	Used Space	Ŧ	Total Space	Ŧ	FabricPool	Ŧ	External Capaci	VoluŦ	Disk
Storage 👻	L	+	۲	aggr0_n1	cluster1-01		Standard		84		548.6 MB	2.8 GB		3.34 GB		No		-NA-	1	6
Nodes	L	+	۲	aggr0_n2	cluster1-02		Standard		84		548.45 MB	2.8 GB		3.34 GB		No		-NA-	1	6
Aggregates &	L		۲	n01_aggr1	cluster1-01		Standard		0		4.39 GB	168 KB		4.39 GB		No		-NA-	0	7
Disks			OVERVIEW																	
External Capacity Tiers	External Capacity Status 🔮 online					SPACE ALLOCATION				SPACE SAVINGS					PERFORMANCE					
Aggregates	Arromatos			Node		cluster1-01		•	Internal tier							0				
Channer Dania				RAID Configuration	raid_dp (Data RAID	group size	of 16 d		1	68.00 KB US	ed	4.39 G8				. 1			0 MBp	15
Storage Pools	Storage Pools			RAID Status	normal												Throughput			
Disks				Root	No															
Flash Pool Statistics	L			lumber of Volumer	0															
				tomoer or voromes	o tolulles															
SVMS				Allocated Disks	7 Disks															

Step 2.

In the Aggregates toolbar, click Create. In the right upper corner click on "Manually Create Aggregate" button.

The Create Aggregate dialog window appears.

Name:		
Disk Type:		Browse
Number of Disks:	~	
RAID Configuration:	-NA-	
New Usable Capacity:	-NA-	
3 🔲 FabricPool		
	×	
fell me more about FabricPool		
🗿 🔲 Mirror this aggregate		
Fell me more about mirrored aggre	egates	
O Use Flash Pool cache with		

Step 3.

On the Create Aggregate dialog page, enter these aggregate properties:

- a. Enter the Aggregate Name *n02_aggr1*
- b. Select disk type FCAL on node cluster1-02
- c. Number of Disks: 10
- d. RAID Configuration: RAID-DP, RAID group size of 16 disks



e. Ensure that the Mirror this aggregate and Use Flash Pool cache checkbox is not selected.

Step 4.

Create the aggregate

Enter Aggregate Details	
To create an aggregate, select a dis	k type then specify the number of disks.
Name:	n02_aggr1
Oisk Type:	FCAL Browse
	Disks of 1020.5 MB each from node: cluster1-02
Number of Disks:	10 Max: 21 (excluding 1 hot spare), min: 5 for RAID-DP
RAID Configuration:	RAID-DP; RAID group size of 16 disks Change
New Usable Capacity:	7.03 GB (Estimated)
🕜 🗔 FabricPool	
	×
Tell me more about FabricPool	
😢 🔲 Mirror this aggregate	
Tell me more about mirrored aggre	egates
👔 🔲 Use Flash Pool cache with	this aggregate

Click Submit.

Step 5.

Navigate to **Storage > Aggregates&Disks > Aggregates** and examine the new aggregate. Aggregates

-	+ Create 🖌 Edit × Delete : More Actions C Refresh											
	Status \Xi	Name 🕾	- Node -	Туре 😇	Used (%)	÷	Available Space \Xi	Used Space 👳	Total Space 👳	FabricPool 📼	F	
	۲	n02_aggr1	cluster1-02	Standard	0		7.03 GB	148 KB	7.03 GB	No		
	OVERVIEW											
	Status 🔮 online SPACE ALLOCATION 🕕 SPACE SAVINGS											
	Node cluster1-02											
RAID Configuration raid_dp (Data RAID group size of 16 d 148.00 KB used 7.03 GB										. 1		
		RAID Status	normal							•• / 📕		
		Root	No									
	N	umber of Volumes	0 volumes									
		Allocated Disks	10 Disks									
•	S	aggr0_n1	cluster1-01	Standard	84		540.51 MB	2.81 GB	3.34 GB	No		
÷	0	aggr0_n2	cluster1-02	Standard	84		548.45 MB	2.8 GB	3.34 GB	No		
٠	۲	n01_aggr1	cluster1-01	Standard	0		4.39 GB	168 KB	4.39 GB	No		

TASK 4: Create a flash pool

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In this task, you will create a 10-disk aggregate of type "flex," and then you will convert it to the HDD tier of a flash pool.

Step 1.

Type stor aggr create followed by a question mark (?).

cluster1::> stor aggr create ?

NOTE: There is no option to enable hybrids on the create command.

Step 2.

We create a standard aggregate of type flex first, then convert it to a Flash Pool. Create a new 10-disk aggregate on cluster1_01. This becomes the HDD tier of our Flash Pool:

cluster1::> stor aggr create -aggr n01_fp1 -node cluster1-01 -diskcount 10 -disktype fcal

Step 3.

Inspect the properties of the new aggregate.

cluster1::> stor aggr show -aggr n01_fp1

Step 4.

Enable flash pool by setting hybrid-enabled to true on n01_fp1.

cluster1::> stor aggr modify -aggr n01_fp1 -hybrid-enabled true

Step 5.

Check the status of your aggregate before adding the SSD tier, noticing the available size.

cluster1::> stor aggr show -aggr n01_fp1

Step 6.

Add SSDs to the aggregate and complete the flash pool.

cluster1::> stor aggr add-disk -aggr n01_fp1 -diskcount 5 -disktype SSD

NOTE: You can also specify a list of SSDs by using the -disklist option.

Step 7.

Explore the flash pool, noticing these properties:

- The number of disks
- The two RAID groups (in spite of the default RAID group size)
- The available size and the total hybrid cache size

cluster1::> stor aggr show -aggr n01_fp1

Step 8.

In GUI, perform these actions:

- a. Select your new flash pool.
- b. Below the lower pane, click the Disk Layout tab.

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c. Inspect the RAID groups that were created.

+	100 - 90														
Ŧ	create 7	Luit A Delete 1	More Actions C Reliesin												
	Status 👻	Name	- Node -	Туре 😇	Used (%) =	Available Space \Xi	Used Space 👳	Total Space $=$	FabricPool =	External Capac \Xi	Volu_=	Disk 포	Flash Pool		
+	۲	aggr0_n1	cluster1-01	Standard	84	548.59 MB	2.8 GB	3.34 GB	No	-NA-	1	6	-NA-		
٠	۲	aggr0_n2	cluster1-02	Standard	84	548.45 MB	2.8 GB	3.34 GB	No	-NA-	1	6	-NA-		
+	۲	n01_aggr1	cluster1-01	Standard	0	4.39 GB	168 KB	4.39 GB	No	-NA-	0	7	-NA-		
	۲	n01_fp1	cluster1-01	Flash Pool	0	7.03 GB	204 KB	7.03 GB	No	-NA-	0	15	1.46 GB		
	OVERVIEW														
		Status	🥝 online			SPACE ALLOC	ATION		SPACE SAVINGS		PERFORMANCE				
	Node cluster1-01					đ			_		0				
	R	AID Configuration	raid_dp (Data RAID group si	re of 16 d	204.00 KB u	sed	7.03 GB				0 MBos				
		RAID Status	hybrid, normal									Throughput			
		Root	No												
	N	umber of Volumes	0 volumes												
		Allocated Disks	15 Dels												
													Show More		
+	۲	n02_aggr1	cluster1-02	Standard	0	7.03 GB	188 KB	7.03 GB	No	-NA-	0	10	-NA-		

END OF EXERCISE





LAB 6: Logical data storage

In this exercise, you create a data storage virtual server (Vserver), create a flexible volume, and mount a volume in a SVM's namespace. You also create an infinite volume.

Objectives of this exercise:

- Create a data SVM
- Create a flexible volume
- Mount a volume in a SVM's namespace
- Create an flexgroup volume

TASK 1: Create a cluster SVM

Step 1.

View the SVMs and volumes in your cluster.

cluster1::> vserver show

cluster1::> volume show

Step 2.

View the "node" Vservers and "admin" Vserver.

The node SVMs are the scope in which entities like the vol0 volumes exist, along with the node management LIFs and cluster LIFs of each node. The administrative SVM is the scope in which the cluster management LIF exists.

Step 3.

Create a data SVM named vs1 and provide the name of a root volume (which will be created by this command).

cluster1::> vserver create -vserver vs1 -rootvolume vs1root -aggr n01_aggr1 -ns-switch file -rootvolume-security-style unix

NOTE: This command creates the root volume of the SVM, which means that it's the root of this namespace. You created the SVM root volume on node cluster1_01, but that does not mean that the SVM is assigned to node cluster1_01. SVMs are independent of physical nodes. The root of the SVM namespace happens to reside there.

Step 4.

View the SVM that you created and note that the new SVM type is "data."

cluster1::> vserver show

Step 5.

Get more details about the SVM and notice that all protocols are allowed by default.

cluster1::> vserver show -vserver vs1

Step 6.



View the list of volumes.

cluster1::> volume show

The SVM root volume that was just created is listed.

Step 7.

Notice the default volume size.

NOTE: You can't specify a volume size with the *vserver create* command, but you can use the *volume modify* command to change the size.

Step 8.

View all the attributes of this volume.

cluster1::> volume show -vserver vs1 -volume vs1root

Step 9.

Review the Junction Path value of this volume.

The slash (/) signifies that this is the root volume of this namespace. Giving this volume the name "vs1root" is merely a convention to make it obvious that this is a SVM root volume.

Step 10.

View the number of volumes on n01_aggr1.

cluster1::> stor aggr show

This reflects the new root volume and the size of it is reflected in (is subtracted from) the available field of the aggregate.

TASK 2: Create a flexible volume

Step 1.

In your SVM, on the aggregate n01_aggr1, create a volume.

cluster1::> volume create -vserver vs1 -volume volume1 -aggregate n01_aggr1 -junctionpath /vol1

Warning: The export-policy "default" has no rules in it. The volume will therefore be inaccessible.

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

Each volume is associated with one SVM.

Step 2.

View the volumes.

cluster1::> vol show

Step 3.

View the details of the new volume.

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cluster1::> vol show -vserver vs1 -volume volume1

Step 4.

View the assigned security style.

cluster1::> vol show -vserver vs1 -volume volume1 -fields security-style

vserver volume security-style

vs1 volume1 unix

TASK 3: Use GUI to create a flexible volume

Step 1.

In GUI, select **Storage > Volumes**.

Volume1 and the root volume for your SVM appear.

Volumes on SVM All SVMs 🔹

	+ Create 💌 🖍 Edit 📋 Delete 🗹 Actions 💌 🔍 View Missing Protection Relationships				💐 Refresh			
	Status 🔻	Name T	Style 🔻	SVM T	Aggregates T	Thin Provisioned	Available Spa 🝸	Total Space 🛛 🝸
Ŀ	. 0	volume1	FlexVol	vs1	n01_aggr1	No	18.82 MB	20 MB
C		vs1root	FlexVol	vs1	n01_aggr1	No	18.78 MB	20 MB

Step 2.

In the Volumes toolbar, click the **Create > Flexvol**.

Step 3.

Select SVM.



Step 4.



To select a home aggregate for the new volume, click the **Choose** button and select **n02_aggr1**, tiering policy **snapshot-only**.

NOTE: To host a user volume, never choose a node's aggr0 aggregate.

ate Volume	
Seneral Storage Effi	ciency Quality of Service Protection
lame: vo	lume2
ggregate: n0	2_aggr1 Choose
torage Type	
NAS (Used for CIFS	i or NFS access)
SAN (Used for FC/F	-CoE or iSCSI access)
Data Protection ///	ised as destination volume)
lering Policy	אבת פא תפארוופרוטון אחוחוובי
Delien	
Policy.	snapsnot-only
Tell me more about e: Ize	sternal capacity tier and tiering policies.
Total Size:	400 MB 💙
Snapshot Reserve (%):	5
Data Space:	380 ME
Snapshot Space:	20 MB
pace Reserve	
Space Reserve (option	al): Thin Provisioned 💌
Tell me more about sp	pace reservation
	Create

Step 5.

Under Storage Type, verify that NAS is selected.

Hint: What happens when protocols aren't licensed for your cluster?

Step 6.

Set the Total Size to 400 MB.

Step 7.

Leave the Snapshot Reserve percentage at the default.

Step 8.

Select Space Reserve (optional): Thin Provisioned.

Step 9.

Click Create.

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Step 10.

After the wizard is finished, verify the new volume in the volume list.

	√olumes on SVM All SVMs ▼										
+ Create V Edit Delete 🗹 Actions V View Missing Protection Relationships 🛇 Refresh											
		Status 🔻	Name T	Style 🔻	SVM T	Aggregates T	Thin Provisioned	Available Spa 🝸	Total Space 🔻		
	÷	Ø	volume2	FlexVol	vs1	n02_aggr1	Yes	379.84 MB	400 MB		
	÷	Ø	volume1	FlexVol	vs1	n01_aggr1	No	18.82 MB	20 MB		
	٠	Ø	vs1root	FlexVol	vs1	n01_aggr1	No	18.78 MB	20 MB		

Step 11.

Select **Storage > Junction Path** and verify where the new volume is mounted in the namespace. The UI shows that the volume is accessed by clients as /volume2.

NOTE: The junction-path option was not specified when you created the volume with GUI. GUI automatically mounts new volumes at the SVM root by using the volume name as the junction name. The default Export Policy has been assigned to the volume.

Junction Pat	vs1	•	
📑 Mount 📑 Ur	imount 🧪 Char	nge Export Policy	${f C}$ Refresh
Path	Storage Object	Export Policy	Security Style
₄∓ [/]	🛢 vs1root	default	unix
⊳ ∓ volume2	😂 volume2	default	unix
⊳ ∓_vol1	S volume1	default	unix

Step 12.

To unmount volume2, click **volume2** to select it and then, on the Junction Path toolbar, click **Unmount**.

NOTE: It is not necessary to force the unmount operation.

Step 13.

To begin a series of steps that will remount volume2 in the namespace as vol2 under volume1, on the Junction Path toolbar, click **Mount**.

The menu lists all unmounted volumes.





Mount Volume	
Volume Name:	v
Junction Name:	
Junction Path:	Browse
	Mount Cancel

Step 14.

Select volume2.

Step 15.

Change the Junction Name to "vol2."

Step 16.

To choose a point in the Junction Path to mount the volume, click **Browse**.

Step 17.

Select /vol1 as the mountpoint.

elect a junction path to mount	the volume.			
Nol1				
Name	T	Туре	T	
vol1		directory		*
				7

To complete the operation, click **OK** and then click **Mount**.



	×
volume2	
vol2	
Nol1	Browse
Mount	Cancel
	volume2 vol2 Avol1 Mount

Step 19.

Verify that volume2 is mounted at /vol1/vol2.

Junction Path on SVM vs1							
P∰ Mount P∰ Ur	nmount 🧪 Chai	nge Export Policy	${f C}$ Refresh				
Path	Storage Object	Export Policy	Security Style				
⊿ ∓ /	😂 vs1root	default	unix				
⊿ ∓⊤ vol1	😂 volume1	default	unix				
¥ vol2	😂 volume2	default	unix				

TASK 4: Configure a flexgroup volume

Step 1.

From CLI, create a SVM to host flexgroup volume.

Step 1.

From the CLI, create a SVM to host flexgroup volume

cluster1::> vserver create -vserver vsflxg -rootvolume vsflxgroot -aggregate n02_aggr1 - rootvolume-security-style unix -language C

Step 2.

Create 6 GB flexgroup volume

cluster1::> volume create -vserver vsflxg -volume flxg_vol -aggr-list n01_aggr1 ,n02_aggr1 -aggr-list-multiplier 3 -size 6gb

Warning: The FlexGroup "flxg_vol" will be created with the following number of

constituents of size 1GB: 6.

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

Step 3.

Display the volumes.

cluster1::> vol show

cluster1::> vol show -vserver vsflxg

Step 4.

Display view a FlexGroup volume and its constituents, and monitor the space used by the FlexGroup volume.

cluster1::> volume show -vserver vsflxg -is-constituent *

Step 5.

Set your session to diag privilege mode, and enter y in response to the prompt:

cluster1::> set diag

Warning: These diagnostic commands are for use by NetApp personnel only.

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

Step 6.

Display the list of volumes again.

cluster1::*>vol show -vserver vsflxg -fields is-constituent, constituent-role

Step 7.

Examine the aggregates hosting the constituents and the size of the constituents.

cluster1::*> vol show -vserver vsflxg -fields aggregate, size

Step 8.

Set your session back to administrative privilege mode.

cluster1::> set admin

Step 9.

Configure FlexGroup volumes to automatically grow and shrink their size. Starting with ONTAP 9.3, you can configure FlexGroup volumes to automatically grow and shrink according to how much space they currently require.

cluster1::> volume autosize -vserver vsflxg -volume flxg_vol -mode grow_shrink

You can also specify the maximum size, minimum size, and thresholds for growing or shrinking the volume.

END OF EXERCISE.



LAB 7: Physical networking

In this exercise, you identify port roles and create an interface group.

Objectives of this exercise

- Create ipspace
- Create broadcast domain
- Create subnet
- Create an interface group
- Create a virtual LAN (VLAN)

TASK 1: Create an ipspace

Step 1.

View existing ipspaces

cluster1::> network ipspace show

A list of the existing ipspaces appears.

Step 2.

You can see default created ipspaces: Cluster and Default

Step 3.

To which ipspaces are belonging existing vservers?

Step 4.

Create ipspace with name ipspace1.

cluster1::> network ipspace create ipspace1

Step 5.

What is broadcast domain for ipspace1? Try to create new broadcast domain. Go to **Network** -> **Broadcast Domains** -> **Create**

Step 6.

We cannot create new broadcast domain for the now because all existing ports are assigned to others broadcast domains. (From the CLI is possible to create broadcast domain without assigned ports, but not from GUI.)



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Step 7.

Remove ports cluster1-01:e0e, cluster1-01:e0f, cluster1-02:e0e, cluster1-02:e0f from Default broadcast domain. Go to **Network -> Broadcast Domains** and **Edit** Default. Uncheck mentioned ports.

Edit Broadcast	t Don	nain			×	
Edit the broadcast domain details and the assigned ports.						
Name: Default						
MTU:	ru: 1500					
IPspace:	Defa	ault				
Assign Ports:	Ports	s that can be assigne	d or unassigned to the selected	d broadcast domain are shown below.		
		Port Name	cluster1-01	cluster1-02		
	\checkmark	eOc				
	\checkmark	eOd				
		eOe				
		eOf				
				Save Save and Close Cancel		

Click Save and Close.

TASK 2: Create an interface group

You can aggregate ports that aren't currently hosting logical interfaces and that aren't assigned to any broadcast domain.

Step 1.

In GUI, navigate to **Network -> Ethernet Ports**. You can see that ports e0e and e0f on both nodes haven't assigned Broadcast Domain.





Ethe	Ethernet Ports							
a 0	🐊 Create Interface Group 🙀 Create VLAN 📝 Edic 🗴 Delete 😋 Refresh							
T	Port T	Node T	Broadcast Domain T	IPspace				
•	e0a	cluster1-01	Cluster	Cluster				
•	e0b	cluster1-01	Cluster	Cluster				
•	eOc	cluster1-01	Default	Default				
۰	e0d	cluster1-01	Default	Default				
٠	e0e	cluster1-01	·NA-	Default				
٠	eOf	cluster1-01	·NA-	Default				
٠	e0a	cluster1-02	Cluster	Cluster				
۰	e0b	cluster1-02	Cluster	Cluster				
۰	eOc	cluster1-02	Default	Default				
•	e0d	cluster1-02	Default	Default				
٠	e0e	cluster1-02	·NA-	Default				
•	eOf	cluster1-02	-NA-	Default				

Step 2.

To begin creating an interface group, click Create Interface Group.

Interface Group Name: a0a Node: cluster1-01 Choose the ports to include in this interface group. Image: e0e Image: e0f Mode Mode Mode Mode determines how the ports in the group are used. Image: Single - Only one of the ports is active at a time Image:	eate interrace or oup					
Node: cluster1-01 Choose the ports to include in this interface group. Image: Cluster1-01 Image: Cluster1-01 Image: Cluster1-01	nterface Group Name:	a0a				
Choose the ports to include in this interface group.	lode:	cluster1-01	~			
 e0e e0f Mode Mode determines how the ports in the group are used. Single - Only one of the ports is active at a time Multiple - All ports are simultaneously active LACP - LACP protocol determines which port should be used Load distribution Load distribution determines how the network traffic is distributed IP based - Network traffic is distributed based on IP addresses MAC based - Network traffic is distributed based on MAC addresses Sequential - Network traffic is distributed as it is received Port - Network traffic is distributed based on the transport layer (TCP/UDP) ports. 	Choose the ports to include i	n this interface group.				
Image: Point and the point of the points in the group are used. Image: Single - Only one of the points is active at a time Image: Multiple - All points are simultaneously active Image: LACP - LACP protocol determines which point should be used Image: Load distribution Load distribution determines how the network traffic is distributed Image: Protocol determines how the network traffic is distributed Image: Protocol determines how the network traffic is distributed Image: Protocol determines how the network traffic is distributed Image: Protocol determines how the network traffic is distributed Image: Protocol determines how the network traffic is distributed Image: Protocol determines how the network traffic is distributed based on IP addresses Image: Protocol determines how the network traffic is distributed based on MAC addresses Image: Point - Network traffic is distributed based on MAC addresses Image: Point - Network traffic is distributed based on the transport layer (TCP/UDP) ports. Assign Broadcast Domain: Prowse. (Optional)	🖌 eOe					
Mode Mode determines how the ports in the group are used. Single - Only one of the ports is active at a time Multiple - All ports are simultaneously active LACP - LACP protocol determines which port should be used Load distribution Load distribution determines how the network traffic is distributed IP based - Network traffic is distributed based on IP addresses MAC based - Network traffic is distributed based on MAC addresses Sequential - Network traffic is distributed based on the transport layer (TCP/UDP) ports. Assign Broadcast Domain: Browse (Optional)	🕑 eOf					
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Mode Mode determines how the ports in the group are used. Single - Only one of the ports is active at a time Multiple - All ports are simultaneously active LACP - LACP protocol determines which port should be used Load distribution Load distribution determines how the network traffic is distributed IP based - Network traffic is distributed based on IP addresses MAC based - Network traffic is distributed based on MAC addresses Sequential - Network traffic is distributed based on the transport layer (TCP/UDP) ports. Assign Broadcast Domain: Browse						
Mode determines how the ports in the group are used. Single - Only one of the ports is active at a time Multiple - All ports are simultaneously active LACP - LACP protocol determines which port should be used Load distribution Load distribution Load distribution determines how the network traffic is distributed MAC based - Network traffic is distributed based on IP addresses MAC based - Network traffic is distributed as it is received Port - Network traffic is distributed based on the transport layer (TCP/UDP) ports. Assign Broadcast Domain: Draft	Mode					
 Single - Only one of the ports is active at a time Multiple - All ports are simultaneously active LACP - LACP protocol determines which port should be used Load distribution Load distribution determines how the network traffic is distributed IP based - Network traffic is distributed based on IP addresses MAC based - Network traffic is distributed based on MAC addresses Sequential - Network traffic is distributed based on the transport layer (TCP/UDP) ports. Assign Broadcast Domain: Browse (Optional)	Mode determines how the	ports in the group are used.				
 Multiple - All ports are simultaneously active LACP - LACP protocol determines which port should be used Load distribution Load distribution determines how the network traffic is distributed IP based - Network traffic is distributed based on IP addresses MAC based - Network traffic is distributed based on MAC addresses Sequential - Network traffic is distributed based on the transport layer (TCP/UDP) ports. Assign Broadcast Domain: Browse	Single - Only one of th	e ports is active at a time				
LACP - LACP protocol determines which port should be used Load distribution Load distribution determines how the network traffic is distributed IP based - Network traffic is distributed based on IP addresses MAC based - Network traffic is distributed based on MAC addresses Sequential - Network traffic is distributed based on the transport layer (TCP/UDP) ports. Assign Broadcast Domain: Browse (Optional)	Multiple - All ports are simultaneously active					
Load distribution Load distribution Load distribution determines how the network traffic is distributed IP based - Network traffic is distributed based on IP addresses MAC based - Network traffic is distributed based on MAC addresses Sequential - Network traffic is distributed as it is received Port - Network traffic is distributed based on the transport layer (TCP/UDP) ports. Assign Broadcast Domain: Browse (Optional)	LACP - LACP protocol	determines which port should be used				
Load distribution Load distribution Load distribution determines how the network traffic is distributed I P based - Network traffic is distributed based on IP addresses MAC based - Network traffic is distributed based on MAC addresses Sequential - Network traffic is distributed as it is received Port - Network traffic is distributed based on the transport layer (TCP/UDP) ports. Assign Broadcast Domain: Browse (Optional)						
Load distribution determines how the network traffic is distributed IP based - Network traffic is distributed based on IP addresses MAC based - Network traffic is distributed based on MAC addresses Sequential - Network traffic is distributed as it is received Port - Network traffic is distributed based on the transport layer (TCP/UDP) ports. Assign Broadcast Domain: Browse (Optional)	-Load distribution		_			
 IP based - Network traffic is distributed based on IP addresses MAC based - Network traffic is distributed based on MAC addresses Sequential - Network traffic is distributed as it is received Port - Network traffic is distributed based on the transport layer (TCP/UDP) ports. Assign Broadcast Domain: Browse (Optional)	Load distribution determine	es how the network traffic is distributed				
MAC based - Network traffic is distributed based on MAC addresses Sequential - Network traffic is distributed as it is received Port - Network traffic is distributed based on the transport layer (TCP/UDP) ports.	IP based - Network tra	ffic is distributed based on IP addresses				
Sequential - Network traffic is distributed as it is received Port - Network traffic is distributed based on the transport layer (TCP/UDP) ports. Assign Broadcast Domain: Browse (Optional)	MAC based - Network	traffic is distributed based on MAC addresses				
Port - Network traffic is distributed based on the transport layer (TCP/UDP) ports. Assign Broadcast Domain: Browse (Optional)	Sequential - Network t	raffic is distributed as it is received				
Assign Broadcast Domain: Browse (Optional)	Port - Network traffic i	s distributed based on the transport layer (TCP/LIDP) ports				
Assign Broadcast Domain: Browse (Optional)						
		(Ortigae)				
	Assian Broadcast Domain:	Hrowse UDDUUID				
	Assign Broadcast Domain:	Browse (Optional)				
	Assign Broadcast Domain:	Browse (Opuonar)				



Step 3.

Select the **e0e** and **e0f** checkboxes.

Step 4.

Keep the default Interface group name.

Step 5.

Keep the node **cluster1-01**.

Step 6.

Choose Multiple for the Mode and IP based for the Load distribution.

Step 7.

Click Create.

Step 8.

Check the Ports list to verify the creation of the interface group.

Ethernet Ports

	違 Create Interface Group 🙀 Create VLAN 🔡 Edit 🗙 Delete 🖏 Refresh							
T	Port T	Node T	Broadcast Domain T	IPspace				
•	a0a	cluster1-01	-NA-	Default				
•	eOa	cluster1-01	Cluster	Cluster				
٠	e0b	cluster1-01	Cluster	Cluster				
٠	eOc	cluster1-01	Default	Default				
•	e0d	cluster1-01	Default	Default				
•	eOe	cluster1-01	-NA-	Default				
•	eOf	cluster1-01	-NA-	Default				
•	e0a	cluster1-02	Cluster	Cluster				
•	e0b	cluster1-02	Cluster	Cluster				
	Interface Group Properties							

Distribution: ip Create Policy: multimode Member List: [e0e, e0f] Health Status: Healthy

TASK 3: Create a VLAN

Step 1.

In GUI, go to **Network -> Ethernet Ports**.

Step 2.

To begin creating a VLAN, click Create VLAN:

Interface Name

T SVI



	ace for the VLAN.		_
Node:	cluster1-02		*
Physical Interface:	eOe		*
VLAN Tags Enter a list of VLAN	tag numbers. All numbers must be betw	veen 1 and 4094.	
11		Add	
		Delete	
	nain:	Browse (Optional)	

Step 3.

From the menu, choose port **e0e** on node **cluster1_02** to host the VLAN.

Step 4.

Choose a list of VLAN tags to identify each VLAN hosted on this port:

- a. Type **11**, and then click **Add**.
- b. Repeat with 22 and 33.

Step 5.

Click Create to create the VLANs.



Create VLAN		×	3
Choose physical interfa	ce for the VLAN.		
Node:	cluster1-02	*	
Physical Interface:	e0e	~	
VLAN Tags			
Enter a list of VLAN ta	ag numbers. All numbers must be between 1 and 4094.		
	Add		
11	Delete		
22			
33			
Assign Broadcast Doma	in: (Optional)		
Hooigin Broaddait Boina	Drowse (optional)		
	Create Can	icel	

Step 6.

Check the Ports list to verify the creation of the VLANs. (If vlan ports are red, click refresh).

Ethernet Ports

т	Port	Ŧ	Node	т	Broadcast Domain	T IPspace
•	e0b		cluster1-02		Cluster	Cluster
	eOc		cluster1-02		Default	Default
	e0d		cluster1-02		Default	Default
•	eOe		cluster1-02		-NA-	Default
•	e0e-11		cluster1-02		-NA-	Default
•	e0e-22		cluster1-02		-NA-	Default
	e0e-33		cluster1-02		-NA-	Default
	eOf		cluster1-02		-NA-	Default
v	/LAN Properties				Interfaces on the Port	
Pi	arent Port:	eOe			Interface Name	T SVI
V	/LAN Tag:	11				
н	lealth Status:	Healthy				

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TASK 4. Create Broadcast Domain

Step 1.

In GUI, navigate to **Network -> Broadcast Domains**, and click **Create**.

Step 2.

	5		Broadcast Domains						
H	Dashboard		🙀 Create 📝 Edit 🗙 Delete 🍣 Refresh	ate 📝 Edit 🗙 Delete 🌄 Refresh					
- Angliantiana B Tire			Broadcast Domain T	MTU T	IPspace				
	Applications of ners	,	Cluster	1500	Cluster				
1	Storage	•	Default	1500	Default				
*	Network	•							
	Subnets								
	Network Interfaces								
	Ethernet Ports								
	Broadcast Domains	5							

Step 3.

Specify the bro	e broadcast domain details and assign ports to it.									
lame:										
ITU:										
^o space:			×							
Assign Ports:	Ports that can be ass	igned to a new broadcast do	main are shown below.							
	Port Name	cluster1-01	cluster1-02							
	a0a									
	e0e									
	🔲 e0e-11									
	e0e-22									
	e0e-33									
	e0f									
			Create	Cancel						



Enter the name bd1, MTU size 1500, IPspace ipspace1, and assign all available ports.

Step 5.

Create Broadc	ast [)omain				×
Specify the bro	adca	ast domain details and	assign ports to it.			
Name:	bd1					
MTU:	150	0				
IPspace:	ipsp	bace1		~	•	
Assign Ports:	Ports	s that can be assigne	ed to a new broadcast domain a	are sl	nown below.	
		Port Name	cluster1-01	clus	ster1-02	
	V	a0a				
	V	eOe			\checkmark	
	1	e0e-11			V	
	V	e0e-22				
	V	e0e-33				
		eOf				
					Create	Cancel

Click Create.

Step 6.

Why not all ports are available for assignment to broadcast domain?





TASK 5. Create subnet

Step 1.

In GUI, navigate to **Network -> Subnets**, and click **Create**.

Step 2.

Create Subnet
You can create a subnet to provide a logical subdivision of an IP network to pre-allocate the IP addresses and divide space efficiently.
Name:
Subnet IP/Subnet mask:
IP Addresses: IP addresses can be a range or a list of comma separated entries or a mix of both. For example: IPv4 - 192,168,1.2,192,168,1.5-192,168,1.9 etc. or IPv6 - f6::c3;f6::c9 etc. (Optional) (Optional)
Gateway: (Optional)
Broadcast Domain: Browse Show ports on this domain
Create Cancel

Enter the name **subnet1**, subnet IP/Subnet mask **10.34.x1.0/24**, IP address range will be **10.34.x1.40-10.34.x1.59**, and Broadcast Domain will be **Default**.

Step 3.





You can create a subnet to pr	ovide a logical subdivision of an IP netw	work to pre-allocate the IP addresses and divide space	
efficiently.		······	
Name:	subnet1		
Subnet IP/Subnet mask:	10.34.11.0/24		
IP Addresses:	IP addresses can be a range or a list o For example: IPv4 - 192.168.1.2,192.10	f comma separated entries or a mix of both. 58.1.5-192.168.1.9 etc. or IPv6 - f6::c3,f6::c5-f6::c9 etc.	
	10.34.11.40-10.34.11.59	(Optional)	
Gateway:		(Optional)	
	If you specify the gateway, a defa when a LIF is created using this si	ult route to that gateway is added to the associated SVM ubnet.	И
😮 Broadcast Domain:	Default	Browse	
	Show ports on this domain		

Then click Create.

Step 4.

Subnets							
🙀 Create 📝 Edit 🗙 Delete 🈋 Refi	esh						
Name	Subnet 1	Gateway	т	Available IP Addresses	T Used IP Addresses	т	Total IP Addresses
subnet1	10.34.11.0/24	-NA-		20	0		20

Subnet subnet1 is ready.

END OF EXERCISE.



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LAB 8: Logical networking

In this exercise, you create a NAS data LIF, explore routing groups, migrate a data LIF, send home a data LIF, and fail over a data LIF.

Objectives of this exercise

- Create a NAS data LIF
- Explore routing groups
- Migrate a data LIF
- Rehome a data LIF
- Fail over a data LIF
- Create a failover group

TASK 1: Delete the VLANs and the interface group

Because we need the ports for future exercises, in this task, you delete the VLANs and the interface group that you created in an earlier exercise.

Step 1.

Ensure that no LIFs are hosted by the either the interface group or the VLAN.

cluster1::> network interface show

cluster1::> network port show

cluster1::> net port vlan show

Step 2

Delete all VLANs.

cluster1::> net port vlan delete -node cluster1-02 -vlan-name e0e-11

cluster1::> net port vlan delete -node cluster1-02 -vlan-name e0e-22

cluster1::> net port vlan delete -node cluster1-02 -vlan-name e0e-33

Step 3.

Take interface group a0a offline.

cluster1::> set advanced

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

cluster1::> net port modify -node cluster1-01 -port a0a -up-admin false

cluster1::> set admin

Step 4.

Check status of interface a0a.

cluster1::> net port show -node cluster1-01 -port a0a



Step 5.

Delete the interface group.

cluster1::> net port ifgrp delete -node cluster1-01 -ifgrp a0a

Step 6.

Delete the broadcast domain **bd1**.

cluster1::> broadcast-domain delete -ipspace ipspace1 -broadcast-domain bd1

Step 6.

Delete the ipspace ipspace1.

cluster1::> ipspace delete -ipspace ipspace1

Step 7.

Assign free ports to Default Broadcast Domain.

cluster1::> broadcast-domain add-ports -ipspace Default -broadcast-domain Default -ports cluster1-01:e0e, cluster1-01:e0f, cluster1-02:e0e, cluster1-02:e0f

TASK 2: Create a NAS LIF

Step 1.

Create a data LIF called "data1" for one of your data IP addresses, setting e0e as the home port.

cluster1::> net int create -vserver vs1 -lif data1 -role data -home-node cluster1-01 -homeport e0e -address 10.34.x1.111 -netmask 255.255.255.0 –firewall-policy data

NOTE: The combination of home node and home port is what determines which physical port on which physical node will be the home of this LIF. The home concept exists because data LIFs can migrate to other ports on the same node or to any other node in the cluster.

Step 2.

Review the LIFs.

cluster1::> net int show

Now that a LIF is associated with your virtual server (SVM), the cluster SVM appears in the list. This view of the LIFs includes an Is Home field that indicates whether this LIF resides on its home node and home port, which were chosen when the LIF was created.

Step 3.

View the details of the data LIF.

cluster1::> net int show -vserver vs1 -lif data1

This view shows all the attributes of the new LIF. In addition to the Home Node and Home Port fields, Current Node and Current Port fields exist. If the LIF is migrated, one or both of these Current fields might differ from the Home fields.



TASK 3: Migrate a data LIF

Step 1.

Migrate your data LIF to the other node in your cluster.

cluster1::> net int migrate -vserver vs1 -lif data1 -dest-port e0c -dest-node cluster1-02

NOTE: The node and port parameters of the *net int migrate* command are for the destination node and port. You could have migrated to any other data port (on either node) instead. Remember that data LIFs aren't owned by nodes, but they do reside on a node at any given time, transparent to any NFS and CIFS clients.

Step 2.

Review the LIFs.

cluster1::> net int show

In this summary view, your data LIF's Current Node field is the other node, and its Is Home field is false.

Step 3.

View the details.

cluster1::> net int show -vserver vs1 -lif data1

NOTE: Unlike storage failover (SFO), this LIF migration does not cause a reboot of the node from which the LIF is moving. Also unlike SFO, LIFs can migrate to any node in the cluster, not just the high-availability (HA) partner.

Step 4.

Revert the data LIF (send it "home").

cluster1::> net int revert -vserver vs1 -lif data1

NOTE: You don't have to specify the destination node and port. A LIF knows where its home is.

Step 5.

View the LIFs to verify that this one went home.

TASK 4: Rehome a data LIF

Step 1.

Assign the LIF a new home port on port e0d on the opposite node.

cluster1::> net int modify -vserver vs1 -lif data1 -home-node cluster1-02 -home-port e0d

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Step 2.

Check the status of your data LIF again.

cluster1::> net int show

It has not yet moved to its home port, but because it is in a migrated state (because the current port is no longer the home port), the Is Home status is false.

Step 3.

Revert the data LIF to send it to its new home. *cluster1::> net int revert -vserver vs1 -lif data1* **Step 4.**

Verify that your data LIF has moved to its new home port. *cluster1::> net int show*

TASK 5: Fail over a data LIF

Step 1.

View the failover group that was chosen by default.

cluster1::> net int show -vserver vs1 -lif data1

Step 2.

View the Failover Group values for the LIF.

It is set to system-defined.

Step 3.

Show the current LIF failover groups and view the targets defined for the data and management LIFs.

cluster1::> net int show -failover

Groups were automatically created for the data LIF.

Step 4.

To see how it fails over, reboot the node that hosts LIF data1.

cluster1::> system node reboot -node cluster1-02

Step 5.

Type **Y** to confirm.

Step 6.

If you are accessing the cluster via the node management interface on cluster 1-02, sign in to the cluster management interface or the node management interface on cluster 1-01.



From there you can view all the LIFs by using *net int show* to see that the data LIF fails over to the other node.

NOTE: Because the Auto Revert value of the LIF is set to false, the LIF does not revert to its home port automatically. If the cluster-management LIF is on the node that booted, it also fails over to the opposite node.

Step 7.

When the rebooted node is up and running again, revert the data LIF by issuing this command from either node:

cluster1::> net int revert -vserver vs1 -lif data*

Step 8.

Look at the data LIF to see that it went home.

If the cluster management LIF did indeed fail over, there is no compelling reason to revert it.

TASK 6: Create a failover group

Step 1.

Create a custom failover group that excludes data ports e0e and e0f on both nodes.

cluster1::> net int failover-groups create -failover-group newfogroup -vserver vs1 -targets cluster1-01:e0c

cluster1::> net int failover-groups show

cluster1::> net int failover-groups add-targets -failover-group newfogroup -vserver vs1 - targets cluster1-01:e0d

cluster1::> net int failover-groups add-targets -failover-group newfogroup -vserver vs1 - targets cluster1-02:e0d

cluster1::> net int failover-groups add-targets -failover-group newfogroup -vserver vs1 - targets cluster1-02:e0c

Step 2.

Assign the cluster failover group to the LIF data1.

cluster1::> net int modify -vserver vs1 -lif data1 -failover-group newfogroup

Step 3.

Check the failover groups assigned to each LIF.

cluster1::> net int show -fields failover-group

Step 4.

Verify the failover targets for data1.

cluster1::> net int show -failover -vserver vs1 -lif data1

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Step 5.

Set your session to diagnostic privilege mode.
cluster1::> set diag
Warning: These diagnostic commands are for use by NetApp personnel only.
Do you want to continue? {y/n}: y

Step 6.

Deactivate the port that hosts LIF data1.

cluster1::*> net port modify -node cluster1-02 -port e0d -up-admin false

Step 7.

Verify that the port is down.

cluster1::*> net port show

Step 8.

To which port did data1 migrate?

cluster1:*:> net int show

Step 9.

Reactivate the inactive port.

cluster1::*> net port modify -node cluster1-02 -port e0d -up-admin true

cluster1::> net port show*

Step 10.

Revert LIF data1 back to its home port.

cluster1::*> net int revert -vserver vs1 -lif data1

cluster1::> net int show*

Step 11.

Set your session back to administrative privilege mode. *cluster1::*> set admin*

END OF EXERCISE.



LAB 9: NAS protocols

In this exercise, you create a SVM, configure CIFS and NFS, and access the SVM namespace with CIFS and NFS clients.

Objectives of this exercise

- Create a SVM
- Use OnCommand GUI to configure a SVM and NAS protocols
- Create an export policy
- Create a CIFS share
- Access a CIFS share from a Windows client
- Access the namespace from an NFS client

TASK 0: Check and/or set up system time

Step 1. Set NTP server.

cluster1::> cluster time-service ntp server show

This table is currently empty.

cluster1::> cluster time-service ntp server create -server 10.34.x1.10

cluster1::> cluster time-service ntp server show

Server Version

----- -----

10.34.x1.10 auto

Step 2.

Set date and time (to be synchronized with your AD server). Time difference between AD controller and clusters have to be less than 5 minutes, otherwise you'll be not able register SVMs to domain. Even you set up NTP server, the system time is not moved immediately but in some steps. So better is set up the time manually.





cluster1::> cluster date show Time zone	Node	Da	ate
cluster1-01 1/12/2016 12:17:29 +01:00 Europe/Bratislava cluster1-02 1/12/2016 12:17:27 +01:00 Europe/Bratislava 2 entries were displayed.			
TASK 1: Configure a SVM to serve CIFS and NFS			
Step 1.			Dashboard
In the GUI navigation frame, click Storage > SVMs (a	Storage	-	Applications & Tiers
Virtual Machines).		9	Storage
			Nodes
Step 2.			Aggregates & Disks
In the SVMs toolbar, click Create to create a new SVM.			SVMs
SVMs			

SVMs						
🕂 Create 🅜 Edit	X Delete D S	tart 🔳 Stop	🔧 SVM Settings	${f C}$ Refresh		
Name		Ŧ	State	Ŧ	Subtype \Xi	Allowed Protocols
vs1			running		default	NFS, CIFS, FC/FCoE, ISCSI
vsflxg			running		default	NFS, CIFS, FC/FCoE, iSCSI

Step 3.

Enter vs2 as the name for your new SVM.

Step 4.

Select the aggregate **n02_aggr1**.

NOTE: Keep in mind that SVMs are independent of aggregates and nodes. Here you are simply choosing an aggregate to host the new SVM's root volume. Best practices suggest that you do not use a node root aggregate to host a SVM root. If you do so, you receive a warning.

Step 5.

To complete the SVM Details page of the wizard, take these actions:

- a. Data protocols: CIFS and NFS
- b. Language: C.UTF-8 [c.utf_8]
- c. Security style: UNIX
- d. Root aggregate: n02_aggr1
- e. DNS configuration: Leave defaults
- f. Click Submit & Continue.

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rage Virtual Machin	e (SVM) Setup					
• 1)0					
Enter SVM b	asic details					
Specify a unique n	ame and the data pro	tocols for the SVM				
SVM Name:	vs2					
 IPspace: 	Default	~				
?) Volume Type:	FlexVol volumes	Infinite Volume				
	An SVM can contain	either multiple FlexVol volu	umes or a single Infinite V	olume.		
	You cannot change	the volume type of the SVM	after you set it.			
Data Protocols. Defeuit Lenguage:			*			
Derault Language.	The language of the	SVM specifies the default la	anguage encoding setting	for the SVM and		
	its volumes. Using a	setting that incorporates UTF	F-8 character encoding is r	ecommended.		
Security Style:	UNIX		~			
Root Aggregate:	n02_aggr1		*			
DNS Configura	tion					
Specify the DNS dom	ain and name server:	s. DNS details are required t	to configure the CIFS prot	ocol.		
Search Don	nains.	ntap.lab1				
Name Serve	ers:	10.34.x1.10				
					Submit & Continue	Cancel

Step 6.

Select the Retain the CIFS data LIFs checkbox.

This option specifies that the data LIF supports both CIFS and NFS sessions. Assign IP address select "Using a subnet". Subnet will be **subnet1** and let radio-button "Auto-select the IP address from this subnet" selected.

As a home port select cluster1-02:e0d.

Step 7.





Sto	orage Virtual Mach	ine (SVM) Setup		
	•(1)		2	3	-0
	Enter SVM ba	sic details	Configure CIFS/NFS protocol	Enter SVM administrator details	
C	Configure CIFS	/NFS pr	otocol		
(To enable CIFS, sp	ecify the d	ata interfaces and the	CIFS server details. If y	ou are configuring NFS, specify NIS details.
	To enable access t	to the NFS	ports, add rules to the	default export policy o	r create a new policy for the SVM.
	– 🔺 Data LIF Config	uration —			
	💌 Retain the CIFS da	ata LIF's co	nfiguration for NFS clie	ents.	
	Data Interface details	for CIFS			
	Assign IP Address:	Using a su	ibnet	•	
		Subnet: su	bnet1 Change		
		a	uto-assign mode		
	? Port:	cluster1-0	D2:e0d B	rowse	

Step 8.

In the CIFS Server Configuration type **ntapvs2** as the name for your CIFS server, and enter your fully qualified domain name **ntap.lab1**.

Step 9.

CIFS Server Configuration					
CIFS Server Name: ntapvs2	Provision a volume for CIFS storage (Optional).				
Active Directory: ntap.lab1	Share Name:				
Organizational Unit: CN=Computers	Size: GB 🗸				
Administrator Name: administrator	Everyone - Full Control				
Administrator Password:					
Incrypt data while accessing all the shares in this SVM	Incrypt data while accessing this share				
— NIS Configuration (Optional) —					
Skin	Submit & Continue Cancel				

Enter the domain administrator name **administrator** and the password supplied by your instructor, and then click **Submit & Continue**.

Step 10.

On the SVM administration page, click Skip.

Step 11.

Review the configuration summary and click OK.



Step 12.

In GUI, select SVMs (Storage Virtual Machines).

SVMs

🙀 Create 📝 Edit 🗙 Delete 🕗 Start 💿 Stop 🖏 SVM Settings 🍣 Refresh								
Name T	State T	Subtype T	Allowed Protocols					
vs2	running	default	NFS, CIFS					
vs1	running	default	NFS, CIFS, FC/FCoE, iSCSI					
vsflxg	running	default	NFS, CIFS, FC/FCoE, iSCSI					

Step 13.

In the list of **SVMs**, select **vs2** and, on the toolbar, click the **Edit** and then **Services**.

Step 14.

Be sure that only the files in first column are selected

Details	Resource A	llocation	Ser	vices		
Name serv proper acc the name s	ice switches ar ess to clients. 1 ervice sources	e used to The order are cons) look up of the se sulted to r	and retrie ervices lis retrieve in	ve user information ted determines in w formation.	to provid hich orde
Tell me moi	re about how na	ame serv	ice switc	h configu	ration works	
Name Ser	vice Switch					
hosts:	files	~	dns	×		
namemap	files	~		~		
group:	files	~		~	~	
netgroup:	files	~		~	•	
passwd:	files	~		~	~	
f you and L proto	have selected DAP servers ar col access perf	nis or Ida e configu ormance	pasana ⊮ed corr degradal	ime servio ectly. Inva ion.	ce source, ensure ti alid configuration car	nat the NI n result in
			s	ave	Save and Close	Cano

Step 15.

Click the **Resource Allocation** tab.



Step 16.

Select Delegate volume creation, and then choose aggregates that are available to host volumes for this SVM by clearing the checkboxes for the aggr0 aggregates and selecting the rest.

Best practices suggest that data volumes should never be stored on a node's aggr0 aggregate.

	Do not delegate v	olume creation			
	No specific aggre volume creation.	egates are assig	ned to this Stora	ge Virtual Machir	ie to provision
۲	Delegate volume (creation			
	Aggregate	Available S	Raid Type	Disk Type	Controller N
	📄 aggr0_n1	548.54 MB	raid_dp, nor	FCAL	cluster1-01
	📄 aggr0_n2	548.55 MB	raid_dp, nor	FCAL	cluster1-02
	🖌 n01_aggr1	2.09 GB	raid_dp, nor	FCAL	cluster1-01
	🖌 n01_fp1	6.28 GB	raid_dp, hy	FCAL,SSD	cluster1-01
	💽 n02_aggr1	3.97 GB	raid_dp, nor	FCAL	cluster1-02
	4				
			Save	Save and Close	e Cancel

Click

Step 18.

If the Configure Services warning appears, click OK.

TASK 2: Create a NAS data LIF

Step 1.



Select Network > Network Interfaces.

Step 2.

Click the Create button to begin creating a data LIF.

Create Network Interface	2	X
Specify the following details	to add a new network interface.	
Name:		
Interface Role:	 Serves Data Intercluster Connectivity 	
SVM:	•	
Protocol Access:	CIFS iSCSI NFS FC/FCoE	
Management Access:	Enable Management Access	
Assign IP Address:	Select 💌	
Port:	Ports or Adapters 🔺 Hosted In	terface Co Speed
Oynamic DNS (DDNS):	Enable Dynamic DNS	
		Create Cancel

Step 3.

Name the LIF vs2_cifs_nfs_lif2 and select the Serves Data role. Select SVM vs2 and choose NAS protocols CIFS and NFS. Assign IP address Using a Subnet. Subnet will be subnet1 and let radio-button "Auto-select the IP address from this subnet" selected.

As a home port select cluster1-01:e0e.



pecify the following detai	ils to add a new networ	rk interface.							
Name	مراجع والمراجع								
Name.		vs2_cits_nfs_lif2							
Interface Role:	Serves Data	Serves Data							
0.44		nectivity							
SVIVI:	VS2	`							
Protocol Access:	CIFS i	iSCSI							
	MFS F	FC/FCoE							
	NVMe								
Management Access:	🔲 Enable Manager	ment Access							
Assign IP Address:	Using a subnet	~							
	Subnet: subnet1	Change							
	auto-assigr	n mode							
Port:	Ports or Adapters	A Hosted Interf	ace C Speed						
	⊿ cluster1-01	⊿ cluster1-01		•					
	eOc	2	1000 Mbos						
	e0d	0	1000 Mbps						
	e0e	0	1000 Mbps	-					
 Dynamic DNS (DDNS): DDNS is disabled 	Enable Dynamic on the selected SVM: v	: DNS /s2.							
			Create	Cancel					
			Create		Cancel				
reate.		1000		5					
ck Create . p 4.	1	2	0						
ck Create . p 4. rify creation of the	data LIF.		-	0					
ck Create . p 4. rify creation of the observed on the obs	data LIF.			0					
ck Create. p 4. rify creation of the of twork Interfaces Treate P Edit × Delete As S	data LIF.	Home C Refresh		0					
ck Create. p 4. rify creation of the of twork Interfaces Treate Edit × Delete Solutions	data LIF. tatus ፣ 라 Migrate ♠ Send to 로 Storage Virtual Machin로	Home C Refresh IP Address/WWPN			Is Ho				



TASK 3. Create an export policy

Step 1.

Select Storage > SVMs > vs2 > SVM Settings > Export Policies.

SVM vs2 v				
SVM Settings	+ Create	🖋 Rename	X Delete	${f C}$ Refresh
Protocols	Policy			
CIFS	default			
NFS				
iSCSI				
NVMe				
Policies				
Export Policies				
Efficiency Policies				
Protection Policies				
Snapshot Policies				

Step 2.

Click the **Create Policy** button.

Step 3.

Name the policy **vs2def** and click **Add** to add a rule.

_					
Copy Rules from	1				
			¥		
			~		
Export Rules:					
+ Add 🕜 Edit	× Delete	Move Up O Mo Access Protocols	ve Down Read-Only Rule	Read/Write Rule	Superuser A
				1	1

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Step 4.

Specify **0.0.0/0** for the client specification.

Select both CIFS and NFS for protocols.

Select all checkboxes for each access type and click OK

eate Export Rule				l
Client Specification:	0.0.0/0			
	Enter comma-se	eparated values for mu	Itiple client specifications	
Access Protocols:	CIFS			
	🕑 NFS 🛛 🕅	IFSv3 📝 NFSv4		
	Flexcache			
	i If you do no through any configured	t select any protocol, a / of the above protocol on the Storage Virtual	access is provided is (CIFS, NFS, or FlexCache) Machine (SVM).	
Access Details:		🖉 Read-Only	🕑 Read/Write	
	UNIX	s de la constante de la consta		
	Kerberos 5			
	Kerberos 5i			
	Kerberos 5p			
	NTLM			
	🕑 Allow Supe	ruser Access		
	Superuser a	ccess is set to all		
				scal
				icei

Step 7.

Click Create.

SVM vs2	•			
SVM Settings	🙀 Create 📝 Rename	🗙 Delete 🎖 Refresh		
	Policy			
Protocols	default			
CIFS				
NFS	vs2der			
iSC5I				
SYM User Details				
Users				
Roles	🙀 Add 📝 Edit 🗙 Del	ete 👚 Move Up 😽 Move Down 🏹 Refre	sh	
Host Users and Groups	Rule Index	T Client	T Access Protocols	т
UNIX	1	0.0.0/0	CIFS, NFS	
Mindows				

TASK 4: Create and export of a volume

Step 1.

Select Storage > Volumes



1	Volumes on SVM vs2 v										
	+ Create C Edit T Delete Z Actions View Missing Protection Relationships S Refresh										
		Status 🔻	Name T	Style T	Aggregates T	Thin Provisioned	Available Space 🛛 🝸	Total Space			
	٠	Ø	vs2_root	FlexVol	n02_aggr1	No	18.8 MB	20 MB			

Step 2

In the Volumes toolbar, click the Create FlexVol button to create a new volume.

Step 3.

Name the volume **vs2_vol01**. Click the **Choose** button to select a home aggregate for the new volume. Select **n01_aggr1** and click **OK**.

eneral Stor	age Efficiency	Quality of Service	Protection			
ame:	vs2_vol01					
gregate:	n01_aggr1	Cho	ose			
orage Type						
NAS (Used feed)	or CIFS or NFS acce	255)				
O Data Prote	Select Aggreg	ate			×	
ering Policy	American	Available Cire	Disk Tures	FabriaDe al		
Policy:	Aggregate 🔺	Available Size	Біяк туре	FabricPool	Ť	
Tell me more a	n01_aggr1	1.34 GB	FCAL	No		
ze	n01_fp1	7.03 GB	FCAL (FlashPool)	No		
Total Size:	n02_aggr1	3.97 GB	FCAL	No		
Snapshot Rese					- 11	
Data Space:						
Snapshot Spac					T	
oace Reserve			0	K Cance	1	
Space Reserve						
Tell me more at	out space reserva	tion				
					Create	Cancel

Step 4.

In the Storage Type area, ensure that NAS is selected and tiering policy let default **snapshot**only.



Step 5.

To complete the volume specifications, enter these values:

- a) Set the Total Size to **400 MB**.
- b) Leave the Snapshot Reserve at the default.
- c) Choose Space reserve as **Thin Provisioned**.
- d) Click Create.

General	Storage Efficie	cy Quality of Service Protection	
Name:	vs2_vo	1	
Aggregate:	n01_ag	1 Choose	
Storage T	уре		
NAS	(Used for CIFS or N	S access)	
🔘 Data	Protection (Used a	destination volume)	
Tiering Po	plicy	,	
Policy:	,	spanshot-only	
T u		snapsnot-only	
Size —	more about extern	capacity tier and tiering policies.	
Total Siz	ze:	400 MB 💙	
Snapsho	ot Reserve (%):	5	
Data Spi	ace:	380 MB	
Snapsho	ot Space:	20 MB	
Space Res	serve		
Space Re	eserve (optional):	Default	
·			
Tell me i	more about space i	servation	

Step 5.

After the wizard completes the volume creation, verify the new volume in the volume list.

Volur	mes on S	vs2	•							
+ Cr	reate 🧪 Ec	dit 🗙 Delete	More Actions	View Missing Protection Relation	onships	C Refresh				
	Status \Xi	Name		÷ Aggregates	Ŧ	Thin Provisioned	Ŧ	Available Spa \Xi	Total Space	Ŧ
÷	0	vs2_vol01	FlexVol	n01_aggr1		No		379.8 MB	400 MB	
٠	0	vs2_root	FlexVol	n02_aggr1		No		18.77 MB	20 MB	

Step 6.

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Perform these actions to modify permissions on the volume that was created at the beginning of this task:

- a. With vs2_vol01 selected, click Edit and check Configure UNIX permissions (Optional)
- b. Select all of the **Read**, **Write**, and **Execute** checkboxes for **Owner**, **Group**, and **Others**.
- c. Clear the **Thin Provisioned** checkbox.
- d. Click Save and Close.

ieneral	Storage I	Efficiency	Advanced					
lame:		vs2 vol01						
Security sty	le:	UNIX		*				
Configu	re UNIX per	missions (Op	otional)		Read	Write	Execute	
Owner						\checkmark	V	
Group						\checkmark		
Others Thin Pro When a data is y LUNs.	visioned volume is t vritten to th re about Thi	hin provisior ne volume. Ti in Provisionii	ned, space for th he unused aggra	e volume is not al egate space is avai	Coated in advance able to other thin	Insteac provision	I, space is all ned volume:	ocated a s and
Others Thin Pro When a data is ¥ LUNs.	visioned volume is t vritten to th re about Thi	hin provisior ie volume. Ti in Provisionii	ned, space for th he unused aggro	e volume is not al egate space is avai	Ecated in advance able to other thin	e. Instead	I, space is all	ocated a s and

Step 8.

Select **Storage > vs2 > Junction Path** and verify where the new volume has been mounted in the namespace.





This page indicates that the volume is accessed by clients as /vs2_vol01 and that the default export policy has been assigned to the volume.

Junction Pat	th on SVM	vs2	•
📑 Mount 📑 Un	imount 🧪 Chai	nge Export Policy	${f C}$ Refresh
Path	Storage Object	Export Policy	Security Style
⊿ ∓ ^{_/}	😂 vs2_root	default	unix
⊳ ∓ vs2_vol0	Svs2_vol01	default	unix

Step 12.

To unmount the volume and remount it with a different junction name, select the volume on the **Junction Path** page, click **Unmount** and, leaving the "Force volume unmount operation" checkbox unselected, click **Unmount**.

Unmount	Volume	×
4	Are you sure, you want to unmount the volume 'vs2_vol01'?	
	Unmount Cancel	

Step 13.

On the Junction Path toolbar, click Mount.

-		vs2	•
📑 Mount 📑 Un	mount 🧪 Cha	nge Export Policy	c Refresh
Path	Storage Object	Export Policy	Security Style
▷ ∓ /	🛢 vs2_root	default	unix

Step 14.

Perform the following actions:

- a. Select volume vs2_vol01.
- b. Type junction name vs2vol01.
- c. Click Browse and select the root directory as the junction path.
- d. Click Mount.


NOTE: In this exercise, the junction name is slightly different from the volume name. It is not necessary for the names to be the same. The volume name is used to reference the volume within the cluster. The junction name is used to reference the root of the volume in the namespace.

Volume Name:	vs2_vol01	*
Junction Name:	vs2vol01	
Junction Path:	1	Browse

Step 15.

Verify that the junction path in the vs2 namespace is correct.

Junction Path on SVM vs2 v				
📑 Mount 📑 Ur	nmount 🧨 Chai	nge Export Policy	${f C}$ Refresh	
Path	Storage Object	Export Policy	Security Style	
⊿ ∓ /	😂 vs2_root	default	unix	
∓ vs2vol01	Svs2_vol01	default	unix	

Step 16.

Select the volume vs2_root and click Change Export Policy.

Step 17.

www

Select export policy vs2def and click Change.

Volume Name:	vs2 root	
Junction Path:	1	
Export Policy:	vs2def	•
1		Change Cancel
3.	8-12-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1	1.5.1
the process for vs2_vo	101.	



Change Export Poli	су		×
Volume Name: Junction Path:	vs2_vol01 /vs2vol01		
Export Policy:	vs2def	v	
		Change Cancel	

TASK 5: Create CIFS share

Step 1.

To create a CIFS share for the new volume, select **Storage > Shares -> vs2**, and click the **Create Share** button.

Shares on SVM vs2	v	
+ Create Share + Create Home Directory	🖌 Edit 🔳 Stop Sharing 🛛 C Refresh	
Share Name		Ŧ
admin\$	/	
c\$	1	
ipcs	1	

Step 2.

When the Create Share window appears, click the **Browse** button to select a folder to share.

NOTE: It is helpful to remember that you share folders, not volumes. You can share a subdirectory within a volume or any junction path.

Folder To Share: Browse
Share Name:
Comment:
Enable continuous availability for Hyper-V and SQL
Select this option if the share contains Hyper-V VHDs over SMB
Encrypt data while accessing this share
Encrypts data using SMB 3.0 to prevent unauthorized file access on th share



Step 3.

Expand the root directory to view the volume that was recently mounted in the namespace, select the folder that represents the junction for the volume, and click **OK**.

rowse For Folde	91				
Select a folder to	share				
4 🏹 I					
⊳ 🚞 .vsadi	nin				
∓ vs2vc	101				
Only volumes wh	ich are mounte	ed are visible			
Selected Path:	/vs2vol01				
				ок	Cancel

Step 4.

Change the Share Name to vol1 and click Create.

rolder to Share.	Avs2vol01 Brows	e
Share Name:	vol1	
Comment:		
Enable continue	us availability for Hyper-V and SQL	
 Select this optic 	on if the share contains Hyper-V VHDs over SMB	
🔲 Encrypt data w	nile accessing this share	
-	ining SMP 2.0 to provent uportherized file ecocoop on this	

Step 5.

Verify that the new CIFS share appears in the Shares list.



Shares on SVM vs2	•	
+ Create Share + Create Home Directory	🖍 Edit 🔳 Stop Sharing 🛛 C Refresh	
Share Name		Ŧ
vol1	/vs2vol01	
admin\$	/	
cS	1	
ipc\$	1	

Step 6.

Create a second CIFS share, sharing the root directory as **rootdir**.

Shares on SVM vs2	•			
+ Create Share + Create Home Directory	🖋 Edit 🔳 St	top Sharing	C Refresh	
Share Name	Ŧ	Path	Ŧ	
rootdir		1		
vol1		/vs2vol01		
admin\$		/		
c\$		/		
ipc\$		1		

TASK 6: Access your CIFS share from a Windows client

Step 1.

From the Windows command line, access the CIFS share by entering the following command:

PS C:\> *net view ntapvs2*

You access the CIFS server by the name that you assigned when you used the *cifs create* command to create the server.

Step 2.

If you encounter "Error 53. The Network Path was not found." attempt to identify the problem by performing one or more of the following actions:

- Verify that the export policy allows CIFS access.
- Verify that CIFS access is enabled for the SVM.
- Review the data LIF setup to ensure that the LIF has the proper routing group and that you can ping the IP address from the Windows client.



- Verify that can you ping the CIFS server by name.
- If you cannot ping the CIFS server by name (the DNS is not set up to resolve the CIFS server), attempt to access the CIFS server with the IP address of a data LIF.

Step 3.

Map a drive letter to the CIFS shares.

PS C:>*net use* * \backslash *ntapvs2* \vee *ol1*

PS C:> *net use* * *ntapvs2**rootdir*

Step 4.

Verify successful access.

 $PS C: \geq dir z:$ $PS C: \geq dir y:$

TASK 7: Configure CIFS home directories

Step 1.

In GUI, select **Storage > Shares on SVM -> vs2**, and click the **Create Home Directory** button.

Step 2.

Enter the share name and the relative path name %w, and click Manage.

The path must b	e relative to one or more of the search paths below.
Name:	~%w
Relative Path:	%w
Comment:	
-Home direc	tory search paths
	Manage

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Step 3.

Click Browse.

NOTE: You can add one or more search paths for a directory name match.

Manage Home	e Directories	×
Path:	Browse Add	
Path	Up	
	Down	
	Delete	
	Save Save and Close Cancel)

Step 4.

Select /vs2vol01 and click OK.





rowse for Sear	ch Path				×
Select a folder fo	or a home dire	ctory search	path.		
4 ∓ /					
⊳ 🚞 .vsad	min				
▷ ∓ vs2vo	bl01				
Only volumes wh	nich are moun	ted are visible			
Selected Path:	/vs2vol01				
				ок	Cancel



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Manage Ho	me Directories		×
Path:		Browse	Add
Path			Up
/vs2vol01			Down
			Delete
	Sav	Save and Close	Cancel

Step 6.

Click Save & Close.

Step 7.

Click Create.

	The path must k	be relative to one or more of the search paths below.
	Name:	~%w
	Relative Path:	%w
	Comment:	
	Home direc	tory search paths
	/vs2vol01	Manage
The second		
12		
100	Learn more abo	ut home directory patterns
1 al		

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Notice that the home directory share is among your list of CIFS shares.

Shares on SVM vs2 v		
+ Create Share + Create Home Directory 🖌 Edit 🔳 S	top Sharing C Refresh	
Share Name	Path =	Home Directory
admin\$	1	
cs	1	
ipcs	1	
rootdir	/	
vol1	/vs2vol01	
~%w	96wv	\checkmark

Step 9.

From your Windows desktop, open Windows Explorer.

	Windows Explorer Displays the files and folders on your (computer
🎊 Start 🛛 🚠 💻 🏉 🖡	Administrator: SnapDrive	luster1 - NetApp OnCo

Step 10.

Navigate to the **vol1** share on your z: drive.

🖃 🥽 Libraries
🕀 📑 Documents
🕀 🌙 Music
🕀 🔛 Pictures
🛨 🚼 Videos
🖃 🌉 Computer
🕀 🏜 Local Disk (C:)
🕀 坖 rootdir (\\ntapvs2) (Y:)
🗉 🚍 voli (\\ntapvs2) (Z:)
🕀 📬 <u>Network</u>

Step 11.

On the vol1 share, create a directory called **administrator** and, in that directory, create an empty text file called **adminfile**.

🕌 administrator		6 m ()
GOV 🕨 - Computer - ve	ol1 (\\ntapvs2) (Z:) 🔻 administrator	0 0
Organize 🔻 河 Open 💌 Pr	rint New folder	1.1
🚖 Favorites	Name *	
🧮 Desktop	🛗 adminfile	
Downloads		
Step 12.		

Map a drive to the home-directory share and verify the contents.



$PS C: > net view \setminus ntapvs2$

PS C: > *net use* * *ntapvs2*\~*administrator*



TASK 8: Access your data from a NFS client

Step 1.

Verify the export policy that was created for your volume.

cluster1::> vserver export-policy rule show -vserver vs2

Step 2.

Using Putty log in to the Linux (CentOS) machine.

[root@linsrv ~]# mkdir /mnt/vs2

[root@linsrv ~]# mkdir /mnt/path01

Step 3.

Using the IP address of either data LIF within vs2, access vs2 exports through NFS.

[root@linsrv ~]# mount -t nfs 10.34.x1.40:/ /mnt/vs2

[root@linsrv ~]# mount -t nfs 10.34.x1.40:/vs2vol01 /mnt/path01

Step 4.

Explore both NFS mounts, which are mounted at different points in the vs2 namespace, and locate the home directory that you created earlier in the exercise.

[root@linsrv ~]# cd /mnt/vs2/vs2vol01/administrator/

[root@linsrv administrator]# ls

adminfile.txt

Step 5.



Copy some data into the vs2_vol01 volume, and compare the amount of space that was used before the copy with the amount of space that is used after the copy:

a. From the cluster shell:

cluster1::> vol show -volume vs2_vol01 -fields used

b. Then from your Linux client:

[root@linsrv /]# cd /mnt/path01
[root@linsrv /]# cp /usr/include/* .

[root@linsrv/]# ls

c. Then from the cluster shell:

cluster1::> vol show -volume vs2_vol01 -fields used

The space consumed before the copy represents the Snapshot copy reserve space.

TASK 9: Create fpolicy to block mp3 files on file system

We will use the native engine, so we don't need to create external engine.

Step 1.

We need to create events for all protocols

cluster1::> vserver fpolicy policy event create -vserver vs2 -event-name mp3_cifs -protocol cifs -file-operations create,open,rename -volume-operation false

cluster1::> vserver fpolicy policy event create -vserver vs2 -event-name mp3_nfsv3 - protocol nfsv3 -file-operations create,write,rename,symlink -volume-operation false

cluster1::> vserver fpolicy policy event create -vserver vs2 -event-name mp3_nfsv4 - protocol nfsv4 -file-operations create,open,rename,symlink -volume-operation false

cluster1::> vserver fpolicy policy event show -vserver vs2

Step 2.

In second step we will create fpolicy and assign event to fpolicy container

cluster1::> vserver fpolicy policy create -vserver vs2 -policy-name mp3blocker -events mp3_cifs, mp3_nfsv3, mp3_nfsv4 -engine native -is-mandatory true -allow-privileged-access no

cluster1::> vserver fpolicy policy show -vserver vs2

Step 3.

Scope defines on which shares and volumes is fpolicy active using include and exclude sections.

cluster1::> fpolicy policy scope create -vserver vs2 -policy-name mp3blocker -shares-toinclude * -file-extensions-to-include mp3 -volumes-to-include *

cluster1::> vserver fpolicy policy scope show -vserver vs2

Step 4.

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When fpolicy definition is ready we need to enable it.

cluster1::> vserver fpolicy enable -vserver vs2 -policy-name mp3blocker -sequence-number 1

cluster1::> vserver fpolicy show -vserver vs2

Step 5.

Try to create a file with extension mp3 in the NFS mount on the Linux server or on the Windows share.

[root@linsrv path01] cd /mnt/vs2

[root@linsrv vs2]# dd if=/dev/urandom of=file.mp3 bs=1k count=30

dd: opening `file.mp3': Permission denied

END OF EXERCISE



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LAB 10: SAN protocols

In this exercise, you experiment with scalable SAN by configuring a SVM as an iSCSI target and connecting a LUN to a Windows host.

Objectives of this exercise:

- Use NetApp GUI to create a SVM for iSCSI
- Enable an aggregate as a resource for a SVM
- Configure Windows for multipath I/O (MPIO)
- Install the Windows Host Utilities Kit (HUK)
- Configure the iSCSI software initiator in Windows
- Use NetApp GUI to create an iSCSI-attached LUN
- Access the iSCSI-attached LUN on the initiator

TASK 1: Use NetApp GUI to create a SVM for iSCSI

Step 1.

In the GUI navigation frame, click **Storage > SVMs**.

SVMs

🕂 Create 🛛 🖋 Edi	X Delete	Start	Stop	🔧 SVM Settings	${f C}$ Refresh			
Name			Ŧ	State	Ŧ	Subtype	Ŧ	Allowed Protocols
vs1				running		default		NFS, CIFS, FC/FCoE, ISCSI
vs2				running		default		NFS, CIFS
vsflxg				running		default		NFS, CIFS, FC/FCoE, ISCSI

Step 2.

Click **Create** to create a SVM for iSCSI.

Step 3.

On the SVM Details page, enter and select the following, and then click Submit & Continue.

- SVM Name: vsISCSI1
- IPspace: **Default**
- Volume Type: FlexVol volumes
- Data Protocols: iSCSI
- Language: C.UTF-8 [c.utf_8]
- Security Style: UNIX
- Aggregate: **n01_aggr1**



Storage Virtual Machin	e (SVM) Setup					
•(1)0					
Enter SVM ba	asic details					
Specify a unique n	ame and the data prot	ocols for the SVM				-
SVM Name:	vs/SCS/1					
IPspace:	Default	~				
Volume Type:	FlexVol volumes	C Infinite Volume				
	An SVM can contain You cannot change th	either multiple FlexVol volu ie volume type of the SVM . 	mes or a single Infinite Vo after you set it.	lume.		
② Data Protocols:	CIFS INFS	Z iscsi				
Pefault Language:	C.UTF-8 [c.utf_8]		*			
	The language of the	SVM specifies the default la	anguage encoding setting	for the SVM and		
Security Style:	UNIX	ening that incorporates of th		commended.		
Root Aggregate:	n01_aggr1		~			
DNS Configura	tion ain and name servers	. DNS details are required to	o configure the CIFS prote	peol.		
? Search Doi	mains:	ntap.lab1				
? Name Serv	ers:	10.34.x1.10				
					Submit & Continue	Cancel

Step 4.

On the iSCSI configuration page, enter and select the following, and then click **Submit & Continue.**

- Target Alias: vsISCSI1_target
- LIFs Per Node: 2
- Assign IP address: Using a subnet
 - Subnet: subnet1
 - o Radio button: Auto-select the IP address from this subnet
- Review or Modify LIFs configuration checkbox: Select
- Number of portsets: 1
- Click Submit and Continue



Enter S	 ∵VM basic detail:	2 s Configure iSCSI protocol E		nistrator					
ata Interface	(LIF) Config	juration	uctuis						
Target Alias:	vslSCSl1_tar	get		Provision a LUI	N for iSCSI storage (O	ptional):			
LIFs Per Node:	2			LUN Size:		GB	*		
	(Minimum: 1,	Maximum: 6)		LUN OS Type:	Windows 2008 or lat	ter	~		
? Subnet:	subnet1	~		Host Initiator:					
	Auto colo	t the ID address from this s	nulamet						
	I lea this a	s the starting ID address							
	Use this a	s the starting IP address							
Review or n	Use this a	s the starting IP address	sì						
✓ Review or n	Use this a Use this a	s the starting IP address guration (Advanced Settings	s)						
Review or n Number of po	Use this a nodify LIF config	s the starting IP address juration (Advanced Settings	s)						
Review or n Number of po	Use this a nodify LIF config	s the starting IP address juration (Advanced Settings 1 (<i>Minimum: 0</i>)	s)), Maximum: 1)						
Review or n Number of po	Use this a nodify LIF config rtsets:	s the starting IP address suration (Advanced Settings 1 2 (<i>Minimum: 0</i>)	s)), Maximum: 1)						
Review or n Number of po Double-clic	Use this a nodify LIF config rtsets: k row to edit	s the starting IP address guration (Advanced Settings 1 (Minimum: 0)	s)), Maximum: 1)	Davidant					
Review or m Number of po Double-clic Node Name objected 04	Use this a nodify LIF config rtsets: k row to edit	s the starting IP address uration (Advanced Settings (Minimum: 0) Interface Name	s)), Maximum: 1) Home Port	Portset					
Review or m Number of po Double-clic Node Name cluster1-01 cluster1.01	Use this a nodify LIF config rtsets: k row to edit	s the starting IP address juration (Advanced Settings (Minimum: 0) Interface Name cluster1-01_iscsi_lif_1 cluster1 (M_iscsi_lif_2)	s)), Maximum: 1) Home Port e0c	Portset iscsi_pset_1					
Review or m Number of po Double-clic Node Name cluster1-01 cluster1-02	Use this a nodify LIF config rtsets: k row to edit	s the starting IP address juration (Advanced Settings (Minimum: 0, Interface Name cluster1-01_iscsi_lif_1 cluster1-02_iscsi_lif_2 cluster1_02_iscsi_lif_1	s)), Maximum: 1) Home Port eOc eOd	Portset iscsi_pset_1 iscsi_pset_1					
Review or n Number of po Double-clic Node Name cluster1-01 cluster1-02 cluster1-02	Use this a nodify LIF config rtsets: k row to edit	s the starting IP address uration (Advanced Settings (Minimum: 0, Interface Name cluster1-01_iscsi_lif_1 cluster1-02_iscsi_lif_2 cluster1-02_iscsi_lif_1	s) Maximum: 1) Home Port eOc eOd eOc	Portset iscsi_pset_1 iscsi_pset_1 iscsi_pset_1 iscsi_pset_1					
 Review or n Number of po Double-clic Node Name cluster1-01 cluster1-02 cluster1-02 	Use this a nodify LIF config rtsets: k row to edit	s the starting IP address uration (Advanced Settings (Minimum: 0, Interface Name cluster1-01_iscsi_lif_1 cluster1-02_iscsi_lif_2 cluster1-02_iscsi_lif_2 cluster1-02_iscsi_lif_2	s) Maximum: 1) Home Port eOc eOc eOc	Portset iscsi_pset_1 iscsi_pset_1 iscsi_pset_1					
Review or n Number of po Double-clic Node Name cluster1-01 cluster1-02 cluster1-02	Use this a nodify LIF config rtsets: k row to edit	s the starting IP address uration (Advanced Settings (Minimum: 0, Interface Name cluster1-01_iscsi_lif_1 cluster1-02_iscsi_lif_2 cluster1-02_iscsi_lif_2	s) Maximum: 1) Home Port e0c e0d e0e	Portset iscsi_pset_1 iscsi_pset_1 iscsi_pset_1 iscsi_pset_1					

Step 5.

On the SVM administration page, click Skip.

Step 6.

Review the summary and, click OK.











Step 7.

Select **Storage** > **SVMs** > **vsISCSI1** > **SVM Settings** > **iSCSI** to review your iSCSI configuration.

SVM vsiscsi1 v							
SVM Settings	Service Initiator Securit	У					
Protocols	🖌 Edit 🔘 Start 🔳 Stop	$\mathbf C$ Refresh					
CIFS							
NFS	iSCSI Service:	SCSI service is running					
iSCSI	iSCSI Target Node Name:	iqn.1992-08.com.netapp:sr	n.bc9319348e4411e8a18a0050569	fec97:vs.8			
NVMe	iSCSI Target Alias:	vsISCSI1_target					
Policies Export Policies	iSCSI Interfaces						
Efficiency Policies	🧭 Enable 🛛 😣 Disable						
Protection Policies	Network Interface	Ŧ	Target Portal Group Tag	Ŧ	IP Address	Ŧ	Current Port
Snapshot Policies	cluster1-01 isosi lif 1		1029		10 34 11 42		cluster1-01:e0c
QoS Policy Groups	cluster - or jucajing r		102.5		10.04.11.42		chaster - o neoc
Services	cluster1-01_iscsi_lif_2		1030		10.34.11.43		cluster1-01:e0d
NIS	cluster1-02_iscsi_lif_1		1031		10.34.11.44		cluster1-02:e0c
LDAP Client	cluster1-02_iscsi_lif_2		1032		10.34.11.45		cluster1-02:e0e

TASK 2: Enable an aggregate as a resource for a SVM

Step 1.

Select SVMs, and then select vsISCSI1.

Step 2.

In the menu bar at the top of the page, click **Edit**.

SV	M	s	

+ Create	🖋 Edit 🗙 Delete	O Start	Stop	🔧 SVM Settings	${f C}$ Refresh					
Name			Ŧ	State		- Subtype	Ŧ	Allowed Protocols	÷	IPspace
vs1				running		default		NFS, CIFS, FC/FCoE, iSCSI		Default
vs2				running		default		NFS, CIFS		Default
vsISCSI1				running		default		iSCSI		Default
vsflxg				running		default		NFS, CIFS, FC/FCoE, iSCSI		Default

Step 3.

When the Edit Storage Virtual Machine dialog box appears, click the **Resource Allocation** tab.

Step 4.

Select Delegate volume creation, n01_aggr1, and n02_aggr1.

Selecting these values enable this Storage Virtual machine to provision volumes in these aggregates.



Edit	Storage Virtu	ial Machine			×
Det	tails Resou	rce Allocatio	Services		
•	Do not delegate No specific aggr provision volun Delegate volume	volume creatio egates are assig re creation. e creation	n ned to this Stor	age Virtual Mac	hine to
	Aggregate	Available S	Raid Type	Disk Type	Controller
	🗖 aggr0_n1	548.56 MB	raid_dp, no	FCAL	cluster1-01
	aggr0_n2	548.56 MB	raid_dp, no	FCAL	cluster1-02
	▼ n01_aggr1	1.68 GB	raid_dp, no	FCAL	cluster1-01
	🗖 n01_fp1	6.28 GB	raid_dp, hy	FCAL,SSD	cluster1-01
	▼ n02_aggr1	3.96 GB	raid_dp, no	FCAL	cluster1-02
	•				Þ
			Save	Save and Close	e Cancel

Step 5.

Click Save and Close to complete the process.

TASK 3: Configure Windows for MPIO (MPIO is already installed)

NOTE: This exercise uses the Microsoft device-specific module (DSM) instead of the NetApp DSM.

Step 1.

On the Windows desktop, click the Server Manager icon.





📕 Server Manager	
<u>File Action View H</u> elp	
🗢 🔿 🖄 📅 🔢	
 Server Manager (Y2K8-NETAPP) 	Features View the status of f
	 Features Summary

Step 2.

On the toolbar at the top right of the page, right click on **Features** and then **Add Features**.







Step 3.

On the Select features page, select Multipath I/O and click Next.

Add Features Wizard		×
Select Features		
Features Confirmation Progress Results	Select one or more features to install on this server. Easture:	
	< <u>Previous</u> <u>Next ></u> <u>Instell</u> Cancel	

Step 4.

On the Confirm installation selections page, select the "Restart the destination server" checkbox, reply **Yes** to the warning, and then click **Install**.

Features Confirmation Progress Results	To install the following roles, role services, or features, click Install. (i) 1 informational message below (i) This server might need to be restarted after the installation completes.
	Print, e-mail, or save this information

Step 5.

After the feature is installed and the Results window appears, confirm that the installation was successful and click **Close** and close Server Manager.



TASK 4: Install the Windows host utilities (Optional)

Step 1.

On the desktop of your Windows system, open the Downloads folder.

Step 2.

Double-click the NetApp Windows Host Utilities installation file.

Step 3.

If are prompted with a security warning, confirm that you want to continue.

Step 4.

On the title page of the installation wizard, click Next.

Step 5.

Confirm the license agreement and click Next.

Step 6.

On the Support for Multipathing page, select **Yes, install support for Multipath I/O** and click **Next**.

Step 7.

Confirm the destination folder and click Next.

Step 8.

Click Install.

Step 9.

If an FC Configuration Tool warning appears, click **OK**.

Step 10.

After the installation is complete, click **Yes** to restart the Windows system.

Step 11.

Wait about five minutes before you attempt to reconnect to your Windows Server system.

TASK 5: Configure the iSCSI software initiator (in Windows)

In this task, you use the MPIO instead of Multiple Connections per Session (MCS) technique for multipathing.



Step 1.

On your Windows desktop, open the Control Panel.



Step 2.

Select View by small icons and double-click iSCSI Initiator.



Step 3.

If an error message appears to indicate that the Microsoft iSCSI service is not running, click **Yes** to start the service.





If a message asks if you want to unblock the Microsoft iSCSI service through the Windows Firewall, click **Yes**.

Step 5.

When the iSCSI Initiator Properties dialog box appears, click the General tab.

iSCSI Initiator Properties		×
Favorite Targets General	Volumes and Devic Discovery	es RADIUS Targets
iSCSI devices are disk, ta another computer on you Your computer is called a the iSCSI device, which is	apes, CDs, and other sto ur network that you can in initiator because it init s called a target.	prage devices on connect to. iates the connection to
Initiator Name	iqn.1991-05.com.micro srv1.ntap.lab1	osoft:ntap-w2k8dc-
To rename the initiator, (click Change.	Change
To use mutual CHAP auth targets, set up a CHAP s	nentication for verifying ecret.	Secret
To set up IPsec tunnel m click Set up.	ode addresses,	S <u>e</u> t up
What is ISCSI ?		
	ок	Cancel <u>Apply</u>

Step 6.

Record the Initiator Name (IQN):	
Step 7.	
Click the Discovery tab.	



iSCSI Initiator Prope	rties				×
Favorite Targets General		Volumes and Discovery	Devices	RADIUS Targets	Ì
_ <u>T</u> arget portals					
Address	Port	Adapter		IP address	
Add <u>P</u> ortal		<u>R</u> emove	Rel	fresh	
_iSNS servers					
Name					
Add		Remove	Reļ	fresh	
		ОК	Cancel	Apply	

Step 8.

Click **Add Target Portal**, enter the IP address of one of ports within the vsISCSI1 port set, and click **OK**.

	Add Target Portal Type the IP address or DNS name a to add. To select settings for the dis Advanced.	nd port number of the covery session to the	portal you want portal, click
	IP address or DNS name:	Port:	<u>A</u> dvanced
		ОК	Cancel
Step 9.	22		



Click the **Targets** tab.

SCSI Initiator Propertie	5		×
Favorite Targets General	Volumes and Device	es RADIUS Targets	
To access storage devic Log on.	es for a target, select the	target and then click	
To see information abou click Details.	it sessions, connections, a	nd devices for a target,	
Targets:			
Name		Status	
<u>Details</u>	Log on	R <u>e</u> fresh	
	ок	Cancel Apply	

Step 10.

Verify that the discovered target appears in the list and click Log On to Target.

Step 11.

In the Connect To Target dialog box, select Enable multi-path and click Advanced.

Log On to Target		×
Target name:		
In.1992-08.com.netapp:sn	.47f79902a56011e487f61234785	563412:vs.6
Automatically restore thi	s connection when the computer	starts
🔽 Enable multi-path		
Only select this option i on your computer.	f iSCSI multi-path software is alre	ady installed
<u>A</u> dvanced	ОК	Cancel

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Step 12.

In the Advanced Settings dialog box, from the **Target portal IP** list, select the lowest target portal IP address, and click **OK**.

eral IPsec	
Connect by using	
	D-Guilt
Local <u>a</u> dapter:	
Source <u>I</u> P:	Default
Target portal:	Default
	Default
CRC / Checksum	10.34.21.50 (3260
	10.34.21.52 / 3260
<u>D</u> ata digest	10.34.21.51 / 3260
User name: iqn	n.1991-05.com.microsoft:ntap-w2k8dc-srv1.ntap.lab1
User name: iqn Target secret:	n.1991-05.com.microsoft:ntap-w2k8dc-srv1.ntap.lab1
User name: iqn Target <u>s</u> ecret: 	n.1991-05.com.microsoft:ntap-w2k8dc-srv1.ntap.lab1
User name: iqn Target <u>s</u> ecret: Us<u>e</u> RADIUS to ge <u>P</u> erform mutual au	n.1991-05.com.microsoft:ntap-w2k8dc-srv1.ntap.lab1 enerate user authentication credentials uthentication
User name: iqn Target <u>s</u> ecret: Use RADIUS to ge <u>P</u> erform mutual au To use mutual CHAP e	n.1991-05.com.microsoft:ntap-w2k8dc-srv1.ntap.lab1 enerate user authentication credentials uthentication either specify an initiator secret on the Initiator Settings page or use
User name: iqn Target <u>s</u> ecret: Us <u>e</u> RADIUS to ge <u>P</u> erform mutual ar To use mutual CHAP « RADIUS, The same s	n. 1991-05. com.microsoft:ntap-w2k8dc-srv1.ntap.lab1 enerate user authentication credentials uthentication either specify an initiator secret on the Initiator Settings page or use recret must be configured on the target.
User name: iqn Target secret: Use RADIUS to ge Perform mutual au To use mutual CHAP e RADIUS. The same s	n.1991-05.com.microsoft:ntap-w2k8dc-srv1.ntap.lab1 enerate user authentication credentials uthentication either specify an initiator secret on the Initiator Settings page or use secret must be configured on the target.
User name: iqn Target <u>s</u> ecret: Use RADIUS to ge Eerform mutual au To use mutual CHAP e RADIUS, The same s	n.1991-05.com.microsoft:ntap-w2k8dc-srv1.ntap.lab1 enerate user authentication credentials uthentication either specify an initiator secret on the Initiator Settings page or use secret must be configured on the target, uthenticate target credentials
User name: iqn Target <u>s</u> ecret: Use RADIUS to ge Eerform mutual at To use mutual CHAP & RADIUS. The same s Use RADIUS to at	n.1991-05.com.microsoft:ntap-w2k8dc-srv1.ntap.lab1 enerate user authentication credentials uthentication either specify an initiator secret on the Initiator Settings page or use eccret must be configured on the target. uthenticate target credentials

Step 13.

Click **OK** to close the Connect to Target dialog box and start a new iSCSI session between the initiator and target.

Step 14.

In the **Target->Details-> Properties** dialog box, clicking on the Properties tab you can create additional sessions with all of the iSCSI LIFs within the port set.

Step 15.

Click OK to close the Properties window.

Step 16.

Click OK to close the iSCSI Initiator Properties window.

Step 17.

Close Control panel.

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TASK 6: Use NetApp GUI to create an iSCSI attached LUN

Step 1.

In GUI, select **Storage** > (vsISCSI) > LUNs.

	Ns on SVM vsiSCS11	
Dashboard	N Management Initiator Groups Portsets	
Applications & Tiers	reate 🗍 Clone 🧨 Edit 🗙 Delete 😂 Status 🔹 🕃 Move 🖓	$\overline{\mathcal{A}}$ Storage QoS $ \mathbf{C}$ Refresh
Storage 👻	ne $\overline{\overline{\overline{\nabla}}}$ Container Path $\overline{\overline{\overline{\nabla}}}$ Space	Reservation \Xi Available Size
Nodes		
Aggregates & Disks		
SVMs		
Volumes		
LUNs		

Step 2.

Click the **Create** button. The Create LUN Wizard appears.





On the next page, enter and select the following:

- Name: lun_vsISCSI1_1
- LUN Type: Windows 2008 or later
- LUN size: 100 MB
- Thin Provisioned checkbox: clear

Create LUN Wiza General Prop You can spec create.	erties ify the name, si	ze, type, and an optional o	les	cription fe	r the	LUN that you would like to	×
0	You can enter	a valid name for the LUN	an	d an optio	nal sh	nort description	
	Name: Description:	lun_vsl5C5l1_1			(0	optional)	
	You can specify the size of the LUN. Storage will be optimized according to the type selected.			zed according to the			
E	Туре:	Windows 2008 or later Tell me more about LUN t	ур	es	*		
	Size:	100		MB	~		
Space F	Reserve:	Default	Y	(optiona	lλ		
Tell r	ne more about	space reservation					
				Back	(Next Cancel	

Step 5.

Click Next.

Step 6.

On the LUN Container page, first select **Create a new flexible volume in**, then click **Choose**, select the **n01_aggr1** aggregate, and click **OK**.

Step 7.

In the Volume Name text box, accept the default name and click Next.



Create LUN Wizard	×
LUN Container You can let the wizard create a volume or you can choose an existing volume as the	LUN container.
The wizard automatically chooses the aggregate with most free space for creatin volume for the LUN. But you can choose a different aggregate of your choice. Yo select an existing volume/qtree to create your LUN.	ig flexible ou can also
Select an existing volume or qtree for this LUN	
Volume/Qtree: Browse	
Create a new flexible volume in	
Aggregate Name: n01_aggr1 Choose	
Volume Name: lun_vslSCSI1_1_vol	
Tiering Policy: snapshot-only	
Tell me more about external capacity tier and tiering po	licies.
Back Next	Cancel

Step 8.

On the Initiators Mapping page, click **Add Initiator Group** to begin creating an initiator group (igroup).

Step 9.

In the Create Initiator Group dialog box, on the General tab, enter or select the following:

- Name: ig_myWin
- Operating System: Windows
- Type: iSCSI

Step 10.

In the Portset area, click Choose.

Step 11.

Select the port set that you created with the Vserver in task 1 and click **OK**.



Create Initiator Group		×			
General Initiators					
Name:	ig_myWin				
Operating System:	Windows				
Туре					
Select the supported proto iSCSI 	Select the supported protocol for this group iscsi 				
FC/FCoE					
Mixed (iSCSI & FC/FCo	E)				
Portset					
Portsets control the nur	mber of paths visible to the hosts.				
Portset:	iscsi_pset_1 Choose				
	Create	Cancel			

Step 12

Click the Initiators tab, and click Add.

Step 13.

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Enter the initiator **IQN** that you recorded earlier (Task 5, Step 5) (or select it from pull down menu) and click **OK**.(Or you can use command *vserver iscsi initiator show* from CLI.)

	General	Initiators			
	Select In	itiators		▼ A	dd Initiator
	ign. 1991	-05.com. <u>microsoft</u> :ntap-w	2k8dc-srv. <u>ŋtạp</u> .lab1		
				Create	Cancel
Step 14.					
Click Create					



Step 15.



Step 16.

Back on the Initiators Mapping page, verify that the new igroup has been added to the list; then select the **Map** checkbox to the left of the igroup and click **Next**.

Map 🔻	Initiator Group Name	Туре	LUN ID (Optional)
V	ig_myWin	Windows	

Step 17.

On the page Storage Quality of Service Properties click **Next**. Then review the LUN Summary page and click **Next**.

Step 18.



Review the Create LUN Wizard completion page and click **Finish**. Creation of the iSCSIattached LUN is now complete.

LUNs on SVM	vsISCSI1 ▼		
LUN Management	Initiator Groups Portsets		
+ Create 「 Clone	🖌 Edit 🗙 Delete 😂 Status 🗸	🕄 Move 🛛 📈 Storage QoS	${f C}$ Refresh
Name	\Xi Container Path		\Xi 🛛 Available Size
lun_vslSCSI1_1	/vol/lun_vslSCSl1_1_vol	Enabled	101.98 MB
LUN Properties			
Name:	lun_vsISCSI1_1	Policy Group: None	
Container Path:	/vol/lun_vsISCSI1_1_vol	Maximum NA	
Size:	101.98 MB	Throughput:	
Status:	🖉 Online	Move Job Status: NA	
Туре:	Windows 2008 or later	Move Last Failure NA Reason:	
LUN Clone:	false	Application: NA	
Serial No:	wpEzz]M6/6-X		
Description:			

TASK 7: Access the iSCSI attached LUN on the Windows host

Step 1.

On the desktop right click on Computer icon, and click on Manage.



Step 2

In Server Manager window click on Storage > Disk Management.

🚂 Server Manager				
Eile Action View Help				
🗢 🔿 🖄 📅 🚺 📷				
Server Manager (NTAP-W2K8DC-SF	Disk Managemer	nt Volume List + Graphical View	Actions	
E Roles	Volume Layout	Type File System Status	Disk Management	
Features June Diagnostics Fondiguration	🕞 (C:) Simple I	Basic NTFS Healthy (System, Boot, Page File, Active, Crash Dump, Primary Partition)	More Actions	•
E SpanDrive				
Windows Server Backup				
📑 Disk Management	Disk 0 Basic 30.00 GB Online	(C-) 30.00 GB NTF5 Healthy (System, Boot, Page File, Active, Crash Dump, Primary Partition)		
	Unallocated	Primary partition		

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Step 3.

If you do not see the LUN disk in the bottom section of the center pane, right-click the Disk Management node in the left pane and select **Rescan Disks**. New disk will appear.

Image: Second system Image: Second system Unknown 102 MB 102 MB 102 MB Not Initialized Unallocated

Step 4.

Right-click the disk header and, if the disk is offline, select **Online**.

Step 5.

Right-click the disk header again and select Initialize Disk.

Oisk Unknown 102 MB Not Initia	1 lized	102 MB Upallocated Initialize Disk	
CD-R	= 0M	Offline]
DVD (D:)		Properties	
📕 Unallo	ocati	Help	ition

Step 6.

Review the Initialize Disk dialog box and click OK.

Initialize Disk 🛛 🗙	
You must initialize a disk before Logical Disk Manager can access it.	
Select disks:	
Disk 1	
Use the following partition style for the selected disks:	
MBR (Master Boot Record)	
GPT (GUID Partition Table)	
Note: The GPT partition style is not recognized by all previous versions of Windows. It is recommended for disks larger than 2TB, or disks used on Itanium-based computers.	
OK Cancel	

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Step 7.

In the Disk Management pane, right-click the **Unallocated** partition and select **New Simple Volume.**

Disk 1 Basic 101 MB	101 MB	
Online	Unallocated	New Simple Volume
		New Spanned Volume
Дср.ром о		New Scriped Volume
		New Mirrored Volume
010 (01)		New RAID-5 Volume
Unallocated	Primary partition	Properties
		Help

Step 8.

On the introduction page of the New Simple Volume wizard, click Next.

Step 9.

On the Specify Volume Size page, click Next.

pecify Volume Size Choose a volume size that is betwe	en the maximum and minimum sizes.
Maximum disk space in MB:	100
Minimum disk space in MB:	8
<u>S</u> imple volume size in MB:	
	< <u>B</u> ack <u>N</u> ext > Can



On the Assign Drive Letter or Path page, click Next.

New Simple Volume Wizard			×
Assign Drive Letter or Path For easier access, you can assign a drive letter of	or drive path to	your partition.	
 Assign the following drive letter Mount in the following empty NTFS folder: Do not assign a drive letter or drive path 	E Browse	-	
	< <u>B</u> ack	<u>N</u> ext >	Cancel

Step 11.

On the Format Partition page, perform one of these two actions:

- Click **Next** to accept the default values.
- In the "Volume label" text box, enter a label (such as the one shown here), and then click **Next**.





New Simple Volume Wizard	×
Format Partition To store data on this partition, you	ı must format it first.
Choose whether you want to forma	at this volume, and if so, what settings you want to use.
O Do not format this volume	
• Format this volume with the	following settings:
<u>F</u> ile system:	NTFS 💌
Allocation unit size:	Default
⊻olume label:	lun_vsISCSI1_1
☑ Perform a quick forma	at
🔲 Enable file and folder	compression
	< <u>B</u> ack <u>N</u> ext > Cancel

Step 12.

Review the Completing page and click **Finish**.

Step 13.

Verify that the new LUN is now provisioned and, when you are finished, close the Computer Management window.

Disk 0 Basic 30.00 GB Online	(C:) 30.00 GB NTF5 Healthy (System, Boot, Page File, Active, Crash Dump, Primary Partition)	
Disk 1 Basic 102 MB Online	lun_vsISCSI1 (E:) 100 MB NTFS Healthy (Primary Partition)	
		0.0
Step 14.		

Navigate to the mount location of the LUN and verify that you can create a file in the LUN.




📔 lun_vsISCSI1 (E:)				_ 🗆 🗵
G - Computer - lun_vs	siscsii (E:)	•	🤛 Search	
Eile Edit <u>V</u> iew <u>T</u> ools <u>H</u> elp ○ Organize ▼ III Views ▼				0
Favorite Links Documents Pictures Music More Folders Desktop Administrator Public Computer Local Disk (C:) response conducts More visit Local Disk (C:) response rootdir (\\10.34.41.40) (Y:) vol1 (\\10.34.41.40) (Y:) Network Control Panel Recycle Bin	Name A	Date modified	▼ Size ▼ ent 1 KB	

END OF EXERCISE





LAB 11: Storage efficiency

In this exercise, you create a volume so that you can learn about resizing, working with qtrees and quotas, creating FlexClone volumes, and configuring storage efficiency.

Objectives of this exercise

By the end of this exercise, you should be able to:

- Resize a volume
- Create a qtree and set user quotas
- Work with FlexClone volumes
- Enable deduplication and data compression

Step 1.

In GUI, select Storage > (Volumes on SVM: vs2) > Volumes, and then click Create FlexVol.

Step 2.

In the Create Volume window, enter these volume attributes, and then click the **Create** button:

- Name: dataefficiency
- Aggregate: n02_aggr1
- 20 MB size, with 0% Snapshot copy reserve, and Space reserve: Thin-provisioned

General Storage Efficiency Quality of Service Protection Name: dataefficiency Aggregate: n02_aggr1 Choose Storage Type NAS (Used for CIPS or NFS access) Data Protection (Used as destination volume) Tlering Policy Policy: snapshot-only Tell me more about external capacity tier and tiering policies. Size Total Size: 20 MB Snapshot Reserve (%): 0 0 0 Tell me more about space: 0 Byte Space Reserve Space Reserve (optional): Thin Provisioned Tell me more about space reservation 	Create Volume	Create Volume			
Name: dataefficiency Aggregate: n02_aggr1 Choose Storage Type • NAS (Used for CIFS or NFS access) • Data Protection (Used as destination volume) Tiering Policy Policy: snapshot-only Tell me more about external capacity tier and tiering policies. Size Total Size: 20 MB Data Space: 20 MB Snapshot Space: 0 Byte Space Reserve (optional): Thin Provisioned Tell me more about space reservation	General Sto	rage Efficiency	Quality of Service Protection		
Aggregate: 002_aggr1 Choose Storage Type NAS (Used for CIFS or NFS access) Data Protection (Used as destination volume) Tlering Policy Policy: snapshot-only Tell me more about external capacity tier and tiering policies. Size Total Size: 20 MB Snapshot Reserve (%): 0 Data Space: 20 MB Snapshot Space: 0 Byte Space Reserve Space Reserve (optional): Thin Provisioned Tell me more about space reservation	Name:	dataefficie	ency		
Storage Type NAS (Used for CIFS or NFS access) Data Protection (Used as destination volume) Tiering Policy Policy: snapshot.only ▼ Policy: snapshot.only ▼ Tell me more about external capacity tier and tiering policies. Size Total Size: 20 MB<▼	Aggregate:	n02_aggr1	1 Choose		
 NAS (Used for CIFS or NFS access) Data Protection (Used as destination volume) Tiering Policy Policy: snapshot.only v Tell me more about external capacity tier and tiering policies. Size Total Size: 20 MB Snapshot Reserve (%): 0 Data Space: 20 MB Snapshot Space: 0 Byte Space Reserve Space Reserve (optional): Thin Provisioned v Tell me more about space reservation 	Storage Type				
● Data Protection (Used as destination volume) Tiering Policy: Policy: Tell me more about external capacity tier and tiering policies. Size Total Size: 20 Data Space: 20 MB Snapshot Space: 0 Byte Space Reserve	NAS (Use)	d for CIFS or NFS	i access)		
Tiering Policy Policy: snapshot-only Tell me more about external capacity tier and tiering policies. Size Total Size: 20 Snapshot Reserve (%): 0 Data Space: 20 MB Snapshot Space: 0 Byte Space Reserve	Data Prot	ection (Used as d	destination volume)		
Policy: snapshot-only V Tell me more about external capacity tier and tiering policies. Size Total Size: 20 MB Snapshot Reserve (%): 0 0 Data Space: 20 MB Snapshot Space: 0 Byte Space Reserve Space Reserve Thin Provisioned V Tell me more about space reservation	Tiering Policy				
Tell me more about external capacity tier and tiering policies. Size Total Size: 20 Snapshot Reserve (%): 0 Data Space: 20 MB Snapshot Space: 0 Byte Space Reserve Space Reserve Space Reserve (optional): Thin Provisioned ▼ Tell me more about space reservation	Policy:		snapshot-only		
Size Total Size: 20 MB Snapshot Reserve (%): 0 Data Space: 20 MB Snapshot Space: 0 Byte Space Reserve Space Reserve Tell me more about space reservation	Tell me more	about external o	capacity tier and tiering policies.		
Total Size: 20 MB Snapshot Reserve (%): 0 Data Space: 20 MB Snapshot Space: 0 Byte Space Reserve (optional): Thin Provisioned Tell me more about space reservation	Size				
Snapshot Reserve (%): 0 Data Space: 20 MB Snapshot Space: 0 Byte Space Reserve Space Reserve Tell me more about space reservation	Total Size:		20 MB		
Space Reserve Space reservation	Snapshot Re	serve (%):			
Space Reserve Space Reserve (optional): Thin Provisioned Tell me more about space reservation	Snanshot Sn	ace.	0 Byte		
Space Reserve (optional): Thin Provisioned Tell me more about space reservation	Space Reserve				
Tell me more about space reservation	Space Reserv	e (optional):	Thin Provisioned		
Tell me more about space reservation					
	Tell me more	about space res	servation		
			Create Cancel		

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Step 3.

Check the Namespace page to see where the volume was mounted. Remember that GUI automatically mounts new volumes at /<volname>.

Namespace on SVM vs2 v		
👤 Mount 🖳 Unmount 📝 Change Export Policy 🏹 Refresh		
Path	Storage Object	Export Policy
4 /	🖯 vs2_root	vs2def
▷ ¥ vs2vol01	🖯 vs2_vol01	vs2def
Final Action of Actiono	🖯 dataefficiency	default

Step 4.

Select the dataefficiency volume from the list, click Change Export Policy, and change the export policy to vs2def.

Step 5.

Navigate to the Volumes page for vserver vs2, select the volume dataefficiency, and click Edit.

Step 6.

In the Edit Volume window, on the General tab, click Configure UNIX permissions and give the Group and Others read, write, and execute permissions, and then click Save and Close.

General Stora	ge Efficiency .	Advanced					
Name:	dataefficien	cy					
Security style:	UNIX	~					
Configure UNIX	permissions (Opti	ional)	R	ead	Write	Execute	
Owner			[v	1	V	
Group			[v	v	V	
Others			[1	\checkmark	\checkmark	
data is written i Tell me more about	o the volume. Th	e unused aggregate spa g	ce is available to oth	er thir	i provisio	a, space is ned volun	allocated
data is written i Tell me more about	o the volume. Th	e unused aggregate spa g	ce is available to oth	er thir	Save ap	d Close	Capre
data is written i	o the volume. Th	e unused aggregate spa g	ce is available to oth	er thir	Save an	d Close	allocated nes and L Cance
data is written i	o the volume. Th	e unused aggregate spa g	ce is available to oth	evantion of the second s	Save an	d Close	Cance

Step 7.

From your NFS

cd /mnt/vs2/dat

echo "This is the content of datafile in volume dataefficiency" > datafile

ls

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cat datafile

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Step 8.

In GUI, on the Shares page, click **Create Share** to create a **CIFS** share for the new volume.

Shares on SVM vs2 v		
🙀 Create Share 🙀 Create Home Directory 📝 Edit 🔘 Stop	Sharing 😋 Refresh	
Share Name	Path T	Home Directory
admins	1	
cs.	1	
ipc s	1	
rootdir	1	
vol1	/vs2vol01	
~96707	96 vvr	×

Step 9.

Click **Browse** to select a folder to share, select the dataefficiency junction, and click **OK**.

	Browse For Folder		×
	Select a folder to share		
	4 /		
	🕑 🧰 .vsadmin		
	Attaching the second		
	ν + vs2v0i01		
	Only volumes which are mounted are Selected Path: /dataefficien	visible	
		OK	Cancel
10.			
- 4h a al-	a do and alial Creat		
e the sha	re de and click Create.		
e the sha	re de and click Create .		
e the sha	re de and click Create .		
e the sha	re de and click Create .		
e the sha	re de and click Create .		
e the sha	re de and click Create .		



C	create Share		×		
ſ	Folder To Share:	/dataefficiency Browse			
l	Share Name:	de			
l	Comment:				
l	Enable continuous a	wailability for Hyper-V and SQL			
l	Select this option if the share contains Hyper-V VHDs over SMB				
l	Encrypt data while a	accessing this share			
	Encrypts data using share.	3 SMB 3.0 to prevent unauthorized file access on this			
		Create Cancel			

Step 11.

In Windows, map the new share as the T: drive.

PS C: $>$	net use	e t:	\\nta	pvs2\de		
The com	mand com	nple	ted su	ccessfully.		
$PS C: \setminus >$	t:					
PS $T: \setminus >$	dir					
Dire	ectory:	$T: \setminus$				
Mode			Last	WriteTime	Length	Name
-a	10.	12.	2014	11:25	63	datafile

TASK 2: Resize a volume

Step 1.

Using Putty log in to the Linux (CentOS) machine and issue command cd /mnt/vs2/dataefficiency/

Step 2.

Then we will try to create 30MB file.

dd if=/dev/urandom of=30mfile bs=1k count=30000

Step 3.



Action ended with message "No space left on device". Remove partial file.

▼

ls -la

rm 30mfile

rm: remove regular file `30mfile'? y

ls -la

Step 4.

In GUI, on the Volumes page, select the **dataefficiency** volume and click the **Actions** > **Resize** option to start the Volume Resize wizard.

Volumes on SVM vs2

+	+ Create 🔹 🖍 Edit 🖀 Delete 🕼 Actions 💌 🛡 View Missing Protection Relationships 🖒 Refresh									
	Status 🝸	Name	Ŧ	5tyle	Ŧ	Aggregates	T	Thin Provisioned	T	Available Space 🛛 🝸
+	Ø	dataefficiency		FlexVol		n02_aggr1		Yes		19.83 MB
٠	Ø	vs2_root		FlexVol		n02_aggr1		No		16.84 MB
+	Ø	vs2_vol01		FlexVol		n01_aggr1		No		378.77 MB

Step 5.

When the wizard starts, click Next.

Step 6.

In the Resize Volume Settings window, change the Total capacity value to **100 MB** without changing the value in the Snapshot reserve field, and click **Next**.

Volume Re	esize Wizard - dataeffici	ency			
Resize You c	: Volume Settings an resize data space by ch	anging the size or Snapshot r	eserve percentage	e of the volume	
	100 MB	- Space Settings			_
		Total Capacity:	100	мв 💌	
		Snapshot Reserve (%):	0	(0 Byte)	
		Available Space			
		Dete Ferrer	Current	New	
		Snapshot Reserve	0 Byte	0 Byte	
12			-		
		Total	19.83 MB	99.83 MB	
- C					
1					
State of Sta					
East 1					
-					
			В	ack Next C	ancel



Step 7.

On the Delete Snapshot Copies page, click Next.

Step 8.

On the Summary page, confirm the new capacity, and then click Next and Finish.

Volume Resize Wizard - dat	aefficiency	×
Summary You should review this so to go back and make any	ummary before resizing the selected volume. You can use the Back butto r necessary changes.	'n
	Summary * You are resizing the volume from '20 MB' to '100 MB'	
	Back Next Cancel	

Step 9.

On the Linux (CentOS) machine create 30MB file.

```
dd if=/dev/urandom of=30mfile bs=1k count=30000

ls -la

total 30132

drwxrwxrwx. 2 root root 4096 Dec 10 2014 .

drwxrwxrwx. 4 root root 4096 Dec 10 2014 ..

-rw-r--r--. 1 root root 30720000 Dec 10 2014 30mfile

-rw-r--r--. 1 root root 63 Dec 10 2014 datafile
```

TASK 3: Create a qtree and set quotas

Step 1.

In GUI, select Storage > Qtrees > (Qtrees on SVM: vs2).

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Step 2.

On the Qtrees page, click Create.

Step 3.

In the Create Qtree window, on the Details tab, name the qtree **qtdemo** and ensure that it is in the dataefficiency volume.

Create Qtree		×
Details Qu	iota	
Name:	qtdemo	
Volume:	dataefficiency	Browse
Oplocks:	Enable oplocks for files and directories in	this qtree
Security Style:	Inherit volume security style	
Export Policy:	Inherit volume export policy	Browse Create Export Policy
Tell me more ab	out gtree options	
		Create Cancel

Step 4.

On the Quota tab, add a user quota of **5 MB**, and then click **Create**.

ee Quota			
imit total space us	age within this qtr	ee	
Space Usage Limit:		кв 💌	
total space us	age for users of th	ns qu'ee	
Space Usage Limit:	5	мв 🎽	
	ee Quota .imit total space us Space Usage Limit: er quota .imit total space us Space Usage Limit:	ee Quota imit total space usage within this qtr Space Usage Limit: r quota imit total space usage for users of th Space Usage Limit: 5	ee Quota imit total space usage within this qtree Space Usage Limit: r quota imit total space usage for users of this qtree Space Usage Limit: 5 MB



Step 5.

In quota Activate window check "OK to activate the quota" and click Activate.



Step 6.

On the Quotas page, check the **dataefficiency** volume. Initialization can take several minutes.

Quotas on SVM vs2	2 🔻		
User Defined Quotas	Quota Report Quota Status o	n Volumes	
🙀 Create 📝 Edit Limits	🗙 Delete 🔀 Refresh		
Volume	١	Q tree	Туре
dataefficiency		qtdemo	🔒 user

Step 7.

Verify that the activation was successful.

You might need to click the Refresh button.

Step 8.

On your Windows desktop, from the **Desktop**, copy the file **10mfile** into **T:\qtdemo**.





Copy Iter	n 🗙
	There is not enough space on de (\\ntapvs2) (T:)
93	9,76 MB is needed to copy this item. Delete or move files so you have enough space.
	There was not enough space for this item:
	de (\\ntapvs2) (T;) Type: File folder Date modified: 10. 12. 2014 13:18
	Free up space from this disk and try again:
	de (\\ntapvs2) Space free: 70,3 MB Total size: 100 MB
	Tty Again Cancel

Step 9.

Notice that the copy operation puts the qtree over quota and click **Cancel**.

Step 10.

In GUI, click the User Defined Quotas, and then click the Edit Limits button.

Quotas on SVM vs2 v
User Defined Quotas Quota Report Quota Status on Volumes
🙀 Create 📝 Edit Limits 🗙 Delete 🔀 Refresh
Volume Type
dataefficiency qtdemo 着 user

Step 11.

In the Edit Limits window, click the Space Limit tab, change the Hard Limit to 15 MB, and then click Save and Close.





Edit Limits					×
Details 5	Space Limit F	ile Limit			
Hard Limit:	15		мв	*	
Soft Limit:			КВ	~	
Threshold:			КВ	~	
		Save	Save and Clos	e	Cancel

Step 12.

Go back to the **Quota Status on Volumes** tab, select the **dataeffeciency** volume, and click **Refresh**.

Quotas on SVM vs2 v		
User Defined Quotas Quota Report Quota Status on Volumes		
🔴 Activate 🕘 Deactivate 📴 Resize 🔀 Refresh		
Volume	Status	r Error
vs2_root	• Off	No Error
vs2_vol01	nto 🔍	No Error
dataefficiency	On On	No Error

Step 13.

When resizing is over, copy the 10mfile to T:\qtdemo again. The operation should succeed this time.



TASK 4: Use FlexClone volumes

Step 1.

On the Volumes page, select the **dataefficiency** volume, click **Actions** > **Clone**, and then click **Create** and **Volume** to create a FlexClone copy of the volume.



Volu	imes on SV	M vs2	•							
+	Create 💌 🖌	Edit 🗍 Delete	🗹 Actions 💌 🛡 View Missing	; Pro	tection Relationships	t) Refresh			
	Status 🝸	Name	Change status to	•	Aggregates T		Thin Provisioned	Available Space 🔻	Total Space	T
٠	Ø	dataefficiency	Protect		n02_aggr1		Yes	70.19 MB	100 MB	
٠	Ø	vs2_root	Manage Snapshots	٨	0.02 armr1		No	16.8 MB	20 MB	
+	Ø	vs2_vol01	Clone Storage Efficiency	•	<u>Create</u> Split		File	378.73 MB	400 MB	
			Move		View Hierarchy					
			Storage QoS							
			Provision Storage for VMware							
			Change Tiering Policy							

Step 2.

In the Create FlexClone Volume window, accept the default name, select **Create new Snapshot copy now**, and then click **Clone**.

Name:	dataefficiency_clone	_07032018_092003_28	
Thin Pr	ovisioning		
llocate sp	ace for the volume as it's	used. Otherwise, the sys	tem reserves
- FlexClor	ie parent Snapshot copy –		
Creat	e new Snanshot convino)r	
	in existing Spanshot conv		
Name	in caloring shapshot copy	Date	

Step 3.

In the top-right corner of the Volume page, click the small icon 🌣 (cogwheel) at the edge to display a selection list that enables you to add additional fields.





V	Status
V	Name
V	Style
V	Aggregates
V	Thin Provisioned
	Root volume
V	Available Space
V	Total Space
V	% Used
V	Туре
V	Protection Relationship
V	Storage Efficiency
	Encrypted
	QoS Policy Group
	SnapLock Type
V	Clone
	Is Volume Moving
	Tiering Policy
V	Application

Step 4.

Select the **Type** (if not selected) and **Clone** checkboxes.

Step 5.

In GUI, navigate to the **Storage > Namespace** page and notice that clone1 does not appear in the Namespace list.

Step 6.

Mount your clone volume under the path /vs2vol1 as clone1.

Volume Name:	dataefficiency_clone_1012201]
Junction Name:	clone1]
Junction Path:	/vs2vol1	Bro
100000000		



Determine where the clone is mounted in the namespace.

Namespace on SVM vs2 v		
👤 Mount 🖳 Unmount 📝 Change Export Policy 🍣 Refresh		
Path	Storage Object	Export Policy
4 7 1	🖯 vs2_root	vs2def
⊿ ∓ vs2vol01	🖯 vs2_vol01	vs2def
🔺 ∓ clone1	🖯 dataefficiency_clone_07032018_092003_28	vs2def
🐳 qtdemo	📴 qtdemo	vs2def
a ∓ dataefficiency	🖯 dataefficiency	vs2def
∓ qtdemo	🔯 qtdemo	vs2def

Step 8.

Check the export policy on the clone and set to vs2def.

Step 9.

In Windows File Explorer, from your vs2 root volume drive, navigate to /vs2vol01/clone1.



Step 10.

From your NFS client, append some text to datafile on clone1.

```
cd /mnt/vs2/vs2vol01/clone1
```

ls

```
30mfile datafile qtdemo
```

echo "Edited from a FlexClone..." >> datafile

cat datafile

"This is the content of datafile in volume dataefficiency"

Edited from a FlexClone...

Step 11.

Check the contents of the file on the parent volume, and notice that, although the clone and parent share common data blocks, they function as separate volumes.

cd /mnt/vs2/dataefficiency/

cat datafile

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"This is the content of datafile in volume dataefficiency"

Step 12.

In GUI, on the Volumes page, select the clone, and then select Actions > Clone > Split.



Step 13.

In the Clone Split window, select the OK to split the clone and delete all its Snapshot copies checkbox, and then click Start Split.

The split takes some time to complete.

Clone	Split	×		
A	The clone "dataefficiency_clone_10122014_121500" will be split off from its parent volume"dataefficiency".			
This may take several minutes to complete for large volumes All Snapshot copies taken on the clone will be deleted.				
1	OK to split the clone and delete all its Snapshot copies			
	Start Split Cancel			
V	This may take several minutes to complete for large volumes All Snapshot copies taken on the clone will be deleted. OK to split the clone and delete all its Snapshot copies Start Split Cancel			

Step 14.

On the Volumes page, notice the status in the **Clone** column. The clone no longer shares blocks with the parent and is now a separate volume.

Vo	olumes on S	VM vs2	•									
	+ Create - 🖌 Edit 🗈 Delete 🖾 Actions - 🕲 View Missing Protection Relationships 🖏 Refresh											
	Status 🝸	Name T	Style 🔻	Aggregates T	Thin Provisioned T	Available Space 🔻	Total Space 🛛 🝸	% Used 🛛 🝸	Туре 🛛 🝸	Protection Relations T	Storage Efficiency 🝸	Clone
8	0	dataefficiency	FlexVol	n02_aggr1	Yes	70.08 MB	100 MB	29	rw	No	Disabled	No
	0	dataefficiency_clone_0703	FlexVol	n02_aggr1	Yes	70.38 MB	100 MB	29	rw	No	Disabled	No
B	•	vs2_root	FlexVol	n02_aggr1	No	16.73 MB	20 MB	16	rw	No	Disabled	No
B	•	vs2_vol01	FlexVol	n01_aggr1	No	378.7 MB	400 MB	5	rw	No	Disabled	No
	4 1	-										

Step 15.

(Optional) If you wish, you can rename the volume to reflect its new status.

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TASK 5: Enable deduplication and data compression

Step 1.

In GUI, on the **Storage > Volumes** page, select the **dataefficiency** volume and click the **Edit** and **Storage Efficiency** tab.

Step 2.

Select the **Enable Background Deduplication, Policy based** checkboxes, select **Storage Efficiency Policy: Default, Background Compression** and click **Save and Close**.

lit volume			
General	Storage Efficiency	Advanced	
🕑 Backgro	ound Deduplication		
Recom	mended for volumes us	ed for server o	r desktop virtualization, file system shares, or backups.
Pol	icy based - Deduplicatio	n happens bas	sed on the selected policy.
Stor	rage Efficiency Policy:	default	Choose
🔘 On	-demand - Deduplicatio	n must be run	manually.
🖉 Backgro	ound Compression ו		
👍 Co	mpression runs along w	rith deduplicati	ion. Not recommended for performance-critical applications.
🔲 Inline C	Compression		
Tell me mo	ore about storage efficier	ncy.	
			Eave Eave and Close Cancel

Step 3

On the Volumes page, notice the dataefficiency volume's status in the **Storage Efficiency** column.

	Status 🔻	Name T	Style 🔻	Aggregates T	Thin Provisioned T	Available Space 🔻	Total Space 🛛 🝸	% Used 🔻	Туре 🔻	Protection Relationship 🝸	Storage Efficient
÷	0	dataefficiency	FlexVol	n02_aggr1	Yes	69.65 MB	100 MB	30	rw	No	Enabled
Ð	0	dataefficiency_clone_0703	FlexVol	n02_aggr1	Yes	69.98 MB	100 MB	30	TW	No	Disabled
÷	0	vs2_root	FlexVol	n02_aggr1	No	16.6 MB	20 MB	16	TW	No	Disabled
÷	0	vs2_vol01	FlexVol	n01_aggr1	No	378.55 MB	400 MB	5	rw	No	Disabled



Step 4.

With the dataefficiency volume selected, notice % Used and Available space.

Vo	lumes on SV	M vs2		7										
ŀ	treate ✓ Edit Delete Create View Missing Protection Relationships S Refresh													
	Status 🔻	Name	T	5tyle	T	Aggregates	T	Thin Provisioned	T	Available Space 🝸	Total Space	T	% Used	T
)	dataefficiency		FlexVol		n02_aggr1		Yes		69.04 MB	100 MB		30	

Step 5.

From the Y:\vs2vol01\clone1 directory, copy the 30mfile to the T: drive, which is mounted to the dataefficiency volume.

Step 6.

When prompted, select Copy, but keep both files



Step 7.

Again with the dataefficiency volume selected, notice % Used and Available space.

Volu	'olumes on SVM vs2													
	Status 🝸	Name	Ŧ	5tyle	T	Aggregates	Ŧ	Thin Provisioned	Ŧ	Available Space 🔻	Total Space	Ŧ	% Used	Ŧ
٠	Ø	dataefficiency		FlexVol		n02_aggr1		Yes		39.98 MB	100 MB		60	



Step 8.

With the dataefficiency volume selected, click the **Actions > Storage Efficiency** and check box **Scan Entire Volume** and than click **Start**.

Storage Efficiency (Backgrou	und Mode)	×
Volume Name:	dataefficiency	
Deduplication Mode:	Scheduled (default)	
Compression:	Enabled (Background)	
Last Run End Time:	Mar/07/2018 12:31:13	
🕑 Scan Entire Volume		
Select this option if you deduplication is run onl	are running deduplication for the first time. By default, y on data added since the last scan.	
	Start. Cance	

Step 9.

Refresh volume page and notice % Used and Available space.

Volumes on SVM vs2 • + Create -👕 Delete 🛛 🗹 Actions 💌 View Missing Protection Relationships 🖋 Edit 🕉 Refresh 5tyle Thin Provisioned Available Space Total Spa Status Name Aggregates Φ Ø dataefficiency FlexVol n02_aggr1 69.21 MB 100 MB

On production systems, it can take longer time.

END OF EXERCISE.



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LAB 12: Data Protection: SnapShot and SnapMirror copies

Objectives of this exercise:

- Create and initialize LS and DP SnapMirror replications
- Compare DP mirror replication times
- Add volumes and files to a replicated namespace
- Schedule periodic SnapMirror replications
- Promote an LS mirror
- Use System Manager to configure a SnapMirror relationship
- Use the CLI to configure a SnapMirror relationship
- Update SnapMirror relationships

TASK 1: Create and initialize LS and DP snapmirror replications

Step 1.

Create a mirror for the root volume of your virtual server on the same aggregate as the root volume.

cluster1::> vol create -vserver vs2 -volume vs2_root_ls1 -aggregate n01_aggr1 -type dp

NOTE: Although this is an LS mirror, it must be created as a DP mirror volume and then changed.

Step 2.

Establish the mirror relationship between the source volume and the destination volume and change the destination to an LS mirror.

cluster1::> snapmirror create -source-cluster cluster1 -source-vserver vs2 -source-volume vs2_root -destination-cluster cluster1 -destination-vserver vs2 -destination-volume vs2_root_ls1 -type ls

Step 3.

Create another LS mirror of the same volume on the other node and establish the mirror relationship with the same source.

cluster1::> vol create -vserver vs2 -vol vs2_root_ls2 -aggregate n02_aggr1 -type dp cluster1::> snapmirror create -source-path cluster1://vs2/vs2_root -destination-path cluster1://vs2/vs2_root_ls2 -type ls

Step 4.



Use a summary view and then an instance (detailed) view to view the mirrors.

cluster1::> snapmirror show

cluster1::> snapmirror show -instance

The state of each mirror is "Uninitialized." No data has been transferred to the mirrors.

Step 5.

Perform the initial (baseline) replication to the set of LS mirrors of this source volume.

cluster1::> snapmirror initialize-ls-set -source-path cluster1://vs2/vs2_root

cluster1::> snapmirror show

NOTE: Now that the first replication of the LS mirrors has occurred, all requests that are sent through existing NFS mounts or CIFS shares to the Vserver root volume are transparently routed to one of the LS mirrors of this Vserver root volume rather than to the read and write volume. This includes write requests, which will fail, because mirrors are read-only.

Step 6.

Create two DP mirrors.

```
cluster1::> volume create -vserver vs2 -volume vs2_root_dp1 -aggregate n01_aggr1 -type dp
```

cluster1::> volume create -vserver vs2 -volume vs2_root_dp2 -aggregate n02_aggr1 -type dp

Step 7.

Establish the DP mirror relationships.

cluster1::> snapmirror create -source-path cluster1://vs2/vs2_root -destination-path cluster1://vs2/vs2_root_dp1 -type dp

cluster1::> snapmirror create -source-path cluster1://vs2/vs2_root -destination-path cluster1://vs2/vs2_root_dp2 -type dp

cluster1::> snapmirror show

Step 8.

Perform the initial (baseline) replication to one of the DP mirrors.

cluster1::> snapmirror initialize -source-path cluster1://vs2/vs2_root -destination-path cluster1://vs2/vs2_root_dp1

Step 9.



View the volume Snapshot copies of the source volume.

cluster1::> volume snapshot show -vserver vs2 -volume vs2_root

NOTE: The Snapshot copies are named with a prefix of "snapmirror." These Snapshot copies are specifically for the mirrors and are kept so that future replications to the mirrors can determine which data is new since the last replication. Two SnapMirror Snapshot copies of this volume exist. One is for the set of two LS mirrors. The other is for the DP mirror.

Step 10.

Review the mirrors.

cluster1::> snapmirror show -inst

NOTE: The mirror root_dp1 has the state "Snapmirrored," and the Mirror Timestamp field shows the date and time of that replication. Because this is asynchronous mirroring, mirrors are only as up to date as the manual replications or the scheduled replications keep them.

TASK 2: Compare DP mirror replication times

Step 1.

Replicate the DP mirror that has not been replicated.

cluster1::> snapmirror initialize -source-path cluster1://vs2/vs2_root -destination-path cluster1://vs2/vs2_root_dp2

Step 2.

Review the mirrors.

cluster1::> snapmirror show -inst

The two DP mirrors have different replication times.

Step 3.

View the volume Snapshot copies of the source volume.

cluster1::> volume snapshot show -vserver vs2 -volume vs2_root

NOTE: Three SnapMirror Snapshot copies of this volume exist. They enable SnapMirror software to perform incremental transfers to the mirrors of this source volume. One of these SnapMirror Snapshot copies is for the set of two LS mirrors. The other two are for the two independent DP mirrors.

Step 4.

Replicate to both DP mirrors.



cluster1::> snapmirror update -source-path cluster1://vs2/vs2_root -destination-path cluster1://vs2/vs2_root_dp1

cluster1::> snapmirror update -source-path cluster1://vs2/vs2_root -destination-path cluster1://vs2/vs2_root_dp2

Step 5.

Review the mirrors.

cluster1::> snapmirror show -inst

Step 6.

Review the volume Snapshot copies of the source volume.

cluster1::> volume snapshot show -vserver vs2 -volume vs2_root

Three SnapMirror Snapshot copies of this volume still exist.

TASK 3: Add volumes and files to a replicated namespace

Step 1.

In your Vserver on the aggregate vs2_aggr1, create a volume.

cluster1::> volume create -vserver vs2 -volume vs2_vol03 -aggregate n01_aggr1 - junction-path /vs2vol3 -policy vs2def

Step 2.

Access your Linux client machine.

Step 3.

Assuming that your data LIF is still mounted from that NFS client, view the root of your namespace.

cd /mnt/vs2

ls

Step 4.

From your cluster shell, perform an incremental replication to the set of LS mirrors of the Vserver root volume.

cluster1::> snapmirror update-ls-set -source-path cluster1://vs2/vs2_root

Step 5.

After the mirror jobs are completed, from your NFS client, review the mirror of the root of your namespace.



ls /mnt/vs2

The junction for vs2_vol03 appears.

Step 6.

In the root of the namespace, begin to create a file called "myfile."

touch /mnt/vs2/myfile

Because the NFS client references one of the LS mirrors, which is read-only, the file creation fails. No writes can be done to an LS mirror.

Step 7.

Using the special .admin path, mount (as "root") your namespace.

mkdir /mnt/vs2rw

mount 10.34.x1.40:/.admin/mnt/vs2rw

The .admin path forces your mount to use the source volume, which is read and write, rather than allowing automatic routing to LS mirrors.

Step 8.

In the read and write root of the namespace, create a file called "myfile."

touch /mnt/vs2rw/myfile

ls /mnt/vs2rw/myfile

The new file should appear.

Step 9.

Using the "normal" path that is routed to the LS mirrors, view the Vserver root.

ls /mnt/vs2/myfile

Because the new file is on the read/write volume and the LS mirrors have not been rereplicated, the "myfile" file is not visible.

Step 10.

From your cluster shell, perform an incremental replication to the set of LS mirrors of the Vserver root volume.

cluster1::> snapmirror update-ls-set -source-path cluster1://vs2/vs2_root

Step 11.

From your NFS client, review the mirror of the root of your namespace.



ls /mnt/vs2/myfile

The file should appear.

TASK 4: Schedule periodic snapmirror replications

For this exercise, you use the 5min schedule for LS mirrors and the hourly schedule for a DP mirror.

NOTE: In a real-world situation, it might be sufficient to replicate to LS mirrors hourly and DP mirrors daily.

Step 1.

View the schedules that were created by default.

cluster1::> job schedule show

NOTE: The schedule that you use for replication depends on the data that is contained in each volume and the requirements of the particular mirror. Some volumes might not need to be replicated, while other volumes do; for example, the DP mirrors don't have to be synchronized as often as the LS mirrors. For this exercise, we'll use the 5min schedule for LS mirrors and the hourly schedule for a DP mirror. In the real world, it may be sufficient to replicate to LS mirrors hourly and DP mirrors daily.

Step 2.

Modify one of the LS mirrors to use the 5min schedule.

cluster1::> snapmirror modify -destination-path cluster1://vs2/vs2_root_ls1 -schedule 5min

Step 3.

View the details of the LS mirrors.

cluster1::> snapmirror show -destination-path cluster1://vs2/vs2_root_ls* -instance

cluster1::> snapmirror show -destination-path cluster1://vs2/vs2_root_ls* -fields schedule

The SnapMirror schedule of each LS mirror is now set to 5min.

Step 4.

Modify one of the DP mirrors to use the hourly schedule.

cluster1::> snapmirror modify -destination-path cluster1://vs2/vs2_root_dp1 -schedule hourly

Step 5.

View the details of the DP mirrors.

cluster1::> snapmirror show -fields schedule

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NOTE: Only the schedule for the DP mirror that you explicitly modified is set to use this schedule. Each DP mirror of a read and write volume is separate from the other DP mirrors, except that they're associated with the same read and write. They can each have separate replication schedules, or one DP can have a schedule while another does not.

Step 6.

Check the time on a node.

cluster1::> system date show

Step 7.

While waiting for the scheduled mirror update to run, continue to run the *system date show* command and watch for the system clock to reach a multiple of five, which triggers the replication of all the LS mirrors of this volume.

NOTE: After the system clock reaches the five-minute mark, the mirror update occurs but is not visible, which means that no job is created for it.

Step 8.

To determine which ones were replicated, view the summary of the mirrors.

cluster1::> snapmirror show -instance

cluster1::> snapmirror show -fields newest-snapshot-timestamp

TASK 5: Promote an LS mirror

Step 1.

Examine the read and write copy of the Vserver root volume and all its mirrors.

cluster1::> volume show -volume vs2_root*

The Type field shows the values RW, LS, and DP.

Step 2.

Promote one of the LS mirrors.

cluster1::> snapmirror promote -source-path cluster1://vs2/vs2_root -destination-path cluster1://vs2/vs2_root_ls2

Step 3.

At the prompt to proceed, type y.

Step 4.

While the command runs in the foreground, wait for the command to complete.



Step 5.

Review this volume family.

cluster1::> volume show -volume vs2_root*

The old read and write volume (vs2_root) is gone and the volume vs2_root_ls2 has the type RW. The name of the volume didn't change, but it is the read and write volume now, and all the mirrors replicate from that volume.

Step 6.

Review the SnapMirror relationships.

cluster1::> snapmirror show

Only one LS mirror (vs2_root_ls2) exists.

Step 7.

From the newly appointed read/write volume, replicate everything again.

cluster1::> snapmirror update-ls-set -source-path cluster1://vs2/vs2_root_ls2

TASK 6. Set up an intercluster peer relationship

Step 1.

Start a PuTTY session Console node3.

Step 2.

Create a single node cluster2. Accept the defaults for all values except for the following, and use specific IP addresses and netmasks.

Cluster name:	cluster2
CIFS	COXCBSUQACAAAABGAAAAAAAAAAAA
FlexClone	WGKOESUQACAAAABGAAAAAAAAAAAA
iSCSI	OIVRBSUQACAAAAABGAAAAAAAAAAA
NFS	QTZNASUQACAAAAABGAAAAAAAAAAA
SnapMirror	KMMZDSUQACAAAABGAAAAAAAAAAA
SnapProtect	SKBWGSUQACAAAAABGAAAAAAAAAAA
SnapRestore	YROKDSUQACAAAABGAAAAAAAAAAAA
SnapVault	IBIDFSUQACAAAAABGAAAAAAAAAAAA



Cluster management port:	e0c
Cluster management IP:	10.34.x1.22
Cluster management subnet mask:	255.255.255.0
Cluster management gateway:	10.34.x1.1
DNS domain:	ntap.lab1
Name server:	10.34.x1.10
Node management port:	e0c
Node management IP:	10.34.x1.33
Node management netmask:	255.255.255.0
Node management gateway:	10.34.x1.1

Step 3.

To check the status of your new cluster, enter the **cluster show** command at the console.

cluster2::> cluster show

Node	Health	e Eligibility
cluster2-01	true	true

Step 4.

Disable autosupport

cluster2::> autosupport modify -support disable

Step 5.

Log off from terminal (telnet) session and log on trough SSH session to cluster management.

Step 6.

Log on cluster2 using ssh and cluster management IP address.

Step7.

This step is necessary only when running a virtualized cluster. The virtual disks attached to each node are small compared to real hard disks, resulting in unrealistic sizes for aggr0 and vol0.

Turn off snapshots on vol0 on both nodes.

cluster2::> system node run -node cluster2-01 vol options vol0 nosnap on

Step 8.

Set snap reserve on vol0 to 0%.





cluster2::> system node run -node cluster2-01 snap reserve vol0 0

Step 9.

From the command line, show the aggregates:

cluster2::> stor aggr show

Step 10.

Rename the aggr0 aggregates so that they are more easily identifiable.

cluster2::> aggr rename -aggregate aggr0 -newname aggr0_n3

Step 11.

Verify the new names.

cluster2::> stor aggr show

The aggr0 aggregates have only one data disk each. The size of the data disk is 1GB.

Step 12.

Next steps till end of the exercise are specific only for the simulator environment. Add 3 data disks to each aggr0 aggregate.

cluster2::> aggr add-disk -aggregate aggr0_n3 -diskcount 3

Step 13.

Increase the size of vol0 to 3GB.

cluster2::> system node run -node cluster2-01 vol size vol0 +2g

Step 14.

Verify the vol0 settings.

cluster2::> volume show -vserver cluster2-01 -volume vol0

Step 15.

Assign all unassigned disk drives

cluster2::> storage disk show -container-type unassigned

•••

cluster2::> storage disk assign -all -node cluster2-01

cluster2::> storage disk show -container-type unassigned

There are no entries matching your query.

Step 16. Set NTP server.

cluster2::> cluster time-service ntp server show

This table is currently empty.

cluster2::> cluster time-service ntp server create -server 10.34.x1.10





cluster1::> cluster time-service ntp server show

auto

Server Version

----- ----

10.34.x1.10

Step 17.

Set date and time (to be synchronized with your AD server). Time difference between AD controller and clusters have to be less than 5 minutes, otherwise you'll be not able register SVMs to domain. Even you set up NTP server, the system time is not moved immediately but in some steps. So better is set up the time manually.

cluster2::> cluster date show Node Date Time zone

cluster2-01

3/9/2018 10:33:46 +00:00 Etc/UTC

cluster1::> cluster date modify -timezone Europe/Bratislava -date "1/12/2016 12:17:25"

Step 19.

Step 18.

From the cluster shell, create an aggregate.

cluster2::> aggr create -aggr aggr1 -diskcount 16 -node cluster2-01

Step 20.

From the cluster2 tab in GUI, access Storage > SVMs window and click Create to start SVM creation wizard.





Primary domain:	ntap.lab1
Name server:	10.34.x1.10
Data LIF home ports:	cluster2_01:e0d
Data LIF IP addresses:	10.34.x1.61
Data LIF netmask:	255.255.255.0
Data LIF gateway:	10.34.x1.1

Enter SVM basic details Specify a unique name and the data protocols for the SVM SVM Name: vs9 IPspace: Default Volume Type: FlexVol volumes © Infinite Volume An SVM can contain either multiple FlexVol volumes or a single Infinite Volume. You cannot thing the volume type of the SVM after you set it. Data Protocols: CIFS © NFS ISCS Default Language: C[c] The language of the SVM specifies the default language encoding setting for the SVM and its volumes. Using a setting that incorporates UTFS character encoding is recommended. Security Style: UNIX Root Aggregate: aggr1 SNS Configuration Profify the DNS domain and name servers. DNS details are required to configure the CIFS protocol. Secure: nager1 Name Servers: 0.34 x1.10	\cup	●	
Specify a unique name and the data protocols for the SVM SVM Name: vs9 IPspace: Default Volume Type: FlexVol volumes Infinite Volume An SVM can contain either multiple FlexVol volumes or a single Infinite Volume. You cannot change the volume type of the SVM after you set it. Data Protocols: CIFS INFS ISCSI Default Language: C[c] The language of the SVM specifies the default language encoding setting for the SVM and its volumes. Using a setting that incorporates UTF-8 character encoding is recommended. Security Style: UNIX Root Aggregate: aggr1 ONS Configuration Networks: 10.34 x1.10	Enter SVM ba	c details	
SVM Name: vs9 IPspace: Default Volume Type: IP FexVol volumes An SVM can contain either multiple FlexVol volumes or a single Infinite Volume. You cannot change the volume type of the SVM after you set it. Data Protocols: CIFS INFS ISCSI Default Language: C[c] The language of the SVM specifies the default language encoding setting for the SVM and its volumes. Using a setting that incorporates UTFS character encoding is recommended. Security Style: UNIX Obst Configuration Specify the DNS domain and name servers. DNS details are required to configure the CIFS protocol. @ Search Domains: Dtap.lab1 0.34 Name Servers: 10.34 x1.10) Specify a unique r	me and the data protocols for the SVM	•
Pipspace: persuit	SVM Name:	vs9	
 Volume Type: FlexVol volumes Infinite Volume An SVM can contain either multiple FlexVol volumes or a single infinite Volume.) IPspace:	Default 💙	
An SVM can contain either multiple RexVol volumes or a single Infinite Volume. Vou cannot charge the volume type of the SVM after you set it. Data Protocols: CIFS NFS ISCS Default Language: C[c] The language of the SVM specifies the default language encoding setting for the SVM and its volumes. Using a setting that incorporates UFFS character encoding is recommended. Security Style: UNIX Root Aggregate: aggr1 DNS Configuration Specify the DNS domain and name servers. DNS details are required to configure the CIFS protocol. Security Style: DNS details are required to configure the CIFS protocol. Security Style: 10.34.x1.10) Volume Type:	FlexVol volumes O Infinite Volume	
You cannot charge the volume type of the SVM after you set it. Data Protocols: CIFS INFS ISCSI Default Language: C[c] The language of the SVM specifies the default language encoding setting for the SVM and its volumes. Using a setting that incorporates UFAs character encoding is recommended. Security Style: UNIX Root Aggregate: aggr1 Specify the DNS domain and name servers. DNS details are required to configure the CIFS protocol. @ Search Domains: Dtap.lab1 10.34 x1.10		An SVM can contain either multiple FlexVol volumes	or a single Infinite Volume.
Default Language: C [c] The language of the SVM specifies the default language encoding setting for the SVM and its volumes. Using a setting that incorporates UTFS character encoding is recommended. Security Style: UNIX Root Aggregate: aggr1 V DNS Configuration Specify the DNS domain and name servers. DNS details are required to configure the CIFS protocol. Security Security is a server se	Data Brotocole:	fou cannot change the volume type of the SVM after	r you set it.
	Default Language		
its volumes. Using a setting that incorporates UTF-8 character encoding is recommended. Security Style: DNS Configuration Specify the DNS domain and name servers. DNS details are required to configure the CIFS protocol. Search Domains: Intep.lab.1 Intep.lab.1		The language of the SVM specifies the default language	age encoding setting for the SVM and
Security Style: UNIX Root Aggregate: aggr1 DNS Configuration Specify the DNS domain and name servers. DNS details are required to configure the CIFS protocol. Search Domains: ntep.lab1 Name Servers: 10.34.x1.10		ts volumes. Using a setting that incorporates UTF-8	character encoding is recommended.
Root Aggregate: aggr1 DNS Configuration Specify the DNS domain and name servers. DNS details are required to configure the CIFS protocol. ③ Search Domains: Intep.ieb1 10.34.x1.10	Security Style:	UNIX	
Specify the DNS domain and name servers. DNS details are required to configure the CIFS protocol. Image: Search Domains: Im	Root Aggregate:	aggr1 🗸	
3 Name Servers: 10.34 x1.10	NS Configurati	n in and name servers. DNS details are required to	o configure the CIFS protocol.
(2) Name Servers: 10.34 x1.10	Search Dom	IIIBP/IBP/	
	 Search Dom 		

On the SVM administration page, click Skip.

NOTE: Unless the destination SVM has the same language type as the source SVM, SnapMirror software does not let you create an intercluster SnapMirror relationship.

Step 23.

Select **Network > Network Interfaces**, click **Create**, and create a second data LIF, using following values:

Name:	vs9_nfs_lif2
Role:	Data
Home port:	cluster2_01:e0c
IP address:	10.34.x1.62
Netmask:	255.255.255.0
Gateway:	10.34.x1.1



Step 24.

Create intercluster LIF on cluster2.

cluster2::> net int create -vserver cluster2 -lif ic1 -role intercluster -home-node cluster2-01 -home-port e0e -address 10.34.x1.71 -netmask 255.255.255.0

Step 25.

On both nodes in cluster1, create an intercluster LIF.

cluster1::> net int create -vserver cluster1 -lif ic1 -role intercluster -home-node cluster1-01 -home-port e0e -address 10.34.x1.81 -netmask 255.255.255.0

cluster1::> net int create -vserver cluster1 -lif ic2 -role intercluster -home-node cluster1-02 -home-port e0e -address 10.34.x1.82 -netmask 255.255.255.0

Step 26.

To create peer relationship between clusters, on the **cluster1** go to **Configuration > Cluster Peers.**



Step 28.

To get a passphrase, insert cluster2 management IP address: **10.34.x1.22**, and then click on the shortcut, which will take you to peering management on the cluster2.

Quick access to launch the target cluster to generate a new passphrase (Optional)	
Management Address	
Management URL Enter the Management Address	



-		
Click on the	Generate Peering Passphrase	and generate passphrase.
	Generate Peering Passphrase	2
	Generate a passphrase for the local cluster cluster for peering. Note: Passphrase cannot be used beyond	IPspace and use the same passphrase in the remote Its specified validity.
	IPspace	Default
	Passphrase Validity	1 Hour
	SVM Permissions	 All SVMs Selected SVMs
		Cancel Generate
Step 30.		
Copy passpl	nrase.	
	Generate Peering Passphrase	
	Passphrase generated successfully	
	Use the following information for peering ba	sed on the IPspace "Default":
	Intercluster LIF IP Address	10.34.11.71
	Passphrase	nWXz2uX1fRZSDDWeoCGAAUbD
	Passphrase Validity	Valid Until Fri Mar 09 2018 14:51:17 Europe/Bratislava
	SVM Permissions	All
		Email passphrase details
		Copy passphrase details
		Done
and enter it	to field on page for Peering es	stablished relationship.



Passphrase	
Enter a passphrase of your cho	vice, or get a passphrase from the target cluster.
Tell me more about passphras	e
() Passphrase	0

and then click Initiate Cluster Peering.

Step 32.

From the cluster shell of cluster1 and cluster2, verify the relationship.

cluster peer show

cluster peer health show

Step 33.

Enter the following command to troubleshoot connectivity issues and long response times between specific intercluster LIFs.

cluster peer ping

TASK 7: Configure a vserver peer relationship

Step 1.

From your putty session on cluster1, verify that the cluster peer relationship is currently configured.

cluster1::> cluster peer show

Step 2.

Verify that the source Vserver has the language set to C.

cluster1::> vserver show -vserver vs2 -fields language

Step 3.

From your PuTTY session on cluster2, verify that the cluster peer relationship is currently configured.

cluster2::> cluster peer show

Step 4.

cluster2::> vserver show -vserver vs9 -fields language

Step 5.

From cluster1, create a new Vserver peer relationship between vs2 in cluster1 and vs9 in

cluster2.

cluster1::> vserver peer create -vserver vs2 -peer-vserver vs9 -applications snapmirror - peer-cluster cluster2



Step 6.

From cluster2, accept the peer request.

cluster2::> vserver peer accept -vserver vs9 -peer-vserver vs2

Step 7.

From both clusters, verify that the new Vserver peer relationship is successfully configured. *vserver peer show-all*

vserver peer snow-

TASK 8.

Step 1.

In System Manager, click the Protection > Relationship tab.



Step 2.

Open the Protection window, click Create and select vs9.

™ vs9 running default			T State	▼ Subtype	T
		vsg	running	default	
		1			
	- 11				



Step 3.

Configure the mirror relationship as follows:

Relationship type: Mirror

Source Cluster: cluster1

Source SVM: vs2

Source Volume: vs2_vol01

Destination SVM: vs9

Destination Volume Name Suffix: _vs9_vol01

Mirror Policy: MirrorAllSnapshots

Schedule: hourly

II me more about different ty	bes of data protection relationships.	
ationship Type		
🚺 Relationship Type:	Mirror 👻	
urce Volume		
1 Cluster:	cluster1	
SVM:	vs2 💌	
Volume:	vs2_vol01 Browse 1	
stination Volume		
SVM:	vs9	
Volume Name Suffix:	_vs9_vol01	
nfiguration Details		
(i) Mirror Policy:	MirrorAllSnapshots Browse	
🚺 Schedule:	hourly Browse	
	Every hour at 05 minute(s)	
	None	

Click Create.

Step 4.

Go to tab **Storage > Volumes** and change the name to **vs9_vol01**.



Volu	Volumes on SVM vs9 v										
+	Create 💌 🖍	Edit 🗊 Delete	🗹 Actions	🔹 🛡 View	Missing Pr	otection Relations	nips	S Refresh			
	Status 🝸	Name	T	5tyle	T	Aggregates	Ŧ	Thin Provisioned	T	Available Space 🛛 🝸	
+	Ø	vs9_vol01		FlexVol		aggr1		No		48.13 MB	
+	Ø	vs9_root		FlexVol		aggr1		No		18.11 MB	

Step 5.

Return to **Storage > Relationships** tab and verify successful initialization of the SnapMirror relationship. The intercluster initialization might take a few minutes.

Relationships

🙀 Create 😸 Edit 🗙 Delete 🔩 Operations 🗸 🍋 Refresh										
Source Storage Virtual 🔻	Source Volume T	Destination Volume T	Destination Storage Vir ${f T}$	Is Healthy T	Relationship State 🛛 🔻	Transfer Status 🛛 🔻				
vs2	vs2_vol01	vs9_vol01	vs9	• Yes	Snapmirrored	Idle				

Step 6.

To view the relationship status from cluster1, select Storage > Volumes > vs2 > vs2_vol01

+	Create 🔹 🖌	Edit 🖀 Delete 🗹	í Actions	• 🛡 View h	Aissing Pr	otection Relations	ships	S Refresh						
	Status 🔻	Name	T	Style	T	Aggregates	Ŧ	Thin Provisioned	Available Space 🔻	Total Space	% Used 🔻	Туре Т	Protection Relationship $\overline{\mathbb{Y}}$	Storage Ef
٠	Ø	dataefficiency		FlexVol		n02_aggr1		Ves	67.38 MB	100 MB	32	nv	No	Enabled
٠	Ø	dataefficiency_clone	_0703	FlexVol		n02_aggr1		Ves	68.74 MB	100 MB	31	ne	No	Disabled
٠	Ø	vs2_root_dp1		FlexVol		n01_aggr1		No	16.34 MB	20 MB	18	dp	No	Disabled
٠	Ø	vs2_root_dp2		FlexVol		n02_aggr1		No	16.5 MB	20 MB	17	dp	No	Disabled
٠	Ø	vs2_root_ls1		FlexVol		n01_aggr1		No	15.56 MB	20 MB	22	Is	No	Disabled
٠	Ø	vs2_root_ls2		FlexVol		n02_aggr1		No	15.52 MB	20 MB	22	ne	Yes	Disabled
-	Ø	vs2_vol01		FlexVol		n01_aggr1		No	378.75 MB	400 MB	5	DV.	Yes	Disabled
	OVERVIEW													
	Status 🔮 Online										SPACE ALLOCATION		PROTECTION	
	Snapshot Copies Enabled Yes													
	Aggregates n01_aggr1													
		Tiering Policy	snaps	hot-only						1.25	MB Total Data Space	Used	Protected on cluster	
		Junction Path	/vs2vi	5101						Tota 20 N	l Data Space: 380 ME IB Snapshot Reserve	Space	cluster2 is Version-Flexible Mirror relatio	nship
	Export Policy vs2def													

TASK 9.

Use the CLI to configure a snapmirror relationship

Step 1.

Check the language on the source volume.

cluster1::> volume language -vserver vs2 -volume vs2_vol03 -fields language

Step 2.

On cluster2, create a destination volume of type DP with the same language type.

cluster2::> vol create -vserver vs9 -volume vs2_vol03 -aggregate aggr1 -size 25mb -type dp -language C.UTF-8

Step 3.

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Create the SnapMirror relationship for vs2_vol03.

cluster2::> snapmirror create -source-path cluster1://vs2/vs2_vol03 -destination-path cluster2://vs9/vs2_vol03 -type DP -schedule daily

NOTE: The source and destination volume names are not required to be the same. In this exercise, you chose the names for clarity. This command can be issued from either cluster without modification.

Step 4.

Initialize the SnapMirror relationship.

cluster2::> snapmirror initialize -destination-path cluster2://vs9/vs2_vol03

NOTE: When you create Storage Virtual Machine (SVM), the language is set for the SVM. The language of the SVM determines the default language setting for volumes in that SVM. You can modify the language of an SVM. You can specify the language for a volume when creating a volume and it can be different from the language of an SVM. If you do not specify the language for a volume then it inherits the language setting of its SVM. After the volume is created, you cannot modify the language of a volume. Therefore, you must be aware of the available language options.

TASK 10. Update snapmirror relationship

Step 1.

From your CIFS client, copy 30mfile into the vol1 share.

net use New connections will be remembered. Status Local Remote OK T: \\ntapvs2\de OK X: \\ntapvs2\~administrator OK Y: \\ntapvs2\rootdir Z: OK \\ntapvs2\vol1 🚍 vol1 (\\10.34.11.41) (Z:))-> 🚘 • Computer • vol1 (\\10.34.11.41) (Z:) •

Organize 🔻 New folder											
🔆 Favorites	Name *	Date modified	Туре	Size							
Downloads	🔑 administrator	28. 2. 2018 13:19	File folder								
Recent Places	💫 clone1	7. 3. 2018 9:28	File folder								
📃 Desktop	30mfile	7. 3. 2018 8:59	File	30 000 KB							

The scheduled update occurs daily, but you can perform an on-demand transfer from the CLI or from System Manager.

Step 2.





To perform an on-demand transfer in System Manager, from cluster 2, in the **Protection** > **Relationship** pane, select the relationship for **vs2_vol01**, click **Operations** to see the menu, and then click **Update**.

Relationships							
🙀 Create 📝 Edit 🗙 Del	ete 🔧 Op	erations 🕶 🈋 I	Refresh				
Source Storage Virtual 🔻	Source Volu	ume T	Destination Volume	Destination Storage Vir T	Is Healthy	T	Relationship State
vs2	vs2_vol01		vs9_vol01	VS9	Yes		Snapmirrored
vs2	vs2_vol03		vs2_vo103	vs9	Yes		Snapmirrored
		Update Updates Updates operatio status in Source: Destination: Configuratio As per Select Limit	the data from the source vo n will continue to run in the the details tab. cluster1://vs2/vs2_vol01 cluster2://vs9/vs9_vol01 n	olume to the destination volum background. You can check th background background backgr	e.This e transfer owse.		

Step 3.

In the Details frame at the bottom of the SnapMirror window, view the status of each SnapMirror relationship.

Source Location:	vs2:vs2_vol01	Is Healthy:	Yes	Transfer Status:	Idle
Destination	vs9:vs9_vol01	Relationship State:	Snapmirrored	Current Transfer Type:	None
Source Cluster:	cluster1	Network Compression Ratio:	Not Applicable	Current Transfer Error:	None
Destination Cluster:	cluster2			Last Transfer Error:	None
Fransfer Schedule:	hourly			Last Transfer Type:	Update
Data Transfer Rate:	Unlimited			Latest Snapshot Timestamp:	03/19/2018 12:09:48
.ag Time:	None			Latest Snapshot Copy:	snapmirror.51ff3e41-238f-11e8-ad04-0050569f3f78_2163735876.2018 03-19_120851



LAB 13: Data Protection: Backups and disaster recovery

In this exercise, perform a SnapVault backup restore data from a SnapVault backup.

OBJECTIVES

By the end of this exercise, you should be able to:

- Configure SnapMirror replication
- <u>Perform a SnapVault backup</u>
- Restore data from a SnapVault backup

TASK 1. Configure a snapvault relationship

Step 1.

In System Manager, click the cluster2 tab and select Protection > Protection Policies.



Step 2.

Click Create.

	Create Policy		×
	Policy Type:	Vault	
		This policy is of type vault that enables you to associate user- defined rules to the policy.	
	Policy Name:	vs2-vs9-policy	
	Transfer Priority:	Normal	
	🔲 Enable Networ	k Compression	
	Add Comments		
	Policy Rules		
	SnapMirror Label	Destination Retention Count	
Ĩ1			
Read and	daily	7 ×	
12000			
E.	A Snapshot co source volume	py with the same SnapMirror label attribute must be created on th : for the new label to be effective.	e
12=		Create	

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Policy type: Vault

Policy name: vs2-vs9-policy

Policy rules:

SnapMirror label: daily

Destination Retention Count: 7

Click + to add rule.

Click Create.

Step 3.

Verify creation of the policy.

Protection Policies

	🙀 Create 📝 Edit 🗙 Delete 🈋 Refresh		
Name T		Туре Т	Comment T
	DPDefault	Asynchronous Mirror	Asynchronous SnapMirror policy for mirroring all Snapshot copies and the lat
	MirrorAllSnapshots	Asynchronous Mirror	Asynchronous SnapMirror policy for mirroring all Snapshot copies and the lat
	MirrorAndVault	Mirror Vault	A unified Asynchronous SnapMirror and SnapVault policy for mirroring the la
	MirrorLatest	Asynchronous Mirror	Asynchronous SnapMirror policy for mirroring the latest active file system.
	Unified7year	Mirror Vault	Unified SnapMirror policy with 7year retention.
	XDPDefault	Vault	Vault policy with daily and weekly rules.
	vs2-vs9-policy	Vault	

Step 4.

Select **Protection > Schedule** and review the current schedules.

Schedules

🙀 Create 📝 Edit 🗙 Delete 🏡 Refresh	
Name T	Туре
5min	Time based
Shour	Time based
Auto Balance Aggregate Scheduler	Interval based
daily	Time based
hourly	Time based
monthly	Time based
pg-daily	Time based
pg-hourly	Time based
pg-weekly	Time based
RepositoryBalanceMonitorJobSchedule	Interval based
weekly	Time based

Step 5.

Select **Protection > Relationship** then **Create**, and select SVM vs9.

Relationships

🙀 Create 📝 Edit 🗙 Del	🎍 Create 🔡 Edit 🗙 Delete 🔧 Operations 🕶 🖏 Refresh									
Source Storage Virtual 🝸 Source Volume 🍸		Destination Volume 🛛 🔻 Destination Storage Vir 🗡		Is Healthy T	Relationship State 🛛 🔻					
vs2	vs2_vol01	vs9_vol01	vs9	Yes	Snapmirrored					
vs2	vs2_vol03	vs2_vol03	vs9	Yes	Snapmirrored					

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Step 6.

On the Create Protection Relationship page, enter and select following:

Relationship Type: Vault

Source Cluster: cluster1

Source SVM: vs2

Source volume: vs2_vol01

Destination SVM: vs9

Volume Name Suffix: _dst

Vault Policy: vs2-vs9-policy

Schedule: hourly

Initialize Relationship: selected

Create Protection Relationship					×
Tell me more about different typ	es of data protection relationships.	ao, or aroabeer in			
Relationship Type					- 1
🚺 Relationship Type:	Vault	*			
Source Volume					- 1
1 Cluster:	cluster1	*			
SVM:	vs2	*			
Volume:	vs2_vol01	Browse	1		
Destination Volume					- 1
SVM:	VS9				- 1
Volume Name Suffix:	_dst	(
Configuration Details					- 1
🚯 Vault Policy:	vs2-vs9-policy		Browse		
🚯 Schedule:	 hourly Every hour at 05 minute(s) None 		Browse		
🚺 🗹 Initialize Relationship	0				-
				Create	Cancel

Click Validate.

Step 7.

After successful validation, click Create.



Validate Matching L	abels			< Ba
Vault Policy	vs2-vs9-policy			
	All selected volumes h	have matching labels.		
	Volumes	Snapshot Matchi	Other Labels fro	Other Labels fro
	vs2_vol01	daily	weekly	
			Displaying 1	1 of 1 🖌 🕨
	Continue to protect th	he volumes.		
	consist to protot o	in tomine.		

Step 8.

Verify initialization from cluster2.

Relationships

🙀 Create 📝 Edit 🗙 Delete 🛛 🔌 Operations 🔻 😽 Refresh								
Source Storage Virtual 🔻	Source Volume 🛛 🔻	Destination Volume 🛛 🔻	Destination Storage Vir ${f T}$	Is Healthy T	Relationship State 🛛 🔻	Transfer Status 🛛 🔻 🔻		
vs2	vs2_vol01	vs9_vol01	vs9	Yes	Snapmirrored	Idle		
vs2	vs2vol01		vs9	• Yes	Uninitialized	Transferring		
vs2	vs2_vol03	vs2_vol03	vs9	• Yes	Snapmirrored	Idle		

Step 9.

To view the SnapVault relationship status from cluster1, select Storage > Voumes > select vs2_vol01 from the list, and click + to see details.

	2 104				354 43 440	100.117	13		
OVERALEW	052_00101	Plexvoi	nor_aggin	NO	330.03 Mil	400 MB	12	100	tes
OVERVIEW	Status apshot Copies Enabled Aggregates Tiering Policy Junction Path Export Policy	Online Ves n01_aggr1 snapshotonly /vs2vol01 vx2xef				S 29.97 350.0 Total 20 ME	MB Total Data Space A Data Space: 380 MI 3 Snapshot Reserve	i ce Used vallable 8 Space	PROTECTION Protected There are 2 relationship View more
t ep 1(lick V umes on 5'). 7 iew mor vm vs2 vol01	'e. •		110					< Back to All volume
Overview S	napshots Copies Data	Protection Storage Efficie	ency Performance						
ి Refresh									
Health	Destination SVM		Destination Volume	Destina	tion Cluster	Relationship State	e Trar	isfer Status	Туре
Ø	vs9		vs9_vol01	dustera		Snapmirrored	idie		Version-Flexible Mirror
Ø	vs9		vs2_vol01_dst	dustera		Snapmirrored	idie		Vault



TASK 2. Restore from a SnapVault backup

Step 1.

On cluster2, navigate to the **Protection > Relationship** page, select **vs2_vol01**, with Relationship Type **Vault** and click the **Operations button**, and select **Restore**.

telationships									
🙀 Create 📝 Edit 🗙 Dele	rte 🖂	Operations 🔹 🛛 😋 Re	fresh						
Source Storage Virtual 🔻	Sou	Initialize	Destination Volume 🛛 🔻	Destination Storage Vir \pmb{T}	Is Healthy T	Relationship State 🛛 🔻	Transfer Status 🛛 🔻	Relationship Type	
vs2	vs2_	Update	vs9_vol01	VS9	Yes	Snapmirrored	Idle	Version-Flexible Mirror	
vs2	vs2_	Quiesce	vs2_vol01_dst	vs9	Yes	Snapmirrored	Idle	Vault	
vs2	vs2_	Resume	vs2_vol03	VS9	Yes	Snapmirrored	Idle	Version-Flexible Mirror	
		Restore							

Step 2.

On the restore page, enter and select following.

- Restore to: Other volume
- Cluster: cluster1
- SVM: vs2
- Volume (new): vs2_vol01_vault_restore
- Aggregate: n01_fp1
- Configuration: Latest Snapshot Copy
- OK to restore the volume from the SnapShot copy: select

NOTE: The Restore button is activated when you select the "OK to restore the volume from the snapshot copy" checkbox.





estore			
(1) Restores the backed up data fro Snapshot copies that were not t operation is completed. Restore from	m the destination volume to the source volum aacked up and quotas on the volume will be tu	e, or to another volume. The restore ope irned off. You can activate quotas on the	ration will delete new volume after this
Destination: cluster2://vs9/vs3 (Used space:30.1	2_vol01_dst 4 MB}		
Source volume Other volume	Jme		
(?) Cluster:	duster1 Cluster peering status is healthy.		
Storage Virtual Machine:	vs2(peered)	Browse ?	
Volume:	💿 New Volume 🛛 Select Volume		
	Volume name:	Aggregate:	
	vs2_vol01_vault_restore	n01_fp1	Browse
	🔲 Enable dedupe	7.03 GB available (of 7.03 GB)	
Configuration			
Latest Snapshot copy: *snapm	irror.51ff3e41-238f-11* 03/19/2018 14:41:12		
Select Snapshot copy:			
OK to restore the volume from the	Browse		
	ie anapsnot copy		
Enable Network Compression			
		Res	tore Cancel

Step 3.

Click Restore.

Step 4.

On the cluster1 tab, select Storage > Volumes > volumes on SVM: vs2

4	Create 💌	Edit 🗐 Delete	K Actions -	💼 View Missing Pr	ntection Relationships	1 Refresh			
	ereate	E die		• occorring of		O HEREAR			
	Status 🝸	Name	Ť	style 🝸	Aggregates T	Thin Provisioned	Available Space 🝸	Total Space	% Used 🝸
F	Ø	dataefficiency	1	FlexVol	n02_aggr1	Yes	67.47 MB	100 MB	32
÷	Ø	dataefficiency_c	lone_0703 I	FlexVol	n02_aggr1	Yes	68.48 MB	100 MB	31
÷	Ø	vs2_root_dp1	1	FlexVol	n01_aggr1	No	16.17 MB	20 MB	19
÷	Ø	vs2_root_dp2	1	FlexVol	n02_aggr1	No	16.5 MB	20 MB	17
÷	Ø	vs2_root_ls1	1	FlexVol	n01_aggr1	No	15.52 MB	20 MB	22
÷	Ø	vs2_root_ls2	1	FlexVol	n02_aggr1	No	15.41 MB	20 MB	22
÷	Ø	vs2_vol01	1	FlexVol	n01_aggr1	No	349.96 MB	400 MB	12
÷	Ø	vs2_vol01_vault	_restore I	FlexVol	n01_fp1	No	20.03 MB	49.98 MB	59
÷	Ø	vs2_vol03		FlexVol	n01_aggr1	No	17.65 MB	20 MB	11

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Step 5.

Mount the volume at /vault_restore. Go to **Storage > Namespace** and click Mount.

Volume Name:	vs2_vol01_vault_restore
Junction Name:	vault_restore
Junction Path:	/ Browse

Step 6.

Click Mount.

Step 7.

Click Change Export Policy button and change the export policy to vs2def.

Change Export Poll	су		×
Volume Name: Junction Path:	vs2_vol01_vault_restore /vault_restore		
Export Policy:	vs2def		~
		Change	Cancel

Step 8.

Click Change.

Step 9.

From your Linux client, inspect the contents of the restored volume.

ls /mnt/vs2/vault_restore/

ls /mnt/vs2/vs2vol01

NOTE: The restored volume will not appear in the namespace until the Vserver root volume replicates its LS mirrors. This occurs at five-minute intervals. You can manually update the LS mirrors by using the snapmirror update-ls-set command if you prefer.

END OF EXERCISE.





LAB 14: Cluster Management

Objectives of this exercise

- Move a volume
- Use roles to delegate administrative tasks using

TASK 1: Move a volume

Step 1.

From your cluster1 PuTTY session, look at your volumes and note the aggregate on which vs2_vol01 is found.

cluster1::>volume show

Step 2.

Check for Snapshot copies of this volume and notice that there are some Snapshot copies.

cluster1::> volume snapshot show -volume vs2_vol01

Step 3.

Move the volume from its aggregate to an aggregate on the opposite node, and note the job ID that is displayed.

cluster1::> vol move start -vserver vs2 -volume vs2_vol01 -destination-aggregate n02_aggr1

Step 4.

While the move job is running, continually show the volumes (vol show) to watch the temporary (type TMP) volume that is created (on the destination aggregate) as part of this process.

cluster1::> vol show -vserver vs2

After the data movement is complete, an automatic action is taken to change the identity of this temporary volume to become the flexible volume that was moved, and then the old volume on the source aggregate is deleted.

Step 5.

Look at the jobs, then look at the move job by using its job ID while it is running and after it finishes.

cluster1::> job show

cluster1::> job show -id <jobid>

Jobs only remain in the job show output for a few minutes after they are complete.



Step 6.

When the move operation is finished, look at the details of the volume and assure yourself that the only thing that changed was the aggregate (and node).

cluster1::> vol show -vserver vs2 -volume vs2_vol01

The junction path is the same as it was before, which means that the volume retained its place in the namespace hierarchy, and because of that, the path known to all NFS and CIFS clients is the same. The change of location is transparent to clients.

Step 7.

Look at the Snapshot copies of the volume that was just moved and notice that the volume move kept all the Snapshot copies as they were.

cluster1::> vol snapshot show -volume vs2_vol01

Step 8.

In GUI, select **vs2_vol01** and click the **Move** button to move the same volume from that node and aggregate back to its original node and aggregate.

Volumes

🙀 Create 📝 Edit 🗙 De	ilete 🛅 Clone 🕶 🎅 Status	👻 🐻 Snapshot Copies 🕶 🛛	⊖ ° Resize ∰99 Storage Effici	ency 📴 M	ove 📑 Storage	QoS Protect by 👻 🔀 Ret	fresh
Name T	Aggregate T	Status T	Thin Provisioned T	% Used	Move volumes to	o other aggregates non-disrupt	ively I Space
dataefficiency	n02_aggr1	😔 online	Yes	40		59.55 MB	100 MB
dataefficiency_clone_101	n02_aggr1	😔 online	Yes	39		60.32 MB	100 MB
vs2_root	n02_aggr1	😔 online	No	5		18.88 MB	20 MB
vs2 vol01	n02 aggr1	😔 online	Yes	5		378.48 MB	400 MB

Step 9.

Select **n01_aggr1** and click **Move**.



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Step 10.

Click Move again and then OK.



TASK 2: Use roles to delegate administrative tasks

Step 1.

Enable a data LIF owned by Vserver vs2 to support Vserver-level management connections.

cluster1::> net int modify -vserver vs2 -lif vs2_cifs_nfs_lif2 -firewall-policy mgmt

Step 2.

In GUI, select **Configuration > Roles** to display the predefined cluster-scoped roles.





Step 3.

Select SVMs > vs2 > SVM Settings > Roles to display the Vserver-scoped, predefined roles.

Dashboard LUNs SVM	Network	Hardware and Diagnostics -	Protection -	Configurations
vs2 Volume Overview	v Volumes	Namespace Shares LUN	ls Qtrees	Quotas SVM Settings
SVM Settings				
Protocols	🙀 Add 📝 E	dit 😋 Refresh		
CIFS	Role 🔺			
NFS	vsadmin			
Policies	vsadmin-backi	qu		
Export Policies	vsadmin-proto	col		
Efficiency Policies	vsadmin-reado	only		
Protection Policies	vsadmin-snap	lock		
Snapshot Policies	vsadmin-volur	ne		
QoS Policy Groups				
Services				
NIS				
LDAP Client				
LDAP Configuration				
Kerberos Realm				
Kerberos Interface				
DNS/DDNS				
SYM User Details				
Users				
Roles				

Step 4.

Select a Vserver-scoped administrative role and scroll through the **Role Attributes** pane to see the commands that are available to a user with this role.

rotocols	🙀 Add 🔡 Edit 😋 Refresh	
CIFS	Role 🔺	
NFS	vsadmin	
olicies	vsadmin-backup	
Export Policies	vsadmin-protocol	
Efficiency Policies	vsadmin-readonly	
Protection Policies	vsadmin-snaplock	
Snapshot Policies	vsadmin-volume	
QoS Policy Groups		
M User Details		
Jsers		
Roles	Role Attributes	
ost Users and Groups		- 10 (Start)
JNIX	Command	
Windows		
Name Mapping		
	network interface	
	network interface failover-groups	
	security certificate	
	security certificate file	
	security login banner	
	security login motd	

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Step 5.

Examine the other roles and compare the commands that are available to users who are assigned to the roles.

Step 6.

Select SVMs > vs2 > SVM Settings > Users to display the users for your Vserver, vs2.

Step 7.

Click **Add** to create a user.

Step 8.

Name the user **vs2admin**, choose a password, and click the **Add** button on the right side of the window.

Password:	•••••		
Confirm Password:	ods		
Application	Authentication	Role	A
	password	~	Ec
Tell me more about role	es		



		vs2admin		
assword:		•••••		
onfirm Passwo	rd:	•••••		
-User login n	netho	ods		
Application		Authentication	Role	Add
ssh	~	password	vsadmin 🗸	Edit
		OK Car	ncel	Delete
ell me more abc	ut rol	es		

Select the application ssh and the role vsadmin, and click OK.

Step 10.

Click Add at the bottom of the window to finish creating the user vs2admin.

Step 11.

Add another user with the following properties:

- User name: vs2intern
- Application: **ssh**
- Role: vsadmin-readonly

🙀 Add 📝 Edit 🗙 Delete 📝 Change password 🔒 Lock 🖏 Refresh	
User 🔺	Account Locked
vs2admin	No
vs2intern	No
vsadmin	Yes

Step 12.

Use PuTTY to start an SSH session to the data LIF IP (10.34.x1.40 or 41) address that was management-enabled in the first step of this task, and log in as vs2admin.

Step 13.

Display the status of the cluster.

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vs2::> cluster show

The command fails. Why?

Step 14.

Display all available volumes and observe the SVM that are represented in the output.

vs2::> volume show

Step 15.

Modify a volume.

vs2::> volume modify -volume vs2_vol01 -comment "modified by vs2admin"

Step 16.

Verify the change.

vs2::> volume show -volume vs2_vol01 -fields comment

Step 17.

Use PuTTY to start another SSH session to the same data LIF, and log in as vs2intern.

Step 18.

Display network ports.

vs2::> network port show

The command fails.

Step 19.

Display network interfaces, examine the LIFs that are displayed, and compare the list to a list of LIFs that is displayed for the cluster admin user.

vs2::> network interface show

Step 20.

Modify a volume.

vs2::> volume modify -volume vs2_vol01 -comment "modified by vs2intern"

The command fails. Why?

Step 21.

Close both of the vs2 administrative PuTTY sessions.

END OF EXERCISE

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LAB 15: Best practices – optional (if LAB 12 was not done)

TASK 1. SVM root volume protection

To protect the Storage Virtual Machine (SVM) namespace root volume, you can create a load sharing mirror volume on every node in the cluster, including the node in which the root volume is located. Then you create a mirror relationship to each load-sharing mirror volume and initialize the set of load-sharing mirror volumes.

On every node, create a load sharing mirror volume. For protecting the root volume of a Storage Virtual Machine (SVM), you must create a FlexVol volume on every node of the cluster and designate it as a load-sharing mirror destination. A group of load-sharing mirror destination volumes that replicate from the same source volume is referred to as a load-sharing mirror set.

Step 1.

Identify the data aggregates in the nodes of the cluster by using the **aggr show** command.

cluster1::> aggr show -root false

Aggregate	Size Av	ailable Us	sed% State	#Vols Nodes	RAID Status
n01_aggr1	4.39GB	1.70GB	61% online	4 cluster1-01	raid_dp, normal
n01_fp1	7.03GB	6.27GB	11% online	1 cluster1-01	raid_dp, hybrid, normal
n02_aggr1	7.03GB	3.97GB	44% online	5 cluster1-02	raid_dp, normal
3 entries w	ere displa	yed.			

Step 2.

On each node, create a load-sharing mirror volume by using the volume create command with the -type parameter set to DP. The destination volume that you create must be the same size or greater than the SVM root volume.

cluster1::> volume create -vserver vs2 -volume vs2_m1 -aggregate n01_aggr1 -size 20mb -state online -type DP

cluster1::> volume create -vserver vs2 -volume vs2_m2 -aggregate n02_aggr1 -size 20mb -state online -type DP

Step 3.

Verify that the volume type is set to DP for the load-sharing mirror volumes by using the **volume show** command.

cluster1::> vol show -vserver vs2

Vserver Volume Aggregate State Type Size Available Used%



----- -----

vs2	vs2_m1	n01_aggr1	online	DP	20MB	19.89MB	0%			
vs2	vs2_m2	n02_aggr1	online	DP	20MB	19.89MB	0%			
vs2	vs2_root	n02_aggr1	online	RW	20MB	18.86MB	5%			
vs2	vs2_vol01	n01_aggr1	online	RW	400MB	379.8MB	5%			
4 entri	4 entries were displayed.									

Step 4.

Create a load-sharing mirror relationship between the SVM root volume and each of the load sharing mirrors created on every node of the cluster by using the **snapmirror create** command with the -type parameter set to LS.

cluster1::> snapmirror create -source-path vs2:vs2_root -destination-path vs2:vs2_m1 - type LS -schedule hourly

cluster1::> snapmirror create -source-path vs2:vs2_root -destination-path vs2:vs2_m2 - type LS -schedule hourly

Step 5.

The type attribute of the load-sharing mirror volumes changes from DP to LS. Verify that the load-sharing mirror relationships are created and their mirror state is **Uninitialized** by using the **snapmirror show** command.

cluster1::> snapmirror show -source-volume vs2_root

SourceDestination Mirror RelationshipTotalLastPathTypePathStateStatusProgressHealthy Updated

cluster1://vs2/vs2_root

LS cluster1://vs2/vs2_m1

cluster1://vs2/vs2_m2

Uninitialized

Uninitialized

Idle

Idle

2 entries were displayed.

Step 6.

Initialize all the load-sharing mirrors in the set by using the **snapmirror initialize-ls-set** command.



cluster1::> snapmirror initialize-ls-set -source-path vs2:vs2_root

[Job 61] Job is queued: snapmirror initialize-ls-set for source "cluster1://vs2/vs2_root".

Step 7.

Verify that the load-sharing mirror relationships are in the Snapmirrored state by using the **snapmirror show** command.

cluster1::>	snapmirror	show -source-vol	lume vs2_root
-------------	------------	------------------	---------------

Source	Destinati	ion Mirror Relati	onship Total	Last
Path	Type Path	State Status	Progress He	althy Updated

cluster1://vs2/vs2_root

LS cluster1://vs2/vs2_m1				
Snapmirrored	Idle	-	true	-
cluster1://vs2/vs2_m2				
Snapmirrored	Idle	-	true	-

2 entries were displayed.

Step 8.

You should update the set of load-sharing mirror volumes to make the changes in the root volume visible to all the clients before the next scheduled update. For example, when a new volume is mounted on the root volume of the SVM, you should update the set of load-sharing mirror volumes. Update all the load-sharing mirror volumes in the set by using the **snapmirror update-lsset** command.

cluster1::> snapmirror update-ls-set -source-path vs2:vs2_root

[Job 62] Job is queued: snapmirror update-ls-set for source "cluster1://vs2/vs2_root".

Restore procedure:

If the Storage Virtual Machine (SVM) root volume becomes unavailable and you have protected it with a set of load-sharing mirrors, you can promote one of the mirrored volumes and then rename it to take the place of the original SVM source volume. For more information read the "SVM Root Volume Protection Express Guide"

END OF EXERCISE.



LAB SOLUTIONS

LAB1

TASK1: Put a "P" or "L" beside each item in the following list of Data ONTAP cluster-mode concepts to indicate whether it is physical or logical.

- __P__ node
- __P__ disk
- __P__ aggregate
- __L__ virtual server (Vserver)
- __L__ cluster
- __P__ network port
- __L__ flexible volume
- __L__ Snapshot copy
- __L__ SnapMirror copy
- __P__ host bus adapter (HBA)
- __L__ LIF

TASK2: Put an "N," "A," or "D" (or a combination of those letters) beside each item to indicate whether it has a node Vserver, administration Vserver, or data Vserver scope.

__N__ disk

__D__ namespace

- ___D___ data LIF
- __N__ network port
- ____A___ cluster management LIF
- __N__ aggregate
- ______ D___ Snapshot copy
- __N__ host bus adapter (HBA)
- _D_LUN



LAB4

TASK 1: Identify kernel and user-space processes

Step 1.

Using the following list of cluster components, show the path of a network-attached storage (NAS) write request by labeling each component with a number, starting with 1 for the initiator of a write request and proceeding in order to the destination of the request.

- _4__Cluster session manager (CSM)
- _5__D-blade
- _2__Data network port
- _1__NFS or CIFS client
- _3__N-blade
- _7__Disks
- _6__Nonvolatile RAM (NVRAM)

TASK 2: Explain RDB and quorum concepts

Step 1. List the names of the RDB units.

Answer: Management, VifMgr, VLDB, BCOM

Step 2. Which RDB unit keeps track of the data that is used to operate the clustershell?

Answer: Management

Step 3. Which RDB unit keeps track of the volumes and aggregates and which volumes are on which aggregates?

Answer: VLDB

Step 4. How many healthy nodes are needed in a 16-node cluster to maintain a quorum?

Answer: 9, or 8 + Epsilon

TASK 3: vol0 and Vserver root volumes uses and limitations

Step 1. What is the minimum number of vol0 volumes in a 20-node cluster? What is the maximum?

Answer: 20. 20.

Step 2. What is stored on a vol0 volume?

Answer: Log files, RDB databases.



Step 3. For the following characteristics, write **vol0**, **vsroot**, or **both** to match the volumes with their characteristics.

- a) Is a flexible volume ____both____
- b) Can have Snapshot copies __ both ____
- c) Can have mirrors __vsroot___
- d) Can be accessed by NFS or CIFS clients ____ vsroot ____
- e) Can be backed up to tape ___ vsroot ____
- f) Can be copied ____ vsroot ____
- g) Can be accessed by the systemshell __vol0___
- h) Can have junctions to other volumes ____ vsroot ____
- i) Cannot be moved to another aggregate __vol0___



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