Exercise Guide Managing Nutanix Clusters

This guide contains the labs for an Environment with three clusters:
One `three-node` cluster and two `single-node` clusters.

(This three-node cluster is something you will configure yourself in Module 1).

The three node cluster is named **ntnx-1**, the single nodes are named **ntnx-2** and **ntnx-3** respectively.

Each module has a lab with multiple exercises.

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Remarks.

Attention!

The last lab in this environment is a lab on Prism Central. The deployment of Prism Central takes about an hour. It is suggested you install Prism Central at the end of the day 1, 2 or 3. We will only use Prism Central on the last day of this training. To install Prism Central, go to the **`Addendum LAB`** and perform exercise 1-1 and 1-2.

Images.

In the labs we use small images because of download and deploy times.

Module 1 - Introduction.

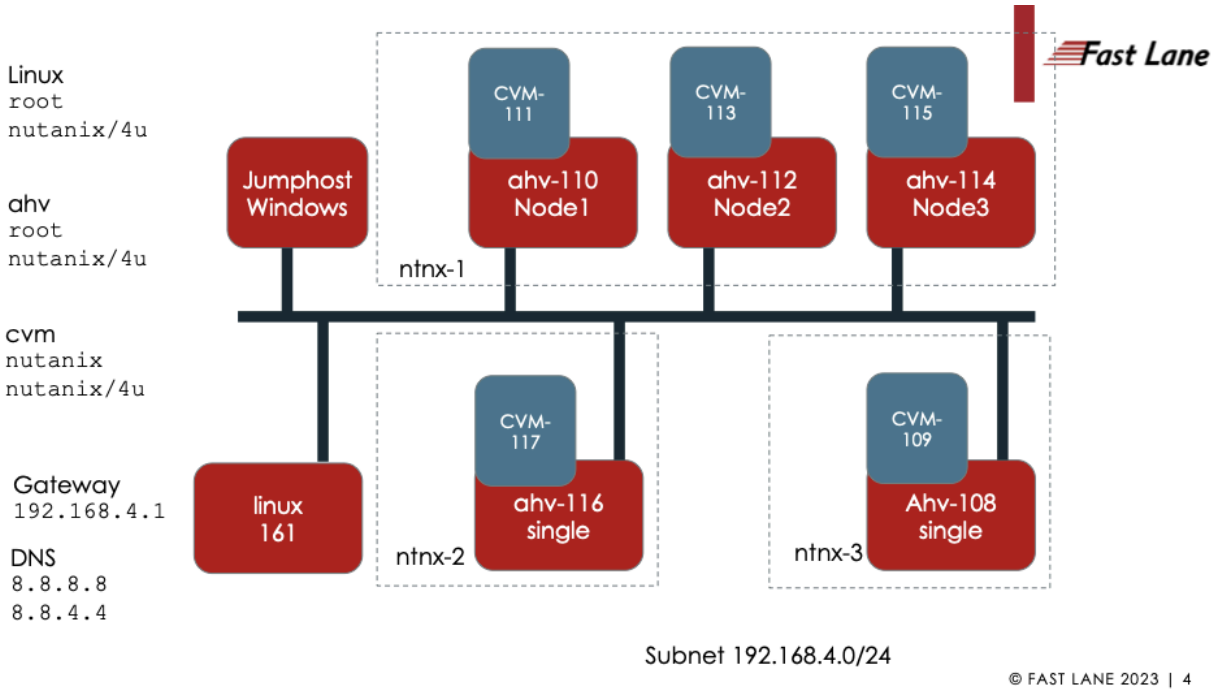
How to login:

The Active Directory Domain is **`nutanix.local`**.

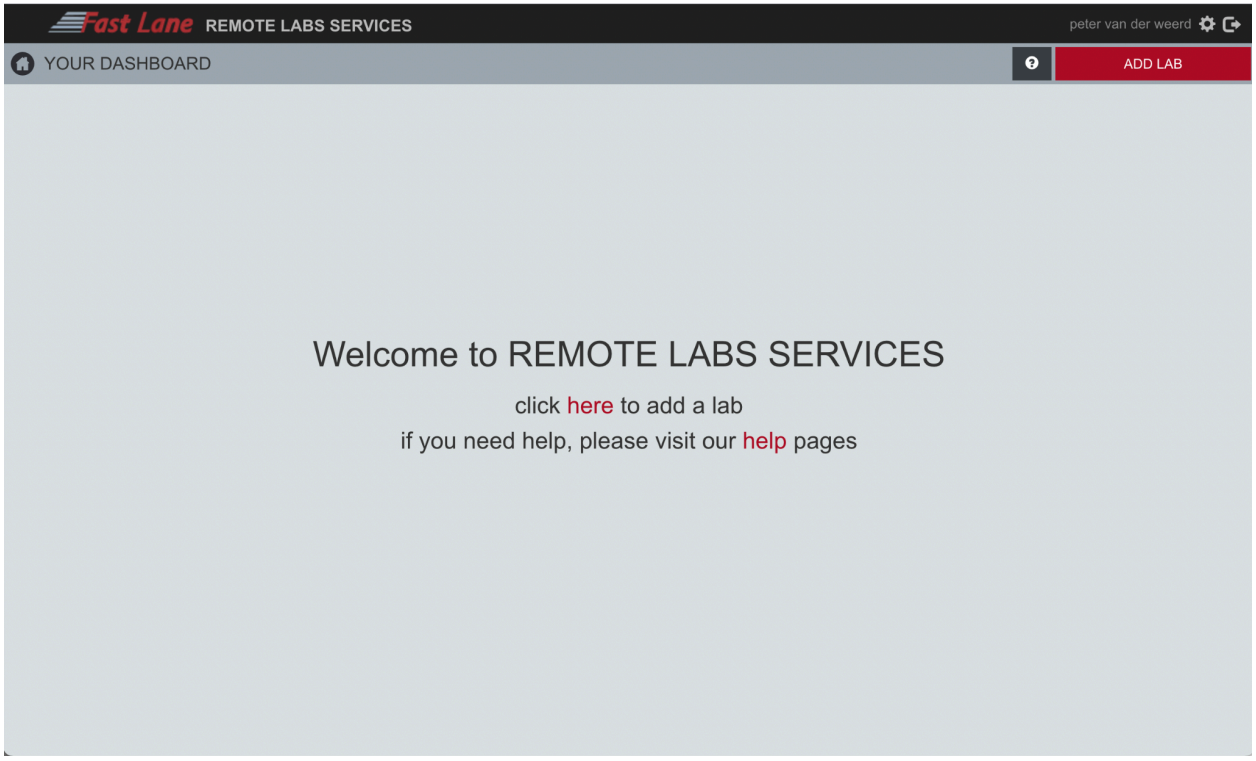
For all AHV logins: PUTTY	For all CVM logins: PUTTY	For all Prism logins: Browser

For the linux login: PUTTY	For the Windows login: jumphost

System	IP Address	username	password
Windows Server	192.168.4.253	Administrator	1234QWer
AHV-110	192.168.4.110	root	nutanix/4u
AHV-112	192.168.4.112	root	nutanix/4u
AHV-114	192.168.4.114	root	nutanix/4u
AHV-116	192.168.4.116	root	nutanix/4u
AHV-108	192.168.4.108	root	nutanix/4u
CVM-111	192.168.4.111	nutanix	nutanix/4u
CVM-113	192.168.4.113	nutanix	nutanix/4u
CVM-115	192.168.4.115	nutanix	nutanix/4u
CVM-117	192.168.4.117	nutanix	nutanix/4u
CVM-109	192.168.4.109	nutanix	nutanix/4u
Linux	192.168.4.161	root	nutanix/4u
Prism Element	192.168.4.117 and 192.168.4.109	admin	Br@@mspun1



M1	Exercise 1. Connecting to your lab environment.	
1-1	Download the Remote Labs Client for Windows or MacOSX Open a browser and download the client: **https://remotelabs.io/rl3/download/**	
	Open the Remote Labs Client and create a user with a password. The user is based upon an email address. The password should have uppercase and lowercase characters, special characters and digits.	
1-2	Login using your account `email` and `password`.	

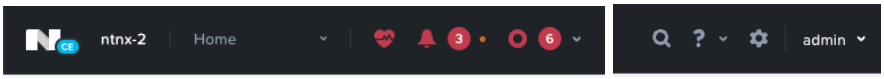


Your Instructor will give you the LabCode to connect to your lab environment.

Note: If you think the display is too small. Click on the settings wheel (top right of the screen). Click **Connection** and change the **resolution**.

M1	Exercise 2. Connecting to the different VMs.	
	In this exercise you will connect with the hypervisor (AHV) of the single-node cluster ntnx-2 and list the virtual machines, and physical storage. Then you will connect to the Control Virtual Machine of that cluster and check the storage in that CVM as well as the cluster status. Finally you will connect to the Linux VM which will be used for ISO images. **Note: when you are asked to login, use PUTTY from the Windows Desktop.**	
2-1	Login to AHV-116. `(root nutanix/4u)` Run the following command: **`virsh list --all`** What is the virtual machine that is running in the AHV?	
	Run the following command: **`lsblk | grep sd`** What is the purpose of the 16G disk? Find a 1TB disk and a 500GB disk.	
2-2	Login to the CVM: **`ssh nutanix@192.168.4.117`** If you are prompted with an authenticity message, type **`yes`**.	
	Run the following command: **`lsblk | grep sd`** Do you notice a difference in the device names between the AHV and the CVM? What is the size of the device that is connected to **`drive-scsi0-0-0-0`** And what is the size of the device that is connected to **`drive-scsi0-0-0-1`** These two disks represent the total amount of physical storage in this cluster.	
	Run the following command: **`cluster status | more`** Notice that this CVM is the ZeusLeader. To see the rest of the services, press the spacebar.	
	Type **`exit`** to leave the CVM, type **`exit`** to leave the AHV.	
2-3	Login to the linux VM `(root nutanix/4u)`. Run the following command: **`ls /mnt/iso`** Do you see an *iso* file?	

M1	Exercise 2. Connecting to the different VMs.	
	This VM will be used to retrieve `images` via the `nfs` protocol.	
	Run the **`exportfs`** command. This VM runs an NFS server and the */mnt/iso* directory is exported to the world. Type **`exit`** to leave the linux VM.	
	End of exercise.	

M1	Exercise 3. Connecting Prism Element.	
	In this exercise you will have a quick look at Prism Element. You will be using this interface throughout these labs. Prism Element is part of every CVM on every node in every cluster.	
3-1	Using a Browser login to Prism Element of ntnx-2. (`https://192.168.4.117:9440`) username: **admin** password: **Br@@mspun1** click `Advanced` and then `Accept the Risk`. If you use *Chrome* type: “thisisunsafe” to accept the risk. If you are asked to reset your password, enter a new valid password twice and make a note of it. And login using the new password. Inspect the icons and menus in the black bar at the top and try to interpret them. 	
	Click on the cluster name next to the Nutanix Logo. Does the cluster have a *Virtual IP* address? If the cluster does not have a Virtual IP, then enter: `192.168.4.102` Click `Save`.	
	Click on the Home pulldown menu. You will use this menu a lot.	
	Click on the *settings wheel* next to admin. Scroll down. You will also use this menu a lot.	
	Click on the **?** `(question mark)`.	

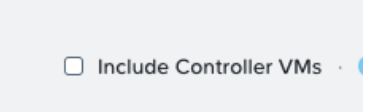
M1	Exercise 3. Connecting Prism Element.	
	Notice the link to `Online Documentation`.	
	In the admin pulldown menu click `sign out`.	
	End of exercise.	

Module 2 - Components.

In this lab you will do the following:

- Inspect Prism Element further.
- Inspect the Command Line Interface.
- Install a three-node cluster.

M2	Exercise 1. The Prism Element Dashboard.	
1-1	Login to Prism Element of **ntnx-2**. (`https://192.168.4.117:9440`) username **admin** password **<the password you chose at 3-1>** The Dashboard holds general information on cluster state and cluster components.	
	Answer the following questions, based upon the Dashboard information. - What is the total logical storage capacity in your cluster? - What is the total physical storage capacity in your cluster? - How many VMs does this cluster have? There should be only `1`. - What is the total amount of Memory in the cluster, and how much is in use? - When you click on the *events* widget, what does it tell you? (to go back to the Dashboard, click *Alerts* next to the cluster name and then *Home*.) - What information do you see in the *Hardware Summary* widget?	
	End of exercise.	

M2	Exercise 2. The Home pull down menu.	
2-1	Login to Prism Element of **ntnx-2**. (https://192.168.4.117:9440) Click on *Home*. You get various options. Some are for configuring resources and others are for status information and events. We are not going to discuss all of them here, but will have a look at some interesting ones now.	
	Click on VM. Click on Table. Depending on the Include Controller VMs checkbox, you should either see a single VM or no VMs.  . Click on VM and then Home to get back to the main Dashboard.	
	Click on Home and then Settings. As you can see it takes you to the settings, like the *Settings Wheel* at the top right of your screen does.	
	Scroll down in the Settings canvas and notice that there are quite a few additional configuration options.	
2-2	Scroll down to *Network* and click Network Configuration. What is the name of the subnet, and what more does it tell you?	
	Still under Network click on NTP Servers. Are there any NTP Servers configured?	
	Still under Network, what are the Name Servers to be used?	
2-3	Scroll up to Setup and click on Rack Configuration. You see Node, Block and Rack. What would a "Fault Tolerant Domain" be?	
2-4	Scroll up to General and click on Configure CVM. How much memory does the CVM have? Would you be able to modify that in this screen. (**Please don't!**).	
	Close the Browser.	
	End of exercise.	

M2	Exercise 3. Other Interfaces.	
	This exercise introduces the different shells that Nutanix offers next to the default Linux Bash shell. These shells give you the command line version of different functionalities of Prism Element.	
3-1	Login to `CVM-117`, using PUTTY. `(nutanix nutanix/4u)` Type the following command: `pwd` This displays your current working directory. This is the logindir or homedir of the nutanix user.	

	Type the following command: `acli`
	You see that the prompt changes to *<acropolis>*
	
	When you hit the TAB-key twice, it will show you the `acli commands`.
	`ads`
	`core`
	`exit`
	`get`
	`ha`
	(et cetera).	

	Still in *acli*, type the following: `vm.` `(there should be a dot after vm)` and do not press `Enter` but hit the `tab key` twice again. This will give you all the actions you can perform on VMs from this shell.	
	Still in `acli`. Run the following command: `net.list` What does that tell you?	
	To leave the acli shell, type `exit` or `<CTRL>+d`.	
3.2	Next to acli, there are other shells like `ncli` and `ecli`. These will be used later in this course, but if you like, try and find out what their purpose is.	
3.3	**A practical example:** Imagine you forget the `Admin` password to login to Prism Element. You could then reset the password using the `ncli` shell. - Login to the CVM with username `nutanix` and password `nutanix/4u`. - Use `ncli` to reset the password of `admin`. `ncli user reset-password user-name="admin" password="Br@ndn3t3l1"` This would reset the password of `admin` to `Br@ndn3t3l1.`	
	End of exercise.	

M2	Exercise 4. Setup a Three-Node Cluster	
	This helps you to configure the remaining three vms in your pod into a 3-node cluster. To set up a new cluster, the nodes and CVMs should be up and running. You then connect to one of the CVMs and create the cluster. Some initial information is needed, like the ip addresses of all CVMs. Other configurations can be set after the cluster has been created and is up and running.	
4-1	Login to CVM-111 as `nutanix` with password `nutanix/4u`. (PUTTY)	

	Make sure the other CVMs are reachable:
	`ping 192.168.4.113`
	`ping 192.168.4.115`	

	To create the cluster use the following command:
	
	`cluster -s 192.168.4.111,192.168.4.113,192.168.4.115 \`
	`--redundancy_factor=2 create`
	
	This will take some time...(may take up to 10 minutes) the cluster will automatically start.	

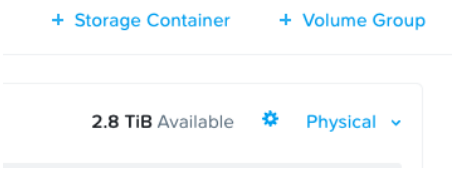
	Open a second PUTTY session to CVM-111. Run the following command: `cluster status` If the `state is unknown` and `CVM is down`, wait a bit longer. If all services are not `UP` yet, wait a bit and try it again. After some time all services should be in the `UP` state. (It may take up to ten minutes.) Do not continue until all services are `UP`. When the cluster is up, close the PUTTY sessions.	
4.2	Open a browser and connect to `https://192.168.4.111:9440` Login as `admin` with password `nutanix/4u`	
	1. You will be prompted to change the password immediately. Attention: This is the password for the admin user of Prism Element. 2. You will automatically be logged out and have to log in again. 3. Then you will be prompted to enter the Nutanix online account and	

M2	Exercise 4. Setup a Three-Node Cluster	
	password (This is something that has already been configured. You just have to login.) Use the following login: User: `uadmin@uadmin.nl` Pass: `Br@@mspun1` (**note: the last character of the password is the digit "1"**)	
4.3	In Prism Element Dashboard to the top left, you see that the cluster is `unnamed`. Click on it and enter the following settings and leave everything else to the default. Clustername : `ntnx-1` Virtual IP : `192.168.4.118` Click `Save`. (this will take about 30 seconds)	
	Click on the Settings Wheel (top right of the screen). Scroll down to `Network` and click `Network Configuration`. Click `Create Network`. Set the Network Name to `ntnx-1` and set the VLAN ID to `0`. Click `Save`.	
	Click `Admin` (top right of the screen) and `Sign Out`.	
	End of exercise.	

Module 3 - Managing Cluster Storage.

In this lab you will do the following:

- Inspect the physical disks and *Default Storage Pool*.
- Inspect the *default storage containers* and *settings*.
- Create a Storage Container.
- Grant access to the Storage Container.

M3	Exercise 1. Default Storage Pool and Physical Disks	
1-1	Login to **ntnx-1** Prism Element. (192.168.4.118:9440) In the default dashboard click on Home and then Storage.	
	Question: In the Overview Page, how many Storage Containers are present in the cluster, and to how many hosts are these containers mounted.	
1-2	Click on Diagram (next to Overview). Make a note of the number of Storage Pools and the number of Storage Containers.	
	In the top right of the screen you see the Logical available storage. Click on it and see what the Physical available storage is. Can you explain the difference? 	
1-3	Click on Table. What are the names of the Storage Containers and what is their Replication-factor?	
	What are the settings of the Efficiency techniques like Deduplication, Compression and Erasure Coding?	
	End of exercise.	

M3	Exercise 2. Creating Storage Containers.	
	In this exercise you will do the following: - Create and remove storage containers. - Set capacities. - Delete storage containers. - Allow a host to use a container via NFS.	
2-1	Login to Prism Element of **ntnx-1**. (192.168.4.118:9440) From the Home pull down menu select Storage. Click on Table. In the top right corner, click +Storage Container. Name the new Container: finance. Click Advanced Settings. Can you modify the Redundancy Factor? Leave the RESERVED CAPACITY blank. Set the ADVERTISED CAPACITY to 100. Leave everything else to the default and click Save.	
	In the table view, what is the Free Logical Space of finance and what is its Max Capacity?	
2-2	In the Table view of Storage Containers, select finance and right-click. Select Update.	
	Click Advanced Settings. Scroll down. In Filesystem Whitelists, enter the following Subnet and Netmask: : 192.168.4.0/255.255.255.0 Click Save. (Wait until the container has been updated.)	
	Close the Browser.	
2-3	Using PUTTY, login to the Linux VM as root. (192.168.4.161).	
	With the following command, find out which Storage Containers are “shared/exported” to others: `showmount -e 192.168.4.118` Is the finance Container listed?	
	To access the finance Container from the Linux VM, you will have to create a directory to use as a mountpoint for the finance Container. Run the following two commands to mount the finance Container:	

M3	Exercise 2. Creating Storage Containers.	

	`mkdir /mnt/finance`
	`mount 192.168.4.118:/finance /mnt/finance`
	
	Run the following command to check whether the mount was successful.
	
	`df -h | grep finance`
	
	The output should be something like this:
	
	`192.168.4.118:/finance 100G  0 100G 0% /mnt/finance`	

	You are still logged in to the Linux client.
	Create an empty file in the finance container.
	
	`> /mnt/finance/emtpy_file`
	
	List the contents of /mnt/finance:
	`ls /mnt/finance`
	`empty_file`
	
	Close the PUTTY session.	

2-4	**The next thing is not a clever thing to do, but it is something to experience.** Using a Browser, login to `ntnx-1`, and from the Home pull down menu select `Storage`. From the `Table` menu select and right-click the `finance` Container. Click `Delete`, and confirm by clicking `Delete`. Close the Browser.	
	Using PUTTY, login to the Linux VM again as root. What happens if you run the following command: `ls /mnt/finance` You will be told that you cannot access the directory because of a "`Stale file handle`". Can you explain this?	
	Close the PUTTY session.	
	End of exercise.	

M3	Optional Exercise 3	
	This is an optional exercise in which you will create a Storage Container using `ncli`. - Use ncli to list the Storage Pools. - Use ncli to create a new Storage Container in the Storage Pool.	
3-1	Login to `192.168.4.118` as `nutanix` via PUTTY. (This IP address is not in the PUTTY list, add it in the field "Hostname [or IP address]" and then click Open). Run the following command to list the Names of all StoragePools. `ncli storagepool list | grep Name` Since we have only got a single Storage Pool, the output will be something like this. **`Name : default-storage-pool-xxxxxxxxxxxxx`**	
	To create a new `Storage Container` in the `Storage Pool` we just listed, run the following command. (The name of your Storage Pool is of course a different name) `ncli storage-container create name=HR sp-name="Enter your StoragePool"` (you can paste the storage pool name by selecting it with your mouse and then right-click. That will paste it after "sp-name=")	
	Can you set the advertised capacity to 100GB? Run the following command: `ncli` (this will change your prompt to **`<ncli>`**) Type: `storage-container` (do not press enter but hit the **<tab>** key. This will list the subcommands) Type: `storage-container edit name=HR adv-capacity=100` Press `Enter`. In the output, what is the `Allowed Max Capacity`? Type `exit`.	
	To delete the Storage Container run the following command: `ncli storage-container rm name=HR`	

M3	Optional Exercise 3	
	`Storage container deleted successfully`	
	End of exercise.	

Module 4 - Networking.

In this lab you will do the following:

- Inspect your Network Configuration.
- Manage DNS and NTP settings..
- Add a Managed Network.
- Work with ncli (optional)

M4	Exercise 1. Inspect your Network Configuration	
1-1	Login to **ntnx-2** Prism Element. `(https://192.168.4.117:9440)` Open Settings by clicking the `Settings Wheel` (top right of the screen)	
	Scroll down to `Network` and select `Network Configuration`. `Ip management` is not enabled for this network, so clients will have to pick their own IP Addresses.	
	How many `Free IPs in Subnets` do you see? -> **N/A**	
1-2	Click on `Internal Interfaces`. Under Interfaces you see `eth2, eth1` and `eth0`. These are physical ports (*of course not in this case, because this is a virtualized environment)	
	Click on `Management Lan`. This shows the `Host IP` and `CVM IP`. Click `Back`. Click on `Hypervisor Lan`. Do you know what this is used for? Click `Back`. To find out what the Backplane Lan is used for by hovering over the `question mark` next to it.	
1-3	Click on `Virtual Switch`. Make a note of its name, the `bridge` and the MTU size. Why is there no `uplink bond` in this setup?	

M4	Exercise 1. Inspect your Network Configuration	
	Back in `Settings`, click on `Name Servers`. What are the current Nameservers? In the `Server Ip` field enter `1.1.1.1` and click `+Add`.	
	Back in `Settings`, click on `NTP Servers`. In the `NTP Server` field add `1.nl.pool.ntp.org` and click `+Add`	
	Return to the `Home Dashboard`.	
	End of exercise.	

M4	Exercise 2. Add a Managed Network	
	A managed network is a network where the clients don't pick their own IP Addresses but the cluster will hand them out based upon a subnet and a predefined range of IP Addresses.	
2-1	You are still connected to `ntnx-2`. Using the `Settings Wheel` (top right of the screen) under `Network`, click on `Network Configuration`.	
	Click on `+Create Subnet.` Name the Subnet: `SmallNet` Virtual Switch: `vs0` Vlan ID: `1` Checkbox `Enable IP address management` Network IP Prefix : `192.168.10.0/24` Gateway IP Address: `192.168.10.1` Scroll down a bit. Uncheck `DHCP Settings`. Click `+Create Pool` Start Address: `192.168.10.100` End Address: `192.168.10.150`	

M4	Exercise 2. Add a Managed Network	
	Click `Submit`. Click `Save`. How many Free IPs in the Subnet are displayed? In the column Used IP Addresses you see that 3 addresses are being used. Click on the 3 and see which addresses are reserved. Unfortunately we cannot use this subnet in our lab, so we delete it to avoid confusion. Click `Delete`. Click `Ok`.	
	End of exercise.	

M4	Optional Exercise 3. Use ncli	
	Using PUTTY, connect to the CVM of **ntnx-2** (192.168.4.102) You will see how many NICs the Hypervisor has and How many Interfaces the CVM has.	
3-1	Start ncli by typing `ncli`. Your prompt will change to this: **`<ncli>`**	

	Run the following command to list all hosts in the cluster:
	
	`host list`
	
	The first line of output will look like this:
	
	`Id  : 00060726-d2e2-6ed2-1f77-000c293dfc1a::2`
	
	Please have a look at the rest of the output.	

	Still in ncli, run the following command: `net list-host-nics host-id=2` What is the name of the Nic?	

M4	Optional Exercise 3. Use ncli	
	How many Nics do you see?	
3-2	Still in ncli, run the following command to list all VMs. `vm list` You should only see one VM: the CVM. Using your mouse select the string after `Id :` Run the following command: `net list-vm-nics vm-id=`**`<paste the id of the CVM in here>`** **There should be no spaces around the '=' sign.** What are the IP Addresses of vnet1? What is the IP Address of vnet0? Close PUTTY.	
	End of exercise.	

Module 5 - Images.

In this lab you will do the following:

- Inspect the Image Configuration.
- Upload Images of different types and from different locations.

M5	Exercise 1. Inspect your IMAGE Configuration and upload an ISO image.	
	In this exercise you will upload an ISO Image from an NFS server. The NFS server is the linux machine in your network. The IP of the NFS server is `192.168.4.161`. The images on the NFS server are stored in the path `/mnt/iso` on the server.	
1-1	Login to **ntnx-1** Prism Element. (https://192.168.4.118:9440) Open Settings by clicking the Settings Wheel (top right of the screen)	
	Under `General`, select `Image Configuration`. No images have been created yet.	
	Click `+Upload Image` Name: `Linux1-iso` Annotation: `Uploaded from NFS server` Image Type: `ISO` Storage Container: `SelfServiceContainer` Image Source : From URL: `nfs://192.168.4.161/mnt/iso/rocky.iso` Click `Save`. (Wait until the upload has finished. Takes about one minute.)	
	What is the size of the image?	
	End of exercise.	

M5	Exercise 2. Upload an ISO image from a website.	
	In this exercise you will upload an ISO Image from a Website. The Url of the Website is `http://uadmin.org` the path of the ISO is `/mini.iso`	
2-1	Login to **ntnx-1** Prism Element. Open Settings by clicking the Settings Wheel (top right of the screen)	
	Under `General`, select `Image Configuration`.	
	Click `+Upload Image` Name: `mini.iso` Annotation: `Uploaded from website` Image Type: `ISO` Storage Container: `SelfServiceContainer` Image Source : From URL: `http://uadmin.org/mini.iso` Click `Save`. (Wait until the upload has finished. Takes about 30 seconds.)	
	What is the size of the image?	
	End of exercise.	

M5	Exercise 3. Upload a DISK image from a website.	
	In this exercise you will upload a DISK Image from a Website. The Url of the Website is `http://uadmin.org` the path of the ISO is `/tiny.img` (This is one of the smallest linux distributions ever.)	
2-1	Login to **ntnx-1** Prism Element. Open Settings by clicking the Settings Wheel (top right of the screen)	

M5	Exercise 3. Upload a DISK image from a website.	
	Click `+Upload Image` Name: `tiny` Annotation: `From Website` Image Type: `Disk` Container: `SelfServiceContainer` URL: `http://uadmin.org/tiny.img` Click `Save` (Wait until the upload has finished. Takes about 10 seconds.)	
	End of exercise.	

M5	Exercise 4. Upload a Disk Image to a Container.	
	In this exercise you will upload an ISO Image to the `SelfService Container`, from the Linux VM. This means that you will have to grant access to the SelfService Container to an NFS client. The NFS client will mount the SelfService Container and store the `ISO Image` in the Container.	
4-1	To grant Access to the NFS client, we need to place this client in the Whilelists for the SelfService Container. You are logged in to `Prism Element` of `ntnx-1`. From the `Home` pulldown menu, go to `Storage`. Click on `Table`. Select the `SelfServiceContainer`. Click `Update` (middle right of the screen) Click `Advanced Settings` and scroll down. In `FILESYSTEM WHITELISTS`, add the IP Address and netmask of the linux VM. `192.168.4.161/255.255.255.0` Click `Save`.	
4-2	We have to create a mountpoint on the Linux VM and mount the SelfServiceContainer to that mountpoint. Login to the `Linux VM` (192.168.4.161 root nutanix/4u)	

M5	Exercise 4. Upload a Disk Image to a Container.	

	Create a mountpoint:
	
	`mkdir /mnt/ssc`
	
	Mount the SelfServiceContainer to the mount point:
	
	`mount 192.168.4.118:/SelfServiceContainer /mnt/ssc`
	
	To check:
	
	`df -h | grep ssc`
	
	Output should be:
	`192.168.4.118:/SelfServiceContainer 1.5T 48G 1.4T 4% /mnt/ssc`	

4-3	We can copy a Disk Image to the SelfServiceContainer.	

	Attention: the DNS server of the Linux VM has to be set.
	The command **nmcli** stands for **network management command line interface**.
	
	`nmcli conn modify ens192 ipv4.dns 8.8.8.8`
	
	With **systemctl** you can restart the network service.
	`systemctl restart NetworkManager`
	
	Still logged in to the Linux VM.
	First get this `tiny.img` from uadmin.org like this:
	
	Change directory to /mnt/iso.
	`cd /mnt/iso`
	`curl -o` **`tiny2.img`** `http://uadmin.org/`**`tiny.img`**
	(this will download the image and save it as **tiny2.img**)
	
	Then copy the `tiny2.img` to the `/mnt/ssc`.
	`cp tiny2.img /mnt/ssc/`
	
	Check whether the ISO has landed in the Container:
	
	`ls /mnt/ssc`
	`tiny2.img`	

	End of exercise.	

Module 6 - Creating Virtual Machines.

In this lab you will do the following:

- Create a VM using a DISK image from ADSF.
- Create a VM using an ISO image from the Image Configuration.

M6	Exercise 1. Deploy a VM using a Disk Image from the Image Configuration.	
	In this exercise you will use a DISK Image from the Image Configuration to deploy a Linux VM. You will deploy it in the `DefaultContainer` in `ntnx-1`.	
1-1	Login to **ntnx-1** Prisim Element. From the Home pulldown menu select `VM`. Click `+Create VM`. (note: Fields that are not mentioned should be left to the default). Name: `VM1-FromDisk` vCPU(s): `1` Memory: `1` Click `+ Add New Disk` Type: `Disk` Operation: `Clone From Image Service` Bus Type: `SCSI` Image: `tiny` Click `Add`. Scroll down and click `+Add New NIC`. Network Name: `ntnx-1` Click `Add`. Click `Save`. In the VM Overview screen, click `Table`.	
	Your VM is powered off, so power it on.	

M6	Exercise 1. Deploy a VM using a Disk Image from the Image Configuration.	

	Right-click the VM `VM1-FromDisk` and click `Power On`.
	
	Wait a bit.
	Right-click the VM `VM1-FromDisk` again and click `Launch Console`.
	Select `Boot TinyCore` and press enter.
	
	This image will log you in automatically.
	
	Give this VM an IP address:
	
	`sudo ifconfig eth0 192.168.4.250`
	
	Ping the default router, to test the network connection.
	
	`ping 192.168.4.1`
	After you see the replies from the 192.168.4.1...
	Type `<CTRL+C>`
	
	This VM is used just to test deploying a VM.
	We have no further use for this VM now. We just leave it the way it is.	

	End of exercise.	

M6	Exercise 2. Deploy a VM using a Disk Image from ADSF.	
	In this exercise you will use a DISK Image to deploy a Linux VM using an ADSF file. You will deploy it in the DefaultContainer in ntnx-1.	
2-1	Login to **ntnx-1** Prism Element. If you are still logged in, that's fine. From the Home pulldown menu select VM. Click `+Create VM`. (note: Fields that are not mentioned should be left to the default). Name: `VM2-FromDisk` vCPU(s): `1` Memory: `1` Click `+ Add New Disk` Type: `Disk`	

M6	Exercise 2. Deploy a VM using a Disk Image from ADSF.	
	Operation: `Clone from ADSF file` Bus Type: `SCSI` ADSF Path: `/SelfServiceContainer/tiny2.img` Click `Add`. Scroll down and click `+Add New NIC`. Network Name: `ntnx-1` Click `Add`. Click `Save`.	
	Your VM is powered off, so power it on. Right-click the VM and click `Power On`. You should now have to User VMs up and running: VM1-FromDisk and VM2-FromDisk. If you like you can launch the console and boot Tiny Core, but you could also leave it the way it is and continue with Exercise 3.	
	End of exercise.	

M6	Exercise 3. Deploy a VM using an ISO Image.	
	In this exercise you will use an ISO Image to deploy a VM from scratch. This means that you will also configure it. This is a somewhat bigger VM we will use again later. This one takes a little bit more effort maybe, and definitely more time to install.	
3-1	Login to **ntnx-1** Prism Element. From the Home pulldown menu select VM. Click `+Create VM`. Name: `VM3-FromIso` vCPU(s): `2` Memory: `4`	

M6	Exercise 3. Deploy a VM using an ISO Image.	
	Click `+ Add New Disk` Type: `Disk` Operation: `Allocate on Storage Container` Bus Type: `SCSI` Storage Container: `default-container-xxxxxxxxx` Size (GiB): `10` Click `Add`. (This Disk will be used to install Linux upon) Click on the "Pencil" in the CD-ROM line. Operation: `Clone from Image Service`. Image: `linux1-iso` Click `Update` Scroll down… Click `+Add New NIC` Network Name: `ntnx-1` Click `Add` Click `Save`	
3-2	Your VM is powered off, so power it on. Right-click the VM `VM3-FromIso` and click `Power On`. Wait for a bit. Right-click the VM again and click `Launch Console`. Activate the console screen by clicking your mouse in the console. Use the UP ARROW key on you keyboard to activate the line that says: **`Install Rocky Linux 9.2`** Press `Enter` It may take a minute before things start to happen. **You will see the VM booting and finally it will start the Graphical Install tool (may take up to 45 seconds).** **If necessary use your mouse to make the console bigger by dragging the corner wider.**	
3-3	Select `English` as the language. Click `Continue` (you may need the to drag the scrollbar down to find ***Continue***) When the installation summary screen appears. Click on `Installation Destination` The 10GiB disk is automatically selected. **(Don't touch it)** Click `Done`. (top left of the screen…you may need to scroll up for the **Done** button)	

M6	Exercise 3. Deploy a VM using an ISO Image.	
	Click `Root Password` Set the password: `nutanix/4u` `(you have to enter it twice!)` Click `Allow root SSH login with password` Click `Done` Click `User Creation` Full Name: `nutanix` Click: `Make this user administrator` Password: `nutanix/4u` Confirm: `nutanix/4u` Click `Done` **`(twice)`** Click: `Network & Hostname` Slide the **white circle** (top right) to the right to enable. Click: `Configure…` (you may need to scroll down.) Click: `IPv4 Settings` Method: `Manual` (you can select Manual by clicking the Method bar) In the Addresses click `Add` In the Address field enter: `192.168.4.122` Netmask: `24` Gateway: `192.168.4.1` DNS servers: `8.8.8.8` Click `Save` Click `Done` (top left…scroll up if you don't see it) Click `Begin Installation` (you need to scroll down to find the button). This will take some 10 minutes. [coffee?]	
3-4	Attention: the boot order of the VM is defaulted to **CD-ROM** and then **Disk**. This is not what we want, because then it would start the installation all over again, so we have to force the VM to boot from **Disk**. Like this. After the installation has finished, **do NOT reboot**. Minimize the installation window. (the minus sign at the top right) Return to the Table view of the VMs. Right-click `VM3-FromIso` and click `Power Off Actions` Select `Power off` and click `Submit`. Wait until it is powered off. Right-click `VM3-FromIso` Click `Update` Scroll down to `Boot Configuration` and change the **Default Boot Order** to `DISK(scsi.0)` Click `Save`	

M6	Exercise 3. Deploy a VM using an ISO Image.	
	Right-click `VM3-FromIso` `Power on.` After a while, right-click the VM VM3-FromIso and click launch the console. login: You can login as **root** with password **nutanix/4u** Or you can login as **nutanix** with password **nutanix/4u** Can you ping the default router? **`ping 192.168.4.1`** To leave the console click on the **X** sign top-right of the console window.	
	End of exercise.	

Module 7 - Managing Virtual Machines.

In this lab you will do the following:

- You will clone VMs
- You will use Affinity for VMs
- You will work with VM Snapshots
- You will Create and Attach Volume Groups

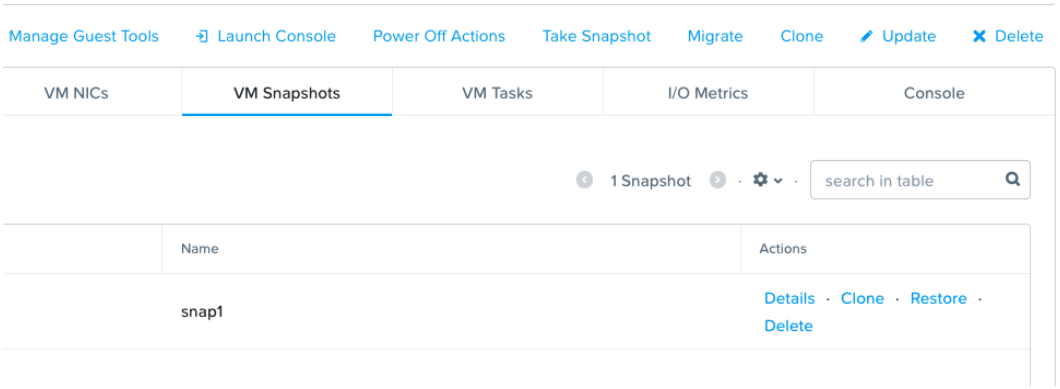
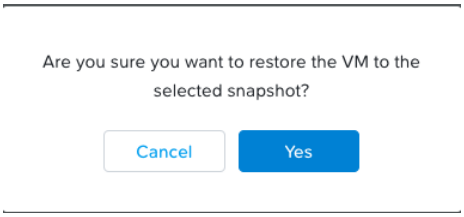
M7	Exercise 1. Cloning VMs	
	In this exercise we will clone a VM. Then we will boot the VM and connect to it using the `launch console` option.	
1-1	Connect to Prism Element of **`ntnx-1`** From the `Home` pulldown menu select `VM`. Right-click `VM1-FromDisk` Select `Clone` Leave everything to the default but read and understand what it all means. Questions: How many clones will it create? What is the name of the clone? Click `Save`.	
	After the clone has been created, find the clone in the list, right-click the clone and power it on.	
	Wait until the clone has booted. Right-click it and click `Launch Console`. TinyCore is ready to boot. Close the console by clicking the **X** at the top right of the console window.	
	End of exercise.	

M7	Exercise 2. VMs and Affinity	
	In this exercise we will limit a VM to two Hosts instead of the three available hosts in the cluster. This means that the VM cannot be started on the host is has no affinity with.	
2-1	Connect to `Prism Element` of **`ntnx-1`** From the `Home` pulldown menu select `VM`. Select the `Table` view. Right-click `VM1-FromDisk` Select `Update` Scroll down.	
	Click `+Set Affinity` The current host is selected. Click on one of the two remaining hosts. Click `Save`. Click `Save` again.	
2-2	From the Home pulldown menu select VM. From the Table view right-click VM1-FromDisk Select `Migrate`. Click on "`System will automatically select a host.`" Only two hosts pop up. Pick the one on which the VM is not currently running.	
	In the Table view you see that the VM has migrated to the other host.	
	End of exercise.	

M7	Exercise 3. VMs and Local Snapshots	
	In this exercise we will Snapshot a VM and restore the snapshot.	
3-1	Connect to *Prism Element* of `ntnx-1` From the `Home` pulldown menu select `VM`. Right-click `VM3-FromIso` Select `Take Snapshot` Name: `snap1` Click `Submit`.	

	To prove that we can restore a snapshot we now create a file in the VM, then restore the snapshot and check that the file is no longer present in the VM.
	
	Right-click VM `VM3-FromIso`
	Click `Launch Console`
	(if you are still logged in, first log off by typing **`exit`**)
	Login as: `root`Password: `nutanix/4u`
	
	Create an empty file:
	`touch newfile`
	Run the ls command:
	`ls`
	(You should see the file **newfile**)
	
	Type `exit`
	To leave the console click on the **X** sign top-right of the console window.	

3-2	In the Actions bar in the middle, find `VM Snapshots` (you may need to scroll down…You should see the snapshot snap1).	

M7	Exercise 3. VMs and Local Snapshots
	
	Click **Restore**  Click **Yes**
	Restoring the snapshot will automatically **power off** the VM. (this may take some 20 seconds.) Right-click `VM3-FromIso` and select `Power-On`.
	After the VM is powered on, Right-click `VM3-FromIso` and select `Launch Console` Login: `root` Password: `nutanix/4u` Type the `ls` command. `ls` Is the file `newfile` still there?
	To leave the console click on the **X** sign top-right of the console window.
	End of exercise.

M7	Optional Exercise 4. Snapshots and the command line interface	
	In this optional exercise we will create and restore a snapshot using **acli**.	
4-1	Connect to one of the CVMs in your three-node cluster. Use `PUTTY` from the windows desktop or `ssh` from the linux machine. Login as `nutanix` with password `nutanix/4u`	
	Run the following command: `acli` `Your prompt will change to` **<acropolis>**	
4-2	Create a snapshot of VM1-FromDisk: **<acropolis> vm.snapshot_create VM3-FromIso snapshot_name_list=clisnap** List the snapshot: **<acropolis> vm.snapshot_list VM3-FromIso** (it should list two snapshots: **clisnap** and **snap1**) Restore the snapshot: **<acropolis> vm.restore VM3-FromIso clisnap** `Replace existing VM with snapshot? (yes/no)` **yes** `VmRestore: complete` **<acropolis>exit**	

	The three commands can also be executed without accessing acli interactively:
	
	acli vm.snapshot_create VM3-FromIso snapshot_name_list=newsnap
	acli vm.snapshot_list VM3-FromIso
	acli vm.restore VM3-FromIso newsnap
	`Replace existing VM with snapshot? (yes/no)` **yes**
	`VmRestore: pending`
	`VmRestore: complete`
	
	Do not forget to boot VM3-FromIso after restoring the snapshot.	

	End of exercise.	

M7	Optional Exercise 5. Attach a Volume Group to a VM	
	In this optional exercise we will create a Volume Group and attach it to `VM3-FromDisk`. A Volume Group consists of one or more Disks. The Volume Group can be attached to a VM. This VM will than see the disks as block devices.	
5-1	Login to `Prism Element` on ntnx-1. From the Home pulldown menu select `Storage`. Click `+Volume Group` (top right of the screen.) (when fields are not mentioned, leave them to the default) Name: `LinuxVG` Click `+Add New Disk` Size(GiB): `10` Click `Add` Click `Save`. Click `Volume Group` (between Storage Container and Storage Pool) When the Volume Group `LinuxVG` appears in the Table list: Right-click the Volume Group Select `Update` Click `+Attach to a VM` From the available VMs (Select a VM) `VM3-FromIso` Click `Attach` Click `Save`	
5-2	From the Home pulldown menu select `VM`. Right-click `VM3-FromIso` and select `Launch Console` There may be some messages on the console. (ignore them.) Press `Enter`. login: `root` password: `nutanix/4u` Run the following command: (this will list all block devices.) `lsblk` In your output you should see two disks of 10G. One is **`sda`** (the bootdisk)	

M7	Optional Exercise 5. Attach a Volume Group to a VM	
	and the second is **`sdb of 10GB`** (the disk in the Volume Group.) Close the console.	
	End of exercise.	

M7	Optional Exercise 6. Nutanix Guest Tools (on Ubuntu)	
	In this optional exercise we will set up **NGT** for Ubuntu. You will download a disk image from the Internet and create a vm. Then you will connect NGT to the VM and install the guest tools. You will verify that the guest tools are installed.	
6-1	Login to `Prism Element` on **ntnx-1**. Using the Settings wheel, open `Settings`. Click `Image Configuration`. Click `+Upload Image` Name: `ubuntu` Image Type: `Disk` From URL: `http://uadmin.org/ubuntu.img` Click `Save` **This image is 3GB so this will take some time. About 10 minutes. [coffee?]**	
6-2	From the `Home` pulldown menu select `VM`. Click `+Create VM` Name: `ubuntu` vCPU(s): `2` Number of Cores Per CPU: `1` Memory: `4` Click `+Add New Disk` Operation: `Clone from Image Service` Image: `ubuntu` Click `Add` Click `+Add New Nic` Click `Add`	

M7	Optional Exercise 6. Nutanix Guest Tools (on Ubuntu)	

Click `Save`
Wait until the VM is in the table list.
Select the VM (ubuntu)
Right-click
Click `Power On`

Right-click
Click `Manage Guest Tools`
Checkbox: `Enable Nutanix Guest Tools`
Checkbox: `Mount Nutanix Guest Tools`
Checkbox: `Self Service Restore(SSR)`
Click `Submit`

Use PUTTY to login to 192.168.4.235
(this IP Address was configured in the Image!)
Login as: `nutanix`
Password: `nutanix/4u`

Run: `sudo bash`
Password: `nutanix/4u`
To mount the cdrom to a mount point:
Run: `mkdir /mnt/cdrom`
Run: `mount /dev/sr0 /mnt/cdrom`
(This will mount the guest tools to /mnt/cdrom)

Run: `python3 /mnt/cdrom/installer/linux/install_ngt.py`
(This will install the guest tools)

Run: `service ngt_guest_agent restart`

Run: `exit`
Close the Putty session

Use PUTTY to connect to **ntnx-1** (192.168.4.118)
Login as: `nutanix`
Password: `nutanix/4u`

Run: `ncli ngt list vm-names=ubuntu`

The output should be like this:

```
VM Id                     :
000607b2-9035-b835-36c3-000c29c656e4::688598e7-cb91-4f72-bbe8-60c3c521b846
    VM Name                   : ubuntu
    NGT Enabled               : true
    Tools ISO Mounted         : false
    Vss Snapshot              : true
```

M7	Optional Exercise 6. Nutanix Guest Tools (on Ubuntu)	
	`File Level Restore : true` `Communication Link Active : true`	
	End of exercise.	

Module 8 - Data Protection.

In this lab you will do the following:

- You will setup a local Protection Domain
- You will setup Remote Sites
- You will failover VMs to a Remote site

M8	Exercise 1. Protection Domain.	
	In this exercise you will create a local Protection Domain to protect VMs for scheduled Snapshots. By creating a Protection Domain you can schedule the creation of Snapshots for one or many Virtual Machines.	
1-1	Connect to `Prism Element` of `ntnx-1` From the `Home` pulldown menu select `Data Protection`. (if you get a warning with regards to Prism Central, ignore it) Click `+Protection Domain` Select `Async DR` Name: `ntnx-1-dp` Click `Create`	
	In the Protection Domain screen you now see `Unprotected Entities`. Checkbox any of the Unprotected entities you want. But Do Not protect the **ubuntu** VM! (We will use this VM later) Scroll down and click **`Protect Selected Entities (..)`** The entities you selected now appear in the `Protected entities` screen. Click `Next`.	
	You have to add a schedule to determine when to protect. Click `New Schedule` Select `Repeat every … minute(s)` enter **`60.`** Leave the `Retention policy` to `1.` Click `Create schedule.` Click `Close.`	

M8	Exercise 1. Protection Domain.	
	Click on `Table` (next to Overview)Wait a minute and then click on `local snapshots`. There will be a protection snapshot of the `ntnx-1-dp` Protection Domain.	
	To the right of the `Summary` screen you see `Details - Restore`. Click on **`Details`** and see which VMs are protected in the snapshot. You should see all the VMs you selected. Click `Close`.	
	End of exercise.	

M8	Exercise 2. Remote Sites.	
	In this exercise you will set up a trust relation between two clusters so that protection domains can be replicated to the other site. This protection can take place in both directions once the Remote sites are set up. In this exercise we will first give ntnx-3 a cluster IP Address and then connect connect ntnx-1 and ntnx-3.	
2-1	Connect to `Prism Element` of **`ntnx-3`** **`(https://192.168.4.109:9440)`** At the top left of the screen, next to the Nutanix logo, click the cluster-name (ntnx-3). In the Virtual IP field, enter the following IP Address: **`192.168.4.103`** Click `Save`	
2-2	Connect to `Prism Element` of **`ntnx-1`** From the `Home` pulldown menu select `Data Protection`. Click `+ Remote Site` Click `Physical Cluster` REMOTE SITE NAME: `ntnx-3` Select `Disaster Recovery` (is selected by default) CLUSTER VIRTUAL IP: `192.168.4.103` (make sure that this is correct!) Click the **`+`** sign. Click `Add Site`. (Now we have to make sure that containers from ntnx-1 can be protected by containers from ntnx-3)	

M8	Exercise 2. Remote Sites.	
	Scroll down. In Network Mapping. Source Cluster: `AHV: ntnx-1` Destination Cluster: `AHV: ntnx-3` Click the **+** sign. Source VStore: `SelfServiceContainer` Destination VStore: `SelfServiceContainer` Click the **+** sign. Source VStore: `default-container-xxxxxxxx` Destination VStore: `default-container-xxxxxxxx` Click the **+** sign. Click `Save`.	
2-3	Connect to `Prism Element` of **`ntnx-3`** From the `Home` pulldown menu select `Data Protection`. (if you get a Protection Domain Warning, ignore and click OK) Click `+ Remote Site` Click `Physical Cluster` REMOTE SITE NAME: `ntnx-1` Select `Disaster Recovery` (is selected by default) CLUSTER VIRTUAL IP: `192.168.4.118` (make sure that this is correct!) Click the **+** sign. Click `Add Site`. Scroll down. In Network Mapping. Source Cluster: `AHV: ntnx-3` Destination Cluster: `AHV: ntnx-1` Click the **+** sign. Source VStore: `SelfServiceContainer` Destination VStore: `SelfServiceContainer` Click the **+** sign. Source VStore: `default-container-xxxxxxxx` Destination VStore: `default-container-xxxxxxxx` Click the **+** sign. Click `Save`.	
2-4	Now we have to add ntnx-3 to the **Protection domain schedule** of ntnx-1	

M8	Exercise 2. Remote Sites.	
	Connect to `Prism Element` of **`ntnx-1`** From the `Home` pulldown menu select `Data Protection`. Click `Async DR` is selected. If not, then select it. Right-click `ntnx-1-dp`. Click `Update` Click `Next` Click the `Pencil` of the one and only schedule. Checkbox `ntnx-3` Keep the last `4` snapshots Click `Save` Click `Close` Instead of waiting for the hourly update... Right-click the `ntnx-1-dp` protection domain. Click `Take Snapshot` In the next screen make sure you checkbox **ntnx-3**. Click `Save`	
2-5	Connect to `Prism Element` of **`ntnx-3`** From the `Home` pulldown menu select `Data Protection`. Click `Async DR` is selected. If not, then select it. Select the protection domain `ntnx-1-dp`. Scroll down and click on `Local Snapshots`. How many snapshots do you see? Click on `Remote Snapshots`. How many snapshots do you see? Go back to Prism Element of **ntnx-1**. From the `Home` pulldown menu select `Data Protection`. Select `Async DR` and `Table`. Right-click `ntnx-1-dp` Select `Take Snapshot` Checkbox `ntnx-3` Click `Save` (this will create a local snapshot and send it to ntnx-3) Connect to `Prism Element` of **`ntnx-3`** From the `Home` pulldown menu select `Data Protection`. Click `Async DR` is selected. If not, then select it.	

M8	Exercise 2. Remote Sites.	
	Select the protection domain `ntnx-1-dp`. Scroll down and click on `Local Snapshots`. How many snapshots do you see? Click on `Remote Snapshots`. How many snapshots do you see?	
	End of exercise.	

M8	Exercise 3. Protection Domain.	
	In this exercise you will Migrate from **ntnx-1** to **ntnx-3**. This will deactivate the protection domain on ntnx-1. This includes automatic powering off the VMs!	
3-1	Connect to `Prism Element` of **`ntnx-1`** From the `Home` pulldown menu select `Data Protection`. Select `ntnx-1-dp` Right-click `ntnx-1-dp` Select `Migrate` Select `ntnx-3` Type: `MIGRATE` This will start the migration. Connect to `ntnx-3` to see the VMs being migrated: From the Home pulldown menu: Click `VM` Click `Table` Do you see any VMs? Are they powered on or not?	
3-2	Think about this: Imagine **ntnx-1** is the source and **ntnx-3** is the destination. The protection domain is regularly replicated to the destination site. What should you do if **ntnx-1** is lost? You cannot actively migrate, because the source site is down. What is the solution to this?	

M8	Exercise 3. Protection Domain.	
	Tip: If you go back to ntnx-1 and check Async DR. The `Migrate` option is gone. What would **`Activate`** do in this situation**?** (Please consider this and maybe discuss it in class)	
	End of exercise.	

M8	Optional Exercise 4. Self Service Restore.	
	To perform this lab, you should have also done the **M7 exercise 6** part. In this exercise you will use **NGT** (Nutanix Guest Tools) to restore files from a snapshot within a Virtual Machine. You will Snapshot a protection domain that holds the Ubuntu VM. You will list the snapshots from within the VM and attach a snapshot. You will mount the snapshot device to a mount point. You will restore a file.	
4-1	Connect to `Prism Element` of `ntnx-1` From the `Home` pulldown menu select `Data Protection`. (if you get a warning with regards to Prism Central, ignore it) Click `+Protection Domain` Select `Async DR` Name: `ngt-dp` Click `Create`	
4-2	In the Protection Domain screen you now see `Unprotected Entities`. Checkbox the **Ubuntu** VM. Scroll down and click **`Protect Selected Entities`** `(..)` The ubuntu VM you selected now appears in the `Protected entities` screen. Click `Next`.	
	You have to add a schedule to determine when to protect. Click `New Schedule` Select `Repeat every … minute(s)` enter **`60.`**	

M8	Optional Exercise 4. Self Service Restore.	
	Leave the `Retention policy` to `1`. Click `Create schedule`. (Ignore the warning, just click Continue. It will be a local protection domain only) Click `Close`.	
4-3	Now you will create a snapshot from the Protection Domain ngt-dp. From the Home pull down menu select `Data Protection`. Right-click the `ngt-dp` protection domain. Click `Take Snapshot`. Click `Save`.	
	Use PUTTY to login to ubuntu. Username: `nutanix` Password: `nutanix/4u` run the following command: `sudo bash` (type the password of the user...nutanix/4u) You are now working as the root user of this system.	
	Change to the `ngtcli` directory like this: **`cd /usr/local/nutanix/ngt/ngtcli`** Start the `ngtcli` using python3 like this: **`python3 ngtcli.py`** Your prompt will change to `ngtcli>`	
	Now you list the snapshots available: `ngtcli>` **`ssr ls-snaps snapshot-count=10`** (this will list the last 10 snapshots if they are there) We need the **Snapshot Id** the **Disk Label**. The snapshot id is the first column, the disk label is the second column. In the example the Snapshot Id is **95** and the Disk Label is **scsi0:0** Attach the snapshot and the disk like this: `ngtcli>` **`ssr attach-disk snapshot-id=95 disk-label=scsi0:0`** **(ignore the error message)**	
4-4	Now we need to mount the attach disk to a subdirectory so we can access the files in the snapshot. First list the attached device: `ngtcli>` **`ssr list-attached-disks`** `95 scsi0:0 (/dev/sda) scsi0:1` **`(/dev/sdb).....`** (The above output states that /dev/sdb is the new device.) We exit the ngtcli. `ngtcli> exit`	

M8	Optional Exercise 4. Self Service Restore.	

	We are interested in **/dev/sdb**.
	Let's list all that **/dev/sdb** has:
	
	`lsblk -f | grep sdb`
	You see that **sdb1** has the **ext4** filesystem.
	
	We create a mount point and mount the file system.
	
	`mkdir /mnt/sdb1`
	`mount /dev/sdb1 /mnt/sdb1`
	
	Now we can restore any file in **/mnt/sdb1** to the VMs active file system.
	
	For example: restore the file /etc/hosts:
	`cd /mnt/sdb1/etc/`
	`cp hosts /etc/hosts`	

	End of exercise.	

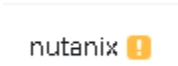
Module 9 - User Management.

In this lab you will do the following:

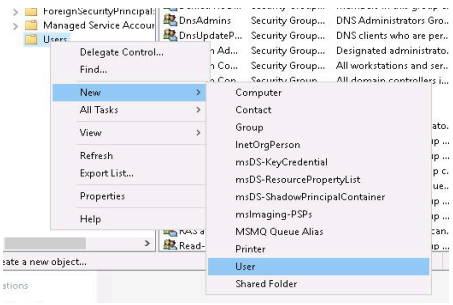
- Create a local user
- Setup Authentication using Active Directory
- Confire Role Mapping
- Create an AD user

M9	Exercise 1. Create a Local User Setup Authentication and create an AD user.	
1-1	Connect to `Prism Element` of `ntnx-1` From the `Home` pulldown menu select `Settings`. In the `Settings` menu, scroll down to `Users and Roles`. Select `Local User Management`. Click `+ New User` Username: `robert` First Name: `robert` Last Name: `deniro` Email: `robert@deniro.com` Password: `Br@@mspun1` Language: `en-US` Roles: `Cluster Admin` **(If Backup Admin is also selected, unselect it)** Click `Save`	
	Click the `admin` user at the top right of the screen and `Sign Out`. Login as the user `robert`. Can you manage the cluster? Can you manage Users and Roles? Click `robert` at the top right of the screen and `Sign Out`.	
1-2	In this exercise you will set up authentication and role mapping.	

M9	Exercise 1. Create a Local User Setup Authentication and create an AD user.	

	Login to `Prism Element` of **`ntnx-1`** as `admin`.
	
	Click the `Settings Wheel` and scroll down to `Users and Roles`.
	`Click Authentication`
	`Click +New Directory`
	
	Directory Type: `Active Directory`
	Name: `nutanix`
	Domain: `nutanix.local`
	Directory URL: `ldap://192.168.4.253:389`
	Search Type: `Non Recursive(Default)`
	Service Account Username: `administrator@nutanix.local`
	Service Account Password: `1234QWer`
	Click `Save`
	
	 
	
	Next to the Name there is a remark that Role Mapping has not been configured...so let's do that.	

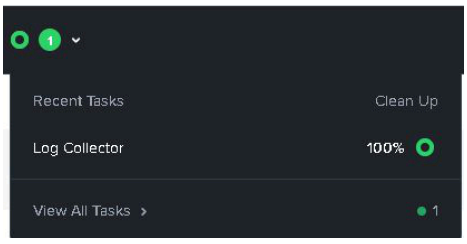
1-3	In `Settings`, click `Role Mapping`. Click `+New Mapping` DIRECTORY OR PROVIDER: `nutanix` TYPE: `user` ROLE: `viewer` VALUES: `monique` Click `Save`	
	We will create the user `monique` in `Active Directory`. In windows. Click the `Start` button and type `users` Click `Active Directory Users and Computers` In the left pane, click to open: `nutanix.local` `Right-click Users -> New -> User`	

M9	Exercise 1. Create a Local User Setup Authentication and create an AD user.	
		
	First name: `monique` Last name: `de wijk` User logon name: `monique` (@nutanix.local is defaulted) Click `Next` Password: `nutanix/4u` Checkbox: `Password never expires` (ignore the warning!) Click `Next` Click `Finish`	
	Connect to `Prism Element` of `ntnx-1` In the `admin` pulldown menu (top right) `Sign Out.` Login: `monique@nutanix.local` Password: `nutanix/4u` In the `Home` pulldown menu click `VM` Can you create a new VM? (this user is a viewer and has no rights besides viewing)	
	End of exercise.	

Module 10 - Cluster Health.

In this lab you will do the following:

- Run Health Checks
- Collect Log Files

M10	Exercise 1. Collect Logs	
	In this exercise you will download all `log files` of `ntnx-2`. Login to `Prism Element` of `ntnx-2`	
1-1	From the `Home` pulldown menu select `Health`. Click `Actions` (top right) Click `Collect Logs` Click `+ Select Nodes` Checkbox the node. Click `Done` Click `Next` All is selected by default Click `Next` Inspect the settings you can change but leave everything to the default. (Is there an option to upload the logs to Nutanix?) Click `Collect.`	
	It will take a couple of minutes to collect the logs.... View the tasks:  When the Log Collector has succeeded:	

M10	Exercise 1. Collect Logs	
	 Click `Succeeded` And it will download a zip file to Windows. Select the file and extract all log files to the Desktop. Drill down into the log structure. And you will see the folders that hold all the log files.  Have fun inspecting them...	
	End of exercise.	

M10	Exercise 2. Health Checks	
	In this exercise you will run Health Checks.	
2-1	From the `Home` pulldown menu select `Health`. Click `Actions` (top right) Click `Run NCC Checks` Click `All Checks` Uncheck `Send the cluster check report in the email?` Click `Run`	

M10	Exercise 2. Health Checks	
	When the health checks have succeeded (View Tasks). From the `Home` pulldown menu select `Health` Click `Summary` Click `Failed` What is the result? Click the "`Failed x`" link above the failures.. Click `Summary` again Click `Warning` What is the result? Click the "`Warning x`" link above the warnings. Click Summary again	
	End of exercise.	

M10	Exercise 3. CVM down
	In this exercise you will bring a CVM down and see that any VMs running on the AHV will not migrate.
3-1	Open PUTTY and connect to ahv-110 and login as root. Run virsh to list the VMs. **`virsh list –all`** (make a note of the CVM id.) Make sure that next to the CVM another VM is running on ahv-110. If that is not the case simply migrate a vm from any of the other ahvs to ahv-110. You can use Prism Element for that.
3-2	Stop the CVM. **`virsh destroy <CVM id>`** Check that the CVM is no longer running. **`.virsh list –all`**

M10	Exercise 3. CVM down
3-3	In your browser open Prism Element of ntnx-1 and login. From the HOME menu, select VM. Click `Table` if it is not active. Checkbox `Include Controller VMs.` What is the status of all CVMs? Is the data VM still running on AHV-110?

3-4	In your PUTTY session in AHV-110, start the CVM. **`virsh start <CVM-name>`** Wait until the CVM has joined the cluster again...may take a while..(coffee?)

3-5	In your browser open Prism Element of ntnx-1 and login. From the HOME menu, select VM. Click `Table` if it is not active. Checkbox `Include Controller VMs` What is the status of all CVMs?

Module 11 - Events and Alerts.

In this lab you will do the following:

M11	Exercise 1. Check Events	
	In this exercise you will check Alerts and Events..	
1-1	You are logged in to `ntnx-2`. In the `Home` pulldown menu click `Alerts`. You can configure an email address to receive Alerts. Click `Email Configuration` Uncheck `Every Single Alert` Email Recipients: `Your Email` Click `Save`	
	Do you see any alerts in the list? If there are any, click on one of them and you will see Possible Causes and Recommendations. Also in the left part of the screen you can find a Knowledge Base Article link to help you investigate further.	
1-2	From the `Home` pulldown menu click `Alerts`. In the `Overview` pane, click `Events`. What type of information is listed? (Logins, Configuration Actions,...)	
	End of exercise.	

Module 12 - Maintenance.

In this lab you will do the following:

- Shutdown a CVM
- Shutdown an AHV node
- Manage Maintenance Mode
- Stop and start a cluster

M12	Exercise 1. Shutdown a CVM	
	In this exercise you will shutdown a CVM, and start it again.	
1-1	Using PUTTY login to `CVM-111` Shutdown the CVM. `cvm_shutdown -P now` This will shutdown and power off the CVM	
	Using PUTTY login to `AHV-110` List all VMs `virsh list --all` Is the CVM shut off? What about any other VMs running on AHV-110?	

	Start the CVM again.
	
	`virsh start  NTNX-xxxxxxxx-A-CVM`
	
	Connect to the CVM.
	
	`ssh nutanix@192.168.4.111`
	
	Check CVM-111 by running cluster status.
	
	`cluster status`
	
	(After a while CVM-111 will automatically join the cluster again.)	

M12	Exercise 1. Shutdown a CVM	
	To leave CVM-111 type: `exit`	
1-2	Still logged in to AHV-110. Shutdown the node. `shutdown -h now` You will lose the connection. Use PUTTY to login to CVM-113 (192.168.4.113 nutanix nutanix/4u) How can you determine that CVM-111 is not part of the cluster?	
	In the lab topology of your Remote Labs environment, find host AHV-110. Underneath the power off icon there is a reboot icon. Double-Click on it. Then click on the console icon in the top left corner of the host. You should see the login prompt. This means that the node is up and running again.	
	Leave the console and go back to PUTTY. Connect to AHV-110. List the VMs again. `virsh list --all` CVM-111 is up and running as are all VMs that were on this host earlier.	
	End of exercise.	

M12	Exercise 2. Place the CVM in maintenance mode.	
	In this exercise you will bring a CVM into maintenance mode and take it out of maintenance again.	
1-1	Using PUTTY login to `CVM-111` Before we enter Maintenance mode, we first need the Id of the CVM. Run the following command:	

M12	Exercise 2. Place the CVM in maintenance mode.	

	ncli host list | more
	Id : 0006085d-8479-f473-26aa-000c29d4fa9e::6
	Uuid : 472fd2df-ca15-465b-81ca-b4b687ad09b1
	Name : NTNX-86c8ad27-A
	IPMI Address :
	Controller VM Address : 192.168.4.111
	The first node listed is CVM-111. We see the Id at the top. Instead of using the very long Id we can use the last digit. 6 in this case.
	
	Place the CVM in maintenance mode.
	
	`ncli host edit id=6 enable-maintenance-mode=true`
	
	Open another PUTTY session: to CVM-115 and login.
	Run this command again:
	
	`ncli host list | more`
	Look for the line "Under Maintenance Mode" it should be `true`.
	
	To bring the CVM back into the cluster:
	
	`ncli host edit id=6 enable-maintenance-mode=false`	

	End of exercise.	

Addendum: Prism Central.

In this lab you will do the following:

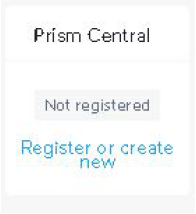
- Remove a host from Prism Central (in case Prism Central was removed whilst a cluster was connected.)
  If Central is not installed…
- Install Prism Central on ntnx-3
- Register ntnx-3 and ntnx-2 with Prism Central
- Get introduced to Prism Central

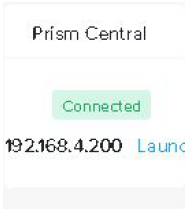
Add	Exercise 1. Unregister Clusters from Prism Central	
	In this environment, Prism Central was running and has been deleted. A cluster may still feel registered and this has to be cleared.	

1-1	Open a Browser session to ntnx-2. In the Prism Central widget, it should say:
	
	`Not registered`
	
	If it says anything else, use PUTTY to connect to the cluster.
	Login and run the following commands:
	
	Using PUTTY connect to 192.168.4.117
	Username: nutanix
	Password: nutanix/4u
	
	`ncli multicluster get-cluster-state`
	Note the `id`
	
	`ncli multicluster delete-cluster-state cluster-id="id"`	

1-2	When ntnx-2 and ntnx-3 are cleared. Connect to Prism Element of **ntnx-3**. (https://192.168.4.109)	
	End of exercise.	

Add	Exercise 2. Register Clusters with Prism Central.	
	In this exercise you will change the admin password of Prism Central You will register ntnx-2 and ntnx-3 with Prism Central You will check the registration.	
2-1	Connect to Prism Central (**`https://192.168.4.200:9440`**) Username: admin Password: **Br@@mspun1** You will be prompted to enter some personal information and choose a new password. Leave the `pulse` checkbox **unchecked**.	
	Practical tip: If you ever lose the password you can reset it on the CommandLine. Use PUTTY or ssh to connect to Prism Central and login with: Username: `nutanix` Password: `nutanix/4u` Command: `ncli user reset-password user-name="admin" password="newpassword"`	
	End of exercise.	

Add	Exercise 3. Register Clusters with Prism Central.	
	You will register ntnx-2 and ntnx-3 with Prism Central and check the registration.	
3-1	Connect to Prism Element of `ntnx-2`.  In the Prism Central widget: Click `Register or create new`.	

Add	Exercise 3. Register Clusters with Prism Central.	
	Click `Connect` Click `Next` Prism Central IP: `192.168.4.200` Enter your `username` and `password`.  Repeat these steps for `ntnx-3`	
	End of exercise.	

Add	Exercise 4. Inspect Prism Central	
	In this exercise you will perform some basic tasks in Prism Central.	
4-1	Open a Browser session to Prism Central, and log in. In the Dashboard you see Configuration- and Performance information of the two clusters `ntnx-2` and `ntnx-3`.	
	In the top left of the Dashboard you see three horizontal white lines. This is referred to as the "`entities button`". Toggle the entities button to open and close the menus. You see a list of menus that all have sub-menus. Click on `Compute & Storage` Click on `Storage Containers` - This will show the containers of both clusters. Spend some time inspecting all the menus and detect that there is overlap with Prism Element, but also differences.	

Add	Exercise 4. Inspect Prism Central	
	End of exercise.	

Add	Exercise 5. Using Placement Policies	
	In this exercise you will place an ISO image on clusters based upon a `placement policy`. To use a placement policy for Images, you need to apply a category to both the Cluster and the Image. Then you configure an image placement policy using the category.	
5.1	From the entities menu: Click `Hardware` Click `Clusters` Click `ntnx-2` Click `Manage Categories` In the Search Bar type `Environment` Select `Environment.Production` Click `Save` From the entities menu: Click `Compute & Storage` Click `Images` Click on `tiny.img` If `Manage Categories` is visible, click on it. If not, then click …`More` Click `Manage Categories` In the Search Bar type `Environment` Select `Environment.Production` Click `Save` In Compute & Storage, click on `images`. Click on `Policies` Click on `Placement Policies` Click on `Create Placement Policy` Policy Name: `image placement for production` In the Images search bar type: `Environment` Select Environment:`Production` In the Clusters search bar type: `Environment` Select Environment:`Production`	

Add	Exercise 5. Using Placement Policies	
	Click on the **+** signs next to the categories Enforcement `Hard` Click `Save` **`tiny.iso will now be removed from ntnx-3 because of the placement policy.`**	
	Finally we will add a new image using a placement policy. From the entities menu select Compute & Storage Select `Images` Click `Add Image` Click `URL` URL: `http://uadmin.org/mini.iso` Click `+ Add URL` Click `Next` Select `Place image using Image Placement policies` In the search bar: `Environment:Production` Click the `plus sign` Click `Save` This will upload `mini.iso` only to `ntnx-2`.	
	End of exercise.	

Add	Exercise 6. Licensing and Lifecycle Management.	
	In this exercise you will check Licenses.	
6.1	Login to `Prism Central`. From the `Entities` menu open `Prism Central Settings` Click `Licensing` Notice that `Prism Central Trial` is applied to 2 Clusters. Click `View & Manage Features` `[this lists an overview off all features and types of clusters]`	

Add	Exercise 6. Licensing and Lifecycle Management.	
6.2	From the Entities Dashboard: Click Administration Click LCM - What is the LCM version? (top right of screen) - What does this screen say about `General Prerequisites`? - What does this screen say about `Updates`? Click the `Inventory` tab - Please read what this tells you Click Perform `Inventory` - This will fail because we have no service contract. Click `Updates` - Click `Software` The cluster is up to date. Click `Settings` - What does this tell you?	
	End of exercise.	

Add	Exercise 7. Roles and Local Users	
	In this exercise you will create a local user and a new role and connect the two.	
7.1	1. Login to prism central as admin. 2. From the entities menu select Administration. 3. From the administration menu select Users. 4. Click Manage Users in the Admin Center. 5. In IAM click Identities. 6. Click + Add Local User - give the user a First Name and Last Name - Enter an email address - Enter a Username - Enter a Password - Click Create	

Add	Exercise 7. Roles and Local Users	
7.2	7. Click Roles in the IAM top bar. 8. Click Create Role -> New Role. - Role Name: img-role - Description: Only manage images - In the Entity Type list scroll down to Image and click on the plus sign. - Click Add all. - Click Save and create authorization policy. 9. The role name is img-role 10. Click Next 11. Select full access 12. Click Next - Connect user to role 13. Add the local user enter the user you created in step 6. 14. Click Save. - Test 15. Sign out and sign in as the new local user. 16. In Compute & Storage click VMs - Can you create a VM? 17. In Compute & Storage click Images - Can you add an Image?	
	End of exercise.	