In today's world of Cloud Computing where all the "tin" and "wire" is managed by the cloud providers, the businesses need to focus on the cost and revenues more than anything else. However, there are still some scenarios where one would need to go ahead and implement the "tin" and "wire" setup. Today, I will walk you through the process which I followed to create a 2 node Windows Server 2004 Cluster on my laptop using VirtualBox. This is a great way to learn the tips and tricks of the game without actually having to go through a server setup inside a data center.

The first and foremost item needed to continue with this setup is a decent enough and capable laptop. Mine is a normal Intel Core i7 2nd Generation laptop with SSD drive and 16GB RAM. I have loaded on this <u>VirtualBox 6.1</u> to create the server nodes.

Let's start first with the high-level design on what our setup will look like and then drill down the bits that we need to download and finally configuring all these together to create our small test cluster.



This is a simple 2 node cluster design with the following components:

- 2 Compute Nodes
- Shared Storage (disks accessible by both nodes at the same time)
- 2 Network segments (public network and private network)

Next step after the design is to list the software stack for these components:

- Compute nodes will run on Windows Server 2004
 - o 2 vCPUs
 - o 2GB RAM
 - o 50GB Boot Drive
 - 2 x Network Interfaces (1 with Bridged network and 1 with Internet Network)
- Since we are using a laptop / standalone machine for the setup, we need a networkbased storage solution to provide shared storage. I am using <u>XigmaNAS</u> for this. You can install and use any other solution which can provide you with a shared storage for your nodes.
 - o 2 vCPUs
 - \circ 3GB RAM
 - o 8GB Boot Drive
 - 2 x Network Interfaces (1 with Bridged network and 1 with Internet Network)

With the software ready and downloaded, let's start with the build. Below is the sequence I recommend.

1. Create the NAS VM by booting it from the live CD for XigmaNAS (v12.1).



- Select option "9" to perform the install locally on the VM

2	Install 'Embedded' OS on HDD/SSD/CF/USB (Preferred) Upgrade 'Embedded' OS from LiveCD/LiveUSB
- 3 4 5 6	Install 'Full' OS on HDD/SSD + DATA/SWAP (For Expert) Upgrade 'Full' OS from LiveCD/LiveUSB Upgrade & Convert 'Full' OS to 'Embedded' installation Launch Advanced ZFS Installer Options (For Expert)
	< DK > < Exit >

- Select option 1 "Embedded" OS install.



- Select option 1 again for installing using the GPT partitioning scheme



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- Select "Ok" again to use the local disk as the target for the install.

•••	demoNAS [Running]
	Enter the size of the US partition (minimum: 2048M, recommended: 2048M)
	2048M
	Cancel>
	👂 💿 🕼 🗗 🖉 🗔 🕒 👘 🛠

- Accept the "2048M" as the size of the "root" partition. This is more than enough for our testing and is even the recommended size by XigmaNAS setup.

demoNAS [Running]
Enter the size of the SWAP partition (minimum: 512M, recommended: 1024M)
1024M
·/
< OK → <cancel></cancel>

- Accept "1024M" as the size of the "swap" partition. These is one of the key partitions for any "*nix"-based setup. For those with Windows background, this is like the "Paging File" but created on its own special partition on the drive instead of residing on the "boot" partition.

•••	demoNAS [Running]
Ī	Enter the size of the DATA partition or enter 'ALL' to take what's available (minimum: 256m) ALL
	Cancel>

Enter "ALL" on this screen to use the remaining space on the local disk for data partition to store our NAS data. This space will serve as the repository of our shared storage drive which we will create in the upcoming steps.



- Once the setup is complete, note down the number of the "DATA" partition as we will need it in later steps. Remove the live CD and reboot the VM to proceed with the shared storage setup.
- On the first boot, the system will show the following on the console. Use the IP and open the web-browser to continue with the configuration.



- Navigate in the browser to the stated WebUI Address on the console screen and login with the default username and password (admin / xigmanas)



- Once logged in, we will accomplish the following:
 - i. Enable the second network card
 - ii. Enable the iSCSI Server
 - iii. Create data mount point
 - iv. Create extends on the data partition
 - v. Create iscsi targets
 - vi. Configure default iscsi access rules

Navigate to "Network" -> "Interface Management"

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	Disks Access Services virtualization Status Diagnostics Tools Help)
twork > Interface M	Management	
Overview		
Interface	Network port	
LAN	em0 (08:00:27:1c:72:f1) 🗸	
		+
Save		

 Click on "+" icon on the right side of the screen, select the "em1" card for "OPT1" interface and clock on "Save" button.

work > Interface M	lanagement	
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The changes t	nave been saved. You have to reboot the system for the changes to take e	ffect.
Overview		
Interface	Network port	
	em0 (08:00:27:1c:72:f1) ¥	
LAN		
LAN OPT1	em1 (08:00:27:29:3e:a5) V	×
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AN OPT1	em1 (08:00:27:29:3e:a5) V	×

- Reboot the NAS system (System->Reboot)
- Once rebooted, login again and click on "Network" -> "OPT1"

System Netwo	rk Disks Access Services Virtualization Status Diagnostics Tools Help
work > Optional	(OPT1)
Type	Activa DHCP V
Description	OPT1 You may enter a description here for your reference.
IP Address	
IPv6 Settings	Active
Туре	Auto 🗡
IP Address	
Advanced Settings	
мти	Set the maximum transmission unit of the interface to n, default is interface specific. The MTU is used to limit t size of packets that are transmitted on an interface. Not all interfaces support setting the MTU, and some interfaces have range restrictions.
Media	Autoselect 💙

- Click on "Activate" for "IPv4 Settings", change the type to "Static", click on "Save" to enable the IP Address box, enter the IP address as "10.0.0.1" / "24" and click "Save" again to save the settings.
- Reboot the NAS system (System->Reboot)
- Once rebooted, login again and click on "Disks" -> "Management"

System	Network	Disks A	ccess Services	Virtualization	Status	Diagnostics	Tools	s Help	_
sks > Mar	agement >	HDD Ma	nagement						
DD Managem	ant HDD Forma	it S.M.A.R.	T. iSCSI Initiator						
HDD Mana	gement				_		_		
De	Device Mode	I Size	Serial Number	Co Controller	Model S	tandby Files	syst	Status	Toolbox
									+
Delete Sel	ected Disks	Rescan Bus	ses						
Import Dis	ks								
Clear Config	uration	Clea	r configuration inform	ation before importing	g disks.				
Import									
Import Sof	tware RAID Dis	:ks							
Clear Config	uration	Clea	r configuration inform	ation before importing	g software RA	AID disks.			
Import									

- <u>Click on "+" icon under the toolbox field</u>

Management HDD Forma	it S.M.A.R.T. ISCSI Initiator					
oisk Settings						
Disk	ada0: 8.58GB (VBOX HARDDISK) 🗸					
Description	You may enter a description here for your reference.					
Transfer mode	Automatic Automa					
HDD standby time	Always On V Puts the disk into standby mode when the selected amount of time after the last disk access has been elapsed.					
Power management	Disabled This allows you to lower the power consumption of the disk, at the expense of performance.					
Acoustic level	Disabled This allows you to set how loud the drive is while it's operating.					
5.M.A.R.T.	Activate S.M.A.R.T. monitoring for this device.					
S.M.A.R.T. extra options	Extra options (usually empty). Please check the documentation.					
Preformatted file system	Unformatted This option allows you to set the file system of already formatted disks containing data. Select option Unformatter (for unformatted disks and format them with the Format Program.					

- Leave everything as default and ensure that "ada0" is selected in the disk dropdown. Click on "Add"

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- Select "ada0" under the "Disk" dropdown and type "data" under "Mount point name". You can provide any name you prefer. I prefer to call this mount point. Also ensure that the correct "Partition number" is specified. This is the same number we noted down after the installation was complete. If you have followed everything step by step till now, this should be "4". Click "Add" to add this data mount point.

	nas been changed.				
You must apply th If this message pe	e changes in order for the ersist take a look at the sys	m to take effect. stem log for more	information.		
Apply changes					
Mount Point Management					
Disk	File System	Name	Description	Status	
/dev/ufsid/5f0c69eefd84b993 (a	ida0p4) ufs	data		Initializing	3

- Click on "Apply changes"
- Now we will configure "iSCSI" interface on the NAS. For that, click on "Services"->"iSCSI ISTGT" menu.

tings Targets Portals Initiat	ors Auths Media
iSCSI Target	Ena
Base Name	iqn.2007-09.jp.ne.peach.istgt. The base name (e.g. iqn.2007-09.jp.ne.peach.istgt) will append the target name that is not starting with 'iqn.'.
Discovery Auth Method	Auto V The method can be accepted in discovery session. Auto means both none and authentication.
Discovery Auth Group	None The initiator can discover the targets with correct user and secret in specific Auth Group.
Advanced Settings	
I/O Timeout	30 I/O timeout in seconds (30 by default).
NOPIN Interval	20 NOPIN sending interval in seconds (20 by default).
Max. Sessions	16 Maximum number of sessions holding at same time (16 by default).
Max. Connections	4 Maximum number of connections in each session (4 by default).
Max. pre-send R2T	32 Maximum number of pre-send R2T in each connection (32 by default). The actual number is limited to QueueDepth of the target.
FirstBurstLength	262144 ISCSI initial parameter (262144 by default).
MaxBurstLength	1048576 ISCSI initial parameter (1048576 by default).
MaxRecvDataSegmentLength	262144 ISCSI initial parameter (262144 by default).
MaxOutstandingR2T	16 ISCSI initial parameter (16 by default).
DefaultTime2Wait	2 ISCSI initial parameter (2 by default).
DefaultTime2Retain	60 ISCSI initial parameter (60 by default).

- _ (
- Click on "Enable" on the "iSCSI Target" line and click on "Save & Restart". If you want to customize the name of the target, you can do so under the "Base Name" field before clicking the "Save & Restart" button. I will leave this as default for this setup and continue.
- Click on "Portals" in the sub-menu items.

ings Targets Portals	Initiators Auths Media		
Portal Groups			
Portal Group	Tag Portals	Comment	
			+

- Click on "+" icon on the right side and then click on "Add" with all the default options. This will setup the initiator portal for our iSCSI interface.

Portal Group Settings		
Tag number	1 Numeric	c identifier of the group.
Portals	0.0.0.0:	:3260
	The port standard address	rtal takes the form of 'address:port'. for example '192.164.1.13260' for IPv4, [2001.db8:1:1:1:1]:3260' for IPv6, the port 3260 is di ISCSI port number. For any IPs (wildcard address), use '0.0.0.0:3260' and/or '[::]:3260'. Do not mix wildcard and other IPs at sa family.
Add Cancel	You may	y enter a description here for your reference.
Comment Add Cancel System Network vices > iSCSI Target ungs Targets Portals	You may Disks Access :> Portal Group Initiators Autho	y enter a description here for your reference. Services Virtualization Status Diagnostics Tools Help p p s Redin
Comment Add Cancel System Network vices > ISCSI Target ungu Targets Portals The configurat You must messag Apply changes	You may Disks Access :> Portal Group Initiators Author ion has been change the changes in or e persist take a loo	y enter a description here for your reference. Services Virtualization Status Diagnostics Tools Help p Services Addition Redd. ander for them to take effect. Add the system log for more information.
Comment Add Cancel System Network vices > ISCSI Target orgs Target Portals The configurat You must apply changes Portal Groups	Vou may Disks Access > Portal Group anidators Autor tion has been changes in or e persist take a loo	y enter a description here for your reference. Services Virtualization Status Diagnostics Tools Help p p p p p p p p p p p p
Comment Add Cancel System Network vices > ISCSI Target opport Portals Portals Portal Group Portal Group	Vou may Disks Access > Portal Group Initiators Autor ion has been changes in or e persist take a loo	y enter a description here for your reference. Services Virtualization Status Diagnostics Tools Help p p reference p p p p p p p p p p p p p

- Click on "Apply changes"
- Next click on "Initiators" in the sub-menu and then on the "+" icon on the right

Initiator Groups					
Initiator Group	Tag Initiators		Networks	Comment	
	Initiator Groups contains as	thorised initiator names and n	etworks to access the tard	vet.	+
System Network D	isks Access Services Vir	tualization Status Di	agnostics Tools I	łelp	
vices > iSCSI Target >	Initiator Group > Add				
ttings Targets Portais	Initiators Auths Media				
Initiator Group Settings					
Tag Number	1				
	Numeric identifier of the gr	oup.			
Initiators	ALL				
	Initiator authorised to acce	ss to the ISCSI target. It takes	a name or 'ALL' for any in	itiators.	
Authorised Network	Initiator authorised to acce	ss to the iSCSI target. It takes	a name or 'ALL' for any in	itiators.	
Authorised Network	Initiator authorised to acce	ss to the iSCSI target. It takes	a name or 'ALL' for any in	itiators.	
Authorised Network	Initiator authorised to acce	as to the ISCSI target. It takes	a name or 'ALL' for any in	išators.	
Authorised Network	Initiator authorised to acce	ss to the ISCSI target. It takes	a name or 'ALL' for any in	išators.	
Authorised Network	Initiator authorised to acce	as to the ISCSI target. It takes	a name or 'ALL' for any in	itiators.	
Authorised Network	Initiator authorised to acce	ss to the ISCSI target. It takes	a name or 'ALL' for any in	Nators.	
Authorised Network	Initiator authorised to acce	ss to the ISCSI target. It takes	a name or 'ALL' for any in	Hators. NLL' for any IPs.	
Authorised Network	Initiator authorised to acce ALL Network authorised to acce	as to the ISCSI target. It takes	a name of VLL* for any in	Histors. WLL' for any IPs.	

- Leave everything as default and click on "Add" and then "Apply changes"
- Next click on "Targets"

			+
ents cannot be used more than once.			
LUNs	PG IG	AG	
itiator, and is made up of one or more e	extents.		+
	LUNs	LUNs PG IG itiator, and is made up of one or more extents.	LUNs PG IG AG

- Click on "+" icon under the "Extent" section

mus Targets more	Contractor and March and Antonia
Extent Seltings	
Extent Name	extent0 String identifier of the extent.
Туре	File Type used as extent.
Path	File path (e.g. /mnt/sharename/extent/extent0) used as extent.
Size	Mile Mile Size offered to the initiator, (up to BEB-8388665Ti8), The adult size is depend on your disks.
Comment	You may antar a description have for your reference

Change the "Extent name" to "1TB01", "Path" to "/mnt/data/1tb01", "Size" to "1" and "TiB" and click on "Add". Repeat the same to add a second extent as "1TB02", "/mnt/data/1tb02" and "1", "TiB". Click on "Apply changes" to save these extents"

The changes ha	we been applied successfull it has been sent to the daen	y. non. You can verify the re	sult in the log fil	e.				
Targets					_	_	_	_
Extent	Name	Path			Size			
	1TB01	/mnt/data/1tb01	/mnt/data/1tb01			1TiB		OX
	1TB02	/mnt/data/1tb02			1TiB			ØΧ
	Extents must be de	fined before they can be us	ed, and extents car	not be used more than o	nce.			+
Target	Name		Flags LUNs		PG	IG	AG	1
	At the highest level	, a target is what is present	ed to the initiator, a	nd is made up of one or	more extents.			+

- Next step is to define the targets for these extents. For that click on the "+" icon under the "Target" section on the same page and add target for both the extents we defined in the previous steps. Includes these extents as LUNO and LUN1 in the "Target" definition page

Target Name	disk0 Base Name will be appended automatically when starting without 'iqn.'.
Target Alias	Optional user-friendly string of the target.
Туре	Disk V Logical Unit Type mapped to LUN.
Flags	Read/Write (rw)
Portal Group (Primary)	Tag1 The initiator can connect to the portals in specific Portal Group.
Initiator Group (Primary)	Tag1 The initiator can access to the target via the portals by authorised initiator names and networks in specific Initiator Group.
Portal Group (Secondary)	None V
Portal Group (Secondary) Initiator Group (Secondary)	None V
Portal Group (Secondary) Initiator Group (Secondary) Comment	None ▼ None ▼ You may enter a description here for your reference.
Portal Group (Secondary) Initiator Group (Secondary) Comment	None ✓ None ✓ You may enter a description here for your reference.
Portal Group (Secondary) Initiator Group (Secondary) Comment LUNO Storage	None ▼ None ▼ You may enter a description here for your reference. 1TB01 (/mnt/data/1tb01) ▼ The storage area mapped to LUN0.

- Click "Add" and then "Apply changes"

rvices > iSCSI T	arget > Target								
ttings Targets Por	tais Initiators Auths	Media							
The char A reload	nges have been applie I request has been sen	d successfully. t to the daemon.	You car	n verify th	e result in	the log fi	ile.		
Extent	Name	Path					Size		1
	1TB01	/mnt/data/1	/mnt/data/1tb01				1TiB		
	1TB02	/mnt/data/1	tb02			:	1TiB		3
							od moro	than onc	+
Target	Extents must be	e defined before the	Flags	LUNs	extents car	not be us	G IG	AG	

- This completes the NAS setup where we have defined a target with 2 LUNs to be used as cluster disks on our 2-node cluster which we will define now in the next steps. So, hang on a bit more and keep reading further for the steps to create this cluster.
- 2. Next create the first VM node using the Windows 2004 ISO. Install the "Standard Edition" and once complete, it should boot up in the command line interface.

E General	• • •	Node1 [Running]
Name: Node1 Operating System: Windows 2019 (64-bit)		*
System		
Base Memory: 2048 MB Boot Order: Floppy, Optical, Hard Disk Acceleration: VT-x/AMD-V, Nested Paging		
E Display	Administrator: C:\Windows\syst	iem32\cmd.exe
Video Memory: 128 MB Graphics Controller: VBoxSVGA Remote Desktop Server: Disabled Recording: Disabled	C:\Users\Administrator>	
Storage		
Controller: SATA SATA Port 0: Node1.vdi (Normal, 50.00 GB) SATA Port 1: [Optical Drive] en_windows_server_version_2004_		
🕪 Audio		
Host Driver: CoreAudio Controller: Intel HD Audio		
📑 Network		
Adapter 1: Intel PRO/1000 MT Desktop (Bridged Adapter, en1: Wi-F Adapter 2: Intel PRO/1000 MT Desktop (Internal Network, 'intnet')		
🖉 USB		
USB Controller: xHCl Device Filters: 0 (0 active)		
Shared folders		
None		
Description		
None		

- We will start with the basic server configuration and complete the below tasks:
 - i. Rename the node (PowerShell Command)

Rename-Computer -NewName "Win2004"

ii. Configure a local DNS Suffix (needed to create clusters which are not part of a domain) (PowerShell Command)

Set-ItemProperty -Path

"hklm:\system\currentcontrolset\services\tcpip\parameters" -Name "Domain" -Value "mylocal.net"

- iii. Assign static IP to the cluster interface (PowerShell Command)
 - Get the IP address configuration using the below command IPconfig
 - 2. Identify the second card (connected to the internal network). This card would have a default IP starting with 169.
 - 3. Get the list of network cards using the below command Get-NetAdapter

4. Note the "ifindex" value of the card identified using the Ipconfig command and use that in the next command to assign a static IP to it.

New-NetIPaddress -InterfaceIndex 3 -IPAddress 10.0.0.2 - PrefixLength 24



iv. Disable the firewall (PowerShell Command)

Set-NetFirewallProfile -Profile Domain,Public,Private -Enabled False

v. Attach the NAS disks (Command Prompt)

3.

5.

- 1. Run the command "iscsicpl.exe"
- It would prompt with a message stating the ISCSI service is not running. Click on "Yes" to enable the service and mark it as "Automatic" to start automatically whenever the server is rebooted.

2 Administrator: C:\Windows\System32\Windows	PowerShell\v1.0\powershell.exe	= □ ×
PS C:\Users\Administrator> : PS C:\Users\Administrator> PS C:\Users\Administrator>	Set-NetFirewallProfile -Profile Domain, iscsicpl.exe	Public,Private -Enabled False
	Microsoft iSCSI	×
	The Microsoft ISCSI service is not running. The service is required to be started for ISCSI to function correctly. To start the service now and have the service start automatically each time the computer restarts, click the les button.	
	yes <u>N</u> o	

4. On the iSCSI configuration screen, enter 10.0.0.1 as the target and click "Quick Connect" and then "Done". If successfully connected, the NAS will show up in the "Discovered targets".

SUSI Initia	tor Properti	ies			
Targets	Discovery	Favorite Targets	Volumes and Devices	RADIUS	Configuration
Quick C	onnect				
To disc DNS na	over and log ime of the ta	on to a target usin rget and then click	g a basic connection, ty Quick Connect.	vpe the IP a	ddress or
<u>T</u> arget:				<u>Q</u> u	ick Connect
Discove	ered targets				
					<u>R</u> efresh
Name				Status	
iqn.20	07-09.jp.ne.j	peach.istgt:disk0		Connected	l .

6. Click on "Volumes and Devices" -> "Auto Configure". This should load both the LUNs that we created earlier on the NAS administration portal.

i	iSCSI Initiator Pro	perties				×
	Targets Discov	ery Favorite Targets	Volumes and Devices	RADIUS Cor	figuration	
	If a program or the list below, o configure all av	service uses a particular r click Auto Configure to ailable devices.	volume or device, ad have the iSCSI initiato	d that volume or r service automa	device to tically	
	This will bind the for use by the p the Favorite Tar	e volume or device so the rogram or service. This gets List.	at on system restart it is only effective if the	t is more readily a e associated targ	ivailable et is on	
	Volume List:	\searrow				
	Volume/mount	point/device				
	\\?\scsi#disk& \\?\scsi#disk&	ven_freebsd∏_iscsi ven_freebsd∏_iscsi	_disk#1&1c121344&(_disk#1&1c121344&(0&00000#{53f56 0&000001#{53f56	6307-b6b. 6307-b6b.	
	To automatically Configure.	configure all available d	evices, click Auto	Auto C	Configure .	
re No to	boot the se ext we will the Opera	erver using com configure these ting System and	mand "shutd iSCSI disks ai I Cluster Man	own /r /t 0 nd make th ager. For t)" nem vi his we	sibl e wi
us	se "DiskPart	command.				
). Ru 	un "DiskPar	t.exe″				
13	/pe "List Dis	SK ^a				
	Administrat	or: C:\Windows\syst	em32\cmd.exe -	diskpart		
С	:\Users\Ad	lministrator≻d	liskpart			
Μ	icrosoft [)iskPart versi	on 10.0.190	41.1		
C O	opyright (n computer	C) Microsoft N200401	Corporation			
D	ISKPART>]	ist disk			k	
	Disk ###	Status	Size	Free	Dyn	Gp
	Disk Ø	Online	50 GB	1024 KB		
	Disk 1	Offline	1024 GB	1024 GB		
	DISK 2	Offline	1024 GB	1024 GB		

12. DISKPART>

7. 8.

13. Bring the Disk 1 and Disk 2 online using commands "Select disk 1", "online disk", "select disk 2", "online disk" and list the disks again using "list disk"

```
Administrator: C:\Windows\system32\cmd.exe - diskpart
     Disk 0
               Online
                               50 GB 1024 KB
     Disk 1
               Offline
                              1024 GB 1024 GB
                              1024 GB 1024 GB
     Disk 2
               Offline
   DISKPART> select disk 1
   Disk 1 is now the selected disk.
   DISKPART> online disk
   DiskPart successfully onlined the selected disk.
   DISKPART> select disk 2
   Disk 2 is now the selected disk.
   DISKPART> online disk
   DiskPart successfully onlined the selected disk.
   DISKPART> list disk
     Disk ### Status
                              Size
                                        Free
                                                 Dyn Gpt
                               50 GB
               Online
     Disk 0
                                        1024 KB
               Online
                                        1024 GB
     Disk 1
                              1024 GB
     Disk 2
               Online
                               1024 GB
                                        1024 GB
   DISKPART>
14.
```

- 15. By default, all disks brought online will be marked as readonly. Next we will mark then as read-write, create the partition and format it using NTFS. For the first disk we will assign it as "Q" drive and for the second disk we will not assign any drive letter as we will use this as a "Clustered Shared Volume" which will be available on both the nodes at the same time under the path "C:\ClusteredVolumes" as a junction point.
- 16. The commands for clearing read-only attributes are "select disk 1", "attrib disk clear readonly", "select disk 2", "attrib disk clear readonly"

```
DISKPART> select disk 1
Disk 1 is now the selected disk.
DISKPART> attrib disk clear readonly
Disk attributes cleared successfully.
DISKPART> select disk 2
Disk 2 is now the selected disk.
DISKPART> attrib disk clear readonly
Disk attributes cleared successfully.
```

- 17. DISKPARTS –
- Next create the partitions using commands "select disk 1", "create partition primary", "select partition 1", "format fs=NTFS label="Q" quick", "assign letter=Q", "select disk 2", "create partition primary", "select partition 1", "format fs=NTFS label="data" quick"

```
DISKPART> select disk 1
    Disk 1 is now the selected disk.
                                                 k
    DISKPART> create partition primary
    DiskPart succeeded in creating the specified partition.
    DISKPART> select partition 1
    Partition 1 is now the selected partition.
    DISKPART> format fs=NTFS label="Q" quick
      100 percent completed
    DiskPart successfully formatted the volume.
    DISKPART> assign letter=Q
    DiskPart successfully assigned the drive letter or mount point.
    DISKPART> select disk 2
    Disk 2 is now the selected disk.
    DISKPART> create partition primary
    DiskPart succeeded in creating the specified partition.
    DISKPART> select partition 1
    Partition 1 is now the selected partition.
    DISKPART> format fs=NTFS label="data" quick
      100 percent completed
    DiskPart successfully formatted the volume.
19. DISKPART>
```

20. This completes the disk operations and now both "quorum" and "data" disks are available to the OS and ready for cluster setup. Let's start with the cluster setup.

- 3. Now that the VM is ready and configured with network adapters and storage disks, the next step is to install the Cluster feature and run the cluster validation task to check the readiness of the VM to host a cluster. All the commands below are to be executed inside the PowerShell session as "Administrator" with elevated permissions.
 - Install the cluster feature using command "Install-WindowsFeature Failover-Clustering -IncludeManagementTools"

2	Administ	ator: C:\Windows\System32\	WindowsPowerShell\v1.0\	powershell.exe	- • ×
Wi Cc	ndows pyrig	PowerShell t (C) Microsoft	t Corporation.	All rights reserved.	Â
Τr	y the	new cross-platf	form PowerShell	l https://aka.ms/pscore6	
PS	; c:\U	sers\Administrat	tor> Install-W	indowsFeature Failover-Clustering -IncludeManagementTools	
Su	iccess	Restart Needed	Exit Code	Feature Result	
Tr	ue	No	Success	{Failover Clustering, Remote Server Admini	
PS	; c:\U	sers\Administrat	tor> _		

 Create hosts entries. Since we are setting this up without a domain, we need to rely on "hosts" file for the name lookups. Add the below entries to the "hosts" file using "notepad" running from an elevated session.

	0		0
i.	10.0.0.2	N200401	N200401.mylocal.net
ii.	10.0.0.3	N200402	N200402.mylocal.net
iii.	10.0.0.10	AppCluster	AppCluster.mylocal.net

Run the cluster validation process using command "Test-Cluster -Node N200401.mylocal.net"

· · · · · · · · · · · · · · · · · · ·
PS C:\Users\Administrator> notepad C:\windows\system32\drivers\etc\hosts
PS C:\Users\Administrator> Test-Cluster -Node N200401.mylocal.net
WARNING: System Configuration - Validate Active Directory Configuration: The test reported some
warnings
WARNING:
Test Result:
HadUnselectedTests, ClusterConditionallyApproved
Testing has completed for the tests you selected. You should review the warnings in the Report. A cluster solution is supported by Microsoft only if you run all cluster validation tests, and all
tests succeed (with or without warnings).
Test report file path: C:\Users\Administrator\AppData\Local\Temp\Validation Report 2020 07 14 At
100 57 07 htm
55157157175M
Mode LastWriteTime Length Name
-a //14/2020 12:5/ AM 28/494 Validation Report 2020.0/.14 At 00.5/.0/.htm

PS C:\Users\Administrator>

i.

- The test will report warnings about "Active Directory" which is true as we do not have an AD setup and the cluster is "Conditionally Approved". We will proceed with this as it is good enough for our testing.
- Once the test is complete, we will create the cluster using command "New-Cluster -Name AppCluster -Node N200401.mylocal.net -AdministrativeAccessPoint DNS"

i R	Administrator C:\Windows\System32\WindowsPowerShellv1D:powershellexe ES: C:\Users\Administrator> New-Cluster -Name AppCluster -Node N200401.mylocal.net -AdministrativeAccessPoint DNS	×
	Name AppCluster	
F	PS C:\Users\Administrator> _	

- Once the cluster is created, let us check which network cards got assigned to what roles on the cluster. For that run the command "Get-ClusterNetworkInteface" and "Get-ClusterNetwork".

Z Administrator: C:\Windows\System32\V	WindowsPowerShell\v1.0\	powershell.exe
PS C:\Users\Administrat	or> Get-Cluste	erNetworkInterface
Name No	de Network	State
N200401 - Ethernet N20 N200401 - Ethernet 2 N20	00401 Cluster 00401 Cluster	Network 1 Up Network 2 Up
PS C:\Users\Administrat	or> Get-Cluste	erNetwork
Name State	Metric	Role
Cluster Network 1 Up Cluster Network 2 Up	79984 79985 Cluste	None PrAndClient
PS C:\Users\Administrat	:or>	

- Based on the details from the above commands, the network cards are incorrectly assigned. We need to fix this. The "Ethernet" is the which we intend to use for the "ClusterAndClient" communications. So, let's change this before we move further.
- First step here would be to mark "Cluster Network 1" as carrying both Cluster and Client communication. Once that is done, we mark "Cluster Network 2" as "None". To accomplish this, we execute the commands "Get-ClusterNetwork "Cluster Network 1" | %{\$_.Role = 3}" and "Get-

Cluster Network $2^{"} | \%{\$}_{3}$. Role = 3?

				· · · _	
PS C:\Users\Admin ⁻	istrat	or> Get	-ClusterNetwork		
Name	State	Metric	Role		
Cluster Network 1 Cluster Network 2	Up Up	79984 79985	None ClusterAndClient		
PS C:\Users\Admin PS C:\Users\Admin PS C:\Users\Admin	istrat istrat	or> Get or> Get or> Get	-ClusterNetwork "Clust -ClusterNetwork "Clust -ClusterNetwork	ter Network 1' ter Network 2'	%{\$Role = 3} %{\$Role = 0}
Name	State	Metric	Role		
Cluster Network 1 Cluster Network 2	Up Up	79986 79984	ClusterAndClient None	k	
PS C:\Users\Admin	istrat	or>			

Next we will configure the static IP on the "Cluster IP Address" resource. To do this execute the command "Get-ClusterResource "Cluster IP Address" | Set-ClusterParameter -Multiple @{"Network"="Cluster Network 1";"Address"="10.0.0.10";"SubnetMask"="255.255.255.0";"EnableDhcp"="0" }". Once set, stop and start the cluster resource for the changes to take effect.



 Since the IP was stopped and started, we will start the "Cluster Name" resource also using command "Start-ClusterResource "Cluster Name""

- This will bring our cluster to a healthy state with a single node.
- Next we will add the disks to the cluster.
- 4. To start with adding disks to the cluster, we need to first check the list of available disks which can be added to the cluster.
 - This can be achieved by the command "Get-ClusterAvailableDisk" PS C:\Users\Administrator> Get-ClusterAvailableDisk Cluster : AppCluster Id : 0x22E4083B Name : Cluster Disk 1 Number : 1 Size : 1099511627776 Partitions : {\\?\GLOBALROOT\Device\Harddisk1\Partition1\} Cluster : AppCluster Id : 0x22E4084E Name : Cluster Disk 2 Number : 2 Size : 1099511627776 Partitions : {\\?\GLOBALROOT\Device\Harddisk2\Partition1\} PS C:\Users\Administrator> _
 - Next, pipe the output of this command to "Add-ClusterDisk" to add both the available disks to the cluster.

PS C:\Users\Adı	ninistra	ator> Get-ClusterA	/ailableD [.]	isk	Add-ClusterDis	k
Name	State	OwnerGroup	Resource	Туре		
Cluster Disk 1 Cluster Disk 2	Online Online	Available Storage Available Storage	Physical Physical	Disk Disk		
PS C:\Users\Adı	ninistra	ator> _				

- We will assign one of these disks as "Quorum". To identify it in the future, we will start by first renaming the resource and then adding it as a quorum.
- To rename the disk, use the command "Get-ClusterResource "Cluster Disk 1"
 | %{\$.Name="Quorum"}"
- To add it as quorum, execute the command "Set-ClusterQuorum -NodeAndDiskMajority "Quorum"". Here the name "Quorum" is what has been set in the previous rename command. So, if you have named it something else, use that in this command.
- Last, we will add the second disk as a "Clustered Shared Volume". For this, the command is "Add-ClusterSharedVolume -Name "Cluster Disk 2""

the comm	
PS C:\Users\ PS C:\Users\	Administrator> Get-ClusterResource "Cluster Disk 1" %{{Name="Quorum"} Administrator> Set-ClusterQuorum -NodeAndDiskMajority "Quorum"
Cluster	QuorumResource
AppCluster	 Quorum
PS C:∖Users∖ Name	dministrator> Add-ClusterSharedVolume -Name "Cluster Disk 2" State Node
 Cluster Disk	2 Online N200401

- This completes the single node cluster setup where we have a cluster name,

IP, quorum and a c	lustere	ed disk availa	ble.
PS C:\Users\Administ	rator>	Get-ClusterRes	ource
Name	State	OwnerGroup	ResourceType
 Cluster TP Address	Online	Cluster Groun	TP Address
Cluster Name	Online	Cluster Group	Network Name
Quorum	Online	Cluster Group	Physical Disk
storage dos Resource	omine	Cluster Group	Storage Qos Politcy Manager

- 5. The next step now is to create the second node and add it to the cluster. For this follow the same steps we used to create the first node N200401. We will call it N200402 and complete till the step of creating the hosts file and installing the cluster feature. Also, skip the steps of creating partitions and formatting the partitions on the NAS disks as they have already been created during the first node setup.
 - Ensure that the password for the local administrator account is the same as the first node. The cluster will use that to communicate between the nodes. If the passwords are different, the nodes will not be able to communicate correctly and the cluster will fail to work as intended.

E General	Node2 [Running]
Name: Node2 Operating System: Windows 2019 (64-bit)	
System	
Base Memory: 2048 MB Boot Order: Floppy, Optical, Hard Disk Acceleration: VT-x(AMD-V, Nested Paging	Administration Collificational and an PR and an
E Display	Administration C. Windows Systems2 complexe
Video Memory: 128 MB Graphics Controller: VBoxSVGA Remote Desktop Server: Disabled Recording: Disabled	C:\Users\Administrator>
Storage	
Controller: SATA SATA Port 0: Node2.vdl (Normal, 50.00 GB) SATA Port 1: [Optical Drive] en_windows_server_version_2004_updated_may_20	
🕪 Audio	
Host Driver: CoreAudio Controller: Intel HD Audio	
P Network	
Adapter 1: Intel PRO/1000 MT Desktop (Bridged Adapter, en1: Wi-Fi (AirPort)) Adapter 2: Intel PRO/1000 MT Desktop (internal Network, 'intnet')	
🖉 USB	
USB Controller: xHCI Device Filters: 0 (0 active)	
Shared folders	
None	
Description	🧕 💿 🕼 🦃 🖉 🗐 🔇 🕒 Left X
None	

 Once the OS, network and disks are configured similar to node 1, add this node to the cluster by running the command from node 1 "Add-ClusterNode N200402.mylocal.net" and view the status of the node by running command "Get-ClusterNode"



 Verify all the resources also by running the command "Get-ClusterResource" which should list all resources as "Online". To further confirm the status of the node 2, check the clustered volume folder for the existence of the "Clustered Shared Disk"

	Administrator> Get-Cluster	Resource	
Name	State OwnerGroup	ResourceType	
Cluster IP / Cluster Nam Quorum Storage Qos	Address Online Cluster Gro Online Cluster Gro Online Cluster Gro Resource Online Cluster Gro	oup IP Address oup Network Name oup Physical Disk oup Storage QoS Policy Manage	er -
PS C:\Users`	Administrator> Get-Cluster	Resource "Cluster IP Address'	
Name	State OwnerGroup	ResourceType	
Cluster IP / PS C:\Users	Address Online Cluster Group	o IP Address terStorage	
Directo	ry: C:\ClusterStorage		
Mode	LastWriteTime	Length Name	
d1	7/14/2020 2:51 AM	Volume1	
PS C:\Users` N200401 PS C:\Users`	\Administrator> hostname \Administrator> _		
PS C:\Users	Administrator> Get-ClusterR	Resource	
Name	State OwnerGroup	ResourceType	
Cluster IP / Cluster Name Quorum Storage Qos	Address Online Cluster Gro Online Cluster Gro Online Cluster Gro Resource Online Cluster Gro	oup IP Address oup Network Name oup Physical Disk oup Storage QoS Policy Manage	r
PS C:\Users	Administrator> Get-Cluster	Resource "Cluster IP Address"	
Name	State OwnerGroup	ResourceType	
Cluster IP /	Address Online Cluster Group	D IP Address	
PS C:\Users	Administrator> Dir C:\Clust	terStorage\	
Directo	∙y: C:\ClusterStorage		
Mode	LastWriteTime	Length Name	
 d1	7/14/2020 3:57 AM	Volume1	
PS C:\Users N200402	Administrator> hostname	▶	
PS C:\Users	Administrator> 🗕		
	test will be to failover the	e node from one to anothe	er. For this
One more	נכסו שווו אכ נט ומווטעכו נוונ		
One more run the cor	nmand "Move-ClusterGr	oup "Cluster Group"".	
One more run the cor	nmand "Move-ClusterGr s\Administrator> Move-Cl	oup "Cluster Group"". usterGroup "Cluster Group	"
One more run the cor S C:\User Name	nmand "Move-ClusterGr s\Administrator> Move-Cl Owner <u>Node State</u>	oup "Cluster Group"". usterGroup "Cluster Group	"
One more run the cor S C:\User Name Cluster Gr	nmand "Move-ClusterGr s\Administrator> Move-Cl ownerNode State	oup "Cluster Group"". usterGroup "Cluster Group	
One more run the cor S C:\User Name Cluster Gr	nmand "Move-ClusterGr s\Administrator> Move-Cl OwnerNode State oup N200402 Online	oup "Cluster Group"". usterGroup "Cluster Group	
One more run the cor S C:\User Name Cluster Gr PS C:\User	nmand "Move-ClusterGr s\Administrator> Move-Cl OwnerNode State oup N200402 Online s\Administrator> Move-Cl	oup "Cluster Group"". usterGroup "Cluster Group usterGroup "Cluster Group	
One more run the cor S C:\User Name Cluster Gr PS C:\User Name	nmand "Move-ClusterGr s\Administrator> Move-Cl ownerNode State oup N200402 Online s\Administrator> Move-Cl OwnerNode State	oup "Cluster Group"". usterGroup "Cluster Group usterGroup "Cluster Group	
One more run the cor S C:\User Cluster Gr PS C:\User Name Cluster Gr	nmand "Move-ClusterGr s\Administrator> Move-Cl ownerNode State 	oup "Cluster Group"". usterGroup "Cluster Group usterGroup "Cluster Group	

This completes the setup and now you have a working 2 node Windows Failover Cluster, all created from the command line using PowerShell and a few other regular commands.