

StarWind NVMe-oF Initiator: Configuration Guide for Microsoft Windows Server [Hyper-V]

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TECHNICAL PAPERS





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Annotation

Relevant Products

StarWind NVMe over Fabrics (NVMe-oF) Initiator

StarWind rPerf utility

Purpose

This guide details the process of creating a Microsoft failover cluster with Windows Server using StarWind NVMe-oF Initiator. It outlines the setup of a cluster involving two Windows Server 2019 nodes and a storage node running CentOS with SPDK NVMe over Fabrics target. The guide includes steps for preparing both the storage and cluster nodes, installing the StarWind NVMe-oF Initiator, and configuring the failover cluster and network preferences.

Audience

The guide is intended for IT professionals, system administrators, and network engineers interested in deploying and managing failover clusters in Windows Server environments, particularly those involving shared NVMe storage using NVMe-oF.

Expected Result

Upon following this guide, users should successfully create a Microsoft failover cluster using StarWind NVMe-oF Initiator. The cluster will involve Windows Server nodes for high availability and a CentOS node as a stable SPDK NVMe over Fabrics target, ensuring high-performance shared storage management.

Solution Diagram

The figure below depicts the network diagram of the environment built for this technical paper.

NOTE: This technical paper describes how to configure StarWind NVMe-oF Initiator and SPDK NVMe over Fabrics target for a setup intended exclusively for proof-of-concept and test purposes.





Preconfiguring The Servers

Cluster Node 1 and Cluster Node 2 are running Windows Server 2019; Hyper-V role is installed and Failover Cluster feature is enabled. Storage Node is running CentOS as it is a stable operating system that can be used to create SPDK NVMe over Fabrics target.

StarWind NVMe over Fabrics Initiator is installed on Cluster Nodes 1 and 2. SPDK NVMe over Fabrics target is installed on Storage Node.

Cluster Node 1 and Cluster Node 2 have Mellanox ConnectX-5 adapters installed. The Storage Node has a Mellanox ConnectX-5 network adapter and an NVMe disk installed. That disk is presented as SPDK NVMe over Fabrics target over the Storage Network that has subnet number of 172.16.77.x.

Windows Servers 2019 servers should have the latest Mellanox driver installed, which is



available at

https://www.mellanox.com/products/adapter-software/ethernet/windows/winof-2

To check the RDMA connectivity and bandwidth between Cluster Nodes and Storage Node, use the StarWind rPerf utility, which can be downloaded at https://www.starwindsoftware.com/starwind-rperf

Preparing The Storage Node

In this document, CentOS is used as an operating system of the Storage Node where SPDK NVMe over Fabrics target is configured. Learn more about SPDK NVMe over Fabrics target at https://spdk.io/doc/nvmf.html

Prepare The New Centos Core With Multipathing Support

Preparation of the Storage Node involves multipath configuration. To configure it, it is necessary to update the OS core and install additional components. Perform the commands below as root on Storage Node.

```
yum update -y
yum install mc wget tar -y
yum install ncurses-devel git-all openssl-devel gcc bc bison
flex elfutils-libelf-devel make -y
```

To install the new CentOS core, it is necessary to run these commands. Find more details about CentOS core installation at https://wiki.centos.org/Documentation

wget https://cdn.kernel.org/pub/linux/kernel/v5.x/linux-5.5.4.tar.xz tar -xvf linux-5.5.4.tar.xz cd linux-5.5.4 make olddefconfig

To activate multipathing, it is necessary to find and delete the rows below in the .config file.

CONFIG_SYSTEM_TRUSTED_KEYRING CONFIG_SYSTEM_TRUSTED_KEYS



#
Certificates for signature checking
#
CONFIG MODULE SIG KEY="certs/signing key.pem"
CONFIG_SYSTEM_TRUSTED_KEYRING=Y
CONFIG_SYSTEM_TRUSTED_KEYS="certs/rhel.pem"
CONFIG_SYSTEM_EXTRA_CERTIFICATE is not set
<pre># CONFIG_SECONDARY_TRUSTED_KEYRING is not set</pre>
CONFIG_SYSTEM_BLACKLIST_KEYRING=y
CONFIG_SYSTEM_BLACKLIST_HASH_LIST=""
CONFIG_BINARY_PRINTF=y

Use the make menuconfig tool to enable NVMe multipath support.

make menuconfig

In Kernel Configuration, select Device Drivers -> NVME Support, choose NVMe multipath support and press the Save button

.confid - tinen/off 3.5.4 Remea configuration > <u>confide trivers ></u> mvm: Support
Arrow keys marigate the ment. erstery selects subments> for empty subments>. Highlighted lat modularizes features. Frees drivermery to exit, do, for Kelp, d/s for Search. Legend: [4] built-in [
otto S. M. Express block device
[*] Side herdware monitoring
HE S'H Express over Febrics FU host driver
GO X No Carpat support
100 Home anopeast market support
(D) When your Fahring PC transport Englands first drive
- OD- H.M. over Fabries FC target driver OD- K.H. over Fabries FC target hopkack fast driv OD- H.M. over Fabries TCP target support

Confirm the changes.



Compile the core. Use the lscpu command to learn the number of logical CPUs in the system; use that number as the parameter in the make -j command (make-j* where *-



the count of logical CPU).

make -j[the number of logical CPUs] && make - j[the number of logical CPUs] modules make - j[the number of logical CPUs] modules_install && make j[the number of logical CPUs] install

In this sample, Linux core was compiled with 8 CPUs.

make -j8 && make -j8 modules
make -j8 modules_install && make -j8 install

Make the new system the first in the boot menu.

grub2-set-default 0
grub2-editenv list

Restart the OS to boot from the new core.



Installing The Necessary Drivers And Components And Enabling Rdma

Run the following commands to install the Mellanox drivers and components.

```
yum -y groupinstall "InfiniBand Support"
dracut --add-drivers "mlx4_en mlx4_ib mlx5_ib" -f
systemctl enable rdma
echo -e "nvme-rdma\nnvme\nnvmet\nnvmet-rdma" > /etc/modules-
load.d/nvme-rdma.conf
systemctl enable systemd-modules-load
systemctl start systemd-modules-load
systemctl status systemd-modules-load
```



dnf install nvmetcli -y
dnf install opensm -y
systemctl enable opensm

Use the command below to check that NVMe multipathing support is enabled. The system should return "Y".

cat /sys/module/nvme_core/parameters/multipath

Run the following commands to install the components for SPDK NVMe over Fabrics target.

```
dnf install epel-release -y
dnf --enablerepo=PowerTools install CUnit-devel -y
dnf --enablerepo=PowerTools install nasm -y
dnf install gcc-c++ rdma-core-devel librdmacm automake libtool
python36 numactl-devel libuuid-devel libaio-devel bzip2 -y
dnf --enablerepo=PowerTools install help2man
yum install python2 -y
ln -s /usr/bin/python2 /usr/bin/python
git clone https://github.com/linux-test-project/lcov.git
cd lcov
make install
```

Installing And Starting The Spdk Nvme Over Fabrics Target

This section describes installing, initialization, and creation of SPDK NVMe over Fabrics target. Find more details at https://spdk.io/doc/getting_started.html

1. SPDK installation

Navigate to the root folder and get the list of available SPDK versions.

```
cd /
git clone https://github.com/spdk/spdk.git
```



cd spdk/

Select the SPDK version.

```
git tag
git checkout v20.01
git submodule update --init
./configure --enable-debug --with-rdmamake -j[the number of
logical CPUs]
```

2. Starting SPDK NVMe over Fabrics target

In order to start SPDK NVMe over Fabrics target, it is necessary to initialize the NVMe drive. To initialize the NVMe drive, please run setup.sh and gen_nvme.sh from spdk/scripts folder

scripts/setup.sh
scripts/gen_nvme.sh

NOTE: gen_nvme.sh generates the NVMe namespace that is going to be reused to create an SPDK NVMe over Fabrics target. The generated namespace should look like Nvme0n1 1. Make sure to note this parameter.

SPDK NVMe over Fabrics target requires nvmf.conf file to get all the parameters for its functioning. The file must be created in spdk folder. Please, find the sample of nvmf.conf file below.

```
[Global]
#[Bdev]
[Rpc]
Enable No
Listen 127.0.0.1
[Nvme]
TransportID "trtype:PCIe traddr:0000:04:00.0" Nvme0
RetryCount 4
TimeoutUsec 0
AcctionOnTimeout None
AdminPollRate 100000
```



#[Malloc]
#NumberOfLuns 8
#LunSizeInMB 64

[Nvmf] AcceptorPollRate 10000 ConnectionScheduler RoundRobin

[Transport] Type RDMA

[Subsystem1] NQN nqn.2016-06.io.spdk:cnode1 Listen RDMA 172.16.77.1:4420 //The IP address of your target NIC AllowAnyHost Yes Host nqn.2016-06.io.spdk:init //the name of your target SN SPDK001MN SPDK_Ctrl1 Namespace Nvme0n1 1

NOTE: Nvme0n1 1 is the namespace generated by gen_nvme.sh.172.16.77.1 is the IP address of the target NIC.NQN is the qualified name to identify a storage target. Run the following command to create the SPDK NVMe over Fabrics target based on the previously created nvmf.conf

./app/nvmf_tgt/nvmf_tgt -c nvmf.conf

₽ root@localhost:/spdk	-	×
[root@localhost spdk]#		~
[root@localhost spdk]# nano nvmf.conf		
[root@localhost spdk]# ./app/nvmf tgt/nvmf tgt -c nvmf.conf		
Starting SPDK v20.01 git sha1 5ffffe9d9 / DPDK 19.11.0 initialization		
[DPDK EAL parameters: nvmfno-shconf -c 0x1log-level=lib.eal:6log-level		
=lib.cryptodev:5log-level=user1:6iova-mode=pabase-virtaddr=0x200000000		
00match-allocationsfile-prefix=spdk pid11779]		
app.c: 642:spdk app start: *NOTICE*: Total cores available: 1		
reactor.c: 316: spdk reactor run: *NOTICE*: Reactor started on core 0		
rdma.c:2744:spdk nvmf rdma listen: *NOTICE*: *** NVMe/RDMA Target Listening on 1		
72.16.77.1 port 4420 ***		
		\sim

NOTE: After the server restarts, the target does not start automatically. The ./app/nvmf_tgt/nvmf_tgt -c nvmf.conf command should be added to autostart of the CentOS server.



Preparing The Cluster Nodes

In this document, Windows Server 2019 is used as an operating system of the Cluster Nodes where StarWind NVMe over Fabrics initiator is configured.

Installing Starwind Nyme Over Fabrics Initiator

1. Download StarWind NVMe-oF in the link here: https://www.starwindsoftware.com/starwind-nvme-of-initiator

2. Execute the starwind-nvmeof.exe to install StarWind NVMe-oF Initiator and follow the steps in the wizard.

Setup - StarWind NVMe-oF Initiator		×
Information Please read the following important information before continuing.		Ð
When you are ready to continue with Setup, click Next.		
StarWind NVMe-oF Initiator v1.8 Copyright (c) StarWind Software, 2018-2020		^
Description		
NVMe-oF is an extremely efficient protocol for connecting block storage over network using RDMA data transfers. StarWind NVMe-oF Initiator is a software module that allows connecting rem NVMe-oF Target to Windows host.	r the iote	
System Requirements		
- OS Windows Server 2016, 2019, Windows 10+. - Mellanox RDMA-capable network adapters on the machine with the initiato on the machine with NVMe-oF Target.	r and	~
< <u>B</u> ack <u>N</u> ext >	Ca	ancel

3. Restart the server.





4. Open Device Manager to check that StarWind NVMe-oF Initiator is installed on the system.



📇 Device Manager	_	×
<u>F</u> ile <u>A</u> ction <u>V</u> iew <u>H</u> elp		
🗢 🏟 📰 📝 🗊 💭		
V 📇 SW1		
> 🛄 Computer		
> 👝 Disk drives		
> 🏣 Display adapters		
> 🔐 DVD/CD-ROM drives		
> 🛺 Human Interface Devices		
> 📷 IDE ATA/ATAPI controllers		
> Keyboards		
Mice and other pointing devices		
> I Nonitors		
Network adapters		
> E Print queues		
Software devices		
Sortade controllers		
LSI Adapter, SAS 3000 series, 8-port with 1068 Microsoft iSCSI Initiator		
Sa Microsoft Storage Spaces Controller		
StarWind NVMe over Fabrics Storage Controller		
> To System devices		
Universal Serial Bus controllers		
-		

Working With Starwind Nvme Over Fabrics Initiator

The StarNVMeoF_Ctrl.exe command-line utility is used to work with the NVMe-oF initiator:

1. Find available NVMe-oF controllers and subsystems (targets). The command will show a list of names and properties of controllers for the address:

StarNVMeoF_Ctrl.exe discovery <target_ip_addr[:port]> <local_ip_addr>

2. Connect the NVMe-oF controller. The command will create a connection to the target.

StarNVMeoF_Ctrl.exe insert <target_ip_addr[:port]> <local_ip_addr> <SubNQN>
 <HostNQN> [<num_io_queues> <io_queue_depth>]



3. Show the list of connected NVMe-oF controllers. The command will show the list of connected controllers:

StarNVMeoF_Ctrl.exe list

4. Disconnect the NVMe-oF controller that is connected to the system. The command will disconnect the controller. The LUNs will be removed from the system:

StarNVMeoF_Ctrl.exe remove <controllerId>

Discovering And Connecting Nvme-Over-Fabrics Targets On Windows Server

1. To discover the target, run the discovery command: StarNVMeoF_Ctrl.exe discovery <target_ip_addr:[port]> <local_ip_addr> by specifying the protocol, target host IP address and port number:

Example: StarNVMeoF_Ctrl.exe discovery 172.16.77.1:4420 172.16.77.2

Where:

<172.16.77.1:4420> — NVMe-oF target host IP and port; <172.16.77.2> — local host IP.





2. To connect the target, run the command: StarNVMeoF_Ctrl.exe insert
 <target_ip_addr[:port]> <local_ip_addr> <SubNQN> <HostNQN> [<num_io_queues>
 <io_queue_depth> <first_core>]

Example: StarNVMeoF_Ctrl.exe insert 172.16.77.1:4420 172.16.77.2 nqn.2008-08.com.starwindsoftware:NVMeofTarget SW_1 512 6 0

Where:

- <172.16.77.1:4420 > target host IP and port;
- <172.16.77.2> local host IP;
- <nqn.2008-08.com.starwindsoftware:NVMeofTarget> SubNQN of the target (may be copied from the discovery results screen);
- <SW_1> local HostNQN;
- <512> quantity of connections to the target;
- <6> queue depth;
- <0> number of the initial core.





3. After the "insert" command is executed, disk LUNs for the connected controller namespaces should appear in the system.



📅 Disk Manag	gement						_		×
<u>File</u> <u>Action</u>	<u>V</u> iew <u>H</u> elp								
	? 🏹 🚈								
Volume	Layout	Туре	File System	Status	Capacity	Free Spa	% Free		
Second Contraction of Contraction	Simple	Basic		Healthy (R	450 MB	450 MB	100 %		
	Simple	Basic		Healthy (E	99 MB	99 MB	100 %		
= (C:)	Simple	Basic	NTFS	Healthy (B	39.45 GB	27.01 GB	68 %		
	i								
Disk 0			[
Basic 39.98 GB	450 MP		00 MR	(C:)	D NITES				
Online	Healthy (Recovery	Partition)	Healthy (EFI Sys	tem Health	y (Boot, Page File,	Crash Dump	, Primary Par	ti	
10 Di-1-4				1					
Unknown									_
100.00 GB	100.00 GB								
Offline 🕕	Unallocated								
]								
Unallocated	Primary partition								× 1

4. To show the list of connected NVMe-oF controllers, run the "StarNVMeoF_Ctrl.exe list" command.





5. To disconnect LUNs from the system, run the the controller disconnection command StarNVMeoF_Ctrl.exe remove <controllerId> Example: StarNVMeoF_Ctrl.exe remove 1 Where:

• <1> — controller Id





NOTE: Make sure that LUNs are not used by other applications at the moment of disconnection, as removing LUNs with active file operations may lead to data corruption.

Configuring A Failover Cluster

NOTE: To avoid issues during the cluster validation configuration, it is recommended to install the latest Microsoft updates on each node.

1. Open Server Manager. Select the Failover Cluster Manager item from the Tools menu.



🚡 Server Manager		– 🗆 X
Server Ma	anager 🕨 Dashboard 🛛 🔹 🕫 🖡 Manage	Tools View Help
III Dashboard	WELCOME TO SERVER MANAGER	Cluster-Aware Updating Component Services Computer Management
Local Server All Servers File and Storage Services	1 Configure this local server	Defragment and Optimize Drives Disk Cleanup Event Viewer
🖪 Hyper-V	QUICK START 2 Add roles and features	Failover Cluster Manager Hyper-V Manager iSCSI Initiator
	3 Add other servers to manage WHATS NEW 4 Create a server group	Local Security Policy Microsoft Azure Services MPIO
	5 Connect this server to cloud se	ODBC Data Sources (32-bit) ODBC Data Sources (64-bit) Performance Monitor
		Print Management Resource Monitor Services
	Roles: 2 Server groups: 1 Servers total: 1	System Configuration System Information Task Scheduler
	Services Hyper-V ① Manageability ① Manageability	Windows Firewall with Advanced Security Windows Memory Diagnostic

2. Click the Create Cluster link in the Actions section of Failover Cluster Manager.

Railover Cluster Manager	– 🗆 X
File Action View Help	
Sailover Cluster Manager Failover Cluster Manager	Actions
Create failover clusters, validate hardware for potential failover clusters	and perform Failover Cluster Manager
contiguration changes to your failover clusters.	Validate Configuration
C. Quantinu	🙀 Create Cluster
A failwar cluster is a set of independent computers that work together to incre	ase the
availability of server roles. The clustered servers (called nodes) are connected cables and by software. If one of the nodes fails, another node herings to provi	I by physical View
This process is known as failover.	Refresh
	Properties
Clusters	I Help
Name Role Status	
No Remo found	
Management	
To begin to use failover clustering, first validate your hardware configuration, a create a cluster. After these steps are complete you can manage the cluster.	and then Managing a
cluster can include copying roles to it from a cluster running Windows Server 2 supported previous versions of Windows Server	2016 or
Validate Configuration	
Create Cluster	
Connect to Cluster	
More Information	
Event State Cluster topics on the Web	
Failover cluster communities on the Web	
Microsoft support page on the Web	

3. Specify the servers to be added to the cluster. Click Next to continue.



Create Cluster Wi	izard		×
Select Se	ervers		
Before You Begin Select Servers Validation Warning	Add the names of all the s	ervers that you want to have in the cluster. You must add at least one server.	
Access Point for Administering the Cluster	Enter server name:	Browse WIN-SW1 starwind local	
Confirmation		WIN-SW2.starwind.local	
Creating New Cluster		<u>R</u> emove	
Summary			
		< Previous Next > Cancel	

4. Validate the configuration by running the cluster validation tests: select Yes... and click Next to continue.

Welidate a Configuration Wizard				
Confirma	tion			
Before You Begin Testing Options	You are ready to start validation. Please confirm that the following settings are correct:			
Confirmation	Servers to Test		^	
Validating	WIN-SW1.starwind.local			
Summary	WIN-SW2.starwind.local			
	Tests Selected by the User	Category		
	List Fibre Channel Host Bus Adapters	Inventory		
	List iSCSI Host Bus Adapters	Inventory		
	List SAS Host Bus Adapters	Inventory		
	List BIOS Information	Inventory	~	
	To continue, click Next.			
		< Previous Next > Car	ncel	

5. Specify Cluster Name.

NOTE: If the cluster servers get IP addresses over DHCP, the cluster also gets its IP address over DHCP. If the IP addresses are set statically, set the cluster IP address



manually.

📲 Create Cluster Wi	zard				×
Access P	oint for Adminis	tering the Cluster			
Before You Begin	Type the name you v	vant to use when administerir	g the cluster.		
Select Servers	Cluster Name:	Production			
Access Point for Administering the Cluster Confirmation	The NetBIOS nar automatically. Fr address.	ne is limited to 15 characters or each network to be used,	One or more IPv4 make sure the netw	addresses could not be configured ork is selected, and then type an	1
Creating New Cluster		Networks		Address	7
Summary		172.16.).0/16	Click here to type an address	
		192.168	1.0/24	192 . 168 . 1 . 99	$\left \right $
			< <u>P</u> revious	<u>N</u> ext > Cancel	

6. In Confirmation, make sure that all settings are correct. Click Previous to make any changes or Next to proceed.

NOTE: If checkbox Add all eligible storage to the cluster is selected, the wizard will add all disks to the cluster automatically. The device with the smallest storage volume will be assigned as a Witness. It is recommended to uncheck this option before clicking Next and add cluster disks and the Witness drive manually.

7. The process of the cluster creation starts. Upon the completion, the system displays the summary with the detailed information. Click Finish to close the wizard.



🚏 Create Cluster Wi	zard X
Confirma	tion
Before You Begin Select Servers	You are ready to create a cluster. The wizard will create your cluster with the following settings:
Access Point for Administering the	Cluster
Cluster	Production
Contimation	Node
Creating New Cluster	WIN-SW1.starwind.local
Summary	WIN-SW2.starwind.local
	Cluster registration
	DNS and Active Directory Domain Services
	Add all eligible storage to the cluster.
	To continue, click Next.
	< <u>P</u> revious <u>N</u> ext > Cancel

Adding Storage to the Cluster

1. In Failover Cluster Manager, navigate to Cluster -> Storage -> Disks. Click Add Disk in the Actions panel, choose StarWind disk from the list and confirm the selection.

囓	Failover Cl	uster Ma	nager					_		\times
File	Action	View	Help							
(ا 🖄									
眼F	ailover Clu	uster Mar				1 .				
~ #	Produc	tion.stan	Add Disks to a Cluster				×			
	Roles									-
	🖌 📩 v 🚵	age Disks	Available disks:	Available disks:						•
		Pools	Resource Name	Disk Info	Capacity	Signature/Id		-		•
	🕮 Net	Enclosur	🗠 📇 Cluster Disk 1	Disk 1 on node WIN-SW1	100 GB	{cffdc497-c0a7-4a95-8113-9973e3dd59c5}				
		ster Even								
						OK	Cancel			
		l								

2. To configure the cluster witness disk, right-click on Cluster and proceed to More



Actions -> Configure

體 Configure Cluster Quorum Wizard					
Before Y	ou Begin				
Before You Begin Select Quorum Configuration Option Configure Cluster Quorum Settings Summary	This wizard guides you through configuring the quorum for your failover cluster. The relevant cluster elements are the nodes and, in some quorum configurations, a disk witness or file share witness. The quorum configuration affects the availability of your cluster. A sufficient number of cluster elements must be online, or the cluster 'loses quorum' and must stop running. Note that the full function of a cluster depends not only on the quorum, but also on the capacity of each node to support the clustered roles. Important: Run this wizard only if you have determined that you need to change the quorum configuration for your cluster. When you create a cluster, the cluster software automatically chooses a quorum configuration that will provide the highest availability for your cluster. To continue, click Next. Failover Cluster Quorum and Witness Configuration Options Do not show this page again				
	Next > Cancel]			

3. Follow the wizard and choose the Select the quorum witness option. Click Next.

體 Configure Cluster Quorum Wizard						
Select Q	uorum Configuration Option					
Before You Begin Select Quorum Configuration Option Select Quorum Witness Confirmation Configure Cluster Quorum Settings Summary	 Select a quorum configuration for your cluster. Use default quorum configuration The cluster determines quorum management options, including the quorum witness. Select the quorum witness You can add or change the quorum witness. The cluster determines the other quorum management options. Advanced quorum configuration You determine the quorum management options, including the quorum witness. 					
	< Previous Next > Cancel					

4. Select Configure a file share witness. Click Next.



Configure Cluster Quorum Wizard							
Before You Begin Select Quorum Configuration Option	Please select a file share that will be used by the file share witness resource. This file share must not be hosted by this cluster. It can be made more available by hosting it on another cluster.						
Select Quorum Witness	File <u>S</u> hare Path:						
Configure File Share Witness	\\WIN-SW-DC\Quorum]					
Confirmation							
Configure Cluster Quorum Settings							
Summary							
	< <u>P</u> revious <u>N</u> ext > Cancel						

5. Select the file share to be assigned as the cluster witness. Click Next and press Finish to complete the operation.

🗄 Configure Cluster Quorum Wizard X							
Summary	,						
Before You Begin Select Quorum Configuration Option	You have successfully configured the quorum settings for the cluster.						
Select Quorum Witness	Cluster Managed Voting Enabled						
Configure File Share Witness	Witness Type File Share Witness						
Confirmation	Witness Resource						
Configure Cluster Quorum Settings	\\WIN-SW-DC\Quorum						
Summary							
	To view the report created by the wizard, click View Report. To close this wizard, click Finish.						
	<u>E</u> inish						

6. In Failover Cluster Manager, right-click the disk and select Add to Cluster Shared Volumes.



📲 Failover Cluster Manager							- 0	×
File Action View Help								
🗢 🔿 🙎 📰 📓 🖬								
🍓 Failover Cluster Manager	Disks (1)					Act	ions	
Production.starwind.local	Search		Q,	Queries 🔻	. • •	Dis	ks	
Roles	Name	Statue	Assigned To		Owner Nod	2	Add Disk	
V A Storage	Cluster Disk-1		Available Ste	ane	WIN-SW1	L.	Move Available Storage	•
📇 Disks		🔂 Bring Online		ugo		<u>ا</u>	we	
Pools 📑		Take Offline					View	•
Enclosures		Add to Cluster Shared Volu	umes			Q	Refresh	
Networks		h Information Details				?	Help	
		Show Critical Events				Clu	ister Disk 1	
	5	Replication	•				Bring Online	
		More Actions	•			1	Take Offline	
		Demons				3	Add to Cluster Shared Volumes	
		Kemove					Information Details	
		Properties					Show Critical Events	
	<				>	8	Replication	•
							More Actions	•
	👻 者 Clust	ter Disk 1					Remove	
							Properties	
	Volumes (1) -					?	Help	
	CSV1	1 (E)				-		
	NTFS	5 99.9 GB free of 100.0 GB						
	<				>			
	Volumes							
Disks: Cluster Disk 1								

7. If renaming of the cluster shared volume is required, right-click on the disk and select Properties. Type the new name for the disk and click Apply followed by OK



Cluster Disk 1 Properties X							
General	Dependencies	Policies	Advanced	Policies	Shadow Copies		
	<u>N</u> ame: (Type: I Status: (CSV1 Physical Dis Online	sk				
Disk nu	mber: 1						
Volum	ie	Capacity		Free Sp	ace		
E:		100.0 GB		99.9 GE	3		
					<u>R</u> epair		
			ОК	Cance	Apply		

Configuring Cluster Network Preferences

1. In the Networks section of the Failover Cluster Manager, right-click on the network from the list. If required, set its new name to identify the network by its subnet. Apply the change and press OK.



Failover Cluster Manager			- 🗆 X		
Failover Cluster Manager	Networks (2)	Cluster Network 1 Properties X	S		
Roles	Search Name Cluster Network 1 Cluster Network 2 Cluster Network 2	General	ve Migration Settings		
Storage Bisks Pools		Name:	efresh		
Enclosures		Storage Network	elp		
题 Cluster Events		 Allow cluster network communication on this network Allow clients to connect through this network 	formation Details		
		O Do not allow cluster network communication on this network	roperties		
				Status: Up Subnets: 172.16.0.0/16	elp
		OK Cancel Apply			
	Summary Network Con	nections			
Networks: Cluster Network 1					

NOTE: Please double-check that cluster communication is configured with redundant networks:

https://docs.microsoft.com/en-us/windows-server/failover-clustering/smb-multichannel

2. Rename other networks as described above, if required.

📲 Failover Cluster Manager					- 🗆	×	
File Action View Help							
🗢 🄿 🙍 📰 🚺							
Railover Cluster Manager	Networks (2)				Actions		
Production.starwind.local Roles	Search		P Que	eries 🔻 🕞 👻 👻	Networks	-	
Nodes	Name	Status	Cluster Use	Information	🖳 Live Migration Settings		
🗸 📇 Storage	Storage Network	🕜 Up	Cluster Only		View	•	
Disks	Hanagement	🕥 Up	Cluster and Client		Q Refresh		
Enclosures					👔 Help		
Networks					Management		
Cluster Events					Information Details		
					B Show Critical Events		
					Properties		
					Help		
				>			
	V Management						
	Name		5	Status ^			
	🖃 🌉 WIN-SW2 - LAN		(🕑 Up			
	Adapter: Intel(R) 82574	L Gigabit Network C	onnection				
	IP V4 Addresses: 192.1	68.1.3		_			
	Adapter: Intel/R) 82574	I Ginabit Network C	onnection (🕦 Up			

The cluster configuration is completed and it is ready for virtual machines deployment.



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Select Roles and in the Action tab, click Virtual Machines -> New Virtual Machine. Complete the wizard.

Conclusion

The StarWind NVMe-oF Initiator installation guide provides a comprehensive method for IT professionals to set up a Microsoft failover cluster with enhanced performance and reliability using NVMe over Fabrics technology. This setup is crucial for environments requiring high-speed shared storage and failover capabilities, contributing significantly to the efficiency of server infrastructures.



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