

QTS Fibre Channel

Getting Started Guide

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1. Preface

Audience

This document is intended for NAS administrators who want to learn how to use Fibre Channel with QTS. The document assumes that the reader has existing knowledge of storage, LUN, and iSCSI concepts.

Disclaimer

This document contains examples and recommended best practices only. Not every recommendation can or should be followed. You should carefully review each example or recommendation to determine whether it is suitable for your environment before starting to implement it.

2. Introduction

Fibre Channel with QTS is a reliable, scalable and budget-friendly Storage Area Network (SAN) solution. By installing one or more Fibre Channel cards into your QNAP NAS, you can easily create a new Fibre Channel SAN or integrate the NAS into an existing SAN environment, while enjoying QTS features such as snapshot protection, Qtier auto-tiering storage, SSD cache acceleration, and more.

Benefits of Using Fibre Channel with QTS

- **Easy to use:** Configure storage settings with iSCSI & Fibre Channel. This QTS utility is user-friendly and provides sensible default options, making it simple to configure small or large Fibre Channel networks.
- **Support for both Fibre Channel and iSCSI:** Move a LUN from an iSCSI network to a Fibre Channel network and back again, allowing you to give clients temporary access to SAN data without buying additional Fibre Channel equipment.
- **Snapshots for Fibre Channel LUN protection:** Quickly revert an iSCSI or Fibre Channel LUN to a previous state in the event of accidental deletion or modification of data.
- **Snapshot Clone:** Create a copy of a LUN from a snapshot, then map the copy using iSCSI or Fibre Channel.
- **Snapshot Replica:** Back up a LUN to another QNAP NAS using snapshots.
- **Qtier™:** Improve the performance of iSCSI and Fibre Channel LUNs and lower total storage costs with automatic data tiering.
- **SSD Cache Acceleration:** Improve the performance of iSCSI and Fibre Channel LUNs with caching.
- **Varied applications:** QTS supports a wide range of applications, including virtualization. A virtual machine running on QTS in Virtualization Station can access a Fibre Channel LUN snapshot and restore data, all on the NAS without using the LAN.

Compatibility

QTS with Fibre Channel requires the NAS and each client to have a compatible Fibre Channel adapter (known as a Host Bus Adapter or HBA). The client and NAS can be connected directly, or you can use a Fibre Channel switch for larger SAN networks with multiple clients. Requirements:

- A compatible QNAP NAS running QTS 4.4.1 or later.
- A compatible Fibre Channel adapter installed in the NAS.



Note

- For a list of compatible NAS devices and Fibre Channel adapters, see <https://www.qnap.com/solution/fibrechannel-san>.
- QNAP highly recommends using Fibre Channel transceivers and Fibre Channel cards with matching native speeds. For example, a 32Gb/s Fibre Channel card should be paired with a 32Gb/s transceiver. Using Fibre Channel cards or transceivers in backwards-compatibility mode may result in compatibility problems.
- Some transceivers may not work when used with an adapter from a different manufacturer.

- QTS does not support Fibre Channel tape libraries.

3. Fibre Channel Overview

Introduction to Fibre Channel

Fibre Channel is a protocol used to transfer data and disk commands between storage servers and storage clients. It is very high-bandwidth and low-latency, allowing servers to access large remote disks as if they were local disks. Fibre Channel does not use standard network equipment and instead requires specialized hardware.

General Fibre Channel Information

- Each Fibre Channel port is a Fibre Channel initiator or a Fibre Channel target. The user selects the role, it cannot be both at the same time.
- Each Fibre Channel port is identified by a unique World Wide Port Name (WWPN).
- Fibre Channel target and LUN access controls are based on WWPNs.
- Each WWPN can have an optional user-defined alias, to make identifying and managing the port easier.

Fibre Channel Hardware

Hardware	Description	Also Known As
Fibre Channel adapter	A device, usually a card, that enables Fibre Channel clients and storage servers to connect to each other.	Host Bus Adapter, HBA
Transceiver	A component that transforms a digital signal into light, located at the end of the optical cable. Transceivers are usually included when you buy a Fibre Channel adapter or Fibre Channel switch.	
Optical cable	A cable that connects two transceivers.	Optical fiber cable, fiber optic cable
Fibre Channel switch	A switch that enables multiple Fibre Channel devices to connect to each other, creating a network known as a Fibre Channel fabric.	

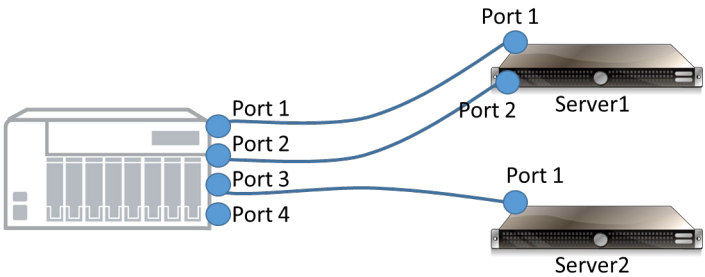


Note

QTS does not support Fibre Channel tape libraries.

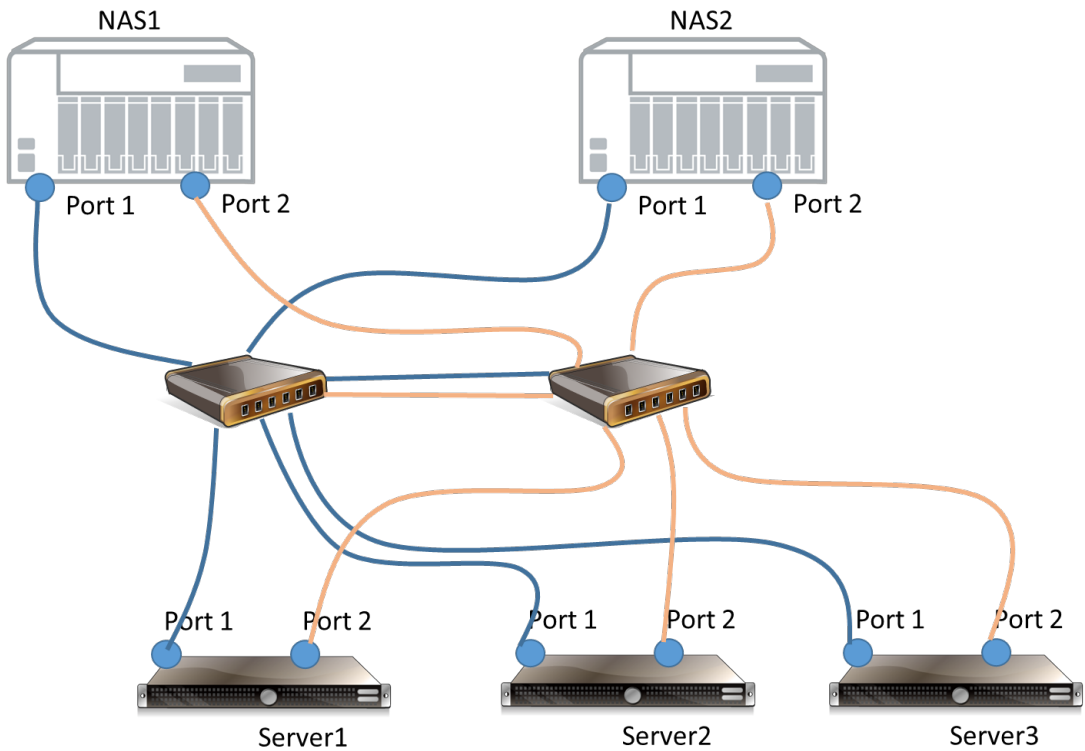
Direct Connection

You can connect Fibre Channel clients to a QNAP NAS directly, using one or more cables.



Connection using a Fibre Channel Switch

You can connect Fibre Channel clients to a QNAP NAS using one or more Fibre Channel switches.

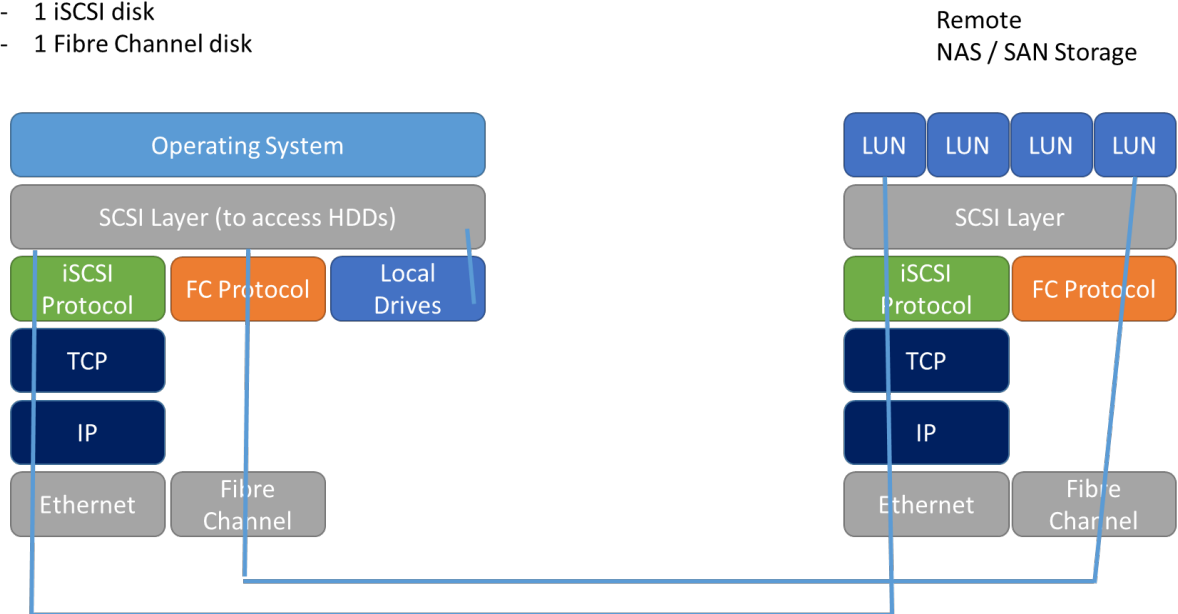


Comparison of Fibre Channel and iSCSI

iSCSI and Fibre Channel are similar in use. For both protocols, you create a LUN on the remote storage server, connect the client to the LUN using the specified protocols, then client can use the LUN as a local disk.

Example of a Computer with 3 Hard Drives :

- 1 local disk
- 1 iSCSI disk
- 1 Fibre Channel disk



Summary of Differences

- Fibre Channel uses dedicated network hardware, which means there are less layers from the client to the storage server compared to iSCSI.
- Each Fibre Channel port can be a target, which means that every Fibre Channel client connects to the same target. LUN masking can limit which clients can access each LUN, and zoning on the Fiber Channel switch can limit which Fibre Channel devices are able to connect to each other. Zoning is described later in this document.
- Each iSCSI client must connect to a specific target and LUN, which can be protected using passwords (CHAP), an iSCSI target access control list (ACL), and LUN masking.

Comparison Table

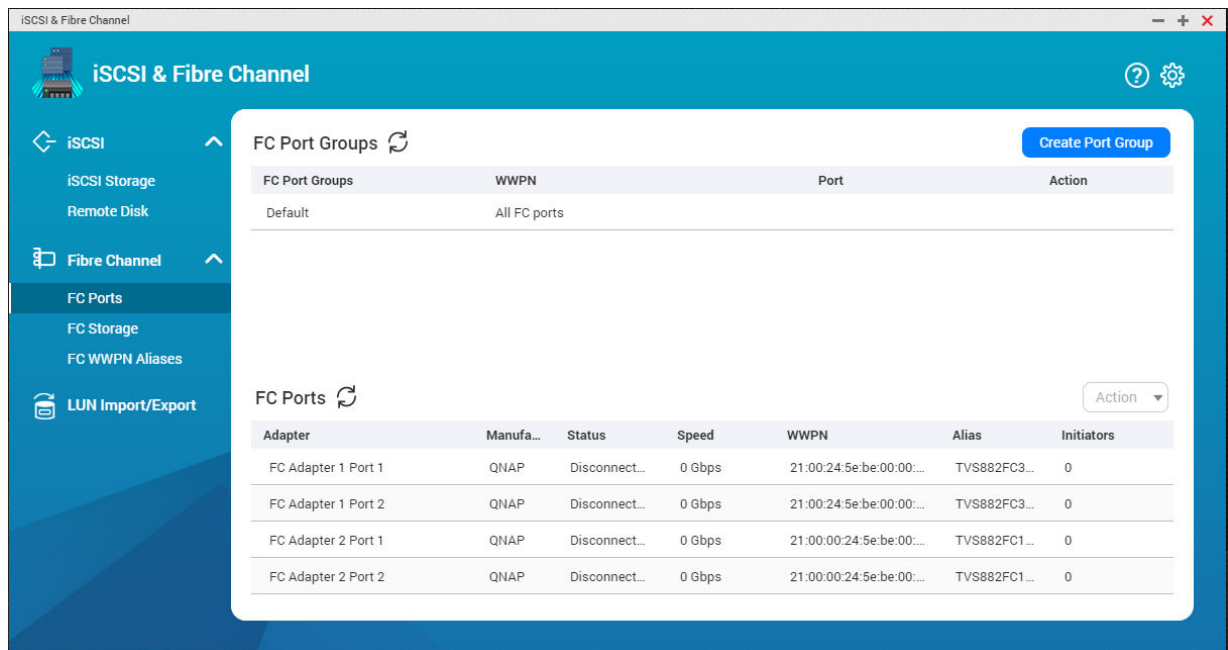
	iSCSI	Fibre Channel
Infrastructure	Existing Ethernet equipment and cabling	Dedicated Fibre Channel equipment and cabling
Layers	More	Fewer
IP Addresses	Yes	No
CPU usage	Higher	Lower
Latency	Higher	Lower
Common speeds	1 Gb/s, 10 Gb/s, 25 Gb/s, 40 Gb/s	4 Gb/s, 8 Gb/s, 16 Gb/s, 32 Gb/s
Most common speed (August 2019)	10 Gb/s	16 Gb/s
Multipath I/O support	Yes	Yes
Default behavior before configuration	Client connects to a specific iSCSI target and can see all LUNs mapped to the target	Client connects to every target and sees every LUN in the Fibre Channel fabric

	iSCSI	Fibre Channel
Target access security	CHAP, mutual CHAP, target ACL	Zoning, port binding
LUN access security	LUN masking	LUN masking

4. Fibre Channel Management in QTS

iSCSI & Fibre Channel

iSCSI & Fibre Channel is a QTS utility that enables you to configure iSCSI and Fibre Channel storage settings on your NAS. To access it, go to **Main Menu > iSCSI & Fibre Channel**



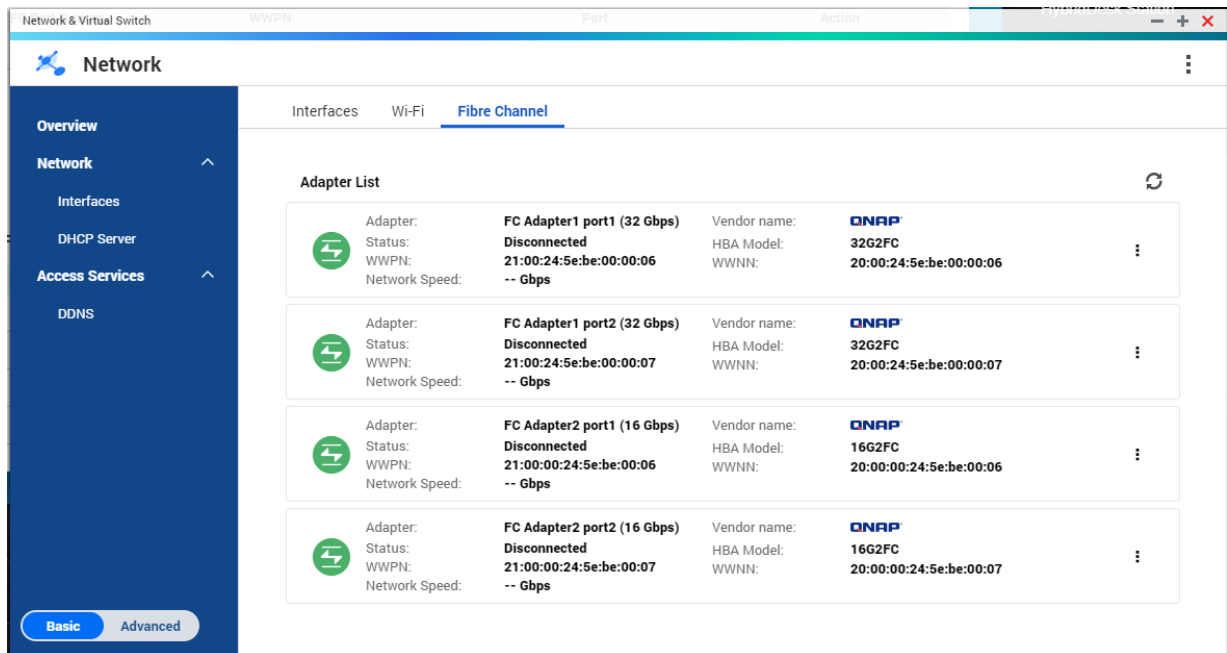
Fibre Channel Management

- In iSCSI & Fibre Channel, each Fibre Channel port is a target. In some scenarios, it is necessary to map a LUN to multiple Fibre Channel ports to allow multipathing and enable failover if cable or a switch fails. This can be done using Fibre Channel port groups, which are described in more detail in [Scenario 3: One NAS, Two Clients, Two Cables \(Port Groups\)](#).
- There is one default port group named `Default` that contains all of the Fibre Channel ports on the NAS. When a LUN is mapped to this default port group, the LUN can be accessed through any Fibre Channel port.
- Individual LUN access can be controlled using LUN masking, which is configured on the **FC Storage** screen. page (explained later). LUN masking is an authorization method that makes a LUN visible to some Fibre Channel initiators and invisible to other initiators, based on their WWPNs. For more details on LUN masking, see [Scenario 4: One NAS, Multiple Clients, One Fibre Channel Switch \(LUN Masking\)](#).

5. Simple Scenarios

The simple scenarios in this chapter all use one QNAP NAS with the following 2 Fibre Channel adapters installed in it:

- 1 x 16Gb/s Fibre Channel adapter, 2 ports
- 1 x 32Gb/s Fibre Channel adapter, 2 ports



Note

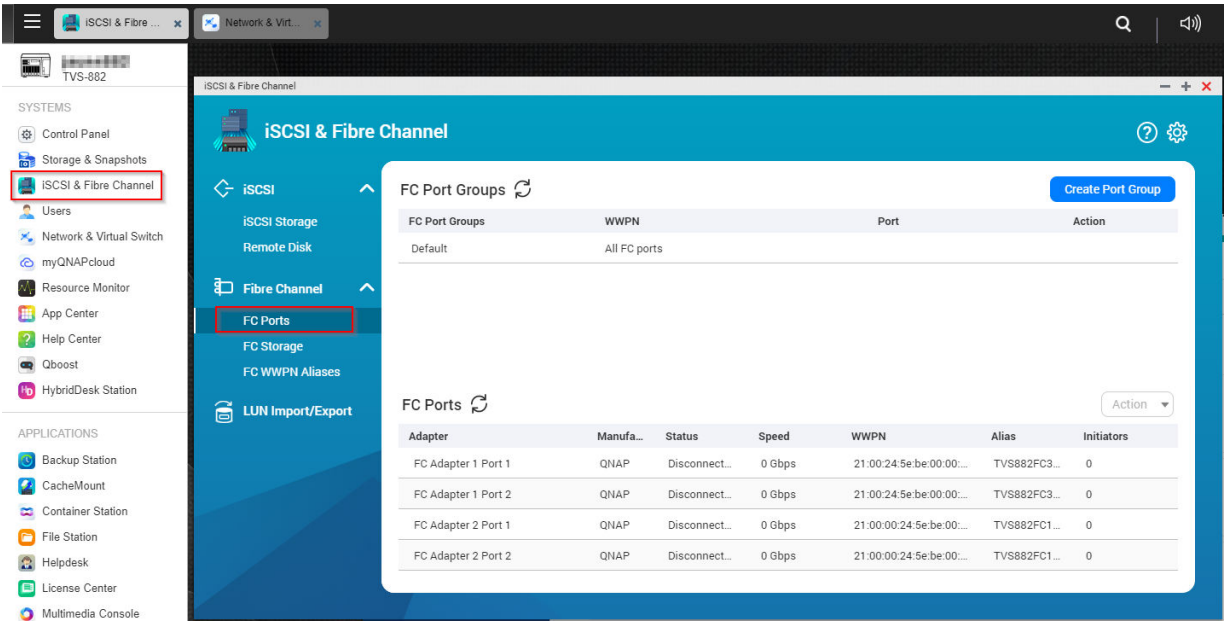
- **Network & Virtual Switch** displays installed Fibre Channel adapters in a separate tab.
- The Fibre Channel adapter information in **Network & Virtual Switch** is read-only. To configure Fibre Channel adapters, use **iSCSI & Fibre Channel**.

Scenario 1: One NAS, One Client, One Cable

In this scenario, one Fibre Channel client is connected directly to the NAS using one optical cable. The configuration is very simple; you only need to connect the cable, create a LUN, and then map the LUN to a port.

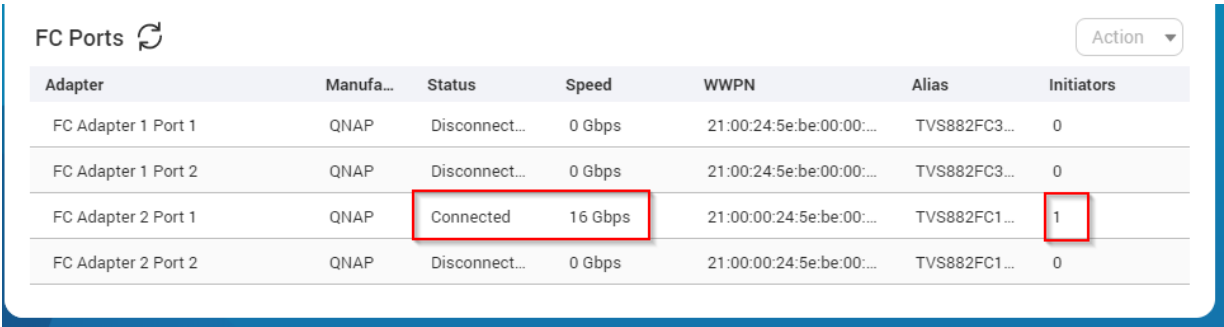
Connecting a Server to the NAS Using One Cable

1. Go to **Main Menu > iSCSI & Fibre Channel > Fibre Channel > FC Ports**.

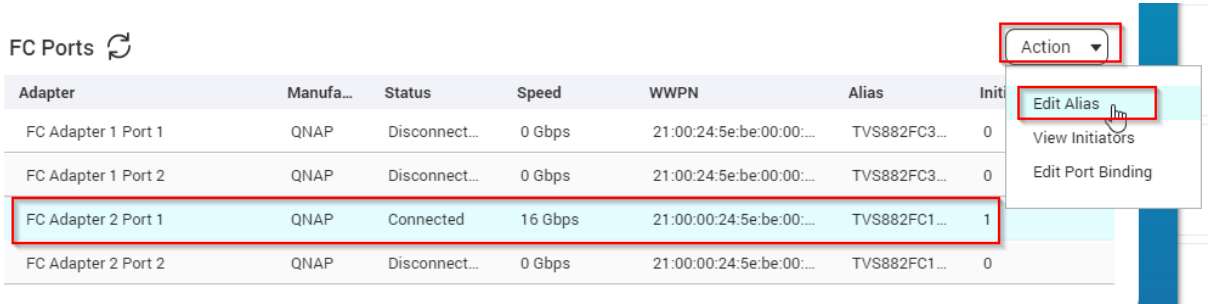


On this screen you can see the two installed Fibre Channel adapters. No initiators are connected because no cables are connected yet.

- 2. Connect port 1 on the 16 Gb/s Fibre Channel adapter to the client server using an optical cable. iSCSI & Fibre Channel shows one connected Fibre Channel initiator.





- 3. Optional: Set an alias for the Fibre Channel port.
Aliases help you to identify ports and clients more easily.
 - a. Select the port.
 - b. Click **Action**, and then select **Edit Alias**.



The **Edit Alias** window opens.

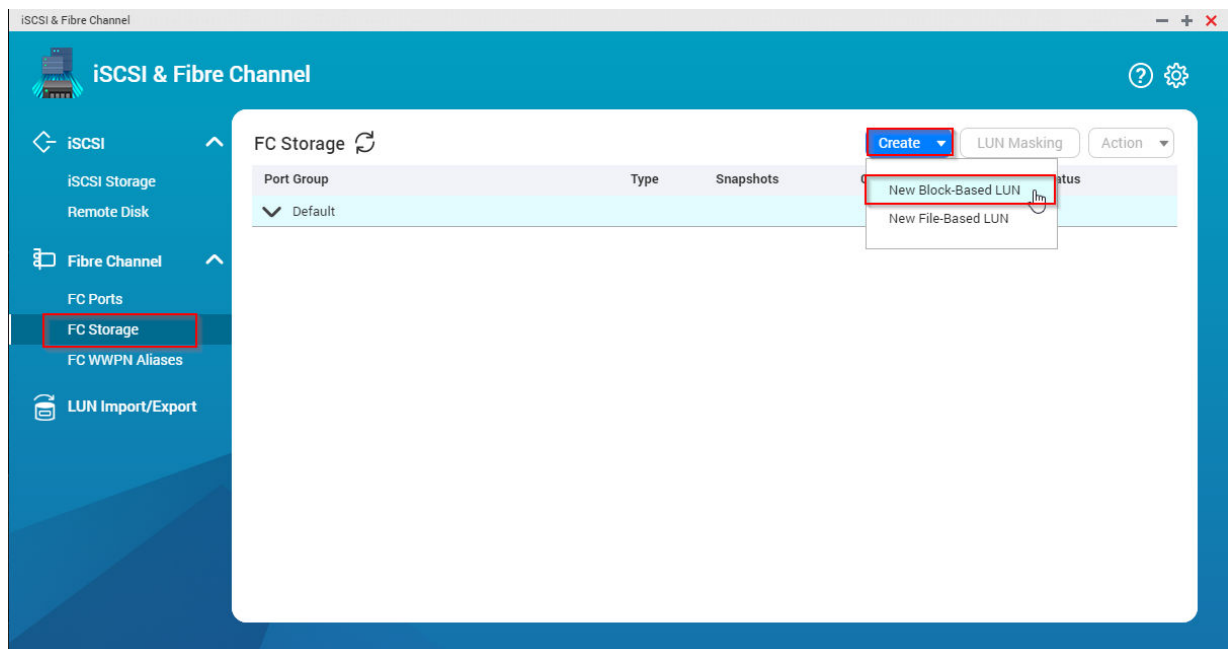
- c. Specify an alias.
- d. Click **OK**.

FC Ports 

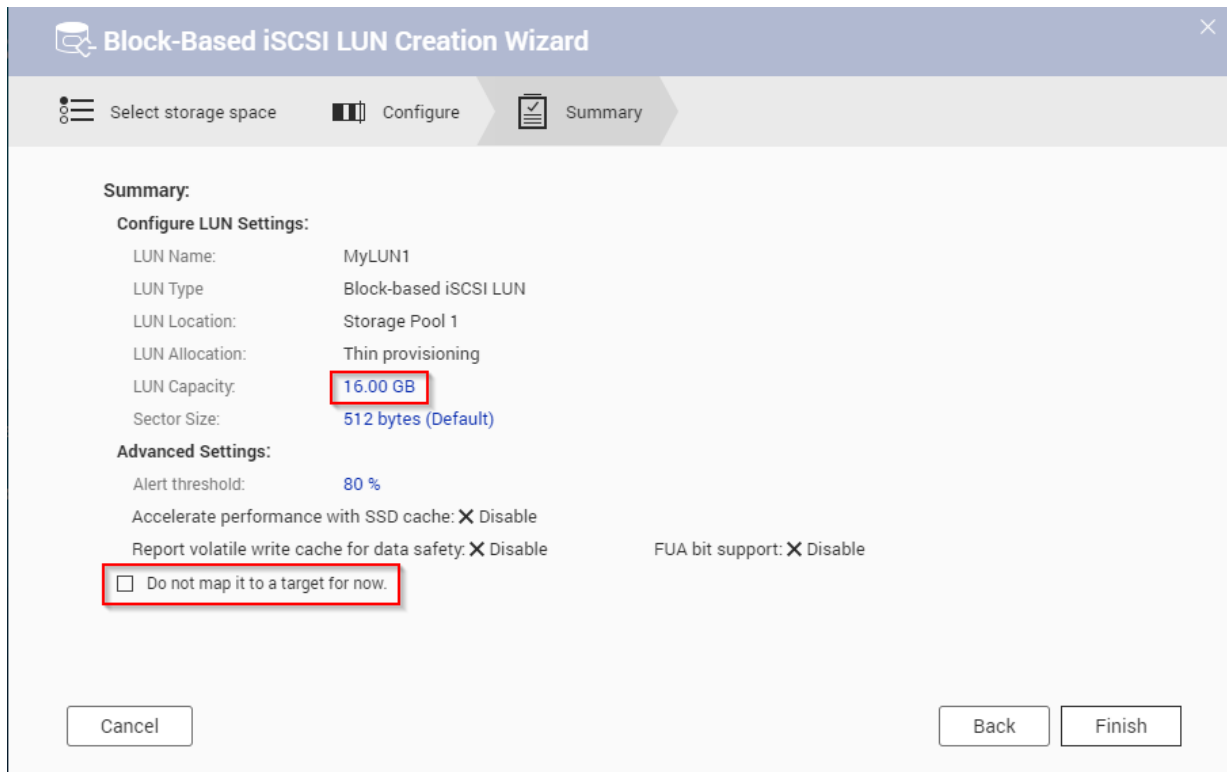
Action 

Adapter	Manufa...	Status	Speed	WWPN	Alias	Initiators
FC Adapter 1 Port 1	QNAP	Disconnect...	0 Gbps	21:00:24:5e:be:00:00:...	TVS882FC3...	0
FC Adapter 1 Port 2	QNAP	Disconnect...	0 Gbps	21:00:24:5e:be:00:00:...	TVS882FC3...	0
FC Adapter 2 Port 1	QNAP	Connected	16 Gbps	21:00:00:24:5e:be:00:...	TVS882FC1...	1
FC Adapter 2 Port 2	QNAP	Disconnect...	0 Gbps	21:00:00:24:5e:be:00:...	TVS882FC...	0

4. Create a block-based LUN.



- a. Go to **Main Menu > iSCSI & Fibre Channel > Fibre Channel > FC Storage**.
- b. Click **Create**, and then select **New Block-Based LUN**.
- c. Following the wizard, specifying your custom settings.
For more details on creating a LUN, see the QTS User Guide.
- d. On the **Summary** screen, deselect **Do not map it to a target for now**.
Deselecting this setting will open the LUN mapping wizard automatically after the LUN has been created, allowing you map the LUN to a FC port group immediately.



The image shows the 'Block-Based iSCSI LUN Creation Wizard' window, specifically the 'Summary' tab. The window has a title bar with a close button (X) and a navigation bar with three tabs: 'Select storage space', 'Configure', and 'Summary'. The 'Summary' tab is active, showing a list of configuration settings. Under 'Configure LUN Settings:', the settings are: LUN Name: MyLUN1, LUN Type: Block-based iSCSI LUN, LUN Location: Storage Pool 1, LUN Allocation: Thin provisioning, LUN Capacity: 16.00 GB (highlighted with a red box), and Sector Size: 512 bytes (Default). Under 'Advanced Settings:', the settings are: Alert threshold: 80 %, Accelerate performance with SSD cache: X Disable, Report volatile write cache for data safety: X Disable, FUA bit support: X Disable, and a checkbox labeled 'Do not map it to a target for now.' (highlighted with a red box). At the bottom, there are three buttons: 'Cancel', 'Back', and 'Finish'.

Block-Based iSCSI LUN Creation Wizard

Select storage space | Configure | **Summary**

Summary:

Configure LUN Settings:

LUN Name: MyLUN1

LUN Type: Block-based iSCSI LUN

LUN Location: Storage Pool 1

LUN Allocation: Thin provisioning

LUN Capacity: **16.00 GB**

Sector Size: 512 bytes (Default)

Advanced Settings:

Alert threshold: 80 %

Accelerate performance with SSD cache: X Disable

Report volatile write cache for data safety: X Disable

FUA bit support: X Disable

☐ Do not map it to a target for now.

Cancel Back Finish

e. Click **Finish**.

QTS creates the LUN, then the **Edit LUN Mapping** window opens.

5. In the **Edit LUN Mapping** window, select **Map to FC port group**.

Edit LUN Mapping (MyLUN1)

Edit the LUN's mapping.

The LUN can only be mapped to one iSCSI target or Fibre Channel port group at a time.

Mapping the LUN to a new target will automatically unmap it from its current iSCSI target or FC port.

☐ Unmap from current target
☒ Map to FC port group
☐ Map to iSCSI target

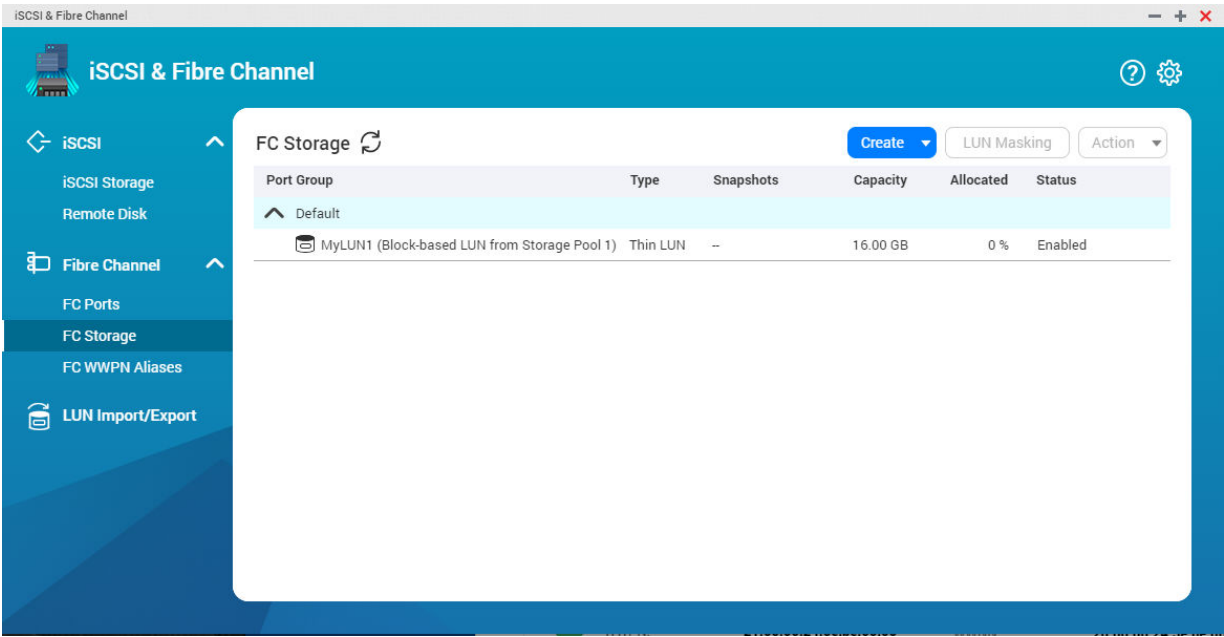
FC Port Groups

- ☒ All FC ports

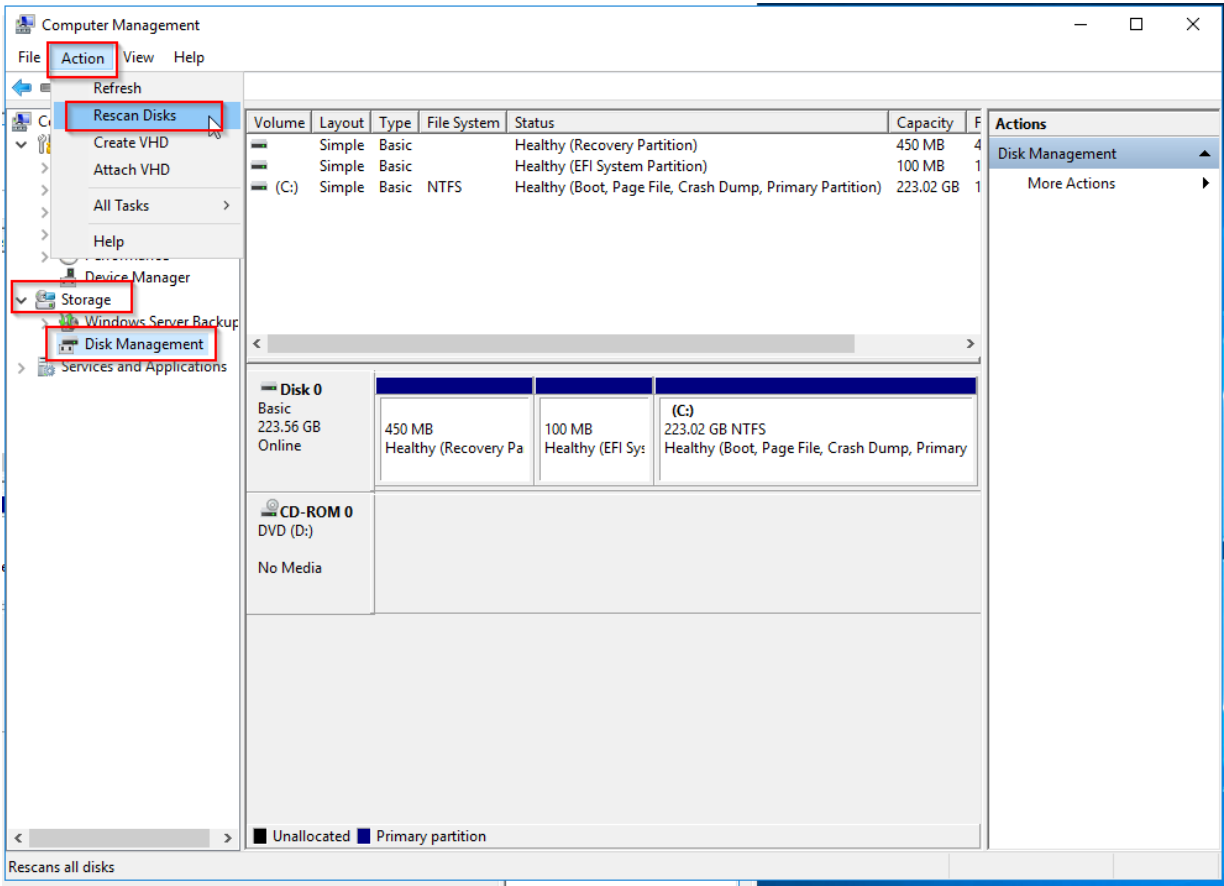
☒ Enable LUN and do not configure LUN masking (Every FC initiator will see the LUN)
☐ Keep LUN disabled and configure LUN masking in the next step

OK Cancel

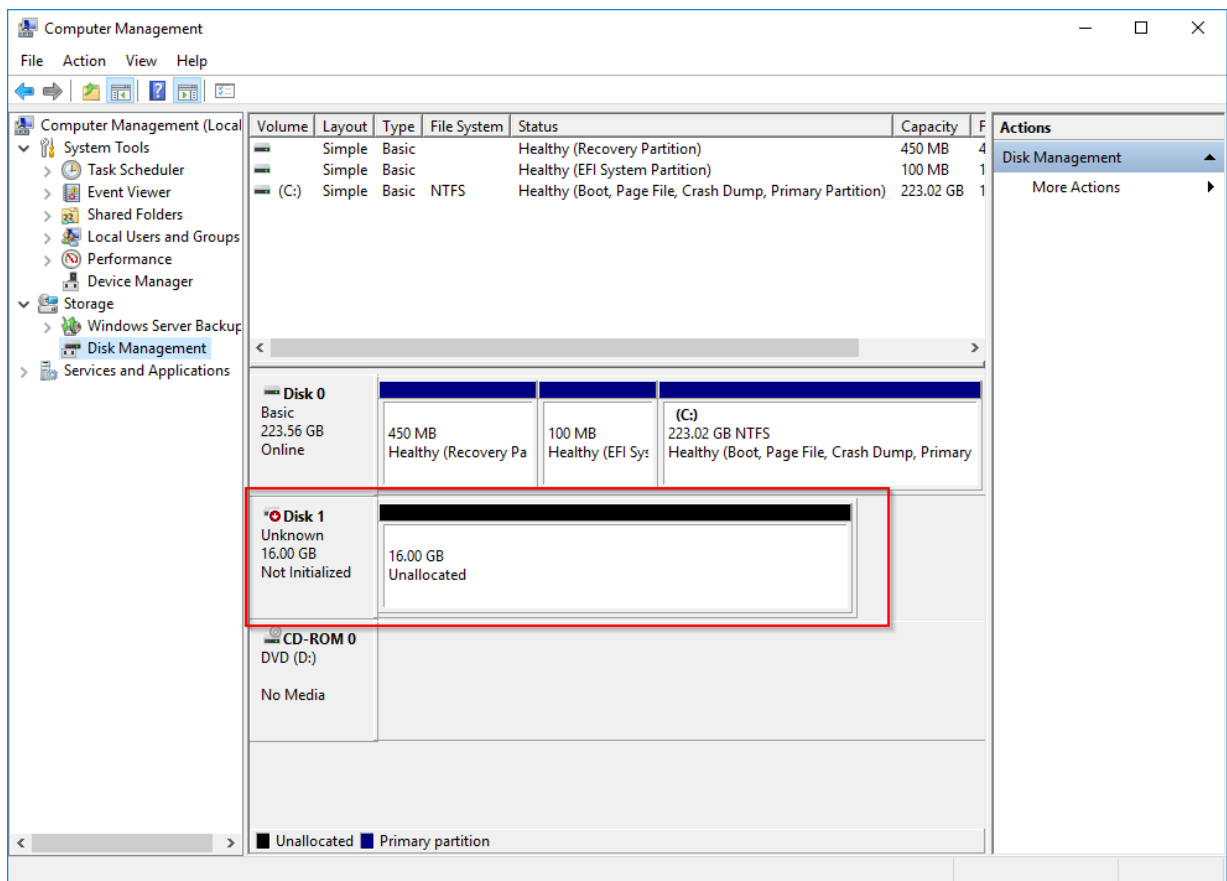
6. Under **FC Port Groups**, select **All FC Ports**.
This is the default port group.
7. Select **Enable LUN and do not configure LUN masking**.
There is only one Fibre Channel client, so you do not need to configure LUN masking for security.
8. Click **OK**.
The LUN appears mapped to the default group at **Main Menu > iSCSI & Fibre Channel > Fibre Channel > FC Storage**.



9. On the Windows client server, rescan disks.



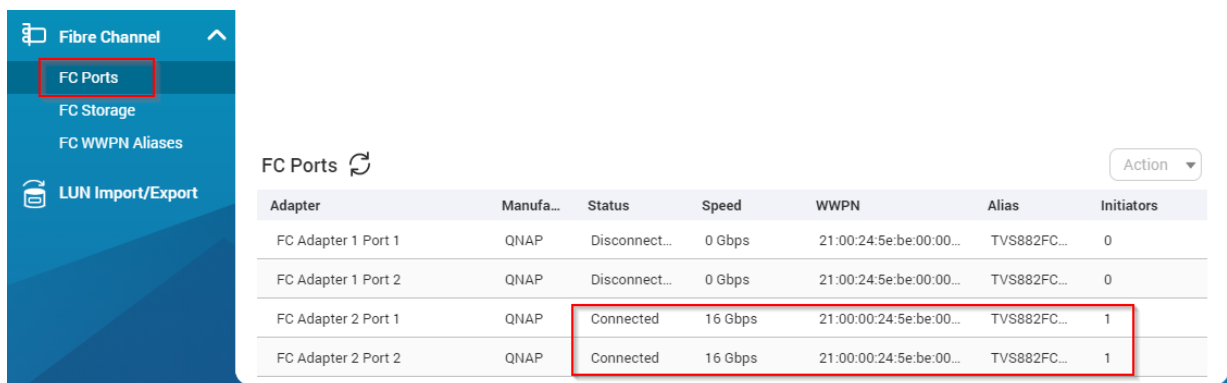
The LUN appears as a local disk, ready to be initialized and formatted.



10. Optional: To add another LUN to the client, create another LUN on the NAS, map it to the default port group, and then rescan disks in Windows

Scenario 2: One NAS, One Client, Two Cables (Multipath I/O)

In this scenario, one client is connected directly to two ports on the NAS using two optical cables. The client is then configured for multi-path I/O (MPIO). MPIO provides failover - if one cable is disconnected, the LUN remains connected through the other cable.



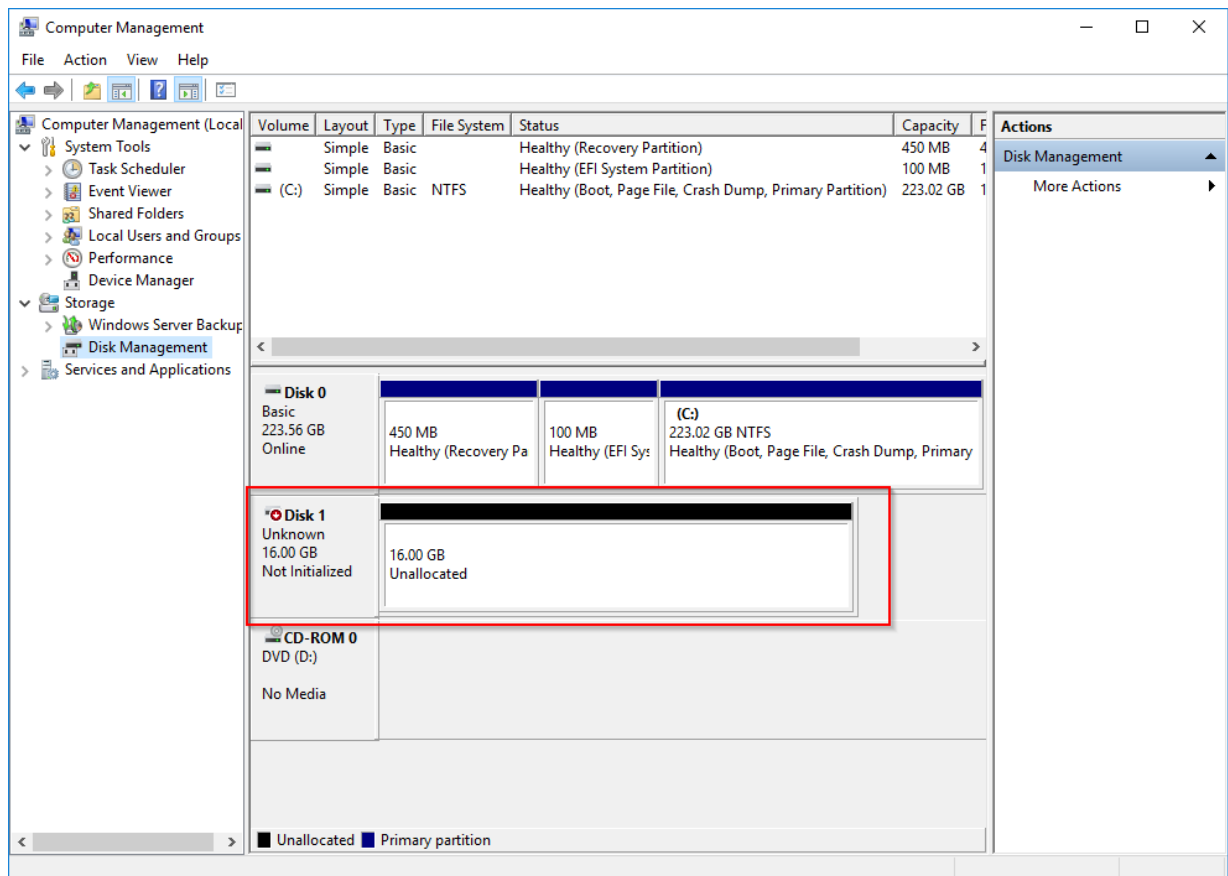
Configuring MPIO in Windows Server 2016



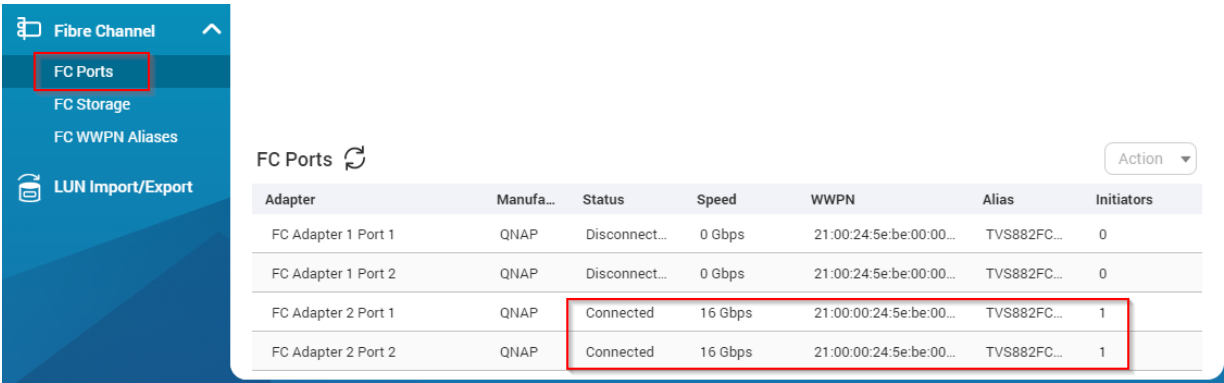
Note

- The following steps show how to configure multipath I/O (MPIO) in Windows Server 2016. For other operating systems, refer to the operating system documentation.
- Usually MPIO only needs to be configured once. Adding additional LUNs will not require further reconfiguration.
- This QNAP tutorial describes configuring MPIO between a QNAP NAS and a client connected using iSCSI: http://files.qnap.com/news/pressresource/product/How_to_connect_to_your_QNAP_Turbo_NAS_from_Windows_Server_2012_using_MPIO.pdf

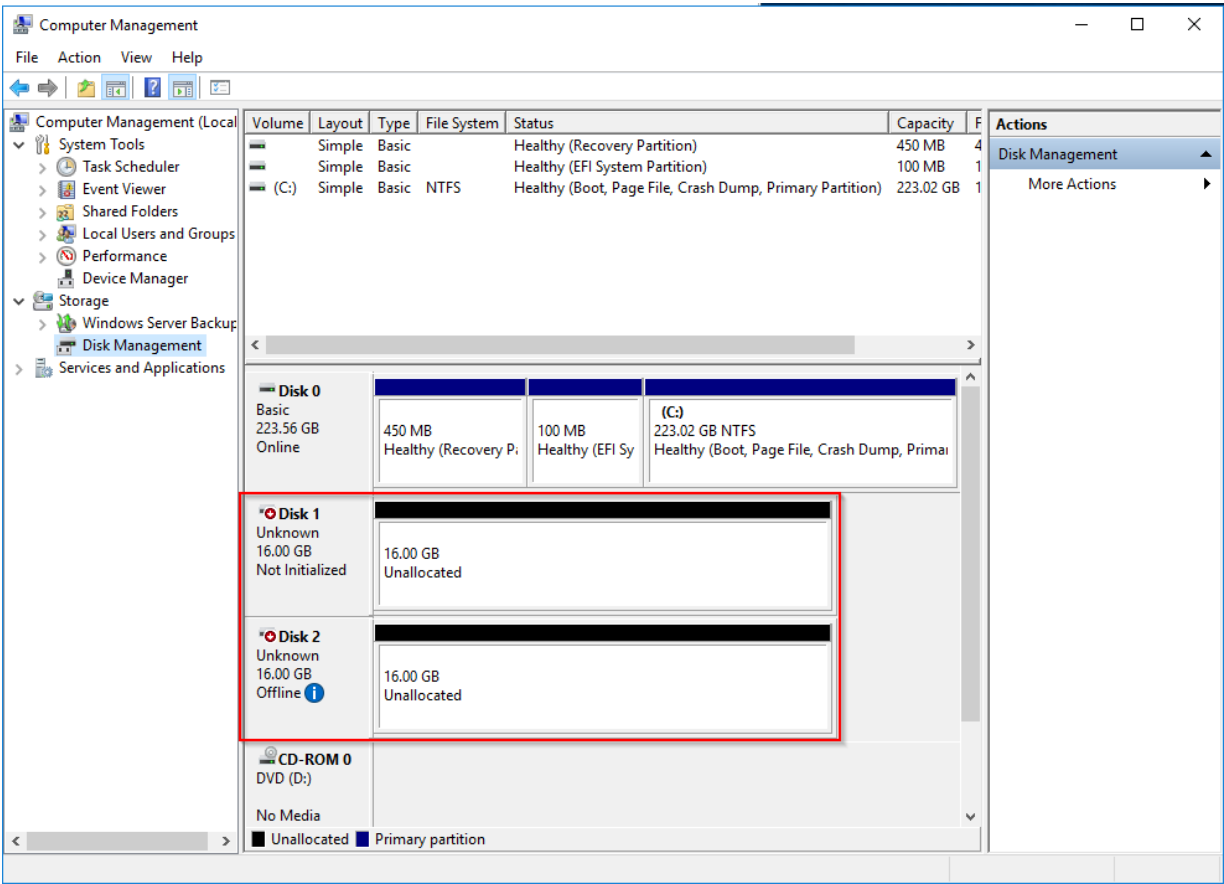
1. Follow all the steps in [Connecting a Server to the NAS Using One Cable](#).
The NAS and client are connected by one optical cable, and the client can access a NAS LUN.



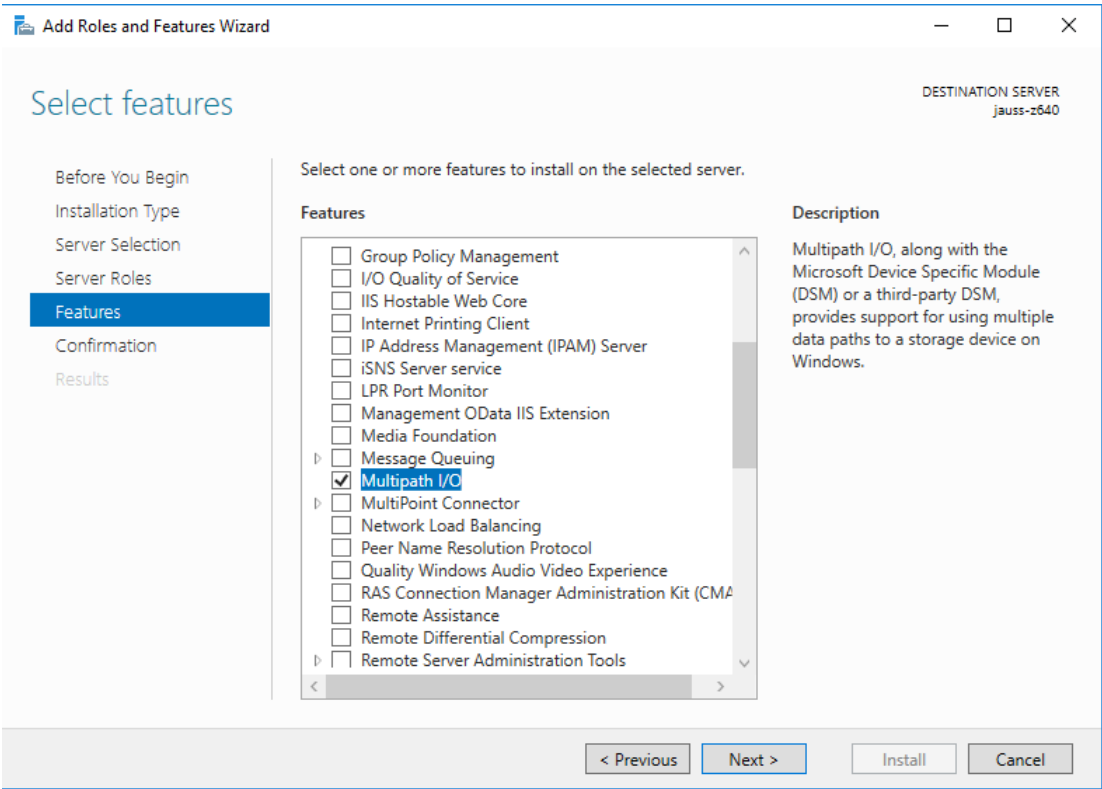
2. Connect the client to the NAS using a second optical cable.
iSCSI & Fibre Channel shows two connected Fibre Channel initiators.



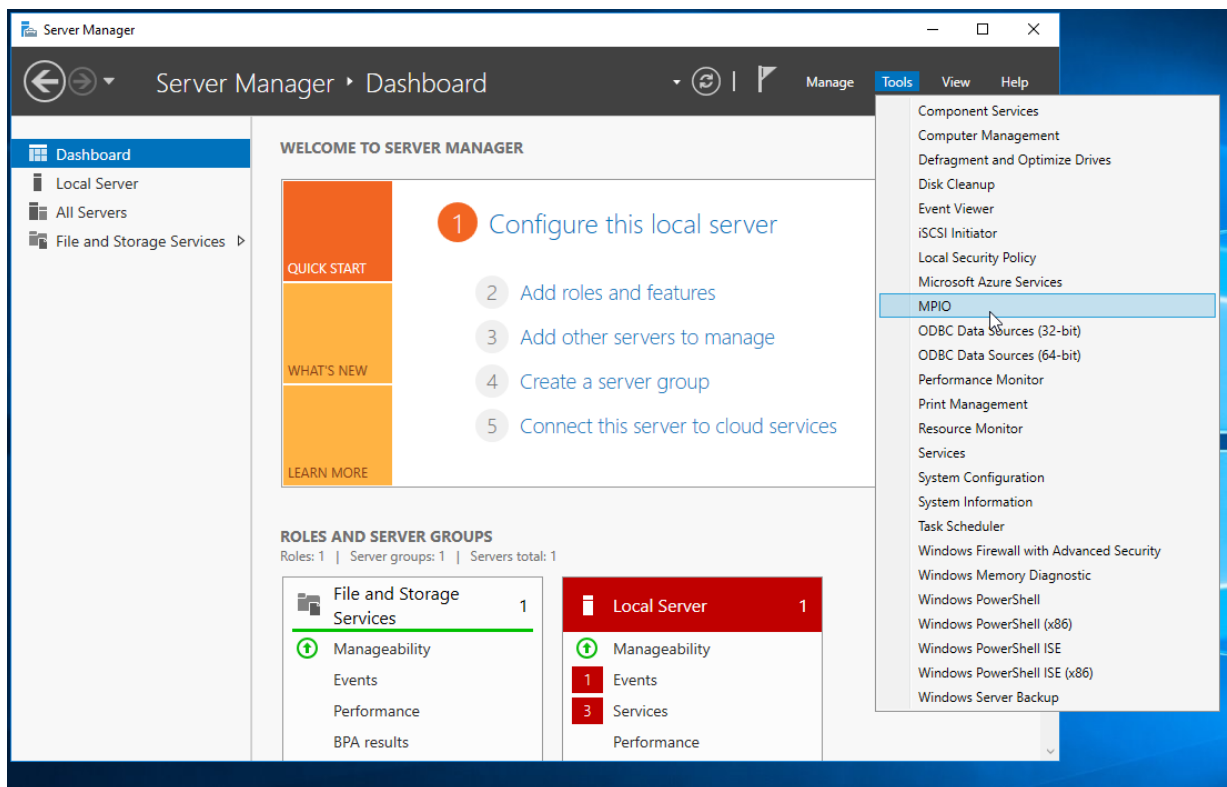
The Windows client sees the LUN twice, because multipath I/O is not configured.



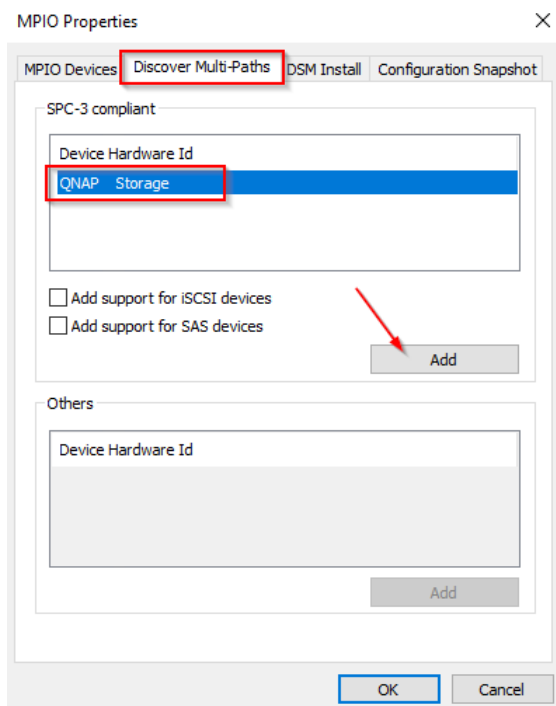
- 3. In Windows Server 2016, open **Server Manager** and then click **Add roles and features**. The **Add Roles and Features Wizard** opens.
- 4. On the **Features** screen, select **Multipath I/O**.



5. Finish the wizard, then restart the server if required.
6. Go to **Server Manager > Dashboard** .
7. Click **Tools**, and then select **MPIO**.

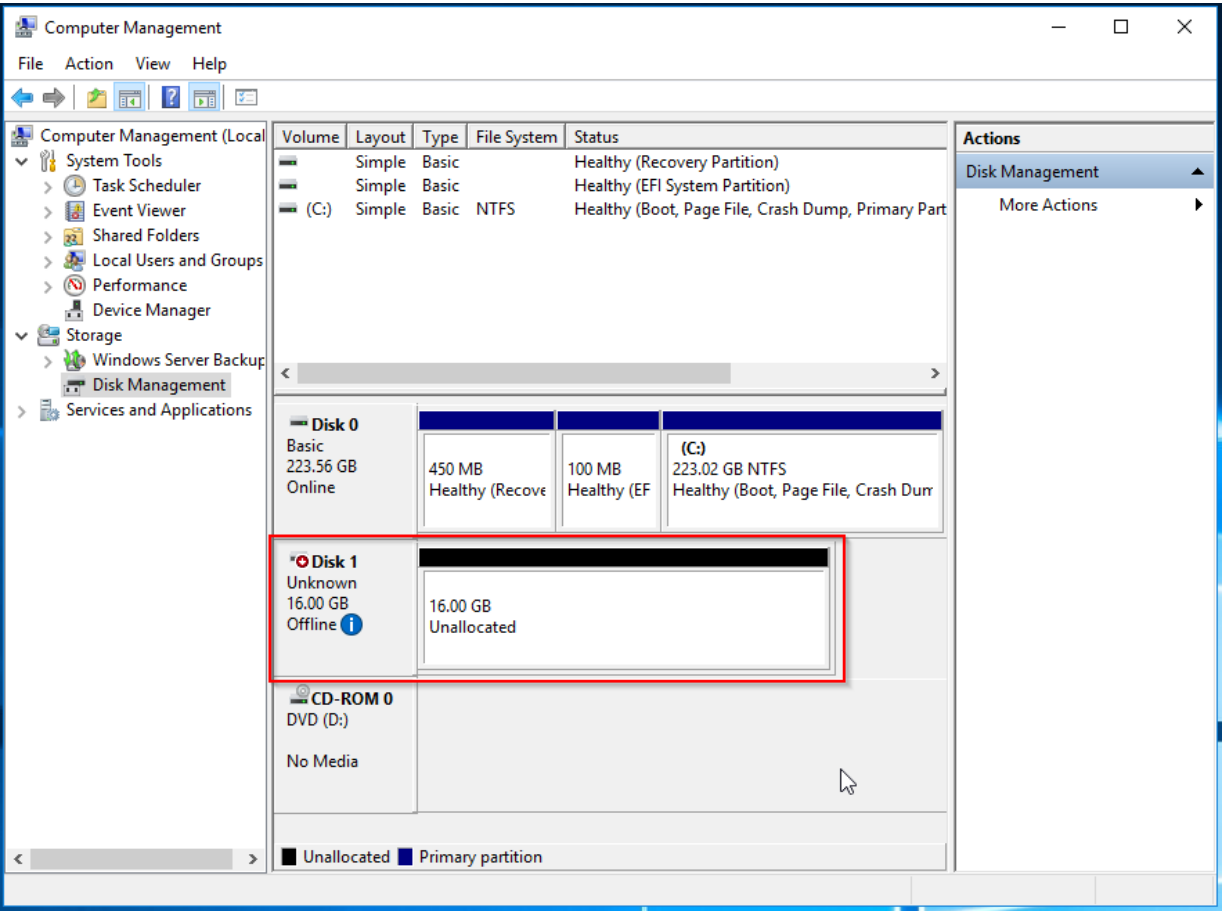


8. Go to **MPIO Properties > Discover Multi-Paths** .
9. Select **QNAP Storage**, and then click **Add**.

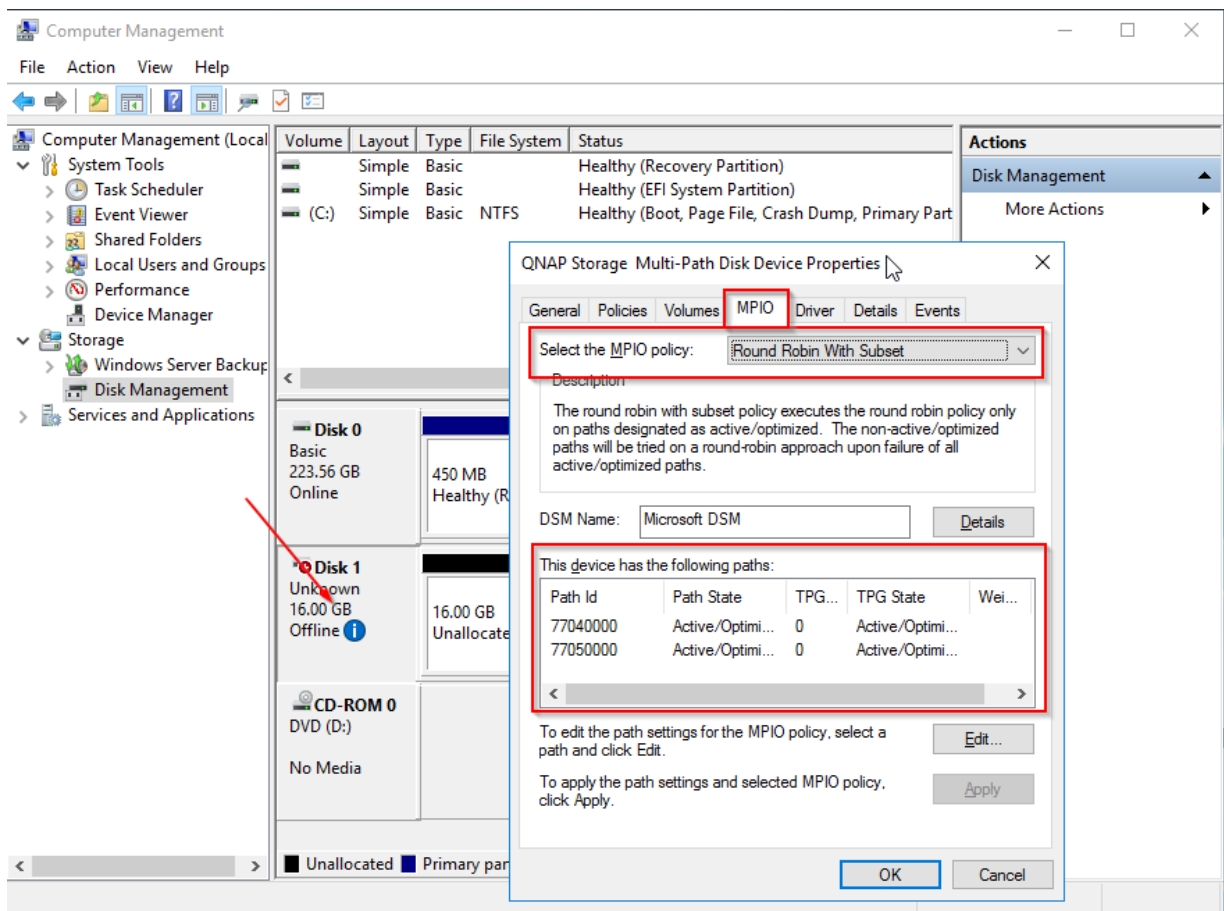


10. Restart the Windows server when prompted.

After the server has restarted, you can only see one LUN.



- 11. In **Disk Management**, right-click on the LUN and then select **Properties**.
- 12. Go to **MPIO**.
You can view and modify the current MPIO policy on this tab.
The information window shows multiple paths to the LUN.



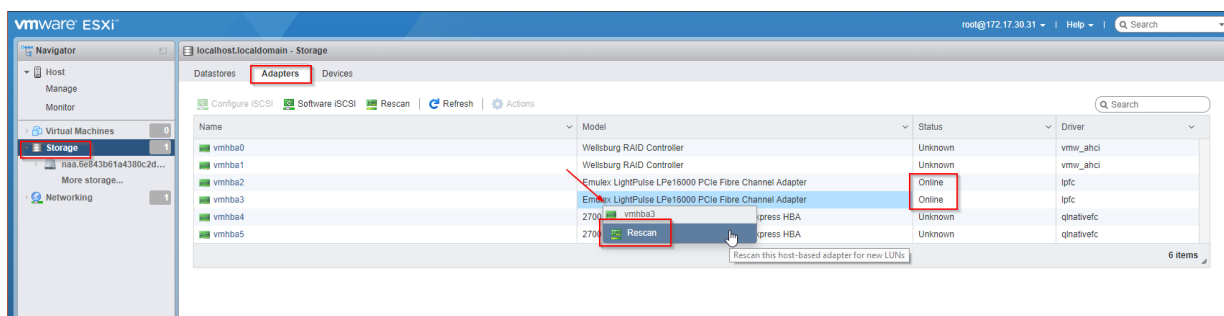
Configuring MPIO in VMware ESXi 6.5



Note

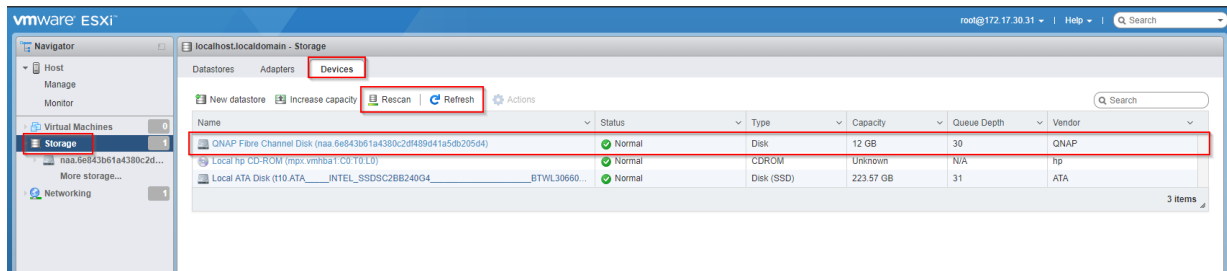
Multipath I/O is enabled in ESXi 6.5 by default.

1. Connect the ESXi client to the NAS using two optical cables.
2. Create a LUN on the NAS, and then map it to the default Fibre Channel port group. For details, see [Connecting a Server to the NAS Using One Cable](#).
3. In the ESXi web management interface, go to **Storage > Adapters**.
4. Rescan all adapters.

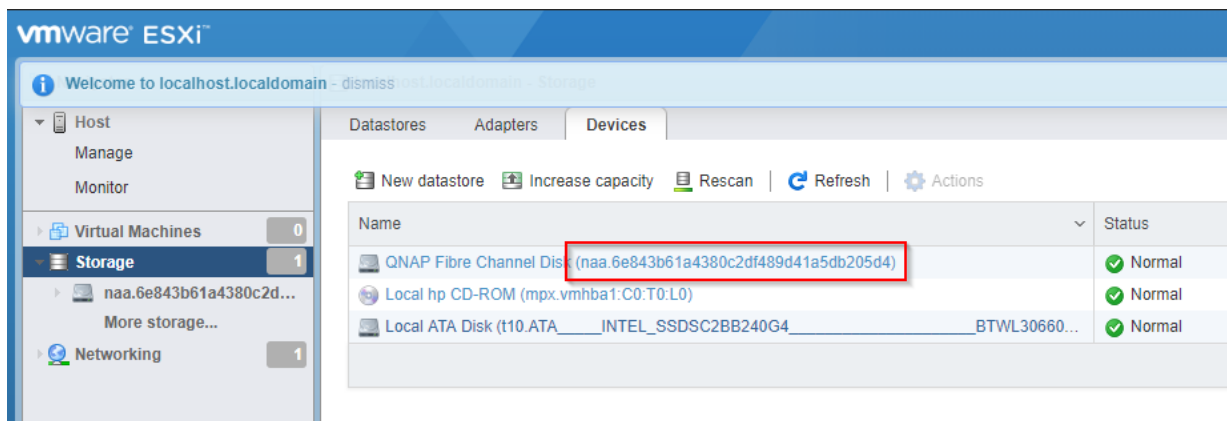


The connected ports appear as Online.

5. Go to **Storage > Devices**, and then click **Rescan**.
The LUN appears as a disk.



6. Optional: Verify that the LUN is using multipath I/O.
 - a. Make a note of the LUN's name.



- b. List all paths that the LUN is connected through using the command `esxcli storage core path list -d LUNNAME`

```
[root@localhost:~] esxcli storage core path list -d naa.6e843b61a4380c2df489d41a5db205d4
fc.200000109b1bcc99:100000109b1bcc99-fc.200000245ebe0007:210000245ebe0007-naa.6e843b61a4380c2df489d41a5db205d4
  UID: fc.200000109b1bcc99:100000109b1bcc99-fc.200000245ebe0007:210000245ebe0007-naa.6e843b61a4380c2df489d41a5db205d4
  Runtime Name: vmhba3:C0:T0:L0
  Device: naa.6e843b61a4380c2df489d41a5db205d4
  Device Display Name: QNAP Fibre Channel Disk (naa.6e843b61a4380c2df489d41a5db205d4)
  Adapter: vmhba3
  Channel: 0
  Target: 0
  LUN: 0
  Plugin: NMP
  State: active
  Transport: fc
  Adapter Identifier: fc.200000109b1bcc99:100000109b1bcc99
  Target Identifier: fc.200000245ebe0007:210000245ebe0007
  Adapter Transport Details: WWNN: 20:00:00:10:9b:1b:cc:99 WWPN: 10:00:00:10:9b:1b:cc:99
  Target Transport Details: WWNN: 20:00:00:24:5e:be:00:07 WWPN: 21:00:00:24:5e:be:00:07
  Maximum IO Size: 33553920

fc.200000109b1bcc99:100000109b1bcc99-fc.200000245ebe0006:210000245ebe0006-naa.6e843b61a4380c2df489d41a5db205d4
  UID: fc.200000109b1bcc99:100000109b1bcc99-fc.200000245ebe0006:210000245ebe0006-naa.6e843b61a4380c2df489d41a5db205d4
  Runtime Name: vmhba2:C0:T0:L0
  Device: naa.6e843b61a4380c2df489d41a5db205d4
  Device Display Name: QNAP Fibre Channel Disk (naa.6e843b61a4380c2df489d41a5db205d4)
  Adapter: vmhba2
  Channel: 0
  Target: 0
  LUN: 0
  Plugin: NMP
  State: active
  Transport: fc
  Adapter Identifier: fc.200000109b1bcc99:100000109b1bcc99
  Target Identifier: fc.200000245ebe0006:210000245ebe0006
  Adapter Transport Details: WWNN: 20:00:00:10:9b:1b:cc:99 WWPN: 10:00:00:10:9b:1b:cc:99
  Target Transport Details: WWNN: 20:00:00:24:5e:be:00:06 WWPN: 21:00:00:24:5e:be:00:06
  Maximum IO Size: 33553920
```

- c. List all devices using VMware Multipath (NMP) using the command `esxcli storage nmp device list`.

```
[root@localhost:~] esxcli storage nmp device list
naa.6e843b61a4380c2df489d41a5db205d4
  Device Display Name: QNAP Fibre Channel Disk (naa.6e843b61a4380c2df489d41a5db205d4)
  Storage Array Type: VMW_SATP_ALUA
  Storage Array Type Device Config: {implicit_support=on; explicit_support=on; explicit_allow=on; alua_follower=on; action_OnRetryErrors=off;
  (TPG_id=0,TPG_state=AO)}
  Path Selection Policy: VMW_PSP_MRU
  Path Selection Policy Device Config: Current Path=vmhba2:C0:T0:L0
  Path Selection Policy Device Custom Config:
  Working Paths: vmhba2:C0:T0:L0
  Is USB: false

mpx.vmhba1:C0:T0:L0
  Device Display Name: Local hp CD-ROM (mpx.vmhba1:C0:T0:L0)
  Storage Array Type: VMW_SATP_LOCAL
  Storage Array Type Device Config: SATP VMW_SATP_LOCAL does not support device configuration.
  Path Selection Policy: VMW_PSP_FIXED
  Path Selection Policy Device Config: {preferred=vmhba1:C0:T0:L0;current=vmhba1:C0:T0:L0}
  Path Selection Policy Device Custom Config:
  Working Paths: vmhba1:C0:T0:L0
  Is USB: false

t10.ATA_____INTEL_SSDSC2B5240G4_____BTWL306601CR240NGN_____
  Device Display Name: Local ATA Disk (t10.ATA_____INTEL_SSDSC2B5240G4_____BTWL306601CR240NGN_____)
  Storage Array Type: VMW_SATP_LOCAL
  Storage Array Type Device Config: SATP VMW_SATP_LOCAL does not support device configuration.
  Path Selection Policy: VMW_PSP_FIXED
  Path Selection Policy Device Config: {preferred=vmhba0:C0:T0:L0;current=vmhba0:C0:T0:L0}
  Path Selection Policy Device Custom Config:
  Working Paths: vmhba0:C0:T0:L0
  Is USB: false
[root@localhost:~]
```

Configuring MPIO in VMware vSphere Client 6.5

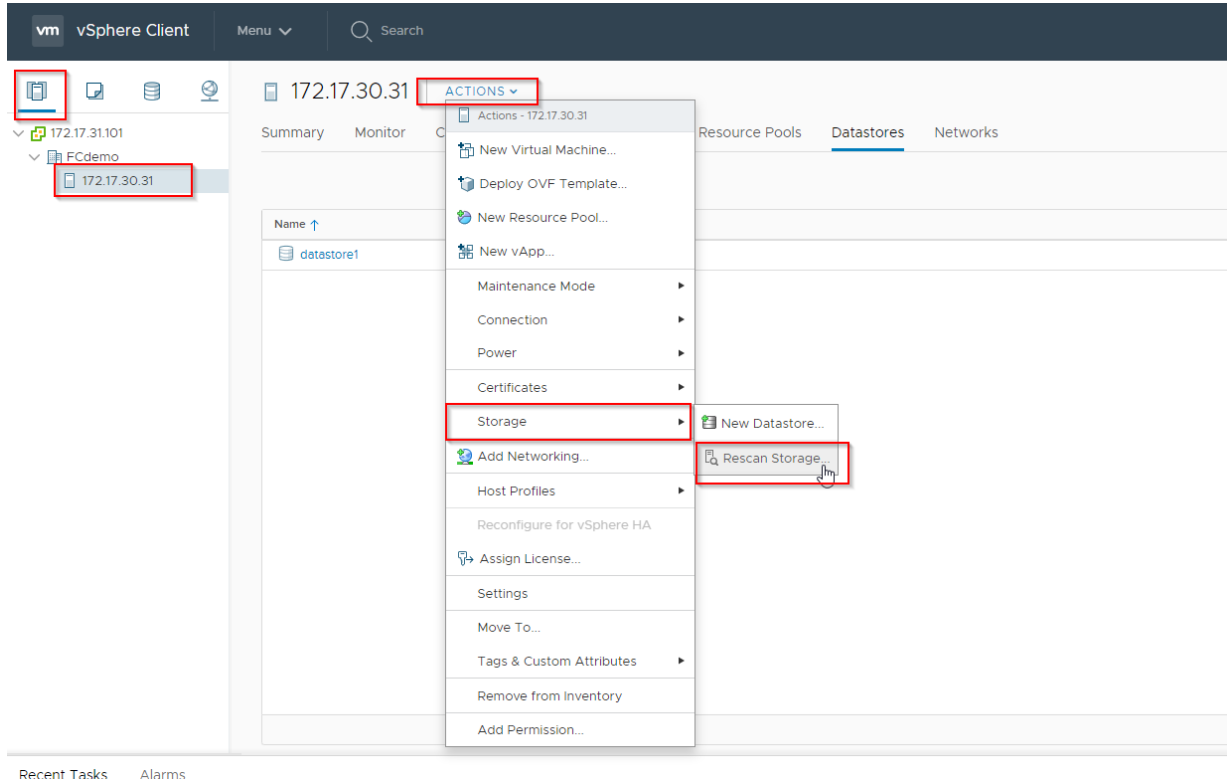


Note

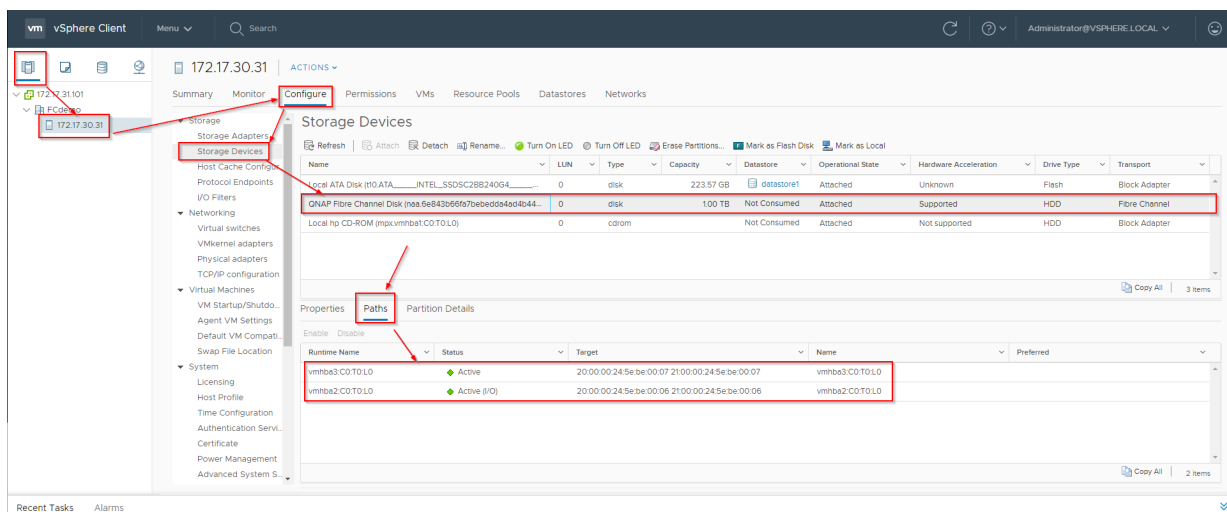
Multipath I/O is enabled in ESXi 6.5 by default.

1. Connect the ESXi client to the NAS using two optical cables.

2. Create a LUN on the NAS and map it to the default Fibre Channel port group.
For details, see [Connecting a Server to the NAS Using One Cable](#).
3. In vSphere Client, select the ESXi host.
4. Click **ACTIONS**, and then select **Storage > Rescan Storage**.



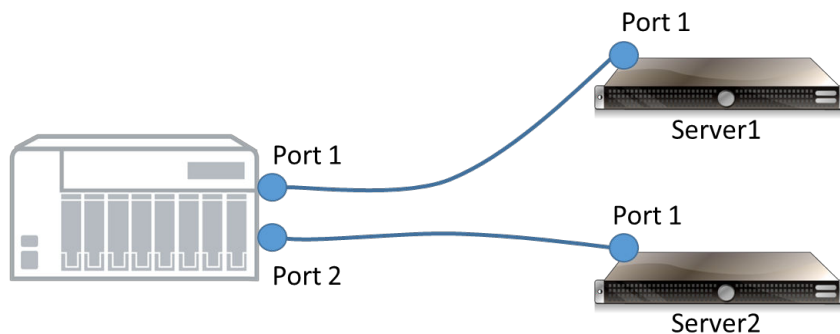
5. Go to **Configure > Storage Devices**.
You should see the LUN in the list of devices.
6. Select the LUN and then click **Paths** to verify that the LUN is using MPIO.



7. Optional: Go to the **Properties** tab to change the multipathing policy.

Scenario 3: One NAS, Two Clients, Two Cables (Port Groups)

In this scenario, two servers are connected directly to the NAS, each through a single optical cable. Each server is connected to a different port, which makes configuration simple. You can control which LUNs each server can access using port groups, without having to configure port binding or LUN masking.



Port Groups

In iSCSI & Fibre Channel, Fibre Channel ports are organized into port groups. When a LUN is mapped to a port group, QTS automatically maps the LUN to every port in the group.

Fibre Channel port groups help you manage LUN mappings more easily. A LUN is usually mapped directly to a Fibre Channel port, as the port is the target. If you want to map a LUN to four Fibre Channel ports, you would need to map the LUN four times and then keep track of what each port it used for. Using a port group means you only need to map the LUN once, and you can give the group a user-friendly name which states its purpose.



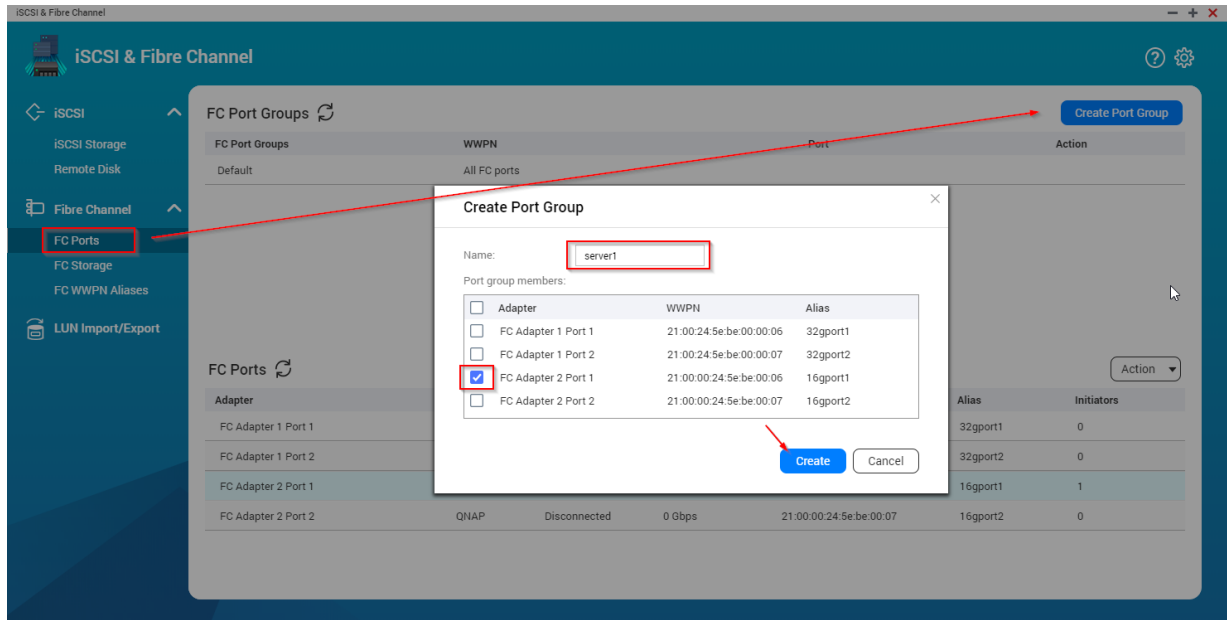
Important

- Each Fibre Channel port can be in one or more port groups.
- Each LUN can only be mapped to one port group.
- There is a default port group with the WWPN `All FC ports` that contains all Fibre Channel ports on the NAS. To make a LUN available to any Fibre Channel client connected to any port, map it to the default group.
- For a simple scenario, such as two client computers connected to the NAS using a direct connection, you can map a LUN to one port only and then create a port group only containing that port, without configuring Fibre Channel port binding or LUN masking.
- Port groups can also be use to map a LUN to different Fibre Channel fabrics in larger environment with multiple fabrics. For example:
 - Fabric 1: Ports 1 and 2, in port group 1
 - Fabric 2: Ports 3 and 4, in port group 2

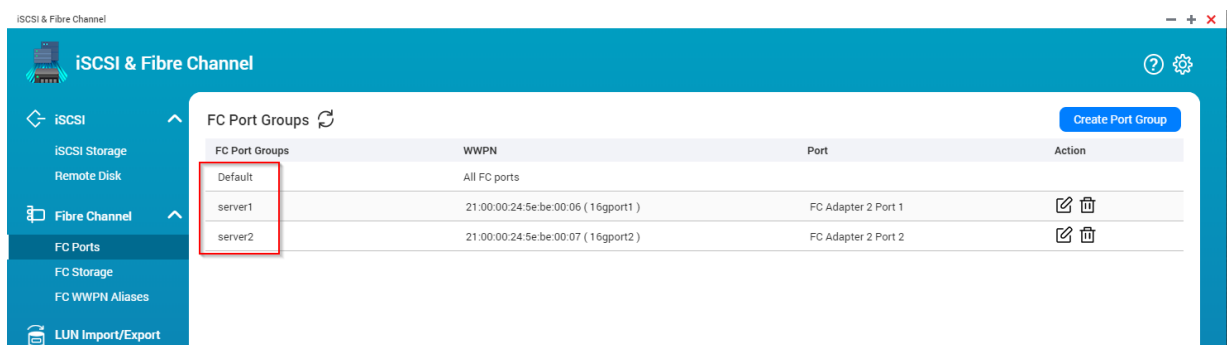
You can map a LUN to either fabric, then use LUN masking to filter the servers on each fabric.

Connecting Two Servers to the NAS Using Two Cables

1. Connect each server to a Fibre Channel port on the NAS.
2. Go to **Main Menu > iSCSI & Fibre Channel > Fibre Channel > FC Ports**.
3. Create a port group for Server 1.



- a. Click **Create Port Group**.
 - b. Specify group name `server1`.
 - c. Select the port that Server 1 is connected to.
 - d. Click **Create**.
4. Repeat the above steps to create a port group for Server 2, with group name `server2`. There are now three port groups; `Default`, `server1`, and `server2`.



5. Map one or more LUNs to the port groups. The port group that a LUN is mapped to determines which server can see the LUN.

Port Group that LUN is mapped to	LUN is visible to
Default	Server 1, Server 2
server1	Server 1
server2	Server 2

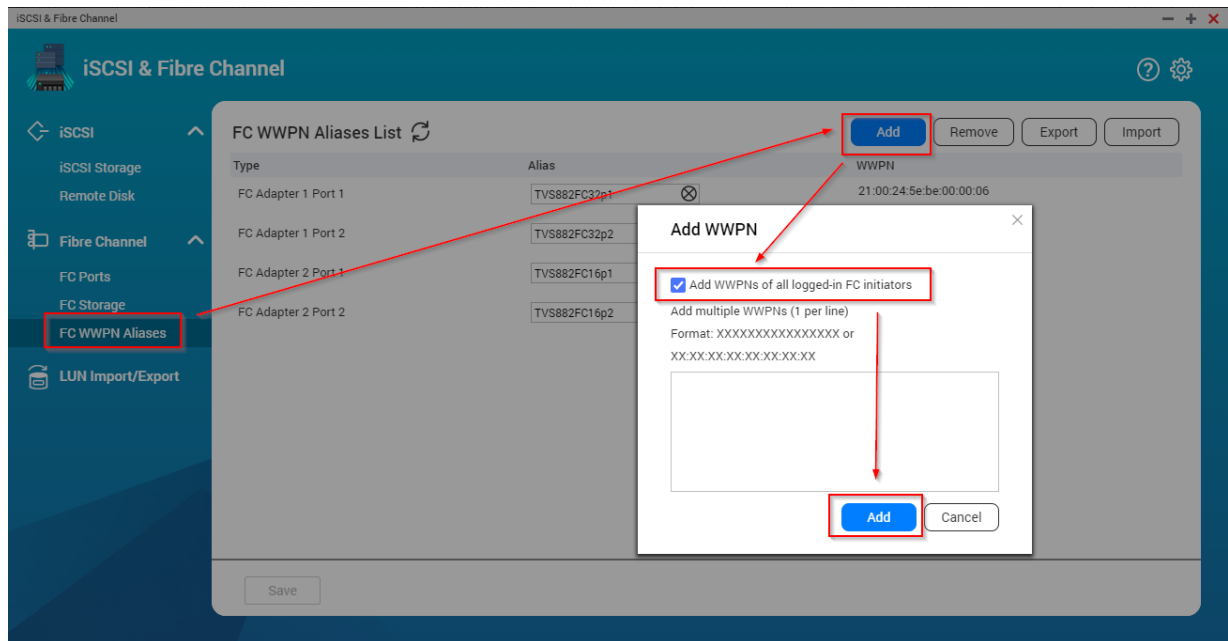
6. Advanced Scenarios

WWPN Aliases

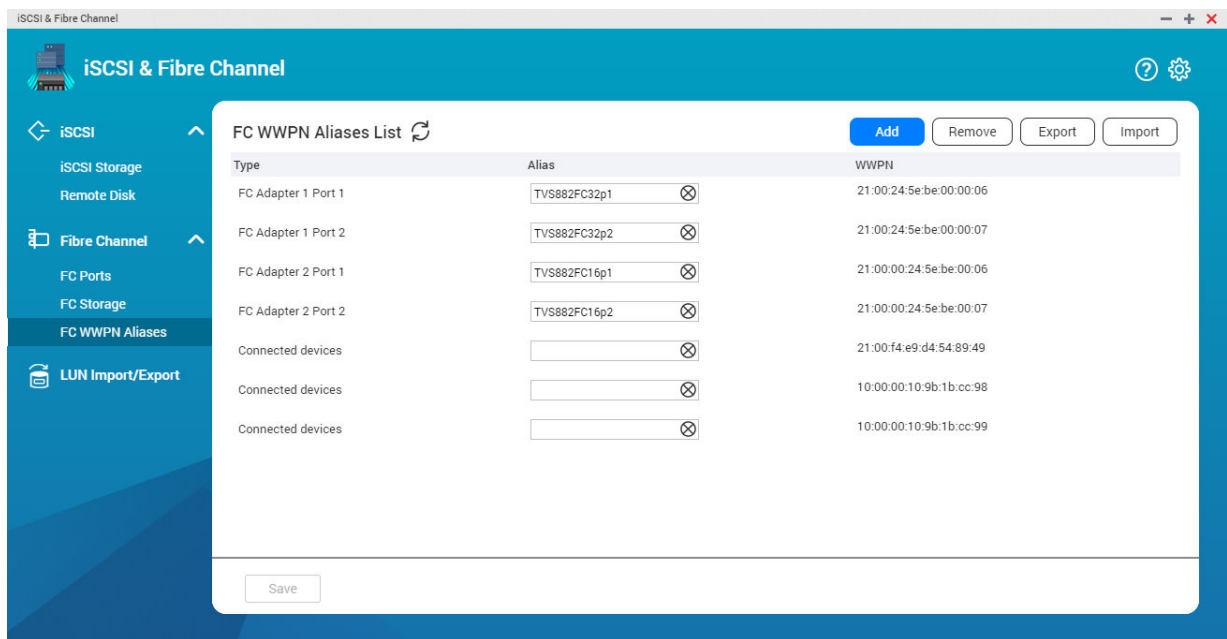
When you have multiple clients on your Fibre Channel network, you should set a WWPN alias for each client port. This will help when setting LUN and port access permissions.

Configuring WWPN Aliases for Connected Initiators

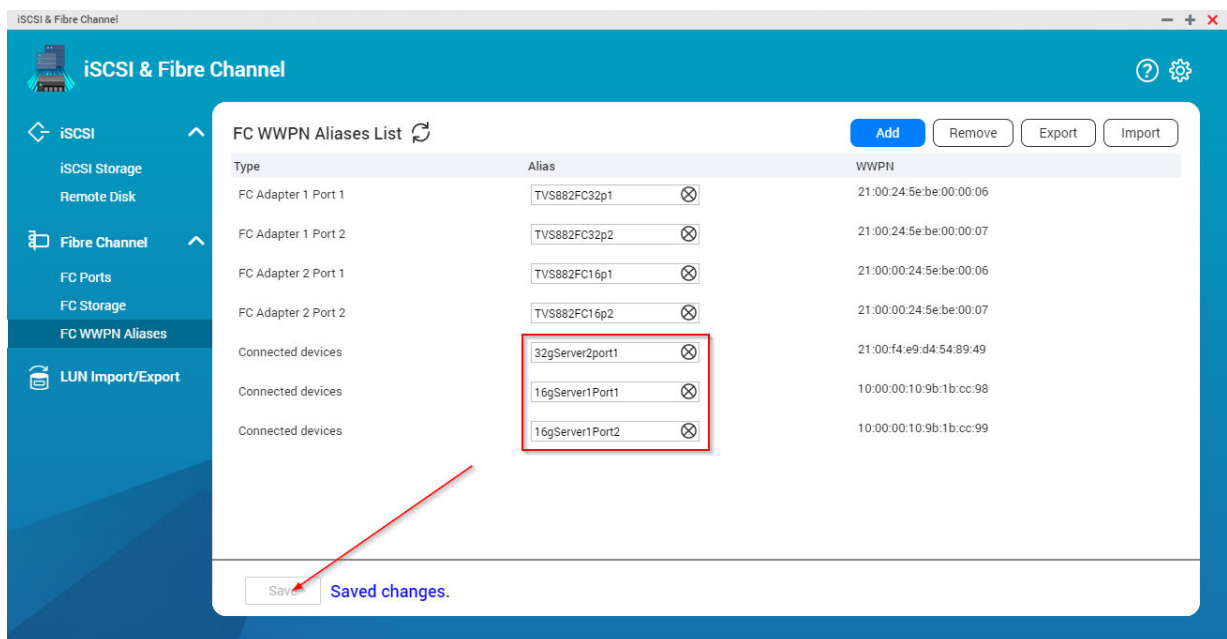
1. Go to **Main Menu > iSCSI & Fibre Channel > Fibre Channel > FC WWPN Aliases**.



2. Click **Add**.
The **Add WWPN** window appears.
3. Select **Add WWPNs from all logged-in FC initiators**.
4. Click **Add**.
The connected initiators appear in the **FC WWPN Aliases List**.



- Under **Alias**, specify a meaningful alias for each of them.



- Click **Save**.

Configuring WWPN Aliases for Unconnected Initiators

- Note down the WWPNs of all Fibre Channel clients on your network.
A simple way to do this is to connect to your Fibre Channel switch and list the connected devices.
Example (Brocade switch):

```
G610:admin>switchshow
```

```
...
```

Index	Port	Address	Media	Speed	State	Proto	
0	0	010000	id	N16	No_Light	FC	
1	1	010100	id	N16	Online	FC	F-Port 21:00:f4:e9:d4:58:32:46
2	2	010200	id	N16	Online	FC	F-Port 21:00:00:24:5e:be:00:06
3	3	010300	id	N16	Online	FC	F-Port 10:00:00:10:9b:1b:cc:98
4	4	010400	id	N16	No_Light	FC	
5	5	010500	id	N16	Online	FC	F-Port 21:00:00:24:5e:be:00:07
6	6	010600	id	N16	Online	FC	F-Port 21:00:f4:e9:d4:58:32:47
7	7	010700	id	N16	Online	FC	F-Port 10:00:00:10:9b:1b:cc:99



Note

The command and resulting output depend on the switch model. For details, refer to your switch documentation.

- Go to **Main Menu > iSCSI & Fibre Channel > Fibre Channel > FC WWPN Aliases**.
- Click **Add**.
The **Add WWPN** window appears.
- In the input box, specify one WWPN per line using any of the following formats:
 - XXXXXXXXXXXXXXXXXXXX
 - XX:XX:XX:XX:XX:XX:XX:XX

- Click **Add**.
The initiators you added appear in the **FC WWPN Aliases List**.

FC WWPN Aliases List

Add

Remove

Export

Import

Type	Alias	WWPN
FC Adapter 1 Port 1	<div>TVS882FC32p1</div>	21:00:24:5e:be:00:00:06
FC Adapter 1 Port 2	<div>TVS882FC32p2</div>	21:00:24:5e:be:00:00:07
FC Adapter 2 Port 1	<div>TVS882FC16p1</div>	21:00:00:24:5e:be:00:06
FC Adapter 2 Port 2	<div>TVS882FC16p2</div>	21:00:00:24:5e:be:00:07
Connected devices	<div>32gServer2port1</div>	21:00:f4:e9:d4:54:89:49
Connected devices	<div>16gServer1Port1</div>	10:00:00:10:9b:1b:cc:98
Connected devices	<div>16gServer1Port2</div>	10:00:00:10:9b:1b:cc:99
	<div></div>	21:00:f4:e9:d4:54:89:48

Save

6. Under **Alias**, specify a meaningful alias for each of them.

FC WWPN Aliases List

Add

Remove

Export

Import

Type	Alias	WWPN
FC Adapter 1 Port 1	<div>TVS882FC32p1</div>	21:00:24:5e:be:00:00:06
FC Adapter 1 Port 2	<div>TVS882FC32p2</div>	21:00:24:5e:be:00:00:07
FC Adapter 2 Port 1	<div>TVS882FC16p1</div>	21:00:00:24:5e:be:00:06
FC Adapter 2 Port 2	<div>TVS882FC16p2</div>	21:00:00:24:5e:be:00:07
Connected devices	<div>32gServer2port1</div>	21:00:f4:e9:d4:54:89:49
Connected devices	<div>16gServer1Port1</div>	10:00:00:10:9b:1b:cc:98
Connected devices	<div>16gServer1Port2</div>	10:00:00:10:9b:1b:cc:99
	<div>32gServer2port2</div>	21:00:f4:e9:d4:54:89:48

Save

Saved changes.

7. Click **Save**.

WWPN Alias Export and Import

You can export a list of WWPNS and aliases as a CSV file, and then import it into another QNAP NAS. You can also manually edit the CSV file to add, edit, or remove WWPNS and aliases. Exporting and importing a list of WWPNS is useful in the following cases:

- Your Fibre Channel network has multiple QNAP NAS devices.

- You already have a list of every WWPN in your SAN.

Exporting a List of WWPN Aliases

1. Go to **Main Menu > iSCSI & Fibre Channel > Fibre Channel > FC WWPN Aliases**.
2. Click **Export**.
The file browser window opens.
3. In the file browser window, navigate to the folder where you want to save the file.
4. Specify a filename.
5. Click **Save**.

Importing a List of WWPNs from a CSV File

You can import a list of WWPNs and aliases from a CSV file in the following format:

- Field 1: WWPN
- Field 2: Alias

Example:

XX:XX:XX:XX:XX:XX:XX:XX,alias1

XXXXXXXXXXXXXXXXXXXX,alias2

YY:XX:XX:XX:XX:XX:XX:XX,alias3



Important

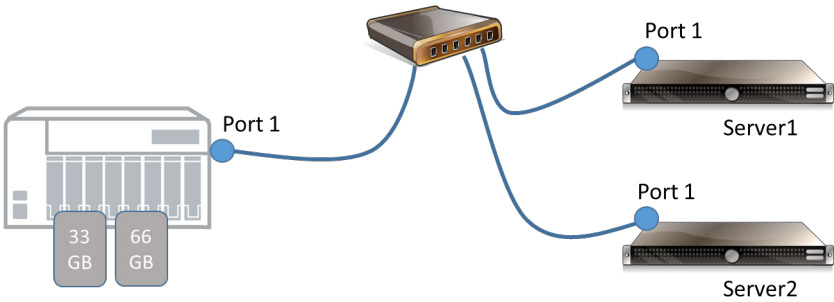
- Identical aliases will be overwritten from the CSV file.
- Lines not formatted correctly will be ignored.

1. Go to **Main Menu > iSCSI & Fibre Channel > Fibre Channel > FC WWPN Aliases**.
2. Click **Import**.
The file browser window opens.
3. Locate and open the CSV file.

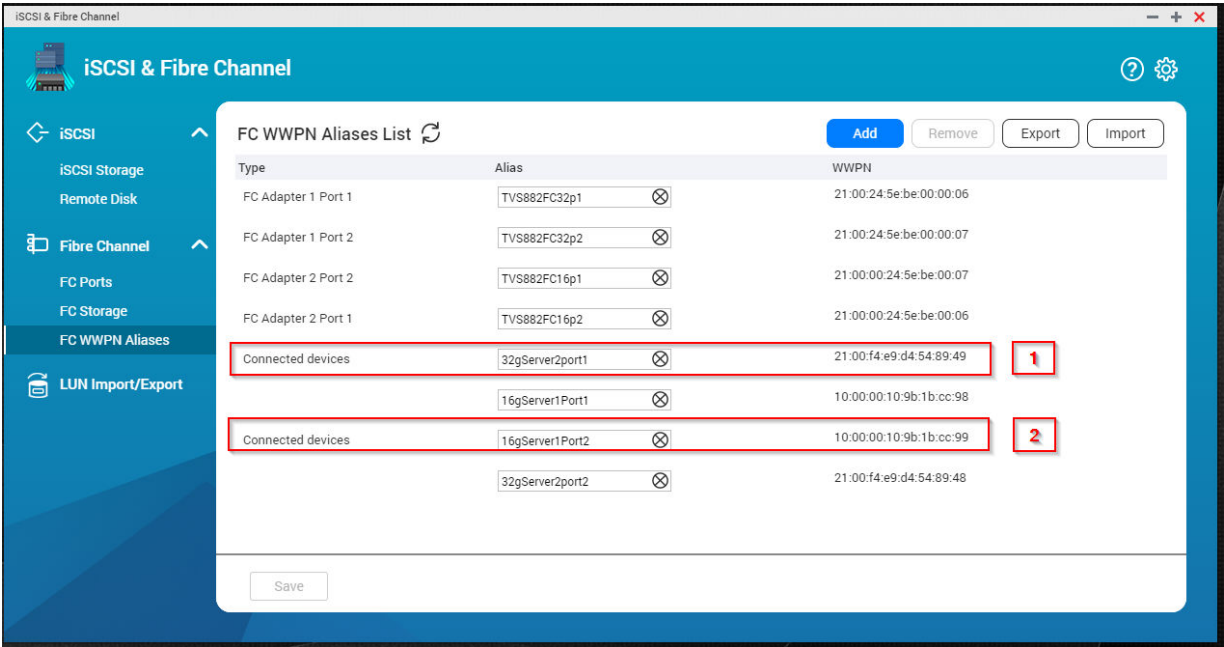
Scenario 4: One NAS, Multiple Clients, One Fibre Channel Switch (LUN Masking)

LUN Masking is a security feature that allows you to define which initiator WWPNs can access a LUN on the NAS. LUN masking is demonstrated in the following scenario.

Two clients, Server 1 and Server 2, are connected to the NAS using a Fibre Channel switch. Both clients are connected through the same NAS Fibre Channel port. We will create two LUNs on the NAS; LUN 1 and LUN 2.

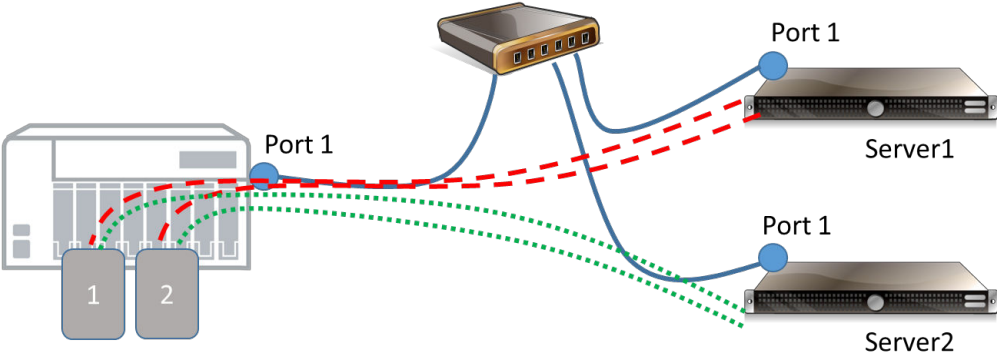


Client Name	Client Port WWPN Alias
Server 1	16gServer1Port1
Server 2	32gServer2Port1



Without LUN Masking

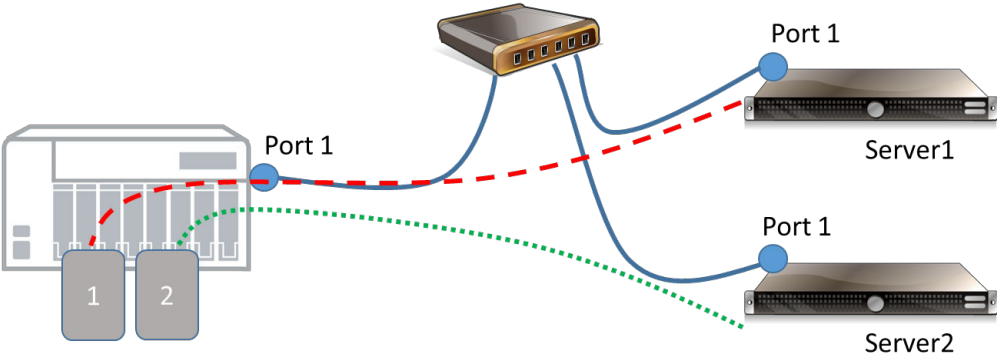
If LUN masking is not configured, both Server 1 and Server 2 can access both LUNs. Allowing a LUN to be accessed by multiple initiators simultaneously may result in data corruption, unless the clients are in a cluster such as a VMware Datastore or Windows Cluster.



LUN	LUN Masking Enabled	LUN is Visible to
LUN 1	No	Server 1, Server 2
LUN 2	No	Server 1, Server 2

With LUN Masking

By configuring LUN masking, we can allow each client to only access one LUN each.

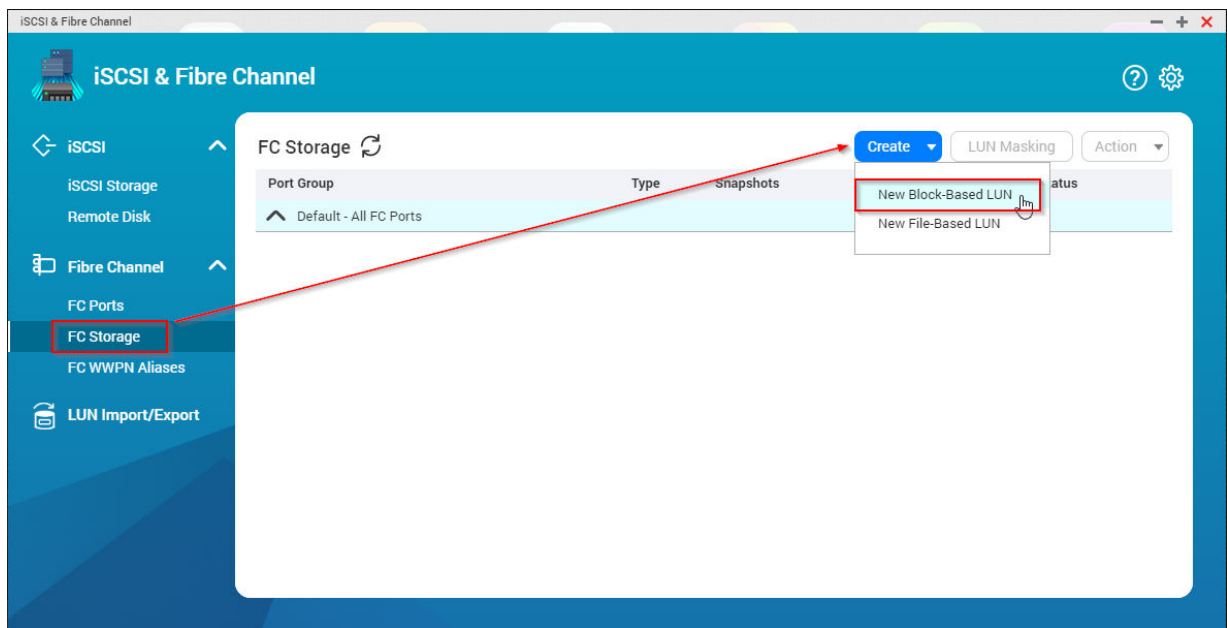


LUN	LUN Masking Enabled	LUN is Visible to
LUN 1	Yes	Server 1
LUN 2	Yes	Server 2

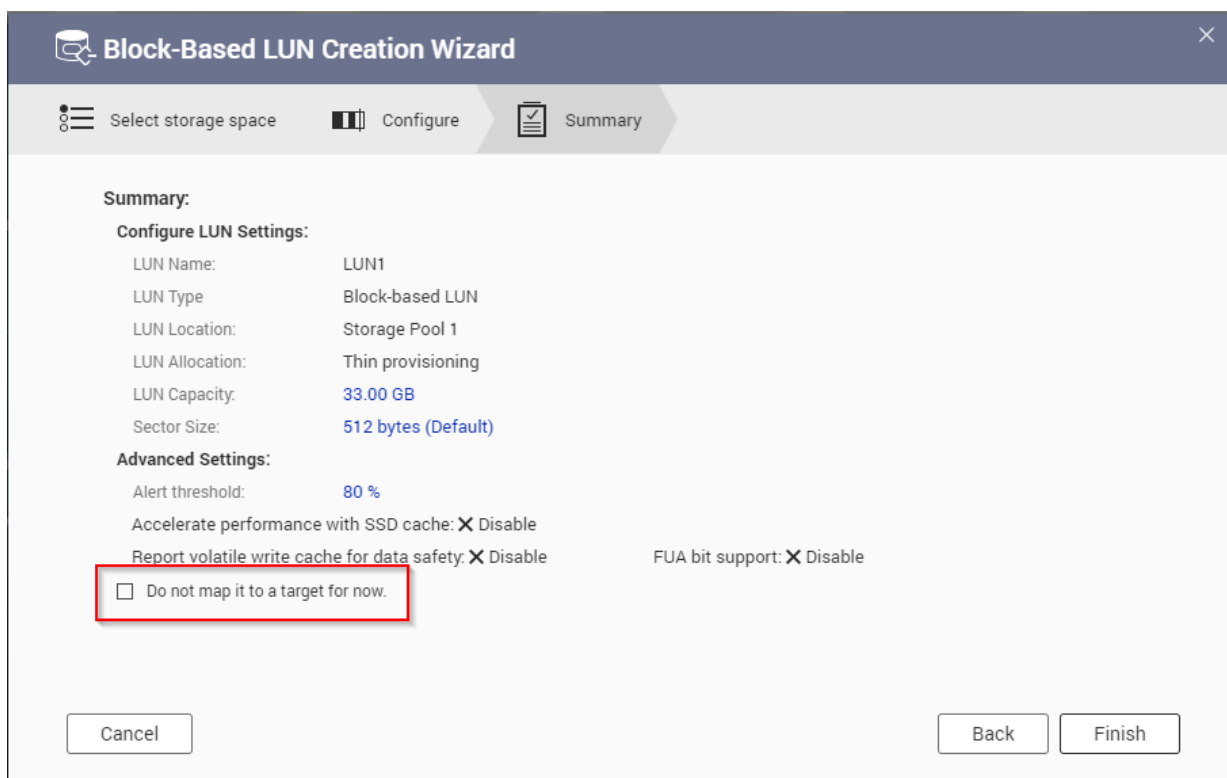
Creating a LUN with LUN Masking Enabled

In this task we will create LUN 1, and configure LUN masking during LUN creation.

1. Go to **Main Menu > iSCSI & Fibre Channel > Fibre Channel > FC Storage**.
2. Click **Create**, and then select **New Block-Based LUN**.



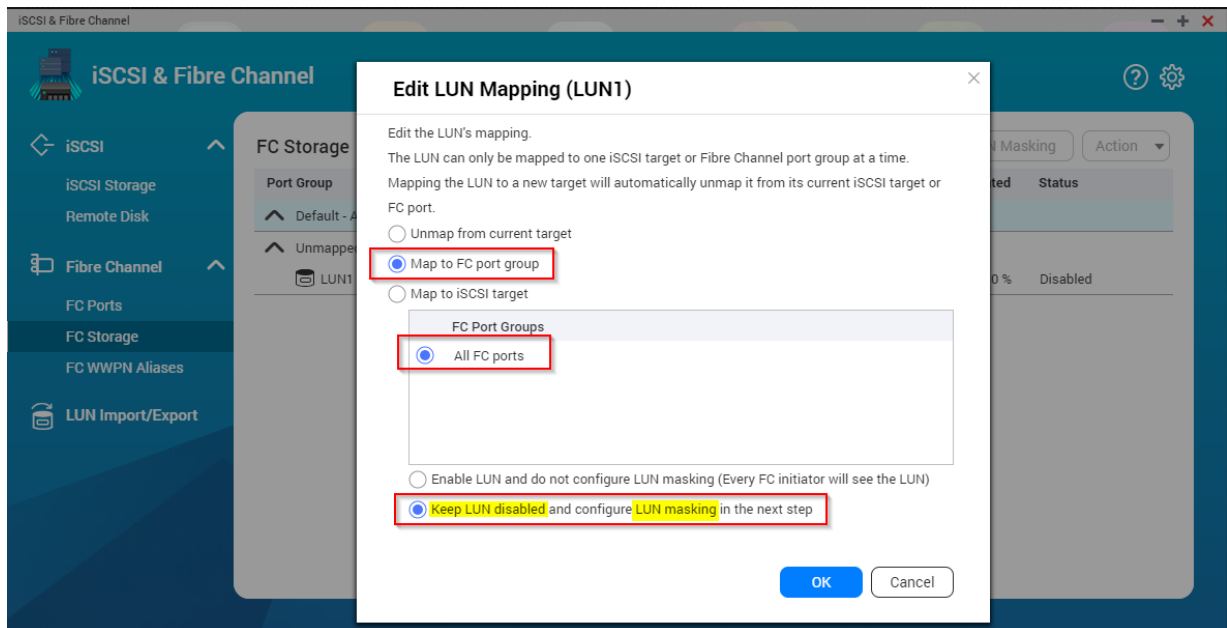
3. Following the wizard, specifying a capacity of 33 GB.
For more details on creating a LUN, see the QTS User Guide.
4. On the **Summary** screen, deselect **Do not map it to a target for now**.
Deselecting this setting will open the LUN mapping wizard automatically after the LUN has been created, allowing you map the LUN to a FC port group immediately.



5. Click **Finish**.

QTS creates the LUN, then the **Edit LUN Mapping** window opens.

6. Select **Map to FC port group**.



7. Under **FC Port Groups**, select **All FC Ports**.

This is the default port group.

8. Select **Keep LUN disabled and configure LUN masking in the next step**.

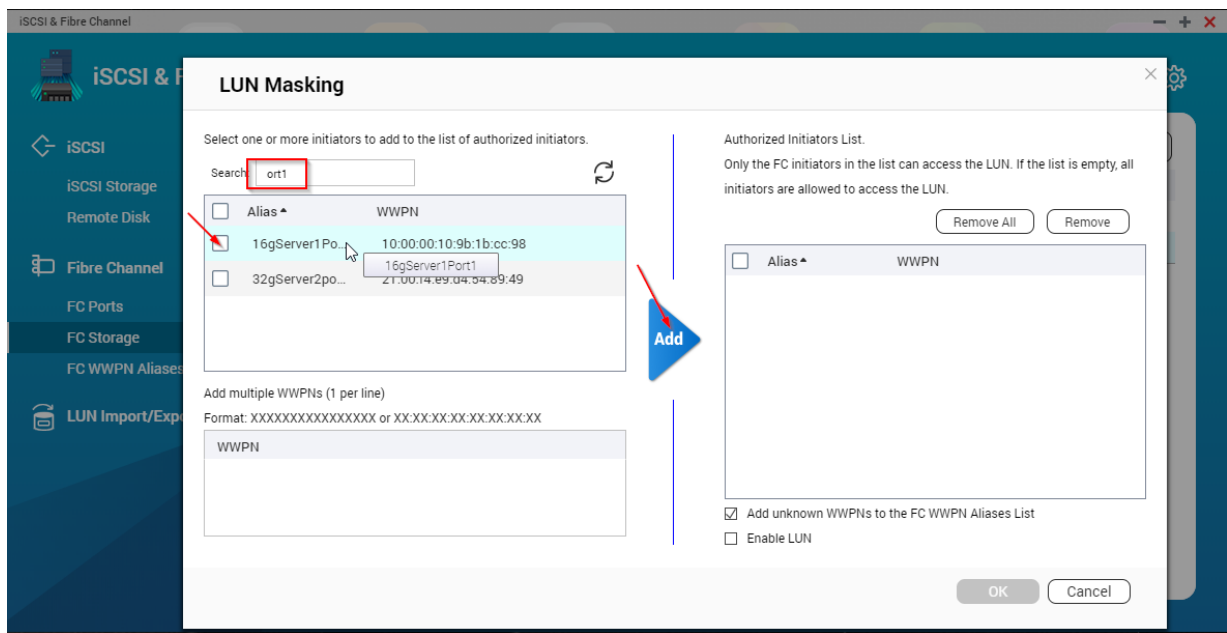
Selecting this option keeps the LUN disabled and opens the LUN masking configuration window. Keeping the LUN disabled avoids unauthorized access to the LUN before LUN masking has been configured.

9. Click **OK**.

QTS maps the LUN to the default Fibre Channel port group, and then the **LUN Masking** window opens.

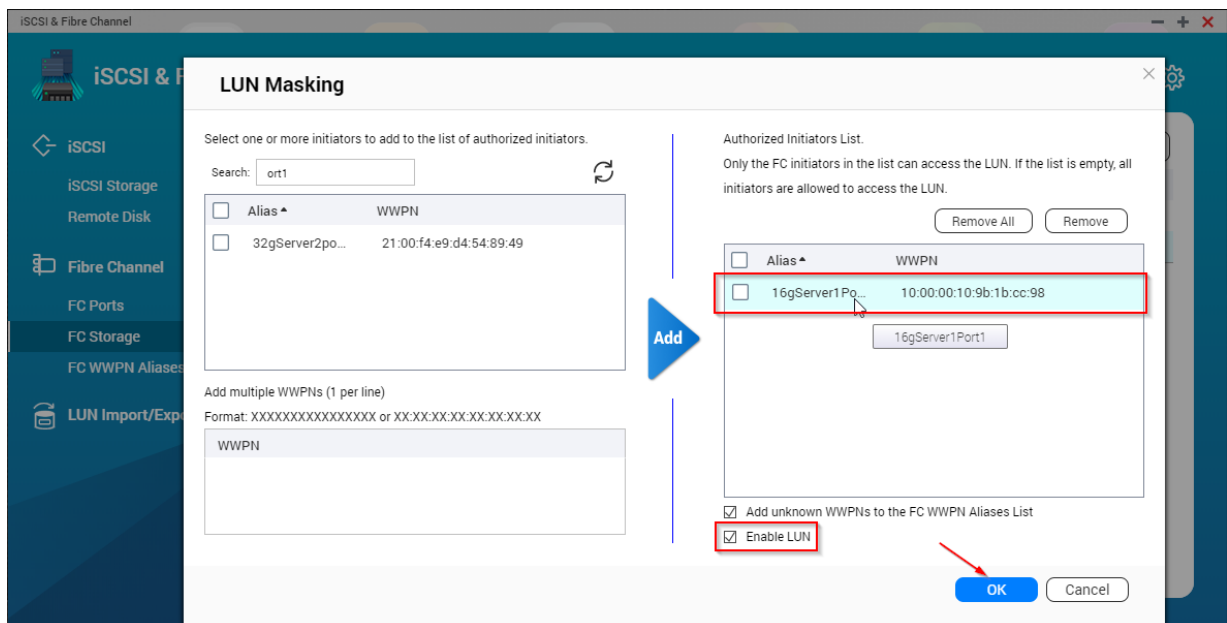
10. Optional: Under **Search**, enter the full or partial WWPN alias of the initiators you want to add.
For example, enter `ort1` to display all initiator WWPN aliases containing `port1`.

11. Select the WWPNs of the Fibre Channel initiators that you want to give access to this LUN.
In this example, we select `16gServer1Port1` which is the WWPN of Server 1.



12. Click **Add**.

The selected initiators are added to the LUN's **Authorized Initiators List**.



Note

- You can remove WWPNs from the list using the **Remove** or **Remove All** buttons.
- If the **Authorized Initiators List** is empty, then every logged in Fibre Channel initiator can access the LUN.

13. Select **Enable LUN**.

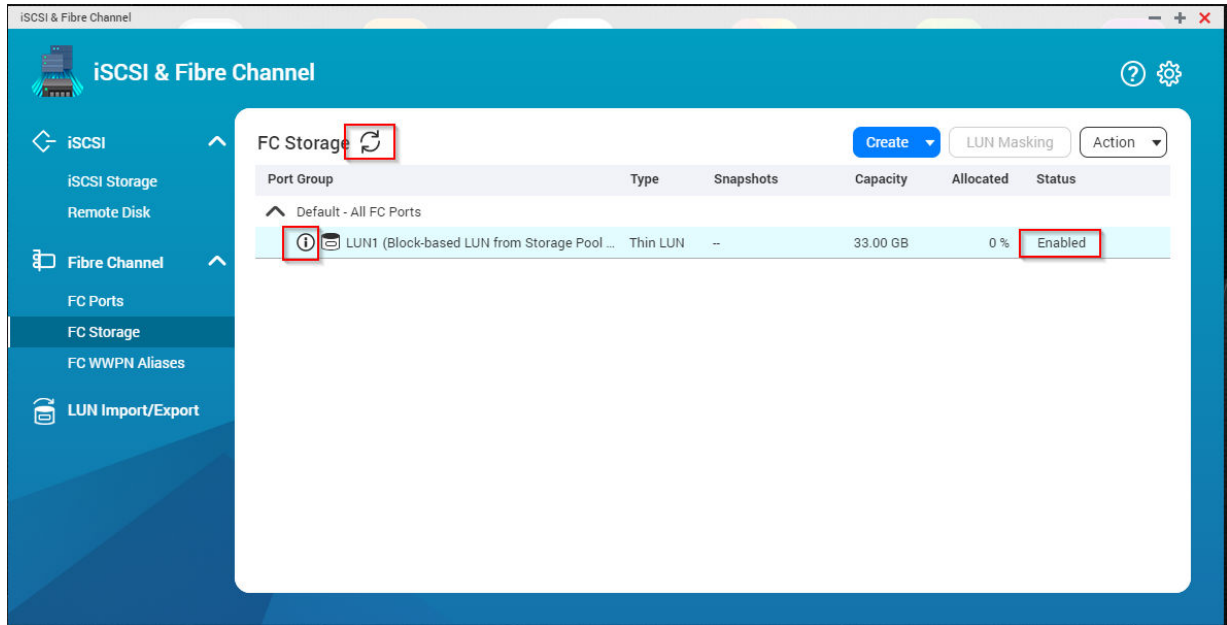
The LUN will be enabled after you finish configuring LUN masking, so that Server 1 can access it.

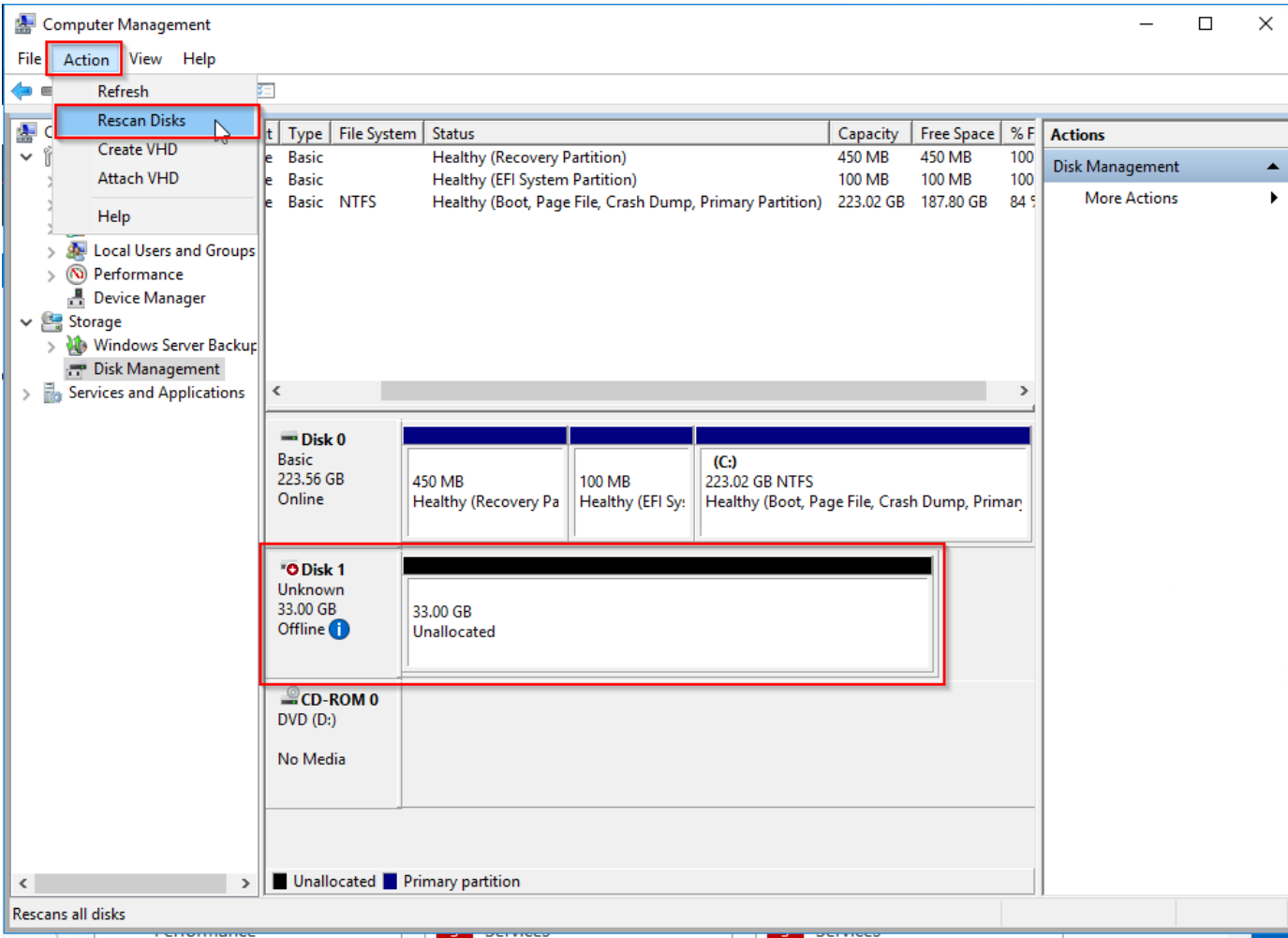
14. Click OK.

LUN masking is configured. Only Server 1 can access the LUN through its port with WWPN alias 16gServer1Port1. Other Fibre Channel ports, adapters, and servers cannot access the LUN.

15. Go to Main Menu > iSCSI & Fibre Channel > Fibre Channel > FC Storage and verify that the LUN and LUN masking are both enabled.

If LUN masking is enabled, the LUN will have  in front of it. If the LUN does not appear to be enabled, you can click the refresh button to refresh the page.


**16. On Server 1, rescan disks to see LUN 1.**

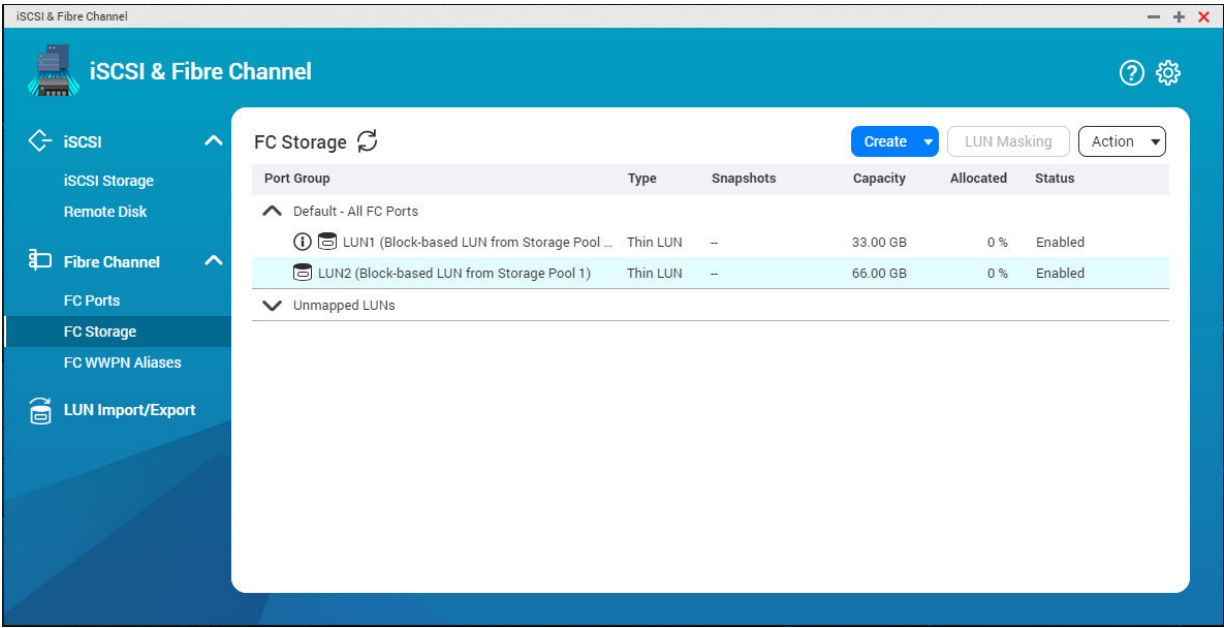


Configuring LUN Masking on an Existing LUN

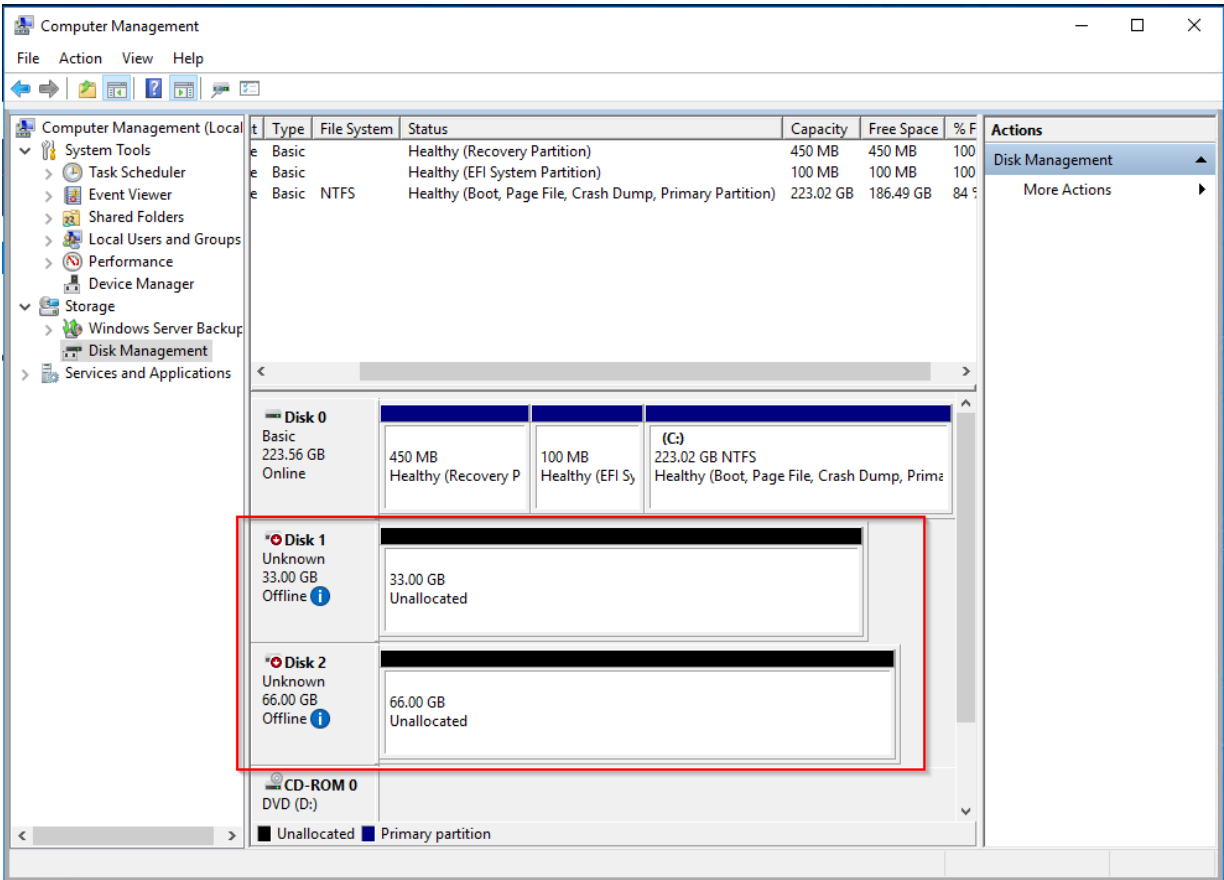
This tutorial follows on from [Creating a LUN with LUN Masking Enabled](#). We have created a second LUN (LUN 2, 66GB) that does not have LUN masking enabled.

LUN	Size	LUN Masking Enabled	LUN is Visible to
LUN 1	33 GB	Yes	Server 1
LUN 2	66 GB	No	Server 1, Server 2

Note that LUN 1 has an  next to it, which shows that LUN masking is enabled.



Server 1 can now access both LUN 1 (33GB) and LUN 2 (66GB), as seen on its **Disk Management** screen.



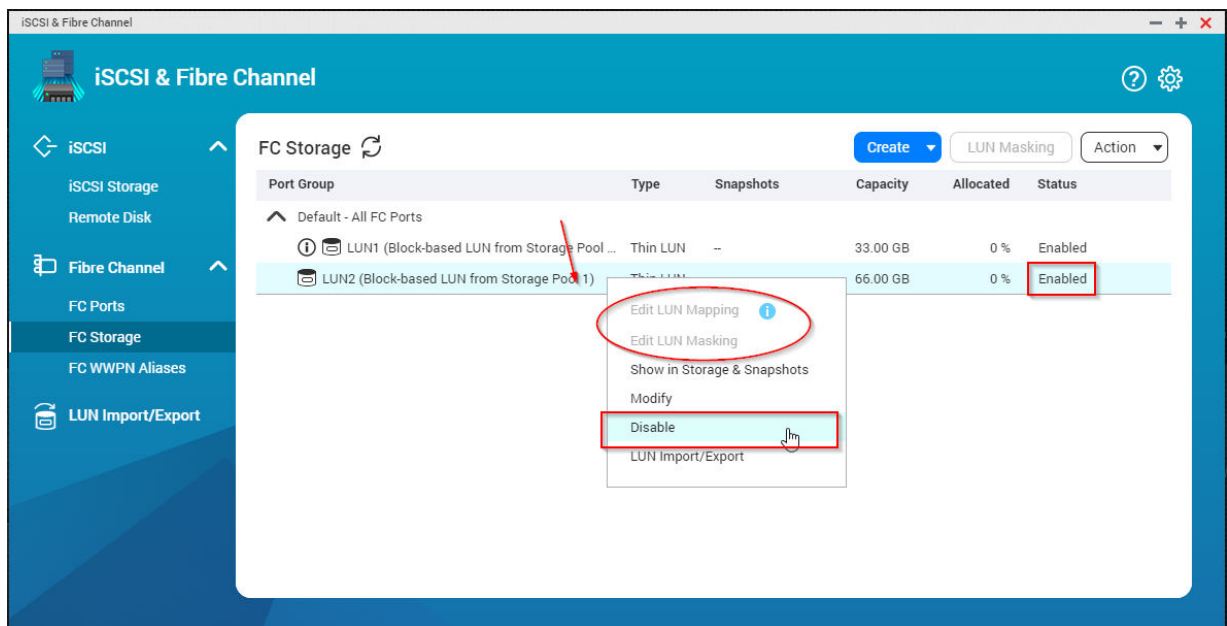
It is possible to edit LUN masking after LUN creation. We will now edit LUN masking for LUN 2 so that only Server 2 can access it.

1. Shutdown the remote servers accessing the LUN.


Warning

Removing, disconnecting, or disabling a LUN while a server is accessing it may result in data loss or data corruption.

2. Go to **Main Menu > iSCSI & Fibre Channel > Fibre Channel > FC Storage**.
3. Right-click on the LUN, and then select **Disable**.



LUN mapping and LUN masking can be configured only when the LUN is disabled. These options are grayed out when the LUN is enabled.

4. Click **LUN Masking**.
The **LUN Masking** window opens.
5. Optional: Under **Search**, enter the full or partial WWPN alias of the initiators you want to add.
For example, enter `ort1` to display all initiator WWPN aliases containing `port1`.
6. Select the WWPNs of the Fibre Channel initiators that you want to give access to this LUN.
In this example, we select `32gServer2port1` which is the WWPN of Server 2.

LUN Masking

Select one or more initiators to add to the list of authorized initiators.

Search:

<input type="checkbox"/>	Alias ▲	WWPN
<input type="checkbox"/>	16gServer1Po...	10:00:00:10:9b:1b:cc:98
<input checked="" type="checkbox"/>	32gServer2po...	21:00:f4:e9:d4:54:89:49

32gServer2port1

Add multiple WWPNs (1 per line)
Format: XXXXXXXXXXXXXXXX or XX:XX:XX:XX:XX:XX:XX:XX

WWPN

Authorized Initiators List.

Only the FC initiators in the list can access the LUN. If the list is empty, all initiators are allowed to access the LUN.

Remove All Remove

☐ Alias ▲ WWPN

☒ Add unknown WWPNs to the FC WWPN Aliases List

☐ Enable LUN

OK Cancel

7. Click **Add**.

The selected initiators are added to the LUN's **Authorized Initiators List**.

LUN Masking

Select one or more initiators to add to the list of authorized initiators.

Search:

<input type="checkbox"/>	Alias ▲	WWPN
<input type="checkbox"/>	16gServer1Po...	10:00:00:10:9b:1b:cc:98

Add multiple WWPNs (1 per line)
Format: XXXXXXXXXXXXXXXX or XX:XX:XX:XX:XX:XX:XX:XX

WWPN

Authorized Initiators List.

Only the FC initiators in the list can access the LUN. If the list is empty, all initiators are allowed to access the LUN.

Remove All Remove

<input type="checkbox"/>	Alias ▲	WWPN
<input type="checkbox"/>	32gServer2po...	21:00:f4:e9:d4:54:89:49

☒ Add unknown WWPNs to the FC WWPN Aliases List

☒ Enable LUN


OK Cancel

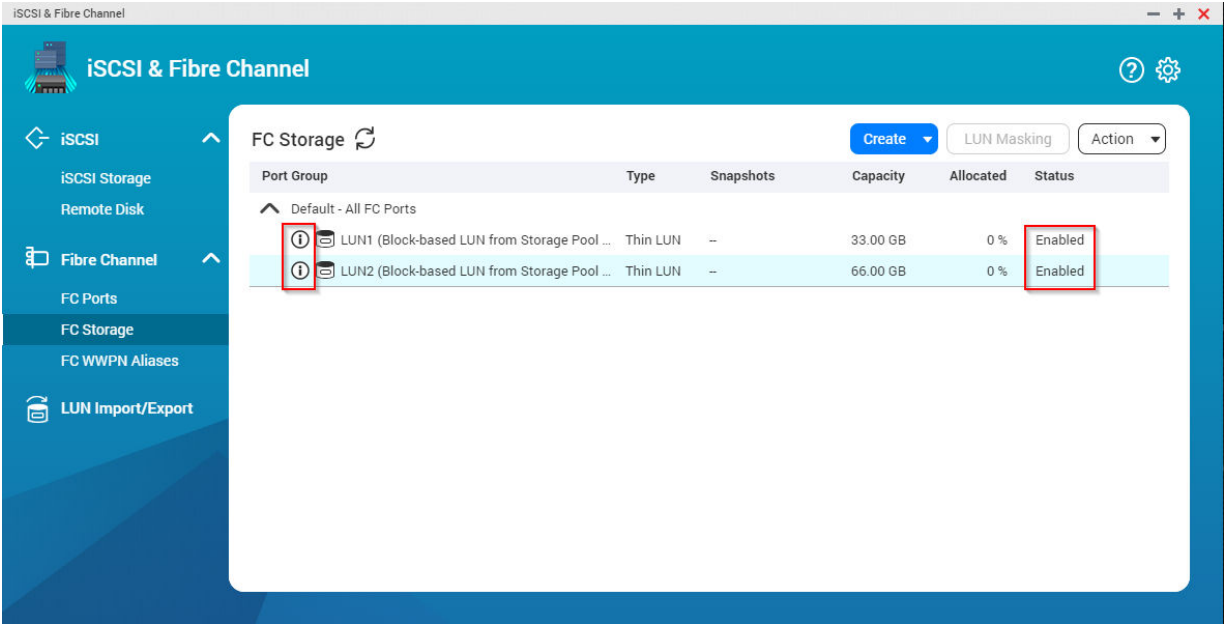
8. Select **Enable LUN**.

The LUN will be enabled after you finish configuring LUN masking, so that Server 2 can access it.

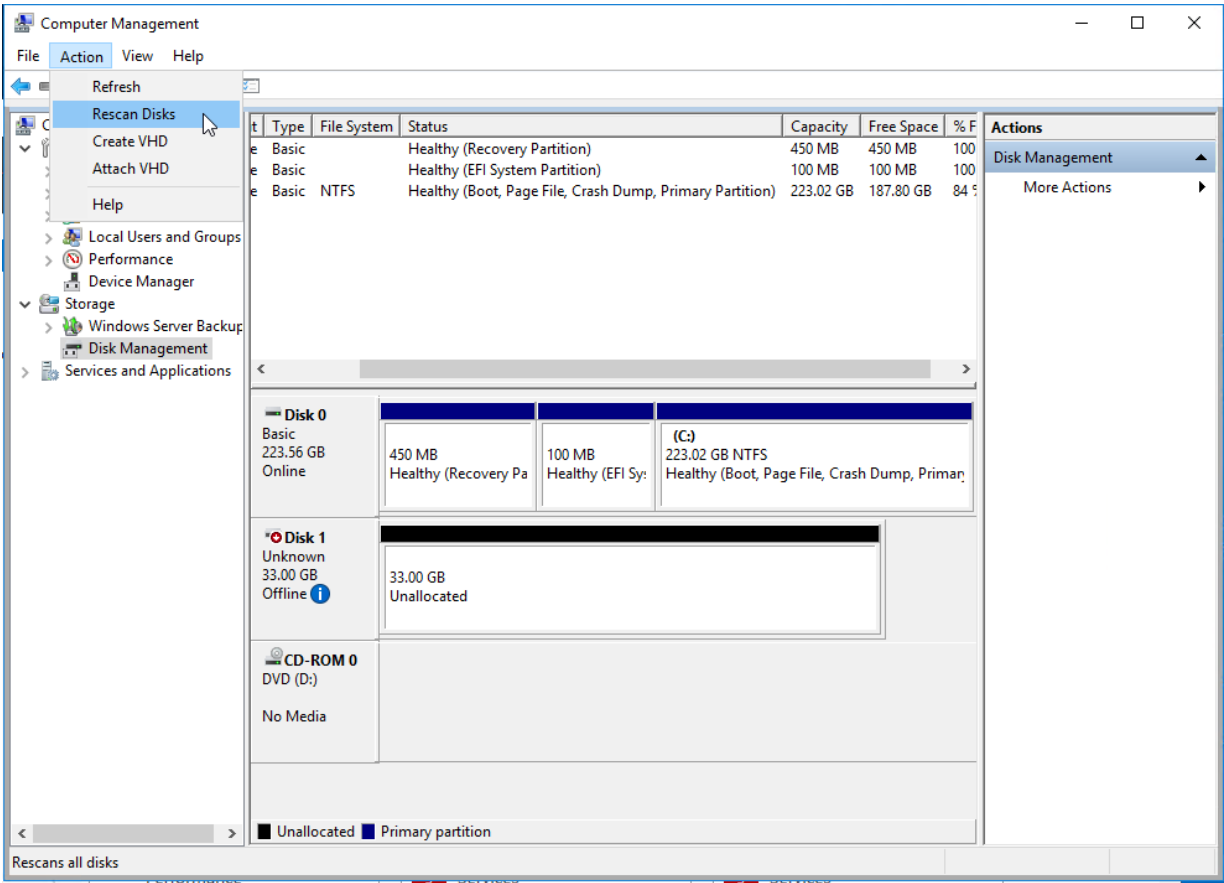
9. Click **OK**.

Now Server 2 can only access LUN 2 (66 GB), and Server 1 can only access LUN 1 (33 GB).

Both LUNs are enabled and have LUN masking configured, which is shown by the  icons.



Server 1 can now only access LUN 1 (33 GB).



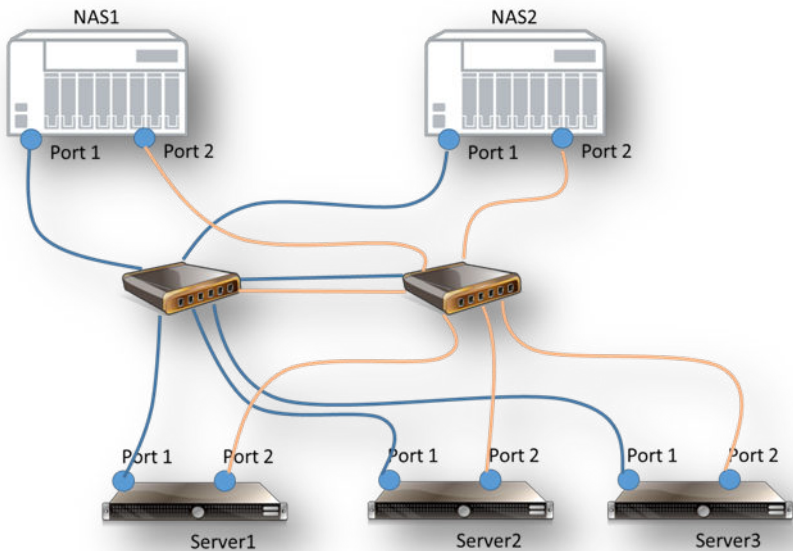
Scenario 5: Two NAS Devices, Two Switches, Three Clients (Zoning, Port Binding)

In the following scenario, three Fibre Channel client servers are connected to two different NAS devices using two Fibre Channel switches. The default behavior in Fibre Channel is that every device can communicate with every other device. If the servers are in a cluster, this is acceptable behavior. However, if the servers are independent from each other, this behavior might be undesirable as every server can access every LUN on each NAS.

We want to restrict which NAS each server can connect to. To do this, there are two security protocols which can be configured; zoning which is configured on the Fibre Channel switches, and port binding which is configured on the NAS.

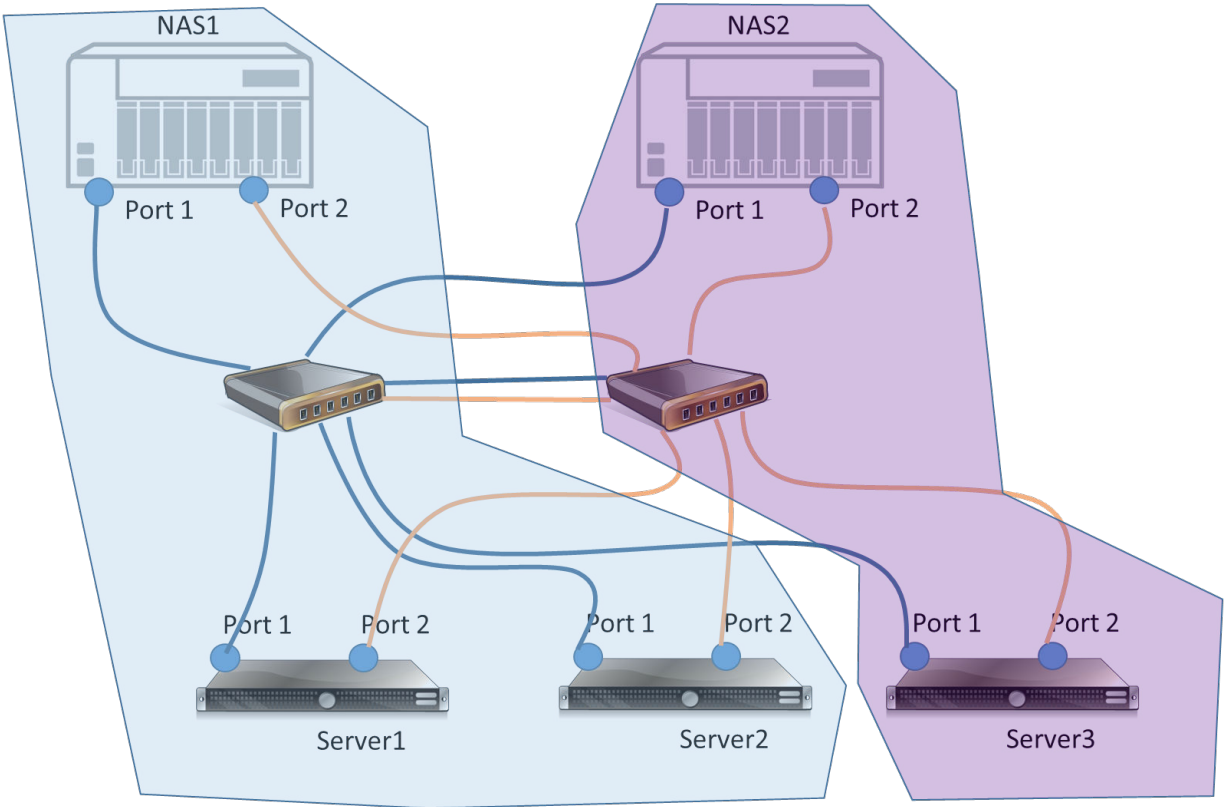
Important

Zoning is more secure and is more likely to prevent errors when adding and removing devices from a Fibre Channel fabric. For this reason, zoning should be the preferred security method, and porting binding should be considering an additional security layer on top of zoning.



Zoning

Zoning allows you to control which Fibre Channel devices can communicate with each other in a Fibre Channel fabric, by partitioning the fabric into zones. Only devices in the same zone can communicate with each other. Zoning is configured on the Fibre Channel switch. The following is a simple example of zoning:



Client	Zone	Can Access
Server 1	ZoneNAS1 (Blue)	NAS 1
Server 2	ZoneNAS1 (Blue)	NAS 1
Server 3	ZoneNAS2 (Purple)	NAS 2

Configuring Zoning on a Fibre Channel Switch



Note

- This example is designed to illustrate how zoning works. It is not a recommended method of configuring zoning, as it is not very efficient.
- There are two types of zoning: hard zoning which is based on Fibre Channel initiator hardware, and soft zoning which is based on WWPNs. The following example uses soft zoning.
- This example uses a Brocade G610 switch. The commands will differ depending on switch brand and mode, but the task steps and workflow should be similar.

For our example, we need to create the following two zones:

Zone	Members
ZoneNAS1	NAS1Port1, NAS1Port2, Server1Port1, Server1Port2, Server2Port1, Server2Port2
ZoneNAS2	NAS2Port1, NAS2Port2, Server3Port1, Server3Port2

1. Log into the switch.
2. Optional: Create an alias for each Fibre Channel device in the fabric.
Creating aliases makes managing devices and zones easier, as it allows you to use aliases in the switch configuration commands instead of the full WWPNs.

```
G610:admin> alicreate nas1p1,21:00:00:24:5e:be:00:06
G610:admin> alicreate nas1p2,21:00:00:24:5e:be:00:07
G610:admin> alicreate server1p1,21:00:f4:e9:d4:58:32:46
G610:admin> alicreate server1p2,21:00:f4:e9:d4:58:32:47
G610:admin> alicreate server2p1,10:00:00:10:9b:1b:cc:98
G610:admin> alicreate server2p2,10:00:00:10:9b:1b:cc:99
G610:admin> alicreate nas2p1,21:00:00:24:5e:be:00:12
G610:admin> alicreate nas2p2,21:00:00:24:5e:be:00:13
G610:admin> alicreate server3p1,21:00:f4:e9:d4:58:30:10
G610:admin> alicreate server3p2,21:00:f4:e9:d4:58:30:11
G610:admin>
```

3. Create the two zones.

```
G610:admin> zonecreate "ZoneNAS1", "nas1p1;nas1p2;server1p1;server1p2;server2p1;2p2;serv
G610:admin> zonecreate "ZoneNAS2", "nas2p1;nas2p2;server3p1;server3p2"
G610:admin>
```

4. Create a zone configuration `ZoneDemo` that contains the 2 zones.

```
G610:admin> cfgCreate "ZoneDemo", "ZoneNAS1;ZoneNAS2"
G610:admin>
```

5. Enable the zone configuration ZoneDemo on the switch.

```
G610:admin> cfgenable ZoneDemo
You are about to enable a new zoning configuration.
This action will replace the old zoning configuration with the
current configuration selected. If the update includes changes
to one or more traffic isolation zones, the update may result in
localized disruption to traffic on ports associated with
the traffic isolation zone changes.
Do you want to enable 'ZoneDemo' configuration (yes, y, no, n): [no] y
sw0 Updating flash ...
2019/06/21-10:43:22, [ZONE-1022], 69, FID 128, INFO, G610, The effective configuration has
zone config "ZoneDemo" is in effect
Updating flash ...
G610:admin>
```

6. Check the switch's active zoning configuration, to ensure it is using the ZoneDemo configuration.

```

G610:admin> cfgshow
Defined configuration:
cfg:   ZoneDemo
      ZoneNAS1; ZoneNAS2
zone:  ZoneNAS1
      nas1p1; nas1p2; server1p1; server1p2; server2p1; server2p2
zone:  ZoneNAS2
      nas2p1; nas2p2; server3p1; server3p2
alias: nas1p1  21:00:00:24:5e:be:00:06
alias: nas1p2  21:00:00:24:5e:be:00:07
alias: nas2p1  21:00:00:24:5e:be:00:12
alias: nas2p2  21:00:00:24:5e:be:00:13
alias: server1p1
      21:00:f4:e9:d4:58:32:46
alias: server1p2
      21:00:f4:e9:d4:58:32:47
alias: server2p1
      10:00:00:10:9b:1b:cc:98
alias: server2p2
      10:00:00:10:9b:1b:cc:99
alias: server3p1
      21:00:f4:e9:d4:58:30:10
alias: server3p2
      21:00:f4:e9:d4:58:30:11

Effective configuration:
cfg:   ZoneDemo
zone:  ZoneNAS1
      21:00:00:24:5e:be:00:06
      21:00:00:24:5e:be:00:07
      21:00:f4:e9:d4:58:32:46
      21:00:f4:e9:d4:58:32:47
      10:00:00:10:9b:1b:cc:98
      10:00:00:10:9b:1b:cc:99
zone:  ZoneNAS2
      21:00:00:24:5e:be:00:12
      21:00:00:24:5e:be:00:13
      21:00:f4:e9:d4:58:30:10
      21:00:f4:e9:d4:58:30:11

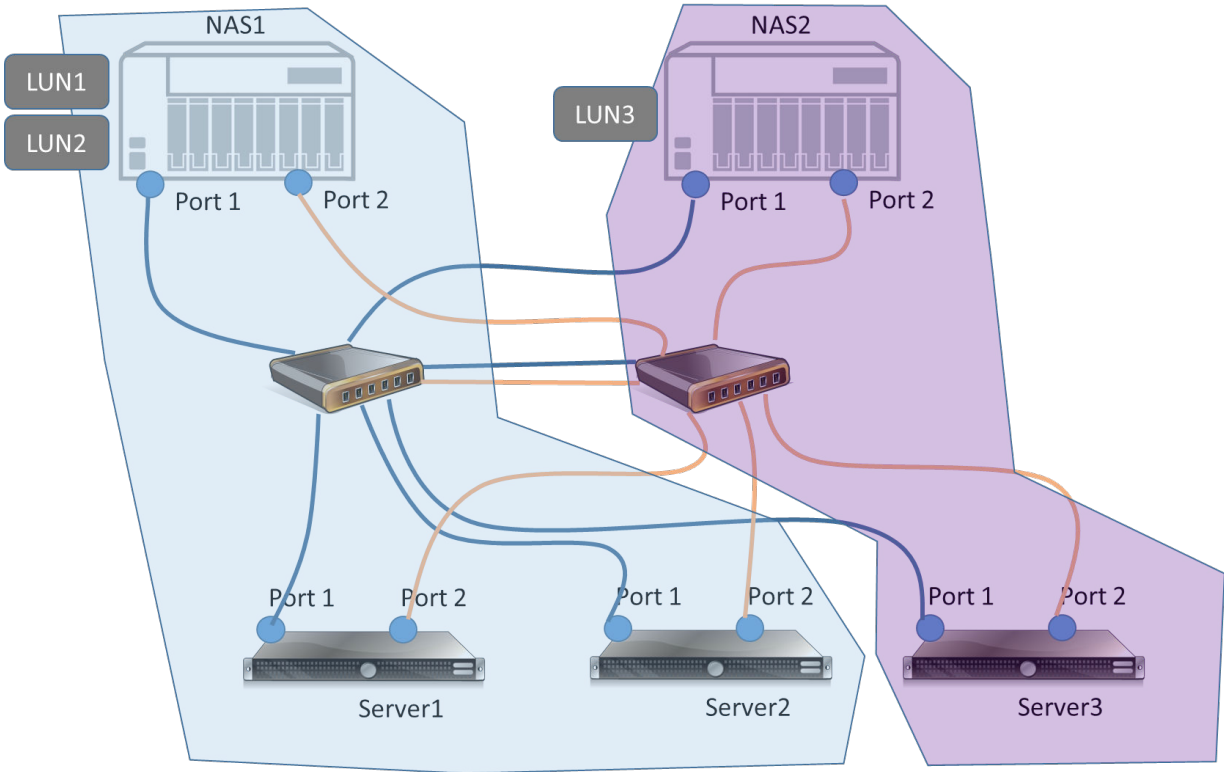
G610:admin>

```

7. Create two LUNs on NAS 1.

8. Create one LUN on NAS 2.

Final result:



LUN	LUN Masking Enabled	LUN is Visible to
LUN 1	No	Server 1, Server 2
LUN 2	No	Server 1, Server 2
LUN 3	No	Server 3

After zoning, each server has access to their specific NAS storage. Configuring LUN masking is the next necessary step in order to restrict which LUNs Server 1 and Server 2 can access. Summary of the configuration steps:

1. Create or edit the zoning on the switch (zoning determines which server can connect to which NAS)
2. Configure LUN masking to control LUN access permissions (LUN masking determines which server can which LUN)

Zoning Recommendations

The zoning example in this document is very simple, and should only be implemented in a very small environment with few members. Adding more members to a zone results in more management traffic (RSCN messages), which reduces the network bandwidth available for data transfer. Best practice is to create many zones, each containing a small number of members.

Zoning Methods

Zoning Method	Description	Advantages/ Disadvantages	Recommended
Flat	Create one zone containing all devices that needs to communicate.	Each zone will have a high number of WWPNS, increasing RSCN message traffic.	No
Single Target Multiple Initiators	Create one zone per target which contains the WWPNS of all initiators that need to connect to the target.	RSCN message traffic is high and it allows communication between initiators.	No
Single Target Single Initiator	Create one zone for every initiator-target connection.	This method avoids unnecessary RSCN traffic and SAN disruption due to fabric and storage updates. However, it requires creating and managing a large number of zones.	Yes (Preferred method)
Peer Zoning	Create one zone per target which contains the WWPNS of all initiators that need to connect to the target. The target is marked as the principal device, which means it can communicate with any other device in the zone. Non-principal devices (initiators) cannot communicate with each other.	Avoids unnecessary RSCN traffic and also is easier to manage, as it does not require creating one zone per connection.	Yes

Port Binding

Port binding is a security method that enables you to restrict which initiator WWPNS are allowed to log onto a Fibre Channel port. Port binding is configured on the NAS, in QTS.

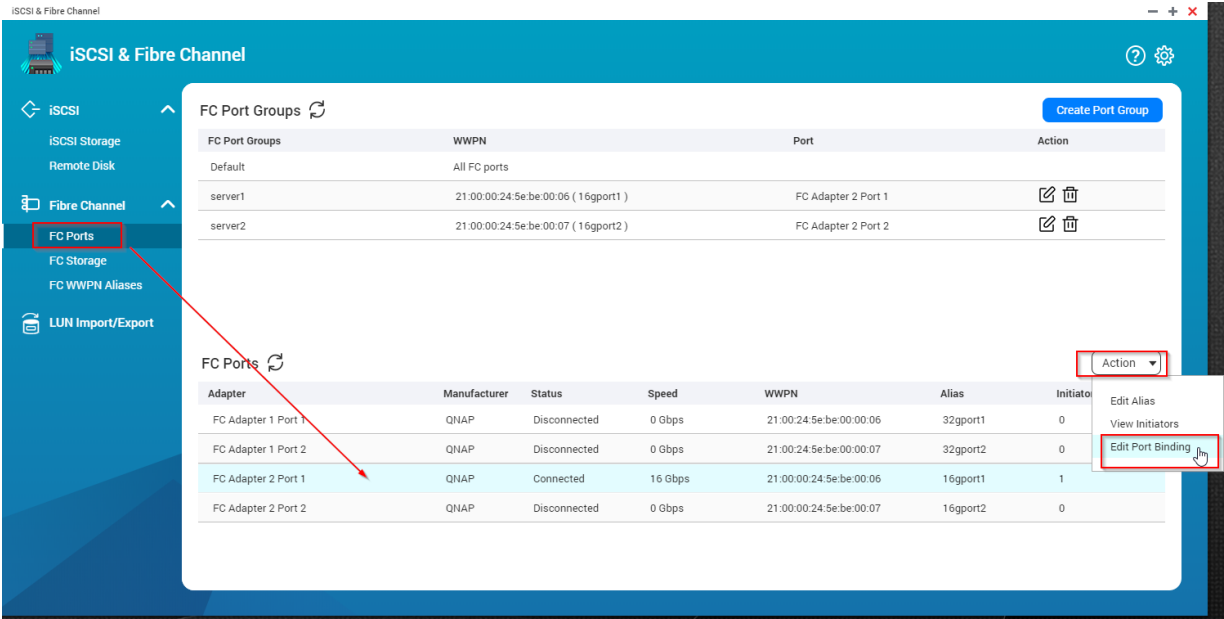


Note

- The previous example used zoning and LUN masking to restrict which servers can access which LUNs.
- Port binding should be considered an extra security layer in addition to zoning.
- By default, port binding is disabled on all Fibre Channel ports.

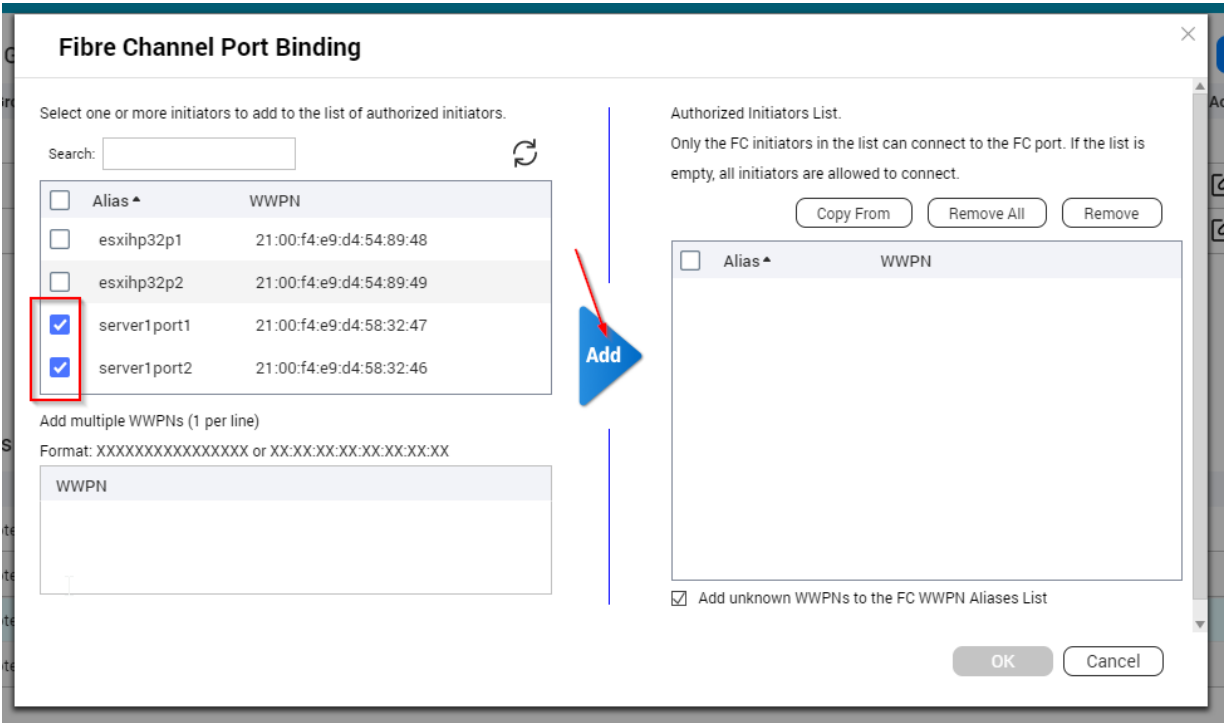
Configuring Port Binding

1. Go to **Main Menu > iSCSI & Fibre Channel > Fibre Channel > FC Ports**.
2. Select a Fibre Channel port.
3. Click **Action**, and then select **Edit Port Binding**.

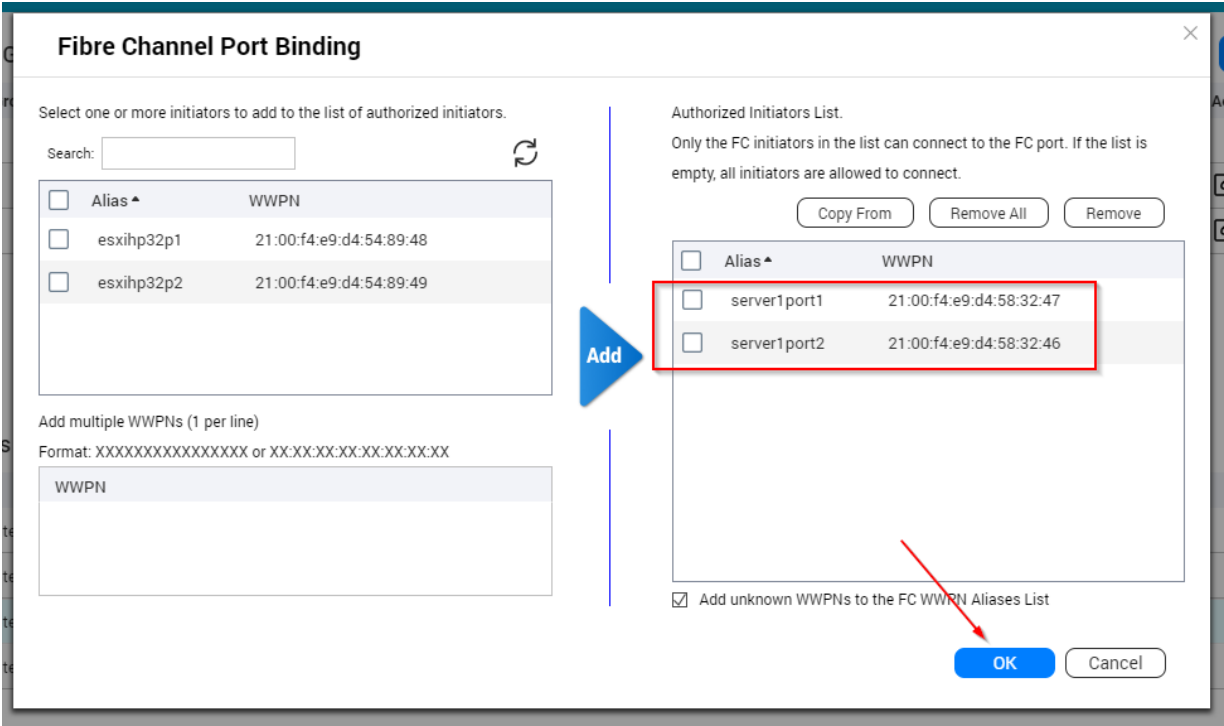


The **Fibre Channel Port Binding** window opens.


4. Select the WWPNs that are allowed to connect to this Fibre Channel port.

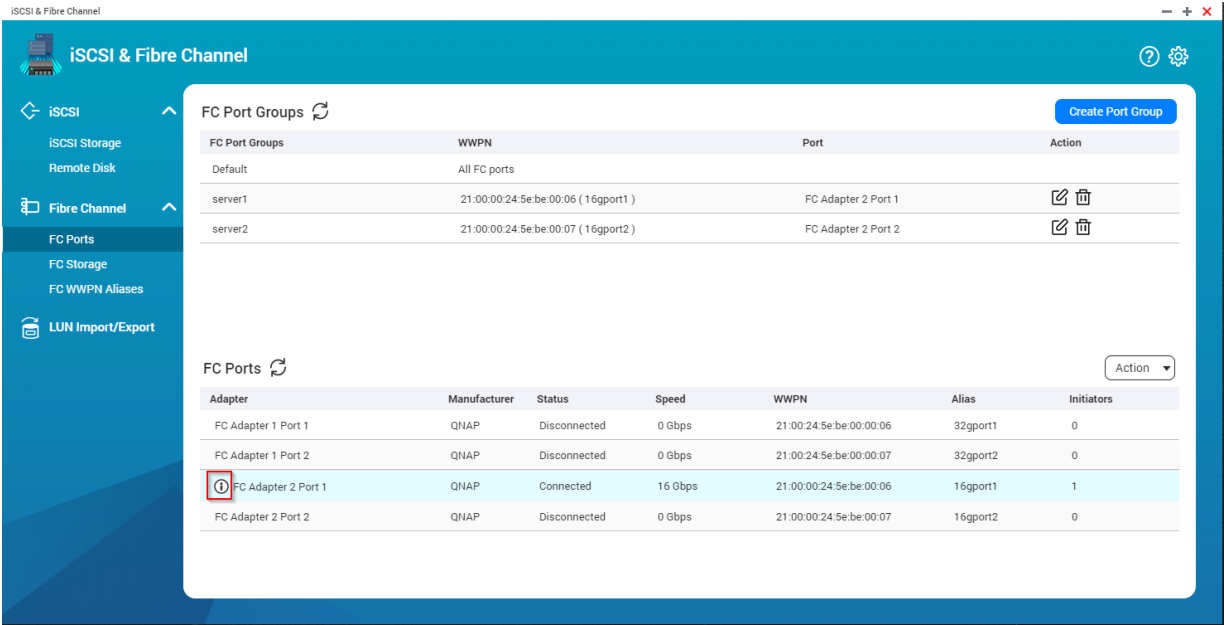


5. Click **Add**.
The WWPNs are added to the port's **Authorized Initiators List**.

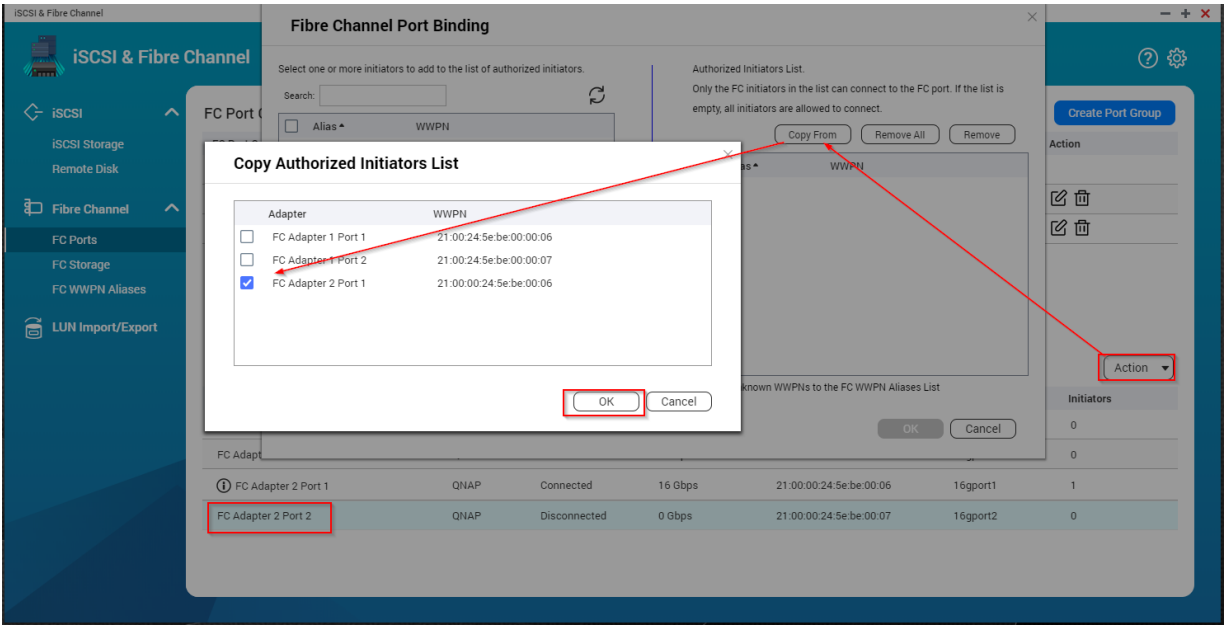


6. Click **OK**.
Only Server 1 ports `server1port1` and `server1port2` can log into the NAS port FC Adapter 2 Port 1.

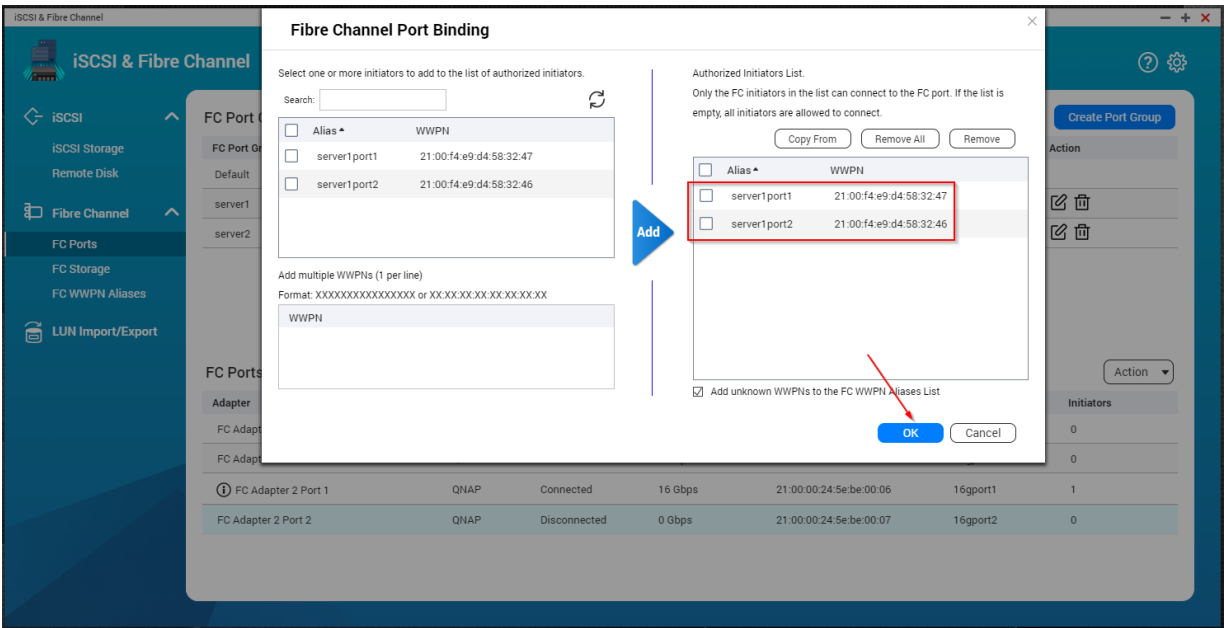
The  icon next to a port shows that port binding is configured.




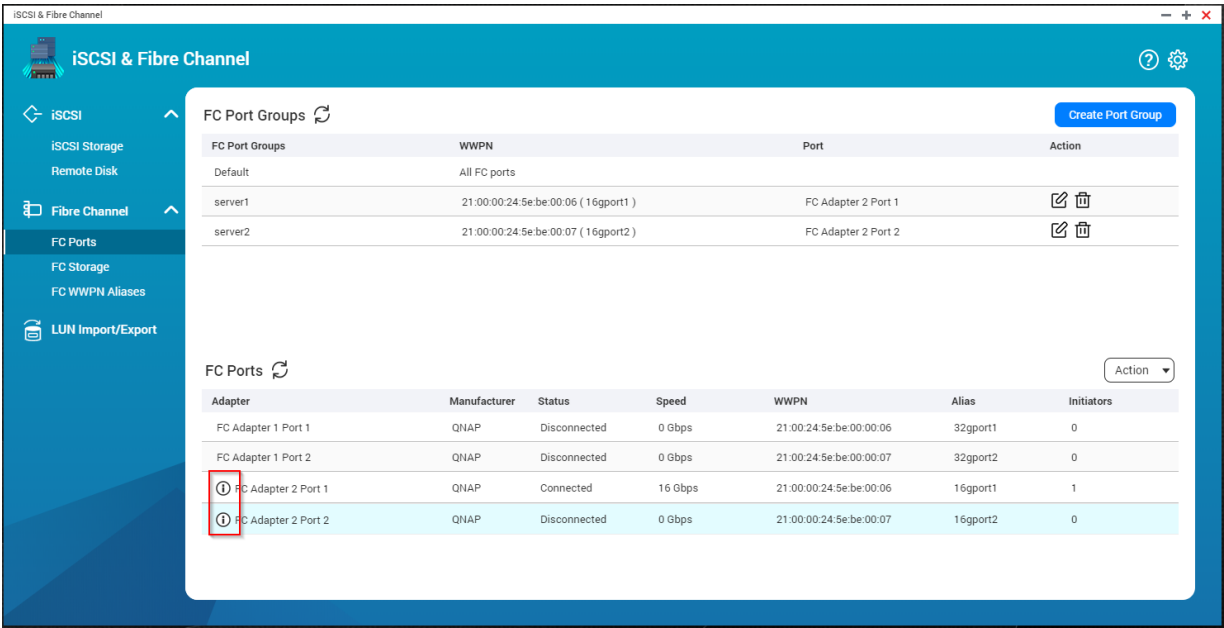
7. Optional: If a second port needs the same port binding permissions as FC Adapter 2 Port 1, configure port binding on the second port and then copy the authorized WWPN list from FC Adapter 2 Port 1 using **Copy From**.



After clicking **OK**, the second port has the same **Authorized Initiators List** as FC Adapter 2 Port 1.



The  icons confirm that both ports have port binding enabled. Now only Server 1 ports `server1port1` and `server1port2` can log into these two ports.



7. More Information

Notes

- If only one client is connected to the NAS with only one cable, then you only need to map the LUN to the default port group.
- Zoning should always be configured on all Fibre Channel switches in your fabric. Even if it's not needed immediately, configuring it at the beginning avoids disruption when adding more devices in the future.
- Generally if zoning is properly configuring on your Fibre Channel switches, then mapping LUNs to the default port group and configuring LUN Masking is sufficient for security.
- When disabling a LUN, always shutdown the servers using the LUN, or unmount the file systems properly to avoid data loss or data corruption. Disabling a LUN is required before configuring LUN mapping or LUN masking, to avoid unintentional LUN removal from a server.
- QNAP highly recommends using Fibre Channel transceivers and Fibre Channel cards with matching native speeds. For example, a 32Gb/s Fibre Channel card should be paired with a 32Gb/s transceiver. Using Fibre Channel cards or transceivers in backwards-compatibility mode may result in compatibility problems.
- Some transceivers may not work when used with an adapter from a different manufacturer.
- QTS does not support Fibre Channel tape libraries.

References

- Use MPIO with QNAP Turbo NAS for iSCSI:
http://files.qnap.com/news/pressresource/product/How_to_connect_to_your_QNAP_Turbo_NAS_from_Windows_Server_2012_using_MPIO.pdf
- [Obtaining LUN pathing information for ESX or ESXi hosts \(1003973\)](#)
- [QNAP Fibre Channel Product Page](#)
- [QNAP Compatibility list](#)