Using QNAP Enterprise-class ES NAS with Microsoft Windows Server and Hyper-V
Notices
This user manual provides detailed instructions of using the QNAP Enterprise Storage NAS. Please read carefully and start to enjoy the powerful functions of the Enterprise Storage NAS.

- The QNAP Enterprise Storage NAS is hereafter referred to as the ES NAS or the NAS.

- This manual provides the description of all the functions of the ES NAS. The product you purchased may not support certain functions dedicated to specific models.

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## Table of Contents

- Overview ................................................................. 4
- Infrastructure diagram .............................................. 4
- Pre-configure table .................................................... 4
- Server data ports configuration .................................... 5
  - Enable Jumbo Frame in Windows Server (optional) ............ 9
- Use storage through iSCSI .......................................... 13
  - Some updates are recommended. See “I. Optimize network performance” ........................................ 17
- Connect to iSCSI targets using Microsoft iSCSI initiator ........ 21
- Install the MPIO Service in Windows Server ....................... 24
- Configure the MPIO Service in Windows Server .................. 33
- Configure and start iSCSI initiator ................................ 39
- Mount iSCSI virtual disks ............................................ 42
- Optimize MPIO policies and performance ........................ 49
- Use iSCSI LUN to store Hyper-V virtual machines ............... 53
- Appendix ......................................................................... 55
  - I. Optimize network performance ................................ 55
  - II. Recommended updates and hotfixes for Windows Server .... 59
  - III. Optimize MPIO high availability fault tolerance timer .... 61
- References ..................................................................... 63
Overview

This application note aims for guiding users to mount the iSCSI LUN on ES NAS to Windows Server and Hyper-V, as well as the MPIO(Multi-Path I/O) settings. As for how to create a iSCSI LUN on ES NAS, refer to “Network and Storage Settings of ES NAS High-Availability Network Storage Services” instead.

Infrastructure diagram

Pre-configure table

<table>
<thead>
<tr>
<th></th>
<th>Windows Server</th>
<th>ES 1640dc v2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SCA</td>
</tr>
<tr>
<td>Data Port 1</td>
<td>8.8.1.80</td>
<td>8.8.1.107</td>
</tr>
<tr>
<td>Data Port 2</td>
<td>8.8.2.80</td>
<td>8.8.2.107</td>
</tr>
</tbody>
</table>
1. Take Windows Server as example, use “Windows Key + X” on the keyboard and click “Network Connections”.

2. Click the desired connections to configure the connection properties.
3. Click “Properties”.

5. Type the IP address, and an appropriate subnet mask. User can skip default gateway and DNS Server.

![Internet Protocol Version 4 (TCP/IPv4) Properties](image)

6. After configuring the IP settings, click “Details” to view the configured network settings.

![Ethernet 2 Status](image)
7. Check out the IP address and subnet mask, and click “Close”.

![Network Connection Details]

8. Follow the steps above, complete configuration of all the other data ports, obtaining their own IP addresses.

![Network and Sharing Center]
Enable Jumbo Frame in Windows Server (optional)

Each link in the network path, including servers and endpoints, should be configured to enable jumbo frames at the same MTU if jumbo frames function is needed. Otherwise, performance may actually decrease as incompatible devices drop frames.

1. Choose one data port at Network and Sharing Center.

![Network and Sharing Center](image1)

2. Click “Properties”.

![Ethernet 2 Status](image2)
3. Click “Configure” in the adaptor’s Properties window.

4. Select the “Advanced” tab. Then select “Jumbo Packet” in the “property” list and choose “9014 Bytes” from the Value drop-down menu.
5. Follow the steps above to complete all other data port, and enable Jumbo Frame.
To optimize the network performance, see “Optimize network performance” in Appendix I.

2. If this is the first time that you have launched Microsoft iSCSI Initiator, you receive a prompt that says the Microsoft iSCSI service is not running. You must start the service for Microsoft iSCSI Initiator to run correctly. Click “Yes” to start the service. The Microsoft iSCSI Initiator Properties dialog box opens, and the Targets tab is displayed.

3. Click the “Discovery” tab. To add the target portal, click “Discover Portal”.

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4. In the “Discover Target Portal” dialog box, type the IP address or name of the target portal to connect to. Keep the TCP port to 3260 as the default.

5. IP address of NAS data port is added in the list.
6. The available iSCSI targets and their status will then be shown under the "Targets" tab. Select the target you wish to connect to and click "Connect".

7. Click “OK” to connect to target.

8. The status of the target should now display "Connected".
### iSCSI Initiator Properties

#### Targets

**Quick Connect**

To discover and log on to a target using a basic connection, type the IP address or DNS name of the target and then click Quick Connect.

**Target:**

- **Target:** [Input Field]
- **Quick Connect...** [Button]

**Discovered targets**

<table>
<thead>
<tr>
<th>Name</th>
<th>Status</th>
</tr>
</thead>
</table>

- **Connect** [Button]
- **Disconnect** [Button]
- **Properties...** [Button]
- **Devices...** [Button]

To connect using advanced options, select a target and then click Connect.

To completely disconnect a target, select the target and then click Disconnect.

For target properties, including configuration of sessions, select the target and click Properties.

For configuration of devices associated with a target, select the target and then click Devices.
Install the MPIO Service in Windows Server

1. Open Server Manager, click “Add roles and features” under “Configure this local server”.

2. In the “Before you begin” step, read the description, and then click “Next”.
3. In the “Select installation type” step, select “Role-based or feature-based installation”, and then click “Next”.

4. Choose “Select a server from the server pool”, select the Windows Server 2012 R2 (you can identify the server using its IP address) from Server Pool, and then click “Next>”.
5. In the “Select server roles” step, click “Next”.

6. In the “Features” list, find and select “Multipath I/O”, and click “Next”.
7. On the “Confirm installation selections” window, click “Install”. Then click “Close” when it is finished.

8. Click “Close” when installation completes.
Configure the MPIO Service in Windows Server

1. Open Server Manager, click “Tools” > “MPIO” to open the “MPIO Properties” window.
2. Switch to the “Discover Multi-Paths” tab, select “Add support for iSCSI devices” to use Microsoft Multipath I/O (MPIO) with iSCSI Initiator, and then click “Add”.

3. Click “Yes” to reboot the server.
4. After restarting the computer, log in as a domain administrator and then launch MPIO again. You should see an iSCSI device added into the list.
Configure and start iSCSI initiator

1. Open Server Manager, click “Tools” > “iSCSI Initiator”.

2. To avoid some possible problems resulted from iSCSI connection, user should remove the former connection used for installing MPIO, and reconnect it with MPIO enabled. Select the connected iSCSI LUN, click “Disconnect”.
3. Switch to “Discovery” tab, select added IP and click remove.

4. Under “Favorite Targets”, select iSCSI targets and remove it.
5. Back to “Discovery” tab and click “Discover Portal”.

6. In the “Discover Target Portal” dialog box, type the IP address of data ports in NAS. Keep the TCP port to 3260 as the default.
7. The available iSCSI targets and their status will then be shown under the "Targets" tab. The two targets shown here are owned by each of the two controllers. Select the target you wish to connect to and click "Connect".

- Quick Connect: To discover and log on to a target using a basic connection, type the IP address or DNS name of the target and then click Quick Connect.

- Discovered targets:

<table>
<thead>
<tr>
<th>Name</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>ign.2004-04.com.qnap:es1640dc::iscsi.hvlun1.ee048c.0</td>
<td>Inactive</td>
</tr>
</tbody>
</table>

- To connect using advanced options, select a target and then click Connect.
- To completely disconnect a target, select the target and then click Disconnect.
- For target properties, including configuration of sessions, select the target and click Properties.
- For configuration of devices associated with a target, select the target and then click Devices.
8. Select “Enable multi-path” and click “Advanced...”.

9. On the “Advanced Settings” window, select “Microsoft iSCSI Initiator” from the “Local adapter” drop-down menu. Then select an IP address from “Initiator IP” drop-down list and “Target portal IP” drop-down list respectively. Please ensure the Initiator IP and Target portal IP are in the same subnet.

10. Click “OK” to close the window.
11. It shows that one of these iSCSI targets is successfully connected. Select this target and then click “Properties”.

**iSCSI Initiator Properties**

<table>
<thead>
<tr>
<th>Targets</th>
<th>Discovery</th>
<th>Favorite Targets</th>
<th>Volumes and Devices</th>
<th>RADIUS</th>
<th>Configuration</th>
</tr>
</thead>
</table>

**Quick Connect**

To discover and log on to a target using a basic connection, type the IP address or DNS name of the target and then click Quick Connect.

**Target:**

*Quick Connect...*

**Discovered targets**

<table>
<thead>
<tr>
<th>Name</th>
<th>Status</th>
</tr>
</thead>
</table>

To connect using advanced options, select a target and then click Connect.

To completely disconnect a target, select the target and then click Disconnect.

For target properties, including configuration of sessions, select the target and click Properties.

For configuration of devices associated with a target, select the target and then click Devices.
12. On the “Sessions” tab, select “Add session”.

![Properties dialog box](image)

To add a session, click Add session.

To disconnect one or more sessions, select each session and then click Disconnect.

13. Select “Enable multi-path”, and then click “Advanced...”.

![Connect To Target dialog box](image)

- Add this connection to the list of Favorite Targets.
- Enable multi-path

14. Add the IP address of the other data port that belongs to a different subnet. Please ensure the Initiator IP and Target portal IP are in the same subnet. Click “OK” to close the window.

![Advanced Settings dialog box](image)
15. You should see another session added into the list. Click “OK” to close the window.

16. Repeat steps above to set up the other iSCSI target with MPIO.
17. After configuring both targets with MPIO, add the iSCSI volume and/or device to be persistently bound to the iSCSI service. It ensures that the iSCSI Initiator service will not complete initialization until all persistently bound volumes and devices are available to the computer. Select “Volumes and Devices” tab on the iSCSI Initiator Properties window, and then click “Auto Configure” to automatically configure all available devices. You should see a new volume named as “mpio#disk.............” in the Volume list. Click “OK” to close the window.

iSCSI Initiator Properties

<table>
<thead>
<tr>
<th>Targets</th>
<th>Discovery</th>
<th>Favorite Targets</th>
<th>Volumes and Devices</th>
<th>RADIUS</th>
<th>Configuration</th>
</tr>
</thead>
</table>

If a program or service uses a particular volume or device, add that volume or device to the list below, or click Auto Configure to have the iSCSI initiator service automatically configure all available devices.

This will bind the volume or device so that on system restart it is more readily available for use by the program or service. This is only effective if the associated target is on the Favorite Targets List.

Volume List:

```

```

To automatically configure all available devices, click Auto Configure.

To add a specific device, click Add.

To remove a device, select the device and then click Remove.

To immediately remove all devices, click Clear.

Ok Cancel Apply
Mount iSCSI virtual disks

1. In Windows Server 2012 or the later versions, use “Windows Key + X” to select “Disk Management”.

2. User should see a new disk appears as “Offline” in the bottom panel. Click “Offline” and select “Online” to bring this disk online.
3. The disk status becomes “Not Initialized”. Before you can use a disk, you must first initialize it. Right click on “Not Initialized” and select “Initialize Disk”.

4. Select the disk that is to be initialized, and select MBR as default. (GPT is for disks larger than 2 TB).
5. The disk is now initialized. You can now create a volume on it. Right click on the disk and select “New Simple Volume”.

6. Follow the on-screen instruction of the “New Simple Volume Wizard”. After the volume is formatted, a new drive is attached to your PC.

7. Specify volume size, set maximum disk space as default.
8. Assign drive letter as user desire, then click “Next”.
9. Specify partition name and file system, select “Perform a quick format” to accelerate format, and click “Next”.

10. Confirm all the settings, and click “Finish”.
11. After quick format, it will specify disk name and letter as shown in the figure.

12. Start Windows Explorer. Then click “This PC” and you can now use this iSCSI LUN as a regular disk partition.
Optimize MPIO policies and performance

1. Open Disk Management, right-click the mounted iSCSI disk, and select Properties.
2. Click on the "MPIO" tab and select the "Round Robin with Subset" in "Select the MPIO policy" field. Round Robin with Subset allows the data to be transmitted only on path close to the controller, thus improves transmission efficiency. To test performance, it is recommended to select "Least Queue Depth" instead.

3. Click the "Details" button to confirm that "Path Verify Enabled" is checked in DSM Details.
**TIPS : MPIO Policy Description**

**Fail Over Only:** Policy that does not perform load balancing. This policy uses a single active path, and the rest of the paths are standby paths. The active path is used for sending all I/O. If the active path fails, then one of the standby paths is used. When the path that failed is reactivated or reconnected, the standby path that was activated returns to standby.

**Round Robin:** Load balancing policy that allows the Device Specific Module (DSM) to use all available paths for MPIO in a balanced way. This is the default policy that is chosen when the storage controller follows the active-active model and the management application does not specifically choose a load-balancing policy. (Windows default)

**Round Robin with subset:** Load balancing policy that allows the application to specify a set of paths to be used in a round robin fashion, and with a set of standby paths. The DSM uses paths from a primary pool of paths for processing requests as long as at least one of the paths is available. The DSM uses a standby path only when all the primary paths fail. For example, given 4 paths: A, B, C, and D, paths A, B, and C are listed as primary paths and D is the standby path. The DSM chooses a path from A, B, and C in round robin fashion as long as at least one of them is available. If all three paths fail, the DSM uses D, the standby path. If paths A, B, or C become available, the DSM stops using path D and switches to the available paths among A, B, and C. (QNAP recommend)

**Least Queue Depth:** Load balancing policy that sends I/O down the path with the fewest currently outstanding I/O requests. For example, consider that there is one I/O that is sent to LUN 1 on Path 1, and the other I/O is sent to LUN 2 on Path 1. The cumulative outstanding I/O on Path 1 is 2, and on Path 2, it is 0. Therefore, the next I/O for either LUN will process on Path 2.

**Weighted Paths:** Load balancing policy that assigns a weight to each path. The weight indicates the relative priority of a given path. The larger the number, the lower ranked the priority. The DSM chooses the least-weighted path from among the available paths.

**Least Blocks:** Load balancing policy that sends I/O down the path with the least number of data blocks currently being processed. For example, consider that there are two I/Os: one is 10 bytes and the other is 20 bytes. Both are in process on Path 1, and both have completed Path 2. The cumulative outstanding amount of I/O on Path 1 is 30 bytes. On Path 2, it is 0. Therefore, the next I/O will process on Path 2.


To optimize fault tolerance timer, see “III. Optimize MPIO high availability fault tolerance timer” in Appendix III.
Use iSCSI LUN to store Hyper-V virtual machines

2. The New Virtual Machine wizard opens. Click “Next” to create a virtual machine with a custom configuration.

3. On the “Specify Name and Location” page, type an appropriate name. Then select “Store the virtual machine in a different location” and click “Browse...”.
4. Select the iSCSI drive that we have created to store the virtual machine.

5. Click “Next” to proceed.
6. Specify the generation for the virtual machine. Note that you cannot change its generation once a virtual machine has been created.

7. On the “Assign Memory” page, specify enough memory to start the guest operating system.
8. On the “Configure Networking” page, connect the virtual machine to the switch you created when you installed Hyper-V.

9. In this example Hyper-V built a virtual disk in iSCSI LUN, if you will install the guest operating system from a DVD or an image file (an .ISO file), choose “Create a virtual hard disk”. Confirm the size and click “Next>”.

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10. Then click the option that describes the type of media you will use. For example, to use an .iso file, click “Install an operating system from a bootable CD/DVD” and then specify the path to the .iso file.

11. On the Summary page, verify your selections and click “Finish”.
12. From Hyper-V Manager, right-click the name of the virtual machine and click “Connect...”. The virtual machine starts, searches the startup devices, and loads the installation package. Proceed through the installation.

13. Open the Windows Explorer and click the iSCSI drive to view all the installation files or files created on the VM.
Appendix

I. Optimize network performance

TIPS: Different brands, network adapter models may need different optimization, the effect may not be the same, here to Intel X540 network card as an example.

1. Open Device Manager, right-click the Data-port where the card, press the "Properties".
2. Click the "Advanced" page, in "Settings" to find the "Jumbo Packet" item and modify the value to 9000 or 9014 bytes.

3. Click "Interrupt Moderation", and modify the value to Disabled. (This step is optional, if your card is Intel X550, it is recommended to the default value).
4. Click "Performance Options", then press the "Properties" button on the right, turn off "Interrupt Moderation Rate". (This step is optional, if your card is Intel X550, it is recommended to leave the default.)
5. Open Windows PowerShell, enter "netsh int tcp set supplemental datacenter", until the screen shows OK.
II. Recommended updates and hotfixes for Windows Server

We recommend the following hotfixes that offer reliability and performance enhancements and protect against security vulnerabilities of the Windows Server. You may choose to install these hotfixes manually or automatically. The updates and hotfixes are organized by operating system version.

Windows Server 2012 R2:


Windows Server 2012:

<table>
<thead>
<tr>
<th>Hotfix</th>
<th>Importance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2796995</td>
<td>Recommended</td>
<td>Offloaded Data Transfers fail on a computer that is running Windows 8 or Windows Server 2012.</td>
</tr>
</tbody>
</table>

Windows Server 2008 R2 SP1:

<table>
<thead>
<tr>
<th>Hotfix</th>
<th>Importance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2684681</td>
<td>Required</td>
<td>Iscsicpl.exe process stops responding when you try to reconnect a storage device to a computer that is running Windows Vista, Windows Server 2008, Windows 7, or Windows Server 2008 R2.</td>
</tr>
<tr>
<td>2754704</td>
<td>Required</td>
<td>A hotfix is available that provides a mechanism for DSM to notify MPIO that a particular path is back to online in Windows Server 2008 and Windows Server 2008 R2.</td>
</tr>
</tbody>
</table>

Windows Server 2008 R2:

<table>
<thead>
<tr>
<th>Hotfix</th>
<th>Importance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>979711</td>
<td>Required</td>
<td>Stop error message on a computer that is running Windows 7 or Windows Server 2008 R2 and that has iSCSI storage: &quot;0x0000000A&quot;</td>
</tr>
<tr>
<td>2520235</td>
<td>Recommended</td>
<td>&quot;0x0000009E&quot; Stop error when you add an extra storage disk to a failover cluster in Windows Server 2008 R2.</td>
</tr>
<tr>
<td>2522766</td>
<td>Required</td>
<td>The MPIO driver fails over all paths incorrectly when a transient single failure occurs in Windows Server 2008 or in Windows Server</td>
</tr>
</tbody>
</table>
### Windows Server 2008:

<table>
<thead>
<tr>
<th>Hotfix</th>
<th>Importance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2684681</td>
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</tr>
<tr>
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<td>Required</td>
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</tr>
</tbody>
</table>

### Windows Server 2003 (and Windows Server 2003 R2) SP2:

<table>
<thead>
<tr>
<th>Hotfix</th>
<th>Importance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>945119</td>
<td>Required</td>
<td>Stop error that is related to the Storport.sys driver on a Windows Server 2003-based computer: &quot;0x000000D1 (parameter1, parameter2, parameter3, parameter4) DRIVER_IRQL_NOT_LESS_OR_EQUAL&quot;</td>
</tr>
<tr>
<td>982109</td>
<td>Required</td>
<td>Access to an MPIO-controlled storage device fails after you disconnect all data cables in Windows Server 2003.</td>
</tr>
</tbody>
</table>
III. Optimize MPIO high availability fault tolerance timer

1. Press the keyboard Windows key + R button, enter regedit.

2. In "HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Disk" path, find "TimeOutValue", click the right mouse button, then press Modify.
3. Click on the right Decimal option, and then enter the value on the left.

![Image Path](imagePath)

**Edit DWORD (32-bit) Value**

- Value name: TimeoutValue
- Value data: 60
- Base: Decimal

4. Follow the instructions on the next page to modify the value of other registry keys.
TIPS: Proposed modification of the registry keys

Registry Entries for SCSI Miniport Drivers

Path: HKLM\SYSTEM\CurrentControlSet\Services\Disk

Value Name: TimeOutValue
Description: Timeout (seconds) after the disk is offline.
Default Value: 60
Recommended Value: 60 or adjust as necessary
Range: 1~255

Microsoft iSCSI Initiator Driver Timers

Path: HKLM\SYSTEM\CurrentControlSet\Control\Class\{4D36E97B-E325-11CE-BFC1-08002BE10318\}0001\Parameters

Value Name: DelayBetweenReconnect
Description: When the connection is interrupted, the iSCSI driver attempts to reconnect, log in. Modify this value to adjust the reconnect interval (seconds).
Default Value: 5
Recommended Value: 10

Value Name: LinkDownTime
Description: An I/O request sent, the maximum time to wait (seconds), only to determine the connection is interrupted, and then re-connected again.
Default Value: 15
Recommended Value: 300

(Continued on next page)
**TIPS:** Proposed modification of the registry keys (Continued on the previous page)

<table>
<thead>
<tr>
<th>Value Name</th>
<th>Description</th>
<th>Default Value</th>
<th>Recommended Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MaxRequestHoldTime</td>
<td>An I/O request sent out found that the target is lost, the maximum time to wait (seconds), and then reconnect.</td>
<td>60</td>
<td>300</td>
</tr>
<tr>
<td>SrbTimeoutDelta</td>
<td>The system disk driver (such as disk.sys) does not take into account the network latency when deciding on a transmission timeout. This value provides a reference time (in seconds) for network timeouts to these disk drivers.</td>
<td>15</td>
<td>300</td>
</tr>
</tbody>
</table>

**Microsoft Multipath I/O (MPIO) Timers**

Path: HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters

<table>
<thead>
<tr>
<th>Value Name</th>
<th>Description</th>
<th>Default Value</th>
<th>Recommended Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PathVerificationPeriod</td>
<td>Indicate the time period (in seconds) that MPIO performs path validation.</td>
<td>30</td>
<td>30 or adjust as necessary</td>
</tr>
<tr>
<td>PDORemovePeriod</td>
<td>The amount of time (in seconds) that the MPIO LUN remains in system memory, even if all device paths fail. When this time is exceeded, the I/O operation will fail and the system will no longer attempt to recover the connection path and inform the application that I/O has failed.</td>
<td>20</td>
<td>600</td>
</tr>
</tbody>
</table>
TIPS: Proposed modification of the registry keys (Continued on the previous page)

Value Name: RetryCount

Description: The number of times that DSM (device-specific modules) must retry when it determines that an I/O request has failed.

Default Value: 3

Recommended Value: 3, or adjust as necessary

Value Name: RetryInterval

Description: Indicate the time interval (in seconds) that must be retried when DSM (device-specific modules) determines that an I/O request has failed.

Default Value: 1

Recommended Value: 1, or adjust as necessary
References
