QNAP and Failover Technologies

USE MC/S WITH QNAP NAS
How to connect an iSCSI initiator on Windows 2008 with MC/S feature

QNAP provides you what others cannot!

MC/S (Multiple Connections per Session) enables you to have multiple TCP connections per session to reach an iSCSI target. This ensures better performance, and provides load balancing and failover.
MC/S is part of all x86-based QNAP NAS, e.g. TS-239, TS-439, TS-509, TS-639, TS-809 (see http://www.qnap.com/images/products/comparison/Comparison_NAS.html)

In this application note, we will connect an iSCSI target with multiple connections.

Benefits of using MC/S with a QNAP NAS:
- It allows better performance! Using several TCP connections for data transmission will enhance network throughput.
- It allows Failover! In case of network problem (e.g. faulty cable, switch power unit malfunction), it will avoid downtime! All applications will remain online!
- It allows load balancing! Whenever a large transfer occurs, it can use different switches for the transfer to avoid a possible switch overload if only one is used!

Before getting started, please know:
- DO NOT use NIC Teaming on the server: NIC Teaming used with iSCSI is not supported by Microsoft.
- DO NOT use MC/S and MPIO together to connect to a target. Microsoft does not support that configuration: “Although it is technically possible to layer Microsoft MPIO and MC/S together since they function at different layers in the Windows stack, Microsoft does not support the layering of MPIO and MC/S due to complexities this can introduce if troubleshooting is needed on a configuration.”
In this Application note, you will find:

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Two different configurations will be demonstrated in this application note. 
  - The first one is based on a simple network architecture. 
  - The second one will use a more advanced configuration to allow failover and load balancing.

**Some Possible Physical Network architectures**

1 network link

The simplest way to try MC/S is to have a simple connection with 1 physical interface on each side.

![Diagram of 1 network link configuration](image)

2 network links

Dual connection: 2 network interfaces on each side.

![Diagram of 2 network links configuration](image)

This architecture offers failover, load balancing and performance enhancement. We will see in details how to set up the MC/S feature on this network architecture to allow failover.
MC/S over a single network interface

In this example, we will have only one network connection on each side. Without MC/S, one connection to an iSCSI target would result in 1 session each time you click "logon" to logon and connect to an iSCSI target. Each session is composed in this case with 1 TCP connection. It would look like:

With MC/S, we can have more than 1 TCP connection for each session. That means you can logon onto the target and add several connections for the same session. It would look like:
MC/S over a 2 network interfaces

MC/S can also provide failover. If your server has multiple network interfaces, it is possible to use MC/S in that purpose.

As we’ve seen previously, after an iSCSI logon, we can add TCP connections to the same session (this procedure will be explained in details later). When adding a TCP connection to a session, it is possible to specify the source interface. In that case, if we connect through the first interface, then add a connection through the second interface. The session will remain alive even if one on the network interface fails.

If your QNAP NAS has 2 network interfaces, you can enable failover mode (trunking mode) to allow failover on both sides.
Different possible failures and failover concept

Handled by MC/S feature

If the cable or the switch linked to IP1 or IP2 failed, one of the 2 connections will fail, but the other connection will remain connected:
Handled by QNAP Trunking mode (failover setting)

If one of the cable linked to the QNAP NAS failed, the all path will remain UP, because it is protected by the QNAP port trunking mode:

**Pre-requisites of using MC/S (detailed later)**

- Have an existing iSCSI target created on the NAS (firmware version 3.2.0 or later).
- To allow full network failover, have trunking mode enabled on the QNAP NAS.

**Steps review**

The following procedure will guide you to:
- Set up an iSCSI target on your QNAP NAS
- Add your QNAP iSCSI portal
- Connect to your iSCSI target
- Add a second connection to your current iSCSI session
Set up an iSCSI target on your QNAP NAS

Set up an iSCSI target on your QNAP NAS. You can refer to the online application note “Create and use the iSCSI target service on the QNAP NAS” on http://www.QNAP.com/pro_features.asp.

Connect to your QNAP iSCSI portal

You can add an iSCSI LUN.

From the administrative tools, launch the iSCSI Initiator menu:

You will obtain a new window. From there you will be able to connect the first path to your iSCSI target.
Click the "Discovery" tab, then click "Add Portal" to add your QNAP NAS.
Enter the IP address or DNS name of your QNAP NAS,

Then click “OK”.

Return to the initiator window; go to the “Targets” tab. You will see all the targets on your QNAP NAS.
Connect to your iSCSI target (first connection)

Select the target you want to connect to, and click “Log on…”

On the new window, check “Automatically restore this connection when computer starts” to make that iSCSI target to be connected at Windows startup.

**DO NOT** check “Enable multi-path”.

[Diagram of iSCSI Initiator Properties window with highlighted options for logging on and selecting targets.]

[Diagram of Log On to Target window with options for automatic connection and multi-path selection.]
If you have only **1 network interface**, just click “OK”.

If you have **2 network connections**, click “Advanced”.

On the “Advanced” tab you can add the specific target-initiator pair in **one of the iSCSI networks ONLY** by choosing the initiator, IP source (first IP) and portal. Assuming we have 2 IP addresses: 172.17.23.210 and 172.17.23.211, we choose the first one: 172.17.23.210:

Click “OK”  
Click “OK” again.
Then, you can see your iSCSI target connected.
Once you are connected with a first connection, we can add the second TCP connection to the same iSCSI session. To do so, click “Details” after selecting the connected target.

You can see on the next windows the session you have connected before. You can also see that there is only 1 connection “1”.

Click “Connections” to add another connection.
A new window will appear.

The load balancing policy is shown. The default policy is "Round Robin". You can also see the previous connection that has been done before. Note that the connection may appear different depending on your configuration:

- With 1 network interface, it may appear without source IP address, because we didn’t precise it when we’ve connected to the target.

- With 2 network interfaces, we can see the source IP address that we used to connect to the target.
Click “Add” to add a connection.

A new window appears.

2 Network Interfaces

1 Network Interface
If you have only 1 network interface, click “OK”.

If you have 2 network connections, click “Advanced”. Select the initiator, IP source (second IP) and portal for the second connection.

Assuming we have 2 IP addresses: 172.17.23.210 and 172.17.23.211 and that we already connected the first one, we now choose 172.17.23.211 for the second one.

Click “OK”. Click “OK” again.
You will see the second connection.
Click “OK”.

On the new windows, you will find one connected session and two connections.
On the “Devices” tab, you will see only 1 disk.

Click “OK”.
Return to the iSCSI initiator properties, click "OK".

To access storage devices for a target, select the target and then click Log on.

To see information about sessions, connections, and devices for a target, click Details.

Targets:

<table>
<thead>
<tr>
<th>Name</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>jan.2004-04.com.qnap.ts-439.iscsi.laws01.8d1f82</td>
<td>Connected</td>
</tr>
</tbody>
</table>

Click the "OK" button.
Check the settings

- In the main iSCSI initiator panel, select your target LUN and click “Details”. You will see your two connected sessions.

On the iSCSI initiator panel, the LUN is connected.

Click “Details”.

![iSCSI Initiator Properties](image)
You can see the 1 session with 2 connections.

If you have only 1 network interface:
You can also find those 2 connections by opening a command prompt window (cmd.exe) and using netstat.exe. We can see the 2 connections that you made from the same IP address:

<table>
<thead>
<tr>
<th>Proto</th>
<th>Local Address</th>
<th>Foreign Address</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCP</td>
<td>172.17.23.214:3389</td>
<td>10.8.12.35:53523</td>
<td>ESTABLISHED</td>
</tr>
</tbody>
</table>

If you have 2 network connections, you can also find those 2 connections by opening a command prompt window (cmd.exe) and using netstat.exe. We can see the 2 connections that you made from the 2 different IP addresses.

<table>
<thead>
<tr>
<th>Proto</th>
<th>Local Address</th>
<th>Foreign Address</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCP</td>
<td>172.17.23.210:49164</td>
<td>10.8.12.98:3260</td>
<td>ESTABLISHED</td>
</tr>
<tr>
<td>TCP</td>
<td>172.17.23.211:49165</td>
<td>10.8.12.98:3260</td>
<td>ESTABLISHED</td>
</tr>
<tr>
<td>TCP</td>
<td>172.17.23.214:3389</td>
<td>10.8.12.35:56117</td>
<td>ESTABLISHED</td>
</tr>
</tbody>
</table>
- In Server Manager console, go to “Storage” > “Disk Management”. You can configure the newly added disks as appropriate.
You can format your newly added disk and use it:
Example of a failover

During the formatting of the disk, one of the network cables has been disconnected, the system started to use only the remaining connection (1). When the cable is plugged back, the first connection is reestablished (2).
Advices


"if Jumbo Frames if supported in your network infrastructure. Jumbo Frames can be used to allow more data to be transferred with each Ethernet transaction and reduce the number of frames. This larger frame size reduces the overhead on both your servers and iSCSI targets. For end to end support, each device in the network needs to support Jumbo frames including the NIC and Ethernet switches."


On your Windows 2008 server, configure your network interface properties.
On your NAS administration interface
You can also unbind unnecessary protocols from your iSCSI NICs

This has to be done only on DEDICATED network interfaces that are used only for iSCSI!

- Clear the checkbox for “Client for Microsoft Networks”
- Clear the checkbox for “QoS Packet Scheduler”
- Clear the checkbox for “File and Printer Sharing for Microsoft Networks”
- Clear the checkboxes for the “Link-Layer Topology” options
- Clear the checkbox for “Register this connection’s address in DNS”
- Clear the checkbox for “Enable LMHOSTS Lookup”
- Select the radio button for “Disable NetBIOS over TCP/IP”
Internet Protocol Version 4 (TCP/IPv4) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

- Obtain an IP address automatically
- Use the following IP address:
  - IP address: 172.17.23.210
  - Subnet mask: 255.255.254.0
  - Default gateway: 172.17.22.1

- Obtain DNS server address automatically
- Use the following DNS server addresses:
  - Preferred DNS server: 
  - Alternate DNS server: 

Advanced... button

Advanced TCP/IP Settings

IP Settings DNS WINS

IP addresses

- IP address: 172.17.23.210
- Subnet mask: 255.255.254.0

Add... Edit... Remove

Default gateways

- Gateway: 172.17.22.1
  - Metric: Automatic

Add... Edit... Remove

- Automatic metric:
  - Interface metric: 

OK Cancel
Advanced TCP/IP Settings

IP Settings | DNS | WINS

DNS server addresses, in order of use:
[Add... Edit... Remove]

The following three settings are applied to all connections with TCP/IP enabled. For resolution of unqualified names:
- Append primary and connection specific DNS suffixes
- Append parent suffixes of the primary DNS suffix
- Append these DNS suffixes (in order):
[Add... Edit... Remove]

DNS suffix for this connection:
[Register this connection's addresses in DNS]
[Use this connection's DNS suffix in DNS registration]

[OK Cancel]

Advanced TCP/IP Settings

IP Settings | DNS | WINS

WINS addresses, in order of use:
[Add... Edit... Remove]

If LMHOSTS lookup is enabled, it applies to all connections for which TCP/IP is enabled.
[Enable LMHOSTS lookup]

NetBIOS setting
- Default:
  Use NetBIOS setting from the DHCP server. If static IP address is used or the DHCP server does not provide NetBIOS setting, enable NetBIOS over TCP/IP.
- Enable NetBIOS over TCP/IP
- Disable NetBIOS over TCP/IP

[OK Cancel]