

NexentaStor

iSCSI Multipath Configuration Document **Version 1.0.0**

Nexenta Solutions Engineering Team

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Document Overview

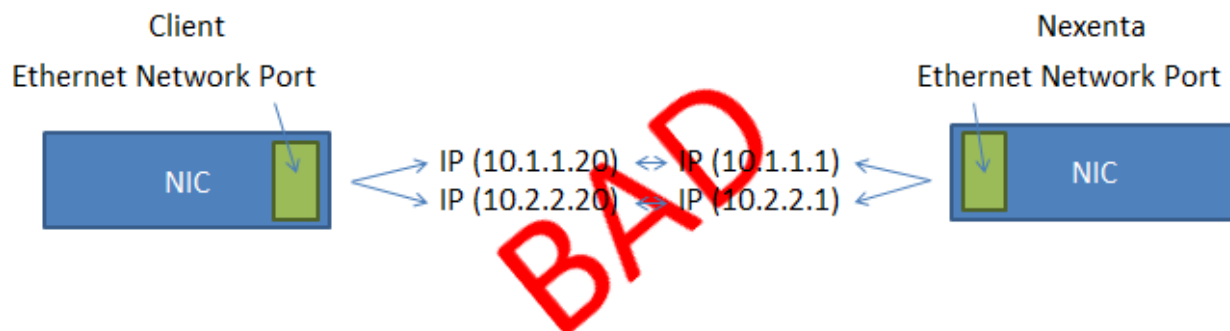
The purpose of this document is to provide recommendations and configuration instructions for setting up iSCSI multipathing on both a NexentaStor Enterprise appliance and various common client operating systems. This document provides sane standardized configuration options; they should be suitable in most environments (but not all, so when in doubt, please reach out to a certified and experienced Nexenta professional).

The primary purpose of this guide is to cover how to set up NexentaStor properly for multipath iSCSI environments. While we have taken the additional step of providing simple instructions for configuration of iSCSI MPIO on various client systems, this document should not be looked at as a replacement for documentation from the various vendors of these client systems. Many vendors have significant and detailed instructions for configuring and enabling multipath on iSCSI on their platforms, and we highly advise locating any such documentation for your chosen platform, if it exists.

MPIO Design

It is important to understand what it is we're attempting to achieve by using MPIO. Proper configuration and deployment of MPIO on an iSCSI network can have a significant impact on both uptime and performance. Improper configuration can lead to absolutely no benefit, and even potentially some performance penalty. At a bare minimum, MPIO requires the following:

- Two separate IP addresses on the NexentaStor appliance
- Two separate IP addresses on any client doing MPIO

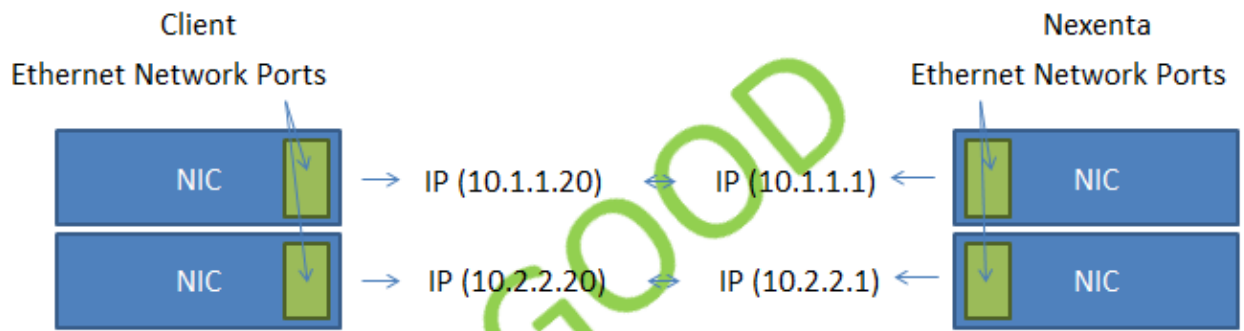


The above picture represents all that is **technically** required to do iSCSI MPIO. This sort of setup has (unfortunately) been seen many times, and often is seen by Nexenta because of problems that arise because of this sort of setup (or, because the client complains that having configured MPIO like the above, they are seeing no improvement in performance or that the loss of a single piece of this setup still led to downtime despite the existence of MPIO). The above setup is ultimately to blame, and it is not going to be of much use to you if all that is done is configure two IP addresses on a single interface on both sides and set up MPIO. While MPIO would function on a technical level, the lack of any redundancy in client, server, or network between the two means the two paths are both utilizing all the same hardware, and thus, no benefits are achieved by doing this.

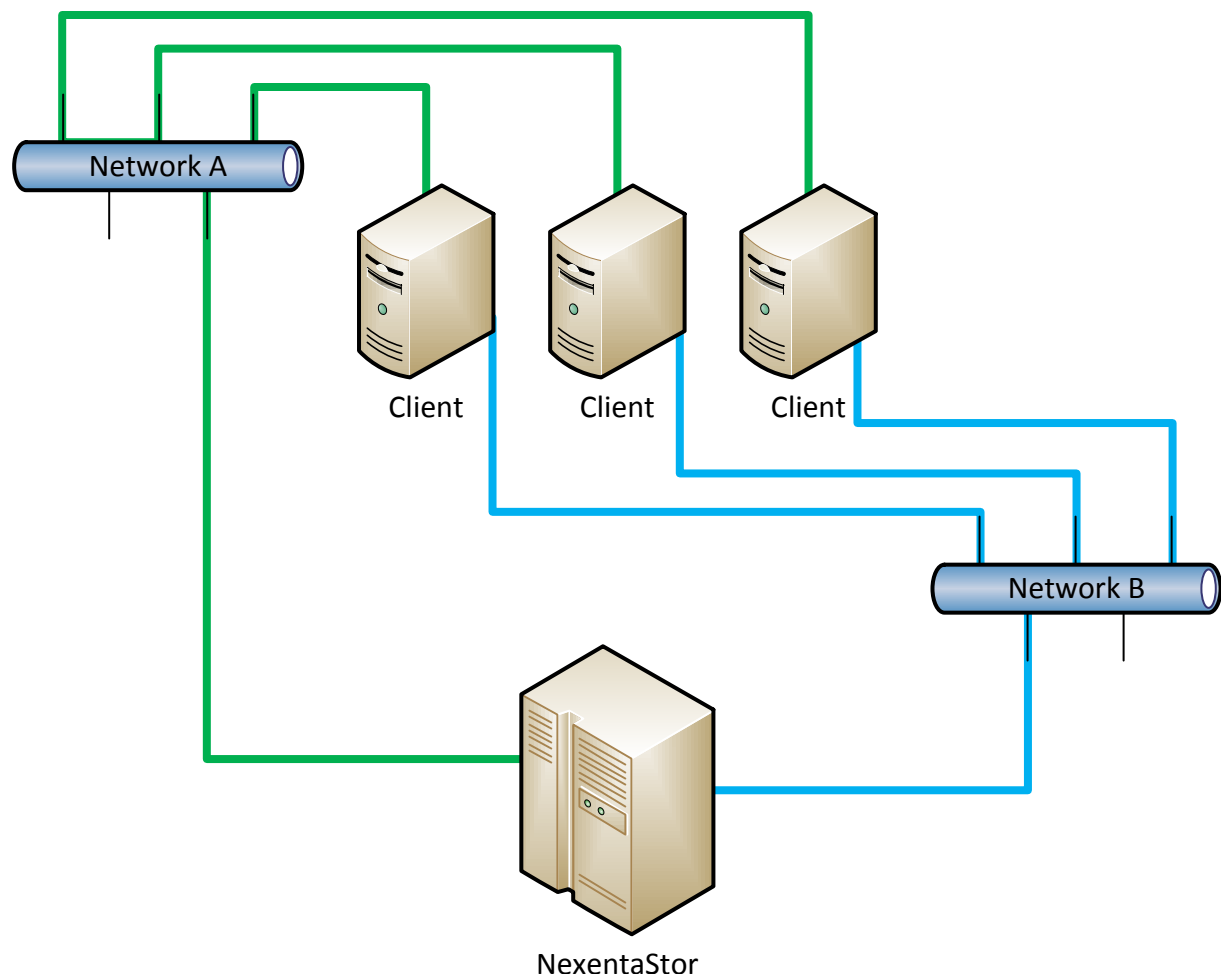
A more sane set of minimum requirements would be:

- Two separate network interfaces on the NexentaStor appliance
- Two separate network interfaces on any client doing iSCSI MPIO
- [optional, but strongly encouraged] The two network interfaces are plugged into separate physical networks (different switches), thus making both networks completely separate at a physical level
 - [optional, rarely seen] The switches are of different manufacturer
 - [optional, rarely seen] The NICs are of different manufacturer

The picture below attempts to capture this to some degree:

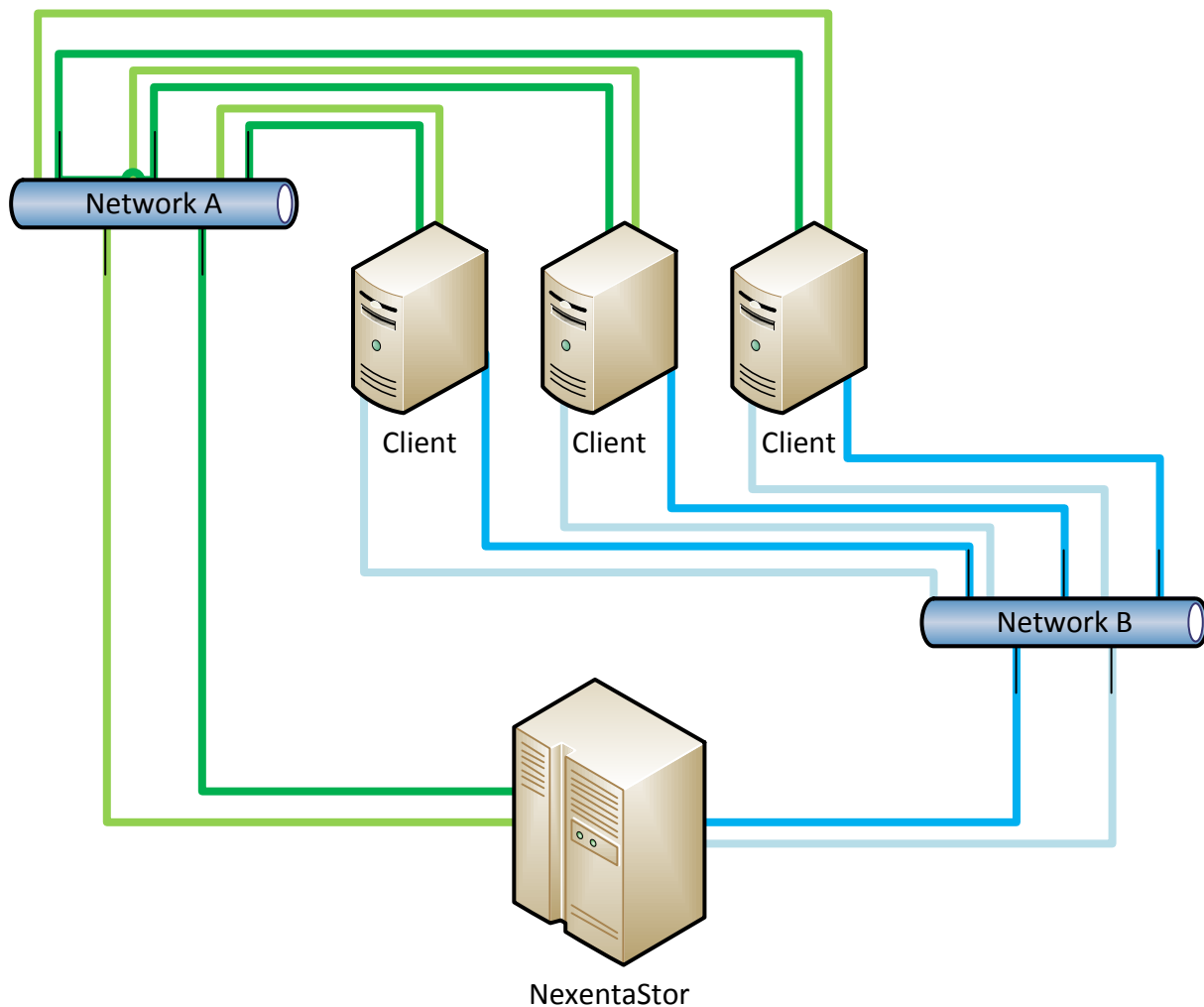


The rest of this guide is based upon this example—two separate interfaces on the Nexenta appliance and on each client, with each interface plugged into a separate physical network (no ability to talk to the other subnet from either interface, only from the proper interface). Another example of this good setup:



This diagram shows the two separate networks (A & B) connected from each client and NexentaStor; this provides both path redundancy and switch redundancy (assuming there are one or more switches on each network), and may increase performance by as much as double that of a single link.

The same setup, but with double the redundancy (and also double the performance, assuming all interfaces are the same speed individually) is diagramed below:



This diagram shows how there are two separate connections (green and blue, with shading to differentiate the two connections to each) from both NexentaStor and the clients to each network (Network A and Network B). This setup would require four separate ports on each of the clients and NexentaStor machines, but would provide path redundancy within each network, as well as network redundancy. And, while not technically covered by this guide, all that changes is the addition of more interfaces, Targets, and Target Portal Groups on NexentaStor and more interfaces and paths on the client installations.

Nexenta Setup

First, we will step through how to configure the NexentaStor appliance for iSCSI MPIO. This section will show how to do this in both the NMC and the NMV interfaces of NexentaStor (as of Nexenta version 3.1.3).

Fundamentally, the following things must be done to enable MPIO in a proper manner on NexentaStor:

- 1) Configure two separate network interfaces
- 2) Create Target Portal Groups for each network interface (IP)
- 3) Create two iSCSI Targets
- 4) Create a Target Group
- 5) Map a Zvol out of that Target Group

The steps for completing all of this are contained within this section of the guide (using example IP addresses). Where possible, instructions for both NMC and NMV are provided—you need not do both, merely use whichever UI you are more comfortable with.

Network Configuration

First step is configuring the network interfaces. For the purposes of this example, we will be using the network interfaces e1000g2 and e1000g3. The e1000g2 interface is on the 10.100.1.x subnet (a class C, subnet 255.255.255.0) and the e1000g3 interface is on the 10.200.2.x subnet (a class C, subnet 255.255.255.0). Both subnets reside on completely separate physical switching infrastructure, and cannot talk to one another (no route exists between the two subnets).

It is strongly preferred that you mimic this design in terms of using separate IP subnets; using multiple IPs from the same subnet can lead to default routes that negate much of the point of MPIO.

The question also has been posed if these IP addresses must reside on physical interfaces, or if they instead could be on aggregates. Technically, they could be on aggregates (provided by LACP or IPMP), but that is outside the scope of this document (and if iSCSI is the only intended use for the network, ultimately often an extra complication with zero return, since iSCSI MPIO already deals with path loss itself, negating the need for that by any underlying technology).

Network Configuration (NMC)

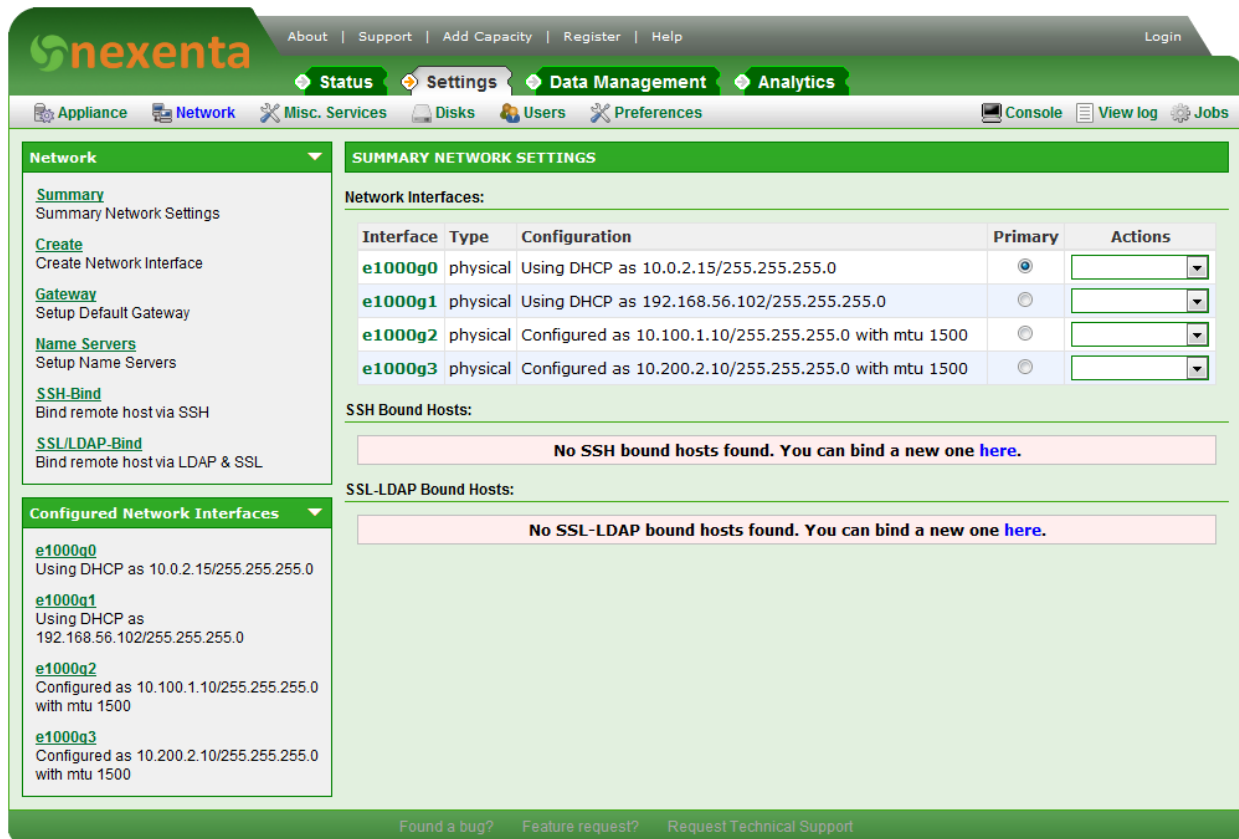
```
nmc@myhost:/$ setup network interface e1000g2
Option ? static
e1000g2 IP address   : 10.100.1.10
e1000g2 netmask      : 255.255.255.0
e1000g2 mtu          : 1500
Enabling e1000g2 as 10.100.1.10/255.255.255.0 mtu 1500 ... OK.

nmc@myhost:/$ setup network interface e1000g3
Option ? static
e1000g3 IP address   : 10.200.2.10
e1000g3 netmask      : 255.255.255.0
e1000g3 mtu          : 1500
Enabling e1000g3 as 10.200.2.10/255.255.255.0 mtu 1500 ... OK.

nmc@myhost:/$
```

As the above picture shows, configuring network interfaces in NMC is simply a matter of typing “**setup network interface <interface>**” and following the prompts. You also can just type “**setup network interface**” and then pick the interface from the resulting list to kick off the same operation (if you’re unsure what interfaces you have). If you have any question about which interfaces are connected, try typing “**show network devices**”, which has a **STATE** section that should show “**up**” for any device that has been plugged in.

Network Configuration (NMV)



Network

- [Summary](#)
Summary Network Settings
- [Create](#)
Create Network Interface
- [Gateway](#)
Setup Default Gateway
- [Name Servers](#)
Setup Name Servers
- [SSH-Bind](#)
Bind remote host via SSH
- [SSL/LDAP-Bind](#)
Bind remote host via LDAP & SSL

Configured Network Interfaces

- [e1000g0](#)
Using DHCP as 10.0.2.15/255.255.255.0
- [e1000g1](#)
Using DHCP as 192.168.56.102/255.255.255.0
- [e1000g2](#)
Configured as 10.100.1.10/255.255.255.0 with mtu 1500
- [e1000g3](#)
Configured as 10.200.2.10/255.255.255.0 with mtu 1500

SUMMARY NETWORK SETTINGS

Network Interfaces:

Interface	Type	Configuration	Primary	Actions
e1000g0	physical	Using DHCP as 10.0.2.15/255.255.255.0	<input checked="" type="radio"/>	[Edit]
e1000g1	physical	Using DHCP as 192.168.56.102/255.255.255.0	<input type="radio"/>	[Edit]
e1000g2	physical	Configured as 10.100.1.10/255.255.255.0 with mtu 1500	<input type="radio"/>	[Edit]
e1000g3	physical	Configured as 10.200.2.10/255.255.255.0 with mtu 1500	<input type="radio"/>	[Edit]

SSH Bound Hosts:

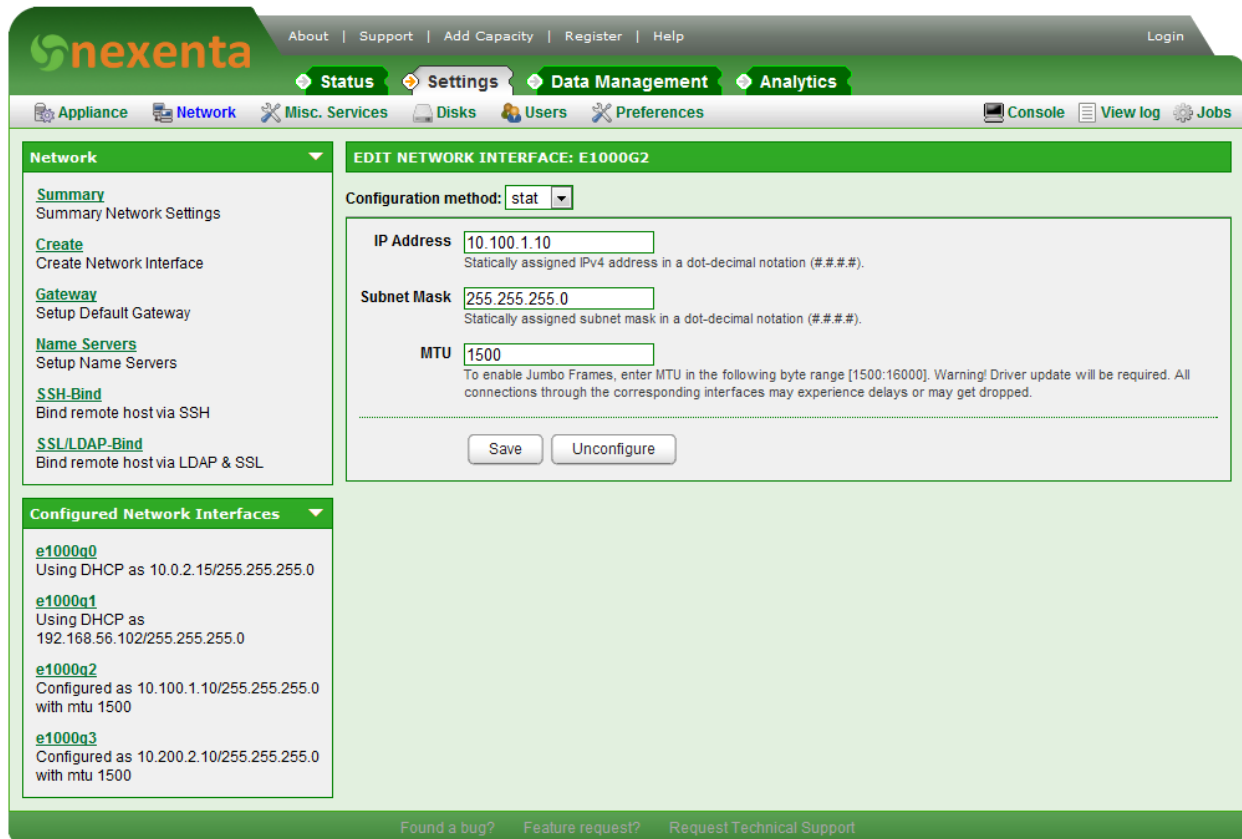
No SSH bound hosts found. You can bind a new one [here](#).

SSL-LDAP Bound Hosts:

No SSL-LDAP bound hosts found. You can bind a new one [here](#).

Found a bug? Feature request? Request Technical Support

To configure a network interface in the NMV, mouse-over **Settings** and then choose **Network**. On the resulting page, similar to the one pictured above, pick the interface you wish to configure from the list by clicking its interface name (for instance, e1000g2), which will result in this page:



The screenshot shows the Nexenta management web interface. The top navigation bar includes links for About, Support, Add Capacity, Register, and Help. Below this is a secondary navigation bar with tabs for Status, Settings (active), Data Management, and Analytics. A third bar contains icons for Appliance, Network, Misc. Services, Disks, Users, and Preferences, along with links for Console, View log, and Jobs.

The main content area is titled 'EDIT NETWORK INTERFACE: E1000G2'. On the left is a sidebar with a 'Network' section containing links for Summary, Create, Gateway, Name Servers, SSH-Bind, and SSL/LDAP-Bind. Below this is a 'Configured Network Interfaces' section listing four interfaces: e1000q0 (DHCP), e1000q1 (DHCP), e1000q2 (Static IP 10.100.1.10/255.255.255.0, MTU 1500), and e1000q3 (Static IP 10.200.2.10/255.255.255.0, MTU 1500).

The main configuration area for 'E1000G2' shows a 'Configuration method' dropdown set to 'stat'. It includes input fields for 'IP Address' (10.100.1.10), 'Subnet Mask' (255.255.255.0), and 'MTU' (1500). Each field has a descriptive tooltip. A warning message states: 'To enable Jumbo Frames, enter MTU in the following byte range [1500:16000]. Warning! Driver update will be required. All connections through the corresponding interfaces may experience delays or may get dropped.' At the bottom of the form are 'Save' and 'Unconfigure' buttons.

At the very bottom of the interface, there are links for 'Found a bug?', 'Feature request?', and 'Request Technical Support'.

Here you can pick a configuration method of “**stat**”, short for “**Static IP Assignment**” or ‘**dhcp**’, which will attempt to configure the interface using DHCP. With “stat”, type in the proper IP address, subnet mask, and MTU settings (usually 1500, unless utilizing jumbo frames), and then hit **Save** to set it up. Bear in mind, if the interface you’re configuring is responsible for any live traffic, it will be interrupted. Also, if the interface is the one you’re currently utilizing to reach the management UI and you change its settings, you will need to go to the new IP you set up on the interface to continue to use the UI (it will not automatically forward your browser to the new IP).

Target Portal Group Configuration

The next step is to build the two Target Portal Groups (TPG). Each TPG will contain one of the IP addresses we’ve already configured. Target Portal Groups define one or more IP addresses that any Target linked to them may listen on (a Target can belong to more than one TPG, though in this example we will not utilize this). Create two Target Portal Groups, defining one of your IPs for each. In this example, we create a “tpg0” with the IP 10.100.1.10 as the only IP in it, and “tpg1” with the IP 10.200.2.10 as the only IP in it.

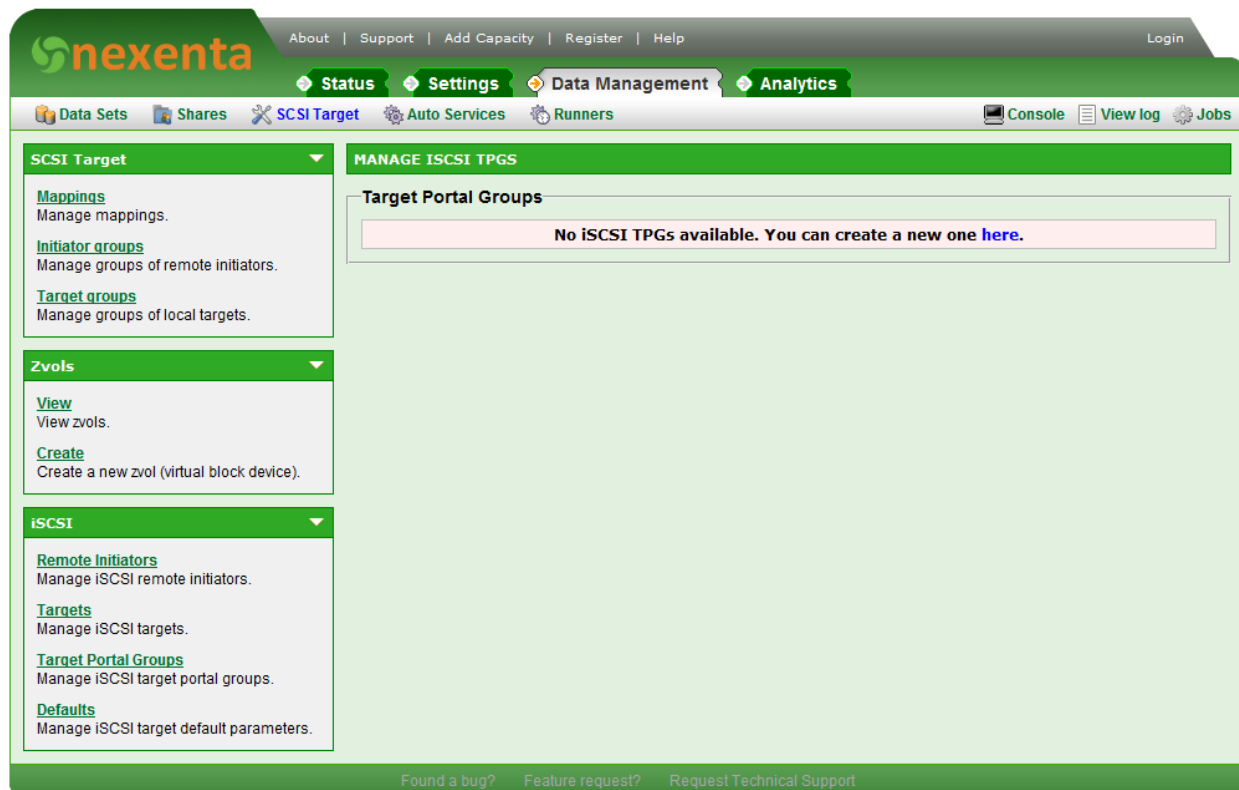
The purpose of Target Portal Groups is to limit visibility of Targets to the IP addresses of any/all Target Portal Groups they are members of (and not to IPs they are not). Unfortunately, as of NexentaStor 3.1.3, COMSTAR, the SCSI target mode framework utilized by Nexenta, does not properly obey the purpose of TPGs. Targets that exist and are limited to specific Target Portal Groups still are visible to clients attempting to connect to other IPs on the system rather than those that are part of the TPG. This is a known issue, but will not affect the ability to follow this guide. Also, it is still a best practice to create these TPGs for when they do become functional.

TPG Configuration (NMC)

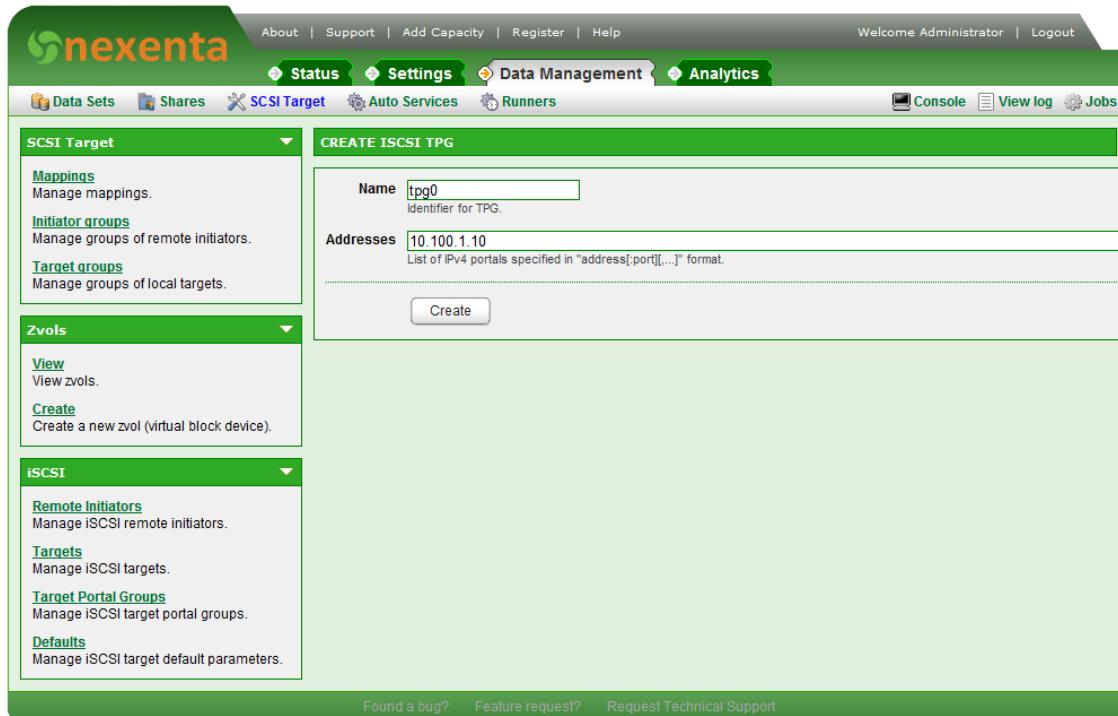
As of NexentaStor 3.1.3, it is not possible to manipulate Target Portal Groups in NMC. They must be configured in the web GUI.

TPG Configuration (NMV)

To configure, mouse-over “**Data Management**” and then click on “**SCSI Target**”—on the resulting page, click on the “**Target Portal Groups**” link in the iSCSI box on the left of the interface. If you’ve never configured a Target Portal Group before, you will see something like this:



Click the small “**here**” link at the end of the “You can create a new one here.” sentence to get to the creation page, and populate it as shown here:

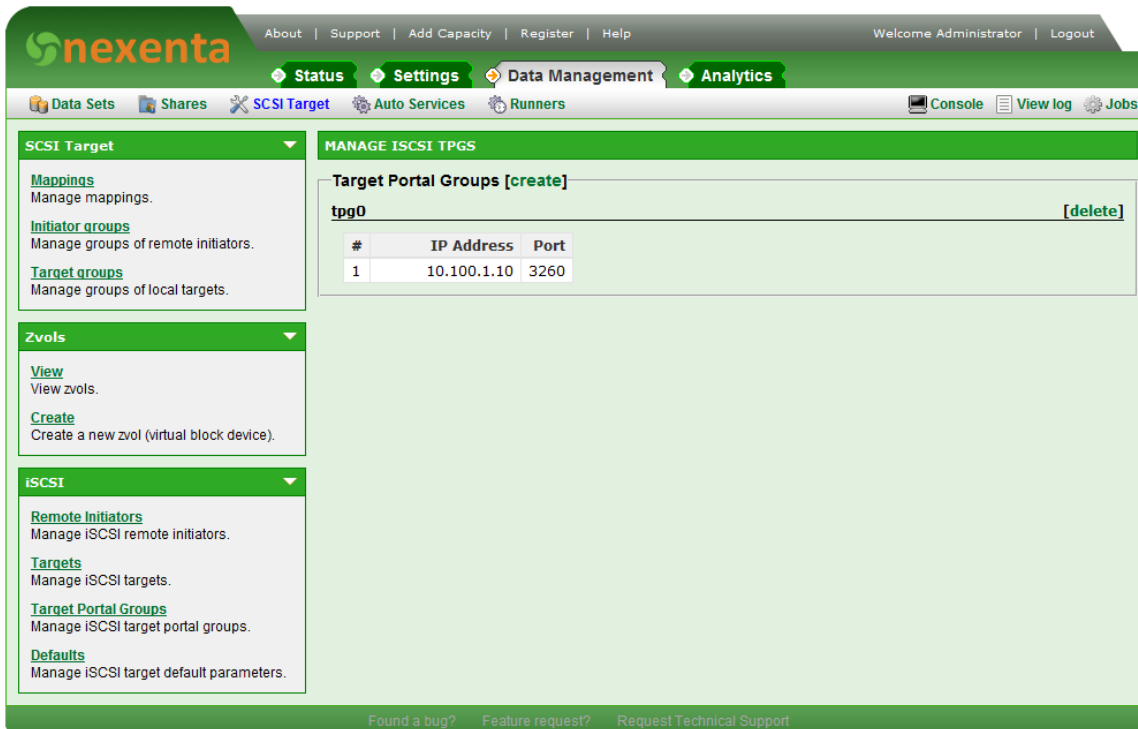


The screenshot shows the Nexenta web interface with the 'Data Management' tab selected. On the left, the 'SCSI Target' menu is expanded, showing options like 'Mappings', 'Initiator groups', 'Target groups', 'Zvols', and 'iSCSI'. The main content area is titled 'CREATE ISCSI TPG'. It contains a form with the following fields:

- Name:** A text input field containing 'tpg0'. Below it, a small text label reads 'Identifier for TPG.'
- Addresses:** A text input field containing '10.100.1.10'. Below it, a small text label reads 'List of IPv4 portals specified in "address[:port][,...]" format.'

At the bottom of the form is a 'Create' button. The footer of the interface includes links for 'Found a bug?', 'Feature request?', and 'Request Technical Support'.

Then hit **“Create”**. You’ll end up back at this page, looking like this:



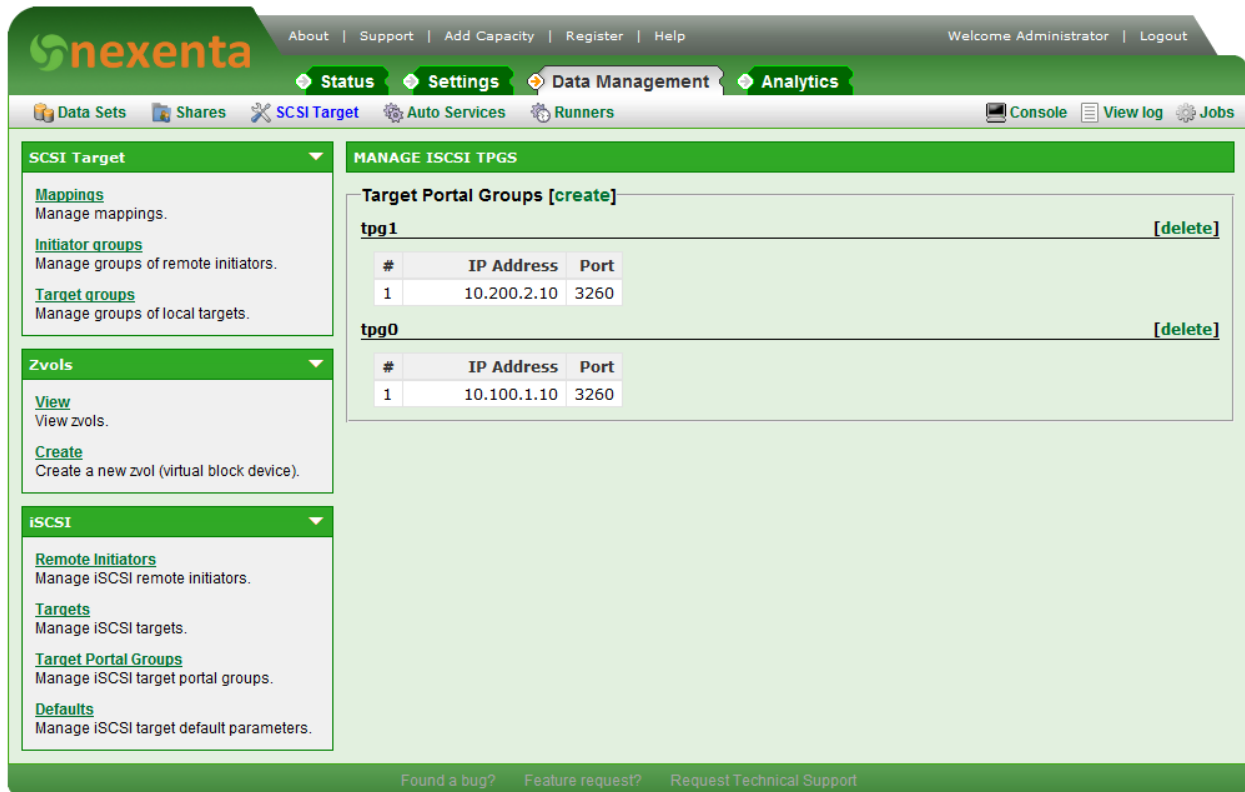
The screenshot shows the Nexenta web interface after clicking the 'Create' button. The main content area is now titled 'MANAGE ISCSI TPGS'. It displays a table of Target Portal Groups. The table has columns for '#', 'IP Address', and 'Port'. There is one entry in the table:

#	IP Address	Port
1	10.100.1.10	3260

Below the table, there is a 'create' link and a 'delete' link. The footer of the interface includes links for 'Found a bug?', 'Feature request?', and 'Request Technical Support'.

As you can see, the page has changed slightly. Most notably, in addition to listing your new Target Portal Group “tpg0”, the “create” link now exists instead of the old “here” link from before. Click the **“Create”** link and fill in the information again, but this time creating the second TPG with the 10.200.2.10 IP address. Note that the name of a Target Portal Group is entirely unimportant—you can name them

whatever you wish within the constraints of the system (we recommend sticking to short, alpha-numeric names for ease of administration). Also note that more than one IP address can be specified on a TPG by typing a comma (,) followed by another IP, etc., though that is not necessary for this example. When you've created the second Target Portal Group, the page should look similar to this:



The screenshot shows the Nexenta NMC interface. The main content area is titled 'MANAGE ISCSI TPGS'. It lists two Target Portal Groups: 'tpg1' and 'tpg0'. Each group has a table with columns for '#', 'IP Address', and 'Port'.

#	IP Address	Port
1	10.200.2.10	3260

#	IP Address	Port
1	10.100.1.10	3260

The sidebar on the left contains the following links:

- SCSI Target**
 - [Mappings](#): Manage mappings.
 - [Initiator groups](#): Manage groups of remote initiators.
 - [Target groups](#): Manage groups of local targets.
- Zvols**
 - [View](#): View zvols.
 - [Create](#): Create a new zvol (virtual block device).
- iSCSI**
 - [Remote Initiators](#): Manage iSCSI remote initiators.
 - [Targets](#): Manage iSCSI targets.
 - [Target Portal Groups](#): Manage iSCSI target portal groups.
 - [Defaults](#): Manage iSCSI target default parameters.

Target Configuration

Having created the network interfaces and Target Portal Groups limited to the necessary IPs, the next step is to create the iSCSI Targets themselves. iSCSI Targets are what iSCSI Initiators (clients) connect to.

Target Configuration (NMC)

In NMC, iSCSI Targets are created using the ***“setup iscsi target”*** command, which then will lead you through a set of menus. Here is how it starts:

```
nmc@myhost:/$ setup iscsi target
Option ?
create _destroy <?> default
-----
Navigate with arrow keys (or hjkl), 'q' or Ctrl-C to quit
Create new iSCSI target
```

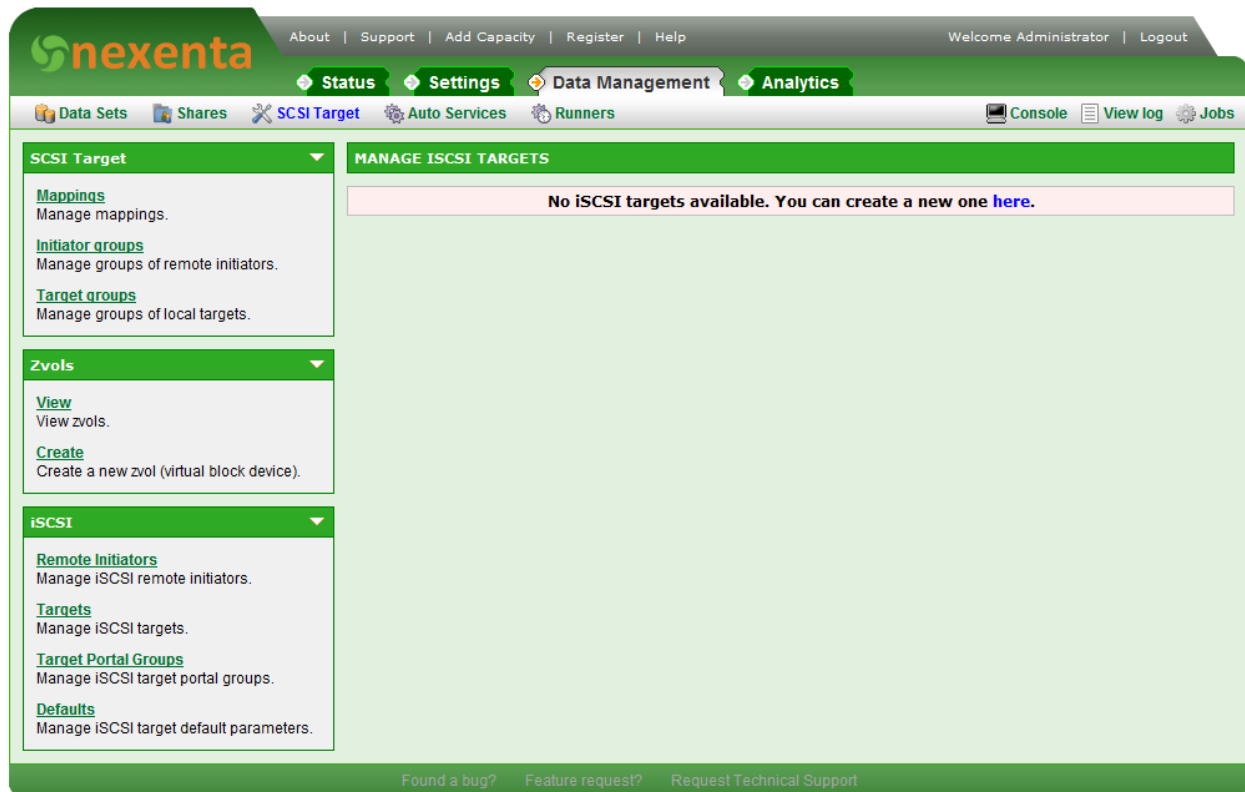
Choose the **Create** option here, and then fill in the menu options. Note that you can leave the “**Target Name**” and “**Target Alias**” empty if you wish. Leaving “**Target Name**” empty automatically generates a valid IQN, and “**Target Alias**” is merely an unused label to assist with identification by human administrators on the NexentaStor appliance and is not required for operation. When it gets to the “**Target Portal Groups**” section, type in “**tpg0**” (without quotes), or whatever you labeled the first Target Portal Group, as shown here:

```
nmc@myhost:/$ setup iscsi target
Option ? create
Target Name      :
Authorization Method : none
Target Alias     :
Target Portal Groups : tpg0_
-----
Enter or edit Target Portal Groups. Leave empty to use default one.. Press
Ctrl-C to exit.
```

This will create the iSCSI Target (it can take a minute to complete this action, be patient). Repeat this again with **“setup iscsi target”** and go through the steps for the second Target. Be sure to choose “tpg1” (or whatever you labeled the second Target Portal Group) when prompted, and not “tpg0”.


Target Configuration (NMV)

Configuring iSCSI Targets in NMV is done by mousing over **“Data Management”** and selecting **“SCSI Target”**, then clicking **“Targets”** from the iSCSI box on the left on the resulting page. If you have no existing Targets, you’ll get a page akin to this:



The screenshot shows the Nexenta NMV web interface. The top navigation bar includes links for About, Support, Add Capacity, Register, and Help. The main navigation bar has tabs for Status, Settings, Data Management (selected), and Analytics. Below this is a sub-navigation bar with icons for Data Sets, Shares, SCSI Target (selected), Auto Services, and Runners. The left sidebar contains a 'SCSI Target' dropdown menu with links for Mappings, Initiator groups, and Target groups. Below this is a 'Zvols' dropdown menu with links for View and Create. At the bottom of the sidebar is an 'iSCSI' dropdown menu with links for Remote Initiators, Targets, Target Portal Groups, and Defaults. The main panel is titled 'MANAGE ISCSI TARGETS' and contains a message: 'No iSCSI targets available. You can create a new one [here](#).' The footer of the interface includes links for Found a bug?, Feature request?, and Request Technical Support.

Click the **“here”** link in the “You can create a new one here” sentence to get started, resulting in a page like this:


[About](#) | [Support](#) | [Add Capacity](#) | [Register](#) | [Help](#)
Welcome Administrator | [Logout](#)

[Status](#)
[Settings](#)
[Data Management](#)
[Analytics](#)

[Data Sets](#)
[Shares](#)
[SCSI Target](#)
[Auto Services](#)
[Runners](#)

[Console](#)
[View log](#)
[Jobs](#)

SCSI Target

- [Mappings](#)
Manage mappings.
- [Initiator groups](#)
Manage groups of remote initiators.
- [Target groups](#)
Manage groups of local targets.

Zvols

- [View](#)
View zvols.
- [Create](#)
Create a new zvol (virtual block device).

iSCSI

- [Remote Initiators](#)
Manage iSCSI remote initiators.
- [Targets](#)
Manage iSCSI targets.
- [Target Portal Groups](#)
Manage iSCSI target portal groups.
- [Defaults](#)
Manage iSCSI target default parameters.

CREATE ISCSI TARGET

Name

An iSCSI Target Node is identified by its Target Node Name, formatted in either IQN or EUI format (see RFC 3720). You can keep that field empty - the name will be generated automatically.

Alias

An alternate identifier associated with a target node. The identifier does not need to be unique.

Auth Method

none

Specifies the authentication method to use for the target.

iSCSI Target Portal Groups

☐ tpg1 (10.200.2.10:3260)
 ☐ tpg0 (10.100.1.10:3260)


A list of Target Portal Group (TPG) identifiers that specifies the TPGs that an initiator can use to access a specific target.

Create

[Found a bug?](#)
[Feature request?](#)
[Request Technical Support](#)

When creating an iSCSI Target, you can choose to leave all the fields blank (just hit **Create**) and it will automatically populate the Name with a proper IQN, and leave the alias blank (as it's just for identification purposes within the appliance and not functionally required). In our example, we can go ahead and leave Name blank and let it auto-generate an IQN for us, and leave Alias blank for this. Auth method has to do with the use of CHAP or RADIUS for authentication of iSCSI, neither of which is within the scope of this guide so we also will leave it as "none" (this is very common, even in production deployments). But what we do want to do is check the checkbox next to 'tpg0' to add this new Target to the first Target Portal Group we created earlier.

We only want to add it to tpg0, the first group, and not to tpg1 as well. Once done, you'll see a screen similar to this one:


[About](#) | [Support](#) | [Add Capacity](#) | [Register](#) | [Help](#)

[Welcome Administrator](#) | [Logout](#)

[Status](#) | [Settings](#) | [Data Management](#) | [Analytics](#)

[Data Sets](#) | [Shares](#) | [SCSI Target](#) | [Auto Services](#) | [Runners](#) | [Console](#) | [View log](#) | [Jobs](#)

SCSI Target

- [Mappings](#)
Manage mappings.
- [Initiator groups](#)
Manage groups of remote initiators.
- [Target groups](#)
Manage groups of local targets.

Zvols

- [View](#)
View zvols.
- [Create](#)
Create a new zvol (virtual block device).

iSCSI

- [Remote Initiators](#)
Manage iSCSI remote initiators.
- [Targets](#)
Manage iSCSI targets.
- [Target Portal Groups](#)
Manage iSCSI target portal groups.
- [Defaults](#)
Manage iSCSI target default parameters.


MANAGE iSCSI TARGETS

<input type="checkbox"/>	#	Target	Alias	Target Portal Groups
<input type="checkbox"/>	1	iqn.1986-03.com.sun:02:d61d5157-442a-46b0-be06-b72e037e680a		1

[Delete](#)
[Create](#)

[Found a bug?](#) | [Feature request?](#) | [Request Technical Support](#)

Repeat this again by clicking the **“Create”** button and creating another Target, using the “tpg1” Target Portal Group assigned to the second Target. When complete, you should have two Targets, each belonging to a different one of the two Target Portal Groups. It will look something like this:


[About](#) | [Support](#) | [Add Capacity](#) | [Register](#) | [Help](#)

[Welcome Administrator](#) | [Logout](#)

[Status](#) | [Settings](#) | [Data Management](#) | [Analytics](#)

[Data Sets](#) | [Shares](#) | [SCSI Target](#) | [Auto Services](#) | [Runners](#) | [Console](#) | [View log](#) | [Jobs](#)

SCSI Target

- [Mappings](#)
Manage mappings.
- [Initiator groups](#)
Manage groups of remote initiators.
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- [View](#)
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- [Remote Initiators](#)
Manage iSCSI remote initiators.
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Manage iSCSI targets.
- [Target Portal Groups](#)
Manage iSCSI target portal groups.
- [Defaults](#)
Manage iSCSI target default parameters.

MANAGE iSCSI TARGETS

<input type="checkbox"/>	#	Target	Alias	Target Portal Groups
<input type="checkbox"/>	1	iqn.1986-03.com.sun:02:1545f8f9-6e34-e1e4-b43a-a1bd63982a49		1
<input type="checkbox"/>	2	iqn.1986-03.com.sun:02:d61d5157-442a-46b0-be06-b72e037e680a		1

[Delete](#)
[Create](#)

[Found a bug?](#) | [Feature request?](#) | [Request Technical Support](#)

Target Group Configuration

Having created the Targets and Target Portal Groups, the next step is to add both Targets into a Target Group. Not to be confused with a Target Portal Group (which just designates the IP addresses Targets may listen on), Target Groups are part of the LUN mapping configuration. When mapping Zvols for exposure to clients, the key part is LUN mapping. When mapping, one must specify the Zvol to expose, the Initiator Group it is to be exposed to, and the Target Group it is to be exposed to. By allowing exposure based on both Initiator Groups and Target Groups, a great deal of flexibility is exposed in terms of which Zvols to expose to which clients, based on both the client's initiator name and the target it is attempting to access.

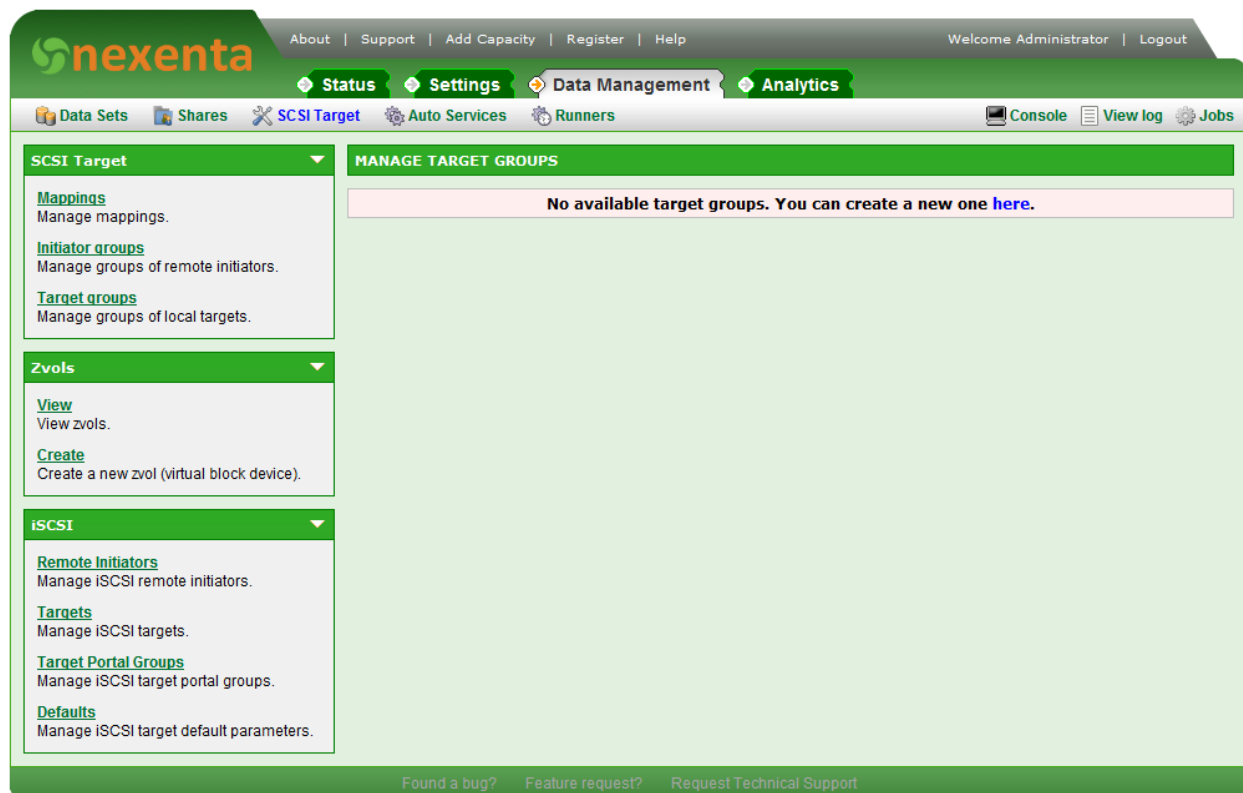
In this part of the example, we will create a single Target Group containing both Targets (since we know the two Targets to essentially be a group; they exist independently solely to allow the LUNs exposed through them to be accessible from two IPs at once, and are thus related to each other). We will call it "MPIO Group 1", but any name is fine.

Target Group Configuration (NMC)

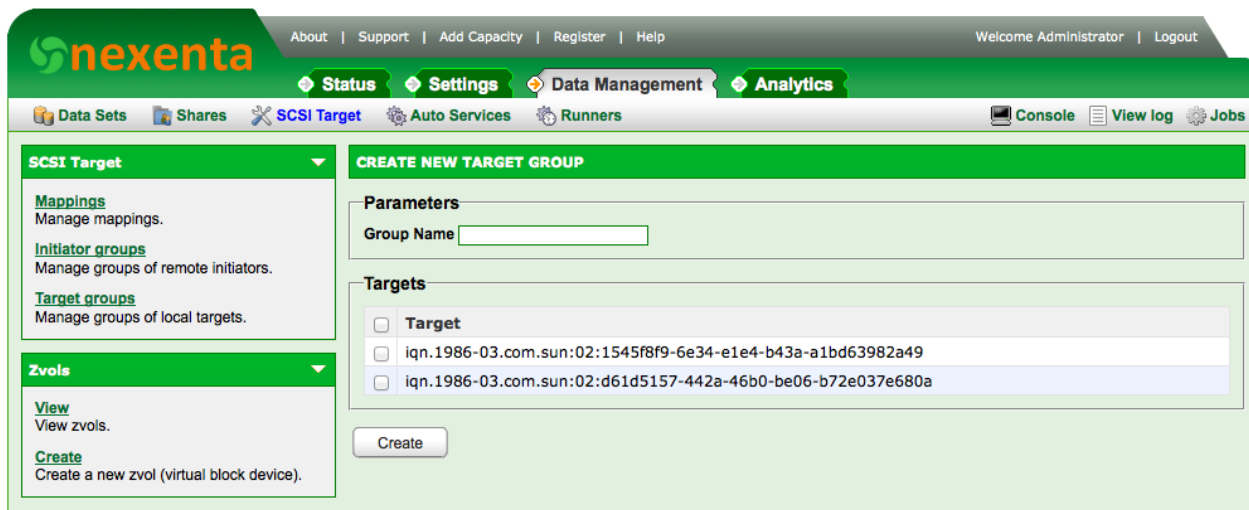
As of 3.1.3, the NMC cannot currently configure any part of LUN mappings—this includes Initiator Groups, Target Groups, and creating mappings from Zvols. All of this must be done within the web GUI.

Target Group Configuration (NMV)

By clicking on the **"Target groups"** link inside the SCSI Target box on the page you were on before, you should be presented with a page similar to this:



By clicking the “**here**” link in the “You can create a new one here” sentence, you will be presented with the Target Group creation page:



CREATE NEW TARGET GROUP

Parameters

Group Name

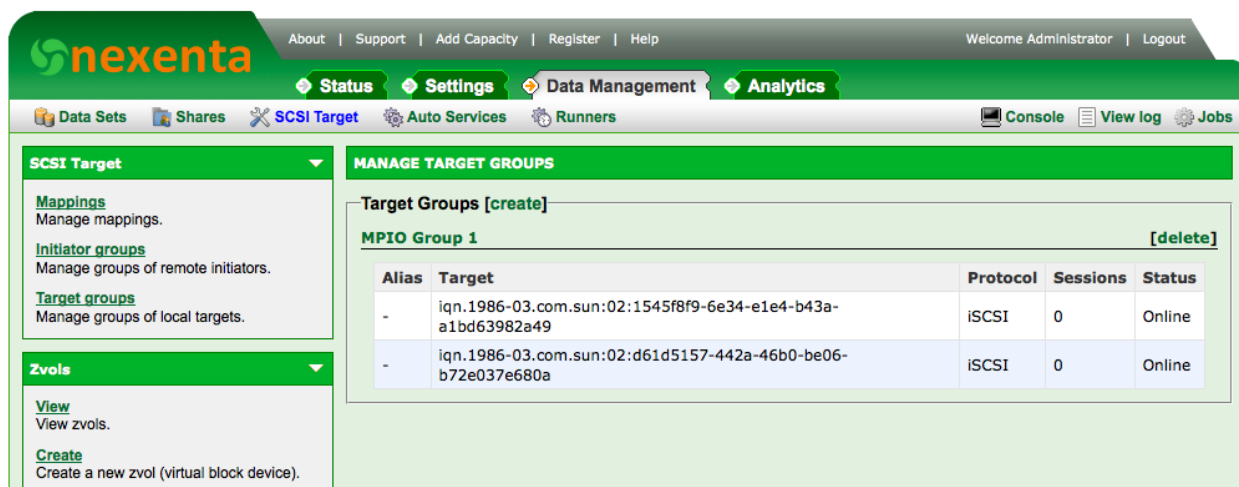
Targets

☐ Target

☐ iqn.1986-03.com.sun:02:1545f8f9-6e34-e1e4-b43a-a1bd63982a49

☐ iqn.1986-03.com.sun:02:d61d5157-442a-46b0-be06-b72e037e680a

On this page, create a new group by typing in a unique Group Name (we’ll be using “MPIO Group 1” for this example, but the name is not important) and check both the Targets you created earlier (the only two in this example) and hit “**Create**”. This will set up a Target Group containing these two Targets (which, in turn, are each a member of a separate Target Portal Group). This will handle the Target side of the LUN mapping setup. The created Target Group should land you on a page similar to this, at which point you’re done with Target Groups:



MANAGE TARGET GROUPS

Target Groups [create] [delete]

Alias	Target	Protocol	Sessions	Status
-	iqn.1986-03.com.sun:02:1545f8f9-6e34-e1e4-b43a-a1bd63982a49	iSCSI	0	Online
-	iqn.1986-03.com.sun:02:d61d5157-442a-46b0-be06-b72e037e680a	iSCSI	0	Online

Zvol Mapping

Having configured two interfaces with distinct IP addresses, created two Target Portal Groups each set up for one of those IP addresses, set up two Targets, and bound one to each TPG, and created a TG (Target Group) containing both Targets, the final step is to map a Zvol. For the purposes of this guide, let

us assume a Zvol already exists (you can create one using the “**Zvols -> Create**” link on the page you’re already on, but more information on that is contained in the *Nexenta User Guide*). For this example, our Zvol is called “testzvol1”.

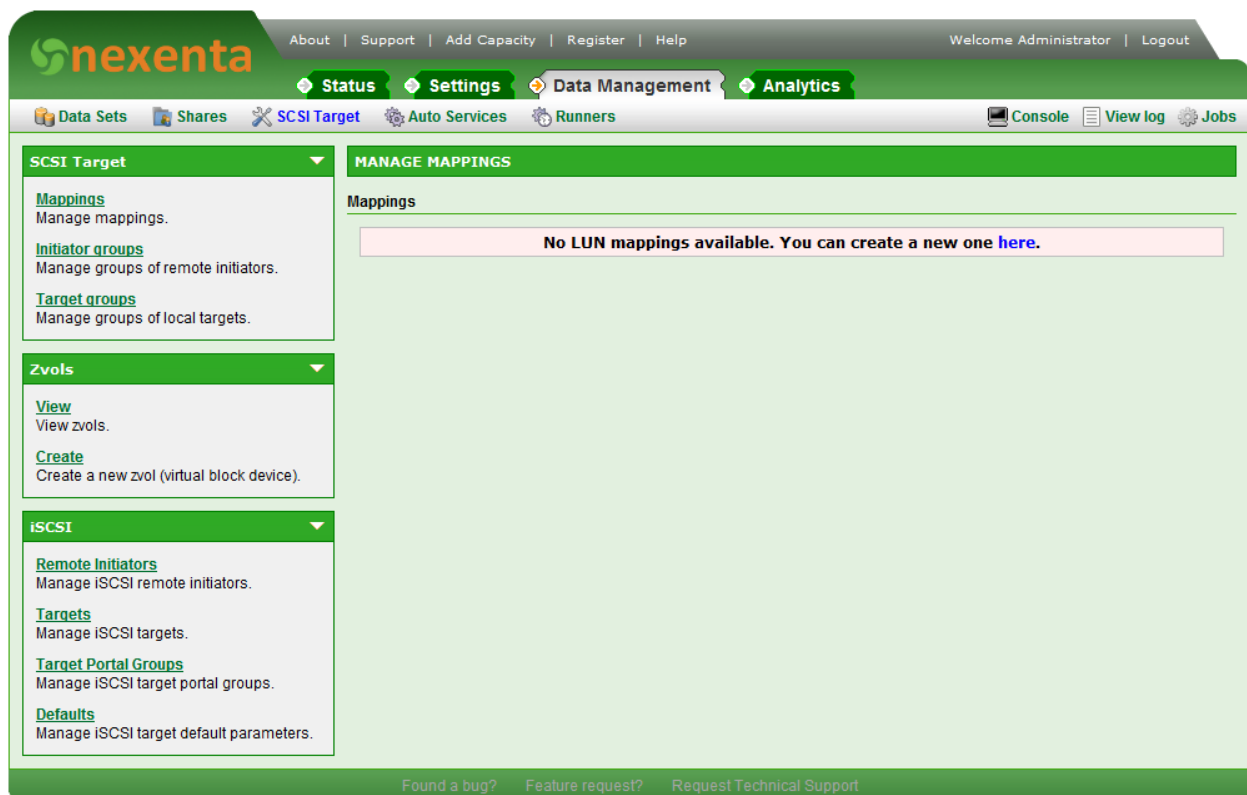
Let us further assume for the purposes of this guide that we want the LUN we are about to expose to be accessible to any client, so no Initiator Group setup is required. If we wished to limit the clients who could see this LUN, we would simply create an Initiator Group containing only the allowed Initiator IQNs and use that when mapping out the Zvol.

Zvol Mapping (NMC)

As of 3.1.3, mapping cannot be accomplished in the NMC.

Zvol Mapping (NMV)

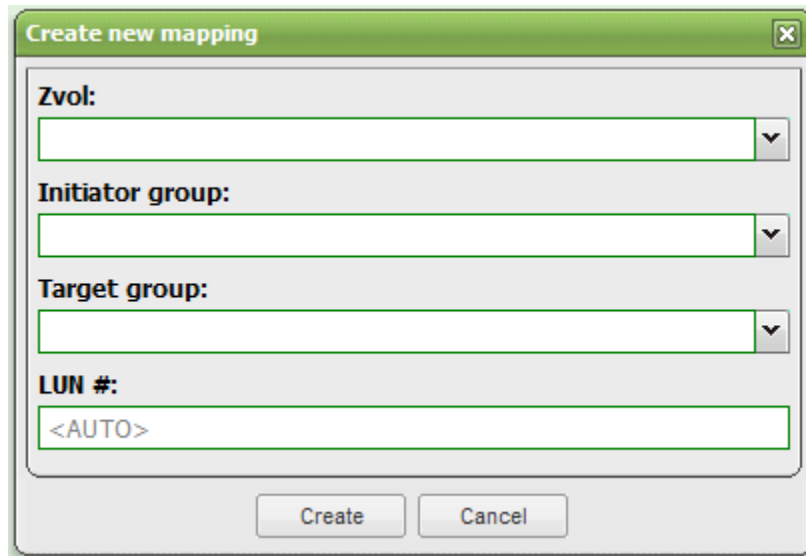
To create a mapping, click on “**Mappings**” on the same page you are already on, then on “**here**” or “**Create**” depending on if any mappings already exist. In our example, no mappings exist, as shown here:



The screenshot shows the Nexenta Management Console (NMV) interface. The top navigation bar includes links for About, Support, Add Capacity, Register, and Help. The user is logged in as Administrator. The main navigation bar has tabs for Status, Settings, Data Management (selected), and Analytics. Below this, there are sub-tabs for Data Sets, Shares, SCST Target (selected), Auto Services, and Runners. The left sidebar contains a tree view with categories: SCST Target (with links for Mappings, Initiator groups, and Target groups), Zvols (with links for View and Create), and iSCSI (with links for Remote Initiators, Targets, Target Portal Groups, and Defaults). The main content area is titled 'MANAGE MAPPINGS' and shows a message: 'No LUN mappings available. You can create a new one here.' The bottom of the page has links for Found a bug?, Feature request?, and Request Technical Support.

Upon clicking “**here**”, a dialog box will appear with four choices:

- Zvol to expose
- Initiator Group for this exposure
- Target Group for this exposure
- LUN ID (leave <AUTO> or blank for auto-assignment)



The image shows a dialog box titled "Create new mapping" with a close button (X) in the top right corner. It contains four fields, each with a dropdown arrow on the right:

- Zvol:** An empty dropdown menu.
- Initiator group:** An empty dropdown menu.
- Target group:** An empty dropdown menu.
- LUN #:** A text field containing the value "<AUTO>".

At the bottom of the dialog box are two buttons: "Create" and "Cancel".

You can create multiple mappings for any Zvol, so you can imagine the flexibility. For the purpose of this guide, however, we chose our quorum-disk Zvol (residing on a Volume called “**testpool1**”), specified the magic “**All**” for Initiator Group (meaning any initiator can see it if it meets the prerequisites established by our Target Group choice as well), specified our “**MPIO Group 1**” as the Target Group and left LUN ID blank (which, in the absence of any other mappings, defaulted to LUN 0). Populated, our example looks like this:

Create new mapping

Zvol:

testpool1/testzvol1

Initiator group:

All

Target group:

MPIO Group 1

LUN #:

<AUTO>

Create

Cancel

And upon hitting “Create”, we’re presented with this mappings summary page:

[About](#) | [Support](#) | [Add Capacity](#) | [Register](#) | [Help](#)

Welcome Administrator | Logout

Status

Settings

Data Management

Analytics

Data Sets

Shares

SCSI Target

Auto Services

Runners

Console

View log

Jobs

SCSI Target

[Mappings](#)
 Manage mappings.
 [Initiator groups](#)
 Manage groups of remote initiators.
 [Target groups](#)
 Manage groups of local targets.

Zvols

[View](#)
 View zvols.
 [Create](#)
 Create a new zvol (virtual block device).

iSCSI

[Remote Initiators](#)
 Manage iSCSI remote initiators.
 [Targets](#)
 Manage iSCSI targets.
 [Target Portal Groups](#)
 Manage iSCSI target portal groups.
 [Defaults](#)
 Manage iSCSI target default parameters.

MANAGE MAPPINGS

Mappings [create]

testpool1/testzvol1

	#	LUN #	Initiator Group	Target Group
<input type="checkbox"/>	1	0	All	MPIO Group 1

Delete

[Found a bug?](#)
[Feature request?](#)
[Request Technical Support](#)

This confirms for us that a new mapping now exists for the testpool1/testzvol1 Zvol, offered up as LUN 0 to any initiator (client) who connects to any of the Targets in “MPIO Group 1”.

Nexenta Configuration Synopsis

At this point, we have:

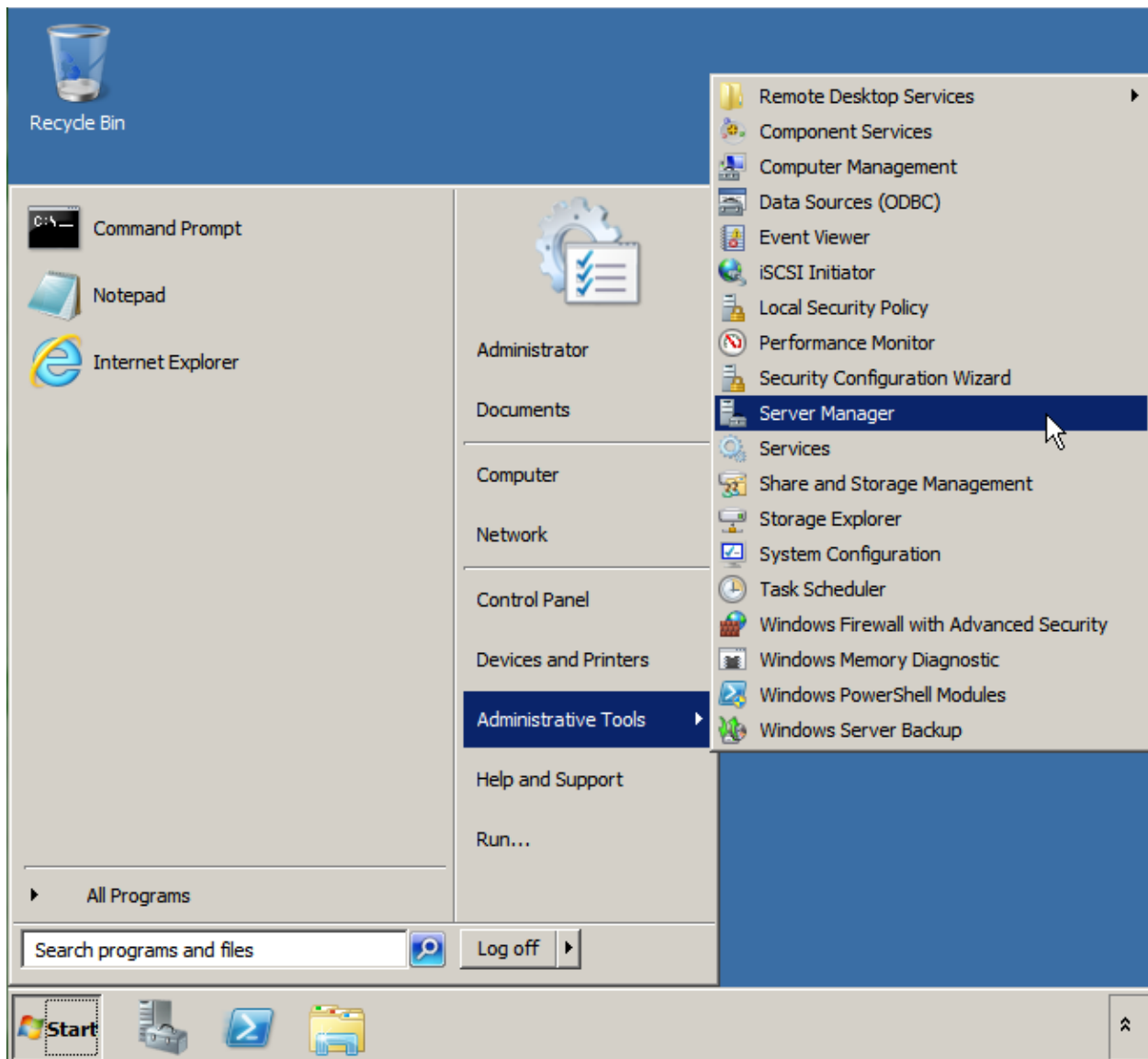
- Set up two network interfaces with distinct IP addresses.
- Configured a Target Portal Group for each IP address.
- Created two Targets, each bound to one of the Target Portal Groups.
- Created a Target Group containing both Targets.
- Mapped a Zvol to be exposed on that Target Group to all Initiators (clients) that connect.

So now, the entire NexentaStor configuration to allow an MPIO iSCSI LUN to exist is in play. No extra configuration is required to inform NexentaStor of the desire for MPIO—it now is up to the client to properly understand what is happening. The rest of this guide is devoted to configuring various common clients for iSCSI multipathing.

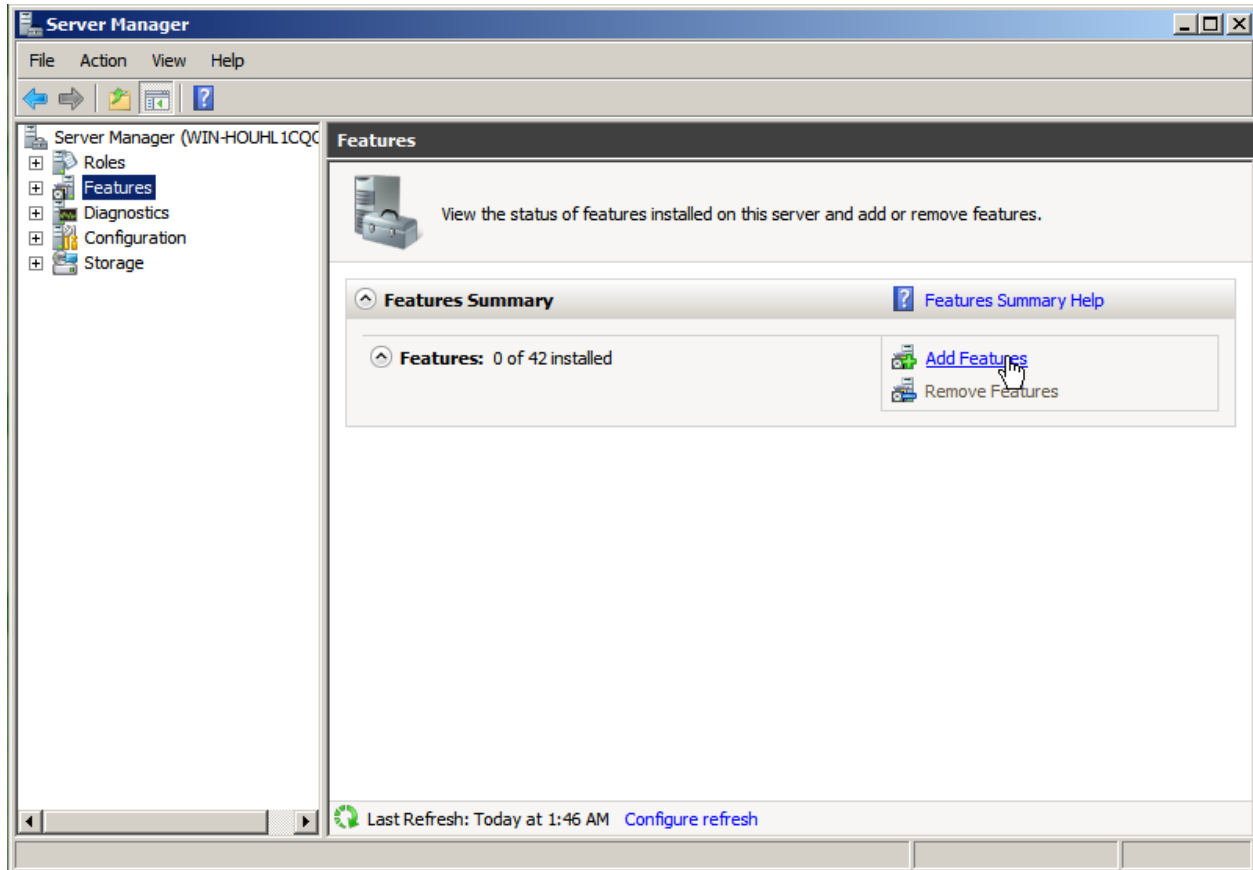
Windows

Server 2008 R2

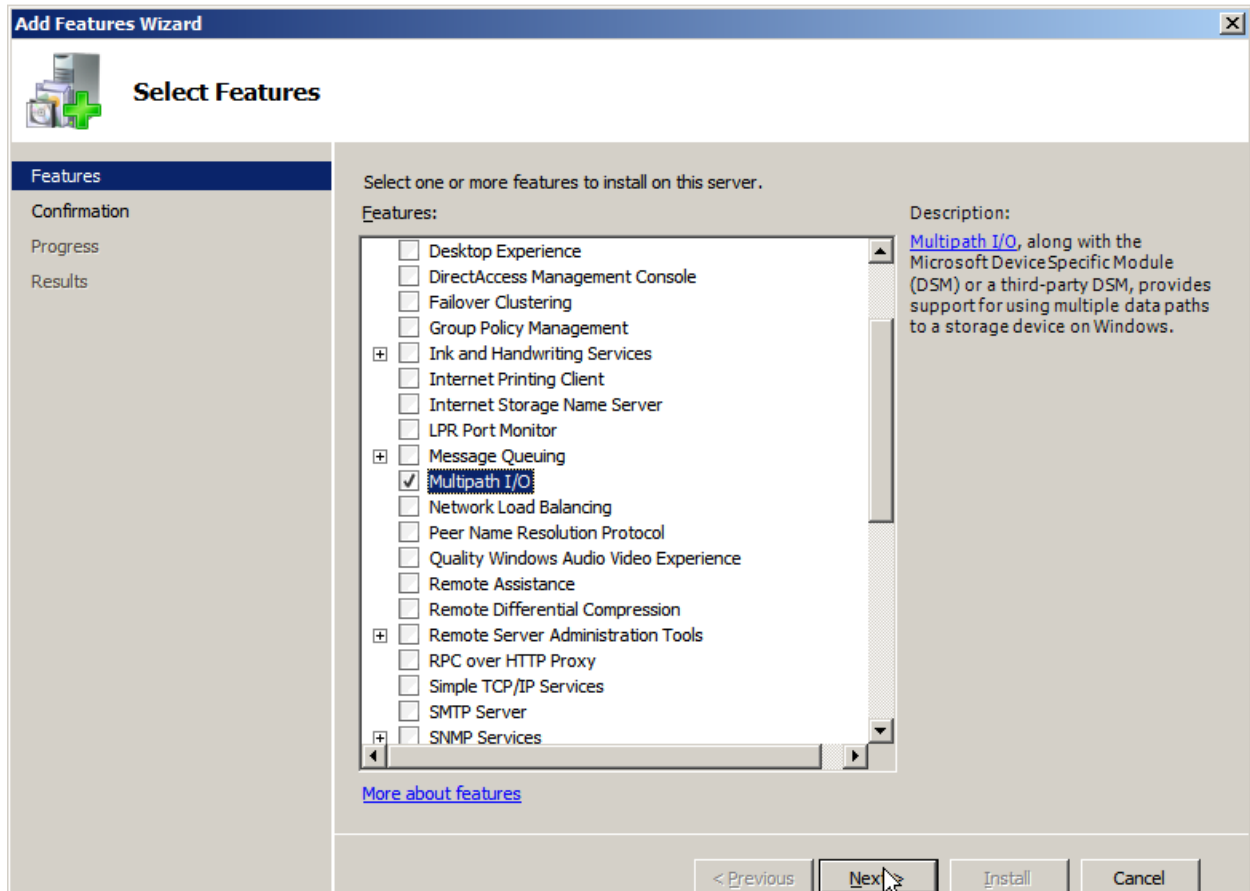
This version of Windows Server has built in iSCSI MPIO support, but it must be enabled (**it is not enabled by default on Windows**). To enable it, first go to **Start -> Administrative Tools -> Server Manager**, as shown:



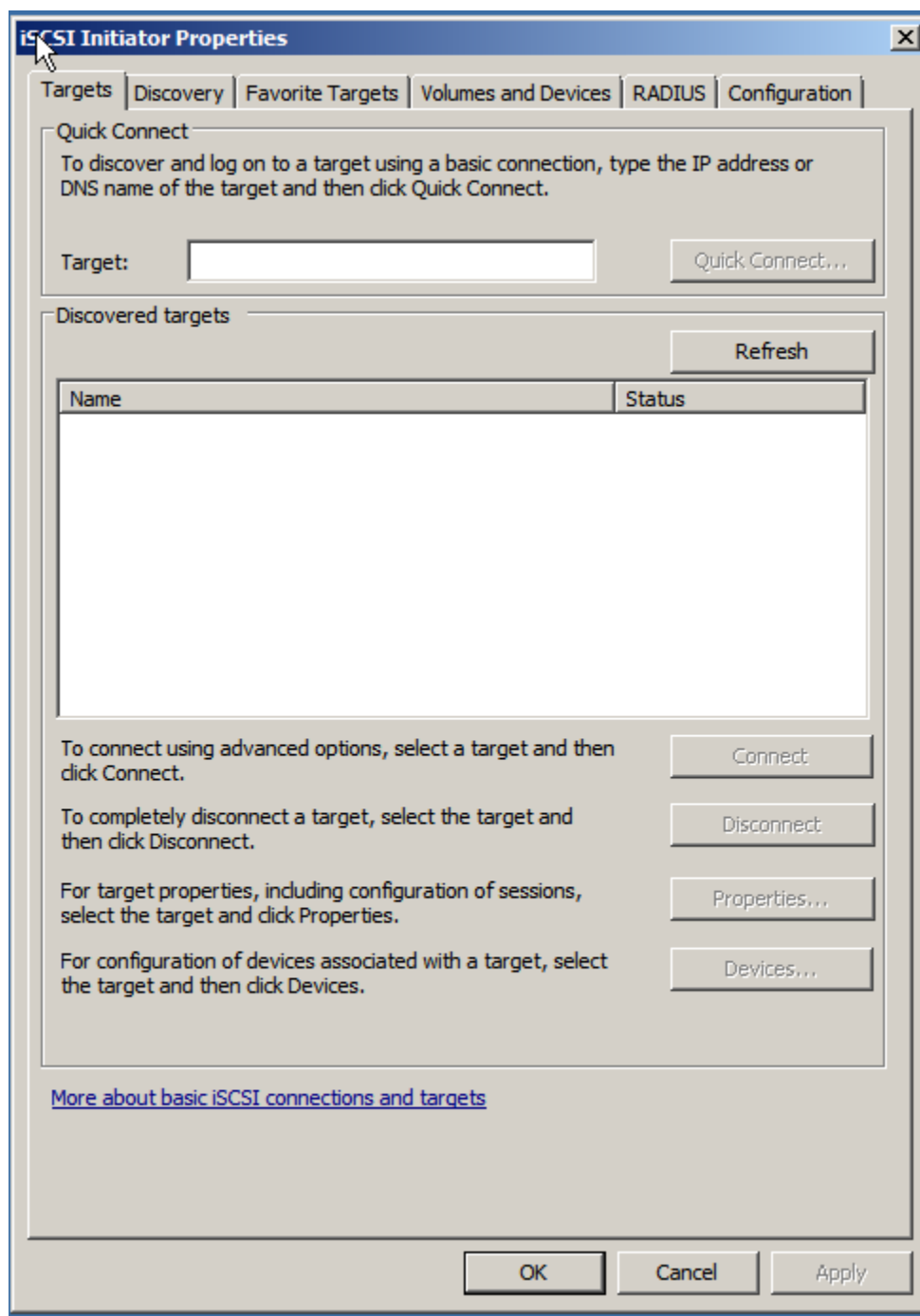
Within the Server Manager, go to the Features section and choose to “**Add Features**”:



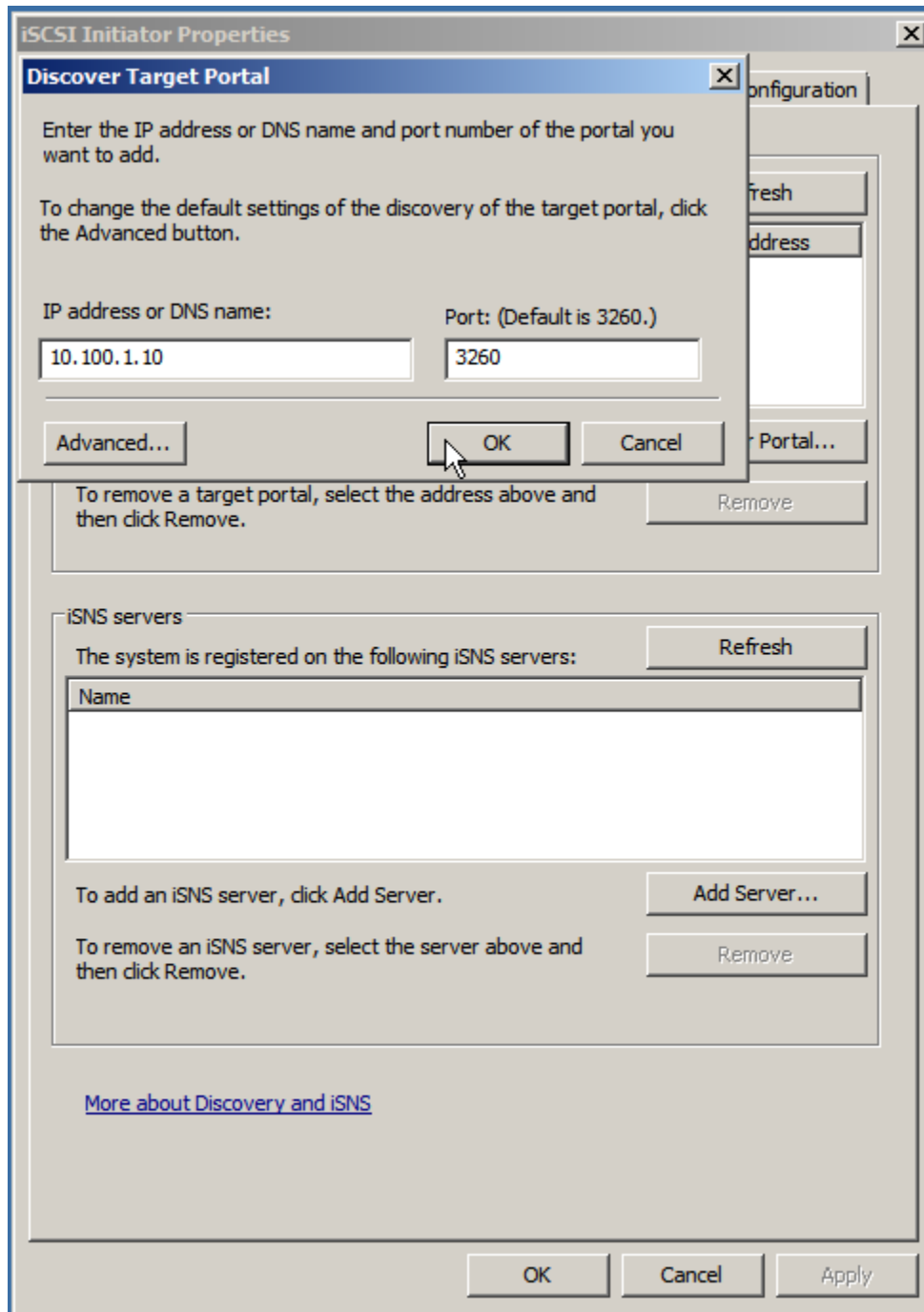
On the resulting page, find “**Multipath I/O**” and select it to install, as shown below.



Hit “**Next**”, and then “**Install**” to install the MPIO feature. This will enable Multipath I/O for iSCSI (as well as Fibre Channel and other technologies). After this feature is installed, it is time to set up iSCSI. To do this, navigate to **Start -> Administrative Tools -> iSCSI Initiator**. If you’ve never clicked this before, Windows will ask you if you wish to enable the service, which you should say **Yes** to if prompted. If you have used iSCSI before, it should not prompt you, and will simply display a dialog box similar to this:



On the resulting iSCSI Initiator window, change to the “**Discovery**” tab and click on “**Discover Portal**” then type in the IP address of your first TPG, as shown in the example here (be sure to substitute your IP address, and not use the one from this example!):



iSCSI Initiator Properties

Discover Target Portal

Enter the IP address or DNS name and port number of the portal you want to add.

To change the default settings of the discovery of the target portal, click the Advanced button.

IP address or DNS name: Port: (Default is 3260.)

Advanced... OK Cancel

To remove a target portal, select the address above and then click Remove. Remove

iSNS servers

The system is registered on the following iSNS servers: Refresh

Name

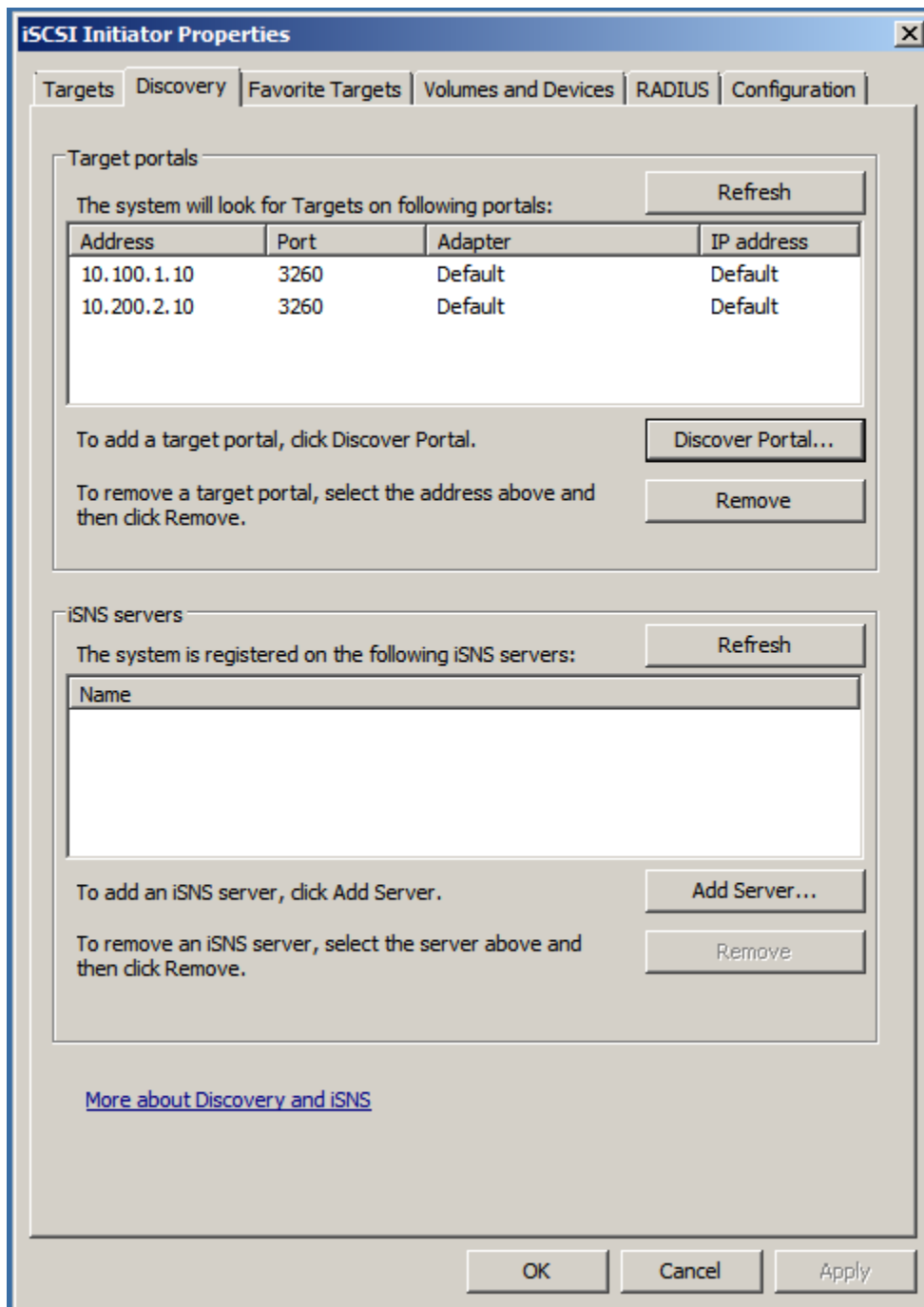
To add an iSNS server, click Add Server. Add Server...

To remove an iSNS server, select the server above and then click Remove. Remove

[More about Discovery and iSNS](#)

OK Cancel Apply

Repeat this, clicking “**Discover Portal**” again, and type in the IP address of your second TPG. Once that is complete, the dialog should look something like this:

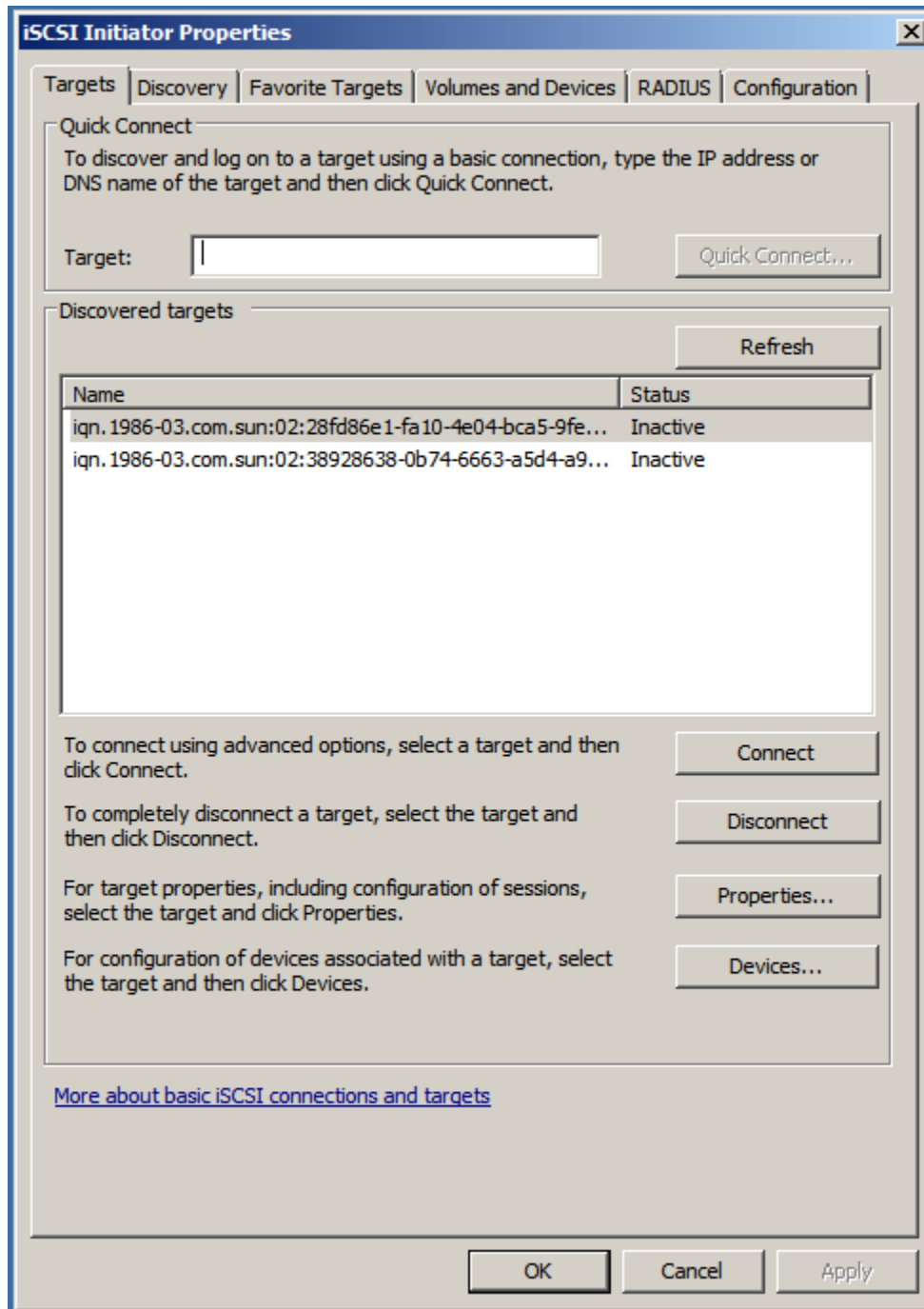


The iSCSI Initiator Properties dialog box is shown with the 'Discovery' tab selected. It contains two main sections: 'Target portals' and 'iSNS servers'. The 'Target portals' section has a table with two rows of discovered portals and buttons for 'Discover Portal...' and 'Remove'. The 'iSNS servers' section has an empty table and buttons for 'Add Server...' and 'Remove'. A link for 'More about Discovery and iSNS' is at the bottom.

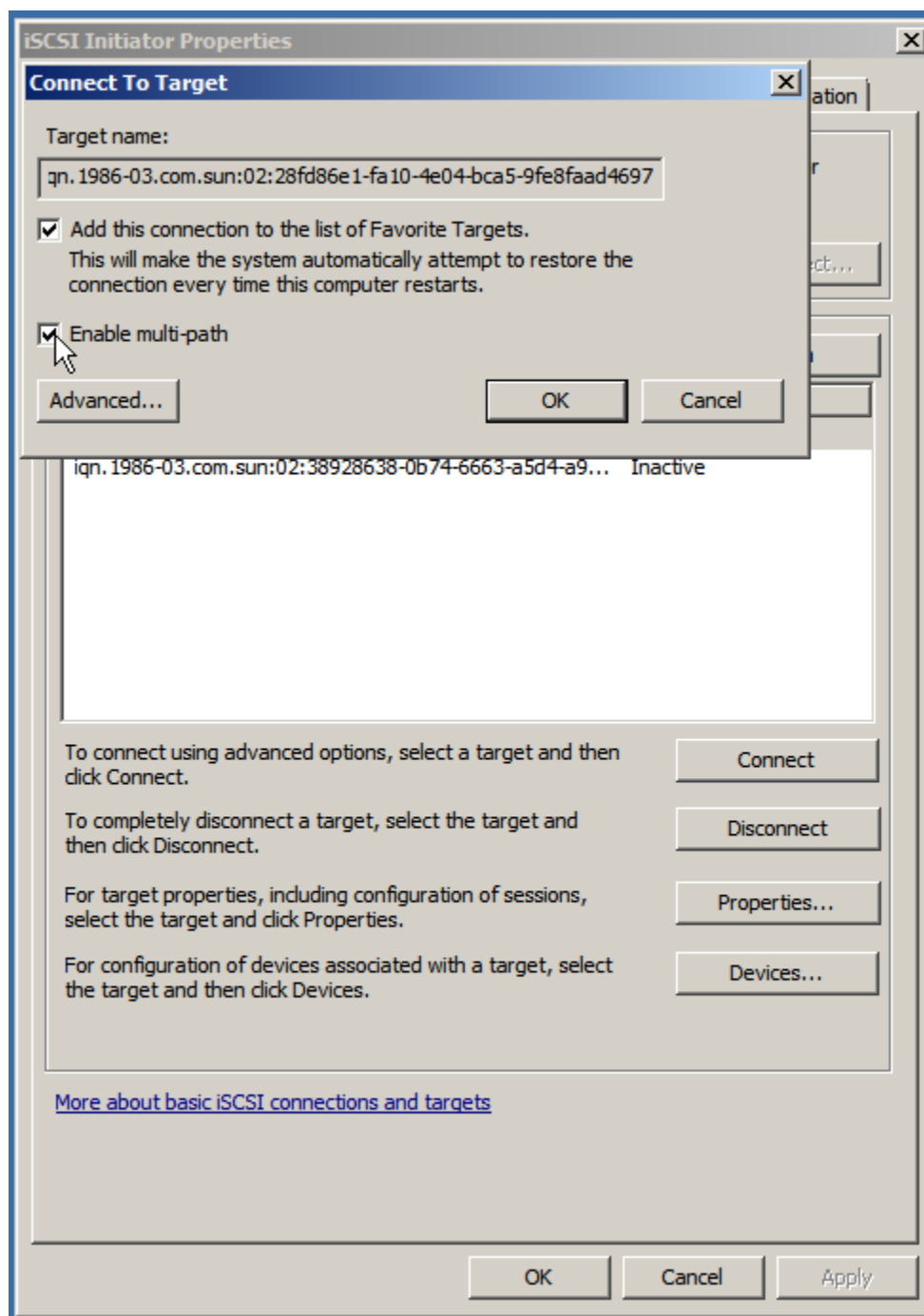
Address	Port	Adapter	IP address
10.100.1.10	3260	Default	Default
10.200.2.10	3260	Default	Default

Name

Switch back to the first tab (**Targets**), and it now should show both the IQNs of the Targets you created on NexentaStor earlier, similar to this:

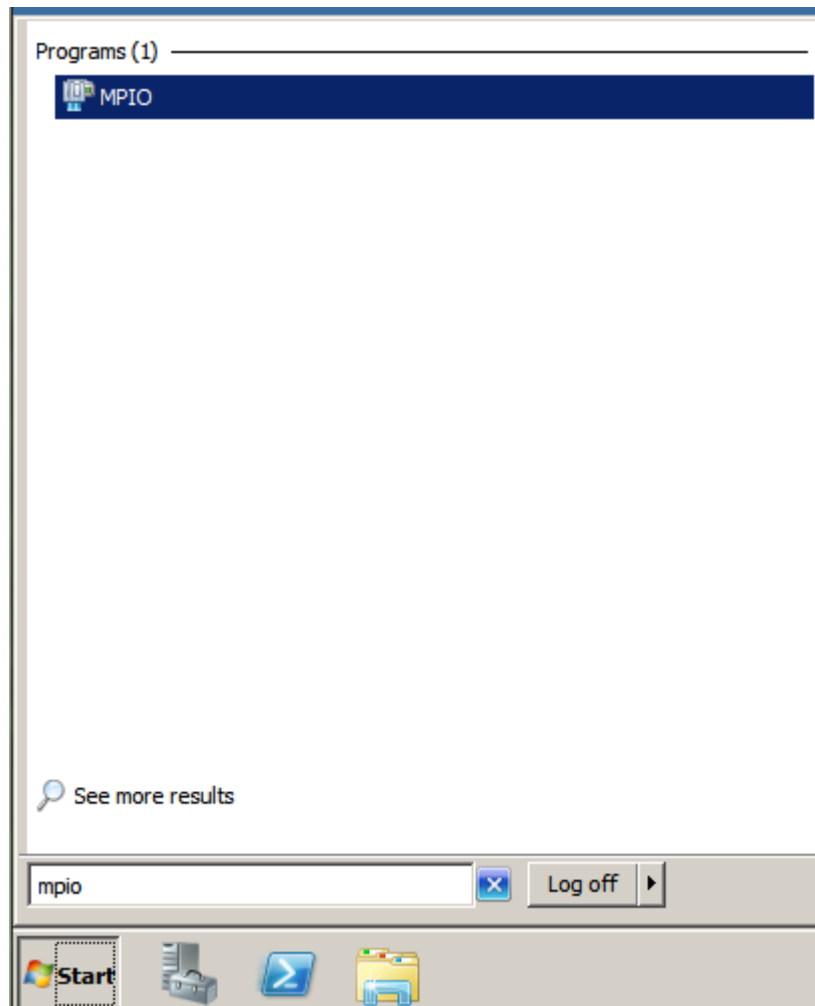


Click on the first of the Targets and hit **"Connect"**. In the resulting dialog box, choose the checkbox **"Enable multi-path"**, as shown (you need to check this box for MPIO to work, and it is **not** checked by default):

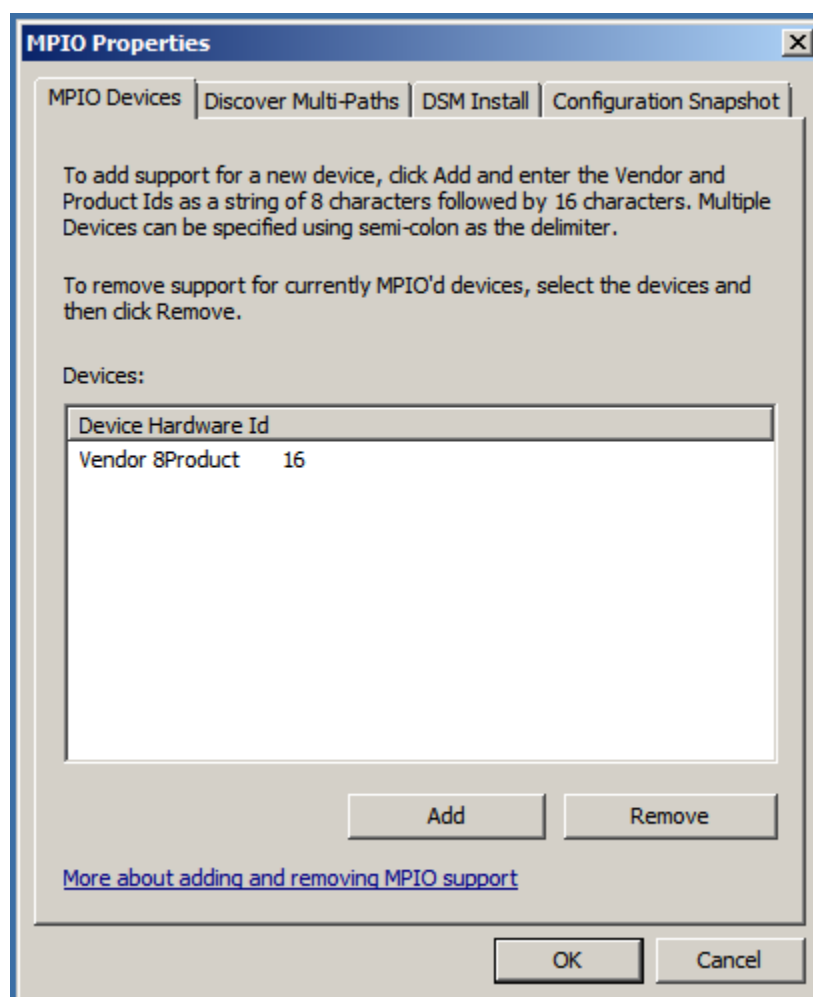


This has connected to the first Target with the Windows iSCSI Initiator, which is a necessary prerequisite to actually enabling MPIO in Server 2008 R2 (earlier we installed the functionality, but we didn't actually enable it).

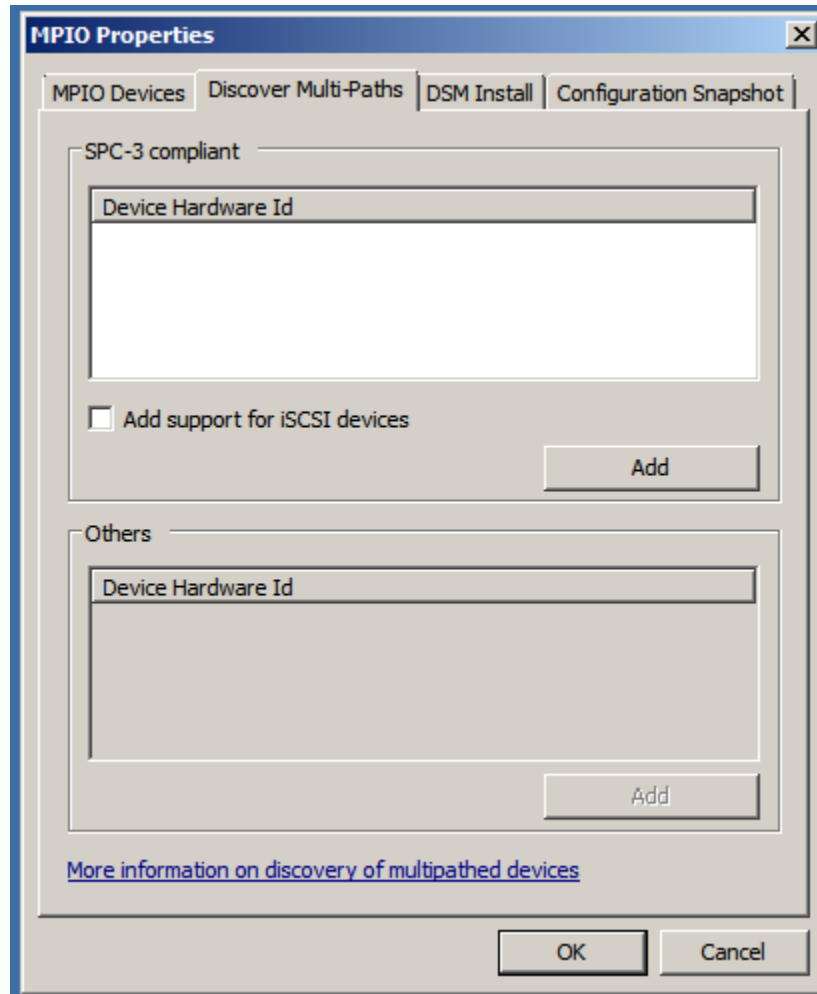
Go ahead and close the iSCSI Configuration utility for now (yes, with only one Target connected and the other listed as Inactive) and click on **"Start"**, then type **MPIO**, which should end up showing you an MPIO program, like this:



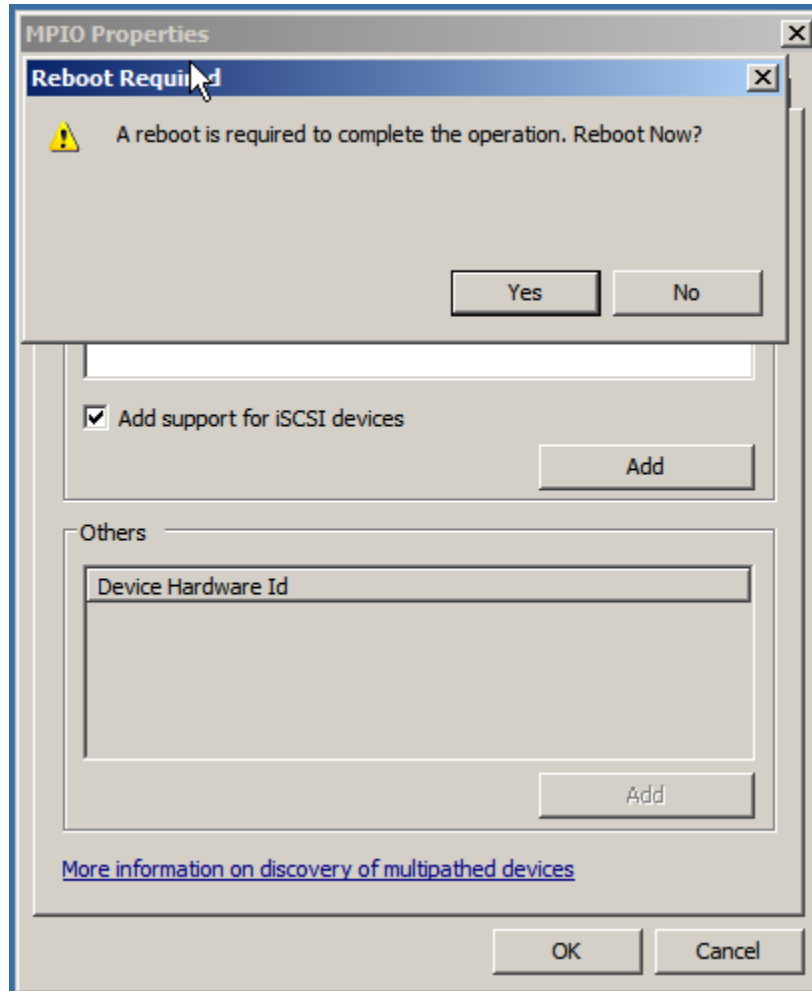
Run the MPIO program, resulting in a dialog box similar to this one:



In the MPIIO utility, choose the second tab labeled **“Discover Multi-paths”**. If you’ve followed the above steps, the **“Add support for iSCSI Devices”** checkbox should be available for selection, as shown (if you do not see an **“Add support for iSCSI devices”** checkbox or it is grayed out, you need to go back and install the MPIIO functionality as shown earlier in this guide:

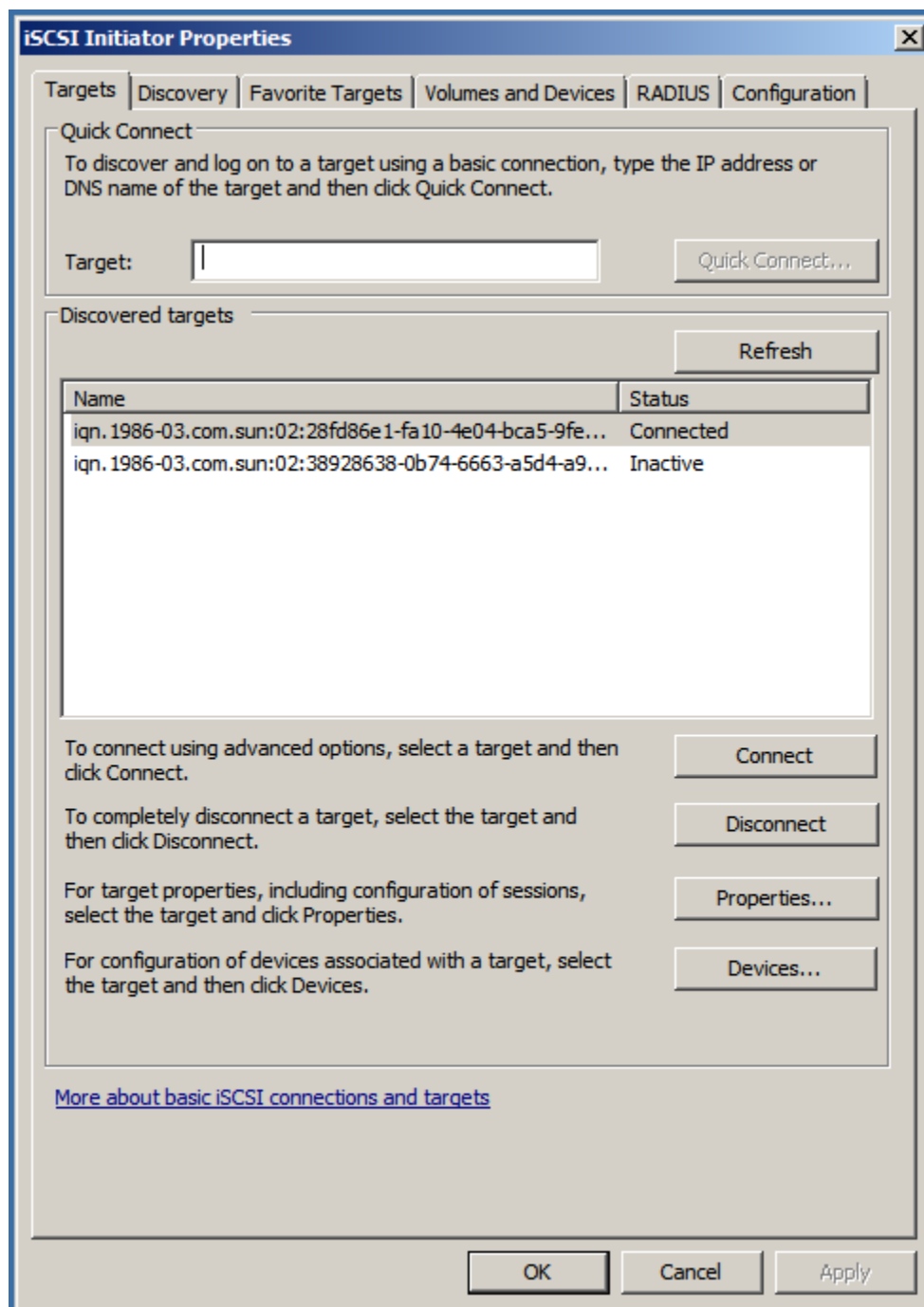


Check the checkbox for “**Add support for iSCSI devices**”, then click the **Add** button. Windows should pop up a dialog box similar to this one, prompting you to reboot the machine:

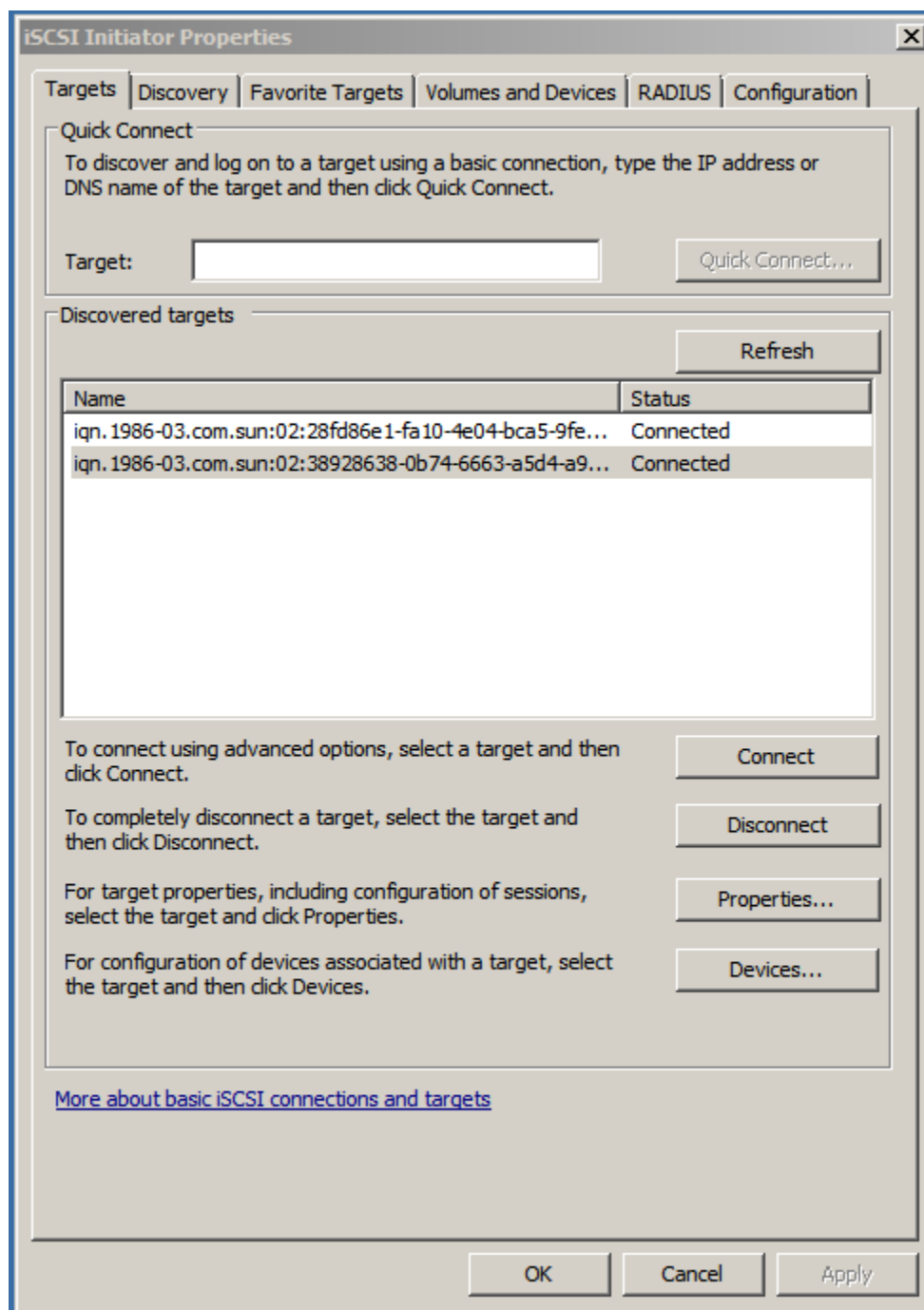


You should say “**Yes**” and let it reboot. If you choose No here, you should not continue with this guide or attempt to set up iSCSI further until you have a chance to reboot the system. Once the system has rebooted, it now will be possible to set up MPIO iSCSI LUNs. At this point, re-open the iSCSI Initiator utility. It still should have your one Target connected on the first tab.

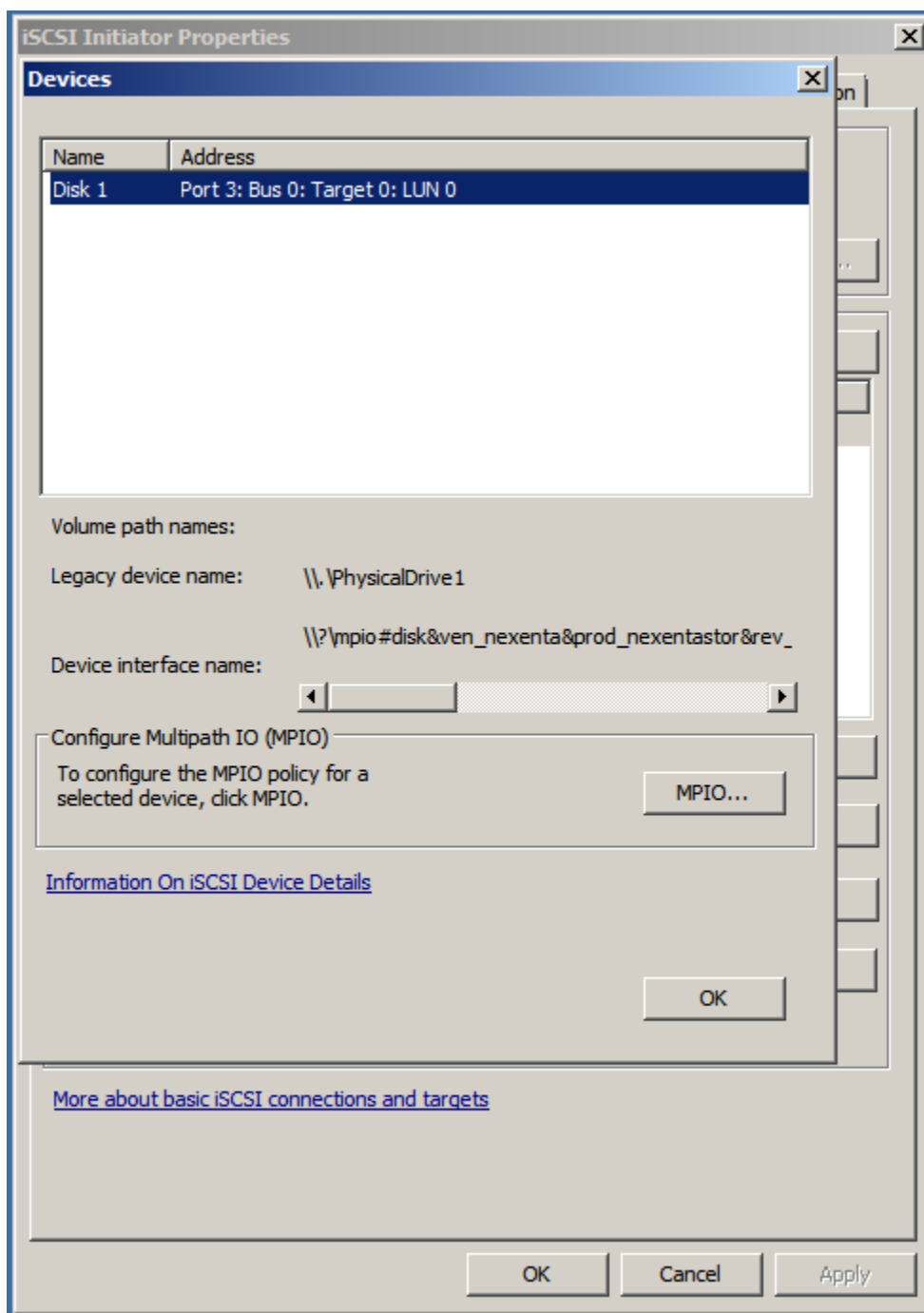
Click **“Refresh”** and you will see the second Target still in an inactive state, like this:



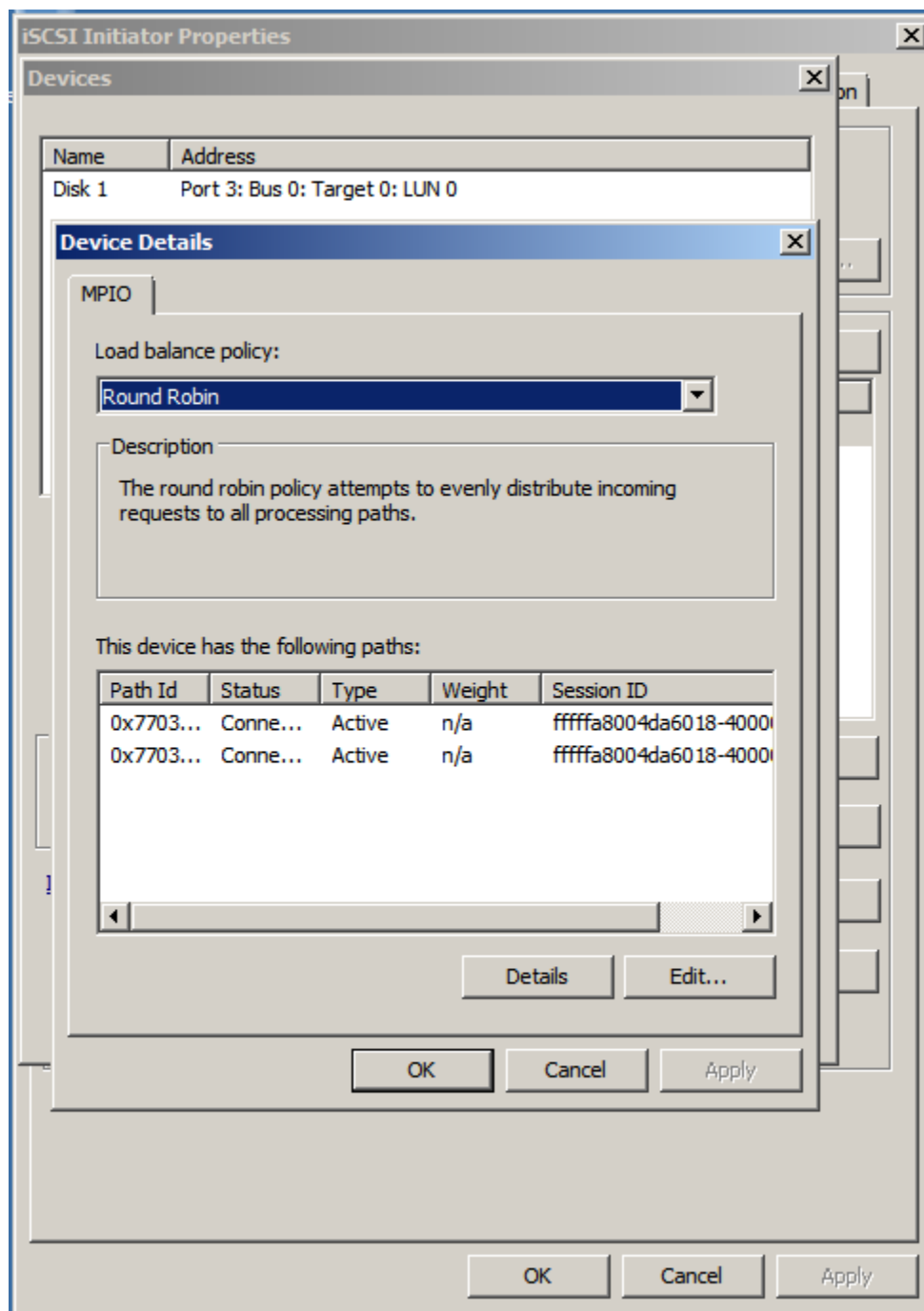
Click the **"Inactive Target"** and click **"Connect"**, and check the **"Enable multi-path"** checkbox as you did before with the other Target. The resulting screen should look something like this:



At this point, MPIO actually is set up and working! If you followed this example, you have exactly one Zvol exposed to this client and, if you click on either of the Discovered targets and click on “**Devices**”, you should see one listed there, similar to this example:

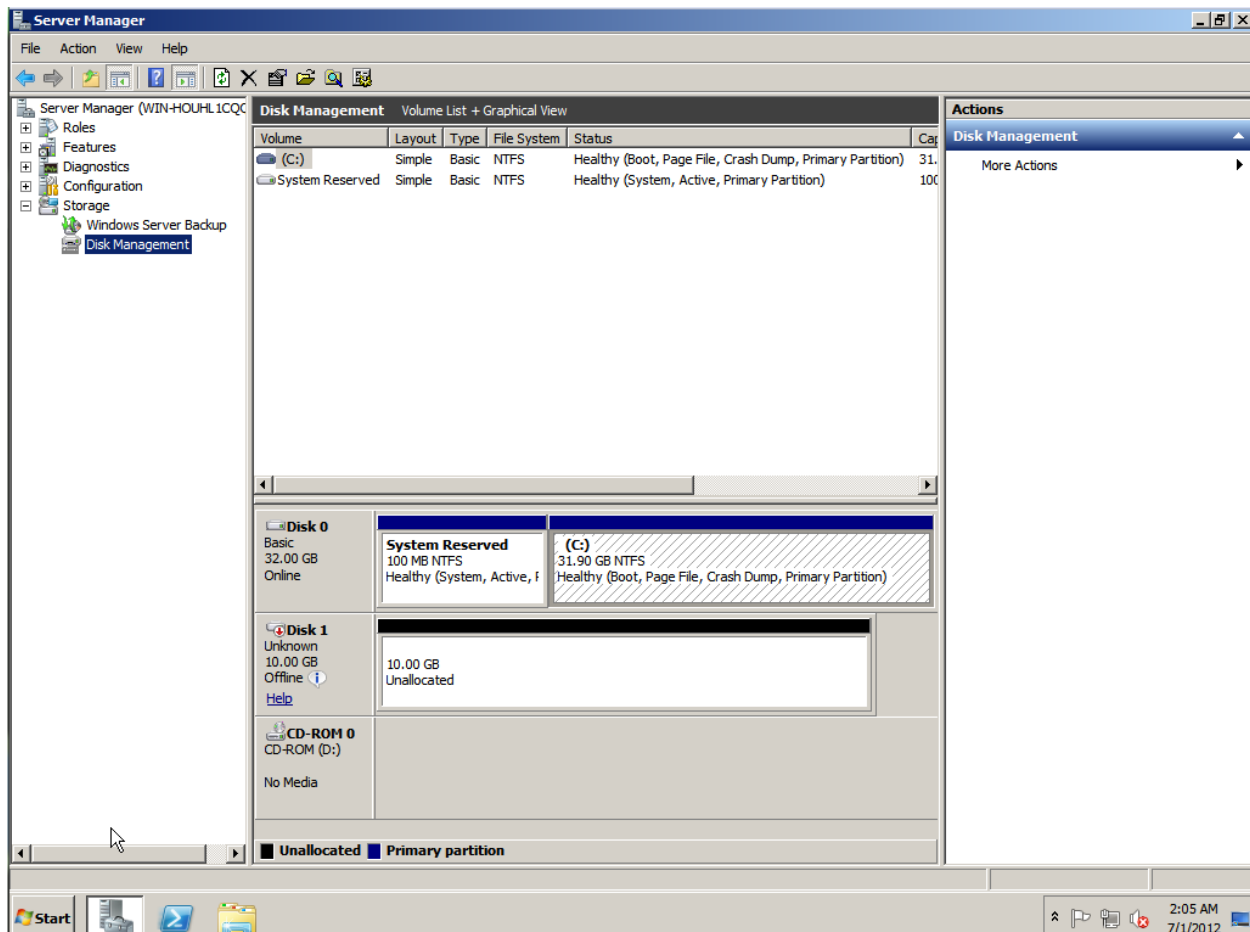


Click the “**Disk 1**” device, then click the “**MPIO**” button. The resulting dialog box should look like the following picture, showing two paths to the same iSCSI LUN:



You now can verify that the exposed Zvol is showing up to the system as a disk (and if it’s new, likely as a completely unformatted, un-partitioned disk) by clicking on “**Start**”, right-clicking on “**Computer**”, and choosing “**Manage**”. In the *Server Manager* utility that opens, expand the “**Storage**” section on the left

pane and click “Disk Management”. As you can see from the next picture, in our example, Disk 1 is the Zvol (which was a 10 GB Zvol from NexentaStor). You now can partition and format this like any other disk and, in addition to being capable of surviving the loss of one path, it also will round-robin data between both paths, improving speed beyond the capacity of a single link.



This concludes the Windows Server 2008 R2 iSCSI Initiator with multipathing section. For discussions around what the best Load Balance policy is or about the proper network setup (MPIO will not properly protect you if your network is not correctly designed and configured), please consult with a certified Nexenta Service Professional.

Linux

This guide will cover setup on two common Linux server distributions (CentOS and Ubuntu Server), but the logic shown herein should apply to any distribution using open-iSCSI.

Open-iSCSI and dm-multipath

This guide will show how to configure multipath iSCSI on Linux. The screenshots and instructions were based around Ubuntu 12.04 LTS, but you will find notes in each section on what to do on CentOS 6.2 if it differs (sometimes it does not). It assumes you already have two network interfaces set up in separate subnets, which for this example will be eth2 and eth3, as shown:

```
root@mon-1:~# ifconfig eth2 && ifconfig eth3
eth2      Link encap:Ethernet  HWaddr 08:00:27:fe:ee:b6
          inet addr:10.100.1.24  Bcast:10.100.1.255  Mask:255.255.255.0
          inet6 addr: fe80::a00:27ff:fe6e:eeb6/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:222 errors:0 dropped:0 overruns:0 frame:0
          TX packets:9 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:13358 (13.3 KB)  TX bytes:650 (650.0 B)

eth3      Link encap:Ethernet  HWaddr 08:00:27:69:6a:06
          inet addr:10.200.2.24  Bcast:10.200.2.255  Mask:255.255.255.0
          inet6 addr: fe80::a00:27ff:fe69:6a06/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:200 errors:0 dropped:0 overruns:0 frame:0
          TX packets:11 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:12076 (12.0 KB)  TX bytes:790 (790.0 B)

root@mon-1:~#
```

First, install the necessary packages with “**apt-get install multipath-tools open-iscsi open-iscsi-utils**”, like so:

```
root@one:~# apt-get install multipath-tools open-iscsi open-iscsi-utils
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
  kpartx
Suggested packages:
  multipath-tools-boot
The following NEW packages will be installed:
  kpartx multipath-tools open-iscsi open-iscsi-utils
0 upgraded, 4 newly installed, 0 to remove and 0 not upgraded.
Need to get 781 kB/885 kB of archives.
After this operation, 2,560 kB of additional disk space will be used.
Do you want to continue [Y/n]? ☐
```

On CentOS 6.2, the command is “**yum install iscsi-initiator-utils device-mapper-multipath**”.

Note that there also exists a “multipath-tools-boot” package in the Apt repository for use if your boot device is itself a multipath device, which is mentioned (but not by default added) when installing these packages; **do NOT** install this package on accident. If your environment is not ready for it, the system may not be able to boot up on next reboot! Installation, setup, and prerequisites for multipath boot are not within the scope of this guide. If you do mistakenly include or allow the installation of multipath-tools-boot and, on the next reboot your system can’t boot up and drops you to BusyBox in initramfs, reboot again to a “**Previous Version**”, run “**apt-get remove multipath-tools-boot**” and then reboot again back into the latest kernel and it should work fine.

If you wish iSCSI to start up automatically when the server is rebooted, it is recommended you modify the default configuration of iscsid. To do this, edit the file `/etc/iscsi/iscsid.conf` and comment out the “**node.startup = manual**” line and remove the comment in front of the “**node.startup = automatic**”. If you’ve done so properly, the before/after of “**cat /etc/iscsi/iscsid.conf | grep node.startup**” should look like this:

```
root@mon-1:~# cat /etc/iscsi/iscsid.conf | grep node.startup
# node.startup = automatic
node.startup = manual
root@mon-1:~# vim /etc/iscsi/iscsid.conf
root@mon-1:~# cat /etc/iscsi/iscsid.conf | grep node.startup
node.startup = automatic
# node.startup = manual
root@mon-1:~#
```

On CentOS 6.2, this step is not necessary as `/etc/iscsi/iscsid.conf` defaults to `node.startup` equaling `automatic`. The above “**cat**” command can verify this if unsure.

Then type **“/etc/init.d/open-iscsi restart”** to have that change take affect. Next, we need to discover the two Targets using open-iscsi, which can be accomplished with a command similar to this (substitute the IP of the first Target Portal Group from Nexenta in this command): **“iscsiadm -m discovery -t sendtargets -p 10.100.1.10”**, with a response similar to:

```
root@mon-1:~# iscsiadm -m discovery -t sendtargets -p 10.100.1.10
10.200.2.10:3260,2 iqn.1986-03.com.sun:02:28fd86e1-fa10-4e04-bca5-9fe8faad4697
10.100.1.10:3260,2 iqn.1986-03.com.sun:02:38928638-0b74-6663-a5d4-a9da460ed5ae
root@mon-1:~#
```

On CentOS 6.2, the first time you run this command it may start iscsid; do not be alarmed, and this is not indicative of a need to add iscsi or iscsid to chkconfig, the package installation already did this.

Note: Target Portal Groups in NexentaStor 3.1.3 don't currently hide discovery of Targets even when connected from an unassociated IP, which is why two show up here. This may be fixed in a future release, so only one may show up. If only one is visible, run the command again but with the other IP to discover the IQN of the other Target.

With both IQNs now known (and you could skip this step if you have a login to the Nexenta appliance and can go look up the IQNs there), you need to login to the Target using this command (substitute the IP of the first Target and the IQN of the first Target where appropriate):

"iscsiadm -m node --targetname iqn.1986-03.com.sun:02:38928638-0b74-6663-a5d4-a9da460ed5ae -p 10.100.1.10 --login", which should respond similar to this:

```
root@mon-1:~# iscsiadm --m node --targetname iqn.1986-03.com.sun:02:38928638-0b74-6663-a5d4-a9da460ed5ae -p 10.100.1.10 --login
Logging in to [iface: default, target: iqn.1986-03.com.sun:02:38928638-0b74-6663-a5d4-a9da460ed5ae, portal: 10.100.1.10,3260]
Login to [iface: default, target: iqn.1986-03.com.sun:02:38928638-0b74-6663-a5d4-a9da460ed5ae, portal: 10.100.1.10,3260]: successful
root@mon-1:~# █
```

It is important to note that you need to include the **"-p <ip>"** part of this command; it can be left off, but that may lead to unusual behavior if iSCSI ends up connecting to both IQNs via the same portal (IP) instead of the separate IPs.

While “**successful**” has been shown below, you further can verify that something has occurred because at this point Ubuntu should have located any available LUNs off of this iSCSI Target and created devices for them already, a quick “**dmesg | tail**” can verify this, showing something similar to this:

```
root@mon-1:~# iscsiadm --m node --targetname iqn.1986-03.com.sun:02:38928638-0b74-6663-a5d4-a9da460ed5ae -p 10.100.1.10 --login
Logging in to [iface: default, target: iqn.1986-03.com.sun:02:38928638-0b74-6663-a5d4-a9da460ed5ae, portal: 10.100.1.10,3260]
Login to [iface: default, target: iqn.1986-03.com.sun:02:38928638-0b74-6663-a5d4-a9da460ed5ae, portal: 10.100.1.10,3260]: successful
root@mon-1:~# dmesg | tail
[50280.974756] iscsi: registered transport (iser)
[50876.961498] scsi3 : iSCSI Initiator over TCP/IP
[50877.468067] scsi 3:0:0:0: Direct-Access      NEXENTA  NEXENTASTOR      1.0  PQ
: 0 ANSI: 5
[50877.468290] sd 3:0:0:0: Attached scsi generic sg2 type 0
[50877.471022] sd 3:0:0:0: [sdb] 20971520 512-byte logical blocks: (10.7 GB/10.0 GiB)
[50877.473044] sd 3:0:0:0: [sdb] Write Protect is off
[50877.473046] sd 3:0:0:0: [sdb] Mode Sense: 53 00 00 00
[50877.473684] sd 3:0:0:0: [sdb] Write cache: enabled, read cache: enabled, doesn't support DPO or FUA
[50877.478231] sdb: unknown partition table
[50877.483126] sd 3:0:0:0: [sdb] Attached SCSI disk
root@mon-1:~# █
```

In our example, there is only one LUN visible off of this Target and, as you can see, Ubuntu has created an “sdb” drive based on it. This is enough to now allow use of the device via iSCSI at this time, but not enough for multipath. For multipath, we now need to repeat the previous iSCSI login command, this time for the second Target with a command similar to this (substitute second Target’s IP and IQN where appropriate): “**iscsiadm --m node --targetname iqn.1986-03.com.sun:02:28fd86e1-fa10-4e04-bca5-9fe8faad4697 -p 10.200.2.10 --login**”, with a result similar to the last login command:

```
root@mon-1:~# iscsiadm --m node --targetname iqn.1986-03.com.sun:02:28fd86e1-fa10-4e04-bca5-9fe8faad4697 -p 10.200.2.10 --login
Logging in to [iface: default, target: iqn.1986-03.com.sun:02:28fd86e1-fa10-4e04-bca5-9fe8faad4697, portal: 10.200.2.10,3260]
Login to [iface: default, target: iqn.1986-03.com.sun:02:28fd86e1-fa10-4e04-bca5-9fe8faad4697, portal: 10.200.2.10,3260]: successful
root@mon-1:~#
```

Where things get interesting at this stage on Linux is that if you again run “**dmesg | tail**”, you’ll see something similar to this:

```
root@mon-1:~# dmesg | tail
[51176.895295] connection1:0: detected conn error (1020)
[51205.203719] scsi4 : iSCSI Initiator over TCP/IP
[51205.709490] scsi 4:0:0:0: Direct-Access      NEXENTA  NEXENTASTOR      1.0  PQ
: 0 ANSI: 5
[51205.709736] sd 4:0:0:0: Attached scsi generic sg3 type 0
[51205.713225] sd 4:0:0:0: [sdc] 20971520 512-byte logical blocks: (10.7 GB/10.0 GiB)
[51205.715323] sd 4:0:0:0: [sdc] Write Protect is off
[51205.715325] sd 4:0:0:0: [sdc] Mode Sense: 53 00 00 00
[51205.715961] sd 4:0:0:0: [sdc] Write cache: enabled, read cache: enabled, doesn't support DPO or FUA
[51205.723736] sdc: unknown partition table
[51205.727297] sd 4:0:0:0: [sdc] Attached SCSI disk
root@mon-1:~#
```

As you can see, Ubuntu has created a “**sdc**” drive for the new LUN it has seen off the second Target—but we know this is the same LUN from the first target! It has created two disks to represent the same physical storage (which is very, very bad if you try to then use both separately, resulting in complete data corruption)! This is where the multipath packages we installed earlier come into play.

On CentOS 6.2, you need to run the command “**chkconfig multipathd on**” at this point. Unlike Ubuntu, CentOS does not default to enabling the multipath daemon.

CentOS 6.2

On CentOS 6.2, there’s no need to manually edit a multipath.conf file. Simply run the command “**mpathconf --enable --user_friendly_names y**” followed by a restart of multipath using “**/etc/init.d/multipathd restart**” and then proceed past this next Ubuntu 12.04 LTS section to “**Both**” section below. Here is an example of CentOS configuration of multipath.conf:

```
[root@localhost ~]# mpathconf --enable --user_friendly_names y
[root@localhost ~]# /etc/init.d/multipathd restart
Stopping multipathd daemon:                [ OK ]
Starting multipathd daemon:                [ OK ]
[root@localhost ~]# multipath -ll
mpathb (3600144f054420000000004ff00c510001) dm-2 NEXENTA,NEXENTASTOR
size=10G features='0' hwhandler='0' wp=rw
|-+- policy='round-robin 0' prio=1 status=active
|  '- 3:0:0:0 sdb 8:16 active ready running
`-+- policy='round-robin 0' prio=1 status=enabled
    '- 4:0:0:0 sdc 8:32 active ready running
[root@localhost ~]#
```


Ubuntu 12.04 LTS

We need to teach Ubuntu that these two LUNs are the same drive. To do so, we first need to create an **“/etc/multipath.conf”** file (one is not created by default) containing a simple set of initial instructions. For this example, we choose to blacklist **“sda”** since we know it to be a single-path local SATA disk and, more important, we set up a default of **user_friendly_names** to yes. But MOST important is that we create the **“/etc/multipath.conf”** file at all, which then will allow multipath functionality to properly work. Below, we created the file and this is what it looks like on our test box:

```
root@mon-1:/etc# cat /etc/multipath.conf
cat: /etc/multipath.conf: No such file or directory
root@mon-1:/etc# vi /etc/multipath.conf
root@mon-1:/etc# cat /etc/multipath.conf
blacklist {
    devnode "sda"
}

defaults {
    user_friendly_names yes
}
root@mon-1:/etc# █
```

After creating this file, restart multipath with **“/etc/init.d/multipath-tools restart”** and then verify that it has created a **“/dev/mapper/mpath#”** device that represents both iSCSI LUNs together by typing **“multipath -ll”**, which should have output similar to this:

```
root@mon-1:/etc# multipath -ll
mpath0 (3600144f05442000000004ff00c510001) dm-0 NEXENTA,NEXENTASTOR
size=10G features='0' hwhandler='0' wp=rw
|+- policy='round-robin 0' prio=1 status=active
|  '- 3:0:0:0 sdb 8:16 active ready running
`+- policy='round-robin 0' prio=1 status=enabled
   '- 4:0:0:0 sdc 8:32 active ready running
root@mon-1:/etc# █
```

Both

As you can see, an mpath0 entry exists on our test box, and represents two paths for our 10 GB iSCSI LUN, represented by both sdb and sdc. Further tuning and configuration of other path topology is beyond the scope of this guide, but it is now safe to use the “**/dev/mapper/mpath0**” device as a regular block device (as you would use /dev/sdb or /dev/sdc) to create a filesystem or make part of an LVM setup. **Do not use /dev/sdb or /dev/sdc—only use /dev/mapper/mpath0!**

Using the underlying block devices of a multipath device will corrupt data and lead to unhappiness.

If you followed all the instructions in this section, this device still will exist even after a reboot, assuming network connectivity to the iSCSI LUNs remains up for at least one path at all times.

Here is “**multipath -ll**” directly after a reboot of our test box, after following these instructions:

```
root@mon-1:~# uptime
 21:03:39 up 0 min,  2 users,  load average: 0.00, 0.00, 0.00
root@mon-1:~# multipath -ll
mpath0 (3600144f05442000000004ff00c510001) dm-0 NEXENTA,NEXENTASTOR
size=10G features='0' hwhandler='0' wp=rw
|+- policy='round-robin 0' prio=1 status=active
|  '- 4:0:0:0 sdc 8:32 active ready running
`+- policy='round-robin 0' prio=1 status=enabled
   '- 3:0:0:0 sdb 8:16 active ready running
root@mon-1:~# █
```

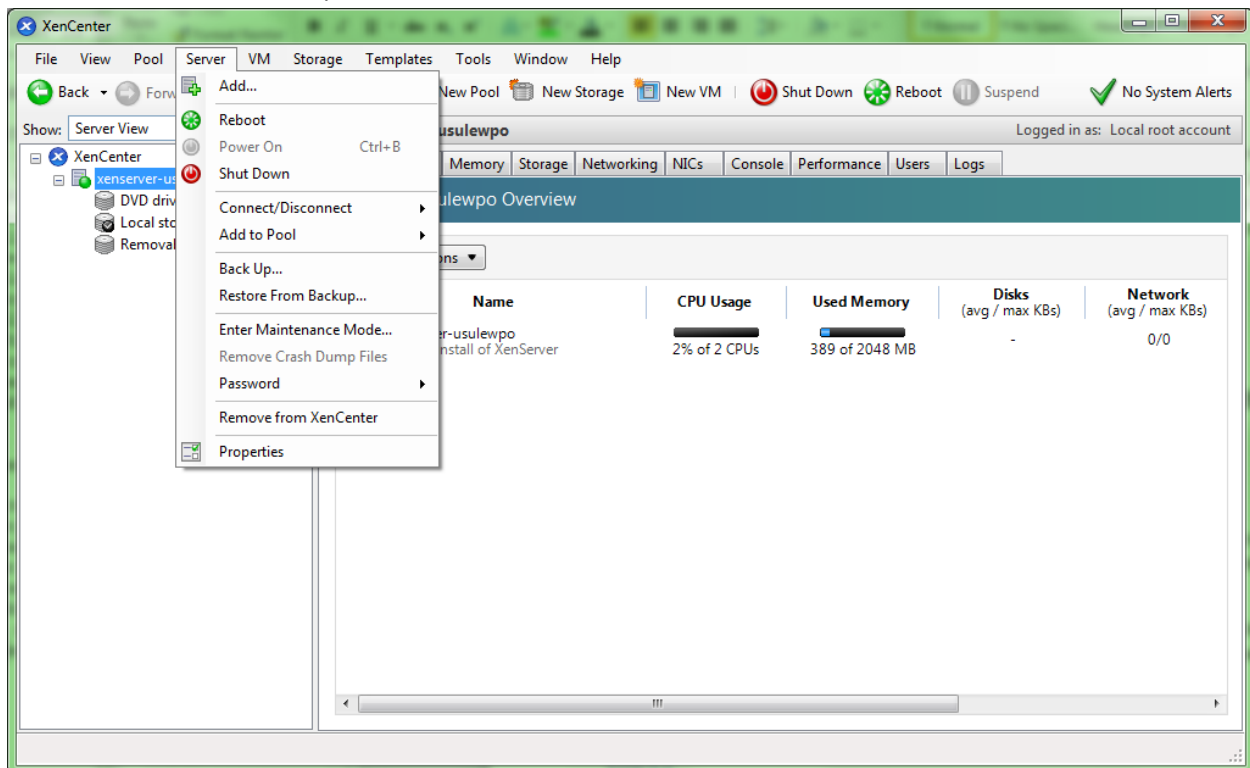
Citrix

XenServer 6

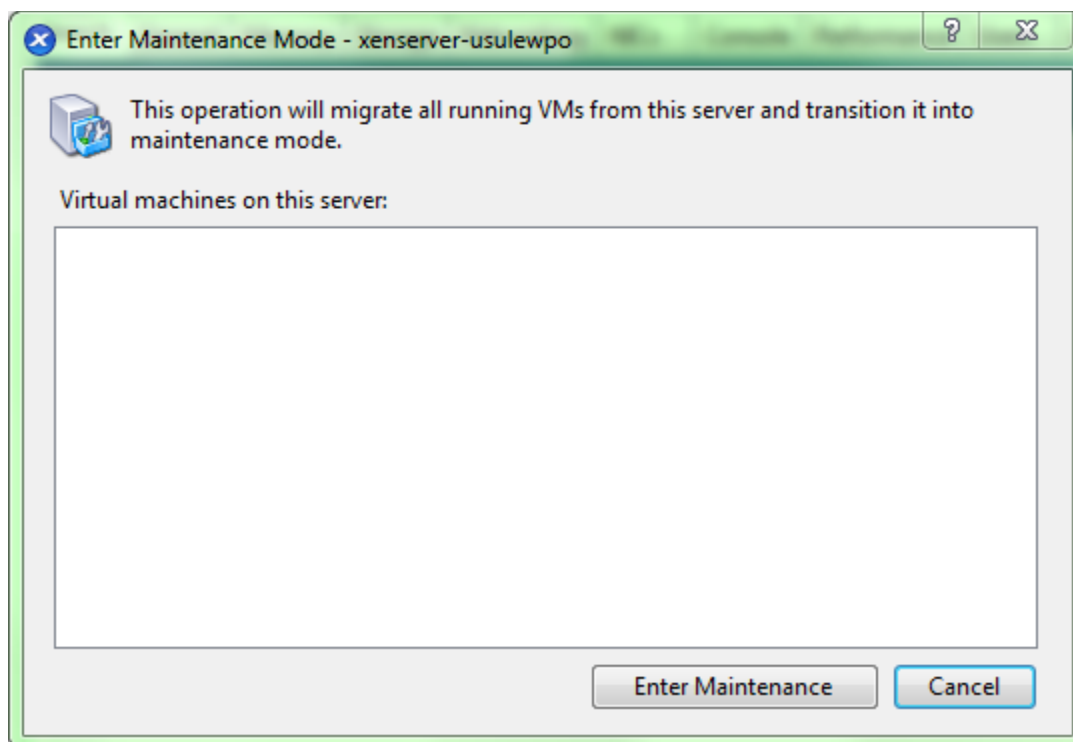
This guide assumes that the XenServer host already has been properly configured in terms of networking and other settings. It is important to note about networking that, in general, it is not recommended to utilize bonded networks on the XenServer host to pass multipath iSCSI traffic—the two are redundant, with iSCSI multipath being the superior technology. This only is true if the networks in question are passing only iSCSI traffic, and no other types of traffic.

This guide will show you how to enable multipath and set up an iSCSI Storage Repository. Enabling multipath on XenServer is recommended to take place **prior** to creating any Storage Repositories and before placing any VMs on the machine.

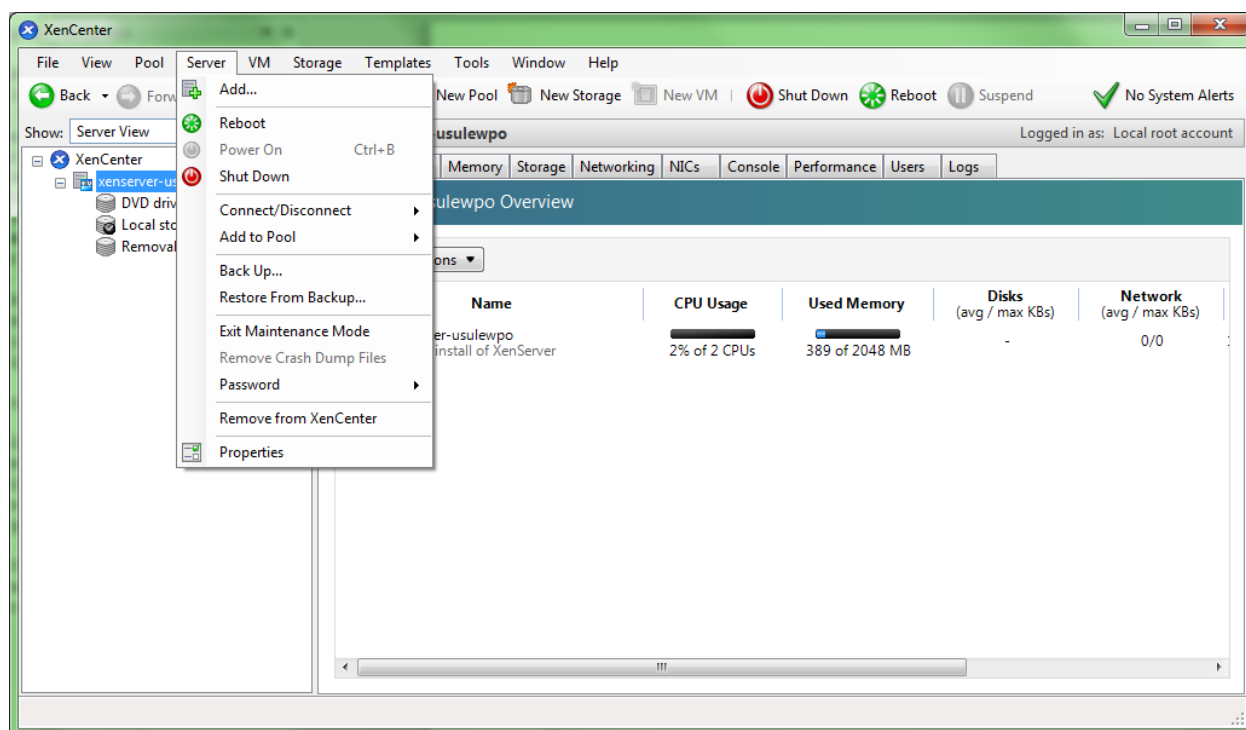
Assuming for this example that Network 3 and Network 4 exist, and have Storage 1 and Storage 2 interfaces on them respectively, the first step is to put the XenServer host into maintenance mode in order to enable multipathing. To enter maintenance mode in XenCenter, choose the correct host and click on the Server menu option, then choose “**Enter Maintenance Mode**”:



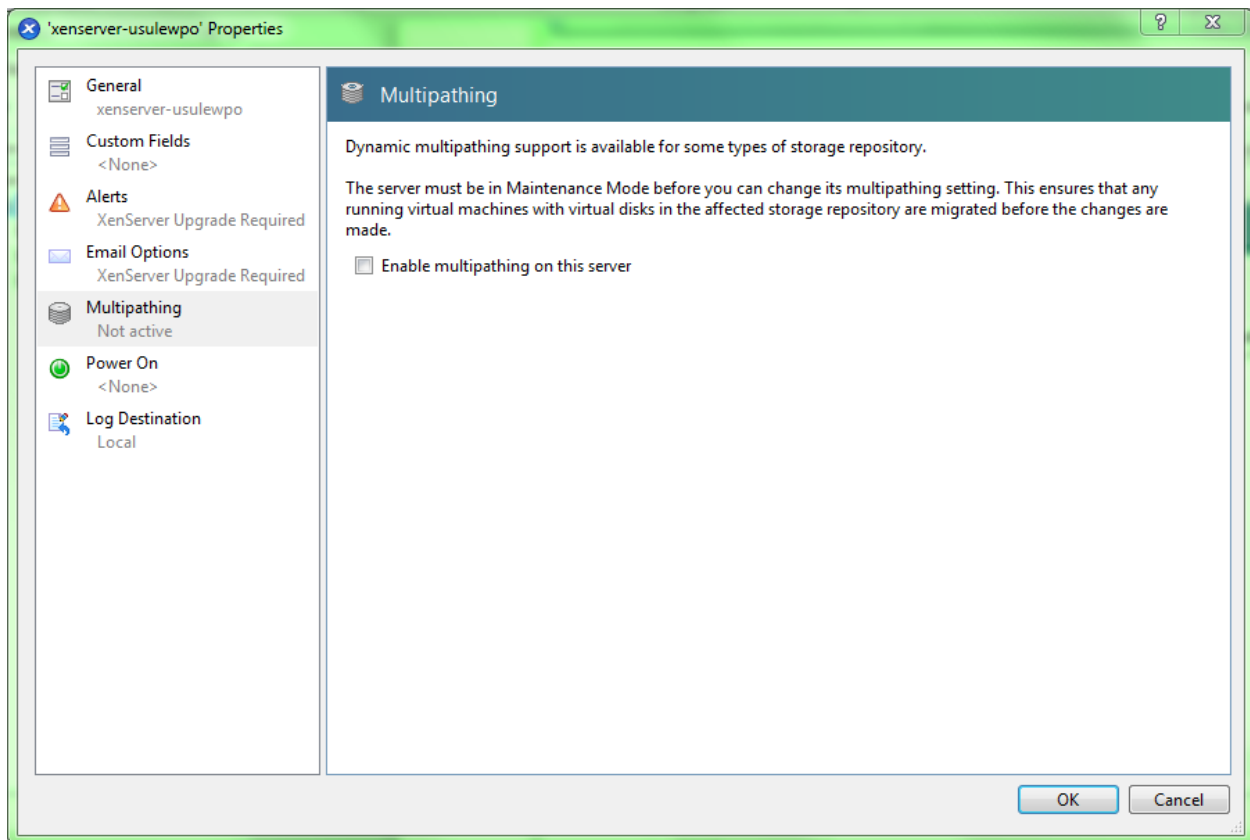
You will be presented with a dialog box similar to this, where you click “Enter Maintenance”:



After the server enters maintenance mode, click on the Server menu option again and choose **“Properties”** from the menu:

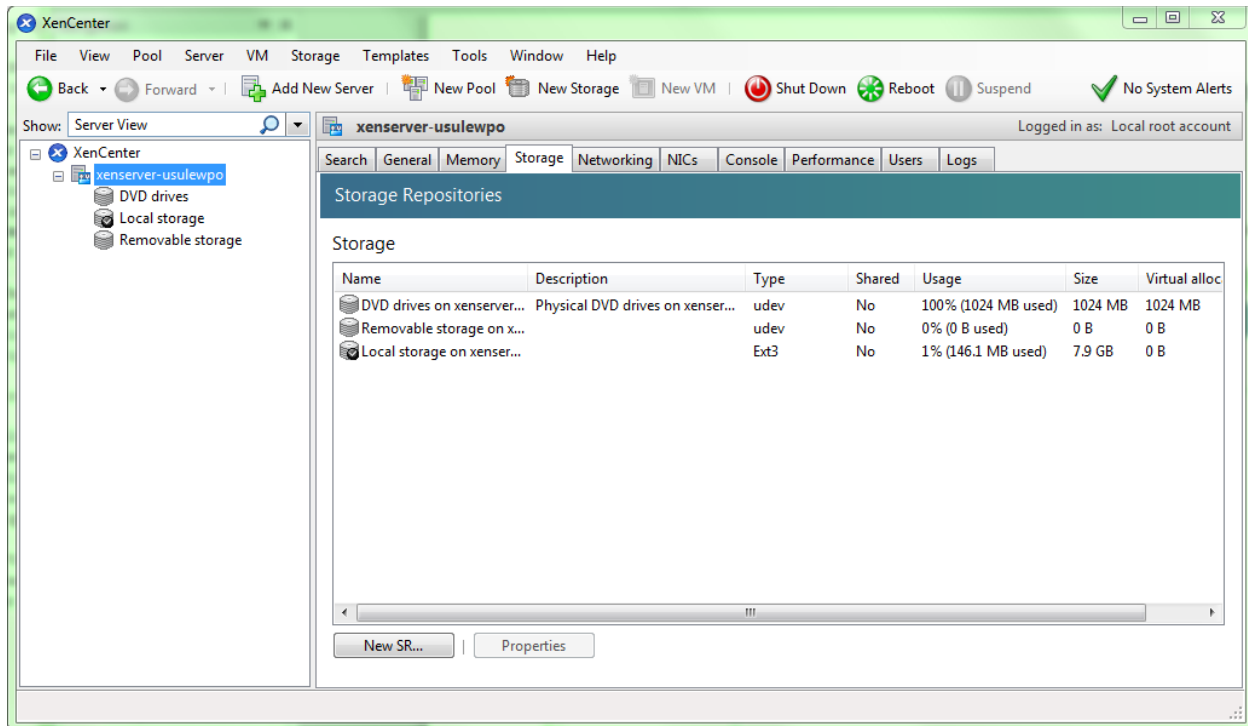


On the Properties page, click the “**Multipathing**” section on the left, which will present a screen similar to this:

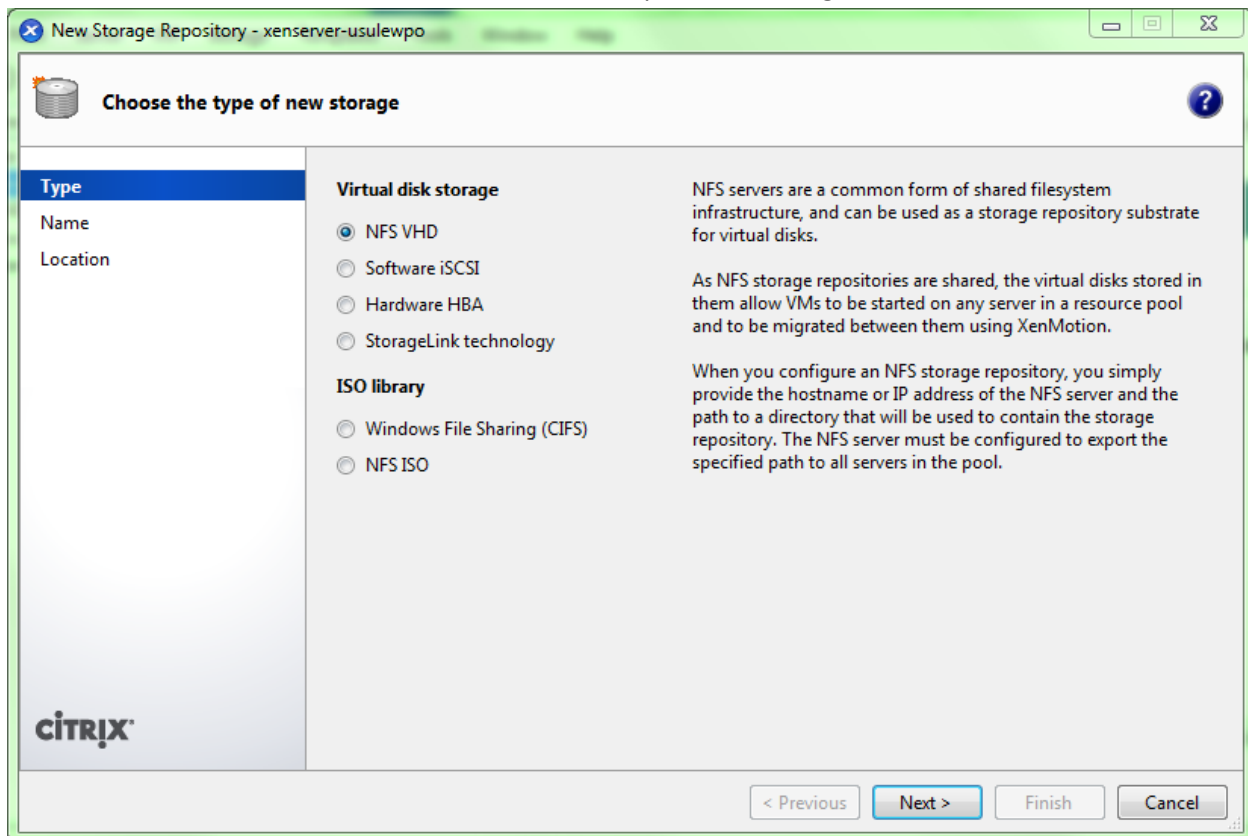


Check the “**Enable multipathing on this server**” checkbox and hit **OK**.

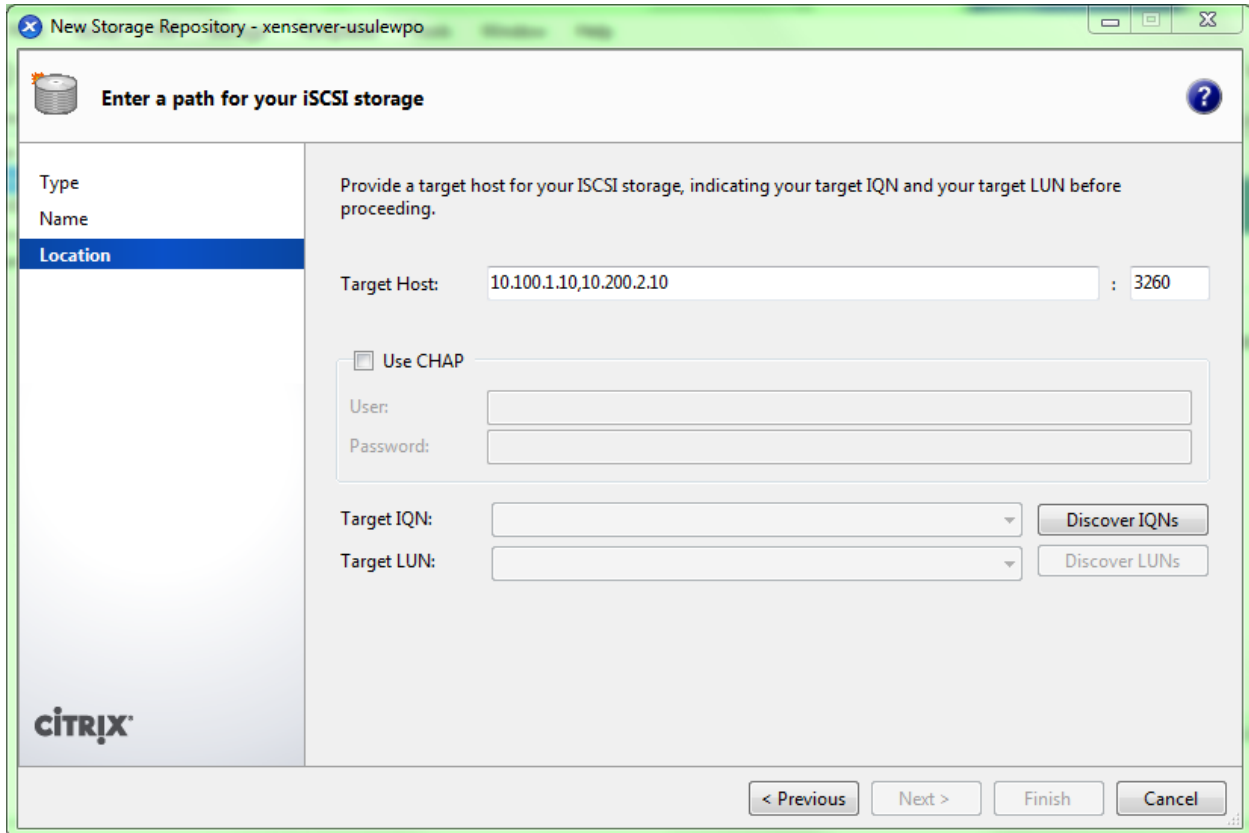
At this point, the XenServer host has multipathing enabled, and will be prepared to understand iSCSI multipathing when we set up the Storage Repository. To add the iSCSI SR, click on the **Storage** tab for the server:



Then click on “New SR...” in the lower left, which will present a dialog similar to this one:

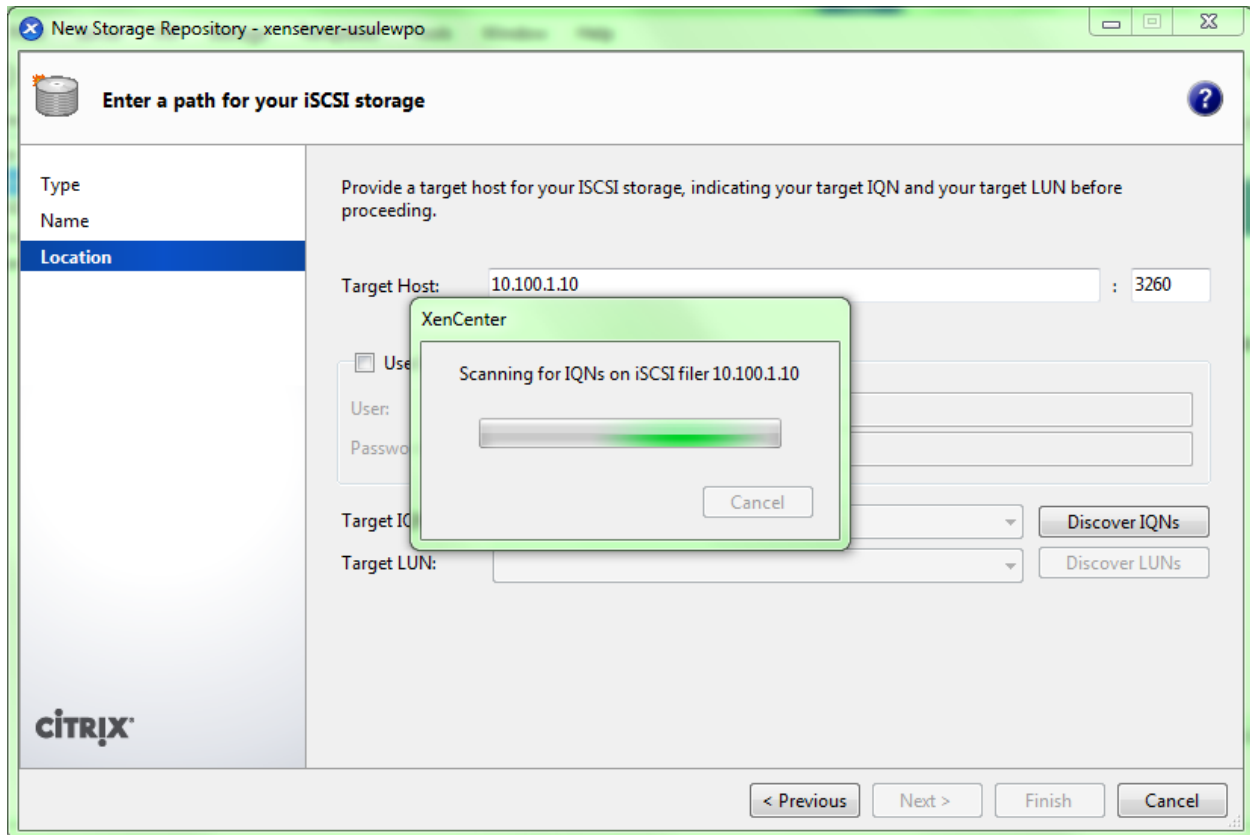


Choose the “**Software iSCSI**” radio button and hit **Next**. The following page asks for the name and description for the iSCSI Storage Repository. Choose whatever you wish (for this *Guide*, we left the defaults), then hit **Next**, which should present a screen similar to this:



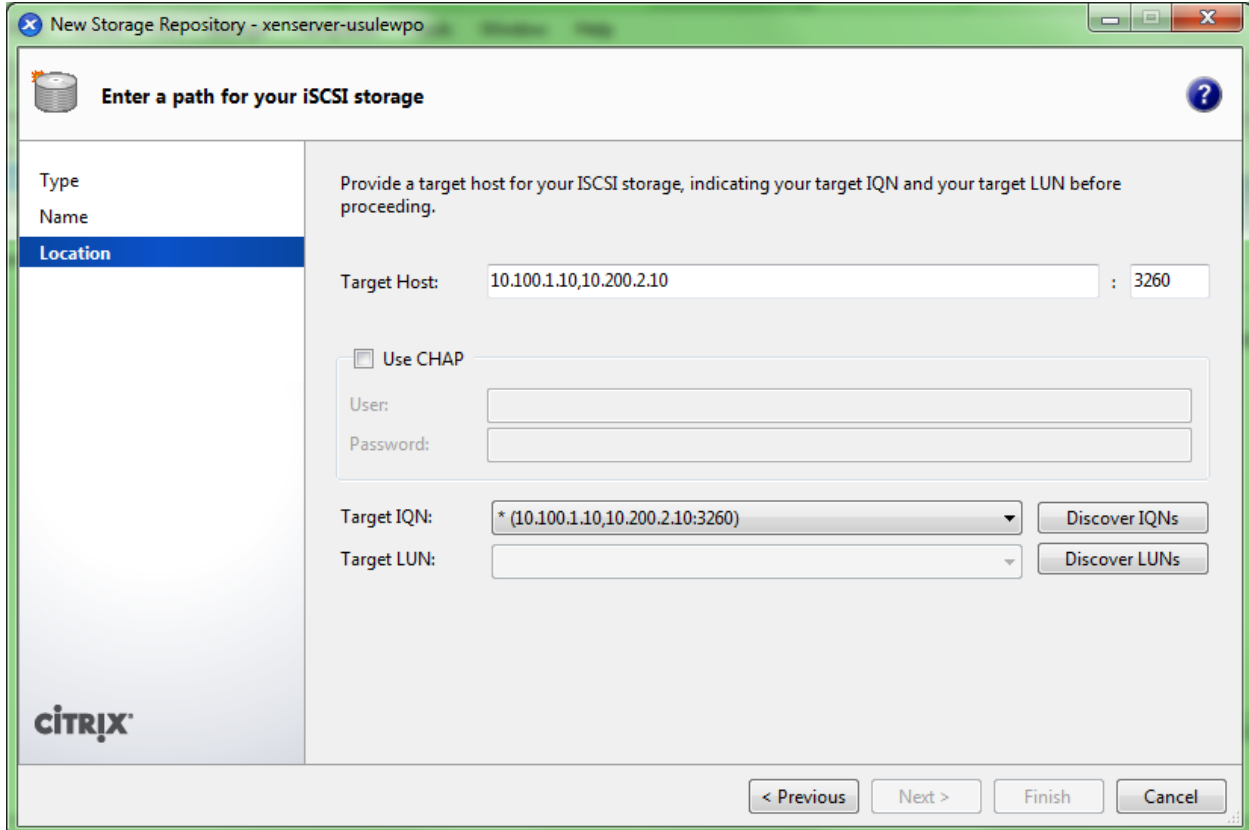
As the picture shows, on this page, type in the IP of the first Target Portal Group from your NexentaStor appliance (as with all other examples in this guide, this is 10.100.1.10 for us), followed by a comma, and then the IP of the second Target Portal Group (10.200.2.10 for this example) and then click the “**Discover IQNs**” button, which will become clickable after you type in a valid IP in the “**Target Host**” field.

Upon clicking “**Discover IQNs**”, you’ll get a screen similar to this:



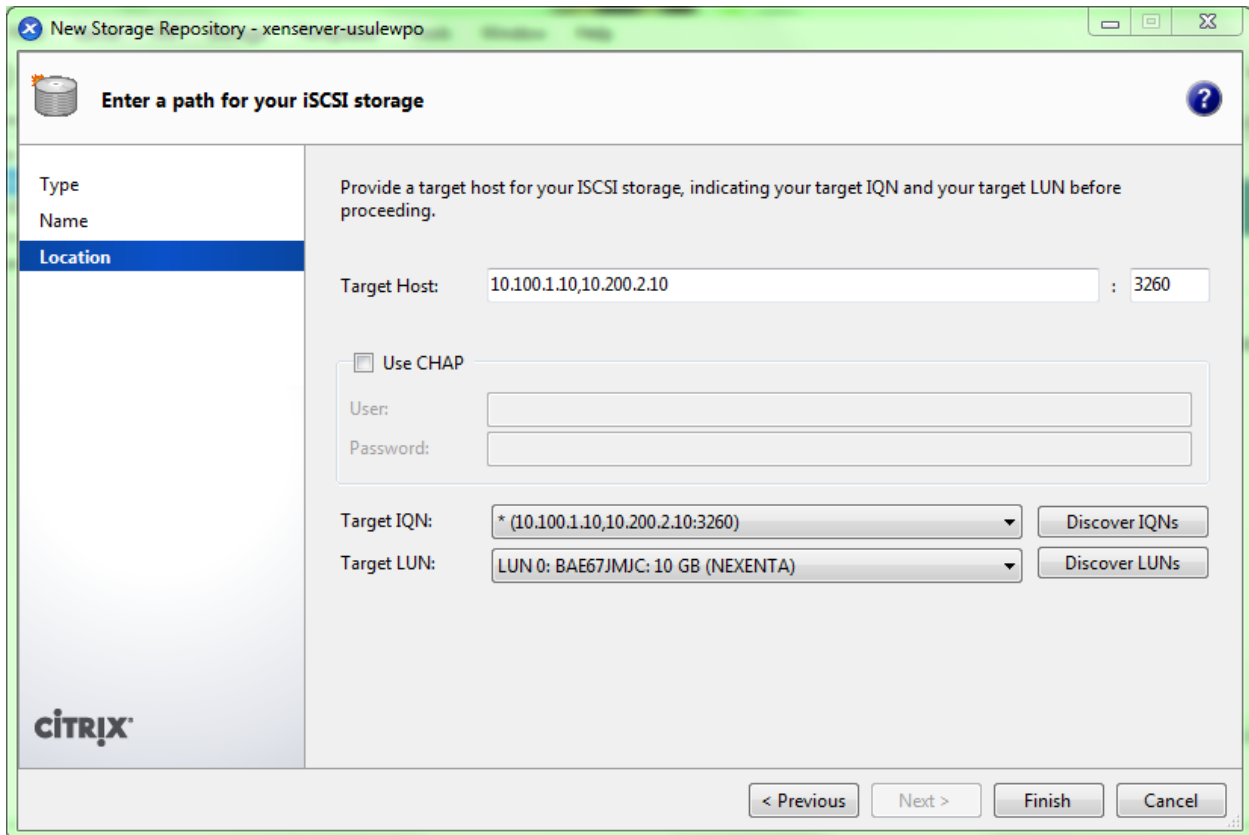
This may take a few moments to finish. When complete, the drop down list next to “**Target IQN**” will contain a list of all visible IQNs from the specified host.

It also will contain a final option of a wildcard asterisk (*), so of the IPs you input in parentheses, this is the option to pick, as shown here:



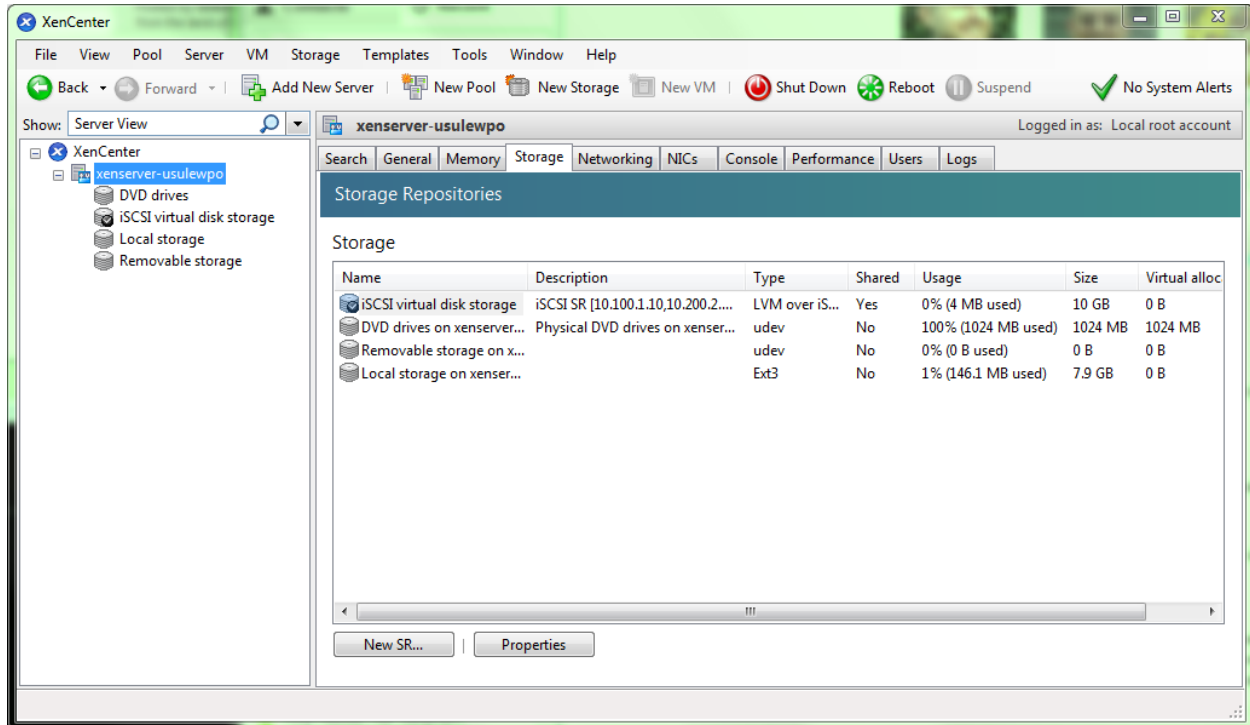
After picking the wildcard IQN option, click the “**Discover LUNs**” button. XenCenter will spend some time scanning, and then populate the drop-down list with all visible LUNs.

For our example, there is only one and it is shown in this example below:



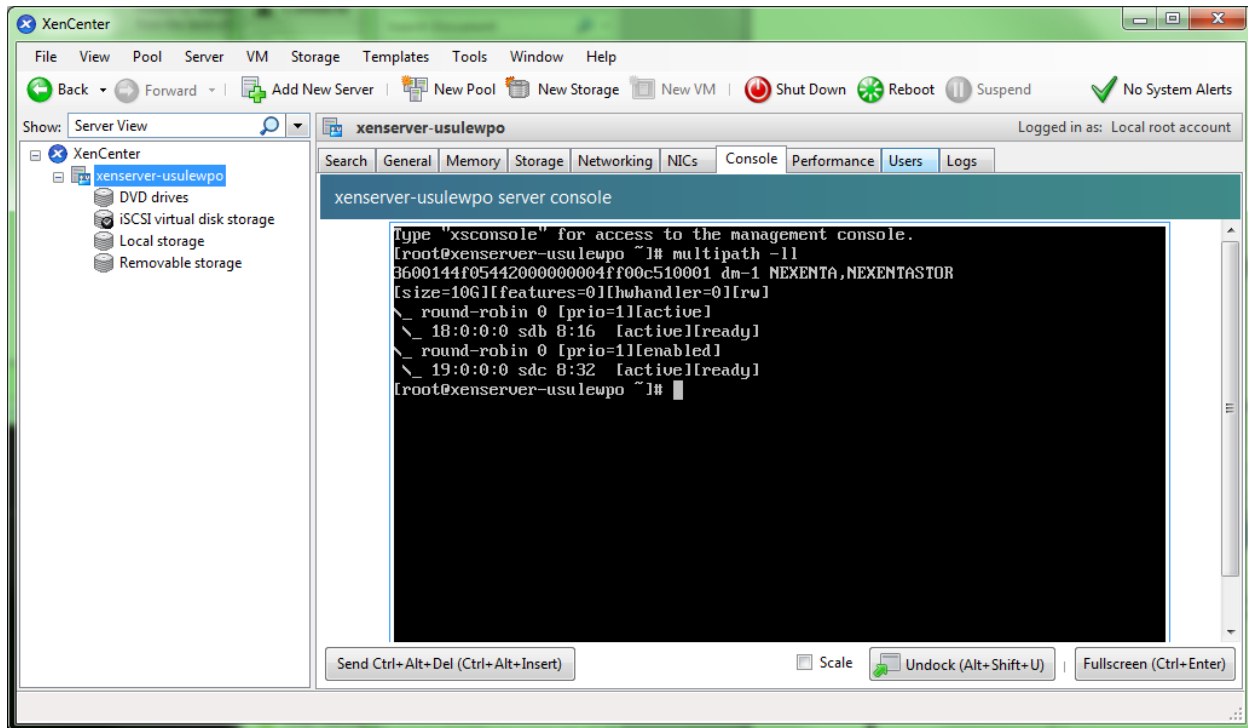
Pick the correct LUN and hit the **“Finish”** button. If this is a new unformatted LUN, XenCenter will prompt you if you wish to format it, which you should, of course, accept.

Upon finishing that, the **Storage** tab within XenCenter now will have a new iSCSI storage repository, such as this:



This storage is, by virtue of how it was created, multipathed. One way to quickly verify this is to click the **Console** tab, hit **Enter** to login, and then, at the prompt type "**multipath -ll**".

You should see a response similar to the following, showing two paths:



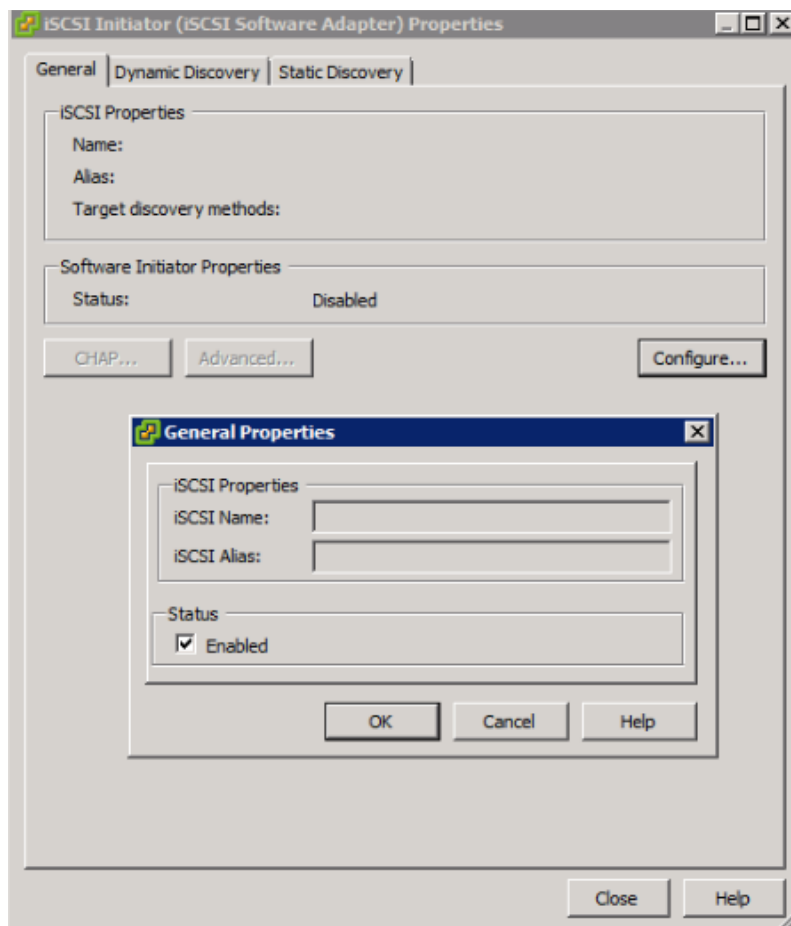
You now have an iSCSI Storage Repository on XenServer 6 that is multipath. Assuming the two IPs in use come from separate NICs on the XenServer and go to separate switching fabrics, the storage now is wholly redundant and, in typical use, potentially up to twice as fast.

VMware

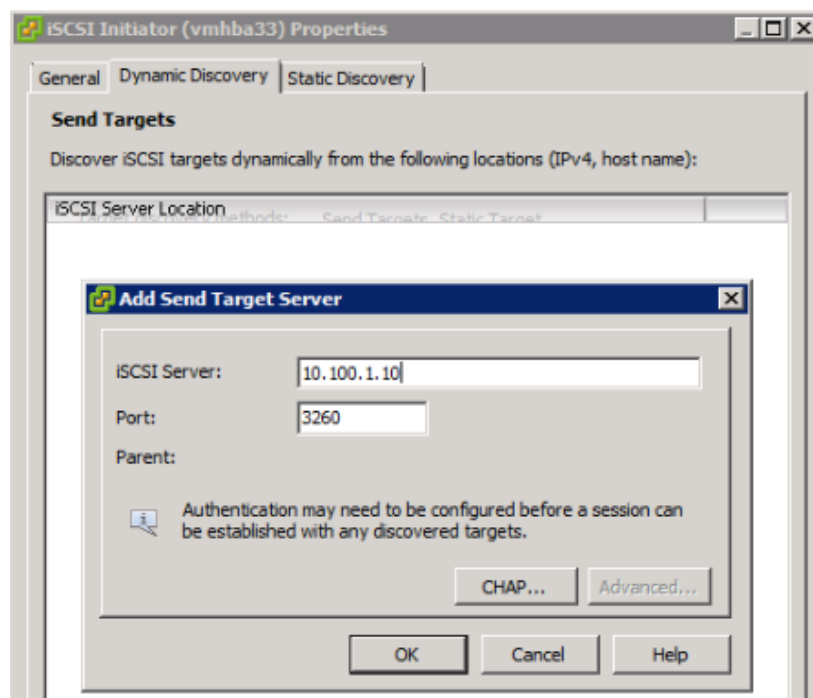
ESXi 4.1

It is assumed by this instructional guide that all proper networking configuration already has been configured on the VMware host—specifically, in this example, at least two separate physical adapters have been configured with IP addresses to two separate subnets, preferably cabled into separate physical networks that then are both able to communicate with the NexentaStor appliance. Configuring the network adapters and network configuration is beyond the scope of this guide.

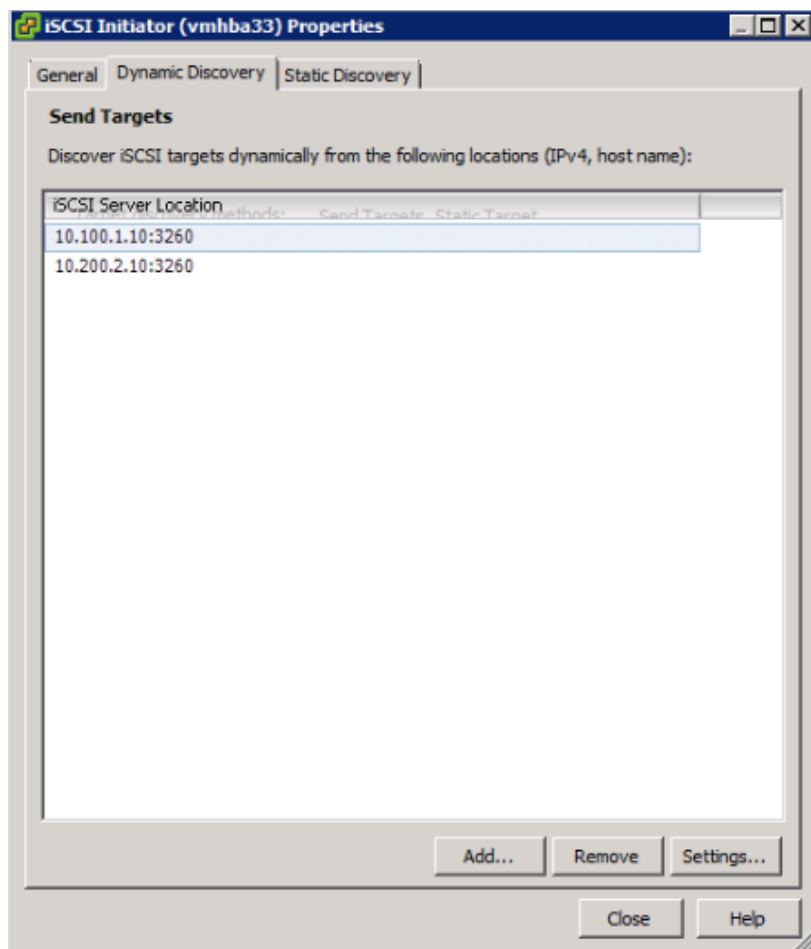
Assuming all the networking is configured, the next step is to click on the **Configuration** tab within the vSphere Client and click on **“Storage Adapters”**. Highlight the **iSCSI Software Adapter** and click **Properties**. By default, the iSCSI Software Adapter is disabled. Click the **Configure** button, check the **Enabled** box, and click **OK**.



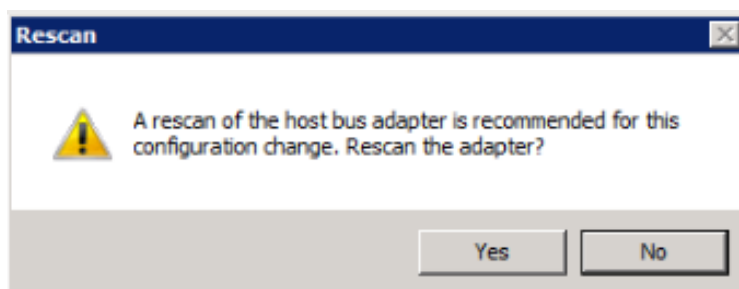
Within this dialog, choose the **Dynamic Discovery** tab and then hit the **Add** button, presenting a dialog box similar to this one, into which you should fill in the IP address of the first Target you created earlier (as shown in this picture), then hit **OK**:



It may take a moment for VMware to respond after you hit **OK**. Once it does, and shows your IP showing up in the list, click **Add** again and fill in the box with the other Target IP you previously configured and hit **OK**. Once that finishes, the dialog should look similar to this, with two IP addresses displayed:



At this point, click the **Close** button, and you will be prompted with the Rescan dialog box:



Click **Yes**, as you do wish to scan the adapter. The vSphere Client should display the mapped LUN presented from the NexentaStor available on this iSCSI Adapter.

Details

vmhba33
[Properties...](#)

Model: iSCSI Software Adapter
 iSCSI Name: iqn.1998-01.com.vmware:localhost-18aebbb6
 iSCSI Alias:
 Connected Targets: 2 Devices: 1 Paths: 2

View: **Devices** Paths

Name	Runtime Name	LUN	Type	Transport	Capacity	Owner	Hardware Acc
NEXENTA iSCSI Disk (naa.600144f0...	vmhba33:C0:T0:L0	0	disk	iSCSI	1.46 GB	NMP	Unknown

If it does not, open the iSCSI Adapter back up and be sure to add in the proper network adapters to it so that it can pass traffic. Be sure to add all adapters necessary to provide IP connectivity for all the IPs used for the MPIO connection. You may test connectivity from the ESXi host by opening up a SSH session and run the command:

vmkping <ip-address-of-target-port-group>

example:

vmkping 10.100.1.10

To verify that you have mounted the target with multiple paths, click on the **Paths** tab above the Device Name and under the **Target** header should be two targets that match the iSCSI Initiator target names and IP addresses in the **Nexenta Setup** section:

vmhba33
[Properties...](#)

Model: iSCSI Software Adapter
 iSCSI Name: iqn.1998-01.com.vmware:localhost-18aebbb6
 iSCSI Alias:
 Connected Targets: 2 Devices: 1 Paths: 2

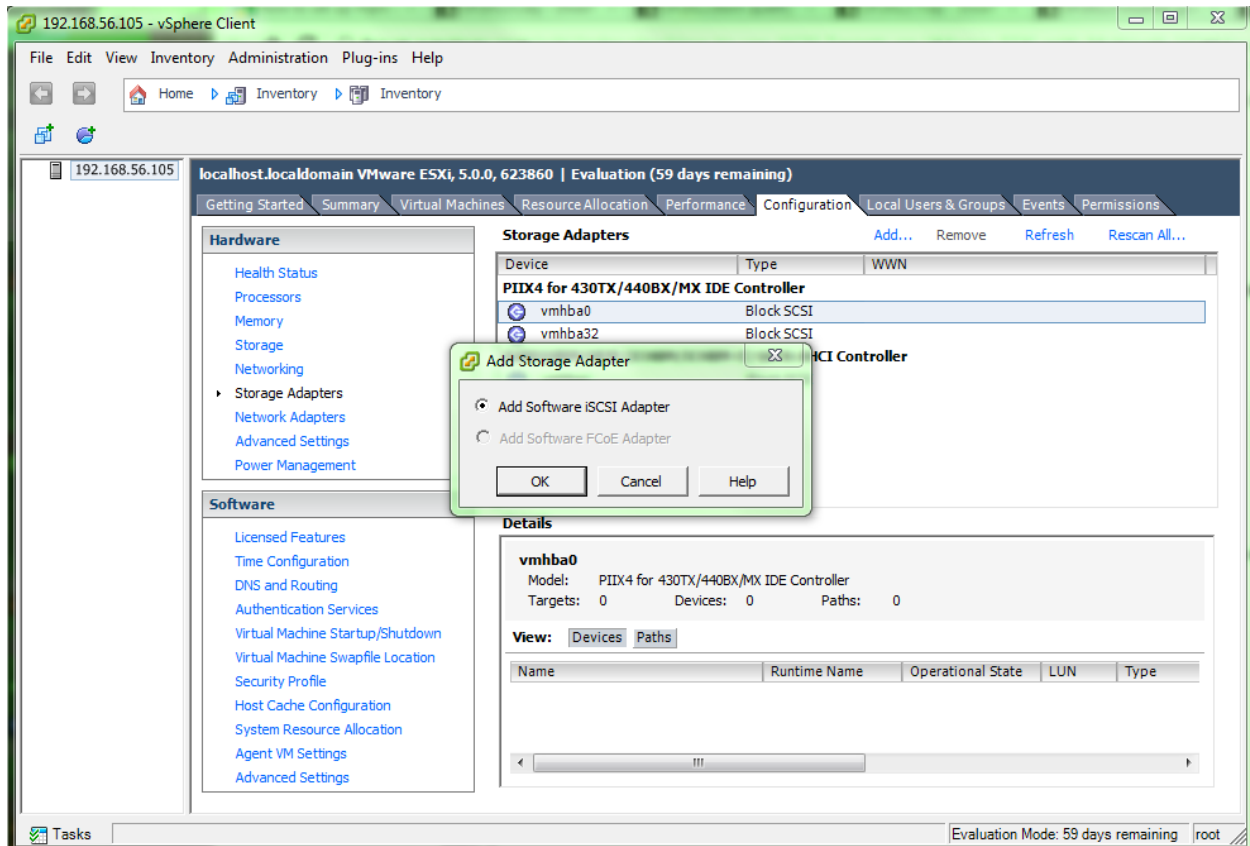
View: **Devices** **Paths**

Runtime Name	Target	LUN	Status
vmhba33:C0:T1:L0	iqn.1986-03.com.sun:02:8845e545-aeaf-ea9-aa2a-f2dc54d96394:10.200.2.10:3260	0	Active (I/O)
vmhba33:C0:T0:L0	iqn.1986-03.com.sun:02:21f335a9-3efb-46c1-9ce2-f0a2759748c7:10.100.1.10:3260	0	Active

ESXi 5.0 and 5.1

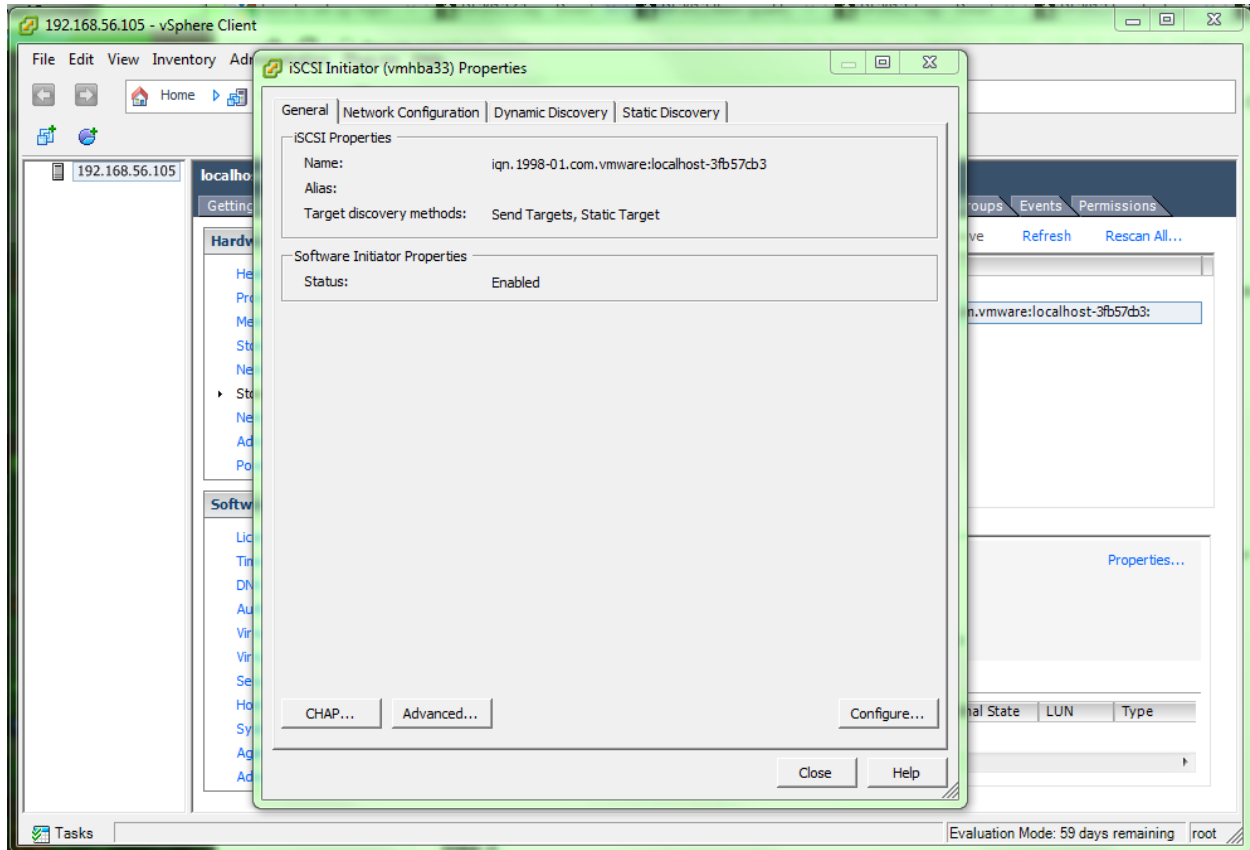
It is assumed by this instructional guide that all proper networking configuration already has been configured on the VMware host—specifically, in this example, at least two separate physical adapters have been configured with IP addresses to two separate subnets, preferably cabled into separate physical networks that then are both able to communicate with the NexentaStor appliance. Configuring the network adapters and network configuration is beyond the scope of this guide.

Assuming all the networking is configured, the next step is to click on the **Configuration** tab within the vSphere Client and click on **“Storage Adapters”** and then click on **Add**, which will put you on a dialog box similar to this:

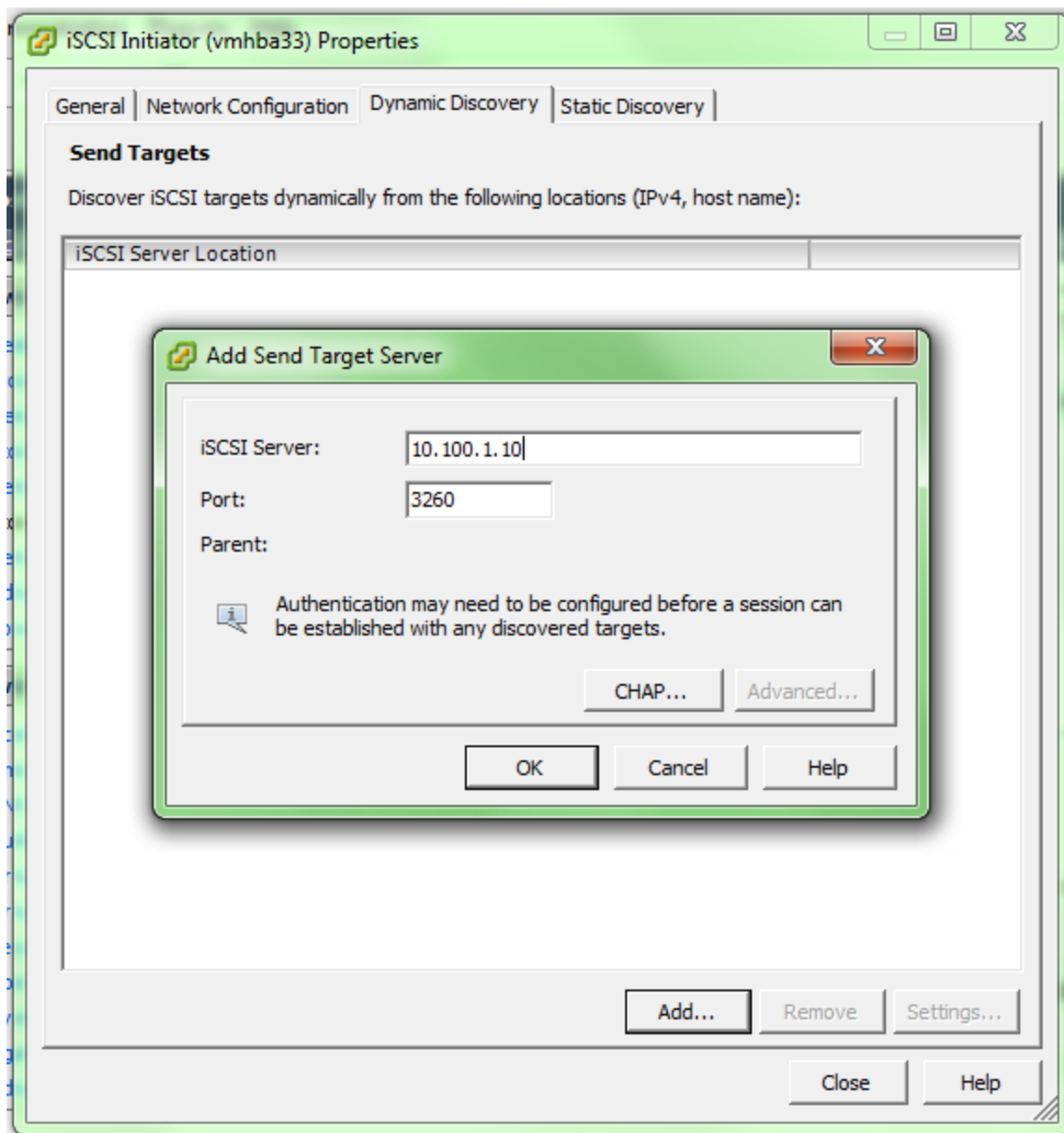


Choose **Add Software iSCSI Adapter** and hit **OK**, which will present a confirmation dialog box, on which you should also hit **OK**.

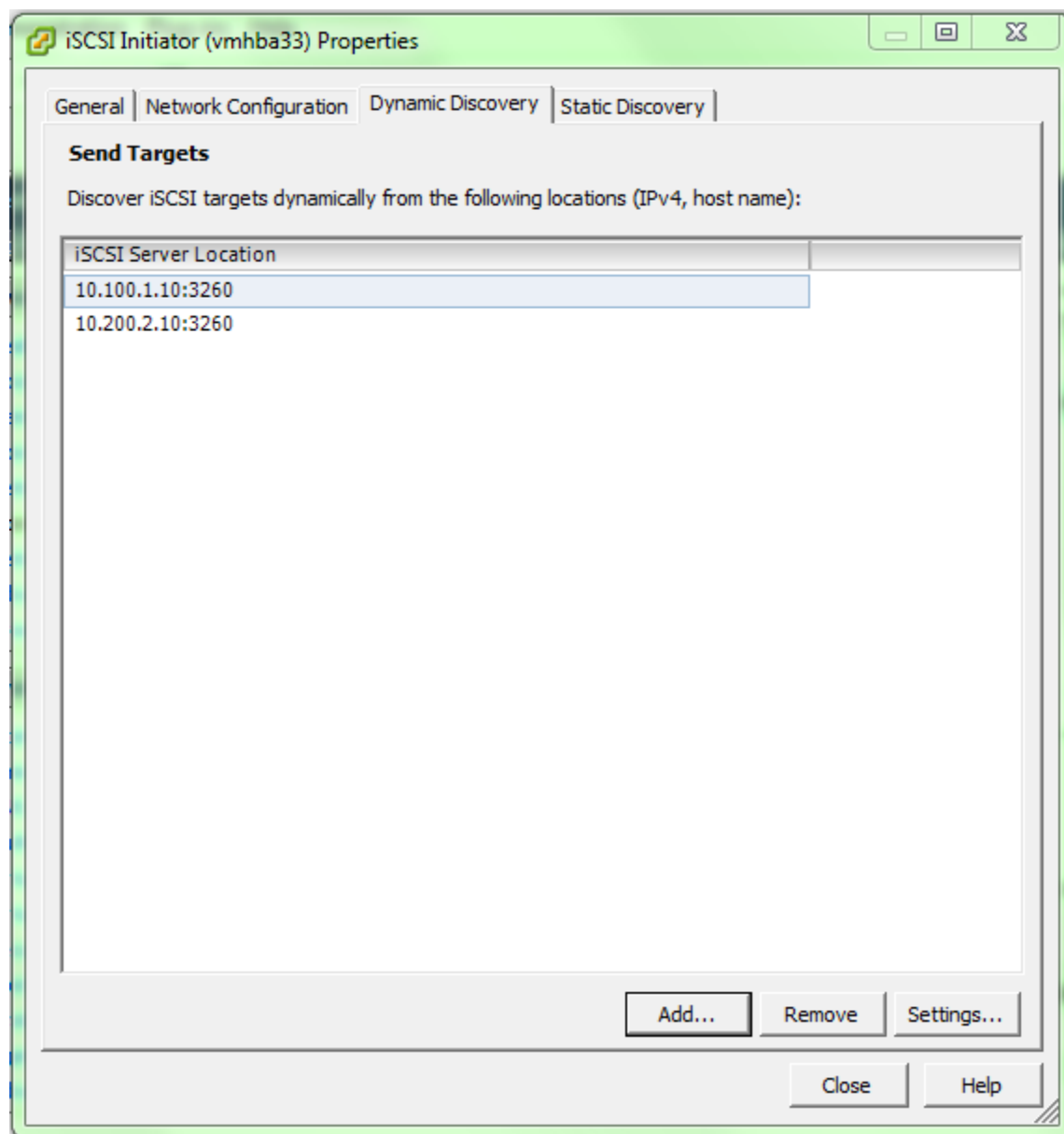
This will create a new iSCSI adapter that you then will need to select from the list and click. Then choose the **Properties** link (right-click and choose Properties), resulting in this dialog box:



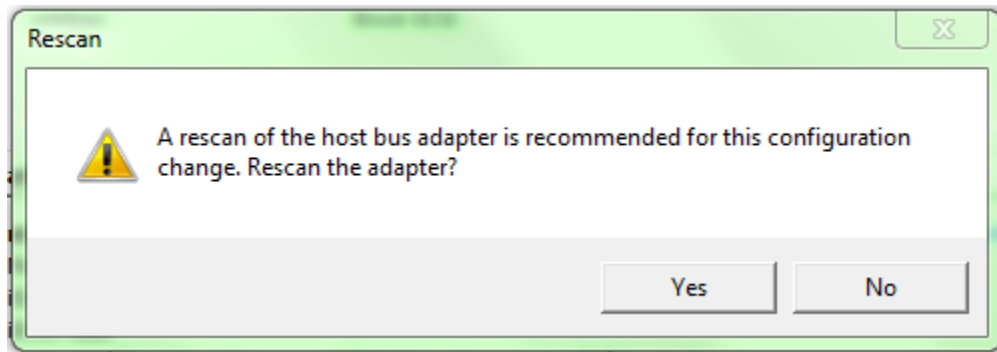
Within this dialog, choose the **Dynamic Discovery** tab and then hit the **Add** button, presenting a dialog box similar to this one, into which you should fill in the IP address of the first Target you created earlier (as shown in this picture), then hit **OK**:



It may take a moment for VMware to respond after you hit **OK**. Once it does, and shows your IP showing up in the list, click **Add** again and fill in the box with the other Target IP you previously configured and hit **OK**. Once that finishes, the dialog should look similar to this, with two IP addresses displayed:



At this point, click the **Close** button, and you will be prompted with the Rescan dialog box:



You should hit **Yes**, as you do wish to scan the adapter. After a bit of a wait, the vSphere Client should display something similar to this, showing that you have LUNs available on this iSCSI Adapter.

Details

vmhba33
[Properties...](#)

Model: iSCSI Software Adapter
 iSCSI Name: iqn.1998-01.com.vmware:localhost-36789ee6
 iSCSI Alias:
 Connected Targets: 2 Devices: 1 Paths: 2

View: Devices Paths

Name	Runtime Name	Operational State	LUN	Type	Drive Type
NEXENTA iSCSIDisk (naa.600144f...	vmhba33:C0:T0:L0	Mounted	0	disk	Non-SSD

If you do not, open the iSCSI Adapter back up and be sure to add in the proper network adapters to it so that it can pass traffic. Be sure to add all adapters necessary to provide IP connectivity for all the IPs used for the MPIO connection. You may test connectivity from the ESXi host by opening up a SSH session and run the command:

vmkping <ip-address-of-target-port-group>

example:

vmkping 10.100.1.10

To verify that you have mounted the target with multiple paths, click on the **Paths** tab above the Device Name and, under the **Target** header, should be two targets that match the iSCSI Initiator target names and IP addresses in the **Nexenta Setup** section:

Details

vmhba33
[Properties...](#)

Model: iSCSI Software Adapter
 iSCSI Name: iqn.1998-01.com.vmware:localhost-36789ee6
 iSCSI Alias:
 Connected Targets: 2 Devices: 1 Paths: 2

View: [Devices](#) [Paths](#)

Runtime Name	Target	LUN	Status
vmhba33:C0:T1:L0	iqn.1986-03.com.sun:02:d61d5157-442a-46b0-be06-b72e037e680a:10.100.1.10:3260	0	◆ Active
vmhba33:C0:T0:L0	iqn.1986-03.com.sun:02:1545f8f9-6e34-e1e4-b43a-a1bd63982a49:10.200.2.10:3260	0	◆ Active

This concludes the VMware ESXi 5.0 and 5.1 iSCSI multipathing section. For discussions around this and other sections of this document, please consult with a certified Nexenta Service Professional.