



NEC Corporation of America
Technical Support Group
10850 Gold Center Drive, Suite 200
Rancho Cordova, CA 95670

To: D-Series SAN Storage Partners
From: NEC Technical Support
Doc: VMWARE NEC iSCSI Storage Multipath Setup procedure
Date: Nov 13, 2010

Revision Information

This procedure is for:
VMWARE vSphere 4.X
NEC Storage Manager 6.3E
D3-10i Storage Disk array

EXAMPLE INSTALLATION STEPS

Each environment will be different but the following is a list of example installation steps to configure a new ESX 4.0 host to a NEC D3-10i. In these examples the names and IP addresses assigned will need to be changed to match your environment. This example assumes 2 NICs are being used for iSCSI traffic in a single vSwitch with Jumbo Frame support on the physical hardware. All commands are case sensitive and can be found in their full context in the VMware iSCSI SAN Configuration Guide.

ESX for VMotion, NFS, and iSCSI you are required to have a vmkernel vNIC and for service console a service console vNIC. None of these devices can be on the same subnet.

The recommendation is to have iSCSI and the service console on different subnets.

Step 1: Configure vSwitch and Enable Jumbo Frames

This step will create a new vSwitch and enable Jumbo Frame support for this switch. Currently there is no option to enable Jumbo Frames on a vSwitch from VMware vCenter GUI so these commands must be run via CLI. Be sure to check the environment to make sure that Jumbo Frames are supported at the networking layer before enabling it on the ESX host.

The following command will create a new vSwitch called vSwitch2:

```
esxcfg-vswitch -a vSwitch2
```

Next, enable Jumbo Frames on the vSwitch:

```
esxcfg-vswitch -m 9000 vSwitch2
```

To verify that the switch was configured properly run the following command:

```
esxcfg-vswitch -l
```

Your output will look like this:

Switch Name	Num Ports	Used Ports	Configured Ports	MTU	Uplinks
vSwitch2	64	1	64	9000	

PortGroup Name	VLAN ID	Used Ports	Uplinks

Note the new vSwitch2 with the MTU of 9000 verifies that the switch was created correctly. You can also see it displayed in the GUI of vCenter. In this procedure some of the verification can be done via command line or the vCenter GUI.



vCenter GUI - New vSwitch2

Step 2: Add iSCSI VMkernel Ports

The next step will assign VMkernel Ports to the new vSwitch2. It will also configure Jumbo Frame support as well as assign the IP Addresses. Administrators familiar with iSCSI connectivity in ESX 3.5 will find that it is no longer required to configure a Service Console port for the iSCSI connection. Another thing to notice is that because the Service Console is not needed, the iSCSI switch environment should be on a different subnet than the public environment or existing service console. Each VMkernel Port will need its own IP Address and they must all be on the same subnet and be on the same subnet as the NEC D3-10i's IP Address.

In the procedure we are assigning one VMkernel port for each physical NIC in the system. So if there are 2 NICs, assign 2 VMkernel Ports. VMware vCenter has a maximum of 8 connections to a single volume but we used 1 in this procedure.

If more connections are desired follow the sample configurations to obtain the number of VMkernel Ports that match the environment and the number of paths you need.

All of these configurations are done for the vSwitch itself. This means that once it is done, the ESX 4.0 host will create multiple connections to the NEC D3-10i. Every new volume will have more connections as well. Once this is configured there only need to be changes done if more NICs are being added or if more paths are needed.

The following command will add a new iSCSI VMkernel Port named iSCSI1 on the vSwitch created in the previous step.

```
esxcfg-vswitch -A iSCSI1 vSwitch2
```

This next command will configure the IP Address, Subnet Mask and enable Jumbo Frame support for the new VMkernel Port iSCSI

```
esxcfg-vmknic -a -i 10.2.80.140 -n 255.255.255.0 -m 9000 iSCSI1
```

We need to create 1 more VMkernel Ports named iSCSI2 but if you want more connections to the volume you can create up to a total of 8 IE... iSCSI3, iSCSI4, iSCSI5.... Then configure the IP Addresses, subnet masks and enable Jumbo Frames.

```
esxcfg-vswitch -A iSCSI2 vSwitch2
esxcfg-vmknic -a -i 10.2.80.141 -n 255.255.255.0 -m 9000 iSCSI2
```

To verify the configuration enter the following command:

```
esxcfg-vswitch -l
```

Your output will look like this:

Switch Name	Num Ports	Used Ports	Configured Ports	MTU	Uplinks
vSwitch2	64	1	64	9000	

PortGroup Name	VLAN ID	Used Ports	Uplinks
iSCSI2	0	1	
iSCSI1	0	1	

This will show the VMkernel ports that are assigned to the vSwitch. To verify the IP addresses enter the following command:

```
esxcfg-vmknic -l
```

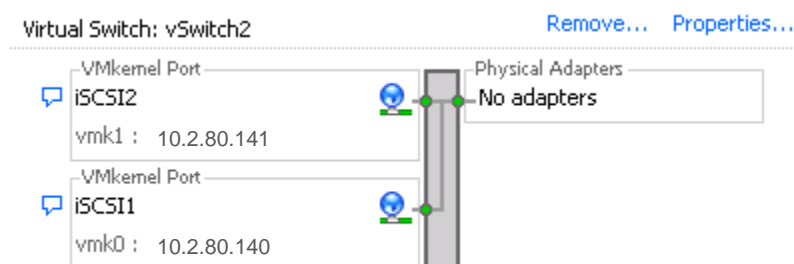
Your output will look like this:

```

Interface      Port      Group/DVPort      IP Family   IP Address
Netmask                Broadcast      MAC Address      MTU   TSO MSS
Enabled Type
Vmk0           iSCSI1
255.255.0.0    10.1.255.255    00:50:56:7e:ae:80 9000  65535 true
STATIC
vmk1           iSCSI2
255.255.0.0    10.1.255.255    00:50:56:7b:d8:3e 9000  65535 true
STATIC

```

You can also verify the IP Addresses on the vCenter GUI. Navigate to **Configuration-> Networking**.



vCenter GUI - VMkernel Ports

Step 3: Assign Network Adapters

The next step in the process is to assign the network adapters (NICs) that will be attached to the iSCSI network and used for iSCSI traffic. These will be attached to the vSwitch2 that we created earlier. This can be done two ways, in the vCenter GUI or by CLI.

To list all of the adapters in the system run the following command:

```
esxcfg-nics -l
```

The output will look similar to this:

```

Name      PCI      Driver      Link Speed      Duplex MAC Address
MTU      Description
vmnic0  07:00.00 e1000e      Up  1000Mbps      Full
00:19:db:aa:74:f6 1500 Intel Corporation 80003ES2LAN Gigabit
Ethernet Controller
vmnic1  07:00.01 e1000e      Up  1000Mbps      Full
00:19:db:aa:74:f7 1500 Intel Corporation 80003ES2LAN Gigabit
Ethernet Controller
vmnic2  08:03.00 e1000      Up  1000Mbps      Full
00:02:b3:bb:c5:f5 1500 Intel Corporation PRO/1000 XT Server
Adapter

```

This will list all of the adapters in the system. Assign the NICs that are physically connected to the SAN infrastructure and to the vSwitch. The following command assumes that we are assigning vmnic1 and vmnic2 to the vSwitch.

```
esxcfg-vswitch -L vmnic1 vSwitch2
```

```
esxcfg-vswitch -L vmnic2 vSwitch2
```

Once again to verify the configuration type the following command to list the vSwitch information:

```
esxcfg-vswitch -l
```

Your output will look similar to the following. Note the new vmnics that were assigned to the vSwitch under uplinks.

```

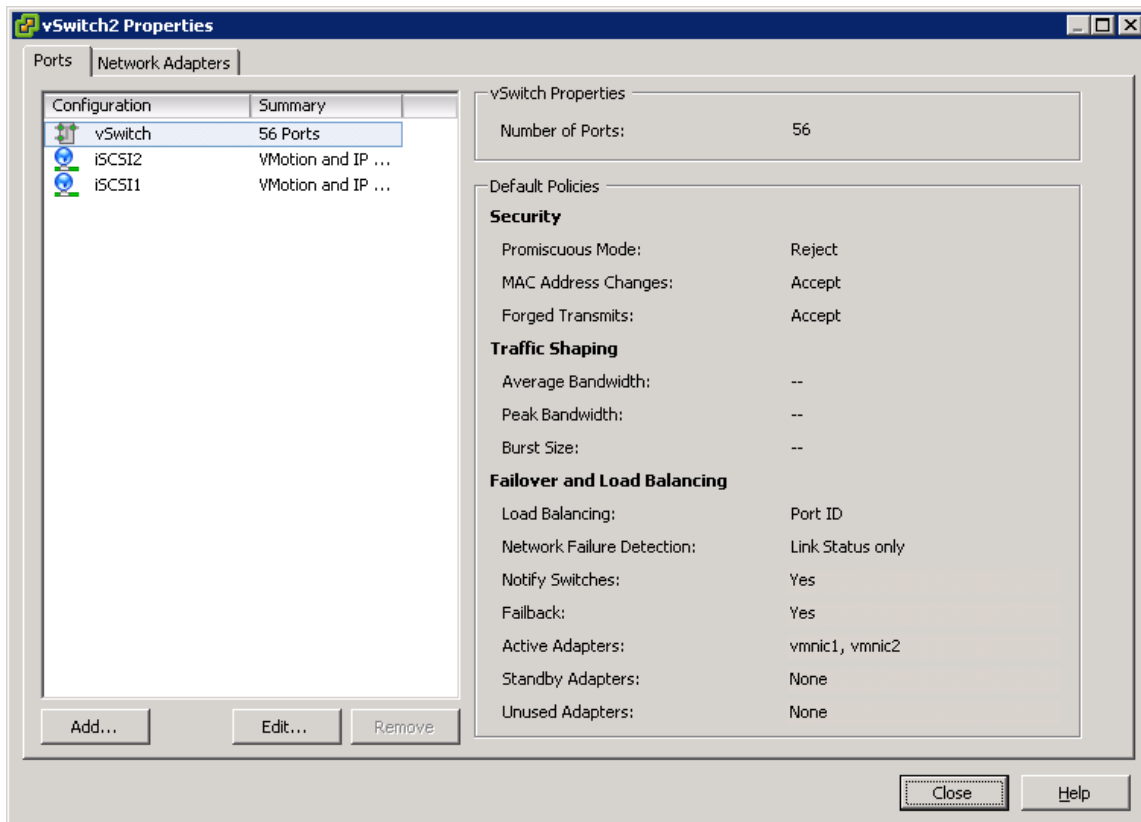
Switch Name      Num Ports      Used Ports      Configured Ports      MTU      Uplinks
vSwitch2        64              5                64                    9000     vmnic1,vmnic2

  PortGroup Name      VLAN ID      Used Ports      Uplinks
  iSCSI2              0            1                vmnic1,vmnic2
  iSCSI1              0            1                vmnic1,vmnic2

```

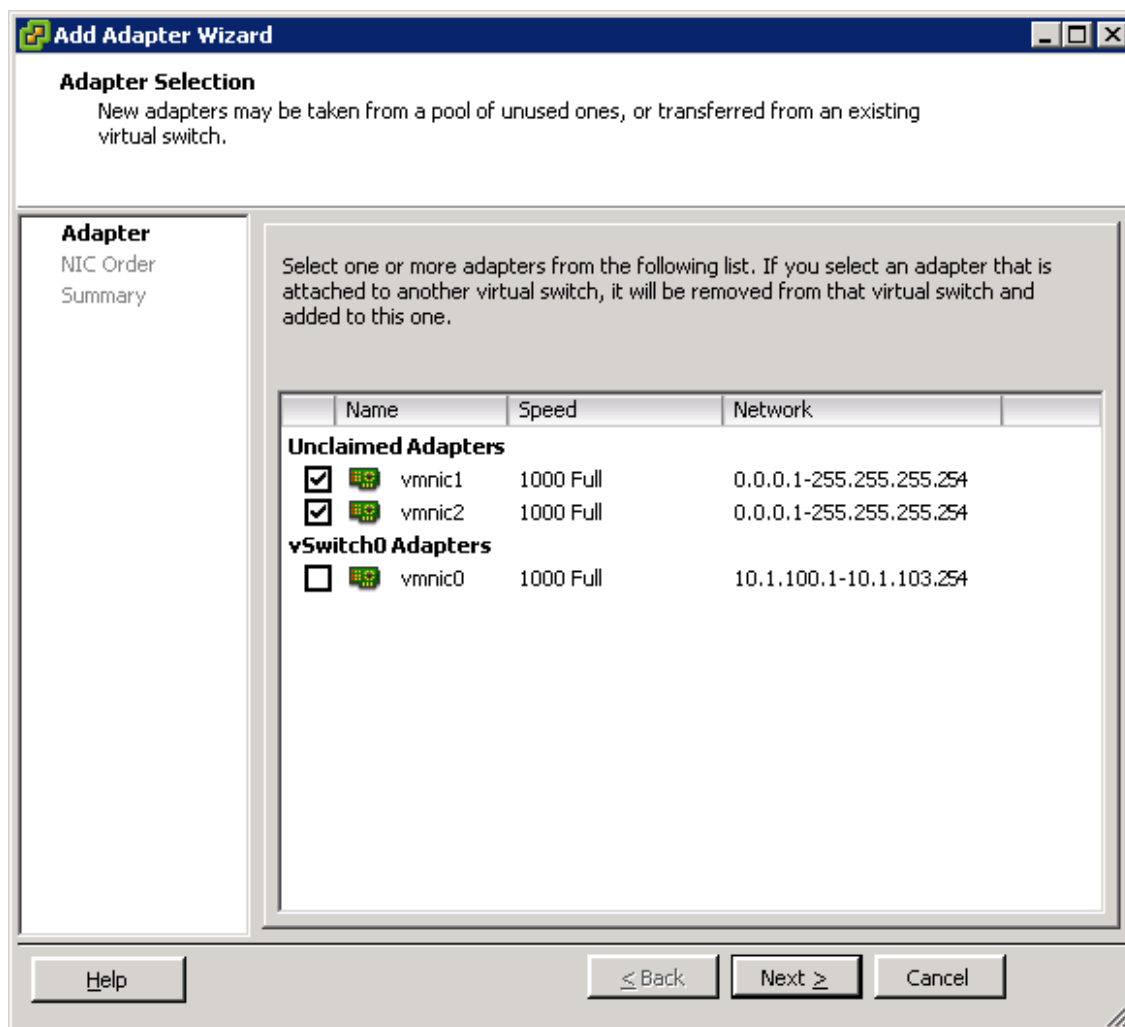
This can also be configured and verified in the vCenter GUI. Remember that the polling of vCenter is not instant so a **refresh** might need to occur to see the latest changes. To configure this same process from the GUI first navigate to the Networking section on the ESX host you are configuring. **Configuration -> Networking**.

From GUI, click **Properties** on the vSwitch2.



vCenter GUI - vSwitch Properties

Click the **Network Adapters** tab. Then click **Add**. This will open up the Add Adapter Wizard. From here select the vmnics that you want to add to the vSwitch. In our example it will be vmnic1 and vmnic2.



vCenter GUI - Add Adapter Wizard

Click **Next** after you have selected the chosen adapters. For now keep the defaults listed in the Failover Order screen and click **Next**. Review the adapters listed and click **Finish** to complete the process.

These adapters will now show up in the GUI under the Network Adapters tab.

Step 4: Associate VMkernel Ports to Physical Adapters

The next step is used to create the individual path bindings for each VMkernel to a NIC. This is required in order to take advantage of the new advanced features such as Round Robin MPIO or 3rd party MPIO plug-ins that are available.

From our previous step there are 2 VMkernel ports and 2 NICs. This means that each NIC will have 1 VMkernel port assigned to it. Again, each environment will differ and these numbers can change based on the number of NICs and the number of paths assigned. If we ever add a third NIC then we would rebalance the number of VMkernel ports to one port per NIC.

This process can be done either via CLI or through the vCenter GUI.

By default, both vmnic1 and vmnic2 are assigned to each VMkernel port. We need to remove one vmnic from each VMkernel port so that each VMkernel port has only one uplink.

Before running these commands the switch information looks like the following

```
esxcfg-vswitch -l
```

Switch Name	Num Ports	Used Ports	Configured Ports	MTU	Uplinks
vSwitch2	64	5	64	9000	vmnic1,vmnic2
PortGroup Name	VLAN ID	Used Ports	Uplinks		
iSCSI2	0	1	vmnic1,vmnic2		
iSCSI1	0	1	vmnic1,vmnic2		

You can see that there are two vmnics in each uplink for each VMkernel Port. This is what we need to change so that only a single vmnic is in each uplink and that we manually load balance them across all available VMkernel Ports.

To configure this process via CLI first note the vmnic number of the NICs you want to remove and type the following command:

```
esxcfg-vswitch -p iSCSI1 -N vmnic2 vSwitch2
```

What this will do is remove vmnic2 from VMkernel port iSCSI1 so that just vmnic1 is on iSCSI1. We then need to do the same thing for the other VMkernel port making sure to remove vmnics so that an equal number of VMkernel ports are on each vmnic (1 per vmnic).

```
esxcfg-vswitch -p iSCSI2 -N vmnic1 vSwitch2
```

To verify that this was done correctly type the following command:

```
esxcfg-vswitch -l
```


The output will look similar to this:

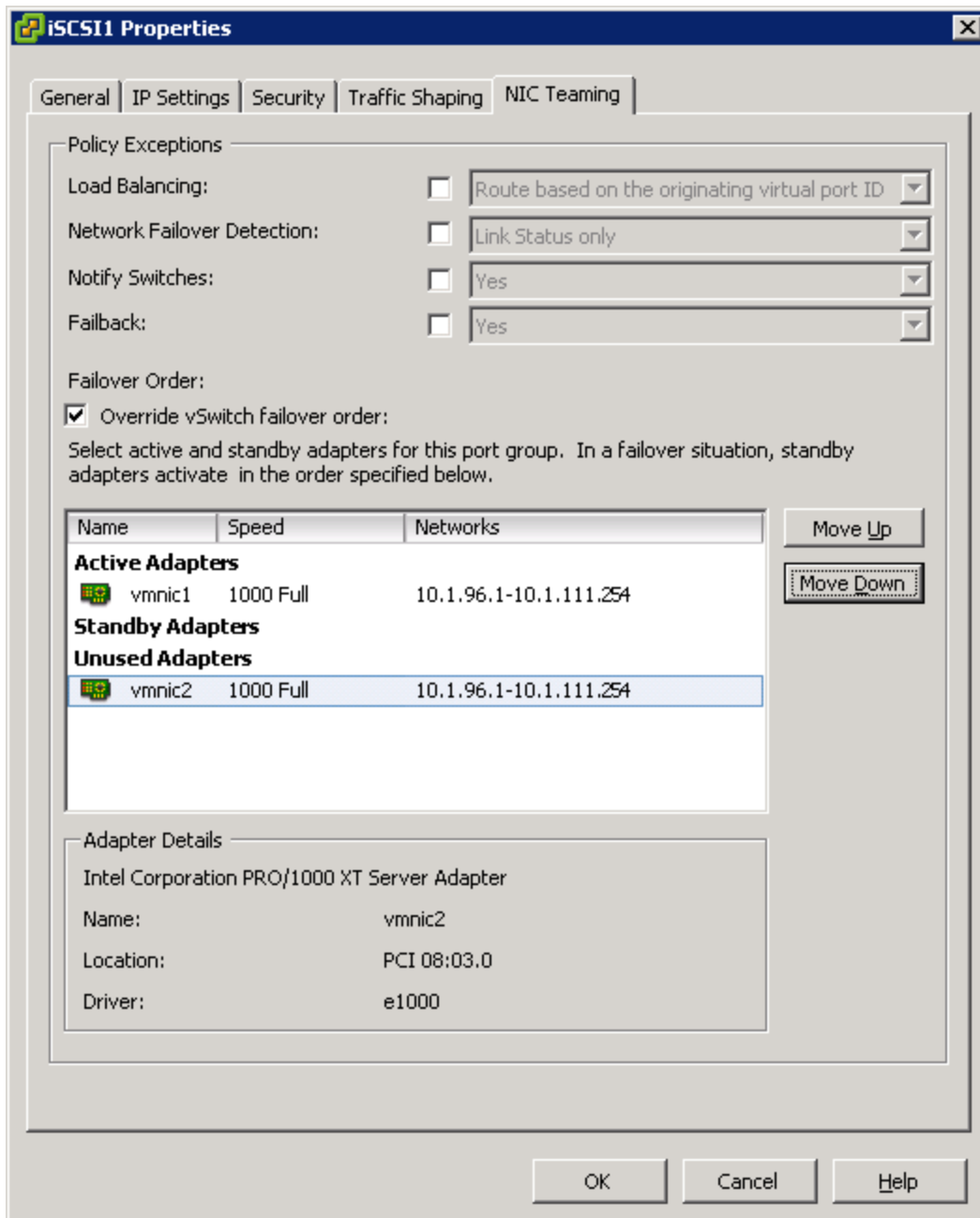
Switch Name	Num Ports	Used Ports	Configured Ports	MTU	Uplinks
vSwitch2	64	5	64	9000	vmnic1,vmnic2

PortGroup Name	VLAN ID	Used Ports	Uplinks
iSCSI2	0	1	vmnic2
iSCSI1	0	1	vmnic1

The important thing to note is that under the Uplinks section there is only one vmnic assigned to each iSCSI VMkernel port and that they are evenly distributed across them all.

This can also be done through the vCenter GUI. To configure this from the GUI first navigate to the Networking section on the ESX host you are configuring. **Configuration -> Networking.** Click **Properties** on the vSwitch2. Select one of the VMkernel Ports, in this example iSCSI1 and click **Edit**. From here select the **NIC Teaming** tab. Select the check box for **Override vSwitch Failover Order**.

Just like in the CLI example we will assign vmnic1 to iSCSI1. This is done by selecting the adapter that is not going to be assigned to the VMkernel (vmnic2 in this case) and clicking the **Move Down** button until it is listed under Unused Adapters. The following figure shows the completed result. Click **Ok** to complete the process. Do this same thing for each of the iSCSI VMkernel ports so that each VMkernel port is mapped to only one adapter and they are balanced across them all. In this example we assigned iSCSI1 to vmnic1 and assigned iSCSI2 to vmnic2.



vCenter GUI - Mapping VMkernel Ports to vmnics

Step 5: Enable VMware iSCSI Software Initiator

The next step, if it has not been done already, is to enable the iSCSI initiator to prepare the ESX host to connect to the D3-10i. This can be done either through a CLI command or through the vCenter GUI.

To enable the iSCSI initiator through the CLI type the following command:

```
esxcfg-swiscsi -e
```

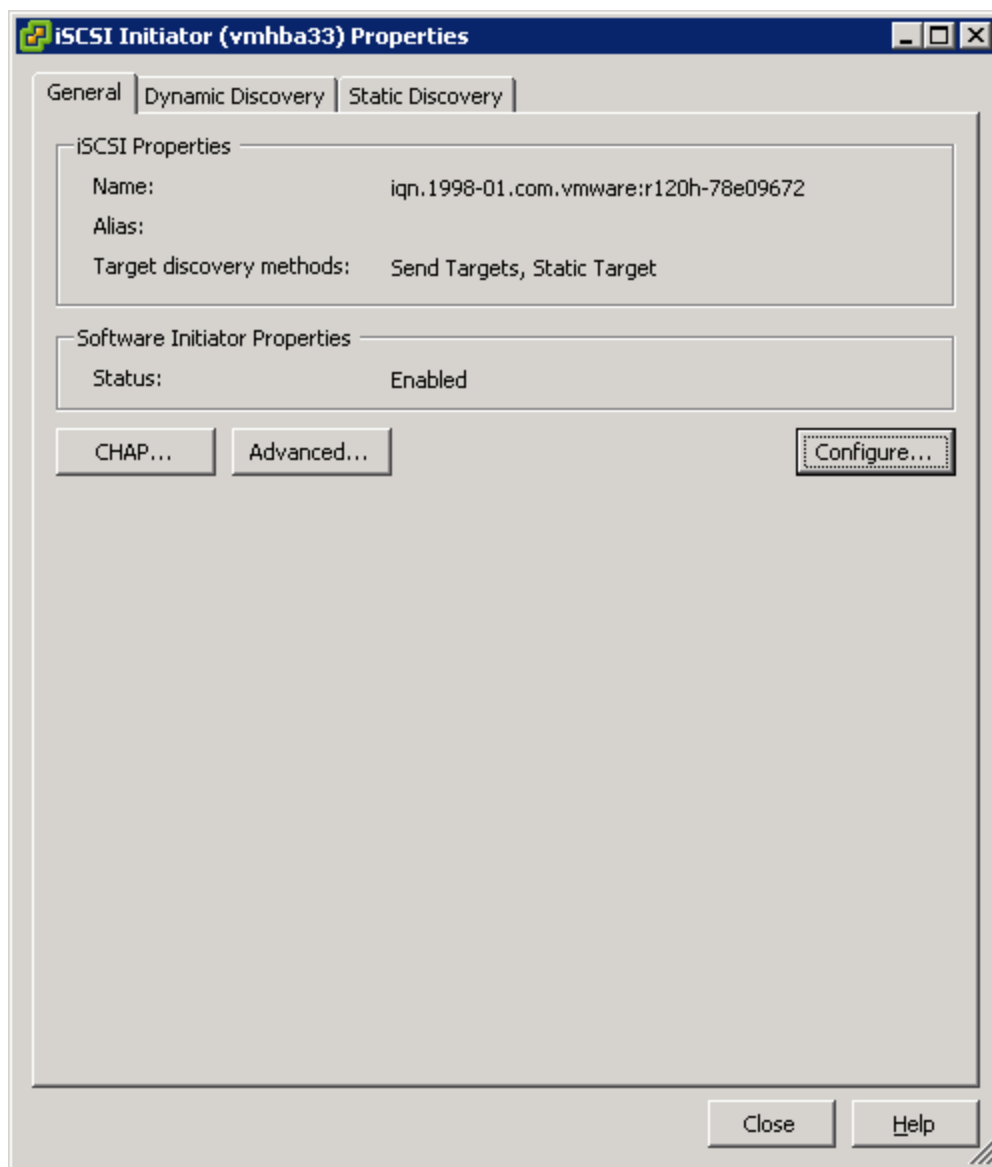
This will enable the software iSCSI initiator. To verify that it is enabled type the following command:

```
esxcfg-swiscsi -q
```

This can also be accomplished by using the vCenter GUI.

From the GUI first navigate to **Configuration -> Storage Adapters**. Select the iSCSI Software Adapter and click **Properties**.

Under the General tab click the **Configure** button. Place a check mark in **Enabled** and hit **Ok**. This will enable the iSCSI initiator and assign a unique iqn to the ESX host.



vCenter GUI - Enabling iSCSI Software Initiator

Step 6: Binding VMkernel Ports to iSCSI Software Initiator

This next step will bind the VMkernel ports that were configured in Step 4 earlier, to the iSCSI Software Initiator. If this step is skipped there will only ever be a single connection to the D3-10i. This step must be done via CLI.

The first thing to do is to note the vmhba# of the iSCSI Software Initiator. This can be seen in the vCenter GUI under **Configuration -> Storage Adapters**.

Storage Adapters

Device	Type	WWN
iSCSI Software Adapter		
vmhba33	iSCSI	iqn.1998-01.com.vmware:r120h-78e09672:
631xESB/632xESB IDE Controller		
vmhba3	Block SCSI	
vmhba32	Block SCSI	
LPe1150 4Gb Fibre Channel Host Adapter		
vmhba2	Fibre Channel	20:00:00:00:c9:73:66:48 10:00:00:00:c9:73:66:48

vCenter GUI - vmhba# for iSCSI Software Adapter

This can also be found by running the following CLI command to discover all SCSI devices including the iSCSI software adapter:

```
esxcfg-scsidevs -a
```

The output will look something like the following:

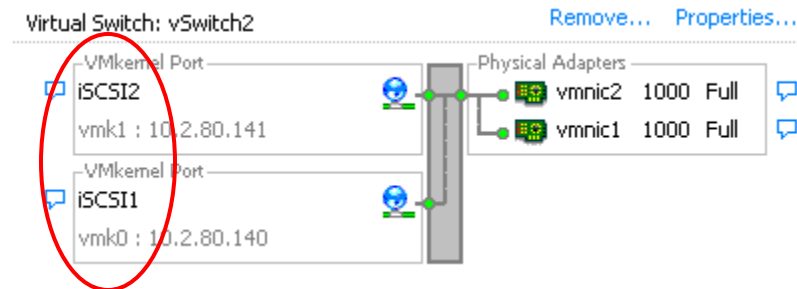
```
vmhba1 mptsas link-n/a sas.50016170000342f8 (8:5.0) LSI
Logic / Symbios Logic LSI1068
vmhba2 lpfc820 link-n/a fc.20000000c9736648:10000000c9736648 (18:0.0)
Emulex Corporation LPe1150 4Gb Fibre Channel Host Adapter
vmhba3 ata_piix link-n/a ide.vmhba3 (0:31.1)
Intel Corporation 631xESB/632xESB IDE Controller
vmhba32 ata_piix link-n/a ide.vmhba32 (0:31.1)
Intel Corporation 631xESB/632xESB IDE Controller
vmhba33 iscsi_vmk link-n/a iscsi.vmhba33 () Software
iSCSI
```

In this example from both the GUI and CLI we can determine that the vmhba# for the iSCSI Software Initiator is vmhba33. This will be used in the next part. This will differ on various systems based on the devices installed.

The next piece of information to gather is the vmk# of each of the VMkernel ports. This can be done via the GUI or CLI.

To determine the vmk# of each VMkernel port from the GUI navigate to **Configuration -> Networking**. From the vSwitch that was created earlier under each VMkernel port, the vmk# will be listed.

NOTE: It is important to recognize that they may not start with vmk0, VMotion ports and other VMkernels will utilize the same numbers based on the order they are created.



vCenter GUI - Noting the vmk# of the VMkernel Ports

In this example we see that iSCSI1 is vmk0 and iSCSI2 is vmk1.

This is also information that we need to note. We can also see this in the CLI by using the following command:

```
esxcfg-vmknic -l
```

Interface	Port	Group/DVPort	IP Family	IP Address	Netmask
Broadcast	MAC Address	MTU	TSO MSS	Enabled	Type
vmk0	iSCSI1		IPv4	10.2.80.140	
255.255.0.0	10.1.255.255	00:50:56:76:80:5c	9000	65535	true
vmk1	iSCSI2		IPv4	10.2.80.141	
255.255.0.0	10.1.255.255	00:50:56:7a:be:92	9000	65535	true
					STATIC

You can determine the same information that was found in the GUI.

Now that we know the vmhba# and the vmk# we can map each VMkernel Port to the iSCSI Software Initiator. This is done through the CLI by typing the following command:

```
esxcli swiscsi nic add -n vmk0 -d vmhba33
```

This will bind the vmk0 VMkernel port to the iSCSI Software Adapter vmhba33. We then proceed to bind all of the other vmk# to the same vmhba. In our case we only have vmk1 to do.

```
esxcli swiscsi nic add -n vmk1 -d vmhba33
```

To verify that all of the vmk# are bound properly to the vmhba run the following command:

```
esxcli swiscsi nic list -d vmhba33
```

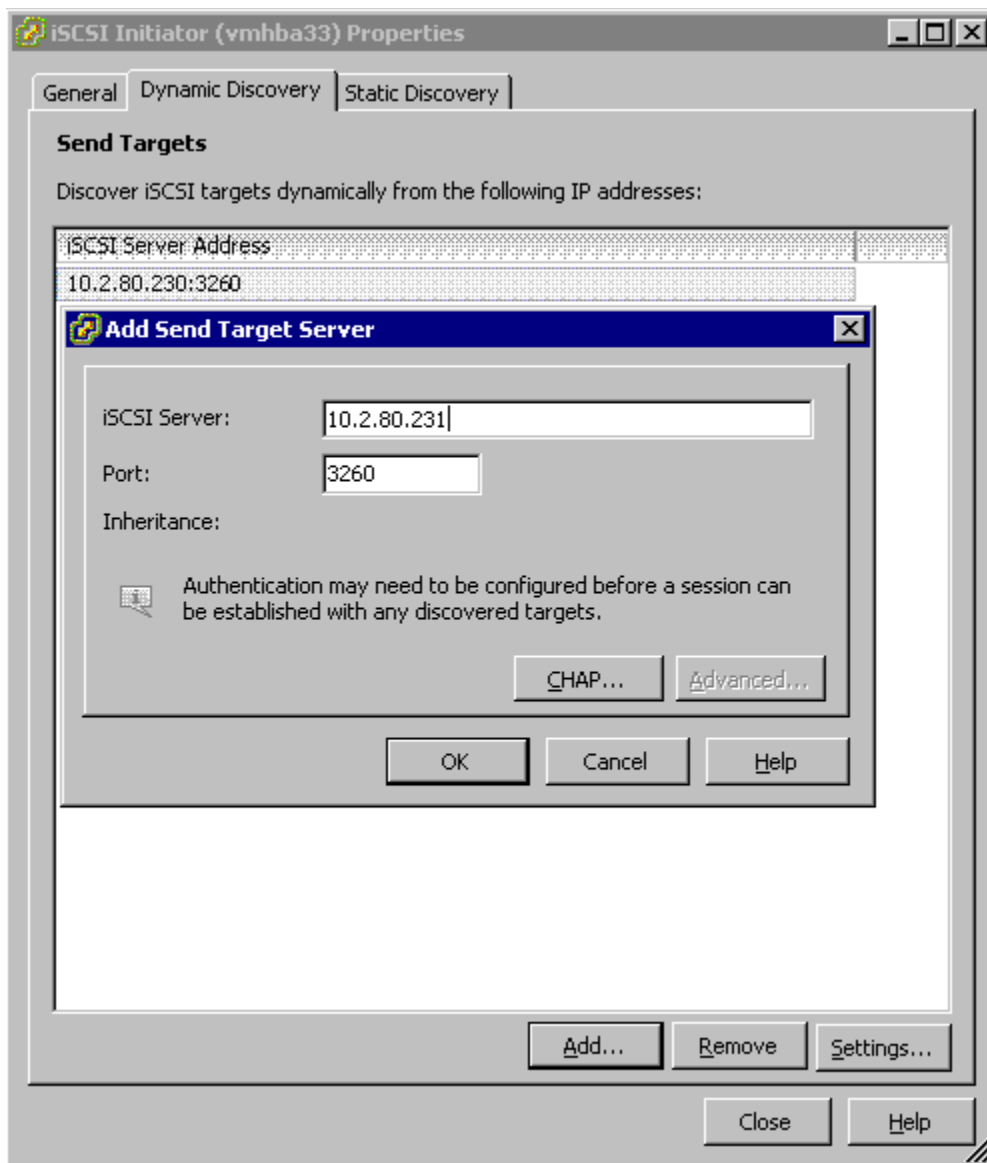
This will list all of the information for VMkernel ports that are assigned to the iSCSI Software Adapter.

Step 7: Connect to the D3-10i Storage

Now that the advanced configuration for the vSphere iSCSI Software Initiator has been completed, the next stage is to connect to the D3-10i and the volumes it contains. For more information on setup of the D3-10i see the User's Guide or the Quick Start guide that was provided with your unit. In this example we will attach the iSCSI Software Initiator to the D3-10i and a single volume. We will skip configuring CHAP.

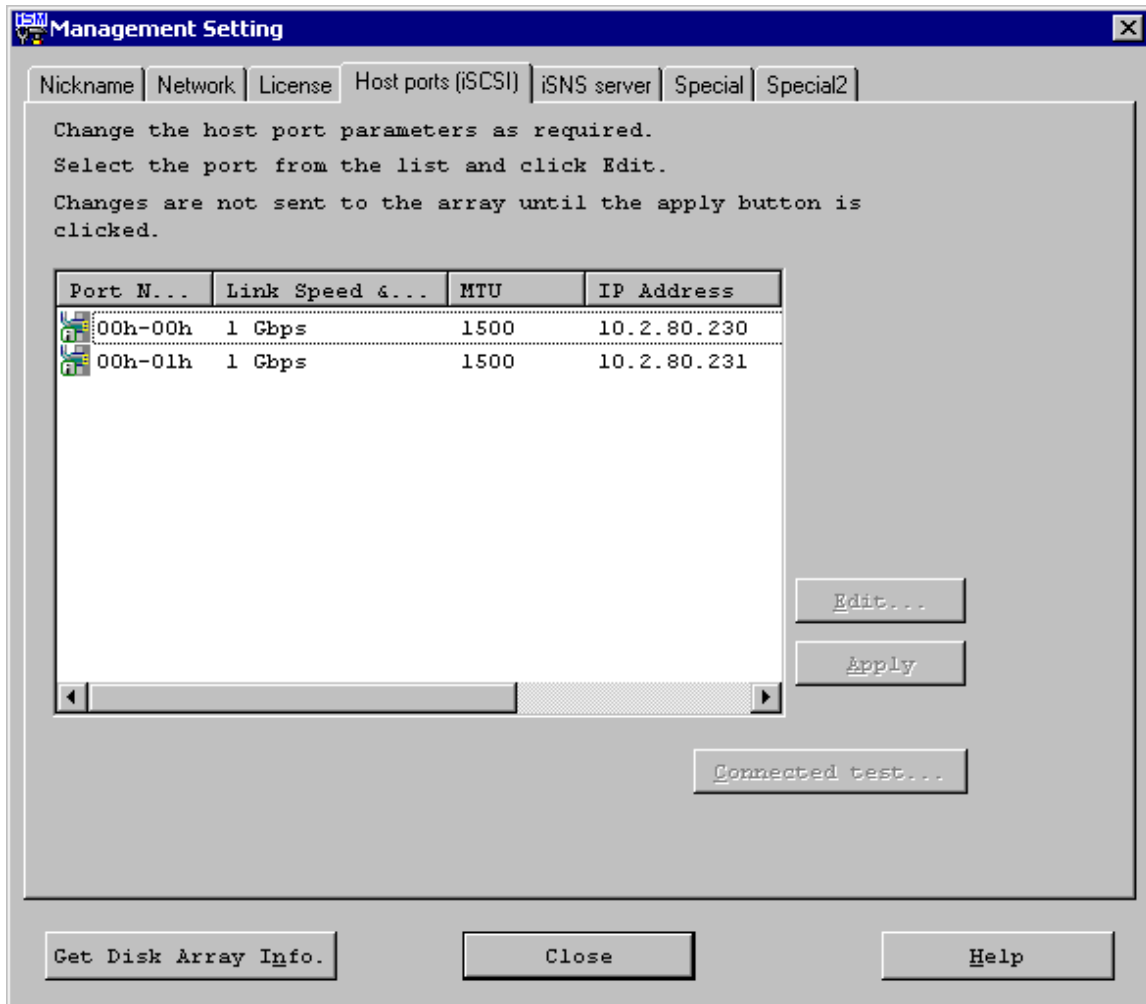
The first thing to do is add the Host Connection Port IP Address to the dynamic discovery of the ESX Host iSCSI Software Initiator. This is done to enable rescans to find new volumes that can be seen by ESX and used to create Datastores.

To configure this, navigate in the vCenter GUI to **Configuration -> Storage Adapters**. Click on the iSCSI Software Adapter and click **Properties**. Click the **Dynamic Discovery** tab. Click **Add**. In the iSCSI Server box type in the Connection Port IP Address of the D3-10i and hit **Ok**.



Repeat the process to add the next Connection Port IP Address of the D3-10i.

To retrieve the Connection Port IP Address of the D3-10i go to NEC Storage Manager and look under **Configuration Settings -> Management Settings -> Host Port (iSCSI)**.



Configuration Settings -> Management Settings -> Host Port (iSCSI)

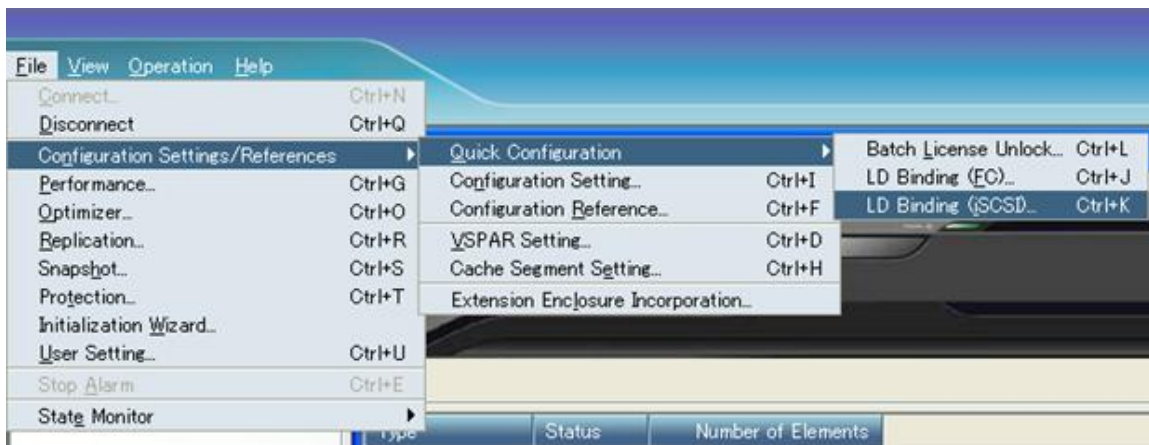
vCenter GUI - Add Group IP Address to Dynamic Discovery

When this is done click **Close** or enter in other Connection Port IP Address as needed.

You will be prompted for a Rescan of the HBAs but at this time as there are no volumes assigned it is unnecessary.

Configuration LD using iSCSI Configuration Wizard

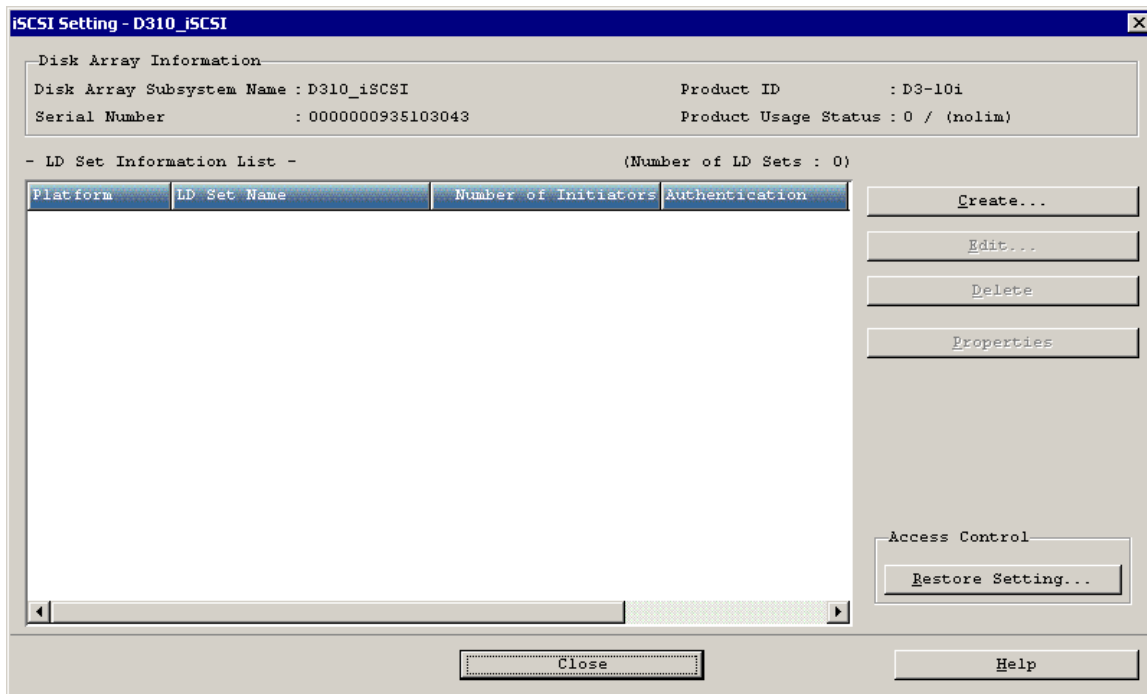
Select LD Binding (iSCSI) by clicking on [File] → [Configuration Settings/Reference] → [Quick Configuration] → [LD Binding (iSCSI)] or click the [Configuration Settings/Reference] icon from the tool bar and select [Quick Configuration] → [LD Binding (iSCSI)].



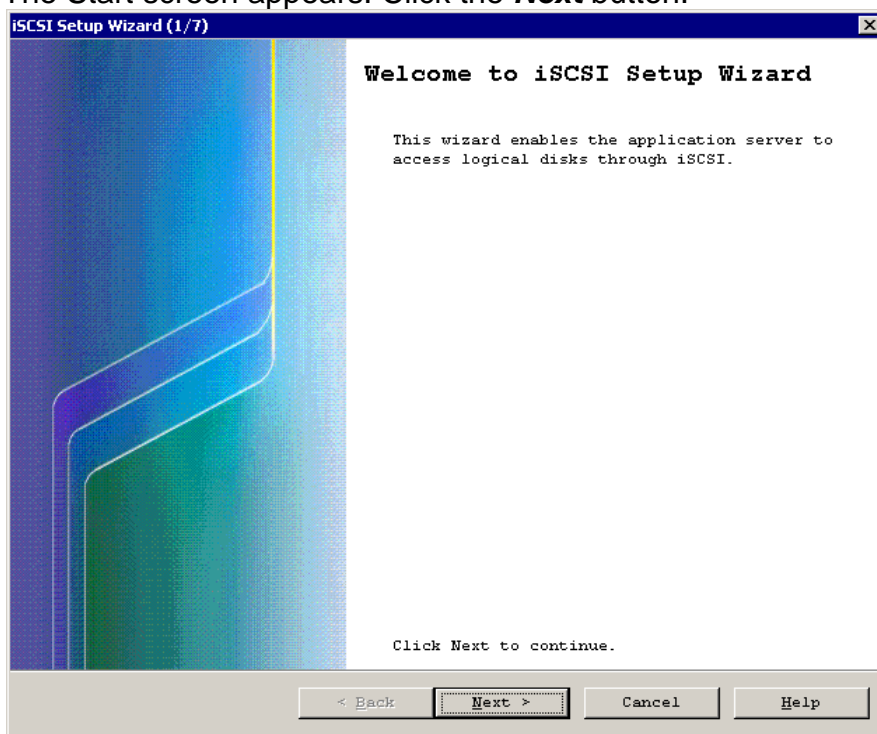
OR



The iSCSI configuration screen appears. Click [Create] button and configure setting as follows.



The Start screen appears. Click the **Next** button.



LD set configuration

iSCSI Setup Wizard (2/7)

Set the LD Set

Enter the platform and LD set name, and click Next.

LD Set settings

Platform : LX

LD Set name : ESX240

Action Mode : Normal

Authentication Settings...

Access Restriction per Portal...

Note

The target name is specified automatically in the following format.
(disk array eigenvalue).(platform)-(LD Set name).target(LD Set eigenvalue)

*Authentication Settings
Click this button to use the CHAP authentication for iSCSI communication.

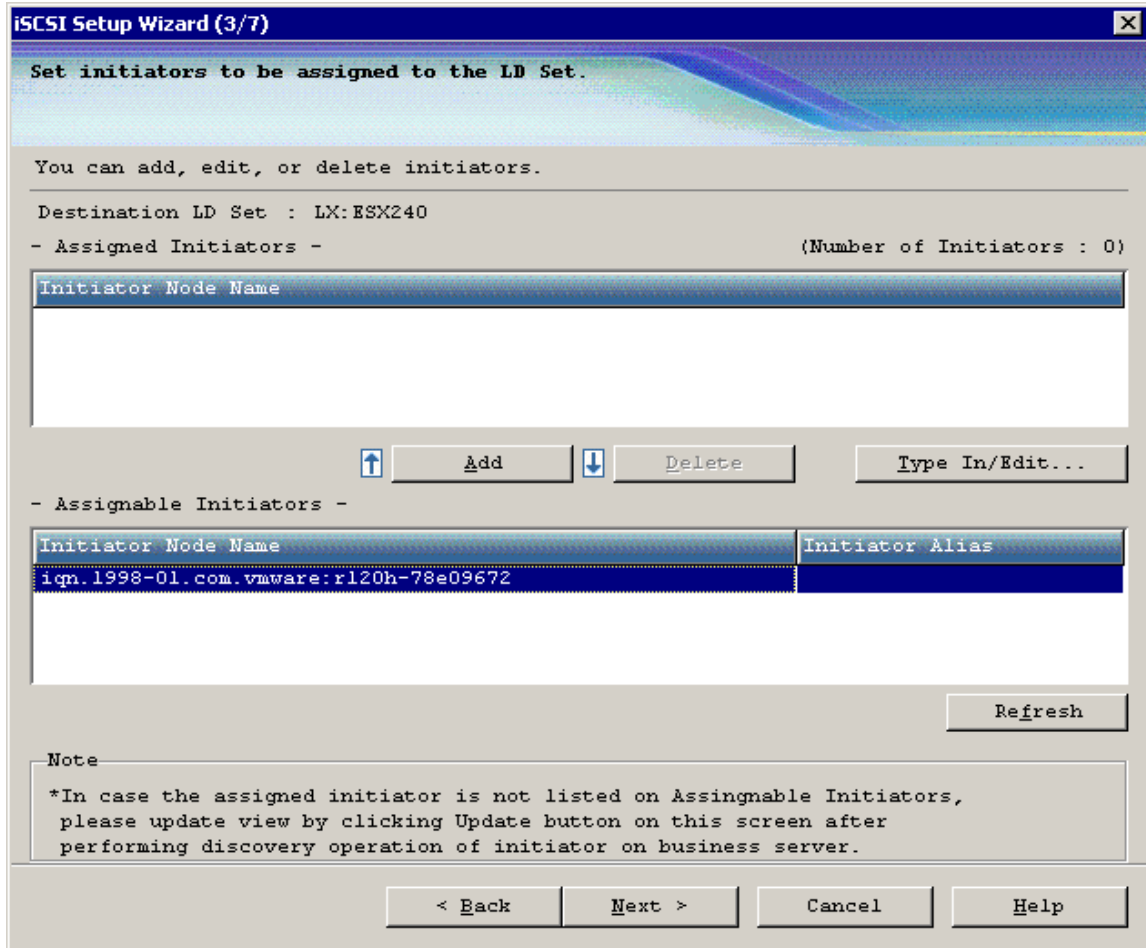
*Access Restriction per Portal
Click this button to restrict access on a disk array portal basis.

*Action Mode
If you need operation which ensures security against each servers or operation which prevent changing disk array structure, please select "Secure".
In other operation, please select "Normal".
If you select "Secure", the operation range of ControlCommand will be restricted to the logical disks which are recognized by OS and the logical disks which has a pair-relation with the logical disks.

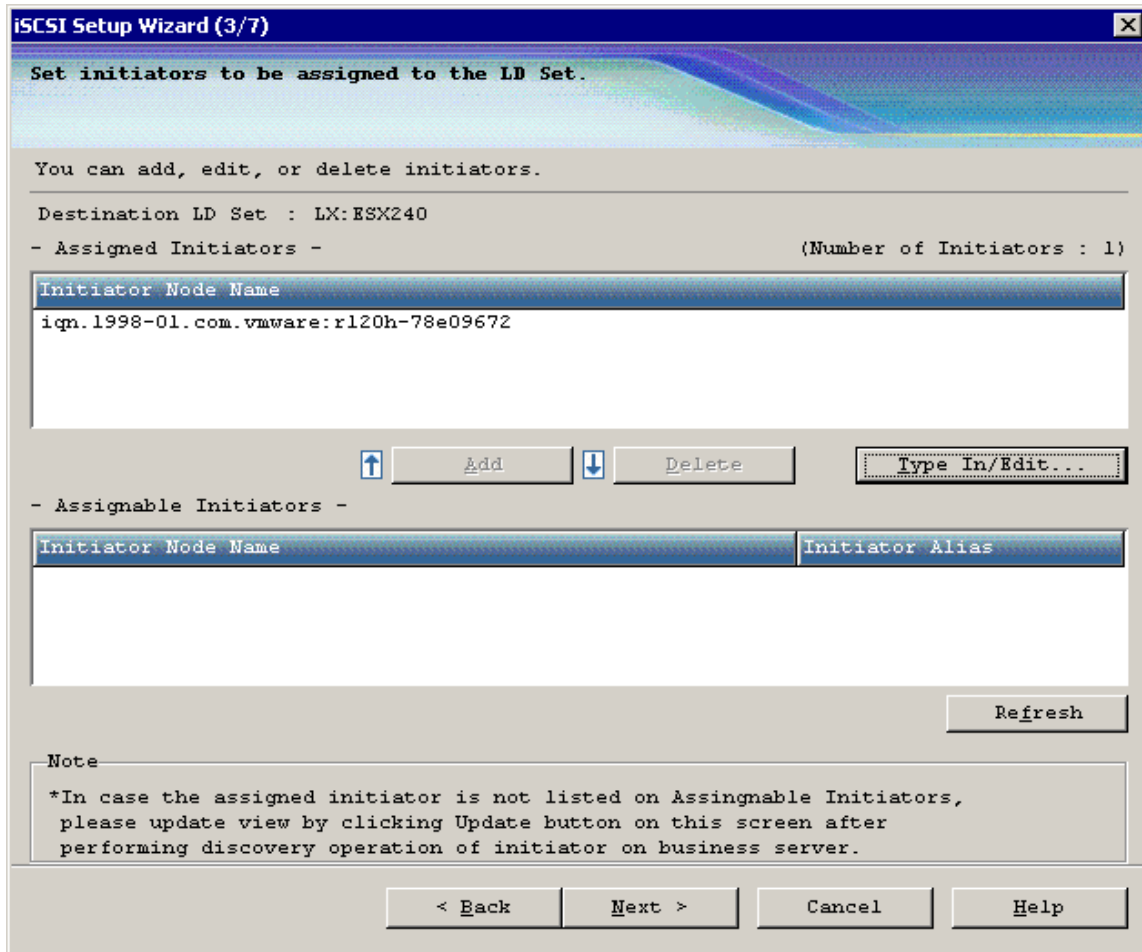
< Back Next > Cancel Help

Set Platform to LX. Enter a Name in the LD Set name.

Initiator configuration

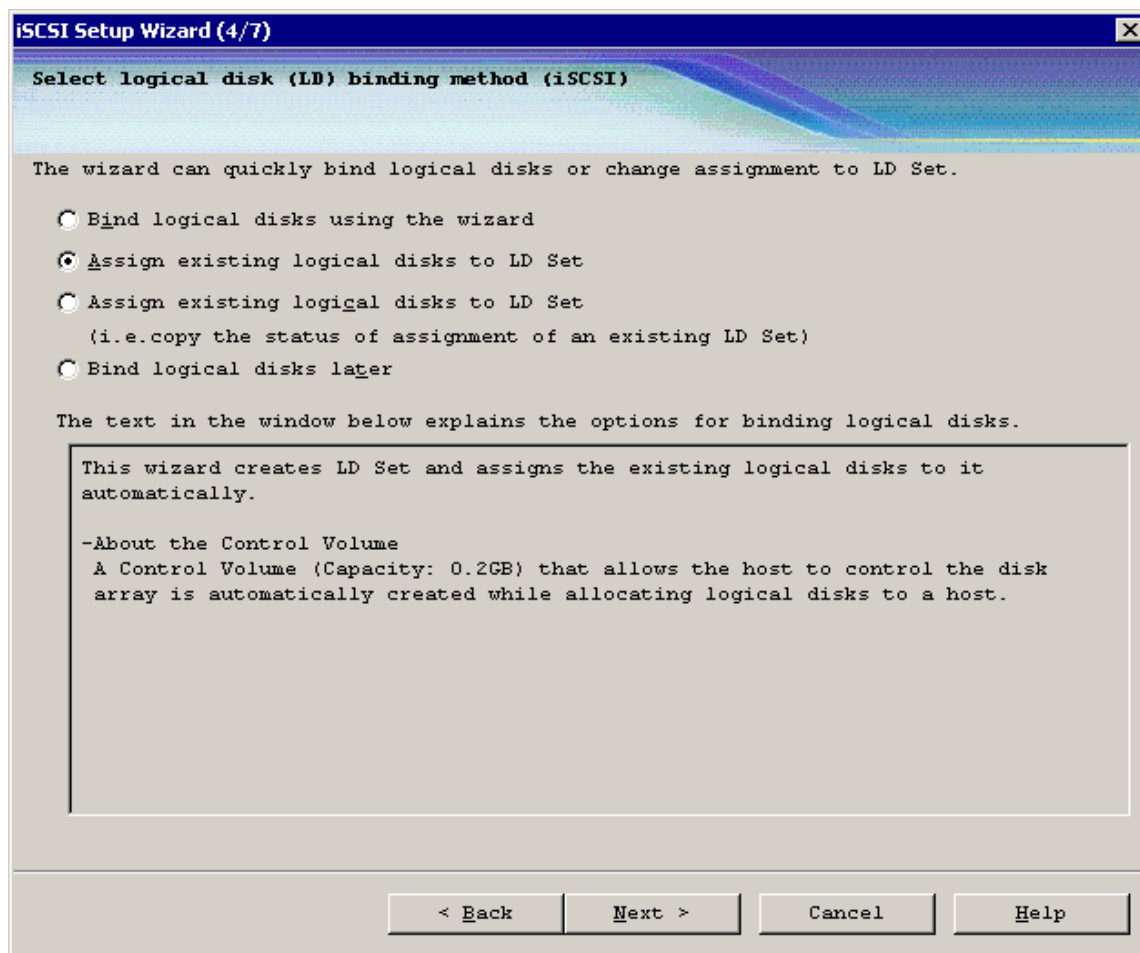


Select the Initiator form the ESX system out of the Assignable Initiators section. Click the **ADD** button to move it up to the Assigned Initiators Section.



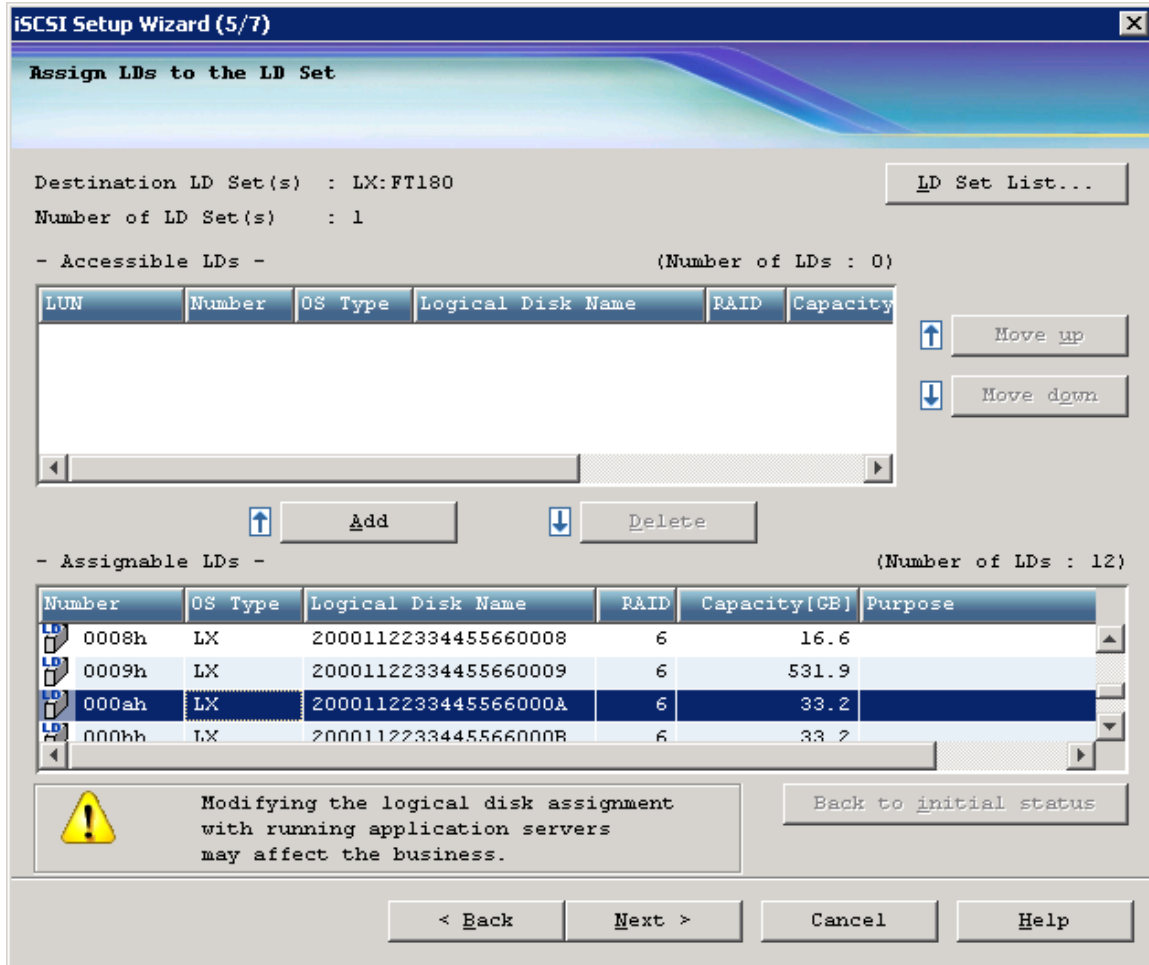
Click the **Next** button.

Selection of LD binding

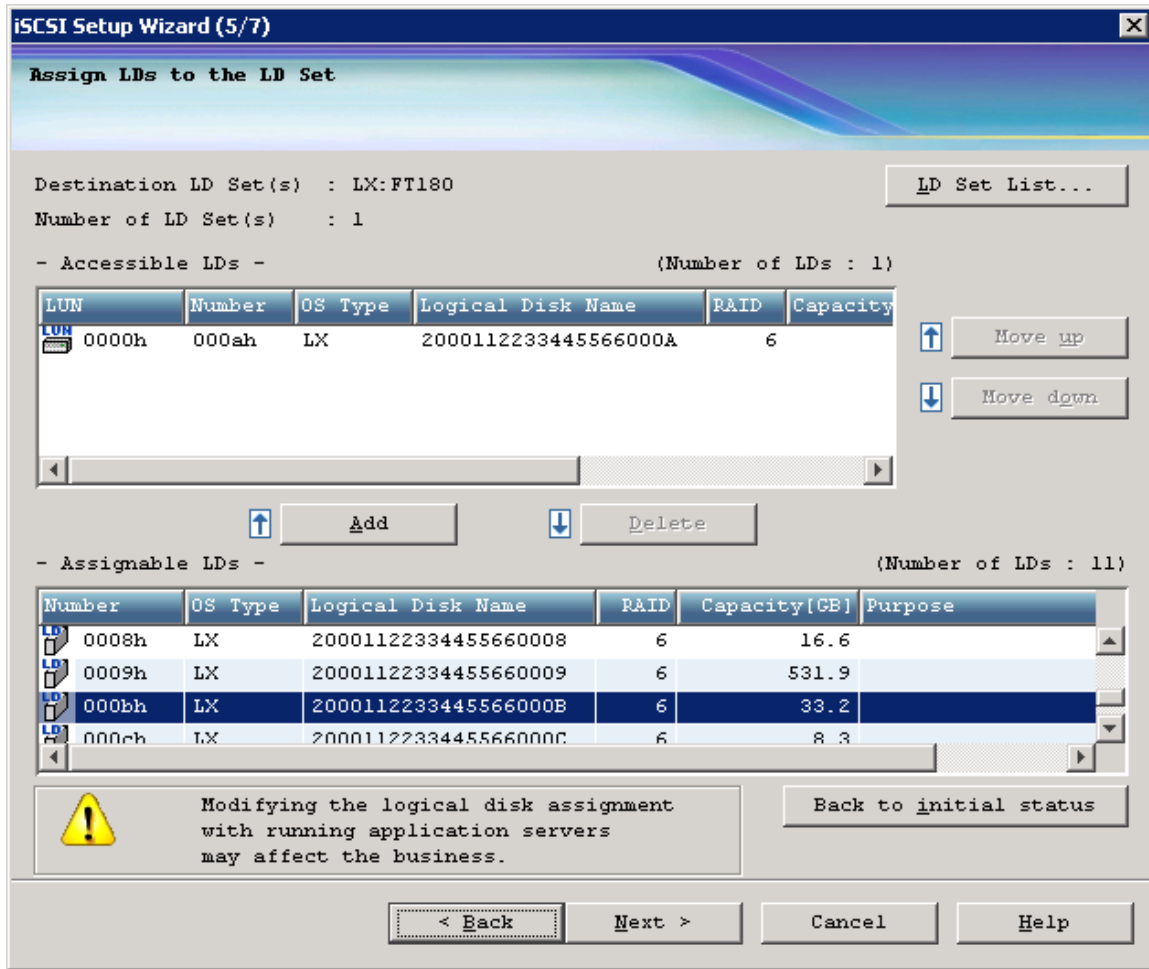


Click on the **Assign existing logical disk to LD Set** this will allow you to assign existing Logical Disk to the LD Set. Click the **Next** button.

LD Assignment to LD Set

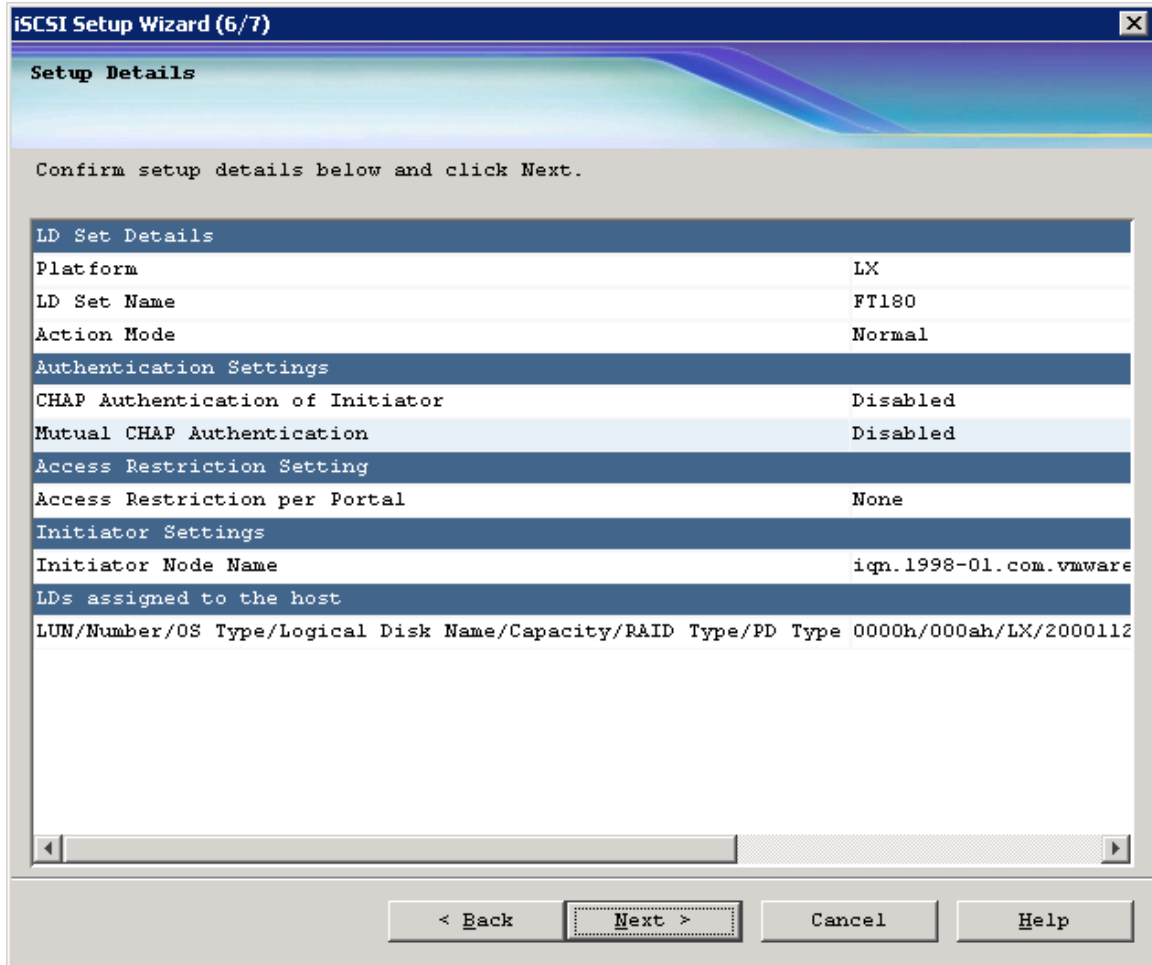


Select the Logical Disk from the Assignable LD's section and click on the **Add** button to move them to the Accessible LD's section.



Click the **Next** button

Confirmation Screen



The Set up Details Screen appears to confirm the configuration of the LD Set.

Click the **Next** Button a warning appears click the **OK** button and then the **Finish** Button. Then **Close** out of the iSCSI Setting window and Resume Monitoring.

Step 8: Connect to a Volume on D3-10i

The next step is to connect to the volume on the D3-10i and verify the connection status. Since the iSCSI access and configuration was configured in the last step, the only thing to do now is to rescan the HBAs and make sure the volume appears correctly.

In the vSphere GUI click on **Configuration -> Storage Adapters** and select the iSCSI Software Adapter.

Click **Rescan** and choose to Scan for New Storage Devices and select **Ok**.

When this is done, if everything has been configured properly under Devices there will be a new D3-10i iSCSI Disk with the correct size shown.

Storage Adapters [Refresh](#) [Rescan...](#)

Device	Type	WWN
LSI1068E		
vmhba100500	Block SCSI	
vmhba110500	Block SCSI	
iSCSI Software Adapter		
vmhba32	iSCSI	iqn.1998-01.com.vmware:r320a-68f9223e:

Details [Properties...](#)

vmhba32

Model: iSCSI Software Adapter
 iSCSI Name: iqn.1998-01.com.vmware:r320a-68f9223e
 iSCSI Alias:
 Connected Targets: 1 Devices: 1 Paths: 4

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

Name	Runtime Name	LUN	Type	Transport	Capacity	Owner
NEC iSCSI Disk (eui.112233445566000a)	vmhba32:C0:T0:L0	0	disk	iSCSI	33.25 GB	NMP

Step 9: Enabling VMware Native Multipathing - Round Robin

One of the new advanced features that is enabled by configuring the iSCSI Software Initiator the way we have is that now we can take advantage of MPIO by using Round Robin. This allows for greater and better bandwidth utilization than in previous versions of ESX.

To configure Round Robin Multipathing on a volume, select the volume from the vCenter GUI. **Configure -> Storage Adapters**. Click on the iSCSI Software adapter.

Storage Adapters [Refresh](#) [Rescan...](#)

Device	Type	WWN
LSI1068E		
vmhba100500	Block SCSI	
vmhba110500	Block SCSI	
iSCSI Software Adapter		
vmhba32	iSCSI	iqn.1998-01.com.vmware:r320a-68f9223e:

Details [Properties...](#)

vmhba32

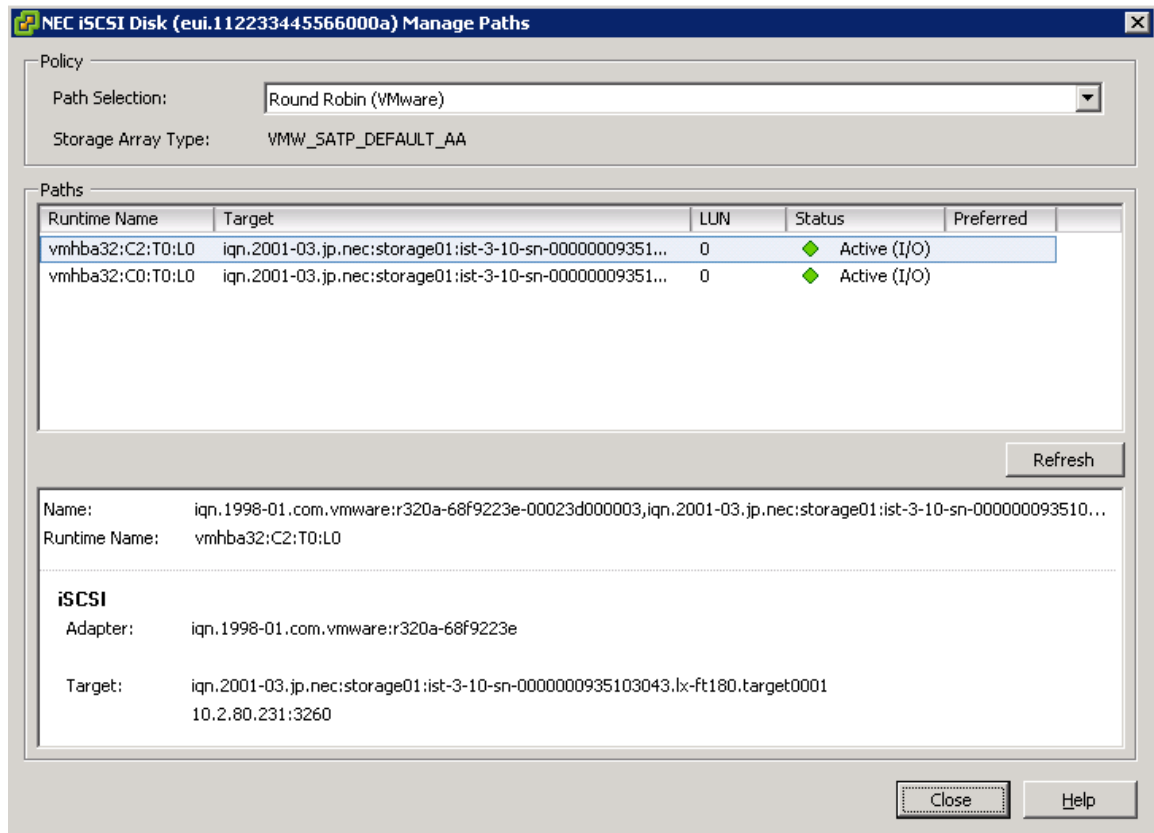
Model: iSCSI Software Adapter
 iSCSI Name: iqn.1998-01.com.vmware:r320a-68f9223e
 iSCSI Alias:
 Connected Targets: 1 Devices: 1 Paths: 4

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

Name	Runtime Name	LUN	Type	Transport	Capacity	Owner
NEC iSCSI Disk (eui.112233445566000a)	vmhba32:C0:T0:L0	0	disk	iSCSI	33.25 GB	NMP

Highlight the NEC iSCSI Disk under View Devices and then right click and select **Manage Paths**. This will display the path information with the default of fixed path.

To enable Round Robin select the drop down next to Path Selection and choose Round Robin (VMware). This will reconfigure the volume to utilize a load balancing policy going across all available paths.



Step 10: Create VMFS Datastores and Connect More Volumes

Now that the iSCSI Software vSwitch is set up and configured, you can assign new volumes in the D3-10i in the **LD Assignment to LD Set** section in NEC Storage Manager, Rescan for the Device under **Configure -> Storage Adapters** and then **Enabling VMware Native Multipathing** for each additional new Volume that is created. Each Volume can also be formatted VMFS and utilized as normal.

Each existing Volume can be modified to allow multiple ESX servers to attach to it by adding the **Initiator configuration** section in NEC Storage Manager.

If there is any question about this procedure or any NEC products please contact NEC Support at (877) 632-0064.