



Deployment Guide

Using Emulex 10Gb Virtual Fabric Adapters for IBM BladeCenter for iSCSI with ESX 4.1



**Solution
Implementer's
Series™**

How to deploy and optimize SCSI storage using Emulex 10Gb Virtual Fabric Adapters for IBM BladeCenter with VMware vSphere 4.1



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Emulex Solution Implementer's Series

This document is part of the Emulex Solution Implementer's Series, providing Implementers (IT administrators and system architects) with solution and deployment information on popular server and software platforms. As a leader in I/O adapters – Fibre Channel, Ethernet, iSCSI and Fibre Channel over Ethernet (FCoE) – the Emulex technology team is taking a lead in providing guidelines for implementing I/O for these solutions.

Executive summary

Emulex Virtual Fabric Adapters (VFAs) for IBM Blade Center provide high-performance server connectivity for network and storage traffic. Emulex VFAs are based on the Emulex OneConnect™ Universal Converged Network Adapter (UCNA) family that supports 10Gb/s Ethernet (10GbE) networks with full protocol offload for TCP, iSCSI and Fibre Channel over Ethernet (FCoE).

This document outlines deployment and optimization of Emulex VFAs with iSCSI storage in a VMware® vSphere environment and provides guidelines for installing drivers, setting the appropriate configuration and attaching target iSCSI LUNs. Advanced topics such as booting from LUN and multipathing are introduced, as is the use of Virtual LAN (VLAN) technology to isolate iSCSI traffic.

Intended audience: This document is intended for server administrators, virtualization administrators, network administrators, system and sales engineers and application engineers.



Introduction

The white paper provides information on deployment and management of Emulex Virtual Fabric Adapters (VFAs) for IBM BladeCenter with network and iSCSI storage connectivity. The following topics are discussed:

- Installing Emulex VFA Drivers
- Installing the Emulex Applications Kit
- Installing the Emulex CIM Provider
- Configuring iSCSI for Emulex VFAs
- Advanced topics

Emulex Virtual Fabric Adapters

Emulex VFAs for IBM BladeCenter servers provide high-performance dual-port connectivity for networking and storage over 10Gb/s Ethernet (10GbE). Emulex VFAs are also backward compatible with 1Gb/s Ethernet (1GbE) allowing data centers to install a solution that will meet current and future requirements.

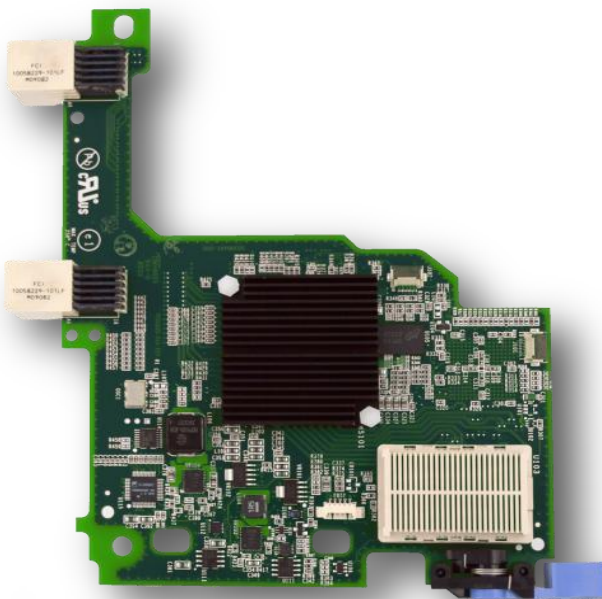


Figure 1. Emulex VFA for IBM Blade Center



Note

Emulex VFAs also offer unique capabilities that allow each physical port to present four virtual NIC (vNIC) devices to the host operating system or hypervisor. Bandwidth can be allocated to each vNIC in 100Mb increments, which is particularly beneficial to optimize performance for virtualized servers that are supporting multiple applications.

Emulex VFAs are CFFh (Combination Form Factor horizontal) adapters with the following options:

- VFA - First-generation network adapter (IBM Part# 49Y4235)
- Advanced VFA - First-generation network adapter with hardware offload for iSCSI storage (IBM Part# 49Y4275)
- VFA II - Second-generation network adapter (IBM Part# 90Y3550)
- Advanced VFA II - Second-generation network adapter with hardware offload for iSCSI or Fibre Channel over Ethernet (FCoE) storage (IBM Part# 90Y3566)
- VFA Upgrade - Upgrade VFA to Advanced VFA (first or second generation)

This Guide will use VFA to reference both first-generation VFA and second generation VFA II adapters. The main differences between VFA and VFA II adapters are as follows:

- VFA uses the Emulex BladeEngine 2 (BE2) controller. VFA II uses the Emulex BladeEngine 3 (BE3), which reduces power consumption by 20%.
- Both VFA and VFA II support vNIC capabilities using BNT Virtual Fabric Switch modules that enable dynamic bandwidth allocation with management software that runs on the switch module. VFA II adds Switch Independent vNIC support that can be used with any 10GbE switch that is supported by IBM. Switch Independent vNIC support requires a sever reboot to change bandwidth allocation.

Emulex VFAs present NIC or vNIC ports to the ESX hypervisor for IP network connectivity. Emulex Advanced VFAs also present iSCSI (or FCoE) hardware adapter ports for storage connectivity.

OneCommand Manager overview

OneCommand Manager supports configuration and management of Emulex network and storage adapters. Key functionality includes:

- Single, uniform management interface for Emulex devices
- Firmware updates



- Driver parameter settings
- Digital diagnostics and loop-back tests

For more information on the features and benefits of OneCommand Manager, visit the [Emulex Web site](#).

Installing Emulex VFA Drivers

Emulex Advanced VFAs present NIC and hardware iSCSI adapters to the ESX hypervisor. Separate drivers need to be installed for each function. All of the Emulex drivers for ESX are qualified under the VMware I/O Vendor Program (IOVP).

This section describes how to install ESX drivers for Emulex Advanced VFAs. Emulex also recommends installing OneCommand Manager, which is included in the Emulex Applications Kit.

Emulex drivers and management applications that have been qualified for Advanced VFAs can be downloaded from the Emulex Web site at www.emulex.com/downloads/ibm.

Note

It may be difficult to select drivers that are qualified for IBM servers by going directly to the VMware web site. It will be much easier to begin the download process at the Emulex web site.

Select the link for a VMware Software Kit for IBM BladeCenter based on the part number of the Advanced VFA to be installed. The most recent software version is generally recommended.

The link will go to a second web page with downloads for software kits, documentation, firmware and boot code. Downloads for the following software kits are available:

- Ethernet Driver Kit - Ethernet driver for both VFA and Advanced VFA
- iSCSI Driver Kit - iSCSI driver for Advanced VFA
- Visor Kit - CIM Provider used to interface with OneCommand Manager for VMware vCenter
- Applications Kit - OneCommand Manager with GUI and CLI support

The links for Ethernet and iSCSI drivers redirect to the VMware site for download of the ISO file.

The instructions in this section apply to drivers for ESX and ESXi 4.1. If you are using ESXi, you need to utilize the VMware vSphere CLI or [vSphere Management Assistant](#) (vMA), a pre-packaged Linux virtual machine (VM) to deploy scripts and select third-party agents to manage ESXi systems. For more information on using vSphere command-line interface please refer to



the [vSphere Command-Line Interface Installation and Scripting Guide for ESX, ESXi and vCenter 4.1](#).

Installation Setup Procedure for ESX 4.1

Copy the downloaded ISO images for the NIC and iSCSI drivers to the /tmp directory on the host. Create a mount point directory using the following command:

```
# mkdir /tmp/mountpoint
```

Installing the NIC driver on an ESX 4.1 host

Use the followings steps to install the NIC driver:

1. Mount the ISO image for the NIC driver.

Use the following command:

```
# mount -r -o loop /path/to/<driver.iso> /tmp/mountpoint
```

where <driver.iso> is the iso file name.

After the ISO image has been mounted, you can access the offline bundle in the /tmp/mountpoint/offlinebundle/ directory.

2. Install the offline bundle.

An offline bundle can be installed on a VMware ESX server locally using the "esxupdate" command. The following example uses the offline bundle file name "offline-bundle.zip":

```
# esxupdate --maintenancemode update --bundle offline-bundle.zip
```

3. Install the driver.

Use the following command to install the NIC driver:

```
# esxupdate --maintenancemode update --bundle /tmp/mountpoint/offline-bundle/<BE NIC driver>
```

where <BE NIC driver> is the iso file name.

For example,

```
# esxupdate --maintenancemode update --bundle /tmp/mountpoint/offline-bundle/vmware-esx-drivers-net-be2net-400.2.102.499.0-1vmw.2.17.249663.x86_64.iso
```

4. Reboot the ESX server.

Installing the iSCSI driver on an ESX 4.1 host

Use the followings steps to install the iSCSI driver:



1. If not created previously, create a mount point directory using the following command:

```
# mkdir /tmp/mountpoint
```

2. Mount the ISO image for the iSCSI driver.

Use the following command:

```
# mount -r -o loop /path/to/<driver.iso> /tmp/mountpoint
```

where <driver.iso> is the iso file name.

3. Install the offline bundle.

The following example uses the offline bundle file name "offline-bundle.zip":

```
# esxupdate --maintenance update --bundle offline-bundle.zip
```

4. Install the driver.

Use the following command to install the iSCSI driver:

```
# esxupdate --maintenancemode update --bundle  
/tmp/mountpoint/offline-bundle/<BE iSCSI iso>
```

where <BE iSCSI iso> is the BE iSCSI driver released as an iso.

For example,

```
# esxupdate --maintenancemode update --bundle  
/tmp/mountpoint/offline-bundle/vmware-esx-drivers-scsi-  
be2iscsi-400.2.103.308.0-1vmw.0.0.235786.x86_64.iso
```

5. Reboot the ESX server.

Installation Setup Procedure for ESXi 4.1 using VMware vSphere CLI on Windows

Use the following setup procedure, which is based on running the VMware vSphere CLI from a Windows client system.

- Create a CD/DVD from the iso image
- Mount on a Windows client system.
- Remotely login to the ESXi host.

Installing the NIC driver on an ESXi 4.1 host

Use the following command from a Windows client:

```
c:\Program Files\VMware\VMware vSphere CLI\bin\vihostupdate.pl  
<conn_options> --install --bundle D:\offline-bundle\<BE NIC zip>
```



where:

- `<conn_options>` is the server name, ip address, username and password of the ESXi host
D: is the CD/DVD
- `<BE NIC zip>` is the zip file containing the iSCSI driver

For example:

```
c:\Program Files\VMware\VMware vSphere CLI\bin\vihostupdate.pl  
<conn_options>vi --install --bundle c:\temp\SVE-be2net-  
2.102.404.0-offline_bundle-281453.zip
```

Verify that the bundles are installed on the ESX/ESXi host:

```
c:\Program Files\VMware\VMware vSphere CLI\bin\vihostupdate.pl  
<conn_options> --query
```

Installing the iSCSI driver on an ESXi Host

Use the following command:

```
c:\Program Files\VMware\VMware vSphere CLI\bin\vihostupdate.pl  
<conn_options>--install --bundle D:\offline-bundle\<BE iSCSI zip>
```

where:

- `<conn_options>` is the server name, ip address, username and password of the ESXi host
- D: is the CD/DVD
- `<BE iSCSI zip>` is the zip file containing the iSCSI driver

For example:

```
c:\Program Files\VMware\VMware vSphere CLI\bin\vihostupdate.pl  
<conn_options> --install --bundle D:\offline-bundle\SVE-  
be2iscsi-2.102.525.9-offline_bundle-362543.zip
```

Verify that the bundles are installed on the ESX/ESXi host:

```
c:\Program Files\VMware\VMware vSphere CLI\bin\vihostupdate.pl  
<conn_options> --query
```



Installing the Emulex Applications Kit on a VMware ESX host

Note

The `lpfc` driver for Emulex LightPulse® HBAs and FCoE CNAs must be downloaded and installed before installing the Applications Kit. Follow the same steps outlined for the NIC and iSCSI drivers.

Use the following steps to install the Applications Kit (which includes OneCommand Manager and OCM Agent):

- Download the rpm file from the [Emulex web site](#) to a temporary directory on the VMware ESX host
- Use the following command to install the rpm file:

```
# rpm -U <elxocmcore>
```

where `<elxocmcore>` is the rpm file.

For example:

```
# rpm -U /tmp/elxocmcore-esx41-5.1.42.7-1.x86_64.rpm
```

Installing the Emulex CIM Provider on VMware ESXi host

Use the following steps to install the CIM provider from a Windows client:

Verify that the ESXi host is not in lockdown mode. Lockdown mode needs to be disabled for `vihostupdate` to work correctly. Lockdown mode can be enabled after the CIM provider has been installed.

1. Download the Visor Kit zip file (contains CIM provider) from the [Emulex web site](#) to a temporary directory.
2. Using vCLI or vSphere client, place the host into maintenance mode to install the offline-bundle.

For example in vCLI:

```
c:\Program Files\VMware\VMware vSphere CLI\bin>vicfg-hostops.pl  
<conn_options> -o enter
```

3. Use the following command to install the CIM provider file:



```
c:\Program Files\VMware\VMware vSphere CLI\bin>vihostupdate.pl  
<conn_options> --install --bundle <cim provider>
```

where <cim provider> is the zip file containing the CIM provider.

For example:

```
c:\Program Files\VMware\VMware vSphere CLI\bin\vihostupdate.pl  
<conn_options> --install --bundle C:\tmp\elx-esx-4.1.0-emulex-  
cim-provider-3.2.30.1-offline_bundle-364582.zip
```

4. Using vCLI or vSphere client, exit from maintenance mode.

For example in vCLI:

```
c:\Program Files\VMware\VMware vSphere CLI\bin>vicfg-hostops.pl  
<conn_options> -o exit
```

You are now ready to configure the Emulex VFA and attach the required LUNs. Guidelines are provided for setting up hardware and software iSCSI.

Configuring iSCSI for Emulex VFAs

Emulex Advanced VFAs provide iSCSI connectivity with full protocol offload that enhances iSCSI performance with ESX 4.1. iSCSI support can also be enabled by purchasing an entitlement for the base Emulex VFA.

With Advanced VFAs, iSCSI sessions and connections are directly managed in hardware, making it is easy to create and manage iSCSI target attachments. No additional ESX network port configuration is required.

This section describes how to use OneCommand Manager and VMware vSphere Client to attach iSCSI LUNs to an Advanced VFA.

Using OneCommand Manager to configure iSCSI

OneCommand Manager delivers centralized management for Emulex devices. To identify TCP/IP host servers in a particular environment:

1. Select a TCP/IP host and review the Emulex devices installed on this server.

Note

OneCommand Manager represents Emulex VFAs as OneConnect adapters.



2. Select the desired device (the iSCSI adapter associated with Port 1 of a OneConnect OCe11100 iSCSI Adapter in this example) and then the iSCSI Port Info tab. Select Modify.

You can use the resulting Modify TCP/IP Configuration dialog box shown in Figure 1 to enable DHCP, if desired, or specify a fixed IP Address, Subnet Mask and Gateway Address.

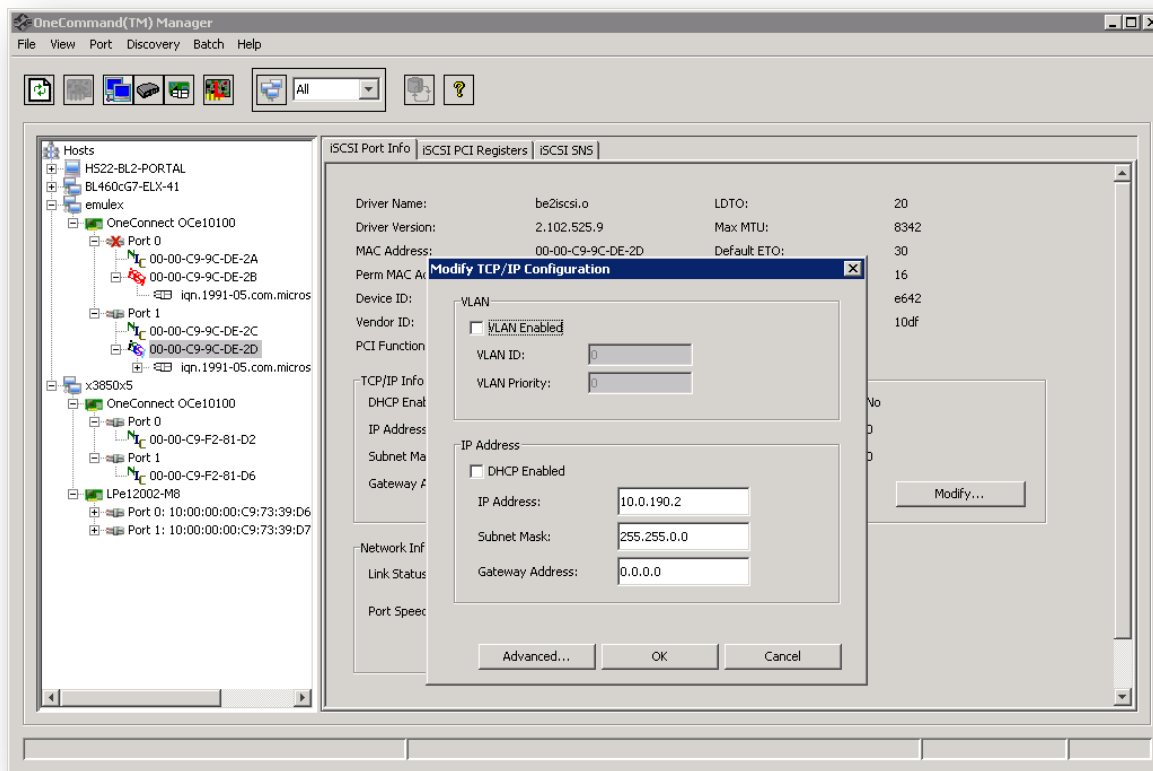


Figure 2: Modifying the TCP/IP configuration

3. Select the iSCSI port that appears under the adapter's iSCSI icon, then select the **iSCSI Initiator Login Options** tab to view the **Initiator iSCSI Name**, as shown in Figure 2.

Note

Consider forwarding the iSCSI name to the storage administrator so that the name can be bound to the target being provisioned.

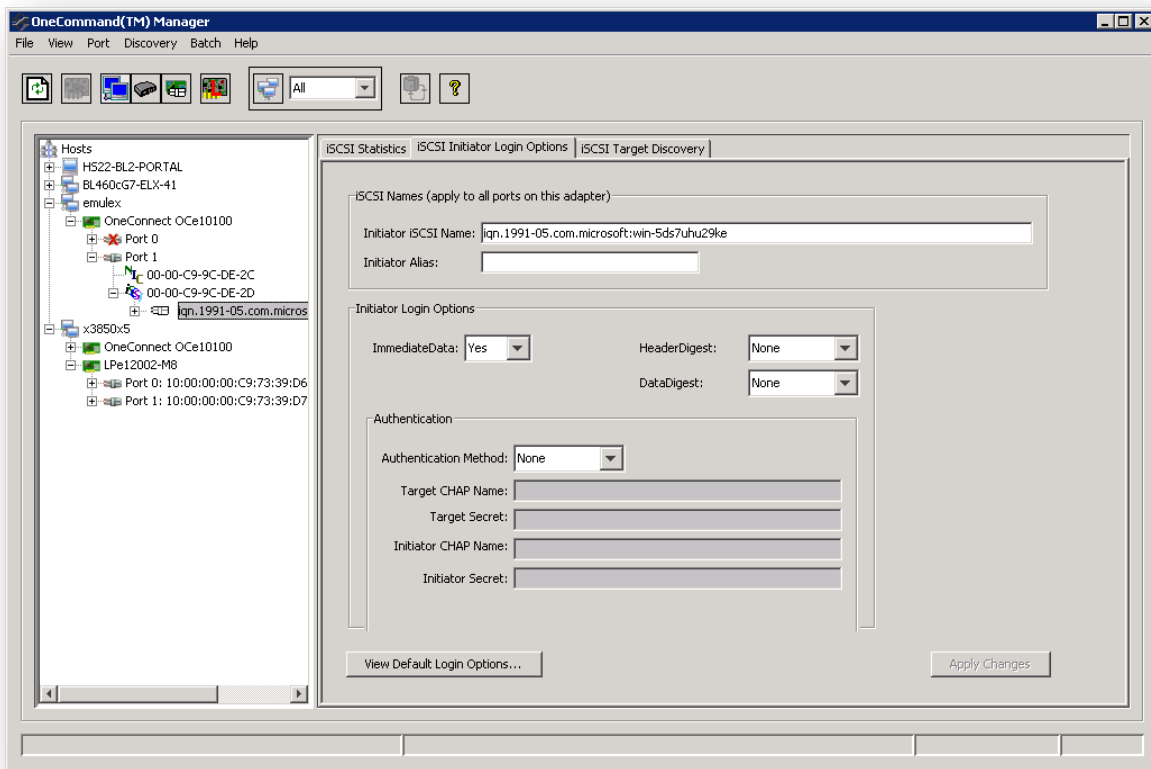


Figure 3: Viewing the Initiator iSCSI name

4. Select the **iSCSI Target Discovery** tab, then select the "Add Portal" button, allowing you to specify the IP address of the iSCSI target portal, as shown in Figure 3. Verify that port address 3260 is being used.

Note

LUNs may not be shown on the initiator until the storage administrator has bound the iSCSI name to the target.

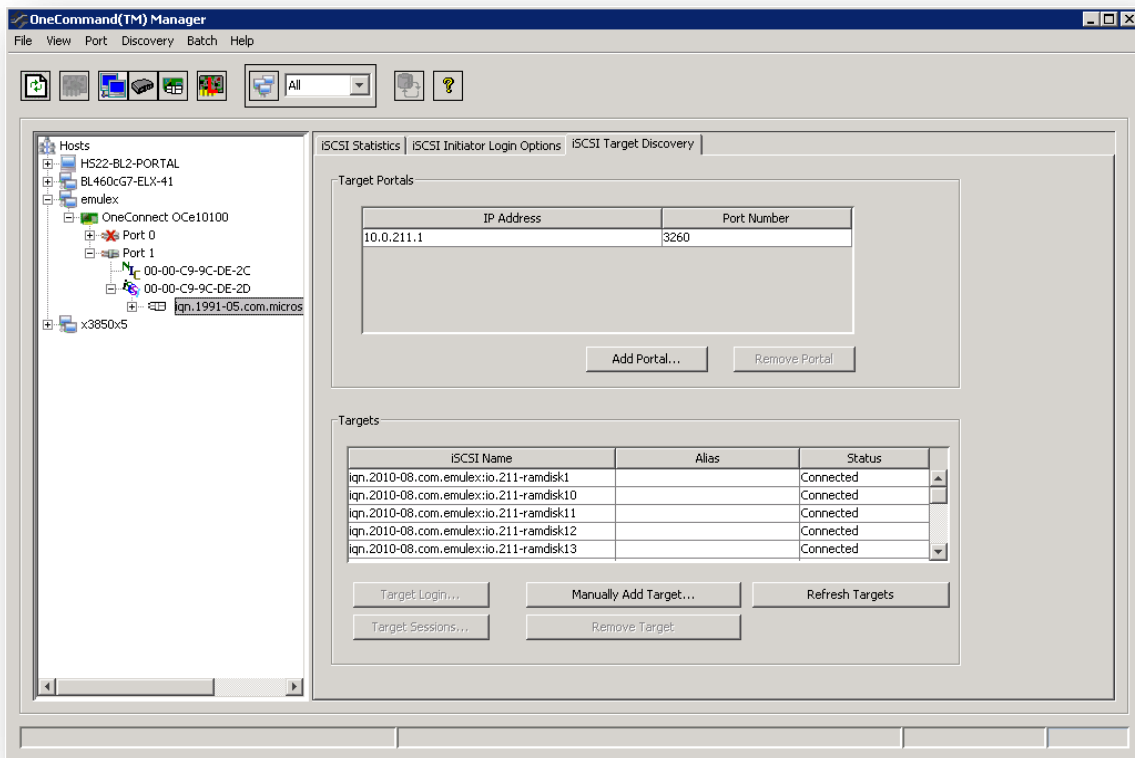


Figure 4: Attaching to the target

Note

At this point, the OneCommand Manager screen is similar to that used for other forms of storage, such as Fibre Channel.

The iSCSI LUNs are now visible to ESX.



Viewing LUNs from vSphere Client

The iSCSI adapter and attached storage can be viewed in vSphere Client under **Storage Adapters** in the **Configuration** tab, as shown in Figure 4.

The screenshot shows the vSphere Client interface for a VMware ESX host. The 'Configuration' tab is active, and the 'Storage Adapters' section is expanded. The 'Details' pane for the selected 'vmhba2' adapter shows the following information:

- Model:** Emulex OneConnect
- ISCSI Name:** iqn.1991-05.com.microsoft:win-5ds7uhu29ke
- ISCSI Alias:** (empty)
- IP Address:** 10.0.190.1
- Connected Targets:** 10
- Devices:** 10
- Paths:** 10

Below the details, the 'View' section is set to 'Devices', displaying a table of attached LUNs:

Name	Identifier	Runtime Name	LUN	Type	Transport	Capacity	Owner
EQLOGIC ISCSI Disk (naa.6090a07...)	naa.6090...	vmhba2:CO:T3:L0	0	disk	ISCSI	30.00 GB	NMP
EQLOGIC ISCSI Disk (naa.6090a07...)	naa.6090...	vmhba2:CO:T8:L0	0	disk	ISCSI	30.00 GB	NMP
EQLOGIC ISCSI Disk (naa.6090a07...)	naa.6090...	vmhba2:CO:T2:L0	0	disk	ISCSI	30.00 GB	NMP
EQLOGIC ISCSI Disk (naa.6090a07...)	naa.6090...	vmhba2:CO:T7:L0	0	disk	ISCSI	30.00 GB	NMP
EQLOGIC ISCSI Disk (naa.6090a07...)	naa.6090...	vmhba2:CO:T1:L0	0	disk	ISCSI	30.00 GB	NMP
EQLOGIC ISCSI Disk (naa.6090a07...)	naa.6090...	vmhba2:CO:T6:L0	0	disk	ISCSI	30.00 GB	NMP
EQLOGIC ISCSI Disk (naa.6090a07...)	naa.6090...	vmhba2:CO:T0:L0	0	disk	ISCSI	30.00 GB	NMP

Figure 5: Using vSphere Client to view LUNs attached to storage adapter vmhba2



Using vSphere Client to configure an iSCSI adapter

As an alternative to OneCommand Manager, you could use vSphere Client to configure iSCSI adapters. Figure 5 shows using General Properties on the **Configuration** tab under Storage Adapters to configure IP settings.

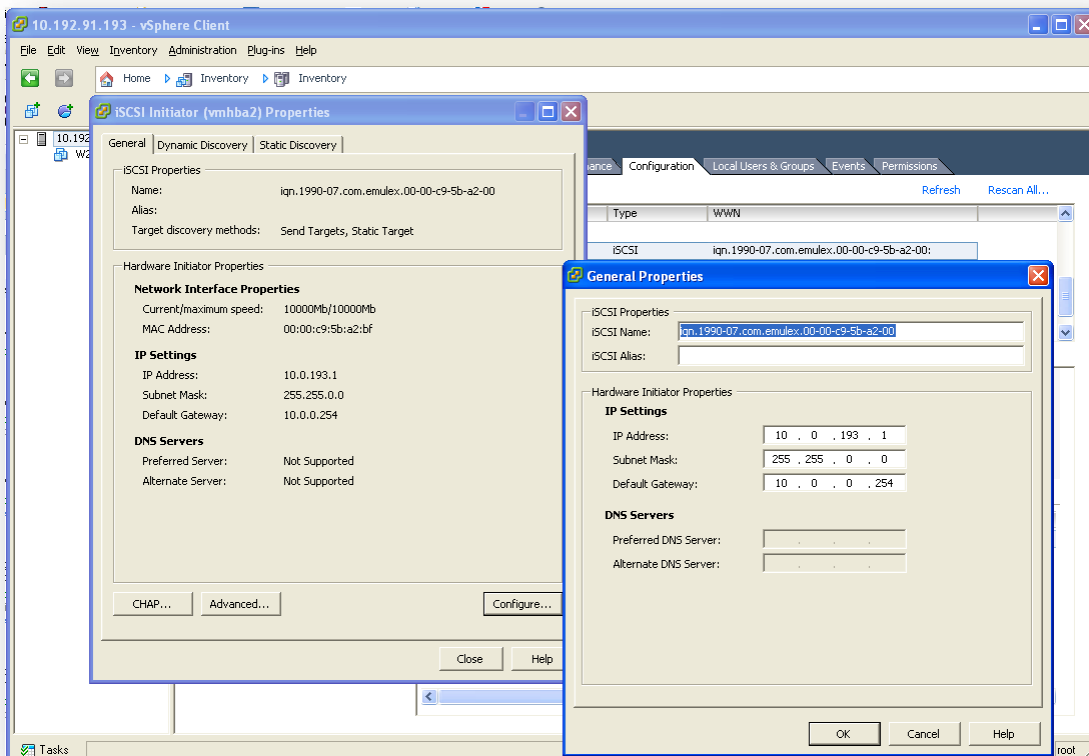


Figure 6: Using the Configuration tab of VMware vSphere Client to set Emulex VFA properties



After you have configured the properties for the iSCSI adapter, the next step is to discover the target portal, as shown in Figure 6.

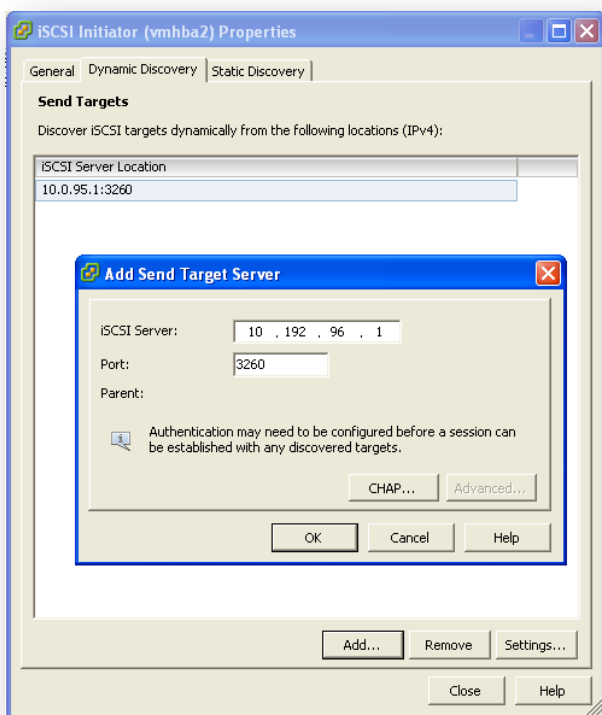


Figure 7: Using vSphere Client to add the target portal using dynamic discovery

Advanced topics

This section provides information on the following advanced topics:

- Configuring Emulex VFAs to boot an ESX server from an iSCSI target
- Emulex VFAs and iSCSI multipathing
- Using virtual LAN (VLAN) technology to isolate and better route iSCSI data

Configuring Emulex VFAs to boot an ESX server from an iSCSI target

Emulex VFAs can attach to an iSCSI target at boot time, allowing the ESX server to boot remotely.

To enable remote boot,



1. Press F1 to go into the System Configuration and Boot Management application that uses the Universal Extensible Firmware Interface (UEFI). Select System Settings.

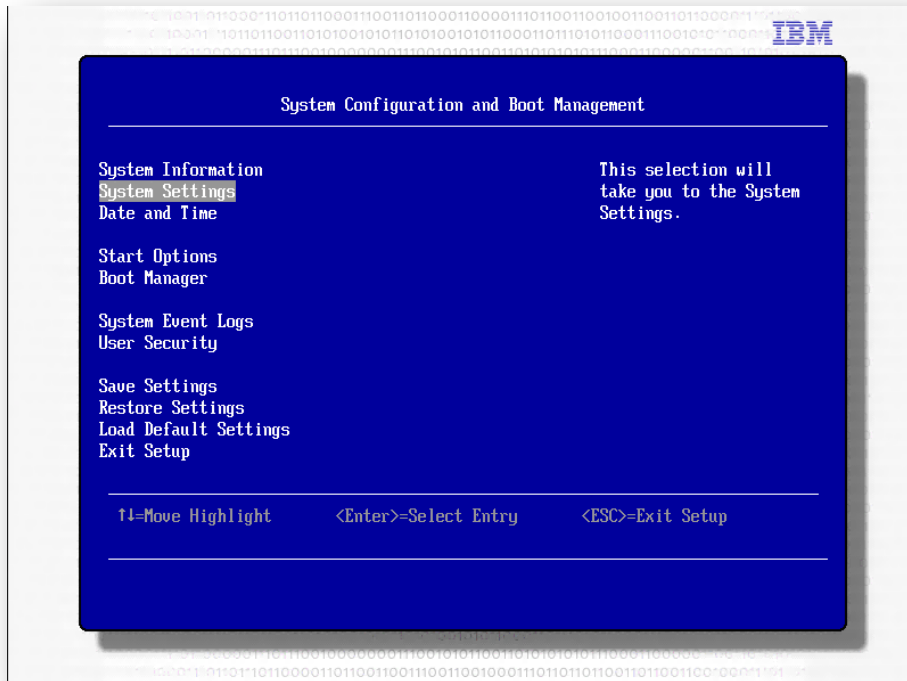


Figure 8: System Configuration and Boot Management

2. Select Emulex iSCSI EFI Configuration Utility.

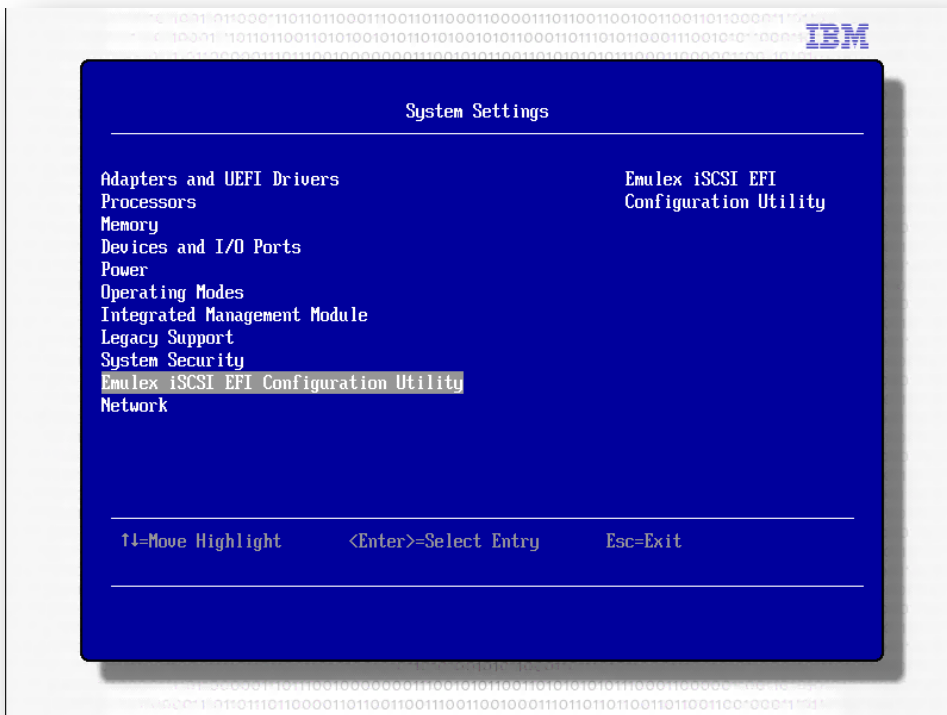


Figure 9: System Settings



3. Select Emulex Configuration Setup Utility.

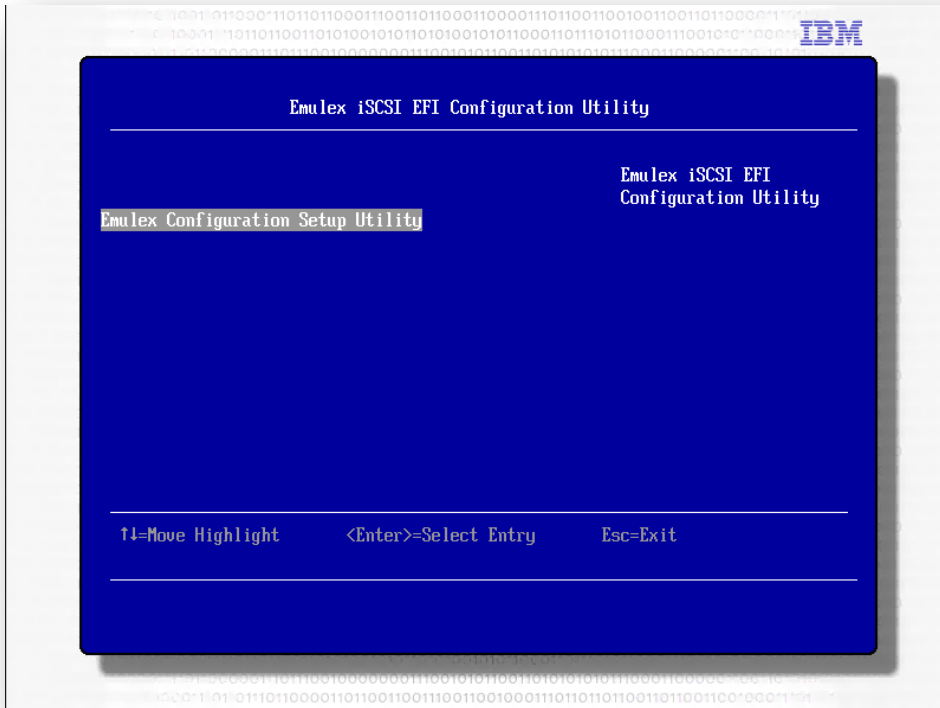


Figure 10: iSCSI EFI Configuration Utility

4. Enable Boot Support and save changes.

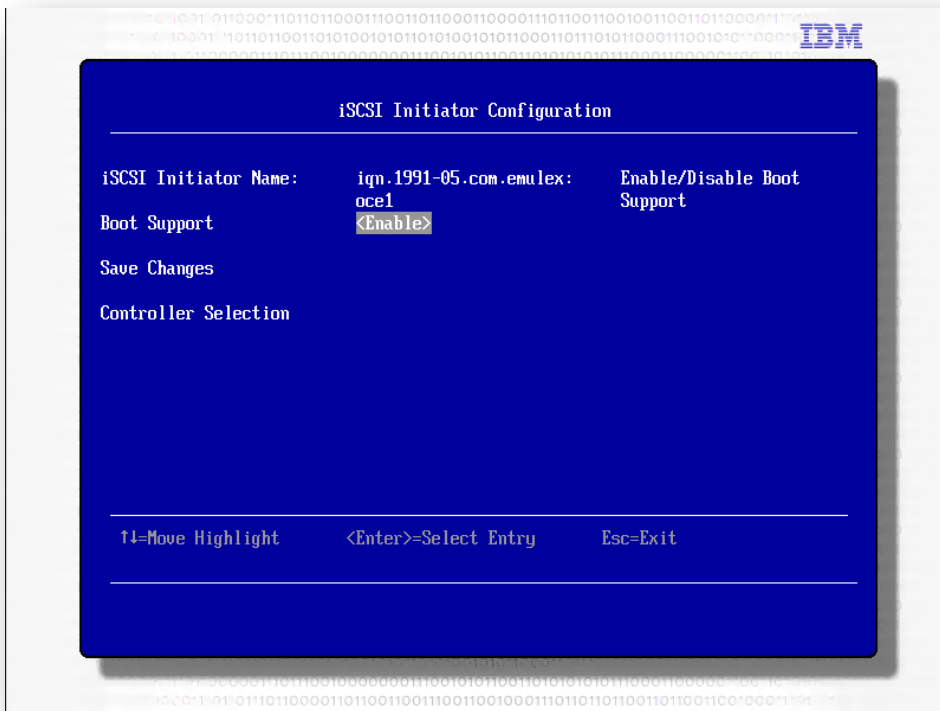


Figure 11: iSCSI EFI Configuration

5. Select the controller to use for Boot

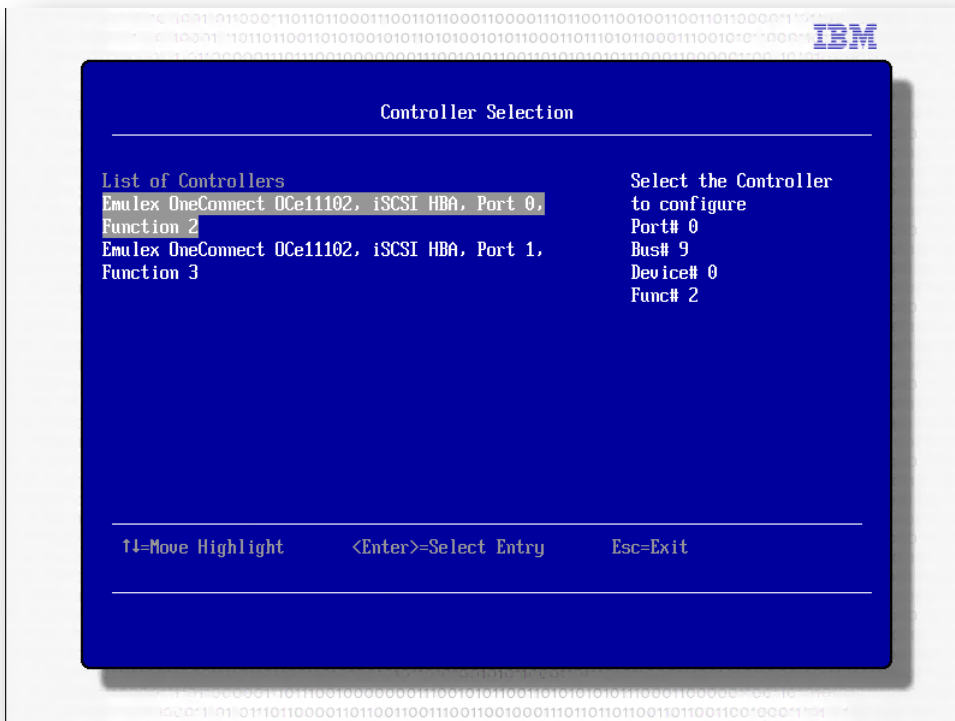


Figure 12: Controller Selection

6. Select Controller Properties

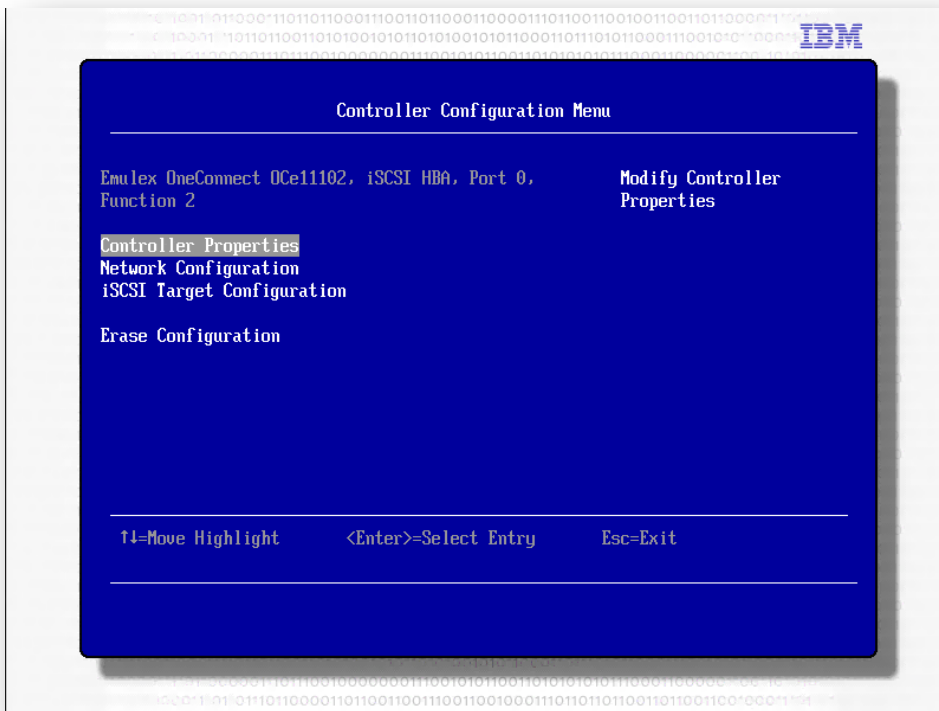


Figure 13: Controller Configuration

7. Verify the adapter has the correct BIOS and Firmware versions. Press ESC to exit.
8. Select Network Configuration and assign an IP address. If you are using DHCP then enable the DHCP settings. A manual IP address will be used for this example.

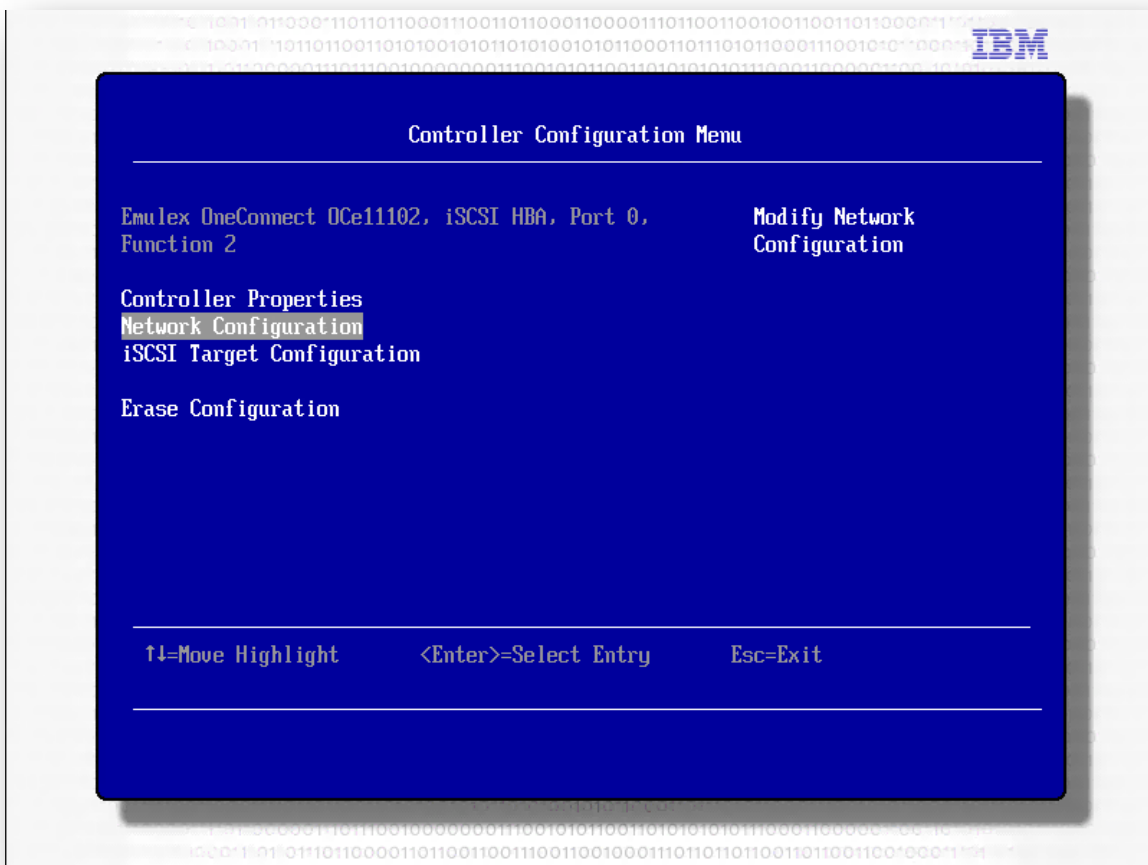


Figure 14.: Controller Configuration



9. Configure Static IP Address

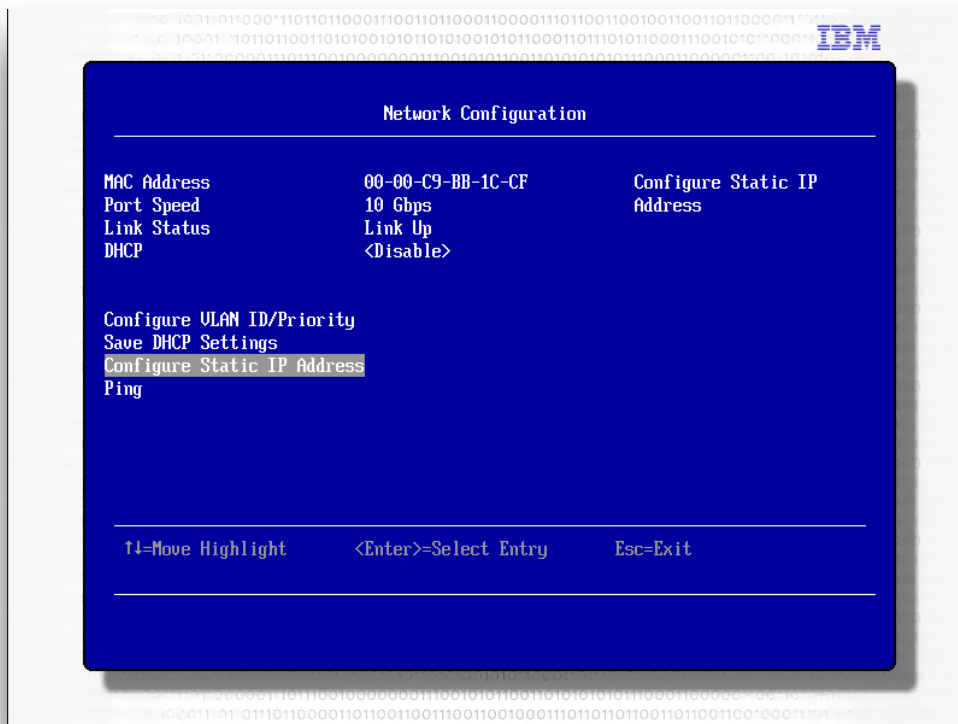


Figure 15: Network Configuration

10. Enter IP Address, Subnet Mask and Default Gateway. Save Changes and Esc to Exit.

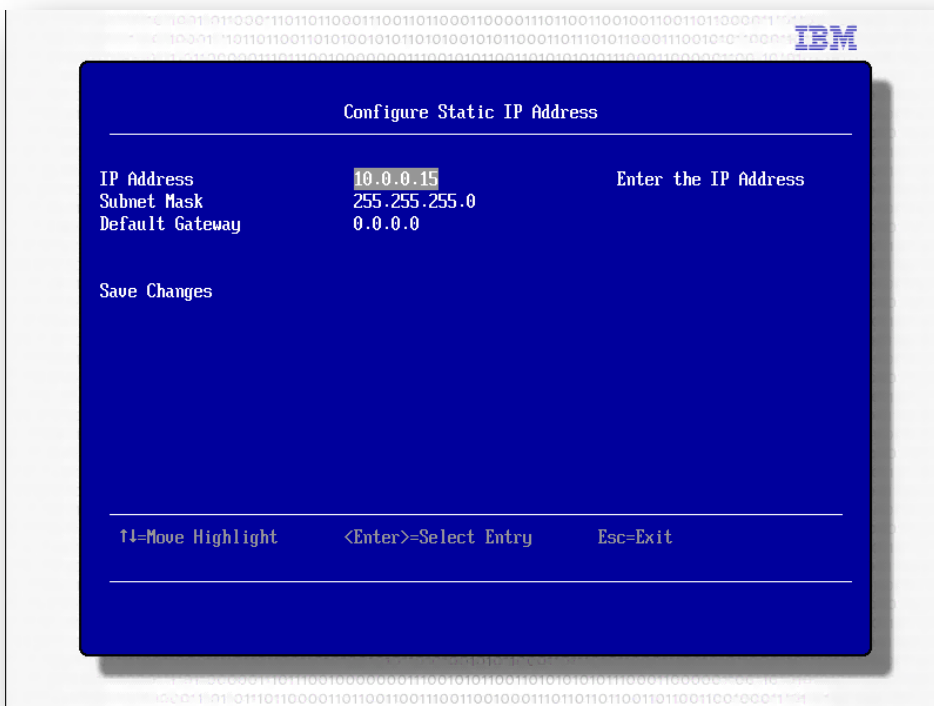


Figure 16: Configure Static IP Address

11. Manually add and discover boot targets. On the iSCSI Target Configuration Screen, highlight Add Targets and press Enter. Highlight the iSCSI Target IP Address and enter the IP address of the target. You may also enter the iSCSI Target name.

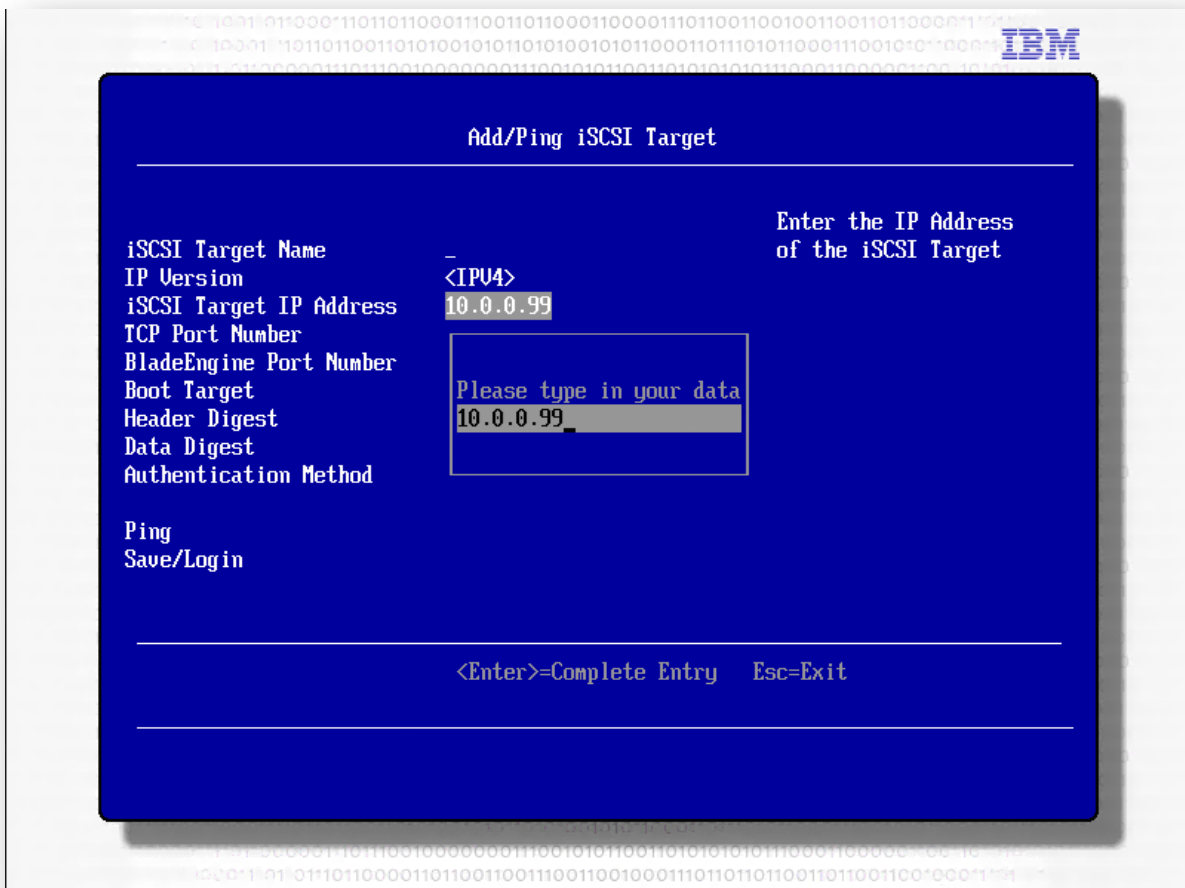


Figure 17: Enter IP Address for Target



12. Highlight Boot Target and Enter to select Yes. Set your authentication method if using one. For the purpose of this configuration it was set to None.

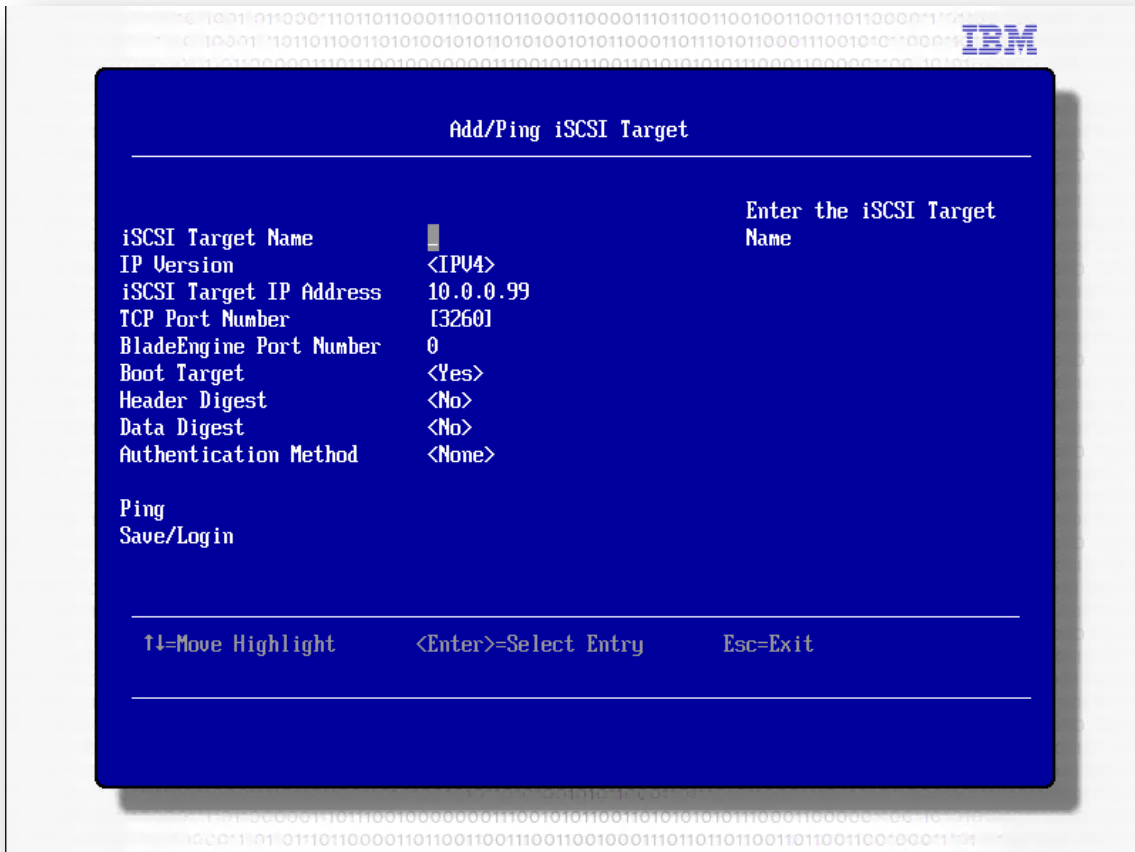


Figure 18: Set Authentication Method



13. Select Save/Login

14. Select Save. Discovered Targets will appear. Place an X by pressing the spacebar on the discovered target.

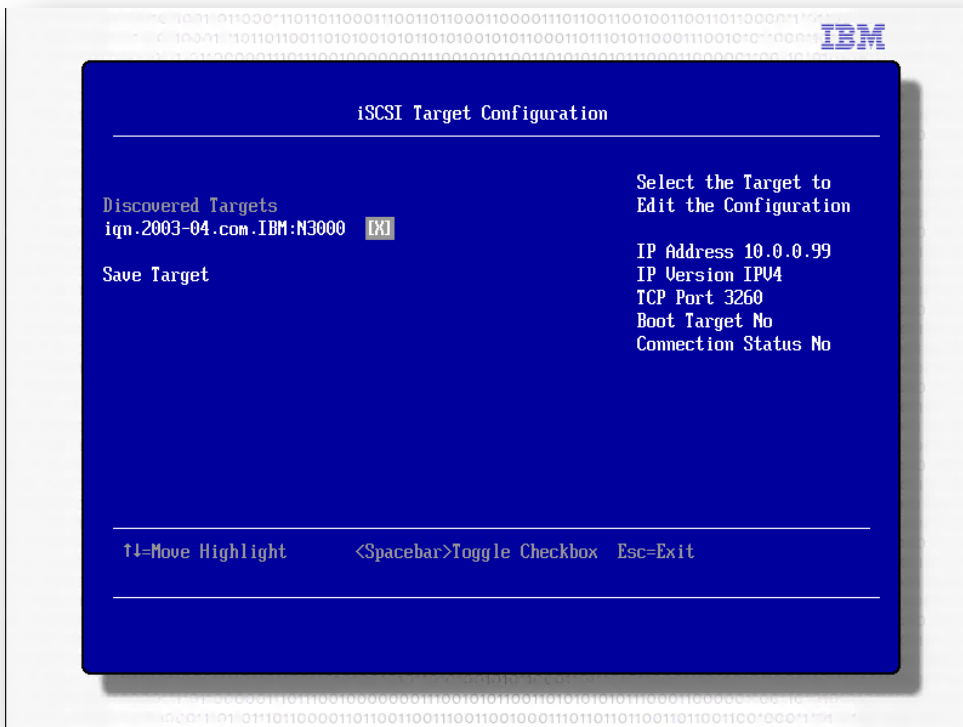


Figure 19: Select Target



15. Select Save Target. Once the iSCSI Target Configuration has been saved the connection Status will change from No to Yes.

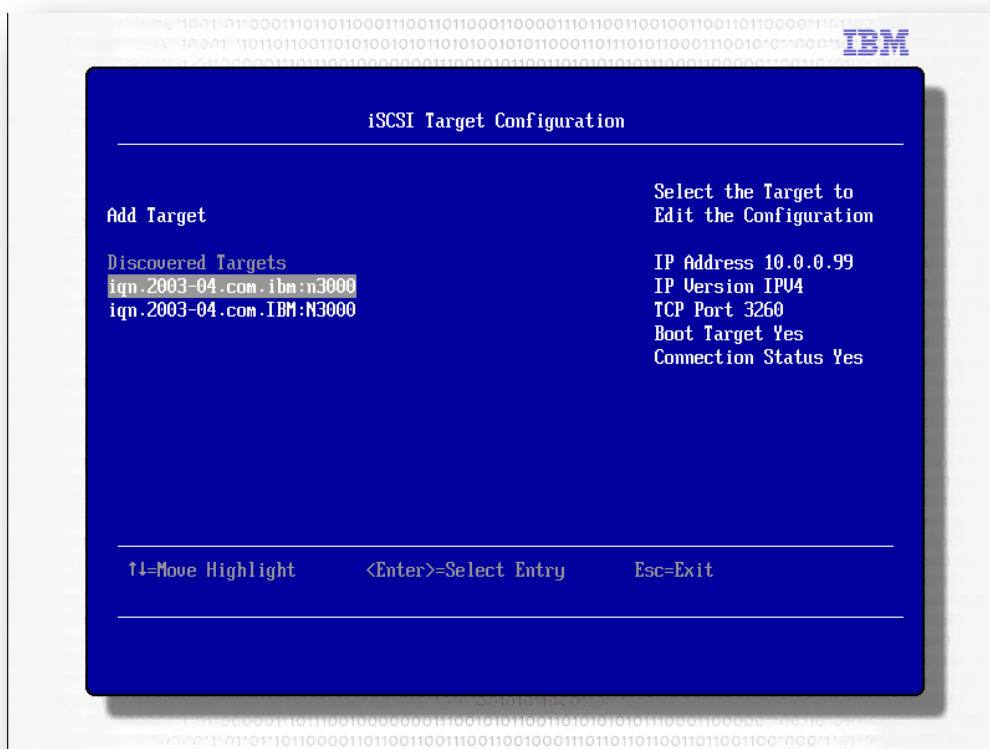


Figure 20: Confirm Connection Status

16. Save the settings and exit to reboot the server. The BIOS loads during the boot process and the VFA adapter logs in to the boot LUN:

```

Controller#0 Port#0 Base 0x97AA0000 at Bus:09 Dev:00 Fun:02
Controller#0 Port#1 Base 0x97AE0000 at Bus:09 Dev:00 Fun:03

Initiator iSCSI Name: iqn.1991-05.com.emulex:ocel
Initiator IP Address: 10. 0. 0. 15
Initiator IP Address: 10. 0. 0. 16

Drive #0 IBM      2105800 0      953 MB
Device Geometry   3B9      20      40
BIOS Installed Successfully!

```

Figure 21: BIOS Loads During Boot

You are now ready to install ESX 4.1 on iSCSI boot LUN.



Emulex VFAs and iSCSI Multipathing

If there was only a single path between an iSCSI initiator and its target, the loss of any single point of failure in that path would render data in the LUN unavailable. To mitigate this risk, VMware provides the VMware Native Multipathing plug-in (NMP) which provides redundancy and I/O load balancing between paths. VMware NMP supports storage arrays listed on the VMware HCL and uses a default path selection algorithm based on the array type.

You can easily implement multipathing by connecting to the same iSCSI target from two separate iSCSI adapters, as shown in Figure 21. iSCSI CNA 1 and iSCSI CNA 2 provide two physical paths to the storage system. VMkernel NMP monitors the health of each physical path. If the iSCSI CNA 1 fails, the data path will switch to iSCSI CNA 2.

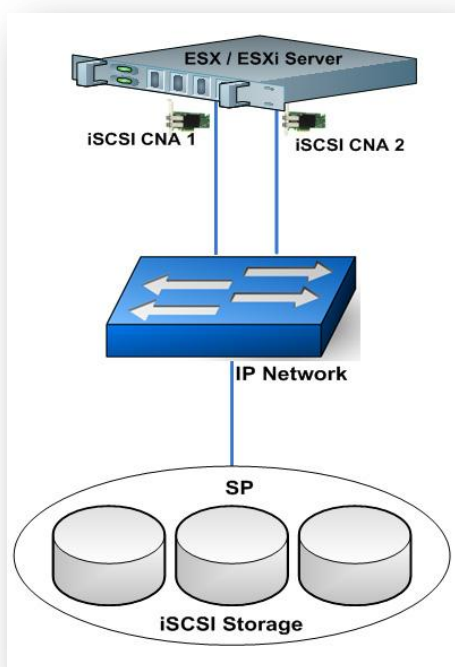


Figure 22: Implementing MPIO by connecting from two separate Emulex VFAs to a single storage portal (SP)

Using VLAN technology to isolate and route iSCSI traffic

Best practices for iSCSI deployments include the separation of network and storage traffic – for example, by using different physical networks for each traffic type. Alternatively, VLAN technology allows you to create independent logical networks within a single physical network to isolate iSCSI traffic, which delivers the following benefits:



- Bandwidth – Since traffic only goes to the intended devices, traffic to remaining devices is decreased
- Latency – By effectively eliminating routers and their associated latency, VLAN connections are faster
- Security – In a single broadcast domain, only valid initiators can connect to the target storage array
- Cost-effective – There are fewer physical switches
- Manageability – Fewer physical switches translates to less management time

For a VLAN implementation involving iSCSI, all the related components (initiator, switch and target) must support this capability; moreover, in addition to configuring the iSCSI initiator for the VLAN, the VLAN configuration must also be applied to switch and target ports in the data path.

Summary

This document, which is part of the Emulex Solution Implementer's Series, provides details for configuration and optimization of iSCSI connectivity with Emulex VFAs for VMware ESX servers. Based on the OneConnect 10GbE product family, Emulex VFAs support high-performance networking with protocol offloads that reduce I/O load on the host server and simplify port management.

More information

Emulex UCNAs	http://www.emulex.com/products/oneconnect-ucnas.html
Emulex OneCommand Manager	http://www.emulex.com/products/management-software/device-management/onecommand-manager/overview.html
VMware vSphere	http://www.vmware.com/products/vsphere/
VMware vSphere documentation	http://www.vmware.com/support/pubs/vs_pubs.html
VMware iSCSI SAN Configuration Guide ESX 4.1	http://www.vmware.com/pdf/vsphere4/r41/vsp_41_iscsi_san_cfg.pdf

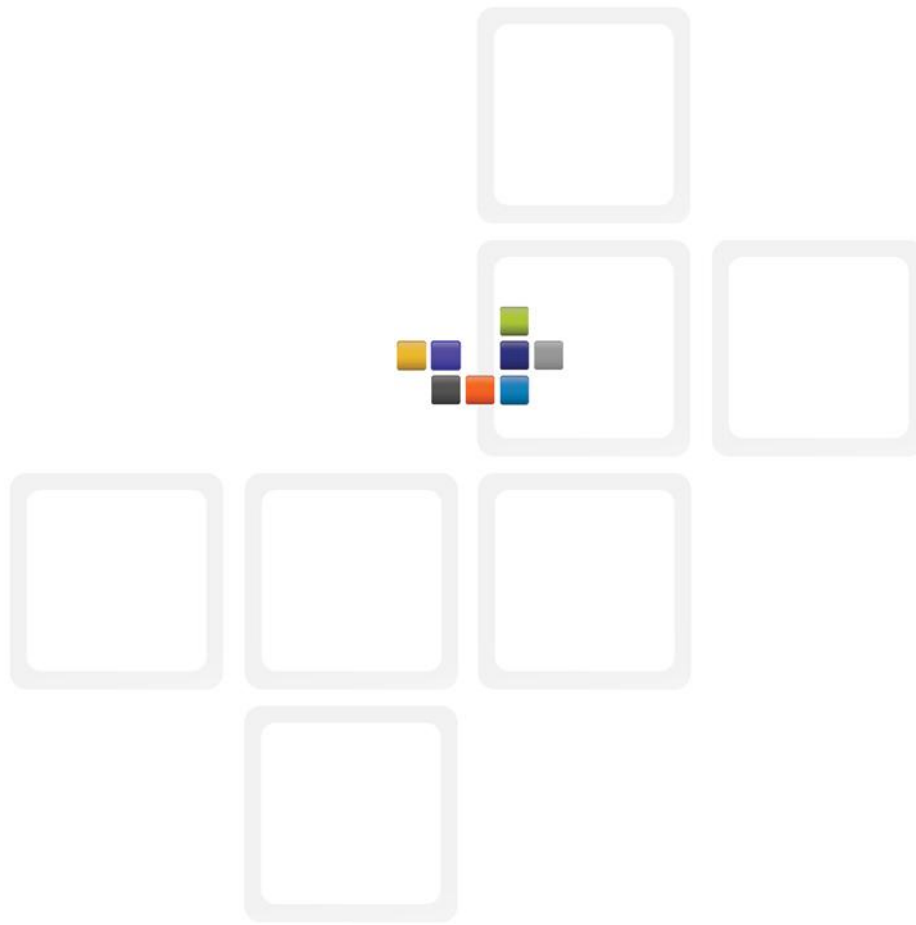
To help us improve our documents, please provide feedback at ImplementersLab@emulex.com.

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