Technical Marketing Solutions Guide

Nimble Storage SmartStack
Getting Started Guide
Cisco UCS and VMware ESXi5

Document Revision

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OVERVIEW

The Nimble Storage SmartStack is an example of a converged infrastructure for virtualization, building upon the basic components of storage, network, compute and hypervisor. Once the basic environment is assembled, the specific use cases for the virtualized infrastructure are left to the reader.

Audience

This Getting Started Guide was developed to help new SmartStack administrators quickly setup a Nimble Storage, Cisco UCS and VMware ESXi5 environment as defined in many of the Nimble Storage SmartStack solutions.

It is not intended to be a complete implementation or customization guide. Where choices are available, we will identify the optimal or chosen methods applicable to the particular area.

If you have further questions, please contact Nimble Storage, Cisco or VMware technical support.

This guide is intended for administrators and architects new to Nimble Storage UCS SmartStack solution configurations. It will cover most of the basic setup steps and considerations for a reference architecture style deployment.

Assumptions

- General knowledge of Cisco UCS and UCSM – this is not a tutorial on how to set up UCS environments.
- Familiarity with Nimble Storage UI and basic setup tasks
- Familiarity with basic setup of VMware ESXi5
- This guide will not address all of the possible configuration options for Cisco UCSM (e. g., pools, and policies). Where the configuration has an impact on the operation of the Nimble Storage solution, details, options and recommendations will be provided.
- This is not a “how to” guide. Step by step setup is not covered, examples of screen shots and settings should be sufficient for the reader to apply the right changes to implement the steps outlined in this guide.

Limitations and Other Considerations

Since this is not intended as a step by step setup guide, some configuration details may be missing (e. g., changing default choices and simple click through steps). If you find trouble in applying the content of this guide, please contact Nimble Storage.

UCS Topology Review

This guide is based on the SmartStack configuration approach to deploying UCS. There are alternate UCS network topologies possible. Pay particular attention to determining if you need a single iSCSI subnet or if you need dual subnets for network diversity. Nimble Storage can be attached to the Cisco UCS systems in one of two basic methods:

- Directly to the Fabric Interconnect (FI) ports as an Appliance Port storage component, or
- Attached to an access layer switch (e.g., Nexus 5K) as a general purpose iSCSI storage system.

Nimble Storage SmartStack solutions are based on the Fabric Interconnect topology. This getting Started Guide is not intended to cover all of the various scenarios and options for connecting iSCSI storage to a Cisco UCS environment; but is focused on the SmartStack configuration aspects. The next sections will highlight a few of the considerations in the two choices. For more information about general purpose connectivity, please consult with your Cisco UCS solutions team.

UCS operation mode determines how the Fabric Interconnects forward network traffic. Note that in this case we are only interested in the Ethernet operation mode. Ethernet End-host mode is the most common setting, and the general case used for SmartStack setup. To confirm which mode you are currently in, perform the following steps from the UCSM GUI:

- Go to the Equipment tab
- Expand the Fabric Interconnects section
- Select one of the Fabric Interconnects and observe the details in the General section.

You should see something similar to this:

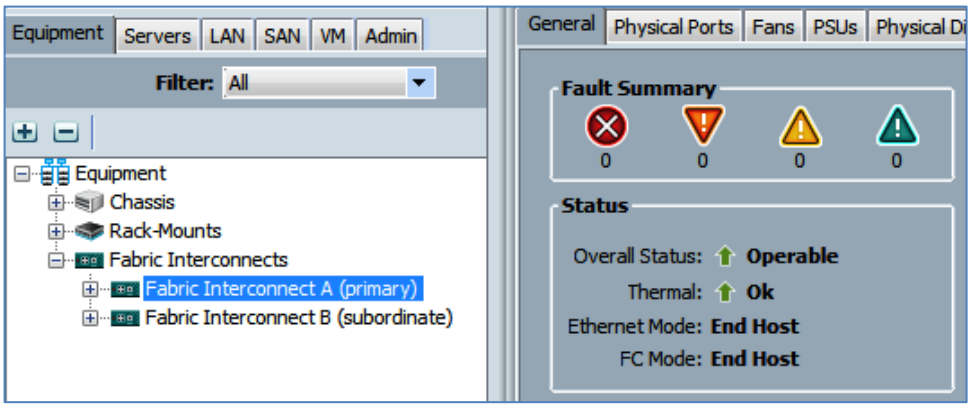

Figure 1 – Equipment Tab FI Operation Mode

Fabric Interconnect Only Configuration

In this configuration, the Nimble Storage connects directly to unified 10G ports on the Cisco UCS Fabric Interconnect FI (UPN-6248) devices. This solution illustrates the direct attach cabling option and presents the Nimble Storage appliance closest to the UCS servers – blade or rack series. This configuration requires special testing and certification between Cisco and Nimble. You need to ensure that all CASL and Cisco UCS versions are supported; this should be checked before putting the host into production. From the Nimble Storage side, verify that you are running a current GA release which has been certified to work with Cisco UCS and supported for SAN boot.

From the Cisco UCS side, the authoritative place to verify this information is in the Cisco UCS Hardware and Software Interoperability Matrix:

http://www. cisco.com/web/techdoc/ucs/interoperability/matrix/matrix. html

In this case Nimble Storage is directly connected to the Cisco Fabric Interconnects (FIs) as Appliance ports. Appliance ports are essentially untagged traffic bound for one specific VLAN in the UCS environment. In the below graphic each Nimble Controller uses one interface to connect to FI-A and the other to FI-B (for example tg1 connections from both controllers to FI-A and tg2 to FI-B). In addition there needs to be two separate VLANs (and associated subnet) for iSCSI connectivity. One VLAN will be specific to FI-A and the other will be specific to FI-B. The VLANs should exist only on a single FI and do not allow failover between the FIs. Each UCS blade server profile will in turn need to have a presence on each iSCSI VLAN. This is accomplished by creating a specific vNIC and assigning it a native VLAN of each of the iSCSI VLANs created previously. The host OS will have an IP presence in these subnets and in turn manage MPIO connectivity via these paths.

The connections can be either 10G twinax or 10G optical as long as the SFP+ connectors and cables are supported by Cisco and Nimble Storage.

With the current UCSM Fabric Interconnect architecture, this will result in a dual data path iSCSI network topology – one subnet through FI-A and one subnet through FI-B.

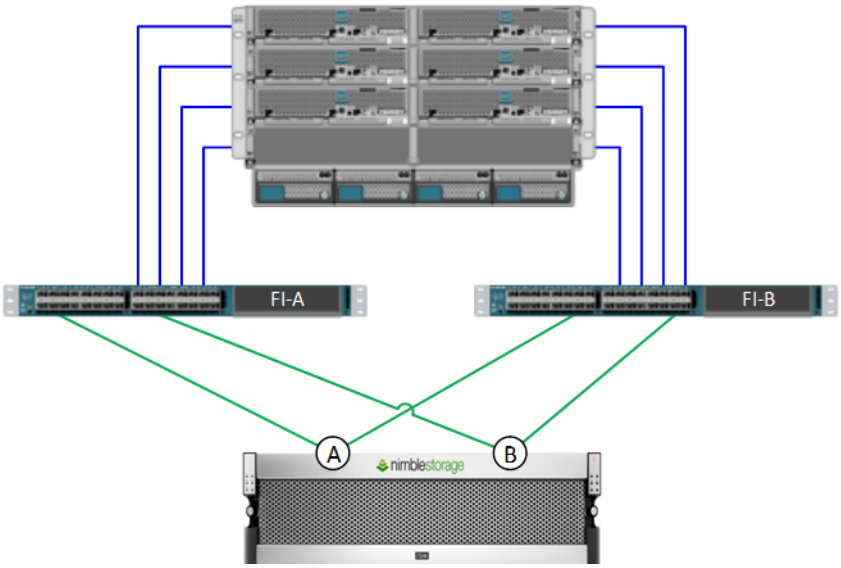

Figure 2 – SmartStack Basic Network Connectivity

Nexus Access Layer Switch Configuration (optional)

It is also possible to connect the Nimble Storage appliance to general purpose access layer switches (e.g., Cisco Nexus 5K) which are in turn connected to the UCS FI switches. This method will work when properly configured; however, this is not the typical specified method for SmartStack UCS solutions.

In this setup, the Nimble Storage appears to the UCS environment as a basic iSCSI storage appliance and can be configured pretty much as you would any iSCSI storage to the rest of the UCSM environment. No special certification is required; however, additional access layer switches are introduced and this brings additional cost and switch configuration complexities. These complexities include additional considerations for VLAN tagging, QoS, and MTU settings.

This approach also allows for non-Cisco hosts to be connected to the access layer switches if desired.

For more information about this particular setup, please consult with your Cisco UCS solutions team.

Configuring Basic Policies and UCSM Settings

There are several basic policies and UCSM settings that are best handled up front before configuring the storage, appliance ports or service profiles.

Jumbo Frames

For proper use of jumbo frame capabilities, you will need to ensure the values are set consistently throughout the entire configuration. For this SmartStack setup, we are using a common MTU value of 9000 size throughout. This includes:

- Nimble Storage
- QoS System Class
- Service Profile vNIC definitions
- Host / Hypervisor physical and virtual network configuration
- Virtual Machine NIC configuration

QoS System Class

On the LAN tab under LAN Cloud, you will find the QoS System Class. One of these entries should be selected for the iSCSI data traffic. For this configuration, we will focus on just the Nimble Storage iSCSI considerations. The choices you make should be weighed with other factors like FC devices and other types of network traffic through and within the UCS FI network.

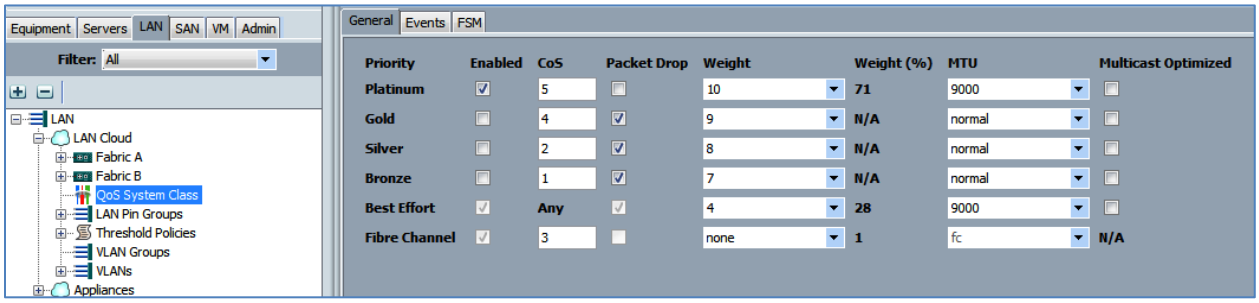

Figure 3 – LAN QoS System Class

For the selection used – in this case Platinum – make sure Packet Drop is unchecked, MTU is set to 9000 for jumbo frames and the weight is increased (or set appropriately) to support high bandwidth iSCSI traffic. In this case, since there is not any FC, we increase the weighting to a little over 70%. Enable the selected policy.

LAN Policies

On the LAN tab under Policies under root level definitions, you will find these key areas to configure: Flow Control, Network Control and QoS.

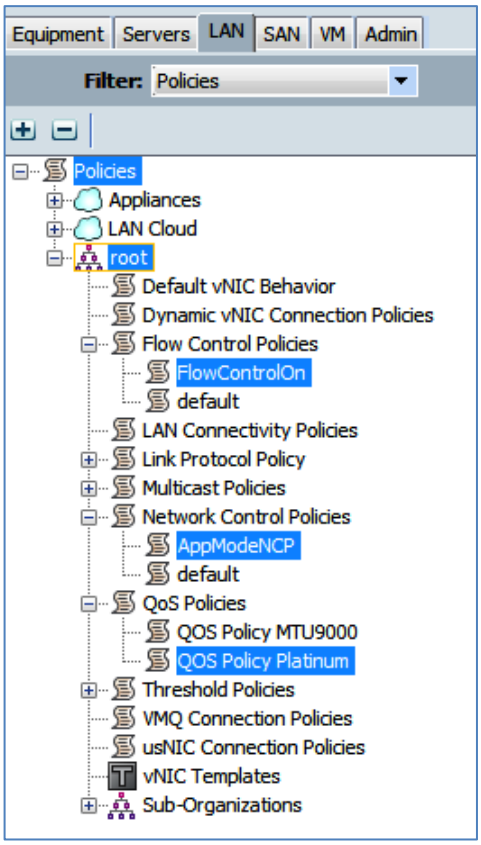

Figure 4 – LAN Policies

Setting Flow Control

Create a flow control policy to use for the appliance port properties. The example below is called “FlowControlOn” and sets the values for receive and send to On.

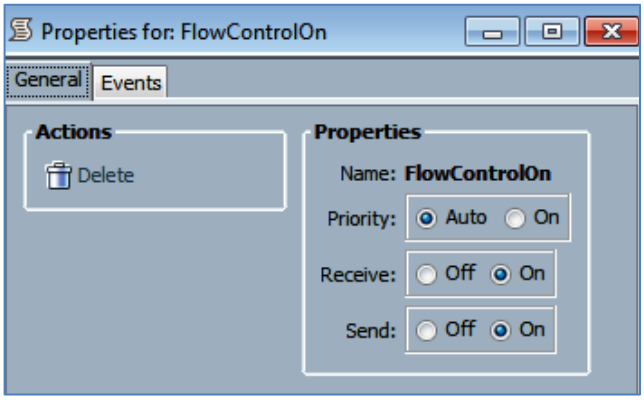

Figure 5 – Flow Control Policy

Network Control Policy

Define a network control policy to disable failure of vNICs in the event of losing FI uplink. The example is called “AppModeNCP”. Set the Action on Uplink Fail to Warning.

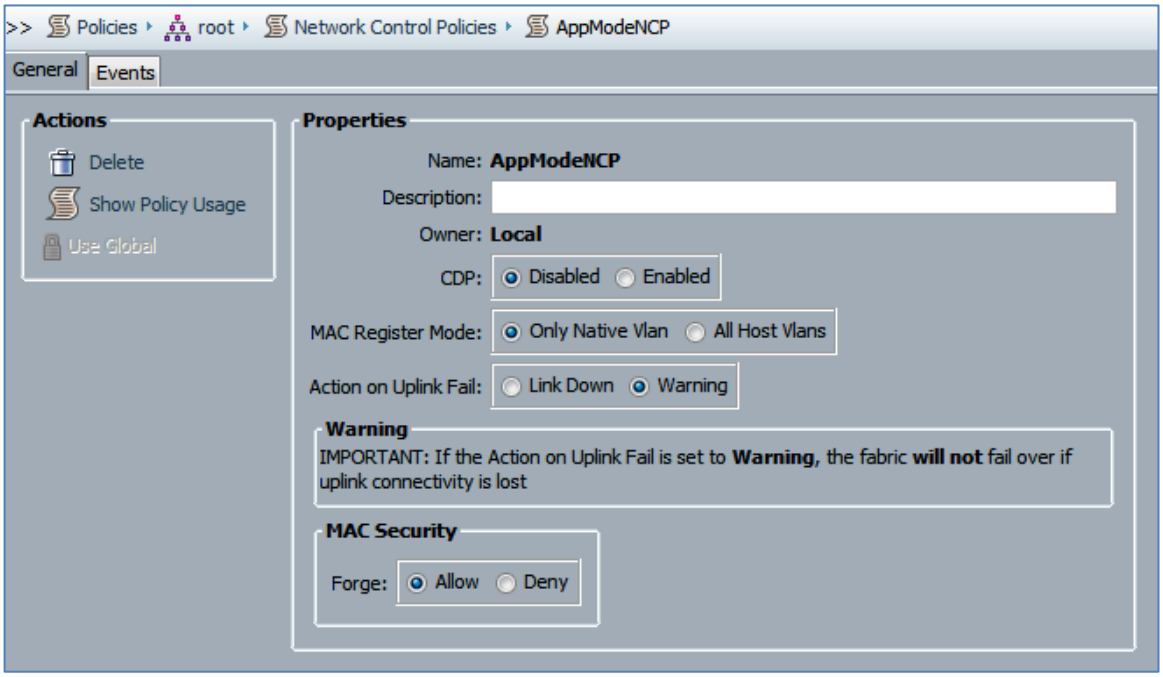

Figure 6 – Service Profile Network Control Policy

Setting QoS

Define a QoS Policy to use with the vNIC definitions. For this configuration we use “Platinum” from the QoS System Class selections discussed above.

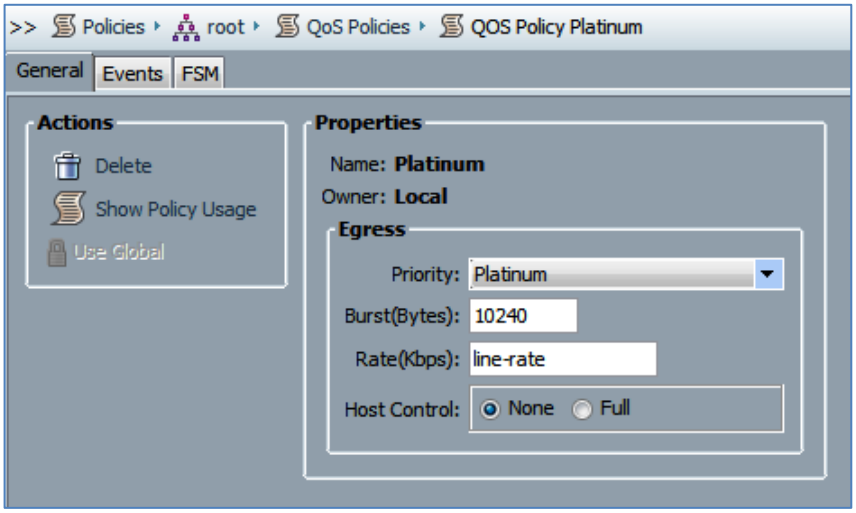

Figure 7 – QoS Policy

Appliance Network Control Policy

It's also important to define a Network Control Policy for the Appliance ports to disable failure of vNICs in the event of losing FI uplink. The example is called "AppNCP". Set the Action on Uplink Fail to Warning.

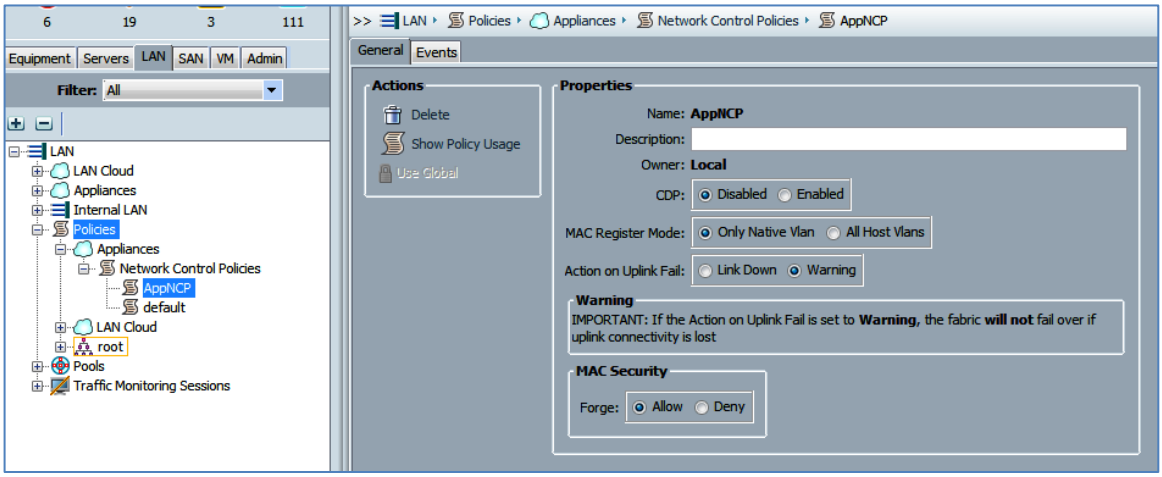

Figure 8 – Appliance Network Control Policy

Appliance VLANs

The final configuration to set up on the LAN tab is the VLAN definitions used to separate the iSCSI traffic between the two FIs (A & B). For this configuration we will define VLANs called "iSCSI-A" and "iSCSI-B" and give them unique VLAN IDs to separate traffic on other network configuration definitions in this guide. These can be defined as dual Fabric VLANs or independently defined in each Fabric. For simplicity of this guide, we have defined them at the combined outer level.

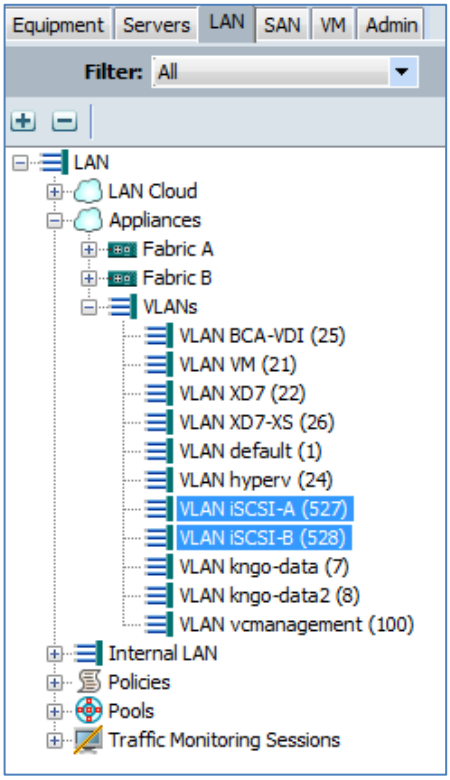

Figure 9 – Appliance VLANs

Configuring Appliance Ports

In this section we will configure the Appliance Ports to support the connectivity of the Nimble Storage.

In UCSM, go to Equipment View -> Equipment -> Fabric Interconnects -> Fabric Interconnect A -> Fixed Module or Expansion Module 2 -> Ethernet Ports

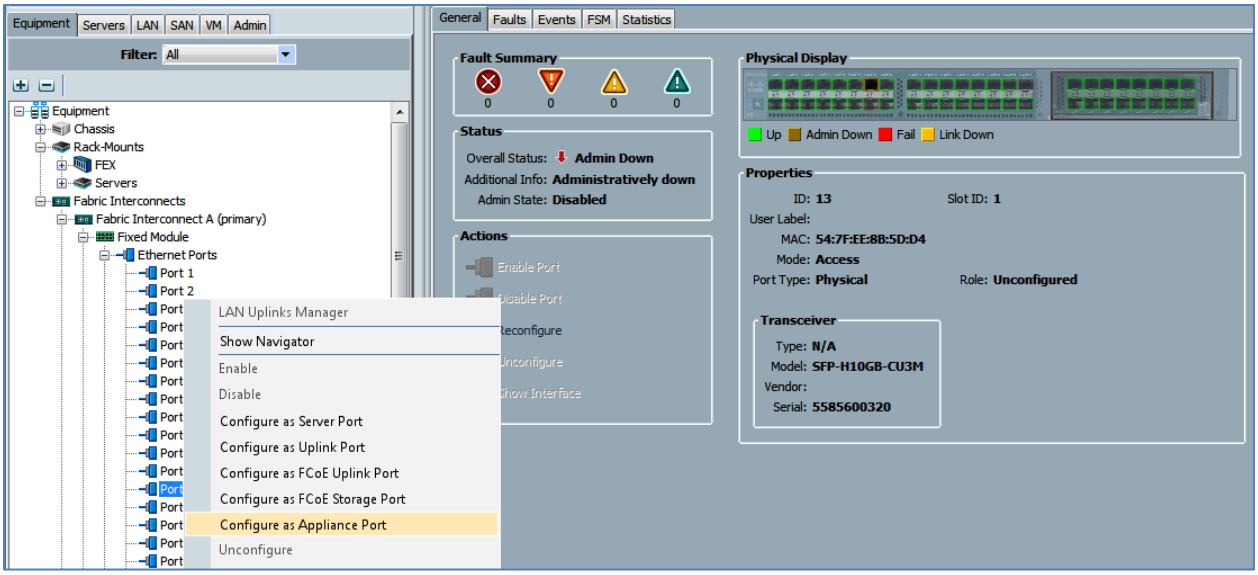

Figure 10 – Configure Appliance Port

From here select the port where you will connect the Nimble Storage and choose Port # -> Configure as Appliance Port

Set the following attributes and choices from the configuration defined above:

- Priority = Platinum
- Network Control Policy = <name> (example = AppNCP)
- Flow Control Policy = <name> (example FlowControlOn)
- Admin Speed = 10Gbps
- Port Mode = Trunk
- Select VLAN and choose Native VLAN – in this case “iSCSI-A”

From the Show Navigator view you should see something like the following.

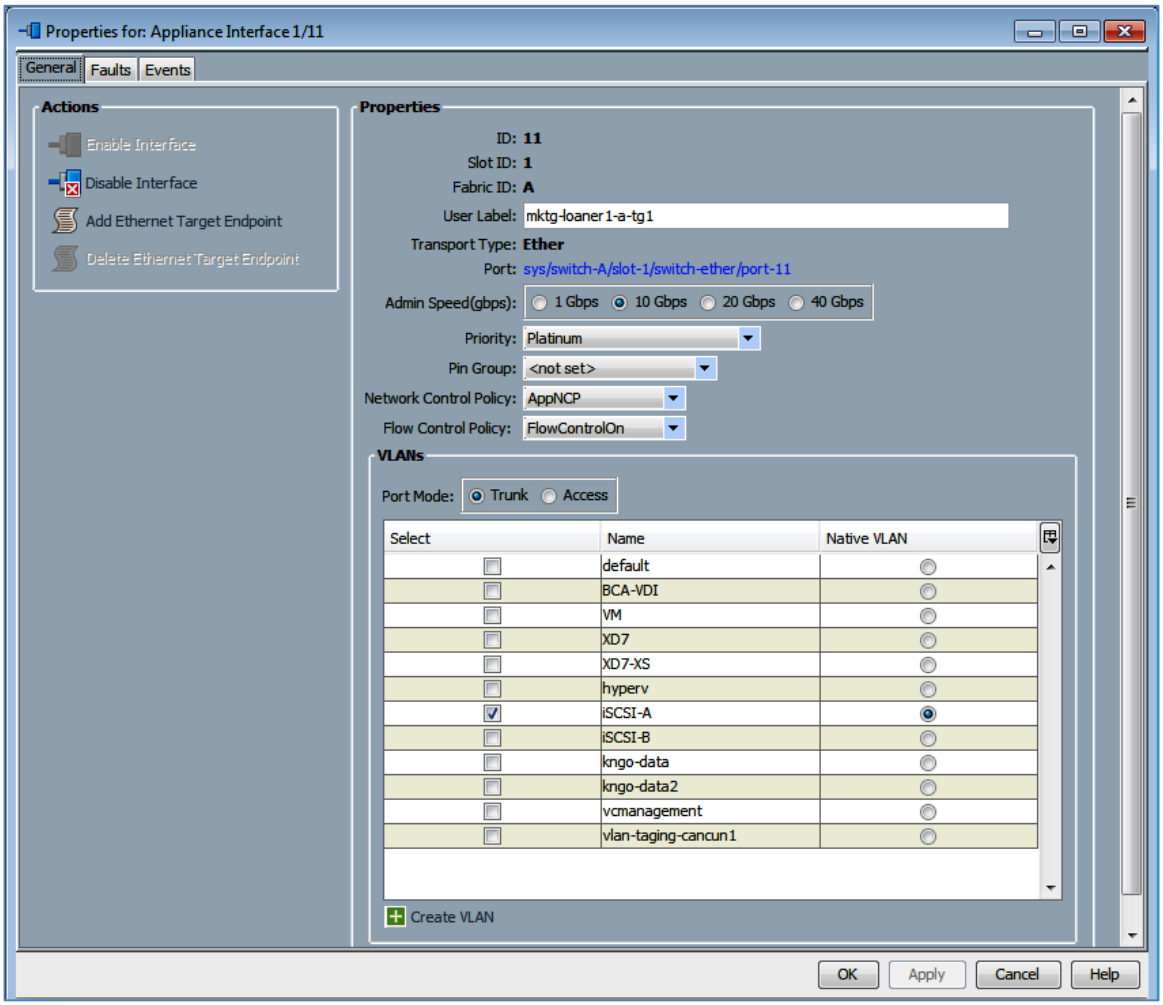

Figure 11 – Show Interface - Appliance Port

Configuring UCSM Service Profile

Once the basic UCSM policies are set up, the Nimble Storage is connected and Appliance Ports defined, you can now work on defining the Service Profile for the ESXi5 host that will be configured. This section will cover the key aspects of connecting the Nimble Storage in the same manner done for the SmartStack solutions. The first step is to create the appropriate Service Profile. We will work from a copy of an existing profile or create a new one. This approach in this guide does not leverage the updating profile capabilities of the UCSM at this time.

vNICs

For the SmartStack configuration, we typically define several vNICs in the service profile. These address basic management connectivity to the host, inter-host cluster traffic, VM traffic between and from the hosts and specifically for Nimble Storage, the iSCSI connectivity to the array through the FI. The iSCSI vNICs will be isolated one to each FI Appliance VLAN defined above.

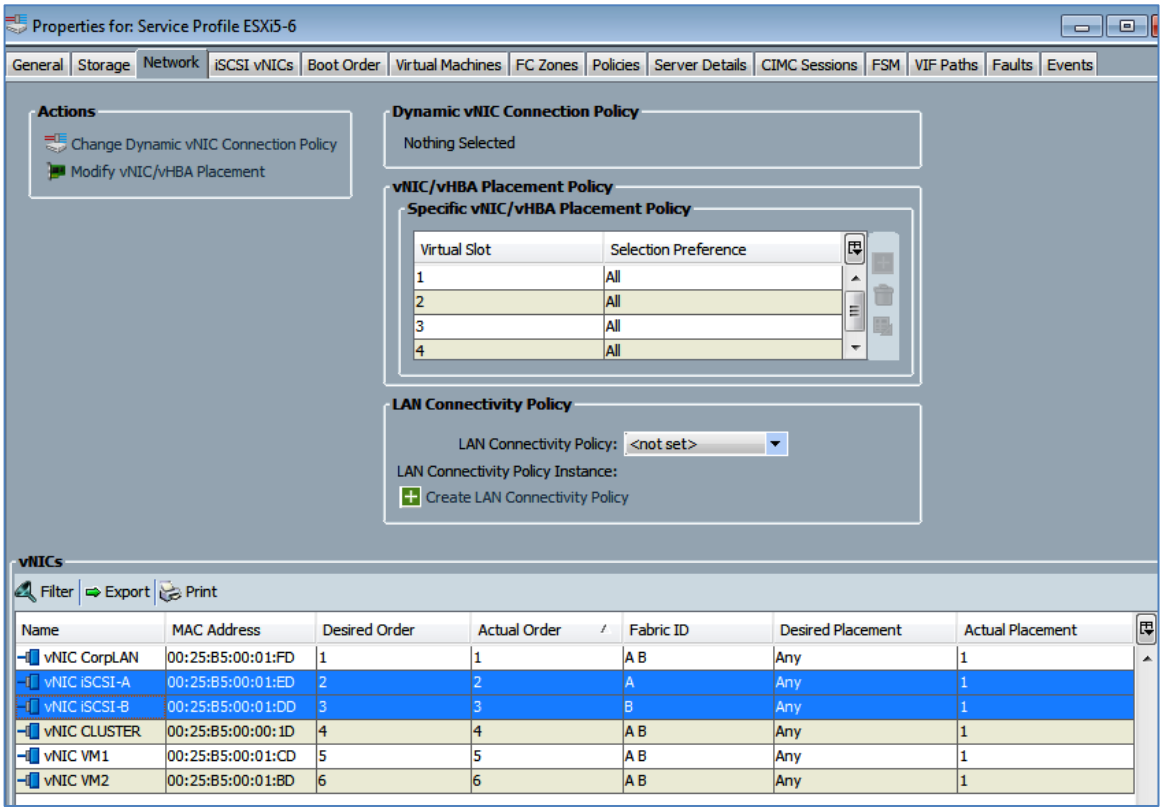

Figure 12 – Service Profile Properties

The details of the specific iSCSI vNIC are shown below. Pay attention to key settings for:

- Fabric ID
- MTU

- Adapter Policy
- QoS Policy
- Network Control Policy

Figure 13 – vNIC Properties for iSCSI

Boot From San – iSCSI BFS – Basic Configuration

Disk and Boot Policy Definitions

Before setting up iSCSI boot from Nimble Storage SAN, you should define some of the basic UCSM policies to use in the service profile. These include: iSCSI Adapter, Boot and Local Disk Policy definitions. Examples are provided below.

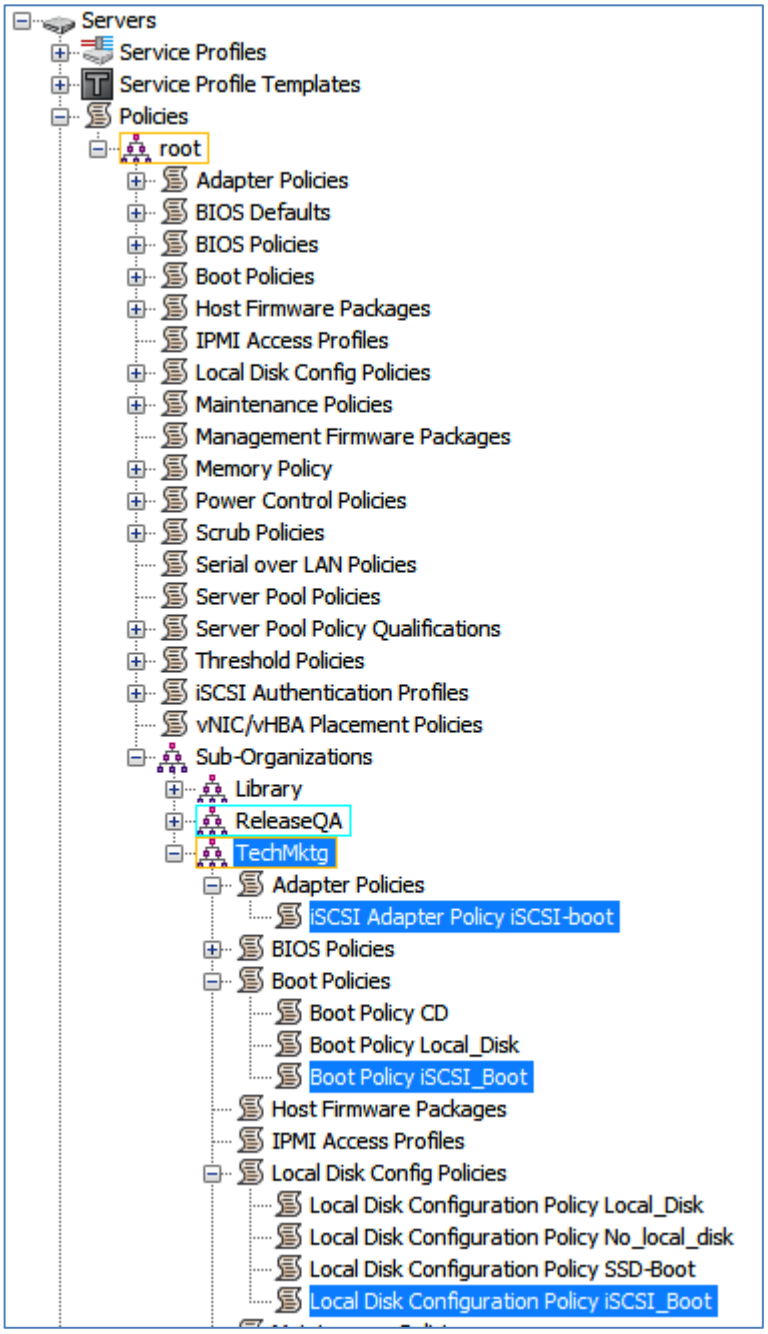

Figure 14 – Disk and Boot Policies

Adapter Policies Example

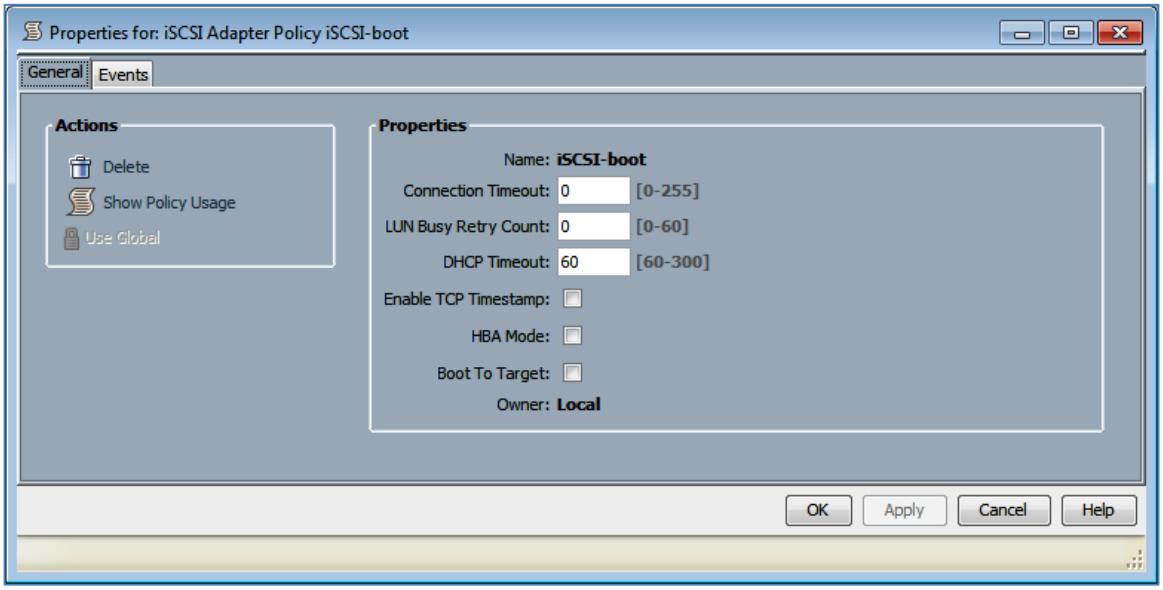

Figure 15 – Adapter Policies

Boot Policies Example

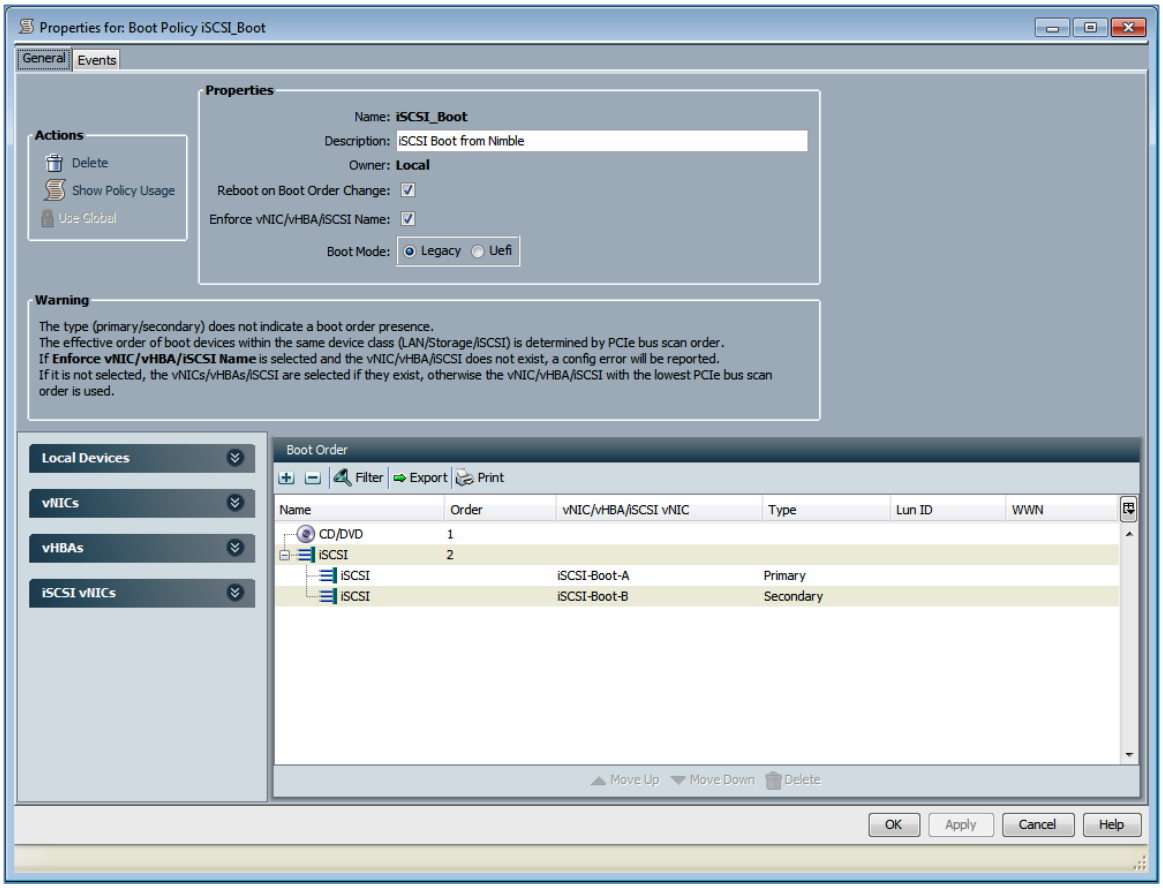

Figure 16 – Boot Policies

Local Disk Config Policies Example

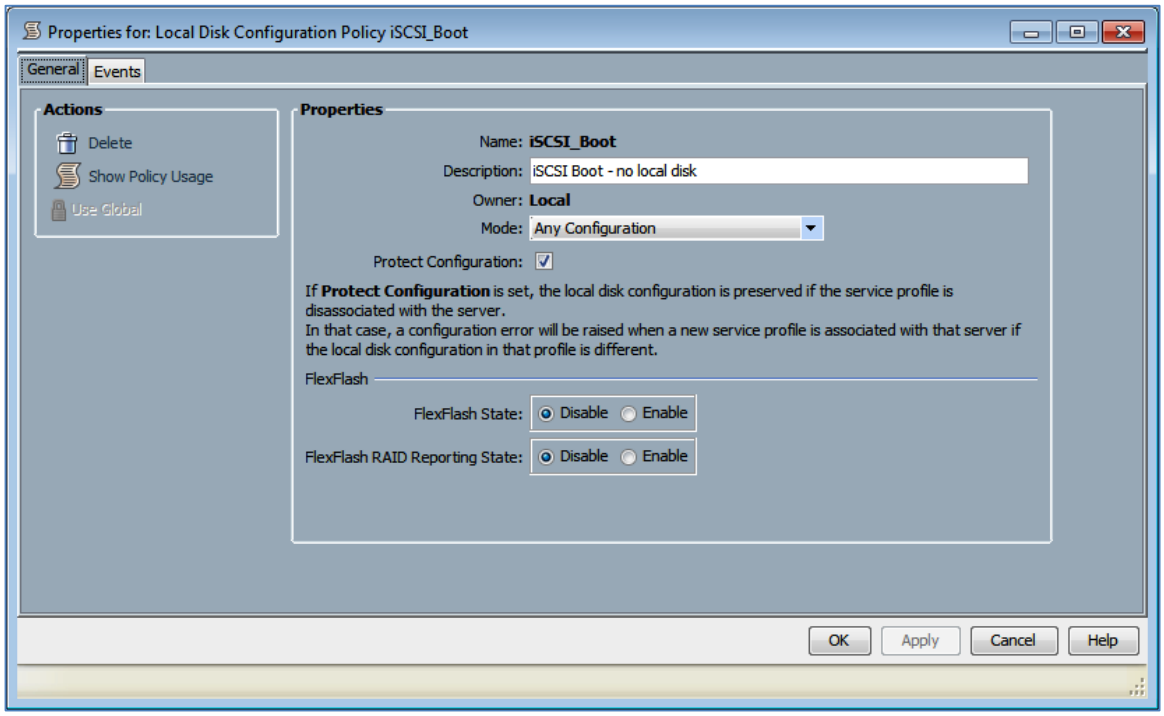

Figure 17 – Local Disk Configuration Policy

For the SmartStack configuration, we are iSCSI booting from the Nimble Storage system. To do this, we have iSCSI vNICs overlaid onto the regular vNICs as shown below. You will need to set the iSCSI Boot Parameter details from the Boot Order tab on the main Service Profile definition. An example of this is shown below. We will need to come back to this panel as part of connecting the Nimble Storage volumes to the Service Profile.

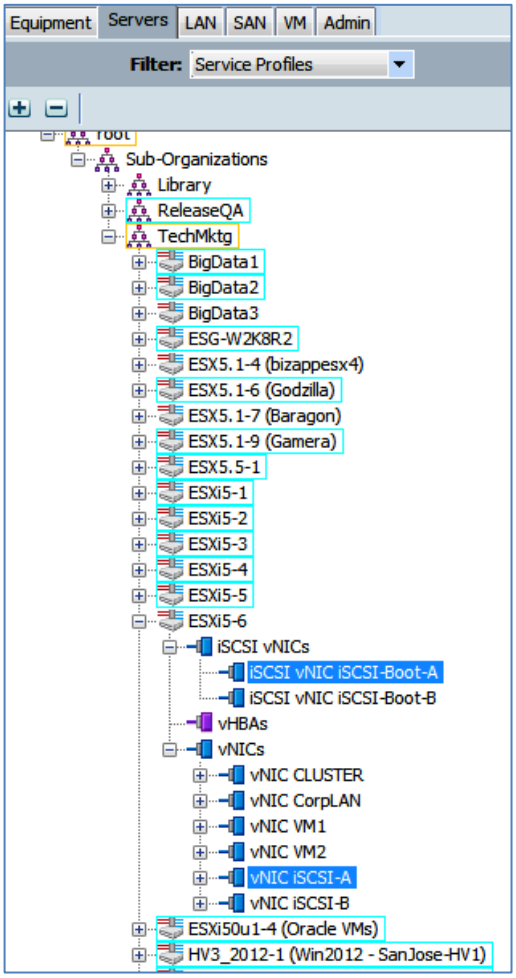

Figure 18 - iSCSI Boot vNIC Overlay

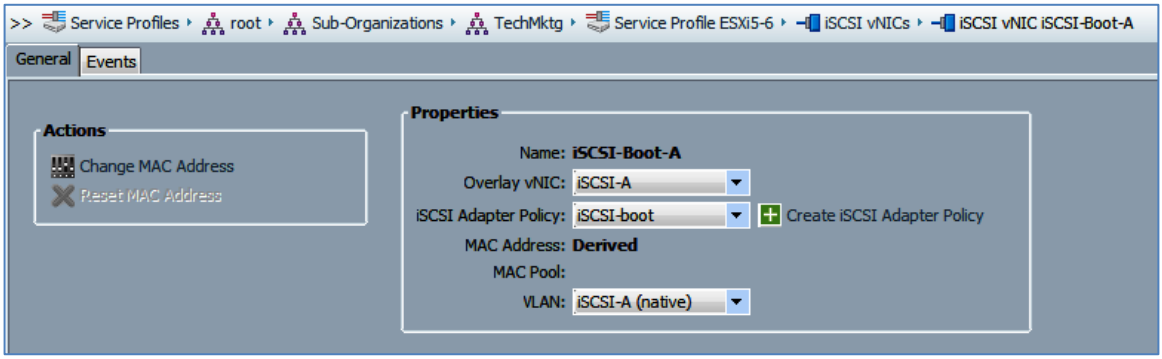

Figure 19 - iSCSI vNIC Overlay Details

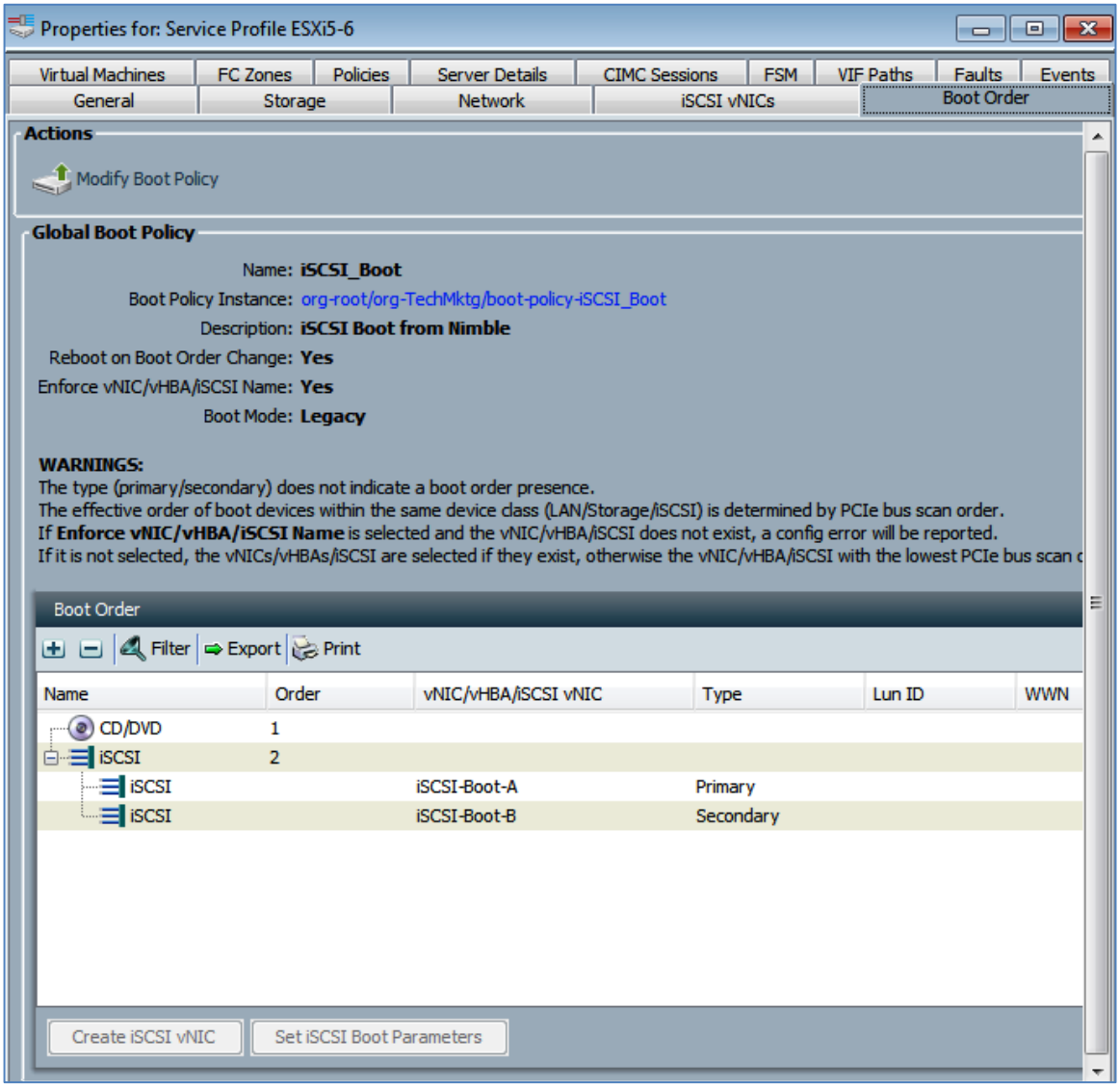

Figure 20 – Boot Order Details

Connecting Nimble Storage

In the SmartStack UCS configuration, the Nimble Storage is connected to the FI switches. The first 10G ports (TG1) from each controller are attached to FI-A and the second 10G ports (TG2) from each controller are attached to FI-B.

In this configuration, the Nimble Storage controller fail-over will always have two paths for MPIO – one through FI-A and one through FI-B. This configuration also covers failure of any networking components (e. g., NIC, cable, or FI) and will not result in data path loss as there will always be at least one active path from the UCS servers to the Nimble Storage.

Network Cabling

Data Ports – connect the 10G (TG1 and TG2) NIC ports on the Nimble Storage to the FI ports as described above and shown in Figure 2 – SmartStack Basic Network Connectivity.

Management ports – connect the 1GbE (eth1 and eth2) NIC ports on the motherboard to the same management network used by other devices connected to the UCS. Note – these ports could be connected to the FI with appropriate GbE SFP modules but this is not the tested solution.

It may also be possible to run management functionality through the 10G ports used for iSCSI data traffic but this has not been tested and is often not recommended.

Jumbo Frames

For this setup, we will assume the use of 10G networking and jumbo frame practices for iSCSI data connections. Set the data ports used for iSCSI traffic to use jumbo frames. For this setup, we will be using MTU=9000 throughout all settings. The key is to consistently set jumbo frame properties throughout the configuration.

To set network interface MTU, open the Nimble Storage management UI and navigate to Administration -> Network Configuration. Then choose the Active Settings and select the Subnets tab. If needed, edit the subnets associated with the iSCSI data networks. In the example below, subnets iSCSI-A and iSCSI-B are configured to use Jumbo MTU of 9000.

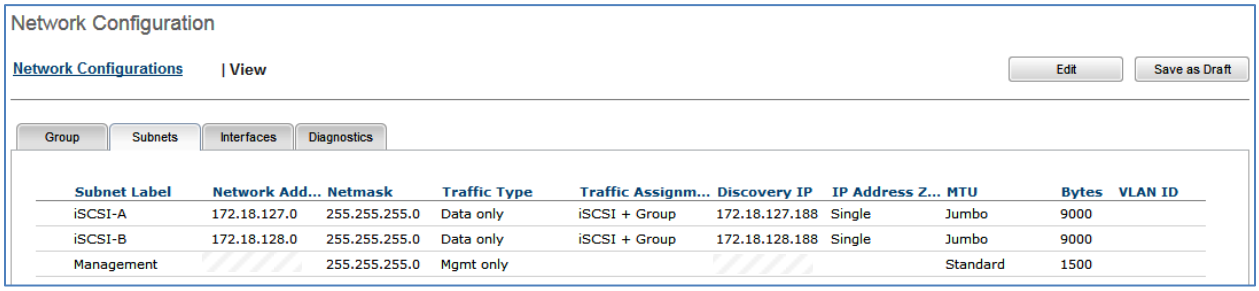

Figure 21 – Setting Jumbo Frames on Nimble Storage

Subnet Definitions

With Nimble Storage 2.1 and later, you can define subnets for the different types of traffic and then associate the NICs with the defined subnets. For our UCS SmartStack setup, we want to define two separate data subnets for the Fabric Interconnects and an additional subnet for the management array UI network. As shown in Figure 21 – Setting Jumbo Frames on Nimble Storage, we have defined two subnets (iSCSI-A and iSCSI-B) to carry Data Only traffic and support the iSCSI and Group traffic. These will correspond to the FI-A and FI-B configuration covered later in this guide. These subnets are set for a Single IP address zone and jumbo MTU. In our example, the subnets are: 172.17.127.0/24 and 172.18.128.0/24

It is important to define an iSCSI Discovery IP address on each of these subnets. This will be used to connect the hosts to the actual Nimble Data ports. The data port IPs are defined on the Interfaces tab as shown below.

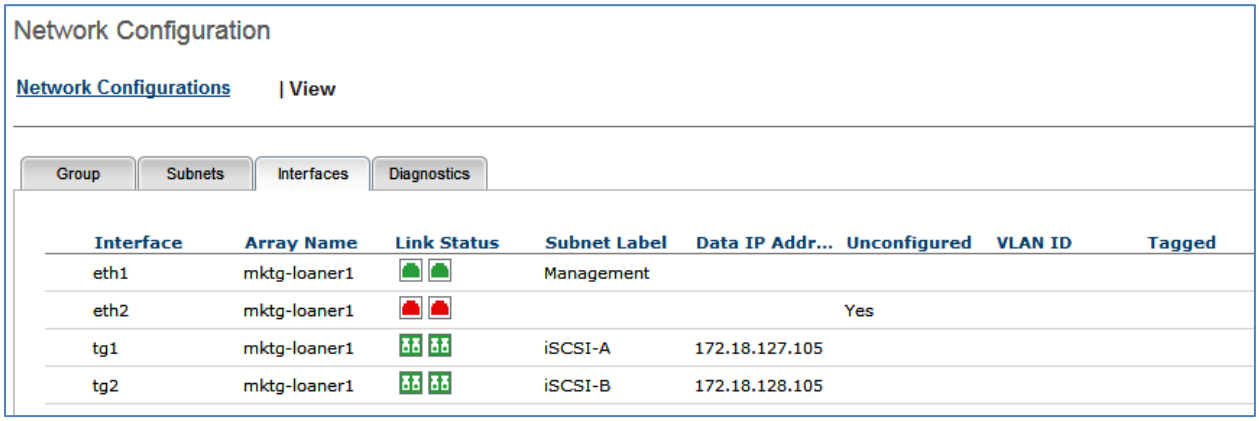

Figure 22 – Nimble Storage Interfaces Setup

Nimble Storage Policies

The following setup steps help define sub policies and configuration options to easier manage the Nimble Storage configuration.

First define a performance policy specifically for the iSCSI boot volumes. We will use the default settings for this configuration. The performance policy gives us another method for identifying distinctions between Nimble volumes within the overall storage setup.

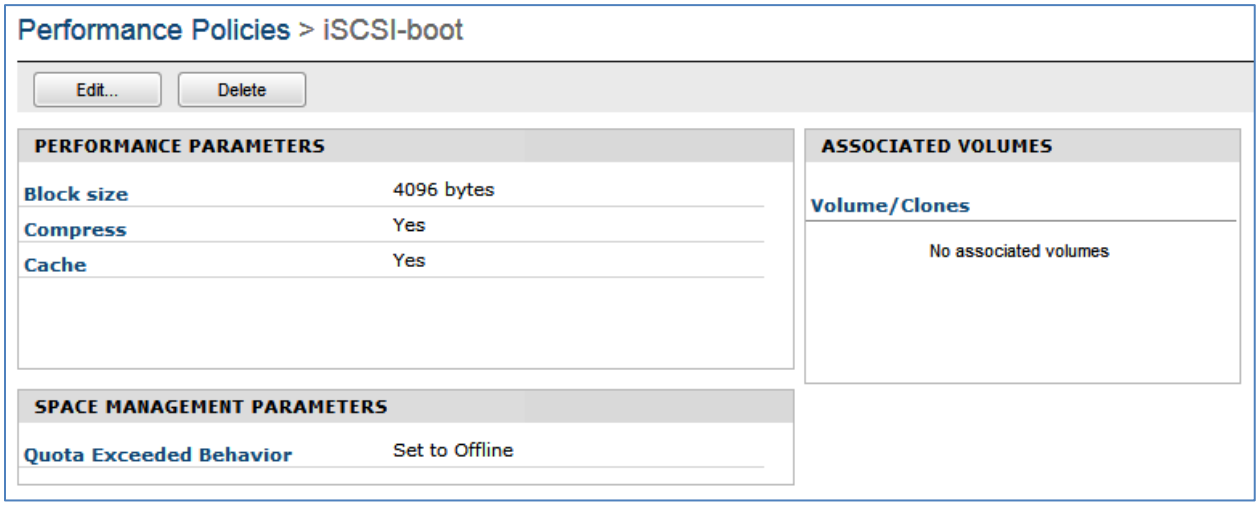

Figure 23 – iSCSI Boot Performance Policy

Define an Initiator Group to associate with the new Service Profile instance created earlier. Initiator Groups provide us a host access control mechanism. For this definition, we will need the IQNs from the service profile we are attaching to this volume. The UCS Service Profile IQN can be obtained from the

iSCSI Boot Parameters details view as shown below. This is also the place where you will set the host side IP address for the iSCSI network connection. In this case we are using static IP assignments. UCSM policy based methods for IQN and IP assignments are outside the scope of this guide. Please consult with a UCS specialist for more information, guidance and options regarding these other configuration option details. For this setup, simply copy the assigned IQN Initiation Name for the service profile for use in the Nimble Initiator Group definition. Get the IQN Initiator Name for both A and B interfaces as shown in Figure 20 – Boot Order Details.

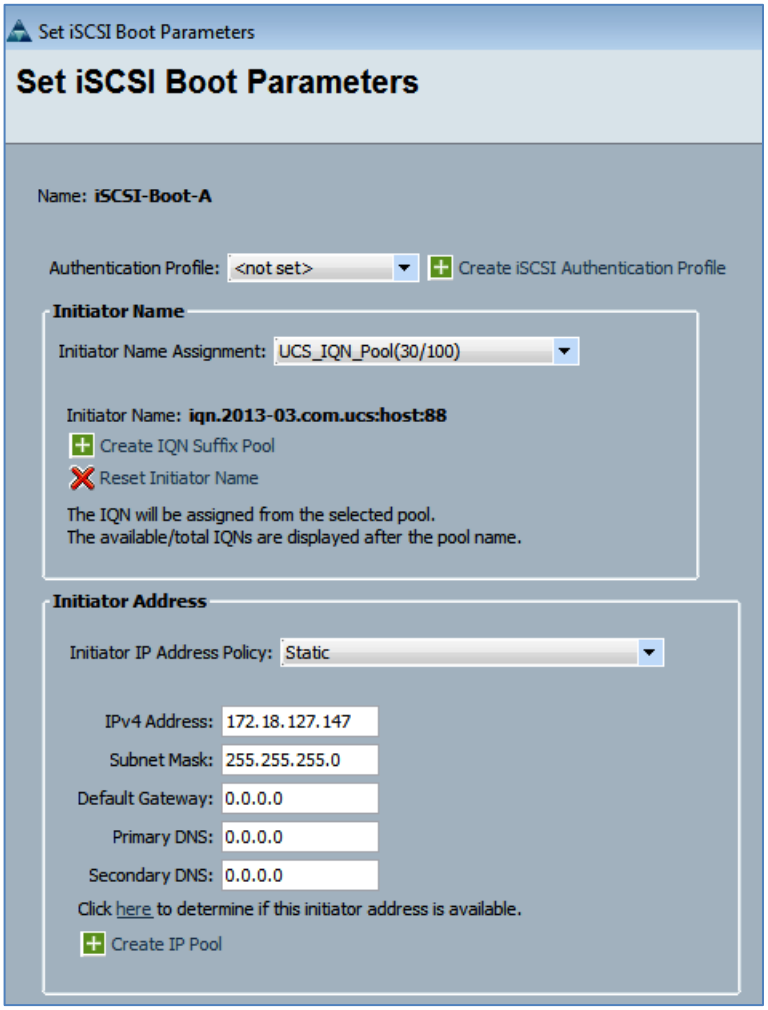

Figure 24 – UCS IQN Boot Parameter Details

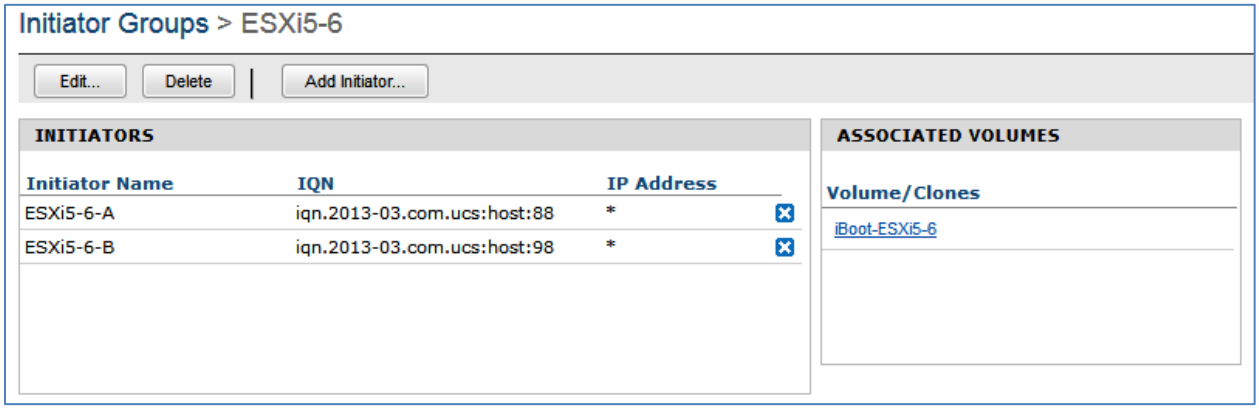

Figure 25 – Nimble Initiator Group Definition

Create the Nimble volume for iSCSI boot. In this example, we are naming the volume “iBoot-ESXi5-6”. The volume is 200 GB in size (thin provisioned by default) and assigned to the ESXi5-6 Initiator Group and the iSCSI-Boot Performance Policy created earlier in this section. We have also opted for no protection (snapshot or replication) at this time.

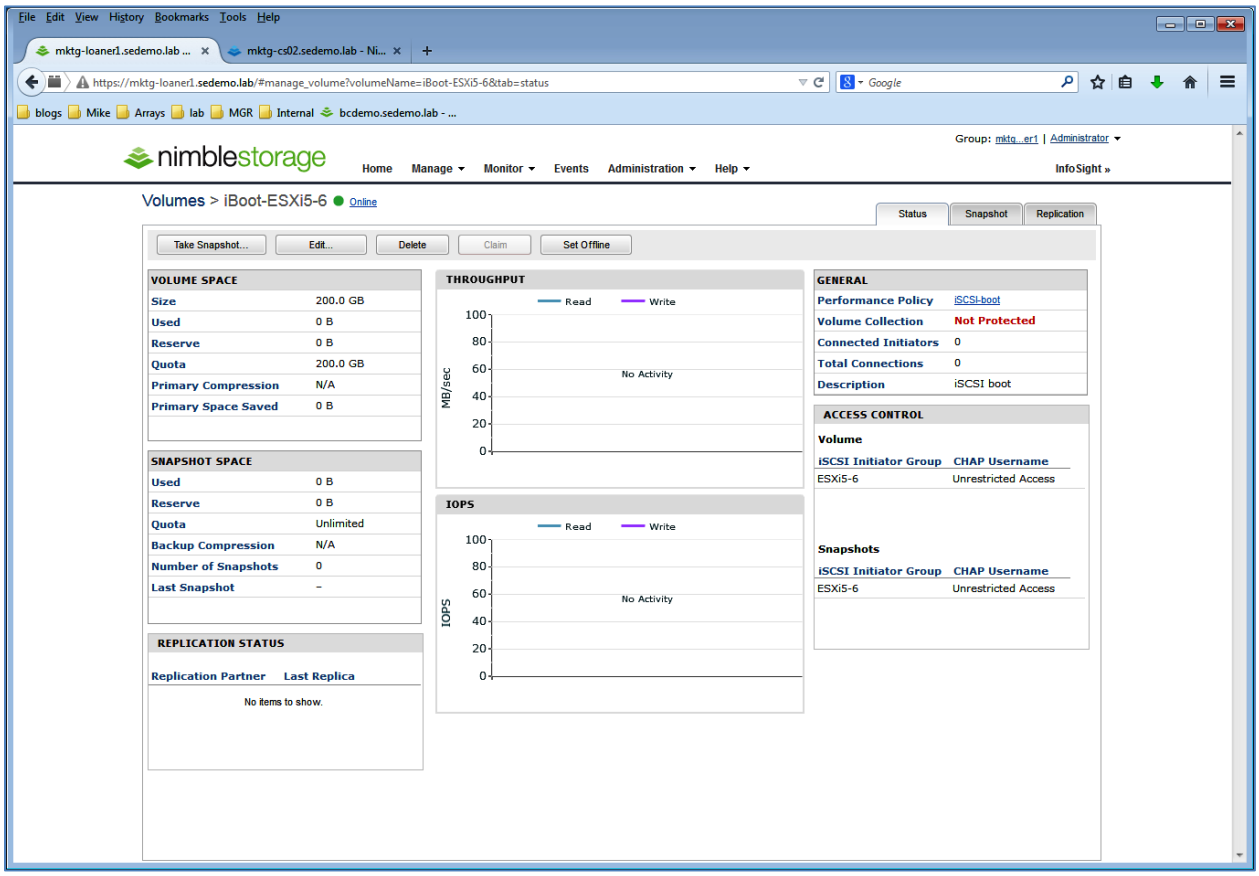

Figure 26 – Nimble Volume for iSCSI Boot

Boot From SAN Details

Settings IQNs and iSCSI Discovery IPs

To get the IQN of the Nimble boot volume, you will need to log into the CLI and perform the following command (Note: the name of the example volume is “iBoot-ESXi5-6”):

```
vol --info iBoot-ESXi5-6 | grep "iSCSI target"

iSCSI target: iqn. 2007-11. com. nimblestorage:iboot-esxi5-6-v730bccdab71a8923. 0000039a.
c41145f9
```

This IQN obtained above then needs to be pasted into the iSCSI Boot Parameter details for the service profile you are configuring. Paste the IQN from the Nimble into the iSCSI Target Name and the iSCSI Discovery IP into the IPv4 Address fields as shown below.

Figure 27 – UCS Boot Parameter Details from Nimble

The iSCSI Discovery IP needed above can be easily obtained from the Nimble through the UI on the Administration -> Network page.

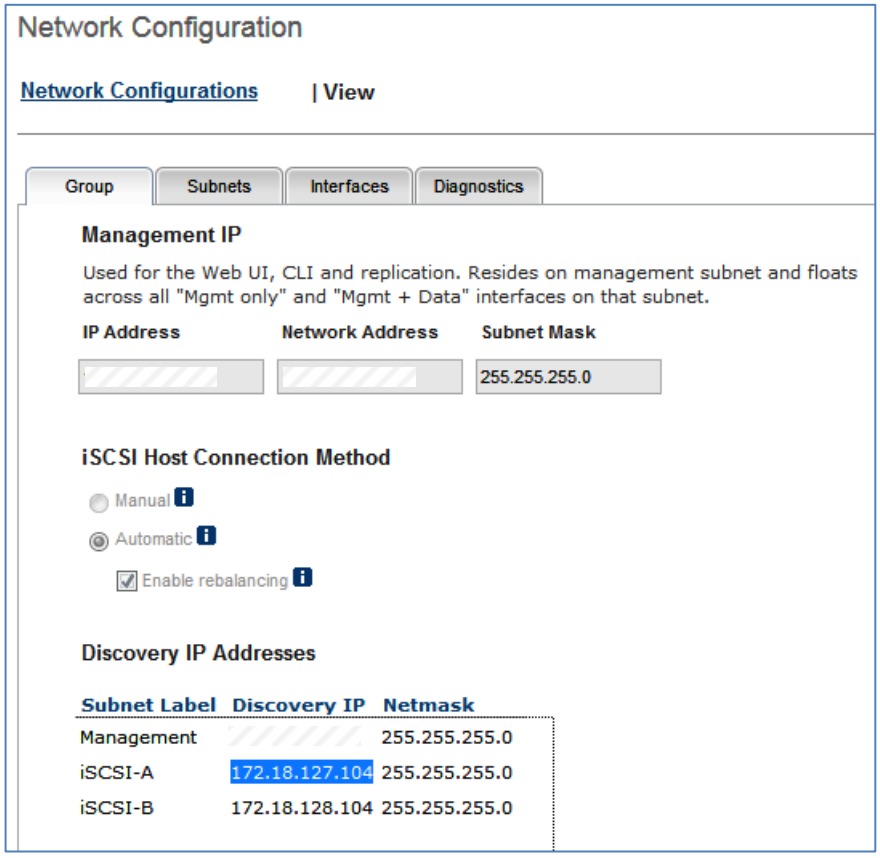

Figure 28 – Nimble iSCSI Discovery IP

Booting from Nimble Storage – Basic Steps

Make sure the Nimble is discovered at the UCSM boot configuration iSCSI level. You should see something like this message on the KVM console.

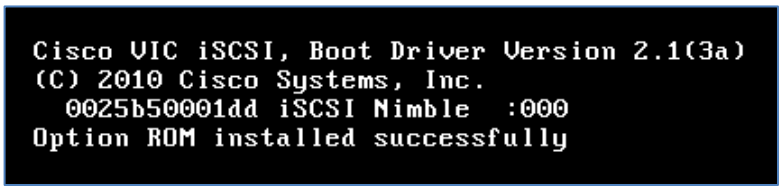

Figure 29 – Nimble Discovered at Boot

The Nimble Storage UI should also indicate that a connected initiator matching one of the Service Profile IQNs is also present as shown below.

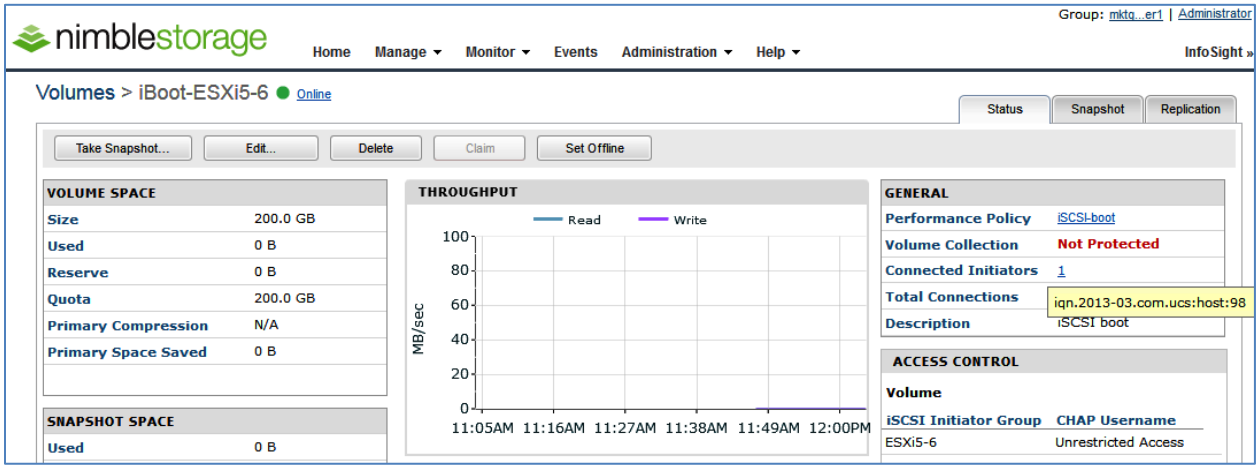

Figure 30 – iSCSI Boot LUN is Connected

Through the UCSM KVM you can attach the appropriate ESXi5 ISO image for installation.

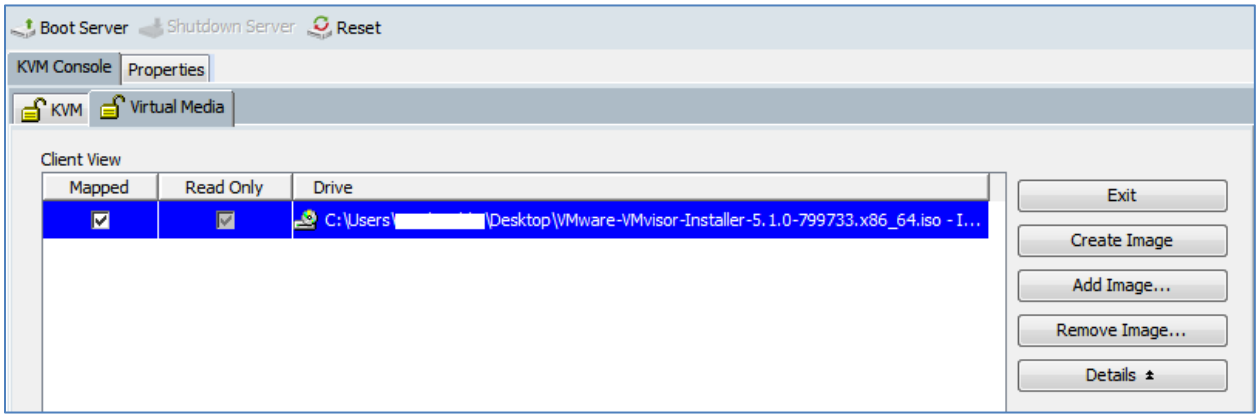

Figure 31 – KVM Attach ESX ISO to Host

On reset, the ESX installer should appear:

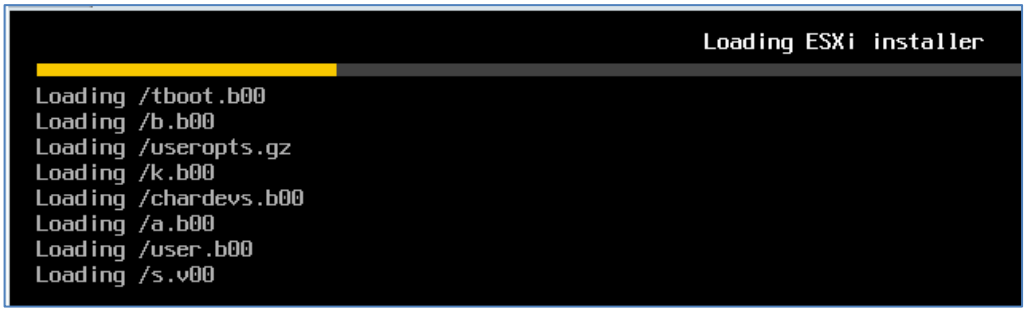

Figure 32 – ESX Installer

Then the Nimble LUN should now be discovered as an option for installation target device as shown below. Select the Nimble Storage device and proceed with the installation.

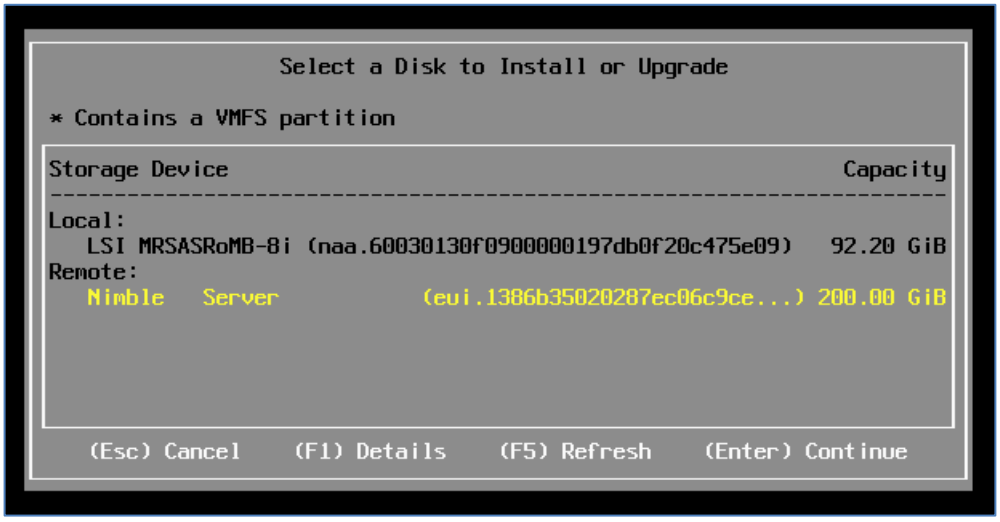

Figure 33 – Select Nimble Boot Device

Host OS Considerations – VMware ESXi5

ESXi 5.x

The complete setup of the ESXi5 host is beyond the scope of this guide. The main steps we have followed in our SmartStack approach are:

- Install ESXi5 to the Nimble Storage iSCSI boot volume
- Bring the host online and perform basic management network setup steps for your environment. This typically includes setting the management IP and enabling SSH/CLI access.
- Join the host to an existing Virtual Center configuration for subsequent configuration. We exploit VMware Host Profiles to assist with much of the standardization steps for consistency. One of the key results of this step is to define the networking setup for the two iSCSI networks that leverage the UCS FI connection architecture. More detail will be provided on this below.
- Install the Nimble Connection Manager (NCM) to enable optimal MPIO with Nimble Storage. This setup is described in further detail below.
- Verify the basic storage, network and hypervisor host setup.

Device Drivers, network settings, MPIO

To set up the Nimble Storage NCM (Nimble Connection Manager) for VMware, first download the appropriate NCM version for connecting to your array. For this configuration, we are using Nimble software version 2.1. Also download the VMware Integration Guide as a useful guide for explaining many other aspects of the VMware support with Nimble Storage.

Once you have the NCM software downloaded from Nimble Storage Infosight, transfer it to the ESXi5 host you just configured. Place it somewhere like /tmp.

To install the software, you will need to put the newly provisioned ESXi5 host into maintenance mode. You can do this through Virtual Center or the CLI with the following command:

```
# vim-cmd hostsvc/maintenance_mode_enter
```

Once this is done, then install the NCM with the following command (change the actual path if you download a different version or place it somewhere other than /tmp):

```
# esxcli software vib install -d /tmp/ncm_2-1-0-0_nimble-ncm-2. 1. 0-500006. zip --no-sig-check
```

You should see results something like this:

```
Installation Result

   Message: Operation finished successfully.

   Reboot Required: false

   VIBs Installed: Nimble_bootbank_nimble-ncs_2. 1. 0-500006, Nimble_bootbank_nimble-psp_2. 1. 0-
500006

   VIBs Removed:

   VIBs Skipped:
```

You can check the results of the installation with these commands:

```
# esxcli software vib list | grep nimble

nimble-ncs                     2. 0. 4-500110                          Nimble  VMwareAccepted
2013-12-06

nimble-psp                     2. 0. 4-500110                          Nimble  VMwareAccepted
2013-12-06

# esxcli storage nmp psp list

Name                 Description

-------------------  ------------------------------------

NIMBLE_PSP_DIRECTED  Nimble Storage Path Selection Plugin

VMW_PSP_MRU          Most Recently Used Path Selection

VMW_PSP_RR           Round Robin Path Selection

VMW_PSP_FIXED        Fixed Path Selection

# esxcli storage nmp device list

eui. c93a31e1f3b4edf76c9ce9002f3db6f5

   Device Display Name: Nimble iSCSI Disk (eui. c93a31e1f3b4edf76c9ce9002f3db6f5)

   Storage Array Type: VMW_SATP_ALUA

   Storage Array Type Device Config: {implicit_support=on;explicit_support=off;
explicit_allow=on;alua_followover=on;{TPG_id=0,TPG_state=AO}}

   Path Selection Policy: NIMBLE_PSP_DIRECTED

   Path Selection Policy Device Config: {policy=iops iops=0 bytes=0 useANO=0 NUM_OF_MEM_ARRAY=0
GROUP_MODE=1 MODE_CHANGED=0 GROUP_ID=0 numIOsForIssueInq=10000 numIOsSinceLastInq=9300
lastPathIndex=1 NumIOsPending=0 numBytesPending=0 }
```

```
   Path Selection Policy Device Custom Config:

   Working Paths: vmhba32:C1:T11:L0, vmhba32:C0:T11:L0

   Is Local SAS Device: false

   Is Boot USB Device: false
```

Finally, remove the host from maintenance mode:

```
# vim-cmd hostsvc/maintenance_mode_exit
```

Network Configuration

To leverage the UCS FI dual subnets, we configure the two vNICs used for iSCSI traffic into appropriate VMware constructs. The vmnic and vSwitch results will look like the examples below.

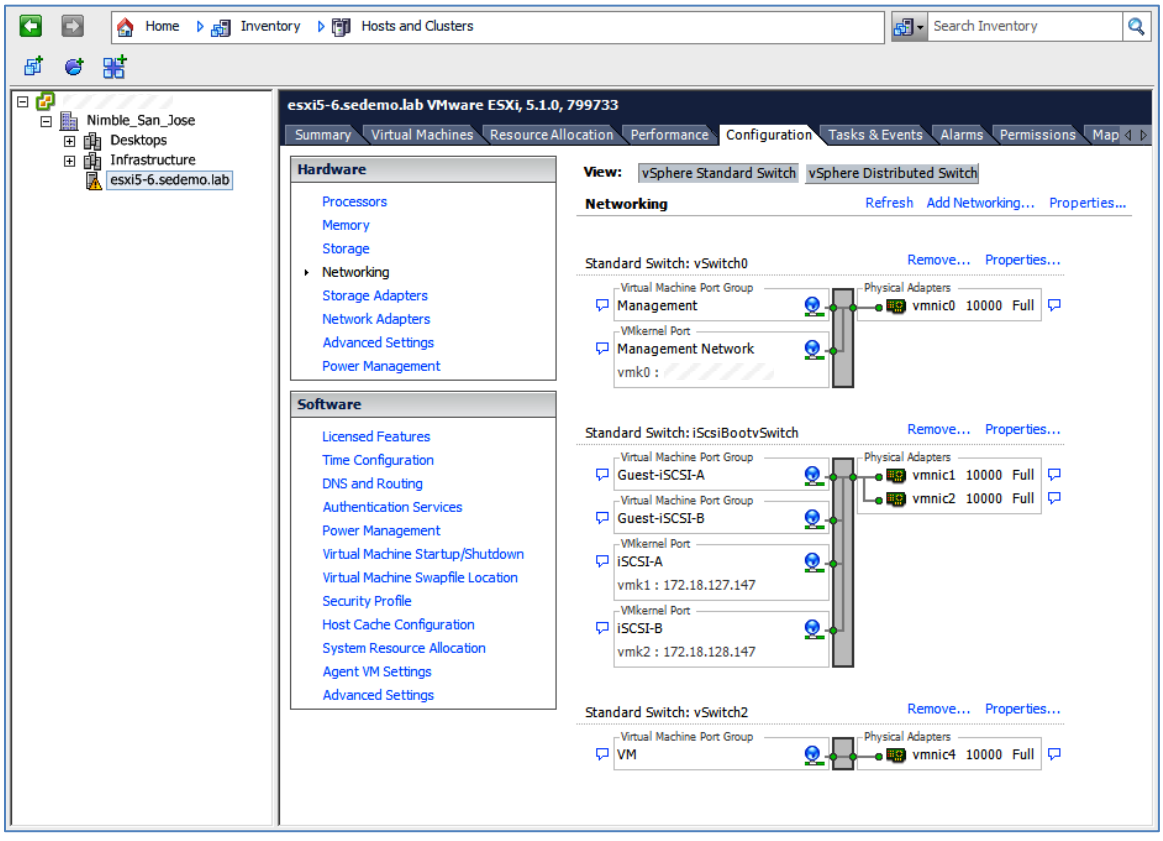

Figure 34 – ESX Network Configuration

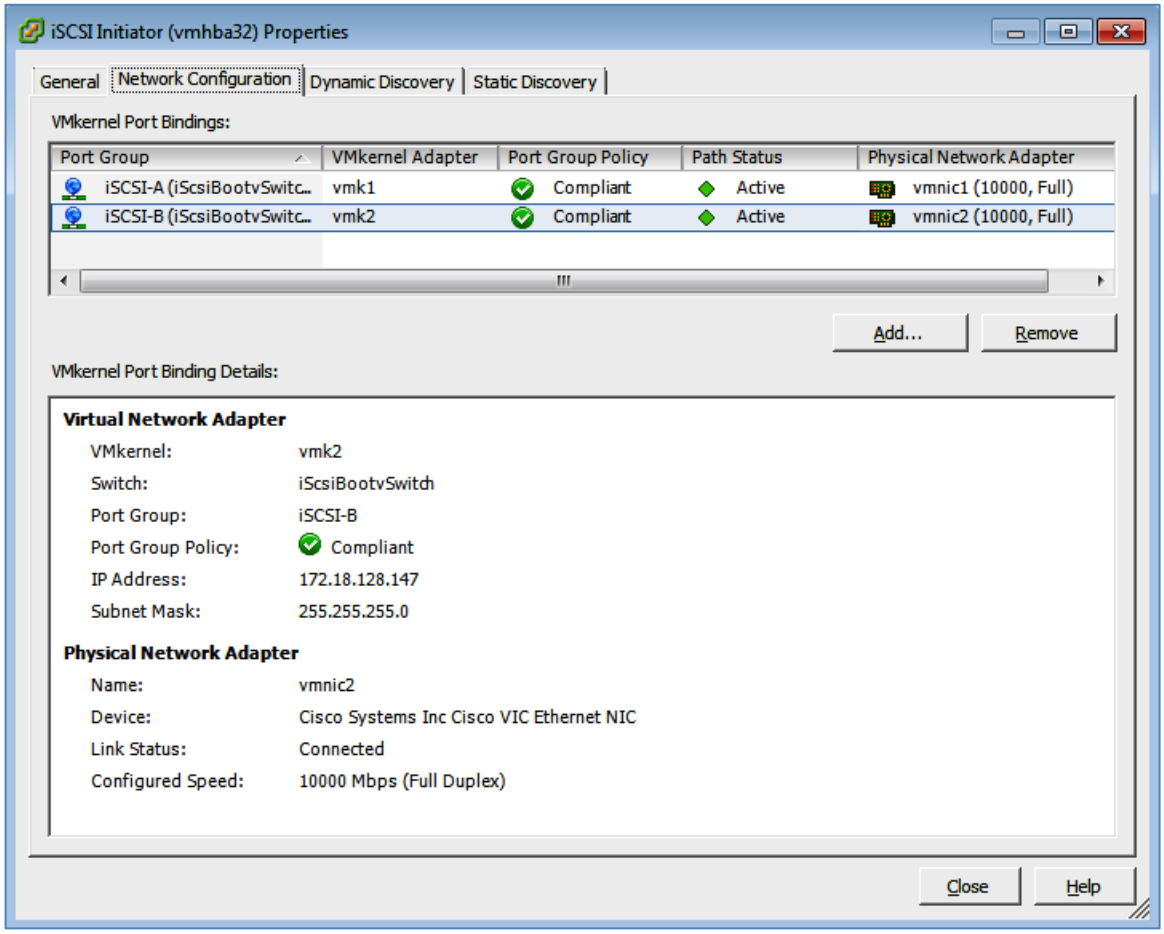

Figure 35 – ESX iSCSI Initiator Properties

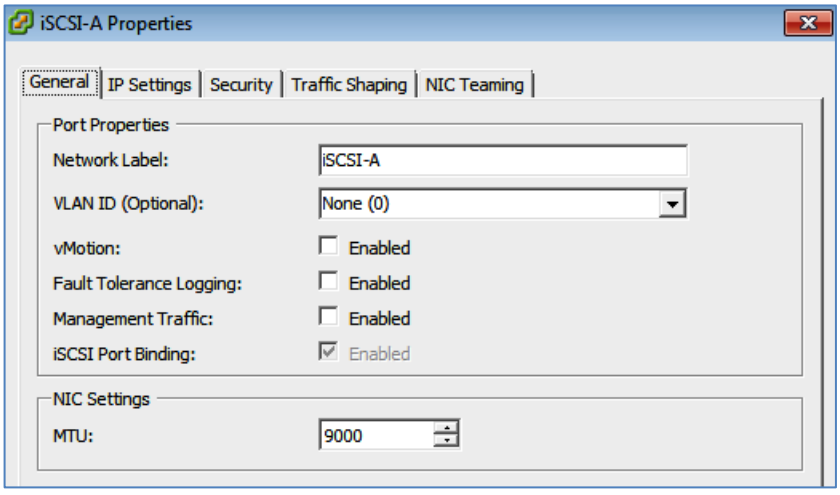

Figure 36 – ESX iSCSI General Properties

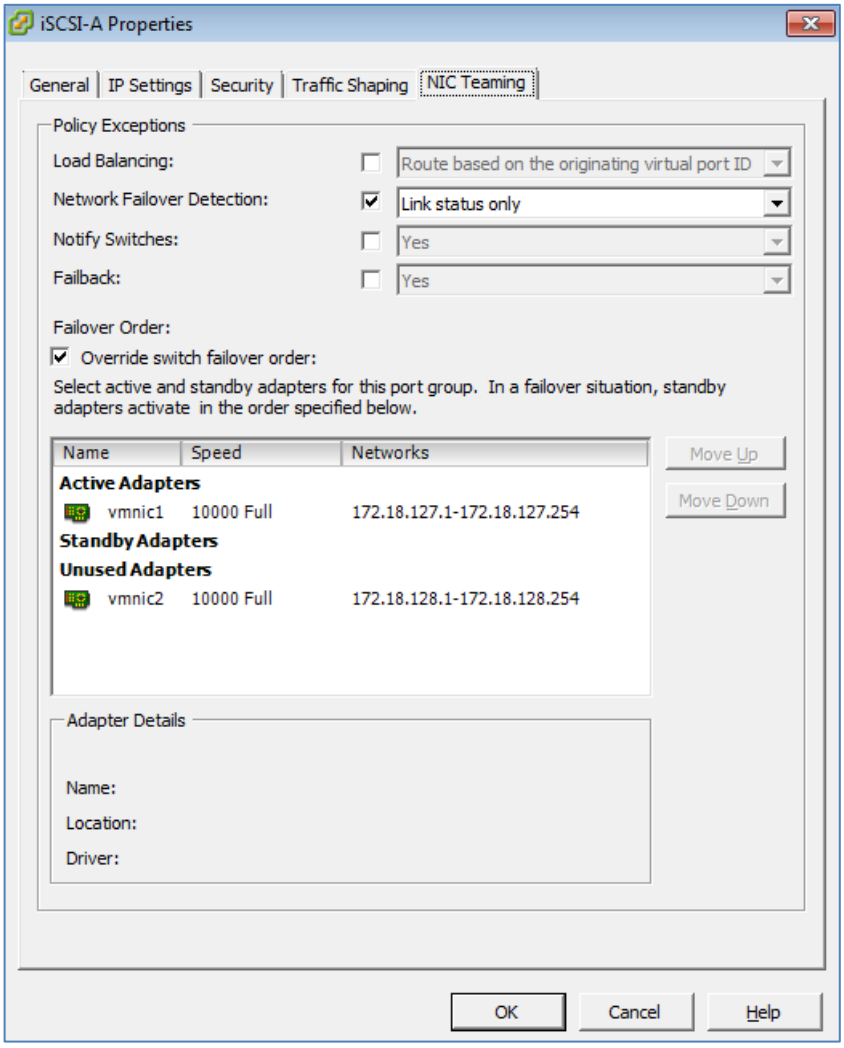

Figure 37 – ESX iSCSI NIC Teaming

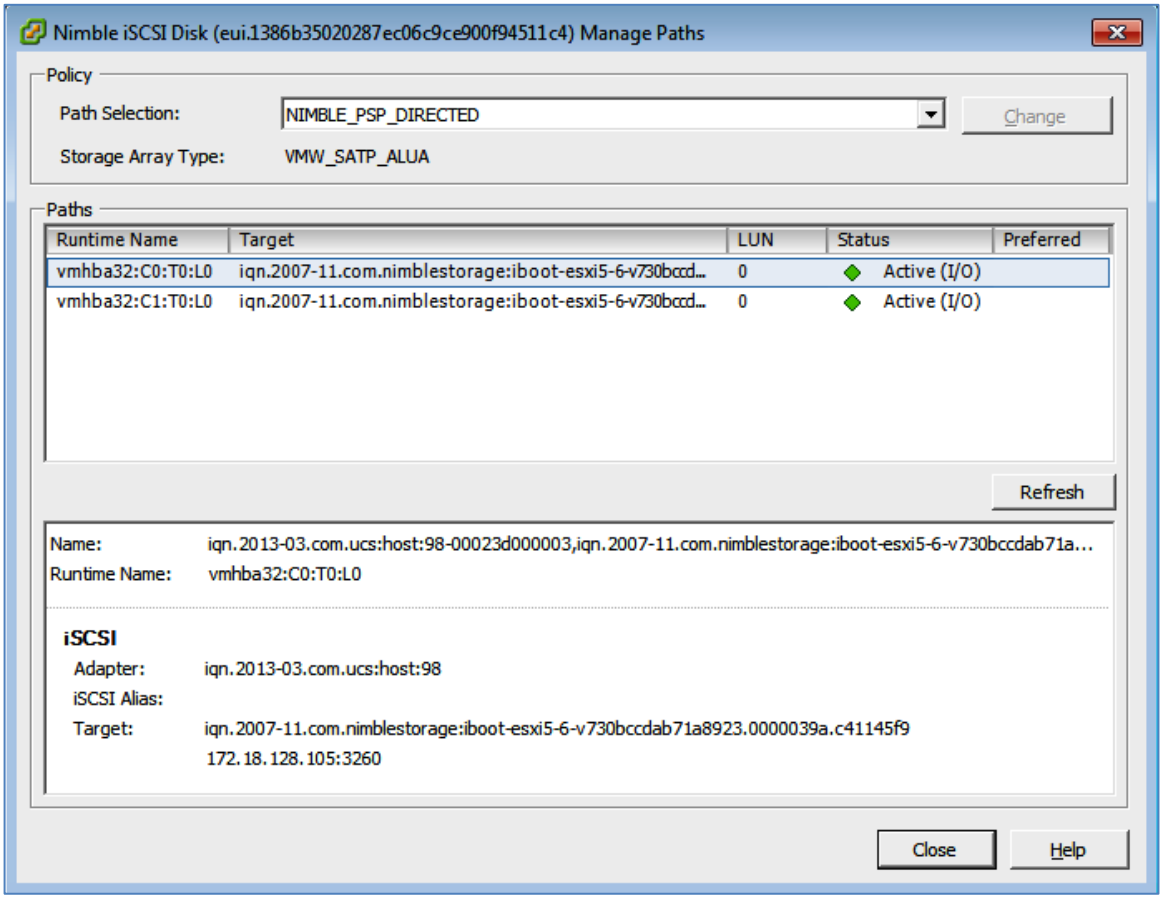

Figure 38 – ESX iSCSI Paths and PSP

Summary

This document provides a high level set of steps that can be followed to help get started with configuring Nimble Storage, Cisco UCS and VMware ESXi5 to form the basis of the Nimble Storage SmartStack integrated infrastructure solution suite. With a little experience in the base products from Nimble Storage, Cisco and VMware, this guide should help you get on the right track to supporting many of the SmartStack solutions built on these technologies.

For more information, contact your local integrator or vendor for more details.

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