Running vSphere 4 of HP P2000 (formerly MSA2000) SAN Solutions

The Unofficial Guide for HP P2000 setup for VMware vSphere Revision2

This document presents important configuration guidelines, best practices, and answers to frequently asked questions that will help you accelerate a successful deployment of VMware vSphere 4 on HP P2000 SAN Solutions.

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A quick note

The original HP document on the P4000 SAN uses screenshots from ESX hosts. This guide will be using screenshots from ESXi hosts. The reasoning behind this is because full ESX is going end of life after version 4.1. Also the added features of ESX and the local service console are beyond the needs of most SMB's who are just looking for virtualization.

Initial iSCSI setup of the ESX/ESXi servers

Networking for the software initiator

Before SAN connectivity can be established a specific network configuration must be in place. To correctly enable connectivity, two VMkernel ports must be created and each configured to use a separate vmnic port. As a best practice, the VMkernel networks for iSCSI should be separate from the management and virtual networks used by virtual machines. If enough vmnic ports are available, it is preferred to have VMotion and VMware Fault Tolerance (FT) use a separate VMkernel network.

Network port configurations

At a minimum you will need four gigabit network ports in order to provided network separation and redundancy for your cluster. Two of the ports will be used for teaming on your VM Network, while the other two ports are used for iSCSI. While more ports are desirable in order to separate out FT and vMotion traffic, less than 4 ports is NOT recommended for use with the HP P2000 SAN as multipathing is not possible while maintaining a redundant VM Network.

Four network Ports

VMware vSphere 4 servers with four Gigabit network ports can perform better if you separate management and virtual machine traffic from iSCSI, VMotion, and FT traffic. As illustrated in Figure 2, vSphere 4 servers with four Gigabit network ports should be configured with two virtual switches, each comprising two Gigabit ports teamed together. If possible, use one port from each of two separate Gigabit adapters. For example, if using two onboard Gigabit adapters and a dual-port Ethernet card, team together port 0 from the onboard adapter and port 0 from the Ethernet card, and then team together port 1 from the onboard adapter and port 1 from the Ethernet card. This process provides protection from some bus or card failures.

- The first virtual switch should have:
  - A service console (ESX) or management network (ESXi)
  - A virtual machine network
  - vMotion and FT enabled on the VMkernel port is needed
- The second virtual switch should have:
  - Two VMkernel networks, each configured to use a single vmnic

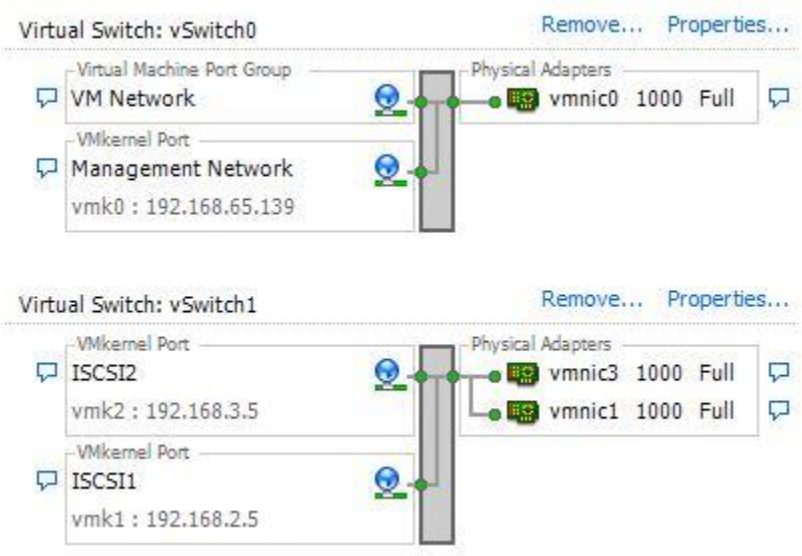

Figure 1 Configuring four Gigabit network ports using two virtual switches

Six network ports

VMware vSphere 4 servers with six Gigabit network ports are ideal for delivering performance with the software iSCSI initiator. The improvement over four ports is achieved by separating VMotion and FT traffic from iSCSI traffic and or VM Network traffic so that they do not have to share bandwidth. iSCSI, VMotion, and FT will perform better in this environment.

To configure vSphere 4 servers with six Gigabit network ports, use three virtual switches, each comprising two Gigabit ports teamed together, as shown in Figure 2. If possible, one port from each of the separate Gigabit adapters should be used in each team to prevent some bus or card failures from affecting an entire virtual switch.

- The first virtual switch should have:
  - A virtual machine network
  - A service console (ESX) or management network (ESXi)
- The second virtual switch, for iSCSI, should have:
  - Two VMkernel networks with VMotion and FT disabled
- The third virtual switch should have:
  - A VMkernel network with VMotion and FT enabled

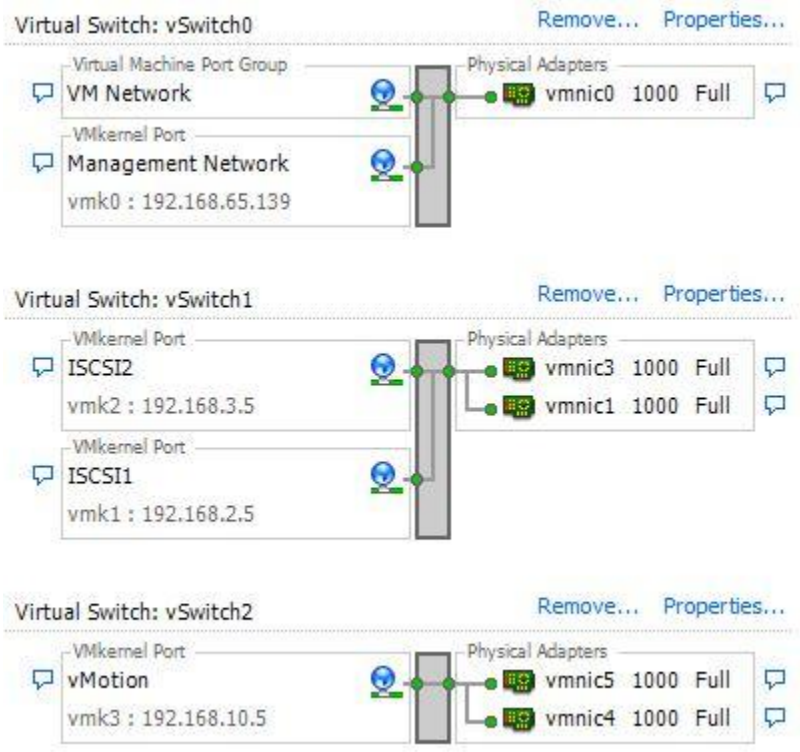

Figure 2 Configuring six Gigabit network ports by using three virtual switches

More than six ports

If more than six network ports are available, you can add more virtual switches for different groups of Virtual Machines. As an alternative you could also add more vmnics to vswitch0 for more bandwidth for the virtual machines in that group. It should be noted that a single virtual machine will only use one vmnic at a time. Therefore if you have 4 vmnics in your VM Network, but only 3 virtual machines you will see no real benefit unless all virtual machines are saturating 1Gbps.

Enabling the iSCSI software adapter

You will need to enable the vSphere 4 iSCSI software adapter on each ESX or ESXi server. The iSCSI software adapter is managed from each server's storage adapters list. Here are some guidelines:

- Enable the iSCSI adapter on each ESX or ESXi server.
- Copy or write down the iSCSI qualified name (IQN) that identifies each vSphere 4 server; it will be needed for authentication later on the SAN. (the best way is to copy and paste them into a text editor to avoid mistakes)
- Reboot the ESX or ESXi server after enabling the iSCSI software adapter if prompted to do so.

HBA connectivity and networking

SAN connectivity via iSCSI HBAs enables both offloading of the iSCSI processing from the vSphere 4 server and booting of ESX itself from the iSCSI SAN. HBAs do not require licensing or special networking within vSphere 4 servers as they provide a dedicated network connection for iSCSI only. The physical network for HBAs should be a Gigabit network dedicated to the SAN, just as it is for software initiators. As a best practice, use two HBA initiators (a dual port or two single ports), each configured with a path to all iSCSI targets for failover. Configuring multiple HBA initiators to connect to the same target requires authentication for each initiator's IQN to be configured on the SAN. Typically this is configured in the HP P2000 software as two servers (one for each HBA initiator), each with permissions to the same volumes on the SAN.

Multi-pathing iSCSI for vSphere 4

Native iSCSI multi-pathing in vSphere 4 provides superior bandwidth performance by aggregating network ports. Configuring iSCSI multi-pathing requires at least two network ports on the virtual switch. The following steps must be performed on each ESX or ESXi server individually.

- Create a second VMkernel port on the virtual switch for iSCSI. (you should already have this if you followed the 4 or 6 port configuration above)
- For each VMkernel port on the virtual switch assign a different physical network adapter as the active adapter. This ensures the multiple VMkernel ports use different network adapters for their I/O. Each VMkernel port should use a single physical network adapter and not have any standby adapters. (See Figure 3)
- From the command line, bind both VMkernel ports to the software iSCSI adapter. The vmk# and vmhba## must match the correct numbers for the ESX or ESXi server and virtual switch you are configuring, for example: (See Figure 4)
    - vmkiscsi-tool -V -a vmk1 vmhba33
    - vmkiscsi-tool -V -a vmk2 vmhba33
- If using ESXi it is important to unbind the vmk0 interface from the software adapter. Or make sure to NOT use a default gateway for your iSCSI SAN ports so that iSCSI traffic does not try to move through vmk0 and possibly a router. (As a side note, if you are connecting to other iscsi or NFS storage devices that are on your normal data subnet (the same subnet as your vmk0) then do not run this command as you will no longer be able to connect to them)
    - vmkiscsi-tool –V –r vmk0 vmhba33

Once configured correctly, perform a rescan of the iSCSI adapter. An iSCSI session should be connected for each VMkernel bound to the software iSCSI adapter. This gives each iSCSI LUN two iSCSI paths using two separate physical network adapters. As an example refer to Figure 5 for NIC teaming tab for VMkernel properties.

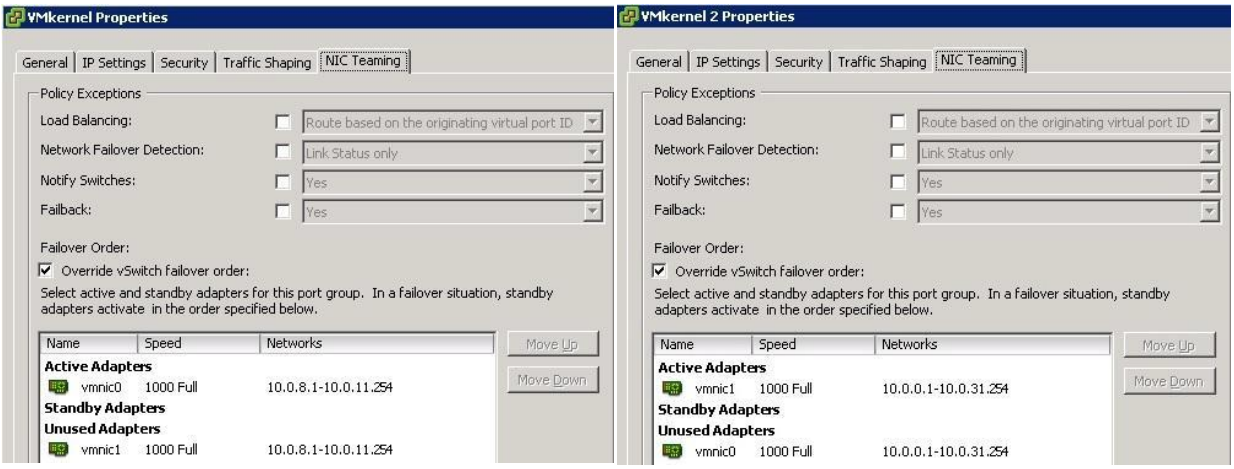

Figure 3 Physical Network Adapter Failover Order for VMkernel MPIO (Multipath I/O)

To achieve load balancing across the two paths, datastores should be configured with a path selection policy of round robin. This can be done manually for each datastore in the vSphere client or ESX can be configured to automatically choose round robin for all datastores. To make all new datastores automatically use round robin, configure ESX to use it as the default path selection policy from the command line:

- esxcli corestorage claiming unclaim --type location
- esxcli nmp satp setdefaultpsp --satp VMW_SATP_DEFAULT_AA --psp VMW_PSP_RR
- esxcli corestorage claimrule load
- esxcli corestorage claimrule run

It is important to note that in order to properly use multi-pathing you will need to utilize two subnets. So for vmnic1/vmk1 you could use 192.168.10.x, and then for vmnic2/vmk2 you could use 192.168.20.x. Then on the P2000 you configure each controller with one port in each of the subnets. This will allow you to use two physical switches, or a switch stack with multiple vlans.

Physical network configuration

Multi-pathing allows you to create two physical paths from the SAN to your vSphere hosts. Two paths allow for hardware failure without interrupting production, and also allows for future network upgrades without downtime. There are several possible ways two create switch redundancy most cost effective way for the SMB is to use two HP 2610al switches. (Or similar, gigabit ports are the only requirement, however high packet switching rates are a plus) Both switches are stand alone and in their own collision domains. They should NOT be a link between the two switches. Then one port from each controller on the MSA and one port from each ESX/ESXi host should be cabled to each switch. See Figure 5 for an example configuration.

Setup and initial provisioning of the SAN

After unboxing and racking your new storage appliance the first thing you will need to do is find out what IP addresses the appliance has taken. By default the controllers will pull DHCP addresses from whatever source is available on the management ports. The SAN comes with a setup CD that can help discover these addresses, or alternatively look inside of your DHCP server to see what addresses have been assigned.

Controller Management IP addresses

After finding the address of controller A open a web browser and point it at your SAN's IP address. You should be presented with a login screen which you can use admin/!admin as the username and password. After logging in there is a configuration wizard that you can run to setup the SAN, or you can perform each step manually. To run the wizard click "Configuration" and then "Configuration Wizard" and answer all the questions. If you want to configure the SAN manually the first step is to set static IP addresses on each controller. Click "Configuration" and then "Network Interfaces". Inside of this screen change the IP address source from "DHCP" to "manual" and then set the two controllers address information. Click Apply to save the changes.

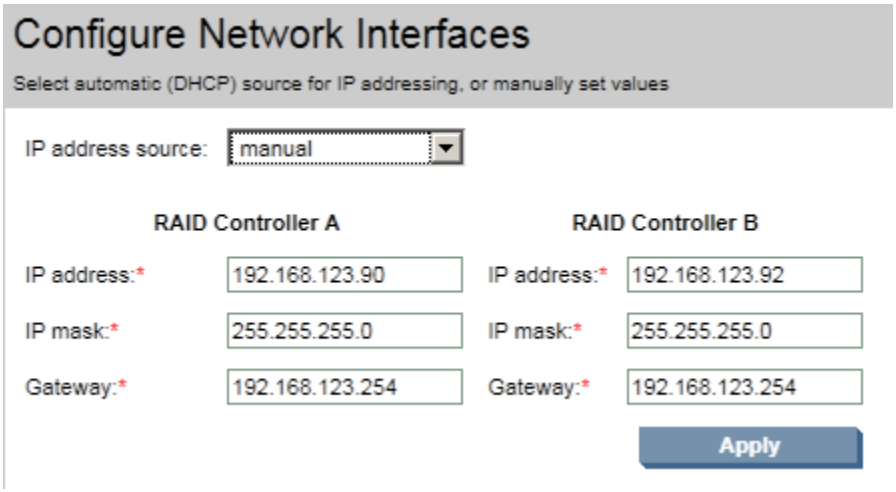

Figure 4 Controller IP information

iSCSI Host Ports

Next we need to setup the iSCSI host ports. These are the ports that your iSCSI initiators will communicate to the targets on. Each controller will have at least two iSCSI ports per controller, and each port on the controller should be configured in one of the two subnets that we setup.

Controller A			Controller B		
	IP Address:*	192.168.50.100		IP Address:*	192.168.50.101
Port A3 (iSCSI):	Netmask:*	255.255.255.0	Port B3 (iSCSI):	Netmask:*	255.255.255.0
	Gateway:*	0.0.0.0		Gateway:*	0.0.0.0
	IP Address:*	192.168.51.100		IP Address:*	192.168.51.101
Port A4 (iSCSI):	Netmask:*	255.255.255.0	Port B4 (iSCSI):	Netmask:*	255.255.255.0
	Gateway:*	0.0.0.0		Gateway:*	0.0.0.0

One thing to note is that the default gateway settings have been set to 0.0.0.0, this is to ensure that iSCSI traffic cannot be routed outside of your iSCSI subnets. We want to ensure that iSCSI isn't routed for two reasons; one is security and two is performance. No one will be able to mount your iSCSI targets or

sniff the traffic if the packets cannot leave the iSCSI subnet. And routers are much slower at moving packets then switches, so without a gateway we can ensure that the ESX/ESXi servers cannot see the LUN's from any interface except the iSCSI adapters. There are other various Common Settings that can be configured as well; however the defaults are the recommended settings unless your situation requires customization. Now that your ports are configured you can cable the iSCSI host ports to the appropriate physical switches, as well as the ESX/ESXi ports.

Cabling the iSCSI network

In order to properly scan and discover your targets we need to make sure that your network is properly cabled. A high level overview is that half of the ports get cabled to one switch and half goes to the other switch. See Figure 5 for more information.

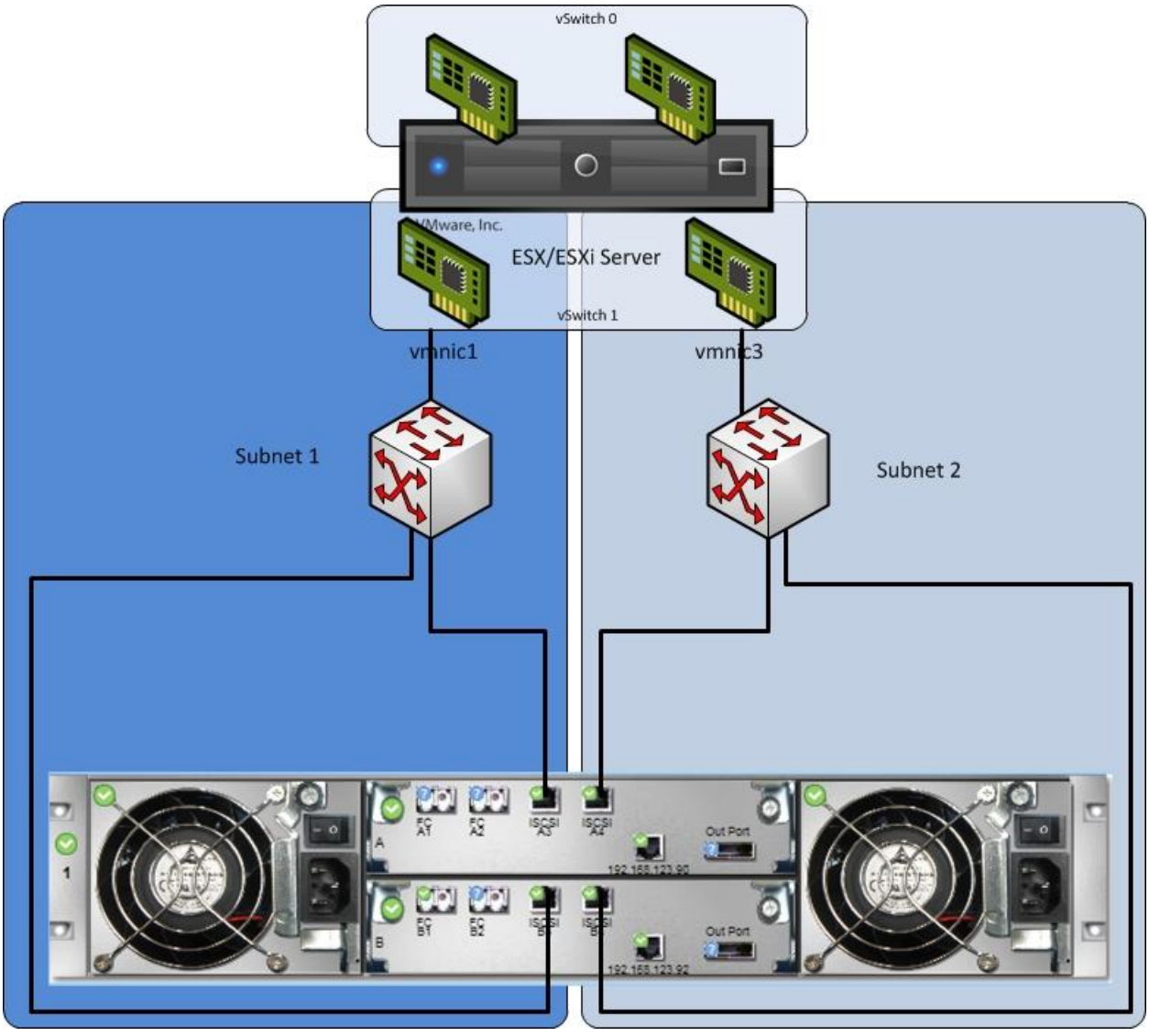

Figure 5 Physical Cabling overview

Storage Provisioning

The HP P2000 SAN provides several different RAID configuration levels. The P2000 array can have Vdisks, each with different RAID levels. This is beneficial because you can create a RAID 5 array for file

sharing while at the same time have a RAID 10 array for databases. Before we start creating storage we need to understand the P2000 terms.

Vdisk – vdisks are virtual disks created from many physical disks. Vdisks are not presented to VMware servers. Instead you carve out

Volume – Volumes are similar to partitions. They are subsets of Vdisks and are presented to VMware as a target.

Creating a Vdisk

To create a Vdisk expand "Logical" and then click "Vdisks". After clicking Vdisks click "Provisioning" on the right panel and under provisioning you should find "Create Vdisk".

Inside of this screen you can choose your RAID level, and the number of drives inside of the Vdisk. Also you can select which controller is the primary controller for this Vdisk. If you have multiple Vdisks you should alternate the primary controller so that you can maximize performance during normal operations. As a side note, performance will decrease during a single controller failure as all Vdisks will be serviced by a single controller.

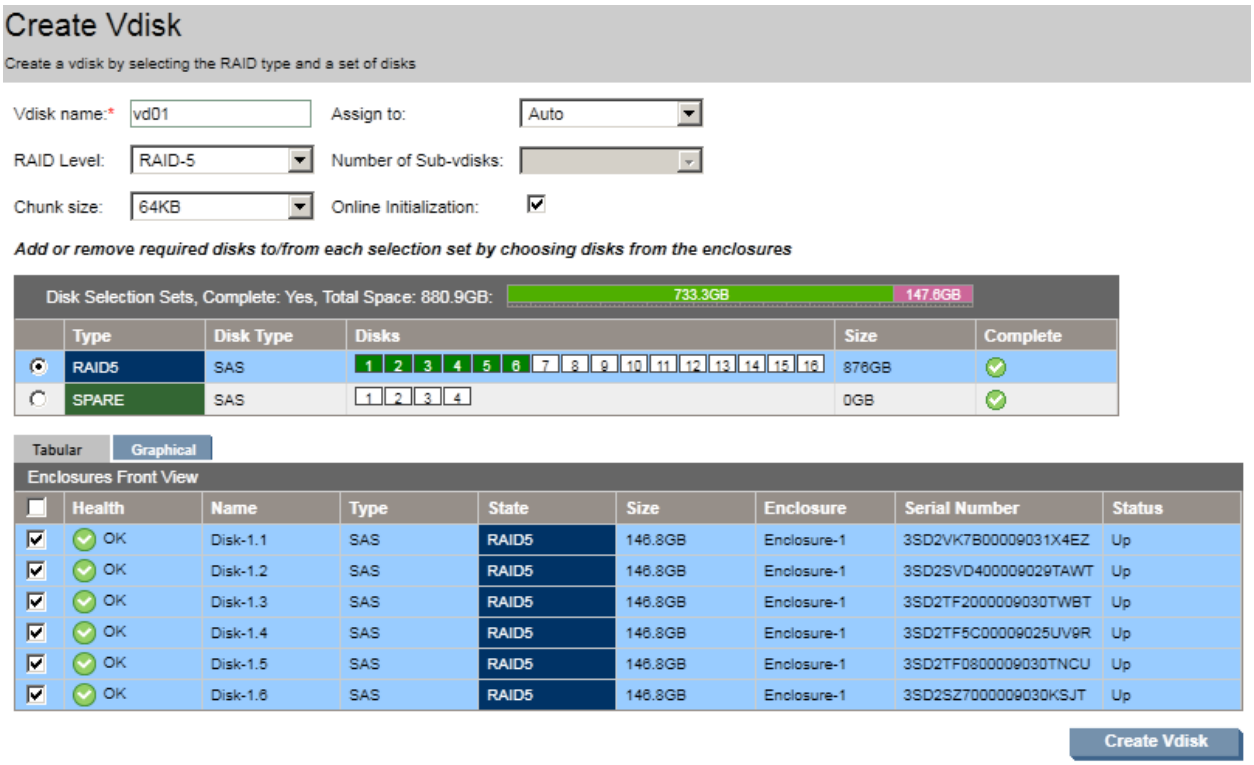

Figure 6 Vdisk Creation

Creating a Volume

After you have created your Vdisks volumes will need to be provisioned inside of the Vdisk. To do this click on the Vdisk on the left and then click the provisioning tab and click "Create Volume". On the create volume screen you can name the volume, determine what size it will be, enable snapshots if needed and select which ports the volume will be available on. See Figure 6.

Note: Unless remote replication is needed, snapshotting at the SAN level is not recommended. Virtual machines will be unaware of snapshots taken at the SAN level and will not be consistent.

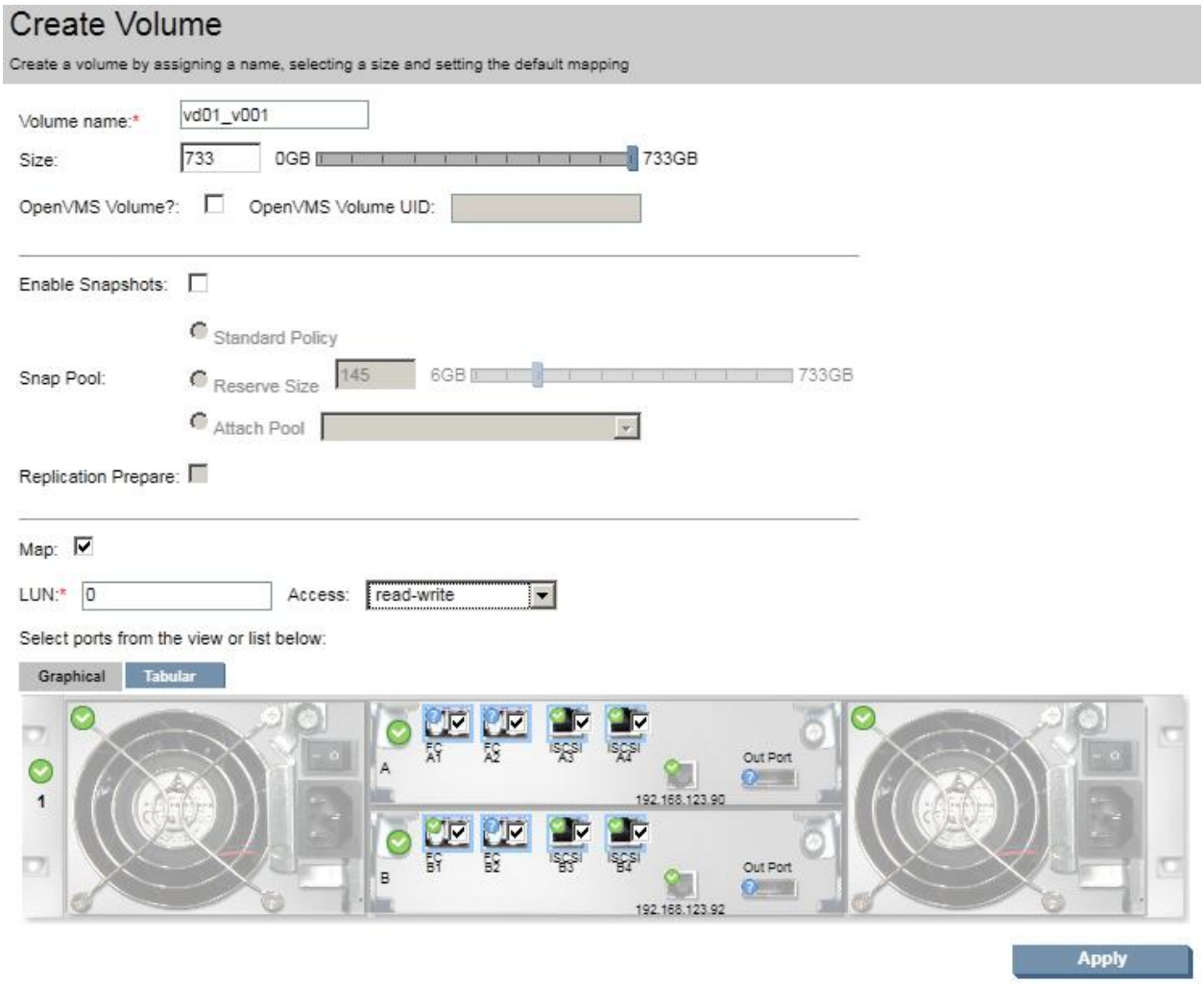

Figure 7 Volume creation

Performance will be degraded while the Vdisk is being initialized. Depending on the number of disks and the size, initialization time will vary. You can monitor initialization progress by clicking on the Vdisk's name on the left and then looking for the "Current Job" on the right.

Properties for vd01	
Property	**Value**
Health	OK
Health Reason	The virtual disk is fault tolerant.
Name	vd01
Size	733.2GB
Free	0B
Current Owner	A
Preferred Owner	A
Serial Number	00c0ffdafc940000c25d164d00000000
RAID	RAID5
Disks	6
Spares	0
Chunk Size	64k
Created	2010-12-25 21:10:26
Minimum Disk Size	146.6GB
Status	FTOL
Current Job	Initialize (16%)
Drive Spin Down Vdisk Enable	Disabled

Figure 8 Initialization progress

Adding Hosts

Before VMware will be able to see your Volumes we need to add our IQN names to the SAN. Click on the "Hosts" link on the left and then on the right click "Provisioning" and then "Add Host". Paste in your IQN name and if you want to use easy names type in a name in the "Host Name" box, otherwise the IQN name will be used. Do this for each of your ESX/ESXi hosts.

Mapping Volumes to Hosts

After adding in your hosts, we will need to map our volumes to the hosts. By default volumes cannot be seen unless you allow them to be. To map volumes to a host click on the host on the left panel, then Provisioning on the right, followed by Manage Host Mappings. Inside this screen click on the radial button beside of the virtual disk you want to map, and then click the "Map" check box. To save click Apply.

Figure 9 Volume to Host Mapping

After mapping your volumes to your hosts you can rescan your iSCSI adapters and they should now show up.

Creating a new data store on the iSCSI volume

After the vSphere 4 server has an iSCSI SAN volume connected, it can be formatted as a new VMFS (VMware ESX Server File System) datastore or mounted as a raw device mapping (RDM) directly to virtual machines. New datastores are formatted from within the VMware vSphere client. After creating a volume we need to make sure that multi-pathing is working properly. Right click on the data store and click properties. At the bottom right corner of the properties box there is a “Manage Paths” button, click it. We need to verify that the path selection is “Round Robin”. If this is already selected you should have two paths that say “Active (I/O)”, if it wasn’t selected select it and click change. After a few seconds it should update and have multiple paths with Active I/O.

Note: If using Fiber Channel and iSCSI at the same time, VMware may not select Fiber Channel as the primary medium. You will need to check to see which medium has Active I/O and select “Fixed” path in order to pick a preferred path. See Figure 10 more an example.

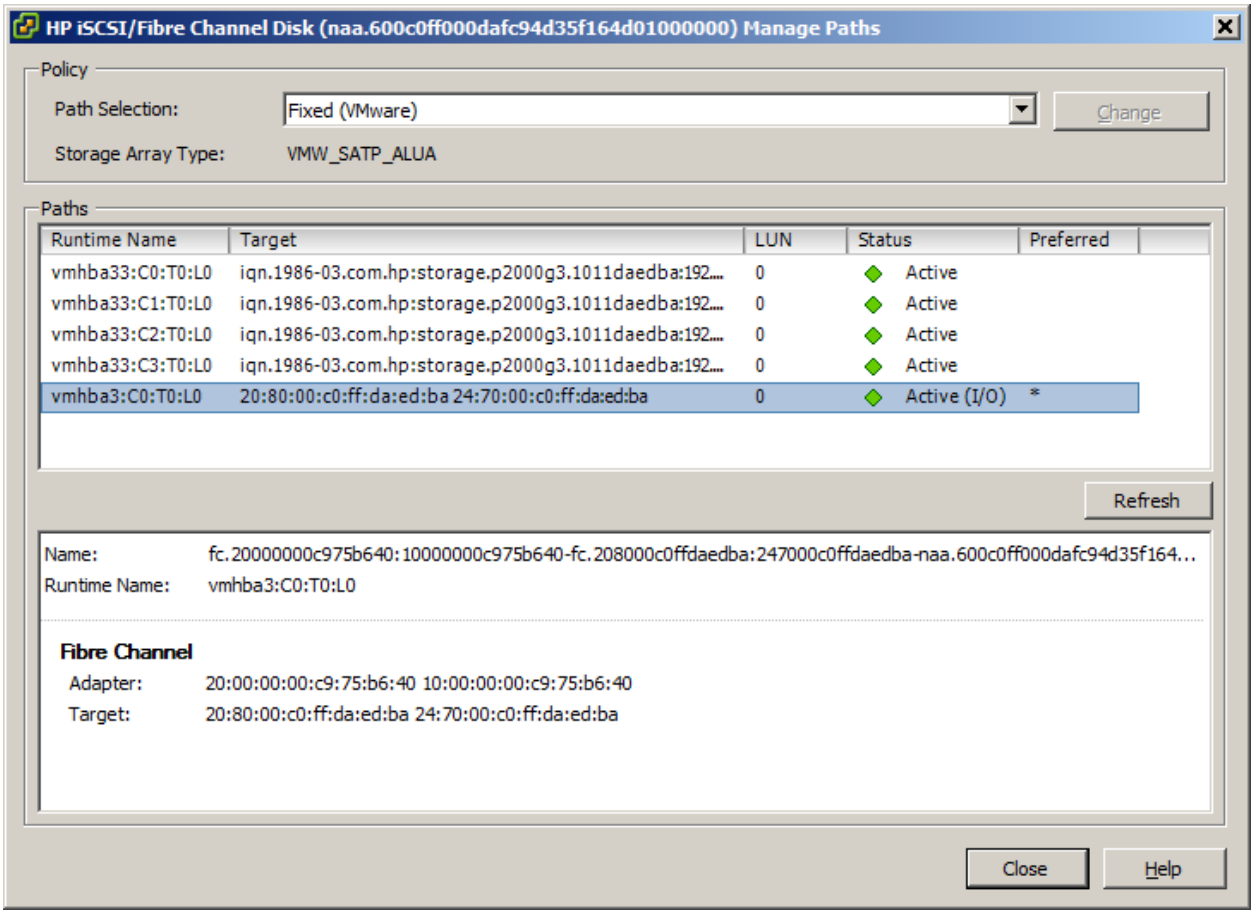

Figure 10 FC and iSCSI Fixed Path Selection

Expanding an HP P2000 volume and extending a data store on the iSCSI volume

HP P2000 Vdisks, volumes and vSphere 4 datastores can be expanded dynamically. If space is running low on a datastore, you must first expand the Vdisk, and then the volume on the HP P2000 SAN. To increase the size of the HP P2000 Vdisk insert the new drives into the SAN chassis and then login to the web interface and add them to the Vdisk. After they have been added navigate to the volumes properties, simply edit the volume's size in the web interface. The HP P2000 software immediately changes the LUN size and lays out data across the cluster accordingly, without affecting the volumes availability. However performance will be degraded while the Vdisk restripes across the new drives. Once the volume has been expanded, you can increase the size of the VMFS datastore from within the vSphere client. Increasing the size of the datastore is preferred over adding extents.

Disclaimer

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Document Improvement

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Change Log

Revision 2	Updated Figure 5	2010-12-27
Revision 1	Initial Release	2010-12-26