



Technical Report

VMware View on NetApp Deployment Guide

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**A SCALABLE SOLUTION ARCHITECTURE USING NFS ON A CISCO
NEXUS NETWORK INFRASTRUCTURE**



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1 INTRODUCTION TO VMWARE VIEW ON NETAPP STORAGE

1.1 PURPOSE

The purpose of this document is to provide a step-by-step guide on how to deploy VMware® View™ 4.5 on NetApp® FAS series active-active controller configurations on Cisco Nexus switches. This document details the deployment of a typical Windows® 7 virtual desktop infrastructure (VDI), also known as a hosted virtual desktop (HVD). A storage build-out of a VMware View environment to 100,000 seats is also covered.

This document is intended as an instructional guide and does not attempt to explain why certain steps are taken. For more detailed information on the steps included in this document, see [TR-3749: NetApp and VMware vSphere Storage Best Practices](#) and [TR-3705: NetApp and VMware View \(VDI\) Solution Guide](#).

This document demonstrates a typical mixed deployment scenario for different user types in an environment that requires different desktop types while needing to be able to achieve desired storage efficiency, performance, operational agility, and data protection. Table 1 shows a sample customer environment with a mix of users. The mixed user requirements can be easily met by using different desktop delivery models in VMware View, leveraging both NetApp VSC 2.0.1P1 and VMware View Composer. Table 2 details the deployment scenario demonstrated in this document.

Table 1) VSC 2.0.1P1 and linked clones deployment mix.

Virtual Machine Distribution	Number of Virtual Machines
Number of VMs deployed with VSC 2.0.1P1	1,000
Number of View Composer Linked Clones	1,000

This document focuses on achieving multiple levels of storage efficiency and performance acceleration for each of the deployment scenarios in this mixed environment. While this document has a 50% split for deployment models, the principles for storage layout, efficiency, performance acceleration, and operational agility can be used for every type of deployment mix.

This guide does not focus on maximizing the number of virtual desktops that can be placed on a storage controller. Instead, it focuses on the methodology needed to deploy the given scenario of virtual desktops in a step-by-step approach. The methodology demonstrated in this guide can be scaled up for larger deployments and down for smaller deployments. Each virtual desktop environment should have a sizing exercise performed as part of the planning phase of a virtual desktop deployment.

Table 2 shows a sample customer environment with different user profiles having different requirements in terms of desktop usage and data hosted on the virtual desktops. It highlights how the different deployment solutions (NetApp VSC 2.0.1P1 and VMware View Composer) can be leveraged to fulfill requirements for the different user types.

Table 2) Types of VMware View deployment scenarios.

User Profile	User Requirements	Number of Virtual Desktops	VMware View Manager Desktop Delivery Model	Access Mode	Deployment Solution
Marketing/ finance/ consultants	<ul style="list-style-type: none"> • Customizable, personalized desktops using a mix of office and specialized, decision-supporting applications • Download and use several applications as required • Installed apps and/or data on the OS disk to be retained after patches, OS upgrade, and reboots • Requires protecting the user data 	500	Manual desktop pool	Dedicated	NetApp VSC 2.0.1P1
Helpdesk/ call center	<ul style="list-style-type: none"> • Works with only one application at a time • Does not require customizable, personalized desktops • Does not require applications and data on the OS disk to be retained after patches, OS upgrade, and reboots • Requires protecting the user data on the separate user data disk 	500	Manual desktop pool	Floating	NetApp VSC 2.0.1P1

User Profile	User Requirements	Number of Virtual Desktops	VMware View Manager Desktop Delivery Model	Access Mode	Deployment Solution
Helpdesk/call center/training /students	<ul style="list-style-type: none"> • Works with only one application at a time • Does not require customizable, personalized desktops • Does not require applications and data on the OS disk to be retained after patches, OS upgrade, and reboots • Requires protecting the user data on the separate user data disk • Temporary desktops for the duration of the training session • Requires clean desktop for every class • Does not require customization or personalization • Does not require protection of the OS or user data 	1000	Automated desktop pool	Floating	VMware linked clones

1.2 THE DEPLOYMENT SCENARIO

This guide demonstrates deploying a 2,000-seat pool of desktops (POD) environment on a single NetApp FAS active-active controller configuration using the NFS protocol. A 1,000-seat deployment using only NetApp technologies and a 1,000-seat environment using VMware linked clones are detailed in this guide. Also, both dedicated and floating desktop virtualization deployment models are highlighted. This configuration can be used with NetApp FAS series active-active controller configurations as well as NetApp V-Series controllers. For reference purposes a FAS3160A is used. At the end of the document a table is included detailing the configuration requirements for the various storage controller platforms. By detailing this representative VMware View environment, deployment methodologies for larger or smaller environments can be derived. The design can be easily altered to suit any combination and number for each deployment type, be the deployment dedicated or floating or comprised solely of either VSC 2.0.1P1 deployed VMs or link cloned VMs. The information contained in this guide will assist in setting up environments ranging from proof of concept (POC) to production deployments. Note that this guide is intended for storage and systems administrators who are familiar with VMware and NetApp storage.

The design presented in this document uses a NetApp FAS3160 active-active controller configuration as the primary storage environment. The deployment uses a 50% read/write mix and allows a minimum of 20% CPU availability on each controller. It is assumed that each virtual machine has 24GB of storage and uses 12 IOPS in the configuration. Because deployments vary greatly, this maximum number of seats is to be used only as a reference and may not reflect each individual implementation.

1.3 THE ENVIRONMENT

Note that proper licensing for the NetApp controllers, VMware products, and Windows 7 must be obtained to use the features detailed in this guide. Also, Cisco Nexus 5000 and 7000 switches are used and licensed for [virtual port channels \(vPCs\)](#) and virtual device context (VDC). Where appropriate, trial licenses can be used for many of the solution components in order to test the configuration.

1.4 SOFTWARE NEEDED FOR DEPLOYMENT

- NetApp System Manager 1.01
- VMware vSphere™ (ESX 4.1 and vCenter™ Server 4.1)
- VMware View Manager and Composer 4.5
- NetApp Virtual Storage Console (VSC) 2.0.1P1

2 NETWORK SETUP AND CONFIGURATION

For the purposes of this deployment guide we used a network design with two Cisco Nexus 7000 switches and two Cisco Nexus 5020 switches. Because of the complexity and variety of each organization's network environment, it is very difficult to provide one general way to set up and configure all networks. For more detailed information on additional network configuration options, refer to [TR-3749: NetApp and VMware vSphere Storage Best Practices](#).

Below is a list of the topics that are covered in depth in the networking section in TR-3749:

- Traditional Ethernet switch designs
- Highly available storage design with traditional Ethernet switches
- vSphere networking with multiple virtual machine kernel ports
- vSphere with multiple virtual machine kernel, traditional Ethernet, and NetApp networking with single-mode VIFS
- vSphere with multiple virtual machine kernel, traditional Ethernet, and NetApp networking with multilevel VIFS
- Cross-stack EtherChannel switch designs
- Highly available IP storage design with Ethernet switches that support cross-stack EtherChannel
- EtherChannel vSphere networking and cross-stack EtherChannel
- vSphere and NetApp with cross-stack EtherChannel
- Datastore configuration with cross-stack EtherChannel

Detailed below are the steps used to create the network layout for the NetApp storage controllers and for each vSphere host in the environment.

2.1 NETWORK SETUP OF CISCO NEXUS NETWORK SERIES

For the purposes of this deployment guide, a network design with two Cisco Nexus 7000 switches and two Cisco Nexus 5020 switches was used. Cisco's best practices were followed in the setup of the Nexus environment. For more information on configuring a Cisco Nexus environment, visit <http://www.cisco.com>.

The goal in using a Cisco Nexus environment for networking is to integrate its capabilities to logically separate public IP traffic from storage IP traffic. In doing this, the chance of issues developing from changes made to a portion of the network is mitigated.

Since the Cisco Nexus 5020 switches used in this configuration support [vPCs](#) (Virtual PortChannels) and Nexus 7000 switches are configured with a VDC specifically for storage traffic, logical separation of the storage network from the rest of the network is achieved while providing a high level of redundancy, fault tolerance, and security. The vPC provides multipathing, which allows you to create redundancy by enabling multiple parallel paths between nodes and load balancing traffic where alternative paths exist.

Alternatively, instead of two Nexus 7000s, two Nexus 5020s can be used. With this configuration, vPCs can be configured as well for network segmentation using VLANs. Using this configuration will reduce the network cost significantly, but it does not allow VDC network segmentation.

Details in the diagrams below are for a pure 10GbE environment.

On the Nexus network, perform the following configurations:

- Set up a Peer Keep Alive Link as a management interface between the two Nexus 7000 switches.
- On the default VDC on the Nexus 7000 switches, be sure to enable a management VLAN for the service console; a public VLAN for the virtual machine network; and a private, nonroutable VLAN for VMotion™.
- To isolate and secure the NFS traffic, create a separate VDC on the Nexus 7000 switches for NFS traffic. Assign ports to this VDC and configure these ports for a private, nonroutable VLAN.*
- Create virtual port channels between the Nexus 5020 switches for the public VLAN, service console VLAN, NFS VLAN, and the VMotion VLAN.

**Note: This is an optional configuration. If you do not use this configuration or have this option available, create an additional private, nonroutable VLAN.*

2.2 STORAGE VLAN FOR NFS

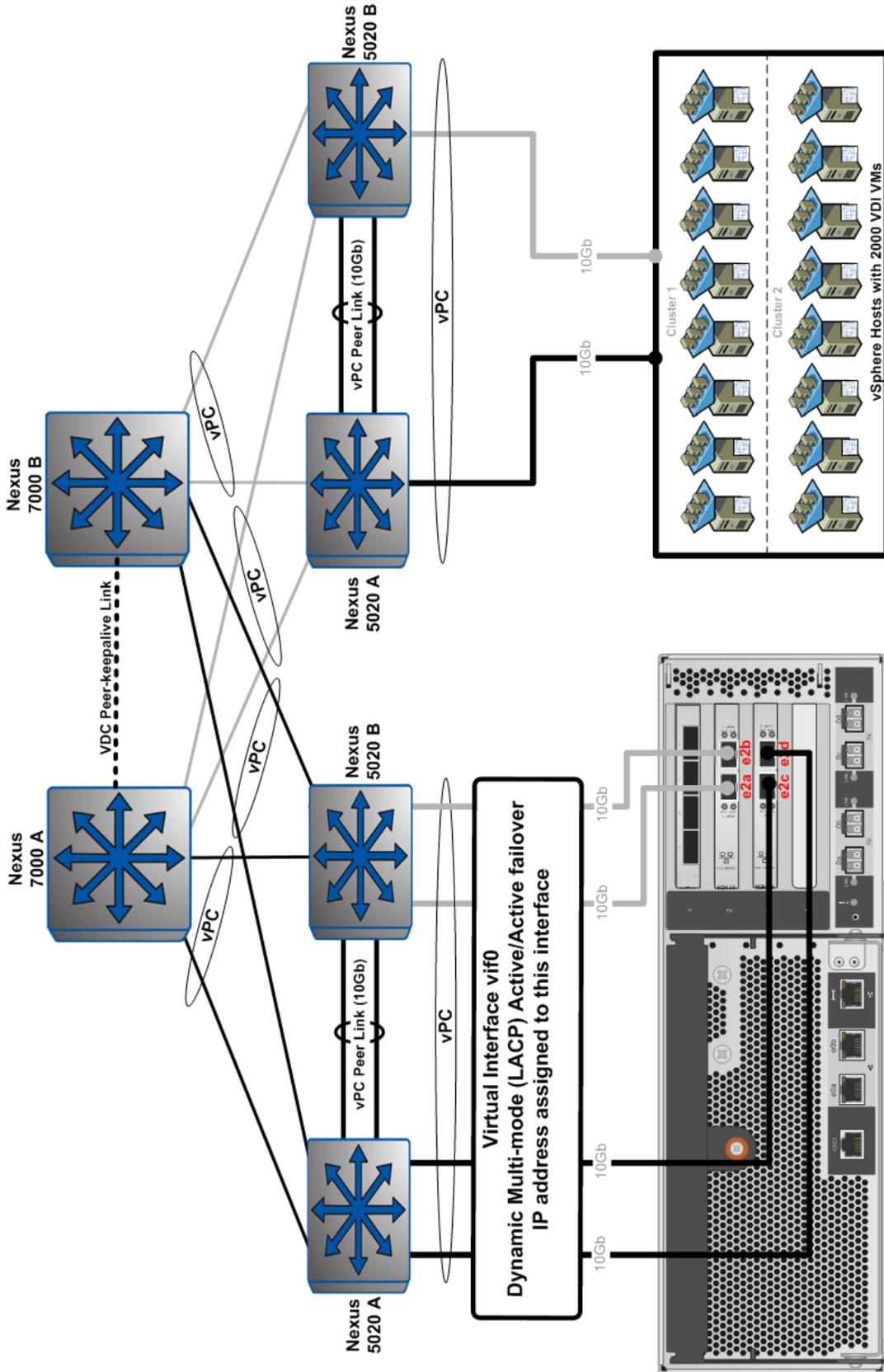
If you are using VDCs on the Nexus 7000s, be sure to configure a nonroutable VLAN on a separate VDC for the NFS storage traffic to pass to and from the NetApp storage controllers to the vSphere hosts. With this setup the NFS traffic is kept completely contained, and security is more tightly controlled.

Also, it is extremely important to have at least two physical Ethernet switches for proper network redundancy in your VMware View environment. Carefully plan the network layout for your environment, including detailed visual diagrams detailing the connections for each port.

2.3 VMWARE VIEW NETWORK

When creating a VMware View environment that contains several hundred or several thousand virtual machines, be sure to create a large enough DHCP scope to cover the number of IP addresses that will be needed by the clients. This step should be planned well before implementation.

Figure 1) NetApp storage controller VIF configuration for 10GbE.



3 VMWARE VSPHERE HOST SETUP

3.1 PHYSICAL SERVER CONFIGURATION

Table 3 lists the server specifications that were used in this configuration. You might have different servers with different configurations.

Table 3) vSphere host configuration.

Server Component	Number or Type
VMware vSphere host	21
Memory per vSphere host	96GB
CPUs per vSphere host	2 Intel® Nehalem quad-core CPUs
Network interface cards (NICs) per vSphere host	2

3.2 LICENSES NEEDED

Table 4) vSphere licenses needed per 2,000-seat installation.

VMware View Infrastructure Component	Number
vSphere Server licenses (1 license needed per 2 CPUs)	42
VMware vCenter Server licenses	1
VMware View Enterprise licenses	1,000
VMware View Premier licenses	1,000
Windows 7 licenses	2,000

3.3 INSTALL VSPHERE

For information on the installation and configuration of vSphere, refer to the [ESX and vCenter Server Installation Guide](#) published by VMware.

Below are guidelines used for this environment when deploying the VMware View infrastructure.

Table 5) VMware View infrastructure components.

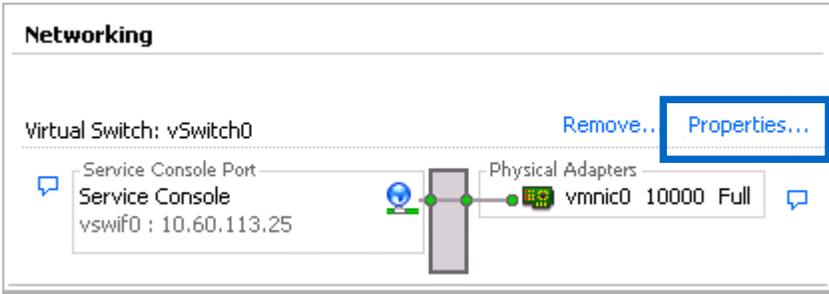
VMware View Infrastructure Component	Number
Virtual machine per vSphere server	96
Virtual machine per CPU core	12
Memory per Windows 7 VMware View desktop	1GB

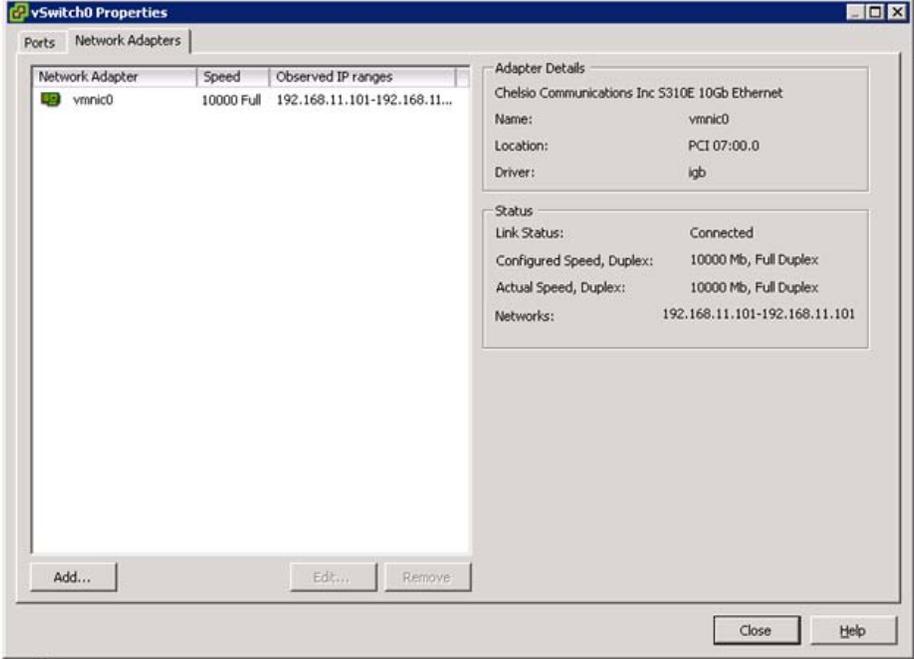
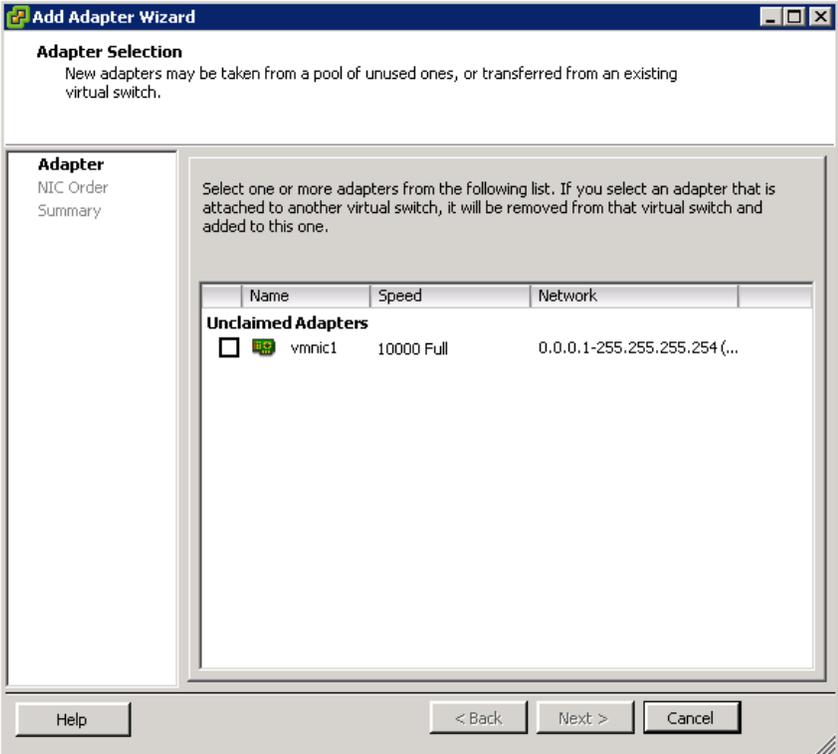
3.4 INSTALL VMWARE VCENTER SERVER

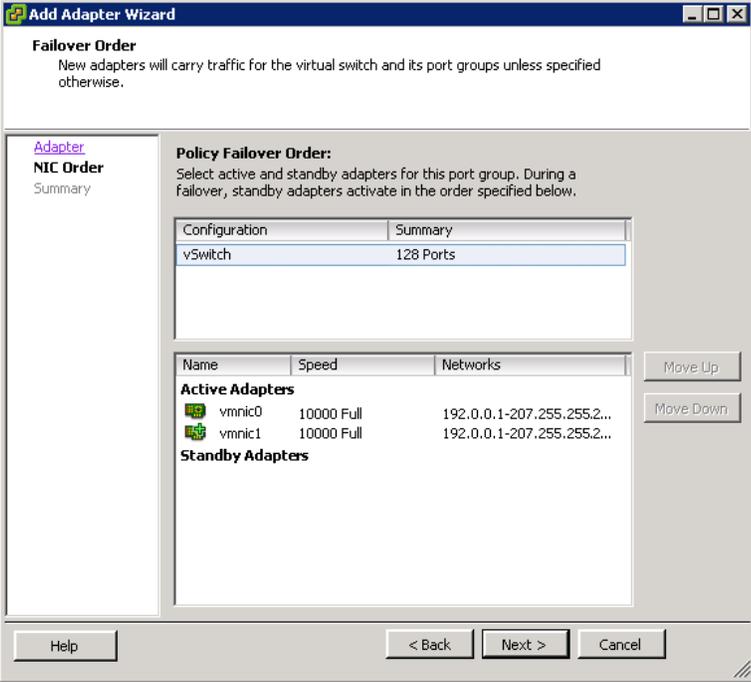
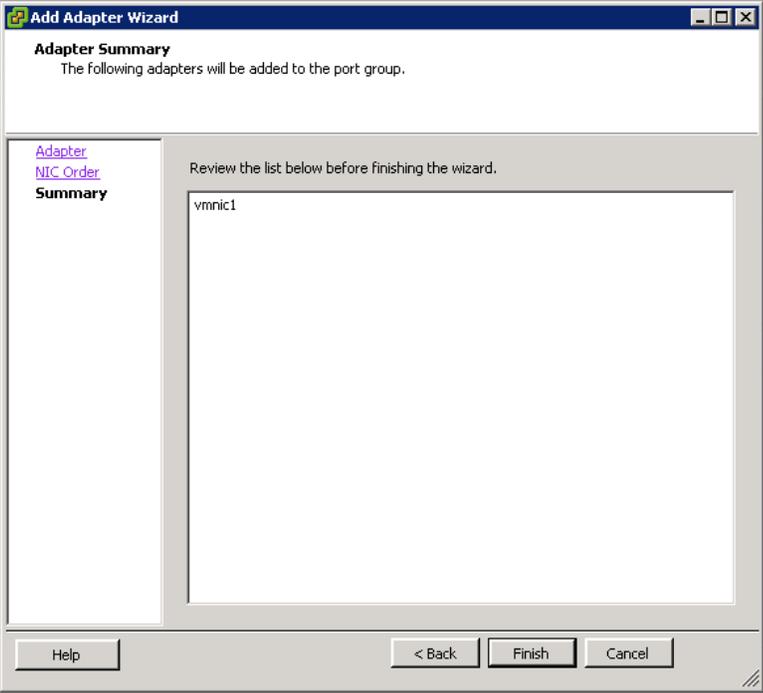
For information on the installation and configuration of VMware vCenter Server, refer to the [ESX and vCenter Server Installation Guide](#) published by VMware.

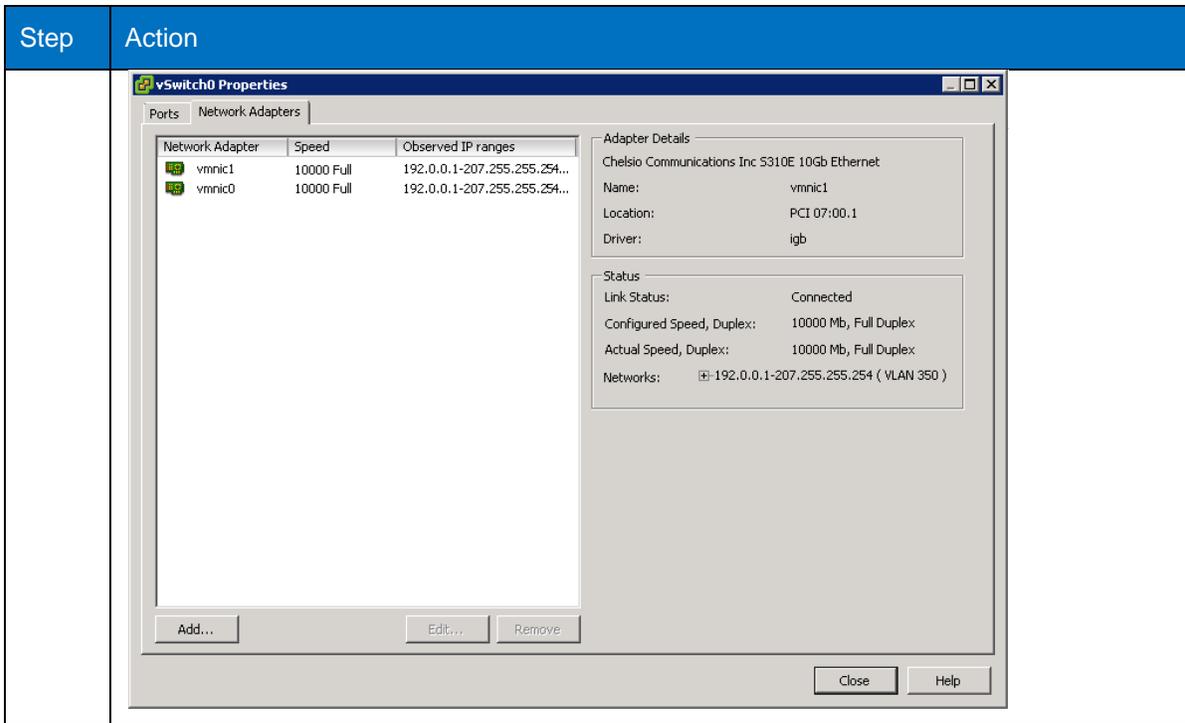
To obtain licenses for VMware, contact your VMware sales representative.

3.5 CONFIGURE SERVICE CONSOLE FOR REDUNDANCY

Step	Action
1	Make sure that the primary Service Console vSwitch has two NICs assigned to it. Note: The network ports that the NICs use must exist on the administrative VLAN and be on separate switches to provide network redundancy.
2	Open VMware vCenter.
3	Select a vSphere host.
4	In the right pane, click the Configuration tab.  A screenshot of the VMware vCenter interface. The left pane shows a tree view with 'VEABU-VC1' expanded to 'VEABU Datacenter 1', which contains two hosts with IP addresses 10.61.177.123 and 10.61.177.124. The right pane shows the configuration for host '10.61.177.123 VMware ESX, 4.0.0, 171294'. The 'Configuration' tab is selected and highlighted with a blue box. Below the tabs are 'General' and 'Resources' sections.
5	In the Hardware box under the Configuration tab, click Networking.  A screenshot of the 'Hardware' box in the VMware vCenter interface. The box contains several links: 'Health Status', 'Processors', 'Memory', 'Storage', 'Networking' (which is expanded to show 'Storage Adapters' and 'Network Adapters'), 'Storage Adapters', and 'Network Adapters'.
6	In the Networking section, click the Properties section of vSwitch1.  A screenshot of the 'Networking' section in the VMware vCenter interface. It shows a 'Virtual Switch: vSwitch0' connected to 'Physical Adapters'. A 'Service Console Port' is shown with 'Service Console' and 'vswif0 : 10.60.113.25'. A 'Physical Adapter' is shown with 'vmnic0 10000 Full'. The 'Properties...' button is highlighted with a blue box.
7	In the Properties section, click the Network Adapters tab. Click Add.

Step	Action
	
8	<p>Select the vmnic that will act as the secondary NIC for the service console. Click Next.</p> 
9	In the following screen, verify and click Next.

Step	Action																			
	 <p>Add Adapter Wizard</p> <p>Failover Order New adapters will carry traffic for the virtual switch and its port groups unless specified otherwise.</p> <p>Adapter NIC Order Summary</p> <p>Policy Failover Order: Select active and standby adapters for this port group. During a failover, standby adapters activate in the order specified below.</p> <table border="1" data-bbox="527 478 982 598"> <thead> <tr> <th>Configuration</th> <th>Summary</th> </tr> </thead> <tbody> <tr> <td>vSwitch</td> <td>128 Ports</td> </tr> </tbody> </table> <table border="1" data-bbox="527 613 982 703"> <thead> <tr> <th>Name</th> <th>Speed</th> <th>Networks</th> </tr> </thead> <tbody> <tr> <td colspan="3">Active Adapters</td> </tr> <tr> <td>vmnic0</td> <td>10000 Full</td> <td>192.0.0.1-207.255.255.2...</td> </tr> <tr> <td>vmnic1</td> <td>10000 Full</td> <td>192.0.0.1-207.255.255.2...</td> </tr> <tr> <td colspan="3">Standby Adapters</td> </tr> </tbody> </table> <p>Buttons: Help, < Back, Next >, Cancel, Move Up, Move Down</p>	Configuration	Summary	vSwitch	128 Ports	Name	Speed	Networks	Active Adapters			vmnic0	10000 Full	192.0.0.1-207.255.255.2...	vmnic1	10000 Full	192.0.0.1-207.255.255.2...	Standby Adapters		
Configuration	Summary																			
vSwitch	128 Ports																			
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vmnic0	10000 Full	192.0.0.1-207.255.255.2...																		
vmnic1	10000 Full	192.0.0.1-207.255.255.2...																		
Standby Adapters																				
10	<p>Click Finish.</p>  <p>Add Adapter Wizard</p> <p>Adapter Summary The following adapters will be added to the port group.</p> <p>Adapter NIC Order Summary</p> <p>Review the list below before finishing the wizard.</p> <p>vmnic1</p> <p>Buttons: Help, < Back, Finish, Cancel</p>																			
11	Click Close.																			



3.6 CONFIGURE VMWARE KERNEL NFS PORT

Step	Action																
1	<p>For each vSphere host, create a separate NFS VMkernel network in the existing virtual switch. The VMkernel will be set up on the private, nonroutable NFS VLAN created in previous steps. This VLAN can be created on either the separate VDC on the Nexus 7000 or on a private, nonroutable VLAN using a vPC on the Nexus 5020 network. For this example, VLAN 350 is used.</p> <p>Note: Currently, VDC is not supported on Cisco Nexus 5000 switches.</p>																
2	<p>Use the following assignments for your NFS storage traffic VMware kernel IP addresses.</p> <p>Note: For the storage network the private subnet of 192.168.0.xxx is being used.</p> <table> <tbody> <tr> <td>vSphere Host 1: 192.168.0.11</td> <td>vSphere Host 5: 192.168.0.15</td> <td>vSphere Host 9: 192.168.0.19</td> <td>vSphere Host 13: 192.168.0.23</td> </tr> <tr> <td>vSphere Host 2: 192.168.0.12</td> <td>vSphere Host 6: 192.168.0.16</td> <td>vSphere Host 10: 192.168.0.20</td> <td>vSphere Host 14: 192.168.0.24</td> </tr> <tr> <td>vSphere Host 3: 192.168.0.13</td> <td>vSphere Host 7: 192.168.0.17</td> <td>vSphere Host 11: 192.168.0.21</td> <td>vSphere Host 15: 192.168.0.25</td> </tr> <tr> <td>vSphere Host 4: 192.168.0.14</td> <td>vSphere Host 8: 192.168.0.18</td> <td>vSphere Host 12: 192.168.0.22</td> <td>vSphere Host 16: 192.168.0.26</td> </tr> </tbody> </table>	vSphere Host 1: 192.168.0.11	vSphere Host 5: 192.168.0.15	vSphere Host 9: 192.168.0.19	vSphere Host 13: 192.168.0.23	vSphere Host 2: 192.168.0.12	vSphere Host 6: 192.168.0.16	vSphere Host 10: 192.168.0.20	vSphere Host 14: 192.168.0.24	vSphere Host 3: 192.168.0.13	vSphere Host 7: 192.168.0.17	vSphere Host 11: 192.168.0.21	vSphere Host 15: 192.168.0.25	vSphere Host 4: 192.168.0.14	vSphere Host 8: 192.168.0.18	vSphere Host 12: 192.168.0.22	vSphere Host 16: 192.168.0.26
vSphere Host 1: 192.168.0.11	vSphere Host 5: 192.168.0.15	vSphere Host 9: 192.168.0.19	vSphere Host 13: 192.168.0.23														
vSphere Host 2: 192.168.0.12	vSphere Host 6: 192.168.0.16	vSphere Host 10: 192.168.0.20	vSphere Host 14: 192.168.0.24														
vSphere Host 3: 192.168.0.13	vSphere Host 7: 192.168.0.17	vSphere Host 11: 192.168.0.21	vSphere Host 15: 192.168.0.25														
vSphere Host 4: 192.168.0.14	vSphere Host 8: 192.168.0.18	vSphere Host 12: 192.168.0.22	vSphere Host 16: 192.168.0.26														

4. For the vSwitch for the NFS VMware kernel, set the load balancing policy to “Route based on IP hash.”

ESX1

Virtual Switch: vSwitch2

Vmkernel Port

Vmkernel NFS

192.168.0.1

VMkernel 1 Properties

General | Security | Traffic Shaping | NIC Teaming

Policy Exceptions

Load Balancing: Route based on ip hash

Network Failover Detection: Link Status only

Notify Switches: Yes

Failback: Yes

Failover Order:

Override vSwitch failover order:

Select active and standby adapters for this port group. In a failover situation, standby adapters activate in the order specified below.

Name	Speed	Networks
vmnic1	1000 Full	192.168.0.1-192.168.0.7
vmnic2	1000 Full	192.168.0.1-192.168.0.7

Active Adapters

Standby Adapters

Unused Adapters

Adapter Details

No adapter selected

Driver:

Location:

OK Cancel Help

3.7 CONFIGURE VMOTION

Step	Action																
1	For each vSphere host, create a separate VMotion VMkernel network in the existing virtual switch. The VMkernel will be set up on the private, nonroutable VMotion VLAN created in previous steps. For this example, VLAN 350 is used.																
2	Use the following assignments for your VMotion VMware kernel IP addresses. Note: For the storage network the private subnet of 192.168.1.xxx is being used. <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">vSphere Host 1: 192.168.1.11</td> <td style="width: 25%;">vSphere Host 5: 192.168.1.15</td> <td style="width: 25%;">vSphere Host 9: 192.168.1.19</td> <td style="width: 25%;">vSphere Host 13: 192.168.1.23</td> </tr> <tr> <td>vSphere Host 2: 192.168.1.12</td> <td>vSphere Host 6: 192.168.1.16</td> <td>vSphere Host 10: 192.168.1.20</td> <td>vSphere Host 14: 192.168.1.24</td> </tr> <tr> <td>vSphere Host 3: 192.168.1.13</td> <td>vSphere Host 7: 192.168.1.17</td> <td>vSphere Host 11: 192.168.1.21</td> <td>vSphere Host 15: 192.168.1.25</td> </tr> <tr> <td>vSphere Host 4: 192.168.1.14</td> <td>vSphere Host 8: 192.168.1.18</td> <td>vSphere Host 12: 192.168.1.22</td> <td>vSphere Host 16: 192.168.1.26</td> </tr> </table>	vSphere Host 1: 192.168.1.11	vSphere Host 5: 192.168.1.15	vSphere Host 9: 192.168.1.19	vSphere Host 13: 192.168.1.23	vSphere Host 2: 192.168.1.12	vSphere Host 6: 192.168.1.16	vSphere Host 10: 192.168.1.20	vSphere Host 14: 192.168.1.24	vSphere Host 3: 192.168.1.13	vSphere Host 7: 192.168.1.17	vSphere Host 11: 192.168.1.21	vSphere Host 15: 192.168.1.25	vSphere Host 4: 192.168.1.14	vSphere Host 8: 192.168.1.18	vSphere Host 12: 192.168.1.22	vSphere Host 16: 192.168.1.26
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vSphere Host 2: 192.168.1.12	vSphere Host 6: 192.168.1.16	vSphere Host 10: 192.168.1.20	vSphere Host 14: 192.168.1.24														
vSphere Host 3: 192.168.1.13	vSphere Host 7: 192.168.1.17	vSphere Host 11: 192.168.1.21	vSphere Host 15: 192.168.1.25														
vSphere Host 4: 192.168.1.14	vSphere Host 8: 192.168.1.18	vSphere Host 12: 192.168.1.22	vSphere Host 16: 192.168.1.26														

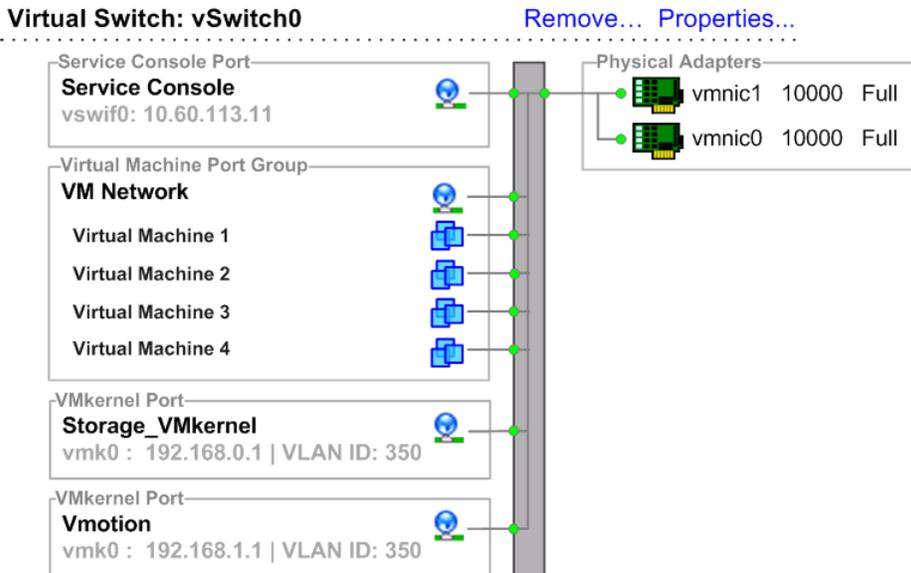
3.8 VMWARE VSPHERE HOST NETWORK CONFIGURATION

Figure 2 depicts how a fully configured network environment will look once all the networking steps above are completed.

Figure 2) VMware vSphere host configuration example.

ESX Host

Virtual Switch: vSwitch0



4 INSTALL NETAPP VIRTUAL STORAGE CONSOLE (VSC 2.0.1P1)

The NetApp Virtual Storage Console (VSC) 2.0.1P1 for VMware vSphere helps manage ESX and ESXi servers connected to NetApp storage systems. VSC 2.0.1P1 is a plug-in to the VMware vCenter that is available to all vSphere clients that connect to the vCenter Server. VSC 2.0.1P1 provides storage configuration and monitoring using VSC 2.0.1P1 capability, datastore provisioning, and virtual machine cloning using the Provisioning and Cloning capability, and backup and recovery of virtual machines and datastores using the Backup and Recovery capability.

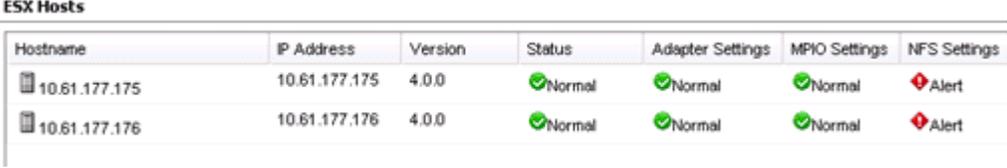
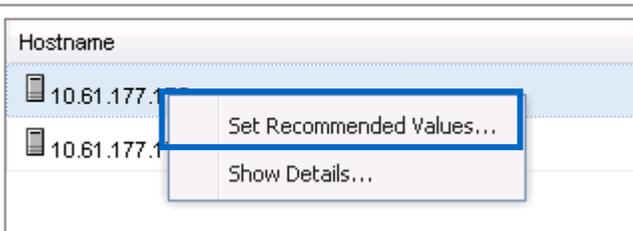
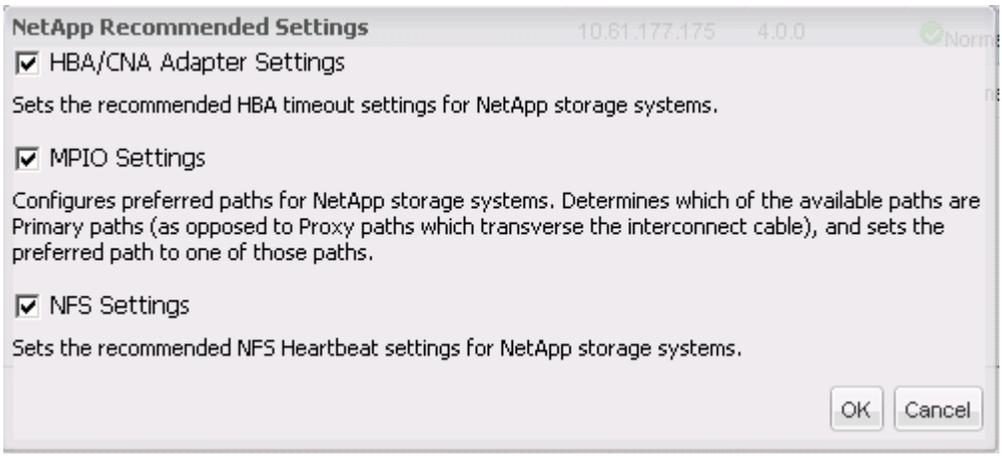
Detailed installation procedures can be found here:

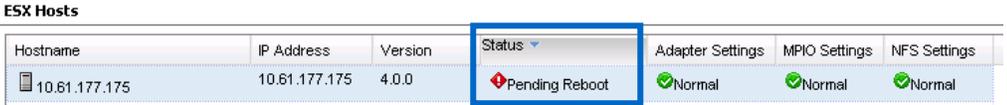
- [NetApp Virtual Storage Console 2.0.1P1 for VMware vSphere Installation and Administration Guide](#)
- [NetApp Virtual Storage Console 2.0.1P1 for VMware vSphere Provisioning and Cloning Administration Guide](#)
- [NetApp Virtual Storage Console 2.0.1P1 for VMware vSphere Backup and Recovery Administration Guide](#)

VSC 2.0.1P1 can be installed on the same system as the vCenter Server or on another 32-bit or 64-bit Windows computer. For detailed installation instructions see the [NetApp Virtual Storage Console 2.0.1P1 for VMware vSphere Installation and Administration Guide](#) available on the [NOW™](#) site.

5 CONFIGURING THE ESX ENVIRONMENT WITH VSC 2.0.1P1

VSC 2.0.1P1 checks and allows administrators to easily set the host's NFS, multipath I/O, and HBA timeout settings recommended by NetApp for proper behavior of NetApp storage systems. For more information, see the NetApp [Virtual Storage Console 2.0.1P1 for VMware vSphere Installation and Administration Guide](#).

Step	Action
1	Open VMware vCenter.
2	Click the NetApp tab. 
	VSC 2.0.1P1 should now be visible. A screen similar to the image below should be visible. 
3	Set the Recommended Values by right-clicking on the ESX host and selecting "Set Recommended Values." 
4	The NetApp Recommended Settings screen should be visible. Leave the defaults checked and select OK. This will begin making the necessary changes to the ESX host. 
5	Once the settings have been changed, the main VSC 2.0.1P1 screen will be visible once again.

	<p>The status will change to “Pending Reboot.”</p>  <p>The screenshot shows a table titled 'ESX Hosts' with columns: Hostname, IP Address, Version, Status, Adapter Settings, MPIO Settings, and NFS Settings. The first row shows Hostname: 10.61.177.175, IP Address: 10.61.177.175, Version: 4.0.0, Status: Pending Reboot (indicated by a red stop sign icon), Adapter Settings: Normal (green checkmark), MPIO Settings: Normal (green checkmark), and NFS Settings: Normal (green checkmark). The 'Status' column is highlighted with a blue box.</p>
6	Reboot the ESX host to apply the configuration changes and repeat the steps for all of the hosts listed.

6 NETAPP STORAGE CONTROLLER SETUP FOR VMWARE VSPHERE

Perform all of the steps listed below on both controllers of the NetApp system. Failure to do so could result in inconsistencies and performance problems within the environment.

6.1 NETAPP CONTROLLER 2,000-SEAT PHYSICAL CONFIGURATION

Table 6) NetApp solution configuration.

NetApp System Components	Number and/or Type	Slot on Each NetApp Controller Part Installed In
Disk shelves required	2 (totaling 48 SAS disks; 1 shelf per controller)	N/A
Size and speed of hard disk in shelves	450GB @ 15K RPM*	N/A
Disk shelf type	DS4243	N/A
Dual-port 10GB Ethernet NIC	4 (2 per controller)	2 and 3
Quad Port 6-Gb SAS card	2 (one per controller)	4
256GB Flash Cache	2 (one per controller)	varies
NFS licenses	2 (one per controller)	N/A
FlexClone® licenses	2 (one per controller)	N/A
FlexShare® licenses (optional)	2 (one per controller)	N/A

*If the deployment will not have a CIFS component, 300GB SAS drives can be substituted.

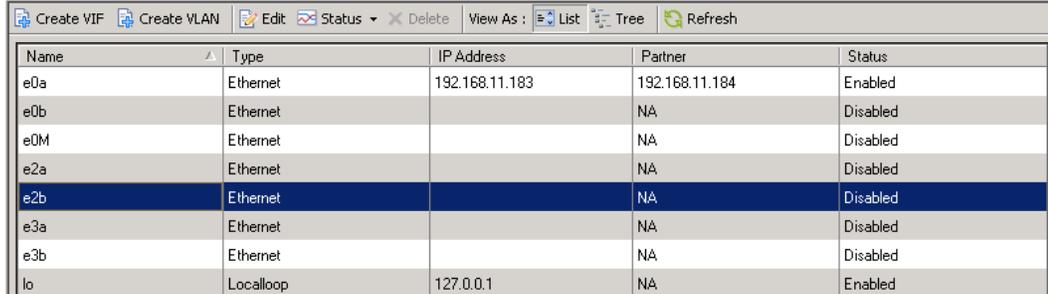
For the purposes of this configuration, the basis for the design architecture is 12 IOPs per virtual machine. This number might vary per environment and for different user types. For more details on sizing best practices, see NetApp [TR-3705](#).

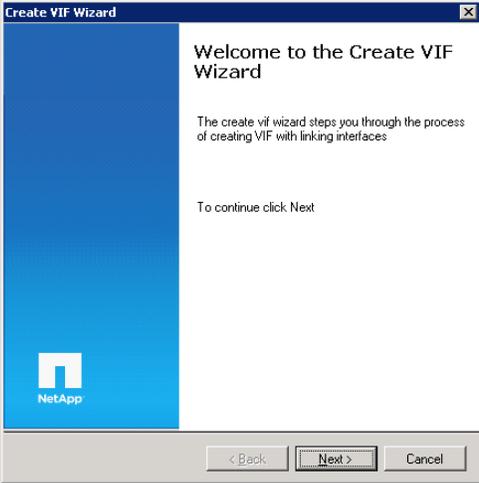
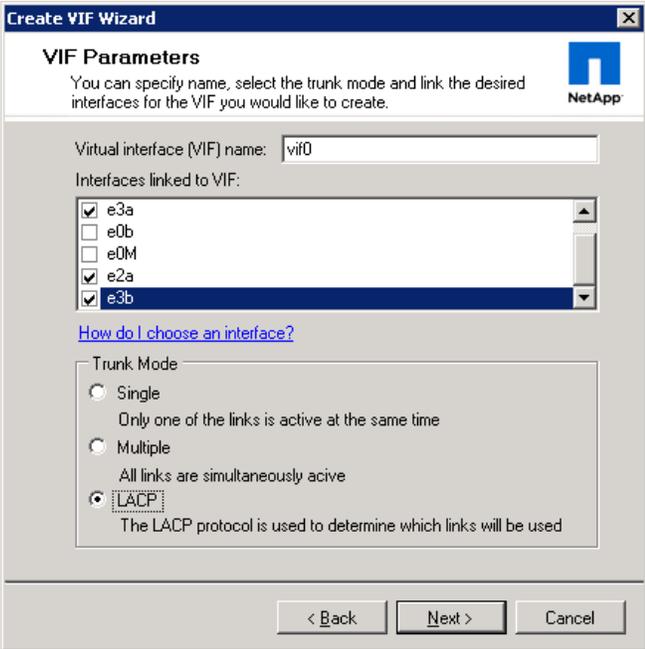
6.2 NETWORK SETUP OF NETAPP STORAGE CONTROLLER

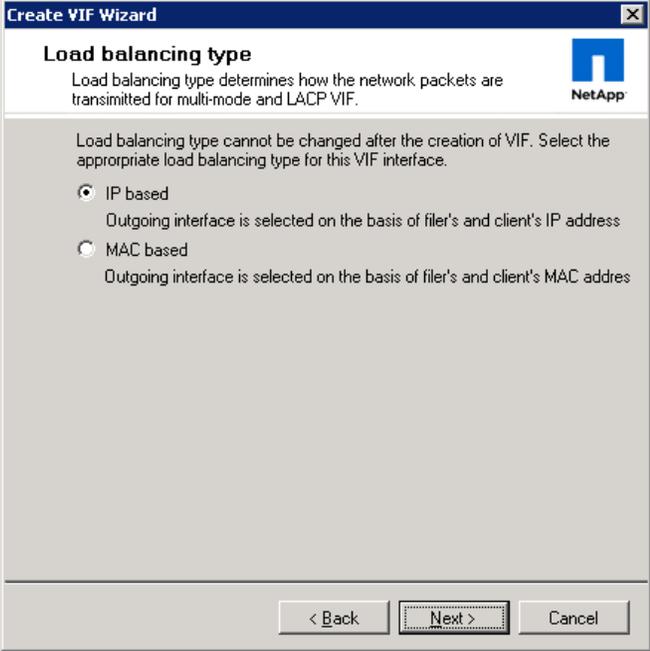
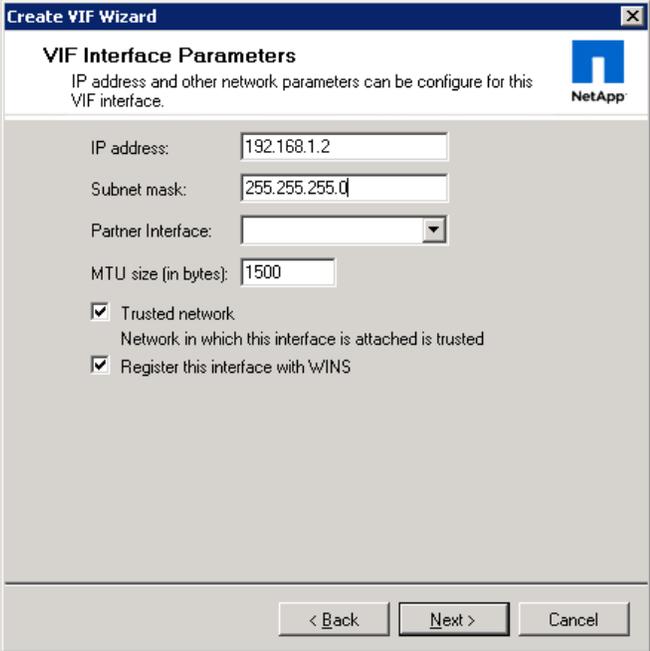
To achieve optimal performance, maximize the number of Ethernet links for both controllers in the NetApp active-active controller configuration. The following steps describe how to set up the network for both storage controllers.

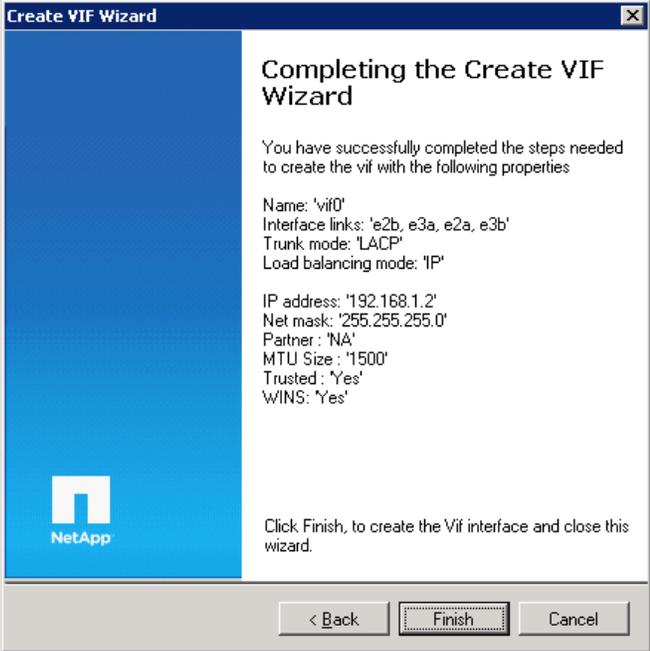
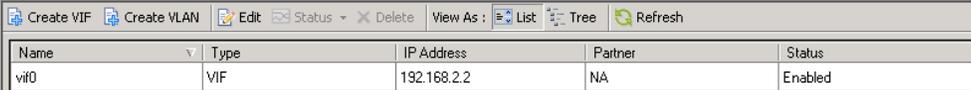
Step	Action
1	Connect to the NetApp storage controllers using System Manager.
2	<p>Please use the diagrams above for a reference on how to configure the cabling for the FAS storage controller.</p> <p>For 10GbE connections, please determine that one interface from each of the two dual-port NICs will separate the Cisco Nexus 5020 switches. In total, two connections should go to Cisco Nexus 5020 A and two should go to Cisco Nexus 5020 B.</p> <p>Please use this setup on both FAS storage controllers in the active-active controller configuration.</p>
3	<p>The ports that these interfaces are connected to on the switches must meet the following criteria:</p> <ol style="list-style-type: none"> They must be on the nonroutable VLAN created for NFS network traffic. They must be configured into a trunk, either manually as a multimode VIF or as an LACP VIF. If LACP is used, then the VIF type must be set to static LACP instead of multimode on the NetApp storage controller. <p>Note: For the purposes of this document we use the 192.168.0.0/24 network for the private subnet for NFS and the 192.168.1.0/24 network for the private subnet for VMotion.</p> <ul style="list-style-type: none"> The NetApp storage controller IP address range is from 192.168.0.2 through 192.168.0.10. The vSphere NFS VMware kernel IP address range is 192.168.0.11 through 192.168.0.254. The VMware VMotion-enabled VMware kernel IP address range is 192.168.1.11 through 192.168.1.254.

6.3 CONFIGURE NFS TRUNK

Step	Action																																													
1	<p>Connect to the NetApp storage controllers using System Manager.</p>  <table border="1"> <thead> <tr> <th>Name</th> <th>Type</th> <th>IP Address</th> <th>Partner</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>e0a</td> <td>Ethernet</td> <td>192.168.11.183</td> <td>192.168.11.184</td> <td>Enabled</td> </tr> <tr> <td>e0b</td> <td>Ethernet</td> <td></td> <td>NA</td> <td>Disabled</td> </tr> <tr> <td>e0M</td> <td>Ethernet</td> <td></td> <td>NA</td> <td>Disabled</td> </tr> <tr> <td>e2a</td> <td>Ethernet</td> <td></td> <td>NA</td> <td>Disabled</td> </tr> <tr> <td>e2b</td> <td>Ethernet</td> <td></td> <td>NA</td> <td>Disabled</td> </tr> <tr> <td>e3a</td> <td>Ethernet</td> <td></td> <td>NA</td> <td>Disabled</td> </tr> <tr> <td>e3b</td> <td>Ethernet</td> <td></td> <td>NA</td> <td>Disabled</td> </tr> <tr> <td>lo</td> <td>Localloop</td> <td>127.0.0.1</td> <td>NA</td> <td>Enabled</td> </tr> </tbody> </table>	Name	Type	IP Address	Partner	Status	e0a	Ethernet	192.168.11.183	192.168.11.184	Enabled	e0b	Ethernet		NA	Disabled	e0M	Ethernet		NA	Disabled	e2a	Ethernet		NA	Disabled	e2b	Ethernet		NA	Disabled	e3a	Ethernet		NA	Disabled	e3b	Ethernet		NA	Disabled	lo	Localloop	127.0.0.1	NA	Enabled
Name	Type	IP Address	Partner	Status																																										
e0a	Ethernet	192.168.11.183	192.168.11.184	Enabled																																										
e0b	Ethernet		NA	Disabled																																										
e0M	Ethernet		NA	Disabled																																										
e2a	Ethernet		NA	Disabled																																										
e2b	Ethernet		NA	Disabled																																										
e3a	Ethernet		NA	Disabled																																										
e3b	Ethernet		NA	Disabled																																										
lo	Localloop	127.0.0.1	NA	Enabled																																										

Step	Action
2	<p>Click Next in the Create VIF Wizard screen.</p> 
3	<p>Enter the name of the VIF, select the four 10GbE interfaces, choose the LACP option, and click Next.</p> 

Step	Action
4	<p>Select IP based as the load-balancing type and click Next.</p> 
5	<p>In the VIF Interface Parameters screen, enter the IP address and the subnet mask and click Next.</p> 

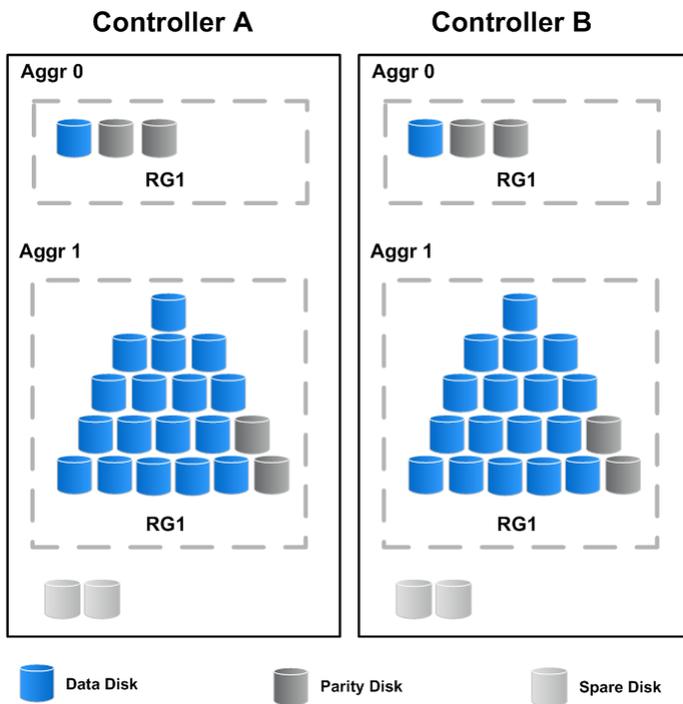
Step	Action										
6	<p>Click Finish to build the VIF.</p> 										
7	<p>Verify that the VIF is enabled. The VIF created should appear as an entry similar to the one below.</p>  <table border="1" data-bbox="342 1052 1313 1142"> <thead> <tr> <th>Name</th> <th>Type</th> <th>IP Address</th> <th>Partner</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>vif0</td> <td>VIF</td> <td>192.168.2.2</td> <td>NA</td> <td>Enabled</td> </tr> </tbody> </table>	Name	Type	IP Address	Partner	Status	vif0	VIF	192.168.2.2	NA	Enabled
Name	Type	IP Address	Partner	Status							
vif0	VIF	192.168.2.2	NA	Enabled							

Note: Repeat these steps for the two remaining ports. Be sure that one NIC is on switch A and the other is on switch B. These ports will be used for CIFS and management traffic and should be set up using VLAN tagging.

6.4 OVERVIEW OF THE NETAPP STORAGE CONTROLLER DISK CONFIGURATION

Figure 3 shows the disk layout for production data on both of the NetApp storage controllers. Aggr0 is only used for the root file system and is typically three drives. To meet the performance and capacity needs of this configuration, each controller has one data aggregate (Aggr1 for hosting production virtual machines) with the required number of spindles and enough spares disks that can be easily added later to the aggregates to deal with unknowns.

Figure 3) NetApp storage controller disk configuration.

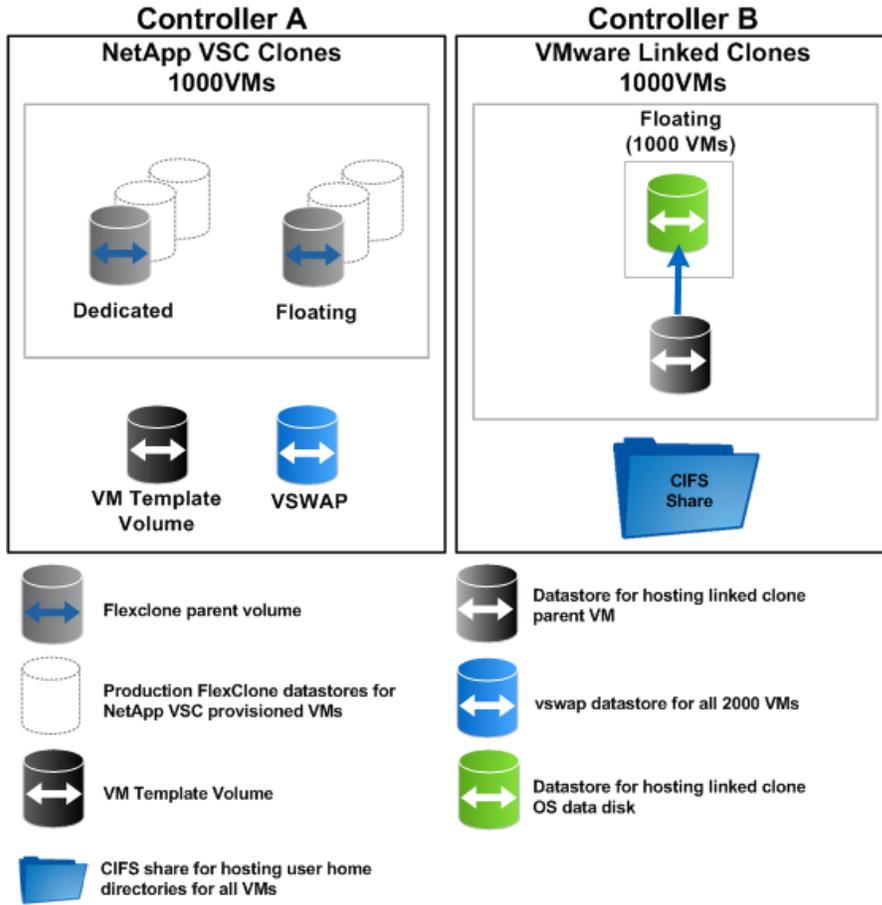


6.5 OVERVIEW OF THE LOGICAL STORAGE CONFIGURATION

Figure 4 shows the logical storage layout for the 2,000-seat POD configuration:

- Controller A hosts 1,000 virtual machines created using NetApp VSC 2.0.1P1 and is part of a manual desktop pool, with 500 in dedicated access mode and 500 in floating access mode.
- Controller B hosts 1,000 virtual machines created using VMware linked clones and is part of an automated desktop pool with 1000 in floating access mode.
- The virtual machine swap file (vswap) datastore on storage controller A hosts the virtual machine swap file for all 2,000 virtual machines. The assumption is that the backup of the OS disk is not in the scope of the project for phase 1 of the deployment but might be in phase 2.
- Controller B hosts the CIFS share for storing the user data for all 1,000 NetApp VSC 2.0.1P1–created virtual machines and also the 1000 virtual machines created using VMware linked clones in floating access mode.

Figure 4) NetApp storage controller logical storage configuration.



FAS CONTROLLER A (1,000 NETAPP VSC 2.0.1P1 DESKTOPS)

Table 7) NetApp FAS controller A configuration.

VDI Infrastructure Component	Number
Total volumes on FAS controller A	9 (including root volume)
FlexClone parent volumes	2
FlexClone volumes	4
Volume for virtual machine swap file (vswap) datastore	1
Volume to host template virtual machine (to be used as the source for creating all the NetApp VSC 2.0.1P1-based virtual machines)	1

FAS CONTROLLER B (1,000 FLOATING VMWARE LINKED CLONES)

Table 8) NetApp FAS controller B configuration.

VDI Infrastructure Component	Number
Total volumes on FAS controller B	7 (including root volume)
FlexClone parent volume	1
FlexClone volumes	2
Volume for hosting linked clone parent virtual machine	1
Volume for hosting OS disk for linked clone virtual machines in floating access mode	1
Volume for hosting CIFS user data	1

6.6 CONFIGURE NETAPP STORAGE CONTROLLERS' SSH CONFIGURATION

For both storage controllers, perform the following steps:

Step	Action
1	Connect to the NetApp storage controller's console (via either telnet or console connection).
2	Execute the following commands and follow the setup script: <pre>secureadmin setup ssh options ssh.enable on options ssh2.enable on</pre>

6.7 CONFIGURE FLEXSCALE FOR FLASH CACHE

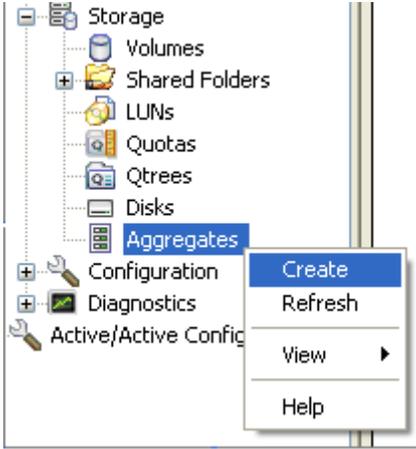
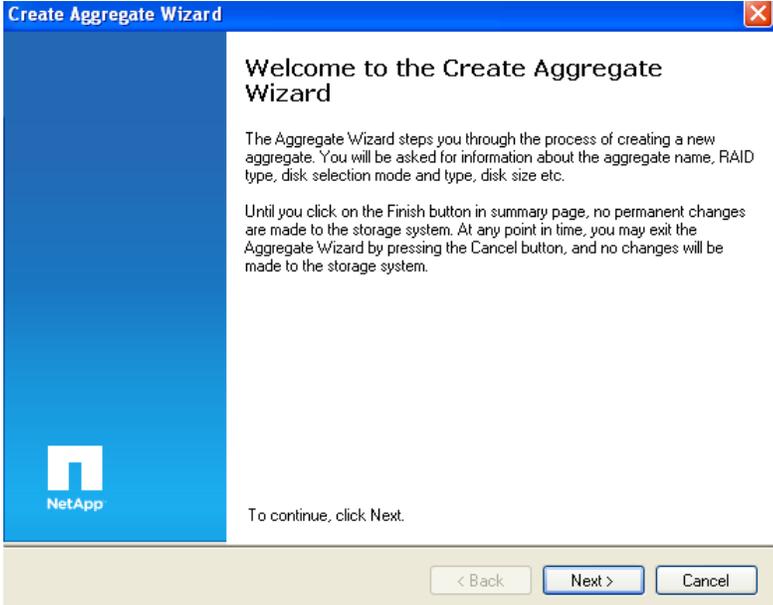
Flash Cache is an intelligent read cache that reduces storage latency and increases I/O throughput by optimizing performance of random read intensive workloads. As a result, disk performance is increased and the amount of storage needed is decreased.

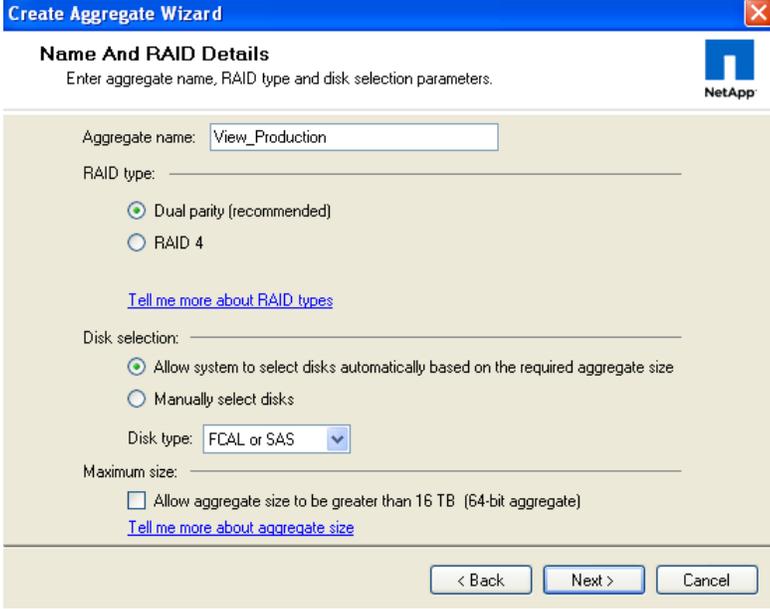
Step	Action
1	Connect to the NetApp storage controller's console (via either SSH, telnet, or console connection).
2	To enable and configure FlexScale™, do the following: <pre>options flexscale.enable on options flexscale.normal_data_blocks on</pre>

6.8 CONFIGURE VIRTUAL MACHINE DATASTORE AGGREGATE

For both storage controllers, perform the following steps:

Note: The data aggregate should have a RAID group size no smaller than 12.

Step	Action
1	<p>Open NetApp System Manager, right-click on Aggregates, and select Create.</p>  <p>The screenshot shows the NetApp System Manager interface. The left-hand navigation pane is expanded to 'Storage', and the 'Aggregates' folder is selected. A right-click context menu is open over the 'Aggregates' folder, with the 'Create' option highlighted. Other options in the menu include 'Refresh', 'View', and 'Help'.</p>
2	<p>The Create Aggregate Wizard will launch; click Next.</p>  <p>The screenshot shows the 'Create Aggregate Wizard' window. The title bar reads 'Create Aggregate Wizard'. The main content area has a blue background on the left with the NetApp logo. The text reads: 'Welcome to the Create Aggregate Wizard. The Aggregate Wizard steps you through the process of creating a new aggregate. You will be asked for information about the aggregate name, RAID type, disk selection mode and type, disk size etc. Until you click on the Finish button in summary page, no permanent changes are made to the storage system. At any point in time, you may exit the Aggregate Wizard by pressing the Cancel button, and no changes will be made to the storage system.' At the bottom, there are three buttons: '< Back', 'Next >', and 'Cancel'. The 'Next >' button is highlighted.</p>
3	<p>Name the aggregate View_Production, choose Dual parity for the RAID type.</p>

	
4	For the Aggregate size, choose 19 of the available 21 drives. This will provide 17 data drives, 2 parity drives, and 2 spares. Click Next.
5	Review the settings and click Next, and then click Finish to build the new data aggregate.

6.9 MODIFY THE AGGREGATE SNAPSHOT RESERVE FOR THE VMWARE VIEW_PRODUCTION AGGREGATE

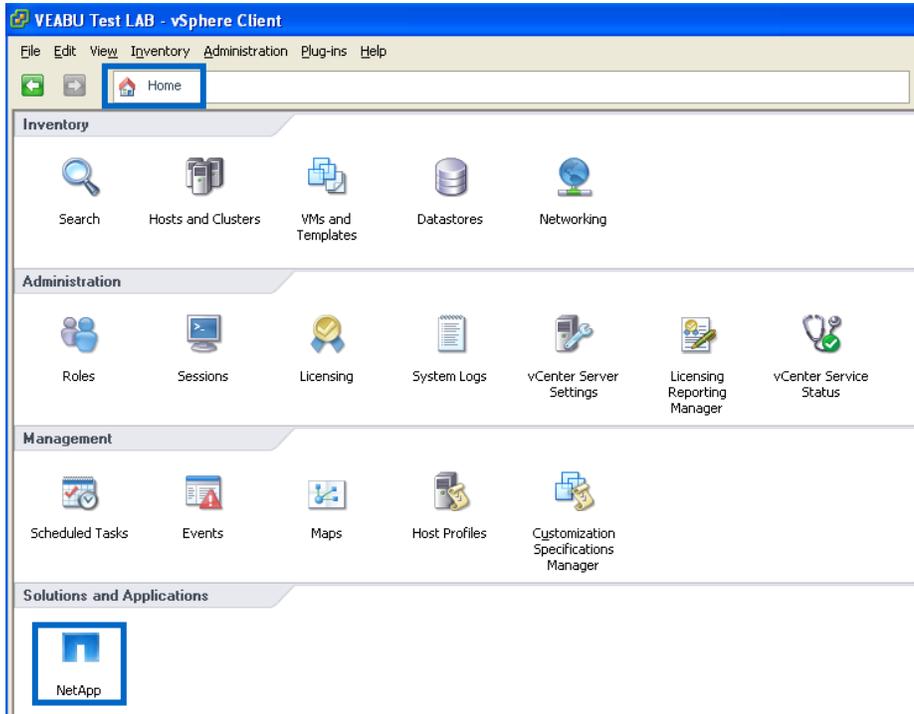
On both storage controllers, perform the following steps:

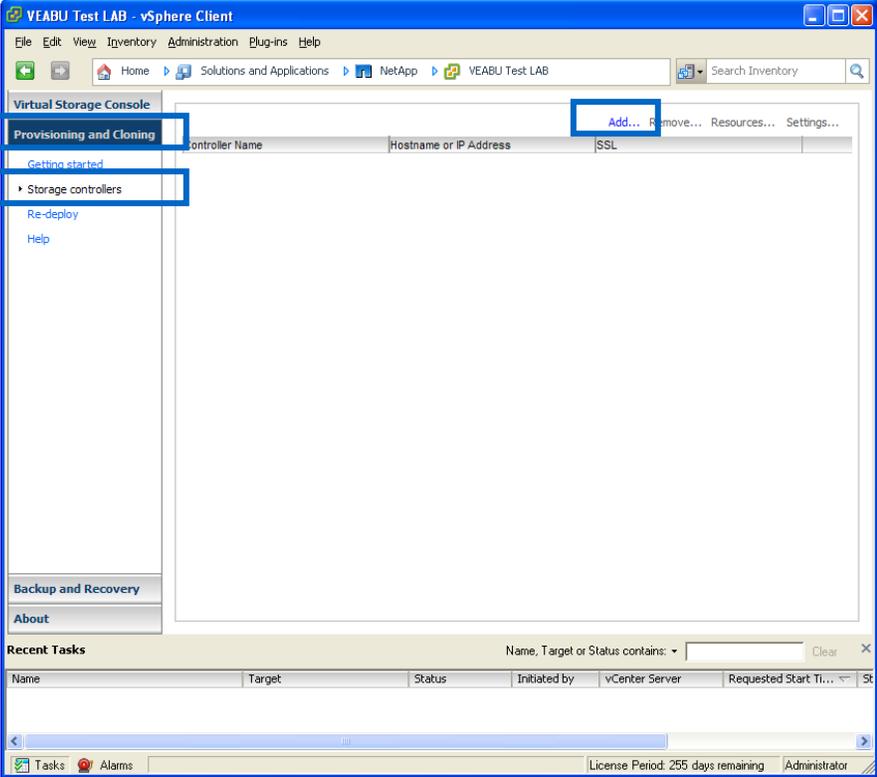
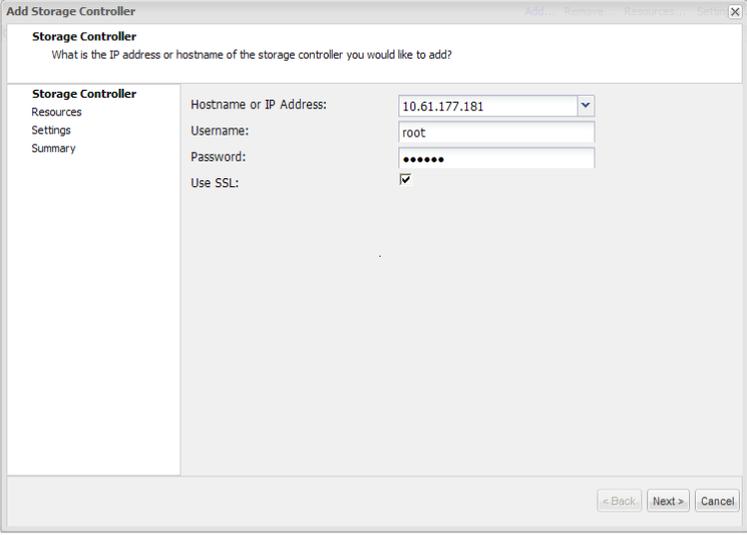
Step	Action
1	Connect to the controller's console, using either SSH, telnet, or serial console.
2	Set the aggregate Snapshot [®] schedule: <code>snap sched -A <aggregate-name> 0 0 0</code>
3	Set the aggregate Snapshot reserve: <code>snap reserve -A <aggregate-name> 0</code>
4	Delete existing Snapshot copies, enter: <code>snap list -A <vol-name></code> Then enter: <code>snap delete <vol-name> <snap-name></code>
5	To log out of the NetApp console, press CTRL+D.

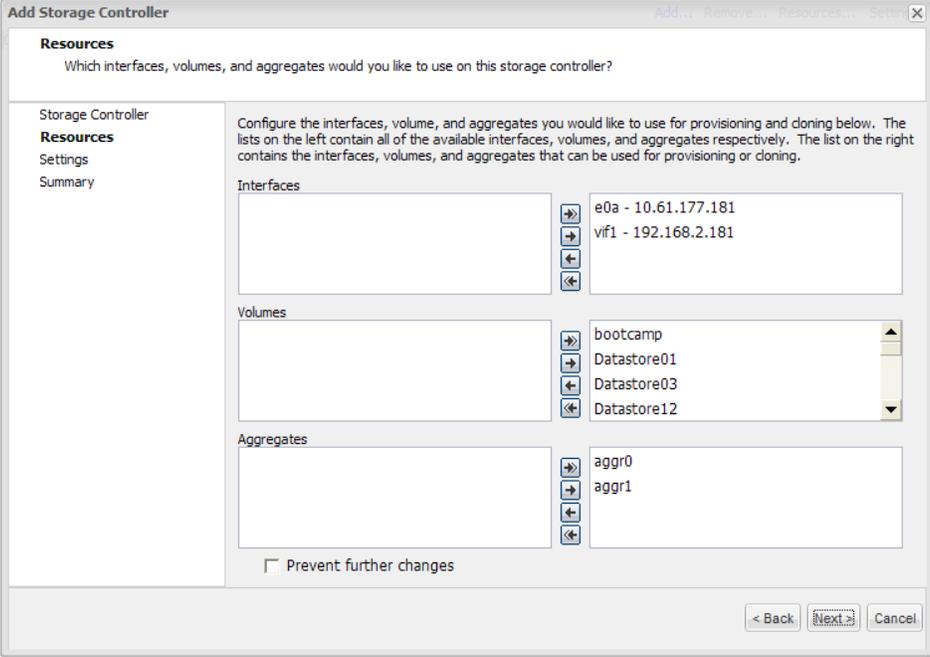
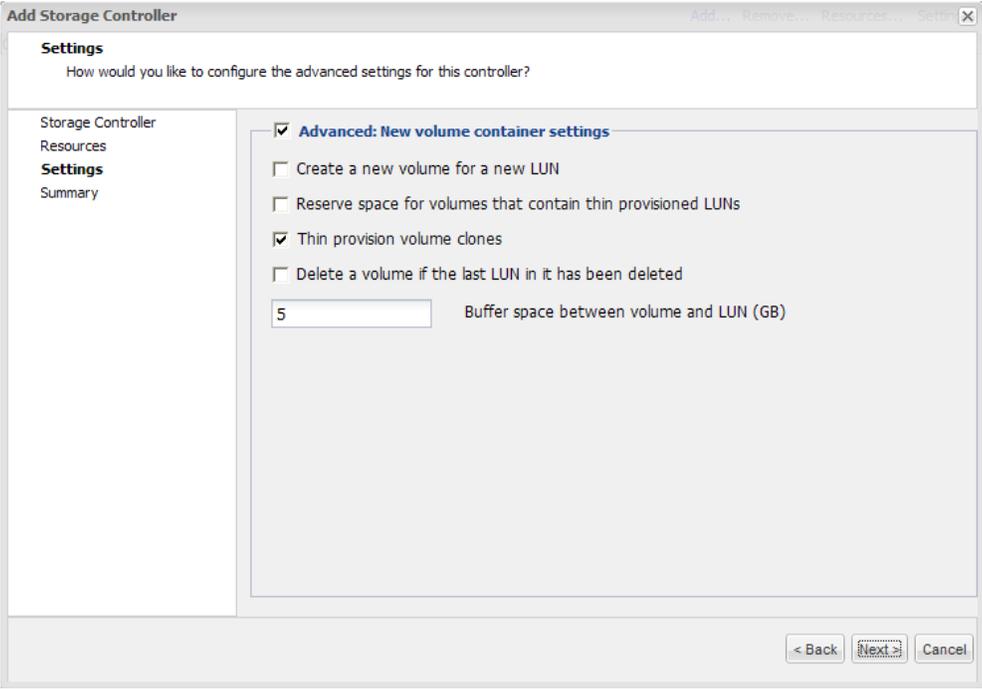
7 NETAPP STORAGE SETUP USING VSC 2.0.1P1

The following steps demonstrate how to create NetApp volumes and VMware datastores through the use of VSC 2.0.1P1. Note that creation of the gold datastore on controller B is not required because VSC 2.0.1P1 uses the template virtual machine in the template datastore as the basis to create the gold datastore on controller B as well.

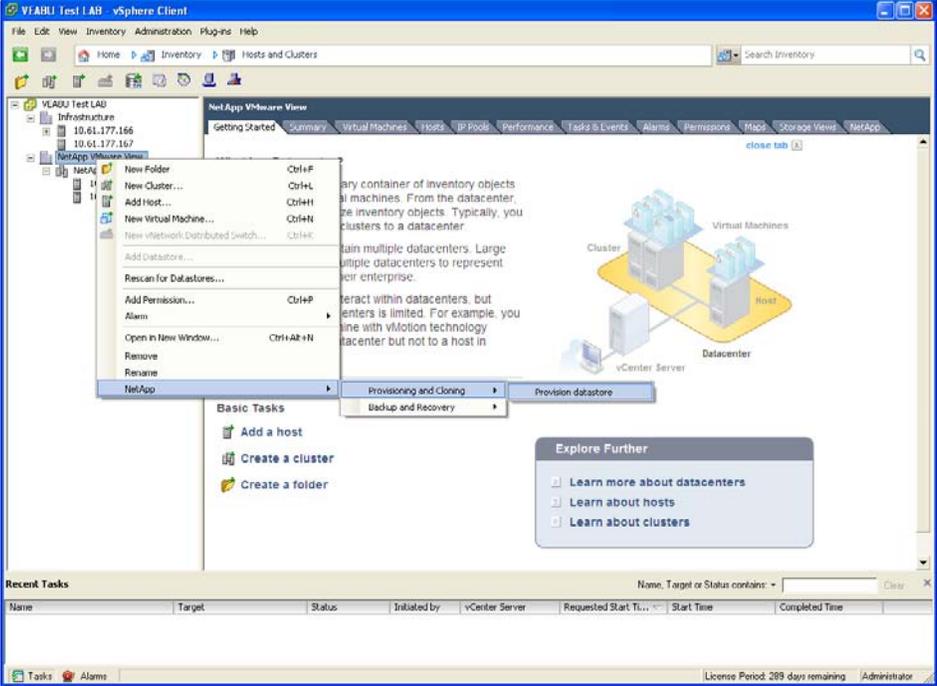
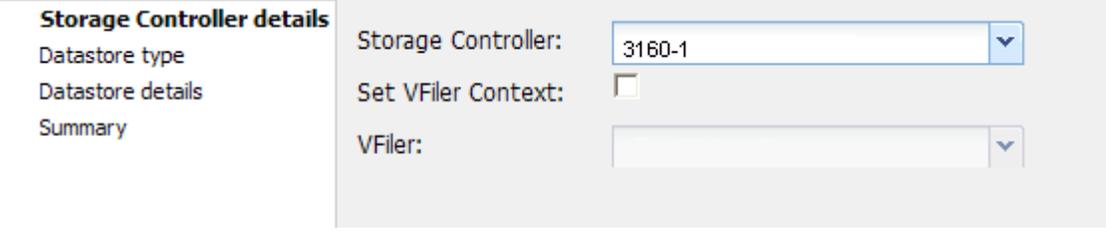
7.1 VSC 2.0.1P1 CONFIGURATION

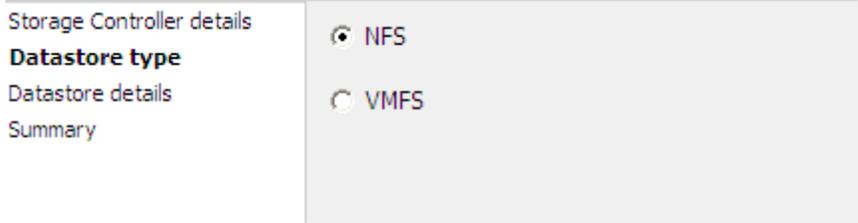
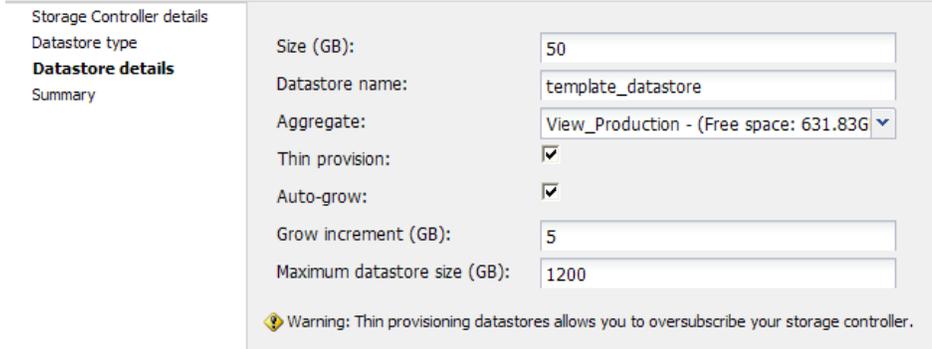
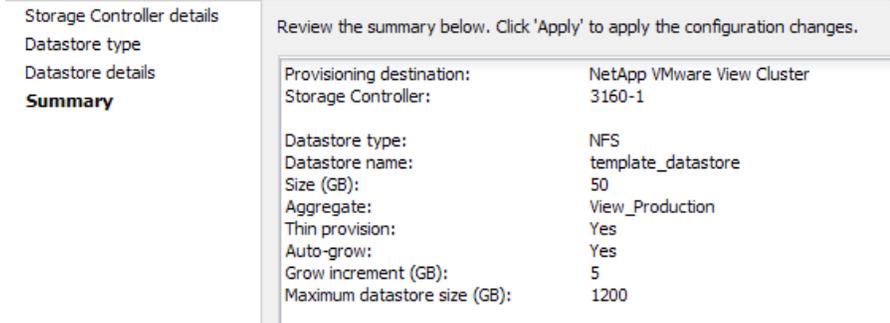
Step	Action
1	<p>To begin provisioning storage with VSC 2.0.1P1, the storage controllers must be added to vCenter through the VSC 2.0.1P1 plug-in. Log in to vCenter and click on the Home link and then click on the NetApp icon listed under Solutions and Applications.</p>  <p>The screenshot shows the vSphere Client interface for 'VEABU Test LAB - vSphere Client'. The 'Home' link in the top navigation bar is highlighted with a blue box. Below the navigation bar, the interface is organized into several sections: 'Inventory' (Search, Hosts and Clusters, VMs and Templates, Datastores, Networking), 'Administration' (Roles, Sessions, Licensing, System Logs, vCenter Server Settings, Licensing Reporting Manager, vCenter Service Status), 'Management' (Scheduled Tasks, Events, Maps, Host Profiles, Customization Specifications Manager), and 'Solutions and Applications'. The 'NetApp' icon is highlighted with a blue box in the 'Solutions and Applications' section.</p>

Step	Action
2	<p data-bbox="326 258 1162 289">On the left pane, click Provisioning and Cloning, Storage controllers, Add...</p> 
3	<p data-bbox="326 1104 1365 1167">Enter the Hostname or IP address, Username, and Password, and select SSL if it is currently configured on the storage controller. Click Next.</p> 
4	<p data-bbox="326 1745 1344 1797">Select the Interfaces, Volumes, and Aggregates that will be available to VSC 2.0.1P1. Click Next.</p>

Step	Action
	
5	<p>The following screen provides advanced settings. In this architecture the defaults that have been chosen are shown below. Click Next.</p> 
6	<p>Review the selections and click Apply. Repeat the process for all storage controllers that VSC 2.0.1P1 will use.</p>

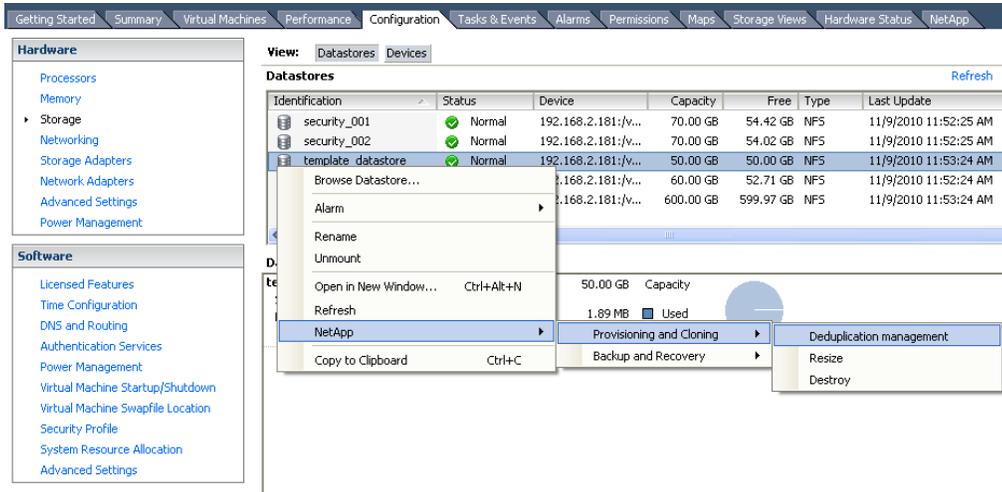
7.2 CREATE A VOLUME TO HOST THE TEMPLATE VIRTUAL MACHINE

Step	Action
1	<p>To provision datastores across multiple ESX hosts in a data center, in vCenter right-click on a data center, select NetApp, and then select Provision datastore.</p>  <p>The screenshot shows the vSphere Client interface. In the left-hand tree view, the 'NetApp' storage controller is selected, and a context menu is open. The 'Provisioning and Cloning' sub-menu is expanded, and 'Provision datastore' is highlighted. The main pane shows a diagram of a vCenter Server connected to a Datacenter, which contains a Cluster and several Hosts. An 'Explore Further' panel is visible on the right, with links to 'Learn more about datacenters', 'Learn about hosts', and 'Learn about clusters'.</p>
2	<p>Click the storage controller you would like to deploy the datastore to.</p> <p>Specify the storage controller What is the storage controller you would like to use?</p>  <p>The screenshot shows a dialog box titled 'Specify the storage controller'. It contains a section for 'Storage Controller details' with the following fields: 'Datastore type', 'Datastore details', and 'Summary'. The 'Storage Controller' field is a dropdown menu currently set to '3160-1'. The 'Set VFile Context' checkbox is unchecked. The 'VFile:' field is a dropdown menu.</p>
3	<p>Specify the datastore type. Here we use NFS.</p>

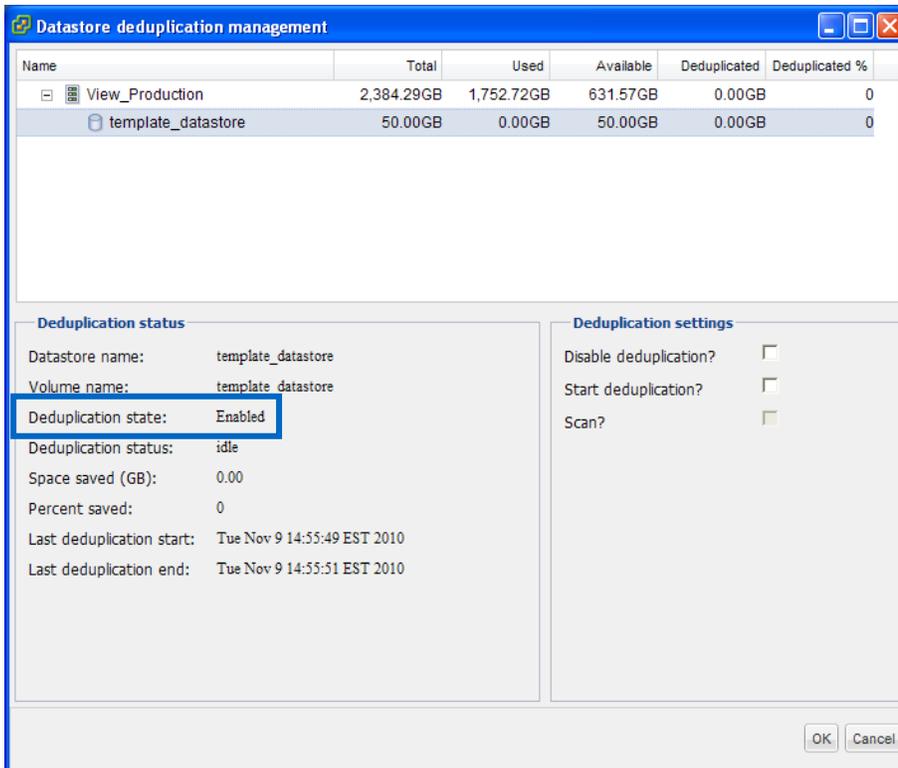
Step	Action
	<p>Select the datastore type you would like to create Which of the 2 types of datastores would you like to use?</p> 
4	<p>Complete the Wizard using the following:</p> <ul style="list-style-type: none"> • Set the size of the volume as 50GB. • Name the volume template_datastore. • Place the template_datastore volume on the View_Production aggregate. • Enable thin provisioning. • Enable auto-grow. <ul style="list-style-type: none"> – Enter a Grow increment of 5. – Enter a Maximum datastore size of 1200. <p>Click Next when all information is entered.</p> <p>Specify the details for new datastore What is the size and the name of the new datastore that you would like to create?</p> 
5	<p>At the following screen, verify that all information is correct and click Apply.</p> <p>Ready to complete the configuration changes Are these the settings you want to use?</p> 

Step	Action
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Select one of the ESX hosts the new datastore was created on, click the Configuration tab, right-click on the new datastore, select NetApp, Deduplication Management, and make sure that Deduplication state is set to Enabled.

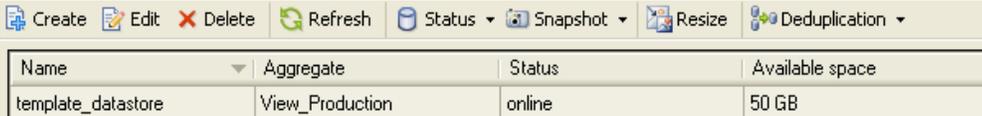
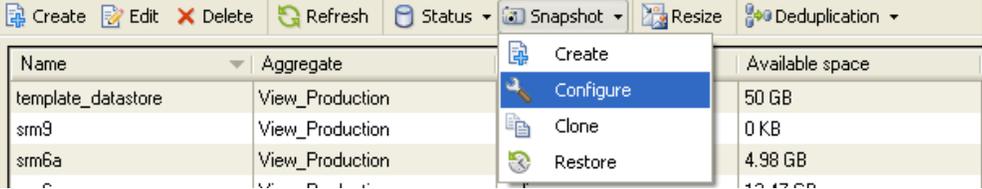
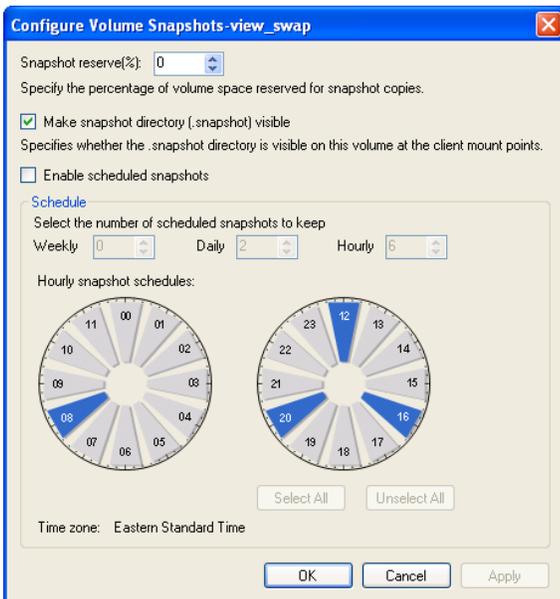


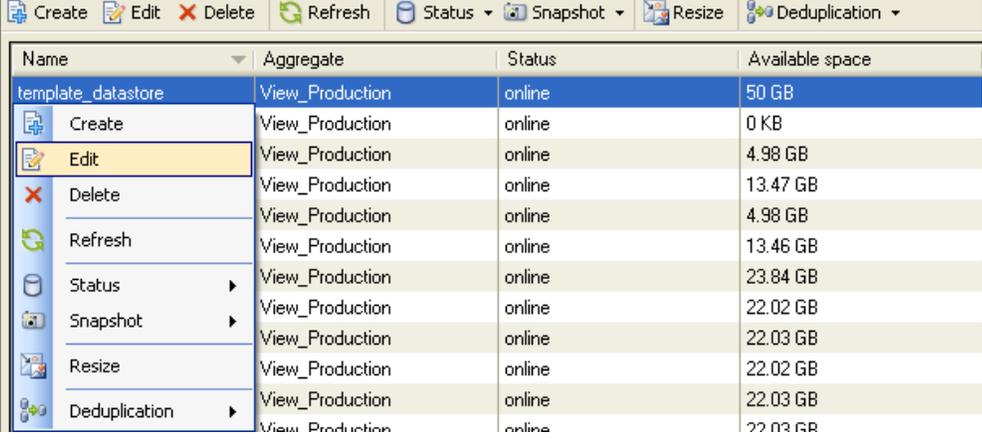
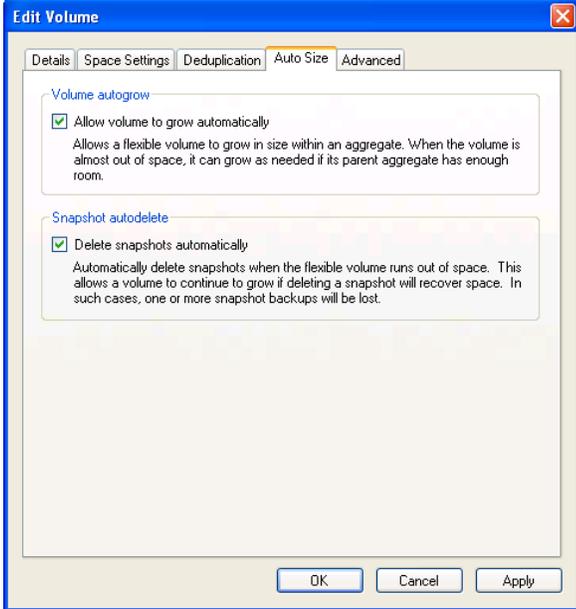
6



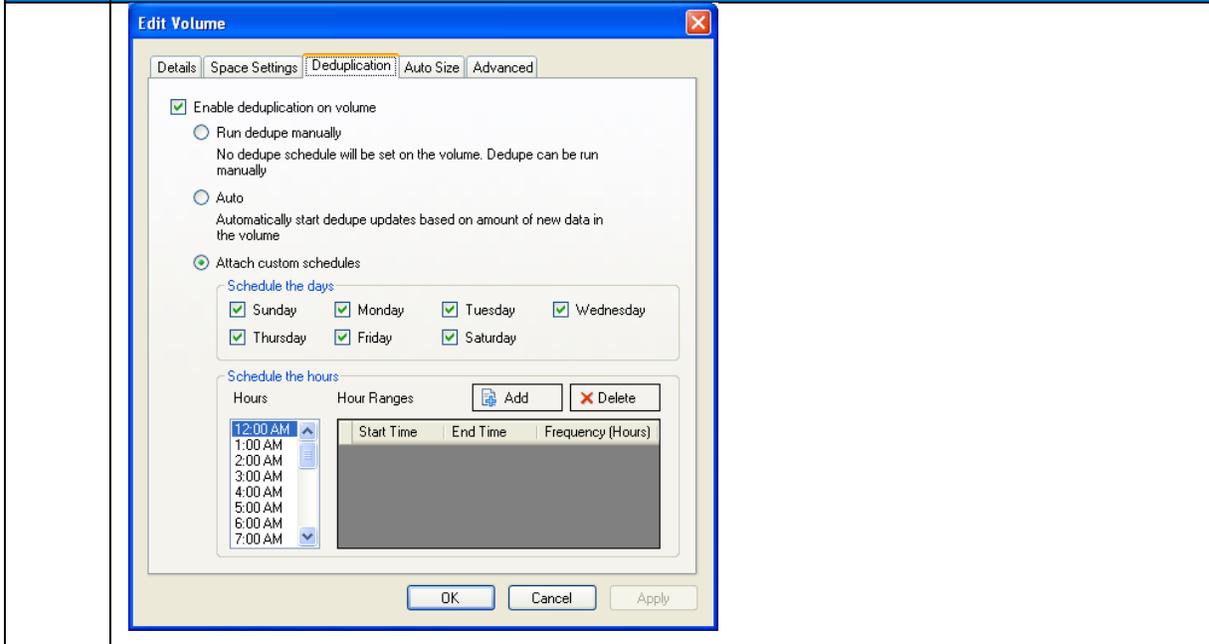
7.3 CONFIGURE SNAPSHOT COPIES AND OPTIMAL PERFORMANCE

The following steps describe how to host volumes in the template virtual machine.

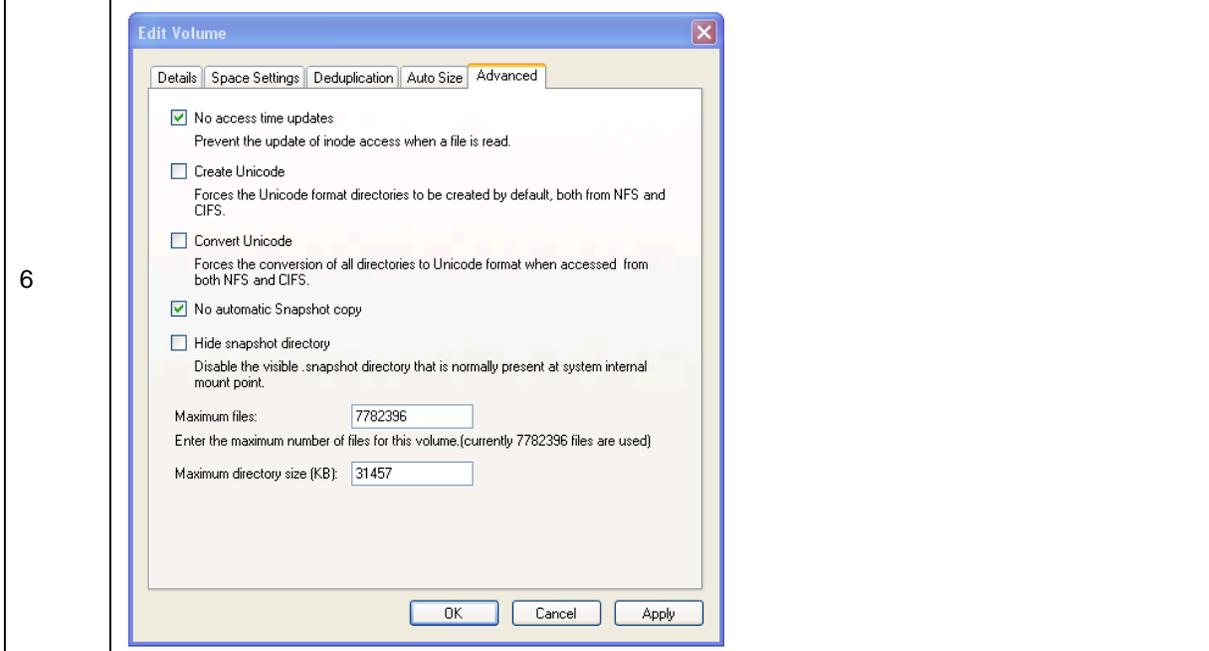
Step	Action
1	<p>Log in to System Manager.</p> 
	<p>To configure Snapshot copies, highlight the rcu_gold volume, click Snapshot, and then click Configure.</p> 
2	<p>Set the Snapshot reserve (%) to 0 and clear the “Enable scheduled snapshots” option. Click Apply and then OK to return to the System Manager main screen.</p> 
3	<p>To set optimal performance, highlight template_datastore , right-click the directory, and select Edit from the drop-down list.</p>

Step	Action																																								
	 <p>The screenshot shows a table with columns: Name, Aggregate, Status, and Available space. The 'template_datastore' volume is selected, and a context menu is open with options: Create, Edit, Delete, Refresh, Status, Snapshot, Resize, and Deduplication. The 'Edit' option is highlighted.</p> <table border="1"> <thead> <tr> <th>Name</th> <th>Aggregate</th> <th>Status</th> <th>Available space</th> </tr> </thead> <tbody> <tr> <td>template_datastore</td> <td>View_Production</td> <td>online</td> <td>50 GB</td> </tr> <tr> <td>Create</td> <td>View_Production</td> <td>online</td> <td>0 KB</td> </tr> <tr> <td>Edit</td> <td>View_Production</td> <td>online</td> <td>4.98 GB</td> </tr> <tr> <td>Delete</td> <td>View_Production</td> <td>online</td> <td>13.47 GB</td> </tr> <tr> <td>Refresh</td> <td>View_Production</td> <td>online</td> <td>4.98 GB</td> </tr> <tr> <td>Status</td> <td>View_Production</td> <td>online</td> <td>13.46 GB</td> </tr> <tr> <td>Snapshot</td> <td>View_Production</td> <td>online</td> <td>23.84 GB</td> </tr> <tr> <td>Resize</td> <td>View_Production</td> <td>online</td> <td>22.02 GB</td> </tr> <tr> <td>Deduplication</td> <td>View_Production</td> <td>online</td> <td>22.03 GB</td> </tr> </tbody> </table>	Name	Aggregate	Status	Available space	template_datastore	View_Production	online	50 GB	Create	View_Production	online	0 KB	Edit	View_Production	online	4.98 GB	Delete	View_Production	online	13.47 GB	Refresh	View_Production	online	4.98 GB	Status	View_Production	online	13.46 GB	Snapshot	View_Production	online	23.84 GB	Resize	View_Production	online	22.02 GB	Deduplication	View_Production	online	22.03 GB
Name	Aggregate	Status	Available space																																						
template_datastore	View_Production	online	50 GB																																						
Create	View_Production	online	0 KB																																						
Edit	View_Production	online	4.98 GB																																						
Delete	View_Production	online	13.47 GB																																						
Refresh	View_Production	online	4.98 GB																																						
Status	View_Production	online	13.46 GB																																						
Snapshot	View_Production	online	23.84 GB																																						
Resize	View_Production	online	22.02 GB																																						
Deduplication	View_Production	online	22.03 GB																																						
4	<p>Click the Auto Size tab and make sure that both the “Allow volume to grow automatically” and “Delete snapshots automatically” boxes are checked. Click Apply.</p>  <p>The 'Edit Volume' dialog box is shown with the 'Auto Size' tab selected. Under 'Volume autogrow', the checkbox 'Allow volume to grow automatically' is checked. Under 'Snapshot autodelete', the checkbox 'Delete snapshots automatically' is checked. The 'Apply' button is highlighted.</p>																																								
5	<p>Click the Deduplication tab and make sure that the Enable deduplication on volume is selected. Set the deduplication schedule according to your business needs.</p>																																								

Step	Action
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Click the Advanced tab. Make sure that the “No access time updates” option is selected. Also make sure that the “No automatic Snapshot copy” is selected. Click Apply and then OK to return to the main System Manager screen.



7.4 STORAGE CONTROLLER “A” ADDITIONAL SETUP AND CONFIGURATION

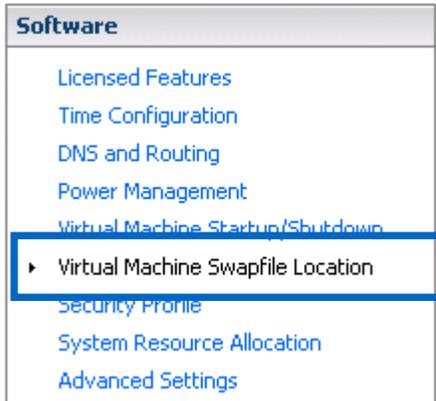
CREATE THE VOLUME TO HOST VIRTUAL MACHINE SWAP FILES

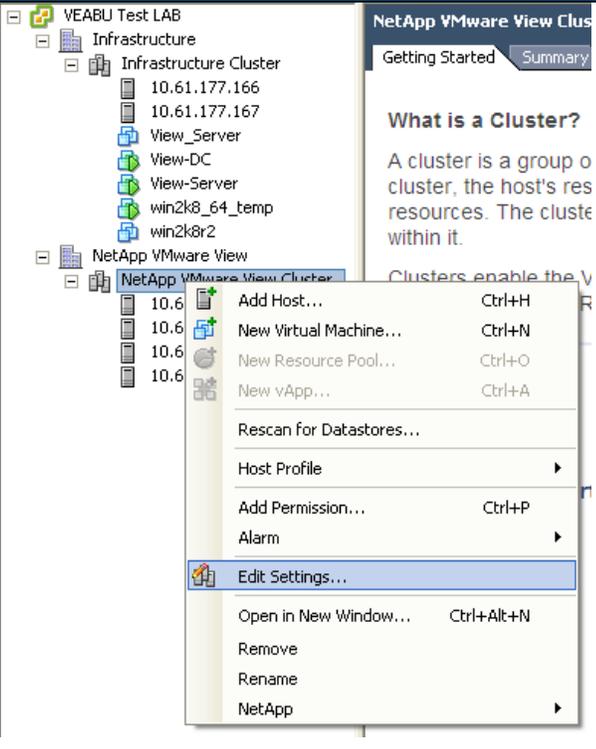
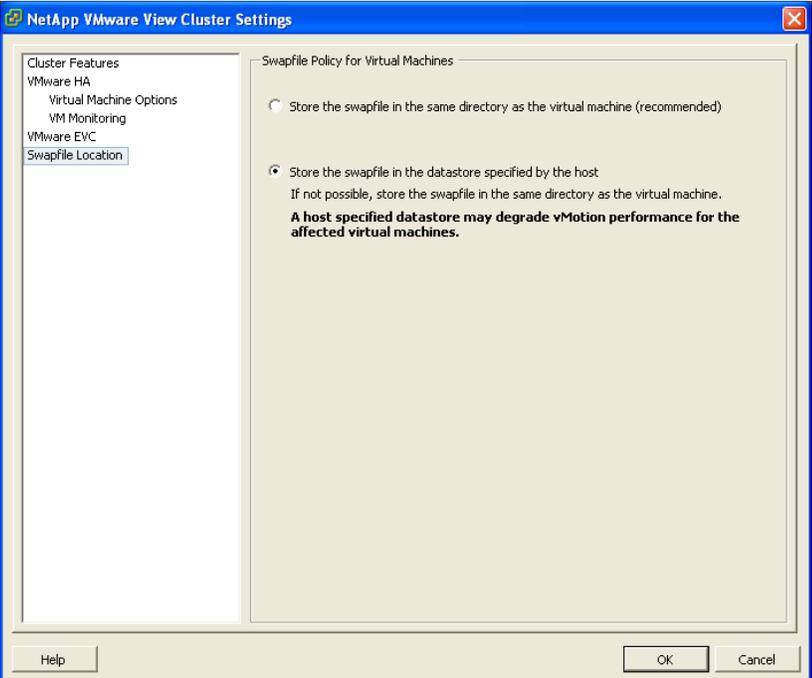
Step	Action
1	In vCenter, right-click on cluster and click NetApp, and then select Provision datastores. This will provision datastores across multiple ESX hosts in a data center.
2	At the next screen, select the storage controller to which you would like to deploy the datastore.
3	Complete the Wizard using the following and click Next: <ul style="list-style-type: none"> • Make the size of the volume 1100GB. • Name the volume view_swap. • Place the view_swap volume on the View_Production aggregate. • Enable thin provisioning. • Enable Auto-grow. <ul style="list-style-type: none"> – Enter a Grow increment of 5. – Enter a Maximum datastore size of 1200.
4	In the next screen, verify that all information is correct and click Apply.
5	Select one of the ESX hosts the new datastore was created on, click the Configuration tab, right-click on the new datastore, select NetApp, Deduplication Management, and ensure that Deduplication state is set to Enabled.
6	For a visual reference refer to section 7.2.

CONFIGURE THE VOLUME

Step	Action
1	Log in to System Manager.
2	To configure Snapshot copies, highlight the view_swap volume, click Snapshot, and then click Configure.
3	Set the Snapshot reserve (%) to 0 and clear the “Enable scheduled snapshots” option. Select Apply and then OK to return to the System Manager main screen.
4	To set optimal performance, highlight and right-click on view_swap, and click Edit from the drop-down list.
5	Click the Auto Size tab and make sure that both the “Allow volume to grow automatically” and “Delete snapshots automatically” boxes are selected. Click Apply.
6	Click the Deduplication tab and set the deduplication schedule according to your business needs.
7	Select the Advanced tab. Make sure that the “No access time updates” option is selected. Also make sure that the “No automatic Snapshot copy” box is selected. Click Apply and then OK to return to the main System Manager screen.
8	For a visual reference refer to section 7.3.

7.5 CONFIGURE LOCATION OF VIRTUAL SWAPFILE DATASTORE

Step	Action
1	Open VMware vCenter.
2	Select a vSphere host.
3	In the right pane, click the Configuration tab.  <p>The screenshot shows the VMware vCenter interface. On the left, there is a tree view with 'VEABU-VC1' expanded to show 'VEABU Datacenter 1' containing two hosts with IP addresses 10.61.177.123 and 10.61.177.124. On the right, the configuration page for host '10.61.177.123 VMware ESX, 4.0.0, 171294' is displayed. The 'Configuration' tab is selected and highlighted with a blue box. Below the tabs, the 'General' and 'Resources' sections are visible.</p>
4	In the Software box, select Virtual Machine Swapfile Location.  <p>The screenshot shows the 'Software' section of the VMware vCenter configuration page. A list of software options is displayed, including 'Licensed Features', 'Time Configuration', 'DNS and Routing', 'Power Management', 'Virtual Machine Startup/Shutdown', 'Virtual Machine Swapfile Location', 'Security Profile', 'System Resource Allocation', and 'Advanced Settings'. The 'Virtual Machine Swapfile Location' option is highlighted with a blue box.</p>
5	In the right pane, click Edit. The virtual machine Swapfile Location Wizard opens.
6	Click view_swap datastore and click OK.
7	Repeat steps 2 through 7 for each vSphere host in the vSphere cluster.
8	Note: If the vSphere hosts are part of a cluster, the swap file location must be changed first in the cluster configurations. In vCenter, right-click the cluster and click Edit Settings.

Step	Action
	 <p>The screenshot shows the vSphere Web Client interface. On the left, a tree view displays the hierarchy: VEABU Test LAB > Infrastructure > Infrastructure Cluster > NetApp VMware View. The 'NetApp VMware View' folder is selected, and a context menu is open over it. The menu items include: Add Host... (Ctrl+H), New Virtual Machine... (Ctrl+N), New Resource Pool... (Ctrl+O), New vApp... (Ctrl+A), Rescan for Datastores..., Host Profile, Add Permission... (Ctrl+P), Alarm, Edit Settings... (highlighted), Open in New Window... (Ctrl+Alt+N), Remove, Rename, and NetApp. On the right, a 'NetApp VMware View Cluster' panel is visible with tabs for 'Getting Started' and 'Summary'. The 'Getting Started' tab is active, showing a 'What is a Cluster?' section with text: 'A cluster is a group of hosts within it. Clusters enable the vSphere host's resources to be shared across the cluster. The host's resources are shared across the cluster within it.'</p>
9	<p>Select Swapfile Location and select Store the swapfile in the datastore specified by the host. Next click OK and proceed editing the individual vSphere hosts.</p>  <p>The screenshot shows the 'NetApp VMware View Cluster Settings' dialog box. The 'Swapfile Location' tab is selected in the left-hand navigation pane. The main area is titled 'Swapfile Policy for Virtual Machines' and contains two radio button options: <ul style="list-style-type: none"> <input type="radio"/> Store the swapfile in the same directory as the virtual machine (recommended) <input checked="" type="radio"/> Store the swapfile in the datastore specified by the host. If not possible, store the swapfile in the same directory as the virtual machine. A host specified datastore may degrade vMotion performance for the affected virtual machines. At the bottom of the dialog, there are 'Help', 'OK', and 'Cancel' buttons.</p>

7.6 CONFIGURE OPTIMAL PERFORMANCE FOR VMDKS ON NFS

For all the volumes with NFS exports configured above for controller A, do the following:

Step	Action
1	Log in to the NetApp console.
2	From the storage appliance console, run <code>options nfs.tcp.recvwindowsize 64240</code>

8 STORAGE CONTROLLER “B” SETUP AND CONFIGURATION

8.1 CREATE VOLUMES FOR HOSTING LINKED CLONES AND CIFS USER DATA

The following steps show how to create the volumes for hosting linked clones and CIFS user data. Refer to section 7.2 for a visual reference and step-by-step instructions.

Step	Action
1	<p>Volume Name: view_lcnp Volume Purpose: Volume for floating linked clones Settings:</p> <ul style="list-style-type: none">• Select NFS as the Datastore type.• Make the size of the volume 700GB.• Name the volume view_lcnp.• Place the view_lcnp volume on the View_Production aggregate.• Enable thin provisioning.• Enable Auto-grow.<ul style="list-style-type: none">– Enter a Grow increment of 5.– Enter a Maximum datastore size of 800.
2	<p>Volume Name: view_cifs Volume Purpose: Volume for user's CIFS home directory</p> <ul style="list-style-type: none">• Select NFS as the Datastore type.• Make the size of the volume 1750GB.• Name the volume view_cifs.• Place the view_cifs volume on the View_Production aggregate.• Enable thin provisioning.• Enable Auto-grow.<ul style="list-style-type: none">– Enter a Grow increment of 5.– Enter a Maximum datastore size of 1850.

8.2 CONFIGURE VOLUMES FOR LINKED CLONES AND CIFS USER DATA

The following steps show how to configure the volumes for hosting linked clones and CIFS user data. Refer to section 7.3 for a visual reference. Repeat the following steps for each of the new volumes created.

Step	Action
1	Log in to System Manager.
2	To configure Snapshot copies, highlight the volume, click Snapshot, and then click Configure.
3	Set the Snapshot reserve (%) to 0 and clear the Enable scheduled snapshots option on all of the newly created volumes except view_cifs. For view_cifs, set the Snapshot reserve (%) to 20 and make sure that Enable scheduled snapshots is selected. Click Apply and then OK to return to the System Manager main screen.
4	To set optimal performance, highlight and right-click on the volume, and select Edit from the drop-down list.
5	Click on the Auto Size tab and make sure that both the “Allow volume to grow automatically” and “Delete snapshots automatically” boxes are selected. Click Apply.
6	Click the Deduplication tab and set the deduplication schedule according to your business needs.
7	Click the Advanced tab. Make sure that the “No access time updates” option is selected. Make sure that the “No automatic Snapshot copy” box is selected. Once this is complete, click Apply and then OK to return to the main System Manager screen.

8.3 CONFIGURE OPTIMAL PERFORMANCE FOR VMDKS ON NFS

For all the volumes with NFS exports configured above for controller B, do the following:

Step	Action
1	Log in to the NetApp console.
2	From the storage appliance console, run: <code>options nfs.tcp.recvwindowsize 64240.</code>

9 SET UP VMWARE VIEW MANAGER 4.5 AND VMWARE VIEW COMPOSER

VMware View Manager is a key component of VMware View and is an enterprise-class desktop management solution that streamlines the management, provisioning, and deployment of virtual desktops. This product allows security and configuration of the VMware View environment and allows an administrator to determine exactly which virtual machines a user may access.

View Composer is a component of the VMware View solution and uses VMware linked clone technology to rapidly create desktop images that share virtual disks with a master image to conserve disk space and streamline management.

For setup and configuration details for the different components of VMware View Manager and View Composer, see the [VMware View Administrator's Guide](#).

10 SET UP AND CONFIGURE WINDOWS 7 GOLD IMAGE

10.1 CREATE A VIRTUAL MACHINE IN VMWARE VSPHERE

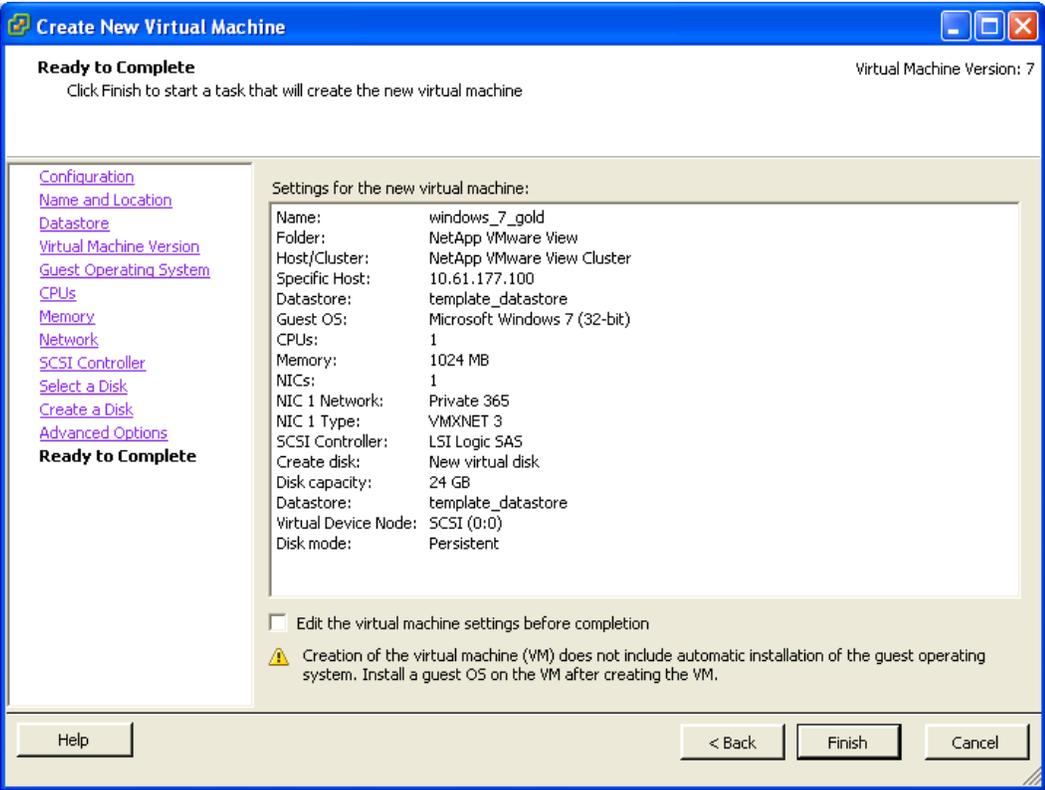
In this section, follow whatever guidelines you have for the virtual machine size and RAM for your Windows 7 virtual machine. For the purposes of this implementation, we use 1GB RAM (VMware guidelines for RAM are between 1 and 3GB). Follow the [Guest Operating System Installation Guide](#) and [VMware View Optimization Guide for Windows 7](#) by VMware. The steps below follow the traditional installation described in the [VMware View Optimization Guide for Windows 7](#).

10.2 FORMAT THE VIRTUAL MACHINE WITH THE CORRECT STARTING PARTITION OFFSETS

Note: Virtual machines running a clean installation of Microsoft Windows 2008, 7, or Vista operating systems automatically have their starting partitions set to 1048576. By default, this value does not require any adjustments. For more information regarding file system alignment, see NetApp [TR 3749: NetApp and VMware vSphere Storage Best Practices](#) and [TR 3747: Best Practices for File System Alignment in Virtual Environments](#).

10.3 WINDOWS 7 PREINSTALLATION TASKS

Step	Action
1	Be sure to have a Windows 7 CD or ISO image that is accessible from the virtual machine.
2	Using the Virtual Infrastructure Client (VI Client), connect to VMware vCenter.
3	Select a vSphere host to create the Windows 7 gold image. Right-click on the vSphere host and select New Virtual Machine and prepare vSphere for the Windows 7 gold image.
4	The following options were used to create the Windows 7 gold image: Note: Below is a summary of the Windows 7 virtual machine gold image used in this document. This is for reference only and specific information will be different in each environment. <ul style="list-style-type: none">• Custom Configuration• windows_7_gold as the name• template_datastore as the datastore• Virtual Machine Version: 7

Step	Action
	<ul style="list-style-type: none"> • Microsoft® Windows 7 (32-bit) • 1 virtual processor • 1GB of memory • 1 NIC card utilizing adapter VMXNET 3 on Private 365 network • LSI Logic SAS SCSI controller • Create a new virtual disk • 24GB of disk space • Virtual device node SCSI (0:0) 

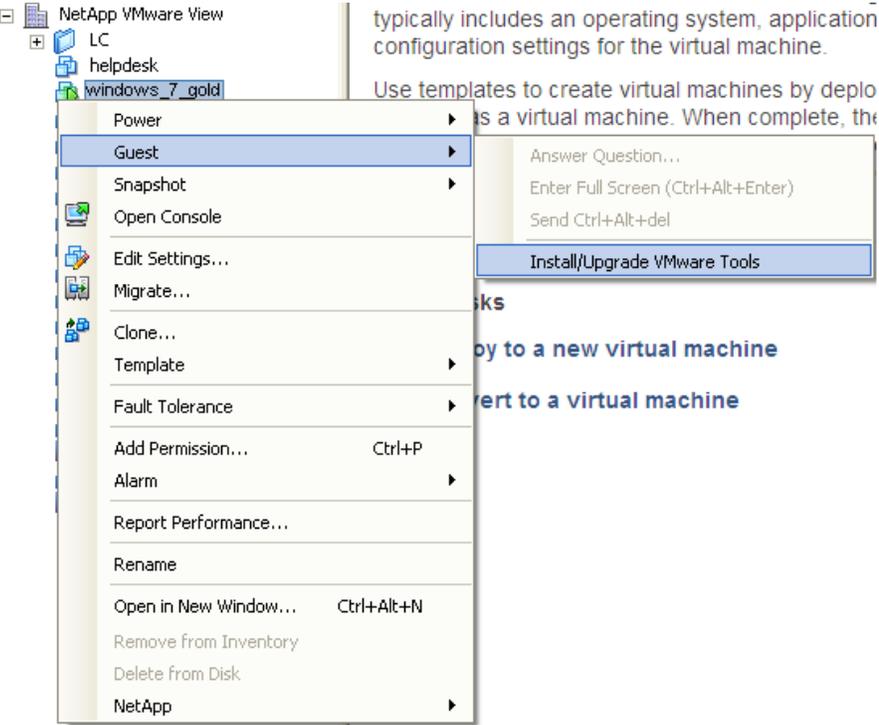
10.4 INSTALL AND CONFIGURE WINDOWS 7

INSTALL WINDOWS 7

Step	Action
1	Using the virtual infrastructure client, connect to VMware vCenter Server.
2	Right-click the virtual machine and select Open Console. This will allow you to send input and view the boot process.
3	Power on the virtual machine created earlier by clicking the green arrow icon at the top of the console screen (shown below). Make sure that the Windows 7 CD has been placed in the vSphere host or that the ISO is available through vCenter.

Step	Action
	
5	Perform the installation of Windows 7 as normal, selecting any specifics for your environment that need to be configured.
6	Because this is a template, keep the installation as generic as possible.

CONFIGURE WINDOWS 7

Step	Action
1	<p>Install and configure the VMware tools by right-clicking on the newly created Windows 7 machine and selecting Guest > Install/Upgrade VMware Tools. Open the console to the Windows 7 machine and follow the installation steps on the virtual machine.</p> 
2	If not applied to the installation CD, install the most recent service pack and the most recent Microsoft updates.
3	Included in the VMware View Optimization Guide for Windows 7 is a commands.txt file. This file contains the VMware recommended profile settings, registry, services, scheduled tasks, and miscellaneous modifications. Review the file and customize for your environment. Once all customizations are complete, rename the file to <code>commands.bat</code> and run on the Windows 7 gold image. Run the file from the command line to make sure that the settings are properly configured. Reboot the Windows 7 machine after successfully running <code>commands.bat</code> .
4	Install the connection broker agent if you plan to use VMware View Manager to allow specific users or groups RDP access to the virtual machines.

Step	Action
5	Disable unused hardware.
6	Disable any unwanted services that were not removed from <code>commands.txt</code> (that was changed to <code>.bat</code>).
7	Run disk cleanup: Start>All Programs>Accessories>System Tools>Disk Cleanup
8	Run disk defrag: Computer>C: properties>Tools

INSTALL APPLICATIONS

Install all the necessary infrastructure and business applications in the gold VM. A few examples include Microsoft Office and Adobe Reader.

POWER OFF VM AND CONVERT TO TEMPLATE

After performing all the template customizations and software installations, power off the virtual machine because the customizations and installations need to be powered off to deploy. Then convert the VM to a template. This reduces the risk of accidentally powering on the VM.

11 RAPID DEPLOYMENT OF WINDOWS 7 VIRTUAL MACHINES IN A VMWARE VIEW ENVIRONMENT USING VSC 2.0.1P1

For detailed installation and configuration instructions for VSC 2.0.1P1, see the [NetApp Virtual Storage Console 2.0 for VMware vSphere Installation and Administration Guide](#). NetApp highly recommends using VSC 2.0.1P1 because further steps in this guide will use VSC 2.0.1P1 to create datastores, deploy virtual machines, and configure datastores from vCenter.

11.1 CREATE CUSTOMIZATION SPECIFICATION

Create a customization specification for use with deployment of the VMs. The customization specification creates the information necessary for sysprep to successfully customize a guest OS from the VMware vCenter Server. It includes information on hostname, network configuration, license information, domain membership, and other information necessary to customize a guest OS. This procedure can be found in the [vSphere Virtual Machine Administration Guide](#) on page 49. This customization specification can be used by VSC 2.0.1P1 to personalize each VM.

Note: For Windows 7, the System Preparation tools are built into the operating system and do not have to be downloaded. Please see [Sysprep file locations and versions](#) located on the VMware Web site for more information and operating systems other than Windows 7.

Note: When creating the customization specification, do not use the following characters: `&`, `<`, `>`, `"`, `'`. VSC 2.0.1P1 may not successfully customize the new desktops if any of these characters are used.

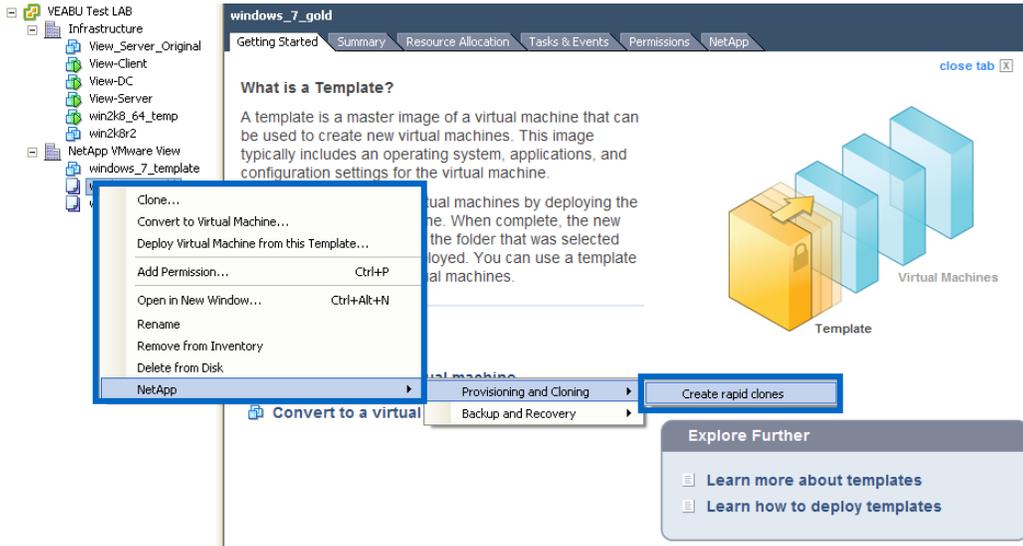
11.2 DEPLOY SPACE-EFFICIENT CLONES USING VSC 2.0.1P1 FOR FLOATING DESKTOPS

Using the `windows_7_gold` template as the source virtual machine, create the virtual machines using VSC 2.0.1P1 in two datastores (250 virtual machines per datastore) on storage controller A in vSphere Cluster A with eight vSphere hosts. These virtual machines will be imported into VMware View Manager as part of a manual desktop pool in floating access mode.

VSC 2.0.1P1 will perform the following steps:

1. Create the clones using file FlexClone.
2. Clone the datastores using volume FlexClone.
3. Mount the NFS datastores to the vSphere hosts.
4. Create the virtual machines from the cloned vmdk.
5. Customize the virtual machines using the customization specification.
6. Power on the virtual machines.
7. Import virtual machines into VMware View Manager.

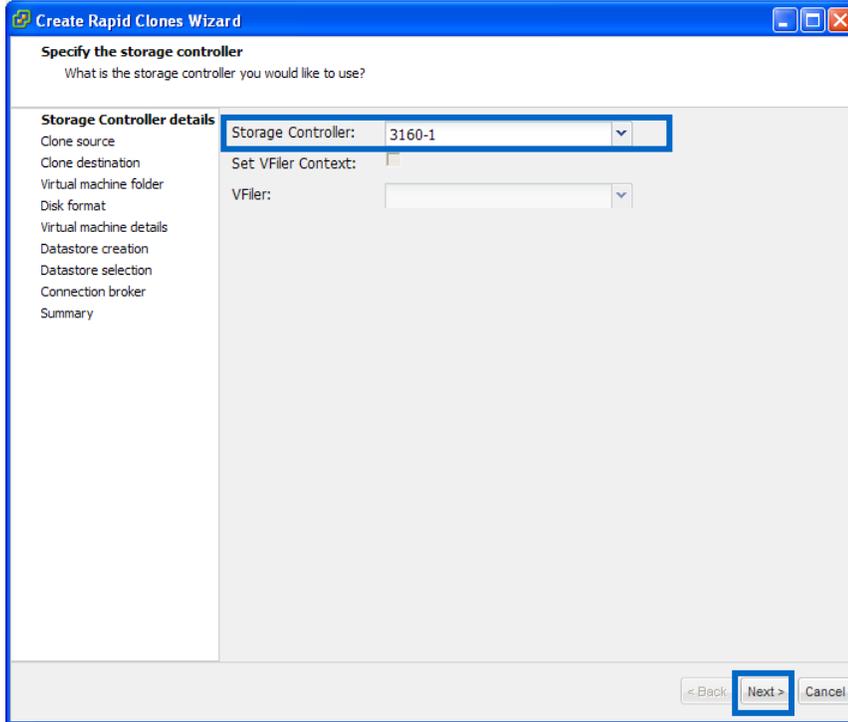
Table 9) Deploy space-efficient clones using VSC 2.0.1P1.

Step	Action
1	Log into the VMware vCenter Server using the vCenter  Client.
2	<p>Once storage controllers have been added, select the inventory button to get back to the servers and VMs. Right-click the VM template to be cloned and select "Create NetApp Rapid Clones."</p>  <p>The screenshot shows the VMware vCenter interface. In the left-hand inventory pane, the 'windows_7_gold' template is selected under the 'NetApp VMware View' folder. A right-click context menu is displayed over the template, with the 'NetApp' option highlighted. A submenu is open for 'NetApp', and the 'Create rapid clones' option is selected. An information window titled 'What is a Template?' is also visible, explaining that a template is a master image of a virtual machine. The 'Create rapid clones' option is highlighted with a blue box, and the 'Create rapid clones' option in the submenu is also highlighted with a blue box. An 'Explore Further' box is visible at the bottom right of the screenshot, containing links to 'Learn more about templates' and 'Learn how to deploy templates'.</p>

Step	Action
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3

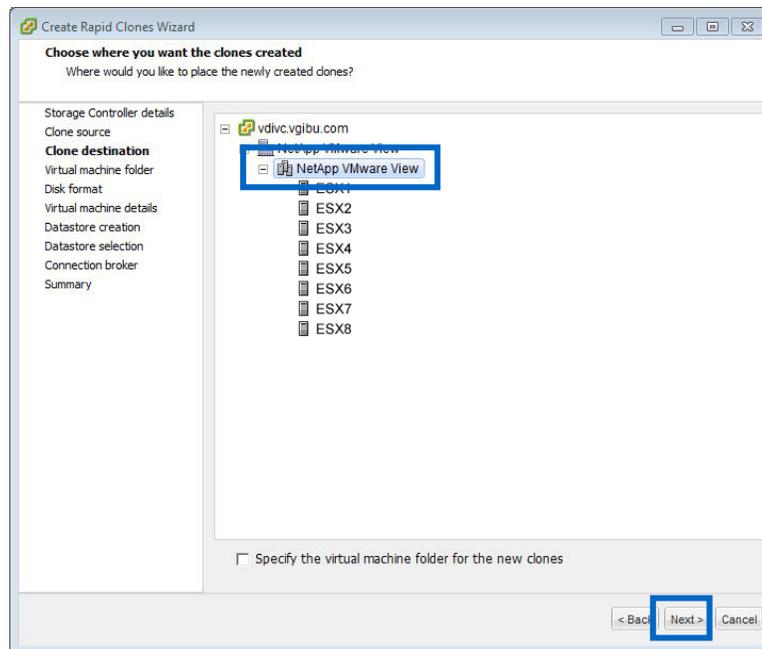
Select the storage controller from the drop-down list and click Next.

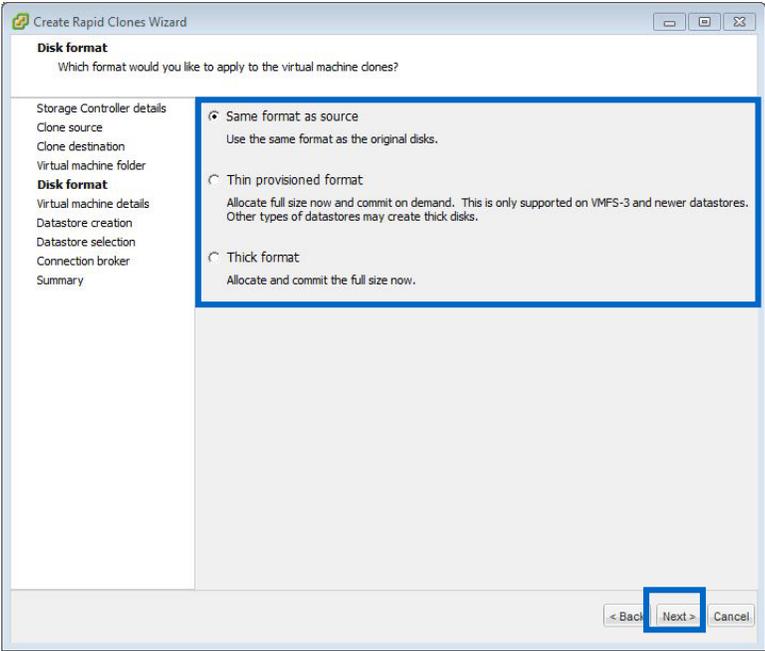


Additionally, if the VMware VI client is not running, select Advanced Options and enter the password for the vCenter Server.

4

Select the data center, cluster, or server to provision the VMs to and select "Specify the virtual machine folder for the new clones" if necessary. Click Next.



Step	Action
5	<p>Select the disk format you would like to apply to the virtual machine clones and click Next.</p>  <p>The screenshot shows a 'Create Rapid Clones Wizard' window. On the left is a navigation pane with the following items: Storage Controller details, Clone source, Clone destination, Virtual machine folder, Disk format, Virtual machine details, Datastore creation, Datastore selection, Connection broker, and Summary. The 'Disk format' step is active, displaying the question 'Which format would you like to apply to the virtual machine clones?'. Three radio button options are listed: 'Same format as source' (selected and highlighted with a blue box), 'Thin provisioned format', and 'Thick format'. The 'Next >' button at the bottom right is also highlighted with a blue box.</p>

Step	Action
------	--------

Enter the number of clones, the clone name, the starting clone number, and the clone number increment. Then, if guest customization is required, select the checkbox and the customization specification that will be applied after the VM has been provisioned. Then select whether or not the virtual machine will be powered on after the clones are created. If using VMware View, select "Import into connection broker" and choose "VMware View." Then select Create new datastores if required and click Next.

6

Create Rapid Clones Wizard

Specify the details of the virtual machine clones
How many clones would you like to create and what settings would you like to apply to them?

Storage Controller details
Clone source
Clone destination
Virtual machine folder
Disk format
Virtual machine details
Datastore creation
Datastore selection
Connection broker
Summary

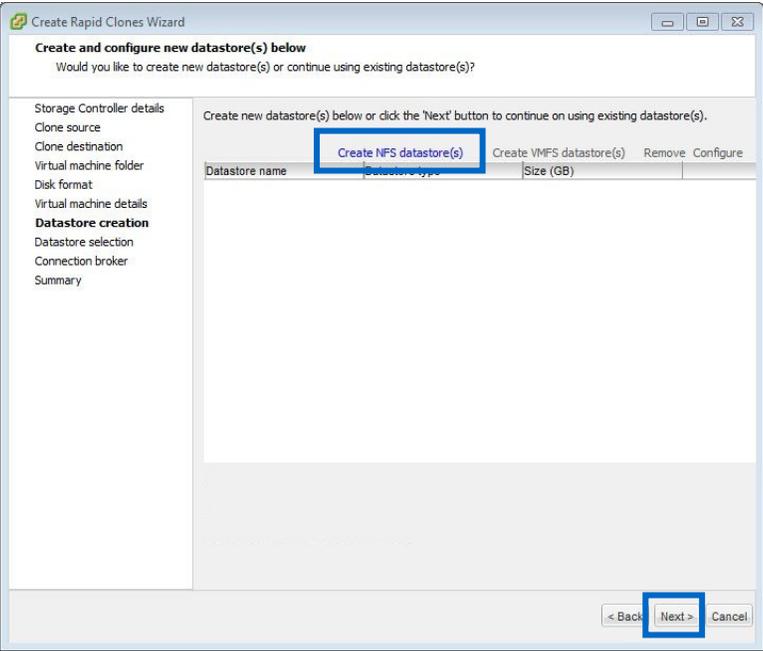
Specify VM Details Import VM Details

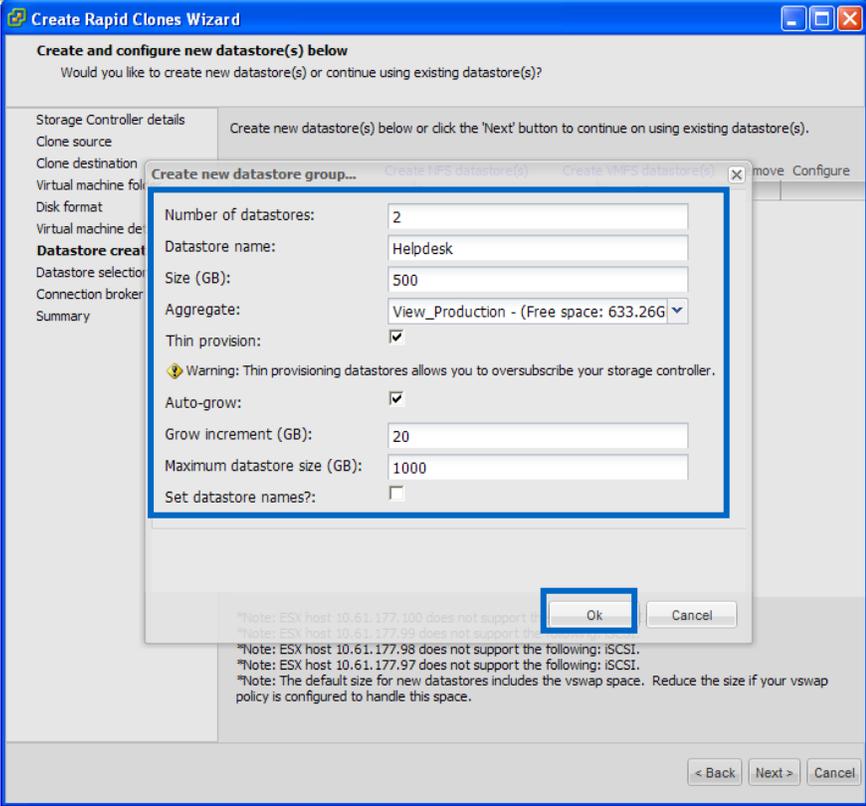
Create new datastore(s)?
Import into connection broker?
Connection broker: VMware View 4.5
Number of clones: 500
Clone name: Helpdesk
Starting clone number: 1
Clone number increment: 1
Power on?
Apply customization specification?
Customization specification: Windows7

Sample clone names
Helpdesk001
Helpdesk002
Helpdesk003
Helpdesk004
Helpdesk005
Helpdesk006
Helpdesk007
Helpdesk008
Helpdesk009
Helpdesk010
...

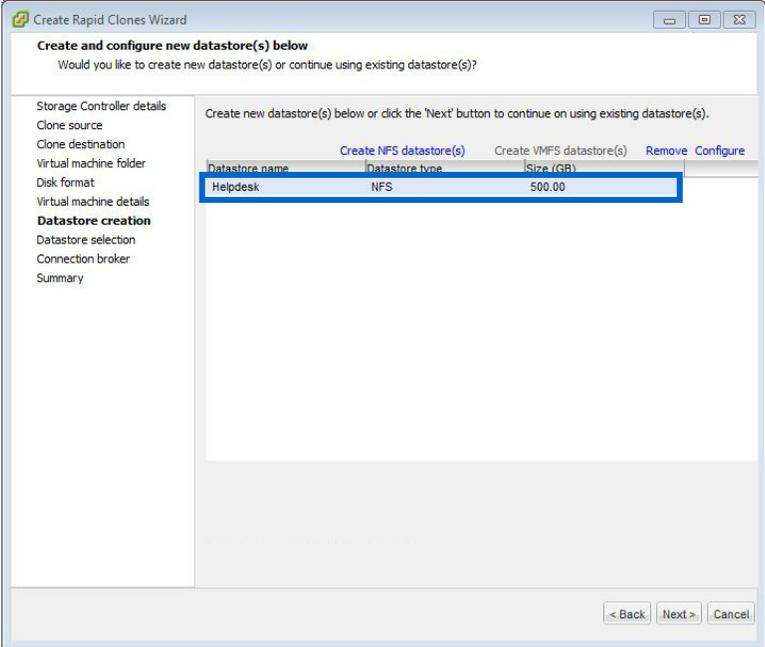
*Note: The success of the creation of 2000 or more VMs will be determined by the size and performance of the vCenter server.
*Note: The selected virtual machine/template has a snapshot. This will cause a native clone operation for the first of the requested clones.

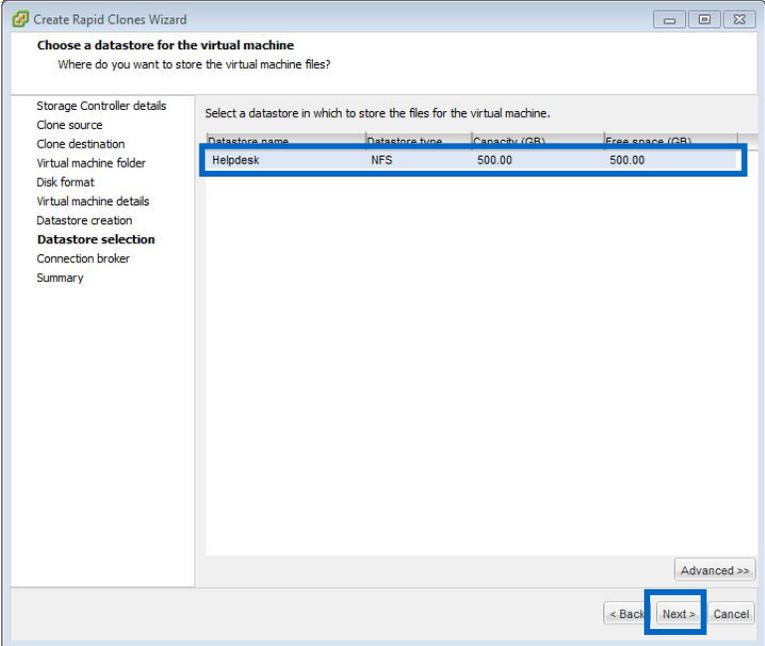
< Back Next > Cancel

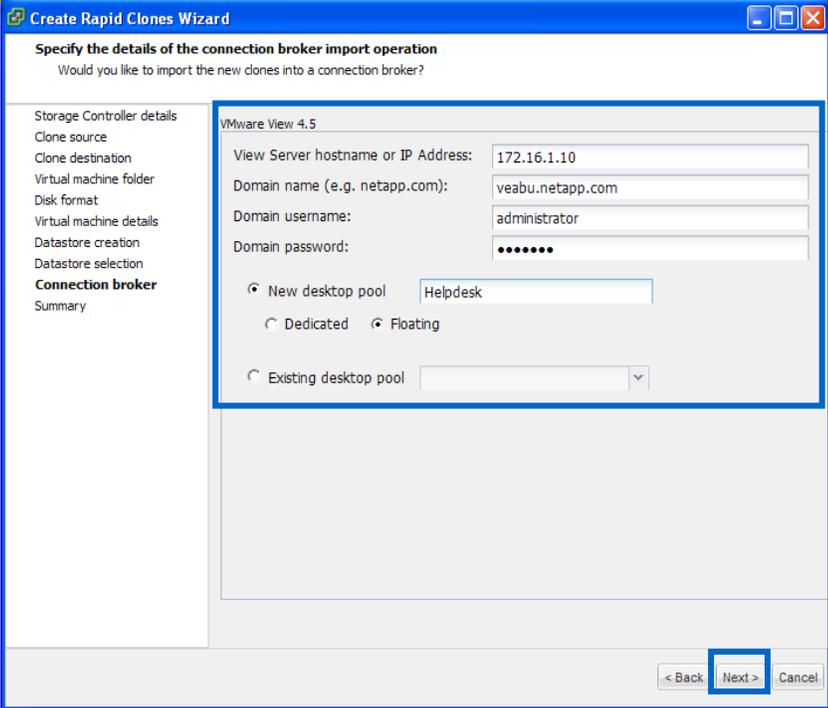
Step	Action
7	<p>If no datastores are present click Create NFS or VMFS datastore(s).</p>  <p>The screenshot shows the 'Create Rapid Clones Wizard' window. The title bar reads 'Create Rapid Clones Wizard'. The main heading is 'Create and configure new datastore(s) below'. Below this, it asks 'Would you like to create new datastore(s) or continue using existing datastore(s)?'. On the left, a list of steps includes 'Storage Controller details', 'Clone source', 'Clone destination', 'Virtual machine folder', 'Disk format', 'Virtual machine details', 'Datastore creation' (which is bolded), 'Datastore selection', 'Connection broker', and 'Summary'. The 'Datastore creation' section contains a table with columns 'Datastore name', 'Datastore type', and 'Size (GB)'. Above the table are buttons for 'Create NFS datastore(s)', 'Create VMFS datastore(s)', 'Remove', and 'Configure'. The 'Create NFS datastore(s)' button is highlighted with a blue box. At the bottom right of the wizard, there are buttons for '< Back', 'Next >', and 'Cancel'. The 'Next >' button is also highlighted with a blue box.</p>

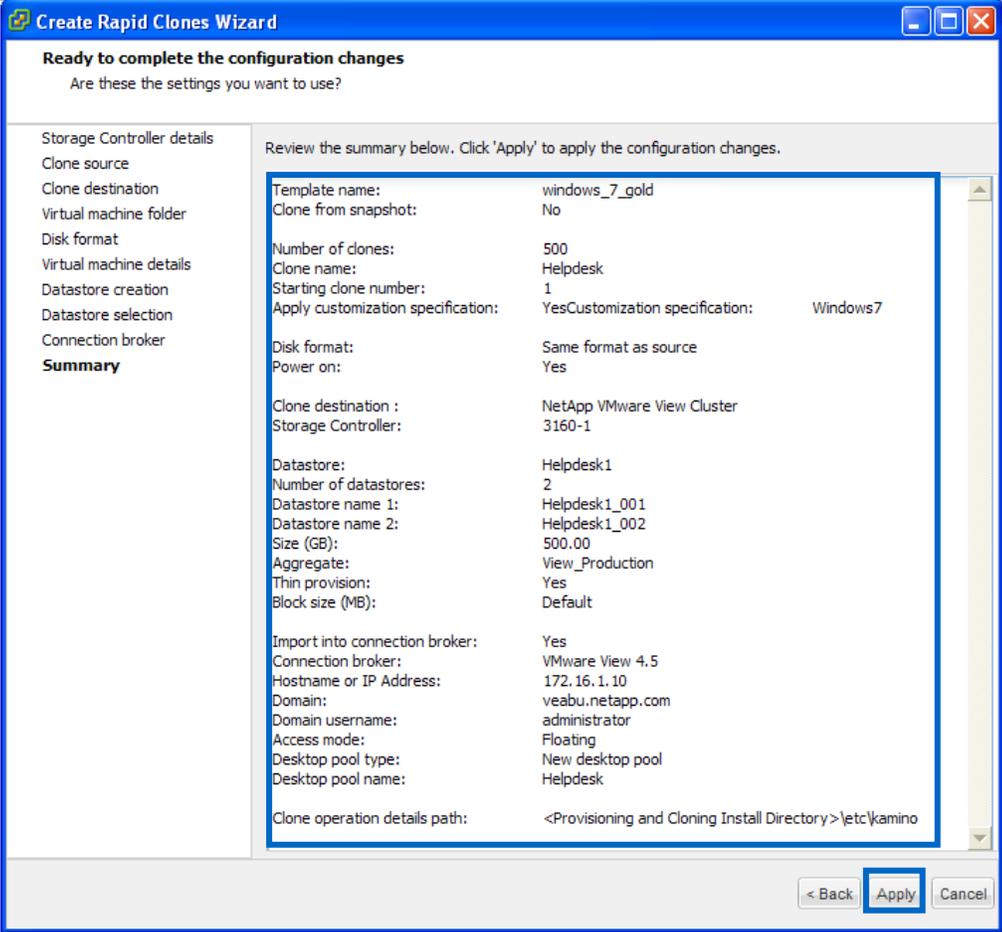
Step	Action
8	<p>Enter the number of datastores to be created. Then, enter the root of the datastore name, the size of the datastore in GB, and the aggregate that is to be used for the virtual machines. Select the thin provisioning checkbox if needed. For NFS-based datastores the option to auto-grow the datastore will appear. You can then select the Grow increment size, the Maximum size, and whether or not you want to provide specific datastore names. Click OK.</p>  <p>The screenshot shows the 'Create Rapid Clones Wizard' window. The main window title is 'Create Rapid Clones Wizard'. The subtitle is 'Create and configure new datastore(s) below'. Below the subtitle is the question 'Would you like to create new datastore(s) or continue using existing datastore(s)?'. The main area is divided into several sections: 'Storage Controller details', 'Clone source', 'Clone destination', 'Virtual machine folder', 'Disk format', 'Virtual machine details', 'Datastore creation', 'Datastore selection', 'Connection broker', and 'Summary'. The 'Datastore creation' section is currently active. A sub-dialog box titled 'Create new datastore group...' is open over the main window. This sub-dialog has the following fields and options: 'Number of datastores:' with a value of 2; 'Datastore name:' with the value 'Helpdesk'; 'Size (GB):' with the value 500; 'Aggregate:' with a dropdown menu showing 'View_Production - (Free space: 633.26G)'; 'Thin provision:' with a checked checkbox; a warning icon and text: 'Warning: Thin provisioning datastores allows you to oversubscribe your storage controller.'; 'Auto-grow:' with a checked checkbox; 'Grow increment (GB):' with the value 20; 'Maximum datastore size (GB):' with the value 1000; and 'Set datastore names?:' with an unchecked checkbox. At the bottom of the sub-dialog are 'Ok' and 'Cancel' buttons. The 'Ok' button is highlighted with a red box. Below the sub-dialog, there are several notes: '*Note: ESX host 10.61.177.100 does not support the following: iSCSI.', '*Note: ESX host 10.61.177.98 does not support the following: iSCSI.', '*Note: ESX host 10.61.177.97 does not support the following: iSCSI.', and '*Note: The default size for new datastores includes the vswap space. Reduce the size if your vswap policy is configured to handle this space.' At the bottom of the main wizard window are '< Back', 'Next >', and 'Cancel' buttons.</p>

Step	Action
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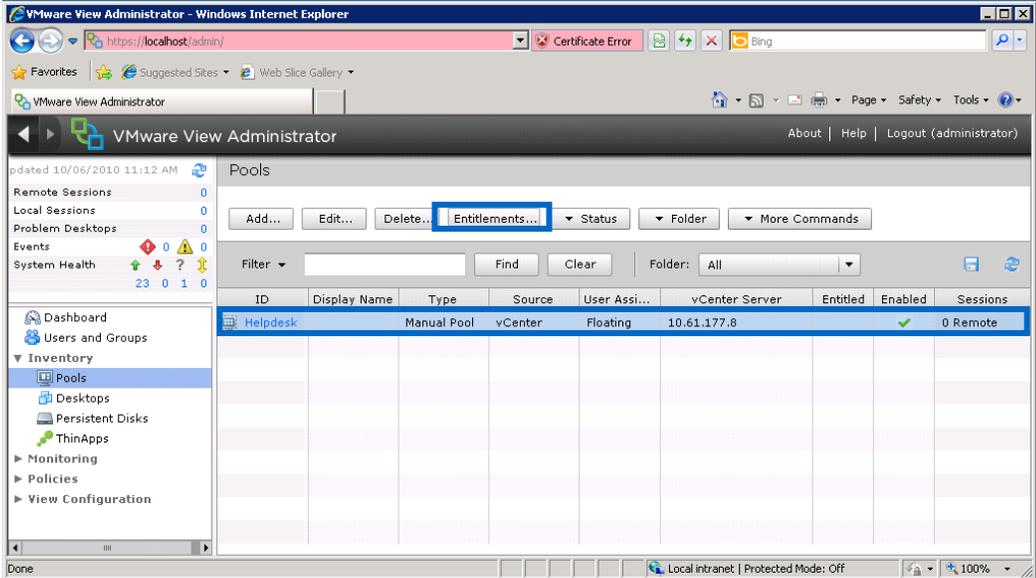
9	<p>After datastore creation, VSC 2.0.1P1 will display the datastore that was created. If necessary you can create additional datastores at this point.</p>  <p>The screenshot shows the 'Create Rapid Clones Wizard' dialog box. The title bar reads 'Create Rapid Clones Wizard'. The main heading is 'Create and configure new datastore(s) below' with the question 'Would you like to create new datastore(s) or continue using existing datastore(s)?'. On the left, a list of steps includes 'Storage Controller details', 'Clone source', 'Clone destination', 'Virtual machine folder', 'Disk format', 'Virtual machine details', 'Datastore creation', 'Datastore selection', 'Connection broker', and 'Summary'. The 'Datastore creation' step is active. The main area contains a table with columns 'Datastore name', 'Datastore type', and 'Size (GB)'. One row is visible: 'Helpdesk', 'NFS', '500.00'. Buttons for 'Create NFS datastore(s)', 'Create VMFS datastore(s)', 'Remove', and 'Configure' are above the table. At the bottom, there are '< Back', 'Next >', and 'Cancel' buttons.</p>
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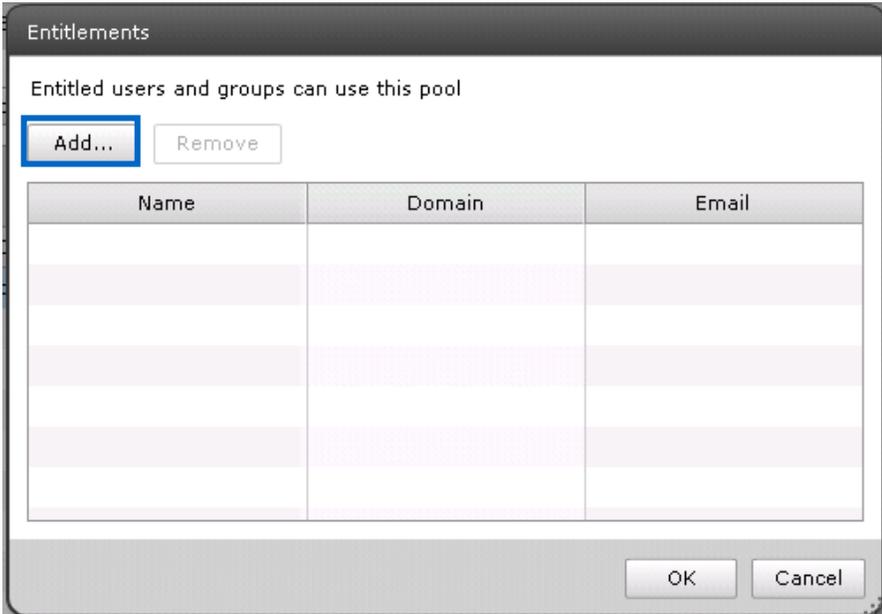
10	<p>When no further datastores need to be created, select the datastore and click Next.</p>  <p>The screenshot shows the 'Create Rapid Clones Wizard' dialog box. The title bar reads 'Create Rapid Clones Wizard'. The main heading is 'Choose a datastore for the virtual machine' with the question 'Where do you want to store the virtual machine files?'. On the left, the same list of steps is shown, but 'Datastore selection' is now active. The main area contains a table with columns 'Datastore name', 'Datastore type', 'Capacity (GB)', and 'Free space (GB)'. One row is visible: 'Helpdesk', 'NFS', '500.00', '500.00'. An 'Advanced >>' button is located above the 'Next >' button. At the bottom, there are '< Back', 'Next >', and 'Cancel' buttons.</p>
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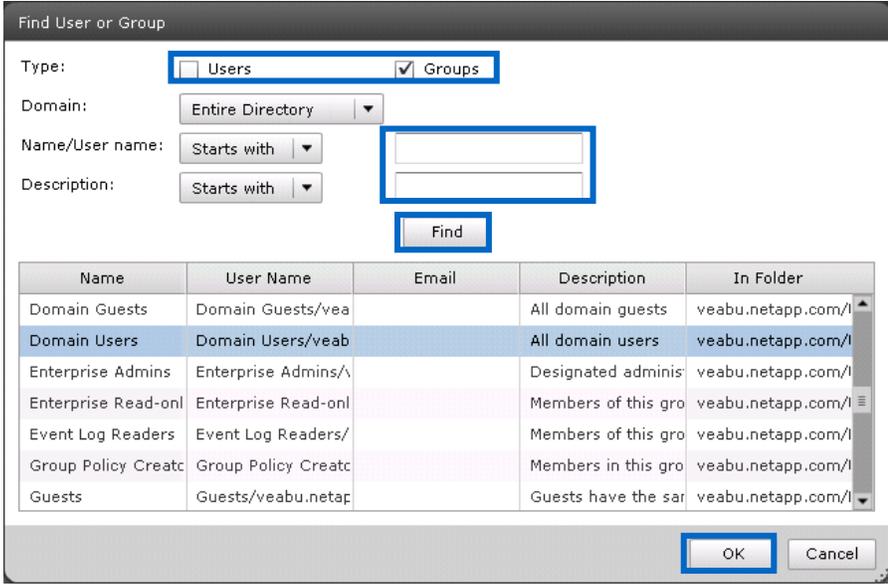
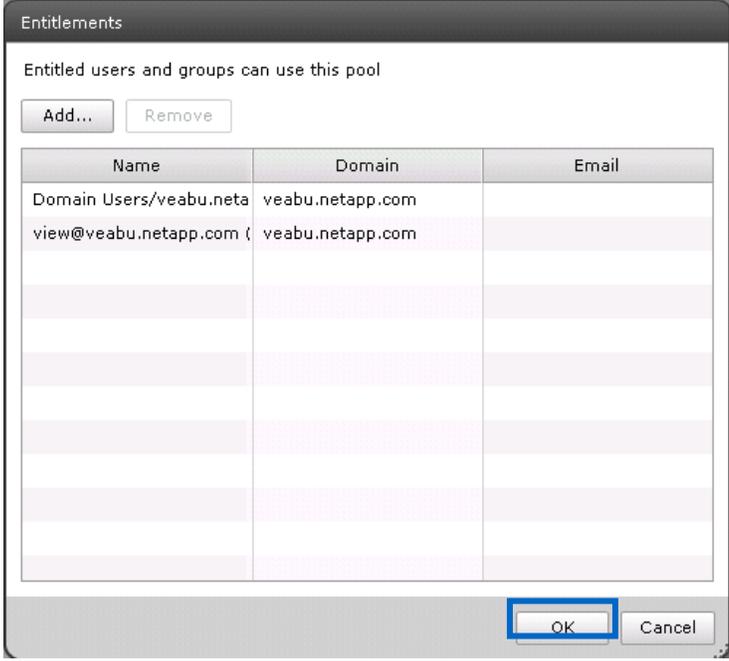
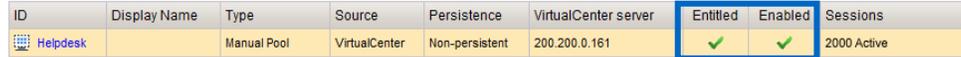
Step	Action
11	<p>If you selected "Import into connection broker" the wizard will ask for the View Server hostname, the Domain name of the view server, the username, and the password. Select to create either an individual or a manual desktop pool and provide a new or an existing pool name. For manual pools, the admin has the option of creating a dedicated or a floating pool. After this has been completed click Next.</p> 

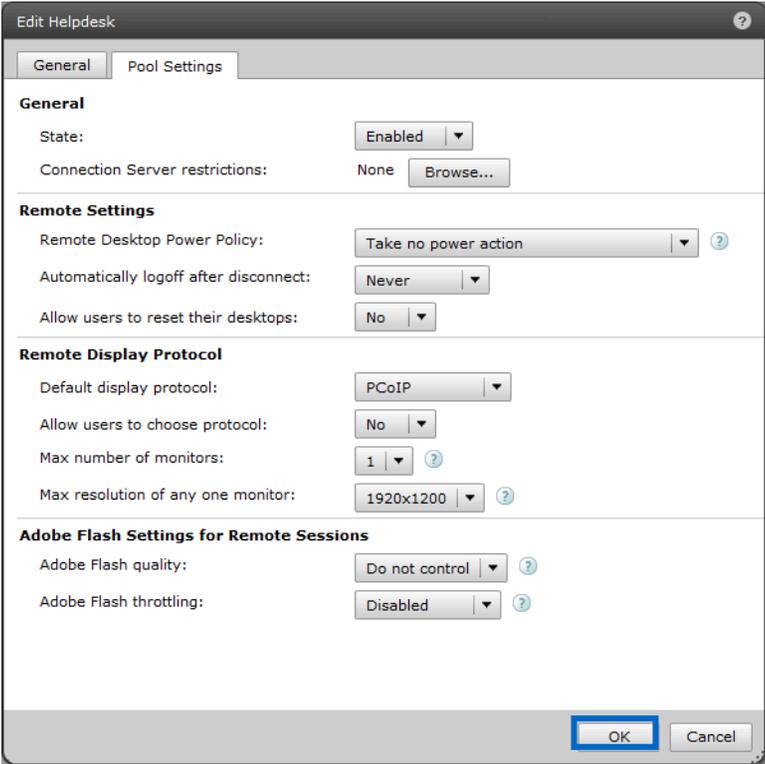
Step	Action
12	<p>Review the configuration and click Apply. The provisioning process will now begin. You can use the Tasks window within the vCenter Client to view the current tasks as well as the NetApp storage controller console.</p> 
13	<p>After creating the virtual machines, review the View Manager configuration and entitle users by logging into the VMware View Administrator 4.5 interface.</p> 

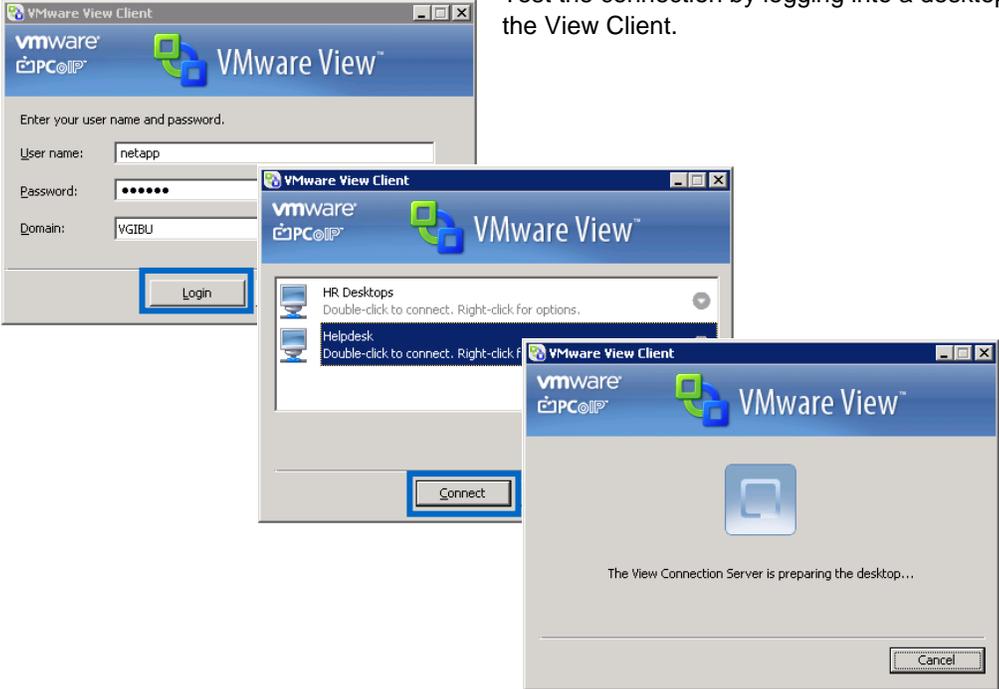
Step	Action
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14	<p>Select the pool to be entitled—in this case it is the manual floating pool Helpdesk. Click Entitlements.</p>  <table border="1" data-bbox="539 640 1351 913"> <thead> <tr> <th>ID</th> <th>Display Name</th> <th>Type</th> <th>Source</th> <th>User Assi...</th> <th>vCenter Server</th> <th>Entitled</th> <th>Enabled</th> <th>Sessions</th> </tr> </thead> <tbody> <tr> <td>Helpdesk</td> <td>Manual Pool</td> <td>vCenter</td> <td>Floating</td> <td>10.61.177.8</td> <td>✓</td> <td>0 Remote</td> <td></td> <td></td> </tr> </tbody> </table>	ID	Display Name	Type	Source	User Assi...	vCenter Server	Entitled	Enabled	Sessions	Helpdesk	Manual Pool	vCenter	Floating	10.61.177.8	✓	0 Remote		
ID	Display Name	Type	Source	User Assi...	vCenter Server	Entitled	Enabled	Sessions											
Helpdesk	Manual Pool	vCenter	Floating	10.61.177.8	✓	0 Remote													

15	<p>Then, on the Entitlements screen, click Add.</p>  <table border="1" data-bbox="349 1186 1185 1522"> <thead> <tr> <th>Name</th> <th>Domain</th> <th>Email</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>	Name	Domain	Email															
Name	Domain	Email																	

Step	Action																																								
16	<p>Select users or groups and either enter Name or Description to narrow down the search and click Find. Then click on the user(s) or group(s) to be entitled. Then click OK.</p>  <table border="1"> <thead> <tr> <th>Name</th> <th>User Name</th> <th>Email</th> <th>Description</th> <th>In Folder</th> </tr> </thead> <tbody> <tr> <td>Domain Guests</td> <td>Domain Guests/vea</td> <td></td> <td>All domain guests</td> <td>veabu.netapp.com/l</td> </tr> <tr> <td>Domain Users</td> <td>Domain Users/veab</td> <td></td> <td>All domain users</td> <td>veabu.netapp.com/l</td> </tr> <tr> <td>Enterprise Admins</td> <td>Enterprise Admins/\</td> <td></td> <td>Designated adminis</td> <td>veabu.netapp.com/l</td> </tr> <tr> <td>Enterprise Read-onl</td> <td>Enterprise Read-onl</td> <td></td> <td>Members of this gro</td> <td>veabu.netapp.com/l</td> </tr> <tr> <td>Event Log Readers</td> <td>Event Log Readers/</td> <td></td> <td>Members of this gro</td> <td>veabu.netapp.com/l</td> </tr> <tr> <td>Group Policy Creatc</td> <td>Group Policy Creatc</td> <td></td> <td>Members in this gro</td> <td>veabu.netapp.com/l</td> </tr> <tr> <td>Guests</td> <td>Guests/veabu.netap</td> <td></td> <td>Guests have the sar</td> <td>veabu.netapp.com/l</td> </tr> </tbody> </table>	Name	User Name	Email	Description	In Folder	Domain Guests	Domain Guests/vea		All domain guests	veabu.netapp.com/l	Domain Users	Domain Users/veab		All domain users	veabu.netapp.com/l	Enterprise Admins	Enterprise Admins/\		Designated adminis	veabu.netapp.com/l	Enterprise Read-onl	Enterprise Read-onl		Members of this gro	veabu.netapp.com/l	Event Log Readers	Event Log Readers/		Members of this gro	veabu.netapp.com/l	Group Policy Creatc	Group Policy Creatc		Members in this gro	veabu.netapp.com/l	Guests	Guests/veabu.netap		Guests have the sar	veabu.netapp.com/l
Name	User Name	Email	Description	In Folder																																					
Domain Guests	Domain Guests/vea		All domain guests	veabu.netapp.com/l																																					
Domain Users	Domain Users/veab		All domain users	veabu.netapp.com/l																																					
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Enterprise Read-onl	Enterprise Read-onl		Members of this gro	veabu.netapp.com/l																																					
Event Log Readers	Event Log Readers/		Members of this gro	veabu.netapp.com/l																																					
Group Policy Creatc	Group Policy Creatc		Members in this gro	veabu.netapp.com/l																																					
Guests	Guests/veabu.netap		Guests have the sar	veabu.netapp.com/l																																					
17	<p>Verify that the users and groups to be added are correct and click OK.</p>  <table border="1"> <thead> <tr> <th>Name</th> <th>Domain</th> <th>Email</th> </tr> </thead> <tbody> <tr> <td>Domain Users/veabu.neta</td> <td>veabu.netapp.com</td> <td></td> </tr> <tr> <td>view@veabu.netapp.com (</td> <td>veabu.netapp.com</td> <td></td> </tr> </tbody> </table>	Name	Domain	Email	Domain Users/veabu.neta	veabu.netapp.com		view@veabu.netapp.com (veabu.netapp.com																																
Name	Domain	Email																																							
Domain Users/veabu.neta	veabu.netapp.com																																								
view@veabu.netapp.com (veabu.netapp.com																																								
18	<p>Verify that the pool is now Entitled and Enabled.</p>  <table border="1"> <thead> <tr> <th>ID</th> <th>Display Name</th> <th>Type</th> <th>Source</th> <th>Persistence</th> <th>VirtualCenter server</th> <th>Entitled</th> <th>Enabled</th> <th>Sessions</th> </tr> </thead> <tbody> <tr> <td>Helpdesk</td> <td></td> <td>Manual Pool</td> <td>VirtualCenter</td> <td>Non-persistent</td> <td>200.200.0.161</td> <td>✓</td> <td>✓</td> <td>2000 Active</td> </tr> </tbody> </table>	ID	Display Name	Type	Source	Persistence	VirtualCenter server	Entitled	Enabled	Sessions	Helpdesk		Manual Pool	VirtualCenter	Non-persistent	200.200.0.161	✓	✓	2000 Active																						
ID	Display Name	Type	Source	Persistence	VirtualCenter server	Entitled	Enabled	Sessions																																	
Helpdesk		Manual Pool	VirtualCenter	Non-persistent	200.200.0.161	✓	✓	2000 Active																																	

Step	Action
19	<p>Adjust the pool settings by clicking the pool and clicking Edit. After adjusting the pool as required, click Finish.</p> <p>Note: The settings in this example are for demonstration purposes only. Your individual settings may be different. For more information, see the View Manager Administration Guide.</p>  <p>The screenshot shows the 'Edit Helpdesk' dialog box with the 'Pool Settings' tab selected. The settings are as follows:</p> <ul style="list-style-type: none"> General: State: Enabled; Connection Server restrictions: None (with a 'Browse...' button). Remote Settings: Remote Desktop Power Policy: Take no power action; Automatically logoff after disconnect: Never; Allow users to reset their desktops: No. Remote Display Protocol: Default display protocol: PCoIP; Allow users to choose protocol: No; Max number of monitors: 1; Max resolution of any one monitor: 1920x1200. Adobe Flash Settings for Remote Sessions: Adobe Flash quality: Do not control; Adobe Flash throttling: Disabled. <p>The 'OK' button at the bottom right is highlighted with a blue box.</p>

Step	Action
20	<p data-bbox="829 289 1406 348">Test the connection by logging into a desktop using the View Client.</p> 

RESIZE THE FLEXCLONE VOLUMES TO THE ESTIMATED SIZE

Using VSC's datastore resizing feature, resize the four FlexClone volumes created on storage controller A to 525GB, planning for future growth considering the assumptions on new writes.

Note: The architecture proposed in this deployment guide balances the 2,000 virtual machines across three vSphere clusters with eight vSphere hosts in two clusters and a minimum of five vSphere hosts in the third cluster (21 vSphere hosts in total). The reason for this is that VMware does not support more than eight vSphere hosts per cluster when using VMware View Composer/linked clones. For details, refer to the [VMware View Architecture Planning Guide](#).

11.3 DEPLOY SPACE-EFFICIENT CLONES USING VSC 2.0.1P1 FOR DEDICATED DESKTOPS

Repeat the procedures in section 10.2 to create 500 dedicated desktops.

12 DEPLOY LINKED CLONES

This sample deployment has 1000 virtual machines that are part of 1 automated desktop pool created using linked clones.

- **Pool 1:** 1000 virtual machines provisioned in floating access mode with 1 datastore hosting OS data disk created earlier

For provisioning the linked clone-based desktop pools and associated virtual machines, see the [VMware View Administrator's Guide](#).

13 ENTITLE USERS/GROUPS TO DESKTOP POOLS

The next step is to entitle users/groups to the various desktop pools created in VMware View Manager. Follow the instructions in the [VMware View Administrator's Guide](#). Finally, install VMware View Client on every end user access device (PCs, thin clients, and so on).

14 SET UP FLEXSHARE (OPTIONAL)

FlexShare is a Data ONTAP® software feature that provides workload prioritization for a storage system. It prioritizes processing resources for key services when the system is under heavy load. FlexShare does *not* guarantee the availability of resources or how long particular operations will take to complete. FlexShare provides a priority mechanism to give preferential treatment to higher-priority tasks.

FlexShare provides storage systems with the following key features:

- Relative priority of different volumes
- Per-volume user versus system priority
- Per-volume cache policies

These features allow storage administrators to tune how the system should prioritize system resources in the event that the system is overloaded.

Since the configuration presented in this design guide uses a high-water mark of 80% CPU utilization for each storage controller in an active-active controller configuration, it may be necessary to enable critical VMs to be available in the event of a failover. NetApp recommends setting priorities for volumes that contain VMs that are especially critical and where potential downtime due to a storage controller failure could cause issues. By performing the following optional steps, critical VMs will not be affected by any performance degradation that could result in a storage controller takeover in the event of a failure.

Note: Set appropriate priority levels on all volumes. The following example shows how to set priority as high on one volume and priority as low on another volume.

Step	Action
1	To enable priority settings, log in to the storage console.
2	Enter the following command: <pre>3160-2> priority on Wed Feb 3 11:16:32 EST [wafl.priority.enable:info]: Priority scheduling is being enabled Priority scheduler starting.</pre>
3	To set the volume priority enter the following command: <pre>3160-2*> priority set volume <volume name> level=High system=High cache=keep</pre>
4	To make sure that the proper settings were made for the volume, enter the following command: <pre>3160-2*> priority show volume -v veabugold Volume: veabugold Enabled: on Level: High System: High Cache: keep User read limit: n/a</pre>

	Sys read limit: n/a NVLOG limit: n/a%
--	--

Step	Action
1	To set the volume priority enter the following command: <pre>3160-2*> priority set volume <volume name> level=low system=low cache=default</pre>
2	To verify that proper settings were made for the volume, enter the following command: <pre>3160-2*> priority set volume rcu_gold level=low system=low cache=default 3160-2*> priority show volume -v rcu_gold</pre> Volume: rcu_gold Enabled: on Level: Low System: Low Cache: default User read limit: n/a Sys read limit: n/a NVLOG limit: n/a%

15 100,000-SEAT STORAGE SCALE-OUT IN 10,000-SEAT INCREMENTS

Table 10 shows a chart detailing a FAS3160 HA pair storage scale-out from 10,000 to 100,000 seats. This chart uses the base deployment scenario detailed in section 1.2. Because configurations are different in each environment the numbers may vary for different implementations. Therefore, the chart below represents this specific configuration and is to be used only as a reference; it may not reflect each individual implementation.

Table 10) Incremental scale-out to 100,000 seats.

# of Seats	# Active-active Controller Configurations	# Disk Shelves	# Servers	# Nexus 5020s*
10,000	2	8	105	4
20,000	3	15	209	6
30,000	5	22	313	7
40,000	6	30	417	9
50,000	8	37	521	11
60,000	10	45	625	12
70,000	11	53	730	14
80,000	13	60	834	18
90,000	15	68	938	19
100,000	16	76	1,042	21

*This configuration assumes that two 6-port expansion slots have been added to the Nexus 5020.

16 VMWARE VIEW AND NETAPP STORAGE ENVIRONMENT VALIDATION CHECKLIST

Table 11) VDI prerequisites checklist.

Step	Task Description	Completed (Y/N)
1	vSphere design is approved.	
2	vSphere host is configured.	
3	Network switches are configured.	
4	VLANs created for NFS traffic, VMotion, service console, and administration.	
5	Storage racked and has had basic configuration setup.	
6	vSphere is installed and virtualization network is approved and created within vSphere. <ul style="list-style-type: none"> • Service Console – Management • VMKernel – Storage / VMotion • VM Network – Desktop Access 	
7	DHCP scope is created, authorized, and tested.	
8	A desired user authentication method is chosen and configured. <ul style="list-style-type: none"> • Active Directory® • RSA SecurID • Smart Card • Log in as Current User Feature 	
9	Manual versus automated desktop pools chosen.	
10	Total number of dedicated and floating desktops chosen.	
11	Total number of linked clone desktops chosen.	
12	VMware View deployment scenarios table completed.	
13	All software is available.	
14	All hardware is available.	
15	All licenses are available.	

VDI IMPLEMENTATION CHECKLIST

The following checklist is used to plan and track the steps of the implementation.

Table 12) VDI implementation checklist.

Step	Task Description	Completed (Y/N)
1	Configure the advanced storage controller networking.	
2	Configure SSH on the storage controllers.	
3	Configure FlexScale for Flash Cache on the storage controllers.	
4	Install VSC 2.0.1P1.	
5	Set NetApp storage recommended volumes in VSC.	
6	Create VDI virtual machine datastore aggregate.	
7	Modify snapshot reserve for the “view_production” aggregate.	
8	Create a volume to host the template datastore.	

Step	Task Description	Completed (Y/N)
9	Configure Snapshot copies and set the optimal performance for the template datastore.	
10	Create volume-to-host virtual machine swap files.	
11	Snapshot copies and optimal performance set for the swap file volume.	
12	Create volumes to host linked clones and CIFS user data.	
13	Snapshot copies and optimal performance set for the linked clone and CIFS user data volumes.	
14	Set the snapshot schedule and snap reserve for all volumes to zero except the CIFS volume.	
15	Set options <code>nfs.tcp.recvwindowsize 64240</code> on the storage controller that has the NFS exports. (Allows for optimal performance of VMDKs on NFS.)	
16	Reboot the ESX hosts for the new settings to take effect.	
17	Create Windows 7 gold image. (If using an OS that does not have the proper offset, align the partition before installing the operating system.)	
18	Configure the Windows 7 gold image.	
19	Review commands.txt located in the VMware View Optimization Guide for Windows 7 and adjust if necessary.	
20	Run commands.bat located in the VMware View Optimization Guide for Windows 7 on the Windows 7 gold image.	
21	Adjust additional desktop customizations not included in command.bat.	
22	Install all necessary applications on the Windows 7 gold image.	
23	Install VMware View Agent on the Windows 7 gold image.	
24	Power off and convert the Windows 7 gold image to a template.	
25	Create the customization specification.	
26	Download sysprep if desktops are not Windows 7.	
27	Deploy clones using VSC 2.0.1P1.	
28	Entitle users through VMware View Administrator after the clones are created.	
29	Resize the FlexClone volumes for future growth through VSC 2.0.1P1.	
30	Create automated desktop pools through linked clones.	
31	Entitle users through VMware View Administrator after the clones are created.	
32	Install VMware View Client on a test machine and attempt to log in to one of the new virtual machines to test functionality.	
33	Set up NetApp FlexShare.	

17 TESTING AND VALIDATION OF THE VMWARE VIEW AND NETAPP STORAGE ENVIRONMENT

Below is a checklist designed to determine if your environment is set up correctly. Run these tests as appropriate for your environment and document the results.

Table 13) Testing and validation steps.

Item	Item Description
1	Test Ethernet connectivity for VMware vSphere servers and NetApp. If using NIC teams or VIFs, pull network cables or down the interfaces and verify network functionality.
2	If running in a cluster, test SAN multipathing by performing a cable pull or by disabling a switch port (if applicable).
3	Verify that datastores are seen as cluster-wide resources by creating a custom map of the hosts and datastores and verifying connectivity.
4	Test vCenter functionality for appropriate access control, authentication, and VI clients.
5	Perform NetApp active-active controller configuration failover testing for NAS and verify that datastores remain connected.
6	Test performance and IOPs to determine that the environment is behaving as expected.

10 REFERENCES

[TR-3705: NetApp and VMware View Best Practices](#)

[TR-3749: NetApp and VMware vSphere Storage Best Practices](#)

[TR-3505: NetApp Deduplication for FAS Deployment and Implementation Guide](#)

[TR-3747: NetApp Best Practices for File System Alignment in Virtual Environments](#)

[TR-3808: VMware vSphere and ESX 3.5 Multiprotocol Performance Comparison Using FC, iSCSI, and NFS](#)

[ESX and vCenter Server Installation Guide](#)

[ESX Configuration Guide](#)

[vSphere Virtual Machine Administration Guide](#)

[Guest Operating System Installation Guide](#)

[VMware Infrastructure Documentation](#)

[VMware View Documentation](#)

[VMware View Optimization Guide for Windows 7](#)

[VMware View Administrator's Guide](#)

[VMware View Architecture Planning Guide](#)

[Cisco Nexus 7000 Series NX-OS Interfaces Configuration Guide, Release 4.1](#)

[Cisco Nexus 5000 Series Switch CLI Software Configuration Guide](#)

18 ACKNOWLEDGEMENTS

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19 FEEDBACK

Send an e-mail to xdl-vgibutmevmtr@netapp.com with questions or comments concerning this document.

VERSION HISTORY

Table 14) Version history.

Version	Date	Document Version History
	May 2009	Original document.
Version 2.0	February 2010	Updates to network configuration. RCU 3.0 and System Manager added.
Version 3.0	February 2011	Updates for vSphere 4.1, VSC 2.0.1P1, and VMware View 4.5.

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