

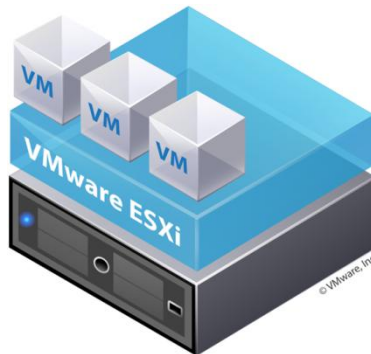


## Remote PC Guide Series - Volume 2

### Installing and Configuring VMware vSphere 5.1

Please be aware that a more recent edition of the Remote PC Guide Series, Volume 2, Installation that is specific to **VMware ESXi version 6.0 with vCenter** is available.

Document Version: **2014-06-02**



This guide covers features available in NETLAB+ version **2011.R2** and later. The details of this guide are specific to **VMware ESXi version 5.1 with vCenter**.

[Learn more about the Remote PC Guide Series](#) or see the [Documentation Library](#) for a list of all NETLAB+ guides.

This guide will lead you through the process of adding remotely accessible PC or servers into your NETLAB+ equipment pods using the [VMware](#) ESXi and vCenter virtualization products.

This guide is part of a multi-volume series, designed to provide you with the guidance needed to implement remote PCs on your NETLAB+ system

1	Background .....	3
2	VMware ESXi Planning .....	4
2.1	VMware ESXi Host Requirements .....	4
2.2	Hardware Assisted Virtualization Technology .....	5
2.3	Obtaining VMware ESXi and Licenses for NDG Supported Servers – Dell R710 and R720 .....	5
2.3.1	Downloading ESXi software from Dell .....	6
2.3.2	Obtain licenses for VMware IT Academy Program (vITA) .....	6
2.3.3	Obtain licenses for VMware Academic Program (VMAP) .....	7
2.4	Obtaining VMware ESXi and Licenses for Non-Supported Servers.....	11
3	VMware vCenter Planning .....	13
3.1	VMware vCenter Server Requirements .....	13
3.2	Obtaining VMware vCenter Server Appliance .....	14
3.3	Obtaining VMware Licenses.....	14
4	Network Planning.....	17
5	VMware ESXi Server Setup .....	19
5.1	Preparing the ESXi Server.....	19
5.2	Installing ESXi on Host Server.....	20
6	Basic Network Configuration .....	23
7	Management Console.....	28
8	vCenter Server Appliance Deployment.....	29
8.1	Installing the vSphere Client .....	29
8.2	Deploying vCenter Server Appliance.....	31
8.3	Configuring Basic Network Connectivity.....	37
8.4	Creating NETLAB+ user on the vCenter Appliance.....	40
8.5	Initial Configuration on the vCenter Appliance .....	42
8.6	Setting the hostname and changing the root password.....	47
8.7	Configure Automatic Startup for vCenter .....	50
9	Datacenter Configuration .....	52
9.1	Create NETLAB+ datacenter in vCenter .....	52
9.2	Create a NETLAB+ role in vCenter .....	54
9.3	Adding ESXi hosts to the NETLAB+ datacenter .....	60
9.4	Allowing Remote PC Viewer sessions in ESXi firewall.....	62
9.5	vSwitch Configuration .....	64
9.5.1	Verifying vSwitch0 Configuration .....	65
9.5.2	Inside Network Configuration.....	66
9.5.3	Creating vSwitch1 and Binding to Physical NIC .....	69
9.5.4	Increasing the Inside vSwitch Port Count .....	73
9.5.5	Create a Safe Staging Network .....	76

## 1 Background

NETLAB+ remote PCs and servers in a pod can be implemented using virtual machines running on VMware vSphere 5.1. This guide is designed to help you setup your virtual machine infrastructure for use with NETLAB+.

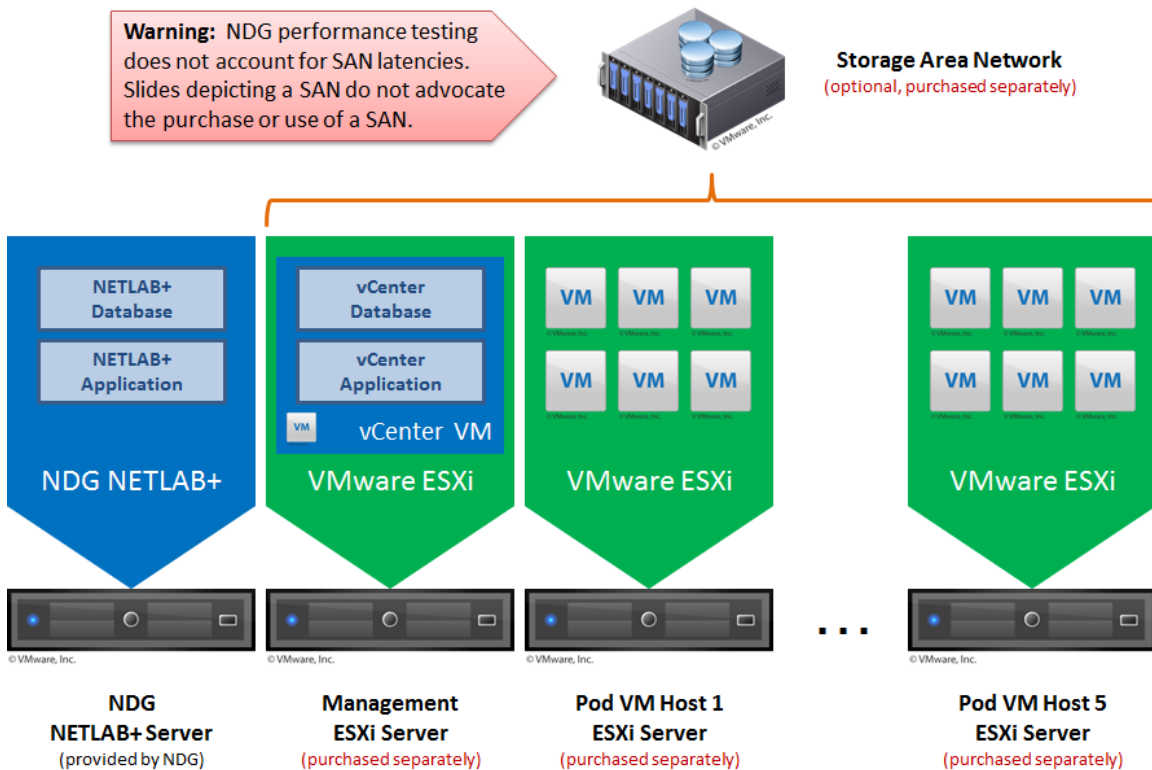
This guide assumes you are familiar with the Remote PC concept behind NETLAB+. Please review the [Remote PC Guide Series - Volume 1, Introduction and Planning for Remote PC Implementation with NETLAB+](#).

This guide is designed to help you install and configure vSphere 5.1 for using with NETLAB+. You will be installing VMware ESXi 5.1 and VMware vCenter 5.1 Server Appliance.

This guide also assumes that you have configured the NDG supported servers, the Dell R710, R720. Please refer to the appropriate model-specific guide:

- [Remote PC Guide Series - Volume 2a - Dell R710 BIOS and RAID Configuration](#)
- [Remote PC Guide Series - Volume 2b - Dell R720 BIOS and RAID Configuration](#)

The basics of a NETLAB+ infrastructure consist of a NETLAB+ Appliance, Management Server, vCenter Appliance and ESXi Host Server. The following image illustrates how these all work together:



## 2 VMware ESXi Planning

Physical VMware ESXi servers host the virtual machines in your pods. Virtualization using ESXi is performed on separate physical servers, not included with NETLAB+. You can interface with multiple ESXi servers if necessary.

NETLAB+ is compatible with VMware ESXi versions 4.1U2 and 5.1. For new installations, version 5.1 is recommended. The hardware you use for your ESXi server(s) must be compatible with the version of ESXi you select.

### 2.1 VMware ESXi Host Requirements

Please refer to our host server specifications page for the latest information on recommended ESXi Host servers. Currently NDG supports the Dell R710 and Dell R720. Use the following link to get detailed requirements:

[http://netdevgroup.com/support/remote\\_pc.html#vm\\_host\\_server\\_specifications](http://netdevgroup.com/support/remote_pc.html#vm_host_server_specifications)

Please search the VMware Compatibility guide to ensure your ESXi host hardware is compatible with the VMware version you wish to use.

<http://www.vmware.com/resources/compatibility/search.php>

#### **NDG Equipment Selection Disclaimer**

NDG offers no warranties (expressed or implied) or performance guarantees (current or future) for third party products, including those products NDG recommends. Due to the dynamic nature of the IT industry, our recommended specifications are subject to change at any time.

NDG recommended equipment specifications are based on actual testing performed by NDG. To achieve comparable compatibility and performance, we strongly encourage you to utilize the same equipment, exactly as specified and configure the equipment as directed in our setup documentation. Choosing other hardware with similar specifications may or may not result in the same compatibility and performance. The customer is responsible for compatibility testing and performance validation of any hardware that deviates from NDG recommendations. NDG has no obligation to provide support for any hardware that deviates from our recommendations, or for configurations that deviate from our standard setup documentation.

## 2.2 Hardware Assisted Virtualization Technology

Hardware Assisted Virtualization (Intel VT-x) is **REQUIRED** on any host you use for the VMware IT Academy Install, Configure, Manage (ICM) course and many others.

Virtualization courses, such as the VMware IT Academy labs, have not been tested on AMD processors and are not supported on AMD processors. VMs available from CSSIA were created on the Intel platform. As such, they will not work correctly on an AMD processor.

## 2.3 Obtaining VMware ESXi and Licenses for NDG Supported Servers – Dell R710 and R720

If you are not using the NDG recommended host servers, the Dell R710 and Dell R720, please skip to Section 2.4 for Obtaining VMware ESXi and Licenses for non-supported servers.

Guidance on navigating licensing is available on the [VMware Product Licensing Through VMware Academic Subscription \(VMAS\)](#) chart.

**It is very important that you download the software from Dell, as they have customized the installer ISO with drivers for the server platform, including networking and storage adapters.**

### 2.3.1 Downloading ESXi software from Dell

The following procedure assumes you are using a Dell R710 or Dell R720 server:

1. Go to Dell's website at <http://www.dell.com>.
2. Click on **Technical Support** in the upper-right hand corner.
3. The easiest way is to enter your Dell Service Tag, usually found on the front of your Dell Server. It may be on a plastic pullout (Dell R720). Enter your service tag and click **Submit**.
4. If you cannot locate your Dell Service Tag, choose **Servers, Storage & Networking** under *choose a product category*. Select **PowerEdge** and select your server model, **PowerEdge R710** or **PowerEdge R720** respectively.
5. Click on **Drivers and Downloads** from the tabs listed in the middle.
6. Under **Refine your results**, change the **Operating System** to **VMware ESXi 5.1**.
7. In the list of categories below, select **Enterprise Solutions (1)**.
8. Click on **Download File** on the right-hand side.
9. Click **Continue** to begin the download.
10. This should point you to the following link, however it is strongly recommended that you use the steps above to make sure you are getting the latest copy:  
[http://downloads-us.dell.com/FOLDER00953628M/1/VMware-VMvisor-Installer-5.1.0-799733.x86\\_64-Dell\\_Customized\\_RecoveryCD\\_A01.iso](http://downloads-us.dell.com/FOLDER00953628M/1/VMware-VMvisor-Installer-5.1.0-799733.x86_64-Dell_Customized_RecoveryCD_A01.iso)

### 2.3.2 Obtain licenses for VMware IT Academy Program (vITA)

Licensing considerations will vary, depending on your school's participation in the [VMware IT Academy Program \(VITA\)](#) program and/or the [VMware Academic Subscription \(VMAS\)](#).

Guidance on navigating licensing is available on the [VMware Product Licensing Through VMware Academic Subscription \(VMAS\)](#) chart.

### 2.3.3 Obtain licenses for VMware Academic Program (VMAP)

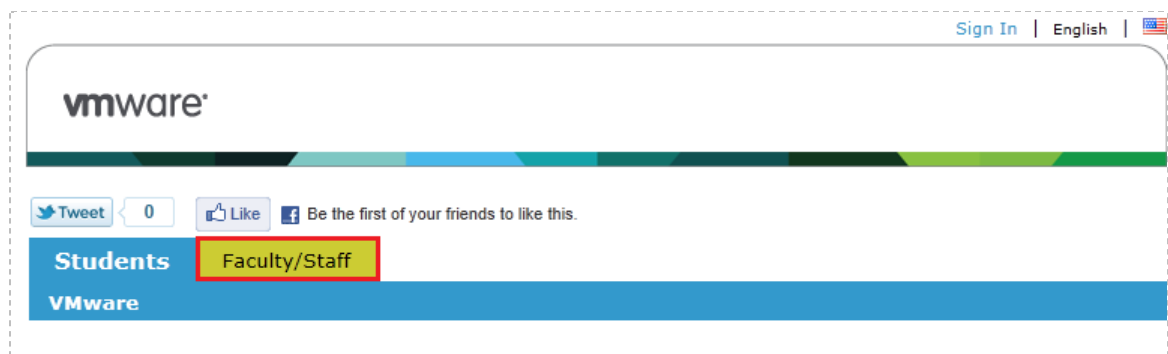
Licensing considerations will vary, depending on your school's participation in the [VMware IT Academy Program \(VITA\)](#) program and/or the [VMware Academic Subscription \(VMAS\)](#).

Guidance on navigating licensing is available on the [VMware Product Licensing Through VMware Academic Subscription \(VMAS\)](#) chart.

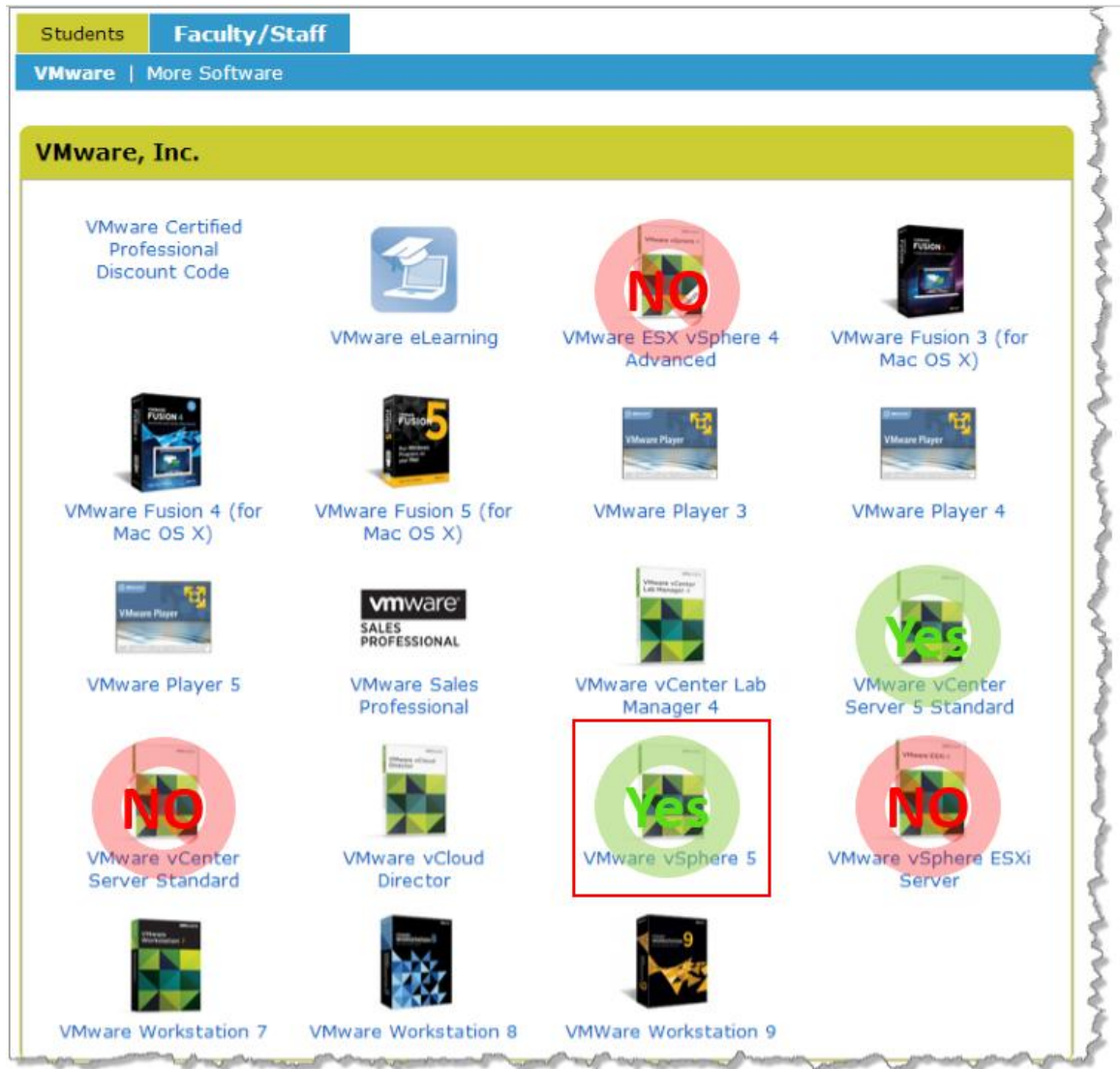
The following procedure assumes you are a registered member of the VMware Academic Program (VMAP). Non-members can obtain evaluation copies of VMware vCenter and ESXi software from <http://www.vmware.com> and purchase through retail partners.

When downloading ESXi it is important to select a version that is compatible with NETLAB+.

- NETLAB+ is compatible with VMware ESXi versions 4.1 U2 and 5.1.
  - For new installations, version 5.1 is recommended.
  - VMware ESXi 5.1 is a required component if you plan to use your NETLAB+ system to teach future virtualization courses.
1. Follow the link provided to you by VMware when you registered in the VMware Academic Alliance Program. This will take you to the academic software store.
  2. Click on **Faculty/Staff** at the top to see the available downloads. You must be a registered Faculty/Staff user. For more information, contact the VMware Academy contact at your school.

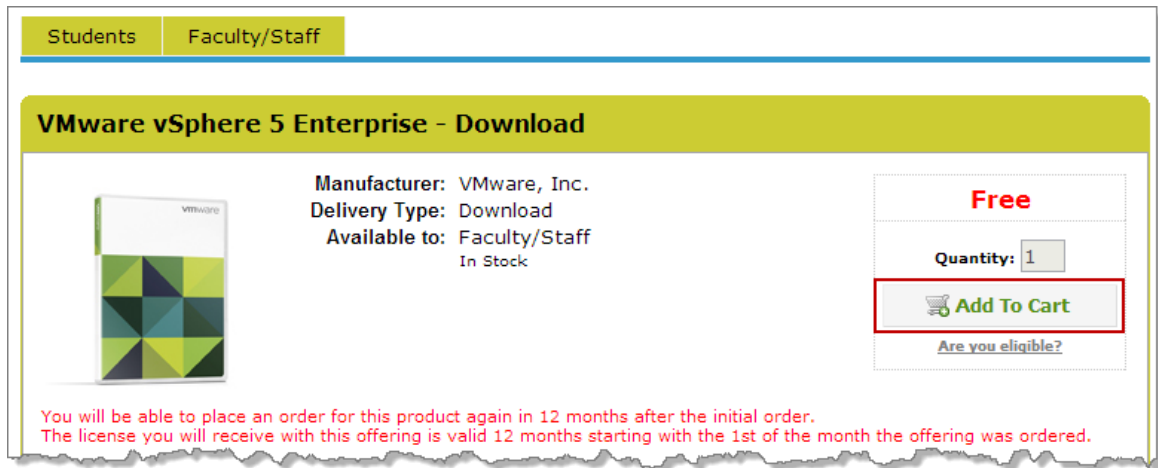


3. Click on **VMware vSphere 5**, which is marked with a red box in the picture below. This is the first of two software items you will obtain from the e-academy website. These items are marked with “Yes” in the picture below.






4. Click on **Add to Cart**.



Students Faculty/Staff


### VMware vSphere 5 Enterprise - Download



**Manufacturer:** VMware, Inc.  
**Delivery Type:** Download  
**Available to:** Faculty/Staff  
In Stock

**Free**

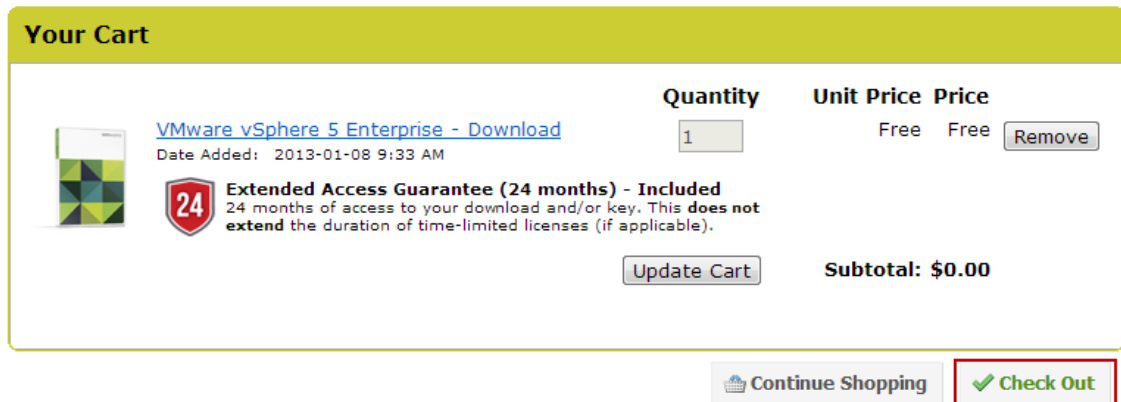
Quantity:

 **Add To Cart**



[Are you eligible?](#)

You will be able to place an order for this product again in 12 months after the initial order.  
The license you will receive with this offering is valid 12 months starting with the 1st of the month the offering was ordered.

5. Sign in with your registered login if necessary.
6. Click on **Check Out** to continue.



### Your Cart

	Quantity	Unit Price	Price	
 <a href="#">VMware vSphere 5 Enterprise - Download</a> Date Added: 2013-01-08 9:33 AM	<input type="text" value="1"/>	Free	Free	<input type="button" value="Remove"/>
 <b>Extended Access Guarantee (24 months) - Included</b> 24 months of access to your download and/or key. This does not extend the duration of time-limited licenses (if applicable).				
<input type="button" value="Update Cart"/>		<b>Subtotal: \$0.00</b>		

7. Read and accept the **EULA**.
8. On the confirmation page, click on **Proceed With Order**.

9. On the receipt page, record the serial number found under **Items**. **You will need this serial number for the installation later.**

**Items** All prices are in US Dollars Start Download

	Quantity	Unit Price	Amount
VMware vSphere 5 Enterprise - Download	1	\$0.00	\$0.00

**24** **Extended Access Guarantee (24 months) - Included**  
24 months of access to your download and/or key. This **does not extend** the duration of time-limited licenses (if applicable).  
Expires 2015-01-08

**Activation Code:** 5M2AL-XXXXXXXXXXXX-1473N

**Messages:**

- [VMware EULA](#)

**Agreement Number:** XXXXXXXXXXXX

**Subtotal:** \$0.00  
**Taxes:** \$0.00  
**Total:** \$0.00

## 2.4 Obtaining VMware ESXi and Licenses for Non-Supported Servers

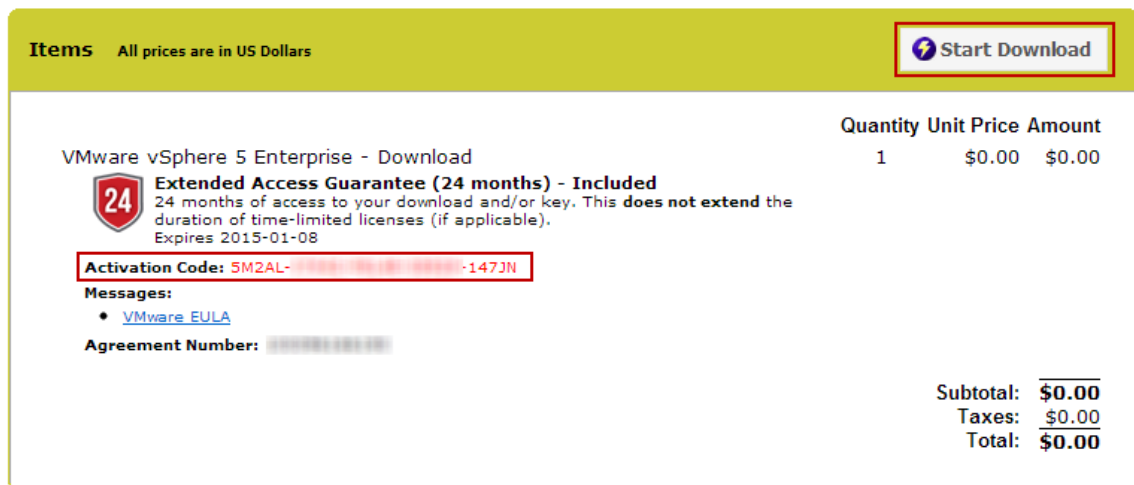
If you are using the NDG recommended host servers, the Dell R710 and Dell R720, please go to Section 2.3 for Obtaining VMware ESXi and Licenses for NDG Supported Servers – Dell R710 and R720.

If you are using servers other than NDG's recommendation of Dell R710 and R720, it is strongly recommended you contact your vendor to find out if there is a customized version of VMware ESXi needed for your hardware. The following information will point you to the generic VMware ESXi installable ISO.

If you are part of the VMware IT Academy Program (vITA), the keys provided on the community website are valid for VMware ESXi 5.1 installs. They also provide a link for obtaining VMware ESXi 5.1.

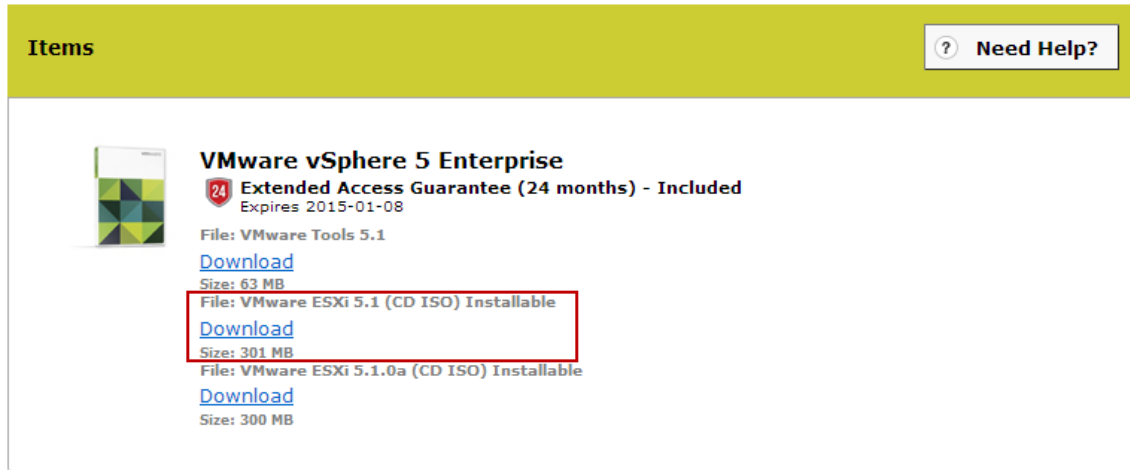
If you are part of the VMware Academic Program (VMAP), please follow Section 2.3.3 for Obtaining Licenses for VMware Academic Program. That section will provide you with the key. Perform these additional steps to download a copy of the ISO:

1. You may download the ISO image by clicking on **Start Download**.




The screenshot shows a VMware license download page. At the top, it says "Items All prices are in US Dollars" and has a "Start Download" button. The main item is "VMware vSphere 5 Enterprise - Download" with a quantity of 1, unit price of \$0.00, and amount of \$0.00. Below the item name, there is a "24 Extended Access Guarantee (24 months) - Included" badge and text stating "24 months of access to your download and/or key. This does not extend the duration of time-limited licenses (if applicable). Expires 2015-01-08". An "Activation Code" is displayed as "5M2AL- [REDACTED] -147JN". There are "Messages" including a link to "VMware EULA" and an "Agreement Number" field. On the right side, a summary shows "Subtotal: \$0.00", "Taxes: \$0.00", and "Total: \$0.00".

2. Click the **Download** link for **VMware ESXi 5.1 (CD ISO) Installable**.



The screenshot shows a web page titled "Items" with a "Need Help?" button. The main content is for "VMware vSphere 5 Enterprise". It includes a product icon, a "24 Extended Access Guarantee (24 months) - Included" badge with an expiration date of "Expires 2015-01-08", and a list of files for download. The file "File: VMware ESXi 5.1 (CD ISO) Installable" is highlighted with a red box, and its "Download" link is also highlighted.

**Items** ? Need Help?

 **VMware vSphere 5 Enterprise**  
**24 Extended Access Guarantee (24 months) - Included**  
Expires 2015-01-08

File: VMware Tools 5.1  
[Download](#)  
Size: 63 MB

**File: VMware ESXi 5.1 (CD ISO) Installable**  
[Download](#)  
Size: 301 MB

File: VMware ESXi 5.1.0a (CD ISO) Installable  
[Download](#)  
Size: 300 MB

### 3 VMware vCenter Planning

VMware vCenter Server enables you to manage the resources of multiple ESXi hosts and allows you to monitor and manage your physical and virtual infrastructure. Starting with software version 2011.R2, NETLAB+ integrates with VMware vCenter Server to assist the administrator with installing, replicating and configuring virtual machine pods.

#### 3.1 VMware vCenter Server Requirements

As of vSphere 5.1, NDG only supports the VMware vCenter Appliance. The physical server on which vCenter resides should be a dedicated "management server" to provide ample compute power. It is strongly recommended you follow our server recommendations listed below to provide ample compute power now and in the future.

[http://www.netdevgroup.com/support/remote\\_pc.html#vcenter\\_server\\_specifications](http://www.netdevgroup.com/support/remote_pc.html#vcenter_server_specifications)

NDG does not support configurations where vCenter is running on a heavily loaded ESXi host and/or an ESXi host that is also used to host virtual machines for NETLAB+ pods. Such configurations have exhibited poor performance, API timeouts, and sporadic errors in NETLAB+ operations.

The vCenter server must have network access to your ESXi servers. You will use the VMware vSphere Client to access vCenter Server. As of vSphere 5.1, there is a vSphere Web Client, however this is currently not used by NDG for setup and configuration.

Below is a list of reasons why NDG will only support the VMware vCenter Server Appliance:

- Starting with vCenter 5.1, the appliance now uses Postgres databases. This allows the appliance to be able to handle multiple VMs and multiple ESXi hosts compared to the 5 ESXi hosts and 50 VM limit that the vCenter 5.0 Appliance had.
- The vCenter Appliance is a standalone VM that runs on SUSE Linux, instead of Microsoft Windows Server. This eliminates the need for Microsoft licensing for both Microsoft Windows Server and SQL Server.
- The Windows version of vCenter 5.1 now requires multiple databases. It also requires an Active Directory setup in order to work with the VMware Single Sign-On feature that is embedded in the appliance. Because of the complexity of configuring an Active Directory and multiple databases, NDG no longer recommends nor supports the Windows version. Based on our research, VMware is migrating to the appliance version in the future.
- The quick and easy deployment of the vCenter Appliance makes the infrastructure configuration much easier to deploy for NETLAB+ administrators.
- NDG strongly recommends and only supports the use of the vCenter Appliance on a separate Management Server. NDG has Management Server

recommendations that will not only support the vCenter Appliance but also future versions of the NETLAB+ software.

### 3.2 Obtaining VMware vCenter Server Appliance

Follow the instructions at the following link in order to obtain the NDG Optimized vCenter Server v5.1 Appliance OVA from CSSIA.org:  
<http://www.netdevgroup.com/support/documentation/CSSIA%20Preconfigured%20Virtual%20Machine%20Requests.pdf>

When filling out the form, the "vCenter 5.1 Appliance NETLAB+ Optimized" entry is at the bottom of the page. Be sure to select the version for ESXi 5.1 hosts.

The vCenter Server virtual appliance downloaded from VMware has a 5 host / 50 active VM limit. We applied changes to the default vCenter Server appliance to support a much larger 50 host / 500 VM limit, expanded the filesystem, and adjusted the RAM and CPU settings. This optimized version has been packaged as an OVA and given to CSSIA.org for distribution. Note, this 500 limit is active VMs and exceeds the limits of any one NETLAB AE (80 active VM) or PE (160 active VM) system.

### 3.3 Obtaining VMware Licenses

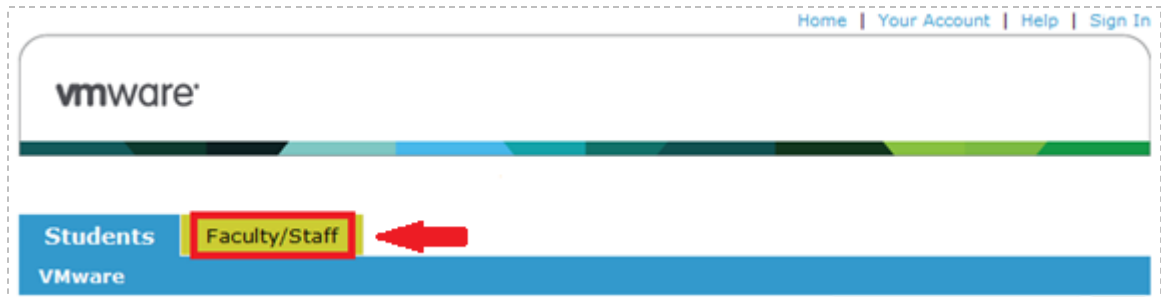
Please review the following flowchart that helps with VMware product licensing:  
[VMware Product Licensing Through VMware Academic Subscription \(VMAS\)](#)

If you are part of the VMware IT Academy Program (vITA), the keys provided on the community website are valid for VMware vCenter Server 5 installs. They also provide a link for obtaining VMware vSphere 5 software. You will want to obtain an OVA file of the vCenter Server Appliance, not the ISO for installing on Windows. NDG no longer recommends installing on a Windows machine for vCenter Server.

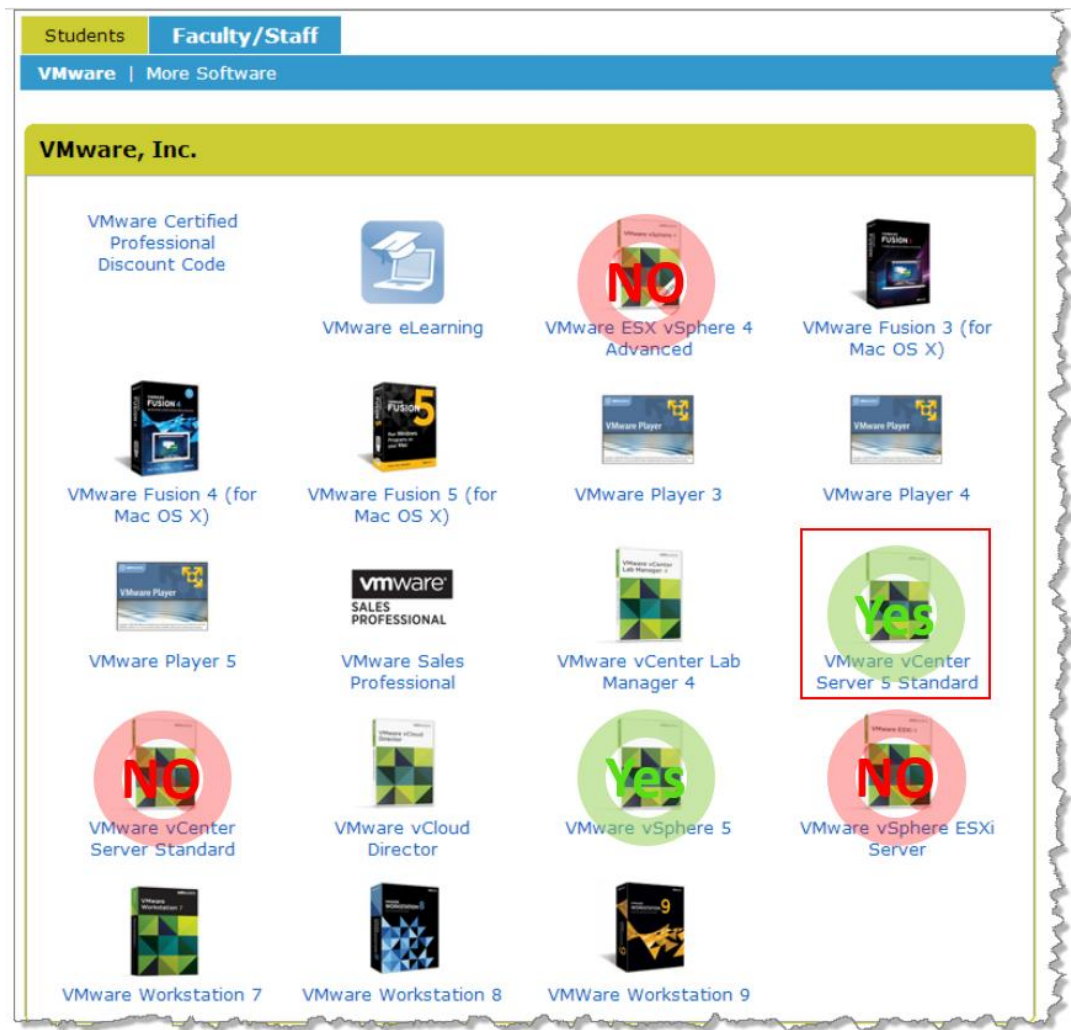
If you are a part of the VMware Academic Program the following procedure will assist you in obtaining the license key as well as downloading the OVA file. You will later deploy that image use VMware vSphere Client.

1. Follow the link provided to you by VMware when you registered the academy. This will take you to the academic license software store.

2. Click on **Faculty/Staff** at the top to see the available downloads. You must be a registered Faculty/Staff user. For more information, contact your VMware academy contact at your school.



3. Click on **VMware vCenter Server 5 Standard**, which is marked with a red box in the picture below. This is the second of two software items you will obtain from the e-academy website. These items are marked with "Yes" in the picture below.



4. Click on **Add To Cart**.

### VMware vCenter Server 5.0 Standard - Download



**Manufacturer:** VMware, Inc.  
**Delivery Type:** Download  
**Available to:** Faculty/Staff  
In Stock

**Free**

Quantity:


**Add To Cart**

[Are you eligible?](#)

You will be able to place an order for this product again in 12 months after the initial order.  
The license you will receive with this offering is valid 12 months starting with the 1st of the month the offering was ordered.

5. Sign in with your registered login.
6. Click on **Check Out** to continue.

### Your Cart

	Quantity	Unit Price	Price	
 <a href="#">VMware vCenter Server 5.0 Standard - Download</a> Date Added: 2013-01-18 11:39 AM	<input type="text" value="1"/>	Free	Free	<input type="button" value="Remove"/>

**24 Extended Access Guarantee (24 months) - Included**  
24 months of access to your download and/or key. This does not extend the duration of time-limited licenses (if applicable).

**Subtotal: \$0.00**

7. Read and accept the **EULA**.
8. On the confirmation page, click on **Proceed With Order**.
9. On the receipt page, record the serial number found under **Items** next to Activation Code. **You will need this code for installation later.**

### Items

All prices are in US Dollars

	Quantity	Unit Price	Amount
VMware vCenter Server 5.0 Standard - Download <b>24 Extended Access Guarantee (24 months) - Included</b> 24 months of access to your download and/or key. This does not extend the duration of time-limited licenses (if applicable). Expires 2015-01-18 <b>Activation Code:</b> <span style="border: 1px solid red; padding: 2px;">AM221-...QWGOJ</span>	1	\$0.00	\$0.00

**Instructions:**  
[http://e5.onthehub.com/d\\_ashx?a=va7l2cbf0](http://e5.onthehub.com/d_ashx?a=va7l2cbf0)

**Messages:**  
• [VMware EULA](#)

**Agreement Number:** 00000000000000000000

Subtotal: **\$0.00**  
Taxes: **\$0.00**  
Total: **\$0.00**

10. You do not need to download the vCenter Server software from this screen. You will use the key with the NDG Optimized vCenter Server Appliance you downloaded from CSSIA.org.



## 4 Network Planning

This section is designed to help you plan your networking infrastructure. Please review the "Networking Models" section of the [Remote PC Guide Series - Volume 1, Introduction and Planning for Remote PC Implementation with NETLAB+](#).

Remember, dual-homed is only necessary and required if you plan to use real physical lab devices, such as pods for the Cisco Networking Academy.

The IP addressing and DNS servers will be dictated by the model you select. Please fill out the appropriate table below to help assist you with configuration.

It is strongly recommended that you print out your table in order to have it available for easy reference throughout the installation and configuration of your Virtual Machine Infrastructure.

Single-Homed Model	
vCenter Outside IP Address	
ESXi Management Server Outside IP Address	
ESXi Host Server 1 Outside IP Address	
ESXi Host Server 2 Outside IP Address	
ESXi Host Server 3 Outside IP Address	
ESXi Host Server 4 Outside IP Address	
Subnet Mask	
Default Gateway	
Primary DNS Server	
Secondary DNS Server	

	NETLAB+		vCenter Appliance		ESXi Management Server		ESXi Host 1 Server	
	Outside	Inside	Outside	Inside	Outside	Inside	Outside	Inside
IP Address	Campus		Campus		Campus		Campus	
Subnet Mask	Campus		Campus		Campus		Campus	
Gateway	Campus		Campus		Campus		Campus	
vSwitch			vSwitch0		vSwitch0		vSwitch0	
Management Path			*		*		*	



Dual-Homed Model – Real Equipment Pods	
<b>vCenter Outside IP Address</b>	
<b>ESXi Management Server Outside IP Address</b>	
<b>ESXi Host Server 1 Outside IP Address</b>	
<b>ESXi Host Server 1 Inside IP Address</b>	169.254.0.241
<b>ESXi Host Server 2 Outside IP Address</b>	
<b>ESXi Host Server 2 Inside IP Address</b>	169.254.0.242
<b>ESXi Host Server 3 Outside IP Address</b>	
<b>ESXi Host Server 3 Inside IP Address</b>	169.254.0.243
<b>ESXi Host Server 4 Outside IP Address</b>	
<b>ESXi Host Server 4 Inside IP Address</b>	169.254.0.244
<b>Outside Subnet Mask</b>	
<b>Inside Subnet Mask</b>	255.255.255.0
<b>Outside Default Gateway</b>	
<b>Inside Default Gateway</b>	None
<b>Primary DNS Server</b>	
<b>Secondary DNS Server</b>	

	NETLAB+		vCenter Appliance		ESXi Management Server		ESXi Host 1 Server	
	Outside	Inside	Outside	Inside	Outside	Inside	Outside	Inside
<b>IP Address</b>	Campus	169.254.0.254	Campus		Campus		Campus	169.254.0.241
<b>Subnet Mask</b>	Campus	255.255.255.0	Campus		Campus		Campus	255.255.255.0
<b>Gateway</b>	Campus	not set	Campus		Campus		Campus	not set
<b>vSwitch</b>			vSwitch0		vSwitch0		vSwitch0	vSwitch1
<b>Management Path</b>			*		*		*	

## 5 VMware ESXi Server Setup

This section describes the software installation on a VMware ESXi host server.

All tasks in this section are performed on **separate dedicated physical servers** that you provide. Do not perform any of the tasks in this section on the NETLAB+ server appliance, as this will delete the NETLAB+ software, requiring you to return it to NDG for re-installation.

There should be a minimum of two (2) ESXi host servers. One will be used for management, referred to, as the Management Server, and the other will be your ESXi Host Server, which will hold the virtual machines for the pods. You may have one or multiple ESXi Host servers depending on the courses you plan to teach.

NDG supports the Dell R710 and the Dell R720 as a Management Server and as an ESXi Host Server. Please refer to the NDG requirements website for the latest supported server configurations:

[http://www.netdevgroup.com/support/remote\\_pc.html#vm\\_host\\_server\\_specifications](http://www.netdevgroup.com/support/remote_pc.html#vm_host_server_specifications)

### 5.1 Preparing the ESXi Server

NDG recommends the Dell R710 and R720 server platforms. If you are using non-supported servers, please contact your vendor for assistance in configuring the BIOS and RAID options.

Please refer to the appropriate guide for each respective server for instructions on BIOS and RAID configuration:

- [Remote PC Guide Series - Volume 2a - Dell R710 BIOS and RAID Configuration](#)
- [Remote PC Guide Series - Volume 2b - Dell R720 BIOS and RAID Configuration](#)

It is highly recommended that you read your server hardware section completely, prior to making changes to your system.

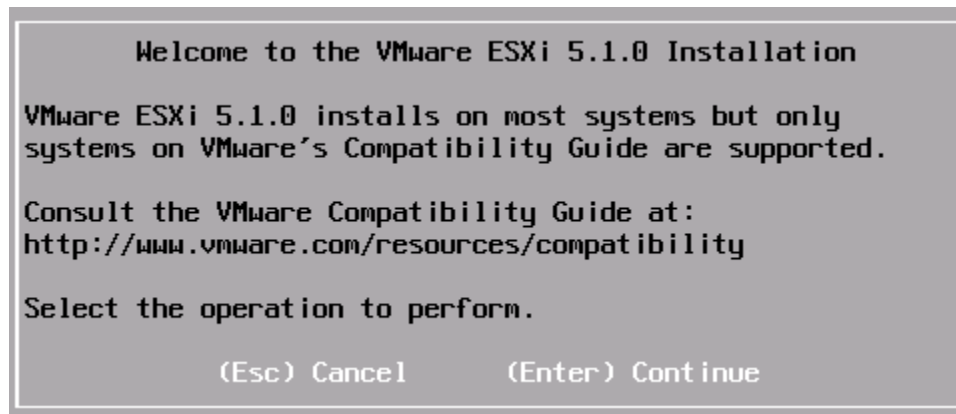
## 5.2 Installing ESXi on Host Server

This section will walk you through installing VMware ESXi to your Management Server and to each ESXi Host Servers. Please note that the content in the images below will vary based on your system. The instructional steps are the same.

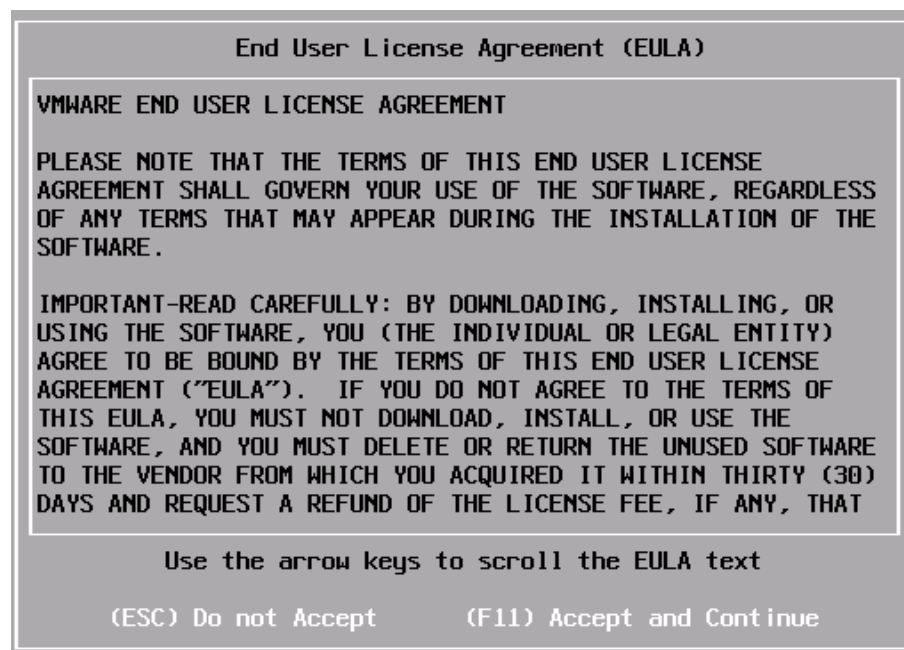
If you have not done so already, burn a copy of the ESXi 5.1 Installable ISO.

Instructions for installing ESXi:

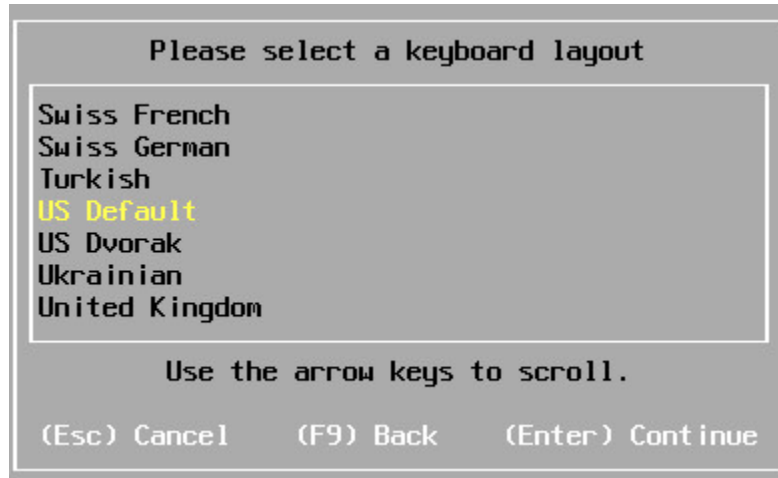
1. Turn on or restart your system.
2. Insert your ESXi 5.1 media to install the ESXi Installable.
3. You are presented with the Installation screen below.



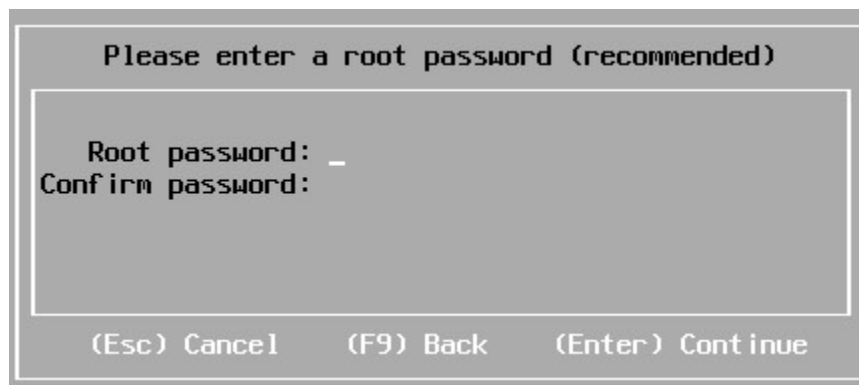
4. Press **Enter** to continue.
5. You are prompted with the User Agreement. Press **F11** to Accept and Continue.



6. On the Select a Disk screen, choose the available Dell PERC drive. The size will vary depending on your configuration and server. Press **Enter** to continue.
7. Make sure **US Default** is selected for keyboard layout and press **Enter** to continue.

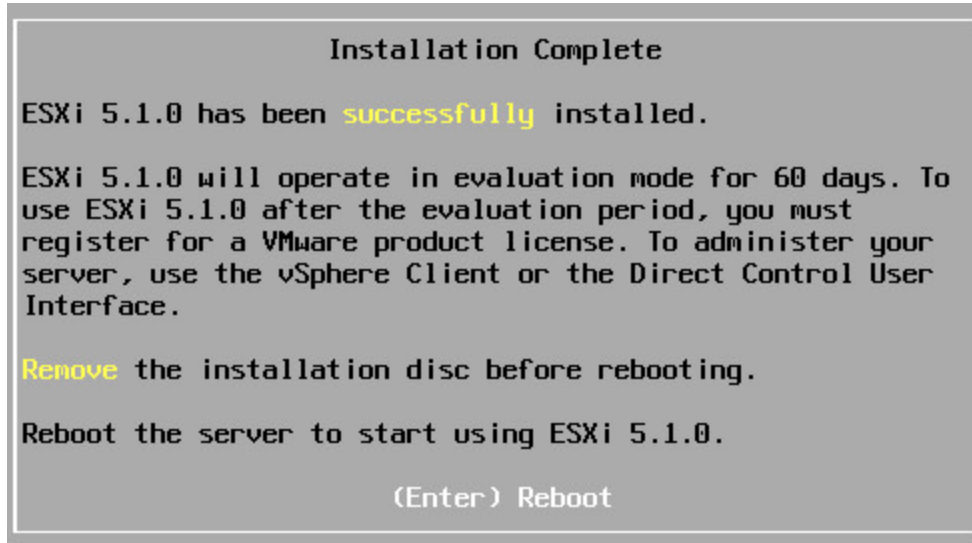


8. You will be prompted to set the root password. Enter your custom password in the **Root password** and **Confirm password** fields.



Be sure to record this password in a safe place. You will need it to integrate the ESXi host with the vCenter Server.

9. Press **F11** to begin the installation. Installation can take 1-10 minutes depending on hardware.
10. When the **Installation Complete** window appears, press **Enter** to reboot the machine.

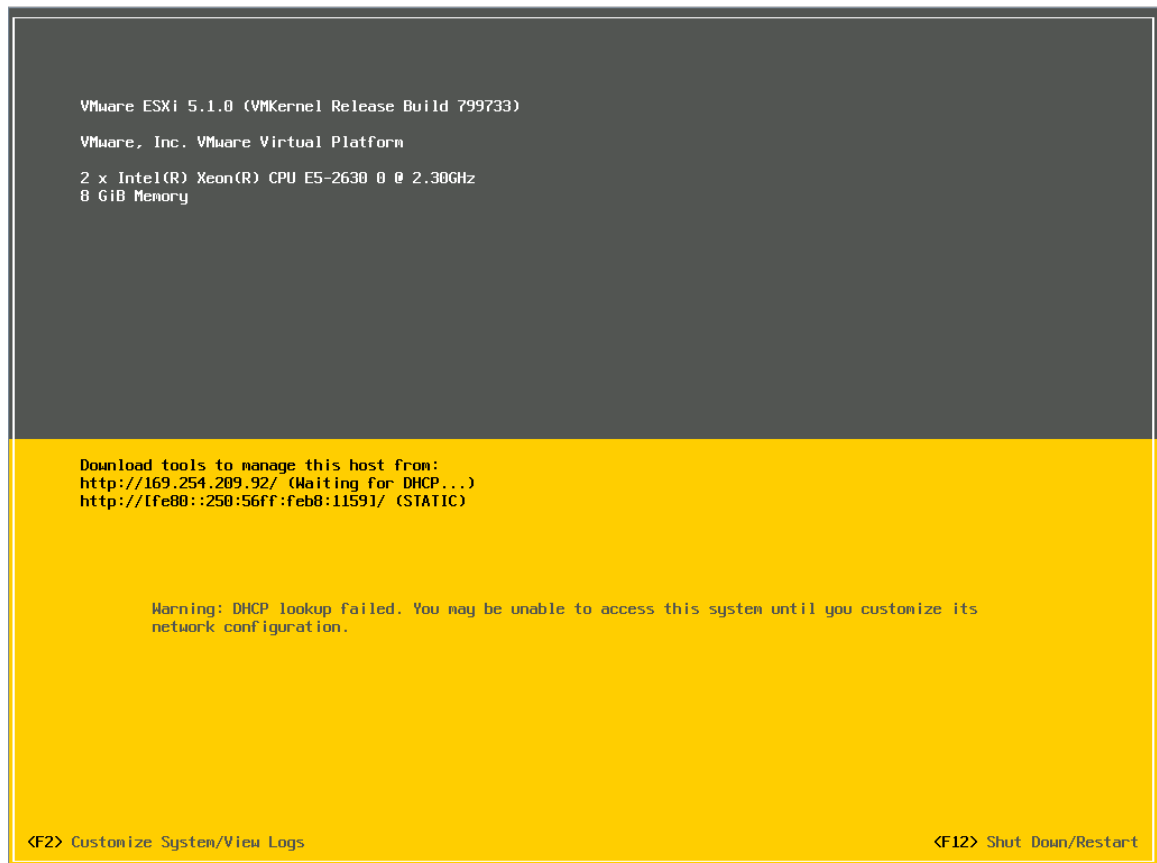


11. As stated before, you will need to complete these steps on your Management Server, and on all ESXi Host servers that will be used to host virtual machines for the pods.

## 6 Basic Network Configuration

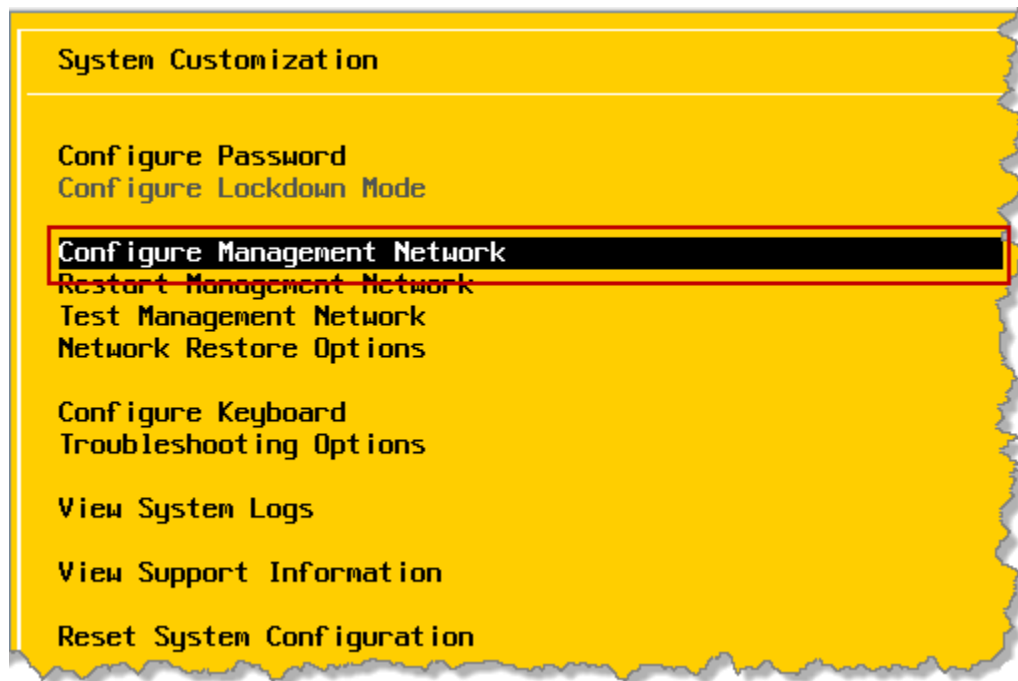
This section will assist you in the setup of basic network configuration on an ESXi host. This will need to be performed on the Management Server and on each ESXi Host Server.

1. When the ESXi host server is booted, you are prompted with the console screen. The information on this screen will vary based on your setup.

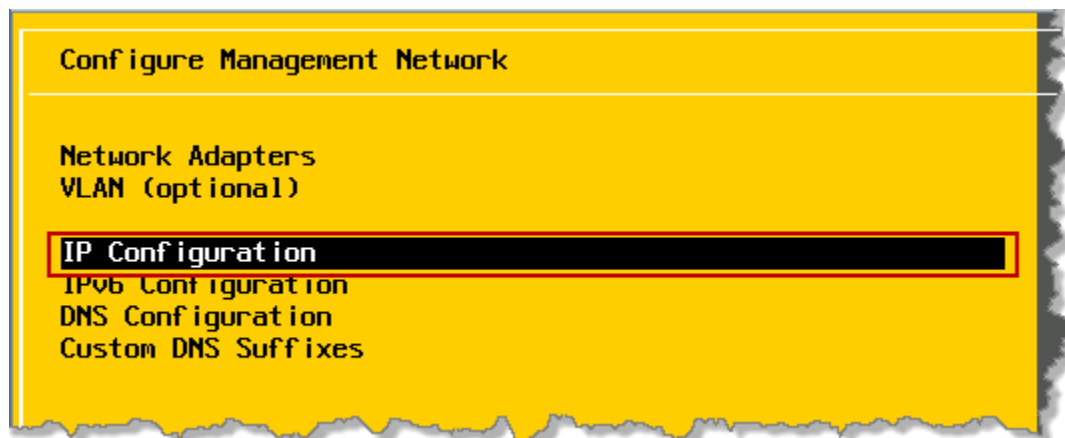


2. Press **F2** to begin setting up the host.
3. When prompted with the login screen, make sure the username is **root** and enter the password you created in Section 5.2.

4. From the System Customization menu, select **Configure Management Network** and press **Enter**.



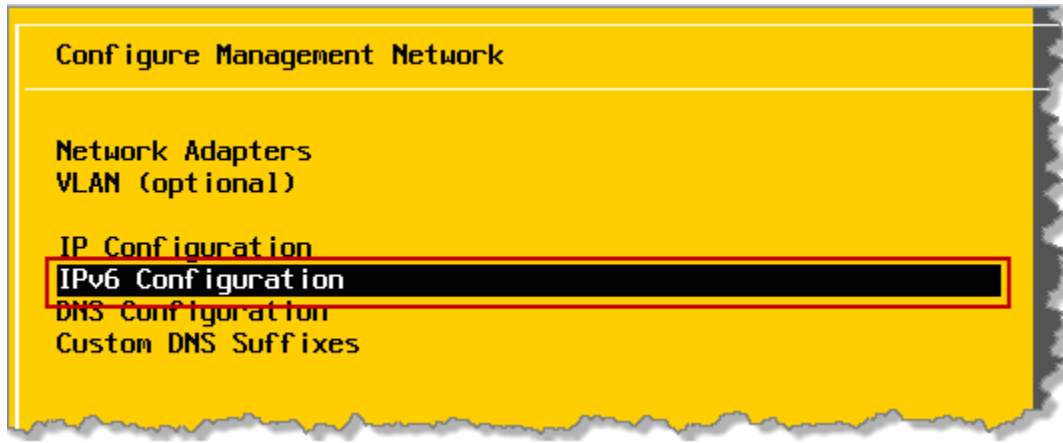
5. Select **IP Configuration** and press **Enter**.



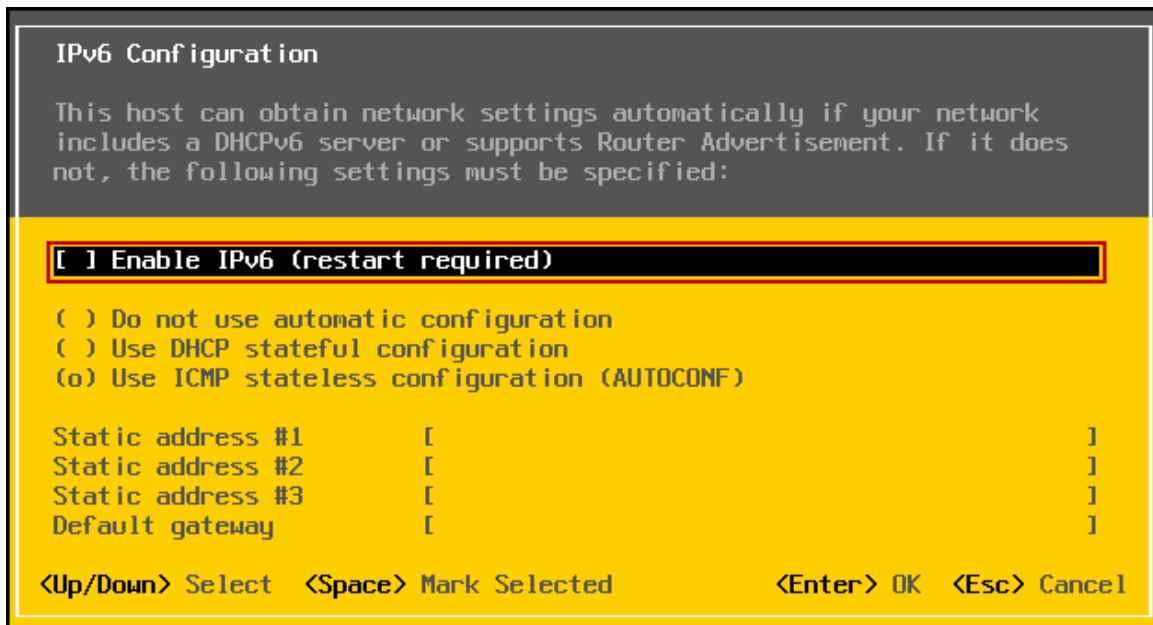
6. Select **Set Static IP address and network configuration** and set **IP Address**, **Subnet Mask** and **Default Gateway** to an inside or outside IP configuration to fit your network configuration and model. Use the table you filled out in Section 10. Press **Enter** to save settings.



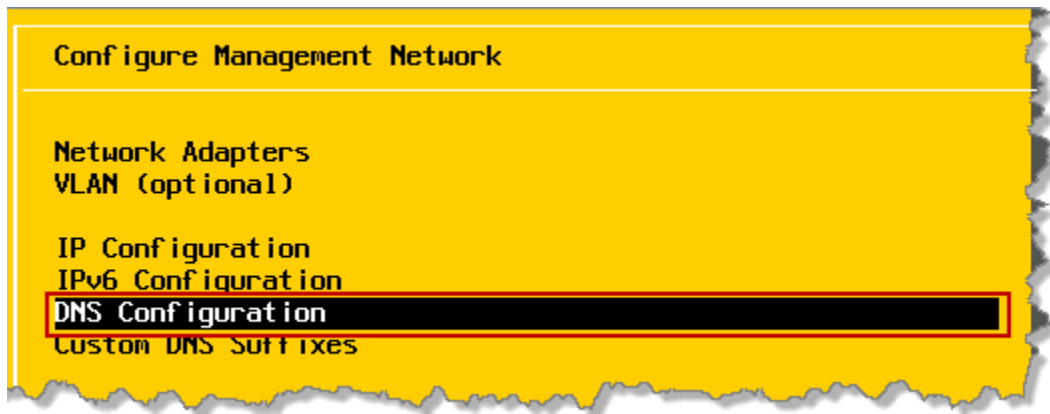
7. If you are not using IPv6, it is strongly recommended that you disable it to prevent possible networking issues in a production environment. Select **IPv6 Configuration** from the **Configure Management Network** menu.



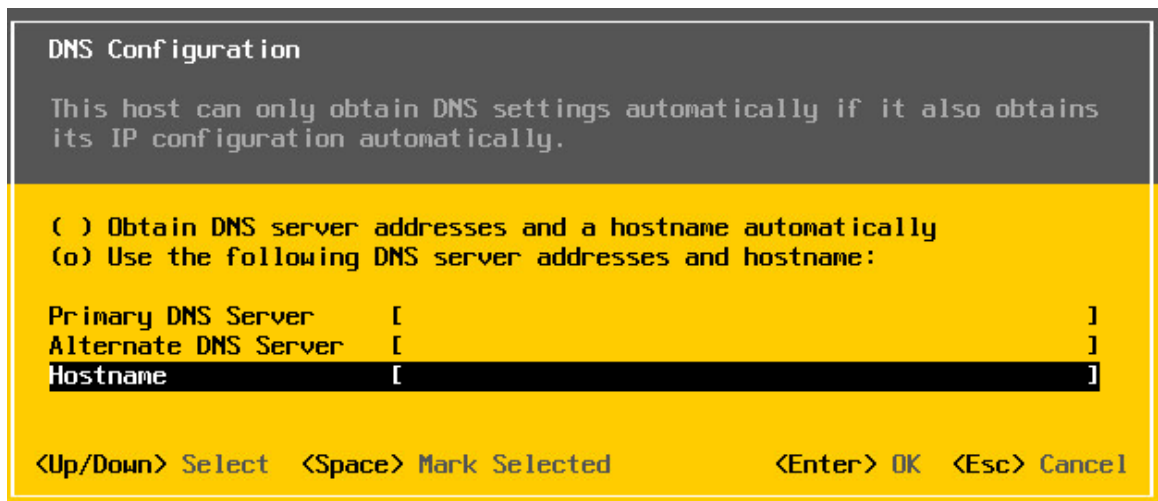
8. Make sure **Enable IPv6 (restart required)** is highlighted and press the **Spacebar** to remove the **X** from the checkbox. Make sure the window matches the one below and then press **Enter** to save settings.



- Next, select **DNS Configuration** from the **Configuration Management Network** menu.

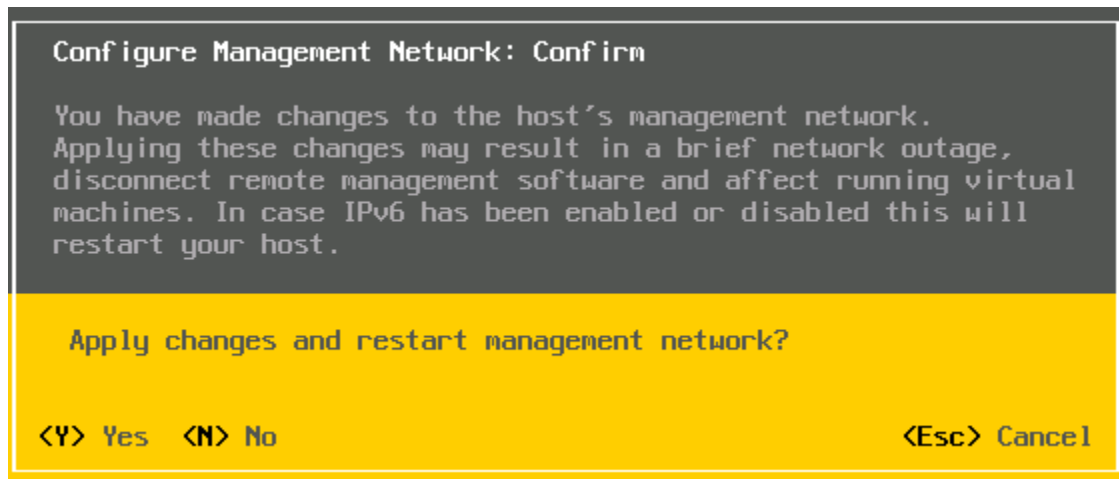


- Set the appropriate **Primary DNS Server**, **Alternate DNS Server**, and **Hostname** based on the table you filled out in Section 10. Press **Enter** to save settings.



- Press **Enter** to confirm changes and return to the **Configure Management Network** window.

12. Press **ESC** to exit. When prompted to **Apply changes and restart management** press **Y** to continue.



## 7 Management Console

The VMware vCenter Server Appliance can be managed through any web browser or the vSphere client. This configuration requires a “management console” in order to configure the vCenter Server appliance, ESXi Host Servers and virtual machines. The management console can be a Windows Server or Windows Desktop operating system. The management console can be either a virtual machine or a physical host like a workstation or laptop. The management console will need to be on the same network as the ESXi hosts and vCenter Server appliance.

NDG recommends deploying a Windows Server or Windows Desktop virtual machine on the Management Server. This virtual machine should be configured with one NIC regardless of your networking model choice.

The management console will also be where you want to download any virtual machine images for pod deployment. As such, it is strongly recommended that you have plenty of storage available to this virtual machine.

## 8 vCenter Server Appliance Deployment

In this section, you will deploy and configure the NDG Optimized vCenter Server Appliance.

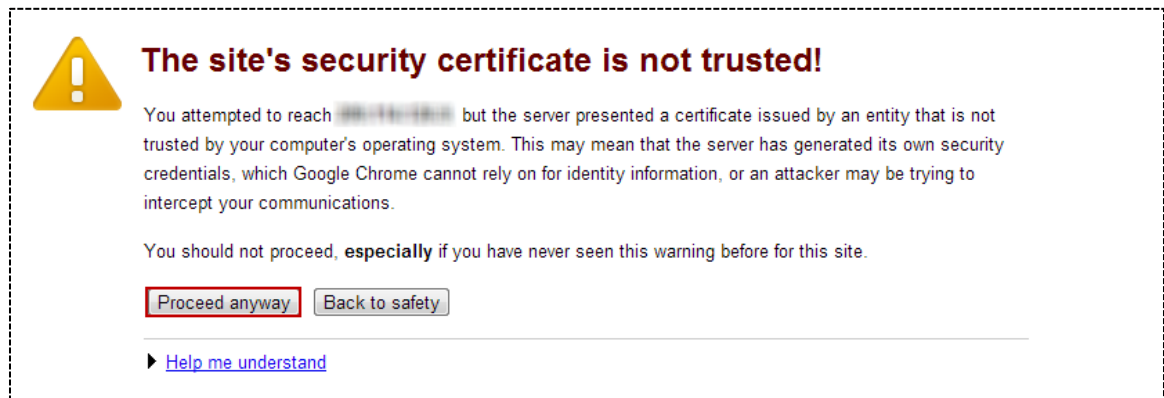
Starting with VMware ESXi 5.1, NDG strongly recommends using the NDG Optimized VMware vCenter Server Appliance. This appliance is a virtual machine that runs on ESXi 5.1. The physical server on which vCenter resides should be a dedicated "management server" to provide ample computing power.

NDG does not support configurations where vCenter is running on a heavily loaded ESXi host and/or an ESXi host that is also used to host virtual machines for NETLAB+ pods. Such configurations have exhibited poor performance, API timeouts, and sporadic errors in NETLAB+ operations.

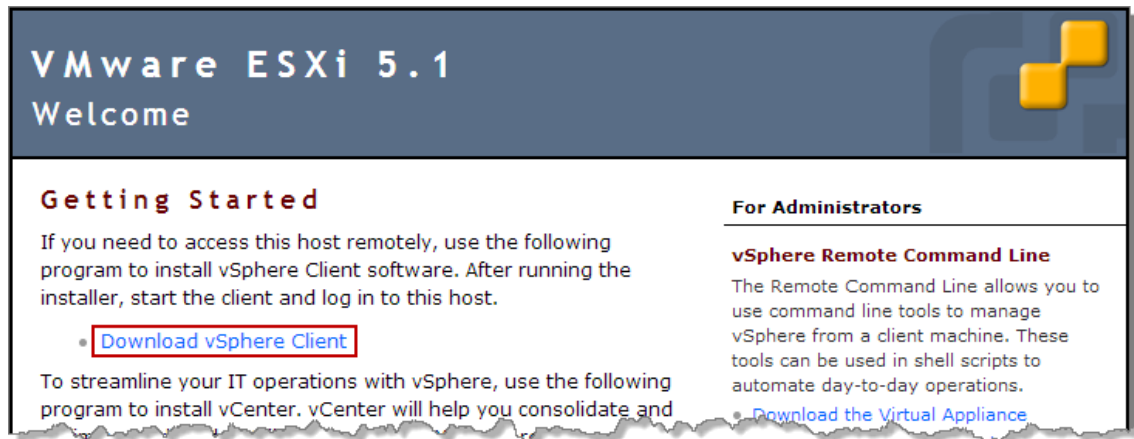
### 8.1 Installing the vSphere Client

In order to manage the vSphere infrastructure, you must install the vSphere Client on the Windows PC you will use to manage your vCenter Server.

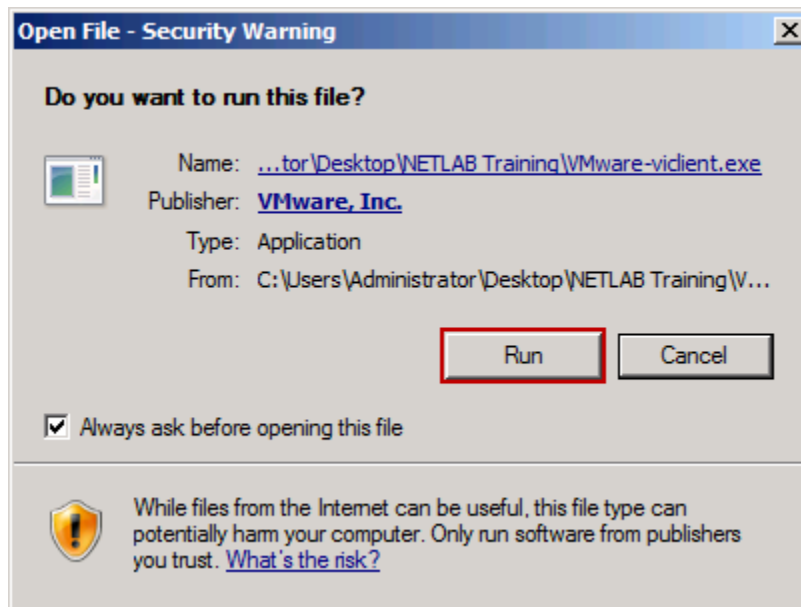
1. Open a web browser and go to `http://your-esxi-management-server-ip-address`.
2. Depending on your browser, you will be prompted with a security certificate issue. This issue exists because the certificate on the ESXi server is not signed. Click on the option to ignore, proceed anyway, or otherwise agree to the non-trusted security certificate. Below is an example of Google Chrome:



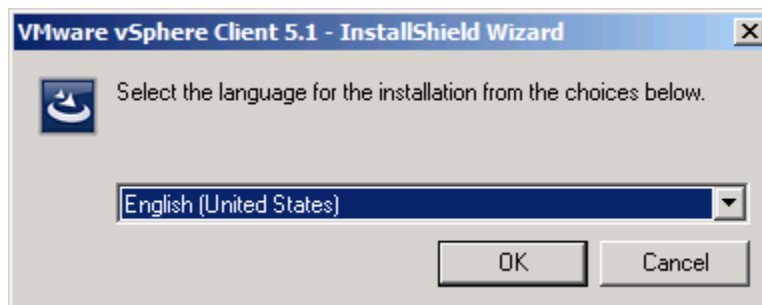
3. Click on the **Download vSphere Client** hyperlink.



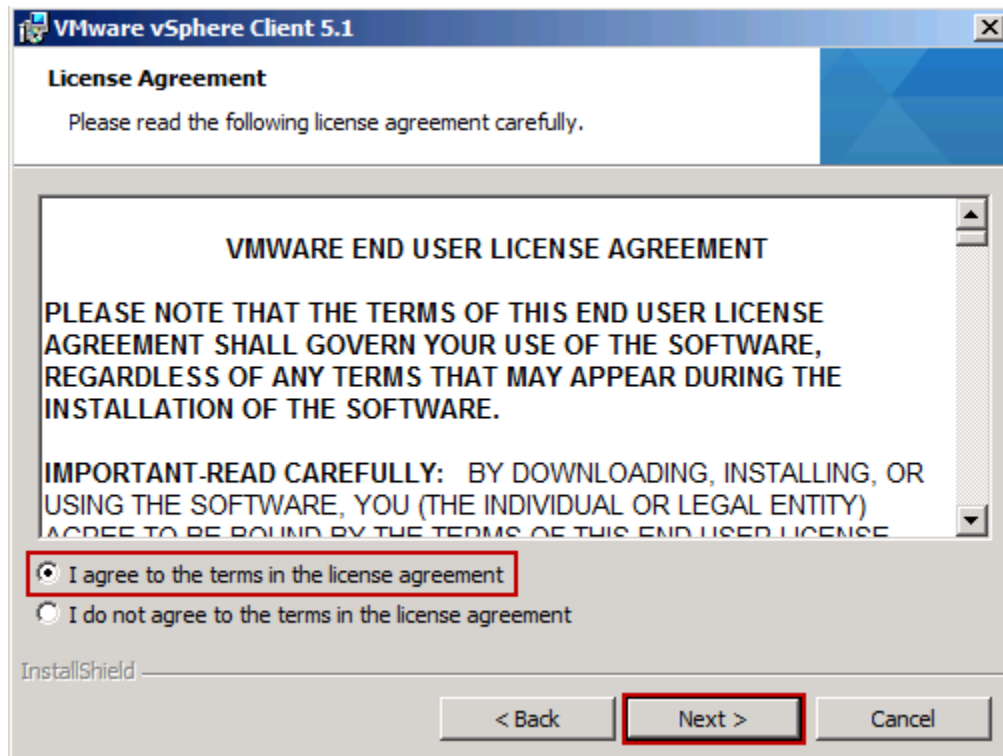
4. Save the installer to your desktop. Once the file is saved, double-click the installer file to start the installation.
5. You may be prompted with a **Security Warning**. Click on **Run** to start the install.



6. The installer will begin extracting the setup files. When prompted, make sure **English** is selected and click **OK**.



7. Click **Next** to continue.
8. Click **Next** to Accept the End-User Patent Agreement.
9. Click **I agree to the terms in the license agreement** and click **Next** to continue.

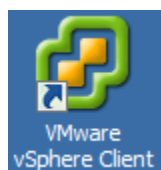


10. Click **Next** to accept the default Destination Folder.
11. Click **Install** to continue installation.
12. Click **Finish** to finish installation.

## 8.2 Deploying vCenter Server Appliance

In this section, you will be deploying the NDG Optimized vCenter Server Appliance on the ESXi Management Server. Make sure you have downloaded the NDG Optimized vCenter Server Appliance from Section 3 to your desktop.

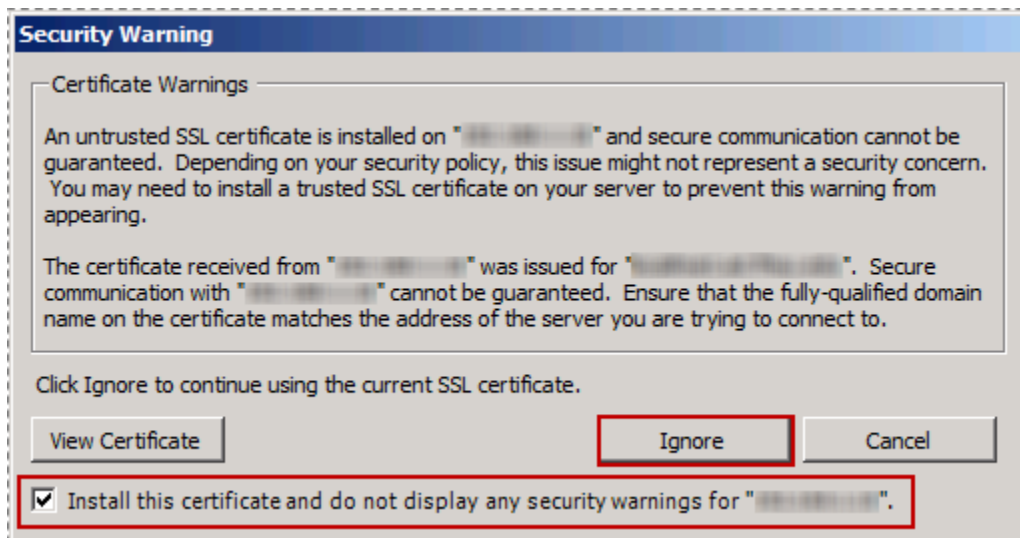
1. Double-click the **VMware vSphere Client** shortcut on the desktop.



2. Enter the IP address of your ESXi Management Server (use the table you filled out in Section 10, User Name is **root**, and the Password is the one you set during installation in Section 5.2.

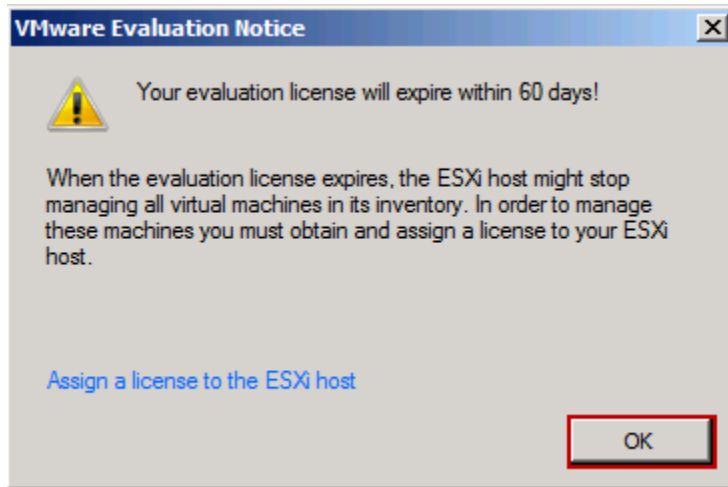


3. If a Security Warning window appears, click the checkbox **Install this certificate and do not display any security warnings for "yourserverip"** and click **Ignore**.

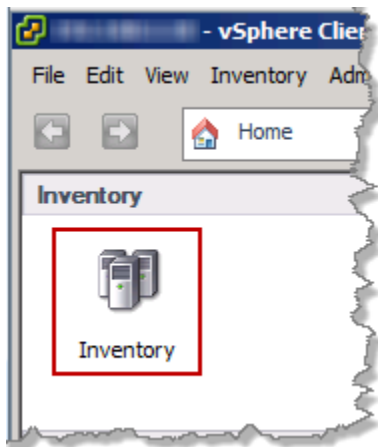




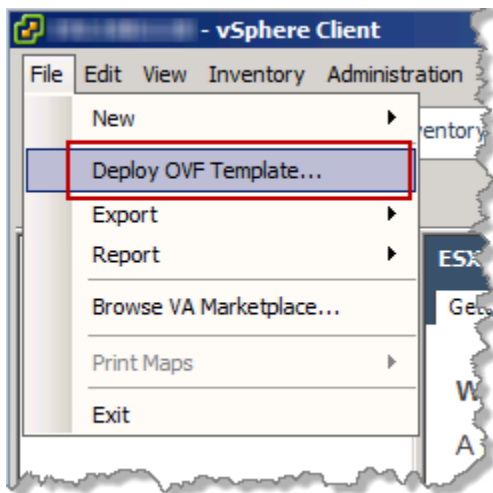
4. When prompted with the **VMware Evaluation Notice** click **OK** to continue.



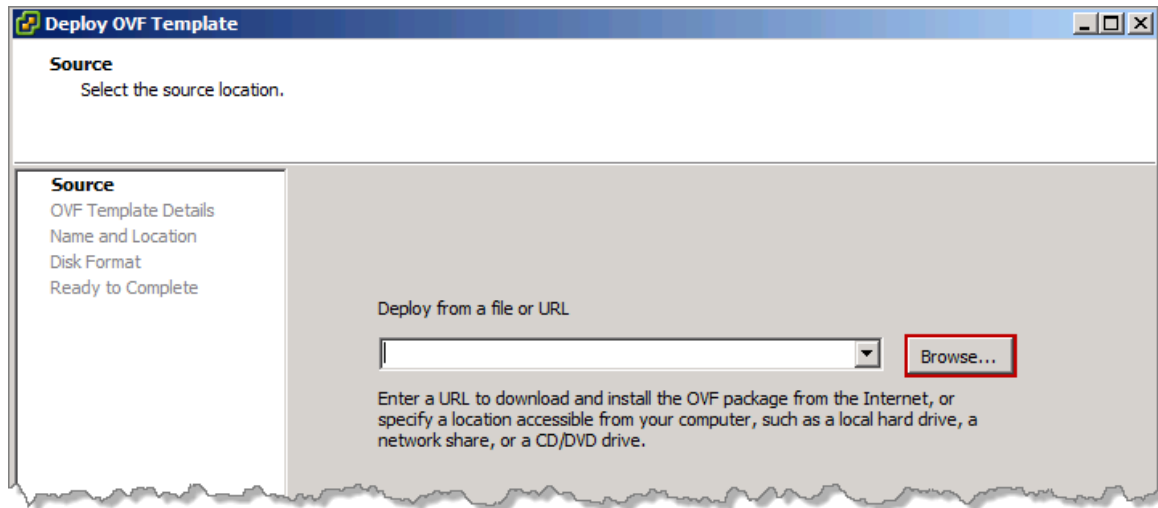
5. Click the **Inventory** icon.



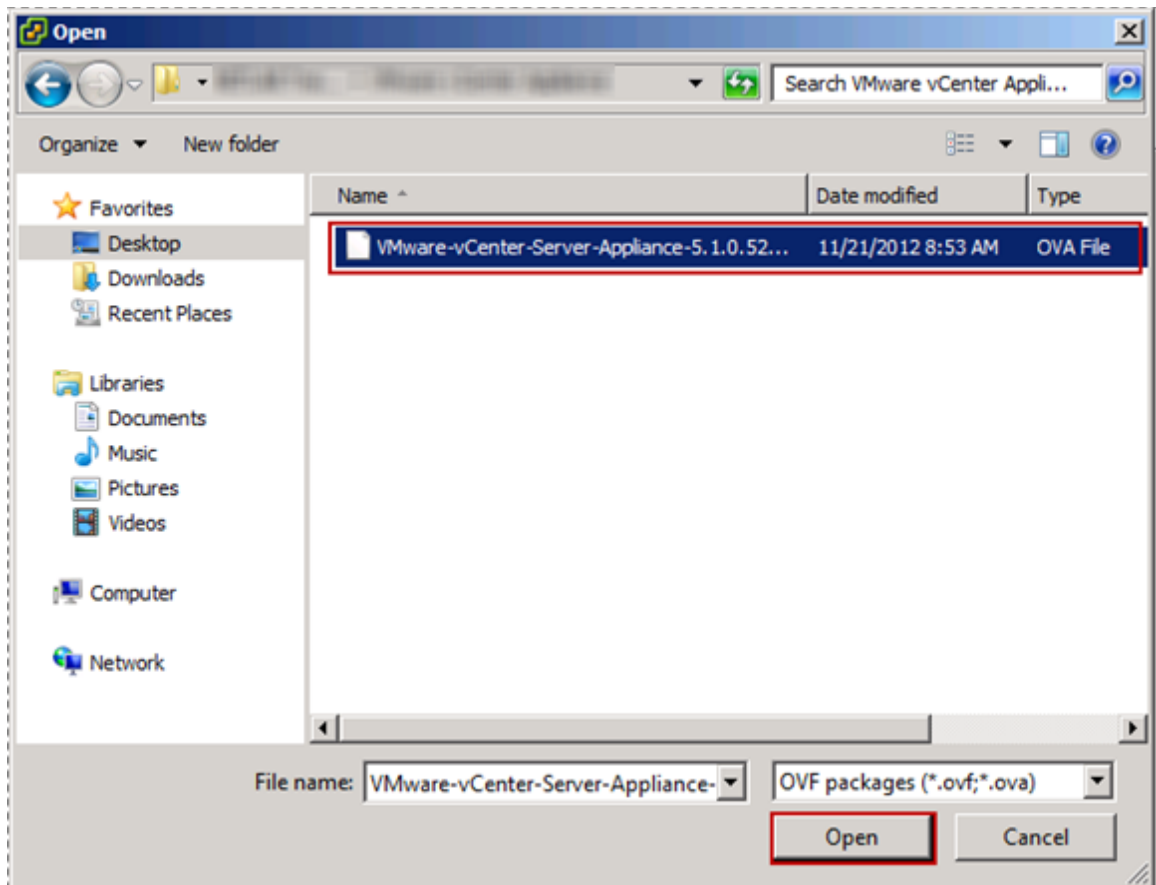
6. Make sure the ESXi host is highlighted on the left. Click **File** menu and select **Deploy OVF Template...**



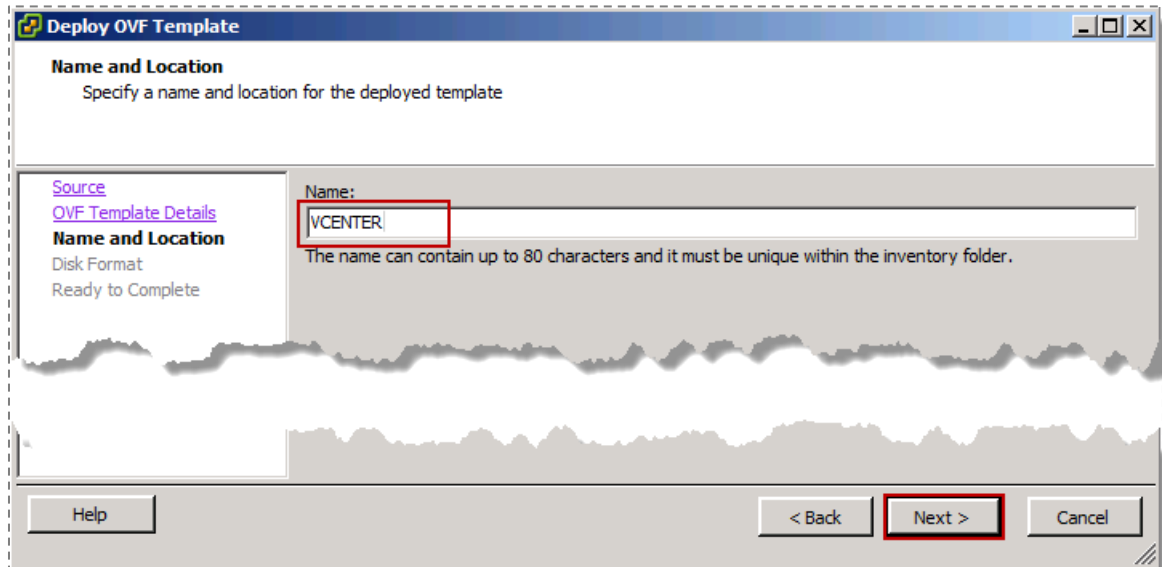
7. When the **Source** window appears, click on **Browse...**



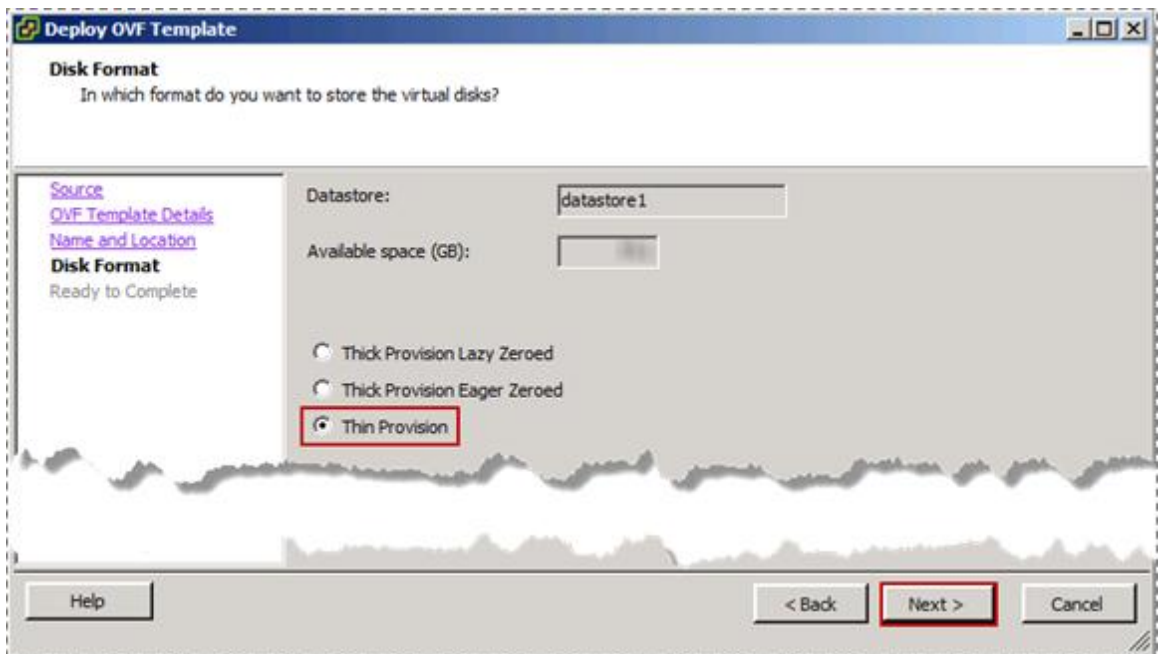
8. In the **Open** window, click **Desktop** in the left pane, then click the OVA file you downloaded from Section 3. Click **Open**.



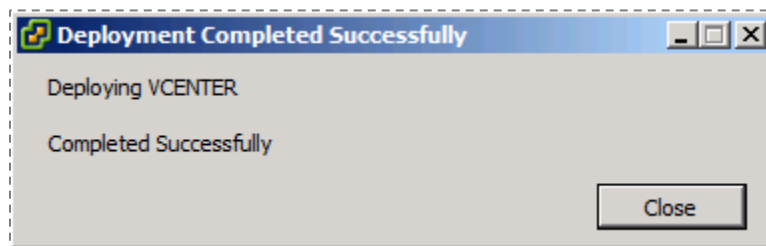
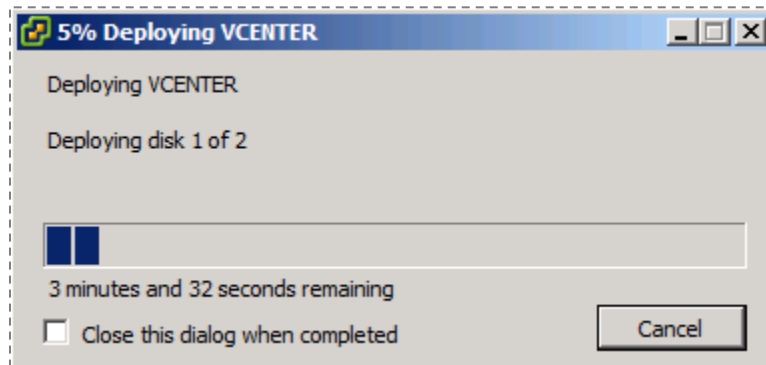
9. Click **Next** to continue.
10. On the **OVF Template Details** window, review the information and click **Next** to continue.
11. On the **Name and Location** window, in the **Name** field, enter **VCENTER** and click **Next**.



12. On the **Disk Format** window, select **Thin Provision** and click **Next**.



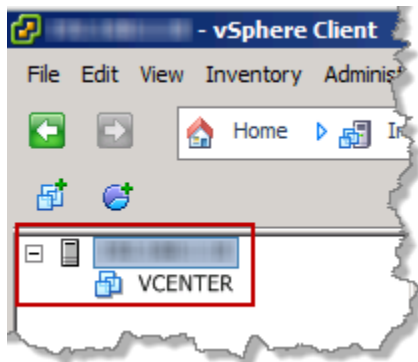
13. On the **Ready to Complete** window, click **Finish** to deploy the appliance.
14. Wait for the progress window to complete; this will take a few minutes. Click on **Close** when it has completed.



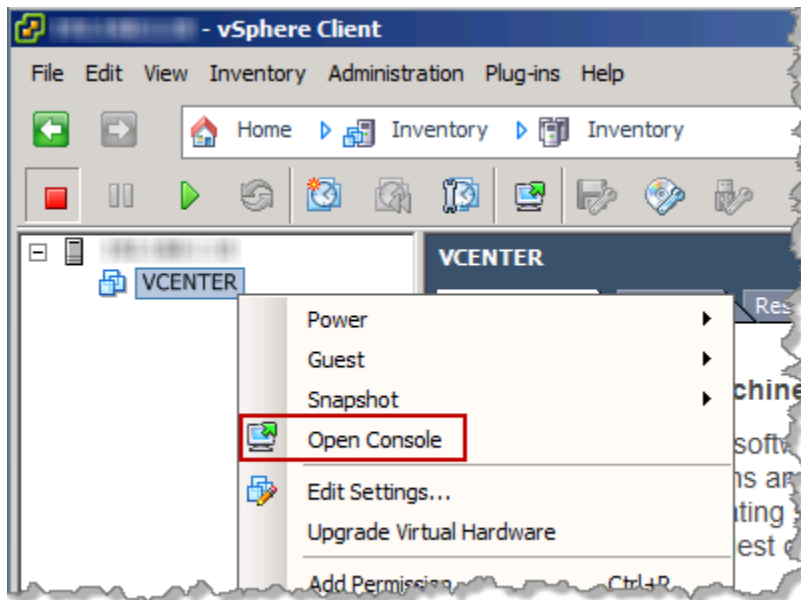
### 8.3 Configuring Basic Network Connectivity

In this section, you will be configuring the IP address via the console on **VCENTER**. By default, the appliance is set for DHCP. If you have DHCP running on your management network, the appliance will initially pull an IP address. NDG strongly recommends you use a static IP address. These steps will walk you through configuring an IP address.

1. In the vSphere Client, expand the ESXi host on the left to display the **VCENTER** VM.



2. Right-click the **VCENTER** VM, and select **Open Console**.



3. Click the **Power On** button in the toolbar to power on the VM.



4. When the appliance has finished loading you will see the following screen. This screen may vary if you have DHCP enabled on your management network:

```
NO NETWORKING DETECTED. PLEASE LOGIN AND RUN THE COMMAND
/opt/vmware/share/vami/vami_config_net
TO CONFIGURE THE NETWORK.
VMware vCenter Server Appliance 5.1.0.5200 Build 880472
To manage your appliance please browse to https://0.0.0.0:5480/
Welcome to VMware vCenter Server Appliance
Quickstart Guide: (How to get vCenter Server running quickly)
 1 - Open a browser to: https://0.0.0.0:5480/
 2 - Accept the EULA
 3 - Select the desired configuration mode or upgrade
 4 - Follow the wizard

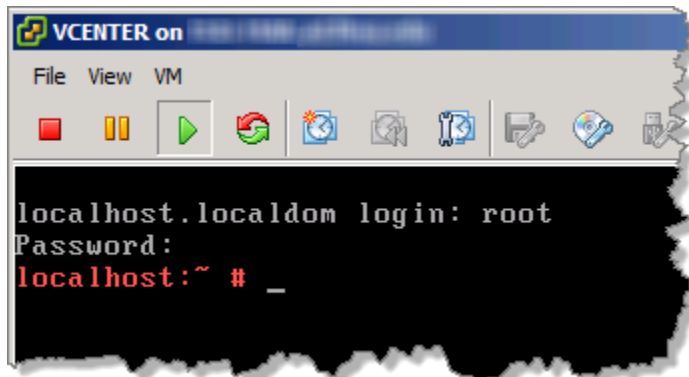
The configured appliance will be ready to use.
In case of upgrade the appliance will reboot and may change
its network address.

*Login
Set Timezone (Current:UTC)

Use Arrow Keys to navigate
and <ENTER> to select your choice.
```

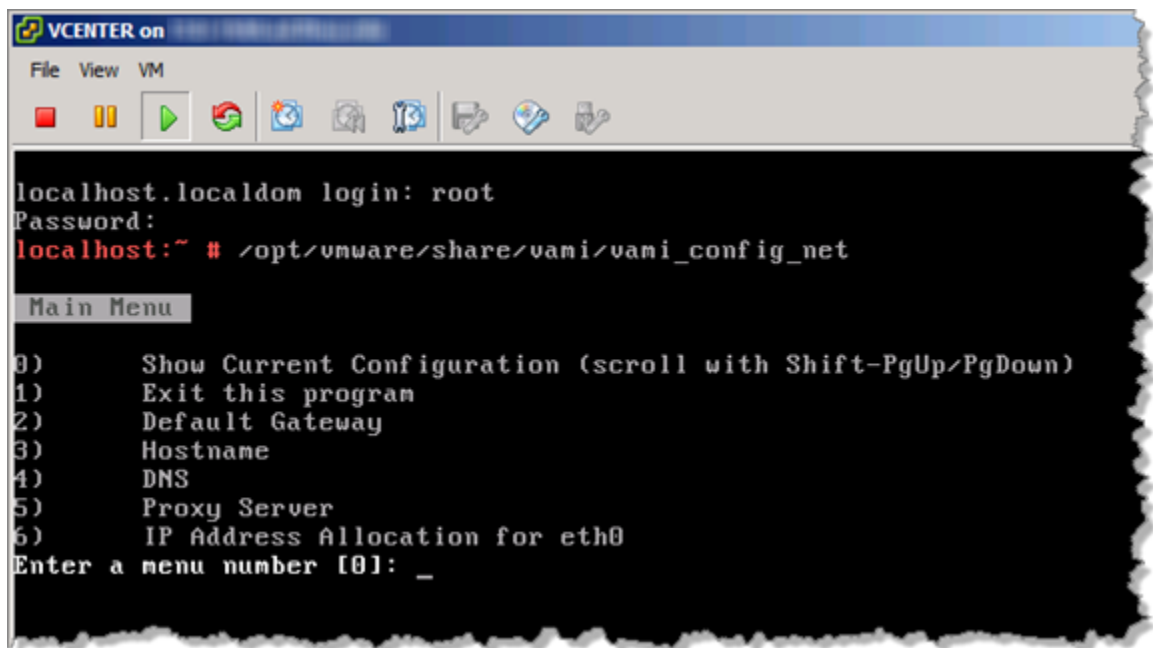
5. We must configure the network settings manually to set a static address. Make sure **Login** is selected and press **Enter**.

6. Enter `root` for the username and enter `vmware` for the password.



7. Enter the following command:

```
localhost:~# /opt/vmware/share/vami/vami_config_net
```



8. Type **6** and press **Enter** to set the IP Address Allocation for eth0.
9. When prompted to “**Configure an IPv6 address for eth0?**” press **Enter** to select the default answer.
10. When prompted to “**Configure an IPv4 address for eth0?**” type **y** then press **Enter**.
11. When prompted to “**Use a DHCPv4 Server instead of a static IPv4 address?**” type **n** and press **Enter**.
12. Enter *youripaddress* for the **IPv4 Address** and press **Enter**. Please use your table from Section 10 for reference.
13. Enter *yoursubnetmask* for the **Netmask** and press **Enter**. Please use your table from Section 10 for reference.
14. When asked “**Is this Correct?**” press **Enter** to say yes.

15. Type **2** and press **Enter** to set the Default Gateway.
16. When prompted to select the interface, press **Enter** to select the default.
17. Enter the IPv4 Default Gateway, *yourdefaultgateway* and press **Enter**. Please use your table from Section 10 for reference.
18. Leave IPv6 Default Gateway blank and press **Enter**.
19. After the changes have been made, type **1** at the Main Menu then press **Enter** to exit.

## 8.4 Creating NETLAB+ user on the vCenter Appliance

In this section, you will be creating a NETLAB+ user account and setting the password for NETLAB+ to access **VCENTER**.

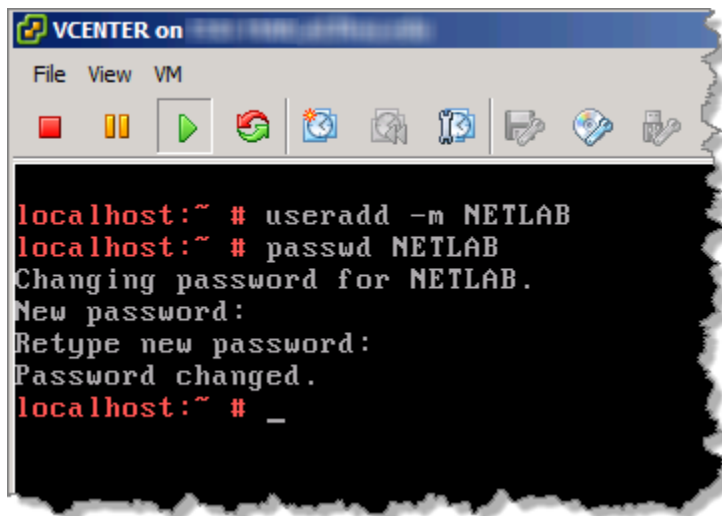
1. While still in the command prompt of the vCenter Server Appliance, enter the following command to add the NETLAB+ user:

```
localhost:~# useradd -m NETLAB
```

2. Enter the following command to change the password:

```
localhost:~# passwd NETLAB
```

3. Enter a password and retype the new password. It is important that you write this information down, as it is needed when connecting NETLAB+ to your vSphere Infrastructure.

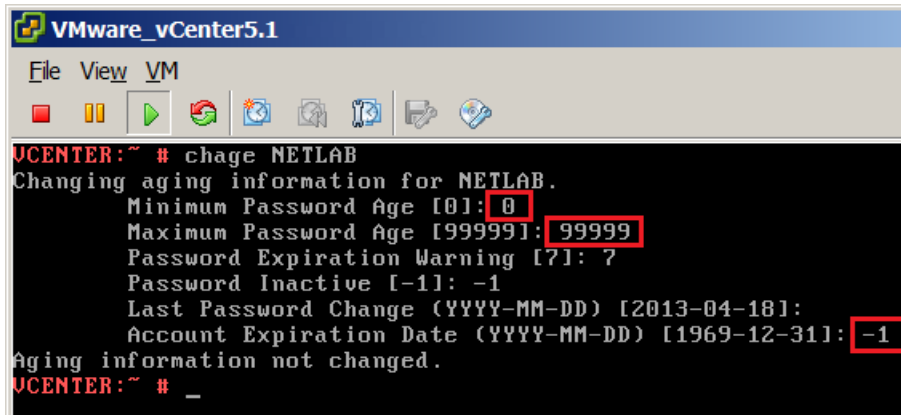


4. Enter the following command to change the user password expiry information:

```
localhost:~# chage NETLAB
```



5. Enter the following information:

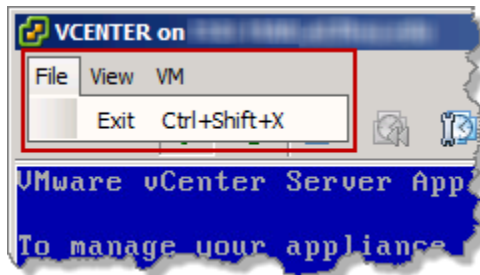


```
VMware_vCenter5.1
File View VM
UCENTER:~ # chage NETLAB
Changing aging information for NETLAB.
Minimum Password Age [0]: 0
Maximum Password Age [99999]: 99999
Password Expiration Warning [7]: 7
Password Inactive [-1]: -1
Last Password Change (YYYY-MM-DD) [2013-04-18]:
Account Expiration Date (YYYY-MM-DD) [1969-12-31]: -1
Aging information not changed.
UCENTER:~ # _
```

6. Type **exit** and press **Enter** at the console to log out.

```
localhost:~# exit
```

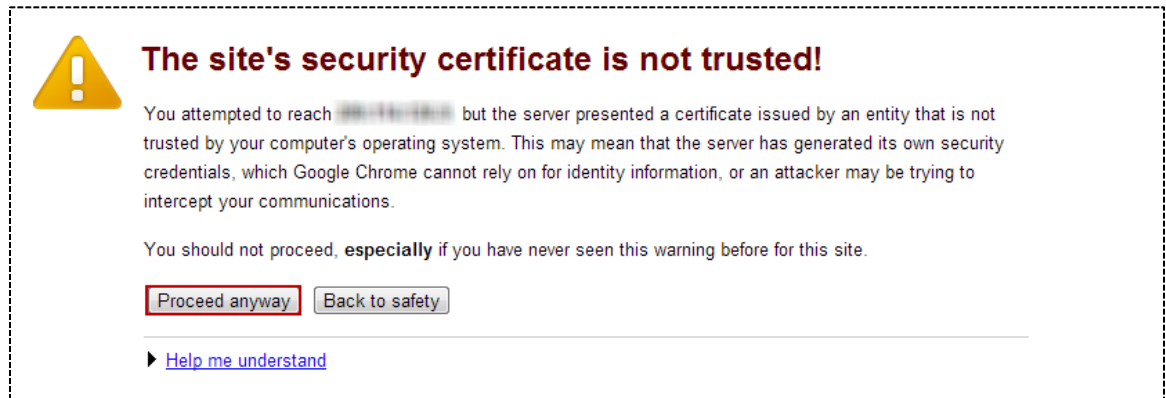
7. Press **CTRL+ALT** to release the mouse from the window. You may need to press this a couple of times and move the mouse. When a mouse cursor appears, you can continue.
8. Click the **File** menu, and select **Exit** to close the console.



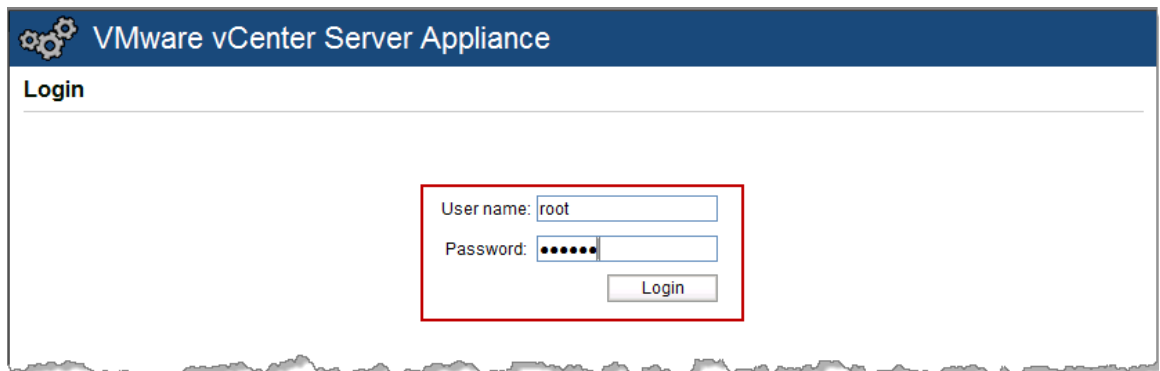
## 8.5 Initial Configuration on the vCenter Appliance

For this section, you will be doing the initial configuration on the vCenter Appliance.

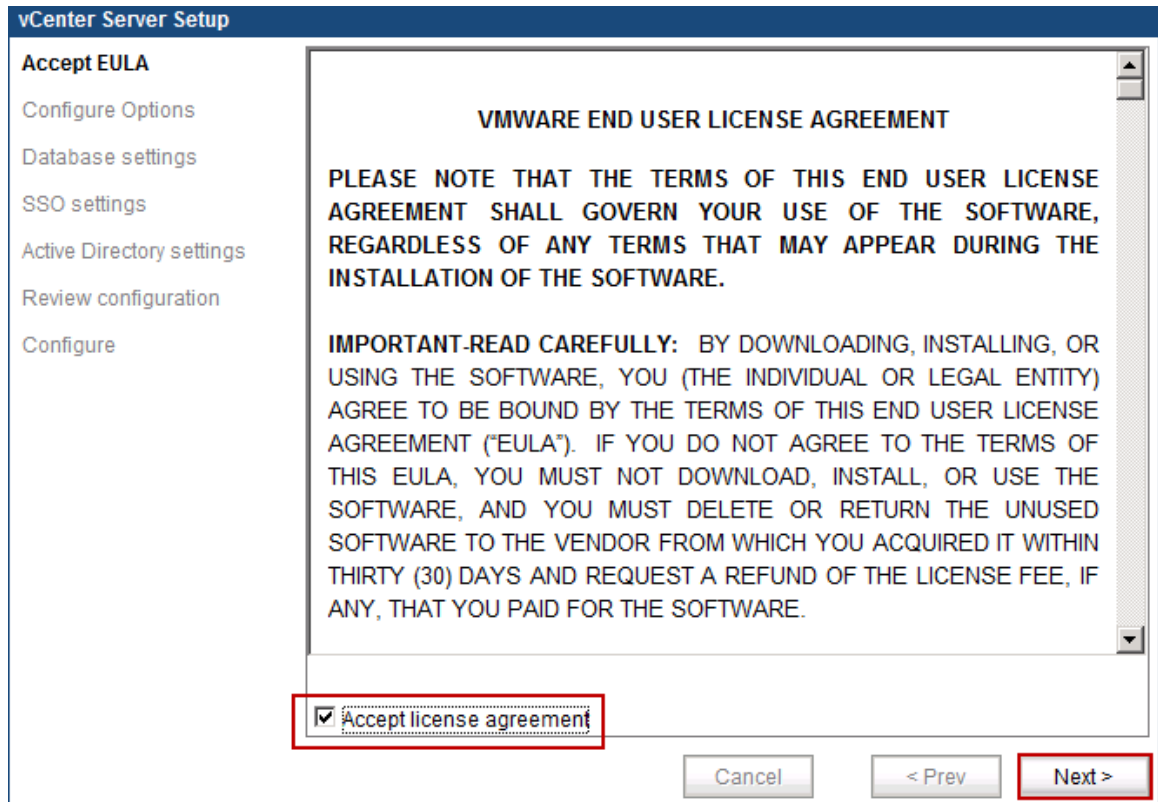
1. Open an Internet Browser.
2. In the address bar, enter `https://yourvcenteripaddress:5480`. When prompted with a security warning, accept this certificate based on your browser. This error is because the default certificate for the vCenter appliance is not signed. Below is an example of Google Chrome:



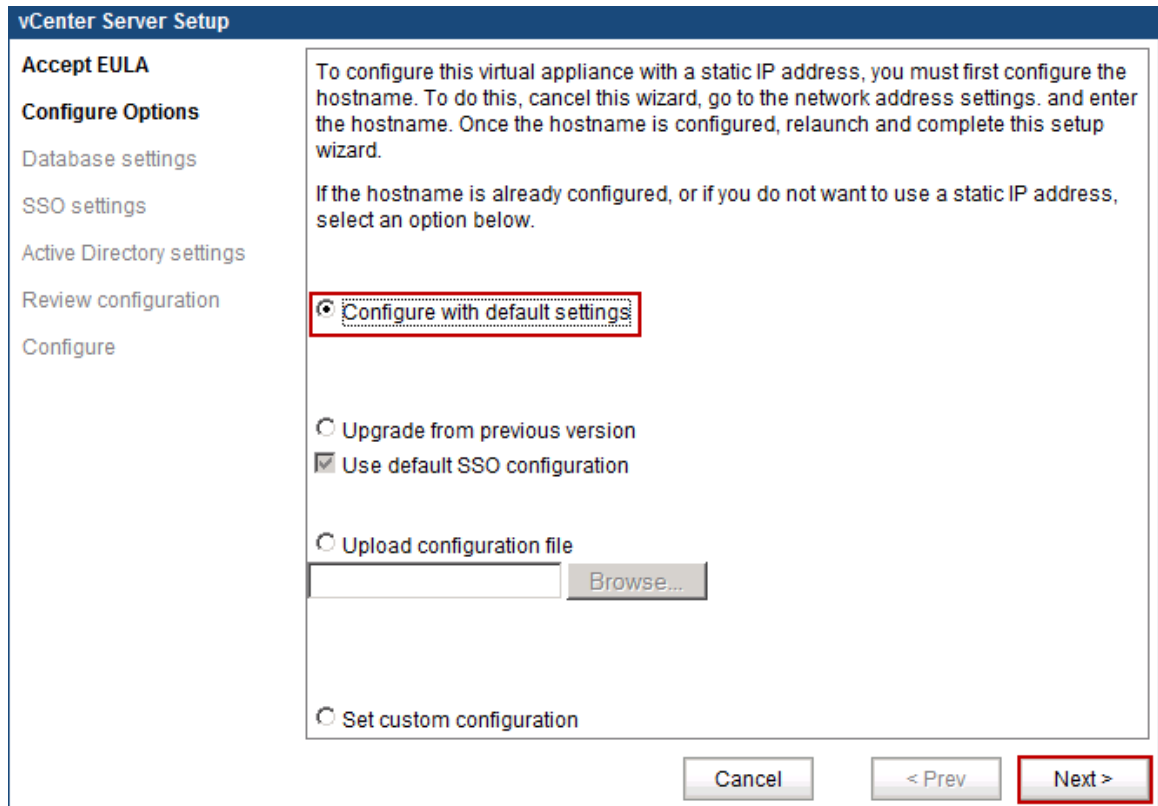
3. Enter the default credentials, `root` for the username and `vmware` for the password and click **Login**.



4. Click the checkbox to **Accept license agreement** and click **Next**.



5. Select **Configure with default settings** and click **Next**.



The screenshot shows the 'vCenter Server Setup' wizard. On the left is a navigation pane with the following items: 'Accept EULA', 'Configure Options', 'Database settings', 'SSO settings', 'Active Directory settings', 'Review configuration', and 'Configure'. The 'Configure Options' section is active. The main area contains the following text and options:

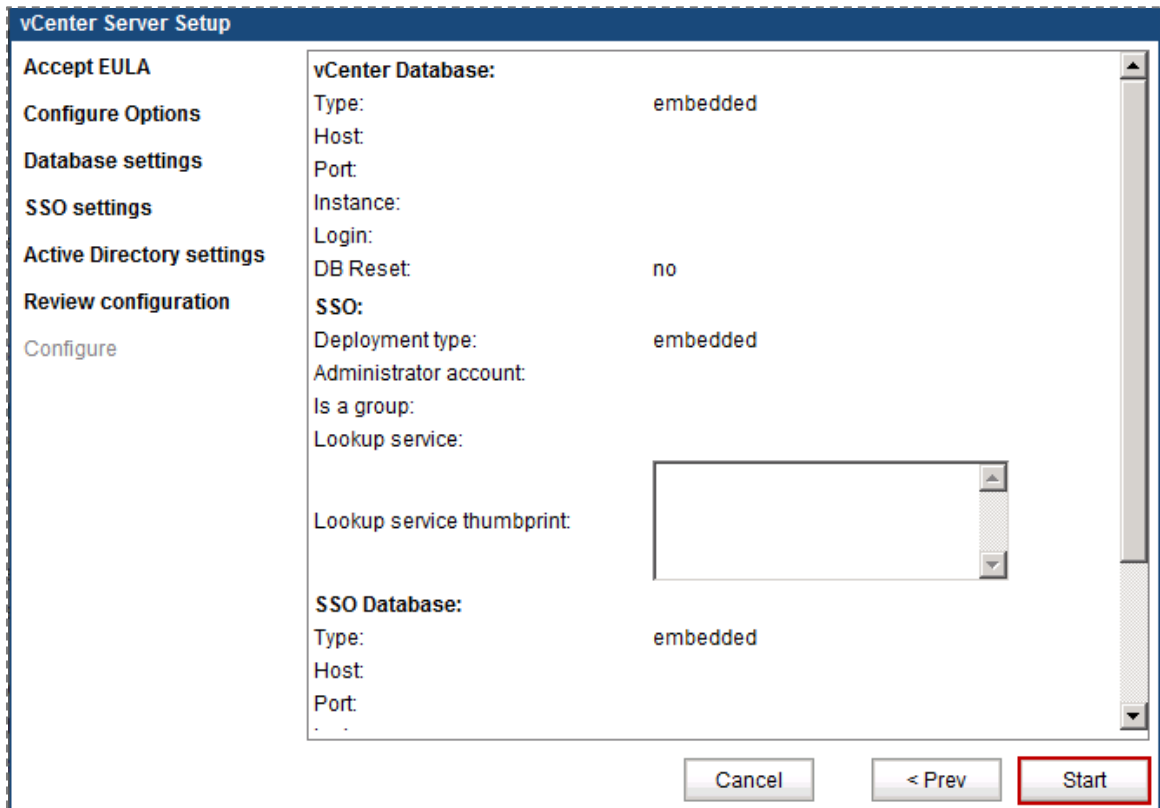
To configure this virtual appliance with a static IP address, you must first configure the hostname. To do this, cancel this wizard, go to the network address settings, and enter the hostname. Once the hostname is configured, relaunch and complete this setup wizard.

If the hostname is already configured, or if you do not want to use a static IP address, select an option below.

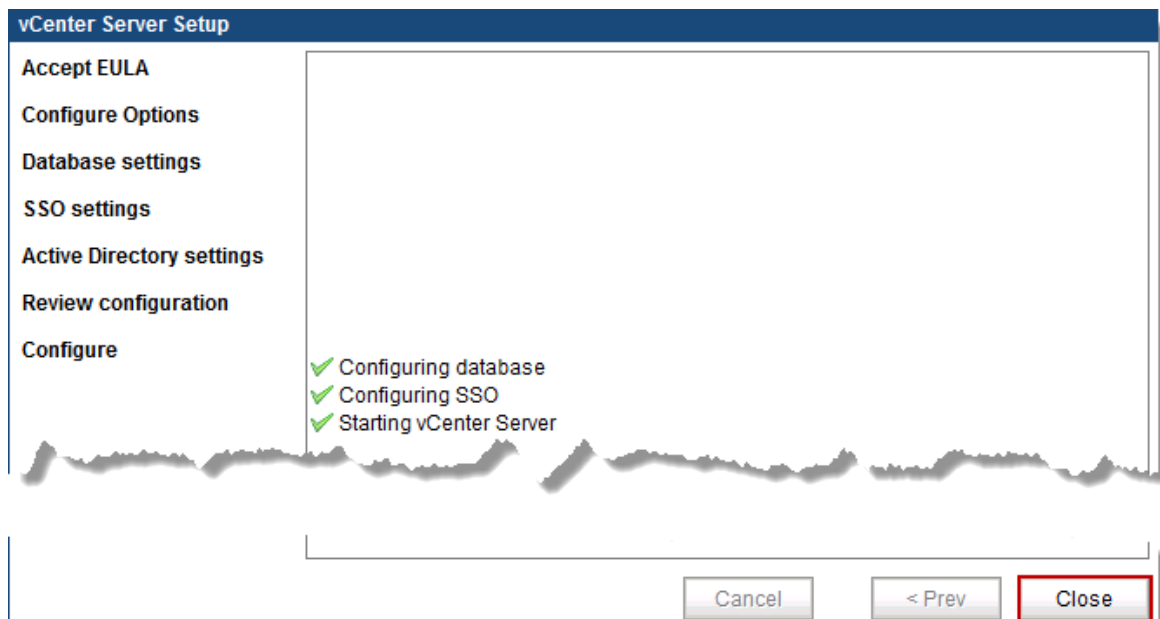
- Configure with default settings** (highlighted with a red box)
- Upgrade from previous version
- Use default SSO configuration
- Upload configuration file  
[Text input field] [Browse...]
- Set custom configuration

At the bottom right, there are three buttons: 'Cancel', '< Prev', and 'Next >' (highlighted with a red box).

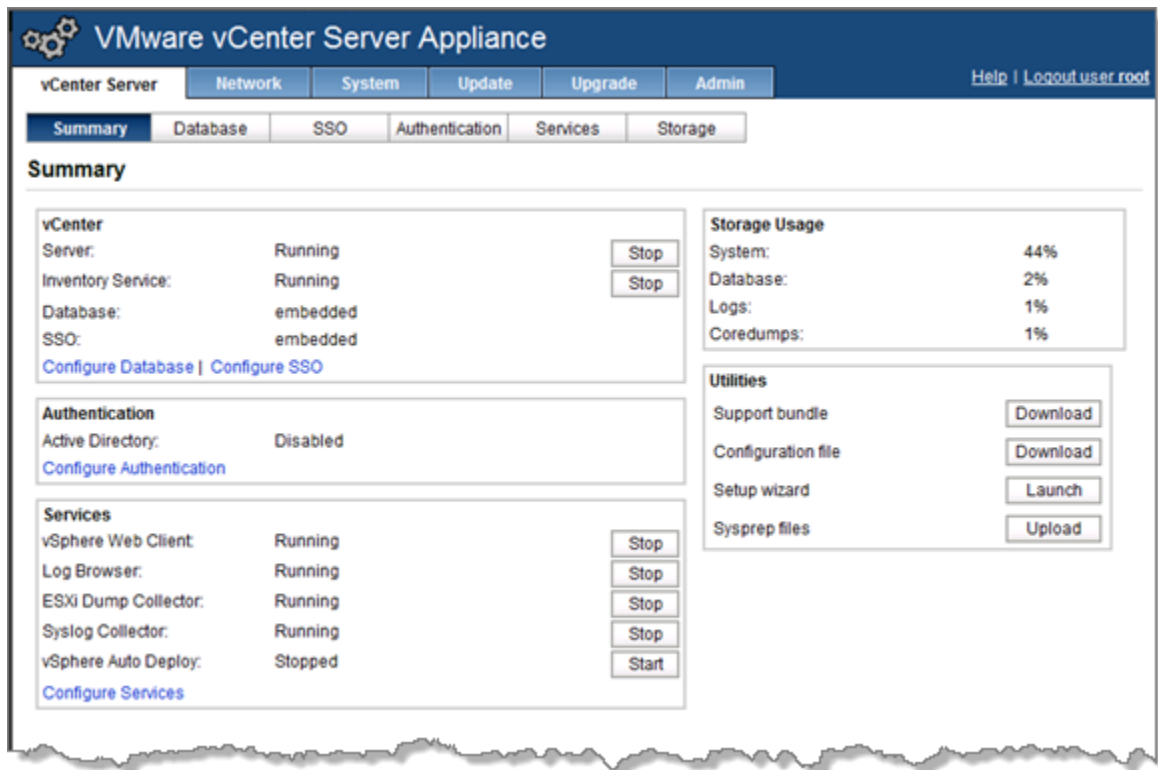
- Review the information and click **Start** to configure vCenter with default settings. This may take a few minutes to complete as it configures the various databases and starts the services.



- Click **Close** to finish vCenter Setup.



8. You will be presented with the Summary screen. Wait until everything has loaded, all spinning wheels should disappear.



The screenshot shows the VMware vCenter Server Appliance management interface. The top navigation bar includes 'vCenter Server', 'Network', 'System', 'Update', 'Upgrade', and 'Admin'. A secondary navigation bar shows 'Summary', 'Database', 'SSO', 'Authentication', 'Services', and 'Storage'. The 'Summary' page is active, displaying the following information:

vCenter		
Server:	Running	<input type="button" value="Stop"/>
Inventory Service:	Running	<input type="button" value="Stop"/>
Database:	embedded	
SSO:	embedded	
<a href="#">Configure Database</a>   <a href="#">Configure SSO</a>		

Authentication		
Active Directory:	Disabled	
<a href="#">Configure Authentication</a>		

Services		
vSphere Web Client:	Running	<input type="button" value="Stop"/>
Log Browser:	Running	<input type="button" value="Stop"/>
ESXi Dump Collector:	Running	<input type="button" value="Stop"/>
Syslog Collector:	Running	<input type="button" value="Stop"/>
vSphere Auto Deploy:	Stopped	<input type="button" value="Start"/>
<a href="#">Configure Services</a>		

Storage Usage	
System:	44%
Database:	2%
Logs:	1%
Core dumps:	1%

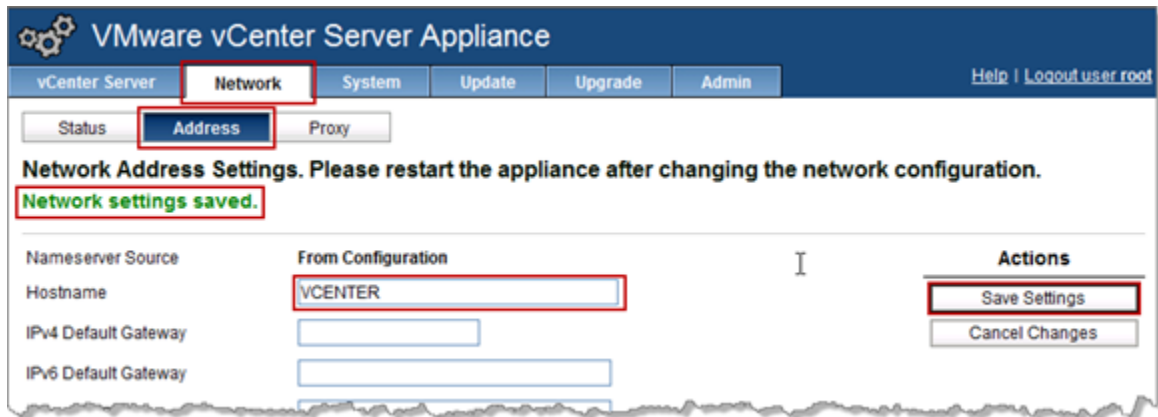
  

Utilities	
Support bundle	<input type="button" value="Download"/>
Configuration file	<input type="button" value="Download"/>
Setup wizard	<input type="button" value="Launch"/>
Sysprep files	<input type="button" value="Upload"/>

## 8.6 Setting the hostname and changing the root password

For this section, we will be changing the hostname of the vCenter Appliance, enabling Certificate Regeneration, and changing the root password.

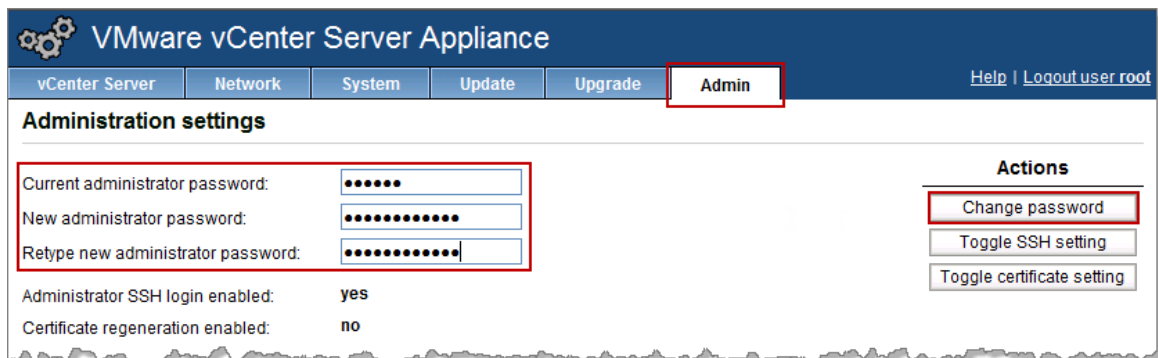
1. Click on the **Network** tab at the top.
2. Click on the **Address** tab below.
3. In the **Hostname** field, enter **VCENTER**.
4. Click **Save Settings**, under Actions on the right-hand side. You will get a confirmation in green, “**Network settings saved**” above the Nameserver Source field.



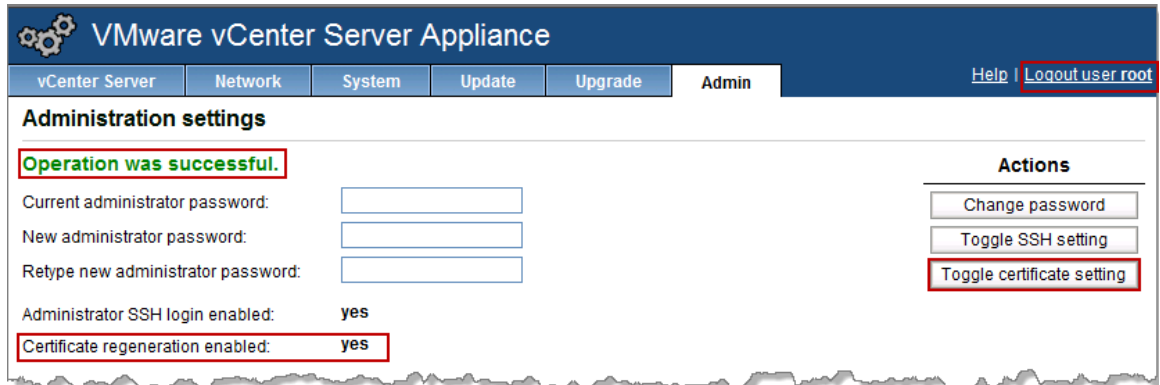
5. Click on the **Admin** tab at the top.

The Admin tab does not display in some versions of Firefox. If you do not see the Admin tab, it may be necessary to use a different browser. The Admin tab displays properly in Internet Explorer 9.

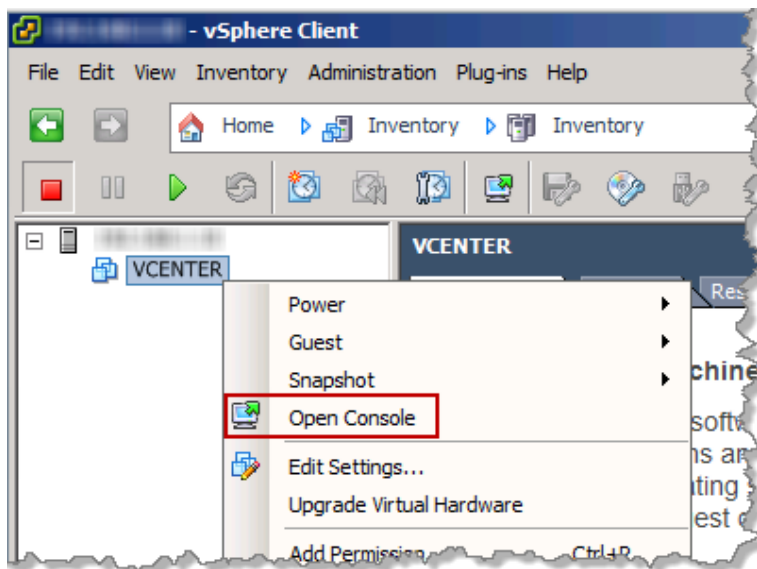
6. Change the administrator password:
  - a. Type **vmware** in the **Current administrator password** field.
  - b. Type **yournewpassword** in the **New administrator password** field and in the **Retype new administrator password** field. This will be now new root password for the vCenter Appliance, so please write this down in a safe place.
  - c. Click on the **Change password** button on the right.



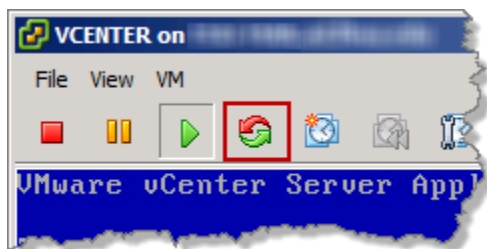
7. Click on **Toggle certificate setting** to change the Certificate regeneration enabled option to yes. This will generate a new certificate after changing the hostname. You will notice that the **Certification regeneration enabled** option changed to **yes** and a green confirmation message **“Operation was successful”** will appear above the **Current administrator password** field.
8. Click **Logout user root** in the upper-right hand corner.



9. Close your browser and maximize vSphere Client.
10. Right-click **VCENTER** in the inventory list and select **Open Console**.

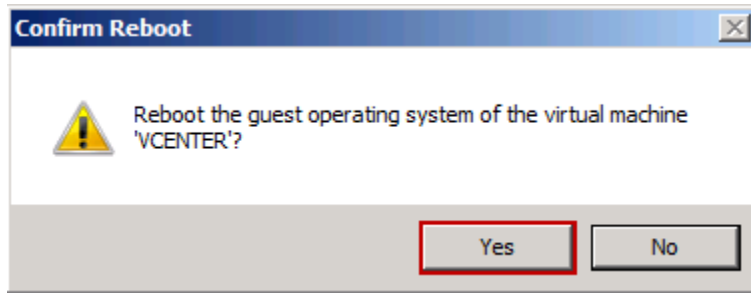


11. Click the **Restart Guest** button to restart the VCENTER VM.

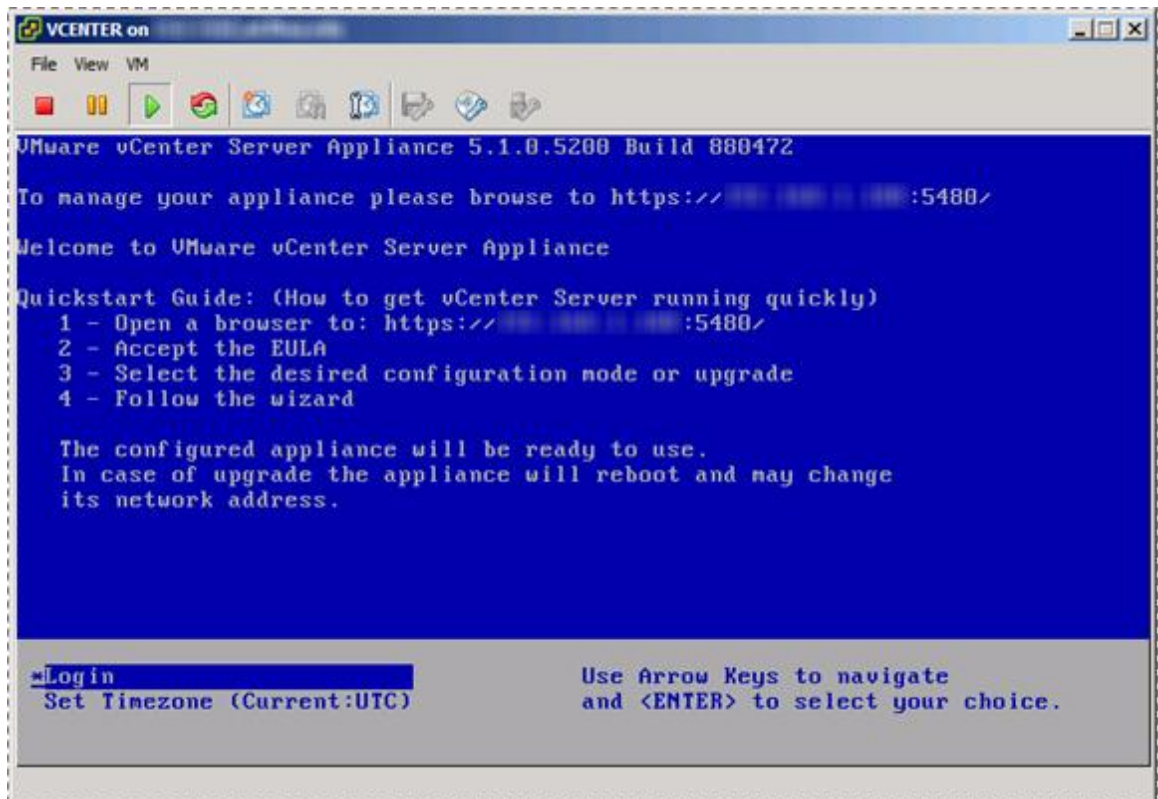




12. If a **Confirm Reboot** window pops up, click **Yes**.



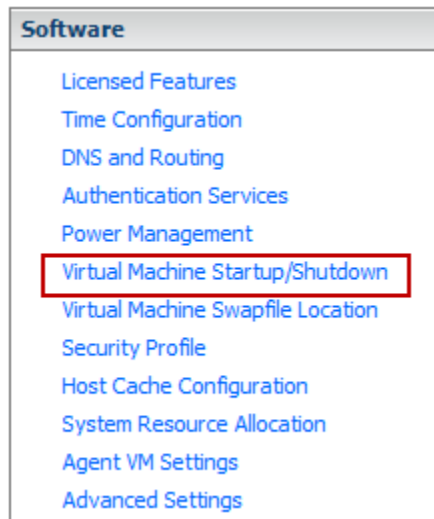
13. Watch the console to **VCENTER** to monitor the reboot. This will take a few minutes. After the VM has rebooted and you are prompted with the Summary screen, close the console and exit vSphere Client.



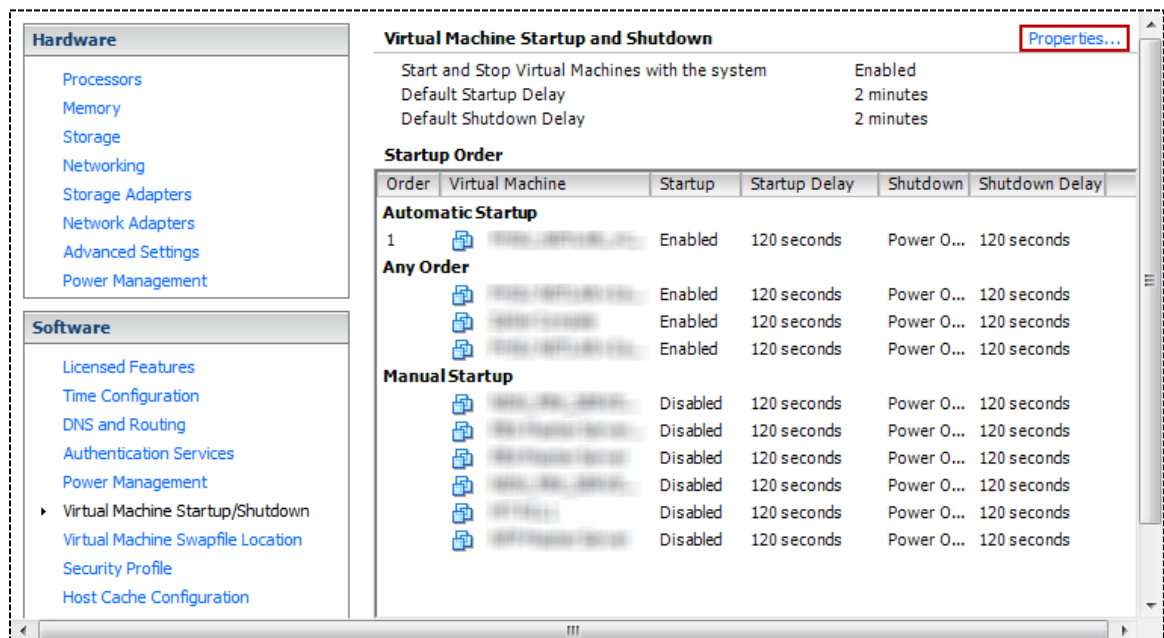
## 8.7 Configure Automatic Startup for vCenter

For this section, you will configure vCenter to automatically start with the ESXi Management Server. This is important because if not set and the ESXi Management Server powers off or is rebooted, the vCenter Appliance will not start up causing NETLAB+ failure and possible loss of administration.

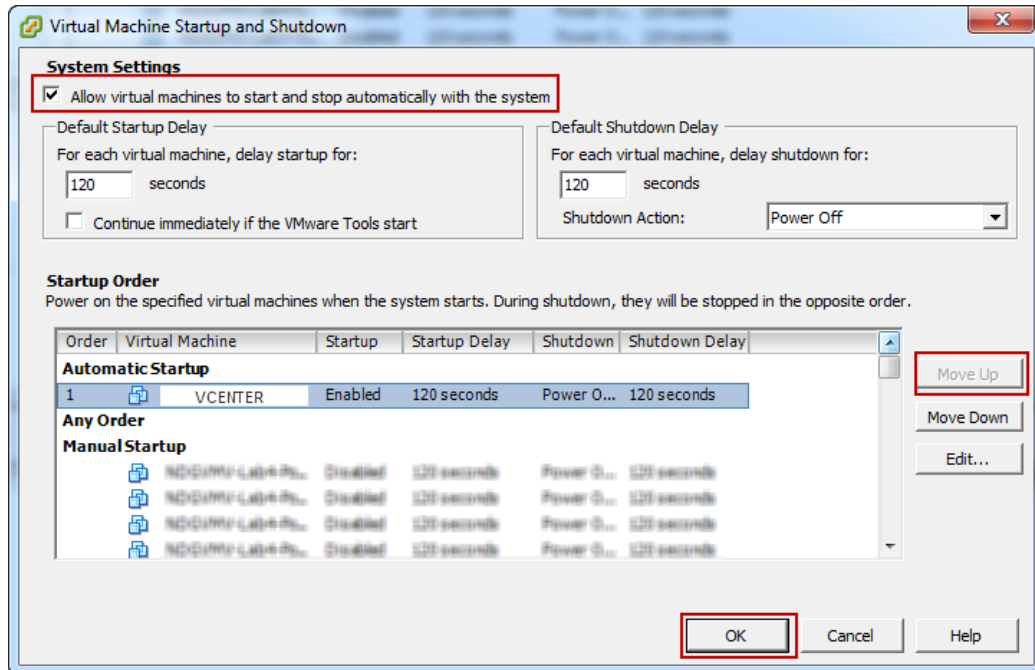
1. Click on your ESXi host in the left pane.
2. Click the **Configuration** tab at the top.
3. Under the software section click on **Virtual Machine Startup/Shutdown**.



4. Click on **Properties** in the upper right.



5. Click the checkbox to **Allow virtual machines to start and stop automatically with the system.**
6. Select your vCenter VM in the list and click **Move Up** until it is under **Automatic Startup.**
7. Click **OK.**



8. Close vSphere client.

## 9 Datacenter Configuration

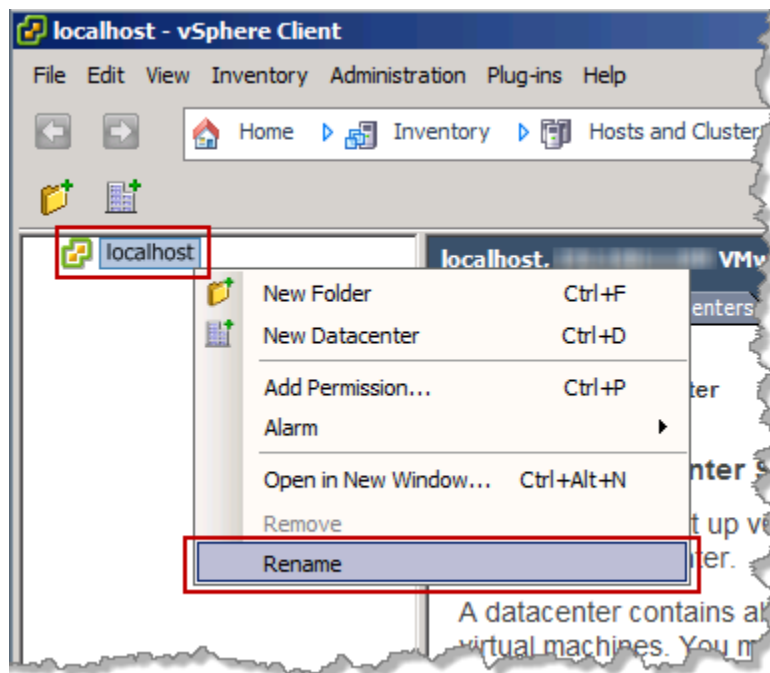
In this section, you will be:

- Setting up and configuring a NETLAB+ datacenter
- Setting up and configuring a NETLAB+ role
- Adding your ESXi Host Servers to the datacenter
- Allowing Remote PC Viewer sessions in the ESXi firewall
- vSwitch Configurations

### 9.1 Create NETLAB+ datacenter in vCenter

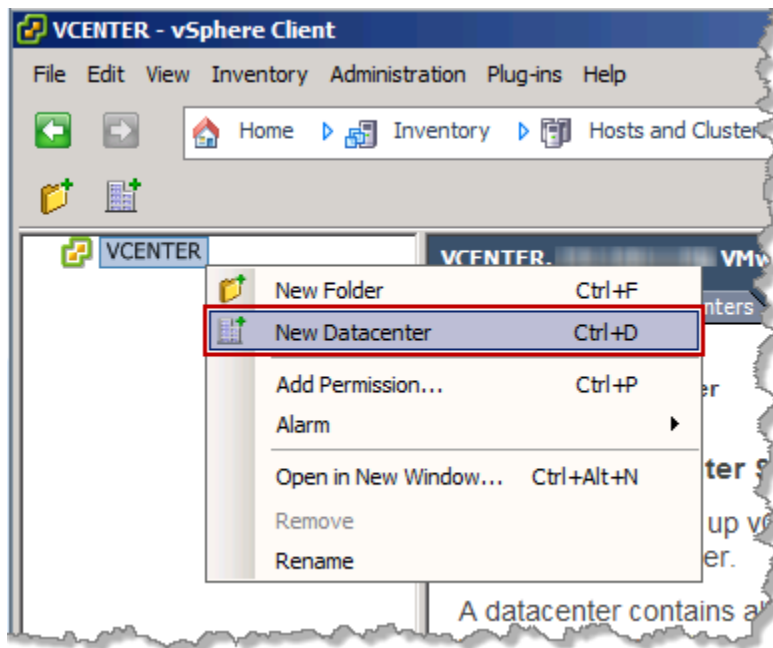
In this section, we will be creating a NETLAB+ datacenter on the vCenter.

1. Using vSphere client, log into the vCenter using the IP address you set in Section 8.3.
2. Right-click the vCenter host, **localhost**, on the left and select **Rename**.



3. Set the hostname to **VCENTER** and press **Enter**.

4. Right-click on the **VCENTER** host and select **New Datacenter**.

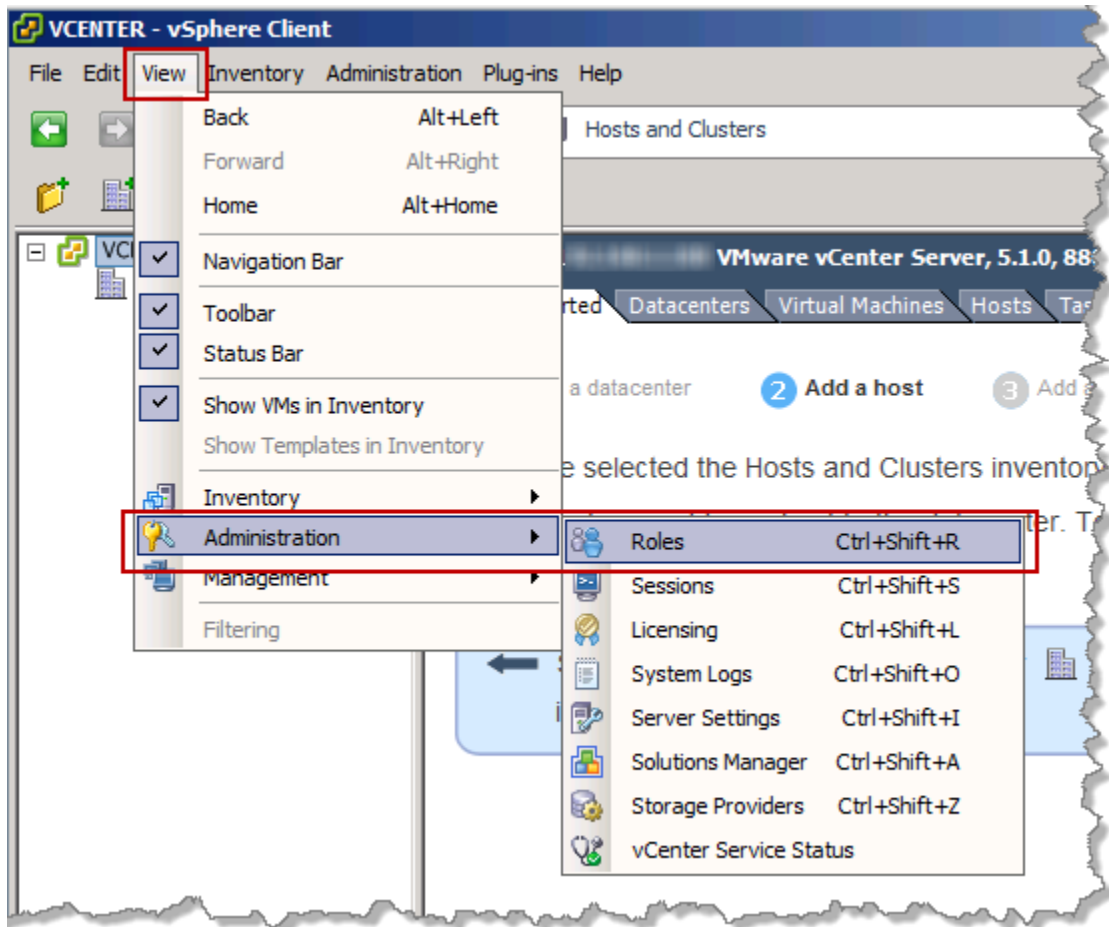


5. Set the datacenter name to **NETLAB** and press **Enter**.

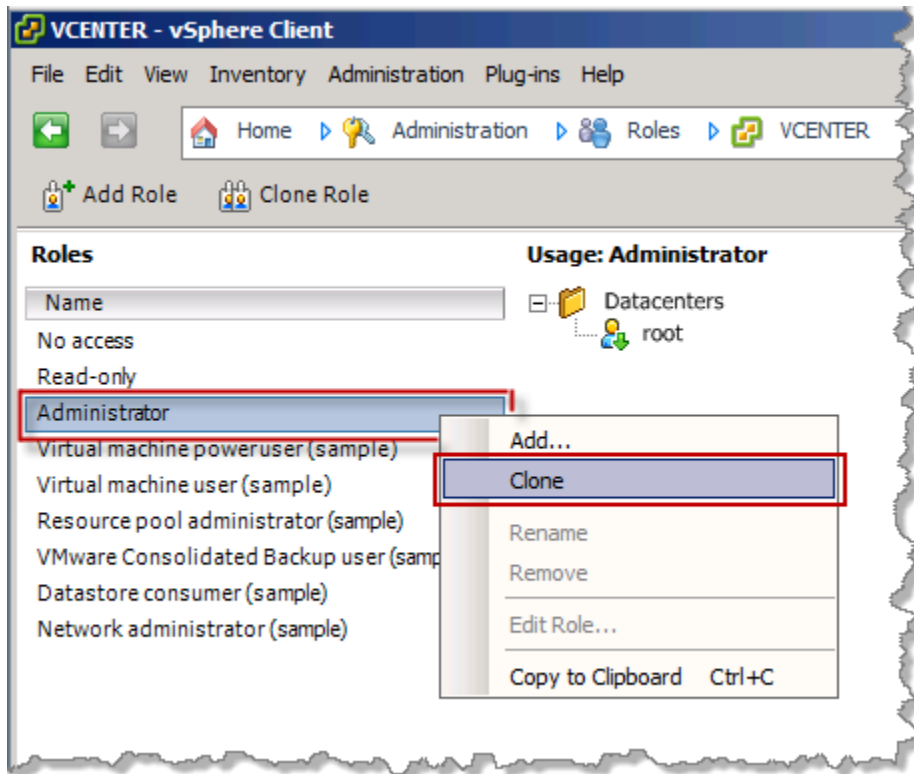
## 9.2 Create a NETLAB+ role in vCenter

In this section, you will be creating a NETLAB+ role in vCenter to map to the NETLAB+ user you created in Section 8.4.

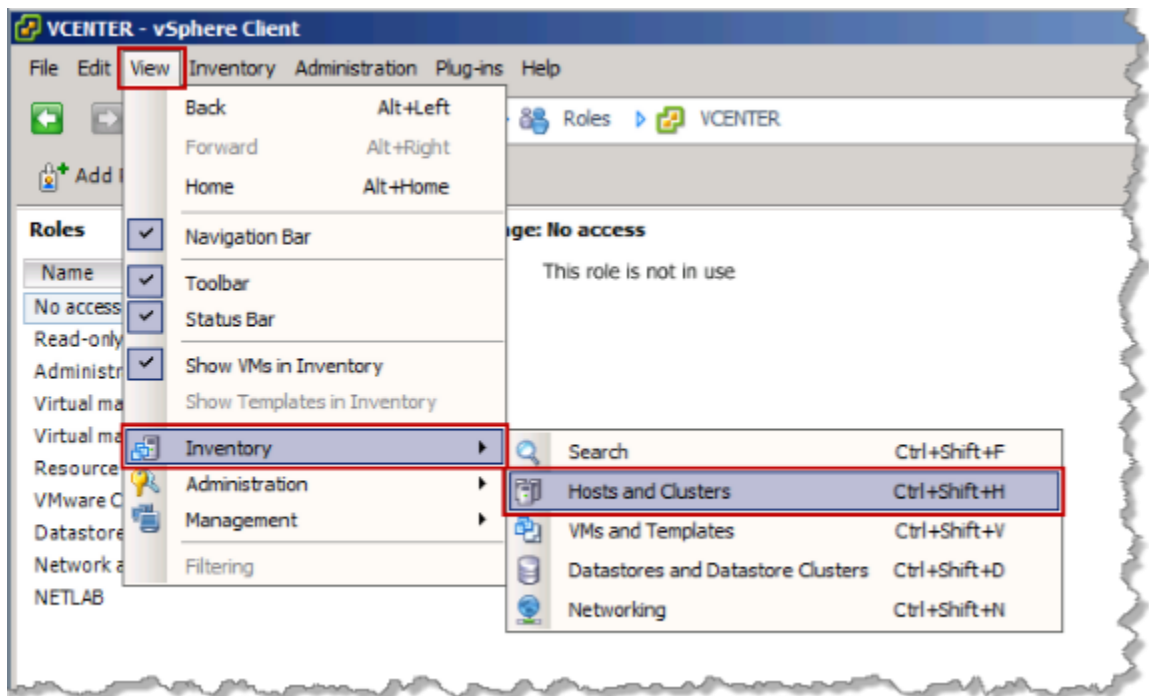
1. To create a vCenter role for NETLAB+, click on **View > Administration > Roles** from the menu.



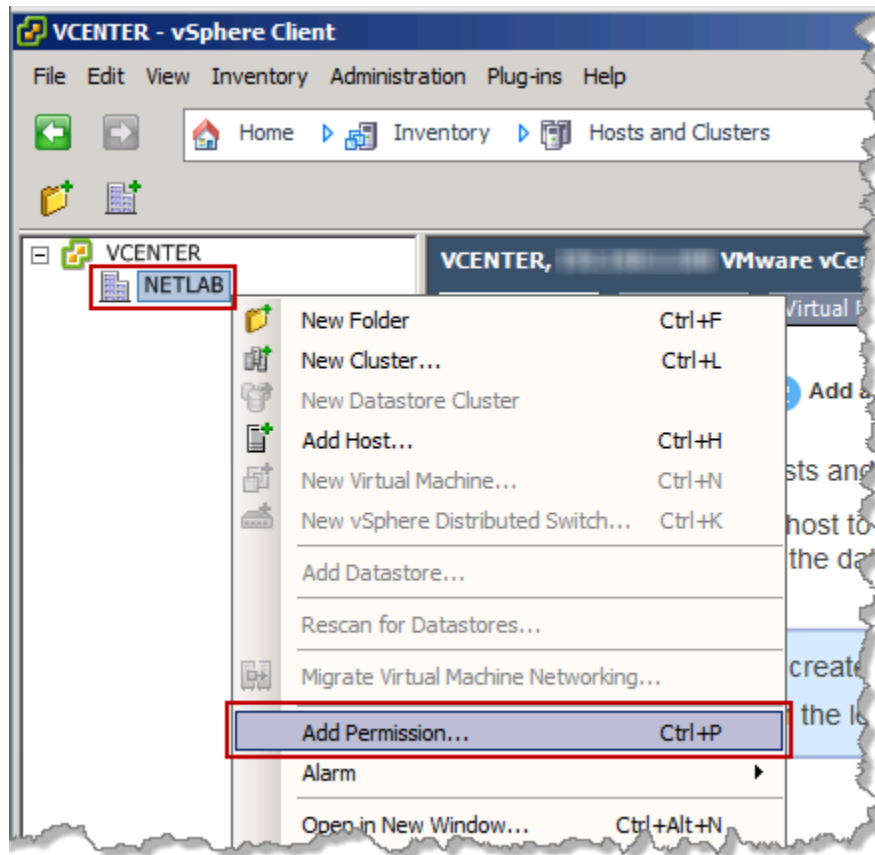
2. Right-click on the **Administrator** Role and select **Clone**.



3. Type **NETLAB** in for the new role name and press **Enter**.
4. On the menu click **View > Inventory > Hosts and Clusters**.

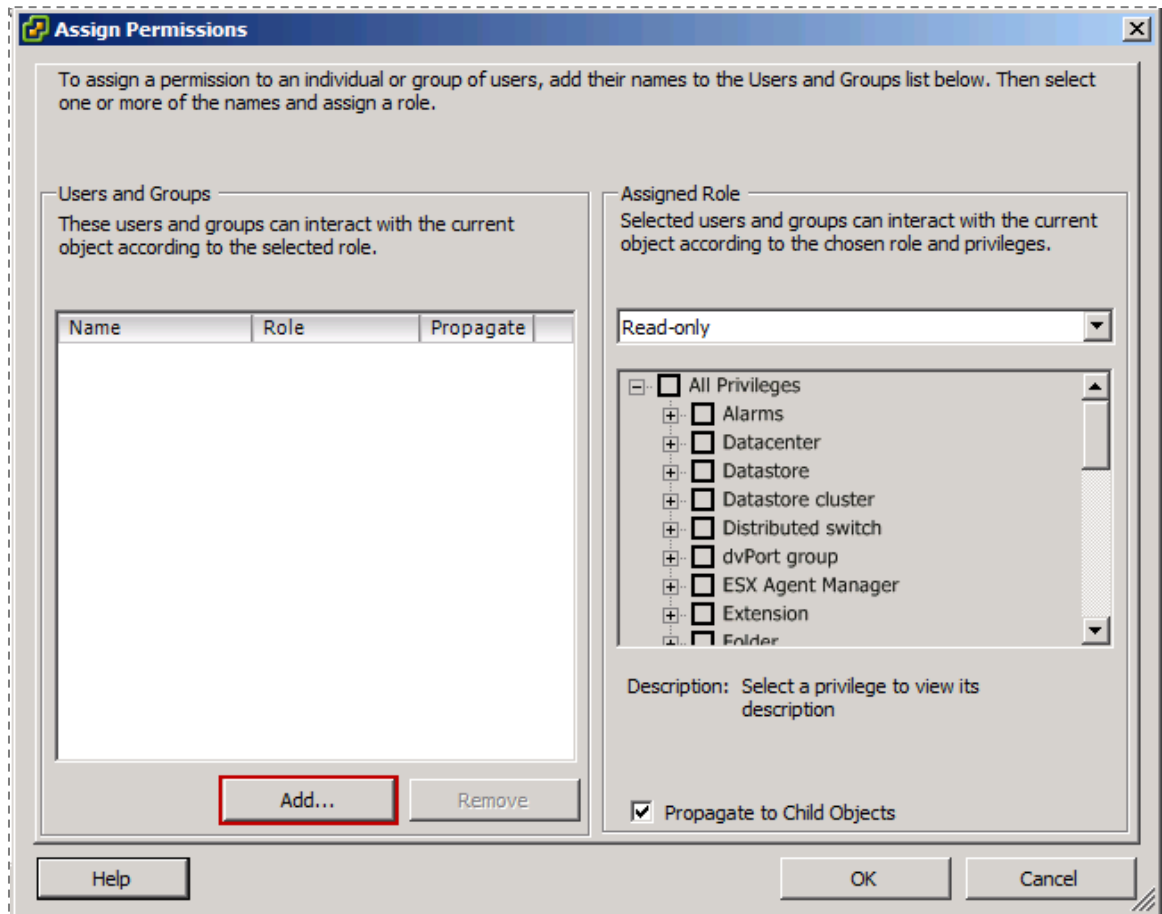


5. Right-click on **NETLAB** and select **Add Permission...**

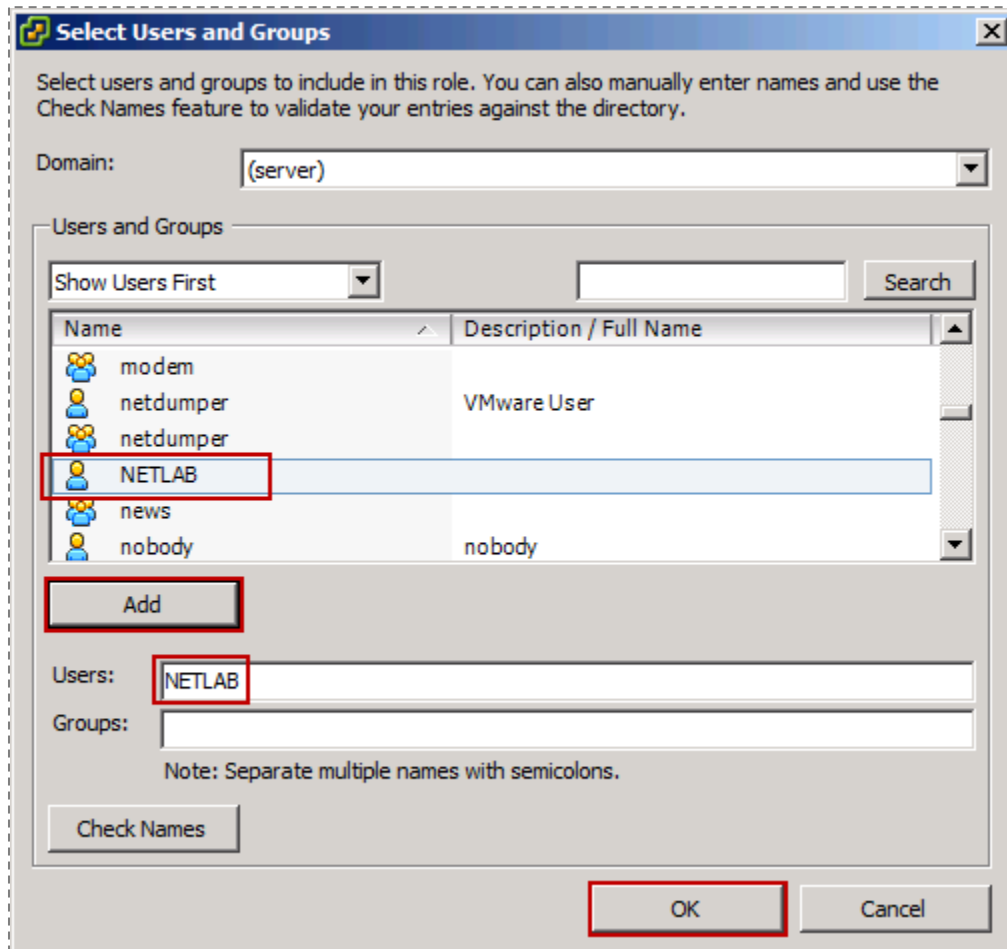




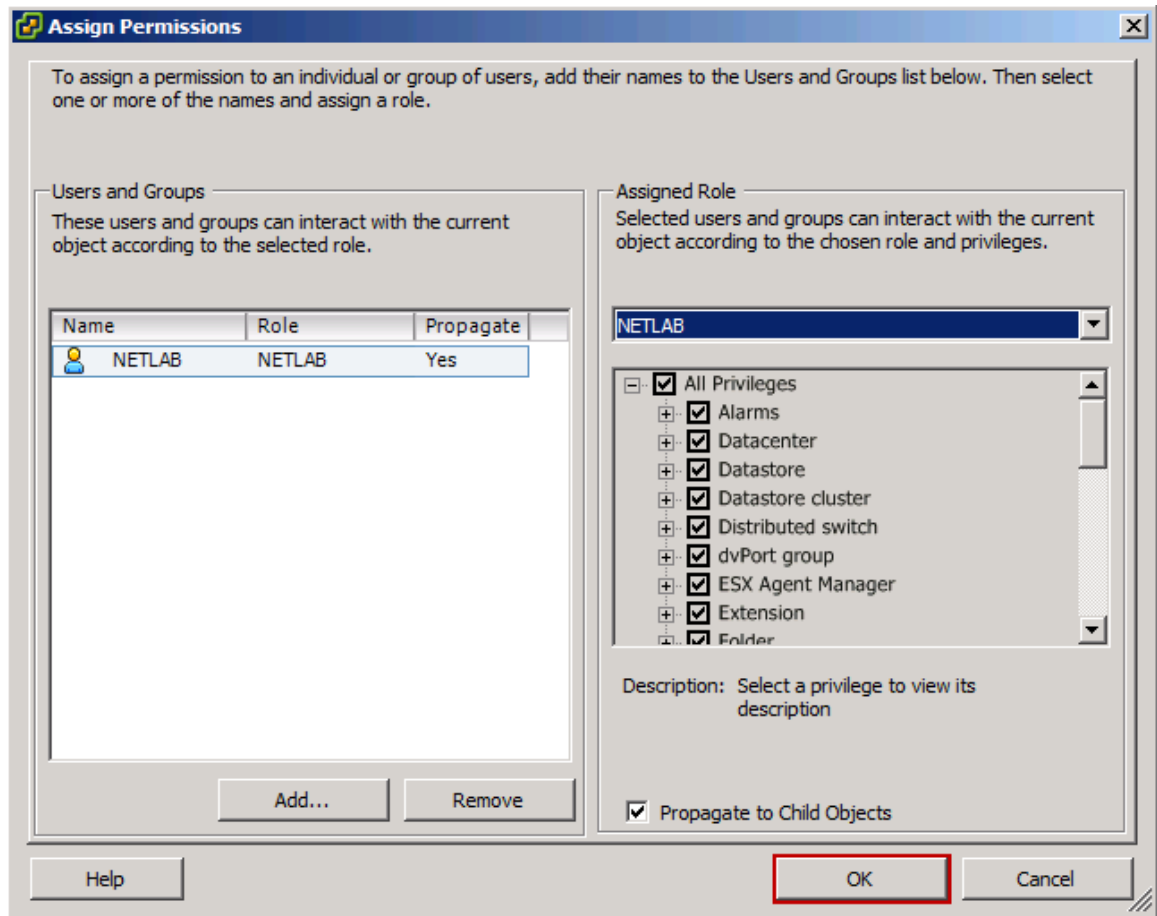
6. In the **Assign Permissions** window, click the **Add...** button.



7. Select the **NETLAB** account in the user list and click **Add** then click **OK**.



8. In the **Assign Permissions** window, select **NETLAB** from the drop box in the **Assigned Role** area and then click **OK**.

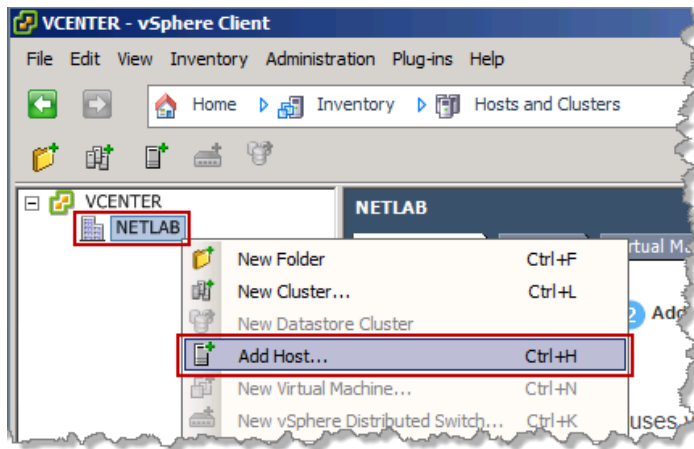


### 9.3 Adding ESXi hosts to the NETLAB+ datacenter

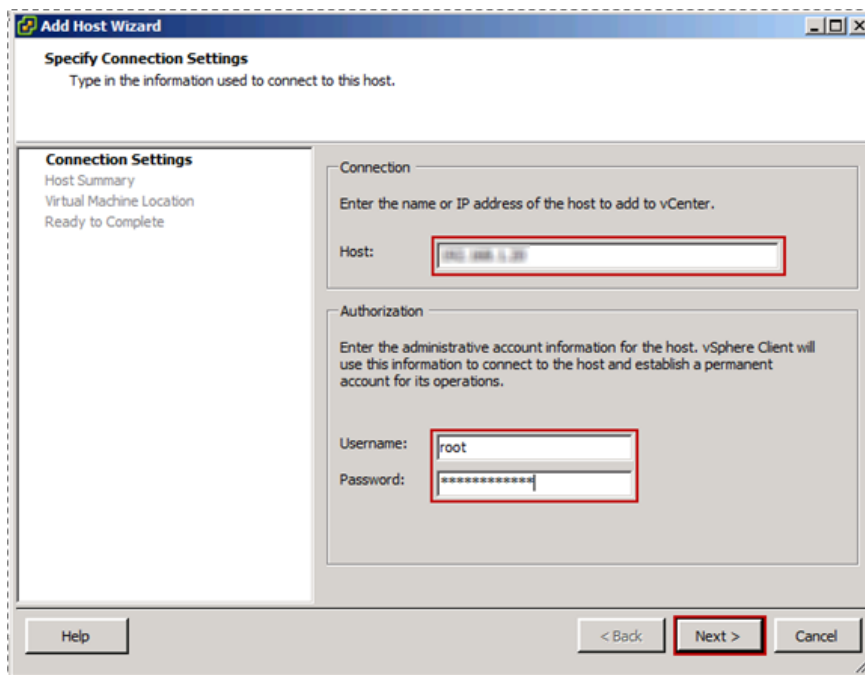
In this section, you will be adding ESXi Host Servers to the NETLAB+ datacenter so that they may be managed by vCenter.

You will **NOT** add the Management Server to vCenter. You will only add your ESXi Host Servers that will house the virtual machines for the pods.

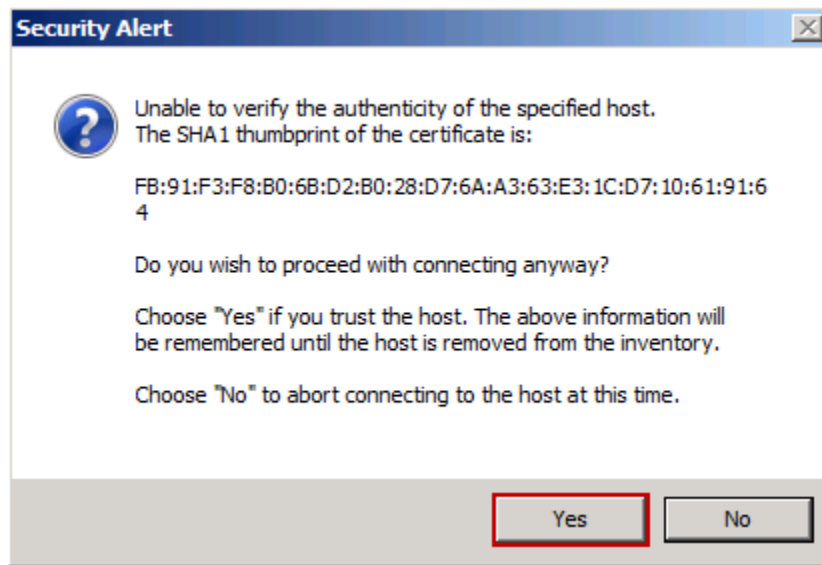
1. Right-click on the datacenter **NETLAB**, and select **Add Host**. The Add Host wizard appears.



2. First, we are going to add your first ESXi-host, enter the IP address you from your table in Section 10.
3. Enter the username `root` and the password you setup in Section 5.2 and click **Next**.



4. When prompted with a **Security Alert** window, click **Yes** to add the Host.



5. On the **Host Summary** page, review the information and click **Next**.
6. On the **Assign License** page, select **Enter Key**.
7. Enter the key you received from VMware in Section 2.
8. On the **Lockdown mode** page, leave the default settings and click **Next**.
9. On the **Virtual Machine Location** page, make sure **NETLAB** is selected and click **Next**.
10. On the **Ready to Complete** page, review the information and click **Finish**.
11. Click the + sign next to the **NETLAB** datacenter on the left and wait for the IP address of the host you entered to be added. Review the **Recent Tasks** pane at the bottom to make sure the status goes to **Completed**.
12. Repeat steps 1-10 to add any additional remaining hosts.

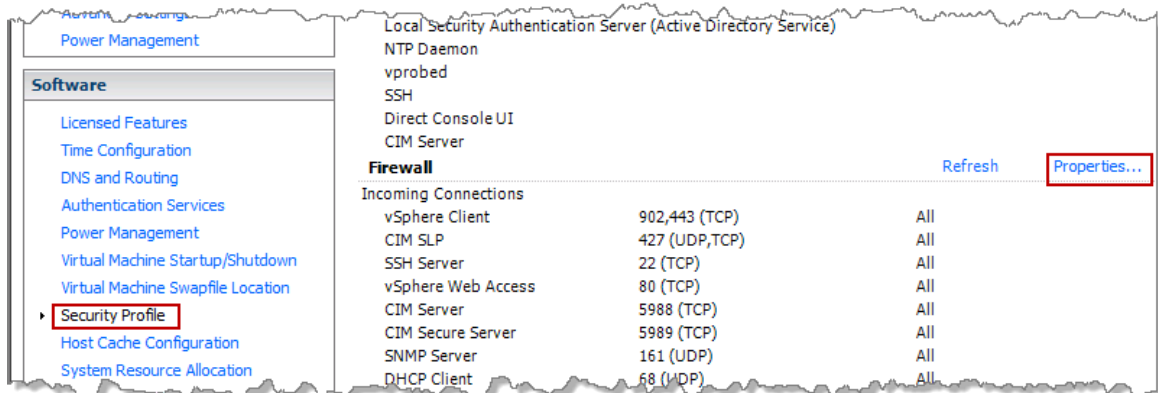
## 9.4 Allowing Remote PC Viewer sessions in ESXi firewall

In this section, you will be enabling a specific port range in the ESXi firewall to allow Remote PC Viewer sessions to have access to the virtual machine console.

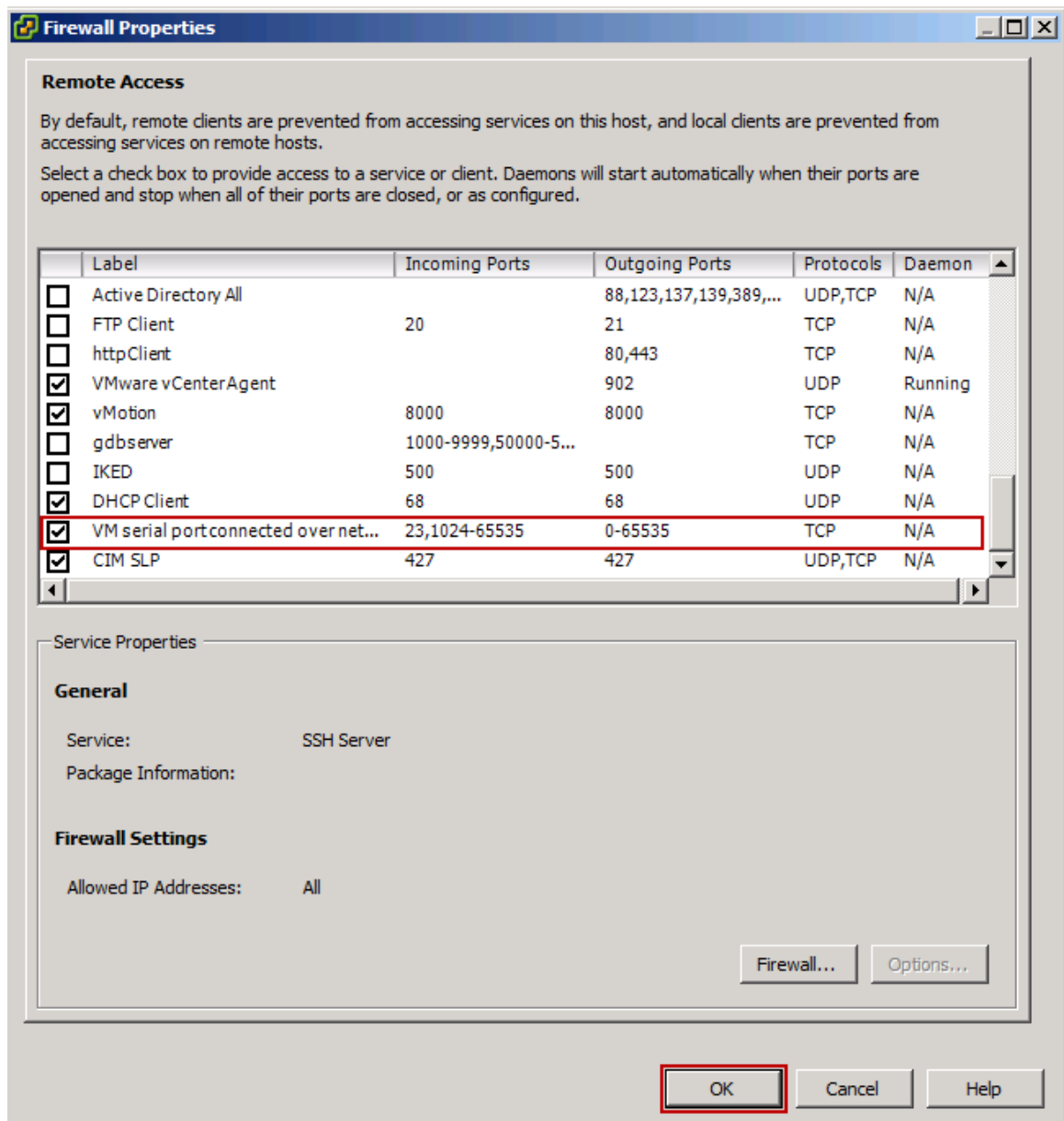
1. Select your first ESXi host in the **Inventory** pane on the left.
2. Click on the **Configuration** tab.



3. In the **Software** box click on **Security Profile**. Then click on the **Properties...** hyperlink to review the built-in ESXi firewall settings.



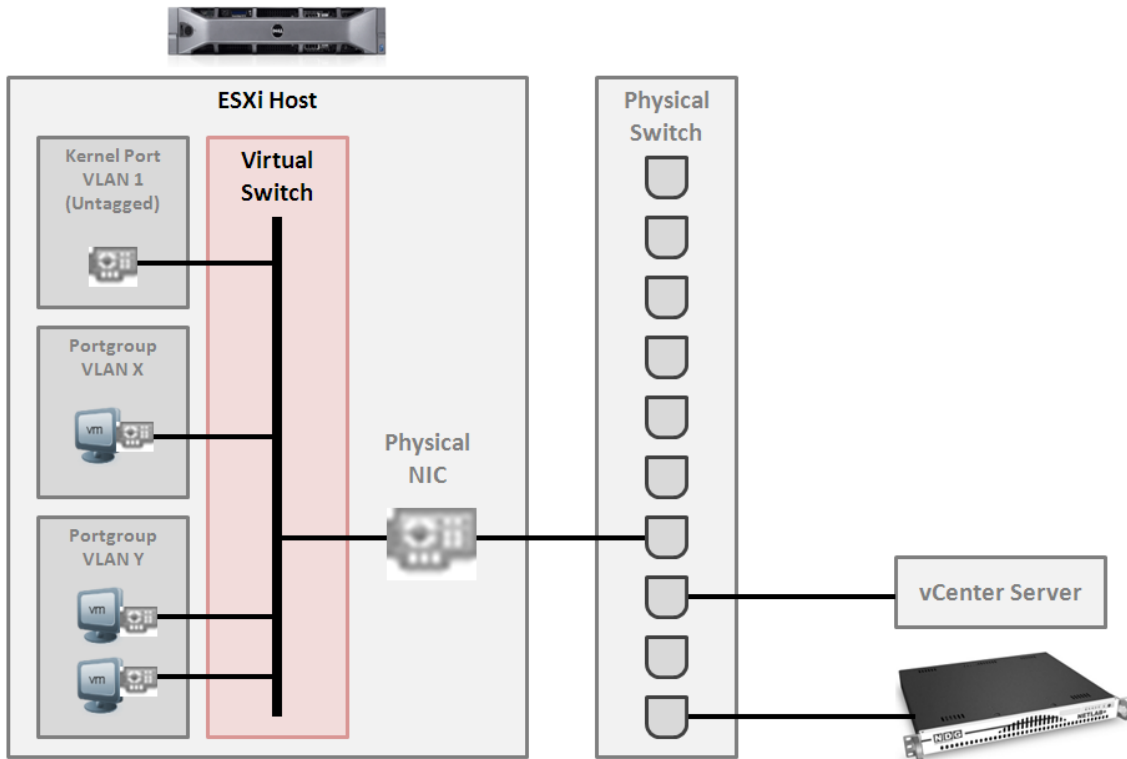
4. In the **Firewall Properties** window, scroll to the bottom of the list and click the checkbox for **VM serial port connected over net...** Click **OK** to save settings.



5. Repeat Steps 1-4 for each ESXi host.
6. Close the vSphere client.

## 9.5 vSwitch Configuration

This section is designed to configure the vSwitches on the ESXi Host Servers. To review, a virtual switch (vSwitch) on the physical ESXi host bridges between physical networks, virtual machines, and the ESXi host kernel. Each vSwitch is an internal LAN, implemented entirely in software by the ESXi kernel.



Your ESXi host(s) may connect to the outside network, inside network, or both depending on the network model you are using. The following table indicates which virtual switches are used for outside and inside connections.

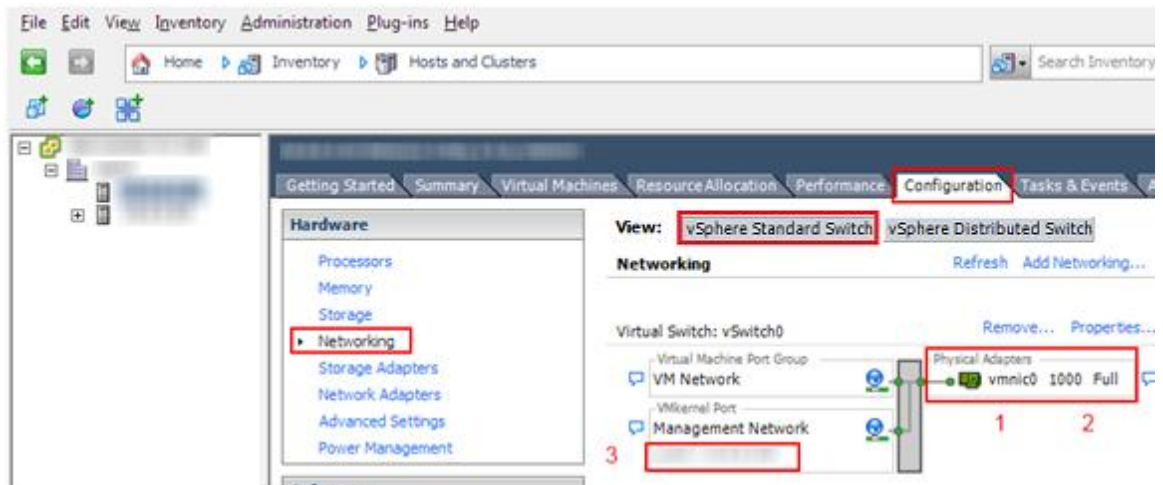
Network Model	OUTSIDE vSwitch	INSIDE vSwitch
Single-Homed	vSwitch0	---
Dual-Homed	vSwitch0	vSwitch1



## 9.5.1 Verifying vSwitch0 Configuration

vSwitch0 is automatically created during the ESXi software installation (Section 5.2). Using vCenter, confirm that networking on vSwitch0 is properly configured (refer to the red numbered items in the screen below):

1. vSwitch0 is bound to the correct physical NIC (vmnic).
2. The physical NIC is connected and with correct speed/duplex.
3. The VMkernel port has the IP address you assigned when configuring your ESXi host. The IP address should be a campus LAN address.

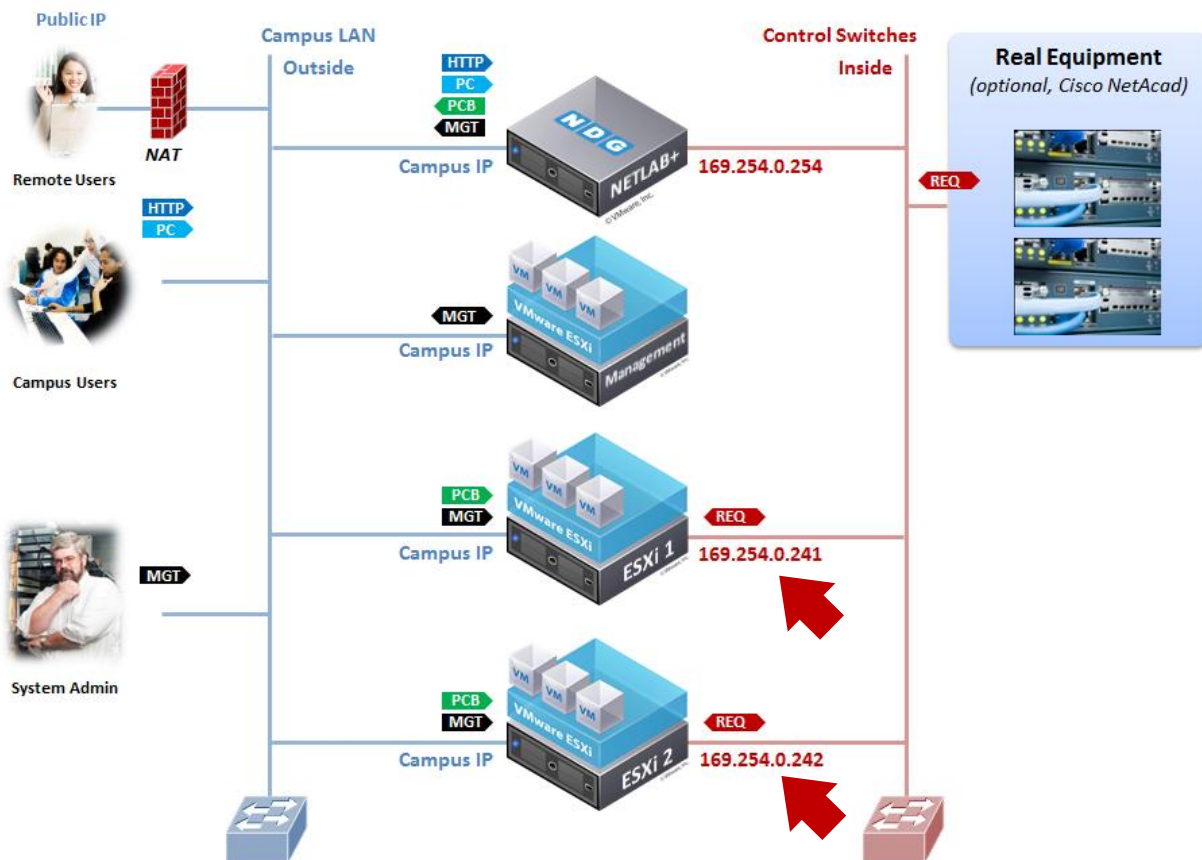


## 9.5.2 Inside Network Configuration

In this section, you will perform the final setup of ESXi host inside networking. This section only applies to the dual-homed networking configuration that connects the ESXi host(s) to the inside network (see table below). This section describes various ESXi host networking components. We recommend reviewing this section even if inside networking is not used in your ESXi host configuration.

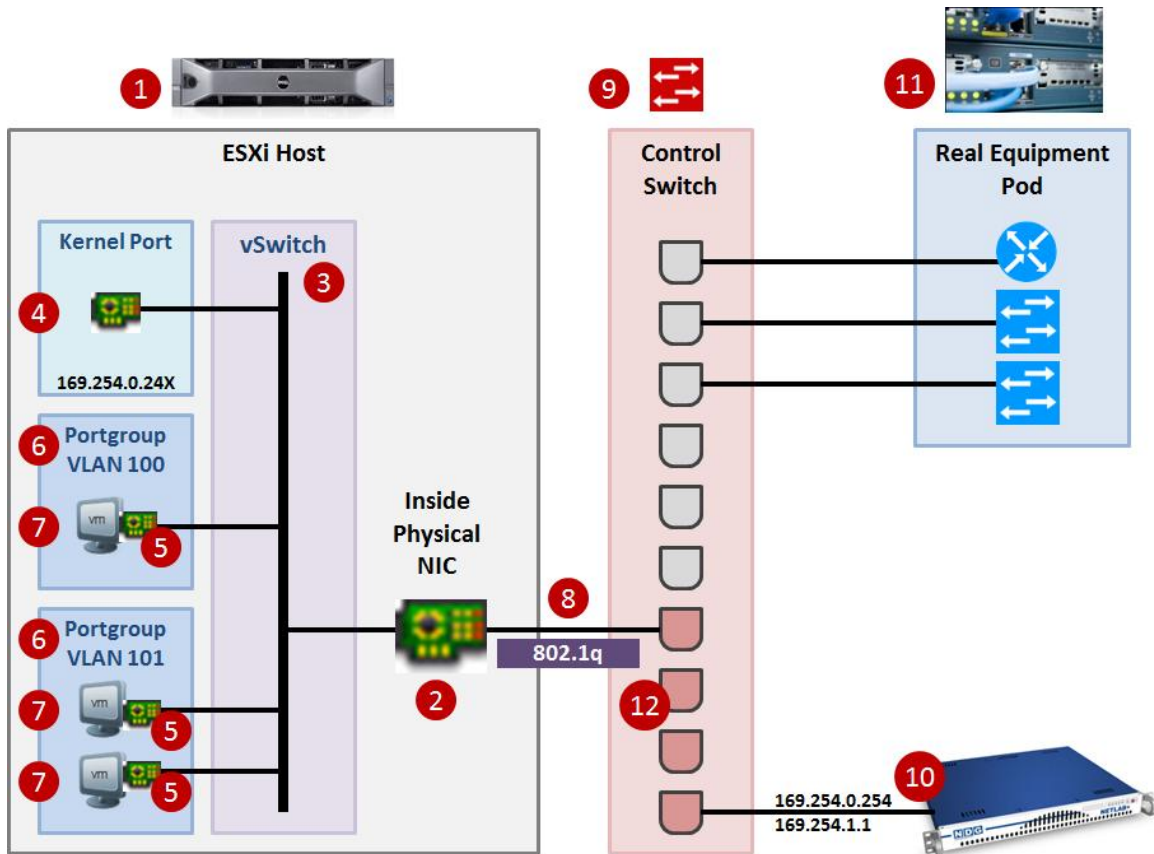
Networking Configuration	Inside Networking
Single-Homed Networking	No
Dual-Homed Networking	Yes

Repeat the setup tasks in this section for each ESXi host in your Virtual Machine Infrastructure



There is only one type of network traffic can flow across the ESXi inside network connection, remote PC traffic between virtual machines and real equipment (VLANs 100 - 899).

The following diagram and table describes the various components of inside networking.



#	Component	Description
1	ESXi Host	The physical server where, your virtual machines run.
2	Inside Physical NIC	The physical network interface on the ESXi Host (1) that connects virtual machines to the inside physical network.
3	vSwitch	A virtual switch on the physical ESXi host that bridges between physical networks (2,8,9), virtual machines (7), and the ESXi host kernel (4). Each vSwitch is an internal LAN, implemented entirely in software by the ESXi kernel.
4	Kernel Port	A virtual network interface on the ESXi host (1) that provides connectivity between the ESXi host kernel and other components such as NETLAB+.
5	Virtual Network Adapter (vNIC)	A virtualized networking adapter inside of a virtual machine that connects the virtual machine to a virtual switch.
6	Port Groups	A template for creating virtual network switch ports with a particular set of specifications. A port group allows a virtual network adapter (5) to be placed in a particular virtual LAN (VLAN). Port groups with specific VLAN IDs to connect virtual machines to real equipment.

7	Virtual Machines	In NETLAB+, a <i>virtual machine</i> is a remote PC or remote server that runs on virtualized hardware. Although the hardware is virtualized, real operating systems and real application software can still be used.
8	Uplink / Trunk	An uplink is a physical connection between ESXi Host (1,2) and a NETLAB+ control switch (9). If you are interfacing with real equipment pods (i.e. Cisco Networking Academy), your ESXi inside physical interface and the control switch port to which it is connected are configured in 802.1q trunk mode. Trunks allow multiple virtual LANs (VLANs) to exist on a single physical connection. VLAN assignments and the VLAN database on the control switch are managed by NETLAB+.
9	Control Switch	<p>A NETLAB+ control switch provides connectivity between the NETLAB+ server, ESXi host servers, asynchronous access servers, and switched outlet devices. Control switches are not accessed by lab users. There are three types of ports: reserved, assigned, and unassigned.</p> <p>An NDG supported control switch is required. See the NDG website for a list of supported control switches.</p>
10	NETLAB+ Inside Connection	<p>The NETLAB+ server inside interface connects to a designated reserved port on a control switch (9). The fixed addresses 169.254.0.254/24 and 169.254.1.1/24 are assigned to the inside interface (these cannot be changed).</p> <p>802.1q trunk mode should NOT be enabled on the control switch port for this connection.</p>
11	Real Equipment Pods	Real lab equipment (optional) is connected to one or more control switches (9).
12	Reserved Ports	Reserved ports are ports on a control switch (9) that are reserved to provide connectivity between the NETLAB+ server, ESXi host servers, asynchronous access servers, and switched outlet devices.

The following table summarizes the traffic types that will flow over the ESXi inside network.

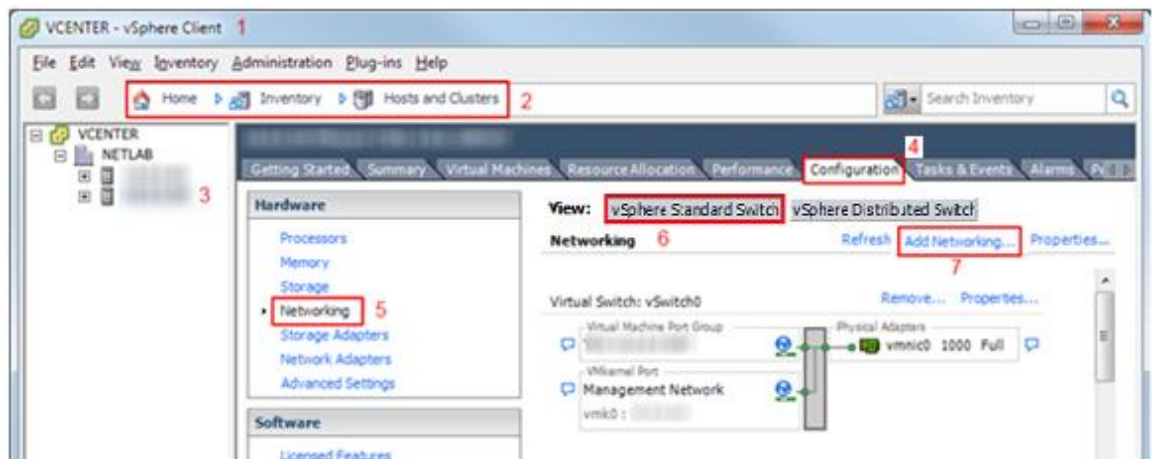
Networking Configuration	Management Traffic (VLAN 1)	Remote Display (VLAN 1)	802.1q Trunk
Single-Homed Networking	n/a	n/a	n/a
Dual-Homed Networking	No	No	Real Gear*

\* ESXi interface and corresponding control port is configured as 802.1q trunk when interfacing with real equipment.

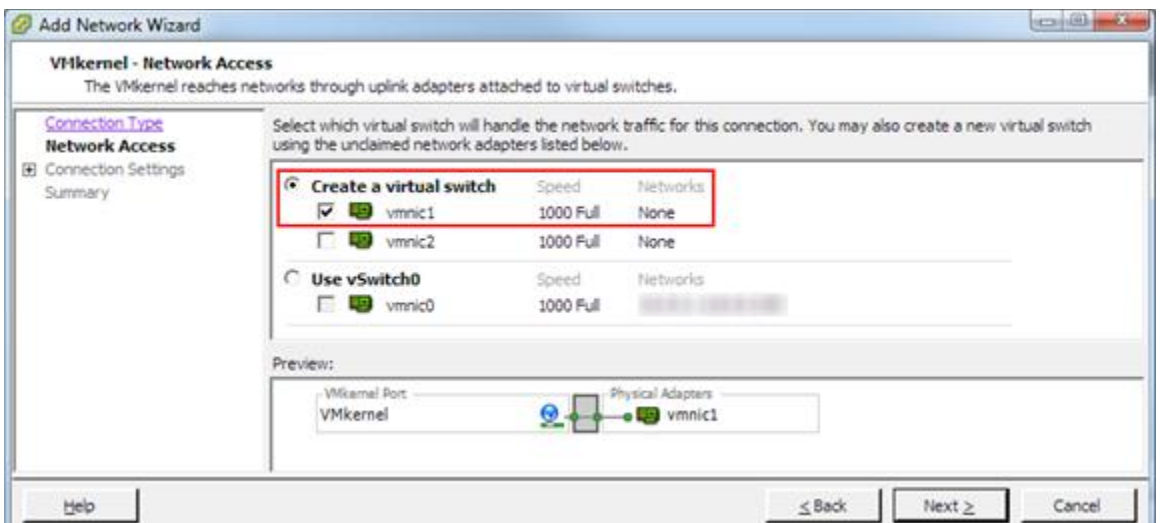
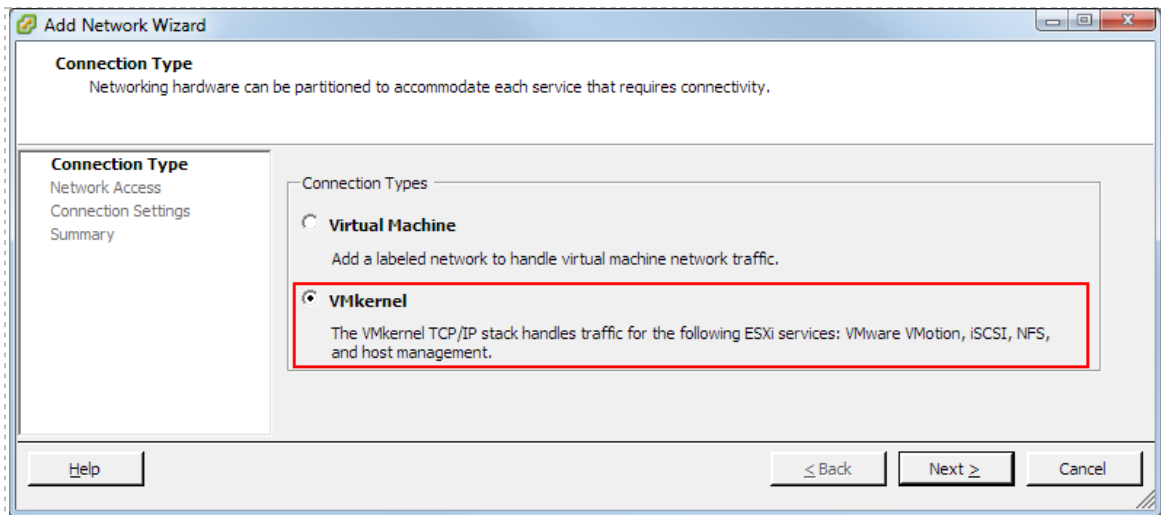
### 9.5.3 Creating vSwitch1 and Binding to Physical NIC

If your ESXi host is dual-homed (connected to both outside and inside networks), you must create an inside virtual switch (vSwitch 1), bind a physical NIC to vSwitch1, and create a VMkernel port for management traffic. These tasks are performed through vCenter.

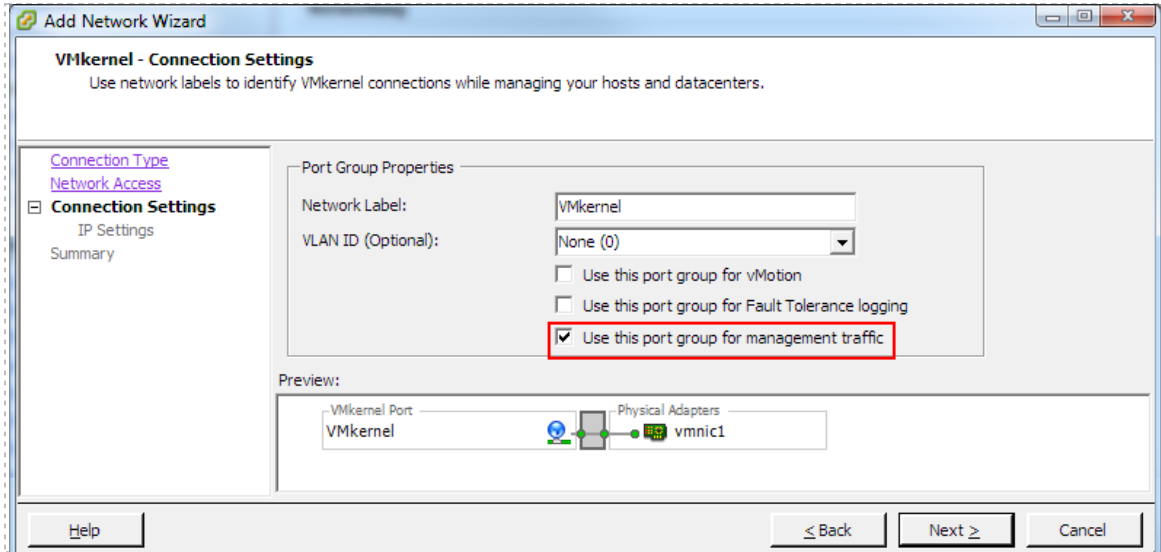
1. Login to vCenter using the vSphere client.
2. Navigate to **Home > Inventory > Hosts and Clusters**.
3. Click on the ESXi host to configure in the left sidebar.
4. Click on the **Configuration** tab.
5. Click on **Networking** in the Hardware group box.
6. Click on the **Virtual Switch** view button if not already selected.
7. Click on **Add Networking**.



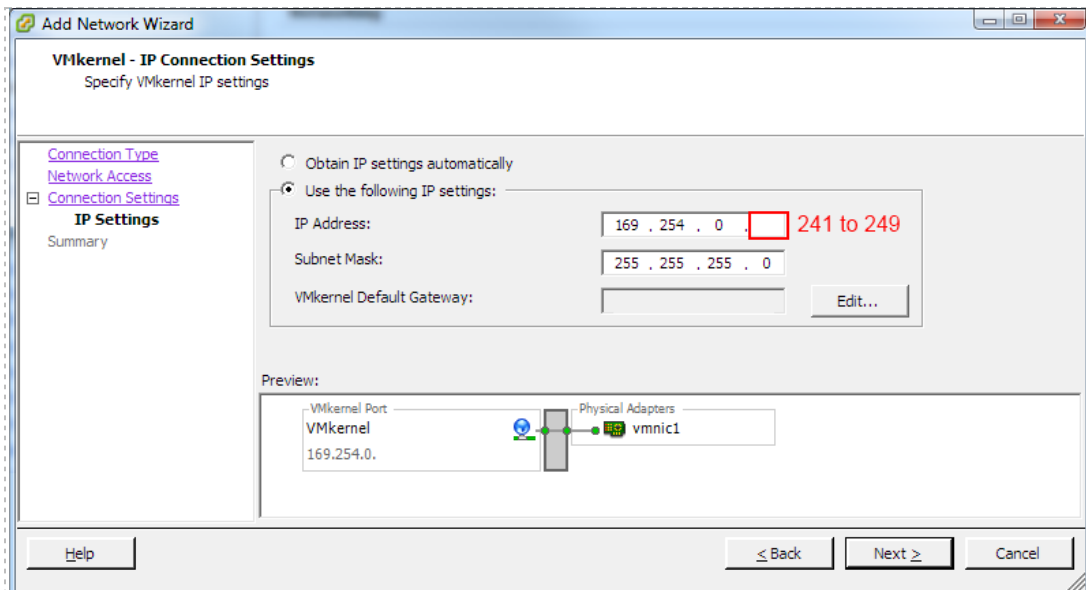
8. Add a VMkernel port to allow the ESXi host kernel to communicate with the inside network. Select the **VMkernel** radio button, and then click **Next**.



9. Select the **"Create a virtual switch"** radio button. The new switch will be named vSwitch1.
10. Select the physical NIC that will connect vSwitch1 to the control switch. We recommend using vmnic1 for inside connections (vmnic0 should already be connected to the outside network).



11. Enter the port group properties as shown above.
  - a. Network Label: **"NETLAB Inside"**
  - b. VLAN ID: **None(0)** (default)
  - c. Check option **"Use this port group for management traffic"**
12. Click **Next**.
13. The VMkernel IP Connection Settings dialog appears.



14. Enter a unique inside IP address and subnet mask from the following table.

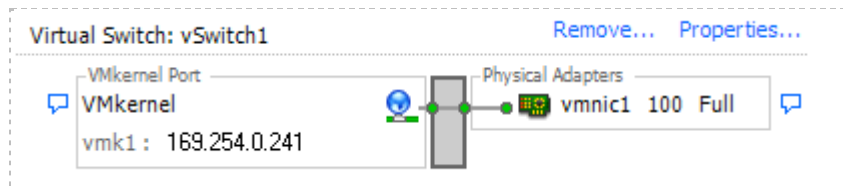
Inside Interface	IP Address	Subnet Mask
<b>ESXi Server 1 Inside</b>	169.254.0.241	255.255.255.0
<b>ESXi Server 2 Inside</b>	169.254.0.242	255.255.255.0
<b>ESXi Server 3 Inside</b>	169.254.0.243	255.255.255.0



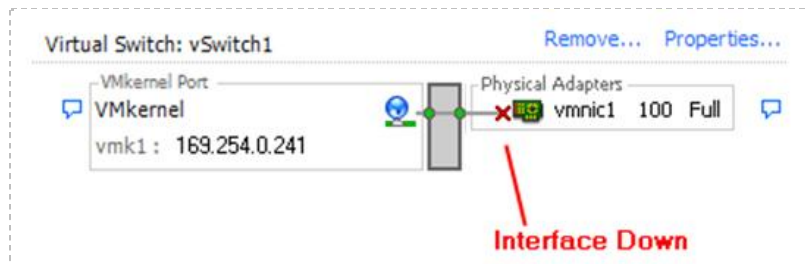
<b>ESXi Server 4 Inside</b>	169.254.0.244	255.255.255.0
<b>ESXi Server 5 Inside</b>	169.254.0.245	255.255.255.0
<b>ESXi Server 6 Inside</b>	169.254.0.246	255.255.255.0
<b>ESXi Server 7 Inside</b>	169.254.0.247	255.255.255.0
<b>ESXi Server 8 Inside</b>	169.254.0.248	255.255.255.0
<b>ESXi Server 9 Inside</b>	169.254.0.249	255.255.255.0

No changes to the VMkernel Default Gateway setting should be necessary. This should already be set to the default gateway on your campus LAN.

15. Click **Next** to continue.
16. Confirm that vSwitch1 appears as follows (IP varies for each host).
  - a. VMkernel port (vmk1) has correct IP address.
  - b. vSwitch1 is bound to physical adapter (vmnic1)
  - c. Physical adapter is up (speed and duplex are detected)



A **✘** mark displayed near the Physical Adapter indicates that the connection has not yet been physically cabled or the corresponding control switch port is shut down.





#### 9.5.4 Increasing the Inside vSwitch Port Count

By default, a vSwitch is provisioned with 56 virtual ports. This means that 56 virtual network adapters can be connected to the virtual switch, regardless of which port group the adapter is connected. For most NETLAB AE setups, this is sufficient for the inside vSwitch. For large NETLAB PE setups or systems with custom real equipment pods, you may need to increase this value to accommodate more virtual machine connections to the inside vSwitch.

This discussion applies to virtual machines that are part of real equipment pods. Pods that contain only virtual machines are usually placed on separate vSwitches that do not connect to the inside network / real equipment.

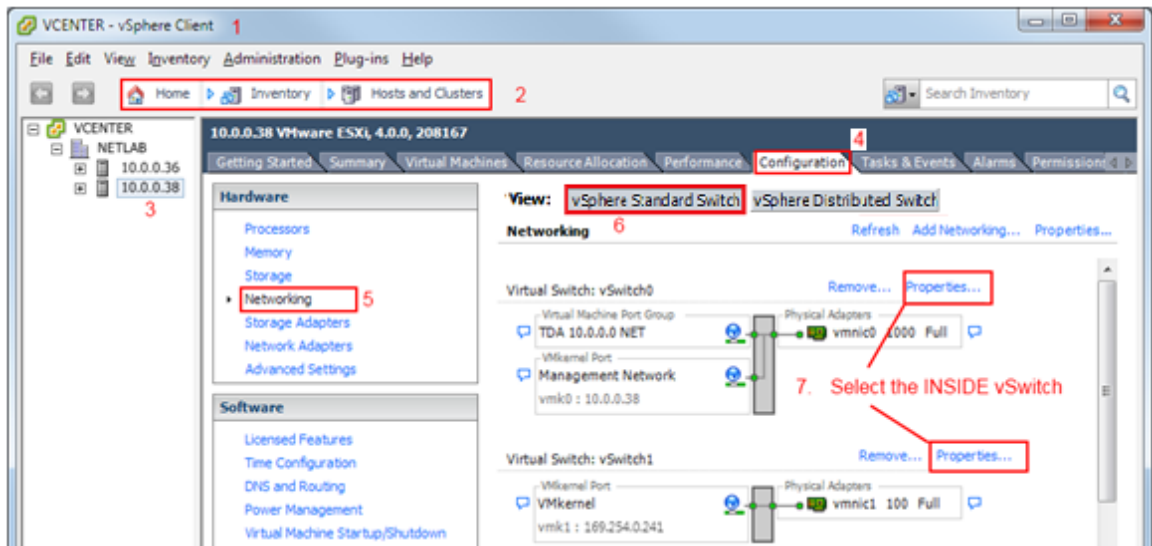
To calculate the number of inside vSwitch ports required on a particular ESXi host, add up the number of virtual machines in real equipment pods that are assigned to the host. This is the number of virtual ports required on the inside vSwitch (assuming one connection per VM). If this number exceeds 50, you should select the next highest port count setting (120). In special cases, an even higher setting may be required. Note: 50 is not an error; 6 extra ports were subtracted (from 56) to allow for VMkernel ports and other possible connections. Higher port count settings consume additional host resources, so you should set this value to the lowest possible setting that provides enough ports for every virtual machine connecting to the inside vSwitch.

There is no warning when the number of virtual ports is exceeded and the problem is not obvious. Some of the virtual machines will fail to communicate for no apparent reason. The only clue may be a disconnected network status from the guest operating system.

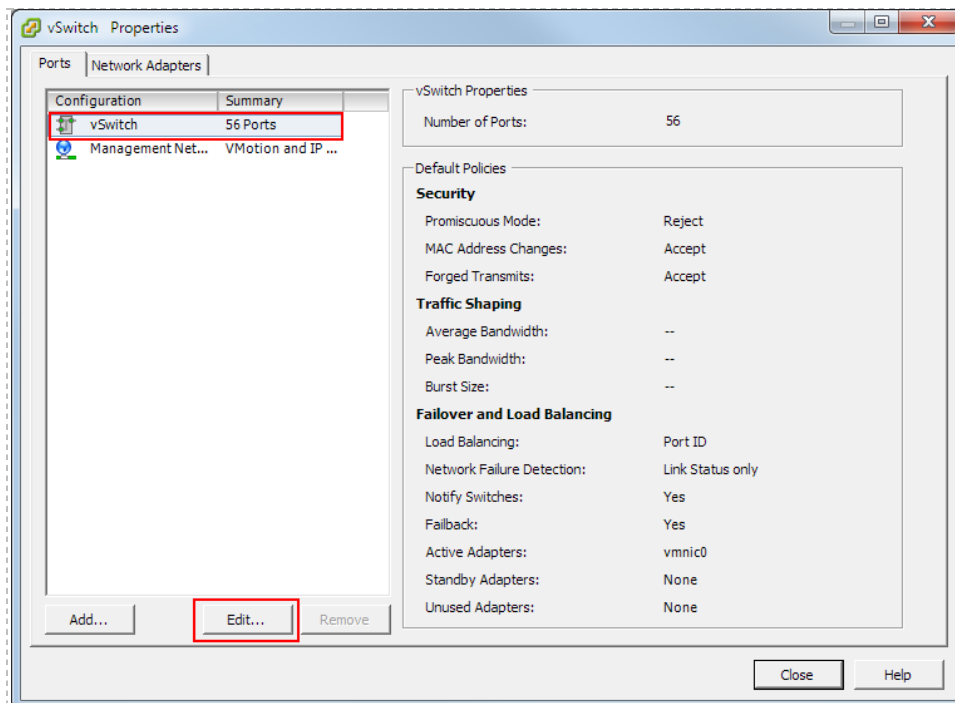
The following procedure is used to increase the number of virtual ports on the inside virtual switch. The same procedure can be used on any virtual switch should the need arise.

1. Login to vCenter using the vSphere client.
2. Navigate to **Home > Inventory > Hosts and Clusters**.
3. Click on the ESXi host where the pod's virtual machines will run.
4. Click on the **Configuration tab**.
5. Click on **Networking** in the Hardware group box.
6. Click on the **Virtual Switch** view button if not already selected.

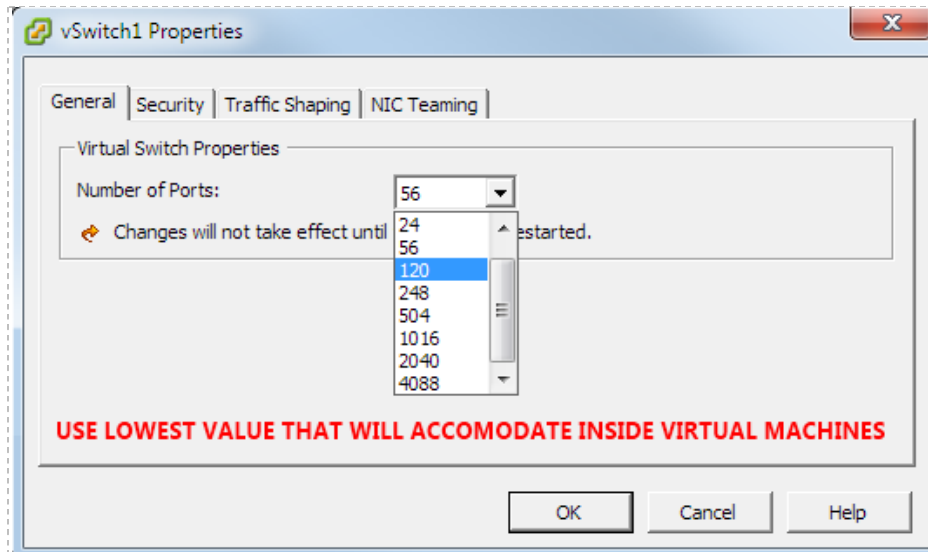
7. Click **Properties** on the INSIDE vSwitch. The inside vSwitch is the one that is connected to the control switch (vSwitch1).



8. Click on the **vSwitch** configuration item.
9. Click the **Edit** button.



10. Increase the number of ports, but not higher than needed.

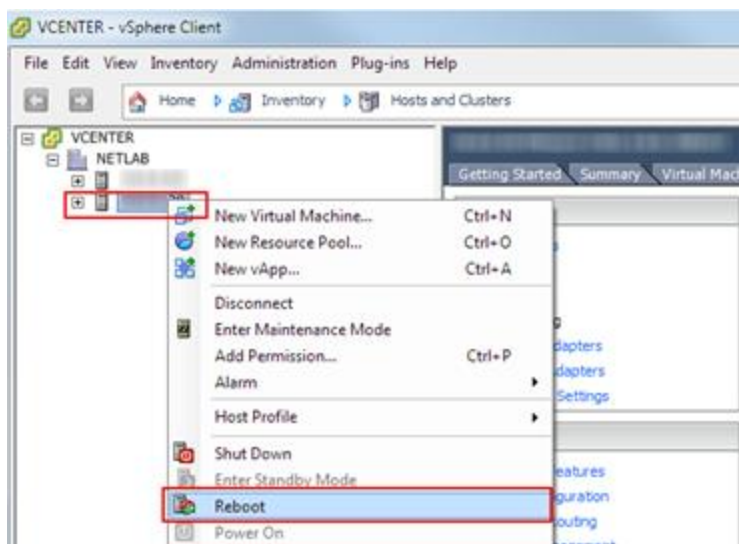


11. Click **OK**.

The ESXi host must be restarted for the change to take effect. Make sure there are no active NETLAB+ reservations that affect this host, or virtual machines running on this host as user work may be affected.

12. **Right click** on the ESXi host in the left sidebar to activate the context menu.

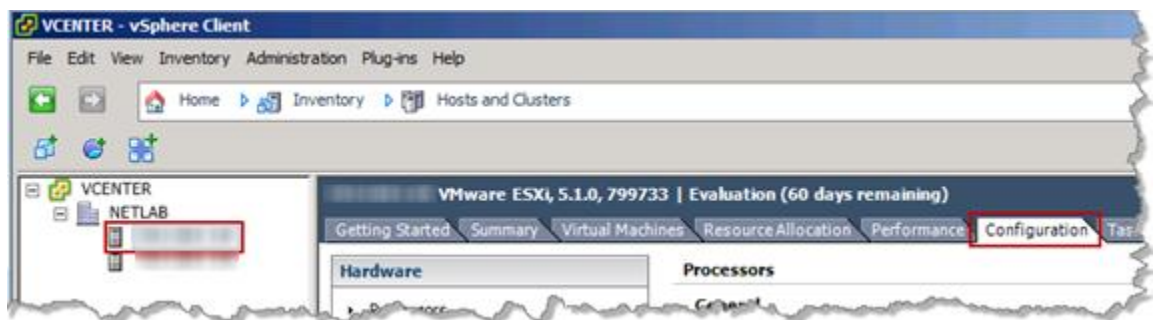
13. Select **Reboot**.



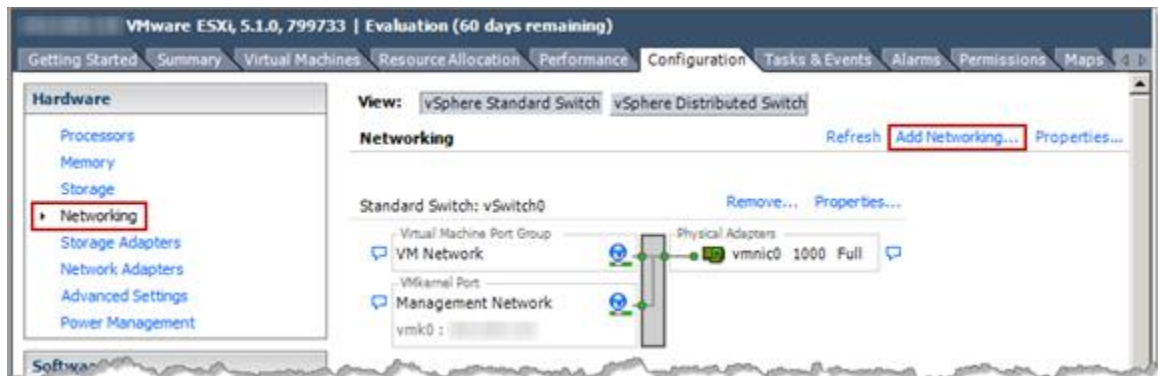
## 9.5.5 Create a Safe Staging Network

In this section, you will be creating a Safe Staging Network called “safety net”, to temporarily connect our VMs. The Safe Staging Network consists of a virtual switch and a port group that is not connected to any other networks (virtual or real). Should the virtual machine be powered on, its traffic will be confined to the safety net. This ensures that the virtual machine will not pose a security risk to your campus LAN or interfere with other pods, until it is relocated to its final network via automatic or manual networking.

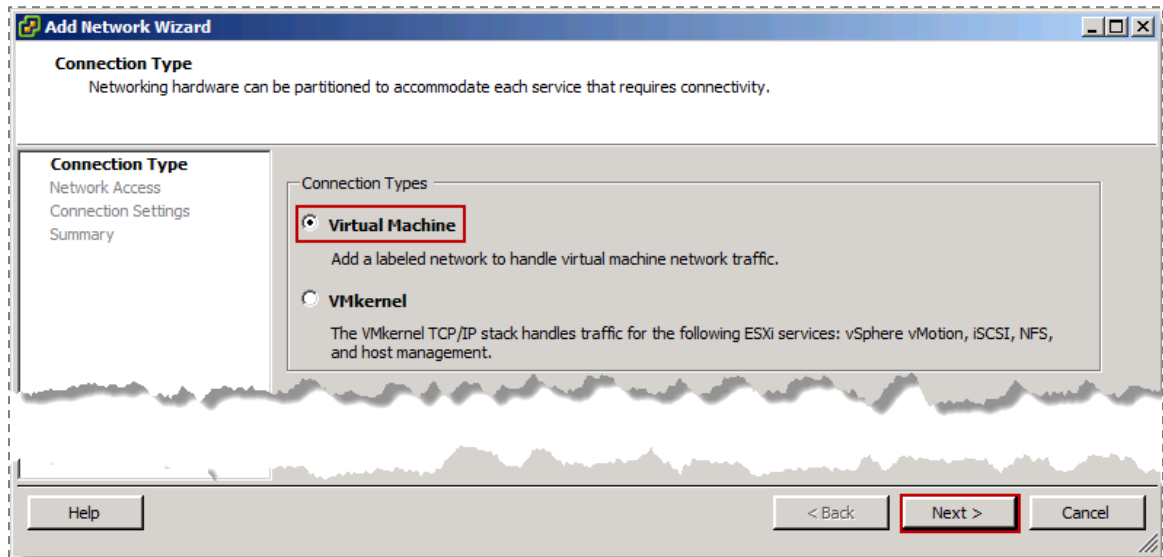
1. Select your first ESXi host in the **Inventory** pane on the left.
2. Click on the **Configuration** tab.



3. In the **Hardware** box click on **Networking**. Then click on the **Add Networking...** hyperlink to create a new virtual switch.

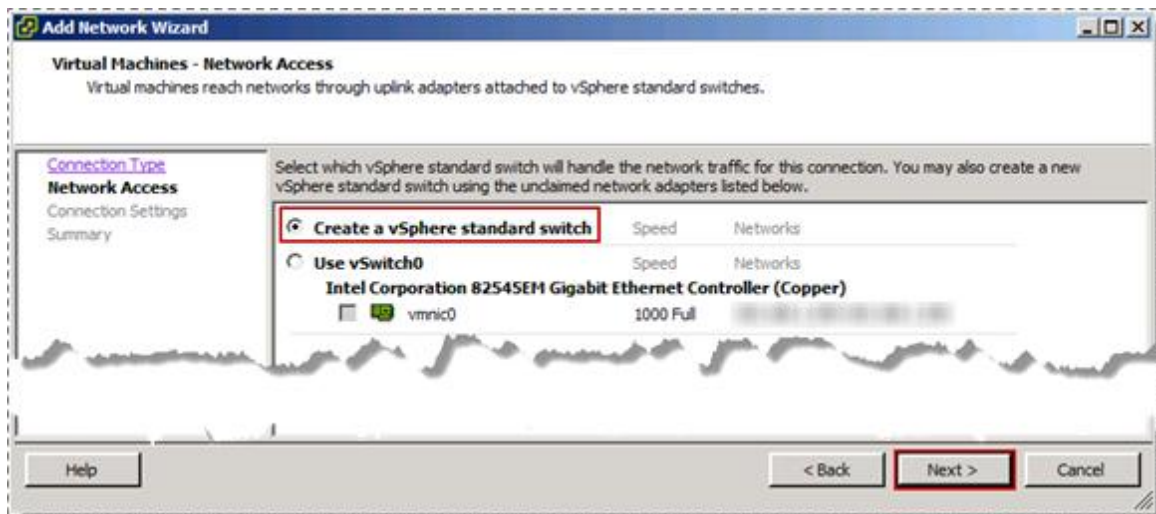


4. On the **Connection Type** page, select **Virtual Machine** and click **Next**.

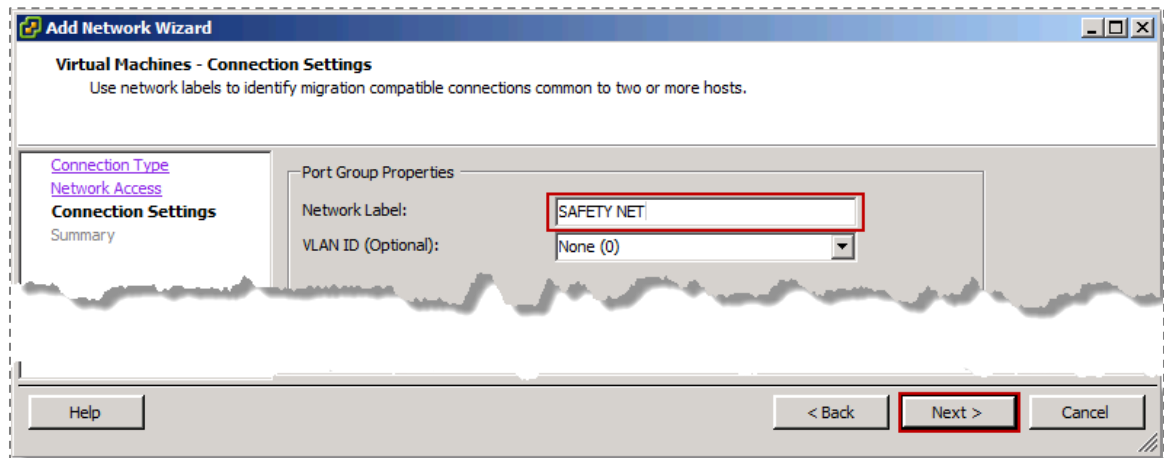


5. On the **Network Access** page, select **Create a vSphere standard switch** and click **Next**.

**UNCHECK** any vmnics under the radio button; this virtual switch should not be bound to any real network adapters on the ESXi host.



6. On the **Connection Settings** page, enter **SAFETY NET** in the Port Group's **Network Label** property and then click **Next**.



7. On the **Summary** page, review the information and click **Finish**.
8. Repeat steps 1-7 for each ESXi host server.

SAFETY NET is now available for use as a safe temporary network location for new virtual machines.

The safety network is an ideal place to bind the network interface(s) of master virtual machines. Automatic networking will bind network interfaces of cloned VMs to their runtime networks when their respective pods are started.