



## Remote PC Guide Series - Volume 4

### Creating and Configuring Virtual Machines for NETLAB+

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This guide provides detailed instructions on adding remotely accessible PCs 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. [Learn more about the Remote PC Guide Series.](#) See the [Documentation Library](#) for a list of all NETLAB+ guides.

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**. If you are using **VMware ESXi version 4.x with vCenter**, please refer to the appropriate guide.

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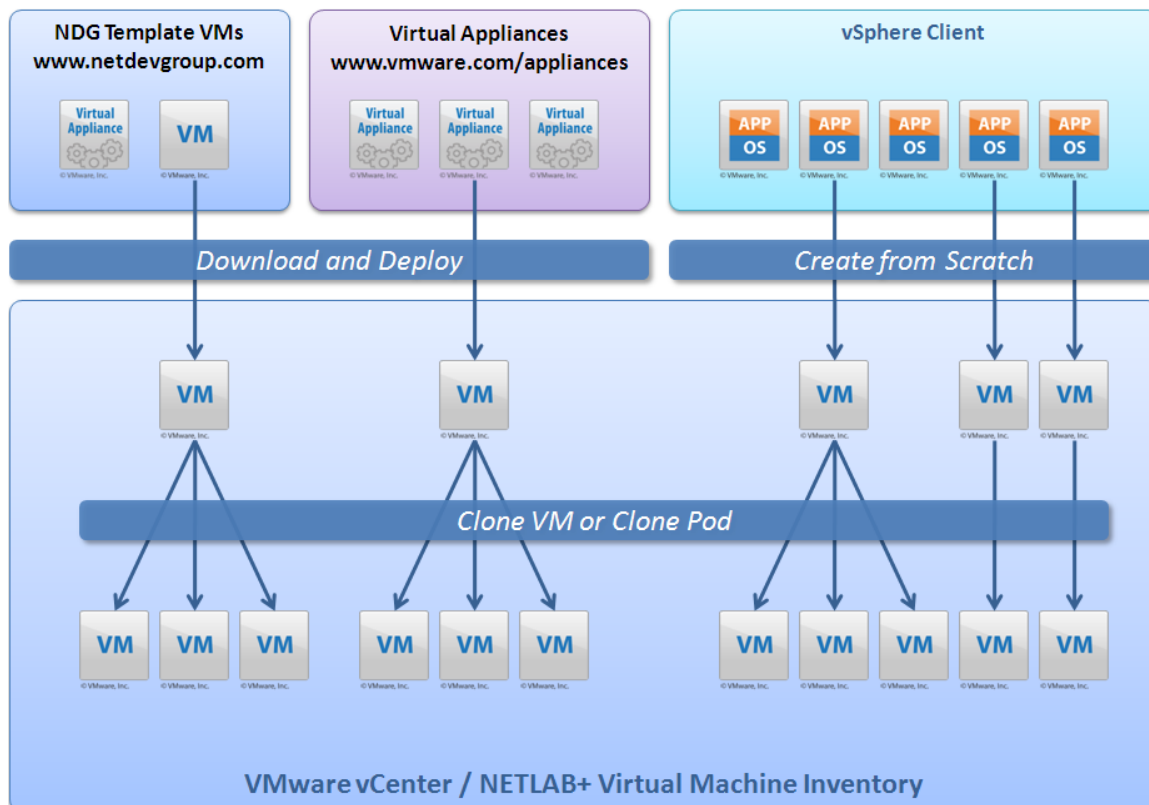
## 1 Background

Detailed guidance on the provisioning of virtual machines is provided in the [vSphere Virtual Machine Administration Guide](#). Becoming familiar with the material in this guide will assist you identifying the best strategy for provisioning your VMs to suit your needs.

## 2 Building Virtual Machines

There are several techniques for building up an inventory of virtual machines and deploying them in NETLAB+ pods:

- Using NDG Virtual Machine Templates
- Using 3rd Party Virtual Appliances
- Creating Virtual Machines from Scratch
- Cloning Individual VMs Using NETLAB+
- Cloning Pods Using NETLAB+



The diagram above illustrates several ways virtual machines can be created.

1. An initial set of virtual machines are populated in VMware vCenter. These VMs can be derived from NDG virtual machine templates, 3rd party prebuilt virtual appliances, or created from scratch using the VMware vSphere client.

2. The initial set of VMs is imported into the NETLAB+ virtual machine inventory.
3. Individual VMs can be cloned directly from NETLAB+ to create more virtual machines. Cloned virtual machines can be modified to perform different roles.
4. After virtual machines are assigned to a NETLAB+ pod, the pod and its virtual machines can be cloned in one operation.

In this section, you will learn three methods that can be used to create an initial set of virtual machines, starting from an empty inventory:

- Using NDG Template Virtual Machines
- Using 3rd Party Virtual Appliances
- Creating Virtual Machines from Scratch

This section also discusses two important tasks that apply to all virtual machines:

- Configuring virtual machines to provide optimal user performance.
- Taking virtual machine snapshots that can be used to place pods in a clean state.

Detailed guidance on the provisioning of virtual machines is provided in the [vSphere Virtual Machine Administration Guide](#). Becoming familiar with the material in this guide will assist you in identifying the best strategy of provisioning your VMs to suit your needs.

All tasks in this section are performed using only the VMware vSphere client.

The *"Importing VMs into the Virtual Machine Inventory"* section of the [Remote PC Guide Series - Volume 3, Configuring the NETLAB+ Virtual Machine Infrastructure](#) provides information on how to import your initial set of virtual machines into NETLAB+, then create additional virtual machines quickly using cloning techniques.

## 2.1 Using NDG Template Virtual Machines and 3rd Party Virtual Appliances

The easiest way to build a virtual machine is to start with an NDG Template Virtual Machine or a 3rd Party Virtual Appliance.

For selected lab content, NDG provides template virtual machines that can be downloaded from the NDG website (<http://www.netdevgroup.com/>). NDG's templates are designed for specific pods and lab content. They can contain one or more of the following elements, depending on software licenses and distribution restrictions of the software required to satisfy lab content requirements:

- Virtual machine configuration file with suitable default settings
- Operating system
- Application software

Please refer to the [supported lab content options](#) on the NDG website to see if templates are available for particular NDG pods and labs.

Some templates are complete virtual appliances that can be deployed and cloned without modifications. Other templates are partial solutions that require local changes, such as adding an operating system or application software.

In cases where NDG does not provide a template virtual machine, you may find a suitable 3rd party virtual appliance at VMware's website:

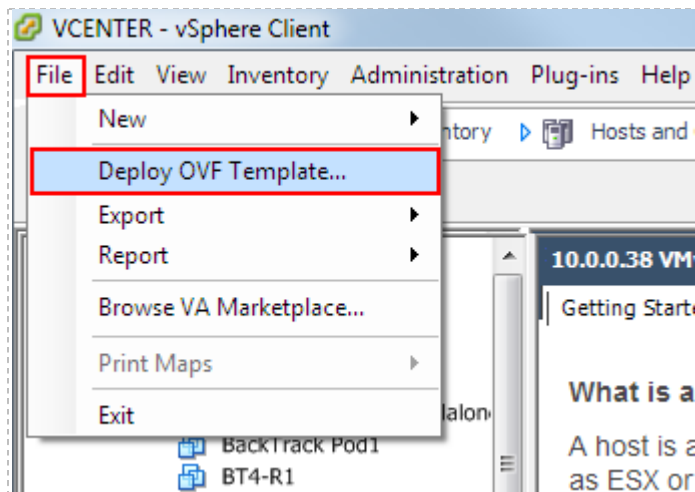
<http://www.vmware.com/appliances>

Virtual Appliances are complete solutions that contain a VM configuration file, operating system and applications that are distributed as a single downloadable unit. The VMware vSphere Client (vSphere Client) allows you to deploy virtual machines that are packaged in Open Virtual Machine Format (OVF). Deploying an OVF template is similar to deploying a virtual machine from a template, except that you may deploy an OVF template from any local file system accessible from the vSphere Client machine, or from a remote web server.

An OVF template is stored as set of files (.ovf, .vmdk, and .mf). An OVA template is used to package an OVF template into a single .ova file. Instructions on deploying OVF templates are available in Chapter 3, "*Deploying OVF Templates*," of the [vSphere Virtual Machine Administration Guide](#).

Virtual machines based on the OVA or OVF file are created using the vSphere client:

### File > Deploy OVF Template



The OVF wizard will prompt for the location of an .ova or .ovf file. This can be a file on your local disk, or a web URL.

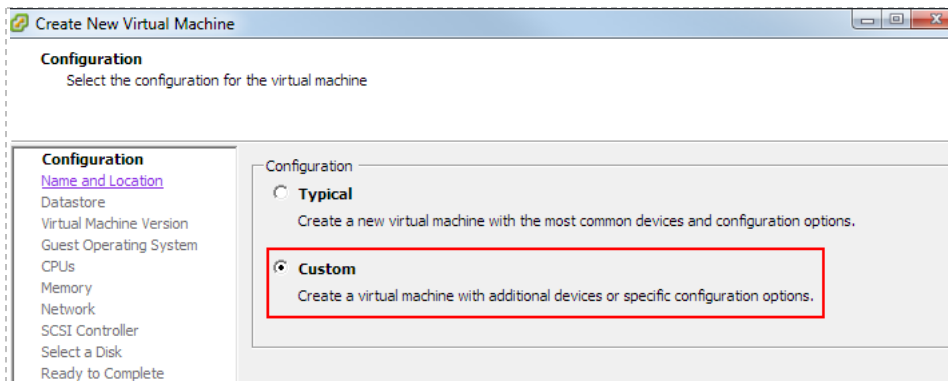
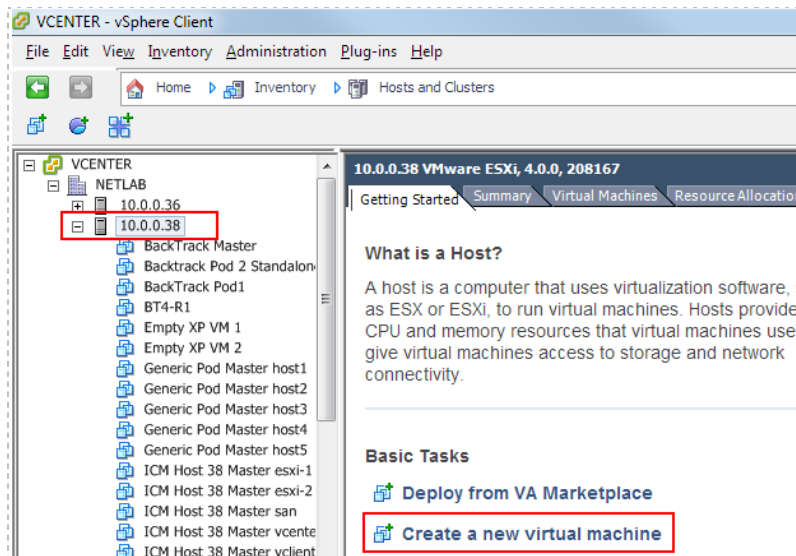
This process will create a virtual machine in vCenter only. This VM must be later imported into the NETLAB+ virtual machine inventory (discussed in the *"Importing VMs into the Virtual Machine Inventory"* section of the [Remote PC Guide Series - Volume 3, Configuring the NETLAB+ Virtual Machine Infrastructure](#)).

Some NDG templates are partial solutions. In this case, please refer to NDG pod-specific guides for additional information required to finalize the installation of the operating system and/or software applications.

## 2.2 Creating Virtual Machines from Scratch

You may use the VMware vSphere client to create a virtual machine from scratch. Choose this option if prebuilt virtual appliances or NDG virtual machine templates do not meet the requirements you are looking for, such as a particular operating system or hardware configuration. Keep in mind that you can create a single virtual machine and install an operating system on it, then use that virtual machine as a template to clone other virtual machines (see the "[Virtual Machine Cloning](#)" section of the [Remote PC Guide Series - Volume 3, Configuring the NETLAB+ Virtual Machine Infrastructure](#)).

1. Open the vSphere client and connect to vCenter server.
2. Select the ESXi host where the new virtual machine will run.
3. Click on the **Getting Started** tab if it is not already selected.
4. Select the **Create a new virtual machine** option.
5. Select the **Custom** option for your virtual machine configuration.
6. The subsections below will provide information on each step you will need to follow using the **New Virtual Machine Wizard**.

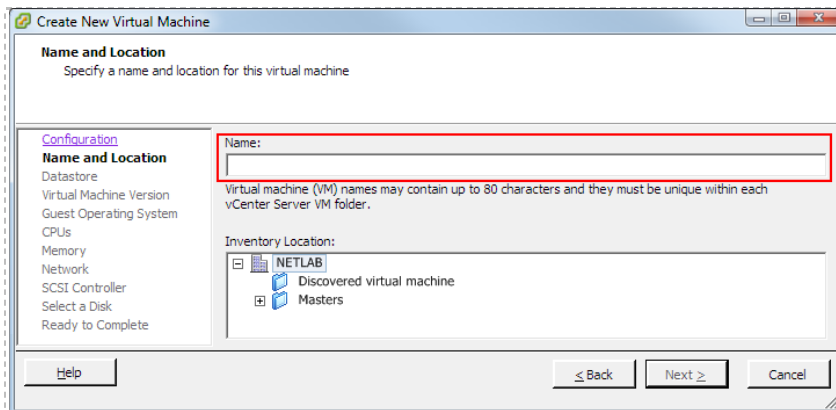


## 2.2.1 Providing a Name for Your Virtual Machine

You will be prompted to enter a name for your new virtual machine. Choose a name for the virtual machine very carefully.

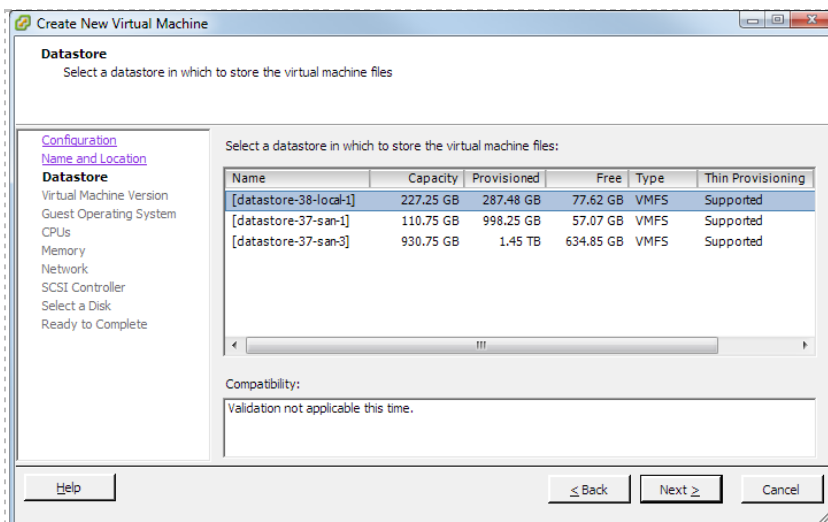
For virtual machines used in pods, we recommend establishing a naming convention, which includes the pod type, numeric ID of the pod and the name of the remote PC (as named in the pod) as part of the name. For example, "Map Pod 12 PC\_A" or "ICM Pod 1150 vcenter".

For master virtual machines that will be used as "golden master" virtual machines (used for pod cloning), we recommend including the pod type, role, and name of the remote PC as part of the name. For example, "ICM Host 1 Master vcenter".



## 2.2.2 Selecting a Datastore

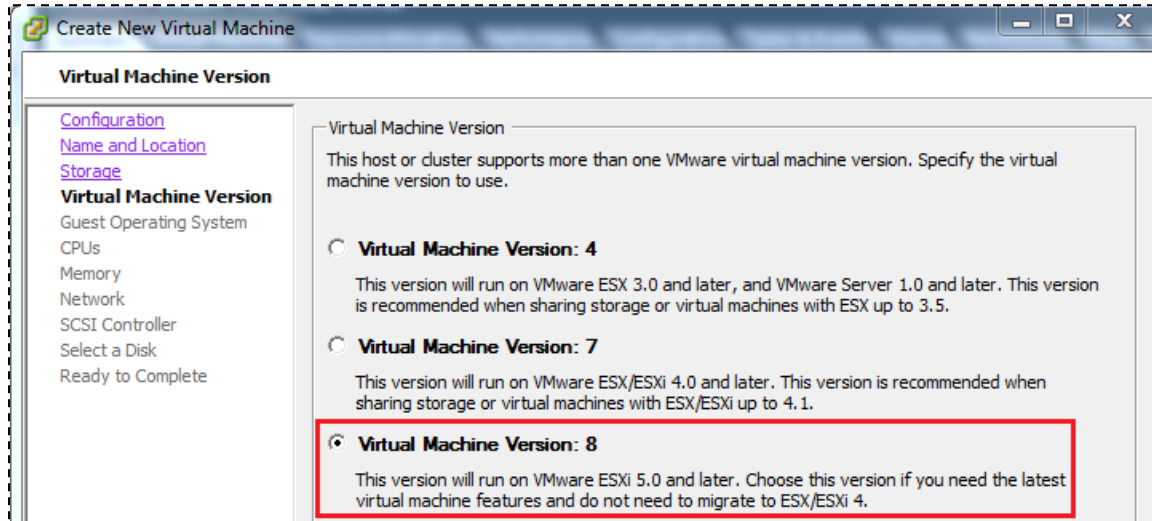
Virtual machine files are stored in a *datastore*. Select a datastore for the virtual machine that will be adequate to store the guest operating system and all of its software applications for pod labs.





### 2.2.3 Select the Virtual Machine Hardware Version

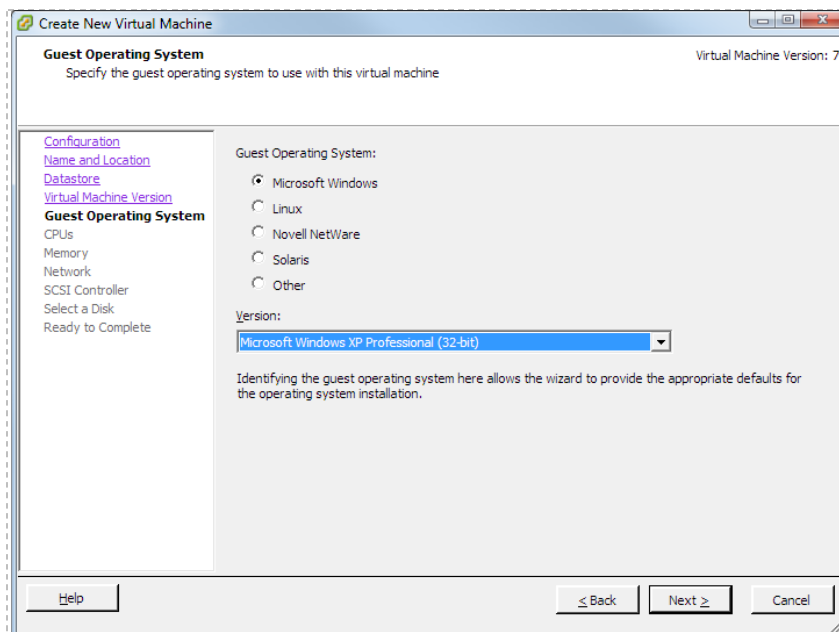
If your host supports more than one virtual machine version, you will be prompted to select the virtual machine version to use. Select **Virtual Machine Version 8**.



### 2.2.4 Selecting the Guest Operating System

The Guest Operating system and version of your choice that you will install on the virtual machine must be selected.

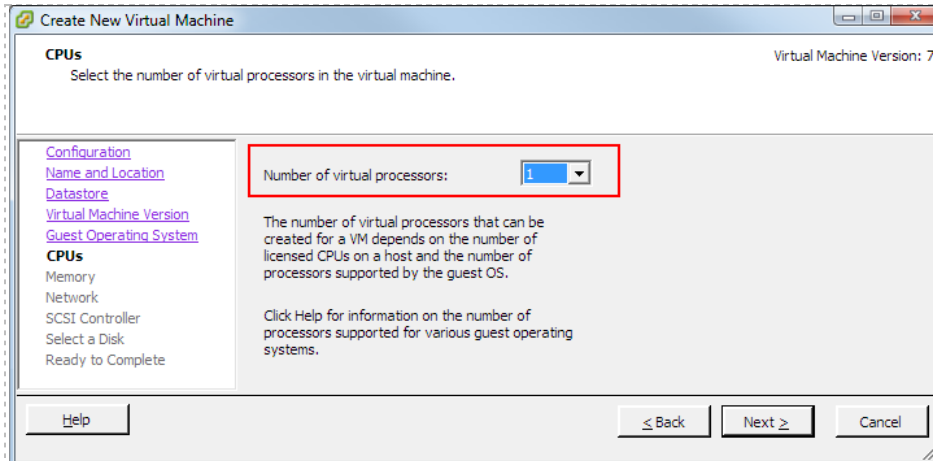
*In this example, Microsoft Windows XP Professional 32-bit is selected as the Guest Operating System.*



## 2.2.5 Selecting the Number of Processors

Selecting the default value of **1** for number of processors in the virtual machine is typically sufficient, depending on the applications you will run on the virtual machine. Please refer to the pod specific documentation for processor guidance.

Each virtual processor consumes core time on the ESXi hosts physical processors. A value of 2 or higher should be used sparingly.

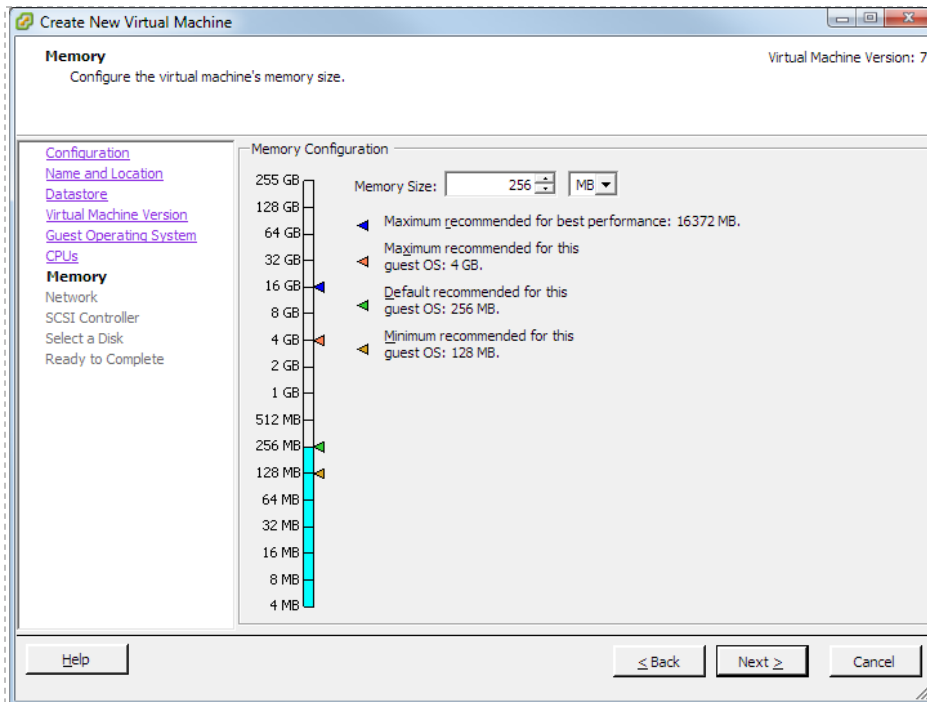


## 2.2.6 Configuring the Memory Size

Choose the amount of memory that will be allocated to the virtual machine. In most cases, you may use the default settings for memory. If memory space is a concern, you may need to select a value closer to the recommended minimum.

The amount of memory you select for the virtual machine is also the value used in NETLAB+ Proactive Resource Awareness calculations when this virtual machine is scheduled in NETLAB+. See the "*Proactive Resource Awareness*" section of the [Remote PC Guide Series - Volume 3, Configuring the NETLAB+ Virtual Machine Infrastructure](#) for details.

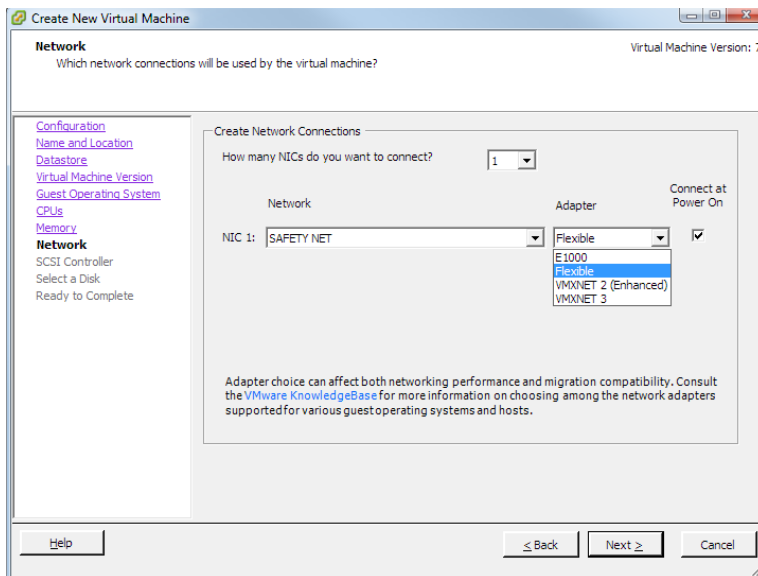
Setting the memory size too low may lead to page swapping to disk and poor virtual machine performance. Setting the memory size too high may limit the number of virtual machines that can be scheduled at the same time, depending on the amount of physical memory in your ESXi hosts and NETLAB+ Proactive Resource Awareness settings.



## 2.2.7 Choosing Network Connections

If your equipment pod will consist of only one individual PC, a Network Adapter is not necessary and number of NICs may be set to **None**.

In most cases, it will be necessary to connect a Network Interface Card (NIC) to the virtual machine.



**How many NICs do you want to connect?** This determines how many virtual network adapters will be created for the virtual machines. In most cases, this will be **1**. For some pods, a value of 2 or higher may be required for certain remote PCs. Please refer to the NDG pod specific guides for guidance.

**Network.** This is the name of an existing port group on the ESXi host that the virtual machine network adapter will connect to.

- If the VM is part of a real equipment pod, select an inside port group. See the *"Connecting Virtual Machines to Real Equipment Pods"* section of the [Remote PC Guide Series - Volume 3, Configuring the NETLAB+ Virtual Machine Infrastructure](#) for further discussion.
- If the target pod type supports NETLAB+ automatic networking, select SAFETY NET (previously created in the *"Create a Safe Staging Network"* section of the [Remote PC Guide Series - Volume 2, Installation](#)). NETLAB+ will move the VM from SAFETY NET to an automatically generated network when the pod is started.
- Select SAFETY NET if the final network has not been created and you need a safe temporary network until the VM can be relocated to its final network.

**Adapter.** Network adapter choices depend on the version number and guest operating system running on the virtual machine. Only those network adapters that are appropriate for the virtual machine you are creating are listed as available configuration options. The following adapter choices are described in VMware Knowledge Base article 1001805. Please refer to the article on the VMware website for the latest information.

<b>Vlance</b>	An emulated version of the AMD 79C970 PCnet32 LANCE NIC, an older 10 Mbps NIC with drivers available in most 32bit guest operating systems except Windows Vista and later. A virtual machine configured with this network adapter can use its network immediately.
<b>VMXNET</b>	The VMXNET virtual network adapter has no physical counterpart. VMXNET is optimized for performance in a virtual machine. Because operating system vendors do not provide built-in drivers for this card, you must install VMware Tools to have a driver for the VMXNET network adapter available.
<b>Flexible</b>	The Flexible network adapter identifies itself as a Vlance adapter when a virtual machine boots, but initializes itself and functions as either a Vlance or a VMXNET adapter, depending on which driver initializes it. With VMware Tools installed, the VMXNET driver changes the Vlance adapter to the higher performance VMXNET adapter.
<b>E1000</b>	An emulated version of the Intel 82545EM Gigabit Ethernet NIC. A driver for this NIC is not included with all guest operating systems. Typically Linux versions 2.4.19 and later, Windows XP Professional x64 Edition and later, and Windows Server 2003 (32-bit) and later include the E1000 driver.
<b>VMXNET3</b>	<p>A next generation of a paravirtualized NIC designed for performance, and is not related to VMXNET or VMXNET 2. It offers all the features available in VMXNET 2, and adds several new features like multiqueue support (also known as Receive Side Scaling in Windows), IPv6 offloads, and MSI/MSI-X interrupt delivery.</p> <p>VMXNET 3 is supported only for virtual machines version 7 and later, with a limited set of guest operating systems:</p> <ul style="list-style-type: none"><li>• 32 and 64bit versions of Windows XP,7, 2003, 2003 R2, 2008,and 2008 R2</li><li>• 32 and 64bit versions of Red Hat Enterprise Linux 5.0 and later</li><li>• 32 and 64bit versions of SUSE Linux Enterprise Server 10 and later</li><li>• 32 and 64bit versions of Asianux 3 and later</li><li>• 32 and 64bit versions of Debian 4</li><li>• 32 and 64bit versions of Ubuntu 7.04 and later</li><li>• 32 and 64bit versions of Sun Solaris 10 U4 and later</li></ul>

## VMXNET2

Adapter based on the VMXNET adapter but provides some high-performance features commonly used on modern networks, such as jumbo frames and hardware offloads. This virtual network adapter is available only for some guest operating systems on ESX/ESXi 3.5 and later.

VMXNET 2 is supported only for a limited set of guest operating systems:

- 32 and 64bit versions of Microsoft Windows 2003 (Enterprise and Datacenter Editions).

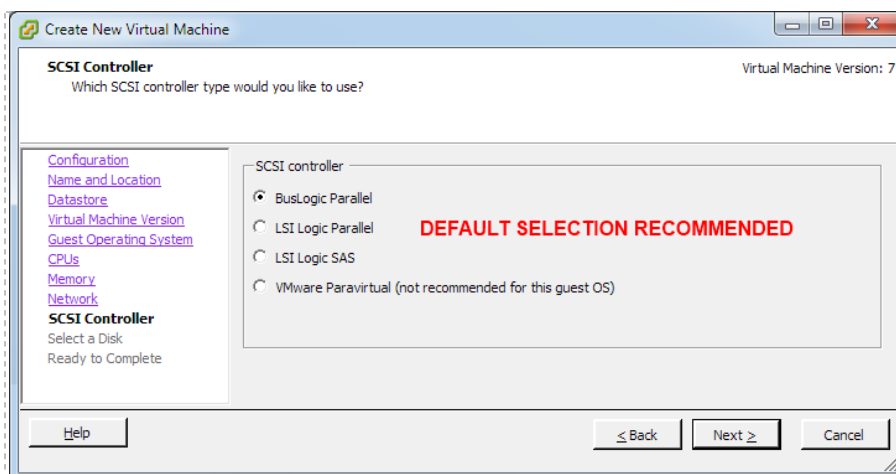
**Note:** You can use enhanced VMXNET adapters with other versions of the Microsoft Windows 2003 operating system, but a workaround is required to enable the option in VMware Infrastructure (VI) Client or vSphere Client. See Enabling enhanced vmxnet adapters for Microsoft Windows Server 2003 (VMware KB 1007195) if Enhanced VMXNET is not offered as an option.

- 32bit version of Microsoft Windows XP Professional
- 32 and 64bit versions of Red Hat Enterprise Linux 5.0
- 32 and 64bit versions of SUSE Linux Enterprise Server 10
- 64bit versions of Red Hat Enterprise Linux 4.0
- 64bit versions of Ubuntu Linux

**Connect at Power On.** This box should be checked so that the network adapter is automatically enabled when the virtual machine powers up.

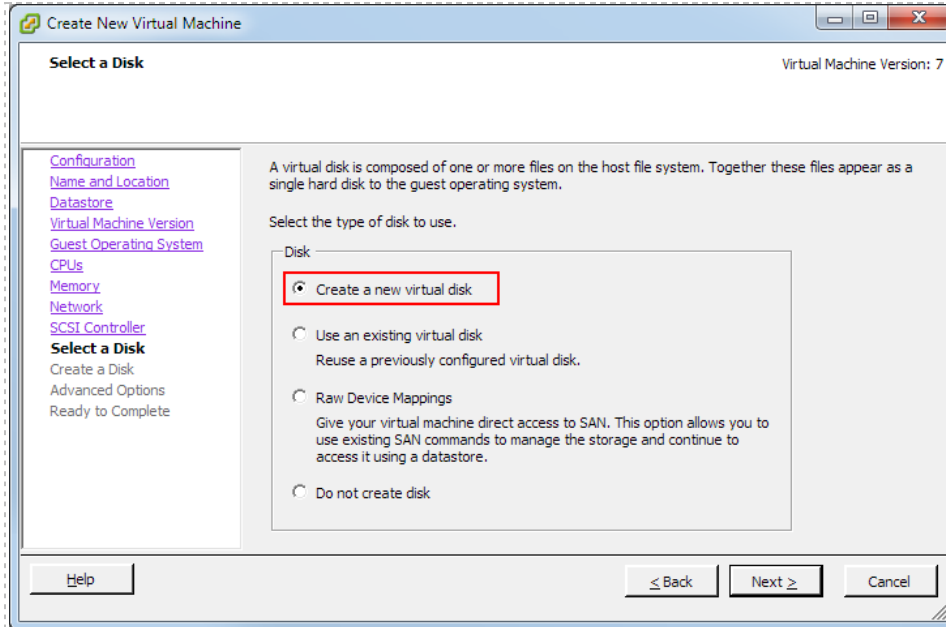
## 2.2.8 Selecting the Disk Controller

In most cases, you may use the default setting for disk controller. Be aware also of any O/S specific driver requirements due to your selection of guest operating system. For example, older versions of Microsoft Windows may require that you provide SCSI drivers during install.



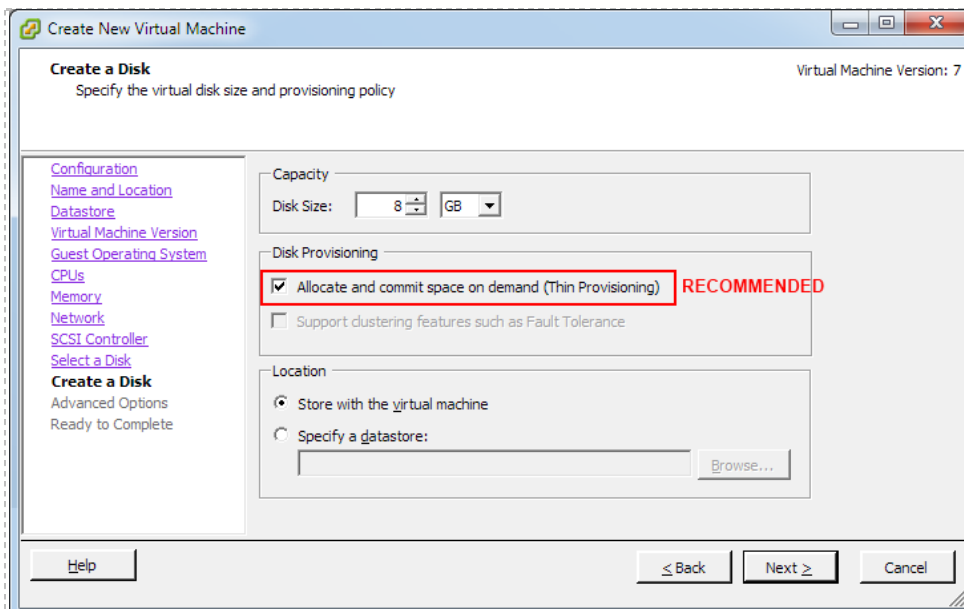
## 2.2.9 Creating a Virtual Hard Disk

Use the default settings to **Create a new virtual disk** for your virtual machine.



Specify the disk capacity for this virtual machine. Select a disk size that will be adequate to store the guest operating system and all of its software applications for pod labs. The example below shows the default selection of 8GB; your requirements may vary.

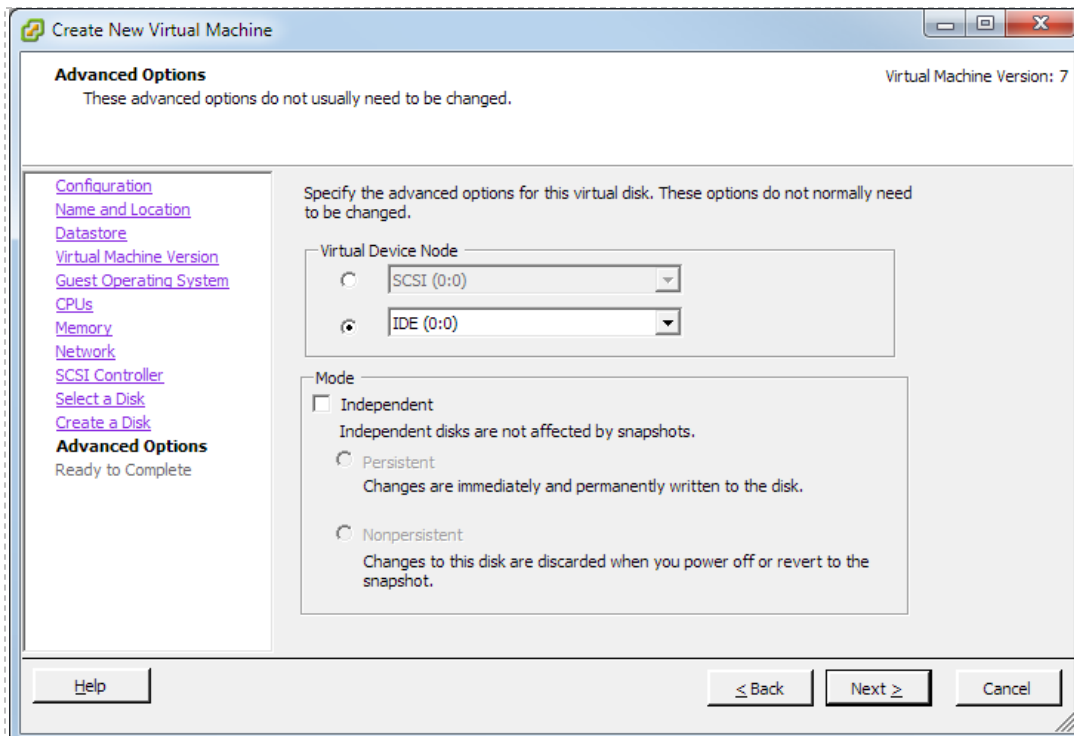
**Check the "Allocate and commit space on demand"** check box to enable *thin provisioning*. This is recommended to conserve disk space. Thin provisioning allows real disk space to be allocated on a just-enough and just-in-time basis.



## 2.2.10 Specifying Advanced Options

In most cases, you may use the default settings for the **Advanced Options**.

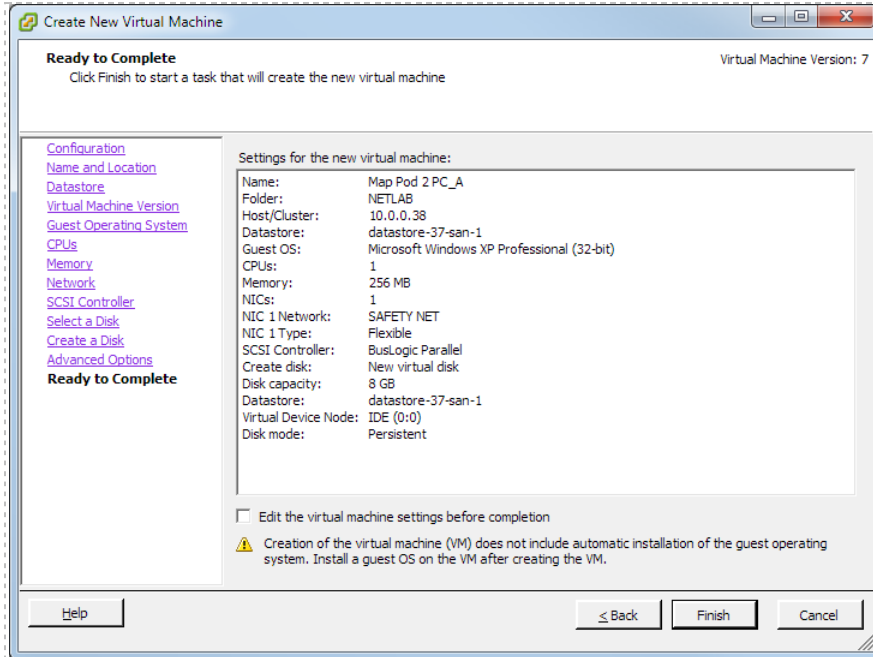
The use of SCSI drivers in a Windows XP or Windows Server 2003 virtual machine requires a special SCSI driver. You may [download the driver from the VMware website](#).



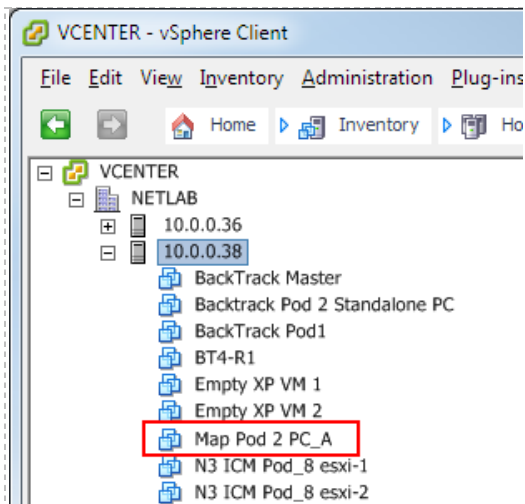


## 2.2.11 Verifying the Settings

Review the configuration settings displayed on the page and select **Finish**.



Your virtual machine will now be listed in the virtual machine inventory.



## 2.3 Installing a Guest Operating System

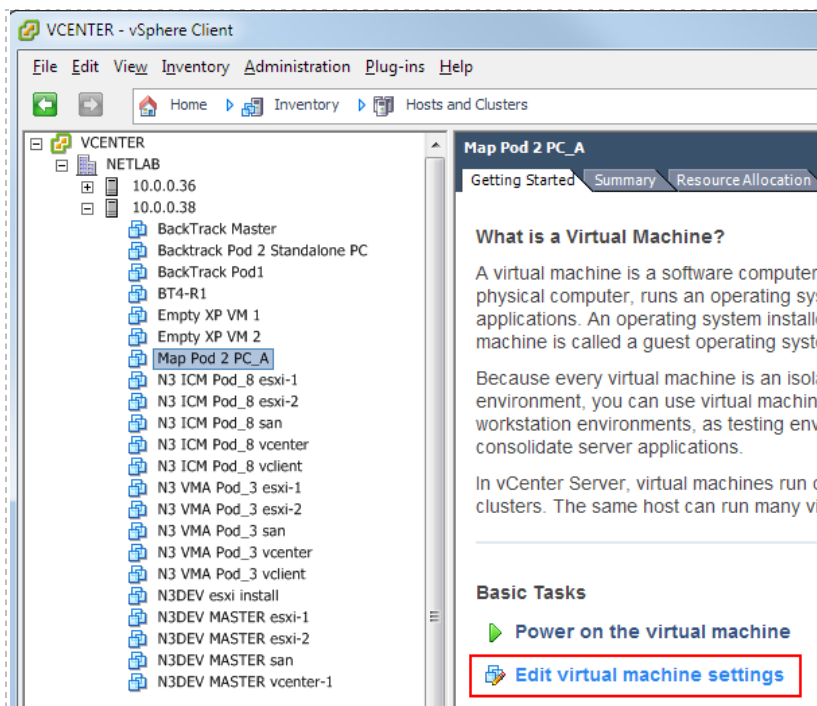
After you have configured the virtual machine settings, you must install an operating system on the virtual machine. Refer to VMware's [vSphere Virtual Machine Administration Guide](#), *Installing a Guest Operating System* for details on the procedure to install a guest operating system.

## 2.4 Editing the Virtual CD/DVD Device

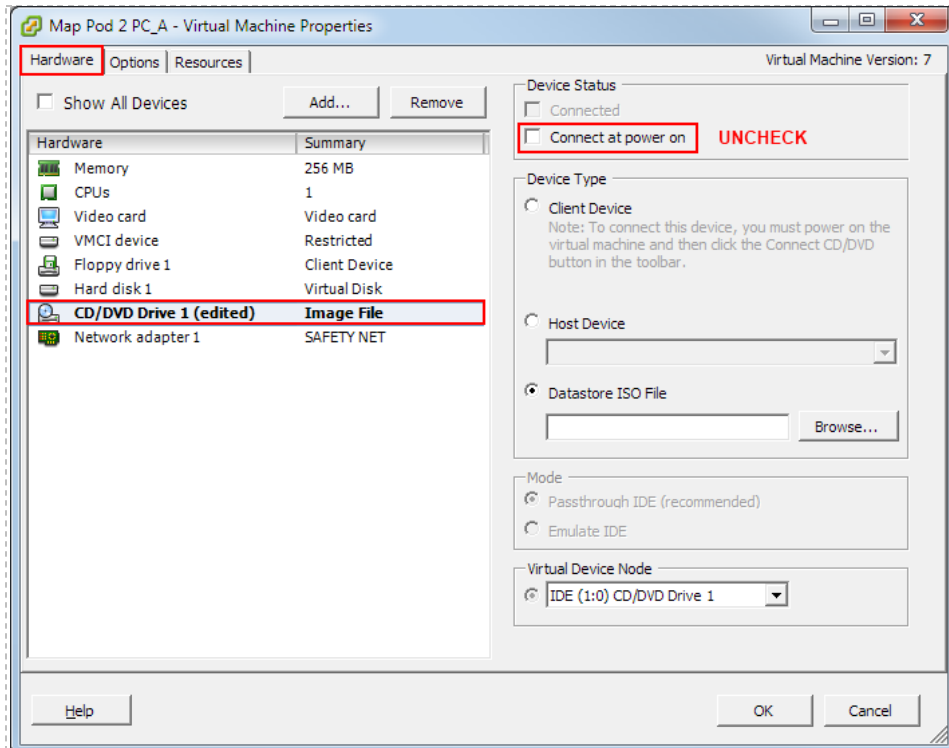
You may have configured your virtual machine to access a physical CD/DVD drive or access an ISO image in order to install the guest operating system. In the process, you may have enabled the **Connect at Power On** setting. For optimal pod performance, please verify the **Connect at Power On** option is **Unchecked**.

This setting must be edited **after** installing the guest operating system.

1. From the vSphere Client, select the virtual machine from the inventory list.
2. Select the **Getting Started** tab if not already selected.
3. Click **Edit virtual machine settings**.



4. Select the CD/DVD drive in the hardware list.
5. **Uncheck** the **Connect at power on** box. This is necessary to prevent the virtual machine from attempting to connect to the ESXi host's CD/DVD device, which could result in undesired properties or boot errors.



You may also point the CD/DVD device connection to a unique ISO image on the local ESXi host. If you choose this option, make sure each VM you create does not point to the same ISO file. Otherwise, you may experience some undesired properties or boot errors.

## 2.5 Essential Virtual Machine Performance Optimizations

This section and subsections outline essential performance optimizations for virtual machines that are required for basic operation and good performance in NETLAB+. Our example throughout this section shows the optimization of a Windows XP virtual machine. The same techniques should be applied on all operating systems.

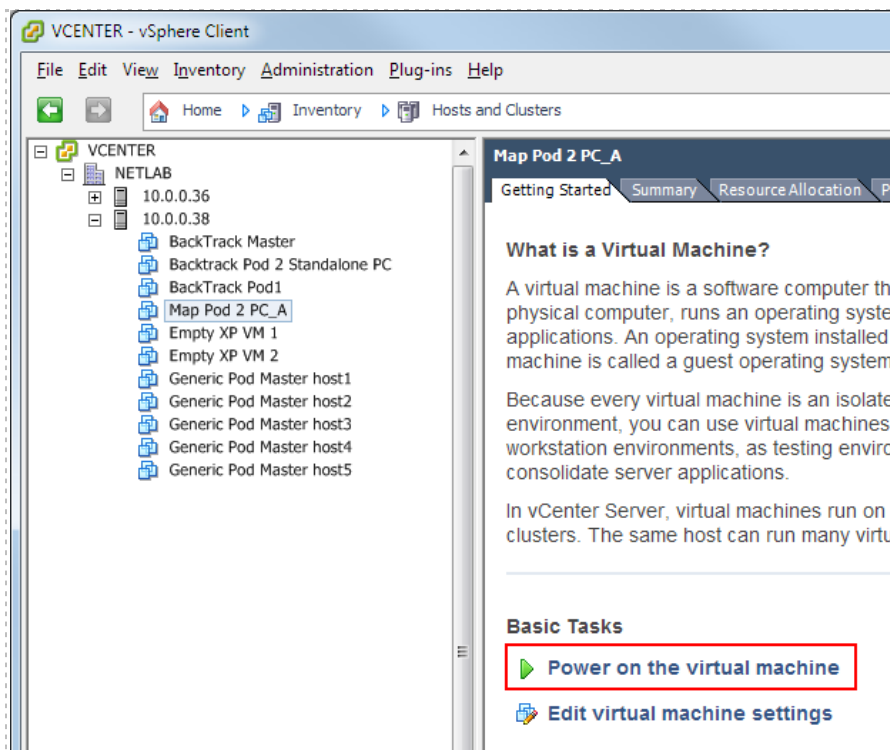
### 2.5.1 Installing VMware Tools

Installation of VMware Tools is **required** for proper NETLAB+ operation and essential for optimal performance.

The mouse will not work in the NETLAB+ Remote PC Viewer if VMware Tools is not installed.

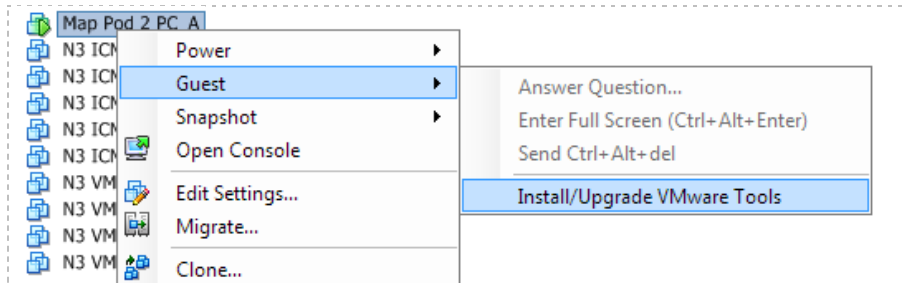
Your virtual machine must be powered on to install VMware Tools.

1. Select the virtual machine in the inventory list.
2. Select the **Getting Started** tab if not already selected.
3. Click **Power on the virtual machine**.

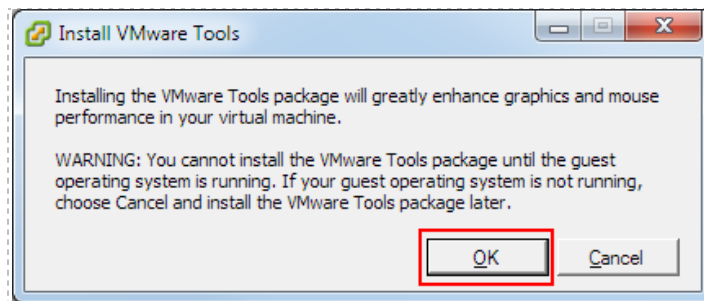


The option to install VMware Tools will now be available.

1. Select the virtual machine in the inventory list.
2. **Right-click** on the page, and select **Guest** from the context menu.
3. Select **Install/Upgrade VMware Tools**.



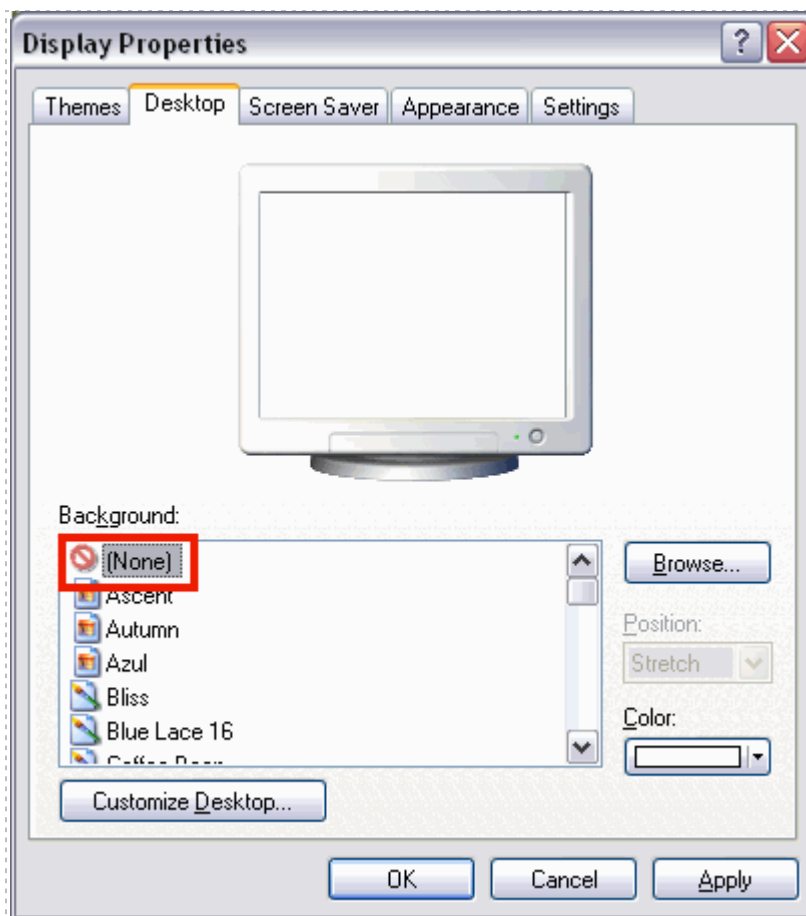
4. Assuming you have completed the installation of the guest operating system as described, you may proceed with the install of VMware Tools.



## 2.5.2 Disabling the Desktop Background

The desktop background **MUST** be set to **None** (solid color) to provide minimal bandwidth utilization and to ensure the responsiveness of the remote experience.

1. Boot the virtual machine.
2. **Right-click** on the display and select **Properties**.
3. Click on the **Desktop** tab.
4. Select **None** for the Background.



A desktop background image will result in very slow screen updates and consume significantly more bandwidth than a solid one-color background.

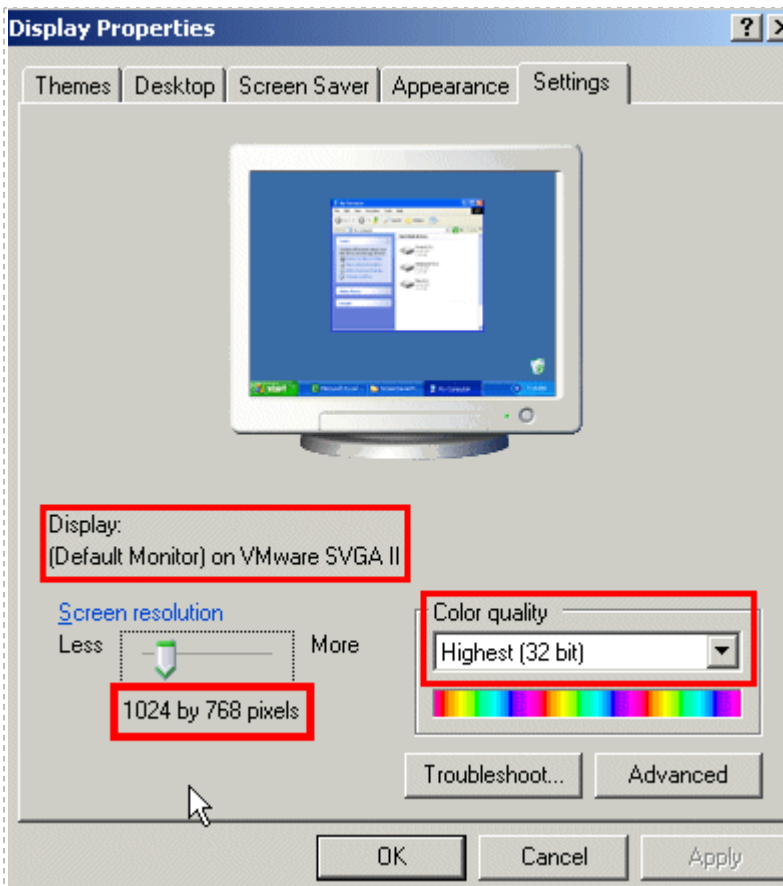
### 2.5.3 Setting the Virtual Machine Display Properties

For optimal performance and minimal bandwidth consumption, we recommend using the lowest possible resolution setting.

- The recommended screen resolution is 1024x768. All courses offered by NDG are compatible with this resolution.

The following task assumes a virtual machine running a Windows XP operating system. Adjust accordingly for other operating systems. To set the screen resolution and color quality:

1. Boot the virtual machine.
2. **Right-click** on the display and select **Properties**.
3. Click on the **Desktop** tab.
4. Click on the **Settings** tab.
5. Set screen resolution to your desired resolution (1024x768 is used in this example).
6. Set color quality to **32-bit**.



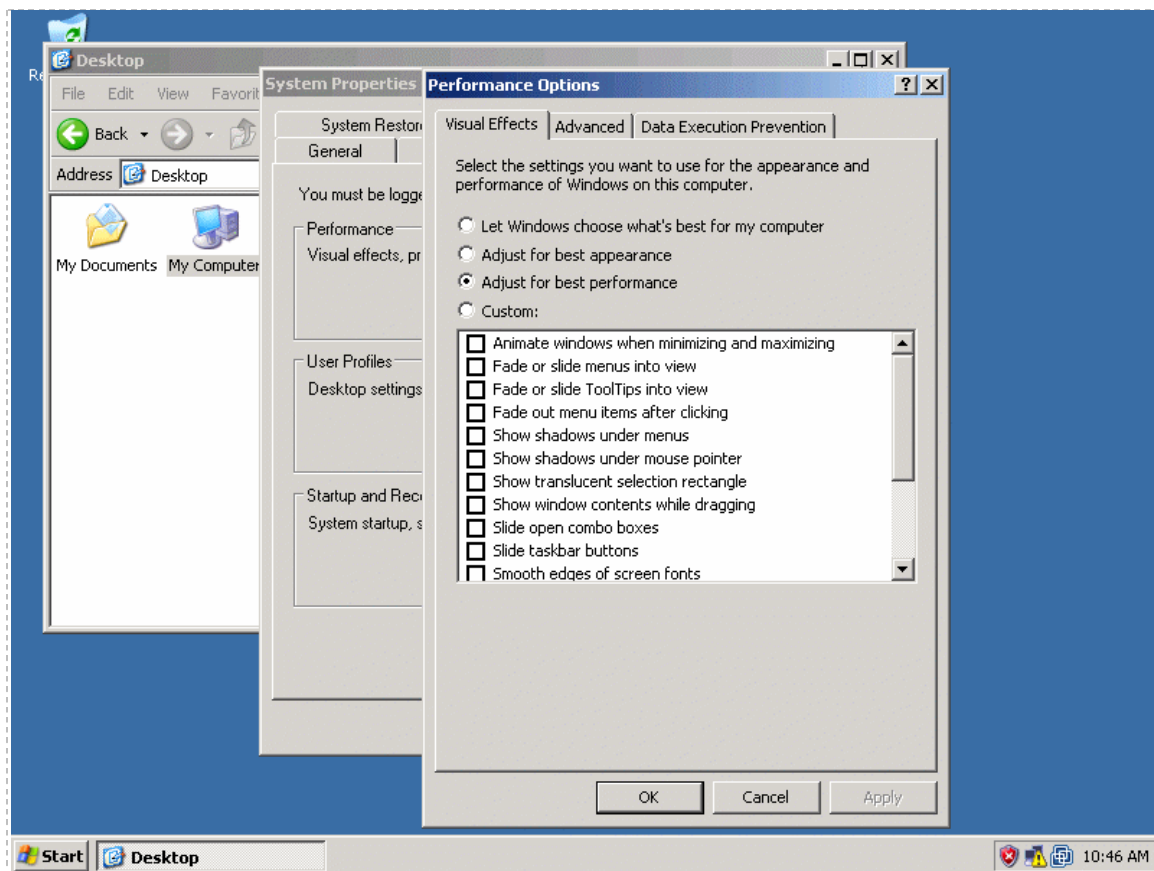
## 2.5.4 Adjusting Visual Effects

Visual effects must be adjusted to provide minimal bandwidth utilization and to ensure the responsiveness of the remote experience.

The following task assumes a virtual machine running a Windows XP operating system. Adjust accordingly for other operating systems.

Adjust the visual effects:

1. **Right-click** on **My Computer** and select **Properties**.
2. Click on the **Advanced** tab.
3. Click the **Settings** button for **Performance**.
4. Click the **Visual Effects** tab.
5. Select the radio button to **Adjust for best performance**.
6. Click **Ok** to accept changes.





## 2.6 Adding Software Applications

You may now add new software to your virtual machine as required by the lab exercises you plan to use on your pods. It may be helpful to temporarily bind the virtual network adapter to the outside campus network to load applications from the Internet or local file server.

The Secure+ network model does not provide outside connectivity. In this model, you will need to load from ISO files on the ESXi servers or from a file server VM on an inside network.

## 2.7 Virtual Machine Snapshots

A snapshot preserves the state and data of a virtual machine at a specific point in time.

- State includes the virtual machine's power state (powered-on, powered-off, suspended, etc).
- Data includes all the files that make-up the virtual machine, including configuration file, disks, memory, and other devices, such as virtual network interface cards.

The VMware vSphere client provides several operations for creating and managing snapshots and snapshot trees. These operations let you create snapshots, revert to any snapshot in the tree, and remove snapshots.

Large snapshot trees are not recommended for production virtual machines (see Snapshot Best Practices, Section [2.7.2](#) below).

### 2.7.1 How NETLAB+ Uses Snapshots

In NETLAB+, snapshots are used for two purposes.

**Virtual Machine Reset.** A virtual machine can be optionally reset to a specific state at the beginning or end of a lab reservation, or when the user initiates the scrub action on the virtual machine or pod.

**Linked Virtual Machines.** A linked virtual machine shares a base virtual disk with a "master" virtual machine in an ongoing manner. This conserves disk space and allows multiple virtual machines to use the same software installation. A snapshot on the master virtual machine becomes the disk starting point for linked virtual machines that are derived from the master.

## 2.7.2 Snapshot Best Practices

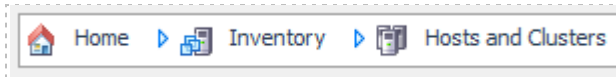
Here are some best practices for using snapshots in the NETLAB+ environment and some common pitfalls to avoid.

1. **Be sure to take a new snapshot each time you edit virtual machine settings or install new applications on a virtual machine.** Unsaved changes to a virtual machine are lost after reverting to snapshot. A revert to snapshot can occur manually when invoked from the vSphere client, or automatically by NETLAB+ (depending on your virtual machine inventory settings).
2. **Take snapshots in a powered-off state.** Snapshots taken in a powered-on or suspended state can reduce virtual machine boot time. However, this consumes significantly more disk space per VM than in a powered-off state. The disk space required can easily exceed one gigabyte since the virtual machine's memory state and/or swap files must also be preserved for powered-on and suspended states. Resuming from a powered-on or suspended state can also result in failed network connection states in some cases. To avoid these issues, gracefully power down the virtual machine before taking a snapshot.
3. **Take only one snapshot per virtual machine for best performance.** In academic environments, there is often an affinity for large snapshot trees since snapshots provide an intuitive way to return to a topic in a course syllabus. This is not recommended for production virtual machines where user performance is paramount. Large snapshot trees can degrade virtual machine performance. Each level in the snapshot tree creates a "delta disk" which must be accessed before data can be read from the "base disk" (where most files typically reside). We recommend only one snapshot per virtual machine, particularly when the virtual machine is used in a production pod, or for master virtual machines that are the basis for linked virtual machines.
4. **Specify a unique name for every snapshot (if you must keep more than one snapshot on the same virtual machine).** The vSphere client will allow you to create multiple snapshots with the same name. To avoid ambiguity during cloning operations, NETLAB+ requires that all snapshots on a single VM be named uniquely. NETLAB+ cloning operations may fail with the error `E_VM_SNAPSHOT_NOT_UNIQUE` when attempting to clone a virtual machine that has two or more snapshots with the same name. Duplicate snapshot names will not be an issue if you follow the best practice of one snapshot per virtual machine for best performance.
5. **Snapshots used for linked clones must be thoroughly tested before cloning.** Replacing a snapshot on the master (parent) virtual machine does not propagate changes to existing linked clones (as one might hope). Only new linked clones will pick up the changes from the new snapshot. Linked clones will be discussed in detail in the Cloning section.

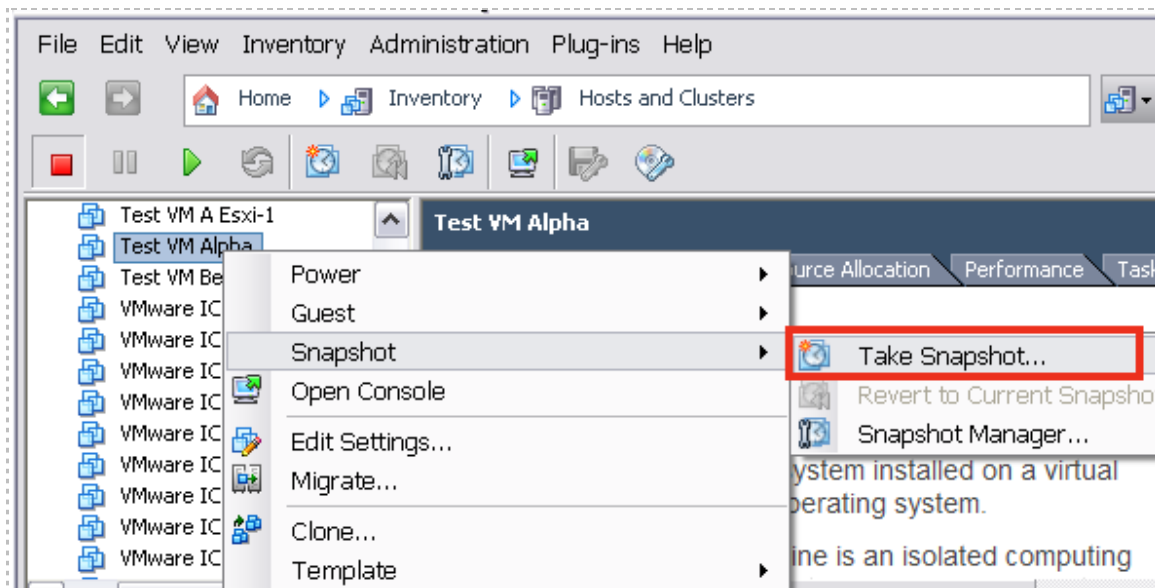
### 2.7.3 Taking a New Snapshot - vSphere

NETLAB+ now includes a Snapshot Manager within the NETLAB+ Virtual Machine Inventory environment, which you may find much more convenient to use. See Section 2.7.5 for details.

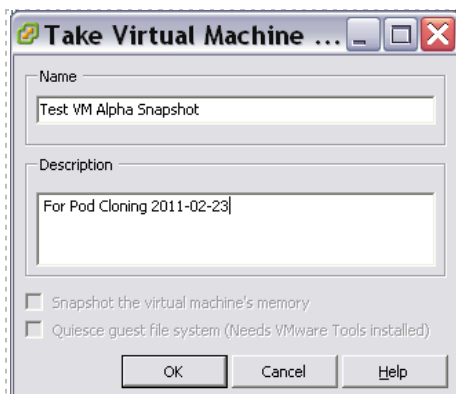
1. Open the vSphere client.
2. Select **Hosts and Clusters** in the address bar.



3. Right-click on the virtual machine and select **Snapshot > Take Snapshot**.



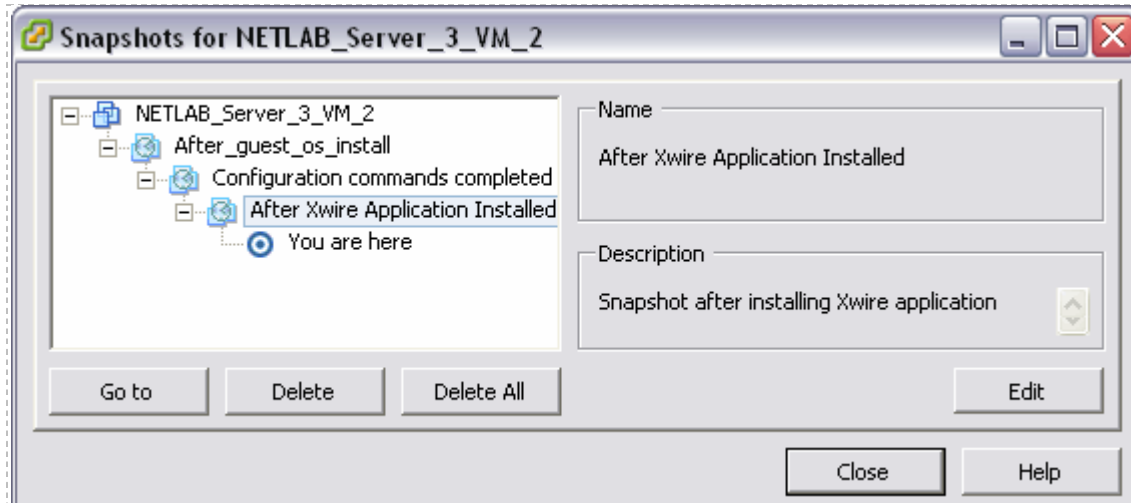
4. Enter a name for the snapshot.
5. Enter a description. It is a good idea to include the date in the description for later reference.
6. Click **OK**.



## 2.7.4 Managing Snapshots - vSphere

vSphere can maintain multiple snapshots of your virtual machine. Use the **Snapshot Manager** to manage snapshots.

In this example, we see that three snapshots have been taken of a virtual machine (after installing the guest operating system, after configuring the remote display commands, and after installing an application).

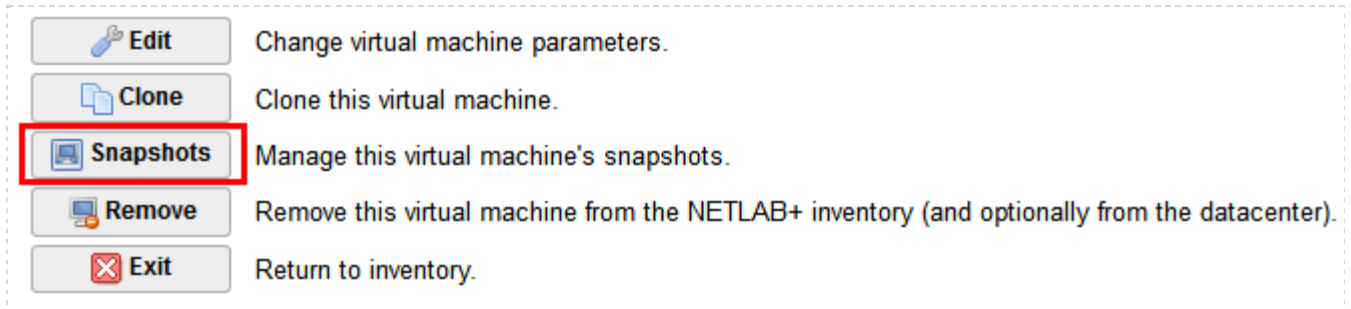


Be aware of features available using the Snapshot Manager.

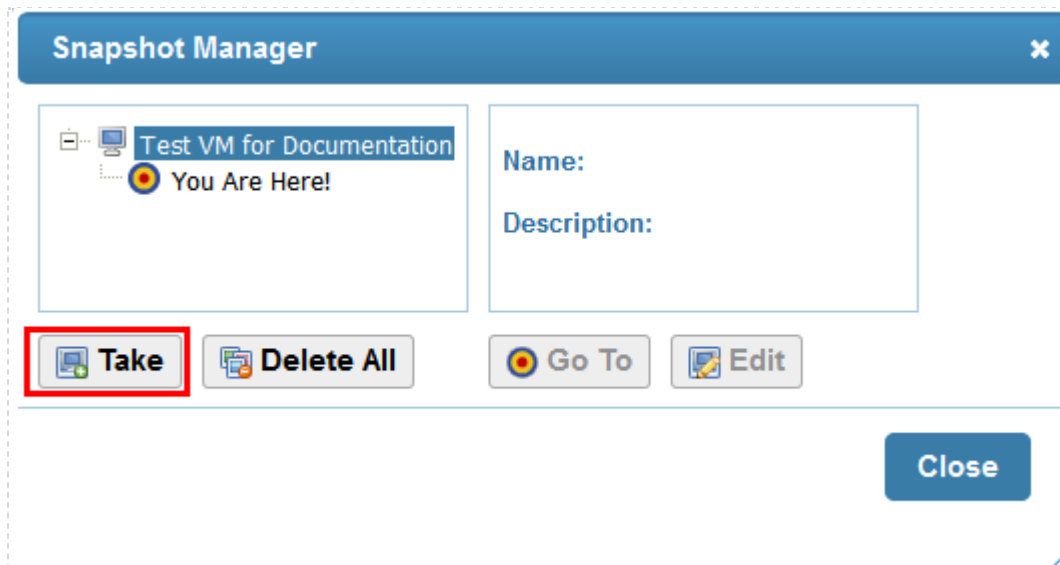
- The **You Are Here** icon represents the current operational state of the virtual machine. Each time you take a new snapshot, the Current Snapshot state is updated. NETLAB+ will revert to the current snapshot.
- **Delete** commits the snapshot data to the parent and removes the selected snapshot.
- **Delete All** commits all the immediate snapshots before the **You Are Here** current active state to the base disk and removes all existing snapshots for that virtual machine.
- **Go To** allows you to select the position of the current operational state of the virtual machine. You may maintain multiple snapshots and control which snapshot NETLAB+ will use by using **Go To** in order to modify the position of **You Are Here**, which indicates the current operational state of the VM.

## 2.7.5 Taking a New Snapshot - NETLAB+ Snapshot Manager

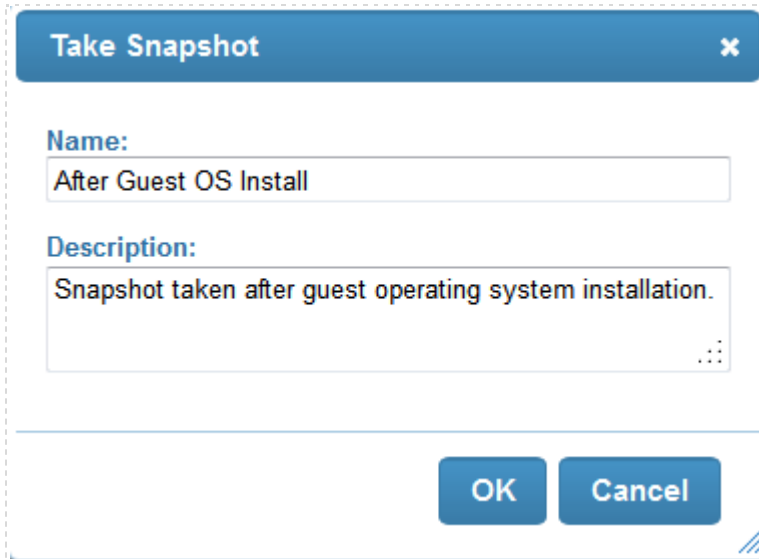
Select a VM in the virtual machine inventory. The **Snapshots** option will be displayed.



1. Click the **Take** button.



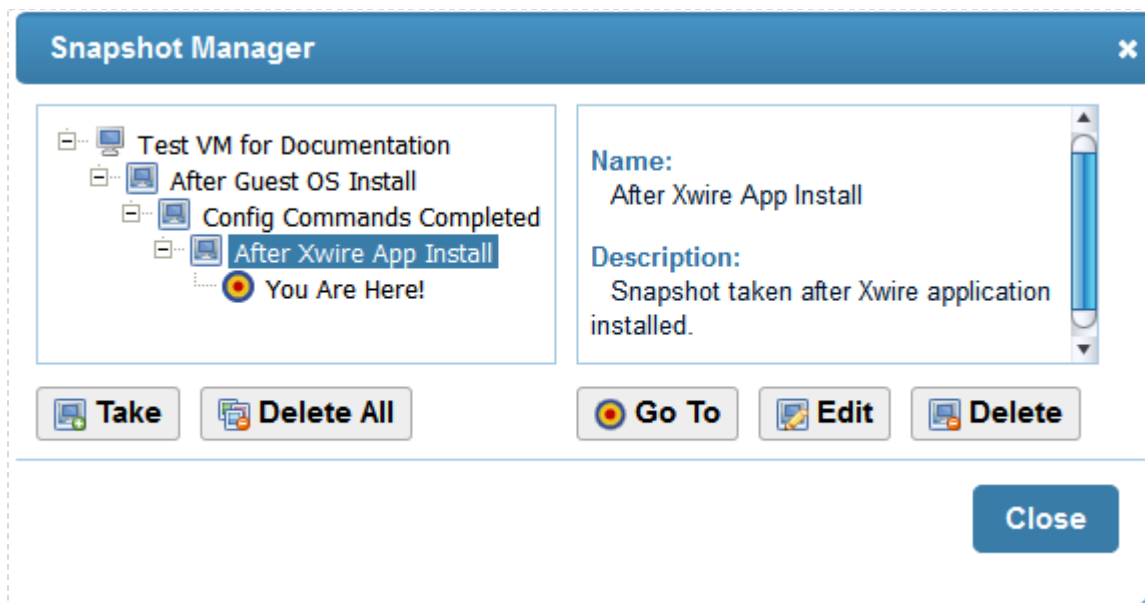
2. Enter a name for the snapshot.
3. Enter a description. It is a good idea to include the date in the description for later reference.
4. Click **OK**.



### 2.7.6 Managing Snapshots - Using the NETLAB+ Snapshot Manager

The NETLAB+ Snapshot Manager can be used to manage snapshots of your virtual machines, similar to snapshot manager available within vSphere. Using the NETLAB+ Snapshot Manager offers a much more convenient approach for managing your VMs, since it is available within the NETLAB+ Virtual Machine Inventory environment.

In this example, we see that three snapshots have been taken of a virtual machine (after installing the guest operating system, after configuring the remote display commands, and after installing an application).



Be aware of the features available using the Snapshot Manager.

- The **You Are Here** icon represents the current operational state of the virtual machine. Each time you take a new snapshot, the Current Snapshot state is updated. NETLAB+ will revert to the current snapshot.
- **Take**, as described in the previous section, is used to take a new snapshot of the virtual machine.
- **Delete** commits the snapshot data to the parent and removes the selected snapshot.
- **Delete All** will consolidate and remove all snapshots for this virtual machine. All the snapshots will be consolidated to a single disk.
- **Go To** allows you to select the position of the current operational state of the virtual machine. You may maintain multiple snapshots and control which snapshot NETLAB+ will use by using **Go To** in order to modify the position of **You Are Here**, which indicates the current operational state of the VM.

## 2.8 Migrating a Virtual Machine to a Different ESXi Host

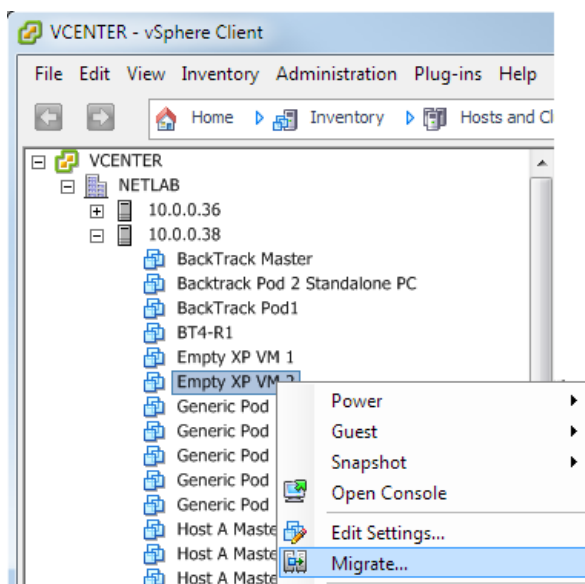
Each virtual machine (other than template VMs) is assigned to a runtime ESXi host in both NETLAB+ and vCenter. The runtime host is the ESXi server where the virtual machine will execute when powered on.

Migration is the process of moving a virtual machine from one ESXi host to another. This may involve moving the virtual machine disk files from one host to another if the files are located on an ESXi host local disk.

Do not use the vSphere client to migrate a virtual machine if the virtual machine is registered in the NETLAB+ inventory. This will create a discrepancy between NETLAB+ and vCenter. You should first unregister the host from the NETLAB+ inventory before migration using vCenter.

At the current time, NETLAB+ does not provide a migration facility. If you absolutely must change the runtime host of a virtual machine, you can follow the following procedure.

1. Unregister the host from the NETLAB+ inventory.
  - a. If the VM is assigned to a pod, you will need to set the corresponding remote PC to ABSENT.
  - b. Select the VM from the Virtual Machine Inventory.
  - c. Click Remove.
  - d. Select "**Remove VM from NETLAB+ inventory only.**"
2. Perform the migrate operation using the vSphere client. A wizard will guide you through the process.







3. Re-import the virtual machine back into NETLAB+ if desired.
4. Assign the virtual machine to a pod if desired.

Remember, do not perform the migrate operation on a virtual machine that is currently registered in the NETLAB+ inventory.