



# VMware vSphere: ICM v5.1 Pod Installation and Configuration Guide

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Installation of VMware vSphere: ICM v5.1 virtual pods as described in this guide, requires that your NETLAB+ system is equipped with software version NETLAB+ version 2013.R1 or later.

Previous versions of NETLAB+ do not support the use of VMware ESXi 5.1 or VMware ESXi 4.1 U2 on **physical** host servers, which is required to support the installation and use of VMware vSphere: ICM v5.1 virtual pods on NETLAB+.

**Please verify that your NETLAB+ system is running NETLAB+ version 2013.R1 or later, prior to upgrading your VMware ESXi servers to version VMware ESXi 5.1 (recommended) or VMware ESXi 4.1 U2 (supported).**

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## 1 Introduction

This document provides detailed guidance on performing the installation and configuration of the VMware vSphere: Install, Configure, Manage (ICM) v5.1 pod on the NETLAB+ system.

## 1.1 About the VMware Install, Configure, Manage Course (ICM)

The ICM course will equip trainees with the knowledge, skills, and abilities to build and run a VMware® vSphere™ environment. The ICM course discusses the installation and configuration of VMware ESXi™ hosts and vCenter™ Server. It also focuses on the management of ESXi hosts and virtual machines with vCenter Server. This course will help to prepare IT professionals to achieve the status of VMware Certified Professional (VCP) for vSphere 5.

## 1.2 Using NETLAB+ to Deliver ICM

NDG has partnered with the [VMware IT Academy Program](#) to enable NETLAB+ support of the VMware Install, Configure, Manage (ICM) course. The use of NETLAB+ provides an enormous opportunity for educational organizations seeking a scalable, cost effective solution to offer access to the technology required for the VMware IT Academy Program, which introduces students to VMware technologies and equips them with valuable VMware technical skills.

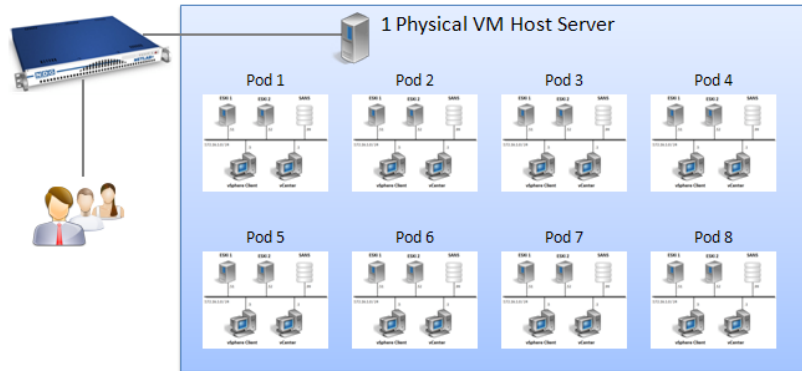
## 1.3 Benefits of NETLAB+ for ICM Delivery

Organizations offering the VMware IT Academy Program curriculum often face a financial challenge. A significant amount of physical hardware is needed in order to provide students with the necessary equipment access both within the classroom and outside the classroom for assignments and practice. This requires a financial commitment that may be beyond the budget of some colleges, universities, and non-profit technical schools.

All lab components in the NETLAB+ ICM pod are 100% virtualized (i.e. ESXi running on ESXi) to achieve a high pod to physical host ratio, at a significantly lower cost point relative to traditional delivery of ICM. Using virtualization and the sharing and scheduling capabilities of NETLAB+, each student (or team of students) has access to their own set of virtual equipment (as shown below), which they may maintain exclusive use of throughout the course.

## Significant Cost Reduction

- Several ICM pods can run on one physical server, on the order of 8 simultaneous pods to 1 physical server on a dual CPU Intel server.



NETLAB+'s use of virtualized lab components results in a significant cost reduction by allowing several pods to run simultaneously on one physical server. This cost reduction can open up the possibility of participating in the VMware IT Academy Program for many organizations who would be unable to afford it otherwise.

In addition to the virtualized environment, NETLAB+ also provides several software features to easily create and manage ICM pods:

- Documentation to guide you through the setup of the ICM course.
- Pre-configured virtual machine templates to assist with setup.
- VMware vSphere ICM lab exercises designed for online delivery via NETLAB+.
- New NETLAB+ software features to support the vSphere ICM course:
  - Integration with vCenter and the vSphere API to automate many virtual machine tasks.
  - A Pod Cloning feature to replicate ICM pods with a few mouse clicks.
  - A Pod Assignment feature to dedicate ICM pods to individual students and teams.
  - Automated ICM Pod Setup and Teardown. NETLAB+ will automatically setup each ICM pod when it is reserved, including automatic setup of virtual networking and remote display settings. At the end of a reservation, virtual networks used by an ICM pod are deleted to conserve hosts resources.

## 1.4 VMware IT Academy Instructor Evaluation System

NDG has worked with VMware to prepare a system for trainers to evaluate the NETLAB+ vSphere ICM course setup.

Prior to setting up the vSphere ICM environment using NETLAB+, we encourage you to conduct some labs on the Instructor Evaluation System. This will help you better understand the environment and the pod setup process.

Organizations meeting any of the following criteria are invited to request an account on the evaluation system:

- VMware IT Academy Program participants
- Organizations who are considering applying to the VMware IT Academy Program
- Current NETLAB+ customers who are evaluating the ICM course
- Potential customers who are considering the purchase of a NETLAB+ system and are evaluating the ICM course

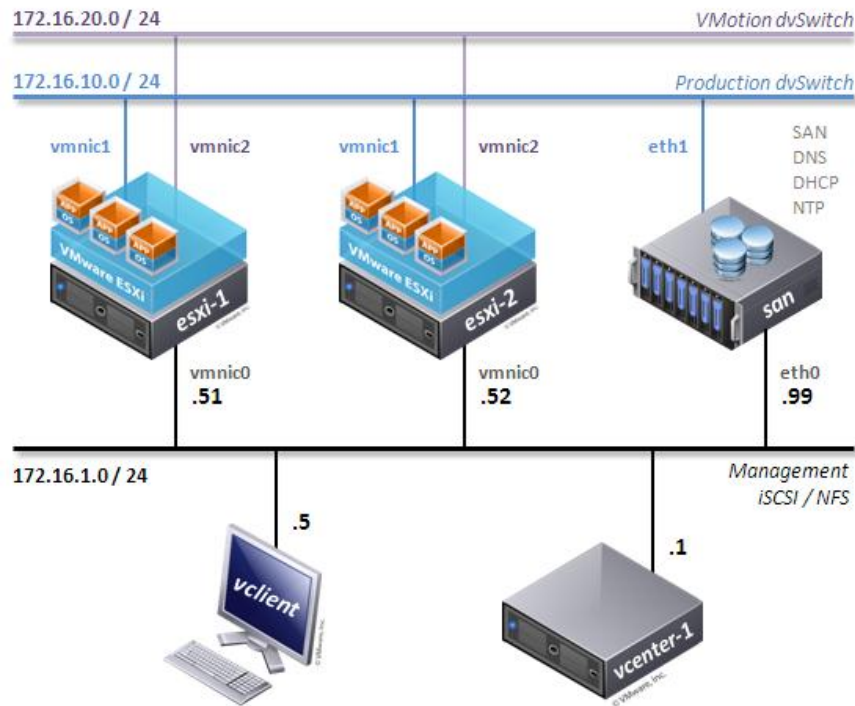
**To request access to the evaluation system:**

[http://www.netdevgroup.com/content/vmita/request\\_evaluation.html](http://www.netdevgroup.com/content/vmita/request_evaluation.html)

**Access is provided on a first-come, first-serve basis for a limited time period.**

## 1.5 Introducing the ICM Pod

The NDG ICM pod is a 100% virtual machine pod consisting of 5 virtual machines. Linked together through virtual networking, these 5 virtual machines provide the environment for a student or team to perform the VMware ICM labs.



Virtual Machine	Role
esxi-1 and esxi-2	Two virtualized ESXi servers.
san	A virtualized Storage Area Network server.
vclient	A virtual Microsoft Windows workstation that runs the VMware vSphere client.
vcenter-1	A VMware vCenter Server Virtual Appliance.

Each ICM pod runs inside a single physical VMware ESXi server. Using the NDG recommended hardware specifications, you can host up to 8 active (Dell R710 infrastructure) or 12 active (Dell R720 infrastructure) ICM pods on a single physical ESXi server.

## 2 Planning

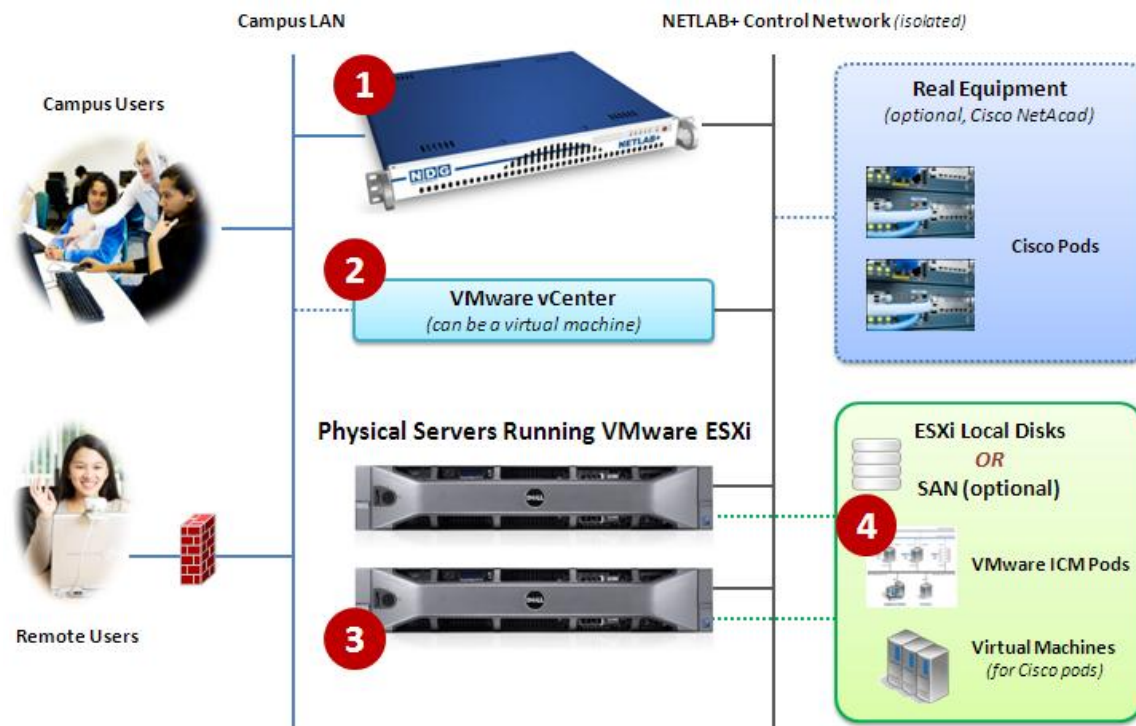
This guide provides specific information pertinent to delivering the ICM 5.1 course. This document assumes you have completed setup of the virtual machine infrastructure. Setup of your VMware infrastructure is addressed in the [NETLAB+ Remote PC Guide Series](#), which includes:

- [Volume 1 - Introduction and Planning](#)
- [Volume 2 - Installing and Configuring VMware vSphere 5.1](#)
- [Volume 2a - Dell R710 BIOS and RAID Configuration](#)
- [Volume 2b - Dell R720 BIOS and RAID Configuration](#)
- [Volume 3 - Configuring the NETLAB+ Virtual Machine Infrastructure](#)
- [Volume 4 - Creating and Configuring Virtual Machines](#)

If you are using ESXi version 4.1 U2, you may refer to the [Remote PC Guide for VMware Implementation Using ESXi versions 4.01 and 4.1 U2 with vCenter](#).

### 2.1 ICM Environment

The following diagram depicts four major components that make up the ICM training environment.



1. The NETLAB+ server provides the user interface for student and instructor access, an interface to manage virtual machines, and software features to automate ICM pod creation. This document assumes you have already setup your NETLAB+ server.
2. VMware vCenter is used to manage your physical VMware ESXi servers, to create virtual machines, and to take snapshots of virtual machines. NETLAB+ communicates with vCenter to perform automated tasks and virtual machine management.
3. Physical VMware ESXi servers host the virtual machines in your ICM pods. The two hosts servers depicted can run up to 16 active ICM pods (Dell R710 infrastructure) or 24 active ICM pods (Dell R720 infrastructure).
4. ICM pods consist of 5 virtual machines that reside on your physical ESXi host server disks.

## 2.2 Setup Tasks

The following is a summary of the setup tasks in this document.

1. Obtain software and templates.
2. Configure templates for the Master Pod.
3. Attach templates to NETLAB.
4. Replicate vSphere ICM pods using the pod cloning feature.
5. Assign vSphere ICM pods to students or instructors.

## 2.3 ICM Pod Creation Workflow

The following list is an overview of the ICM pod setup process. This assumes you do not have a Storage Area Network (SAN) and you will be storing vSphere ICM pods on each VMware server's local disk. SAN storage for virtual machines is not currently supported by NETLAB+.

1. Virtual machine templates for SAN, Windows, and Linux VMs are distributed by CSSIA and installed on vCenter.

To request access to the preconfigured virtual machine templates from CSSIA:

1. Go to the CSSIA Resources page: <http://www.cssia.org/cssia-resources.cfm>.
2. Select **VM Image Sharing Agreement – Image Sharing Agreement**.
3. Select **VM Image Sharing Agreement** to open the request form.
4. Follow the instructions to complete and submit the form.



2. Master VMs are created from each template VM. The master VMs are added to a Master pod. A *Golden\_Snapshot* of the Master pod is taken, which becomes the foundation to clone vSphere ICM User pods.
3. The NETLAB+ pod cloning feature is used to quickly create copies from the vSphere ICM Master Pod on the first VMware host.
4. A full replica of the vSphere ICM Master Pod on Host A is made on Host B, using the NETLAB+ Pod Cloning Feature.
5. The cloning feature is used to quickly create vSphere ICM pods from the vSphere ICM Master Pod on Host B.

Without a Storage Area Network (SAN), vSphere ICM pods on Host B cannot be linked to Host A. This is because Host B cannot access Host A's local disks (and vice-versa). Therefore, we create one Master ICM Pod per host. SAN storage for virtual machines is not currently supported by NETLAB+.

## 2.4 ESXi Host Server Requirements

Please refer to the NDG website for specific ESXi host requirements to support ICM delivery: <http://www.netdevgroup.com/content/vmita/requirements/>

The number of **active** ICM pods that can be used simultaneously depends on the NETLAB+ product edition and the number of VMware ESXi host servers meeting the hardware requirements specifications below. The following table shows the number of **active** pods (students or teams) that can be scheduled at the same time. **You may provision more ICM pods than the active limit.**

NETLAB+ Edition	Number of VMware ESXi Servers	Active ICM Pods (Dell R710/Dell R720)
Academy Edition	1	8/12
	2	16/16
Professional Edition	3	24/32
	4	32/32

For additional information regarding ESXi hardware requirements, please refer to the [Remote PC Support](#) page.

## 2.5 NETLAB+ Requirements

Installation of VMware ICM pods as described in this guide requires that your NETLAB+ system is equipped with software version NETLAB+ version 2013.R1 or later.

Previous versions of NETLAB+ do not support the use of VMware ESXi 5.1 (recommended) or VMware ESXi 4.1 U2 (supported) on the physical host servers, which is required to support the installation and use of VMware ICM Pods on NETLAB+.

Please verify that your NETLAB+ system is running NETLAB+ version **2013.R1** or later, prior to upgrading your VMware ESXi servers to VMware ESXi 5.1 (recommended) or VMware ESXi 4.1 U2 (supported).

## 2.6 vCenter Server Requirements

Starting with software version 2011.R1V, NETLAB+ provides a Virtual Machine Inventory feature that can communicate with VMware vCenter Server. This software has many features to assist the administrator with installing and configuring the ICM Pod.

VMware vCenter 5.1 (or VMware vCenter 4.1) is a required component for the NETLAB+ infrastructure to manage ICM 5.1 virtual pods and ICM 5.1 course delivery. This is separate from the virtual vCenter 5.1 Appliance used inside the pod.

For more information regarding vCenter Server requirements, please refer to the [Remote PC Support](#) page.

## 2.7 Software Requirements

This documentation reflects using VMware ESXi 5.1 (recommended) or VMware ESXi 4.1 U2 (supported) for the physical host servers. Although the NETLAB+ system software will work with ESXi 4.01 servers, 4.1 U2 is the minimum required for the ICM v5.1 course and ICM v5.1 pod deployment.

Please be aware that VMware ESXi / vCenter **5.0** is not supported for the physical host servers.

For the purpose of software licensing, each virtual machine is treated as an individual PC or server. Please refer to the specific vendor license agreements (and educational discount programs, if applicable) to determine licensing requirements for your virtual machines' software, server software, operating systems, and applications.

The following software is required for virtual machines inside the ICM 5.1 pod.

Lab Virtual Machines	OVA Template VM	Software	Source
<b>esxi-1</b>	CSSIA.org	VMware ESXi 5.1	(preinstalled in CSSIA OVA)
<b>esxi-2</b>	CSSIA.org	VMware ESXi 5.1 (ISO)	VMware Free Trial
<b>san</b>	CSSIA.org	Openfiler	CSSIA.org
<b>vclient</b>	CSSIA.org	Windows 7	CSSIA.org
<b>vcenter-1</b>	CSSIA.org	VMware vCenter 5.1 Server Appliance	CSSIA.org

The **esxi-1** virtual machine is downloaded from CSSIA. It already contains pre-installed ESXi 5.1 software that should be used for this VM.

The **esxi-2** virtual machine is downloaded from CSSIA. It does NOT have ESXi 5.1 pre-installed since this is part of lab exercise 0. For this VM, you will download the ISO image for ESXi 5.1 from the e-academy website and make the ISO available to esxi-2 virtual machine pod instances.

The **san** virtual machine is downloaded from CSSIA. It already contains the ISO necessary for installation during the labs.

The **vclient** virtual machine is downloaded from CSSIA. It already has Windows Server 2003 R2 installed, which is licensed through the MSDN-AA program. No additional setup is necessary.

The **vcenter-1** virtual machine uses the VM vCenter v5.1 Server Appliance and is downloaded from CSSIA. This software is used without preconfiguration, except for the setup of a fixed MAC address on the Ethernet interface.

## 2.8 VMware Licenses

A renewable vSphere Advanced license for your physical ESXi Host servers and vCenter Server is available from the VMware IT Academy Program. vSphere Advanced is compatible with all NETLAB+ features.

"Lab Machines" refers to the virtualized VMware ESXi and vCenter virtual machines inside the ICM pods. 90-day Enterprise licenses for Lab Machines are available to VMware IT Academies from VMware Communities.

Please refer to the Licensing PDF found at the following link for more information.  
<http://www.netdevgroup.com/support/documentation/VMware%20VMAP-vITA%20Licensing%20Chart.pdf>

## 2.9 Networking Requirements

To accommodate the movement of large VMs and ISO disk images from one host to another, a Gigabit Ethernet switch is recommended to interconnect your NETLAB+, vCenter Server system, and ESXi host systems.

Three standard networking models are used to interconnect your servers, which are described in detail in the *Networking Models* section of [Remote PC Guide Series, Volume 1 - Introduction and Planning](#).

## 2.10 Using Storage Area Networks

NDG performs all testing on servers with Internal Direct Attached Storage (i.e. RAID arrays and RAID controllers directly attached to each ESXi host server). This is the configuration that most academic institutions are likely to find affordable and adopt.

A Storage Area Network (SAN) is a dedicated network that provides access to consolidated, block level data storage that can be used for disk storage in a VMware vSphere environment.

**Currently NDG does not provide benchmarks, guidance or troubleshooting for SAN configurations.** Our documentation may show an optional SAN in the environment; however this is not a recommendation or requirement to deploy a SAN.

**NDG benchmarks and capacity planning guidance do not account for the additional latencies introduced by SAN.**

- When compared to Direct Attached Storage, a SAN may introduce additional I/O latency between ESXi server and disk. Therefore, a SAN may reduce the number of active VMs you can run on an ESXi host.

- If you deploy a SAN, you should perform your own benchmarks and determine the number of active VMs you can host on your ESXi server. Your mileage may vary.
- Always configure NETLAB+ Proactive Resource Awareness to ensure that the number of VMs that can be activated will remain within your predetermined performance limits.

## 2.11 ICM Pod Storage Requirements

You should budget **20 gigabytes** for each ICM master pod and each user pod instance.

The datastore containing an ICM pod must be accessible to the VMware host to which it is assigned, as either directly attached local storage or a Storage Area Network (SAN).

Details of the storage requirements for each of the lab virtual machines in the ICM pod are provided in the table below. Some fluctuation in the numbers may occur.

Lab Virtual Machines	Master Pod at Lab 0 (using full clones)	User Pod after Last Lab (using linked clones)
esxi-1	452.2 MB	256.48 MB
esxi-2	109.7 KB	688.47 MB
san	2.41 GB	7.67 GB
vcenter-1	5.87 GB	4.27 GB
vclient	7.32 GB	3.61 GB
<b>Minimum Used</b>	<b>16.05 GB</b>	<b>16.35 GB</b>
<b>Total Recommended</b>	<b>20.00 GB</b>	<b>20.00 GB</b>

### 3 Obtaining Software and Licenses

The license and software information for your physical ESXi hosts can be found in the *VMware ESXi Planning* section of the [Remote PC Guide Series Volume 3 - Configuring the NETLAB+ Virtual Machine Infrastructure](#).

#### 3.1 Downloading OVF files

Virtual machine template files (OVF files) for the virtual machines **esxi-1**, **esxi-2**, **san**, and **vclient** in ICM pods have been created. These files are available through CSSIA (see section 2.3).

It is recommended that you request the preinstalled vSphere ICM virtual machines from CSSIA.

Due to the size of the OVF templates, it is advisable to download these files to a system that resides on the same network as your VM infrastructure.

#### 3.2 Download the ESXi 5.1 ISO and vSphere Client executable

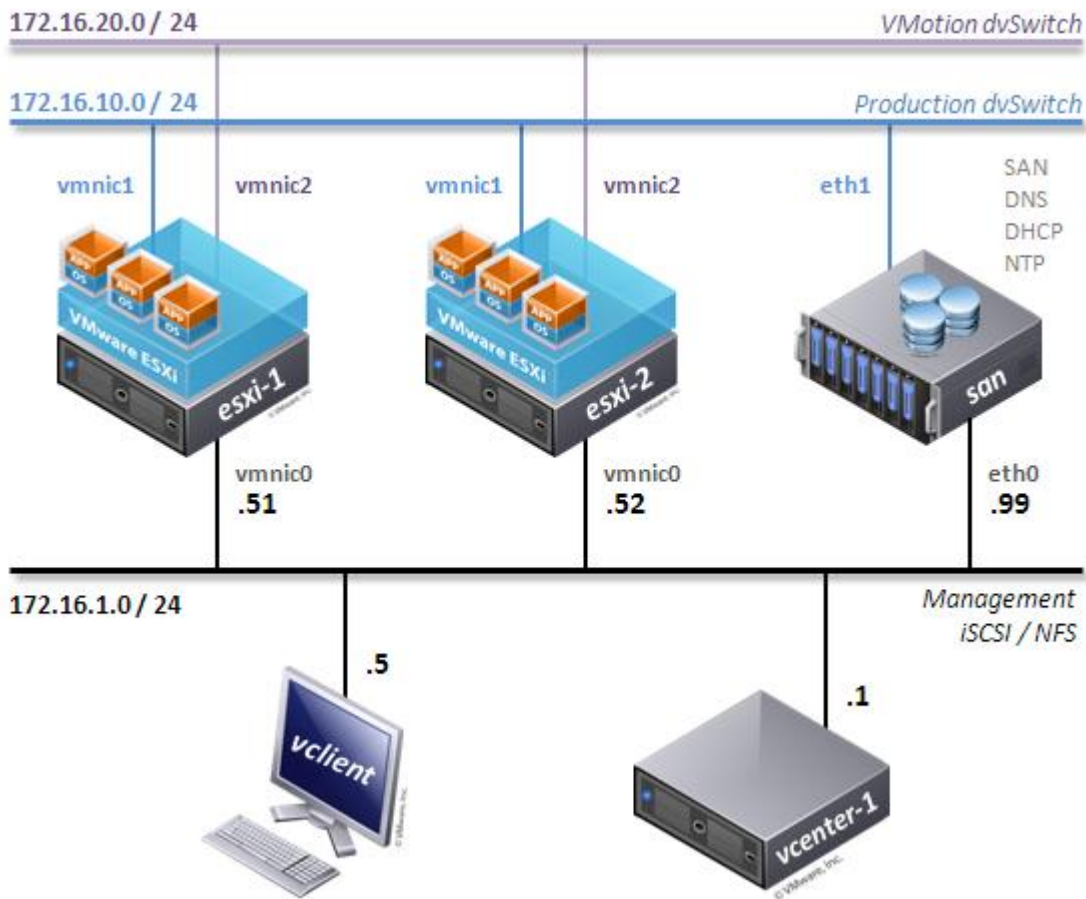
Download the ISO for the **esxi-2** lab virtual machines. This is used in lab 0 when the user installs ESXi on the esxi-2 virtual machine. Please note that the esxi-1 virtual machine from CSSIA has ESXi 5.1 pre-installed.

1. Open [www.vmware.com](http://www.vmware.com) in a browser.
2. Select **Products** at the top and select **VMware vSphere Hypervisor** from the menu. It can be found under the heading **Free Products**.
3. Click on **Download** on the left hand side of the screen.
4. Sign in with your VMware account. If you do not have one, please register.
5. Once logged in, you will be presented with options for download. Click on the + sign next to Binaries under Option 2. Scroll down until you find the **ESXi 5.1 Installable (CD ISO)**.
6. Click on **Manually Download**.
7. Be sure to record your VMware vSphere Hypervisor 5 License key.
8. Save the file to your desktop.
9. You will upload this image for your lab virtual machines.
10. Click on Manually Download next to the VMware vSphere Client.
11. Save the file to your desktop.

## 4 VMware ICM Master Pod Configuration

This section will walk you through creating and adding a Master VMware ICM Pod to the NETLAB+ system. The Master VMware ICM Pod will be used to quickly create copies of the ICM pod that can be assigned to classes and students.

Below is a pod topology diagram that will be referenced during this installation and configuration. The VMware ICM Pod consists of five virtual machines: two ESXi servers, a SAN server, a vClient machine, and a vCenter server.



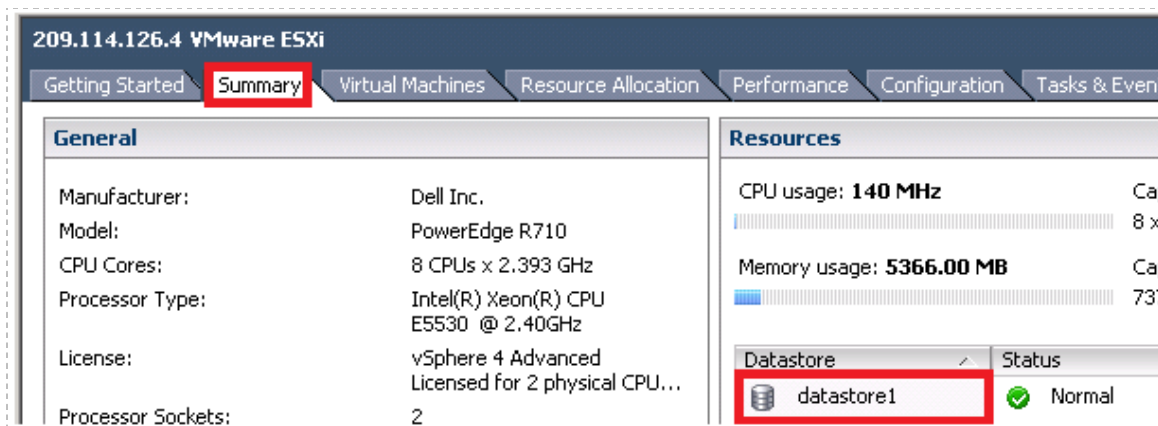
## 4.1 Installing ISOs to Datastore

This section will assist you in preparing the local datastore with the ISOs needed for the lab machines.

Software	Source
VMware ESXi 5.1 ISO	Downloaded - VMware Free Trial

To upload the ISOs:

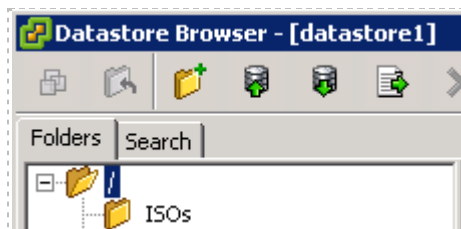
1. In vCenter, click on your host in the inventory.
2. Click the **Summary** tab at the top.



3. Right-click the datastore on the right hand side.
4. Click **Browse Datastore**.
5. Click the new folder icon at the top.



6. Name the new folder **ISOs**.



7. Double-click the new folder.
8. Click the upload files icon at the top.





9. Select **upload file**.
10. Locate your ISO images and click **Open**.
11. Repeat these steps for both ISO images.

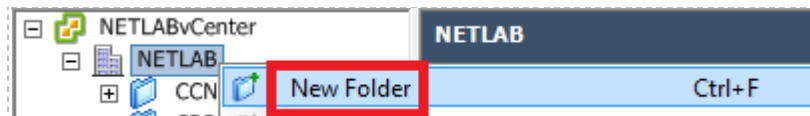
## 4.2 Deploying Virtual Machine Templates (OVA Files)

The OVA files that you downloaded from CSSIA (section 3.1) must be deployed to your host server.

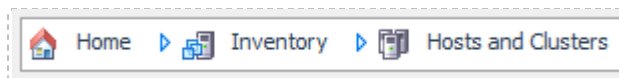
1. Open the vClient on your administration machine where you downloaded the files from NDG. Connect to your vCenter Server.
2. Select **VMs and Templates** in the address bar.



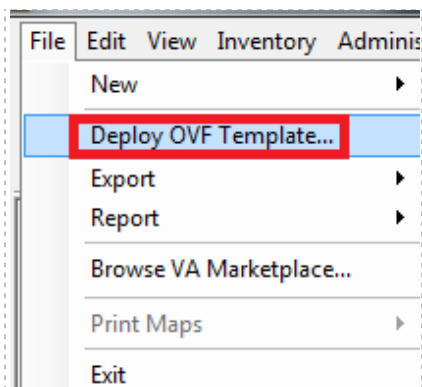
3. Right-click on the **NETLAB** datastore, and select **New Folder**.



4. Name the new folder “**ICM Pod Templates**”. This is where we will store the virtual machine templates as a backup.
5. Select **Hosts and Clusters** in the address bar.



6. Click on the first ESXi Host Server.
7. Click on **File -> Deploy OVF Template**.



8. Click on **Browse** and locate the **san\_ICM\_51\_XXXXXX.ova** file you downloaded from CSSIA. Click **Next** to continue.
9. On the OVF Template Details window, click **Next**.

10. On the Name and Location window, change the name to **ICM\_5\_san\_template** and select the **ICM Pod Templates** folder you created earlier. Click **Next**.
11. On the Disk Format window, select the provisioning format and Click **Next**.

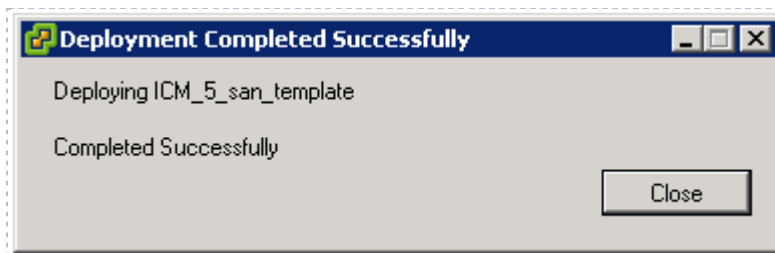
**IMPORTANT:**

- a. Use **Thin** provisioning for all virtual machines.

12. On the Network Mapping window, leave the default networks. Click **Next**.

Network mapping is handled automatically by the NETLAB+ system during pod creation.

13. On the Ready to Complete window, confirm the information and click **Finish**.
14. vCenter will begin deploying the virtual machine. This may take some time depending on the speed of your connection, HDDs, etc. When completed, click on **Close**.

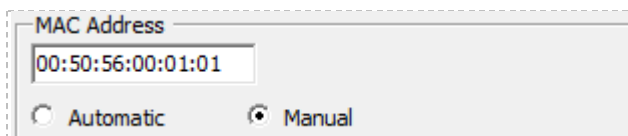


15. Repeat steps 6-14 for the remaining esxi-1, esxi-2, vcenter-1, and vclient OVA files. Be sure to choose **Thin Provisioned format** when prompted. Change the names to **ICM\_5\_esxi-1\_template**, **ICM\_5\_esxi-2\_template**, **ICM\_5\_vcenter-1\_template**, and **ICM\_5\_vclient\_template**.

### 4.3 Modify vCenter Appliance Settings

Modify the virtual machine settings for the vCenter Appliance.

1. Right click the vCenter Appliance virtual machine in the inventory and select **Edit Settings**.
2. Click on Memory, change the text box to **4 GB**.
3. Click on the network adapter.
4. When the right panel updates, select **Manual** under the **MAC address** settings and enter **00:01:01**.



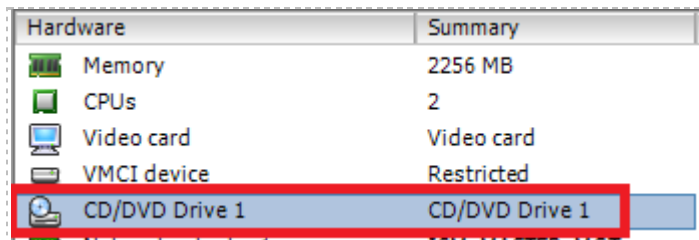
If this step is skipped, cloned instances of this virtual machine may not function properly.

5. Click **OK**.

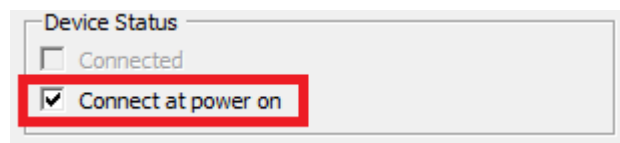
#### 4.4 Modify the esxi-2 virtual machine

Modify the settings for the esxi-2 virtual machine.

1. Right-click on the virtual machine, **ICM Master esxi-2**, under your first ESXi host and select **Edit settings...**
2. Click on **CD/DVD Drive 1** under Hardware.



3. Under Device Type on the right, click on **Datastore ISO File**.
4. Click **Browse**. Select *your datastore* -> ISOs -> **VMware-VMvisor-Installer-5.1.0-XXXXXX.x86\_64.iso**. Click **OK**.
5. Make sure **Connect at power on** is selected under Device Status.

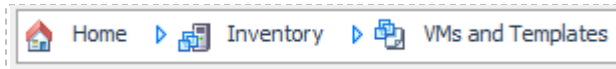


6. Click on **OK** to save changes.

## 4.5 Convert Virtual Machines to Templates

The deployed OVA files will be displayed in your host server's inventory as Virtual Machines and should be converted into templates. This will ensure that the original OVA files are not accidentally modified.

1. Select **VMs and Templates** in the address bar.



1. Right-click on your **ICM\_5\_esxi-1\_template** virtual machine and choose **Template > Convert to Template**.
2. Right-click on your **ICM\_5\_esxi-2\_template** virtual machine and choose **Template > Convert to Template**.
3. Right-click on your **ICM\_5\_san\_template** virtual machine and choose **Template > Convert to Template**.
4. Right-click on your **ICM\_5\_vcenter-1\_template** virtual machine and choose **Template > Convert to Template**.
5. Right-click on your **ICM\_5\_vclient\_template** virtual machine and choose **Template > Convert to Template**.
6. When the tasks complete, you should have five templates and no virtual machines in your inventory.

Aside from the configuration of your master lab virtual machines, all remaining virtual machine management for the ICM Pods will be conducted through your NETLAB+ system.

## 4.6 NETLAB+ Virtual Machine Infrastructure Setup

The NETLAB+ Virtual Machine Infrastructure setup is described in the following sections of [Remote PC Guide Series Volume 3 - Configuring the NETLAB+ Virtual Machine Infrastructure](#):

- *Registering a Virtual Datacenter in NETLAB+*
- *Adding ESXi hosts in NETLAB+*
- *Proactive Resource Awareness*

It is important to configure Proactive Resource Awareness to limit the number of active ICM pods per physical ESXi host. The following values are recommended to achieve an 8 to 1 ICM pod-to-host ratio using physical servers that meets or exceed the NDG recommended specifications for ICM delivery.

Maximum Running VMs	40
Maximum Virtual CPUs	64
Maximum Memory Usage	115136 Megabytes <sup>1</sup>

<sup>1</sup>This number may be slightly larger than physical memory for ICM. In practice, the maximum memory used under peak conditions will be 10% to 20% less than physical due to VMware memory management techniques.

## 4.7 NETLAB+ Virtual Machine Inventory Setup

This section will guide you in adding your templates to the Virtual Machine Inventory of your NETLAB+ system.

1. Login into your NETLAB+ system using the administrator account.
2. Select the Virtual Machine Infrastructure link.



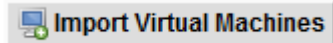
3. Click the Virtual Machine Inventory link.



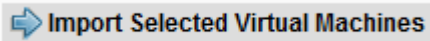
### Virtual Machine Inventory

Import, clone, and manage the inventory of virtual machines to be used with NETLAB+.

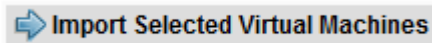
- Click the Import Virtual Machines button.



- Select the check box next to your ICM Template esxi-1, esxi-2, vclient, vcenter-1, and san virtual machines and click Import Selected Virtual Machines.



- When the Configure Virtual Machines window loads, you can set your virtual machine parameters.
  - Check the drop down box for the correct operating system for each imported virtual machine. The esxi-1 and esxi-2 templates will not auto-detect their operating systems. Choose VMware ESX(i) from the drop down boxes.
  - Add any comments for each virtual machine in the box to the right.
  - Verify your settings and click Import Selected Virtual Machines.



- Click OK when the virtual machines have finished loading.
- Verify that your virtual machines show up in the inventory.

**Virtual Machine Inventory**

[Admin](#) [Logout](#)

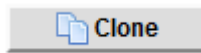
Import, clone, and manage the inventory of virtual machines to be used with NETLAB+.

Virtual Machine Name	Operating System	Role	Datacenter	Runtime Host	Host Group	CPUs
ICM_5_esxi-1_template	VMware ESX(i)	Template	NETLAB			2
ICM_5_esxi-2_template	VMware ESX(i)	Template	NETLAB			2
ICM_5_san_template	Linux	Template	NETLAB			1
ICM_5_vcenter-1_template	Linux	Template	NETLAB			2
ICM_5_vclient_template	Windows XP	Template	NETLAB			1

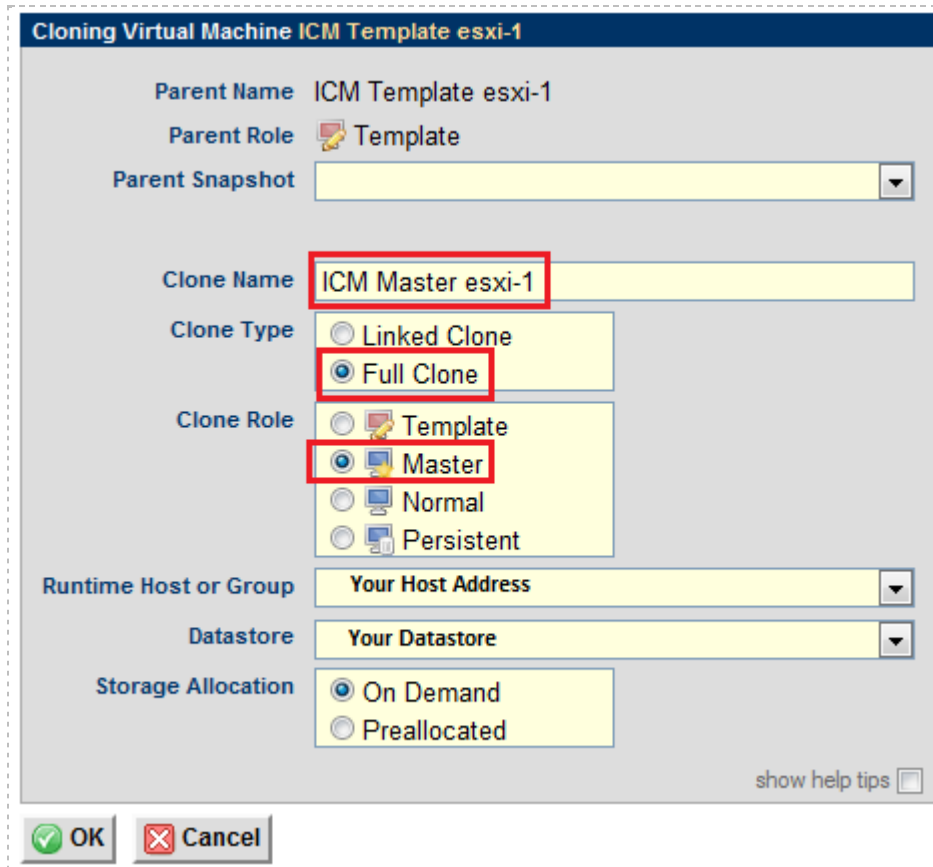
#### 4.8 Create Master ICM Virtual Machines for Pod Configuration

This section will assist you in creating master ICM virtual machines. These VMs will be used in section 5 for software configuration.

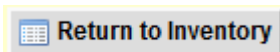
1. Click on **ICM Template esxi-1**.
2. Click the **Clone** button.



3. Use **ICM Master esxi-1** as the Clone Name.
4. Select the radio button next to **Full Clone** in the Clone Type box.
5. Select the radio button next to **Master** in the Clone Role box.
6. Select your first host server and datastore from the drop down boxes.
7. Verify that your settings resemble the picture below.



8. Click **OK**.
9. Click **Return to Inventory**.



10. Repeat steps 1-9 for the esxi-2, san, vclient, and vcenter-1 templates, assigning the following clone names (case sensitive):

- **ICM Master esxi-2**
- **ICM Master san**
- **ICM Master vclient**
- **ICM Master vcenter-1**

Some cloning processes will take longer than others depending on your network connection and hard drive speeds.

#### 4.9 Install the Master VMware ICM Pod

This section will assist you in adding the VMware ICM Pod to your NETLAB+ system.

1. Add a VMware ICM Pod to your NETLAB+ system.
  - a. Login into NETLAB+ with the administrator account.
  - b. Select the **Equipment Pods** link.

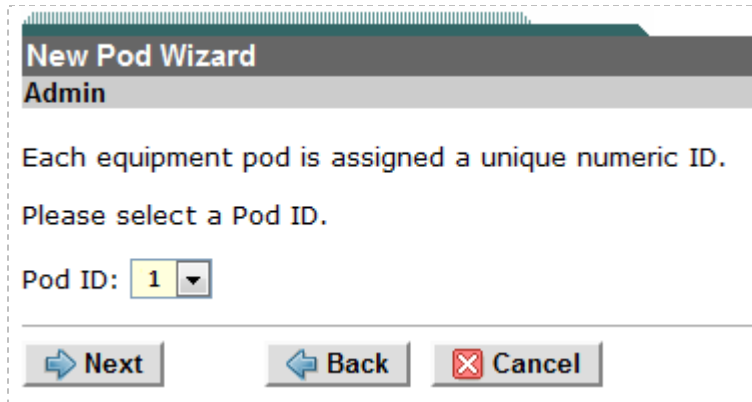


- c. Select **Add a Pod**.

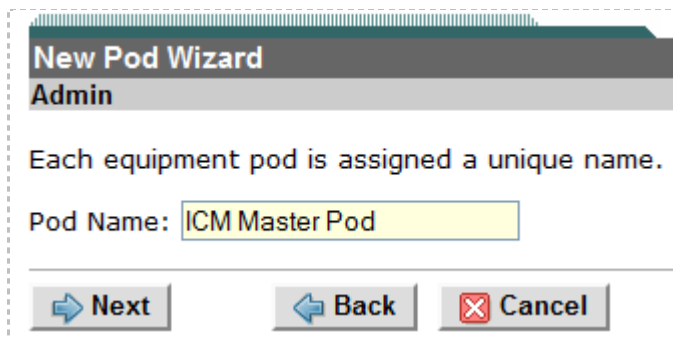


- d. The New Pod Wizard will now help you add an equipment pod to your system.
2. Add a VMware ICM Pod.
  - a. In the New Pod Wizard, click **Next** to continue.
  - b. When prompted, select the VMware ICM Pod and click **Next** to continue.
3. Select a Pod ID number. It is best practice to use a block of sequential ID numbers for the number of ICM pods you are going to install. The Pod ID number determines the order in which the ICM pods will appear in the scheduler. Click **Next** to continue.

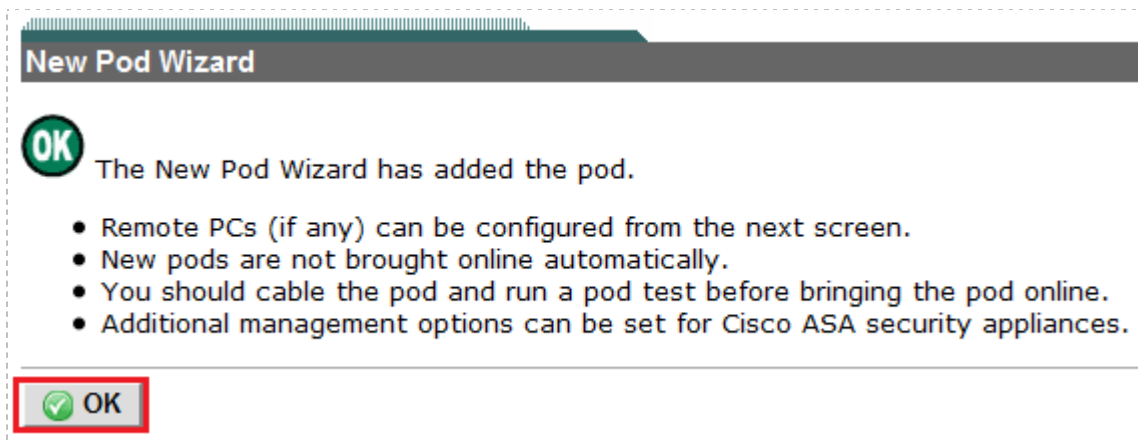














4. Assign the pod a unique Pod Name. Click **Next** to continue.



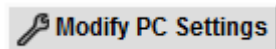
5. The wizard will add the pod to NETLAB+. When completed, click **OK** to finish.



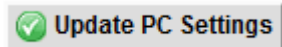
- Click on the Magnifying Glass icon next to the vclient. Please note that your PC IDs will not match the below graphic.

POD 1000 - PCs AND SERVERS (click the GO buttons to reconfigure)					
GO	NAME	PC ID	STATUS	TYPE / VM	OPERATING SYSTEM
	 vclient	239	ONLINE	ABSENT	
	 vcenter-1	240	ONLINE	ABSENT	
	 esxi-1	241	ONLINE	ABSENT	
	 esxi-2	242	ONLINE	ABSENT	
	 san	243	ONLINE	ABSENT	

- Click on Modify PC Settings

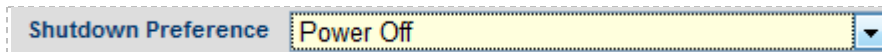


- Change the PC Type drop down box to **Use Virtual Machine Inventory**.
- In the Base Virtual Machine window, select your **ICM Master vclient** virtual machine.
- Review the information on the screen and click **Update PC Settings**.



- Click Show Pod.
- Repeat Steps 6-11 for the vcenter-1, esxi-1, esxi-2, and san virtual machines.

For esxi-1 and esxi-2, change the Shutdown Preference to **Power Off** before you click on Update PC Settings.



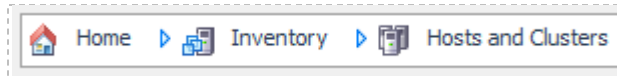
- When all five virtual machines' settings have been updated, click on **Online** to bring the pod online.
- Click on Admin at the top left of the screen and then click Logout.

#### 4.10 Create Snapshots for the ICM Master VMs.

In order to proceed with pod cloning, snapshots must be created for the five ICM Master virtual machines.

Verify that all VMs are powered off before taking snapshots.

1. Open the vClient on your management workstation. Connect to your vCenter Server.
2. Select **Hosts and Clusters** in the address bar.



3. Right-click on the virtual machine, **ICM Master esxi-1** and select **Snapshot > Take Snapshot**.
4. Enter **Golden\_Master** as the Snapshot Name.
5. Enter a description. It is a good idea to include the date in the description for later reference.
6. Click **OK**.
7. Repeat Steps 3-6 for **ICM Master esxi-2**, **ICM Master san**, **ICM Master vcenter-1**, and **ICM Master vclient**.
8. When all tasks have completed, log out of the vClient software.

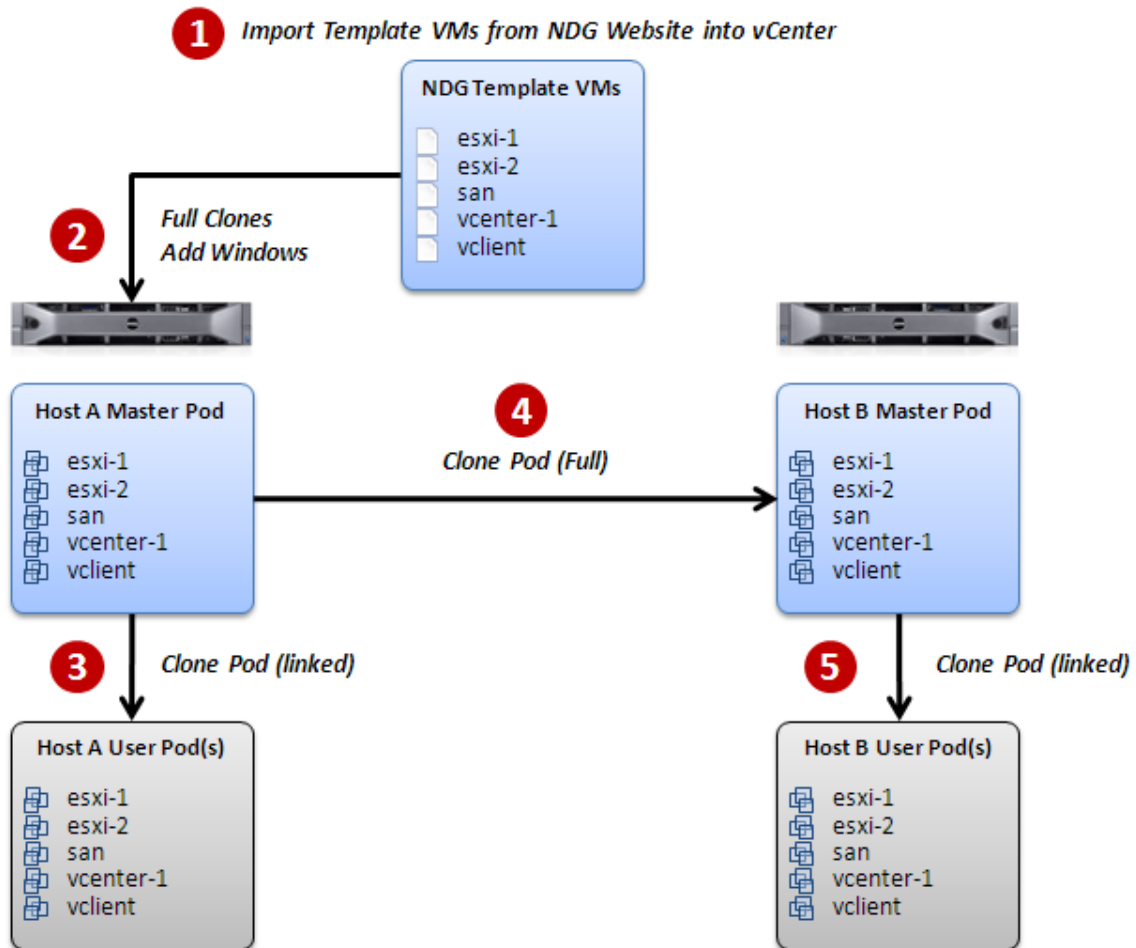
At this point, it is best practice to login into the test account and schedule the ICM Master Pod. Click on the graphic for each virtual machine. The following should be true:

esxi-1	Should boot fully, displaying a preconfigured IP address of 172.16.1.51.
esxi-2	Should boot to the ESXi installation screen.
san	Should boot fully to a login prompt.
vclient	Should boot to the desktop and have a link to the Openfiler, shortcut to Google Chrome or Firefox, have an icon on the desktop to install the vClient software, have a DEPLOY.CAB icon on the desktop and a WinSCP icon as well.
vcenter-1	Should boot to the login screen.

**It is important to revert to the snapshots you took of the Master virtual machines after scheduling the master pod at this point. It is also important to set your Master pod to an offline state.**

## 5 Pod Cloning

This section will help you create multiple ICM student pods.



At this point, you have already completed steps 1 and 2 and have created a Master ICM Pod on one system.

The following sections describe the NETLAB+ pod cloning feature used to create student pods on one or two host systems.

## 5.1 Linked Clones and Full Clones

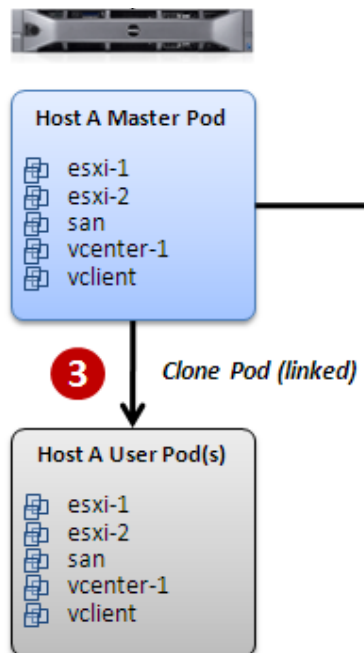
NETLAB+ can create *linked clones* or *full clones*.

A **linked clone** (or linked virtual machine) is a virtual machine that shares virtual disks with the parent (or master) virtual machine in an ongoing manner. This conserves disk space, and allows multiple virtual machines to use the same software installation. Linked clones can be created very quickly because most of the disk is shared with the parent VM.

A **full clone** is an independent copy of a virtual machine that shares nothing with the parent virtual machine after the cloning operation. Ongoing operation of a full clone is entirely separate from the parent virtual machine.

## 5.2 Creating User Pods on the First Host

The following section describes how to create ICM user pods on the same VMware Host system that holds your Master Pod's virtual machines. In this scenario, we will create linked virtual machines using the NETLAB+ pod cloning utility.

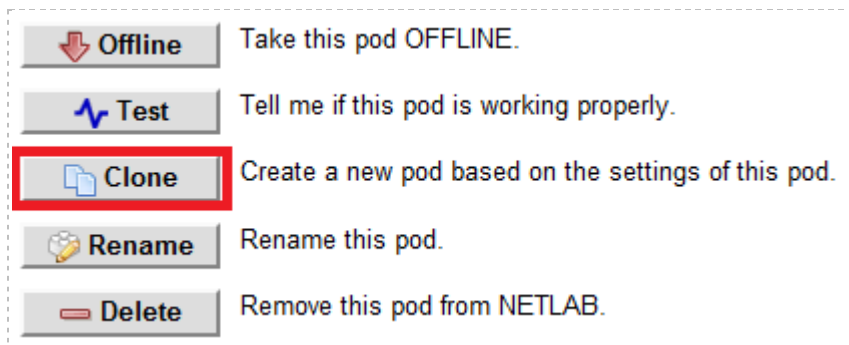


1. Login into NETLAB+ with the administrator account.

2. Select the **Equipment Pods** link.



3. Click on your ICM Master Pod.
4. Click the Clone button to create a new pod based on the settings of this pod.



5. Select the New Pod ID. It is advised to keep the pods in numerical order. If the pod IDs are not in numerical order, they will not show up in the scheduler in numerical order.
6. Click **Next**.
7. Enter a New Pod Name. For example, VMware ICM Pod 1. Click **Next**.
8. When the action has finished processing, you are presented with a settings screen.

Source Pod ID 1000  
 Source Pod Name ICM Master Pod  
 New Pod Type VMware ICM Pod (2E1V)  
 New Pod ID 1004  
 New Pod Name POD 1004

PC Name	Source Virtual Machine	Source Snapshot	Clone Name	Clone Type	Clone Role	Runtime Host or Group	Clone Datastore	Storage Allocated
vclient	ICM Master vclient	Golden Master	POD 1004 vclient	Linked	Persistent	Host a.b.c.d	datastore1	On Demand
vcenter-1	ICM Master vcenter-1	Golden Master	POD 1004 vcenter-1	Linked	Persistent	Host a.b.c.d	datastore1	On Demand
esxi-1	ICM Master esxi-1	Golden Master	POD 1004 esxi-1	Linked	Persistent	Host a.b.c.d	datastore1	On Demand
esxi-2	ICM Master esxi-2	Golden Master	POD 1004 esxi-2	Linked	Persistent	Host a.b.c.d	datastore1	On Demand
san	ICM Master san	Golden Master	POD 1004 san	Linked	Persistent	Host a.b.c.d	datastore1	On Demand

9. The three key columns for this Master Pod clone are Source Snapshot, Clone Type and Clone Role. The following settings should be applied to all 5 virtual machines:
  - a. Source Snapshot should be set to the **Golden\_Master** snapshot you created previously.
  - b. Under Clone Type, click the dropdown menu and verify that **Linked** is selected.
  - c. Under Clone Role, click the dropdown menu and select **Persistent**. A persistent VM does not reset to a snapshot after each lab reservation. Since each ICM lab builds on the next, we want the state of each VM to persist from one lab reservation to the next.
10. When you are done changing settings, Click **Clone Pod**. This should complete within a minute as we are creating linked virtual machines.
11. When the pod clone process is finished, click **OK**.
12. If you want to dedicate this pod to a particular class, team, or student, use the Pod Assignment feature. For details, see the [Pod Assignment Guide](#).
13. Click the **Online** Button in the Pod Management page to activate the pod.

The user pod is now can now be reserved. When the reservation becomes active, NETLAB+ will automatically configure virtual machines and virtual networking for your new ICM pod.

The Golden Snapshot is the starting point for all ICM pods. We recommend that you reserve the 1st ICM pod and conduct some ICM labs to make sure the Golden Snapshot is correct. You should correct any defects on the Master ICM pod and Golden Snapshot before creating additional pods.

You may repeat the pod cloning process to create up to seven more ICM user pods on this host.

**Time Saver:** If you clone the 1st ICM user pod instead of the Master pod, the defaults will all be set correctly, and you will not have to change the Clone Type and Clone Role each time. NETLAB+ will still assume you want to link to the Master VMs as Masters are ranked higher than Normal or Persistent VMs in the default pod cloning selections.

### 5.3 Creating Pods on a Second VMware Host (Overview)

If you are planning to run 16 Pods you may need to create a Master Pod on your second host server. If you only have only one host server or a SAN, you may skip this section.

It is assumed that most Academic institutions will choose local storage as a SAN may be cost prohibitive and/or perform poorly when 40 virtual machines per host are accessing the SAN. For information on use of a SAN, please see the *Storage Area Networks* section of the [Remote PC Guide Series, Volume 1 - Introduction and Planning](#).

VMware ESXi servers can access virtual machines on a *shared datastore*, or *local datastore*.

A *shared datastore* is disk storage that resides on a Storage Area Network (SAN). All VMware hosts connect to the SAN via fiber or Ethernet.

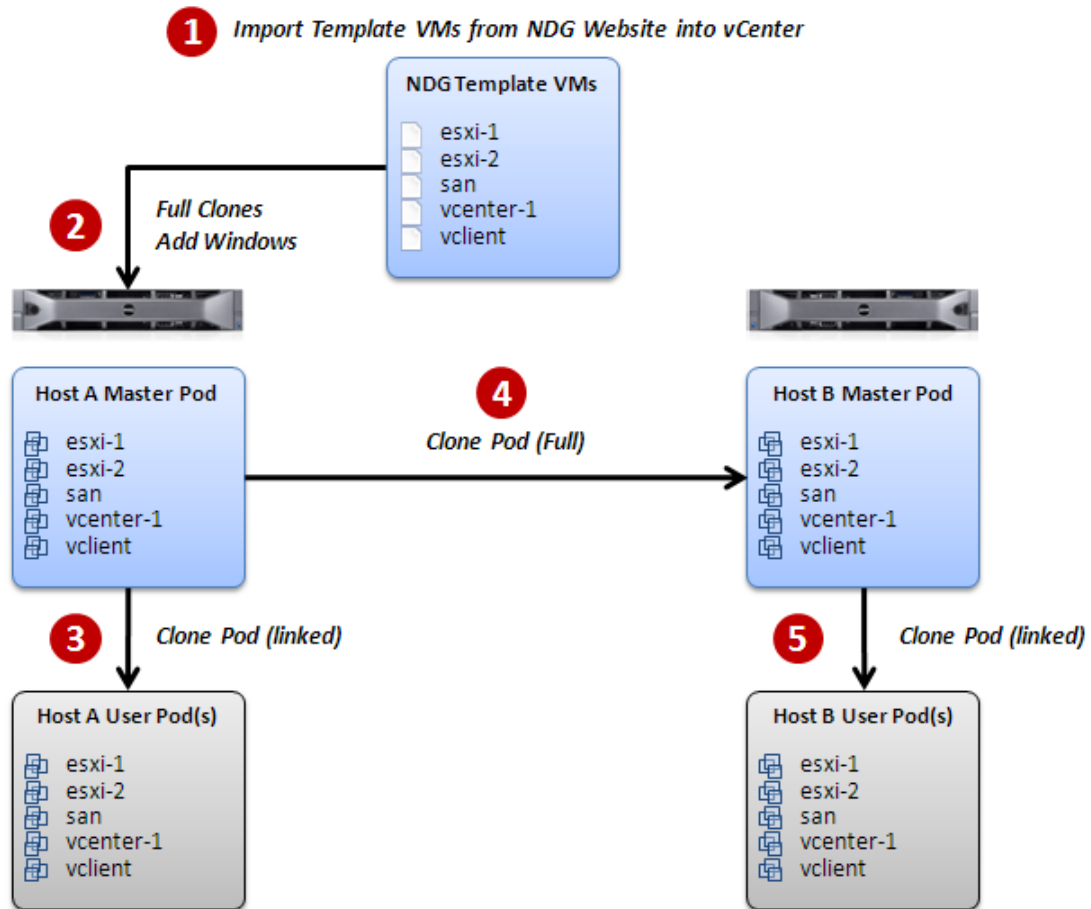
A *local datastore* is disk storage that resides on each VMware hosts server. Only the host server itself can access its local datastore. Given two ESXi hosts (A and B), Host A cannot access Host B's local disks, and Host B cannot access Host A's local disks. In addition, you cannot create linked virtual machines on Host B, which share disks files on Host A (and vice-versa).

In summary, all pods that share local storage must reside on the same host. Therefore, if your Master Pod resides on the local datastore of the 1st VMware server, you will need to make a full copy that Master Pod on your 2nd VMware hosts server.

- User pods on the 1st host server will be linked to the Master Pod on the 1st host server.
- User pods on the 2nd host server will be linked to the Master Pod on the 2nd host server.



This process is depicted in steps 3, 4 and 5 on the following diagram.



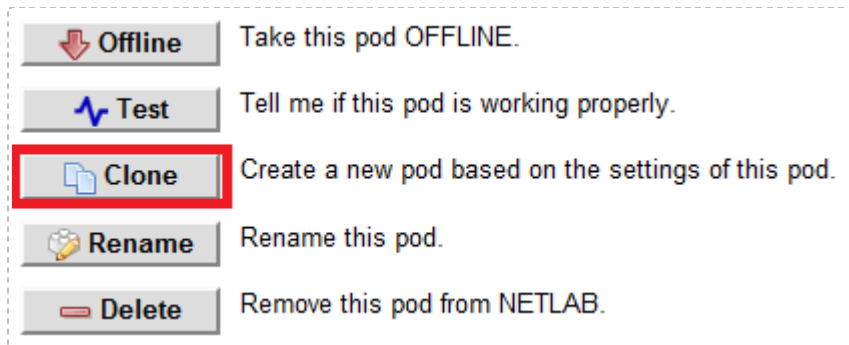
### 5.3.1 Copying Your Master Pod to the 2nd VMware ESXi Host

For this task, we will use the pod cloning utility to copy our Master Pod to the 2nd host.

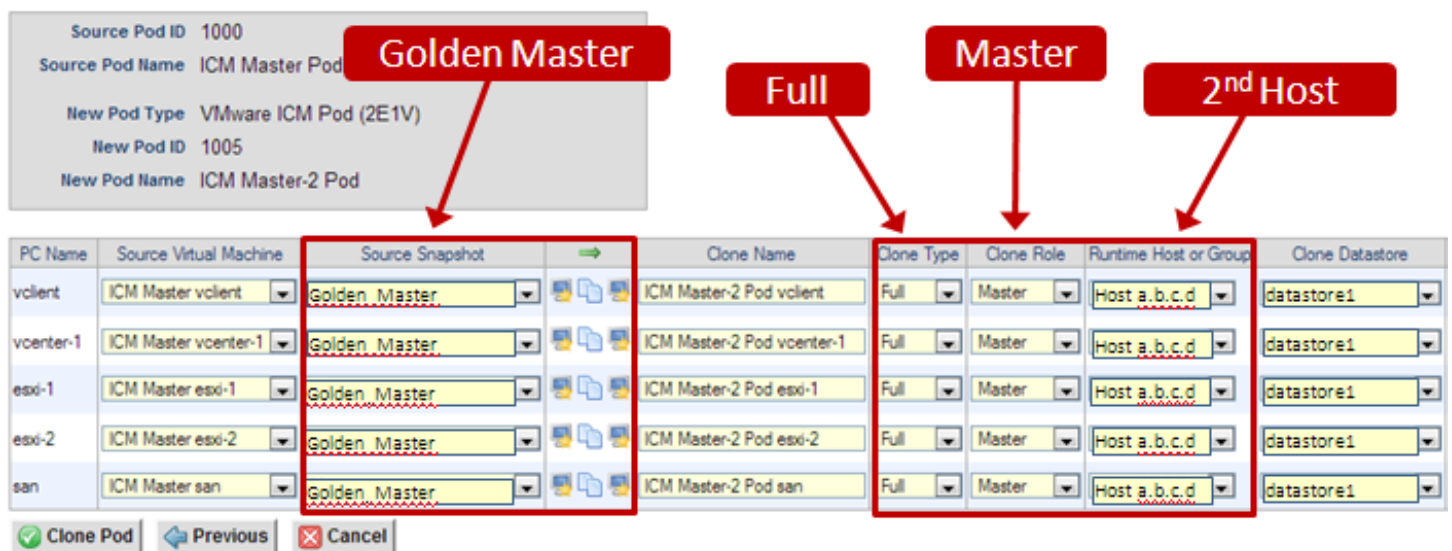
1. Login into NETLAB+ with the administrator account.
2. Select the **Equipment Pods** link.



3. Click on your ICM Master Pod that was created on the 1st VMware host server.
4. Click the Clone button to create a new pod based on the settings of this pod.



5. Select the New Pod ID. It is advised to keep the pods in numerical order. If the pod IDs are not in numerical order, they will not show up in the scheduler in numerical order.
6. Click **Next**.
7. Enter a New Pod Name. For example, **ICM Master-2 Pod**. Click **Next**.
8. When the action has finished processing, you are presented with a settings screen.



9. The four key columns for this Master Pod clone are Source Snapshot, Clone Type and Clone Role, and Runtime Host.
  - a. Source Snapshot should be set to the **Golden\_Master** snapshot you created previously.
  - b. Under Clone Type, click the dropdown menu and verify that **Full** is selected.
  - c. Under Clone Role, click the dropdown menu and select **Master**.
  - d. Under Runtime Host, select the 2nd host system (which should be different than the system you are cloning from).
10. When you are done changing settings, Click **Clone Pod**. This may take up to 30 minutes as full copies are being made. You may navigate away from the cloning progress screen, then later return to the pod to check progress.

The NETLAB+ software does not clone the snapshots of the ICM Master VMs. This is planned for a future software release. It is currently necessary to login into your Management Workstation and create the snapshots manually as you did in section 4.10. The NETLAB+ software does not clone ISO images that are currently attached to cloned virtual machines. You will need to copy the ISO file that is attached to the esxi-2 virtual machine into a folder on the local datastore of the second host and attach it to the new esxi-2 virtual machine created in the above steps.

11. **When the cloning process is complete, you should create a Golden\_Snapshot on each virtual machine in the 2nd Master pod.**

#### 5.4 Creating User Pods on the Second Host

To create up to 8 user pods on the second host, repeat the steps to create User pods on the first host (section 5.2), substituting the 2nd Master pod (created in the previous section) as the cloning source.

## 6 Assigning ICM Pods to Students, Teams and/or Classes

Please refer to the [Pod Assignment Guide](#) for details on using the Pod Assignment feature:

## 7 Known Issues

### 7.1 SAN Support

NDG performs all testing on servers with Internal Direct Attached Storage (i.e. RAID arrays and RAID controllers directly attached to each ESXi host server). This is the configuration that most academic institutions are likely to find affordable and adopt.

A Storage Area Network (SAN) is a dedicated network that provides access to consolidated, block level data storage that can be used for disk storage in a VMware vSphere environment.

**Currently NDG does not provide benchmarks, guidance or troubleshooting for SAN configurations.** Our documentation may show an optional SAN in the environment, however this is not a recommendation or requirement to deploy a SAN.

**NDG benchmarks and capacity planning guidance do not account for the additional latencies introduced by SAN.**

- When compared to Direct Attached Storage, a SAN may introduce additional I/O latency between ESXi server and disk. Therefore, a SAN may reduce the number of active VMs you can run on an ESXi host.
- If you deploy a SAN, you should perform your own benchmarks and determine the number of active VMs you can host on your ESXi server. Your mileage may vary.
- Always configure NETLAB+ Proactive Resource Awareness to ensure that the number of VMs that can be activated will remain within your predetermined performance limits.

NETLAB+ does not support load balancing among ESXi hosts at this time. The ICM pods currently will run on the same ESXi host regardless of load. Proactive load balancing among several hosts is a planned feature.

### 7.2 ICM 5.1 Labs

A lab addendum for each lab provides detailed guidance on performing the labs using a NETLAB+ system. Please note that the sequence of the lab addenda differs slightly from the sequence of the VMware vSphere Install, Configure, Manage 5.1 labs. This is necessary in order to provide compatibility with NETLAB+. The labs should be performed in the order of the lab addenda as shown [ICM 5.1 Lab support](#) page.

Lab 0 – Installing ESXi. This lab is not covered by VMware but we feel it is important for the student to go through the installation process as a learning experience.

Lab 21 – Configuring VMware vSphere Fault Tolerance - This lab is not currently supported by NETLAB+ in a virtual environment.

Lab 23 – VMware vCenter Update Manager – This lab is not currently supported by NETLAB+ in a virtual environment.

Lab 24 – (Optional) Installing VMware vCenter Server – This lab covers the installation of vCenter Server on a Windows host. While important for a student to understand how to install the software, this requires a 64-bit host operating system, which may not be available for all academies. NETLAB+ does not currently support this lab due to resource restrictions and advanced configuration management.

### **7.3 Automatic Snapshot after Cloning**

NETLAB+ does not automatically create a snapshot on the new virtual machine when cloning from a virtual machine snapshot point. This is planned a feature.

### **7.4 Migration**

The current software release does not support migration of virtual machines from one host to another. This is a planned feature.