

Fundamentals of Cloud Computing

Exercises – Guide for Students

Version 2.0

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FCC - Exercises

Introduction

Introduction

In this lab exercise, you learn the major features and functions of self-service provisioning of virtual servers and software using IBM® Tivoli® Service Automation Manager. This lab exercise takes you step-by-step through the various tasks. You, as a cloud administrator, request a project with a VMware virtual server using the self-service user interface and manage the virtual servers and resources through the lifecycle of the project. You also learn how to monitor the deployment status with the Tivoli Service Automation Manager administrative user interface (UI), and perform basic cloud administrator tasks, such as customizing the service catalog.

Later in this lab exercise, you learn how to create and restore virtual server backups. You also learn how to install software as part of the virtual server deployment. You learn how to remove servers and cancel projects. You learn about customers and how to customize Tivoli Service Automation Manager for different customers. Finally, you disable automatic approval of requests and view the Tivoli Service Automation Manager reports.

Three systems are provided for each lab session, as described in the following table.

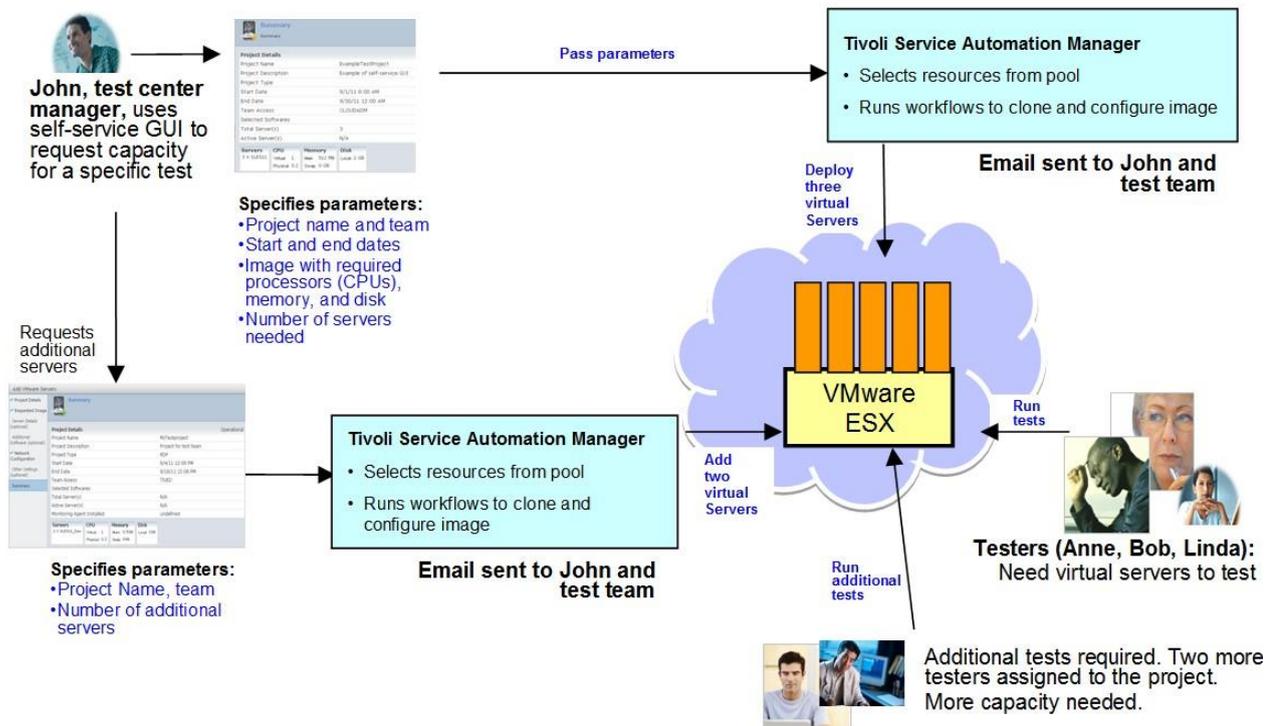
Host name	IP	Description
vm100	192.168.80.100	SUSE 10 SP2: Tivoli Service Automation Manager management server
vm104	192.168.80.104	Windows 2003 STD: VMware vCenter Server, Tivoli Service Automation Manager UIs
vm105	192.168.80.105	VMware ESX Server 4.0

You log in to the **vm104** system, which is your primary user and administrator workstation. From here, you access the Tivoli Service Automation Manager user interfaces and other applications to perform all the exercises.

Refer to the following table for various user names and passwords that are used in the exercises.

User Name	Password	Component	Description
Administrator	object00	OS(vm104)	Administrator user
maxadmin	object00	Tivoli Service Automation Manager	Tivoli Service Automation Manager and Tivoli's process automation engine administrator
cloudadmin	object00	cloud administrator	Self-service UI
tived1dmin	object00	team administrator for TIVED1 customer	Self-service UI

Simple virtual machines deployment



1. As shown in this slide, John begins by using the self-service UI to define his requirements, thus creating a service request.

2. Tivoli Service Automation Manager selects the appropriate resources, runs the appropriate management plan to install the image, and deploys the image through Tivoli Provisioning Manager.
3. John receives a notification that his request has been completed and the system is ready.
4. John provides the testers with the login information he was given in the email.
5. The testers perform the testing.
6. Later, more testers are added to complete the test.
7. John uses the self-service UI to request additional virtual servers for the new testers, thus creating another service request. John receives another notification when the request is completed.
8. John provides the login information to the new testers, and testing continues.
9. When the testing is complete, John saves a copy of the virtual server in the image catalog and returns the resources to the pool.

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Exercise 1: Logging on to Tivoli Service Automation Manager UIs

You log in to the **vm104** system to access the Tivoli Service Automation Manager UI environment and VMware.

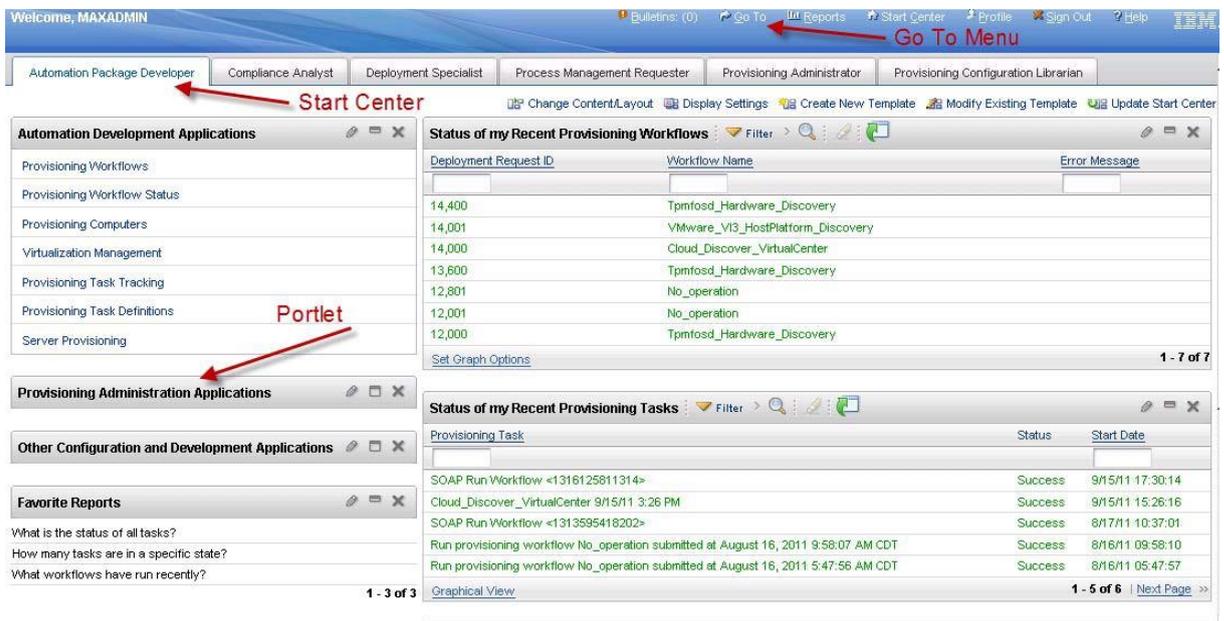


Note: Use different browsers for the administration and user interfaces to eliminate issues that arise with the browser caching the credentials. This action also helps distinguish between administrator and user functions. Use the following browsers:

- **Internet Explorer** for Tivoli Service Automation Manager UI (admin)
- **Firefox** for the self service UI (user)

1. Log in to **vm104** virtual server as **Administrator** with password **object00**.
2. Log in to the Tivoli Service Automation Manager administrative UI.
 - a. Open an Internet Explorer window and browse to the following web address:
 https://vm100.tivoli.edu:9443/maximo
 This web address is the home page.
 - b. Log in with user ID **maxadmin** and password **object00**.

The Tivoli Service Automation Manager administrative UI opens.



- c. After you have logged in and verified connectivity to the application, log out and close the browser.

3. Log on to the self-service UI as **cloudadmin**. This user is a Tivoli Service Automation Manager cloud level administrator that was created for these exercises after the installation completed. Use this ID initially to log on to the self-service user interface.

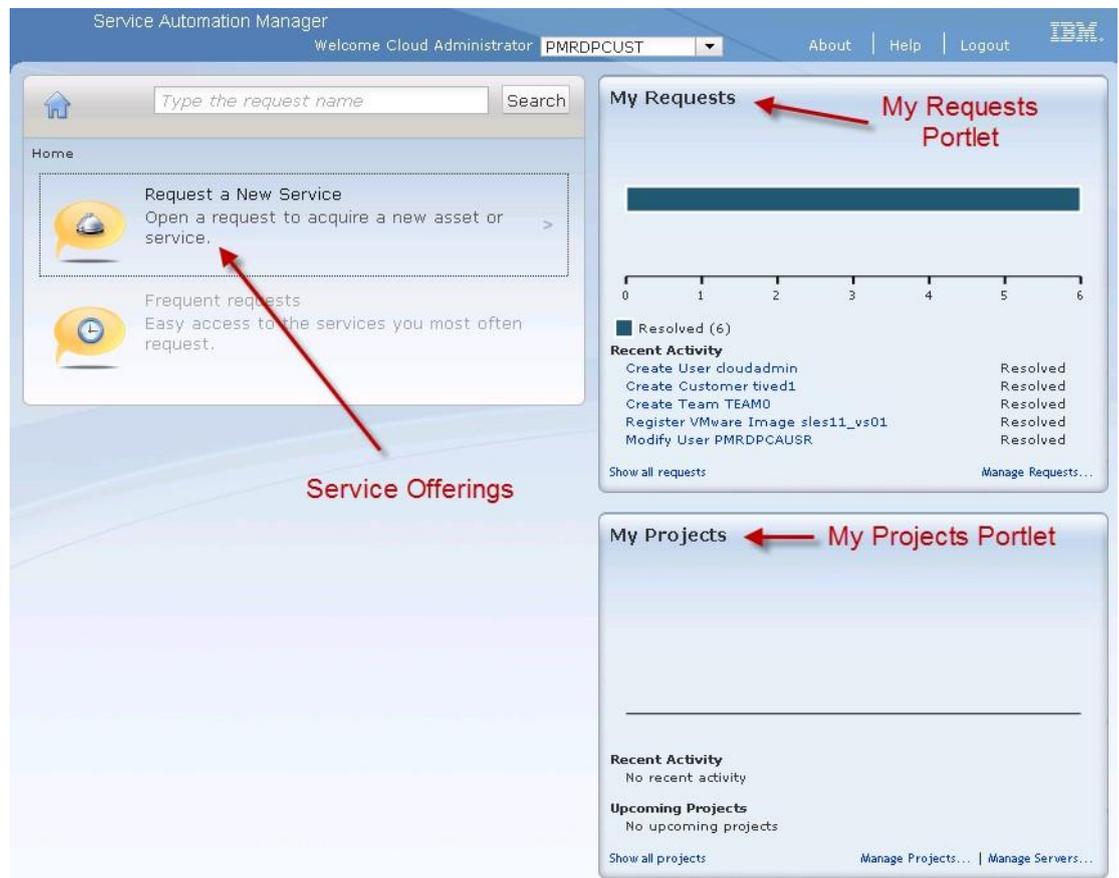
- a. Open a Firefox window and browse to the following web address:

https://vm100.tivoli.edu:9443/SimpleSRM/

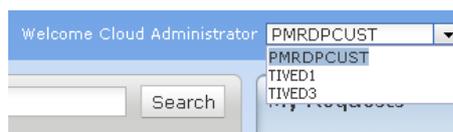
This web address is located on the Bookmarks toolbar as self-service UI.

- b. Log in with user ID **cloudadmin** and password **object00**.

The self-service UI opens.



- c. Expand the customer drop-down list. Three customers are defined.



User **cloudadmin** can submit requests for each of the customers. PMRDPCUST is the default customer defined with Tivoli Service Automation Manager. TIVED1 and TIVED3 are customers created for the lab exercises.

During almost all lab exercises, you submit requests for the PMRDPCUST customer.

- d. After you log in and verify connectivity to the application, log out and close the browser.

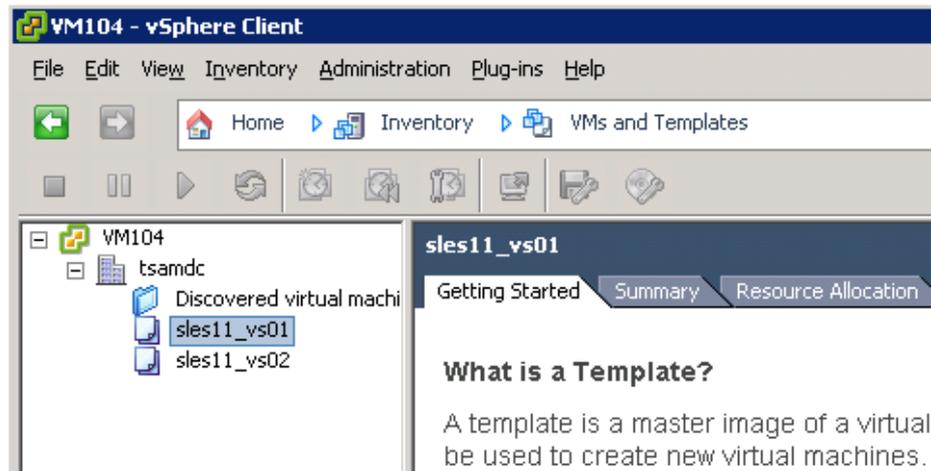
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Exercise 2: Logging in to VMware vSphere client

Log in to the VMware vSphere client to verify that VMware is operational and that you have two Linux templates defined:

1. Double-click **VMware vSphere Client** on the **vm104** desktop.
2. In the VMware vSphere Client login window, perform the following steps:
 - a. Specify **localhost** for the **IP address / Name** field.
 - b. Select **Use Windows session credentials**.
 - c. Click **Login**.
3. Select **View > Inventory > VMs and Templates**.

The **sles11_vs01** and **sles11_vs02** templates are visible in the left pane. You use these templates to deploy new virtual servers from Tivoli Service Automation Manager.



Note: If the templates appears as *sles11_vs01 (disconnected)* or *sles11_vs02 (disconnected)*, notify your facilitator.

4. Minimize the VMware vSphere Client window.

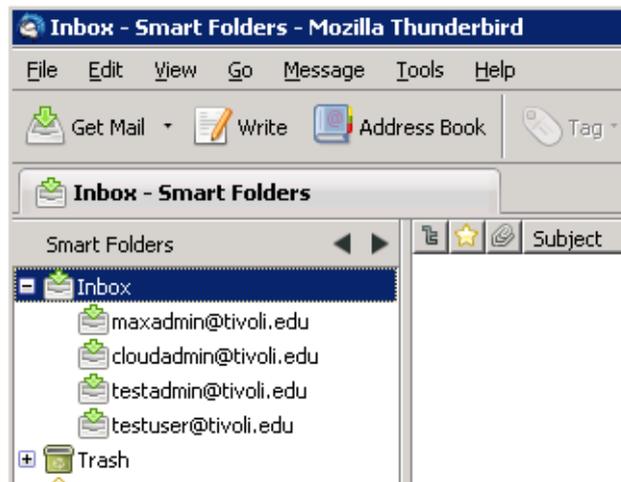
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Exercise 3: Opening the email application

As you perform tasks using the self-service UI, you receive email notifications. Your lab system is already set up to run Mozilla Thunderbird.

1. Locate the **Mozilla Thunderbird** icon on the desktop of **vm104**. Double-click the icon to open the application.

A list of users is displayed in the left pane.



As you proceed through the remaining exercises, notifications sent from the Tivoli Service Automation Manager workflows are added to the inbox of **cloudadmin** and **testadmin**. View them as they arrive to become familiar with them.

2. Minimize the **Mozilla Thunderbird** window.

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Exercise 4: Submitting a new VMware deployment request using the quick path

After the cloud administrator configures the environment and sets up the applications, users can submit requests for virtual server provisioning. You use the self-service UI to request virtual server deployments.

To perform these tasks, you must log in with a user ID that has a role of either Cloud Administrator or Team Administrator, by default. During the first series of these exercises, you use a cloud administrator for simplicity, but you can complete all of the tasks as a team administrator.

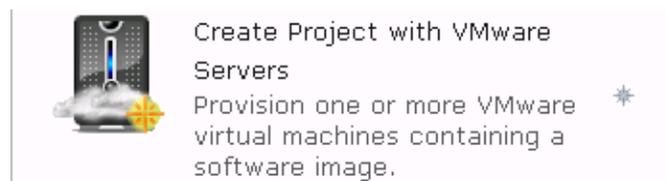
Tivoli Service Automation Manager was redesigned so that users can quickly submit requests when the default values are sufficient for their needs. This use case is shown in this exercise.

1. Open a Firefox window and open the self-service UI. Use the **Self-Service UI** bookmark or browse to this location:

<https://vm100.tivoli.edu:9443/SimpleSRM/>

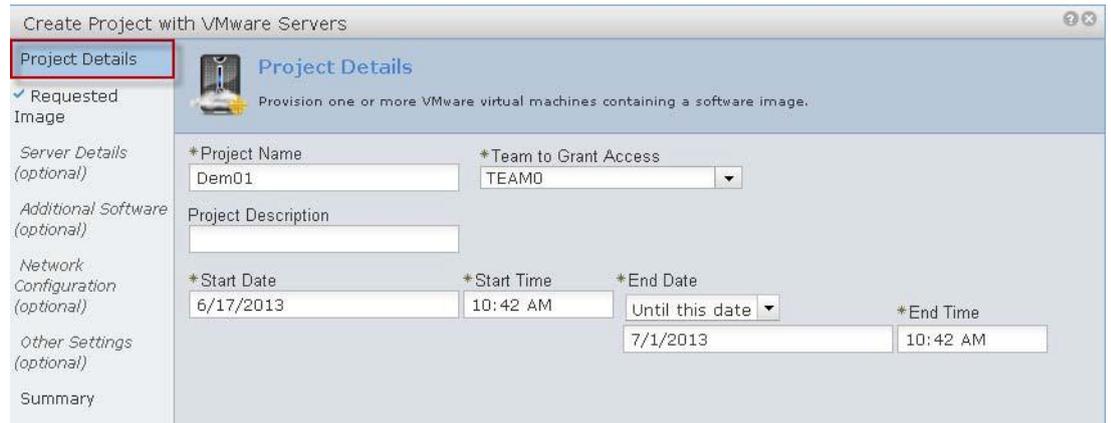
2. Log in to the self-service UI as **cloudadmin** with password **object00**. Verify that you are working for the PMRDPCUST customer.

3. **Click** Request a New Service > Virtual Server Management > Create Project with VMware Servers.



4. Enter the following information in the Project Details window:

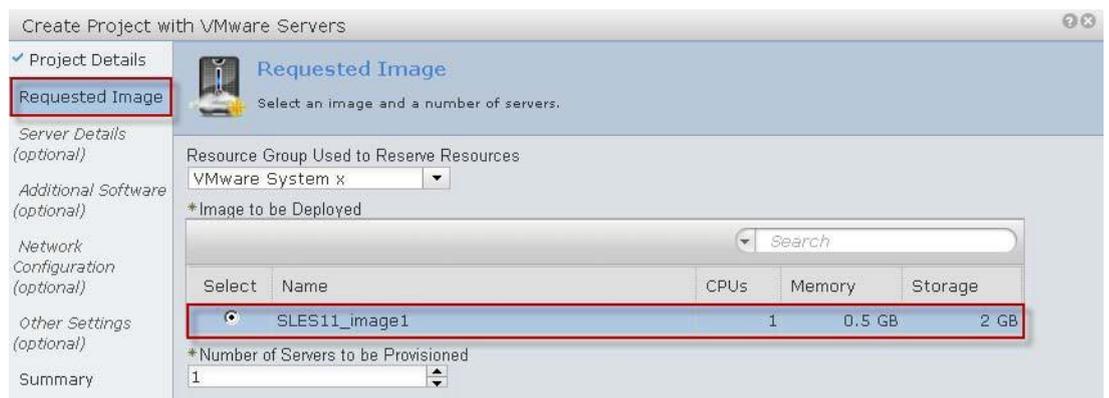
- Project Name: **<your_initials>01**
- Team to Grant Access: **TEAM0**
- Start Date: [Use the default value]
- End Date: [Use the default value]



5. Click **Next**.

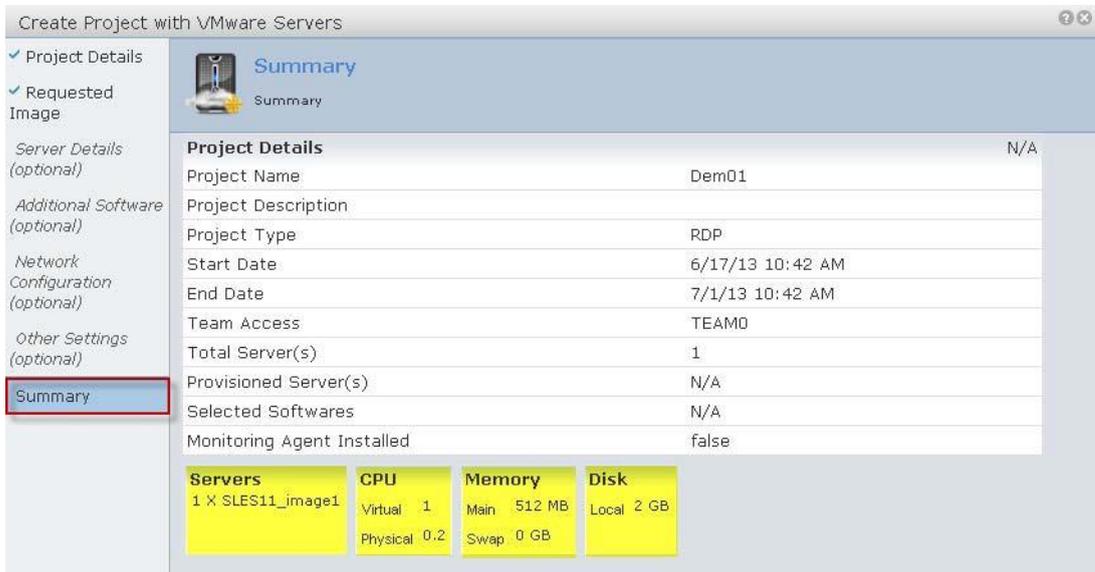
6. Enter the following information in the Requested Image window:

- Resource Group Used to Reserve Resources: **VMware System x**
- Image to be Deployed: **SLES11_image1**
- Number of Servers to be Provisioned: **1**



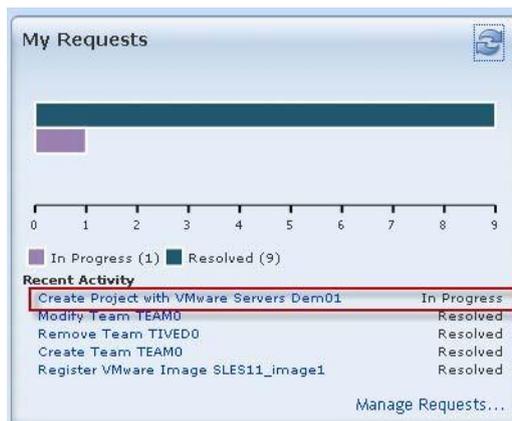
7. Click **Finish** to accept the defaults for the remaining options.

8. Verify that the Summary section is similar to the following screen capture.



9. Click **Finish** to submit your request.

10. Verify that the request in the **My Requests** portlet listed first as **New**, **Queued**, and then **In Progress**. For example, **Demo01** is in progress in the following example.



Note: You monitor the status of the deployment request using the administrative interface in the next exercise. Wait until the status of your request shows **In Progress** before you start the next exercise.

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Exercise 5: Monitoring the deployment status

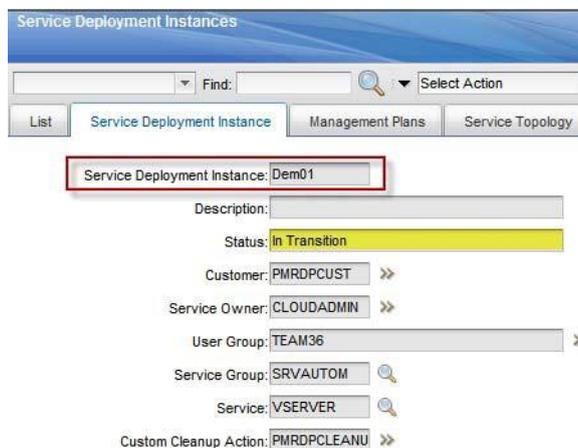
The cloud administrator can log in to the Tivoli Service Automation Manager administrative UI and monitor several operational aspects of the service requests, projects, and the workflows that interface with the hypervisor managers and the virtual machines. In this exercise, you perform some of these monitoring functions.

1. If you are not already logged in, log in to the Tivoli Service Automation Manager administrative UI as **maxadmin** with password **object00**.
2. **Click** Go To > Service Automation > Service Deployment Instances.
3. Press **Enter** to list all instances.
4. Click **<your_initials>01**.



Note: When you create a new project, the application creates a Service Deployment Instance, which you can view in the administrative interface. This instance tracks and manages the service landscape known as the **service topology**. The Service Deployment Instance is exposed to the user as a project in the **My Projects** portlet. Each request to modify this topology is tracked with a unique service request. These service requests are exposed to the user in the **My Requests** portlet.

5. Verify that the status is **In Transition**. This status means that the workflow is currently running to deploy the virtual system.

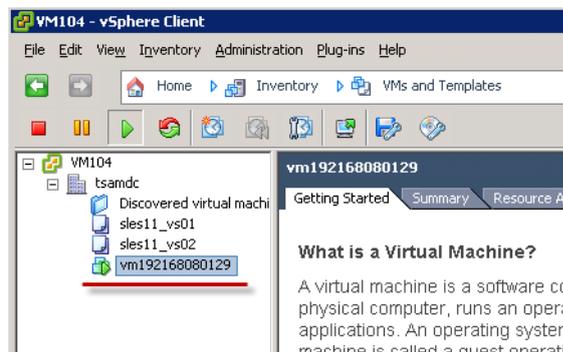


6. Click the **Messages** tab. You can view the messages from deployment; however, there typically are no messages here yet.
7. **Click** Start Center > Automation Package Developer tab > Provisioning Workflow Status.

Two workflows are still in progress.

Deployment Request	Workflow Name	Submit Date	Status
16,020	RP.ClusterProvision	6/17/13 10:55:52	In progress
16,000	Resource_Master	6/17/13 10:55:23	In progress

- Click the **Refresh** button to update the page. Continue to the next step while the workflow is in progress. You check the status of the workflow later. You see a status of **Success** when the workflow is completed.
- Log in to the VMware vSphere client as **Administrator** with password **object00**. Monitor the status to verify that a new virtual server with a name of **vm192168080129** is created.



- Return to the Tivoli Provisioning Manager Workflow Status page to see the progress.

Click **Refresh** to update the page until the workflows complete.

The workflow log contains approximately 700 entries when the workflow completes. *This task might take 10 minutes or more, depending on system load.*

- Return to the self-service UI.

- Verify that the status of the **<your_initials>01** deployment request is **Resolved** in the **My Requests** portlet, and that the new project is **Operational** in the **My Projects** portlet.

My Requests

Resolved (10)

Recent Activity	
Create Project with VMware Servers Dem01	Resolved
Modify Team TEAM0	Resolved
Remove Team TIVED0	Resolved
Create Team TEAM0	Resolved
Register VMware Image SLES11_image1	Resolved

Manage Requests...

My Projects

Operational (1)

Recent Activity	
Dem01	Operational

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Exercise 6: Logging in to the virtual server (optional)

In the exercise, you log in to the virtual server that you provisioned using the vSphere client to demonstrate that the virtual server is operational.

1. Open the Mozilla Thunderbird application. Open the email with a subject **Your request to start a new project has been processed** in the **cloudadmin** inbox. The text describes the virtual server, similar to the following example:

Dear Cloud Administrator,

you have started a new project Dem01 with the following topology:

The server vm192168080129 has been added with the following parameters:

```
Server      host      name:
vm192168080129  Number of
CPU(s): 1
```

```
Number of tenths of physical
CPUs: 2 Amount of Memory:
512 MB
```

```
Swap Size: 0 GB
```

```
IPv4      address(es):
192.168.80.129      IPv6
address(es):
```

```
Disk Space Size:
2 GB Admin
Password:
<password>
```

2. Write the Admin password here: _____.
Passwords are case- sensitive.
3. Log in to **vm192168080129**. You can use either the VMware vSphere Client or PuTTY to access the virtual server. The instructions for the VMware vSphere Client follow.
 - a. Log in to the VMware vSphere Client as **Administrator** with password **object00**.
 - b. Right-click **vm192168080129**.
 - c. Click **Open Console**.
4. Log in as user **root** with the Admin password that you wrote down.

5. Enter the command **cat /etc/SuSE-release** to verify that your virtual machine is running SUSE Linux Version 11.

```
vm192168080129:~ # cat /etc/SuSE-  
release SUSE Linux Enterprise  
Server 11 (i586) VERSION = 11
```

```
PATCHLEVEL = 0
```

6. Enter the command **exit** to log off.

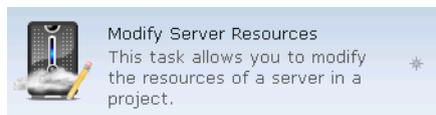
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Exercise 7: Modifying the virtual server by adding additional memory

In preparation for installing and running software, you increase the amount of memory on the virtual machine that you provisioned in the previous exercise.

___1. If you are not already logged in, log in to the self-service UI as **cloudadmin** with password **object00**. Verify that you are working for the PMRDPCUST customer.

2. **Click** Request a New Service > Virtual Server Management > Modify Server > Modify Server Resources.



___3. Enter the following information:

- Select Project Name: **<your_initials>01**
- Select Server Name: **vm192168080129**
- CPU: [*do not change*]
- Memory: [*enter 1 in the GB field*]
- Disk: [*do not change*]

The memory now shows 512+512 to indicate that the virtual machine currently has 512 MB of memory and that an additional 512 MB of memory will be added.



___4. Click **OK** to submit the request.

The request in the **My Requests** portlet is listed first as **New**, **Queued**, and **In Progress**. Wait for the request to be **Resolved**.



Note: You can watch the activity in the **Recent Tasks** portlet in the vSphere client. You see the virtual machine being powered off, reconfigured, and then powered on.

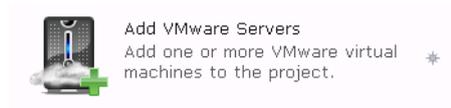
- ___5. When the request completes, you can click **manage servers** in the **My Projects** portlet to view the details for vm192168080129. The memory is now 1 GB.

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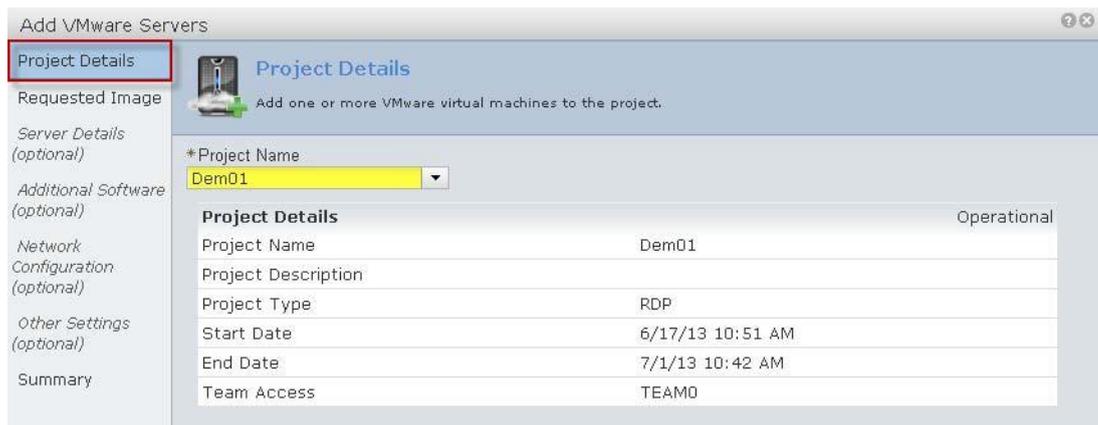
Exercise 8: Adding a VMware server with a monitoring agent to an existing project

___1. If you are not already logged in, log in to the self-service UI as **cloudadmin** with password **object00**. Verify that you are working for the PMRDPCUST customer.

2. **Click** Request a New Service > Virtual Server Management > Modify Project > Add VMware Servers.

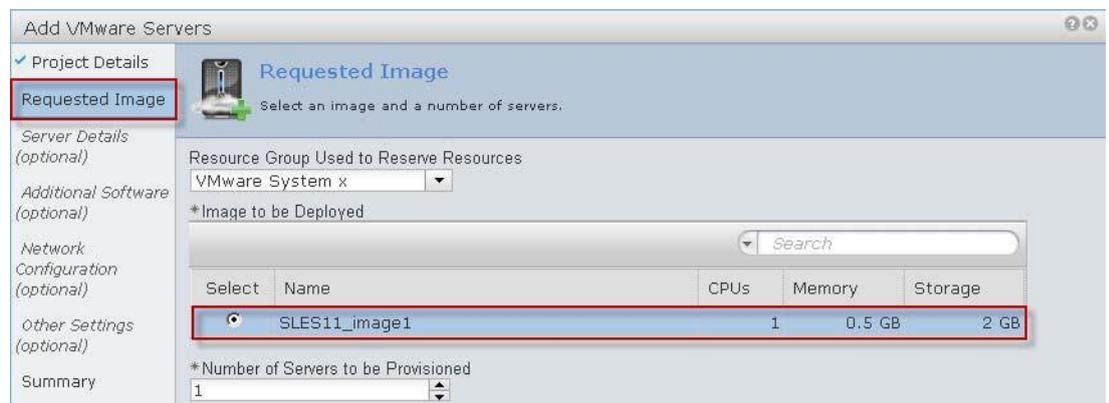


___3. Enter the following information in the Project Details window: Project Name: **<your_initials>01**



___4. Click **Next**.

- ___5. Enter the following information in the Requested Image window:
- Resource Group Used to Reserve Resources: **VMware System x**
 - Image to be Deployed: **SLES11_image1**
 - Number of Servers to be Provisioned: **1**



- ___6. Click **Next**. This time, you specify additional details about the server being requested.

- ___7. Enter the following information in the Server Details window:

- Virtual CPU: **1**
- Physical CPU: **0.3**
- Main Memory: **1.0 GB**
- Swap: **0 GB**
- Disk: **3 GB**

Add VMware Servers

✓ Project Details
✓ Requested Image

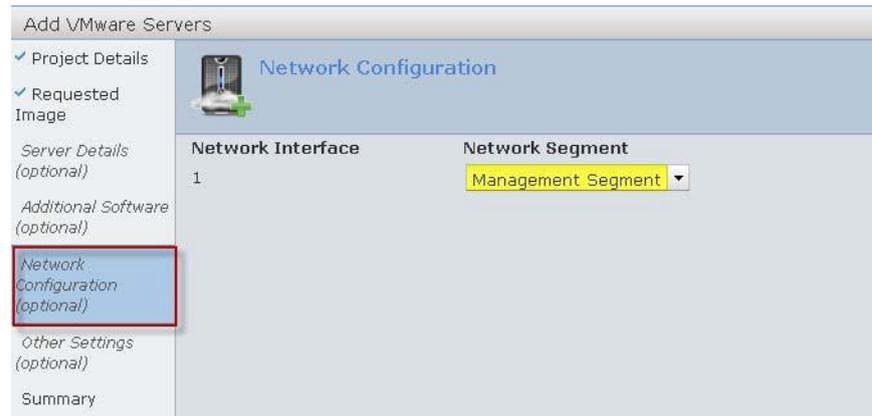
Server Details
Click the slider buttons to adjust the settings for the requested resources.

Server Details (optional)
Additional Software (optional)
Network Configuration (optional)
Other Settings (optional)
Summary

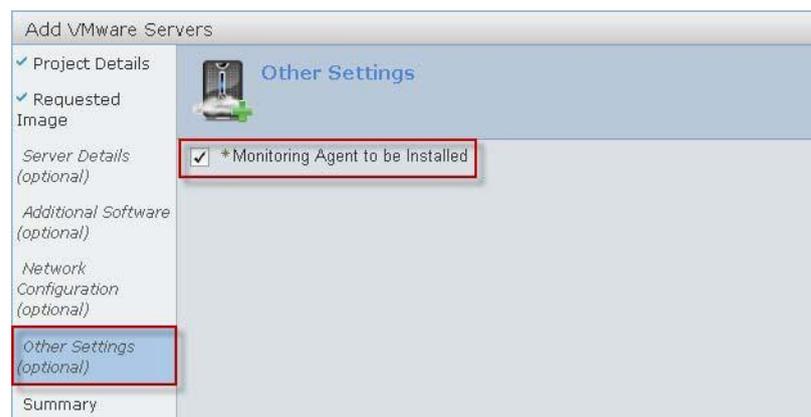
CPUs		Memory		Disk (GB)
Virtual	Physical	Main (GB)	Swap (GB)	
Slider: 1 to 8	Slider: 0.2 to 1	Slider: 0.25 to 8	Slider: 0 to 1	Slider: 2 to 1,024
1	0.3	1 GB	0	3
		1,024 MB		

- ___8. Click **Next**.
- ___9. In the Additional Software window, do not make an entry in the **Select Software to Install** field at this time.
- ___10. Click **Next**.
- ___1. Make sure that the Network Configuration window lists only one network, the Management Segment.

There is only one network, the Management Segment.



- ___2. Click **Next**.
- ___3. Enter the following information in the Other Settings window: Monitoring Agent to be Installed. **[selected]**



- ___d. Click **Next**.

The Summary section is similar to the following screen capture.



___e. Click **Finish** to submit your request.

___4. *This task might take 15 minutes or more, depending on system load.* While the task is processing, you can continue with the next exercise. This task completes when the status of the **<your_initials>01** deployment request is **Resolved** in the **My Requests** portlet.

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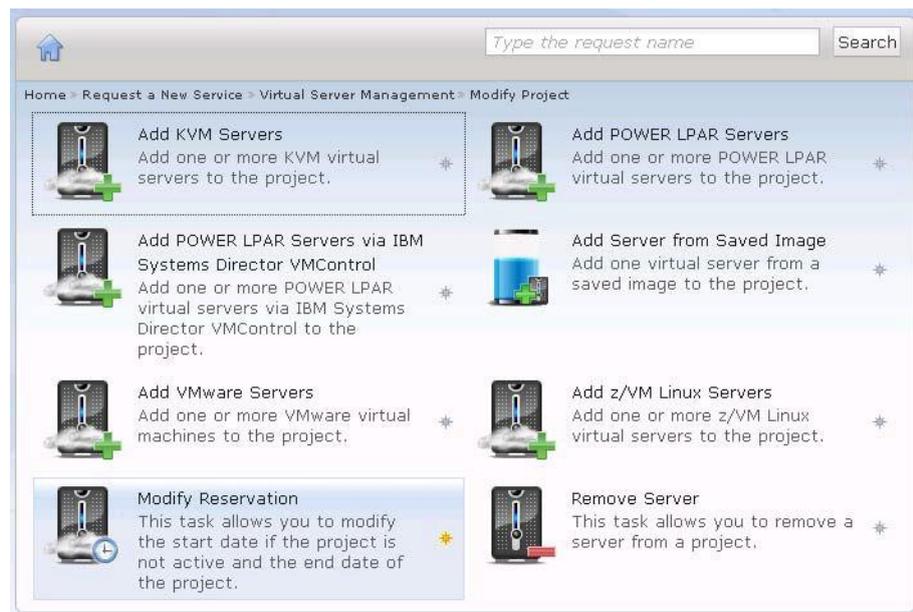
Exercise 9: Customizing the service catalog

The cloud administrator has already made some service catalog customizations to hide the non- VMware services for creating new projects. However, the non-VMware service offerings for adding servers to existing projects are still visible in the catalog. In this exercise, you hide those service offerings because the only cloud pools available in this environment are VMware.

___1. If you are not already logged in, log in to the self-service UI as **cloudadmin** with password **object00**. Verify that you are working for the PMRDPCUST customer.

2. **Click Request a New Service > Virtual Server Management > Modify Project.**

Service offerings are available to add servers with non-VMware hypervisors. These service offerings are not configured in this test environment, which is VMware only.



___3. Log out and close the browser.

___4. If you not already logged in, log in to the Tivoli Service Automation Manager administrative UI as **maxadmin**, with password **object00**.

___5. Click **Go To > Service Request Manager Catalog > Offerings**.

___6. Filter the offerings based on an offering name of **PMRDP** and the description of **Add**.

Eight offerings meet these criteria.

Offering	Description
pmrdp	add
PMRDP_0211A_72	Add VMware Servers
PMRDP_0212A_72	Add POWER LPAR Servers
PMRDP_0213A_72	Add Xen Servers
PMRDP_0214A_72	Add z/VM Linux Servers
PMRDP_0215A_72	Add KVM Servers
PMRDP_0248A_72	Add Server from Saved Image
PMRDP_0216A_72	Add POWER LPAR Servers via IBM Systems Director VMControl
PMRDP_0252A_72	Modify Additional Disks on POWER LPAR Server

Select Records

___7. Check the **Select Records** box below the list of offerings.

___8. Select all of the non-VMware offerings that are active. These offerings are items 2, 3, 4, 5, 7, and 8 in the list.

___9. Choose **Change Status** from the **Select Action** drop-down list.

___10. Set the **New Status** to **Pending** and click **OK**.



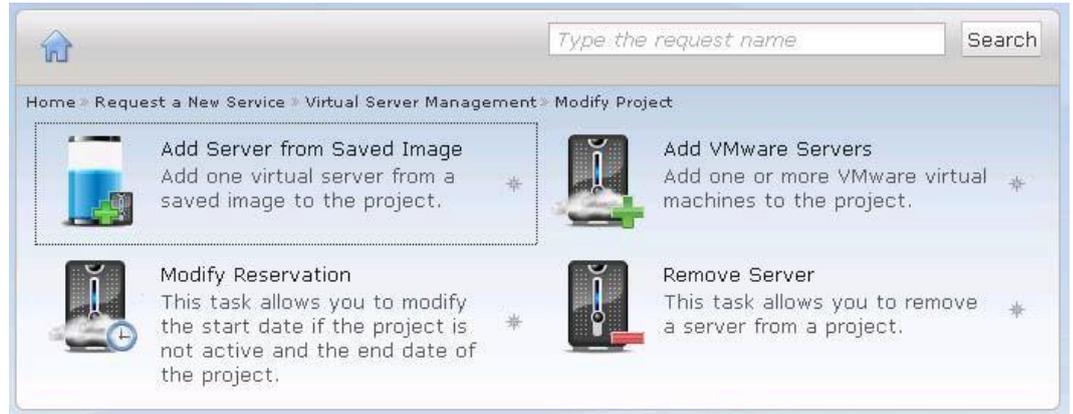
Note: The method you use here for hiding the non-VMware service offerings is a simple way to remove offerings from all catalogs and all user groups. Another method is to add and remove specific service offerings from the catalogs that are associated with each role-based user group. The cloud administrator can then decide which service offerings to make available to which users based in their role.

___11. Service catalogs are dynamically loaded by the self-service UI. Therefore, log out of any remaining self-service UI instances. Users receive the updated service catalog at the next login.

___12. Log in to the self-service UI as **cloudadmin** with password **object00**. Verify that you are working for the PMRDPCUST customer.

13. Click Request a New Service > Virtual Server Management > Modify Project.

Notice that the service offerings with non-VMware hypervisors have been removed.



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Exercise 10: Creating a future reservation request

In this exercise, you create a future reservation for a new project with a single VMware virtual machine. The virtual machine is not provisioned now, but the resources are reserved so that the provisioning task can allocate them on the designated date.

___1. If you are not already logged in, log in to the Tivoli Service Automation Manager self- service UI as **cloudadmin** with password **object00**. Verify that you are working for the PMRDPCUST customer.

2. **Click** Request a New Service > Virtual Server Management > Create Project with VMware Servers.



___3. Enter the following information on the Project Details window:

- Project Name: **<your_initials>02**
- Team to Grant Access: **TEAM0**
- Start Date: [*select one week from today*]
- End Date: [*select three weeks from today*]



Tip: Change the end date before the start date because a project cannot end before it begins.

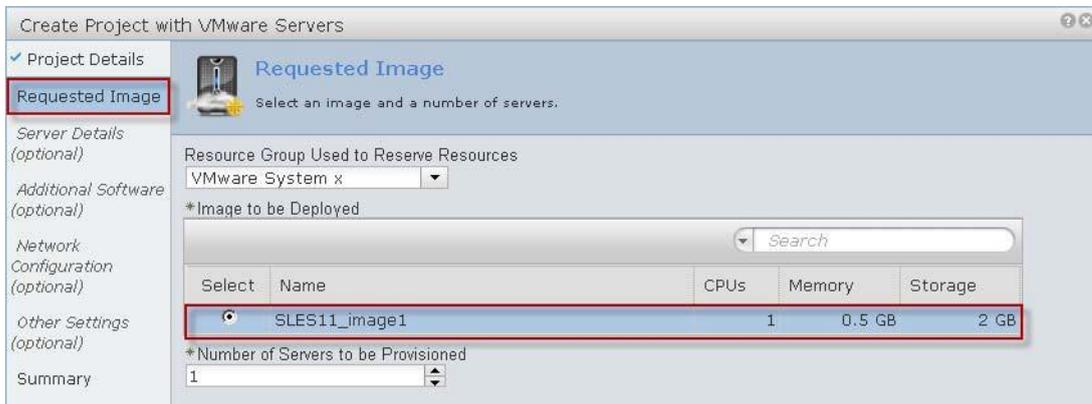
The screenshot shows a web-based form titled "Create Project with VMware Servers". The "Project Details" tab is active. The form includes the following fields:

- Project Name:** Demo02
- Team to Grant Access:** TEAM0
- Project Description:** Project reservation example
- Start Date:** 6/24/2013
- Start Time:** 12:44 PM
- End Date:** Until this date
- End Time:** 12:44 PM

The "Start Date" field is highlighted with a red box, and the "Project Description" field is highlighted with a yellow box.

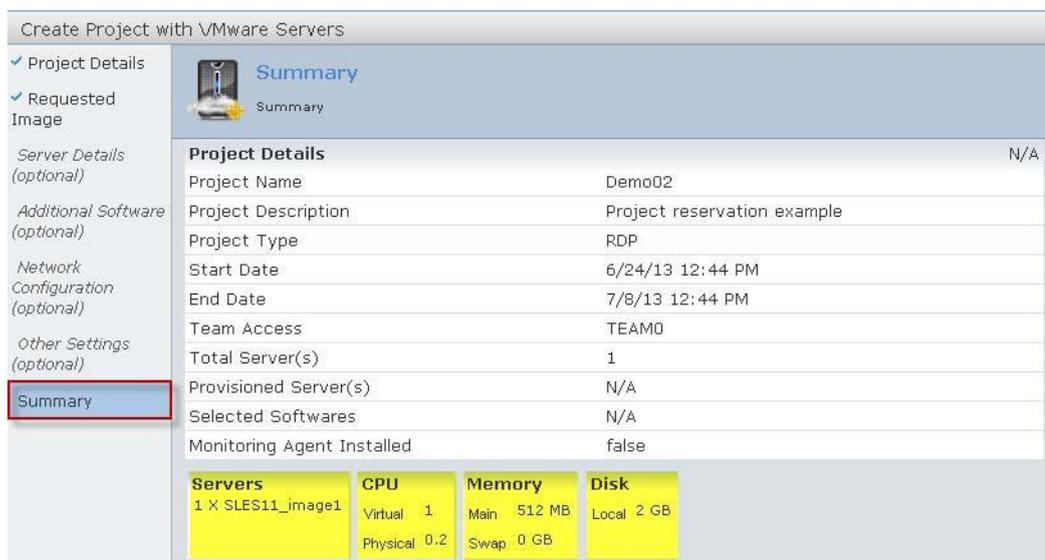
___4. Click **Next**.

- ___5. Enter the following information on the Requested Image window:
- Resource Group Used to Reserve Resources: **VMware System x**
 - Image to be Deployed: **SLES11_image1**
 - Number of Servers to be Provisioned: **1**



___6. Click **Finish** to accept the defaults for the remaining options.

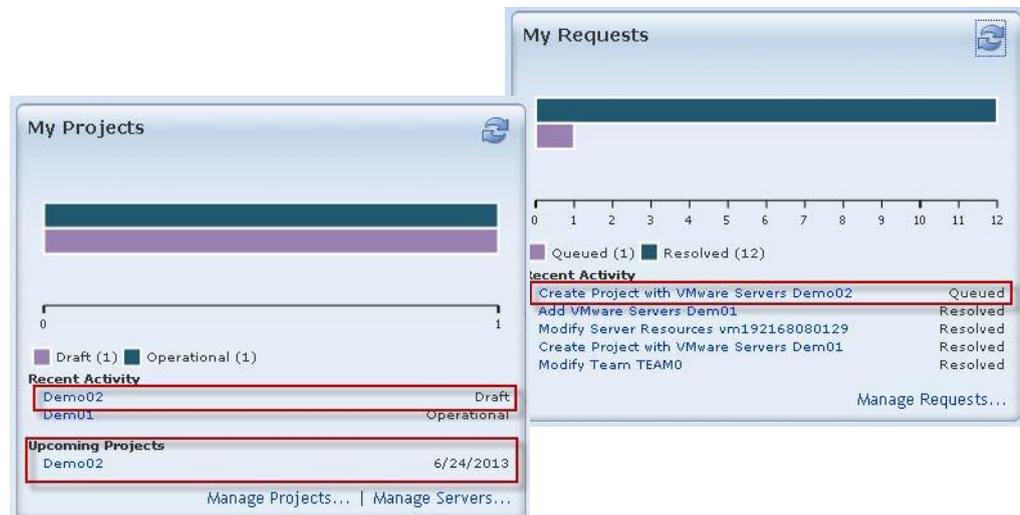
___7. Verify that the Summary section is similar to the following screen capture.



- ___8. Click **Finish** to submit your request.

- ___9. Verify that the request in the **My Requests** portlet listed first as **New** and then **Queued**. This request does not go to the In Progress status until the future date you specified. Your

project name is shown in the **My Projects** portlet with a **Draft** status. You also see an Upcoming Project with the same name and the future start date that you provided.



Fundamentals of Cloud Computing

Exercise 11: Displaying projects and servers in the self-service UI

- ___1. If you are not already logged in, log in to the self-service UI as **cloudadmin** with password **object00**. Verify that you are working for the PMRDPCUST customer.
- ___2. Verify that the state of the **<your_initials>01** project in the **My Projects** portlet is Operational.
- ___3. Click **<your_initials>01** project in the **My Projects** portlet to display the details for the project.

You see two servers. The first server was provisioned without the monitoring agent, and the second was provisioned with the monitoring agent. Because of integration between Tivoli Service Automation Manager and IBM Tivoli Monitoring, monitoring data is displayed in the self-service UI, as shown in this diagram.

Select	Server Name	Management Name	Hypervisor	CPU (%)	Memory (%)	Disk (%)
<input checked="" type="radio"/>	vm192168080130	vm192168080130	VMware	10.0	26.4	53
<input type="radio"/>	vm192168080129	vm192168080129	VMware	...	...	...

- ___4. Close the **Project** window.
- ___5. Click **Manage Servers** in the **My Projects** portlet.

Select	Server Name	Management Name	Hypervisor	CPU (%)	Memory (%)	Disk (%)	La
<input checked="" type="radio"/>	vm192168080130	vm192168080130	VMware	10.0	26.4	53	9/
<input type="radio"/>	vm192168080129	vm192168080129	VMware	...	...	...	9/
<input type="radio"/>	Future Reservation 3	...	VMware	...	...	...	9/

You see both servers here also, and you see monitoring data for the second server. Another entry is visible for the future reservation.

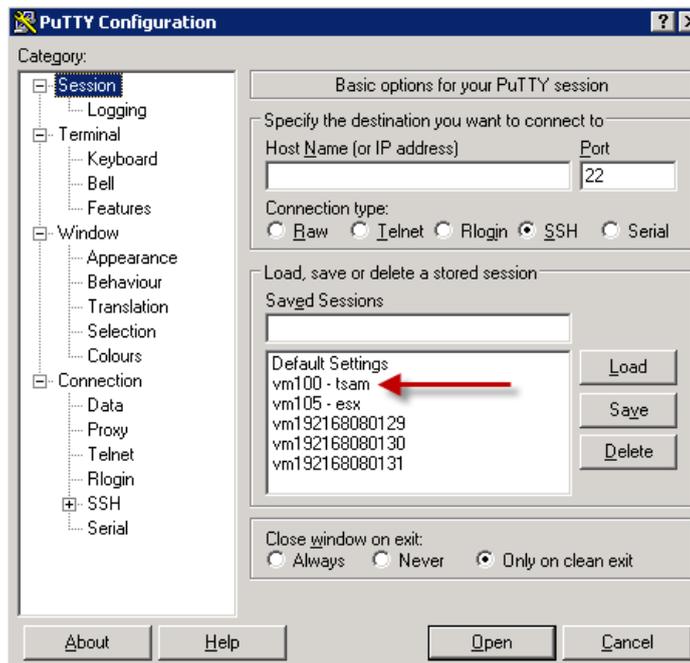
- ___6. Close the **Manage Servers** window.

Fundamentals of Cloud Computing

Exercise 12: Monitoring a virtual server in the IBM Tivoli Monitoring Tivoli Enterprise Portal (optional)

In this exercise, you log in to the Tivoli Enterprise Portal to view IBM Tivoli Monitoring application data for the virtual server.

- ___1. In order to save resources in this demonstration environment, the Tivoli Enterprise Portal Server database is not started. Start the database on vm100.
 - ___a. Start the PuTTY application from the **VM104** desktop and double-click the saved session named **vm100 - tsam**.



- ___b. If you receive a PuTTY security alert, click **Yes** to trust this host.
- ___c. At the login prompt, enter the user name **db2inst1** and **object00** as the password.
- ___d. Enter the command **db2start** to start the database.


```
db2inst1@vm100:~> db2start
09/21/2011 13:27:02      0  0  SQL1063N  DB2START  processing
was successful. SQL1063N  DB2START processing was successful.
```
- ___e. Enter the command **exit** to close the PuTTY session.

___2. Return to the Tivoli Service Automation Manager administrative UI (**Internet Explorer**)

and press **<CTRL>+T** to open a new tab.

___3. Browse to **http://vm100.tivoli.edu:1920//cnp/client**.



Note:

___a. If you are prompted to run certain restricted content, click **the yellow banner**, click

Add-on Disabled, and click **Run Add-on**. Click **Run**. Click **Continue**.



___b. If you see message KFWITM474E, click **Continue**.

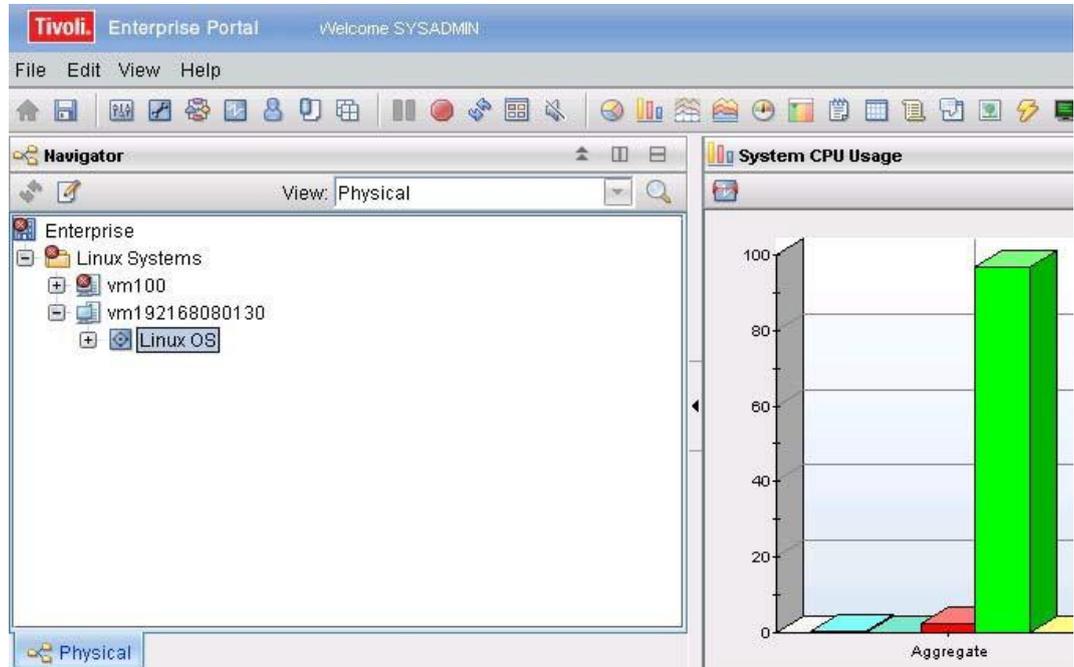
___4. When the Tivoli Enterprise Portal logon page opens, enter **sysadmin** for the logon ID and leave the password field empty. Click **OK**. If you are prompted with a security alert, click **OK**.



___5. In the **Navigator** portlet on the left, click the plus icon (+) next to **Linux Systems** to expand the monitoring group.

___6. Click the plus icon (+) next to host name **vm192168080130** to show the Linux OS agent.

___7. Click **Linux OS** to see an overview of monitoring data for this virtual machine.



___8. Log out and close the browser window.

Fundamentals of Cloud Computing

Exercise 13: Creating a backup image of the virtual machine

If you want to be able to restore a virtual machine to a specific time, you can take a backup image.

___1. If you are not already logged in, log in to the self-service UI as **cloudadmin** with password **object00**. Verify that you are working for the PMRDPCUST customer.

2. Click Request a New Service > Virtual Server Management > Backup and Restore Server Image > Create Server Image.



___3. Enter the following information:

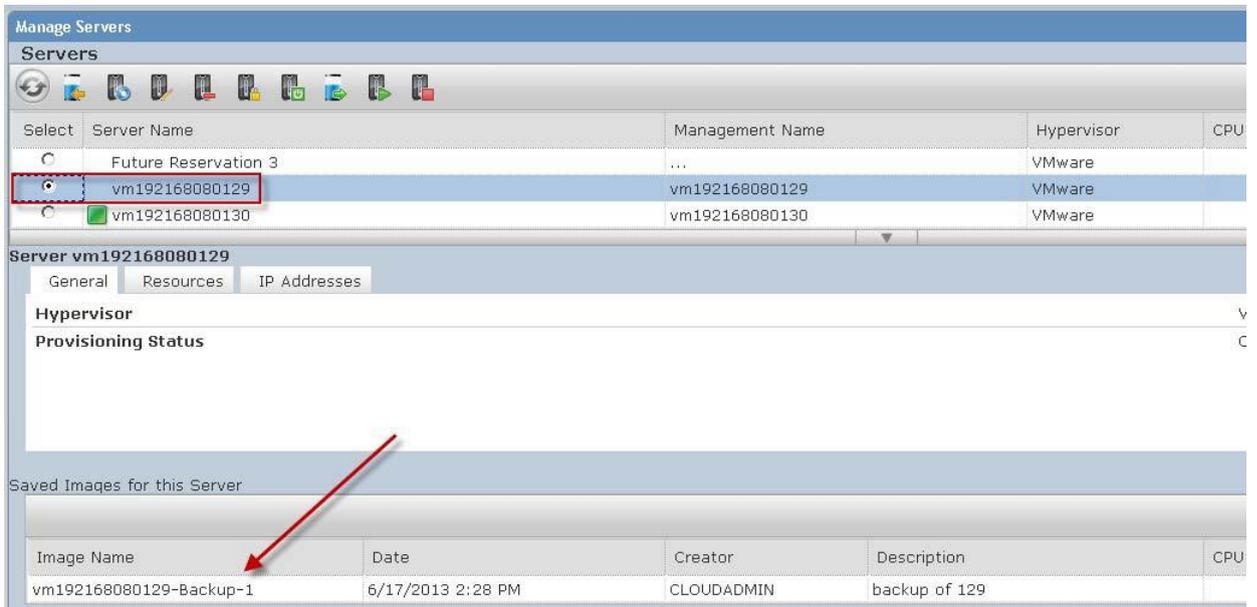
- Name of Virtual Server Image: **vm192168080129-Backup-1**
- Description of Virtual Server Image: [*enter something meaningful*]
- Select Project Name: **<your_initials>01**
- Select Server Name: **vm192168080129**

___4. Click **OK** to submit the request.

The request in the **My Requests** portlet listed first as **New**, **Queued**, and then **In Progress**. Wait for the request to reach a **Resolved** status.

___5. When the request completes, click **Manage Servers** in the **My Projects** portlet.

- ___6. Click the button next to vm192168080129 to view the details for that server. The name of the backup that you just made is listed under **Saved Images for this Server**.



- ___7. Close the Manage Servers window.

Fundamentals of Cloud Computing

Exercise 14: Deleting a virtual server

In this exercise, you delete one server from your project. You cannot delete both servers because the predefined project landscape does not accept empty projects. In the next exercise, you deprovision the final server and cancel the project.

- ___1. If you are not already logged in, log in to the self-service UI as **cloudadmin** with password **object00**. Verify that you are working for the PMRDPCUST customer.

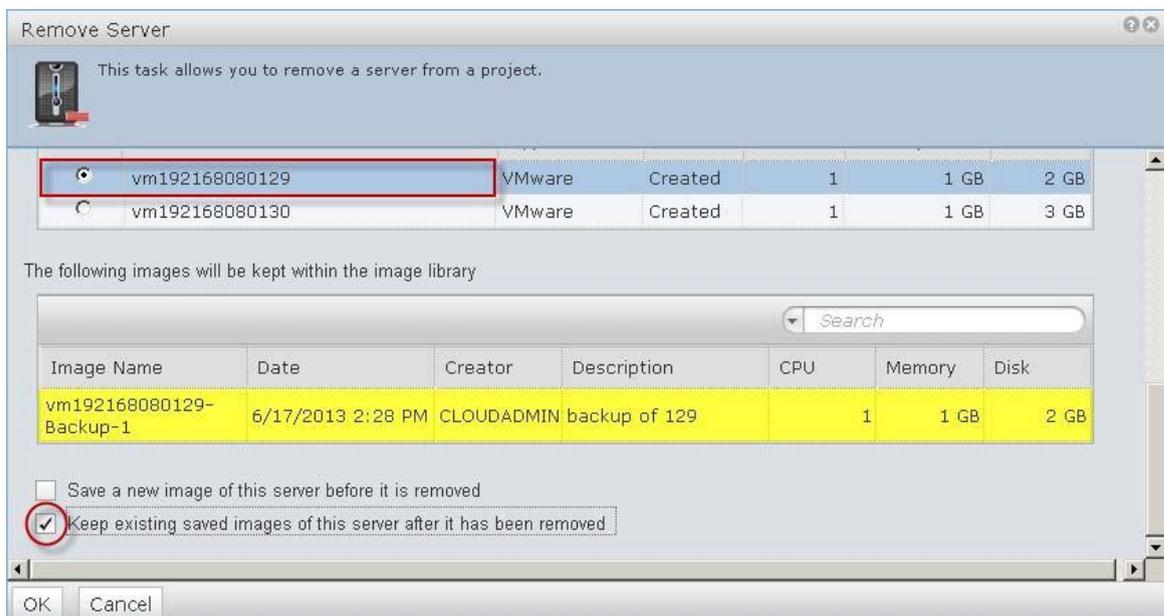
2. **Click** Request a New Service > Virtual Server Management > Modify Project > Remove Server.



- ___3. Select **<your_initials>01** from the **Project Name** drop-down list.

- ___4. Select the server with host name **vm192168080129**.
 The saved image for **vm192168080129** is listed.

- ___5. To keep this saved image, scroll down and click the check box for **Keep existing saved images of this server after it has been removed**.



- ___6. Click **OK** to submit the remove request. Click **Yes** at the Remove Server confirmation. You should see a **Remove Server vm192168080129** request in the **My Requests** portlet. Wait for the request to complete before continuing. *This request might take 5 minutes or longer to complete, depending on system load.*

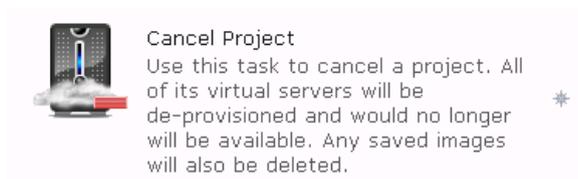
Fundamentals of Cloud Computing

Exercise 15: Canceling a project

In this exercise, you cancel an operational project. This action de-provisions all virtual machines that are associated with the project, assigning those resources (processor, memory, and disk) back into the cloud pool. The status of the project becomes Decommissioned so that it can be accounted for in reporting and usage accounting, if you enable those features.

- ___1. If you are not already logged in, log in to the self-service UI as **cloudadmin** with password **object00**. Verify that you are working for the PMRDPCUST customer.

2. **Click Request a New Service > Virtual Server Management > Cancel Project.**



- ___3. Select **<your_initials>01** from the **Project Name** drop-down list. Scroll down to view the check boxes for **Save an image of each server when the project reaches its end date and is being decommissioned** and **Keep existing saved images after the project has been decommissioned**.

- ___4. Select the check boxes for *both* options.





Note: The **save** statement means that a new backup of the server is taken before deprovisioning. The **keep** statement means that any existing backups will not be deleted.

___5. Click **OK** to submit the request.

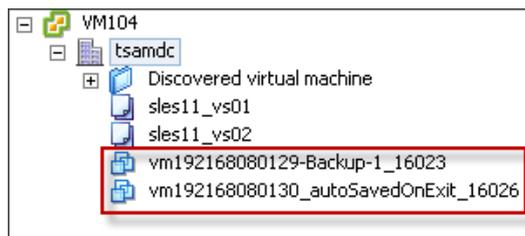
___6. Click **Yes** at the Cancel Project confirmation.

___7. When the request **Cancel Project** <your_initials>01 has a Resolved status, check to see that the backups are complete and the deprovisioning of the virtual machine resources has occurred.

Open the VMware vSphere client.

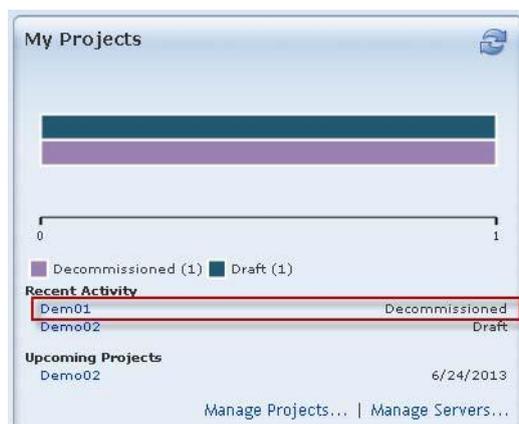
The two virtual machines, **vm192168080129** and **vm192168080130**, have been deleted. Two saved images (clones) still exist:

- One clone represents the backup image that you manually initiated (named similar to *vm192168080129-Backup-1_nnnnn*).
- The other clone represents the backup image that Tivoli Service Automation Manager automatically took during the Cancel Project request (named similar to *vm192168080130_autoSavedOnExit_nnnnn*).



___8. Minimize the VMware vSphere client.

The project <your_initials>01 has a **Decommissioned** status in the **My Projects** portlet.



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Exercise 16: Creating a project with a virtual server restored from a saved backup image

In this exercise, you create a new project with a VMware virtual server. The virtual server is created from a saved backup image from your earlier project. It is possible to use the same name as a previous project, which you do in this exercise.

1. If you are not already logged in, log in to the Tivoli Service Automation Manager self- service UI as **cloudadmin** with password **object00**. Verify that you are working for the PMRDPCUST customer.
2. **Click** Request a New Service > Virtual Server Management > Create Project from Saved Image.



___3. Enter the following information:

- Project Name: <**your_initials**>01
- Team to Grant Access: **TEAM0**
- Project Description: [Enter a meaningful description.]
- Start Date: [Use the default value of today.]
- Start Time: [Use the default value.]
- End Date: [Use the default value of two weeks from today.]
- End Time: [Use the default value.]
- Resource Group Used to Reserve Resources: **VMware System x**
- Select Image Name: [Select any backup image]
- Save an image of each server when the project reaches its end date and is being decommissioned: [checked]
- Keep existing saved images after the project has been decommissioned: [checked]

Requested Image

Resource Group Used to Reserve Resources
 VMware System x

*Select the saved image you want to restore onto a new virtual system:

Select	Image Name	Date	Server	Project	Description
<input checked="" type="radio"/>	vm192168080129-Backup-1	6/17/2013 2:28 PM	vm192168080129	Dem01	backup of 129
<input type="radio"/>	vm192168080130_a	6/17/2013 3:20 PM	vm192168080130	Dem01	-

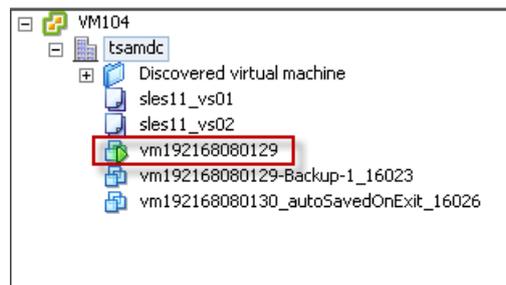


Note: There are no options for resource requirements (processor, memory, and disk) or software to install, because the server that you are provisioning is an identical copy (clone) of the original virtual server that you backed up.

___4. Click **OK** to submit the request.

The request in the **My Requests** portlet listed first as **New**, **Queued**, and then **In Progress**.

- ___5. Verify that the status of the **<your_initials>01** deployment request is **Resolved** in the **My Requests** portlet before continuing.
- ___6. Open the VMware vSphere client. Verify that the virtual server, vm192168080129, has been created from its saved image:



- ___7. Log out of the self-service UI.

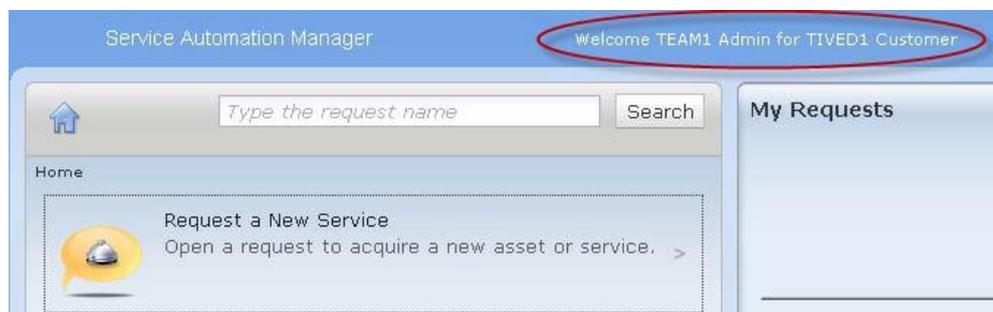
Fundamentals of Cloud Computing

Exercise 17: Requesting a new project with additional software as a different customer

With Tivoli Service Automation Manager, you can create customers to provide different functions to different groups of people or companies. In this exercise, you log on as a user from the TIVED1 customer. Notice that this user has access to different software packages and virtual machine templates. With Tivoli Service Automation Manager, you have granular control over these items and many more.

It is possible to install software as part of the virtual machine deployment. You deploy a virtual machine with the HTTP server in this exercise as a single provisioning activity. To perform these tasks, you must log in with a user ID that has a role of either Cloud Administrator or Team Administrator.

- ___1. Log in to the self-service UI as **tived1admin** with password **object00**.
- ___2. Verify at the top of the self-service UI that you are now logged in as the administrator of team1 for customer **TIVED1**.



3. Click Request a New Service > Virtual Server Management > Create Project with VMware Servers.

- ___4. Enter the following information on the Project Details window:
 - Project Name: **<your_initials>03**
 - Team to Grant Access: **TEAM1**
 - Start Date: [Use the default value]
 - End Date: [Use the default value]

Notice that a different team (TEAM1) is available for this customer.



___5. Click **Next**.

___6. Enter the following information on the Requested Image window:

- Resource Group Used to Reserve Resources: **VMware System x**
- Image to be Deployed: **SLES_image2** (Notice that a different image (SLES_image2) is available for this customer)
- Number of Servers to be Provisioned: **1**



___7. Click **Next**.

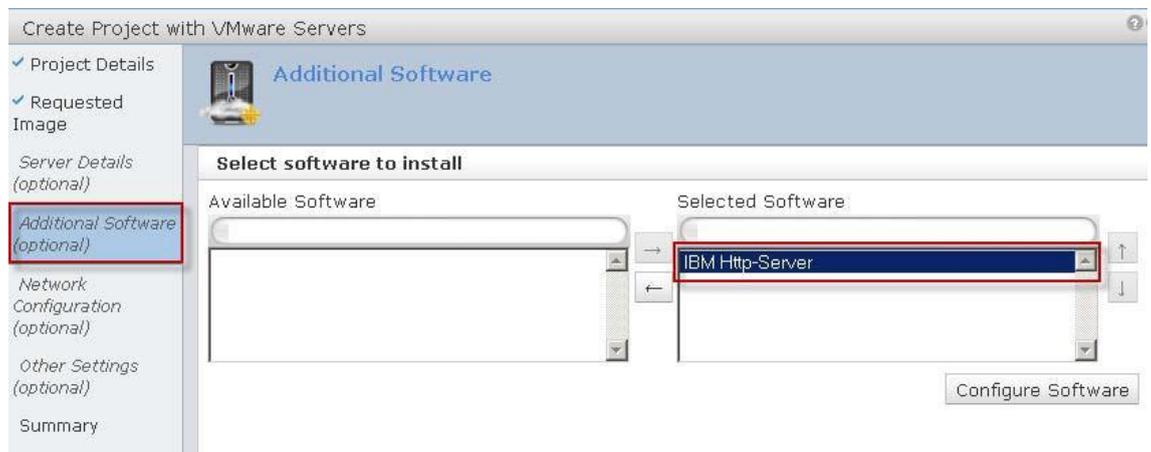
___8. Enter the following information on the Server Details window:

- Virtual CPU: **1**
- Physical CPU: **0.3**
- Main Memory: **1.0 GB**
- Swap: **0 GB**
- Disk: **3 GB**

___9. Click **Next**.

___10. On the Additional Software window, select the **IBM Http-Server** software and use the right arrow to move it from **Available Software** to **Selected Software**.

The HTTP software was available to the TIVED1 customer, but not the default customer used by cloudadmin.



___11. Click **Finish** to accept the defaults for the remaining options.



___12. Review the summary page, and click **Finish** to submit the request.

The request in the **My Requests** portlet listed as **New**, **Queued**, or **In Progress**.

___13. Continue to the next lab exercise when your request is **In Progress**. Notice that the My Requests portlet does not contain any information about the activities of the other customer.



User **tived1admin** receives an email that the request has been accepted.

Fundamentals of Cloud Computing

Exercise 18: Monitoring the deployment status (optional)

In this exercise, you monitor the deployment of the new virtual server deployed with the HTTP server in the previous exercise.

- ___1. Log in to the Tivoli Service Automation Manager administrative UI as **maxadmin** with password **object00**.

- ___2. Click **Start Center > Provisioning Workflow Status**. You see two workflows in progress for your request.

Deployment Request	Workflow Name	Submit Date	Status
16.422	RP.ClusterProvision	6/18/13 11:21:04	In progress
16.401	Resource_Master	6/18/13 11:21:03	In progress

- ___3. Click the number in the Deployment Request column that coincides with **RP.ClusterProvision**. You see the execution details of the virtual machine deployment workflow.

- ___4. Click the **Refresh** icon to update the page. Continue to the next step while the workflows are in progress.

- ___5. Log in to the VMware vSphere Client as **Administrator** with password **object00**. You see the virtual machine being cloned. Use the Recent Tasks pane to monitor the progress.

Name	Target	Status	Initiated by	vCenter Server
Clone virtual machine	sles11_vs02	27%	Administrator	VM104

Cloning the virtual machine is the first of several tasks performed at the VMware vSphere Client. When the cloning completes, monitor the status to see a new virtual server with the **vm19216880131** name is created.

- ___6. Return to the Tivoli Provisioning Manager Provisioning Workflow Status page to view the progress of the workflows. Wait for the workflows to finish. This task might take up to 15 minutes to complete. You can explore other areas of the product while you wait. The workflows status shows a **Success** status after the workflows are completed. Notice that a third workflow started to install the HTTP server.

Deployment Request	Workflow Name	Submit Date	Status
16.423	SoftwareModule.Install	6/18/13 11:28:46	Success
16.422	RP.ClusterProvision	6/18/13 11:21:04	Success
16.401	Resource_Master	6/18/13 11:21:03	Success



Tip: The execution log for the **SoftwareModule.Install** workflow contains approximately 160 records when the software installation completes. The execution log for the **RP.ClusterProvision** workflow contains approximately 765 records when the provisioning completes. Tivoli Service Automation Manager deploys the virtual machine and then installs your requested software.

- ___7. Return to the self-service UI.
- ___8. Verify that the status of the **Create project <your_initials>03** request is **Resolved** in the **My Requests** portlet.
- ___9. Open the Mozilla Thunderbird application. Select the **tived1admin** user.
- ___10. Open the email with a subject **Your request to start a new project has been processed**. The text describes the virtual server, similar to the following example:

Dear TIVED1 TEAM1 Admin,

you have started a new project Demo03 with the following topology:

The server vm192168080131 has been added with the following parameters:

Server host name:
vm192168080131 Number of
CPU(s): 1

Number of tenths of physical
CPUs: 3 Amount of Memory:
1024 MB

Swap Size: 0 GB

IPv4 address(es):
192.168.80.131 IPv6
address(es):

Disk Space Size:
3 GB Admin
Password:
<password>

___ 11. Write the Admin password here: _____.

The HTTP server is installed, but not started as part of the deployment. You must manually start it. You can use either the VMware vSphere Client or PuTTY to access the virtual server.

___12. To use PuTTY to start the HTTP server, perform the following steps:

___a. Start an instance of PuTTY from the desktop of vm104.

___b. Specify an IP address of **192.168.80.131**.

___c. If prompted with a security alert, click **Yes**.

___d. Log in as user **root** with the Admin password that you wrote down.

___e. Issue the following command to start the HTTP Server:

```
/opt/IBMIHS/bin/apachectl start
```

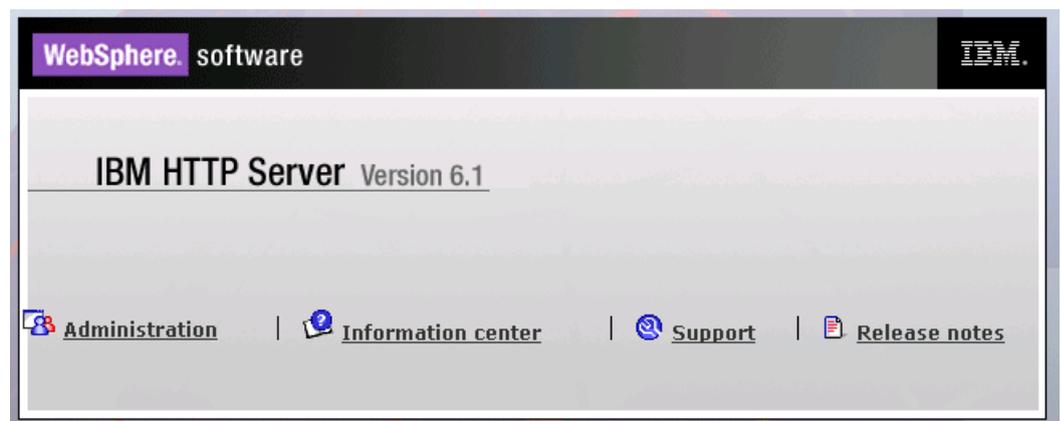
You will not see any messages if the start is successful.

___f. Type **exit** to close the PuTTY session.

___g. Verify that the HTTP server was installed correctly. Use Mozilla Firefox to connect to the IBM Http-Server running on vm192168080131 using this web address:

<http://192.168.80.131/>

You see the following screen.



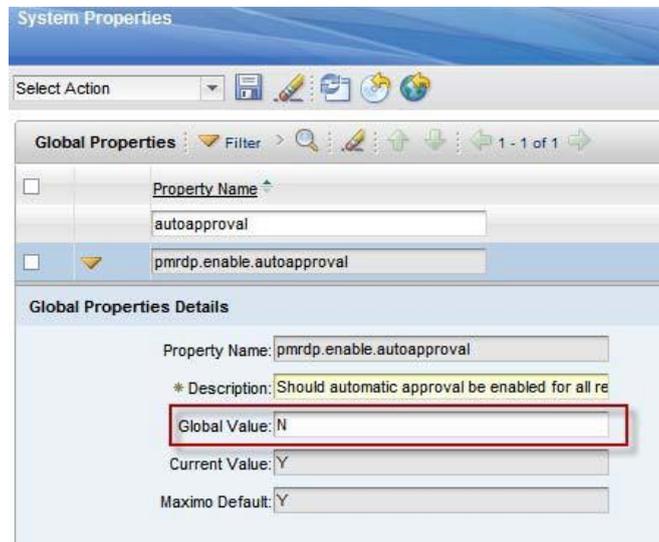
The IBM HTTP Server screen indicates that you have successfully installed the additional software on vm192168080131.

Fundamentals of Cloud Computing

Exercise 19: Disabling automatic approval

In this exercise, you disable automatic approval, which results in all service requests requiring cloud administrative approval in the self-service interface.

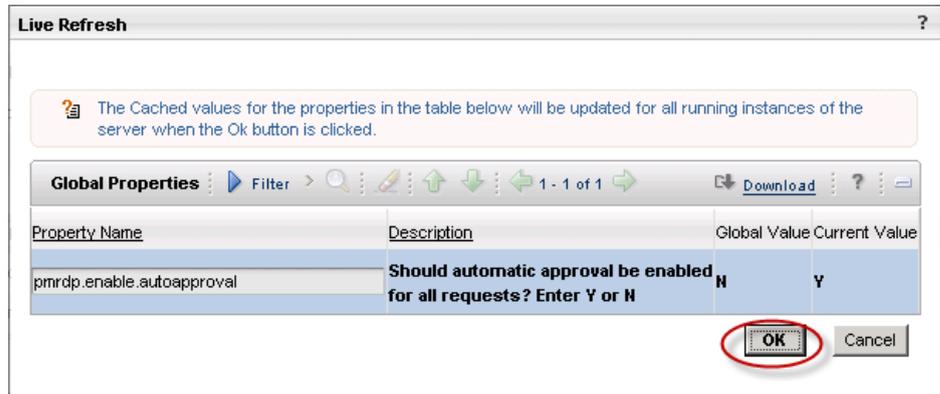
- ___1. If you are not already logged in, log in to the Tivoli Service Automation Manager administrative UI as **maxadmin** with password **object00**.
- ___2. Click **Go To > System Configuration > Platform Configuration > System Properties**.
- ___3. If the row filter is not visible, click **Filter**.
- ___4. Using the row filter, search for and select the property **PMRDP.ENABLE.AUTOAPPROVAL**.
- ___5. Click **View Details** to edit the property value.
- ___6. Change the Global Value to **N**.



- ___7. Click **Save Property**.
- ___8. Select the check box to the left of the **PMRDP.ENABLE.AUTOAPPROVAL** row.



- ___9. Click the **Live Refresh** icon (or select it from the **Select Action** menu) to update the current value of the property.



Click **OK** in the pop-up window to run the live refresh.

Fundamentals of Cloud Computing

Exercise 20: Submitting a service request to restart a virtual machine

In this exercise, you submit a service request to restart a virtual server that is part of your project.

___1. If you are not already logged in, log in to the self-service UI as **tived1admin** with password **object00**.

2. **Click** Request a New Service > Virtual Server Management > Modify Server > Restart Server.



___3. Enter the following information:

- Project Name: **<your_initials>03**
- Server: **vm192168080131**

___4. Click **OK** to submit the request.

___5. In the **My Requests** portlet, verify the status the service request. When the status indicates

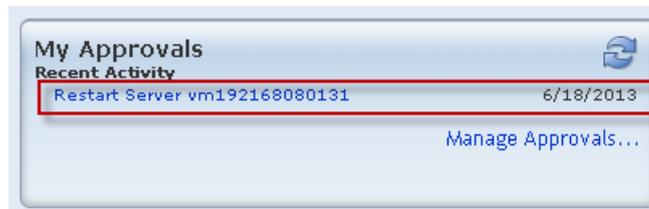
Waiting on Approval, move to the next step.



- ___6. Log out of the self-service UI.

- ___7. Log in to the self-service UI as **cloudadmin** with password **object00**.
Verify that you are working for the TIVED1 customer.

- ___8. Scroll down until you see the **My Approvals** portlet. You should see the new request is waiting for your approval.



- ___9. Click the request that is waiting for approval.

- ___10. Select **Approve request** and enter **Server restart approved** in the **Details** field.
Click

OK.



- ___11. Monitor the status of the service request in the **My Requests** portlet. When it indicates a status of **Resolved**, the server restart has been completed. If you want, you can proceed to the next exercise while the request completes.

Fundamentals of Cloud Computing

Exercise 21: Viewing Tivoli Service Automation Manager reports

In this exercise, you view Tivoli Service Automation Manager report data collected for your project, **<your_initials>01**.



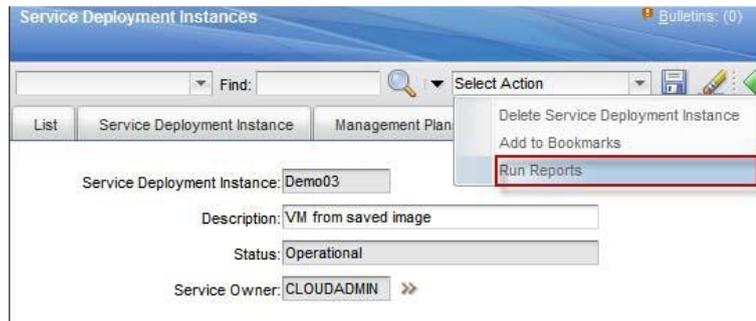
Note: In the self-service UI, **<your_initials>01** is referred to as a *project*, and as a *service deployment instance* in the administrative UI.

- ___1. Log in to the Tivoli Service Automation Manager administrative UI as **maxadmin** with password **object00**.
- ___2. Click **Go To > Service Automation > Service Deployment Instances** to open the **Service Deployment Instances** application.
- ___3. Tab to the **Service Deployment Instance** filter field and press **Enter** to display all service deployment instances (projects).
- ___4. Click a project whose status is **Operational**, such as **<your_initials>03**, for the PMRDPCUST customer.
- ___5. Click the **Service Topology** tab. Verify that your topology nodes look similar to the following example.

Name	Description	Node Tag	Parent Node Name
Project	Deployment	PMRDPLCPR	
Software Stack	Software Stack	PMRDPLCSWS	vm192168080129
vm192168080129	Virtual Server	PMRDPLCVS	Project
Virtual Server Instance 1	Virtual Server Instance	PMRDPLCVSINST	Project

Your project, **<your_initials>03**, is listed with a server and virtual server instance. The virtual server instance is linked to a software stack per virtual machine (vm192168080129, for example).

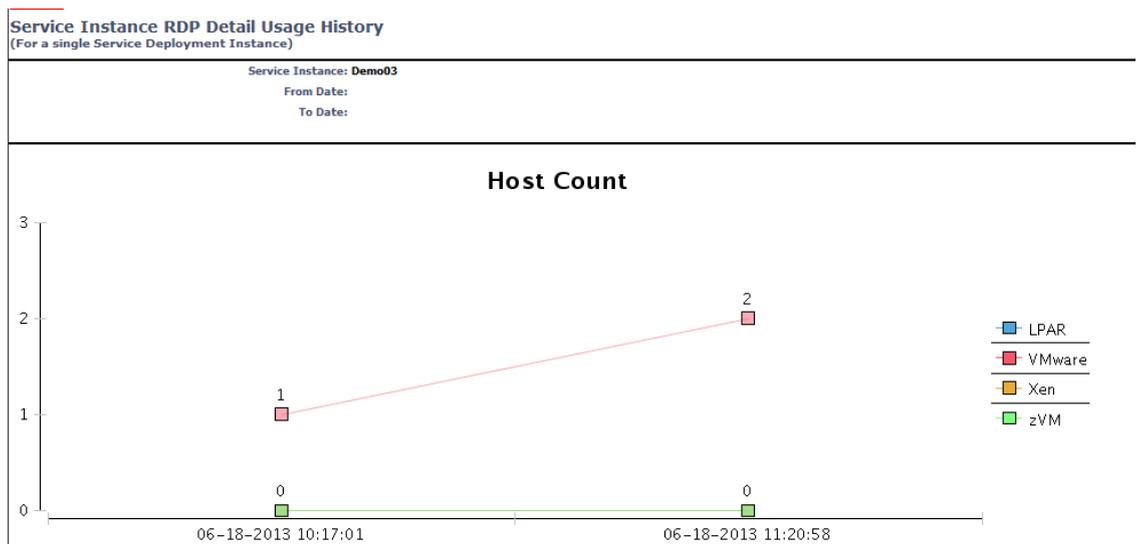
___6. Select **Run Reports** form the **Select Action** menu.



___7. When the **Reports** window opens, click the **RDP History Detail** report.

___8. When the Request Page pop-up window opens, type the name of your project, **<your_initials>03**, in the **Servicename** field and click **Submit**.

Another Internet Explorer window opens for the BIRT Report Viewer with the **Service Instance RDP Detail Usage History** report.



The Service Instance RDP Detail Usage History report graphs host, processor, and memory over time for the project. These graphs display each item across all supported hypervisors. This data is also available to IBM SmartCloud Cost Management (SCCM) after you configure the Tivoli Service Automation Manager integration with SCCM.

___9. Scroll down to view the report data for processor and memory.

You have now completed the Cloud Proof of Technology lab exercises for IBM Tivoli Service Automation Manager. If you have additional questions, contact your facilitator.

Fundamentals of Cloud Computing

Exercise 22: Logging into the standalone VMware ESX server

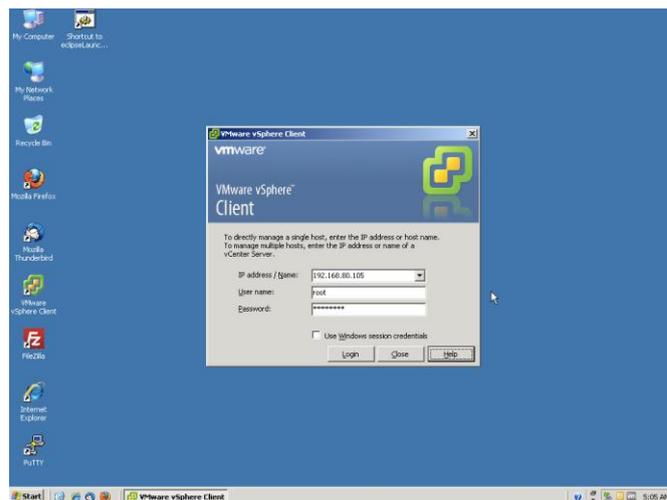
In this exercise you'll log into the system and then use vSphere Client to connect to the VMware ESX Server.



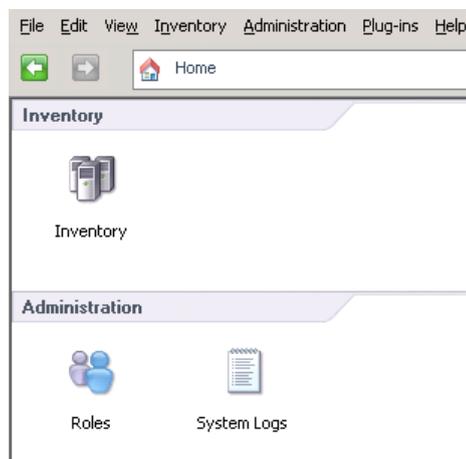
1. Log into the system using username **Administrator** and password **object00**

2. Run **VMware vSphere Client** that is present on the desktop.

3. When the window opens, uncheck **Use Windows session credentials** and provide:
 - a) IP address: **192.168.80.105**
 - b) username: **root**
 - c) password: **object00**



4. In the top bar click **Home**, you should see limited number of options present when connecting to the standalone ESX server:
- 5.

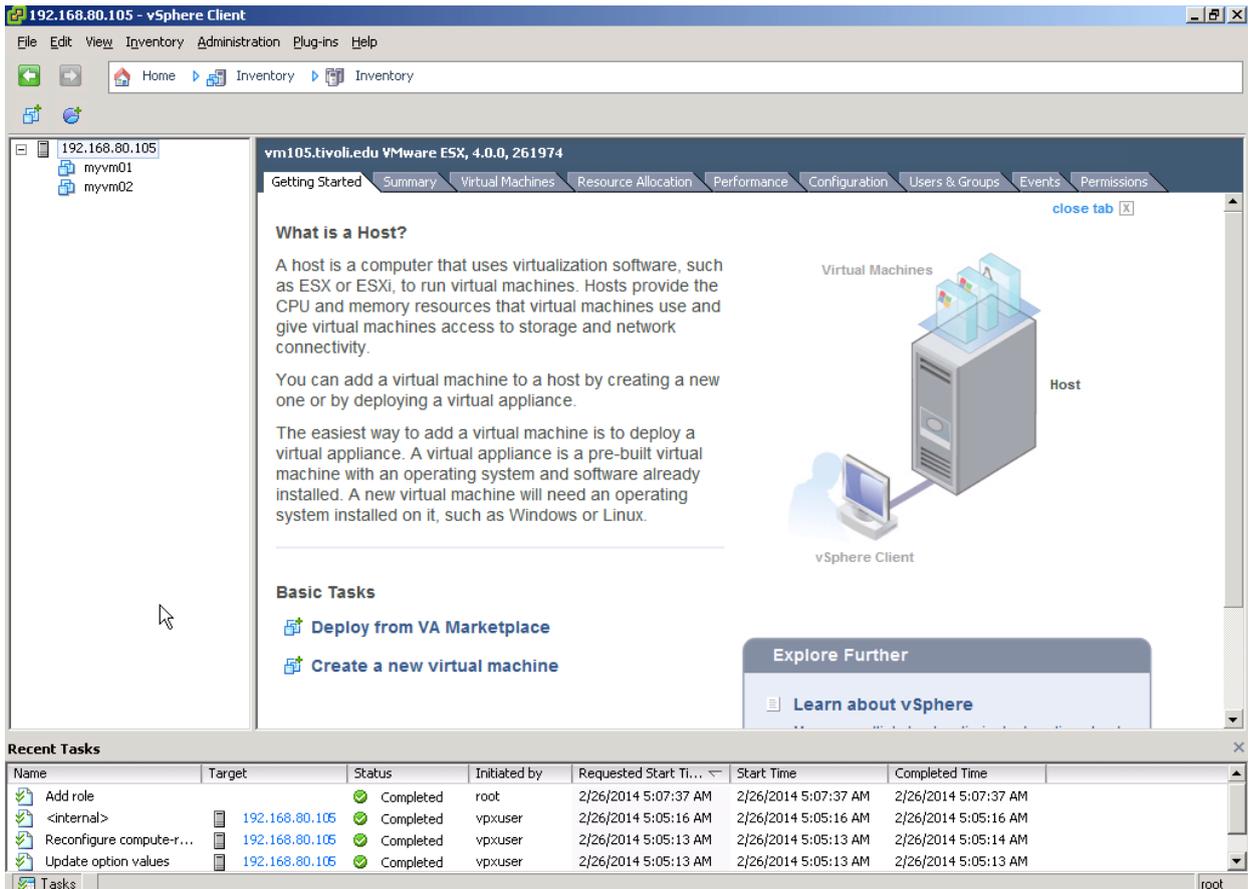


Fundamentals of Cloud Computing

Exercise 23: Exploring general hypervisor information

In this exercise you'll explore several tabs with the information about the host status.

1. Starting from the **Home** screen in the previous exercise, click **Inventory**. Once you see the inventory screen, click + sign near host (**192.168.80.105**) in the root of the object tree on the left side:
2. Make sure the root of the object tree is selected. You should see the screen similar to the one shown.



3. The **Getting Started** page is the main page with basic introductory information and common tasks. Click **Summary** tab.

The screenshot shows the VMware ESX 4.0.0 Summary tab. The interface is divided into several sections:

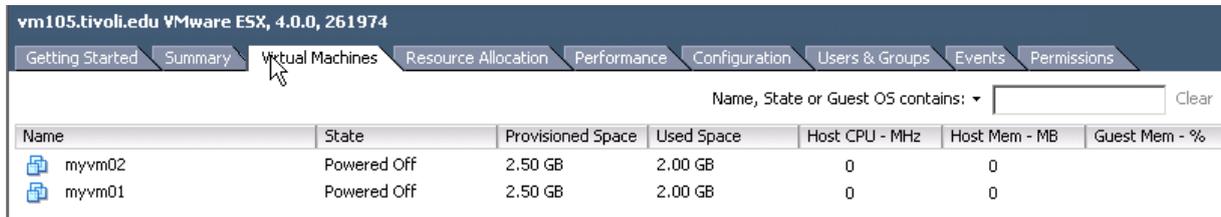
- General:**
 - Manufacturer: VMware, Inc.
 - Model: VMware Virtual Platform
 - CPU Cores: 2 CPUs x 2,504 GHz
 - Processor Type: Intel(R) Xeon(R) CPU E5420 @ 2.50GHz
 - License: vSphere 4 Enterprise Licensed for 2 physical CPU...
 - Processor Sockets: 2
 - Cores per Socket: 1
 - Logical Processors: 2
 - Hyperthreading: Inactive
 - Number of NICs: 1
 - State: Connected
 - Virtual Machines and Templates: 2
 - VMotion Enabled: N/A
 - VMware EVC Mode: N/A
 - Fault Tolerance Enabled: N/A
 - Active Tasks:
 - Host Profile: N/A
 - Profile Compliance: N/A
- Resources:**
 - CPU usage: 76 MHz (Capacity: 2 x 2,504 GHz)
 - Memory usage: 755.00 MB (Capacity: 4095.94 MB)
 - Datstore Table:**

Datstore	Capacity	Free	Last Update
vm105:storage2	19.75 GB	19.36 GB	2/26/2014 !
vm105:storage1	38.75 GB	22.86 GB	2/26/2014 !
 - Network Table:**

Network	Type	Nu
VM Network	Standard switch network	2
- Commands:**
 - New Virtual Machine
 - New Resource Pool
 - Enter Maintenance Mode
 - Reboot
 - Shutdown

4. The **Summary** tab shows general information about the hypervisor capacity and current resources consumption.
- a) In the **General** panel there are information about licenses, CPU capacity, number of VMs and templates and etc. Notice different information about CPU present.
- ⑩ **Processor Sockets** number is number of physical multicore processors available.
 - ⑩ **Cores per Socket** is the number of the cores (physical) present in each processor.
 - ⑩ Each processor can process instructions using multithreading technology (Intel name: **Hyperthreading**). It results in having 2 simultaneously executed instructions per core.
 - ⑩ This multiplied by total number of physical cores gives the number of **Logical processors**.
- b) In **Commands** panel administrator can run common actions on the Hypervisor, like rebooting or shutting it down or creating a virtual machine.
- c) **Resources** panel is the quick way for the administrator to check the resource consumption on the hypervisor.
- ⑩ The total number of MHz is the sum of all MHz for each physical core. Current total MHz consumption shown is proportional to the percent of total CPU utilization on the host.
 - ⑩ Memory usage includes also some part of the memory used by the hypervisor.
 - ⑩ Notice, that there is some utilization even though no virtual machines are running.
 - ⑩ Below there is also a quick view on the list of defined datastores and networks.

5. Click on the **Virtual Machines** tab. This tab is an easy way to see the current resource utilization on the running virtual machines and also it is possible to perform standard actions like suspend or shutdown guest OS on multiple virtual machines (using



Shift or CTRL keys).

6. Click on the **Resource Allocation** tab. This tab enables you to assign reservations, and priorities to the virtual machines.

a) For CPU and Memory you can set a reserved pool of resources assigned to the VM.

⑩ This means that selected VMs will have guaranteed resources, when they will need them.

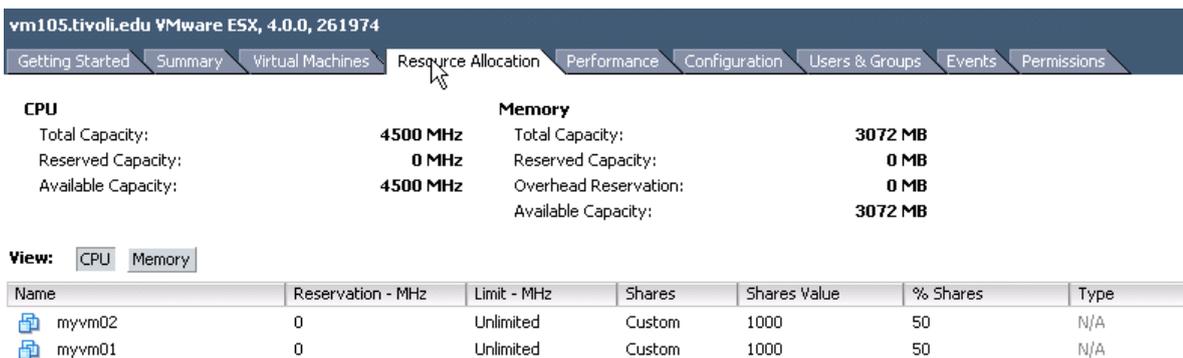
⑩ Notice that **Available Capacity** is smaller than the total amount of memory available on the hypervisor. This is the result of reserving some resources for hypervisor itself.

b) **Shares Value** is the numeric way of assigning weights to the resources for each VM.

⑩ This enables administrator to give for a particular VM i.e. twice as much CPU cycles or twice as high priority when accessing memory than the other VM.

⑩ **% Shares** column shows resulting percentage of the shares assigned to each VM.

⑩ Example: if one VM has shares value for CPU equal to 3000 and the other 1000, then former will have 75% of the CPU time, and the other only 25%.



Fundamentals of Cloud Computing

Exercise 24: Monitoring hypervisor's performance

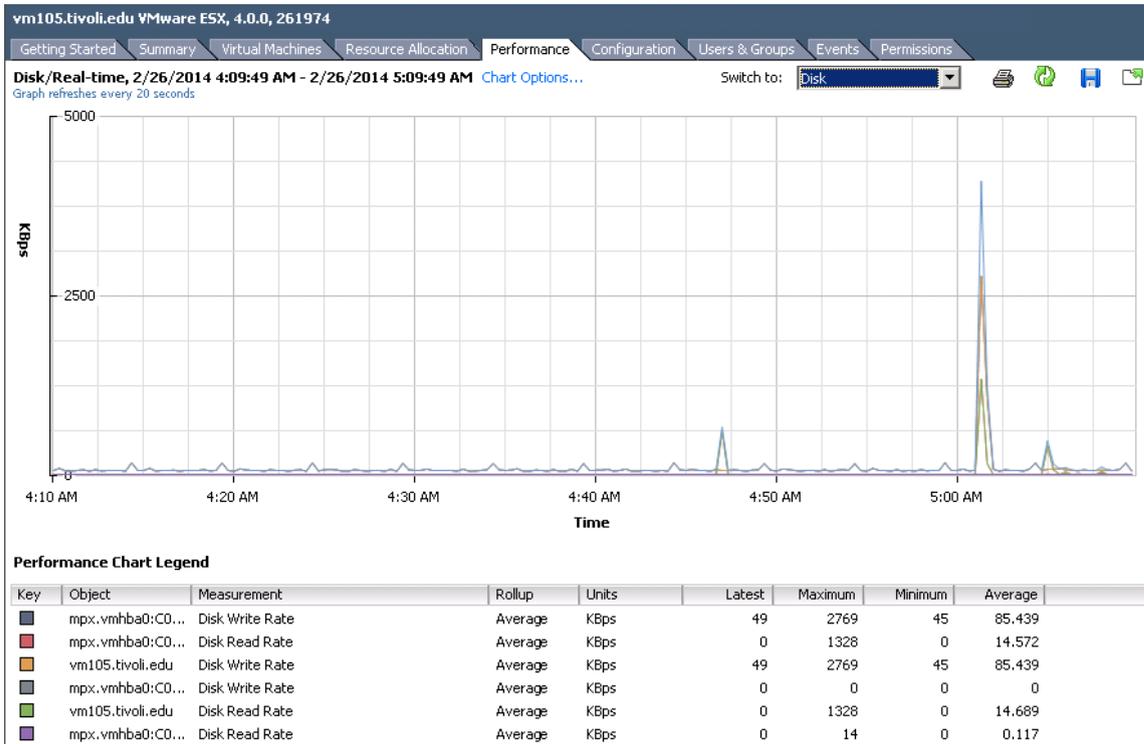
In this exercise you'll explore the performance information available for the hypervisor.



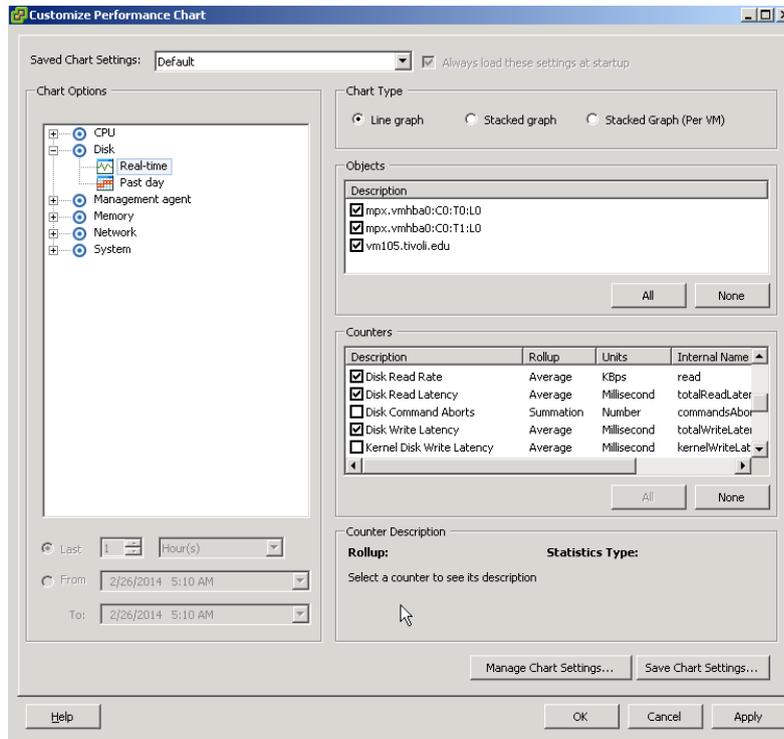
1. Click on the **Performance** tab.

2. By default CPU perspective should be opened.
 - a) This gives the administrator resource utilization information for last 1 hour.
 - b) For CPU the history of utilization is shown for each core, however, more valuable can be **vm105.tivoli.edu CPU Usage** data series, which gives the average utilization for all cores resulting in a more general view of what is the host CPU utilization.

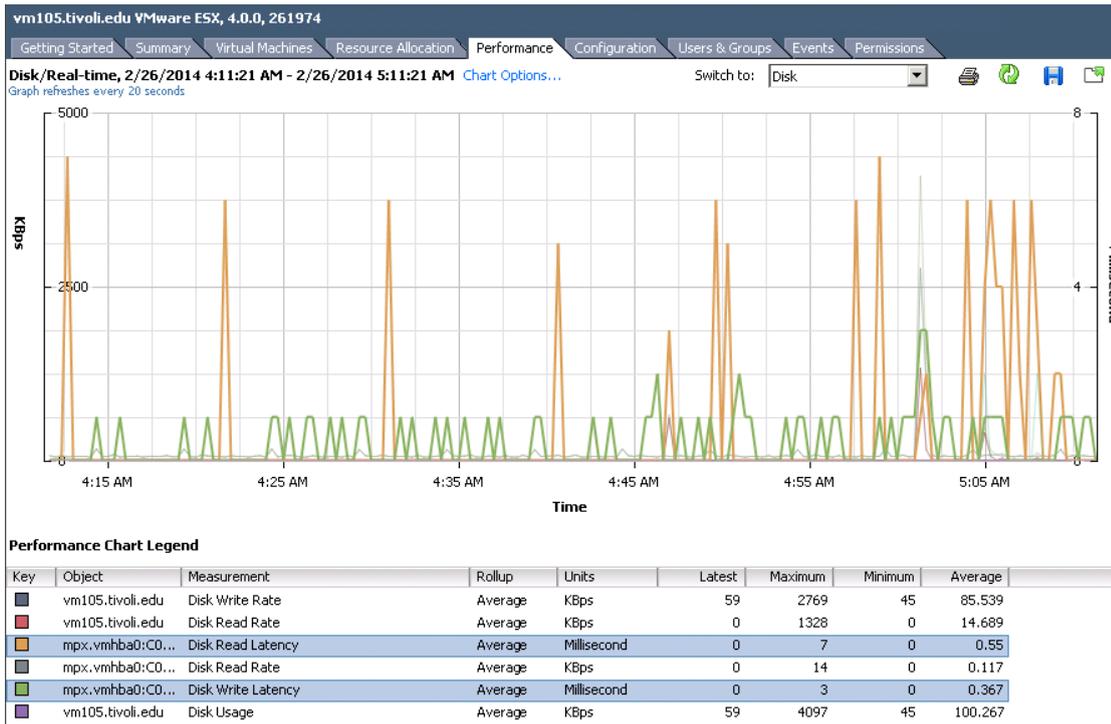
3. Switch to the **Disk** perspective.
- a) This perspective gives the information about current disk activity.



- b) The information presented covers all of the controllers available and the average for hypervisor. Reads and writes are separated.
4. There is also a very useful measurement for the storage subsystem performance – read/write latency. Click **Chart Options**, a window should be opened:



5. On the left **Disk** → **Real-time** should be selected.



6. In the **Counters** list, select **Disk Read Latency** and **Disk Write Latency**. Click **OK** button to close window.

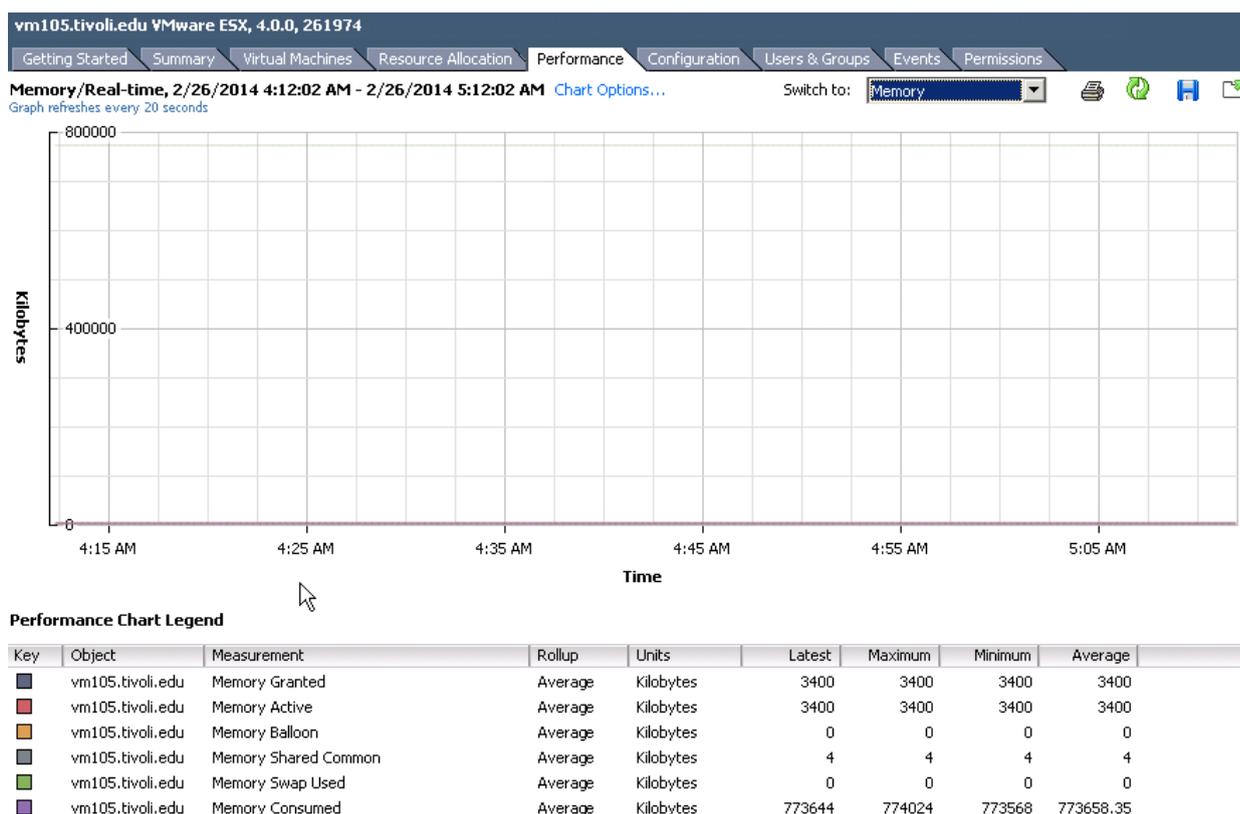
7. New series will be added to the chart.

a) Disk latency is a good performance measurement. The higher the value, the slower the response of the virtual systems is. Up to 10 ms is a reasonable response time.

b) Notice that virtualization generally assumes that the workload will be spread across different virtual machines in time. Therefore, if several workloads will need to access storage more often at the same time, the response time can quickly grow to high values and seconds later go back to 0.

c) The **Average** column is a good indicator of an overall storage performance, cause it takes into consideration data collected for a longer period of time.

8. Switch to the **Memory** perspective. This perspective shows details about memory consumption for each type of memory allocation.



9. Currently, no virtual machines are running, however, you should know the meaning of each measurement:

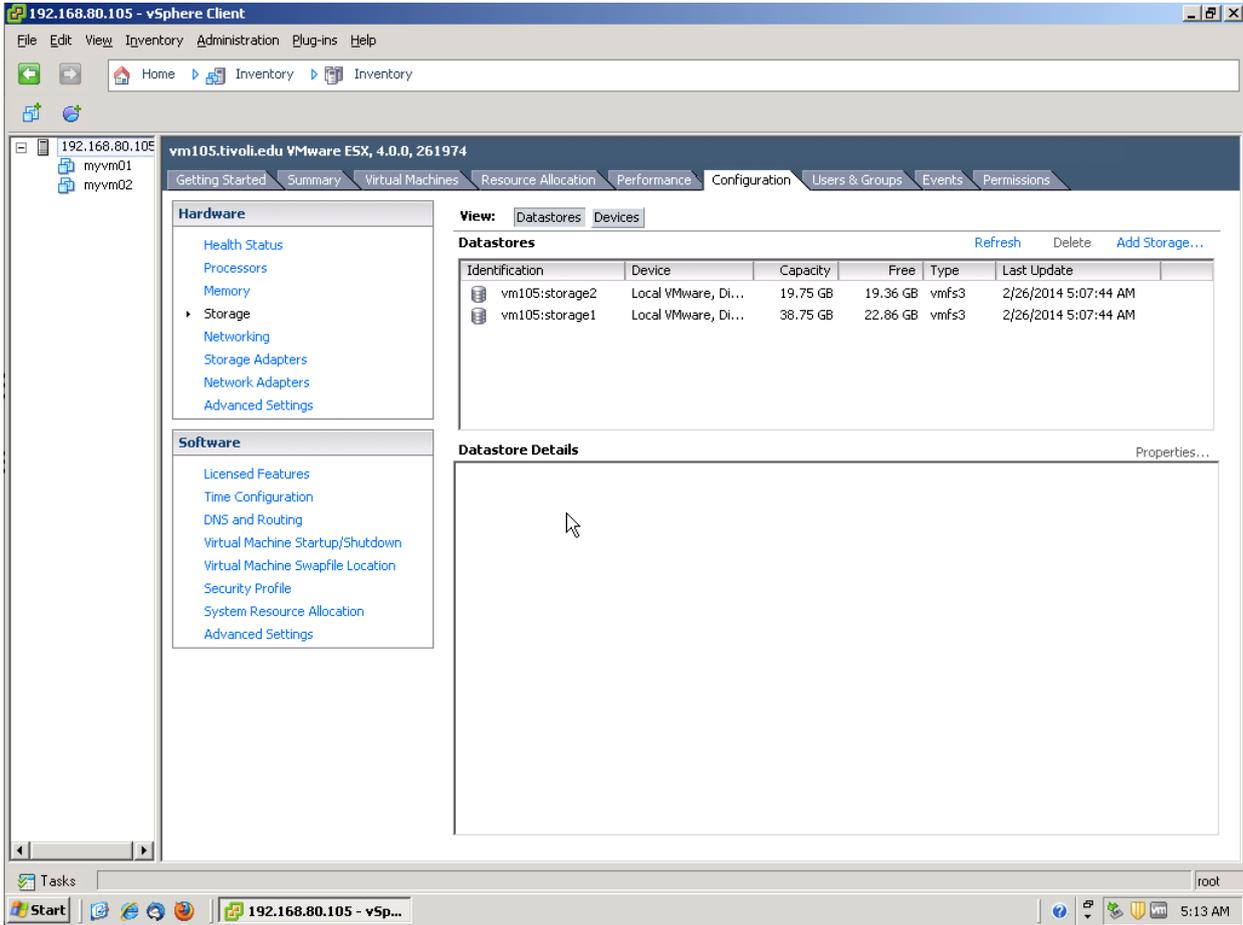
- a) **Granted** – memory granted to the virtual systems – it grows gradually, even though guests systems see all of the memory assigned to them. Moreover, this value can be greater than the physical memory available on the hypervisor.
- b) **Active** – memory that is used currently by the virtual systems
- c) **Consumed** – physical memory consumption, this value at maximum is close to the total physical memory available.
- d) **Balloon** – memory used by Ballooning technique for collecting unused memory from the systems that don't need it at the moment and given to the systems that need it.
- e) **Shared common** – memory shared between virtual systems (**Transparent Page Sharing** mechanism).
 - ⑩ If you have many similar environments, they may keep in the memory the same memory pages – to save memory, hypervisor shares memory pages, that are the same across multiple environments.
 - ⑩ If the page is modified, the hypervisor will then allocate a new page (Copy-On-Write mechanism).
- f) **Swap used** – memory swapped to the hard disk, however notice that this is the memory swapped by the hypervisor not the guest OS when other mechanisms fail (ballooning and TPS)

Fundamentals of Cloud Computing

Exercise 25: Managing datastores

Hypervisor needs a storage for virtual machines. In this exercise you'll remove datastore and add it again to see how storage is visible and can be managed by Hypervisor.

1. Click on the **Configuration** tab on the hypervisor level.



2. Click on the **Storage** link in the **Hardware** panel.

3. A list of configured datastores is shown. Click on any datastore on the list to see details.

Datasstores Refresh Delete Add Storage...

Identification	Device	Capacity	Free	Type	Last Update
vm105:storage2	Local VMware, Di...	19.75 GB	19.36 GB	vmfs3	2/26/2014 5:07:44 AM
vm105:storage1	Local VMware, Di...	38.75 GB	22.86 GB	vmfs3	2/26/2014 5:07:44 AM

Datstore Details Properties...

vm105:storage1 38.75 GB Capacity

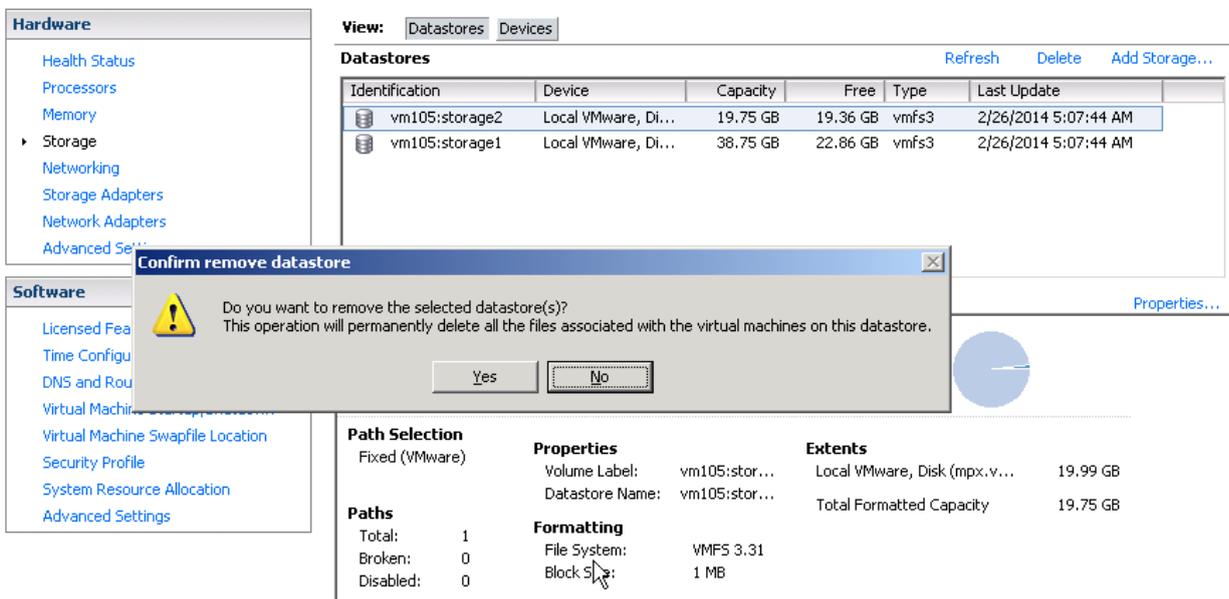
Location: /vmfs/volumes/4c0debd5-c6...

15.89 GB Used 

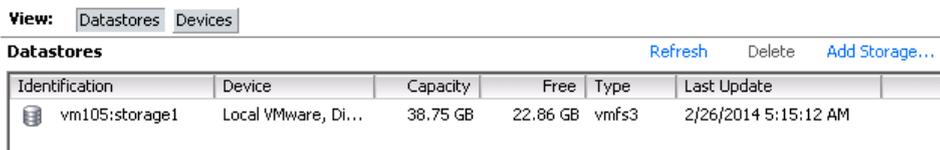
22.86 GB Free

Path Selection	Properties	Extents	
Fixed (VMware)	Volume Label: vm105:stor...	Local VMware, Disk (mpx.v...	38.82 GB
	Datastore Name: vm105:stor...	Total Formatted Capacity	38.75 GB
Paths	Formatting		
Total: 1	File System: VMFS 3.33		
Broken: 0	Block Size: 1 MB		
Disabled: 0			

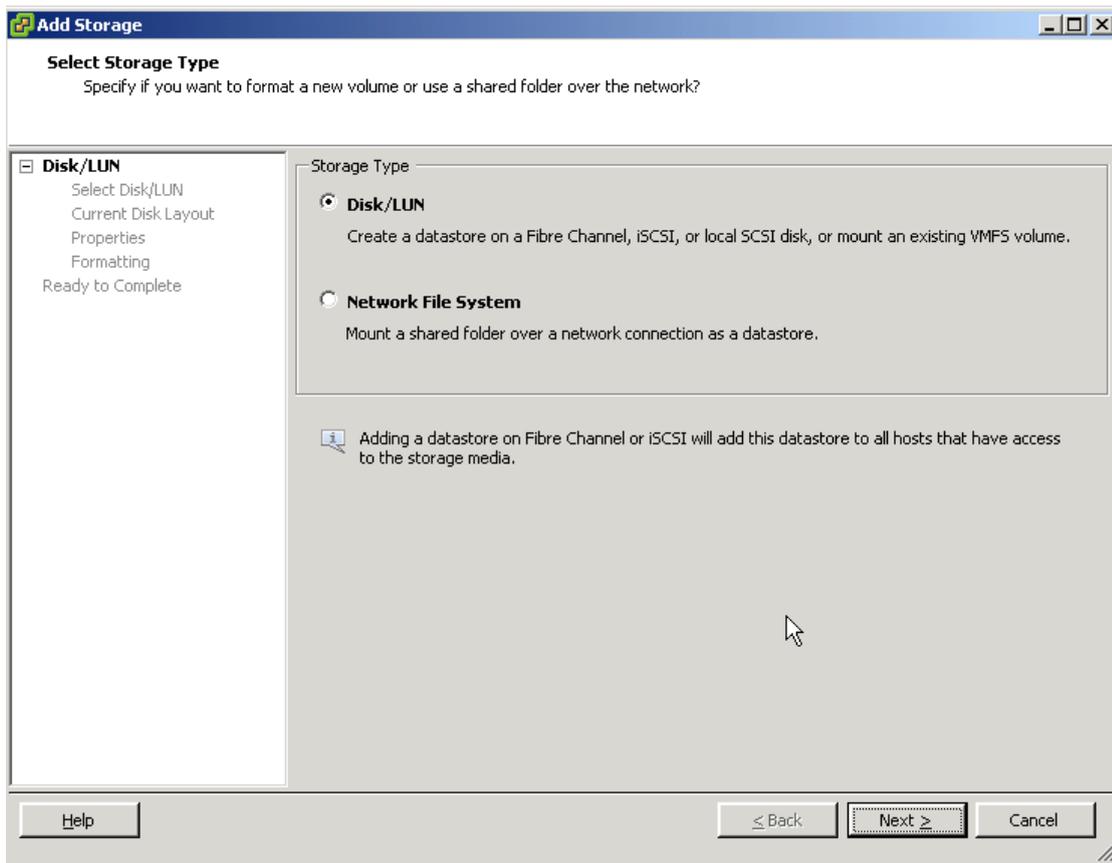
4. Notice the following information:
 - a) **Capacity** – free and used space is shown. Used space value takes into consideration the fact that some of the virtual machine disks are thin provisioned.
 - b) **Paths** – is the number of connections to the underlying storage. In SAN, you can have multiple links between server and storage subsystem. This is used for both performance and high availability purposes.
 - c) **Extents** – datastores can consist of multiple extents, so you can create several LUNs on your disk array, and merge them to act as a single datastore on the hypervisor.
5. Select **vm105:storage2** (*Important*: select the storage that doesn't have any data on it – look for usage information shown below, and verify it with right click and **Browse datastore**).



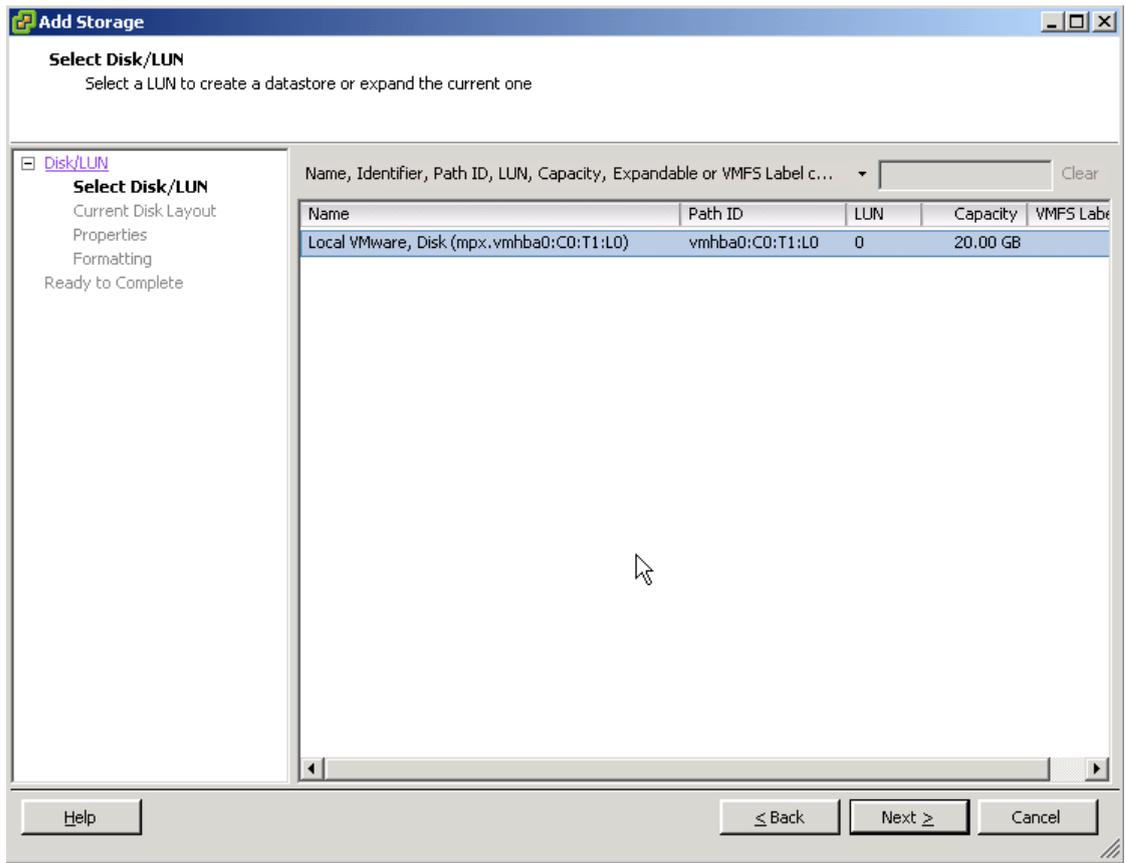
6. Click **Delete** link.
7. Confirm with **Yes** button.
8. The datastore should be removed from the list after couple of seconds. You can click **Refresh** if it doesn't refresh automatically.



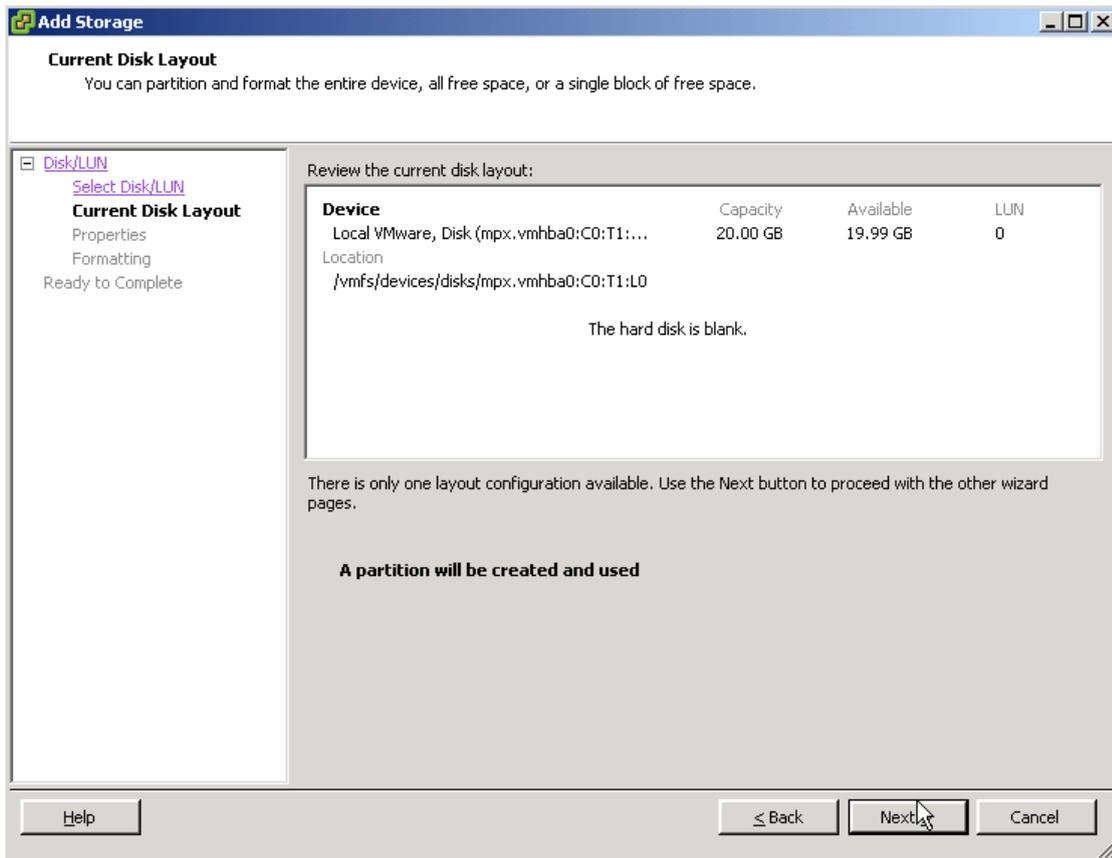
9. This is a moment, when you have configured your storage, created a new LUN and now you want to add it to the hypervisor. Click **Add Storage**.
10. Select **Disk/LUN** as **Storage Type** and click **Next**.



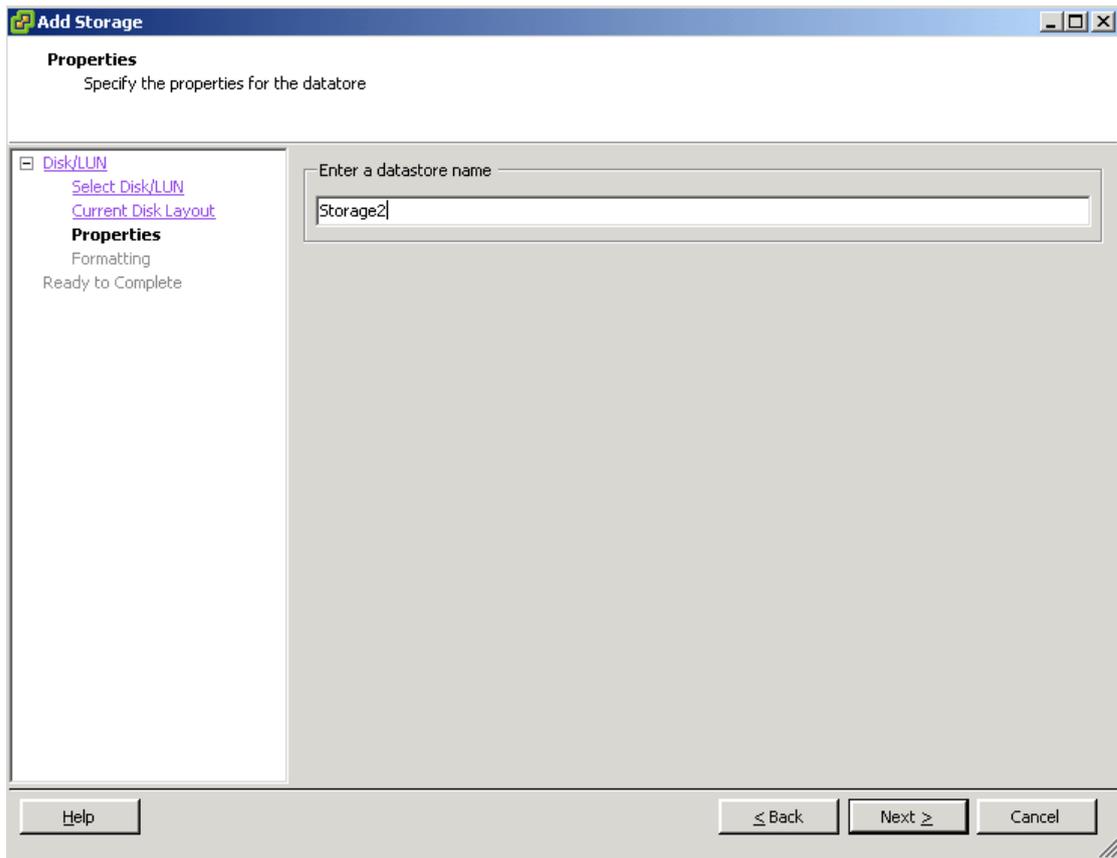
11. At this moment hypervisor searches for LUNs and disks available. There is a directly connected disk to the hypervisor that was previously used by **vm105:storage2** datastore which now is available. Select the disk that has been found and click **Next**.



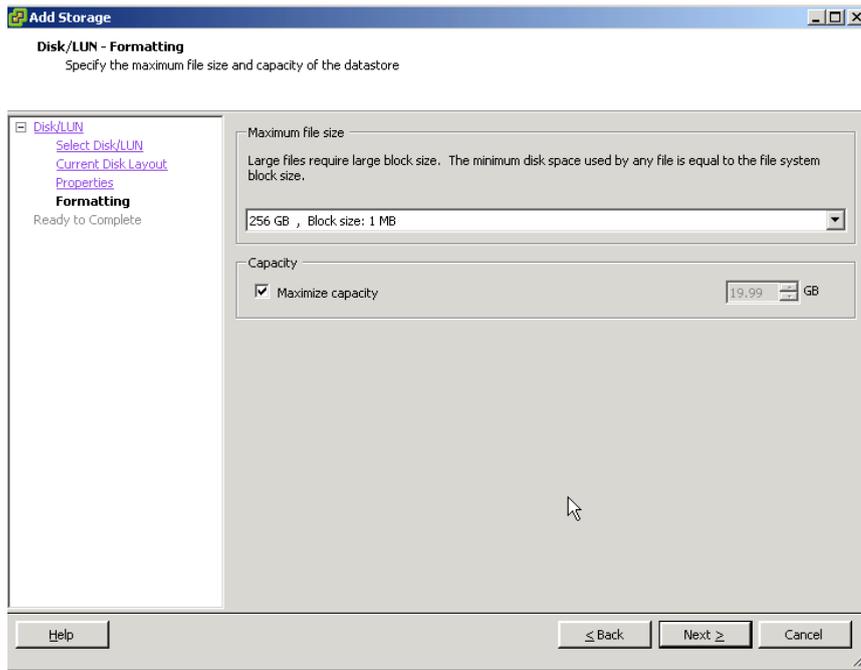
- Review current layout and click **Next**.



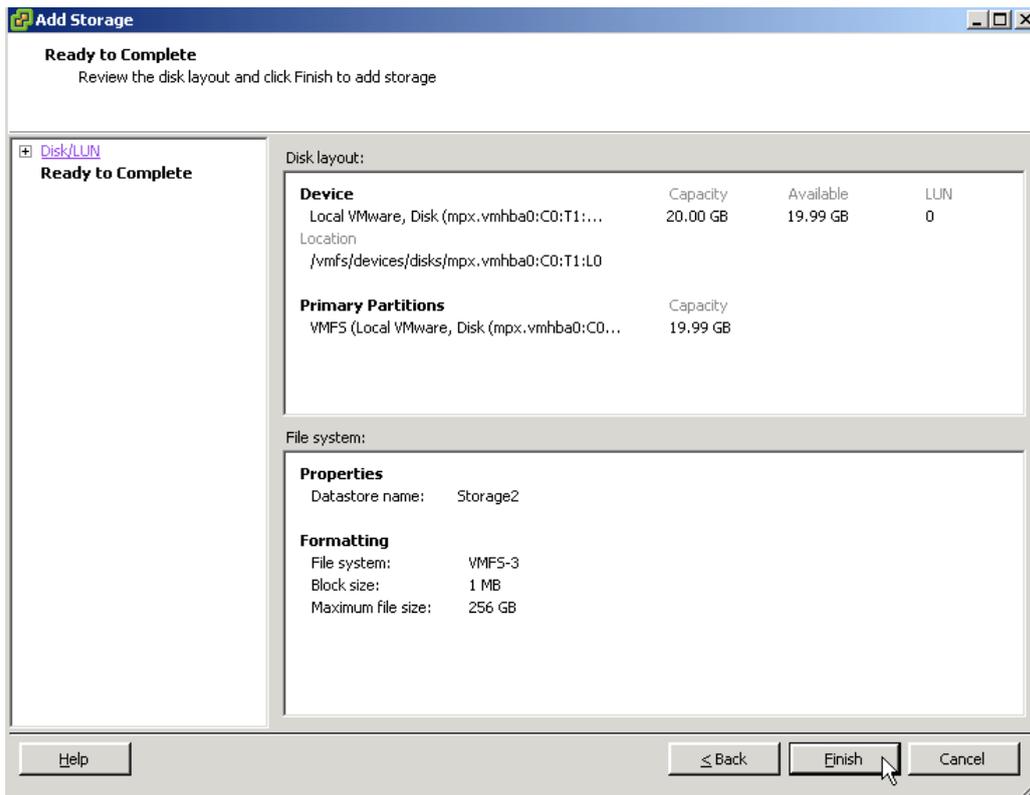
- In the next screen, provide a name **Storage2** and click **Next**.



14. In **Formatting** section choose 1MB as a block size.
 - a) Note the limit for the file size that is different for each block size (the larger the block size, the larger the limit).
 - b) This limit is important, if you need to store large virtual machine disks.



c) Click **Next**



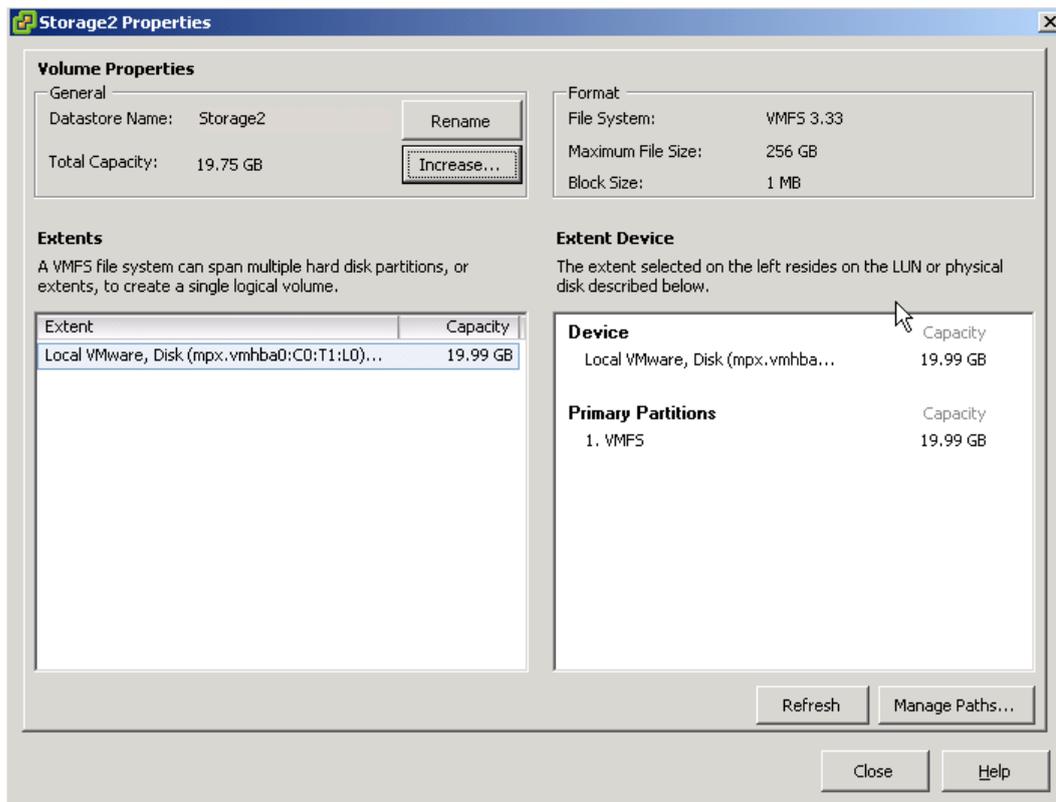
- 15. In the final screen review the summary and click **Finish**
- 16. After a few seconds your datastore should appear on the list.

View: **Datstores** Devices

Datstores Refresh Delete Add Storage...

Identification	Device	Capacity	Free	Type	Last Update
vm105:storage1	Local VMware, Di...	38.75 GB	22.86 GB	vmfs3	2/26/2014 5:18:12 AM
Storage2	Local VMware, Di...	19.75 GB	19.36 GB	vmfs3	2/26/2014 5:18:12 AM

17. In the future, the datastore can be extended by adding another LUN to it.
- It can be done by clicking **Preferences** for selected datastore and using **Increase** button.
 - Click **Close** button.

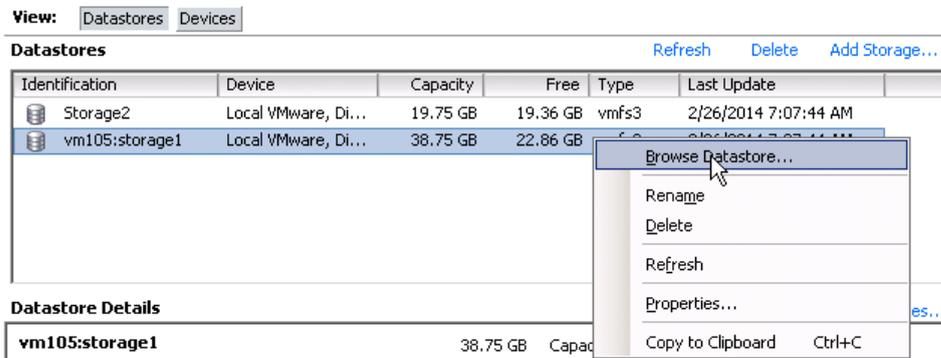


Fundamentals of Cloud Computing

Exercise 26: Exploring Virtual Machine files

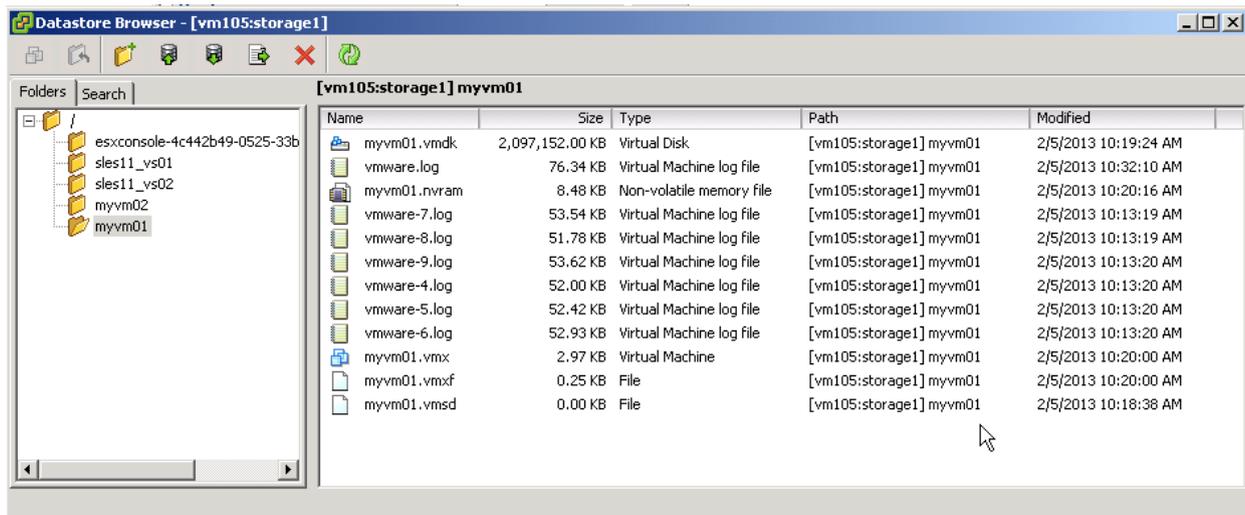
In this exercise you'll explore files necessary for virtual machine to run.

- Starting from the **Storage** section in **Configuration** tab right-click on



vm105:storage1 and select **Browse datastore**.

- Click on the **myvm01** folder on the navigation tree to see the contents.



- Virtual machine consists of set of files:

a) .vmdk files are the virtual machine disks, where the actual data is being stored. There are three main formats of the virtual machine disk files:

- ⑩ thick provisioned – the hypervisor allocates a file of the size of the requested disk
- so even if there is no data inside and a 100 GB disk has been created, then the corresponding file will occupy 100 GB of the storage space.

— Important: it is sometimes important to guarantee the storage that has been assigned to the VM, so this type is commonly used in IaaS environments. If the storage is filled up, and some VMs using thin provisioned disks wouldn't have space to store their data, they would be suspended, even though inside the virtual machine the OS sees free space.

⑩ thin provisioned – the hypervisor also allocates a file of the size of the requested disk, but this time, there is an information in the file system that this particular file occupies only the space needed to store its contents

— as a result if the VM requires only 10 GB of space to store its data inside 100 GB disk, then hypervisor will mark only 10 GB as used.

— useful for test and dev environments, when you don't need to guarantee the storage provisioned, and you need to consolidate as much virtual environments as you can

— Important: information about thin provisioned disk is stored in file system only, therefore if you copy or download VMDK file, it will result in full 100GB file that you need to store on your target storage. Use **vmkfstools** command or **Move** option of the VM in the vSphere Client connected to the vCenter Server.

⑩ 2GB sparse – this format is used mainly for moving or storing VM disks. It splits vmdk files into chunks smaller than 2GB each.

— It means that 32GB vmdk file will be split into 16 chunks, each smaller than 2GB to be able to put this file on other filesystems with 2GB file size limit, like FAT32.

— All of the files contain only data blocks, which means that using 10GB of data out of 100 GB volume, we should expect around 10GB of total space needed.

— VMDK parts can be copied or downloaded directly and their size will remain the same

b) .nvram – stores BIOS settings of the Virtual Machine

c) .vmx – main configuration file of the Virtual Machine

⑩ human-readable file with set of property-value pairs keeping the most important parameters of the virtual machine like memory, CPU resources or virtual disk attached

⑩ with right-click **Add to inventory** option can be used to register VM

d) .vmxf – extended file with additional configuration parameters

e) .vmxt – the same as .vmx but used by virtual machine templates instead of virtual machines

f) .log – log files with actions performed on VM

g) .vmss – file storing information about snapshots done on the VM.

4. Explore icons on the top of the browser. Using them you can upload/download files and directories, create directories, delete files and directories or move them across datastores.

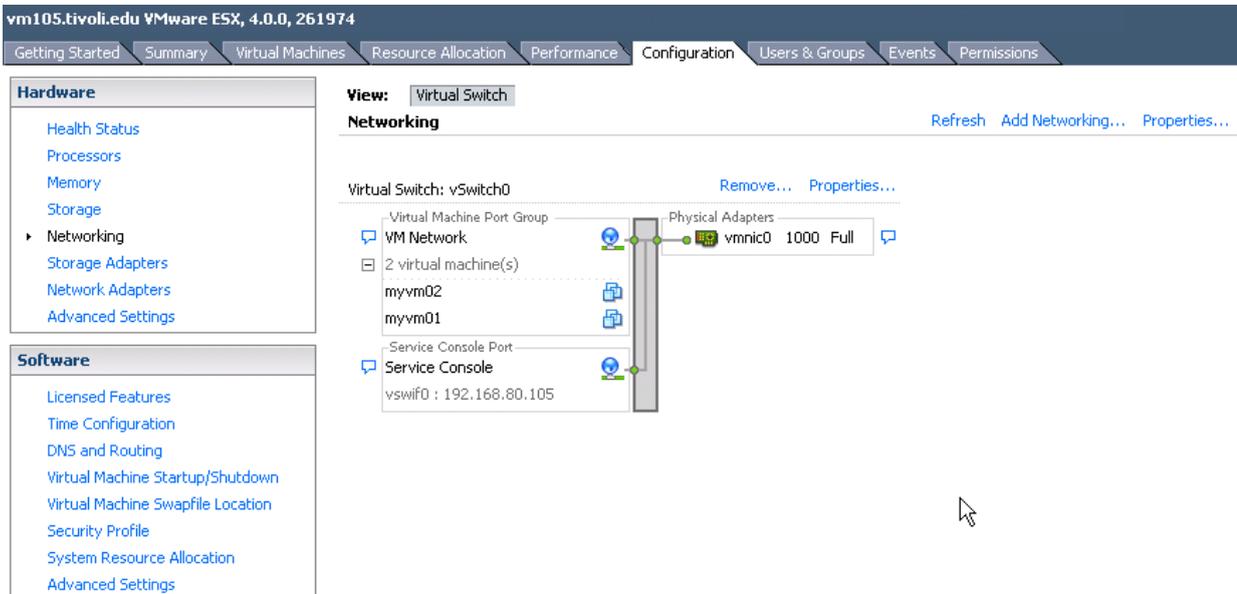
5. Close the browser window.

Fundamentals of Cloud Computing

Exercise 27: Networking

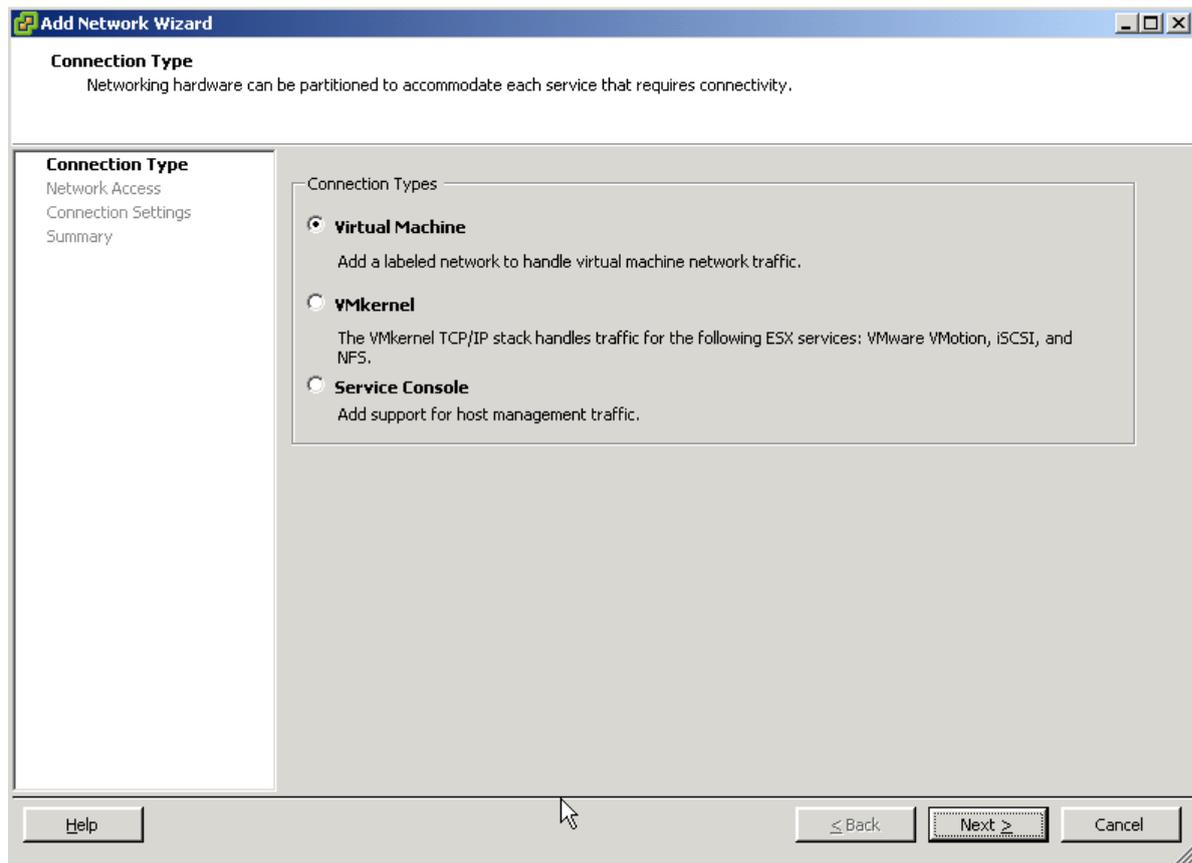
In this exercise you'll see the networking configuration on the hypervisor and add a new port group to your hypervisor, which later can be used by your virtual machines.

1. Starting from **Configuration** tab at hypervisor level click **Networking** link. Current

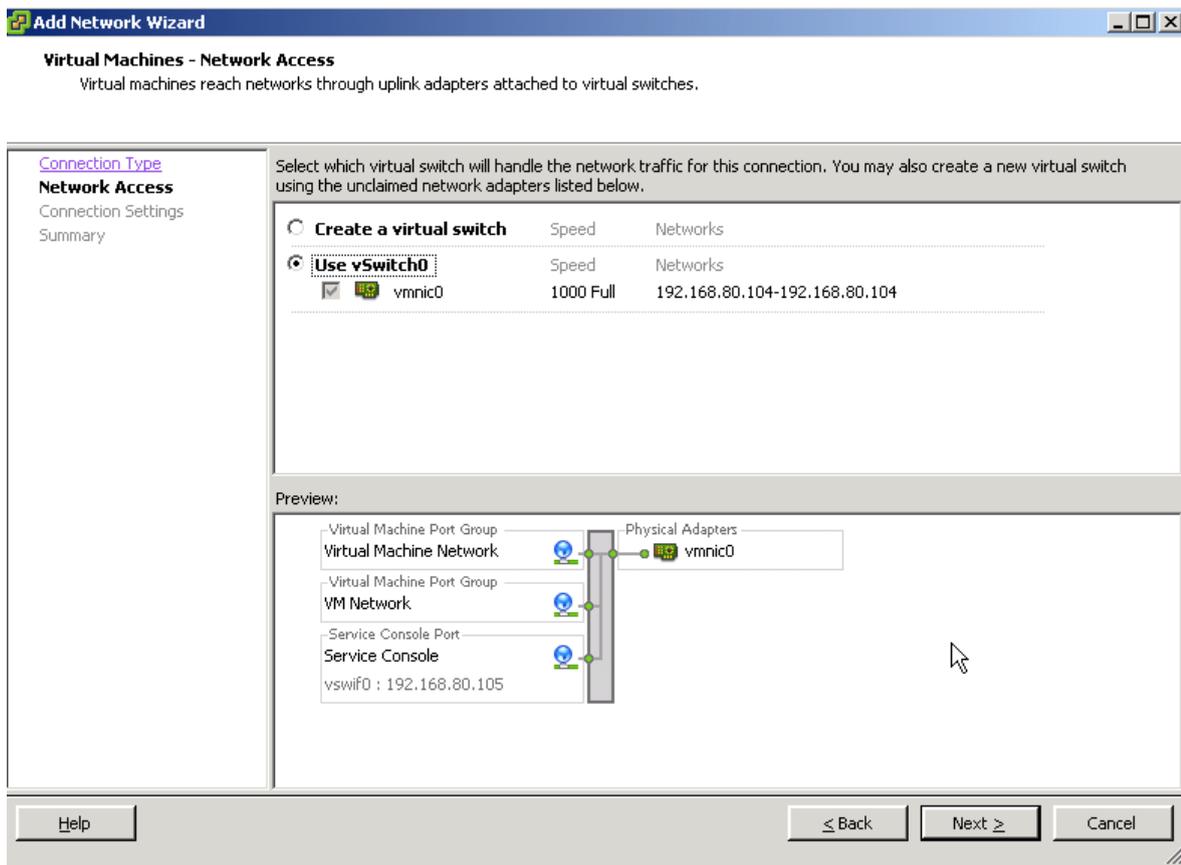


networking configuration should be displayed

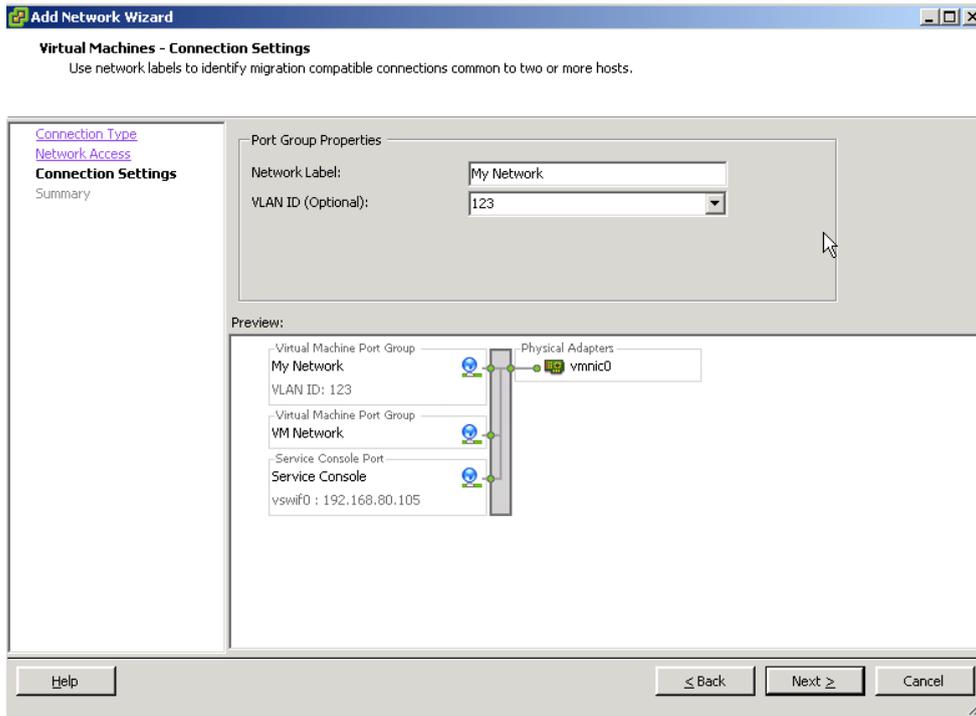
2. Each vSwitch (virtual switch, responsible for packet switching similar to the physical switch) can be assigned a set of physical network adapters.
 - a) Network adapter can belong to one vSwitch only.
 - b) Virtual machines have virtual network interfaces which are assigned to the specific **Port Group**, which is a way of dividing networks on the hypervisor level.
 - c) Each Port Group can be assigned to the specific VLAN, to isolate virtual systems between them.



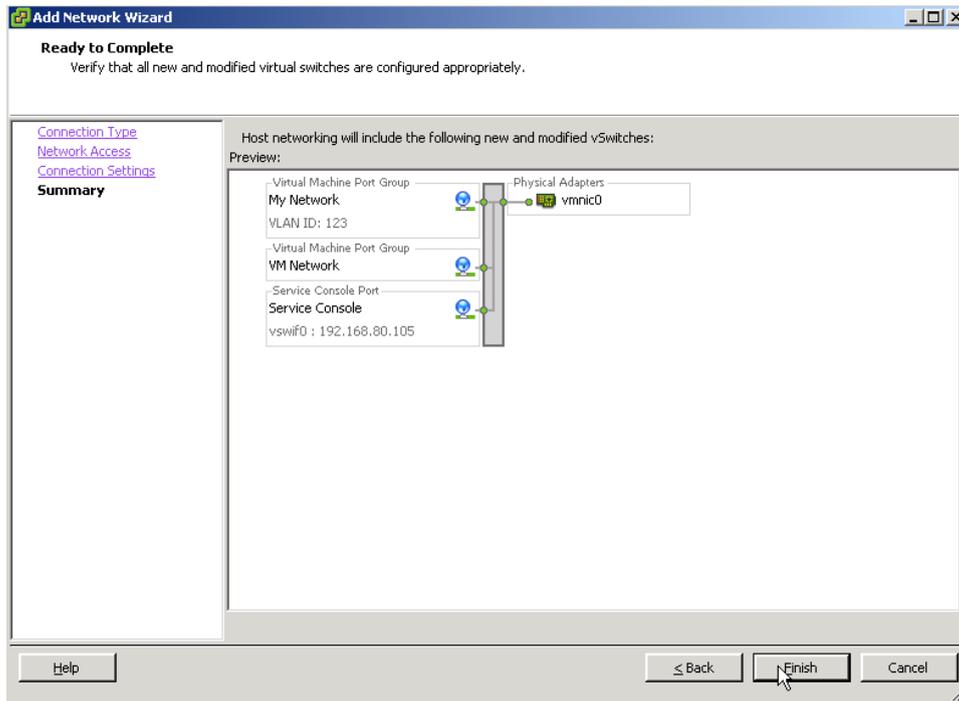
3. To create a new port group click **Add Networking** link. A window opens.
4. Choose **Virtual Machine** in the **Connection Types** section and click **Next**.



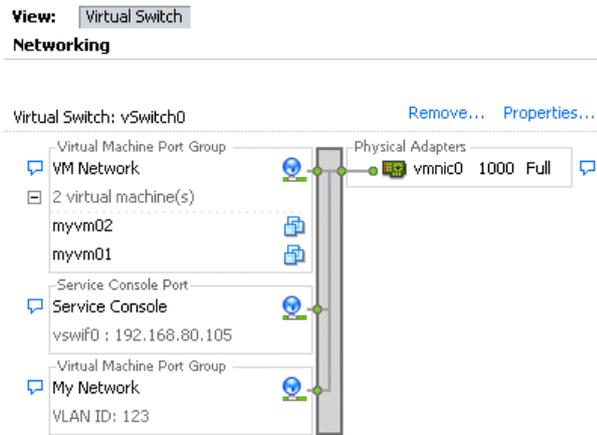
5. Select **Use vSwitch0**. Look how the the topology preview has changed and click **Next**.
6. In the **Connection Settings** section provide:
 - a) a **Network Label** for you network, i.e. **My Network**
 - b) **VLAN ID**, i.e. **123**
7. Click **Next**.



8. In the final screen confirm by clicking **Finish** button.



9. Verify that your new network is present.

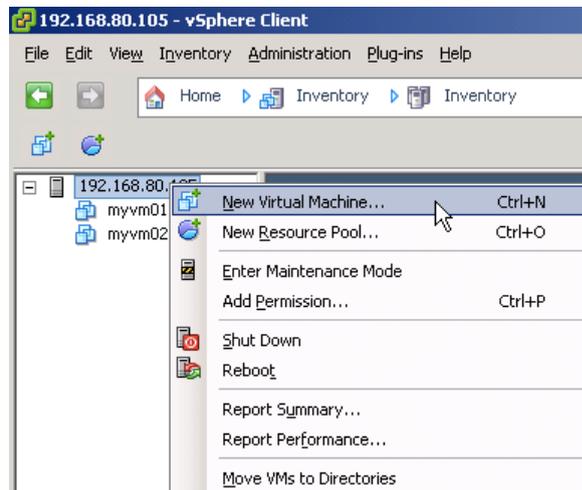


Fundamentals of Cloud Computing

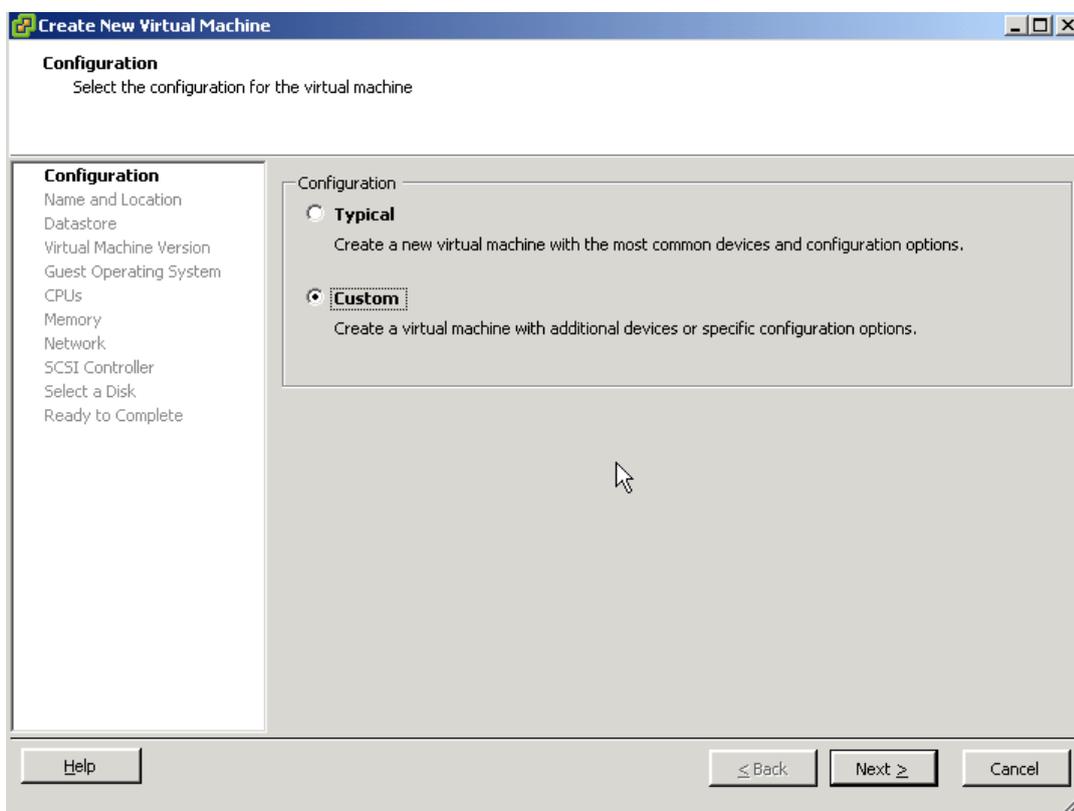
Exercise 28: Creating a new Virtual Machine

In this exercise you'll create a new clean Virtual Machine ready for your operating system to be installed.

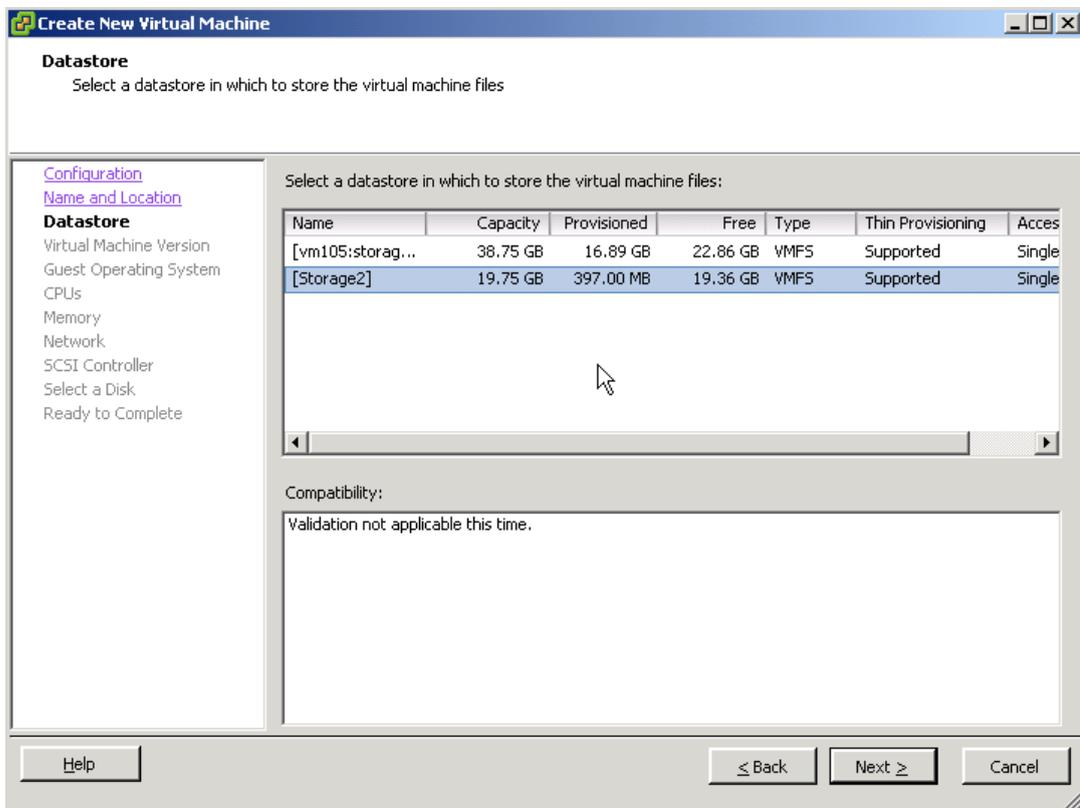
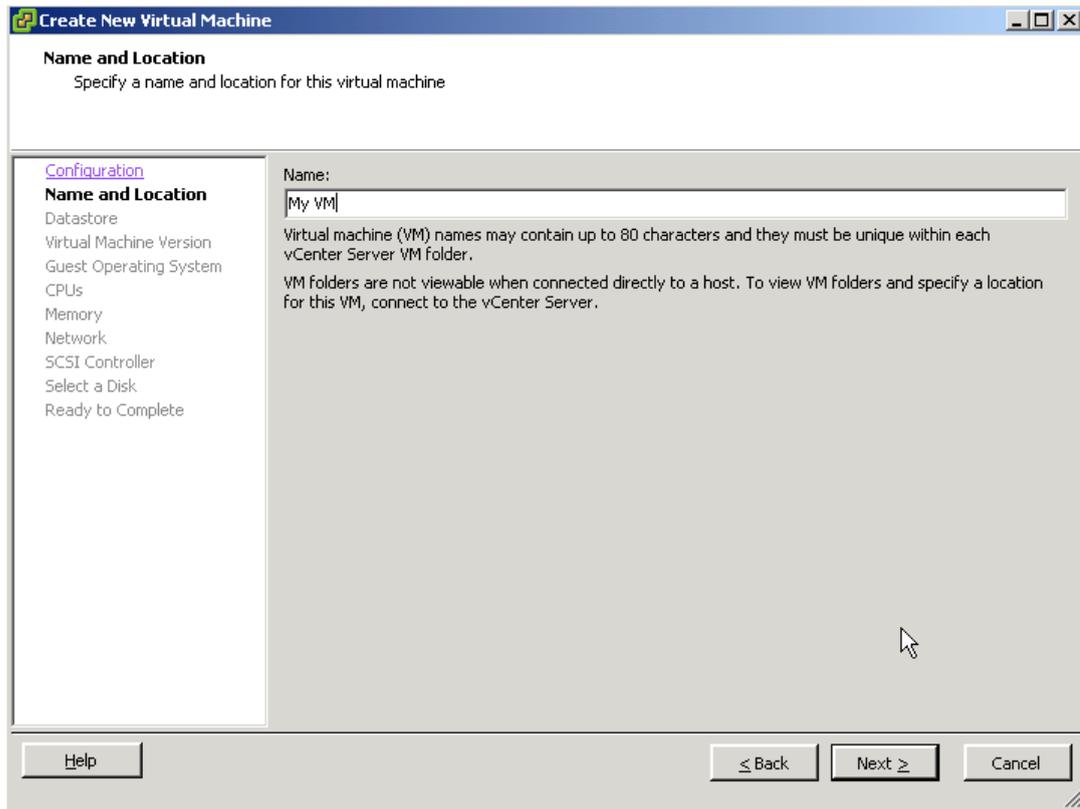
1. Right-click on the hypervisor object in the object tree on the left and choose **New Virtual Machine** option from the menu.



2. In the first screen choose **Custom** and click **Next**

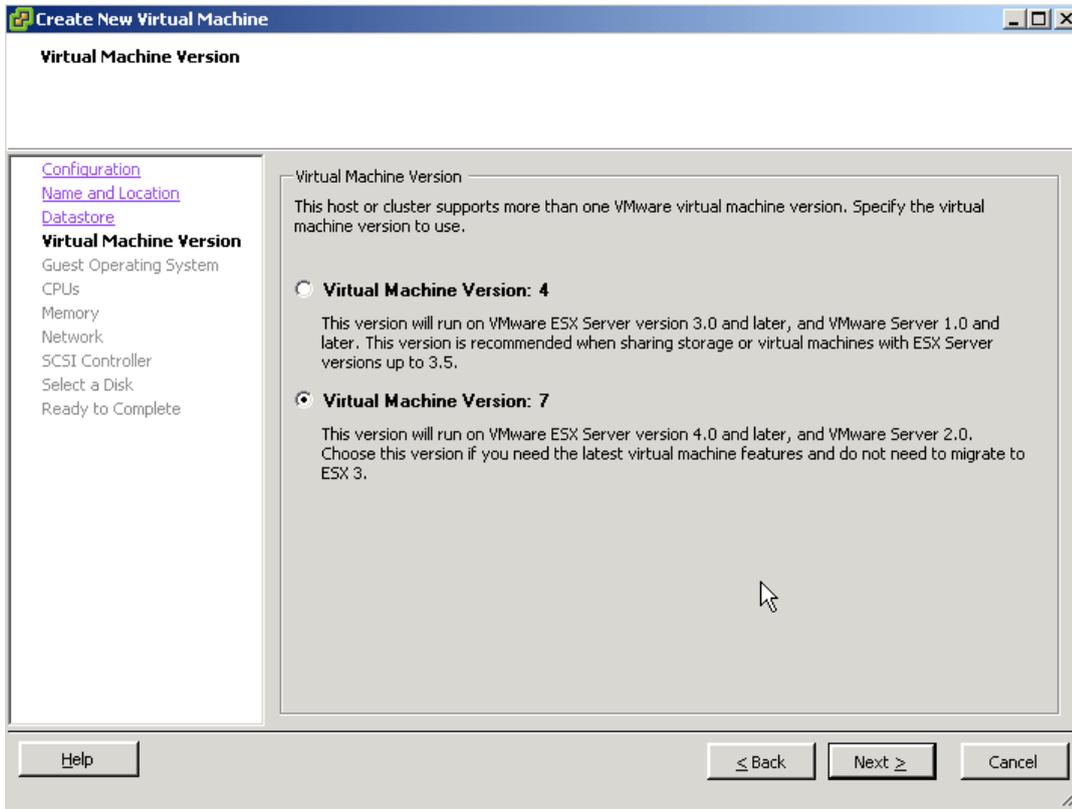


3. In the **Name and Location** provide a name for your VM, i.e. **My VM** and click **Next**.



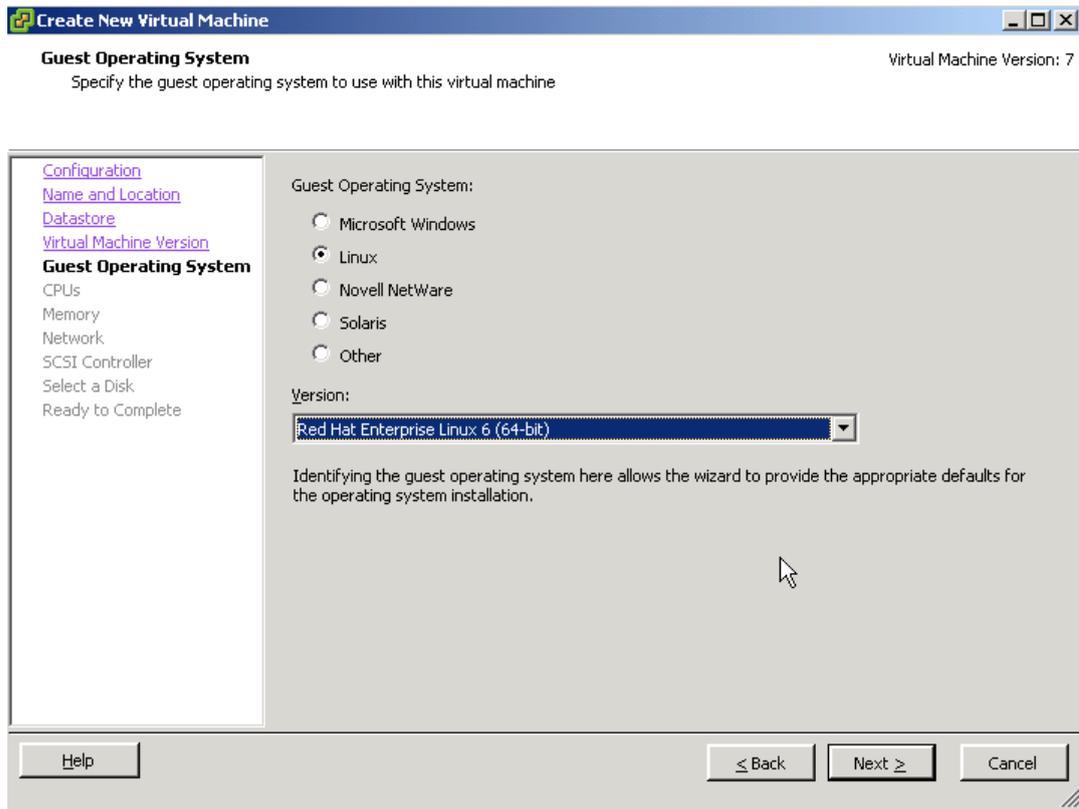
4. Select **Storage2** as the datastore in which VM will be stored and click **Next**.

5. In the **Virtual Machine Version** section leave **version 7** setting of the configuration and click **Next**.

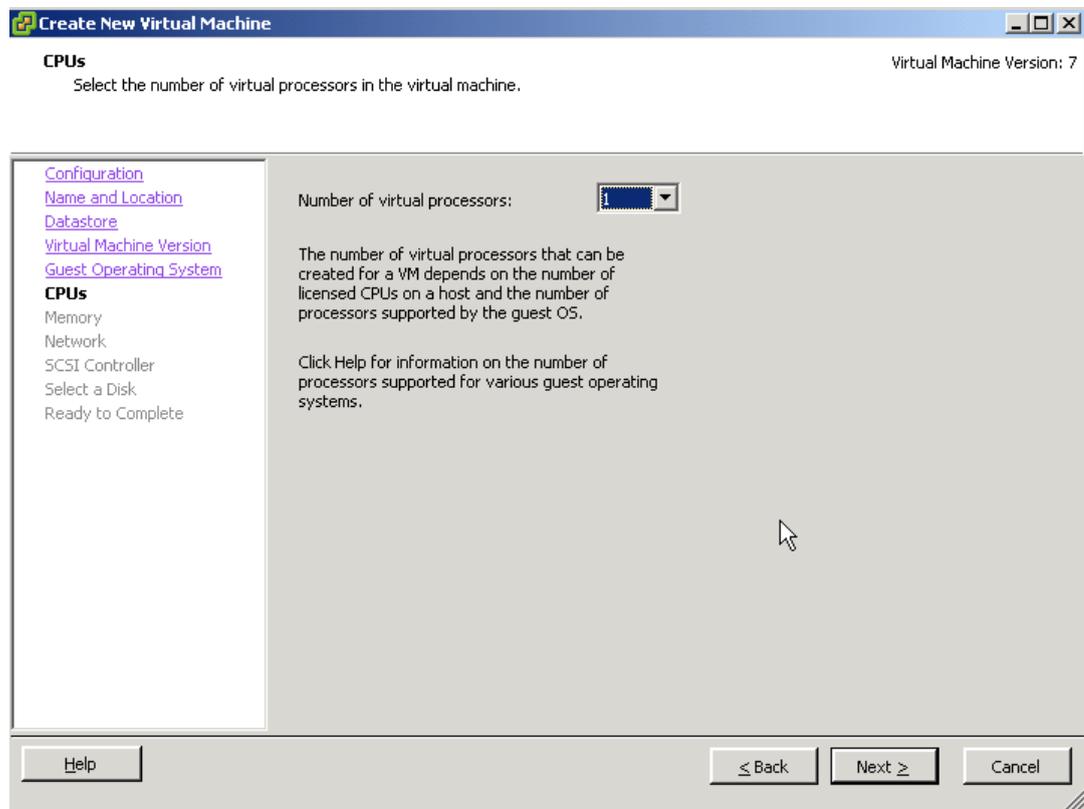


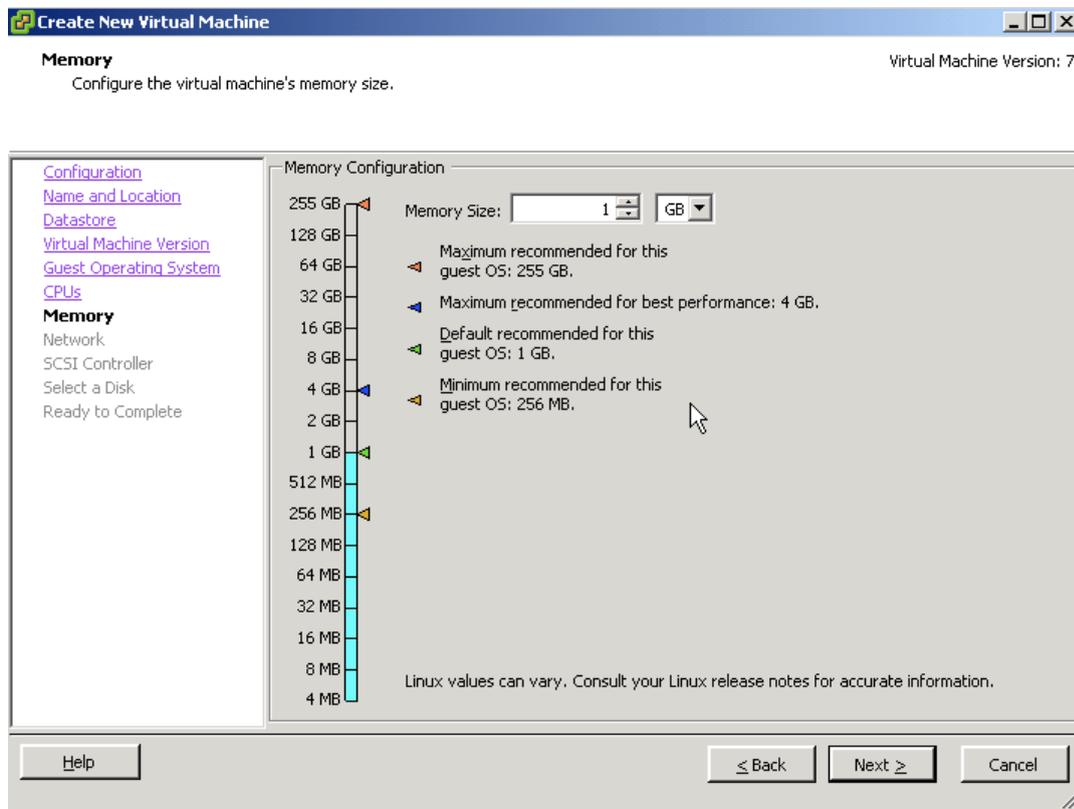
6. In the next section, select operating system type and version, that is going to be installed in your virtual machine, i.e. **Linux** and **Red Hat Enterprise Linux 6 (64-bit)** and click **Next**.

- This information is used in next sections to suggest best settings for this particular operating system.
- It is also used for choosing necessary VMware Tools packages to be installed (different for every OS).



7. In the next section set **Number of virtual processors to 1** and click **Next**.

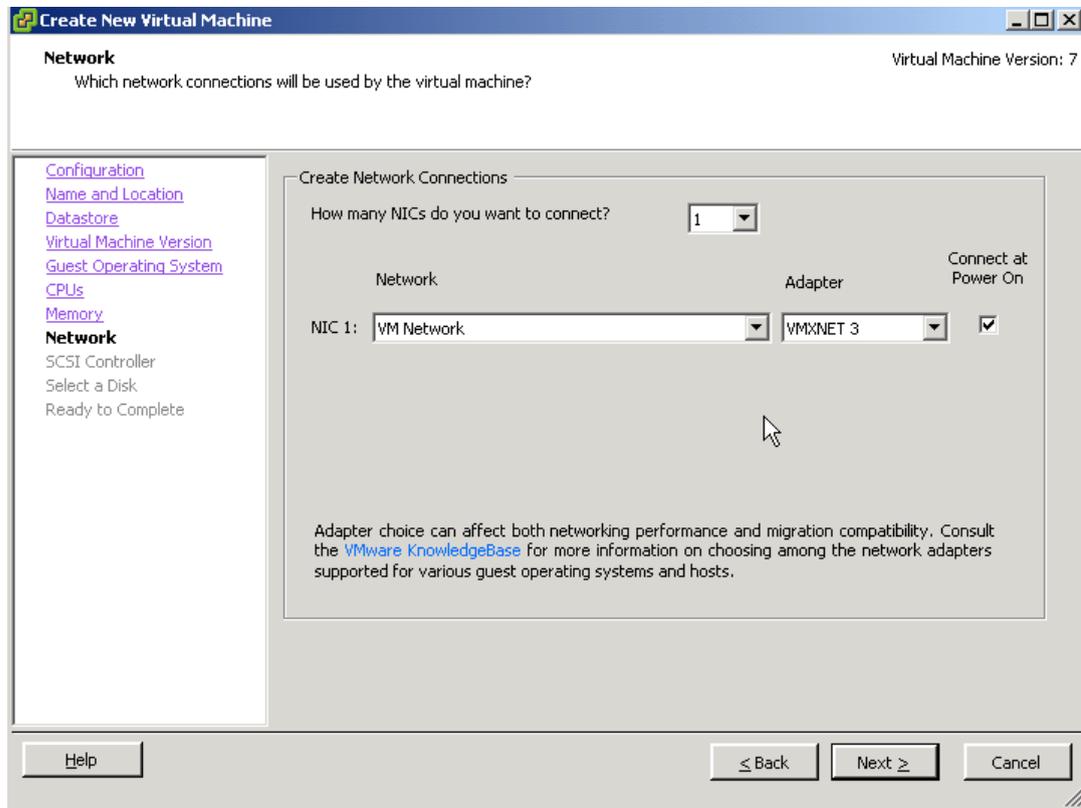




8. In the **Memory** section, leave the defaults (**1 GB**) and click **Next**.

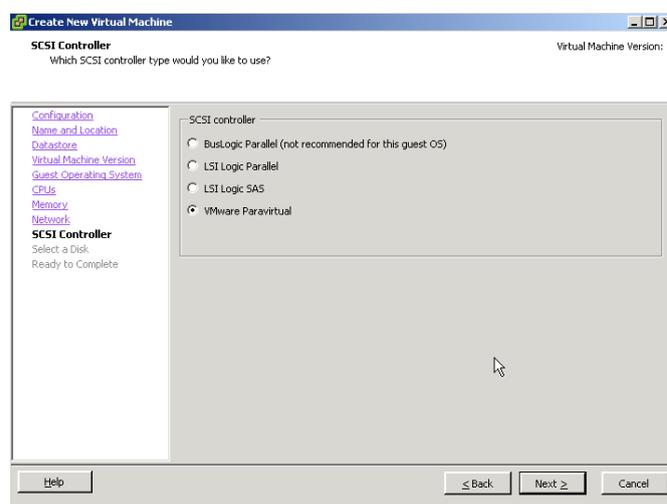
9. In the next section you can define network adapters and attach them to port groups defined on your hypervisor.

- a) Use a single NIC connected to the **VM Network** and using **VMXNET 3**.
- b) Make sure **Connect at Power On** checkbox is checked.
- c) Click **Next**

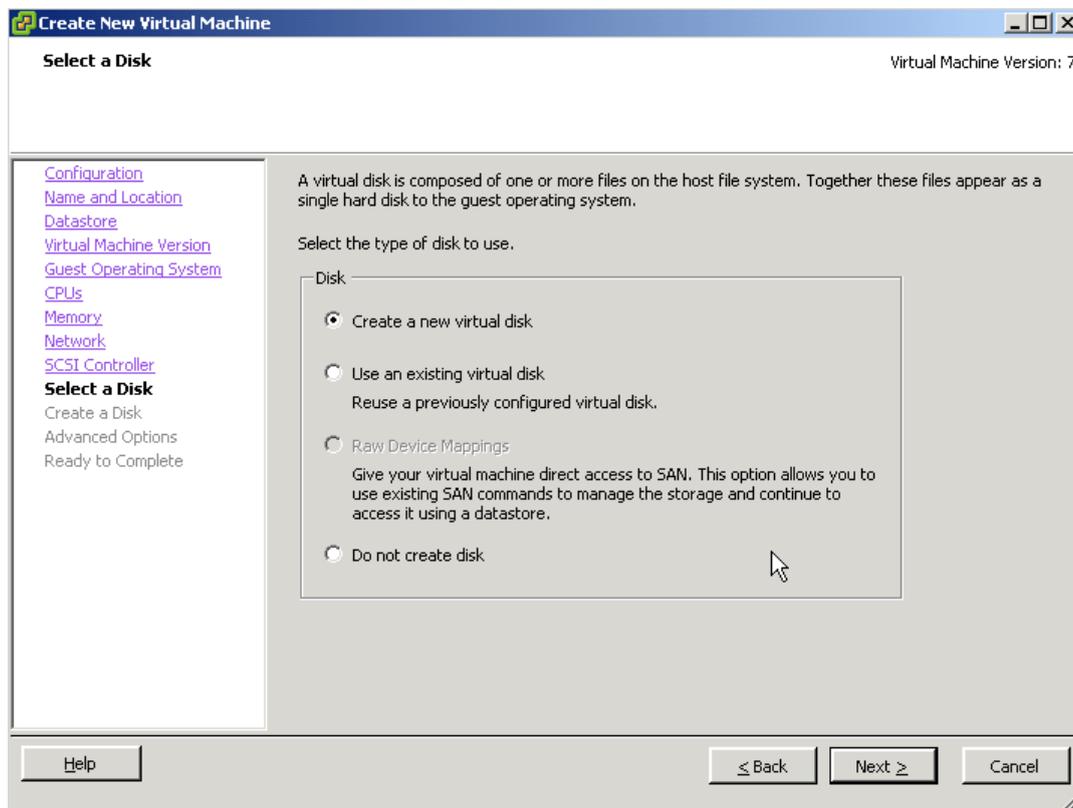


10. In the **SCSI Controller** section you can select virtual disk controller type used in your VM. Depending on the OS, different controller may have to be used.

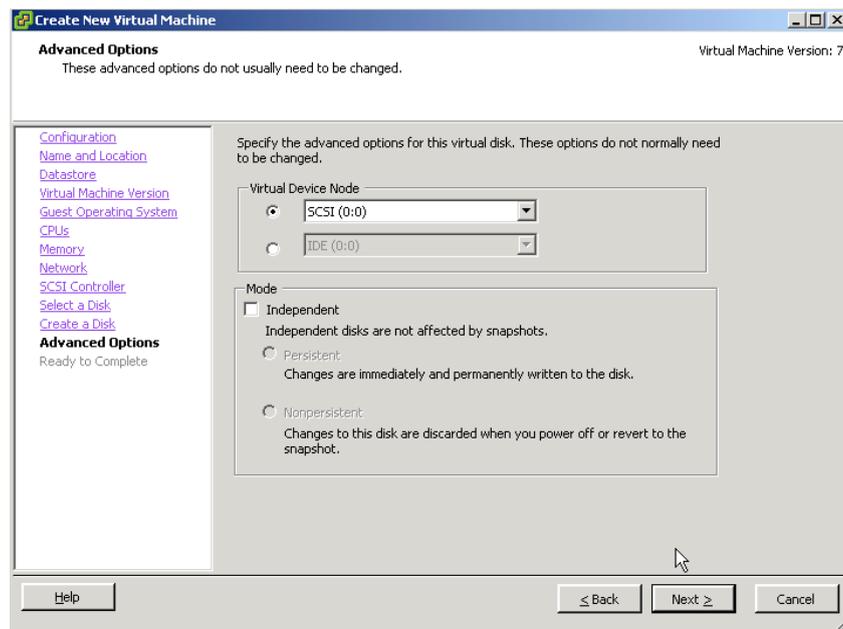
- a) Use default for your OS, in this case **VMware Paravirtual** has been selected by default by the wizard.
- b) Click **Next** button



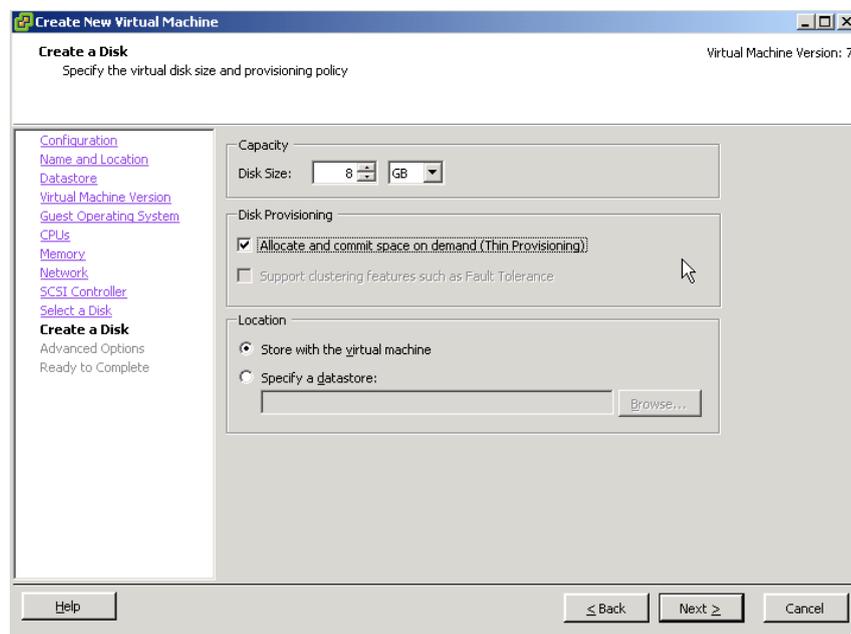
11. In the **Select a Disk** section you can either select an existing virtual disk or create a new one.
12. Choose **Create a new virtual disk** and click **Next**.



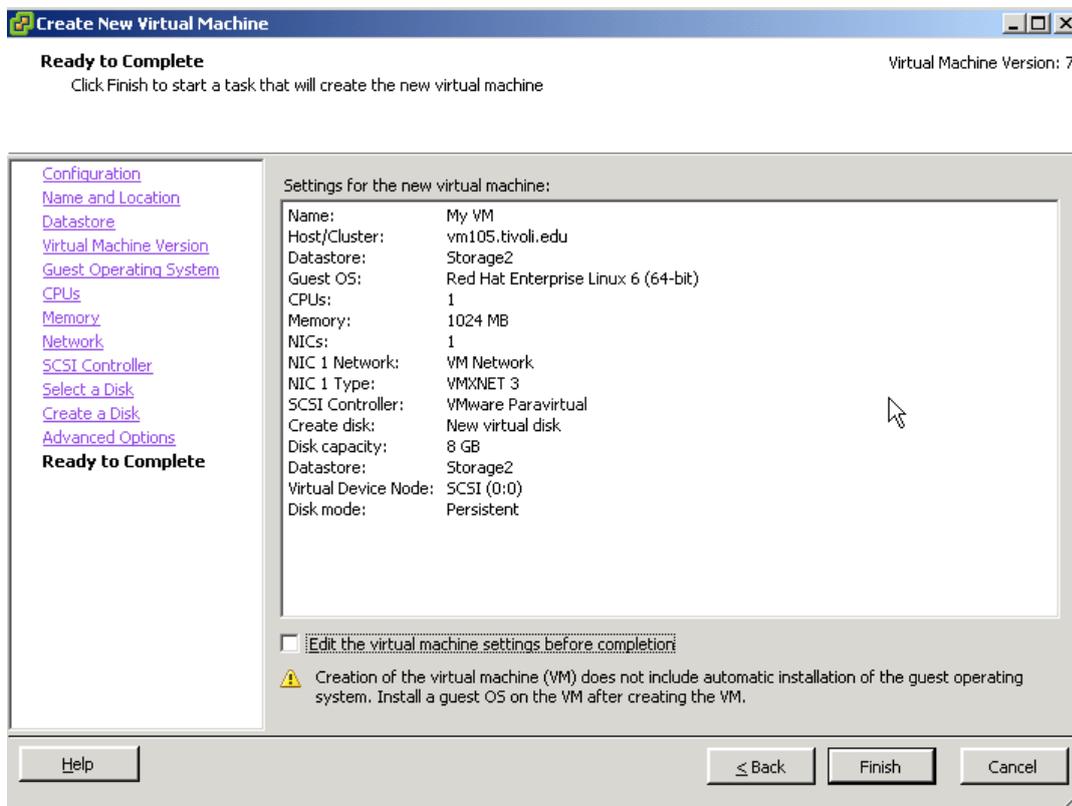
13. A new section has appeared, where you can provide details about disk being created.
14. Set the following:
 - a) Disk size: **8 GB**
 - b) Check the **Allocate and commit space on demand (Thin Provisioning)** option, to use Thin Provisioning for the new disk



15. Click **Next** to proceed to the **Advanced Options** section.



16. Notice the **Independent** option for a virtual disk.
- This option implies that the virtual disk will not be affected by the snapshot mechanism
 - There are 2 types of this option:
 - ⑩ Persistent – all of the data will be directly saved to the specified virtual disk, snapshots will not affect it
 - ⑩ Nonpersistent – like the option above, but changes made to this disk will be lost when the VM is being restarted
17. Click **Next**.
18. Review the summary and click **Finish** button.



19. Your VM has been created and is ready for the OS to be installed. It should appear in the object tree on the left.

The screenshot shows the vSphere interface for a virtual machine named 'My VM'. The left-hand object tree shows the host '192.168.80.105' with three VMs: 'My VM', 'myvm01', and 'myvm02'. The main window displays the 'Summary' tab for 'My VM'. The 'General' section shows the guest OS as 'Red Hat Enterprise Linux 6 (64-bit)', VM version 7, 1 vCPU, 1024 MB memory, and a state of 'Powered Off'. The 'Resources' section shows 9.00 GB of provisioned storage and 2.36 KB of used storage. A table below lists the datastore 'Storage2' with a capacity of 19.75 GB and 19.36 GB free. The network section shows 'VM Network' connected to a 'Standard switch network'. At the bottom, there are 'Power On' and 'Edit Settings' buttons.

General

Guest OS: Red Hat Enterprise Linux 6 (64-bit)
VM Version: 7
CPU: 1 vCPU
Memory: 1024 MB
Memory Overhead: 121.14 MB
VMware Tools: Not installed
IP Addresses:
DNS Name:
State: Powered Off
Host: [vm105.tivoli.edu](#)
Active Tasks:

Resources

Consumed Host CPU:
Consumed Host Memory:
Active Guest Memory: [Refresh Storage Usage](#)

Provisioned Storage: **9.00 GB**
Not-shared Storage: **2.36 KB**
Used Storage: **2.36 KB**

Datastore	Capacity	Free	Last Update
Storage2	19.75 GB	19.36 GB	2/26/2014

Network

Network	Type
VM Network	Standard switch network

Commands

[Power On](#)
[Edit Settings](#)

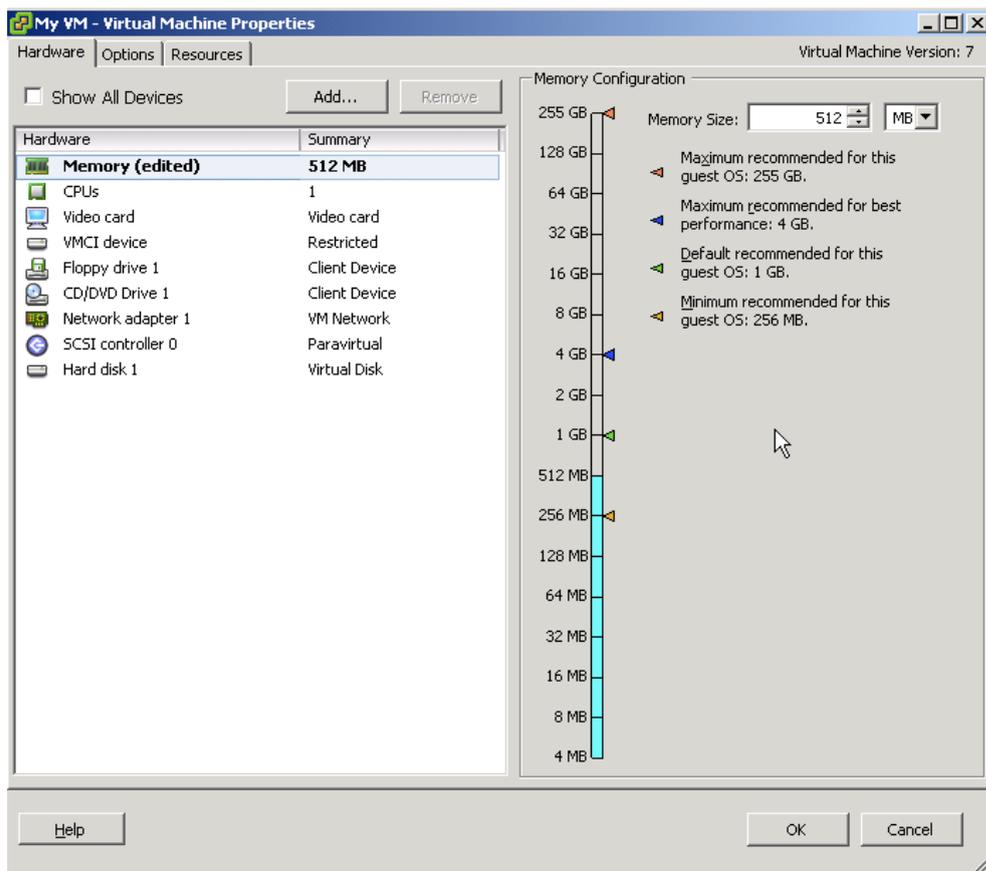
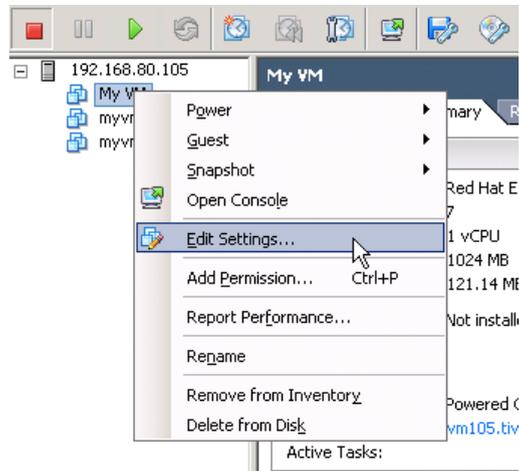
20. Click **My VM** in the object tree and select **Summary** tab to verify your settings.

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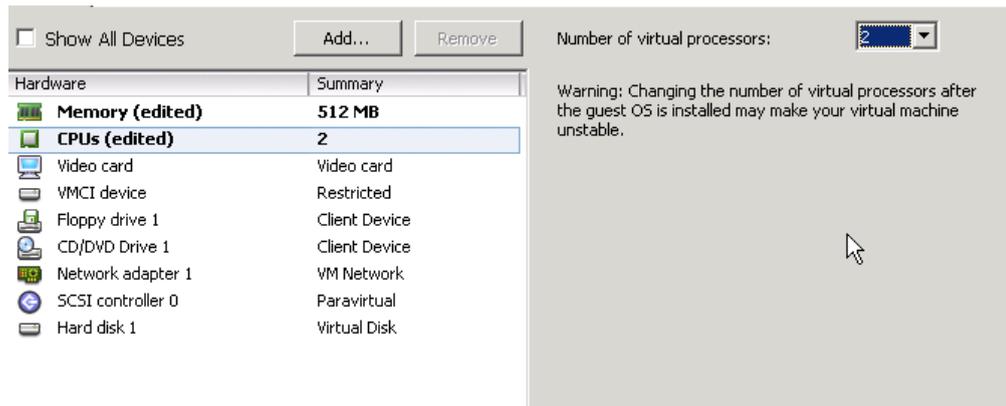
Exercise 29: Modifying Virtual Machine settings

In this exercise you'll modify Virtual Machine settings.

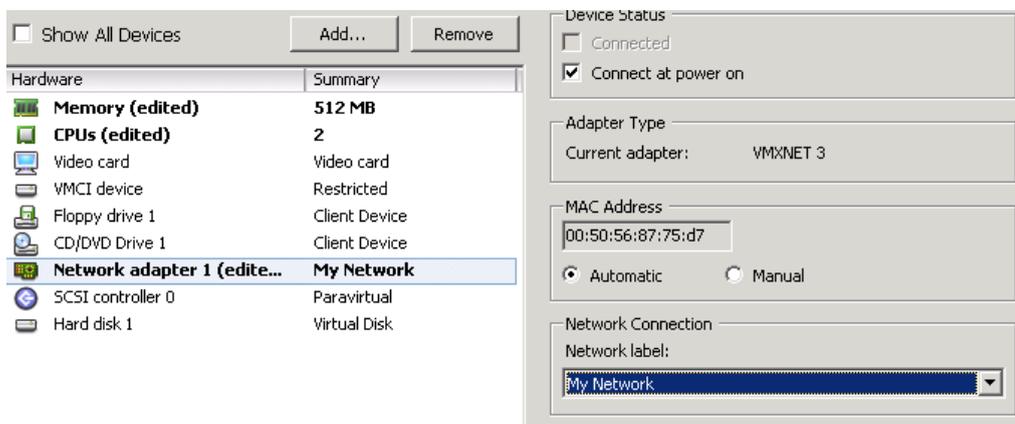
1. Right-click on the **My VM** and choose **Edit Settings**



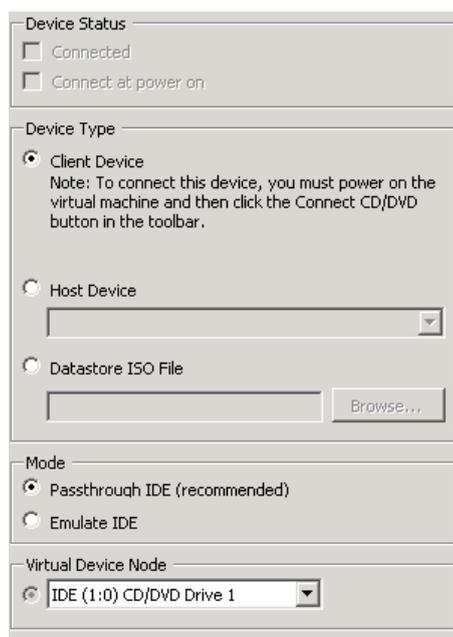
2. Settings window appears. Change amount of RAM to **512 MB**.
3. Click **CPUs** and change the number of virtual processors to **2**.



4. Select **Network adapter 1** and change **Network label** to **My Network** (network that has been defined in previous exercises).

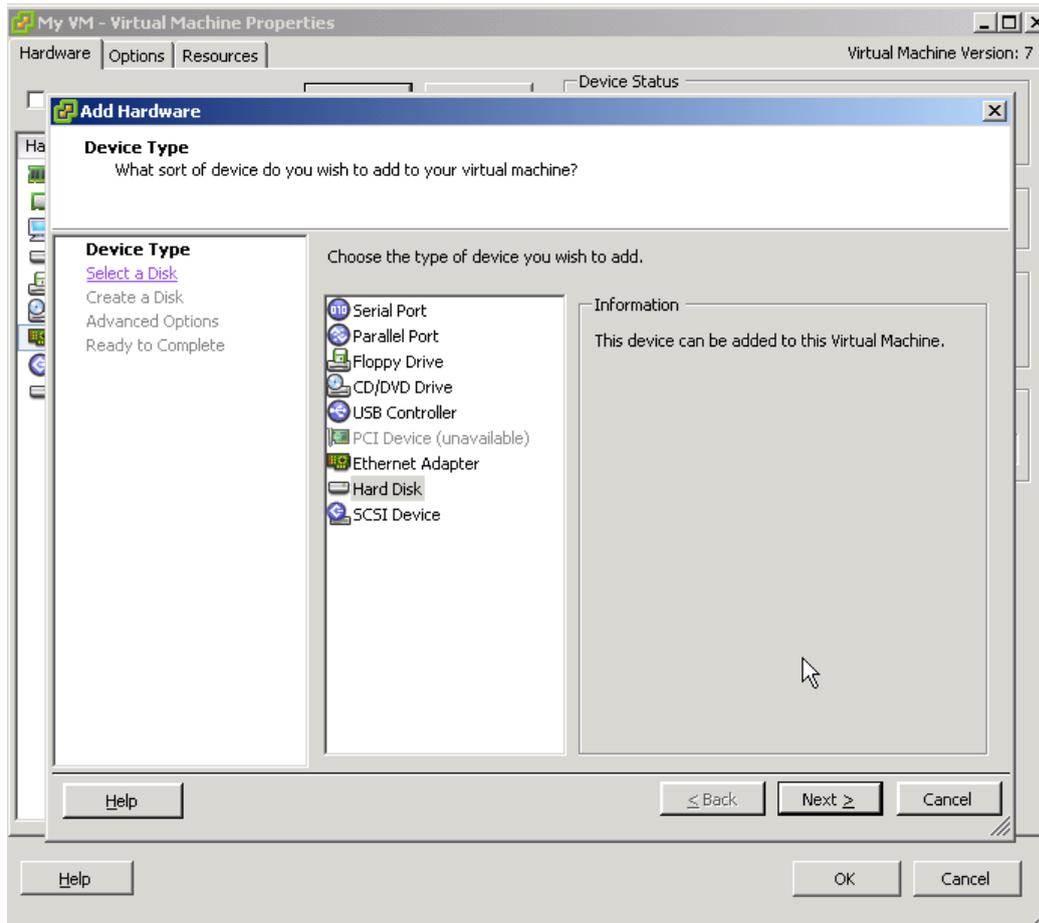


5. When you select **CD/DVD Drive 1** you can also select source of your OS installation.
 a) It can be a client device (on your local client machine), a host device (on the

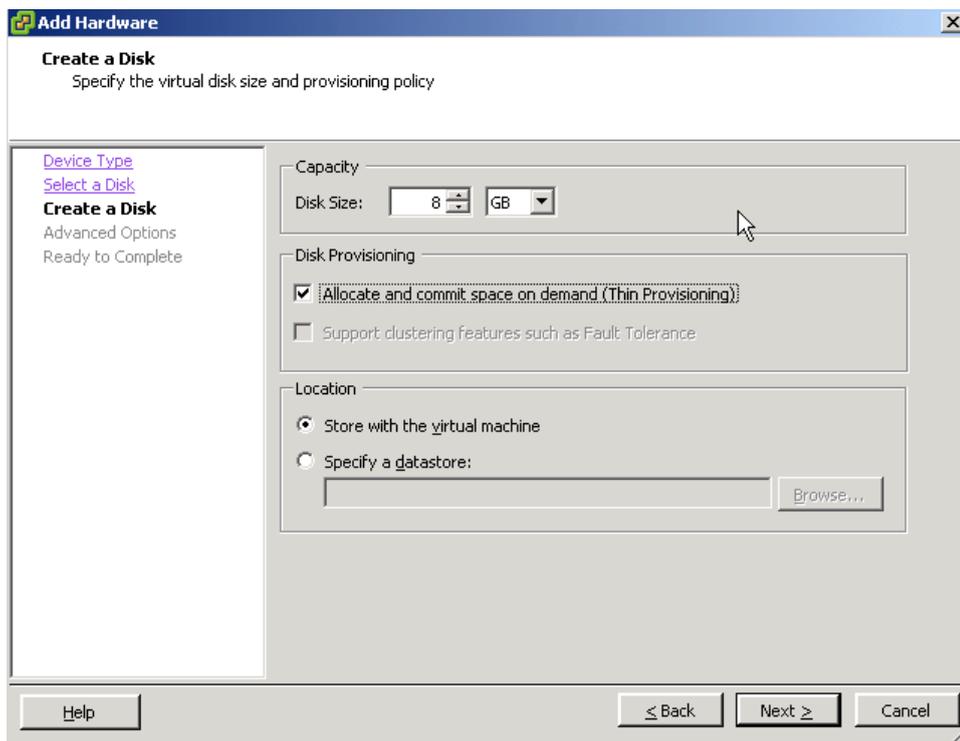
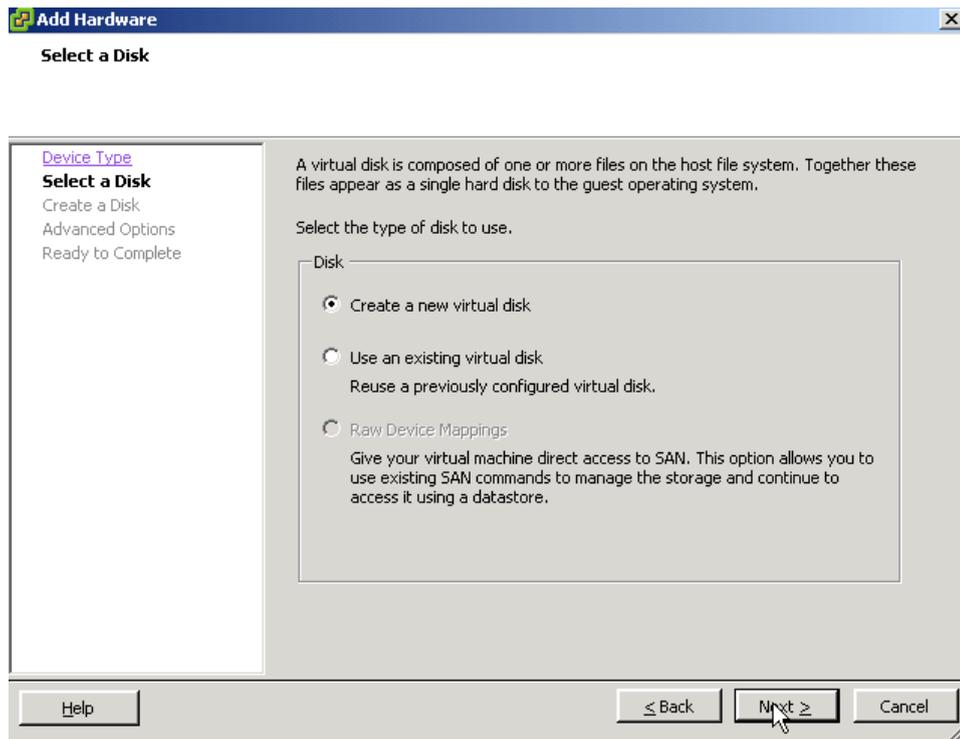


hypervisor server) or an ISO in specific location in your datastore.

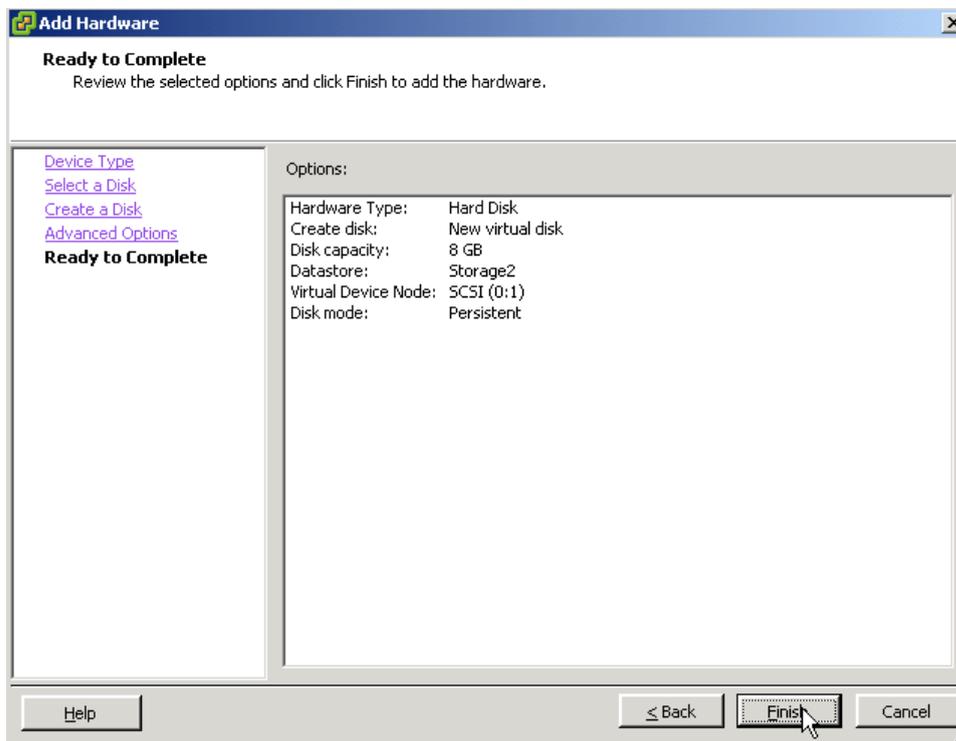
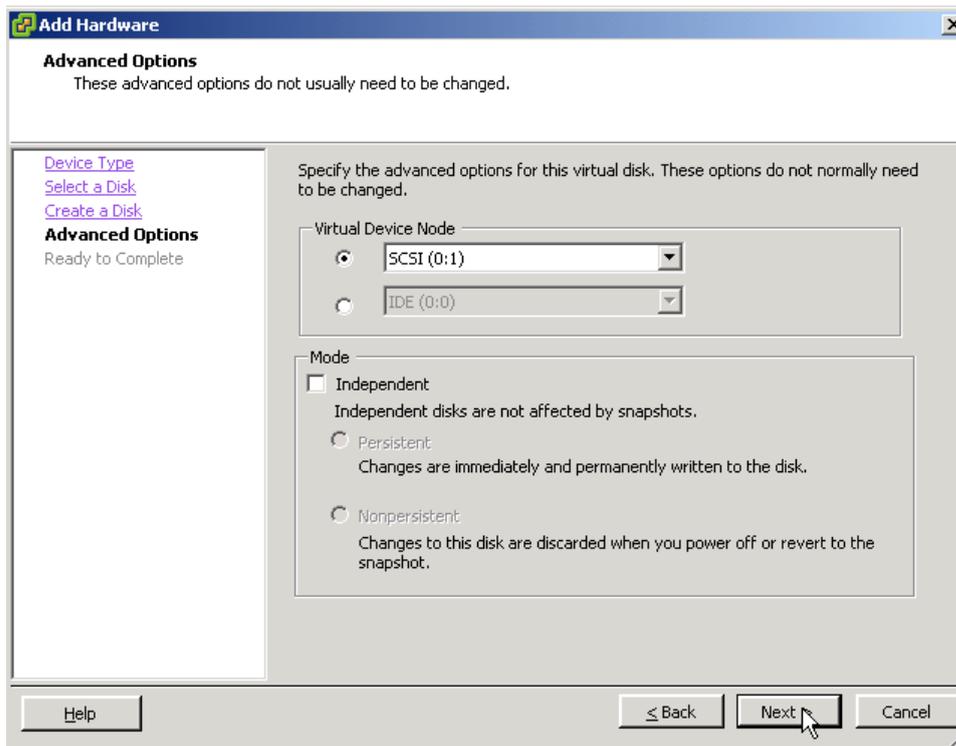
- Now add a new virtual disk to the virtual machine. Click **Add** button.



- Choose **Hard Disk** and click **Next**.
- Select **Create a new disk** option.

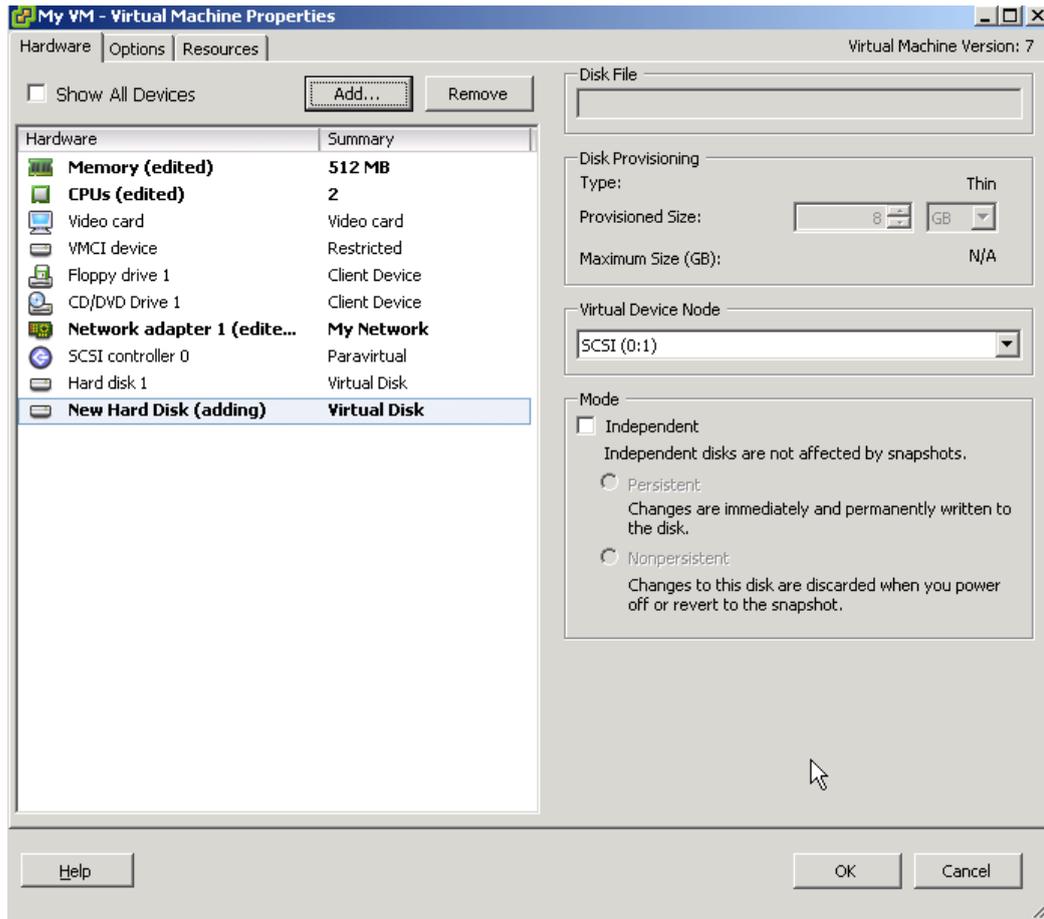


9. Select disk size to be 8 GB and check the **Thin Provisioning** option.
10. In the **Advanced Options** section leave defaults and click **Next**.

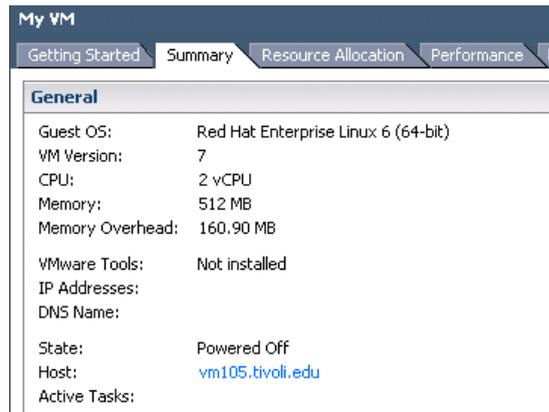


11. Review the summary and click **Finish** button.

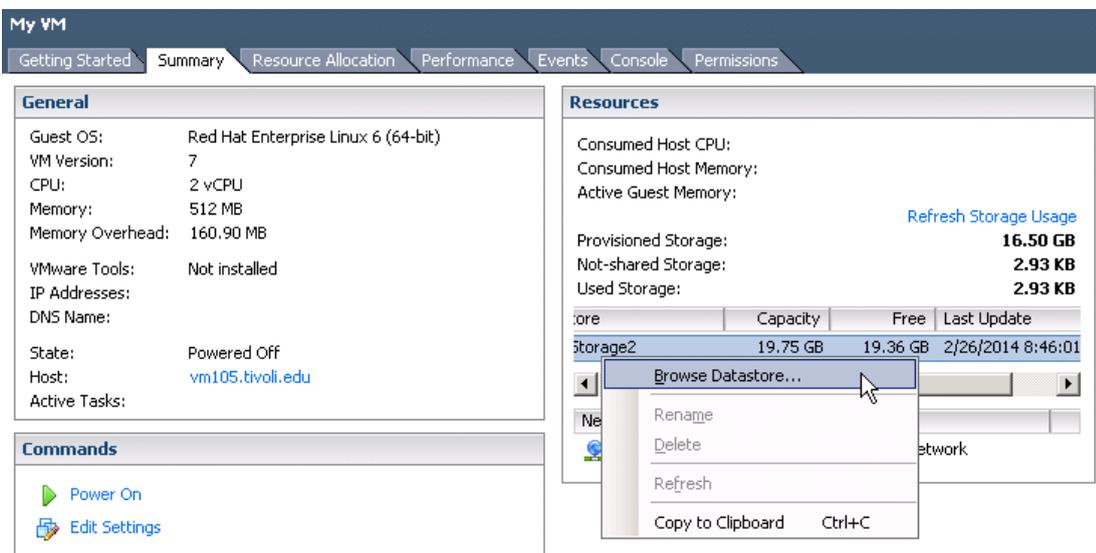
12. Review changes that you had done to the virtual machine configuration and click **OK** button.



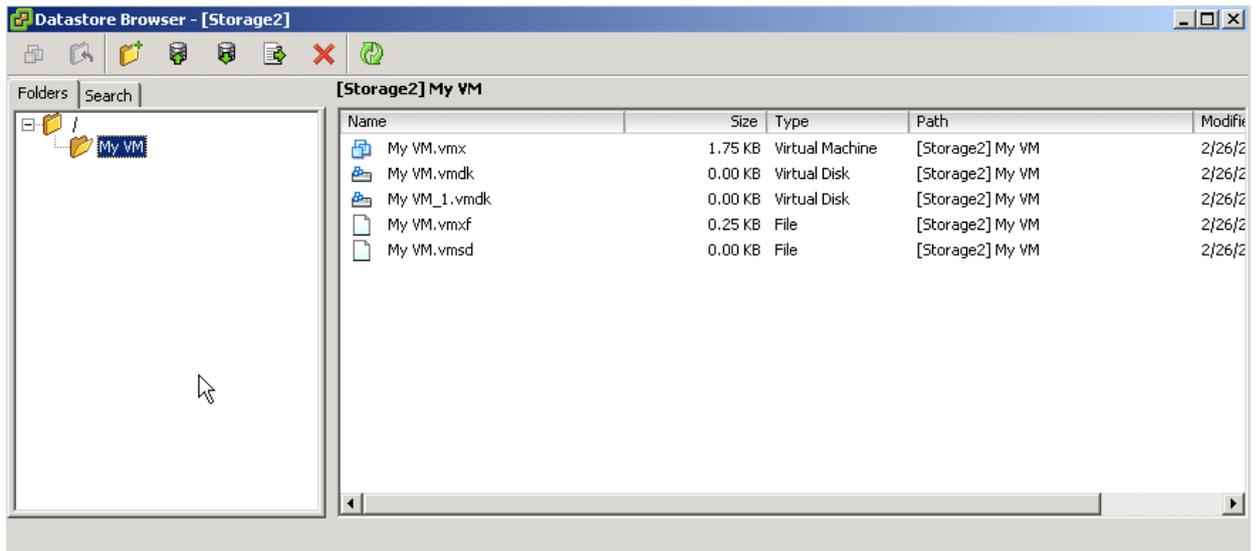
13. In the **Summary** page you should see new settings.



14. Right-click on the **Storage2** in the **Resources** panel and click **Browse datastore**



15. Click on the VM directory on the left to see the files.



16. Datastore Browser opens. Notice that:
- there is no log files or nvram files before first run
 - both virtual disks are thin-provisioned and their size is 0 (although both are 8GB from the guest OS perspective).

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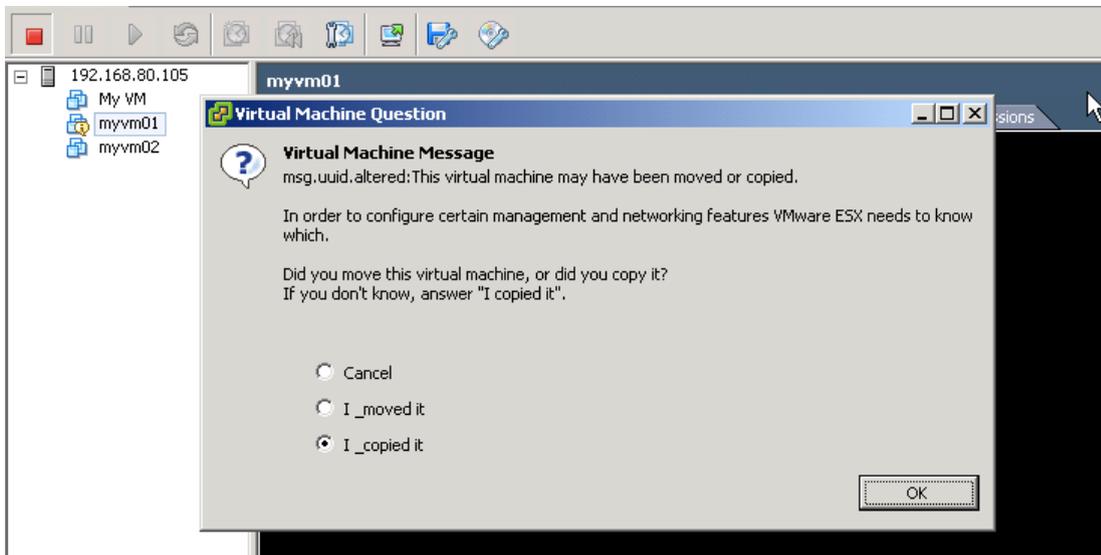
Exercise 30: Using Virtual Machine console

In this exercise you'll power on a VM and connect to its display using Console tab.

1. Select **myvm01** from the object tree on the left and click **Power On** (green triangle)



button.



2. Click on the **Console** tab. A question window is shown.
3. Choose **I copied it** option and click **OK** button.



4. Notice the state of the VM changed to running.
5. Use right scrollbar to scroll console contents down. When OS finishes booting the login prompt appears. Click inside the Console to control keyboard inside VM.
6. Log in as **root** with password **object00**.
7. Run **ls** command to list directories inside VM.

```

myvm01
Getting Started Summary Resource Allocation Performance Events Console Permissions
Enterprise Server
eth1 IP address: 192.168.80.127/24 done
Setting up service (localfs) network . . . . . done
Starting rpcbind done
Not starting NFS client services - no NFS found in /etc/fstab: unused
Starting irqbalance unused
Loading console font lat9w-16.psfu -m trivial G0:loadable done
Loading keymap assuming iso-8859-15 euro done
Loading /usr/share/kbd/keymaps/i386/qwerty/us.map.gz done
Loading compose table latin1.add done
Start Unicode mode done
Starting Name Service Cache Daemon done
Starting smartd unused
Starting mail service (Postfix) done
Setting up (remotefs) network interfaces:
Starting CRON daemon done
Setting up service (remotefs) network . . . . . done
Starting SSH daemon done
Master Resource Control: runlevel 3 has been reached
Skipped services in runlevel 3: nfs irq_balancer smartd

Welcome to SUSE Linux Enterprise Server 11 (i586) - Kernel 2.6.27.19-5-pae (tty1).

myvm01 login: root
Password:
Last login: Fri Jan 13 18:56:43 CST 2012 on tty1
You have new mail.
myvm01:~ # ls
.bash_history .kbd .viminfo bin unpair_vm.sh
.exrc .ssh VMwareTools-4.0.0-261974.i386.rpm inst-sys
.gnupg .tpm autoinst.xml pair_vm.sh
myvm01:~ #

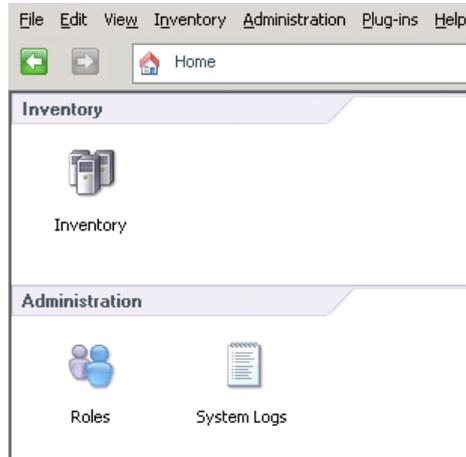
```

8. Use Ctrl+Alt keys to leave console.

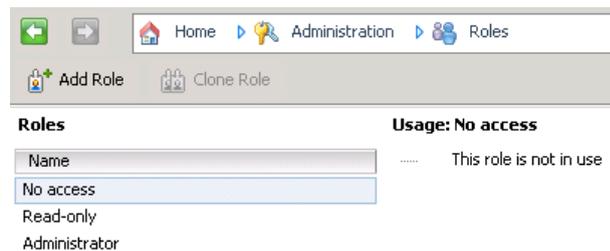
Fundamentals of Cloud Computing

Exercise 31: Creating user role on the Hypervisor

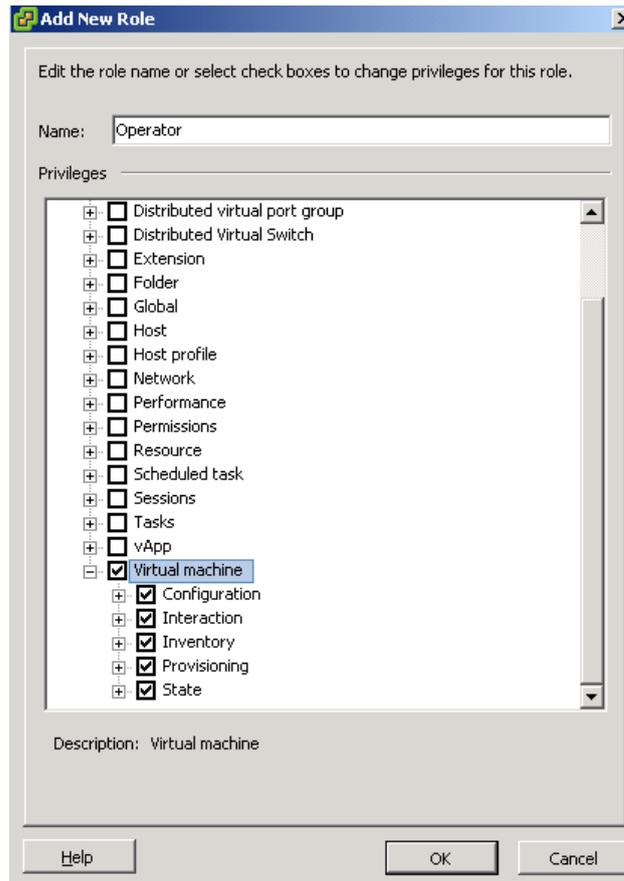
In this exercise you'll create an operator role with set of privileges assigned to it.



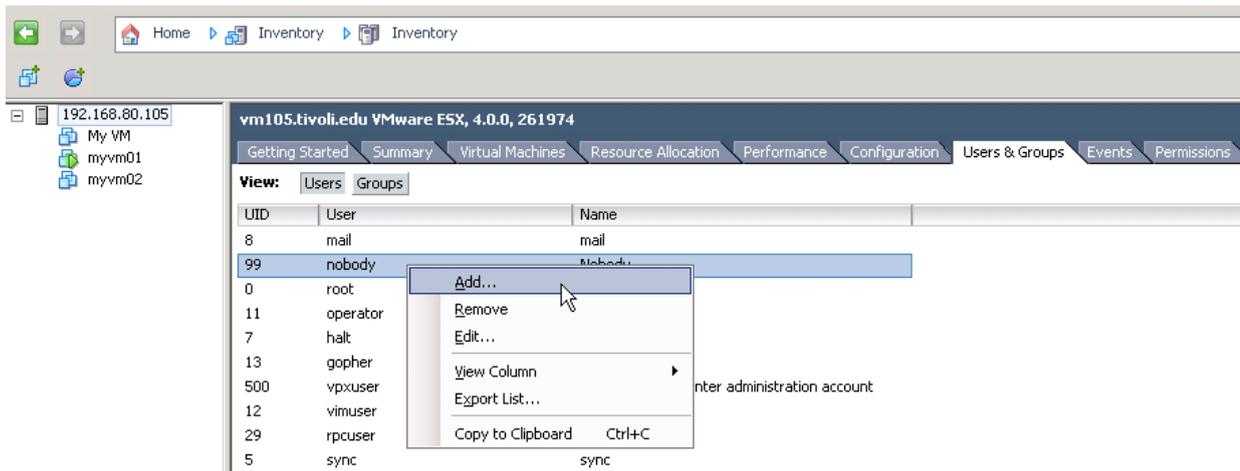
1. Click **Home** in the navigation bar and select **Roles**



2. The list of currently defined roles shows.
3. Click **Add Role** button.
4. An **Add New Role** window appears. Provide:
 - a) role name: **Operator**
 - b) privileges: select all in **Virtual Machine** subtree
5. Click **OK** button.

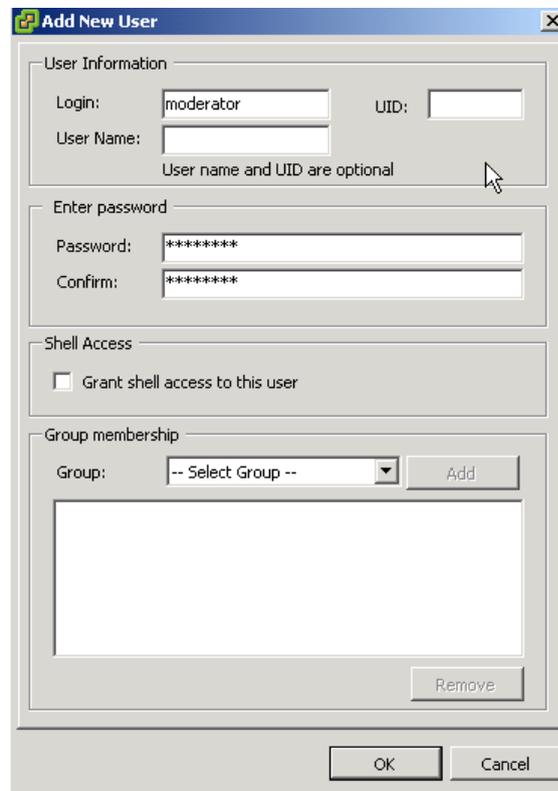


6. New role appears on the list.
7. Click **Home** in the navigation bar.
8. Click **Inventory** and on the hypervisor level select **Users & Groups** tab.
9. Right-click anywhere on the list of users and select **Add**.



10. In the window opened provide:

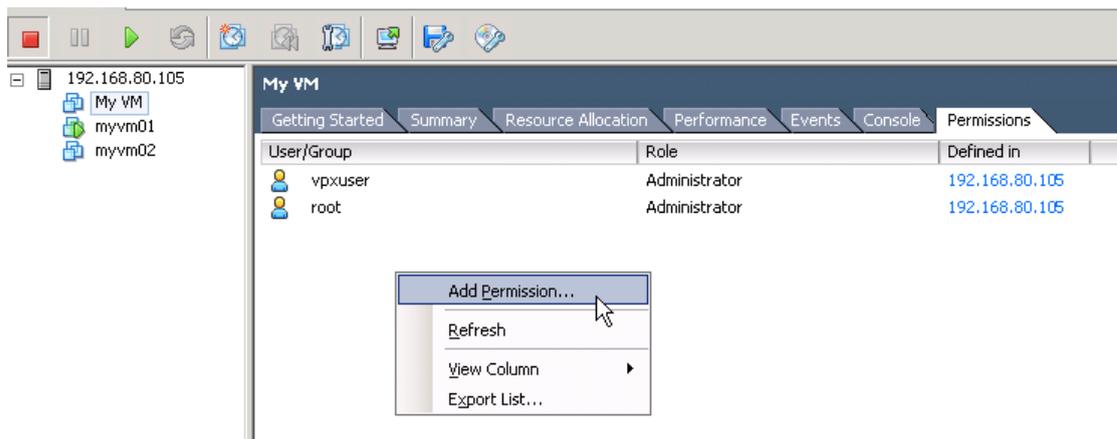
- a) user login: **moderator**
- b) password: **object00**



11. Click **OK** button.
12. New user account is shown in the list.

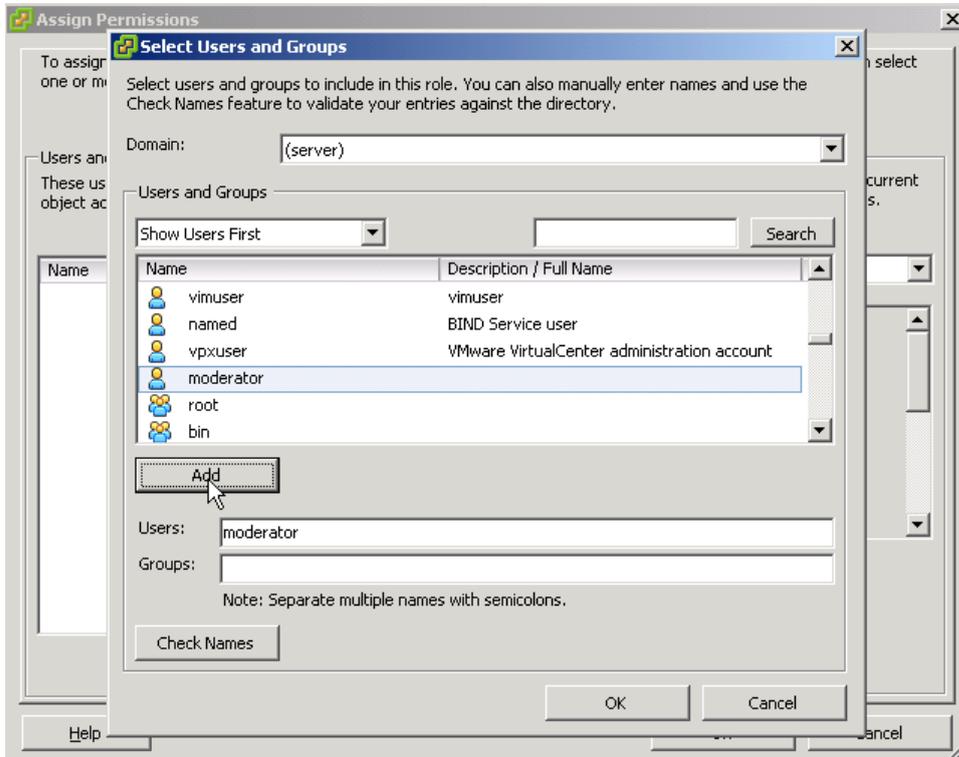
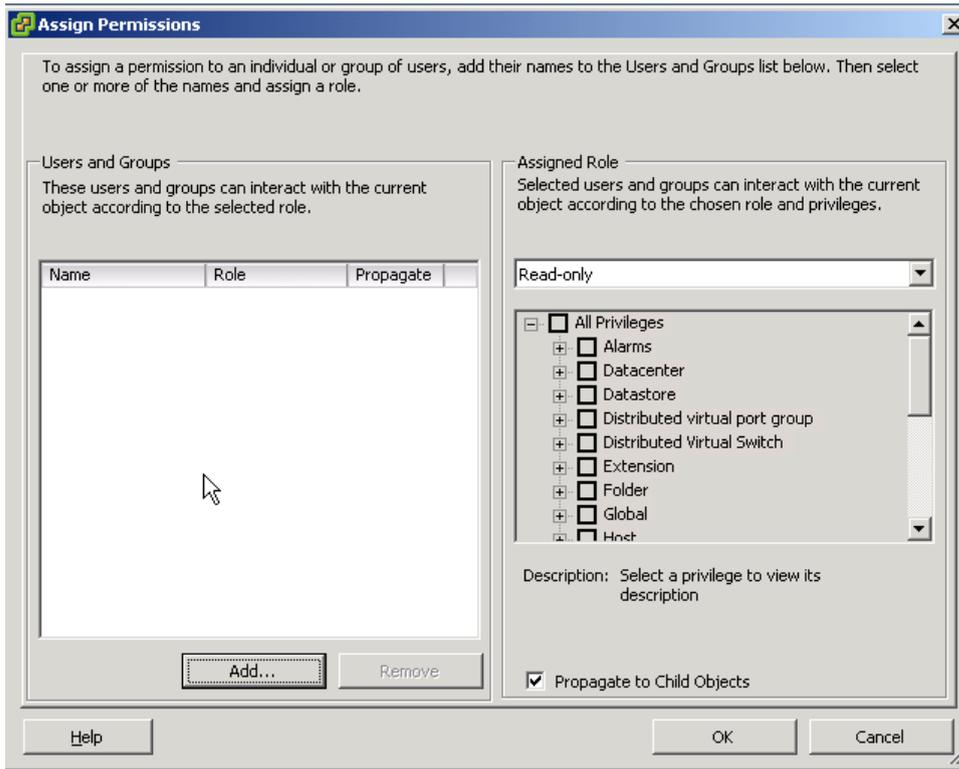
3	adm	adm
14	ftp	FTP User
28	nscd	NSCD Daemon
10	uucp	uucp
25	named	BIND Service user
4	lp	lp
9	news	news
2	daemon	daemon
501	moderator	

13. Click on **My VM** in the object tree on the left and select **Permissions** tab.



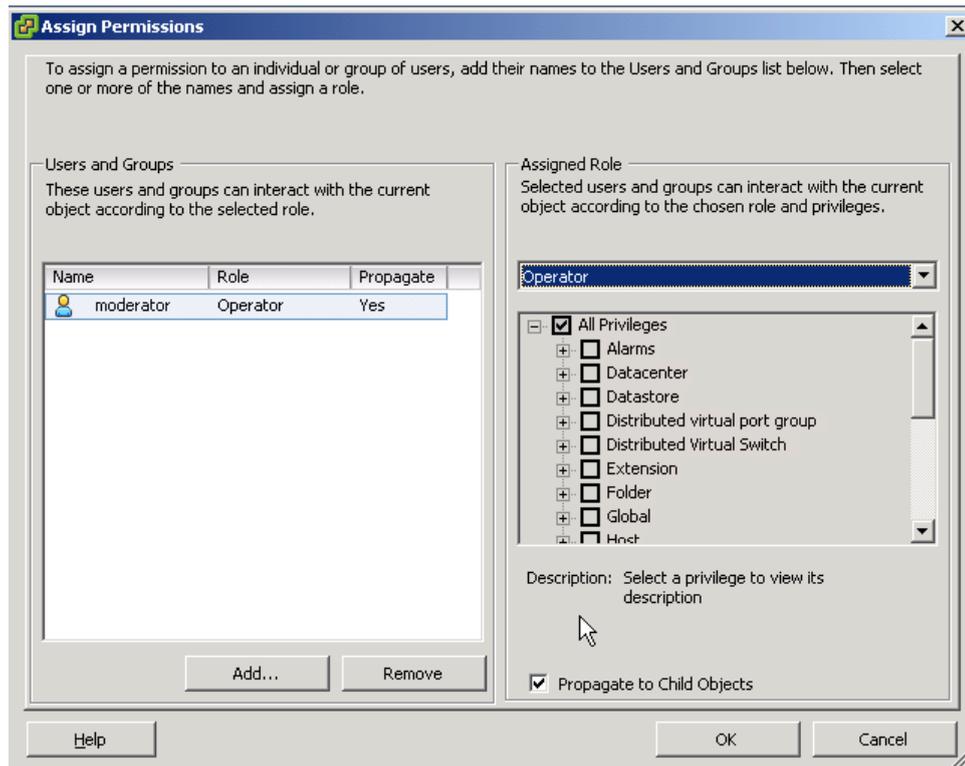
14. Right-click anywhere on the list and select **Add Permission**.

15. New window opens. Click **Add** button.



16. In the next window find **moderator** user in the list and click **Add** button.

17. Click **OK** button to close the window.

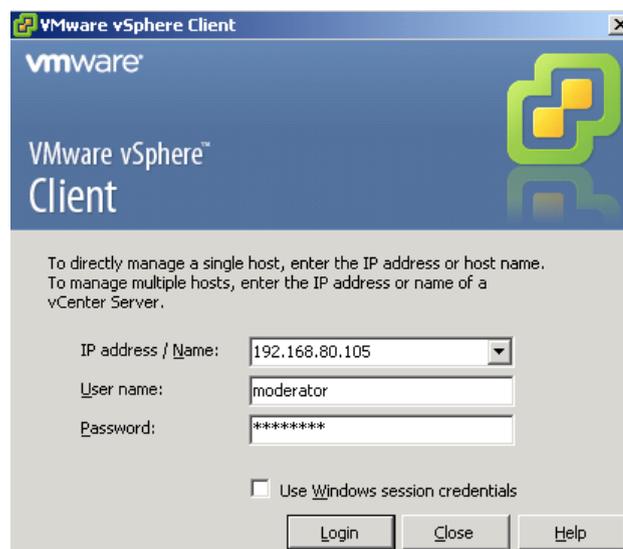


18. Click **OK** button to close the window and add privilege to the user.

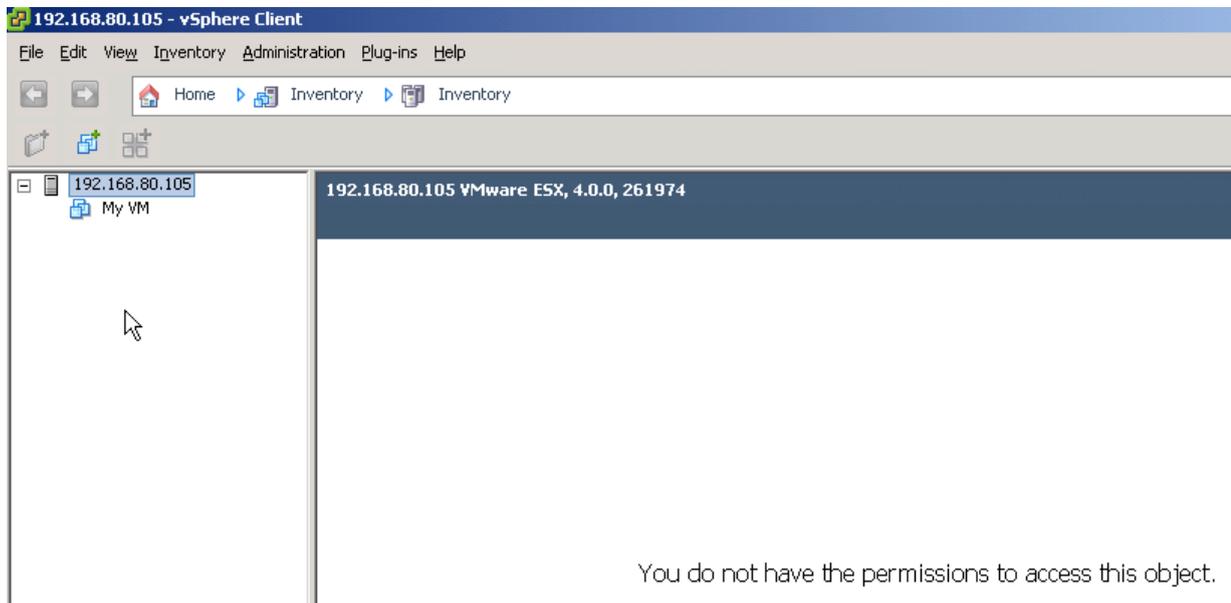
19. New privilege appears in the list.

User/Group	Role	Defined in
moderator	Operator	This object
vpxuser	Administrator	192.168.80.105
root	Administrator	192.168.80.105

20. Use desktop icon to start new vSphere Client. Log in to the same hypervisor as **moderator** with password **object00**.



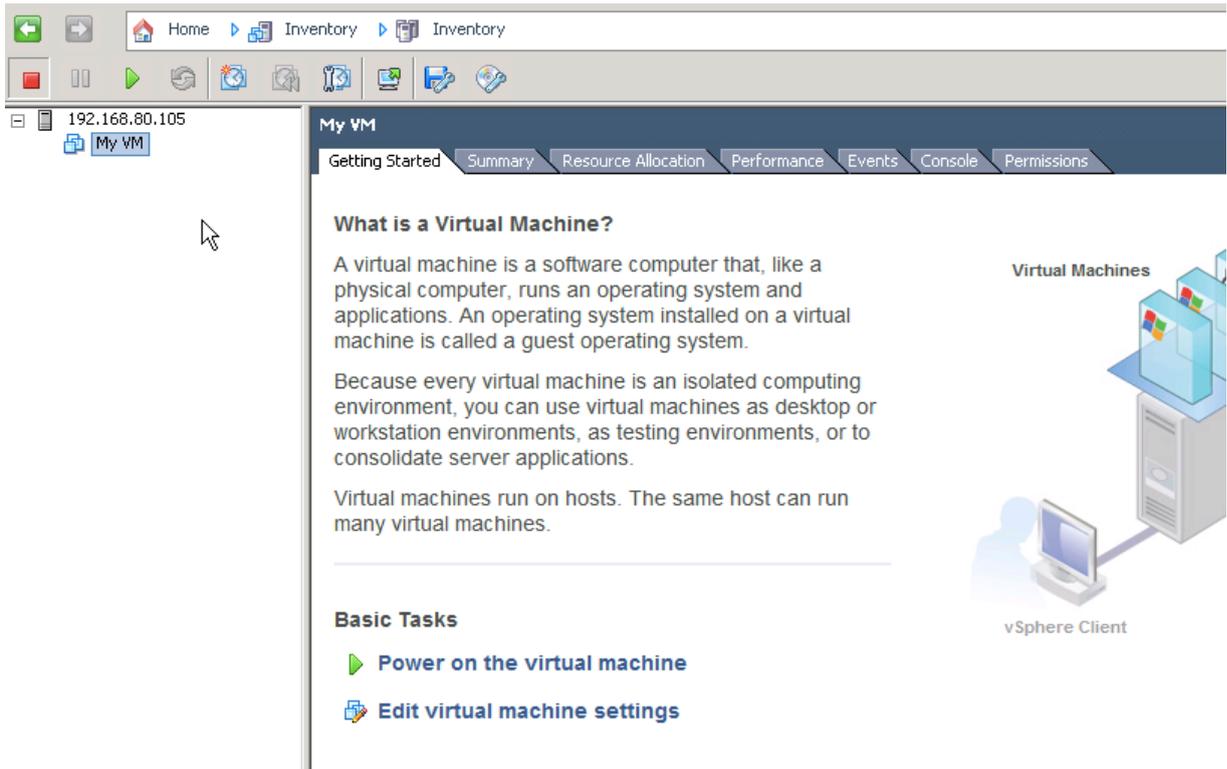
21. Notice that **moderator** doesn't have any privileges at the hypervisor level. And is able



to see only **My VM**.

22. Click **My VM** in the object tree.

23. Notice that **moderator** user has full control over the **My VM**.

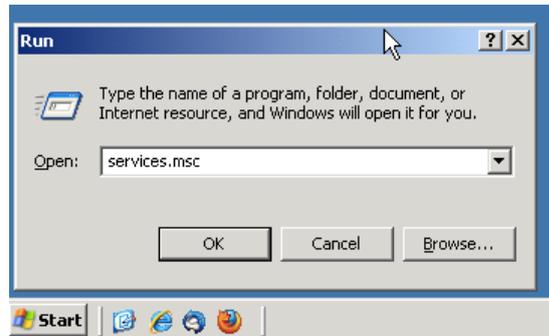


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Exercise 32: Exploring vCenter Server features

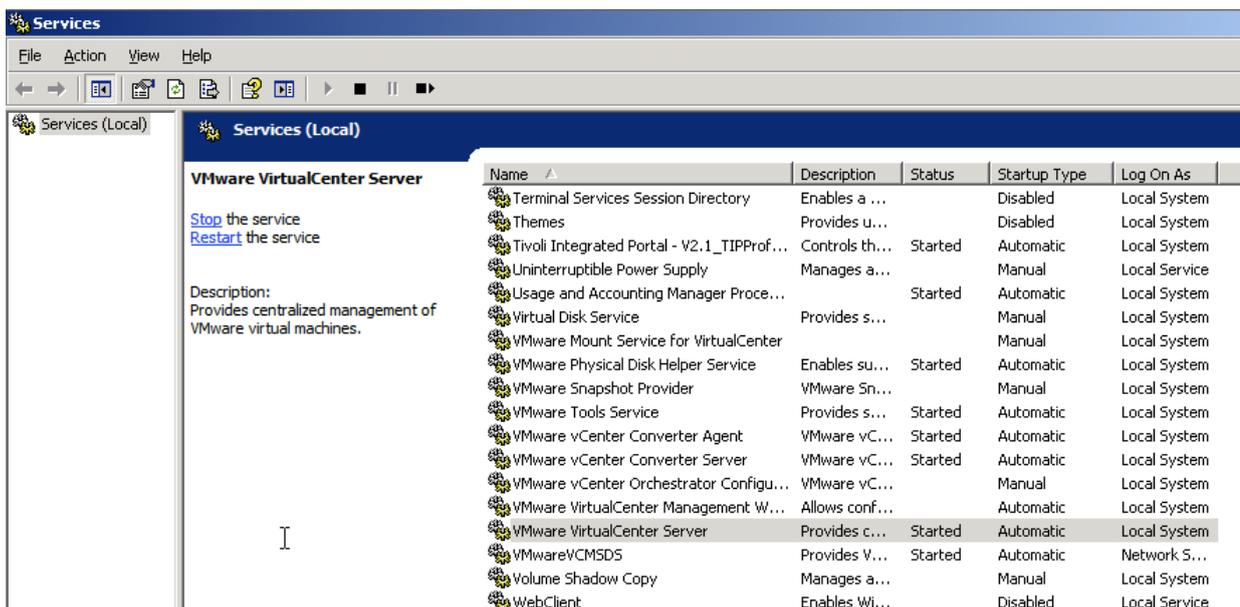
In this exercise you'll connect to the vCenter Server and explore the interface of the vSphere Client.

1. Click **Start Menu** button and select **Run**.



2. Type **services.msc**

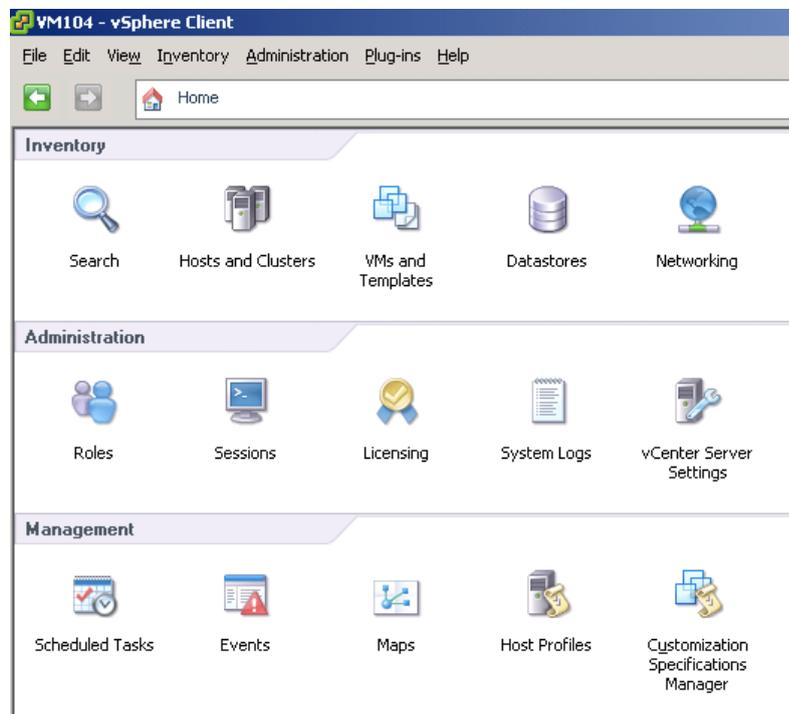
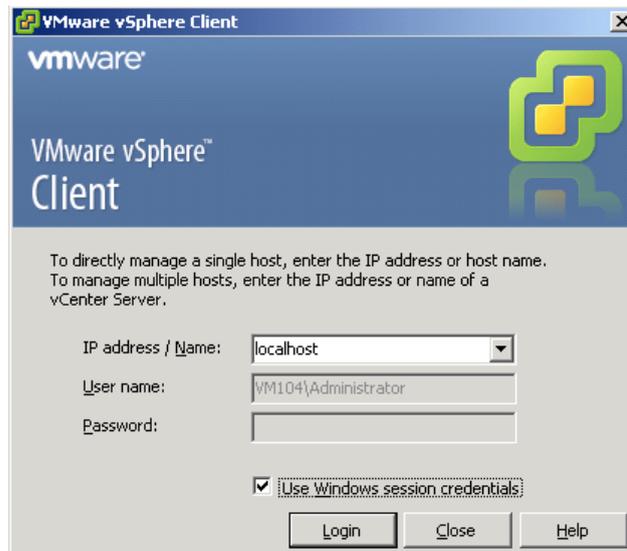
3. Verify that **VMware VirtualCenter Server** service is **Started**. If not use **Start** link to



start the vCenter Server.

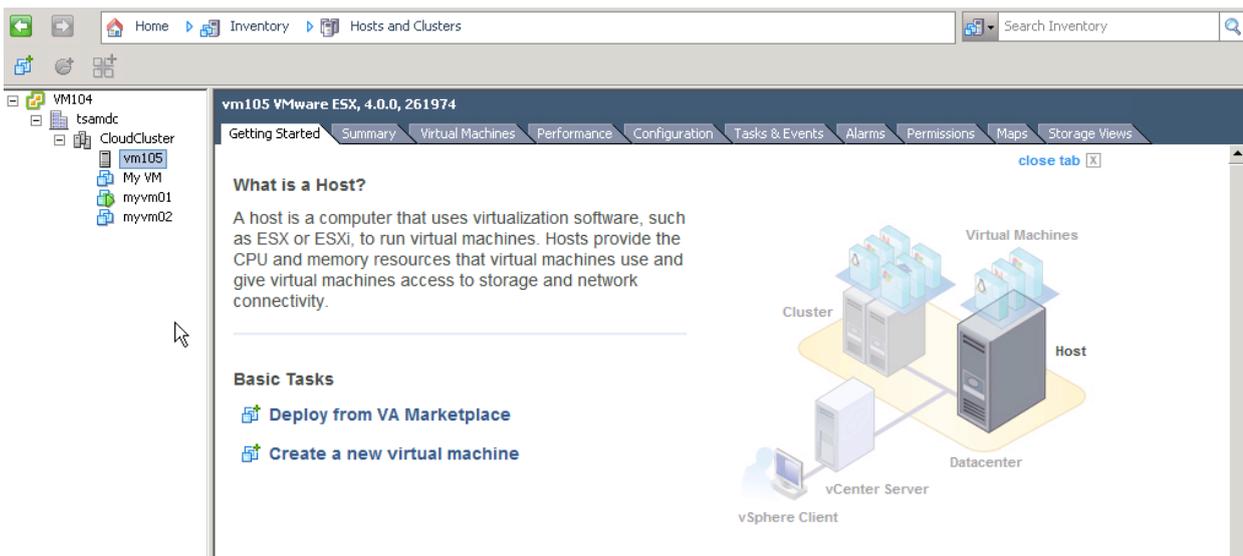
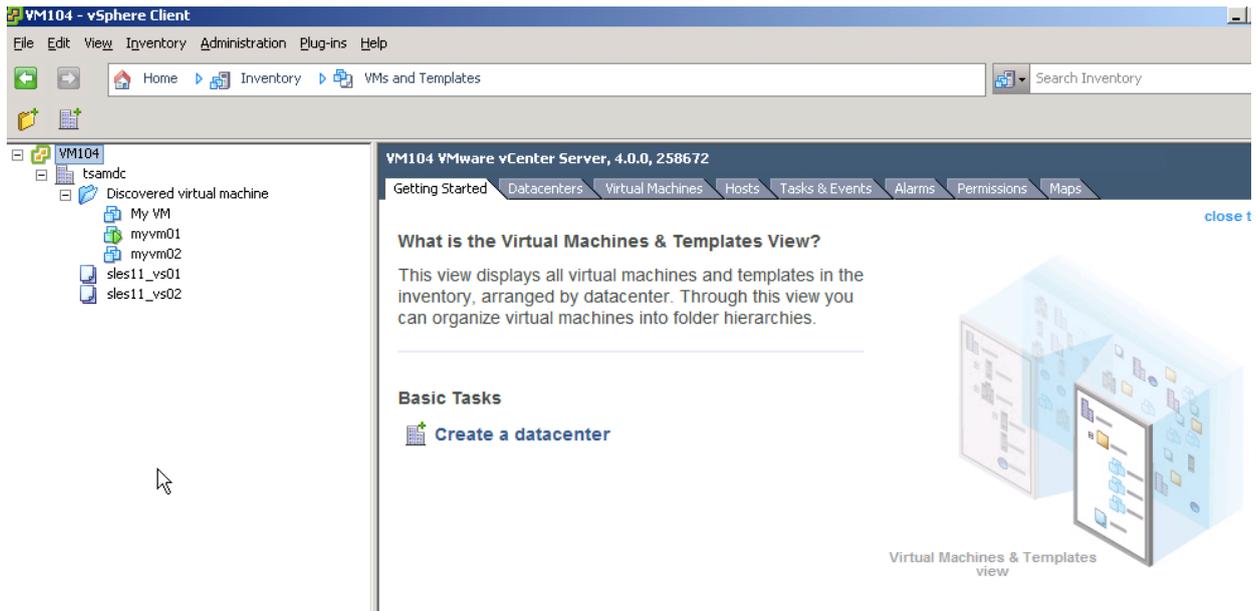
4. Close **Services** window.
5. Use **vSphere Client** shortcut on the desktop to start vSphere Client.
6. Use **localhost** in the **IP address / Name** field and check the **Use Windows session credentials** checkbox.

7. Click **Login** button.

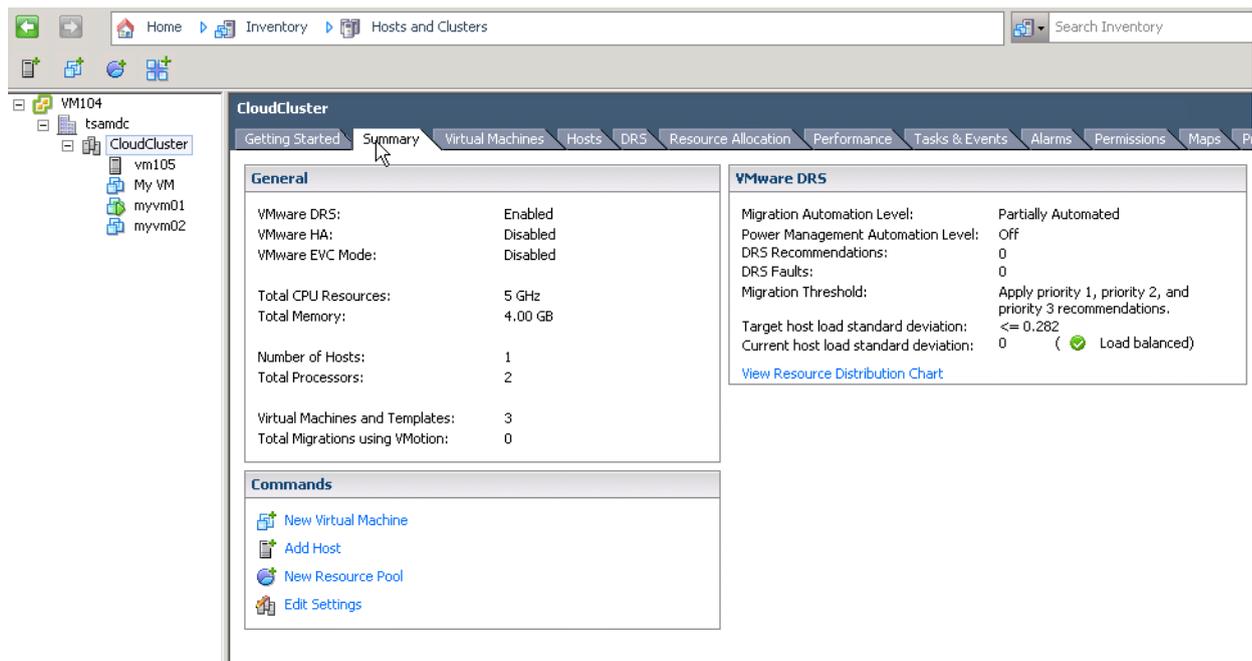


When the window opens, click **Home** in the navigation bar.

8. Notice new options shown when connecting to the vCenter Server instead of ESX server.
9. Click **VMs and Templates**
10. The root in the object tree is now vCenter Server.
- Below, there is a datacenter object, used to group multiple objects in your datacenter.
 - vCenter Server discovered VMs running on the ESX node



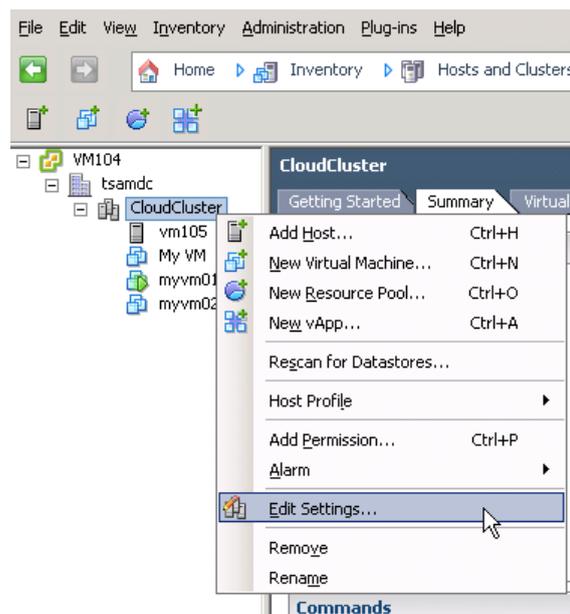
11. Click **Inventory** → **Hosts and Clusters** in the navigation bar.
12. Notice that under **tsamdc** datacenter object there is a **CloudCluster** object. Inside this cluster there is **vm105** ESX node and all VMs registered on it. This is a typical hierarchy. Administrator can managed hypervisors via single console.
13. Explore tabs present in this view.
14. Click on the **CloudCluster**.



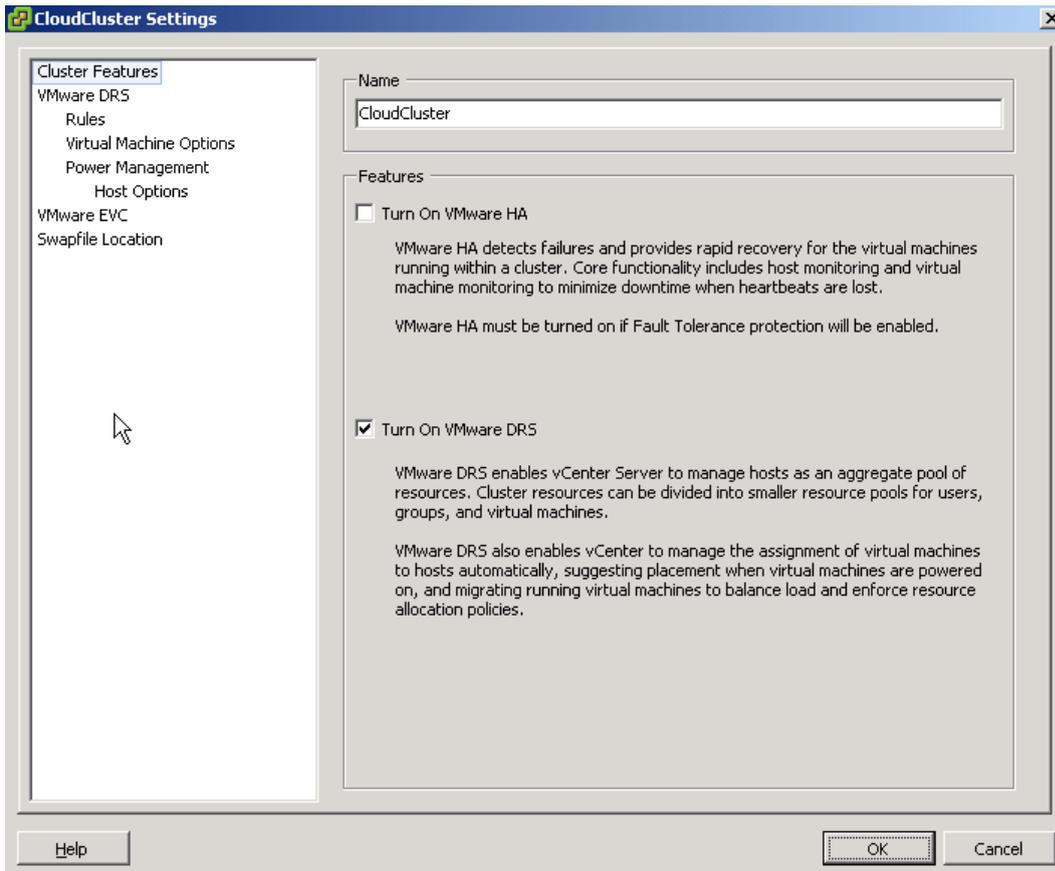
15. Notice three abbreviations in **General** panel:

- DRS – is a Distributed Resource Scheduler used to relocate VMs between hypervisors according to the workload (this is used to balance workload in virtualized environments).
- HA – High Availability – this is used to automatically restart VMs from failed hypervisor on the other in the cluster
- EVC – is the option to use standardized CPU features across hypervisors to be able to move running VMs even if the hypervisors have different CPU models.

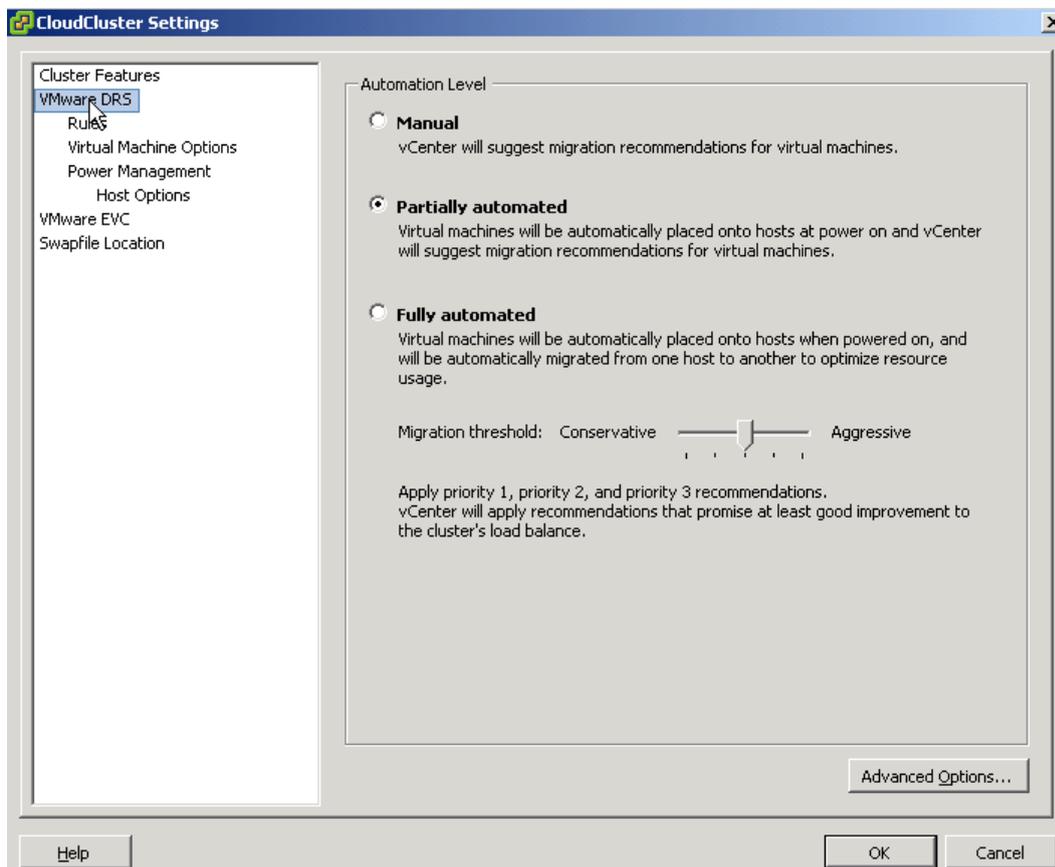
16. Right-click on the **CloudCluster** and select **Edit Settings**.



- 17. This window enables you to turn on DRS and HA features.



- 18. You can also customize DRS settings to act more or less automatically.



19. Explore other settings available now in vSphere Client.
20. After you're done close vSphere Client and log out from Windows.