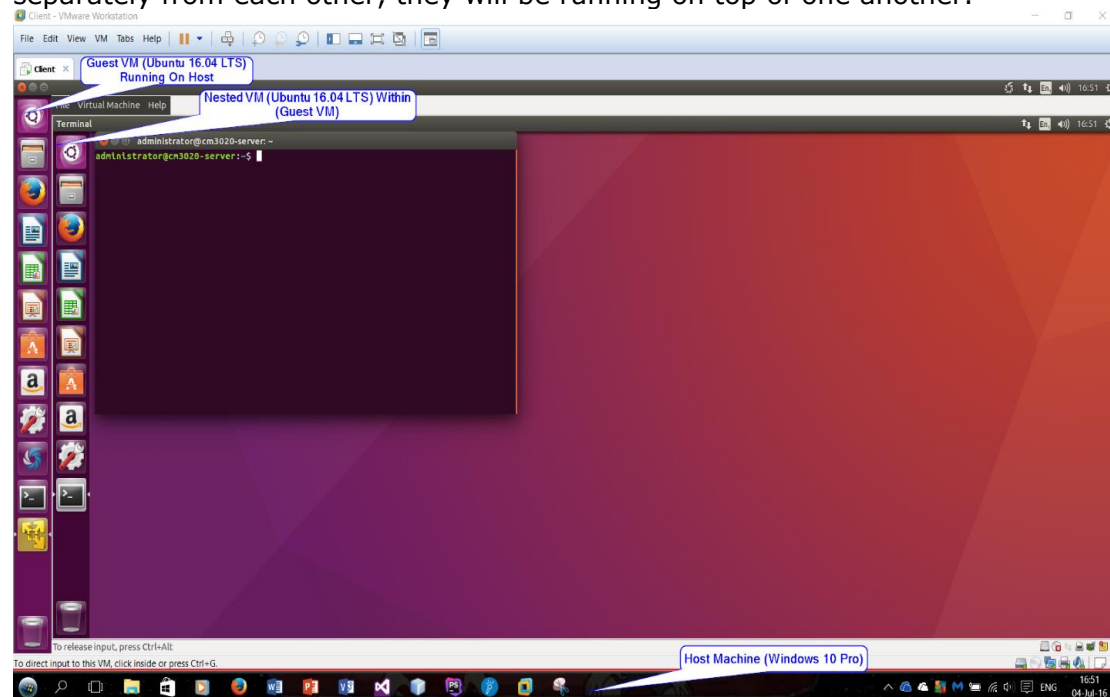# Laboratory 4: Nested Virtual Machines

1. Nested Virtual Machines

In today's lab we will be upgrading the performance of our current Ubuntu Virtual Machine to allow it to run another Virtual machine inside it. This is known as creating **Nested Virtual Machines**. Instead of having two virtual machine running separately from each other, they will be running on top of one another.

1.1 Definitions

Table 4.1 shows the basic definitions for this laboratory.

VM	Virtual Machine: is an emulation of a particular computer system	Client
Nested VM	A nested virtual machine is a virtual machine contained within another VM.	Ubuntu 16.04 LTS Running on top of Guest.
Host	A host system (host operating system) would the primary & first installed operating system	Windows 10 Professional
Guest	A guest system is a virtual machine that is installed under the host operating system (see above). The guests are the VMs that	Ubuntu 16.04 LTS

|	run in your virtualisation platform (see below).	
Hypervisor	A hypervisor or virtual machine monitor (VMM) is a piece of computer software that creates and runs virtual machines.	VMware workstation/ Virtual box

Table 4.1

## Activity 4.1

> VM Reconfiguration
> **Approx. Time Required:** 5 minutes.
> **Objective:** Set the necessary features for the Nested VM to run.

1. Start-up VMware Workstation but **don't** start the client Ubuntu VM just yet.
2. Select your **Client** VM and then select the **Edit virtual machine settings** option.
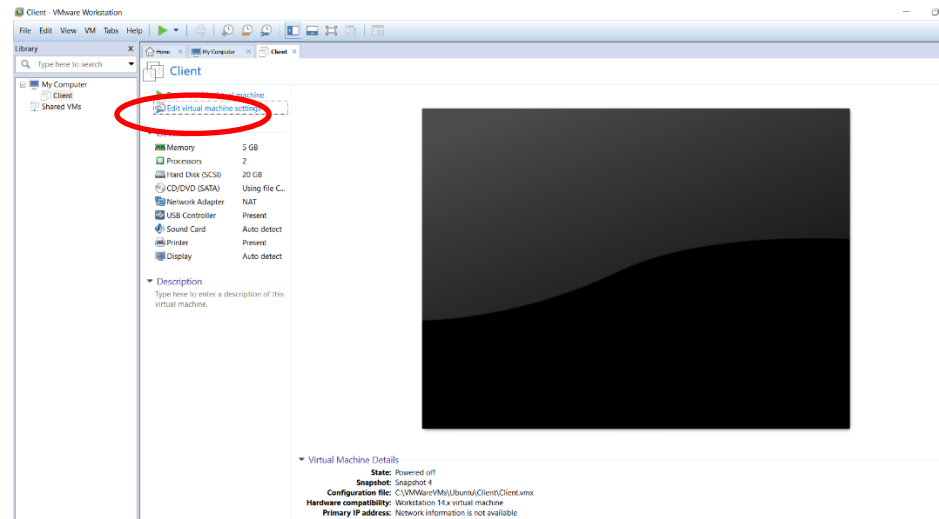
3. The first device that will require changing is **memory**:
   - The memory is currently set to 1GB (1024MB), change to 5GB (type 5120 into the textbox).
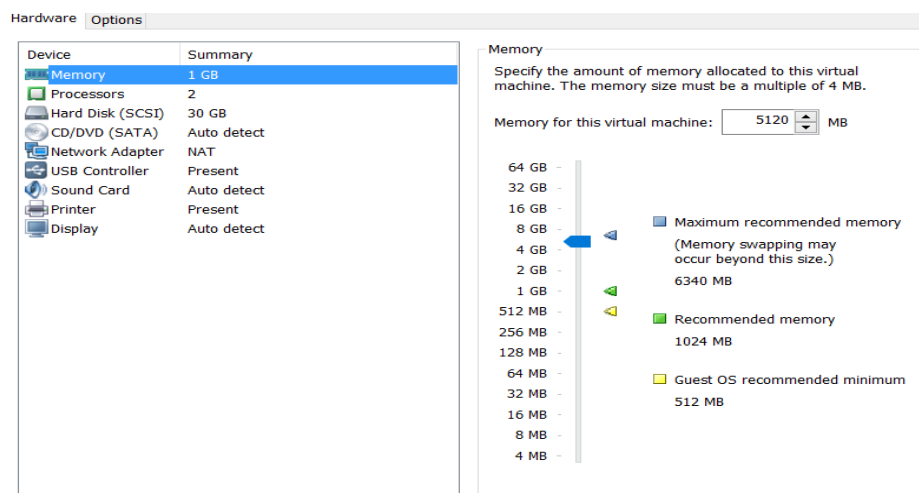
4. Update the processors by enabling the Client Ubuntu VM to run 64 bit Nested VMs. This is done by ticking the virtualize **intel vt-x/ept or amd-v/rvi** option.
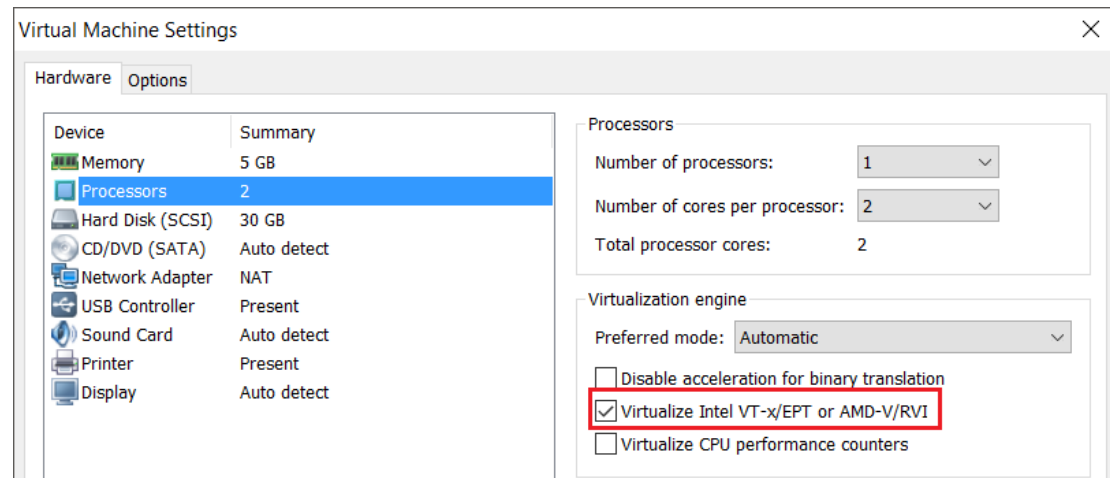
5. Click **OK** to save updated setting and start the Client Ubuntu VM.

> The Virtual Machine has a lot more resources allocated to it now so running additional programs in the background alongside VMWare Workstation will reduce performance for both the host computer and guest VM.
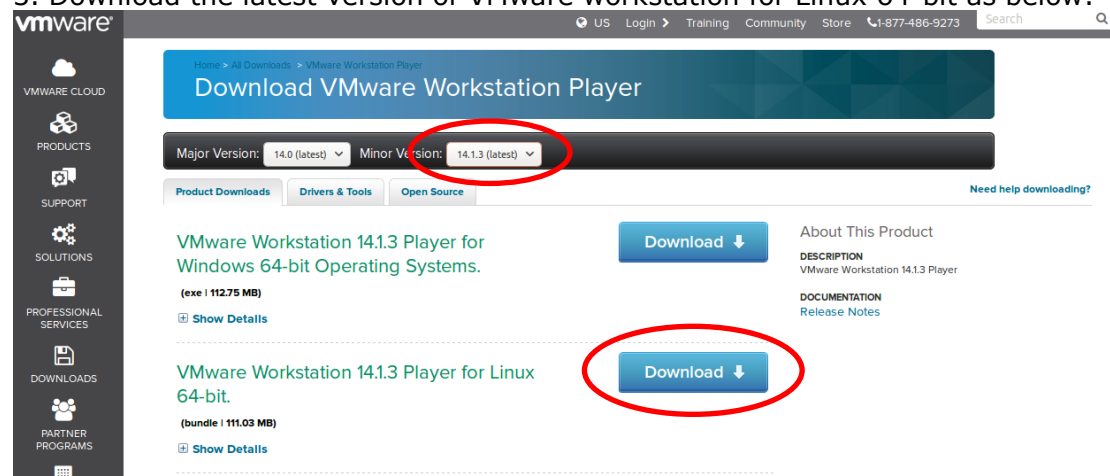
Activity 4.2

> Installing VM Player
> **Approx. Time Required:** 10 minutes.
> **Objective:** Download VM player to run nested VMs.

1. Start up the Ubuntu VM.
2. Start Firefox and navigate to this address:
https://www.vmware.com/go/downloadplayer/
3. Download the latest version of VMware workstation for Linux 64-bit as below:

4. Once the bundle is download, open a terminal window and type in the following commands:

```
a. cd Downloads
b. chmod +x VMware-Player-**COMPLETE NAME OF FILE**.bundle
c. sudo ./VMware-Player-**COMPLETE NAME OF FILE**.bundle
```

It is possible that you get the message in the image below, but after a while the installation should start.

```
administrator@administrator-virtual-machine: ~/Downloads

(vmware-installer.py:3620): Gtk-WARNING **: Unable to locate theme engine in mod
ule_path: "murrine",

(vmware-installer.py:3620): Gtk-WARNING **: Unable to locate theme engine in mod
ule_path: "murrine",

(vmware-installer.py:3620): Gtk-WARNING **: Unable to locate theme engine in mod
ule_path: "murrine",

(vmware-installer.py:3620): Gtk-WARNING **: Unable to locate theme engine in mod
ule_path: "murrine",

(vmware-installer.py:3620): Gtk-WARNING **: Unable to locate theme engine in mod
ule_path: "murrine",
Gtk-Message: Failed to load module "canberra-gtk-module": libcanberra-gtk-module
.so: cannot open shared object file: No such file or directory
Fontconfig error: "/etc/fonts/conf.d/10-scale-bitmap-fonts.conf", line 72: non-d
ouble matrix element
Fontconfig error: "/etc/fonts/conf.d/10-scale-bitmap-fonts.conf", line 72: non-d
ouble matrix element
Fontconfig warning: "/etc/fonts/conf.d/10-scale-bitmap-fonts.conf", line 80: saw
 unknown, expected number
```

5. The installer will now open:
    a. Accept all the Terms and Conditions.
    b. Leave the licence field blank.
    c. Click **Install** to complete installation process.
6. To open the VM Player go the Ubuntu Dash and it should be the first application on the list, otherwise type **VMWare Player** on the search bar. To pin it to the Launcher, open the application, then right click on the icon in the launcher, and finally select **save to launcher**.
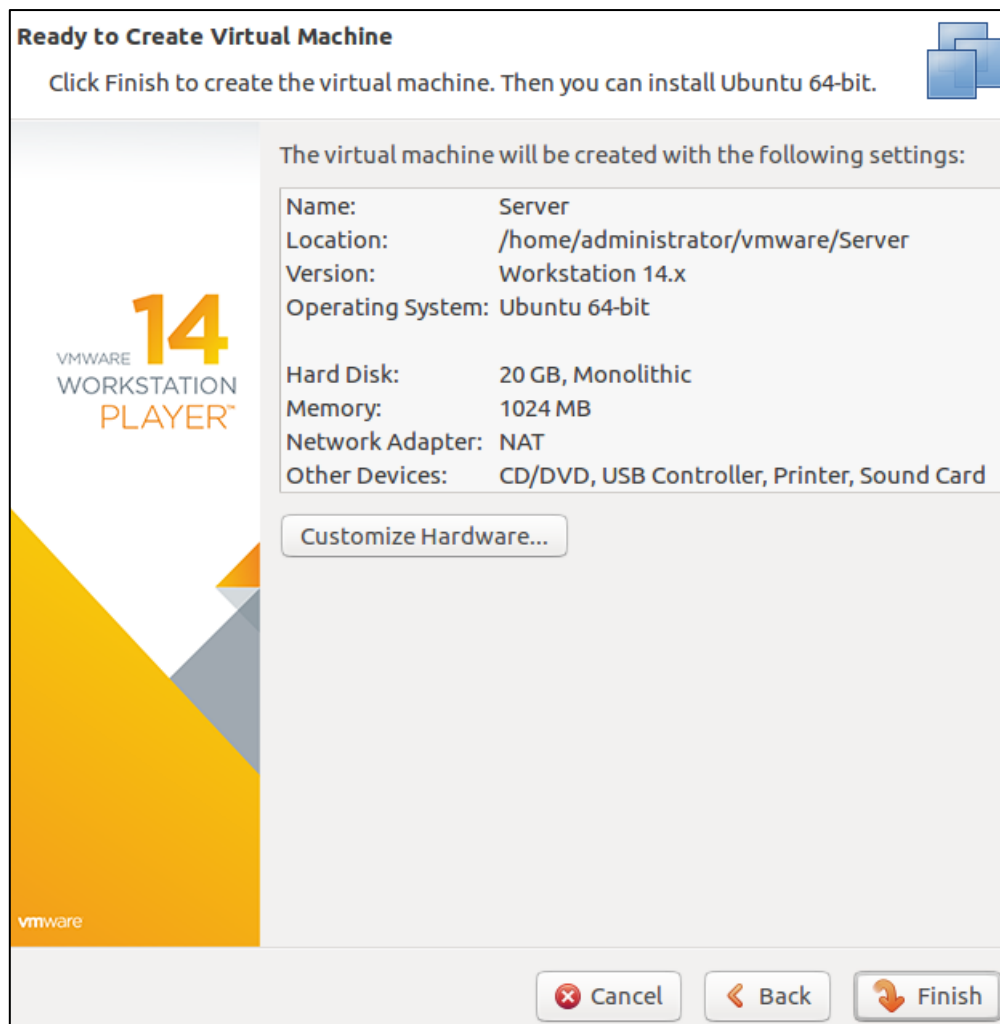7. Once the VMware Player opens a licence prompt will appear, select the non-commercial use option.

Activity 4.3

Creating a Nested VM
Approx. Time Required: 30 minutes.
Objective: Nested VM creation and configuration.

1. Open VM Player in the VM.
2. Select **Create a New Virtual Machine** and then select **I will the operating system later**. Click **Next**.
3. For the guest operating system select **Linux – Ubuntu 64 bit**.
4. Virtual Machine Name: **Server**. Leave the default Location.
5. Virtual Disk Size: **20GB** and **Store virtual disk as single file**.
6. The final review screen should look similar to this:

Ready to Create Virtual Machine

Click Finish to create the virtual machine. Then you can install Ubuntu 64-bit.

The virtual machine will be created with the following settings:

Name: Server
Location: /home/administrator/vmware/Server
Version: Workstation 14.x
Operating System: Ubuntu 64-bit

Hard Disk: 20 GB, Monolithic
Memory: 1024 MB
Network Adapter: NAT
Other Devices: CD/DVD, USB Controller, Printer, Sound Card

Customize Hardware...

VMWARE 14 WORKSTATION PLAYER™

vmware

Cancel   Back   Finish

> Ensure that the Network Adapter type is NAT. If not, select **Customize Hardware – Network Adapter – NAT**.

7. Click **Finish** then close to complete the creation.
8. Ignore the warning that appears after the creation of the VM.
9. Click Play next to the Virtual Machine to start the Nested VM.
10. Ignore any warnings of 3D acceleration or VMware tools installation at this stage.
11. Go to **Edit Virtual Machine Settings → CD/DVD (SATA) → Use ISO Image**.
    a. We're going to use the same ISO as the Client VM, which is stored on the shared folder that we established in lab 1 between the host and the guest.
    b. Browse to the following file path: `/mnt/hgfs/VHDs/Ubuntu/Ubuntu-Installer/`
    c. Select the ubuntu-16.04-desktop-amd64.iso – Open then save the settings.
    d. Reset the VM and follow the instructions for installation as stated in Lab 1 until the user creation stage.

> Note the mouse clicks maybe inconsistent since the VMware Tools aren't installed yet but be persistent it will work. Alternatively, the keyboard shortcuts will work.

12. At the **Who are you?** Screen – the only difference between the client and server is the host name as below:
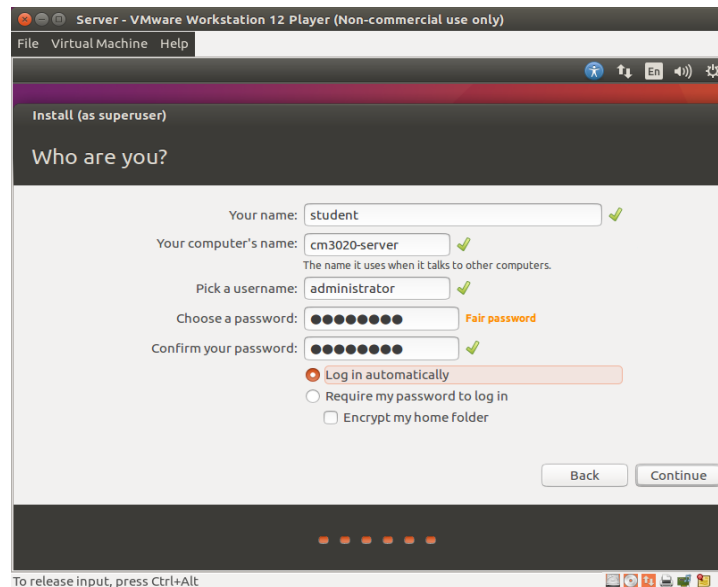
- Your name: student
- Your computer's name: `**STUDENT ID**`-server
- Username: administrator
- Password: `P@ssw0rd` (Note: The 'P' is capitalised and the '0' is a zero).
- Select `Log in automatically`.

1.2 Install Open-VM Tools

Similar in the Client Ubuntu VM, the **open-vm-tools** are also required to be installed on the Server Nested VM.

13. Start the Server Nested VM and open a terminal window.
14. Type the following command:
    ```
    sudo apt-get install open-vm-tools-desktop
    ```
    a. Enter `y` or `yes` for any confirmation prompts.
15. In addition to installing open-vm-tools, **vmware-tools-patches** are required:
    a. Open a terminal window install git:
    ```
    sudo apt-get install git
    ```
    b. Enter `y` or `yes` for any confirmation prompts.
    c. Clone the vmware-tools-patches repo from github:
    ```
    git clone https://github.com/rasa/vmware-tools-patches.git
    ```
    d. Once the repo is cloned, enter the following commands:
    ```
    cd vmware-tools-patches
    sudo ./patched-open-vm-tools.sh
    ```
    e. Enter `y` or `yes` for any confirmation prompts.
16. Reboot once installation is complete

1.3 Shared Folders

To Access both the host and the guest file systems from the Nested VM, follow these instructions:

17. Ensure the Nested VM is offline. To access the shared folder settings, go to **Virtual Machine Settings** (CRTL+D) then **Options**.
    a. Ensure that **Always enabled** is selected.
    b. Click **Add** button.

c. Browse to the /mnt/hgfs/VMWareVMs folder and add the name `VMWareVMs`, then press **OK**.

d. **Save** and then restart the Nested VM. If this doesn't show the shared folder, recall the troubleshoot solution implemented in Lab 1 (i.e. toggle the sharing on and off with the server VM powered on).
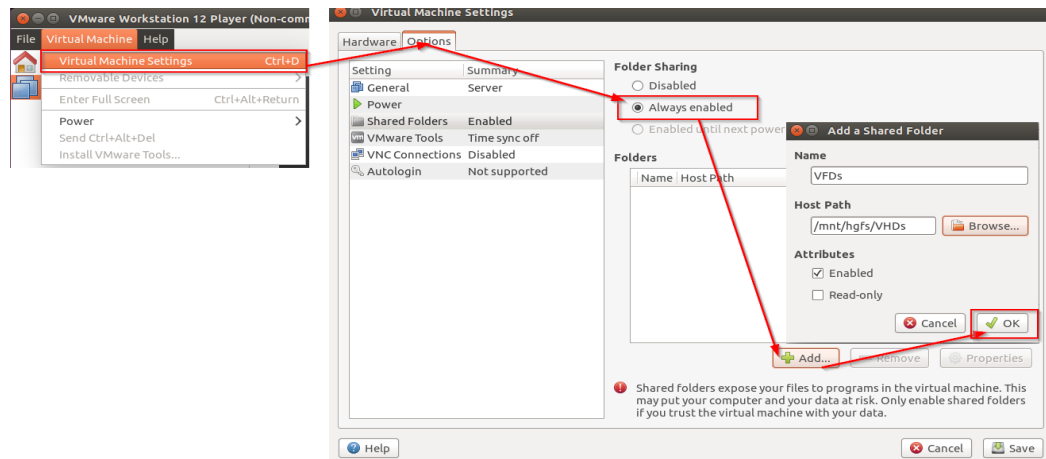

1.4 Nested VM Usage/ Troubleshooting

As of now there will be 3 operating systems running at one time, so expect the host computer's performance to degrade, as it allocates resources to running both the Guest and Nested VM. Here's a short guide to allow the Nested VM and Guest VM to continue to run smoothly.

1.4.1 Saving to USB

- To avoid data corruption, ensure that both the nested and Guest VMs are shutdown correctly.
- The simplest way to do this is to select the settings cog on the top right corner in the nested VM then select shutdown.
- Repeat this process to shut down the Guest/Client Ubuntu VM.
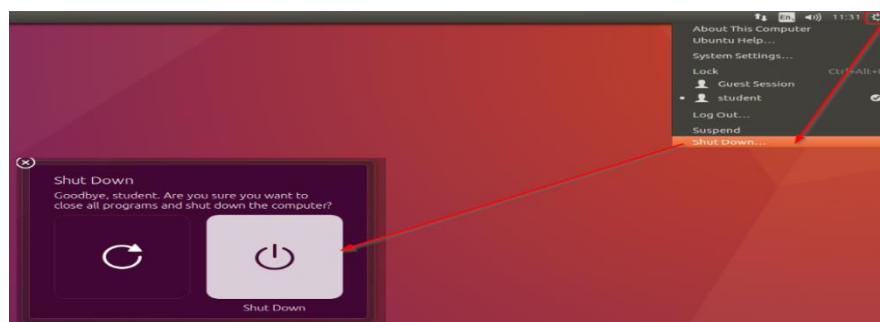

1.4.2 Full screen mode

- To access full screen mode for the Guest VM, go to the full screen button.
- Alternatively, full screen can be accessed through the **CTRL+ALT+ENTER** keyboard shortcut.
- To exit out of full screen mode just reverse the steps above.

1.4.3 Persistent VMWare tools install prompt

After installing the open-vm-tool and vmware-tool patches you may still get a popup asking to install the vmware-tools when you start up the Nested VM:
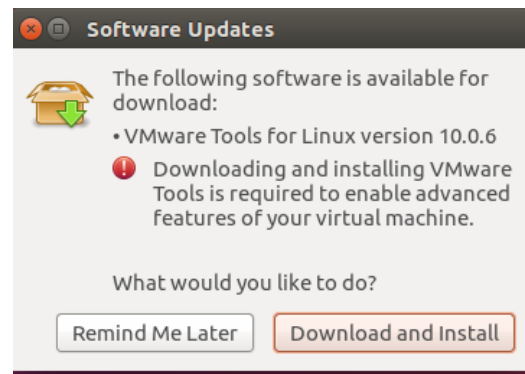
To disable this persistent prompt, the **Server.vmx** (configuration) file needs to be updated.

i.   Ensure that VMware Player is closed.
ii. Open a terminal window.
iii. Type in the following commands:
```
cd vmware/Server/
gedit Server.vmx
```
iv. Add the following lines at the end of the file:
```
tools.remindInstall = "FALSE"
tools.upgrade.policy = "manual"
```
v.   Save and exit.
vi. Restart the nested VM. Now the prompt should be disabled.