Lab Session: Installing Ubuntu on Oracle VirtualBox

Oracle VirtualBox is a cross-platform virtualization application. It installs on your existing Intel or AMD-based computers, whether they are running Windows, Mac, Linux or Solaris operating systems. VirtualBox can create and run a "guest" operating system (virtual machine) in a Window of the host operating system. The virtual machine provides a self-contained environment in which to experiment with new software without risking damaging changes to the host operating system. We will give an instruction with step-by-step screenshots to show how to install VirtualBox with an example of installing Ubuntu OS as a guest machine. We also explain how to share files between the host and guest operating systems.

Reference: https://www.virtualbox.org/manual/

1. VBox Downloads and Installations

*Note the instruction here is based on the latest version of the VirtualBox.*Go to the VirtualBox website here to download the binary for your current operating system. Since our host machine is running on Windows, I'll choose 'x86/amd64' from Windows hosts. When download is finished, run the executable file. Continue with the installation of VirtualBox with the defaults. This will open VirtualBox at the end of the installation.

For installation on Linux refer to: https://phoenixnap.com/kb/install-virtualbox-on-ubuntu

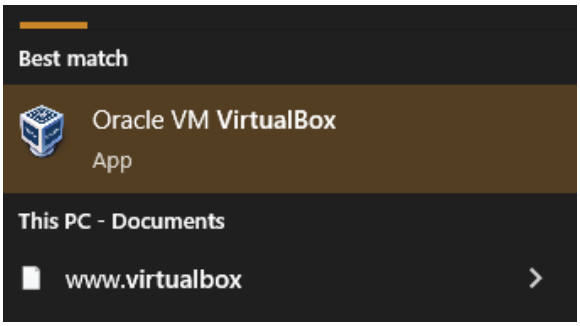
Oracle VirtualBox is split into the following components:

- **Base package.** The base package consists of all open source components and is licensed under the GNU General Public License V3.
- **Extension packs**. Additional extension packs can be downloaded which extend the functionality of the Oracle VirtualBox base package. Currently, Oracle provides a single extension pack, available from: http://www.virtualbox.org

2. Starting Oracle VirtualBox Manager

After installation, you can start Oracle VirtualBox as follows:

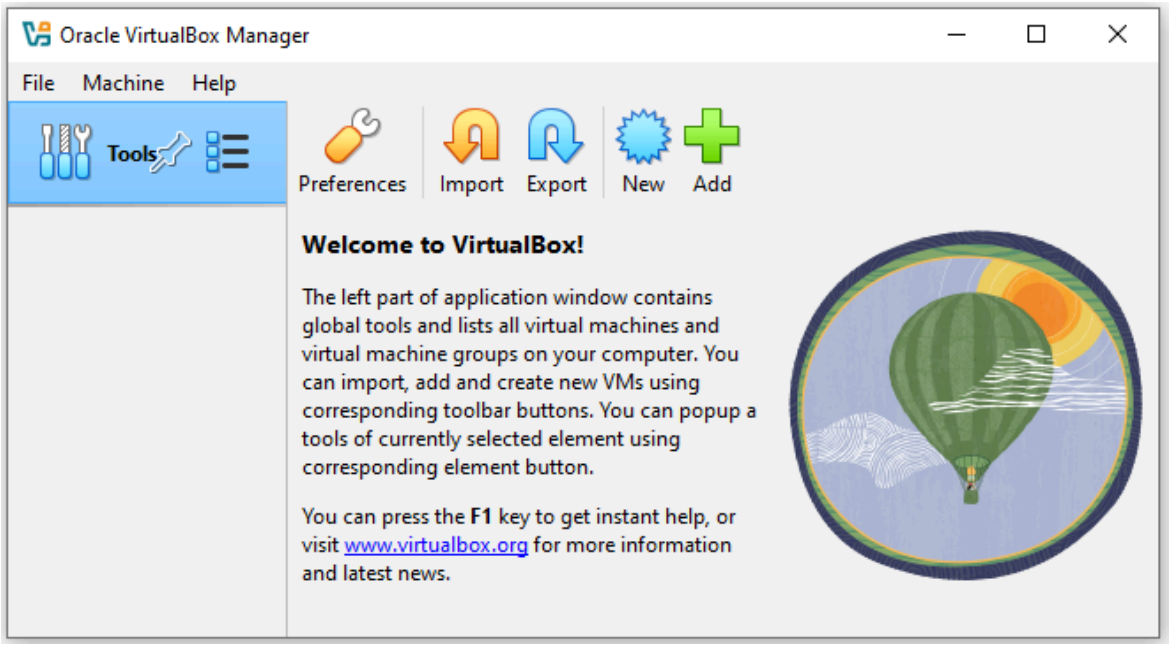
- **Windows hosts.** In the **Programs** menu, click the item in the **VirtualBox** group. On some Windows platforms, you can also enter VirtualBox in the search box of the **Start** menu.



- **macOS hosts.** In the Finder, double-click the **VirtualBox** item in the Applications folder. You may want to drag this item onto your Dock.

- **Linux or Oracle Solaris hosts**. Depending on your desktop environment, an Oracle VirtualBox item may have been placed in either the System or System Tools group of your **Applications** menu. Alternatively, you can enter VirtualBox in a terminal window.

When you start Oracle VirtualBox, the VirtualBox Manager interface is shown as below if there are no existing VMs created (fresh installation).



- **Add:** If you already have a VM saved on your machine, you can add it to the machine list by clicking Add.
- **New:** If you want to create a completely new VM, click New.
- **Import:** If you have a VM on a different machine, you can import it by clicking Import Appliance.
- **Export:** Export an existing VM

3. Configuring Oracle VirtualBox Manager

Before creating, adding or importing any Virtual Machines, you must set up Oracle VirtualBox to work with your network and host machine.

Oracle VirtualBox Preferences

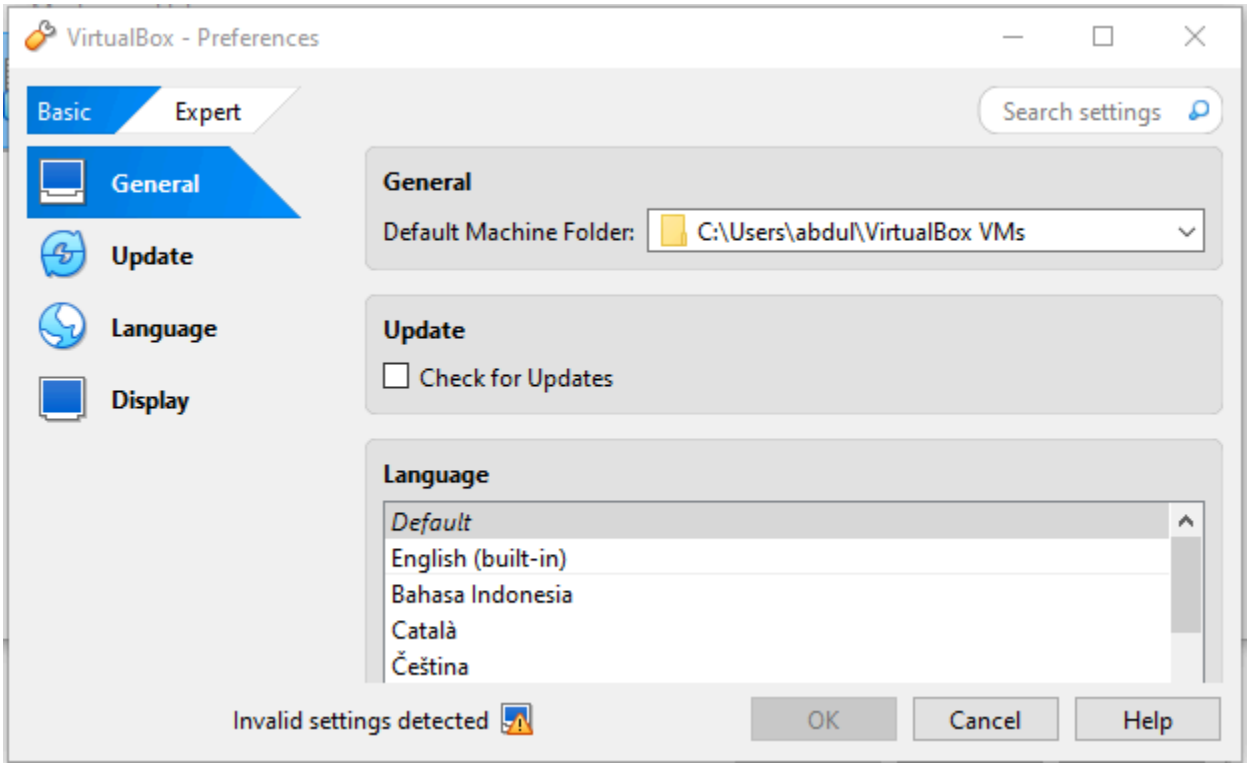
The Preferences window offers a selection of settings, which apply to all virtual machines of the current user. The available Preferences settings depend on the selected experience level. To display all Preference settings at once, ensure the experience level is set to **Expert**. For now, set the experience level to **Basic.**

To display the Preferences window, do either of the following:

- Select **File**, **Preferences**.

- Click **Preferences** on the Welcome screen in VirtualBox Manager.

- Specify the directory for the VM in your computer under **General**. Leave other settings as default.



4. Create a New Virtual Machine

In the VirtualBox Manager window, click **New**. The **Create Virtual Machine** workflow is shown, to guide you through the required steps for setting up a new virtual machine (VM).

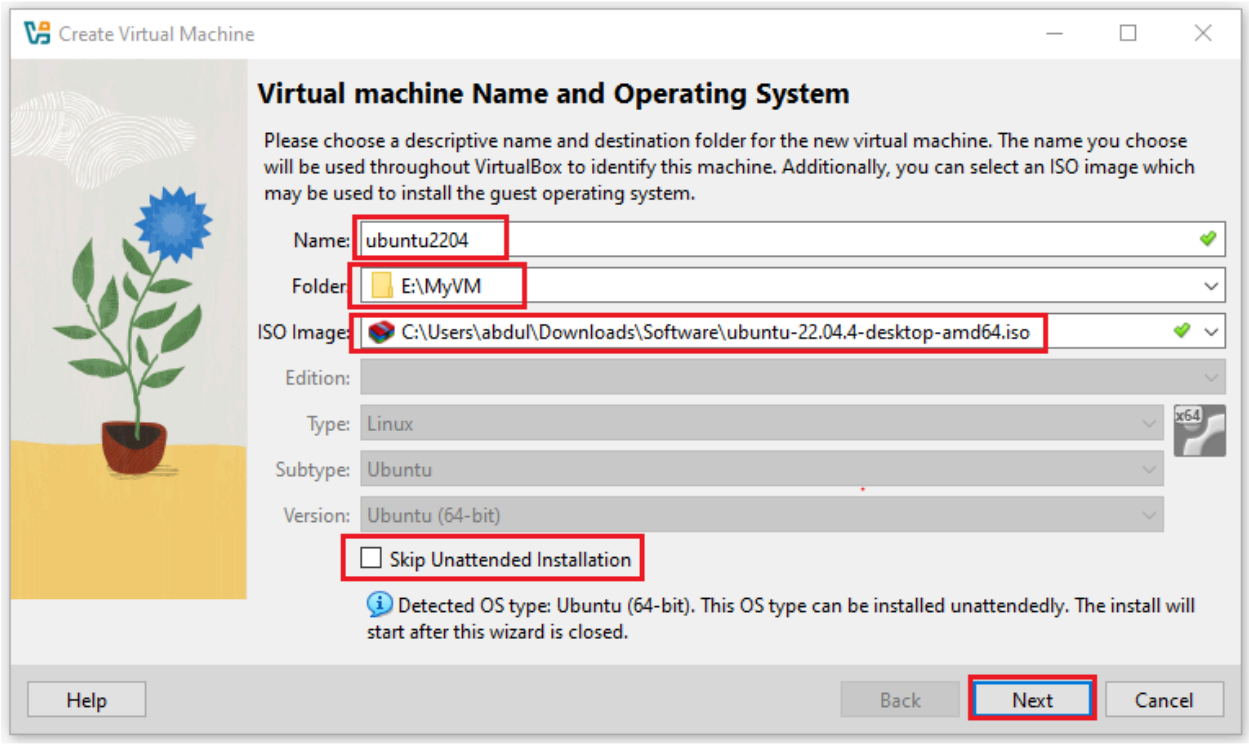
The steps are:

- Specify Name and Operating System
- Configure Unattended Guest OS Install
- Set Up VM Hardware
- Specify a Virtual Hard Disk

4.1 Specify Name and Operating System

- Type a name for the new virtual machine for example, ubuntu2204.
- Select the folder to store the VM files if not specified in the preference. Ensure that the folder location has enough free space
- Browse the Ubuntu OS iso image file that you want to run. The VirtualBox will automatically change the 'Type' to Linux and the 'Version' to 'Ubuntu (64 bit)'.

- Leave the ‘skip Unattended Installation’ untick. By default, Oracle VirtualBox will install the chosen OS using the ISO image provided, if the image supports unattended installation. If you prefer to install the OS manually, you can disable the unattended guest operating system install feature by selecting **Skip Unattended Installation**. In that case, the selected ISO image is mounted automatically on the DVD drive of the new VM and you must install the OS from there. Please note that ‘**not all images support unattended installation**’.
- Click Next

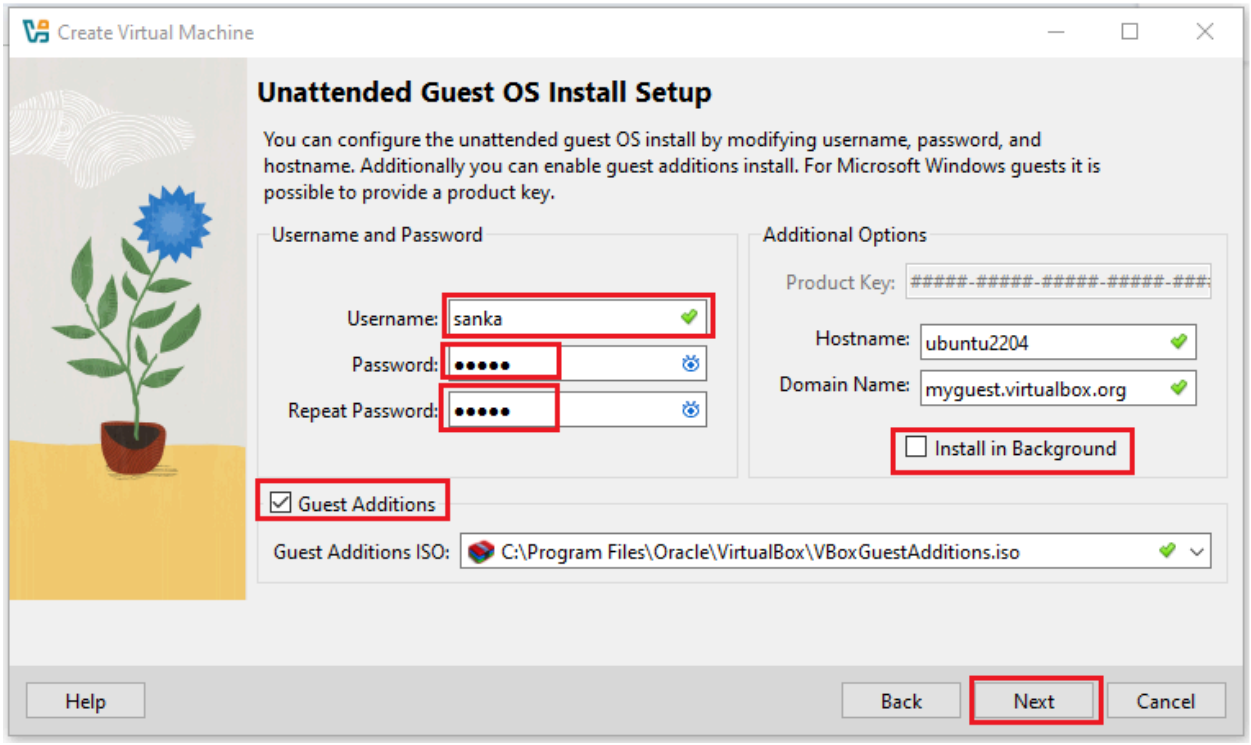


4.2 Configure Unattended Guest OS Install

If you choose Unattended guest OS Installation, Oracle VirtualBox installs the OS on the new virtual machine (VM) automatically. You must supply certain configuration options to be used in the installation. [Note that you will not see these options if you selected the **Skip Unattended Installation** option].

1. Enter the **Username and Password** for a default user on the guest OS.
2. For Windows guests, enter the **Product Key** supplied with Windows.
3. Enter the **Hostname** for the VM. By default, this is the same as the VM name.
4. Enter the **Domain Name** for the VM.
5. Do not tick the ‘**Install in Background**’. This can be selected if you want to enable headless mode for the VM rather than using a graphical user interface.

6. Select **Guest Additions**, the Oracle VirtualBox will install the Guest Additions after the OS installation. Download the Guest Additions installation ISO to the host, and select the file location.
7. Click **Next**



4.3 Set Up VM Hardware

1. For **Base Memory**, select the amount of RAM that Oracle VirtualBox should allocate to the virtual machine (VM) every time it is started. The guest OS will report this size as the VM's installed RAM.

   CAUTION: Choose this setting carefully. The memory you give to the VM will not be available to your host OS while the VM is running.

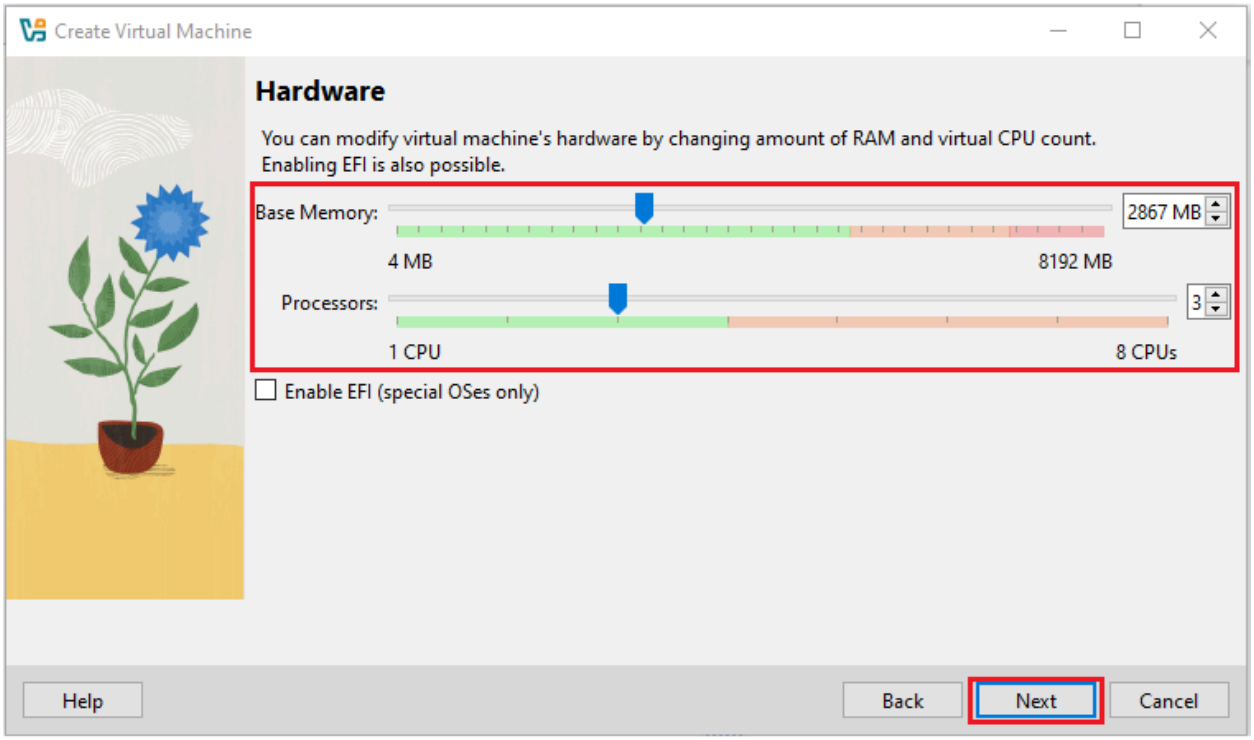
   Do not specify more than you can spare, whilst ensuring you allocate enough for your guest OS and applications to run properly. For example, if your host machine has 4 GB of RAM and you enter 2048 MB as the base memory for a VM, you will have 2 GB left for all the other software on your host while that VM is running.

   A guest OS may require at least 1 or 2 GB of memory to install and boot up. If you intend to run more than one VM at a time, plan accordingly. A VM will not start if it does not have enough RAM to boot.

   Always ensure that the host OS has enough RAM remaining. If insufficient RAM

remains, the system might excessively swap memory to the hard disk, which will effectively bring the host system to a standstill.

2. For **Processor(s)**, select the number of virtual processors to assign to the VM. Do not assign more than half of the total processor threads from the host machine.
3. Select **Enable EFI** if you want to enable Extensible Firmware Interface (EFI) booting for the guest OS.
4. Click **Next**



4.4 Specify a Virtual Hard Disk

There are many ways in which Oracle VirtualBox can provide hard disk space to a VM. The most common way is to use a virtual hard disk. This is a large image file on your physical hard disk, whose contents Oracle VirtualBox presents to your VM as if it were a complete hard disk. You can copy this file to another host, and use it with another Oracle VirtualBox VM.

To prevent your physical hard disk on the host OS from filling up, Oracle VirtualBox limits the size of the image file. But the image file must be large enough to hold the contents of the guest OS and the applications you want to install. For a Windows or Linux guest, you will probably need several gigabytes for any serious use. The size limit of the image file can be changed later.

Note that VirtualBox will create a swap partition with the same amount of space as base memory you have entered here. So later when you are selecting the size of the virtual hard

drive, make sure it is large enough since the hard drive will be splitted into root (/)and swap partitions. The root partition contains by default all your system files, program settings and documents.

Note: If you choose **Do Not Add a Virtual Hard Disk** at this stage you will need to attach a hard disk using VirtualBox Manager or VBoxManage commands before you can install a guest operating system.

Create a Virtual Hard Disk

Follow these steps to create a virtual hard disk to use with this VM.

Select **Create a Virtual Hard Disk Now**. This creates a new empty virtual hard disk image, located in the VM's machine folder.

1. Enter the following settings:
    - **Disk Size**. Use the slider to select a maximum size for the hard disk in the new VM.
    - **Pre-Allocate Full Size.** This setting determines the type of image file used for the disk image. Select this setting to use a *fixed-size file* for the disk image. Otherwise, Oracle VirtualBox will use a *dynamically allocated file* for the disk image.

      The different types of image file behave as follows:

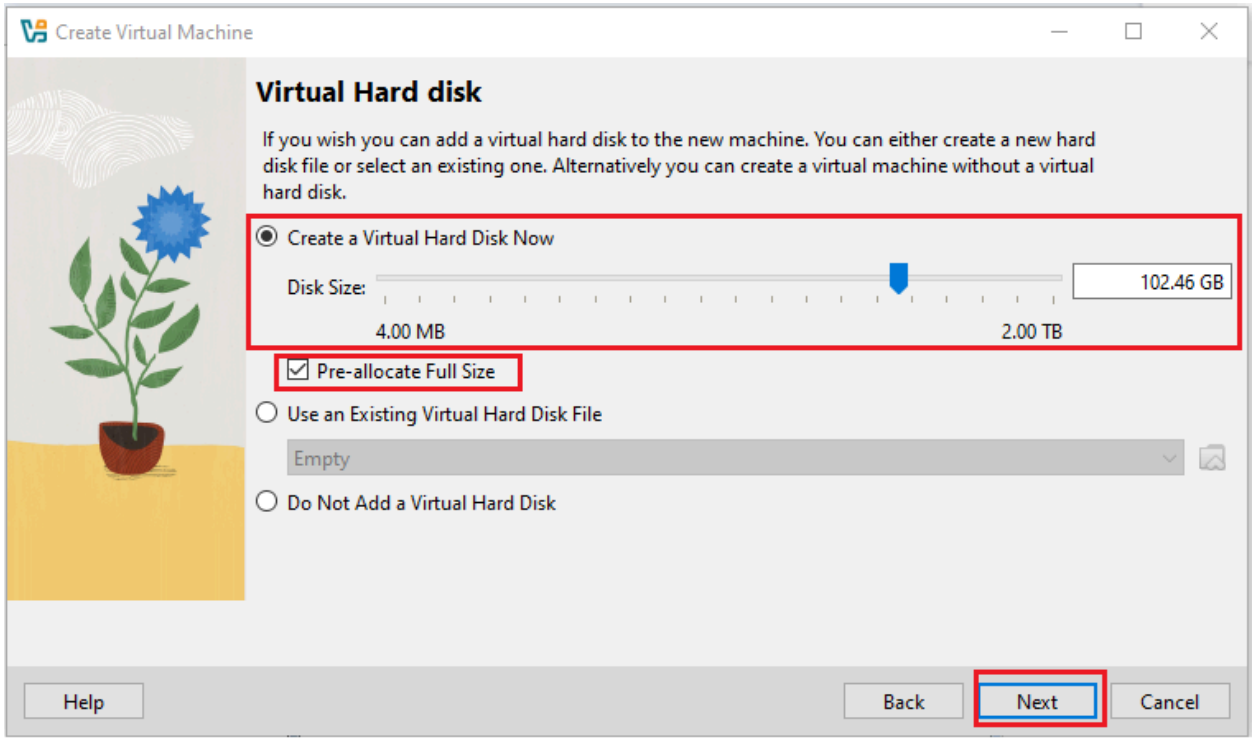
        - **Dynamically allocated file.** This type of image file only grows in size when the guest actually stores data on its virtual hard disk. Therefore, this file is small initially. As the drive is filled with data, the file grows to the specified size.
        - **Fixed-size file.** This type of image file immediately occupies the file specified, even if only a fraction of that virtual hard disk space is actually in use. While occupying much more space, a fixed-size file incurs less overhead and is therefore slightly faster than a dynamically allocated file.

Use an Existing Virtual Hard Disk (optional)

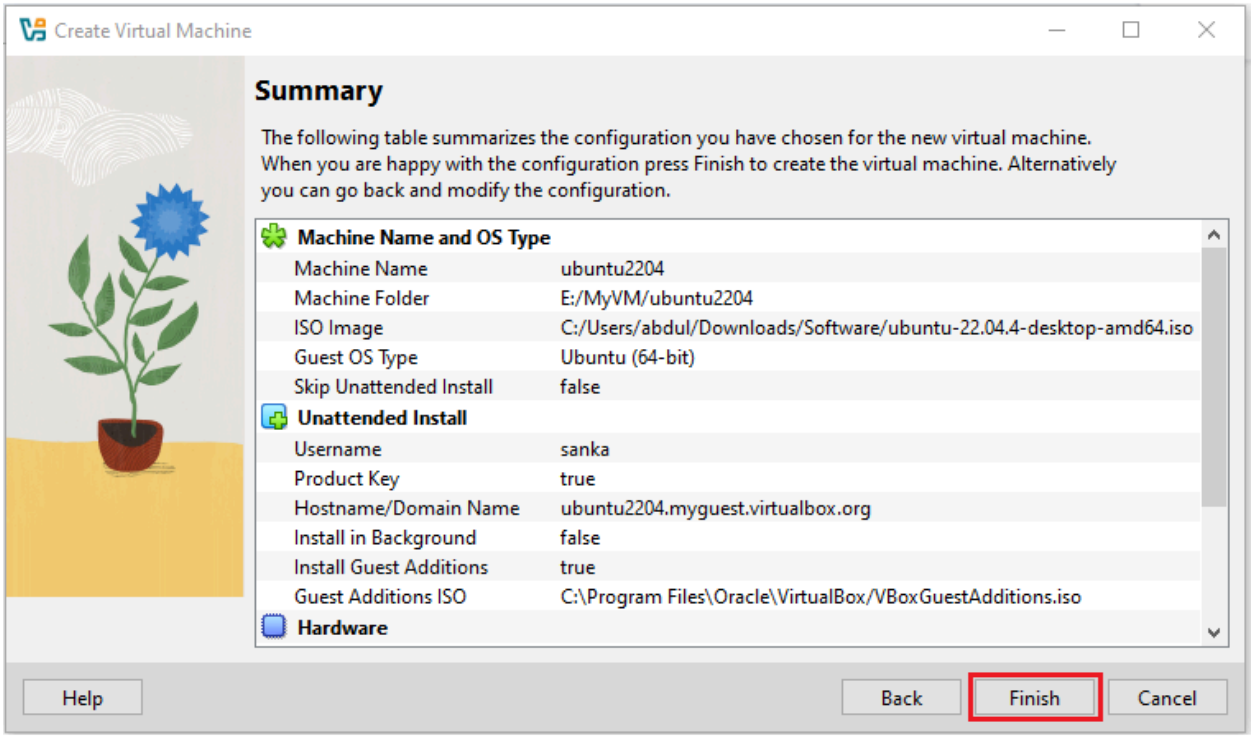
Follow these steps to use a virtual hard disk that already exists on the host. Ensure the image file is in a suitable location (usually the machine folder) and not in use by other VMs.

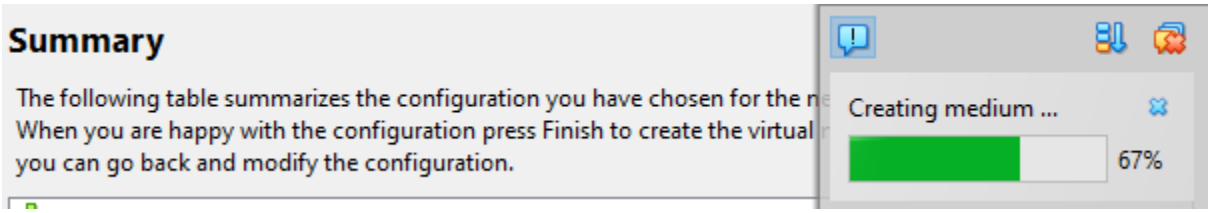
1. Select **Use an Existing Virtual Hard Disk File**

2. Select the image file to use with the new VM, and then click **Add**.



4.5 Check the Summary and Finish

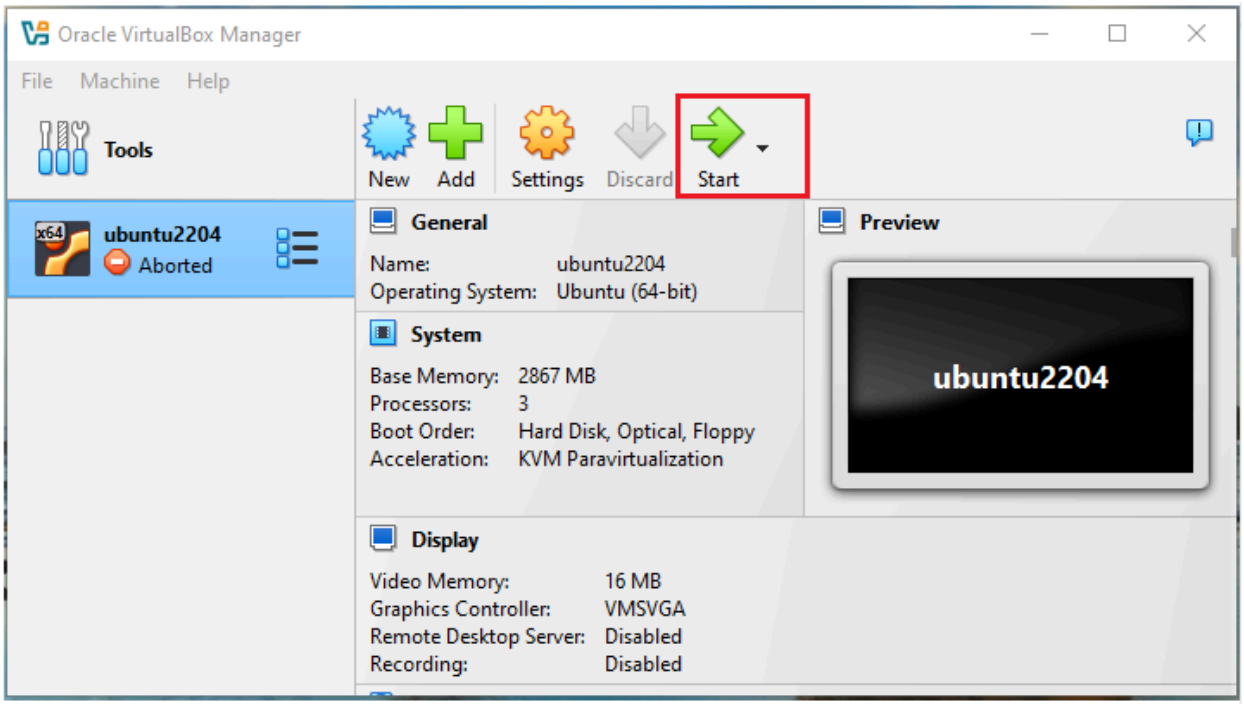




5. Running a Virtual Machine

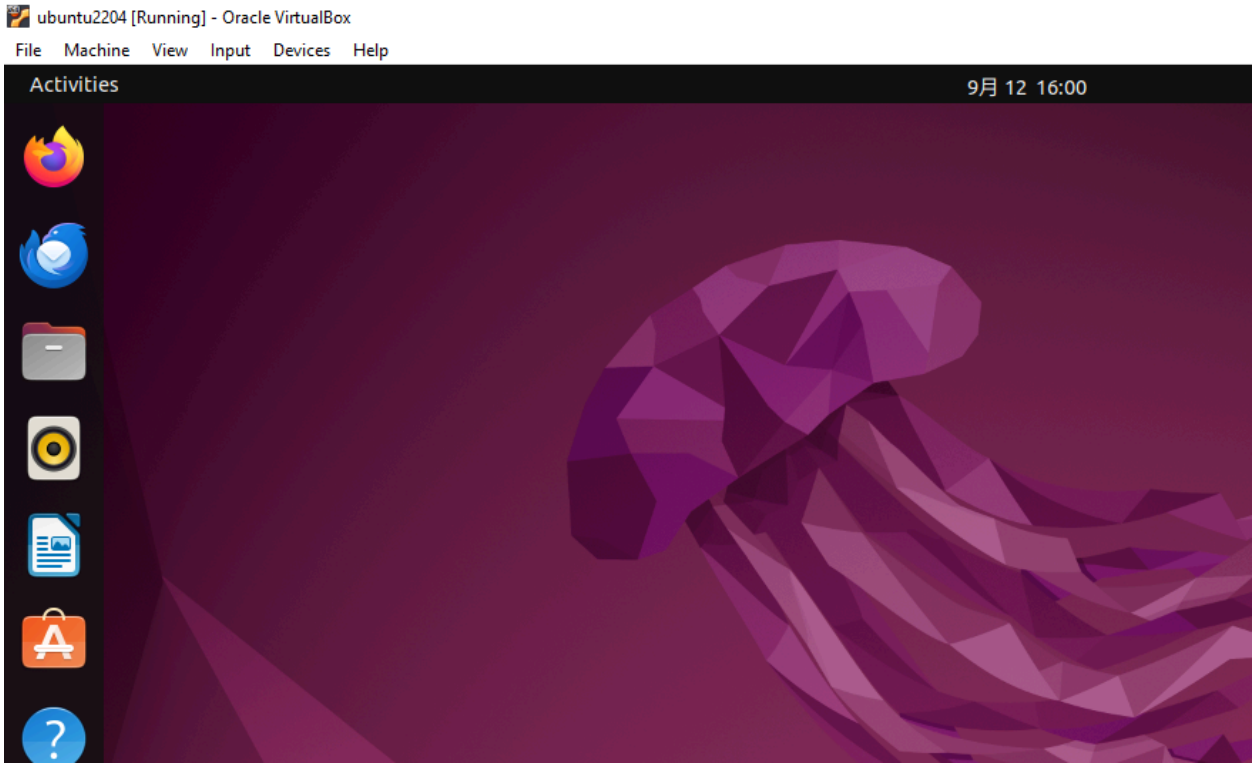
To start a virtual machine (VM), you have the following options:

- Select the VM's name in the machine list in VirtualBox Manager, and click **Start** in the toolbar at the top of the window.
- Double-click the VM's name in the machine list in VirtualBox Manager.
- Go to the VirtualBox VMs folder in your system user's home directory. Find the subdirectory of the machine you want to start and double-click the machine settings file. This file has a .vbox file extension.



When you start a VM for the first time the OS installation process is started automatically, using the ISO image file specified in the **Create Virtual Machine** workflow.

Ubuntu will be installed, follow the onscreen instructions to finalize its configuration..



- Open a Terminal (You can also Press Ctrl + alt + T to open a terminal)
- Try the following commands
    1. Whoami
    2. Lsb_release -al
    3. sudo apt update
    4. sudo apt install build essential

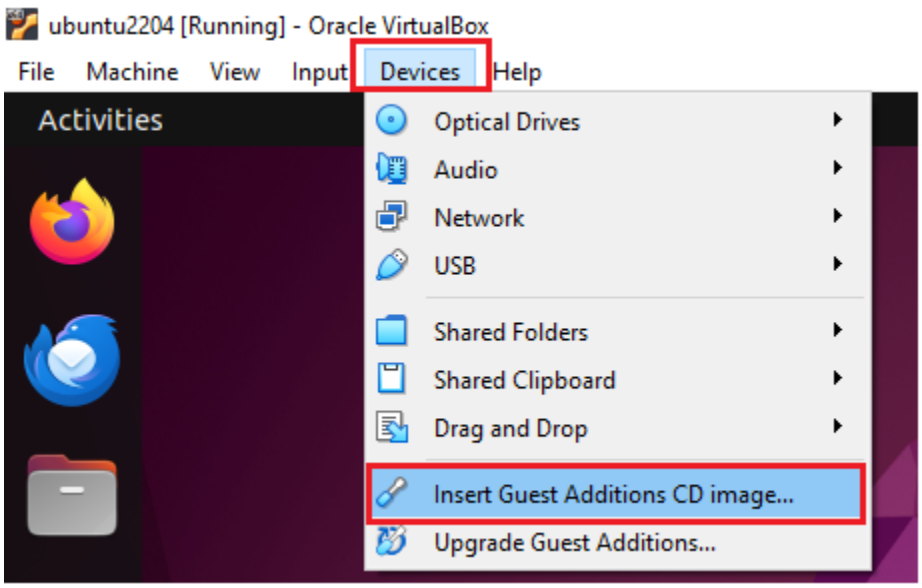
6. More About VirtualBox

Guest Additions software provide additional capability to a guest virtual machine, including mouse pointer integration, better video support, share folders, share clipboard, et al. If you do not tick the Guest Additions box during the installation, you will need to do it now manually

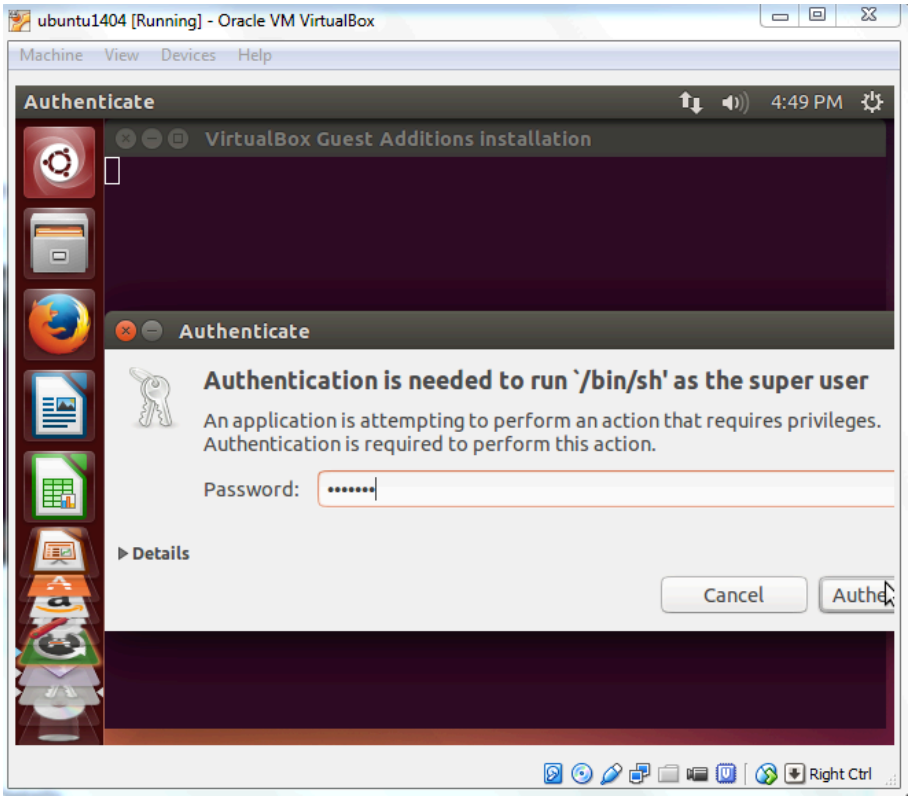
Before we proceed to install Guest Additions, make sure the current user has sudo/root privilege. If the current user does not have sudo/root privilege or it is not sure, run the following terminal command from an account (such as the user created when Ubuntu was first created; see the screenshot of 'Who are you?' above) with root privileges to enable the root privilege for the current user

sudo adduser USERNAME sudo
where USERNAME should be replaced by the current user's name.

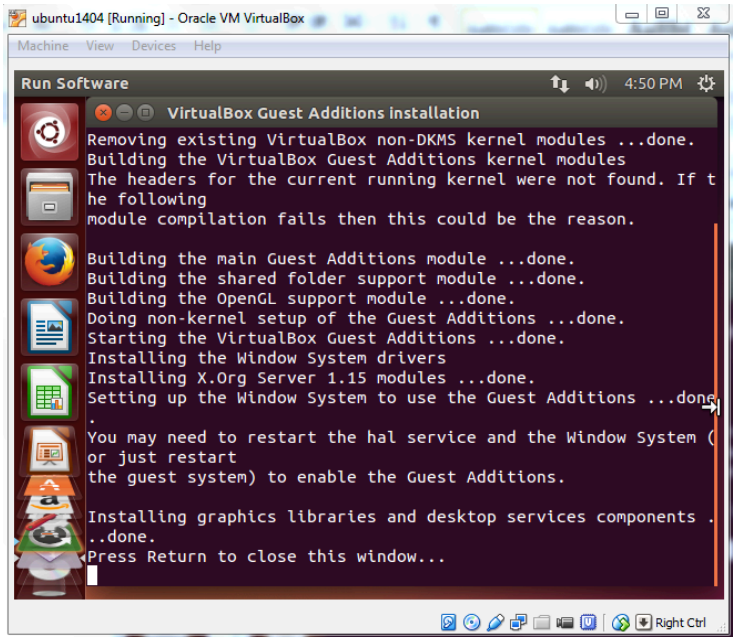
To install **Guest Additions**, click **Devices > Insert Guest Additions CD images…**



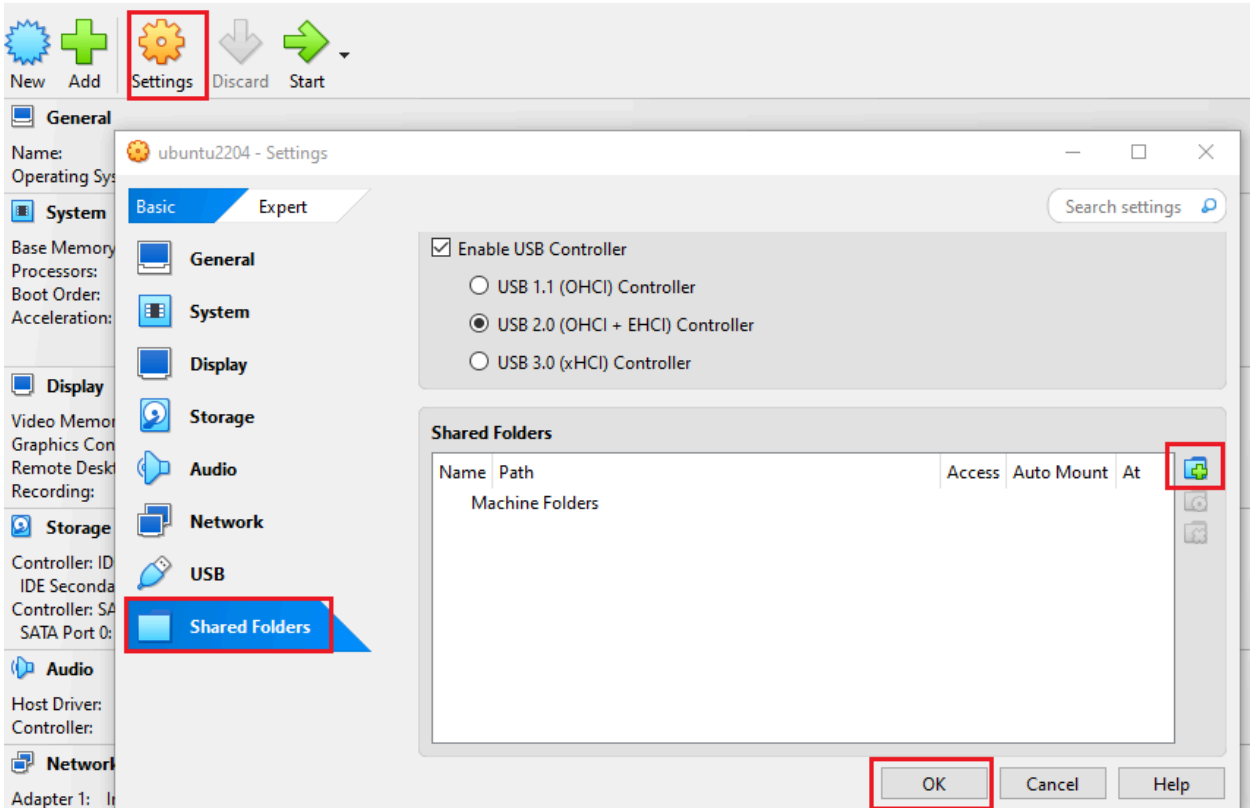
Click 'Run' button (next to 'Cancel' button) to start the installation. Note that the version of VBOXADDITIONS should be matched with the one of VirtualBox you have installed. Installing **Guest Additions** requires root privilege. Enter user's password (assume the current user has sudo privilege).



When the installation is finished, press Return key to close the terminal window.



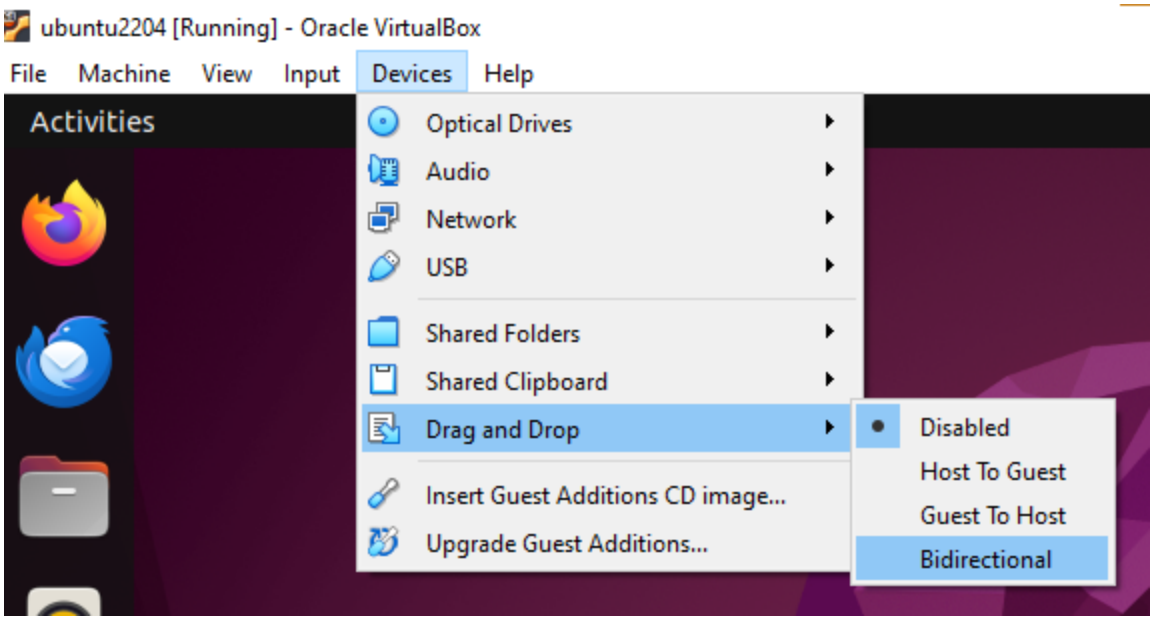
- Now prepare to restart the system to enable the change.
- Click 'Shutdown' on the menu and then the 'Restart' button.
- After rebooting Ubuntu, you will see the desktop resolution is much better.



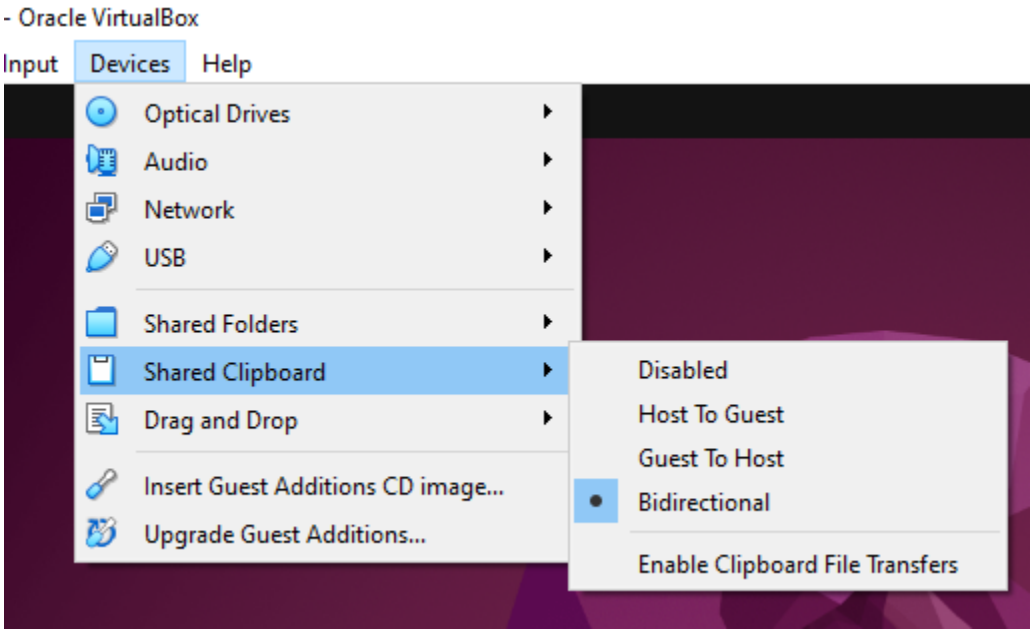
6.1 Enable Drag and Drop & Shared Clipboard

When enabled, you can drag and drop files from the host to the guest OS.

Goto Devices -> Drag and Drop -> Bidirectional



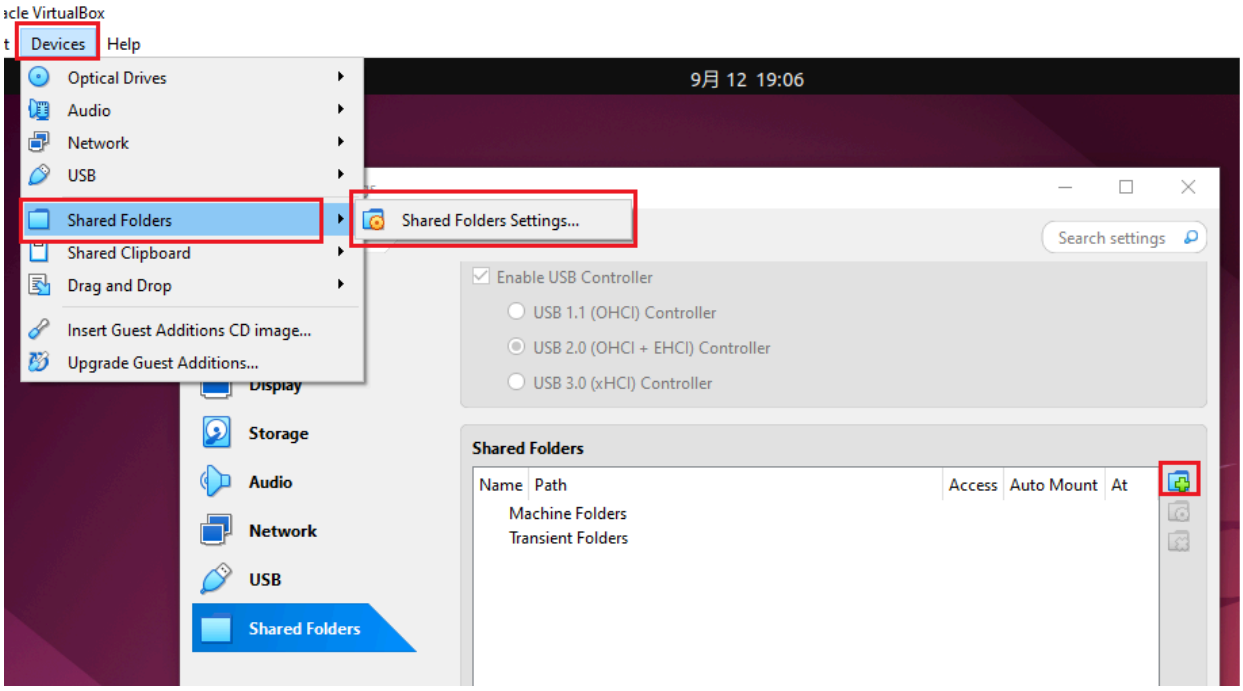
With the **Shared Clipboard** enable, you can copy an item in the host and paste in the guest, and vice-versa. **Goto Devices -> Shared Clipboard -> Bidirectional**

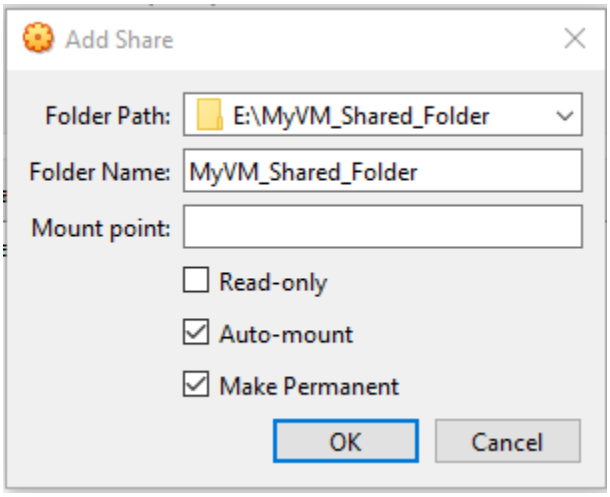


6.2 Enable Shared Folders

With the *shared folders* feature of Oracle VirtualBox, you can access files of your host system from within the guest system. Before you can enable shared folders on the host machine, make sure you have installed VirtualBox **Guest Additions** software on the guest machine.

- When the Ubuntu guest machine is ON, click on **Devices -> Shared Folders -> Shared folders settings…**
- Click the **“ + “** sign to add a shared folder
- Browse and select the shared folder on the host.Check **Auto-mount** and **Make Permanent** options and click OK button.
- Click OK button once more.





When the VM is OFF, you can set the shared folder by going to the **Settings -> Shared Folders** in the **VBox Manager** Window. This will open the **Shared folders settings…** as done before.

Now type 'terminal' in **Dash** to open a Terminal.

Type the following line in the Terminal to add a user to 'vboxsf' group. This step is necessary in order to use the VB's 'Shared Folder' feature.

>> *sudo adduser brb vboxsf*

Replace 'brb' with your account name in Ubuntu. When you are done, restart the Ubuntu guest machine and go to /media/ directory. From **Nautilus** (file manager in Ubuntu), click **Computer > File System > Media** folder and inside it you will see a folder beginning with **sf_** (the folder name is *sf_Downloads* in our example). Now you can transfer files between the Ubuntu guest machine and the Windows host machine in Nautilus.

Although the Shared Folder system in VirtualBox is a nice feature, using VirtualBox shared folder directly for fast data, annotation or output directory can significantly reduce the performance compared to a native (Ubuntu) system or VirtualBox native system.

Exercises

1. Try the Linux commands taught in the lecture
2. Study and get familiar with the following cheatsheets. Other cheatsheets also provided in the program github page.
    a. https://www.digitalocean.com/community/tutorials/linux-commands#the-diff-comm-and-cmp-commands
    b. https://www.dreamhost.com/blog/linux-commands/
    c. https://zerotomastery.io/cheatsheets/linux-commands-cheat-sheet/

3. Attemp to do the Linux command quiz 1:

    https://www.proprofs.com/quiz-school/story.php?title=linux-command-line-quiz-485

4. If you need more quiz, try this:

    https://www.proprofs.com/quiz-school/story.php?title=mtq1mtq2oqtx8h

5. Install build essential, create and run a simple hello world program in C and in Python

6. Create and use a MakeFile for the program

7. Create a simple shell script to add /usr/lib to the system path, create a file hello.txt and change its ownership.