

LabBox

Installation and use

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Introduction

LabBox is a [Virtual Machine](#) (VM) that contains the majority of software used in courses taught by Computer Science and Software Engineering. By using LabBox you can access this software on your own computer as if you were physically on campus using a computer in one of our labs. Any changes that the department pushes out to physical lab computers is also remotely applied to LabBox installations to keep them updated without the need to download it again.

Virtual Machines use some of the hardware resources of your computer by using the CPU, RAM, disk and other components allocated to it, and by sharing these hardware resources you can run more than one operating system on your computer simultaneously.

There are some software titles that are missing from LabBox. These are typically other virtual machines that are used in courses such as COSC364 and COSC264, plus Android Studio and the Android SDK.

Getting Your Computer Ready

ChromeBook-like devices aside, you'd be hard pressed to find a modern computer that could not support virtualisation. However, this may not be turned on in your system by default and activating involves diving into your computer's BIOS system.

The method of getting into the BIOS differs between computer manufacturers. A good web page that guides you through this if you run Windows can be found [here](#). It shows you how to tell if your hardware can do virtualisation and how to turn it on if it isn't already.

If you are running Linux try this from a terminal window:

```
lscpu | egrep "vmx|svm"
```

If you see any output from this command then virtualisation on your hardware is turned on already. If not, check out the link mentioned above for tips on how to get into your BIOS and turn it on.

To use LabBox comfortably it's recommended that your computer has at least 4GB of RAM and an Intel Core i5 CPU (or AMD equivalent) or better. You'll also be needing a bit of free disc space as well, and the amount needed will depend if you pick Option 1 or 2 which is described later in this document. Having said this, 70GB might be a good ball park figure.

Installing VirtualBox

LabBox runs on top of Oracle's VirtualBox [hypervisor](#) software which needs to be installed first. The latest version of this can be downloaded from the platform packages section of this webpage: <https://www.virtualbox.org/wiki/Downloads>. There are packages for Linux, Mac and Windows.

Once you have installed VirtualBox, grab the VirtualBox Extension Pack which is also available on the page above. If you have already installed VirtualBox your web browser should offer you the option of opening the Extension Pack with VirtualBox. If not, just save the file to a convenient place and double-click on it after the download has finished to install it into VirtualBox.

VirtualBox 7.0.10 platform packages

- [Windows hosts](#)
- [macOS / Intel hosts](#)
- [Linux distributions](#)
- [Solaris hosts](#)
- [Solaris 11 IPS hosts](#)

The binaries are released under the terms of the GPL version 3.

See the [changelog](#) for what has changed.

You might want to compare the checksums to verify the integrity of the downloads. *checksums should be favored as the MD5 algorithm must be treated as deprecated.*

- [SHA256 checksums, MD5 checksums](#)

Note: After upgrading VirtualBox it is recommended to upgrade the guest OS.

VirtualBox 7.0.10 Oracle VM VirtualBox Extension Pack

- [All supported platforms](#)

Support VirtualBox RDP, disk encryption, NVMe and PXE boot for Intel

A section of the VirtualBox download page, showing the packages for different operating systems and the Extension Pack

Downloading LabBox

Once VirtualBox and the Extension Pack have been installed you're ready to download LabBox, and there's two options for this. It is suggested you read through each of the following to help you decide which is best for you.

Option 1

This features an ISO file and a small OVA file. These two files are a smaller initial download and you'll need less disc space up front to get going compared to Option 2. The course software installs later on (made up of downloads totalling almost 9GB) and there's also a few more steps to complete which includes installing LabBox. Don't worry though as the [next section](#) of this document walks you through the process.

[Linux Mint install ISO](#) (2.7GB)

[LabBox small OVA](#) (96kB)

Option 2

This option requires the download of an OVA image file that is much larger than Option 1 but it is quicker to set up once you have it because all the software is pre-installed. If you feel your Internet connection is fast enough and reliable then Option 2 could be a good choice.

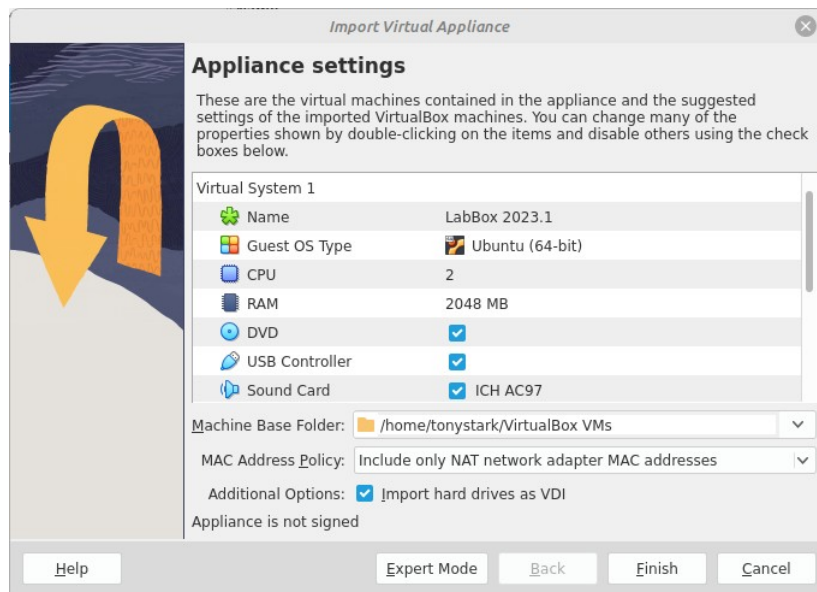
[LabBox large OVA](#) (42GB)

In addition to this OVA file you'll need another 65GB free disc space minimum to import the VM. Once that's done though you can delete the OVA file afterwards.

Installation involves importing the image file and then running it. This is outlined [here](#).

Installing LabBox with Option 1

Once you have downloaded the ISO file and the small OVA file, double-clicking on the OVA file should start VirtualBox with an import option. You should see something like this:

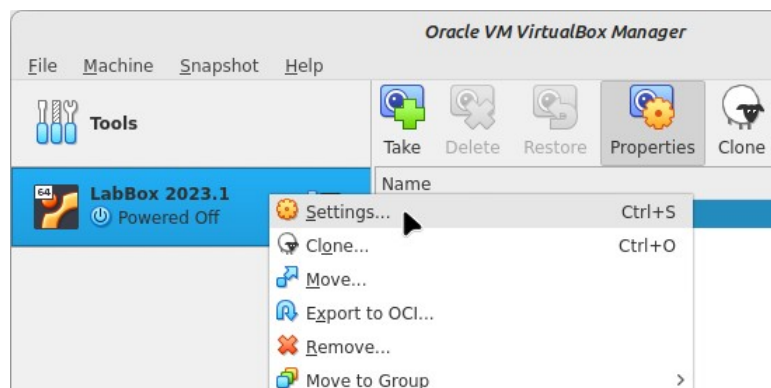


VirtualBox import window


There's nothing to change in this window so go ahead and click on *Finish*. Because the file is small the import will be quick.

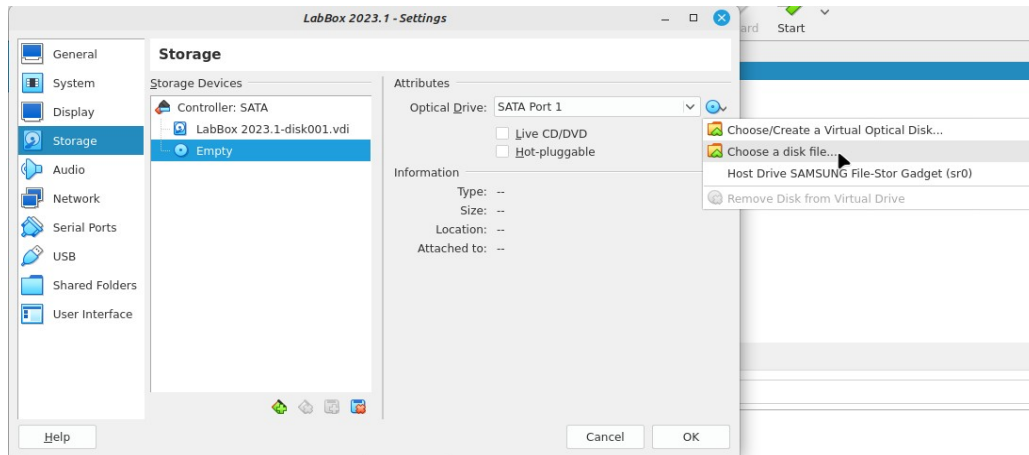
Should double-clicking on the OVA not launch an import option at all, start VirtualBox and go to the File → Import Appliance... menu. A window titled *Import Virtual Appliance* should open allowing you to tell VirtualBox where to import the OVA file from. Click on the 📁 icon to navigate to where you downloaded the file. After you've selected the OVA file click *Next* and you should see the import window as shown above.

Next we need to associate the LabBox ISO file with the virtual machine that was just imported. To do that you need to get to the *Settings* and there's a few ways to do it. The quickest is the keyboard shortcut Control-S (⌘S on a Mac), or you can right-click on the LabBox 2023.1 entry in the Oracle VM VirtualBox Manager window and choose *Settings* from the menu, or finally, click on the *Settings* gear icon. Something like this:



Changing the settings for LabBox by right-clicking on the VM name

When the Settings window has opened, click on the *Storage* category on the left and all the storage devices will be shown. You should see a SATA Controller with the LabBox 2023 virtual disc below it. Below this you'll see the virtual CD drive is shown as Empty. Click on the virtual CD drive and then the  icon towards the right edge of the window. On the menu that's displayed pick *Choose a disc file...* and navigate to where you saved the linuxmint-21.1.0-2023.08.04-cinnamon-64bit.iso file. We'll use this ISO file to install LabBox.



Choosing an ISO file for LabBox

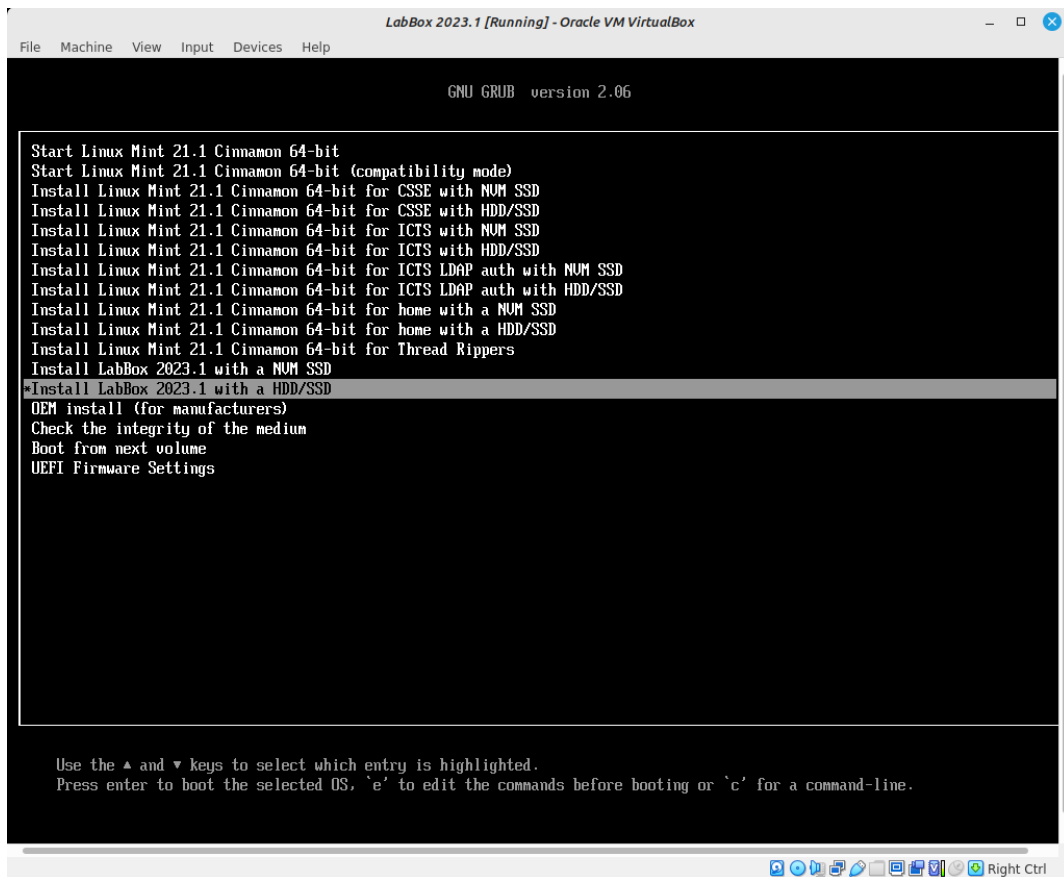
When you have correctly linked the ISO file to the LabBox virtual machine you'll see the virtual CD change from Empty to the name of the ISO file.

Click OK to close the *Settings* window.

Doing the Installation


Now we're ready to start the VM for the first time.

Click *Start* next to the big green arrow at the top of the VirtualBox Manager window. A new window will open momentarily showing the Oracle VirtualBox splash screen. A few seconds later you'll see a menu like the one over the page:

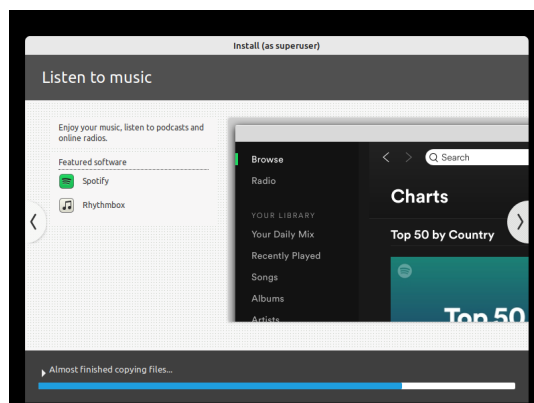


Installing LabBox from the Linux Mint boot menu

There may be a 10 second countdown timer that starts as soon as the menu is displayed. If there is and before it reaches zero, use the down arrow key on your keyboard to select *Install LabBox 2023.1 with a HDD/SSD* as shown above, and then press Enter. This will begin the installation.

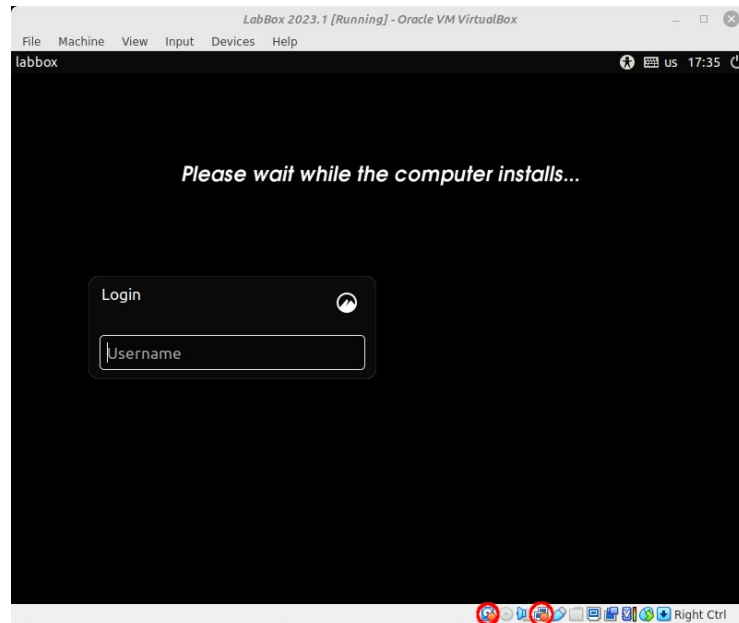
If you're new to using VirtualBox you may get one or more annoying notifications at the top of the VM window (you can see one in the picture above). To the right of each notification you'll see the  icons. Click on the speech bubble for each one and it'll be gone for good.

Some seconds later after you made that menu choice, you'll notice a bunch of text scroll past before a graphical slideshow begins with a blue progress bar underneath. Much like this one:



Installation slideshow

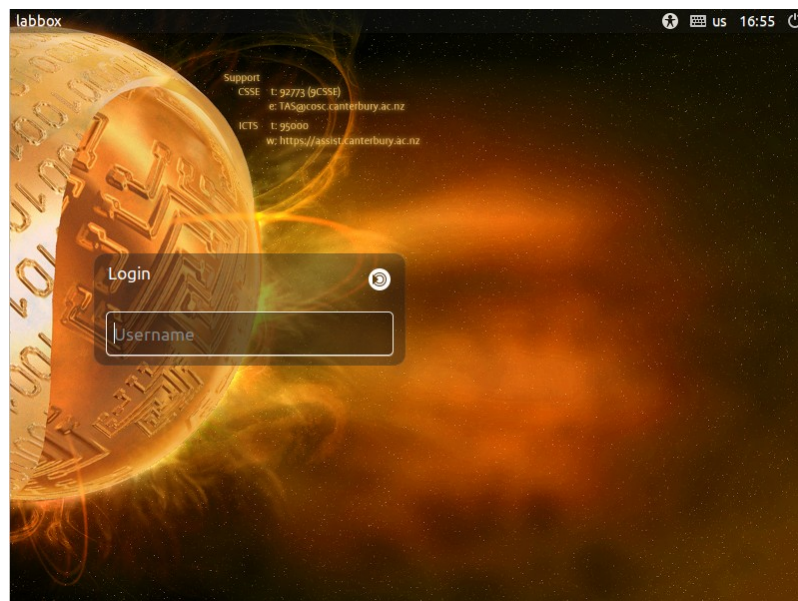
This process will take a few minutes to complete and it will reboot when completed for the post installation process to begin. After the reboot occurs you'll see this:



LabBox post installation

This post installation step will also take some minutes to complete as it downloads resources from the internet so it would be a good idea to do what the message says (i.e wait!). You can be sure things are happening in the background as one or both of the icons in the bottom of the window (circled in red), will show green dots flickering on and off. From left to right these indicate virtual hard disc and network activity respectively.

When that's finished another reboot will occur and you'll be presented with the login screen:



LabBox login display

Now you can login for the first time. The username and password to login with are *lab* and *labbox* respectively. Then you'll be presented with a desktop similar to what you'd see in the computer labs, albeit the window will be small, but we'll address that soon enough.

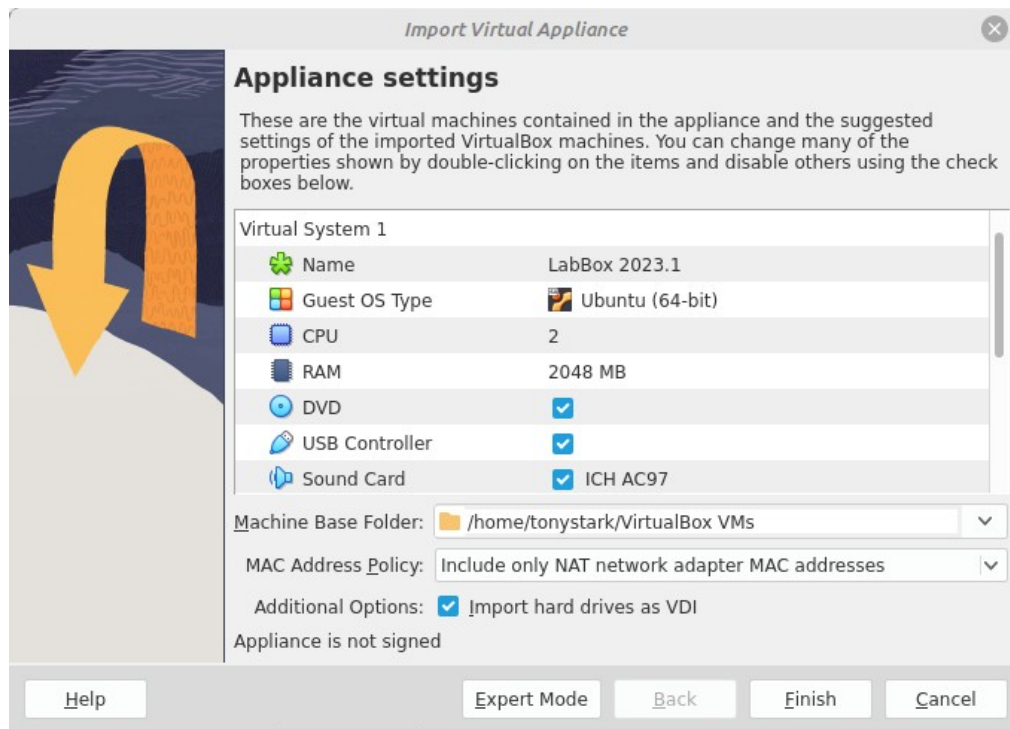
LabBox has a background process that runs approximately once every hour to check for and execute any changes. These changes perform tasks such as installing new software and configuration tweaks that are managed by the Department of Computer Science and Software Engineering. Because you have just installed LabBox this background process has not yet had a chance to run and so there will be a lot of software missing you'd be expecting to find. How do you tell when it's running and when it's finished? Read the section on [Remote Changes](#) now.

The small window that LabBox is running in can be remedied by installing the Guest Additions. Not only do these give you the ability to resize the LabBox window to match your monitor, but it will provide the ability to drag and drop files into the LabBox window as well as accessing files on your local computer. Follow the instructions [here](#) on how to install the Guest Additions.

While this completes the installation of LabBox there are some other things you might like to consider in the section [Going Further](#).


Installing LabBox with Option 2

Once you have downloaded the LabBox.ova image file, double-clicking on it should start VirtualBox with an import option. You should see something like this:



VirtualBox import window

There's nothing to change in this window so go ahead and click on *Import*. Because the file is large the import will take a little time.

Should double-clicking on the OVA not launch an import option at all, start VirtualBox and go to the File → Import Appliance... menu. A window titled *Import Virtual Appliance* should open allowing you to tell VirtualBox where to import the OVA file from. Click on the  icon to navigate to where you downloaded the file. After you've selected the OVA file click *Next* and you should see the import window as shown above.

When the import has completed LabBox is ready to use. You may launch it by clicking *Start* next to the big green arrow at the top of the VirtualBox Manager window. When the login greeter appears you can login with *lab* and *labbox* for the username and password respectively.

This edition of LabBox has the Guest Additions built-in for VirtualBox 7.0.10 so you will not need to install these yourself. If you have installed a different version of VirtualBox however you'll need to fetch this from Oracle's website as mentioned earlier in this document and follow [these instructions](#).

If you want to free up a some disc space you can delete the OVA that you imported.

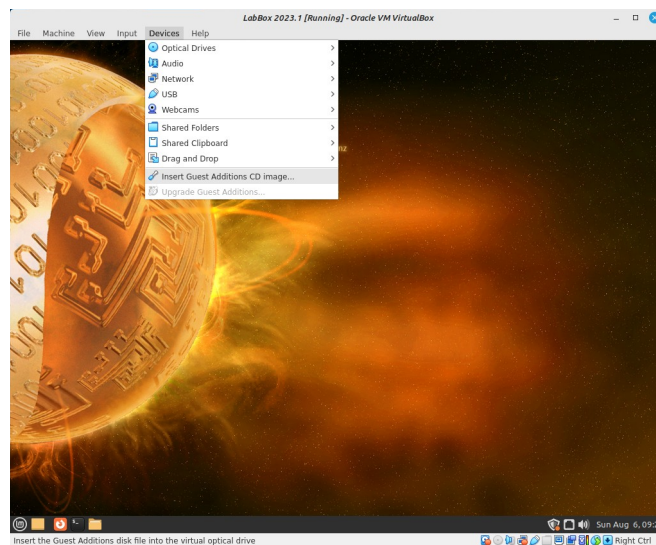
While this completes the installation of LabBox there are some other things you might like to consider in the section [Going Further](#).

Installing Guest Additions

To improve interaction with the host operating system, virtual machines require additional software to be installed into them. For VirtualBox these are called Guest Additions, and when installed they allow you to cut'n'paste text between LabBox and your normal operating system, dynamically resize the LabBox window to change the screen resolution and make the files that exist on your normal operating system available from within LabBox. They're obviously quite handy to have.

The catch however is that you normally need to have the same matching version of the Guest Additions as you do VirtualBox. This means that if you happened to be using VirtualBox version 6.1.6 then you need the Guest Additions of the same version number.

Go to the Devices → Insert Guest Additions CD image... from the top of the LabBox window as seen here:



Starting the Guest Additions install process

You may be prompted for the location of the Guest Additions ISO file that you downloaded earlier. But if VirtualBox already knows where it is the CD image will automount inside LabBox and a CD icon will show on the Desktop. If an autorun prompt appears then follow these, and shortly a terminal window will open where the software will install. When asked for a password, use *labbox*. If you're not presented with an autorun prompt you can start the process manually by double clicking on the CD icon and in the window that appears, click on *Open Autorun Prompt*.


When it's finished and the terminal window has closed, open a new terminal and type in the following command to add the lab user to the vboxsf group, using *labbox* again for the password:

```
lab@labbox:~$ sudo usermod -a -G vboxsf lab
```

With that done, right click on the CD icon on the LabBox desktop and choose Eject from the menu. Once the virtual CD has been removed you may reboot LabBox and enjoyed improved screen resolution and more!

Remote Changes

LabBox has a background process called Remote Changes that runs about once an hour which installs any outstanding additional course related software and configuration changes.

You can tell when this process is running by executing the following command in a terminal window (available from the the system Menu 

```
ps -ef | grep [r]emote
```

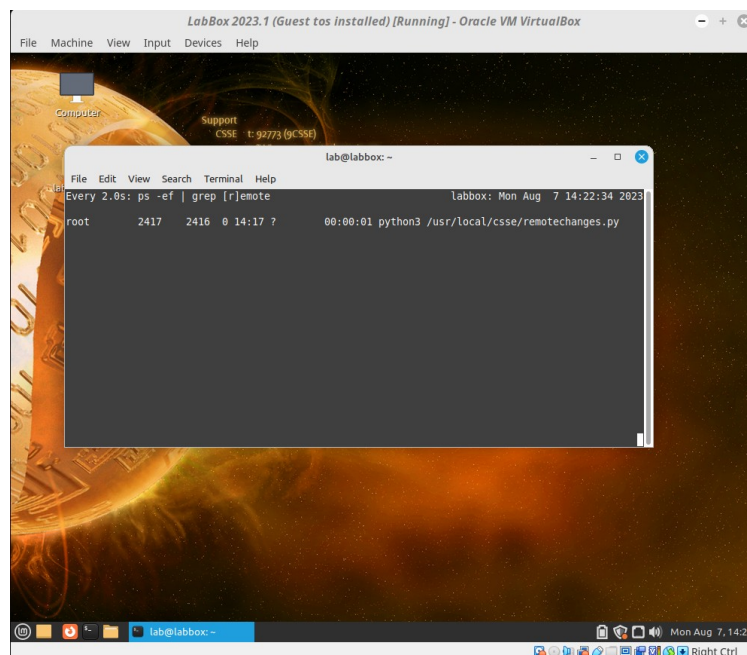
If it happens to be running right now you'll get output similar to the following:

```
root 17237 17236 1 09:17 ? 00:00:14 python3 /usr/local/csse/remotechanges.py
```

You can watch for this process to begin running without having to manually and repeatedly run the above `ps -ef` command. Usefully, the command for this is called *watch*. To do that run this command in the terminal:

```
watch "ps -ef | grep [r]emote"
```

Your terminal window will now show the following output when the process we're looking for is running:



LabBox running the background update process while being monitored by 'watch'

Make sure you have the terminal window stretched wide enough to be sure the watch command output will display. Pressing Control-C at any time will stop the *watch* command and take you back to a command prompt.

If this is the first time that Remote Changes has run and you installed LabBox using Option 1 you can expect it to run for an hour or so, depending on how good your Internet connection is. There's a bunch of software to install! When it's finished you'll see the output from the *watch* command change and the line that shows the python3 process will disappear.

Going Further

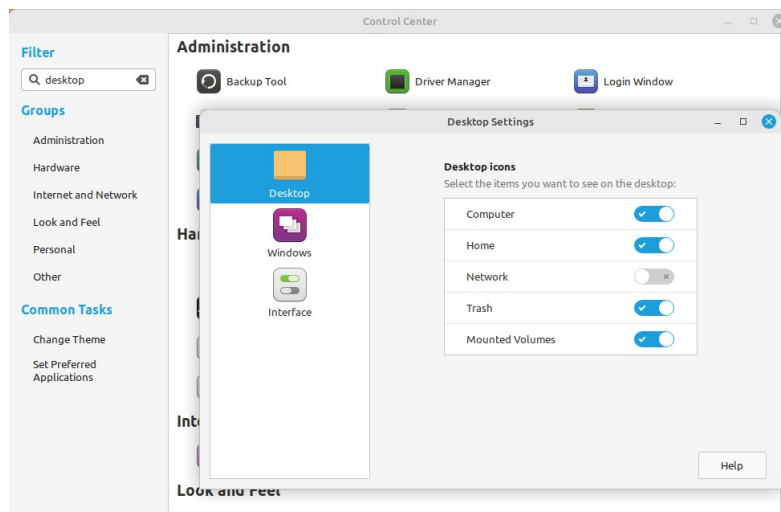
Improving Performance

LabBox is configured to use 2GB of RAM and 2 CPUs by default. You can increase performance by increasing the RAM and if you have it spare, the number of CPUs too. Go to the *Settings* of LabBox and go to the *System* tab which has RAM and CPU under the *Motherboard* and *Processor* sub-tabs respectively.

Icons On The Desktop

If you have installed LabBox using Option 1, you'll notice after logging in there's no icons on the Desktop at all. You can have these show up quite easily. From the Menu, search for *Desktop Settings* or find this option in the *Control Center*.

In the window that opens, make sure the Desktop side tab is selected. Then to the right of this you should be able to turn on what you want. Below you can see that Computer, Home, Trash and Mounted Volumes have been turned on.



Making familiar icons appear on the Desktop

Accessing University Files

You may directly connect to your home directory from within LabBox as if you were on campus and interact with your files. Follow these instructions from within a LabBox terminal window, substituting abc123 with your actual student usercode:

```
[lab@labbox ~]$ mkdir /home/lab/unifiles
[lab@labbox ~]$ sshfs abc123@linux.cosc.canterbury.ac.nz: /home/lab/unifiles
The authenticity of host 'linux.cosc.canterbury.ac.nz (132.181.16.30)' can't be
established.
ECDSA key fingerprint is SHAS256:p0tp90pA0IW2bTuTzFDIiFVETIpeQlluL.
Are you sure you want to continue connecting (yes/no)? Yes
abc123@linux.cosc.canterbury.ac.nz's password:
```

Assuming you got your password correct you should be returned to a command prompt and your files will be available in the directory named *unifiles*.

Note that this mounting is only temporary. Rebooting or shutting down LabBox will cause the connection to be broken and you'll need to run the sshfs command above again.

If you want to manually disconnect from your university files, run this in a terminal window:

```
[lab@labbox ~]$ fusermount -u /home/lab/unifiles
```

Installing NVIDIA driver and CUDA

By default the NVIDIA driver and CUDA are not installed in LabBox as most people will not need it. But if you do simply run the following from a terminal window:


```
[lab@labbox ~]$ sudo install_cuda
This program will download and install the NVIDIA driver and CUDA 11.7
It will install even if there's no NVIDIA video card
Do you wish to proceed? (Y/N):
```

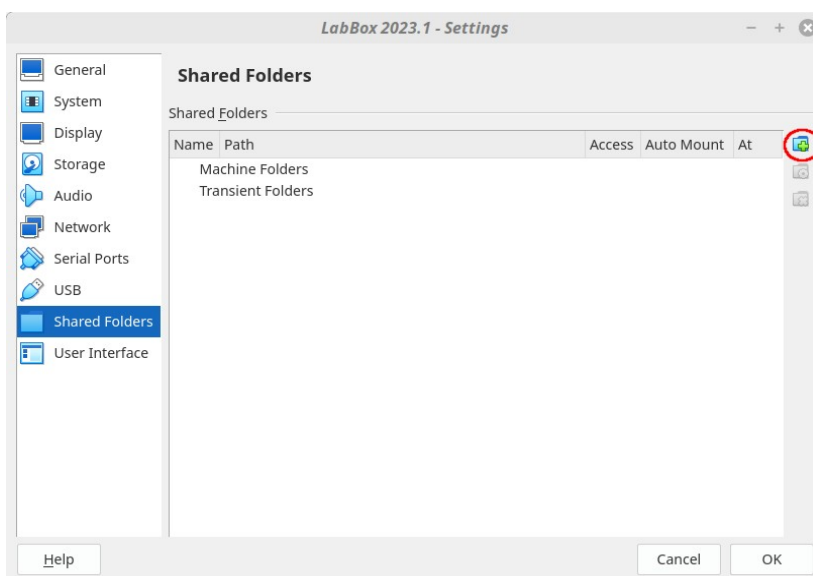
After answering 'Y', this will kick off a process that does what it says on the tin – download the NVIDIA driver with CUDA 11.7 and install it.

Snapshots

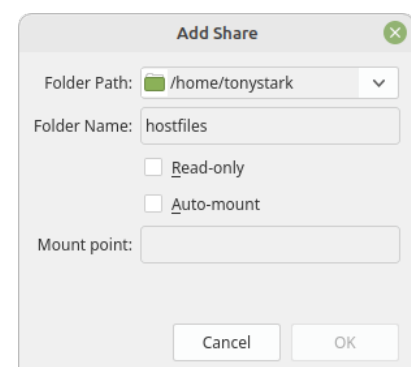
One of the great benefits of virtual machines is the ability to instantly save its state, whether its currently running or not. This big time saver is great for when you are considering making risky changes inside a virtual machine like LabBox and you'd like a way to quickly revert to a known and working state. Have a read of Oracle's [documentation](#) on snapshots for more information.

Transferring Files Between Operating Systems

If the [Guest Additions](#) are installed you can setup VirtualBox and LabBox so that files from your host operating system can be accessed from within LabBox. Firstly, add a new shared folder by going to the Shared Folders section of the LabBox settings and click on the  as shown below in the red circle in the left image:



Adding a new share



Details of the share

This will open a new window (shown above, right), where you can fill in the details of the share. *Folder Path* is the path on your host operating system that you want to make available to LabBox

(e.g C:\Users\TStark and *Folder Name* is the share name that LabBox will see. For this example use *hostfiles* for Folder Name as it's important for the next step. Once you've entered these two details click OK.

In a LabBox terminal window enter these two commands:

```
lab@labbox:~$ mkdir /home/lab/myfiles
lab@labbox:~$ sudo mount -t vboxsf -o uid=$UID,gid=$(id -g) hostfiles
/home/lab/myfiles
```

The *mkdir* command only needs to be done if you're doing this for the first time. The *sudo* command does the mounting of your host operating system files and will make them available in the directory *myfiles* from within LabBox.

You may disconnect from your host operating system with the following:

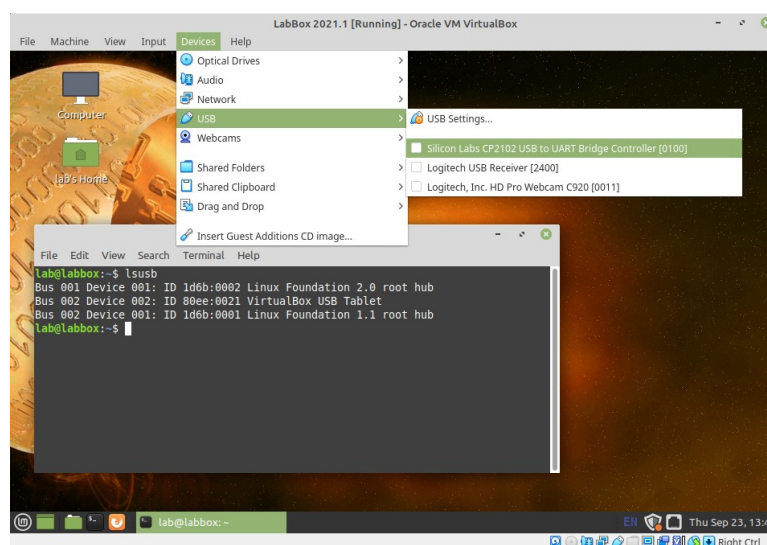
```
lab@labbox:~$ sudo umount /home/lab/myfiles
```

USB Passthrough

VirtualBox allows USB devices which are plugged into your host computer to be used from within LabBox. This includes various devices such as USB hard drives, Arduino style micro controllers and cameras.

To ensure you have the best performance, make sure you have already installed the Extension Pack as mentioned earlier in this document. You should be aware that devices cannot typically be used by your host computer and LabBox simultaneously. With that in mind, if you have a USB hard drive currently used on your host computer and then give control of it to LabBox, it will be disconnected from the host without a proper shutdown. If you have files open on the hard drive it may cause data loss. So make you have closed all open files!

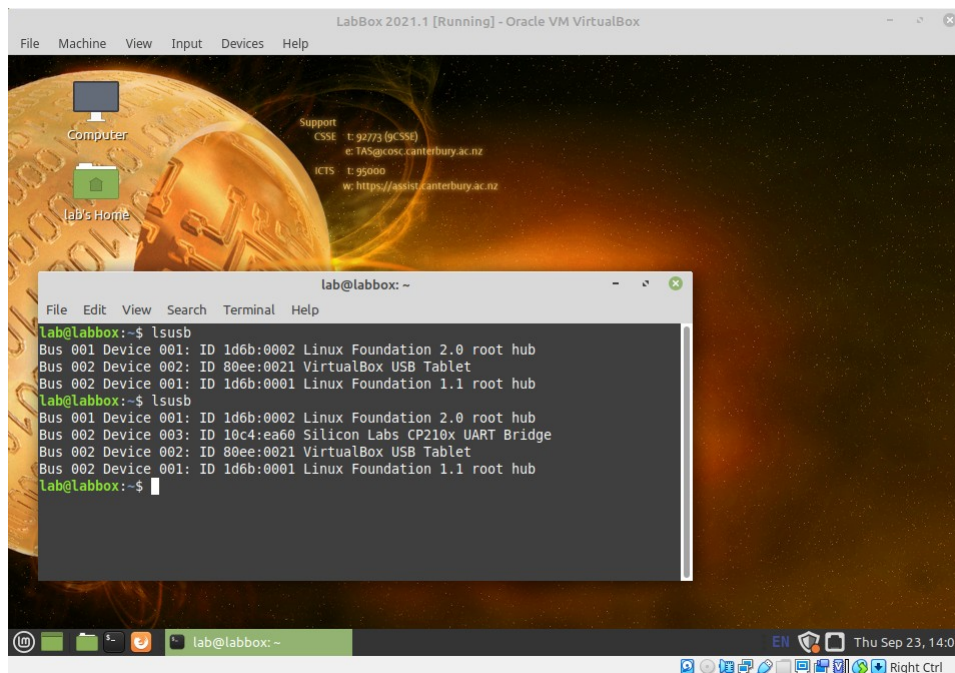
For this example we'll pass through an ESP32 microcontroller so that LabBox has control of it. It's quite straight forward to do, simply go to the *Devices* → *USB* menu and view the USB devices attached.



Viewing USB devices available to LabBox

In the image above you can see three USB devices listed in the VirtualBox *Devices* → *USB* menu. The first device is a Silicon Labs CP2102 USB to UART Bridge Controller. In the case of our ESP32, this is the name for the onboard chip that bridges a connection between the ESP32 and the USB interface.

You'll note in the terminal window image above the three USB devices LabBox can currently see. Now, in the VirtualBox *Devices* → *USB* menu click on the Silicon Labs CP2102 item. This will now remove the ESP32 from the host computer and make it available to LabBox. You can confirm this has happened because you'll see the Silicon Labs CP2102 device now has a tick beside it in the menu, and if you run the *lsusb* command from a terminal window it will appear as a new device for LabBox to use. You can see this below:



Silicon Labs CP2102 USB device now visible in LabBox

When you are ready for the USB device to be given back to the host computer, simply select it again from the *Devices* → *USB* menu. Powering off LabBox will also return control back to the host operating system.