

Programming for Robotics - ROS

Course Preparation (VirtualBox)

In this course, we will work with **Ubuntu 20.04** and **ROS Noetic Ninjemys**. We highly recommend you to **use a virtual machine and the provided image** that already contains a preinstalled environment with the following software:

- **Ubuntu 20.04:** Linux-based operating system
- **Terminator:** Alternative to the terminal for easier management of windows
- **Oh-My-Bash:** Configuration over bash for better terminal experience
- **Git:** Version control system
- **VS Code:** Interactive Development Environment (IDE) for programming
- **ROS Noetic Ninjemys:** ROS1 version
- **Catkin Command Line Tools:** Utilities for cleaner build with ROS
- **ROS package dependencies:**
 - twist_mux, hector_gazebo_plugins, velodyne_description, pointcloud_to_laserscan

Install Virtual Machine

To run the provided image, you need to install VirtualBox (<https://www.virtualbox.org/>) (Windows, Linux, macOS with Intel).

We tested everything on VirtualBox 6.1.XX.

- https://www.virtualbox.org/wiki/Download_Old_Builds_6_1

However, it should also work on VirtualBox 7.0.6.

- <https://www.virtualbox.org/wiki/Downloads>

The virtual machine is free of charge and you do not have to go through ETH Zurich's IT Shop.

Please follow the given instructions to download and install the software from VirtualBox. We recommend you have at least 20GB of available disk space on your computer to run the virtual machine.

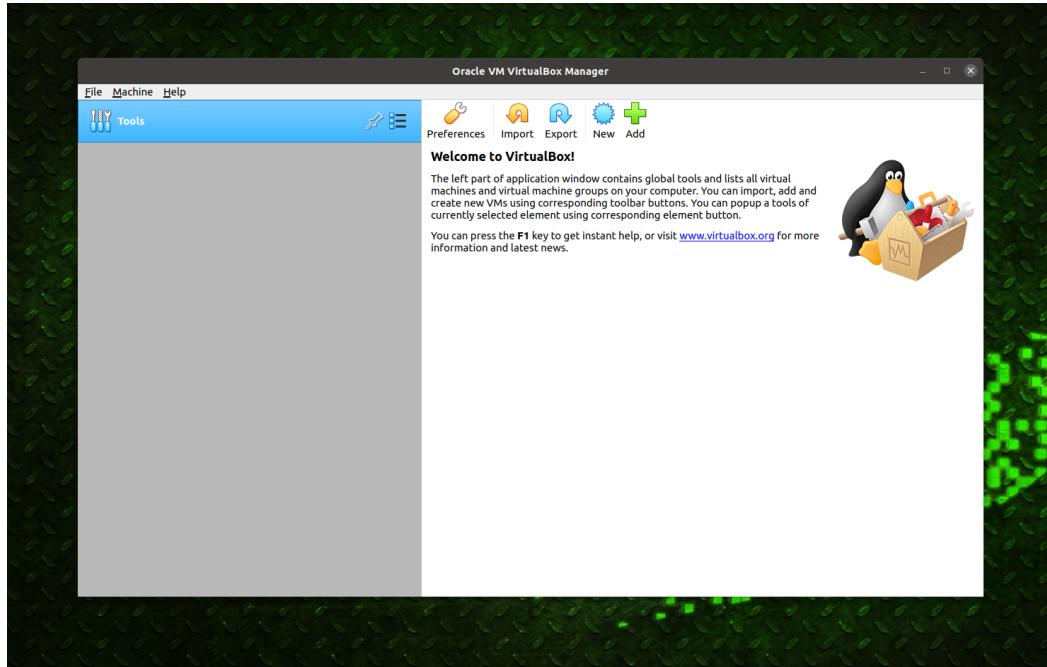
Download Image

The virtual machine image is located in this [folder](#) on Gdrive

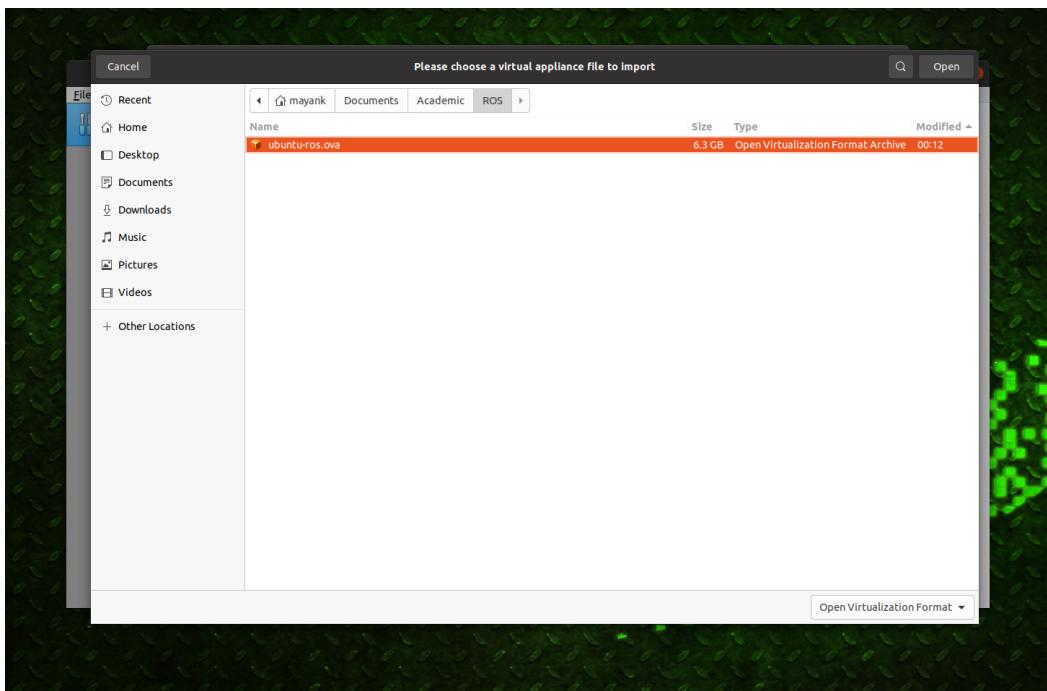
In total, there is one file that you have to download (.ova).

Start-Up Virtual Machine

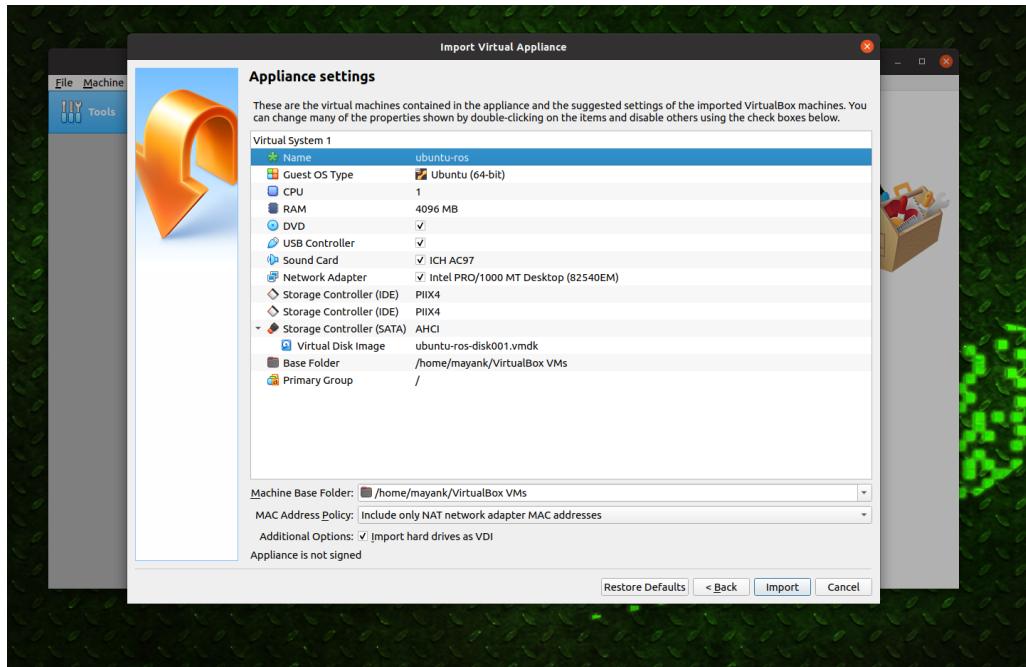
- Open VirtualBox



- Select Import appliance (or, File > Import Appliance)
- Open file "ubuntu-ros.ova" (file that you downloaded from Gdrive)



- A prompt will appear where you can edit virtual machine settings (you can also do this later). By default, the virtual machine will reserve 4 GB of your RAM and use 4 cores of your CPU.
 - Based on your system hardware, you can increase the allocated RAM and CPU cores. Please check the “Tuning the Virtual Machine” section in this document for more details.



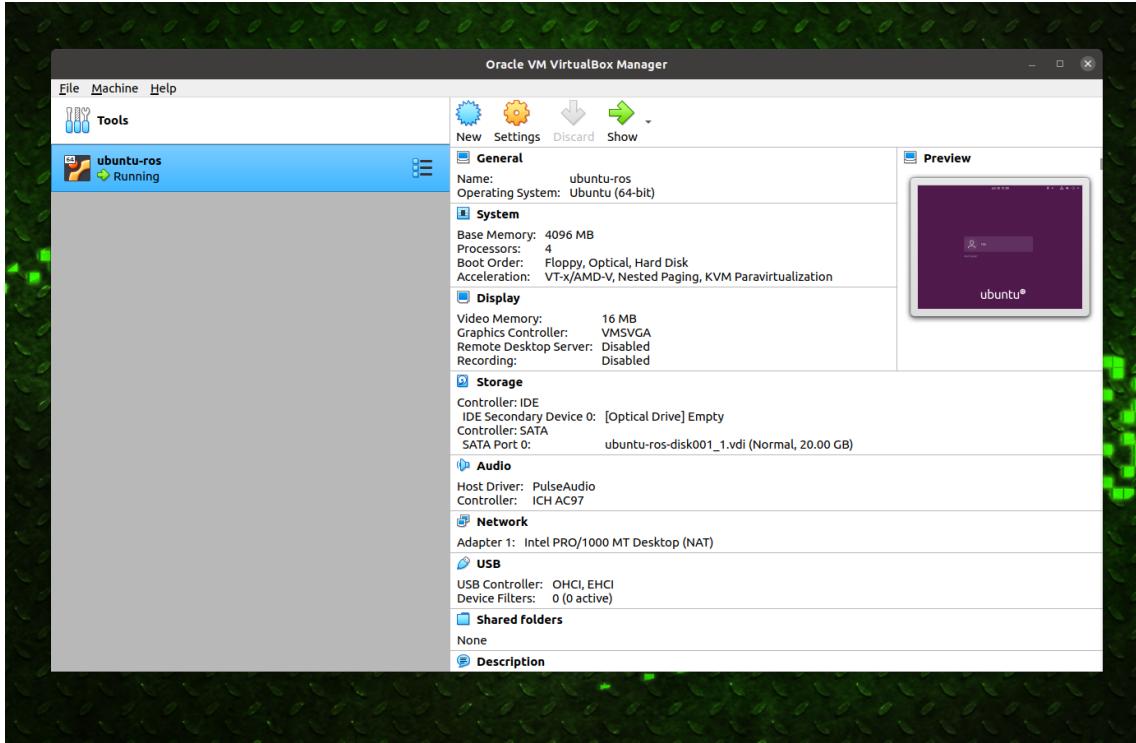
- Start the VM with a green arrow button

Important (Linux users only)! If it is the first time you are using a virtual machine on your system, there might be an issue that some kernel headers are missing. In that case, you should run the configuration script as root which should resolve the issue.

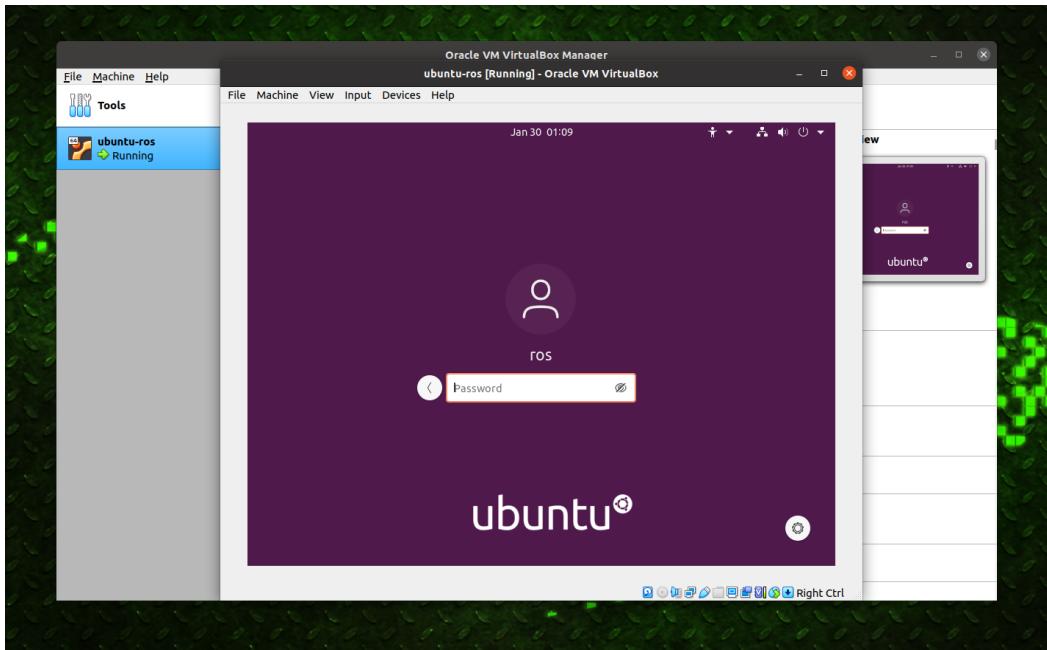
You can run the script with:

```
sudo /sbin/vboxconfig
```

If that does not solve the problem for you, you can try to follow the solution from this [post](#)

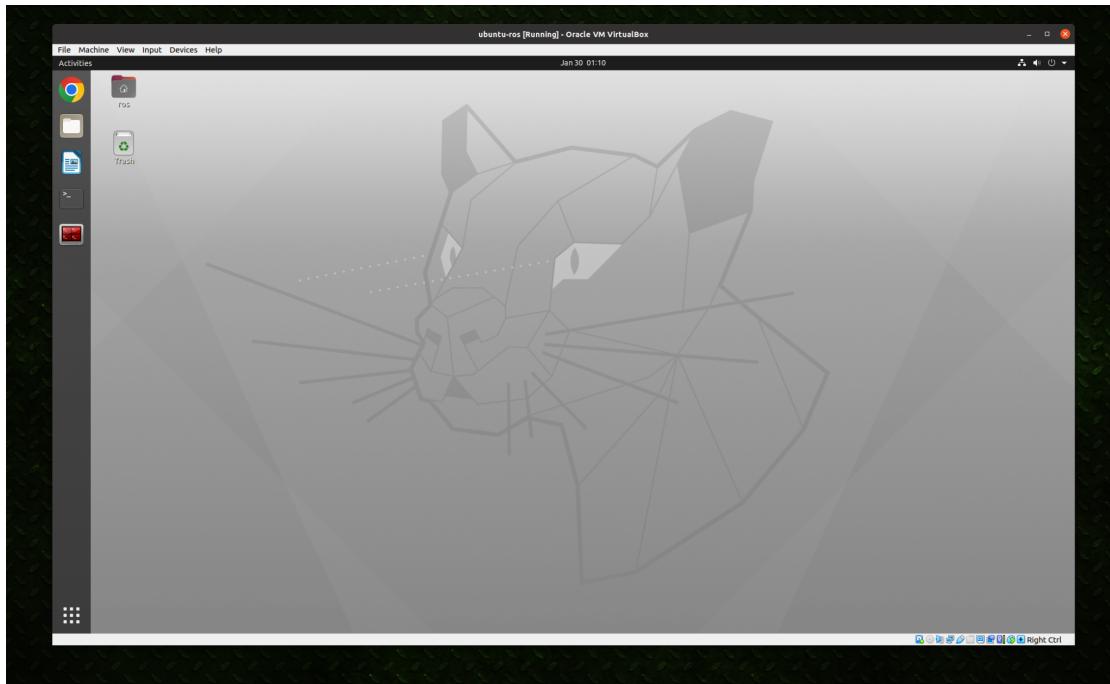


- VM should ask you for a username and password (both are “ros”)



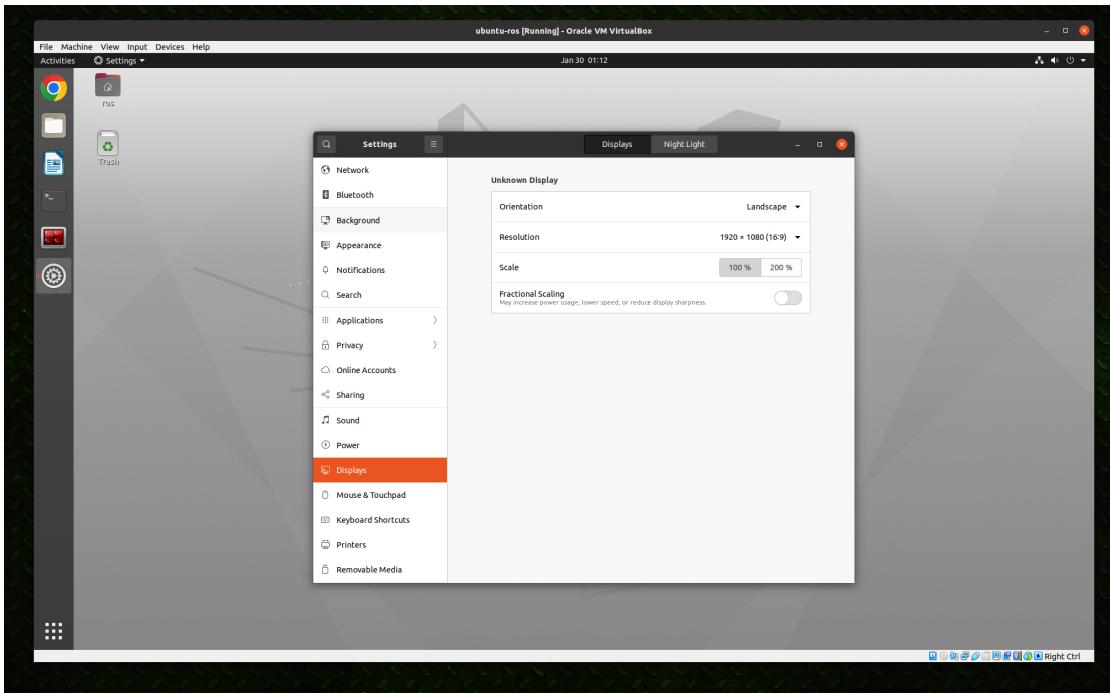
NOTE: The (sudo/root) password for the VMs user 'ros' is: **ros**

- The VM should boot to Ubuntu's Desktop



- You can alter the resolution of the virtual machine's screen through display settings to match your monitor

Go to [“Display” settings on the VM](#). Then change the “Resolution” to your needs.

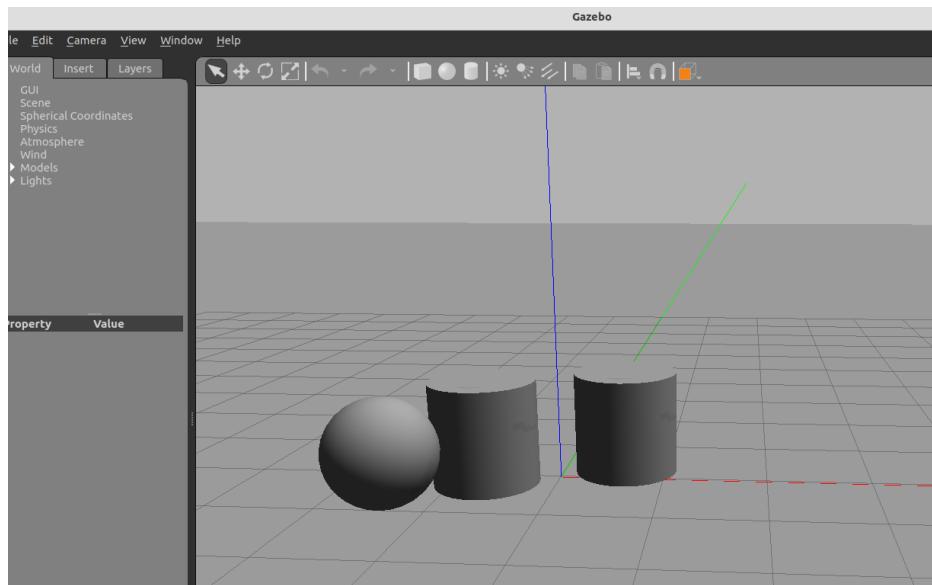


Test the Virtual Machine

You will need to work with the Gazebo simulation from day one of the ROS Course. Therefore, please make sure in advance that everything is running on your virtual machine.

To check that your virtual machine is running as expected start the Gazebo simulation as explained below:

- Open a terminal (Terminator) by clicking on the terminal icon on the left side (alternatively press Ctrl+Alt+T). Type in the terminal `gazebo` and press Enter to run Gazebo.
- A window should appear showing an empty simulation environment, feel free to play around by adding/moving/deleting objects.



- Close the simulation by pressing Ctrl+C in the terminal you used to launch gazebo or click on the close icon in the right upper corner.
- Power Off Ubuntu to stop the session in the virtual machine.

NOTE: The VM might benefit from a performance boost by tuning the machine configuration to your available hardware. See the next section for more.

Tuning the Virtual Machine for performance

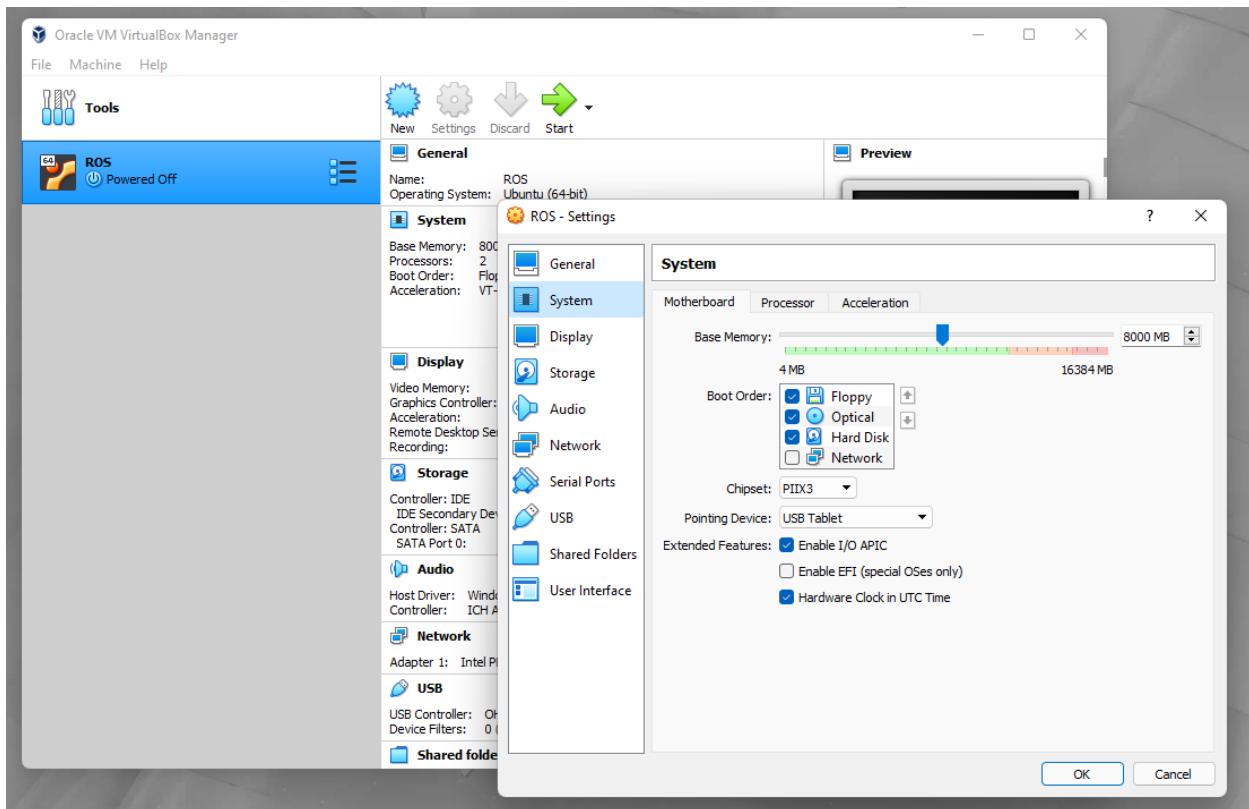
Maximize VMs memory and CPU

Make sure that the VM is turned off.

Go *Settings> System > Motherboard*

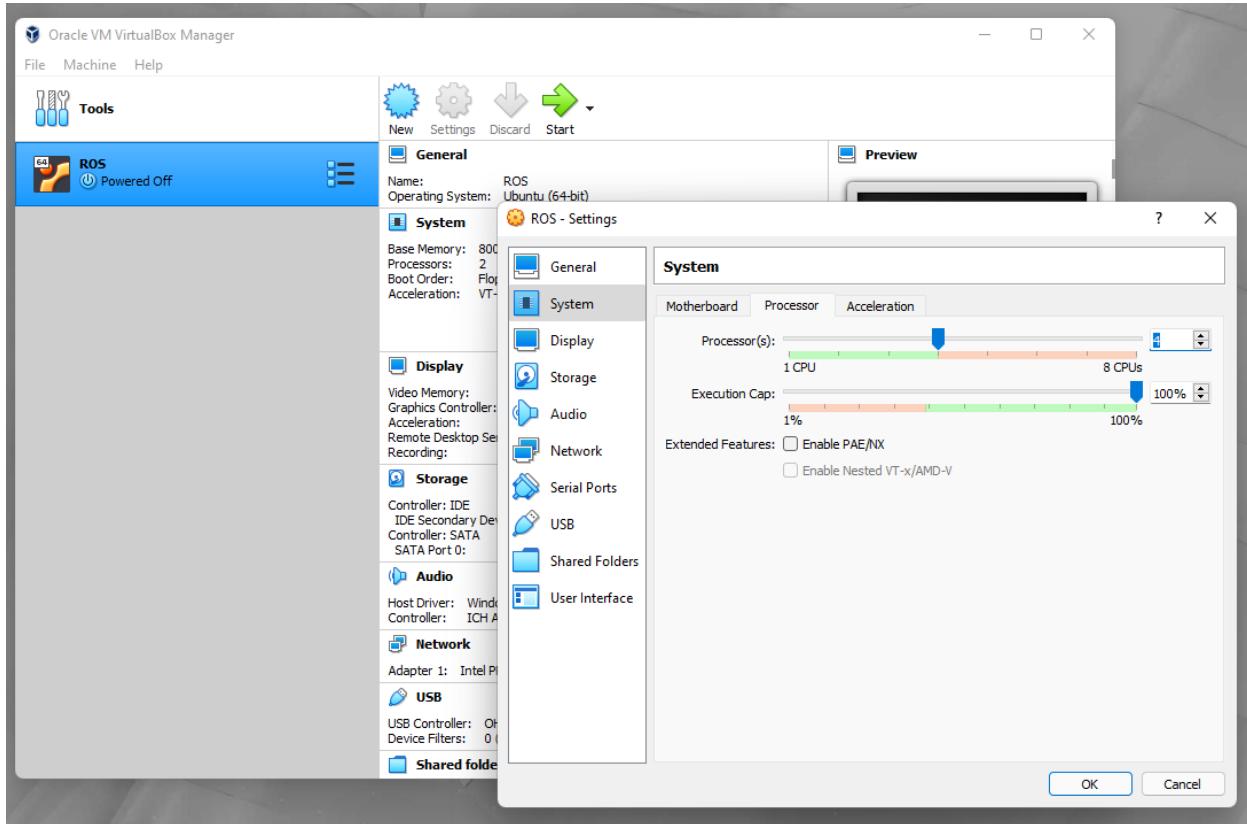
Set the Host RAM for all virtual machines to about 2/3rd of your available RAM, ideally 5GB, up to 12GB.

Select 'Fit all virtual machine memory into reserved host RAM'



Assign CPU cores

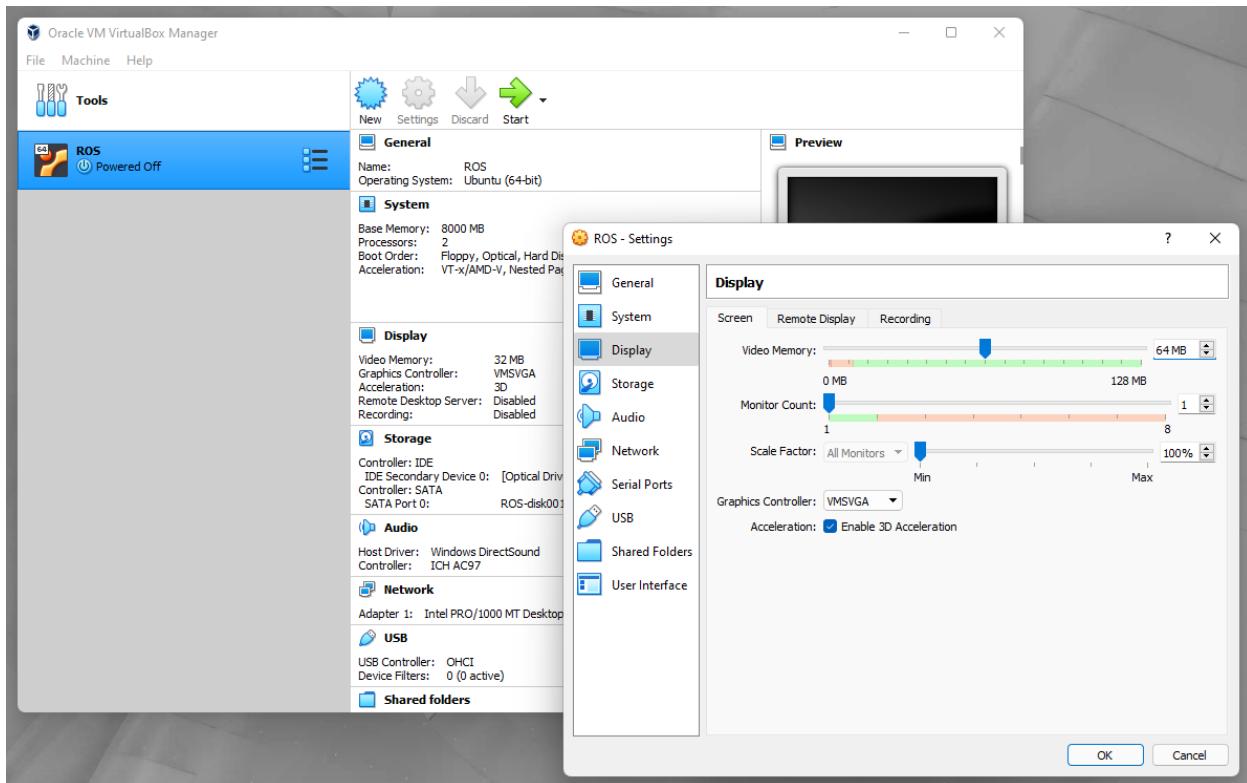
On tab 'Processor', set the number of assigned processors to about 2/3rd of your host's core count. Ideally 4 or more.



Graphics acceleration is important to achieve decent graphics performance.

On the tab 'Display', enable 'Accelerate 3D graphics'.

You can increase the video memory to about $\frac{1}{2}$ or $\frac{2}{3}$ of the maximum available amount.



Save the settings.

Share folders

Optionally you can set up a shared folder between the VM and the native host (see instructions here: https://linuxhint.com/folder_sharing_virtualbox/)