

# Ubuntu 20.04 & ROS Noetic Installation Guide

All projects in COMPSCI-603 must be programmed using Python 3 and *Robot Operating System (ROS) Noetic* in *Ubuntu 20.04 LTS Focal Fossa*. Physical installation of Ubuntu 20.04 and ROS Noetic is recommended, but using a virtual machine can also be an option. This document provides a general guide to install Ubuntu 20.04 LTS and ROS Noetic.

## 1 Installing Ubuntu 20.04 LTS

### 1.1 Physical Installation

For physical installation of Ubuntu 20.04 LTS, please follow all steps in the guide:

- <https://ubuntu.com/tutorials/install-ubuntu-desktop>

Make sure to download and install Ubuntu 20.04 LTS (but not 22.04): “ubuntu-20.04.5-desktop-amd64.iso”, which can be downloaded from:

- <https://releases.ubuntu.com/focal>

### 1.2 Installation in Virtual Machines

For installation on virtual machines, when the host operating system (OS) is Windows or MacOS running on X-86 Intel processors, VirtualBox 7.0 can be used and installed by following the guide:

- <https://ubuntu.com/tutorials/how-to-run-ubuntu-desktop-on-a-virtual-machine-using-virtualbox>

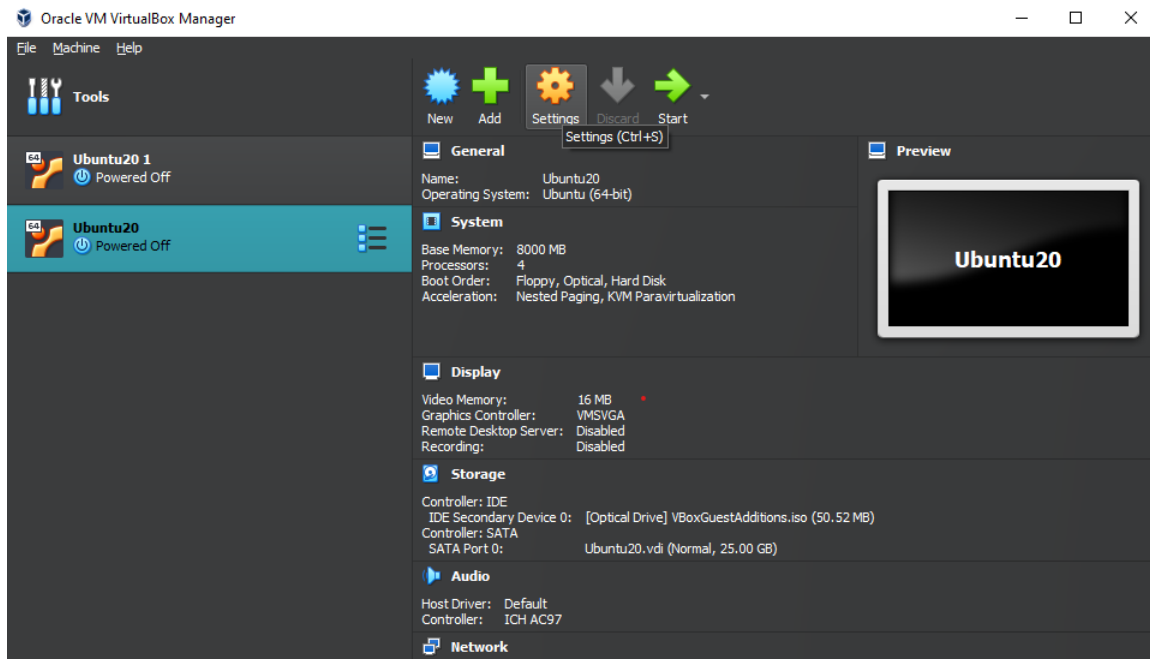
Make sure all steps are followed (including installation of Guest Additions).

Note: VirtualBox does not fully support Apple Silicon (including M1/M2 processors). Although it provides a developer preview package that is an unsupported work in progress ([VirtualBox 7.0.0 changelog](#)), it does not work well for running ROS in Ubuntu.

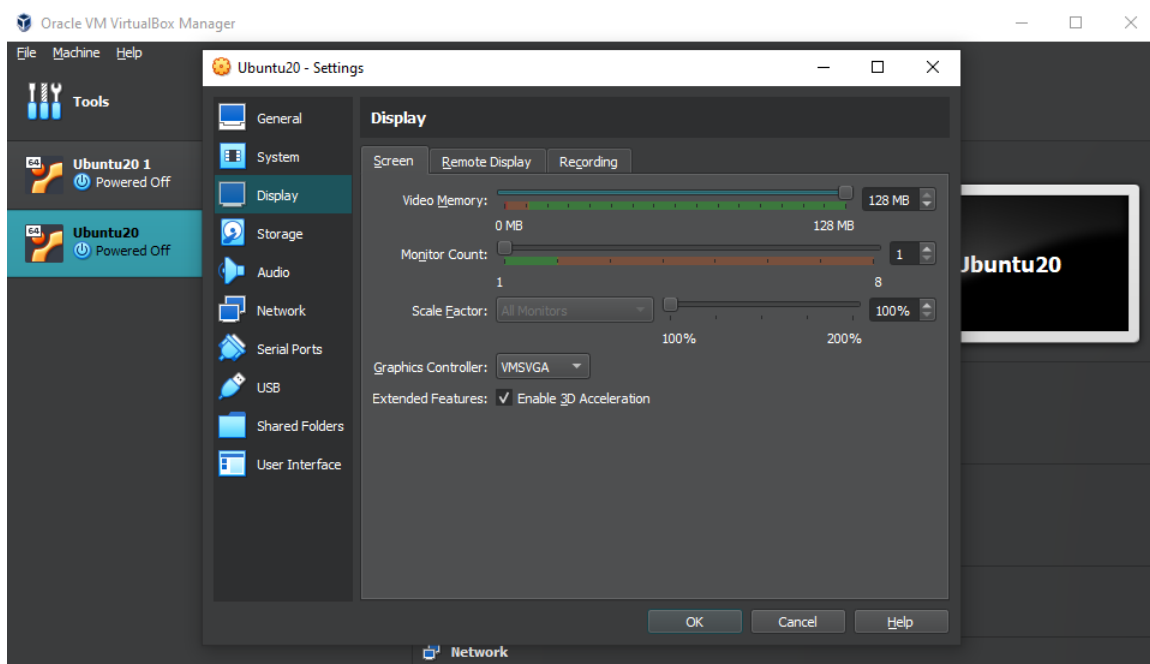
### 1.3 VirtualBox Optimization

VirtualBox may have performance issues, and accordingly provides several features to improve virtual machine performance. VirtualBox optimization is necessary for robot simulations to have reasonable FPS. To optimize VirtualBox, follow the following basic steps:

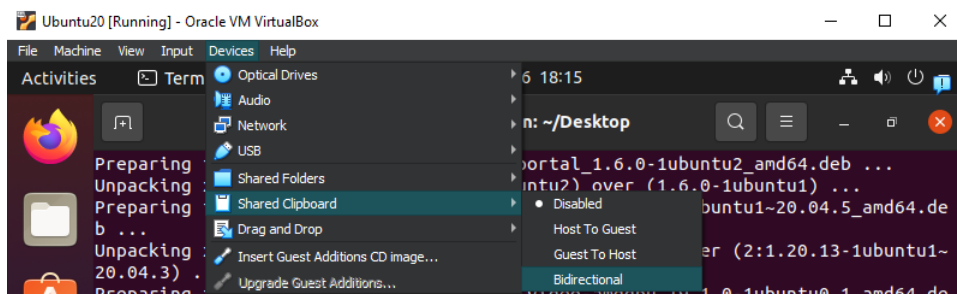
**Step 1 – VirtualBox Settings.** Power off Ubuntu. Within VirtualBox Manager, select your installed Ubuntu and click **Settings**:



Within Display → Screen, drag the Video Memory slider to the maximum and check Enable 3D Acceleration, and then click OK.



**Step 2 – Convenience.** To enable desktop to desktop copy and paste, start Ubuntu in VirtualBox and go to Devices → Shared Clipboard → Bidirectional:



To install Guest Additions, go to `Devices` → `Insert Guest Additions CD Image`. Then, select `Run` and input user password. If you already installed Guest Additions when installing VirtualBox, you may safely skip this step.

You may find more optimization strategies by googling “VirtualBox 7 Optimization”.

## 2 Installing ROS Noetic in Ubuntu

### 2.1 Update Ubuntu and Install Ubuntu Packages

Ubuntu 20.04 LTS has Python 3.8 as the default version, which will be used for grading course projects. Before installing ROS Noetic, get Ubuntu 20.04 LTS updated to the latest versions by launching a terminal (`Ctrl+Alt+T`) and typing:

```
sudo apt update && sudo apt upgrade -y
sudo snap refresh
```

Install necessary Ubuntu packages that you need, especially the development packages.

```
sudo apt-get install build-essential gcc make cmake
```

(Optional) Install additional packages of your choice, e.g., `vi` text editor:

```
sudo apt install vim
```

### 2.2 Install ROS Noetic

After installing and testing your Ubuntu packages, follow this guide to install ROS Noetic **Desktop-Full** `ros-noetic-desktop-full`:

- <http://wiki.ros.org/noetic/Installation/Ubuntu>

This guide offers an explanation of each command. Make sure to follow all steps in Section 1 of the guide; skipping any step will cause problems when using ROS.

After installing ROS Noetic, you can start going through the ROS tutorial’s Beginner Levels to learn ROS and test your Noetic installation:

- <http://wiki.ros.org/ROS/Tutorials>

### 2.3 Install Gazebo 11 for Robot Simulation

Gazebo is one of the most widely used high-fidelity simulations in robotics, and fully integrated with ROS. Noetic is compatible with Gazebo 11 only. When `ros-noetic-desktop-full` is installed, it already

includes Gazebo 11.

To install or reinstall Gazebo 11, you may follow the guide in the section of “Install gazebo\_ros\_pkgs”:

- [https://classic.gazebosim.org/tutorials?tut=ros\\_installing#Install\\_gazebo\\_ros\\_pkgs](https://classic.gazebosim.org/tutorials?tut=ros_installing#Install_gazebo_ros_pkgs)

The Gazebo installation guide provides an explanation of each comment with many additional details. For brevity, you may first install Gazebo in ROS Noetic by typing in terminal:

```
sudo apt-get install ros-noetic-gazebo-ros-pkgs ros-noetic-gazebo-ros-control
```

Then test Gazebo. In a terminal window, type:

```
roscore
```

Start a new terminal window and type the following to see an empty Gazebo world.

```
roslaunch gazebo_ros gazebo
```

More instructions on using and testing Gazebo in ROS are provided in the above Gazebo guide.