Ubuntu & ROS Installation Guidelines

TUNSA Space Robotics

In the next paragraphs, I'm going to talk about the different methods of installing ROS, which you will need to do in order to join us in the certified ROS course during the following days. Below I gave you guidelines for choosing which method, but please read this entire post carefully to know which method is best suited for you.

DISCLAIMER ⚠ Before trying any of these methods (especially the first 3), I highly recommend backing-up any important files and/or documents in your PC to the cloud or to an external drive. If you have an institutional email, you already get plenty of cloud storage on Google Drive and/or OneDrive. If you don't, then use the 100GB free storage on degoo.com + 15GB on your Gmail account. Please note that I'm not responsible for any loss of files that you may encounter during one of installation processes, so please back-up your files and follow the steps very carefully and everything should work as intended.

NOTE: You should install Ubuntu version 20.04.4 LTS rather than version 22.04. This is because we are going to use ROS Noetic which is only supported by Ubuntu 20.04.

For methods 1 to 3, here's the download link for the Ubuntu 20.04.4 Desktop ISO image:
https://releases.ubuntu.com/20.04.4/ubuntu-20.04.4-desktop-amd64.iso

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RECOMMENDED GUIDELINES FOR CHOOSING THE INSTALLATION METHOD

Note: The methods from 1 to 6 are ordered from Most to Least recommended. The following are guidelines if you have specific RAM and/or storage limitations. Otherwise, method 1 is generally recommended.

If you don't have a 2nd internal/external drive AND you have:

0 < Free storage <10GB

=> Method 4

10GB<= Free storage <15GB

=> Method 4, 5

15GB<= Free storage <30GB + RAM < 6GB

=> Method 4, 5

15GB<= Free storage <30GB + RAM >=6GB

=> Method 6, 4, 5

Free storage >= 30GB + RAM < 6GB

=> Method 1, 4, 5

Free storage >= 30GB + RAM >=6GB

=> Method 1, 6, 4, 5

If you do have a 2nd internal drive available (>= 32GB) AND you have:

RAM < 6GB

=> Method 2, 1, 4, 5

RAM >=6GB

=> Method 2, 1, 6, 4, 5

If you have: an external drive available (>= 32GB) +

RAM < 6GB

=> Method 3, 1, 4, 5

RAM >=6GB

=> Method 3, 1, 6, 4, 5

If you have: both 2nd, and external drives, you may choose between method 2 and 3 depending on your preferences.

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METHOD 1: INSTALLING UBUNTO 20.04 LTS ON YOUR INTERNAL HDD/SSD, THEN ROS

If you don't have a 2nd internal drive in your desktop/laptop computer, and you only have less than 6GB of RAM, then this option is the recommended in order to get the smoothest experience. I really recommend this to anyone who meets the storage requirement since we're going to be using Ubuntu OS much more in the future.

Free Storage Requirement: 30 to 35GB (acceptable), 40 to 50GB (recommended)

Other Requirements: 4GB+ USB disk.

SIMPLE & EASY INSTALL (Recommended):

To install Ubuntu 20.04 LTS, first of all, you need to check your BIOS Mode. To do that, in Windows, press Win+R then type msinfo32 and hit enter.

A System Information window should pop-up. Read what's written in front of "BIOS Mode".

- If it says "UEFI" (this means UEFI-GPT combination)", then follow this video until 9:31 (the last part shows you how to uninstall ubuntu in case you don't need it anymore): https://youtu.be/aKKdiqVHNqw After that, for UEFI mode, you should automatically get the "grub boot menu" when booting to choose between windows and Ubuntu (like this screenshot), but in case you don't get it, you need to change the boot order from the BIOS settings and put Ubuntu on top of Windows.
- If it says "Legacy" (this means BIOS-MBR combination), you will mostly follow the same video (https://youtu.be/aKKdiqVHNqw) except there is a bit of a difference when formatting your USB drive in Rufus. Instead of Partition scheme "GPT", select "MBR" and the target system should change from "UEFI (non-CSM)" to "BIOS or UEFI". After that, to configure dual boot for Legacy mode, you need to follow this video from 9:08 to 10:25: https://youtu.be/-iSAyiicyQY?t=548

OPTIONAL: To customize the Grub boot menu, follow this video: https://www.youtube.com/watch?v=Hmdh_x8ZwO4

If you follow the above instructions correctly, That's it! You've installed ubuntu!

ADVANCED INSTALL ⚠ : Read the rest only if you want to customize the partitions of Ubuntu installation. If you want to understand why you might want to do that, read this: https://www.reddit.com/r/Ubuntu/comments/pji9c0/comment/hbxi3uk/?utm_source=reddit&utm_medium=web2x&context=3

Follow this video between 5:51 and 8:12 if you want to do that: https://youtu.be/-iSAyiicyQY?t=351

There are basically 3 types of disk partitions on Linux:

Root (/) {REQUIRED}: This is where the Ubuntu system files go and is required to boot a Linux system. Ubuntu 20.04 LTS recommends 25GB of disk space for the root drive on its own. But we also need a bit more space to account for ROS and other programs in the future. So please dedicate at least 30GB for this partition (instead of the 25GB mentioned in the video).

Home (/home) {OPTIONAL}: This holds user data that is separate from the OS files. It's basically equivalent to your "Personal Files" partition on Windows (if you have one). This is not a required partition. You can choose not to include one, but, by including it, you're free to upgrade your Linux OS in the future without the risk of losing your configurations and other data. To know more on the pros and cons of adding/not adding this partition, you can check these out:

https://askubuntu.com/questions/142695/what-are-the-pros-and-cons-of-having-a-separate-home-partition?noredirect=1&lq=1

https://askubuntu.com/questions/885732/is-it-safe-to-have-no-home-partition

If you choose to add it, I recommend dedicating a size of at least 5GB.

Swap {REQUIRED}: When the system runs out of RAM, the operating system moves inactive pages from RAM into this partition. Apply the following rule to know how much swap space you need:

For more modern systems (>1GB of RAM), your swap space should be at a minimum be equal to your physical memory (RAM) size "if you use hibernation", otherwise you need a minimum of: Round-up(sqrt(RAM)) and a maximum of twice the amount of RAM.

Example: If you don't need to use hibernation mode, and you have 6GB of RAM. sqrt(6) = ~2.45 => Round up (2.45) = 3GB of swap storage.

If you need hibernation mode, and you have 6GB of RAM, you need a minimum of 6GB of swap storage

More on the differences between those 3 drive partitions, read this: https://www.lifewire.com/do-you-need-home-partition-2202048

Pro tip: If you want share files between Windows and Ubuntu seamlessly, check these links to learn what's needed (preferably before beginning the installation):

https://askubuntu.com/questions/223655/windows-ubuntu-dual-boot-share-files-between-os

https://www.howtogeek.com/howto/35807/how-to-harmonize-your-dual-boot-setup-for-windows-and-ubuntu/

In the video, the guy used 25GB for the root partition (/) and 5GB for the swap, its fine if you follow him, but I recommend you to use at least 30GB for the root partition and follow the swap rule above to determine how much you really need for the swap partition.

METHOD 2: INSTALLING UBUNTO 20.04 LTS ON A 2ND INTERNAL DRIVE, THEN ROS

If you have an additional internal SATA/NVME SSD/HDD lying around that you can add to your laptop/desktop PC (or one that's already installed but not in use), then this method is 100% better than method 1, since your initial drive containing windows won't be affected.

For this, after connecting your 2nd drive and formatting it in the Disk Management app in Windows, you will need to basically follow the same steps and instructions as the simple installation in method 1 (https://youtu.be/aKKdiqVHNqw). The only change is that in the Ubuntu "Installation type" (6:28), select "Erase disk and install Ubuntu", then select the separate HDD/SSD you want to install Ubuntu on (make sure it's not the Windows drive!!) and continue from there. For more a guided tutorial; check this video: https://youtu.be/5Ay8UI_wiM8

METHOD 3: INSTALLING UBUNTO 20.04 LTS ON AN EXTERNAL DRIVE, THEN ROS

If you don't have a second internal drive, but instead have a USB disk or an external HDD/SSD with 32-64GB+ of storage, then installing Ubuntu on that drive is not a bad option for a first-time user. The disadvantage is that the speed of the external disk is limited to the USB speed and you may have connectivity issues leading to OS crash. But you get the advantage of safety and portability since you can boot it from other laptops/desktops too.

For this method, follow this guide: https://www.fosslinux.com/10212/how-to-install-a-complete-ubuntu-on-a-usb-flash-drive.htm

METHOD 4: INSTALLING UBUNTO 20.04 LTS ON WSL2 ON WINDOWS 10 THEN ROS

This method is recommended for those who don't have enough RAM to run VMs, and don't have enough storage to install Ubuntu separately.

The disadvantage with this method is not being able to experience the full Ubuntu OS, you will only have access to its terminal (which may be enough for now)

Please follow this guide if you choose to pursue this method: https://youtu.be/WWPQAvHG35M

METHOD 5: INSTALLING DOCKER ON WINDOWS THEN UBUNTO ON DOCKER THEN ROS

If you tried using VMs before but found that they were very sluggish, and don't have much storage in your system, the this might be a good option for you. Like the previous method, the drawback with this is not being able to experience the full Ubuntu OS.

Before you think about diving into this, you need to have a good enough understanding of Docker, that is, how to install it and install Ubuntu on it, and then practice a few of its commands, all of which can be found in this tutorial: https://robocademy.com/2020/05/17/best-4-ways-to-install-ubuntu-for-ros/#4_Installing_Ubuntu_using_Docker

Note: We will be using Docker in future projects as its the industry standard nowadays, so if you choose this method, your Docker practice will not be in vain.

METHOD 6: INSTALLING VMWARE / VIRTUALBOX ON WINDOWS AND USING AN UBUNTU VM IMAGE

If you have 6GB or more of RAM, and you don't have at least 30GB of free space in your system, but instead have about 15GB

or

if you have the required RAM and storage requirements but prefer working with VMs for now, then this might be a good temporary option for you. But be warned, after long use, you might encounter some bugs that could potentially mess-up your VM after a while (broken packages). That's why the first method is always preferred for long-term users.

Free Storage Requirement: ~15GB= 3.9GB for the VM image (temporary, can delete it later) + 11GB for Virtualbox/VMware after extracting the VM image.

RAM Requirement: 6GB or more to run smoothly (will run on less RAM but it might be slow and laggy).

Step 1: Installing VMware or Virtualbox

Download VMWare Workstation Player 16.0 for Windows: https://www.vmware.com/in/products/workstation-player/workstation-player-evaluation.html

Download Virtualbox 6.1.30 for Windows hosts: https://www.virtualbox.org/wiki/Downloads

Note: I found out that VMware is actually better in many ways than Virtualbox. So I actually recommend using it instead of Virtualbox.

Step2: After installing either program, you will get the GUI in which you can import a new or preconfigured Ubuntu VM image. From here, it depends on your choice:

QUICK OPTION: USE THE VM IMAGE PROVIDED BY TU BERLIN'S COURSE (ROS ALREADY INSTALLED AND CONFIGURED): https://tubcloud.tu-berlin.de/s/wFwqDYe44C7xwbR

MANUAL OPTION (More up to date): DOWNLOAD THE UBUNTU 20.04.4 LTS FROM THE OFFICIAL WEBSITE: https://releases.ubuntu.com/20.04.4/ubuntu-20.04.4-desktop-amd64.iso

If you choose the manual option, you will go through the process of installing Ubuntu and ROS yourself, but it will be more up to date. For that, you should follow the video used in method 1 from 5:26 to 8:30: https://youtu.be/aKKdiqVHNqw?t=326

For ROS Installation (in the manual option), read the following paragraph.

Possible issues with VMWare: VMware Workstation and Device/Credential Guard are not compatible

Fix: https://www.youtube.com/watch?v=VIBdY-5zr58&ab_channel=Britec09

Possible issues with VirtualBox: Not in a hypervisor partition

Fixes: https://www.partitionwizard.com/partitionmanager/not-in-a-hypervisor-partition.html

https://techsupportwhale.com/not-in-a-hypervisor-partition/

INSTALLING ROS NOETIC ON UBUNTO 20.04.4 LTS

After completing the steps in one of the above 6 methods, you now need to install ROS Noetic on your Ubuntu OS.

For that, follow this sheet from top to bottom (in each step, enter the commands one by one): https://docs.google.com/spreadsheets/d/1PllYGMQuk5vwVK1FIpOUY1pE_ptbvdL45jO9FLD6daM/edit?usp=sharing

There is also a few sub sheets below on Eclipse installation (recommended for C++ programming), potential problems & solutions, and ROS uninstallation (in case you need it).

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That's it! If you followed one of these 6 methods and installed ROS, you're done! 🥳🎉🎇

If you encounter any problem in your journey, please don't hesitate to leave a comment here, on our chat group, on Discord or send me message and I will try my best to solve it with you. 😉

Good luck! 😊