tesr_ros_six_servo_robot_pkg
&
tesr_ros_six_servo_arm_moveit_config

Ubuntu and ROS Noetic Installation

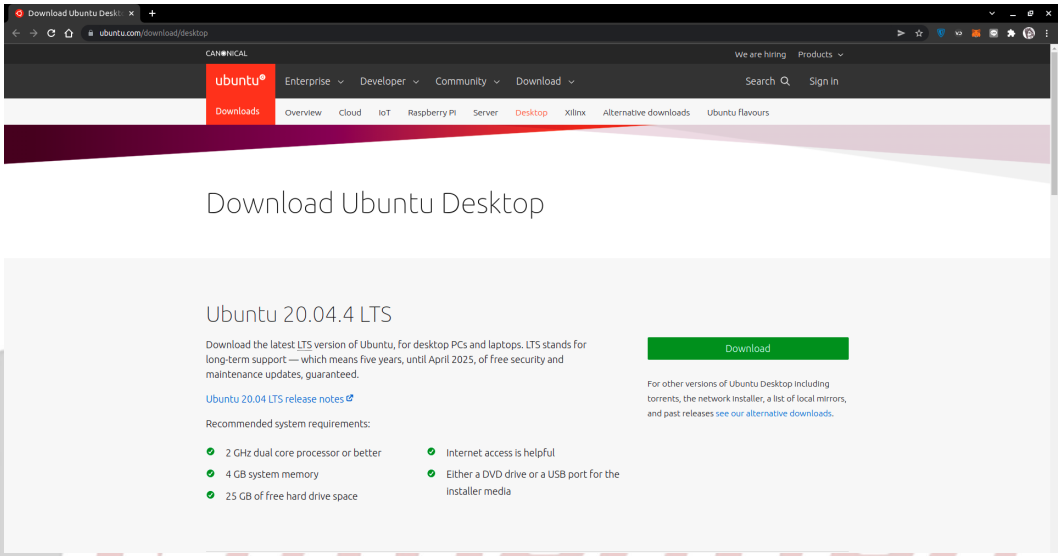
*You can skip this Installation if you already have Ubuntu 20.04 LTS and ROS Noetic on your own PC/Laptop. Go to the Main Topic by **"Click Here"**

Install Ubuntu using VMware player

1. Download Ubuntu Image

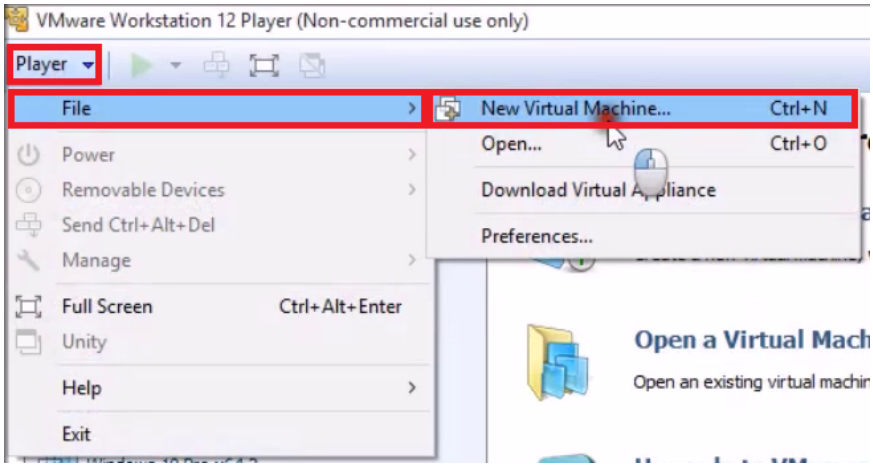
You can download an Ubuntu image at link: https://ubuntu.com/download/desktop

Make sure to save it to a memorable location on your PC! For this tutorial, we will use the Ubuntu 20.04 LTS release.

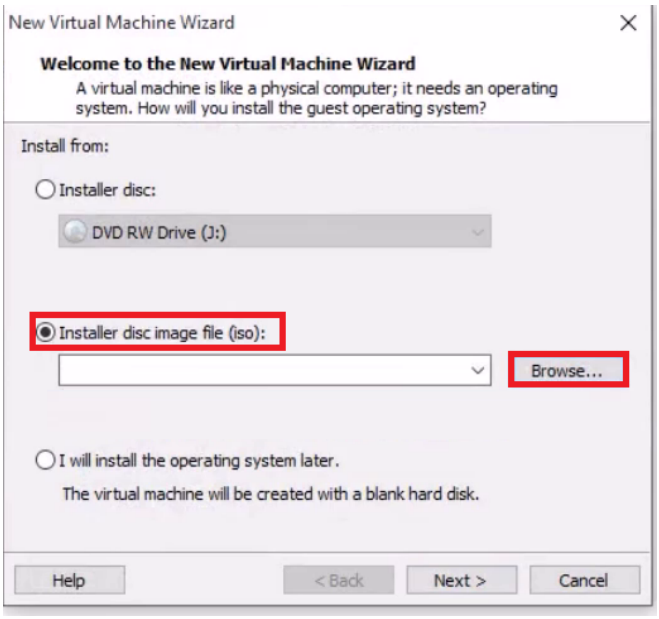


2. Setting up a VM

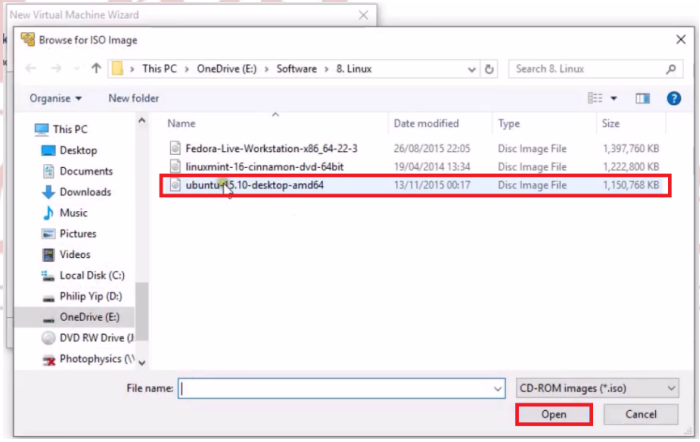
Left click player → Left Click File → Left Click New Virtual Machine:



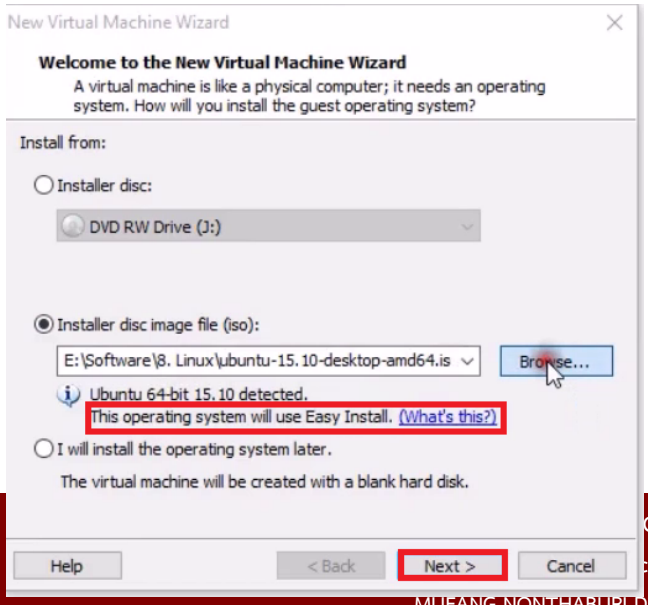
Select Installer Disk Image File (.iso):



Select browse…. and left click the Ubuntu .iso you downloaded:\



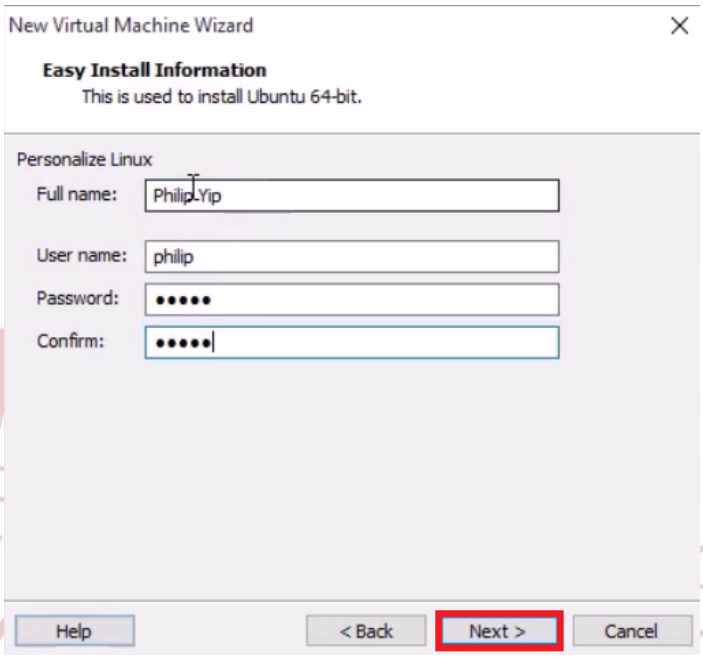
Select Open



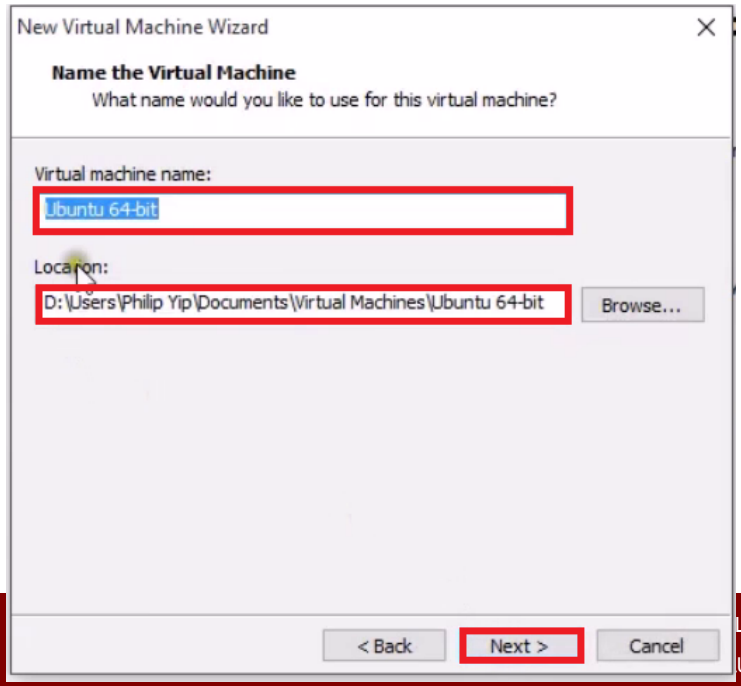
Ensure "This Operating System will use Easy Install" is shown.

With Easy Install VMWare Player will automatically install Ubuntu and VMWare tools without the need for user input. If easy_install is not selected one may have difficulty installing VMWare tools manually. The only disadvantage of easy install is there is no option to select language options using VMWare player and it defaults to English US language and keyboard :(. The language settings for both can easily be changed after installation and I will demonstrate the change of English US to proper English UK.

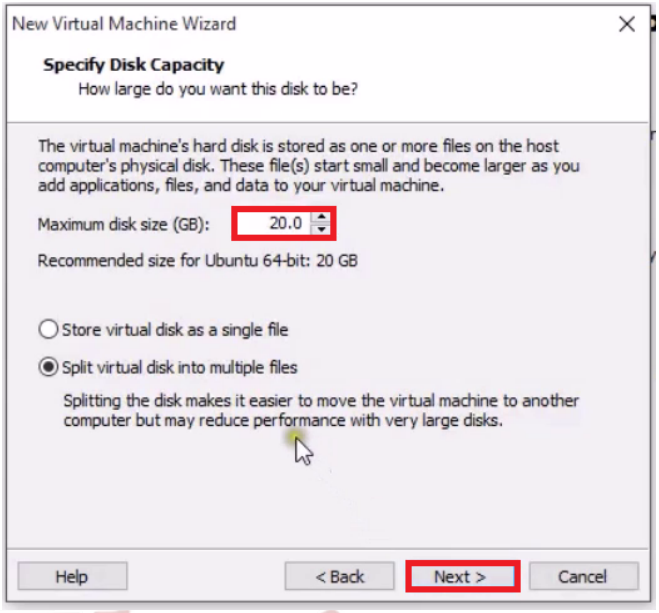
Type in your full name and username. The username has to all be lower case with no spaces. Then type in your password, Ubuntu won't let you install without a password:



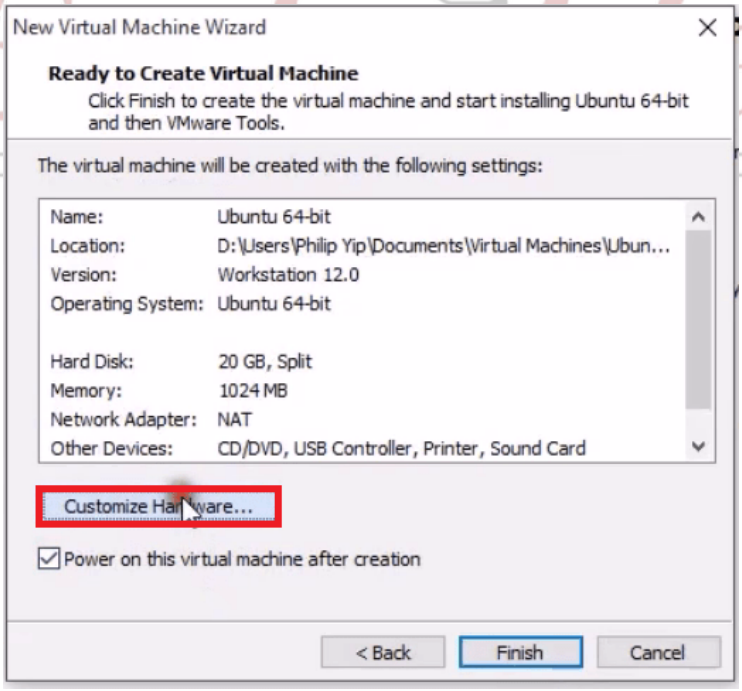
Here you can name your VM and you can also opt to change the location of the VM e.g. to a different HDD/SSD depending what suits.



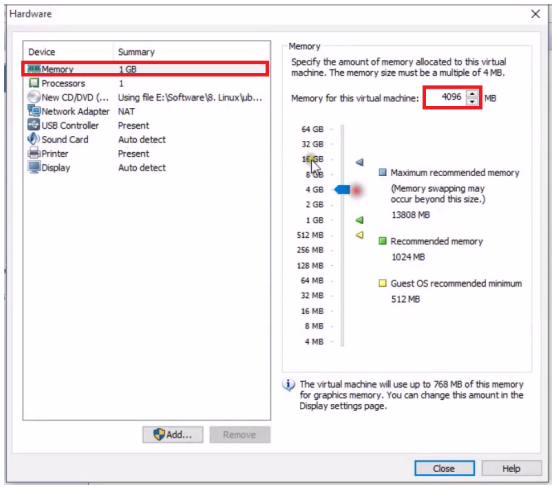
Select next. The default storage is 20 GB but you may increase it. I recommend leaving Split virtual disk into multiple files.



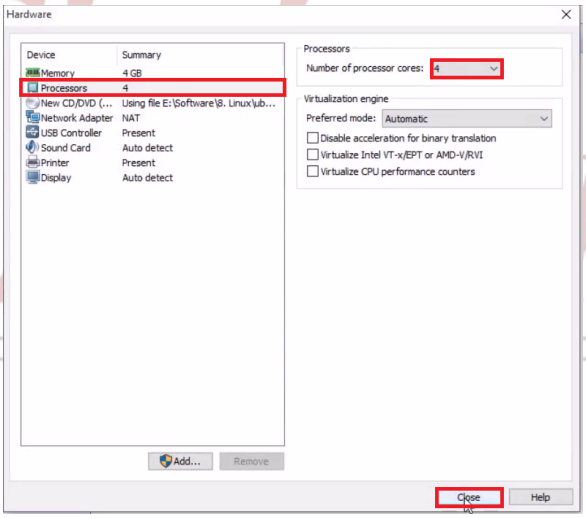
Before installing Ubuntu select Customize Hardware because the default hardware settings are pretty weak:



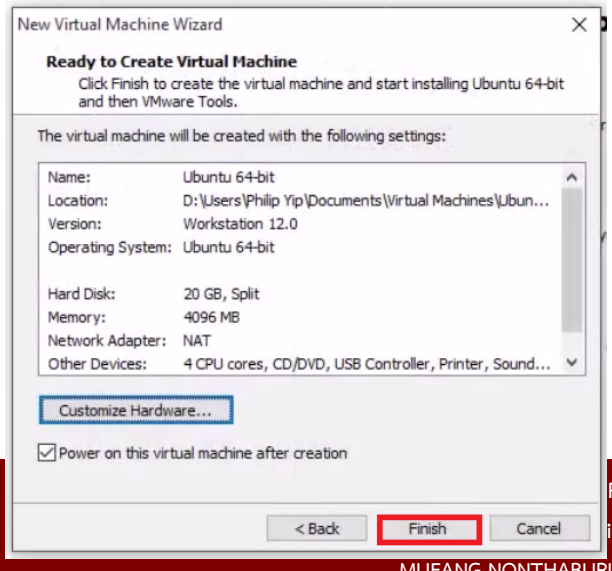
If you computer is capable (has at least 8 GB of RAM) up the RAM to 4 GB:



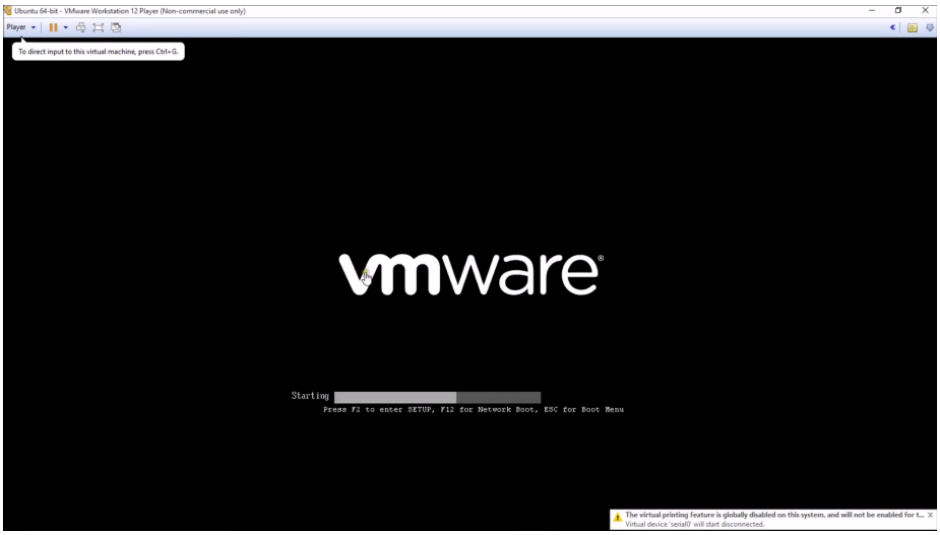
If your computer is capable of at least 8 threads, change the Number of processor cores to 4. If your processor has 4 threads change the Number of processor cores to 2. This will substantially increase the Ubuntu VMs system performance.

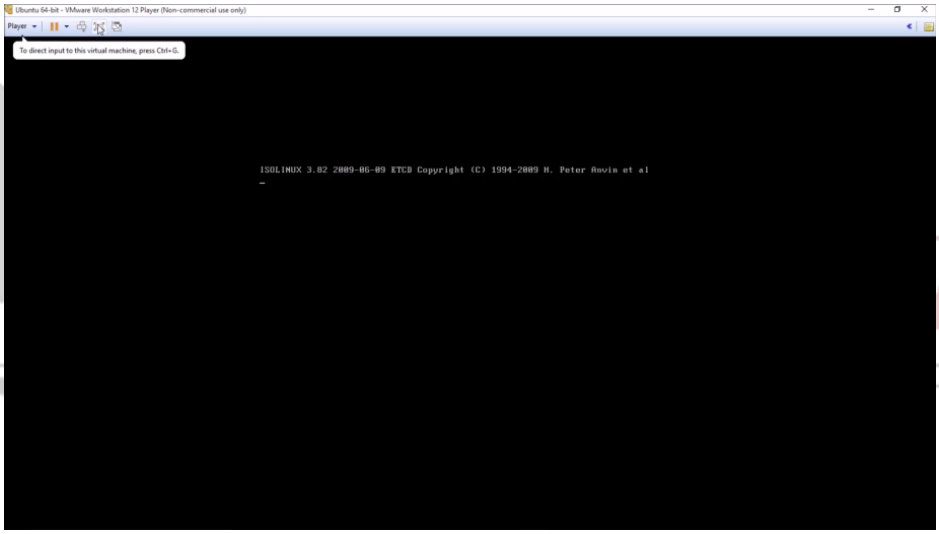


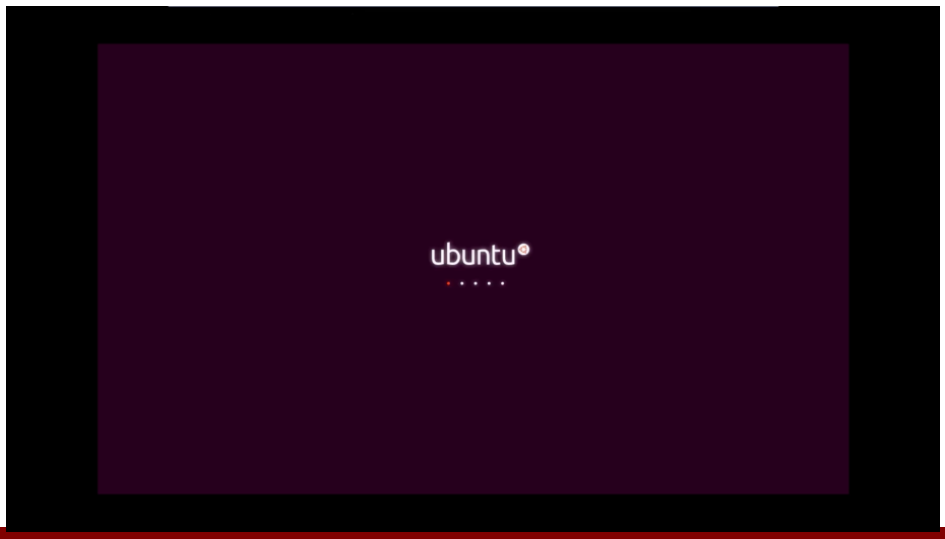
Select close and then Finish

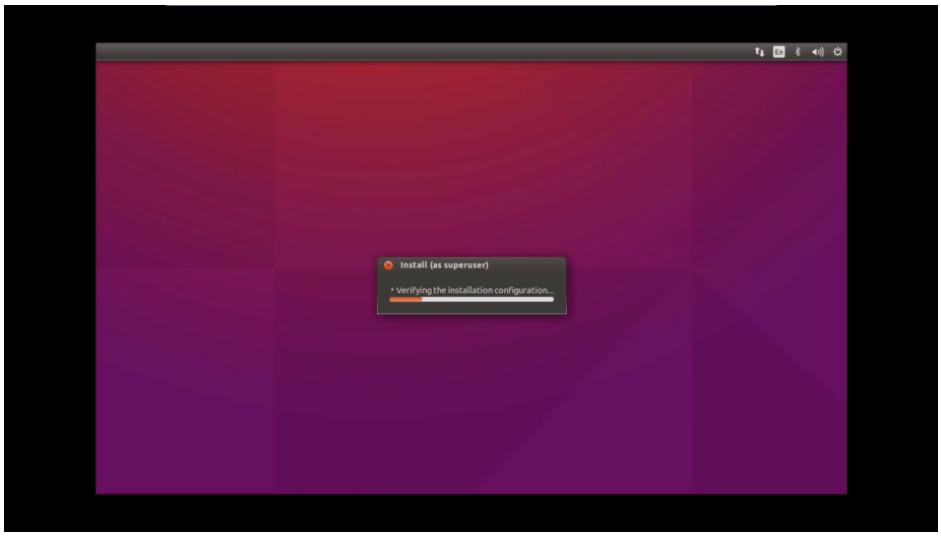


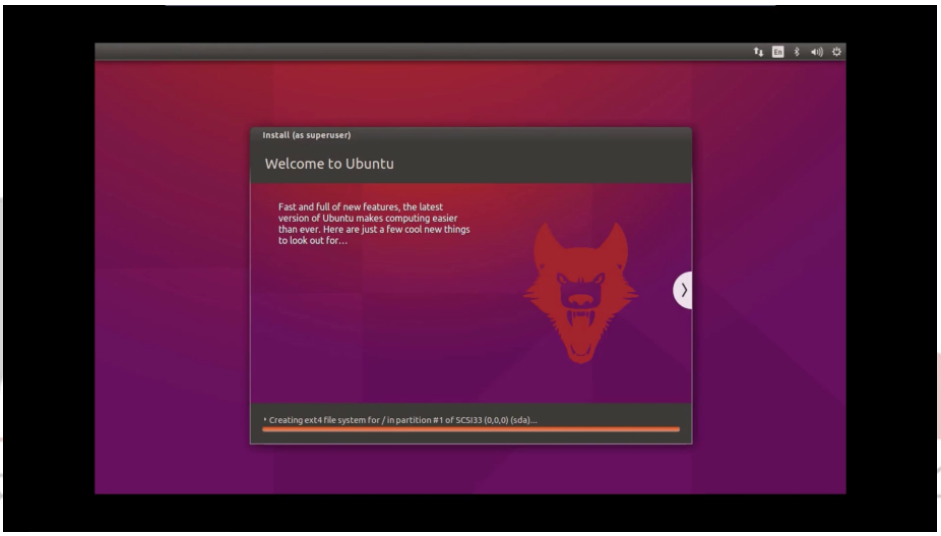
As mentioned the rest of the install will be automated. Make yourself a cup of tea and come back in 5-10 minutes:





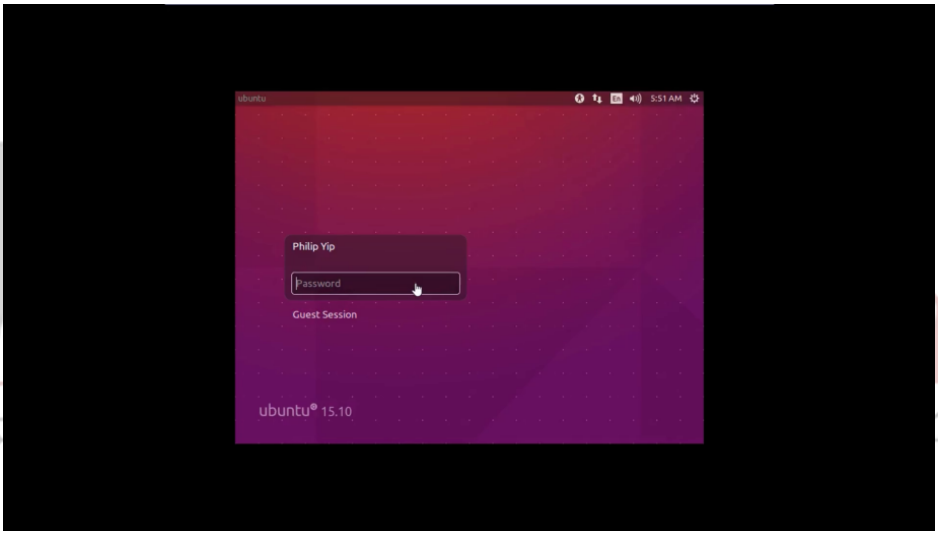



Install (as superuser)
Verifying the installation configuration...


Install (as superuser)
Welcome to Ubuntu
Fast and full of new features, the latest version of Ubuntu makes computing easier than ever. Here are just a few cool new things to look out for...
Creating ext4 file system for / in partition #1 of SCSI33 (0,0,0) (sda)...

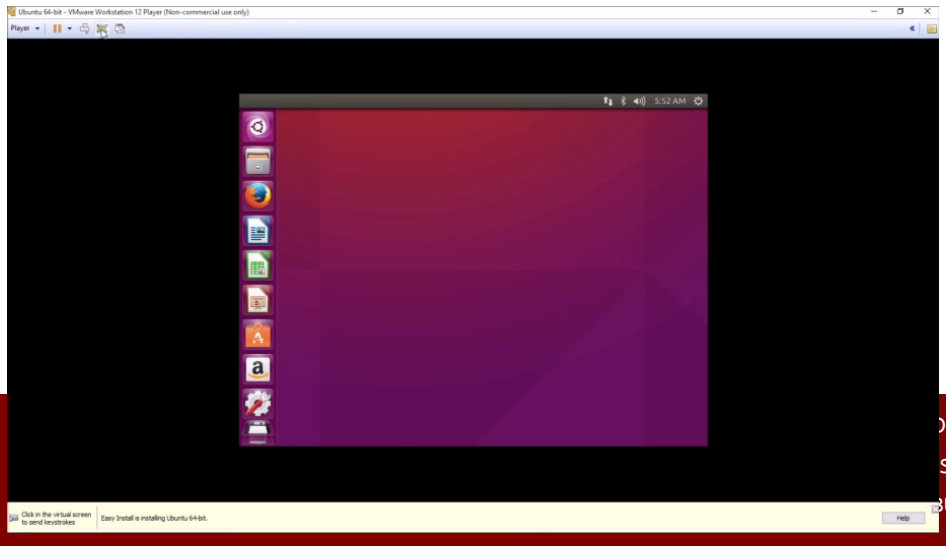

vmware
Starting
Press F2 to enter SETUP, F12 for Network Boot, ESC for Boot Menu

When the install is done you will be prompted to login:

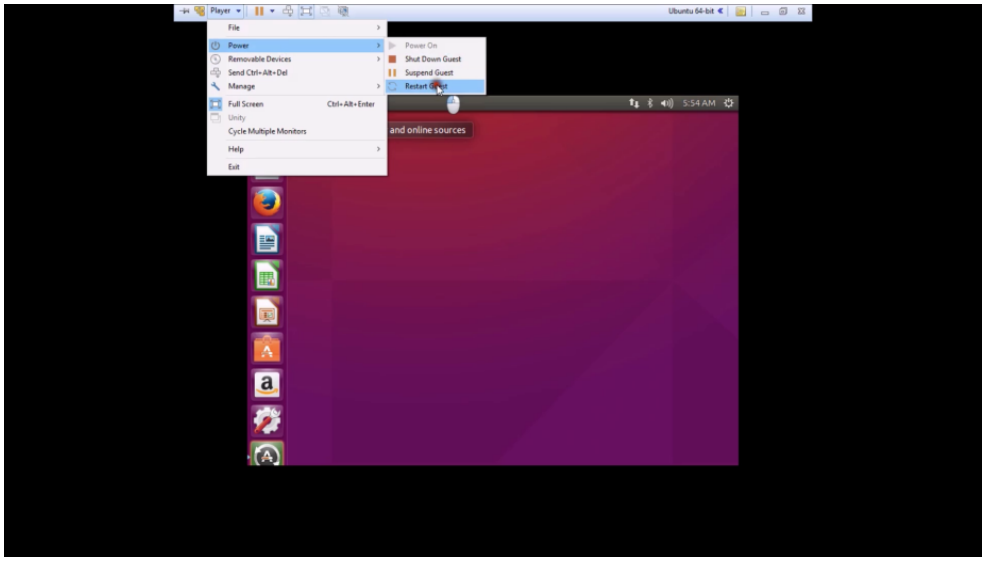


Making Sure VMWare Tools are Installed

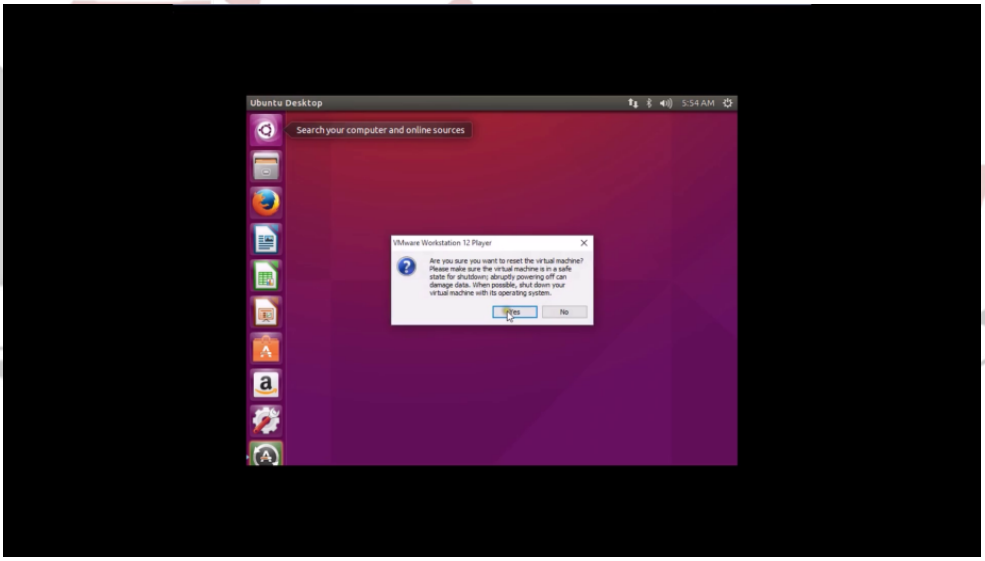
During the first launch the user experience may be terrible because VMWare tools are not installed therefore I recommend signing in waiting 5-10 minutes and then restarting:



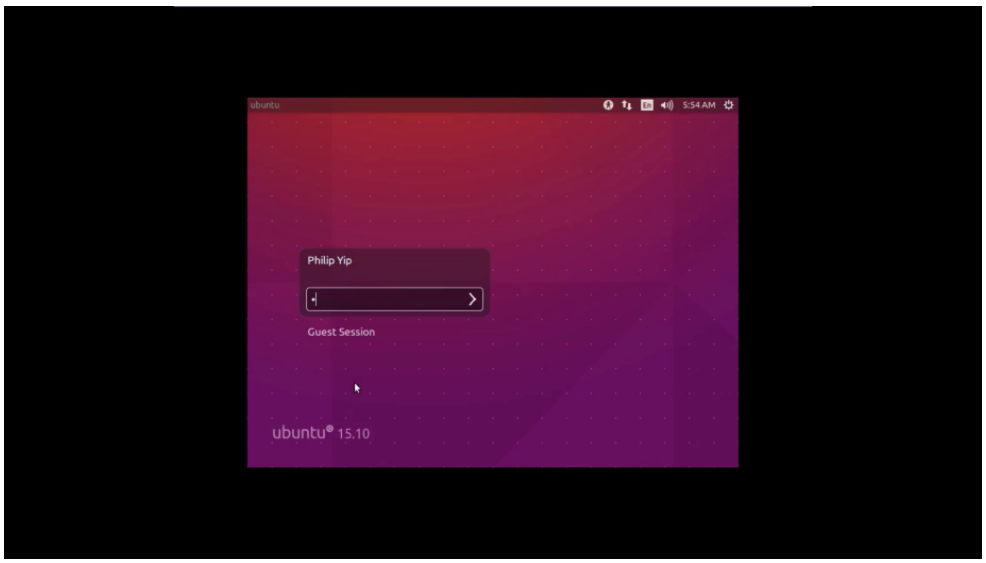
Select the player button at the top left and then power and then restart guest:



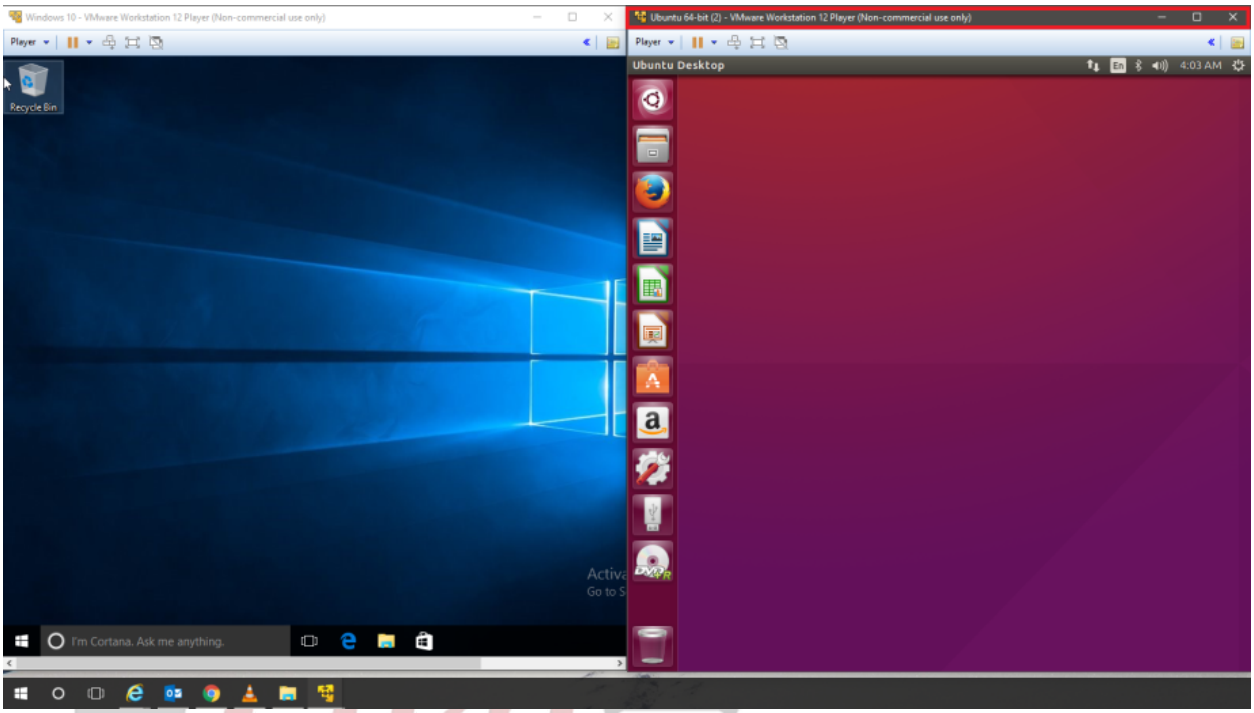
Select yes:



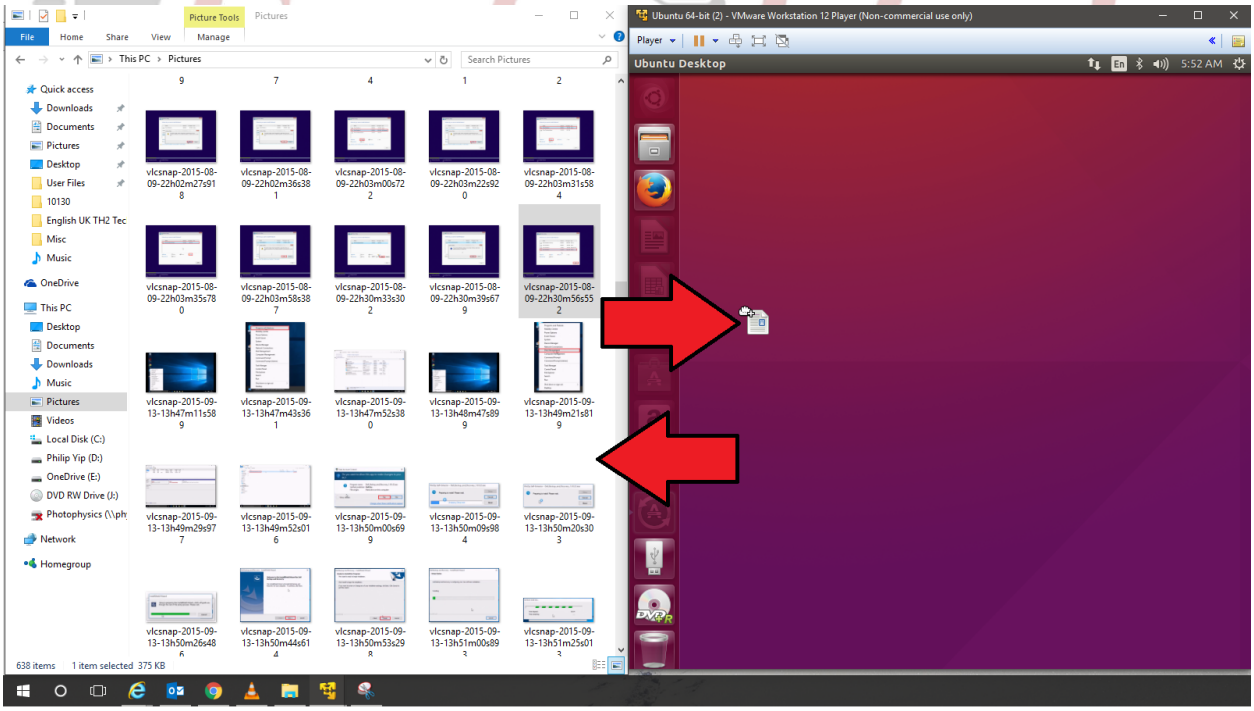
You will be prompted to login again and now it should be full screen:



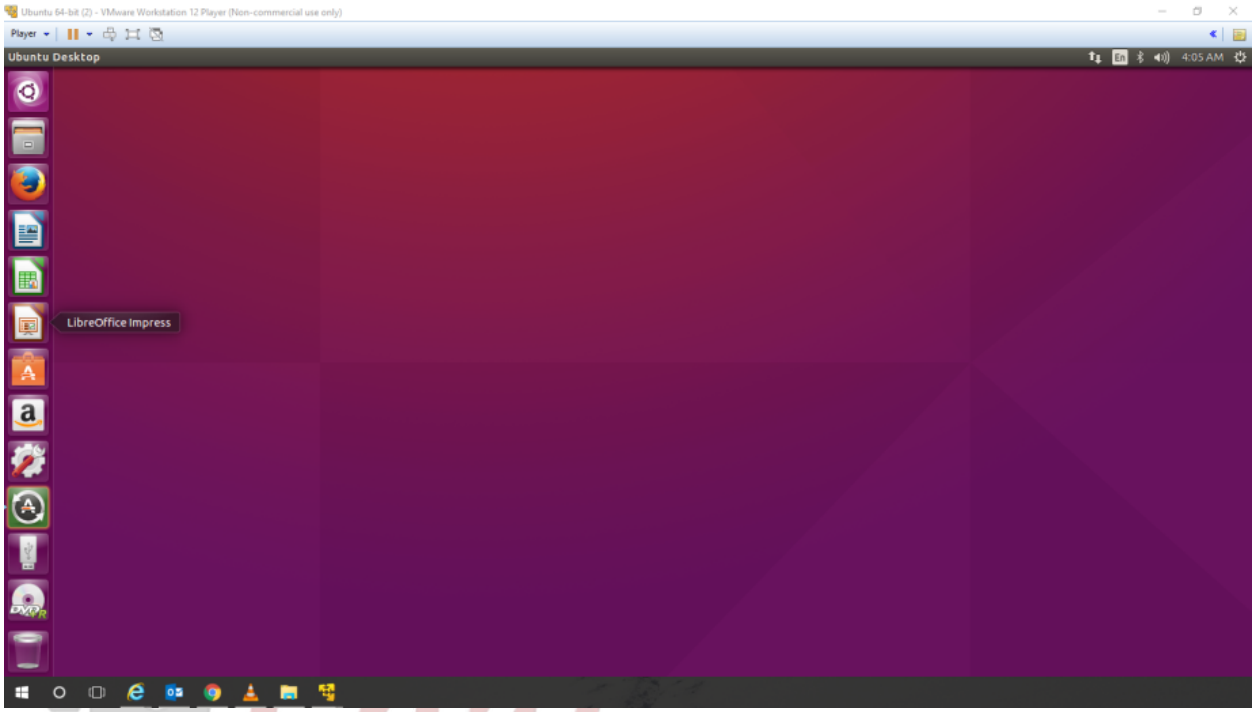
The VM is now full screen if it does not drag and drop the VMWare player Window to the left or right to aero snap half the screen. The VM should automatically resize to fill the Window:



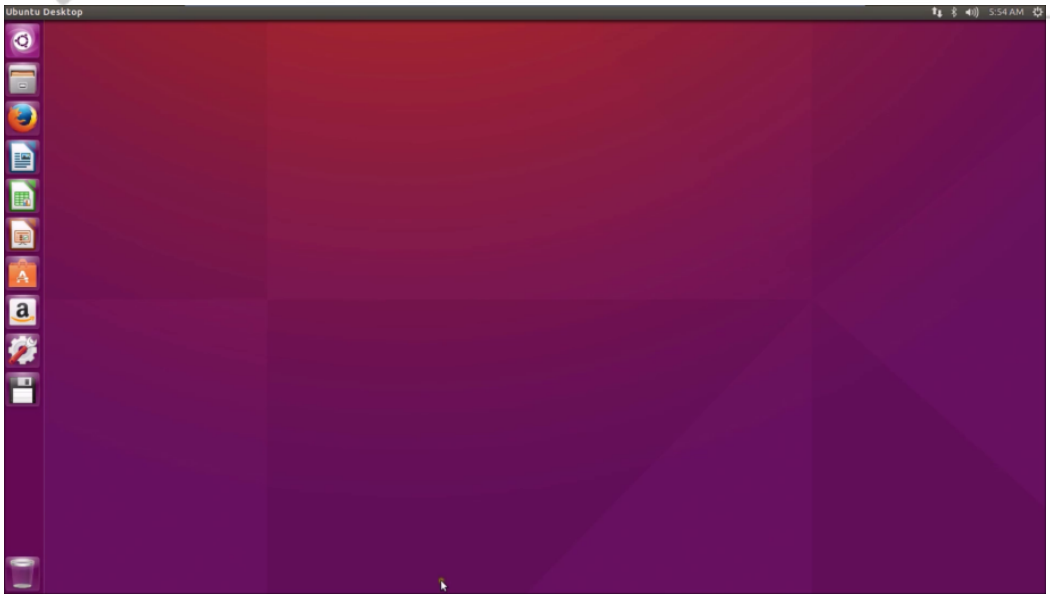
This also allows 2 way drag and drop from the host to the VM:



You can also aero snap it to the top. The VMWare player Window will then be maximized:

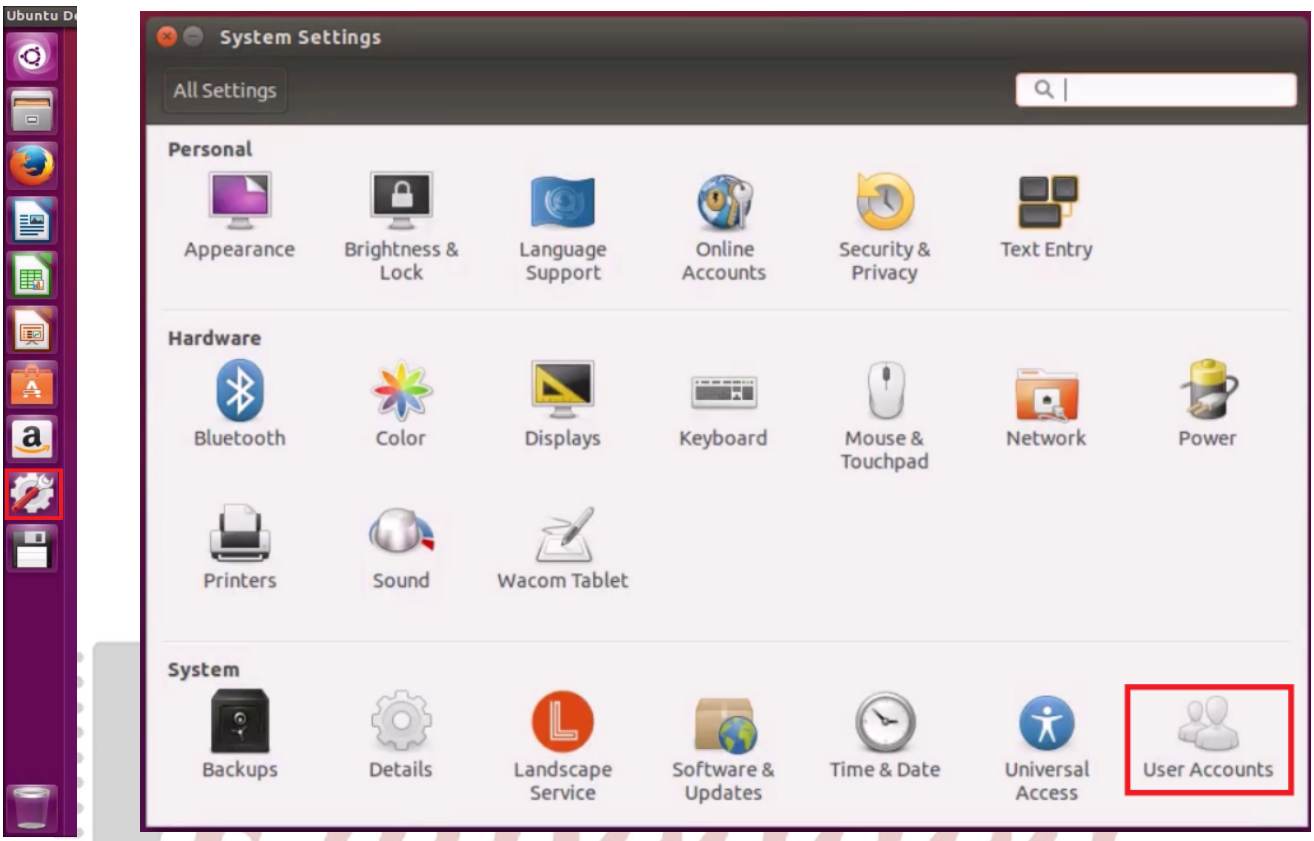


You can also select maximize to occupy the full monitor:

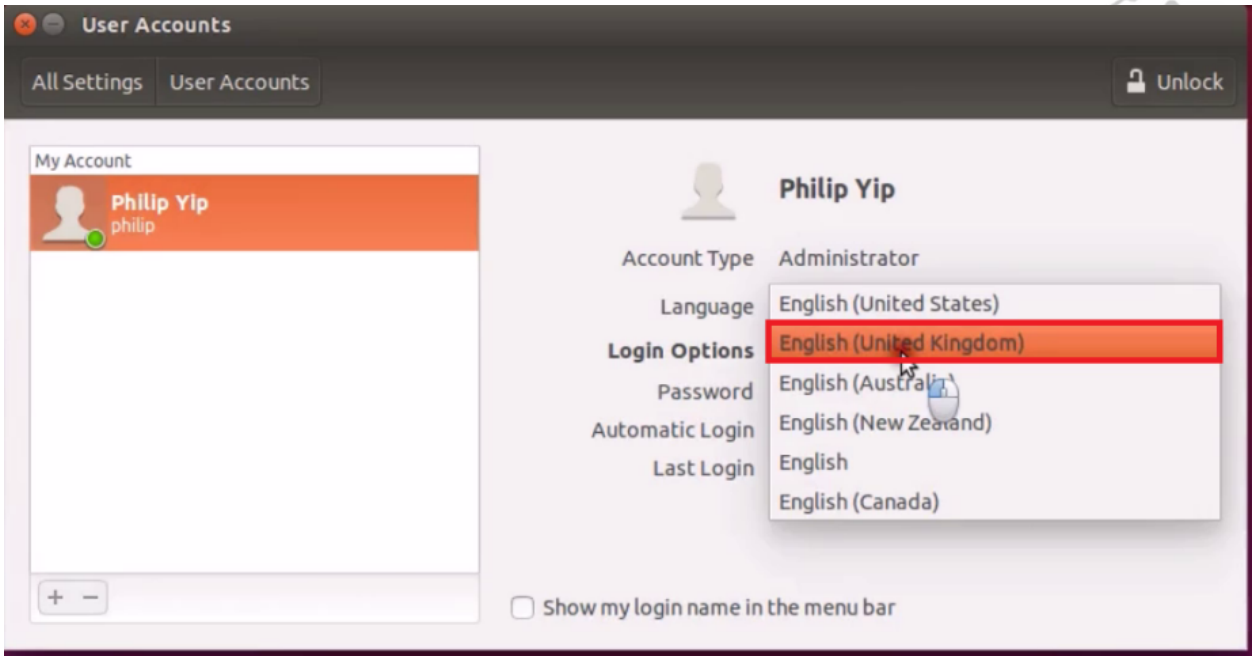


Changing Language and Keyboard

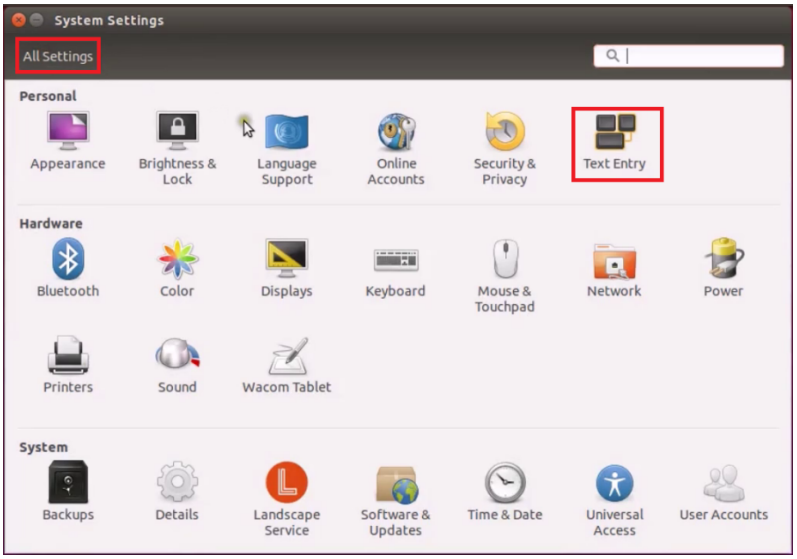
Select the settings crank to the left sidebar and Select User account:



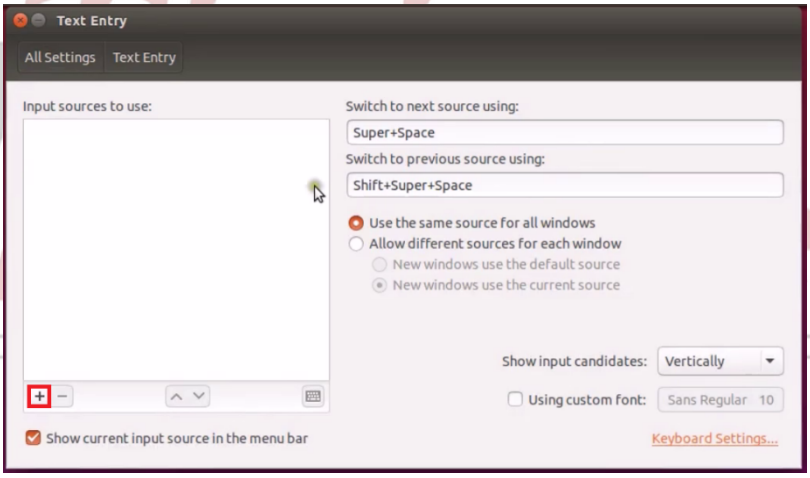
Change language from English (United States) to your desired Language:



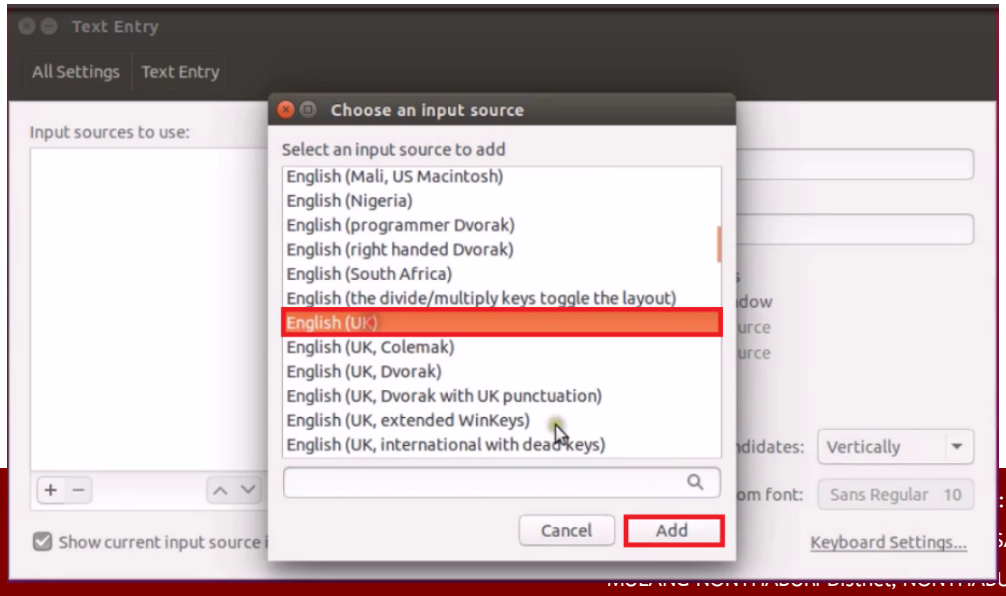
Select All settings and then go to Text Entry:



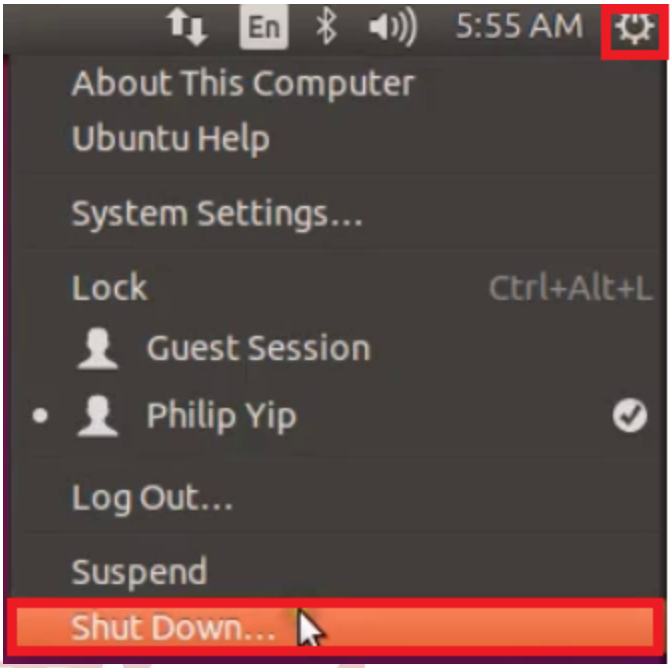
Select [+]



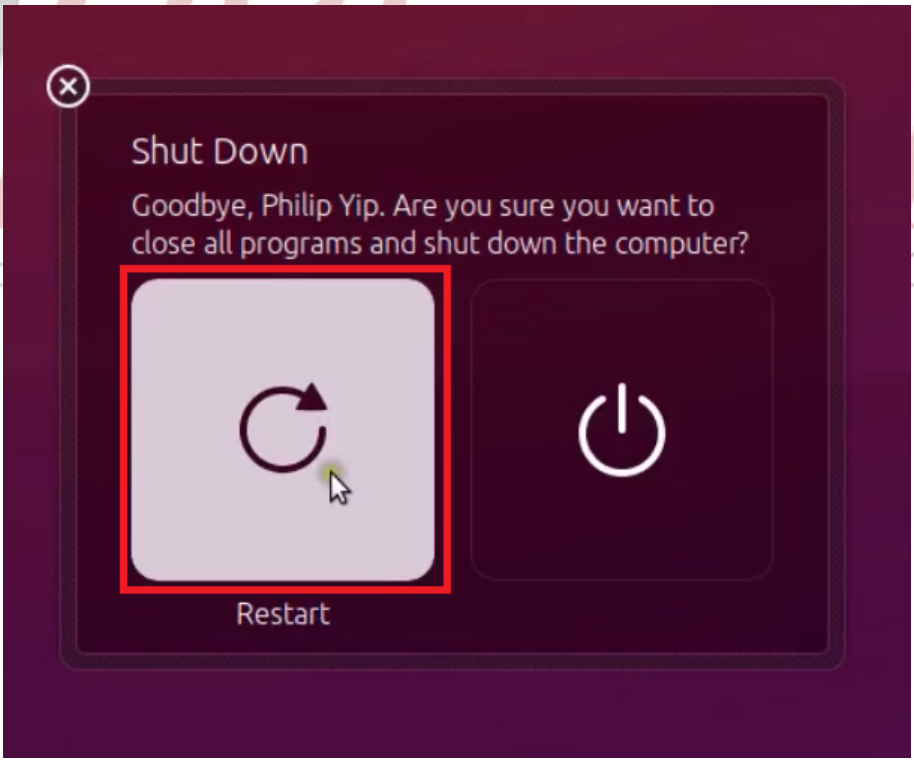
Select English (UK) and then select Add:



Select the power button and then shutdown:



Then restart:



You may now use your Ubuntu VM with your proper keyboard and language settings

Installation of ROS Noetic on Ubuntu

We have 2 methods for install ROS-Noetic are by terminal and synaptic package manager
#Before Install, Let's install useful applications such as Visual Studio and File transfer. It will helpful for programming in Ubuntu

Install Visual Studio for amd64(Work Station)

sudo snap install --classic code

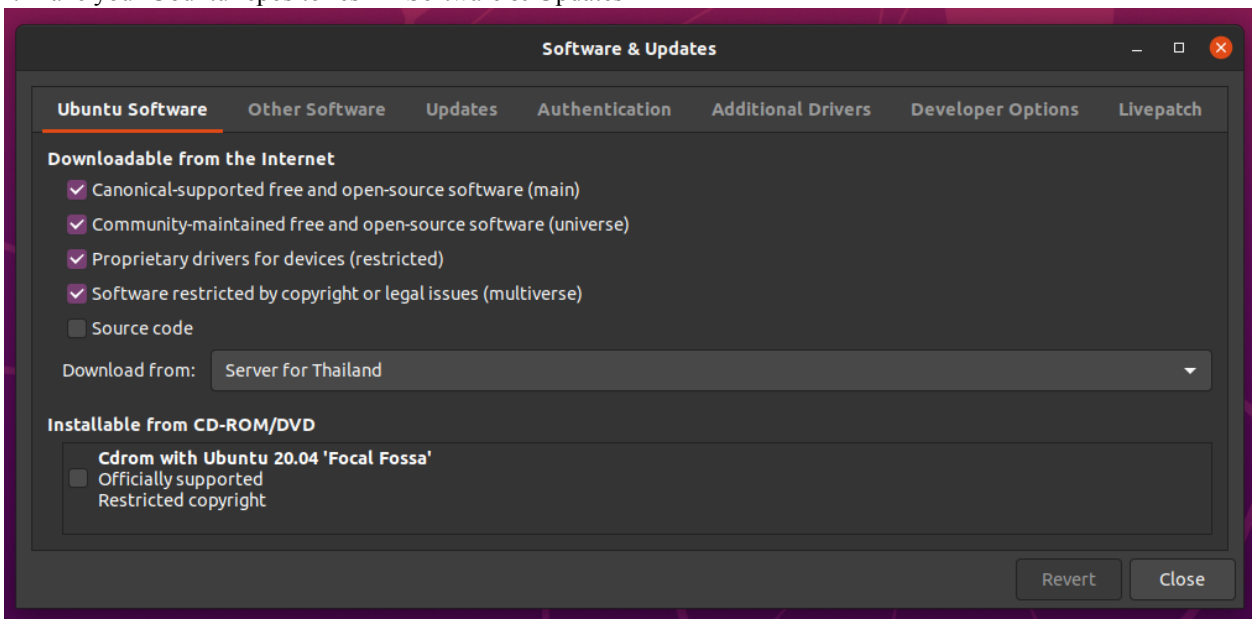
Install File transfers

sudo apt-get install openssh-server openssh-client

So, Let's get started!

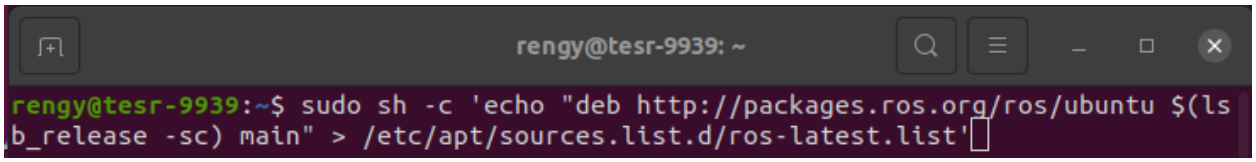
ROS Noetic Terminal method

1. Make your Ubuntu repositories in "Software & Updates"



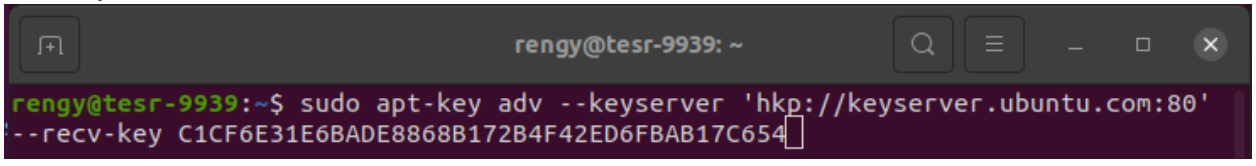
2. Setup your sources.list

sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'



3. Setup your keys

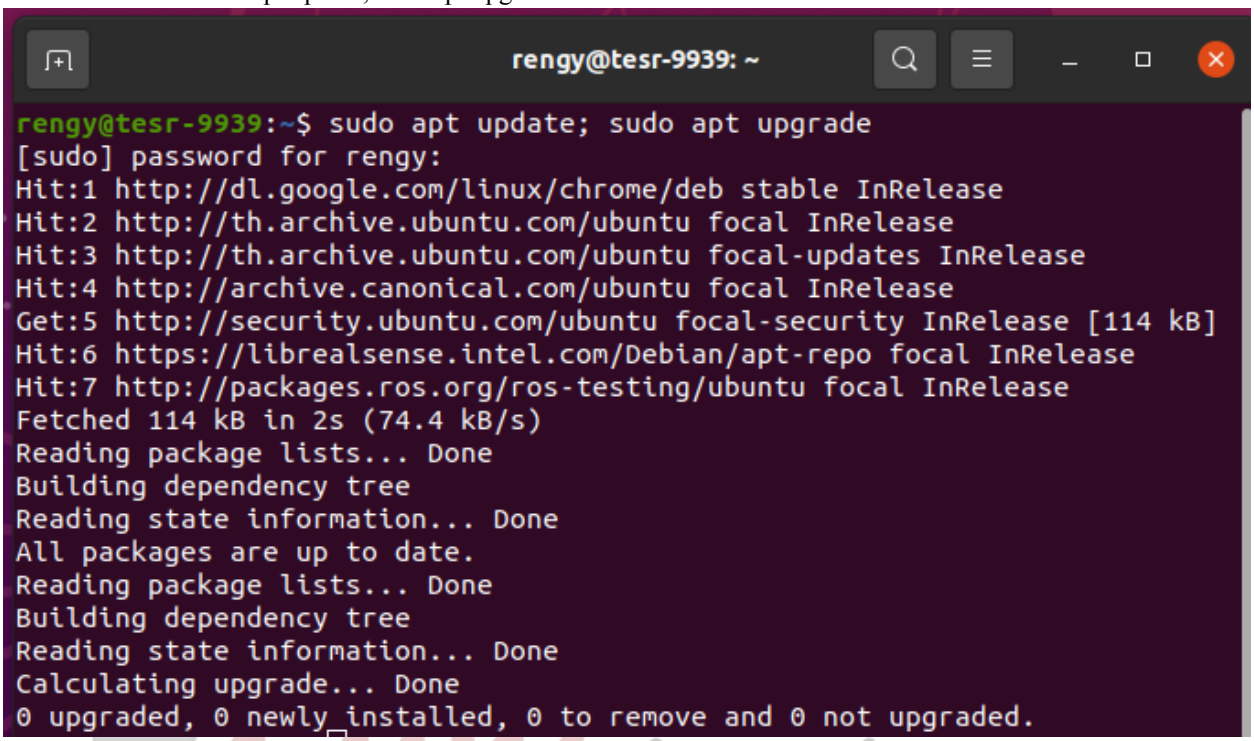
sudo apt-key adv --keyserver 'hkp://keyserver.ubuntu.com:80' --recv-keyC1CF6E31E6BADE8868B172B4F42ED6FBAB17C654



4. Installation

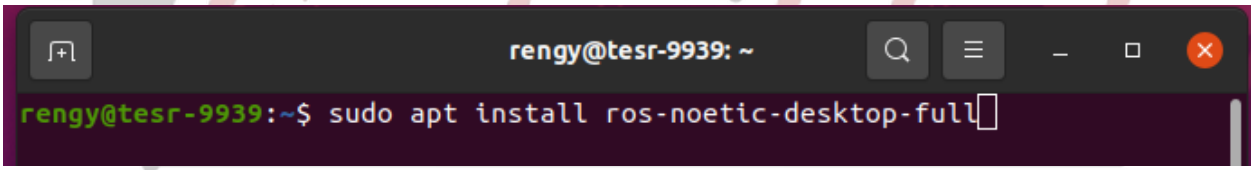
Check software is up to date and upgrade

sudo apt update; sudo apt upgrade



Install ROS desktop-full

sudo apt install ros-noetic-desktop-full



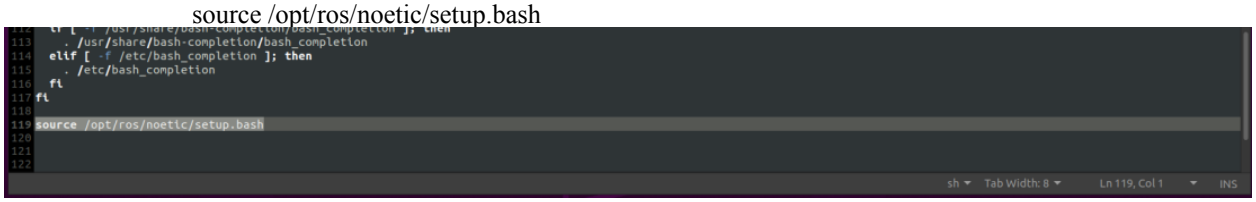
5. Environment setup

Open .bashrc to setup environment by gedit or nano

gedit ~/.bashrc

And then, fill this data to last line of .bashrc

source /opt/ros/noetic/setup.bash



Source .bashrc

source ~/.bashrc

6. Check ROS version

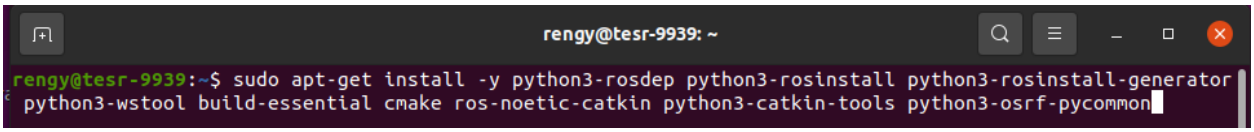
rosversion -d

If your installation is complete and by right version “noetic” will show up

[Optional]

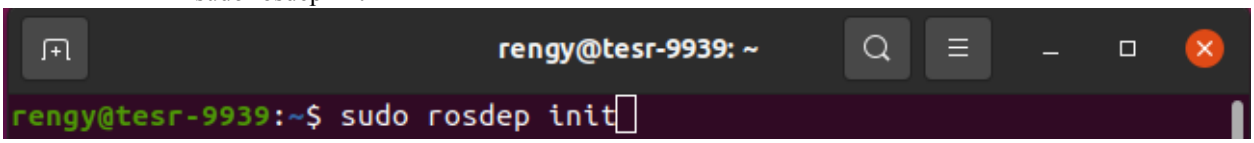
Install dependencies packages for building packages

sudo apt install python3-rosdep python3-rosinstall python3-rosinstall-generator python3-wstool build-essential cmake python3-catkin-tools python3-osrf-pycommon

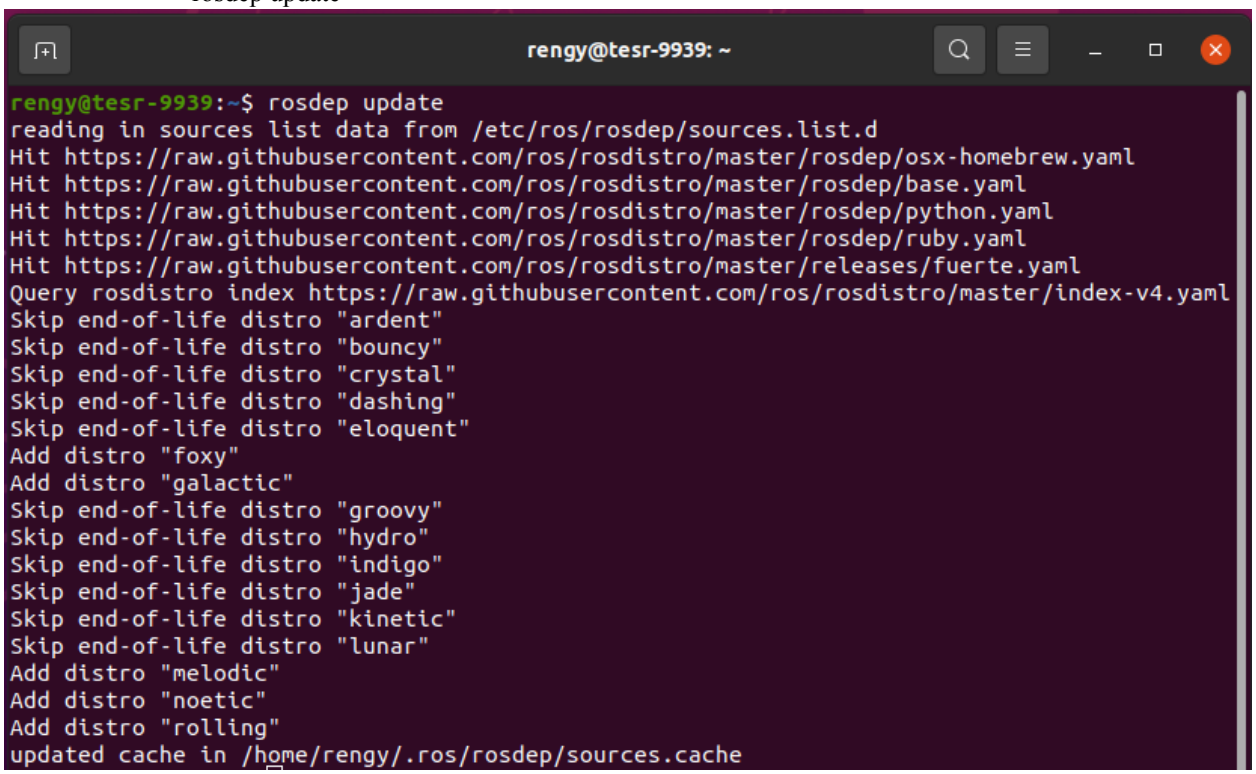


Initialize and update rosdep

sudo rosdep init

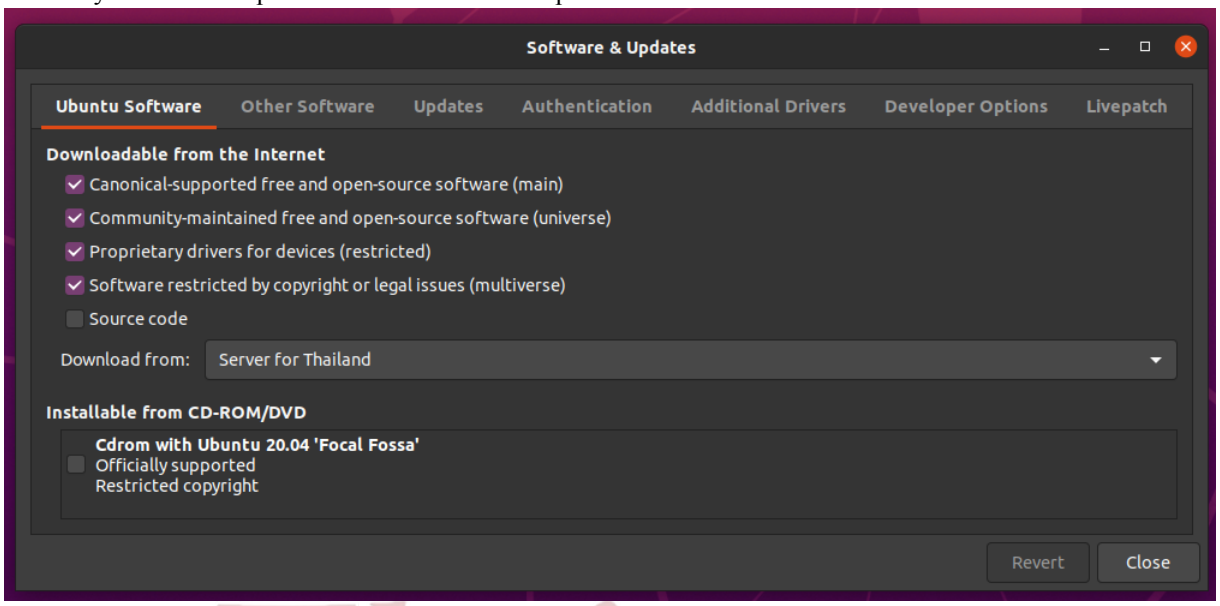


rosdep update



ROS Noetic Synaptic package manager method

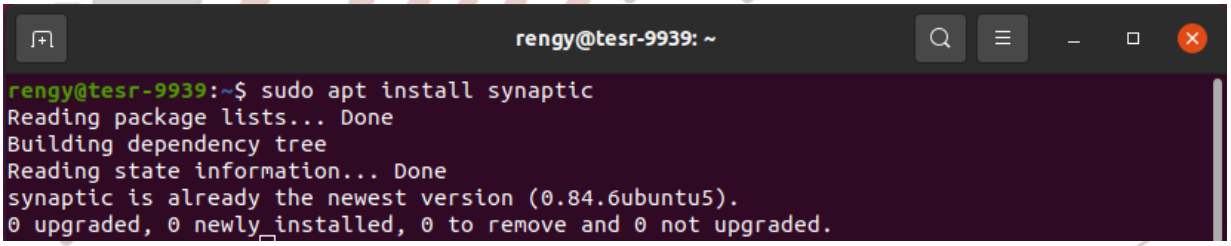
1. Make your Ubuntu repositories in “Software & Updates”



2. Setup Synaptic package manager

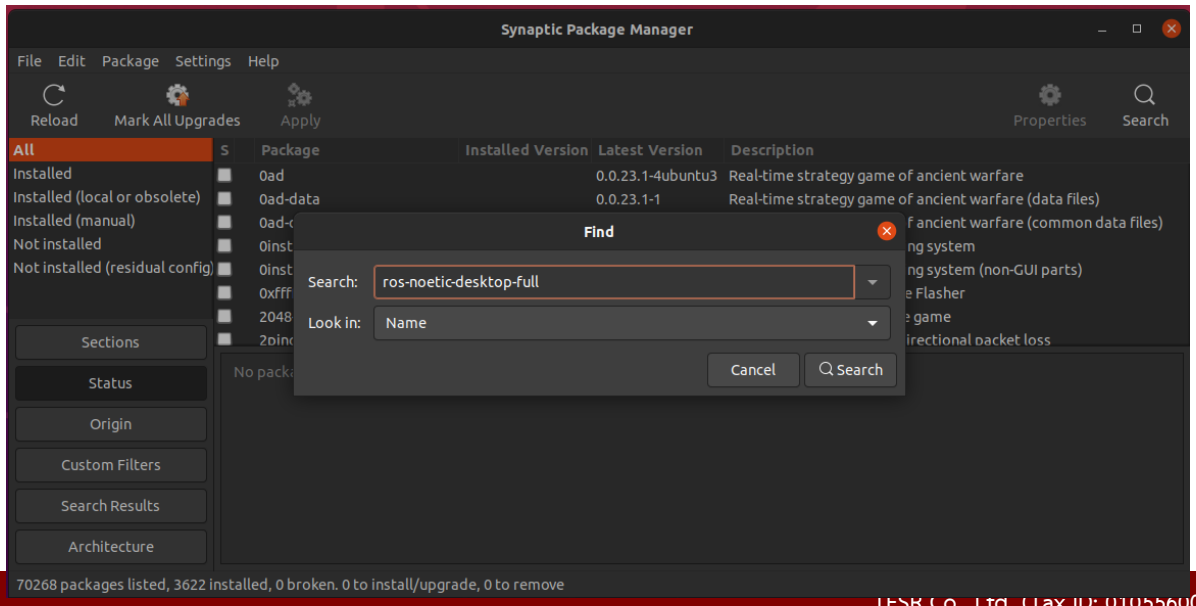
Install “Synaptic package manager”

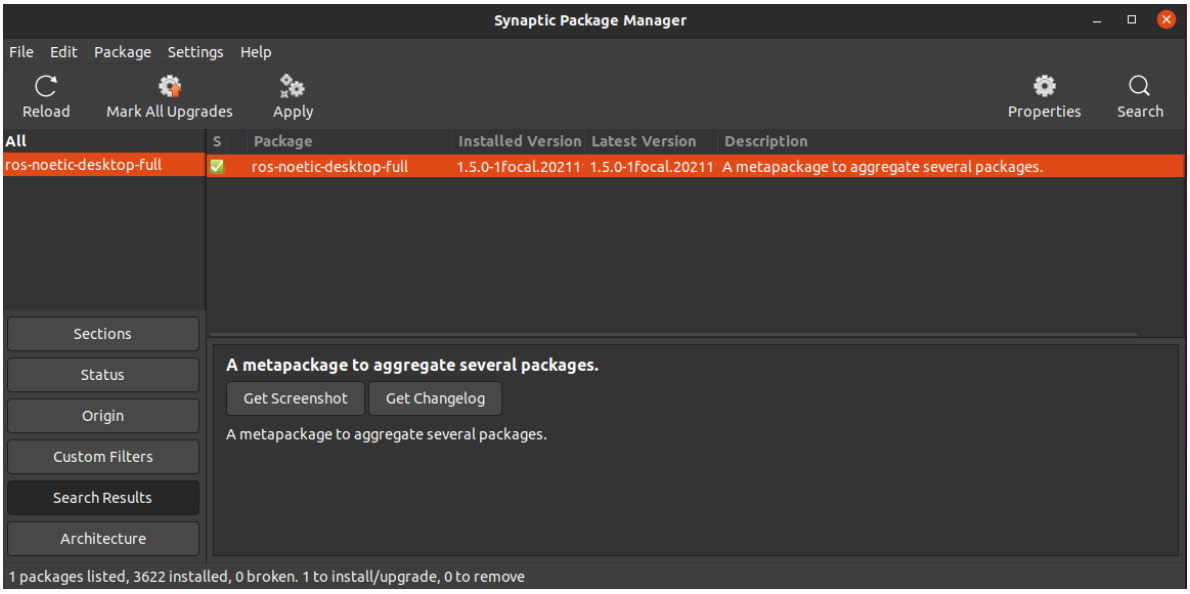
sudo apt synaptic



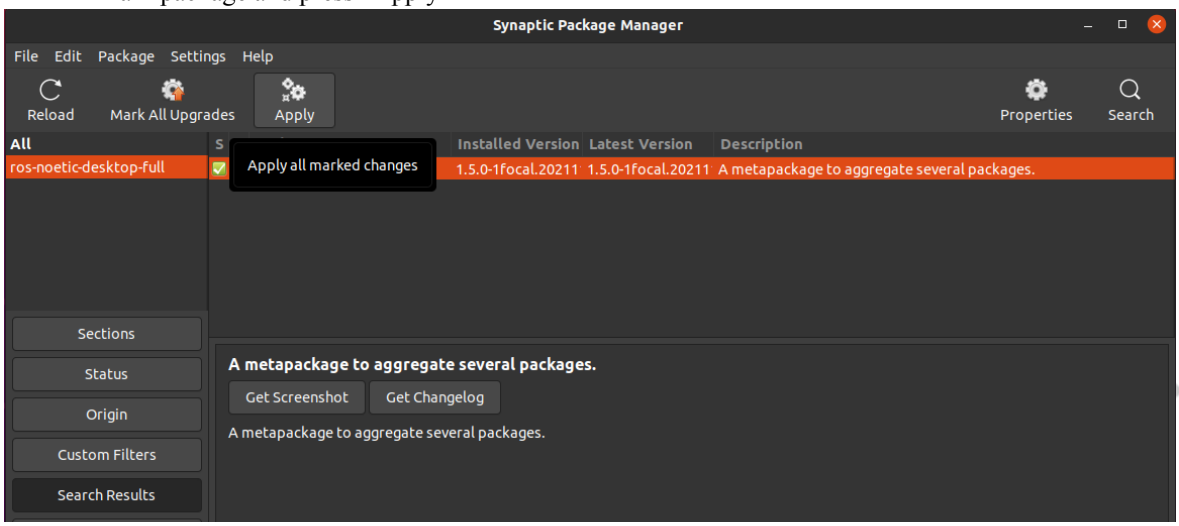
3. Installation

Open Synaptic packages manager and type “ros-noetic-desktop-full” to search box and mark for installation.





Mark package and press “Apply”



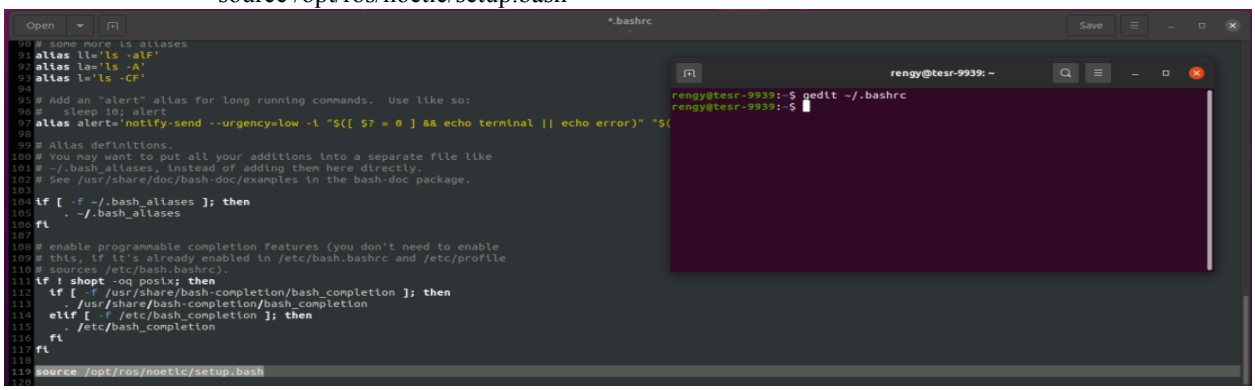
4. Environment setup

Open .bashrc to setup environment by gedit or nano

```
gedit ~/.bashrc
```

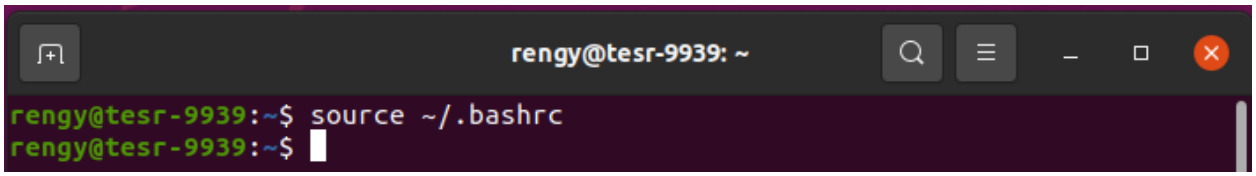
And then, fill this data to last line of .bashrc

```
source /opt/ros/noetic/setup.bash
```



Source .bashrc

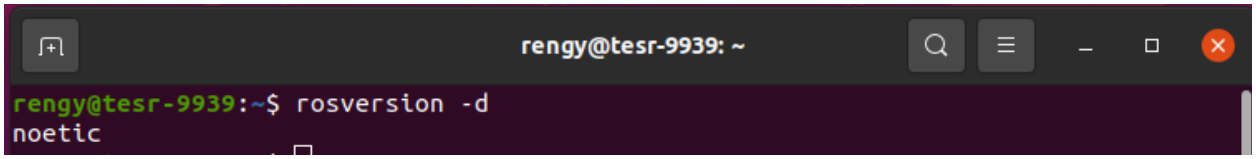
source ~/.bashrc



5. Check ROS version

If your installation is complete and by right version “noetic” will show up

rosversion -d

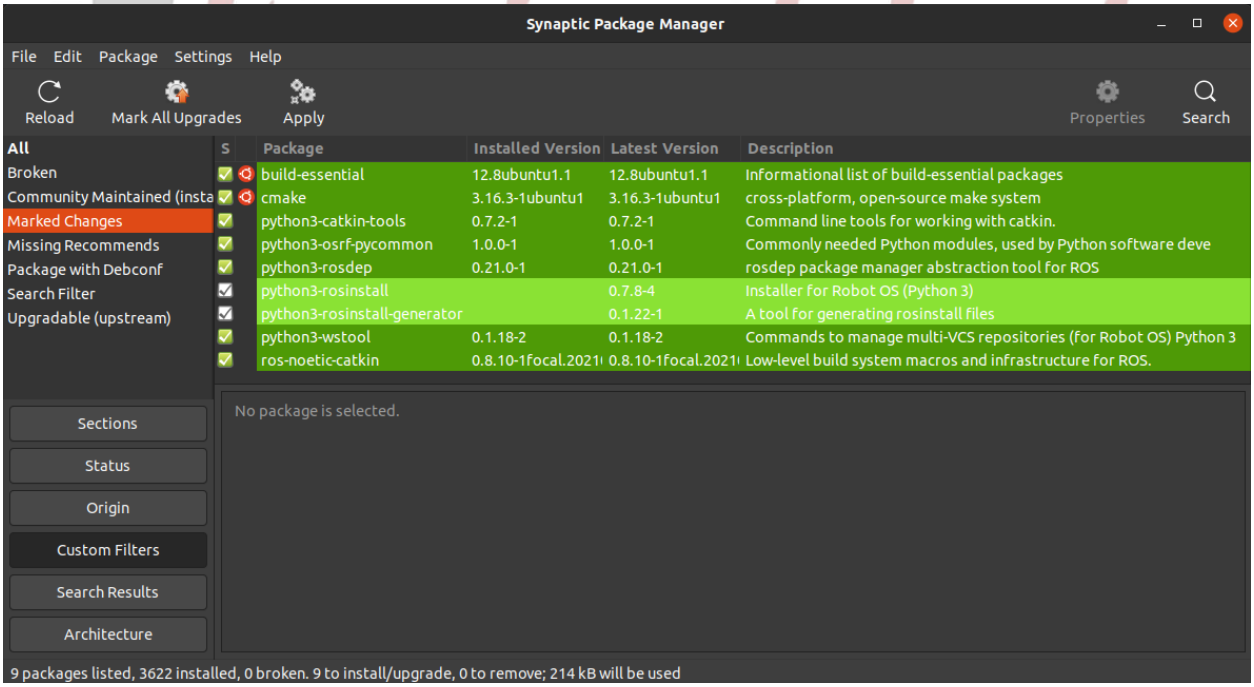


[Optional]

Install dependencies packages for building packages. Type this list in search box and mark it to installation

python3-rosdep
python3-rosinstall
python3-rosinstall-generator
Python3-wstool
Build-essential
Cmake
ros-noetic-catkin
python3-catkin-tools
python3-osrf-pycommon

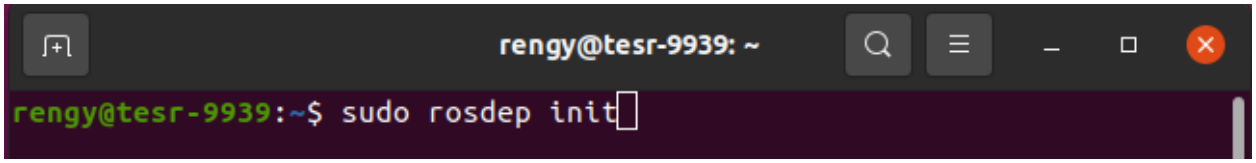
* You can see marked list at “Custom Filter > Marked Changes”



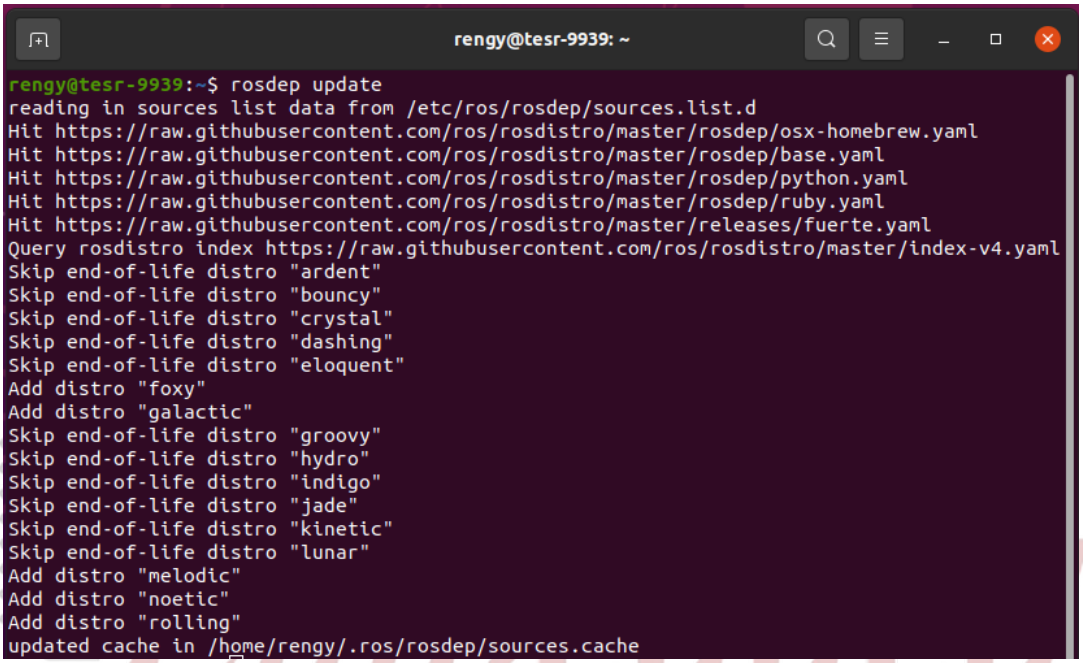
Initialize and update rosdep

Open terminal and initialize rosdep

sudo rosdep init



rosdep update



Install Dependent ROS Packages

Run command line following below:

sudo apt-get install ros-noetic-joy ros-noetic-teleop-twist-joy \
ros-noetic-teleop-twist-keyboard ros-noetic-laser-proc \
ros-noetic-rgbd-launch ros-noetic-rosserial-arduino \
ros-noetic-rosserial-python ros-noetic-rosserial-client \
ros-noetic-rosserial-msgs ros-noetic-amcl ros-noetic-map-server \
ros-noetic-move-base ros-noetic-urdf ros-noetic-xacro \
ros-noetic-compressed-image-transport ros-noetic-rqt* ros-noetic-rviz \
ros-noetic-gmapping ros-noetic-navigation ros-noetic-interactive-markers

```
rengy@tesr-9939:~$ sudo apt-get install ros-noetic-joy ros-noetic-teleop-twist-joy \
>   ros-noetic-teleop-twist-keyboard ros-noetic-laser-proc \
>   ros-noetic-rgbd-launch ros-noetic-rosserial-arduino \
>   ros-noetic-rosserial-python ros-noetic-rosserial-client \
>   ros-noetic-rosserial-msgs ros-noetic-amcl ros-noetic-map-server \
>   ros-noetic-move-base ros-noetic-urdf ros-noetic-xacro \
>   ros-noetic-compressed-image-transport ros-noetic-rqt* ros-noetic-rviz \
>   ros-noetic-gmapping ros-noetic-navigation ros-noetic-interactive-markers
[sudo] password for rengy:
```

Installation of moveit

Step1 Prepare dependencies package

First thing first, make sure you're keep most of packages are up-to-date

- Open the terminal by press "Ctrl + Alt + T"
- Type "rosdep update"
  "sudo apt update"
  "sudo apt dist-upgrade"

Install catkin the ROS build system

- Type "sudo apt install ros-noetic-catkin python3-catkin-tools python3-osrf-pycommon"

Install wstool

- Type "sudo apt install python3-wstool"

Step2 Create a Catkin Workspace and Download Moveit Source

***Moveit is require to have a catkin workspace setup because of the version of tutorials use master branch which is being actively developed, you will most likely need to build all of Moveit from source**

Open the terminal by press "Ctrl + Alt + T" and type command following as:

"mkdir -p ~/ws_moveit/src"
"cd ~/ws_moveit/src"
"wstool init ."
"wstool merge -t . https://raw.githubusercontent.com/ros-planning/moveit/master/moveit.rosinstall"
"wstool remove moveit_tutorials"
"wstool update -t ."

Download Example Code

"cd ~/ws_moveit/src"
"git clone https://github.com/ros-planning/moveit_tutorials.git -b master"
"git clone https://github.com/ros-planning/panda_moveit_config.git -b noetic-devel"

Step3 Build your Catkin Workspace

This step below will install from debian any package dependencies not in the workspace yet.

Open the terminal by press "Ctrl + Alt + T" and type:
"cd ~/ws_moveit/src"
"rosdep install -y --from-paths . --ignore-src --rosdistro noetic"

***If you've found any error while this step. Try to type following this line:**

"sudo sh -c 'echo "deb http://packages.ros.org/ros-testing/ubuntu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'"
"sudo apt update"

Configure your catkin workspace:

"cd ~/ws_moveit"
"catkin config –extend /opt/ros/${ROS_DISTRO} --cmake-args -DCMAKE_BUILD_TYPE=Release"
"catkin build"

Source the catkin workspace:

"source ~/ws_moveit/devel/setup.bash"

[Recommended] Add the previous command to your .bashrc:

"echo 'source ~/ws_moveit/devel/setup.bash' >> ~/.bashrc"

Download and install the dependencies source packages

First thing first, type “sudo apt install ros-noetic-franka-description” to install franka-description. And then, Download files below.

- **tesr_ros_six_servo_robot_pkg.zip**
- **six_servo.zip**
- **tesr_ros_six_servo_arm_moveit_config.zip**

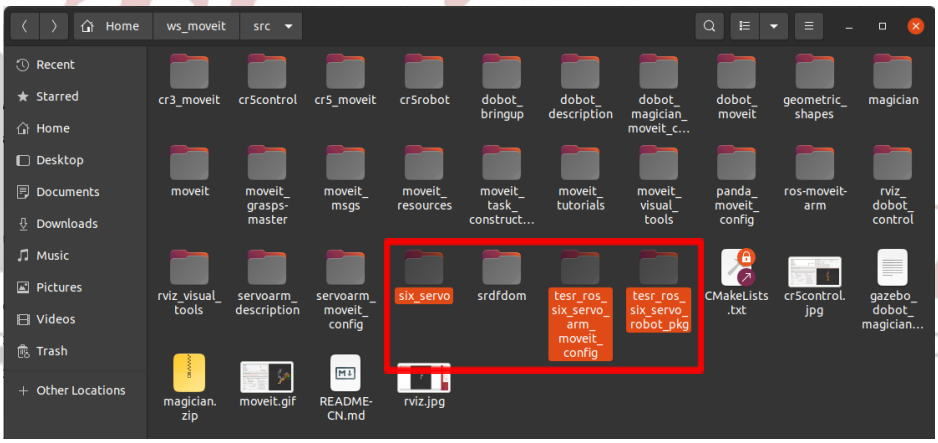
Source package explanation

- tesr_ros_six_servo_robot_pkg is contains the launch file for joystick control and shows the monitoring. And the launch file shows the simulation of a six-servo robot’s motion on Rviz using the python script.
- six_servo.zip is contain the URDF file that is required to use in moveit
- tesr_ros_six_servo_arm_moveit_config is contain the configuration files, launch files and python using control six_servo_arm in moveit

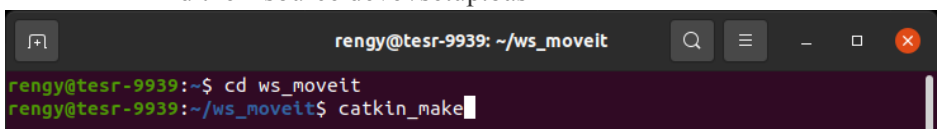
*Keep that in mind, the name of extracted source pkg should as same as original name before extract. If not and error about can’t find the dependencies pkg. So, the package.xml file “**must**” edit to fix a problem that occur.

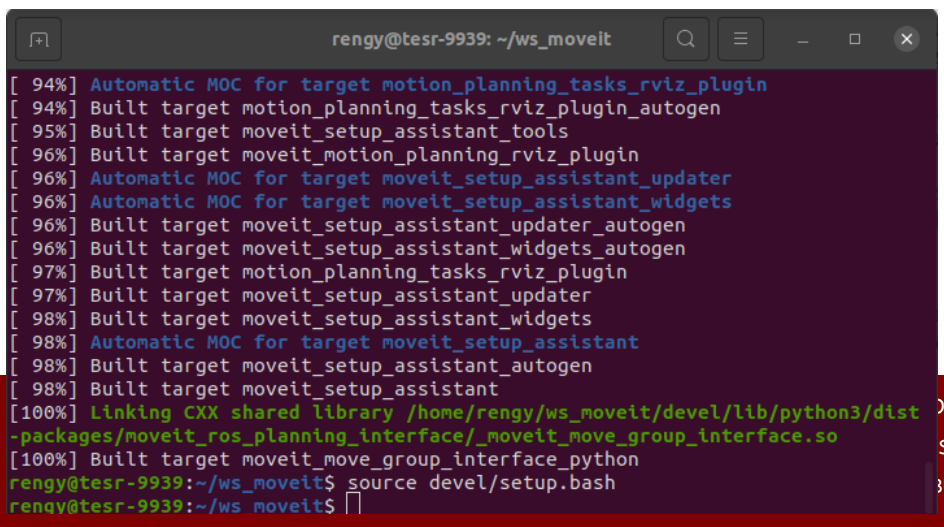
Setup package in workspace

- After download the zip files, move and extract it separately to ws_moveit/src



- Type “cd ws_moveit”, “catkin_make” wait until finish [100%]
  - And then“source devel/setup.bash”





How to launch tesr_ros_six_servo_robot_pkg

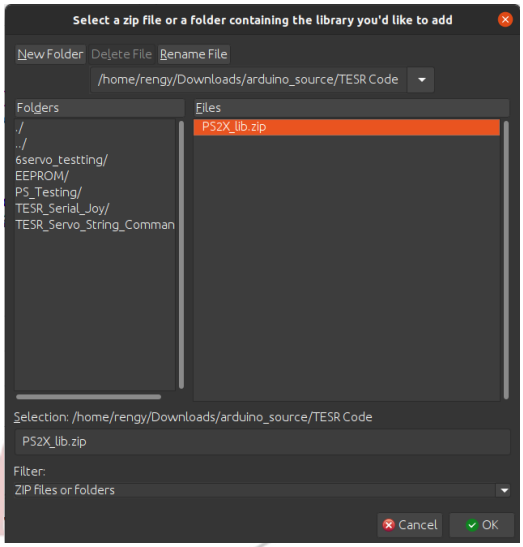
Setup of Arduino board and Setup Robot home pose

*This setup is for robot operation core. So, please set up the following step by steps to make the robot arm operate properly and prevent unpredicted issues.

Step 1

Download TESR Code.zip and Execute.

1.1 Open Arduino and go to Sketch > Import Library... > Add Library... and select "PS2X_lib.zip"

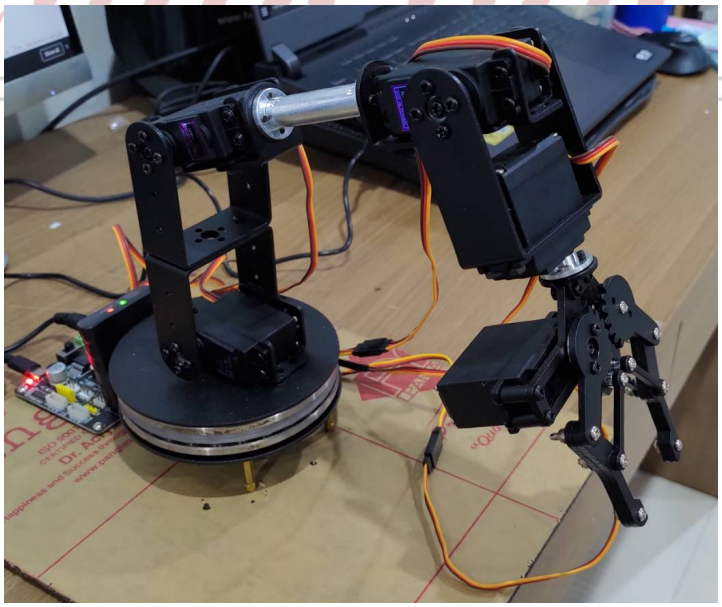


Step 2

Verify and Upload code in Folder as following:

2.1 /TESR Code/EEPROM/EEPROM_Write/EEPROM_Write.ino

2.2 /TESR Code/TESR_Serial_Joy/TESR_Serial_Joy.ino

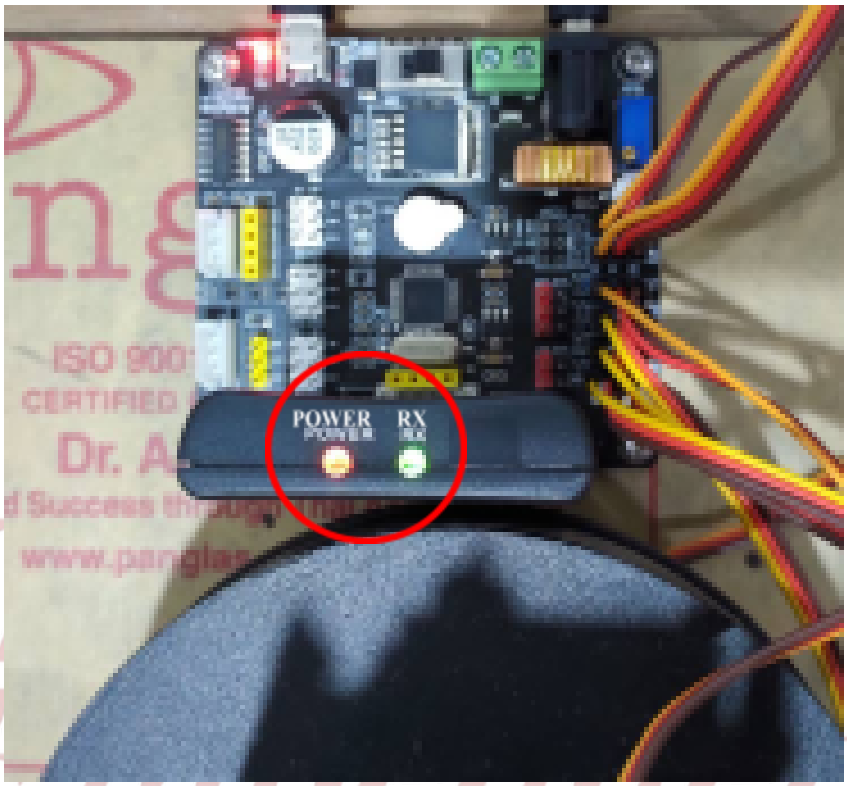


* 2.1 for Set default for home position into microcontroller memory and 2.2 is to make the robot available to connect with the joystick.

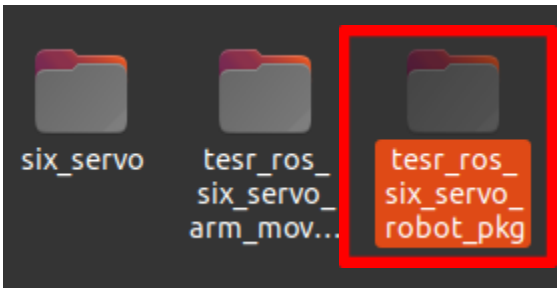
** If Robot Arm doesn't go to home pose while Turn-On. So, Turn-off robot with an Unplug power adapter and USB cable. And then, turn the robot on and repeat step 2 again.

Step 3

After step 2, the robot should be able to be controlled by a Joystick. So, turn-on the joystick and observe the green light status labeled as "RX" on the microcontroller board. if it is bright without blinking. it means the joystick and robot are connected and it ready to work



Operate Joystick control and monitoring on rviz by ROS launch file



Step 1

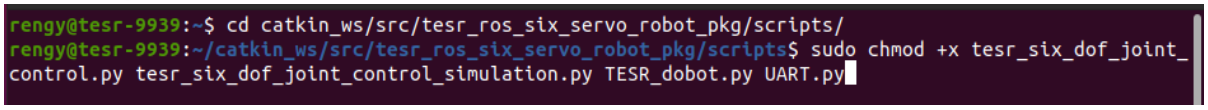
Connect the USB cable to your PC or Laptop and type "ls /dev/tty*" to find which port do we can connect such as /dev/ttyUSB0
give the permission to connect for /dev/ttyUSB0 by type "sudo chmod +x /dev/ttyUSB0"

* ttyUSB or USB port definition can be another number. Make sure you're connected with the right USB port.

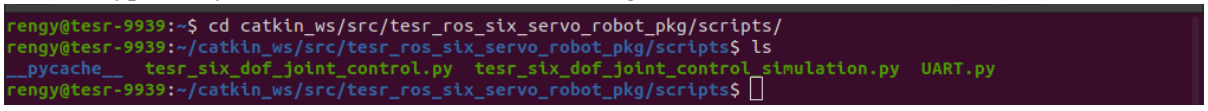
Step 2

Change directory to the scripts by type "cd catkin_ws/src/tesr_ros_six_servo_robot_pkg/scripts/" and type "ls" to check permission of file in scripts. After that, we will see a list of code with the white font.

So, we must to verify permission to those codes by type "sudo chmod +x tesr_six_dof_joint_control.py tesr_six_dof_joint_control_simulation.py TESR_dobot.py UART.py"



After this, type "ls" you will see a list of code with the green font.



* If [Errno 13] Permission denied: '/dev/ttyUSB0' type "sudo chmod 777 /dev/ttyUSB0" if chmod +x doesn't work.

Code Explain

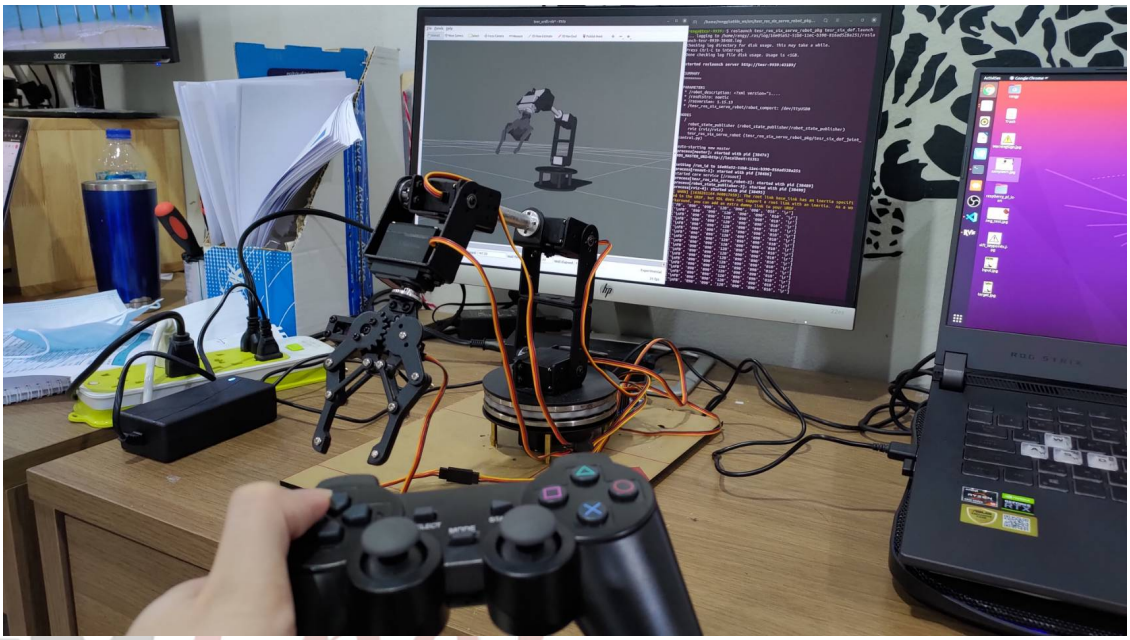
tesr_six_dof_joint_control.py: receive string data from microcontroller using joystick to command the motion of robot and publish value to robot model is included.

tesr_six_dof_joint _control_simulation.py: simulate and publish the joint data to robot model.

UART.py: Coding for check the string data from microcontroller.

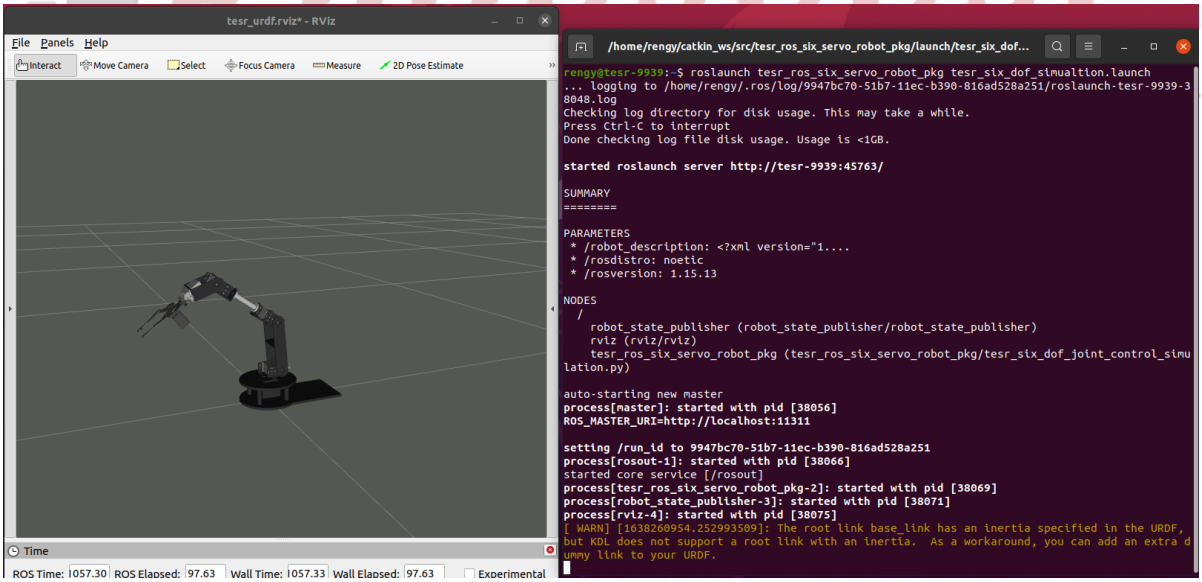
Step 3

Type "roslaunch tesr_ros_six_servo_robot_pkg tesr_six_dof.launch" for control the Robot Arm by Joystick



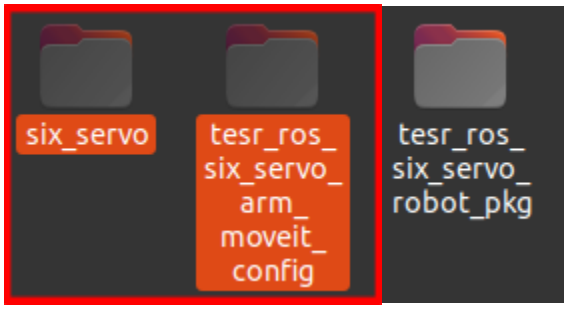
Or

Type "roslaunch tesr_ros_six_servo_robot_pkg tesr_six_dof_simulation.launch" to watch a motion simulation using python scripts.



==========Enjoy==========

How to launch tesr_ros_six_servo_arm_moveit_config



Step 1

First thing first, make sure your PC/Laptop already connect with USB check it as same as Step1 to "Operate Joystick control and monitoring on rviz by ROS launch file"

Type "ls /dev/tty*" #/dev/ttyUSB0 should be show up or can be ttyUSB1, ttyUSB2

* If [Errno 13] Permission denied: '/dev/ttyUSB0' type "sudo chmod +x /dev/ttyUSB0" or type "sudo chmod 777 /dev/ttyUSB0" if chmod +x doesn't work.

Step 2

We must verify the permission of python scripts in tesr_ros_six_ser_arm_moveit_config by type the command following as:

"cd ws_moveit/src/tesr_ros_six_servo_arm_moveit_config/scripts" #go to file's path directory.

"ls" #check the file permission if list of file are white or green font.

```
rengy@tesr-9939:~$ cd ws_moveit/src/tesr_ros_six_servo_arm_moveit_config/scripts
rengy@tesr-9939:~/ws_moveit/src/tesr_ros_six_servo_arm_moveit_config/scripts$ ls
tesr_ros_moveit_to_six_servoarm.py
```

The list with white font is means the file is not verify yet. So, we must verify it by chmod.

"sudo chmod +x *" #After chmod compile list should be turn to green font.

```
rengy@tesr-9939:~/ws_moveit/src/tesr_ros_six_servo_arm_moveit_config/scripts$ sudo chmod +x *
[sudo] password for rengy:
rengy@tesr-9939:~/ws_moveit/src/tesr_ros_six_servo_arm_moveit_config/scripts$ ls
tesr_ros_moveit_to_six_servoarm.py
```

Code Explain

tesr_ros_moveit_to_six_servoarm.py: receive the joint data from moveit and use it to control robot arm to move follow moveit's path planning.

Step 3

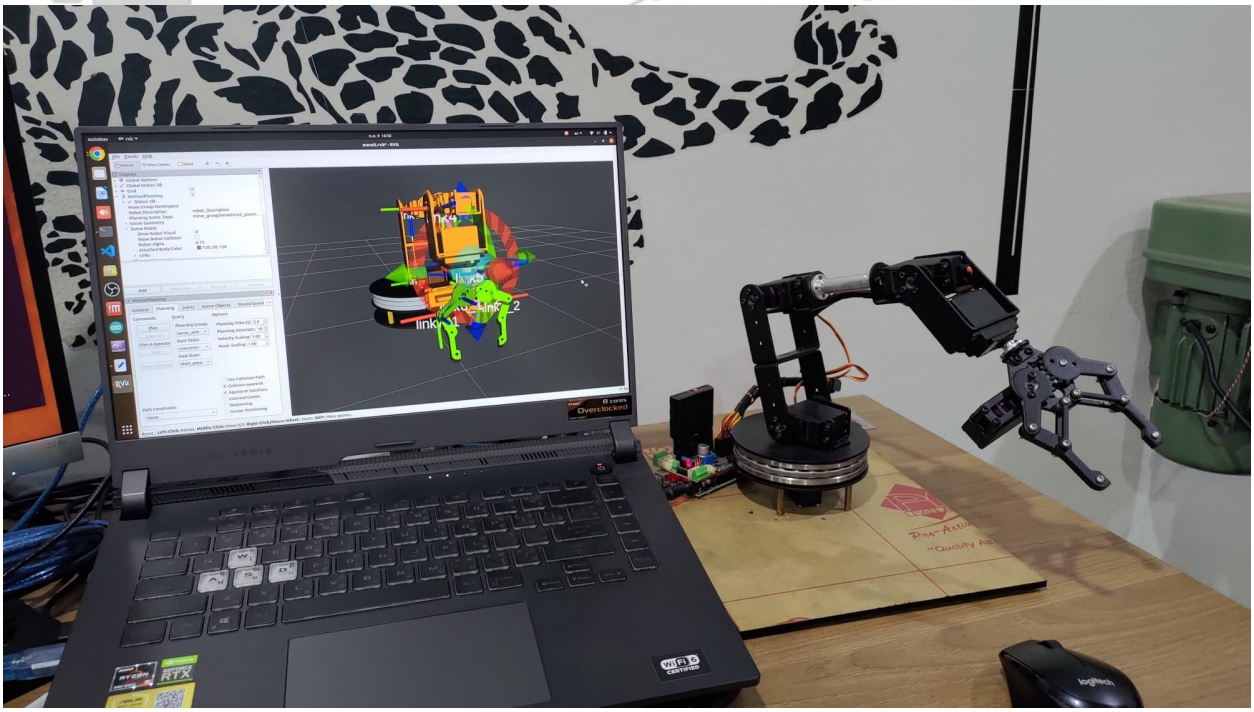
Next, Let's launch the file from package by type:
"roslaunch tesr_ros_six_servo_arm_moveit_config tesr_six_servo_moveit_sync_pose.launch"

```
rengy@tesr-9939:~$ roslaunch tesr_ros_six_servo_arm_moveit_config tesr_six_servo_moveit_sync_pose.launch
... logging to /home/rengy/.ros/log/bdde3fc0-cf6e-11ec-be8f-310e46885196/roslaunch-tesr-9939-75494.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://192.168.1.20:40611/

SUMMARY
========

PARAMETERS
 * /joint_state_publisher/source_list: ['move_group/fake...
 * /move_group/allow_trajectory_execution: True
 * /move_group/capabilities:
```

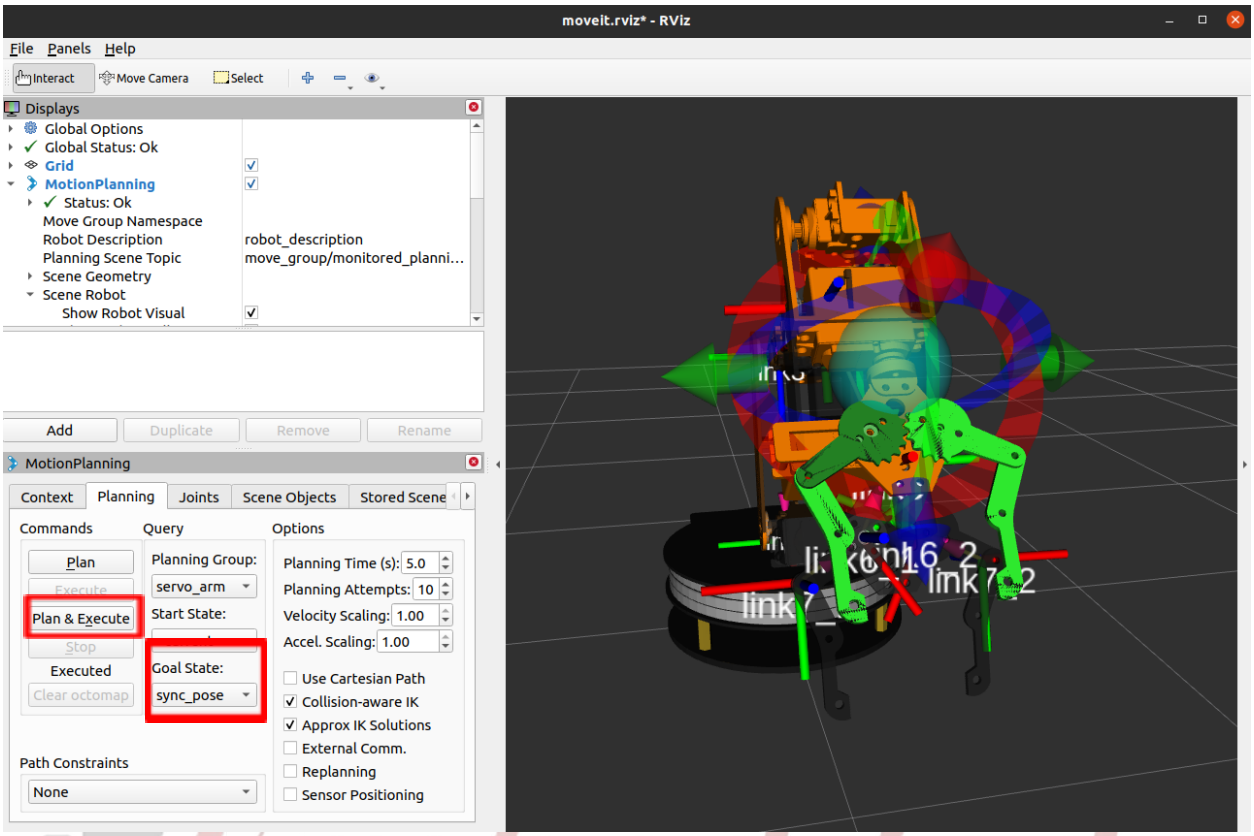
```
[ INFO] [1652089002.811261713]: MoveGroup context using planning plugin ompl_interface/OMPLPlanner
[ INFO] [1652089002.811277503]: MoveGroup context initialization complete

You can start planning now!

[ INFO] [1652089005.304289819]: Loading robot model 'six_servo'...
[ INFO] [1652089005.750240847]: Starting planning scene monitor
[ INFO] [1652089005.751492885]: Listening to '/move_group/monitored_planning_scene'
[ INFO] [1652089006.441400804]: Constructing new MoveGroup connection for group 'servo_arm' in namespace ''
[ INFO] [1652089007.430465720]: Ready to take commands for planning group servo_arm.
```

After the log info show "Ready to take command for planning group servo_arm" that's mean you're ready to use moveit for path planning of six servo arm.

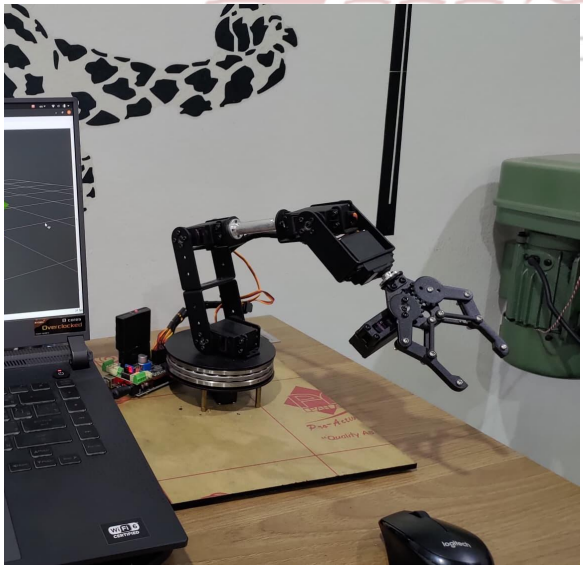
But when you start the launch file robot arm's pose and moveit will not sync.



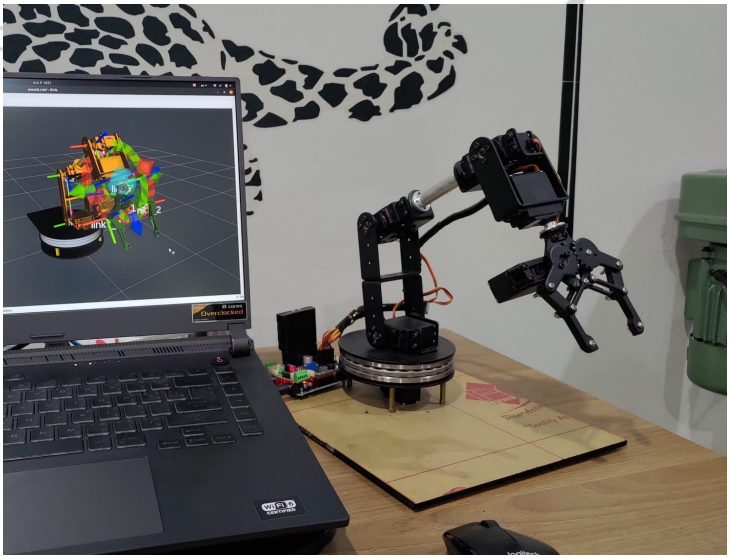
So, Let's sync first pose of robot arm and moveit by select "sync_pose" in Goal State and press "Plan & Execute"



After Plan & Execute robot arm's pose and moveit will sync. So, You can use it properly from now on.

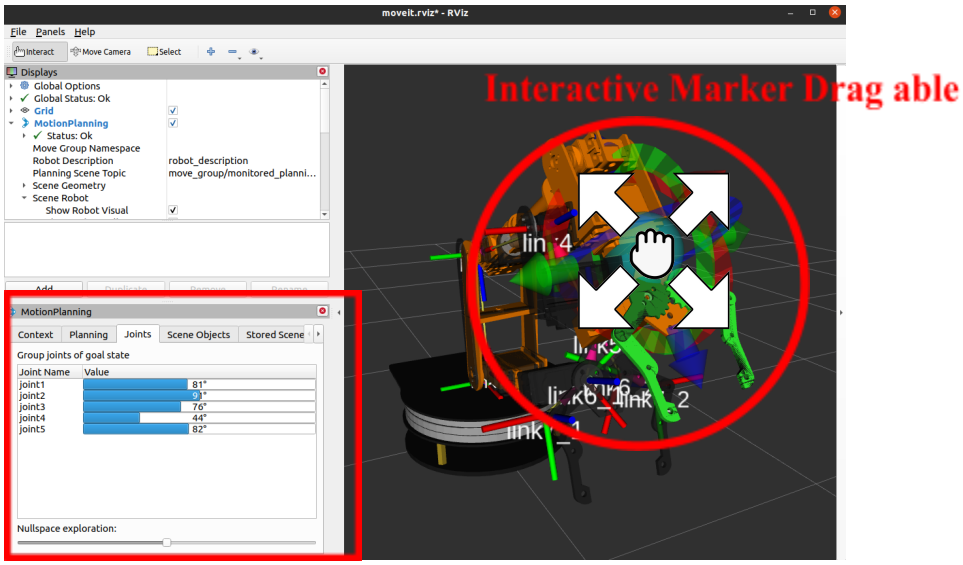


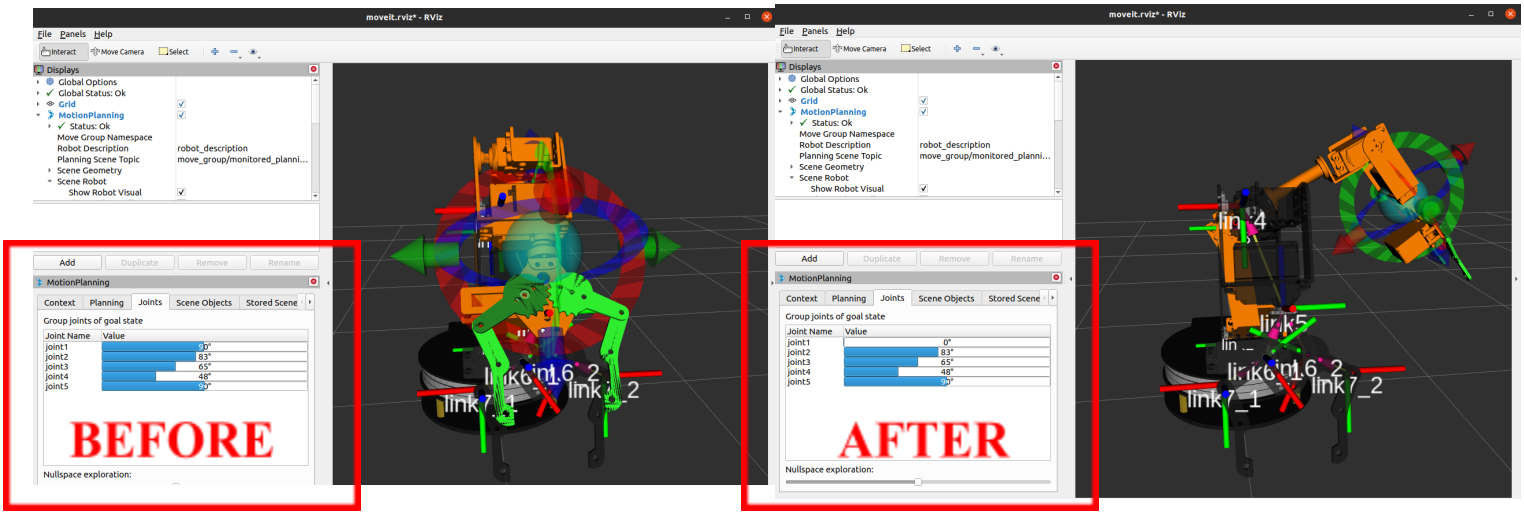
BEFORE

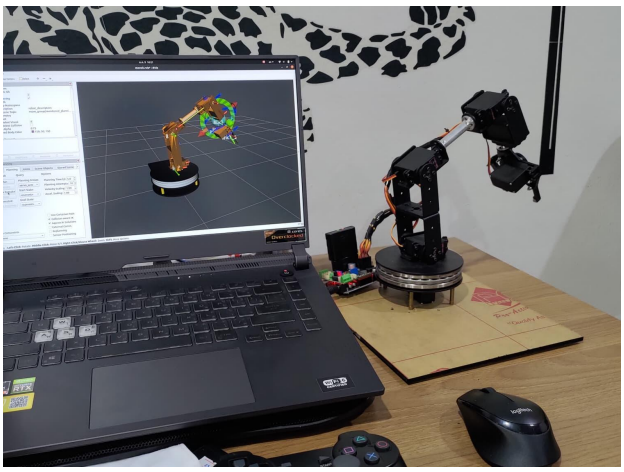


AFTER

Now, you can use Interactive marker or Joint slider bars to move the Goal state to use as robot's goal







BEFORE AFTER