

Robot Operating System

# ROS

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## Overview :

- Developing a robot with a computer brain requires a bunch of software tools on the computer side — like software drivers, third party tools for computer vision and simulation tools. ROS framework gathers all these tools and manages how you develop a code for your robot.

Instead of reinventing the wheel every time, some frameworks can help you by gathering all these tools and managing how you develop code for your robot. ROS (Robot Operating System) is one of these frameworks. It's a special framework initially developed by the Stanford AI Laboratory in 2007 for developing robots. The Open Source Robotics Foundation now maintains ROS.

- **Why do we call ROS OS?** because it provides all the services that any other OS does—like hardware abstraction, low-level device control, implementation of commonly-used functionality, message-passing between processes, and package management.[1]

- **ROS and other frameworks:** Simply, ROS is the most popular frameworks now. most of the other frameworks that were present at the beginning of the development of ROS development support were interrupted and projects closed, for example, CARMEN, ORCOS, YARP, MOOS, Microsoft Developer Robotics Studio, and others, some libraries were transferred from it to the ROS such as Player. With the exception of a number of simulators now in place, there is no ROS competitor doing the same full function now.

- **But what is the main advantage ROS has in exchange for them?**

ROS was not designed to be the largest framework with the largest number of libraries (although now it is) but was designed to facilitate the easy reuse of libraries between different robots in an easy way. ROS focused more on providing the basic infrastructure for developing robots.

The method of working and designing ROS attracted some people to use in some non-robot applications.[2.]

## Installation :

There is more than one ROS distribution supported at a time. Some are older releases with long term support, making them more stable, while others are newer with shorter support life times, but with binaries for more recent platforms and more recent versions of the ROS packages that make them up.[3.]

### ROS Kinetic Kame

Released May, 2016

LTS, supported until April, 2021

*This version isn't recommended for new installs.*



### ROS Melodic Morenia

Released May, 2018

LTS, supported until May, 2023

*Recommended for Ubuntu 18.04*

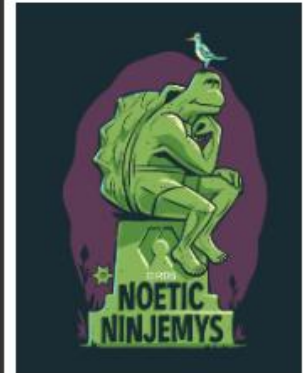


### ROS Noetic Ninjemys

Released May, 2020

**Latest LTS**, supported until May, 2025

*Recommended for Ubuntu 20.04*



- in this report I will explain how install ROS Noetic :

- Prerequisites :

1. download [virtualbox](#) if have computer without Ubuntu operating system.
2. download [ubuntu](#) .

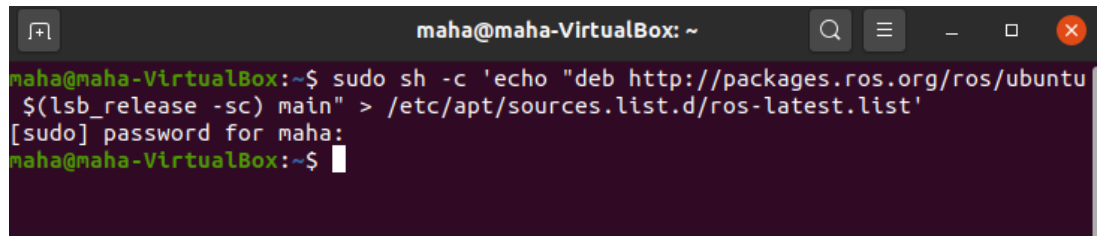
For more details see the reference.[4]

## Download steps [5]

**Step1:** Configure your Ubuntu repositories to allow "restricted," "universe," and "multiverse." You can [follow the Ubuntu guide](#) for instructions on doing this.

**Step2** : open the terminal and type the following command for 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'`

A terminal window titled 'maha@maha-VirtualBox: ~' showing the command `sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'` being executed. The prompt asks for the password for 'maha', which is entered, and the command completes successfully.

```
maha@maha-VirtualBox: ~  
maha@maha-VirtualBox:~$ sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'  
[sudo] password for maha:  
maha@maha-VirtualBox:~$
```

**Step3**: Set up your keys :

- `sudo apt-key adv --keyserver 'hkp://keyserver.ubuntu.com:80' --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654`

A terminal window titled 'maha@maha-VirtualBox: ~' showing the command `sudo apt-key adv --keyserver hkp://ha.pool.sks-keyserver.net:80 --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654` being executed. The prompt asks for the password for 'maha', which is entered. The command outputs information about the key being imported, including the key ID and the name 'Open Robotics'.

```
maha@maha-VirtualBox:~$ sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'  
[sudo] password for maha:  
maha@maha-VirtualBox:~$ sudo apt-key adv --keyserver hkp://ha.pool.sks-keyserver.net:80 --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654  
Executing: /tmp/apt-key-gpghome.2hNk6az0TH/gpg.1.sh --keyserver hkp://ha.pool.sks-keyserver.net:80 --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654  
gpg: key F42ED6FBAB17C654: public key "Open Robotics <info@osrfoundation.org>" imported  
gpg: Total number processed: 1  
gpg: imported: 1  
maha@maha-VirtualBox:~$
```

**Step 4**: Installation

First, make sure your Ubuntu package index is up-to-date:

- `sudo apt update`

```
maha@maha-VirtualBox:~$ sudo apt update
Hit:1 http://us.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://security.ubuntu.com/ubuntu focal-security InRelease [107 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu focal-updates InRelease [107 kB]
Get:4 http://packages.ros.org/ros/ubuntu focal InRelease [4,650 B]
Get:5 http://packages.ros.org/ros/ubuntu focal/main i386 Packages [15.1 kB]
Get:6 http://packages.ros.org/ros/ubuntu focal/main amd64 Packages [199 kB]
Get:7 http://us.archive.ubuntu.com/ubuntu focal-backports InRelease [98.3 kB]
Get:8 http://us.archive.ubuntu.com/ubuntu focal-updates/main i386 Packages [103 kB]
Get:9 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [199 kB]
Get:10 http://us.archive.ubuntu.com/ubuntu focal-updates/main Translation-en [78.8 kB]
Get:11 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 c-n-f Metadata [5,788 B]
Get:12 http://us.archive.ubuntu.com/ubuntu focal-updates/universe amd64 c-n-f Metadata [4,112 B]
Fetched 921 kB in 18s (52.0 kB/s)
Reading package lists... 41%
```

And then type the following command for install full desktop version :

- `sudo apt install ros-noetic-desktop-full`

```
maha@maha-VirtualBox:~$ sudo apt install ros-noetic-desktop-full
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  autoconf automake autopoint autotools-dev binfmt-support blt bzip2-doc
  cmake cmake-data comerr-dev cpp-8 curl cython3 debhelper
  default-libmysqlclient-dev dh-autoreconf dh-strip-nondeterminism
  docutils-common dwz fltk1.3-doc fluid fonts-lato fonts-lyx freeglut3
  freeglut3-dev gazebo11 gazebo11-common gazebo11-plugin-base gcc-8
  gcc-8-base gdal-data gettext gfortran gfortran-8 gfortran-9 gir1.2-gtk-2.0
  gir1.2-harfbuzz-0.0 google-mock googletest graphviz hddtemp hdf5-helpers
  ibverbs-providers icu-devtools ignition-tools intltool-debian
  javascript-common krb5-multidev libaec-dev libaec0 libann0 libapr1
  libapr1-dev libaprutil1 libaprutil1-dev libarchive-cpio-perl
  libarchive-zip-perl libarmadillo-dev libarmadillo9 libarpack2
  libarpack2-dev libass9 libassimp-dev libassimp5 libassuan-dev
  libatk-bridge2.0-dev libatk1.0-dev libatspi2.0-dev libavcodec-dev
  libavdevice-dev libavdevice58 libavfilter-dev libavfilter7 libavformat-dev
  libavresample-dev libavresample4 libavutil-dev libblas-dev libblas3
  libblkid-dev libboost-all-dev libboost-atomic-dev libboost-atomic1.71-dev
  libboost-atomic1.71.0 libboost-chrono-dev libboost-chrono1.71-dev
  libboost-chrono1.71.0 libboost-container-dev libboost-container1.71-dev
```

A message will appear to confirm the installation. Type `y`, and Then press Enter:

```
0 upgraded, 1009 newly installed, 0 to remove and 0 not upgraded.
Need to get 534 MB of archives.
After this operation, 2,700 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
```

-If you encounter some errors when running, try the following:

try install with following command and check the strength of your internet connection:

- `sudo apt install ros-noetic-desktop-full --fix-missing`

#### Step5: Environment setup :

You must source this script in every **bash** terminal you use ROS in.

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

It can be convenient to automatically source this script every time a new shell is launched. These commands will do that for you.

Bash

```
echo "source /opt/ros/noetic/setup.bash" >> ~/.bashrc
source ~/.bashrc
```

zsh


```
echo "source /opt/ros/noetic/setup.zsh" >> ~/.zshrc
source ~/.zshrc
```

```
Setting up ros-noetic-desktop-full (1.5.0-1focal.20200602.152246) ...
Processing triggers for libc-bin (2.31-0ubuntu9) ...
maha@maha-VirtualBox:~$ source /opt/ros/noetic/setup.bash
maha@maha-VirtualBox:~$ echo "source /opt/ros/noetic/setup.bash" >> ~/.bashrc
maha@maha-VirtualBox:~$ source ~/.bashrc
maha@maha-VirtualBox:~$ echo "source /opt/ros/noetic/setup.zsh" >> ~/.zshrc
maha@maha-VirtualBox:~$ source ~/.zshrc
```

#### Step6 : Ensure the a ROS is installed :

First : open new terminal window (ctrl+alt +t), or clear the terminal screen (ctrl+L, other way type 'clear' )

Finally : type 'rosversion -d'

A terminal window with a dark purple background. The prompt is 'maha@maha-VirtualBox:~\$'. The command 'rosversion -d' has been entered, and the output 'noetic' is displayed on the next line. The prompt 'maha@maha-VirtualBox:~\$' is shown again with a white cursor.

```
maha@maha-VirtualBox:~$ rosversion -d
noetic
maha@maha-VirtualBox:~$
```

-If you want to see a video of the installation steps click [here](#).

### **More information :**

- course for ROS Kinetic on udemy click [here](#).
- playlist on youtube for ROS Kinetic click [here](#).
- tutorials click [here](#).
- documentation click [here](#).

## References :

1. [an-introduction-to-robot-operating-system-ros](#) .
2. [robot-operating-system-1](#) .
3. <http://wiki.ros.org/ROS/Installation> .
4. <https://youtu.be/diIW3fgewhI> ,  
[https://youtu.be/vt5Lu\\_ltPkU](https://youtu.be/vt5Lu_ltPkU) ,  
<https://youtu.be/ERi0nchIw8Y> ,  
<https://youtu.be/mOLi4SdRIMc> ,  
<https://www.youtube.com/watch?v=HUFMRYwX9jM> .
5. <http://wiki.ros.org/noetic/Installation/Ubuntu> .