

# ROS tutorial

**How to install ROS on Ubuntu 20.04 OS**

# **Before Installing ROS Noetic**

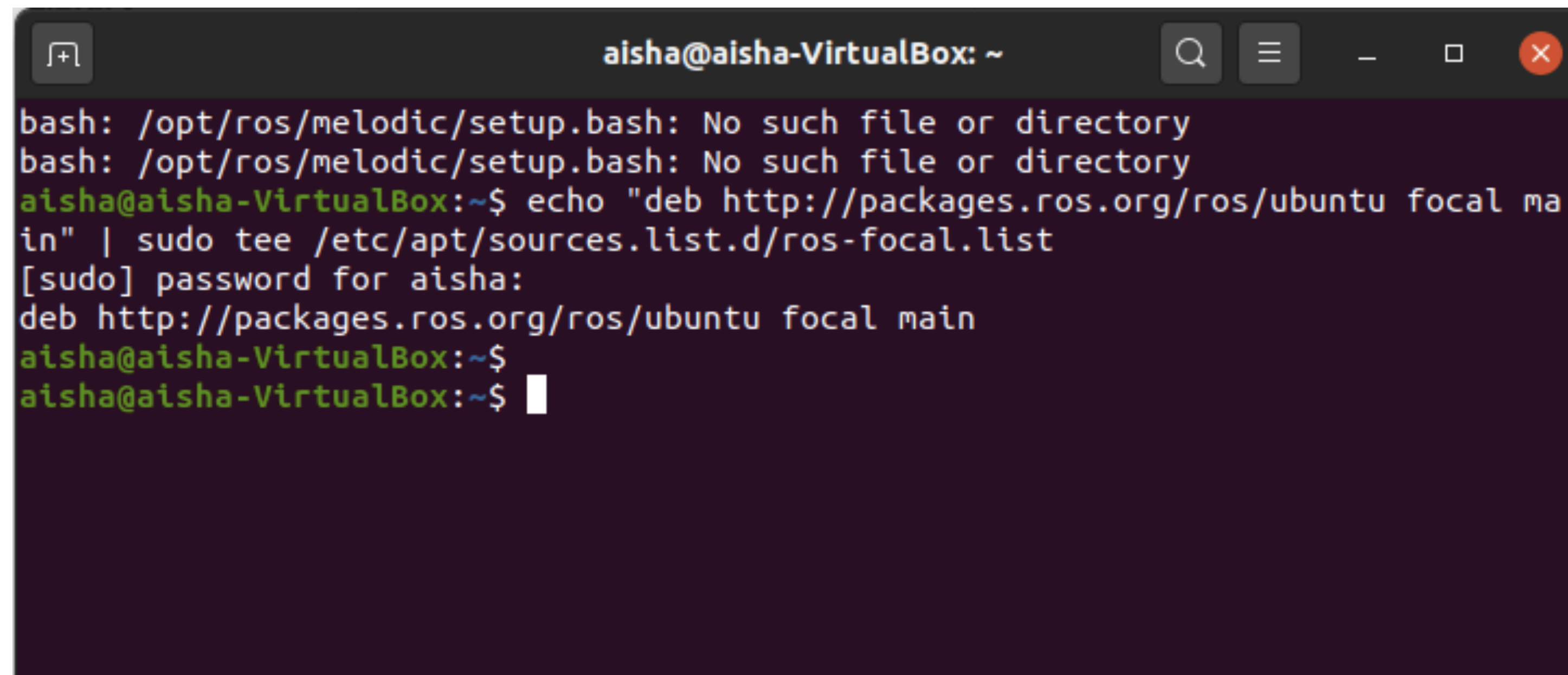
# Step 1 — Set up ROS Noetic repo for Ubuntu 20.04

To install Noetic on Ubuntu 20.04, first we will need to add the official ROS Noetic repo to `sources.list`. Instead of adding directly to `/etc/apt/sources.list`, we will create a new list file `ros-noetic.list`.

To do just that type in the following command:

```
echo "deb http://packages.ros.org/ros/ubuntu focal main" | sudo tee /etc/apt/  
sources.list.d/ros-focal.list
```

The following screenshot illustrates the output you're supposed to see after typing the command:

A terminal window titled 'aisha@aisha-VirtualBox: ~' with standard window controls. The terminal shows the execution of the command to add the ROS Noetic repository. It starts with two failed attempts to run a script from /opt/ros/melodic. Then, the user enters the command to echo the repository line to a new file in the sources.list.d directory. The terminal prompts for a password, which is entered, and then shows the repository line being added to the file. The prompt returns to the user's shell.

```
aisha@aisha-VirtualBox: ~  
bash: /opt/ros/melodic/setup.bash: No such file or directory  
bash: /opt/ros/melodic/setup.bash: No such file or directory  
aisha@aisha-VirtualBox:~$ echo "deb http://packages.ros.org/ros/ubuntu focal ma  
in" | sudo tee /etc/apt/sources.list.d/ros-focal.list  
[sudo] password for aisha:  
deb http://packages.ros.org/ros/ubuntu focal main  
aisha@aisha-VirtualBox:~$  
aisha@aisha-VirtualBox:~$
```

## Step 2 — Add official ROS keyring

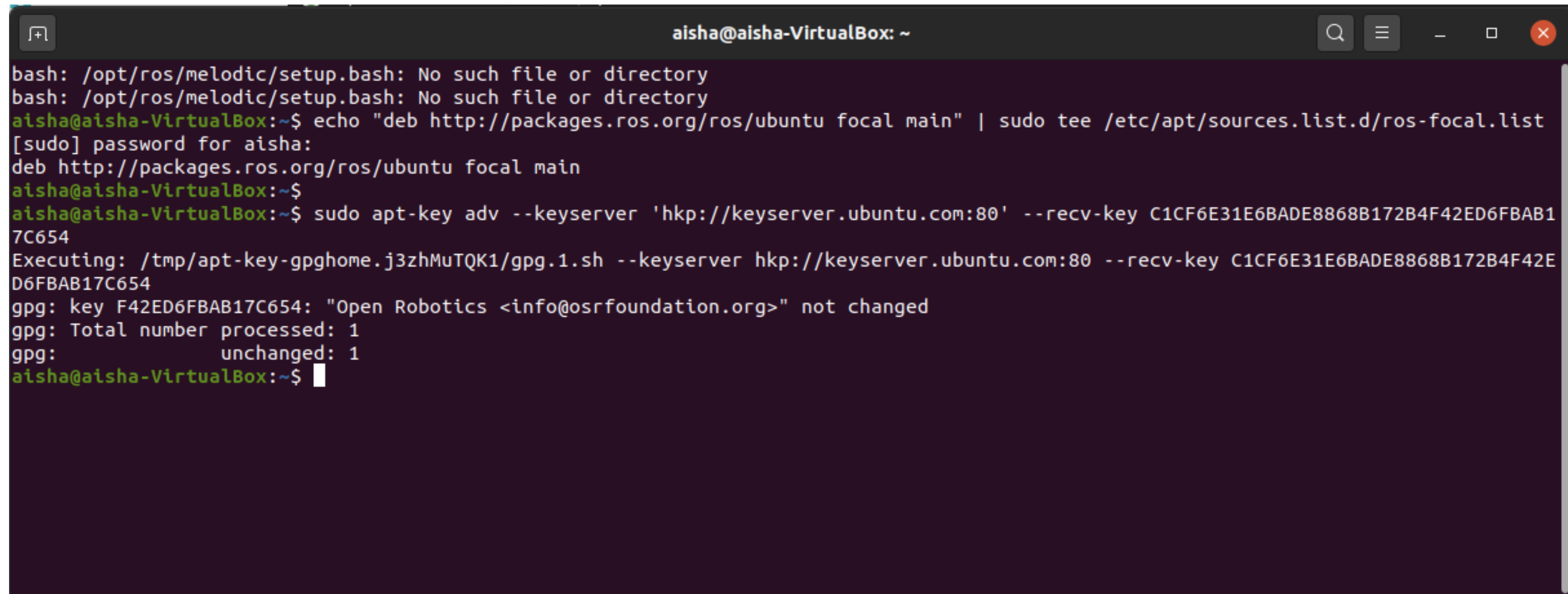
Use `apt-key` to add the key to be downloaded from Ubuntu key server. Note that if this does not work, you can also try to replace `hkp://keyserver.ubuntu.com:80` with `hkp://pgp.mit.edu:80`.

To accomplish just that run the following command:

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

# Expected output:

If you see the following output starting with executing, it means the key is successfully added. As you can see, the key is issued by Open Robotics, which is the maintainer of ROS. Another detail is that `apt-key` downloads the key to the directory `tmp` and the key will be removed automatically.

A terminal window titled 'aisha@aisha-VirtualBox: ~' with standard window controls. The terminal shows the following commands and output:

```
bash: /opt/ros/melodic/setup.bash: No such file or directory
bash: /opt/ros/melodic/setup.bash: No such file or directory
aisha@aisha-VirtualBox:~$ echo "deb http://packages.ros.org/ros/ubuntu focal main" | sudo tee /etc/apt/sources.list.d/ros-focal.list
[sudo] password for aisha:
deb http://packages.ros.org/ros/ubuntu focal main
aisha@aisha-VirtualBox:~$
aisha@aisha-VirtualBox:~$ sudo apt-key adv --keyserver 'hkp://keyserver.ubuntu.com:80' --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654
Executing: /tmp/apt-key-gpghome.j3zhMuTQK1/gpg.1.sh --keyserver hkp://keyserver.ubuntu.com:80 --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654
gpg: key F42ED6FBAB17C654: "Open Robotics <info@osrfoundation.org>" not changed
gpg: Total number processed: 1
gpg:      unchanged: 1
aisha@aisha-VirtualBox:~$
```

## Step 3 — Update ROS package index

Next, we will need to get the ROS Noetic package information from the repository we just added using `apt update`.

```
sudo apt update
```



# You will see output like the following:

```
aisha@aisha-VirtualBox: ~  
aisha@aisha-VirtualBox:~$ curl -sSL 'http://keyserver.ubuntu.com/pks/lookup?op=get&search=0xC1CF6E31E6BADE8868B172B4F42ED6FBAB17C654'  
| sudo apt-key add -  
OK  
aisha@aisha-VirtualBox:~$ sudo apt update  
Hit:1 http://packages.ros.org/ros/ubuntu focal InRelease  
Hit:2 http://archive.ubuntu.com/ubuntu focal InRelease  
Hit:3 http://archive.ubuntu.com/ubuntu focal-updates InRelease  
Hit:4 http://archive.ubuntu.com/ubuntu focal-backports InRelease  
Hit:5 http://archive.ubuntu.com/ubuntu focal-security InRelease  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
41 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

## Step 4 — Install ROS Noetic package

Now we are ready to install Noetic on Ubuntu 20.04 after all the preparation work. Like Ubuntu's `ubuntu-dektpop`, `ubuntu-desktop-mini` packages, ROS comes with [metapackages](#) for you to install.

The four officially documented ROS Noetic metapackages are:

- `ros-noetic-desktop-full`
- `ros-noetic-desktop`
- `ros-noetic-ros-base`
- `ros-noetic-ros-core`



# Install ros-noetic-desktop-full

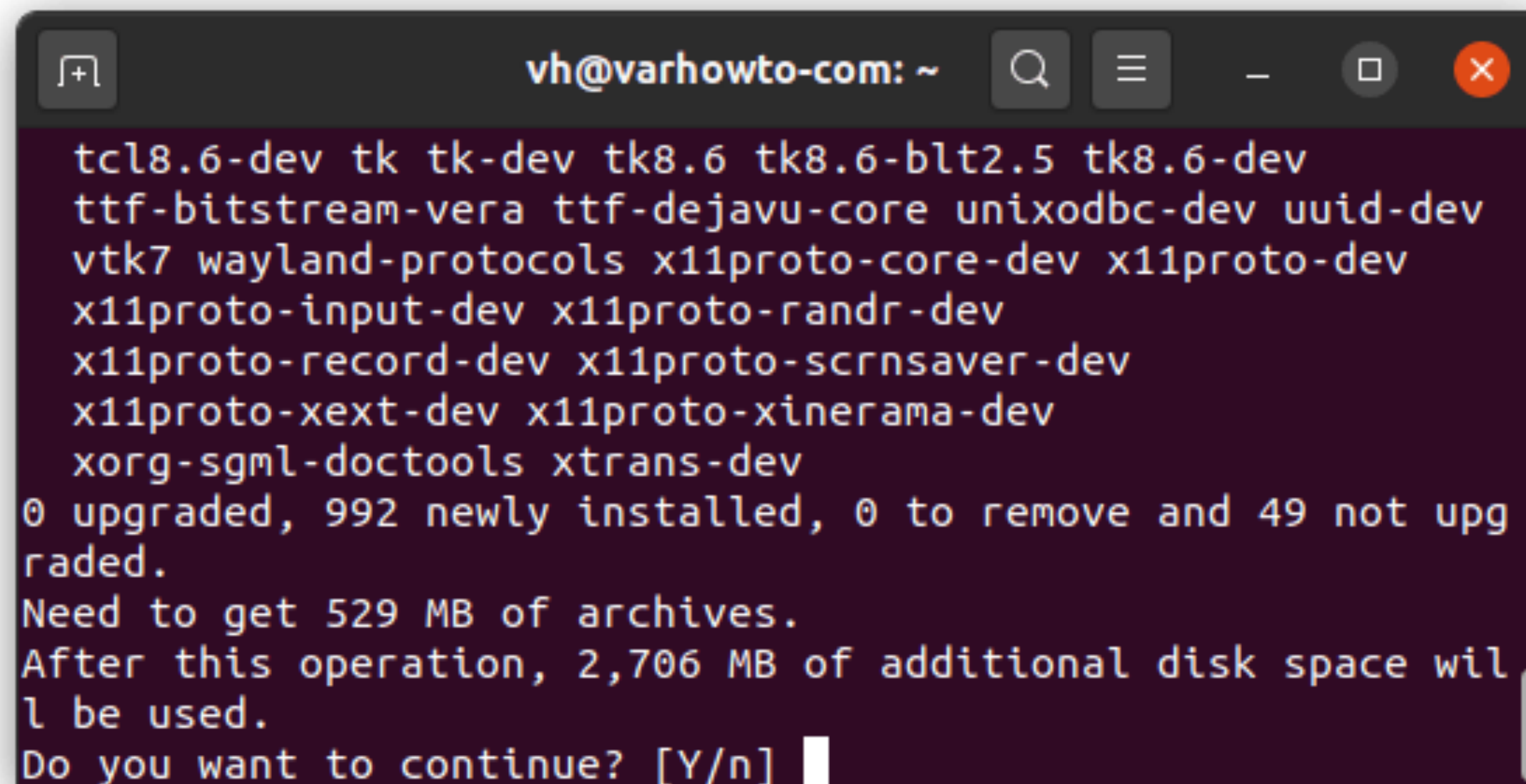
The package `ros-noetic-desktop-full` includes all the packages in `ros-noetic-desktop` and also the perception (`ros-noetic-perception`) and simulation (`ros-noetic-simulators`) packages.

To install `ros-noetic-desktop-full`, run

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

**After you run the command above, you will see the following output. As you can see, 992 new packages will be installed and takes 2.7 GB space.**

**Press Y and enter or simply press enter to continue installing. As this desktop-full metapackage depends on a lot of other messages, this whole installation will take about 10 minutes.**

A terminal window with a dark background and light-colored text. The window title is 'vh@varhowto-com: ~'. The output shows a list of packages to be installed, followed by a summary of the installation (0 upgraded, 992 newly installed, 0 to remove, 49 not upgraded), the disk space requirements (529 MB of archives, 2,706 MB of additional disk space), and a prompt to continue installation with 'Y/n'.

```
vh@varhowto-com: ~  
tcl8.6-dev tk tk-dev tk8.6 tk8.6-blt2.5 tk8.6-dev  
ttf-bitstream-vera ttf-dejavu-core unixodbc-dev uuid-dev  
vtk7 wayland-protocols x11proto-core-dev x11proto-dev  
x11proto-input-dev x11proto-randr-dev  
x11proto-record-dev x11proto-scrnsaver-dev  
x11proto-xext-dev x11proto-xinerama-dev  
xorg-sgml-doctools xtrans-dev  
0 upgraded, 992 newly installed, 0 to remove and 49 not upg  
raded.  
Need to get 529 MB of archives.  
After this operation, 2,706 MB of additional disk space wil  
l be used.  
Do you want to continue? [Y/n]
```

# Set up ROS Noetic environment

After installing ROS Noetic on your Ubuntu 20.04 computer, we will now set up your environment. In order to use ROS terminal commands and let `catkin` find your ROS program files such as header files in your includes directory, you will need to run the `setup.bash` file after you run `apt install`. To do that, run the following command:

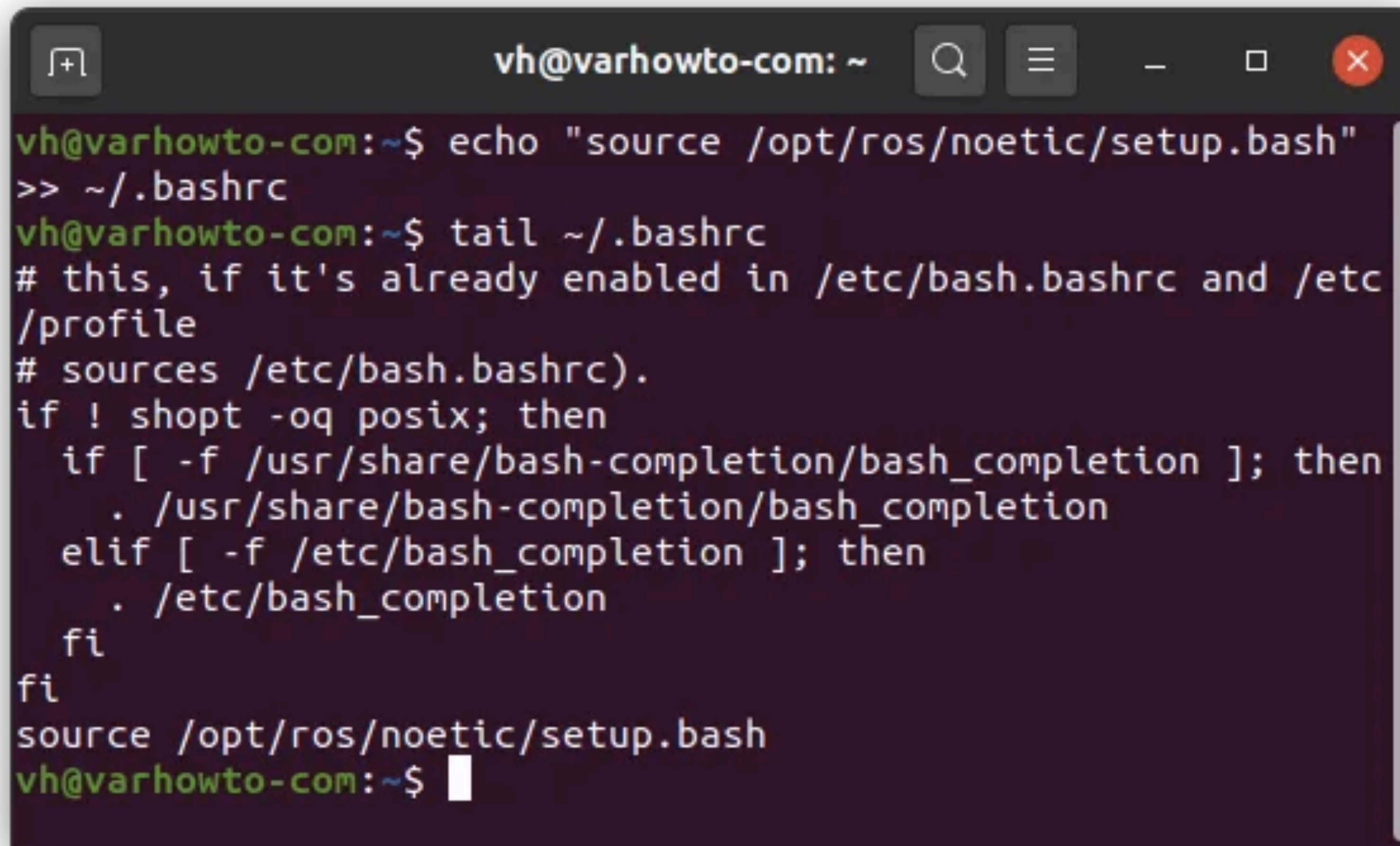
```
source /opt/ros/noetic/setup.bash
```

To avoid run the command above every time, which is especially true when you are developing with ROS, it is recommended to put it in the `.bashrc` file located in the home directory `~`. To do it run the following:

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



Run `tail ~/.bashrc` to double check, you should see the `setup.bash` is being sourced:

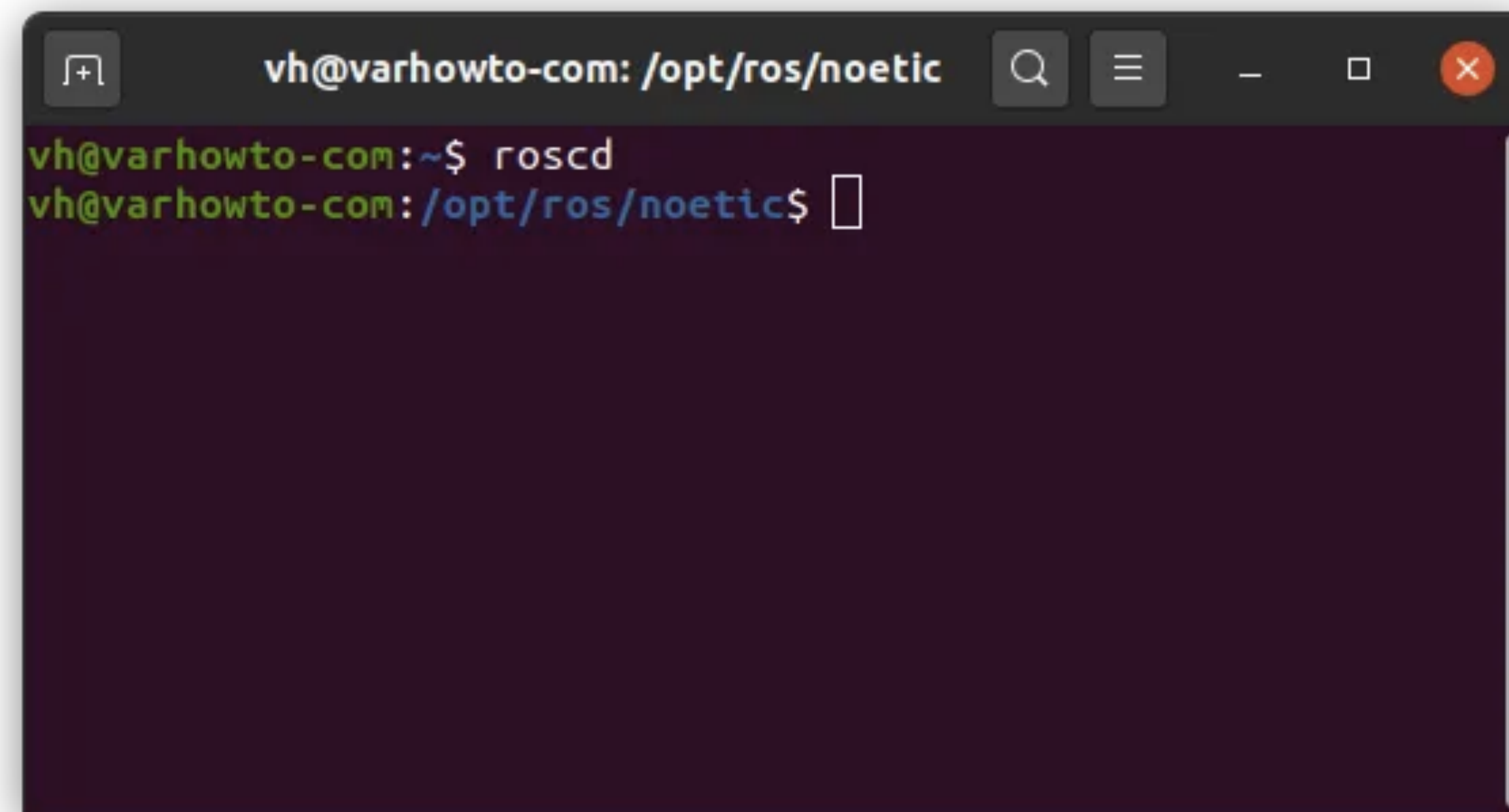
A terminal window with a dark background and light-colored text. The window title is 'vh@varhowto-com: ~'. The terminal shows the command 'echo "source /opt/ros/noetic/setup.bash"' being executed, followed by '>> ~/.bashrc'. Then, the command 'tail ~/.bashrc' is executed, displaying the contents of the file. The output shows a comment about sourcing /etc/bash.bashrc and /etc/profile, followed by a conditional block for bash completion. At the bottom, the line 'source /opt/ros/noetic/setup.bash' is visible, followed by the prompt 'vh@varhowto-com:~\$' and a cursor.

```
vh@varhowto-com:~$ echo "source /opt/ros/noetic/setup.bash"
>> ~/.bashrc
vh@varhowto-com:~$ tail ~/.bashrc
# this, if it's already enabled in /etc/bash.bashrc and /etc
/profile
# sources /etc/bash.bashrc).
if ! shopt -oq posix; then
    if [ -f /usr/share/bash-completion/bash_completion ]; then
        . /usr/share/bash-completion/bash_completion
    elif [ -f /etc/bash_completion ]; then
        . /etc/bash_completion
    fi
fi
source /opt/ros/noetic/setup.bash
vh@varhowto-com:~$
```

# Verify Noetic installation

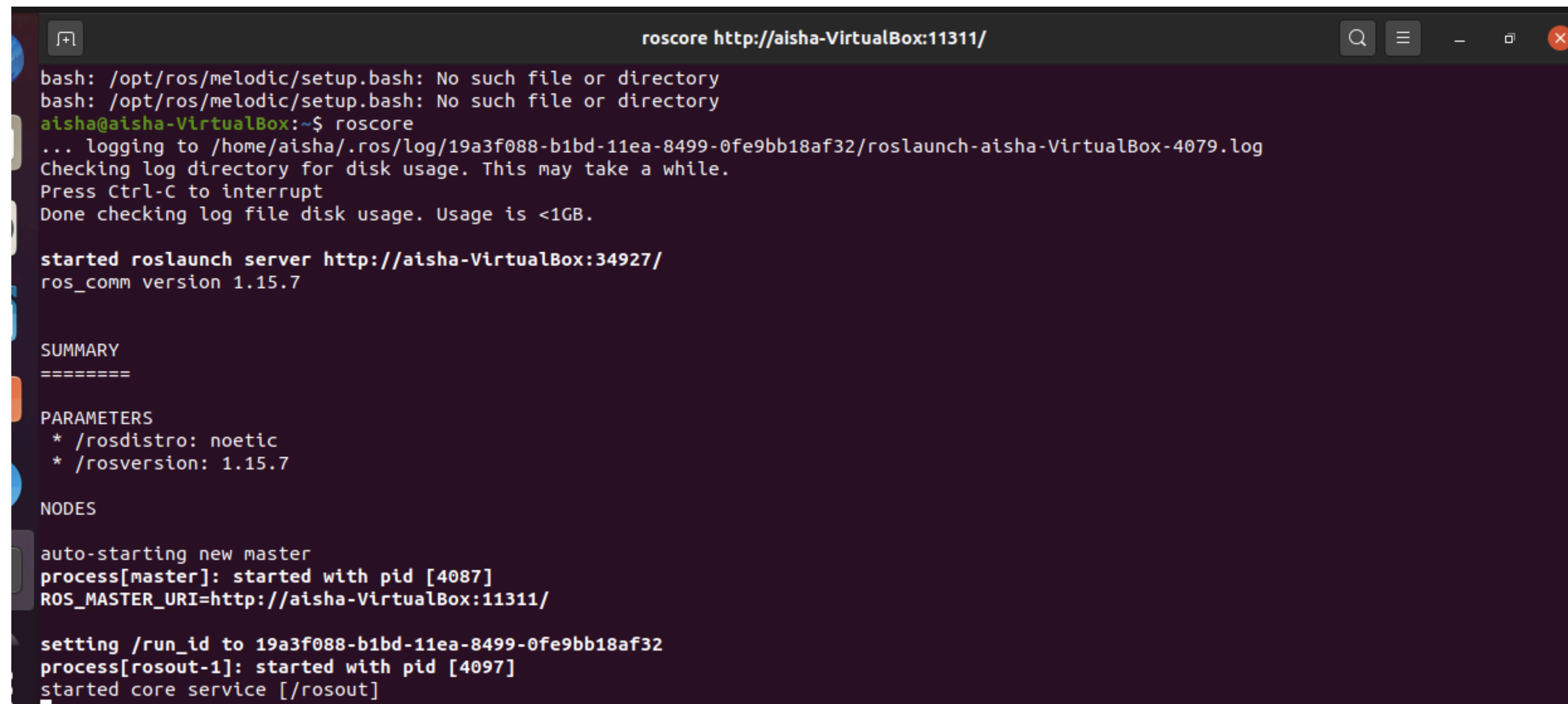
**Congratulations! Now you learned how to install ROS Noetic on Ubuntu 20.04. But how do we know it is installed successfully?**

**We can simply run `roscd`. You can see the current directory of your prompt is changed to where we installed Noetic: `/opt/ros/noetic`.**

A terminal window with a dark purple background. The title bar at the top shows 'vh@varhowto-com: /opt/ros/noetic' along with standard window controls (search, menu, zoom, close). The terminal content shows two lines: the first line is 'vh@varhowto-com:~\$ roscd' and the second line is 'vh@varhowto-com:/opt/ros/noetic\$' with a cursor at the end. The prompt color changes from green to blue after the command is executed.

```
vh@varhowto-com:~$ roscd
vh@varhowto-com:/opt/ros/noetic$
```

We can also verify the installation by running `roscore` to start a ros master. You will see the `roscore` is logging in a log file in `~/ .ros /log/`. You can also see the ros distro and the ros version in the summary. In addition, you also know the ROS master URI is on the 11311 port which is the default ROS port.

A terminal window titled "roscore http://aisha-VirtualBox:11311/" showing the output of the roscore command. The output includes error messages for missing setup files, logging information, a summary of parameters (noetic, 1.15.7), and node startup details for the master and rosout processes.

```
bash: /opt/ros/melodic/setup.bash: No such file or directory
bash: /opt/ros/melodic/setup.bash: No such file or directory
aisha@aisha-VirtualBox:~$ roscore
... logging to /home/aisha/.ros/log/19a3f088-b1bd-11ea-8499-0fe9bb18af32/roslaunch-aisha-VirtualBox-4079.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://aisha-VirtualBox:34927/
ros_comm version 1.15.7

SUMMARY
=====

PARAMETERS
* /rostdistro: noetic
* /rosversion: 1.15.7

NODES

auto-starting new master
process[master]: started with pid [4087]
ROS_MASTER_URI=http://aisha-VirtualBox:11311/

setting /run_id to 19a3f088-b1bd-11ea-8499-0fe9bb18af32
process[rosout-1]: started with pid [4097]
started core service [/rosout]
```



# Reference:

- **How to Install ROS Noetic on Ubuntu 20.04**

Thanks!

# تثبيت ROS على نظام تشغيل Ubuntu

## 20.04

# ١.١ تنصيب source.list

قم بتنصيب جهاز الكمبيوتر الخاص بك لقبول software من [packages.ros.org](http://packages.ros.org)

قم بكتابة الأمر التالي في برنامج terminal:

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

# ١.١ قم بتنصيب المفاتيح الخاص بك

قم بكتابة الأمر التالي في برنامج تيرمينال :

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

ملاحظة :

في حال واجهت أية مشاكل في الوصول إلى سيرفر المفاتيح قم بإزالة hkp://pgp.mit.edu:80

أو hkp://keyserver.ubuntu.com:80 في الأمر السابق

**apt-key** بدلاً من **curl** بدلاً من ذلك ، يمكن استخدام أمر

**proxy server** الأمر خصوصاً مفيد إذا كنت تستخدم

سيظهر لك كما في السكرينشوت التالي :

```
alsha@alsha-VirtualBox: ~  
bash: /opt/ros/melodic/setup.bash: No such file or directory  
bash: /opt/ros/melodic/setup.bash: No such file or directory  
alsha@alsha-VirtualBox:~$ echo "deb http://packages.ros.org/ros/ubuntu focal main" | sudo tee /etc/apt/sources.list.d/ros-focal.list  
[sudo] password for alsha:  
deb http://packages.ros.org/ros/ubuntu focal main  
alsha@alsha-VirtualBox:~$  
alsha@alsha-VirtualBox:~$ sudo apt-key adv --keyserver 'hkp://keyserver.ubuntu.com:80' --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654  
Executing: /tmp/apt-key-gpghome.j3zhMuTQK1/gpg.1.sh --keyserver hkp://keyserver.ubuntu.com:80 --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654  
gpg: key F42ED6FBAB17C654: "Open Robotics <info@osrfoundation.org>" not changed  
gpg: Total number processed: 1  
gpg: unchanged: 1  
alsha@alsha-VirtualBox:~$
```



# تنصيب ROS

أولاً، تأكد من أن Debian package index الخاصة بك مُحدّثة تبعاً لآخر نسخة متاحة. لذا قم بكتابة الأمر التالي في برنامج تيرمينال:

`sudo apt update`

سيظهر كما التالي:

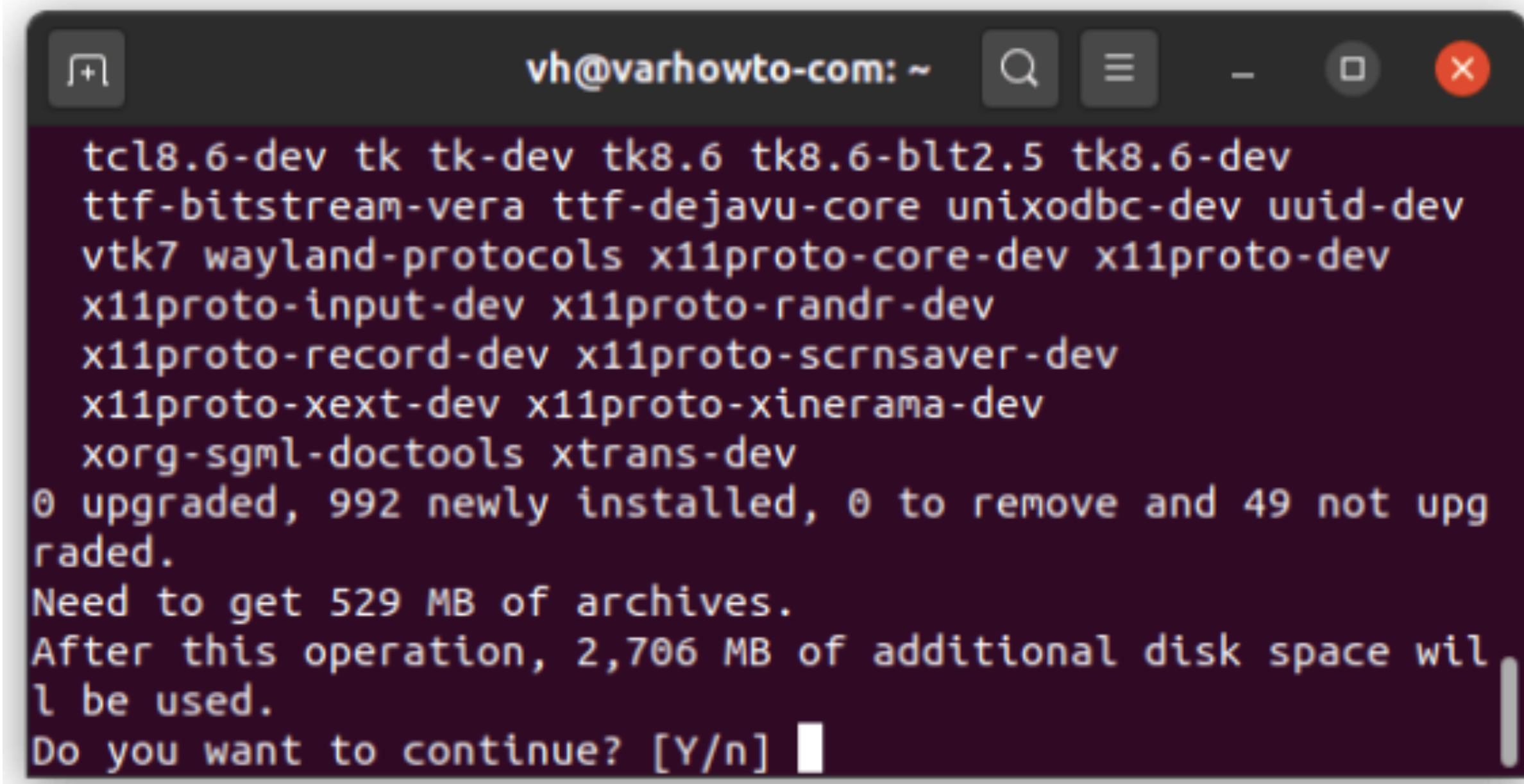
```
aisha@aisha-VirtualBox: ~  
aisha@aisha-VirtualBox:~$ curl -sSL 'http://keyserver.ubuntu.com/pks/lookup?op=get&search=0xC1CF6E31E6BADE8868B172B4F42ED6FBAB17C654'  
| sudo apt-key add -  
OK  
aisha@aisha-VirtualBox:~$ sudo apt update  
Hit:1 http://packages.ros.org/ros/ubuntu focal InRelease  
Hit:2 http://archive.ubuntu.com/ubuntu focal InRelease  
Hit:3 http://archive.ubuntu.com/ubuntu focal-updates InRelease  
Hit:4 http://archive.ubuntu.com/ubuntu focal-backports InRelease  
Hit:5 http://archive.ubuntu.com/ubuntu focal-security InRelease  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
41 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

الآن قم باختيار أية مقدار من ROS تود تنصيبه :

- التنصيب الكامل لسطح المكتب (Desktop-full install) - يُنصح به - : تتضمن كل شيء في سطح المكتب بالإضافة إلى المحاكى (simulators) ثلاثي وثنائي الأبعاد ، وكذلك حُزم الإدراك perception packages . للتنصيب قم بكتابة الأمر التالي :

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

سيظهر لك التالي : مما يعني أنه قام بتنزيل ٩٩٢ من الحُزم. عليك ضغط **enter** أو **Y** حتى يتم إكمال التنزيل .



```
vh@varhowto-com: ~  
tcl8.6-dev tk tk-dev tk8.6 tk8.6-blt2.5 tk8.6-dev  
ttf-bitstream-vera ttf-dejavu-core unixodbc-dev uuid-dev  
vtk7 wayland-protocols x11proto-core-dev x11proto-dev  
x11proto-input-dev x11proto-randr-dev  
x11proto-record-dev x11proto-scrnsaver-dev  
x11proto-xext-dev x11proto-xinerama-dev  
xorg-sgml-doctools xtrans-dev  
0 upgraded, 992 newly installed, 0 to remove and 49 not upg  
raded.  
Need to get 529 MB of archives.  
After this operation, 2,706 MB of additional disk space wil  
l be used.  
Do you want to continue? [Y/n]
```

# قم بتجهيز البيئة الخاصة في ROS

يجب عليك أن تسبق كل نص يخص **bash terminal** تستخدم به نظام ROS بكلمة **source** (مصدر) كما في الأمر التالي:

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

من الأسهل أن تقوم بذلك آلياً في كل مرة هيكل \* جديدة تُدشن ، لذلك قم بكتابة الأمر التالي:

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

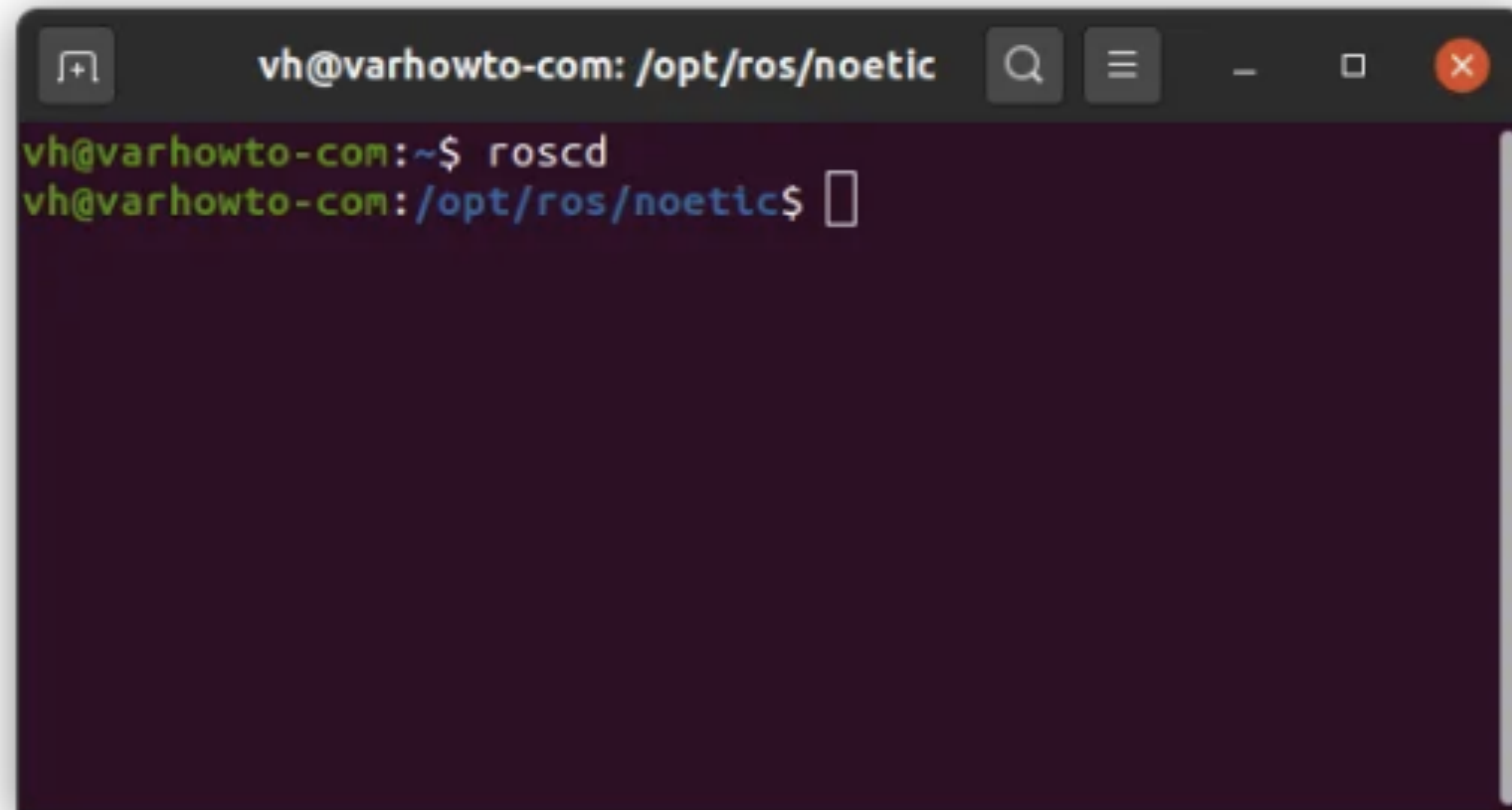
```
source ~/.bashrc
```

shell هيكل يُقصد به \*

# التأكد من تنزيل نظام ROS

**ROS Noetic:** يمكنك كتابة الأمر التالي مما سيُظهر لك المجلد الحالي والذي حيث ما قمنا ب تثبيت نظام

`/opt/ros/noetic`



```
vh@varhowto-com: /opt/ros/noetic
vh@varhowto-com:~$ roscd
vh@varhowto-com:/opt/ros/noetic$
```



## يتبع

أخيراً، للتأكد من أن نظام ROS تم تثبيته في جهاز قم بكتابة الأمر التالي :

roscoe

سترى النتيجة التالية :

```
roscore http://aisha-VirtualBox:11311/

bash: /opt/ros/melodic/setup.bash: No such file or directory
bash: /opt/ros/melodic/setup.bash: No such file or directory
aisha@aisha-VirtualBox:~$ roscore
... logging to /home/aisha/.ros/log/19a3f088-b1bd-11ea-8499-0fe9bb18af32/roslaunch-aisha-VirtualBox-4079.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
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setting /run_id to 19a3f088-b1bd-11ea-8499-0fe9bb18af32
process[rosout-1]: started with pid [4097]
started core service [/rosout]
```

شکراً!