

Docker usage

Docker usage

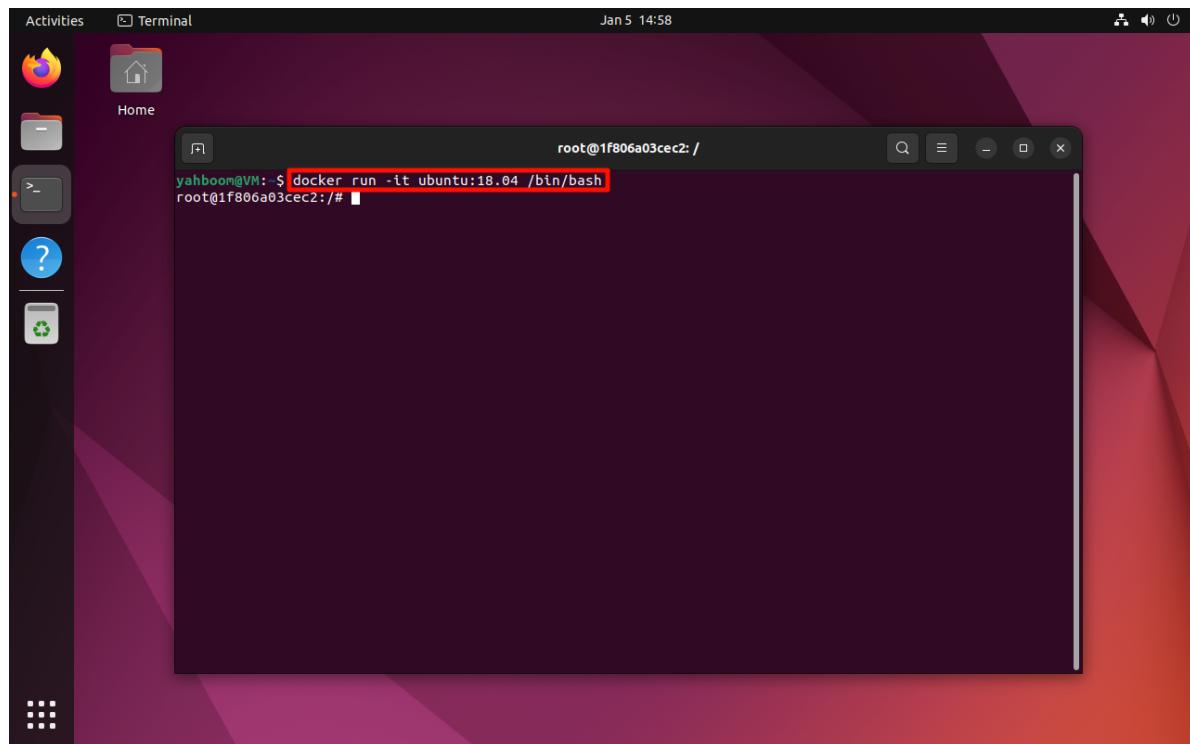
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The tutorial builds ROS1:Melodic environment based on `ubuntu:18.04`!

1. Start the image

Start the `ubuntu:18.04` image in interactive mode:

```
docker run -it ubuntu:18.04 /bin/bash
```



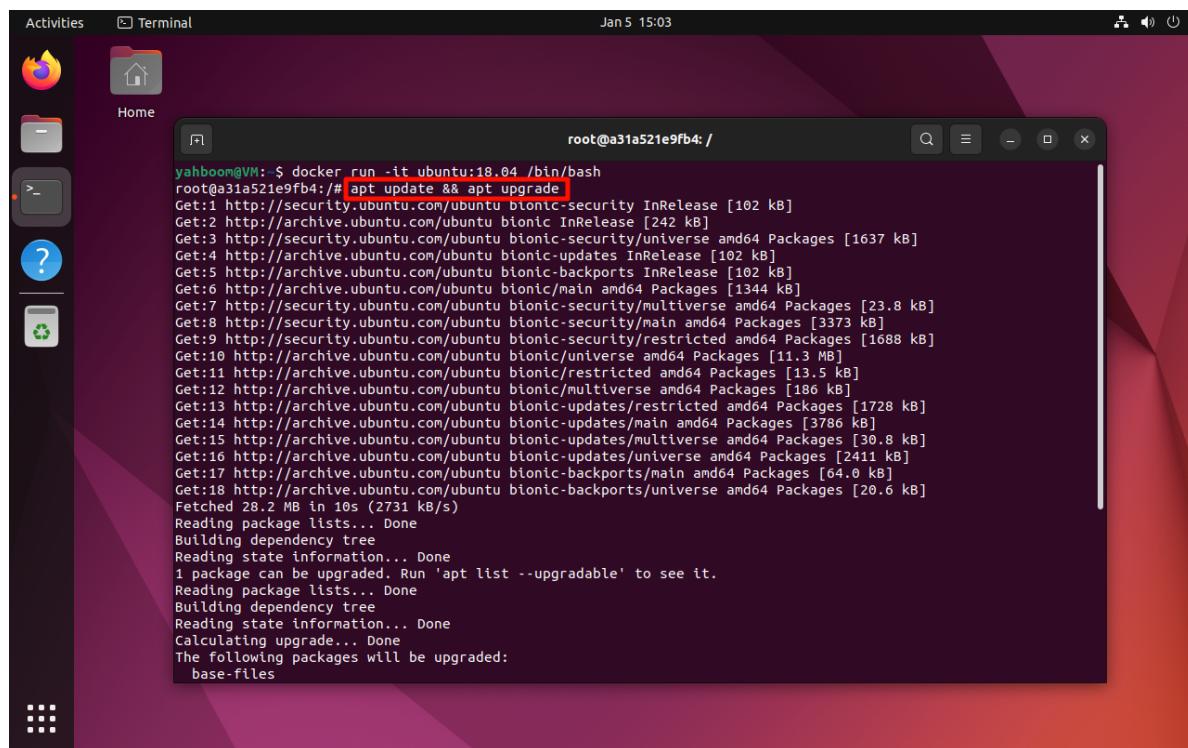
2. ROS environment construction

Administrator privileges are not required in Docker. If the host installs the ROS environment, sudo needs to be added to the command.

2.1. Update system software

To install the ROS1 environment, you generally need to ensure that the system software package is up to date:

```
apt update && apt upgrade
```



A screenshot of a Linux desktop environment, likely Ubuntu, showing a terminal window. The terminal window title is "root@a31a521e9fb4:/". The command "apt update && apt upgrade" is being run. The output shows the progress of the update, including file downloads from various Ubuntu repositories. The desktop background is a dark purple/red gradient, and the taskbar on the left shows icons for Home, Activities, Terminal, and other applications.

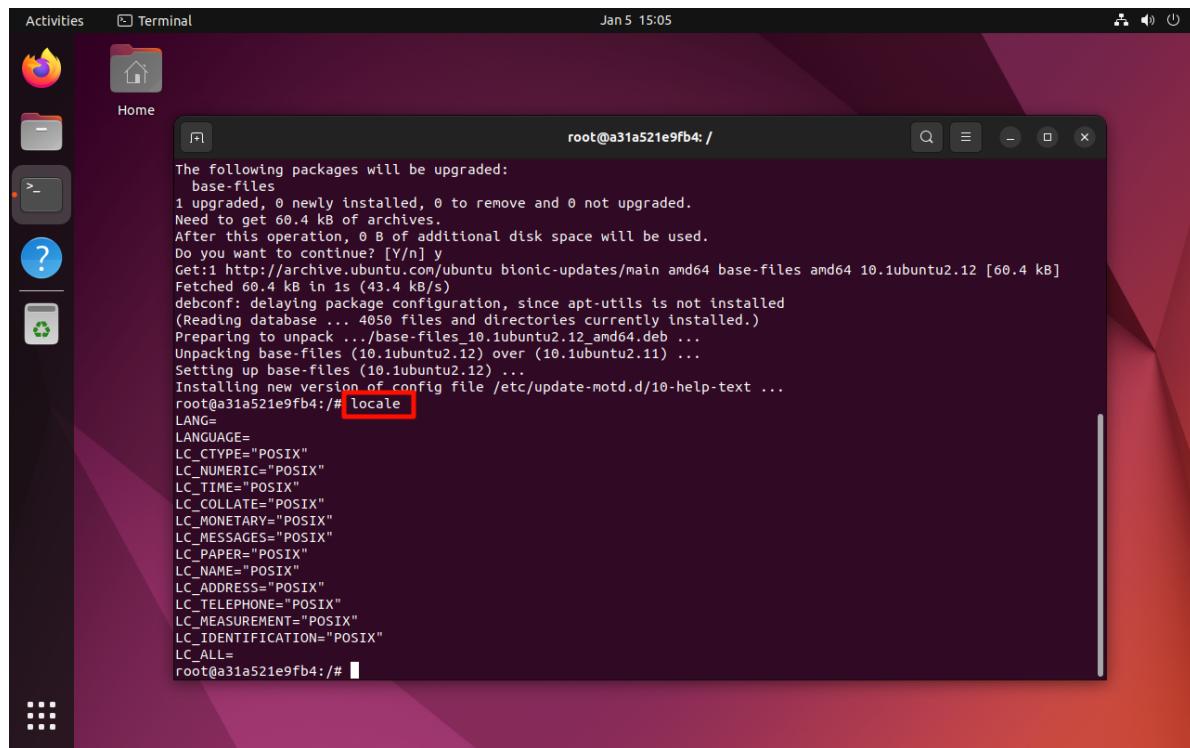
```
yahboom@VM: ~$ docker run -it ubuntu:18.04 /bin/bash
root@a31a521e9fb4:/# apt update && apt upgrade
Get:1 http://security.ubuntu.com/ubuntu bionic-security InRelease [102 kB]
Get:2 http://archive.ubuntu.com/ubuntu bionic InRelease [242 kB]
Get:3 http://security.ubuntu.com/ubuntu bionic-security/universe amd64 Packages [1637 kB]
Get:4 http://archive.ubuntu.com/ubuntu bionic-updates InRelease [102 kB]
Get:5 http://archive.ubuntu.com/ubuntu bionic-backports InRelease [102 kB]
Get:6 http://archive.ubuntu.com/ubuntu bionic/main amd64 Packages [1344 kB]
Get:7 http://security.ubuntu.com/ubuntu bionic-security/multiverse amd64 Packages [23.8 kB]
Get:8 http://security.ubuntu.com/ubuntu bionic-security/main amd64 Packages [3373 kB]
Get:9 http://security.ubuntu.com/ubuntu bionic-security/restricted amd64 Packages [1688 kB]
Get:10 http://archive.ubuntu.com/ubuntu bionic/universe amd64 Packages [11.3 MB]
Get:11 http://archive.ubuntu.com/ubuntu bionic/restricted amd64 Packages [13.5 kB]
Get:12 http://archive.ubuntu.com/ubuntu bionic/multiverse amd64 Packages [186 kB]
Get:13 http://archive.ubuntu.com/ubuntu bionic-updates/restricted amd64 Packages [1728 kB]
Get:14 http://archive.ubuntu.com/ubuntu bionic-updates/main amd64 Packages [3786 kB]
Get:15 http://archive.ubuntu.com/ubuntu bionic-updates/multiverse amd64 Packages [30.8 kB]
Get:16 http://archive.ubuntu.com/ubuntu bionic-updates/universe amd64 Packages [2411 kB]
Get:17 http://archive.ubuntu.com/ubuntu bionic-backports/main amd64 Packages [64.0 kB]
Get:18 http://archive.ubuntu.com/ubuntu bionic-backports/universe amd64 Packages [20.6 kB]
Fetched 28.2 MB in 10s (2731 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
1 package can be upgraded. Run 'apt list --upgradable' to see it.
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following packages will be upgraded:
  base-files
```

2.2. Determine the language environment

Make sure the system language environment supports UTF-8!

2.2.1. Verify the system environment

```
locale
```



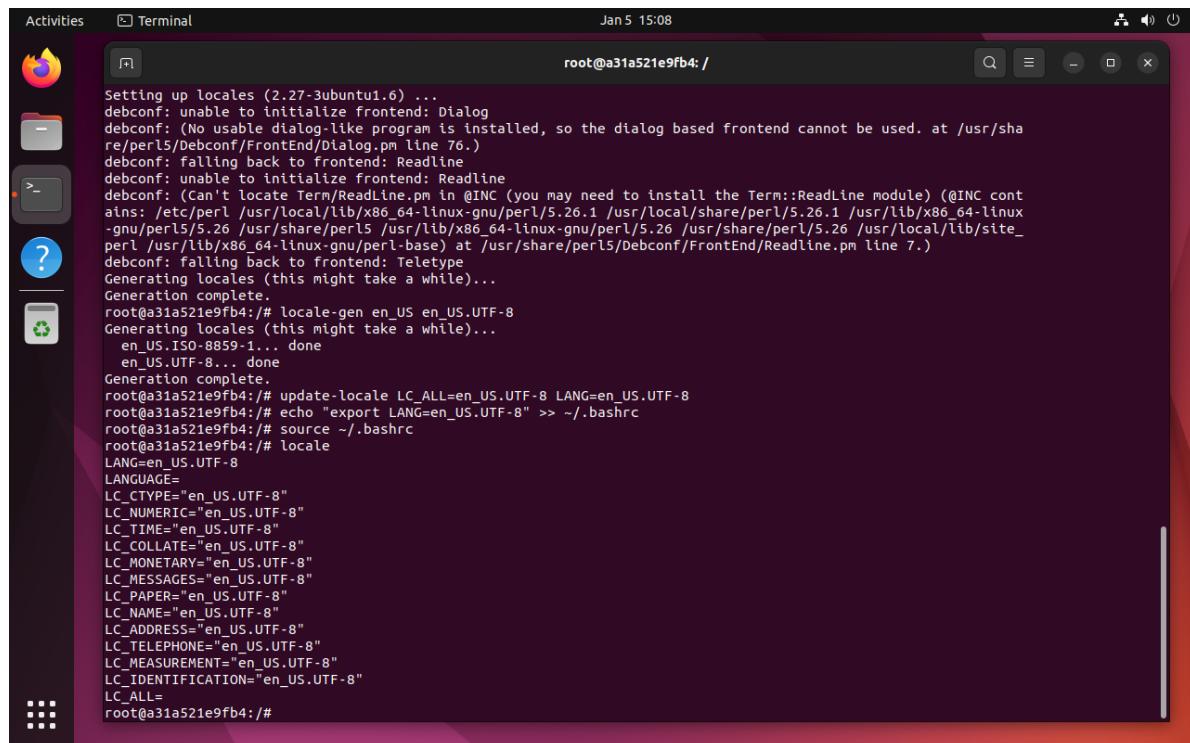
A screenshot of an Ubuntu desktop environment. A terminal window titled 'root@a31a521e9fb4:/' is open, showing the output of a 'locale' command. The output lists various locale parameters like LANG, LANGUAGE, LC_CTYPE, etc., all set to 'POSIX'. The command 'root@a31a521e9fb4:/# locale' is highlighted with a red box.

```
The following packages will be upgraded:
  base-files
  1 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
  Need to get 60.4 kB of archives.
  After this operation, 0 B of additional disk space will be used.
  Do you want to continue? [Y/n] y
Get:1 http://archive.ubuntu.com/ubuntu bionic-updates/main amd64 base-files amd64 10.1ubuntu2.12 [60.4 kB]
Fetched 60.4 kB in 1s (43.4 kB/s)
debconf: delaying package configuration, since apt-utils is not installed
(Reading database ... 4050 files and directories currently installed.)
Preparing to unpack .../base-files_10.1ubuntu2.12_amd64.deb ...
Unpacking base-files (10.1ubuntu2.12) over (10.1ubuntu2.11) ...
Setting up base-files (10.1ubuntu2.12) ...
Installing new version of config file /etc/update-motd.d/10-help-text ...
root@a31a521e9fb4:/# locale
LANG=
LANGUAGE=
LC_CTYPE="POSIX"
LC_NUMERIC="POSIX"
LC_TIME="POSIX"
LC_COLLATE="POSIX"
LC_MONETARY="POSIX"
LC_MESSAGES="POSIX"
LC_PAPER="POSIX"
LC_NAME="POSIX"
LC_ADDRESS="POSIX"
LC_TELEPHONE="POSIX"
LC_MEASUREMENT="POSIX"
LC_IDENTIFICATION="POSIX"
LC_ALL=
root@a31a521e9fb4:/#
```

2.2.2. Set the UTF-8 environment

If the system language does not support the UTF-8 environment, enter the following commands line by line in the terminal:

```
apt install locales
locale-gen en_US en_US.UTF-8
update-locale LC_ALL=en_US.UTF-8 LANG=en_US.UTF-8
echo "export LANG=en_US.UTF-8" >> ~/.bashrc
source ~/.bashrc
```



A screenshot of an Ubuntu desktop environment. A terminal window titled 'root@a31a521e9fb4:/' is open, showing the process of setting the UTF-8 environment. It includes commands for installing locales, generating locales, updating the locale, exporting the LANG variable, and sourcing the bashrc file. The command 'root@a31a521e9fb4:/# locale' is highlighted with a red box.

```
Setting up locales (2.27-3ubuntu1.6) ...
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based frontend cannot be used. at /usr/share/perl5/Debconf/FrontEnd/Dialog.pm line 76.)
debconf: falling back to frontend: Readline
debconf: unable to initialize frontend: Readline
debconf: (Can't locate Term/Readline.pm in @INC (you may need to install the Term::ReadLine module) (@INC contains: /etc/perl /usr/local/lib/x86_64-linux-gnu/perl/5.26.1 /usr/local/share/perl/5.26.1 /usr/lib/x86_64-linux-gnu/perl/5.26 /usr/share/perl/5.26 /usr/local/lib/site_perl /usr/lib/x86_64-linux-gnu/perl-base) at /usr/share/perl5/Debconf/FrontEnd/Readline.pm line 7.)
debconf: falling back to frontend: Teletype
Generating locales (this might take a while)...
Generation complete.
root@a31a521e9fb4:/# locale-gen en_US en_US.UTF-8
Generating locales (this might take a while)...
  en_US.ISO-8859-1... done
  en_US.UTF-8... done
Generation complete.
root@a31a521e9fb4:/# update-locale LC_ALL=en_US.UTF-8 LANG=en_US.UTF-8
root@a31a521e9fb4:/# echo "export LANG=en_US.UTF-8" >> ~/.bashrc
root@a31a521e9fb4:/# source ~/.bashrc
root@a31a521e9fb4:/# locale
LANG=en_US.UTF-8
LANGUAGE=
LC_CTYPE="en_US.UTF-8"
LC_NUMERIC="en_US.UTF-8"
LC_TIME="en_US.UTF-8"
LC_COLLATE="en_US.UTF-8"
LC_MONETARY="en_US.UTF-8"
LC_MESSAGES="en_US.UTF-8"
LC_PAPER="en_US.UTF-8"
LC_NAME="en_US.UTF-8"
LC_ADDRESS="en_US.UTF-8"
LC_TELEPHONE="en_US.UTF-8"
LC_MEASUREMENT="en_US.UTF-8"
LC_IDENTIFICATION="en_US.UTF-8"
LC_ALL=
root@a31a521e9fb4:/#
```

2.3、Set software source

```
apt install lsb-core
```

```
sh -c '. /etc/lsb-release && echo "deb  
http://mirrors.tuna.tsinghua.edu.cn/ros/ubuntu/ `lsb_release -cs` main" >  
/etc/apt/sources.list.d/ros-latest.list'
```

The screenshot shows a terminal window titled 'Terminal' with the command 'root@a31a521e9fb4: /'. The terminal displays the output of several package management commands:

- 'update-alternatives' entries for various system components like messages, mailutils, and readmsg.
- 'debconf' configuration messages indicating that Dialog is not installed.
- 'Setting up' messages for packages such as cups-bsd, curl, gnupg, dh-autoreconf, dh-strip-nondeterminism, debhelper, alien, and lsb-core.
- 'Processing triggers' for libc-bin and ca-certificates.
- 'Updating certificates' in /etc/ssl/certs.
- 'Running hooks' in /etc/ca-certificates/update.d.
- A final command: 'root@a31a521e9fb4: # sh -c '. /etc/lsb-release && echo "deb http://mirrors.tuna.tsinghua.edu.cn/ros/ubuntu/ `lsb_release -cs` main" > /etc/apt/sources.list.d/ros-latest.list'

2.4、Set key

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

The screenshot shows a terminal window titled 'Terminal' with the command 'root@a31a521e9fb4: /'. The terminal displays the output of several package management commands:

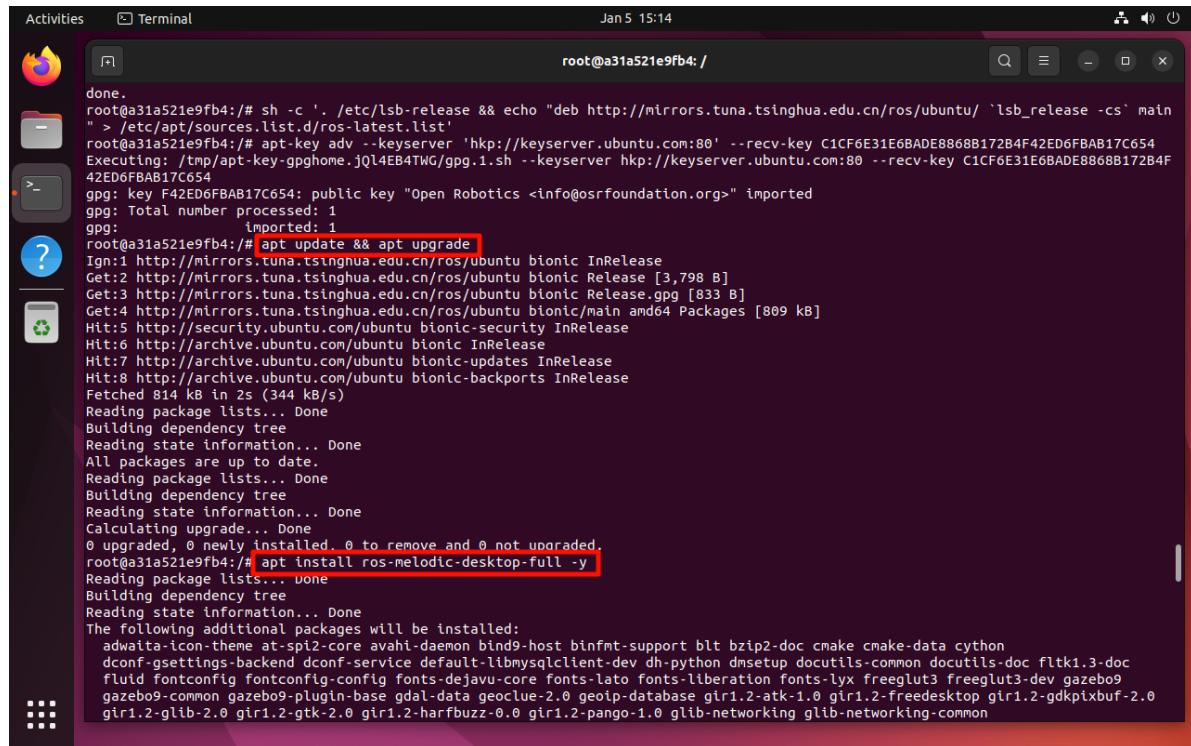
- 'update-alternatives' entries for various system components like readmsg, dotlock, mailutils, and mailx.
- 'debconf' configuration messages indicating that Dialog is not installed.
- 'Setting up' messages for packages such as cups-bsd, curl, gnupg, dh-autoreconf, dh-strip-nondeterminism, debhelper, alien, and lsb-core.
- 'Processing triggers' for libc-bin and ca-certificates.
- 'Updating certificates' in /etc/ssl/certs.
- 'Running hooks' in /etc/ca-certificates/update.d.
- A final command: 'root@a31a521e9fb4: # sh -c '. /etc/lsb-release && echo "deb http://mirrors.tuna.tsinghua.edu.cn/ros/ubuntu/ `lsb_release -cs` main" > /etc/apt/sources.list.d/ros-latest.list'
- The next command is highlighted in red: 'root@a31a521e9fb4: # apt-key adv --keyserver hkp://keyserver.ubuntu.com:80 --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654'
- The terminal then executes a command: 'Executing: /tmp/apt-key-gpghome.jQl4EB4TWC/gpg.1.sh --keyserver hkp://keyserver.ubuntu.com:80 --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654'
- Output from GPG: 'gpg: key F42ED6FBAB17C654: public key "Open Robotics <info@osrfoundation.org>" imported'
'gpg: Total number processed: 1
gpg: imported: 1'
- The final command shown is 'root@a31a521e9fb4: #'

2.5. Install ROS1 desktop version

ROS desktop version includes ROS1 core functions, common tools and libraries:

```
apt update && apt upgrade
```

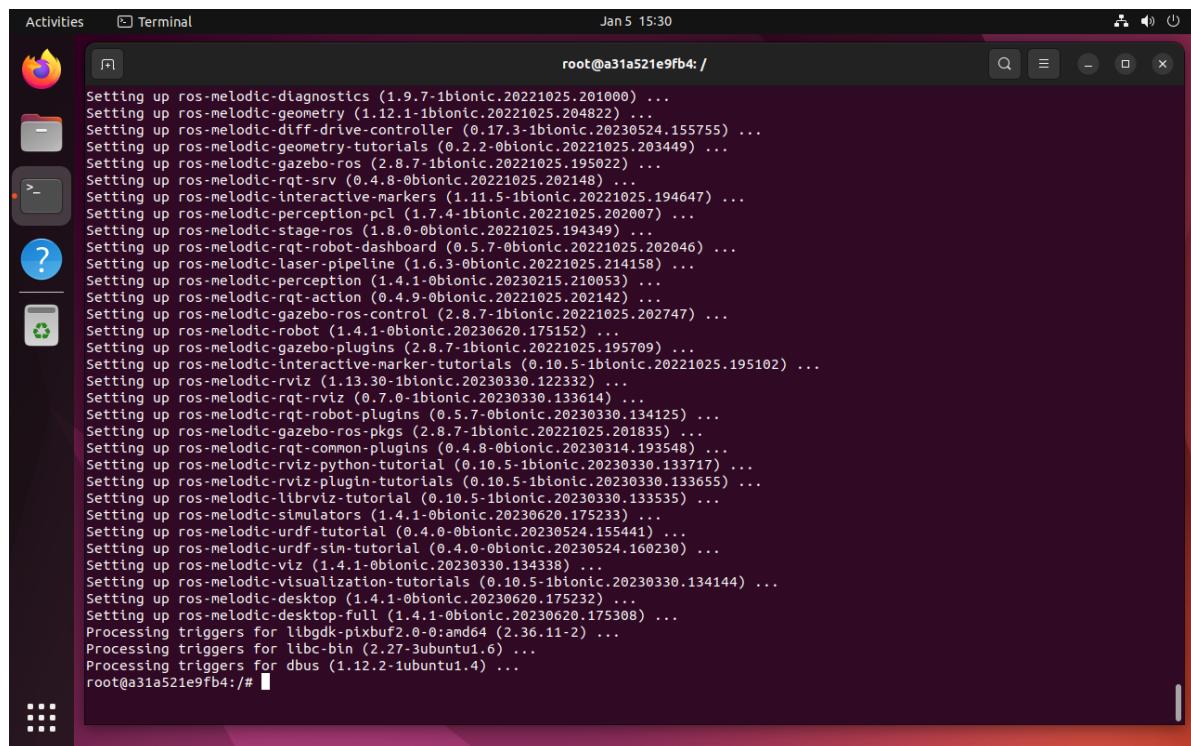
```
apt install ros-melodic-desktop-full -y
```



A screenshot of a Linux terminal window titled "Terminal" running as root. The window shows the command "root@a31a521e9fb4:/# apt update && apt upgrade" highlighted in red. The terminal output shows the progress of updating package lists and upgrading packages, including the installation of the "ros-melodic-desktop-full" package. The background shows the Unity desktop environment with various icons.

```
done.
root@a31a521e9fb4:# sh -c '. /etc/lsb-release && echo "deb http://mirrors.tuna.tsinghua.edu.cn/ros/ubuntu/ `lsb_release -cs` main" > /etc/apt/sources.list.d/ros-latest.list'
root@a31a521e9fb4:# apt-key adv --keyserver 'hkp://keyserver.ubuntu.com:80' --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654
Executing: /tmp/apt-key-gpghome.jQl4EB4tWG/gpg 1.sh --keyserver hkp://keyserver.ubuntu.com:80 --recv-key C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654
gpg: key F42ED6FBAB17C654: public key "Open Robotics <info@osrfoundation.org>" imported
gpg: Total number processed: 1
gpg:           imported: 1
root@a31a521e9fb4:# apt update && apt upgrade
Ign1: http://mirrors.tuna.tsinghua.edu.cn/ros/ubuntu bionic InRelease
Get:2 http://mirrors.tuna.tsinghua.edu.cn/ros/ubuntu bionic Release [3,798 B]
Get:3 http://mirrors.tuna.tsinghua.edu.cn/ros/ubuntu bionic Release.gpg [833 B]
Get:4 http://mirrors.tuna.tsinghua.edu.cn/ros/ubuntu bionic/main amd64 Packages [809 kB]
Hit:5 http://security.ubuntu.com/ubuntu bionic-security InRelease
Hit:6 http://archive.ubuntu.com/ubuntu bionic InRelease
Hit:7 http://archive.ubuntu.com/ubuntu bionic-updates InRelease
Hit:8 http://archive.ubuntu.com/ubuntu bionic-backports InRelease
Fetched 814 kB in 2s (344 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
All packages are up to date.
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
root@a31a521e9fb4:# apt install ros-melodic-desktop-full -y
Reading package lists... done
Building dependency tree
Reading state information... done
The following additional packages will be installed:
  awaita-icon-theme at-spi2-core avahi-daemon bind9-host binfmt-support blt bzip2-doc cmake cmake-data cython
  dconf-gsettings-backend dconf-service default-libmysqldclient-dev dh-python dmsetup docutils-common docutils-doc fltk1.3-doc
  fluid fontconfig fontconfig-config fonts-dejavu-core fonts-lato fonts- liberation fonts-lyx freeglut3-dev gazebo9
  gazebo9-common gazebo9-plugin-base gdal-data geoclue-2.0 geopip-database gir1.2-atk-1.0 gir1.2-freedesktop gir1.2-gdkpixbuf-2.0
  gir1.2-glib-2.0 gir1.2-gtk-2.0 gir1.2-harfbuzz-0.0 gir1.2-pango-1.0 glib-networking glib-networking-common
root@a31a521e9fb4:#[
```

You need to select the region and city by yourself: not demonstrated here



A screenshot of a Linux terminal window titled "Terminal" running as root. The terminal shows the command "root@a31a521e9fb4:/# apt install ros-melodic-desktop-full -y" followed by a large amount of output from the "apt install" command. The output lists numerous packages being installed, such as "ros-melodic-diagnostic", "ros-melodic-geometry", "ros-melodic-diff-drive-controller", and many others related to ROS1 desktop components. The terminal window is part of the Unity desktop environment.

```
Setting up ros-melodic-diagnostics (1.9.7-1bionic.20221025.201000) ...
Setting up ros-melodic-geometry (1.12.1-1bionic.20221025.204822) ...
Setting up ros-melodic-diff-drive-controller (0.17.3-1bionic.20230524.155755) ...
Setting up ros-melodic-geometry-tutorials (0.2.2-0bionic.20221025.203449) ...
Setting up ros-melodic-gazebo-ros (2.8.7-1bionic.20221025.195022) ...
Setting up ros-melodic-qvt-srv (0.4.8-0bionic.20221025.202148) ...
Setting up ros-melodic-interactive-markers (1.11.5-1bionic.20221025.194647) ...
Setting up ros-melodic-perception-pcl (1.7.4-1bionic.20221025.202007) ...
Setting up ros-melodic-stage-ros (1.8.0-0bionic.20221025.194349) ...
Setting up ros-melodic-qvt-robot-dashboard (0.5.7-0bionic.20221025.202046) ...
Setting up ros-melodic-laser-pipeline (1.6.3-0bionic.20221025.214158) ...
Setting up ros-melodic-perception (1.4.1-0bionic.20230215.210053) ...
Setting up ros-melodic-qvt-action (0.4.9-0bionic.20221025.202142) ...
Setting up ros-melodic-gazebo-ros-control (2.8.7-1bionic.20221025.202747) ...
Setting up ros-melodic-robot (1.4.1-0bionic.20230620.175152) ...
Setting up ros-melodic-gazebo-plugins (2.8.7-1bionic.20221025.195709) ...
Setting up ros-melodic-interactive-marker-tutorials (0.10.5-1bionic.20221025.195102) ...
Setting up ros-melodic-rviz (1.13.30-1bionic.20230330.122332) ...
Setting up ros-melodic-rviz (0.7.0-1bionic.20230330.133614) ...
Setting up ros-melodic-qvt-rviz (0.5.7-0bionic.20230330.134125) ...
Setting up ros-melodic-qvt-robot-plugins (0.5.7-0bionic.20230330.134125) ...
Setting up ros-melodic-gazebo-ros-pkgs (2.8.7-1bionic.20221025.201835) ...
Setting up ros-melodic-qvt-common-plugins (0.4.8-0bionic.20230314.193548) ...
Setting up ros-melodic-rviz-python-tutorial (0.10.5-1bionic.20230330.133717) ...
Setting up ros-melodic-rviz-plugin-tutorials (0.10.5-1bionic.20230330.133655) ...
Setting up ros-melodic-lbrviz-tutorial (0.10.5-1bionic.20230330.133535) ...
Setting up ros-melodic-simulators (1.4.1-0bionic.20230620.175233) ...
Setting up ros-melodic-urdf-tutorial (0.4.0-0bionic.20230524.155441) ...
Setting up ros-melodic-urdf-sm-tutorial (0.4.0-0bionic.20230524.160230) ...
Setting up ros-melodic-rviz (1.4.1-0bionic.20230330.134338) ...
Setting up ros-melodic-visualization-tutorials (0.10.5-1bionic.20230330.134144) ...
Setting up ros-melodic-desktop (1.4.1-0bionic.20230620.175232) ...
Setting up ros-melodic-desktop-full (1.4.1-0bionic.20230620.175308) ...
Processing triggers for libgdk-pixbuf2.0-0:amd64 (2.36.11-2) ...
Processing triggers for libc-bin (2.27-3ubuntu1.6) ...
Processing triggers for dbus (1.12.2-1ubuntu1.4) ...
root@a31a521e9fb4:#[
```

2.6, install ROS1 dependencies

```
apt install python-rosdep python-rosinstall python-rosinstall-generator python-wstool build-essential -y
```

```
Setting up ros-melodic-simulators (1.4.1-0bionic.20230620.175233) ...
Setting up ros-melodic-urdf-tutorial (0.4.0-0bionic.20230524.155441) ...
Setting up ros-melodic-urdf-sim-tutorial (0.4.0-0bionic.20230524.160230) ...
Setting up ros-melodic-viz (1.4.1-0bionic.20230330.134338) ...
Setting up ros-melodic-visualization-tutorials (0.10.5-1bionic.20230330.134144) ...
Setting up ros-melodic-desktop (1.4.1-0bionic.20230620.175232) ...
Setting up ros-melodic-desktop-full (1.4.1-0bionic.20230620.175308) ...
Processing triggers for libgdk-pixbuf2.0-0:amd64 (2.36.11-2) ...
Processing triggers for libc-bin (2.27-3ubuntu1.6) ...
Processing triggers for dbus (1.12.2-1ubuntu1.4) ...
root@a31a521e9fb4:/# apt install python-rosdep python-rosinstall python-rosinstall-generator python-wstool build-essential -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
build-essential is already the newest version (12.4ubuntu1).
build-essential set to manually installed.
The following additional packages will be installed:
  bzr git git-man less liblrror-perl libserf-1-1 libssl1.0.0 libsvn1 mercurial mercurial-common openssh-client python-bzrlib
  python-configobj python-crypto python-dbus python-gi python-httpplib2 python-keyring python-keyrings.alt python-launchpadlib
  python-lazr.restfulclient python-lazr.uri python-oauth python-rosdistro python-secretstorage python-simplejson python-vcstools
  python-wadllib subversion xauth
Suggested packages:
  bzr-doc bzrtools python-bzrlib.tests git-daemon-run | git-daemon-sysvinit git-doc git-el git-email git-gui gitk gitweb git-cvs
  git-medialink git-svn kdifff3 | kdifff3-qt | kompare | meld | tkcvs | mgdiff qct python-mysqldb keychain libpam-ssh monkeysphere
  ssh-askpass python-bzrlib-dbg python-kerberos python-pycurl xdg-utils python-configobj-doc python-crypto-doc python-dbus-dbg
  python-dbus-doc python-gi-cairo gnome-keyring libkfswallet-bin gir1.2-gnomekeyring-1.0 python-fs python-gdata python-keyczar
  python-testresources python-secretstorage-doc db5.3-util libapache2-mod-svn subversion-tools
The following NEW packages will be installed:
  bzr git git-man less liblrror-perl libserf-1-1 libssl1.0.0 libsvn1 mercurial mercurial-common openssh-client python-bzrlib
  python-configobj python-crypto python-dbus python-gi python-httpplib2 python-keyring python-keyrings.alt python-launchpadlib
  python-lazr.restfulclient python-lazr.uri python-oauth python-rosdep python-rosdistro python-rosinstall
  python-rosinstall-generator python-secretstorage python-simplejson python-vcstools python-wadllib python-wstool subversion
  xauth
0 upgraded, 34 newly installed, 0 to remove and 0 not upgraded.
Need to get 13.6 MB of archives.
After this operation, 77.6 MB of additional disk space will be used.
Get:1 http://mirrors.tuna.tsinghua.edu.cn/ros/ubuntu bionic/main amd64 python-rosdep all 0.23.1-1 [3,288 B]
Get:2 http://mirrors.tuna.tsinghua.edu.cn/ros/ubuntu bionic/main amd64 python-rosdistro all 0.9.1-100 [6,360 B]
```

2.7, rosdep initialization

```
rosdep init
rosdep update
```

If `rosdep init` displays the error message `ERROR: cannot download default sources.list` from:

<https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/sources.list.d/20-default.list> website may be down., visit <https://www.ipaddress.com/> and search for the `raw.githubusercontent.com` domain name, and fill the IP address obtained in the `/etc/hosts` file:

```
apt install nano -y
```

```
nano /etc/hosts
```

```
185.199.110.133 raw.githubusercontent.com
```

```
GNU nano 2.9.3          /etc/hosts          Modified

127.0.0.1      localhost
185.199.110.133 raw.githubusercontent.com
::1      localhost ip6-localhost ip6-loopback
fe00::0: ip6-localnet
ff00::0: ip6-mcastprefix
ff02::1: ip6-allnodes
ff02::2: ip6-allrouters
172.17.0.2      a31a521e9fb4
```

Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos M-U Undo ^X Exit ^R Read File ^W Replace ^U Uncut Text ^T To Spell ^A Go To Line M-E Redo M-A Mark Text M-G Copy Text

Re-run:

```
rosdep init
rosdep update
```

```
Activities Terminal Jan 5 15:37
root@a31a521e9fb4:/# nano /etc/hosts
root@a31a521e9fb4:/# rosdep init
Wrote /etc/ROS/ROSDEP/sources.list.d/20-default.list
Recommended: please run
rosdep update
root@a31a521e9fb4:/# rosdep update
reading in sources list data from /etc/ROS/ROSDEP/sources.list.d
Warning: running 'rosdep update' as root is not recommended.
You should run 'sudo rosdep fix-permissions' and invoke 'rosdep update' again without sudo.
Hit https://raw.githubusercontent.com/ROS/ROSdistro/master/rosdep/osx-homebrew.yaml
Hit https://raw.githubusercontent.com/ROS/ROSdistro/master/rosdep/base.yaml
Hit https://raw.githubusercontent.com/ROS/ROSdistro/master/rosdep/python.yaml
Hit https://raw.githubusercontent.com/ROS/ROSdistro/master/rosdep/ruby.yaml
Hit https://raw.githubusercontent.com/ROS/ROSdistro/master/releases/fuerte.yaml
Query rosdistro index https://raw.githubusercontent.com/ROS/ROSdistro/master/index-v4.yaml
Skip end-of-life distro "ardent"
Skip end-of-life distro "bouncy"
Skip end-of-life distro "crystal"
Skip end-of-life distro "dashing"
Skip end-of-life distro "eloquent"
Skip end-of-life distro "foxy"
Skip end-of-life distro "galactic"
Skip end-of-life distro "groovy"
Add distro "humble"
Skip end-of-life distro "hydro"
Skip end-of-life distro "indigo"
Skip end-of-life distro "iron"
Skip end-of-life distro "jade"
Add distro "jassy"
Skip end-of-life distro "kinetic"
Skip end-of-life distro "lunar"
Skip end-of-life distro "melodic"
Add distro "noetic"
Add distro "rolling"
updated cache in /root/.ROS/ROSDEP/sources.cache
root@a31a521e9fb4:/#
```

2.8, Setting environment variables

2.8.1, Temporary settings

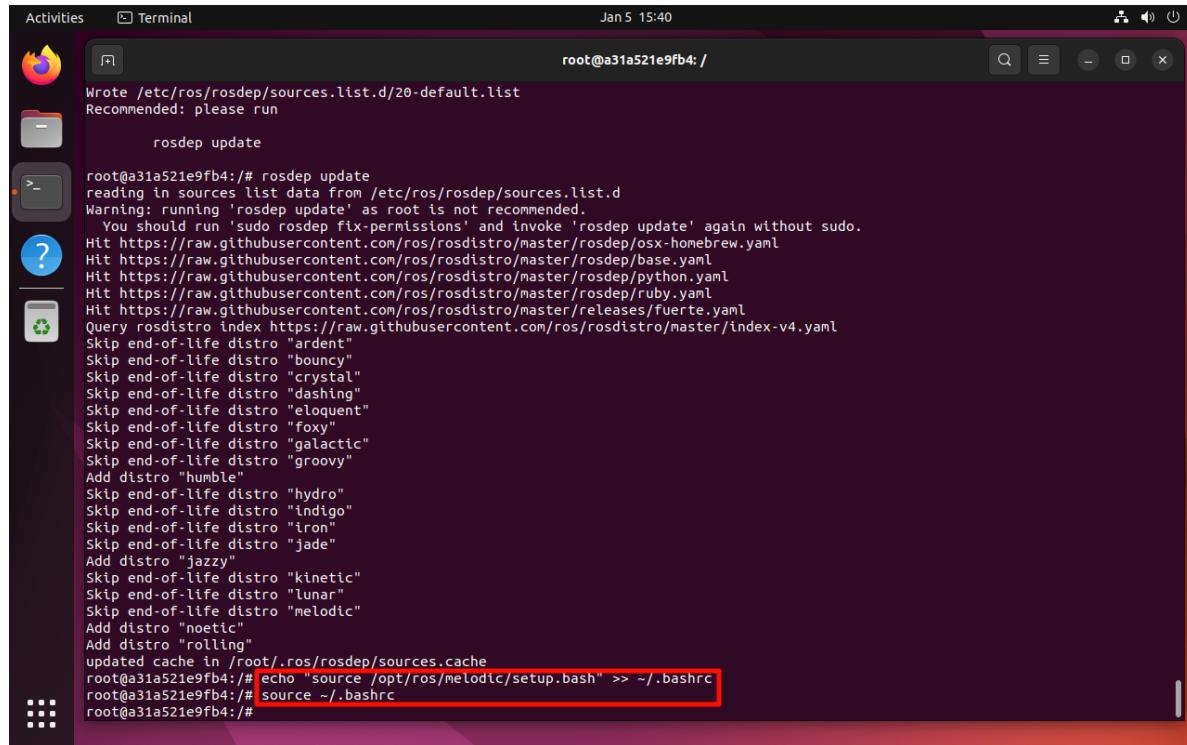
Refresh the current terminal environment variables:

```
source /opt/ROS/melodic/setup.bash
```

2.8.2. Automatic settings (recommended)

Open the terminal to automatically refresh the environment variables: Open the terminal to automatically refresh the .bashrc file content

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



The screenshot shows a terminal window with a dark theme. The terminal title is 'Terminal' and the date and time are 'Jan 5 15:40'. The command 'rosdep update' was run, which updated the sources.list.d/20-default.list file. The output shows various ROS distros being checked for updates. At the end of the output, two commands are run: 'echo "source /opt/ros/melodic/setup.bash" >> ~/.bashrc' and 'source ~/.bashrc'. The last command is highlighted with a red rectangle.

3. Submit the image

Only by submitting a new image locally can the previously built ROS environment be saved. Otherwise, the next time you start the docker image, there will still be no ROS environment in the container.

Note: Modify according to the actual CONTAINER ID

```
docker commit a31a521e9fb4 ros_melodic:1.0
```

```
Skip end-of-life distro "galactic"
Skip end-of-life distro "groovy"
Add distro "humble"
Skip end-of-life distro "hydro"
Skip end-of-life distro "indigo"
Skip end-of-life distro "iron"
Skip end-of-life distro "jade"
Add distro "jazzy"
Skip end-of-life distro "kinetic"
Skip end-of-life distro "lunar"
Skip end-of-life distro "melodic"
Add distro "noetic"
Add distro "rolling"
updated cache in /root/.ros/rosdep/sources.cache
root@a31a521e9fb4:/# echo "source /opt/ros/melodic/setup.bash" >> ~/.bashrc
root@a31a521e9fb4:/# source ~/.bashrc
root@a31a521e9fb4:/#
```

```
yahboom@VM:~$ docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
a31a521e9fb4 ubuntu:18.04 "/bin/bash" 41 minutes ago Up 41 minutes exciting_mayer
yahboom@VM:~$ docker commit a31a521e9fb4 ros_melodic:1.0
sha256:2874758c7f914ac0c671c132cf4a6bed228c22400c0468058e322e1c9181c999
yahboom@VM:~$ docker images
REPOSITORY TAG IMAGE ID CREATED SIZE
ros_melodic 1.0 2874758c7f91 2 minutes ago 2.99GB
ubuntu 18.04 f9a80a55f492 19 months ago 63.2MB
yahboom@VM:~$
```

After saving, you can close the `ubuntu:18.04` container:

```
Skip end-of-life distro "groovy"
Add distro "humble"
Skip end-of-life distro "hydro"
Skip end-of-life distro "indigo"
Skip end-of-life distro "iron"
Skip end-of-life distro "jade"
Add distro "jazzy"
Skip end-of-life distro "kinetic"
Skip end-of-life distro "lunar"
Skip end-of-life distro "melodic"
Add distro "noetic"
Add distro "rolling"
updated cache in /root/.ros/rosdep/sources.cache
root@a31a521e9fb4:/# echo "source /opt/ros/melodic/setup.bash" >> ~/.bashrc
root@a31a521e9fb4:/# source ~/.bashrc
root@a31a521e9fb4:/# exit
yahboom@VM:~$
```

```
yahboom@VM:~$ docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
a31a521e9fb4 ubuntu:18.04 "/bin/bash" 41 minutes ago Up 41 minutes exciting_mayer
yahboom@VM:~$ docker commit a31a521e9fb4 ros_melodic:1.0
sha256:2874758c7f914ac0c671c132cf4a6bed228c22400c0468058e322e1c9181c999
yahboom@VM:~$ docker images
REPOSITORY TAG IMAGE ID CREATED SIZE
ros_melodic 1.0 2874758c7f91 2 minutes ago 2.99GB
ubuntu 18.04 f9a80a55f492 19 months ago 63.2MB
yahboom@VM:~$ docker stop a31a521e9fb4
a31a521e9fb4
yahboom@VM:~$
```

4. Verify the image/ROS

4.1. Start the image

Start the `ros_melodic:1.0` image in interactive mode: Since the turtle case needs to be displayed in the graphical interface, Docker needs to be allowed to access the X Display

```
xhost +
```

```
docker run -it -e DISPLAY=$DISPLAY -v /tmp/.X11-unix:/tmp/.X11-unix
ros_melodic:1.0 /bin/bash
```

4.2. Verify the ROS environment

Use the turtle case to test the ROS environment: open three terminals to enter the same container, and then run the following commands respectively

```
roscore
```

```
rosrun turtlesim turtlesim_node
```

```
rosrun turtlesim turtle_teleop_key
```

Note: The mouse must stay in the third command window to control the turtle

