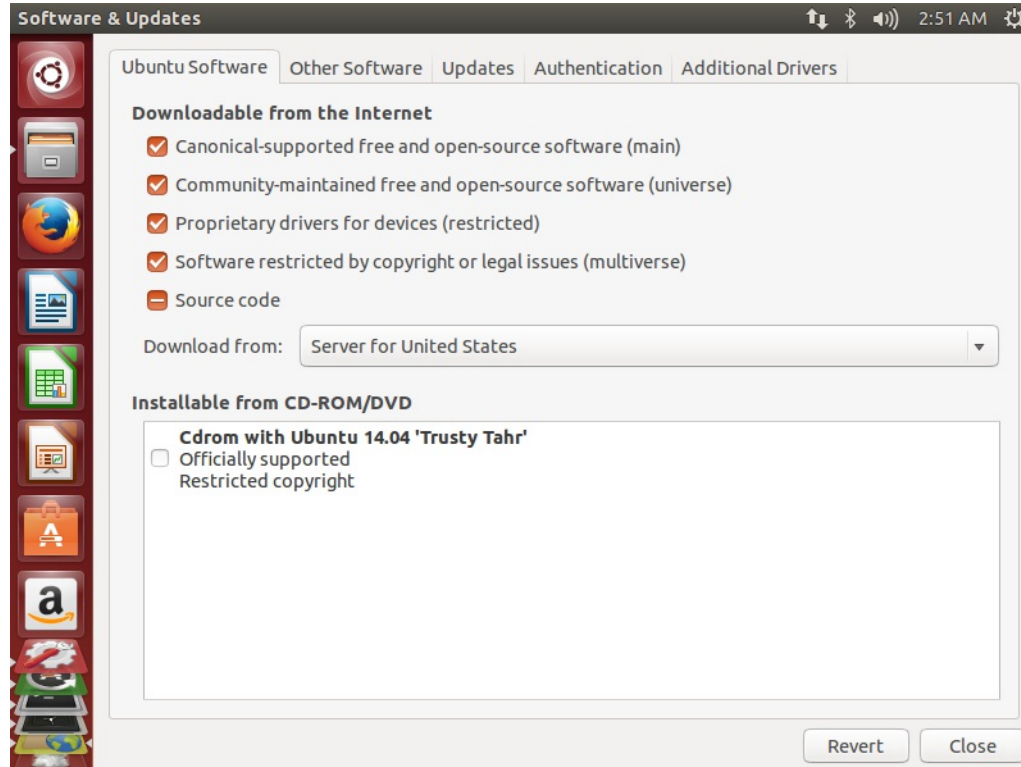


Install ROS

1. Configure Ubuntu repositories

Configure the Ubuntu repositories to allow "restricted," "universe," and "multiverse."



2. Setup your sources.list

Setup the computer to accept software from packages.ros.org. ROS Jade ONLY supports Trusty (14.04), Utopic (14.10) and Vivid (15.04) for debian packages.

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

3. Set up your keys

```
sudo apt-key adv --keyserver hkp://ha.pool.sks-keyservers.net:80 --recv-key 0xB01FA116
```

4. Installation

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

```
sudo apt-get update
```

```
huangyuanji12@Master: ~  
Ign http://extras.ubuntu.com trusty/main Translation-en_US  
Ign http://extras.ubuntu.com trusty/main Translation-en  
Hit http://us.archive.ubuntu.com trusty-backports/universe Sources  
Hit http://us.archive.ubuntu.com trusty-backports/multiverse Sources  
Hit http://us.archive.ubuntu.com trusty-backports/main i386 Packages  
Hit http://us.archive.ubuntu.com trusty-backports/restricted i386 Packages  
Hit http://us.archive.ubuntu.com trusty-backports/universe i386 Packages  
Hit http://us.archive.ubuntu.com trusty-backports/multiverse i386 Packages  
Hit http://us.archive.ubuntu.com trusty-backports/main Translation-en  
Hit http://us.archive.ubuntu.com trusty-backports/multiverse Translation-en  
Hit http://us.archive.ubuntu.com trusty-backports/restricted Translation-en  
Hit http://us.archive.ubuntu.com trusty-backports/universe Translation-en  
Hit http://us.archive.ubuntu.com trusty Release  
Hit http://us.archive.ubuntu.com trusty/main Sources  
Hit http://us.archive.ubuntu.com trusty/restricted Sources  
Hit http://us.archive.ubuntu.com trusty/universe Sources  
Hit http://us.archive.ubuntu.com trusty/multiverse Sources  
Hit http://us.archive.ubuntu.com trusty/main i386 Packages  
Hit http://us.archive.ubuntu.com trusty/restricted i386 Packages  
Hit http://us.archive.ubuntu.com trusty/universe i386 Packages  
Hit http://us.archive.ubuntu.com trusty/multiverse i386 Packages  
Hit http://us.archive.ubuntu.com trusty/main Translation-en  
Hit http://us.archive.ubuntu.com trusty/multiverse Translation-en  
Hit http://us.archive.ubuntu.com trusty/restricted Translation-en  
Hit http://us.archive.ubuntu.com trusty/universe Translation-en  
Ign http://us.archive.ubuntu.com trusty/main Translation-en_US  
Ign http://us.archive.ubuntu.com trusty/multiverse Translation-en_US  
Ign http://us.archive.ubuntu.com trusty/restricted Translation-en_US  
Ign http://us.archive.ubuntu.com trusty/universe Translation-en_US  
Reading package lists... Done  
huangyuanji12@Master:~$
```

Then we can start the ROS, full version is recommended to be download:

```
sudo apt-get install ros-jade-desktop-full
```

5. init rosdep

Before you can use ROS, you will need to initialize rosdep. rosdep enables you to easily install system dependencies for source you want to compile and is required to run some core components in ROS.

```
sudo rosdep init  
rosdep update
```

```
huangyuanji12@Master: ~  
Hit http://us.archive.ubuntu.com trusty/multiverse i386 Packages  
Hit http://us.archive.ubuntu.com trusty/main Translation-en  
Hit http://us.archive.ubuntu.com trusty/multiverse Translation-en  
Hit http://us.archive.ubuntu.com trusty/restricted Translation-en  
Hit http://us.archive.ubuntu.com trusty/universe Translation-en  
Ign http://us.archive.ubuntu.com trusty/main Translation-en_US  
Ign http://us.archive.ubuntu.com trusty/multiverse Translation-en_US  
Ign http://us.archive.ubuntu.com trusty/restricted Translation-en_US  
Ign http://us.archive.ubuntu.com trusty/universe Translation-en_US  
Reading package lists... Done  
huangyuanji12@Master:~$ sudo rosdep init  
ERROR: default sources list file already exists:  
/etc/ros/rosdep/sources.list.d/20-default.list  
Please delete if you wish to re-initialize  
huangyuanji12@Master:~$ rosdep update  
reading in sources list data from /etc/ros/rosdep/sources.list.d  
Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/osx-homebrew.ya  
ml  
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/inde  
x.yaml  
Add distro "groovy"  
Add distro "hydro"  
Add distro "indigo"  
Add distro "jade"  
Add distro "kinetic"  
updated cache in /home/huangyuanji12/.ros/rosdep/sources.cache  
huangyuanji12@Master:~$
```

6. Environment setup

It's convenient if the ROS environment variables are automatically added to your bash session every time a new shell is launched:

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

If you have more than one ROS distribution installed, ~/.bashrc must only source the setup.bash for the version you are currently using.

If you just want to change the environment of your current shell, you can type:

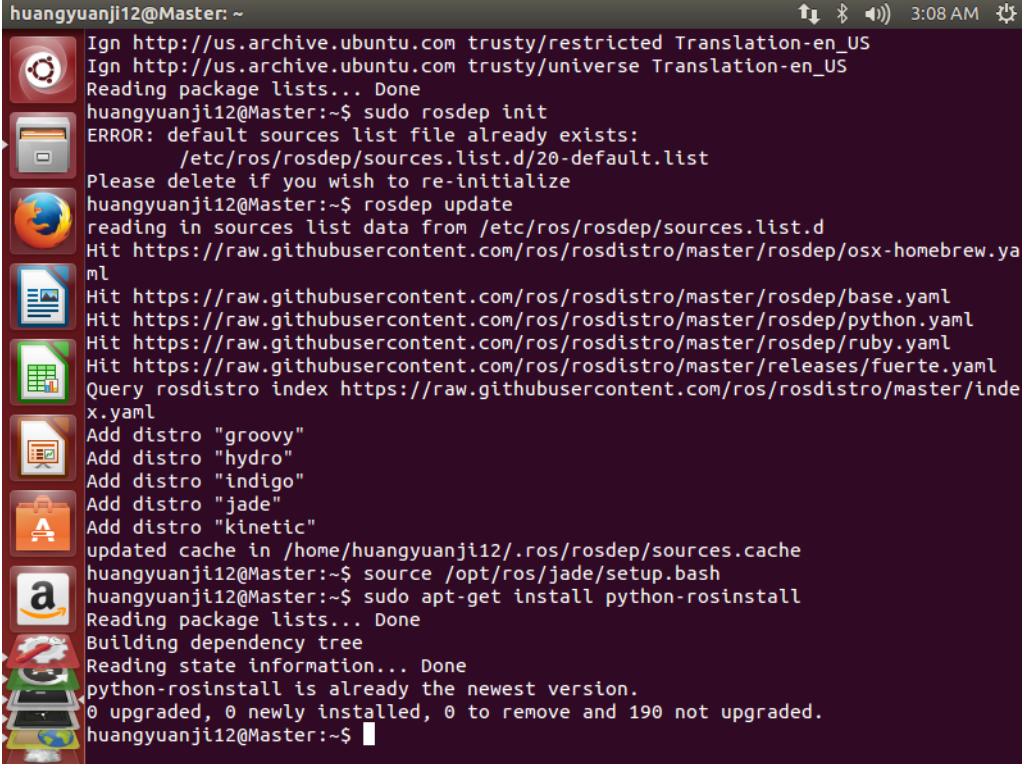
```
source /opt/ros/jade/setup.bash
```

7. Getting rosinstall

rosinstall is a frequently used command-line tool in ROS that is distributed separately. It enables you to easily download many source trees for ROS packages with one command.

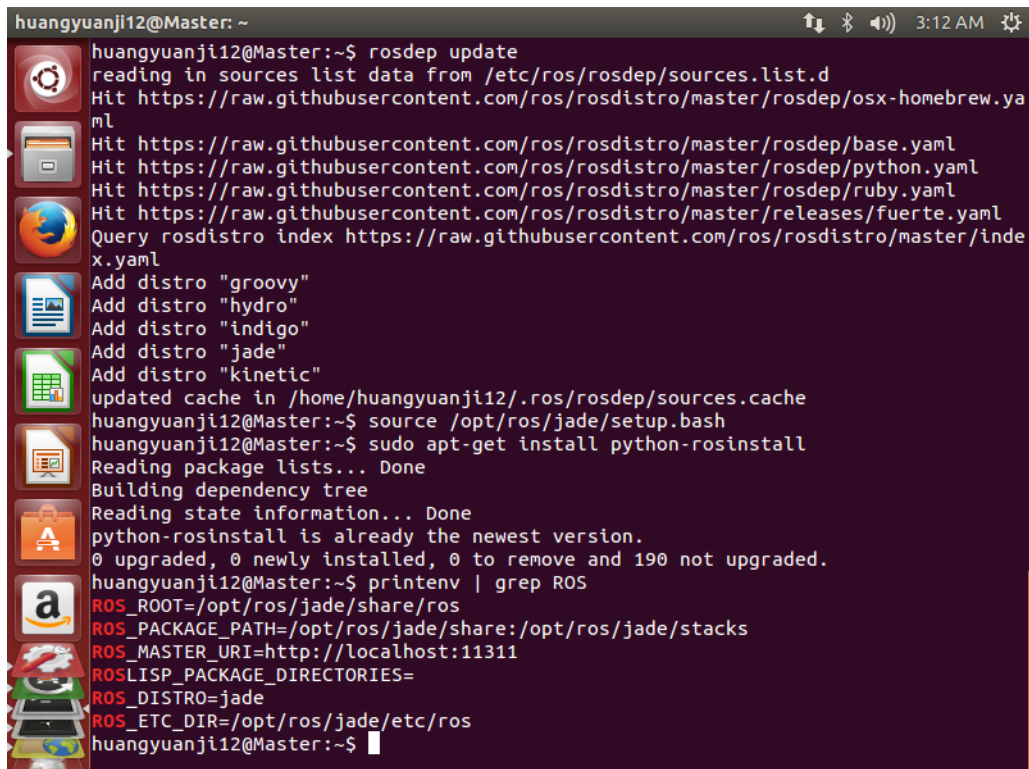
To install this tool on Ubuntu, run:

```
sudo apt-get install python-rosinstall
```

A terminal window titled 'huangyuanji12@Master: ~' with a system tray at the top showing network, Bluetooth, volume, and time (3:08 AM). The terminal output shows the following sequence of commands and their results:
1. Ignoring http://us.archive.ubuntu.com trusty/restricted Translation-en_US and http://us.archive.ubuntu.com trusty/universe Translation-en_US.
2. Reading package lists... Done.
3. Command: sudo rosdep init. Output: ERROR: default sources list file already exists: /etc/ros/rosdep/sources.list.d/20-default.list. Please delete if you wish to re-initialize.
4. Command: rosdep update. Output: reading in sources list data from /etc/ros/rosdep/sources.list.d, 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.yaml.
5. Adding distros: groovy, hydro, indigo, jade, kinetic.
6. updated cache in /home/huangyuanji12/.ros/rosdep/sources.cache.
7. Command: source /opt/ros/jade/setup.bash.
8. Command: sudo apt-get install python-rosinstall. Output: Reading package lists... Done, Building dependency tree, Reading state information... Done, python-rosinstall is already the newest version, 0 upgraded, 0 newly installed, 0 to remove and 190 not upgraded.
9. Prompt returns to huangyuanji12@Master:~\$

Now the ROS has been installed, using the command to make sure that your environment has been properly setup:

```
$ printenv | grep ROS
```



```
huangyuanji12@Master: ~  
huangyuanji12@Master:~$ rosdep update  
reading in sources list data from /etc/ros/rosdep/sources.list.d  
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.yaml  
Add distro "groovy"  
Add distro "hydro"  
Add distro "indigo"  
Add distro "jade"  
Add distro "kinetic"  
updated cache in /home/huangyuanji12/.ros/rosdep/sources.cache  
huangyuanji12@Master:~$ source /opt/ros/jade/setup.bash  
huangyuanji12@Master:~$ sudo apt-get install python-rosinstall  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
python-rosinstall is already the newest version.  
0 upgraded, 0 newly installed, 0 to remove and 190 not upgraded.  
huangyuanji12@Master:~$ printenv | grep ROS  
ROS_ROOT=/opt/ros/jade/share/ros  
ROS_PACKAGE_PATH=/opt/ros/jade/share:/opt/ros/jade/stacks  
ROS_MASTER_URI=http://localhost:11311  
ROSLISP_PACKAGE_DIRECTORIES=  
ROS_DISTRO=jade  
ROS_ETC_DIR=/opt/ros/jade/etc/ros  
huangyuanji12@Master:~$
```

Install cartographer

1. Install ceres solver-1.11.0

Beacuse of the failure in installing ceres solver by the following command

```
catkin_make_isolated --install --use-ninja
```

We need to install the ceres solver in the very first from github:

```
git clone https://github.com/hitcm/ceres-solver-1.11.0.git  
cd ceres-solver-1.11.0/build  
cmake ..  
make -j  
sudo make install
```

But during the installation, the system shutdown when using the command

```
make -j
```

so we use make instead of make -j

2. Install cartographer

In this step, we can also get the source code from github

```
git clone https://github.com/hitcm/cartographer.git  
cd cartographer/build  
cmake .. -G Ninja  
ninja  
ninja test  
sudo ninja install
```

3. Install cartographer-ros

download the cartographer-ros in catkin_ws/src

```
git clone https://github.com/hitcm/cartographer_ros.git
```

4. Running the demos

Now that Cartographer and Cartographer's ROS integration are installed, download the example bags to a known location and run the demos.

```
wget -P ~/Downloads https://storage.googleapis.com/cartographer-public-data/bags/backpack_2d/cartographer_paper_deutsches_museum.bag
wget -P ~/Downloads https://storage.googleapis.com/cartographer-public-data/bags/backpack_3d/cartographer_3d_deutsches_museum.bag
```

Use the following commands to run the demos.

```
roslaunch cartographer_ros demo_backpack_2d.launch bag_filename:=${HOME}/Downloads/cartographer_paper_deutsches_museum.bag
roslaunch cartographer_ros demo_backpack_3d.launch bag_filename:=${HOME}/Downloads/cartographer_3d_deutsches_museum.bag
```

Before running demos, use the following command to modify localhost in the .bashrc using gedit.

```
cd
gedit ~/.bashrc
```

```
.bashrc x
echo error)" "${history|tail -n1|sed -e '\s/\s*[0-9]\+\s*//;s/[;&|]\s*alert
$/\s*\s*'"

# Alias definitions.
# You may want to put all your additions into a separate file like
# ~/.bash_aliases, instead of adding them here directly.
# See /usr/share/doc/bash-doc/examples in the bash-doc package.

if [ -f ~/.bash_aliases ]; then
    . ~/.bash_aliases
fi

# enable programmable completion features (you don't need to enable
# 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

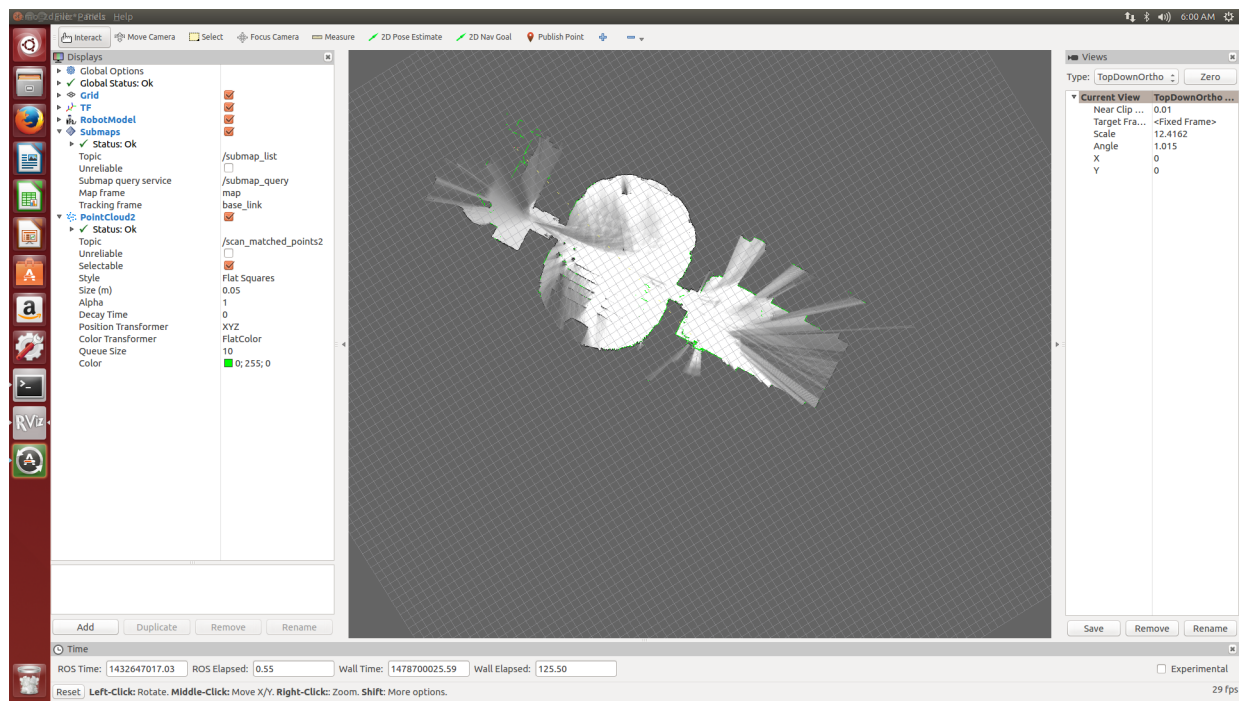
source ~/catkin_ws/devel/setup.bash
export ROS_HOSTNAME=localhost
export ROS_MASTER_URI=http://localhost:11311
```

We need to confirm we can ping to localhost.

```
ping localhost
```

```
huangyuanji12@Master:~$ ping localhost
PING localhost.localdomain (127.0.0.1) 56(84) bytes of data.
64 bytes from ip6-localhost (127.0.0.1): icmp_seq=1 ttl=64 time=0.008 ms
64 bytes from ip6-localhost (127.0.0.1): icmp_seq=2 ttl=64 time=0.045 ms
64 bytes from ip6-localhost (127.0.0.1): icmp_seq=3 ttl=64 time=0.051 ms
64 bytes from ip6-localhost (127.0.0.1): icmp_seq=4 ttl=64 time=0.027 ms
^Z
[1]+  Stopped                  ping localhost
huangyuanji12@Master:~$
```

Running the 2D demos



Finally we have installed the ROS and cartographer.