Ubuntu Core And ROS On Devkit

Host PC OS: Ubuntu 16.04

1. Install Ubuntu Core 16.04

1.1 Download Filesystem

Create rootfs directory

```
mkdir rootfs
```

Download filesystem

```
http://cdimage.ubuntu.com/ubuntu-base/releases/16.04/release/ubuntu-base-16.04-core-armhf.tar.gz
```

Extract:

```
sudo tar -xpf ubuntu-base-16.04-core-armhf.tar.gz -C rootfs
```

1.2 Configure Rootfs

Install qemu-user-static on host PC:

```
sudo apt-get install qemu-user-static
```

Note: The qemu-user-static emulator can run binaries for other architectures but with the same operating system as the current one.

Install qemu-user-static to rootfs

```
sudo cp /usr/bin/qemu-arm-static rootfs/usr/bin/
```

Create script **ch-mount.sh**:

```
#!/bin/bash

function mnt() {
    echo "MOUNTING"
    sudo mount -t proc /proc ${2}proc
    sudo mount -t sysfs /sys ${2}sys
    sudo mount -o bind /dev ${2}dev
    sudo mount -o bind /dev/pts ${2}dev/pts
    sudo chroot ${2}

}
```

```
function umnt() {
    echo "UNMOUNTING"
    sudo umount ${2}proc
    sudo umount ${2}sys
    sudo umount ${2}dev/pts
    sudo umount ${2}dev

}

if [ "$1" == "-m" ] && [ -n "$2" ] ;
then
    mnt $1 $2
elif [ "$1" == "-u" ] && [ -n "$2" ];
then
    umnt $1 $2
else
    echo ""
    echo "Either 1'st, 2'nd or both parameters were missing"
    echo ""
    echo "1'st parameter can be one of these: -m(mount) OR -u(umount)"
    echo "2'nd parameter is the full path of rootfs directory(with trailing '/')"
    echo ""
    echo "For example: ch-mount -m /media/sdcard/"
    echo ""
    echo 1st parameter : ${1}
    echo 2nd parameter : ${2}
fi
```

Mount proc, sys, dev, dev/pts to new rootfs and enter chroot environment with **ch-mount.sh**

```
sudo bash ch-mount.sh -m rootfs/
```

Note: steps below are all done in chroot environment

Configure DNS:

```
echo "nameserver 8.8.8.8" | tee /etc/resolv.conf > /dev/null
```

Update the repositories:

```
apt-get update
```

Install minimal packages required:

```
apt-get install language-pack-en-base sudo ssh net-tools ethtool wireless-tools
iputils-ping rsyslog bash-completion python-gobject-2 python-gtk2 lsb-release vim
ifupdown
```

Enable universe and multiverse sourse(ROS need this):

```
vim /etc/apt/sources.list
```

Add ** universe multiverse** at the end of each line:

```
# See http://help.ubuntu.com/community/UpgradeNotes for how to upgrade to
# newer versions of the distribution.

deb http://ports.ubuntu.com/ubuntu-ports/ xenial main restricted universe multiverse
deb-src http://ports.ubuntu.com/ubuntu-ports/ xenial main restricted universe multiverse

## Major bug fix updates produced after the final release of the
## distribution.
deb http://ports.ubuntu.com/ubuntu-ports/ xenial-updates main restricted universe multiverse
deb-src http://ports.ubuntu.com/ubuntu-ports/ xenial-updates main restricted universe multiverse

## Uncomment the following two lines to add software from the 'universe'
## repository.
## N.B. software from this repository is ENTIRELY UNSUPPORTED by the Ubuntu
## team. Also, please note that software in universe WILL NOT receive any
## review or updates from the Ubuntu security team.
# deb http://ports.ubuntu.com/ubuntu-ports/ xenial universe
# deb-src http://ports.ubuntu.com/ubuntu-ports/ xenial universe
# deb http://ports.ubuntu.com/ubuntu-ports/ xenial-updates universe
# deb-src http://ports.ubuntu.com/ubuntu-ports/ xenial-updates universe

## N.B. software from this repository may not have been tested as
## extensively as that contained in the main release, although it includes
## newer versions of some applications which may provide useful features.
## Also, please note that software in backports WILL NOT receive any review
## or updates from the Ubuntu security team.
# deb http://ports.ubuntu.com/ubuntu-ports/ xenial-backports main restricted
# deb-src http://ports.ubuntu.com/ubuntu-ports/ xenial-backports main restricted

deb http://ports.ubuntu.com/ubuntu-ports/ xenial-security main restricted universe multiverse
deb-src http://ports.ubuntu.com/ubuntu-ports/ xenial-security main restricted universe multiverse
# deb http://ports.ubuntu.com/ubuntu-ports/ xenial-security universe
# deb-src http://ports.ubuntu.com/ubuntu-ports/ xenial-security universe
# deb http://ports.ubuntu.com/ubuntu-ports/ xenial-security multiverse
# deb-src http://ports.ubuntu.com/ubuntu-ports/ xenial-security multiverse
```

Update again:

```
apt-get update
```

Add user, password is robsense:

```
adduser robsense && addgroup robsense adm && addgroup robsense sudo && addgroup
robsense audio
```

Add hostname

```
echo ‘robsense’ > /etc/hostname
```

Add host

```
echo -e '127.0.0.1    localhost\n127.0.1.1    robsense' > /etc/hosts
```

Close system log

```
sudo systemctl disable rsyslog
```

1.3 Configur e Auto Login Ubuntu

Enable getty on serial console:

```
systemctl enable getty@ttyPS1.service
```

Create the folder:

```
mkdir /etc/systemd/system/getty@ttyPS1.service.d
```

Create the file:

```
vim /etc/systemd/system/getty@ttyPS1.service.d/override.conf
```

Add this:

```
[Service]
ExecStart=
ExecStart=-/sbin/agetty --noissue --autologin robsense %I $TERM
Type=idle
```

1.4 Pack Rootfs

Type **exit** to quit chroot environment, and umont proc, sys, dev, dev/pts:

```
sudo bash ch-mount.sh -u rootfs/
```

Compression rootfs:

```
cd rootfs
sudo tar jcpf ubuntu-core-16.04-robsense.tar.bz2 .
or sudo tar jcpf ubuntu-core-16.04-robsense.tar.bz2 -C /media/steven/rootfs/ .
```

1.5 Partition SD Car d

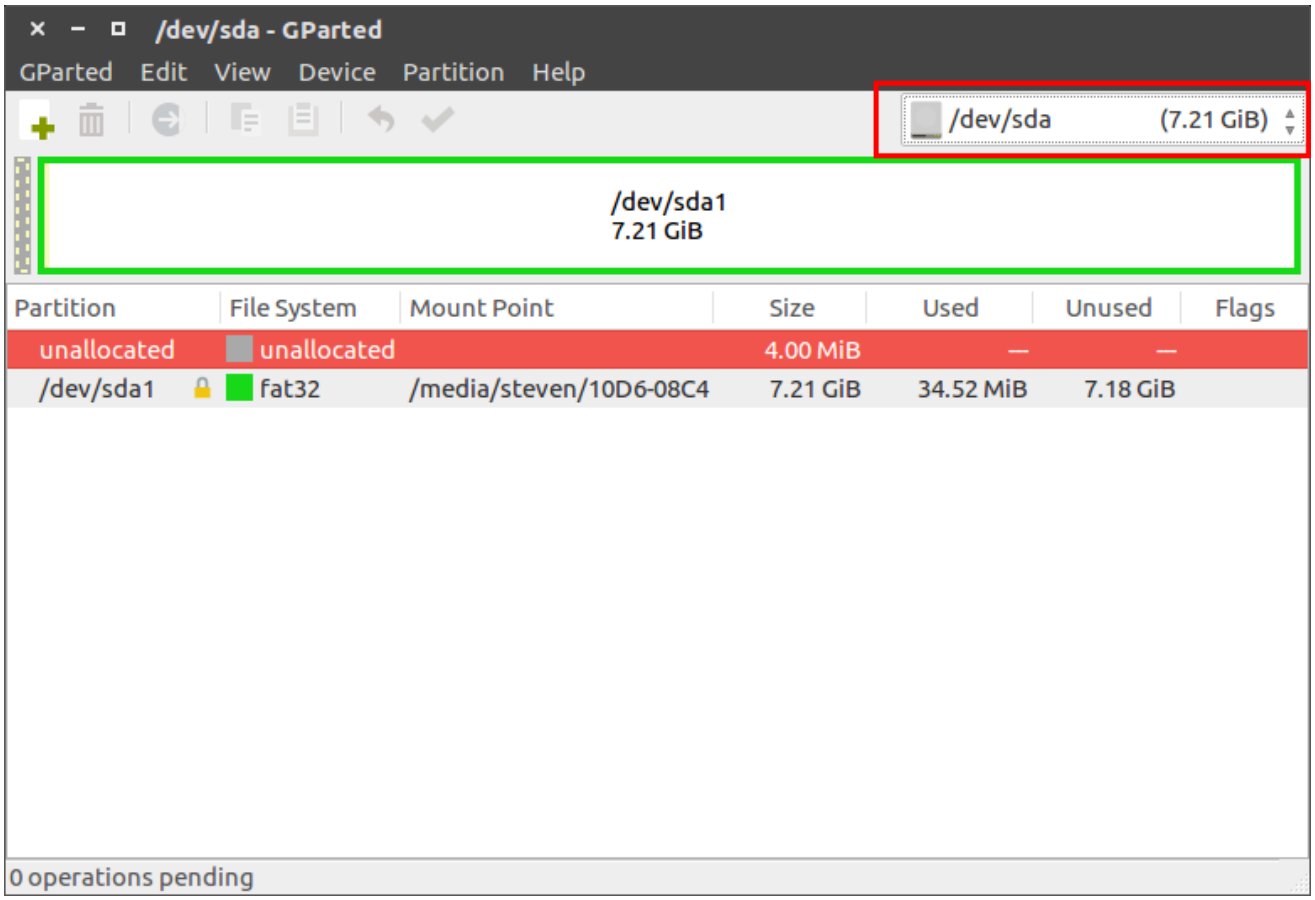
We use gparted to partiton sd card, which is easy to manage patition. Install it with apt:

```
sudo apt-get install gparted
```

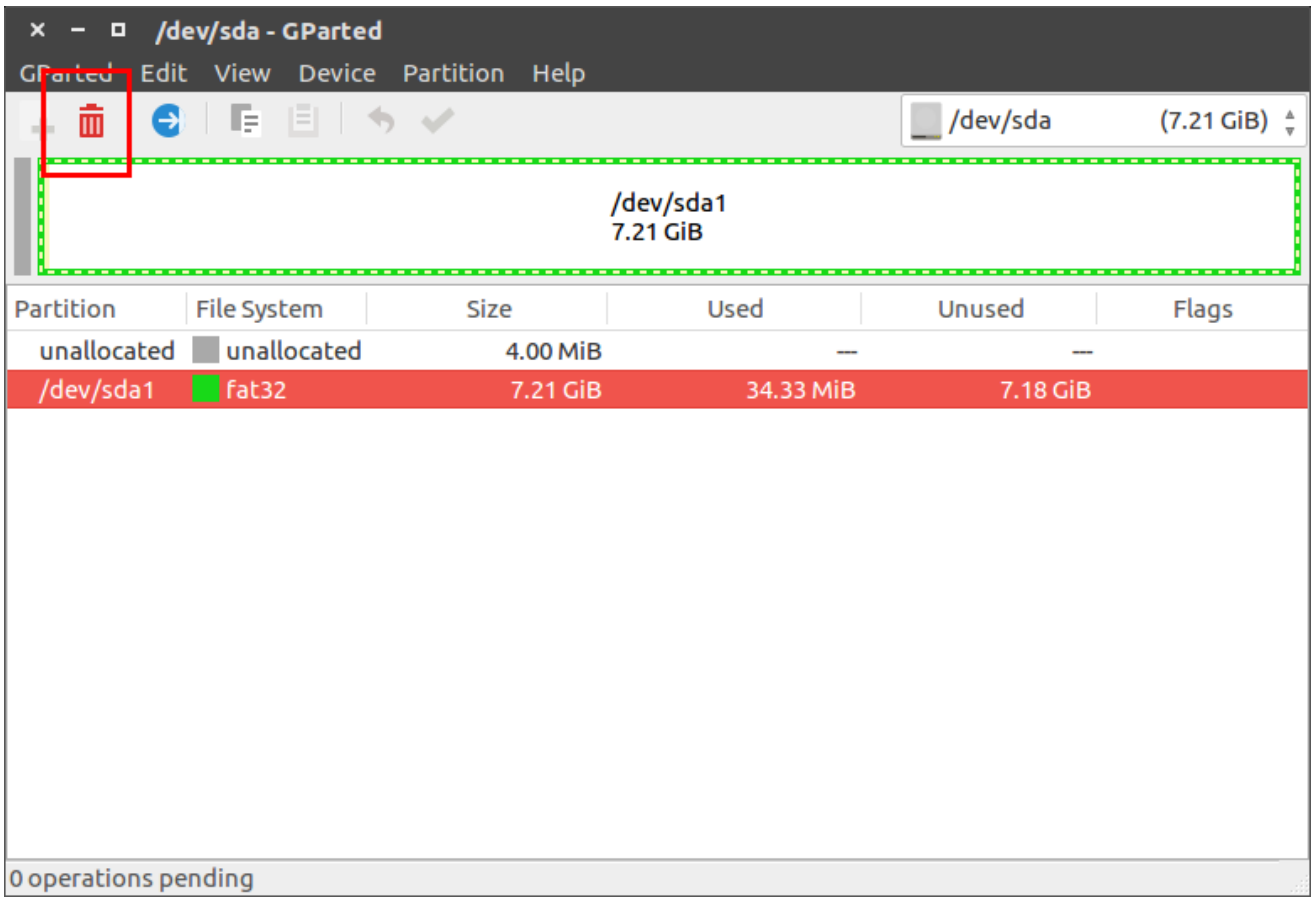
Umount SD card:

```
umount /media/[PC username]/[sd label]
```

Open gparted, and select SD:

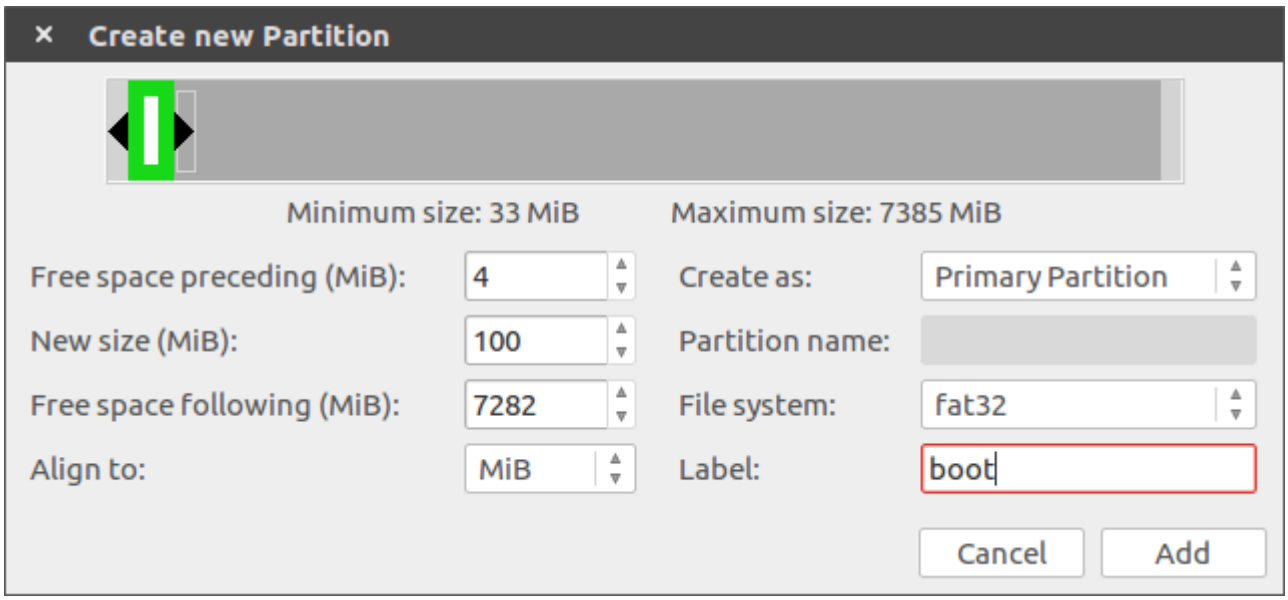


Select current fat32 parition, and delete it:

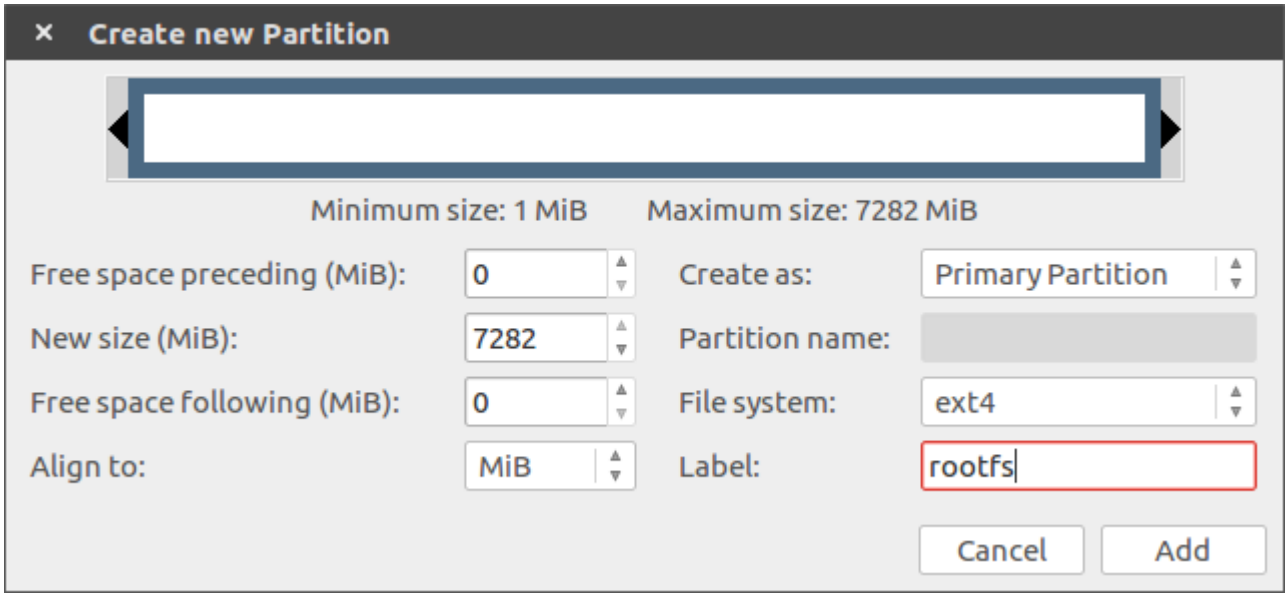


Create two new partiton:

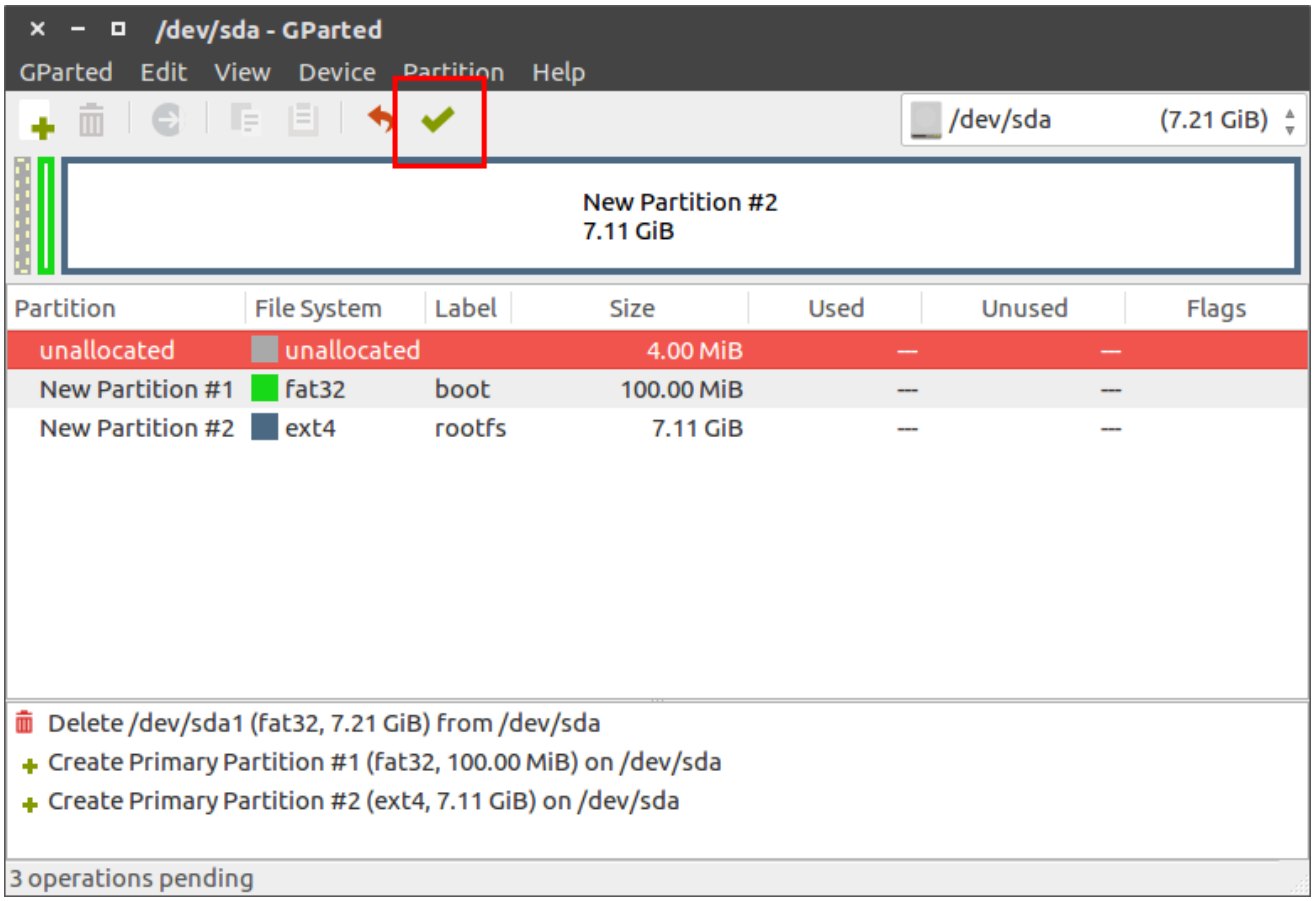
First, fat32 partition, 200M, Primary Partition, Free space preceding is 4M, Label is "boot"



Second, ext4 partition, Primary Partition, Free space preceding is 0, Label is "rootfs"



Finish with button below



1.6 Install Ubuntu T o SD

Copy Boot.bin, uImage, devicetree.dtb to boot partition

Note: reference "Hellow World" section in "PhenixPro DevKit Developers' Guide"

Extract rootfs to SD card:

```
sudo tar -xpf ubuntu-core-16.04-robsense.tar.bz2 -C /media/[PC username]/rootfs
```

Umount SD card:

```
umount /media/[PC username]/*
```

1.7 Configure u-boot

u-boot will default to load ramdisk, we need to tell it to stop load ramdisk:

```
set sdboot 'if mmcinfo; then run uenvboot; echo Copying Linux from SD to RAM... &&
load mmc 0 ${kernel_load_address} ${kernel_image} && load mmc 0
${devicetree_load_address} ${devicetree_image} && bootm ${kernel_load_address} -
${devicetree_load_address}; fi'
```

Tell it to load filesystem from sd card:

```
set bootargs 'console=ttyPS1,115200 maxcpus=1 root=/dev/mmcblk0p2 rw earlyprintk
rootfstype=ext4 rootwait devtmpfs.mount=0'
```

if you want ubuntu to control two cpu:

```
set bootargs 'console=ttyPS1,115200 root=/dev/mmcblk0p2 rw earlyprintk rootfstype=ext4
rootwait devtmpfs.mount=0'
```

Boot system:

```
robsense login: robsense (automatic login)

Last login: Thu Feb 11 16:28:18 UTC 2016 on ttyPS0
Welcome to Ubuntu 16.04 LTS (GNU/Linux 4.4.0-xilinx-g0237368-dirty armv7l

 * Documentation:  https://help.ubuntu.com/
robsense@robsense:~$ ifconfig
lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

robsense@robsense:~$
```

2. Install ROS Kinetic

2.1 Configure Network

```
sudo vim /etc/network/interfaces
```

Add:

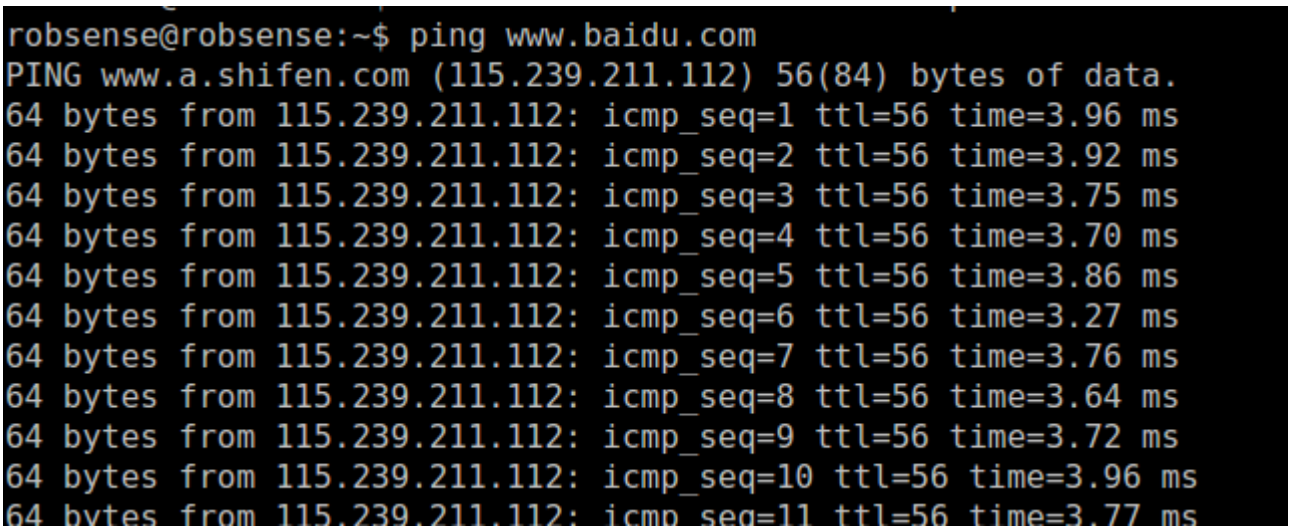
```
auto eth0
iface eth0 inet static
address 192.168.0.234
gateway 192.168.0.1
netmask 255.255.255.0
dns-nameservers 114.114.114.114
```

Restart network:

```
sudo ifdown eth0 && sudo ifup eth0
```

Test:

```
ping www.baidu.com
```



2.2 Setup 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'
```

2.3 Setup keys

```
sudo apt-key adv --keyserver hkp://ha.pool.sks-keyservers.net:80 --recv-key
421C365BD9FF1F717815A3895523BAEEB01FA116
```

2.4 Installation

Update Ubuntu repositories:

```
sudo apt-get update
```

Install Ros-Base:

```
sudo apt-get install ros-kinetic-ros-base
```

```
The following packages will be upgraded:
  gcc-5-base libc6 libstdc++6 libuuid1
4 upgraded, 325 newly installed, 0 to remove and 35 not upgraded.
Need to get 120 MB of archives.
After this operation, 544 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

2.5 Initialize rosdep

```
sudo rosdep init
rosdep update
```

2.6 Environment setup

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

2.7 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.

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

2.8 Check

```
printenv | grep ROS
```

```
robsense@robsense:~$ printenv | grep ROS
ROS_ROOT=/opt/ros/kinetic/share/ros
ROS_PACKAGE_PATH=/opt/ros/kinetic/share
ROS_MASTER_URI=http://localhost:11311
ROSLISP_PACKAGE_DIRECTORIES=
ROS_DISTRO=kinetic
ROS_ETC_DIR=/opt/ros/kinetic/etc/ros
robsense@robsense:~$
```

3. Wakeup CPU1

Pilot code is running on cpu1(reference "Hellow World" section in "PhenixPro DevKit Developers' Guide")