NanoPi NEO2

as an

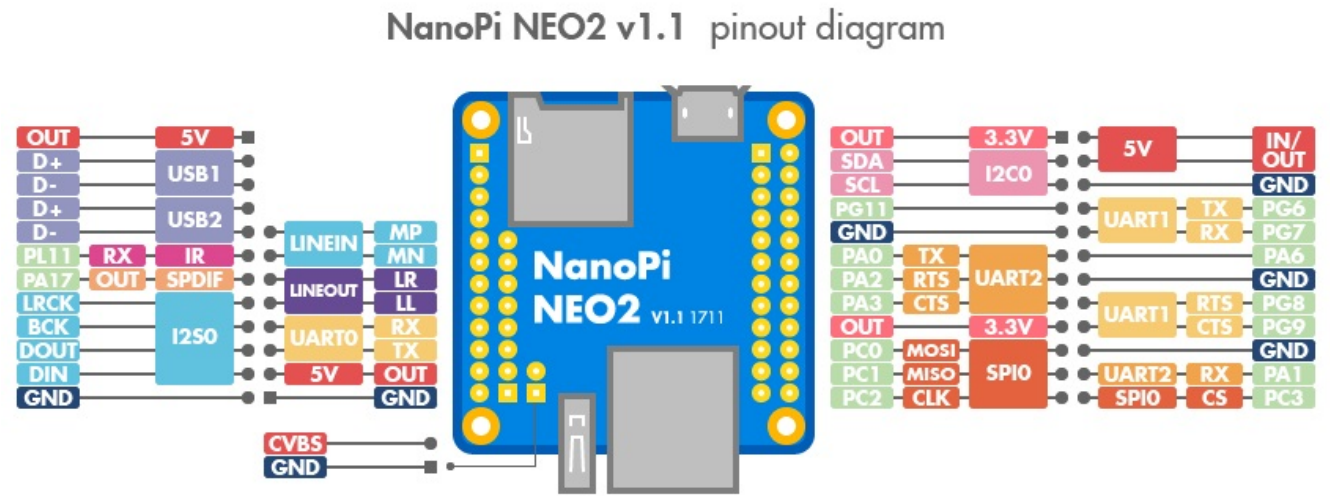
IoT-gateway module

Table of Contents

Aim, purpose, summary....2
Install OS on the SD-Card....3
Boot Linux from SD-Card....4
Login via SSH....4
  Update packages....7
  CPU Architecture....8
  System disk space usage....9
  Python versions....10
  Lsmod....10
UART....11
  Enabling UART....11
  Install the python-serial module....13
  List available UARTs....13
  Test you UART serial communication using python....14
To Sum-up....15
Annexes....15
  Hardware Spec....15

Aim, purpose, summary

The NanoPi NEO2 is a newly released super tiny ARM board by FriendlyElec. It uses Allwinner's 64-bit H5 quad-core SoC (ARM Cortex-A53). It has internal hexa-core Mail450 GPU, 512M DDR3 RAM. It has Gbps Ethernet and one USB host port. These features make it especially suitable for applications that require high data throughput , speedy data transmission and high performance. The idea here is to integrate this little tiny electronics within our own existing architecture to offer an IOT-gateway. As shown in the pinout diagram picture below, the NanoPi NEO2 offers 3 UARTs. (Universal asynchronous receiver-transmitter)



The UART0 is already used for as a Serial Debug. However, the ports UART1 and UART2 are free to use and we need to test them to demonstrate the potential of this board as IOT-gateway device.

Install OS on the SD-Card

First of all let's create an SD-card linux OS image
Download the Image File
xenial_4.14_arm64_YYYYMMDD.img.zip
FriendlyCore (base on UbuntuCore) Image File, kernel:Linux-4.14

Next, flash the image on the SD-Card
Under Windows, to flash the image, get the utilitywin32diskimager.rar.
Under Linux users can use "dd" command line.

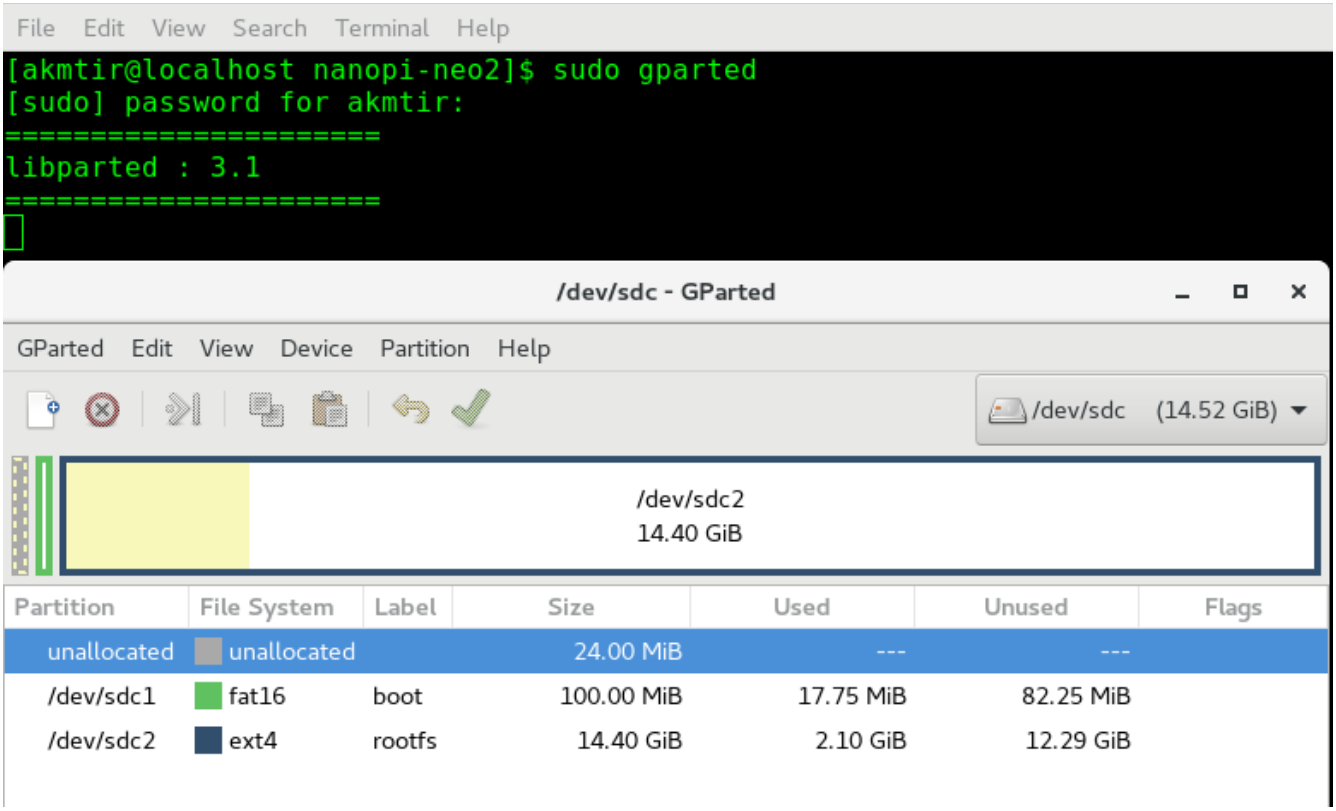


Figure 1: SD card partition

Boot Linux from SD-Card

Insert this card into your board's BOOT slot, connect the network ehternet cable to the NanoPi board and power on (with a 5V/2A power source). If the PWR LED is on and the STAT LED is blinking this indicates your board has successfully booted.

Login via SSH

The NanoPi NEO2 doesn't have a video output interface. You can log into the board via SSH. In our test the IP address detected by our router was 192.168.1.8 as shown below.

Figure 2: IP of the NanoPi NEO2

We ran the following command to log into the NanoPi NEO2:

$ ssh root@192.168.1.8

The password is fa

```
File  Edit  View  Search  Terminal  Help

[akmtir@localhost nanopi-neo2]$
[akmtir@localhost nanopi-neo2]$ sudo ssh -X 192.168.1.8
[sudo] password for akmtir:
The authenticity of host '192.168.1.8 (192.168.1.8)' can't be established.
ECDSA key fingerprint is SHA256:yYVW4kiK3FlmSR+PPodLBhmH9sNdpivwwStcln+L76A.
ECDSA key fingerprint is MD5:34:68:d8:b6:97:c6:1f:be:cb:9b:80:4a:62:75:d0:fe.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.1.8' (ECDSA) to the list of known hosts.
Ubuntu 16.04.2 LTS

root@192.168.1.8's password:
 _____     _                 _____ _     _____ _____
|  ___| __(_) ___ _ __   __| | | |_   _| ____| |    | ____/ ___|
| |_ | '__| |/ _ \ '_ \ / _` | | | | | |  _| | |    |  _| |
|  _|| |  | |  __/ | | | (_| | |_| | | | |___| |___ | |__| |___
|_|  |_|  |_|\___|_| |_|\__,_|\___/  |_| |_____|_____|_____\____|
                                    |___/

Welcome to Ubuntu core 16.04 LTS 4.14.52
System load:   0.01              Up time:       9 min           Local users:   2

Memory usage:  7 % of 481Mb      IP:            192.168.1.8
CPU temp:      39°C
Usage of /:    15% of 15G

 * Documentation: http://wiki.friendlyarm.com/Ubuntu
 * Forum: http://www.friendlyarm.com/Forum/

/usr/bin/xauth:  file /root/.Xauthority does not exist
root@NanoPi-NEO2:~# pwd
/root
root@NanoPi-NEO2:~# ls -l
total 20
drwxr-xr-x 4 root root 4096 Oct 11 07:56 demo
drwxr-xr-x 7 root root 4096 Aug 17  2018 mjpg-streamer
drwxr-xr-x 2 root root 4096 Mar 15  2017 Music
drwxr-xr-x 6 root root 4096 Oct 11 07:56 RPi.GPIO_NP
drwxr-xr-x 7 root root 4096 Oct 11 07:56 WiringNP
root@NanoPi-NEO2:~#
```

Update packages

```
root@NanoPi-NEO2:~#
root@NanoPi-NEO2:~#
root@NanoPi-NEO2:~# sudo apt-get update
Hit:1 http://ports.ubuntu.com/ubuntu-ports xenial InRelease
Get:2 http://ports.ubuntu.com/ubuntu-ports xenial-updates InRelease [109 kB]
Get:3 http://ports.ubuntu.com/ubuntu-ports xenial-backports InRelease [107 kB]
Get:4 http://ports.ubuntu.com/ubuntu-ports xenial-security InRelease [109 kB]
Get:5 http://ports.ubuntu.com/ubuntu-ports xenial-updates/main Sources [330 kB
```

CPU Architecture

```
root@NanoPi-NEO2:~# cat /proc/cpuinfo
processor       : 0
BogoMIPS        : 48.00
Features        : fp asimd evtstrm aes pmull sha1 sha2 crc32 cpuid
CPU implementer : 0x41
CPU architecture: 8
CPU variant     : 0x0
CPU part        : 0xd03
CPU revision    : 4

processor       : 1
BogoMIPS        : 48.00
Features        : fp asimd evtstrm aes pmull sha1 sha2 crc32 cpuid
CPU implementer : 0x41
CPU architecture: 8
CPU variant     : 0x0
CPU part        : 0xd03
CPU revision    : 4

processor       : 2
BogoMIPS        : 48.00
Features        : fp asimd evtstrm aes pmull sha1 sha2 crc32 cpuid
CPU implementer : 0x41
CPU architecture: 8
CPU variant     : 0x0
CPU part        : 0xd03
CPU revision    : 4

processor       : 3
BogoMIPS        : 48.00
Features        : fp asimd evtstrm aes pmull sha1 sha2 crc32 cpuid
CPU implementer : 0x41
CPU architecture: 8
CPU variant     : 0x0
CPU part        : 0xd03
CPU revision    : 4

Hardware        : Allwinnersun50iw2Family
Revision        : 0000
Serial          : 0000000000000000
```

Display information about the CPU architecture

System disk space usage

```
File  Edit  View  Search  Terminal  Help
root@NanoPi-NEO2:~#
root@NanoPi-NEO2:~# df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            207M     0  207M   0% /dev
tmpfs            49M  2.8M   46M   6% /run
/dev/mmcblk0p2   15G  1.9G   13G  13% /
tmpfs           241M     0  241M   0% /dev/shm
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
tmpfs           241M     0  241M   0% /sys/fs/cgroup
/dev/mmcblk0p1  100M   18M   83M  18% /boot
tmpfs            49M     0   49M   0% /run/user/1000
tmpfs            49M     0   49M   0% /run/user/0
root@NanoPi-NEO2:~#
root@NanoPi-NEO2:~#
```

Report file system disk space usage

Python versions

```
root@NanoPi-NEO2:~#
root@NanoPi-NEO2:~# python --version
Python 2.7.12
root@NanoPi-NEO2:~#
root@NanoPi-NEO2:~# python3 --version
Python 3.5.2
root@NanoPi-NEO2:~#
```

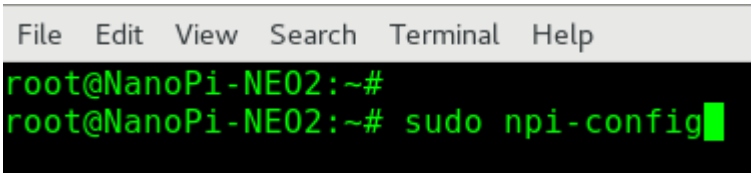
Lsmod

```
File  Edit  View  Search  Terminal  Help
root@NanoPi-NEO2:~#
root@NanoPi-NEO2:~# ls -l /sys/class/gpio/
total 0
--w------- 1 root root 4096 Jan  1  1970 export
lrwxrwxrwx 1 root root    0 Jan  1  1970 gpiochip0 -> ../../devices/platform/soc/1c20800.pinctrl/gpio/gpiochip0
lrwxrwxrwx 1 root root    0 Jan  1  1970 gpiochip352 -> ../../devices/platform/soc/1f02c00.pinctrl/gpio/gpiochip352
--w------- 1 root root 4096 Jan  1  1970 unexport
root@NanoPi-NEO2:~#
root@NanoPi-NEO2:~# lsmod
Module                  Size  Used by
snd_soc_simple_card    16384  0
snd_soc_simple_card_utils    16384  1 snd_soc_simple_card
g_mass_storage         16384  0
usb_f_mass_storage     36864  2 g_mass_storage
libcomposite           45056  2 usb_f_mass_storage,g_mass_storage
root@NanoPi-NEO2:~#
```

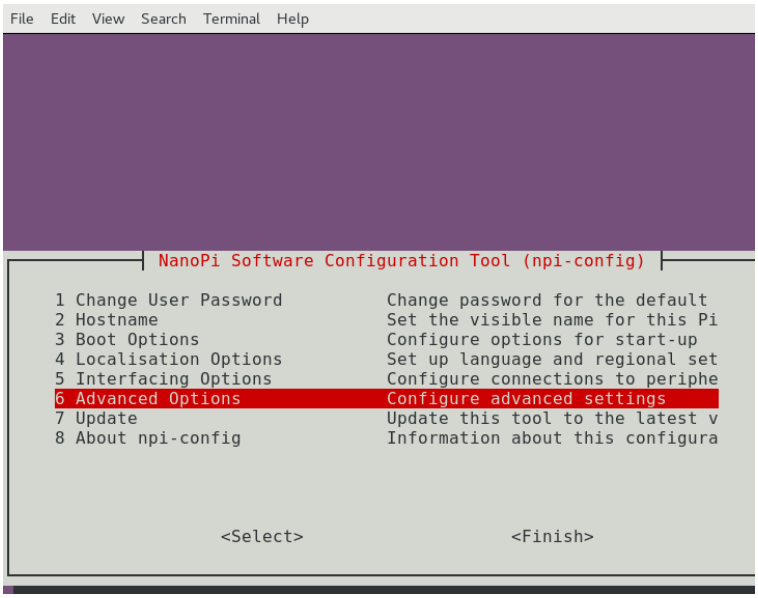
Show the status of modules in the linux Kernel

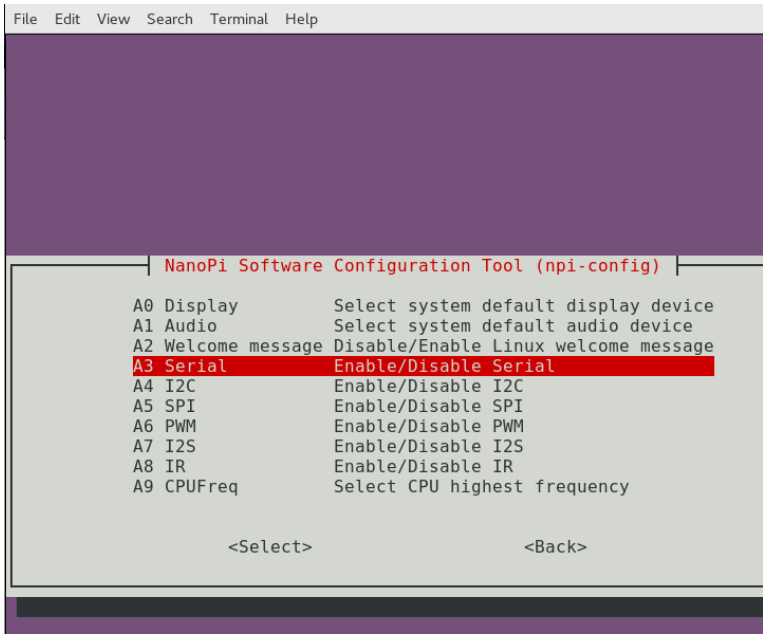
UART

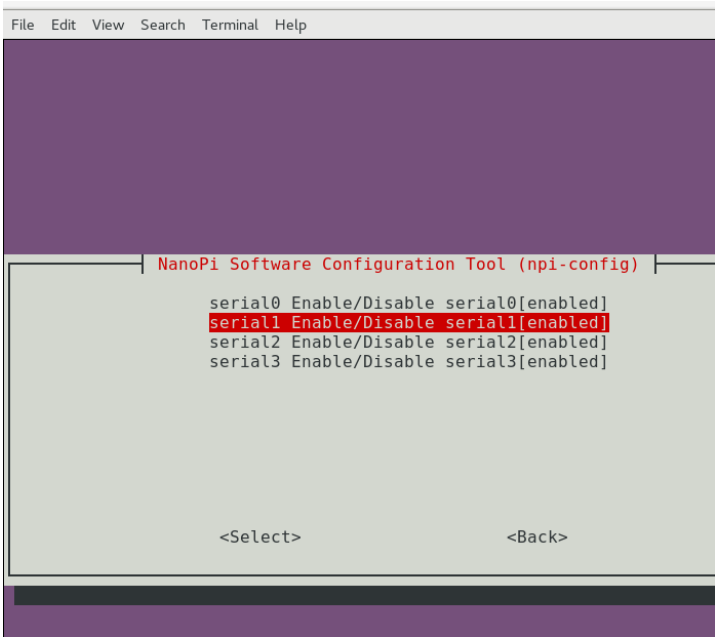
Enabling UART



Make sure that the UART1 and 2 are enabled as shown below in the picture.

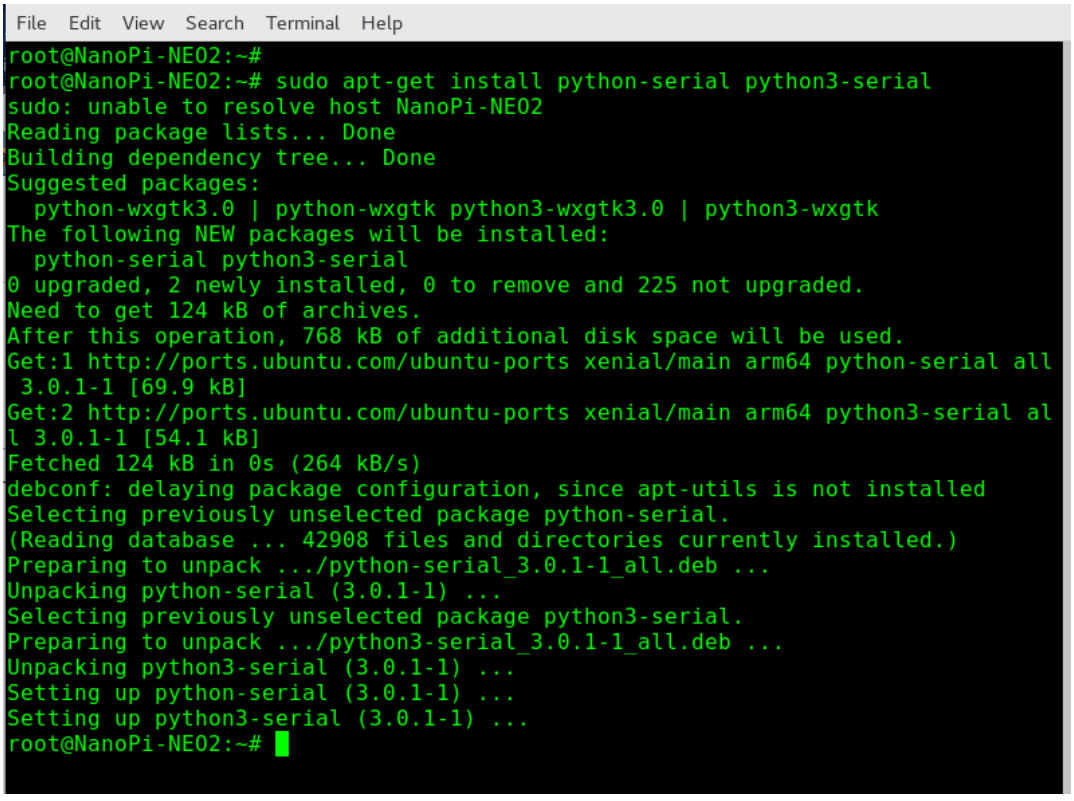






Ensure that the UART1 and 2 are enabled as shown here.

Install the python-serial module



This module encapsulates the access for the serial port. It provides backends for Python running on Windows, and Linux. The module named “serial” automatically selects the appropriate backend.

List available UARTs

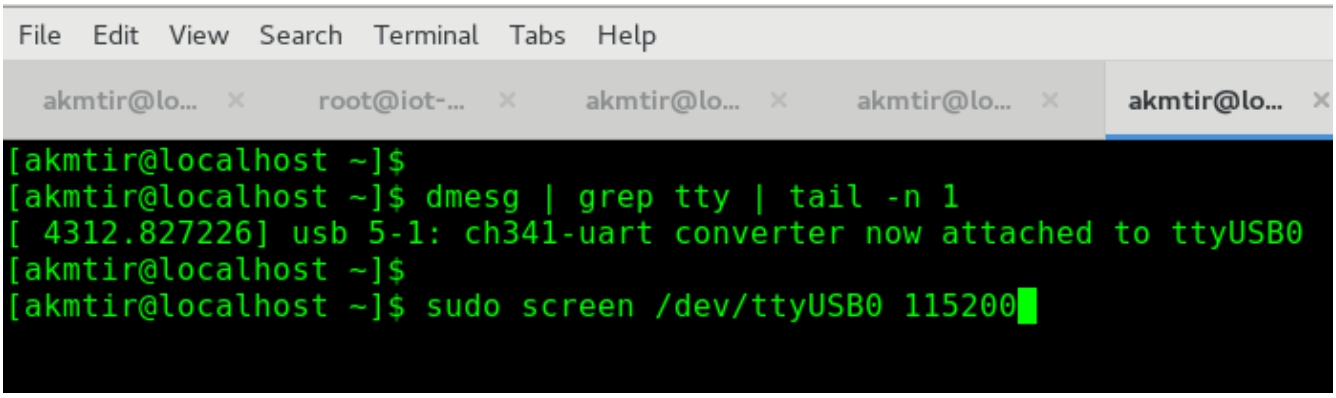
```
root@iot-drinkotec:~#
root@iot-drinkotec:~#
root@iot-drinkotec:~# uname -a
Linux iot-drinkotec 4.14.52 #1 SMP Thu Oct 11 15:51:48 CST 201
root@iot-drinkotec:~#
root@iot-drinkotec:~# whoami
root
root@iot-drinkotec:~#
root@iot-drinkotec:~# ls -l /dev/ttyS*
crw------- 1 pi   tty     4, 64 Feb 25 13:30 /dev/ttyS0
crw-rw---- 1 root dialout 4, 65 Feb 11  2016 /dev/ttyS1
crw-rw---- 1 root dialout 4, 66 Feb 11  2016 /dev/ttyS2
crw-rw---- 1 root dialout 4, 67 Feb 11  2016 /dev/ttyS3
root@iot-drinkotec:~#
root@iot-drinkotec:~#
```

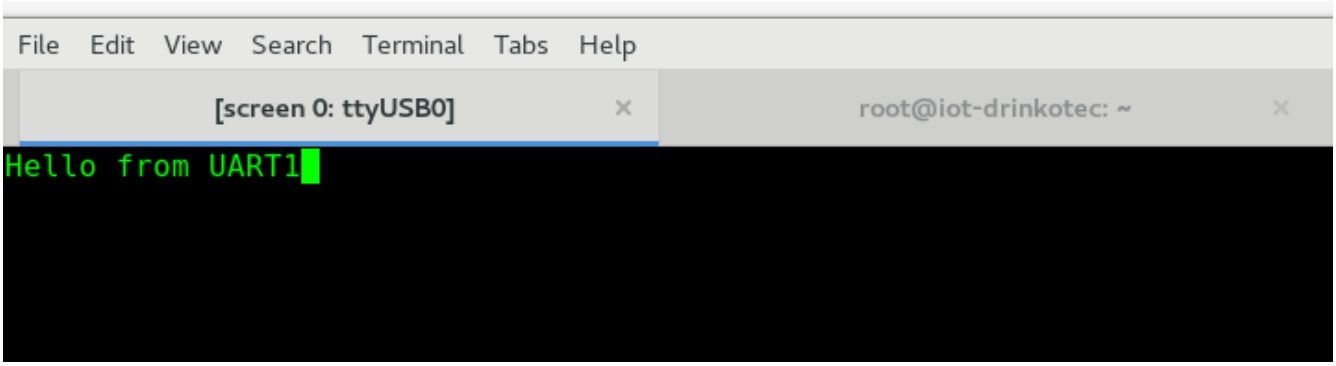
Test you UART serial communication using python

```
[GCC 5.4.0 20160609] on linux
Type "help", "copyright", "credits" or "licens
>>>
>>> import serial
>>>
>>> ser = serial.Serial('/dev/ttyS1', 115200)
>>>
>>> ser
Serial<id=0xffffbde72f60, open=True>(port='/de
ize=8, parity='N', stopbits=1, timeout=None, x
tr=False)
>>>
>>> ser.is_open
True
>>>
>>> ser.name
'/dev/ttyS1'
>>>
>>> ser.write(b'Hello from UART1')
16
>>>
>>>
```

Here we open the uart1 serial port for communication and send the message “Hello from UART1” from the NanoPi NEO2.

Now on my computer I open a terminal to receive the message sent as shown below:





Here is the message received on my computer.

This previous steps prove that the UARTs are working properly on the NanoPI NEO2.

To Sum-up

The NanoPI NEO2 has a Gbps Ethernet, standard USB port and various popular ports and interfaces (GPIO, I2C, UART, SPI, etc.) These features make it suitable to integrate with our own existing architecture to offer an IOT-gateway.

Annexes

Hardware Spec

CPU: Allwinner H5, Quad-core 64-bit high-performance Cortex A53
DDR3 RAM: 512MB
Connectivity: 10/100/1000M Ethernet, RTL8211E-VB-CG chip
USB Host: USB Type A x 1 and USB pin header x 2
MicroSD Slot: MicroSD x 1 for system boot and storage
LED: Power LED x 1, System LED x 1
GPIO1: 2.54mm pitch 24 pin-header, compatible with Raspberry Pi's GPIO pin1 - pin 24. It includes UART, SPI, I2C, IO etc
GPIO2: 2.54mm pitch 12 pin-header. It includes USB, IR receiver, I2S, IO etc
Serial Debug Port: 2.54mm pitch 4pin-header
Audio In/Out: 2.54mm pitch 4 pin-header
MicroUSB: Power input(5V/2A) and OTG
PCB Dimension: 40 x 40mm
Working Temperature: -20℃ to 70℃
Weight: 13g(WITHOUT Pin-headers)
OS/Software: u-boot,Ubuntu Core