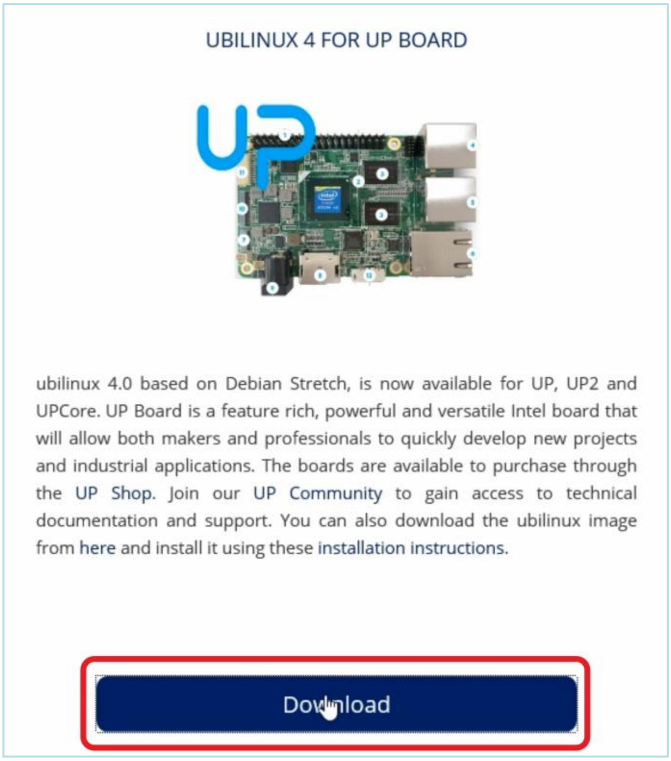
IoT Starter Kit – Part 2: IQRF Gateway

This step-by-step guide is prepared for the UP board but with minor modifications you can use the same process for any other Linux computer. First, we install an operating system on the UP board. Then we will install and configure basic services. And last we will read data and control the development kits that are part of the IoT Starter Kit.

Install OS Linux

To install Linux, prepare a USB flash drive with a capacity of at least 4 GB, a keyboard, a mouse, a monitor with an HDMI cable, and a connection to the Ethernet network.

Download the Ubilinux 4.0 for UP board and save it to your disk.

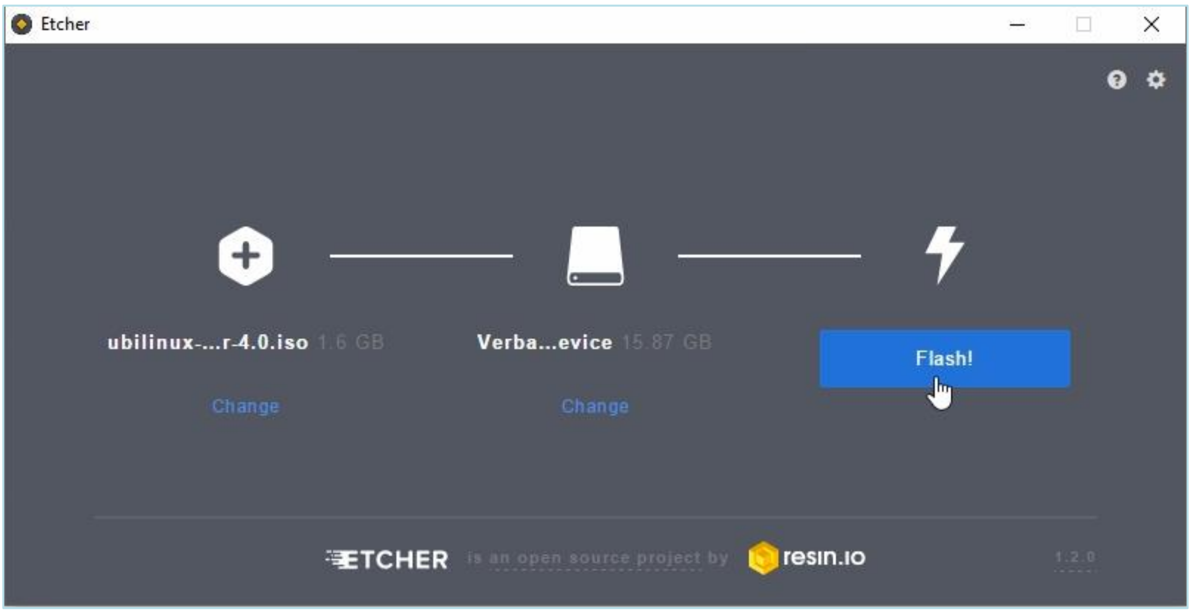


UBILINUX 4 FOR UP BOARD

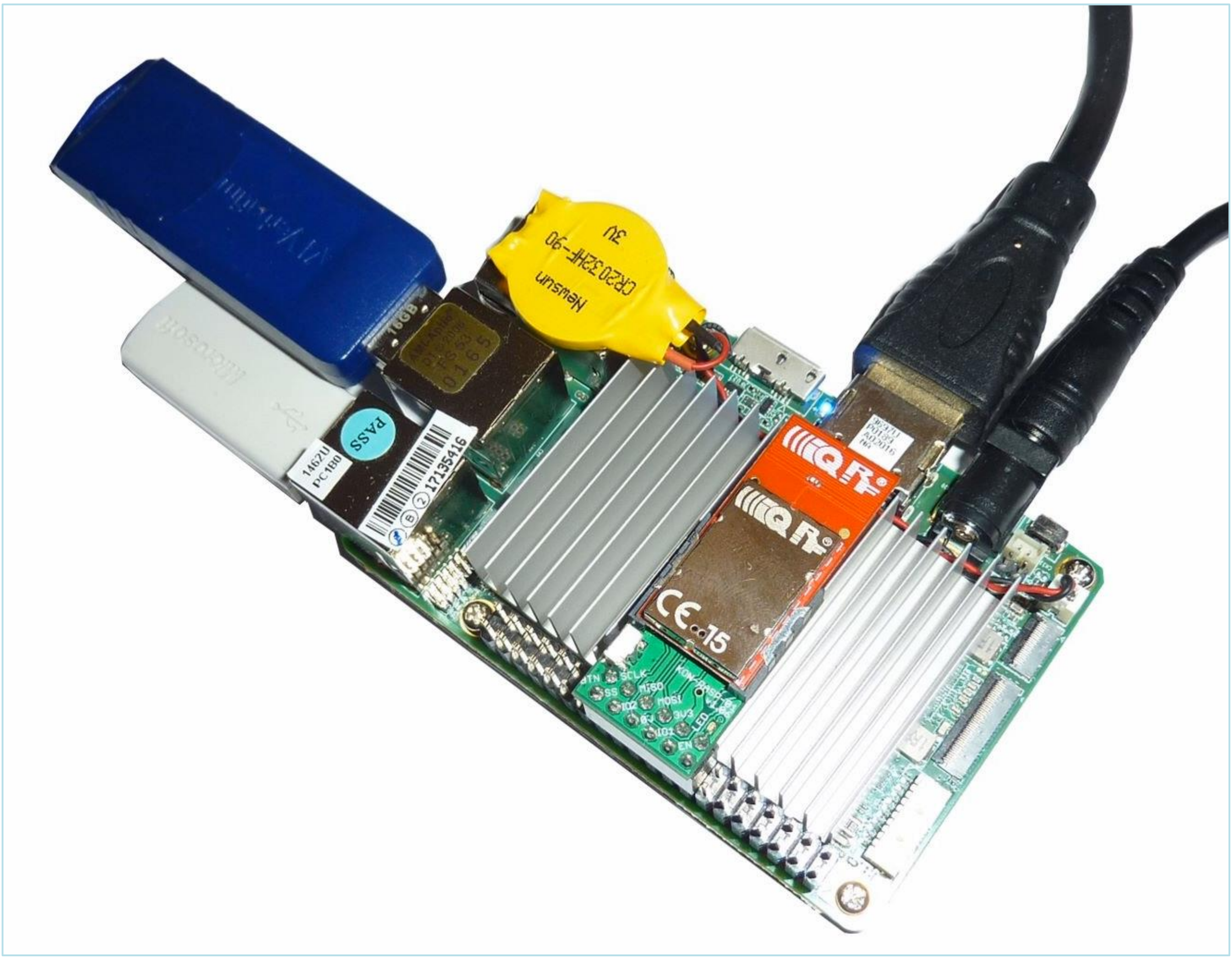
ubilinux 4.0 based on Debian Stretch, is now available for UP, UP2 and UPCore. UP Board is a feature rich, powerful and versatile Intel board that will allow both makers and professionals to quickly develop new projects and industrial applications. The boards are available to purchase through the UP Shop. Join our UP Community to gain access to technical documentation and support. You can also download the ubilinux image from here and install it using these installation instructions.

Then, download the Etcher software for burning the image of the operating system to a USB flash drive and install it.

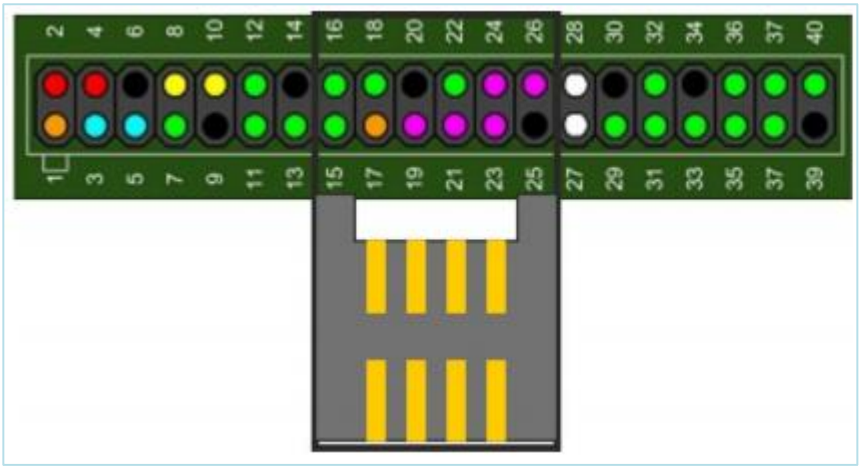
After starting Etcher, select the image of the operating system and choose your USB flash drive to burn it on.


Etcher
ubilinux-...r-4.0.iso 1.6 GB
Verba...evice 15.87 GB
Flash!
Change
Change
ETCHER is an open source project by resin.io
1.2.0

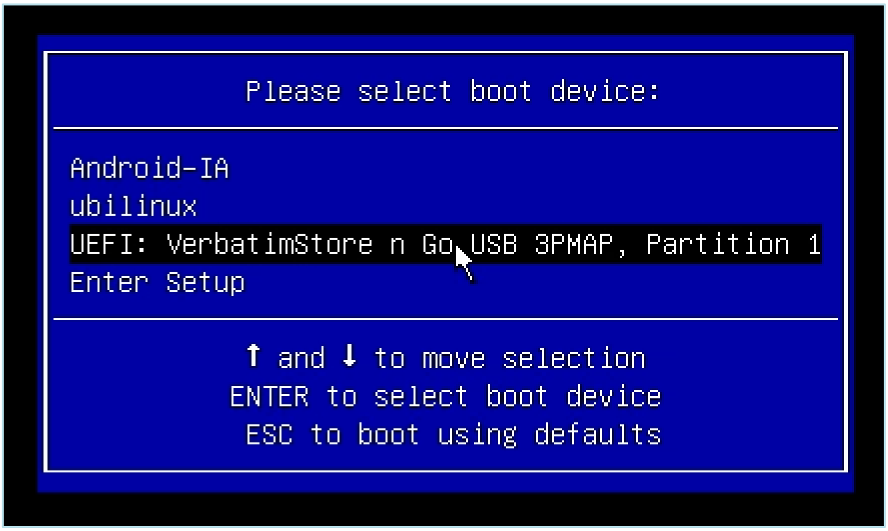
After burning the image to the USB flash drive, connect it to the UP board. Your monitor, keyboard and mouse should be already connected.



Connect the IQRF SPI board to the GPIO pins right in the middle of the header of the UP board and turn it on.

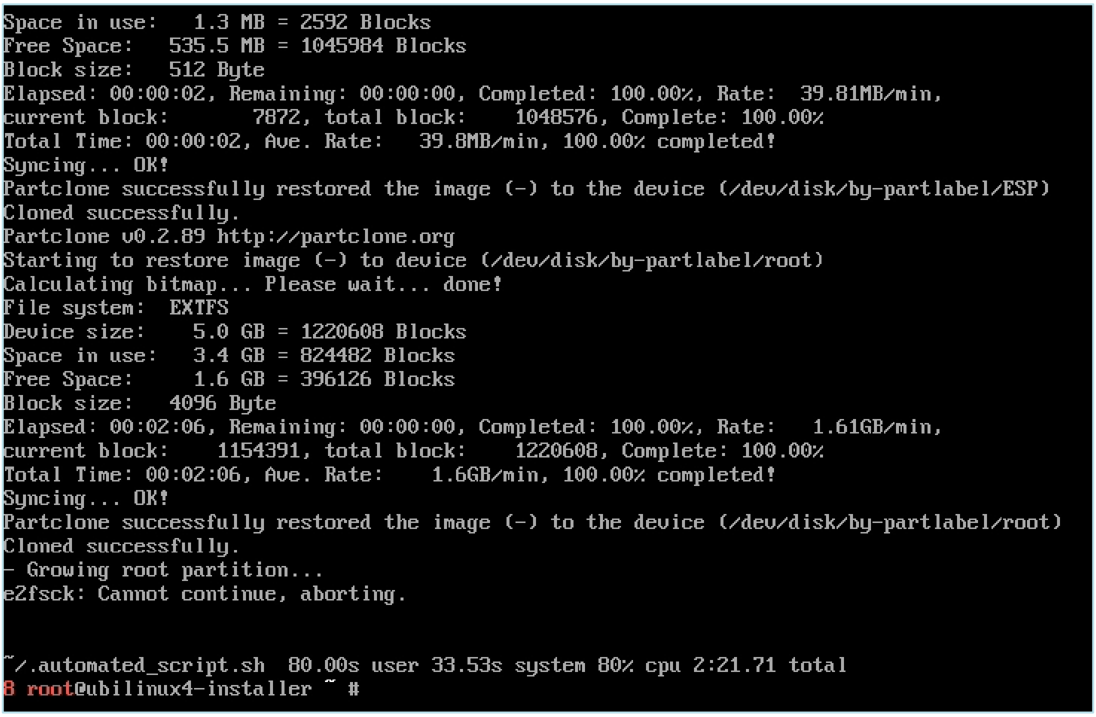


If you have the operating system installed on your UP board already, press **F7** at the beginning and select booting from the USB flash drive. If there's nothing on your UP board, the installation will start automatically.



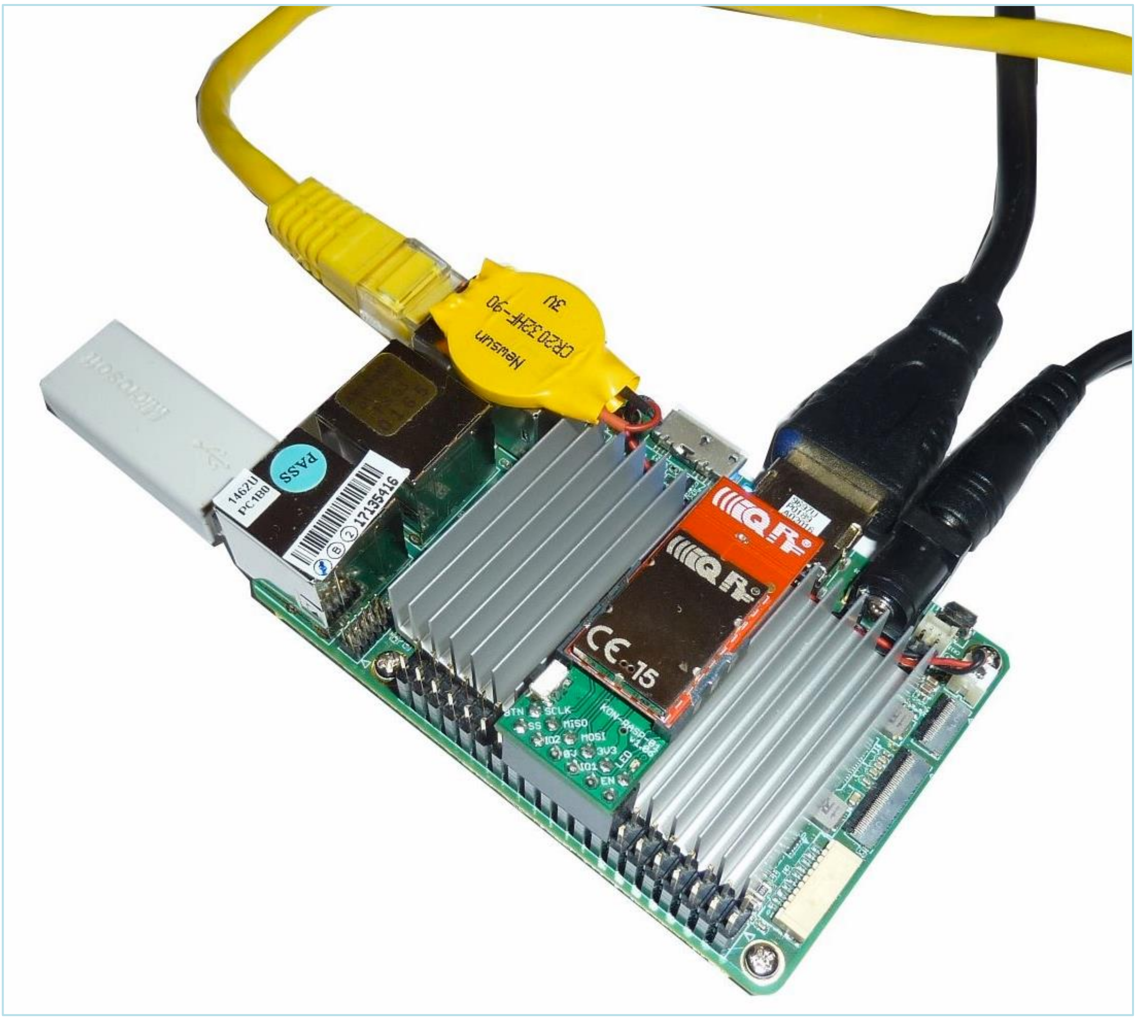
```
Please select boot device:

Android-IA
ubilinux
UEFI: VerbatimStore n Go USB 3PMAP, Partition 1
Enter Setup

↑ and ↓ to move selection
ENTER to select boot device
ESC to boot using defaults
```

The installation continues automatically and doesn't last for more than 4 minutes.



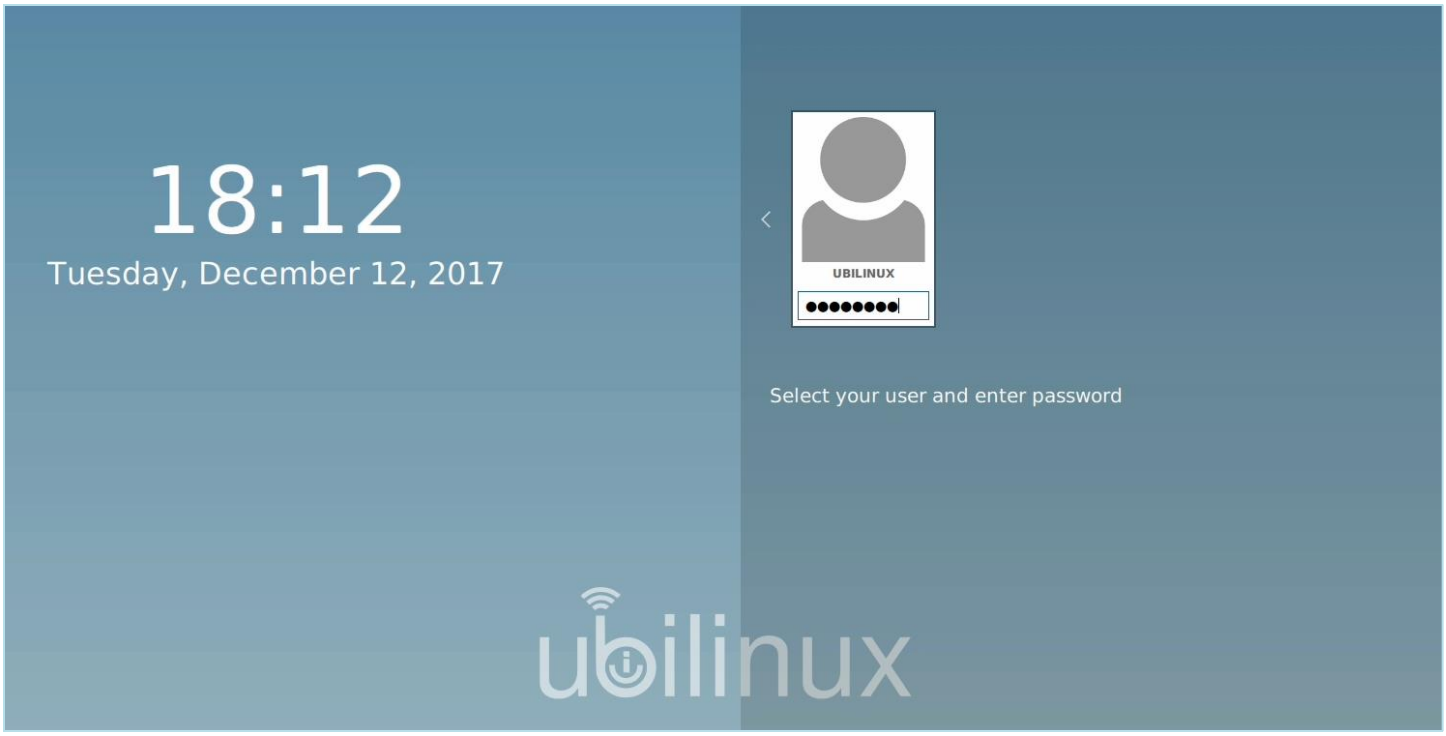
```
Space in use:   1.3 MB = 2592 Blocks
Free Space:   535.5 MB = 1045984 Blocks
Block size:   512 Byte
Elapsed: 00:00:02, Remaining: 00:00:00, Completed: 100.00%, Rate:  39.81MB/min,
current block:       7872, total block:    1048576, Complete: 100.00%
Total Time: 00:00:02, Ave. Rate:   39.8MB/min, 100.00% completed!
Syncing... OK!
Partclone successfully restored the image (-) to the device (/dev/disk/by-partlabel/ESP)
Cloned successfully.
Partclone v0.2.89 http://partclone.org
Starting to restore image (-) to device (/dev/disk/by-partlabel/root)
Calculating bitmap... Please wait... done!
File system:  EXTFS
Device size:    5.0 GB = 1220608 Blocks
Space in use:   3.4 GB = 824482 Blocks
Free Space:     1.6 GB = 396126 Blocks
Block size:   4096 Byte
Elapsed: 00:02:06, Remaining: 00:00:00, Completed: 100.00%, Rate:   1.61GB/min,
current block:    1154391, total block:    1220608, Complete: 100.00%
Total Time: 00:02:06, Ave. Rate:    1.6GB/min, 100.00% completed!
Syncing... OK!
Partclone successfully restored the image (-) to the device (/dev/disk/by-partlabel/root)
Cloned successfully.
- Growing root partition...
e2fsck: Cannot continue, aborting.


~/.automated_script.sh  80.00s user 33.53s system 80% cpu 2:21.71 total
8 root@ubilinux4-installer ~ #
```

After the operating system is installed, the UP board turns off. Then, remove the USB flash drive, connect the UP board to the Ethernet network and turn it on again.



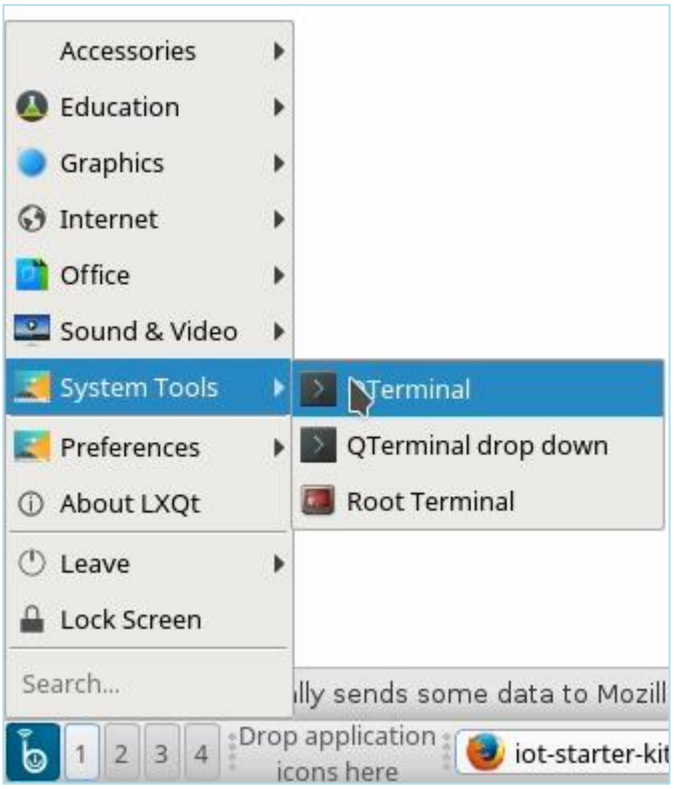
Update UbiLinux 4.0

At this point, we have already installed the operating system. Log in to it with a default password – ubilinux.

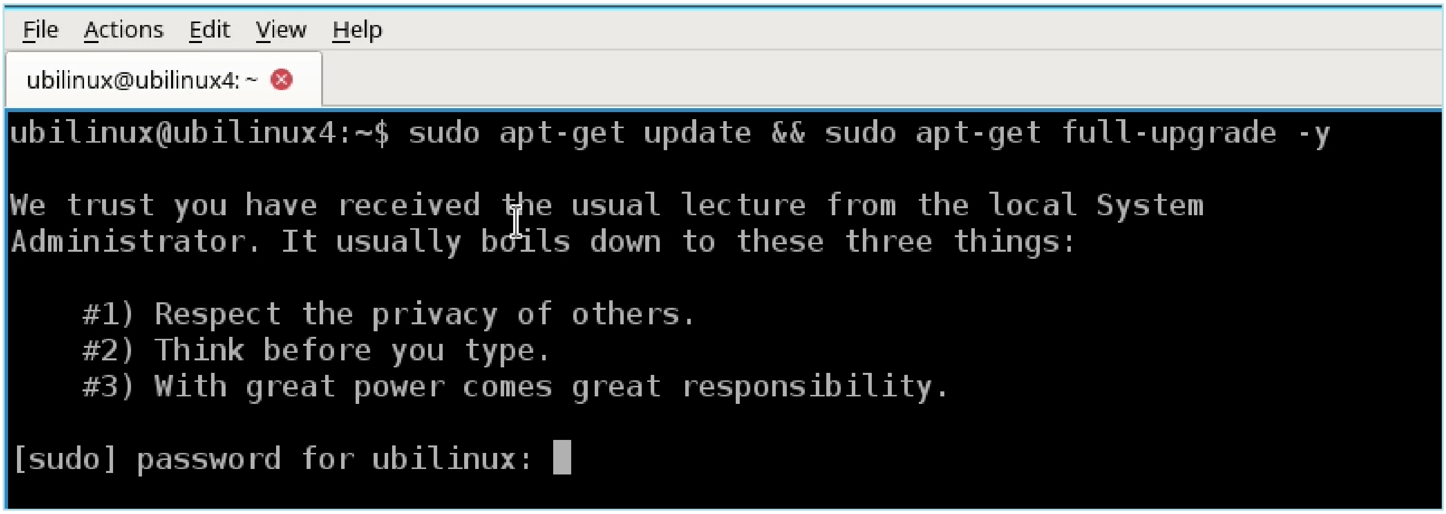

18:12
Tuesday, December 12, 2017
UBILINUX
Select your user and enter password
ubilinux

We need to get the operating system updated. Copy the command for the update and paste it into the terminal.

sudo apt-get update && sudo apt-get -y full-upgrade



Enter the default password – ubilinux for user ubilinux.



```
ubilinux@ubilinux4:~$ sudo apt-get update && sudo apt-get full-upgrade -y

We trust you have received the usual lecture from the local System
Administrator. It usually boils down to these three things:

    #1) Respect the privacy of others.
    #2) Think before you type.
    #3) With great power comes great responsibility.

[sudo] password for ubilinux:
```

Install MQTT broker

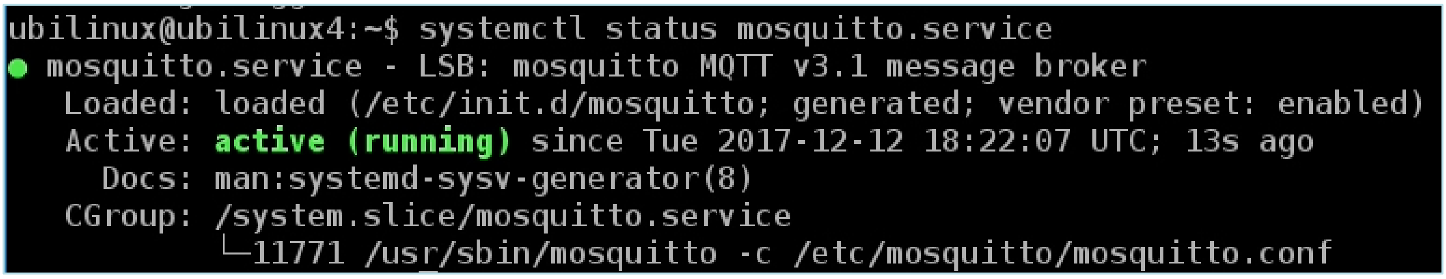
Install the MQTT broker by using this command.

sudo apt-get install -y mosquitto mosquitto-clients

Confirm the MQTT broker is running

Verify that the MQTT broker is running.

systemctl status mosquitto.service



```
ubilinux@ubilinux4:~$ systemctl status mosquitto.service
● mosquitto.service - LSB: mosquitto MQTT v3.1 message broker
   Loaded: loaded (/etc/init.d/mosquitto; generated; vendor preset: enabled)
   Active: active (running) since Tue 2017-12-12 18:22:07 UTC; 13s ago
     Docs: man:systemd-sysv-generator(8)
   CGroup: /system.slice/mosquitto.service
           └─11771 /usr/sbin/mosquitto -c /etc/mosquitto/mosquitto.conf
```

Install the IQRF Gateway Daemon

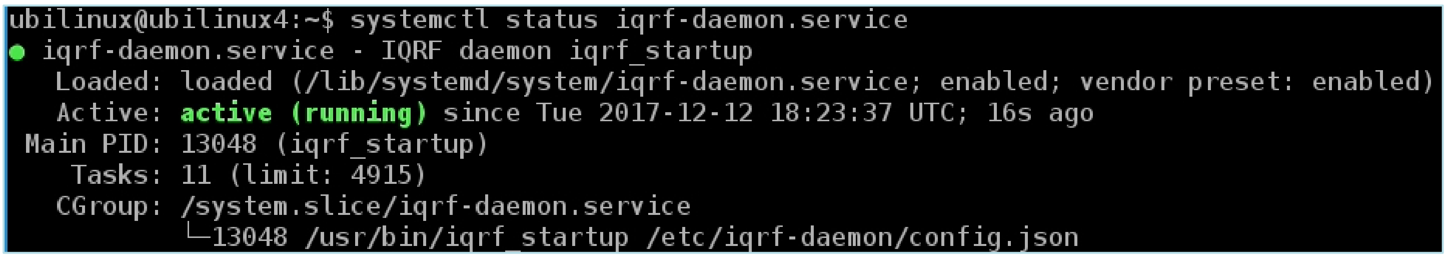
Install the IQRF Gateway Daemon. There are four commands that you need to enter into the terminal. The time of the installation mostly depends on the speed of your internet connection.

sudo apt-get install -y dirmngr
sudo apt-key adv --keyserver keyserver.ubuntu.com --recv-keys 9C076FCC7AB8F2E43C2AB0E73241B9B7B4BD8F8E
echo "deb http://repos.iqrfsdk.org/debian stretch stable" | sudo tee -a /etc/apt/sources.list.d/iqrf-daemon.list
sudo apt-get update && sudo apt-get install -y iqrf-daemon

Confirm IQRF Gateway Daemon is running

Verify that the IQRF Gateway Daemon is running. Press Q to leave the listing.

systemctl status iqrf-daemon.service



```
ubilinux@ubilinux4:~$ systemctl status iqrf-daemon.service
● iqrf-daemon.service - IQRF daemon iqrf_startup
   Loaded: loaded (/lib/systemd/system/iqrf-daemon.service; enabled; vendor preset: enabled)
   Active: active (running) since Tue 2017-12-12 18:23:37 UTC; 16s ago
 Main PID: 13048 (iqrf_startup)
    Tasks: 11 (limit: 4915)
   CGroup: /system.slice/iqrf-daemon.service
           └─13048 /usr/bin/iqrf_startup /etc/iqrf-daemon/config.json
```

Install IQRF Gateway Daemon WebApp

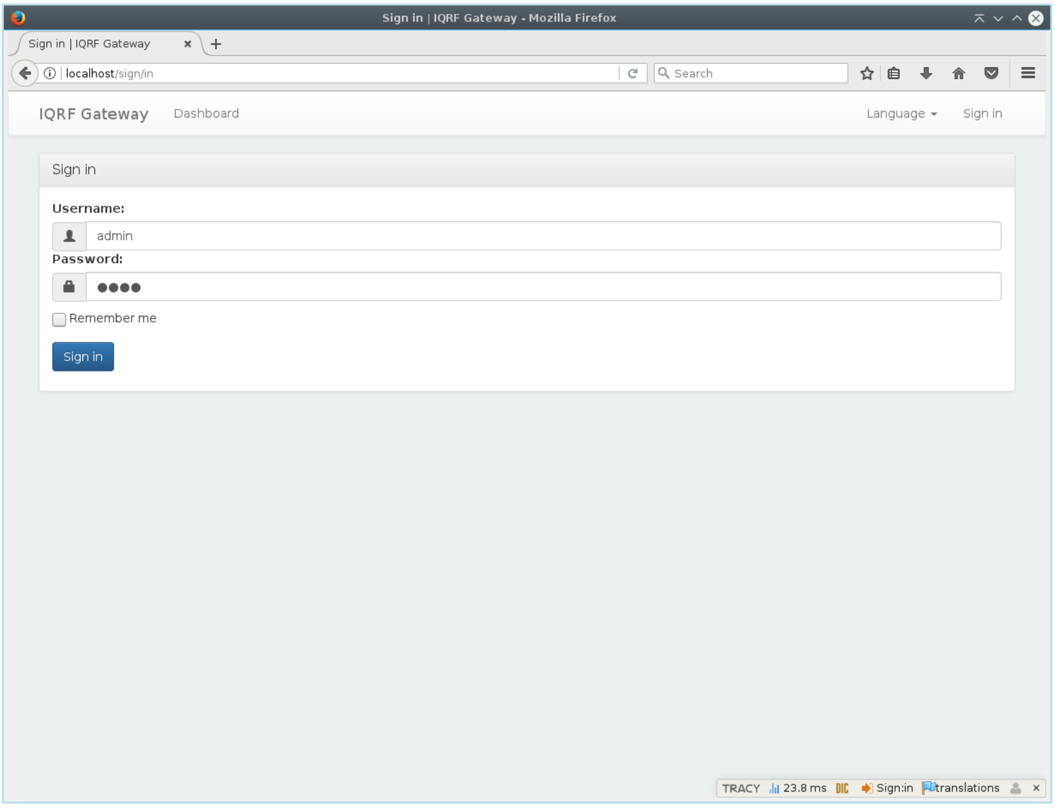
Now install the web application for the IQRF Gateway Daemon configuration. Copy and paste the commands one after the other.

cd /home/ubilinux
git clone https://github.com/iqrfsdk/iqrf-daemon-webapp.git
cd iqrf-daemon-webapp/install/
sudo python3 install.py -d debian -v 9

Confirm IQRF Gateway Daemon WebApp is running

Verify that the web application is running by typing a localhost address in your web browser on the UP board. Log in as **admin** with the password **iqrf**.

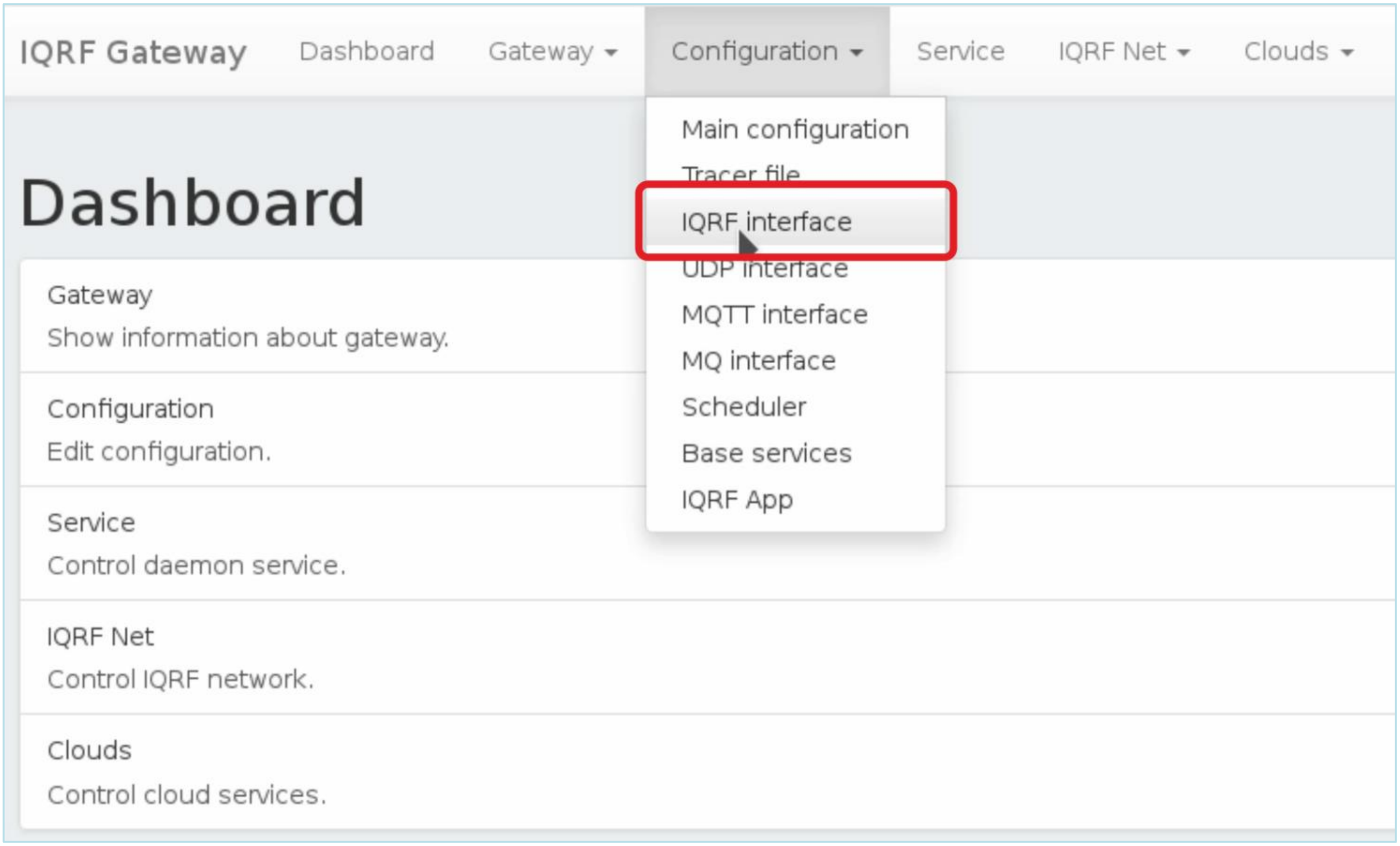
http://localhost/en



Configure IQRF SPI interface

Now configure the connection to the IQRF network through the SPI interface. In the **Configuration** menu, find the **IQRF interface** item, click on the available SPI interface and save the configuration.

http://localhost/en/config/iqrf



Dashboard

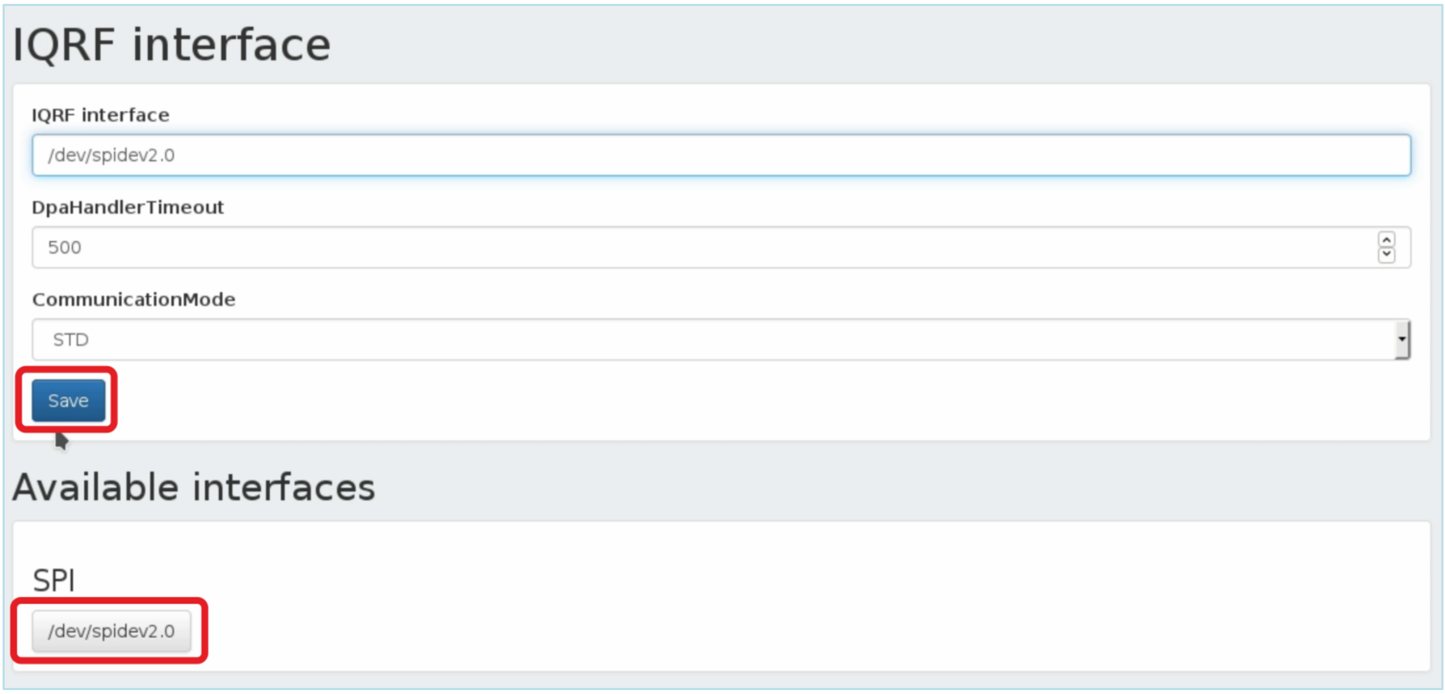
Gateway
Show information about gateway.

Configuration
Edit configuration.

Service
Control daemon service.

IQRF Net
Control IQRF network.

Clouds
Control cloud services.



IQRF interface

IQRF interface: /dev/spidev2.0

DpaHandlerTimeout: 500

CommunicationMode: STD

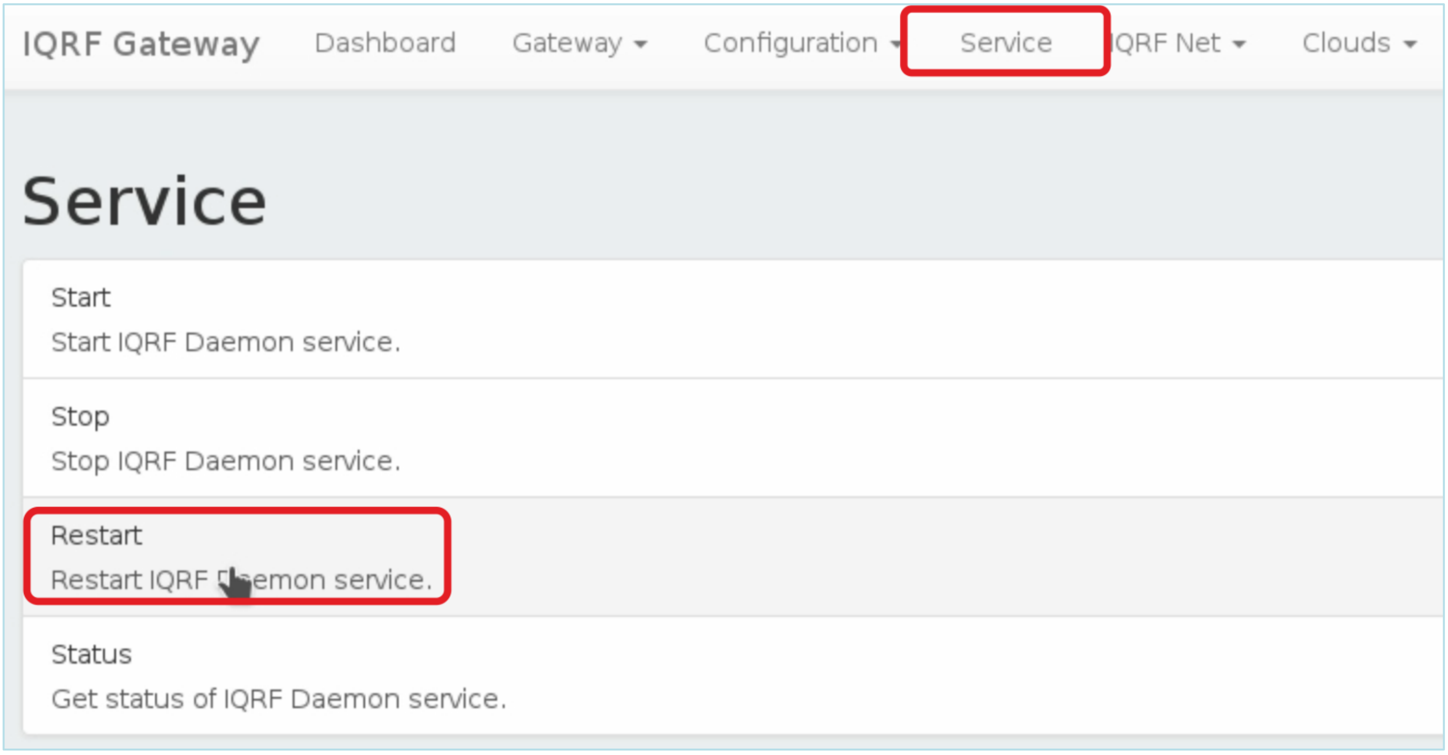
Available interfaces

SPI

Restart IQRF Gateway Daemon

Restart the IQRF Gateway Daemon by clicking on **Restart** in the **Service** menu. You can see here that the daemon has been restarted.

http://localhost/en/service



Service

Start
Start IQRF Daemon service.

Stop
Stop IQRF Daemon service.

Restart
Restart IQRF Daemon service.

Status
Get status of IQRF Daemon service.

Install Node.js

Now install the **Node.js**. This is done by a set of commands you copy and paste one by one into the terminal.

```
cd /home/ubilinux
git clone https://github.com/iqrfsdk/iot-starter-kit.git
cd iot-starter-kit/install
sudo cp etc/lsb-release-debian /etc/lsb-release
sudo apt-get install curl
curl -sL https://deb.nodesource.com/setup_6.x | sudo -E bash -
sudo apt-get install nodejs
sudo cp etc/lsb-release-ubilinux /etc/lsb-release
```

Enter ubilinux as a password

Confirm query by typing Y as Yes.

Install Node-RED

Now install Node-red. Copy the two prepared commands and paste them into the terminal.

```
sudo npm install -g --unsafe-perm node-red
sudo npm install -g pm2
```

Start Node-RED

Run Node-RED with these two commands.

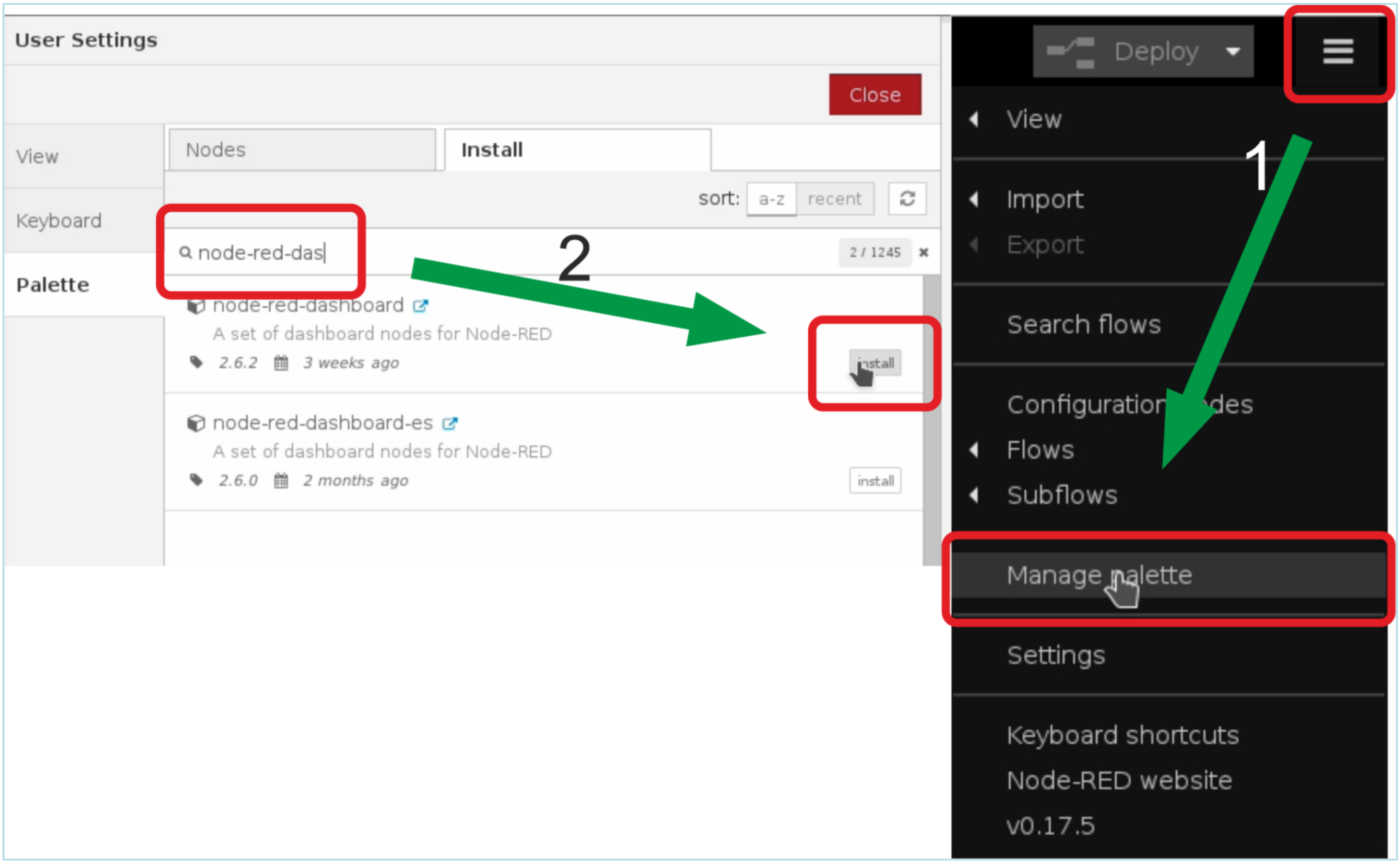
```
cd /home/ubilinux
pm2 start /usr/bin/node-red
```

Add Node-RED dashboard

Now create a **Node-RED** dashboard environment.

In the internet browser of the UP board, enter the localhost address with the port **1880** and select the **Manage palette** item from the menu. Find the **node-red-dashboard** and install it.

http://localhost:1880



Run IoT-Starter-Kit flow

Run the prepared example for the IoT Starter Kit. The acquired data will be visualized in the dashboard and the two relays can be controlled by using buttons.

```
cd /home/ubilinux/iot-starter-kit/install
cp up-board/node-red/* /home/ubilinux/.node-red
pm2 restart node-red
```

Allow Node-RED to run after reboot

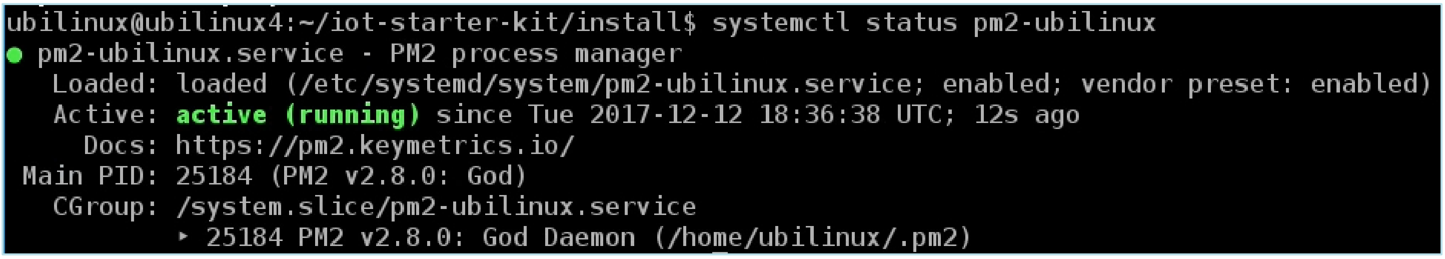
Use these prepared commands to set up Node-RED to start automatically after switching on the UP board.

pm2 save
pm2 startup
sudo env PATH=$PATH:/usr/bin /usr/lib/node_modules/pm2/bin/pm2 startup systemd -u ubilinux --hp /home/ubilinux

Confirm Node-RED is running

Verify that Node-RED is running.

systemctl status pm2-ubilinux

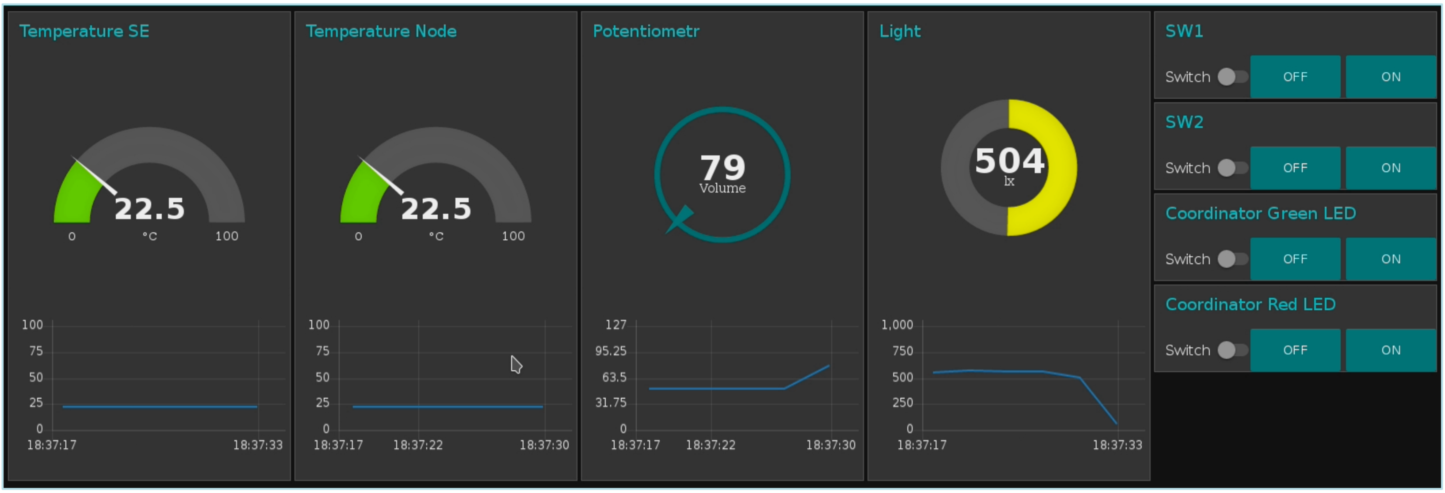


```
ubilinux@ubilinux4:~/iot-starter-kit/install$ systemctl status pm2-ubilinux
● pm2-ubilinux.service - PM2 process manager
   Loaded: loaded (/etc/systemd/system/pm2-ubilinux.service; enabled; vendor preset: enabled)
   Active: active (running) since Tue 2017-12-12 18:36:38 UTC; 12s ago
     Docs: https://pm2.keymetrics.io/
 Main PID: 25184 (PM2 v2.8.0: God)
   CGroup: /system.slice/pm2-ubilinux.service
           ‣ 25184 PM2 v2.8.0: God Daemon (/home/ubilinux/.pm2)
```

Check Node-RED dashboard

Check the dashboard at localhost address with the port 1880/ui. If you have your IQRF network with the sensor and relay kit ready, you can see the measured values on the dashboard and switch the relays on and off.

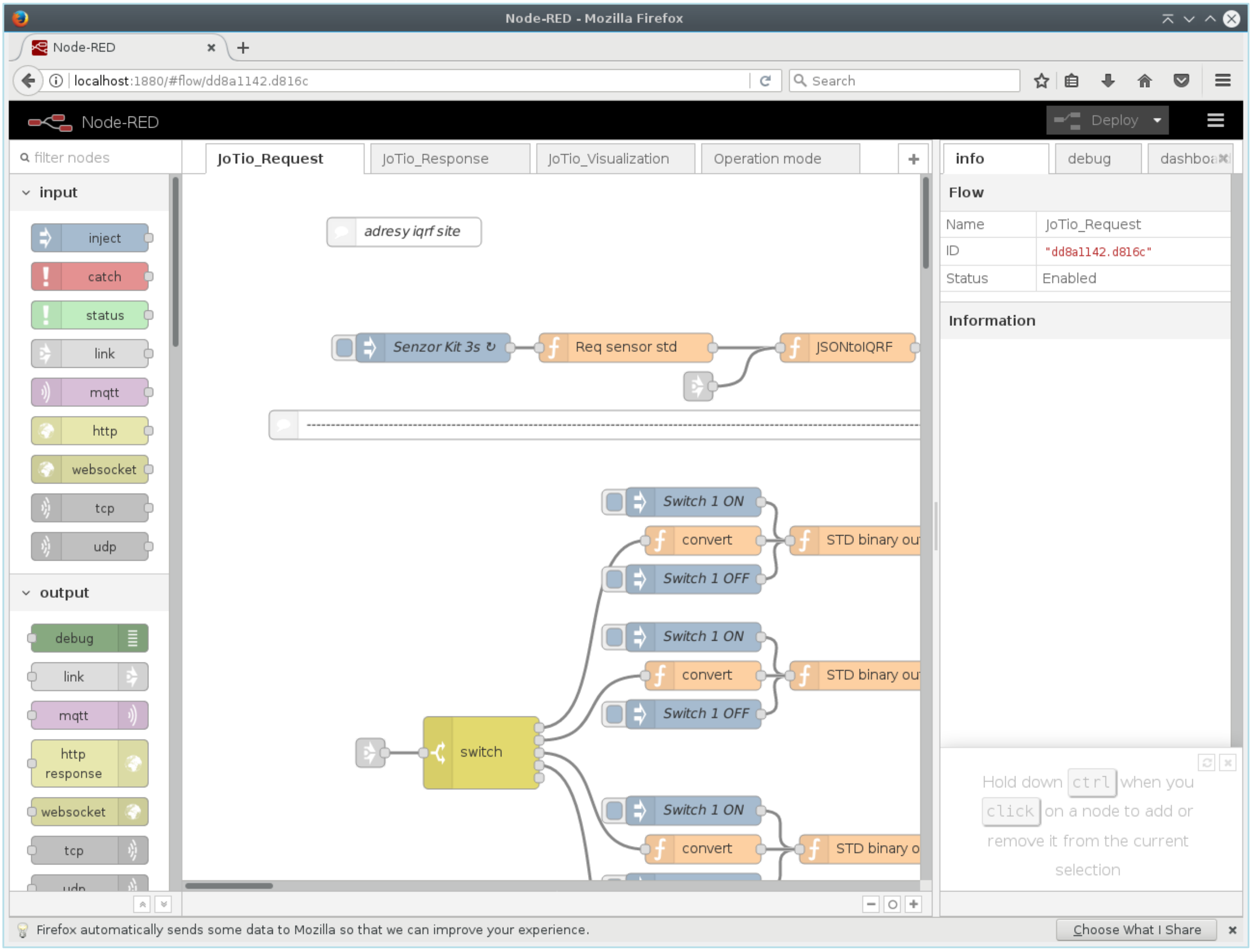
http://localhost:1880/ui



Check Node-RED flow

At the localhost address, port 1880, the Node-RED administration environment can be used to modify your flows and dashboards.

http://localhost:1880

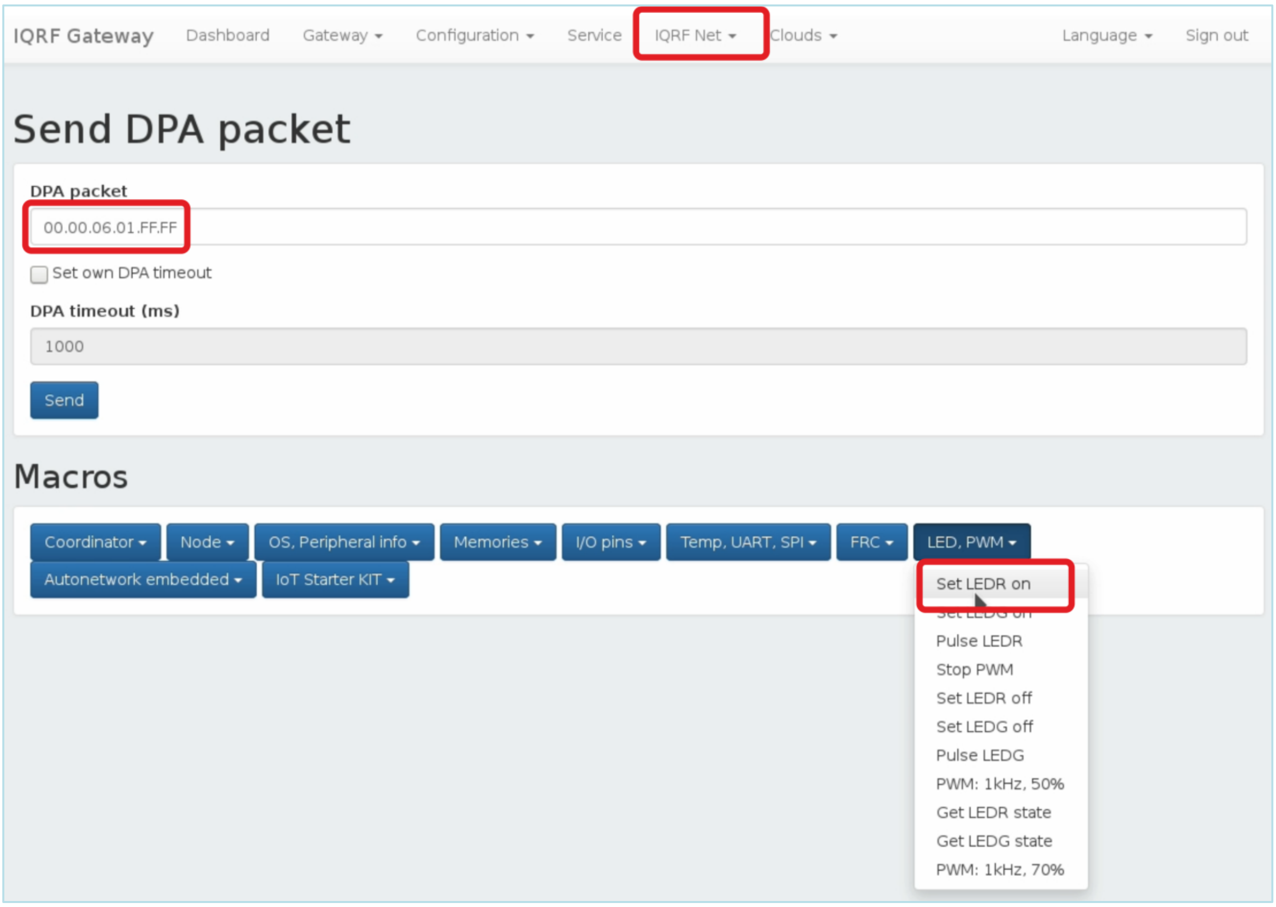


Name	JoTio_Request
ID	"dd8a1142.d816c"
Status	Enabled

Test the functionality

Verify the functionality of controlling the IQRF network from the web application. Click on the **Send DPA Packet** in the **IQRF Net** menu and select any command here, such as turning on the red LED on the coordinator. You can also modify the command.

http://localhost/en/iqrfnet/send-raw



Send DPA packet

DPA packet

00.00.06.01.FF.FF

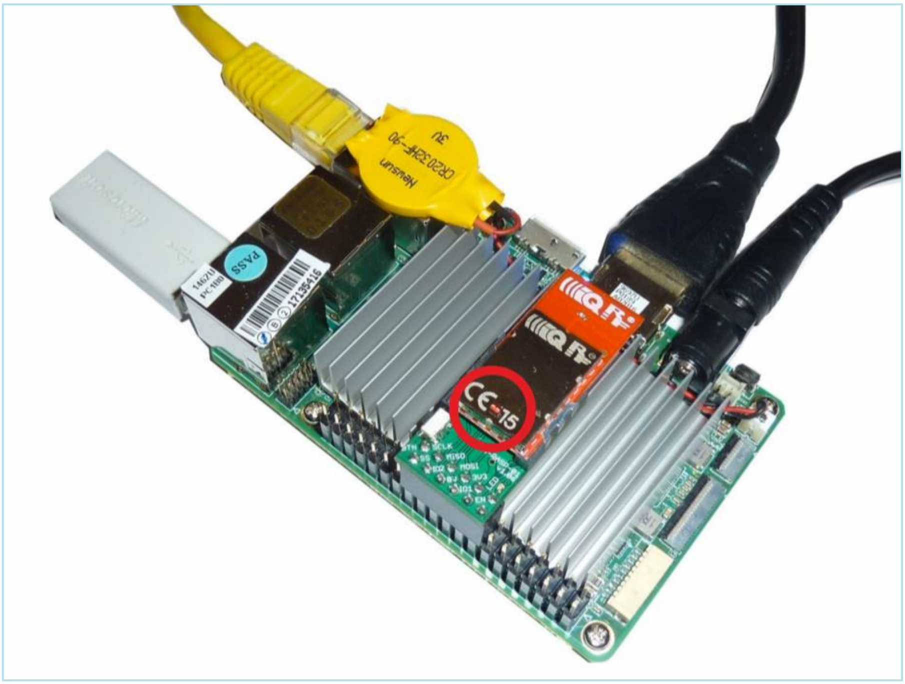
Set own DPA timeout

DPA timeout (ms)

1000

Macros

You can easily double check that the command has been executed.



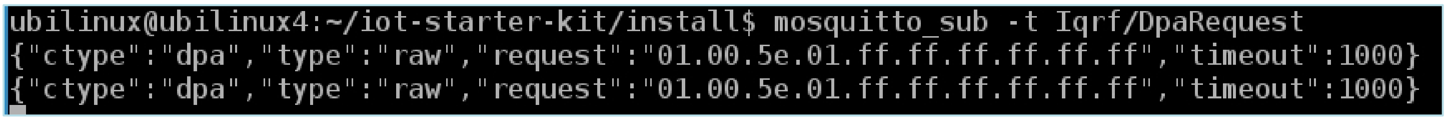
Inspect JSON messages between Node-RED and IQRF Gateway Daemon

Check up the DPA commands in JSON format running between Node-RED and the IQRF Gateway Daemon.

Listen for all JSON DPA RAW Requests:
mosquitto_sub -t Iqrf/DpaRequest

Listen for all JSON DPA RAW Responses
mosquitto_sub -t Iqrf/DpaResponse

Insert the command into the terminal to observe the ongoing communication.



```
ubilinux@ubilinux4:~/iot-starter-kit/install$ mosquitto_sub -t Iqrf/DpaRequest
{"ctype":"dpa","type":"raw","request":"01.00.5e.01.ff.ff.ff.ff.ff.ff","timeout":1000}
{"ctype":"dpa","type":"raw","request":"01.00.5e.01.ff.ff.ff.ff.ff.ff","timeout":1000}
```

Check more examples

cd /home/ubilinux
git clone https://github.com/iqrfsdk/iqrf-daemon-examples.git
cd iqrf-daemon-examples

Summary

We made an IQRF Gateway from UP board. Apparently, you can connect this gateway to any cloud solution such as Microsoft Azure, IBM Cloud Platform, Amazon Web Services or anything else. How to do it, it's the topic of the following part.