Congduc Pham, **http://cpham.perso.univ-pau.fr**

http://www.waziup.eu

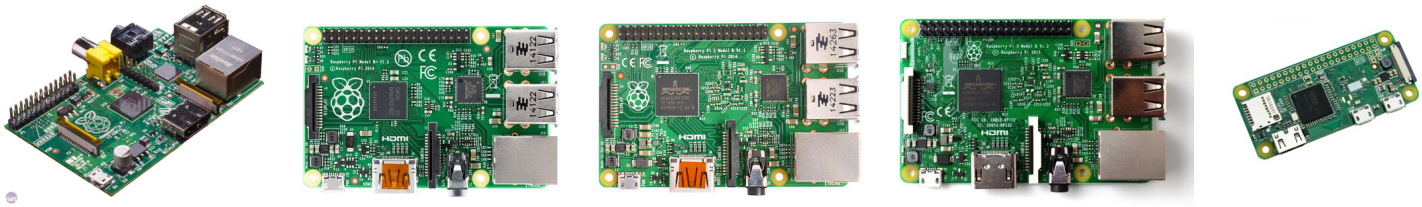
Preparing your Raspberry Pi

Get our ready-to-use Raspbian Jessie SD card image

Download from **http://cpham.perso.univ-pau.fr/LORA/WAZIUP/raspberrypi-jessie-WAZIUP-demo.dmg.zip**

Write the SD card image

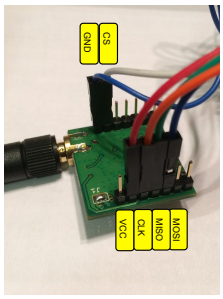
Use a class 10 8GB minimum SD card
See instruction from https://www.raspberrypi.org/documentation/installation/installing-images for various OS



You can use RaspberryPI 1 model B or B+, RaspberryPI 2 model B, RaspberryPI 3 model B and RaspberryPI Zero (W). The most important usefull feature is the Ethernet interface for easy Internet connection. You can add WiFi with a WiFi USB dongle to use access-point features. With the RPI3 & RPI0W, WiFi and Bluetooth are embedded on the board.

Connect the LoRa radio module

Depending on the model, you can have the « short » or the « long » GPIO interface. However, the SPI pins are at the same location therefore it does not change the way you connect the radio module if you take pin 1 as the reference. Connect the SPI pins (MOSI, MISO, CLK, CS) of the radio to the corresponding pins on the RPI. Note that CS goes to CE0_N on the RPI.



GPIO#	2nd func.	Pin#	Pin#	2nd func.	GPIO#
	+3.3 V	1	2	+5 V	
2	SDA1 (I2C)	3	4	+5 V	
3	SCL1 (I2C)	5	6	GND	
4	GCLK	7	8	TXD0 (UART)	14
	GND	9	10	RXD0 (UART)	15
17	GEN0	11	12	GEN1	18
27	GEN2	13	14	GND	
22	GEN3	15	16	GEN4	23
	+3.3 V	17	18	GEN5	24
10	MOSI (SPI)	19	20	GND	
9	MISO (SPI)	21	22	GEN6	25
11	SCLK (SPI)	23	24	CE0_N (SPI)	8
	GND	25	26	CE1_N (SPI)	7
(RPi 1 Models A and B stop here)					
EEPROM	ID_SD	27	28	ID_SC	EEPROM
5	N/A	29	30	GND	
6	N/A	31	32		12
13	N/A	33	34	GND	
19	N/A	35	36	N/A	16
26	N/A	37	38	Digital IN	20
	GND	39	40	Digital OUT	21

Update your gateway

Read more instruction at https://github.com/CongducPham/LowCostLoRaGw

Connect your RPI to Internet (with Ethernet sharing for instance) and use a browser to display the embedded web admin interface: e.g. 10.0.13.96/admin

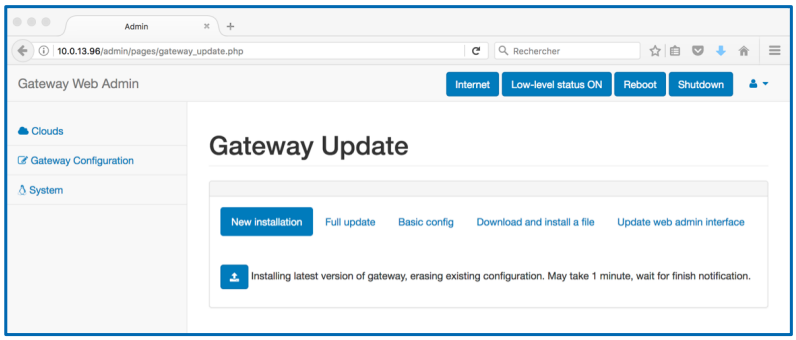
Login: admin Password: loragateway

Check Internet connection with the **Internet** button

Select the **Gateway update** menu and click on **New installation** (or **Full update**). Then click on the download icon button

Perform **Basic config** and **Update web admin interface**

Reboot your RPI with the **Reboot** button



Your LoRa gateway is ready to receive packets and upload data to clouds

Congduc Pham, **http://cpham.perso.univ-pau.fr**

http://www.waziup.eu

Receiving LoRa messages

Gateway default configuration

Default configuration uses BW=125kHz, CR=4/5, SF=12

This configuration allows for the longest range

The gateway uses BW & SF combinations to define 10 LoRa modes. Default mode is then mode 1

Default frequency in each band (868, 900, 433) is indicated in red

Range ↔ Throughput

LoRa mode	BW	CR	SF
1	125	4/5	12
2	250	4/5	12
3	125	4/5	10
4	500	4/5	12
5	250	4/5	10
6	500	4/5	11
7	250	4/5	9
8	500	4/5	9
9	500	4/5	8
10	500	4/5	7

ch	F(MHz)	ch	F(MHz)	ch	F(MHz)
04	863.2*	00	903.08	**00**	**433.3***
05	863.5*	01	905.24	01	433.6*
06	863.8*	02	907.40	02	433.9*
07	864.1*	03	909.56	03	434.3*
08	864.4*	04	911.72	-	-
09	864.7*	**05**	**913.88**	-	-
10	**865.2**	06	916.04	-	-
11	865.5	07	918.20	-	-
12	865.8	08	920.36	-	-
13	866.1	09	922.52	-	-
14	866.4	10	924.68	-	-
15	867.7	11	926.84	-	-
16	867.0	12	915.00	-	-
17	868.0	-	-	-	-
18	868.1*	-	-	-	-

The default frequency at the end-device depends on the selected band, check and set the operating frequency of the gateway accordingly.

Uploading to WAZIUP platform

Configuring WAZIUP cloud

Use the **Clouds** menu and **Waziup Orion** tab to configure the Orion service and service-path

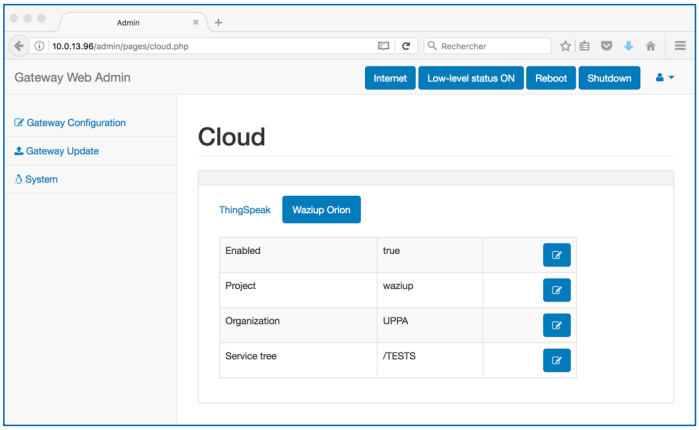
The **service** is the project name

The **service-path** is '/'+organization+service-tree service-tree can be left empty

Here, service=waziup and service-path=/UPPA/TESTS

The device id will be organization+"Sensor"+device_addr

e.g. from sensor 2: UPPA_Sensor2



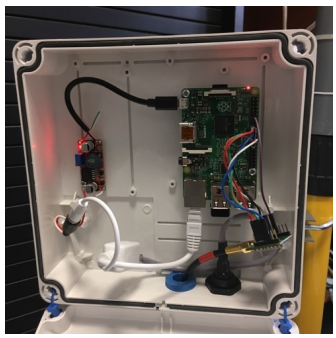
Retrieving sensed values from WAZIUP platform

Using curl command

Assuming device 2 sends **TC/22.5** which means a temperature of 22.5°C

```
curl http://broker.waziup.io/v2/entities/UPPA_Sensor2/attrs/TC/value \
--header 'Fiware-Service:waziup' \
--header 'Fiware-ServicePath:/UPPA/TESTS' -X GET
```

Additionally, go to www.waziup.io and search for your sensor name (e.g. UPPA_Sensor2)



Additional ressources & tutorials

The general github repository **https://github.com/CongducPham/LowCostLoRaGw**
The WAZIUP github **https://github.com/Waziup**
IoT device video **https://www.youtube.com/watch?v=YsKbJeeav_M**
Gateway video **https://www.youtube.com/watch?v=peHkDhiH3IE**

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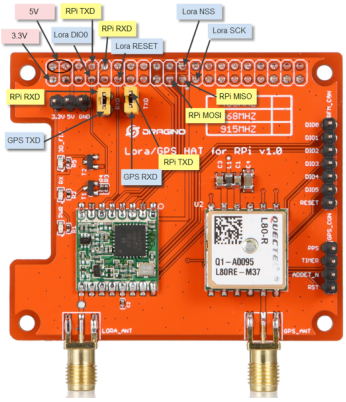
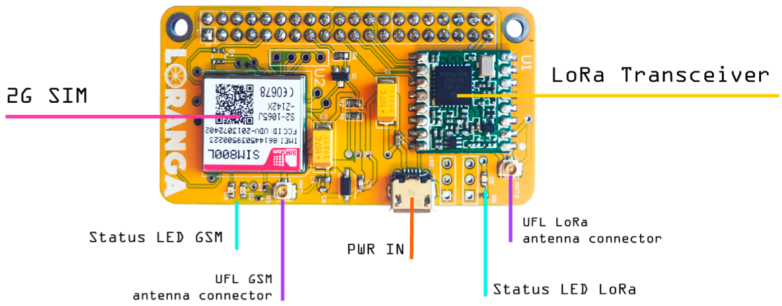
Using integrated LoRa radio shield/hat

Shield/hat with integrated LoRa radio modules

There are some shields/hats that integrate a LoRa radio, mostly the HopeRF RFM95W radio module

Many of these board also propose additional features such as GPS or 2G/3G connectivity
2G/3G connectivity is definitely a good choice if cellular-based Internet is the only solution in isolated areas





Dragino LoRa/GPS hat
For Raspberry PI

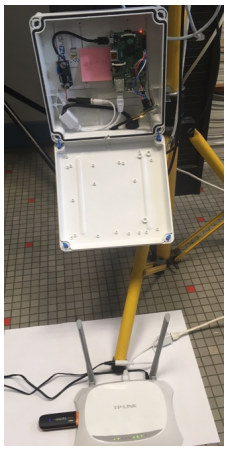
La Fábrica Alegre Loranga LoRa/2G/3G board
For Raspberry PI

Connecting the gateway to the Internet

The best way to provide Internet to the gateway is through Ethernet via a DSL router for instance

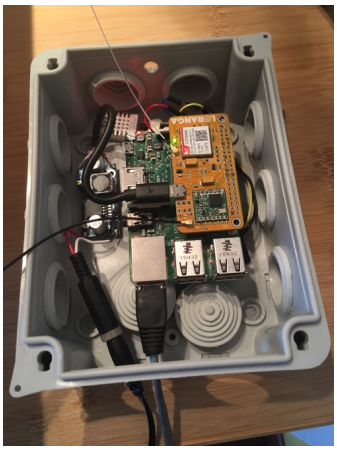
The DSL router can be replaced by a 3G router. This solution is better than using a USB 3G dongle because of power issues.

The Loranga hat mentioned above is a great solution that provides high flexibility of deployment. We have collaboration with the Loranga development team and support of the board is included in the github distribution



External 3G router
+ Ethernet

3G USB dongle



2G/3G Loranga hat

Loranga hat on an RPI0