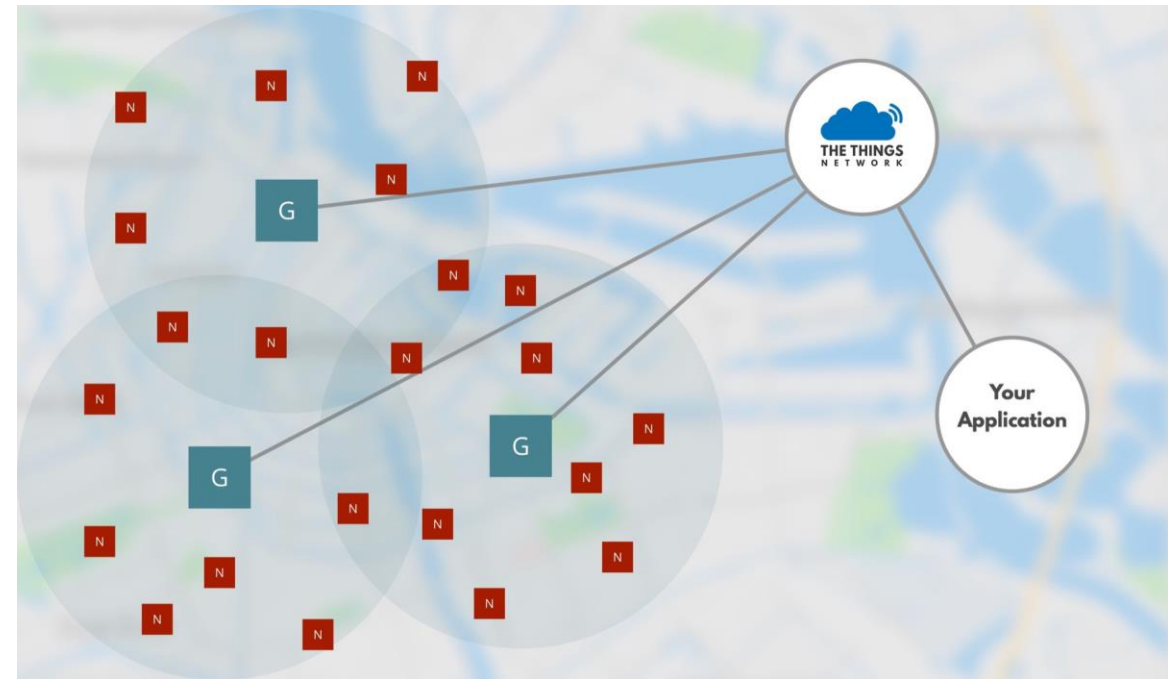


LoRaWan Register a device on TTN

F. Ferrero

LoRaWan with The Thing Network

- The Things Network is a global, open, crowd-sourced Internet of Things data network.
- **The Things Network Backend** route messages from Nodes to the right Application, and back
- First, you have to register to <https://www.thethingsnetwork.org/> , when it is done, tell me your ID, I will add you as a collaborator on the Polytech' application
- You can also join the [Sophia Antipolis TTN community](#) :



Adding a new device

- Go to « Projets Polytech » application and register device
- For ID and EUI, use the N° 50ff1a0000000000XX and just increment XX.
- To remember it : « 50ff1a » is for « SOPHIA »
- It will provide Device EUI, Application EUI and App Key

Activation Method OTAA

Device EUI <> ↕ DA 5A 56 00 00 00 00 02 📋

Application EUI <> ↕ 70 B3 D5 7E D0 00 99 A0 📋

App Key <> ↕ 👁 📋

Activation by Personalization (ABP)

- Go to settings
- Select ABP and save
- Go back to Overview
- You have now the Device Address and the two 128 AES keys
- You can click on Hex-C Style to have the key in the right format



Activation Method **ABP**

Device EUI **<>** **↕** 50 FF 1A 00 00 00 00 01 

Application EUI **<>** **↕** 70 B3 D5 7E D0 00 A3 90 

Device Address **<>** **↕** 26 01 11 44 

Network Session Key **<>** **↕**  msb { 0x14, 0x46, 0xEF, 0x00, 0x4B, 0xC9, 0x96, 0x95, 0xFE, 0x6A, 0x6F, 0x9F, 0xAC, (

App Session Key **<>** **↕**  msb { 0x18, 0xF8, 0xAA, 0x61, 0x31, 0x2C, 0x6C, 0x05, 0x66, 0x4F, 0xCB, 0xE1, 0x81, (

Activation by Personalization (ABP)

- Go to my Github : https://github.com/FabienFerrero/UCA_Board
- Download the archive (.zip) and extract the archive
- Copy the file from Arduino_Code/Libraries/ to /Document/Arduino/Libraries/
- Open the code Arduino_Code/LORAWAN/ABP/Basic/UCA-ABP_Basic.ino
- Copy/Paste NWKSKY, APPSKY and DEVADDR with your IDs from TTN

```
// LoRaWAN NwkSKey, network session key
// This is the default Semtech key, which is used by the early prototype TTN
// network.
static const PROGMEM ul_t NWKSKY[16] = { 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00 };

// LoRaWAN AppSKey, application session key
// This is the default Semtech key, which is used by the early prototype TTN
// network.
static const ul_t PROGMEM APPSKY[16] = { 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00 };

// LoRaWAN end-device address (DevAddr)

static const u4_t DEVADDR = 0x00000000;
```

Activation by Personalization (ABP)

- Compile and download the code on your board
- Look at the TTN device overview
- Frames up should increment each minutes as you board is sending an uplink each 60s.
- Have look on data
- For each uplink, you can look many details as RSSI, SNR, airtime, modulation, coding rate, GW ID, etc ...

Status ● 25 seconds ago

Frames up 0 [reset frame counters](#)

Frames down 0

	time	counter	port	
▲	21:45:35	3	1	payload: 48 65 6C 6C 6F 2C 20 77 6F 72 6C 64 21
▲	21:44:29	2	1	payload: 48 65 6C 6C 6F 2C 20 77 6F 72 6C 64 21
▲	21:43:22	1	1	payload: 48 65 6C 6C 6F 2C 20 77 6F 72 6C 64 21
▲	21:42:16	0	1	retry payload: 48 65 6C 6C 6F 2C 20 77 6F 72 6C 64 21

Activation by Personalization (ABP)

Frame counter security

- Now reset you board (click on the red button on the Arduino mini pro)
- TTN is no more receiving the data
- Click on « reset frame counters » and reset you board again
- As you can see, frame counter is a security features to avoid replay attack (done by capturing and re-transmitting the messages)

Downlink

- Open your serial monitor
- In TTN overview, go to downling, add a payload like « BABA » and click on send
- After the next uplink, you should see the number of byte received in downlink

```
16608545: EV_TXCOMPLETE (includes waiting for RX windows)
Received
2
bytes of payload
```

Over the Air Activation (OTAA)

- In TTN Settings of your device, select OTAA and save
- Open the code Arduino_Code/LORAWAN/OTAA/LP_Basic/UCA-OTAA_Basic.ino
- copy paste after clicking on hexa-style the DEV-EUI, APP-EUI and App Key
- Be carefull !!!
 - Device EUI and Application EUI are **lsb**
 - App Key is **msb**

Device EUI	<>	⇄	lsb	{ 0x02, 0x00, 0x00, 0x00, 0x00, 0x56, 0x5A, 0xDA }	📋
Application EUI	<>	⇄	lsb	{ 0xA0, 0x99, 0x00, 0xD0, 0x7E, 0xD5, 0xB3, 0x70 }	📋
App Key	<>	⇄	👁	msb { 0xAE, 0x1A, 0xBC, 0x3B, 0xE8, 0xEA, 0x47, 0xEF, 0x34, 0xC4, 0x7C, 0x89, 0x72, (📋

Over the Air Activation (OTAA)

- Look in data
- You should see a first uplink that request the connection
- And a second packet with the first data
- On the serial monitor you can see the Joining process and then Joined and Tx.
- The device go to sleep after the Tx

COM18

```
Starting
Vbatt : 346.00
69428: EV_JOINING
745031: EV_JOINED
Datarate: SF8
Vbatt : 346.00
BV=346.00
PQ
1187429: EV_TXCOMPLETE (includes waiting for RX windows)
Datarate: SF8
Sleeping for 360 seconds = 45 x 8 + 0 x 4 + 0 x 2 + 0
```

First packet
with data

Board
request for
connection

	time	counter	port	
First packet with data	▲ 22:10:21	0	1	payload: 00 02 02 01 5A
Board request for connection	⚡ 22:10:18			dev addr: 26 01 2A 04 appeui: 70 B3 D5 7E D0 00 A3 90 dev eui: 50 FF 1A 00 00 00 00 01

Over the Air Activation (OTAA) and data

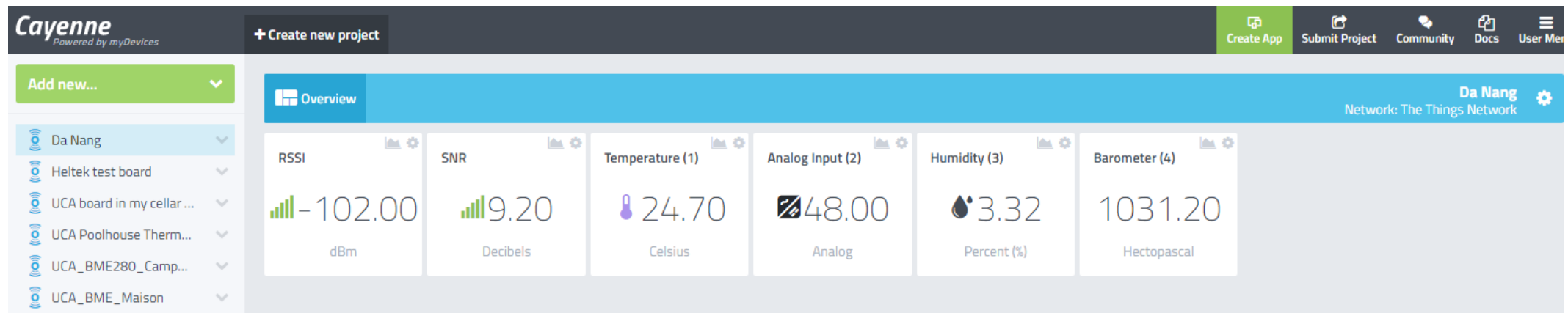
- Try now the code
Arduino_Code/LORAWAN/OTAA/LP_BME280/UCA-BME280.ino
- It use the sensor BME280 that measure T°C, Humidity and Pressure
- The code is using [Cayenne LPP format](#)
- Now you can see sensor data in the uplink packet

The screenshot displays the 'APPLICATION DATA' section of a web interface. At the top right, there are controls for 'pause' and 'clear'. Below this, a 'Filters' section contains five buttons: 'uplink', 'downlink', 'activation', 'ack', and 'error'. The 'uplink' button is currently selected. Below the filters, a table of data is shown with columns for 'time', 'counter', and 'port'. The first row of data shows a timestamp of '22:18:34' with a lightning bolt icon, followed by 'dev addr: 26 01 29 C1', 'app eui: 70 B3D5 7ED000 A3 90', and 'dev eui: 50 FF 1A 00 00 00 00 01'. The second row shows a timestamp of '22:16:49' with an upward arrow icon, a counter of '1', a port of '1', and a payload of '00 02 02 01 5A'. Above the table, a header row lists sensor data: '0 02 02 01 5A 03 68 43 04 73 27 65 05 02 00 3F', 'analog_in_2: 3.46', 'analog_in_5: 0.63', 'barometric_pressure_4: 1008.5', 'relative_humidity_3: 33.5', and 'temperature_1: 22.4'.

time	counter	port
0 02 02 01 5A 03 68 43 04 73 27 65 05 02 00 3F		
analog_in_2: 3.46		
analog_in_5: 0.63		
barometric_pressure_4: 1008.5		
relative_humidity_3: 33.5		
temperature_1: 22.4		
⚡ 22:18:34		
dev addr: 26 01 29 C1		
app eui: 70 B3D5 7ED000 A3 90		
dev eui: 50 FF 1A 00 00 00 00 01		
⬆ 22:16:49	1	1
payload: 00 02 02 01 5A		

Using Cayenne to see you data

- Go to <https://mydevices.com/> and create an account
- Add a device by selecting LoRa/TheThingNetwork and Cayenne LPP.
- Just add your device EUI
- You should see your data



Good luck for you projects !

