



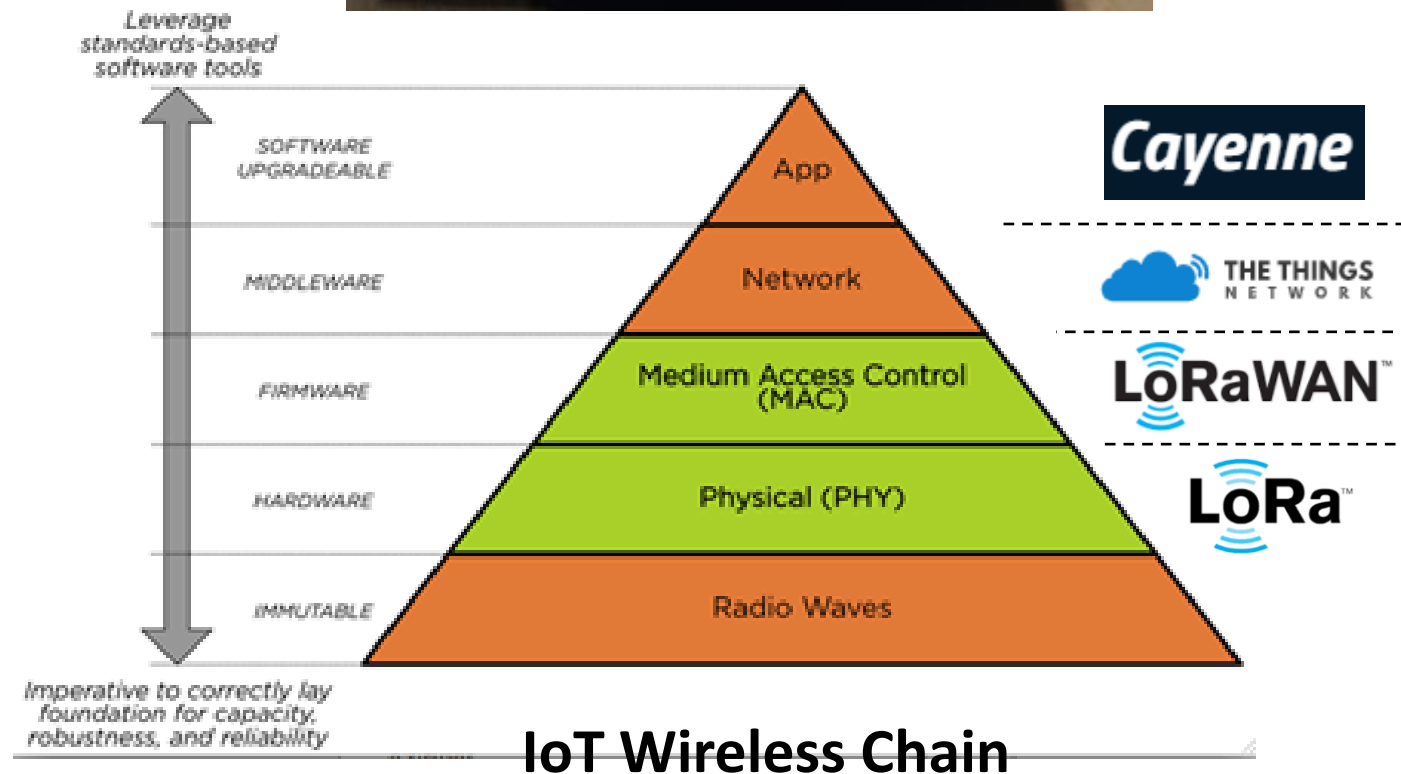
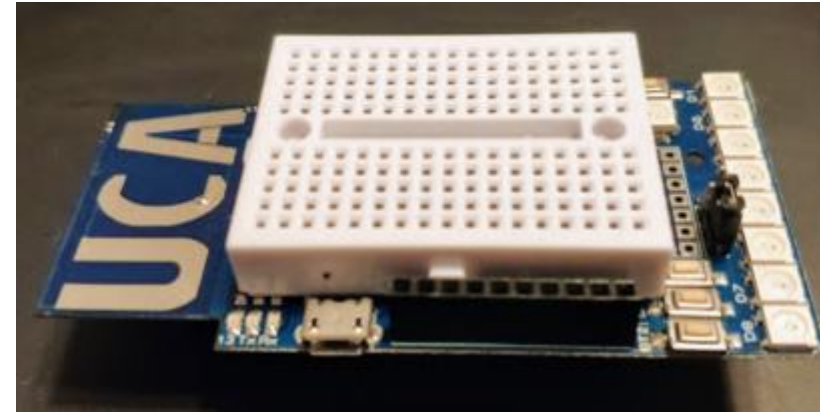
LoRaWan tutorial : Register a device on TTN V3

F. Ferrero, Professor @UCA

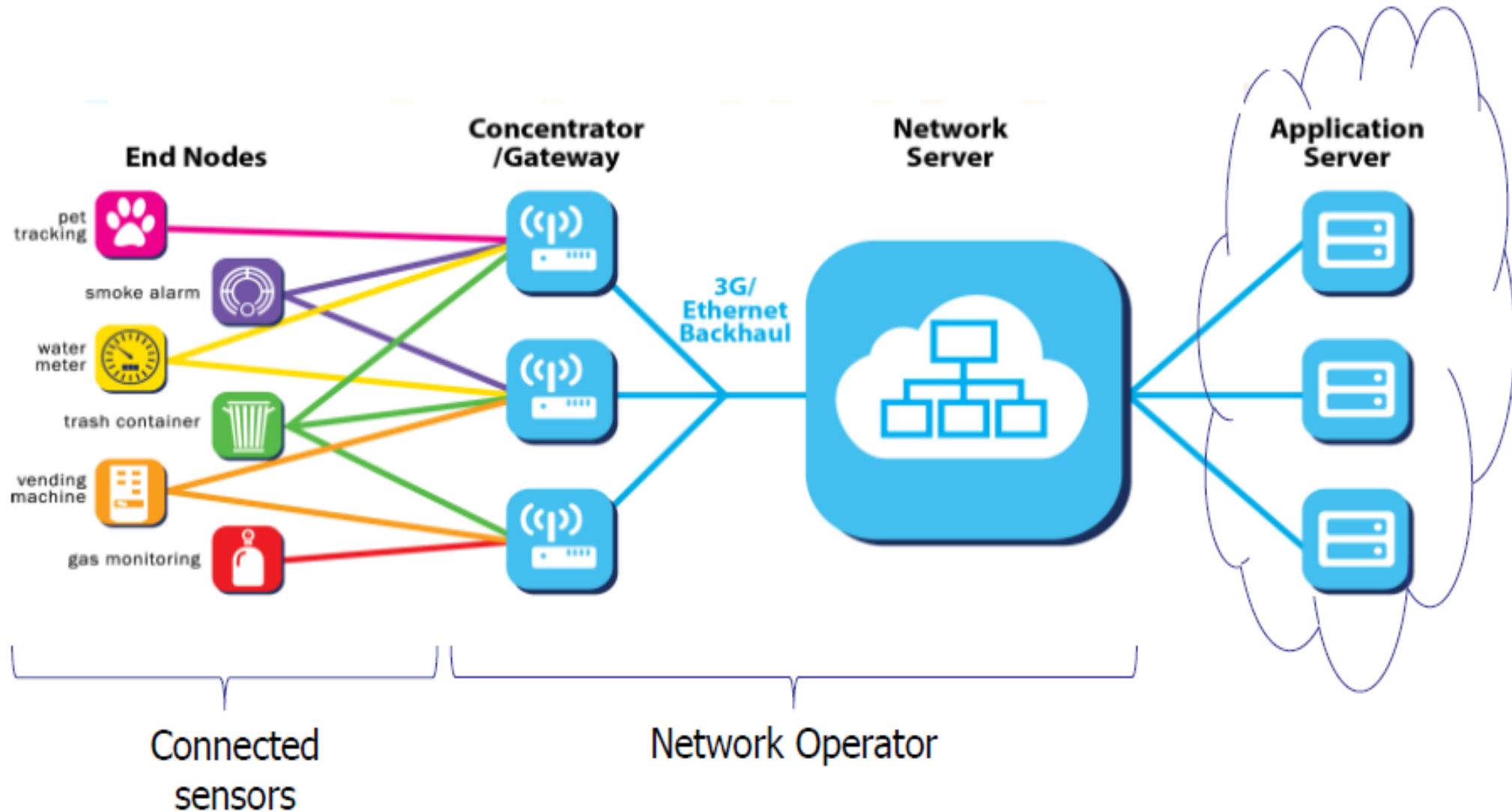
LoRaWan Tutorial Objectives

In this tutorial, you will :

- Use the UCA Education Board
- Program a microcontroller in C with Arduino IDE
- Register the board to a network server
- Transmit data with LoRa modulation
- Push data to an application server



LoRaWan Tutorial Objectives



Downloading Arduino code on Github

- For this tutorial, you are going to use Arduino codes
- Codes are available on : <https://github.com/FabienFerro/UCA21>
- You can click on “Clone or Dowload” and “download zip”
- Then unzip it
- If you are using Github Desktop, you can use “open in Desktop”

Board for Education with LoRa

12 commits 1 branch 0 releases 1 contributor MIT

Branch: master New pull request Find File Clone or download

FabienFerro add code Latest commit ad15230 2 days ago

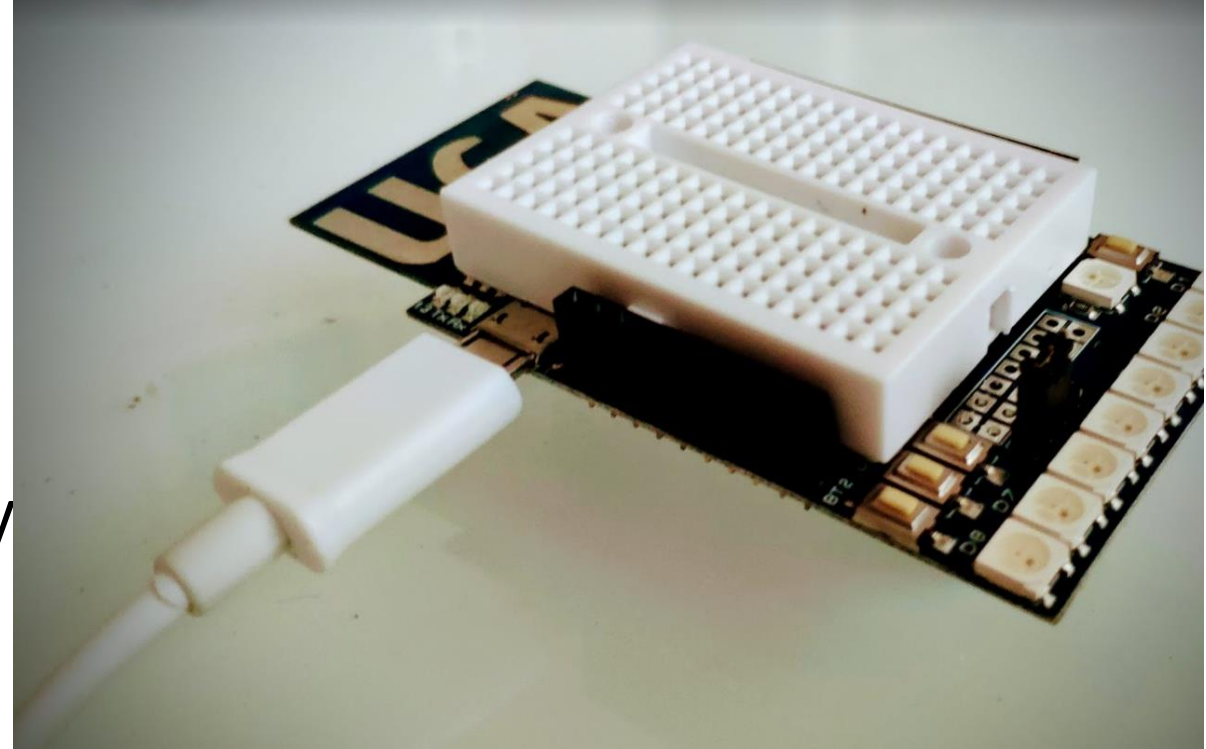
| | | |
|-----------|------------------|------------|
| Antenna | code update | last month |
| Code | add code | 2 days ago |
| Libraries | LED update | last month |
| Schematic | code update | last month |
| LICENSE | Initial commit | last month |
| README.md | Update README.md | last month |

Configuring your Arduino IDE

- After downloading the archive (.zip) and extracting the archive
- Copy the file from : UCA21\Libraries to /Document/Arduino/ Libraries/

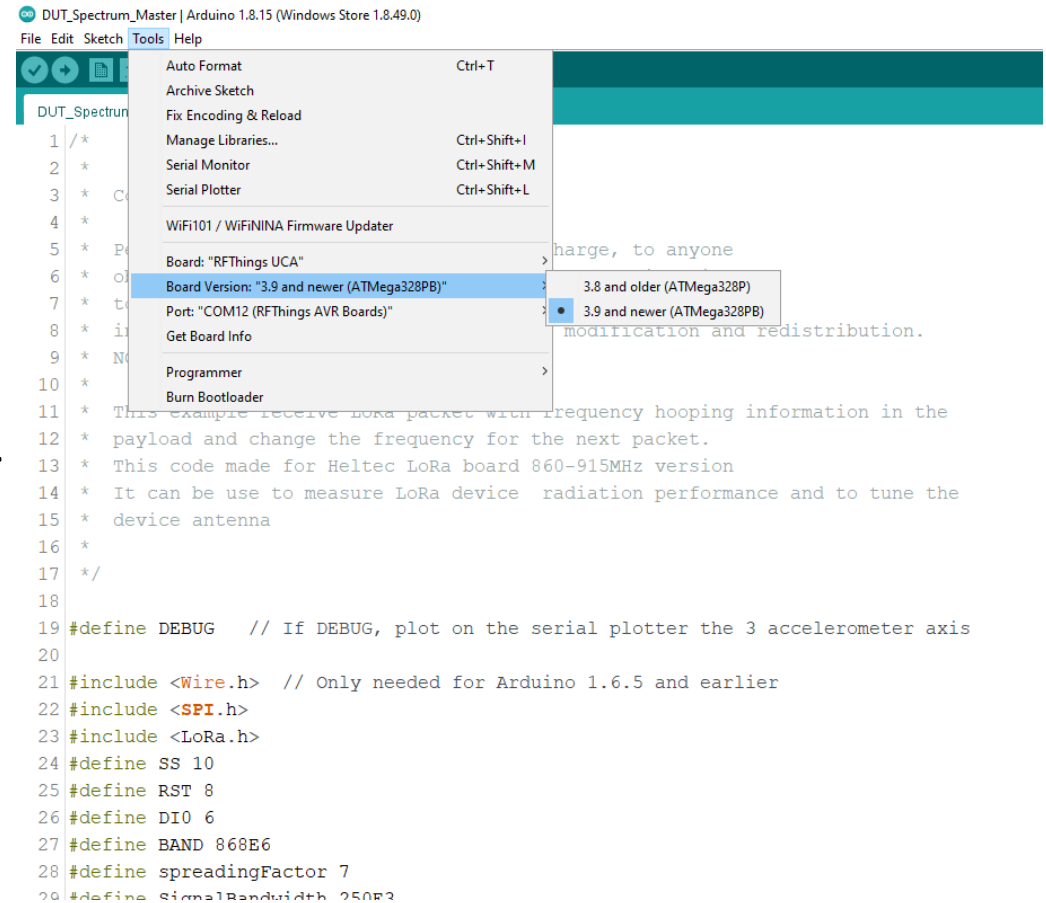
It will install the libs needed during the tutorial

- If your using Windows or Mac, your may need to install the board USB driver (CH340C) : drivers are available [here](#)



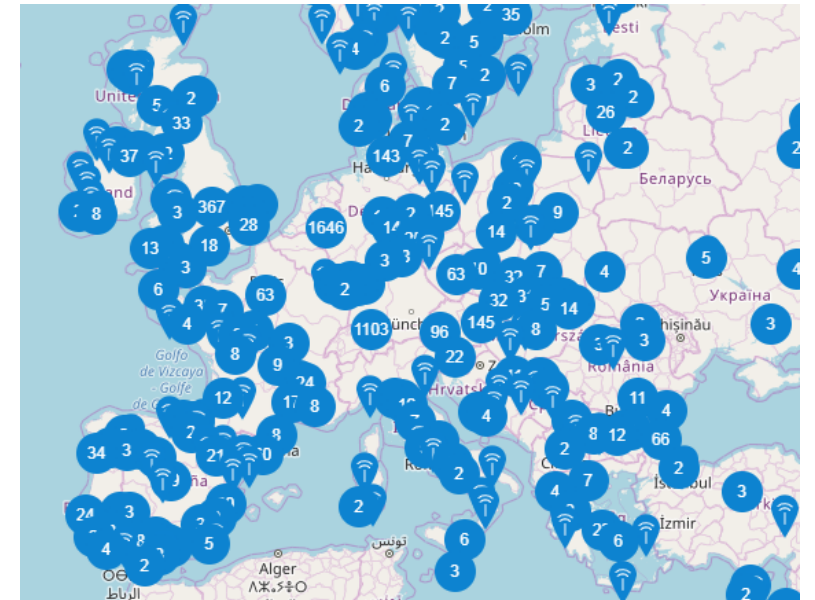
Configuring your Arduino IDE

- Start the Arduino IDE
- Go into Preferences
- Add "***https://rfthings.com.vn/wp-content/uploads/package_rfthings-avr_index.json***" as an "Additional Board Manager URL"
- Open the Boards Manager from the Tools -> Board menu and install "RFTHings AVR Boards by RFThings Vietnam"
- Select your RFTHings UCA board from the Tools -> Board menu
- Select Board version "3.9 and newer : AT328PB" from the Tools -> Board menu
- Select the port



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
- TTN is free
- 10000 LoRa gateways are connected to TTN around the world
- Any TTN can use any GWs, it is a collaborative network



Create a TTN account

- First, you have to [register](https://www.thethingsnetwork.org/) to <https://www.thethingsnetwork.org/>
- Then, give me your USERNAME, I will add you as a collaborator in our application
- You can also join a local community :

[TTN Côte d'Azur](#)

[TTN Da Nang](#)



CREATE AN ACCOUNT

Create an account for The Things Network and start exploring the world of Internet of Things with us.

USERNAME

This will be your username — pick a good one because you will **not** be able to change it.



EMAIL ADDRESS

You will receive a confirmation email, as well as occasional account related emails. If this email address is managed by a third party (such as for corporate email addresses), this third party might block emails coming from The Things Network. This email address is not public.



PASSWORD

Use at least 6 characters.



NEWSLETTER

Subscribe to the newsletter.



Create account

Adding a new device

- Go to « application » and choose the available application
- Click on « + Add end device »
- Select « Manually » for configuration
- Click on « Show advanced activation, LoRaWAN class and cluster settings_»
- Select « ABP »
- Generate DevEUI, Dev Adr, AppSkey, NetwSkey
- Choose a name for End Device ID
- Click on « Register end device » ! It's done

The screenshot displays the 'UCA Project' web interface. At the top, the project name 'UCA Project' and ID 'uca-project' are shown. Below this, a status bar indicates 'Last seen info unavailable', '0 End devices', '1 Collaborator', and '0 API keys', along with a 'Created 4 seconds ago' timestamp. The main content area is divided into two sections: 'General information' and 'Live data'. The 'General information' section shows the 'Application ID' as 'uca-project', 'Created at' as 'Aug 16, 2021 22:48:07', and 'Last updated at' as 'Aug 16, 2021 22:48:07'. The 'Live data' section shows a timestamp '22:48:07' and the text 'uca-project Create application'. Below these sections, there is a search bar labeled 'Search by ID' and two buttons: 'Import end devices' and '+ Add end device'. The 'Register end device' section is active, showing options for 'From The LoRaWAN Device Repository' and 'Manually'. The 'Manually' option is selected. The form includes dropdown menus for 'LoRaWAN version' (set to 'MAC V1.0.3'), 'Regional Parameters version' (set to 'PHY V1.0.3 REV A'), and 'Frequency plan' (set to 'Europe 863-870 MHz (SF9 for RX2 - recommended)'). There is a link to 'Show advanced activation, LoRaWAN class and cluster settings'. The 'Activation mode' section has three radio buttons: 'Over the air activation (OTAA)', 'Activation by personalization (ABP)' (which is selected), and 'Define multicast group (ABP & Multicast)'. The 'Additional LoRaWAN class capabilities' section has a dropdown menu set to 'None (class A only)'. The 'Network defaults' section has a checkbox labeled 'Use network's Rx and frequency defaults' which is checked.

UCA Project
ID: uca-project

Last seen info unavailable 0 End devices 1 Collaborator 0 API keys Created 4 seconds ago

General information

Application ID: uca-project

Created at: Aug 16, 2021 22:48:07

Last updated at: Aug 16, 2021 22:48:07

Live data See all activity →

22:48:07 uca-project Create application

End devices (0)

Search by ID

Import end devices + Add end device

Register end device

From The LoRaWAN Device Repository Manually

LoRaWAN version ⓘ *

MAC V1.0.3

Regional Parameters version ⓘ *

PHY V1.0.3 REV A

Frequency plan ⓘ *

Europe 863-870 MHz (SF9 for RX2 - recommended)

[Show advanced activation, LoRaWAN class and cluster settings](#) ^

Activation mode ⓘ *

☐ Over the air activation (OTAA)

☒ Activation by personalization (ABP)

☐ Define multicast group (ABP & Multicast)

Additional LoRaWAN class capabilities ⓘ

None (class A only)

Network defaults ⓘ

☒ Use network's Rx and frequency defaults

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

Session information

Device address

26 0B 68 02



NwkSKey

0x18, 0x9A, 0x1C, 0x5B, 0xA...

msb ↔



SNwkSIntKey

.....



NwkSEncKey

.....



AppSKey

0x43, 0xB4, 0x29, 0x8D, 0x3...

msb ↔



Activation by Personalization (ABP)

- Open the code UCA21\Code\LORAWAN\ABP\Basic\UCA-ABP_Basic\UCA-ABP_Basic.ino
- Copy/Paste DEVADDR from your TTN window with « 0x » for Hex style
- Copy/Paste NWKSKEY and APPSKEY using C-style from your TTN window

[illegible]

Activation by Personalization (ABP)

- Compile and download the code on your board
- Look at the TTN device overview
- Frames up should increment each half minute as your board is sending an uplink each 30s (« TX_INTERVAL »)
- Have look on Data
- For each uplink, you can look many details as RSSI, SNR, airtime, modulation, coding rate, GW ID, etc ...
- Click on the blue triangle

Status ● 25 seconds ago

Frames up 0 [reset frame counters](#)

Frames down 0

Activation by Personalization (ABP)

Frame counter security

- Now reset you board (click on the right button on your board)
- TTN is no more receiving the data
- Click on « General setting» and expand « Network layer », expand « Advanced MAC settings »
- Enable « Reset Frame counter » options
- As you can see, frame counter is a security features to avoid replay attack (done by capturing and re-transmitting the messages)
- Frame counter can be disabled for debug test in Settings

Downlink

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

```
Packet queued
41330173: EV_TXCOMPLETE (includes waiting for RX windows)
Received 2 bytes of payload
Payload Value : BABA
```

| Overview | | | Live data | Messaging | Location | Payload formatters | Gener |
|------------|-------------------------------|-------------------------|-----------|-----------|----------|--------------------|-------|
| Time | Type | Data preview | | | | | |
| ↓ 22:43:24 | Forward downlink data message | FPort: 1 Payload: BA BA | | | | | |

Activation by Personalization (ABP)

Change SF, power, payload ...

- At the end of the arduino code, you can find :

`LMIC_setDrTxpow(DR_SF12,14);`

- You can change Spreading Factor(SF) from DR_SF7 to DR_SF12
- You can change the power from 2 dBm to 20 dBm
- Payload is in mydata[], and you can change the text.
- You can convert the payload in Hex to normal text using this online [tool](#)
- Change SF and Payload text ! What is the effect on Time on Air ?

ABPand sensor

- You are now going to use a built-in sensor
- Select in
UCA_Education_Board\Code\LORAWAN\ABP\UCA-ABP_Sensor



Over the Air Activation (OTAA) and data

- Select in UCA_Education_Board\Code\LORAWAN\ABP\UCA-ABP_Sensor
- The code is using [Cayenne LPP format](#)
- Now you can see sensor data in the uplink packet

↑ 09:15:56 Forward uplink data message

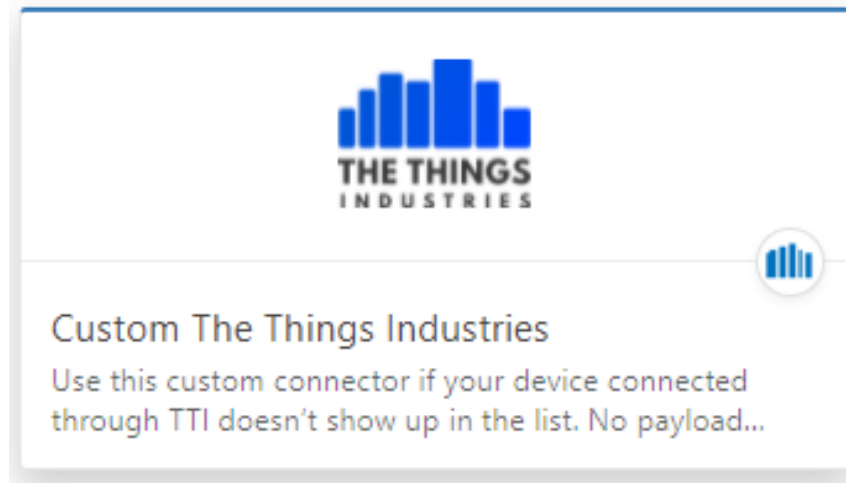
Payload: { accelerometer_4: {...}, analog_in_3: 3.36, luminosity_4: 4889, relative_humidity_2: 48, temperature_1: 29.8 }

01 67 01 2A 02 68 60 03 ...

FPort: 1 Data rate: SF7B


Using TagIO to see you data



- Go to <https://tago.io/> and sign up
- Add a device by selecting LoRa/TheThingsNetwork and Cayenne LPP.
- Add a device and select « LoRaWAN TTI/TTN v3 »
- Select « Custom The Things Industries





Using TagoIO to see you data

- Give a name to your device
- Add Device EUI
- Create an authorization and copy authorization


 **Service Authorization**
Create authorization to allow integration with other services [Read more here](#).


| Name | Additional Parameter (Optional)  | Created at | Authorization  | |
|--|---|----------------------|---|-----------------------------------|
| <input type="text" value="enter a name for this authorization"/> | <input type="text" value="enter an optional additional parameter"/> | <input type="text"/> | <input type="text"/> | <button>Generate</button> |
| TTN | | il y a un jour | <input checked="" type="checkbox"/> Copied | <div><div></div><div></div></div> |


ike
ce via TTI ada...


deZem
Integrate with the deZem data pla...

Integrat


ro
to Qubitro

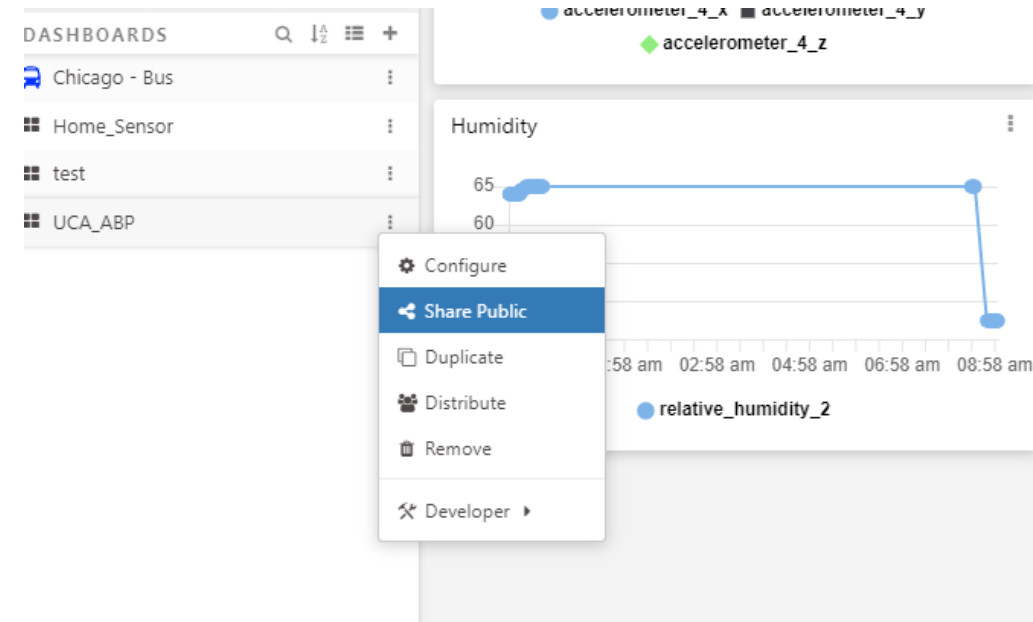
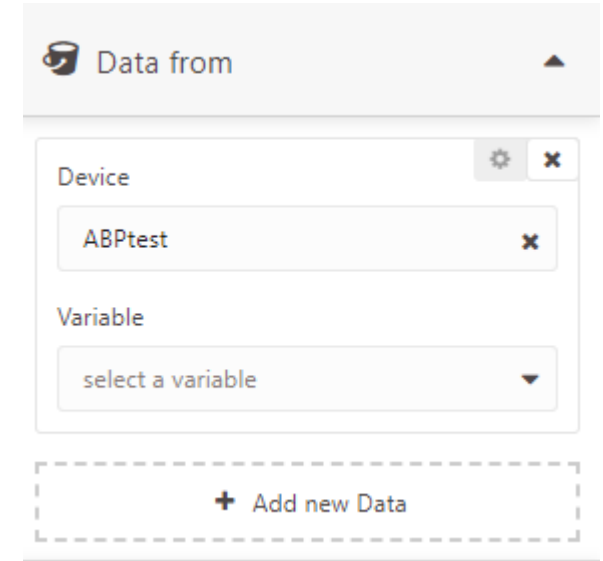
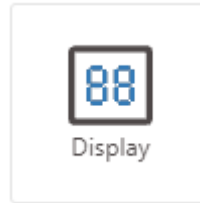

TagoIO
Integrate with TagoIO

Int

- Go to TTN and click on Integration/Webhooks
- Click on « Add a Webhooks »
- Select TagoIO
- Enter a Webhooks ID (what you want) and copy authorization

Using TagIO to see you data

- Go to your dashboard and create a new normal dashboard
- Add a widget like a display
- Choose your Device and select a variable
- You can customize any widget and your dashboard.
- You can share your dashboard with
« Share Public »



Good luck for you projects !

This board as been funded by UCA

