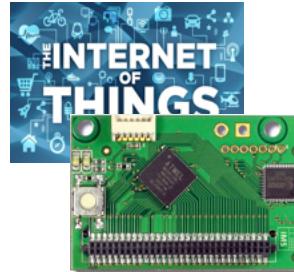


DEPLOYING LOW-COST AND LONG-RANGE INTERNET OF THINGS IN DEVELOPING COUNTRIES



PROF. CONG DUC PHAM
HTTP://WWW.UNIV-PAU.FR/~CPHAM
UNIVERSITÉ DE PAU, FRANCE





IoT FOR DEVELOPMENT



Irrigation



Livestock farming



Fish farming & aquaculture



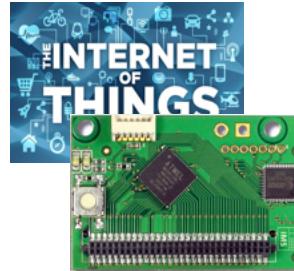
Storage & logistic



Agriculture



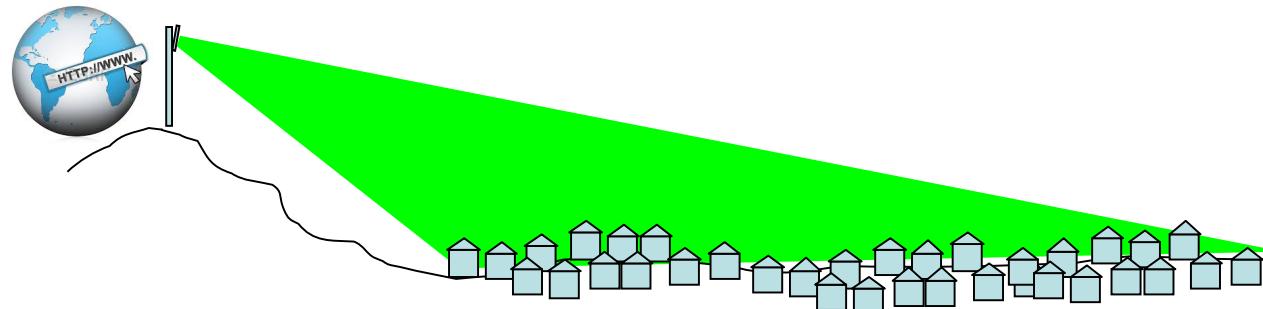
Fresh water



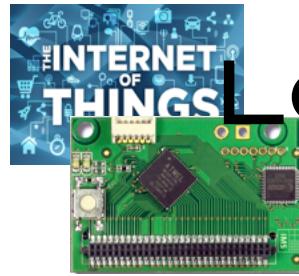
LONG-RANGE SENSING



Moisture/
Temperature of
storage areas



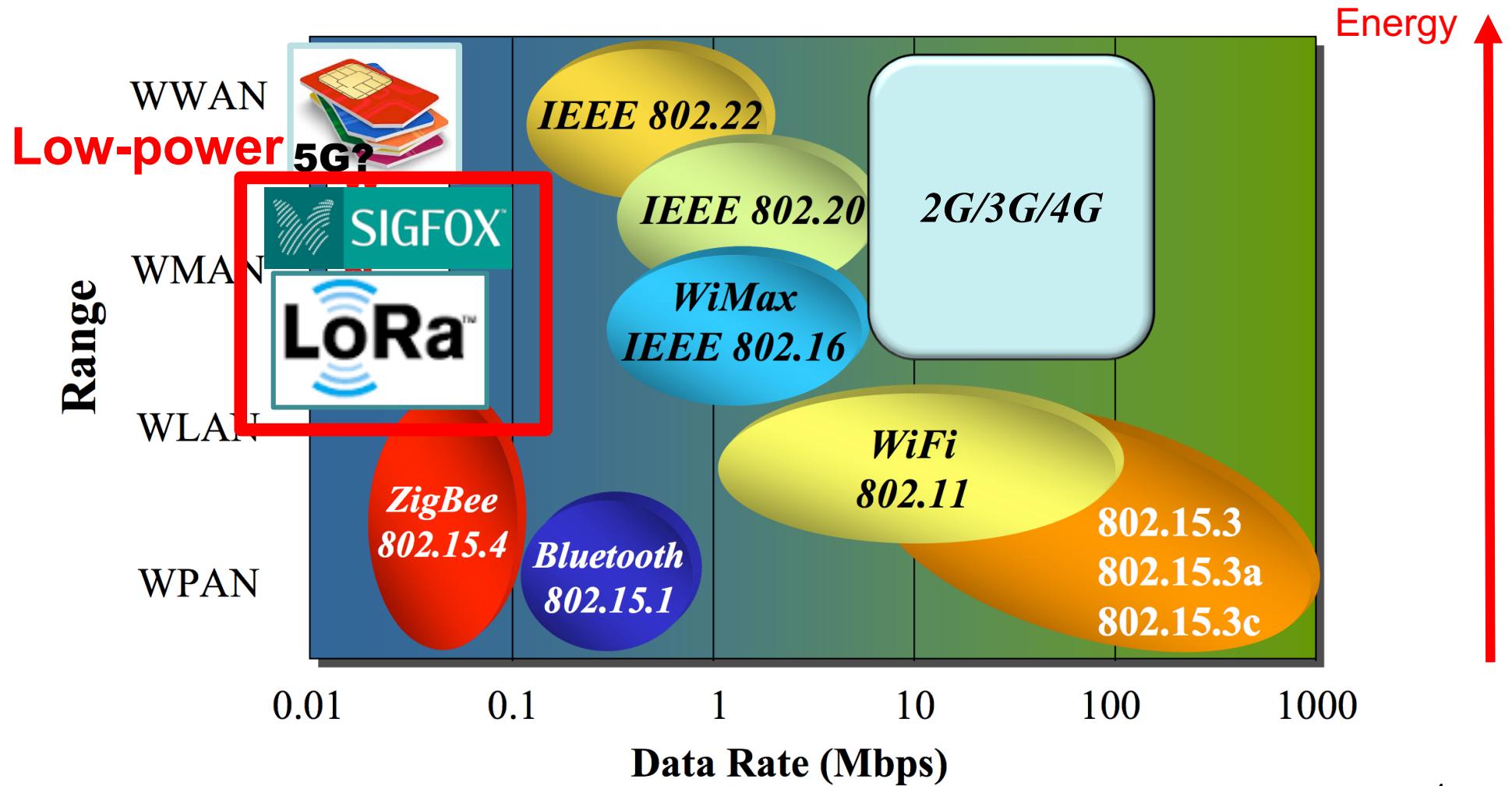
Technology	2G	3G	LAN
Range (I=Indoor, O=Outdoor)	N/A	N/A	O: 300m I: 30m
Tx current consumption	200-500mA	500-1000mA	100-300mA
Standby current	2.3mA	3.5mA	NC

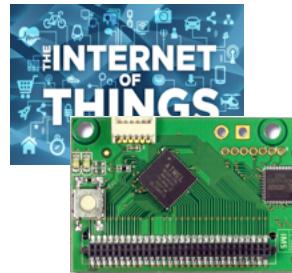


LOW-POWER & LONG-RANGE RADIO TECHNOLOGIES



Energy-Range dilemma

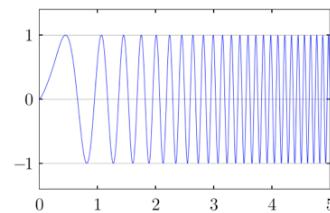




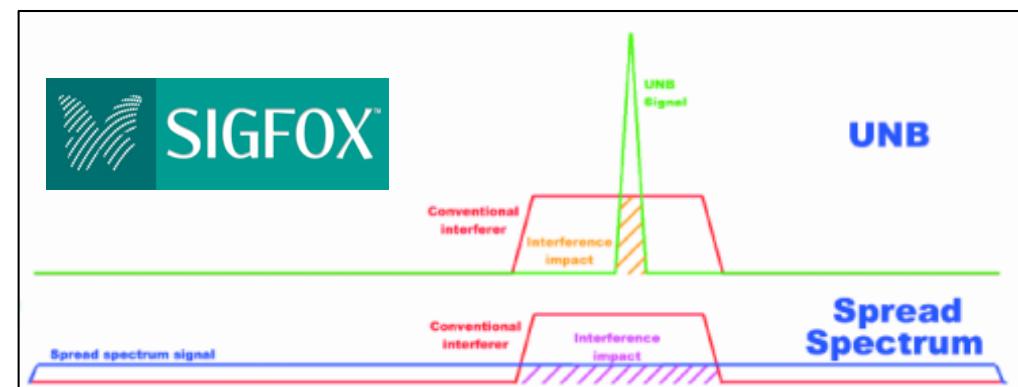
INCREASING RANGE?

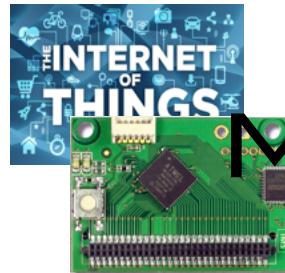


- Generally, robustness and sensitivity can be increased when **transmitting much slower**
- A Sigfox message is sent relatively slowly in an ultra narrow band of spectrum. **Max throughput=~100bps**
- LoRa also increases time-on-air when maximum range is needed. But LoRa uses spread spectrum approach. **Throughput=~300bps-37500bps**



LoRa™



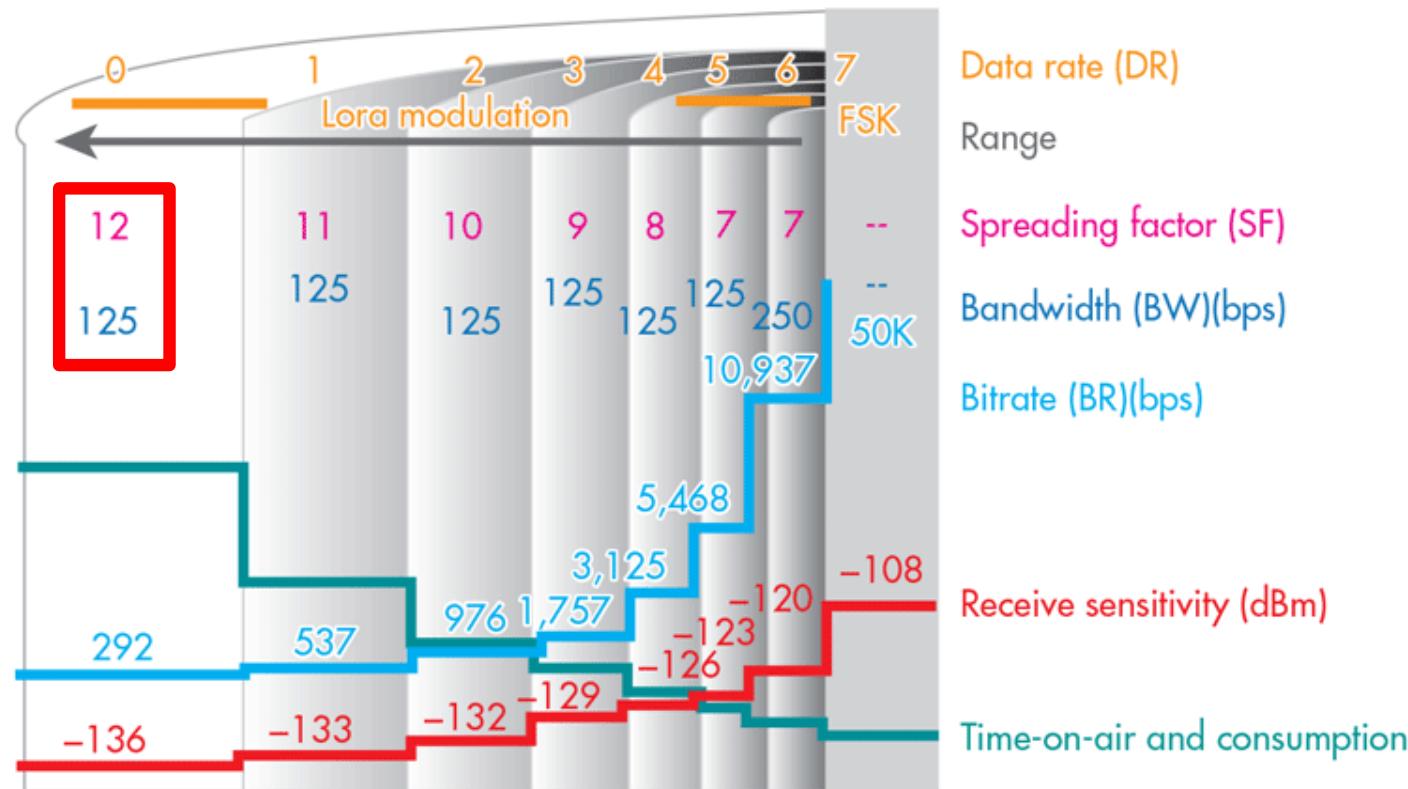


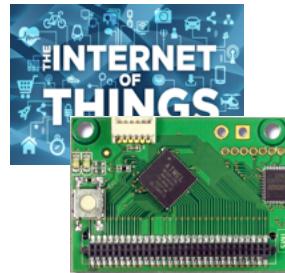
MAIN LORA PARAMETERS



□ Main parameters

- Bandwidth: 62.5kHz, 125kHz, 250kHz, 500kHz
- Spreading factor: 6 to 12





LORA DETAILS SPECS



□ Main parameters

- Bandwidth: 62.5kHz, 125kHz, 250kHz, 500kHz
- Spreading factor: 6 to 12
- Rate code: 4/4+CR (CR=1, 2, 3, 4)

$$R_b = SF * \frac{\text{Rate Code}}{\left[\frac{2^SF}{BW} \right]} \text{ bits/sec}$$

Sensitivity: lowest input power with acceptable link quality, typically 1% PER

<i>SpreadingFactor (RegModemConfig2)</i>	Spreading Factor (Chips / symbol)	LoRa Demodulator SNR
6	64	-5 dB
7	128	-7.5 dB
8	256	-10 dB
9	512	-12.5 dB
10	1024	-15 dB
11	2048	-17.5 dB
12	4096	-20 dB

Bandwidth (kHz)	Spreading Factor	Nominal Rb (bps)	Sensitivity (dBm)
125	6	9380	-122
125	12	293	-137
250	6	18750	-119
250	12	586	-134
500	6	37500	-116
500	12	1172	-131

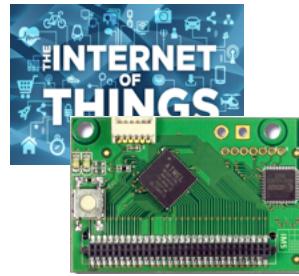
Rule of thumb

6dB increase = twice the range in LOS

12dB needed for urban areas

Bandwidth (kHz)	Spreading Factor	Coding rate	Nominal Rb (bps)	Sensitivity (dBm)
125	12	4/5	293	-137
250	12	4/5	586	-134
500	12	4/5	1172	-131

Tables from Semtech

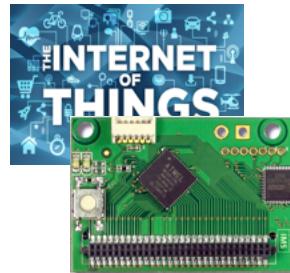


LORA TIME-ON-AIR



**Very low throughput
Transmission time can be several seconds**

LoRa mode	BW	CR	SF	time on air in second for payload size of						max thr. for 255B in bps
				5 bytes	55 bytes	105 bytes	155 Bytes	205 Bytes	255 Bytes	
1	125	4/5	12	0.95846	2.59686	4.23526	5.87366	7.51206	9.15046	223
2	250	4/5	12	0.47923	1.21651	1.87187	2.52723	3.26451	3.91987	520
3	125	4/5	10	0.28058	0.69018	1.09978	1.50938	1.91898	2.32858	876
4	500	4/5	12	0.23962	0.60826	0.93594	1.26362	1.63226	1.95994	1041
5	250	4/5	10	0.14029	0.34509	0.54989	0.75469	0.95949	1.16429	1752
6	500	4/5	11	0.11981	0.30413	0.50893	0.69325	0.87757	1.06189	1921
7	250	4/5	9	0.07014	0.18278	0.29542	0.40806	0.5207	0.63334	3221
8	500	4/5	9	0.03507	0.09139	0.14771	0.20403	0.26035	0.31667	6442
9	500	4/5	8	0.01754	0.05082	0.08154	0.11482	0.14554	0.17882	11408
10	500	4/5	7	0.00877	0.02797	0.04589	0.06381	0.08301	0.10093	20212



ENERGY CONSUMPTION COMPARAISON



Tables from Semtech

Technology	2G	3G	LAN	ZigBee	Lo Power WAN
Range (I=Indoor, O=Outdoor)	N/A	N/A	O: 300m I: 30m	O: 90m I: 30m	Same as 2G/3G
Tx current consumption	200-500mA	500-1000mA	100-300mA	18mA	20-40mA
Standby current	2.3mA	3.5mA	NC	0.003mA	0.001mA
Energy harvesting (solar, other)	No	No	No	Possible	Possible
Battery 2000mAh (LR6 battery)	4-8 hours(com) 36 days(idle)	2-4 hours(com) X hours(idle)	50 hours(com) X hours(idle)	60hours (com)	120 hours(com) 10 year(idle)
Module Revenue Annually	12 \$	20 \$	4 \$	\$3	3 \$

Autonomy GSM with 2000mAh -



Autonomy LP WAN with 2000mAh -



Example for energy meter

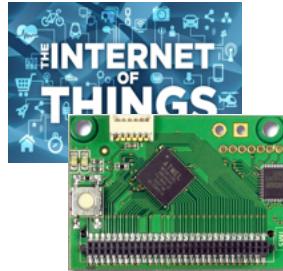
1 year

5 years

10 years

MATURATION OF THE IOT MARKET...





IOT BECOMES REALITY!



NB-LTE



nwave

LTE-M

EC-G

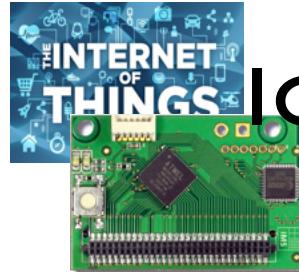
WIFI

BT

RFID

UWB

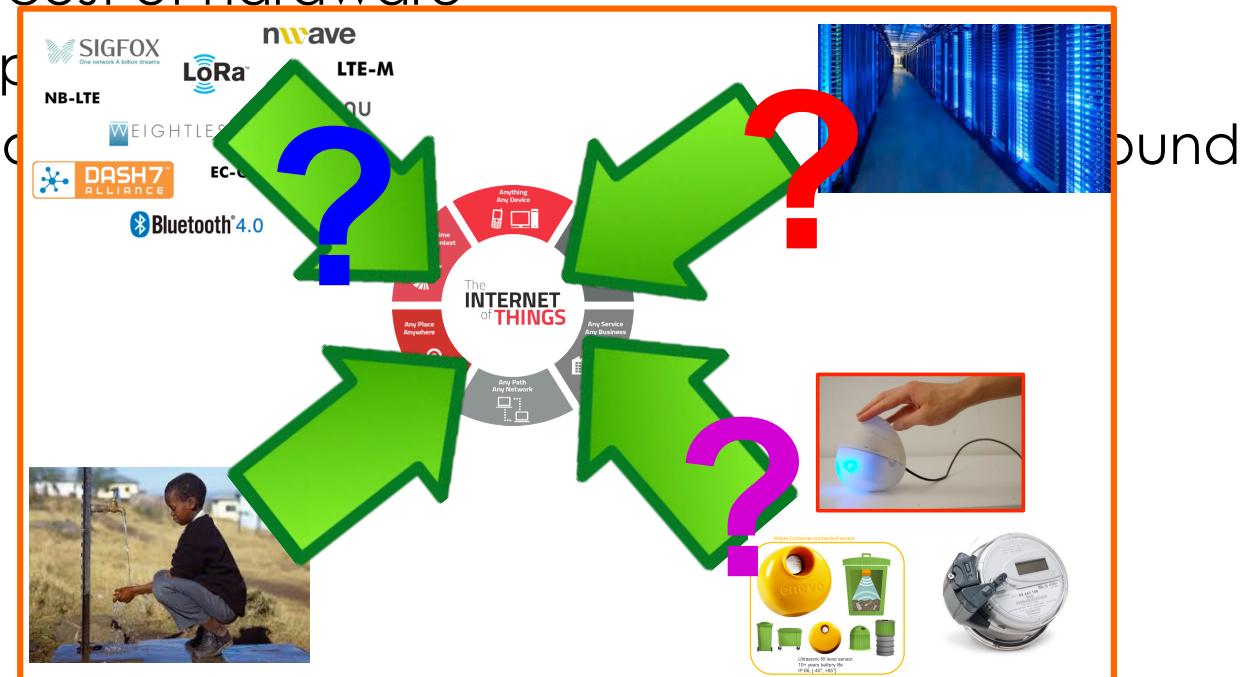
BT



THE INTERNET OF THINGS IN DEVELOPING COUNTRIES OR RURAL AREAS?



- Developing countries/rural areas are still far from being ready to enjoy the smallest benefit of IoT
 - lack of infrastructure
 - high cost of hardware
 - competition
 - lack of skills

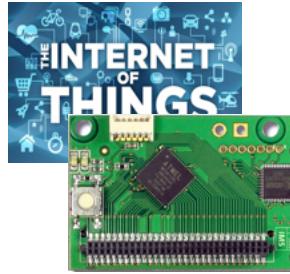


MATURATION OF THE IOT MARKET...

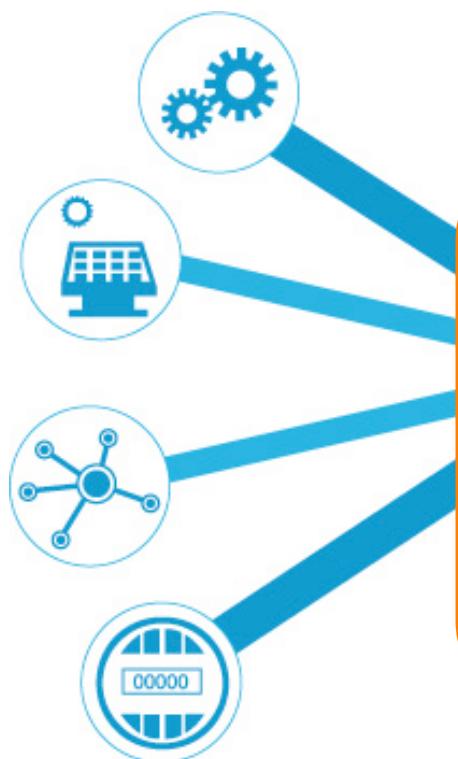


Too expensive
Too integrated
Highly specialized
Difficult to customize
Difficult to upgrade



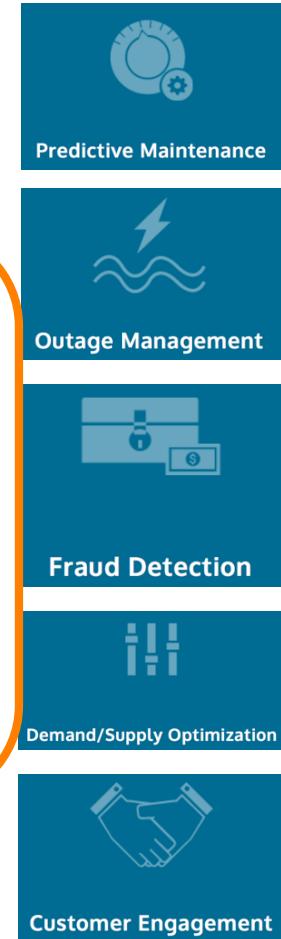


INTERNET, CLOUD & BIG DATA ANALYTICS

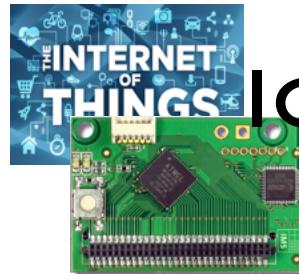


Internet connectivity is weak and expensive!

Nearly impossible in remote/rural areas



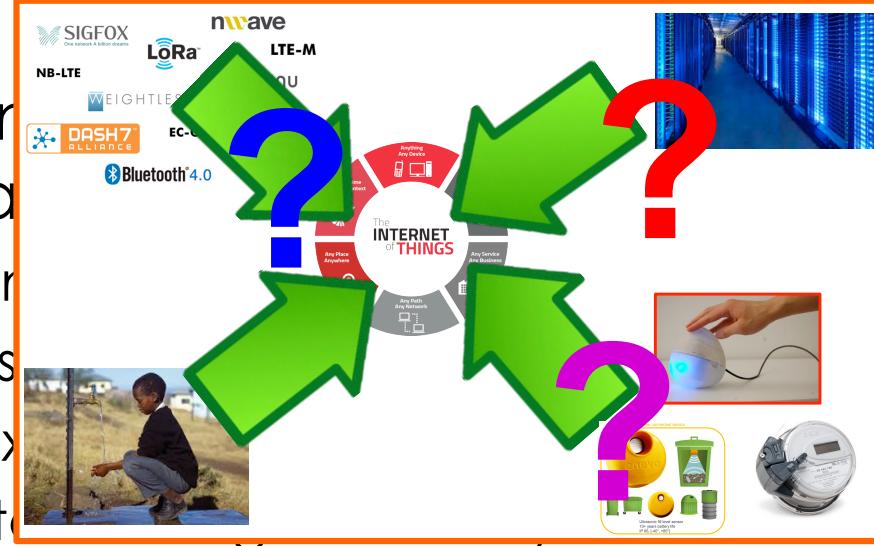
Graphics from <http://www.vitria.com/iot-analytics/>

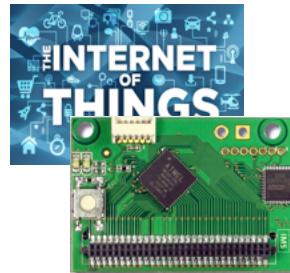


IoT IN DEVELOPING COUNTRIES AND RURAL AREAS



- Developing countries being ready
 - lack of infrastructure
 - high costs
 - complex regulations
 - lack of technology
- still far from benefit of IoT
- to deploy IoT in developing countries, it is necessary to target three major issues
 - reduce cost of infrastructures, hardware and services
 - limit dependency to proprietary infrastructures and provide local interaction models
 - target technology appropriation, push for local business models



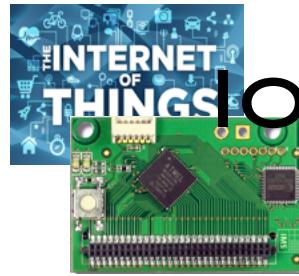


WAZIUP: LOW-COST IoT



[ABOUT »](#) [TECHNOLOGIES »](#) [COMMUNITY](#) [NEWS & EVENT »](#) [DOWNLOADS](#) [DEV KIT](#) [FAQ](#) [CONTACT](#)

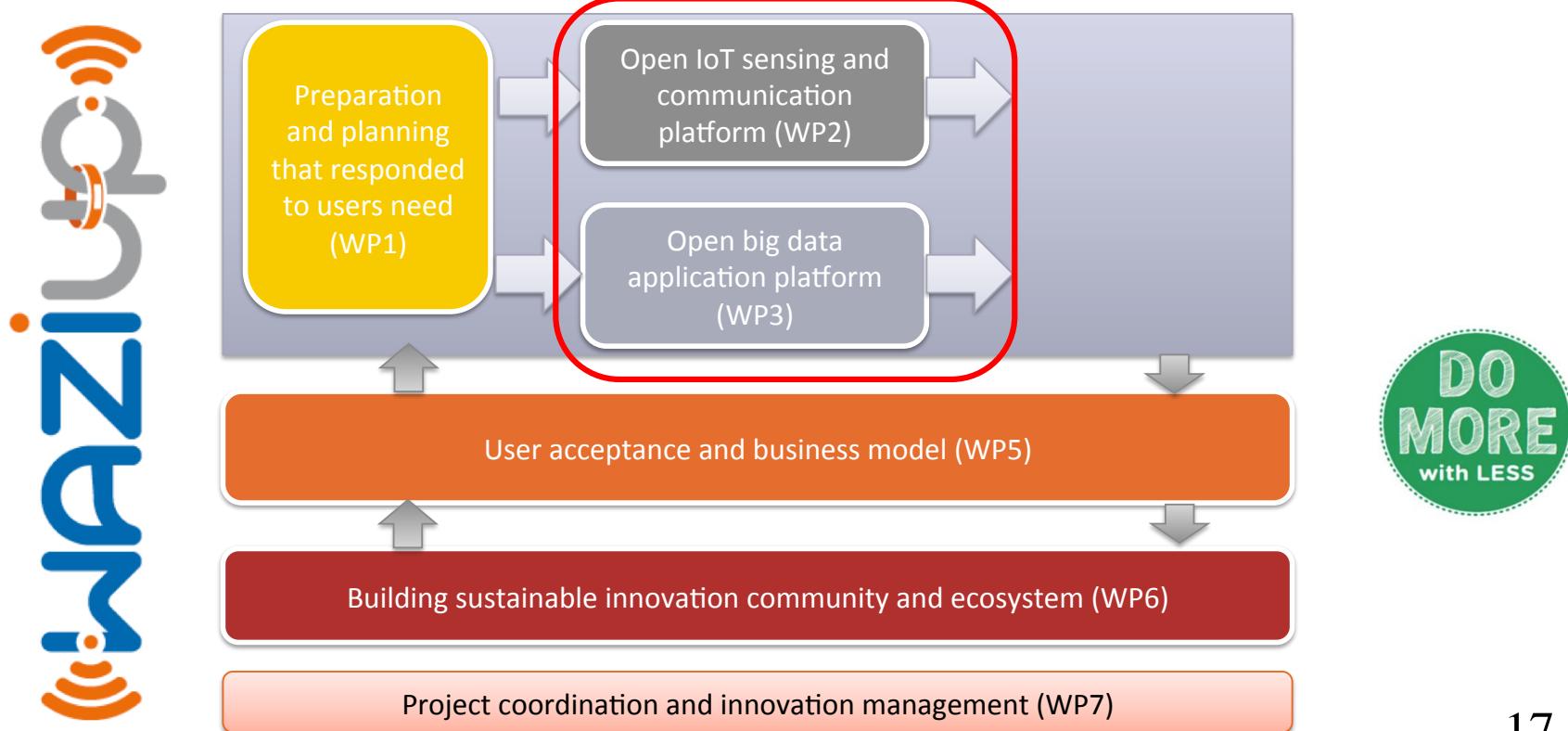


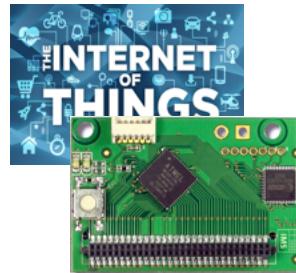


IoT FOR RURAL APPLICATIONS IN DEVELOPPING COUNTRIES



- ❑ WAZIUP is an EU H2020 project (2016-2019)
- ❑ contributes to long-range networks for rural applications with WP2 and big data with WP3





LOW-COST HARDWARE



WHAT IS ARDUINO?

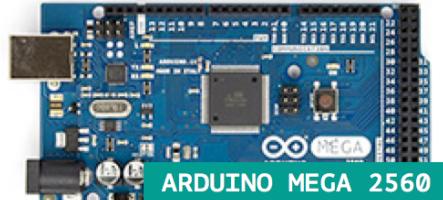
Arduino is an open-source electronics platform based on easy-to-use hardware and software. It's intended for anyone making interactive projects.

ARDUINO BOARD

Arduino senses the environment by receiving inputs from many sensors, and affects its surroundings by controlling lights, motors, and other actuators.



ARDUINO UNO



ARDUINO MEGA 2560



ARDUINO ZERO



ARDUINO DUE



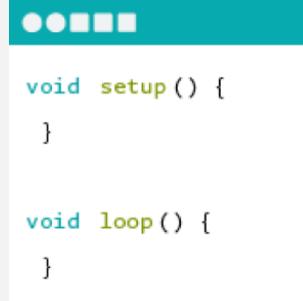
ARDUINO MICRO



ARDUINO PRO MINI



ARDUINO NANO



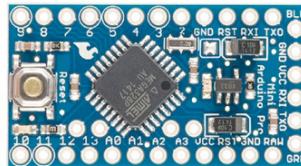
ARDUINO SOFTWARE

You can tell your Arduino what to do by writing code in the Arduino programming language and using the Arduino development environment.

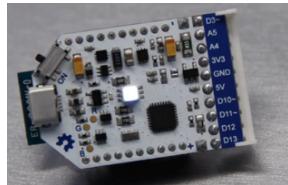
LARGE ECOSYSTEM, STILL GROWING!



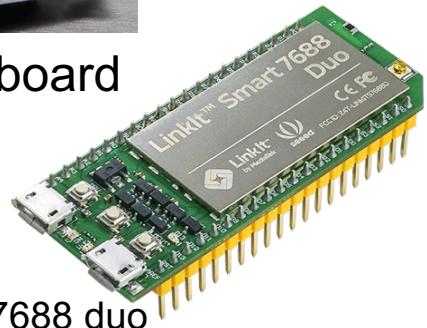
Arduino Pro Mini



LoPy



Theairboard



LinkIt
Smart7688 duo



Expressif ESP32



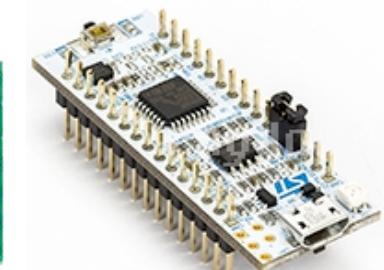
<http://www.postscapes.com/internet-of-things-hardware/>

<http://blog.atmel.com/2015/12/16/rewind-50-of-the-best-boards-from-2015/>

<http://blog.atmel.com/2015/04/09/25-dev-boards-to-help-you-get-started-on-your-next-iot-project/>



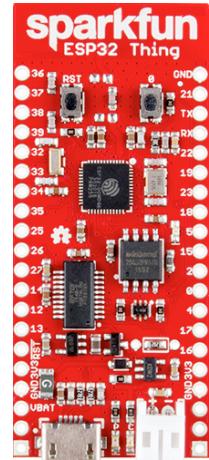
Teensy 3.2



STM32 Nucleo-32



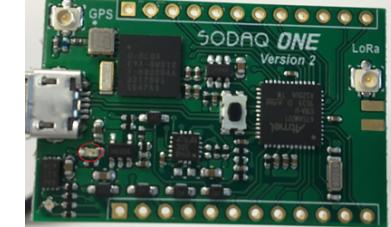
Adafruit Feather



Sparkfun ESP32
Thing



Tessel



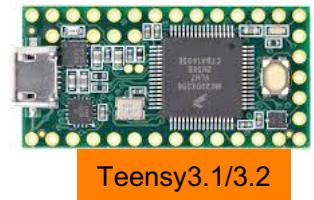
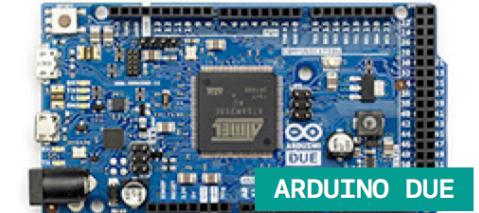
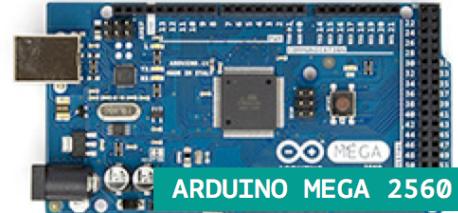
SodaqOnev2



Tinyduino



SW/HW BUILDING BLOCKS INTEGRATION



More to come...



LoRa radios that
our library already
supports



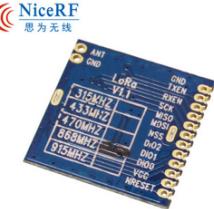
HopeRF
RFM92W/95W



Libelium LoRa

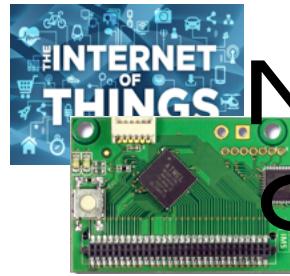


Modtronix
inAir9/9B



NiceRF
LoRa1276

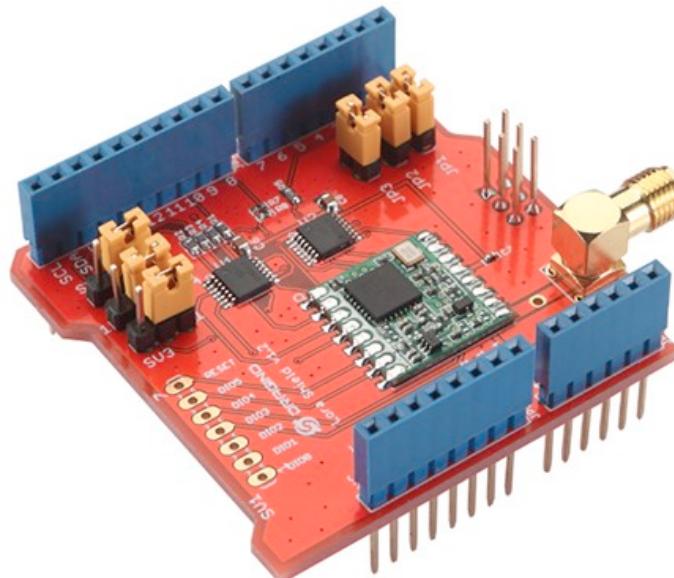
Long-Range communication library



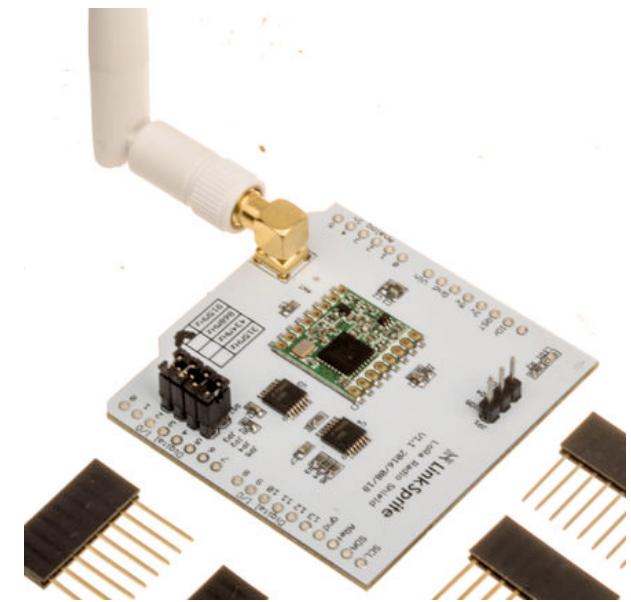
MORE AND MORE EASY-TO-CONNECT LORA MODULES!



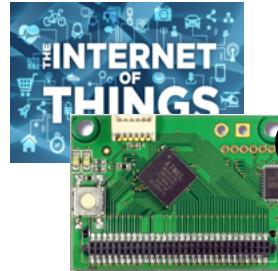
LORANGA LoRa +
2G/3G board,
mainly for
Raspberry PI



Dragino LoRa shield
for Arduino



LinkSprite LoRa shield
for Arduino



OPEN-SOURCE SOFTWARE



```
/* temperature sensor on analog 8 to test the LoRa gateway
 * Copyright (C) 2015 Congduc Pham, University of Pau, France
 *
 * This program is free software: you can redistribute it and/or modify
 * it under the terms of the GNU General Public License as published by
 * the Free Software Foundation, either version 3 of the License, or
 * (at your option) any later version.
 *
 * This program is distributed
 * but WITHOUT ANY WARRANTY;
 * without even the implied warranty of
 * MERCHANTABILITY or FITNESS
 * for a particular purpose. See the
 * GNU General Public License
 * for more details.
 *
 * You should have received
 * along with the program.
 */
*****  

// Include the SX1272.h  

#include "SX1272.h"  

//  

// IMPORTANT  

// please uncomment only 1 ch  

// it seems that both HopeRF  

// boards we set the initial  

// uncoment if your radio is  

// define RADIO_HOPERF_90  

// uncoment if your radio is  

// #define RADIO_INA128B  

//  

// THUMBTANT
```

CongducPham / LowCostLoRaGw

Code Issues 62 Pull requests 2 Projects 0 Pulse Graphs

Low-cost LoRa IoT & gateway with SX1272/76, Raspberry and Arduino

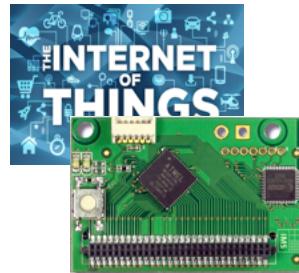
122 commits 1 branch 0 releases 2 contributors

Branch: master New pull request Find file Clone or download

Congduc Pham bug fix in lora_gateway.cpp Latest commit a0daa4a a day ago

File	Commit Message	Time Ago
Arduino	update SMS scripts	15 days ago
gw_full_latest	bug fix in lora_gateway.cpp	a day ago
tutorials	update SMS scripts	15 days ago
.gitignore	.DS_Store banished	10 months ago
README.md	update README	11 days ago

LowCostLoRaGw github has latest general distribution:
<https://github.com/CongducPham/LowCostLoRaGw>
WAZIUP-specific configuration can be found on
<https://github.com/Waziup/waziup-gateway>



LARGE VARIETY OF EXAMPLES



CongducPham / LowCostLoRaGw

Unwatch 49 Unstar 216 Fork 120

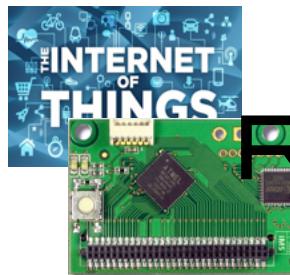
Code Issues 96 Pull requests 2 Projects 0 Wiki Insights Settings

Branch: master LowCostLoRaGw / Arduino / Create new file Upload files Find file History

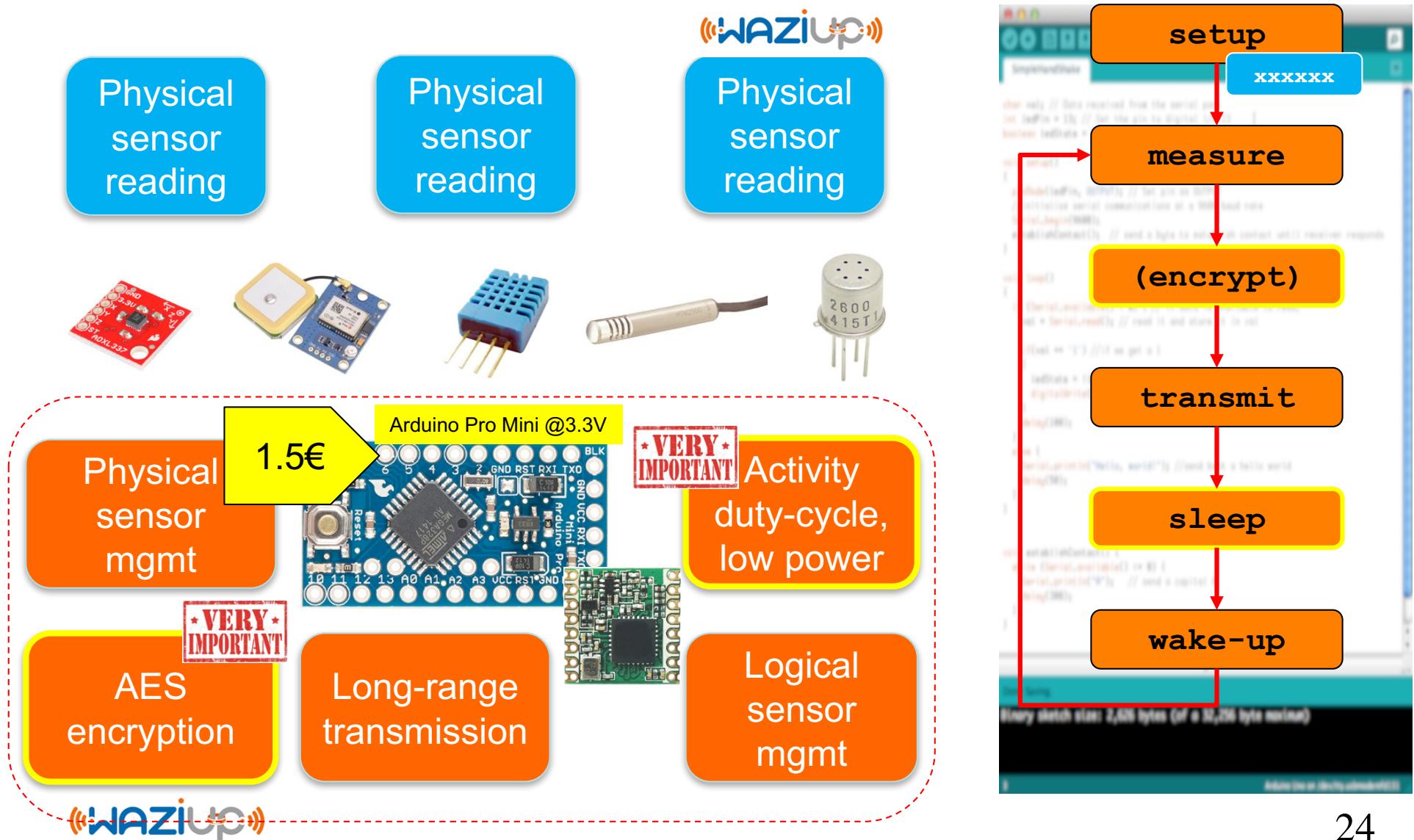
Congduc Pham update README files, fix MD5 digest computation of gw id, always use ... Latest commit aba3ed2 2 days ago

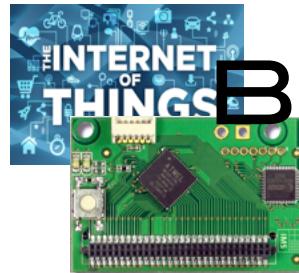
..

Arduino_LoRa_GPS	update README	19 days ago
Arduino_LoRa_Gateway	update gateway related files and some sketch	4 months ago
Arduino_LoRa_Gateway_1_4	improve management of transmission power, add channels in 863-865	a year ago
Arduino_LoRa_Generic_Sensor	update Arduino examples	a month ago
Arduino_LoRa_InteractiveDevice	update Arduino examples	a month ago
Arduino_LoRa_Ping_Pong	update Arduino examples	a month ago
Arduino_LoRa_Simple_BeaconCol...	update Arduino example	23 days ago
Arduino_LoRa_Simple_SoilHum	update Arduino examples	a month ago
Arduino_LoRa_Simple_temp	update Arduino examples	a month ago
Arduino_LoRa_SoilHum	update Arduino examples	a month ago
Arduino_LoRa_temp	update Arduino examples	a month ago
Arduino_LoRa_ucamll	update image support	3 months ago
libraries	update README files, fix MD5 digest computation of gw id, always use ...	2 days ago
README.md	update README	19 days ago

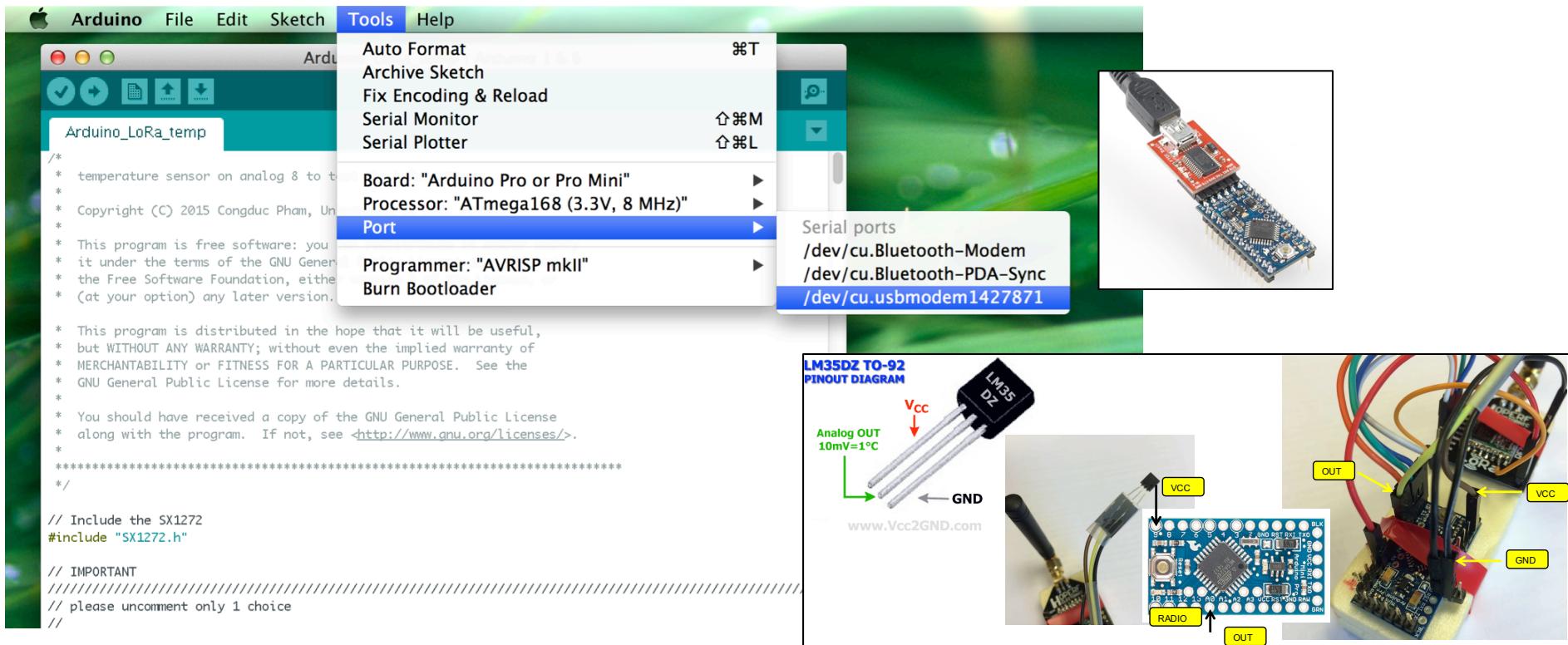


READY-TO-USE TEMPLATES



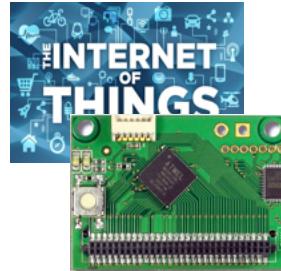


BUILD YOUR FIRST LORA IOT DEVICE

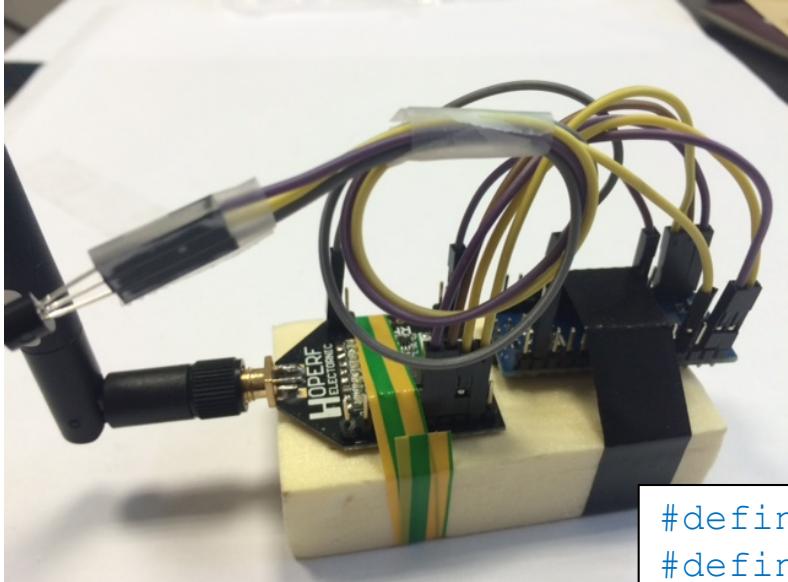


Connect the USB end to your computer and the USB port should be detected in the Arduino IDE. Select the serial port for your device. It may have another name than what is shown in the example. Then click on the « upload » button

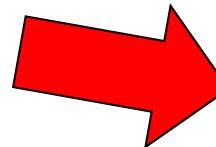




DEFAULT CONFIGURATION



!\!TC/18.5



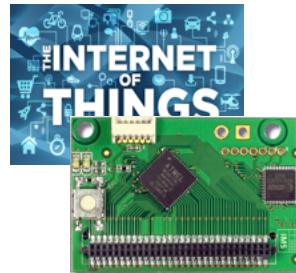
```
#define DEFAULT_DEST_ADDR 1  
#define LORAMODE 1  
#define node_addr 6
```

The default configuration in the Arduino_LoRa_Simple_temp example is:

Send packets to the gateway (one or many if in range)

LoRa mode 1

Node short address is 6



TUTORIALS AND VIDEOS



LOW-COST LoRa IoT DEVICE: A STEP-BY-STEP TUTORIAL

WAZIUP

LIUPPA
T2I team

PROF. CONGDU PHAM
[HTTP://WWW.UNIV-PAU.FR/~CPHAM](http://www.univ-pau.fr/~cpham)
UNIVERSITÉ DE PAU, FRANCE

Université de Pau et des Pays de l'Adour

YouTube

HORIZON 2020 **UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR**
Congduc Pham, <http://cpham.perso.univ-pau.fr>

WAZIUP
<http://www.waziup.eu>

The generic hardware platform

The Arduino Pro Mini

The Arduino Pro Mini is a compact form factor Arduino board based on the ATmega328P microcontroller. Use the **3.3v and 8MHz version** of the Arduino Pro Mini for lower power consumption.

You can get the original board designed by Sparkfun or get one of the various clones available mainly from Chinese manufacturer. The last solution is very cost-effective as the Pro Mini board can be purchased for a bit more than 1€ a piece.

Depending on how many sensors you want to connect, the number of ground (GND) pins may be limited. You can extend a GND pin with a header pin where all pins are soldered together.

The LoRa radio module

There are various LoRa radio modules that are all based on the Semtech SX1272/1276 chips family.

Fully tested LoRa radio modules HopeRF RFM92W/95W Libelium LoRa Modtronix inAir4/9/9B NiceRF LoRa1276

Most of SPI-based LoRa radio modules are supported. We recommend the Modtronix inAir model if you don't have delicate soldering experience as this module can come with header pins ready to be connected with Dupont wires.

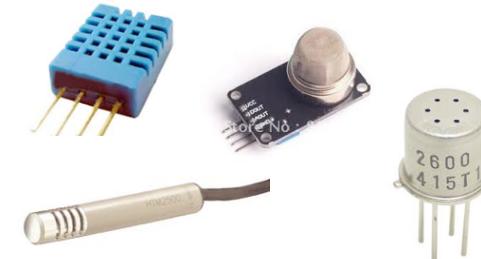
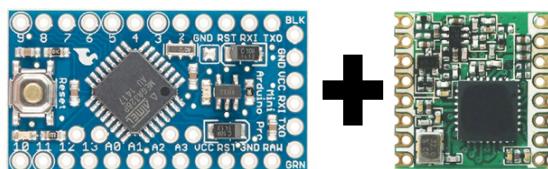
The RFM95W can be found assembled (Adafruit) or an adapter can be purchased (from Ideutron for instance).

Connect the LoRa radio module

Connect the corresponding SPI pins of the radio module to the SPI pins on the Pro Mini board. MOSI (blue) is pin 11, MISO (green) is pin 12, CS (white) is pin 10 and CLK (orange) is pin 13 (right picture). Then connect also the VCC (red) and the GND (black) of the radio module to the VCC and the GND of the board (right picture). The VCC of the Pro Mini board gets 3.3v from the on-board voltage regulator.

GENERIC SENSING IOT DEVICE

- Build low-cost, low-power, Long-range enabled generic platform
- Methodology for low-cost platform design
- Technology transfers to user communities, economic actors, stakeholders,...





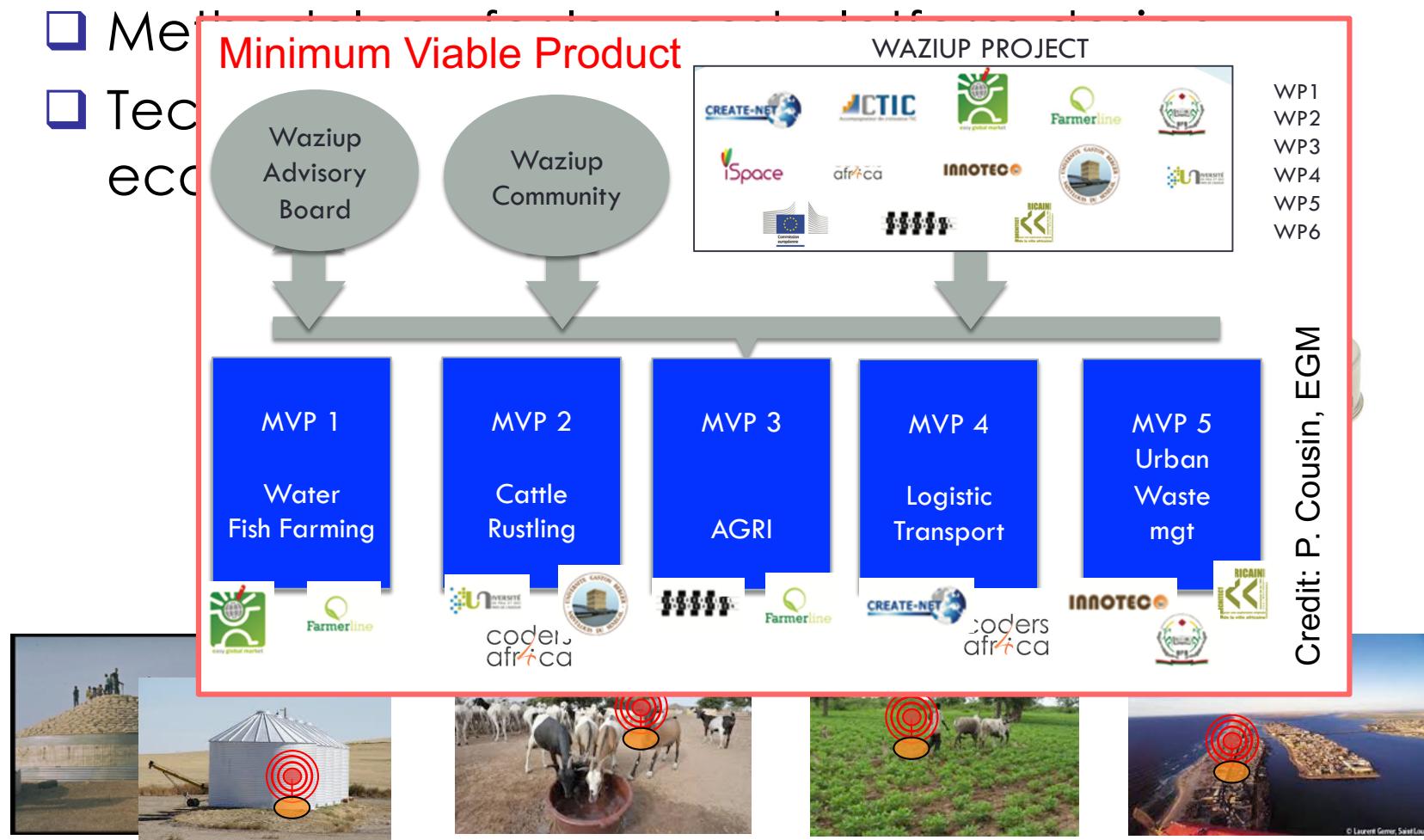
GENERIC SENSING IOT DEVICE

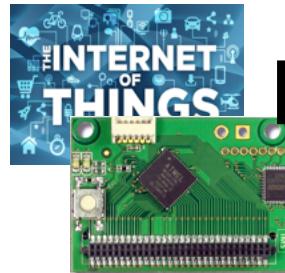


- Build low-cost, low-power, Long-range enabled generic platform

- Meet the needs of the African market

- Technical and economic feasibility





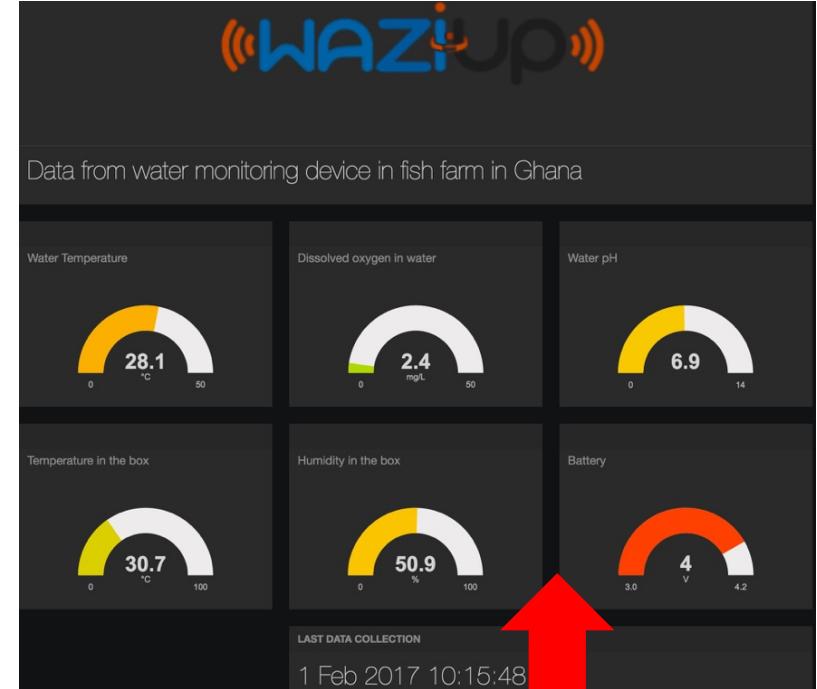
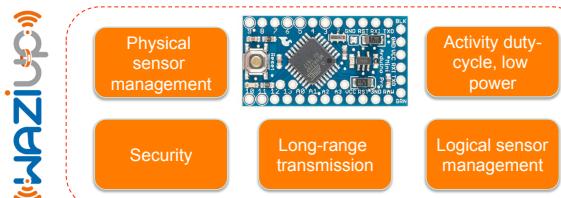
LOW-COST BUOY FOR FISH FARMING MVP



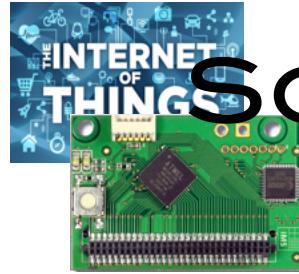
WAZIUP
Physical sensor reading



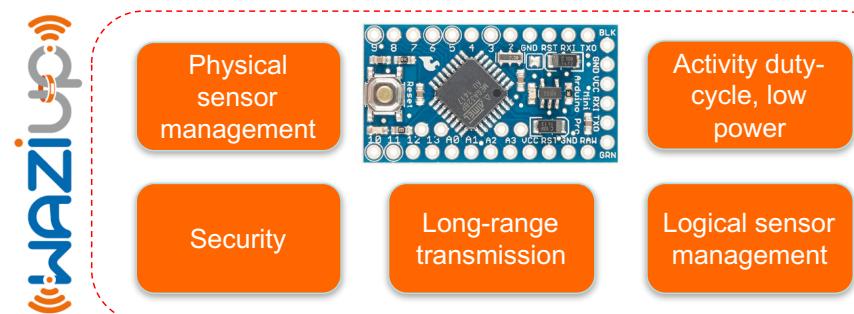
Credit: EGM

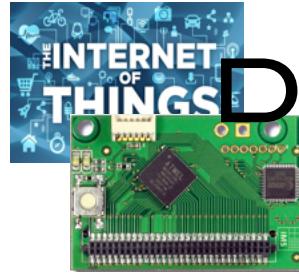


FIWARE

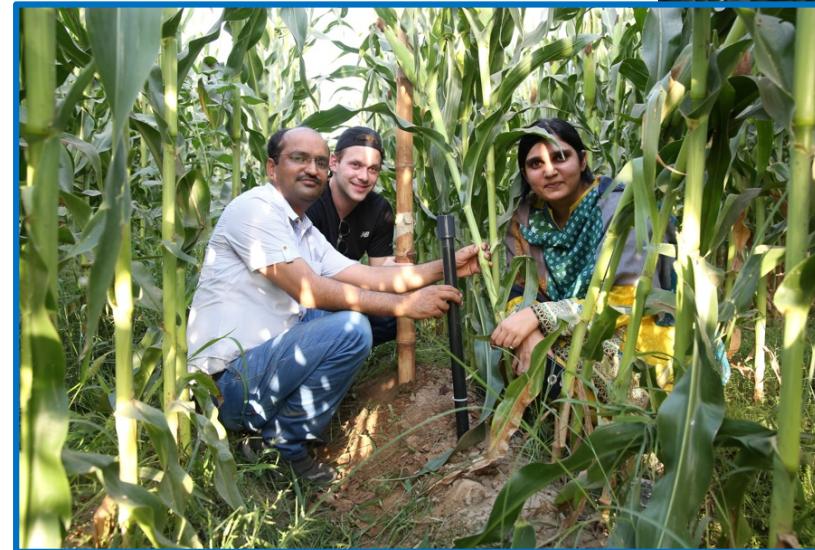


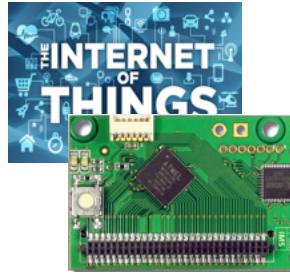
SOIL HUMIDITY SENSORS FOR AGRI MVP



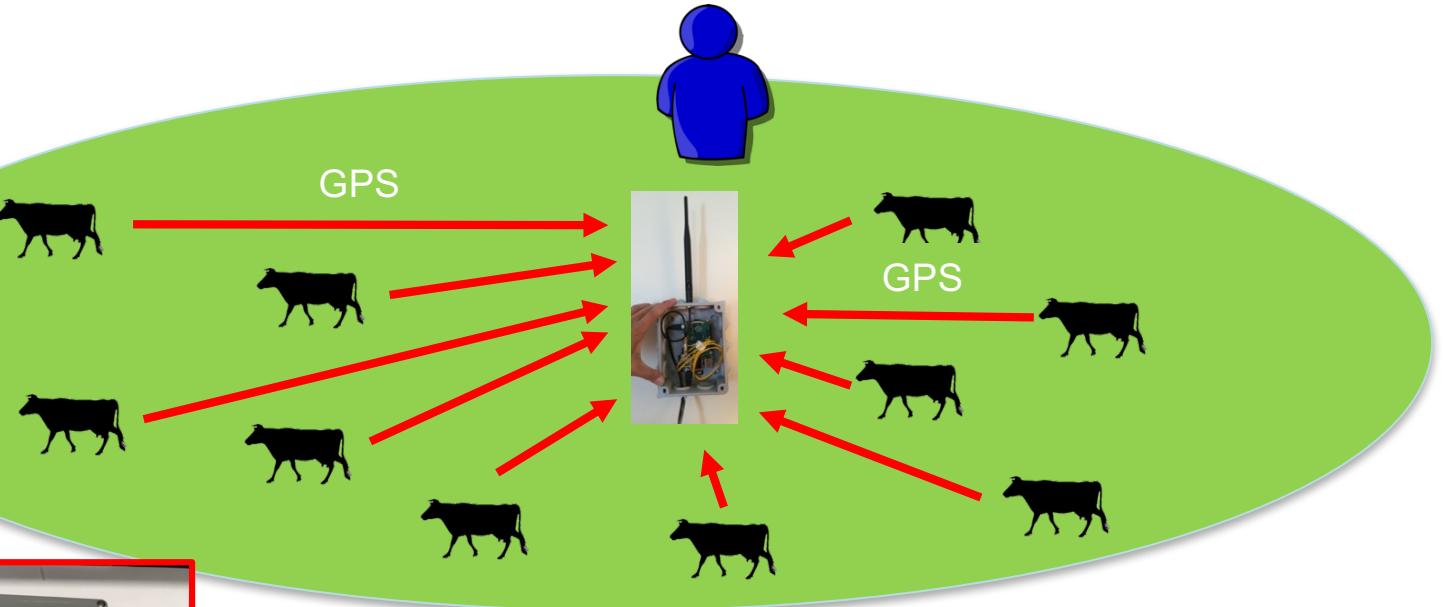
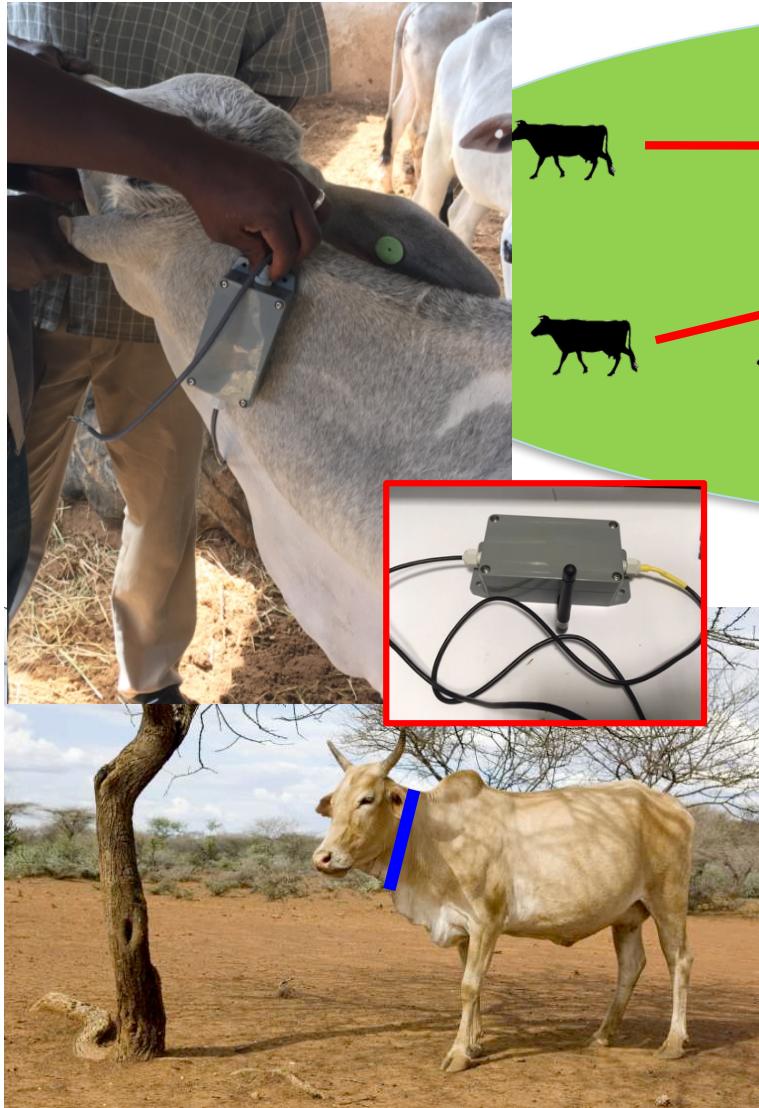


DEPLOYMENT FOR NESTLÉ'S WATERSENSE PROJECT





COLLAR FOR CATTLE RUSTLING MVP

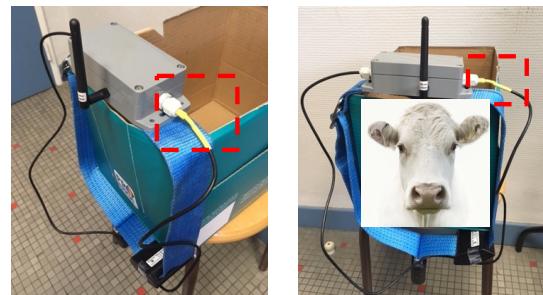
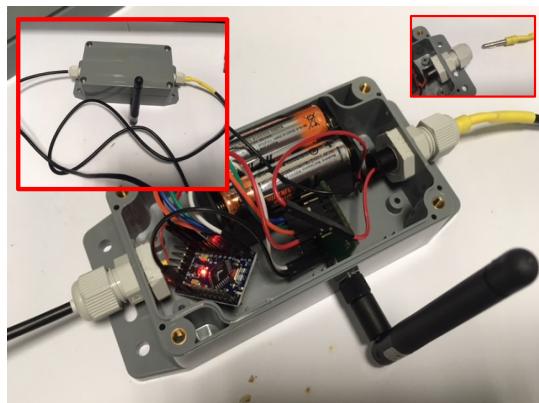
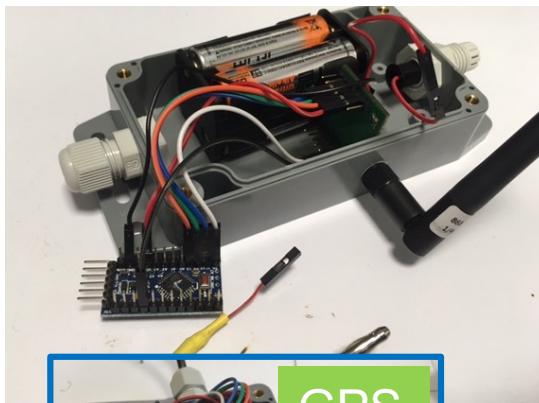
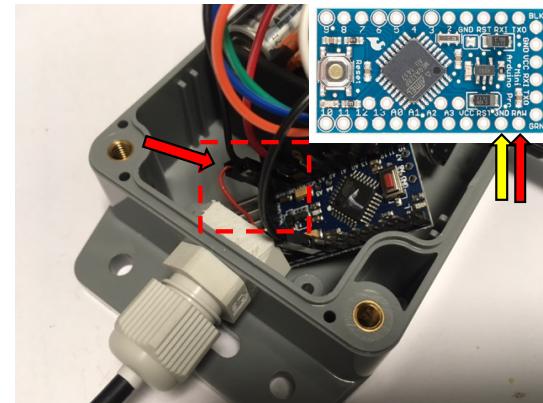
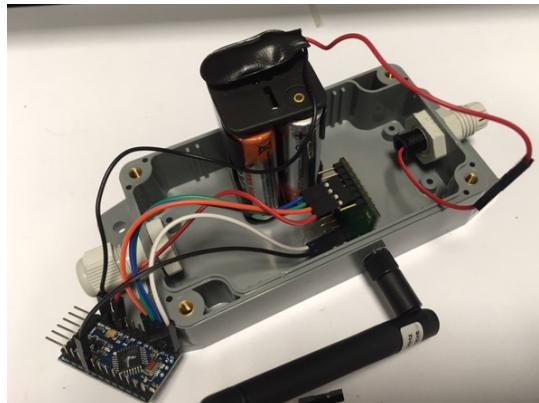


In Africa, the practice of animal husbandry has always been and still remain farmers' livelihood and incomes

Their main problem in this activity remain the cattle rustling and some families are put in dramatic situation after a theft (reported 2 billions CFA losses)



EASY INTEGRATION AND CUSTOMIZATION

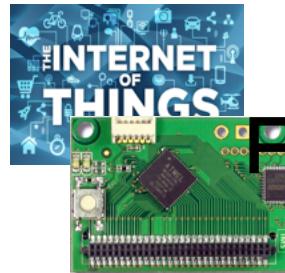


Afimilk collar courtesy of I. Andonovic from University of Strathclyde



Dedicated tutorial on low-cost IoT collar w/GPS

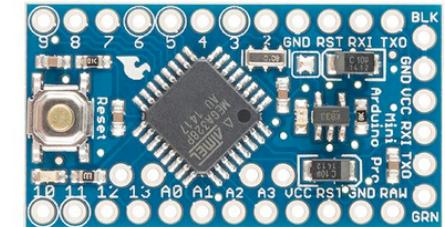
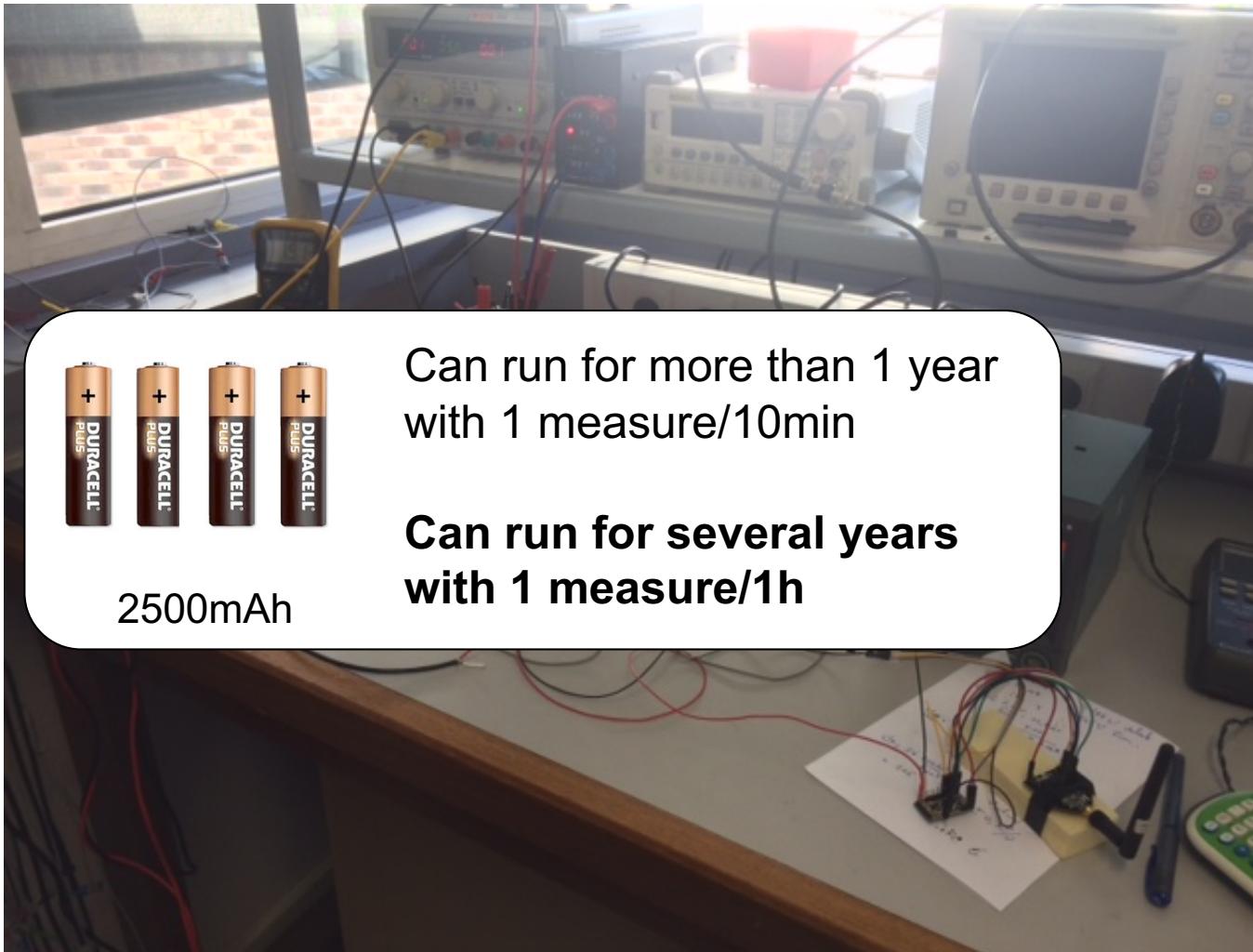
<https://github.com/CongducPham/tutorials/blob/master/Low-cost-LoRa-Collar.pdf>



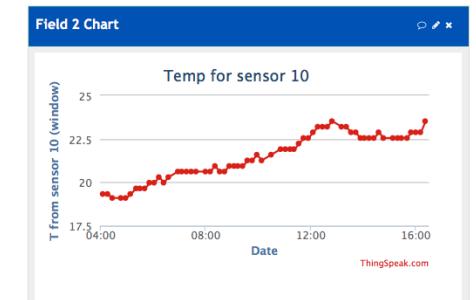
RUNNING FOR SEVERAL YEARS!



Low-Power library from RocketScream

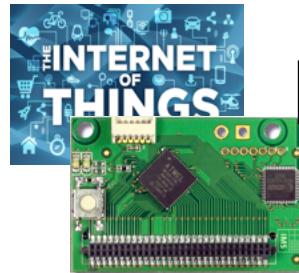


Wakes-up every 10min, take a measure (temp) and send to GW



5µA in deep sleep mode, about 40mA when active and sending!

Thanks to T. Mesplou and P. Plouraboué for their help



RASPBERRY-BASED LOW-COST LORA GATEWAY



We can use all model of Raspberry. The most important usefull feature is the Ethernet interface for easy Internet connection. Then WiFi and Bluetooth can be added with USB dongles. RPI3 provides built-in Ethernet, WiFi and Bluetooth!

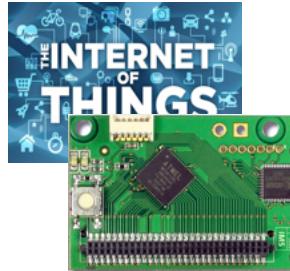


Less than 50€



Get the ready-to-use SD card image

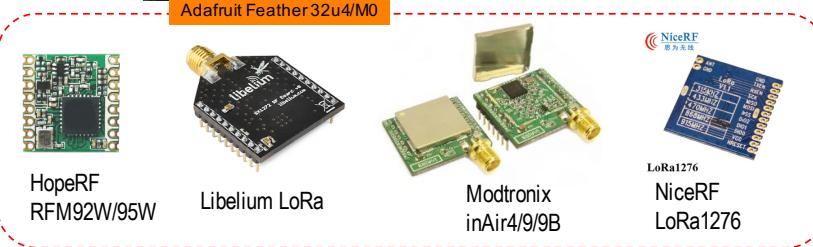
<http://cpham.perso.univ-pau.fr/LORA/WAZIUP/raspberrypi-jessie-WAZIUP-demo.dmg.zip>



SIMPLICITY!



LoRa radios that our library already supports

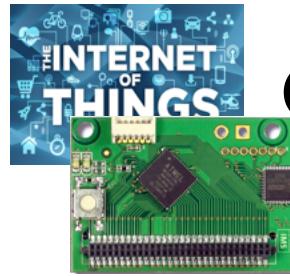


Long-Range communication library

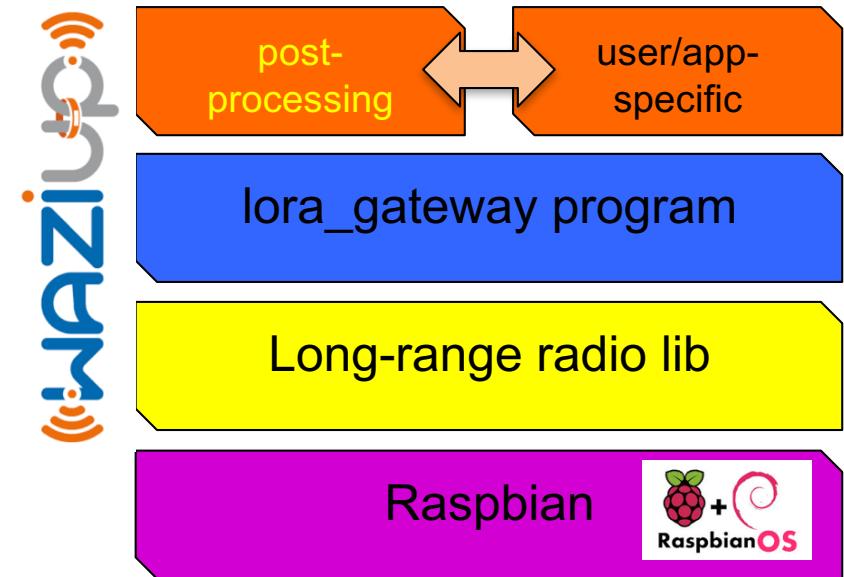
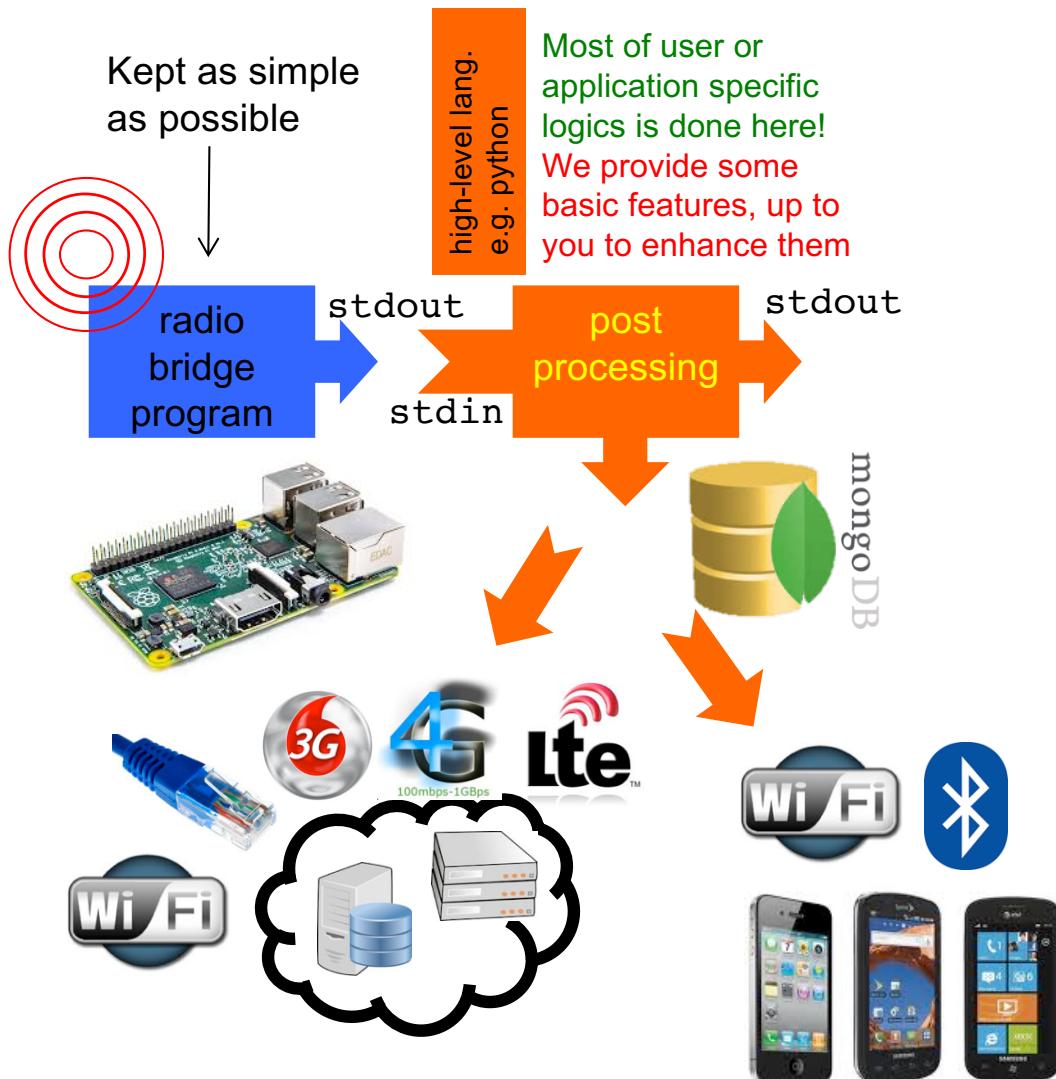
```
sendPacketTimeout("TC/18.5");
// sends to gateway
// TC : temperature celcius
// 18.5 : value
```

1 send function!

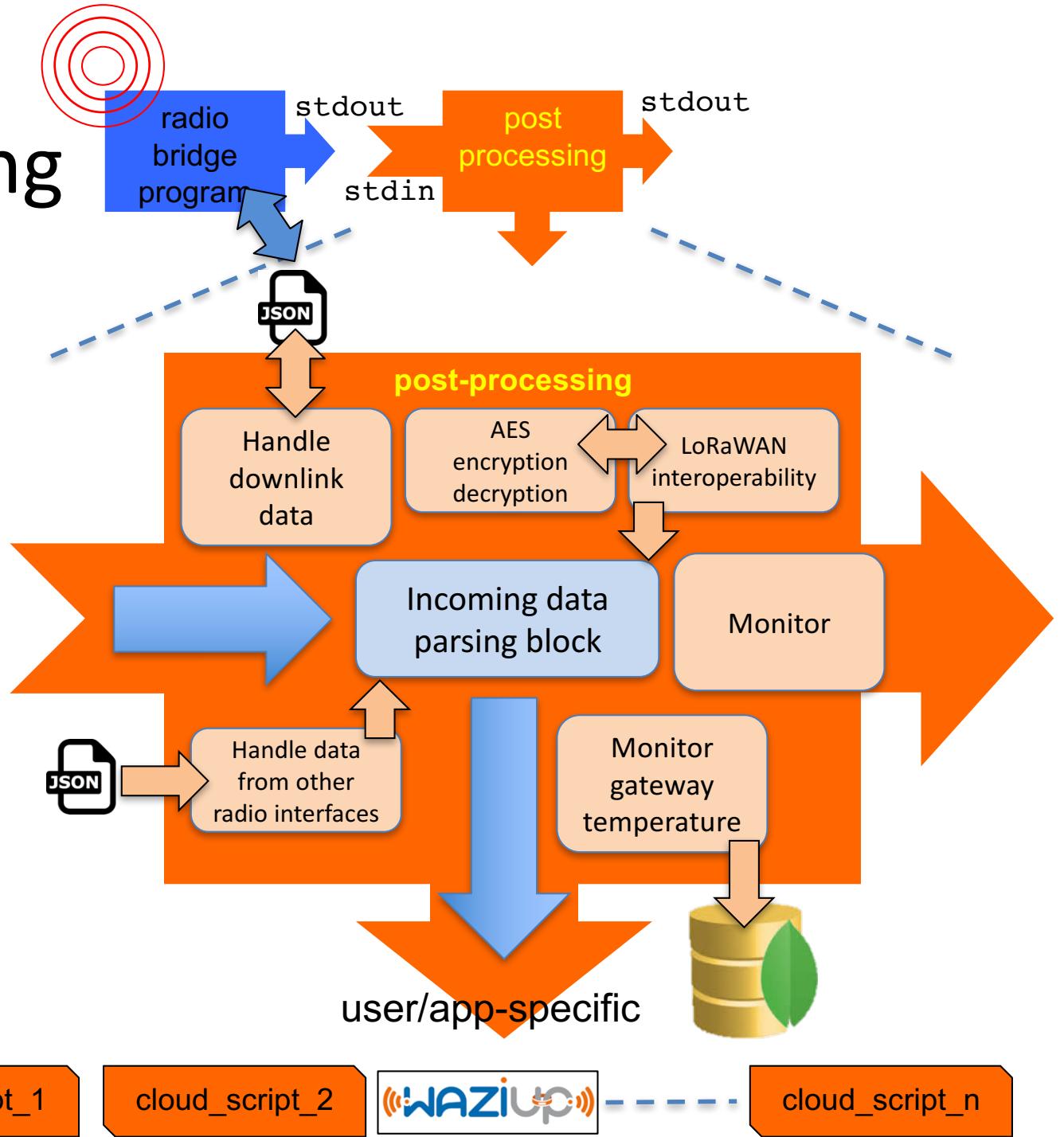




OUR LOW-COST GATEWAY ARCHITECTURE

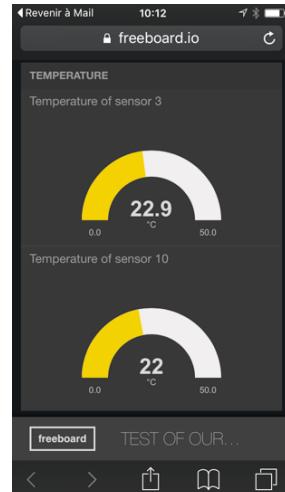


Post-processing stage





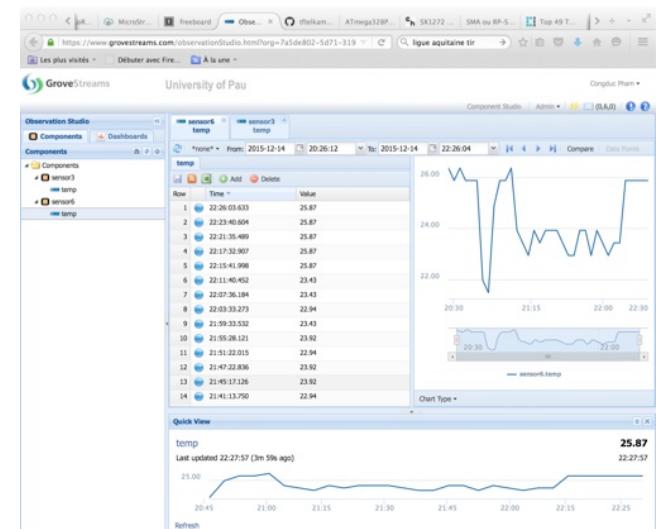
TEMPLATES FOR VARIOUS CLOUDS



Dropbox

Legend
Changed (Yellow square)
Added (Green square)
Deleted (Red square)
Moved (Blue square)

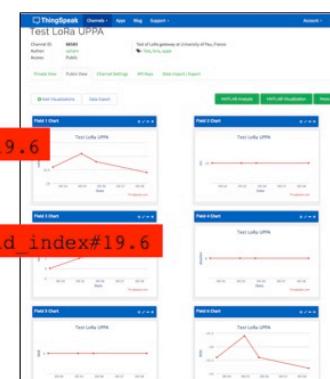
Firebase



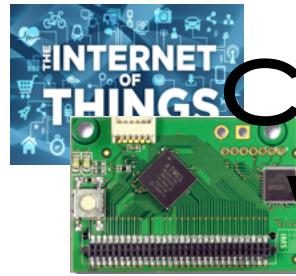
 **GroveStreams**



Node 10
\\!##19.6
\\!write_key#field_index#19.6



 **SensorCloud™**



CONFIGURE YOUR GATEWAY WITH THE WEB INTERFACE

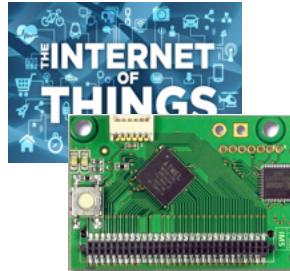


□ <http://192.168.200.1/admin>

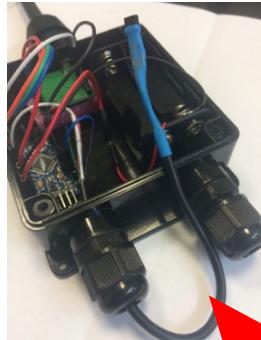
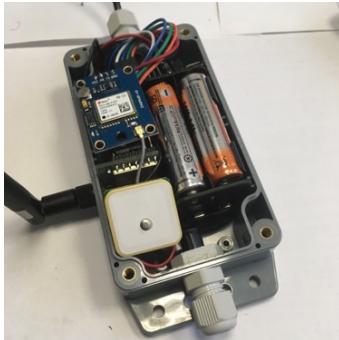
- Login: admin
- Password: loragateway

The screenshot shows a web browser window titled "Admin" with the URL "192.168.200.1/admin/pages/gateway_config.php". The page is titled "Gateway configuration". On the left, there is a sidebar with "Clouds", "Gateway Update", and "System" options. The main content area has tabs for "Radio", "Gateway", "Alert Mail", "Alert SMS", "Downlink Request", and "Get post-processing.log file". Under the "Radio" tab, there are two tables:

Mode	4	
Frequency	-1	



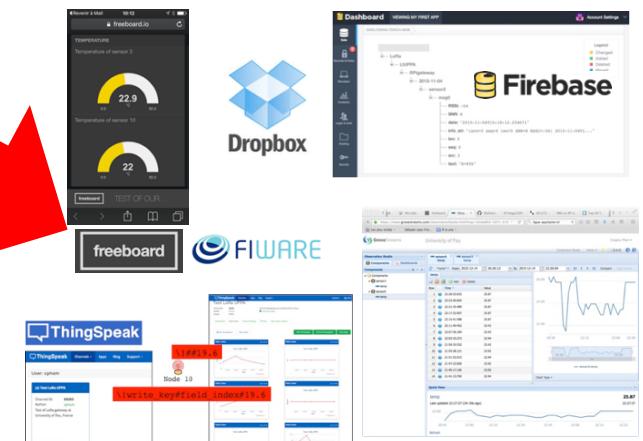
100% DO-IT-YOURSELF !



Step-by-step tutorial
and source code
available



Step-by-step tutorial
and source code
available

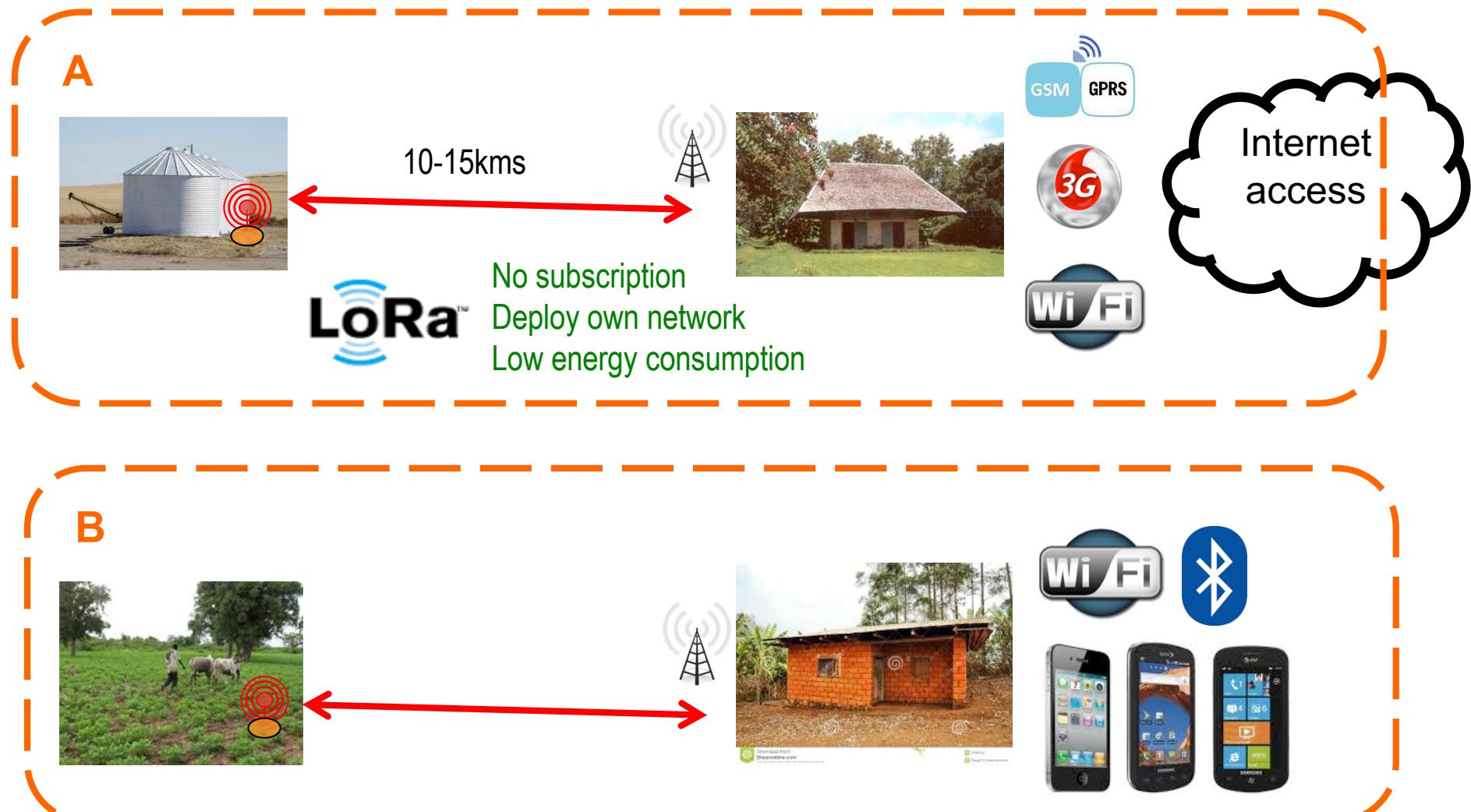


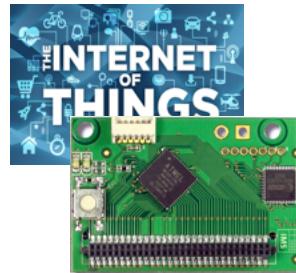
Python scripts
available

<https://github.com/CongducPham/LowCostLoRaGw>

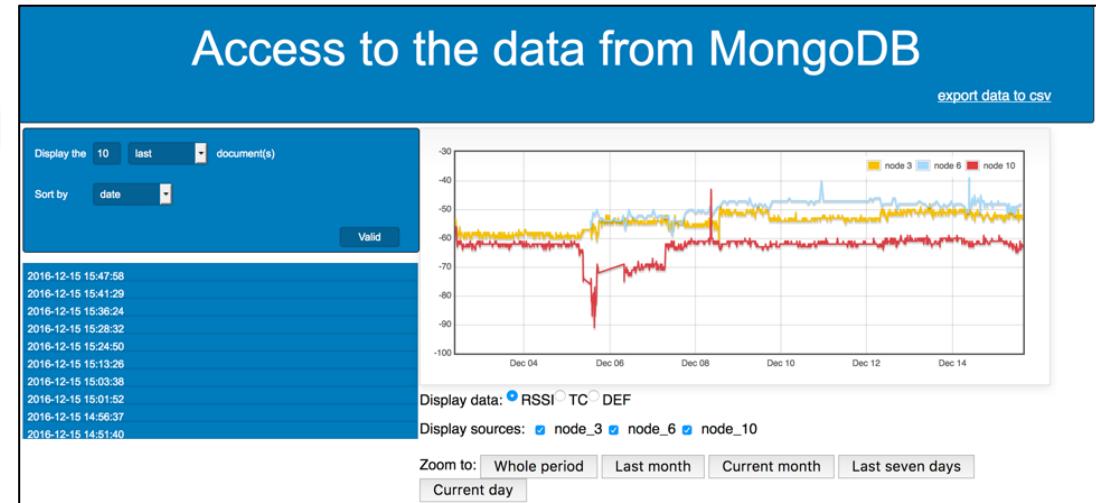
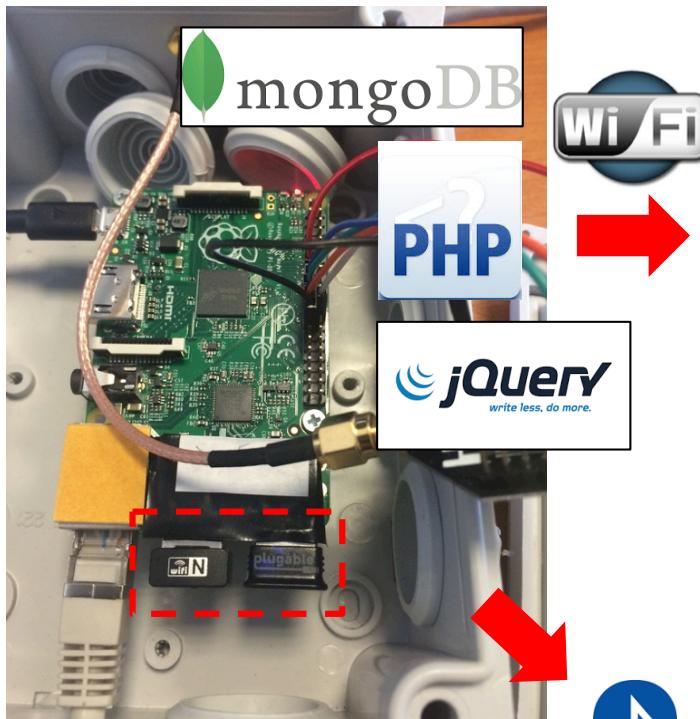


WORKING WITHOUT INTERNET ACCESS





STANDALONE GATEWAY



Isolated areas



Orange F * 10:34

Bluetooth_raspi

NODES PREFERENCES

1 check to retrieve its data

8 check to retrieve its data

DATES PREFERENCES

Pick a begin date Retrieve data since 09-05-2016

Pick an end date Retrieve data until 17-05-2016

DATA LOG

```
NODE: 1 DATE: 2016-05-09 08:04:59.807000 DATA: {"lw": 3.29, "th": 22.6, "hu": 50.7}
NODE: 1 DATE: 2016-05-09 08:28:52.993000 DATA: {"lw": 3.29, "th": 22.89, "hu": 50.29}
NODE: 1 DATE: 2016-05-09 08:53:04.317000 DATA: {"lw": 3.29, "th": 23.2, "hu": 50.79}
NODE: 1 DATE: 2016-05-09 09:05:00.997000 DATA: {"lw": 3.29, "th": 23.29, "hu": 51.29}
NODE: 1 DATE: 2016-05-09 09:17:24.482000 DATA: {"lw": 3.29, "th": 23.39, "hu": 51.7}
NODE: 1 DATE: 2016-05-09 09:41:27.437000 DATA: {"lw": 3.29, "th": 23.6, "hu": 52.0}
NODE: 1 DATE: 2016-05-09 10:05:39.032000 DATA: {"lw": 3.29, "th": 23.79, "hu": 51.5}
NODE: 1 DATE: 2016-05-09 10:17:45.186000 DATA: {"lw": 3.29, "th": 23.79, "hu": 50.79}
NODE: 1 DATE: 2016-05-09 10:29:24.285000 DATA: {"lw": 3.29, "th": 23.79, "hu": 50.79}
NODE: 1 DATE: 2016-05-09 10:53:09.347000 DATA: {"lw": 3.29, "th": 23.79, "hu": 51.9}
NODE: 1 DATE: 2016-05-09 11:17:02.953000 DATA: {"lw": 3.29, "th": 23.5, "hu": 50.79}
NODE: 1 DATE: 2016-05-09 11:52:53.334000 DATA: {"lw": 3.29, "th": 23.29, "hu": 50.7}
NODE: 1 DATE: 2016-05-09 12:04:32.437000 DATA: {"lw": 3.29, "th": 23.5, "hu": 50.29}
NODE: 1 DATE: 2016-05-09 12:16:56.116000 DATA: {"lw": 3.29, "th": 23.6, "hu": 50.9}
```

Display data

Retrieve data in a csv file

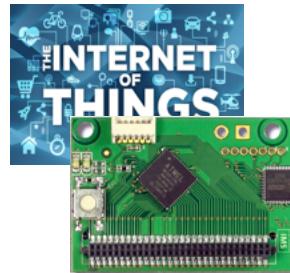
Orange F * 10:37

Bluetooth_raspi

Creating .csv file with the data received... File 17-05-2016_10h39m36s.csv created and saved in the folder /storage/emulated/0/Raspberry_local_data

Display data

Retrieve data in a csv file



NOW,

IoT BECOMES REALITY!

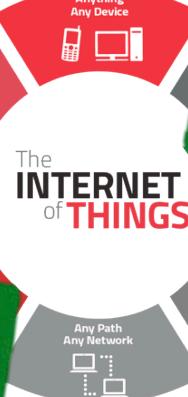


NB-LTE



Bluetooth® 4.0

nwave
LoRa™
NB-IoT
LTE-M
EC-GSM



Firebase
Dropbox

ThingSpeak

SensorCloud™

openRenter

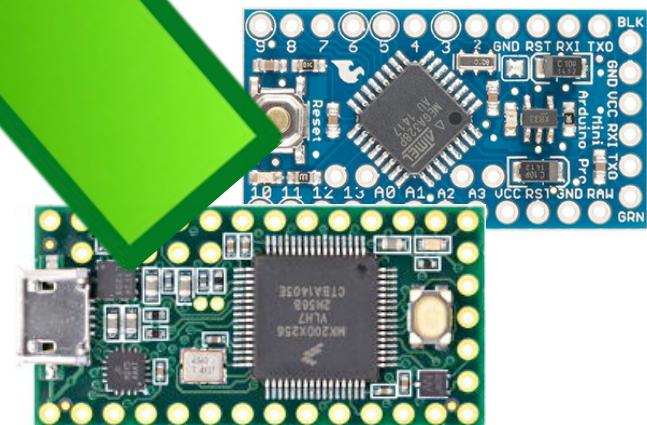
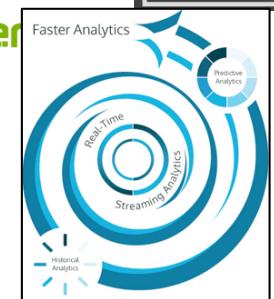
FIWARE

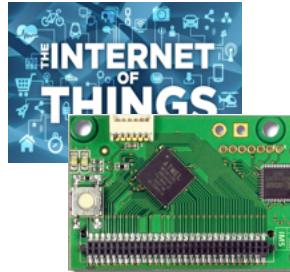
Axēda®

ioBridge®
Connect things.

GroveStreams

freeboard





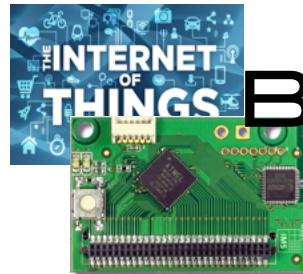
INVOLVING INNOVATION HUBS/STAKEHOLDERS



- **Close to dev & entrepreneurs** communities
- Have their **own community and com channels** (community builders & catalysts)
- Used to organizing disruptive events
- **On the field** (know the targets personally & the market)
- **Used to empowering startups & businesses** (coaching, business dev, incubation, acceleration...)
- Affiliated to **international networks** that could be involved in dissemination or Business dev (Afrilabs)



Credit: C. Vavasseur, CTIC Dakar



BUILDING WAZIUP COMMUNITY AND ECOSYSTEM



International Events
+ 20 organized & attended



Launch event (Senegal, CTIC Dakar)



Launch event (Ghana, iSpace)

Workshop at the European Conference on Networks & Communications (Greece, CNET)



IoTWeek2016 (Belgrade, EGM)



IoTBigData2016 (Italy, EGM)



IoTCareConference (Budapest, CNET)

WAZIUP Workshop on IoT (Togo, L'Africaine d'Architecture)



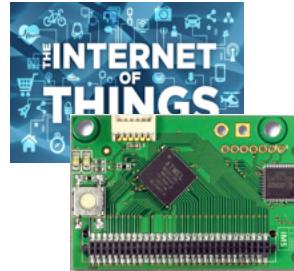
Credit: C. Vavasseur, CTIC Dakar



RESSACS 2016



Workshop at the RESSACS 2016 (France, UPPA) 47



TUTORIALS/RESOURCES



<https://github.com/CongducPham/tutorials>

WAZIUP
EU H2020 grant agreement number 676707
Low-cost LoRa IoT devices and gateway FAQ

1) What is Internet-of-Thing (IoT)?
From IERC (European Research Cluster on the Internet of Thing)
The IERC definition states that IoT is "A dynamic global network infrastructure with self-sensing capabilities based on standard communication protocols where physical and virtual "things" have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the Internet".
From http://www.gartner.com/it/glossary/internet-of-things/
"The Internet of Things (IoT) is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or external environment, and that can be identified and tracked via unique identifiers and able to transfer data over a network without requiring human-to-human or human-to-computer interaction."
From http://internetoffthingsevents.leichtnet.com/definition/internet-of-things-IoT
"The Internet of Things (IoT) is a system of interconnected computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction."

2) What is WAZIUP?
The EU-H2020 WAZIUP project, namely the Open Innovation Platform for IoT-dig Data in Sub-Saharan Africa is a collaborative research project using cutting edge technology applying IoT and Big Data to support the development of the local economy in Sub-Saharan Africa. First, WAZIUP creates by involving farmers and breeders in order to define the platform specifications in a focused validation cases. Second, WAZIUP proposes solutions aiming at long term sustainability. Third, WAZIUP engages the flourishing ICT ecosystem in those countries by fostering new tools and guidelines for the development of interoperable platforms. Fully open source, oriented to radically new paradigms for innovative application/services delivery, WAZIUP is driven by the following vision:
1. Empower the African rural population by enabling them to benefit from the opportunities offered by rapid urbanization and support their agriculture and breeding on a new scale.
Author : Congduc Pham, University of Pau
Last update : 07.09.2016

TUTORIAL ON HARDWARE & SOFTWARE FOR LOW-COST LONG-RANGE IoT



PROF. CONGUDC PHAM
HTTP://WWW.UNIV-PAU.FR-/CPHAM
UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

LOW-COST LoRA IoT DEVICE: A STEP-BY-STEP TUTORIAL



PROF. CONGUDC PHAM
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UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

BUILDING AN IoT DEVICE FOR OUTDOOR USAGE: A STEP-BY-STEP TUTORIAL



PROF. CONGUDC PHAM
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UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

LOW-COST LoRA IoT DEVICE: SUPPORTED PHYSICAL SENSORS



PROF. CONGUDC PHAM
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LOW-COST LoRA GATEWAY: A STEP-BY-STEP TUTORIAL



PROF. CONGUDC PHAM
HTTP://WWW.UNIV-PAU.FR-/CPHAM
UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

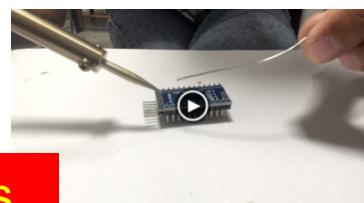
LOW-COST LoRA IoT: USING THE WAZIUP DEMO KIT



PROF. CONGUDC PHAM
HTTP://WWW.UNIV-PAU.FR-/CPHAM
UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

Low-cost IoT device

+43000 views



https://www.youtube.com/watch?v=YsKbJeeav_M

Low-cost IoT gateway



<https://www.youtube.com/watch?v=mj8ltKA14PY>



Thanks.
Let's keep in touch



Carine VAVASSEUR

Communication & Event Manager

Carine.vavasseur@cticdakar.com

www.cticdakar.com
contact@cticdakar.com



facebook.com/waziupIoT



twitter.com/waziupIoT



linkedin.com/groups/8156933



github.com/waziup