

MORE UNDERSTANDING OF THE IOT ECOSYSTEM

**BUNI WAZIHUB BOOTCAMP
DAR-ES-SALAM, TANZANIA**

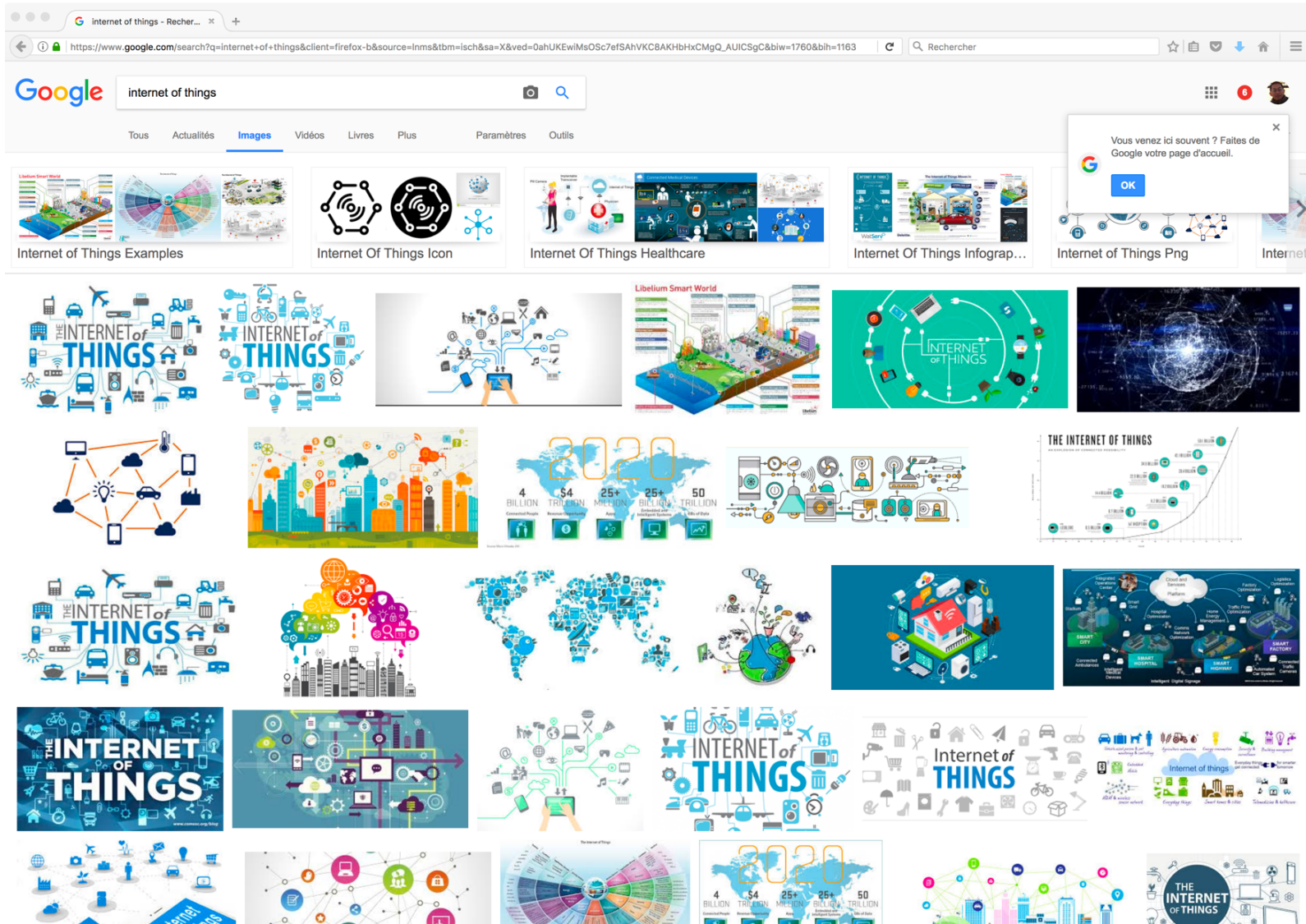
OCTOBER 10 TH, 2018



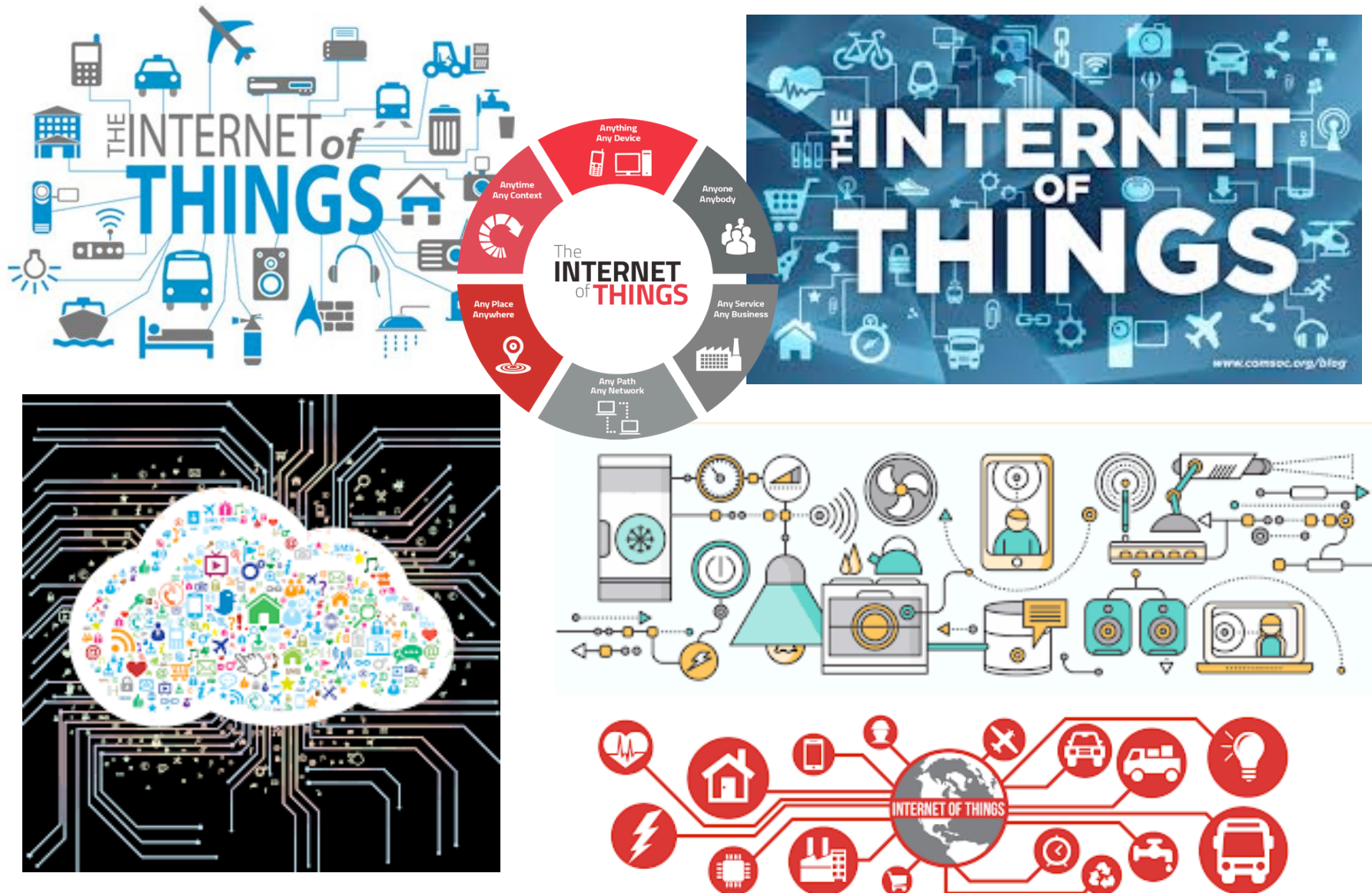
PROF. CONGDUC PHAM
[HTTP://WWW.UNIV-PAU.FR/~CPHAM](http://www.univ-pau.fr/~cpham)
UNIVERSITÉ DE PAU, FRANCE



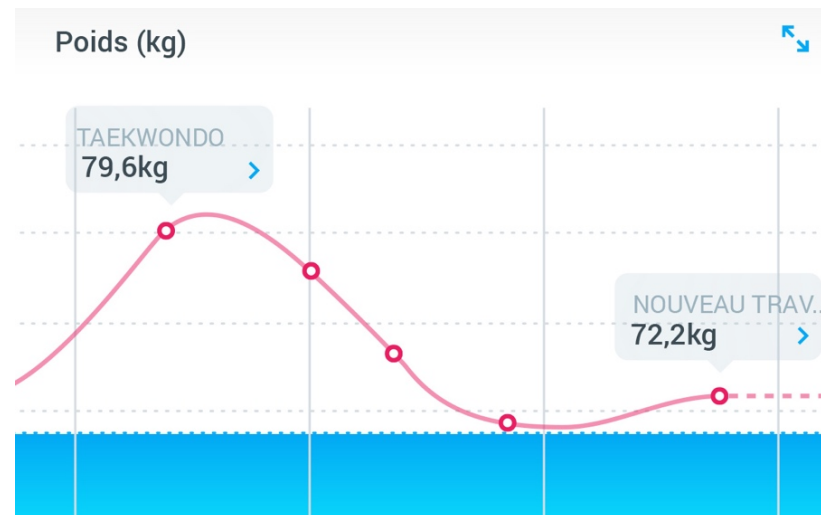
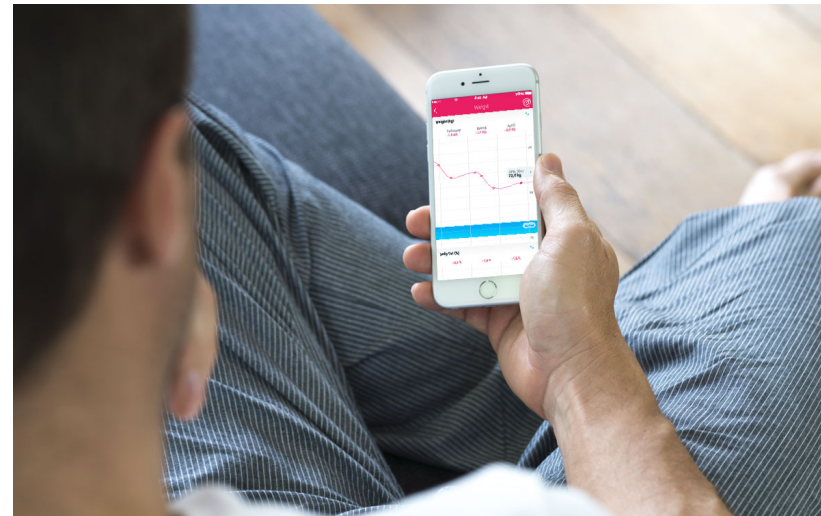
GOOGLING FOR « INTERNET OF THINGS »...



... TYPICALLY SHOWS COMMUNICATING OBJECTS



HOME/CONSUMER IOT PRODUCTS



Pictures from WiThing, <https://www.withings.com/eu/fr/products/body>

IOT FOR DEVELOPMENT



Irrigation



Livestock farming



Fish farming & aquaculture



Storage & logistic



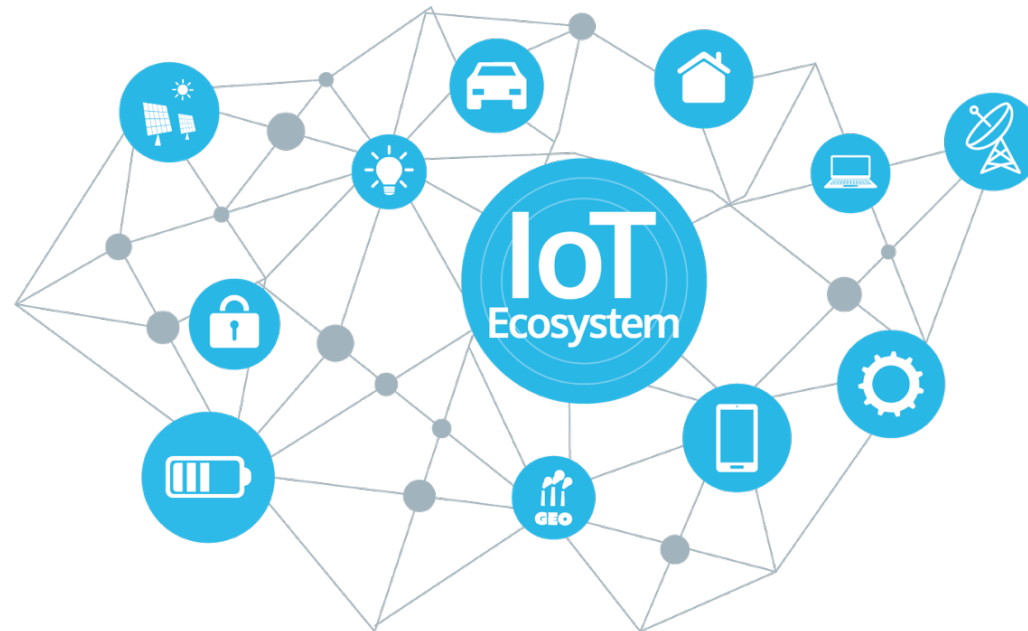
Agriculture



Fresh water



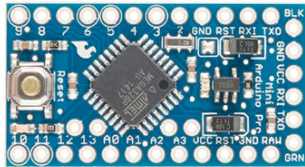
THE IOT ECOSYSTEM



LOW-COST HARDWARE



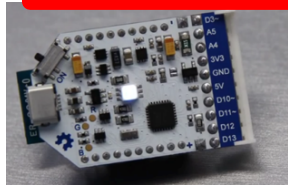
Arduino Pro Mini



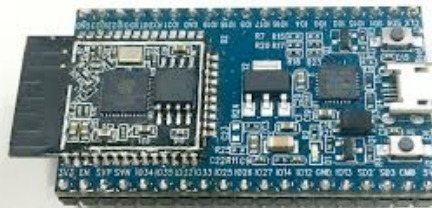
LoPy

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

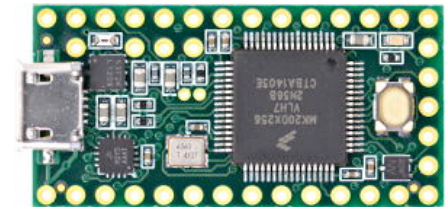
<http://blog.atmel.com/2015/04/09/25-dev-boards-to-help-you-get-started-on-your-next-iot-project/>



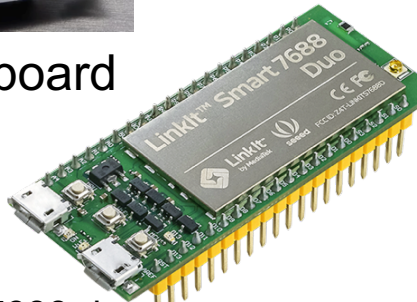
Theairboard



Expressif ESP32

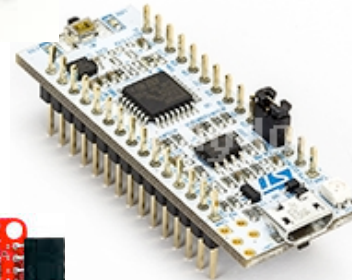


Teensy 3.2



LinkIt Smart7688 duo

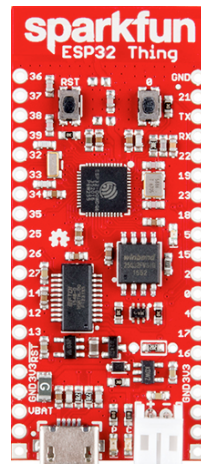
STM32 Nucleo-32



Heltec ESP32 + OLED



Adafruit Feather



Sparkfun ESP32 Thing



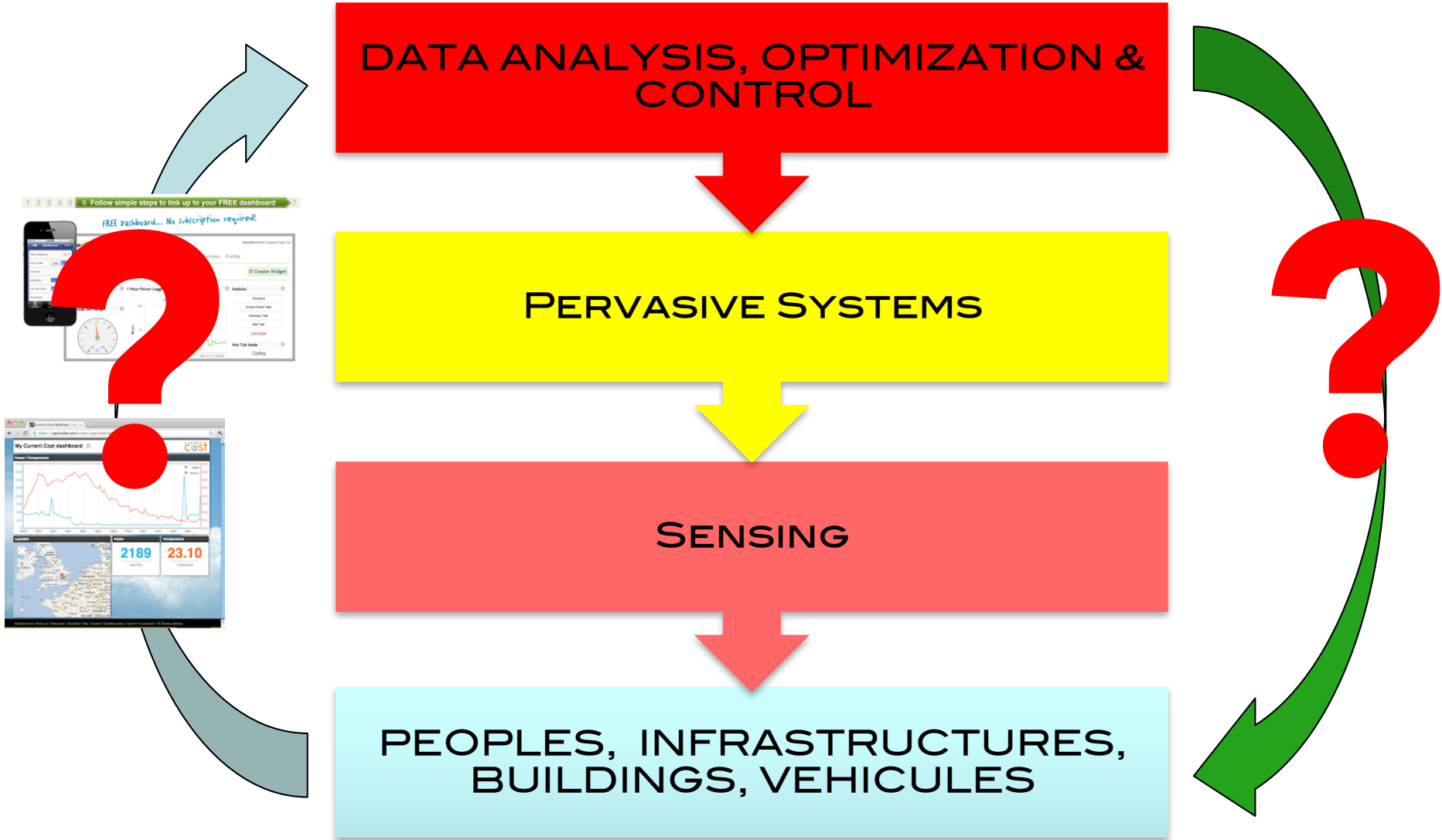
Tessel

SodaqOnev2

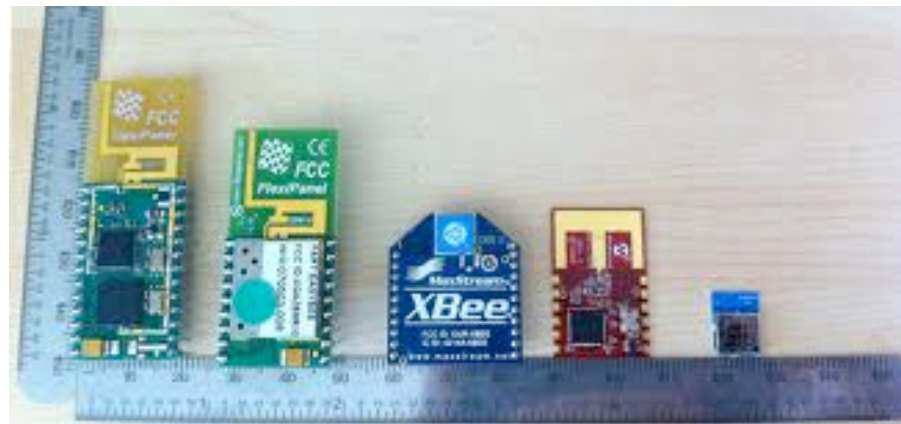


Tinyduino

COLLECT DATA

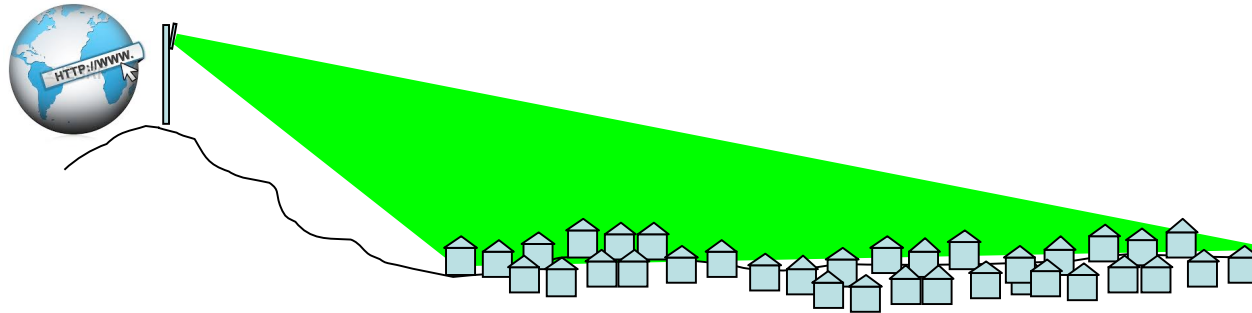


WIRELESS COMMUNICATION MADE EASY



TELEMETRY AND TRANSMISSION COST

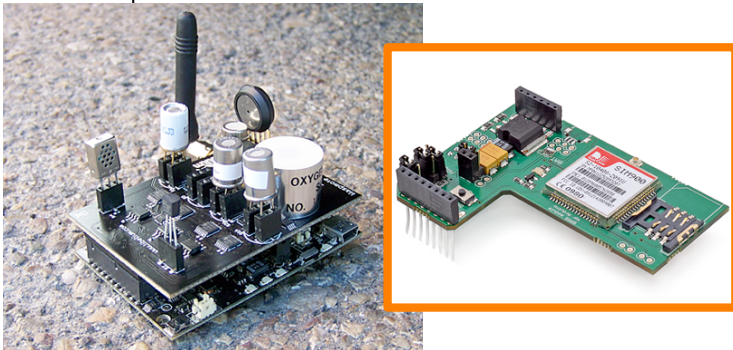
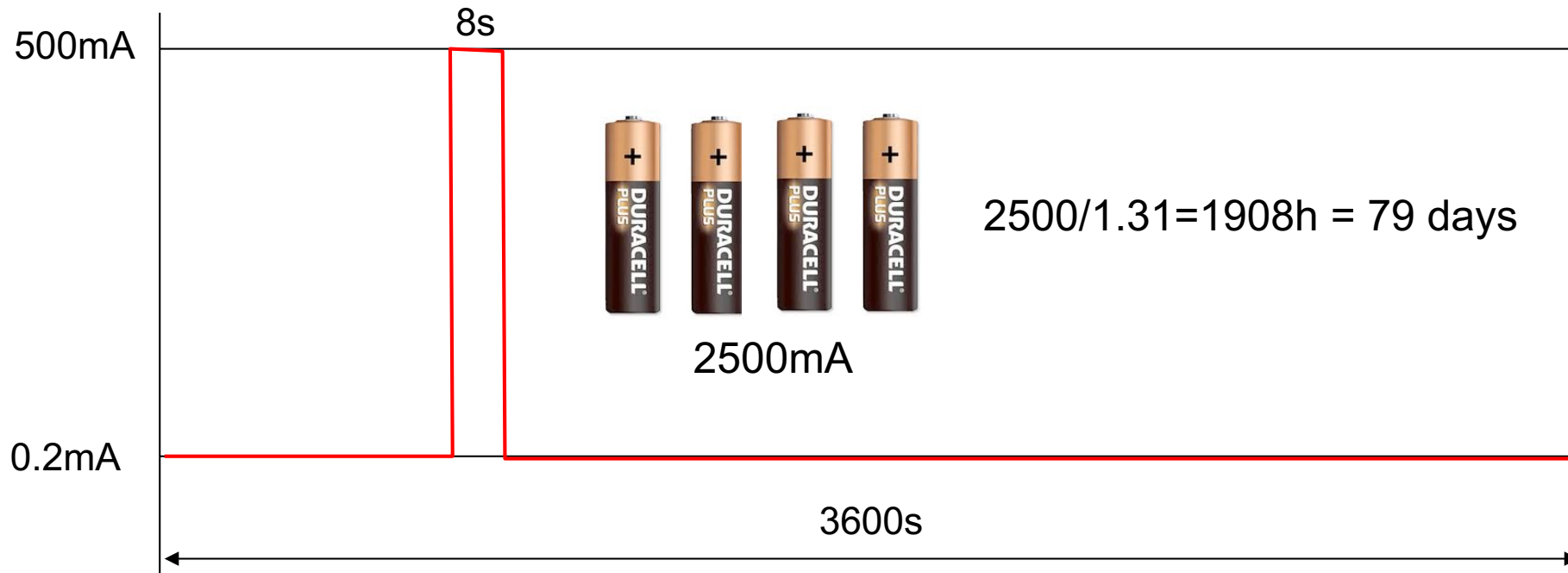
Moisture/
Temperature of
storage areas



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

ENERGY CONSIDERATION

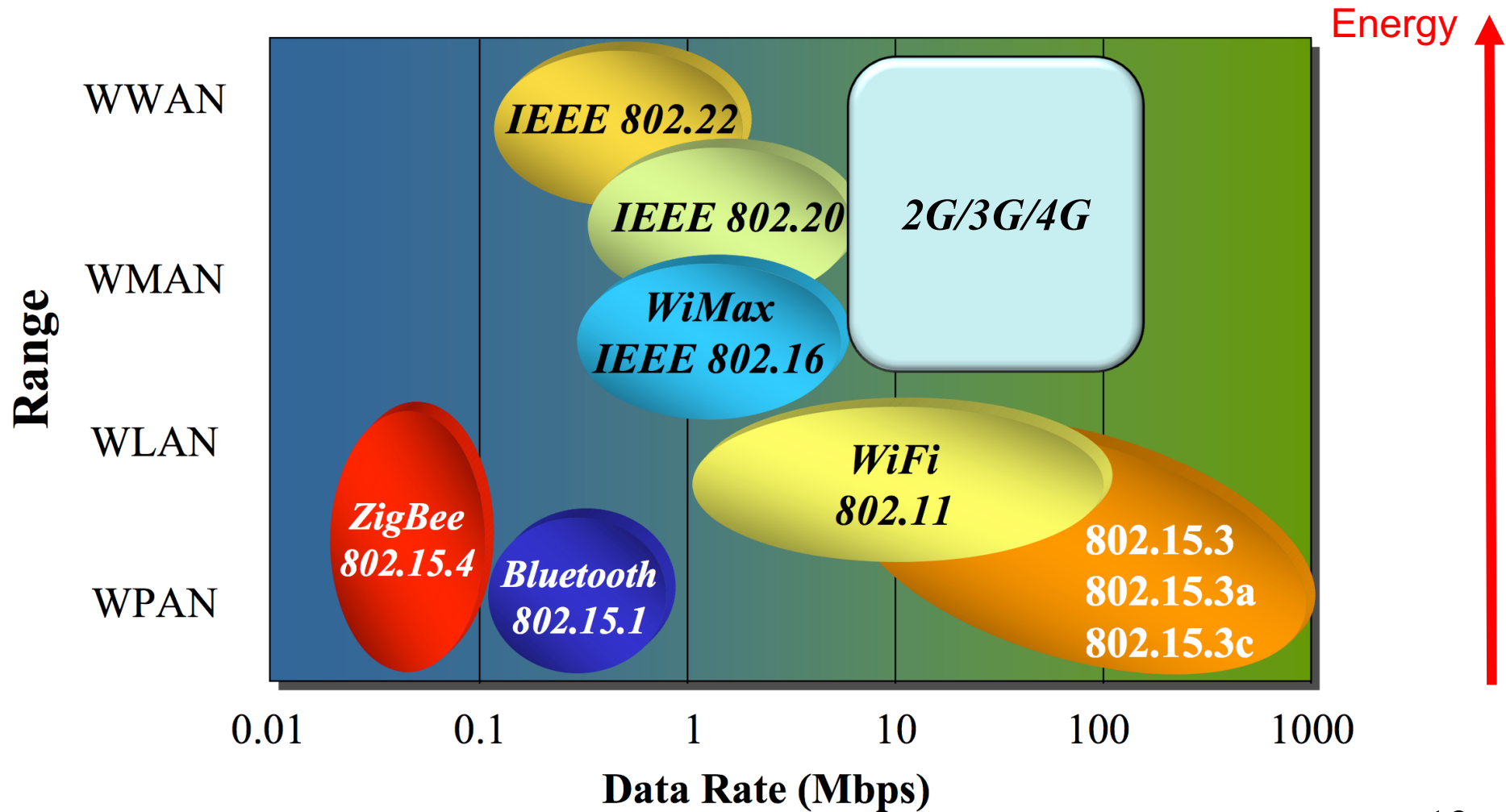
TX power: 500mA. Mean consumption: $(8 \times 500 + 3592 \times 0.2) / 3600 = 1.31 \text{mA}$



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

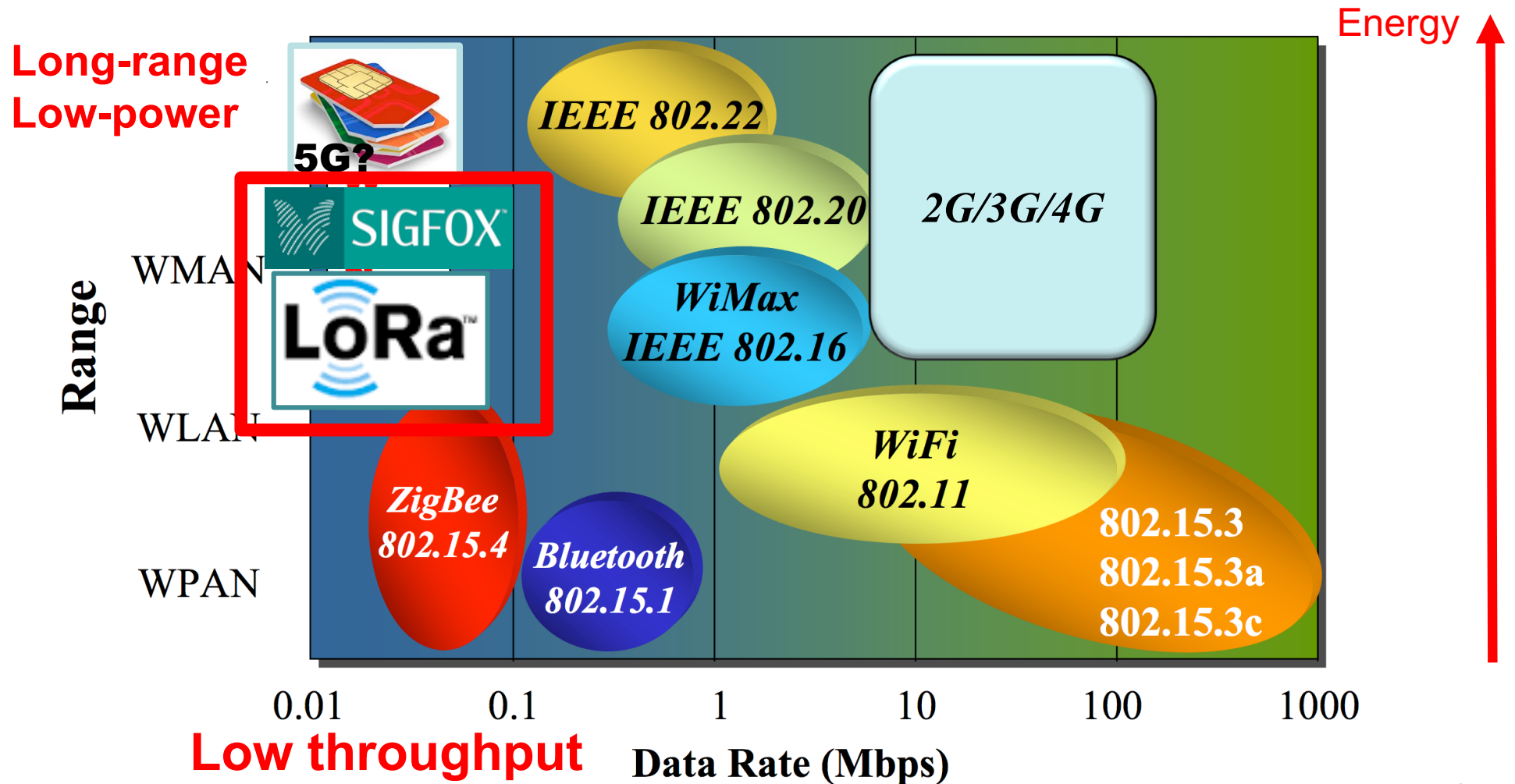
THE WIRELESS SPACE

Energy-Range dilemma



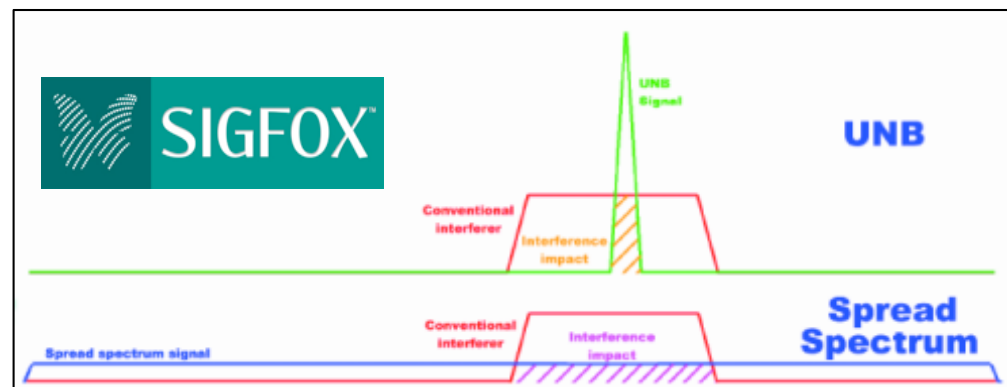
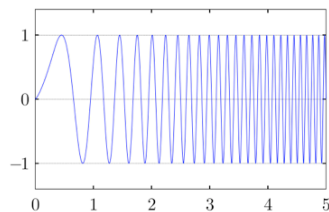
LOW-POWER & LONG-RANGE RADIO TECHNOLOGIES

Energy-Range dilemma

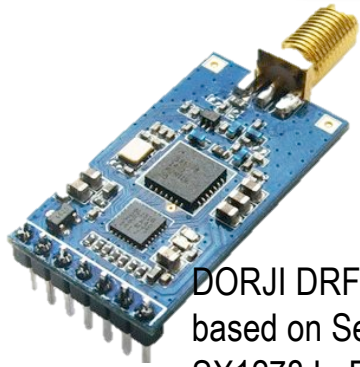


INCREASING RANGE?

- Generally, robustness and sensitivity can be increased when **transmitting much slower**
- A Sigfox message is sent relatively slowly in a very narrow band of spectrum. **Max throughput= $\sim 100\text{bps}$**
- LoRa also increases time-on-air when maximum range is needed. But LoRa uses spread spectrum instead of UNB. **throughput= $\sim 300\text{bps}$ - 37.5kbps**



LoRa Modules from Semtech's SX127x Chips



DORJI DRF1278DM is based on Semtech SX1278 LoRa 433MHz



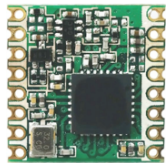
Libelium LoRa is based on Semtech SX1272 LoRa 863-870 MHz for Europe



inAir9 based on SX1276



Froggy Factory LoRa module (Arduino)



HopeRF RFM series



HopeRF HM-TRLR-D



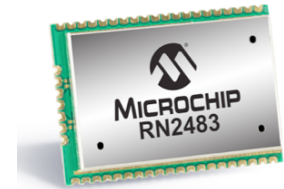
LinkLabs Symphony module



IMST IM880A-L is based on Semtech SX1272 LoRa 863-870 MHz for Europe



Embit LoRa



LoRa™ Long-Range Sub-GHz Module (Part # RN2483)

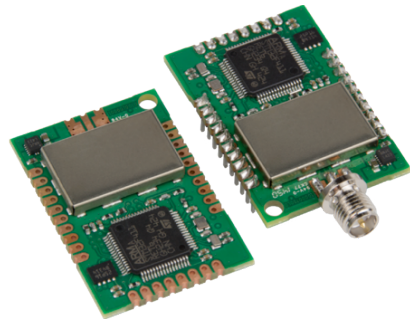


habSupplies



Adeunis ARF8030AA- Lo868

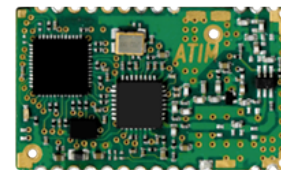
Microship RN2483



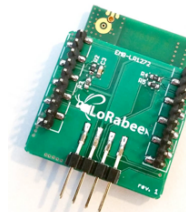
Multi-Tech MultiConnect mDot



AMIHO AM093



ARM-Nano N8 LoRa module from ATIM



SODAQ LoRaBee Embit



SODAQ LoRaBee RN2483

ENERGY CONSUMPTION COMPARAISON

Tables from Semtech

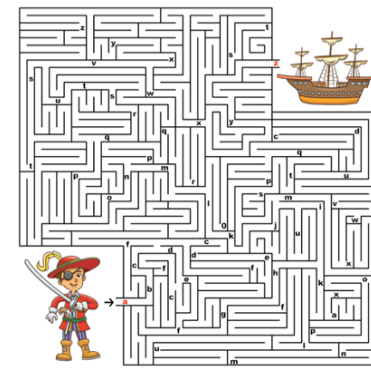
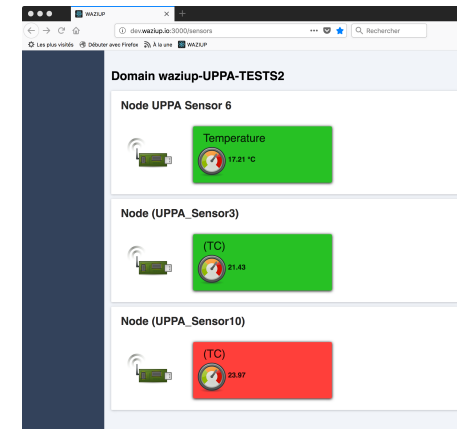
Technology	2G	3G	LAN	ZigBee	Lo Power WAN
Range (I=Indoor, O=Outdoor)	N/A	N/A	O: 300m I: 30m	O: 90m I: 30m	Same as 2G/3G
Tx current consumption	200-500mA	500-1000mA	100-300mA	18mA	18mA-40mA
Standby current	2.3mA	3.5mA	NC	0.003mA	0.001mA
Energy harvesting (solar, other)	No	No	No	Possible	Possible
Battery 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)

TX power: 30mA. Mean consumption: $(8 \times 30 + 3592 \times 0.2) / 3600 = 0.266 \text{mA}$

$2500 / 0.266 = 9398 \text{h} = 391 \text{ days} = 13 \text{ months}$

FINDING THE INFORMATION YOU NEED

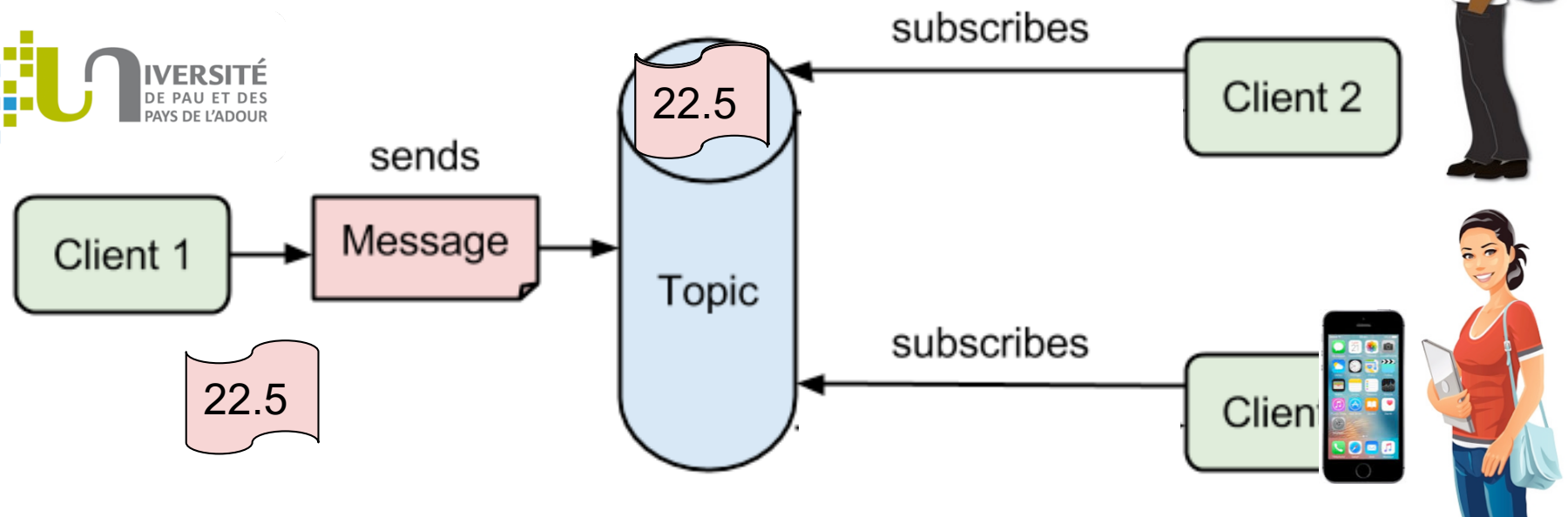
- ❑ Searching for information is a tough issue
 - ❑ Web search engine: Google,...
- ❑ Many IoT clouds uses HTTP request (GET, POST, PUT, ...) to push/store data to web platforms/servers
- ❑ If you need an information, for instance **the temperature in BuniHub**, then you have to go to the right web page
- ❑ When there can be millions of IoT nodes providing large variety of data, it is difficult to find your way!



FROM "SEARCH FOR INFO" TO "GET THE INFO"

- Use the PUBLISH/SUBSCRIBE model

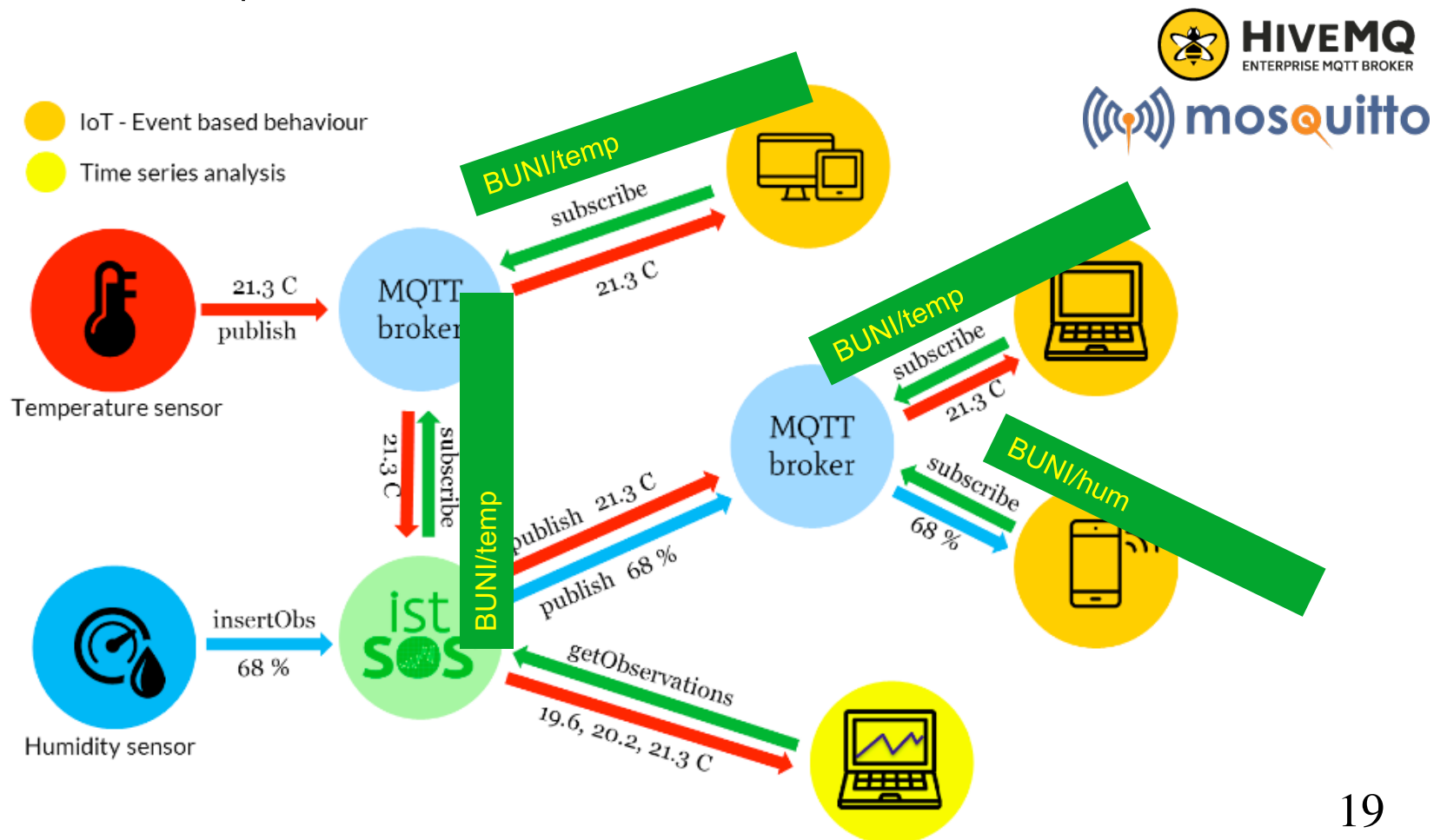
Temperature in BuniHub



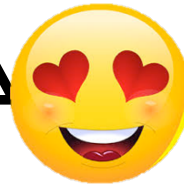
MQTT

MESSAGE QUEUE TELEMETRY TRANSPORT

- Use broker nodes to manage topics
 - BUNI/temp, BUNI/hum



MQTT+SMARTPHONE=



Editors' Choice



Maxime Carrier

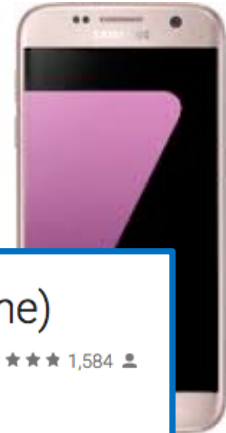
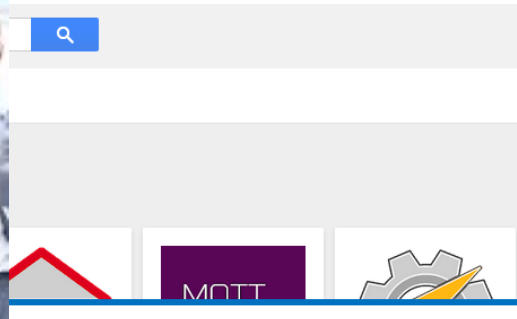
Instant solutions

Thian

★★★★★

★★★★★

★★



MQTT Dash (IoT, Smart Home)

Routix software Communication

★★★★★ 1,584

PEGI 3

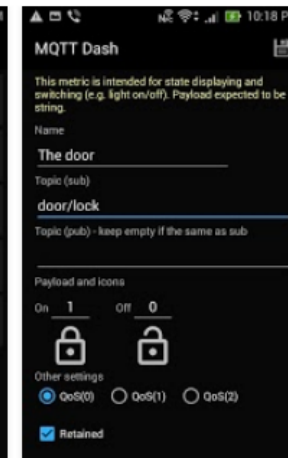
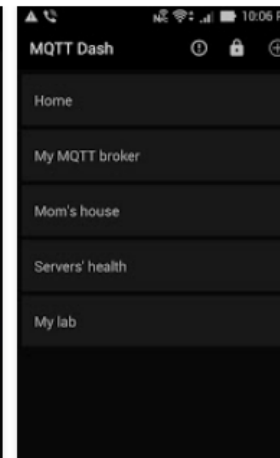
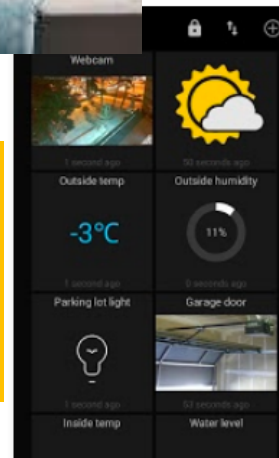
This app is compatible with all of your devices.

Installed

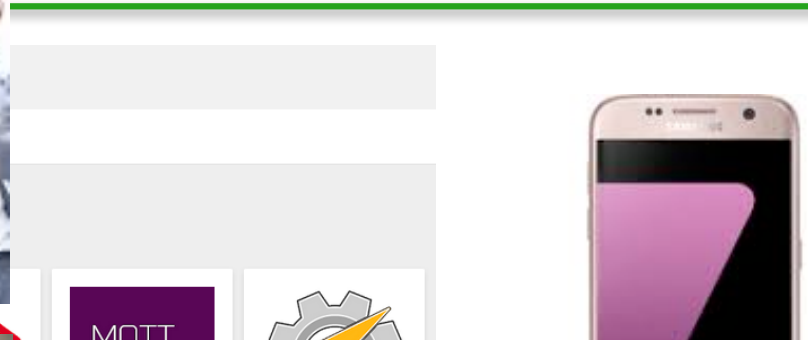
☐ Towards open data

☐ TZ/DS/BUNI/#

☐ TZ/DSCITY/WEATHER/#



MQTT+SMARTPHONE=



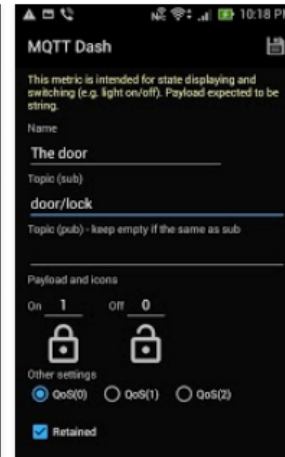
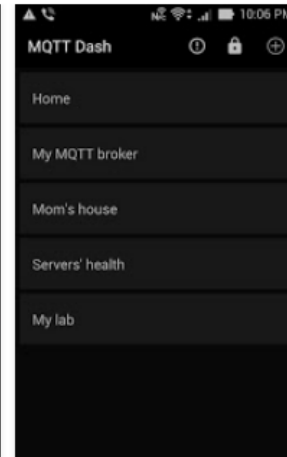
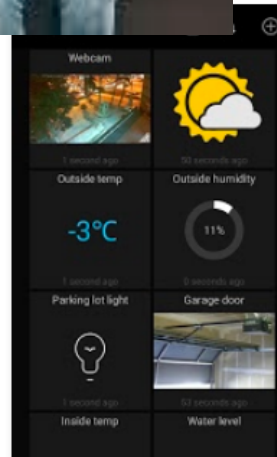
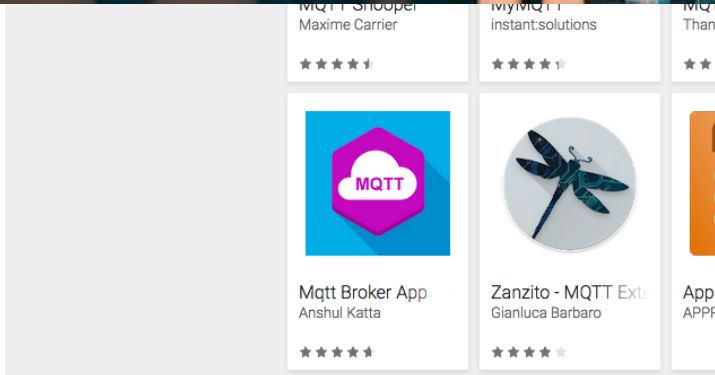
MQTT Dash (IoT, Smart Home)

Routix software Communication ★★★★★ 1,584

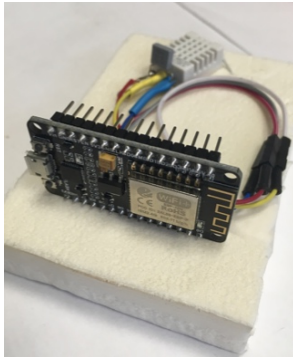
PEGI 3

This app is compatible with all of your devices.

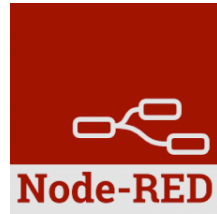
Installed



MAKE IT SIMPLER?

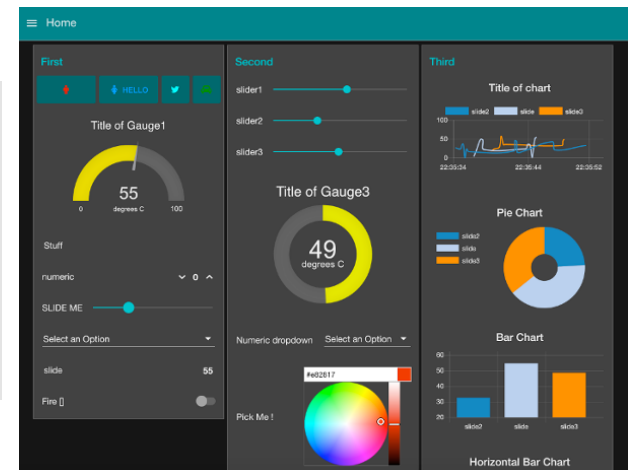
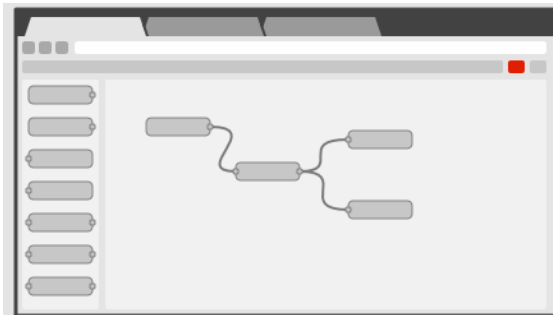


- ❑ End-users are not necessarily computer science experts nor high-skilled programmers
- ❑ Use graphical tools to build data processing flows, allowing intuitive connection from data producers to data consumers



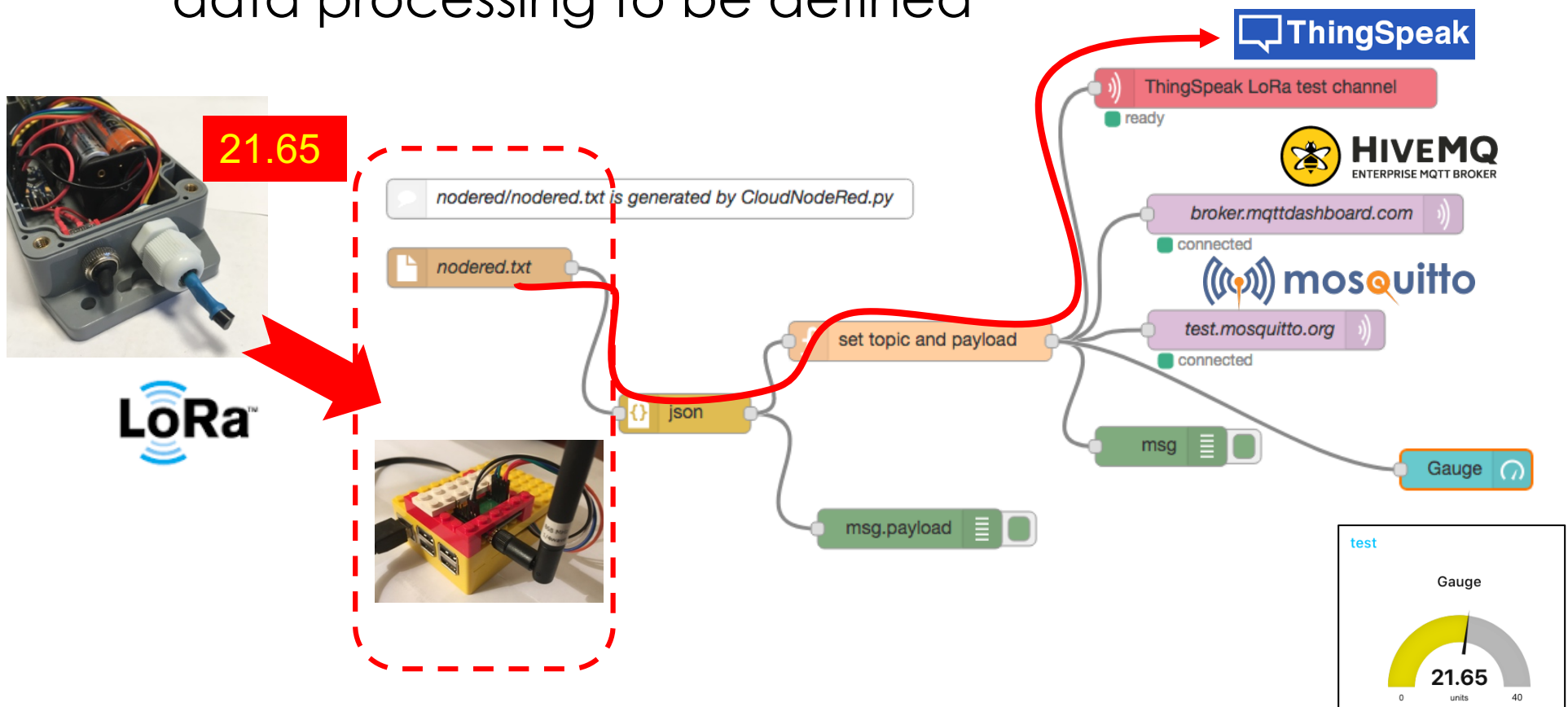
NODE-RED

- ❑ Node-RED is a programming tool for wiring together hardware devices, APIs and online services, e.g. clouds of various types
- ❑ provides a browser-based flow editor to wire together flows with a wide range of nodes



NODE-RED ENABLED IOT GATEWAY

- Messages received on the IoT gateway can be injected into a Node-Red flow, allowing complex data processing to be defined



DEMO TIME

WAZIhub

WAZIup