



Zolertia introduction

Antonio Liñán Colina

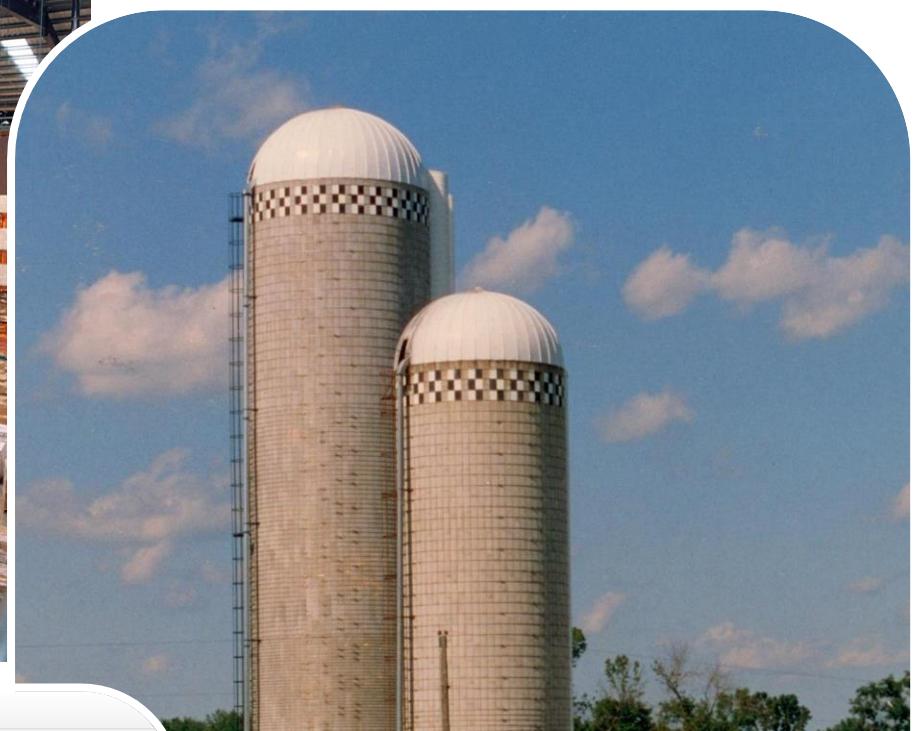
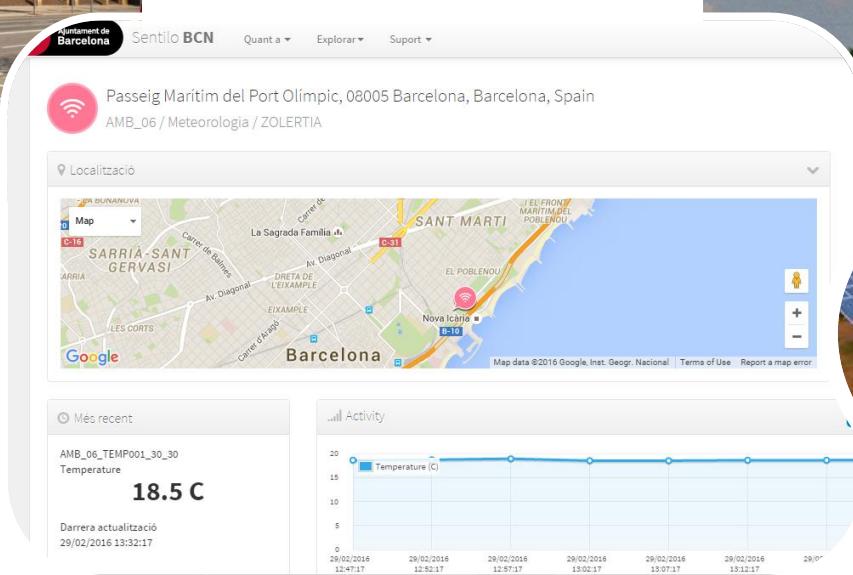
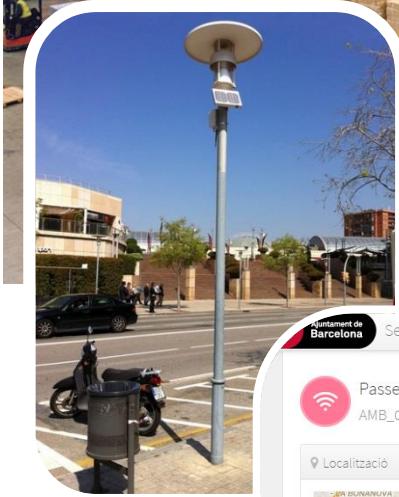


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Electronic Engineer
MsC Computer Science (WSN)
Firmware developer, R+D
Maker + Warranty voider



Featured

DIY amateur Weather Station over 6LoWPAN/IPv6
Project tutorial by Antonio Lignan

1,099 VIEWS

Featured

An IPv6/6LoWPAN Wireless IFTTT Button
Project tutorial by Antonio Lignan

0 COMMENTS 6 RESPECTS

Featured

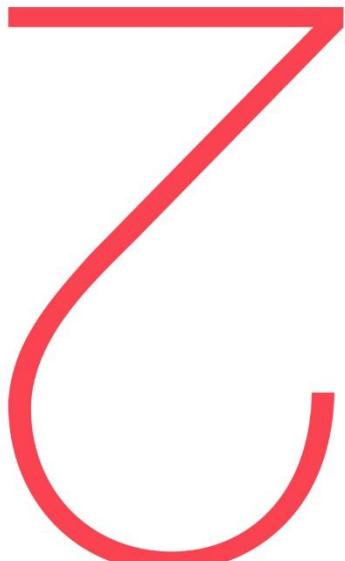
Zolertia IPv6/6LoWPAN Ubiquiti client
Project tutorial by Antonio Lignan and AgustinP

2,111 VIEWS 19 COMMENTS

Featured

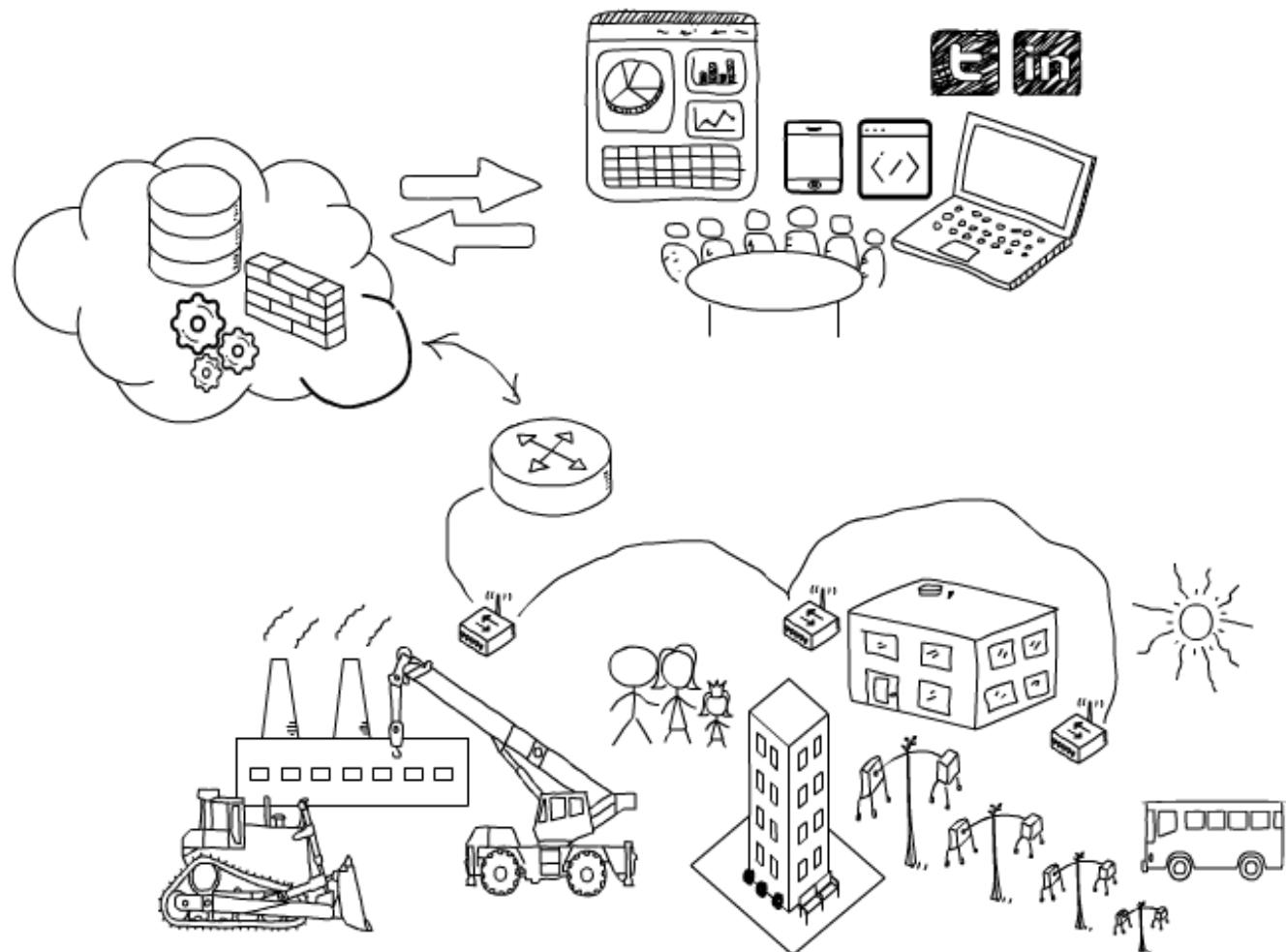
Potato-powered IoT
Project tutorial by 4 developers

1,351 VIEWS 1 COMMENT 20 RESPECTS



zolertia

A connected world



By researchers...

IP Protocol Stack

HTTP		RTP
TCP	UDP	ICMP
IP		
Ethernet MAC		
Ethernet PHY		

6LoWPAN Protocol Stack

Application		Application protocols	
Transport	UDP	ICMP	
Network			
IPv6			
LoWPAN			
IEEE 802.15.4 MAC			
Physical			

Contiki Network Simulator

Broadcast - Cooja: The Contiki Network Simulator

Network View Zoom Simulation control Notes

Time: 00:17.413 Speed: 28.86% Enter notes here

Mote output

File Edit View Time Mote Message

00:17.057 ID:4 At port 1234 from port 1234 with length 4
ID:4 Data Rx: Test

184 ID:2 Data received from fe80::c30c:0:0:a
190 ID:2 Sending broadcast to > fff0::1
197 ID:5 At port 1234 from port 1234 with length 4
199 ID:2 Data Rx: Test

216 ID:6 Sending broadcast to > fff0::1

Models Simulator for Wireless Sensor Networks

Legend: Client (Yellow), Benevolent (Green), Malicious (Red), Relay (Blue)

WSN: 15 Servers: 5 New Servers: 70 Range: 12

Max Num Sensors: 100 Delay: 0

Show IDs: Show links: Show ranges: Show grid:

Collision: Oscillating WSNs: Dynamic WSNs:

Trust & Reputation Model: BTRM_WSN, RTRM_WSN, OpenTrust, PeerTrust, PowerTrust, LTMM, TRIP, TemplateTRM

Outcomes: Accuracy, Path Length, Energy Consumption

Accuracy: Current: 89.83 % Average: 87.47 %

Messages: Starting simulations at Mon Mar 05 13:48:25 CET 2012...
Running BTRM_WSN over WSN 10...
Running BTRM_WSN over WSN 9...
Running BTRM_WSN over WSN 8...
Running BTRM_WSN over WSN 7...
Running BTRM_WSN over WSN 6...
Running BTRM_WSN over WSN 5...
Running BTRM_WSN over WSN 4...
Running BTRM_WSN over WSN 3...
Running BTRM_WSN over WSN 2...
Running BTRM_WSN over WSN 1...
Starting simulations at Mon Mar 05 13:48:25 CET 2012...

Neighbors

```
fe80::c30c:0:0:12e5
fe80::c30c:0:0:12e1
fe80::c30c:0:0:12d4
fe80::c30c:0:0:12c7
fe80::c30c:0:0:12c4
```

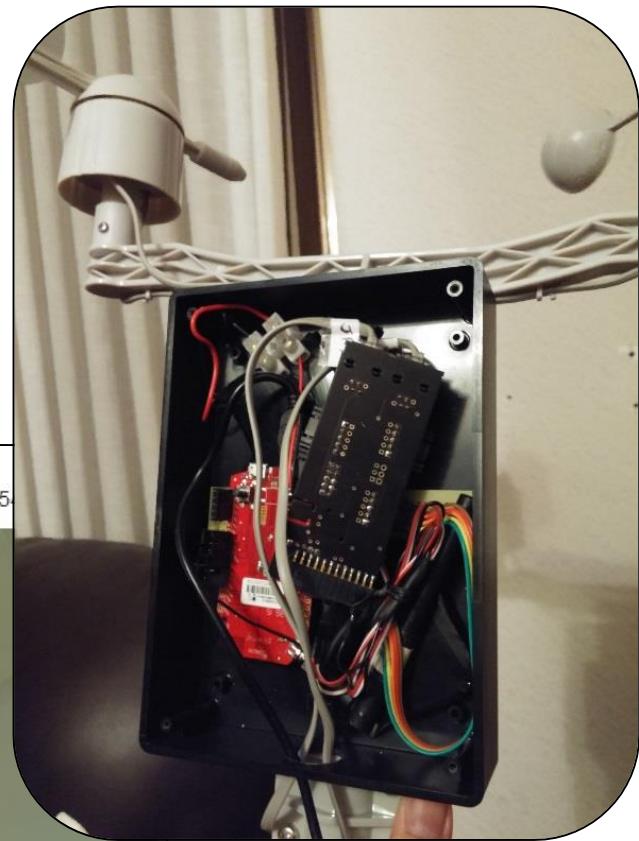
Routes

```
aaaa::c30c:0:0:12e1/128 (via fe80::c30c:0:0:12e1) 16711413s
aaaa::c30c:0:0:12c7/128 (via fe80::c30c:0:0:12c7) 16711413s
aaaa::c30c:0:0:12e5/128 (via fe80::c30c:0:0:12c7) 16711397s
aaaa::c30c:0:0:12d4/128 (via fe80::c30c:0:0:12d4) 16711414s
aaaa::c30c:0:0:12c4/128 (via fe80::c30c:0:0:12c7) 16711411s
```

Makers and hobbyists...



A screenshot of a Twitter post from Aldo de Jong (@aldod). The post includes a small image of an Arduino board and the text: "Zolertia Live! @zolertia_test · 3h Someone got coins! #IoTmeetupBCN ow.ly/JAzja 2015/02/27 08:5". Below the text is a video thumbnail showing a person smiling, and at the bottom is a yellow cube-shaped object.



Integrators and companies...



Wireless industrial monitoring in P+V plants, cable replacement



Tracking and Smart
transportation



Indoor comfort and domotics



Wireless and portable healthcare devices (ECG, pulse-oximeter, etc)



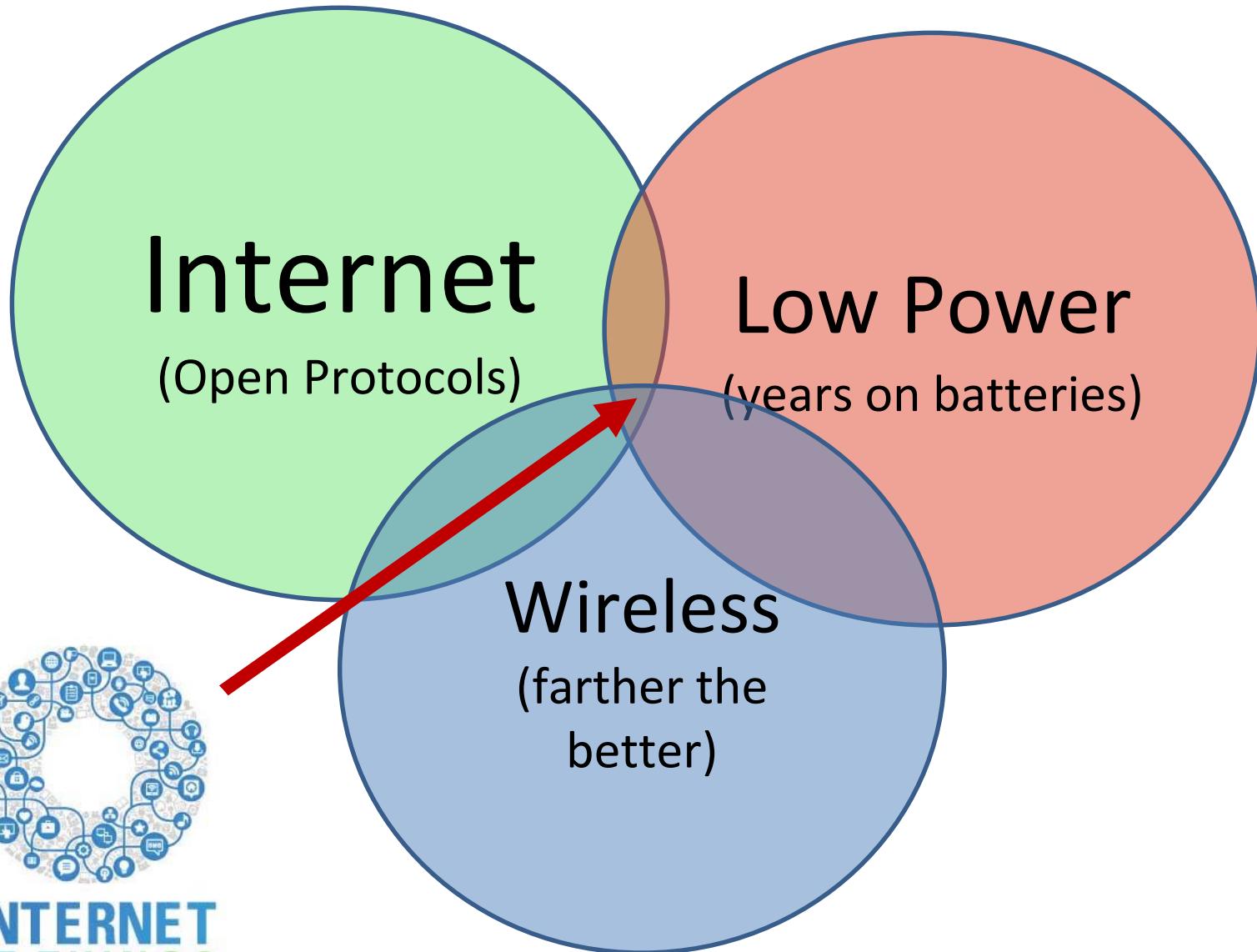
Smart City apps: air quality and noise monitoring

And consumer/commercial products

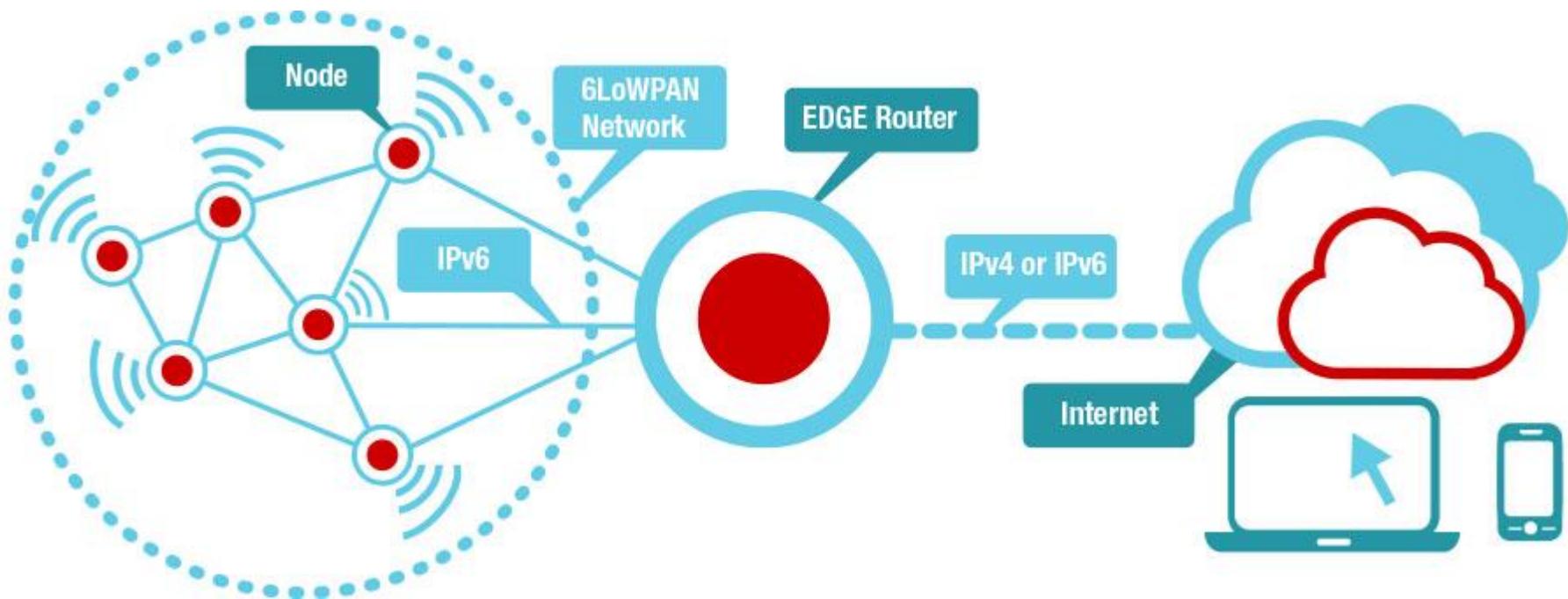


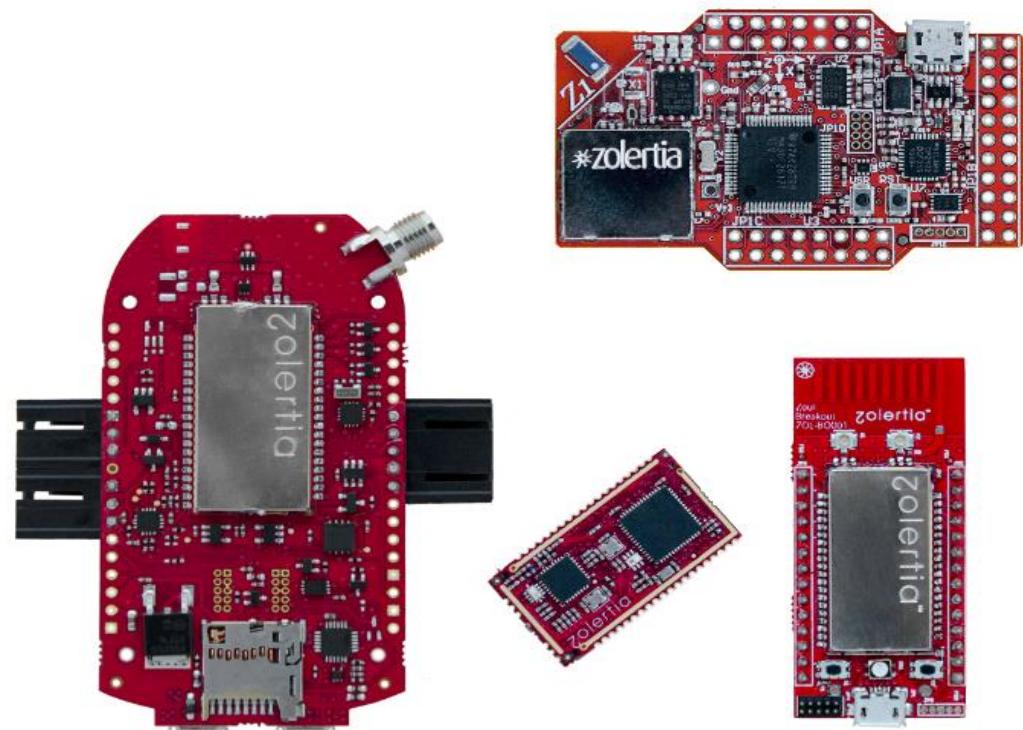
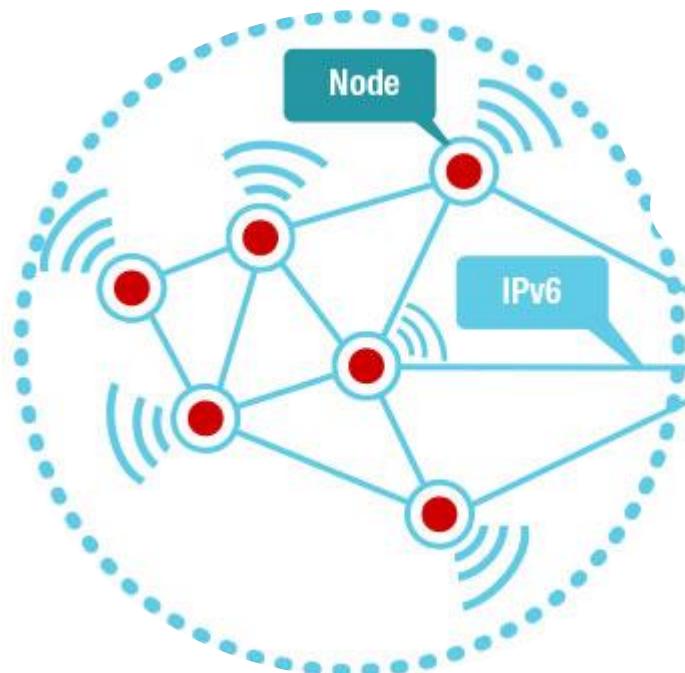
Connect anything to anyone



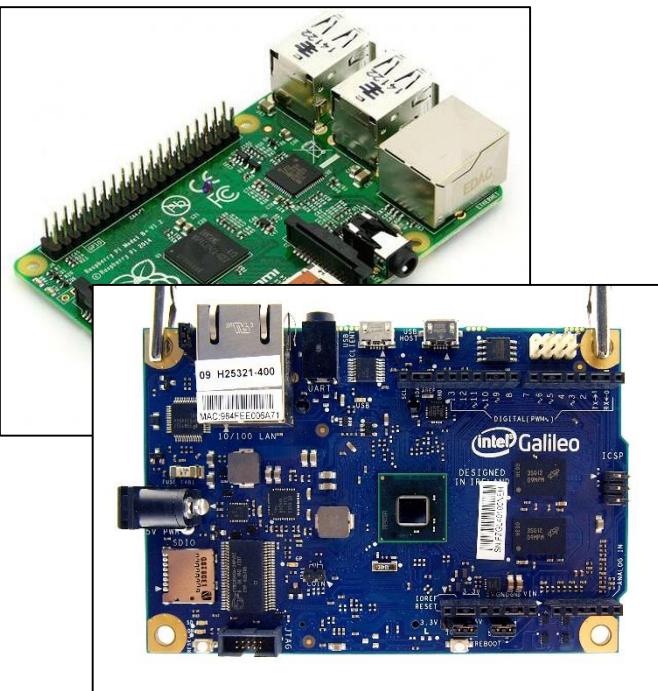


Wireless Sensor Networks (devices) → Internet of Things (people)



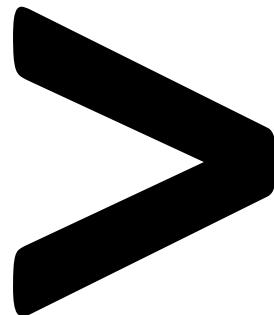


Nodes, motes, field devices, wireless stations... all the same!
Radios + Processing Unit + Power supply + Sensors/Actuators

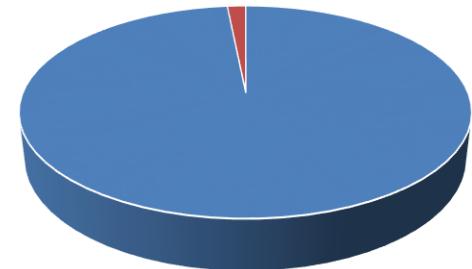
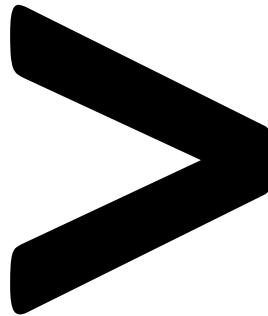


200-500 mA @ 5V → 1- 2.5 Watts
USB power bank 7Ah → 19.6 hours

DietPi build → 16MB RAM (1GB available)
Typical application: 50KB (0.005%)



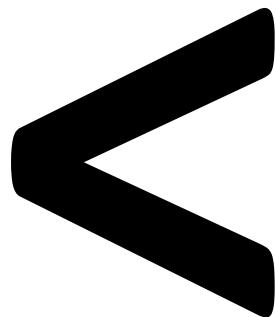
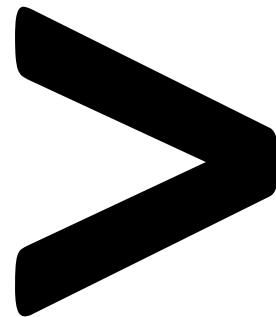
Processing power



■ Unused ■ System ■ Required ■

<http://fuzon.co.uk/phpbb/viewtopic.php?f=8&t=6>

<http://www.digikey.com/en/resources/conversion-calculators/conversion-calculator-battery-life>



50 metres

Spark Core's current draw posting to Ubidots

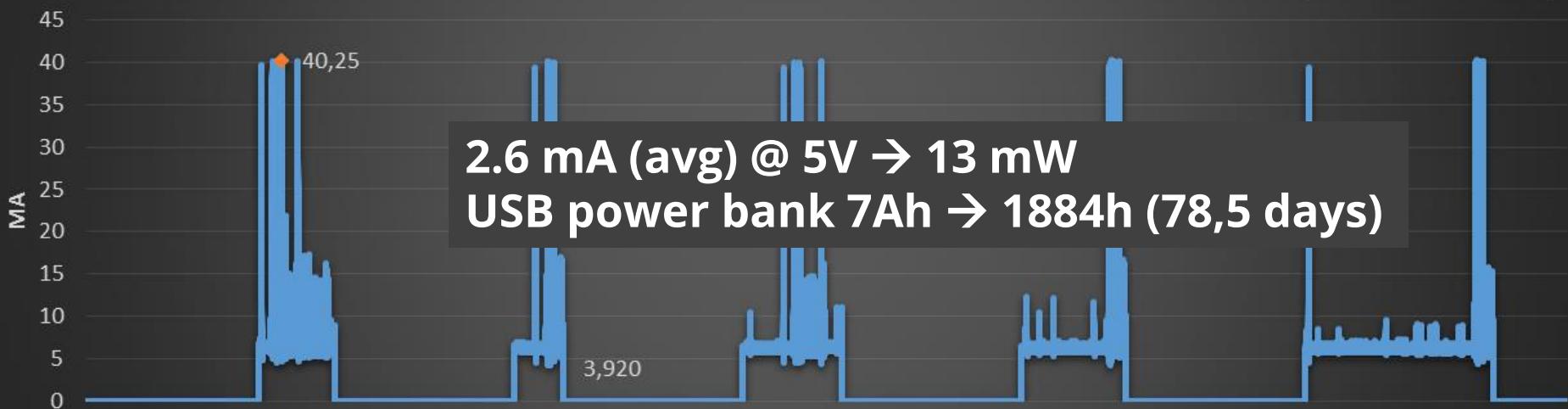
Deep sleep mode and wake-up to post every minute (scaled to mA)

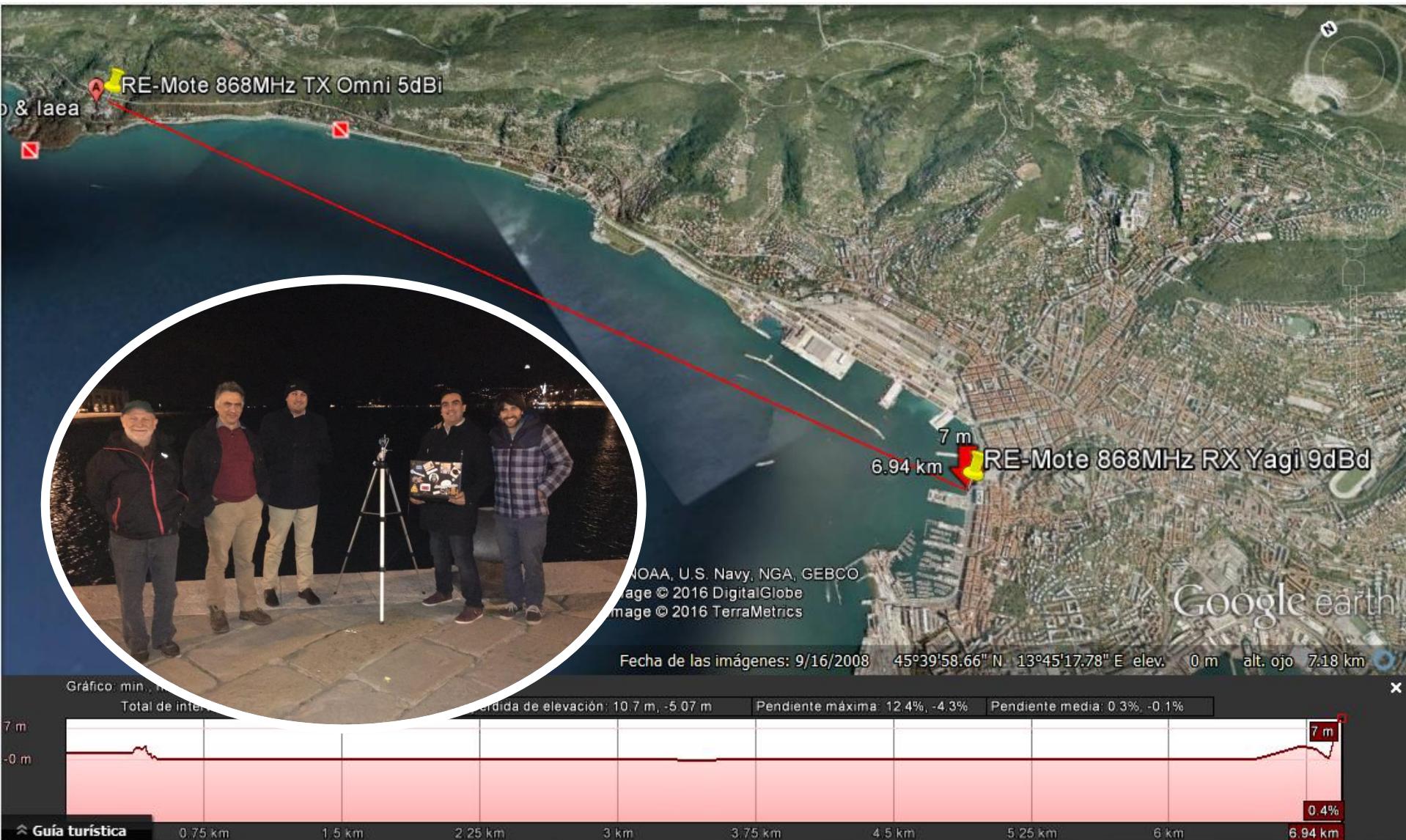


Re-Mote's current draw posting to Ubidots

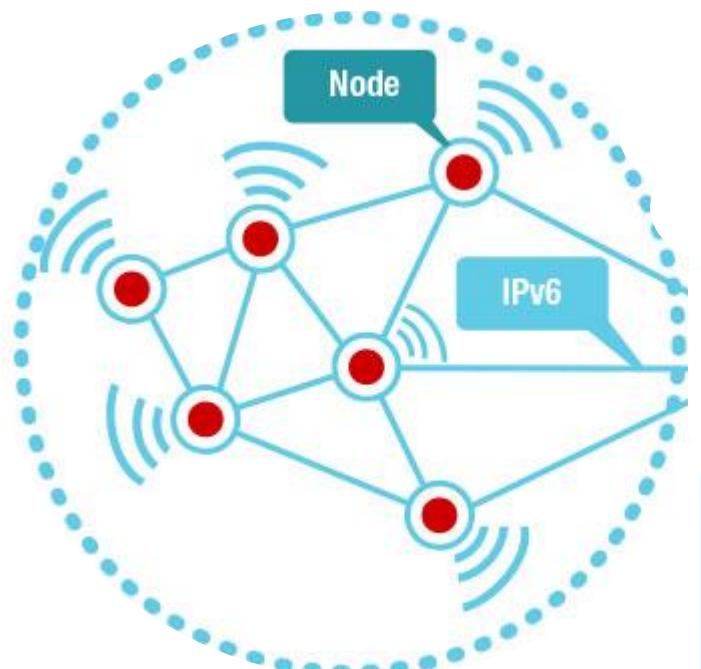
One minute post period (scaled to mA)

AVG: 2.611 mA

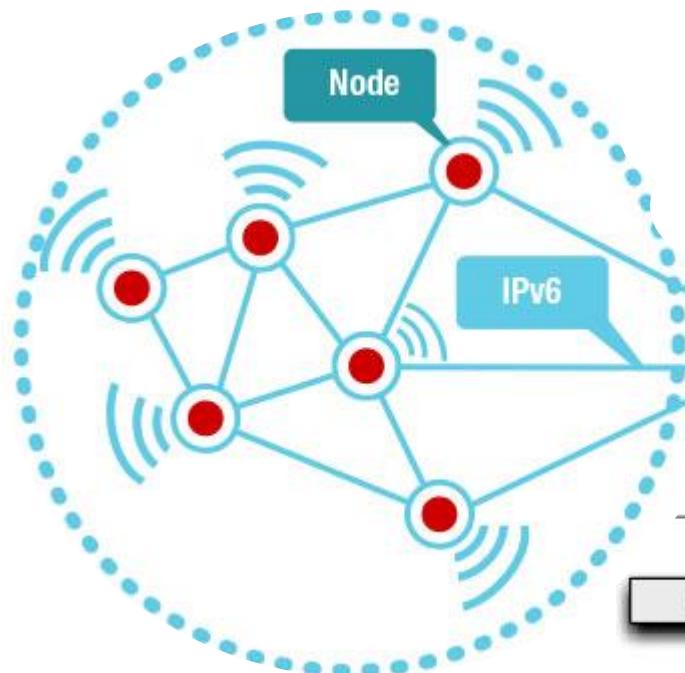




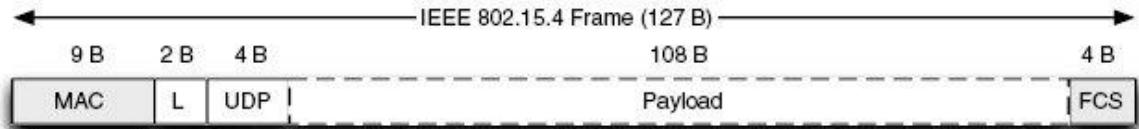
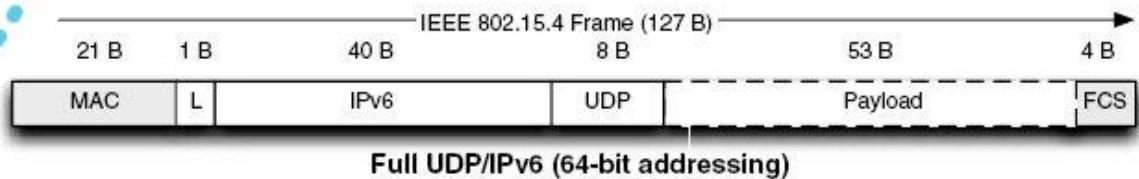
Trieste, Italy 2016 field test: 7Kms, 868MHz 50Kbps



IPv6 has global addresses, allows to communicate directly with any existing IP device, over existing networks



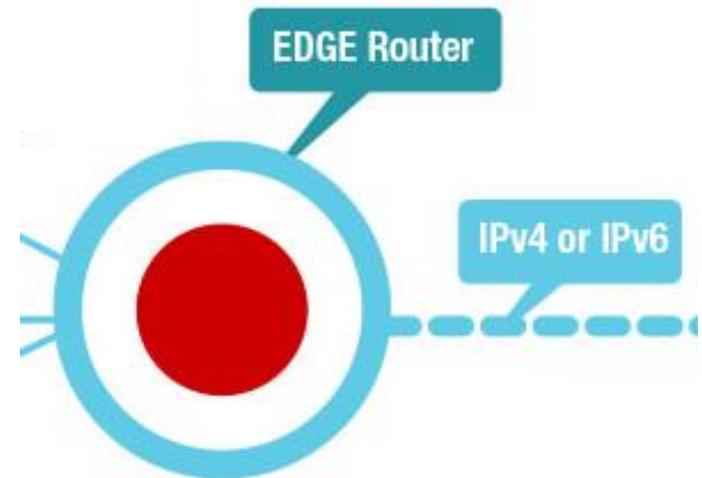
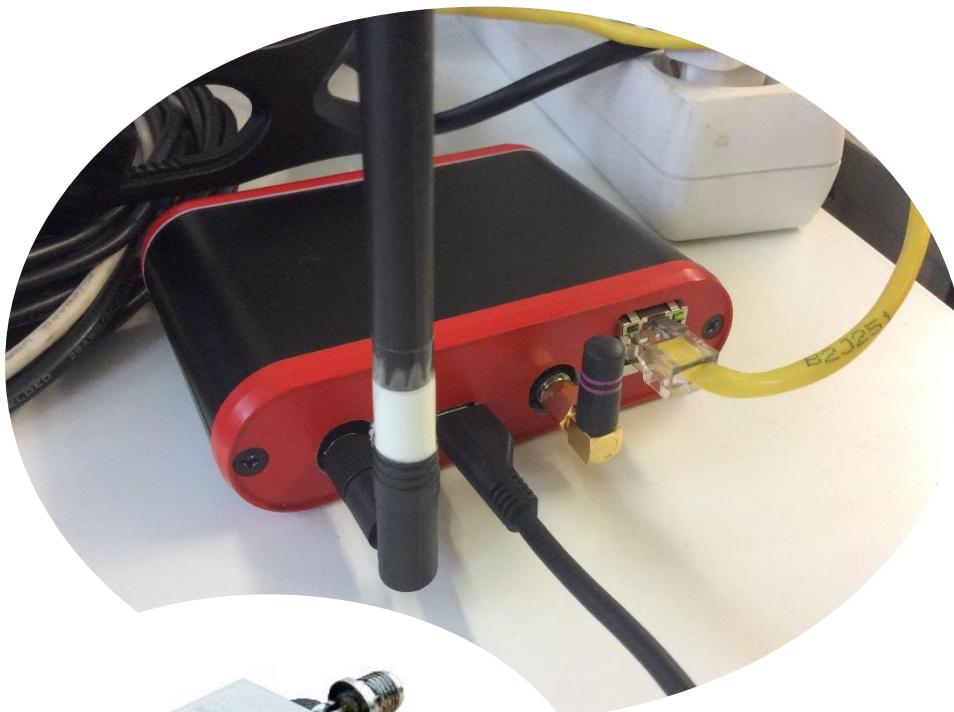
IPv6-based Low-power
Wireless Personal Area Networks



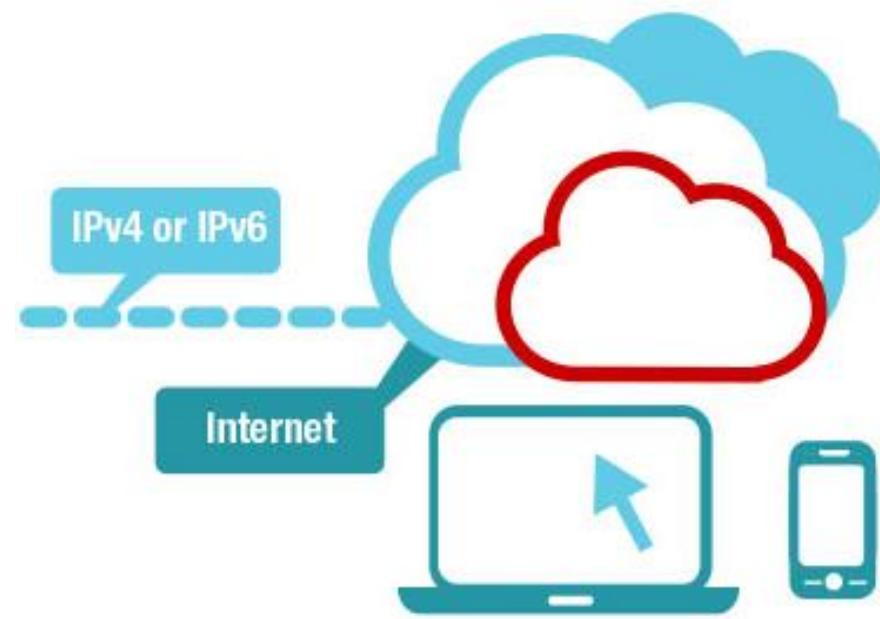
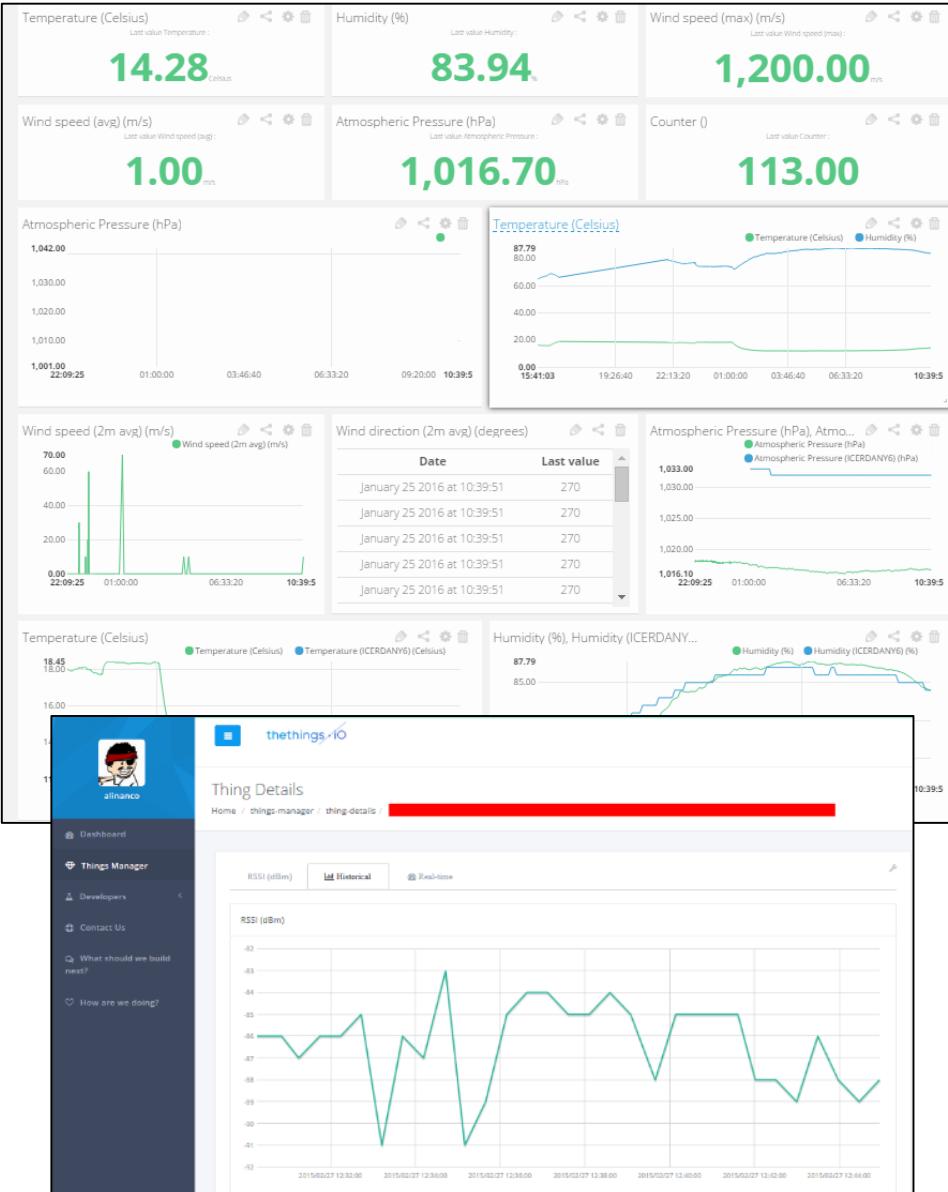
Minimal UDP/6LoWPAN (16-bit addressing)

IPv4/IPv6 single packets are 1280 bytes, embedded radios can transmit only up to 128 bytes (10 times less)... 6LoWPAN allows to fragment into smaller packets

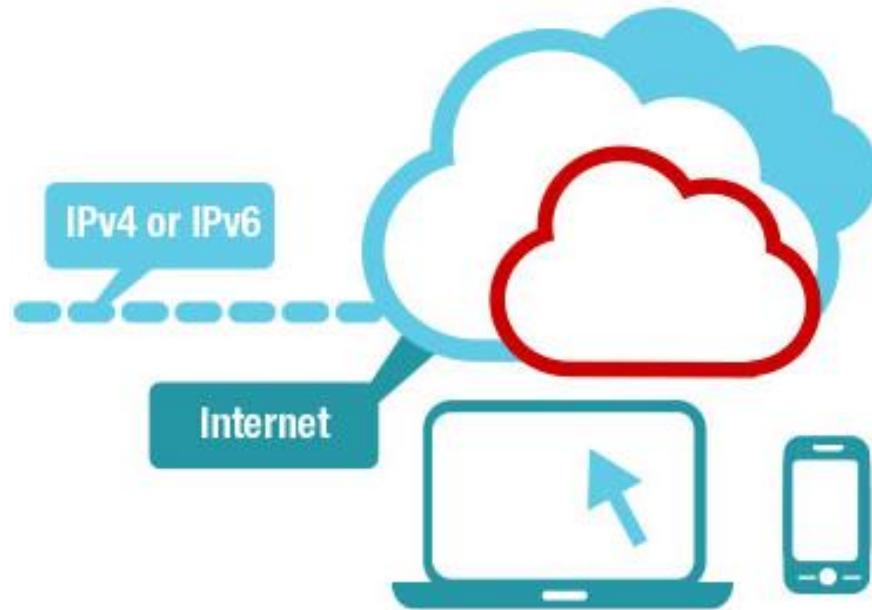




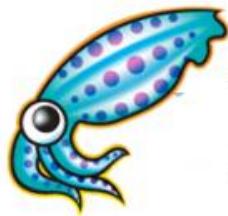
Edge Router, Gateway, Border Router... a translator between 6LoWPAN networks and IPv4/IPv6 networks. It requires an IP interface (Ethernet, WiFi) or GPRS/3G/4G



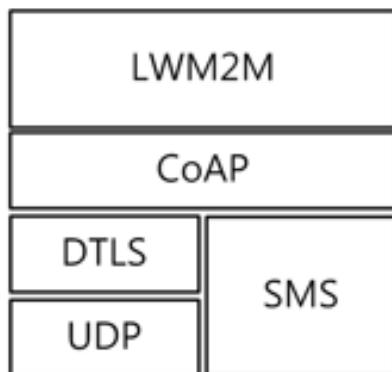
Data is sent for analysis,
monitoring, controlling ...



... to IoT cloud based platforms...

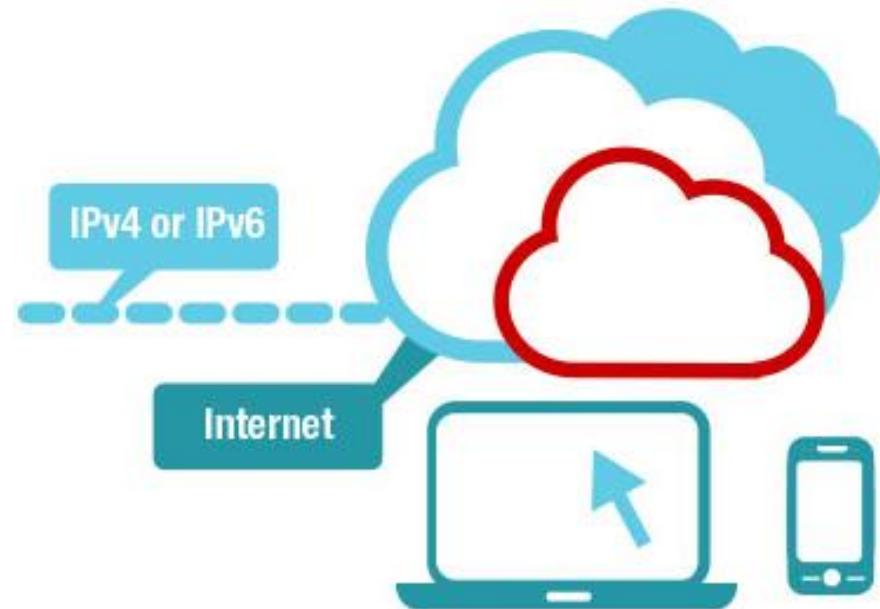


***HTTP
CoAP***

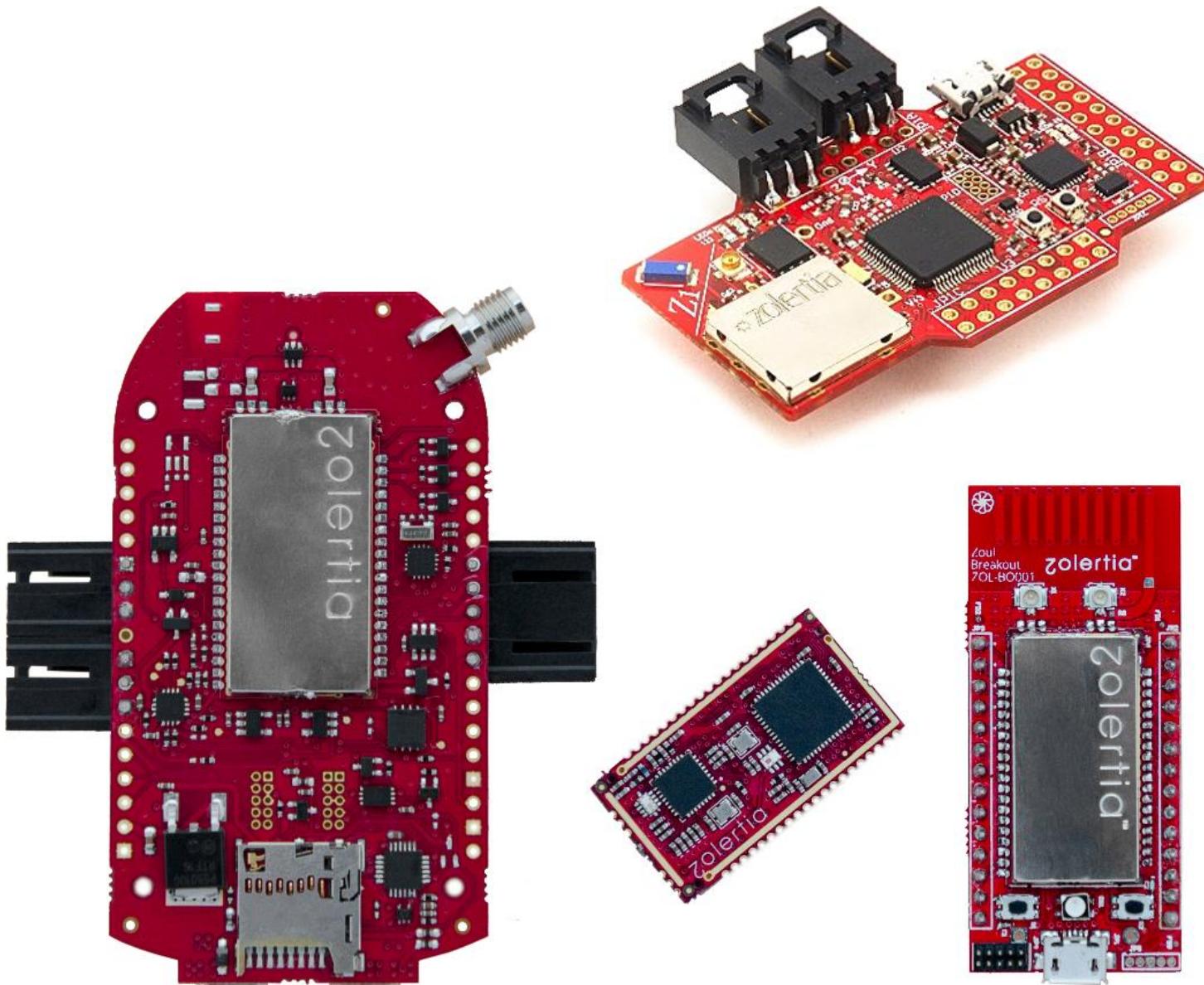


Objects

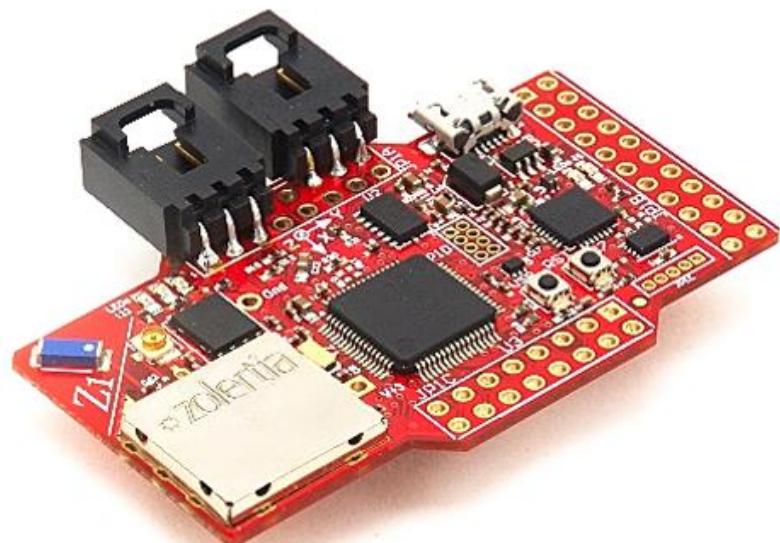
MQTT.ORG



... Using IoT protocols



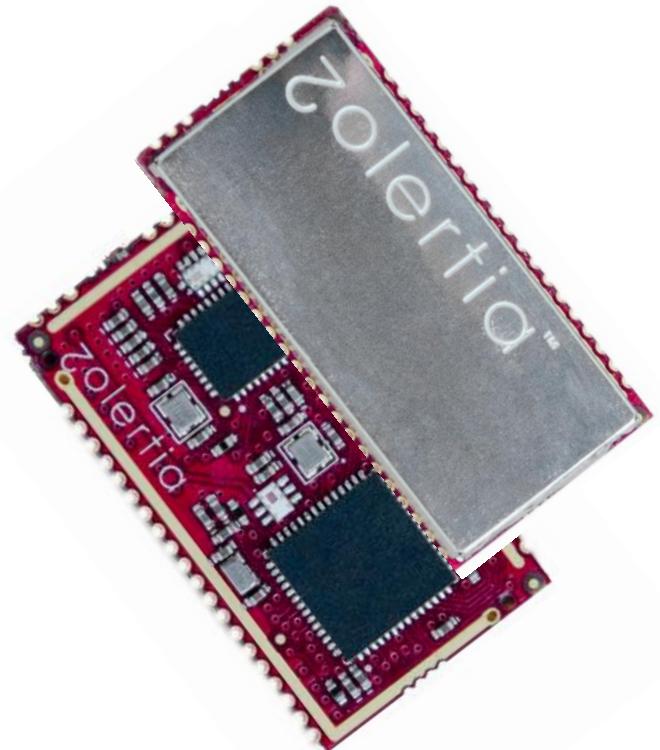
Zolertia Z1 mote



- Ultra-Low Power MCU and 2.4GHz Transceiver
- 2 x Digital Built-in sensors (temperature and 3-axis accelerometer)
- USB Programming Ready
- Flexible Powering: Battery Pack (2xAA or 2xAAA), Coin Cell (up to 3.6V), USB Powered, Directly Connected through two wires coming from a power source. USB VCC and GND pins are available on the digital buses expansion port. You can connect to this pins any power source from 4V to 5.25V and it will be regulated to 5V and 3V.

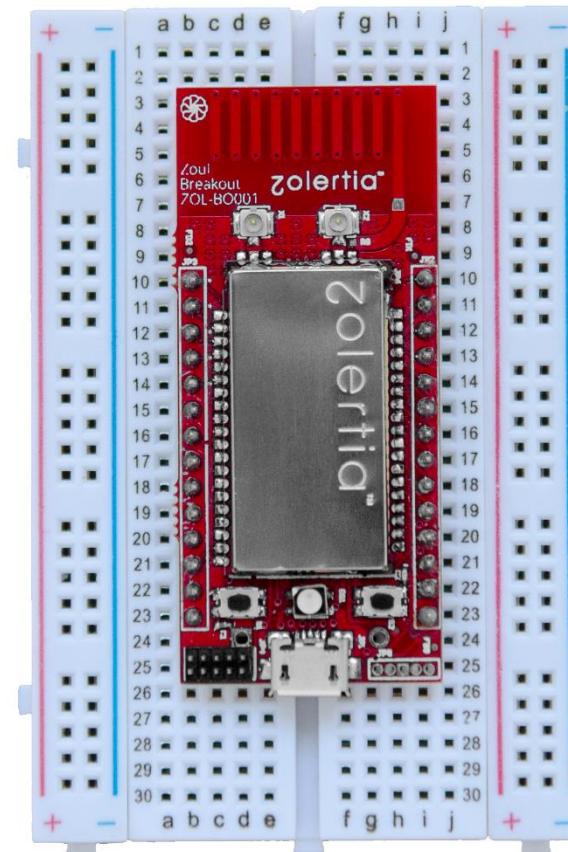
Zolertia Zoul

- ARM Cortex-M3, 32MHz, 32KB RAM, 512KB Flash
- Double Radio: ISM 2.4GHz & 863-925MHz, IEEE 802.15.4-2006/e/g
- Hardware encryption engine and acceleration
- USB 2.0 port for applications
- CE/FCC certified (*2016)
- Design guides and libraries to import for PCB designs



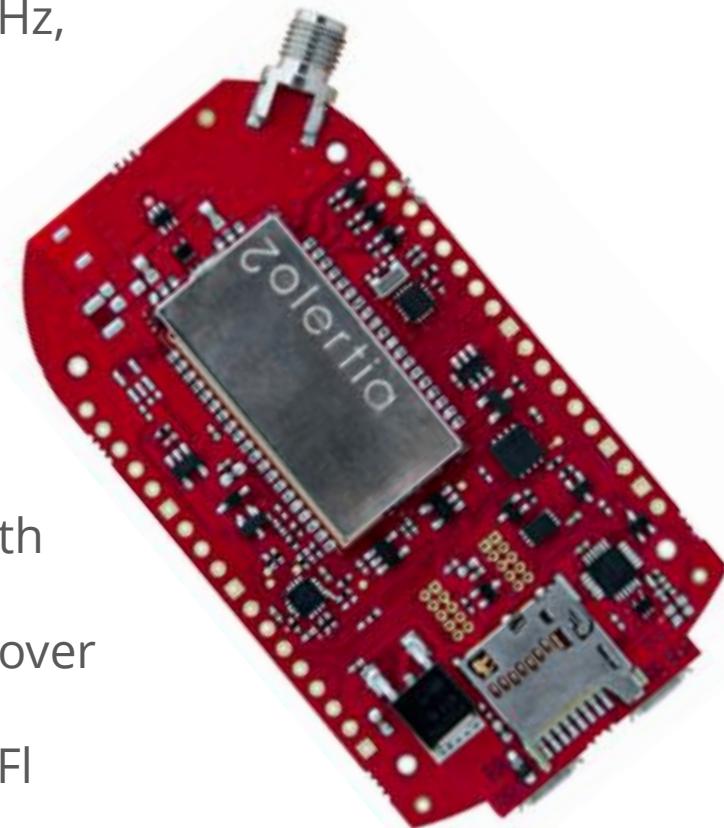
Zolertia Firefly (Zoul inside)

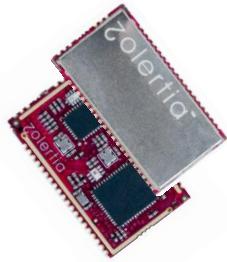
- ARM Cortex-M3, 32MHz, 32KB RAM, 512KB Flash
- Double Radio: ISM 2.4GHz & 863-925MHz, IEEE 802.15.4-2006/e/g
- Hardware encryption engine and acceleration
- USB 2.0 port for applications
- USB programing ready
- RGB LED (HTML colors)
- Printed 868MHz PCB antenna and U.FL to connect external antennas over pigtail
- Power over 3.3V, 2xAA battery holder available



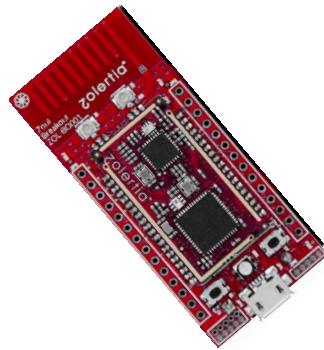
Zolertia RE-Mote (Zoul inside)

- ARM Cortex-M3, 32MHz, 32KB RAM, 512KB FLASH
- Double Radio: ISM 2.4GHz & 863-925MHz, IEEE 802.15.4-2006/e/g
- Hardware encryption engine and acceleration
- USB programing ready
- Real-Time Clock and Calendar
- Micro SD slot and RGB colors
- Shutdown mode down to 150nA
- USB 2.0 port for applications
- Built-in LiPo battery charger to work with energy harvesting and solar panels
- On-board RF switch to use both radios over the same RP-SMA connector
- Pads to use an external 2.4GHz over U.FL connector, o solder a chip antenna





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Designers & Devs
20€ (+50)



Makers,
R+D
42.95€



Fast development,
Start-ups, Makers,
R+D
74.95€

Platform	ROM	RAM	Frequency	Lowest current draw	# Radios	Maximum Radio Range
Z1	92KB	8KB	16MHz	3.5-18uA	1	100 mts (0dBi antenna, LOS)
RE-Mote	512KB	32KB	32MHz	150nA (shutdown mode)	2	20 Km (868/915MHz, LOS)

The RE-Mote has 5 times the storage, 4 times the processing power, two times the operating speed, 120 times less energy required and more than 100 times the range!

Platform	Z1	RE-Mote
Sensors on board	TMP102 (temperature), ADXL345 (accelerometer), voltage (internal)	CC2538 internal (core temperature, voltage)
External Storage	M25P16 (2MB)	MicroSD slot (up to 8GB)
Radio interfaces	2.4GHz IEEE 802.15.4/6LoWPAN	2.4GHz and 868/915MHz IEEE 802.15.4/6LoWPAN
Buttons	User and Reset	User and Reset
LEDs	3 LEDs (red, green, blue)	RGB LED (HTML colours possible)
Debugging/programming	Serial to USB converter	Serial to USB converter
Real Time Clock Calendar	None	On-board
External Watchdog Timer	None	On-board
USB 2.0 native	None	On-board
External antenna	On U.FL connector, requires pigtail	On-board RP-SMA
Dual Radio	None	On-board
Hardware Security acceleration	None	On-board
Emulation support	Cooja	None

Operating Systems and alike

Contiki

The Open Source OS for the Internet of Things



R|IOT

openthread

released by Nest





6000 Units sold since 2009

250 Over 250 clients

+50 Worldwide publications

35 Over 35 countries

1 EU FP7 Project





SICS



Coventry
University



ICTP
The Abdus Salam
International Centre
for Theoretical Physics

cea

énergie atomique • énergies alternatives



UNLP

Inria

UNIVERSITY OF
Southampton



PHILIPS



thingsquare

SONY®



SIEMENS

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