Green Gateway Project
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Problem: Power-Use

Gateways for wireless networks are to power hungry for many applications. Although consuming only a few Watts this is magnitudes more than sensor nodes (motes).

Example of idle power use :

```
Mote:                    40uW   @ 3V
Gateway:   1W = 1000000uW   @ 5V
```

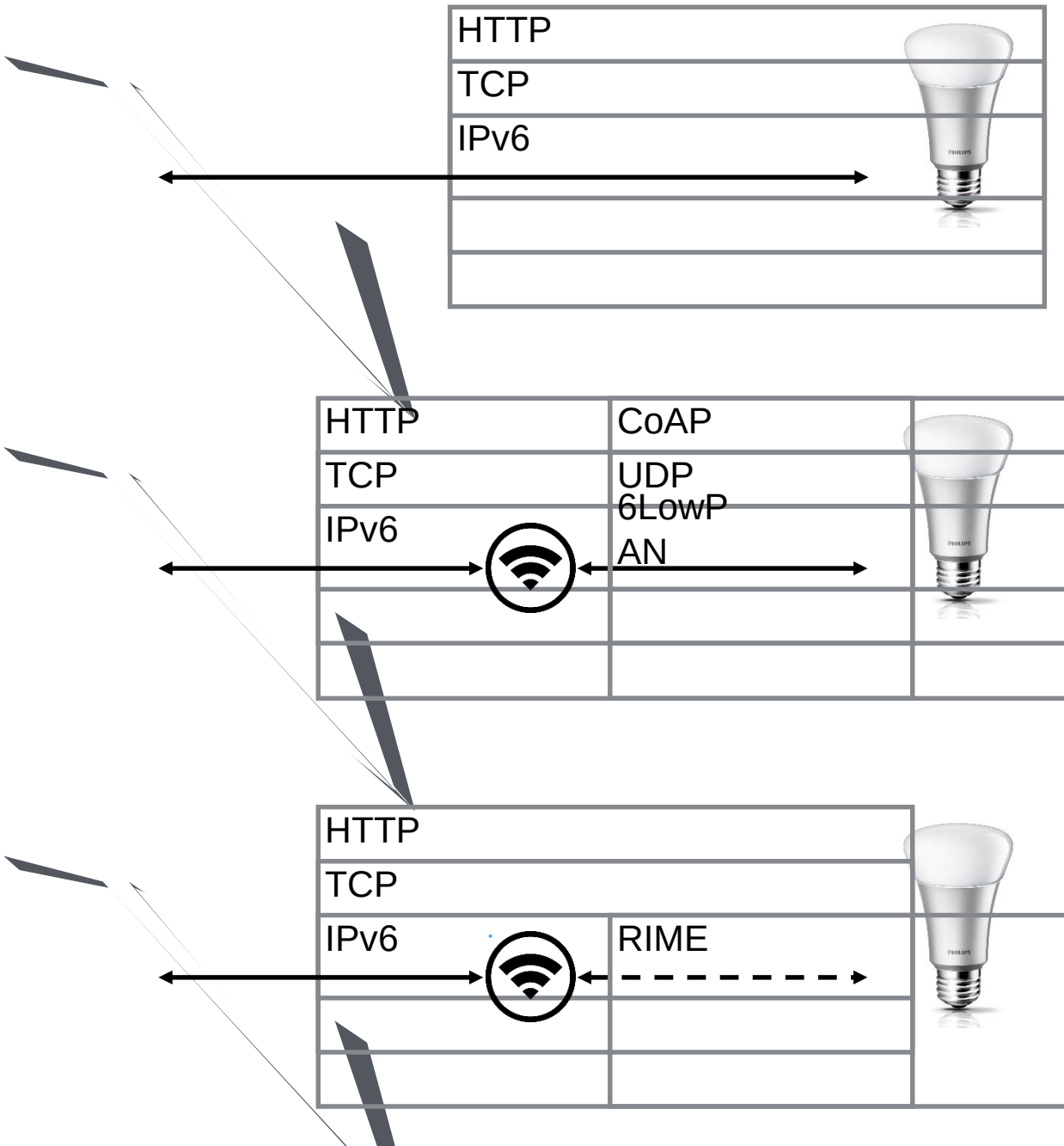
Initial goal: half the power consumption for GW

The Integrated Internet

Internet protocols end-to-end

Gateway translates between two standardized internet protocol stacks.

Gateway translates between two (standardized) protocol stacks.



Motivation: Low-power GW platform

Sensors deployed in areas with limited power
Sensor gateway crucial point
Lots of hardware and software platforms available
Evaluation needed

Objectives: Low-power GW platform

Use with different applications
Robust, rugged
Low-power, renewable power sources
Open design, open source
Off-shelf components
Affordable price
Uplink support for 3/4G & Ethernet

Objectives: Low-power GW platform

Approach: Survey of hardware

Rpi, BB, Odroid etc small (Project focus)

Other:
Android, telephones/OTG
Arduino
Development boards, AVR, PIC, ARM, STM

Knowledge & skills needed

Operating system, Linux kernel build
Programming, C, bash
Communication, IP
Embedded system experinence
Electronics basic skills

Hands-on work is required.

Basic tasks

Litterature study
Procurement if needed

Installation, HW / SW gateway
Installation energy monitoring
Installation WSN

Development & Reseach

Component level
System level

Power & Performance & Robustness

Examples:
Sleep-Modes HW.
Power-Save Linux.

Duty cycling:
Radio modem
    On-demand GW
Suspend/Resume

How measure performance and robustness?

Final design

Test
Verification
Deployment
Demo
Report
Hand-Over. Repository

Project demo: deployment in Electrum!

Practical Example

Automatic Weather Station (AWS) prototype.

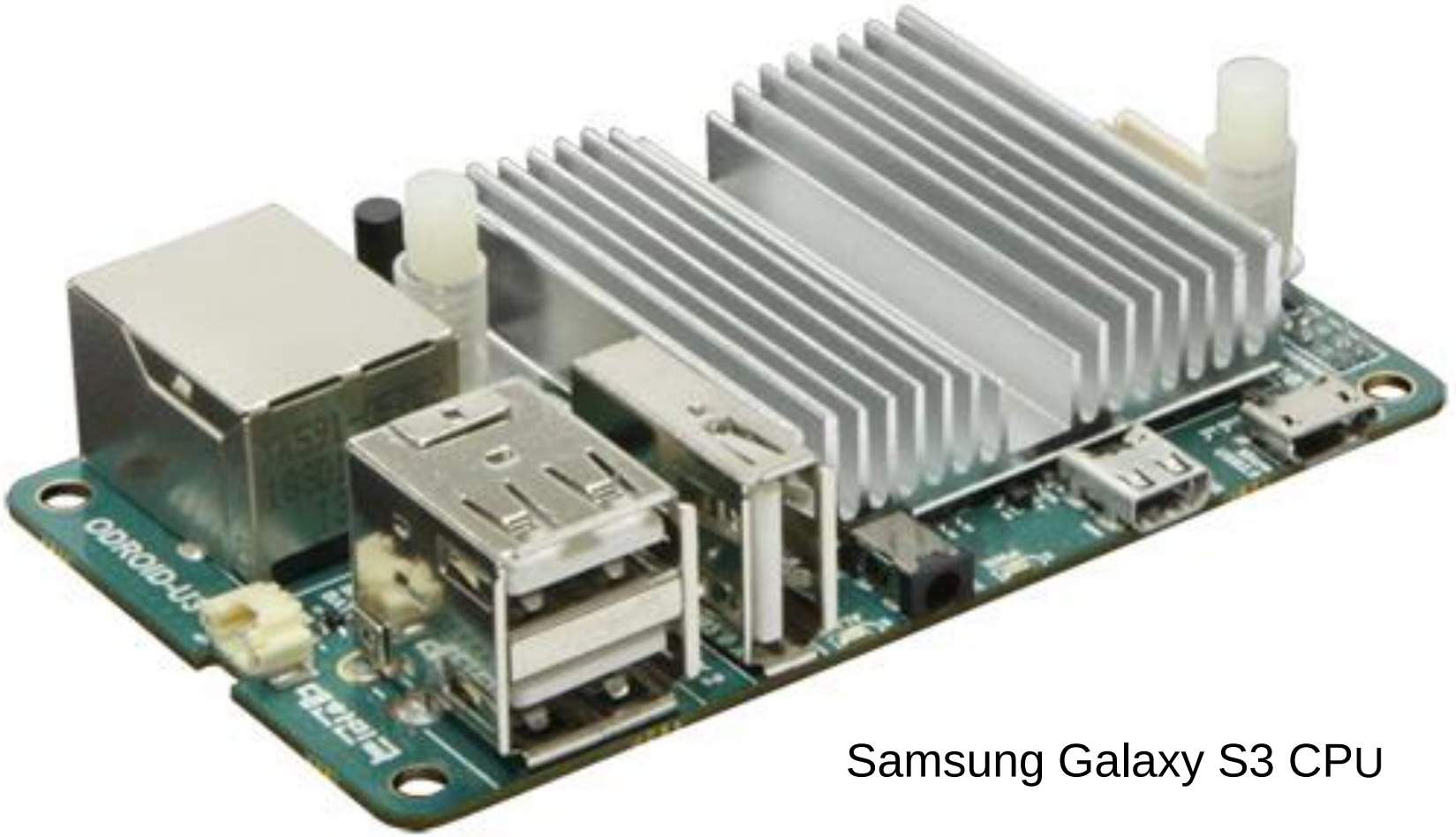
An AWS is based on 4 WSN-nodes. 10m, 2m plus ground and sink nodes. Sink node is connected to a GW Rpi via USB.

Data packets (reports) are sent every minute from each node. 10m node reports 3 pkts/min. An IEEE 802.15.4 is max 127 bytes.

GW uses AC-power today.

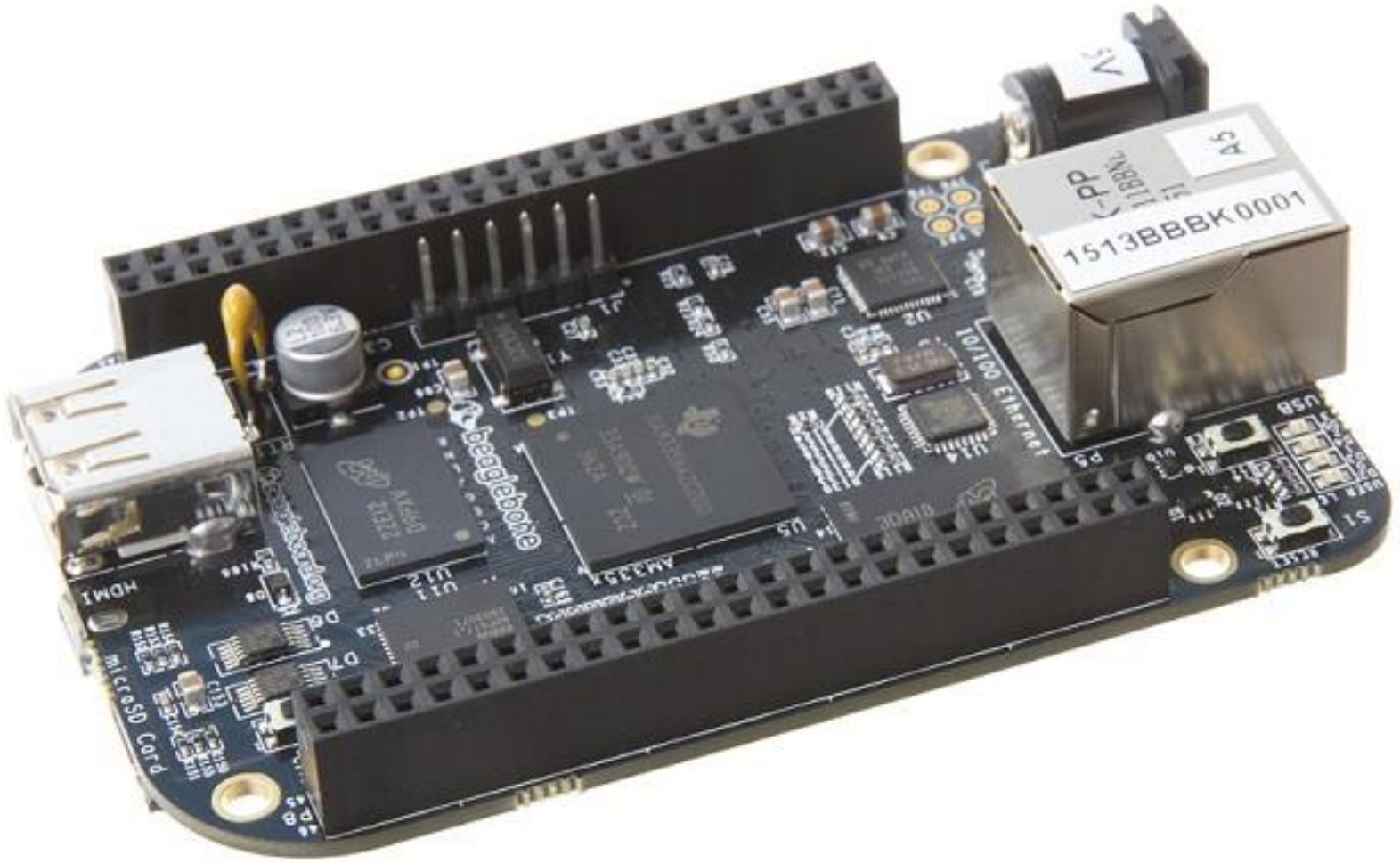
RPI & USB hub unit

Odroid 1.7 GHz 4 cores

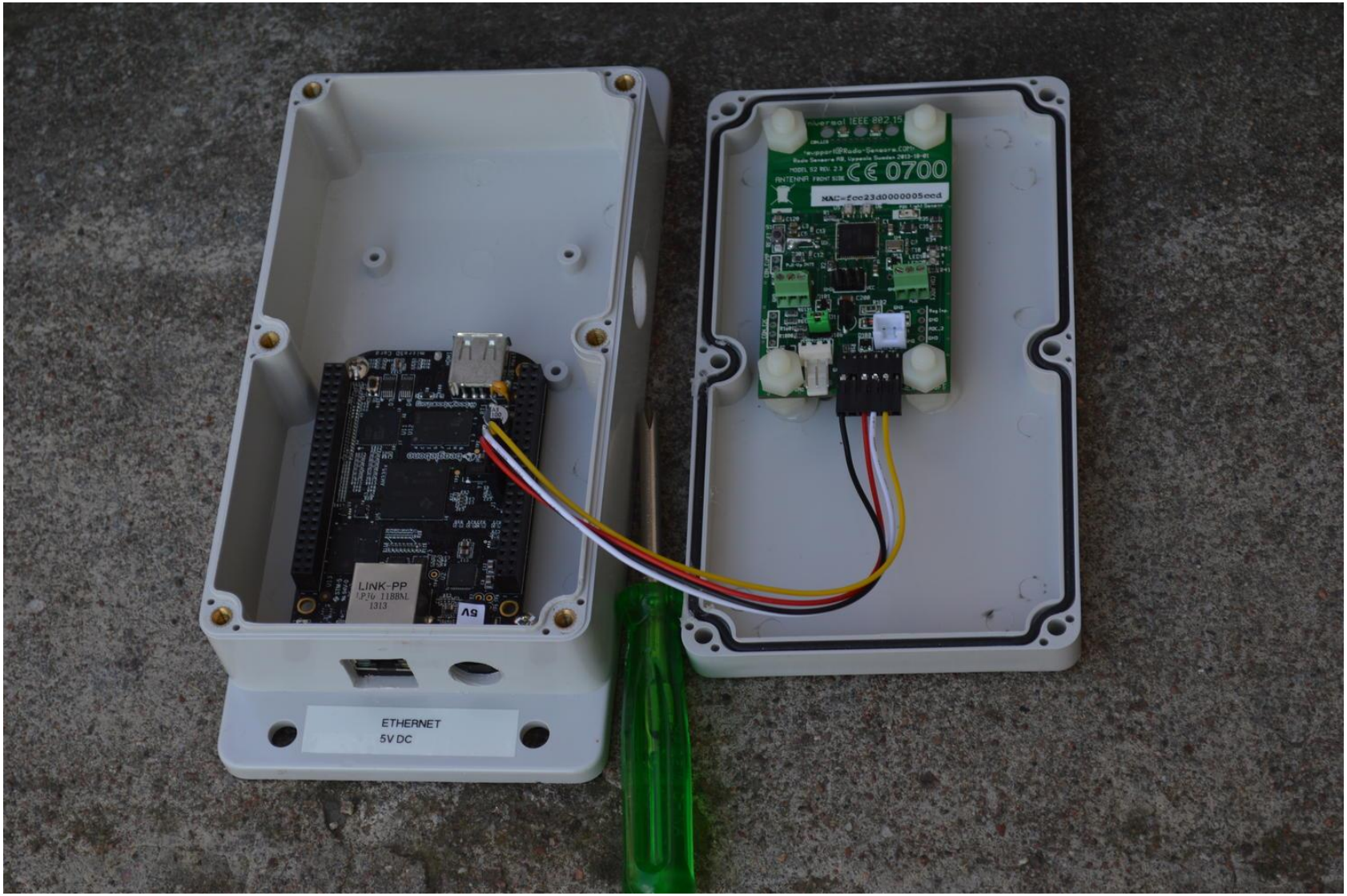


Samsung Galaxy S3 CPU

Beaglebone Black, TI SoC



GW assembly prototype



Intel Quark @ 2.2W

Quark™ SoC X1021

(16K Cache, 400 MHz)

512MB DDR3 ECC

2x Mini-PCI-E slots;

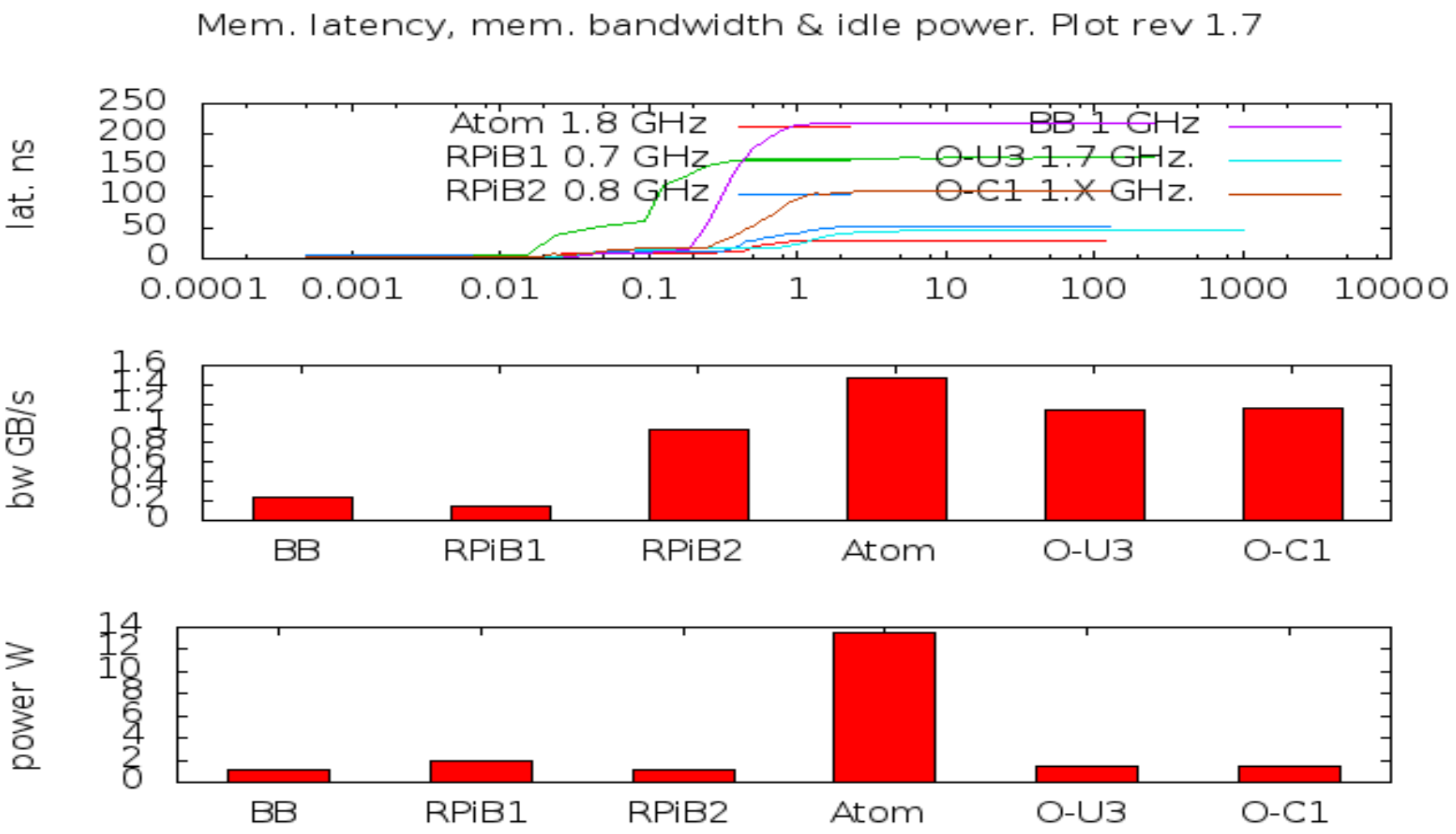
1x ZigBee module socket

2x 10/100Mbps LAN

32 bit

1 Core

performance vs power



Public respostory for collaboration

Repository essential

Git, CVS, SVN
Public github.com

Suggestion github

Referenser

The One Watt Initiative IEA in 1999

WIMEA RC3 project site.
http://www.se.ampr.org:8080/

END

Questions?

WSN IEEE 802.15.4 Sensor Node

PCB antenna

RESET button

P1 pulse header

P0 pulse connector

I2C Pin header

ON/OFF Current Tap

Ext. temp sens

USB-TTL 6-pin cable

EUI-64 MAC address

Light sensor

LED red
LED yellow

ADC1 w. program pwr

Pin header with ADC2

DC-input 3.5-25V

I2C add-ons and break-out boards

Almost everything... Just soma I2C examples

Accelerometer & gyro (MPU-6050)
Magnetometer (HMC5883)
Temp & RH (SHT21, SHT25)
Pressure (BMP180, MS5611)
Hi-RES AD converter (MCP3424)
Lightning (AS3935)
Gamma, beta radiation (RD3024) TTL/Pulse

break-out boards
do it yourself?

Relatively easy... SHT25, MS5611, MCP3424 for WIMEA meteorological project.