KU LEUVEN

Internet of Things code deployment metrics

Ward Schodts, Xavier Goás Aguililla

maandag 10 november 2014

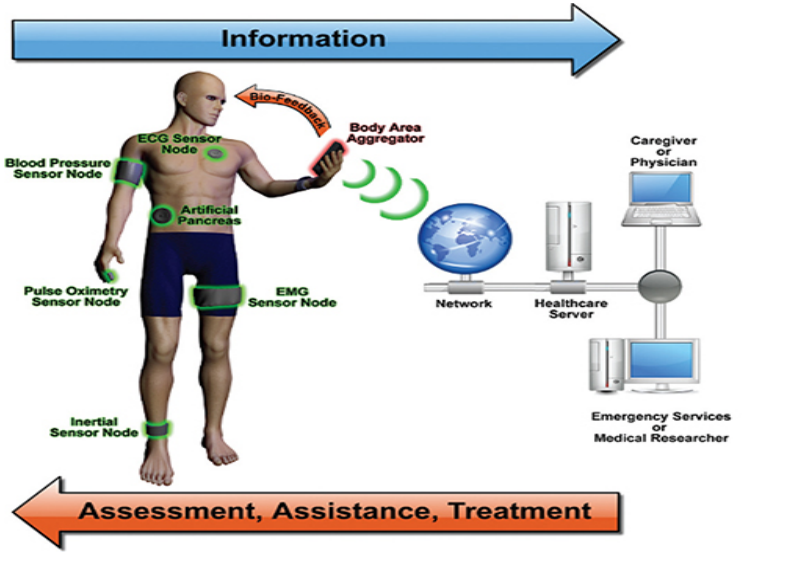
0 – Outline

1 – Outline

1 – Wireless sensor networks: what are they?

- TODO hier een afbeelding zoeken en aan de hand hiervan uitleggen!
- composed of embedded computers, or ‘motes’ TODO foto/video van motes
- low power radios and sensors
- detecting phenomena

1 – Sample applications



1 – The Great Duck Island experiment

- TODO beschrijven
-

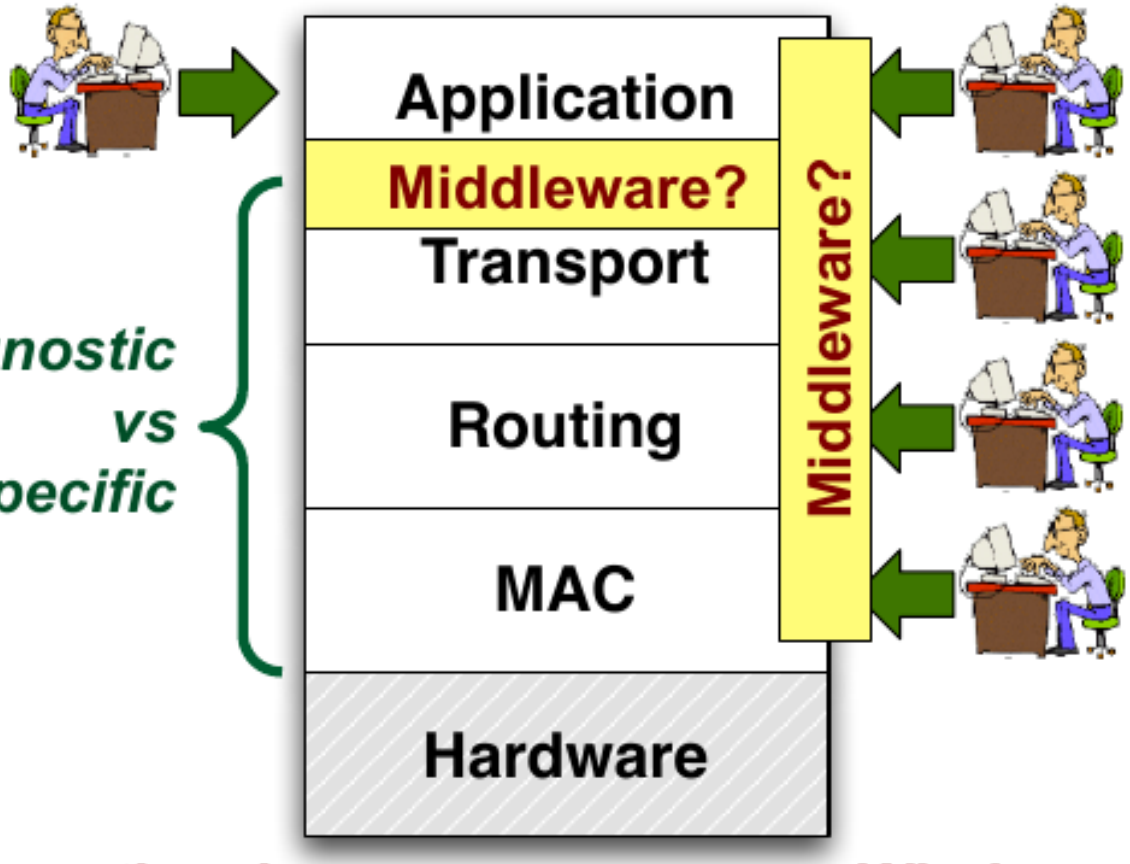
- energy-efficient
- robust
- TODO verder bij survey paper

1 – Store, compute, transmit?

- TODO 3 grote factoren in energie verbruik,
- uitleggen dat transmitting het meeste energie verbruikt
- Mss een grafiekje dat de verschillen duidt?
- diagram van Hughes tijdens presentatie gebruiken

2 – Outline

2 – What is middleware?



Application-agnostic
vs
Application-specific

Conventional distributed systems

Wireless sensor networks

- application-based; ex. Contiki, Squawk
- component-based; ex. OpenCOM, Figaro, LooCi
  - static
  - dynamically reconfigurable

- Kort historisch
- Hoe werkt t. (vb vm?)

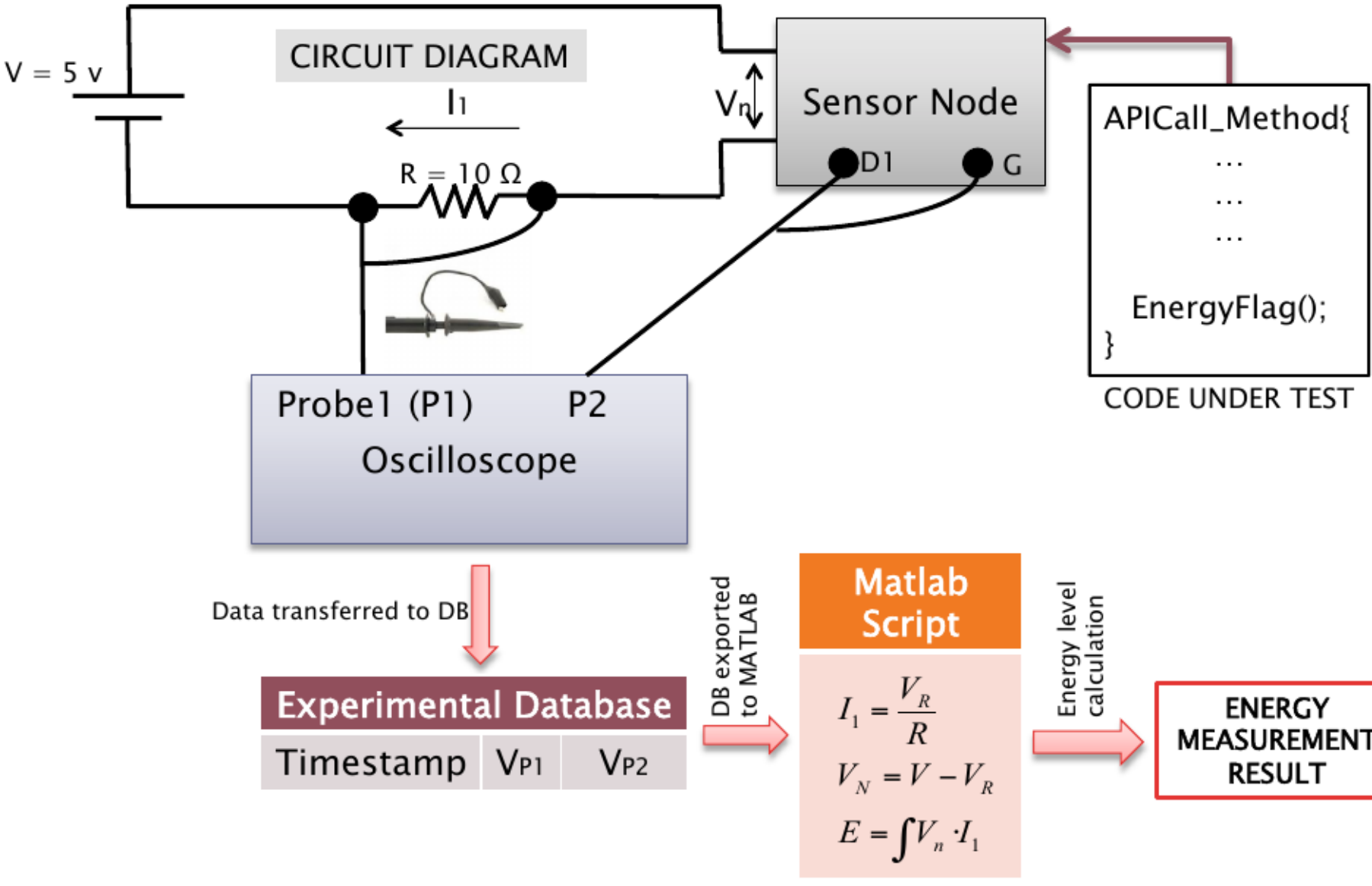
3 – Why is it important?

- WSN motes need to be long-lasting
- energy efficiency is key

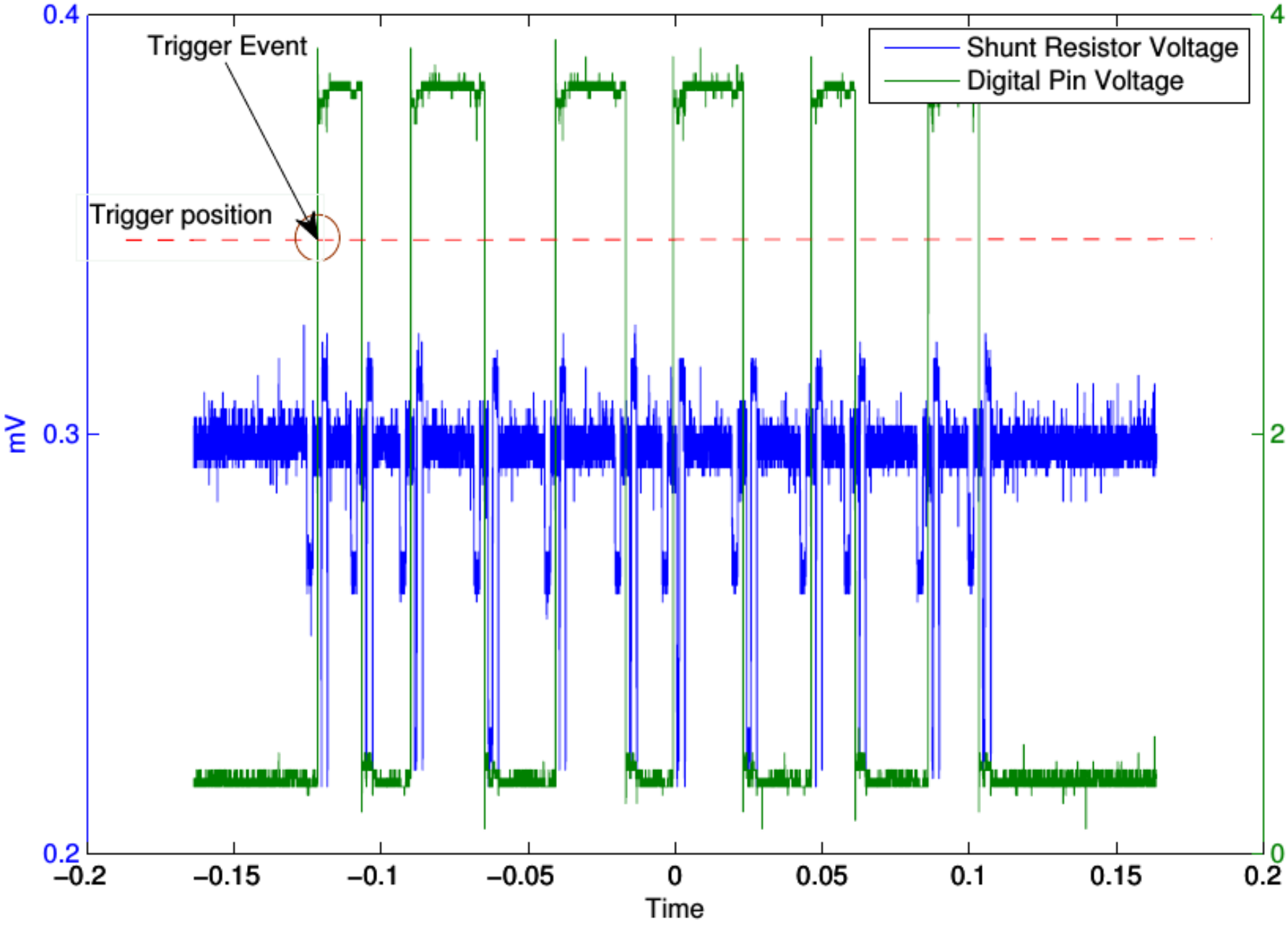
3 – How to measure?

- oscilloscopy! foto/filmpje
- use triggers in software
- derive power usage using Ohm's law

3 – Setup


CIRCUIT DIAGRAM
V = 5 v
I1
R = 10 Ω
Vn
Sensor Node
D1
G
APICall_Method{
…
…
…
EnergyFlag();
}
CODE UNDER TEST
Probe1 (P1)
P2
Oscilloscope
Data transferred to DB
Experimental Database
Timestamp
VP1
VP2
DB exported to MATLAB
Matlab Script
$I_1 = \frac{V_R}{R}$
$V_N = V - V_R$
$E = \int V_n \cdot I_1$
Energy level calculation
ENERGY MEASUREMENT RESULT

3 – Plotting voltage



- can be derived from voltage measurements
- can be modeled using linear regression

4 – Outline

5 – Bibliography

Akyildiz, Ian F et al. (2002). "Wireless sensor networks: a survey". In: *Computer networks* 38.4, pp. 393–422.

Hughes, Danny, Eduardo Canete, et al. (2013). "Energy aware software evolution for wireless sensor networks". In: *World of Wireless, Mobile and Multimedia Networks (WoWMoM), 2013 IEEE 14th International Symposium and Workshops on a*. IEEE, pp. 1–9.

Hughes, Danny, Klaas Thoelen, et al. (2009). "LooCI: a loosely-coupled component infrastructure for networked embedded systems". In: *Proceedings of the 7th International Conference on Advances in Mobile Computing and Multimedia*. ACM, pp. 195–203.

Mainwaring, Alan et al. (2002). "Wireless sensor networks for habitat monitoring". In: *Proceedings of the 1st ACM international workshop on Wireless sensor networks and applications*. ACM, pp. 88–97.