Why are real WSNs so hard for us to achieve?

Jan Beutel, ETH Zurich
"Proof-of-Concept" Deployment Experience

Data Overview
- 820,700 data points
- 49% yield
- 33 motes
- 44 days
- 288 samples/day
- 4 sensors
- 1,672,704 points

Still more than we knew how to handle!

Murphy’s law: everything that can go wrong will go wrong

March 10th [Field test 1]
- Gateway casing does not fit
- Melting DC/DC converter
- NODes antennas fall off
- Incorrect wiring of Sensirion sensor

May 4th [Field test 2]
- Untested T-MAC version (no development tree!)
- T-MAC loose synch (never use unsigned!)
- Debugging nightmare (LEDs off, low data rate)

Counter-Example: Non-Sustainable, Non-Scalable

Size vs. Lifetime for Untethered, Outdoor Sensors

Missing!
Large-Scale, Long-Lived Sensors
If found, please call:
+1 614 975 3658

17 Feb 2006
ETH Zürich

[Prabal Dutta, UC Berkeley]

[Prabal Dutta, UC Berkeley]
Sensornets Are Hard

- Sensor networks often fail/operate poorly
  - Great Duck Island network: median yield 58% [SenSys 2004]
  - Redwood network: median yield 40% [SenSys 2005]
  - Volcano network: median yield 68% [OSDI 2006]
- Survey of causes
  - Protocol conflicts/interference
  - Collisions and congestion induced loss
  - Neighbor management (with layer 2 scheduling, e.g. TMAC)
  - Don't know!
- Low-power, limited resources make complete logging prohibitively expensive...
Is it just generally painful?
Are we doing things the wrong way?
Were we promising too much?
My Contribution – WSN Deployment Survey

- A survey on the **success**, **failure** and generally **experience** in wireless sensor network deployments.

  **Online at**
  - [http://www.btnode.ethz.ch/Projects/WSNDeploymentSurvey](http://www.btnode.ethz.ch/Projects/WSNDeploymentSurvey)

  **Contact**
  - Jan Beutel, ETH Zurich – [j.beutel@ieee.org](mailto:j.beutel@ieee.org)

  **Prize – Win a Free Ski Weekend in the Alps**
  - Drawing is closing on December 15, 2007.
Outrageous Opinions

• Why are …
  – we not applying the same rigor and methods we teach to students in WSN design/deployment practice?
    • Code reviews, calibration, comparable/repetitive experiments …

  – we cramming more and more into tiny microcontrollers, operating them beyond limits, wondering why last minute quick-fixes fail?
    • The embedded industry designs and scales architecture exactly for the required performance/complexity!

  – so many computer scientists building (lower layer) MAC protocols and not the radio designers/manufacturers?