Observations from the IAB Workshop on Smart Objects
With some Thoughts on the Challenges

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I E T F ®

IAB Workshop on Interconnecting Smarts Objects with the Internet

- March 25-26th, 2011
- One day workshop, one day tutorials
- Over 90 participants, invited through position paper submissions (+ a few others)
- We received over 70 position paper submissions
- Papers were on diverse topics: application requirements, communication models, security, management, …
- A few speakers spoke about selected topics to kickstart discussions around different areas

What We Got...

- Exposure to interesting applications and their requirements (buildings, fountains, theatre, ...)
- Discussion about radically different architectures and their issues (information centric networking)
- Looking at existing technology from a new angle (sleep nodes, energy consumption)
- Focusing on some details of the protocol stack (ND, routing)
- Exposure to implementation experience

Snapshot of Conclusions

- Plan for the case where all the different applications live in the same network
- Implementation constraints relax over time
- It is useful to build information-centric abstractions
- Deployable security is important
- Prefer routed over instead of mesh under networking (and one hop over multi-hop)

Snapshot of IETF Actions

- Light-weight implementations   LWIG
- Data models and encodings   ?
- Networking beyond subnet borders   HOMENET
  - Discovery, mDNS, routing by default
- Support for sleeping nodes   CORE/6MAN/...
- Applicability statement needed for RPL   ROLL
- Review of crypto algorithm requirements   ?
- Architectural guidelines   ?

Challenges

- <u>One Internet vs. application specific networks</u>
- <u>Sleeping nodes vs. current protocol models</u>
- Using IP vs. legacy protocols
- Small implementations vs. small protocols
- Different routing models
- Information vs. host centric communication
- Configuration, security, and practical deployment requirements

One Internet for All Devices?

- Seems obvious, but there are many dedicated networks, special link layers, protocol stack profiles, and security concerns
- Is our goal to employ IP, but only in dedicated networks?
- Or to employ common IP-based networks?
- Is there commonality with protocol stacks in different devices?
- Is there end-to-end interoperability?
- Do we use IP as is, or change it?
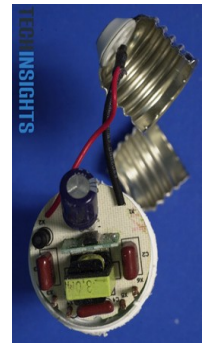
One Internet for All Devices?

- Build for the case where everything is in one network; allow people to deploy differently today – historically, all services tend to end up in one network

- Design transport & middleware tools to be re-used by most or all devices

- Create application standards

- For many purposes you can argue that the Internet of Things is already here

COAP, XML/JSON, ..

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Always-Off Networking

- Still, there are challenges, such as energy usage for the communications
- Universal deployment implies in most cases wireless solutions, ruling out PoE
- We need very long lifetimes for these devices (months... years... a decade)
- The key is to allow devices to sleep most of their time, not wake up unnecessarily
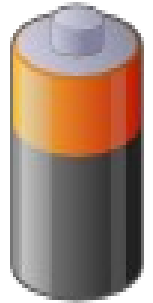
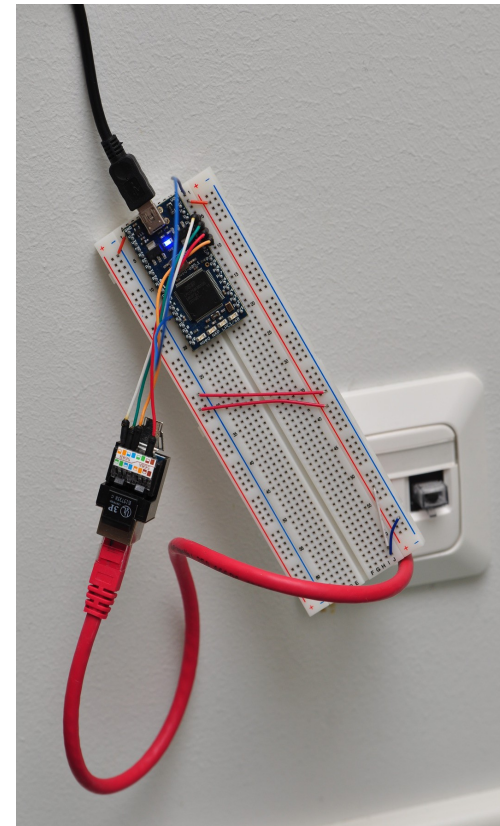# Challenges in Supporting Sleeping Nodes

- Many of our protocols or implementations were not designed with sleeping nodes in mind
- But adding this support is not easy in all cases – there are even architectural implications, like needing a network node to represent you while you are sleeping
- There is also a danger of premature optimizations

Optimizing Our Protocols: Case COAP
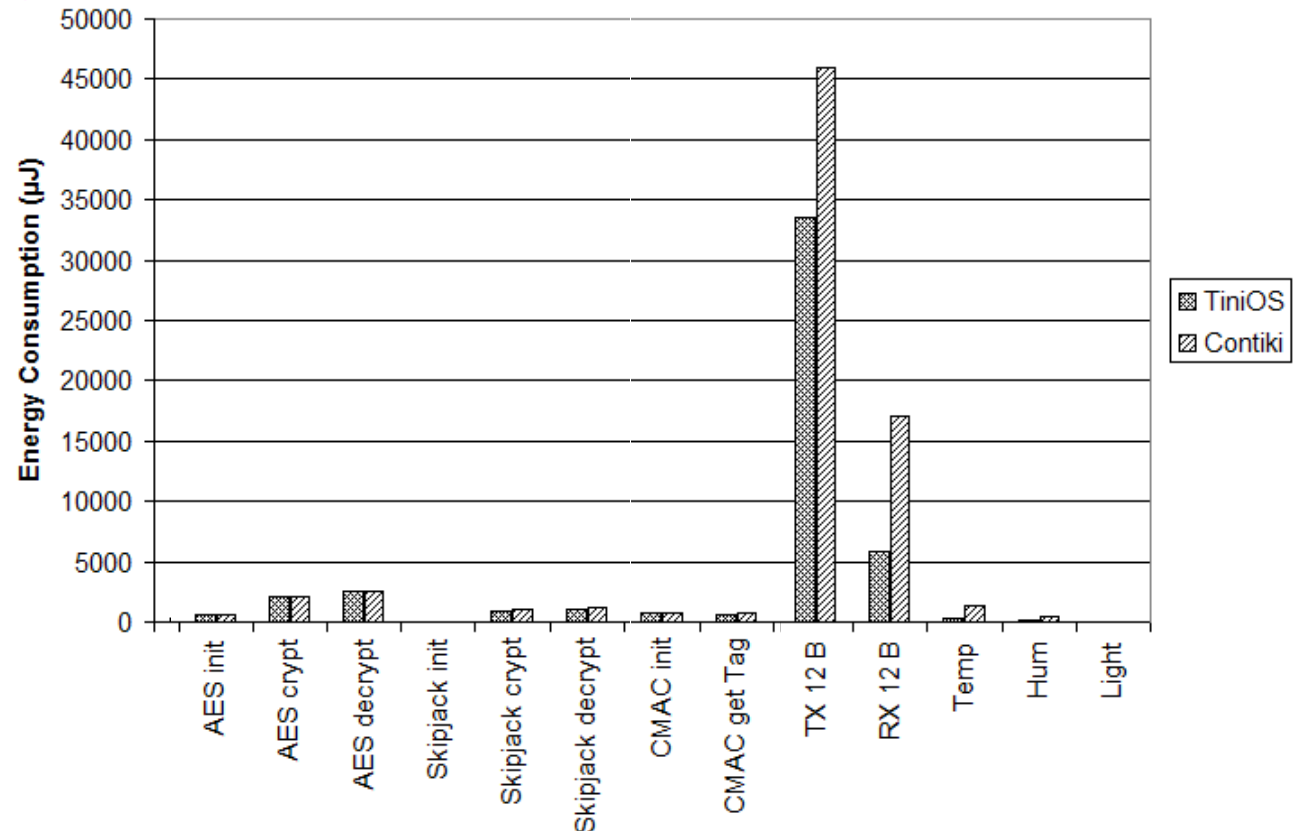

- COAP is for constrained nodes
- But it is <u>not easy</u> to sleep all the time
  - System issues – wait for DHCP, RA, DAD
  - Even COAP issues - wait for GET or Observe
- Many of these issues are fixable with the right communications model
  - Sensor sends (not waits), uses IPv6, uses link-local source address, multicast destination, … (see draft-arkko-core-sleepy-sensors)
- Focus the optimizations on the big things (who is awake etc), not details

Optimizing Our Protocols: Case Security

Most devices today <u>can</u> afford cryptography

C.B. Margi, B.T. de Oliveira, G.T. de Sousa, M.A. Simplicio Jr, P.S.L.M. Barreto,
T.C.M.B. Carvalho, M. Näslund, R. Gold, ICCCN'2010 / IEEE WiMAN 2010]

THANK YOU