Permissionless Innovation for the Internet of Things

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Outline

Connecting Everything

The Ingredients

The Web of Things

Connecting Everything

Connecting Everything 1: Materials

Smart Igloos (Source: Arkko & Keränen at Ericsson Labs)

Connecting Everything II: Power

Heater that pays your electricity bill?

Heating device - a resistor that converts electricity into heat

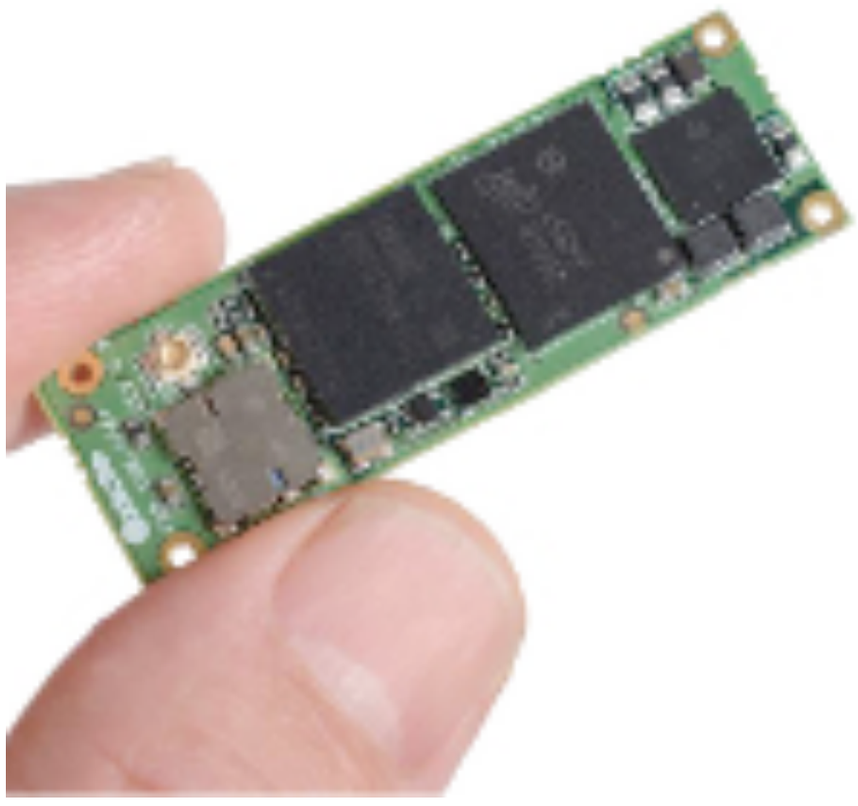
Computing device – does some useful work *and* converts electricity into heat

Bitcoin mining, etc

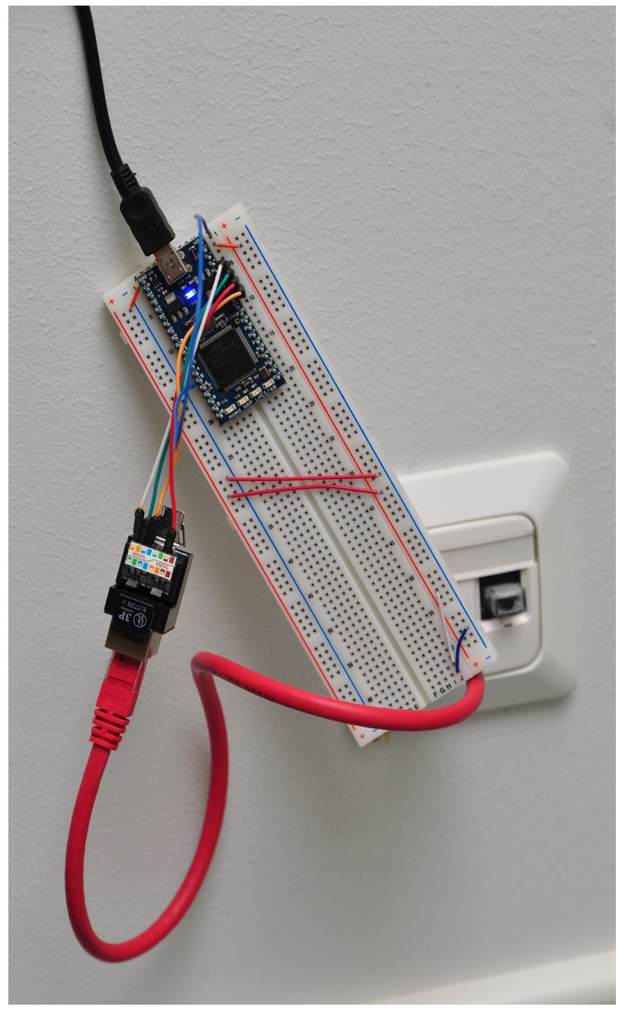
Early design sketch of a smart heater
(Source: Arkko at World IPv6 Conference)

Connecting Everything III: Small And Capable Devices

Dual-Core ARM Cortex-A9 Module
1 GB RAM and 8 GB Flash
(Source: linuxgizmos.com)

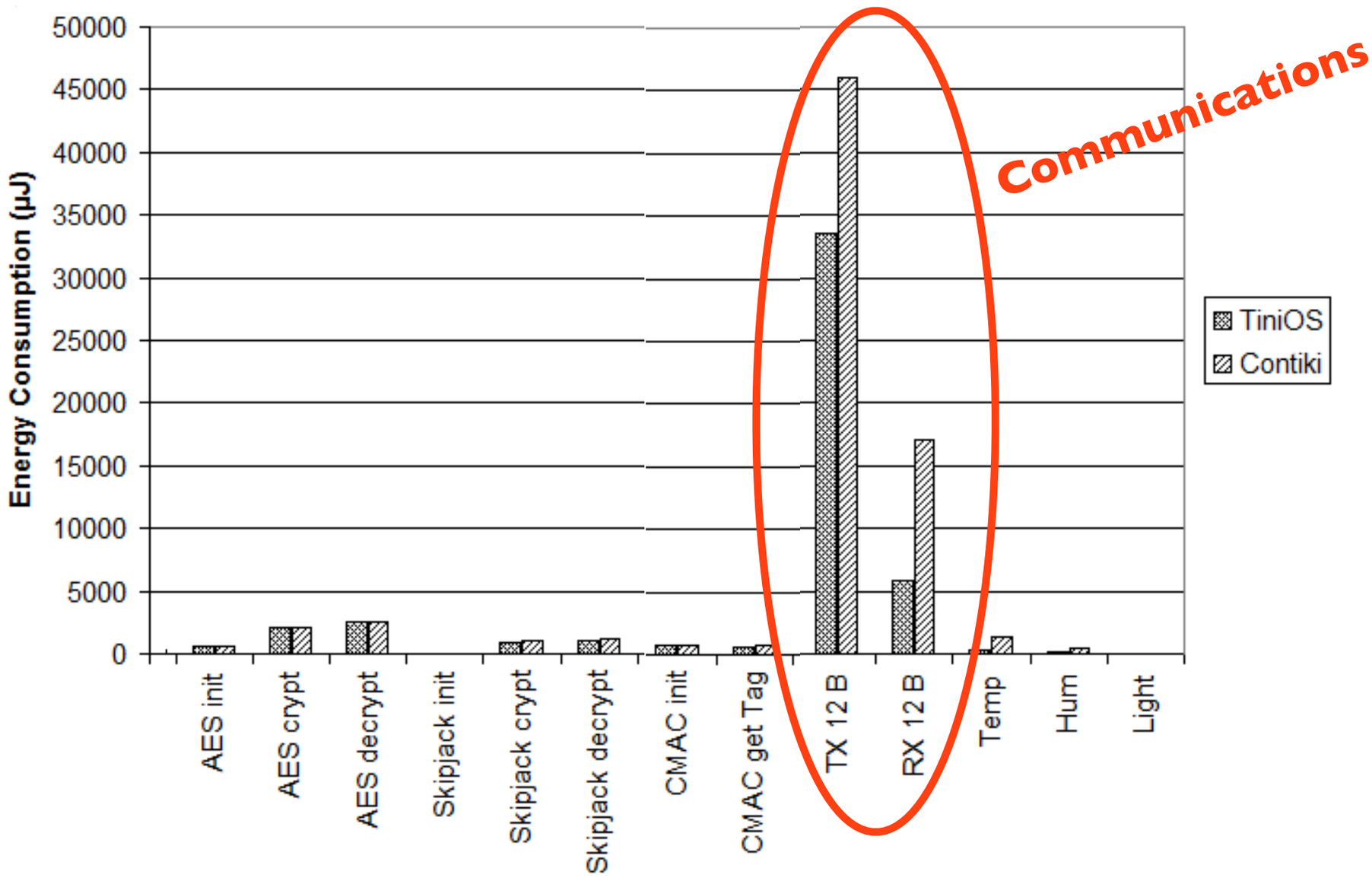


IPv6, UDP, CoAP, XML
in 48 instructions
(Source: draft-arkko-core-sleepy-sensors)



Connecting Everything IV: Small And Capable Devices

Energy consumption of various tasks on 8-bit CPUs
(Source: Margi et al at IEEE WiMAN 2010)



The Ingredients

Conclusions

- The technology is there today, mostly
- Most remaining problems relate to installation effort (e.g., secure configuration), management, network deployment, dependencies, commercial viability, time-to-market, ...

- What can we do to speed up deployment?

Permissionless Innovation

Some Areas of Open Innovation

IP itself:
Building any communications services on top of IP

The Web:
Both for browsing and building applications

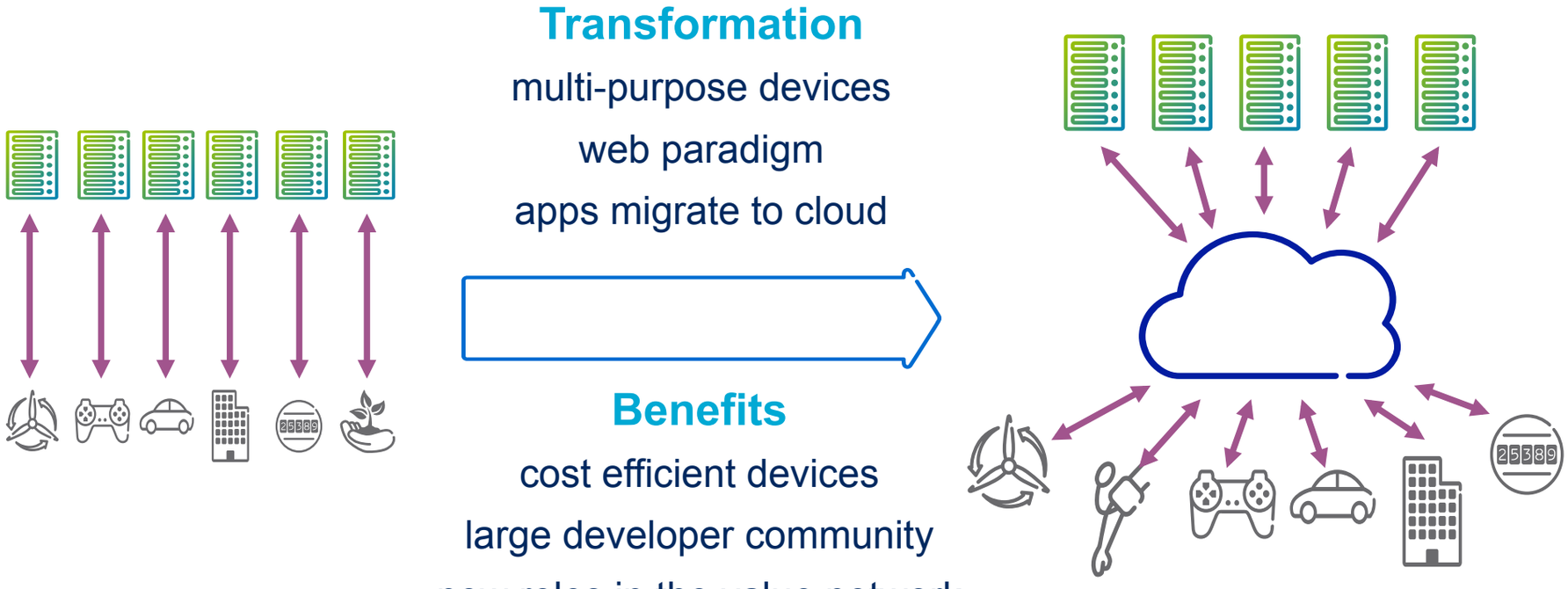
WebRTC:
Real-time communications in your browser

SDN:
Programmable networking

Web of Things:
Building IOT systems on the Web Protocols

Some Experiences from Running Internet of Things Applications

- Legacy devices are moving to an all-IP model
- It is important to reach interoperability at all layers; formats and web interfaces are very important too, not just IP
- The key is general purpose technology (3G, WLAN, web)
- Web tools is the way the market is going

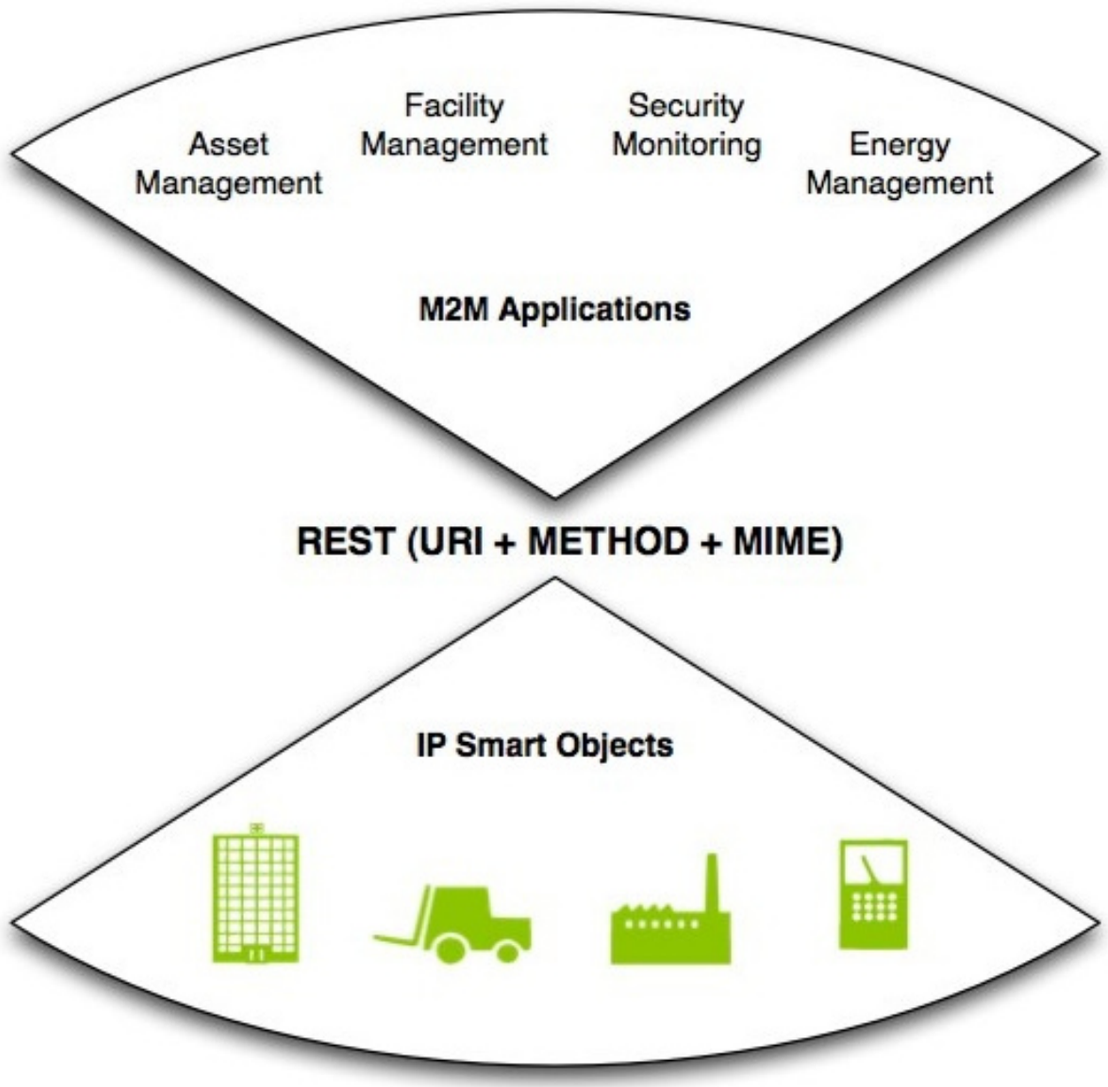


The Web of Things

The Web of Things (WoT)

This is a very attractive model for developing smart object applications

- Very successful for other applications
- Widely available tools & millions of programmers
- Simple and well-defined
- “Permissionless innovation”



(Source: Zach Shelby)

Standards and Consortiums

IPSO Alliance - Application Template

ZigBee - Smart Energy Profile 2.0

IETF - Lightweight HTTP and Object Directories

IETF - JSON, HTTP, HTTP 2.0

W3C - WoT community group

...

IETF goes to Berlin in July!

IETF 87, July 28 - August 2, 2013