Why IoT with ICN?

Oliver Hahm

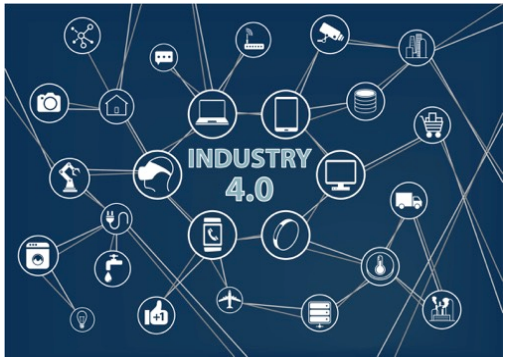
Zühlke

IoT over ICN Tutorial @ ACM ICN 2017
September 26, 2017
Berlin, Germany

IoT: Connecting the Physical World & Internet

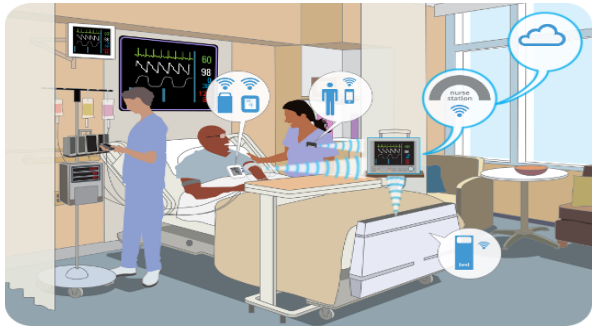
Micro- & Nano Satellites

Industrial Automation



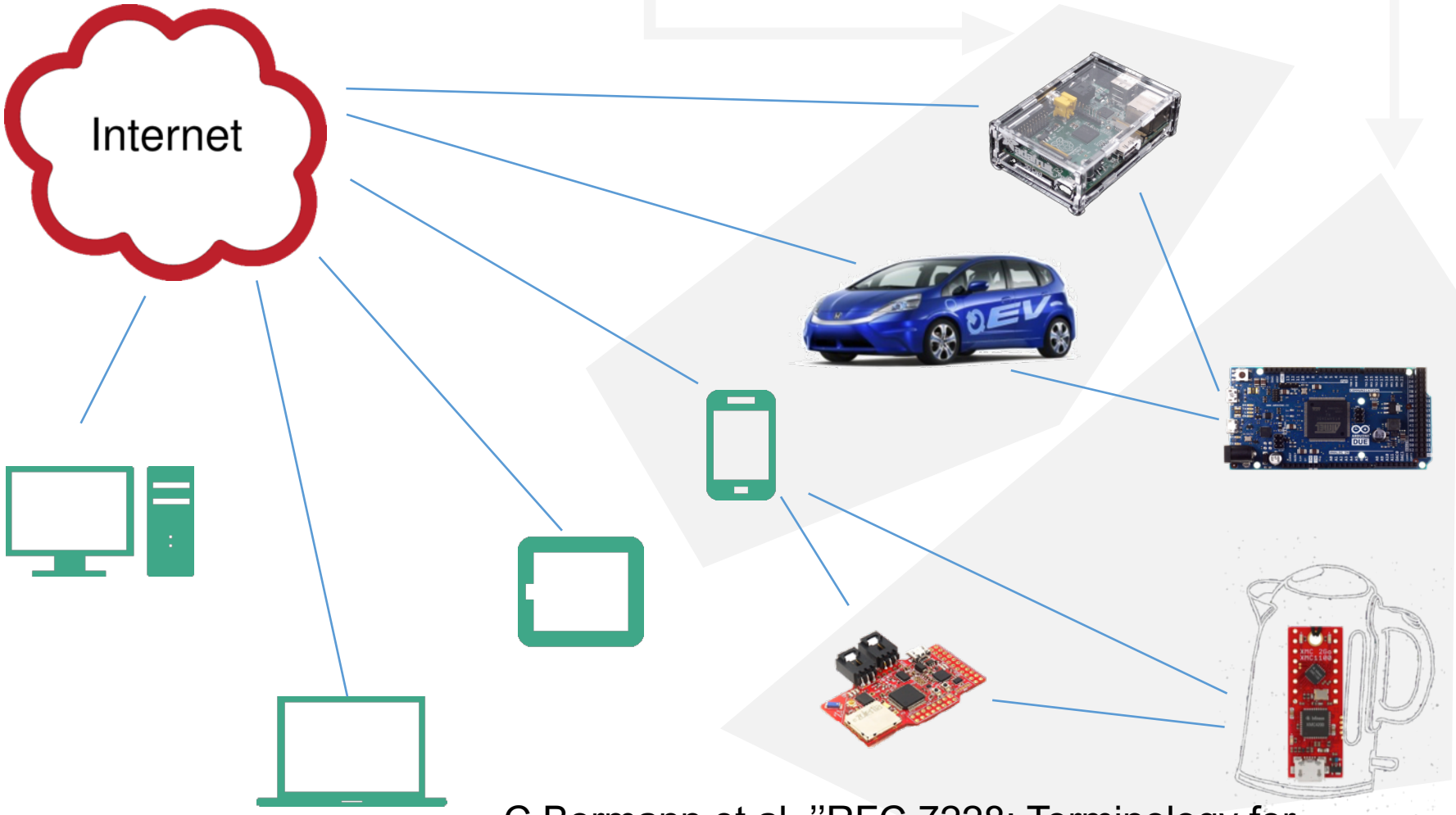
Connected Vehicles

Smart Homes



eHealth

IoT Devices: High-end *vs* Low-end



C.Bormann et al. ”RFC 7228: Terminology for Constrained-Node Networks,” IETF, May 2014.

Low-End IoT Requirements

Interoperability

Energy Efficiency

Security

Reliability

Autonomous

Scalability

Low cost

VS.

- Memory < 1 MB
- CPU < 100 MHz
- Packet size ≈ 100 bytes
- Data rate < 500 kbit/s
- PER: lossy

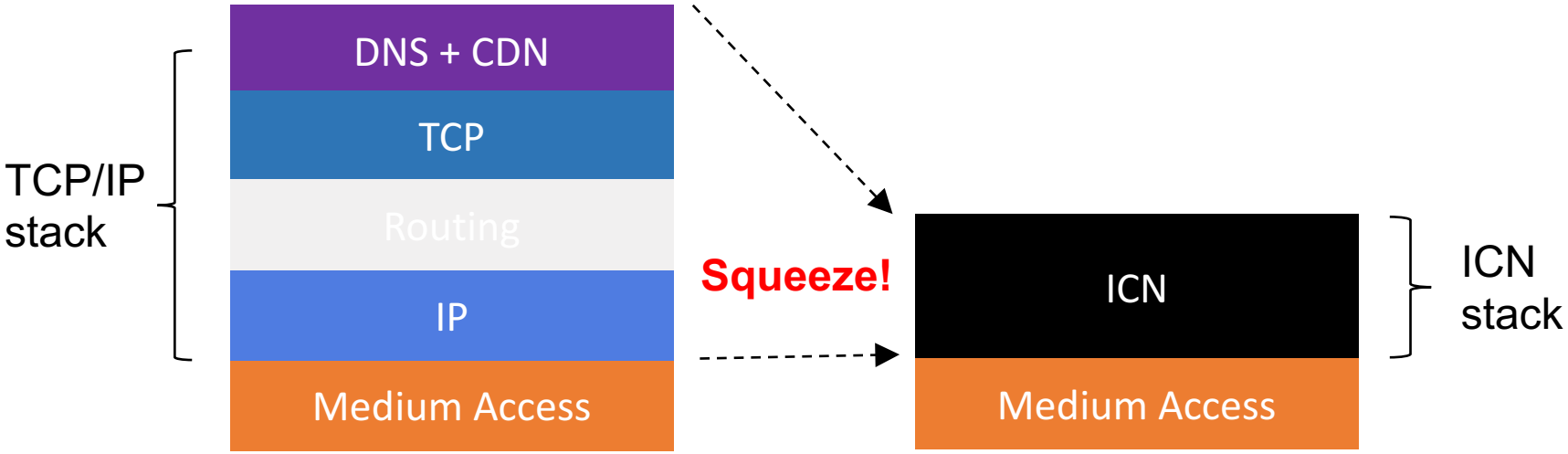
Information-Centric Networking (ICN)

⇒**Focus on accessing named content**

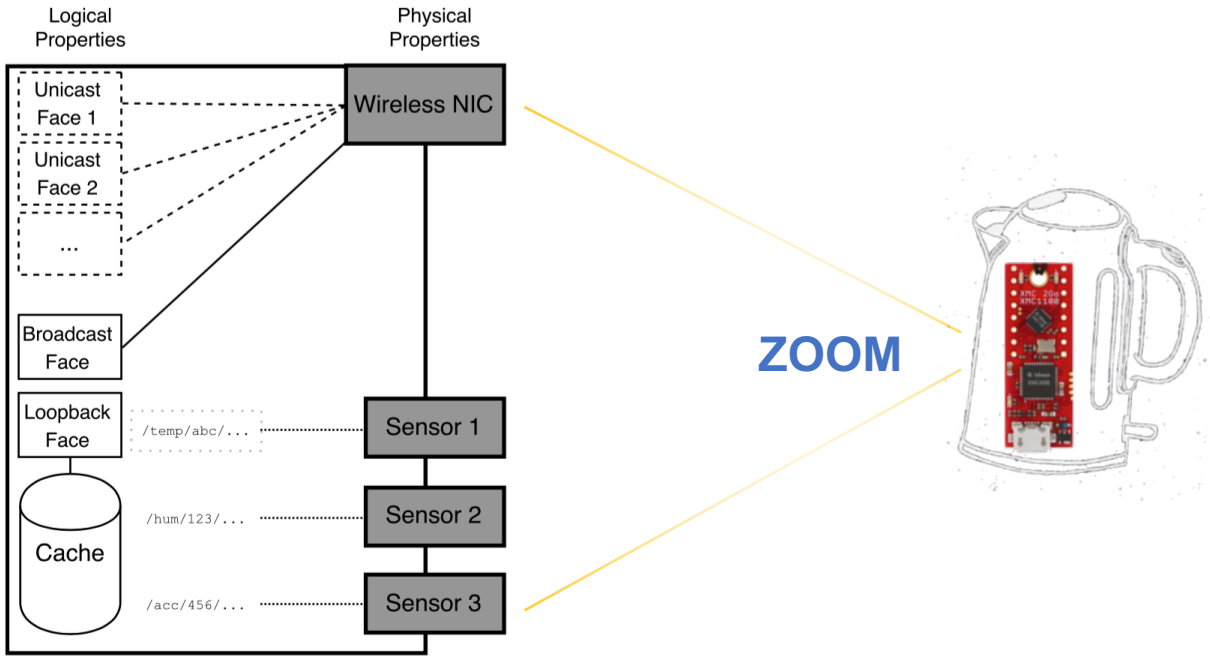
Instead of connection between machines & addresses

⇒**Any network element can cache content on the fly**

Instead of only forwarding user traffic



Low-end IoT Devices running ICN (NDN)



E.Baccelli, C. Mehlis, O. Hahm, TC Schmidt, M. Wählisch, ”Information centric networking in the IoT: Experiments with NDN in the wild,” in ACM ICN, Sept. 2014.

Opportunity I: Memory Footprint

RIOT on Cortex-M3

Hardware	ROM	RAM
CoAP + RPL + 6LoWPAN	48.5 kB	10.7 kB
NDN	15.6 kB	2.7 kB

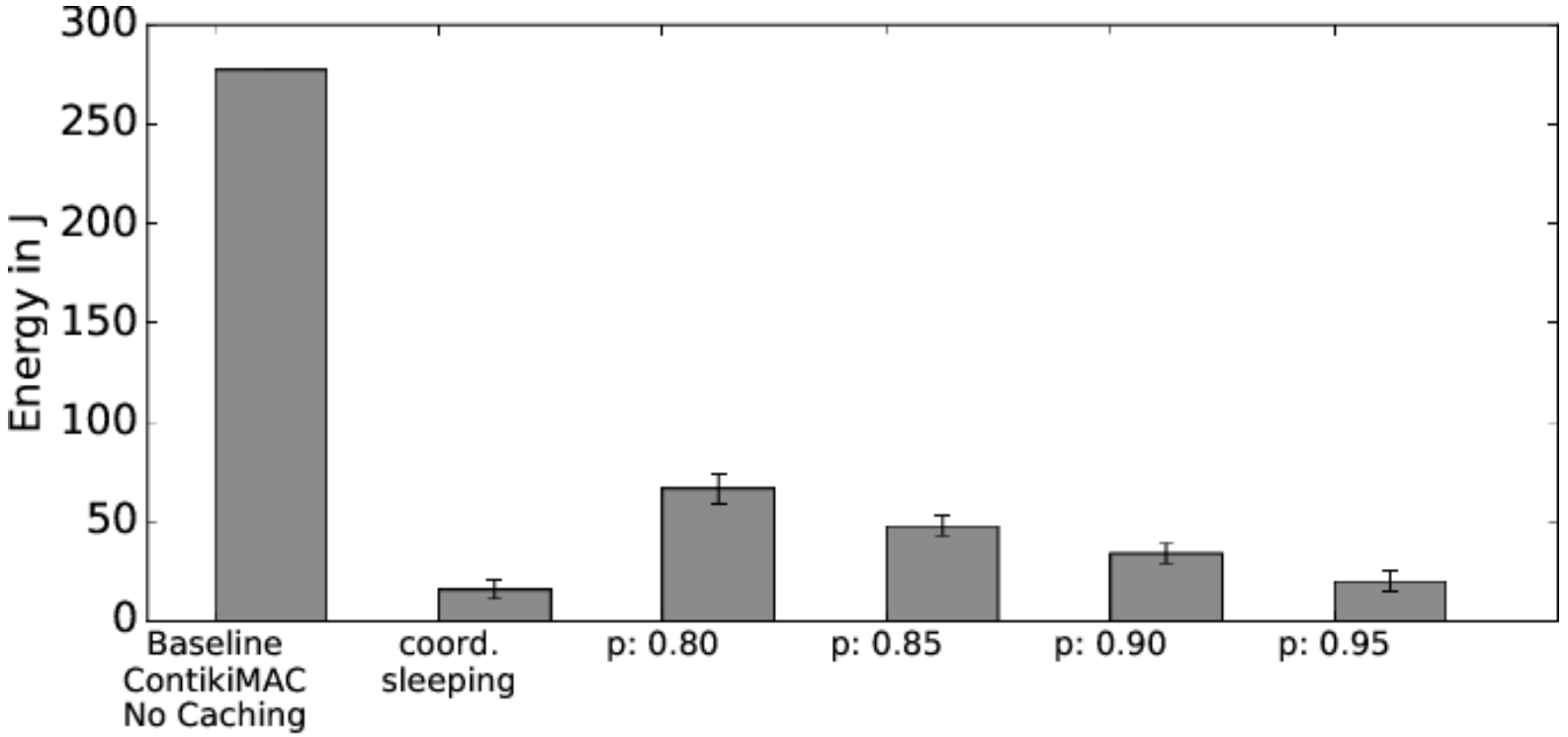
RIOT on ARM7

Hardware	ROM	RAM
CoAP + RPL + 6LoWPAN	78.6 kB	8.8 kB
NDN	22.2 kB	3.5 kB

Contiki on ARM7

Hardware	ROM	RAM
CoAP + RPL + 6LoWPAN	61.3 kB	16.5 kB
CCN	13 kB	5.7 kB

Opportunity II: Caching to reduce energy consumption



Challenge I: Autoconfiguration

- Names have to be
  - unique
  - meaningful
- How to generate names for (transient) content?
- How to fill FIB?

Challenge II: Push traffic

- Many IoT scenarios require push notification (e.g., alerts)
- ICN natively does not support push traffic
- Typical workarounds:
  - Interest-Interest
  - Permanent PIT entries
  - Encapsulation into names
- Pub-Sub Deployment option (`draft-gundogan-icnrg-pub-iot`)

  currently discussed in *ICNRG*

Challenge III: Header size

- Names may get long
- Packet sizes are constrained (e.g., 127 bytes for IEEE 802.15.4)
- Potential solution: use header compression, similar to 6LoWPAN (c.f. `draft-gundogan-icnrg-ccnlowpan`)

Thanks. Questions?