Why IoT with ICN?

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Zühlke

IoT over ICN Tutorial @ ACM ICN 2017
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IoT: Connecting the Physical World & Internet

Micro- & Nano Satellites

Connected Vehicles

Smart Homes

eHealth

Industrial Automation

IoT over ICN Tutorial @ ACM ICN 2017
Internet

IoT Devices: High-end vs Low-end

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)

Opportunity I: Memory Footprint

### RIOT on Cortex-M3

<table>
<thead>
<tr>
<th>Hardware</th>
<th>ROM</th>
<th>RAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoAP + RPL + 6LoWPAN</td>
<td>48.5 kB</td>
<td>10.7 kB</td>
</tr>
<tr>
<td>NDN</td>
<td>15.6 kB</td>
<td>2.7 kB</td>
</tr>
</tbody>
</table>

### RIOT on ARM7

<table>
<thead>
<tr>
<th>Hardware</th>
<th>ROM</th>
<th>RAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoAP + RPL + 6LoWPAN</td>
<td>78.6 kB</td>
<td>8.8 kB</td>
</tr>
<tr>
<td>NDN</td>
<td>22.2 kB</td>
<td>3.5 kB</td>
</tr>
</tbody>
</table>

### Contiki on ARM7

<table>
<thead>
<tr>
<th>Hardware</th>
<th>ROM</th>
<th>RAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoAP + RPL + 6LoWPAN</td>
<td>61.3 kB</td>
<td>16.5 kB</td>
</tr>
<tr>
<td>CCN</td>
<td>13 kB</td>
<td>5.7 kB</td>
</tr>
</tbody>
</table>
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?