CCNx in Every Sensor
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CCNx in Every Sensor

Bilel SAADALLAH, Abdelkader LAHMADI, Olivier FESTOR

Context and Motivation

- Growth of interest in ICNs
- Large expansion of IoT and WSN

Can CCNx be used as the core protocol in WSN applications?

Challenges

Protocol adaptation
- Develop a fully operational CCN communication stack
- Adjust CCN messages and optimize Interest for reused data collection
- Overcome the IEEE 802.15.4 frame size limit (102 bytes for payload)

Management applications adaptation
- Collect desired management content
- Monitoring-oriented naming scheme
- Apply in-network processing functions for data aggregation
- Minimize communication overhead
- Improve delivery speed and reduce congestion

Approach

Contiki Operating System: http://www.contiki-os.org/
- The Open Source Operating System for the Internet of Things
- Contiki allows tiny, battery-operated low-power systems communicate with the Internet
- Providing several communication stacks

CCNx Stack in Contiki

- Implements CCN processing functions, message forwarding and data caching
- Manages event posting to processes
- CCN Driver: handles message exchange with the lower layer

- Hierarchical names with components of arbitrary lengths
- Names in URI representation
- Content storage at intermediate nodes

Message Adaptation

- Simplify Interest and Content Object messages

<table>
<thead>
<tr>
<th>Layer</th>
<th>Examples of Stacks/Protocols</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>HTTP</td>
</tr>
<tr>
<td>Transport</td>
<td>TCP/UDP, CCN</td>
</tr>
<tr>
<td>Network</td>
<td>uiP/Rime</td>
</tr>
<tr>
<td>MAC</td>
<td>CSMA</td>
</tr>
<tr>
<td>RDC (Radio Duty Cycling)</td>
<td>X-MAC/ContikiMAC</td>
</tr>
<tr>
<td>Physical</td>
<td>IEEE 802.15.4</td>
</tr>
</tbody>
</table>

Summary

- C language CCNx stack in Contiki

Interested in getting the code, please contact: abdelkader.lahmadi@loria.fr

Experiment & Results

Topology

Parameters

- Available content at each node $N_i$: temperature, humidity, battery, light, RSSI, ETX
- 180 seconds between two collection requests to every node
- Interest with prefix /COLLECT/$N_i$ to collect data from node $i$
- Content updated every 70 seconds at each node $N_i$

Delivery Delays

<table>
<thead>
<tr>
<th>Node</th>
<th>1st Round</th>
<th>2nd Round</th>
<th>3rd Round</th>
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<tr>
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<tr>
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