CCNx in Every Sensor
Bilel Saadallah, Abdelkader Lahmadi, Olivier Festor

To cite this version:
Bilel Saadallah, Abdelkader Lahmadi, Olivier Festor. CCNx in Every Sensor. CCNx Community Meeting - 2012, Sep 2012, INRIA Sophia Antipolis, France. hal-00747041

HAL Id: hal-00747041
https://inria.hal.science/hal-00747041
Submitted on 30 Oct 2012

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
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, CSMA</td>
</tr>
<tr>
<td>MAC</td>
<td>X-MAC/ContikiMAC</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>

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>Delay (ms)</th>
<th>1st Round</th>
<th>2nd Round</th>
<th>3rd Round</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node 1</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Node 2</td>
<td>328</td>
<td>258</td>
<td>250</td>
</tr>
<tr>
<td>Node 3</td>
<td>250</td>
<td>258</td>
<td>258</td>
</tr>
<tr>
<td>Node 4</td>
<td>328</td>
<td>258</td>
<td>258</td>
</tr>
<tr>
<td>Node 5</td>
<td>328</td>
<td>265</td>
<td>258</td>
</tr>
<tr>
<td>Node 6</td>
<td>461</td>
<td>265</td>
<td>258</td>
</tr>
<tr>
<td>Node 7</td>
<td>461</td>
<td>258</td>
<td>258</td>
</tr>
<tr>
<td>Node 8</td>
<td>461</td>
<td>258</td>
<td>258</td>
</tr>
<tr>
<td>Node 9</td>
<td>328</td>
<td>258</td>
<td>258</td>
</tr>
</tbody>
</table>

Summary

- C language CCNx stack in Contiki

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