Agenda

Motivation

CCN-LoWPAN

Update & WIP
Motivation: Constrained CCN of Things

Objectives

- Connect Things to CCN
- Native CCN deployment
  - No ICN-over-X or X-over-ICN
- Benefit from caching in LLN
  - Content distribution
  - Retrans. using less hops
  - Longer sleep cycles
Problems: CCN on IEEE 802.15.4

1. No protocol identifier in IEEE 802.15.4 header
   - CCN–foo coexistence in wireless medium?
     foo \( \in \{IPv4, IPv6, 6LoWPAN, \ldots\} \)

2. Small-sized MTU (127 bytes)
   a) Header overhead for Interest and Data
      - High verbosity & TLV-based header fields
      - Data: \( \approx 40 \) bytes signature and TLVs for SHA-256 with HMAC
   b) No link fragmentation
Agenda

Motivation

CCN-LoWPAN

Update & WIP
CCN-LoWPAN

1) IEEE 802.15.4 dispatch types

2a) Packet header compression

2b) Link fragmentation

Device 1

Application
NDN / CCNx
CCN-LoWPAN
IEEE 802.15.4

Router
NDN / CCNx
CCN-LoWPAN
IEEE 802.15.4

Device 2

Application
NDN / CCNx
CCN-LoWPAN
IEEE 802.15.4
CCN-LoWPAN – 1) Dispatch Types

Paging dispatch for orthogonal types to 6LoWPAN
## CCN-LoWPAN – 1) New Dispatch Types

<table>
<thead>
<tr>
<th>Bit Pattern</th>
<th>Page</th>
<th>Header Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>0xxx xxxx</td>
<td>2</td>
<td>LOWPAN_CCNX</td>
</tr>
<tr>
<td>0000 0000</td>
<td>2</td>
<td>LOWPAN_CCNX_INT</td>
</tr>
<tr>
<td>0000 0xxx</td>
<td>2</td>
<td>reserved</td>
</tr>
<tr>
<td>0000 1xxx</td>
<td>2</td>
<td>LOWPAN_CCNX_INT_HC</td>
</tr>
<tr>
<td>0001 0000</td>
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<td>LOWPAN_CCNX_DATA</td>
</tr>
<tr>
<td>0001 0xxx</td>
<td>2</td>
<td>reserved</td>
</tr>
<tr>
<td>0001 1xxx</td>
<td>2</td>
<td>LOWPAN_CCNX_DATA_HC</td>
</tr>
<tr>
<td>...</td>
<td>2</td>
<td>reserved</td>
</tr>
<tr>
<td>1xxx xxxx</td>
<td>2</td>
<td>LOWPAN_NDN</td>
</tr>
<tr>
<td>1000 0000</td>
<td>2</td>
<td>LOWPAN_NDN_INT</td>
</tr>
<tr>
<td>1000 0xxx</td>
<td>2</td>
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</tr>
</tbody>
</table>
CCN-LoWPAN – 2a) Packet Header Compression

Compression Scheme

- Compression bit field marks presence of TLVs

Compression bit field

- Remove LEN for fixed-length TLV, e.g. Nonce, Signature
- Remove TYP, VAL for boolean values, e.g. MustBeFresh
CCN-LoWPAN – 2a) NDN Compr. Interest Example

- compression bit field and compressed NDN Interest
- CCN-LoWPAN parser decompresses NDN Interest
  - CCN-LoWPAN parser consumes compression bit field
  - NDN parser consumes decompressed NDN Interest
CCN-LoWPAN – 2a) Extensibility

TLV Support

- CCNx / NDN support overwhelming amount of TLVs
- Few TLVs are defined, remaining ID-fields reserved

Current State

- Compression defined for existing TLVs of CCNx and NDN
- Custom / organizational TLVs remain decompressed

Compression Extensibility

- CCN-LoWPAN reserves further dispatch types
- Define flexible compression bit field (Work-In-Progress)
CCN-LoWPAN – 2b) Link Fragmentation

- Hop-by-Hop link fragmentation for IEEE 802.15.4 MTU
  - Link fragmentation for header and payload
  - In contrast: packet fragmentation for payload (routable)

**Dispatch Types**

<table>
<thead>
<tr>
<th>IEEE 802.15.4 Header</th>
<th>Frag. Dispatch</th>
<th>Dispatch Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>compression bit field</td>
<td>compressed NDN Interest (L–V)</td>
</tr>
</tbody>
</table>

**LoWPAN Payload**

- Fragmentation dispatch of 6LoWPAN is reused
- Packet is reassembled by IEEE 802.15.4 LoWPAN parser
- CCN-LoWPAN parser receives reassembled packet
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Motivation

CCN-LoWPAN

Update & WIP
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Update since -00

- Editorial restructuring
- Added theoretical evaluation
- Reordered dispatch types table
- Extended compression bit field for signature TLVs

Work-In-Progress

- Integrate LEN into compression bit field
- Stateful compr.: Name compr. and prefix eliding
- Evaluate applicability of GHC
- Implementation in RIOT & CCN-lite