

# CCN-LoWPAN

draft-gundogan-icnrg-ccnlowpan-00

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# Agenda

Motivation

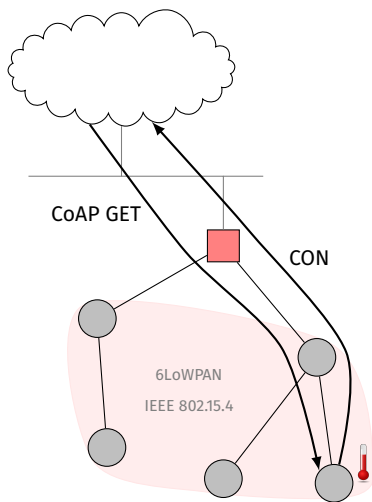
CCN-LoWPAN

Wrap Up

# Scenario: Constrained Internet of Things

## Objectives

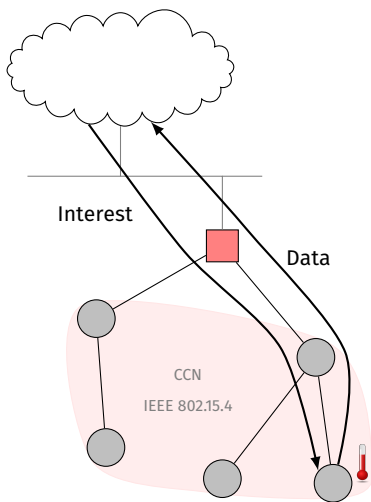
- ▶ Connect Things to Internet
- ▶ IEEE 802.15.4
  - ▶ 127 bytes MTU
  - ▶ 102 bytes max. frame size
  - ▶ AES-CCM-128 ⇒ **81 bytes**
- ▶ 6LoWPAN / RoLL / CoRE / T2TRG
  - ▶ IPv6 adaptation (6LoWPAN)
  - ▶ 6LoWPAN compr. & frag.
  - ▶ IPv6 ND ⇒ 6LoWPAN ND
  - ▶ RPL
  - ▶ CoAP



# Scenario: Constrained CCN of Things

## Objectives

- ▶ Connect Things to CCN
- ▶ IEEE 802.15.4
  - ▶ 127 bytes MTU
  - ▶ 102 bytes max. frame size
  - ▶ AES-CCM-128 ⇒ 81 bytes
- ▶ Benefit from caching in LLN
  - ▶ Longer sleep cycles
  - ▶ Retrans. with less hops
- ▶ CCN all the way



# Problem: CCN on IEEE 802.15.4

## Problems

- ▶ No protocol identifier in IEEE 802.15.4 header
  - ▶ CCN-foo coexistence in wireless medium?  
 $foo \in \{IPv4, IPv6, 6LoWPAN, \dots\}$
- ▶ Small-sized MTU of 127 bytes ( $\approx$  81 bytes payload)
  - ▶ Length of Names
  - ▶ Verbose packet headers (TLVs)
  - ▶  $\approx$  40 bytes signature in Data packet
- ▶ No link fragmentation

# Agenda

Motivation

**CCN-LoWPAN**

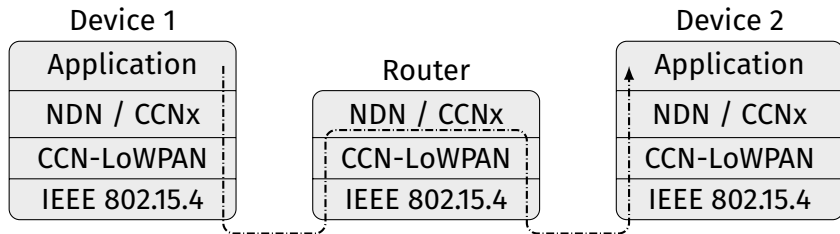
Wrap Up

# CCN-LoWPAN

1) Dispatch types for  
CCNx / NDN

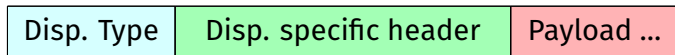
2) Packet header  
compression

3) Link  
fragmentation  
(6LoWPAN)

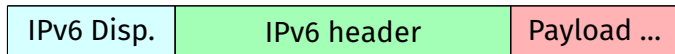


# CCN-LoWPAN: 1) Dispatch Types (6LoWPAN)

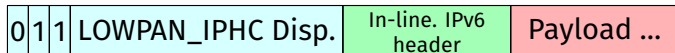
## LoWPAN Dispatch Format



## LoWPAN encapsulated IPv6



## LoWPAN encapsulated IPv6 (compressed)





## CCN-LoWPAN: 1) Existing Dispatch Types (RFC8025)

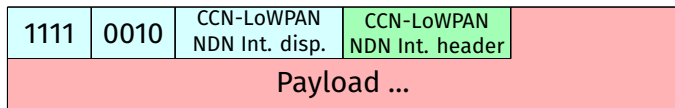
| Bit Pattern | Header Type | Page |
|-------------|-------------|------|
| 00 xxxxxx   | NALP        | 0    |
|             | Unassigned  | 1-14 |
|             | Reserved    | 15   |
| 01 000000   | ESC         | 0    |
|             | Unassigned  | 1-14 |
|             | Reserved    | 15   |
| ...         | ...         | ...  |
| 01 1xxxxx   | LOWPAN_IPHC | 0-1  |
|             | Unassigned  | 2-14 |
|             | Reserved    | 15   |
| ...         | ...         | ...  |
| 11 11xxxx   | Page Switch | 0-15 |

## CCN-LoWPAN: 1) New Dispatch Types

| Bit Pattern | Header Type                       | Page |
|-------------|-----------------------------------|------|
| 0000 0000   | Uncompr. CCNx Header (Interest)   | 2    |
| 0000 0001   | Uncompr. CCNx Header (Data)       | 2    |
| 0000 0010   | Uncompr. NDN Header (Interest)    | 2    |
| 0000 0011   | Uncompr. NDN Header (Data)        | 2    |
| 0001 0000   | CCN-LoWPAN CCNx Header (Interest) | 2    |
| 0001 0001   | CCN-LoWPAN CCNx Header (Data)     | 2    |
| 0001 0010   | CCN-LoWPAN NDN Header (Interest)  | 2    |
| 0001 0011   | CCN-LoWPAN NDN Header (Data)      | 2    |

# CCN-LoWPAN: 1) Dispatch Types Example

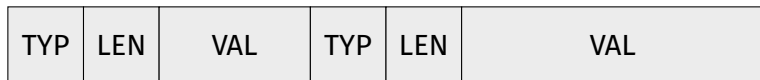
LoWPAN encapsulated CCN-LoWPAN (Page 2 Dispatch)



## CCN-LoWPAN: 2) Packet Header Verbosity

### CCNx / NDN

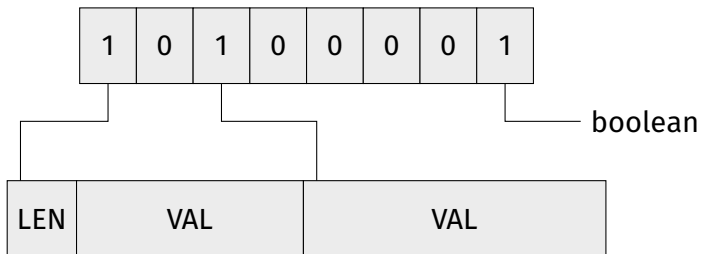
- ▶ Type–Length–Value (TLV) based
- ▶ Fixed order of TLVs
- ▶ Verbose, e.g. name components & boolean TLV



# CCN-LoWPAN: 2) Packet Header Compression

## Compression Scheme

- ▶ Remove superfluous TYP, LEN and VAL



## CCN-LoWPAN: 2) Packet Header Compression (cont.)

### Example: NDN Interest

Interest ::= INTEREST-TYPE TLV-LENGTH

Name  
Selectors?  
Nonce  
InterestLifetime?  
ForwardingHint?

Selectors ::= SELECTORS-TYPE TLV-LENGTH

MinSuffixComponents?  
MaxSuffixComponents?  
PublisherPublicKeyLocator?  
Exclude?  
ChildSelector?  
MustBeFresh?

# CCN-LoWPAN: NDN Int. Specific Compression

## CCN-LoWPAN Header for NDN Interest

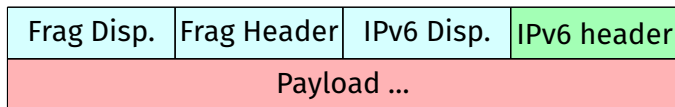
|       |       |     |      |       |       |       |      |
|-------|-------|-----|------|-------|-------|-------|------|
| minSx | maxSx | ppk | excl | ChSel | fresh | IntLt | resv |
|-------|-------|-----|------|-------|-------|-------|------|

## CCN-LoWPAN for NDN Interest

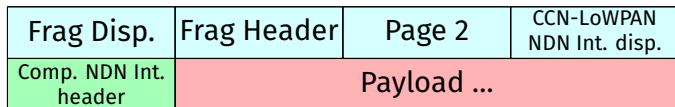
|                      |                              |                               |  |
|----------------------|------------------------------|-------------------------------|--|
| Page 2               | CCN-LoWPAN<br>NDN Int. disp. | CCN-LoWPAN<br>NDN Int. header |  |
| Length-Value Payload |                              |                               |  |

## CCN-LoWPAN: 3) Link Fragmentation

Fragmented, LoWPAN encapsulated IPv6



Fragmented CCN-LoWPAN





# Agenda

Motivation

CCN-LoWPAN

Wrap Up

# Wrap Up

## Summarized highlights of CCN-LoWPAN

- ▶ Specific dispatch types for IEEE 802.15.4
- ▶ Header compression scheme
- ▶ Link fragmentation from 6LoWPAN

# Draft Status

- ▶ -00 submitted on 2017-09-23
- ▶ Question: Split into parts ?
  - ⇒ LoWPAN adaptation & compression