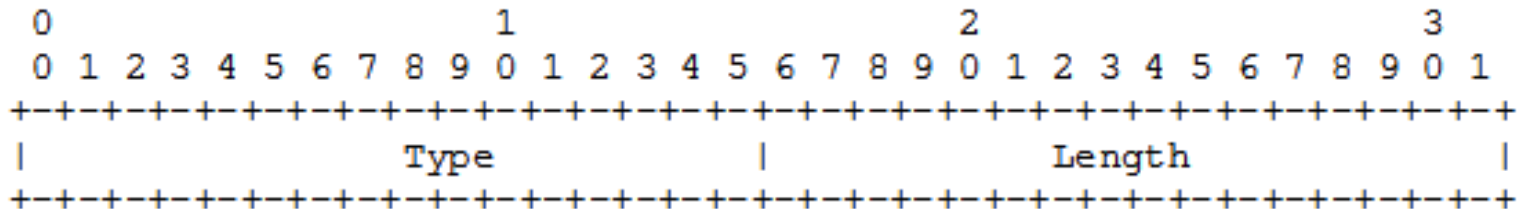# Update on our experimental Wire-speed CCN / NDN packet format.
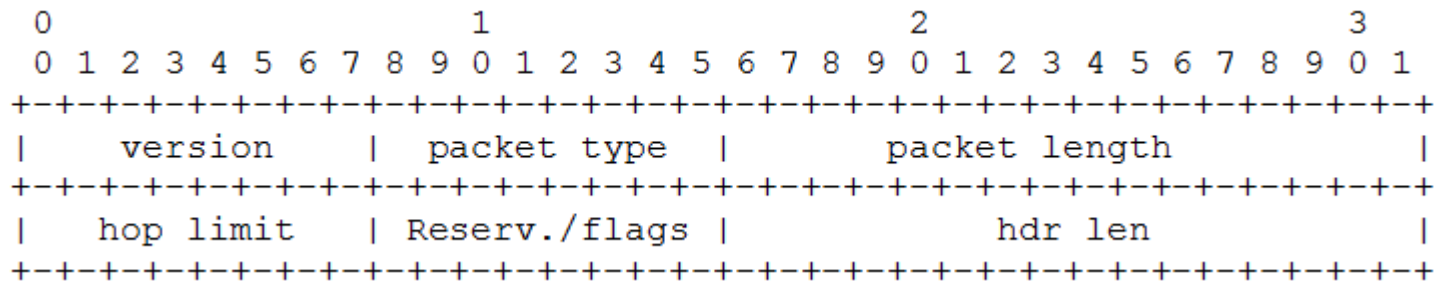
Massimo GALLO

13 January 2015

- We had 4 different TLV types discriminated through first 2 bits:
    - 00 with one Byte for the Type and one Byte for the Length (1B-1B)
    - 01 with one Byte for the Type and one Byte for the Length (1B-2B)
    - 10 with one Byte for the Type and one Byte for the Length (2B-1B)
    - 11 with one Byte for the Type and one Byte for the Length (2B-2B)

- We limit TLV types to the latter one 2B-2B for simplicity.:
    - Avoid aliasing,
    - simpler parsing.
    - If needed we can add further TLV types later.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                 Type            |             Length          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

- Fixed header (Convergence Layer)
- Hop-by Hop fragmentation/reassembly is required but not yet defined :
  - May use additional fixed header fields (through hdr length and / or reserved)
    1. Variable length (optional Hop-by-Hop TLVs) ?
    2. fixed length (additional fields)?
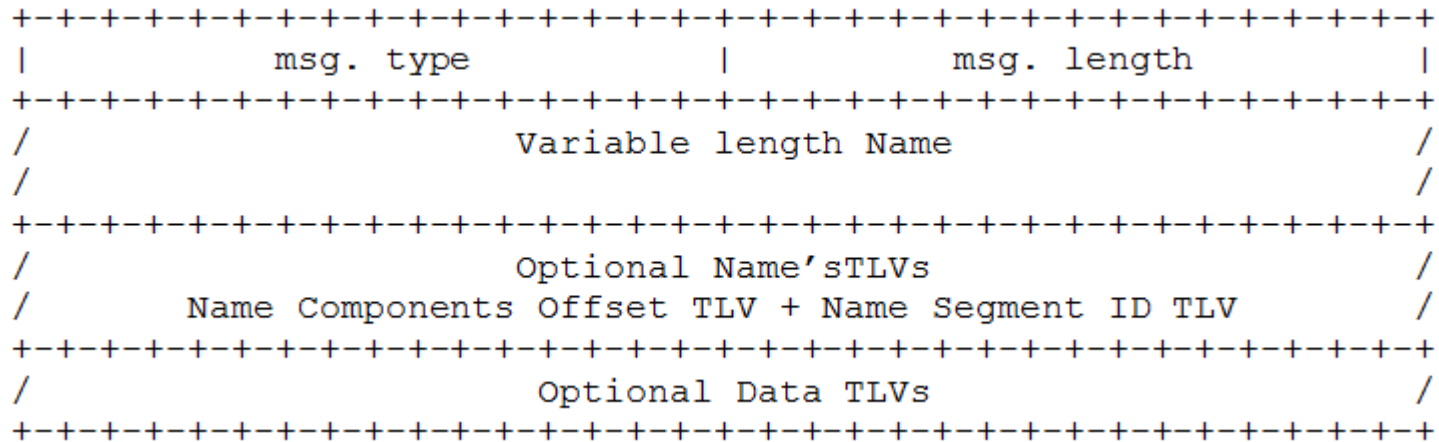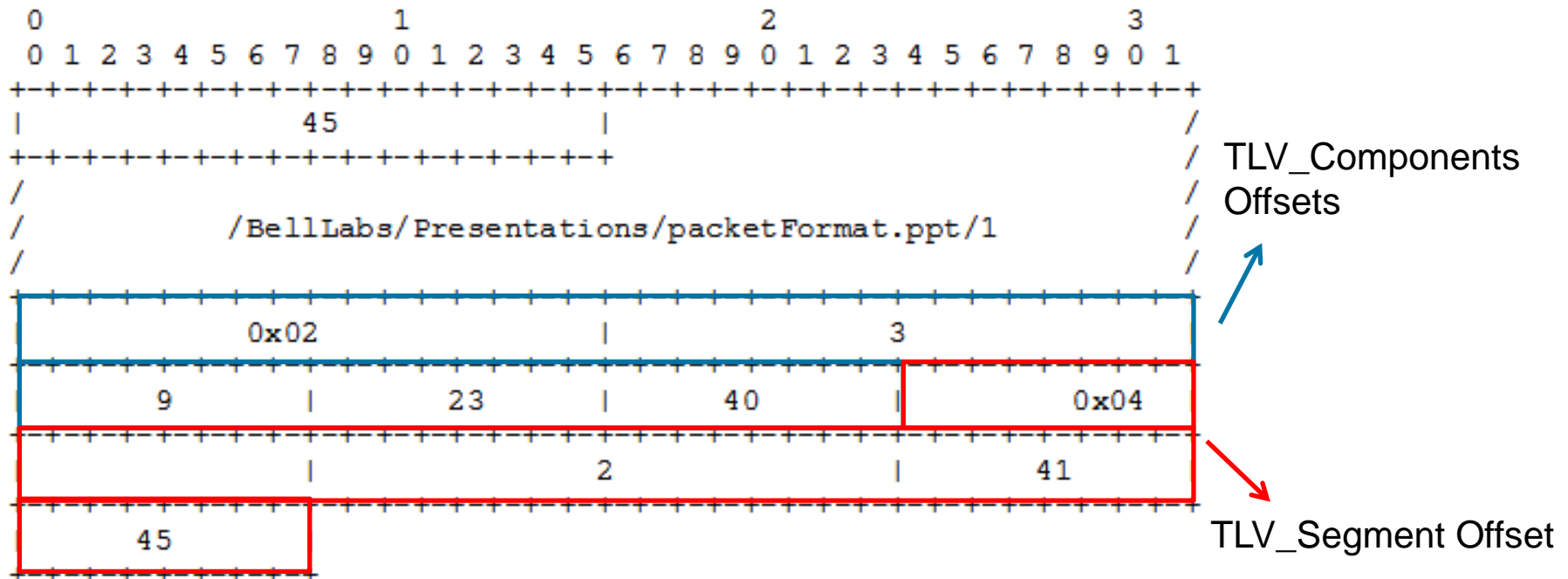 - Reassembly is mandatory for both data and interests

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     version    |   packet type  |          packet length       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   hop limit    | Reserv./flags  |             hdr len          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              msg. type             |            msg. length            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
/                      Variable length Name                      /
/                                                                /
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
/                       Optional Name'sTLVs                      /
/         Name Components Offset TLV + Name Segment ID TLV       /
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
/                            NONCE TLV                           /
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
/                      Optional Interest TLVs                    /
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

- A TLV for the name is not required.
- Due to Hop-By-Hop fragmentation and reassembly through the fixed header, msg. Type and msg. Length are needed
- Nonce is mandatory and inserted after the name
  - Used to prevent loops coupled with name (only associated to a PIT entry, any specific data structure)

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|            msg. type            |            msg. length        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
/                      Variable length Name                      /
/                                                                /
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
/                      Optional Name'sTLVs                       /
/        Name Components Offset TLV + Name Segment ID TLV         /
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
/                      Optional Data TLVs                        /
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

- Fixed Header is the same of Interest
- NONCE is not needed
- Signature and security TLVs (Signature is mandatory)

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                 45                    |                       /
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+                       /
/                                                               /
/             /BellLabs/Presentations/packetFormat.ppt/1        /
/                                                               /
```

TLV_Components Offsets

```
0x02          |              3
   9    |      23     |      40    |        0x04
        |         2        |      41
  45
```

TLV_Segment Offset

- No TLV inside a name container. Field (component) separator needed
- Offset TLV contains the list of offsets of the different components 2B (or 1B depending on the compact/extended Component offset TLV used) :
  - Fast parsing form Exact Match (PIT, CS) and LPM (FIB)
  - Name segment id is encoded with a numeric type (i.e. 4byte unsigned int)
  - Other *special* components (e.g., version) may be added similarly to segm id)

- Intel DPDK version of our content router (credits goes to L. Saino - UCL)
- General purpose server, Intel Xeon processor:
  - L1 Cache 32 KB (each core)
  - L2 Cache 256 KB (each core)
  - L3 Cache 8MB
  - Intel 82599EB 10Gbps card

- Test on FIB lookup and Hash computation+Name decoding cost
  - 60B names composed of 5 or 10 components with different Name encodings
 - FIB with 1 million prefixes

FIB Lookup, two stages approach [1]:

1. Check the Bloom filter
   (Check length n, n-1, …)

2. Check hash at identified length d
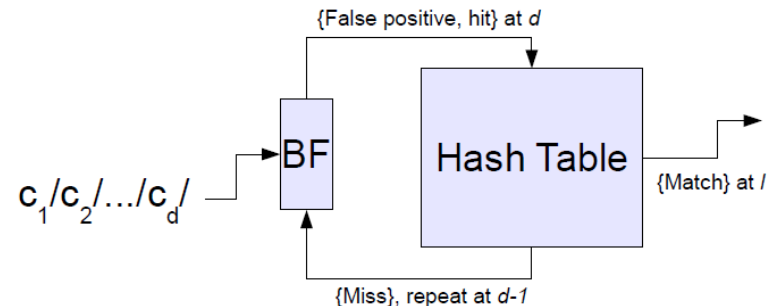
[1] D. PERINO, M. VARVELLO, L. LINGUAGLOSSA, R. LAUFER, R. BOISLAIGUE,
  "Caesar: A Content Router for High-Speed Forwarding on Content Names", ACM/IEEE ANCS 2014.

- 60B names with components 5:
- 2 name encoding under test:
  - Name +offsets (1 Byte component separator needed)
    Total length: 65B, Components length: 13B 7,6% overhead
  - Nested TLVs (T+L = 2B+2B)
    Total length: 80B, Components length: 12B (+4B of T+L). 25% overhead
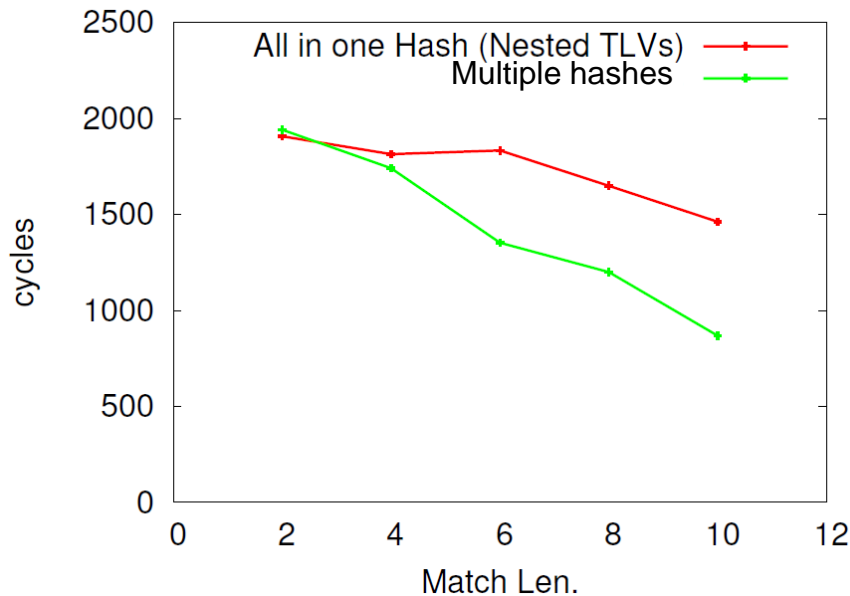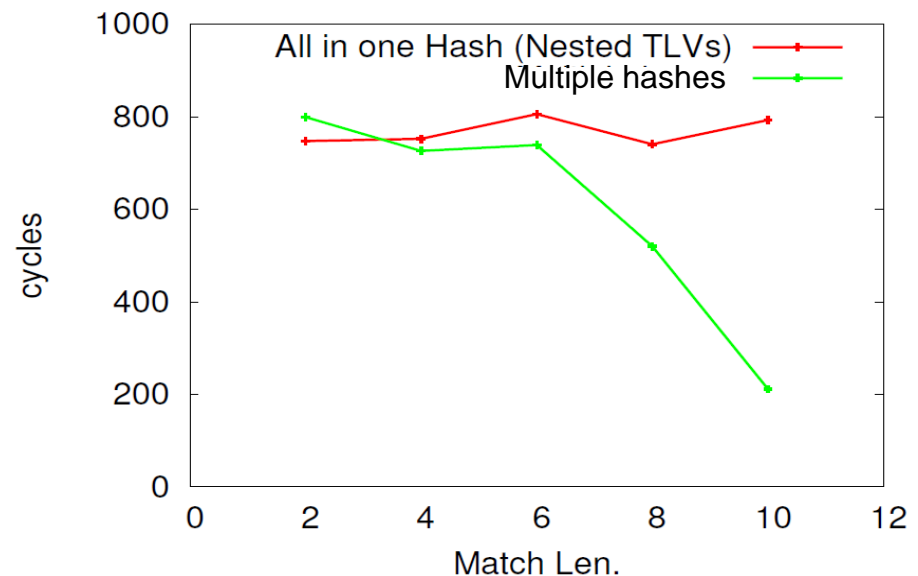
Lookup cost
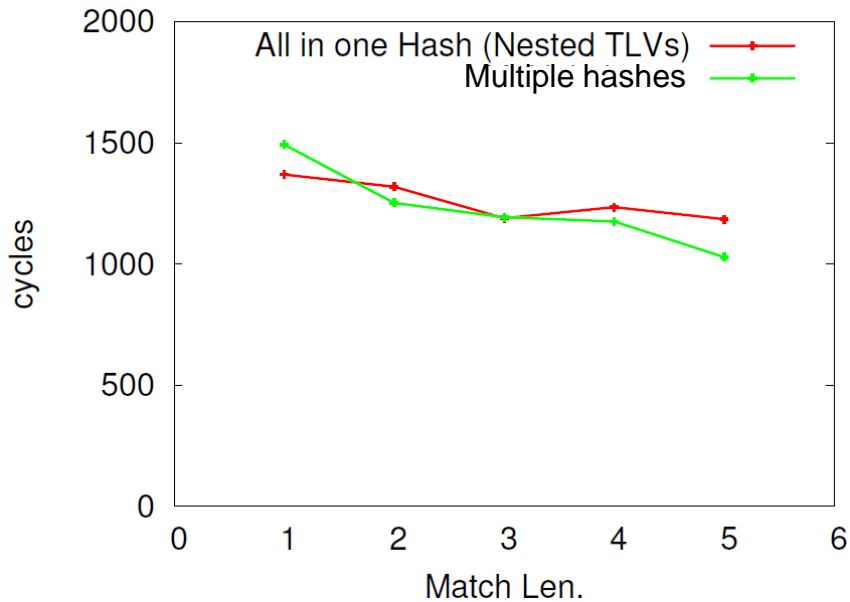
Hash + parsing cost
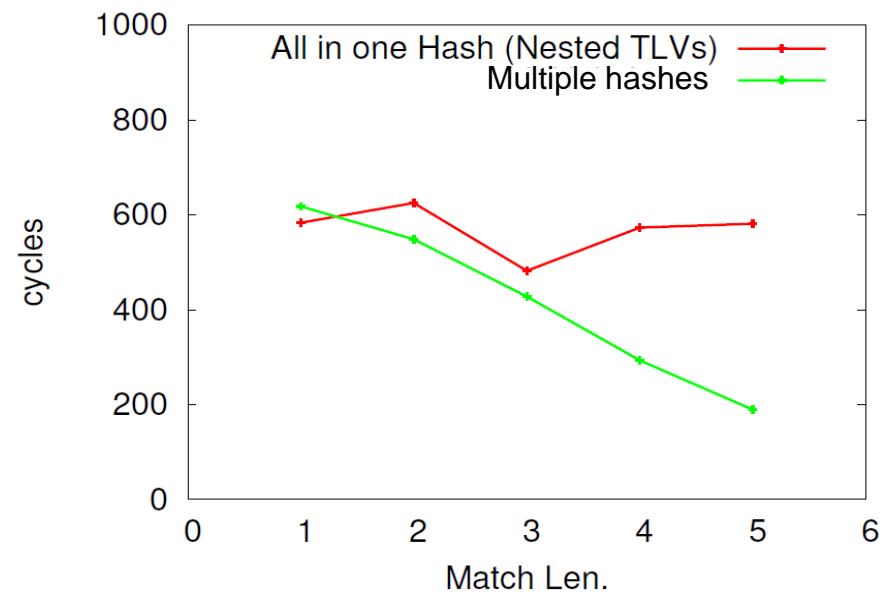
- 60B names with components 10:
- 2 name encoding under test:
    - Name +offsets (1 Byte component separator needed)
      Total length: 70B, Components length: 7B. 12.25% overhead
    - Nested TLVs (T+L = 2B+2B)
      Total length: 100B, Components length: 6B (+4B of T+L) 40% overhead

Lookup cost

Hash + parsing cost

Fixed header + extension

- Topological information (e.g., Hop limit)
- Hop-by-hop fragmentation and reassembly

Naming

- Only few type of *special* components (segment, what else?)

Under discussion

- TLV format: for the moment 2B+2B. Need more?
- Payload for Interest packet ? Not for the moment; security issues.
- ICN architecture interoperability
- Network management/processing commands