Alternative Delta Time Encoding for CCNx Using Compact Floating-Point Arithmetic

draft-gundogan-ccnx-timetlv-05
ICNRG, IETF 113

Cenk Gündoğan[1] Thomas Schmidt[1] Dave Oran[2] Matthias Wählisch[3]

[1]HAW Hamburg

[2]Network Systems Research and Design

[3]Freie Universität Berlin

March 25, 2022

Recap: Motivation

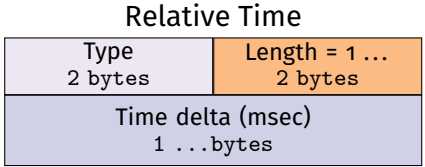
Constrained Network Characteristics

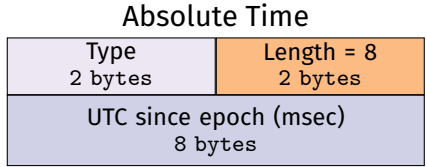
- Bandwidth is low and latency is high
- Link access is slower than intra-stack processing
- Packet transmission time dominates energy consumption

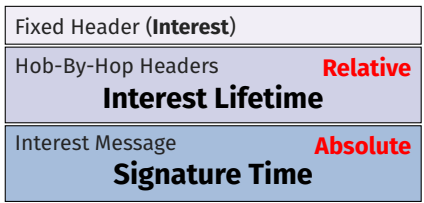
Header compression reduces energy expenditure, see **RFC9139 (ICNLoWPAN)**

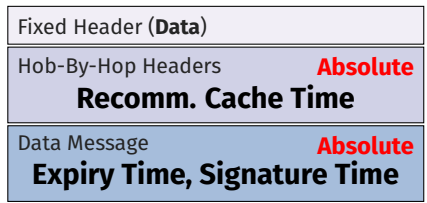
Recap: CCNx TLV Representation of Time

- Relative time: delta (milliseconds) with variable length (1 . . . bytes)
- Absolute time: UTC (milliseconds) since epoch with fixed length (8 bytes)



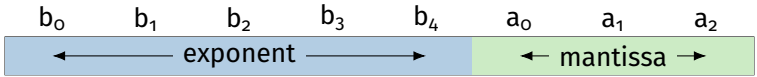






Compact Time Encoding

- Support dynamic range inspired by RFC5497 and IEEE 754
- Range from milliseconds (high precision) to years (low precision)



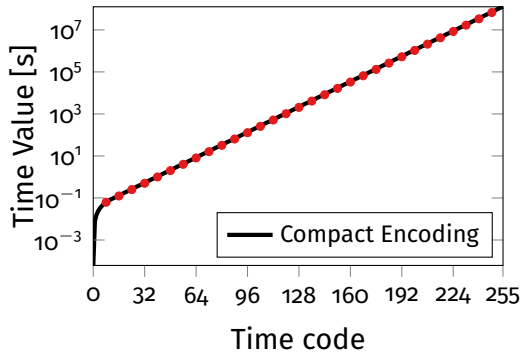
8-bit time code

$$t(a, b) = \begin{cases} \left(0 + \frac{a}{8}\right) \cdot 2 \cdot \frac{1}{32} & b = 0 \quad \text{subnormal} \quad (1) \\ \left(1 + \frac{a}{8}\right) \cdot 2^{b} \cdot \frac{1}{32} & b > 0 \quad \text{normalized} \quad (2) \end{cases}$$

time value in seconds

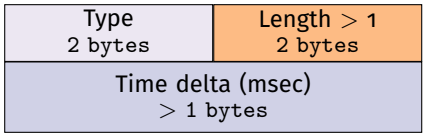
Precision and Range

Time Code	Time Value [s]	Mode
0x00	0.000000	subnormal
0x01	0.007812	subnormal
0x02	0.015625	subnormal
0x07	0.054688	subnormal
0x08	0.062500	normalized
0x10	0.125000	normalized
0x18	0.250000	normalized
0x20	0.500000	normalized
0x28	1.000000	normalized
0x30	2.000000	normalized
0xF8	67108864.000000	normalized
0xFF	125829120.000000	normalized

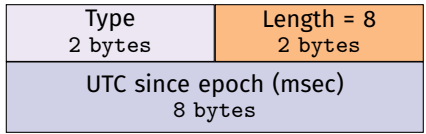


Protocol Integration

Interest Lifetime



Recomm. Cache Time



Pro: No TLV number allocation at IANA
Con: 1) RFC8609 update, 2) Time misinterpretation by unaware routers

Alternative Integration

- New top-level TLV variants, e.g., `Interest-Lifetime-Compact`

Pro: 1) No RFC8609 update, 2) No time misinterpretation
Con: TLV number allocation at IANA

Updates and Next Steps

Diff to version 3

- Describe integration for `InterestLifetime` & `Recomm. Cache Time`

Diff to version 4

- Format formula according to TimeTLV and ICNLoWPAN
- Update pseudo code
- Add `Terminology` and `Acknowledgments`

Further feedback needed on

- Protocol integration
- Expiry & Signature Time encoding

Ready for RG adoption?