An Alternative Delta Time encoding for CCNx using Interval Time from RFC 5497
draft-gundogan-ccnx-timetlv-00
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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 (cf. I-D.irtf-icnrg-icnlowpan)
CCNx Time Values

Interest

- Fixed Header
- Hob-By-Hop Headers
  - Interest Lifetime
- Interest Message
  - Signature Time

Data

- Fixed Header
- Hob-By-Hop Headers
  - Recomm. Cache Time
- Data Message
  - Expiry Time
  - Signature Time
CCNx TLV Representation of Time

- Relative time: delta (milliseconds) with variable length (1… octets)
- Absolute time: UTC (milliseconds) since epoch with fixed length (8 octets)
Compressed Relative Time Representation

- Support dynamic range inspired by RFC5497
- Range from milliseconds (high precision) to days (low precision)
- Represent large deltas using 1–2 octets

CCNx Integration

- **If TLV Length == 1 or 2:** TLV uses compressed time representation
- **Otherwise:** TLV uses normal time representation
Example Time TLV Configuration

time code using 1 octet

\[
\begin{array}{c|c|c}
\text{exponent} & b & \text{mantissa} \end{array}
\]

time value = \((1 + \frac{a}{2^{|a|}}) \cdot 2^b \cdot C\)

Example:

\[|a| = 3 \quad |b| = 5 \quad C = \frac{1}{1024}\]

\[\approx 0.9 \, ms \quad \approx 45 \, days\]
Absolute Time Compression Challenges

- Signature time can be far in the past
- Expiry time can be in the past, or in the future
- Expiry & Signature time are located in security envelope
  \[\Rightarrow\] Compressed representation can only be set by originator
Idea: Signature Time as Base Time

- Use Signature Time (if present) as base
- Use time deltas for Recomm. Cache & Expiry time

Signature Time: Mon 18 Nov 2019 01:53:54 PM UTC
Recomm. Cache Time: Signature Time + 10 minutes
Expiry Time: Signature Time + 20 days
Next Steps

- Investigate on necessary time range and precision
- Find optimal values for mantissa $a$ and exponent $b$
- Explore ideas on compressed time representation for absolute time

Progress is tracked at:
https://github.com/icnrg/draft-gundogan-icnrg-ccnx-timetlv