Packet Expiration Time in 6LoWPAN Routing Header

draft-lijo-6lo-expiration-time-00
Lijo Thomas
Akshay P.M
Satish Anamalamudi
S.V.R Anand
Malati Hegde
Charlie Perkins
lijo@cdac.in
Motivation and Background

- Delay sensitive industrial M2M IoT applications
- Packet expiration assists in meeting delay constraints in 6lo networks
- Positive response from the 6TiSCH ML 😊
  - http://www.ietf.org/mail-archive/web/6tisch/current/msg04731.html
  - http://www.ietf.org/mail-archive/web/6tisch/current/msg04742.html
- Interest from inband-oam draft authors to include packet expiration time in IPv6 Header
  - http://www.ietf.org/mail-archive/web/6tisch/current/msg04742.html
  - Packet expiration time being planned to be included as IPv6 Edge-to-Edge Option in the draft-brockners-inband-oam-data-02, section 3.3
- Applicability: 6lo, 6tisch, roll, and detnet
Overview

- TimeStamp-6LoRH type for 6LoWPAN dispatch page 1
  - Carries packet expiration time
- Enables delay aware forwarding and scheduling decisions
- Operates on time synchronized constrained networks
- Handles different time zones over heterogeneous networks
### 6LoRHC Generic Header Format

<table>
<thead>
<tr>
<th>Bit</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>X</td>
<td>1</td>
<td>TSE</td>
<td>Type</td>
<td>...........................</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **0**: Critical Header
- **1**: Elective Header
- **Type Specific Extension**: (Depending on type field)

The Length implied by Type / TSE.

### Timestamp-6LoRHC Header Format

<table>
<thead>
<tr>
<th>Bit</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>D</td>
<td>Size</td>
<td>6LoRH Type = TBD</td>
<td>Expiration time in micro seconds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Under time expiration:
  - **1**: Drop
  - **0**: Best-effort forwarding

Expiration time in octets.

The Length implied by Size field (Maximum length: 64 Bits).

**Expiration Time** = Packet Origination Time (POT) + Max Delay

For 6TiSCH network, POT is Current ASN * Slot length (micro seconds)
End Points within same 6LBR (Non-storing)

Scenario-1

- Sender includes Timestamp-6LoRH Header
  - Goes into outer IP header (draft-ietf-roll-useofrplinfo-09.txt, Section 6.9)
- 6LR reads expiration time for forwarding and scheduling
- 6LBR, before forwarding to receiver
  - Generates an IPv6-in-IPv6 encapsulated packet
  - Copies Timestamp-6LoRH header to outer IP Header
End Points on Different Time Synchronized Networks

Scenario-2

- Sender includes Timestamp-6LoRH Header
  - Goes into outer IPv6 header (draft-ietf-roll-useofrplinfo-09.txt, Section 6.5)
- 6LR reads expiration time for forwarding and scheduling
- 6LBR
  - Computes the Remaining Time (RT)
  - Removes outer IP header (draft-ietf-roll-useofrplinfo-09.txt, Section 6.5)
  - RT is encoded into In-band OAM Edge to Edge option for further routing
- Post Routing: Expiration Time (ET) in In-band OAM is updated
  - ET = RT + COut (Current time of the outgoing interface)
End Points across 6LBRs (Non-storing)

Scenario-3

- Sender includes Timestamp-6LoRH Header
- 6LR reads expiration time for forwarding and scheduling
- 6LBR of Sender
  - Computes the remaining time, RT
  - Performs the same operation as Scenario 2
- At 6LBR of the Receiver
  - Updates the Timestamp-6LoRHC header with current time of DODAG2
  - Forwards IPv6-in-IPv6 encapsulated packet to the Receiver
Next Steps

• Comments and Questions

Thanks!