Packet Expiration Time in 6LoWPAN Routing Header

draft-lijo-6lo-expiration-time-00
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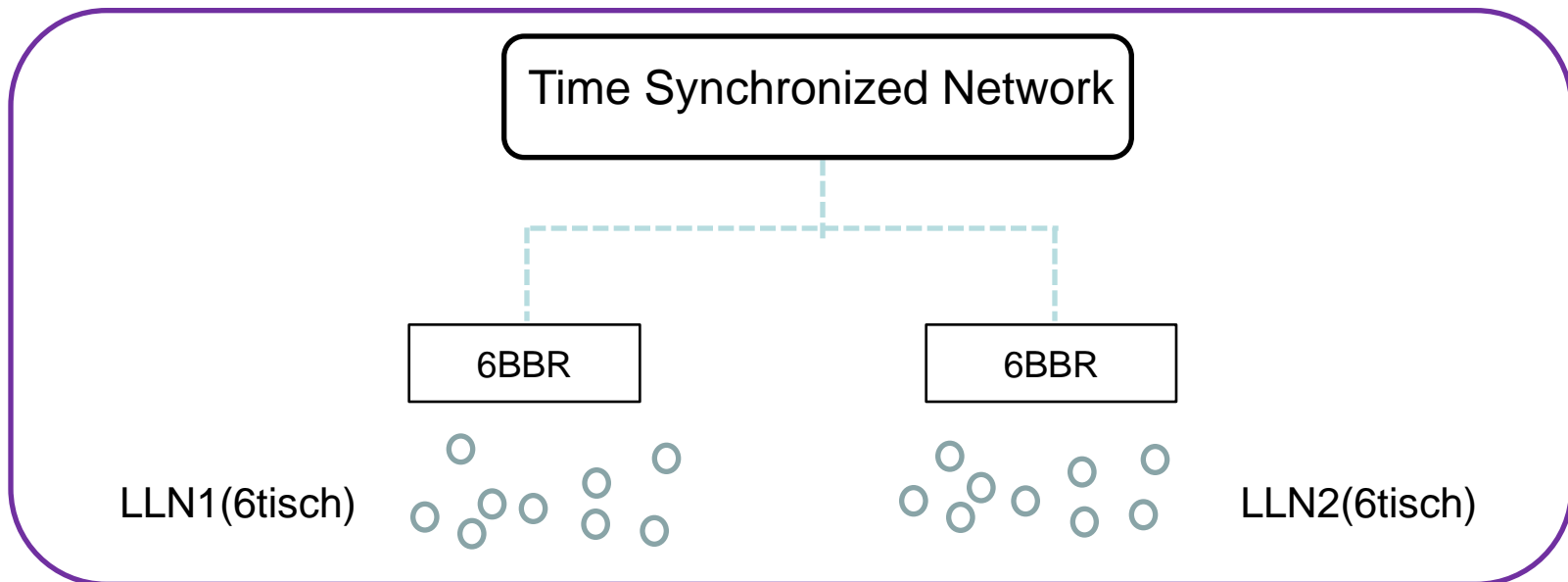Charlie Perkins
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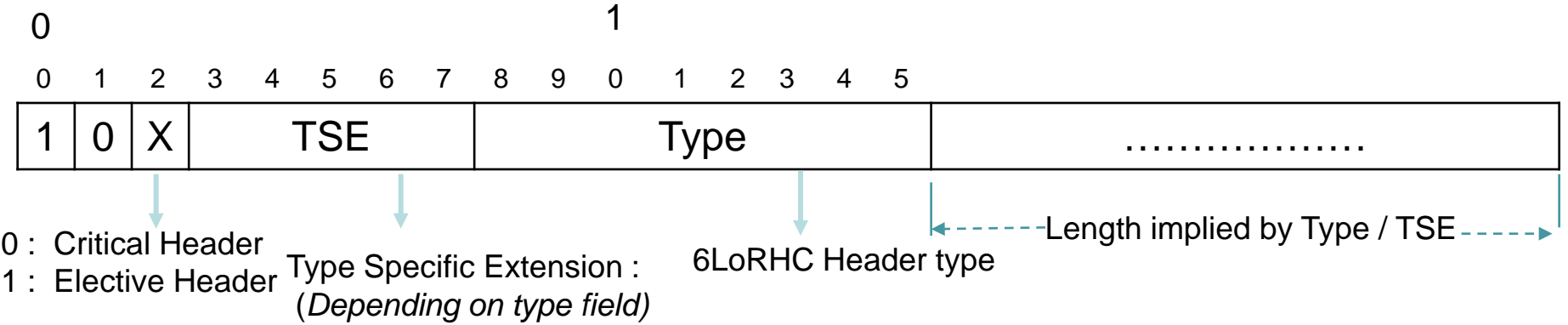
Motivation and Background

- 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
    - https://tools.ietf.org/html/draft-brockners-inband-oam-data-02
    - 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
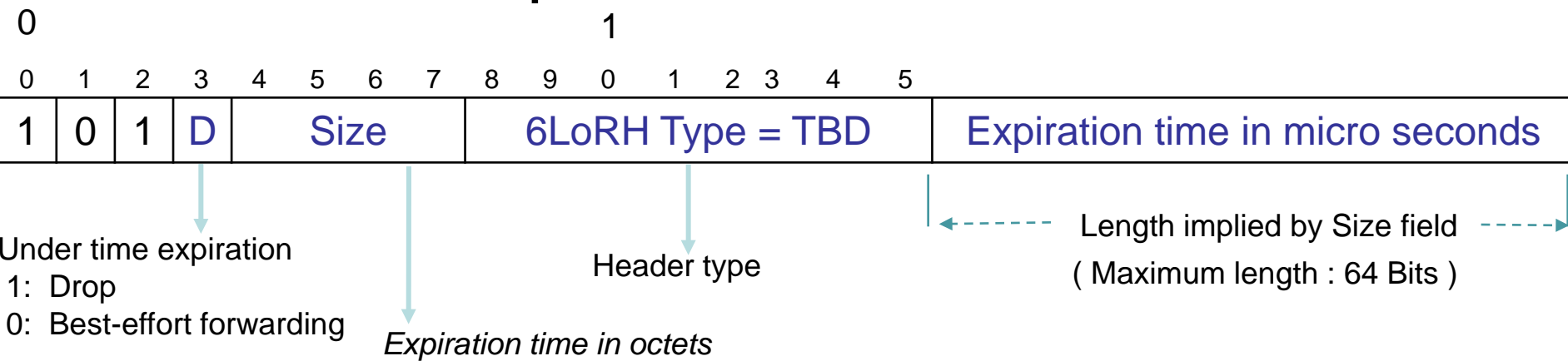- Applicability *:* 6lo, 6tisch, roll, and detnet

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 heterogenous networks

6LoRHC Generic Header Format

```
0                            1
0  1  2  3  4  5  6  7  8  9  0  1  2  3  4  5
┌──┬──┬──┬──────────────┬──────────────────┬──────────────────┐
│ 1│ 0│ X│     TSE      │      Type        │ ……………… │
└──┴──┴──┴──────────────┴──────────────────┴──────────────────┘
```

0 : Critical Header
1 : Elective Header

Type Specific Extension :
(*Depending on type field*)

6LoRHC Header type

Length implied by Type / TSE

Timestamp-6LoRHC Header Format

```
0                            1
0  1  2  3  4  5  6  7  8  9  0  1  2  3  4  5
┌──┬──┬──┬──┬──────────────┬──────────────────┬──────────────────┐
│ 1│ 0│ 1│ D│    Size      │  6LoRH Type = TBD │ Expiration time in micro seconds │
└──┴──┴──┴──┴──────────────┴──────────────────┴──────────────────┘
```

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

Expiration time in octets

Header type

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

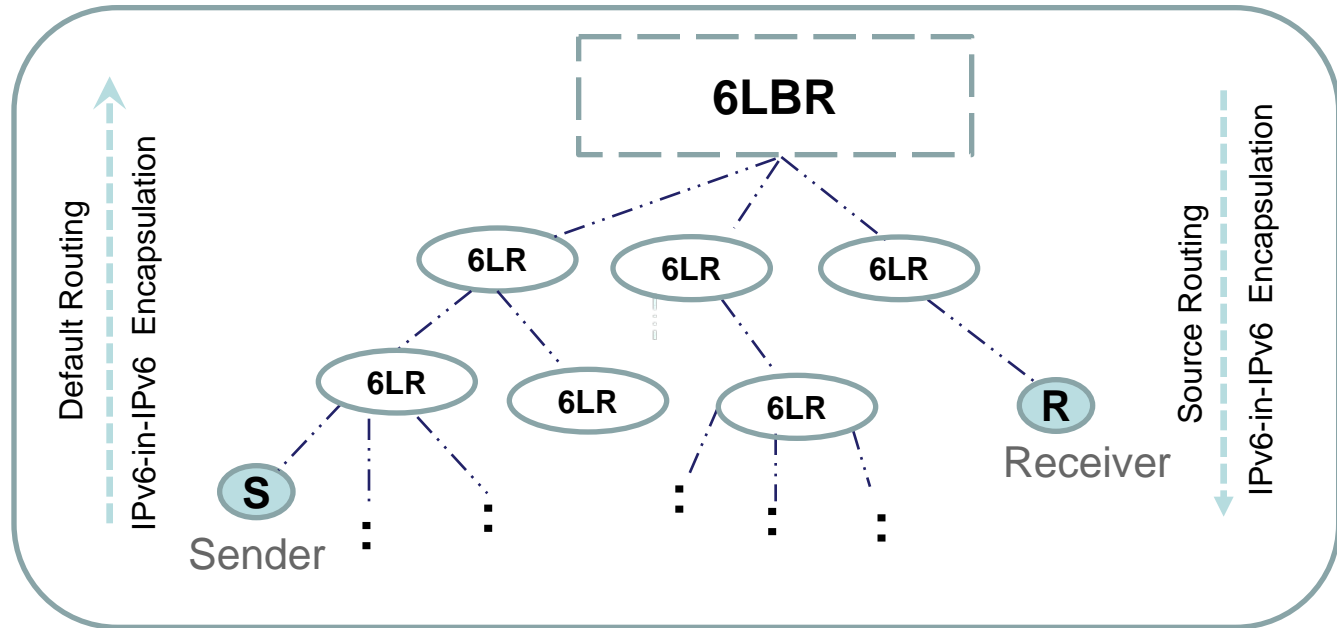**Expiration Time** = Packet Origination Time(POT) **+** Max Delay

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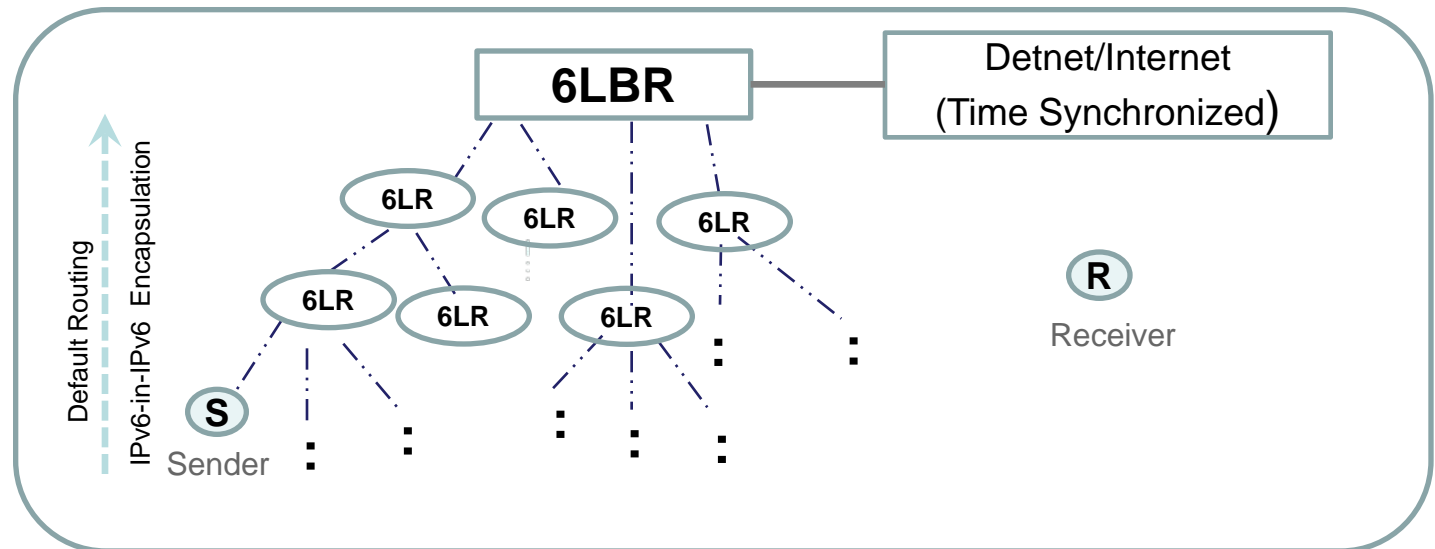
End Points within same 6LBR(Non-storing)

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 + CTout (Current time of the outgoing interface)

End Points across 6LBRs(Non-storing)

Scenario-3
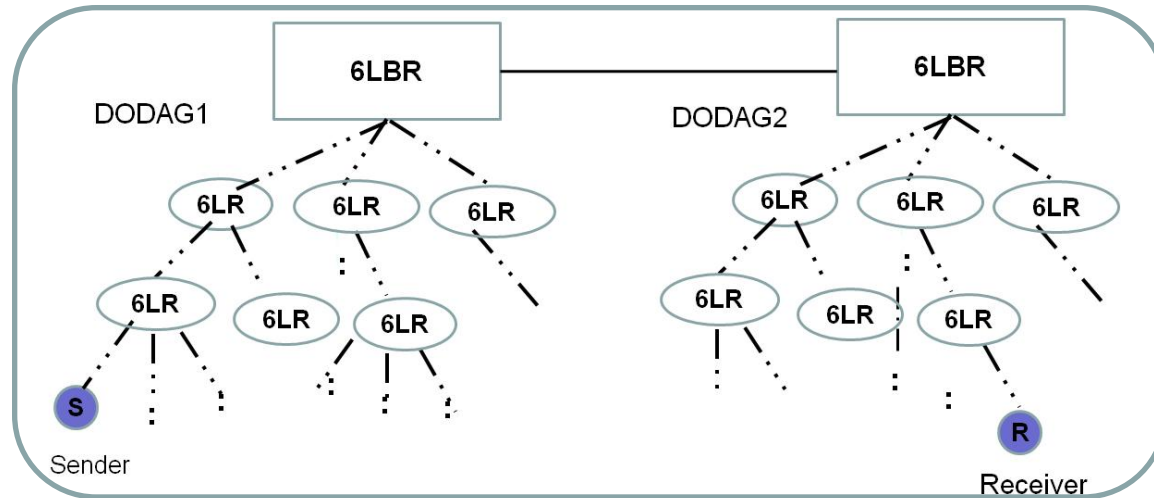
- Sender includes Timestamp-6LoRH Header
- 6LR reads expiration time for forwarding and scheduling
- 6LBR of Sender
  - Computes the remaining time, RT
  - Performs the same operation as Scenario 2
- At 6LBR of the Receiver
  - Updates the Timestamp-6LoRHC header with current time of DODAG2
  - Forwards IPv6-in-IPv6 encapsulated packet to the Receiver

Next Steps

- Comments and Questions

Thanks!