Optimized 6LoWPAN Fragmentation Header for LPWAN

draft-gomez-lpwan-fragmentation-header-01

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Motivation (I/II)

• 6LoWPAN fragmentation (RFC 4944)
  – IPv6 MTU requirement (1280 bytes)
  – IEEE 802.15.4 (maximum frame size of 127 bytes)
    • 4-byte header (1st fragment)
    • 5-byte header (subsequent fragments)

• However, some LPWAN technologies:
  – Lack of L2 fragmentation support
  – Maximum payload size one order of magnitude less
  – Bit rate several orders of magnitude less
  – Further limited message rate
    • E.g. due to regulatory constraints on the duty cycle
Motivation (II/II)

• RFC 4944 fragmentation header
  – May represent high overhead for LPWAN

• Furthermore, the RFC 4944 offset field is expressed in increments of 8 octets
  – Only supports L2 payload size $\geq$ 13 bytes
  – However, there are LPWAN technologies with a shorter maximum payload size
Proposed new format

- 6LoWPAN Fragmentation Header for LPWANs (6LoFHL)
- First fragment
  
  ![First Fragment Diagram]

- Subsequent fragments
  
  ![Subsequent Fragments Diagram]
Changes from RFC 4944 and rationale

• datagram_size field only included in the first fragment
  – Reordering is less likely in (star topology) LPWAN than in a mesh network
  – The format still supports reordering...

• datagram_tag field size reduced to 1 byte
  – Ambiguities due to wrapping not expected
    • Low message rate in LPWAN

• datagram_offset increased from 8 bits to 11 bits
  – Allows to express the offset in 1-byte increments
Benefits of 6LoFHL (I/II)

- Simple, byte-exact, short format
  - Supports maximum L2 payloads ≥ 4 bytes
- Overhead (L2 data units)

<table>
<thead>
<tr>
<th>L2 payload (bytes)</th>
<th>IPv6 datagram size (bytes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11</td>
</tr>
<tr>
<td>10</td>
<td>4944</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
</tr>
</tbody>
</table>
Benefits of 6LoFHL (II/II)

- Overhead (adaptation layer fragmentation header bytes)

<table>
<thead>
<tr>
<th>L2 payload (bytes)</th>
<th>IPv6 datagram size (bytes)</th>
<th>11</th>
<th>40</th>
<th>100</th>
<th>1280</th>
</tr>
</thead>
<tbody>
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<td>45</td>
<td>768</td>
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<td>0</td>
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<td>12</td>
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<td>0</td>
<td>19</td>
<td>9</td>
<td>59</td>
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<td>0</td>
<td>14</td>
<td>6</td>
<td>34</td>
<td>15</td>
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<tr>
<td>30</td>
<td>0</td>
<td>9</td>
<td>6</td>
<td>24</td>
<td>12</td>
</tr>
</tbody>
</table>
Several considerations

• IANA: 6LoFHL allocates 16 Dispatch values:
  – 11001 000 through 11001 111
  – 11010 000 through 11010 111

• Security considerations
  – TBD
Thanks!

Questions?

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Remote presentation
IETF 95 – Buenos Aires, Apr 2015
Back-up slide: RFC 4944 fragmentation header format

• First fragment

• Subsequent fragments