Path-Aware Semantic Addressing (PASA) for Low power and Lossy Networks

draft-li-6lo-path-aware-semantic-addressing-01
draft-ietf-6lo-path-aware-semantic-addressing-00

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IETF 116 – Yokohama
Since IETF 115

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December 2022
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Submitted new revision using new name
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December 2022

Early February WG Adoption 😊
Submitted new revision using new name
Updates since IETF 115 in a Nutshell

- New document name & Status
  - Name: Because of WG adoption
  - Status: Experimental => Standard Track
    - PASA now technically an extension of existing 6lo mechanisms

- Overall text refinement
  - Too much “NSA” relics

- Simplified 6lo Routing Header Format

- Simplified communication with destination outside the PASA domain
  - Avoiding using mapped addresses

- Simplified Address Configuration procedure based on EARO messages
LowPAN Routing Header

Type

Length of the PASA address in quads (i.e. 2 octets). The length N equals Size plus 1, i.e. the length of the PASA address in is at least 1 quad (2 octets) and no more than 16 octets (equal to a non compressed IPv6 address).

<table>
<thead>
<tr>
<th>Addr. Type</th>
<th>Address Type in the PASA 6LoRH header</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>00</td>
<td>Size is set to 15 and Quad 1 to Quad N carry a full IPv6 address as destination</td>
</tr>
<tr>
<td>01</td>
<td>Quad 1 to Quad N carry Mapped Short Address as destination</td>
</tr>
<tr>
<td>10</td>
<td>Quad 1 to Quad N carry PASA as destination and Source Address</td>
</tr>
<tr>
<td>11</td>
<td>Quad 1 to Quad N carry PASA as destination</td>
</tr>
</tbody>
</table>
### 6LoWPAN Routing Header

**Type**

<table>
<thead>
<tr>
<th>Bit 0</th>
<th>Bit 1</th>
<th>Bit 2</th>
<th>Bit 3</th>
<th>Bit 4</th>
<th>Bit 5</th>
<th>Bit 6</th>
<th>Bit 7</th>
<th>Bit 8</th>
<th>Bit 9</th>
<th>Bit 10</th>
<th>Bit 11</th>
<th>Bit 12</th>
<th>Bit 13</th>
<th>Bit 14</th>
<th>Bit 15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rsvd</td>
<td></td>
<td>Size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6LoRH Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Octet 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Octet 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<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>~</td>
<td>~</td>
<td>~</td>
<td>~</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Octet N-1</td>
<td></td>
<td>Octet N</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>

Where $N = Size + 1$, and 6LoRH Type = PASA

**Length of the PASA address in octets.** The length $N$ equals $Size$ plus 1, i.e., the length of the PASA address in is at least 1 octet and no more than 8 octets (the IID part of the IPv6 address).
Sending Packets toward Destination outside the PASA domain

- No PASA-6loRH encapsulation needed
- Use Section 7 RFC 8138 IP-in-IP
  - Use default root at each node (aka the parent)
  - Source address is the encapsulator
  - Destination address the root (implicit)

```
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3
+--------------------------------------------+
| 1 0 1 | Length | 6LoRH Type 6 | Hop Limit |
+--------------------------------------------+
```

- Outgoing packet:

```
+------------------+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| 11110001          | IP-in-IP    | LOWPAN_IPHC  | Payload     |
| Page 1            | 6LoRH      |              |             |
+------------------+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
PASA Address Configuration

- Use RFC 8505 Extended Address Registration Option

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1234567890123456789012345678901</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Length</th>
<th>Status</th>
<th>Opaque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rsd</td>
<td>P</td>
<td>H</td>
<td>I</td>
</tr>
</tbody>
</table>

- PASA bit: If set the message is requesting/delivering a PASA address
- Host bit: If set the node is acting as PASA Host*

*New terminology:
  - PASA Host = leaf
  - PASA Router = forwarder
PASA Address Configuration procedure

1. Node sends Multicast Router Solicitation
   - FCFS may be sufficient...
2. Node selects as parent on of the nodes responding with a Router Advertisement
3. Node sends Neighbor Solicitation with EARO option to register Link-Local Address
   - P-bit set to indicate it is requesting a PASA address as well
   - H-bit set according to its role
4. Selected Parent to send back Neighbor Advertisement with EARO option
   - Status=0 success
   - P-bit and H-bit returned unchanged
   - PASA address to be appended to returning the EARO option

5. Finalizing: child MUST register PASA address (without using P-bit and H-Bit)
   - Necessary to be inline with Sec. 5.6 RFC 8505
   - Also signaling that child node accepted the address
Next Steps

• Core stable
  • Any feedback welcome

• Security Section
  • To be done for next revision
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THANKS!