IPv6 Hop-by-Hop Options Processing Procedures

<draft-ietf-6man-hbh-processing-04>

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Overview

- Changes from -01 to -04 drafts
- Open Issues
- Data about HBH on Internet Paths
- Next Steps
Changes -01 to -04 draft

Editorial:

- More on the separation between hardware and software processing described in [RFC6398], does not apply to all router architectures.
- Cited 2015 survey [RFC7872] and [I-D.iertf-v6ops-hbh]
- Security considerations updated following list comments.
- Various other improvements by editors and others.
Changes -01 to -04 draft

Normative:

- Rev 04 now cites and updates section 2.2 of [RFC7045]
- SHOULD: ... Hop-by-Hop options SHOULD keep the time to process low.
- SHOULD: ... New options SHOULD be defined with the Action type set to 00
- SHOULD: ... New Hop-by-Hop options SHOULD be designed to be the first option in a Hop-by-Hop options header.
- SHOULD NOT: ... The size of an option SHOULD NOT extend beyond what can be reasonably expected to be executed at full forwarding rate
- Changed in Section 5.2 for router to skip over options if it can’t process at full forwarding rate.
- MUST: ... the router MUST be configured ... to use ... the Router Alert option
Issue Tracker

Captured Issues raised in Adoption Call

https://github.com/ietf-6man/hbh-processing/issues

Currently 2 open issues

- #2 High end routers might not support HBH options
- #5 Use of fast path / slow path

We think both are addressed in rev 04.
Relationship with <draft-ietf-6man-eh-limits-01>

- Differences
  - EH Limits gives more guidance on how to handle more options than a node can process
  - Both drafts recommend making “00” bits in Option type the default
  - Both drafts say that variable length options are difficult to process; EH Limits draft is more specific
  - Differences on terminology (Fast/Slow Path, Full Forwarding rates).
  - Suggest adding text about out-of-order processing.
Recommendations

- HBH Processing draft should define *the HBH processing*
  - EH Limits draft should reference it (and cite text)
- Some items should be brought into HBH Processing draft
  - Discuss out of order packets
- EH Limits drafts should continue to define *total EH limits*
Other Proposed Changes

- HBH Processing draft focus on processing HBH Options
  - Normative text on Router node processing
  - Based on recent discussion, this needs some expansion, specifically:
    - Nodes SHOULD process the HBH Option header, if they do not, nodes MUST forward packet normally
      - When processing the HBH Option header, nodes MUST process the first HBH Option, nodes MAY process more
Now for some data…

- What can we learn about current Internet paths?
- *Data from an IEPG talk at IETF-115 by Ana Custura*
Traversals for TCP vs UDP

- Packets carrying TCP have the biggest drop in traversal at 48B:
  - $48 + 20 = 68B$ (108B total)
- UDP has the biggest drop at 56B: $56 + 8 = 64B$ (104B total)
- A 40 B EH more often traverses (max IPv4 options was 40 B)
Per-AS Traversal (UK path)

**DEST OPT EH**

The **local AS** is responsible for most of the drops:
- 5% for UDP
- 25% for TCP

<table>
<thead>
<tr>
<th></th>
<th>1st AS</th>
<th>AS1&gt;AS2</th>
<th>∞</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dest UDP</td>
<td>95.3%</td>
<td>93%</td>
<td>91.5%</td>
</tr>
<tr>
<td>8B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dest TCP</td>
<td>74.7%</td>
<td>70%</td>
<td>68.5%</td>
</tr>
<tr>
<td>8B</td>
<td></td>
<td></td>
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</tbody>
</table>

**HBH EH**

The **local AS** is responsible for most of the drops:
- 68% for UDP
- 74% for TCP

<table>
<thead>
<tr>
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<th>1st AS</th>
<th>AS1&gt;AS2</th>
<th>2nd AS</th>
<th>AS2&gt;AS3</th>
<th>∞</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBH UDP</td>
<td>31.4%</td>
<td>20.1%</td>
<td>15%</td>
<td>12.2%</td>
<td>11.4%</td>
</tr>
<tr>
<td>8B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HBH TCP</td>
<td>26.9%</td>
<td>16.3%</td>
<td>13.9%</td>
<td>9.7%</td>
<td>8.6%</td>
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<td>8B</td>
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Drops are considered to be within the AS if the next hop on a control measurement is also in that AS. If the next hop would otherwise be in a different AS, then the drop is attributed to the AS boundary.
We learned

- Some paths do support HBH Options.
- However, many currently drop packets with a HBH EH.
- Limiting the size of the EH improved traversal.
- draft-ietf-6man-hbh-processing would seem to help.

- See IEPG talk at IETF-115 for more details
Next Steps

- Align this draft with EH Limit draft
- WGLC or Receive more comments/issues?
QUESTIONS / COMMENTS?

https://github.com/ietf-6man/hbh-processing/issues