IETF 94 Yokohama: IPv6 Design Choices

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Purpose

• Describe some basic IPv6 design options (routing focused).

• Assumes reader has working knowledge of IPv4 network design practices.
Summary of Changes from -08 to -09

1. Added paragraph to intro saying Enterprise situation in scope.

2. Added note saying roughly “If using PA space internally, Enterprise will have difficulties multi-homing or changing providers”. Proposing major revision in this area for next version.

3. Added summary of results of survey of operators on which IGPs they use in dual-stack networks.

4. Added paragraph saying that, though ULAs and RFC 1918 are technically different, they are used by operators in the same way.
Change #1: Enterprise Coverage (1 of 2)

- In March/April 2015, scope was expanded to include consideration of Enterprise design issues.
  - Prompted by some emails to the WG mailing list.
  - As a result, (a) added consideration of EIGRP in the IGP Choice section, and (b) consideration of the enterprise situation in the Address Choice section, amongst other changes.

- At the Prague IETF in July, a suggestion (at the mic) that Enterprise coverage would be better handled in a separate document.

- After consideration, authors not taking that approach.
  - Continuing to include Enterprise text in this document.
  - Not going into great detail on the Enterprise situation, but will cover major differences.
Change #1: Enterprise Coverage (2 of 2)

- -09 version adds a paragraph in Introduction saying that Enterprise situation is included.
- Email about authors’ decision sent to mailing list -- no response.
- If the WG prefers, we can remove Enterprise coverage from doc.
  - Work on a possible “Enterprise-focused” doc will be left to others.
Change #2: Addrs for Enterprises (1 of 2)

• Discussion, first at mic in Prague, then recently on mailing list, on choices an Enterprise has for using v6 address space.

• -09 doc has text saying roughly “If using PA space internally, Enterprise will have difficulties multi-homing or changing providers”.

• Lots of discussion on mailing list.

• Propose to add text describing the three options and their pros and cons.
Change #2: Addrs for Enterprises (2 of 2)

Assumption: Enterprise uses some form of perimeter security (firewalls, SBCs, …)

<table>
<thead>
<tr>
<th>#</th>
<th>Choice</th>
<th>Multi-home</th>
<th>Easy to change prov</th>
<th>Comments</th>
</tr>
</thead>
</table>
| 1 | Use PI space internally                      | Y          | Y                   | Pro: No app impact beyond perimeter traversal.  
Con: Must qualify for PI. Must apply and pay annual fee.  
Con: Adds /48 to default-free table. |
| 2 | Use PA + ULA space internally                | Difficult  | Difficult if PA     | Pro: No app impact beyond perimeter traversal.  
Con: Cheap, new concept for smaller enterprises.  
Note: Use of ULA space optional. |
|   | Better in future?                           | today      | addr gets           |                                                                                                                                                                                                             |
|   |                                              |            | hardcoded; otherwise easy. |                                                                                                                                                                                                             |
| 3 | Use ULA space internally and NPT66 on borders | Y          | Y                   | Con: Some app impact beyond perimeter traversal, but not as bad as NAT44.  
Pro: Similar to IPv4 situation                                                                                                          |
Change #3: Survey (1 of 2)

• In May & June, informal survey of operators on IGP combinations deployed today in production dual-stack networks.
  – Asked for responses on various mailing lists: v6ops, NANOG, RIPE, Cluenet ipv6-ops.
  – Received details about 28 different networks.
  – Different sizes: small enterprises to large T1 providers.

• Summarized the responses in a table in the IGP Choices section.

• One unexpected stat was that a number of networks running IS-IS dual-stack in **single topology** mode.
  – Partly due to equipment limitations
# Change #3: Survey (2 of 2)

<table>
<thead>
<tr>
<th>IGP for IPv4</th>
<th>IGP for IPv6</th>
<th># of Production Deployments</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSPFv2</td>
<td>OSPFv3</td>
<td>8</td>
</tr>
<tr>
<td>OSPFv2</td>
<td>IS-IS</td>
<td>3</td>
</tr>
<tr>
<td>OSPFv2</td>
<td>EIGRP</td>
<td>--</td>
</tr>
<tr>
<td>OSPFv3</td>
<td>OSPFv3</td>
<td>--</td>
</tr>
<tr>
<td>OSPFv3</td>
<td>IS-IS</td>
<td>--</td>
</tr>
<tr>
<td>OSPFv3</td>
<td>EIGRP</td>
<td>--</td>
</tr>
<tr>
<td>IS-IS</td>
<td>OSPFv3</td>
<td>2</td>
</tr>
<tr>
<td>IS-IS</td>
<td>IS-IS</td>
<td>12 *</td>
</tr>
<tr>
<td>IS-IS</td>
<td>EIGRP</td>
<td>--</td>
</tr>
<tr>
<td>EIGRP</td>
<td>OSPFv3</td>
<td>1 (small)</td>
</tr>
<tr>
<td>EIGRP</td>
<td>IS-IS</td>
<td>--</td>
</tr>
<tr>
<td>EIGRP</td>
<td>EIGRP</td>
<td>2</td>
</tr>
</tbody>
</table>

* 6 = Single Topology, 4 = Multi-topology, 2 = unknown
Change #4: “Private” addresses

• In Prague, some concerns (at mic) raised over use of word “Private” to refer to both RFC 1918 and ULA addresses.
  – Comments about “they work differently!”
• Authors’ position: “Yes, there are differences, but operators use them in the same way”.
• Added text saying this to “Address Choice” section.
Update after morning discussion

• Authors propose to rewrite section 2.1.
  – Remove IPv4 discussion (including the word “private”) and just focus on IPv6.
  – Incorporate comments received this morning around NAT66/NPT66 and ULA.

• Authors propose to NOT expand the survey discussion to discuss trends
  – Will put in sentence saying “some of these are interim states”
Moving Forward

• Jan Zorg and Tim Chown have done a review of -09.
• Will take their feedback, plus feedback today, and create -10.
• Will ask a few key critics to review -10.
• Will judge readiness for WGLC after those reviews.