IPv6 Address Assignment and Route Selection for End-to-End Multihoming

draft-ohira-assign-select-e2e-multihome-02.txt

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Overview

• Theme:
  – A layer 3 architecture which suits for multi-home available architectures on layer 3.5 or layer 4

• Target:
  – Small networks such as a home network or an office network with multiple upstream ISPs
  – So called ISP multi-homing is NOT a goal of this memo

• Method:
  – Hierarchical Addressing (Multi-address model)
  – Source Address Based Routing (SABR)
Layer Composition

They merge several IP addresses into a connection. This memo concerns about it. Route selection on them.
Updates from -01

• Clarify the conditions of a target site
  – in order to make a consensus about small site at least

• Clarify what kind of information should be announced
  – and how to distribute it automatically
Conditions of a Target Site

- Small site as a home network
- A /48 address space for a site
  - assemble a network flexibly
- Multi links & multi exit routers
- Lower 80 bits are set up in advance

<table>
<thead>
<tr>
<th>48bits</th>
<th>16bits</th>
<th>64bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location ID</td>
<td>Subnet ID</td>
<td>Node ID</td>
</tr>
</tbody>
</table>

upstream independent
Route/Address Information Management Mechanism (1/2)

• Kinds of information
  – from site external (address delegating)
    • Delegated PA address prefix
    • Proper exit router for each PA address prefix
  – site internal
    • State of links in a site
    • State of links which site exit routers have
Route/Address Information Management Mechanism (2/2)

• Candidate methods to carry the information
  – from site external (address delegating)
    • manual configuration
    • DHCP with prefix option (an I-D is proposed by dhcp wg)
      – server: some node in upstream ISP side
      – client: site exit routers
  – site internal
    • manual configuration
    • IGPs with SABR extension (further works)
## Basic capabilities

<table>
<thead>
<tr>
<th>3.1.1 Redundancy</th>
<th>yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1.2 Load Sharing</td>
<td>both incoming and outgoing</td>
</tr>
<tr>
<td>3.1.3 Performance</td>
<td>no information between upstream ISPs is required</td>
</tr>
<tr>
<td>3.1.4 Policy</td>
<td>expressed as a filter rule</td>
</tr>
<tr>
<td>3.1.5 Simplicity</td>
<td>very simple 😊</td>
</tr>
<tr>
<td>3.1.6 Transport Survivability</td>
<td>out of scope</td>
</tr>
<tr>
<td>3.1.7 Impact on DNS</td>
<td>not so much</td>
</tr>
<tr>
<td>3.1.8 Packet Filtering</td>
<td>fine</td>
</tr>
</tbody>
</table>
## Additional capabilities

<table>
<thead>
<tr>
<th>Section</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.1 Scalability</td>
<td>fine</td>
</tr>
<tr>
<td>3.2.2 Impact on Routers</td>
<td>required unless single-homed</td>
</tr>
<tr>
<td>3.2.3 Impact on Hosts</td>
<td>required unless single-homed</td>
</tr>
<tr>
<td>3.2.4 Host-Routing interaction</td>
<td>not required</td>
</tr>
<tr>
<td>3.2.5 Operations &amp; Management</td>
<td>no co-operative work required</td>
</tr>
<tr>
<td>3.2.6 Cooperation between Transit Providers</td>
<td>not required</td>
</tr>
<tr>
<td>3.2.7 Multiple Solutions?</td>
<td>maybe</td>
</tr>
<tr>
<td>4 Security Considerations</td>
<td>not referred</td>
</tr>
</tbody>
</table>

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Test Result of SABR

• **FreeBSD (5.1)**
  – pf (packet filter)
    • pass out quick route-to (dc0 fe80::1) from 3ffe:516:7000:f00::/64 to any
    • pass out quick route-to (dc1 fe80::1) from 2001:200:190:f00::/64 to any

• **NetBSD (1.6.1)**
  – ECMP Extension & ipfilter (need some modifications)
    • route add default fe80::1%fxp0
    • route add default fe80::2%fxp0 -sabrnet 2001:200:190:f80::
      -sabrmasklen 64

• **Cisco (IOS 12.3-3)**
  – Not Available for IPv6
  • We intend to link this with DHCP/RA.

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Conclusion

• The SABR approach is suitable for
  – small sites as home networks
  – sites which do not have full route information

• Some works needed to auto-configuration
  – DHCP, IGPs, …
Hierarchical Addressing

• A site gets a PA prefix from each ISP
• Pro:
  – Avoid explosive increase of global routing information
• Con:
  – Slightly increase renumbering/DNS (mapping) updates
Source Address Based Routing (SABR)

- Select an external connection from multiple entries according to a source address
- Pros:
  - No route information from outside
  - No tunnels
  - No servers to mapping between src/dst address
  - No labels nor extensible headers
- Con:
  - Most of intermediate routers and interior gateway routing protocols in a site must be modified
Apply for “Large Sites”

- An enterprise or an university may be a “Large site”
- Regard as a group of small sites
  – sections, faculties, …
- Address multi-level hierarchically
- use SABR whole in the large site
  (otherwise, full route information is required)
Route Selection

• A pair of src/dst address corresponds a route
• Route selection mechanism should be included in layer 3.5/4 protocols
  – On the basis of RFC3484, RTT result,…
• If full route information is available, it may be useful for address selection