Reliability Considerations of Path-Aware Semantic Addressing

draft-li-6lo-pasa-reliability

IETF 115 – London
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draft-li-6lo-pasa-reliability-00

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Main Content

Main points:
- A general introduction to the problem
- Possible solutions classes
- See rest of the presentation
- Some considerations about failure detection and recovery
- Some considerations about robustness
Solutions

• Pre-requisite
  • Presence of redundant links
  • Some not actively used
  • Active links forming a tree
  • All nodes have a secondary parent
    • Except root node
    • Alternative parent is connected through a non actively used link

• Multi-Address:
  • using multiple addresses per node, one for each alternative parent (logically creating multiple topologies)

• Single-Address:
  • using one single address per node, store the addresses of alternative parents/children
Multi-address: Link Failure

ICMP Message: Primary 100 up-link broken; use my secondary address 01100

Install rule: Dst prefix 100 => encaps to 01100 through 01

ICMP: Down-link to 100 broken (necessary for middle nodes)

ICMP: Consider using your secondary address

- Each node in the PASA only has two addresses built using the same AF but different roots (1 and 01)
- Each node except the root has at least 2 parents (primary and secondary)
- Forwarding done following only primary address (and topology)
- Each node maintains a redirect table if something has to be tunneled via secondary topology
Multi-Address: Forwarding Operation

Forwarder Nodes

- Packet Received
  - Is there a redirect rule that applies? (Yes/No)
    - No: Native Forwarding
    - Yes: Forward according to rule
  - Is there an encapsulation rule that applies? (Yes/No)
    - No: Native Forwarding
    - Yes: Encapsulate according to rule

Root Nodes

- Packet Received
  - Is there an encapsulation rule that applies? (Yes/No)
    - No: Native Forwarding
    - Yes: Encapsulate according to rule
  - Forward to Alternative Root

END
Single Address: Link Failure

- Locally store alternative parents/children

ICMP: Down-link to 100 broken (piggyback packet)

Destination | Flags
--- | ---
100 | I
10 | PP = Primary Parent
1000 | PFC
10010 | PFC
1001 | PLC = Primary Leaf Child
10011 | PLC
110 | AP = Alternative Parent
10100 | AFC
10101 | ALC = Alternative Leaf Child whose alternative parent is the current node

Leaf Node
Forwarder Node

Dst prefix 100 Unreachable
Single Address: Link Failure

Dst prefix 100 Unreachable

Root must be aware of topology and recompute alternative path. Redirect: 10 -> 1010 -> 10011
Single-Address: Forwarding Operation

Forwarder Nodes

- Received Packet
  - Perform PASA Forwarding
    - Outgoing Link working?
      - Yes: Redirect to Root, END
      - No: Send the Packet to the Alternative Parent
    - Up

Root Nodes

- Received Packet
  - Is the a redirect rule due to broken links
    - Yes: Encapsulate to alternative path
      - PASA Native Forwarding
      - END
    - No
## Multiple Addresses vs Single Address

<table>
<thead>
<tr>
<th>Approach</th>
<th>Root State</th>
<th>Forwarder State</th>
<th>Robustness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple Addresses</td>
<td>Low (redirect rule)</td>
<td>Low (redirect rule)</td>
<td>Lower for multiple failures (limited knowledge)</td>
</tr>
<tr>
<td>Single Address</td>
<td>High (topology)</td>
<td>Low (neighborhood)</td>
<td>Higher for multiple failures (root to find feasible path)</td>
</tr>
</tbody>
</table>
Any question/comment welcome!

THANKS!