Layer 2 Aware NAT
draft-miles-behave-l2nat-00

David Miles  david.miles@alcatel-lucent.com
Mark Townsley  townsley@cisco.com
Layer 2-Aware NAT

IPv4 Home Network -> Layer 2 Delim -> Large Scale NAT -> IPv4 Internet

Route or NAT44 -> Layer 2 Delim -> NAT44
Layer2 Aware NAT

- Attempts to support existing CPE (routers, NAT or hosts) with minimal change
- Is not an original idea - takes the common-IP concept from Dual Stack Lite and applies it to other tunnels/link-layers
- Supports a NAT444 mode for existing NAT home gateways
- Subscriber Aware NAT can support existing Windows 3.11, XP, Me, 98, XP, 2000, Vista, etc (direct host attachment - NAT44 mode)
- Can support routing CPE to achieve a NAT44 mode
- It can support a variety of link-layers and topologies: DSL TR-101, DHCP PPPoE, PPPoA, WiMAX, Mobile, Dial-up
- Must be implemented in a device aware of the Layer-2 termination
Layer2-Aware NAT

All subs have the SAME address

Optional NAT Function
- UDP
- TCP
- TCP
- UDP
- IP
- Ethernet
- Ethernet
- RFC 2684
- ATM
- DSL

NAT Function
- UDP
- TCP
- TCP
- UDP
- IP
- Ethernet
- IPoE
- PPP
- L2TP
- 802.1ad
- Ethernet
- 802.3 PHY
Layer 2 Aware NAT

- Creates a virtual NAT table for every Layer 2 connection
- Supports a variety of link-layers like:
  - Ethernet
  - 802.1Q
  - PPPoA
  - PPPoE
  - L2TP
- Performs Network Address and Port translation on all IPv4 traffic
- Uses IPv4 datagrams
- Can support both routed (NAT44) and NAT (NAT444) home gateways
- Does not require a routing protocol to run for routed home gateways
Home Network with existing NAT (NAT444)

<table>
<thead>
<tr>
<th>Inside IP</th>
<th>Inside Port</th>
<th>Outside IP</th>
<th>Outside Port</th>
<th>Dest IP</th>
<th>Dest Port</th>
<th>Proto</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.b.c.d</td>
<td>6631</td>
<td>202.0.37.1</td>
<td>8897</td>
<td>88.3.4.2</td>
<td>80</td>
<td>TCP</td>
</tr>
<tr>
<td>a.b.c.d</td>
<td>7765</td>
<td>202.0.37.1</td>
<td>9822</td>
<td>88.3.4.2</td>
<td>80</td>
<td>TCP</td>
</tr>
<tr>
<td>a.b.c.d</td>
<td>7766</td>
<td>202.0.37.1</td>
<td>9893</td>
<td>88.3.4.2</td>
<td>80</td>
<td>TCP</td>
</tr>
</tbody>
</table>
Home Network with routing (NAT44)

<table>
<thead>
<tr>
<th>Inside IP</th>
<th>Inside Port</th>
<th>Outside IP</th>
<th>Outside Port</th>
<th>Dest IP</th>
<th>Dest Port</th>
<th>Proto</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0.0.20</td>
<td>6631</td>
<td>202.0.37.1</td>
<td>8897</td>
<td>88.3.4.2</td>
<td>80</td>
<td>TCP</td>
</tr>
<tr>
<td>10.0.0.20</td>
<td>7765</td>
<td>202.0.37.1</td>
<td>9822</td>
<td>88.3.4.2</td>
<td>80</td>
<td>TCP</td>
</tr>
<tr>
<td>10.0.0.20</td>
<td>7766</td>
<td>202.0.37.1</td>
<td>9893</td>
<td>88.3.4.2</td>
<td>80</td>
<td>TCP</td>
</tr>
</tbody>
</table>
Or Dial-Up hosts via L2TP Access Concentrator (NAT44)

PPP IPCP (ConfRej/Nak)

ip-address: a.b.c.d

<table>
<thead>
<tr>
<th>Inside IP</th>
<th>Inside Port</th>
<th>Outside IP</th>
<th>Outside Port</th>
<th>Dest IP</th>
<th>Dest Port</th>
<th>Proto</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.b.c.d</td>
<td>6631</td>
<td>202.0.37.1</td>
<td>8897</td>
<td>88.3.4.2</td>
<td>80</td>
<td>TCP</td>
</tr>
<tr>
<td>a.b.c.d</td>
<td>7765</td>
<td>202.0.37.1</td>
<td>9822</td>
<td>88.3.4.2</td>
<td>80</td>
<td>TCP</td>
</tr>
<tr>
<td>a.b.c.d</td>
<td>7766</td>
<td>202.0.37.1</td>
<td>9893</td>
<td>88.3.4.2</td>
<td>80</td>
<td>TCP</td>
</tr>
</tbody>
</table>
### Options for IPv4 Overloading

<table>
<thead>
<tr>
<th>Large Scale NAT</th>
<th>NAT464</th>
<th>Address plus port</th>
<th>Dual Stack Lite</th>
<th>L2-Aware NAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>No CPE Change</td>
<td>CPE change</td>
<td>CPE change</td>
<td>CPE change</td>
<td>No CPE Change*</td>
</tr>
<tr>
<td>NAT444</td>
<td>NAT464</td>
<td>NAT44</td>
<td>NAT44</td>
<td>NAT444 NAT44</td>
</tr>
<tr>
<td>LSN location not specified</td>
<td>NAT64 location not specified</td>
<td>A+P location specified as first routing hop</td>
<td>DS-Lite location not specified</td>
<td>L2-Aware NAT location specified as first routing hop</td>
</tr>
<tr>
<td>Problematic IPv4 address space between CPE and LSN</td>
<td>IPv4 translated into IPv6</td>
<td>IPv4 is tunneled over IPv6</td>
<td>IPv4 as it is today - no pre-requisite for IPv6</td>
<td></td>
</tr>
<tr>
<td>Application Servers can sit between subscriber and LSN</td>
<td>All IPv4 traffic must be subject to NAPT</td>
<td>All IPv4 traffic must be subject to NAPT</td>
<td>All IPv4 traffic must be subject to NAPT</td>
<td>All IPv4 traffic must be subject to NAPT</td>
</tr>
</tbody>
</table>
Thank You