Scalable Operation of NATs with Per-Interface Bindings
or How I Stopped Worrying about NET10 Exhaustion and Learned to Love the NAT

Jari Arkko, Ericsson Research
Lars Eggert, Nokia Research Center

Original ideas are from Alain, Mark, and others
Traditional NAT44 Architecture

hosts identified by a **private** address

hosts identified by a **global** address

flow from a private address to a public address

10.0.0.1:5555 to 2.2.2.2:80
10.0.0.2:5555 to 2.2.2.2:80

flow from a shared public address to a public address

1.1.1.1:6666 to 2.2.2.2:80
1.1.1.1:7777 to 2.2.2.2:80
Per-Interface NAT44 Architecture

hosts identified by an **interface** and a **private** address

hosts identified by a **global** address

**flow from an interface and a private address to a public address**

- `Eth0 10.0.0.1:5555` to `2.2.2.2:80`
- `Eth1 10.0.0.1:5555` to `2.2.2.2:80`

**flow from a shared public address to a public address**

- `1.1.1.1:6666` to `2.2.2.2:80`
- `1.1.1.1:7777` to `2.2.2.2:80`
Per-Interface NAT44 Architecture

hosts identified by an **interface**
and a **private** address

hosts identified by a **global** address

**flow from an interface**
and a private address
to a public address

**mapping**

**flow from a shared public address to a public address**

<table>
<thead>
<tr>
<th>Host</th>
<th>Interface 1</th>
<th>Interface 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eth0</td>
<td>10.0.0.1:5555 to 2.2.2.2:80</td>
<td>10.0.0.1:5555 to 2.2.2.2:80</td>
</tr>
<tr>
<td>Eth1</td>
<td>10.0.0.1:5555 to 2.2.2.2:80</td>
<td>1.1.1.1:6666 to 2.2.2.2:80</td>
</tr>
<tr>
<td></td>
<td>1.1.1.1:7777 to 2.2.2.2:80</td>
<td></td>
</tr>
</tbody>
</table>
Applicability

- Allows reuse of RFC 1918 space for different users
- Applicable when the NAT has separate interfaces: GGSNs, home agents, tunnel servers
- Dual Stack Lite is one example of a tunnel server but the core idea can be applied even without introducing additional tunnels
- No new protocols, standards, or host impacts – just a local implementation technique

- Allows a near-infinite number of private addresses
- But does NOT avoid harmful side-effects of NATs or make it easy to address a host from the outside
- But there's always IPv6...
Recommended Deployment Model

Works well together with Dual Stack:
› NAT44 allows access to the IPv4 Internet
› Per-interface extension allows any number of hosts
› IPv6 avoids the harmful effects of NATs

For instance, selected operator services can employ IPv6 and not suffer from the consequences of NATs or overlapping address space
Questions? Comments?