Sharing a single IPv4 address among many broadband customers

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Disclaimer

- This is still research work and does not necessarily reflect what Comcast is or will be doing.
Problem Statement

• The Internet is running out of IPv4 addresses

• The “Internet” edges are IPv4
  – Most hosts in the home today (Win 9.x, XP,…) are IPv4 and will never be upgraded to work in an IPv6-only environment
  – content servers (Web, Mail,…) hosted by many different parties will take a long time to upgrade to IPv6

• Service providers are in between
  – the plumbing in the middle may be the “easier” part to fix first
Short Term Avenue

• Move from one IPv4 address allocated per customer to one IPv4 address per N customers

• Enable ‘legacy’ IPv4 devices (eg Win 9x) to keep talking to the IPv4 Internet (Web, Mail,…)

• Introduce IPv6 in the house for new devices and/or new services as a longer term evolution

• Assumption: IPv6 deployed (or deployable) inside the service provider network
How to Implement This?

• Customers could be provisioned only with IPv6
  – potentially offered as a different tier of service
  – assume “upgraded” home Internet Gateway Device
  – /56 prefix, no global IPv4 on the WAN IGD port

• Double NAT for legacy home devices
  – legacy home devices will get RFC1918 addresses
    assigned by the home gateway
  – those addresses will be translated to IPv6 by the home gateway…
  – …and translated back to IPv4 within the service provider network

• Native IPv6 service is offered for new devices
Architecture Overview: Double Nat v4 -> v6 -> v4

- **v4 server**
  - www.nanog.org
  - 198.108.1.50

- **ISP**
  - NAT 6->4
  - 192.168.1.2

- **1st hop Router**
  - 2001:db8:42:1::2

- **Home gw NAT 4->6**
  - P/56

- **IPv6 Internet**
  - 2001:db8:42:1::2

- **v4**
  - 192.168.1.2

- **v6**
  - 192.168/16

- **IPv6 Internet**
  - 2001:db8:42:1::2
ISP NAT 6->4 Discovery: DHCPv6 Configuration

ISP NAT64 advertise mapping prefix M in interior routing protocols

Home NAT46 reserve prefix P1 out of P for translation
SRC4: 192.168.1.2, DST4:198.108.1.50
SRC6: P1::192.168.1.2, DST6: M::45.1.2.5

192.168.1.2
v4
v6

ISP
DHCPv6
NAT 6->4
1st hop Router
Home gw
NAT 4->6

DHCPv6 prefix delegation P mapping prefix M proxy addresses
Special Considerations

• **DNS**
  – Just like any other apps, will be translated
  – alternative: DNS proxy within the home gw

• **MTU adaptation**
  – IPv4 pMTUd between NAT 6-4 and IPv4 servers
  – Force lower MTU on legacy host side

• Will **NOT** work for all apps, but for most

• NO worse than regular IPv4 NAT today
FAQ

• Why not use v4/v6 tunneling instead of NAT?
  – tunneling would require a v4 address, which we may not have, not even in the 10/8 range

• Why not simply use double IPv4 NAT?
  – same as above, 10/8 is too small for large deployments

• Why not deploy the home v6-only and translate directly to v4 in the home gateway?
  – Will not help the legacy Win 9x boxes in the home

• What about new v6-only host trying to reach the v4 Internet?
  – one problem at a time! Such device do not really exist today….
  – suggestion: use v6/v4 proxies in ISP network