Deploying IPv6 in IPv4 networks

Marc Blanchet, CTO
Marc.Blanchet@hexago.com
Plan

- Application
- IP stack
- Network
  - IPv6 transition mechanisms
User-app to User-app

- Three pieces
  - Application
  - IP stack
  - Network
User Interface

- Nothing to do except:
Porting Application to IPv6

- Few changes to socket calls
  - ex: gethostbyname() -> getaddrinfo()
- If user may enter/view an IP address
  - Address: 192.0.2.1
  - with IPv6: 3ffe:b00:1:1::1
  - URL: http://192.0.2.1:81/intro.html
  - with IPv6: http://[3ffe:b00:1:1::1]:81/intro.html
- After porting, the application becomes IP version independent
- Application chooses the IP version based on DNS answers
Application Protocol

- IP address processing inside the application protocol
  - New revision of the protocol
  - Possible signaling needs to be done
- Broadcast use -> Multicast
  - Need to register a multicast address
  - Some logic to change
Applications

• Applications need to be ported
  – Usually small changes for porting
  – Then deployed
• New applications
• One by one application
IP stack

• Integrated (or add-on) to operating system
• Manage the upgrading to a new version of the operating system that supports IPv6
• Features needed?
  – Default address selection
  – Mobility
  – IP security
  – etc.
IP stack and DNS

- Resolver/Default address selection
  - Typical rule is to prefer IPv6 over IPv4
  - Connections start using IPv6 transport
  - IPv6 must be at the same level of support than IPv4:
    - network wide
    - infrastructure wide
    - help desk
Users/Applications are IP agnostic

- Need ubiquitous IPv4 _and_ IPv6 connectivity, where all cases are handled
  - IPv4-only network access
  - IPv4-only network access with NAT in the path
  - Dual stack (IPv4,IPv6) network access
  - IPv6-only network access (not yet for most cases…)
  - Users are mobile: laptop/pda/cell phones/wearable/ in office, dorms, starbucks, home (with high-speed nat…), wifi hotspots…

- Need of a technology to handle all these cases “transparently” for the user
Network

- IPv6 native from source to destination:
  - Best
  - But not easy:
    - still in an IPv4 dominant network
    - parts you can not control: Internet, providers, public servers
    - parts you can not easily upgrade: “old” routers, firewalls, printers, etc.
    - non-availability of some solutions
From end to end

End to end reachability using IPv6. Core to node: IPv6 last mile.
IPv4 Dominant Networks

• Tunneling techniques used as overlay over the IPv4 network
  – 6to4, ISATAP, Teredo, Tunnel broker/TSP, etc.
• Important considerations for tunneling
  – NAT in the path
    • you might not know if one is in the path
    • one might appear: if you are mobile
  – Security policies
  – MTU
  – Operational management
6to4

- Site solution
- Embedding the IPv4 external address in the IPv6 prefix
- Automated tunneling between 6to4 sites
- Need a 6to4 relay for non 6to4 sites
- One entry/exit point
- Does not traverse IPv4 NAT
- RFC 3056
ISATAP

- Site solution
- Makes a virtual link-layer over the IPv4 network
- Does not traverse IPv4 NAT
Teredo

- Host solution
- Traverse NAT
- Needs Teredo server and relay
Tunnel Broker with TSP

- Site, small network and host solution; deployed in enterprise and provider networks
- Reaches the end node/app/user without an end to end upgrade of the network
  - Additional services without large upgrade upfront costs
- Has AAA policies, where
  - Authentication: security and no open relay
  - Accounting: billing
- Traverse NAT
- Stable/permanent IPv6 address and prefix
- RFC3053 + enhancements
Tunnel Broker as an IPv6 Access Server

IPv4 Network

IPv6 Network

tsp

broker

IPv4 NAT

Telephone Network

IPv4 Network

IPv6 Network

tsp

broker

IPv4 Network

IPv6 Network
Tunnel Broker as a VPN Server

Diagram showing the interaction between IPv4 and IPv6 networks through a tunnel broker and a VPN server.
Hexago

- Spin-off of Viagénie, a consulting and R&D firm
  - 7 years old, specialized in security and IP networking
  - Heavily involved in IPv6 deployment since 1996:
    - designed the first IPv6 exchange in the world (6tap) with ESnet,
    - provide services to the IPv6 community: NTPv6, ipv6 route registry, Quake-v6, freenet6.net
    - IETF contributions, such as: IPv6 address plan method RFC (RFC3531)
      - IPv6Forum, Nav6tf
Conclusion

• Applications need to be updated
• Network goal: provide end-to-end reachability
• Applications using IPv6 need a network
• IPv6 networks need applications to be deployed
• Devices are connected to:
  – IPv4-only, IPv4-only with NAT, IPv4-IPv6, IPv6
  – mobile, using wifi/wired/2.5G, 3G/…
• Need a cheap-to-deploy technology to provide ubiquitous access to applications and services, agnostic of IP version.
• To reach me: Marc.Blanchet@hexago.com