NPO Intro

• NPO: Dutch Public Broadcasting
• NPO ICT: ISP for broadcasters
• Large network, providing a.o.:
  • uitzendinggemist.nl
  • omroep.nl
  • live-streams of events
  • etc.
Intro

- IPv4
  - In use since 1983
  - 32-bit address space
- IPv6
  - Designed in early 1990s
  - 128-bit address space
  - Individually assigned: more than we could ever use, given only the one planet we’re on.
Address Space

- 128-bits is *staggeringly vast*.
- Divided into two parts: Network vs. Host, both 64 bits.
  - Allows host to generate globally reachable address given only the network prefix
- DHCP no longer needed in its current form
IPv4 Address Space
IPv6 Address Space

(Grossly understated)
Practically Speaking...

- The end of Network Address Translation
- Some built-in obscurity
- More efficient
  - Fixed-length header
  - no checksum
- Improved multicast
- IPSec support required
Advantages for NPO

• Allows UDP use for streaming
• Less traffic, less processing
• Video streams don’t care about a lost packet or two
• In theory, IPSec might be useful with DRM
Implementing IPv6

• First: IPv6 address space
• Second: IPv6 in the Network
• Third: IPv6 services
• Later: IPv6 office
IPv6 address space

- Request space from LIR (SURF, KPN, ...)
- Provider dependent addresses
- Become LIR, request space from RIPE
- Provider independent addresses
- Allows sub-allocating to end-sites
IPv6 address space

- RIPE requirements for requesting as LIR:
  - Old: must have plan for 200 allocations within two years
  - NPO not likely to satisfy
  - New: must have plan for an allocation within two years
  - Easy!
Subnetting

• As a RIPE LIR, you will be allocated a /32.
• 65536 /48s to assign to end-sites
• One /48 allows 65536 /64 subnets for hosts
• End-site:
  • NPO, NOS, VPRO, BNN, etc.
External Connectivity

- The IPv6 world uses BGP, just like IPv4
- Mostly the same, except:
  - IPv6 BGP routing protocols must send two next-hop addresses:
    - Global (2000::/3)
    - Link-local (fe80::/64 for ICMPv6 redirects)
External Connectivity

• Where to go?
  • Internet Exchanges have IPv6 in production (AMS-IX, NL-IX, etc.)
  • As do some (not all) large transit networks (Level3, Global Crossing, etc.)
  • And most (all?) NRENs (SURFnet, Belnet, etc.)
Possible Caveats

- IPv6 does away with ARP
- Instead: ND (neighbour detection)
  - Uses Multicast rather than broadcasts
  - Problem exists with some IGMP-snooping switches
  - Symptom: MAC-addresses aren’t learned
- Only solution: disable IGMP snooping
Clustered IPv6 Services

- Transitioning to IPv6, three possibilities:
  - Single-stack cluster, separate single-stack IPv6 node(s)
  - Dual-stack cluster, single-stack nodes
  - Dual-stack cluster, dual-stack nodes
Single Stack Nodes

- IPv6 testing environment
- No chance of disruption
- Good initial configuration
## Single Stack Nodes

<table>
<thead>
<tr>
<th>Load Balancer (Dual Stack)</th>
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<tbody>
<tr>
<td><strong>Server IPv4</strong></td>
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<tr>
<td><strong>Server IPv4</strong></td>
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<tr>
<td><strong>Server IPv6</strong></td>
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- Still mostly separate, so should not cause interference
- Intermediate configuration
- But: different configurations on servers
Dual Stack Nodes

- Production configuration, after testing
- All servers created equal
Load balancing

- NPO uses Linux IP Virtual Server
- Problem: does not support IPv6 (yet).
  - Use something else, or
  - Financially support IPv6 for IPVS development
- Is that really a problem?
- Not much traffic yet, so load balancing initially not required
Services

• **Name servers**
  • BIND, PowerDNS: good support

• **Web servers**
  • Apache, Lighttpd: likewise
  • IIS: Not so much.
Streaming services

- Windows Media Services
  - Full support for IPv6 since version 9
- Darwin Streaming Server
  - Does not support IPv6 yet (old patch available)
- Shoutcast
  - Also does not support IPv6
  - Can be replaced by Icecast, which does.
Office network

• Some support needed to offer services
• Testing, development
• Requires some more research
• Auto configuration (DHCPv6?)
• Host and software support
• Firewalls
Wrap-up

• Implementing IPv6 is very possible
• Several challenges do exist
• Worthwhile for NPO?
  • Most users currently are nerds, but
  • More and more routers now support automatic 6-to-4 tunneling (2002::/16)
• Make it worthwhile for clients
• Provide incentive to switch
Thanks
Questions?