IPv6 Transitioning

An overview of what's around

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There Was a Plan

- The original idea was to have IPv6 deployed before we were out of IPv4 addresses

- By now the whole of the Internet should have been dual-stacked

- And I wouldn't be standing here

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IPv6 is the End Goal

- Exhaustion of the IPv4 free pool is a permanent problem
- The only way to support the future growth of the Internet is by deploying IPv6
- This will take time, so an intermediate solution has to be found
- Eventually, be prepared to switch off IPv4
- **Dual stack wherever possible!**

Transitioning Techniques

- The IETF has several RFCs and active drafts, and some that have been abandoned already:

6in4	NAT64
6to4	DS-lite
Teredo	A+P
6RD	4RD
ISATAP	SIIT
TSP	TRT
6over4	NAT-PT
IVI	….

Solving Two Problems

- Maintaining connectivity to IPv4 hosts by sharing IPv4 addresses between clients
  - Extending the address space with NAT/CGN/LSN
  - Translating between IPv6 and IPv4
- Provide a mechanism to connect to the emerging IPv6-only networks
  - Tunnelling IPv6 packets over IPv4-only networks

The Options

Network Address Translation

- Extends the capacity of the IPv4 address space by sharing an IPv4 address between clients

- Fairly common technology, used everywhere

- Breaks the end to end connectivity model

- **It doesn't allow communication with IPv6!**

- You are probably going to need it in some form

Transitioning: Two Main Methods

- Transporting X in Y
  - 6in4
  - 6to4
  - Teredo
  - 6RD

- Translating X into Y
  - NAT64/DNS64

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6in4

- Manually configured tunnels towards a fixed tunnel broker like SixXS, Hurricane Electric or your own system

- Stable and predictable but not easily deployed to the huge residential markets

- MTU might cause issues

6to4

- "Automatic" tunnel, system can configure itself
  - IPv4 address is part of the IPv6 address

- Requires a public IPv4 address

- Uses anycast to reach a nearby server

  - Do you know who owns it?

  - Does it come with an SLA?

- Return traffic might choose another server

- IP protocol 41 might get dropped

Teredo

- The other automatic tunnelling system

- Uses UDP to encapsulate packets

  - Works across (most) NAT implementations

- Traffic will be symmetric across a single "Teredo relay", the one closest to the native IPv6 host

  - Do you know the owner?

  - Can you call them when it breaks?

6RD

- Quite similar to 6to4

  - Encodes the IPv4 address in the IPv6 prefix

- Uses address space assigned to the operator

- The operator has full control over the relay

- Traffic is symmetric across a relay

  - Or at least stays in your domain

- Can work with both public and private space

- Needs additional software for signalling

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Tunnelling

- In general allows clients to connect to IPv6-only hosts from an IPv4-only network

- Connecting from an IPv6 host to a tunnel client might be more difficult

- Watch out for MTU issues

- Your mileage may vary depending on which technique you choose

Translating: NAT64/DNS64

- Single-stack clients will only have IPv6

- Translator box will strip all headers and replace them with the other protocol

- Requires some DNS "magic"

  - Capture responses and replace A with AAAA

  - Response is crafted based on target IPv4 address

- Usually implies address sharing on IPv4

The End Game

Did You Deploy IPv6 ?

- IPv4 will probably stay around for a long time

- Despite having full IPv6 deployment you might need to connect to an IPv4 host

- And maybe all you got was a /22 of IPv4 addresses

DS-lite

- Tunnelling IPv4 over IPv6

- Allows clients to use RFC1918 addresses without doing NAT themselves

- NAT is centrally located at the provider

- Client's IPv6 address is used to maintain state and to keep clients apart

  – Allows for duplicate IPv4 ranges

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Other Alternatives

- A+P

  - Share address between clients

  - Restrict the client to a specific port range

- 4RD

  - Automated mapping between IPv4 and IPv6 address

Which To Choose ?

Three Groups

- People who are too late and only got a /22

  - Or maybe even nothing at all

- People who where there in time to get some IPv4 address space. These can be split into two:

  - Those who have enough addresses for the next two years, operating in a saturated market for instance

  - Those who are experiencing growth and don't have enough addresses available

Enough IPv4 Addresses

- If you think you can cope for the next two years with the number of addresses you have:

  - No immediate problems to be expected

  - Focus on dual-stack deployment but don't delay it

  - Consider offering a tunnel server just in case you get confronted with IPv6 only hosts

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Not Enough Addresses

- If you don't have enough IPv4 addresses left to cope with your expected growth

- Focus on the two problems:

    – Maintain IPv4 connectivity with NAT

    – Find a path towards IPv6 deployment

- IPv4 connectivity might be your biggest problem for now

Which Technique?

- It all depends on what your network can do
  - Can you easily deploy native IPv6?

- Use of private addresses limits your options
  - 6RD is probably your best bet
  - If you can do IPv6 natively, DS-lite is an option

Only the Final /22?

- There is not much choice left other than deploying an IPv6 native network

- NAT64 and address sharing is an option
  - But how far will you get with it?

- The key lies with those who provide the content
  - They have to make sure your customers can reach them because those customers don't have a choice

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Offering Content ?

- If you have enough IPv4 addresses left
  - Dual-stack your network!

  - Don't use intermediate solutions like tunnels

- Not enough IPv4 addresses left?
  - You are in trouble

- Address sharing won't get you very far
  - You only have one port 443 to give out

  - How far do virtual hosts really scale?

Choose Wisely

- There are a lot of factors to take into account:

  - Can you deploy IPv6 at the moment?

  - Do you have enough IPv4 addresses available?

  - Do you have full control over the client side?

  - Can you run software upgrades to the CPE?

  - What would the traffic balance be between IPv6 and IPv4?

- Keep in mind most are temporary solutions

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Questions?