

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

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

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

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

Other Alternatives

- A+P
 - Share address between clients
 - Restrict the client to a specific port range
- 4RD
 - Automated mapping between IPv4 and IPv6 address

10ff 198.
:bf98:3080.
98.51.100.14.
:cb00:13be20
:19f2:80::1 198
d:2209:bc:80r
:db8::109b
08 51.

Which To Choose ?

Three Groups

- People who are too late and only got a /22
 - Or maybe even nothing at all
- People who were 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

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

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

Questions?

