

IPv6 ADDRESSING PLANS

How IPv6 makes addressing plans easier and more useful

IPv6 ADDRESSES | 0 |

- Looking at subnet addressing
 - We assume the following delegation structure, which uses common sizes
- 2001 : db8 : abcd : 01b4 : : / 64
 - ISP (allocated by RIPE NCC)
 - Customer / End-site (assigned by ISP)
 - Single subnet / LAN (assigned by net-admin)

ABOUT NIBBLE BOUNDARIES

- Computers and networks work with bits
 - An IPv6 address is 128 bits
 - A nibble is 4 bits (half a byte)
- Characters in an IPv6 address are hexadecimal
 - 0 1 2 3 4 5 6 7 8 9 a b c d e f
 - Each hexadecimal character represents 4 bits

IPv6 ADDRESSING PLANS

- Every organisation gets enough addresses for:
 - 65,536 networks
 - Virtually unlimited number of addresses per network

IPv6 ADDRESSING PLANS

- Divide based on something 'useful':
 - Based on location
 - Based on function / security policy
- Try to make the address readable
 - `2001 : db8 : abcd : 01b4 : : / 64`
 - Readability means using nibble boundaries
 - No more IPv4 ranges like 192-223, 224-239 etc.

SO, HOW DO WE USE THE 16 BITS AVAILABLE FOR SUBNETTING?

- 2001 : db8 : abcd : **01b4** : : / 64
- **01** can represent the function of the network
 - **00** = infrastructure
 - **01** = servers
 - **0f** = office
 - **ab** = guest WiFi
 - **ff** = etc...

SO, HOW DO WE USE THE 16 BITS AVAILABLE FOR SUBNETTING?

- 2001 : db8 : abcd : 01b4 : : / 64
- **b** can represent the location of the network
 - **0** = inter-location
 - **1** = main building
 - **2** = other building
 - **b** = datacenter 2
 - **f** = etc...

SO, HOW DO WE USE THE 16 BITS AVAILABLE FOR SUBNETTING?

- 2001 : db8 : abcd : 01b4 : : / 64
- 4 can be a simple serial number
 - for when there are multiple networks with the same function at the same location
 - 0 = first network
 - 1 = second network
 - f = etc...

WARNING!

- Remember: **this was only an example!**
 - You can use any structure that makes sense for your network
 - Sticking to nibble boundaries makes a lot of sense
 - Much more readable
 - Reverse DNS also uses nibble boundaries

ADVANTAGES FOR NETWORK ADMINS

- Structure makes networks recognisable
 - Admins quickly see which network it is
 - Which limits the possibility for errors

ADVANTAGES FOR SECURITY

- If all networks with one function are put in the same prefix then they can all be covered by one firewall policy
 - No changes in the firewall when adding networks
 - Which limits the possibility for errors
- The same goes for VPN policies

IMPACT OF AN IPv6 ADDRESSING PLAN

- No more NAT
 - IPv4 addresses were usually only visible inside the local network
 - IPv6 addresses are visible everywhere (end-to-end principle)
 - But things like Cookies give more information than IP addresses...
- A good addressing plan improves:
 - planning, which makes deployment much easier
 - traceability, which makes debugging and security much easier

ISN'T THIS A WASTE OF ADDRESSES?

- No, this is using what IPv6 has to offer!
 - We have plenty of addresses
 - 99,999...% of the addresses will never be used
 - You get more than you'll ever use
 - The addressing plan doesn't change the number of devices / the number of addresses used
 - It only determines **which** addresses we use

THAT'S WHAT THEY SAID FOR IPv4...

- The real numbers: (based on the common distribution sizes)
 - 536,870,912 /32s (ISPs) worldwide
(one per 13 people on the planet)
 - 65,536 customers per /32
 - 65,536 networks per customer
 - Virtually unlimited number of addresses per network
(18.446.744.073.709.551.616 to be precise)
- And 83% of the addresses is still kept in reserve

SUMMARY

- IPv6 addressing plans offer many advantages
 - Ease of use
 - Security
 - Scalability
 - Traceability
- Wasting IPv6 addresses is not an issue
 - Network admins need to change their way of thinking!

WHERE TO FIND MORE DOCUMENTATION?

- The document this presentation is based on was written for SURFnet, the Dutch NREN:
 - <http://www.surfnet.nl/en/nieuws/Pages/IPv6numberplan.aspx>
- RIPE NCC provided the translation to English:
 - <http://www.ripe.net/lir-services/training/material/>