

OggCamp11

Introduction to IPv6

Ron Wellsted
Goldthorn Services Limited
www.wellsted.org.uk
www.goldthorn.co.uk

Introduction to IPv6

- The Problem - IPv4
- The Solution - IPv6
- Idea of Size
- Address Notation
- Special Addresses
- Mixed Addresses

Introduction to IPv6

- Auto-configuration
- DNS
- Software Support
- Tunnel Brokers
- What Is Out there?

The problem - IPv4

- 32 bit address
 - 4,294,967,296 - Addresses
 - Except we loose:
 - Multicast etc. ~ 537 million
 - Localhost ~ 16 million
 - RFC 1918/zeroconf ~ 17 million
- Rate of allocation
 - IANA ran out 03 Feb 2011
 - RIRs – Q3 2011 – Q1 2012

The Solution - IPv6

- 128 bit addressing
 - 340,282,366,920,938,463,463,374,607,431,768,211,456 addresses
 - 340 trillion, trillion, trillion addresses
 - 79,228,162,514,264,337,593,543,950,336 internets
 - 79 billion, billion, billion internets

Idea of Size

- Question:
 - If the IPv4 address space = a 1" square (25.4mm x 25.4mm), how big would the square have to be represent the IPv6 space?

Idea of Size

- Question:
 - If the IPv4 address space = a 1" square (25.4mm x 25.4mm), how big would the square have to be represent the IPv6 space?
- Answer:
 - About the size of the Solar System!

Address notation

- Split into 16 bit fields
 - 8 fields
 - Separate with :
 - Specify in hex (0-9a-f)
 - Zero suppression
 - Leading zeros
 - All zero fields
 - /nn = number of active bits in the address
 - /128 = actual address (implicit)
 - /64 = 64 bit subnet

Address notation

- Examples
 - 2a01:348:12d::0/64
 - A global 64 bit subnet
 - 2a01:348:12d::211:d8ff:fef3:fcc1
 - A system on the above network
 - MAC address 00:11:d8:f3:fc:c1
 - 2a01:348:6:5e::2
 - wellsted6.uk.to

Special addresses

- `::1` ~ 127.0.0.1
- `fxxx::` Multicast
 - `ff01::` node-local (this computer)
 - `ff02::` link-local (this LAN)
 - `ff05::` site-local
 - `ff08::` organisation-local
 - `ff0e::` global (the internet)

Mixed Addresses

- Compatible IPv4 as Ipv6
 - Used for devices that support both
 - ::192.168.1.20
- Embedded IPv4 within IPv6
 - Used for IPv4 devices that do not support IPv6
 - ::ffff:192.168.1.1

Auto-configuration

- radvd – Router ADVertisement Daemon
 - Advertises the local subnet details
 - Prefix
 - Router
 - Client uses prefix + modified MAC address
- dhcp6
 - Works with radvd
 - Information not supplied by radvd
 - DNS server
 - NTP, etc.

DNS

- Forward Zones
 - Names – as with IPv4
 - AAAA records (Quad-A)
 - A6 – obsolete
- Reverse Zones
 - Names – long
 - 0.0.0.0.d.2.1.0.8.4.3.0.1.0.a.2.ip6.arpa
 - PTR records – IPv6 addresses

Software Support

- Operating Systems
- Libraries
- Programs

Operating Systems

- Linux
 - 2.4/2.6 kernels (some support in 2.2 kernels)
- Windows
 - XP & Server 2003 - optional
 - Vista & Server 2008 - standard
- Apple
 - OS X
- BSD
 - FreeBSD 4.0, OpenBSD 2.7

Libraries

- C runtime
 - tcp6_socket, udp6_socket, raw6_socket
- Perl
 - Net::IP
- Python
- 6tunnel
 - connects IPv4 client to IPv6 Server

Programs

- Apache2
- Postfix
- Bind9
- Firefox
- Thunderbird
- Pan
- Pidgin
- Wireshark

Tunnel Brokers

- Provide a tunnel over IPv4 to IPv6
- May provide other services
 - Reverse DNS
 - IPv6 to IPv4 proxies
 - IPv6 Bittorrent trackers

Tunnel Brokers

- sixxs.net
 - European (NL)
 - Free
 - Local POPs – London
 - Given an endpoint – Earn Credits
 - Keep tunnel alive
 - "Buy" a subnet (/48)
 - Extra services

Tunnel Brokers

- Hurricane Electric (www.he.net)
 - Requires protocol 41 (6in4)
 - Provide full DNS
 - Provide online certification

Tunnel Brokers

- Gogonet (gogonet.gogo6.com)
 - Canadian
 - Free
 - Anonymous
 - Endpoint only
 - Signup & Authenticate
 - Endpoint
 - Subnet (/64 or /48)

What Is Out There?

- Web
 - US government departments
 - ipv6.google.com
 - Regional registries
- IRC
 - irc.ipv6.freenode.net
- NNTP
- NTP
- etc.

Further Reading

- The TCP/IP Guide by Charles M. Kozierek
 - No Starch Press
 - Online at <http://www.tcpipguide.com>
- IPv6 Essentials by Silvia Hagen
 - O'Reilly, ISBN: 0-596-10058-2

OggCamp11

Introduction to IPv6

Ron Wellsted
Goldthorn Services Limited
www.wellsted.org.uk
www.goldthorn.co.uk