

IPv6.marceln.org

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RFC 1606

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A Historical Perspective On The Usage Of IP Version 9

1 April 1994, J. Onions

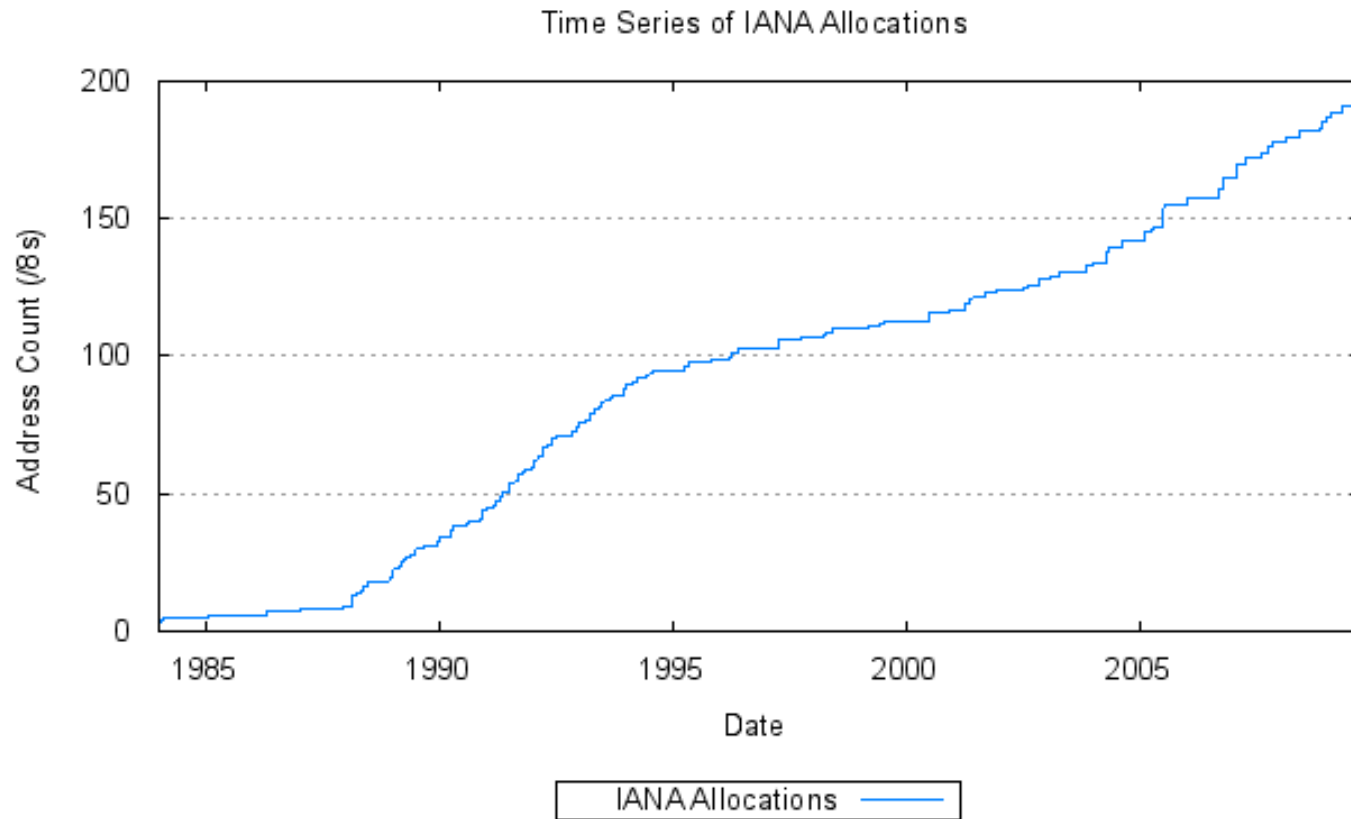
Introduction

The take-up of the network protocol TCP/IPv9 has been phenomenal over the last few years. Gone are the days when there were just a few million hosts, and the network was understood. As the IP version 9 protocol comes to the end of its useful life, once again due to address space exhaustion, we look back at some of the success of the protocol.

Introduction

- Why IPv6
- IPv6 Addresses
- IPv6 Configuration
- IPv6 Routing
- DHCP and DNS
- IPv6 Firewall

Why IPv6 (1)



<http://www.potaroo.net/tools/ipv4/fig06.png>

14 September 2009

Why IPv6 (2)

- Expected Exhaustion
 - <http://www.potaroo.net/tools/ipv4/index.html> (14 Sep 2009)
 - IANA 3 September 2010
 - RIR 8 Juli 2012
- Solutions
 - NAT
 - Reclaiming unused space
 - **IPv6**
- It's time to get some experience with IPv6!

IPv6 Addresses (writing)

- IPv4: 32 bits
 - Written as for decimal numbers
 - 1.2.3.4
- IPv6: 128 bits
 - Written as 8 blocks of 4 hex numbers with colons
 - 1234:5678:9abc:def0:1122:3344:5566:7788
 - Skipping zero at the start of 4 hex numbers
 - Skipping sequences of zero's with ::
 - 0001:0002:0000:0000:0000:0000:0003:0004 = 1:2::3:4

IPv6 Addresses (network part)

- IPv4
 - netmask/CIDR (Classless internet domain routing)
 - 192.0.2.0/24 (host part last byte from 0 to 255)
 - 192.0.2.64/26 (host part last byte from 64 to 127)
- IPv6
 - 1111:2222:3333:4444:5555:6666:7777:8888/48
 - Network type (link local, site local, global)
 - Global routing prefix (64-Subnet bits)
 - Subnet ID (16-48 bits)
 - Host part
 - CIDR bits

IPv6 Addresses (important networks)

- `::1/128`
 - Localhost (IPv4 127.0.0.1)
- `fe80::/10`
 - Link local (IPv4 169.254.0.0/16)
- `fc00::/7`
 - Unique local addresses (IPv4 rfc 1918 192.168.0.0/16)
- `ff00::/8`
 - Multicast (IPv4 224.0.0.0/4)
- `2000::/3`
 - Global unicast addresses

IPv6 Configuration (Autoconfig)

- Install and activate IPv6!
 - Default on many linux distro's, BSD and opensolaris
- Auto configuration
 - Client configures a link local address
 - Listens for IPv6 router advertisements
 - Configures the network part of the address from the advertisement
 - Uses the mac address to calculate the host part
- More than one address per device is normal!

IPv6 configuration (manual)

- Manual configuration
 - `ifconfig <dev> add <addr>`
 - `ip addr add <addr> dev <dev>`
- Use the distro specific configuration files
 - Redhat: `/etc/sysconfig/network-scripts/ifcfg-<dev>`
 - `IPV6ADDR=2001:888:165c:101::1/64`
 - Debian: `/etc/network/interfaces`
 - `iface eth0 inet6 static`
`address 2001:888:165c:ff01::2`
`...`

IPv6 configuration (IPv4 tunnels)

- Add the tunnel on both sides
 - `ip tunnel add sit1 mode sit remote <IPv4 DST>`
`ip addr add <IPv6 ADDR/MASK> dev sit1`
`ip link set sit1 up`
- RH: `/etc/sysconfig/network-scripts/ifcfg-sit1`
 - `DEVICE=sit1`
`BOOTPROTO=none`
`ONBOOT=yes`
`IPV6INIT=yes`
`IPV6TUNNELIPV4=194.109.5.241`
`IPV6ADDR=2001:888:10:65c::2`

IPv6 routing (gateway)

- Enable IPv6 forwarding
 - Forwarding from IPv6 tunnels to local Ethernet
 - Forwarding through multiple tunnels or Ethernet segments
- Default route
 - ip route add default via <IPv6 default router>
 - Or the os depend config file
 - RH: /etc/sysconfig/network
 - IPV6_DEFAULTDEV=<dev>

IPv6 routing (local static routes)

- Static routes work the same as IPv4
 - Just add them to the routing table
 - `ip -6 route add <IPv6 DST> via <IPv6 ADDR>`
- Or use the os dependend config file
 - RH: `cat /etc/sysconfig/network-scripts/route-sit2`
`GATEWAY0=<IPv6 ADDR>`
`NETMASK0=<IPv6 Mask>`
`ADDRESS0=<IPv6 Network>`

IPv6 routing (advertisement)

- Automatic configuration of clients
 - Router announces network and gateway
 - Client chooses a host part of the address
 - The host part is calculated from the mac address
 - The host chooses a random host part (Privacy Extensions)
- Run radvd to advertise IPv6 network
 - Configuration per network interface needed

DHCPv6

- Needed for extra parameters?
 - DNS
 - Servers
 - domain-name
 - Some services
 - Ntp
 - Log servers
 - Netnios name server
- Dynamic DNS update
 - Register the name of the client in DNS

DNS (adding IPv6 Record)

- Forwards

- The record type is “AAAA”

- koning100 IN AAAA 2001:888:165c:100::1

- Reverse

- Other zone name

- c.5.6.1.8.8.8.0.1.0.0.2.**ip6.arpa**

- Normal “PTR” record but every hex character is a sub level

- 1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.1.0 IN PTR

- koning100.marceln.org.

DNS (server)

- The normal bind works
 - Just add one configuration option
 - `listen-on-v6 port 53 { 0::0/0; };`

Firewall (IPv4)

- The IPv6 tunnel over IPv4 sends **IPv4** packages
 - Create a rule to allow IPv4 packets type 41 (Ipv6)
 - `iptables -A OUTPUT -p 41 -j ACCEPT`
`iptables -A INPUT -p 41 -j ACCEPT`
- No other changes needed
- No protection from IPv4 firewall

Firewall (IPv6)

- All your host are now direct connected to the internet
 - No nat
 - All host have routable addresses
- Use a firewall to protect your internal hosts
- Ip6tables works the same as “iptables”

Ip6tables example

```
ip6tables -P INPUT DROP
```

```
ip6tables -P FORWARD DROP
```

```
ip6tables -P OUTPUT DROP
```

```
ip6tables -A INPUT -m state --state \
    ESTABLISHED,RELATED -j ACCEPT
```

```
ip6tables -A FORWARD -m state --state \
    ESTABLISHED,RELATED -j ACCEPT
```

```
ip6tables -A OUTPUT -m state --state \
    ESTABLISHED,RELATED -j ACCEPT
```

```
ip6tables -A INPUT -p tcp --dport 22 -j ACCEPT
```

```
ip6tables -A FORWARD -p tcp --dport 22 -j ACCEPT
```

```
ip6tables -A OUTPUT -p tcp --dport 22 -j ACCEPT
```

RFC 1607

A VIEW FROM THE 21ST CENTURY

1 April 1994, V. Cerf

A NOTE TO THE READER

The letters below were discovered in September 1993 in a reverse time-capsule apparently sent from 2023. The author of this paper cannot vouch for the accuracy of the letter contents, but spectral and radiation analysis are consistent with origin later than 2020. It is not known what, if any, effect will arise if readers take actions based on the future history contained in these documents. I trust you will be particularly careful with our collective futures!

Questions

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