# IPv6 Intro

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SkullSpace Hackathon

# Online HTML5 Slides

Presentation source/download available at
github.com/tbaschak/ipv6-intro-presentation

# Who I Am

- Primary Network Administrator of VOI Network Solutions – Winnipeg-based commercial Internet Service Provider and carrier.
- Involved with both Internet Exchanges in Winnipeg.
  - Elected member on the Board of Directors for MBIX.
  - Also involved with the creation and technical operations of WpgIX.
- Avid opensource software user/fanatic, and recently, contributor.

# My Life with IPv6

- Running IPv6 since ~2004.
  - Over tunnels for many, many years.
  - Native IPv6 since December 2012, via Voi Networks BGP address space.
- My own network currently runs IPv6/OSPFv3 routing protocol.
  - 2604:4280:d00d::/48
  - Most ciscodude.net/henchman21.net services are IPv4/IPv6 enabled.

# IPv6 Address Basics

- The IPv6 address space is 128-bits (2^128) in size, containing 340,282,366,920,938,463,463,374,607,431,768,211,456 IPv6 addresses.
- Like IPv4, Network and Host bits.
- Unlike IPv4, Network and Host bits are usually equal.

# IPv6 Addressing (rfc4291)

- Valid Host Addresses
  - 2001:DB8:0:0:8:800:200C:417A
  - 2001:DB8::8:800:200C:417A
  - 2604:4280:d00d::80
  - 2604:4280:d00d:200::1
  - ::1 (loopback)
  - :: (0:0:0:0:0:0:0:0)

# IPv6 Address Sample

- My IPv6 privacy address at the time of writing: 2604:4280:d00d:202:1986:feb8:ccb0:78e1
  - Prefix: 2604:4280:d00d
  - Network: $Prefix:202
  - Host: 1986:feb8:ccb0:78e1

# rfc4291 (cont)

- Valid Network Addresses
  - 2001:0DB8:0000:CD30:0000:0000:0000:0000/60
  - 2001:0DB8::CD30:0:0:0:0/60
  - 2001:0DB8:0:CD30::/60
  - ::/0

# ARP -> ND (rfc4861)

- Uses link-layer multicast instead of broadcast.
- Subcomponents include
  - Address Resolution
  - Duplicated Address Detection
  - Neighbor Unreachability Detection
- Makes use of a number of predefined multicast addresses (much like routing protocols)
  - all-nodes (FF02::1)
  - all-routers (FF02::2)
- Many components require use of /64 subnet size.

# DHCP -> SLAAC / DHCPv6

- DHCP for autoconfiguration has been replaced with SLAAC, and/or DHCPv6.
- SLAAC uses Neighbor Discovery, ICMPv6 RA discovery, to autoconfigure addresses.
- DHCPv6 does not currently send a default gateway, so SLAAC/RA is still required.
- IPv4 untrusted layer 2 issues have followed to IPv6.
  - Rogue DHCP -> Rogue RA & Rogue DHCPv6.
  - DHCP Snooping -> RA Guard in switches to mitigate.

# IPv4 vs IPv6 Subnets

- Where a /24 is often used on LANs with IPv4, /64's are strongly encouraged with IPv6.
- Recommended Site Prefix: /48 allows 64k /64's.
- Residential providers often using DHCP6pd to allocate /60's to Customer routers (Including Xplornet).
- Not using a /64 subnet prefix length will break many features of IPv6, including Neighbor Discovery, Secure Neighbor Discovery [RFC3971], privacy extensions [RFC4941], and Site Multihoming by IPv6 Intermediation [SHIM6], among others.

# Privacy Addresses (rfc4941)

- Extension to SLAAC.
- New random secondary privacy addresses regenerated periodically.
- Can cause havok for Session based applications which tie the session to your IP (which is recommended to prevent session hijacking).

# ULA (rfc4193)

- Stands for Unique Local IPv6 Unicast Addresses.
- Similar to RFC1918 addresses, for use within LANs and/or isolated/non-connected networks.
- Supposed to be generated using a specific algorithm, they are guaranteed of being somewhat globally unique as well.

# Resources

- ipv6.he.net/certification/
- www.sixxs.net/tools/grh/ula/
- ipvfoo chrome extension
- ipvfox firefox extension

# Useful IPv6 RFCs

- RFC2460: IPv6 Specification
- RFC6434: IPv6 Node Requirements
- RFC4291: IPv6 Addressing Architecture
- RFC3484: Default Address Selection
- RFC4193: Unique Local IPv6 Unicast Addresses (ULA)
- RFC4443: ICMPv6
- RFC3315: DHCPv6 client
- RFC4862: SLAAC
- RFC4861: Neighbor Discovery
- RFC6177: IPv6 Address Assignment to End Sites

# Even More IPv6 RFCs

- RFC1981: Path MTU Discovery
- RFC4213: Basic Transition Mechanisms for IPv6 Hosts and Routers
- RFC3596: DNS protocol extensions for incorporating IPv6 DNS resource records
- RFC2671: DNS message extension mechanism
- RFC3226: DNS message size requirements
- RFC5095: Deprecation of Type 0 Routing Headers in IPv6
- More info at: http://www.ripe.net/ripe/docs/ripe-554
- BIG GIANT list at: http://ipv6now.com.au/RFC.php

# Questions / End

- Question & Answer period as time permits.

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