IPv6 for Linux and z/VM
4th Dimension Information Super Highway

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Disclaimer

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In other words: Your mileage may vary. "It Depends." Results not typical. Actual mileage will probably be less. Use only as directed. Do not fold, spindle, or mutilate. Not to be taken on an empty stomach. Refrigerate after opening.

When in doubt, ask! Don't believe me? Ask the list! Still in doubt? Try it!

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Internet Protocol version 6

- Why do IPv6?

- Where to get IPv6?

- What systems can talk IPv6?

- How does one enable IPv6?

- Now what??

Internet Protocol version 6

- Ports do not change (TCP, UDP)
- Funny syntax ... `[2604:8800:12b::d]`
- "beyond mind boggling" addressability
- External infrastructure (now)
- Consumer internet (immediate)
- Internal infrastructure
- V4 turns vestigial

IPv6 for Linux and z/VM

- This is a personal odyssey
- NOT talking about router config
- NOT detailing app upgrades
- NOT giving you the fire-and-brimstone

If IP v6 is a big yawn,
that's kind of the point!

IPv4 Exhaustion

IPv4 Exhaustion

- Current IP v6 infrastructure 11%
- Latest price for IP v4 address: $11.25

IPv4 Exhaustion

Of the 38575 networks worldwide running BGP, the number running IPv6 has increased to 4427, or 11.5% (an increase from 10.5% just 2 months ago).

Source: http://bit.ly/v6Report

IPv4 Exhaustion

Microsoft pays Nortel $7.5 million for IPv4 addresses

Bankrupt Nortel finds a buyer for 666K of its legacy IPv4 addresses, raising questions if the IPv4 black/grey market has arrived.

By Microsoft Subnet on Thu, 03/24/11 - 3:35pm.

Email   Comment   Print   Recommend   6 people recommend this. Be the first of your friends.

Microsoft this week offered to pay Nortel $7.5 million for 666,624 legacy IPv4 addresses. The sale is pending approval by U.S. Bankruptcy Court for the District of Delaware as part of Nortel's Chapter 11 bankruptcy.

It doesn't sound exactly like the black market for IPv4 address that industry experts have been warning us about for years. But then again, it could be the start of one. This sale is reportedly the first publicly disclosed large-scale sale of IPv4 addresses since ICANN announced they had run out of address blocks, says Kevin Murphy from Domain Incite. And if the court approves the sale on April 26, these 666K-plus addresses will selling for a decent chunk of change, too. (Those who oppose the sale, have until April 4 to file their objections). [Court documents: PDF].

Microsoft will pay $11.25 per address. That's more than the going rate for to register a .com domain name, which these days can be had for as little as $7.50.

BLACK MARKET. IPv4

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IPv6 Tunnel Brokers

- SixXS
- Hurricane Electric
- Gogo6
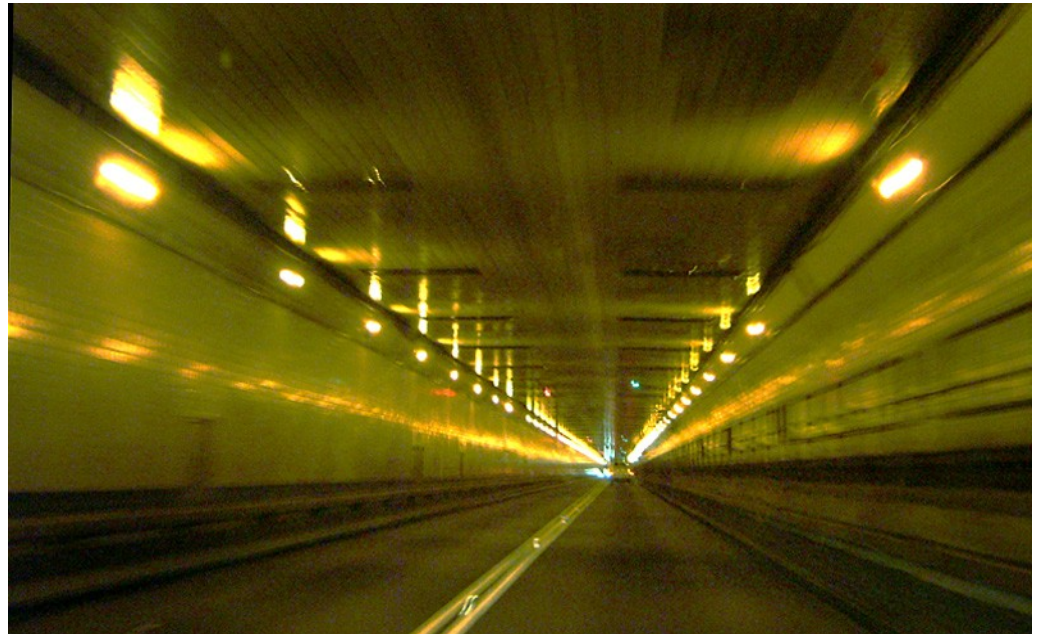
IPv6 Tunnel Brokers

- SixXS = Six Access

- AICCU

- `/etc/aiccu.conf`

```
username aaaa-SIXXS
password sayitnot
protocol tic
server tic.sixxs.net
tunnel_id T73837
```

Hurricane Electric

- Example configurations

- Worked for Linux/390

- Worked for Linux 2.2 '486

IPv6 for Linux, VM, and ...

- AIX
- Solaris - from 8 onward
- Windows - XP, Vista, 7
- Mac OS X
- NetBSD
- OpenBSD
- FreeBSD - stable from 4.4 onward
- HP-UX

IPv6 for Linux - Fedora

- To the file ...

```
/etc/sysconfig/network-scripts/ifcfg-
eth0
```

- Add the lines ...

```
IPV6INIT=yes
IPV6_AUTOCONF=no
IPV6ADDR=2604:8800:12b::25/48
IPV6_DEFROUTE=yes
IPV6_FAILURE_FATAL=no
```

IPv6 for Linux - SLES

- To the file ...

```
/etc/sysconfig/network/ifcfg-eth-id-macaddr
```

- Add the lines ...

```
LABEL_0='0'
IPADDR_0='2604:8800:12b::23'
PREFIXLEN_0='48'
```

IPv6 for z/VM

- Since z/VM 5.1
- `'ping'` and `'telnet'` in z/VM 5.4
- Remember "`ENABLEIPV6`"
- Home address /64 and /128 only
- No (known) tunneling ability

IPv6 for z/VM

```
   DEVICE   ETHDEV   OSD   0200   NONROUTER
AUTORESTART

   LINK     ETH0     QDIOETHERNET   ETHDEV
ENABLEIPV6


   HOME
;    IP Address         Subnet Mask        Link Name
;    --------------- ---------------
------------
     192.168.5.43      255.255.255.0    ETH0
     2001:1938:81:209::2b/64           ETH0
```

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IPv6 Dangers

- Stateless Autoconfig Considered Harmful
  (if you don't use DHCPv6)
- Your "real address" is visible
  (reduced anonymity)
- IPv6 was first used by hackers
  (using V6 address as a covert channel)

- Use static addrs and use DNS

Internet Radio - SLAY Radio

```
#!/bin/sh
#http://www.slayradio.org/
cd /tmp
title SlayRadio IPv6
curl -s
http://relayipv6.slayradio.org:8000/ \
    | madplay -o cdda:- - \
    | aplay -f cdr
```

Internet Radio - Fréquence 3

```sh
#!/bin/sh
#http://www.frequence3.fr/
cd /tmp
title Frequency3 IPv6
curl -s
http://stream.ipv6.frequence3.net:19000/frec `
    | madplay -o cdda:- - \
    | aplay -f cdr
```

Internet Radio - Absolute Radio

```sh
#!/bin/sh
#http://www.absoluteradio.co.uk/
cd /tmp
title Absolute Radio IPv6 Classic Rock
curl -s http://icecast-ipv6.as34763.net:80/vc128.mp3 \
    | madplay -o cdda:- - \
```


FACES FOR RADIO.

CHRISTIAN O'CONNELL WEEKDAYS

FRANK SKINNER SATURDAYS

DAVE GORMAN SUNDAYS

What's My IP Address?

Will report your IPv4 or IPv6 address:

- `http://icanhazip.com/`
- `http://www.sixxs.net/`
- `http://ipv6.he.net/`

Reachable only via IPv6:

- `http://zechariah.casita.net/`

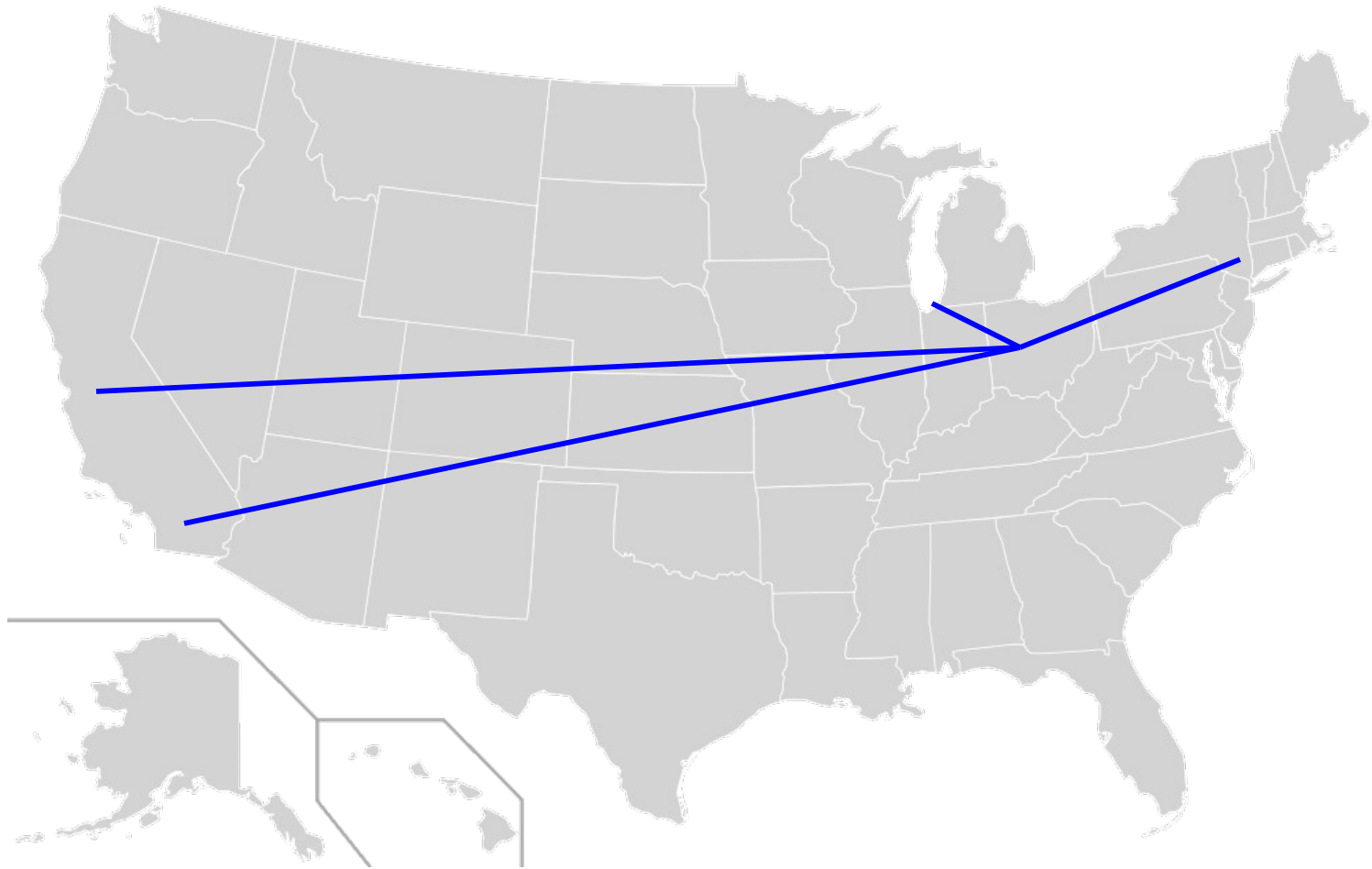## A Personal Odyssey

What I use:

- SSH

- port tunnels

- VNC

- my own DNS

- automation!

The Small World of casita.net

Rick hates NAT

- A way of life since '95
- RFC 1918 (formerly RFC 1597)
- Not just packets, but stateful
- Port swizzling, pain for (eg) SIP
- Lack of uniqueness
- Looked for NAT in V6 ... but ... then ...

`http://www.youtube.com/watch?v=v26BAlfWBm8`

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DNS at La Casita

```
/var/named/master/casita.net
/var/named/master/192.168.29
/var/named/master/2604:8800:12b
```

- "internal" DNS has complete domain
- "external" DNS has partial
- IPv4 PTR records valid internally
- IPv6 PTRs meaningful everywhere

DNS at La Casita – forward

```
$TTL 4H
@ IN SOA @ root@casita.net. ( 2011071300 7200 3600 3600000
86400 )
                IN    A      192.168.29.1
                IN    AAAA   2604:8800:12b::b
                IN    NS     jeremiah.casita.net.
main            IN    A      192.168.29.1
jeremiah        IN    A      192.168.29.11
jeremiah        IN    AAAA   2604:8800:12b::b
nehemiah        IN    A      192.168.29.12
nehemiah        IN    AAAA   2604:8800:12b::c
culdesac        IN    A      192.168.29.26
culdesac        IN    AAAA   2604:8800:12b::1a
```

DNS at La Casita – IPv4 reverse

```
$TTL 4H
$ORIGIN  29.168.192.IN-ADDR.ARPA.
@  IN  SOA  @  root@casita.net.  (
        2008063000 21600 3600 3600000 86400 )
                IN      NS    jeremiah.casita.net.
11              IN      PTR   jeremiah.casita.net.
12              IN      PTR   nehemiah.casita.net.
26              IN      PTR   culdesac.casita.net.
```

DNS at La Casita – IPv6 reverse

```
$TTL 4H

$ORIGIN  b.2.1.0.0.0.8.8.4.0.6.2.ip6.arpa.

@  IN  SOA  @  root@casita.net. (
        2011072400 21600 3600 3600000 86400 )

            IN   NS   jeremiah.casita.net.

b.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR
jeremiah.casita.net.

c.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR
nehemiah.casita.net.

a.1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR
culdesac.casita.net.
```

IPv6 Adoption

9274 raw domains of the Alexa top 1 million sites have a direct IPv6 address. We've been waiting a while to say this, but "it's over nine thousaaaaaand!!"

Summary

- The era of IP v6 is upon us.
- The world is not ending (because of V6).
- There are challenges.
- This is manifestly doable.

Thank You!!

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