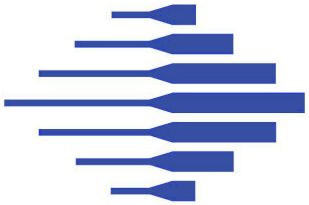

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SOFTWARE

IPv6 for Linux and z/VM

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VM and Linux Workshop 2012
University of Kentucky

Disclaimer

The content of this presentation is informational only and is not intended to be an endorsement by Velocity Software. (ie: I am speaking only for myself.) The reader or attendee is responsible for his/her own use of the concepts and examples presented herein.

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.

In all cases, *“If you can't measure it, I'm just not interested.”*

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Internet Protocol Version 6

World IPv6 Day

- 2011-June-8

World IPv6 Launch

- 2012-June-6

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Internet Protocol Version 6

What really is IPv6 and why should we do it?

Where to get IPv6 connectivity?

What systems can talk IPv6?

How does one enable Ipv6?

- on Linux
- on z/VM

Now what??

- IPv6-specific Resources

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What happened to IPv5?

Experimental

- Internet Stream Protocol

Not really called IPv5

Protocol header says “5”

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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

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This is a personal odyssey

NOT talking about router config

NOT detailing app upgrades

NOT giving you the fire-and-brimstone

If IPv6 is a big yawn,
that's kind of the point!

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IPv4 Exhaustion

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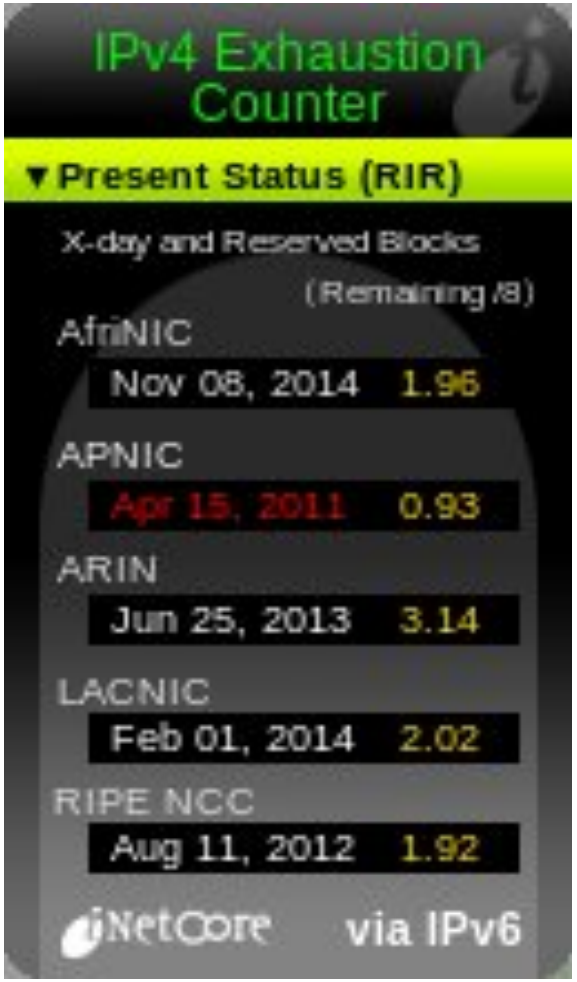
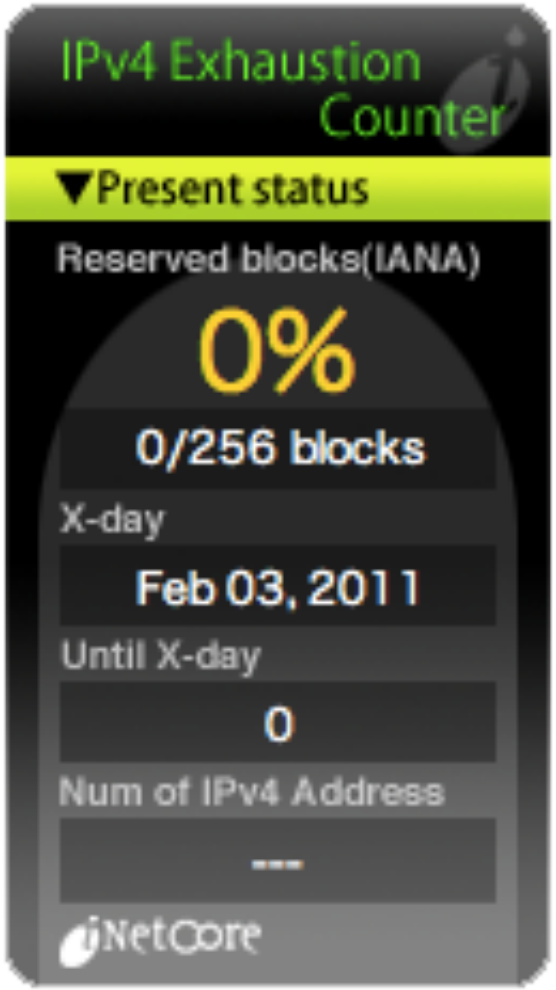
IPv4 Exhaustion





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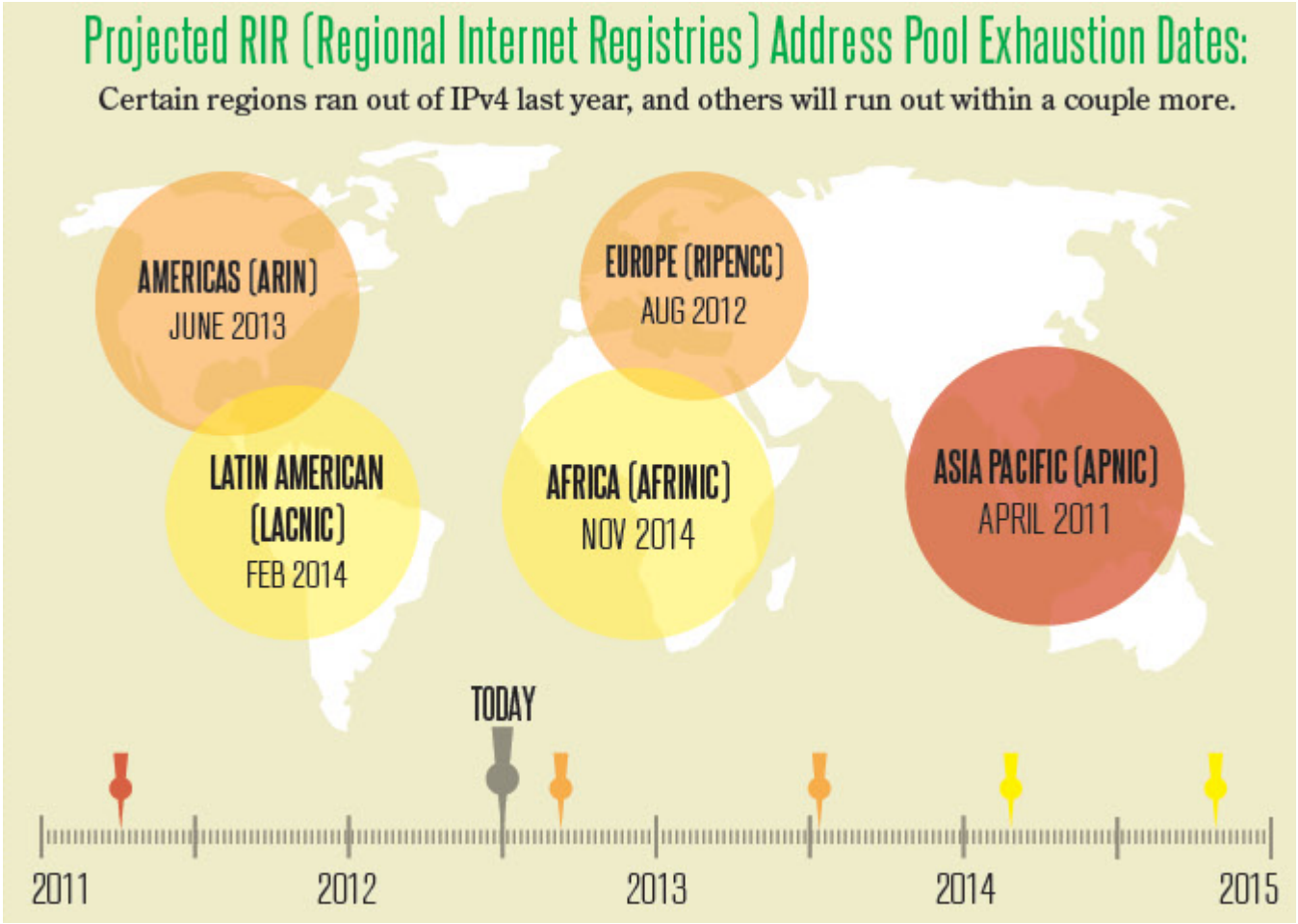
IPv4 Exhaustion



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IPv4 Exhaustion

Microsoft pays Nortel $7.5 million for IPv4 addresses

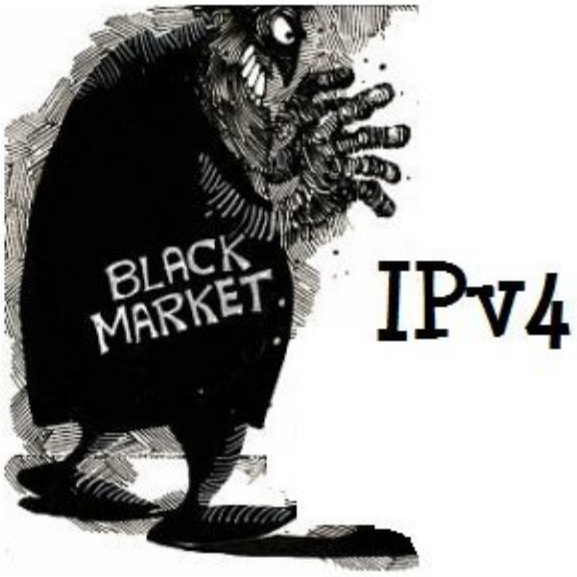
Bankrupt Nortel finds a buyer for 666K of its legacy IPv4 addresses, raising questions if the IPv4 black/grey market has arrived.

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.

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IPv4 Exhaustion

2011 IPv6 infrastructure 11%

2011 price for IP v4 address: $11.25

(something special about number 11?)

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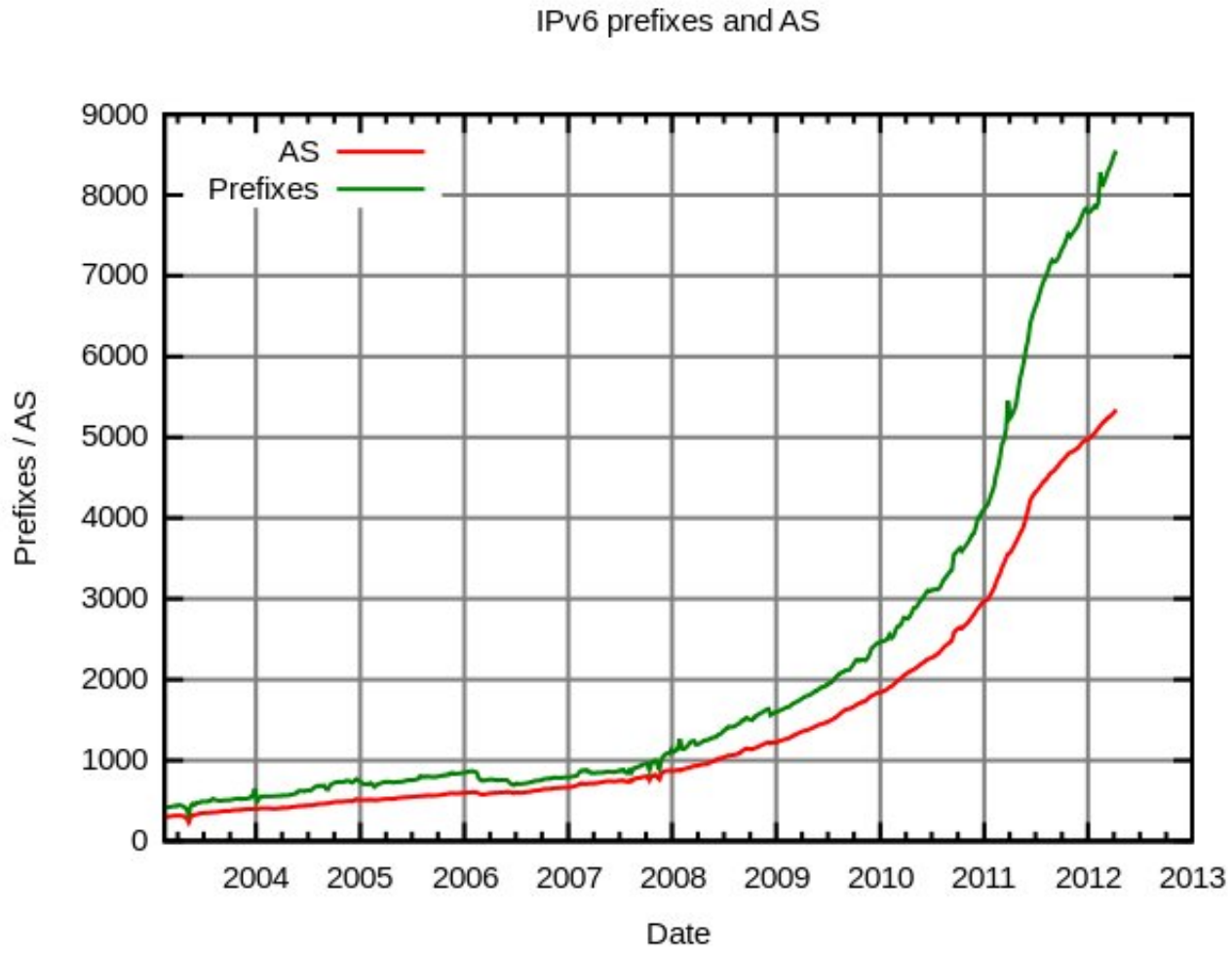
IPv6 Deployment



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US Gov/Mil Committed

Core support since 2008

Many, many tests

Apps, systems, devices

Residential IPv6

Littleton, Colorado

Pleasanton, California

... other markets

What's My IP Address?

Will report your IPv4 or IPv6 address:

http://icanhazip.com/

http://www.sixxs.net/

http://ipv6.he.net/

http://test-ipv6.com/

Reachable only via IPv6:

http://zechariah.casita.net/

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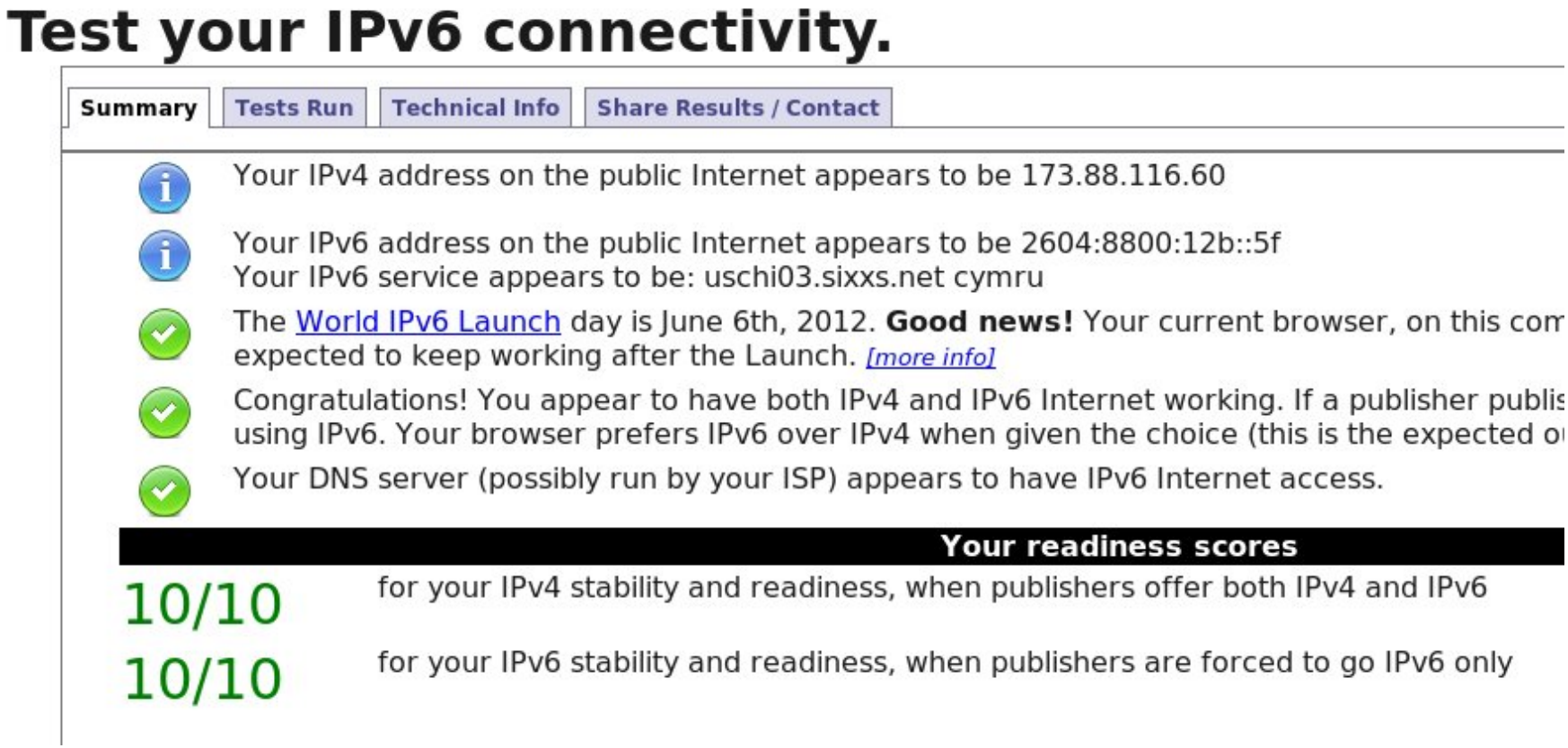
http://test-ipv6.com/



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IPv6 Tunnel Brokers

SixXS

Hurricane Electric

Gogo6

regionals

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IPv6 Tunnel Brokers

SixXS = Six Access

AICCU

/etc/aiccu.conf

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

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IPv6 Tunnel Brokers

Hurricane Electric

Example configurations

Worked for Linux/390

Worked for Linux 2.2 '486

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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

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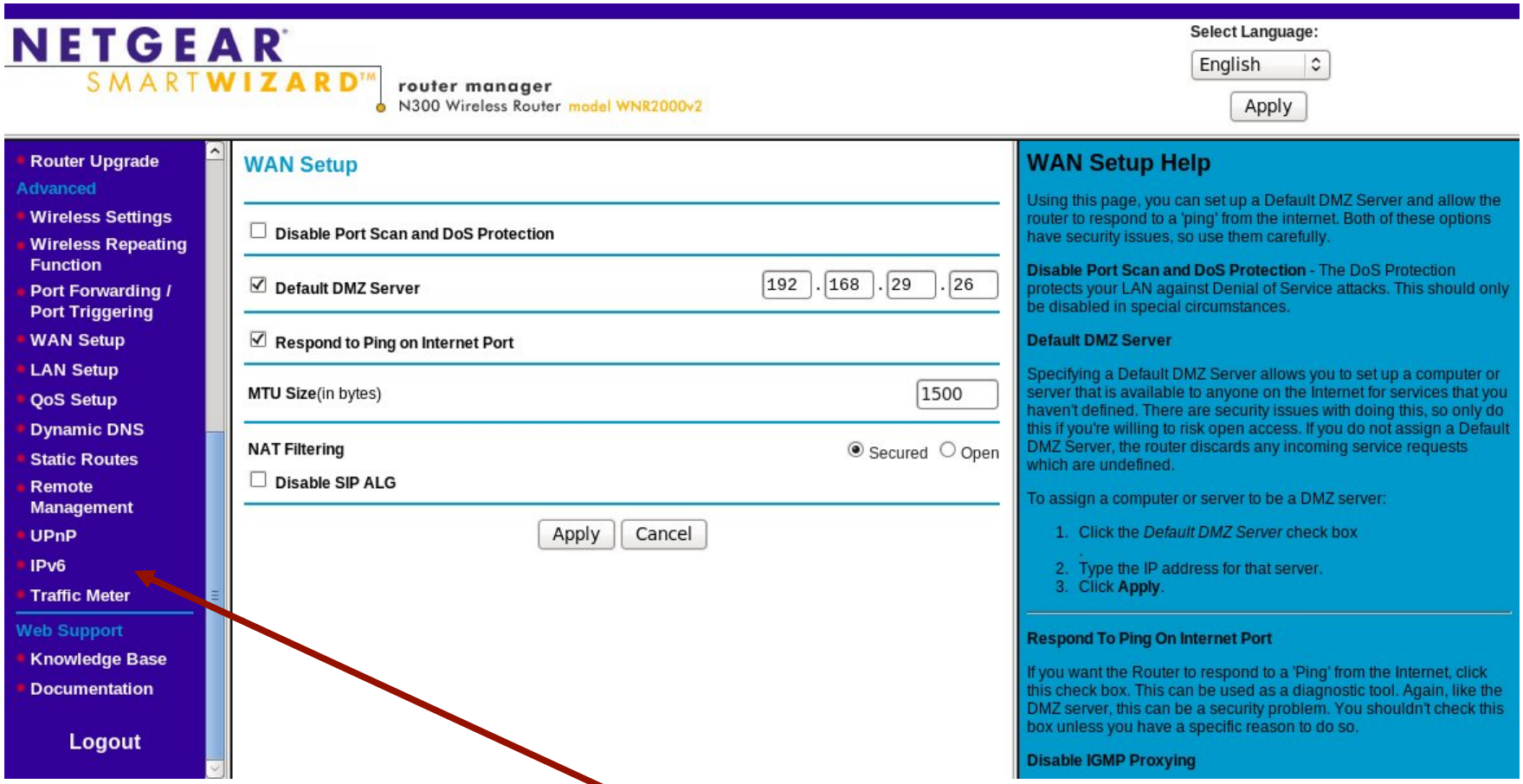
IPv6 for Linux, VM, and ...



new feature after upgrade

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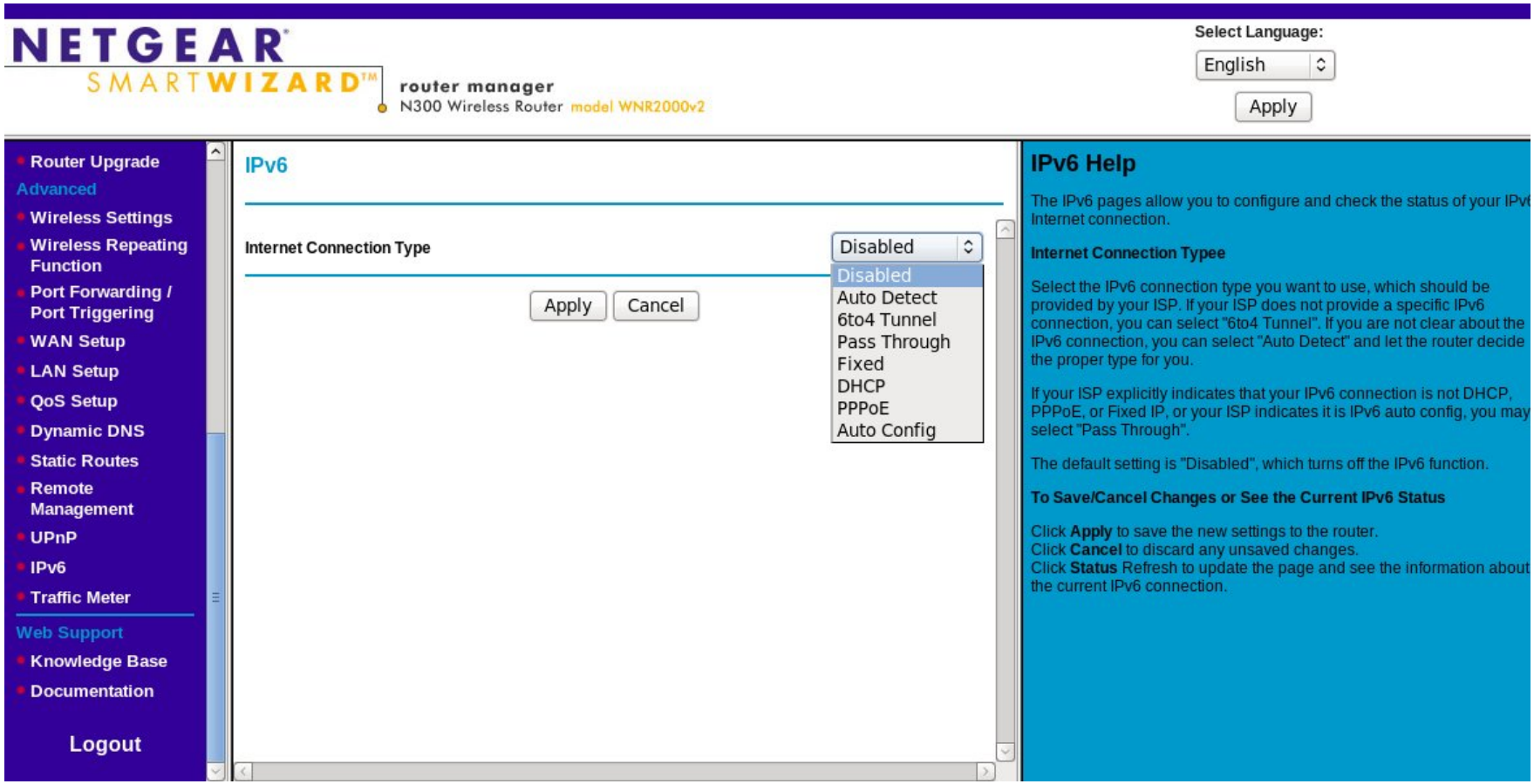
IPv6 for Linux, VM, and ...



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disabled by default, try 6to4

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
```

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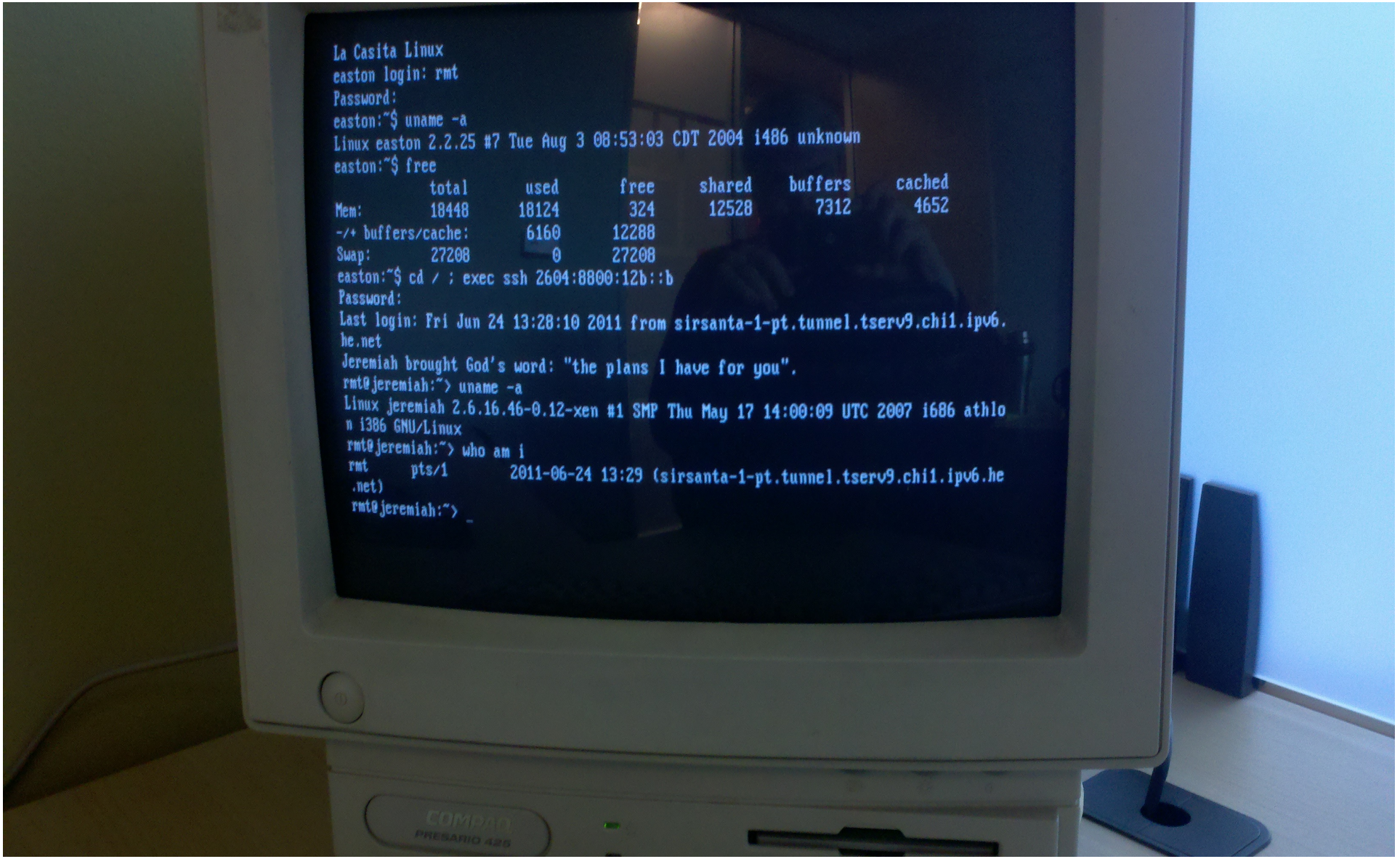
To the file ...

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

Add the lines ...

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

IPv6 for Linux ... any Linux



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

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```
DEVICE   ETHDEV   OSD   0200   NONROUTER   AUTORESTART
LINK     ETH0     QDIOETHERNET   ETHDEV    ENABLEIPV6

HOME
   192.168.5.43      255.255.255.0    ETH0
   2001:1938:81:209::2b/64            ETH0

GATEWAY
   DEFAULTNET          192.168.5.20         ETH0    8992
   DEFAULTNET6    2001:1938:81:8209::1    ETH0    8992
```

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IPv6 Dangers

Stateless Autoconfig Considered Harmful
(use DHCPv6 or static instead)

Your “real address” is visible
(reduced anonymity; Rick sez “good!”)

IPv6 was first used by hackers
(using V6 address as a covert channel)

Use static addrs and use DNS

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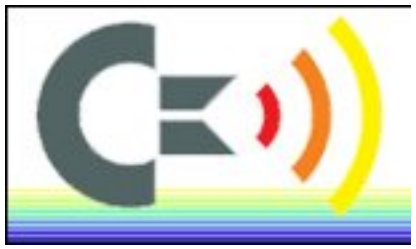
SLAY Radio - Internet Radio

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



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Fréquence 3 - Internet Radio

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

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Absolute Radio - Internet Radio

```
#!/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:- - \
  | aplay -f cdr
```

A Personal Odyssey

What I use:

- SSH
- port tunnels
- VNC
- my own DNS
- automation!

Tried to connect with 6bone

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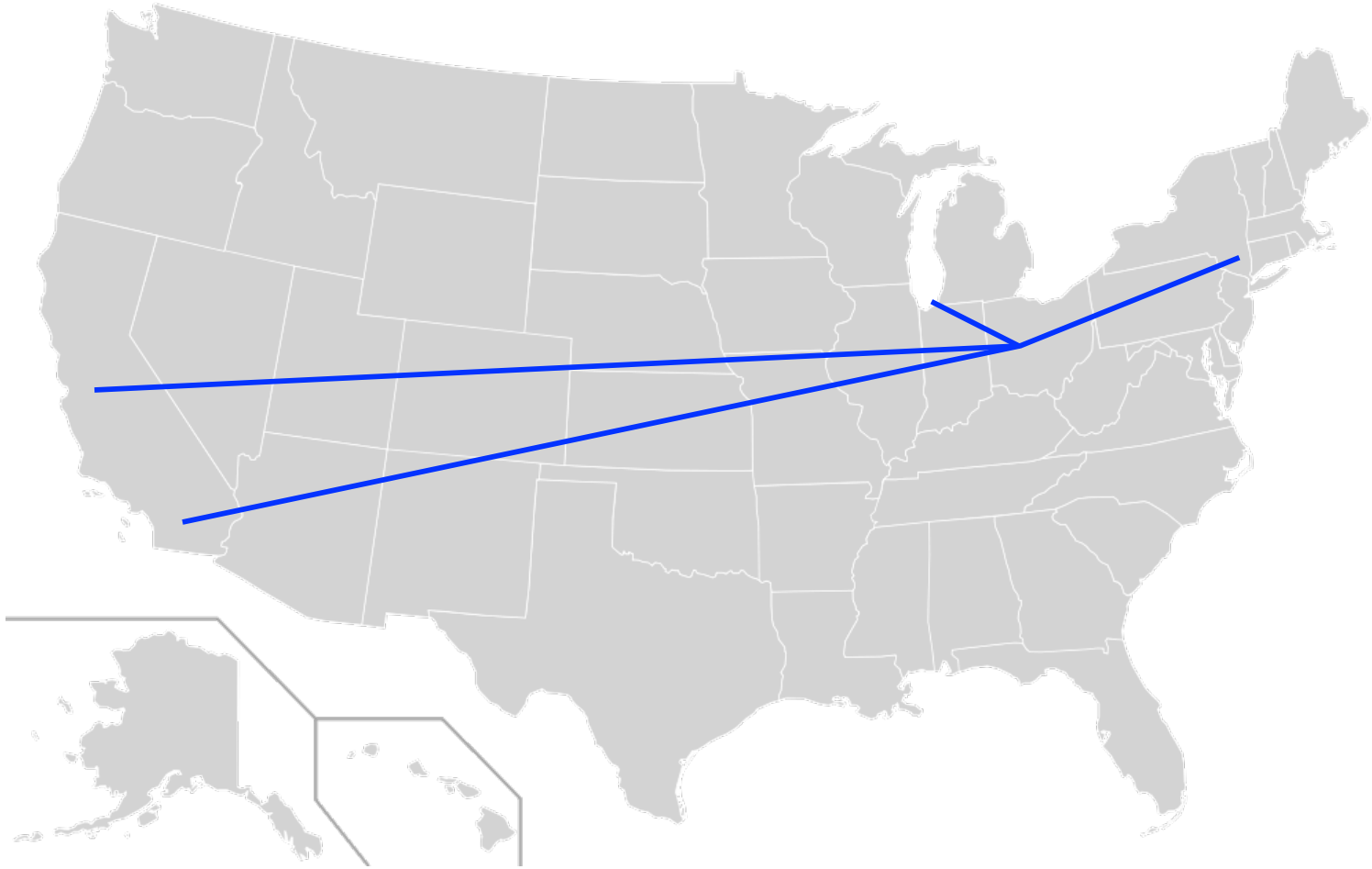
The Small World of casita.net



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DNS at Casita.Net

```
/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 (v4 NAT)

IPv6 PTRs meaningful everywhere

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Forward - DNS at Casita.Net

```
$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
```

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IPv4 Reverse - DNS at Casita.Net

```
$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.
```

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IPv6 Reverse - DNS at Casita.Net

```
$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.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR jeremiah.casita.net.
c.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR nehemiah.casita.net.
a.1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR culdesac.casita.net.
```

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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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Rick hates NAT

NIST SP 800-119

"... can actually defeat certain aspects of the design intent of IPv4"

- network layer end-to-end security
- peer-to-peer (host-to-host connectivity)
- and interoperability

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Summary

The era of IPv6 is upon us.

The world is not ending.

The era of IPv4 *has* ended.

There are challenges.

This is manifestly doable.

Welcome to the 21st century.

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