# Content Providers need to lead the way to IPv6

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# Why is this important?

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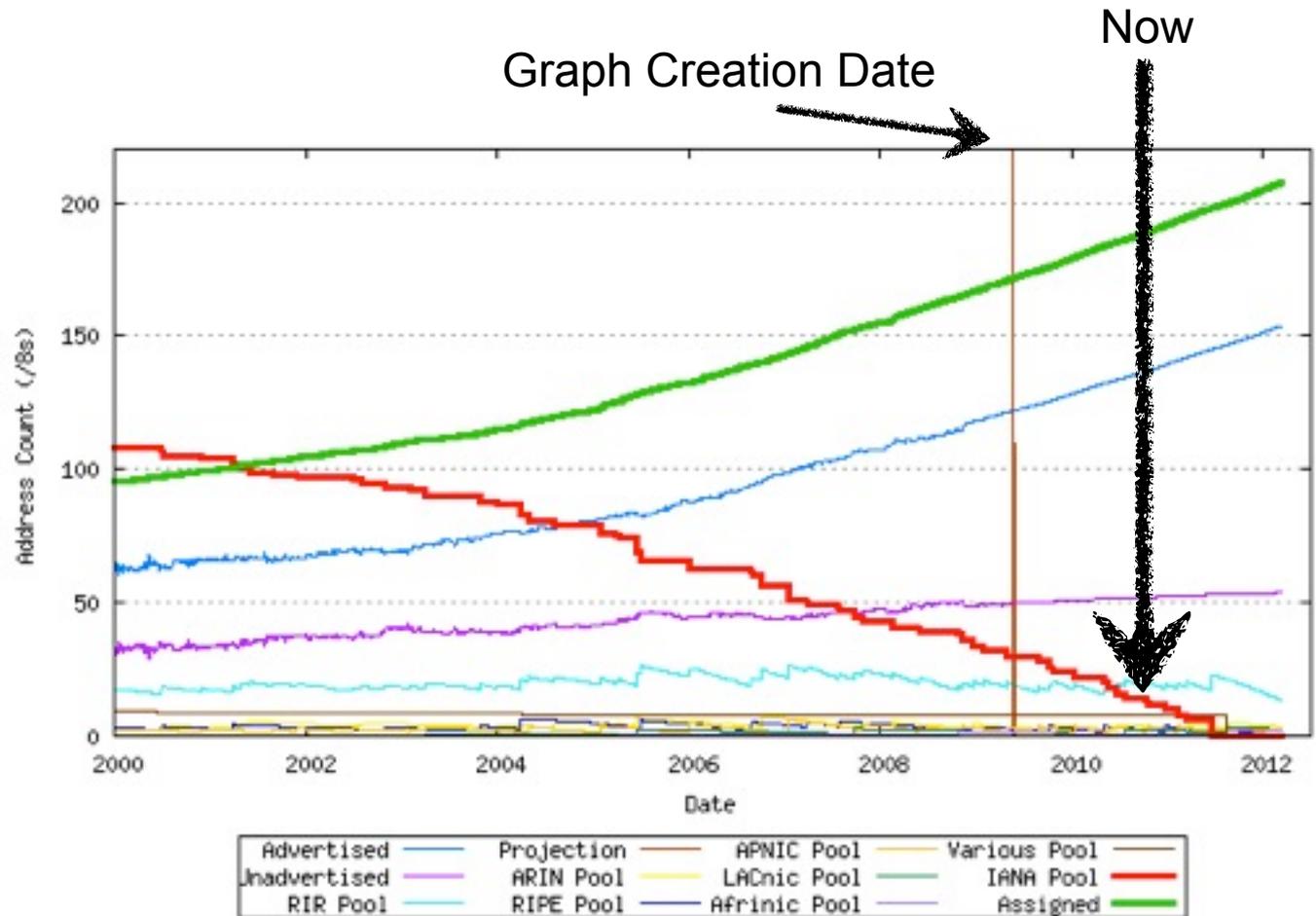
# Another way to look at IPv4 runout*



Quiz Time!

You're driving towards an invisible brick wall at 60 MPH, what do you do?

A. Accelerate. It will encourage brick wall removal.

B. Set cruise control and close your eyes. "We'll all hit the wall at once".

C. Slow down. Figure out if maybe getting out of the car makes sense.

*From DRC's 2007 "Soft Landing" presentation, used without permission

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# IPv4 Runout Process

- IANA runs out first, 2011 (or earlier)

- RIRs start running out probably in 2011-2012

- End-User providers start running out shortly after RIR runout. Most likely, the larger ones first.

- After ISPs start running out, an increasing number of your customers/users will have limited or seriously degraded ability to connect via IPv4, possibly even no ability.

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# Continued service provision will require IPv6

- Upstream network
- Local network infrastructure
- Servers
- Services
- Address-sensitive applications/content
- Provisioning and management systems
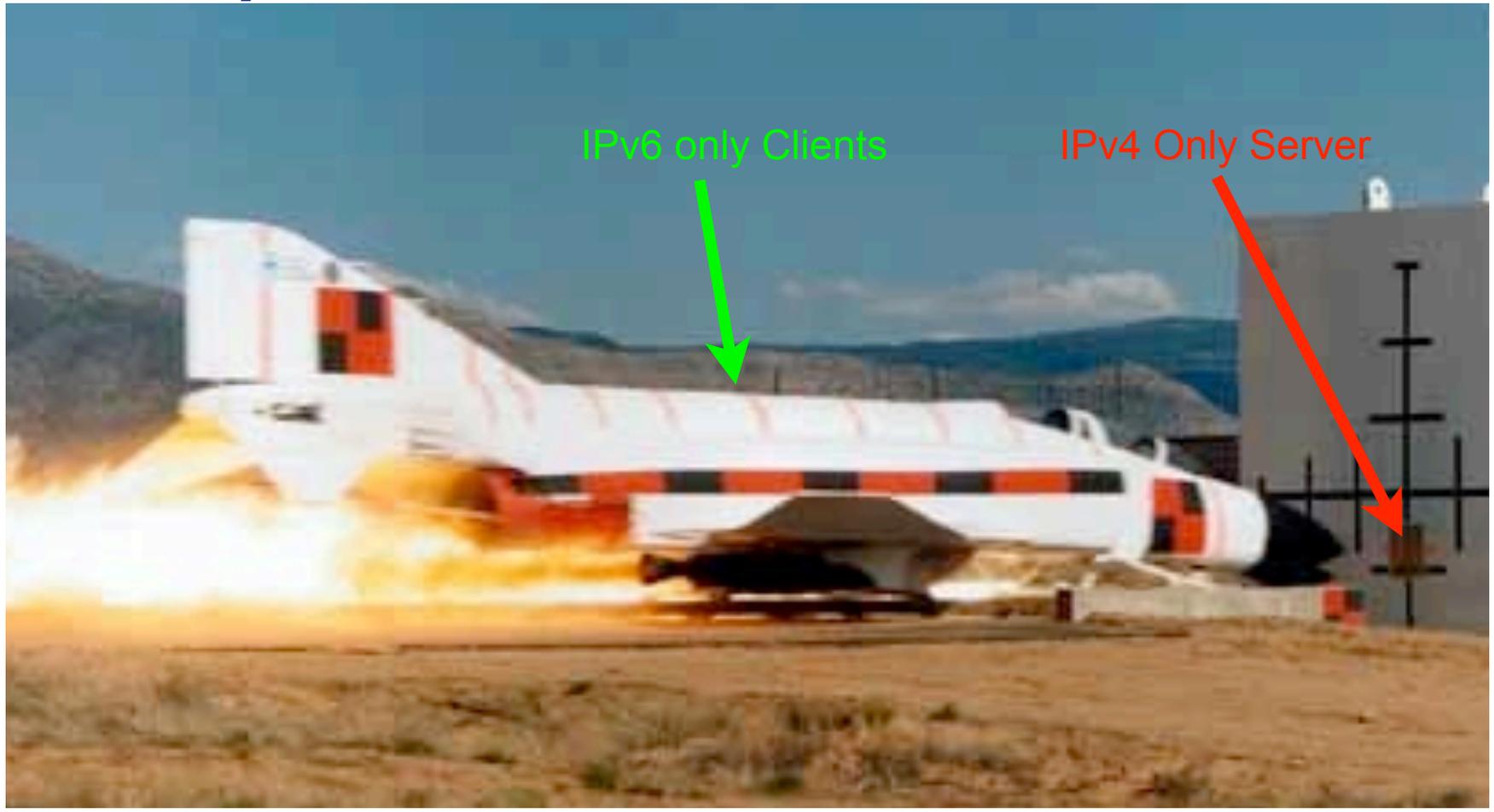- Logging and billing systems
- More?

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# Other considerations

- Team training
- Support
- Troubleshooting
- Customer interaction scripts
- Tools
- Transitional access methodologies (used on customer side, support consideration)
  - 6to4
  - 6in4
  - Teredo
  - Etc.

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# What happens if we aren't ready?



IPv6 only Clients

IPv4 Only Server

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# What about local v4 runout

- Eventually, your network will be unable to expand its IPv4 resources

- This may limit your ability to expand your IPv4 services

- Build a plan for having to support IPv6-only portions of your network/services.

- Possibly identify ways to maximize your availability of IPv4 resources for front-end while shifting backend to v6-only.

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# Corporate IT considerations

- The lessons learned and operational experience gained in your customer-facing environment can aid and inform your dual-stacking process for your enterprise IT environment.

- Important to at least get your support department up to dual stack in order to be able to support and troubleshoot dual-stack environment in production networks.
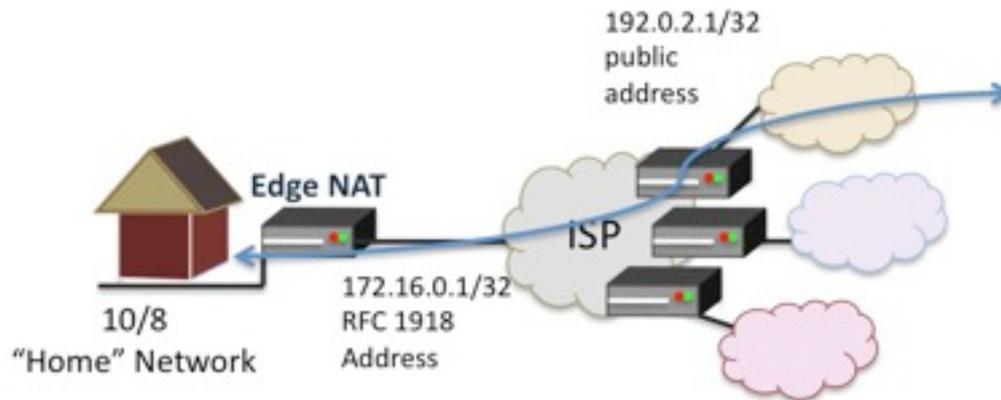
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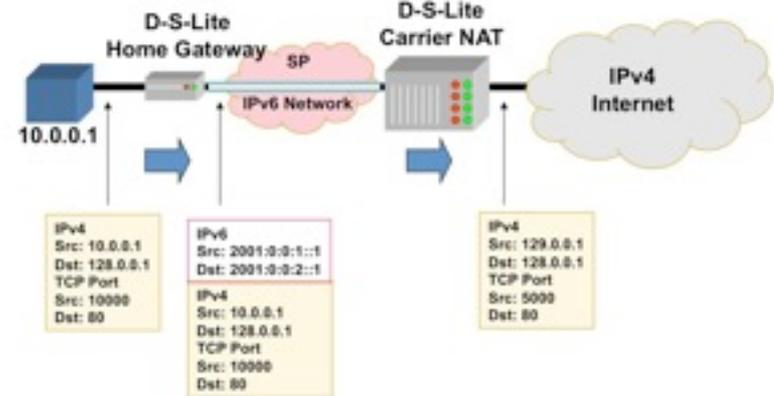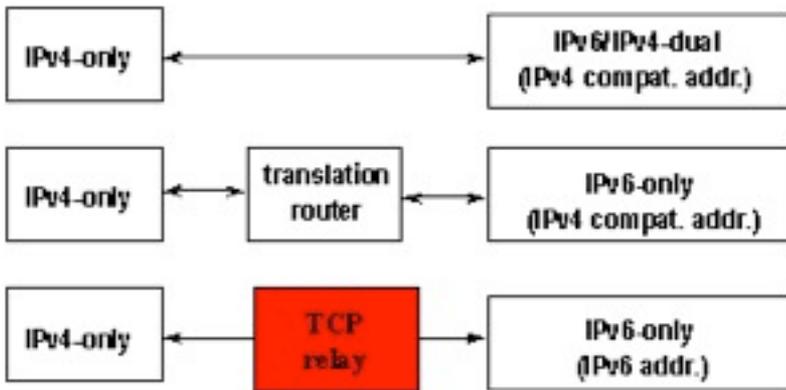
# Why the sense of urgency

- The sooner you start, the more time you have to identify issues while services are not advertised to your general users

- A planned rollout is not trivial, but, is much easier than you may think.

- An urgent deployment is much more difficult and more likely to create bad user experiences.

- You may already be late to the party.

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# A sampling of transitional technologies

## Communication between IPv4 nodes and IPv6 nodes

| IPv4-only | ←→ | IPv6/IPv4-dual (IPv4 compat. addr.) |

| IPv4-only | ←→ | translation router | ←→ | IPv6-only (IPv4 compat. addr.) |

| IPv4-only | ←→ | TCP relay | → | IPv6-only (IPv6 addr.) |

**D-S-Lite Home Gateway**   SP   IPv6 Network

**D-S-Lite Carrier NAT**

IPv4 Internet

10.0.0.1

IPv4
Src: 10.0.0.1
Dst: 128.0.0.1
TCP Port
Src: 10000
Dst: 80

IPv6
Src: 2001:0:0:1::1
Dst: 2001:0:0:2::1
IPv4
Src: 10.0.0.1
Dst: 128.0.0.1
TCP Port
Src: 10000
Dst: 80

IPv4
Src: 129.0.0.1
Dst: 128.0.0.1
TCP Port
Src: 5000
Dst: 80

192.0.2.1/32
public
address

**Edge NAT**

ISP

10/8
"Home" Network

172.16.0.1/32
RFC 1918
Address

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# Why start now?

- A planned rollout in an average moderately complex environment could take 2 to 3 years.

- It's 2010 now.  RIR runout may be less than 2 years away.

- If you started last year, you're ahead of your competitors who are considering this for the first time.

- If you're still procrastinating looking for the ROI on this, your competitors are now salivating over your customers.

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# Migrating to Dual Stack -- Process

- First, you're going to need IPv6 connectivity. If your ISP isn't there yet, you can get a free tunnel from a number of sources, including http://tunnelbroker.net.

- Start with a test network, not your production network.

- Once you have your router speaking IPv6, put IPv6 on a test-host interface and make sure that simple things like ping6 ipv6.google.com work.

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# Process (Part 2)

- Decide about SLAAC/RA (or not). Usually, no reason to turn SLAAC off, unless you expect collisions. (SLAAC addresses will never start with 0000:00xx. Static addresses must start with 0000:00xx, so, no collision potential)

- Use static addresses for publicly accessible servers -- It's just a whole lot easier.

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# Process (Part 3)

- Create a DNS entry for your new test server (AAAA record, similar to A record, but, IPv6 address)

- (Optional) Setup the reverse DNS zone for your IPv6 network (similar to in-addr.arpa, but, zone boundaries are nibbles, hex representation of inverted address, zone is ip6.arpa) e.g.:

   The address 2620:0:930::973:201 (2620:0000:0930:0000:0000:0000:0973:0201)

   is 1.0.2.0.3.7.9.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.3.9.0.0.0.0.0.0.0.2.6.2.ip6.arpa.

   (Note that suppressed zeros in the simplified address must be _CORRECTLY_ expanded in the reversed address. This is harder than it looks at first glance)

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# Process (Part 4)

- Use $ORIGIN to reduce reverse DNS compexity:

  $ORIGIN 0.0.0.0.0.0.0.0.0.0.0.0.0.3.9.0.0.0.0.0.0.2.6.2

  1.0.2.0.3.7.9.0 IN PTR myhostname.mydomain.com.

- Add IPv6 capabilities to your services

- Example, Apache:

IPv4 Only:
Listen 192.159.10.7:80
<VirtualHost 192.159.10.7:80>
    ServerName www.delong.com
...

Dual Stack:
Listen 192.159.10.7:80
Listen [2001:470:1f00:3142::400:7]:80
Listen [2620:0:930::400:7]:80
<VirtualHost 192.159.10.7:80 [2620:0:930::400:7]:80[2001:470:1f00:3142::400:7]:80>
    ServerName www.delong.com
...

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# Process (Part 5)

- ## Example (Sendmail):
  - ### Sendmail.mc

**IPv4 Only:**

```
dnl #
dnl #
dnl # enable ipv4 in sendmail:
dnl #
dnl DAEMON_OPTIONS(`Name=MTA, Family=inet')
dnl #
```

**IPv4/v6 Dual Stack:**

```
dnl # The following causes sendmail to
dnl # additionally listen on the IPv6
dnl # addresses.
DAEMON_OPTIONS(`port=smtp, Name=MTA, Family=inet6')
dnl
dnl #
dnl # enable both ipv6 and ipv4 in sendmail:
dnl #
dnl DAEMON_OPTIONS(`Name=MTA-v4, Family=inet')
dnl #
```

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# Process (Part 6)

- Test your applications, adapt your software, etc. (logging, infrastructure functions, etc. which may embed or contain address information in data structures)

- Get comfortable and familiar with the process on the test network, then, role this same IPv6 base functionality to production, but, don't cut over your real DNS until you're sure it's working on the test names.

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# Supporting Transitional Technologies

- A variety of transitional solutions exist

- Users of these technologies will have various problems getting to your content (possibly even via IPv4)

- Make sure your staff is prepared to troubleshoot these issues to avoid creating poor user experience/perception.

- Operational experience with transitional technologies is minimal so far. More questions than answers right now.

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# Q&A

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