TEOTWAWKI

The end of the world, as we know it.

Cathy Aronson, ARIN Advisory Council & Daydream Imagery
Leo Bicknell, ARIN Advisory Council & ISC

"We didn't lose the game; we just ran out of time."
- Vince Lombardi

IPv6 is Coming

- IPv6 Multihoming, by Marla Azinger, Frontier Communications. NANOG 38, October 2006.
- Pragmatismv6: a Grown-up, Critical Examination of IPv6, by Todd Underwood Renesys, moderator; Daniel Golding,Tier 1 Research; David Meyer, Cisco, University of Oregon; Jason Schiller, Verizon Business. NANOG 38, October 2006.
- Open issues with ipv6 routing/multihoming, by Jason Schiller, UUNET/Verizon. NANOG 37, June 2006.
- IAB IPv6 Multihoming BOF, Dave Meyer, Cisco, moderator. NANOG 35, October 2005.
- Shim6: Network Operator Concerns, by Jason Schiller, UUNET. NANOG 35, October 2005.
- IPv6 Deployment Issues: A Tier 1 Perspective, by Stewart Bamford, Level3. NANOG 35, October 2005.
- Tutorial: Getting Started with IPv6. Level: Introductory. Jordi Palet, Consulintel. NANOG 35, October 2005.
- Inter-AS Traffic Engineering Case Studies as Requirements for IPv6 Multihoming Solutions, by Jason Schiller, UUNET.
- IPv6 - Evolutionary Issues and Challenges, by Udo Steinegger, Cable & Wireless. NANOG 34, May 2005.
- Tutorial: IPv6 Deployment and Case Studies, by Salman Asadullah and Ciprian Popoviciu, Cisco. Level: Introductory/Intermediate. NANOG 32, October 2004.
- Network Augmentation Panel: Experiences in Adding IPv6 Services & Support to Existing IPv4 Networks. Bill Manning, moderator; Rob Rockell, Sprint; Brent Sweeny, Internet2 NOC; Ed Lewis, ARIN. NANOG 31, May 2004.
- IPv6 IPv4 Threat Comparison, by Darrin Miller and Sean Convery, Cisco. NANOG 31, May 2004.
- Overview of the Global IPv6 Routing Table, Gert Doering, SpaceNet AG, Munich, author. Cathy Wittbrodt, presenter. NANOG 29, October 2003.
- Tutorial: Issues in IPv6 Deployment, by Jeff Doyle. Level: Introductory. NANOG 28, June 2003.
- IPv4/IPv6 Dual-Stack on Abilene, by Grover Browning, Indiana University. NANOG 28, June 2003.
- Operational Testing of DNS Resources - IPv6/DNS Symbiosis, by Bill Manning. NANOG 27, February 2003.
- IPv6 Deployment Concepts, by Tony Hain, Cisco. Tutorial, NANOG 27, February 2003.
- Commercial IPv6 Deployment by ISPs in Japan, by J. Hagino, IIJ/KAME. NANOG 26, October 2002.
- Experiences With Developing, Testing, Planning, and Operating IPv6-Enabled Nameservers, by Paul Vixie, ISC. NANOG 26, October 2002.
- IPv6 Impressions: ARIN Update and Routing Table Overview, by Cathy Wittbrodt, Packet Design. NANOG 26, October 2002.
- IPv6 Basics (Tutorial), by Tony Hain, Cisco. NANOG 26, October 2002.
- Operational Experience with IPv6 Migration, by Akira Kato, ISI. NANOG 22, May 2001.
- IPv6 in Mobile Wireless Networking, by Dana Blair, Cisco. NANOG 21, February 2001.
- IPv6: Why, What, When, Where? (Tutorial), by Steve Deering, Cisco. NANOG 19, June 2000.
- IPv6 Update / ARIN IPv6 Delegation Status, by Bill Manning, ISI, and Michael O'Neill, ARIN. Presentation includes "Penetration Rate of Private Address Space," "Current Use of IPv6 Address Space," and "ARIN IPv6 Delegation Status." NANOG 19, June 2000.
- Panel: Operational Experience with IPv6. Bob Fink, Lawrence Berkeley National Lab (moderator), Rob Rockell, Sprint, Greg Miller, MCI WorldCom, Bill Maton, Communications Research Centre, Sean Mentzer, Qwest. NANOG 19, June 2000.

"Life is pleasant. Death is peaceful. It's the transition that's troublesome." - Isaac Asimov

When customers pay, I'll deploy IPv6.

- While there has been some IPv6 deployment, many operators have "slow rolled" IPv6. Common reasons:
  - Deployed hardware doesn't support IPv6.
  - Network management tools don't support IPv6.
  - Too busy doing other things that make money.
  - Customers won't pay for it yet.

What if there were no more IPv4 addresses?

"There are only two tragedies in life: one is not getting what one wants, and the other is getting it." - Oscar Wilde

Death of the Internet Film At 11
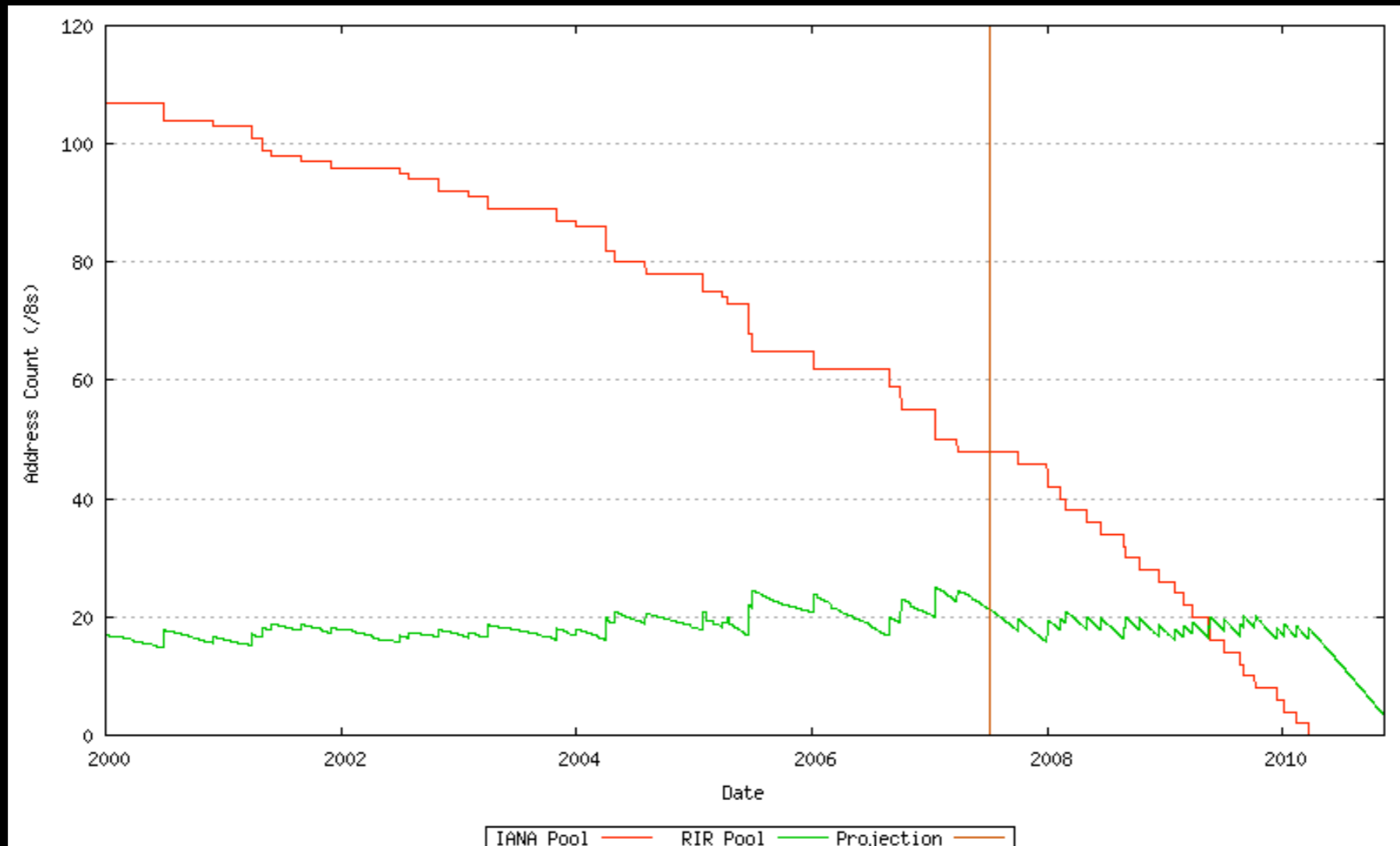
Credit to Geoff Huston, http://www.potaroo.net/tools/ipv4/ Figure 30d.

"Don't worry about the world coming to an end today. It's already tomorrow in Australia." - Charles Schultz

Wait, it might be true?

- Yes...
  - IPv6 deployment not fast enough to transition away from IPv4.
  - IPv4 run-rate predictions seem believable.
  - Timelines are inside equipment refresh cycles.
- But what is exhaustion?
  - IANA to RIR
  - RIR to ISP
  - ISP to Customer

"All truth passes through three stages. First, it is ridiculed. Second, it is violently opposed. Third, it is accepted as being self-evident." - Arthur Schopenhauer

ARIN PRESS RELEASE

FOR IMMEDIATE RELEASE
21 May 2007

Contact:
Megan Kruse
+1.703.227.9872
megank@arin.net

ARIN Board Advises Internet Community on Migration to IPv6

CHANTILLY, VIRGINIA – On 7 May 2007, the ARIN Board of Trustees passed a resolution advising the Internet technical community that migration to a new version of the Internet Protocol, IPv6, will be necessary to allow continued growth of the Internet.

Internet Protocol defines how computers communicate over a network. IP version 4 (IPv4), the currently prevalent version, contains just over four billion unique IP addresses, which is not enough to last indefinitely. IPv6 is a replacement for IPv4, offering far more IP addresses and enhanced security features. To date, ARIN has performed technical coordination of both versions and has not advocated one over the other.

With only 19% of IPv4 address space remaining, however, ARIN is now compelled to advise the Internet community that migration to IPv6 is necessary for any applications that require ongoing availability of contiguous IP number resources.

"We must prepare for IPv4's depletion, and ARIN's resolution to encourage that migration to IPv6 may be the impetus for more organizations to start the planning process," said John Curran, Chairman of ARIN's Board of Trustees.

The Board resolution also directs ARIN staff to heighten its efforts in assuring the veracity of IPv4 resource requests and asks that ARIN's elected policy body, the Advisory Council, consider working with the community on policy changes to encourage migration to IPv6.

To implement this resolution, ARIN will review its internal resource request procedures, send progress announcements to the community, produce new educational documentation, and focus on IPv6 in many of its general outreach activities, such as speaking engagements, trade shows, and technical community meetings.

The full text of the Board resolution is available at www.arin.net/media.

###

About the American Registry for Internet Numbers (ARIN)

ARIN is a nonprofit corporation that distributes Internet number resources, including Internet Protocol (IP) addresses, to Canada, many Caribbean and North Atlantic islands, and the United States. For more information, visit the website at www.arin.net or e-mail info@arin.net.

What does that mean to me?

- More work...
  - To deploy IPv6...
    - on new hardware, not fully baked...
      - with new code, not fully baked...
        - with users clueless on how it works...
          - and implemented way too fast.
- In other words, business as usual!
- *However, at the same time pressure will be applied to extend the life of IPv4 networks.*

"I have seen the future and it is very much like the present, only longer." -Kehlog Albran

What does extending the life of IPv4 mean?

- Smaller allocations, leading to routing table growth.
  - Large blocks will not be available. Need a /16, you may get four /18's from different blocks.
  - How should RIR policies evolve?
- More NAT.
  - Some operators will push customers to NAT based solutions to reduce address usage.
- IPv6 only customers.
- Reclamation of address space.

"If you can't get rid of the skeleton in your closet, you'd best teach it to dance." - George Bernard Shaw
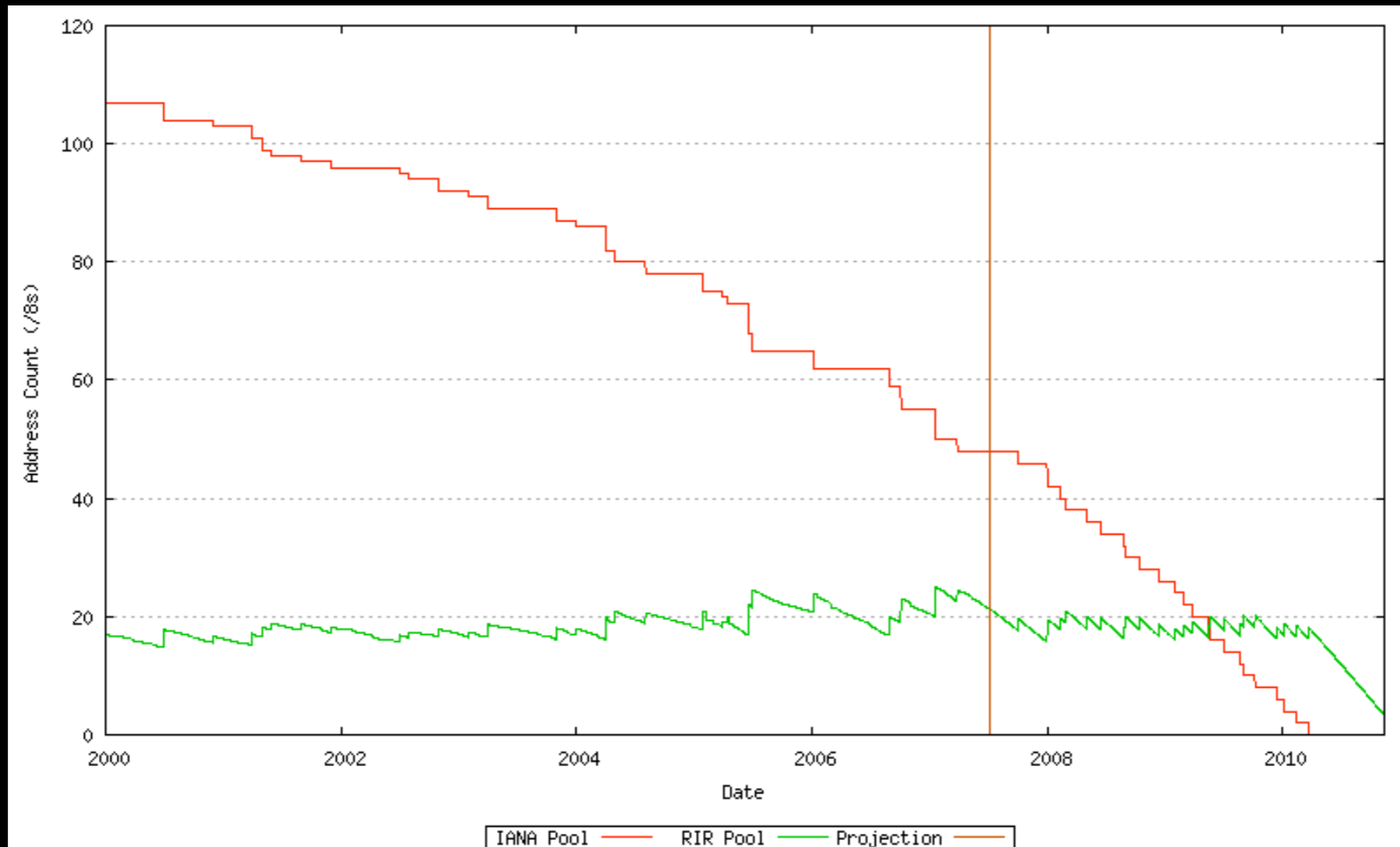
Blue Ribbon Panel

- Round Table Discussion:
  - David Conrad: IANA
  - Paul Vixie: ARIN Board of Trustees
  - Jason Schiller: Verizon Business
  - Ron Bonica: Juniper Networks
  - Mike Leber: Hurricane Electric

"Genius might be described as a supreme capacity for getting its possessors into trouble of all kinds." - Samuel Butler

IPv4 Run Out

Credit to Geoff Huston, http://www.potaroo.net/tools/ipv4/ Figure 30d.

"Planned obsolescence is not really a new concept. God used it with people."
- Robert Orben

IPv6 Deployment

"We accelerated our capital spending in the fourth quarter, particularly in international and next-generation network deployment, which should not only sustain future revenue growth but also drive significant cost reductions across all communications services."
Bernard Ebbers

IPv4 to IPv6 Transition

"The transition was difficult. It's hard to stop something that you've enjoyed and that has been very rewarding." - Kareem Abdul-Jabbar

Special Thanks To

- David Conrad: IANA
- Paul Vixie: ARIN Board of Trustees
- Jason Schiller: Verizon Business
- Ron Bonica: Juniper Networks
- Mike Leber: Hurricane Electric

'Would you tell me, please, which way I ought to go from here?'
'That depends a good deal on where you want to get to,' said the Cat.
'I don't much care where --' said Alice.
'Then it doesn't matter which way you go,' said the Cat.
'--so long as I get somewhere,' Alice added as an explanation.
- Lewis Carroll, Alice's Adventures in Wonderland