



World IPv6 Launch

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Limelight Networks





Limelight's CDN Network

- *A Massively Provisioned, Global IP Backbone and CDN*
 - Over 100 data centers in 40+ markets
 - 40Gb/s fully-redundant backbone
 - >6Tb/s egress capacity delivering >3Tb/s daily
 - ~900 peers
 - Tens of thousands of content servers
 - ~10PB of storage



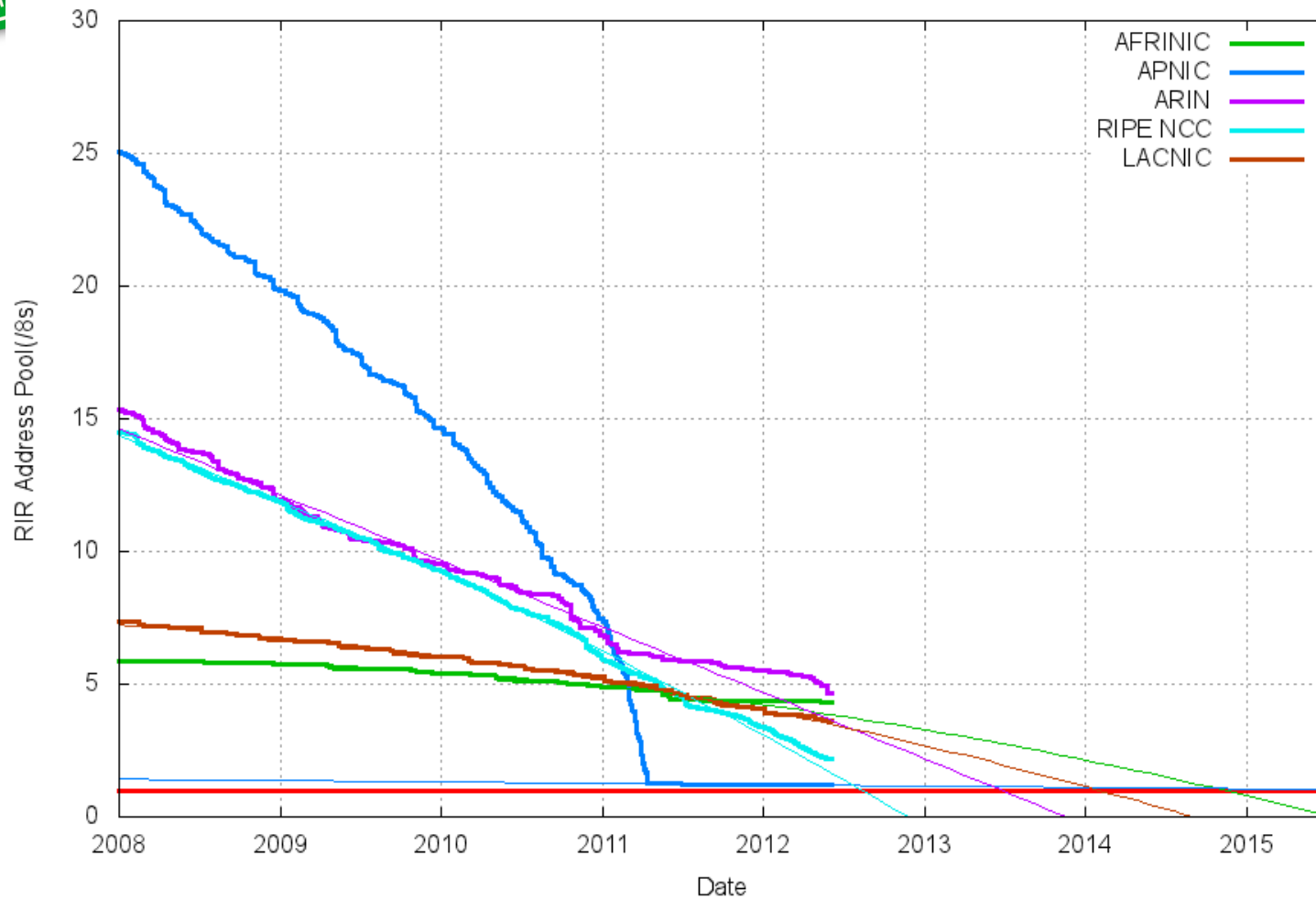
Limelight and IPv6

- Limelight's Core IP Backbone as Adoption Advantage
 - Dual-stack in the core (since 2008)
 - Transit and Peering partners
 - Direct connectivity to subscriber networks
 - Globally distributed *and* site interconnected
- IPv6 at the Server Edge
 - Dual-stack at the edge since 2009
- Success! June of 2009, Netflix *Watch Instantly* over IPv6



IPv4 is Exhausted

RIR IPv4 Address Run-Down Model



<http://www.potaroo.net/tools/ipv4/index.html>

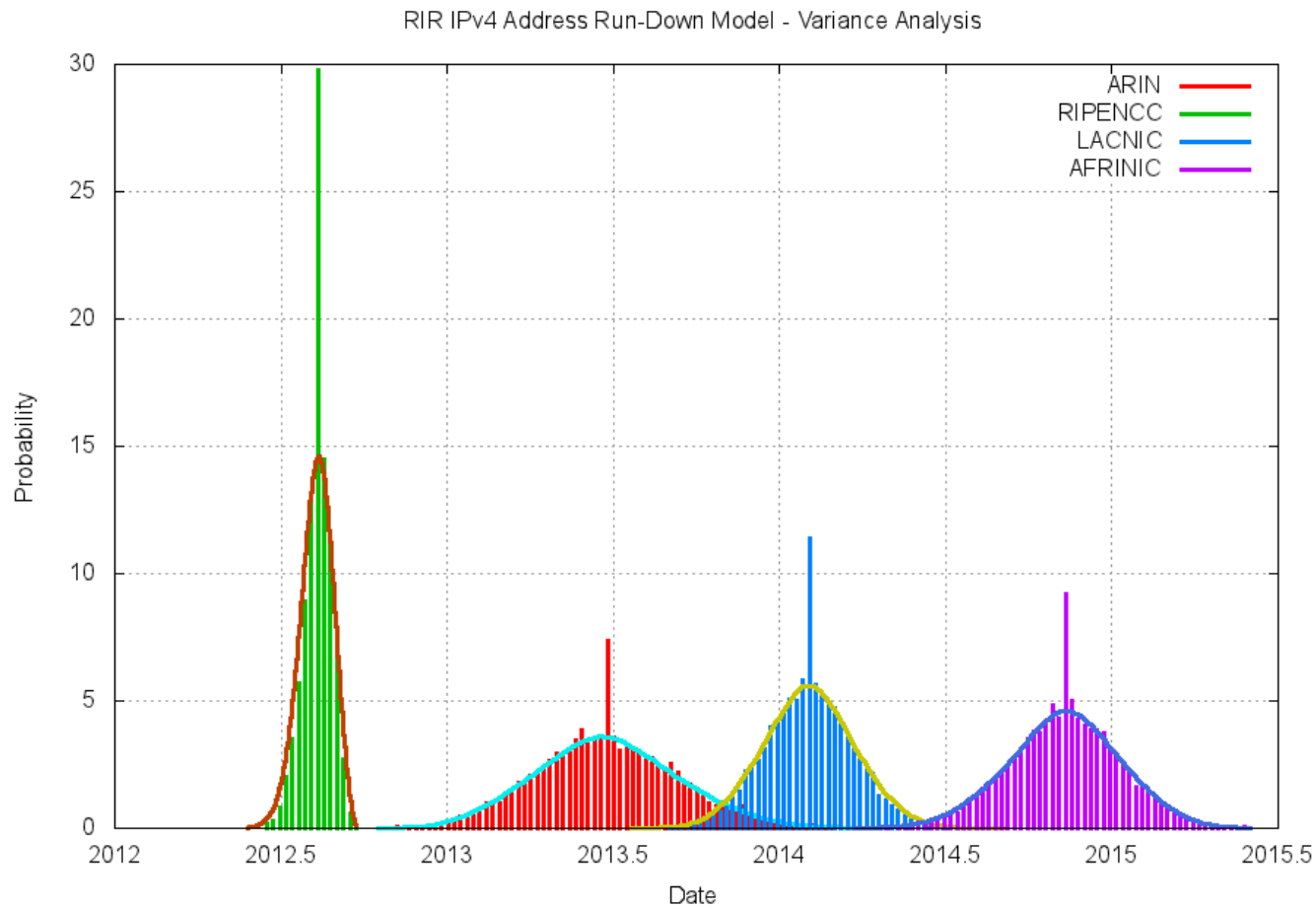


What happened

- Internet is expanding, more people get connected to it
- IPv4 addresses are finite
- 3 Feb 2011 : IANA allocated its last remaining /8 to the RIRs
- 19 April 2011 : APNIC started allocating from its last /8
- End of 2015: All RIRs expected to be in their last /8



Exhaustion timeline



<http://www.potaroo.net/tools/ipv4/index.html>



What are the solutions

- IPv6
 - The planned architecture and replacement for IPv4
 - Will work with existing networks and gradual deployment
- Something else
 - Large scale NATs provide temporary pain relief
 - Yet more techniques and technology give life support to IPv4



IPv6 is mature

- IPv6 as a standard has been around for a long time. Since the mid-90s
- It has been in production in many networks for more than 15 years
- Most backbone providers and content providers are already IPv6 ready

..... but then it is still not widespread



World IPv6 Day 2011

- A planned 24 hours *test-flight* of IPv6 on the Internet
 - DNS resolution for primary domains (e.g. www.facebook.com; www.google.com; et al) to IPv6 addresses
 - No IPv6 DNS *whitelisting*
 - June 8th, 2011 GMT 00:00-23:59
 - Participation by major Internet companies
 - Content providers
 - Subscriber networks
 - CDNs



World IPv6 Day

Why is it just one day? Why not leave it on?

- Facing *IPv6 Brokenness*:
 - Broken homes (so sad)...
 - Client applications are now often designed to have an affinity for IPv6 (thanks developers!) But what about:
 - Problem applications (non-conformance to critical RFCs like RFC3484)
 - User resolvers retrieving AAAA records while actually having no (or shabby) IPv6 connectivity
 - Home gateways configuring 6to4 connections leading to suboptimal routing
 - Rogue RAs on the LAN



World IPv6 Day (cont.)

Why is it just one day? Why not leave it on?

- More *IPv6 Brokenness*:
 - Broken networks
 - LSN: Large Scale NAT (the specter formerly known as CGN or Carrier Grade NAT)
 - Geo-location
 - TCP port exhaustion
 - The challenge of measuring IPv6 brokenness in the CDN
 - Who owns and manages the end-to-end transaction?
 - The potential CDN value proposition of detecting brokenness



Limelight's Participation in World IPv6 Day

Analyzing the outcome

- ISOC
 - LLNW hosted the ISOC v6 day site
 - v6 as % of v4 : 0.53% on v6 day,
 - Compared with 0.46% prior
- NASA (caib.nasa.gov)
 - v6 as % of v4 : 22% on v6 day,
 - Compared with 0% prior, and about ~20% subsequently
 - Universities ? R&E ?
- Overall
 - 200K v6 http object requests, (about 0.0003% of total requests)
 - 3 Mbps sustained traffic with a peak at 9Mbps



After the world IPv6 Day

- Nothing broke
 - A big relief and proof that IPv6 can be turned on the content without significant problems.
- Happy Eyeballs
 - Removes the performance problems associated with broken v6 connectivity
- A lot more publicity and awareness



Contact he.net for more IPv6 information



Web IPv6 bandwidth stats during World IPv6 Day and before World IPv6 Launch





World IPv6 Launch

- Kick off on 6th June 2012
- No turning back, it goes on for real
- Everyone participates – Edge ISPs, backbone providers, Content Providers, everyone..
- Why is this important
 - APNIC already has run out of address space, after IANA allocated it's last blocks
 - Likely that other regions will also run out this year or next year
 - Without IPv6, there is no growth.



Who is participating?

- Networks
 - Access to End users
- Content Creators / Delivery Networks
 - Content fully accessible on IPv6
- Vendors
 - Feature parity with IPv4, ease of deployment
- Checkout the latest list at www.wordlipv6launch.com



What are the drivers

- Lack of v4 Addresses.
- Need to stop distinguishing between v4 and v6 deployments
- Make IPv6 mainstream
 - The technical community knows about it, but a major event of this magnitude will make the business side realize the importance.



What about this Region

- AP region is already under the pressure of the lack of v4 addresses.
- The growing usage of Internet and expansion of networks by operators both demand better and stable connectivity.
- The tremendous growth in Internet Access through mobile phones keeps the pressure on Operators



What needs to be done

- World IPv6 Day was an experiment, that worked
 - Nothing broke
- This effort is similar approach, so that networks can setup a timeline and remove all the hiccups they had the previous year
 - And leave it on for later



What should we do

- Ask our ISPs and service providers about their IPv6 offering.
- If you are a service provider, go to the <http://www.worldipv6launch.com> and register yourself
- Look into your networks and make a plan for deployment
- Talk to people who have done it before, here at APRICOT or on various support forums like APOPS, SANOG,
- Utilize APNIC, ISOC provided resources.

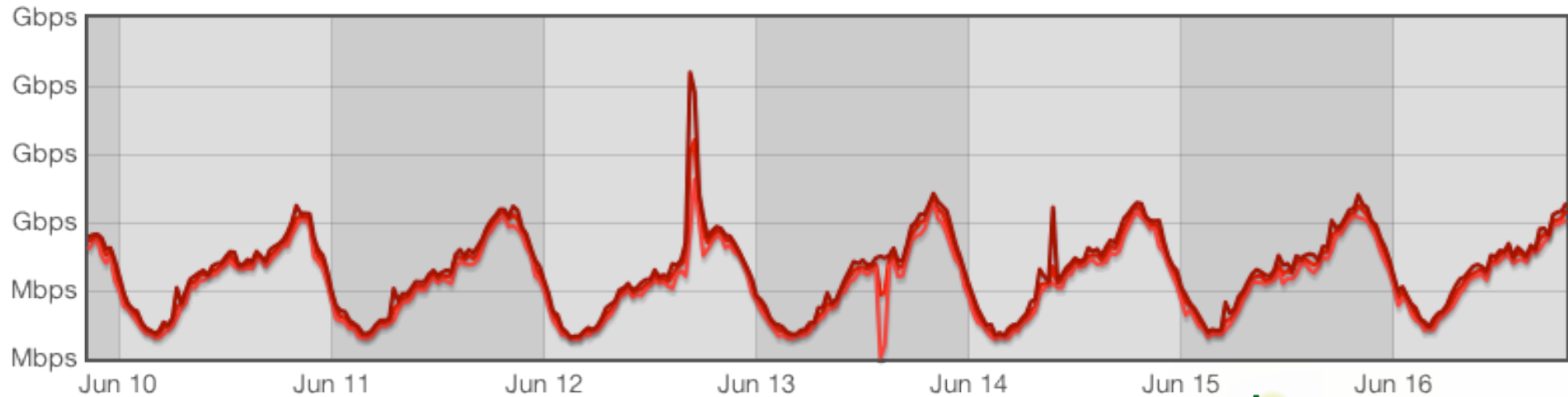
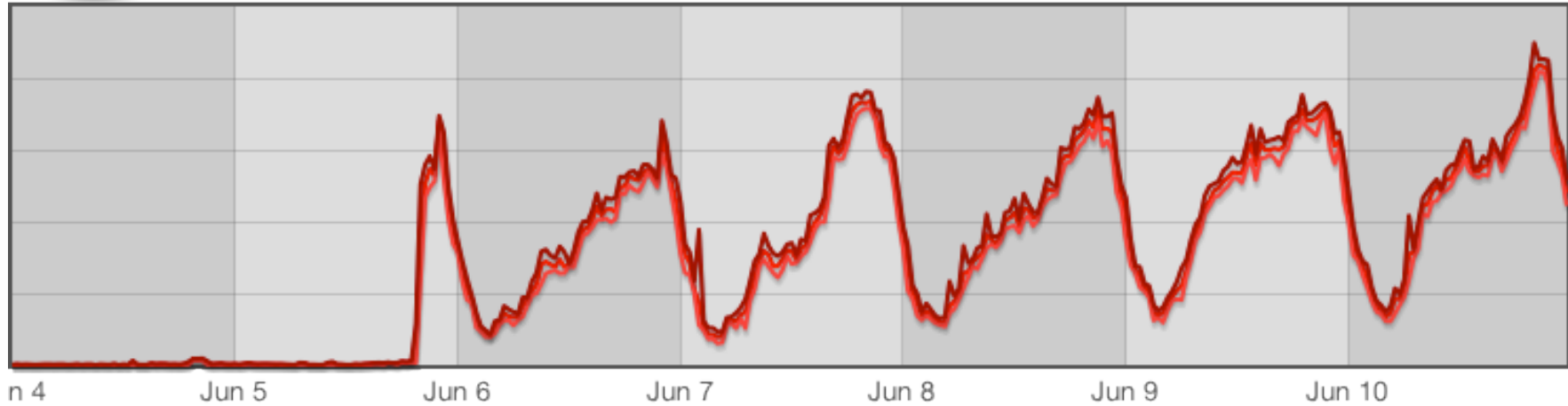


What can we expect

- Most big major content will now remain in v6.
 - Breaks the chicken and egg situation on content vs. access networks.
 - There are going to be issues that users may expect, if their version of software is not updated for happy eyeballs
 - A lot more awareness amongst the non-technical community about IPv6.
 - Internet Primarily based on IPv6



Limelight v6 Traffic





Just in time

From: Henk Steenman <Henk.Steenman@ams-ix.net>
Date: Mon, 4 Jun 2012 19:05:08 +0200
To: tech-l@ams-ix.net
Subject: [peering team] DRAFT: Addressing future IPv4 address space issues on AMS-IX: RFC5549

Dear all,

With the end of IPv4 address space on the horizon we investigated the impact on the AMS-IX exchange platform. We currently have a /22 available for the peering platform and this will be enough for at least a number of years. However there is an end to it.

We (that is Stefan Plug, a trainee working on this project at AMS-IX) have investigated the possibilities for future growth in IP addressing on the peering LAN. The result of the investigation was that the most future proof solution is the use of RFC5549 which defines "Advertising IPv4 network layer reachability information with an IPv6 next hop".

Stefan gave a presentation on this during the latest AMS-IX meeting MORE-IP, for a PDF representation of his presentation see:

<http://more-ip-event.net/presentations/2012/IPv4OverIPv6.pdf>

For a video recording of his presentation and some code updating Quagga to support RFC5549 see as a proof of concept see:

<http://www.ams-ix.net/downloads/RFC5549/>

And of course RFC5549 itself can be found at:

<http://www.ietf.org/rfc/rfc5549.txt>





Thank you.

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