Status of IPv4 Depletion and Transfers

ASO Address Council

25 June 2014

Agenda

- Status of IPv4 depletion
- Status of IPv4 transfers
- Status of IPv6
- Discussion and Q&A

IANA Depletion

What is IANA depletion?

- When the IANA free pool is emptied, IANA has no more IPv4 addresses available for RIRs
- The IANA free pool was emptied when an RIR requested more address space than was in the free pool
  - Except for the last 5 /8s (83,886,080 IPs) which were reserved
    - Each RIR gets one /8 for “special use”
    - To aid transition to IPv6
    - To create a “Soft Landing” to ease pain of IPv4 depletion

Global Policy for the Allocation of the Remaining IPv4 Address Space

Ratified by the

ICANN Board

March 6, 2009

Global Policy for the Allocation of the Remaining IPv4 Address Space | (ratified by ICANN Board on 6 March 2009)

This policy describes the process for the allocation of the remaining IPv4 space from IANA to the RIRs. When a minimum amount of available space is reached, one /8 will be allocated from IANA to each RIR, replacing the current IPv4 allocation policy.

In order to fulfill the requirements of this policy, at the time it is adopted, one /8 will be reserved by IANA for each RIR. The reserved allocation units will no longer be part of the available space at the IANA pool. IANA will also reserve one /8 to any new RIR at the time it is recognized.

The process for the allocation of the remaining IPv4 space is divided in two consecutive phases:

1. Existing Policy Phase

During this phase IANA will continue allocating IPv4 addresses to the RIRs using the existing allocation policy. This phase will continue until a request for IPv4 address space from any RIR to IANA either cannot be fulfilled with the remaining IPv4 space available at the IANA pool or can be fulfilled but leaving the IANA remaining IPv4 pool empty.

https://www.icann.org/resources/pages/remaining-ipv4-2012-02-25-en

What About IPv4 Space Returned to IANA?

- When the IANA emptied its free pool in February 2011 the (then) existing policy phase ended
- Exhaustion phase began
  - IANA allocated one /8 to each RIR
- At this point the IANA had no policy to make any other IPv4 allocations

Global Policy for Post Exhaustion IPv4 Allocation Mechanisms by the IANA

- Passed Global policy to allow IANA to create a recovered IPv4 address pool
- Pool to remain inactive until the first RIR has less than a /9 available in its total inventory
- When activated the space was divided five ways
  - Rounded down to nearest CIDR
  - Remainder left in recovered IPv4 address pool
- Each RIR received 1/5
- Process repeats twice yearly
  - March 1 and September 1

Global Policy for Post Exhaustion IPv4 Allocation Mechanisms by the IANA

Ratified by the ICANN Board May 6, 2012

Global Policy for Post Exhaustion IPv4 Allocation Mechanisms by the IANA | (Ratified 6 May 2012)

The IANA shall establish a Recovered IPv4 Pool to be utilized post RIR IPv4 exhaustion. The Recovered IPv4 Pool will initially contain any fragments that may be left over in the IANA. It will also hold any space returned to the IANA by any other means.

The Recovered IPv4 Pool will be administered by the IANA. It will contain:

a. Any fragments left over in the IANA inventory after the last /8s of IPv4 space are delegated to the RIRs
   - The IANA inventory excludes "Special use IPv4 addresses" as defined in BCP 153 and any addresses allocated by the IANA for experimental use.

b. Any IPv4 space returned to the IANA by any means.

The Recovered IPv4 Pool will stay inactive until the first RIR has less than a total of a /9 in its inventory of IPv4 address space.

When one of the RIRs declares it has less than a total of a /9 in its inventory, the Recovered IPv4 pool will be declared active, and IP addresses from the Recovered IPv4 Pool will be allocated as follows:

a. Allocations from the IANA may begin once the pool is declared active.
b. In each "IPv4 allocation period", each RIR will receive a single "IPv4 allocation unit" from the IANA.
c. An "IPv4 allocation period" is defined as a 6-month period following 1 March or 1 September in each year.
d. The IANA will calculate the size of the "IPv4 allocation unit" at the following times:
   - When the Recovered IPv4 Pool is first activated
   - At the beginning of each IPv4 allocation period

   To calculate the "IPv4 allocation unit" at these times, the IANA will use the following formula:

https://www.icann.org/resources/pages/allocation-ipv4-post-exhaustion-2012-05-08-en

RIR Depletion

What is RIR depletion?

- The RIR is essentially out of available IPv4 addresses
  - Except for “Soft Landing”
- RIRs have no addresses to provide to organizations that are growing and requiring additional addresses
- Once an organization uses its available addresses it must
  - Stop growing
  - Get additional IP addresses from transfers
  - Transition growth to IPv6-only
  - Deploy IPv4 address saving technology (CGN)

Purpose of “Soft Landing”

- To ensure a smooth transit to IPv6
- To prolong IPv4 availability
  - Maintain existing IPv4 during transition to IPv6
- To ensure new entrants are able to get IPv4 addresses post RIR depletion
  - Remove barrier to entry
- Further limit IPv4 address allocations
  - Shorter IP justification window
  - More strict requirements
- Promote more efficient use of IPv4

What is Soft Landing?

- RIPE & APNIC
  - New and existing organizations can get one /22
    - 1024 IP address
    - Generally a large amount of addresses for a small organization
- LACNIC
  - First half: an additional /22 every 6 months
  - Second half: only new organization can get only one /22

What is Soft Landing?

- ARIN
  - One /10 (4,194,304 IPs) for new networks who are deploying IPv6-only, but needs some small amount of IPv4 for boot strapping
- AFRINIC
  - First phase business as usual except allocation cap reduced from /10 11 (4,194,304 IPs) to /13 (524,288 IPs)
  - Second phase when only a /11 (2,097,152 IPs)
    - Each organization can get up to a /22 at a time
  - /12 (1,048,576 IPs) reserved for future use

Depletion Timeline

IANA IPv4 Depletion

IANA depletes Feb 3, 2011

NRO AFRINIC APNIC ARIN lacnic RIPE NCC

ABOUT | INTERNET GOVERNANCE | IPV6 | POLICIES | STATISTICS

3 February 2011

Free Pool of IPv4 Address Space Depleted

IPv6 adoption at critical phase

Montevideo, 3 February 2011 – The Number Resource Organization (NRO) announced today that the free pool of available IPv4 addresses is now fully depleted. On Monday, January 31, the Internet Assigned Numbers Authority (IANA) allocated two blocks of IPv4 address space to APNIC, the Regional Internet Registry (RIR) for the Asia Pacific region, which triggered a global policy to allocate the remaining IANA pool equally between the five RIRs. Today IANA allocated those blocks. This means that there are no longer any IPv4 addresses available for allocation from the IANA to the five RIRs.

IANA assigns IPv4 addresses to the RIRs in blocks that equate to 1/256th of the entire IPv4 address space. Each block is referred to as a "/8" or "slash-8". A global policy agreed on by all five RIR communities and ratified in 2009 by ICANN, the international body responsible for the IANA function, dictated that when the IANA IPv4 free pool reached five remaining /8 blocks, these blocks were to be simultaneously and equally distributed to the five RIRs.

"This is an historic day in the history of the Internet, and one we have been anticipating for quite some time," states Raúl Echeberría, Chairman of the Number Resource Organization (NRO), the official representative of the five RIRs. "The future of the Internet is in IPv6. All Internet stakeholders must now take definitive action to deploy IPv6."

"This is truly a major turning point in the on-going development of the Internet," said Rod Beckstrom, ICANN's President and Chief Executive Officer. "Nobody was caught off guard by this, the Internet technical community has been planning for IPv4 depletion for quite some time. But it means the adoption of IPv6 is now of paramount importance, since it will allow the Internet to continue its amazing growth and foster the global innovation we've all come to expect."

IPv6 is the "next generation" of the Internet Protocol, providing a hugely expanded address space and allowing the Internet to grow into the future. "Billions of people world wide use the Internet for everything from sending tweets to paying bills. The transition to IPv6 from IPv4 represents an opportunity for even more innovative applications without the fear of running out of essential Internet IP addresses," said Vice President of IANA Elise Gerich.

Adoption of IPv6 is now vital for all Internet stakeholders. The RIRs have been working with network operators at the local, regional, and global level for more than a decade to offer training and advice on IPv6 adoption and ensure that everyone is prepared for the exhaustion of IPv4.

"Each RIR will have its final full /8 from IANA, plus any existing IP address holdings to distribute. Depending on address space requests received, this could last each RIR anywhere from a few weeks to many months. It's only a matter of time before the RIRs and Internet Service Providers (ISPs) must start denying requests for IPv4 address space. Deploying IPv6 is now a requirement, not an option," added Echeberría. IPv6 address space has been available since 1999. Visit http://www.nro.net/ipv6/ for more information on IPv6, or your local RIR for information on how to get address space.

http://www.nro.net/news/ipv4-free-pool-depleted

APNIC IPv4 Depletion

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APNIC depletes April 15, 2011

Key Turning Point in Asia Pacific IPv4 Exhaustion

IPv4 "Final Stage" Begins Today

Brisbane, Australia – ***6:00 (UTC+10) Friday, 15 April 2011***

APNIC activates Final /8 Policy

Today the Asia Pacific Network Information Centre (APNIC) reached the last block of Internet Protocol version 4 (IPv4) addresses in its available pool, activating a major change in regional delegation policy.

This event is a key turning point in IPv4 exhaustion for the Asia Pacific, as the remaining IPv4 space will be 'rationed' to network operators to be used as essential connectivity with next-generation IPv6 addresses. All new and existing APNIC Members who meet the current allocation criteria will be entitled to a maximum delegation of a /22 (1,024 addresses) of IPv4 space.

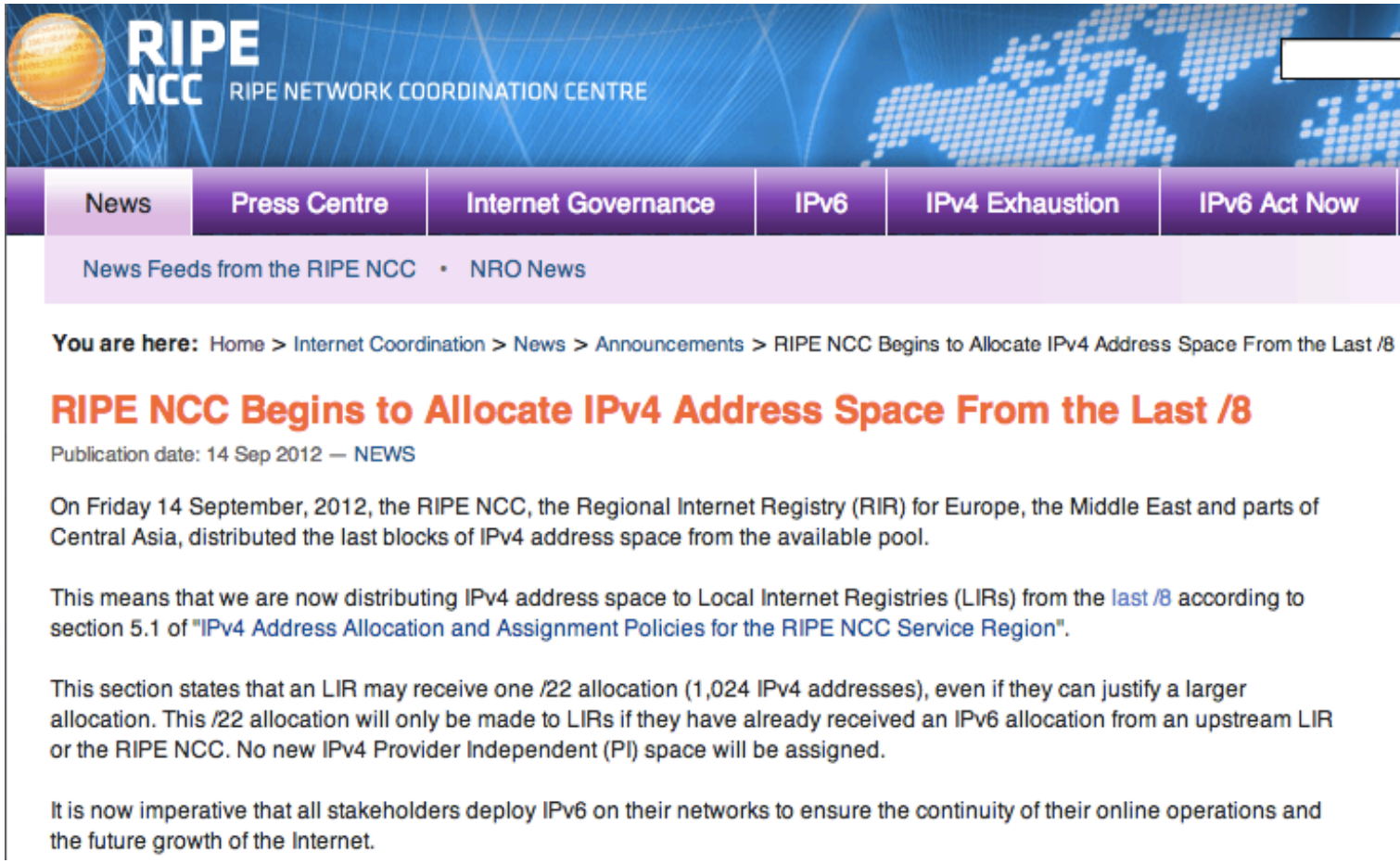
APNIC Director General Paul Wilson explained the Asia Pacific region is the first to reach the point of being unable to meet IPv4 demand. This is due to the unprecedented fixed and mobile network growth the region is experiencing.

"Considering the ongoing demand for IP addresses, this date effectively represents IPv4 exhaustion for many of the current operators in the Asia Pacific region," Mr Wilson said. "From this day onwards, IPv6 is mandatory for building new Internet networks and services."

http://www.apnic.net/__data/assets/pdf_file/0018/33246/Key-Turning-Point-in-Asia-Pacific-IPv4-Exhaustion_English.pdf

RIPE IPv4 Depletion

RIPE Depletes Sept 14, 2012



RIPE NCC RIPE NETWORK COORDINATION CENTRE

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You are here: Home > Internet Coordination > News > Announcements > RIPE NCC Begins to Allocate IPv4 Address Space From the Last /8

RIPE NCC Begins to Allocate IPv4 Address Space From the Last /8

Publication date: 14 Sep 2012 — NEWS

On Friday 14 September, 2012, the RIPE NCC, the Regional Internet Registry (RIR) for Europe, the Middle East and parts of Central Asia, distributed the last blocks of IPv4 address space from the available pool.

This means that we are now distributing IPv4 address space to Local Internet Registries (LIRs) from the last /8 according to section 5.1 of "IPv4 Address Allocation and Assignment Policies for the RIPE NCC Service Region".

This section states that an LIR may receive one /22 allocation (1,024 IPv4 addresses), even if they can justify a larger allocation. This /22 allocation will only be made to LIRs if they have already received an IPv6 allocation from an upstream LIR or the RIPE NCC. No new IPv4 Provider Independent (PI) space will be assigned.

It is now imperative that all stakeholders deploy IPv6 on their networks to ensure the continuity of their online operations and the future growth of the Internet.

http://www.ripe.net/internet-coordination/news/announcements/ripe-ncc-begins-to-allocate-ipv4-address-space-from-the-last-8

LACNIC IPv4 Below /9 (8,388,608 IPs)

Announced
May 20, 2014

LACNIC's IPv4 Address Pool Now Down to a /9

LACNIC's IPv4 address pool is now down to 8,388,606 addresses, which is equivalent to a /9. This fact triggers a new phase of the IPv4 exhaustion plan designed by LACNIC for Latin America and the Caribbean based on the policies approved by the regional community. This phase, which will extend from the moment when there are 8,388,606 available IPv4 addresses until only 4,194,302 remain, or, in other words, while LACNIC's pool of available IPv4 resources goes from a /9 to a /10, is referred to as Phase 1. From now on, the application analysis and evaluation process will become increasingly strict.

For more information, please see http://www.lacnic.net/web/lacnic/agotamiento-ipv4

As of this moment, there are only about 4 million addresses available before reaching exhaustion Phase 2, when the rules and procedures for the assignment of the remaining addresses will be extremely restrictive in terms of assignment size and frequency.

The fact that LACNIC is now down to 8.3 million IPv4 addresses also triggers a global policy that states that the IANA must make a first round of assignments from the small pool of IPv4 addresses it was returned. This space must be distributed equally among the five Regional Internet Registries. Under LACNIC policies, these addresses will be added to the pool for new entrants which will become active when LACNIC enters Phase 2 of its IPv4 Exhaustion Plan.

The need to deploy IPv6 is now more pressing than ever. It cannot be delayed any longer if connectivity providers still wish to comply with the demands of their customers and those of new users. The Internet continues to grow in leaps and bounds, and an increasing number of business opportunities continue to emerge. It is estimated that next year our region will have tens of millions of new Internet users. To meet the demand for the years to come, it is essential that every access network and content service in our region deploys IPv6.

http://www.lacnic.net/en/web/anuncios/2014-el-stock-de-direcciones-de-ipv4-de-lacnic-alcanzo-el-9

IANA Redistribution

22 May 2014

IANA Allocates Recovered IPv4 Addresses to RIRs

On 20 May 2014, LACNIC became the first of the five Regional Internet Registries (RIRs) to reach their last /9 of remaining IPv4 address space. This triggered a global policy for IANA to make equal allocations from its recovered IPv4 pool to each of the five RIRs. On this same day, each RIR received the equivalent of a /11 allocation from IANA (2,097,152 million IP addresses).

The "**Global Policy for Post Exhaustion IPv4 Allocation Mechanisms**" was ratified in 2012 by the five regional communities served by the RIRs, after the **final /8 blocks were distributed in 2011**. The policy created a special pool of addresses that were left over or returned to IANA. It stated that IANA would begin making equal periodic allocations from this pool when the first RIR reached less than a total of a /9 in its inventory.

The latest announcement from LACNIC indicates that it is not far from IPv4 exhaustion. This leaves AFRINIC as the only RIR with a significant pool of remaining IPv4 addresses. After exhaustion, the RIRs will continue to distribute IPv4 space to their communities, with some RIRs issuing at a greatly reduced rate according to varying run out policies established by their communities.

While the RIRs now have some additional IPv4 addresses, this will likely be one of the last significant allocations they receive from IANA. This fact underscores more than ever the need for network operators to move towards full deployment of the IPv6 protocol, which has more than enough addresses to allow for the continued growth of the Internet.

More information about IPv4 depletion and IPv6 adoption can be found **here**.

http://www.nro.net/news/iana-allocates-recovered-ipv4-addresses-to-rirs

IANA Redistribution

- Each RIR was allocated a /11 equivalent
  - 2,097,152 IP addresses
  - 8,192 /24s

Start address	End address	Designation	Date	Whois	Status	Note
43.224.0.0	43.231.255.255	APNIC	2014-05	whois.apnic.net	ALLOCATED	
43.236.0.0	43.243.255.255	APNIC	2014-05	whois.apnic.net	ALLOCATED	
43.245.0.0	43.252.255.255	APNIC	2014-05	whois.apnic.net	ALLOCATED	
43.254.0.0	43.255.255.255	APNIC	2014-05	whois.apnic.net	ALLOCATED	
45.32.0.0	45.63.255.255	ARIN	2014-05	whois.arin.net	ALLOCATED	
45.64.0.0	45.65.15.255	APNIC	2014-05	whois.apnic.net	ALLOCATED	
45.128.0.0	45.159.255.255	RIPE NCC	2014-05	whois.ripe.net	ALLOCATED	
45.160.0.0	45.191.255.255	LACNIC	2014-05	whois.lacnic.net	ALLOCATED	
45.192.0.0	45.222.255.255	AFRINIC	2014-05	whois.afrinic.net	ALLOCATED	
150.107.0.0	150.107.255.255	APNIC	2014-05	whois.apnic.net	ALLOCATED	
150.129.0.0	150.129.255.255	APNIC	2014-05	whois.apnic.net	ALLOCATED	
150.242.0.0	150.242.255.255	APNIC	2014-05	whois.apnic.net	ALLOCATED	
154.16.0.0	154.16.255.255	AFRINIC	2014-05	whois.afrinic.net	ALLOCATED	
163.47.4.0	163.47.18.255	APNIC	2014-05	whois.apnic.net	ALLOCATED	
163.47.20.0	163.47.21.255	APNIC	2014-05	whois.apnic.net	ALLOCATED	
163.47.32.0	163.47.45.255	APNIC	2014-05	whois.apnic.net	ALLOCATED	
163.47.47.0	163.47.255.255	APNIC	2014-05	whois.apnic.net	ALLOCATED	
163.53.0.0	163.53.255.255	APNIC	2014-05	whois.apnic.net	ALLOCATED	

http://www.iana.org/assignments/ipv4-recovered-address-space/ipv4-recovered-address-space.xhtml

LACNIC IPv4 Depletion

Depletion Announced June 10, 2014

No more IPv4 addresses in Latin America and the Caribbean

Latin America and the Caribbean have entered the IPv4 exhaustion phase; the delay in deploying Internet Protocol version 6 in our region is cause for concern.

La Casa de Internet de Latinoamérica y el Caribe, 10 June.- Today, the Internet Address Registry for Latin America and the Caribbean (LACNIC), the organization responsible for assigning Internet resources in the region, announced the exhaustion of its IPv4 address pool and expressed its concern regarding the fact that operators and governments throughout the region are delaying the deployment of Internet Protocol version 6 (IPv6).

LACNIC reported that its pool of available IPv4 addresses reached the 4.194.302 mark, and that this has triggered stricter Internet resource assignment policies for the continent. In practice, this means that IPv4 addresses are now exhausted for Latin American and Caribbean operators.

"This is an historic event; the fact that it was anticipated and announced doesn't make it any less significant," said Raúl Echeberría, LACNIC's CEO. "From now on, LACNIC and its National Registries will only be able to assign very small numbers of IPv4 addresses, and these will not be enough to satisfy our region's needs." Since it began operating in 2002, the organization has assigned more than 182 million IPv4 addresses throughout Latin America and the Caribbean.

As agreed by the regional community, now that only 4,194,302 available IPv4 addresses (/10) remain, LACNIC's pool of IPv4 addresses is considered officially exhausted and the Gradual Exhaustion and New Entrants policies have come into effect, introducing new procedures and requirements for those requesting resources.

The policy on Transfers of IPv4 Blocks within the LACNIC Region (see 2.3.2.18), which allows and governs the transfer of resources among different organizations within the region, is now also in effect.

"Today, the need to deploy IPv6 is now more pressing than ever. It cannot be delayed any longer if connectivity providers still wish to meet the demands of their customers and those of new users. LACNIC and the Internet community have been working for years in preparation for this very moment," said Echeberría. 67% of LACNIC member organizations have already been assigned IPv6 addresses by LACNIC and National Registries, NIC.br and NIC.MX.

LACNIC's CEO, however, expressed his concern that "10 years after LACNIC and National Registries, NIC.br and NIC.MX. began promoting IPv6 deployment, many operators and companies still haven't taken the steps needed to duly address this circumstance."

2,097,150 of the remaining 4,194,302 addresses may be assigned during this phase, in blocks of limited sizes (assignments) comprising between 256 and 1,024 IP addresses. Likewise, an organization may only request additional resources six months after receiving a prior assignment. Once these 2 million IPv4 addresses are exhausted, LACNIC members will no longer be able to receive any IPv4 assignments.

At that point, the reserve for new members (/11) will be activated, thus triggering Phase 3 of the IPv4 exhaustion plan designed by LACNIC and the National Registries. According to the policies in force, during this final phase only new members will be able to request IPv4 addresses, which will be assigned in blocks of between 256 (/24) and 1,024 (/22) addresses. Each new member will only be able to receive one assignment from this space.

http://www.lacnic.net/en/web/anuncios/2014-no-hay-mas-direcciones-ipv4-en-lac

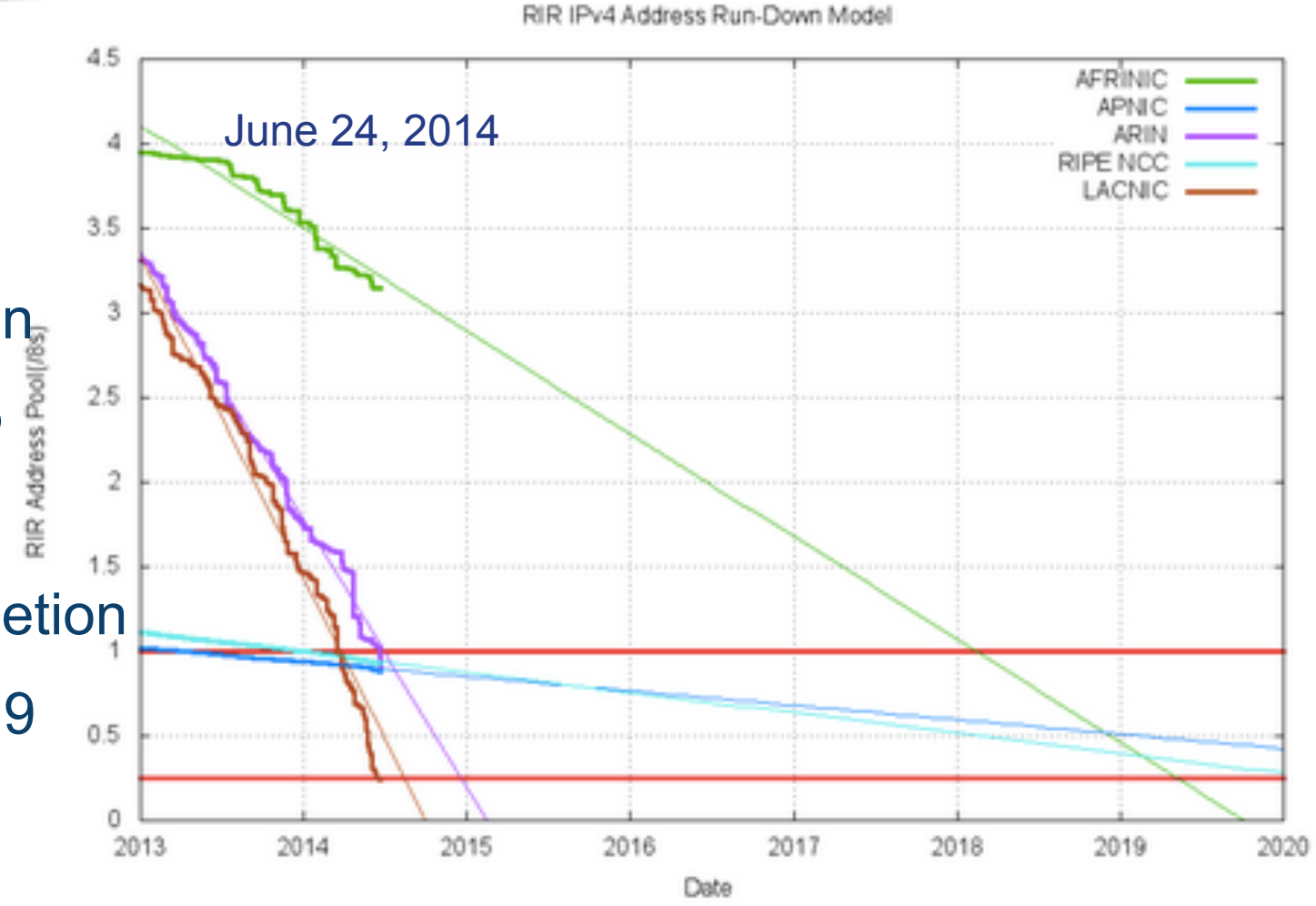
RIR IPv4 Depletion

ARIN depletion

~ Feb 8, 2015

AFRINIC depletion

~ Aug 26, 2019



Projection of consumption of Remaining RIR Address Pools

http://www.potaroo.net/tools/ipv4/

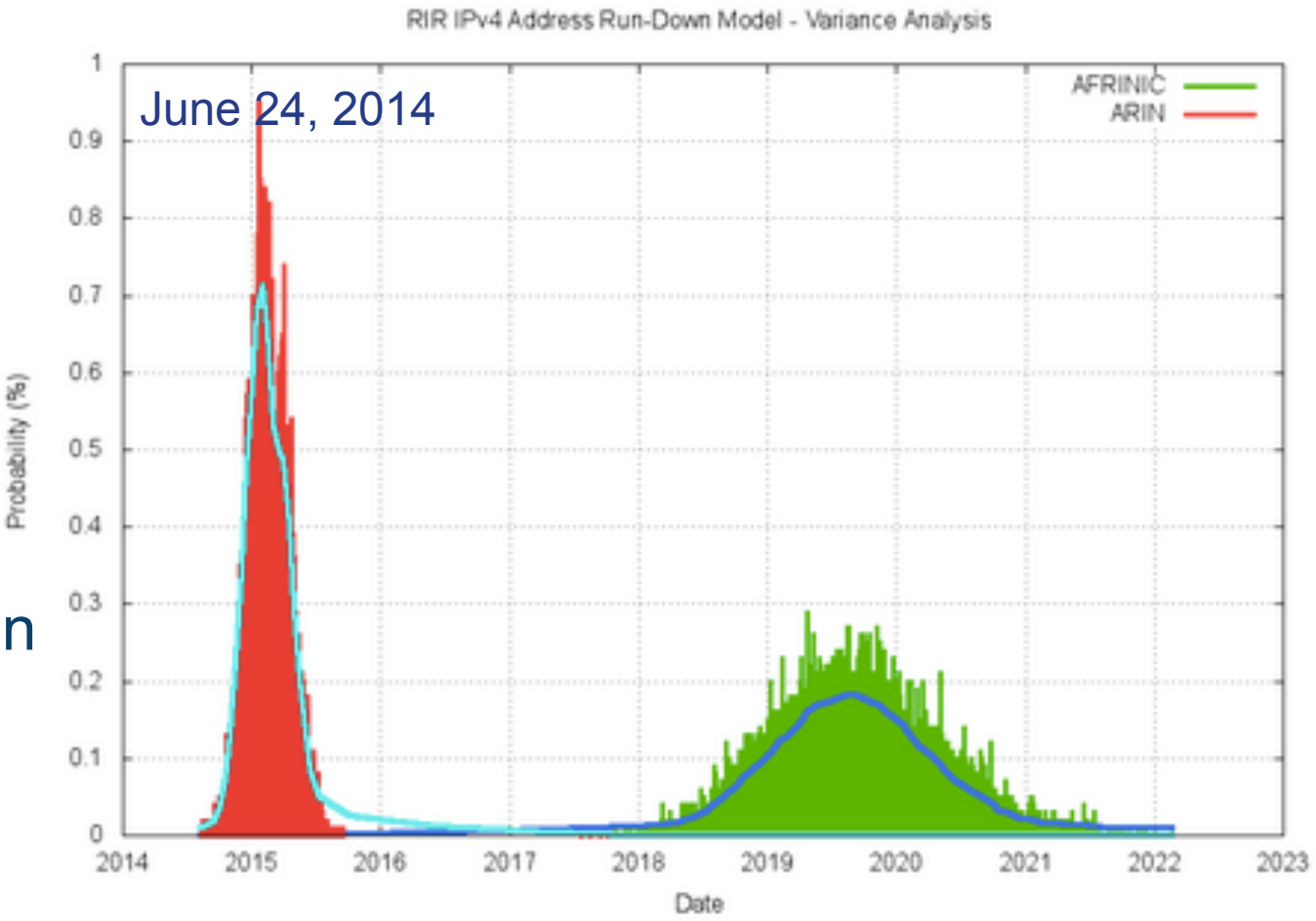
RIR IPv4 Depletion

ARIN depletion

~ Feb 8, 2015

AFRINIC depletion

~ Aug 26, 2019



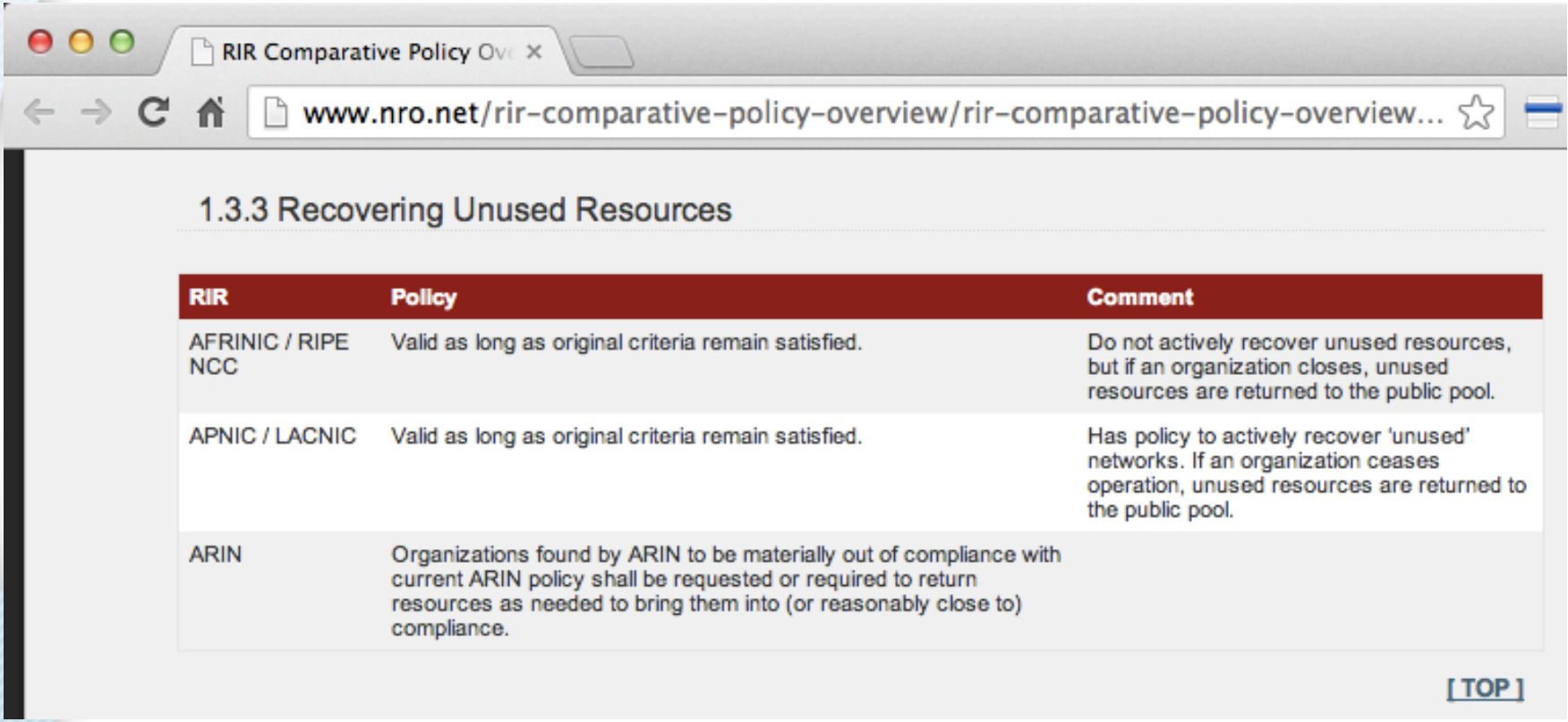
Variance of Projections of Remaining RIR Address Pools

http://www.potaroo.net/tools/ipv4/

RIR IPv4 Address Recovery

What is the Policy for IPv4 Recovery?

- NRO RIR comparative overview
- http://www.nro.net/rir-comparative-policy-overview/rir-comparative-policy-overview-2014-01



1.3.3 Recovering Unused Resources

RIR	Policy	Comment
AFRINIC / RIPE NCC	Valid as long as original criteria remain satisfied.	Do not actively recover unused resources, but if an organization closes, unused resources are returned to the public pool.
APNIC / LACNIC	Valid as long as original criteria remain satisfied.	Has policy to actively recover 'unused' networks. If an organization ceases operation, unused resources are returned to the public pool.
ARIN	Organizations found by ARIN to be materially out of compliance with current ARIN policy shall be requested or required to return resources as needed to bring them into (or reasonably close to) compliance.	

[TOP]

What is the Policy for IPv4 Recovery?

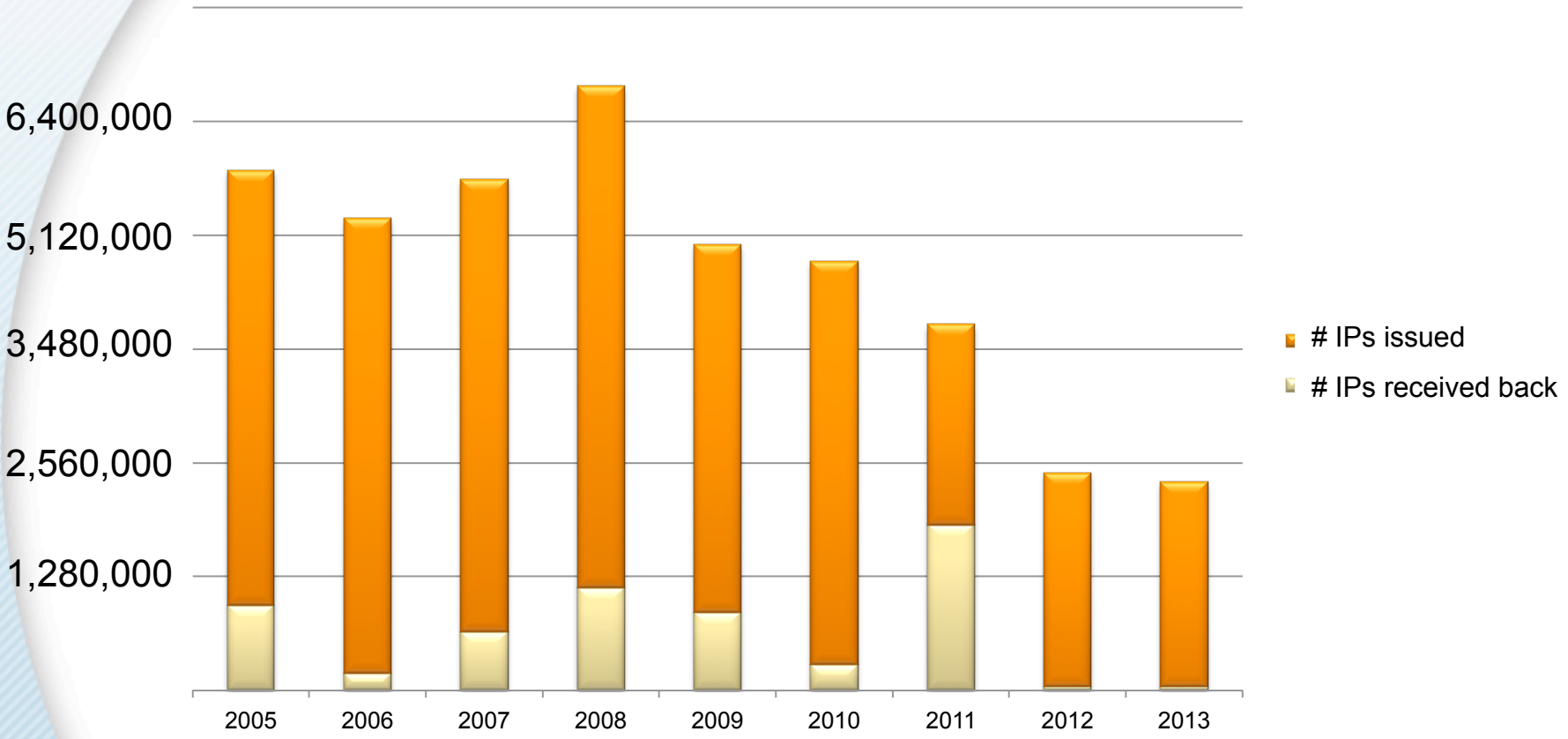
- Valid as long as original criteria continues to be met
- Resources of organizations who cease are recovered
- Resources of organizations who do not renew their membership are recovered
- APNIC & LACNIC
  - Actively recover unused resources
- ARIN
  - Actively recover unused resources
  - Organizations out of compliance are requested or required to return resources to bring them back (or reasonably close) to compliance
  - Resources revoked for lack of payment
  - Resources revoked for fraud

ARIN IPv4 Churn

- IPv4 addresses go back into ARIN's free pool 3 ways
  - Return = voluntary
  - Revoke = for cause (usually nonpayment)
  - Reclaimed = fraud or business dissolution

- 3.68 /8s (61,740,154 IPs) received back since 2004
  - /8 (16,777,216 IPs) equivalent returned to IANA in 2012

ARIN Burn vs Churn rate



ARIN IPv4 Recovery

Year	IPv4 Addresses	ASNs
2007	6,632,243 (85% returns)	1552 (12% returns)
2008	11,704,729 (87% returns)	704 (28% returns)
2009	8,722,841 (86% returns)	462 (40% returns)
2010	2,916,352 (49% returns)	1446 (32% returns)
2011	186,38,438 (96% returns)	365 (39% returns)
2012	458,752 (45% returns)	853 (41% returns)
2013*	288,358 (4% returns)	390 (33% returns)

*As of Sep 30, 2013

LACNIC Recovery

- 53 ASNs
- 86 blocks, 354,560 IPs
  - As of June 2014

RIR IPv4 Address Transfers

IPv4 Transfers

- Merger and Acquisition
  - When M&A activity occurs that include IP addresses
  - All RIRs have this policy
- Specified transfer policy
  - Transferring just IP addresses
  - APNIC
  - ARIN
  - RIPE
  - LACNIC
- Inter-RIR
  - Transfer between members of different regions
  - ARIN
  - APNIC

APNIC IPv4 Transfers

- Merger and Acquisition
  - Transfer of users, equipment, etc., and the associated IP addresses
  - Requires legal documentation of the transaction
  - When an organization merges its membership merges
  - When an organization is no longer holding resources, its member ceases

APNIC IPv4 Transfers

- Specified IPv4 transfer policy
  - Permits transfer without M & A
  - Source is registered holder of Address space
    - Except if source is another region, then conditions defined in source's region
  - Recipient requires justified need of 24 months
  - Recipient must comply with APNIC policy
    - Except if recipient is in another region, then conditions defined in recipient's region

ARIN IPv4 Transfers

- IP addresses are not sold
- Issued to organizations based on need
- If an organization goes out of business resources must be returned
- Merger and Acquisition
  - Transfer of users, equipment, etc., and the associated IP addresses
  - Requires legal documentation of the transaction
  - Recipient must sign RSA
  - Recipient must comply with current ARIN policies
    - Must demonstrate efficient utilization
  - Must meet current minimum allocation (/24)

ARIN IPv4 Transfers

- Specified IPv4 transfer policy
  - Permits transfer without M & A
  - Minimum /24
  - Condition on Source

    Except if source is another region, then conditions defined in source's region
    - Is registered holder of Address space
    - Is not eligible to receive IPs from ARIN for 12 months
  - Conditions on recipient

    Except if source is another region, then conditions defined in source's region
    - Requires justified need of 24 months
    - Must comply with ARIN policy
    - Must sign RSA

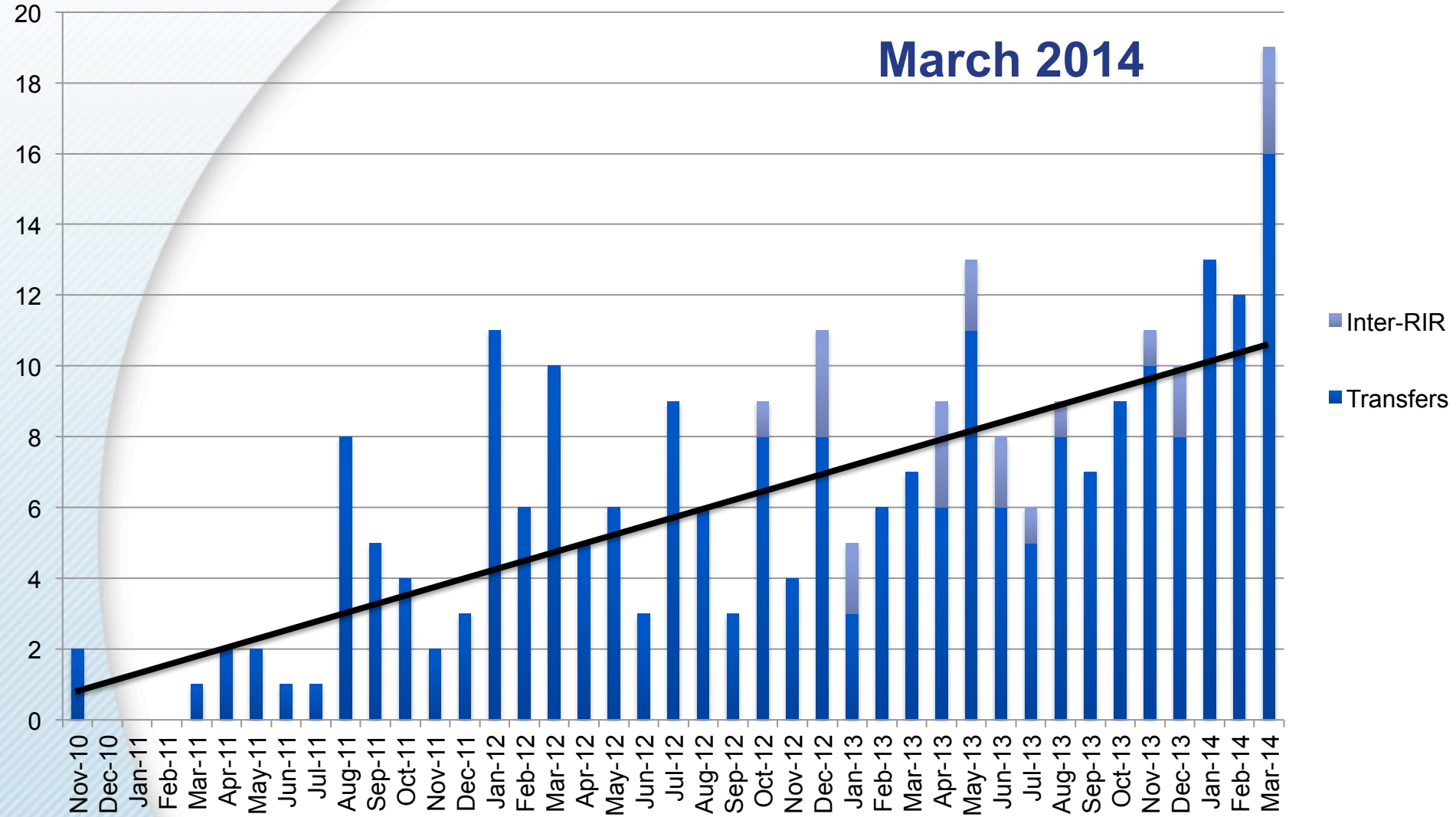
RIPE IPv4 Transfers

- Merger and Acquisition
  - Requires legal documentation of the transaction
  - Requires legal documentation of company registration
  - Between ISPs or End sites
- Specified transfer policy
  - Permits transfer without M & A
  - Only between ISPs that are RIPE members
  - Minimum /22
  - Source is registered holder of Address space
  - Recipient must make assignments
- Legacy specified transfer policy
  - Permits transfer without M & A
  - Only between RIPE members
  - Block retains legacy status

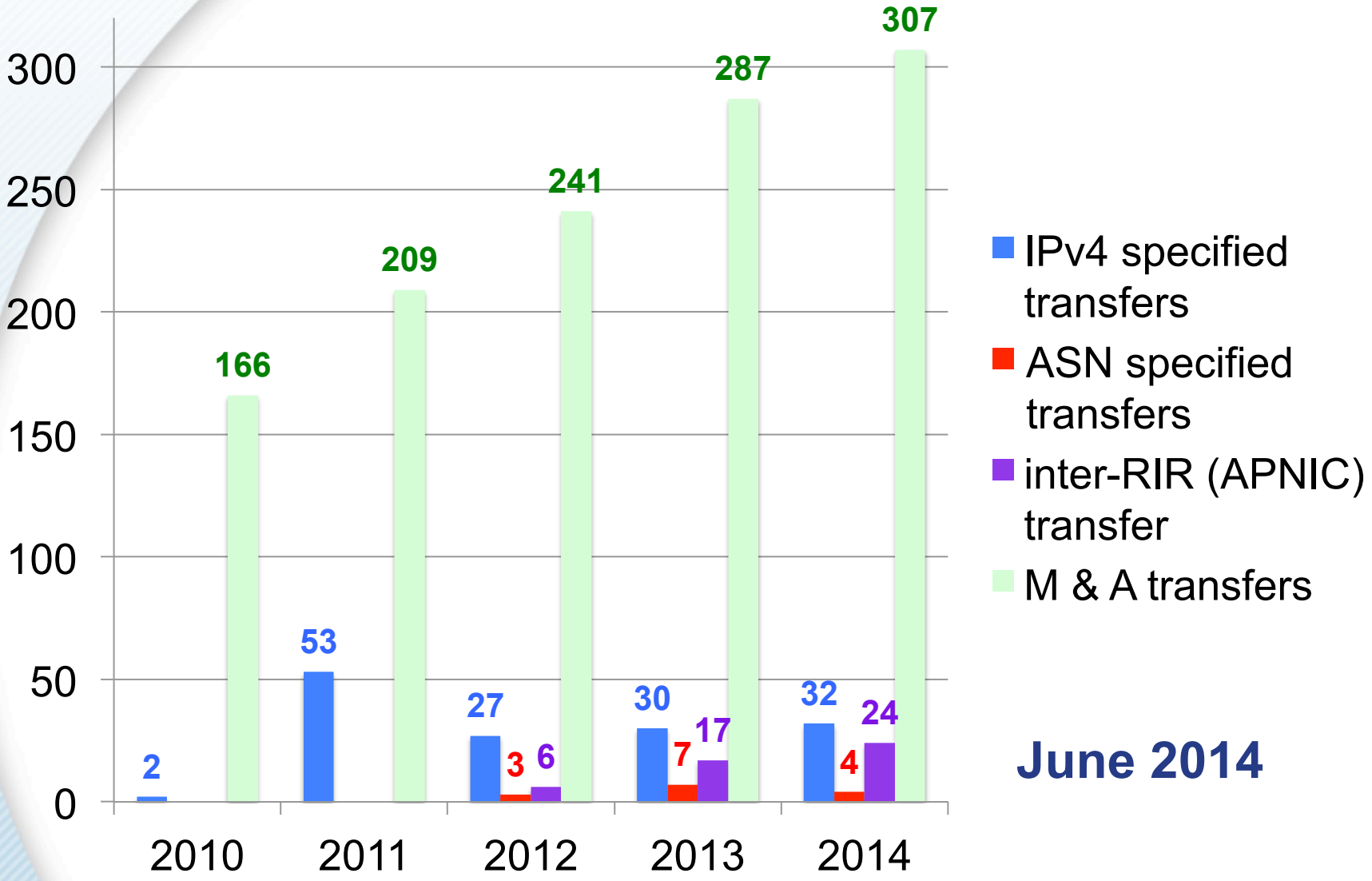
LACNIC IPv4 Transfers

- Merger and Acquisition
  - Transfer of users, equipment, etc., and the associated IP addresses
  - Requires legal documentation of the transaction
- Specified transfer policy
  - Permits transfer without M & A
  - Source is registered holder of Address space
  - Recipient requires justified need of 12 months
  - Minimum /24
  - Recipient must hold the block for 1 year prior to transfer
  - Recipient cannot receive any other allocation from LACNIC for 12 months
  - Recipient must comply with LACNIC policy

APNIC IPv4 Transfers

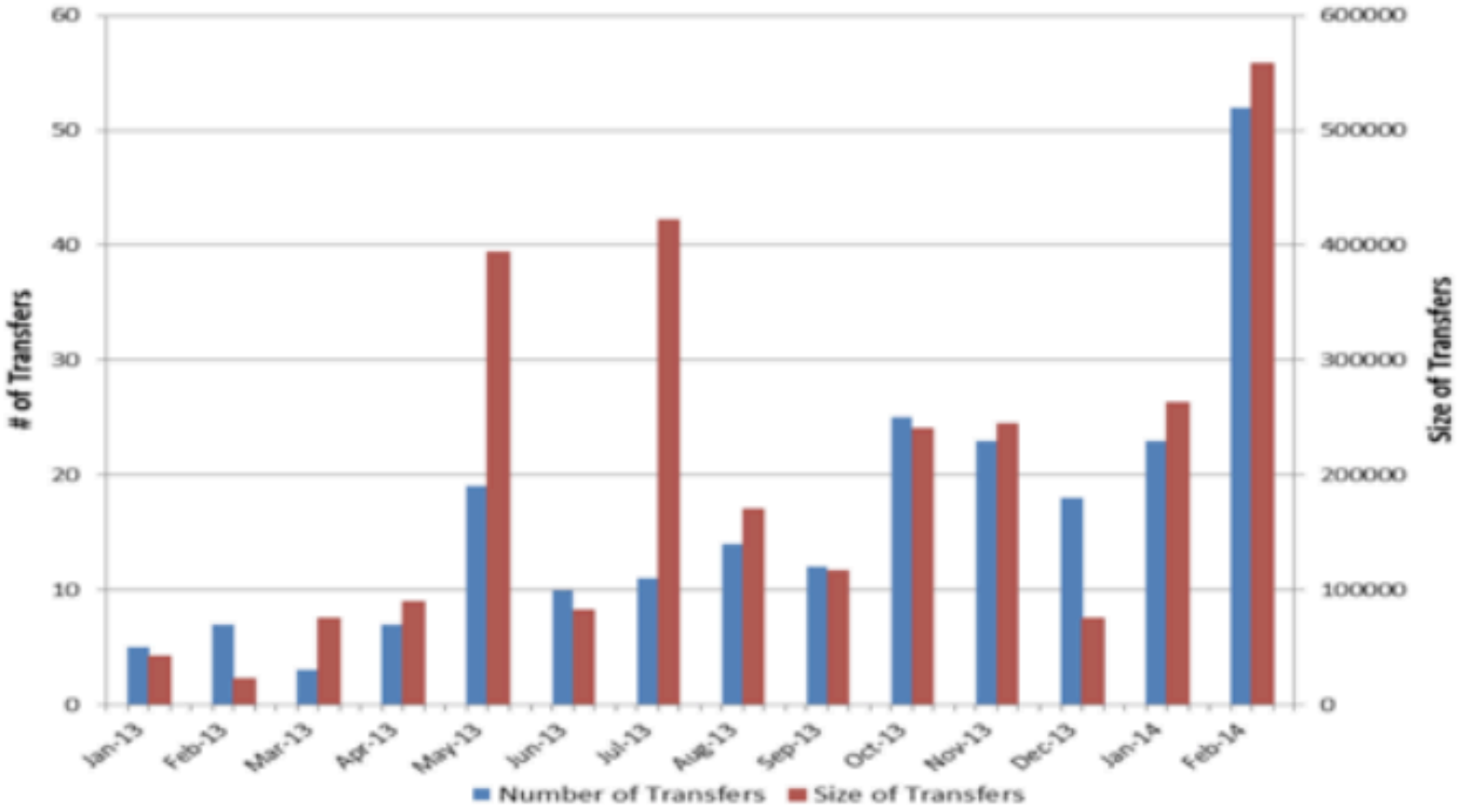


ARIN IPv4 Transfers



RIPE IPv4 Transfers

February 2014

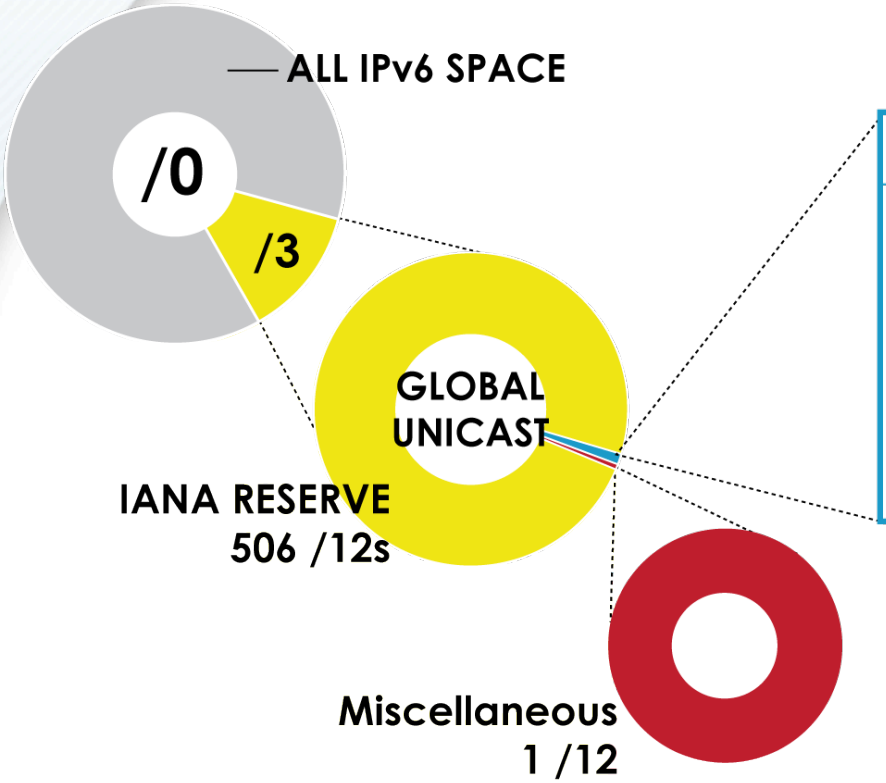


LACNIC & AFRINIC Transfers

- AFRINIC lacks a transfer policy other than M&A
- LACNIC Transfer policy just activated
  - June 10, 2014

Status of IPv6 Address Space

IPv6 Address Space

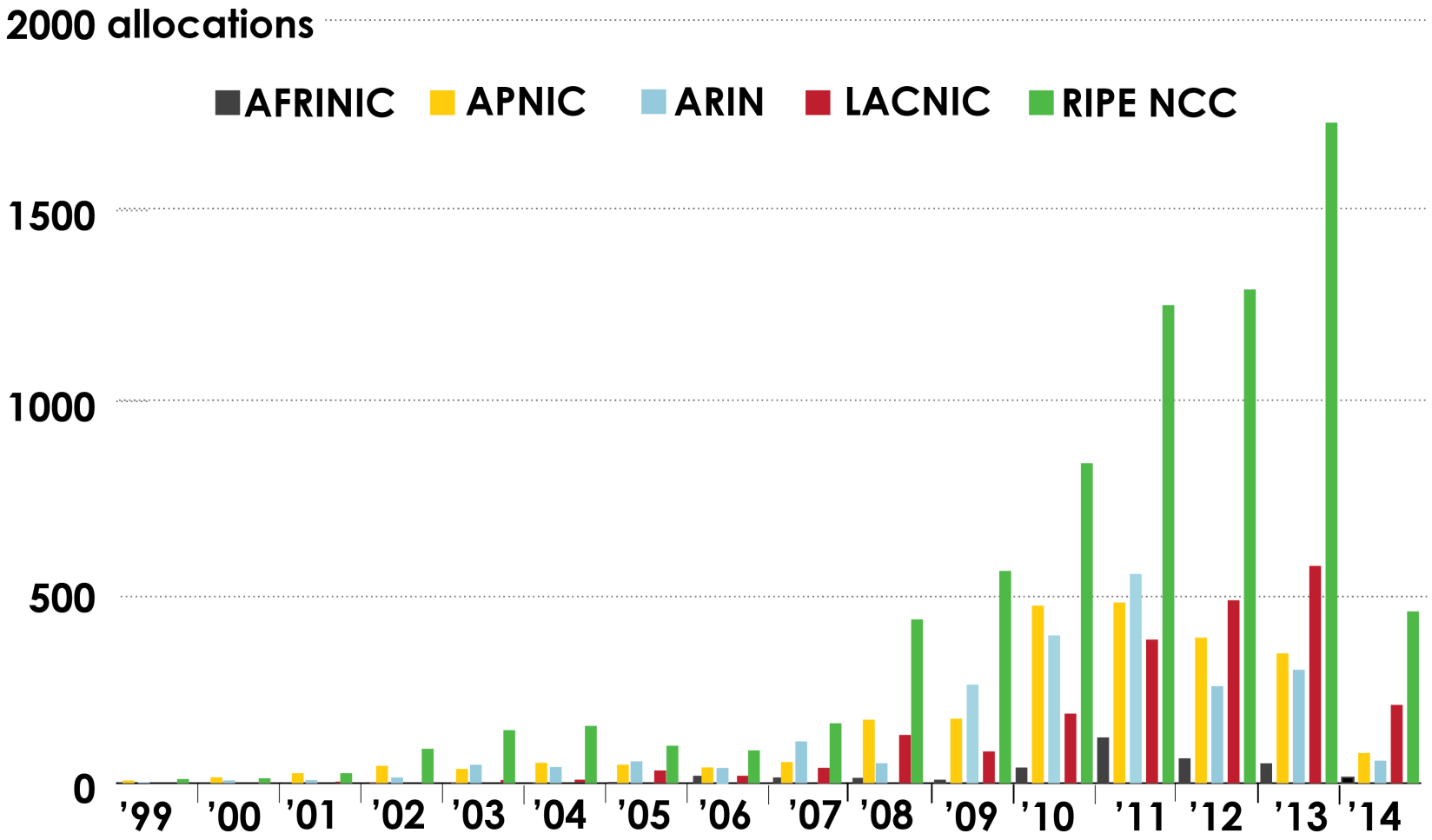


RIRs 5 /12s (October 2006)

RIR	IPv6 ADDRESS
AfriNIC	2C00:0000::/12
APNIC	2400:0000::/12
ARIN	2600:0000::/12
LACNIC	2800:0000::/12
RIPE NCC	2A00:0000::/12

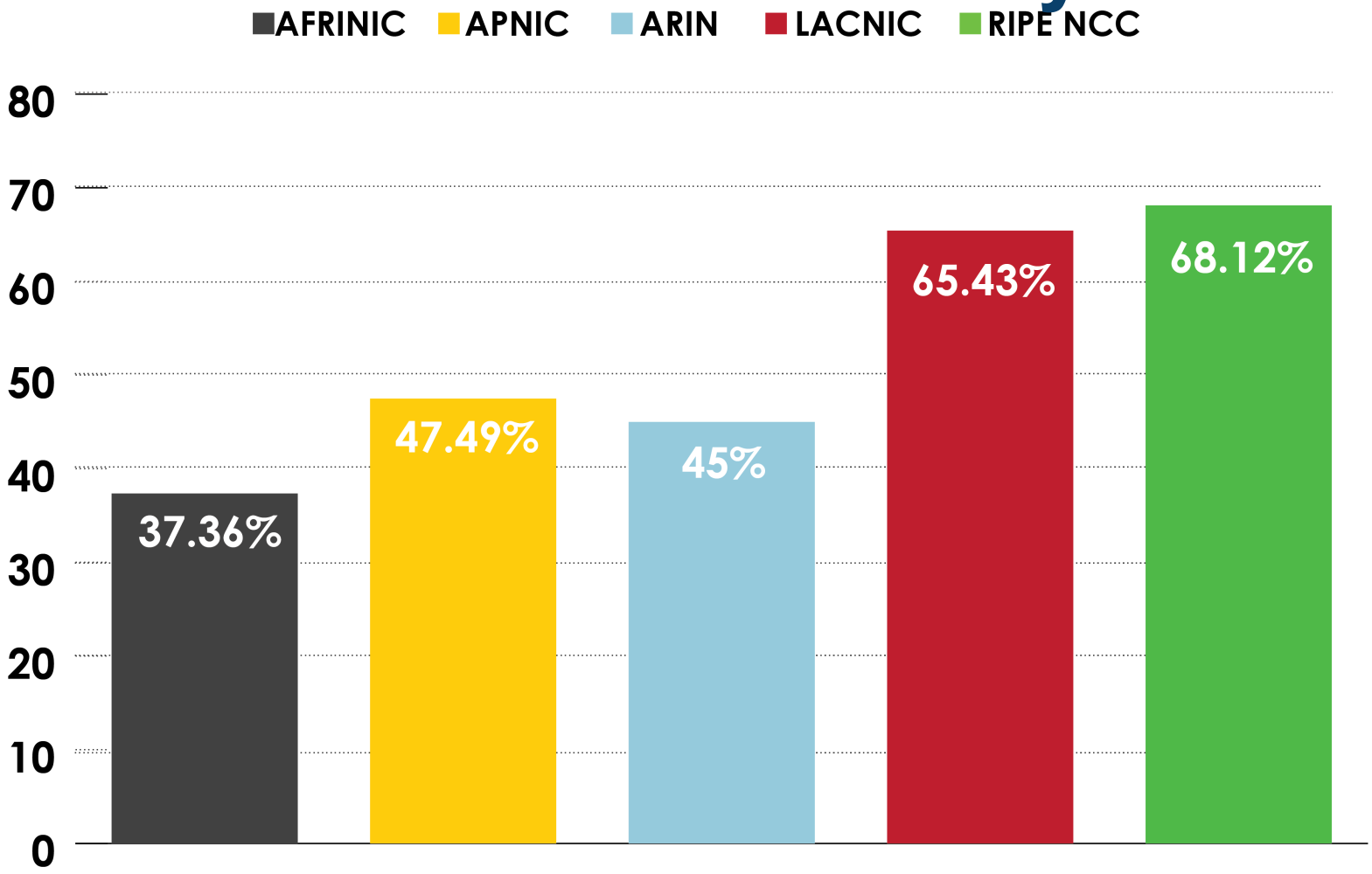
Source: INTERNET NUMBER RESOURCE STATUS REPORT (NRO, March 2014)

IPv6 Allocations (RIRs to LIRs/ISPs) by years



Source: INTERNET NUMBER RESOURCE STATUS REPORT (NRO, March 2014)

Percentage of members with both IPv4 and IPv6 by RIR



Source: INTERNET NUMBER RESOURCE STATUS REPORT (NRO, March 2014)

IPv6 All Deployment

World IPv6 Day

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ABOUT WORLD IPV6 DAY

On 8 June, 2011, Google, Facebook, Yahoo!, Akamai and Limelight Networks will be amongst some of the major organisations that will offer their content over IPv6 for a 24-hour "test flight". The goal of the Test Flight Day is to motivate organizations across the industry – Internet service providers, hardware makers, operating system vendors and web companies – to prepare their services for IPv6 to ensure a successful transition as IPv4 addresses run out.

Please join us for this test drive and help accelerate the momentum of IPv6 deployment.

TOPICS

About World IPv6 Day
List of Participants

World IPv6 Day

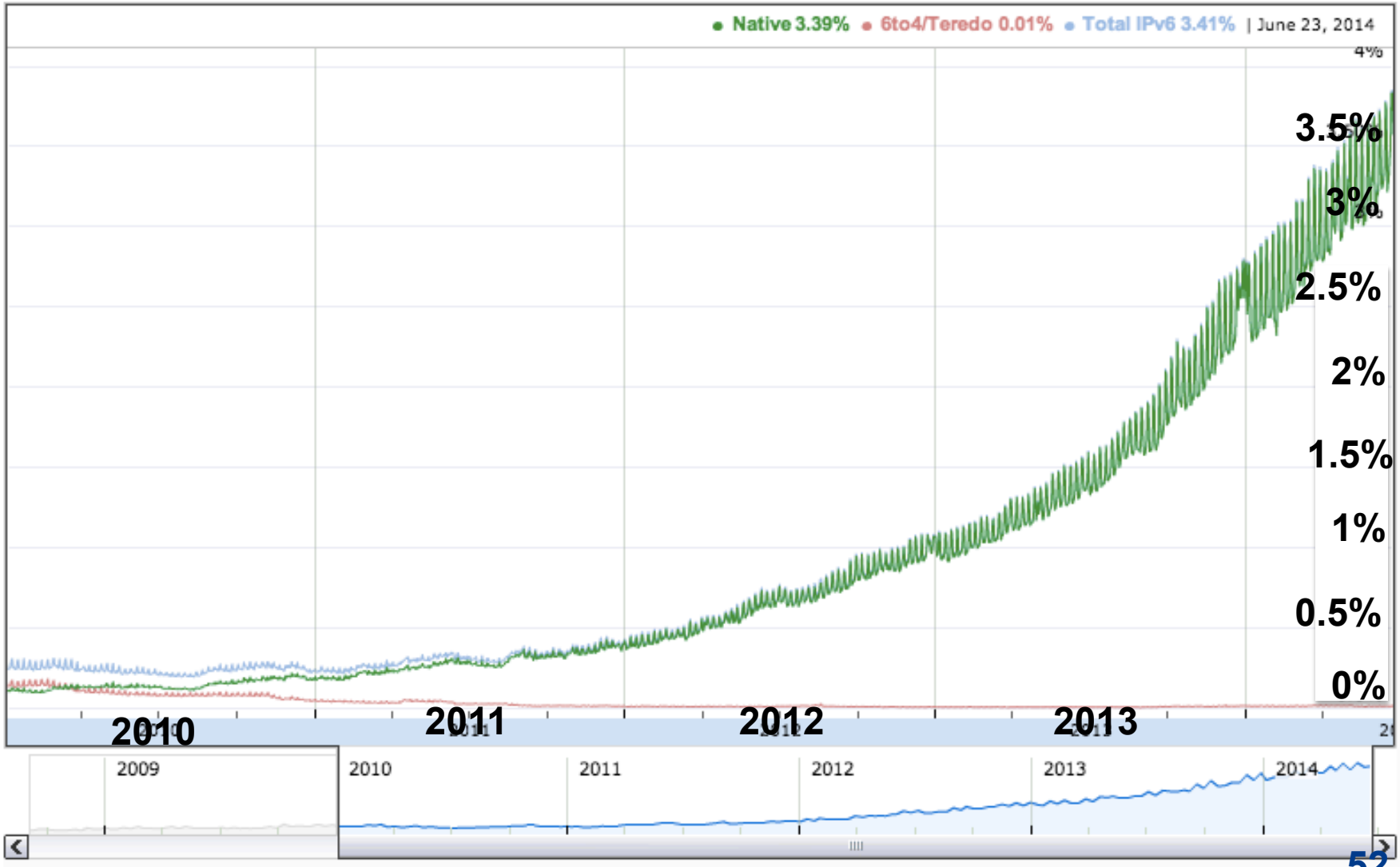
- ISOC organized World IPv6 day
- June 8, 2011
- Turn on IPv6 for 24 hours
  - Test flight
- Initiative by large content providers
  - Facebook, Google, Yahoo!, Akamai, Limelight
- Prove IPv6 can work
- Raise awareness for IPv6 brokenness
  - No “happy eyeballs”
- Motivate transit providers and vendors to support IPv6
  - Break the chicken and egg problem

World IPv6 Launch

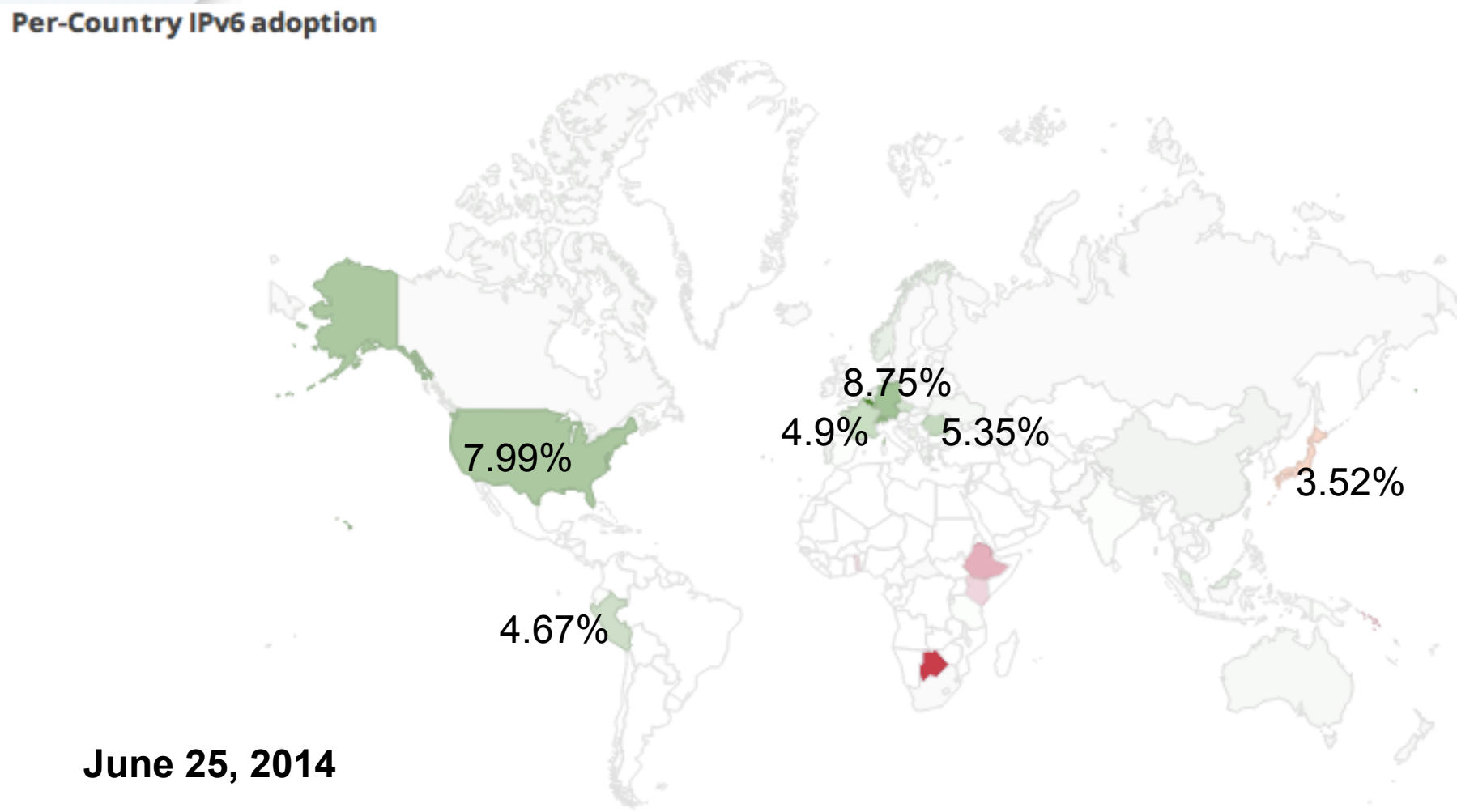
World IPv6 Launch

- ISOC organized World IPv6 Launch
- June 6, 2012
- Turn on IPv6 and leave it on
- ISPs to commit to turning on IPv6 for >1% of their residential customer base
- Content providers turn on IPv6 on their main site and leave it on
- Home router vendors enable IPv6 by default

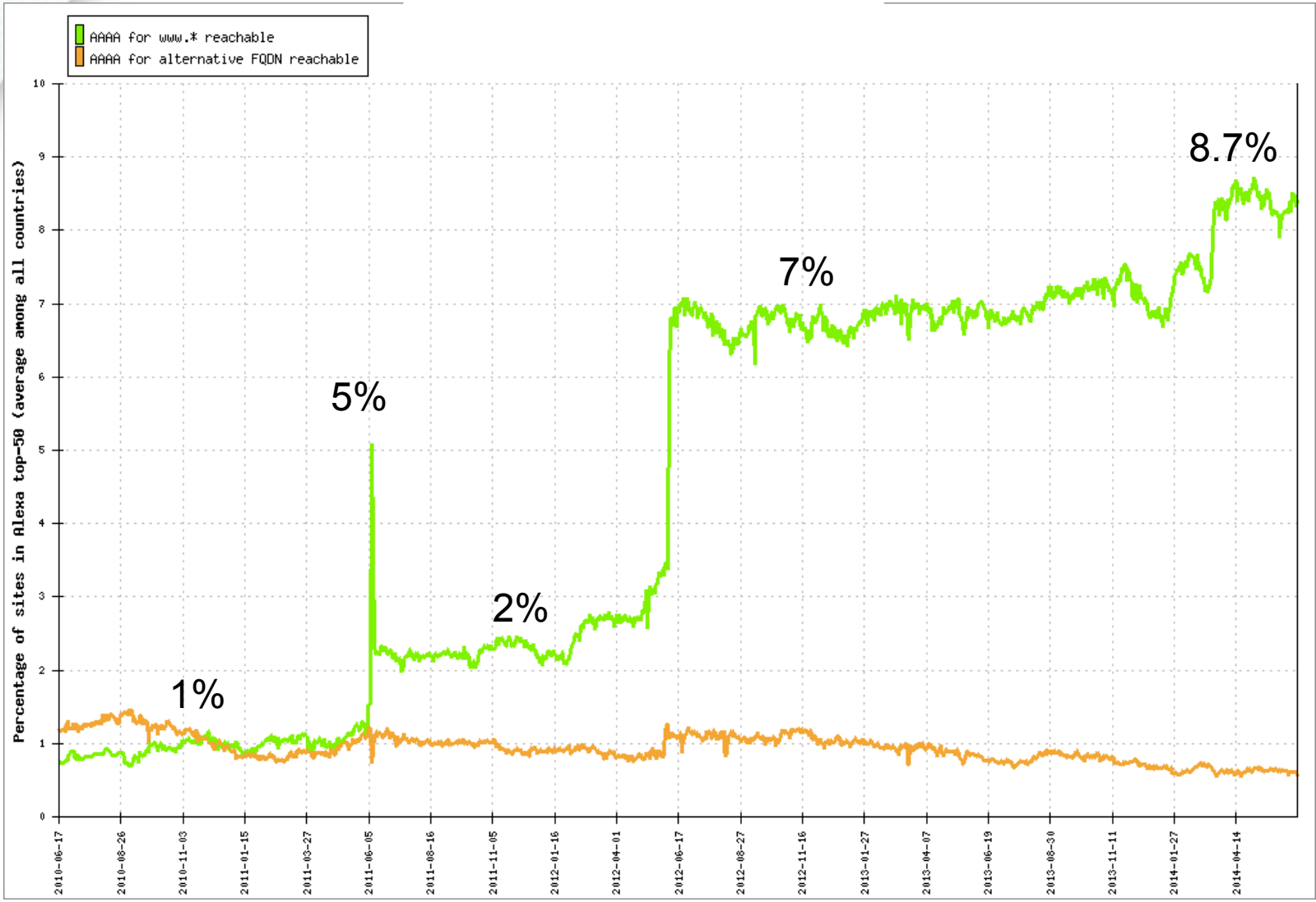
IPv6 Traffic as seen by Google



IPv6 Traffic as seen by Google



Alexa top 50 IPv6 enabled web sites



World IPv6 Day Results

- IPv6 traffic doubled from 0.024% to 0.041% relative to IPv4 traffic
- IPv6 support for Alexa top 50 web sites increased five fold from 1% to 5%
  - Doubled permanently to 2%
- Over 1,000 content providers participated
- Generated a lot of interest in IPv6
- Disproved IPv6 brokenness would severely impact content providers

World IPv6 Launch Results

- 243 ISPs with 0.1% or more IPv6 subscribers
  - 191 ISPs with > 1% IPv6 subscribers
- IPv6 traffic continues to double year over year
- IPv6 support for Alexa top 50 web sites increased more than 3 fold from 2% to 7%
  - IPv6 enabled sites left on
  - Little growth in the number of sites recently 8.7%
- Number of IPv6 enabled residential customers continues to increase
  - Doubled at one year

Thank you.
Questions?

Backup Slides

ARIN IPv4 Transfers

8. TRANSFERS

8.1. Principles

Number resources are nontransferable and are not assignable to any other organization unless ARIN has expressly and in writing approved a request for transfer. ARIN is tasked with making prudent decisions on whether to approve the transfer of number resources.

It should be understood that number resources are not 'sold' under ARIN administration. Rather, number resources are assigned to an organization for its exclusive use for the purpose stated in the request, provided the terms of the Registration Services Agreement continue to be met and the stated purpose for the number resources remains the same. Number resources are administered and assigned according to ARIN's published policies.

Number resources are issued, based on justified need, to organizations, not to individuals representing those organizations. Thus, **if a company goes out of business, regardless of the reason, the point of contact (POC) listed for the number resource does not have the authority to sell, transfer, assign, or give the number resource to any other person or organization. The POC must notify ARIN if a business fails so the assigned number resources can be returned to the available pool of number resources if a transfer is not requested and justified.**

ARIN IPv4 M&A Transfers

8.2. Mergers and Acquisitions

ARIN will consider requests for the transfer of number resources in the case of mergers, acquisitions, and reorganizations under the following conditions:

- The new entity must provide evidence that they have acquired assets that use the resources to be transferred from the current registrant. ARIN will maintain an up-to-date list of acceptable types of documentation.
- The current registrant must not be involved in any dispute as to the status of the resources to be transferred.
- The new entity must sign an RSA covering all resources to be transferred.
- The resources to be transferred will be subject to ARIN policies.
- The minimum transfer size is the smaller of the original allocation size or the applicable minimum allocation size in current policy.

In the event that number resources of the combined organizations are no longer justified under ARIN policy at the time ARIN becomes aware of the transaction, through a transfer request or otherwise, ARIN will work with the resource holder(s) to return, aggregate, transfer, or reclaim resources as needed to restore compliance via the processes outlined in current ARIN policy.

ARIN IPv4 Specified Transfers

8.3. Transfers between Specified Recipients

- In addition to transfers under section 8.2, IPv4 numbers resources and ASNs may be transferred according to the following conditions.
- Conditions on source of the transfer:
- The source entity must be the current registered holder of the IPv4 address resources, and not be involved in any dispute as to the status of those resources.
- The source entity will be ineligible to receive any further IPv4 address allocations or assignments from ARIN for a period of 12 months after a transfer approval, or until the exhaustion of ARIN's IPv4 space, whichever occurs first.
- The source entity must not have received a transfer, allocation, or assignment of IPv4 number resources from ARIN for the 12 months prior to the approval of a transfer request. This restriction does not include M&A transfers.
- The minimum transfer size is a /24
- Conditions on recipient of the transfer:
- The recipient must demonstrate the need for up to a 24-month supply of IP address resources under current ARIN policies and sign an RSA.
- The resources transferred will be subject to current ARIN policies.

ARIN IPv4 Specified Transfers

- **8.4. Inter-RIR Transfers to Specified Recipients**
- Inter-regional transfers may take place only via RIRs who agree to the transfer and share reciprocal, compatible, needs-based policies.
- Conditions on source of the transfer:
  - The source entity must be the current rights holder of the IPv4 address resources recognized by the RIR responsible for the resources, and not be involved in any dispute as to the status of those resources.
  - Source entities outside of the ARIN region must meet any requirements defined by the RIR where the source entity holds the registration.
  - Source entities within the ARIN region will not be eligible to receive any further IPv4 address allocations or assignments from ARIN for a period of 12 months after a transfer approval, or until the exhaustion of ARIN's IPv4 space, whichever occurs first.
  - Source entities within the ARIN region must not have received a transfer, allocation, or assignment of IPv4 number resources from ARIN for the 12 months prior to the approval of a transfer request. This restriction does not include M&A transfers.
  - The minimum transfer size is a /24.

ARIN IPv4 Specified Transfers

- **8.4. Inter-RIR Transfers to Specified Recipients**
- Conditions on recipient of the transfer:
  - The conditions on a recipient outside of the ARIN region will be defined by the policies of the receiving RIR.
  - Recipients within the ARIN region will be subject to current ARIN policies and sign an RSA for the resources being received.
  - Recipients within the ARIN region must demonstrate the need for up to a 24-month supply of IPv4 address space.
- The minimum transfer size is a /24.

APNIC IPv4 Transfers

3. Transfers of IPv4 addresses and AS numbers between APNIC account holders

APNIC will process and record IPv4 address and ASN transfer requests between current APNIC account holders subject to the following conditions.

3.1 Conditions on the resources to be transferred

The minimum size for an IPv4 transfer is a /24.

The resources must be:

- In the resource ranges administered by APNIC
- Allocated or assigned to a current APNIC account holder
- The resources will be subject to all current APNIC policies from the time of transfer.

APNIC IPv4 Transfers

3.2 Conditions on source of the transfer

The source entity must be the currently registered holder of the resources, and not be involved in any dispute as to the status of those resources.

3.3 Conditions on recipient of the transfer

The recipient entity will be subject to current APNIC policies.

Recipients of AS number resources must meet the criteria for normal assignment of ASNs.

Recipients that do not already hold IPv4 resource must demonstrate a detailed plan for the use of the transferred resource within 24 months.

Recipients that already hold IPv4 resources must:

- Demonstrate a detailed plan for the use of the transferred resource within 24 months,
- Show past usage rate, and
- Provide evidence of compliance with APNIC policies with respect to past delegations.

APNIC will maintain a public log of all IPv4 transfers made under this policy.

RIPE IPv4 Transfers

- **5.5 Transfers of Allocations**

Any LIR is allowed to re-allocate complete or partial blocks of IPv4 address space that were previously allocated to them by the RIPE NCC or otherwise through the Regional Internet Registry System.

Address space may only be re-allocated to another LIR that is also a member of the RIPE NCC. The block that is to be re-allocated must not be smaller than the minimum allocation block size at the time of re-allocation.

Re-allocation must be reflected in the RIPE Database. This re-allocation may be on either a permanent or non-permanent basis.

LIRs that receive a re-allocation from another LIR cannot re-allocate complete or partial blocks of the same address space to another LIR within 24 months of receiving the re-allocation.

The RIPE NCC will record the change of allocation after the transfer

The RIPE NCC will publish a list of all allocations transferred under this section. The publication shall occur on monthly basis or more frequently if the RIPE NCC so chooses.

The list will contain information about approved and non-approved transfers.

RIPE IPv4 Transfers

5.5 Transfers of Allocations.

The following information will be published for approved transfers:

- the name of the transferring party,
- the block originally held by the transferring party,
- the name(s) of the receiving party or parties,
- each subdivided prefix (each partial block derived from that original block) transferred,
- the date each prefix was transferred.

Non-approved transfers will be published in an aggregate statistics. In the statistics the following information will be published

the number of requested transfers not approved after the RIPE NCC's evaluation,

the sum of the number of addresses included in the requested transfers.

Neither the blocks nor the organizations involved will be identified in these statistics.

Please note that the LIR always remains responsible for the entire allocation it receives from the RIPE NCC until the transfer of address space to another LIR is completed or the address space is returned. The LIR must ensure that all policies are applied.

Re-allocated blocks are no different from the allocations made directly by the RIPE NCC and so they must be used by the receiving LIR according to the policies described in this document.

ARIN Resource Review

12. RESOURCE REVIEW

1.ARIN may review the current usage of any resources maintained in the ARIN database. The organization shall cooperate with any request from ARIN for reasonable related documentation.

2. ARIN may conduct such reviews:

a. when any new resource is requested,

b. whenever ARIN has reason to believe that the resources were originally obtained fraudulently or in contravention of existing policy, or

c. whenever ARIN has reason to believe that an organization is not complying with reassignment policies, or

d. at any other time without having to establish cause unless a full review has been completed in the preceding 24 months.

At the conclusion of a review in which ARIN has solicited information from the resource holder, ARIN shall communicate to the resource holder that the review has been concluded and what, if any, further actions are required.

Organizations found by ARIN to be materially out of compliance with current ARIN policy shall be requested or required to return resources as needed to bring them into (or reasonably close to) compliance.

The degree to which an organization may remain out of compliance shall be based on the reasonable judgment of the ARIN staff and shall balance all facts known, including the organization's utilization rate, available address pool, and other factors as appropriate so as to avoid forcing returns which will result in near-term additional requests or unnecessary route de-aggregation.

ARIN Resource Review

To the extent possible, entire blocks should be returned. Partial address blocks shall be returned in such a way that the portion retained will comprise a single aggregate block.

If the organization does not voluntarily return resources as requested, ARIN may revoke any resources issued by ARIN as required to bring the organization into overall compliance. ARIN shall follow the same guidelines for revocation that are required for voluntary return in the previous paragraph.

Except in cases of fraud, or violations of policy, an organization shall be given a minimum of six months to effect a return. ARIN shall negotiate a longer term with the organization if ARIN believes the organization is working in good faith to substantially restore compliance and has a valid need for additional time to renumber out of the affected blocks.

In case of a return under paragraphs 12.4 through 12.6, ARIN shall continue to provide services for the resource(s) while their return or revocation is pending, except any maintenance fees assessed during that period shall be calculated as if the return or revocation was complete.

This policy does not create any additional authority for ARIN to revoke legacy address space. However, the utilization of legacy resources shall be considered during a review to assess overall compliance.

In considering compliance with policies which allow a timeframe (such as a requirement to assign some number of prefixes within 5 years), failure to comply cannot be measured until after the timeframe specified in the applicable policy has elapsed. Blocks subject to such a policy shall be assumed in compliance with that policy until such time as the specified time since issuance has elapsed.

ARIN Annual Renewal

4.2. Allocations to ISPs (Requirements for Requesting Initial Address Space)

4.2.1.2. Annual Renewal

An annual fee for registered space is due by the anniversary date of the ISP's first allocation from ARIN. ISPs should take care to ensure that their annual renewal payment is made by their anniversary due date in accordance with the Registration Services Agreement. **If not paid by the anniversary date, the address space may be revoked**. Please review the Annual Renewal/Maintenance Fees Page for more details.