



IPv6 - Successor to IPv4 Confronting Transition

Leo Vegoda

IANA

Agenda (1)

- Addressing history
- Define the problem
- IPv6 deployment milestones
- Statistics
- Allocations being returned
- Dispelling some myths

One World
One Internet



Key dates in IPv4 history

How did we get here?

Significant dates in IPv4



- 1980 - the start
- 1981 - Classes introduced
- 1993 - CIDR introduced
- 1997 - ARIN formed
- 2005 - 1st Global Policy
- 2009 - 2nd Global Policy
- 2011 - Fully Allocated

One World
One Internet

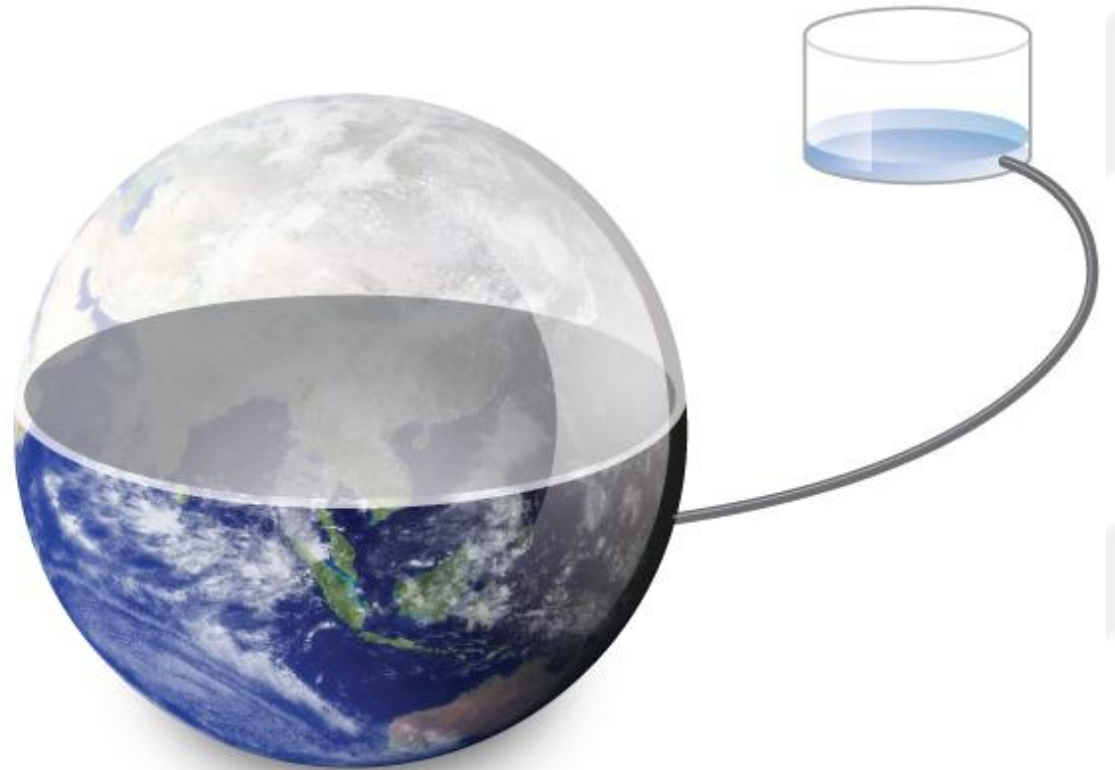


Identify the problem

*7 billion does not go into
4 billion*

State of the IPv4 pool

**7 billion people need
more than 4 billion
addresses**



State of the IPv4 pool

The IPv4 pool is now fully allocated – at least at the top level

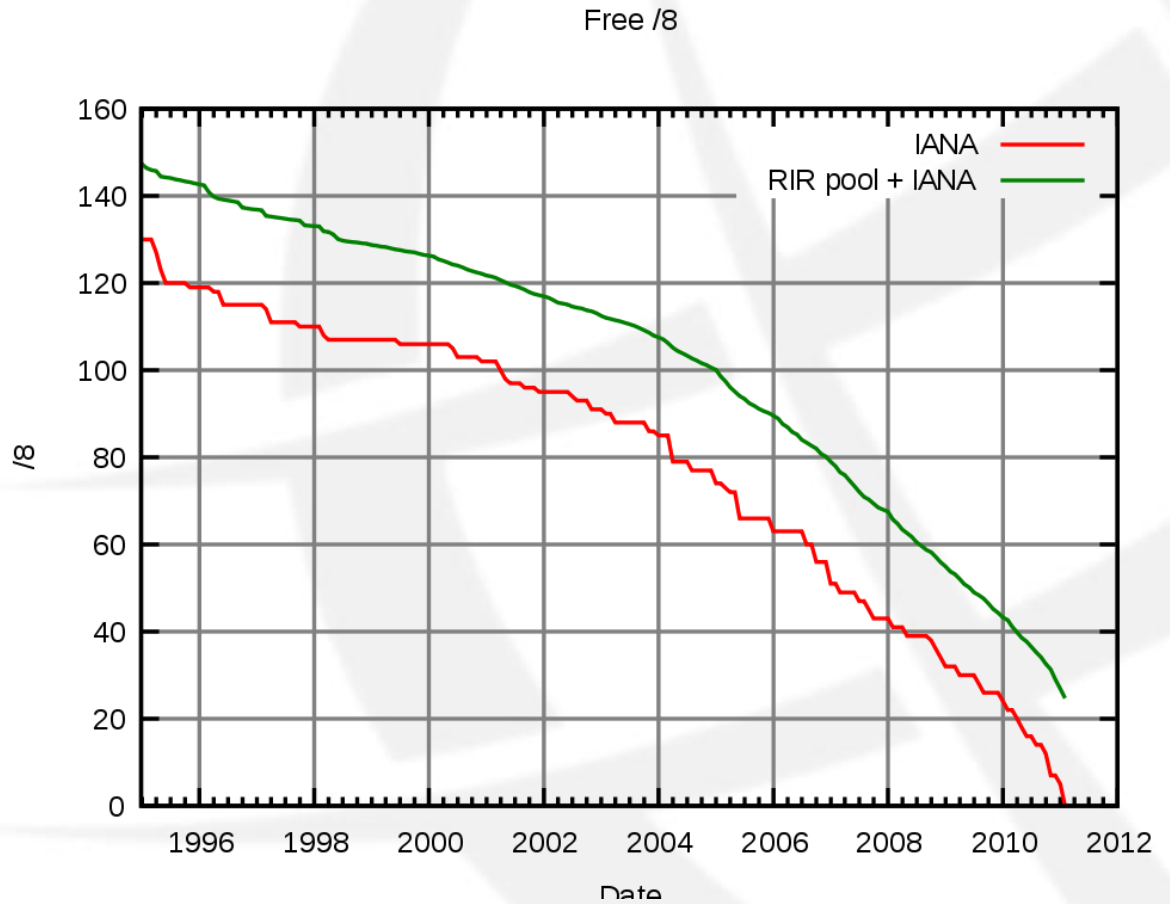


Photo by Silverstealth

Didn't it go fast!

One World

One Internet



Source: [Mro](#)

One World
One Internet



IPv6 deployment milestones

Building momentum

Significant dates in IPv6

- 1996 - Protocol finalised
- 1999 - 1st allocations
- 2006 - 1st Global Policy
 - All RIRs receive /12s

One World

One Internet

Infrastructure deployment (1)



- IPv6 addresses have been included in the root DNS zone since 2004
- Root DNS servers have been reachable over IPv6 since 2008
- 221 TLDs have at least 1 IPv6 nameserver (Feb 2011)

Infrastructure deployment (2)



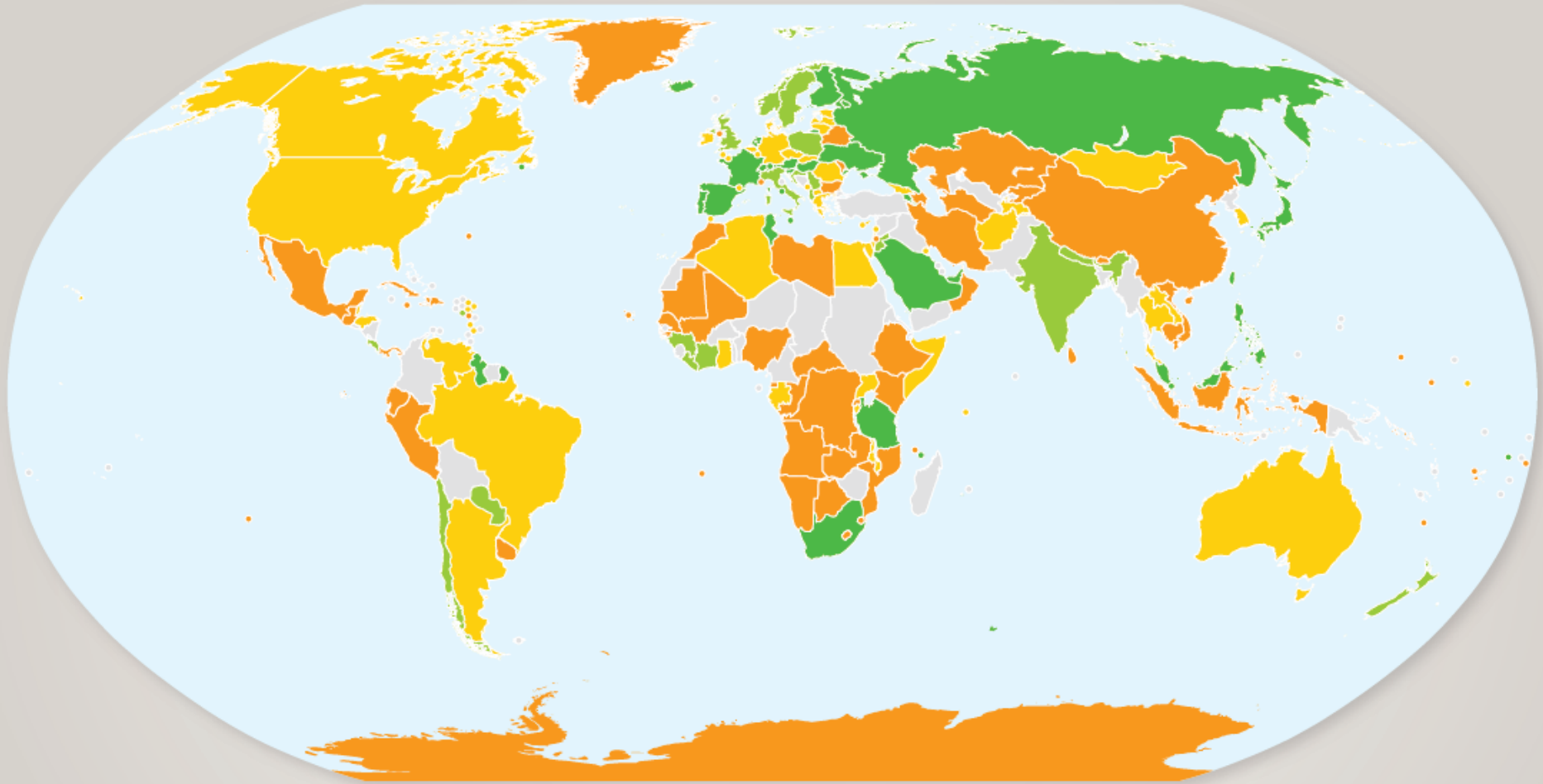
- 146 TLDs have more than 1 IPv6 nameserver (Feb 2011)
- 10 of the 11 settlement-free peering (Tier 1) networks offer IPv6 connectivity
- 26% of IXPs have an IPv6 peering LAN

One World
One Internet



Key IPv6 deployment measurements

DNS, allocation & deployment

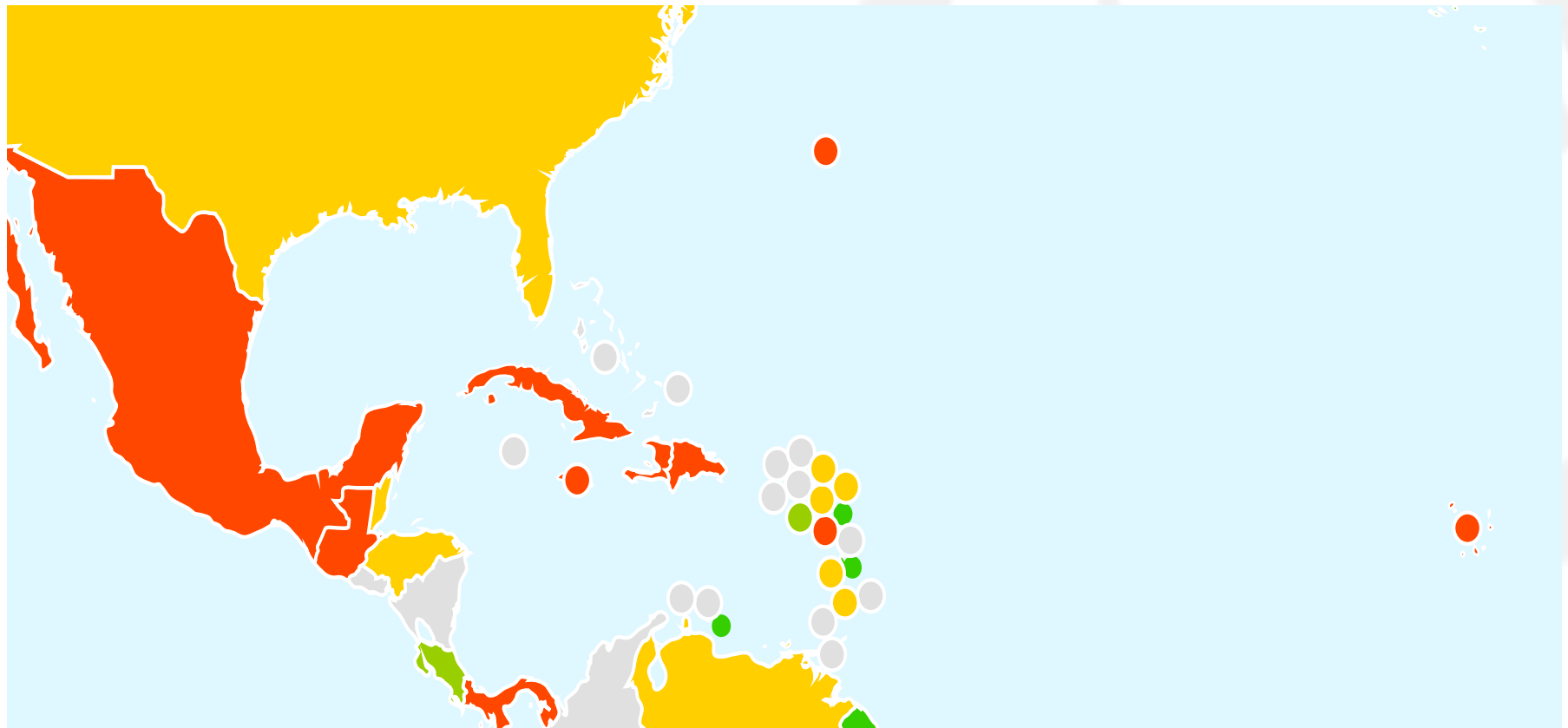


None 1 2 3 4+

ccTLD diversity by origin AS of IPv6 nameservers

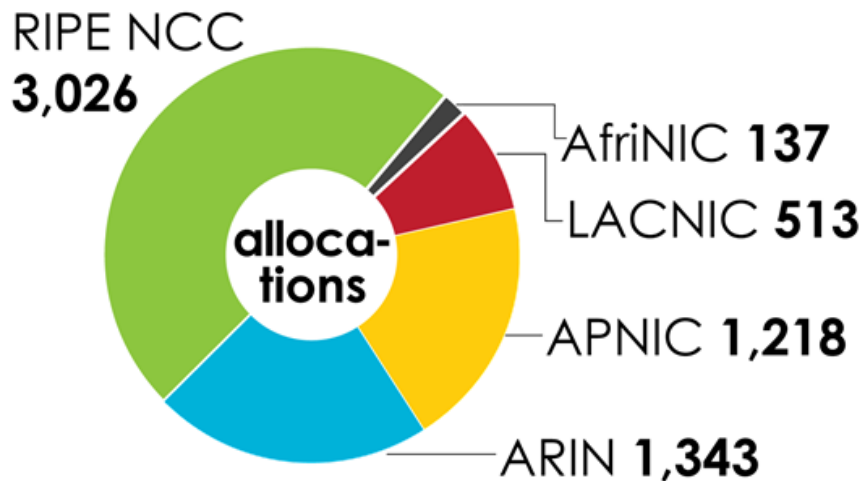
As at 8 June 2011

Regional IPv6 Diversity in ccTLDs

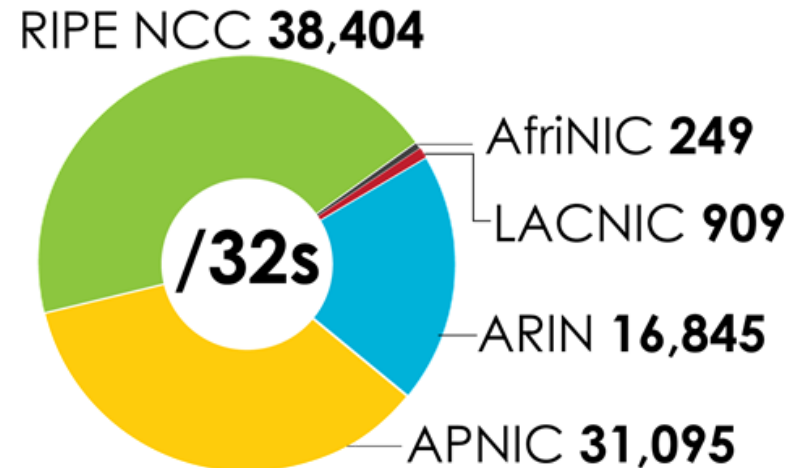


Allocated IPv6 space (2)

How many total allocations have been made by each RIR?



In terms of /32s, how much total space has each RIR allocated?



Source: NRO

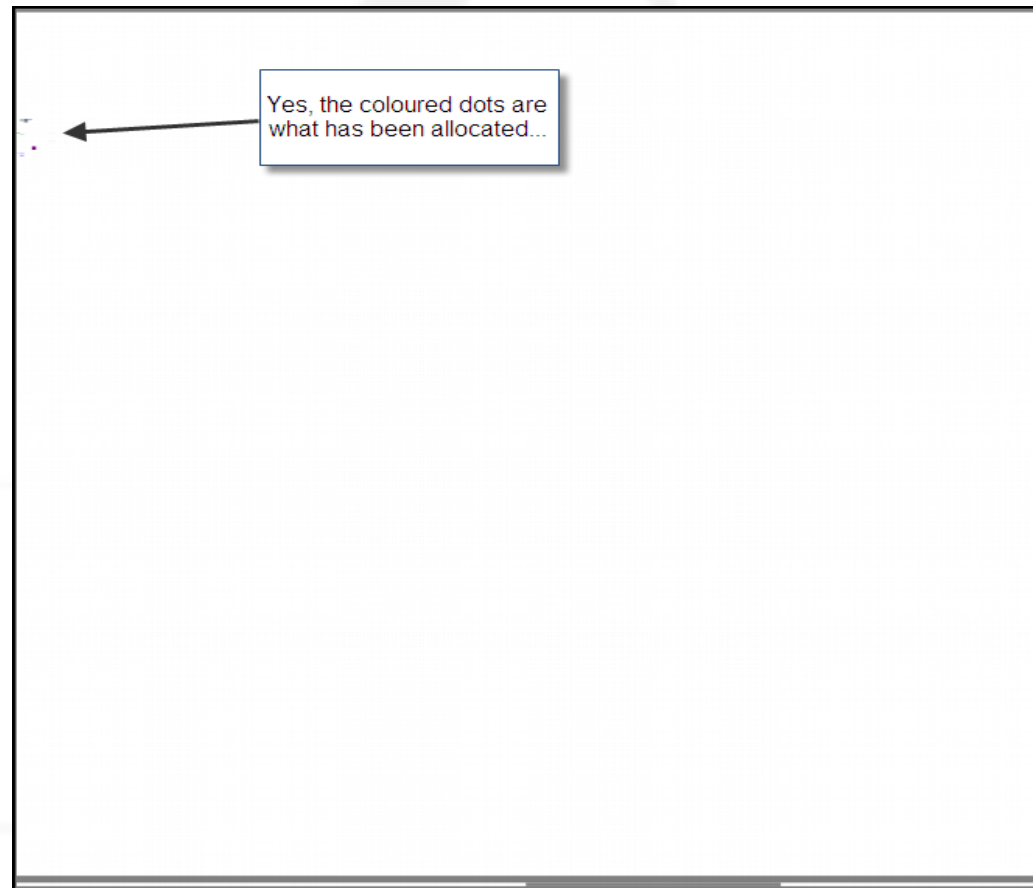
Seen another way

The coloured dots are the address space the RIRs have allocated to ISPs

The grey stripes are address space used for multicast and loopback

The white space is unallocated addresses

Source:
v6stuff.leclanche.net

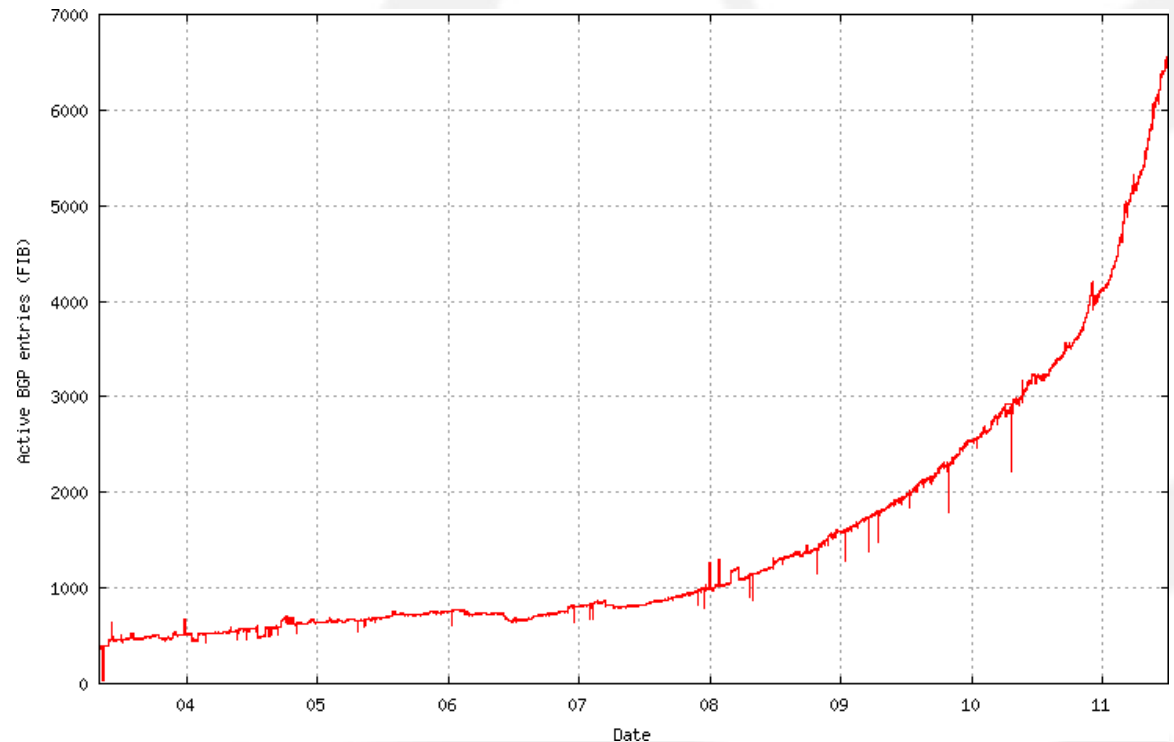


What is routed?

There are about
6,500 IPv6 routes
and 364,000 IPv4
routes

This means almost
all space is routed
and there is almost
no deaggregation,
which is good

Source:
Geoff Huston



Seen another way

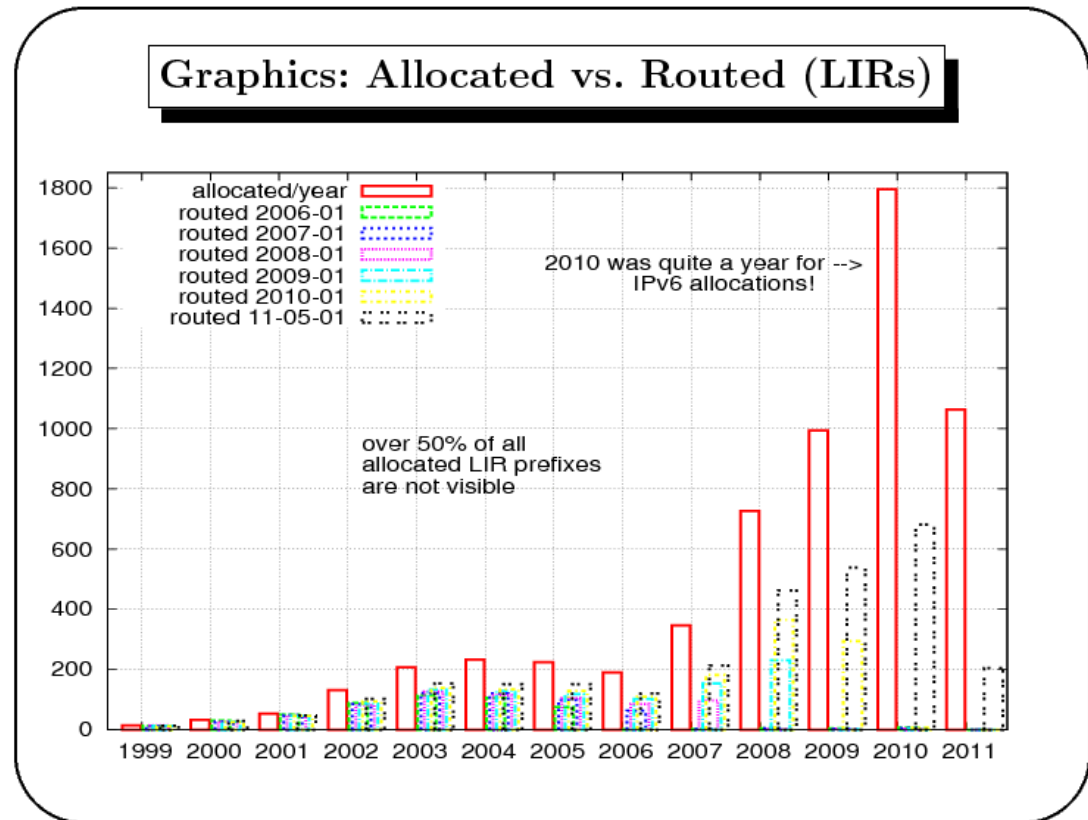
IPv6 allocations grew dramatically in 2010 and operational reality needs to catch up

Source:
Gert Doering

IPv6 routing table

More Numbers

27



Looking by region

Almost half of ARIN region ISP IPv6 allocations are routed and slightly more than half RIPE NCC region IPv6 allocations are routed

Source:
Gert Doering

IPv6 routing table

More Numbers

28

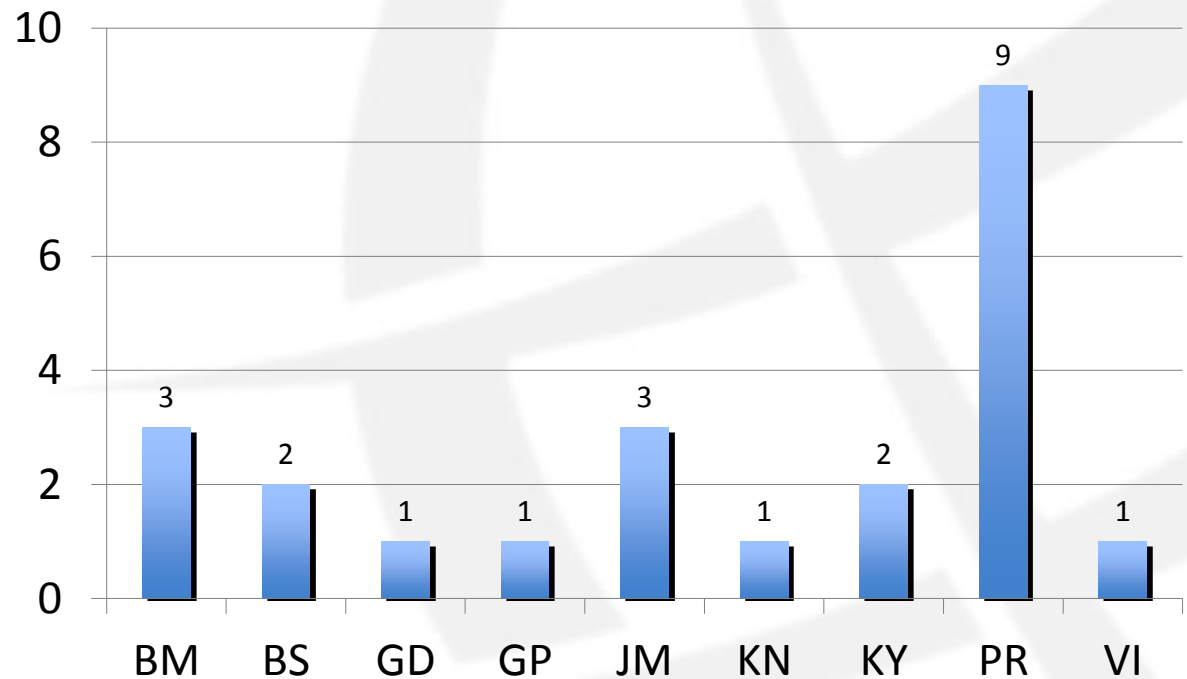
Allocated vs. Routed - by region & class

RIR	type	alloc.	visible	%	subnets	
ARIN	LIR	1365	596	44%	631	
	IXP	31	1	3%	0	
	Critical Inf.	127	53	42%	118	
	PI	638	178	28%	113	(*)
APNIC	LIR	1300	470	36%	585	
	IXP	20	3	15%	0	
	PI	298	65	22%	31	(*)
RIPE	LIR	3071	1681	55%	353	
	IXP	97	27	28%	2	
	Anycast DNS	29	20	69%	0	
	PI	394	241	61%	18	
LACNIC	LIR	146	45	31%	147	(NIR)
	Crit.Inf.+PI	74	28	38%	16	
AfriNIC	LIR	131	36	28%	29	
	PI	38	5	13%	0	

Looking more locally

Only 9 of the 22 Caribbean and North Atlantic island countries and territories served by ARIN have IPv6 allocations

IPv6 Allocations

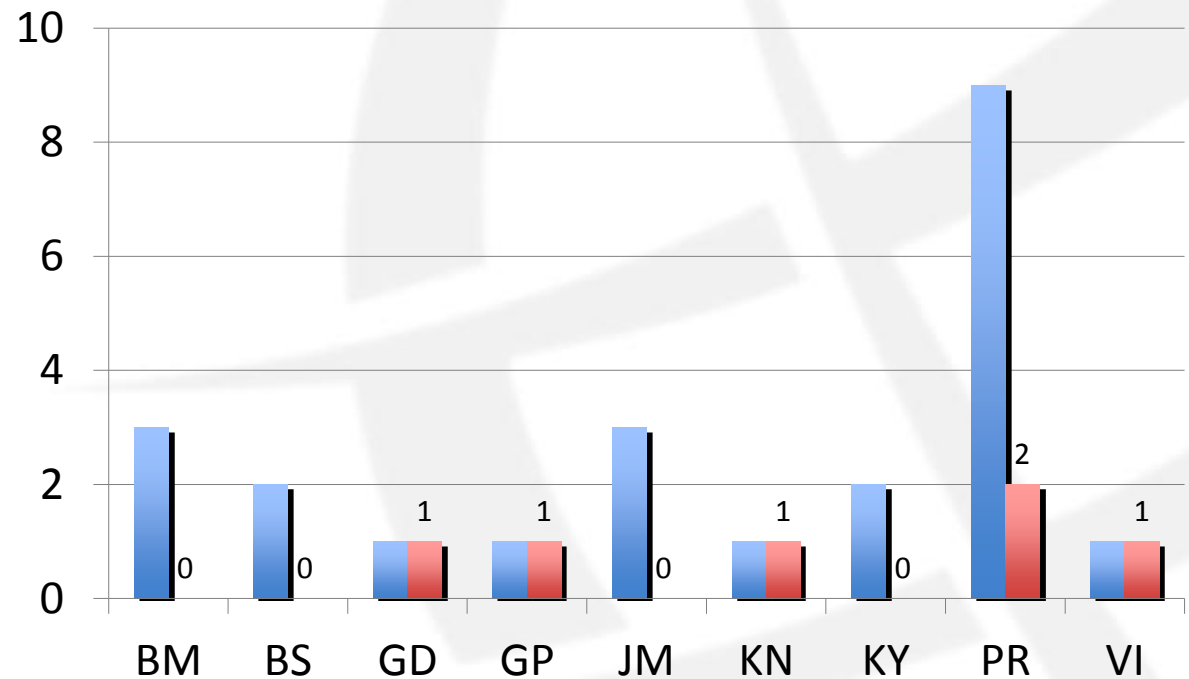


Source: ARIN

Looking more locally - routing

Of the 22 IPv6 allocations to Caribbean and North Atlantic island countries and territories, just 6 are routed

Routed IPv6 Allocations



Source: RIPE NCC RIS Project

Major returns to the IPv4 pool

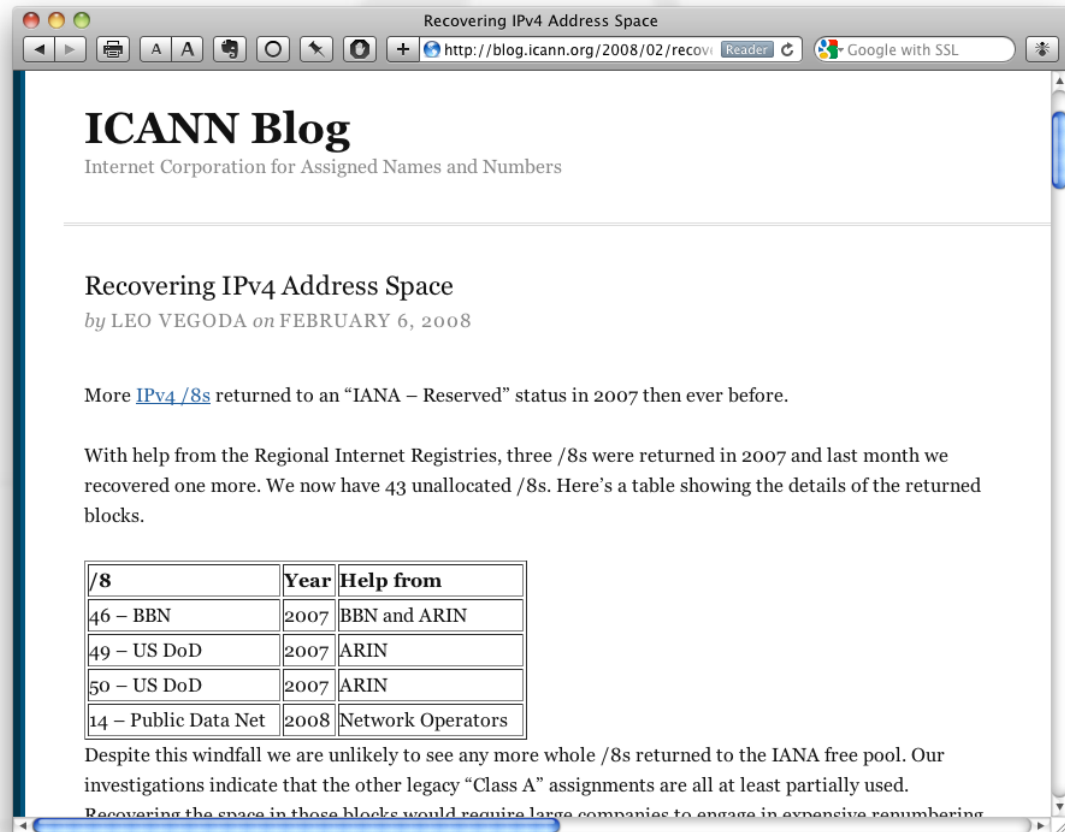
One World
One Internet



Major returns to the IPv4 pool

3 /8s were returned to IANA in the last few years and another was actively reclaimed by us

Recently, Interop returned over 99% of a /8 to ARIN



The screenshot shows a web browser window displaying an ICANN blog post. The browser's address bar shows the URL <http://blog.icann.org/2008/02/recovering-ipv4-address-space>. The page title is "Recovering IPv4 Address Space" and the author is "LEO VEGODA on FEBRUARY 6, 2008". The post content includes a table of returned IPv4 blocks and a concluding paragraph.

ICANN Blog
Internet Corporation for Assigned Names and Numbers

Recovering IPv4 Address Space

by LEO VEGODA on FEBRUARY 6, 2008

More [IPv4 /8s](#) returned to an "IANA – Reserved" status in 2007 than ever before.

With help from the Regional Internet Registries, three /8s were returned in 2007 and last month we recovered one more. We now have 43 unallocated /8s. Here's a table showing the details of the returned blocks.

/8	Year	Help from
46 – BBN	2007	BBN and ARIN
49 – US DoD	2007	ARIN
50 – US DoD	2007	ARIN
14 – Public Data Net	2008	Network Operators

Despite this windfall we are unlikely to see any more whole /8s returned to the IANA free pool. Our investigations indicate that the other legacy "Class A" assignments are all at least partially used. Recovering the space in those blocks would require large companies to engage in expensive renumbering

One World
One Internet



IPv6 implementation costs

Build it into regular technology refresh cycles

Looking at transition costs



Medium sized companies can be too big for packaged services but not large enough to support a department to manage the network

Small companies can buy packaged services & rely on the supplier to make IPv6 happen

Big companies have network management departments, regular technology refresh cycles and testing labs. IPv6 is just another feature & won't cost extra

Subscriber CPEs

Few routers and modems used by broadband customers support IPv6 yet and some will need to be replaced when IPv6 is provided

In some cases, the ISP will cover the cost if the subscriber renews for 18 months or more

The RIPE NCC tracks equipment that supports IPv6

IPv6 CPE Survey - Updated (January 2011) — RIPE Labs

Site Map | Contact

RIPE NCC RIPE NETWORK COORDINATION CENTRE

Site Search

RIPE Labs Log In Register

Home • Users • Data Repository • RIPE Database • Atlas • RIPEstat • About

You are here: Home > Users > mirjam > IPv6 CPE Survey - Updated (January 2011)

IPv6 CPE Survey - Updated (January 2011)

— filed under: CPE, ipv6

Mirjam Kühne — 24 January 2011 15:00
Contributors: Marco Hogewoning

Based on new information we received since the last publication, we updated the IPv6 CPE matrix below. Please also note a call for help. We are preparing a detailed survey to gather more user feedback and would like you participate in this survey.

Note: The latest version of the IPv6 CPE survey and matrix can always be found here: IPv6 CPE Surveys.

Your input is needed

<http://labs.ripe.net/Members/mirjam/ipv6-cpe-survey-updated-january-2011/>

IPv6 Measurements - A Compilation (Part2...)

LIR Locator Tool

IPv6 Monitor - An Interview with Alain D...

IPv6 Measurements - A Compilation

Fighting Spam on RIPE Labs

One World

One Internet

Dispelling some myths

Security



- While IPSEC is a part of the IPv6 protocol standard it is not supported in all implementations
- Key Exchange remains a hard problem and most IPv6 traffic is not secured with IPSEC

Renumbering



- Auto-configuration can be useful but won't make renumbering much easier than in IPv4
- Renumbering still requires lots of manual edits to configurations where IP addresses are used
- IETF RENUM WG

Bigger



- IPv6 is massively bigger than IPv4
- There is plenty of IPv6 space left for new networks connecting from developing countries over the next 100+ years

One World

One Internet

References

References



- ARIN
 - [Policy](#)
 - [Fees](#)
 - [Statistics](#)
- NRO
 - [Policy comparison matrix](#)
 - [Statitics](#)

References



- [NSRC](#)
- RIPE NCC
 - [Labs](#)
 - [RIS](#)
- [Gert Doering](#)
- [Guillaume Leclanche](#)
- [Geoff Huston](#)



Thank You

One World

One Internet

Questions