IPv6 – Successor to IPv4 Confronting Transition

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IANA

Agenda (1)

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

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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

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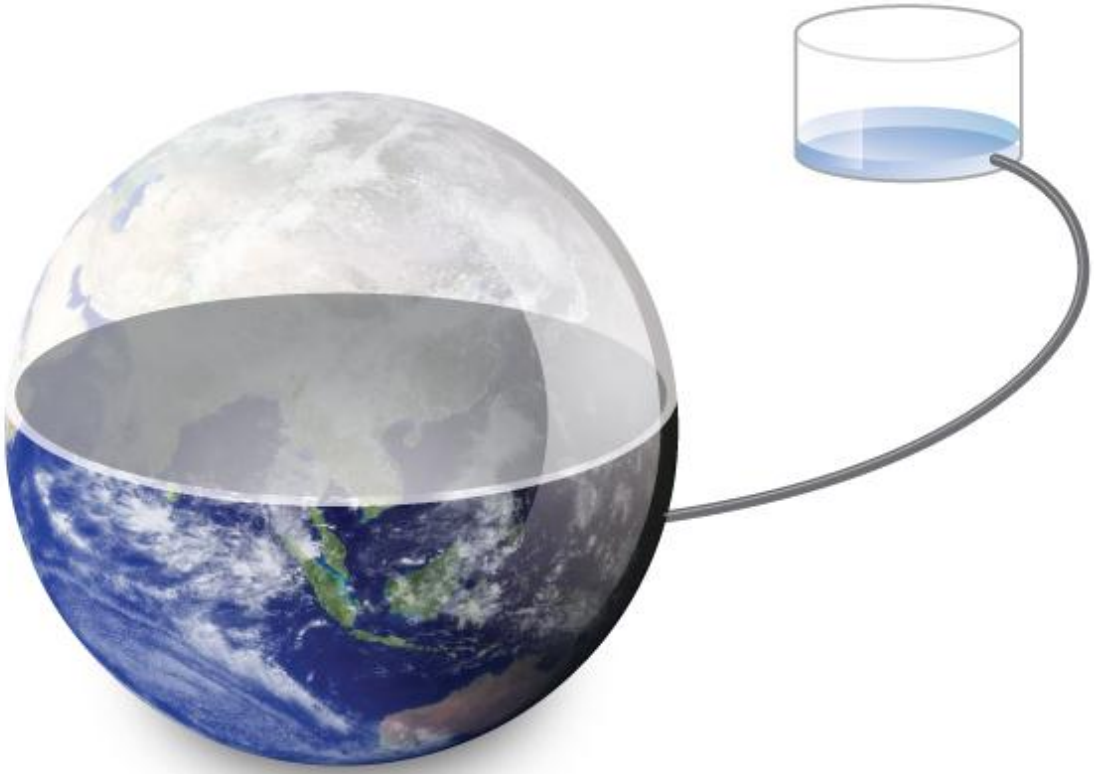
Identify the problem

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!

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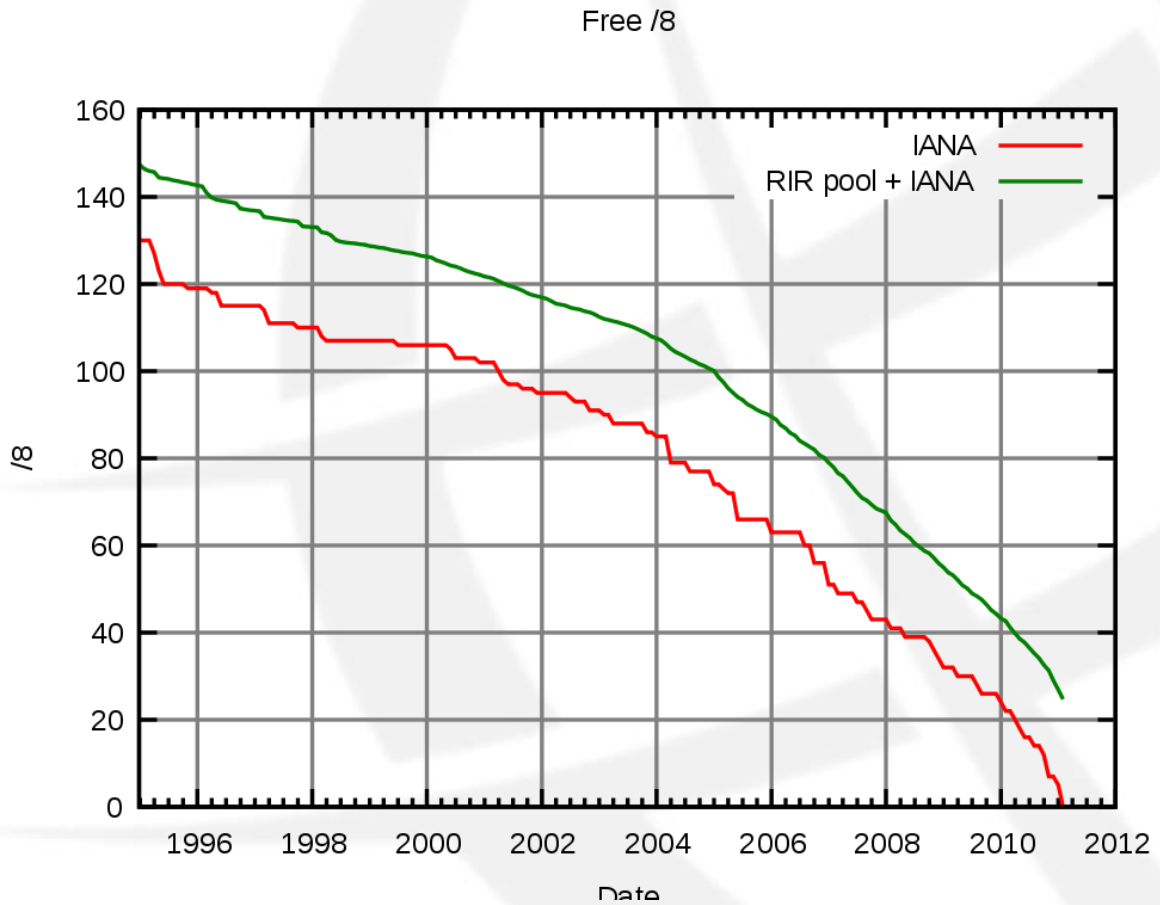

Source: Mro

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IPv6 deployment milestones

Building momentum

Significant dates in IPv6

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

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

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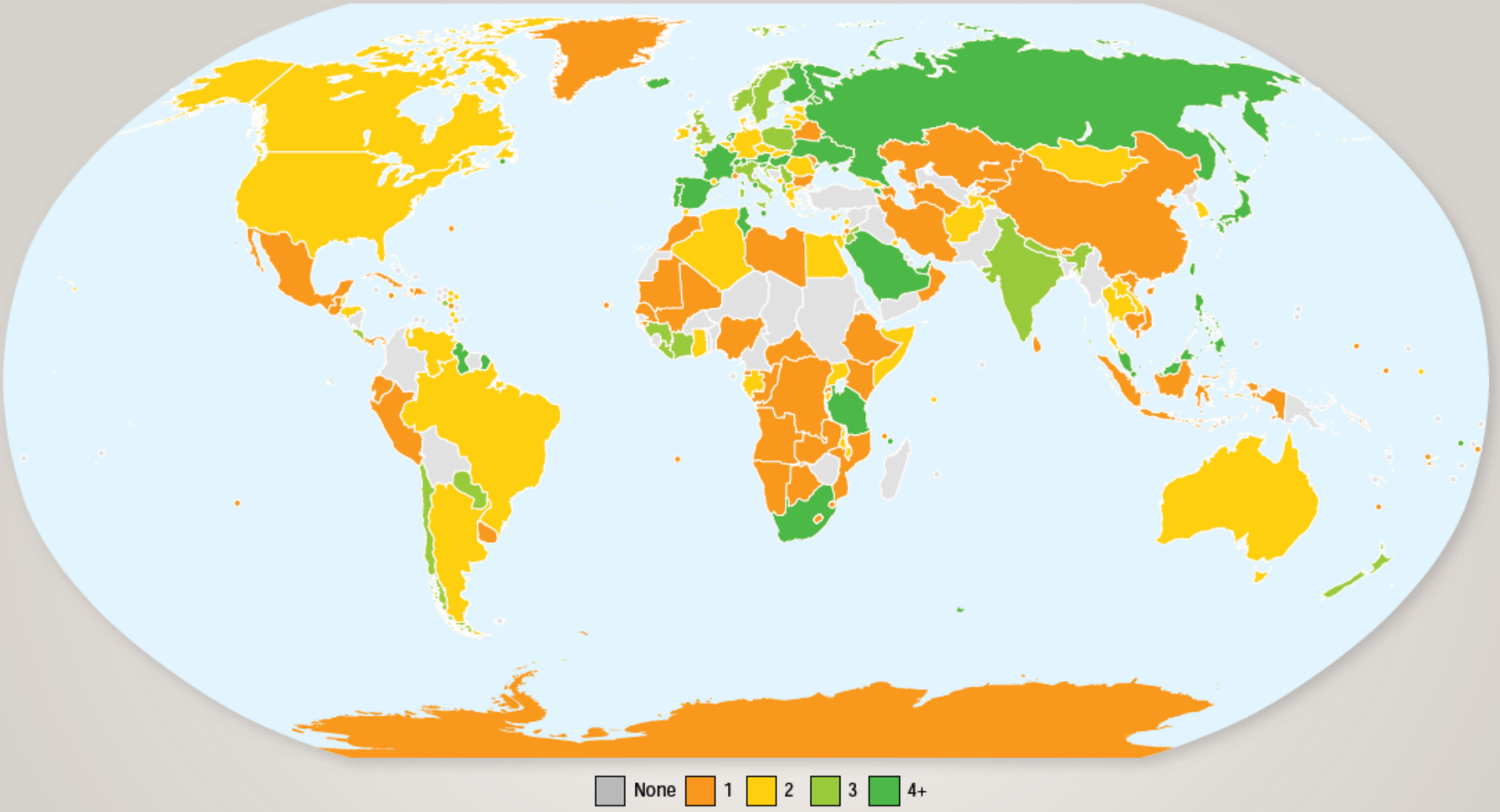
Key IPv6 deployment measurements

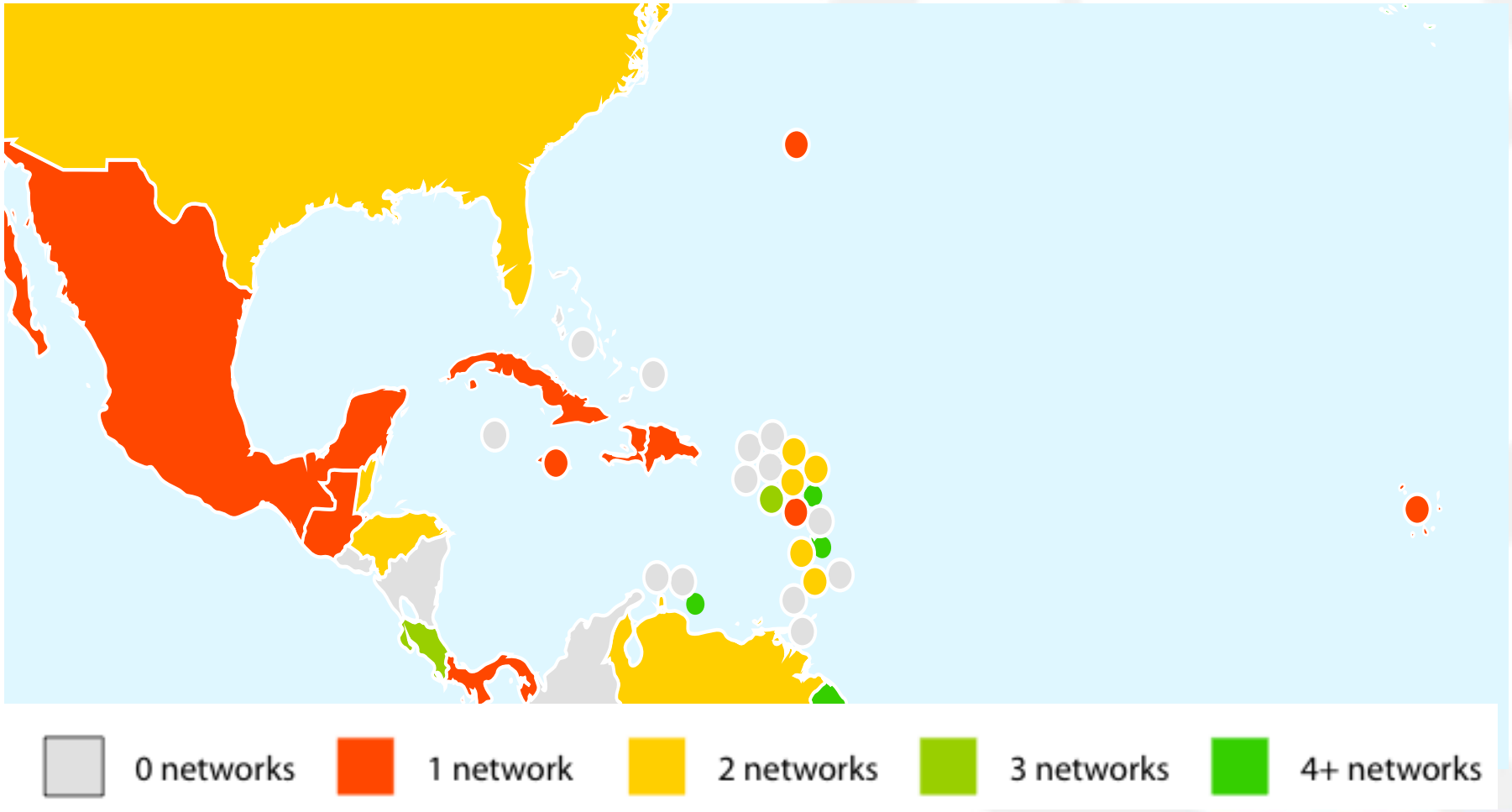
DNS, allocation & deployment



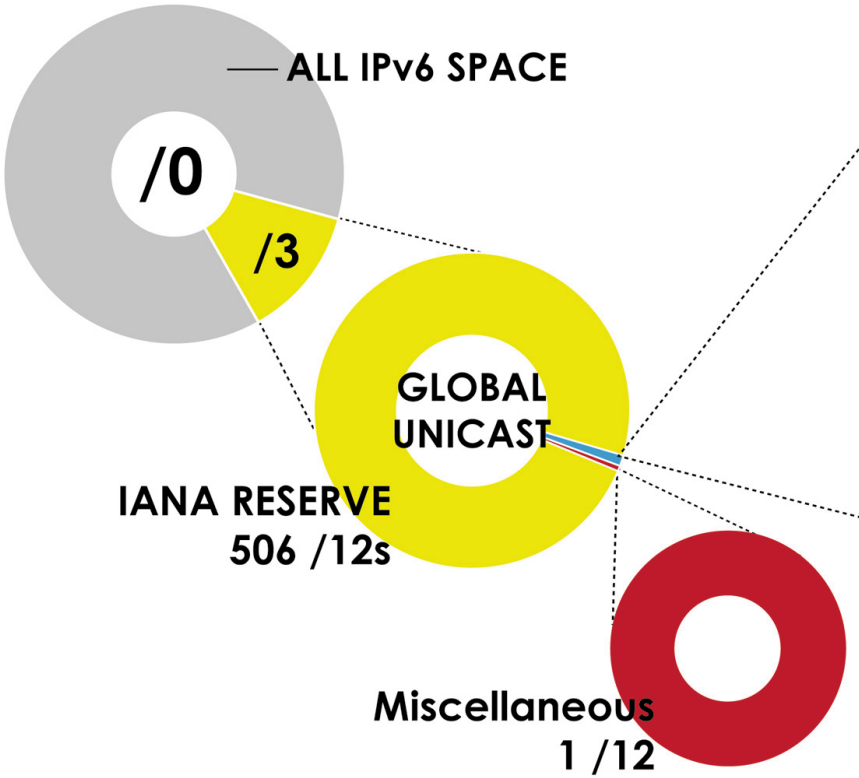
ccTLD diversity by origin AS of IPv6 nameservers

As at 8 June 2011

Regional IPv6 Diversity in ccTLDs



Allocated IPv6 space (1)



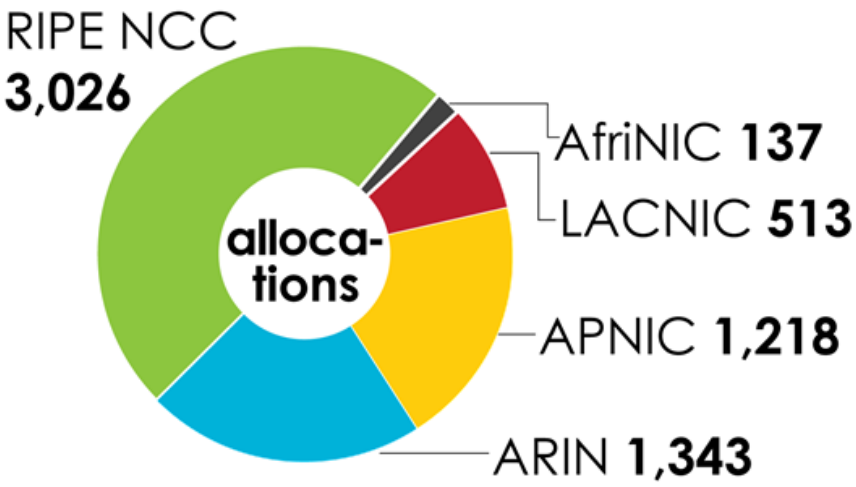
RIRs 5 /12s (October 2006)

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

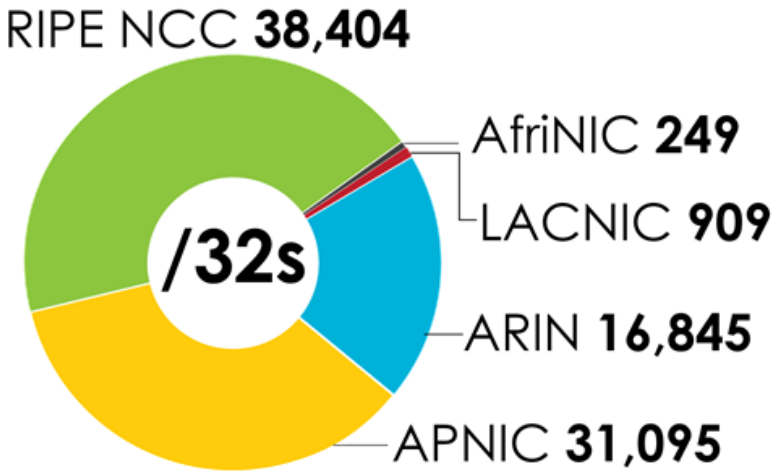
Number Resource Organi

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

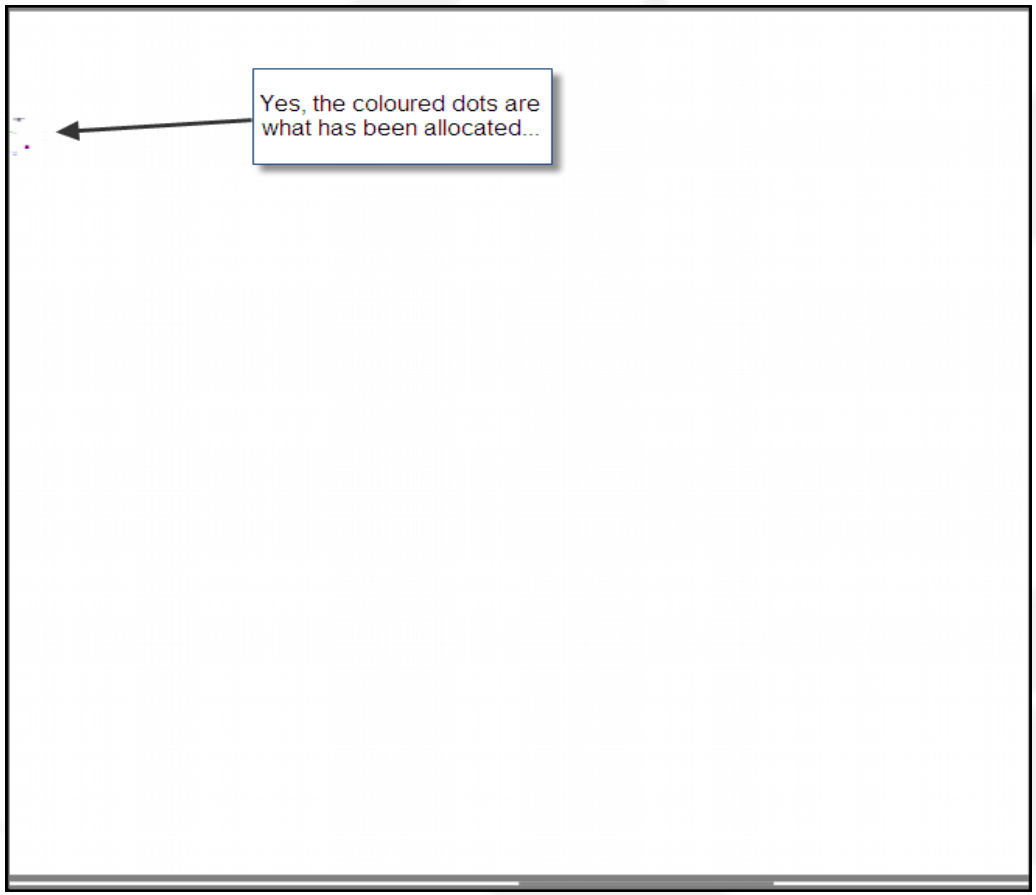
Seen another way

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

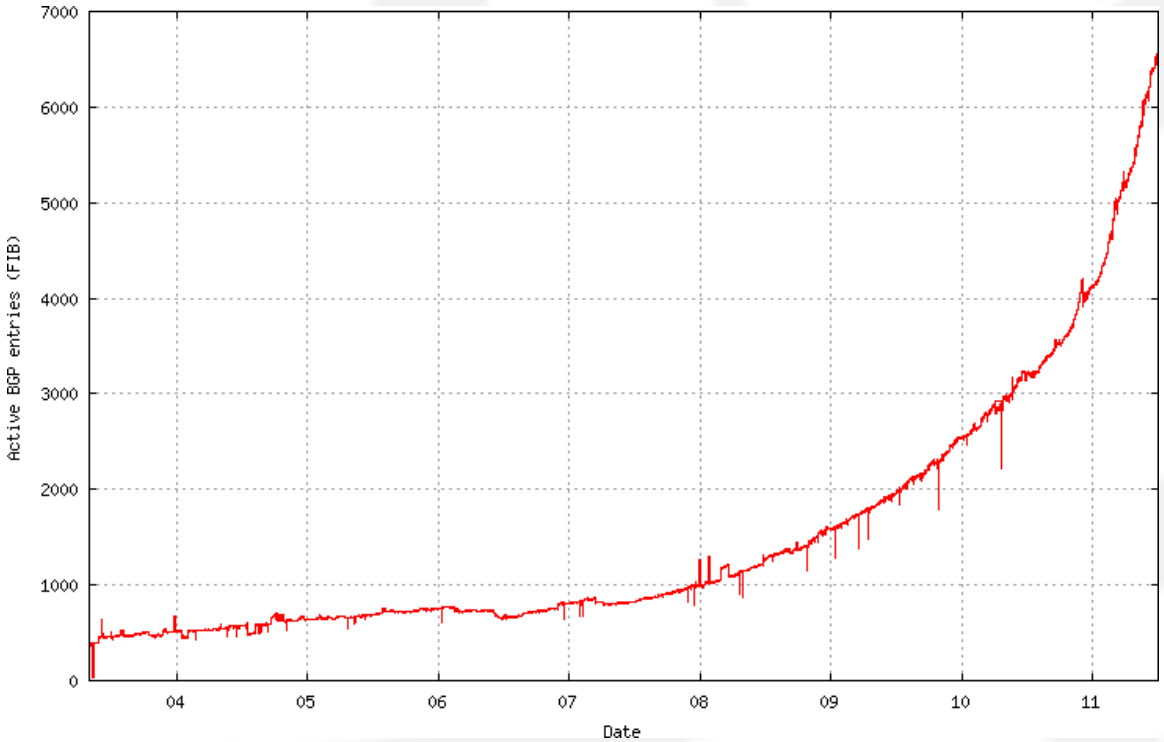


What is routed?

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

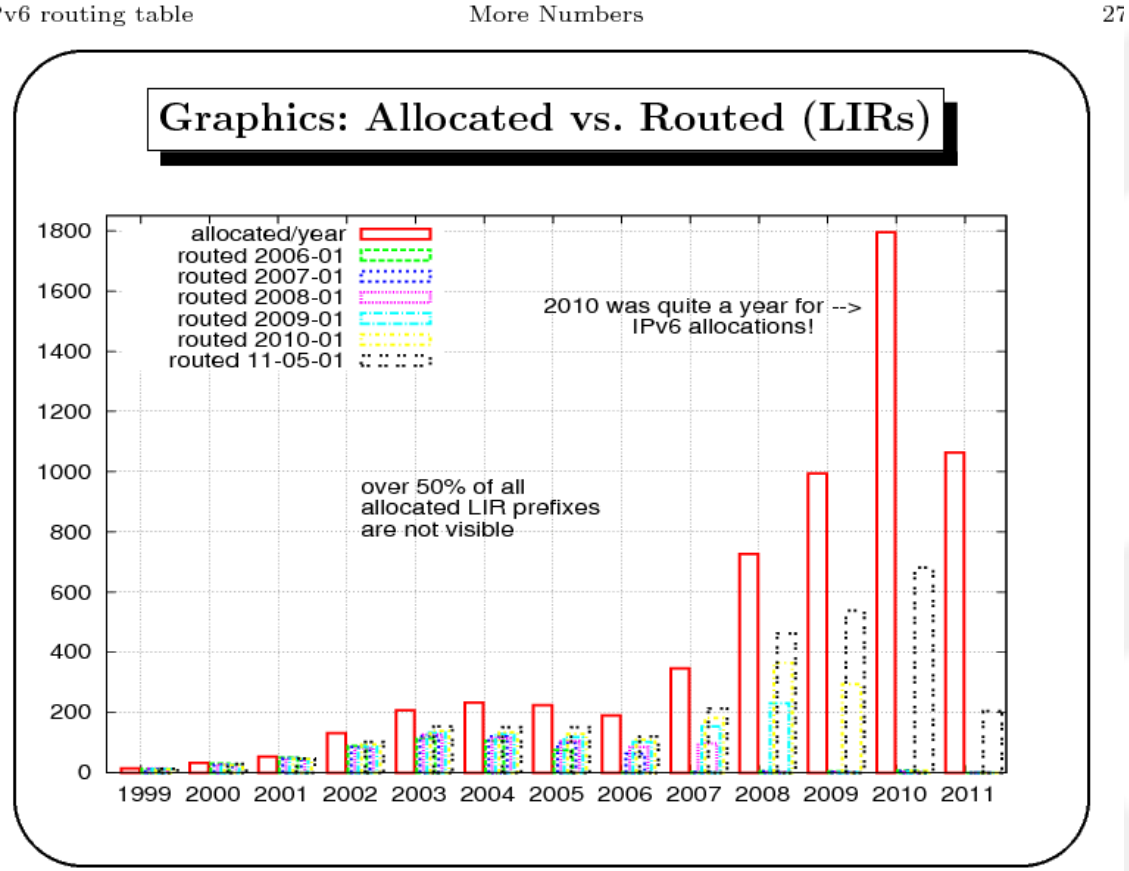
This means almost all space is routed and there is almost no deaggregation, which is good

Source:
Geoff Huston



Seen another way

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



Source:

Gert Doering

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

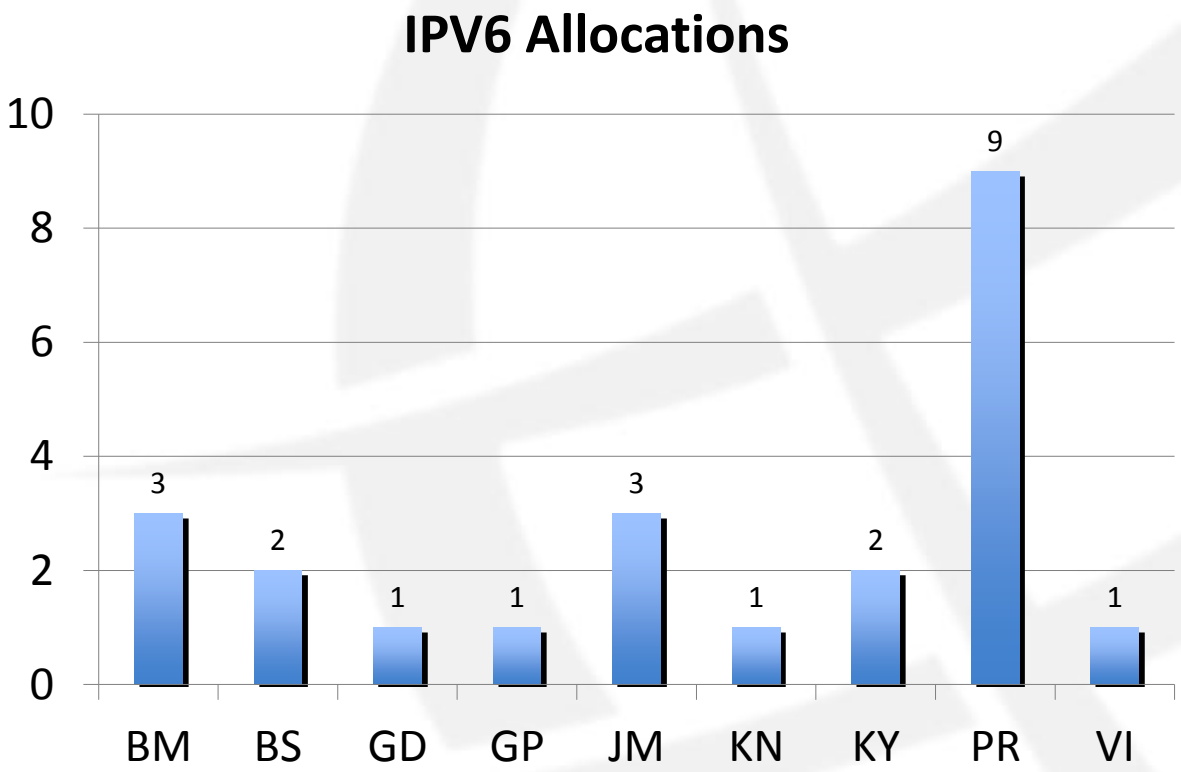
Source:
Gert Doering

Allocated vs. Routed - by region & class

RIR	type	alloc.	visible		subnets	
ARIN	LIR	1365	596	44%	631	
	IXP	31		3%	0	
	Critical Inf.	127	5	42%	118	
	PI	638	178	28%	113	(*)
APNIC	LIR	1300	470		585	
	IXP	20	3	15%	0	
	PI	298	65		31	(*)
RIPE	LIR	3071	1681	55%	353	
	IXP	97	2	28%	2	
	Anycast DNS	29	2	69%	0	
	PI	394	241	61%	18	
LACNIC	LIR	146	45		147	(NIR)
	Crit.Inf.+PI	74	77	38%	16	
AfriNIC	LIR	131	36	28%	29	
	PI	38	5	13%	0	

Looking more locally

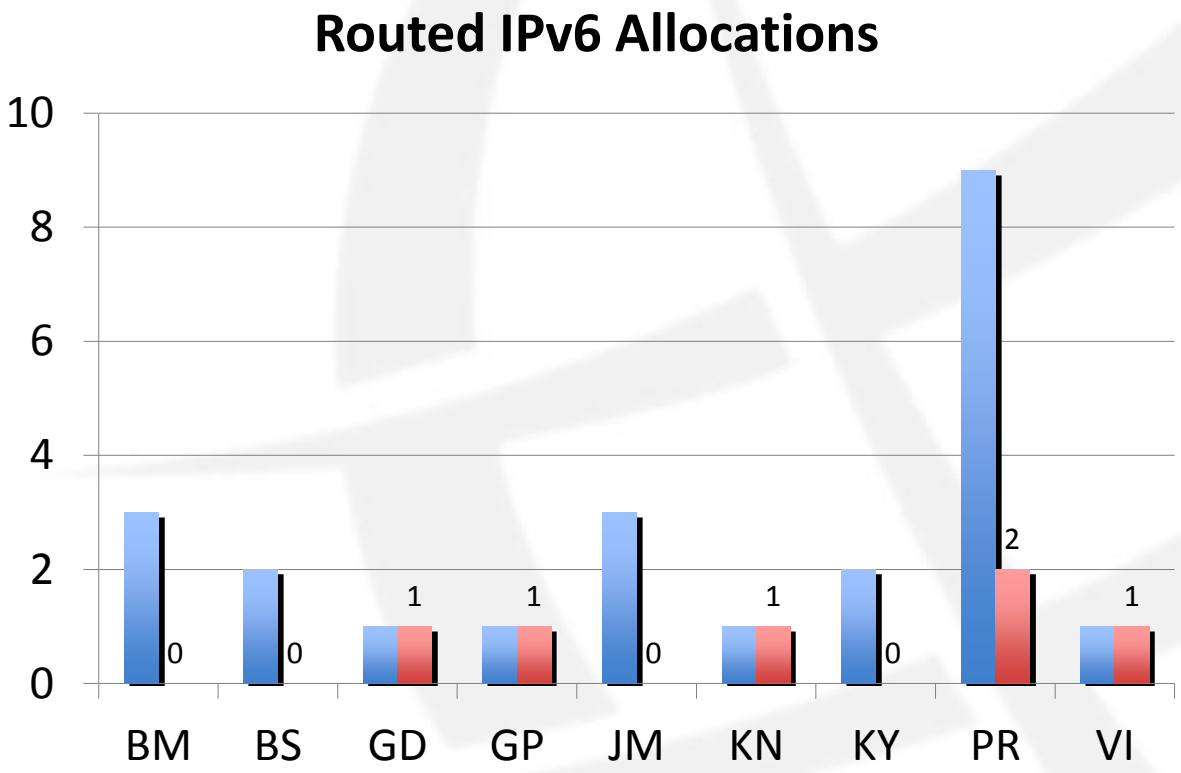
Only 9 of the 22 Caribbean and North Atlantic island countries and territories served by ARIN have IPv6 allocations



Source: ARIN

Looking more locally - routing

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



Source: RIPE NCC RIS Project

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Major returns to the IPv4 pool

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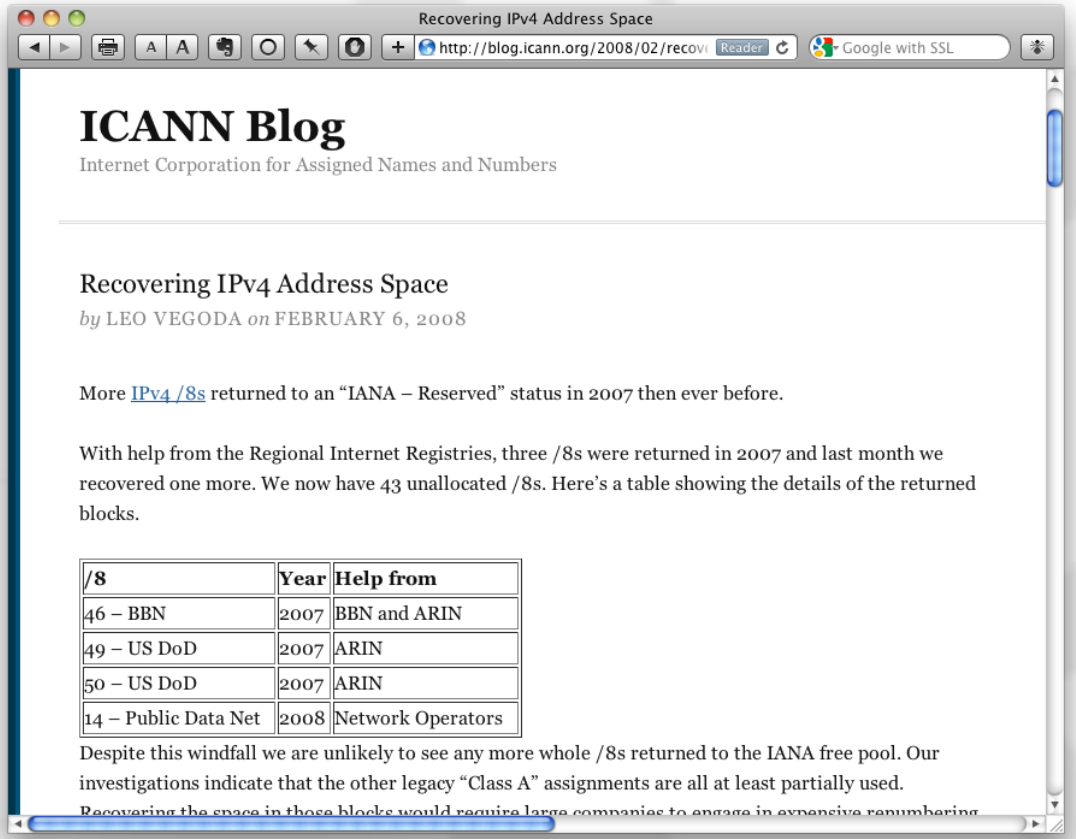
3 /8s were returned to IANA in the last few years and another was actively reclaimed by us

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



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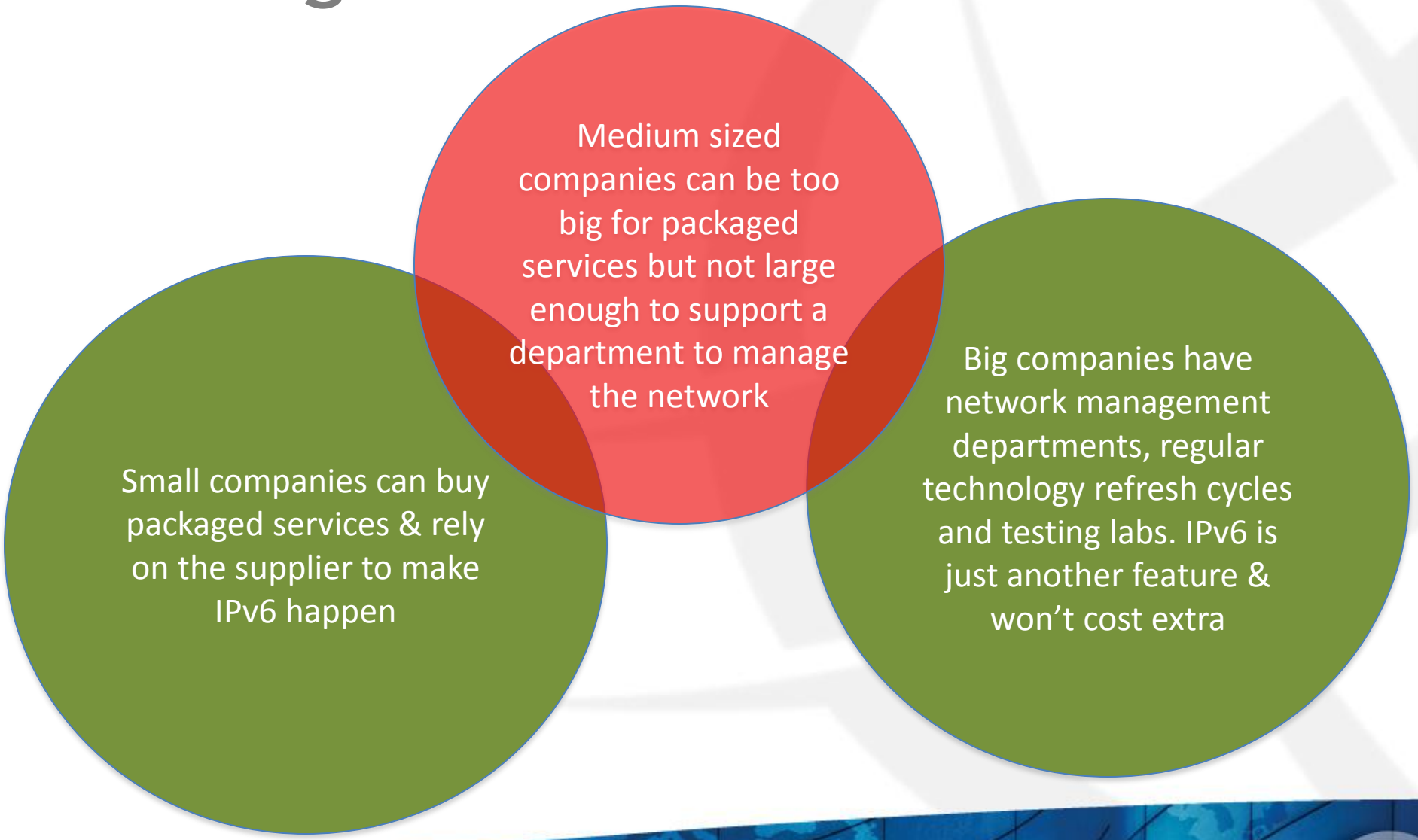
IPv6 implementation costs

Build it into regular technology refresh cycles

Looking at transition costs



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

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

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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

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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

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Questions