Doom, gloom & IP addresses

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From experiment to core infrastructure

IANA begins allocating IPv4 addresses in early 1980

IPv4: spreads like a pandemic

1985

Primarily Academic and Research Networks using IPv4.

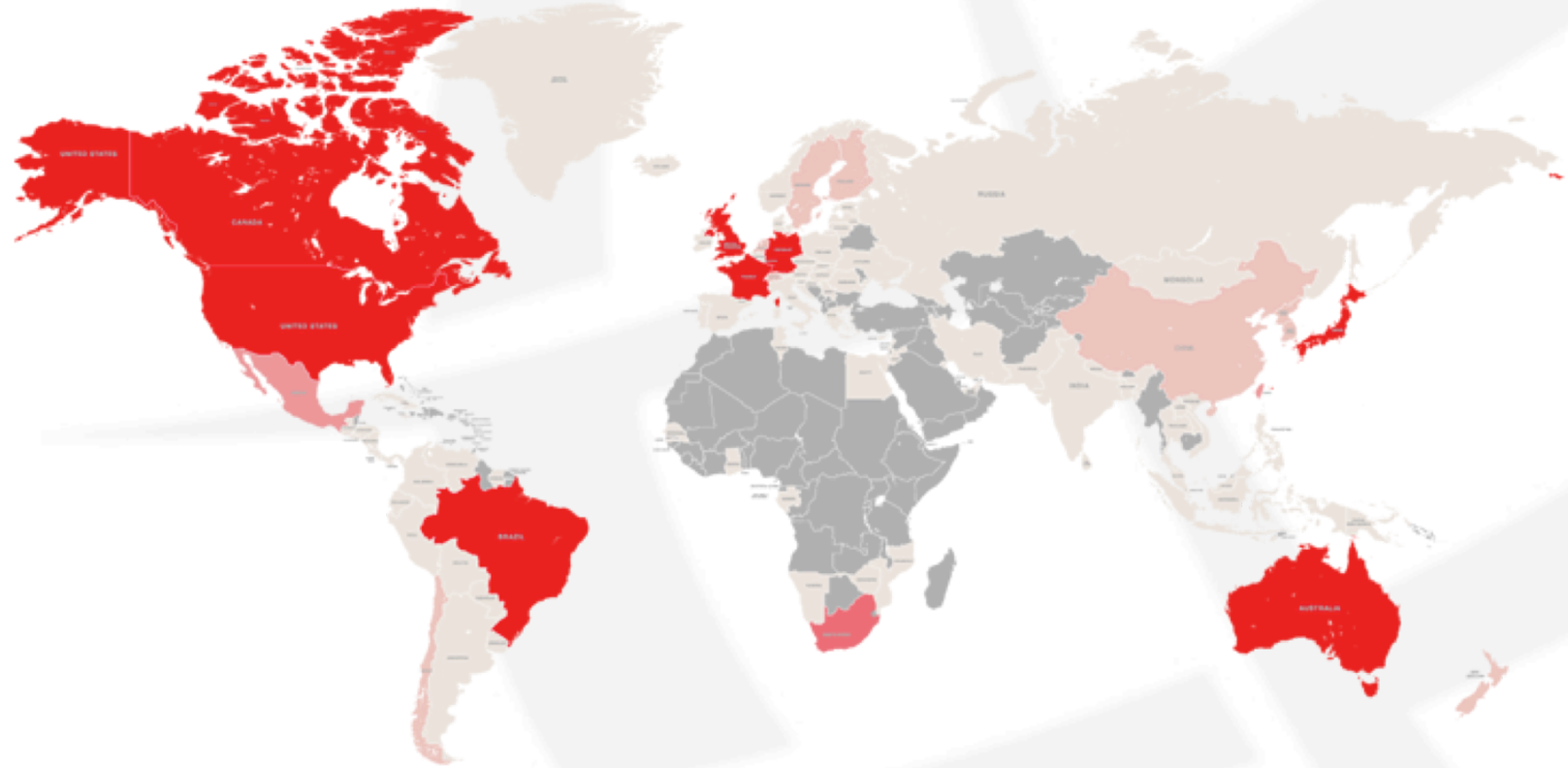
Data source: AfriNIC, APNIC, ARIN, LACNIC, RIPE NCC

IPv4: spreads like a pandemic

1995

As time progressed, Internet Service Providers building IPv4 networks and offering email and other Internet services.

RFC 1466, in 1993, proposes geographic allocation of address blocks to RIRs. Classless Inter-Domain routing introduced in 1993.



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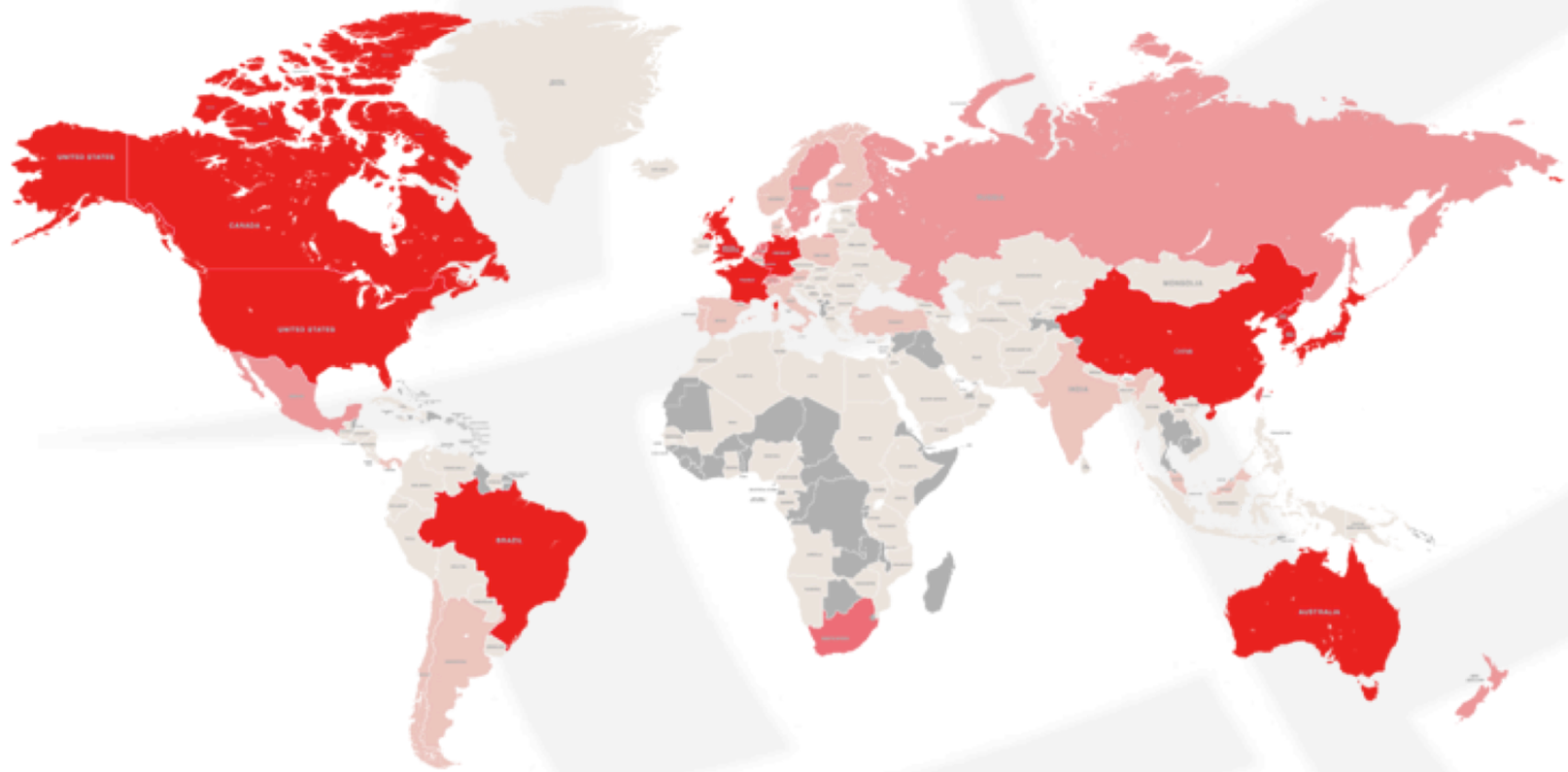
IPv4: spreads like a pandemic

2000

Mainstream telecommunications providers and cable companies offering broadband services using IPv4.

ICANN founded in 1998 to oversee Internet Assigned Numbers Authority.

RFC 2460 for IPv6 standardized in 1998.



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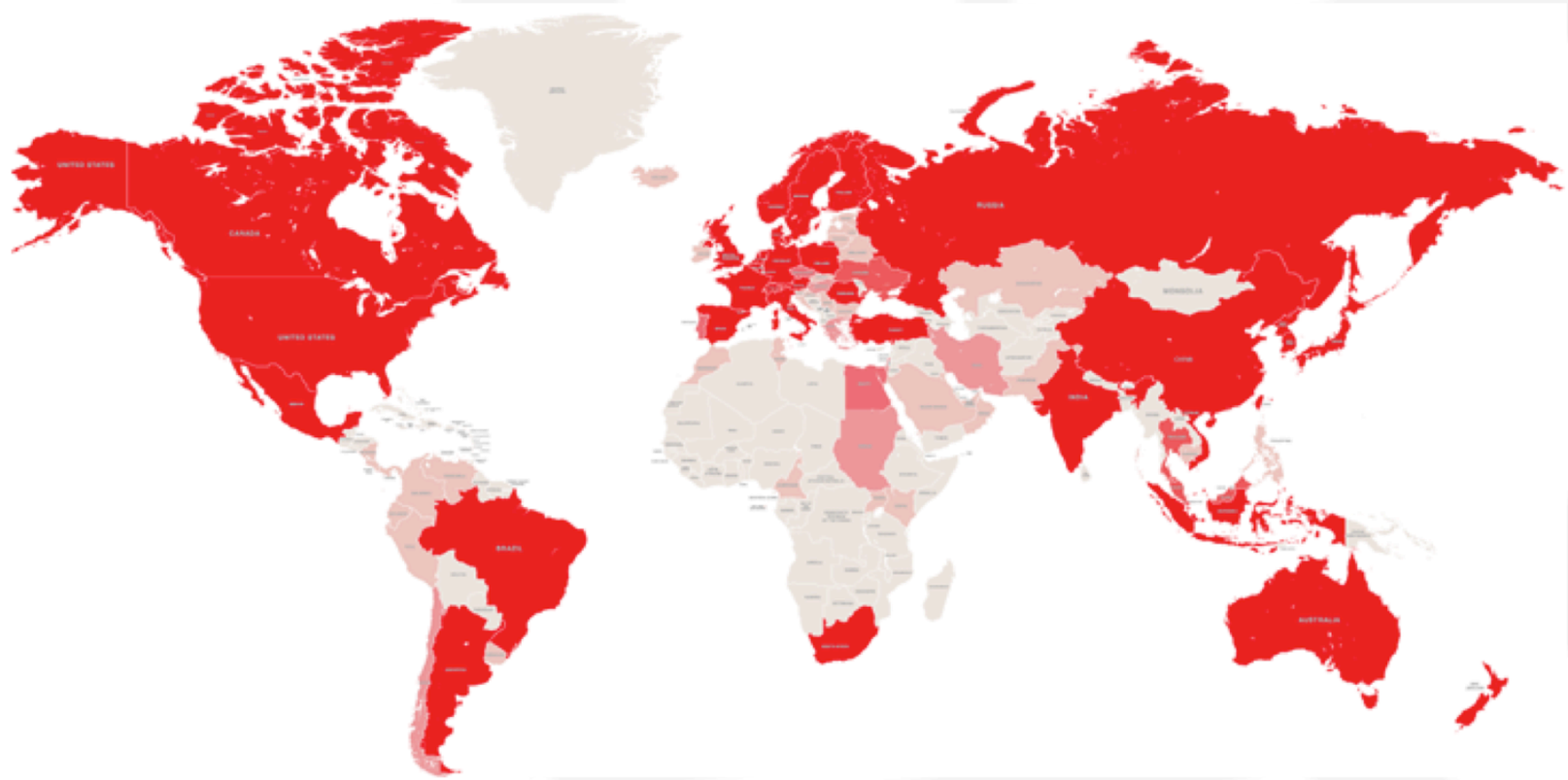
IPv4: spreads like a pandemic

2010

Today's concentration of IPv4 addresses by geography based on data maintained by RIRs.



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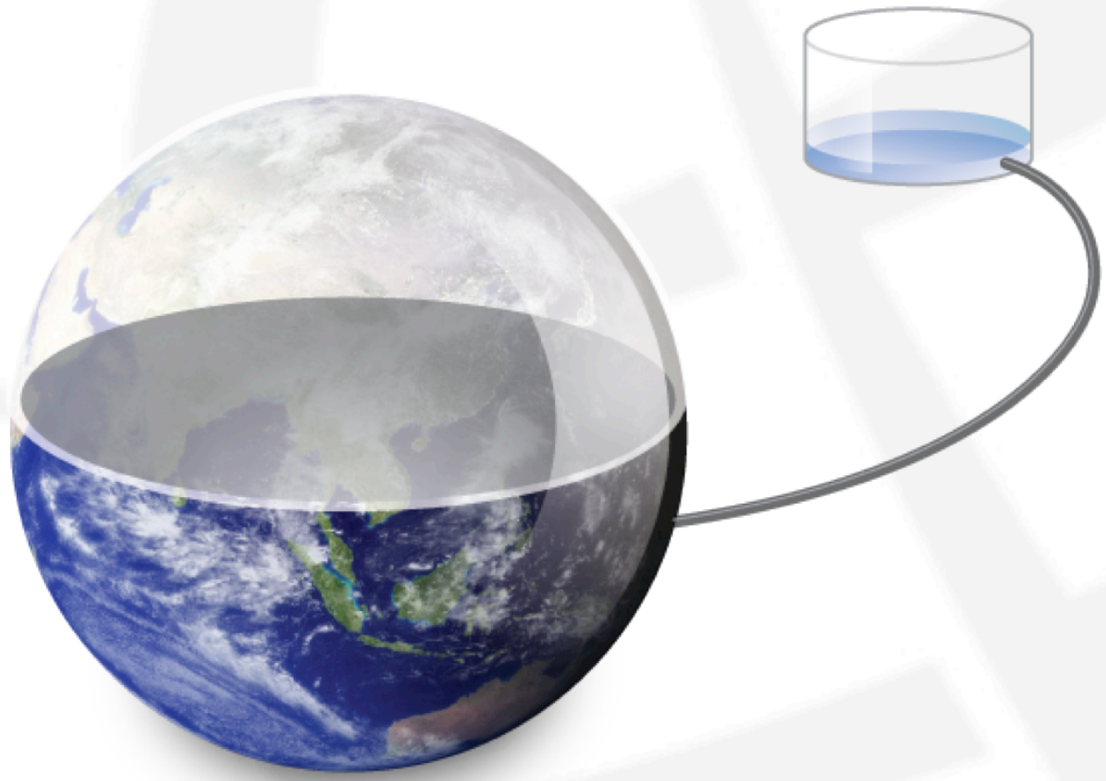
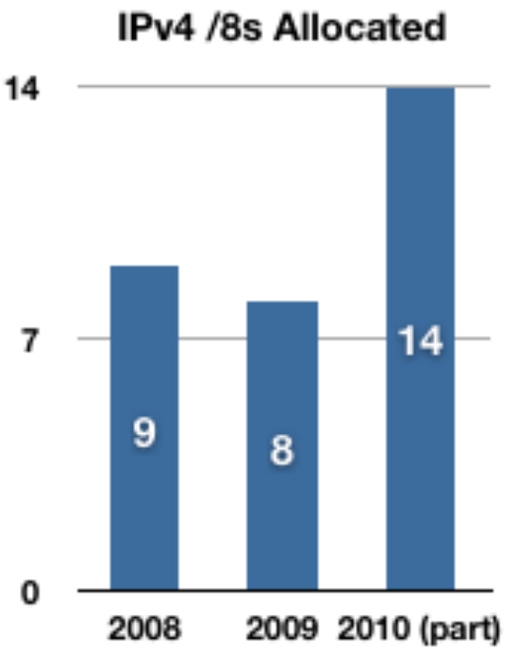
IPv4: launched the Internet

Only 3.7 of IPv4's 4.3 billion addresses are available to the RIRs for allocation. The rest are reserved for IP Multicasting, future use, loopback, local identification and private use.

With a population of about 7 billion, only about half of the world can have an address.



IPv4 Status 2010



- 14 /8s have been allocated so far this year
- 8 have been allocated to APNIC
- ARIN, LACNIC & RIPE NCC have each received 2

IPv4 Status 2010

- 12 unallocated /8s remain
- 7 will be allocated under the global policy that was ratified in 2005
- Then the last 5 blocks will be allocated simultaneously as per the special global policy ratified in 2009

State of the IPv4 Pool

Less than 5% of total IPv4 space left in the pool. That is approximately 200 million unique addresses.

Photo by Silverstealth.

IPv6: more than enough

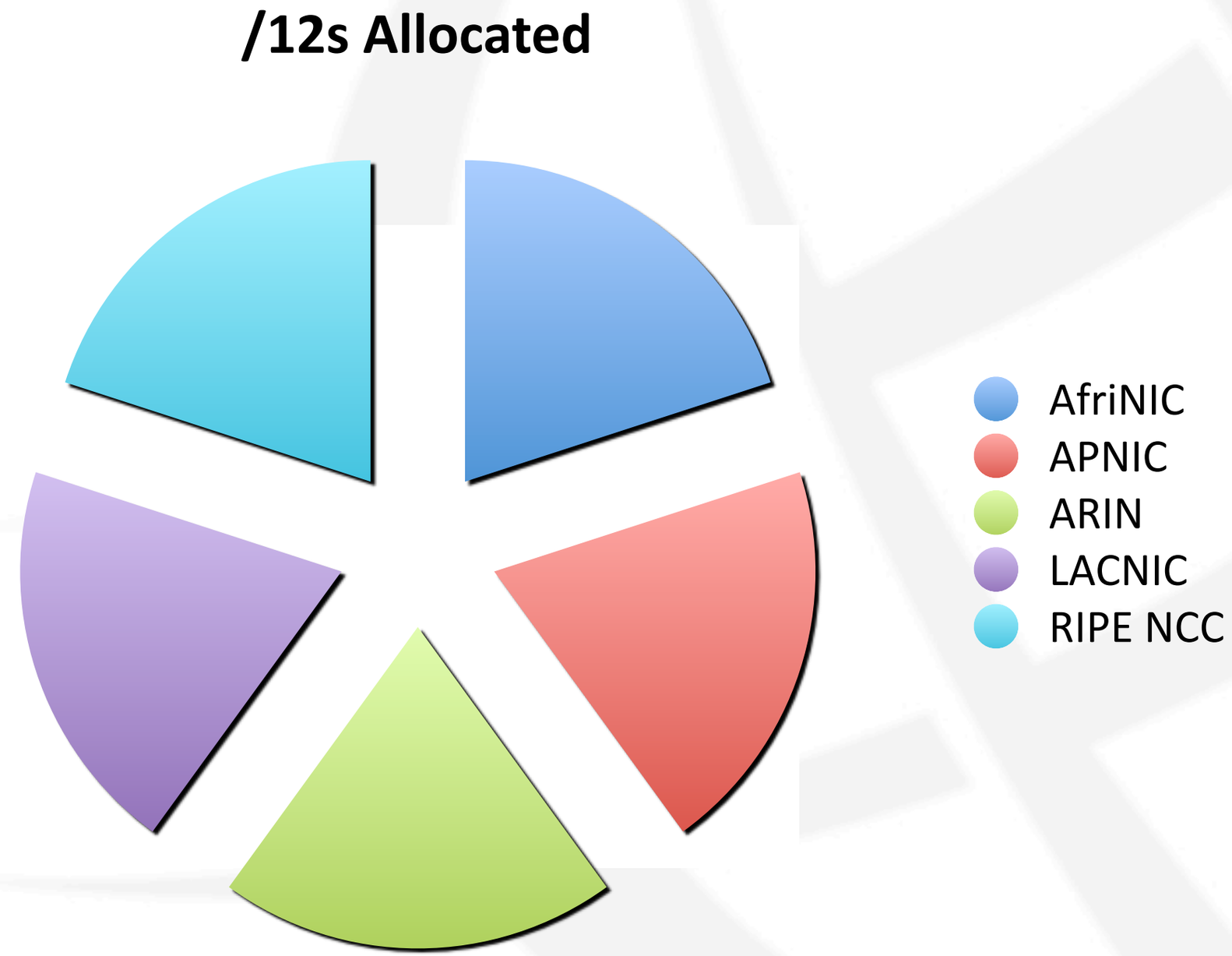
If all of Earth's 7 billion people received a /48 there would be enough for trillions of worlds. That's far more than can fit in Earth's orbit around the sun, which can only hold about 3,250.

Each /48 is equivilant to 1,208,925,819,614,629,174,706,176 unique IP addresses.

IPv6: spread evenly, like butter

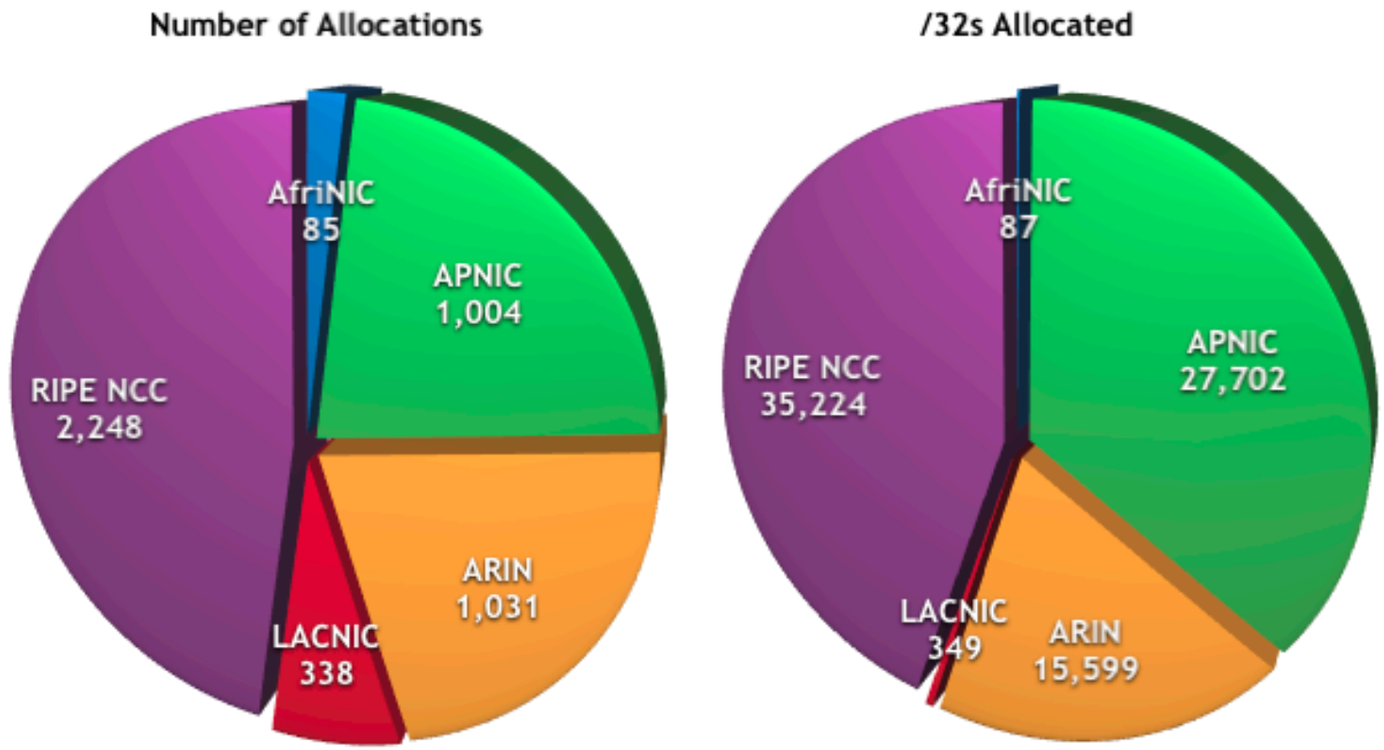
In 2006, all five RIRs received a /12, when the global IPv6 allocation policy was ratified.

None of the RIRs have requested additional IPv6 address space yet.



Looking in more detail

2010 is still early days for IPv6 deployment. But it is clear that early growth is happening in a different set of regions than we see with IPv4.



Data source: AfriNIC, APNIC, ARIN, LACNIC, RIPE NCC

One missing piece for IPv6 success?

- One key supporting technology is DNS
- Deployment of IPv6 DNS services needed in:
  - The root
  - Top Level Domains
  - Support for glue registration

IPv6 glue for TLDs in the root

IPv6 glue for TLDs was first added to the root in July 2004. Since then, most TLDs have added IPv6 connectivity for their nameservers and we track the diversity of routing for TLDs' nameservers.

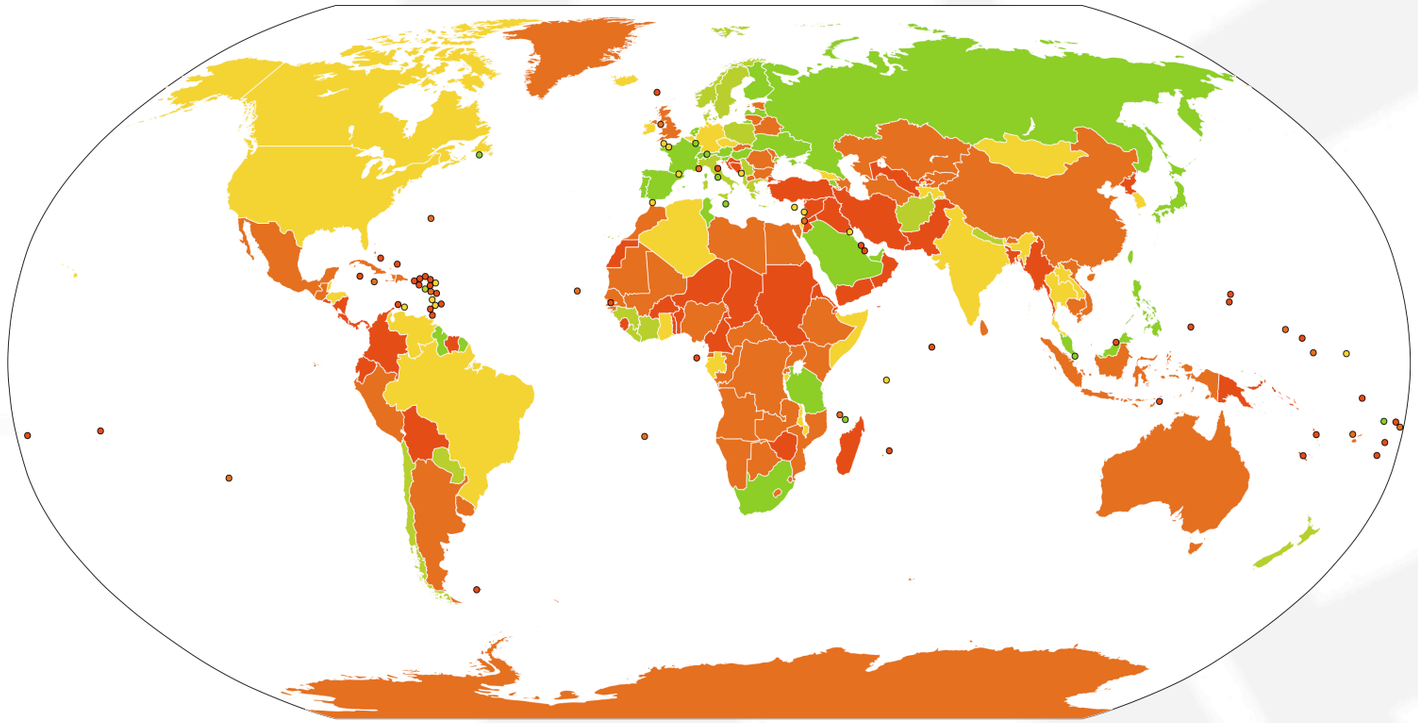
Red = 0 networks

Orange = 1 networks

Yellow = 2 networks

Pale Green = 3 networks

Green = 4+ networks

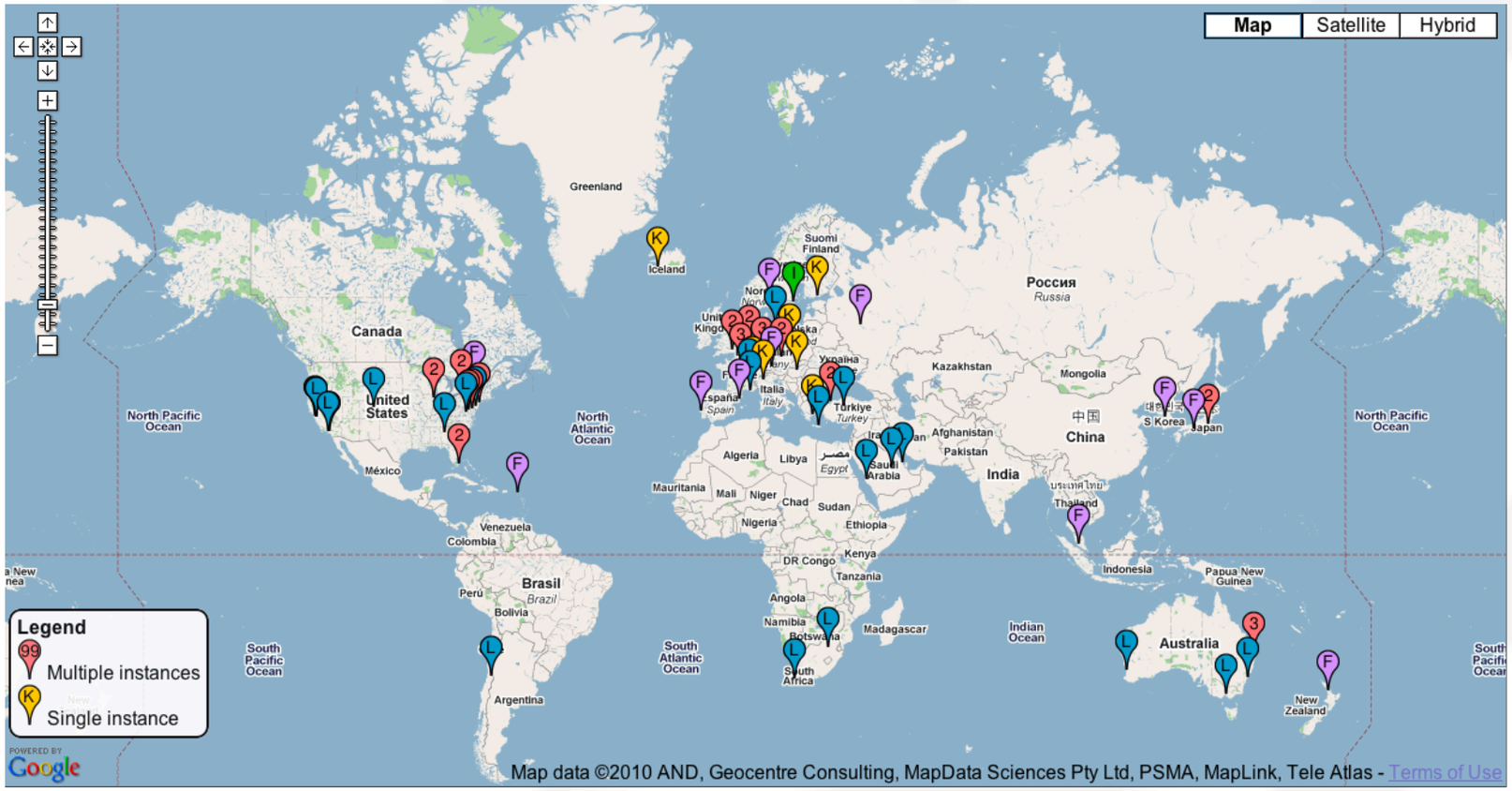


Situation in mid-October 2010

IPv6 has taken root in the DNS

IPv6 addresses for the root DNS servers were added to the root in January 2008. Additional servers' addresses have been added since then.

The map shows locations where root DNS servers are available over IPv6.

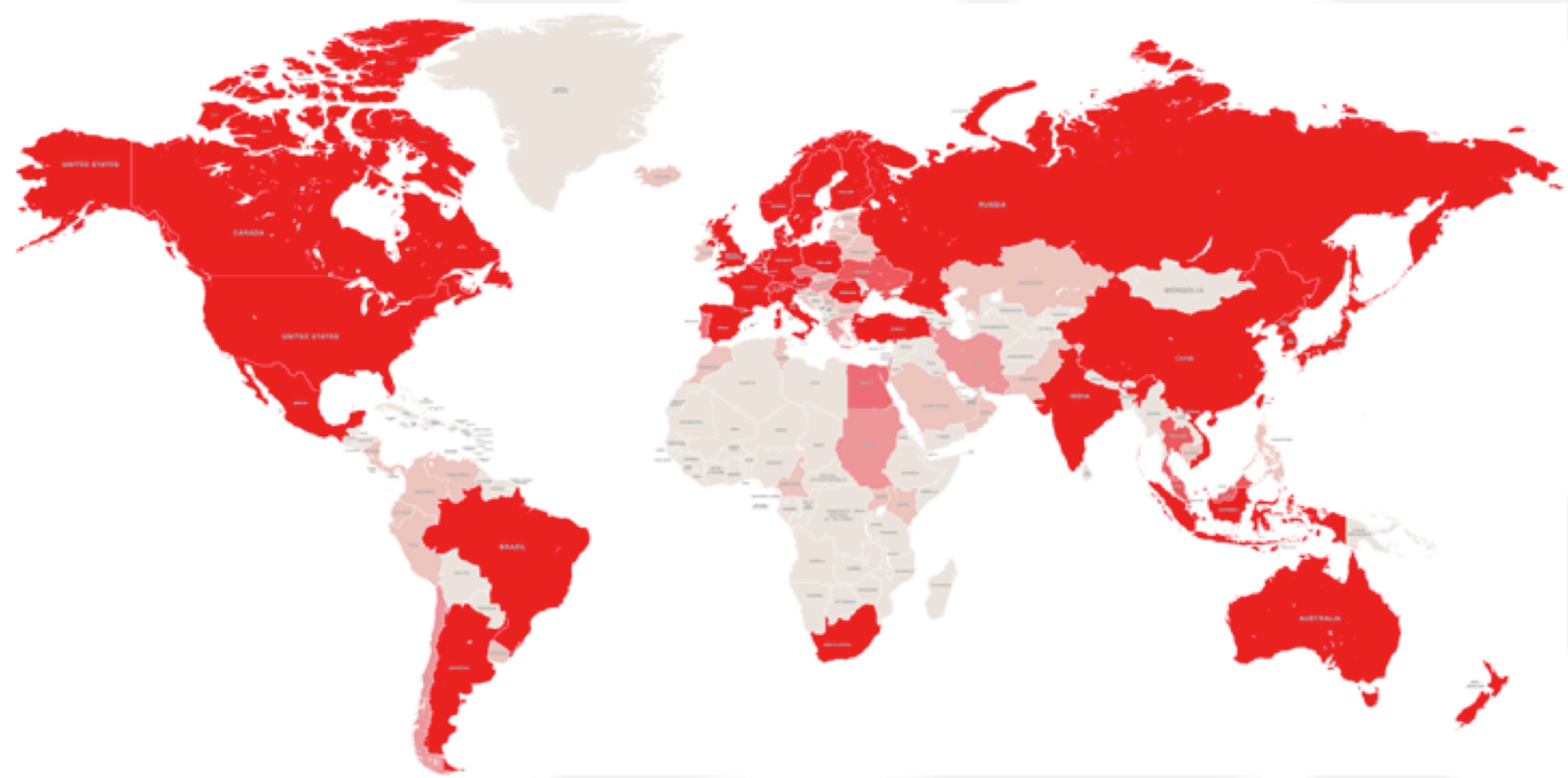


http://www.root-servers.org/meta/version-1.xml

IPv6 DNS readiness?

Those geographic areas with strong IPv4 deployment need IPv6 deployment, too.

A smooth transition is going to need root and TLD DNS servers available over IPv6



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Thank you