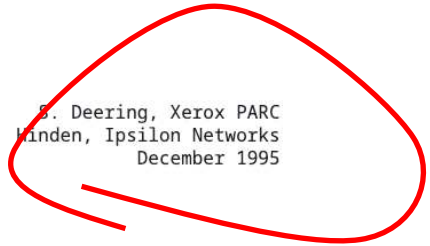
IPv6 Deployment: 30 Years Later

Geoff Huston AM
APNIC Labs

Well - about 30 years!



Network Working Group
Request for Comments: 1883
Category: Standards Track

S. Deering, Xerox PARC
R. Hinden, Ipsilon Networks
December 1995

Internet Protocol, Version 6 (IPv6)
Specification

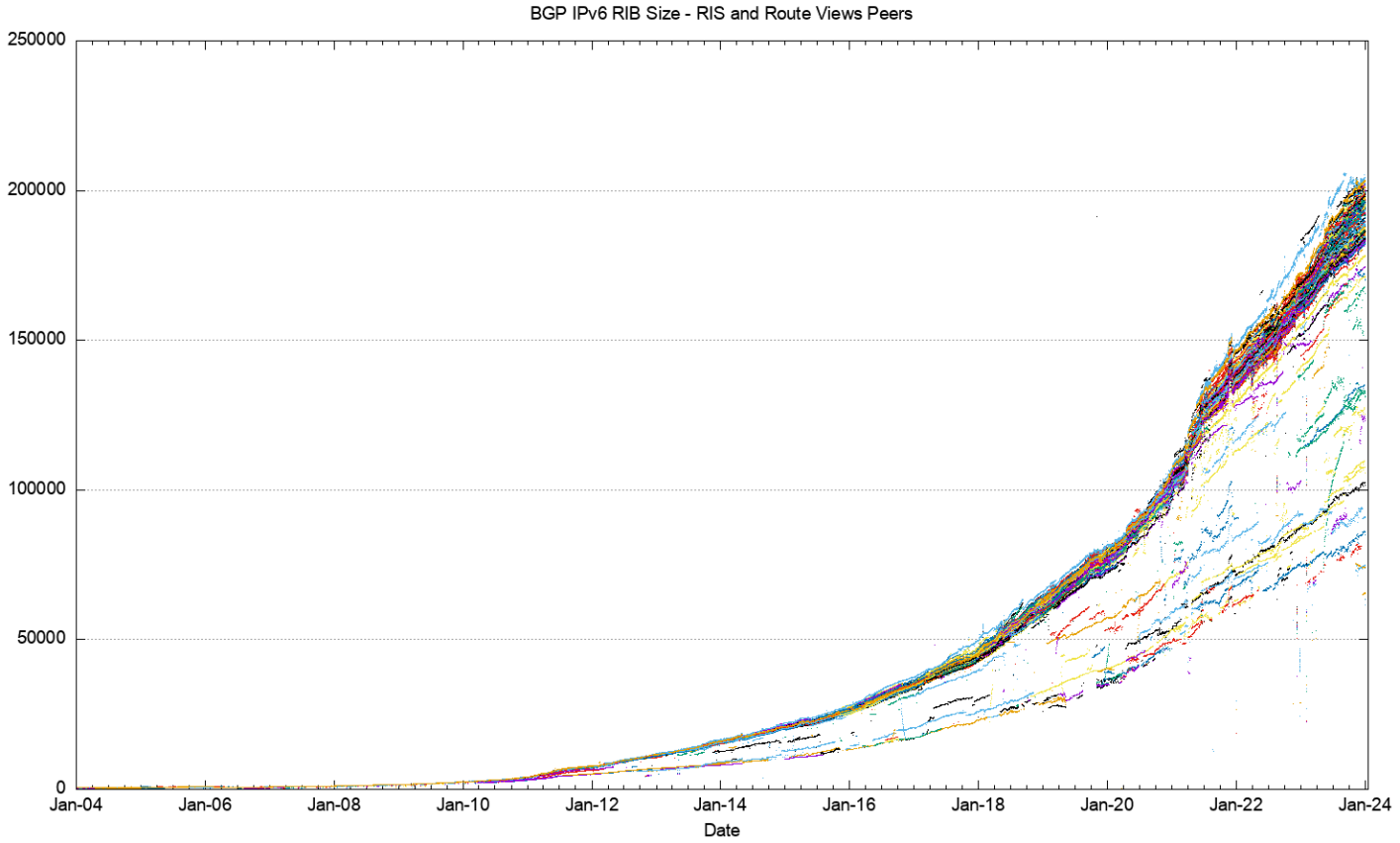
Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

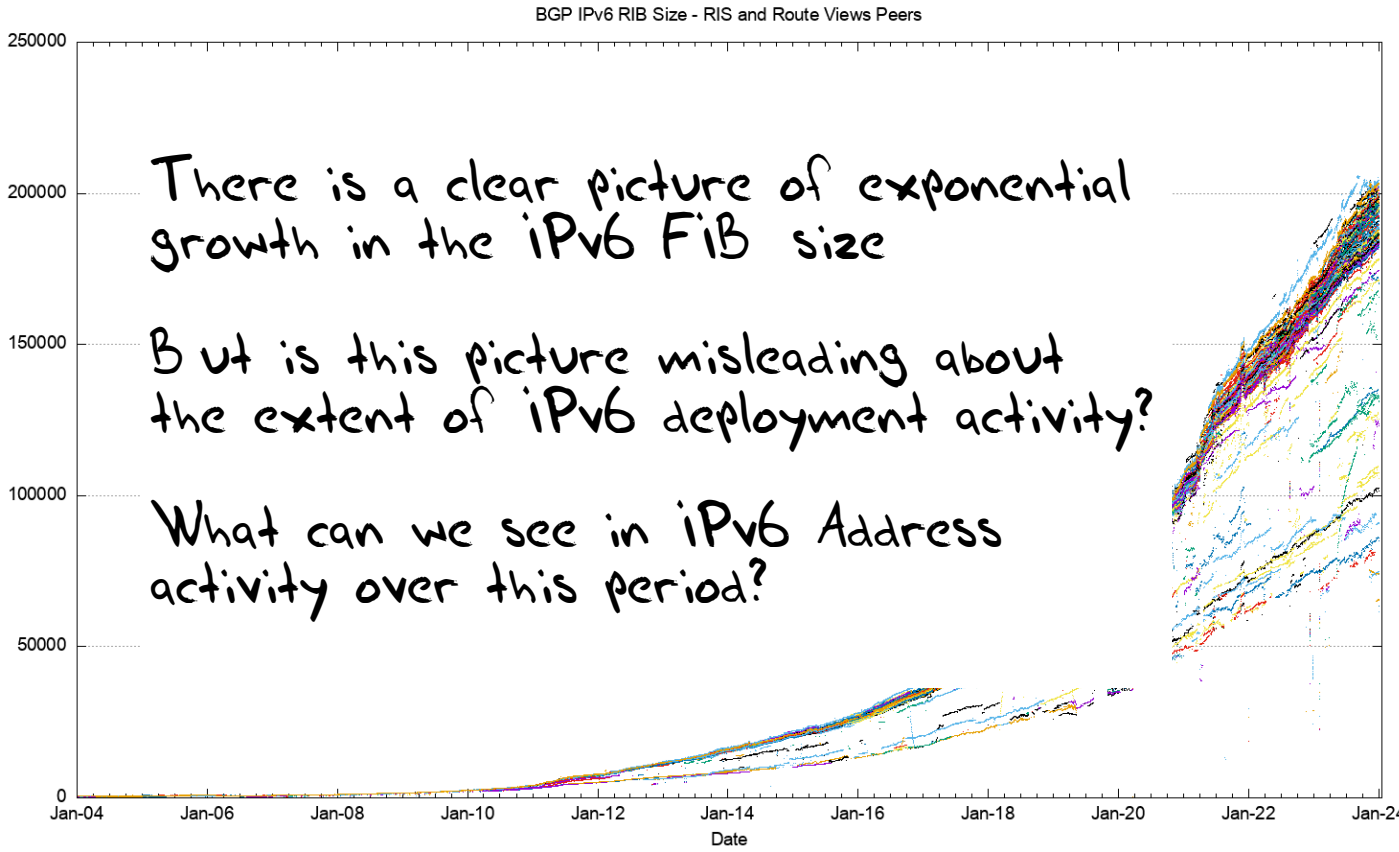
Abstract

This document specifies version 6 of the Internet Protocol (IPv6), also sometimes referred to as IP Next Generation or IPng.

20 Years - IPv6 Routing Table



20 Years - IPv6 Routing Table



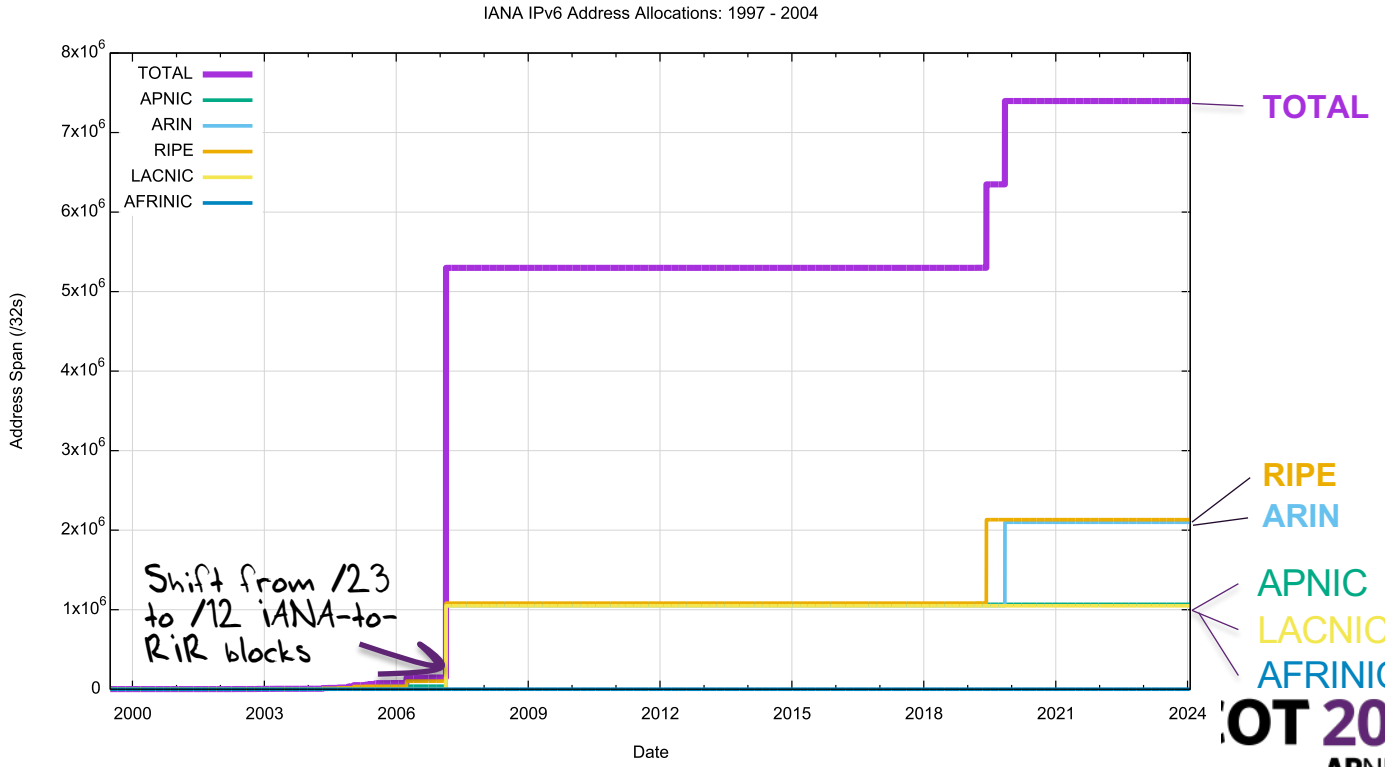
Early IPv6 Deployment

- Early work in IPv6 was undertaken as an overlay network, using IPv6-over-IPv4 encapsulation
- The “6Bone” was set up in March 1996, using the IPv6 Trial Address allocation 3FFE::/16 (RFC 2471)
- This 6Bone network was phased out starting Jan 2004 and fully decommissioned in June 2006

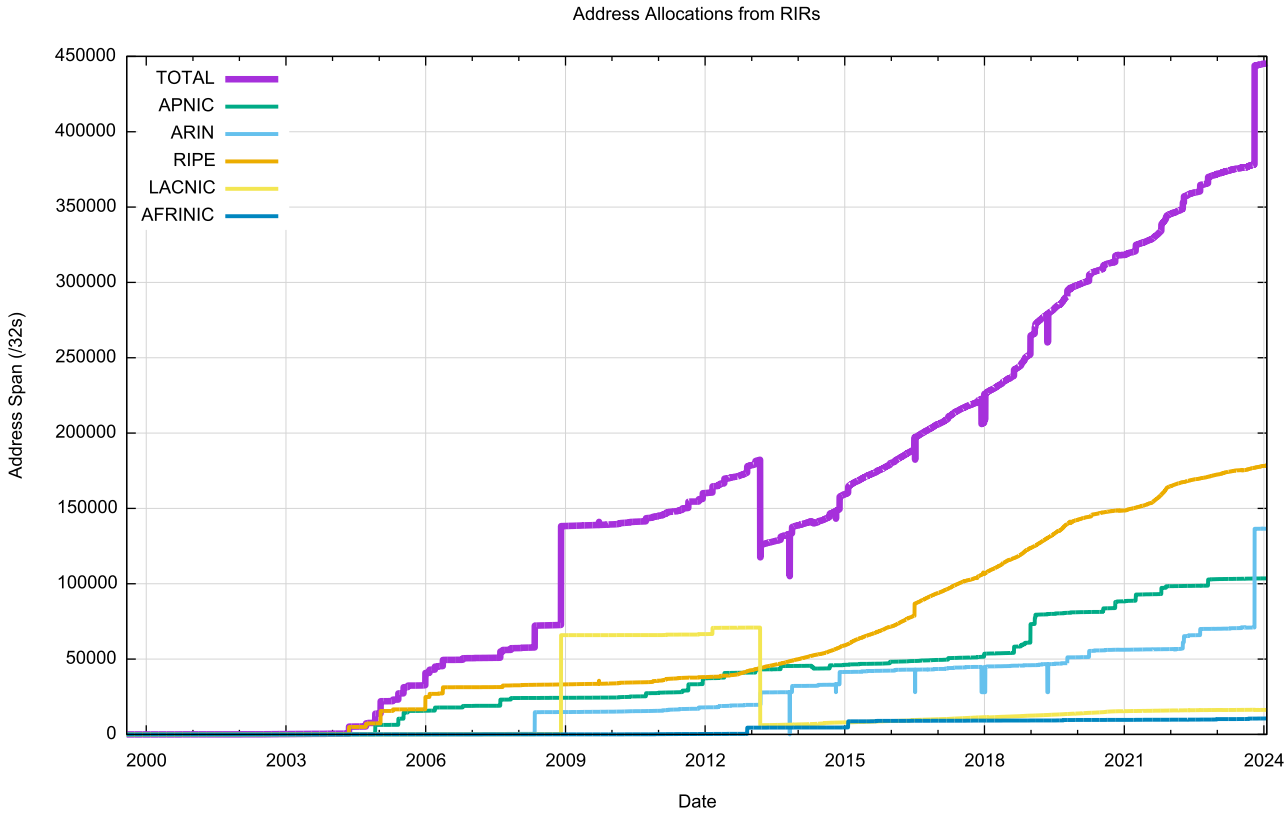
Early IPv6 Address Allocations

- On 1 January 1999, the IANA recorded the following IPv6 Address Allocations:
  - 2001:200::/23 to APNIC
  - 2001:400::/23 to ARIN
  - 2001:600::/23 to the RIPE NCC
- The next allocation was 2002::/16 for the 6to4 overlay network, in February 2021

Address Allocations: IANA to the RIRs



RIR Address Assignments



TOTAL

RIPE

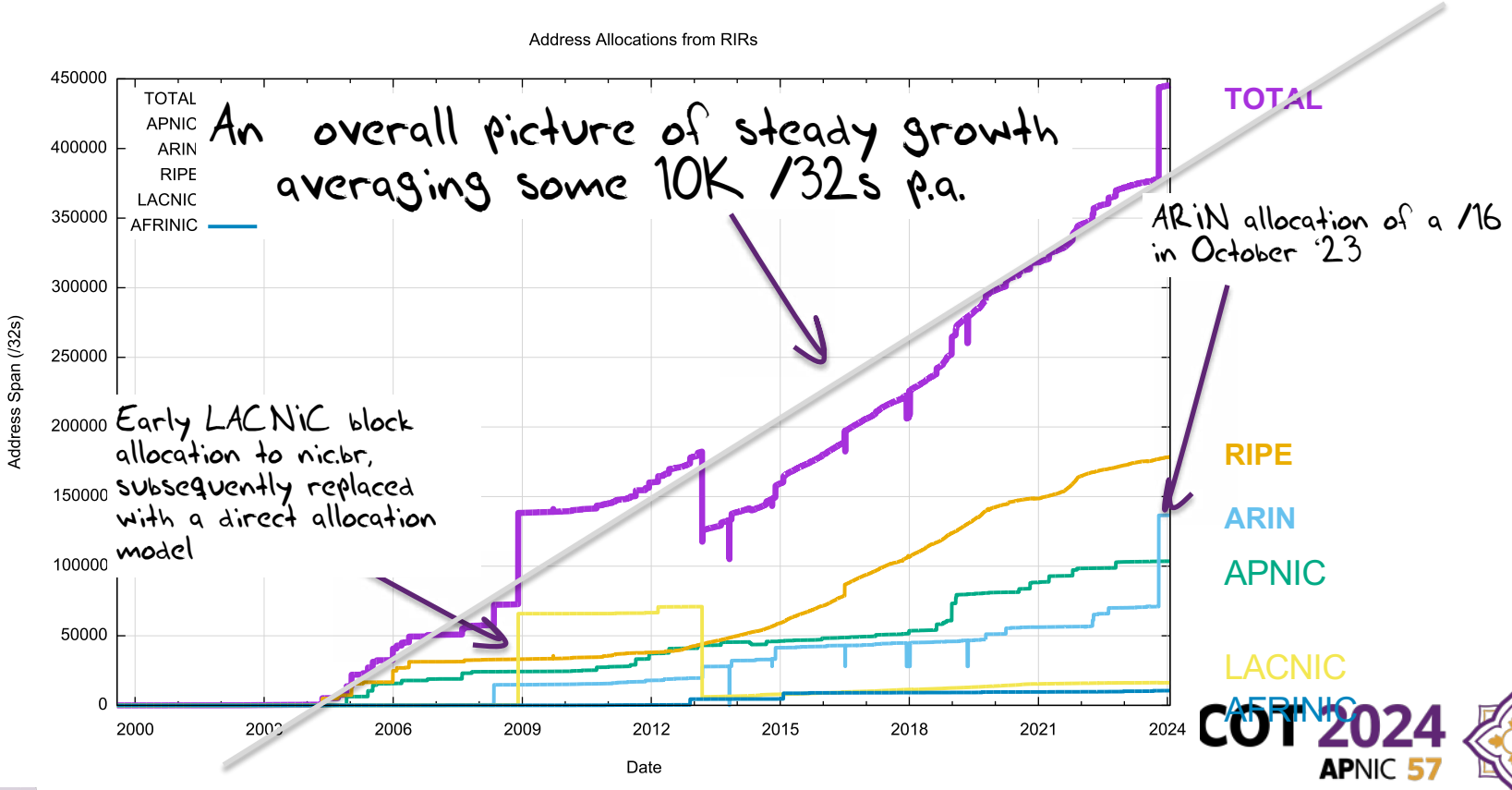
ARIN

APNIC

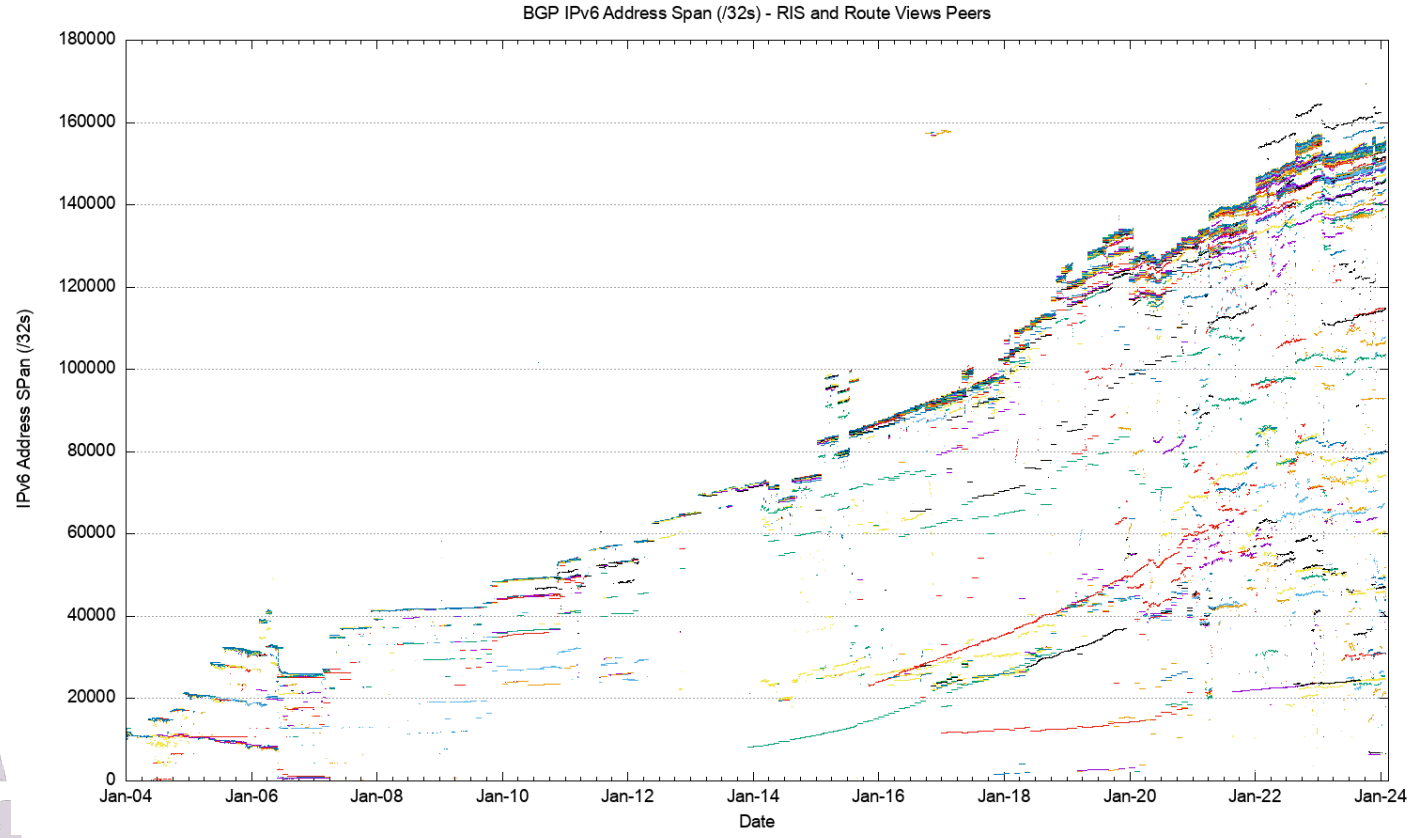
LACNIC

AFRINIC

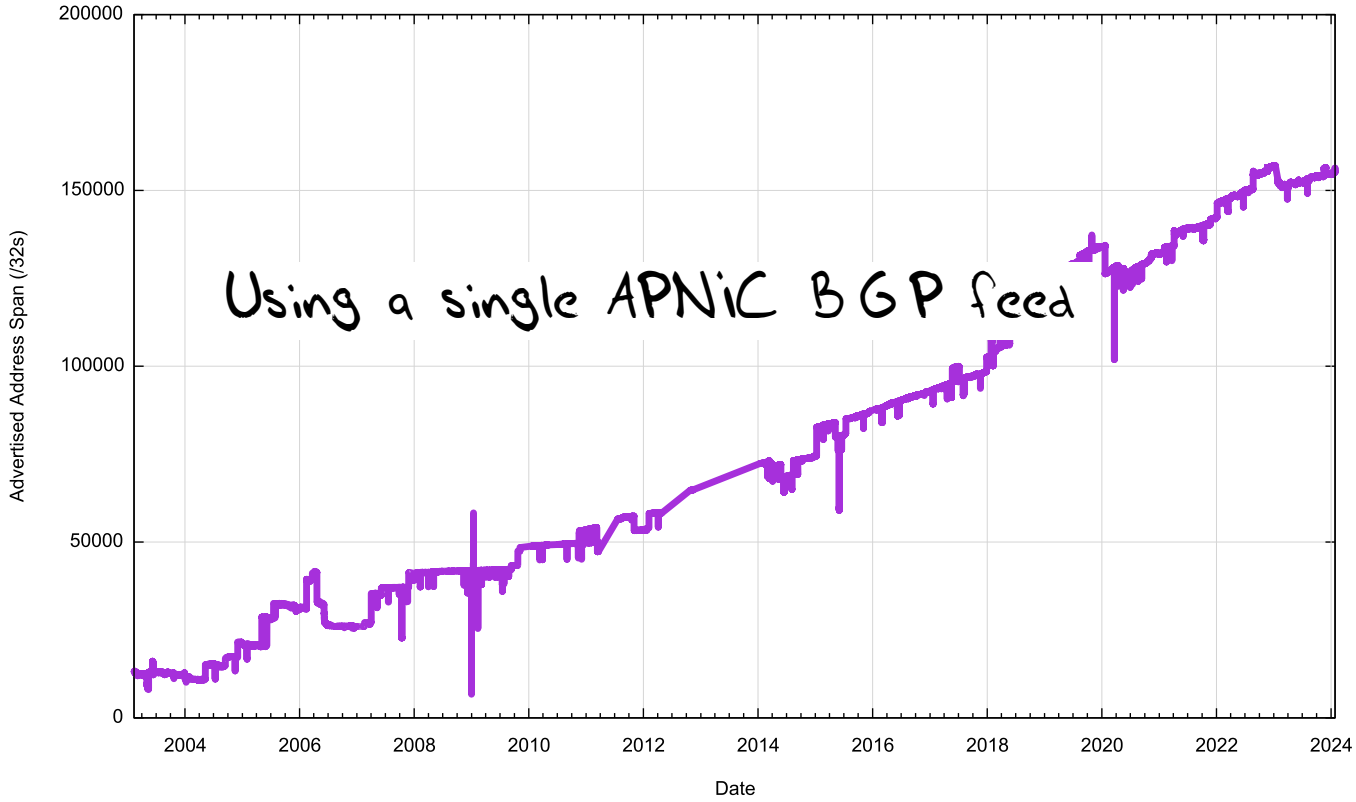
RIR Address Assignments



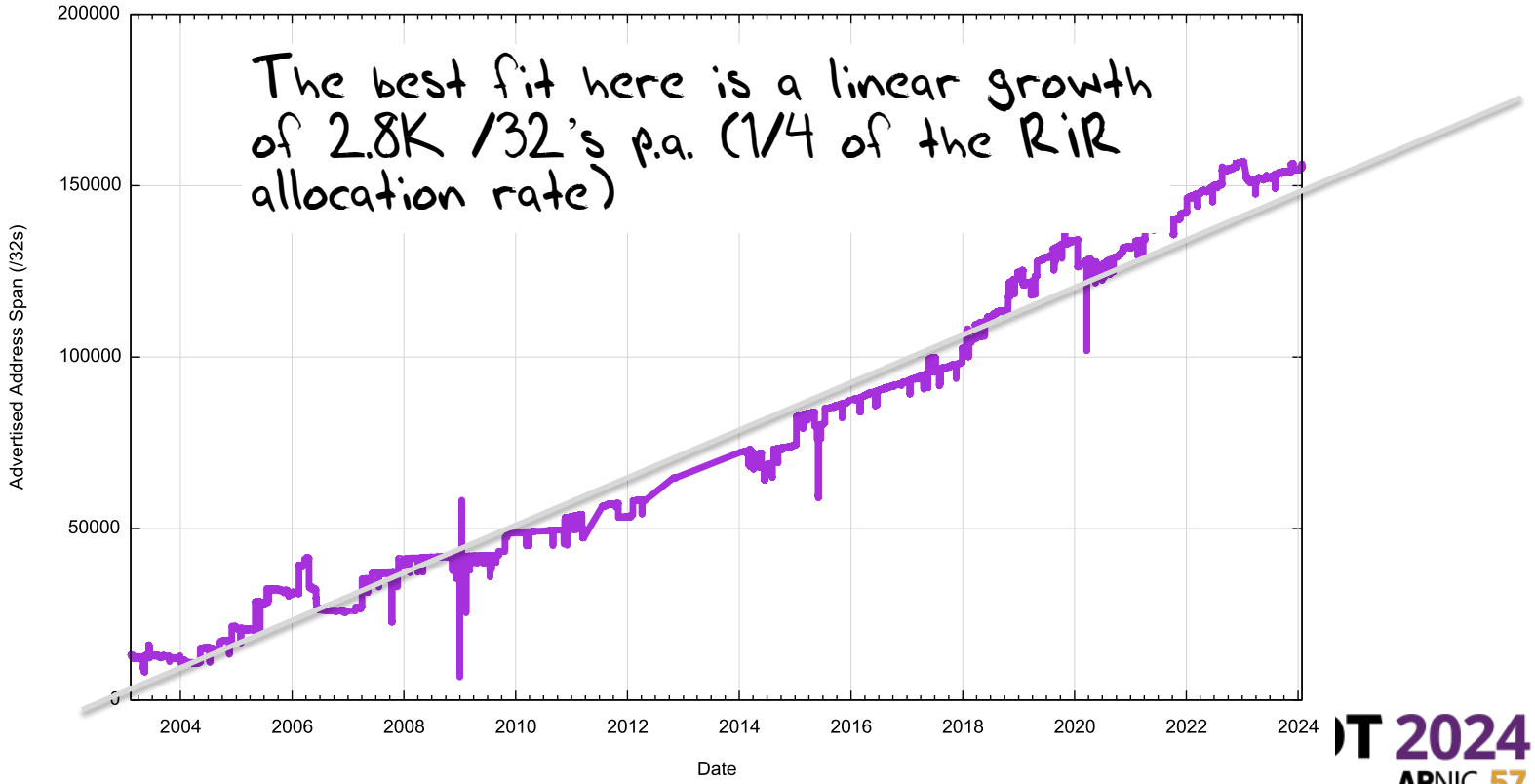
20-Year IPv6 Advertised Address Span



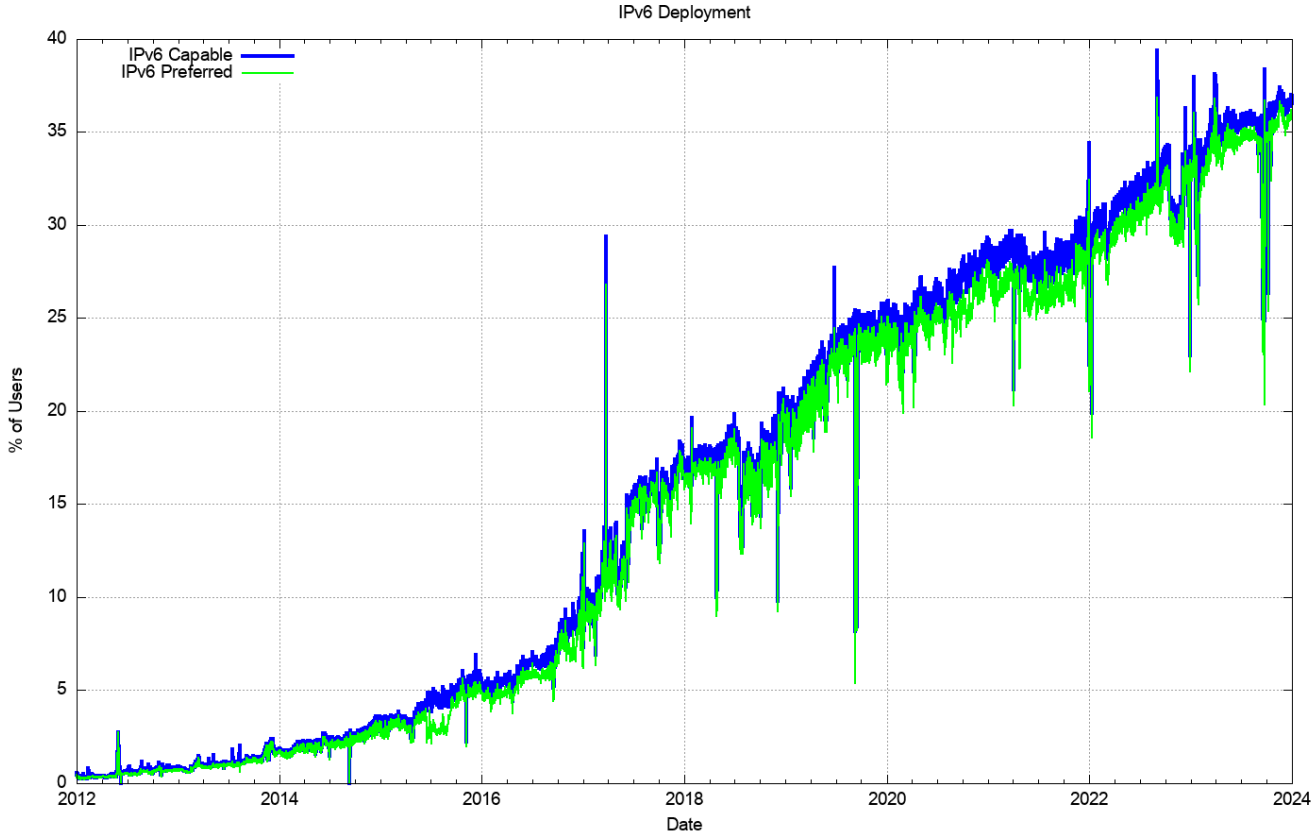
IPv6 Advertised Address Span



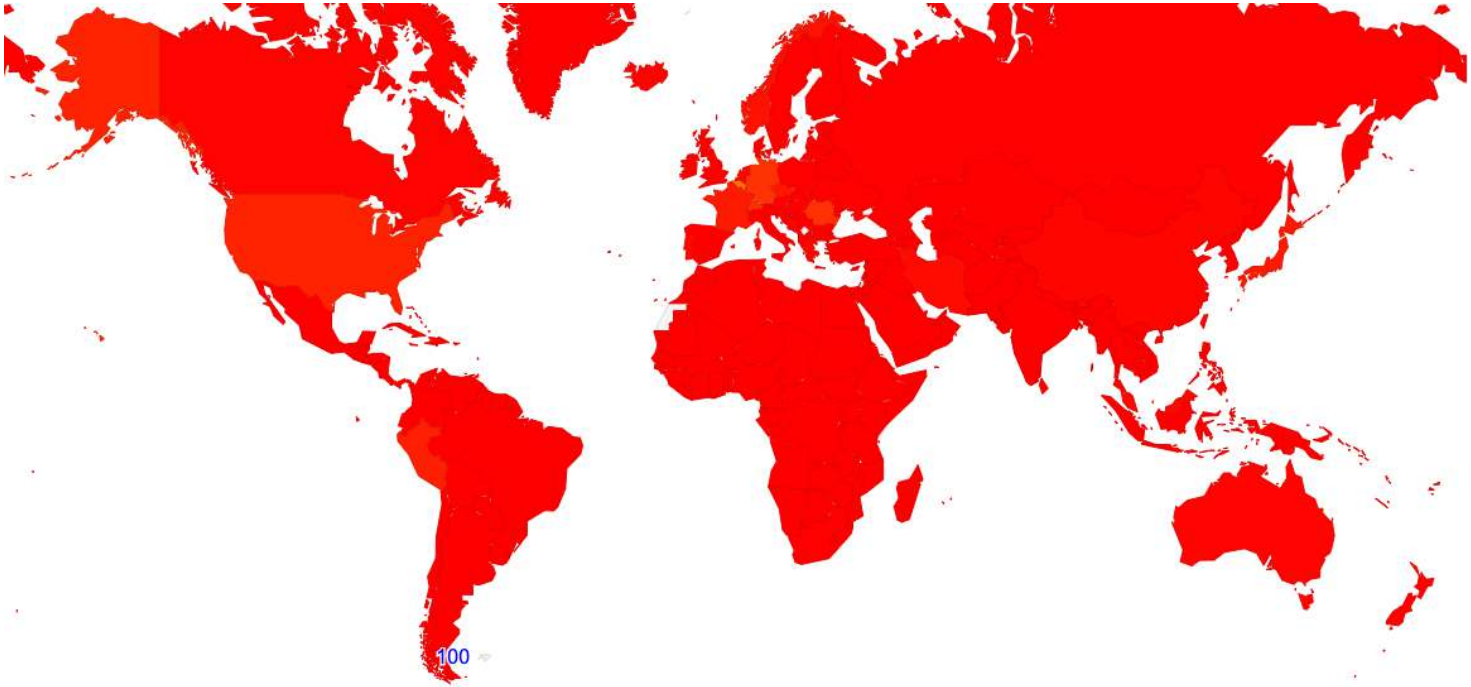
IPv6 Advertised Address Span



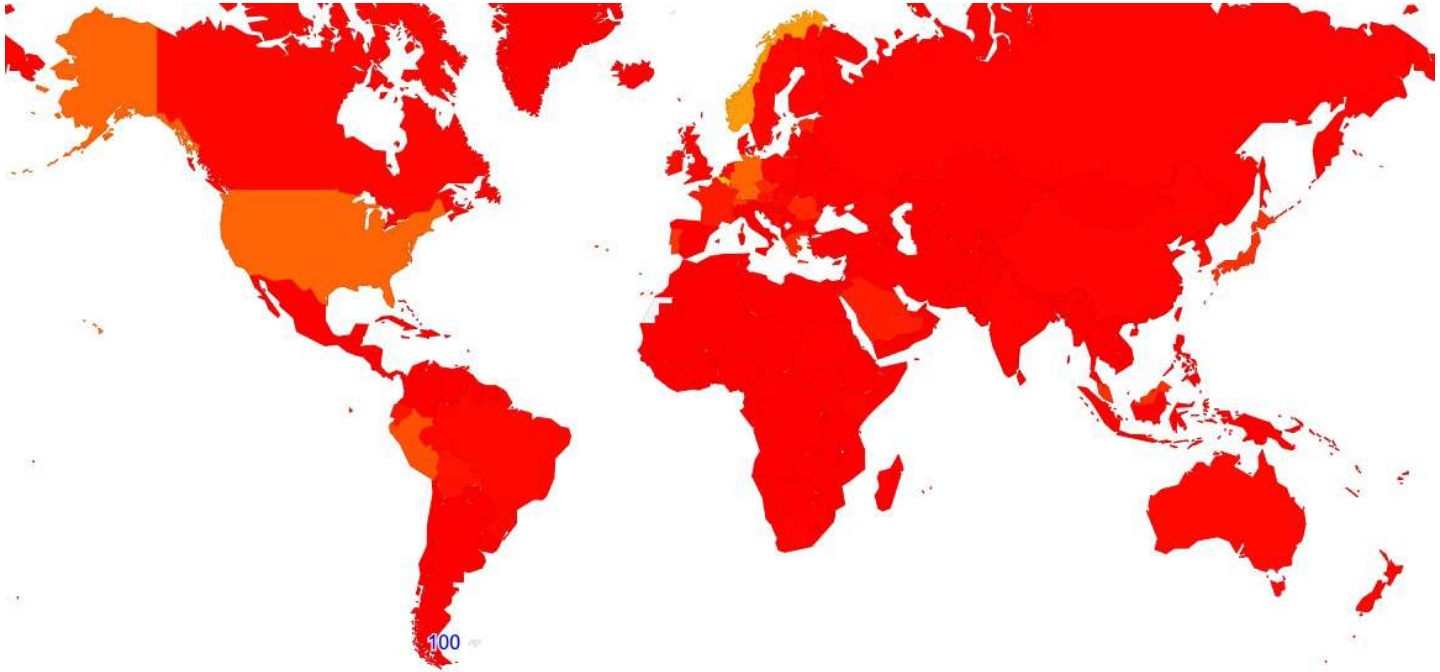
IPv6 Deployment



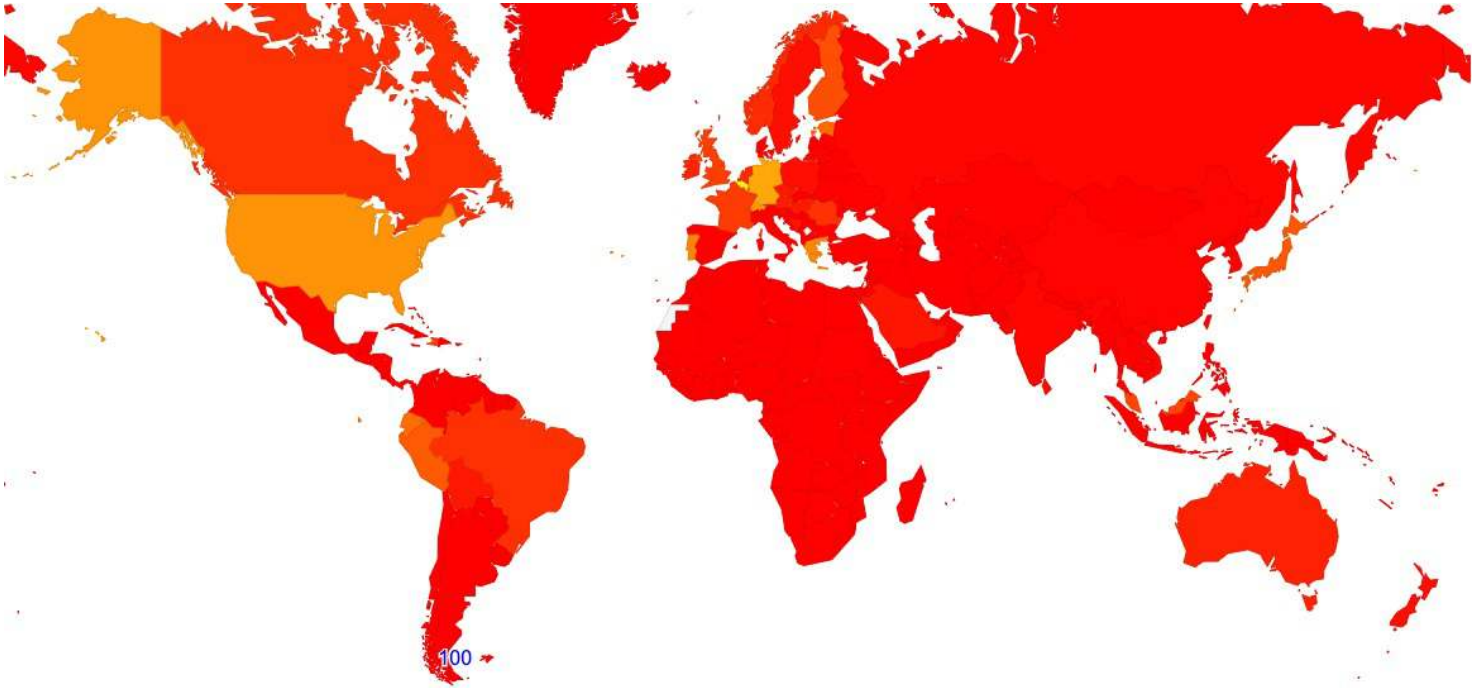
IPv6 Deployment by Economy - 2014



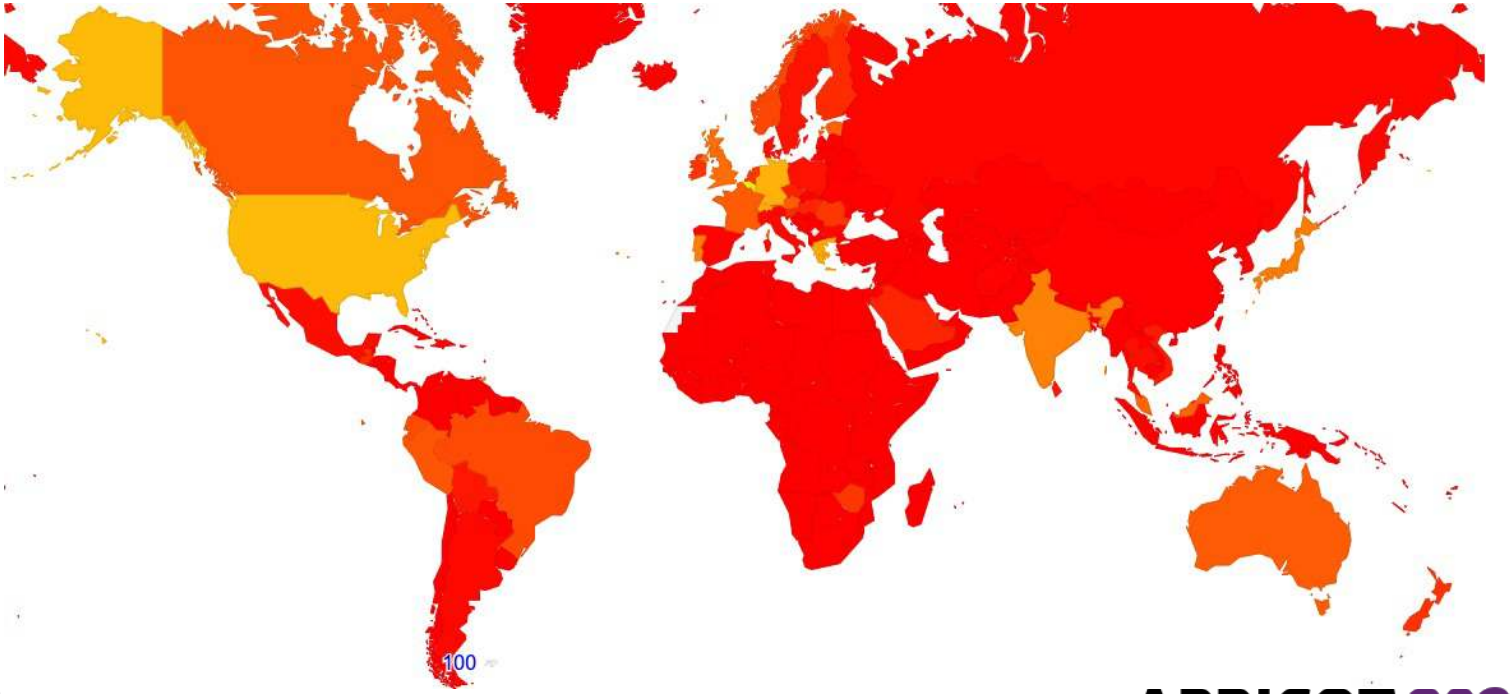
IPv6 Deployment by Economy - 2015



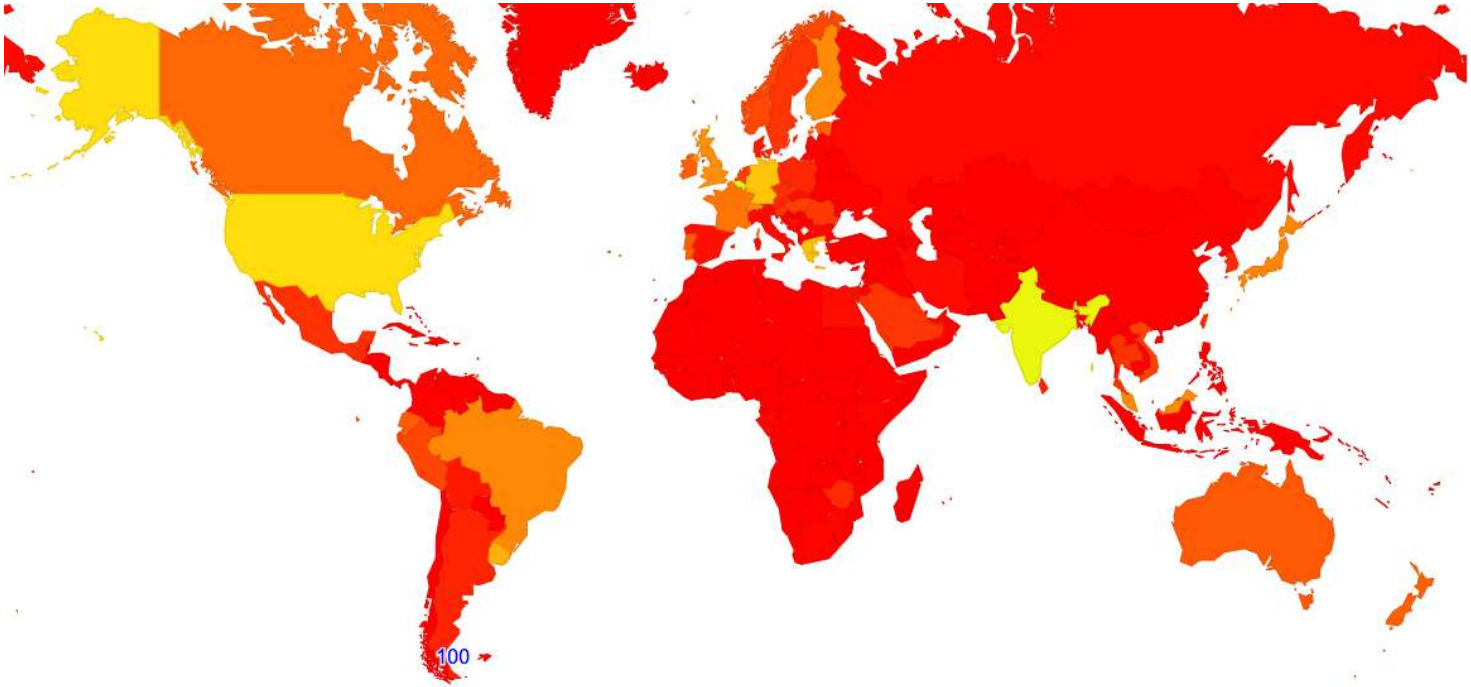
IPv6 Deployment by Economy - 2016



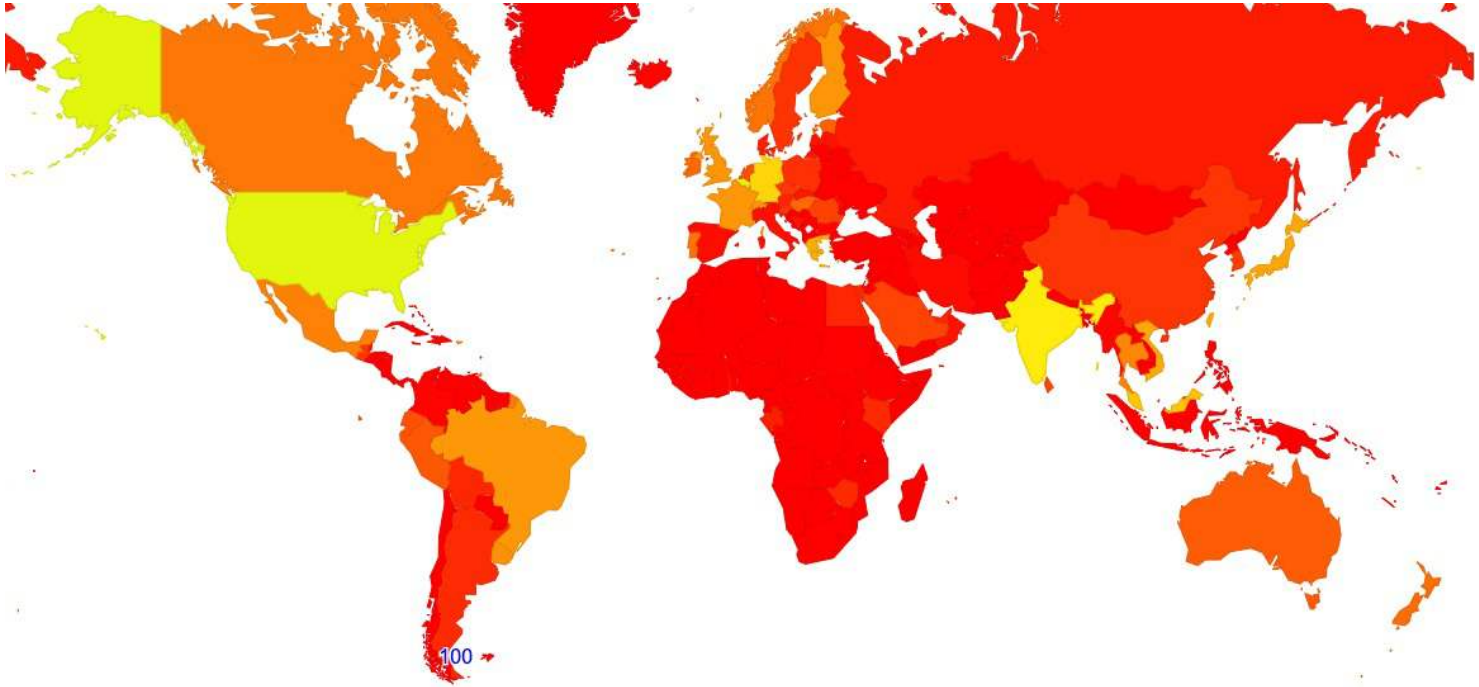
IPv6 Deployment by Economy - 2017



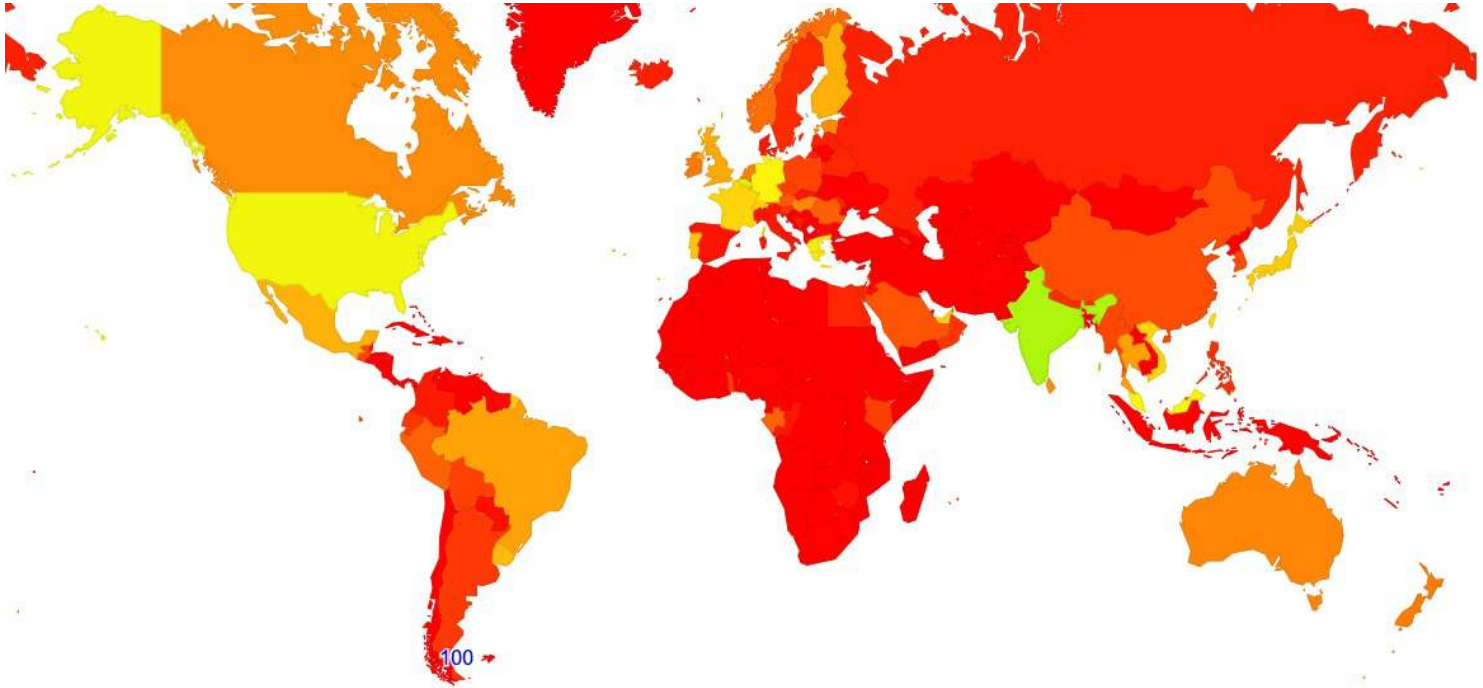
IPv6 Deployment by Economy - 2018



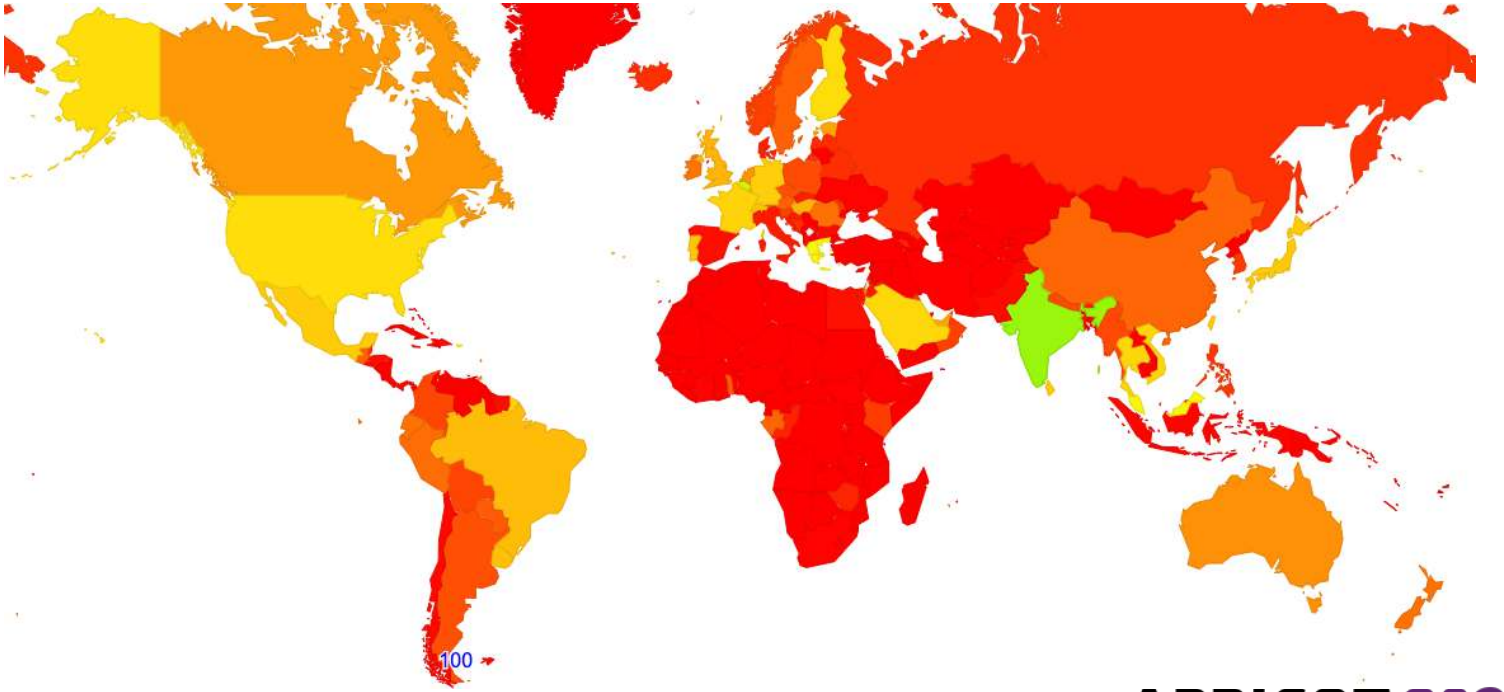
IPv6 Deployment by Economy - 2019



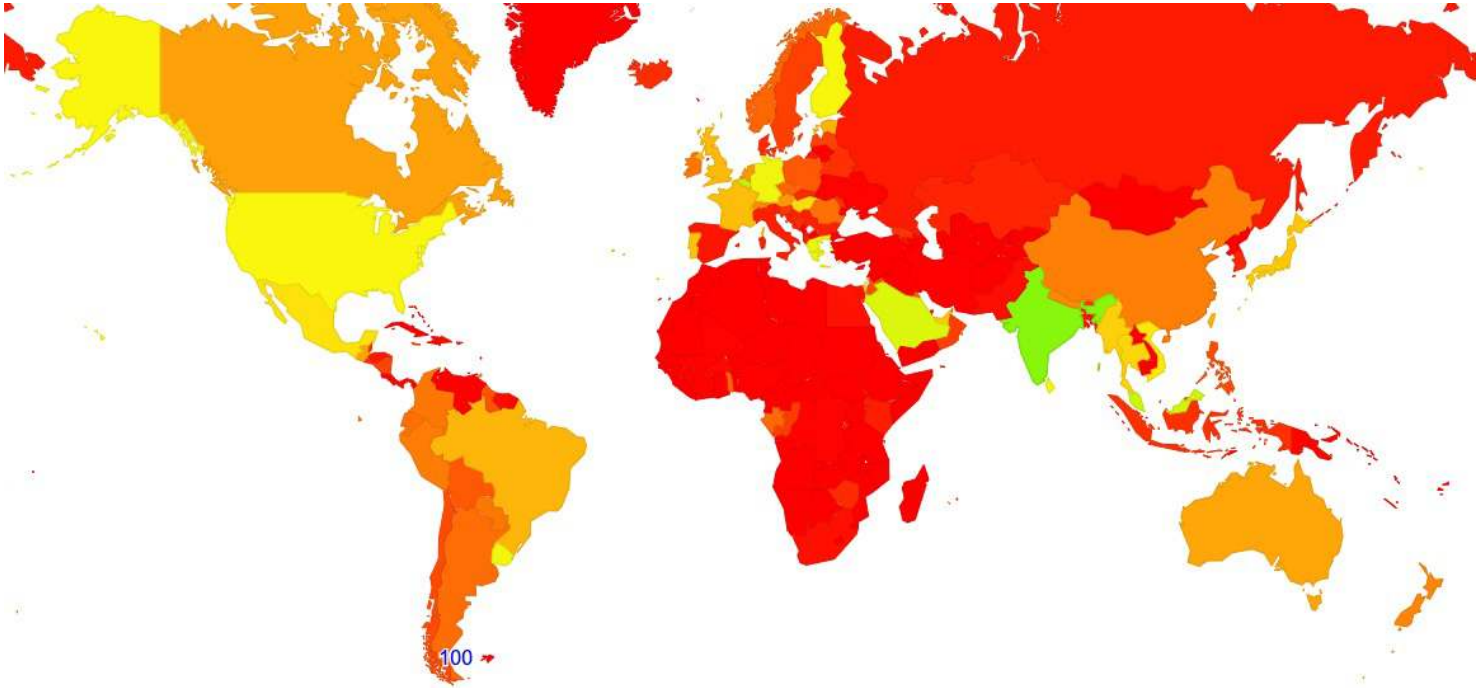
IPv6 Deployment by Economy - 2020



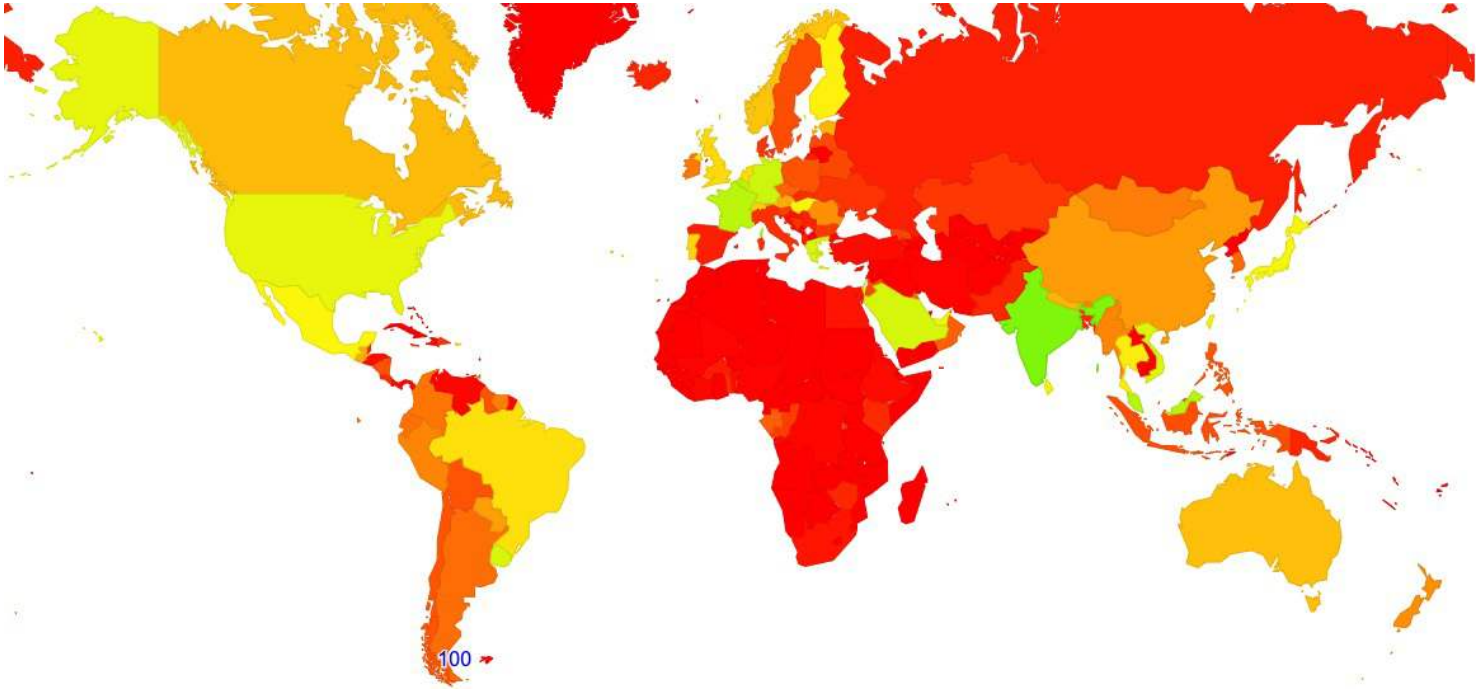
IPv6 Deployment by Economy - 2021



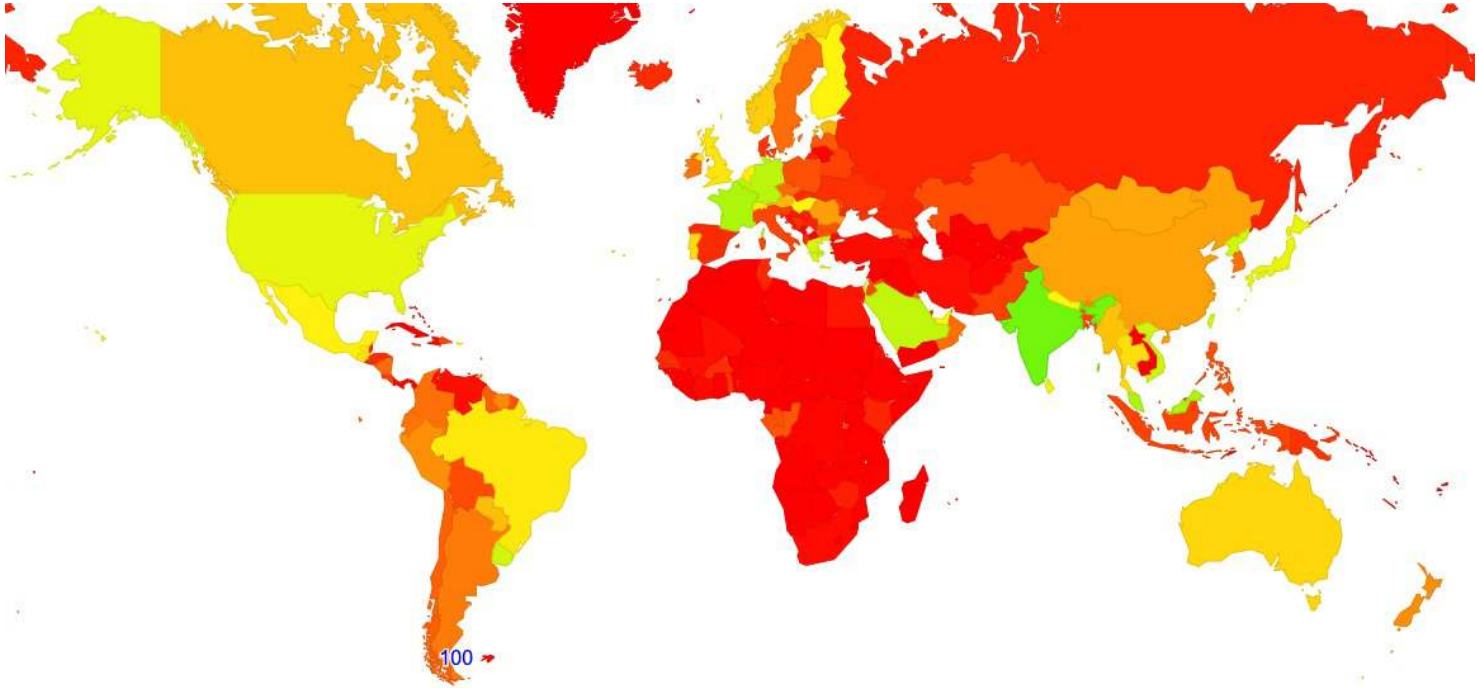
IPv6 Deployment by Economy - 2022



IPv6 Deployment by Economy - 2023

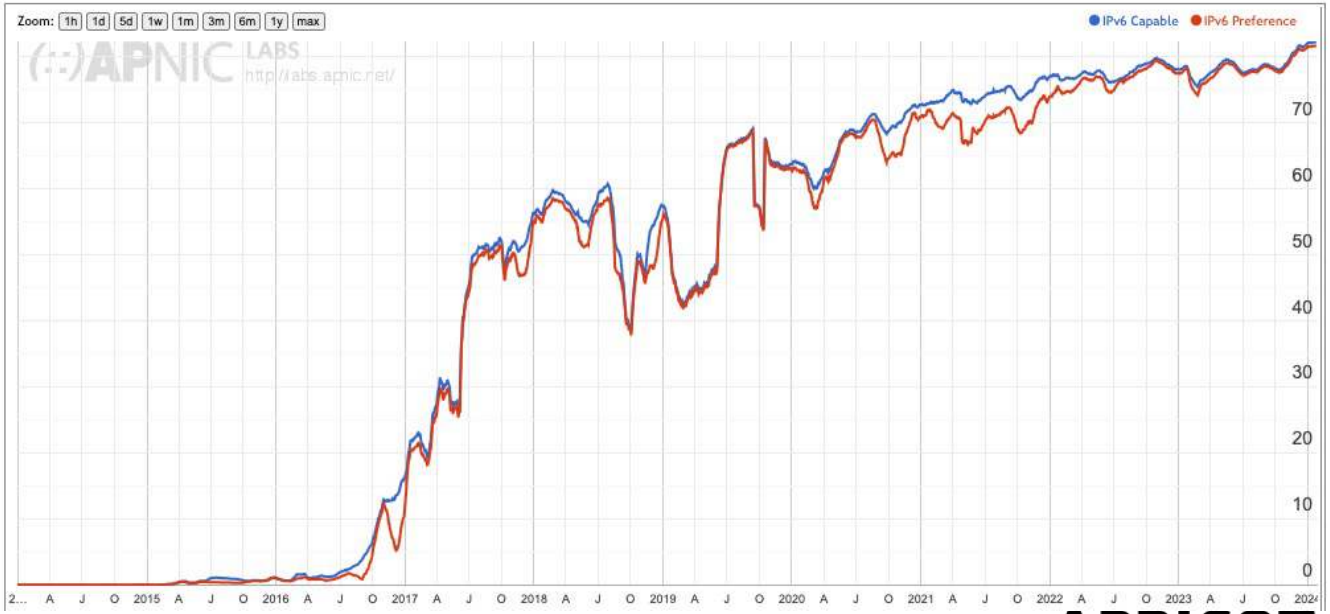


IPv6 Deployment by Economy - 2024



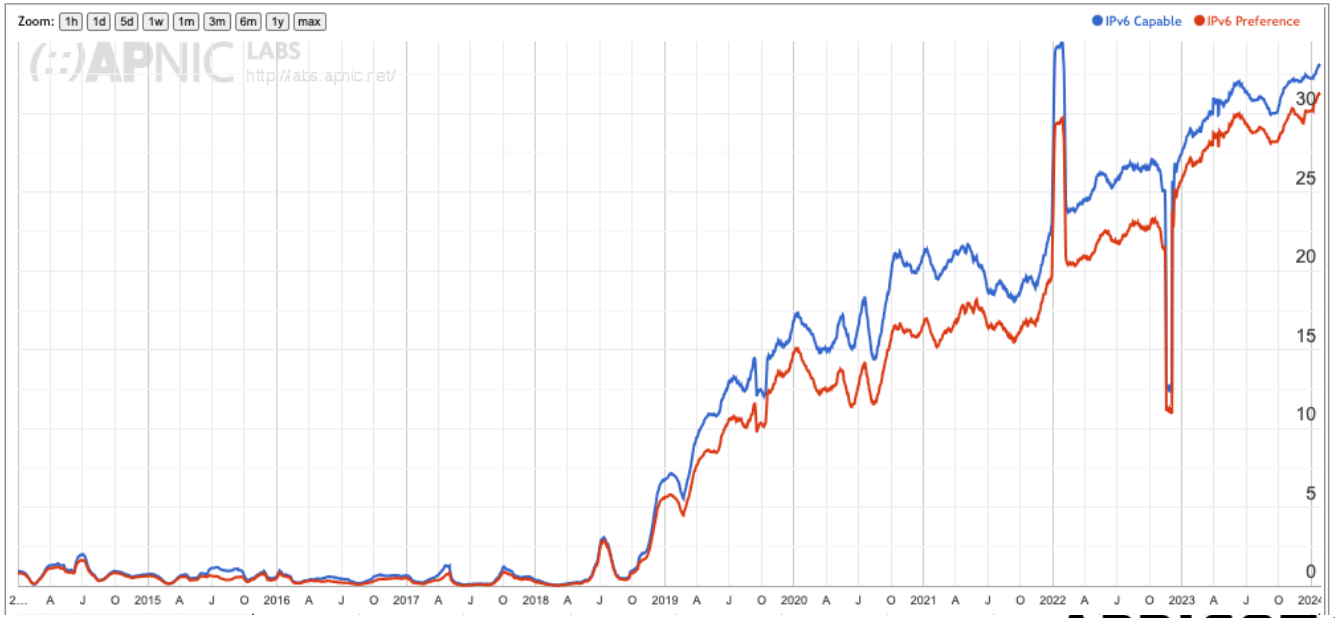
IPv6 in India

Use of IPv6 for India (IN)



IPv6 in China

Use of IPv6 for China (CN)



IPv6 in Malaysia

Use of IPv6 for Malaysia (MY)



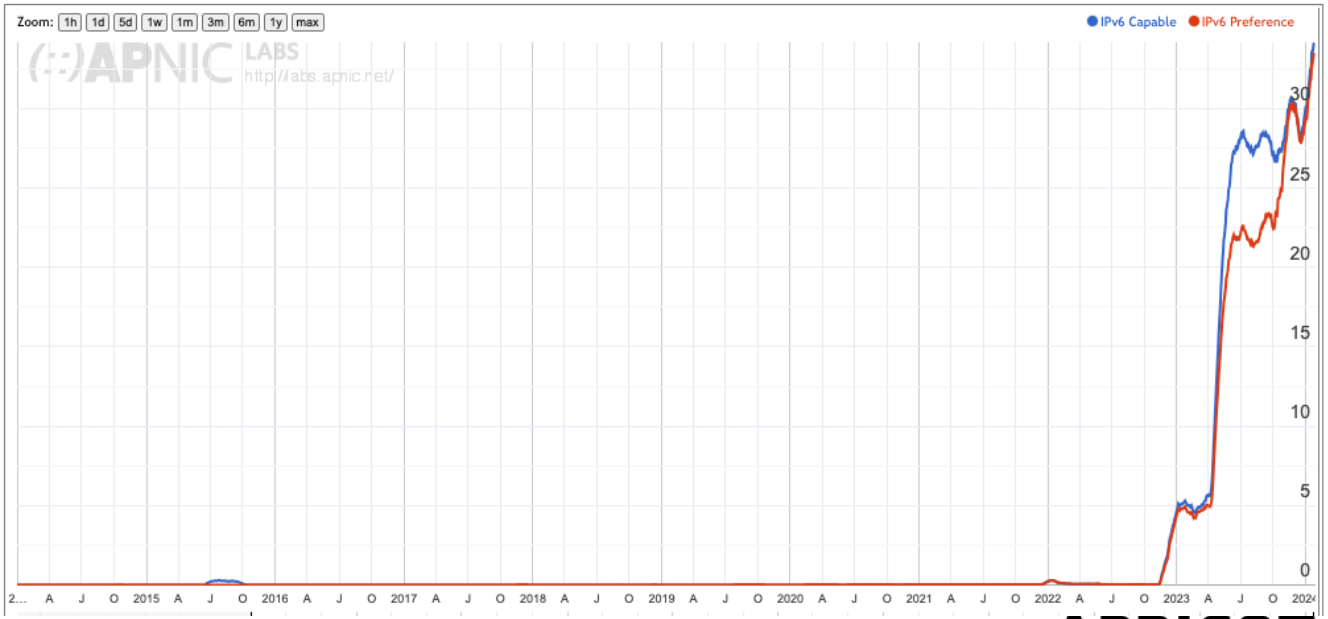
IPv6 in Japan

Use of IPv6 for Japan (JP)



IPv6 in Mongolia

Use of IPv6 for Mongolia (MN)



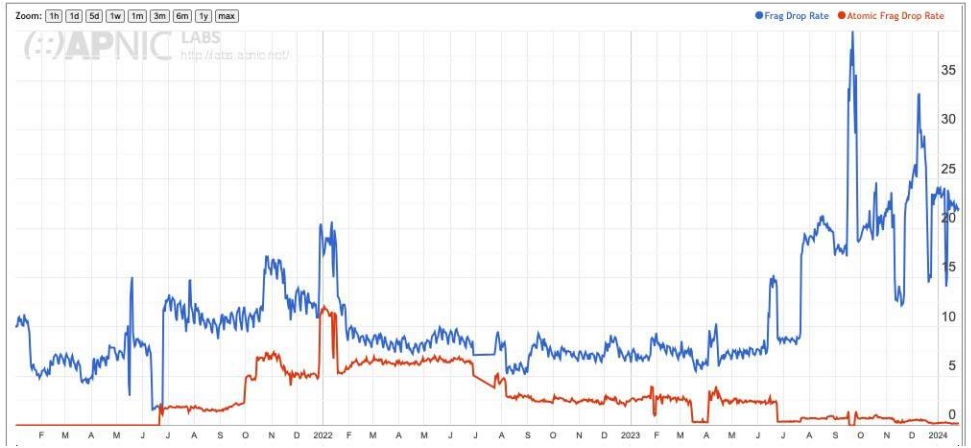
Where are we with IPv6?

- It's still a piecemeal picture:
  - IPv6 is well established in India, France, Germany, Malaysia, Saudi Arabia, US, Uruguay and Vietnam
  - Scant deployments in Africa, the Middle East, Eastern and Southern Europe
- There is no common sense of urgency driving IPv6 deployment:
  - Overall growth rates appear to have slowed down (market saturation?) which means that existing IPv4/NAT networks are under no immediate pressure to change
  - IPv6 deployment in 2024 appears to be generally following equipment lifecycles if service networks

There are still unresolved IPv6 Issues

- IPv6 Fragmentation support, and the more general case of Extension Header support
  - We can live without IPv6 extension headers in the public Internet, with the exception of the IPv6 Fragmentation header

Use of V6FRAG Drop Rate for World (XA)



There are still active IPv6 Issues

- DHCP6 vs RA
- ULAs and various permutations of private addresses and address translation
- Happy Eyeballs behaviour
- Use of IPv6 as a transport for DNS queries/responses

Dual Stack was not meant to be the end point!

- The entire aim of the transition of the Internet from IPv4 to to Dual Stack was **not** meant to see a generally ubiquitous IPv4 + IPv6 Dual Stack environment
- Once a “critical mass” of Dual Stack deployment has been reached, it’s then viable to drop IPv4 support
- It might be taking us some time to get to this “critical mass” deployment scenario, but once this threshold has been achieved, then the next step of discarding IPv4 support is likely to be a lot faster

Thanks!

2024 APRICOT APNIC 57

BANGKOK, THAILAND

21 February – 1 March 2024

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