

IPv6

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Motivation for IPv6

- IPv4 address space limitation
 - In 1994, the *IETF Address Lifetime Expectation* working group projected IPv4 address exhaustion sometime between 2005 and 2011 based on the available statistics
- RFC 1883, “Internet Protocol, Version 6 (IPv6) Specification” was published in 1995
 - The core set of IPv6 protocols became an IETF Draft Standard on August 10, 1998. This included RFC 2460, which obsoleted RFC 1883
 - IPv6 finally became an Internet Standard in July 2017 (RFC 8200) – really nothing changes, combined version of RFC 2460 along with other relevant RFCs and Errata

Questa DWR80 DISPOSITIVO HA BISOGNO DI UN WORKAROUND PER NON PERDERE 32 BIT PER IPv6

a DRAFT
a PROPOSED
a STANDARD

Motivation for IPv6

- IPv4 address space depletion (theoretical limit: 4.3 billions addresses)

- Fast growth of Internet users (much faster than projected)
- Inefficient allocation (also because of the IPv4 address space hierarchical organization)

- Why then IPv6 is not yet "the" current Internet protocol? Because of IPv4 "patches"

multicast support

PRIMA DAZZO

FIXED →

- Variable Length Subnet Mask (VLSM) and Classless Interdomain Routing (CIDR)

*costo di gestione di entrate, le code-up
e l'implementazione in hardware, se cambia*

- Network Address Translation (NAT)

le code-up, cambia il hardware

Motivation for IPv6



WORLD INTERNET USAGE AND POPULATION STATISTICS 2021 Year-Q1 Estimates

World Regions	Population (2021 Est.)	Population % of World	Internet Users 31 Mar 2021	Penetration Rate (% Pop.)	Growth 2000-2021	Internet World %
<u>Asia</u>	4,327,333,821	54.9 %	2,762,187,516	63.8 %	2,316.5 %	53.4 %
<u>Europe</u>	835,817,920	10.6 %	736,995,638	88.2 %	601.3 %	14.3 %
<u>Africa</u>	1,373,486,514	17.4 %	594,008,009	43.2 %	13,058 %	11.5 %
<u>Latin America / Carib.</u>	659,743,522	8.4 %	498,437,116	75.6 %	2,658.5 %	9.6 %
<u>North America</u>	370,322,393	4.7 %	347,916,627	93.9 %	221.9 %	6.7 %
<u>Middle East</u>	265,587,661	3.4 %	198,850,130	74.9 %	5,953.6 %	3.9 %
<u>Oceania / Australia</u>	43,473,756	0.6 %	30,385,571	69.9 %	298.7 %	0.6 %
<u>WORLD TOTAL</u>	7,875,765,587	100.0 %	5,168,780,607	65.6 %	1,331.9 %	100.0 %

Source: <http://www.internetworldstats.com/stats.htm>

Motivation for IPv6

- Not only more users, but also more devices per user
 - “The other [milestone] is the growing demand for Internet addresses to be assigned to mobiles, set-top boxes, automobiles, and literally tens of billions of other programmable devices. This is the so-called ***Internet of Things***” – Vint Cerf, Internet Pioneer
 - Always-on access
 - Applications that are difficult, expensive or impossible to operate through NAT
 - IP telephony, peer-to-peer gaming, ...
- NETWORK ENGINES
 ARE PRESENT IN
 DISAGREEMENT DOWN
 FIRST CENTER FOR RESEARCH
 IN INFORMATICS

Motivation for IPv6



- IPv4 address space top-level depletion already happened!

COMPUTERWORLD

ISP hanno a mano esaurito il uso
di us wdm 220 e associato da/

Home > Internet

News

Address allocation kicks off IPv4 endgame

By Stephen Lawson

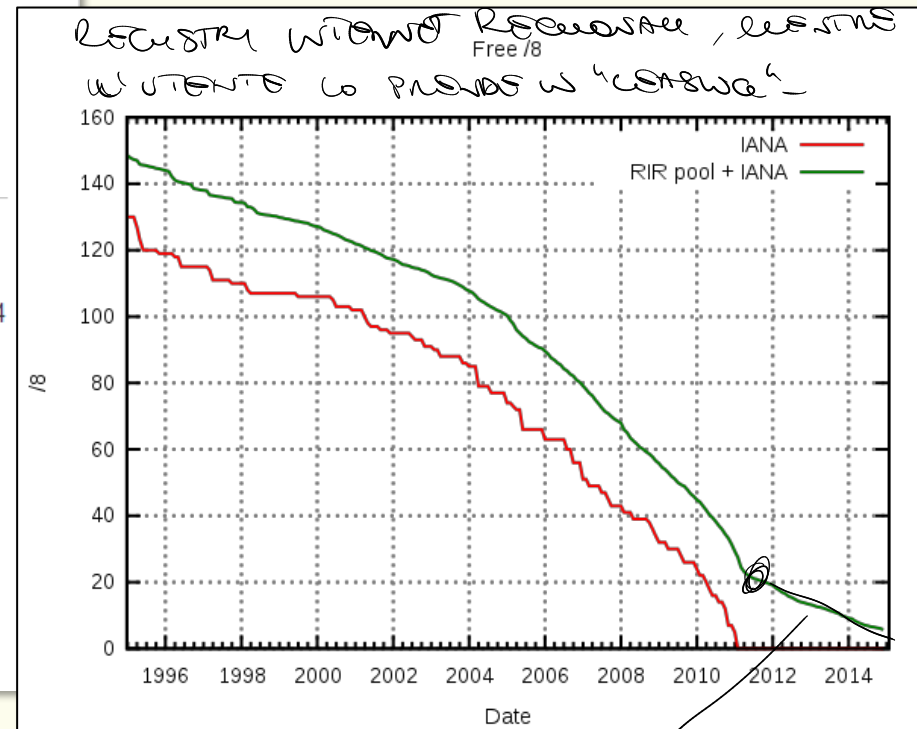
January 31, 2011 07:04 PM ET [Add a comment](#)

IDG News Service - The Internet Assigned Numbers Authority has assigned two large blocks of IPv4 addresses to the Asia-Pacific Network Information Centre, activating a rule under which the agency will give out the last of its IPv4 addresses.

The rule states that when only five large blocks of IP addresses remain, one will be handed out to each of the world's five regional Internet registries. With the latest allocation to APNIC, the number of remaining IP address blocks is down to five.

IANA is expected to assign the remaining blocks within a matter of days or less. After that, the regional bodies will have no higher source of addresses to turn to when they have assigned the addresses they hold.

Source: http://en.wikipedia.org/wiki/IPv4_address_exhaustion



Reserve Address as per ATTACHED

Motivation for IPv6



- IPv4 address space exhausted!

already

<https://www.ripe.net/publications/news/about-ripe-ncc-and-ripe/the-ripe-ncc-has-run-out-of-ipv4-addresses>



Today, at 15:35, we made our final /22 IPv4 allocation from the last remaining addresses in our available pool. We have now run out of IPv4 addresses.

Read our full announcement here:
[ripe.net/publications/n...](https://www.ripe.net/publications/news/about-ripe-ncc-and-ripe/the-ripe-ncc-has-run-out-of-ipv4-addresses)

In the picture, the Registration Services team at the RIPE NCC

Traduci il Tweet



3:50 PM · 25 nov 2019 · Hootsuite Inc.

Home > Internet

News

Address allocation kicks off IPv6

By Stephen Lawson

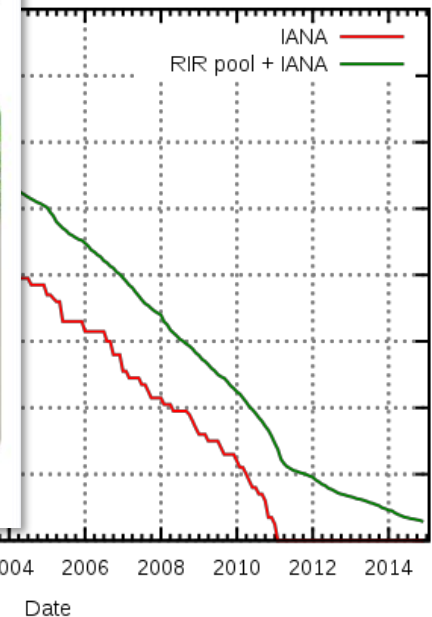
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free /8



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IPv4 address market

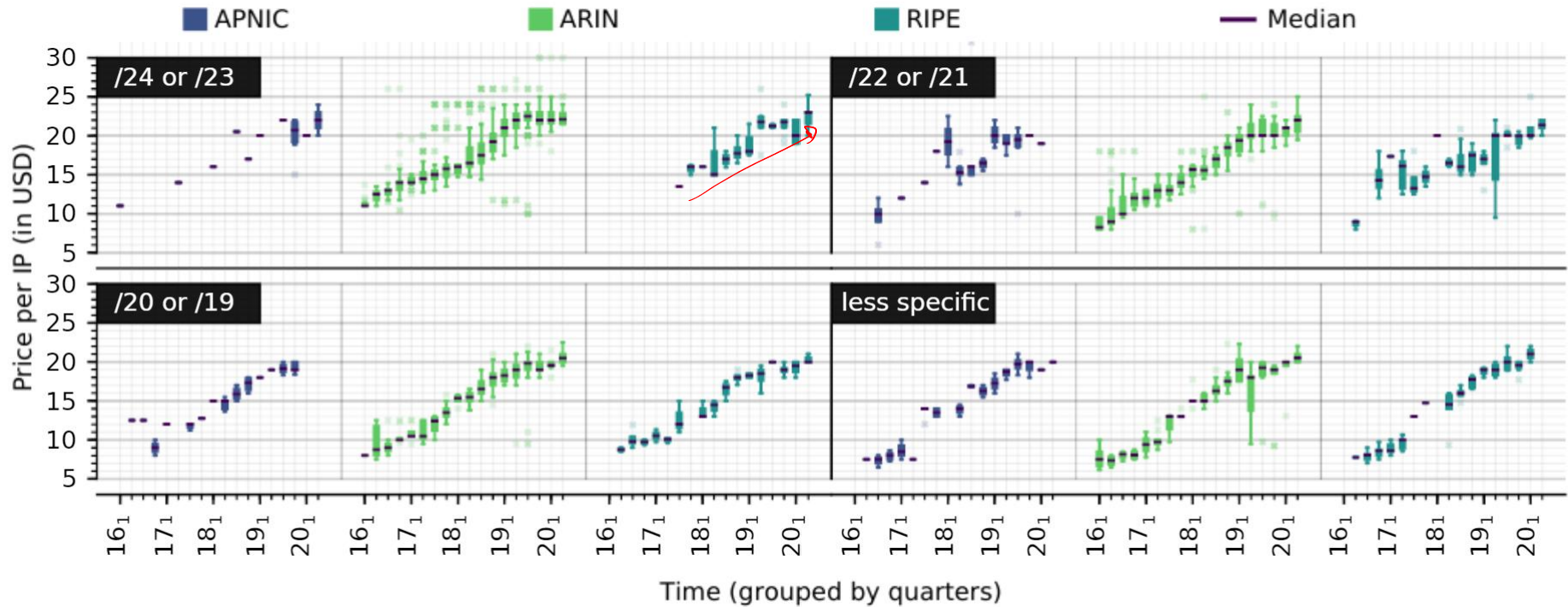
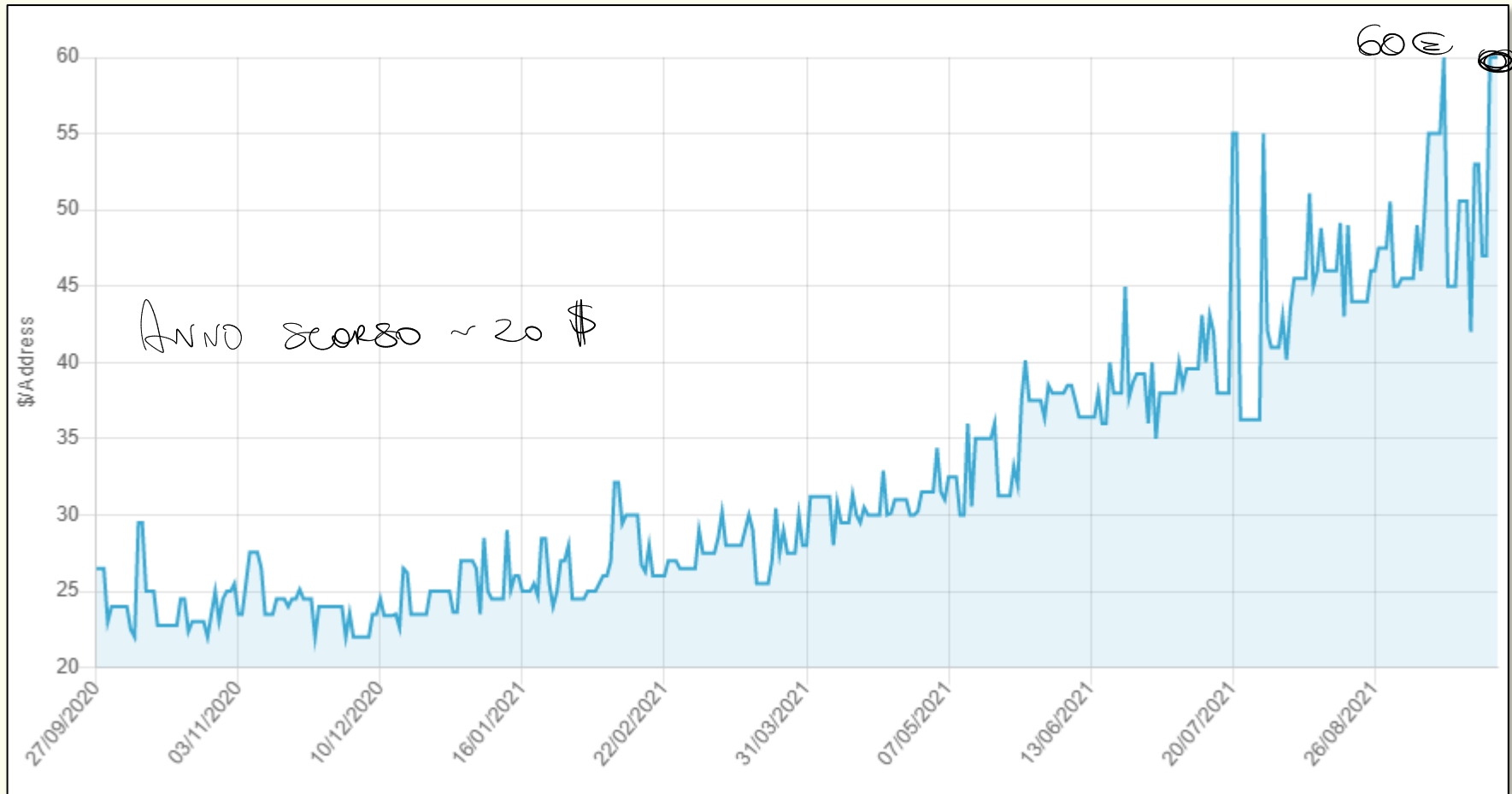


Figure 1: Evolution of Price per IP based on prefix size and region.

Source: [When wells run dry: the 2020 IPv4 address market | CoNEXT 2020](#)

IPv4 address market

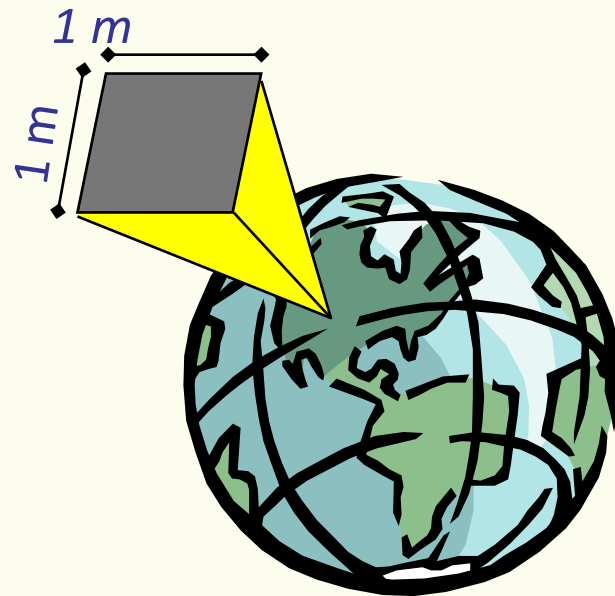


[IPv4 Address Pricing - Previous IP Address Auction Sales Data | IPv4.Global](https://www.ipv4.global/)

Motivation for IPv6

- IPv6 address space
 - 2^{128} → Dimensione spazio indirizzi IPv6 = 340.282.366.920.938.463.463.374.607.431.768.211.456
 - 340 trillion trillion trillion (i.e. $\sim 340 \times 10^{36}$)

- About 6.65×10^{23} addresses per square meter on earth (including waters)



Motivation for IPv6

Not only address space extension, but also

- **Autoconfiguration**

→ now it's possible to have per configuration a state_

IPv6 now it's seen as a stateless_

DSUO SPASO DECU

WDIRU1

8) CONFIGURAZIONE SQUA_

 - Purely **stateless** (!!!)
 - A must for Future Internet systems like IoT
- **Simplification of the header format**
 - **Fixed length** → faster processing
- **Improved support for options and extensions**
 - Information carried **only when needed**
 - **Open and extensible**

DIFFERENZE ON PROTOCOLLO ESISTENTE E PER

SCENARI FUTURI ANCORA NON PREVISTI

IPv6 today



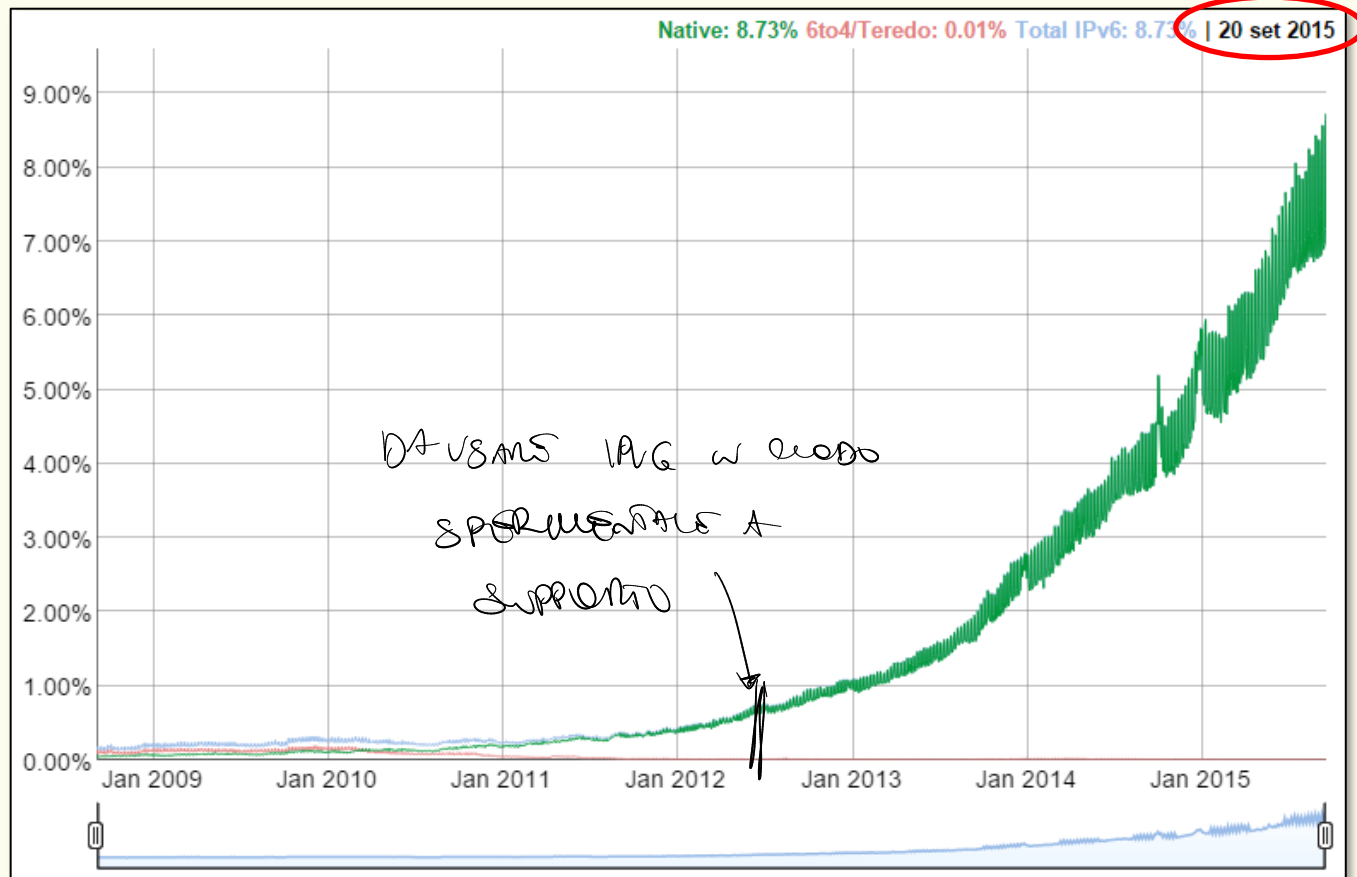
- IPv6 deployment has started systematically
- World IPv6 Launch on June 6, 2012
 - Major Internet Service Providers (ISPs), home networking equipment manufacturers, and web companies around the world were involved (updated statistics available at <http://www.worldipv6launch.org/>)
- [Despite this, many popular services are still not reachable via IPv6: see [IPv6 Status of Alexa 500 Websites](#)]



IPv6 today



- Percentage of users that access Google over IPv6

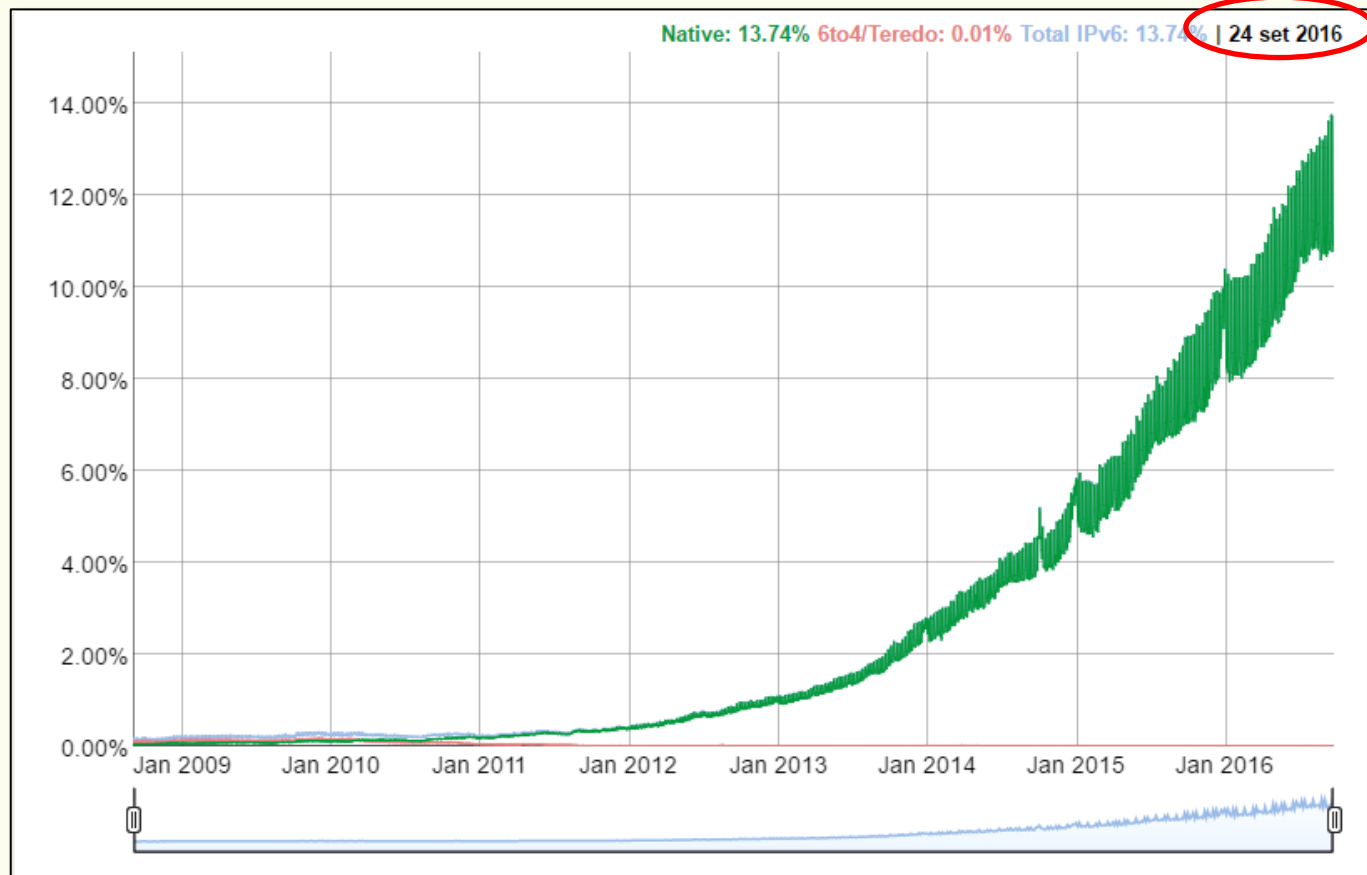


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IPv6 today



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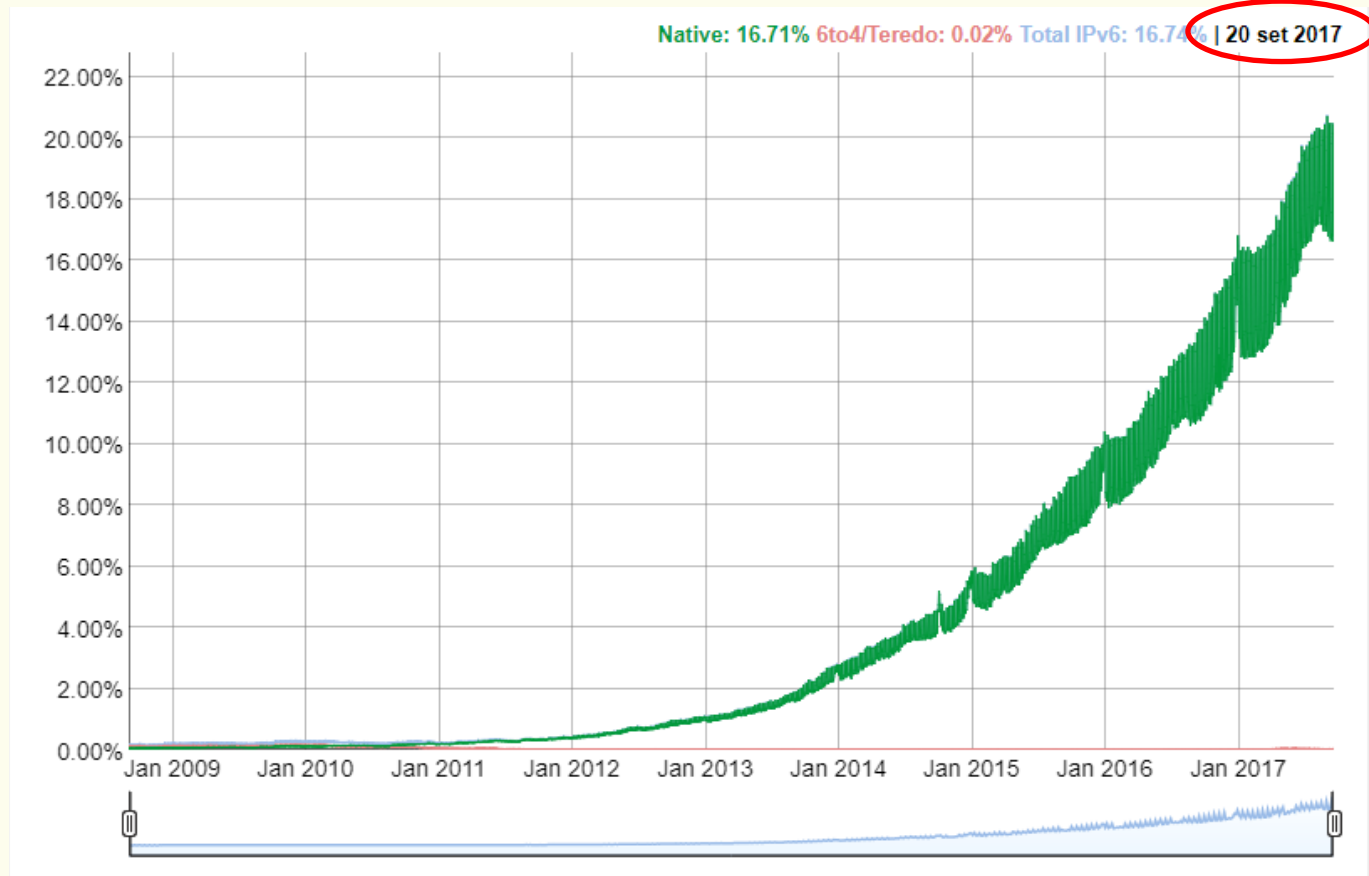


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IPv6 today



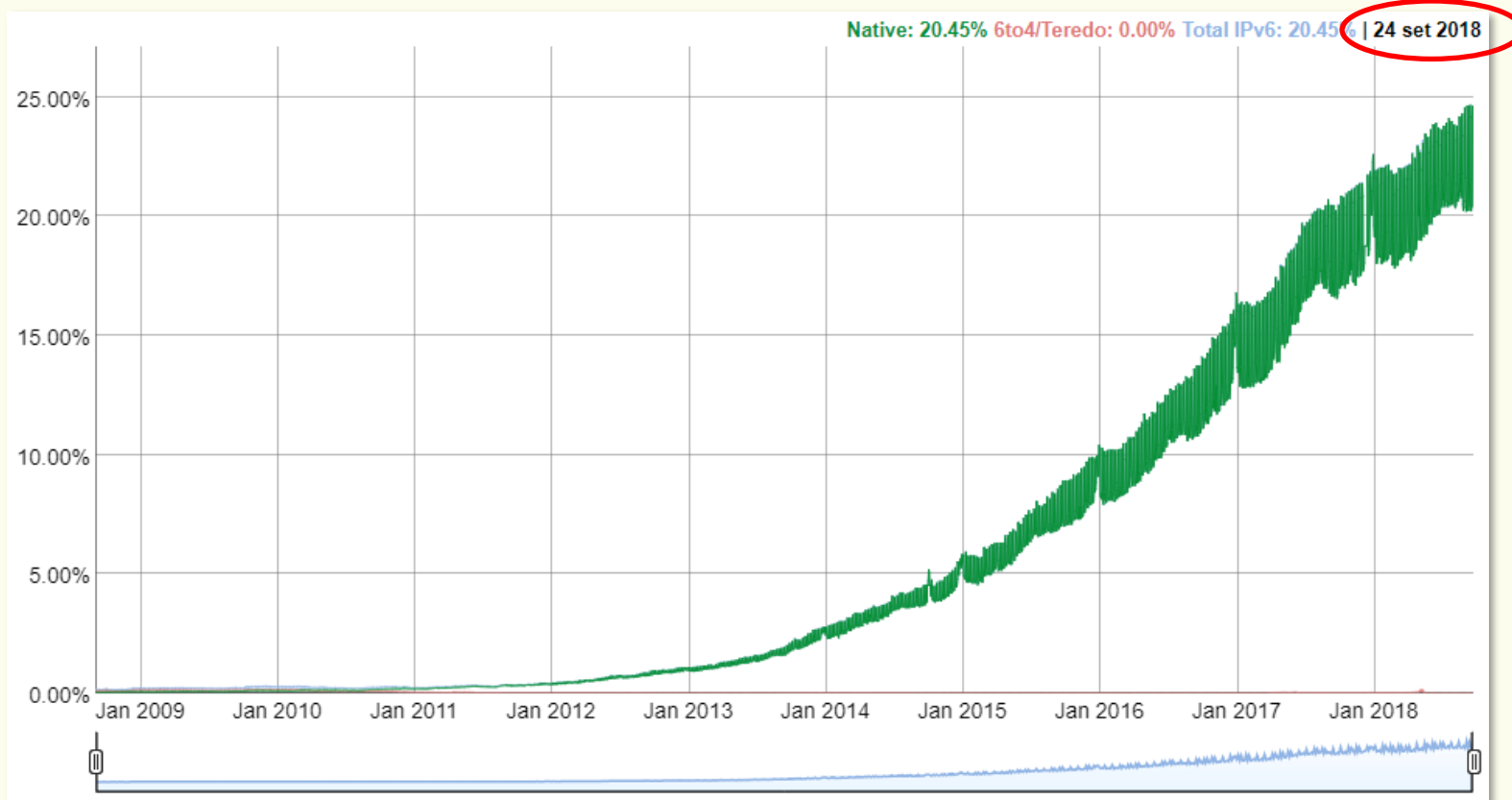
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IPv6 today

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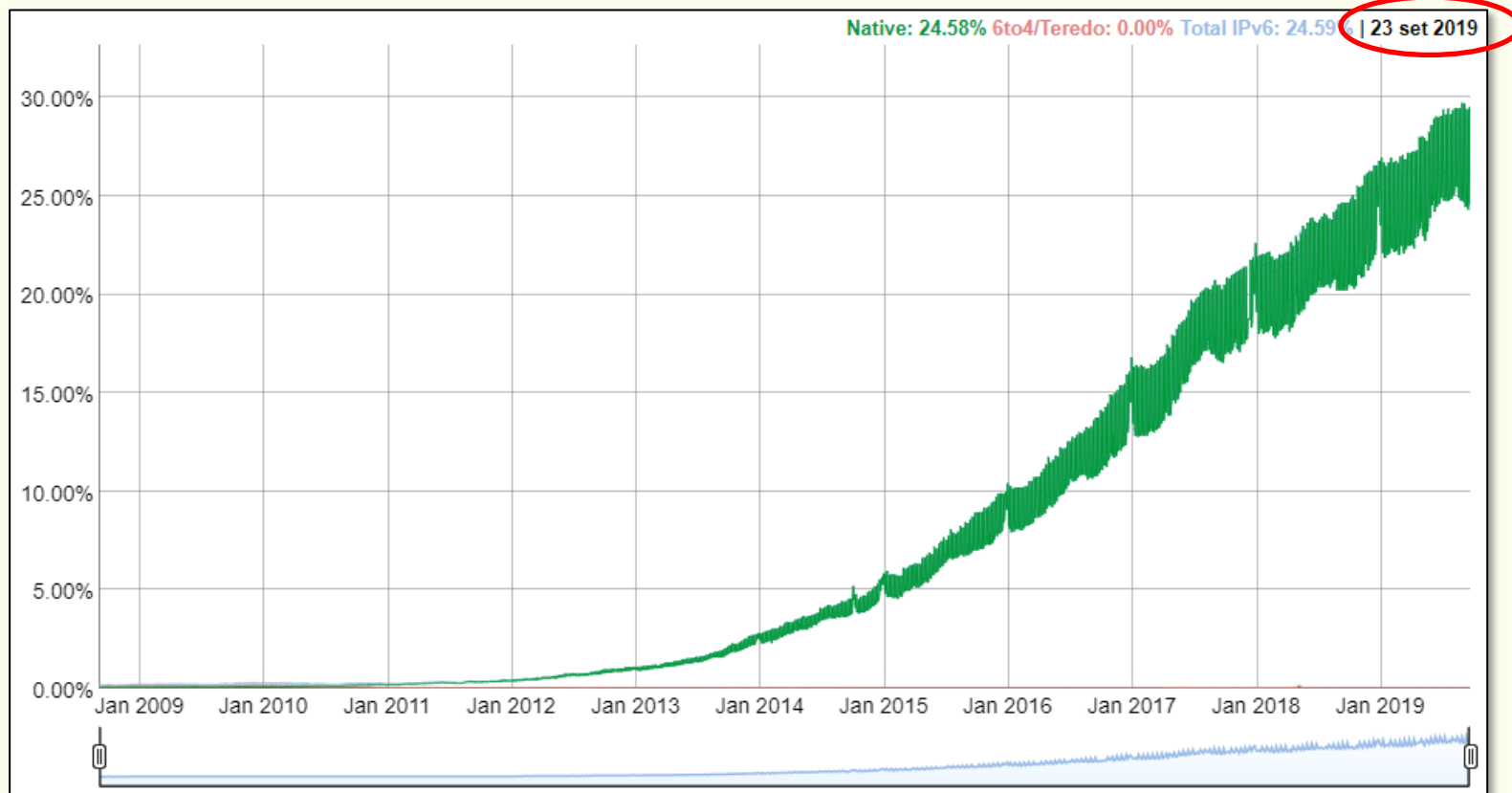


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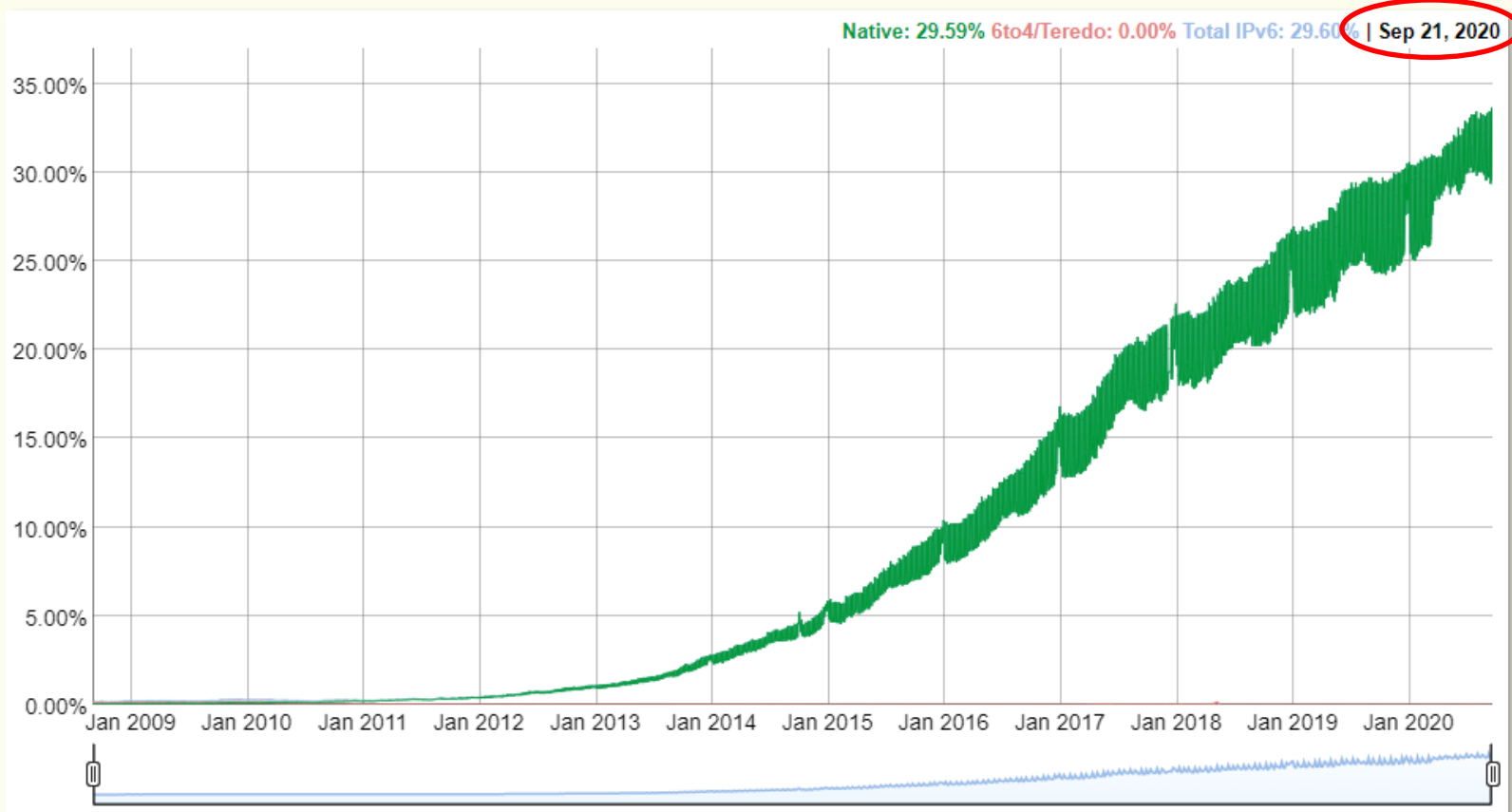


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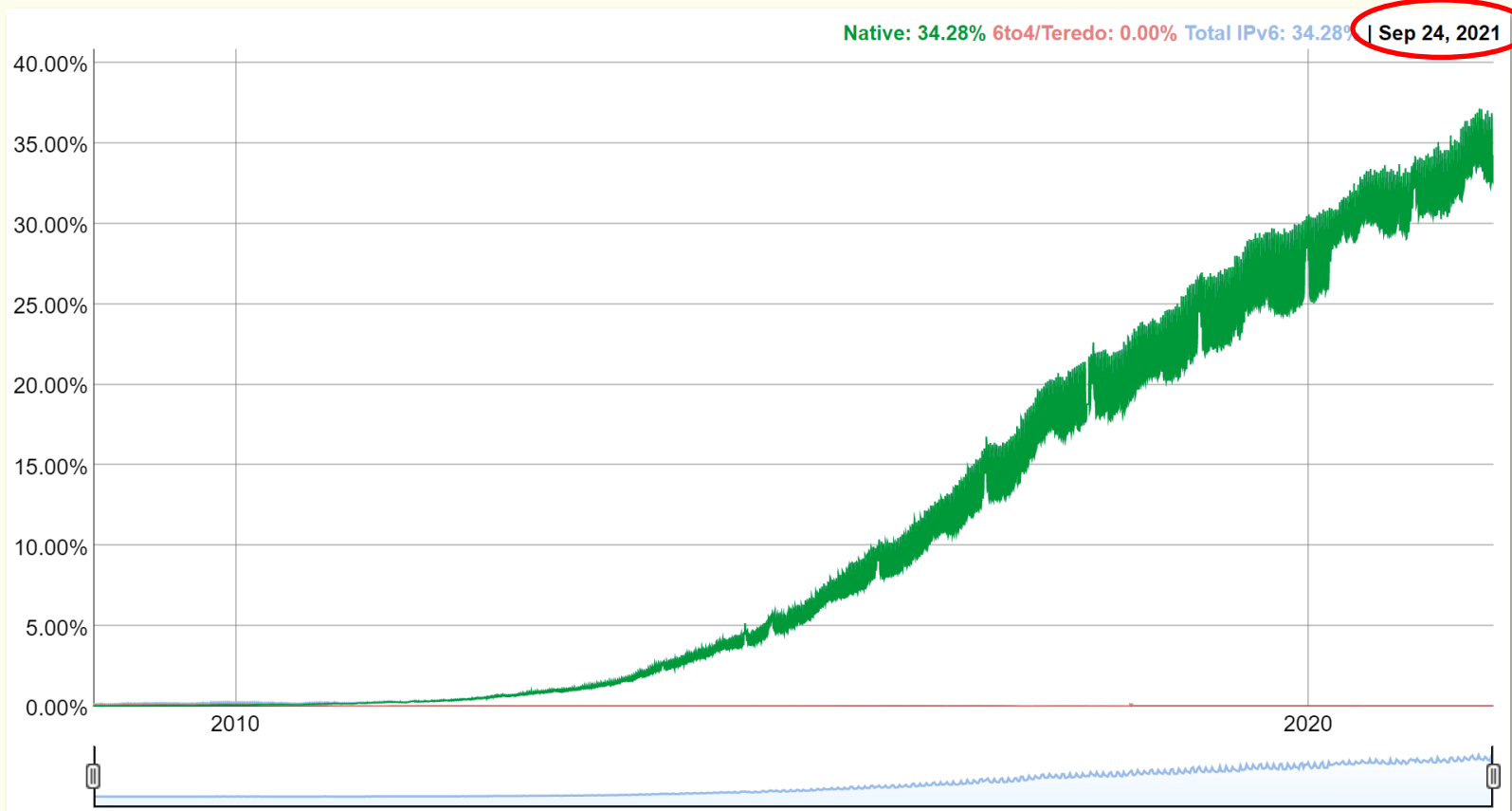


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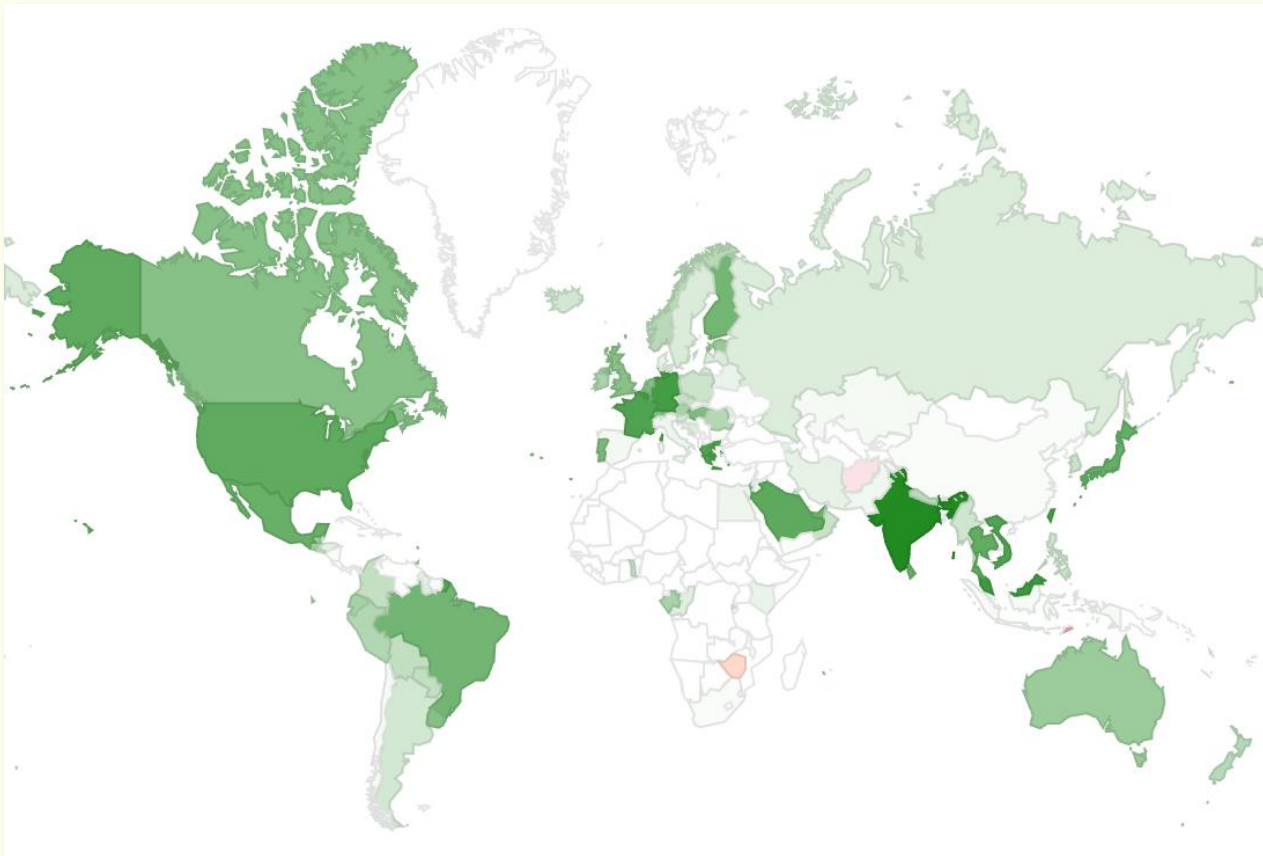


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IPv6 today



- Per-country IPv6 adoption



Source: <http://www.google.com/ipv6/statistics.html>