IPv6

The Internet's Best Kept Secret

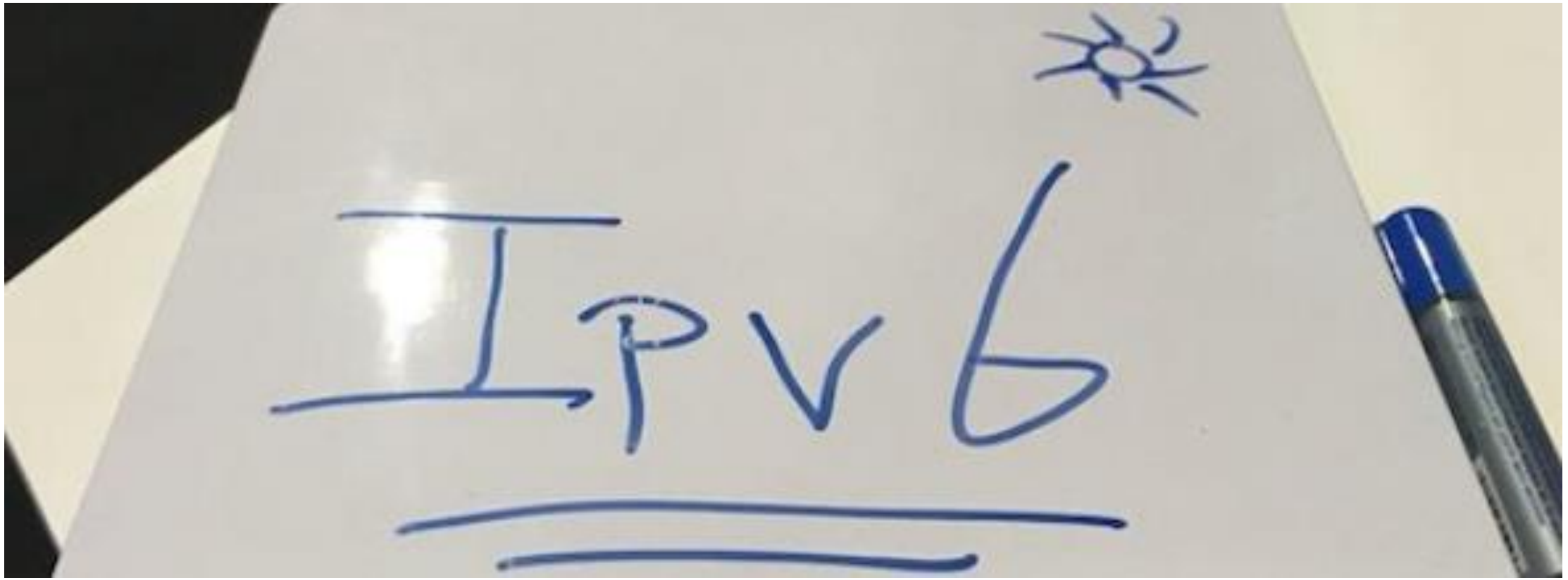
Nicole Wajer – Chief Stroopwafel Officer


The
fututure
is here!!!
IPv6

How is IPv6 like Broccoli ?

Nicole

Don't Panic: Welcome to the Galaxy of IPv6



The Answer to Life, the Universe, and Everything (But Nobody's Using It)

APNIC

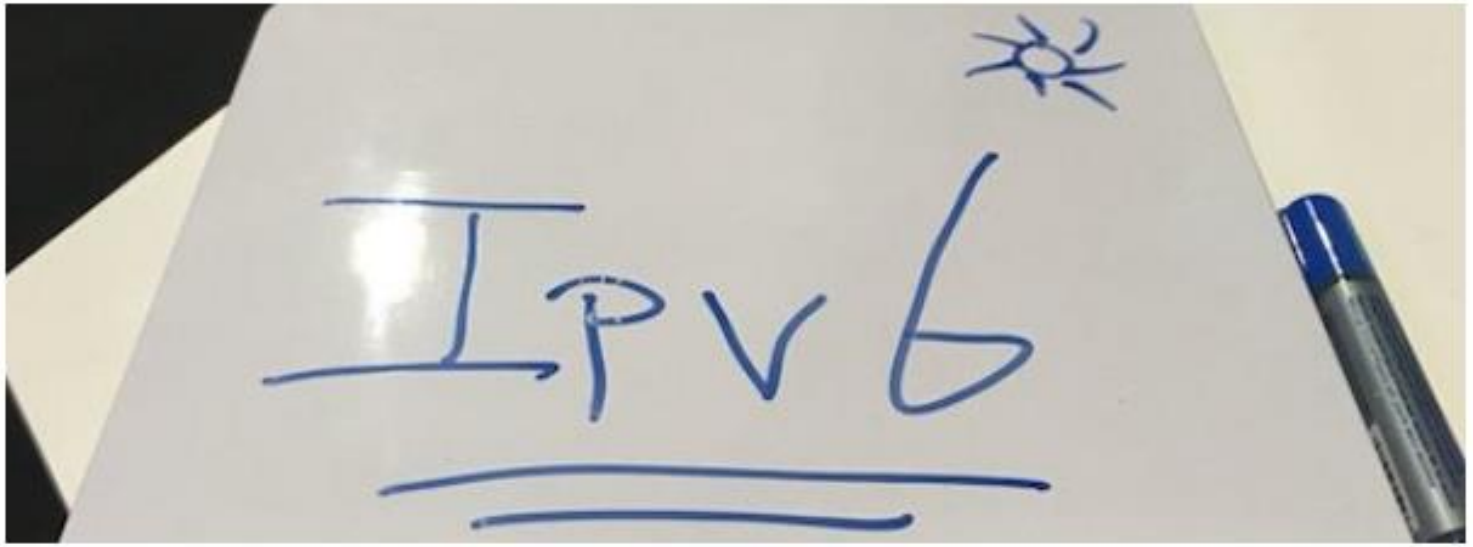
Get IP ▾ Manage IP ▾ Training ▾ Events ▾ Insights ▾ Community ▾ Blog

IPv6? Nobody uses IPv6

By Nicole Wajer on 4 Sep 2018

Categories: Development Tech matters

Tags: enterprise, Guest Post, IPv6

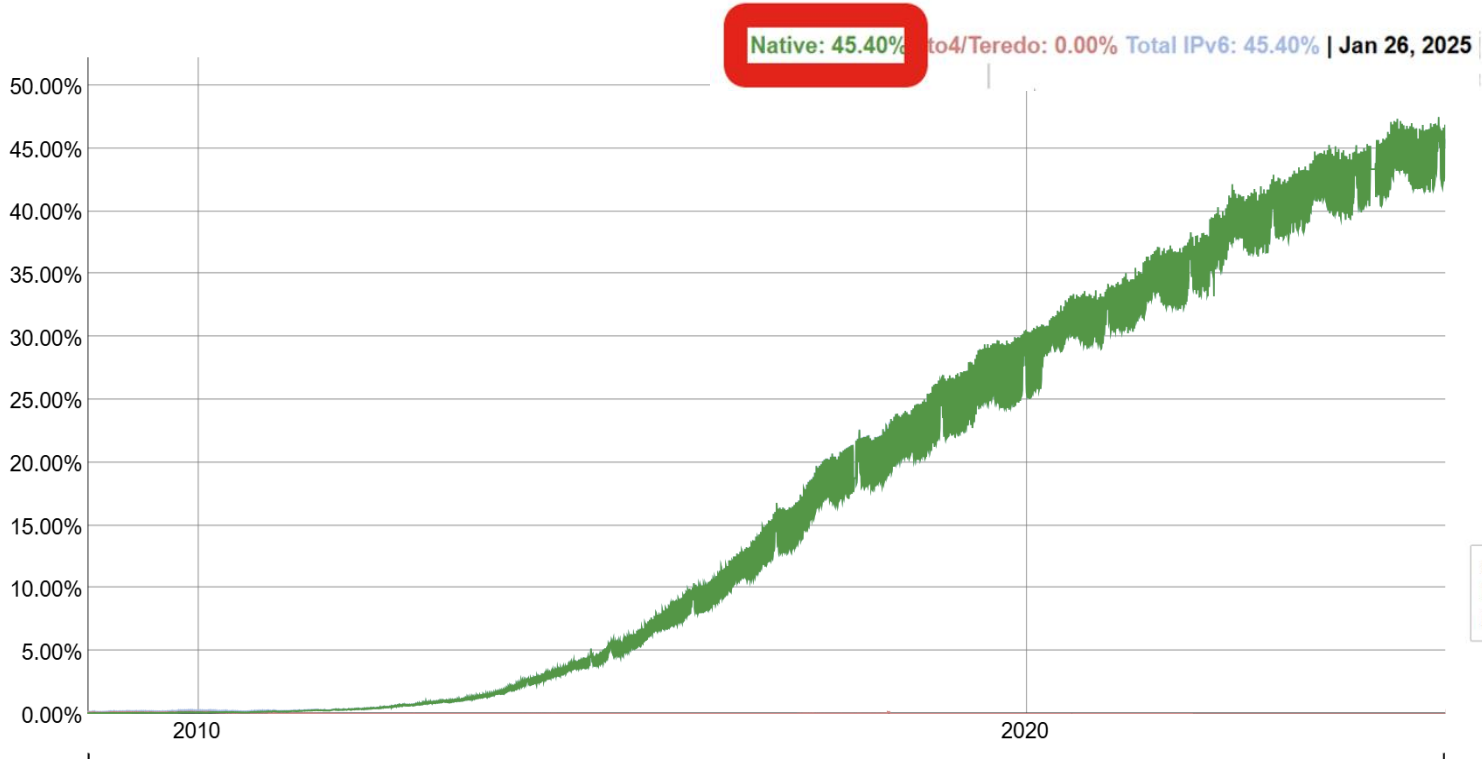



This doesn't scale. I want everything connected
I don't need IPv6! I have NAT!

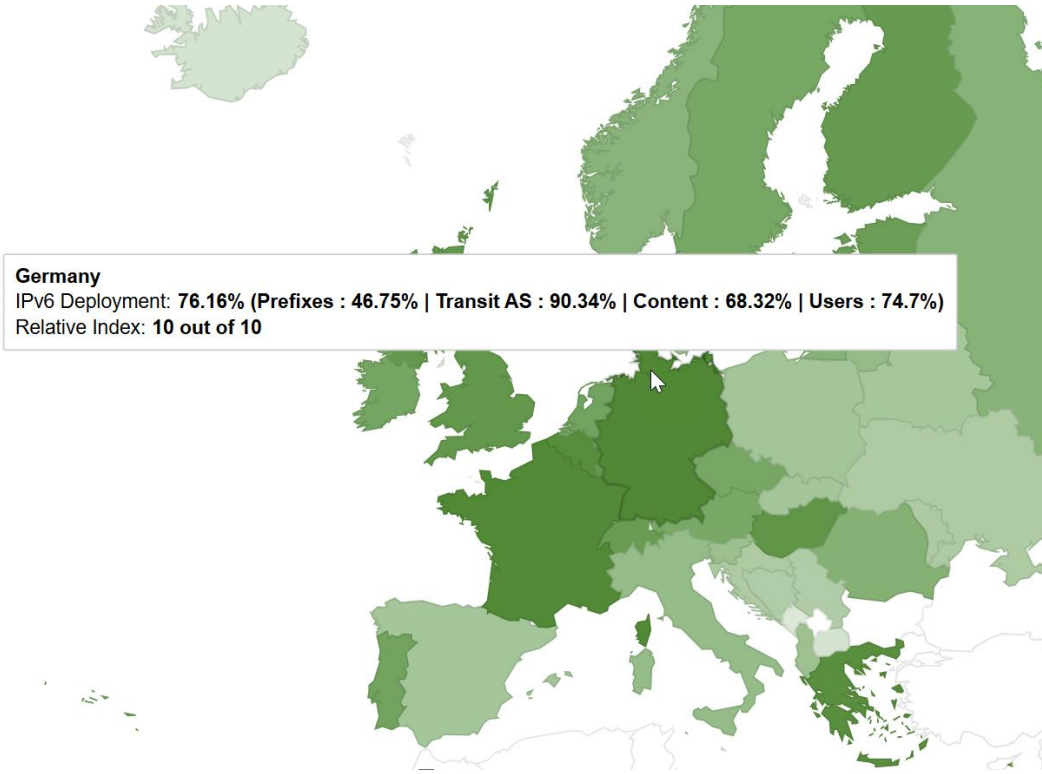
The Vogons of the Internet: Understanding IPv4 vs IPv6

Two-Headed Beast: IPv6 Adoption in Enterprises vs. the Rest of the Galaxy

IPv6 Adoption

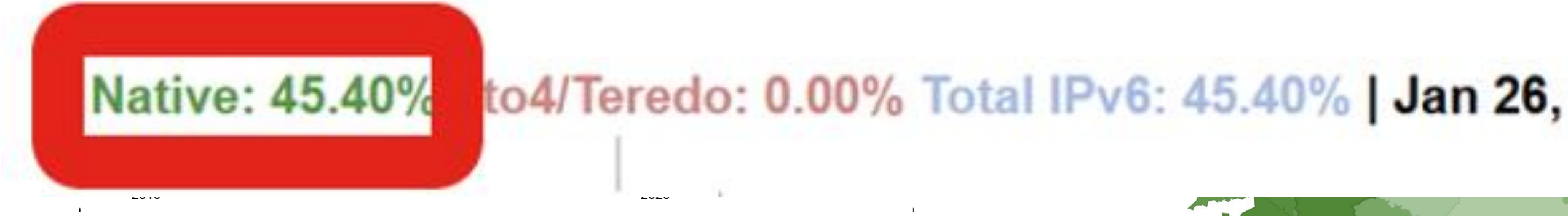


Source: https://www.google.com/intl/en/ipv6/statistics.html



Source: https://6lab.cisco.com

IPv6 Adoption



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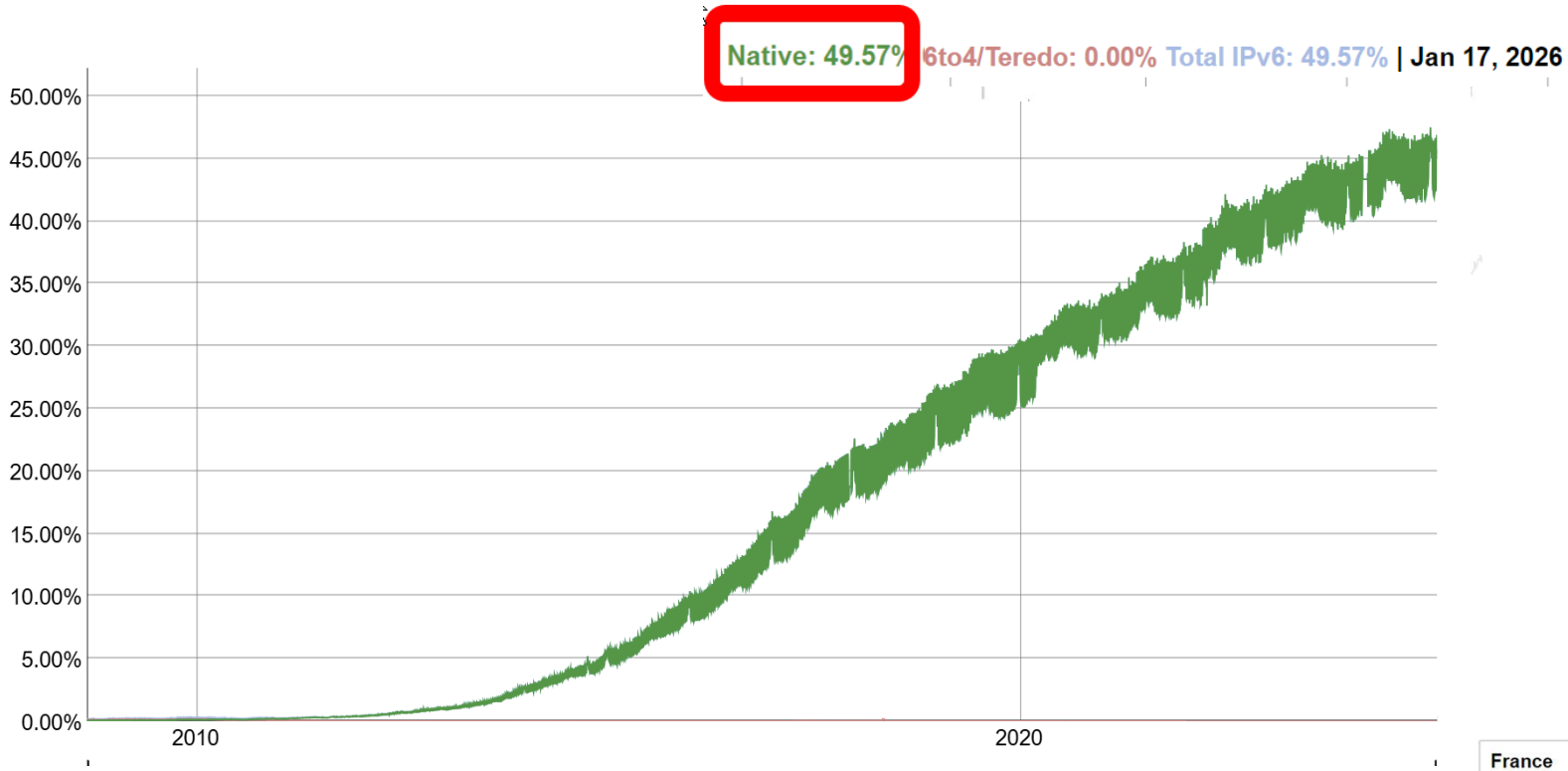
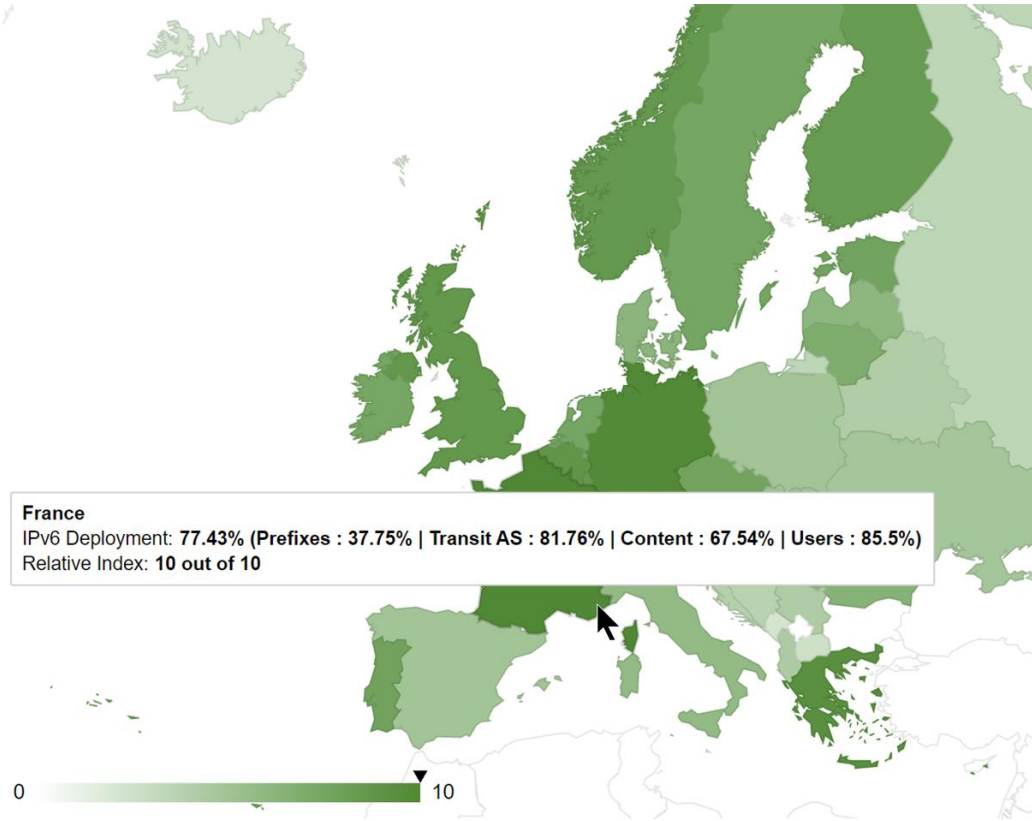
Source: https://6lab.cisco.com

IPv6 Adoption



Source: https://www.google.com/intl/en/ipv6/statistics.html



Source: https://6lab.cisco.com

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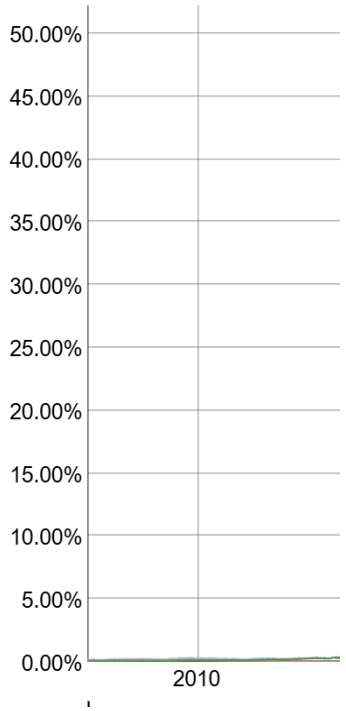
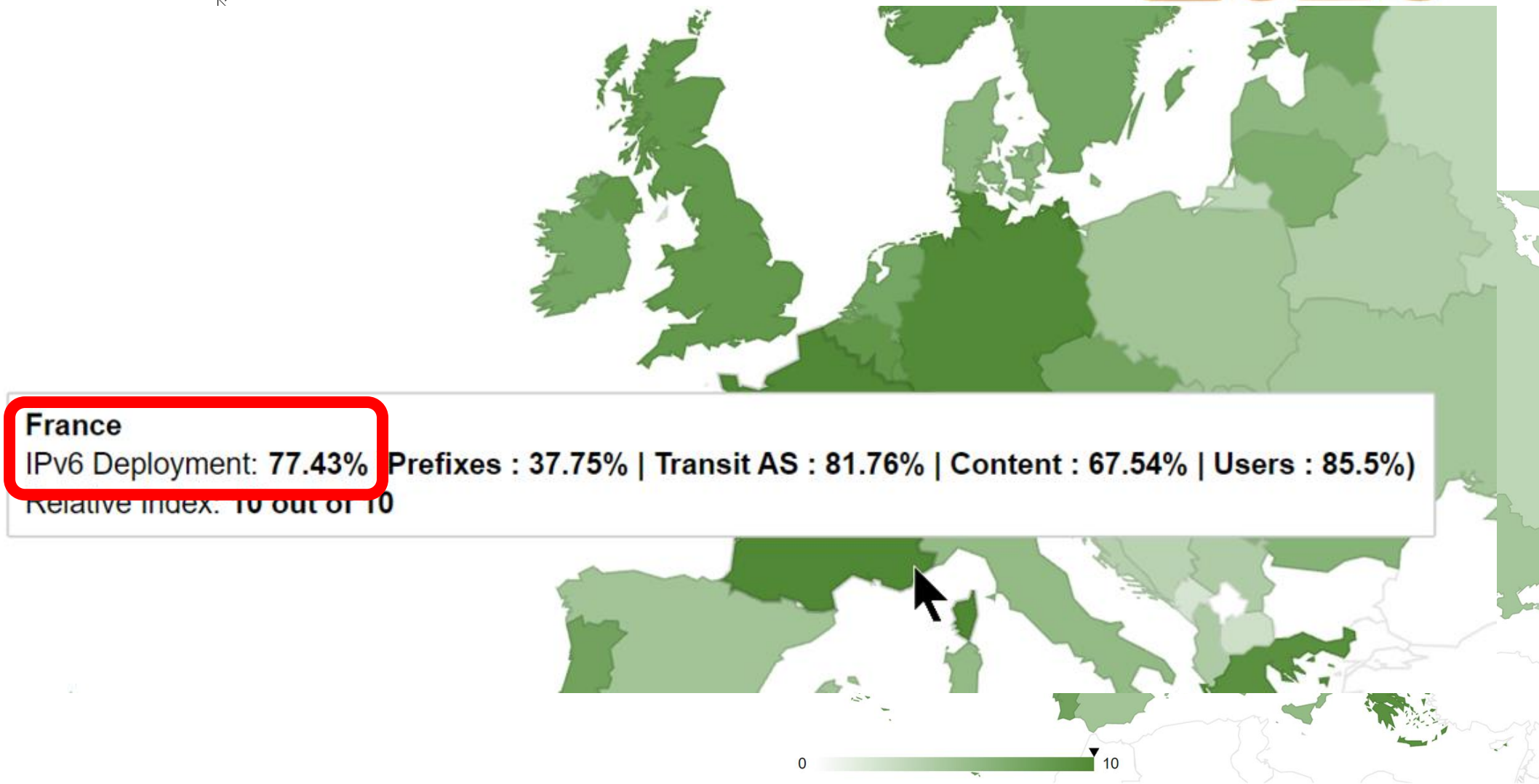
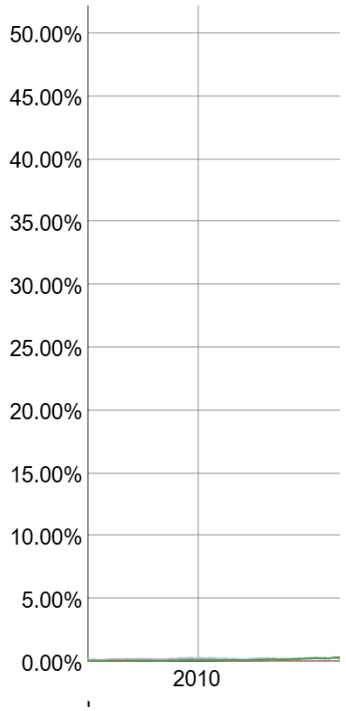
IPv6 Adoption

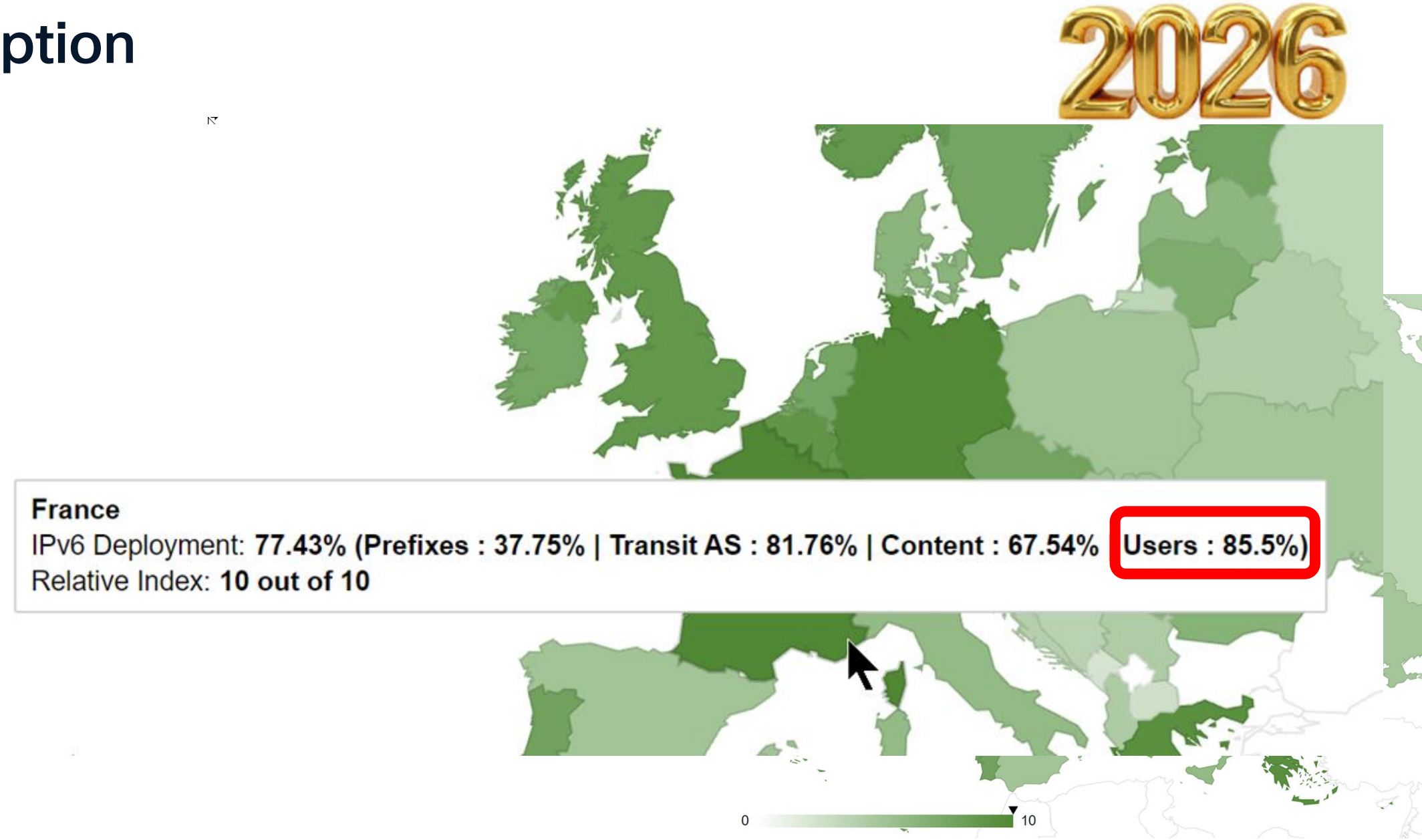




Source: https://6lab.cisco.com

IPv6 Adoption





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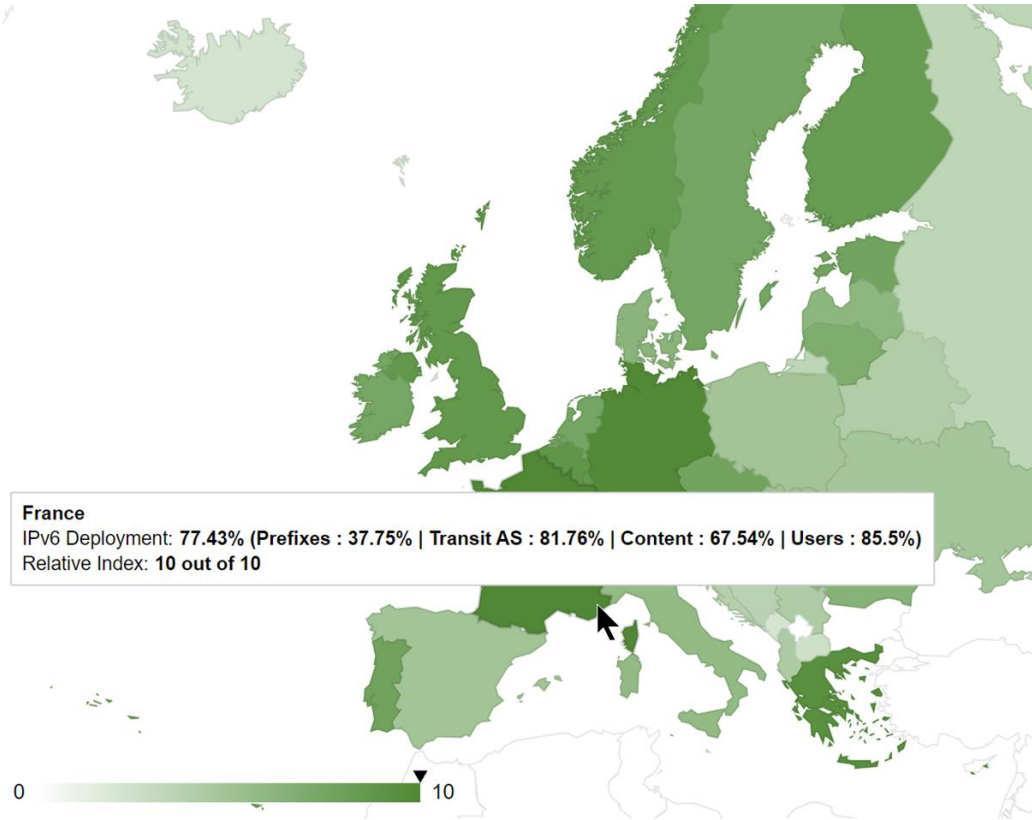
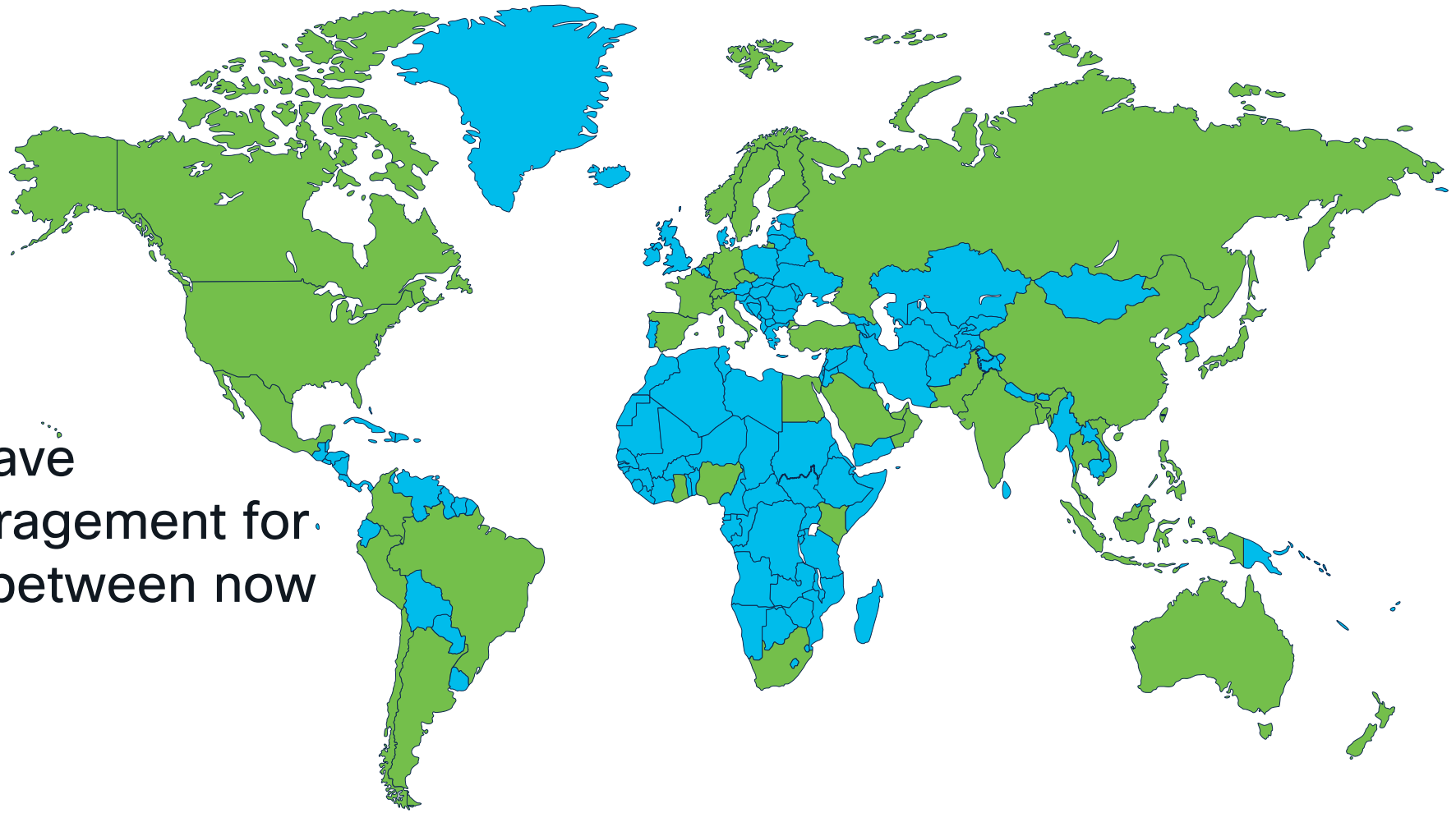


Source: https://6lab.cisco.com

Country “Mandates”

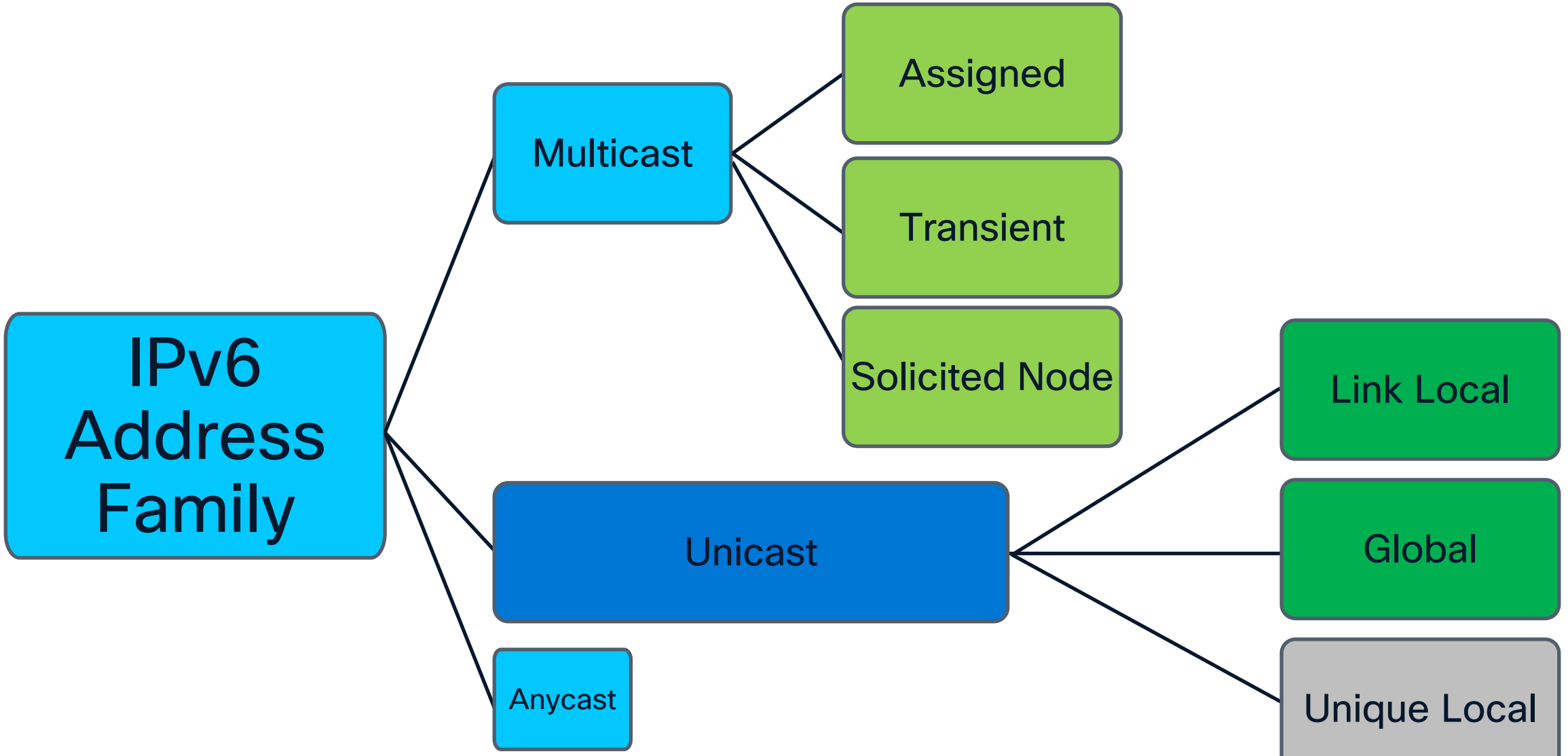


50+ countries have mandate/encouragement for IPv6/IPv6-only between now and 2030+.

- No Mandate
- With Mandate

128 Bits if Addressing

IPv6 Addressing



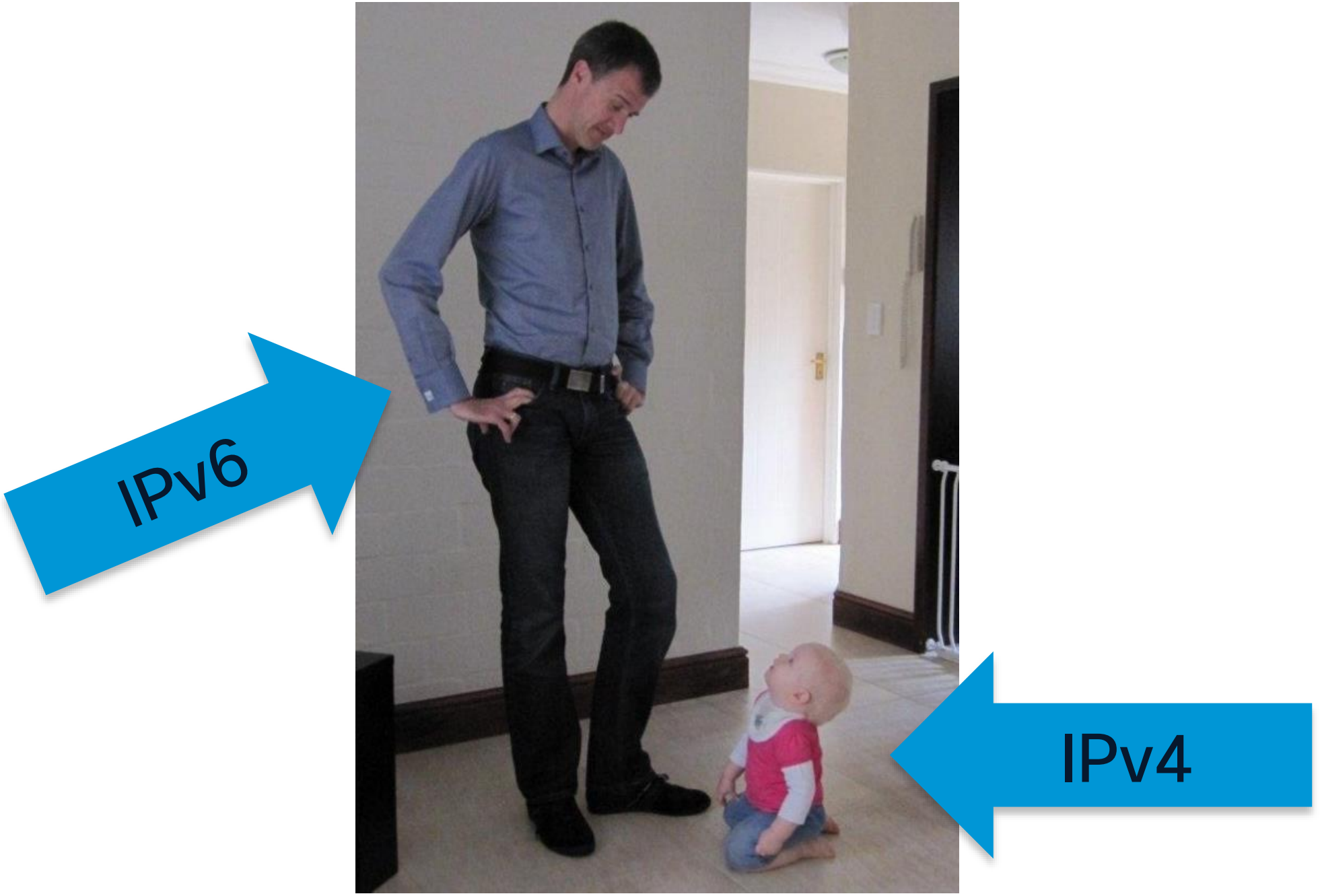
IPv6 Address rules (RFC 5952)

Lower case, suppress leading / compress consecutive zeros

2001:0db8:0046:a1d1:0000:0000:0000:0001

2001:db8:46:a1d1:0:0:0:1

2001:db8:46:a1d1::1



Different things I can do with IPv6

1. Expose every container with a public IPv6 address

2. Spin up 10M containers every second

3. Burn the address with the container !!

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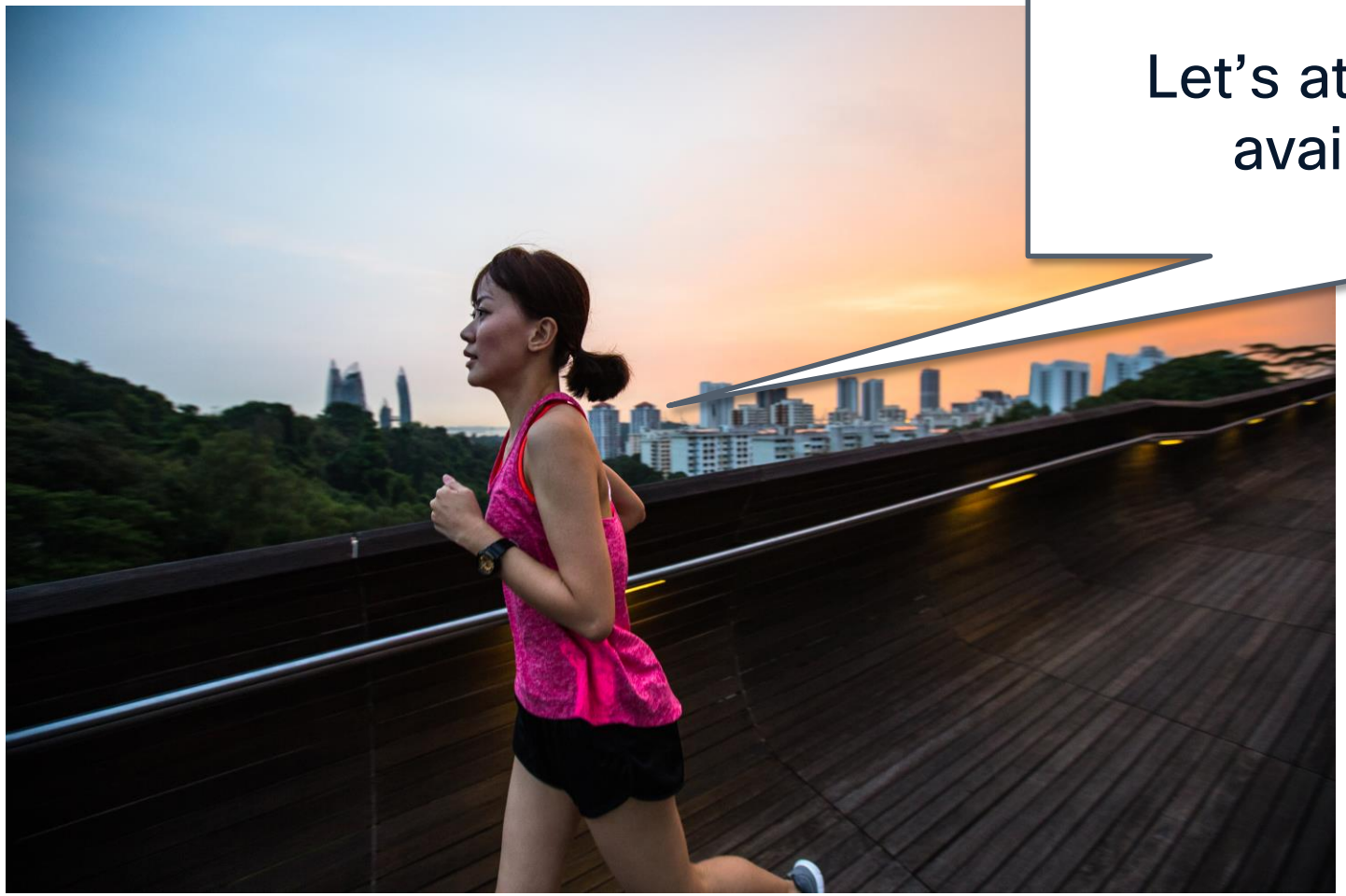
Depleting a /64

Prefix of /64 has
18,446,744,073,709,600,000
IPv6 addresses

Depleting a /64



Let’s attempt to exhaust all the available IPv6 addresses

Depleting a /64

We allocate 10,000,000 addresses per second

There are 31,536,000 seconds per year

315,360,000,000,000 addresses per year

Depleting a /64

We allo
10,000
address
seco

There
31,536,000
per y

315,360,000
addresses

Depleting a /64

$$\frac{18,446,744,073,709,600,000}{315,360,000,000,000}$$

Depleting a /64

58,494 year


We allocate a /48 to a Data Centre Network
Prefix of /64? We need to Scale!

Depleting a /48

A /48 contains 65,536 /64's

It takes 58,494 years to deplete a /64 at 10M addresses per second

315,360,000,000,000 addresses per year

Depleting a /48

65,536 x 58,494

Depleting a /48

3.8B years

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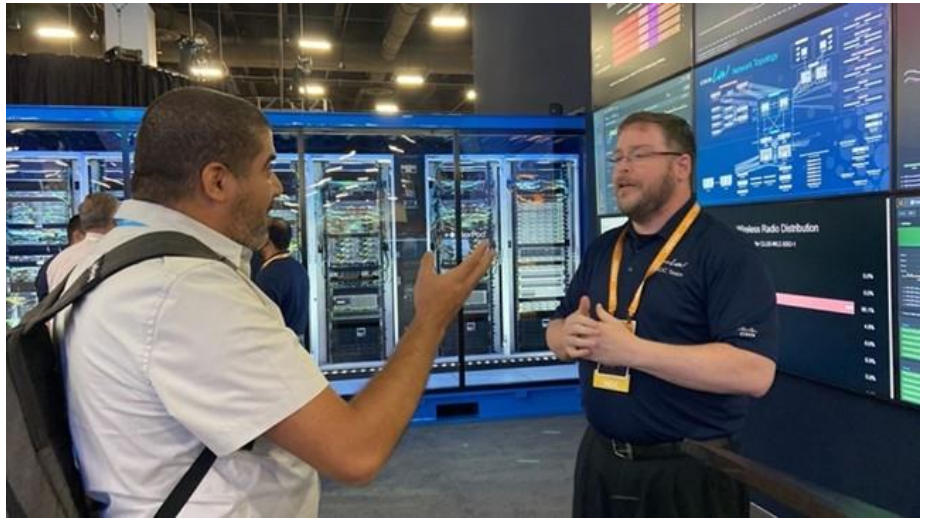
Nobody
uses IPv6!

Global IPv6 Stats



Facebook US: 61%

Akamai US: 52%

Cisco Live US: 54%

Cisco Live Melbourne: 52%

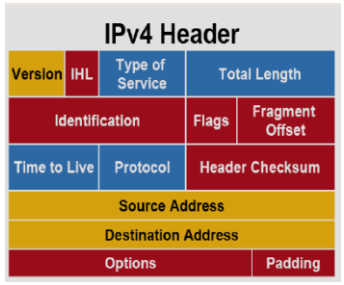
Cisco Live EMEA (external): 51%

Cisco Live EMEA (internal): 76%

https://www.facebook.com/ipv6/?tab=ipv6_country
https://www.akamai.com/internet-station/cyber-attacks/state-of-the-internet-report/ipv6-adoption-visualization


Is there a business case deploying IPv6?

IPv4 more expensive than Broccoli on AWS



€€€

€ 37.24 Per Year Per IP

€

Public IP Address Type	Current Price/Hour (USD)	New Price/Hour (USD) (Effective February 1, 2024
In-use Public IPv4 address (including Amazon provided public IPv4 and Elastic IP) assigned to resources in your VPC, Amazon Global Accelerator, and AWS Site-to-site VPN tunnel	No charge	$0.005
Additional (secondary) Elastic IP Address on a running EC2 instance	$0.005	$0.005
Idle Elastic IP Address in account	$0.005	$0.005

AWS News Blog

New – AWS Public IPv4 Address Charge + Public IP Insights

by Jeff Barr | on 28 JUL 2023 | in Amazon EC2, Announcements, Launch, News | Permalink | Comments | Share

00:00 00:00

Voiced by Amazon Polly

We are introducing a new charge for public IPv4 addresses. Effective February 1, 2024 there will be a charge of $0.005 per IP per hour for all public IPv4 addresses, whether attached to a service or not (there is already a charge for public IPv4 addresses you allocate in your account but don't attach to an EC2 instance).

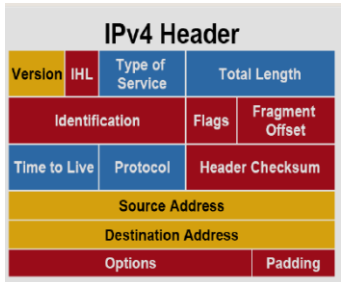
Public IPv4 Charge

As you may know, IPv4 addresses are an increasingly scarce resource and the cost to acquire a single public IPv4 address has risen more than 300% over the past 5 years. This change reflects our own costs and is also intended to encourage you to be a bit more frugal with your use of public IPv4 addresses and to think about accelerating your adoption of IPv6 as a modernization and conservation measure.

This change applies to all AWS services including Amazon Elastic Compute Cloud (Amazon EC2), Amazon Relational Database Service (RDS) database instances, Amazon Elastic Kubernetes Service (EKS) nodes, and other AWS services that can have a public IPv4 address allocated and attached, in all AWS regions (commercial, AWS China, and GovCloud). Here's a summary in tabular form:

https://aws.amazon.com/blogs/aws/new-aws-public-ipv4-address-charge-public-ip-insights/

IPv4 more expensive than Broccoli on AWS



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Public IPv4 Address Charge + Public IP Insights

JUL 2023 | in Amazon EC2, Announcements, Launch, News | Permalink | Comments | Share

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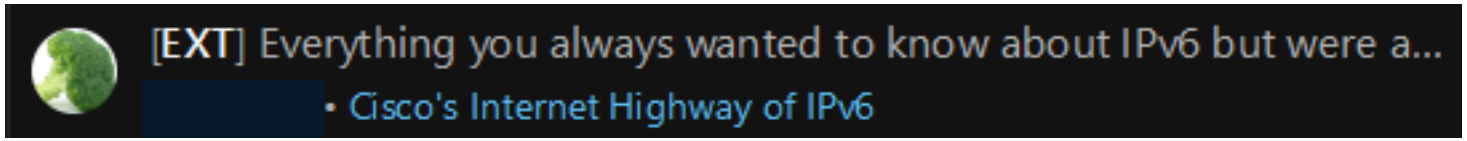
I would love
to Deploy
IPv6 NOW!

So Long, and Thanks for All the Fish: The Future of IPv6

So Long, and Thanks for All the Fish: The Future of IPv6

"IPv6 is Internet broccoli. Good for us in the long run but no immediate sugar rush from deploying it now"

Shameless self promotion of my own Quotes
- Nicole Wajer



https://eurl.io/#Pw7m5J7S-

Cisco Live EMEA IPv6 Learning Map

Monday–9th

TECIPV-2000 8:30AM
A Practical Guide to IPv6 for Enterprise Networks How to Transition from the Legacy Protocol

CTF-1912 1PM
SRv6 uSID - Because IPv6 Was Always Meant to Do More

TECIPV-2419 2PM
Deploying and Securing Networks for the IPv6 Enterprises

TECENT-2525 2PM
A Practical Guide to IPv6 for Enterprise Networks How to Transition from the Legacy Protocol

Tuesday–10th

BRKIPV-2033 8:00AM
From IPv4 to IPv6: AI-Validated Standalone Cisco Deployments with MCP and pyATS

BRKIOT-2114 10:30AM
Redefining Industrial Networking: SRv6 for Utilities and Distributed Automation

IBOENT-2811 11:30AM
Everything You Wanted to Know about IPv6 but Were Afraid to Ask

IBOIPV-2000 3PM
Sharing Experience on IPv6 Deployments

BRKSEC-2044 3:45PM
Secure Operations for an IPv6 Network

BRKIPV-1552 5PM
Inside Cisco IT: Our IPv6-only Deployment

Wednesday–11th

BRKSPG-2203 9:30AM
Introduction to SRv6 uSID Technology

BRKIPV-2005 9:45AM
Riding the IPv6 Wave: Network Operations in an Increasingly IPv6 World

BRKMSI-2386 11:45AM
Driving the Future: SRv6 as the Backbone of Mission-Critical Utility and Transportation Networks

IBOENT-2811 1:30PM
Everything You Wanted to Know about IPv6 but Were Afraid to Ask

BRKIPV-2282 3:15PM
IPv6 Transition Technologies - IPv4aaS

Thursday–12th

IBOIPV-2000 8:30AM
Sharing Experience on IPv6 Deployments

BRKMSI-2533 8:45AM
Unlocking SRv6 Innovation: Real-World Use Cases with Crosswork Network Controller

BRKIOT-2114 10:00AM
Redefining Industrial Networking: SRv6 for Utilities and Distributed Automation

BRKIPV-2418 11:45AM
Deploying IPv6 Routing Protocols: Specifics and Considerations

BRKENT-3002 11:45AM
IPv6 Security in the Local Area with First Hop Security

CTF-1400 12:00PM
IPv6: The Internet's best kept secret!

BRKIPV-2235 4:45PM
SRv6 uSID in Your IPv6 Roadmap: Unlocking Scale and Simplicity

Friday–13th

BRKIPV-2191 9:00AM
IPv6:: It's Happening!

BRKENT-3340 11:00AM
The Hitchhiker's Guide to Troubleshooting IPv6

Walk in Labs

LABIPV-1639 IPv6 Foundations: A Dive into Basic Networking Concepts

LABIPV-2640 IPv6 Deep Dive: Beyond Basics to Brilliance

LABEND-2743 SDA Made Simple: Experience Fabric Innovation with IPv6

LABMPL-1201 SRv6 Basics

LABSP-2129 SRv6 Micro-Segment Basics

LABSP-3393 Implementing Segment Routing v6 (SRv6) Transport on NCS 55xx/5xx and Cisco 8000: Advanced

LABIPV-2468 Securing IPv6 Access: Deep Dive into First Hop Security Features on Catalyst Switches

LABSP-2541 SRv6-Traffic Engineering

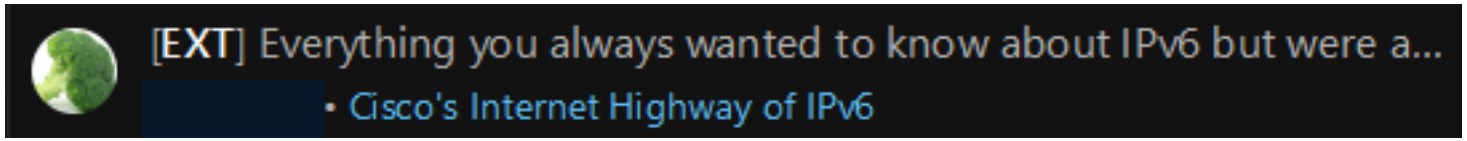
LABSP-2199 EVPN Over SRv6 on IOS XR Routers

Instructor-led Labs

LTRIPV-2222 Implementing Future-Ready Networks - Deploy IOS XE IPv6 Configuration with Python

LTRMSI-2000 Deploying SRv6 Networks: From Locator Assignments to Resilient VPN Services

LTRSPG-2006 Explore the Power of SRv6: Unleashing the Potential of Next-Generation Networking



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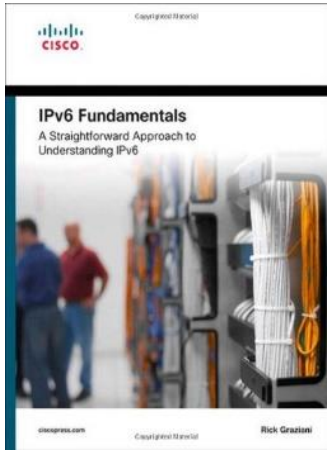
Thank You

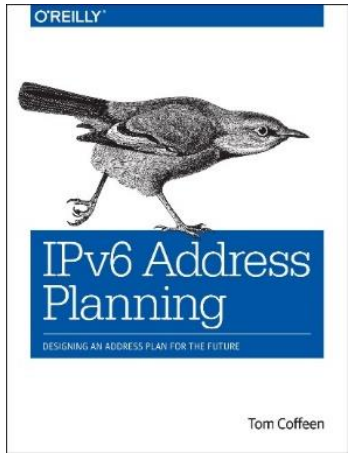
Resources

Resources - Books

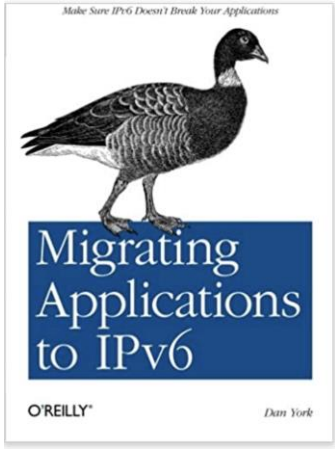


https://www.amazon.com/IPv6-Fundamentals-Straightforward-Approach-Understanding/dp/1587144778

https://www.oreilly.com/library/view/dns-and-bind/9781449308025/



https://www.amazon.com/IPv6-Address-Planning-Designing-Future/dp/1491902760



https://www.oreilly.com/library/view/migrating-applications-to/9781449309688/

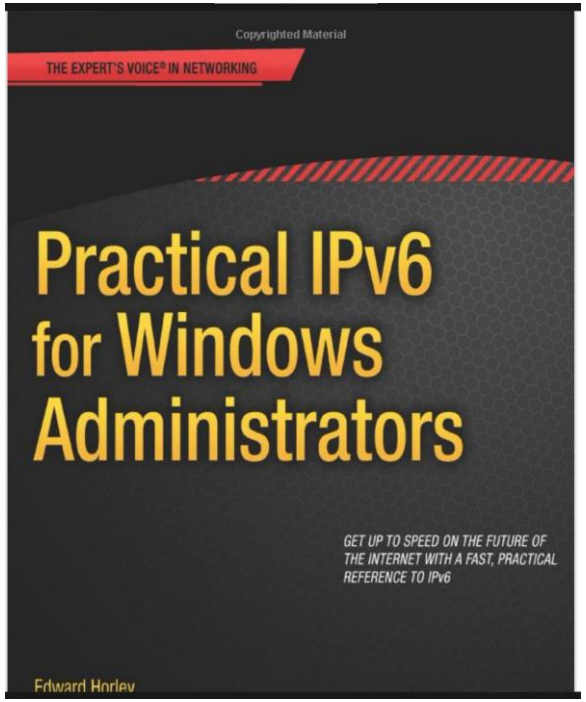
Additional Books:

Cisco Press - https://www.ciscopress.com/store/ipv6-design-and-deployment-livelessons-9780134655512

Cisco Press - https://www.ciscopress.com/store/ipv6-fundamentals-livelessons-a-straightforward-approach-9781587204579

O'Reilly Media – https://www.oreilly.com/library/view/introduction-to-ipv6/9781771375269/

More Books



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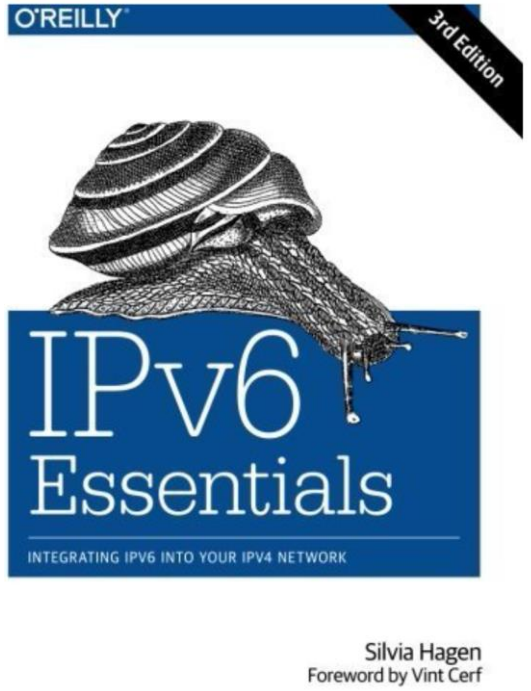


https://amzn.eu/d/i5PVjAs

Online References

- Akamai IPv6 Adoption Visualization - https://www.akamai.com/internet-station/cyber-attacks/state-of-the-internet-report/ipv6-adoption-visualization
- Cisco 6lab - https://6lab.cisco.com/
- Google IPv6 Statistics - https://www.google.com/intl/en/ipv6/statistics.html
- Tunnelbroker Hurricane Electric - https://tunnelbroker.net/
- World IPv6 Launch - https://www.worldipv6launch.org/

Online References

- IPv6 Buzz Podcast - https://packetpushers.net/series/ipv6-buzz/
- Infoblox IPv6 Center of Excellence - https://blogs.infoblox.com/category/ipv6-coe/
- ARIN IPv6 Information - https://www.arin.net/resources/guide/ipv6/
- APNIC IPv6 Information - https://www.apnic.net/community/ipv6/
- RIPE IPv6 Info Centre - https://www.ripe.net/publications/ipv6-info-centre

Training Options

- **HexaBuild**
  - https://hexabuild.arlo.co/w/
- **Pluralsight**
  - https://www.pluralsight.com/courses/ipv6-introduction-to-protocol
  - https://www.pluralsight.com/courses/ipv6-microsoft-windows
- **NterOne**
  - https://www.nterone.com/training/cisco/courses/ip6fd
- **O'Reilly LiveLessons**
  - https://www.oreilly.com/videos/ipv6-design-and/9780134655529
- **Rick Graziani – YouTube Playlist**
  - https://www.youtube.com/playlist?list=PLMLm7-g0V0kfGg8g8KutNFK7rS3laA9QQ

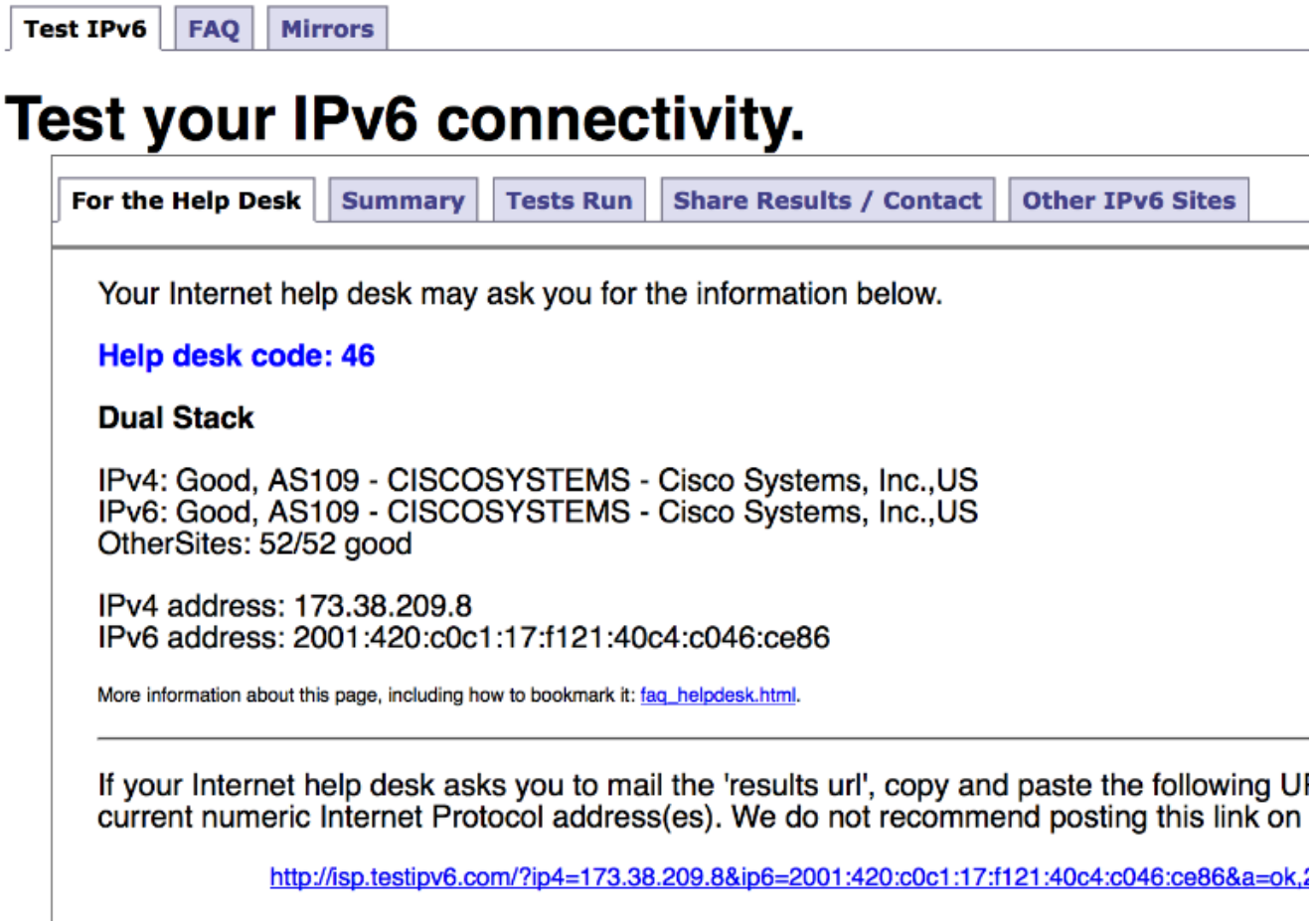
Training Options

Cisco Live! (On-Demand)

- **IPv6:: It's Happening! – BRKIPV-2191 – Nathan Sherrard**
  - https://www.ciscolive.com/c/dam/r/ciscolive/global-event/docs/2023/pdf/BRKIPV-2191.pdf
- **What Do you Mean there isn't a Broadcast? – BRKIPV-1616 – Fish Fishburne**
  - https://www.ciscolive.com/c/dam/r/ciscolive/global-event/docs/2023/pdf/BRKIPV-1616.pdf
- **Deploying IPv6 in the Cloud – BRKIPV-3927 – Shannon McFarland**
  - https://www.ciscolive.com/c/dam/r/ciscolive/global-event/docs/2023/pdf/BRKIPV-3927.pdf
- **Hitchhikers Guide to Troubleshooting IPv6 – BRKENT-3340 – Nicole Wajer**
  - https://www.ciscolive.com/c/dam/r/ciscolive/emea/docs/2024/pdf/BRKENT-3340.pdf

IPv6 troubleshooting for Helpdesks

http://isp.testipv6.com ➔



https://www.ripe.net/ripe/groups/tf/bcop/ipv6-troubleshooting-for-residential-isp-helpdesks