



IPconomics:

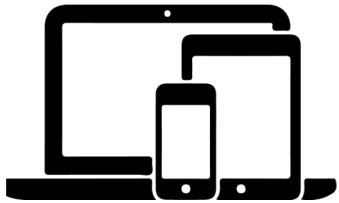
Getting Comfortable with the Business Side of IPv6



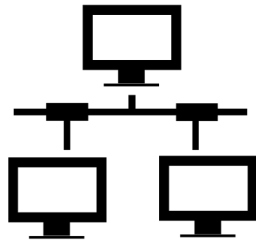
Disclaimer: The views and opinions expressed in this presentation are those of the speaker and do not necessarily reflect the views or positions of their employer.

Memory Lane

The End-to-End Utopia



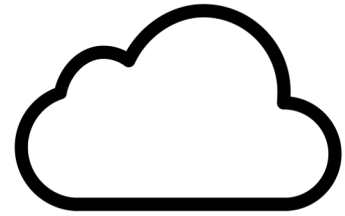
Clients



Enterprise
Network



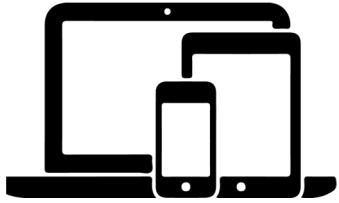
ISP



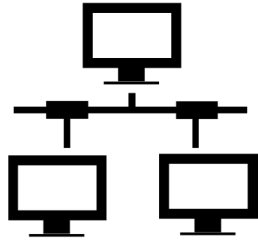
Internet



The Reality Today (high-level)



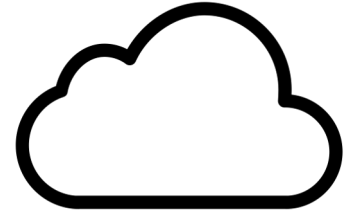
Clients



Enterprise
Network



ISP



Internet



What did we
learn?

Scale
&
Automation

A Learning Journey

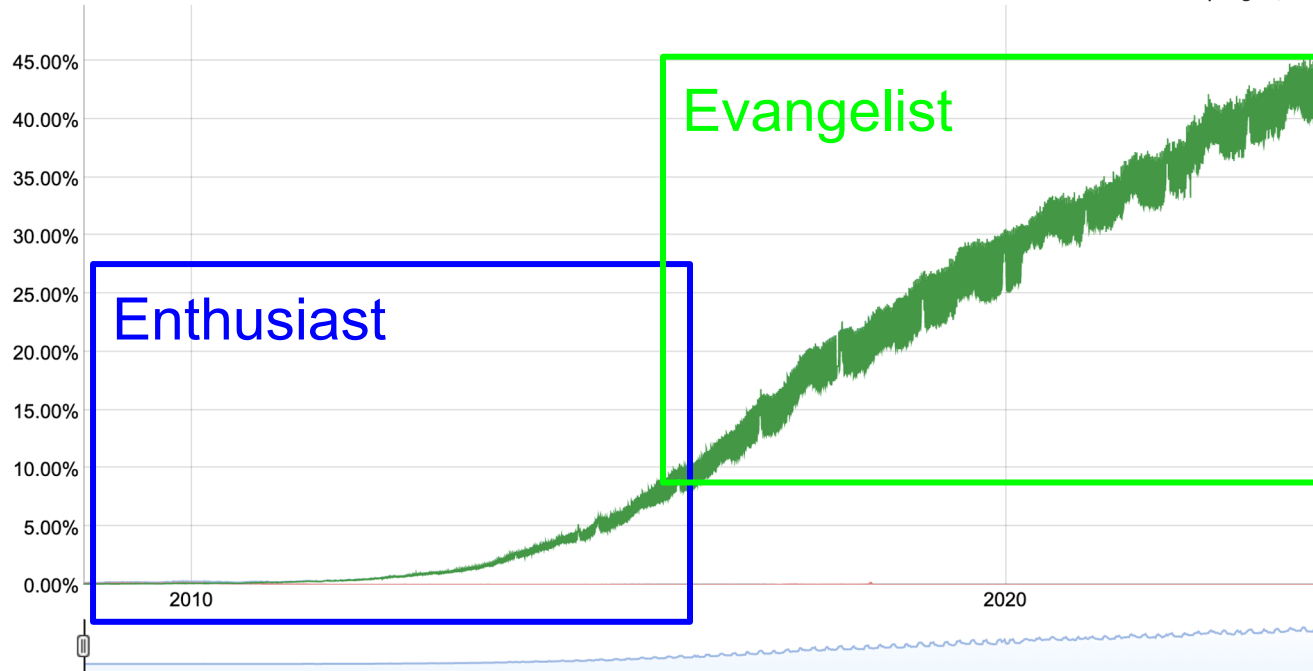


Learning Evolution

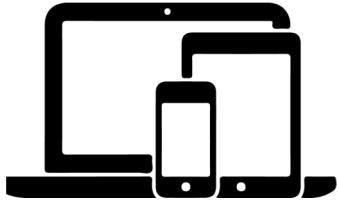
IPv6 Adoption

We are continuously measuring the availability of IPv6 connectivity among Google users. The graph shows the percentage of users that access Google over IPv6.

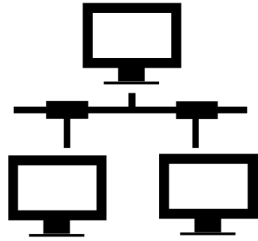
Native: 43.11% 6to4/Teredo: 0.00% Total IPv6: 43.11% | Aug 27, 2023



The Reality Today (high-level)



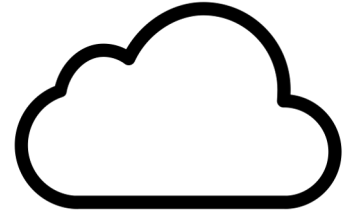
Clients



Enterprise
Network



ISP



Internet



Supporting The Enterprise Transition

Business Outcomes

Process modernization
and simplification



Cost reduction

New line of business



New offering

Mandates &
Compliance

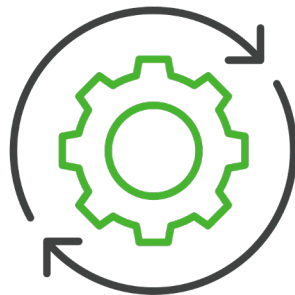


Staying in business

How does IPv6 adoption meet
business outcomes?

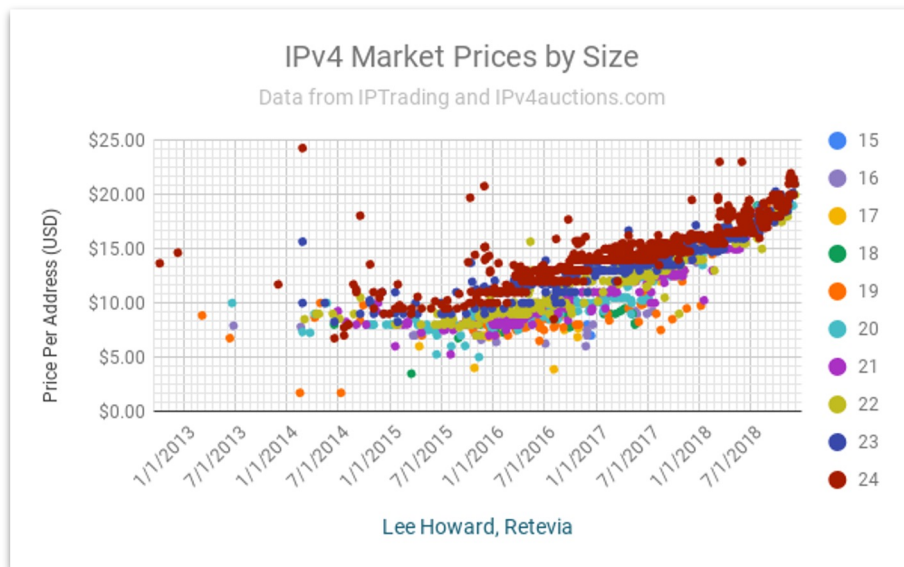
Simplicity And Efficiency from the Protocol

- Less moving parts
 - No NAT, or better application of NAT
 - No DHCP (mostly)
 - SLAAC improvements to deliver more (e.g., DNS)
- Improved summarization
 - Less memory on router => longer life of existing infrastructure



Internet Opex

- Average cost
 - Retevia projections (<https://www.retevia.net/address-pricing-2019-and-beyond/>)



IPv4 “Marketplace” on the Rise

2023

2019

The image displays a collage of IPv4 marketplace listings, comparing offerings from 2019 and 2023. Each listing card provides details on the IP block, its registration status, transferability, and pricing.

2019 Listings (Left Column):

- Top Card:** /24 Block registered in ARIN. Transferable to: ARIN, APNIC, RIPE. SALE PRICE: \$6,400.00. \$/ADDRESS: \$25.00. ENDS IN: 5d 2h 0m.
- Bottom Card:** /24 Block registered in APNIC. Transferable to: ARIN, APNIC, RIPE. SALE PRICE: \$5,632.00. \$/ADDRESS: \$22.00. ENDS IN: 5d 1h 53m.

2023 Listings (Right Column):

- Top Card:** /19 Block registered in APNIC. Transfer to: RIPE, APNIC, ARIN, LACNIC. SALE PRICE: \$303,104.00. \$/ADDRESS: \$37.00. ENDS IN: 2d 1h 11m.
- Second Card:** /22 Block registered in RIPE. Transfer to: RIPE, APNIC, ARIN, LACNIC. SALE PRICE: \$45,056.00. \$/ADDRESS: \$44.00. ENDS IN: 1d 23h 47m.
- Third Card:** /22 Block registered in APNIC. Opening Bid: \$36,864.00. \$/ADDRESS: \$36.00. ENDS IN: 2d 23h 38m. BIDS: 0.
- Bottom Card:** /20 Block registered in ARIN. Auction. ENDS IN: 5d 1h 53m.

Other 2023 Listings (Middle and Bottom Rows):

- Top Row (Left to Right):**
 - /22 Block registered in RIPE. Transfer to: RIPE, APNIC, ARIN, LACNIC. SALE PRICE: \$38,912.00. \$/ADDRESS: \$38.00. ENDS IN: 1d 23h 40m.
 - /22 Block registered in APNIC. Transfer to: RIPE, APNIC, ARIN, LACNIC. SALE PRICE: \$31,744.00. \$/ADDRESS: \$31.00. ENDS IN: 2d 23h 38m. BIDS: 0.
 - /21 Block registered in ARIN. Transfer to: RIPE, APNIC, ARIN, LACNIC. SALE PRICE: \$81,920.00. \$/ADDRESS: \$40.00. ENDS IN: 1d 23h 53m.
 - /17 Block registered in ARIN. Auction. ENDS IN: 5d 1h 53m.
- Second Row (Left to Right):**
 - /23 Block registered in ARIN. Transfer to: RIPE, APNIC, ARIN, LACNIC. OPENING BID: \$16,256.00. \$/ADDRESS: \$31.75. ENDS IN: 2d 23h 28m. BIDS: 0.
 - /22 Block registered in APNIC. Transfer to: RIPE, APNIC, ARIN, LACNIC. OPENING BID: \$31,744.00. \$/ADDRESS: \$31.00. ENDS IN: 2d 23h 38m. BIDS: 0.
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- Bottom Row (Left to Right):**
 - /17 Block registered in ARIN. Auction. ENDS IN: 5d 1h 53m.
 - /18 Block registered in ARIN. Auction. ENDS IN: 5d 1h 53m.
 - /22 Block registered in RIPE. Auction. ENDS IN: 5d 1h 53m.
 - /20 Block registered in ARIN. Auction. ENDS IN: 5d 1h 53m.

IPv4 Total Cost of Ownership (TCO)

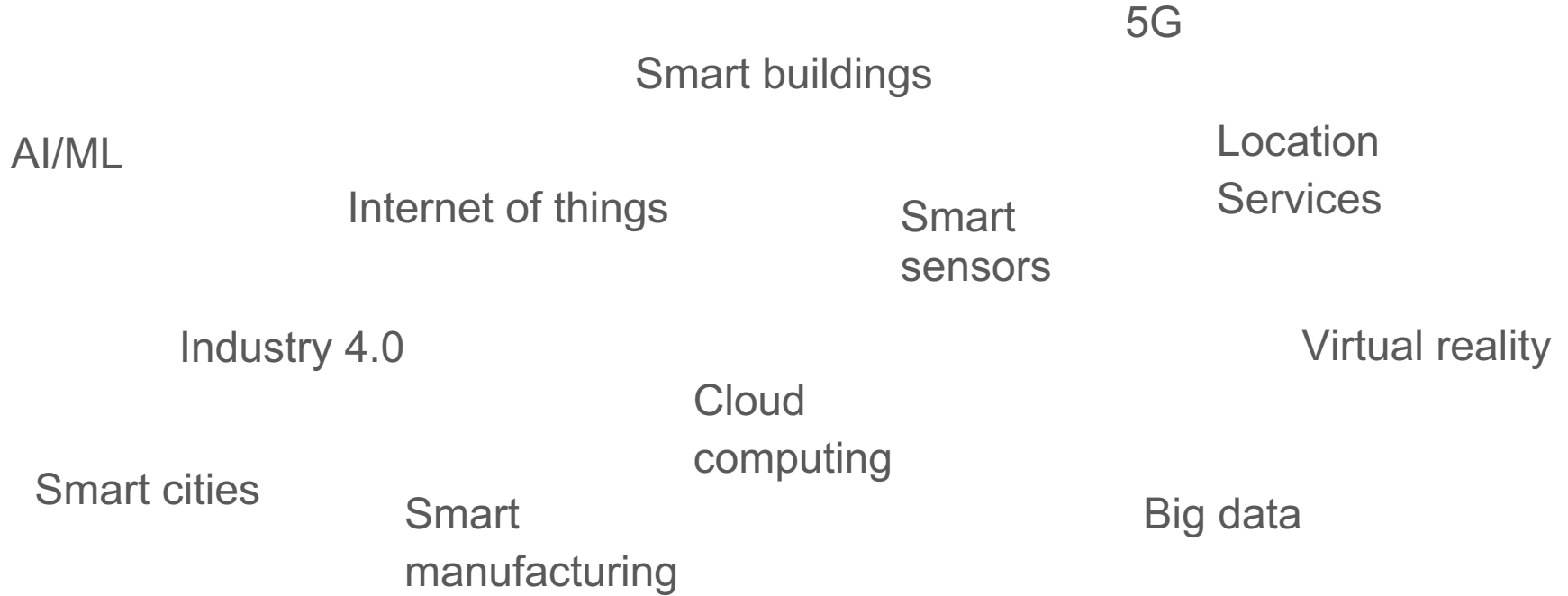
Maintaining IPv4 operations:

- Big NAT/CGN boxes
 - More complexity in setup and troubleshooting (time = money)
- “Tainted” IPv4
- Providers charging extra for IPv4 and NAT
 - [GCP](#)
 - [AWS](#)



Lines of Business

Experiences



Mandates & Compliance

Compliance - Country Mandates



Example countries:

- China- [China sets goal of running single-stack IPv6 network by 2030, orders upgrade blitz](#)
 - New update May 2023 <https://www.networkcomputing.com/networking/ipv6-adoption-china-steps-deployment-pedal>
- USA Federal Government - <https://www.whitehouse.gov/wp-content/uploads/2020/11/M-21-07.pdf>
- India- [India is promoting a new internet protocol](#)
- Germany- [DE German Govt IPv6 Plan](#)
- Mexico - [Mandate similar to US delayed by 1 year](#)

Government Objectives



Economic Empowerment

Enable entire populations to participate in the digital economy

Innovation Potential

Designing with abundant resources

Modernization

Develop egov options to serve communities

IPv6 adoption is the catalyst to achieving their goals

Case Study: The Cisco Meraki Platform



Product Development - Building a Business Case

What are we solving for?

Is there a market for the solution?

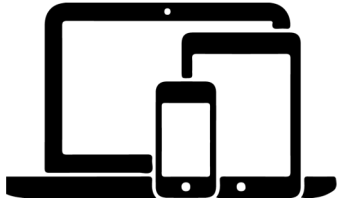


Will this development unlock areas of innovation? patents?

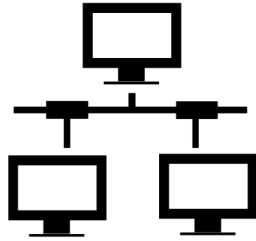
Does the solution benefit the majority of customers?

Is this a market access problem?

The Enterprise Transition Opportunity



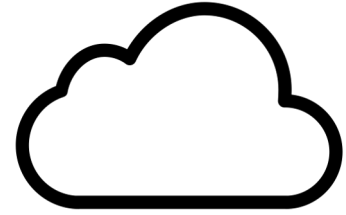
Clients



Enterprise
Network



ISP



Internet



Business Outcome





Automating the transition to
IPv6/IPv6-only for the enterprise

Example Design Principles

Always on design

| | | |
|---|---------|--------------|
| WAN  | | |
| TYPE | IPv4 | IPv6 |
| CONFIGURED AS | Dynamic | Auto (DHCP6) |

Simplified operations

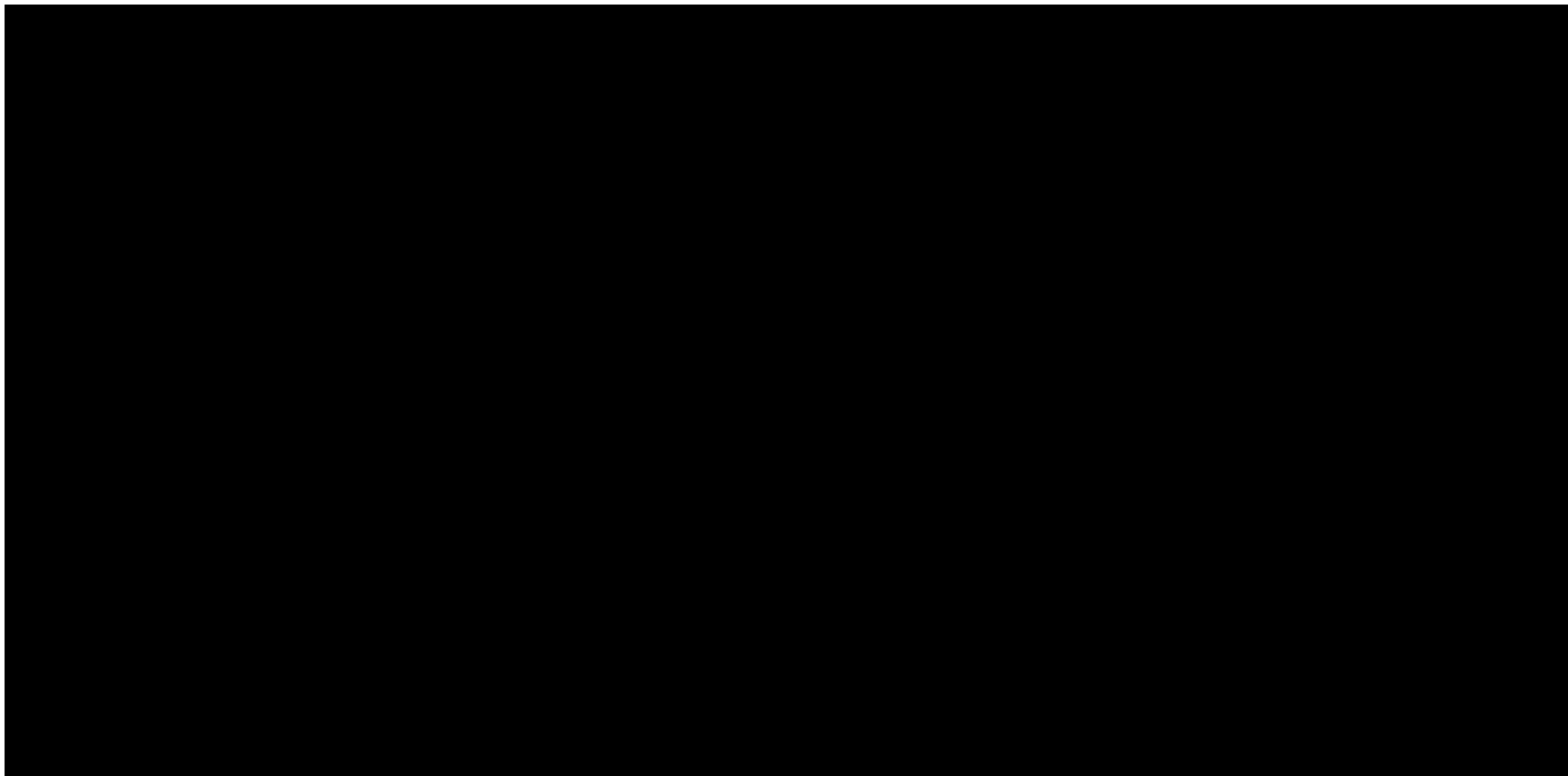
| | | | | | | | | | |
|---|--|-----------|-----|---|-----|---|-----|---|---|
| 2 |  Deny | UKv6 Demo | TCP |  AMS MAIN DSv6 | Any |  BACKDOOR KIAH | Any | 0 |  |
|---|--|-----------|-----|---|-----|---|-----|---|---|

Effortless audits

| IPv6 Address log Export | | | |
|--|--|------------|----------------|
| <input type="checkbox"/> First connected at ▼ | Address | Type | Time connected |
| <input type="checkbox"/> 2023-11-18T22:34:31+01:00 | 2001:1000:000:100:1000:1000:100:100:9bc9 | Public | 17h 39m 24s |
| <input type="checkbox"/> 2023-11-18T21:40:17+01:00 | fe00:000:000:1400:1400:1000:000:0bd4 | Link-Local | 18h 33m 38s |
| <input type="checkbox"/> 2023-11-18T21:40:17+01:00 | 2001:1000:000:100:1000:1000:1000:9be6 | Public | 54m 13s |
| <input type="checkbox"/> 2023-11-17T09:40:31+01:00 | 2001:1000:000:100:1000:1000:1000:1f65 | Public | 1d 11h 59m 46s |
| <input type="checkbox"/> 2023-11-14T16:32:37+01:00 | 2001:1000:000:100:1000:1000:1000:1c77 | Public | 2d 17h 7m 54s |

Steadily marching towards IPv6-only operations

Merakiv6 Demo



Call to Action

ITOps with IPv6

Business Ally

Understand the business and what makes it tick



Transition IT Operations

IPv6-as-an enabler to solve business problems explicitly



Take Action Soon

NAT Gateway

IPAM

Network Analysis

Public IPv4 Address

- **What is a public IPv4 address?**

A public IPv4 address is an IPv4 address that is routable from the internet. A public IPv4 address is necessary for a resource to be directly reachable from the internet over IPv4.

- **How do public IPv4 address work with AWS services?**

Nearly all resources you launch in your VPC come with an IP address for connectivity. While the vast majority of resources in your VPC use private IPv4 addresses (RFC1918), resources that require direct access to the internet over IPv4 use public IPv4 address. For example, EC2 instances that launch in a default VPC come with a public IPv4 address. You use Elastic IP addresses and attach them to resources such as Elastic Load Balancer, NAT Gateway etc. Also, there are AWS services such as Amazon EKS, Amazon EMR, Amazon ECS, Amazon RDS, Amazon Workspaces that create resources in your VPC with public IPv4 addresses associated with them to provide internet connectivity. Finally, there are public IPv4 address that you use with services such as AWS Global Accelerator, AWS Site-to-Site VPN that may not directly be in their VPC but are associated with AWS resources they use.

- **What type of public IPv4 address is charged?**

Any public IPv4 address associated with a resource launched in an Amazon VPC, and public IPv4 addresses assigned to AWS Global Accelerator and AWS Site-to-Site VPN tunnel endpoints are charged as in-use public IPv4 address. Any public IPv4 address associated to your AWS account that is not used on a resource is charged as idle public IPv4 address. Public IPv4 addresses that are not dedicated to your resource are not charged; for example, public IPv4 addresses associated with Amazon S3 that are not dedicated per S3 bucket. For a list of AWS services where you are charged for public IPv4 addresses, refer to the public [IPv4 documentation page](#).

- **When does public IPv4 address pricing take effect?**

Charges for In-use public IPv4 address take effect on **February 1, 2024**. Until this time, you will not notice any changes to your bills. All existing Elastic IP Address charges, described on the [EC2 pricing page](#) will apply.



Thank you!