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The bridge to possible

Cloud Bound

Key Differences in Cloud Connectivity Architectures

Angelique Medina, Head of Internet Intelligence and Product Marketing

@bitprints

BRKAPP-1002



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Cisco Webex App

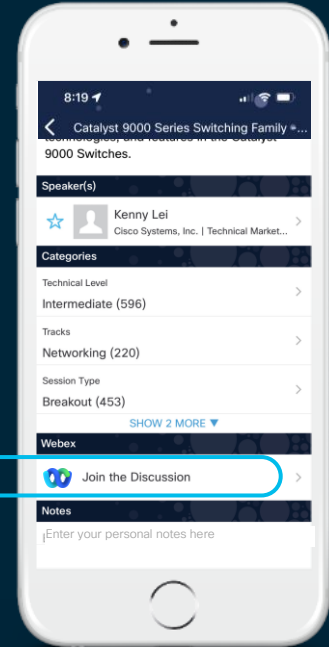
Questions?

Use Cisco Webex App to chat with the speaker after the session

How

- 1 Find this session in the Cisco Live Mobile App
- 2 Click “Join the Discussion”
- 3 Install the Webex App or go directly to the Webex space
- 4 Enter messages/questions in the Webex space

Webex spaces will be moderated by the speaker until June 17, 2022.



<https://ciscolive.ciscoevents.com/ciscolivebot/#BRKAPP-1002>

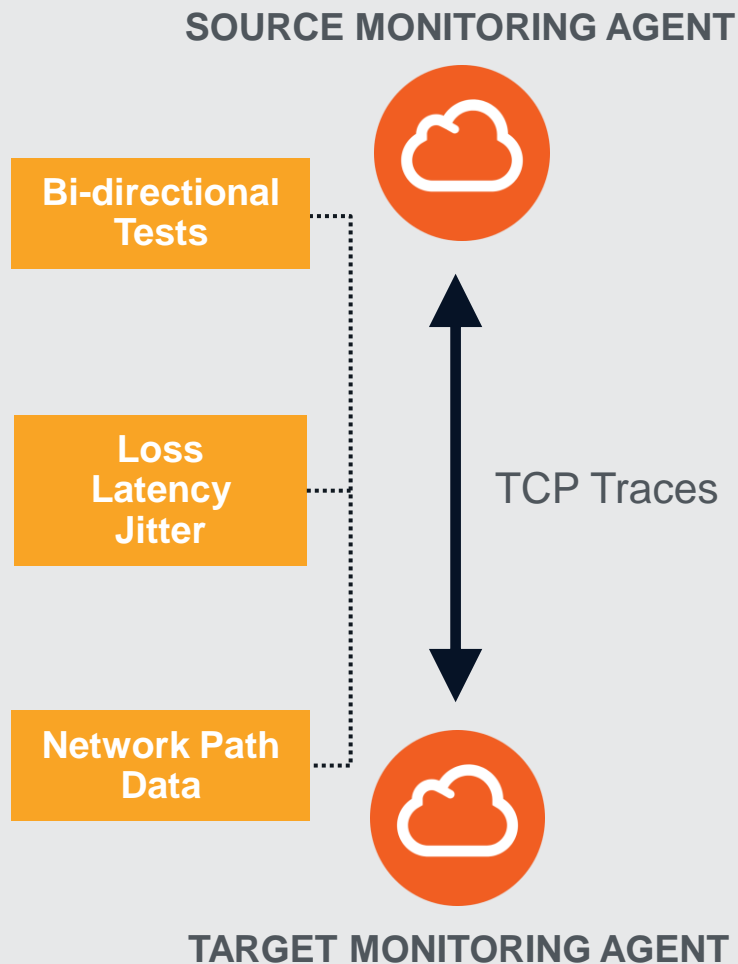
Cloud Performance Reporting Journey



Research Methodology

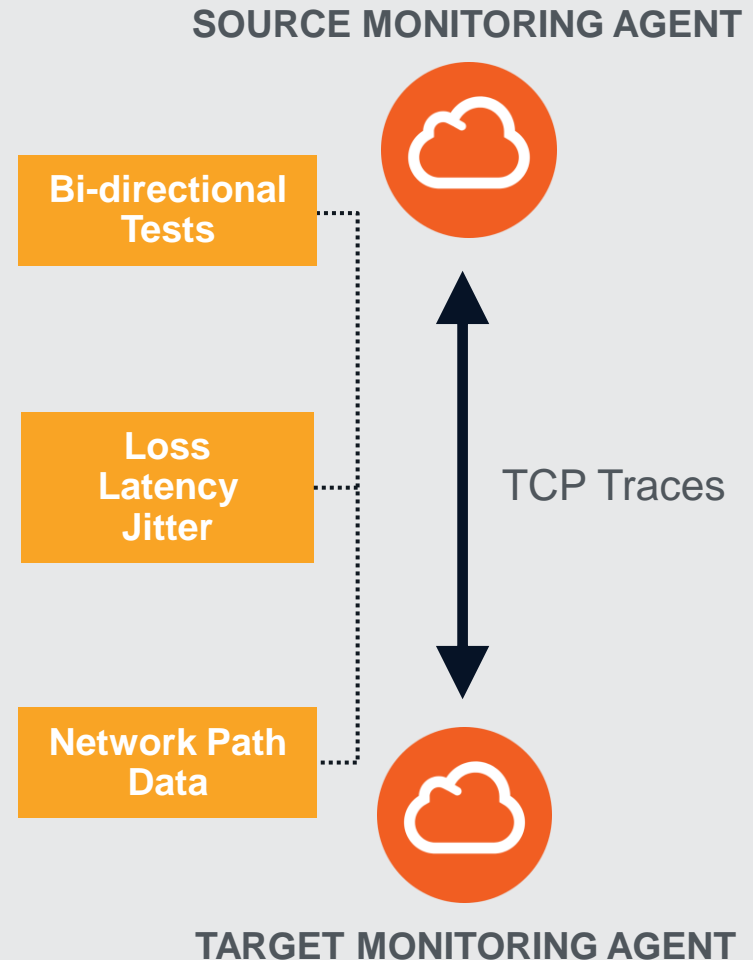
Measurements & Metadata

- Customized traceroute
 - TCP-based
- Bidirectional measurements
 - Accounts for variation in forward and return routes
 - Unidirectional metrics computed at target agent
- Network path
 - Layer 3 per-hop AS path, metrics, QoS re-markings, geo-location
- End-to-end network metrics
 - Latency, loss, jitter

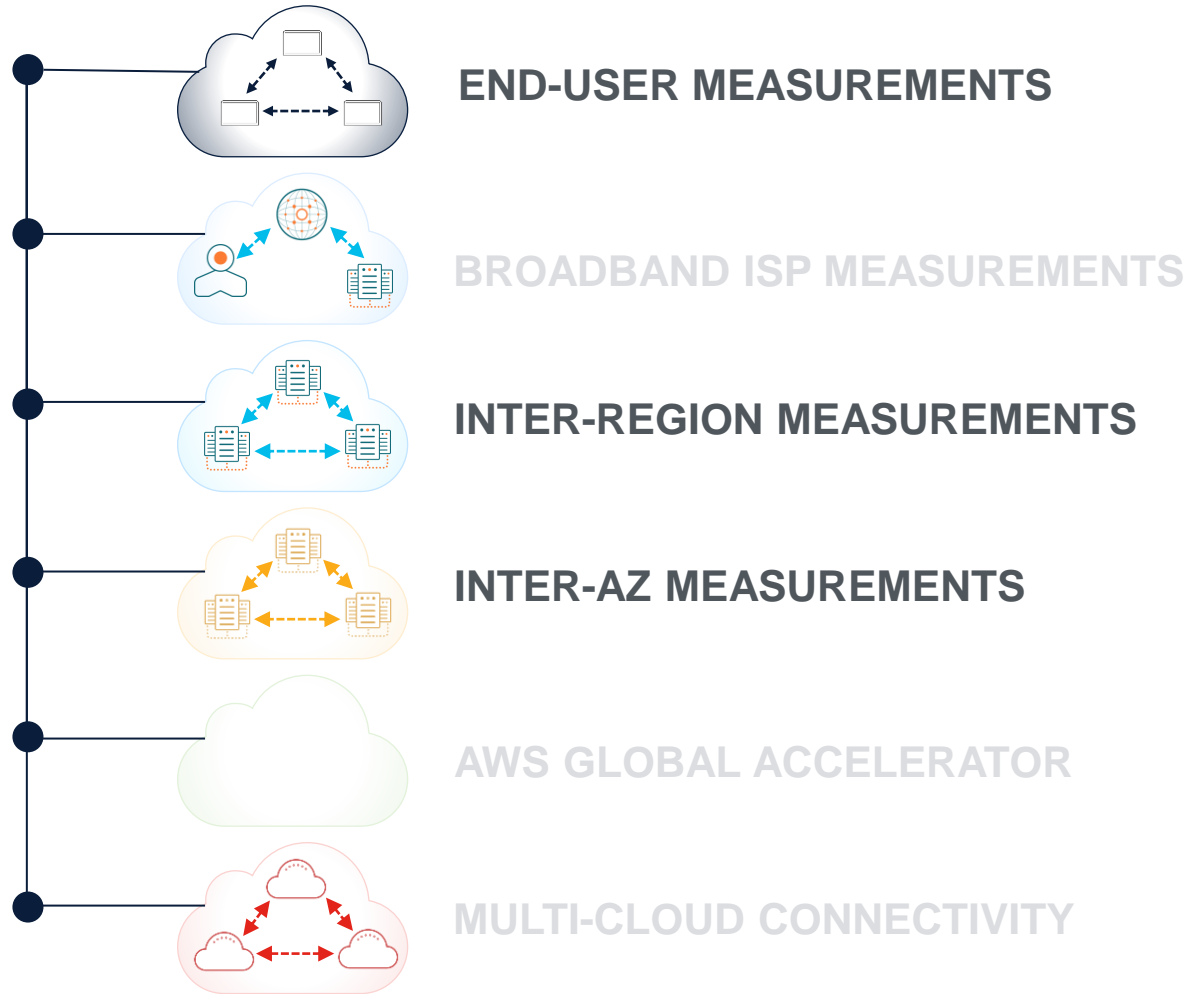


Data Collection

- Managed vantage points
 - Consistent measurement
 - Hosted in data centers
- 10-minute testing interval
- Ongoing data collection
 - Data collection spans Oct. 2019 to present



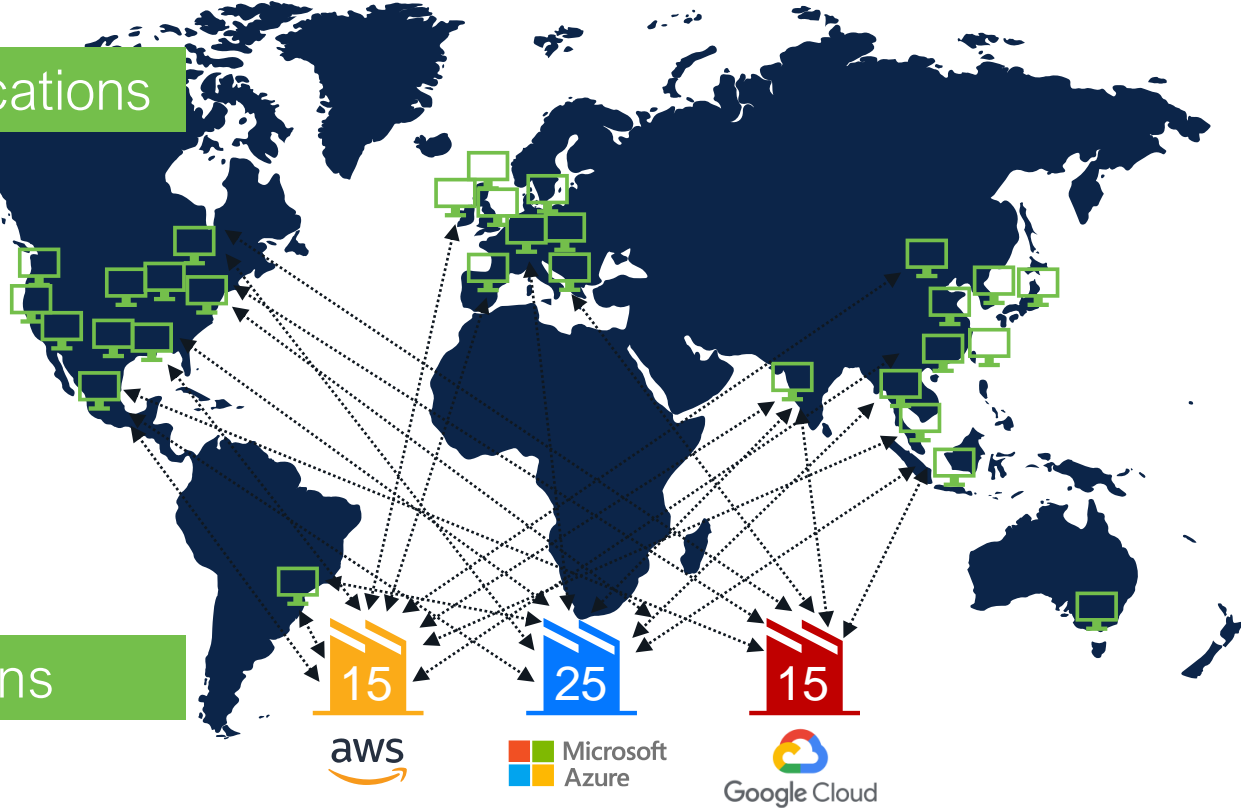
Research Scope



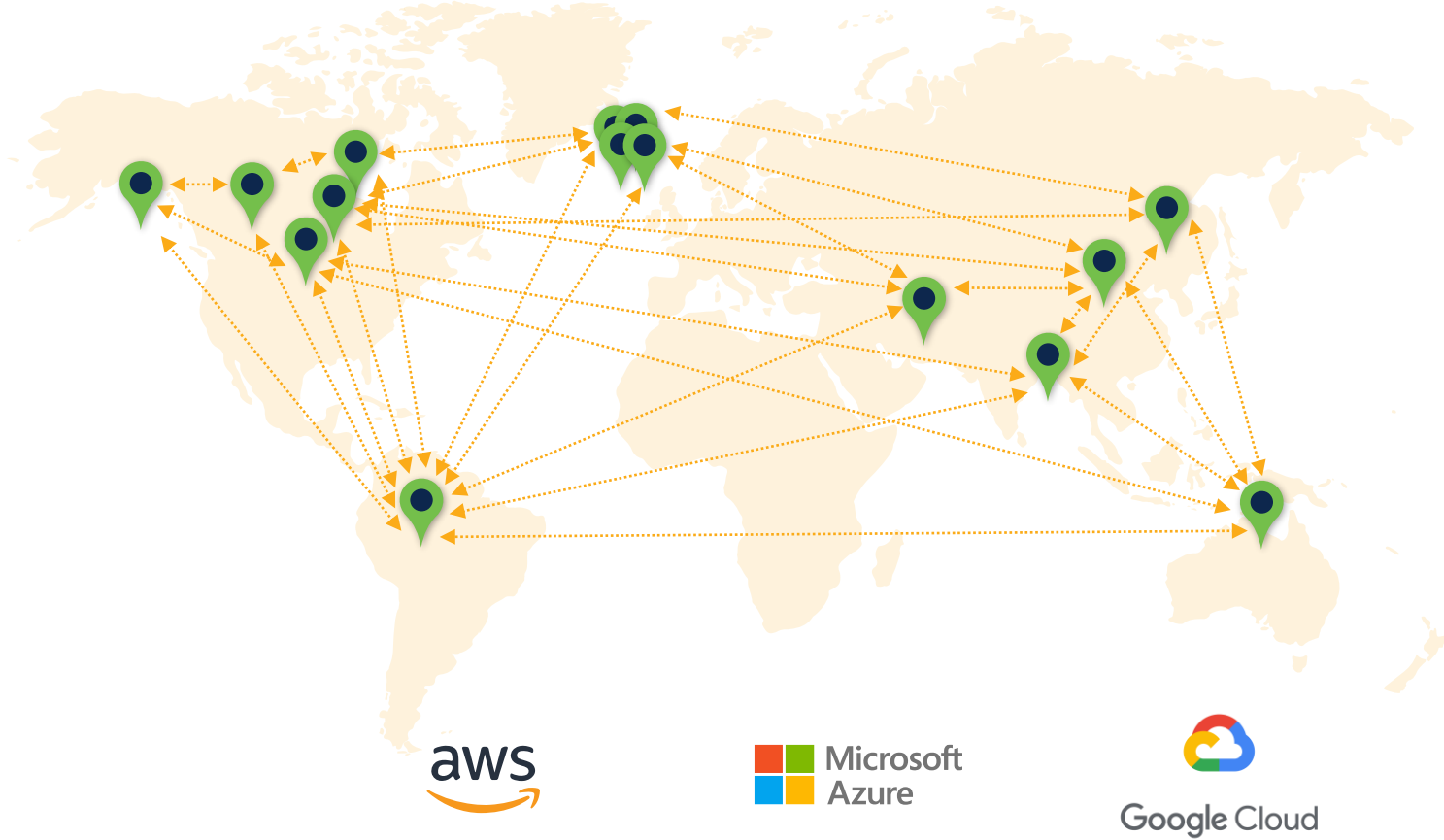
End-User Measurements

98 Global Locations

95 Regions



Inter-Region Measurements



Inter-AZ Measurements

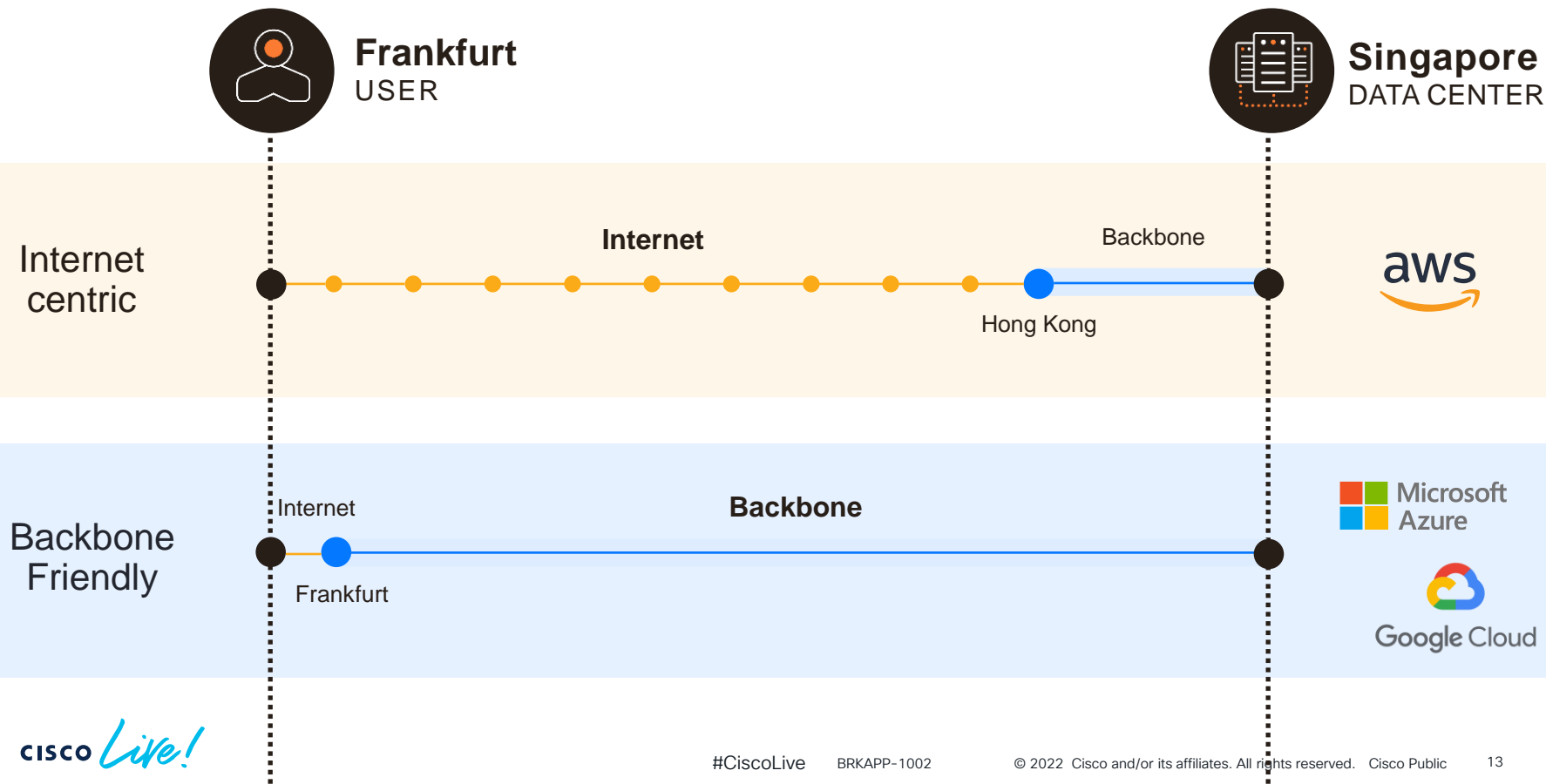


- AWS: 6 regions
- Azure: 5 regions
- GCP : 6 regions



User to Cloud Performance

Two Types of User <-> Region Connectivity

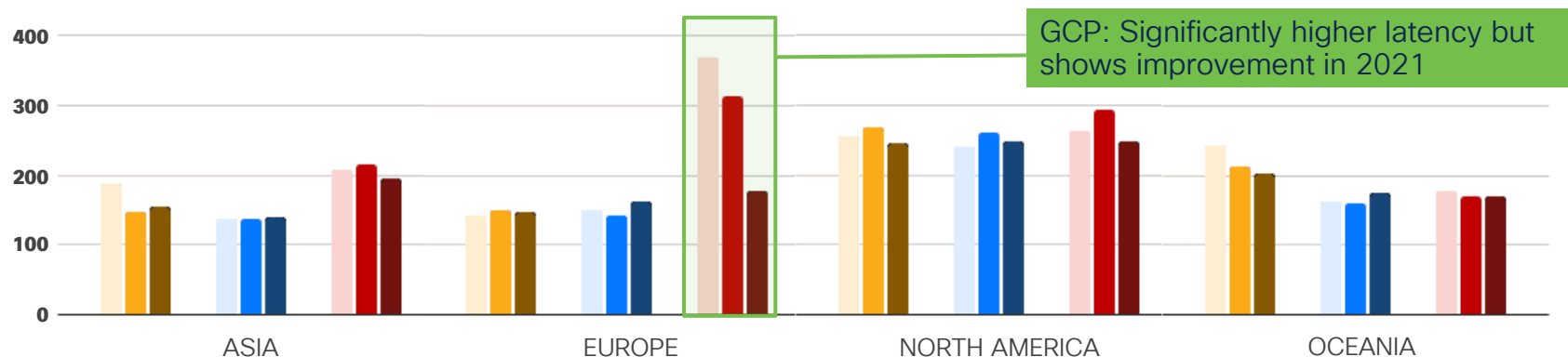
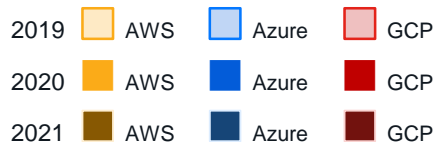


Global End User Measurements to India Host Region

HOSTING REGION: MUMBAI, INDIA

BI-DIRECTIONAL LATENCIES

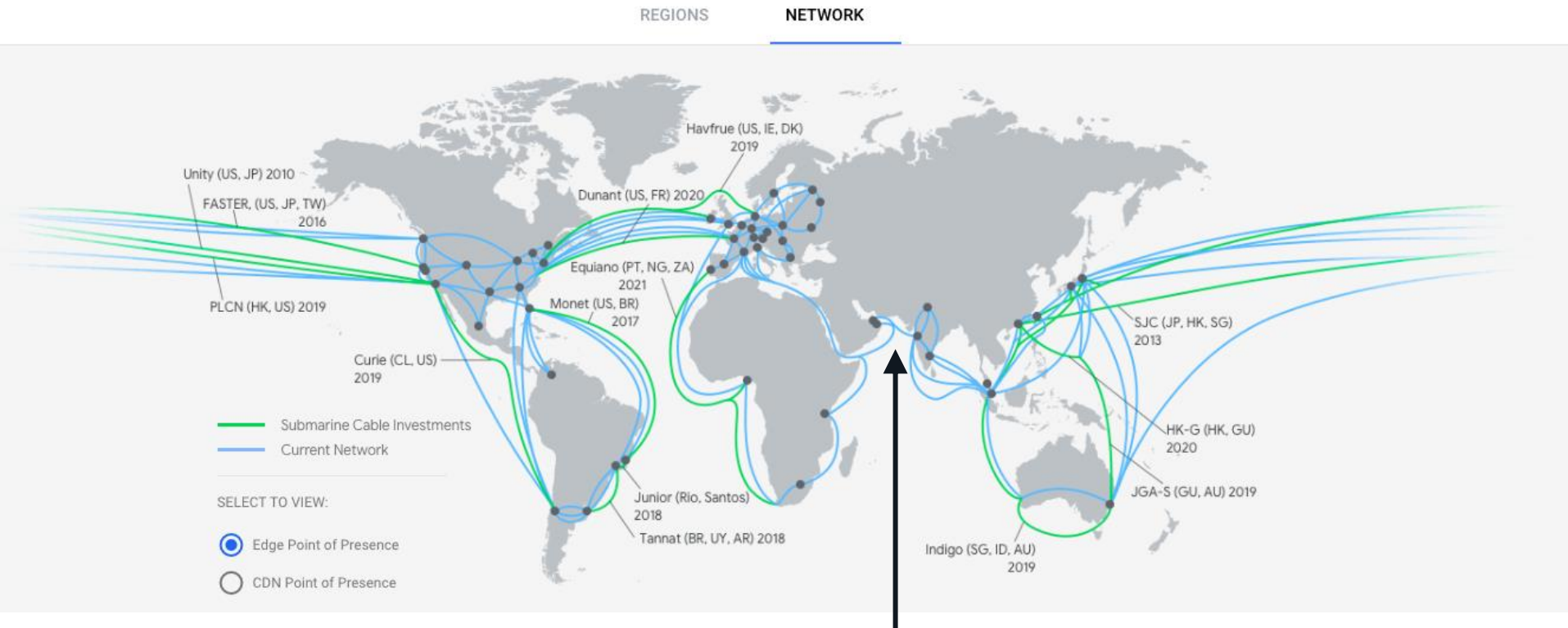
End-User Measurements



GCP Infrastructure Map in 2018



GCP Infrastructure Map Updated in 2019



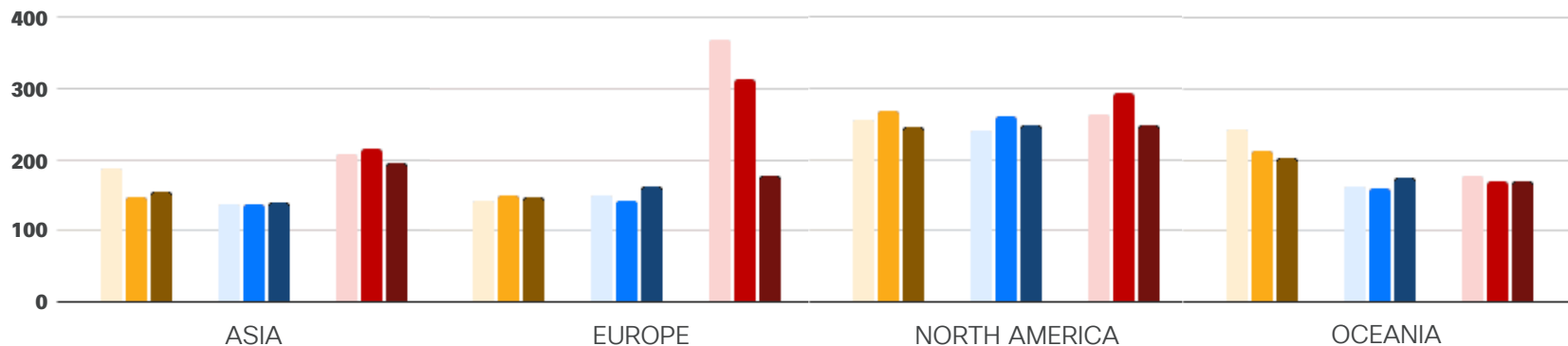
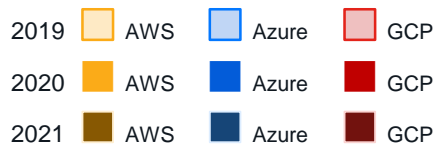
GCP infrastructure updated in 2019

Global End User Measurements to India Host Region

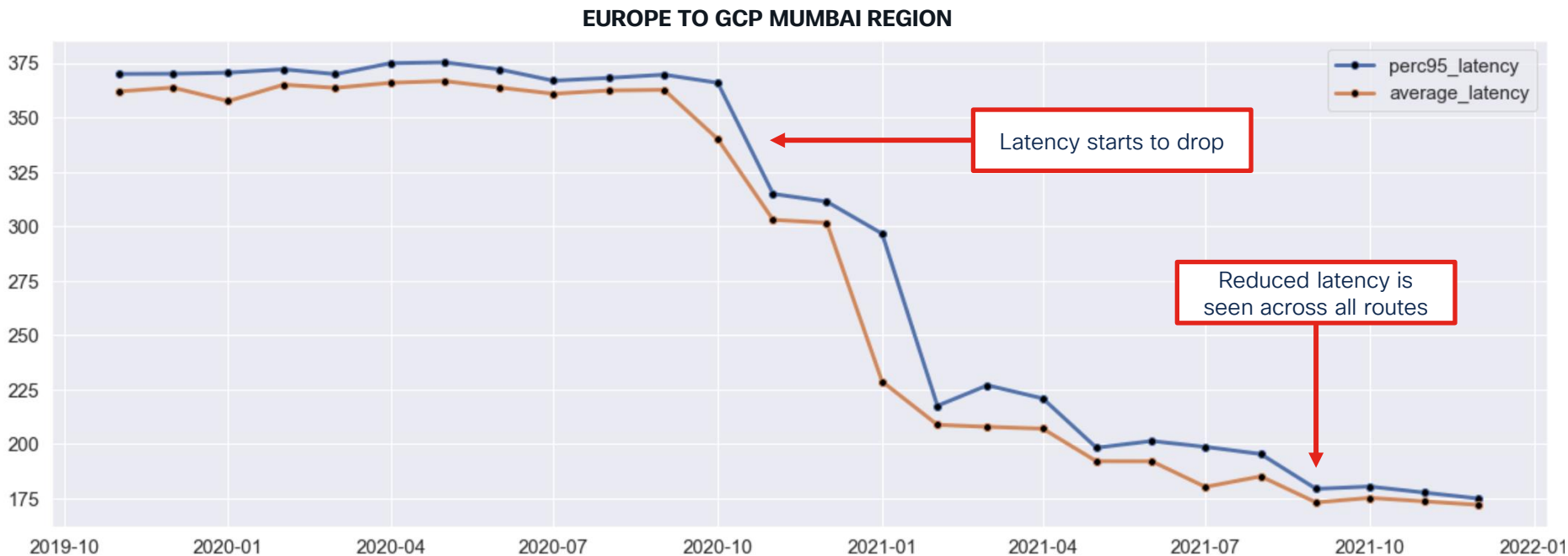
HOSTING REGION: MUMBAI, INDIA

BI-DIRECTIONAL LATENCIES

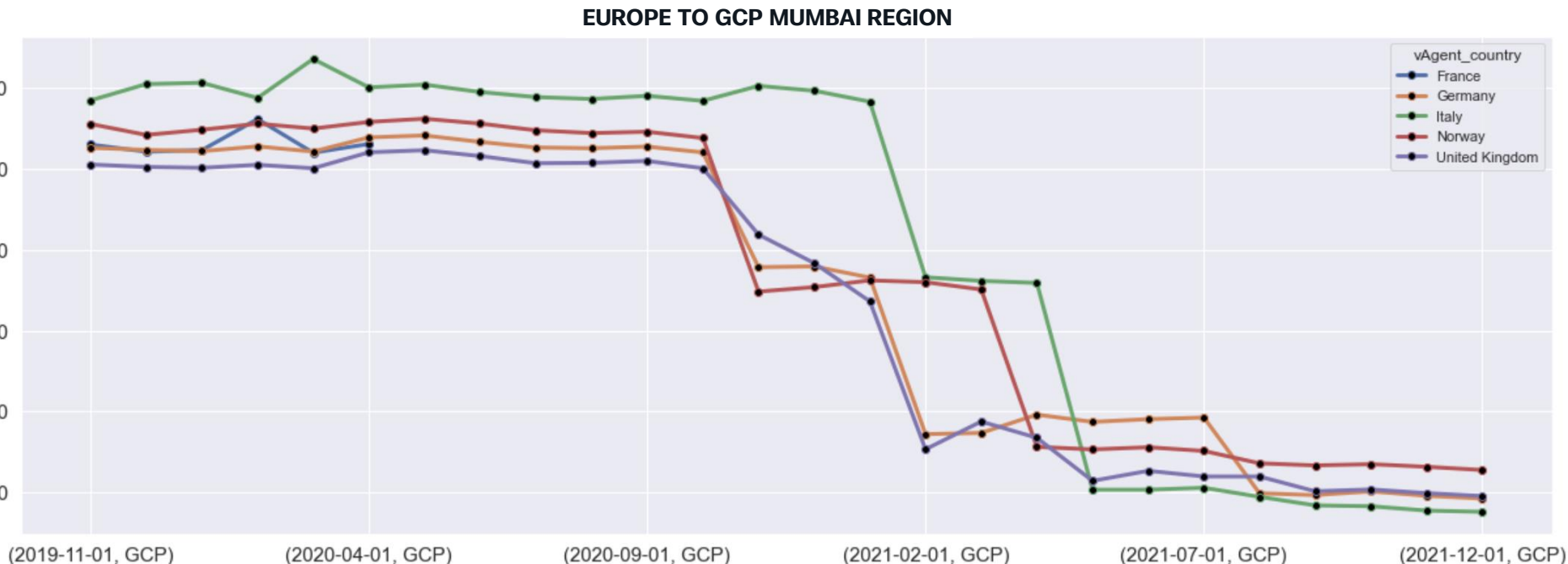
End-User Measurements



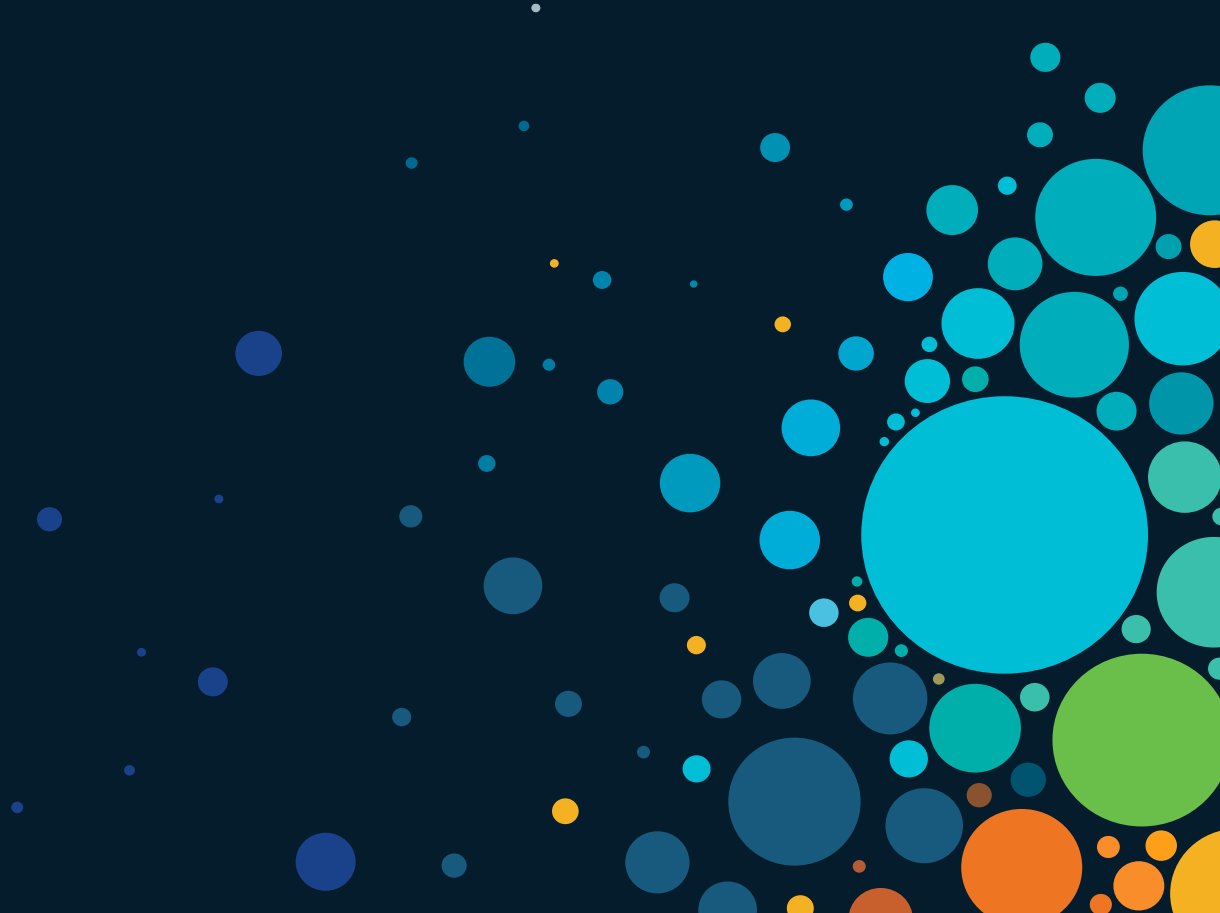
GCP Rolls Out Direct Route for Inbound Traffic



But not every city is treated equally...



Inter-Region Performance

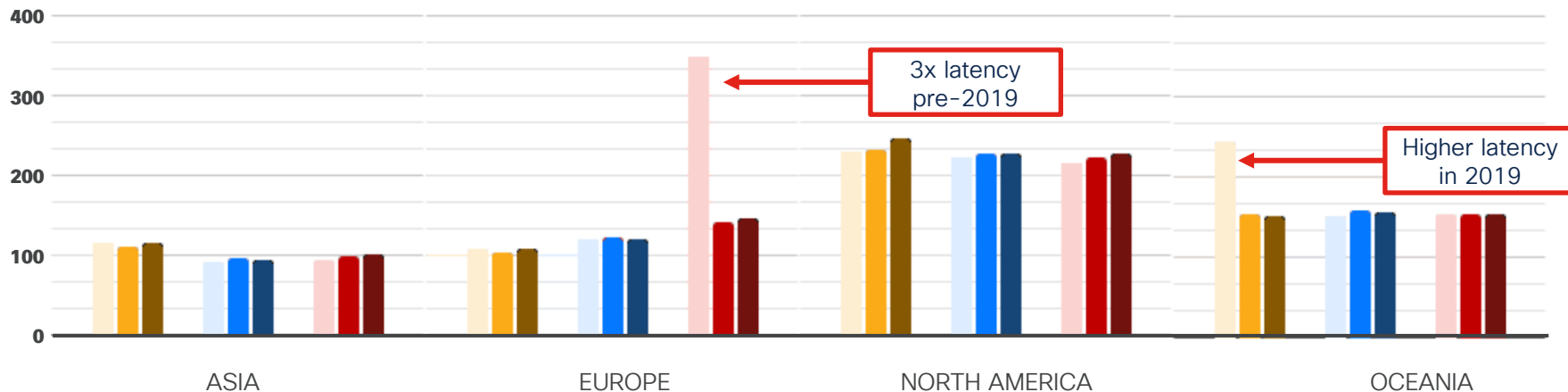
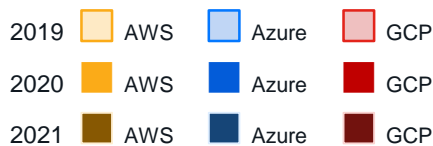


Inter-region performance to India Host Region

HOSTING REGION: MUMBAI, INDIA

BI-DIRECTIONAL LATENCIES

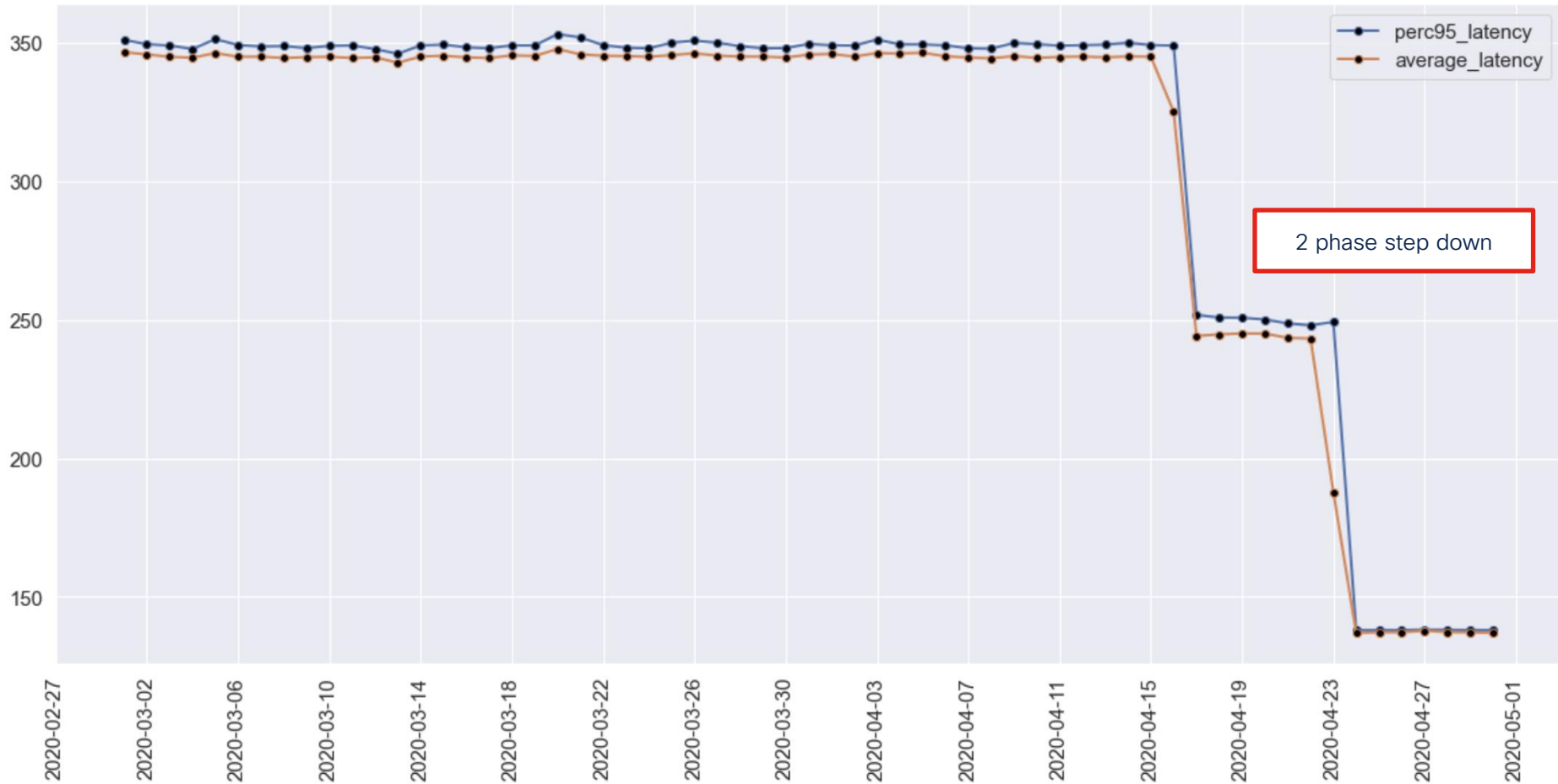
Inter-region

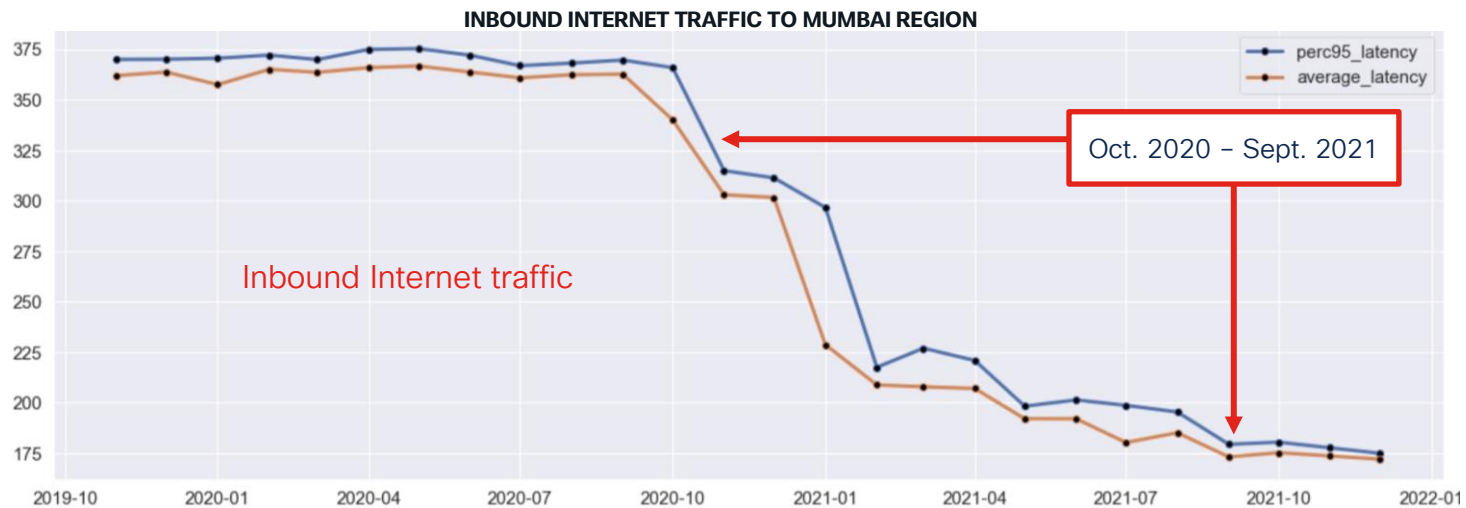
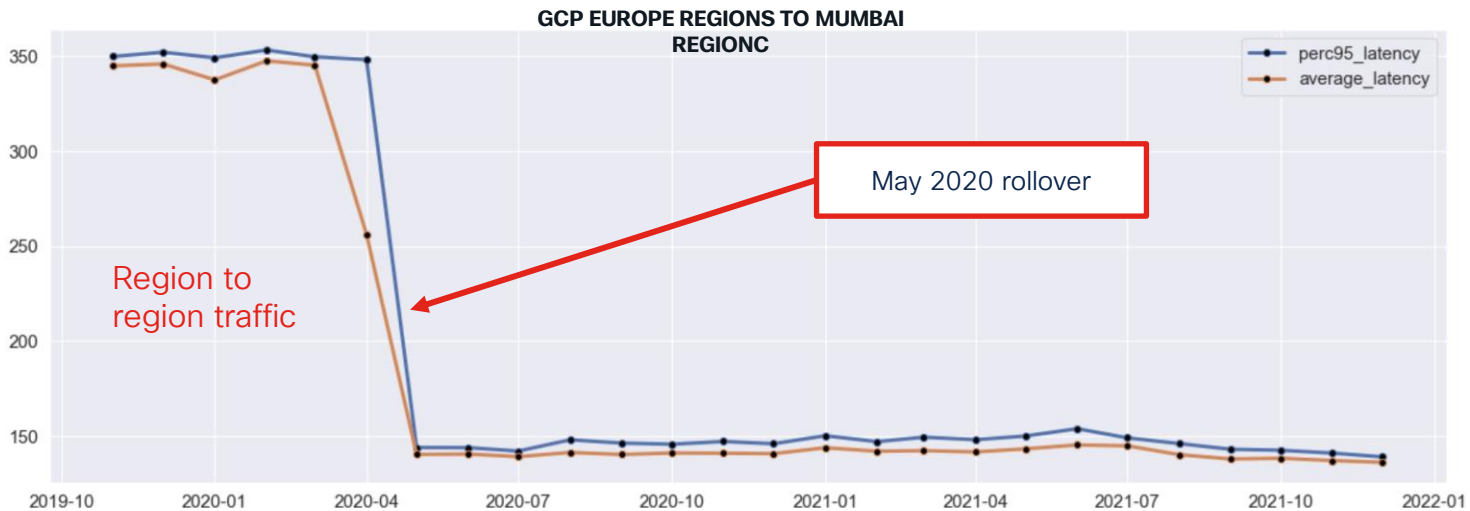


GCP Rolls Out New Route for Inter-Region Traffic

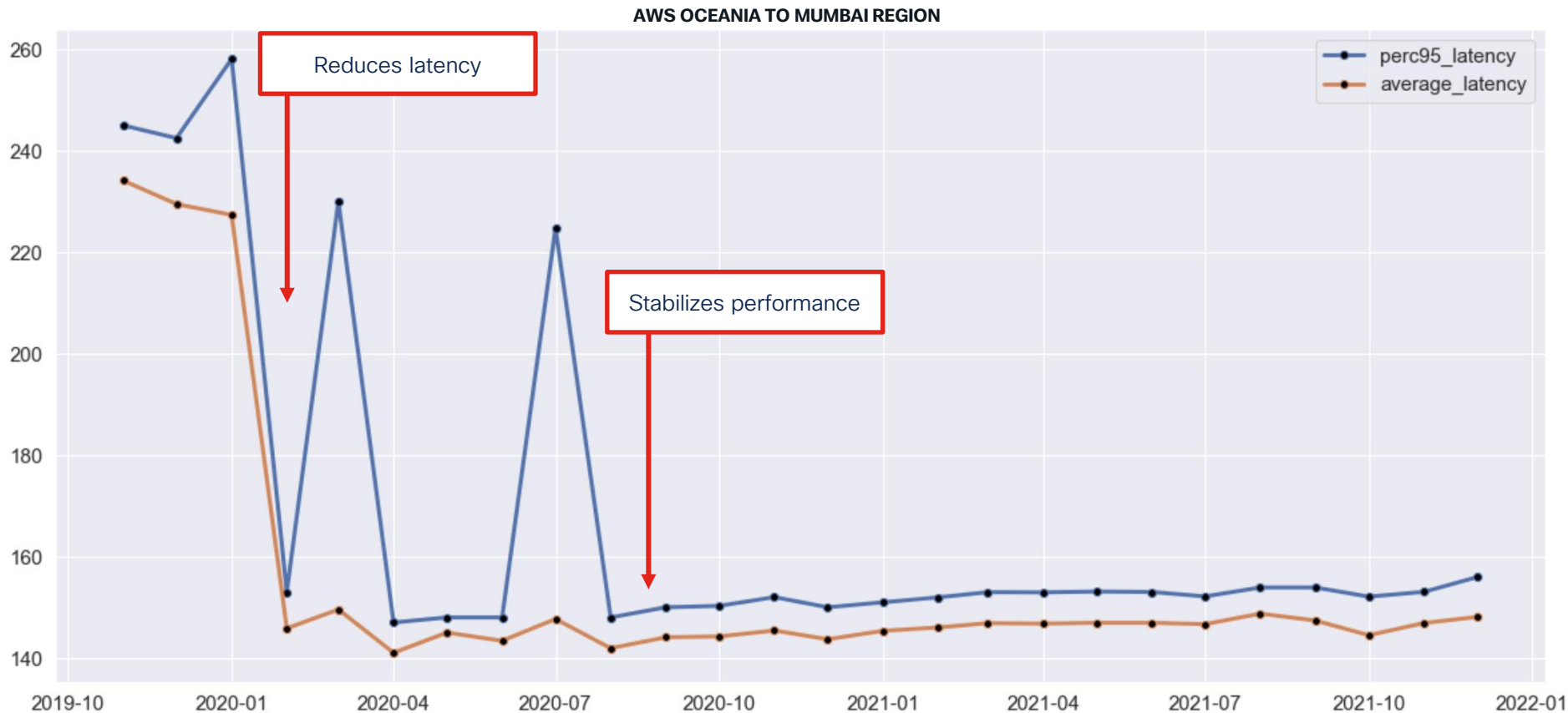


GCP EUROPE REGIONS TO MUMBAI REGION – JANUARY TO MAY 2020

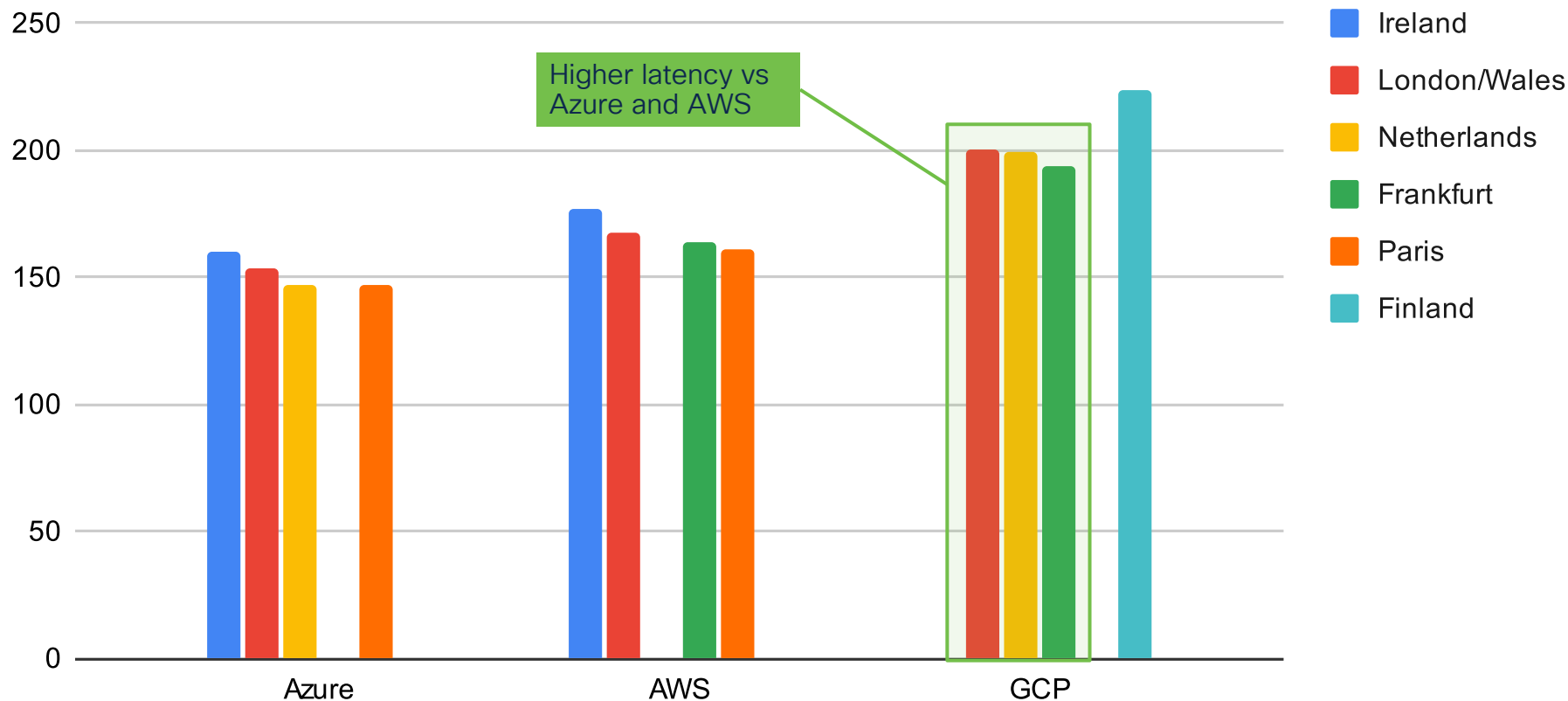




AWS Improves Performance in 2020



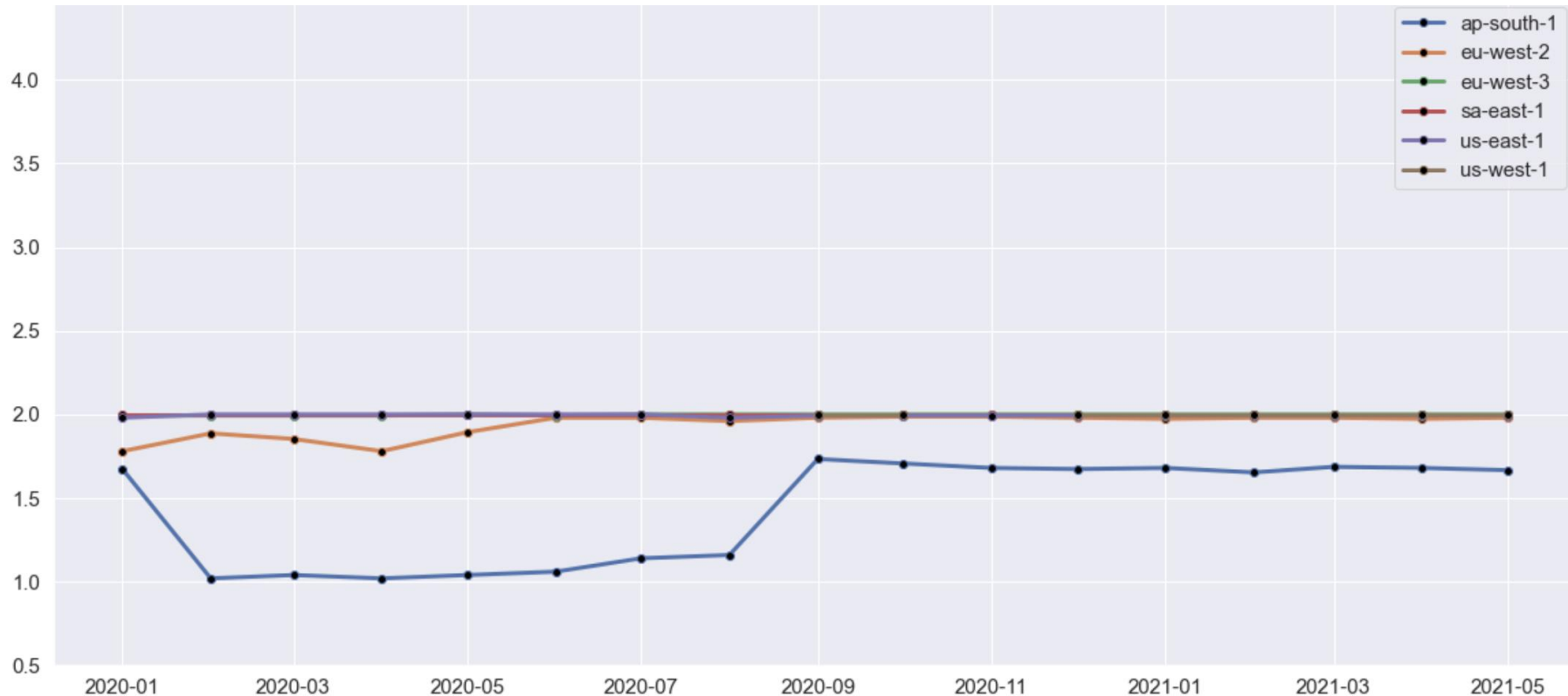
Inter-Region: Europe to Singapore - 2021



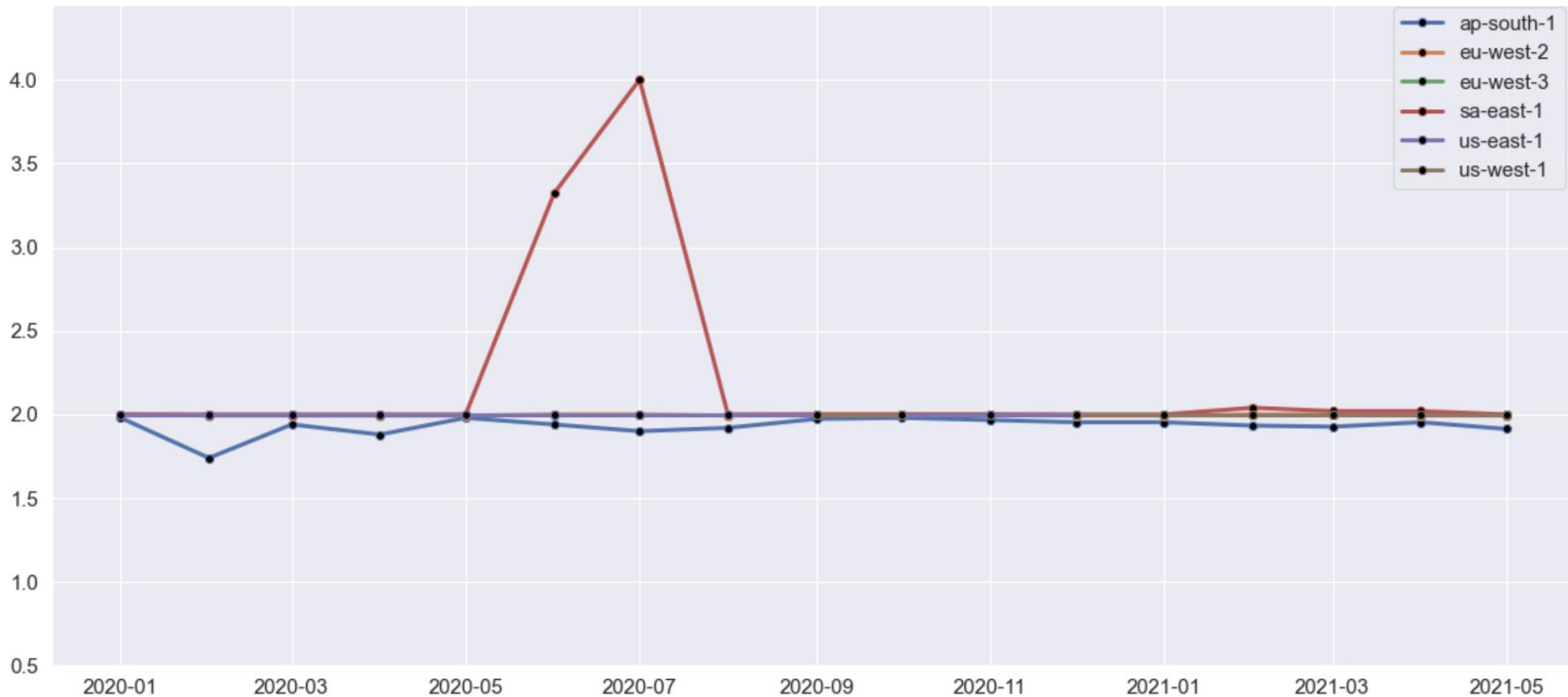
Inter-AZ Performance



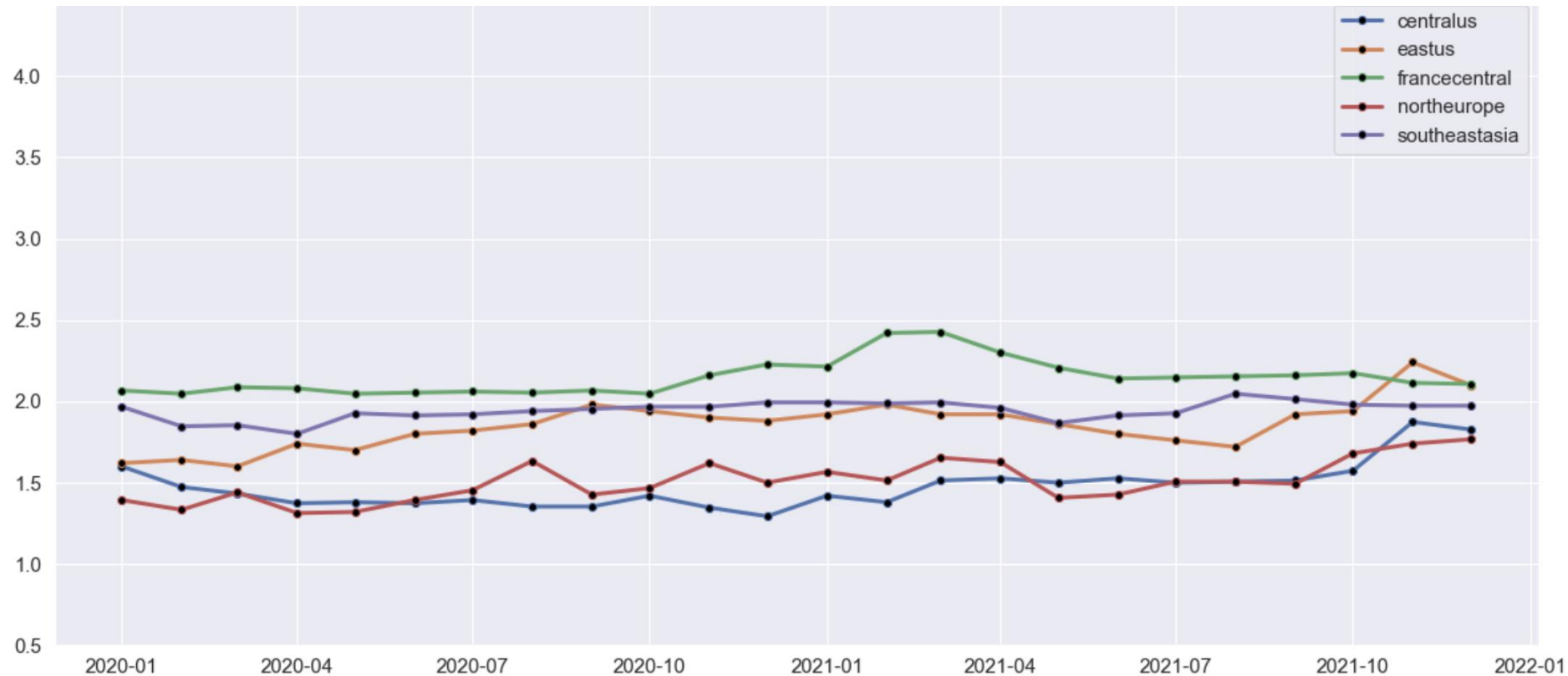
AWS Inter-AZ Performance – 95th Percentile



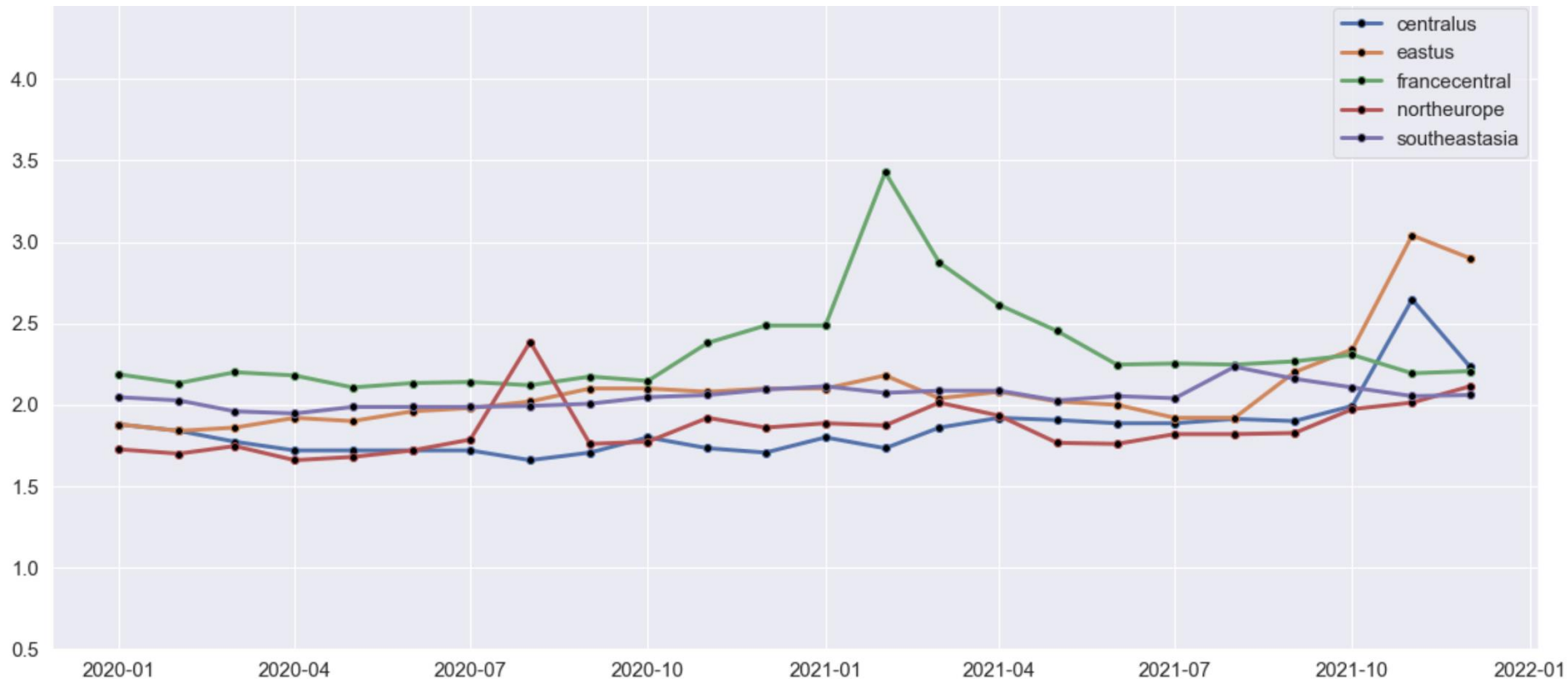
AWS Inter-AZ Performance – 98th Percentile



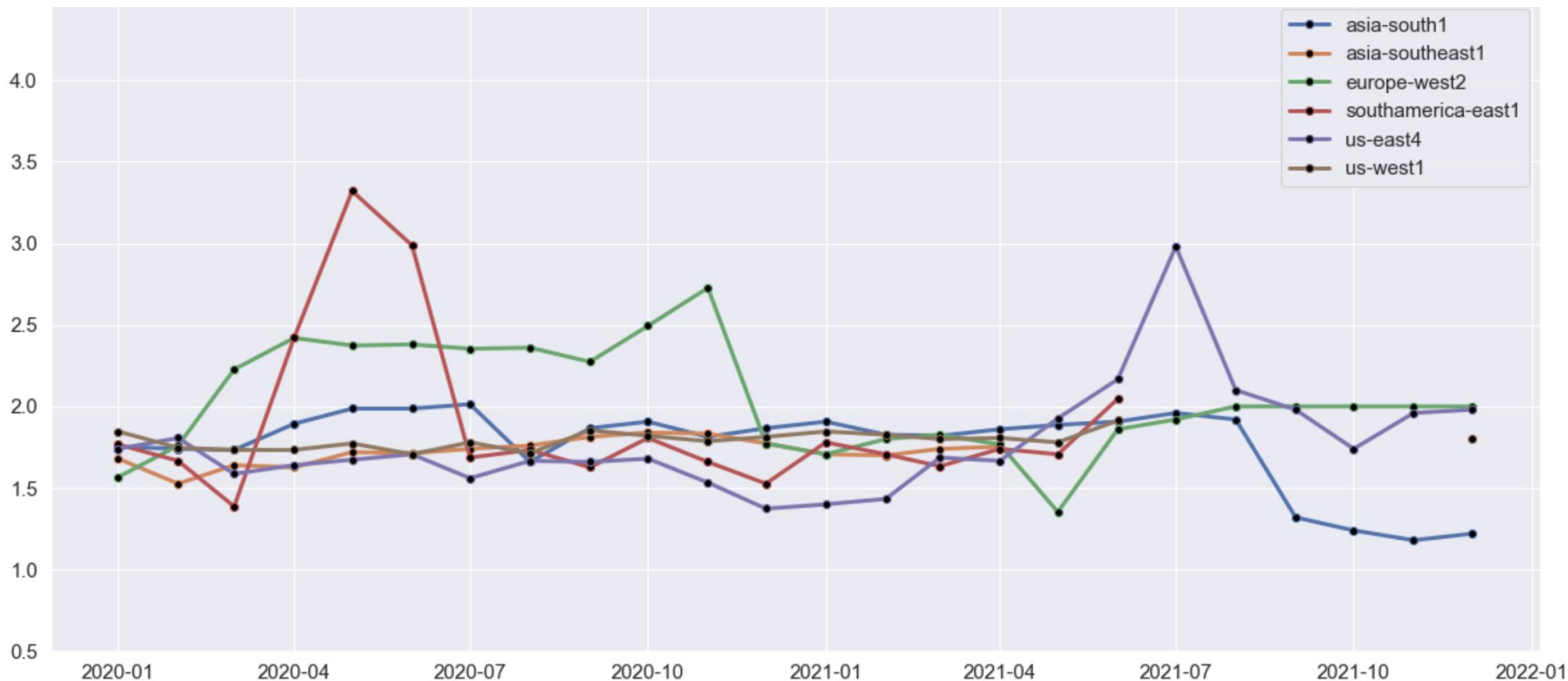
Azure Inter-AZ Performance – 95th Percentile



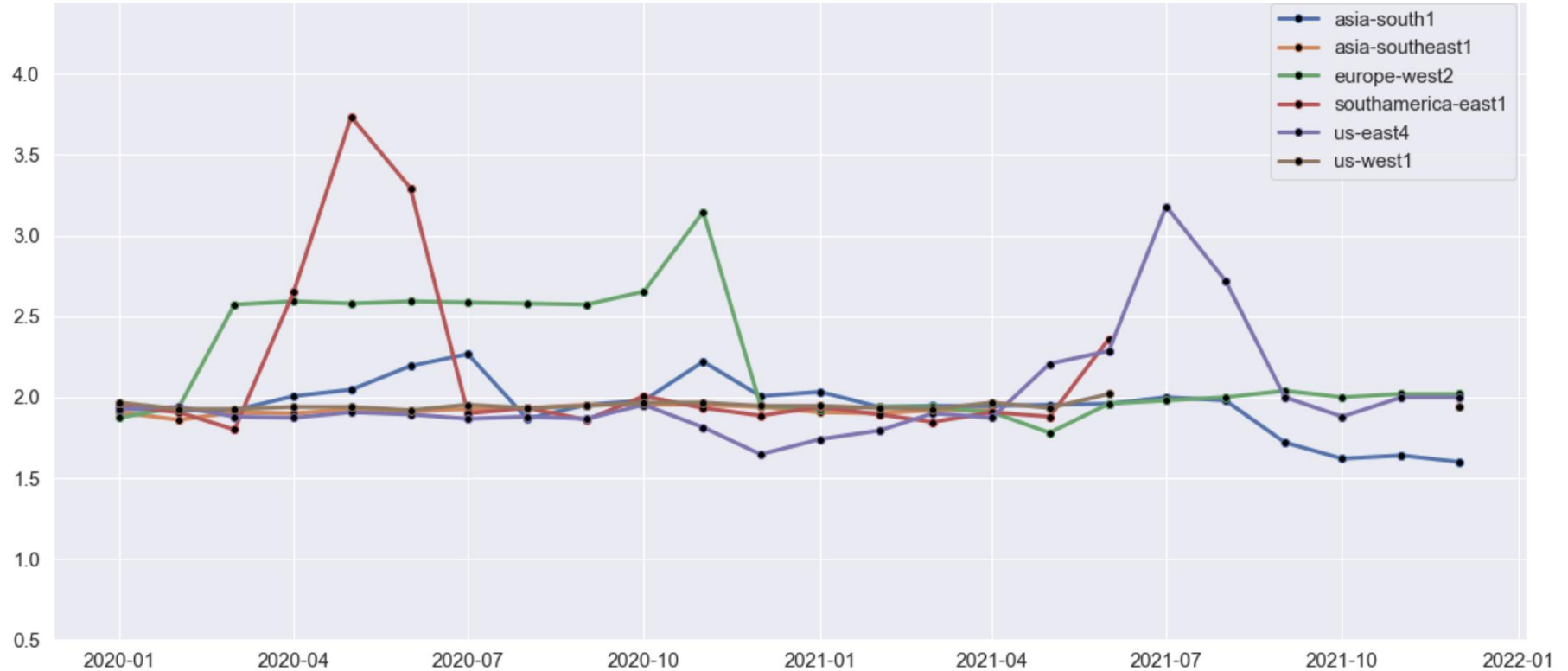
Azure Inter-AZ Performance – 98th Percentile



GCP Inter-AZ Performance – 95th Percentile

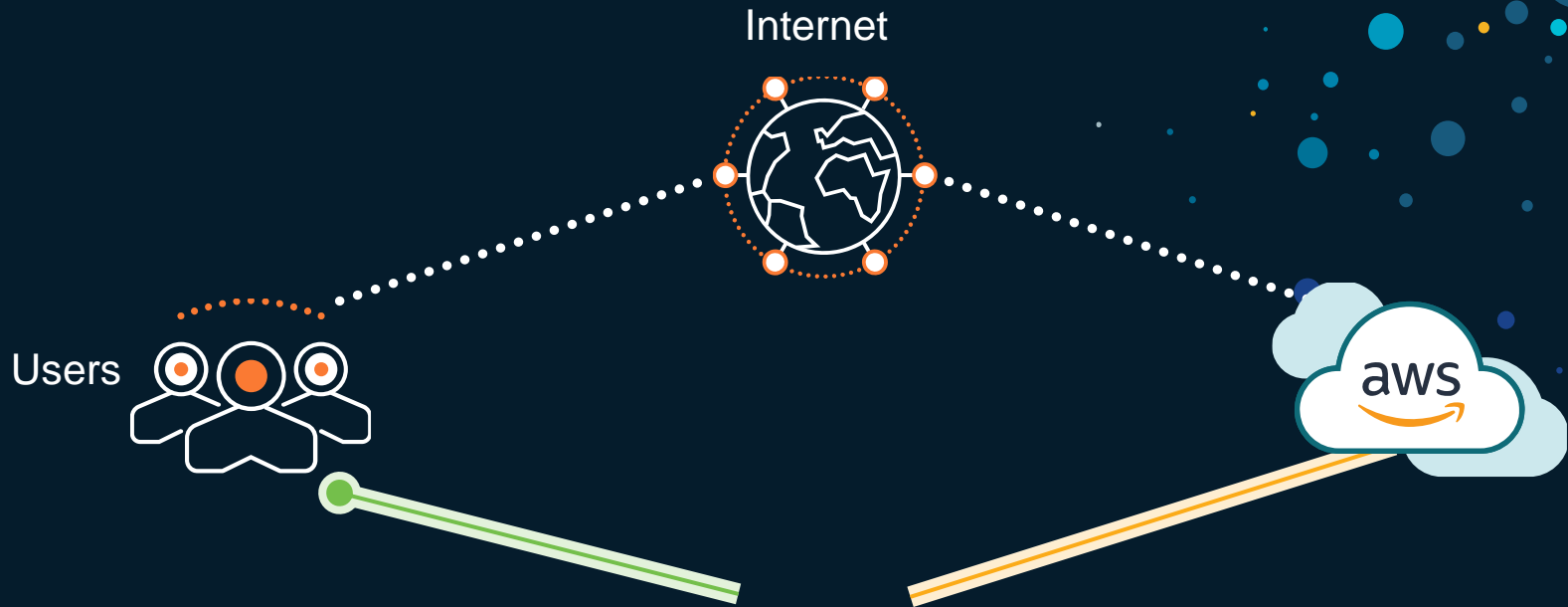


GCP Inter-AZ Performance – 98th Percentile



AWS Global Accelerator Performance

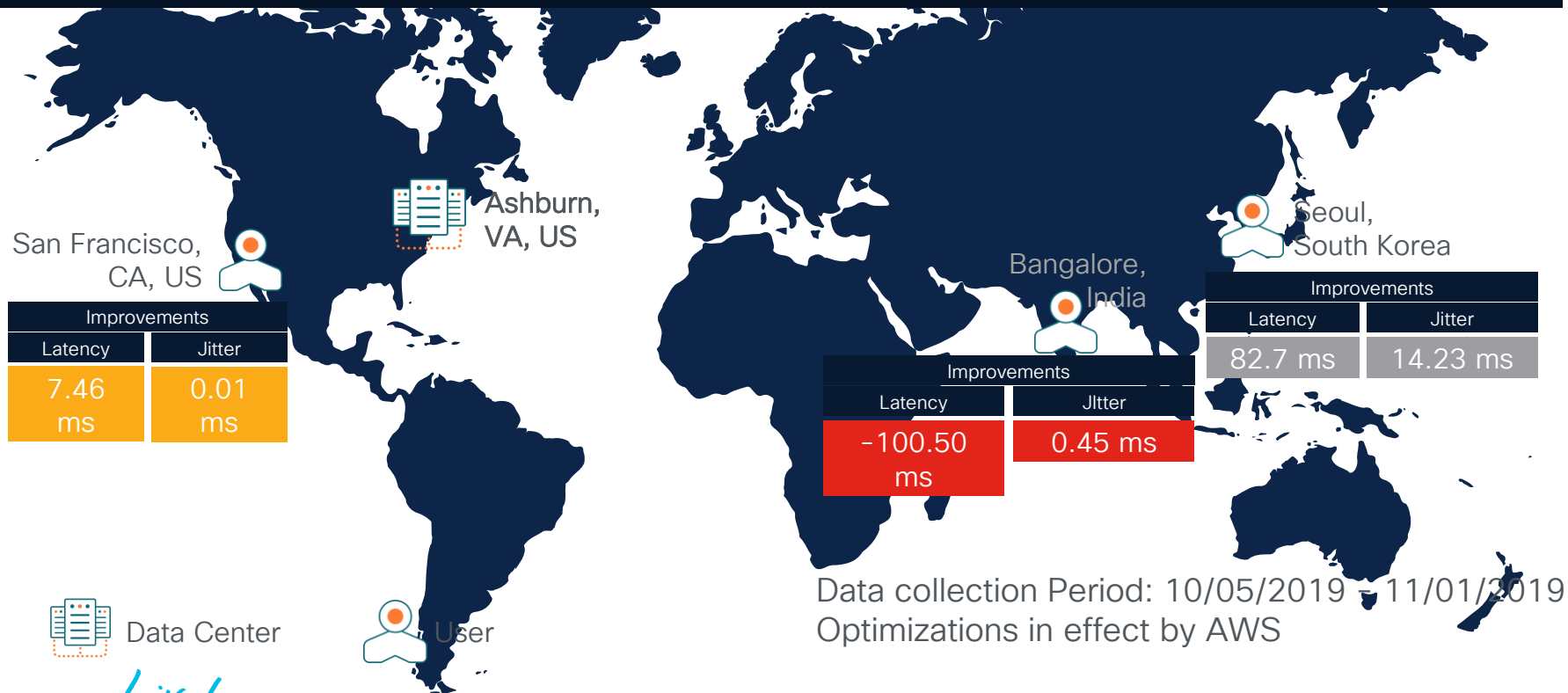




AWS Global Accelerator

AWS Global Accelerator

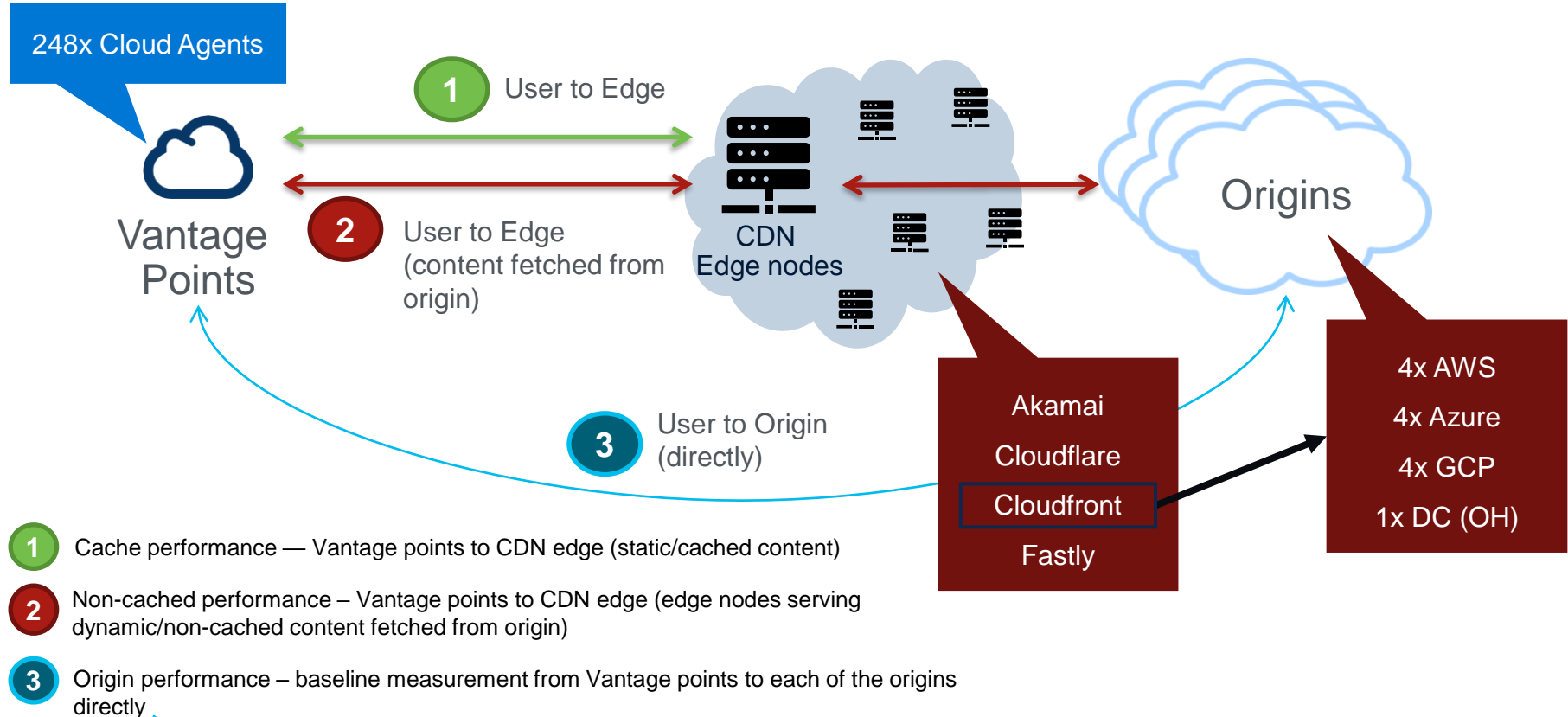
Your Mileage May Vary



CDNs and Cloud to Cloud Connectivity



CDN Test Architecture



AWS Cloudfront to Cloud-hosted Origins

CDN	Vantage Points Continent	Origin Cloud Provider/Region			
		Rank 1	Rank 2	Rank 3	Rank 4
Cloudfront	Africa	AWS/Europe (2192)	Azure/Europe (2274)	GCP/Europe (2865)	AWS/US East (3539)
Cloudfront	Asia	AWS/Japan (1125)	GCP/Japan (1343)	Azure/Japan (1380)	AWS/US West (2479)
Cloudfront	Europe	AWS/Europe (684)	Azure/Europe (730)	GCP/Europe (854)	Azure/US East (1619)
Cloudfront	North America	GCP/US East (897)	GCP/US West (905)	Azure/US East (921)	AWS/US West (953)
Cloudfront	Oceania	Azure/Japan (2211)	AWS/Japan (2225)	GCP/Japan (2257)	AWS/US West (2640)
Cloudfront	South America	Azure/US East (1899)	GCP/US East (2109)	AWS/US East (2462)	GCP/US West (2575)

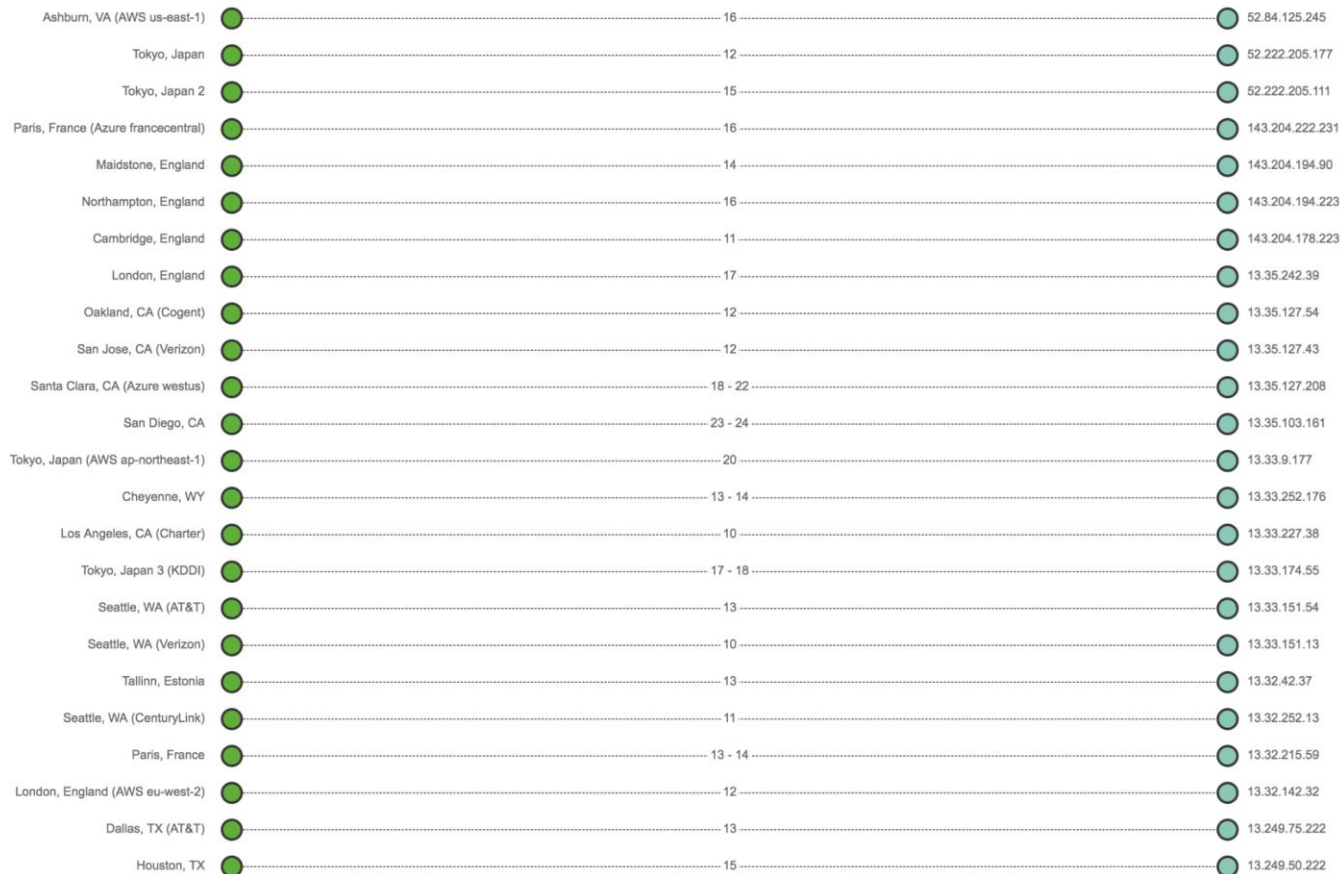
Akamai to Cloud Connectivity

CDN	Vantage Points Continent	Origin Cloud Provider/Region			
		Rank 1	Rank 2	Rank 3	Rank 4
Akamai	Africa	Azure/US West (2015)	Azure/Europe (2645)	AWS/Europe (2674)	GCP/Europe (3004)
Akamai	Asia	Azure/US West (1034)	Azure/Japan (1383)	GCP/Japan (1401)	AWS/Japan (1497)
Akamai	Europe	Azure/Europe (741)	AWS/Europe (745)	GCP/Europe (933)	Azure/US West (1069)
Akamai	North America	Azure/US West (699)	AWS/US East (964)	GCP/US East (974)	Azure/US East (997)
Akamai	Oceania	Azure/US West (1338)	AWS/Japan (2388)	Azure/Japan (2401)	GCP/Japan (2498)
Akamai	South America	Azure/US West (1032)	Azure/US East (2265)	GCP/US East (2380)	AWS/US East (2408)

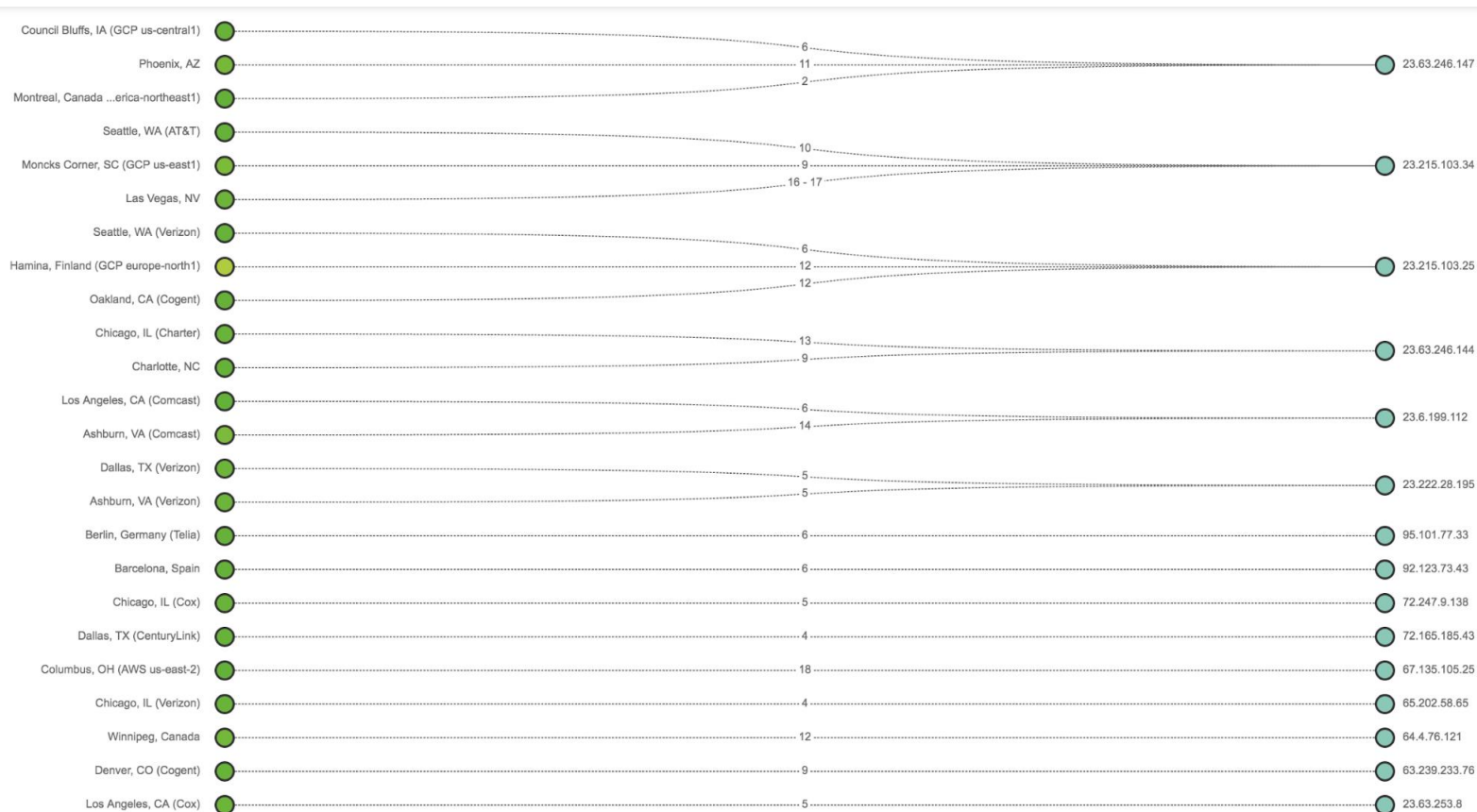
Journey to the Edge



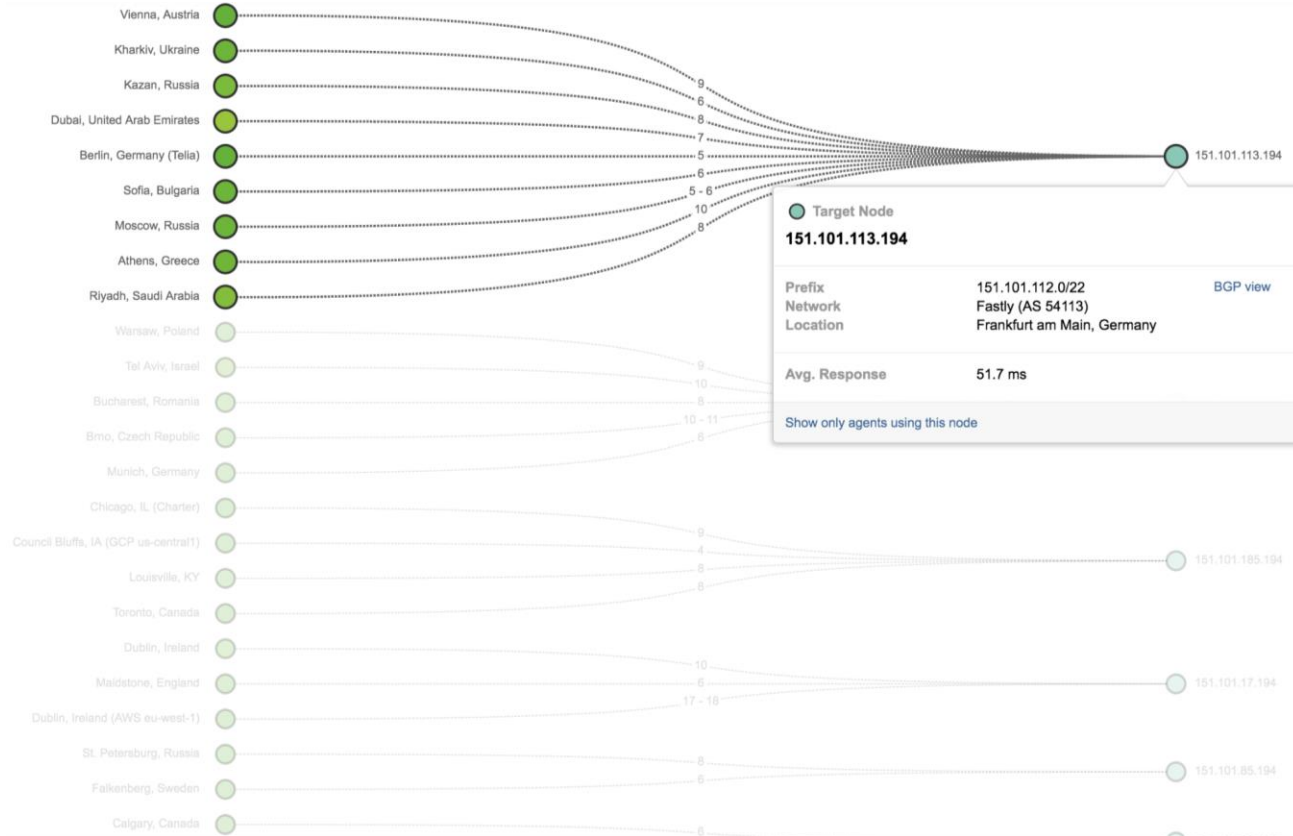
AWS Cloudfront



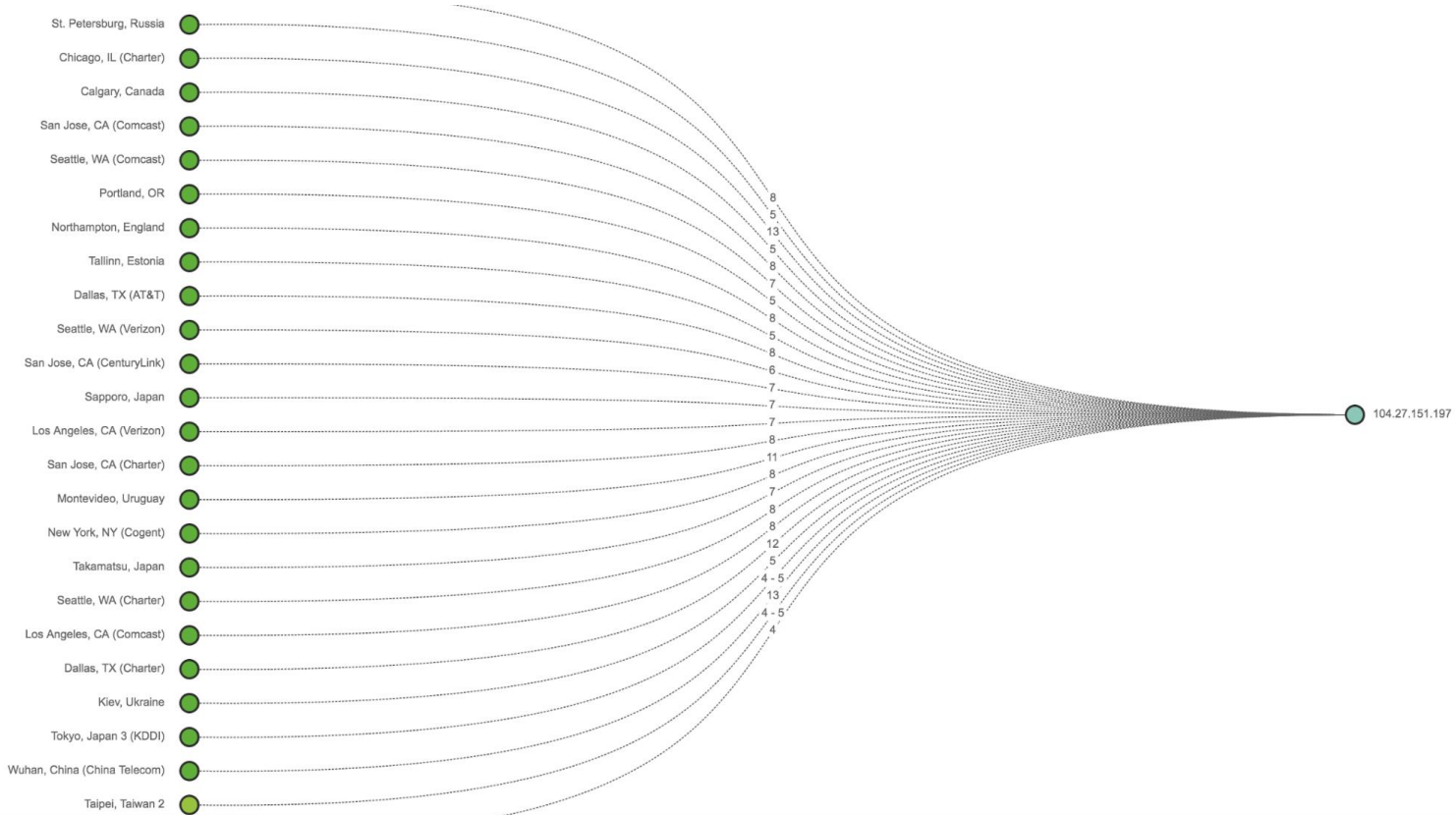
Akamai



Fastly



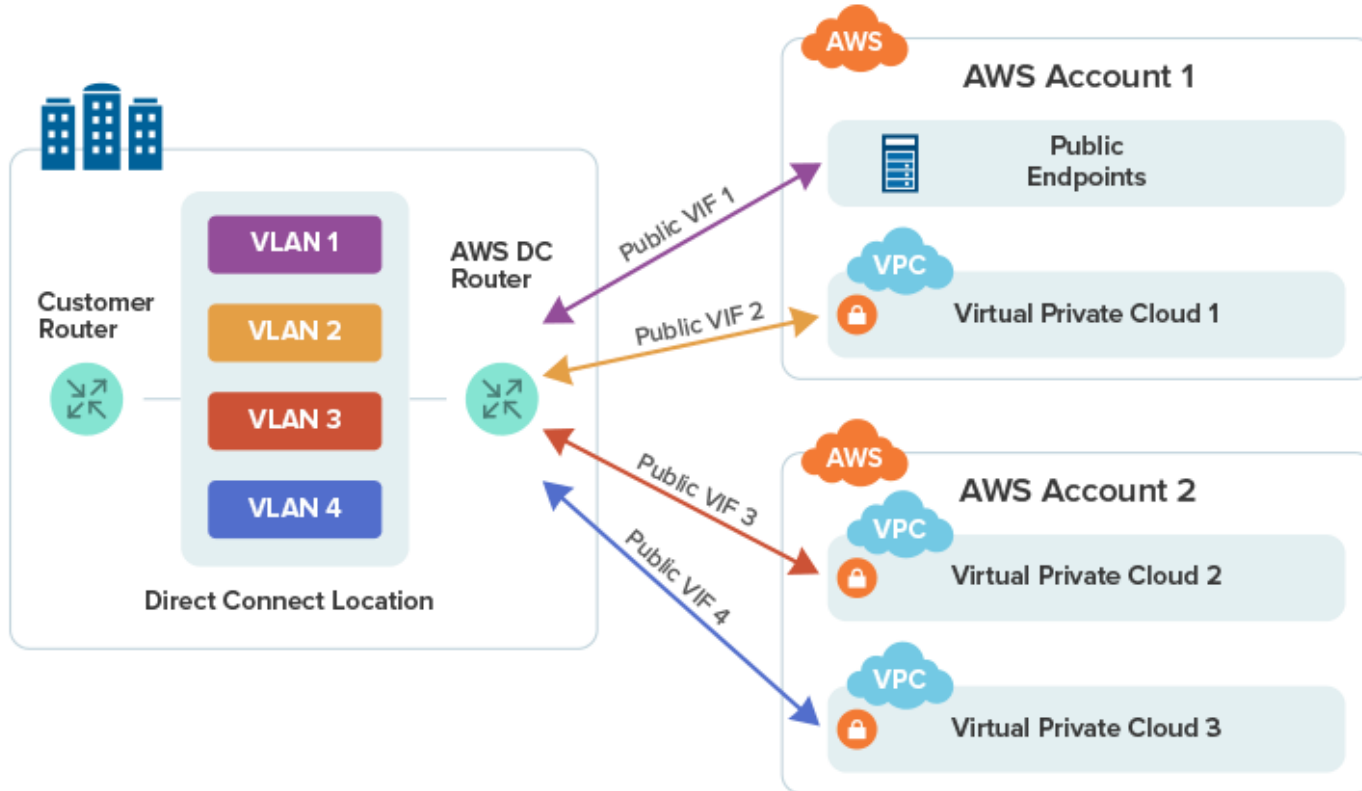
Cloudflare



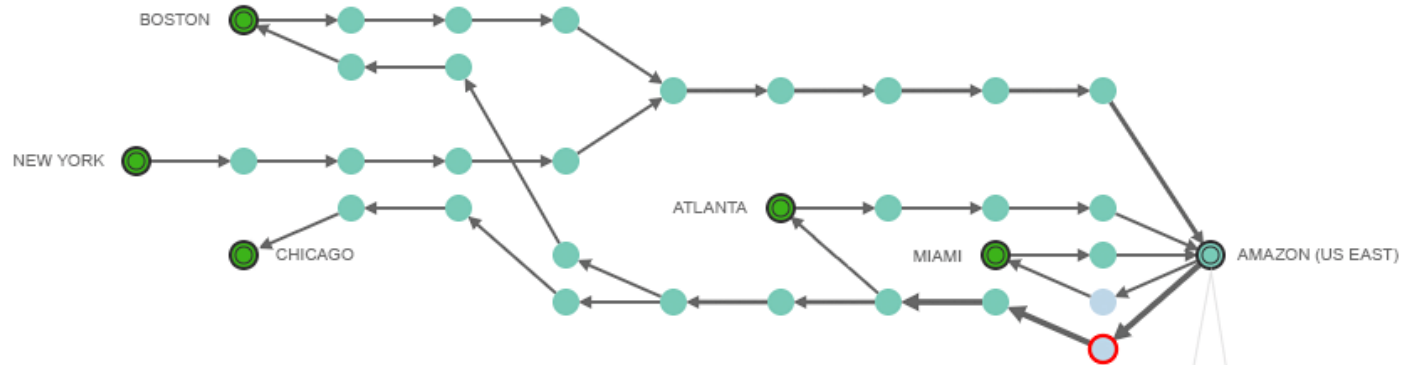
AWS Direct Connect



Direct Connect Architecture



Direct Connect Connectivity From User Sites



Enterprise Agent

AMAZON (US EAST)

Agent Details

Private IPv4 Address	172.19.201.35
Public IPv4 Address	64.22.121.89
Network	Amazon.com, Inc. (AS 14618)
Location	Ashburn Area

Interface Details

IP Address	172.19.201.35
Avg. Response	28.1 ms
TCP MSS	1379 bytes
Min. Path MTU	1422 bytes


Direct Connect Goes Down

North AmericaSouth AmericaEuropeAsia Pacific

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 AWS Direct Connect (N. Virginia)

Network Connectivity

[less](#)

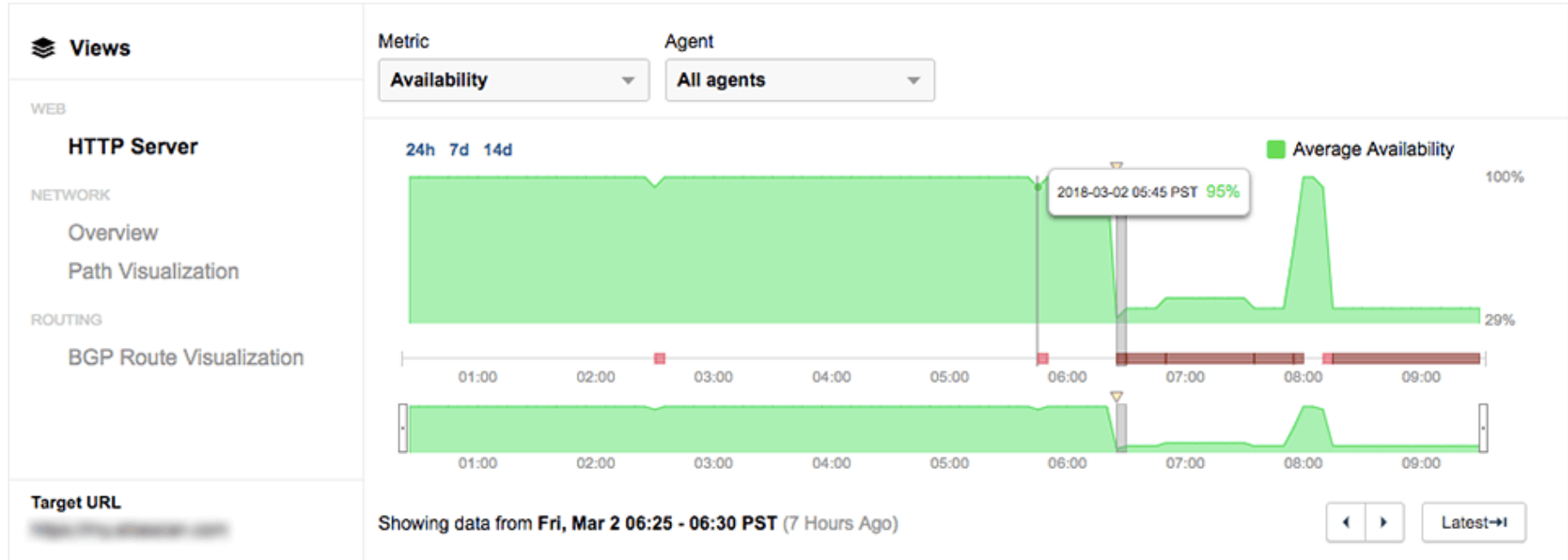


7:29 AM PST We are investigating increased packet loss possibly impacting some AWS Direct Connect customers in the US-EAST-1 Region.

8:03 AM PST We continue to work towards resolving the increased packet loss impacting AWS Direct Connect connectivity to the US-EAST-1 Region. Direct Connect connections from the Equinix DC1 - DC6 & DC10 - DC12, Ashburn, VA and CoreSite VA1 & VA2, Reston, VA locations are affected by this issue.

9:43 AM PST Connections in the CoreSite VA1 & VA2 (Reston, VA) location, and some connections in the Equinix DC1 - DC6 & DC10 - DC12 (Ashburn, VA) location are inactive. Inactive connections are not receiving routes advertised from Direct Connect routers. We are now working to restore service on these Direct Connect connections. The AWS VPN service is operating normally and may be an alternative for some workloads.

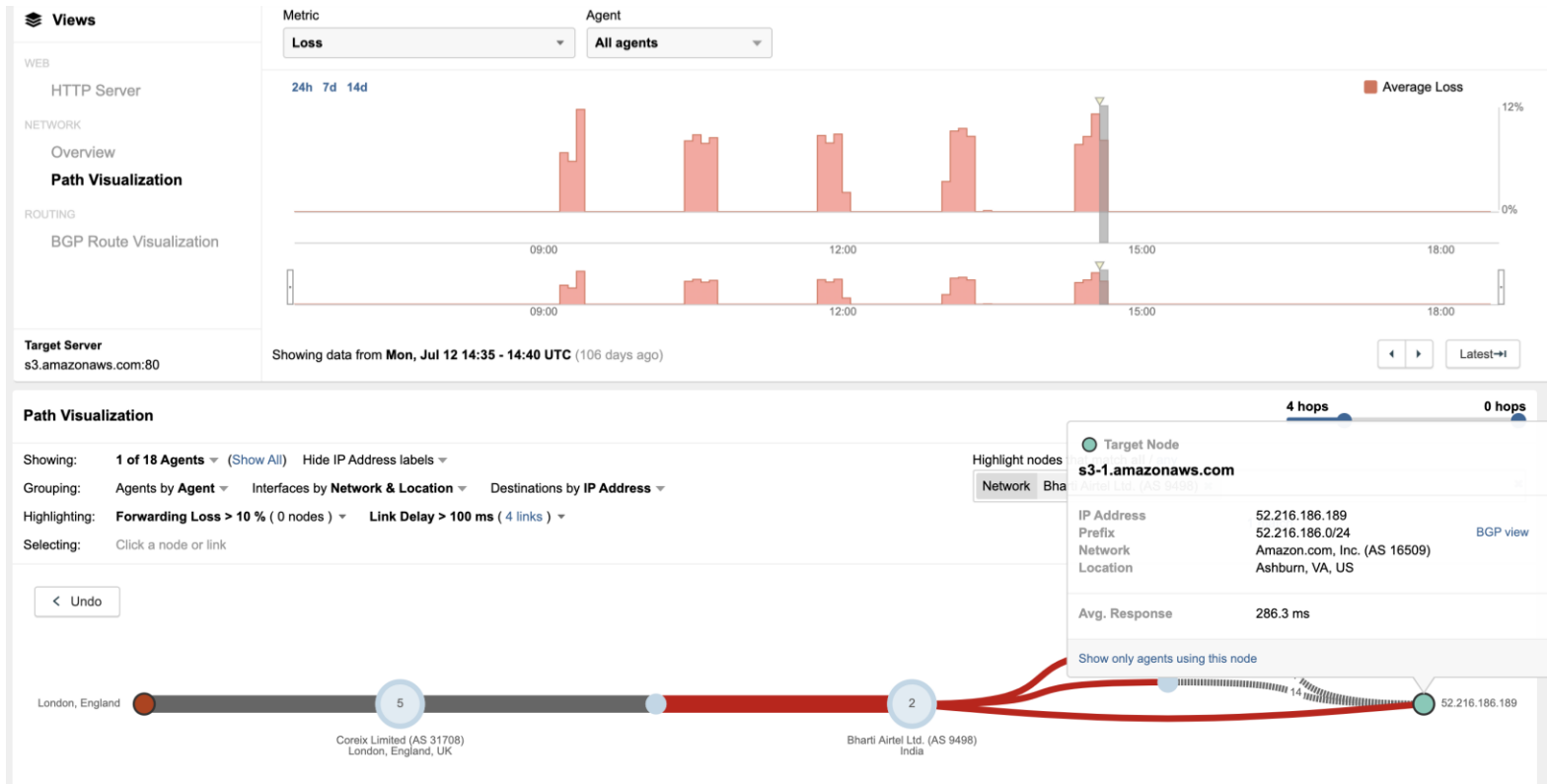
Lack of Redundancy Led to Service Disruptions



Cloudy with a Chance of Route Leaks

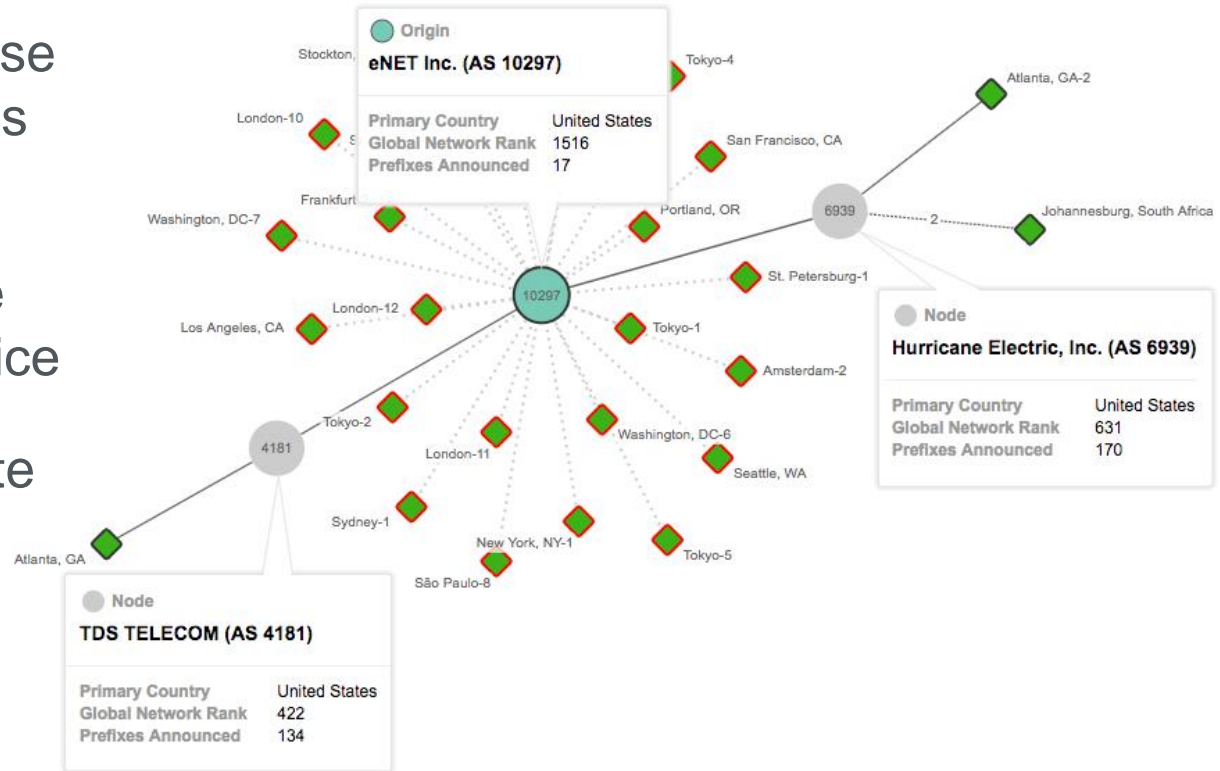


US-East 1 Prefixes Route Leak



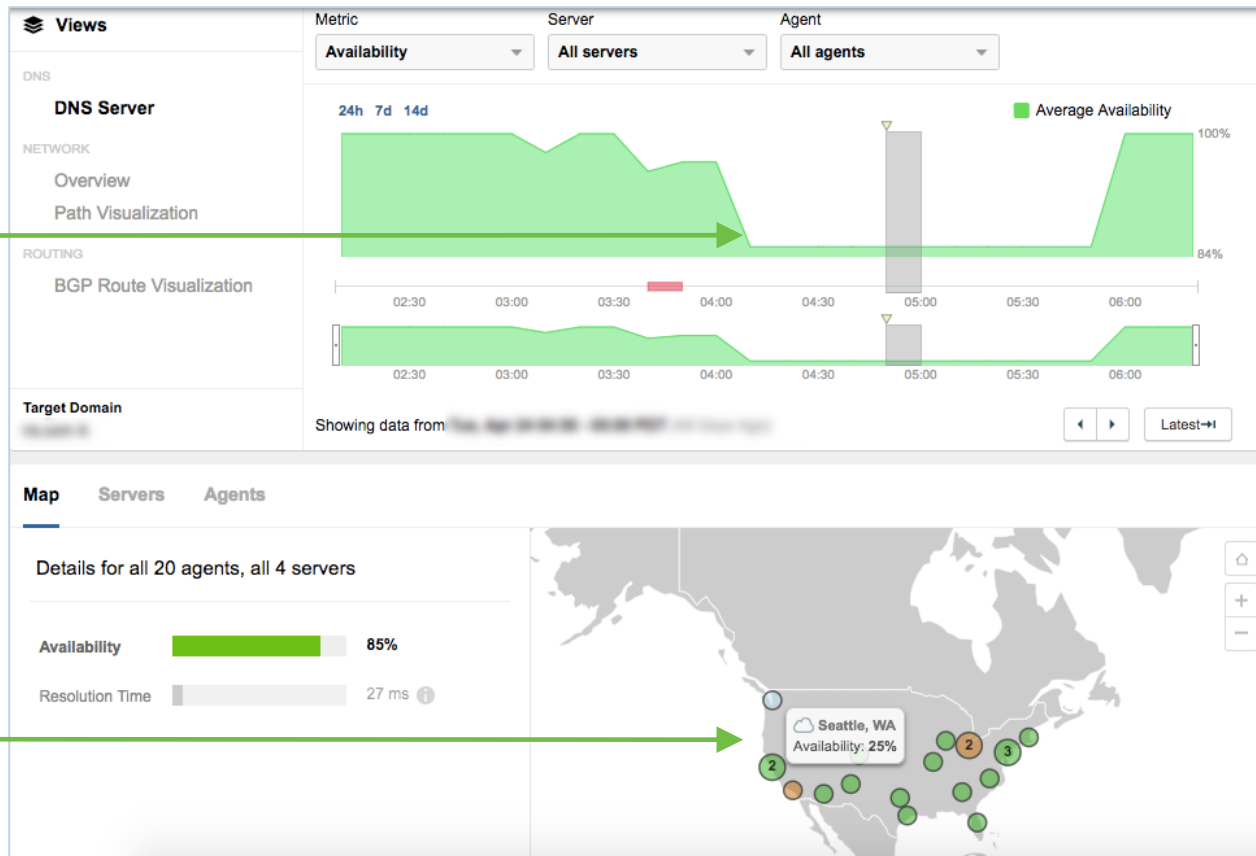
Route 53: The Hijacking Begins...

- Hackers compromise small ISP's systems
- ISP announces a more specific route to AWS' DNS Service
- Two ISPs propagate the prefix



AWS DNS Servers Unreachable

DNS Servers unavailable for
~ 2 hours



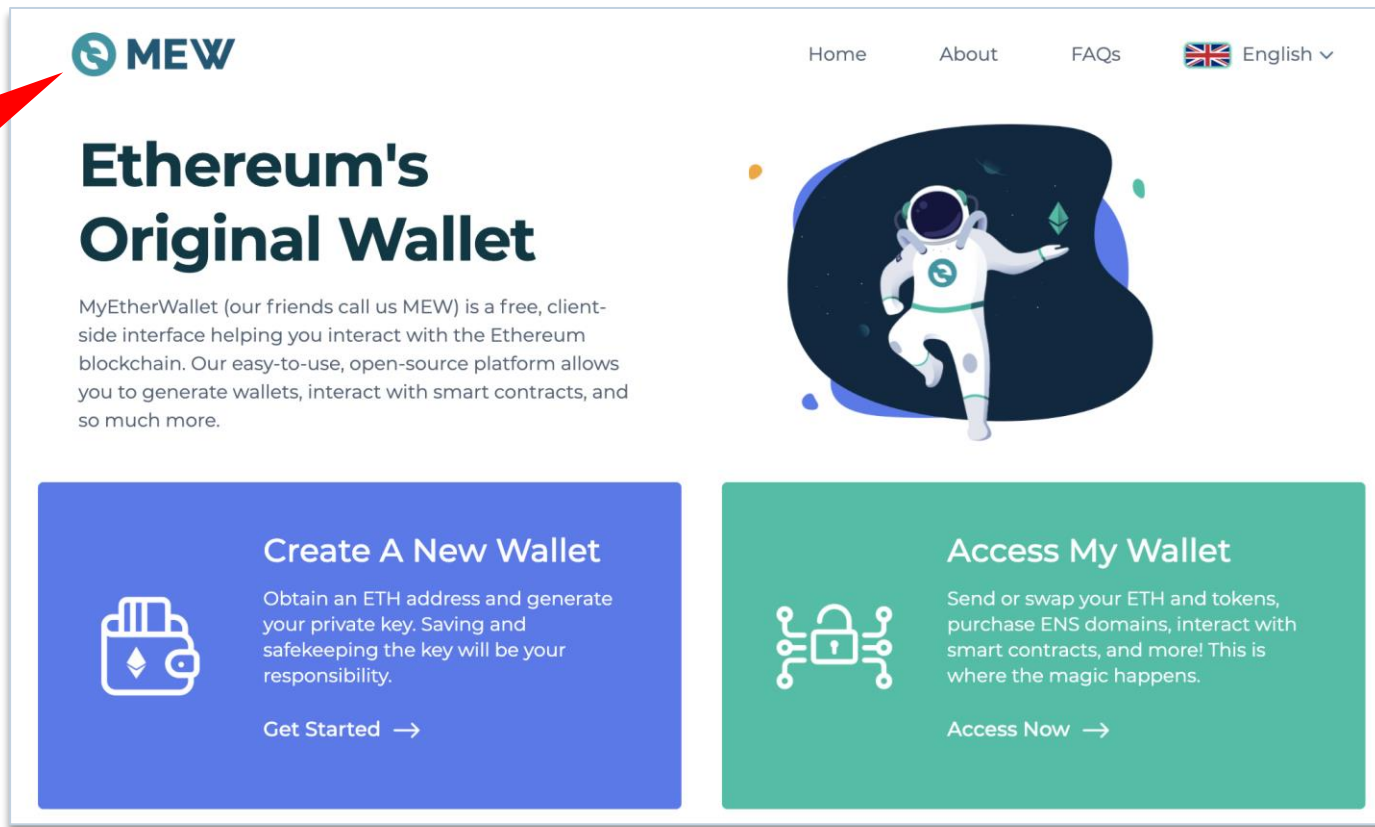
Availability map indicates
problem areas

DNS Traffic Blackholed at Compromised ISP



Digital Bank Robbery, A.K.A. Crypto-Wallet Theft

The
Target



The screenshot shows the MyEtherWallet (MEW) website. At the top left is the MEW logo. To the right are navigation links for Home, About, and FAQs, followed by a language selector showing a UK flag and the word "English" with a dropdown arrow. The main heading is "Ethereum's Original Wallet". Below it is a paragraph describing MEW as a free, client-side interface for interacting with the Ethereum blockchain. To the right of the text is an illustration of an astronaut in a white suit with a green stripe and a green 'E' on the chest, floating in space and holding a green Ethereum diamond. Below the main text are two large colored boxes. The left box is blue and titled "Create A New Wallet", featuring an icon of a wallet with a diamond and a "Get Started" link with a right arrow. The right box is green and titled "Access My Wallet", featuring an icon of a padlock with circuit lines and an "Access Now" link with a right arrow.

MEW

Home About FAQs English ▾

Ethereum's Original Wallet

MyEtherWallet (our friends call us MEW) is a free, client-side interface helping you interact with the Ethereum blockchain. Our easy-to-use, open-source platform allows you to generate wallets, interact with smart contracts, and so much more.

Create A New Wallet

Obtain an ETH address and generate your private key. Saving and safekeeping the key will be your responsibility.

[Get Started →](#)

Access My Wallet

Send or swap your ETH and tokens, purchase ENS domains, interact with smart contracts, and more! This is where the magic happens.

[Access Now →](#)

Takeaways



Top 5 Takeaways

- No steady state in the cloud
- Trust, but verify performance and routing expectations
- Visibility key to provider oversight and accountability
- Everything matters!
- Just because you don't see something, doesn't mean its not hurting you (or your customers)

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- These points help you get on the leaderboard and increase your chances of winning daily and grand prizes.



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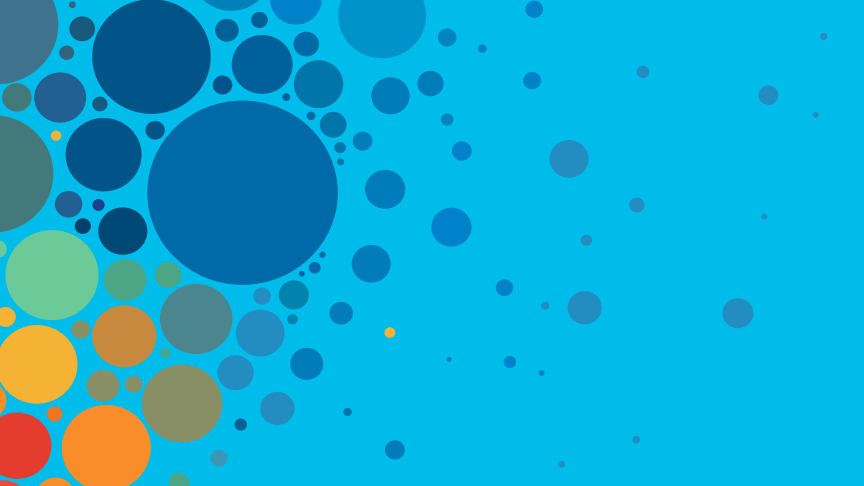
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Recertification training options for Cisco certified individuals

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- Book your one-on-one Meet the Engineer meeting
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at www.CiscoLive.com/on-demand



The bridge to possible

Thank you

CISCO *Live!*



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