Google

Inside Google Peering: Observed trends, recent policy changes, and future direction

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Google Peering Update: Why?

- Google traffic plays a significant role in the internet ecosystem.
- We have made many changes over the last few years to our peering policies.
- Our goal is to provide transparency and share our experience.
- Clarify available peering options.
- We'll cover the challenges we saw, the evolution of our policies, and what happens next.

Let's take a trip back to 2015.....

Key Google Traffic Trends

- **YouTube's Rapid Ascent:** YouTube was experiencing significant y/y traffic growth. At the time, YouTube was only ad-supported.
- **Search and Ads Continued Growth**: Despite their relative maturity, Google Search and Ad products continued to grow in traffic and revenue.
- **Google Cloud in Nascent Stage**: Google Cloud Platform (GCP) became GA in November 2011. GCE (Compute) was GA in 2012

Implications for Network Operations and Connectivity

- **Open Peering Policy**: Google willing to peer with anyone, anywhere with as much capacity as possible to facilitate broad reach and low latency.
- **Widespread GGC deployment:** Google's Global Cache (GGC) nodes were liberally deployed to bring content closer to users and reduce transit costs.
- **New Market Expansion**: AS15169 expanded globally to support Search, Ads and YouTube.

2025 Edge: Aligning Peering for Cloud Growth

Current Landscape (Circa Present)

- **Enterprise Cloud Growth at the Edge:** Enterprises leveraging Google's internet edge for business critical data transfer, frontending, API calls and VPN Tunnels.
- **Low and stable Cloud latency**: Customer pressure on achieving and maintaining low, stable internet latency near cloud regions. Ultra-sensitive to even minor latency changes or spikes.
- **Search & Ads: Stable Foundations**: While remaining critical, Google Search and Ads are mature businesses with largely stable and predictable traffic patterns.
- **Successful Peering and GGC Depth**: 10+ years of aggressive peering and GGC deployments had us connected with many networks.

Implications for Network Operations and Connectivity

- **Selective Peering Policy**: 10G+ traffic required. Only 100G PNIs. No new IX peering. Higher traffic requirements to deploy a cache. Updated Q1 2025.
- **Verified Peering Provider (VPP) for Cloud Customers:** Encourage cloud customers to use a VPP to connect vs peering.
- **New Market Expansion for Cloud**: New internet edge presences driven by cloud internet connectivity. Many new peering locations don't serve YouTube (eg BRU).

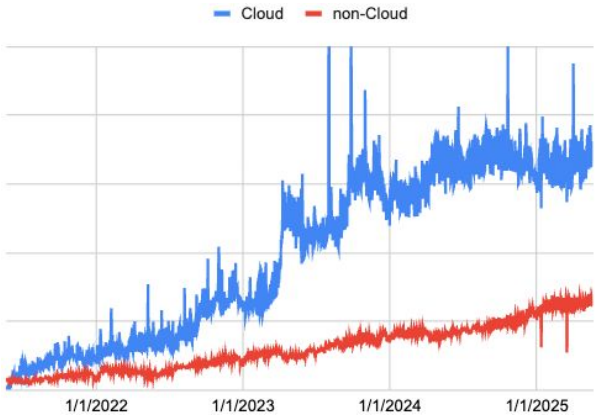
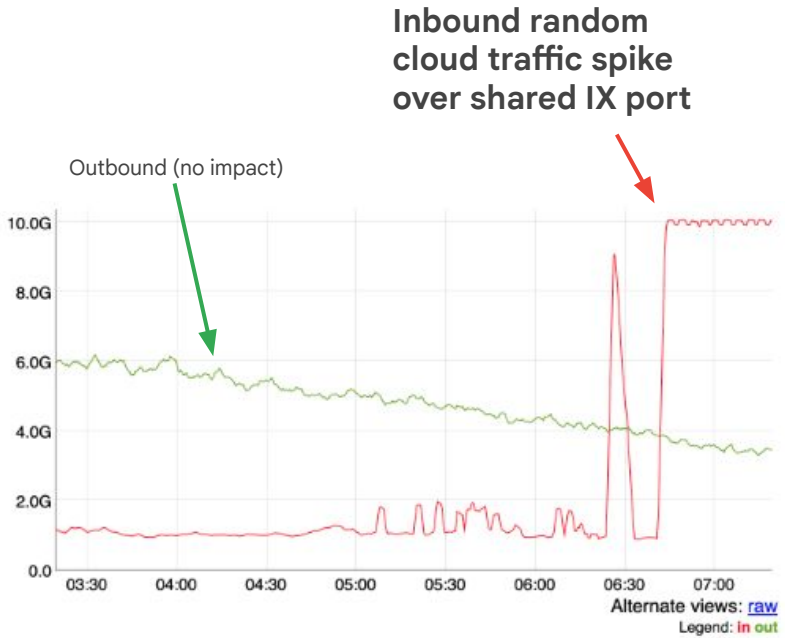


Chart has been modified to compare growth rate.
It does not represent actual traffic volume.

What did we observe that lead us to change?

Early Cloud customer pain points: Unpredictable inbound IX traffic causing packet loss

- Sudden Google Drive/Storage spikes often congest IX ports, affecting multiple networks on shared port.
- **Cloud customers peering on the IX experience packet loss and latency.**
- Route servers amplified the issue by broadly announcing our prefixes to many networks, attracting more ingress.
- Large operational churn to address with 64+ peering metros, most with multiple IXs.
- IXs rarely mitigate this congestion; PNIs fare better due to proactive ISP TE for shared customers.
- The largest PNIs also offer more predictable rerouting during prefix mitigation + scalable headroom.

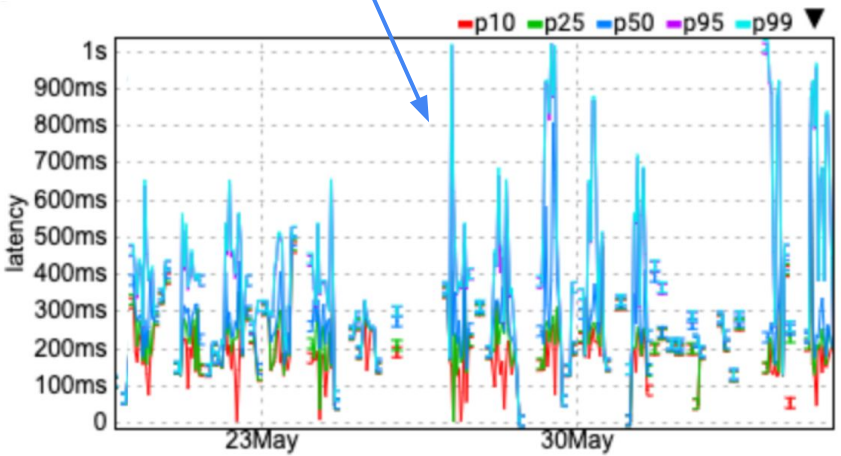


One example of unpredictable in/out traffic profile of NSW-IX

Latency fluctuations due to cross metro failovers

- Unplanned and planned maintenances can take down optics, line cards, or routers for extended periods of time.
- A single peering outage has, in many cases, rerouted traffic across metros or continents—leading to high latency and customer complaints.
- **Customer challenge: Cross metro failover equals high latency, which for full tunnel VPN overlay users means poor internet experience, which directly impacts GCP product quality.**
- Certain geographies, such as LATAM, can experience excessive latency during these events.

Example of high latency due to cross metro failover



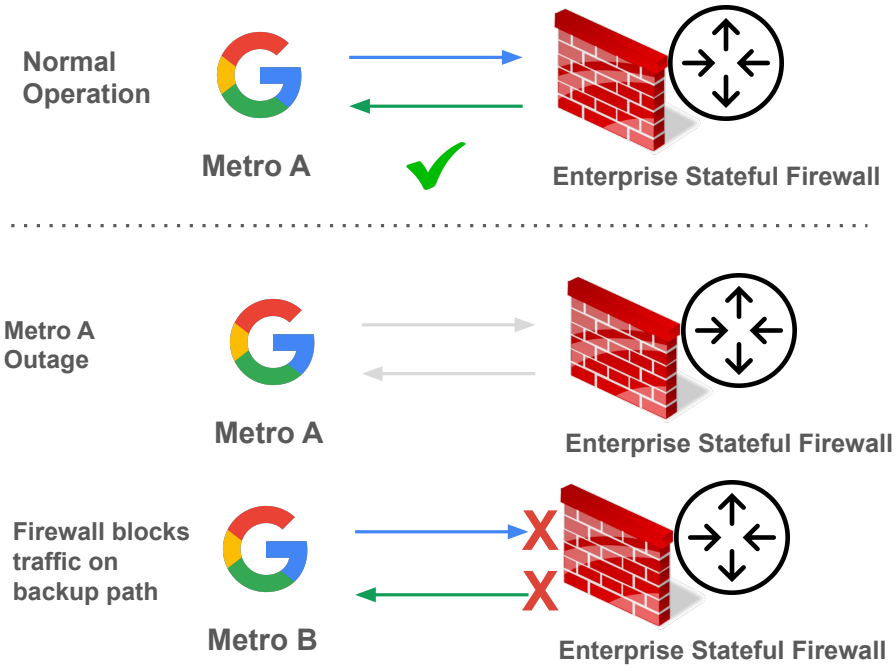
Customer in LATAM: High latency was observed from ~80ms to ~350ms. Expected latency is under 100ms

More customer pain points: Enterprise firewalls can blackhole peering traffic failover

- Many cloud customers peer with Google and have cross-metro redundancy, but their architecture prevents effective failover.
- **During maintenances/outages, Google may shift traffic to another metro or upstream transit, causing black holes for multiple customers.**

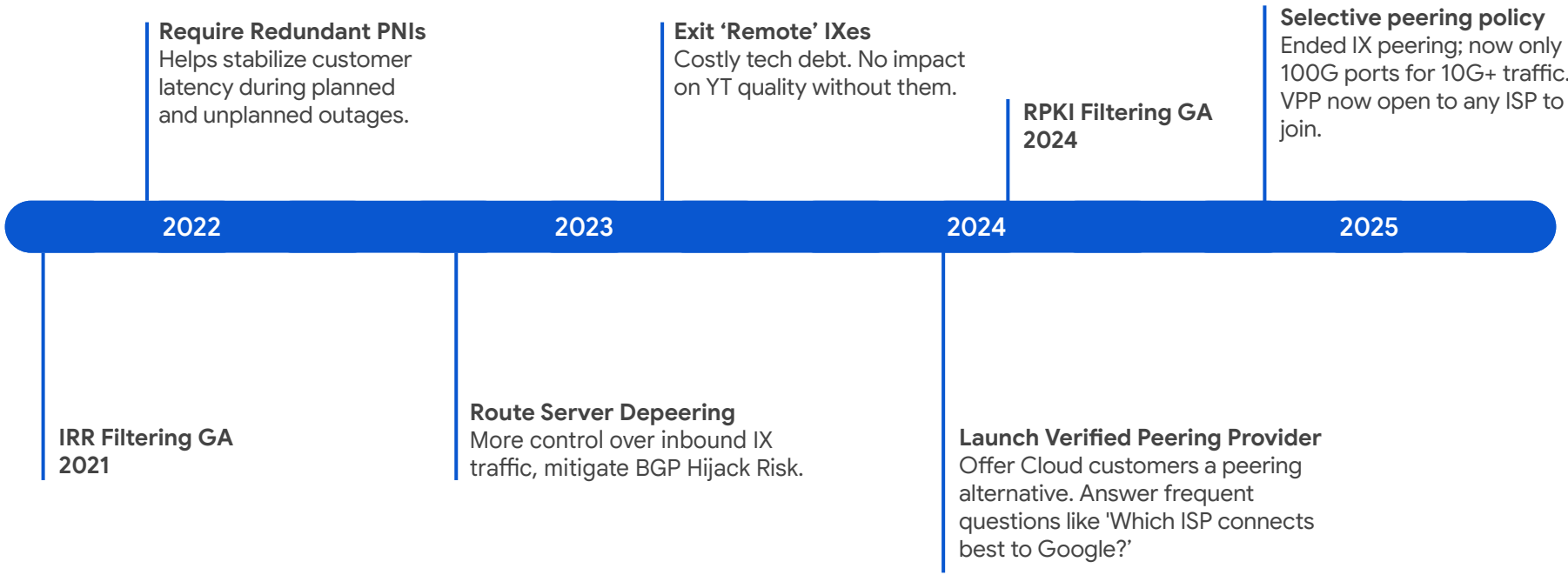
Why?

- Customer firewalls are directly connected to specific peerings and reject asynchronous return paths.
- Customers lack an external mesh to maintain consistent enterprise ingress points, so backup paths don't work.
- Google historically offered no product alternative for publicly reachable resources—just peering or the public internet.



What did we do in response?

Peering policy changes over time



What is Verified Peering Provider?

The Verified Peering Provider (VPP) is a Google recognized badging program for Internet Service Providers (ISPs).

Its primary goal is to offer Google customers an alternative to direct peering. It also recommends well connected ISPs to customers for accessing workloads on GCP over the internet.

ISPs awarded the VPP badge have demonstrated diverse and reliable connectivity to Google.

Instead of direct peering, Google Cloud can use a VPP for optimized public Google connectivity.

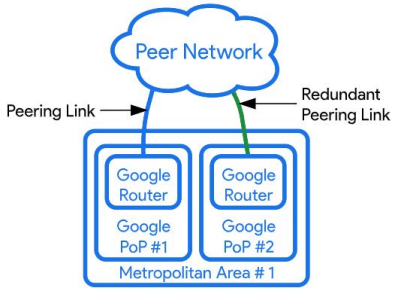
ISPs in the VPP program are classified into two tiers—Silver and Gold—based solely on technical criteria related to their connectivity depth with Google.

Technical requirements for ISPs to be a VPP

Minimum Google PNI Peering Requirements

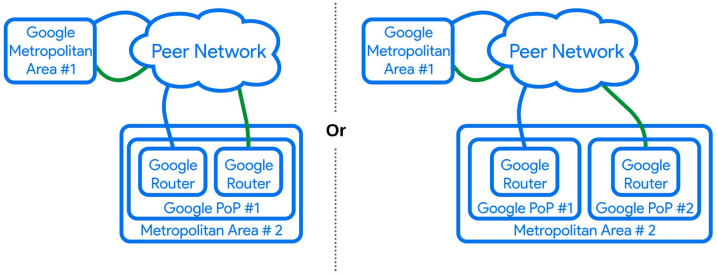
- **Minimum of two redundant PNIs in one metro area.** Specifically:
  - Within one metro area, at least two PNI with both being either in the same or split between separate Google PoPs

Peering Provider Verified Silver



- **Minimum of two redundant PNIs in one metro area.** Specifically:
  - **Within one metro area, at least one PNI in one Google PoP and one PNI in another Google PoP**
- All PNIs IPv4+IPv6 Dual Stacked
- No BGP sessions with Google over an Internet Exchange (IX).
- NOC contacts verified in ISP Portal

Peering Provider Verified Gold



Two alternate examples of a gold verified provider peering topology.

- All Silver criteria and:
- **Minimum of four redundant PNIs between two metro areas.** Specifically:
  - **Within one metro area, at least one PNI in one Google PoP and one PNI in another Google PoP**
  - In a second metro area, at least two PNI with both being either in the same or split between separate Google PoPs

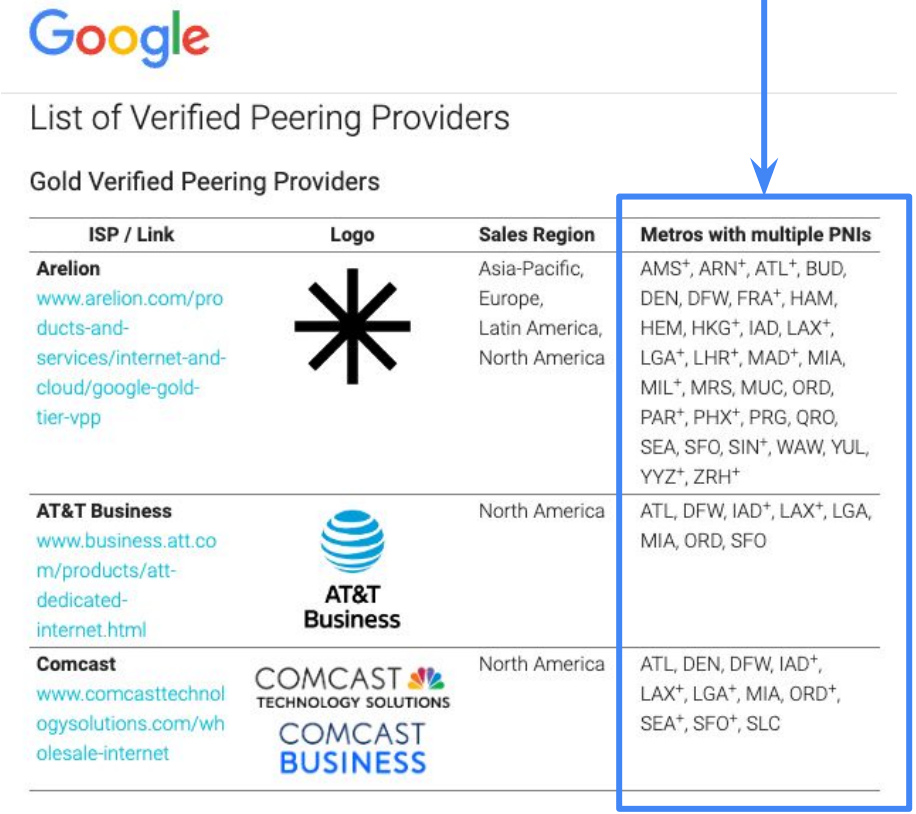
Sharing peering locations

VPP website [shares where ISPs connect with Google](), helping customers choose low-latency paths to Google's network.

How it works:

- Only metros where VPP and Google have redundant connectivity (>1 link) are shown.
- A '+' sign next to a metro indicates redundant connectivity across multiple physical PoPs for greater resilience.

VPP open for any ISP to join, Google proactively enrolls ISP as part region expansion.



Google

List of Verified Peering Providers

Gold Verified Peering Providers

ISP / Link	Logo	Sales Region	Metros with multiple PNIs
Arelion www.arelion.com/products-and-services/internet-and-cloud/google-gold-tier-vpp		Asia-Pacific, Europe, Latin America, North America	AMS+, ARN+, ATL+, BUD, DEN, DFW, FRA+, HAM, HEM, HKG+, IAD, LAX+, LGA+, LHR+, MAD+, MIA, MIL+, MRS, MUC, ORD, PAR+, PHX+, PRG, QRO, SEA, SFO, SIN+, WAW, YUL, YYZ+, ZRH+
AT&T Business www.business.att.com/products/att-dedicated-internet.html	AT&T Business	North America	ATL, DFW, IAD+, LAX+, LGA, MIA, ORD, SFO
Comcast www.comcasttechnologysolutions.com/wholesale-internet	COMCAST TECHNOLOGY SOLUTIONS COMCAST BUSINESS	North America	ATL, DEN, DFW, IAD+, LAX+, LGA+, MIA, ORD+, SEA+, SFO+, SLC

VPP Features for ISPs

Google web exposure

A dedicated space on Google's website where ISPs can showcase their name, logo, VPP Tier, sales region, redundant peering information and sales information.

Marketing badge license

ISPs are granted the rights to use VPP badges in their promotional materials, thus validating alignment with Google's standards.

New sales channel

A direct link from Google's website to ISP's internet sales website creates a new sales channel for ISPs.

No enrollment cost

ISPs can join the VPP program without any financial commitments. No enrollment costs to Google customers to find a VPP.

ISP Portal management

Enrollment and management via the Google ISP Portal. Update logos and change sales links at anytime.

What’s next?

Call to action: What does this mean for ISPs, IX Operators or Cloud customer?

If you are already peering via PNI or qualify for a PNI:

- No changes are required. However, consider enrolling as a Verified Peering Provider (VPP) to promote your services to Google Cloud customers and smaller ISPs who do not qualify for direct peering.

If you do not qualify for a PNI or are a Google Cloud customer:

- We recommend connecting through a Verified Peering Provider (VPP).
- Note: For ISPs currently peering with Google over an IX, we will maintain existing sessions but are no longer establishing new IX peerings.

For Internet Exchanges (IXes):

- Google remains committed to working with IXes and the community. We are open to enrolling IXes as VPPs—provided they meet the technical requirements for VPP connectivity (i.e., operate as a Layer 3 IX).

Forward looking

Google Cloud expanding to more regions - Google's internet edge and peering will follow many new regions. For example, Thailand and Kuwait cloud regions have been announced.

VPP focus continues - Google continues to invest in the VPP program, with enrollment open to new providers and ongoing evaluation of enhanced benefits and tiering to deliver more value to ISPs and Google/ISP customers. Feedback from multiple customers using a VPP being evaluated for improvements.

Continued evaluation our IX and metro footprint - Focusing on alignment with evolving Cloud and Google product needs.

AI's impact on peering is still unfolding - New products may shift traffic patterns and introduce new requirements.

Thank you!

Google