IP Address Geolocation – Use Cases, Gaps, and Future Directions

Abstract

IP address geolocation shapes how the Internet adapts to place. It answers "where is this IP?" so apps can localize content, steer CDNs, flag fraud risk, enforce compliance, and measure performance. Providers use it for everything from routing and coarse country blocks to fine-grained controls like fraud prevention, ad targeting, and regulatory gating.

Methods range from latency measurements to triangulate approximate location on multiple signals, but lag when ISPs reassign or renumber prefixes, causing misrouting, bad geoblocks, and poor targeting that lead to user complaints and service issues. To close the gap, operators publish geofeeds, a simple standard mapping prefix to locations. Large platforms consume these feeds, for example Google, and many ISPs now publish them, which update location data faster and more accurately than static databases.[1]

Deployments still break in predictable ways, including over-broad claims, conflicts on leased space, dead discovery links, duplicate CIDRs, bad admin codes, and uneven refresh and attestation. Demand for precise, current data fuels a busy geolocation market. This paper explains why today's ecosystem fails in predictable ways and proposes implementable practices to convert IP-geo from a "best-effort guess" into a trustworthy coarse signal.[2]

1 Use Cases

1.1 Content Localization and Access Control

Streaming services and online media platforms determine available content based on a user's IP-derived location. For example, Netflix checks your IP address and then shows the catalog licensed for your country. This ensures compliance with regional content licensing and avoids teasing users with shows they can't actually watch. Similarly, websites may redirect users to country-specific pages or enforce geo-blocks when content must be limited by region.[3]

1.2 CDN mapping and Edge Selection

Content Delivery Networks and edge networks use IP-geo data to direct users to the nearest servers. Placing content closer to users reduces latency and improves load times. Online games might also use geolocation to match players in the same region for fairness and a better experience. If IP-geo data is wrong, users can suffer high lag (for instance, being matched with far-away opponents in a game can be frustrating).

1.3 Search and Personalization

Search engines leverage IP-geo to deliver location-aware results. A search for "coffee shops" will include nearby cafes, and a query like "events this weekend" uses your approximate location to show relevant local events. Location data also helps personalize ads and recommendations — users are more likely to click on content relevant to where they live.

1. IETF, *A Format for Self-Published IP Geolocation Feeds*, technical report RFC 8805 (Internet Engineering Task Force, 2020), https://datatracker.ietf.org/doc/rfc8805/.

2. Internet Architecture Board, "Call for Papers: IAB Workshop on IP Address Geolocation (ip-geo)," *IAB Announcements*, July 17, 2025, https://www.iab.org/announcements/call-for-papers-iab-workshop-on-ip-address-geolocation-ip-geo/.

3. Mudassir Tariq, "5 Companies Employing IP Geolocation for Success," *IPGeolocation.io Blog*, June 30, 2025, https://ipgeolocation.io/blog/5-companies-employing-ip-geolocation-for-success-what-we-can-learn.

1.4 Security and Fraud Analytics

Country/region anomalies (e.g., sudden cross-border logins) are common risk features. IP-geo scores logins and payments by checking country, region, and ASN against user history, flagging impossible travel, and matching IP country with BIN, phone, and shipping. Clean matches keep flows smooth, mismatches trigger step-up like OTP or WebAuthn or a block. When IP-geo is wrong, good users get challenged and fraud can slip through.[4]

2 Gaps and Problems

Despite its importance, the current approach to IP address geolocation has many gaps and problems. These range from technical limitations and data quality issues to business process hurdles and privacy concerns. Key problems include:

2.1 Coarse or Inaccurate Data

Many published IP geolocation entries are too broad to be truly useful. Some organizations provide a single location for a large IP range especially for IPv6 addresses even when that range spans multiple cities or regions. This coarse granularity often results in inaccuracy: if an ISP lists an entire /16 prefix as <Country=X, Region=Whole-State>, users in outlying areas of that prefix may be misidentified. The gap here is a lack of more granular, region-specific entries. Networks should ideally subdivide large prefixes by region where feasible, to advertise more precise locations.

2.2 Conflicting or Duplicate Entries

A large ISP might lease out a portion of its address space to a smaller ISP or customer, and both end up publishing geolocation information for the same IP range. This conflict can mean one source lists the block in City A while another lists it in City B. Such situations violate the one-prefix-one-entry principle – duplicate IP prefix entries should be treated as errors – and they undermine trust in the data. Providers need to coordinate. If a parent ISP delegates a range and the sub-allocating organization maintains its own geofeed, the parent should remove or update its overlapping entry to avoid contradictions.

2.3 Poor Maintenance and Low Coverage

Many geolocation feeds are not being maintained or published consistently. Some operators never update their geofeed after an initial upload or neglect to update it when networks move, resulting in stale data. Others fail to include a geofeed URL in WHOIS/RDAP records, so their data isn't discoverable.[5] Coverage is still very low in the global address space, and accessibility problems are common, with some geofeed URLs failing to resolve or returning errors. Consumers are advised to re-fetch feed data at least weekly, and publishers should update regularly.

2.4 Data Quality and Format Issues

Even when geofeed data is published, quality issues abound. Common errors include malformed entries, duplicate lines for the same prefix, simple typos in prefix length (i.e., x.x.x.x/2 instead of x.x.x.x/24) and incorrect region or country codes that do not conform to ISO standards.[6] Some feeds list postal codes or cities incorrectly, or include unexpected whitespace or encoding problems.

4. Sheharyar Malik, "Top 10 IP Geolocation Use Cases in 2025 for Businesses and Developers," *IPGeolocation.io Blog*, July 24, 2025, https://ipgeolocation.io/blog/top-10-ipgeolocation-use-cases-in-2025.

5. R. Bush et al., *Finding and Using Geofeed Data*, technical report RFC 9632 (Internet Engineering Task Force, 2024), https://www.rfc-editor.org/rfc/rfc9632.html.

6. IETF, *A Format for Self-Published IP Geolocation Feeds*.

Producers often lack tooling to validate their data, which results in feeds that cannot be parsed or trusted.

2.5 Trust and Privacy Concerns

Any network can publish geolocation info for its prefixes, but consumers need to verify that the publisher is authoritative. Without proper authentication, an attacker could claim that an IP is somewhere it is not, undermining security. On the privacy side, publishing too fine-grained data might reveal the approximate location of an individual user. Today's ecosystem lacks strong, automated authentication and a clear privacy governance framework.[7]

3 Future Opportunities and Alternative Solutions

Given these gaps, there are several opportunities to improve how IP geolocation is handled, and even to rethink it entirely:

3.1 Strengthening data authenticity

Authenticate geolocation data at the source.[8] Adopt signing of geofeeds using RPKI-based digital signatures so consumers can verify integrity and authority. Tools should make signing and verification simple, and clients should prefer signed data.[9]

3.2 Improving Data Quality and Timeliness

Automate geofeed generation so updates happen right after allocations, leases, or routing changes. Publish in CSV as the common format, keep feeds reachable on stable HTTPS, and use cache headers to guide refresh cycles.[10]

3.3 Enhanced Granularity and Additional Attributes

Revisit granularity so operators publish region-specific entries for large prefixes. Explore adding network attributes such as type of last-mile connection (mobile, fiber, satellite, VPN) to inform delivery and security decisions, with a standardized taxonomy.

3.4 Coordination and Replace Semantics

When a range is leased, the lessee publishes the subprefix and the lessor removes that exact subprefix from the parent feed. Treat updates as replace-not-append. Fail on duplicate CIDRs, overlapping same length entries with different locales, and non standard codes.[11]

3.5 Alternative Approaches Without IP Addresses

For some use cases, rely less on IP-derived location. Use device consented location when appropriate, or network-assisted, privacy-aware tokens that assert coarse region without exposing exact details. Consider ISP-provided, rate-limited APIs for authoritative region lookup.

7. IETF, *Finding and Using Geofeed Data*, technical report RFC 9092 (Internet Engineering Task Force, 2021), https://datatracker.ietf.org/doc/rfc9092/.
8. Desai et al., "Geofeed Adoption and Authentication," *arXiv*, February 2025, https://arxiv.org/abs/2502.08849.
9. RIPE NCC, "geofeed: attribute for inetnum/inet6num objects," *RIPE Database Documentation*, 2023, https://docs.db.ripe.net/all-docs-combined.
10. IETF, *A Format for Self-Published IP Geolocation Feeds*.
11. NCC, "geofeed: attribute for inetnum/inet6num objects."

3.6 Pointer Compliance and Freshness Policy

Put the geofeed pointer in WHOIS inetnum or use the geofeed attribute and mirror it in RDAP where supported.[12] Publishers set Cache Control max age in the 1 to 7 day window based on churn. Consumers honor cache headers. If headers are missing they poll weekly at most. Standards talk about polling and cache headers, operators should tighten with explicit max age.[13]

4 Conclusion

IP address geolocation remains essential to how the Internet works, but today's ecosystem is uneven in accuracy, maintenance, and trust. The failures are predictable: ranges too broad, conflicts in leased space, dead pointers, weak refresh, and no proof of authenticity. The fixes are equally clear: publish granular data, coordinate lessor–lessee feeds, keep pointers live, refresh on a steady cadence, validate codes, and sign what you publish.

If the community takes these steps, IP-geo can shift from a "best-effort guess" to a dependable coarse signal. That means fewer false blocks, better routing, smoother fraud checks, and less friction for users. It also means a foundation sturdy enough to explore alternatives — from privacy-preserving tokens to consented device location. Collaboration between ISPs, content providers, geolocation vendors, and policymakers will be key to building a trusted, efficient, and privacy-respecting geolocation layer for the Internet.

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12. NCC, "geofeed: attribute for inetnum/inet6num objects."
13. IETF, *Finding and Using Geofeed Data*.