RIPE NCC
RIPE NETWORK COORDINATION CENTER

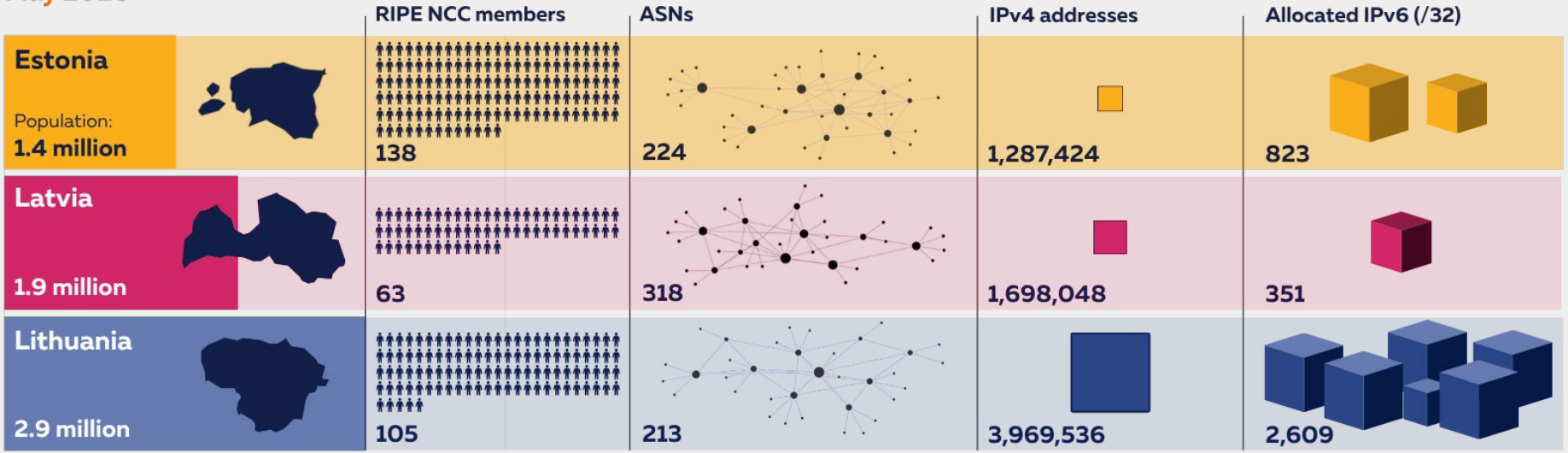
RPKI Deployment and IPv6 Uptake in the Baltic States

Anastasiya Pak | RIPE NCC | 4 June 2026

Resources Overview

The Baltic States in the RIPE Registry: Population, Membership, and Internet Numbers

May 2026



Source: RIPE NCC, Population: World Bank

Routing Security

The Need for RPKI

- Internet routing determines how data packets get forwarded across the Internet.
- Attackers or misconfigurations can redirect traffic, causing outages or data theft.
    - **Example**: Google Japan (2017) Google accidentally leaked BGP prefixes resulting in a major outage.
- Why RPKI?
    - Prevents such incidents by cryptographically verifying the legitimacy of route announcements.
    - Helps mitigate both accidental and malicious BGP misconfigurations.

Enhancing Routing Security

- Used to validate the origin of BGP announcements
  - Is the originating ASN authorised to originate this particular prefix?

- Has (now) three parts:

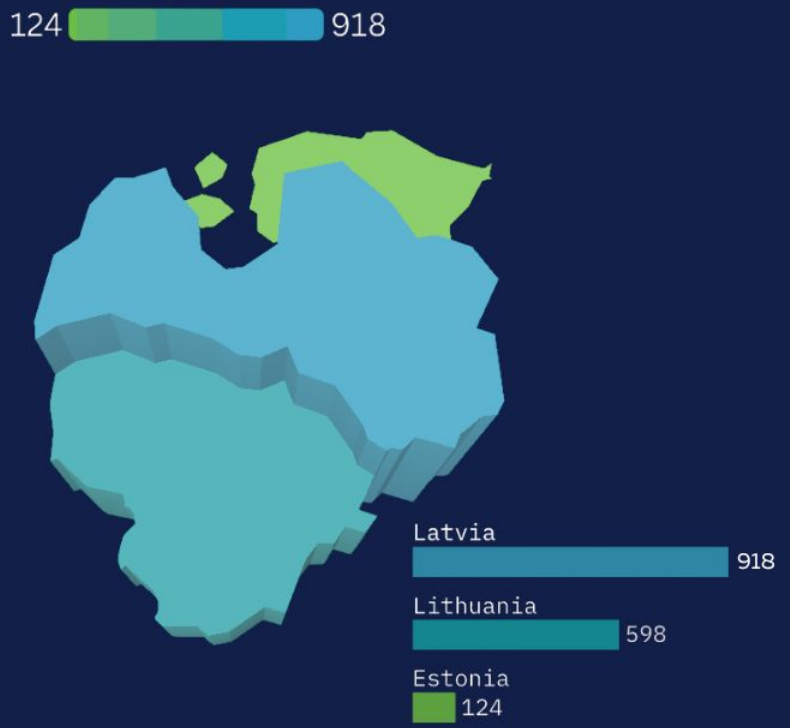
  - **Route Origin Authorisation (ROA):** Defines which ASes are authorised to announce specific IP prefixes

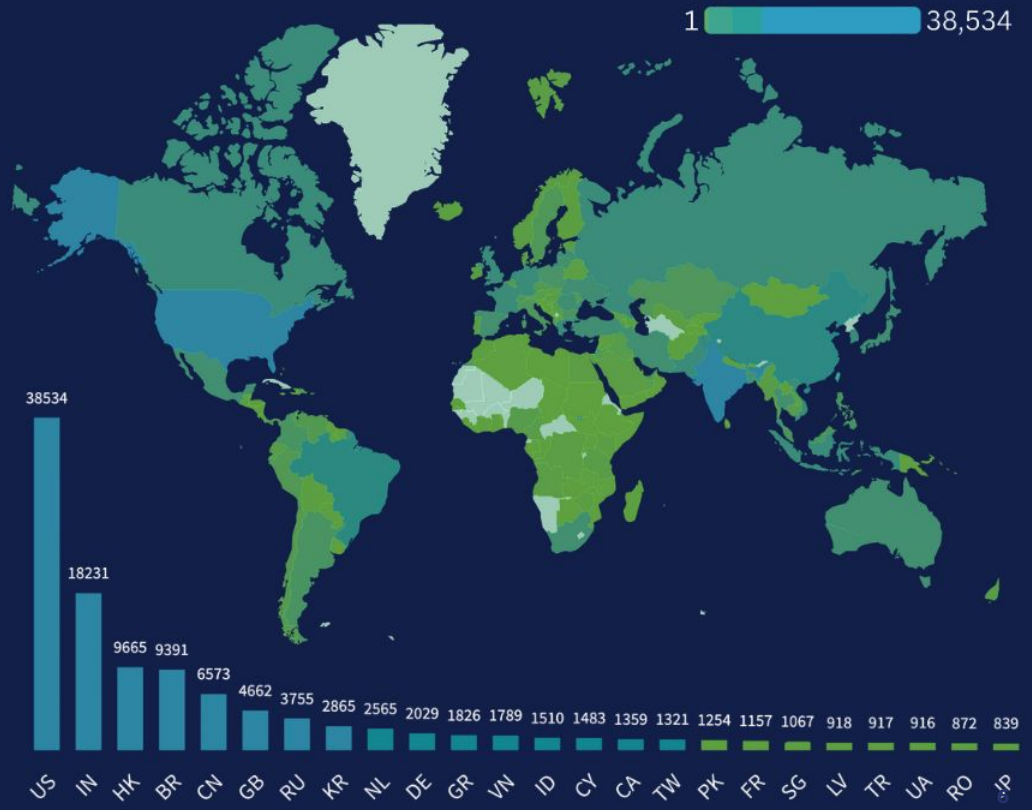
  - **Route Origin Validation (ROV):** Validates routes based on ROAs, ensuring only legitimate routes are accepted

  - **Autonomous System Provider Authorisation (ASPA):** Helps mitigate routing incidents by enabling validation of AS path relationships

BGP Events in the Region and Globally

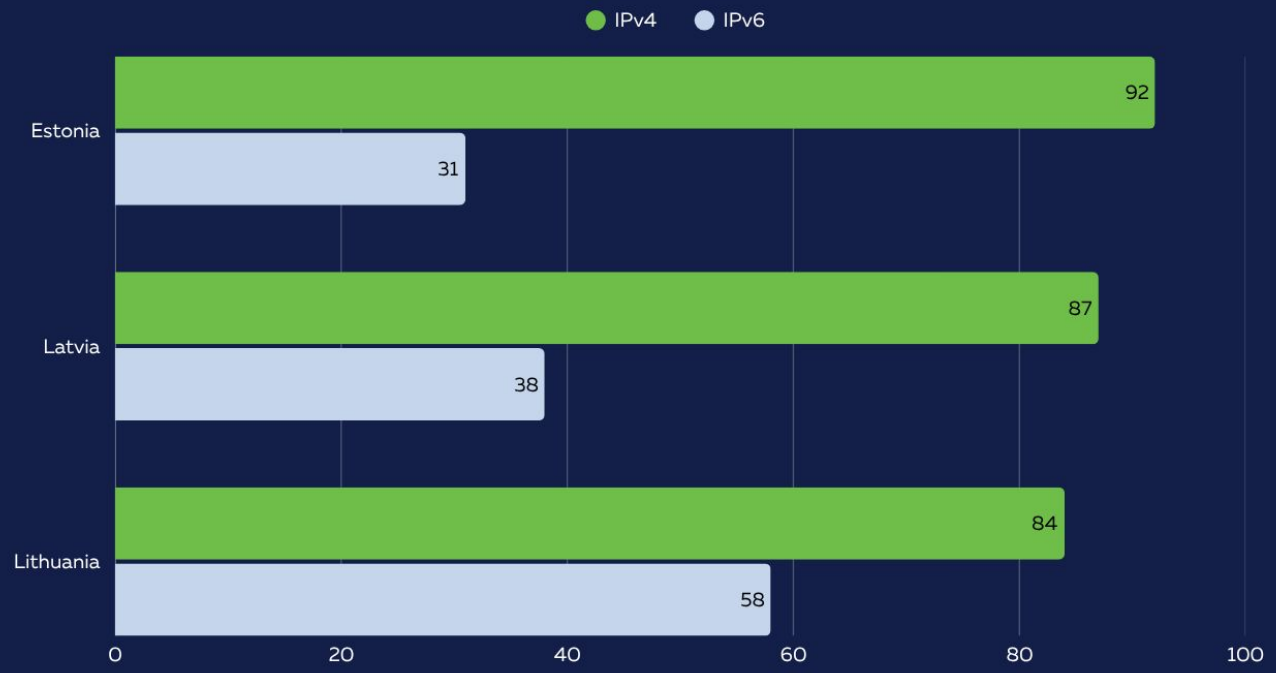
May 2025 - May 2026, source: GRIP





Route Origin Authorisation (ROA)

ROA Coverage in the Region (IPv4 and IPv6, %)

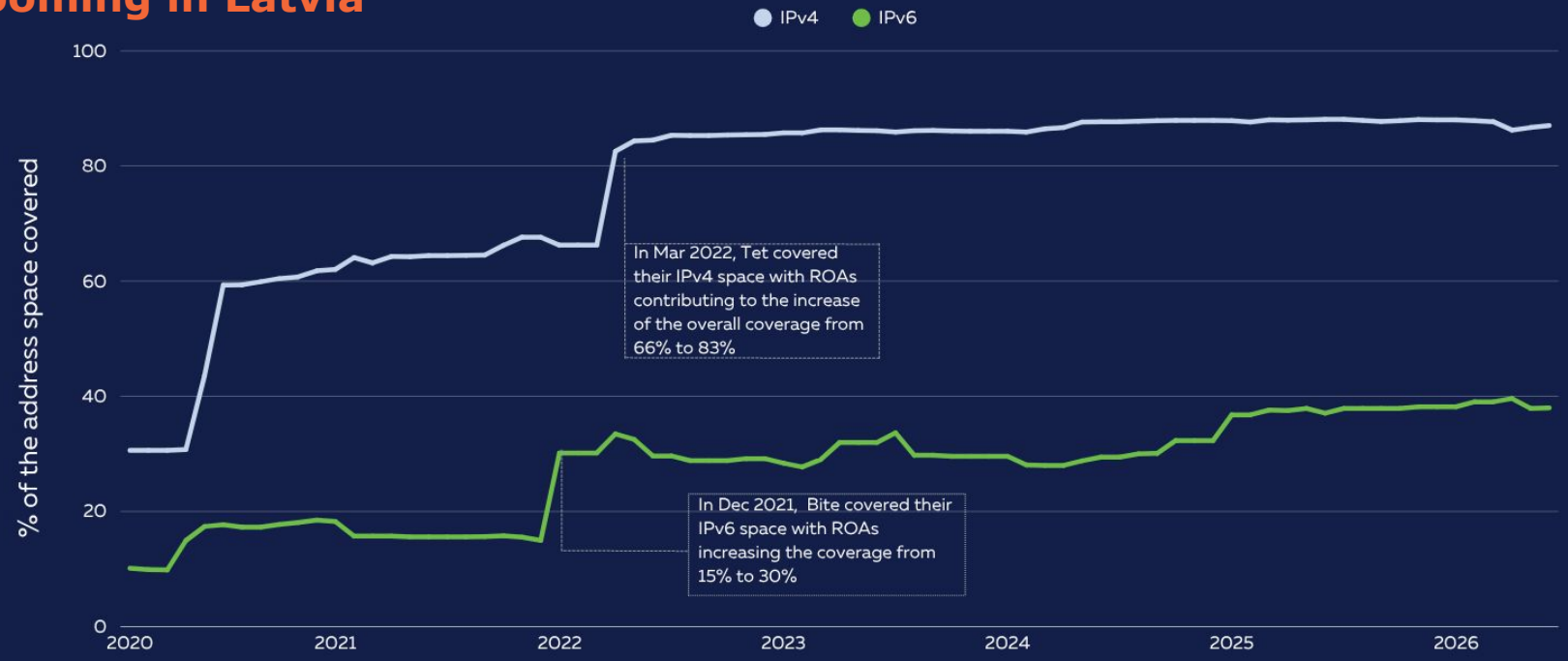


1 May 2026

Source: RIPE NCC
Snapshots from March 2025 and March 2026

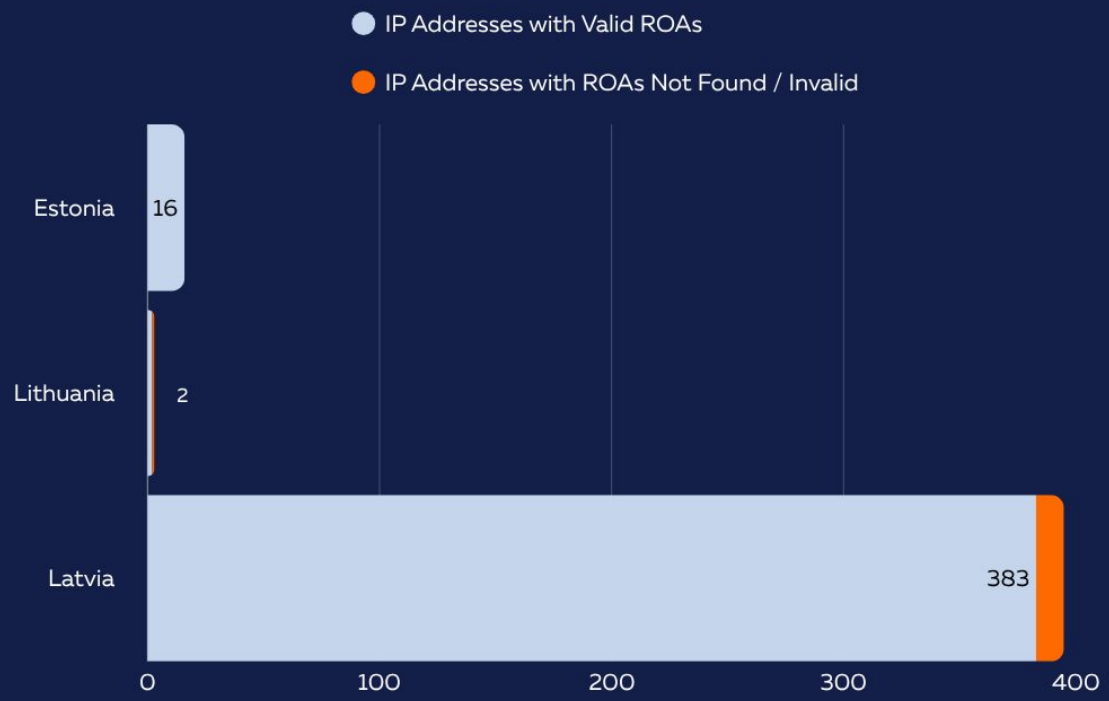
ROA Coverage in Latvia (2020-2026)

Zooming in Latvia



Source: RIPE NCC

ROA Coverage: Government Domains in the Baltic States



Source: RIPE NCC, RIS

The methodology involves extracting BGP routing data from RIS and then validating against RIPE NCC's RPKI Validator, categorising each prefix as follows:
Valid: IP addresses covered by an RPKI-Valid route announcement.
Invalid: IP addresses covered by an RPKI-Invalid route announcement.
NotFound: IP addresses covered by a route announcement in the NotFound state.

IP addresses that fell under Invalid or Not-Found prefixes, and were not concurrently covered by a more specific Valid ROA, were classified as being associated with IP addresses under RPKI Invalid or Not-Found prefixes.

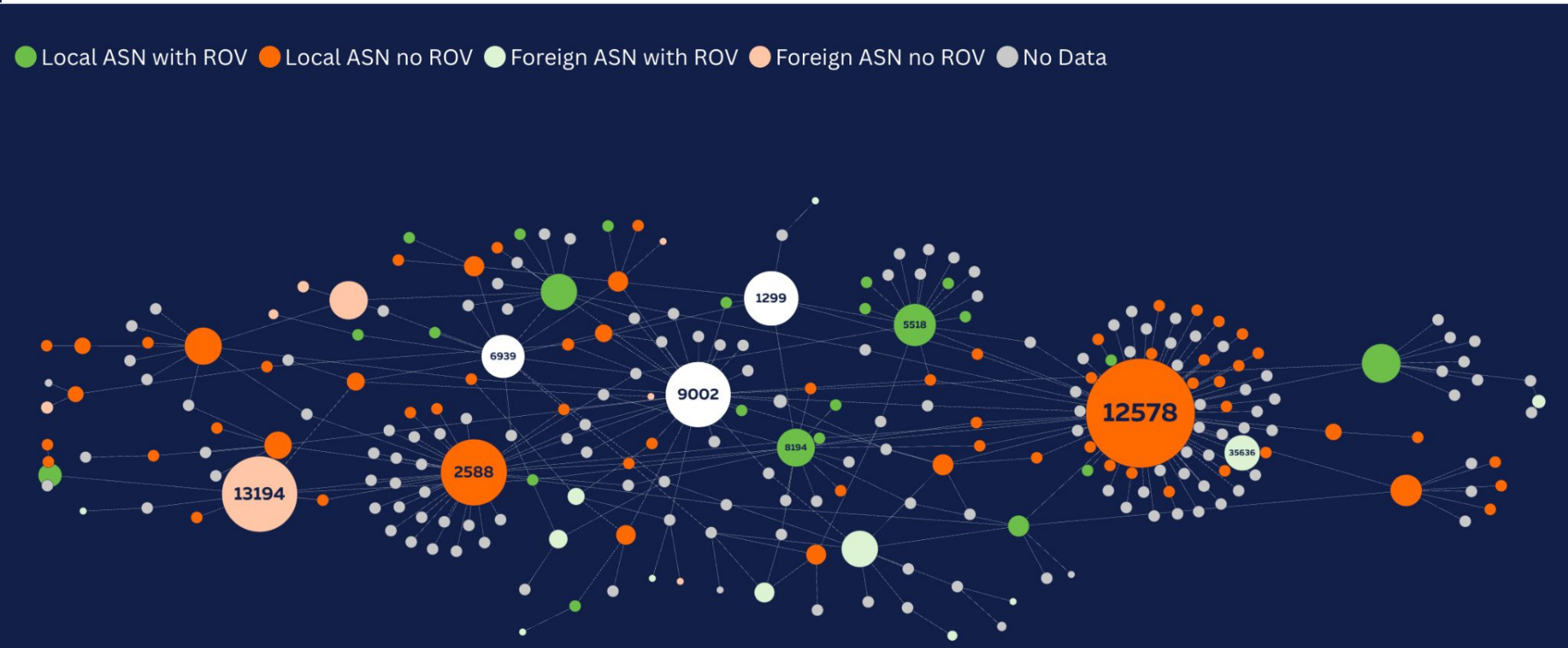
Note: To compile a list of government institutions we used Certificate Transparency (CT) logs. The list might be non-exhaustive, and some domains might not have been analysed.

Route Origin Validation (ROV)

Measuring ROV

- We used **RoVISTA** to analyse deployment of ROV
  - Calculates the scores based on the number of RPKI-invalid prefixes that an AS can reach
  - We classify an AS as having implemented ROV if its score is greater than 0, indicating any level of ROV deployment
- **Collateral benefit**
  - We assessed ROV impact from the perspective of network centrality, utilising **AS Hegemony**, which measures the centrality of autonomous systems within a country
  - Measures the common transit networks to a local AS and how much this AS relies on these transit networks based on BGP data. Values range between 0 and 1 and indicate the fraction of paths crossing a node.

Latvia Interconnectivity Map (AS Hegemony, ROV)



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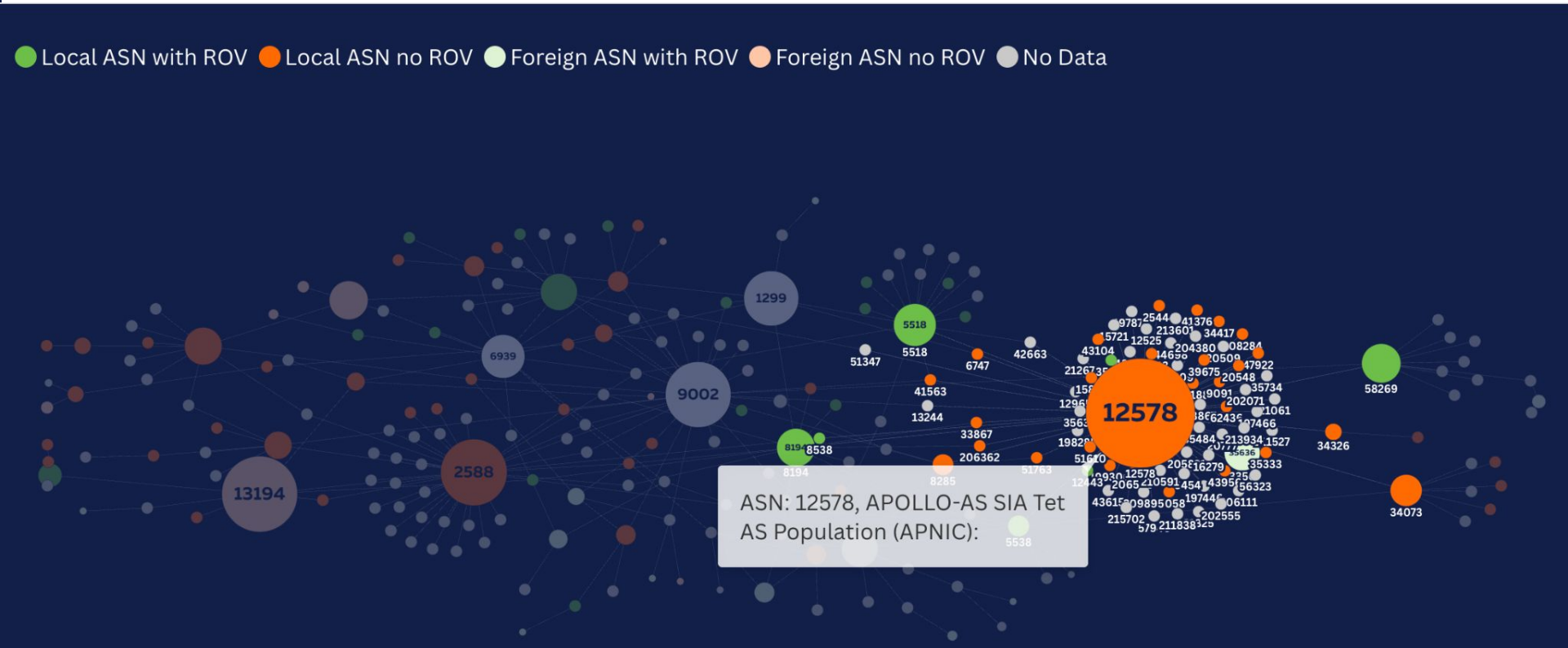

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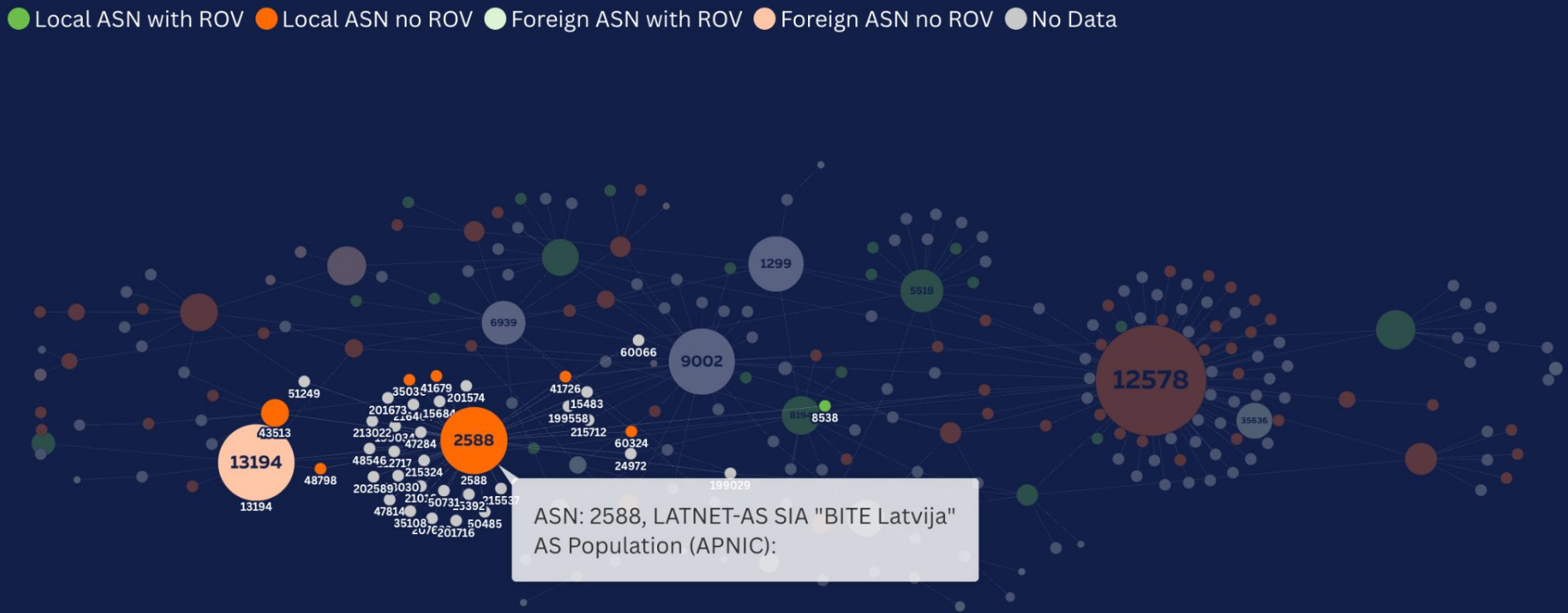
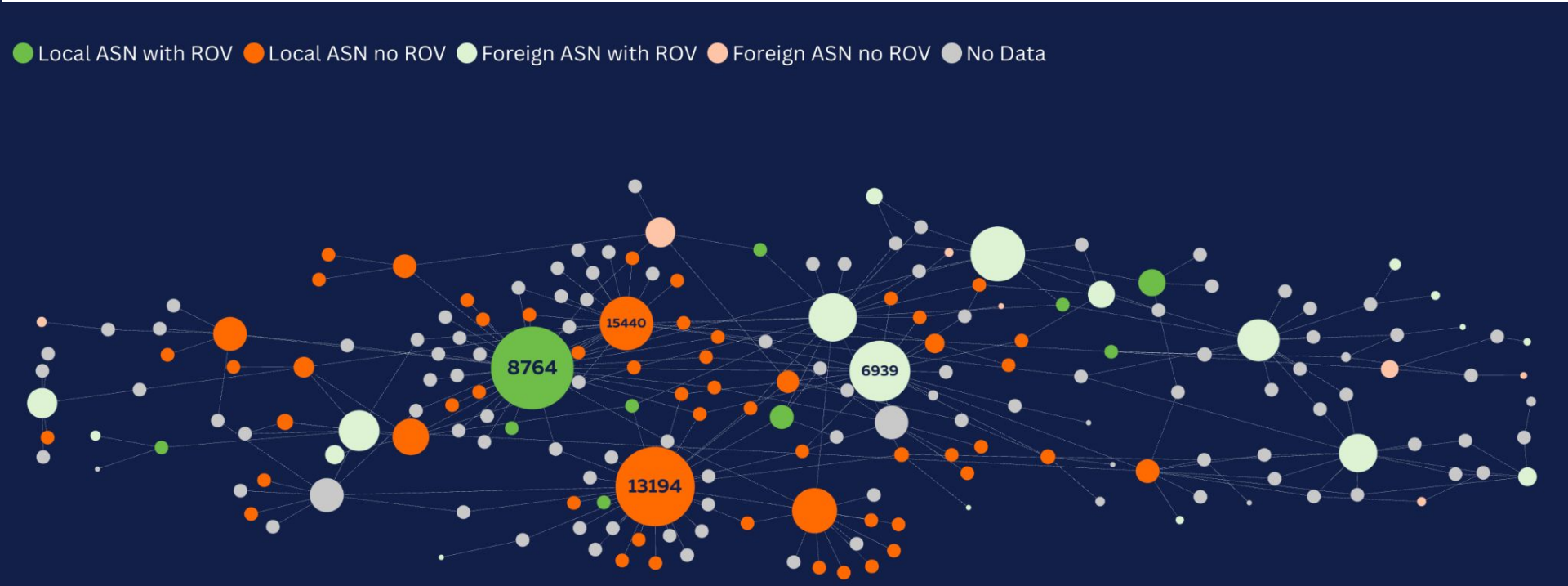


Lithuania Interconnectivity Map (AS Hegemony, ROV)



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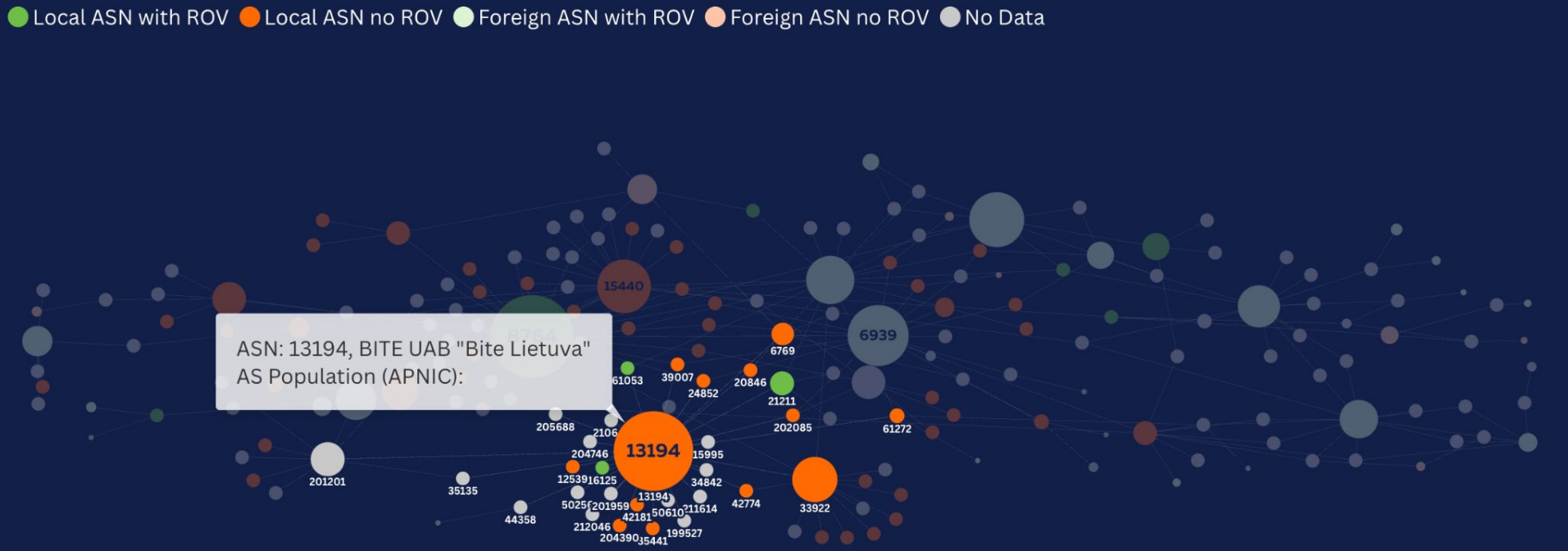
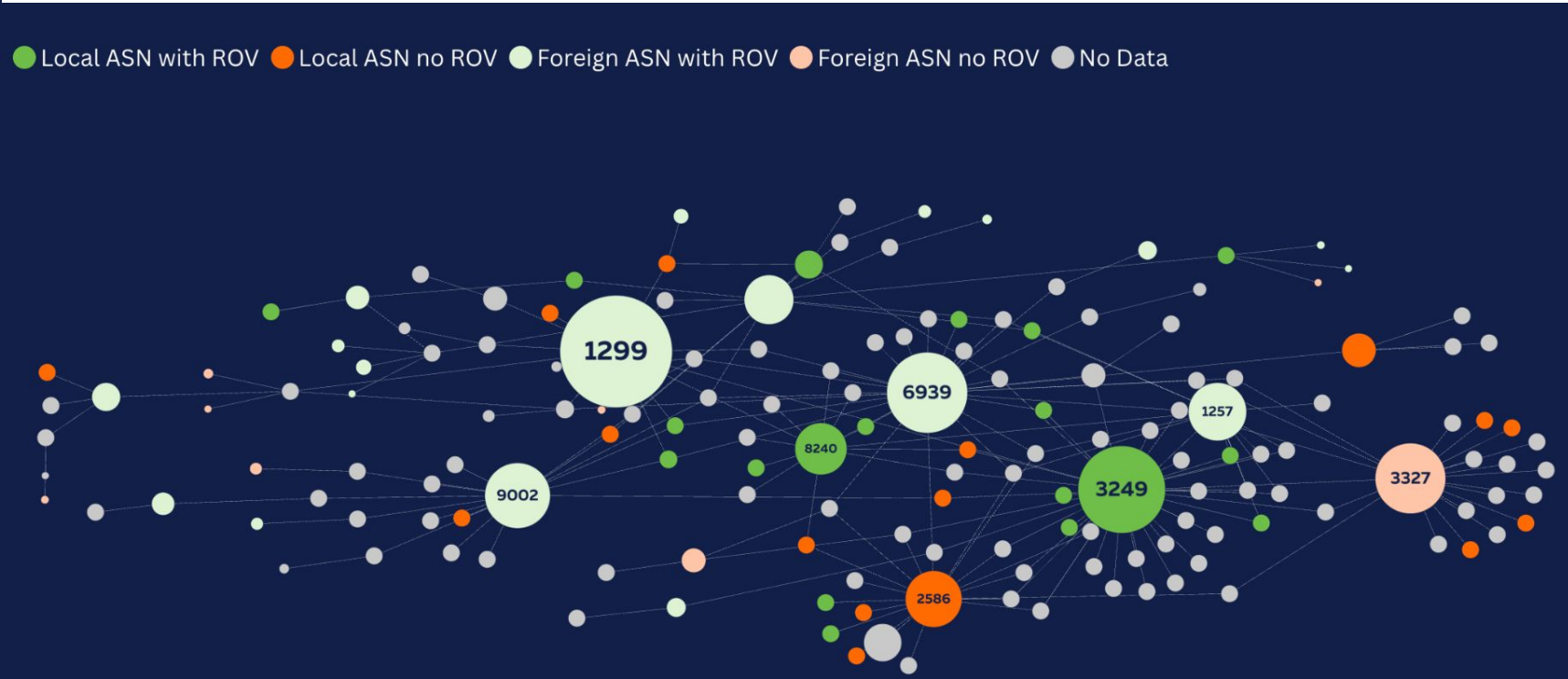


Estonia Interconnectivity Map (AS Hegemony, ROV)



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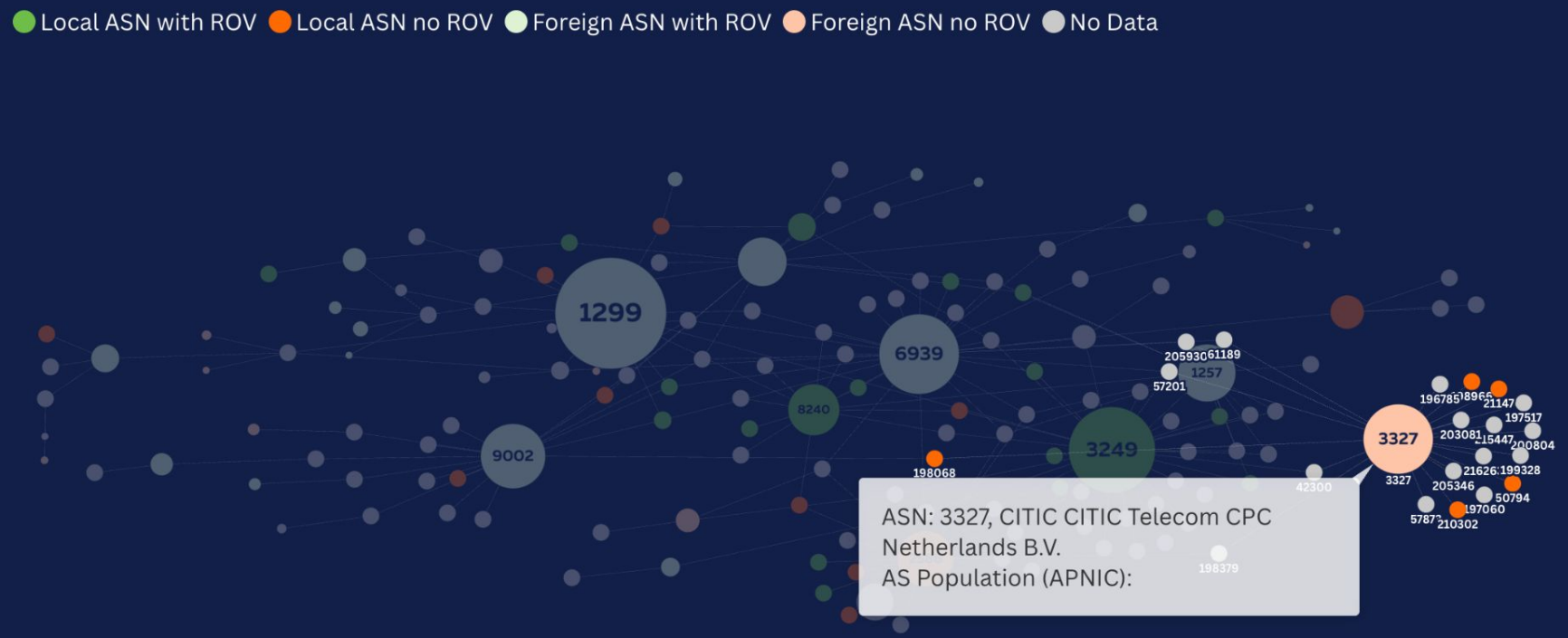

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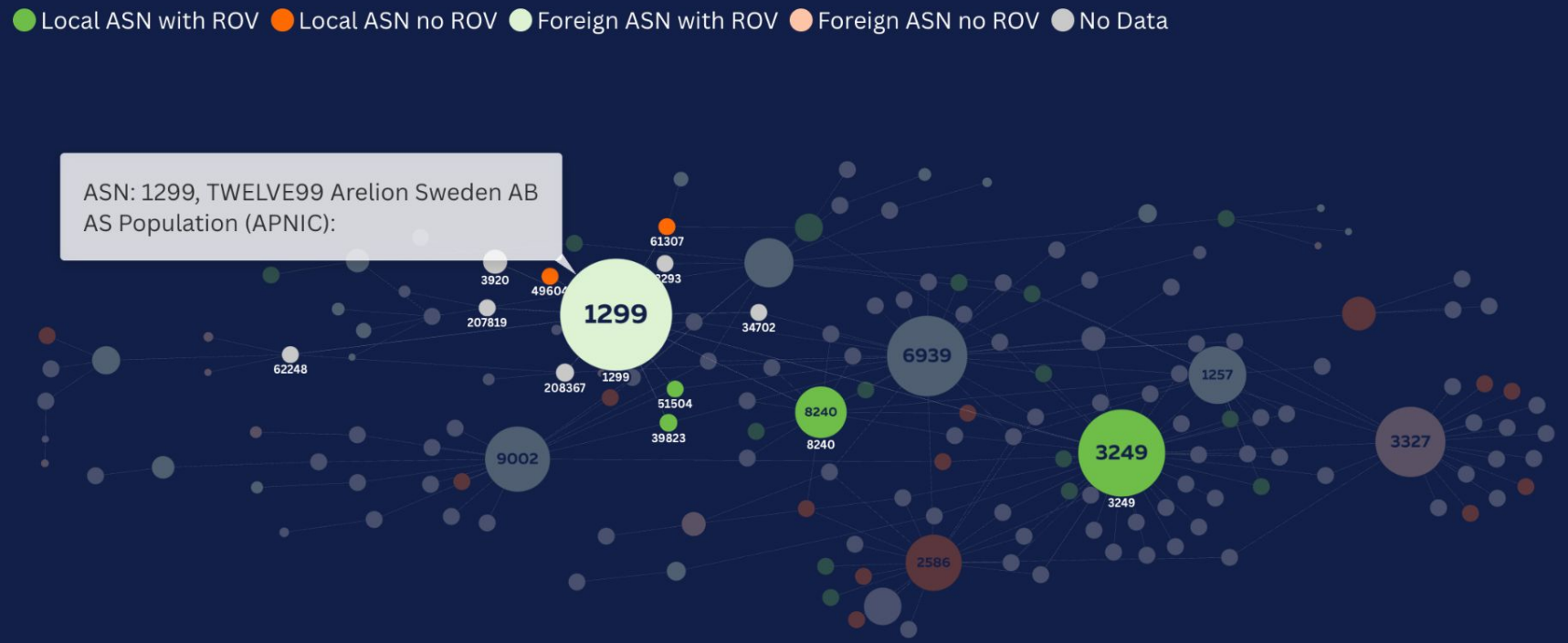
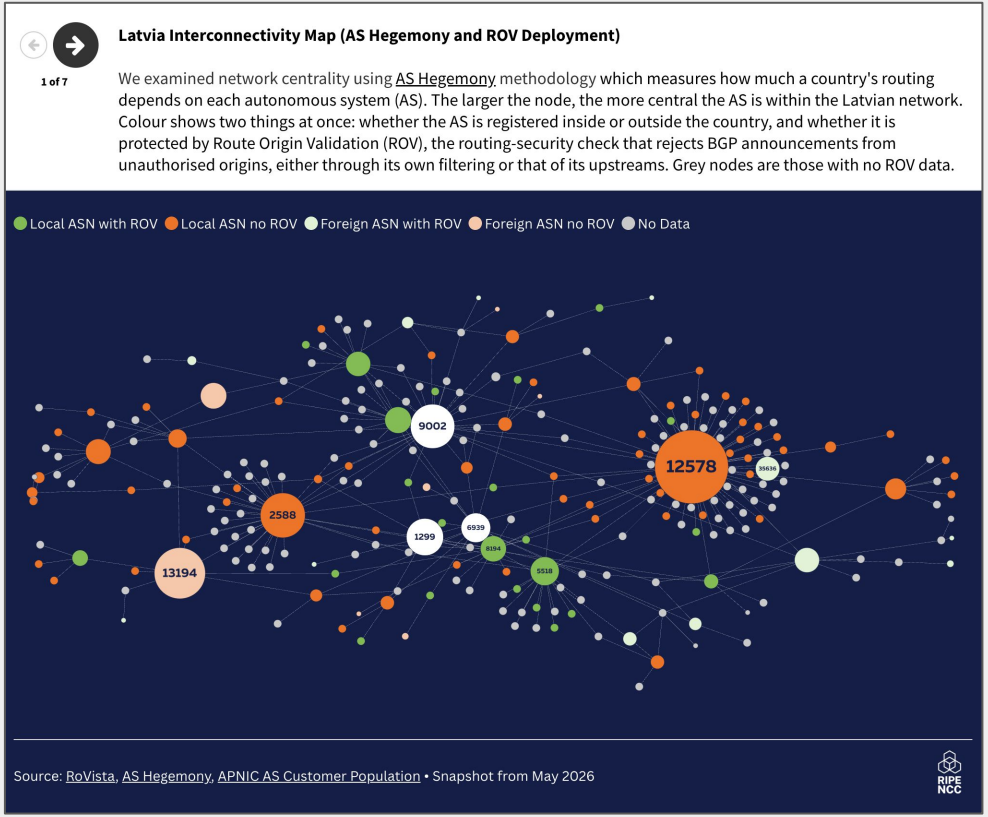


Find Your AS!

Check out the interactive graph

Network graph made with Flourish
Sources: AS Hegemony, RoVista, APNIC



And How’s ASPA Uptake?

ASPA Uptake in the Region

% of ASNs by country that created an ASPA object listing their authorised upstream providers

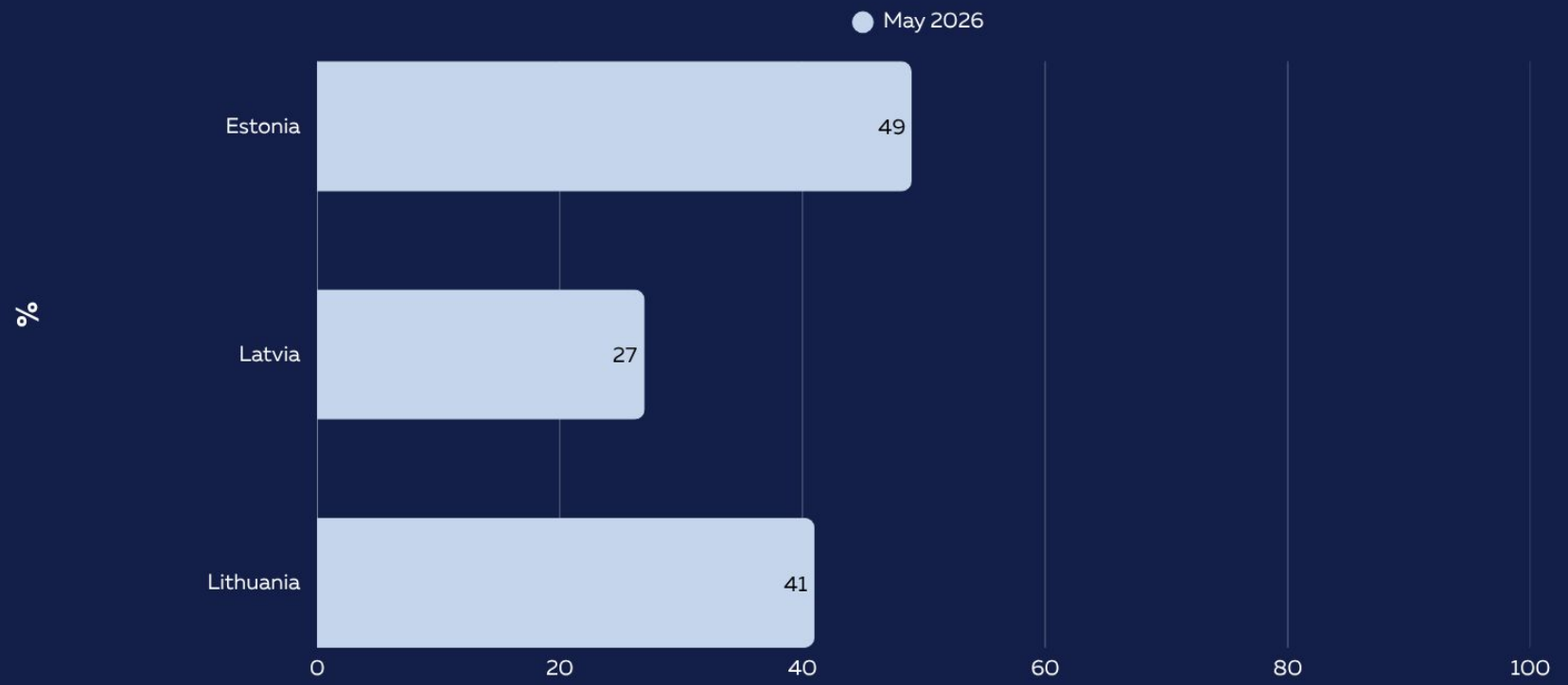
May 2026

IPv6 Uptake in the Baltic States

IPv6 Capability

- We calculated (IPv6 capability) the percentage of ASes in each country that announce both IPv4 and IPv6 addresses, as well as those that announce only IPv6, compared to those that announce only IPv4
    - IPv6 capability indicates that addresses are being routed, this does not equate to adoption.
    - IPv6 capability should be viewed as an initial step toward broader adoption.

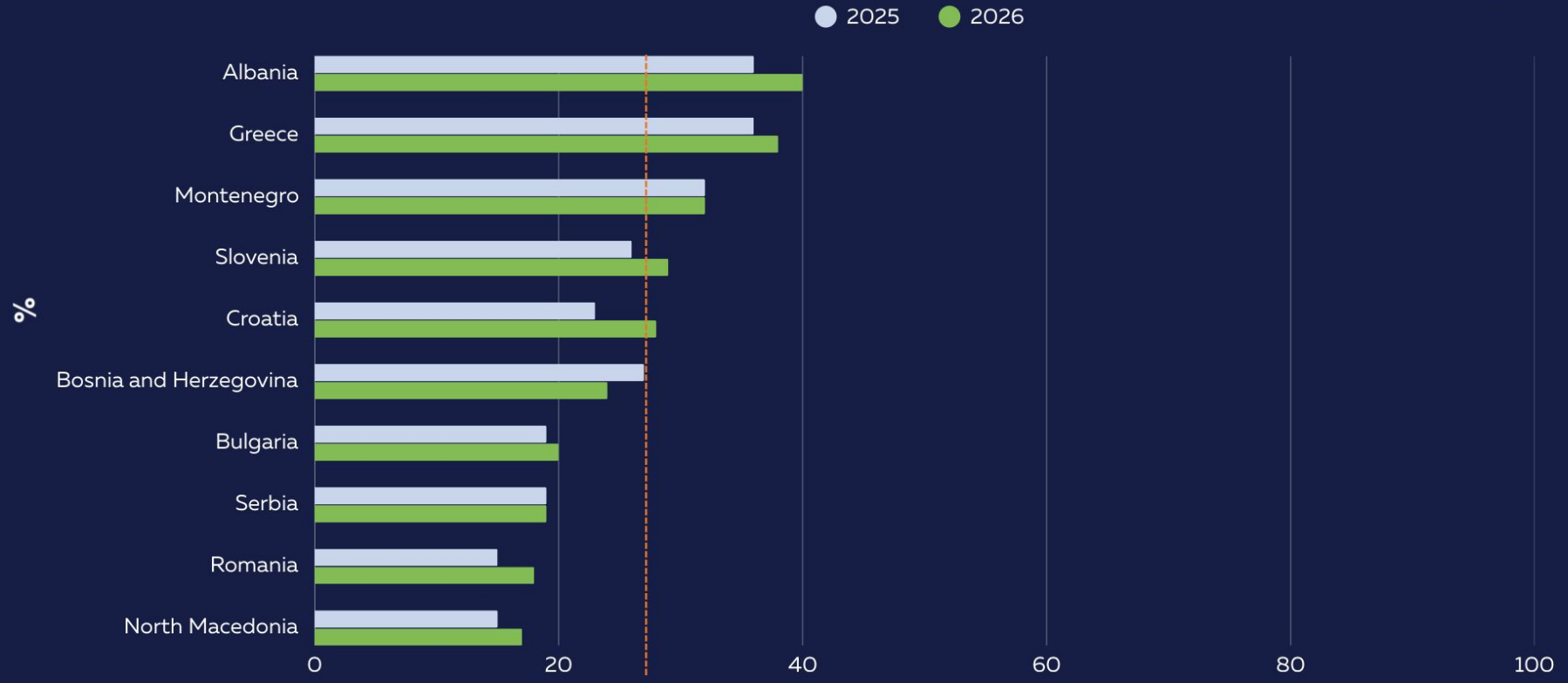
% of IPv6-capable ASNs in the Baltic States



Snapshot from May 2026

Source: RIPE NCC

% of IPv6-capable ASNs in South East Europe

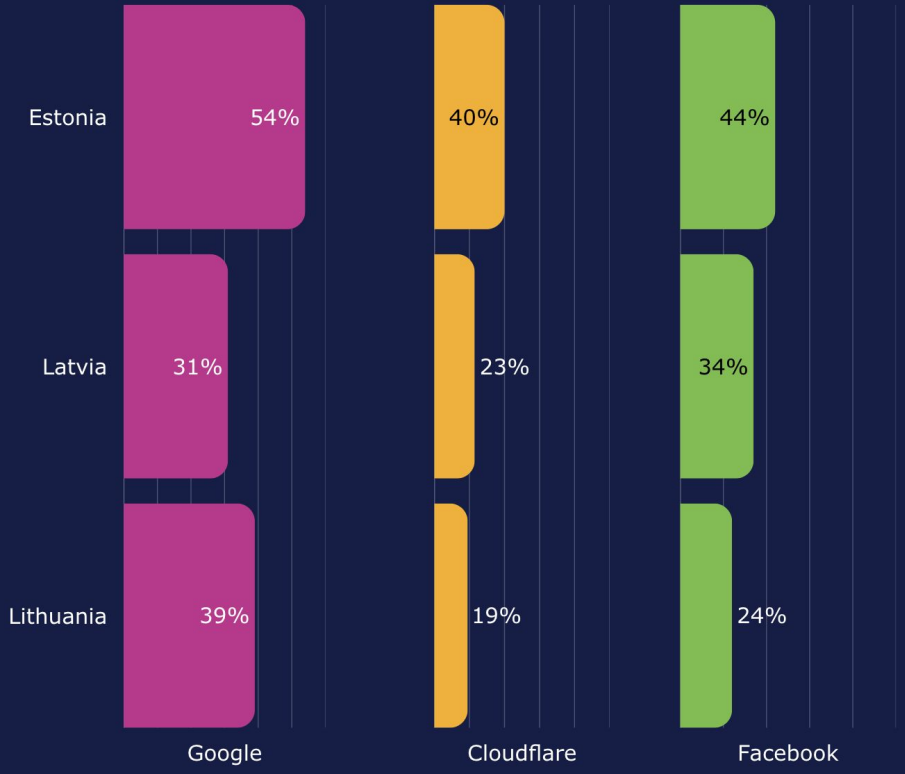


Snapshot from March 2025 and March 2026

SEE Average: 27%

Source: RIPE NCC

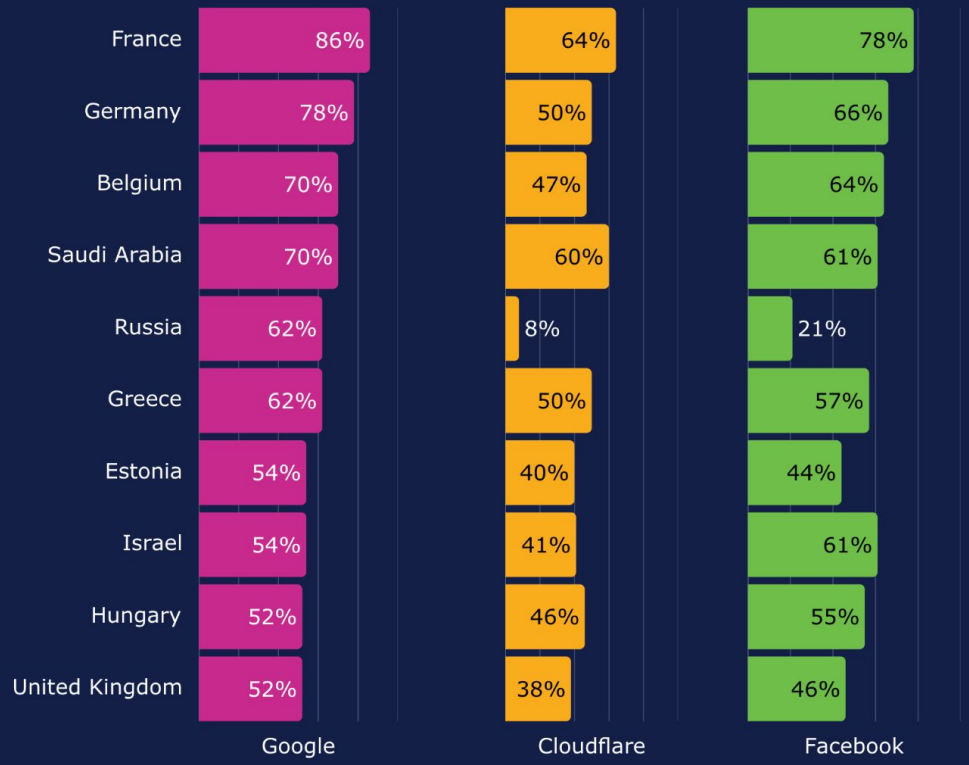
IPv6 Adoption in the Baltic States



Sources: Google, Facebook, Cloudflare, 1 May 2026

- While IPv6 capability indicates the readiness of networks to use IPv6, actual adoption is not easy to measure
- We looked at measurements reported by some major CDNs on IPv6 adoption in the region
- Varying adoption level in the region, with Estonia leading in IPv6 adoption

Top 10 Countries - IPv6 Adoption (Google)



Sources: Google, Facebook, Cloudflare, 1 May 2026, RIPE NCC Service Region Countries only

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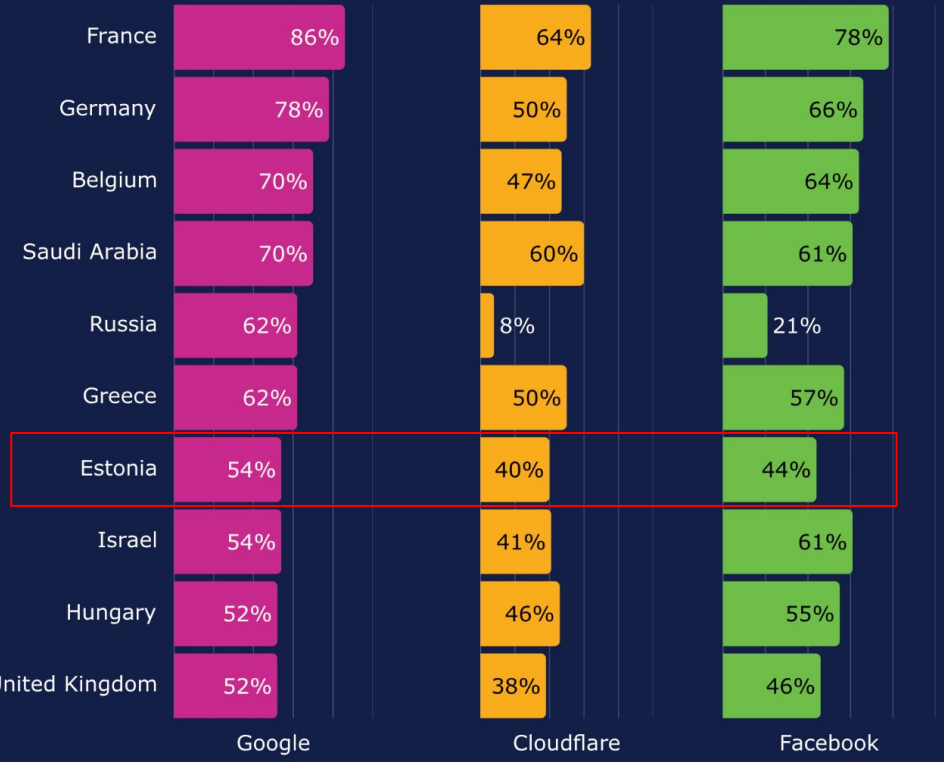

Sources: Google, Facebook, Cloudflare, 1 May 2026, RIPE NCC Service Region Countries only

Questions & Comments

apak@ripe.net

References

- [1] RoVista, https://rovista.netsecurelab.org
- [2] AS Hegemony, https://labs.ripe.net/author/romain_fontugne/as-hegemony-measuring-as-interdependence/
- [3] Cloudflare, https://developers.cloudflare.com/api/resources/radar/subresources/bgp/subresources/hijacks/subresources/events/methods/list/
- [4] RIS, ripe.net/ris
- [5] GRIP, https://grip.inetintel.cc.gatech.edu/