



RIPE NCC

RIPE NETWORK COORDINATION CENTRE

The Internet Landscape in Romania

As seen by the RIPE NCC

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RIPE NCC



- One of five Regional Internet Registries in the world
- Also provide a number of technical services and tools
 - K-root
 - RIPE Atlas
 - RIPEstat
 - RIS
- Involved in public policy discussions and Internet governance

RIPE NCC Internet Country Reports

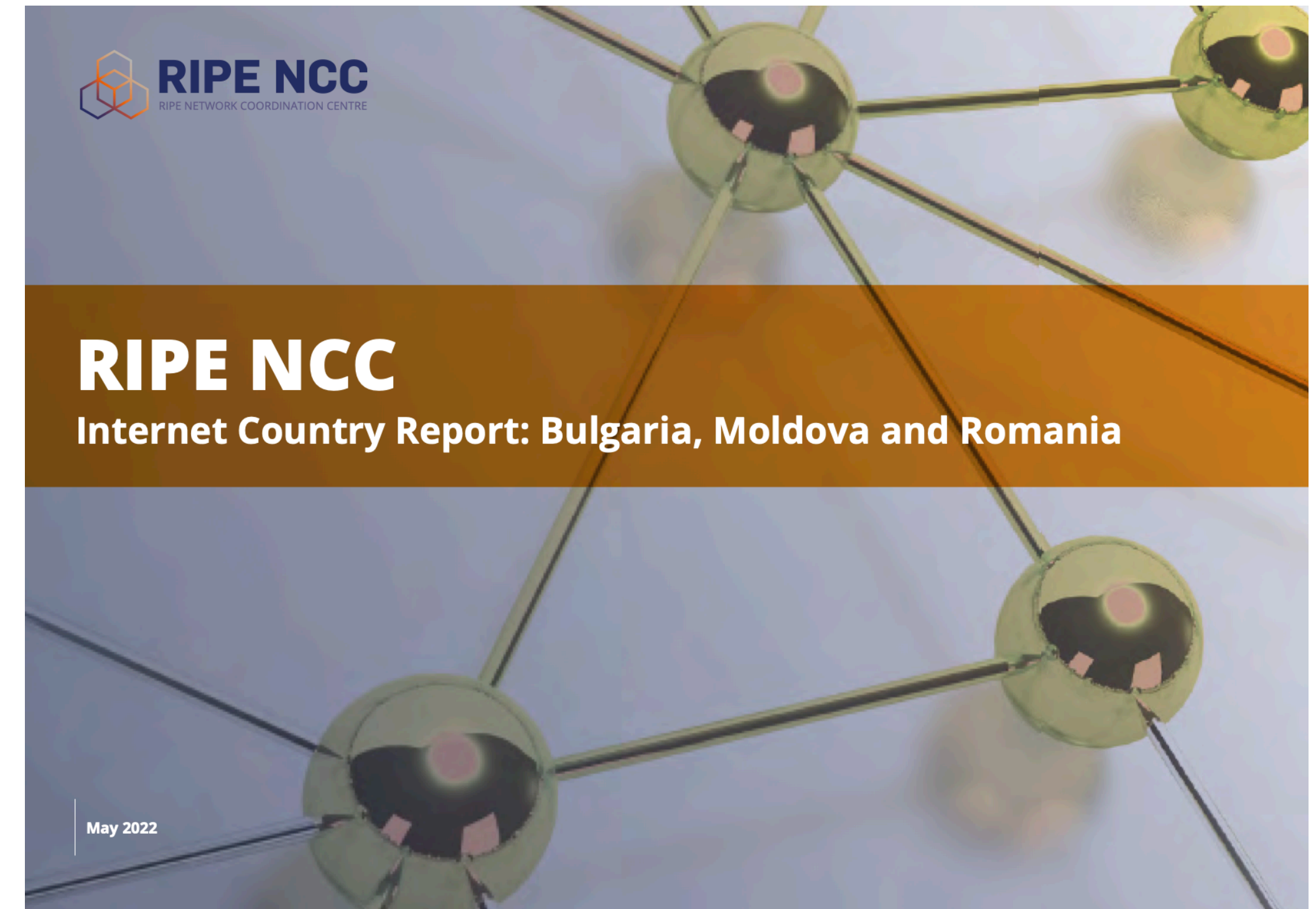


- Showcase RIPE NCC data and measurement platforms
- Bring value to local technical communities
- Support Internet development throughout service region
- Inform public policymaking

RIPE NCC Internet Country Reports



- Nine reports so far
- Latest report published May 2022
 - <https://labs.ripe.net/country-reports/>
- Covers Romania, Moldova and Bulgaria
- Translation in Romanian



Market Development Challenges



- Losing skilled ICT workers to emigration
- Relatively low levels of Internet use compared to the rest of Europe
- Large urban-rural digital divide
- Relative lack of digital services such as e-government

Market Development



- Healthy levels of market competition
 - The incumbent market share in Romania is one of the lowest in the EU, at 17%
- Low Internet access prices
- Fast Internet speeds
 - 10th globally for fixed broadband speeds
- New investments made in both infrastructure and updated digital regulation

Figure 1:
Number of Local Internet Registries over time



- More LIRs - more diversified market
- Not always:
 - More non-ISP LIRs
 - Members with multiple LIR accounts



Figure 3:
IPv4 holdings over time

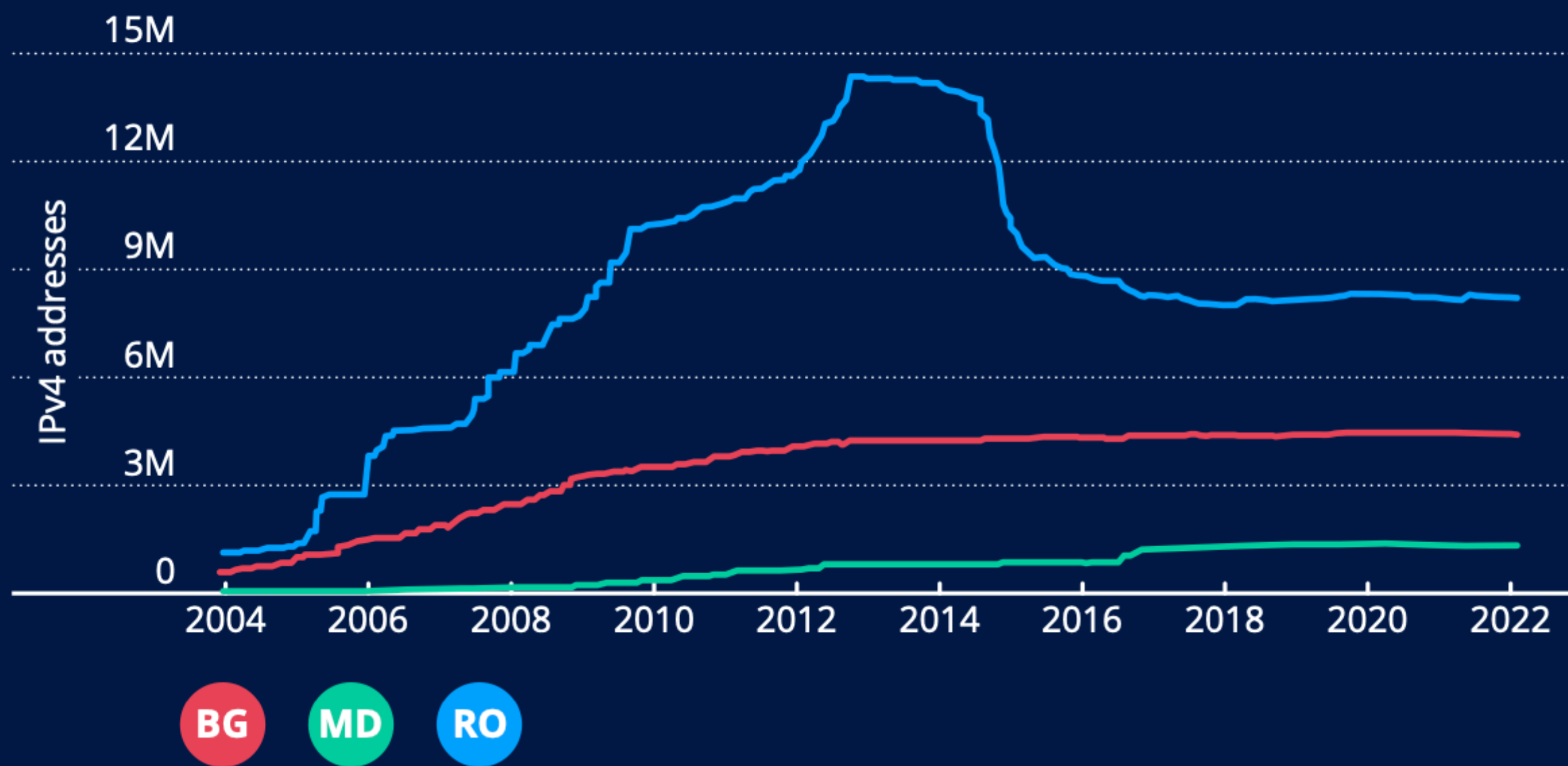
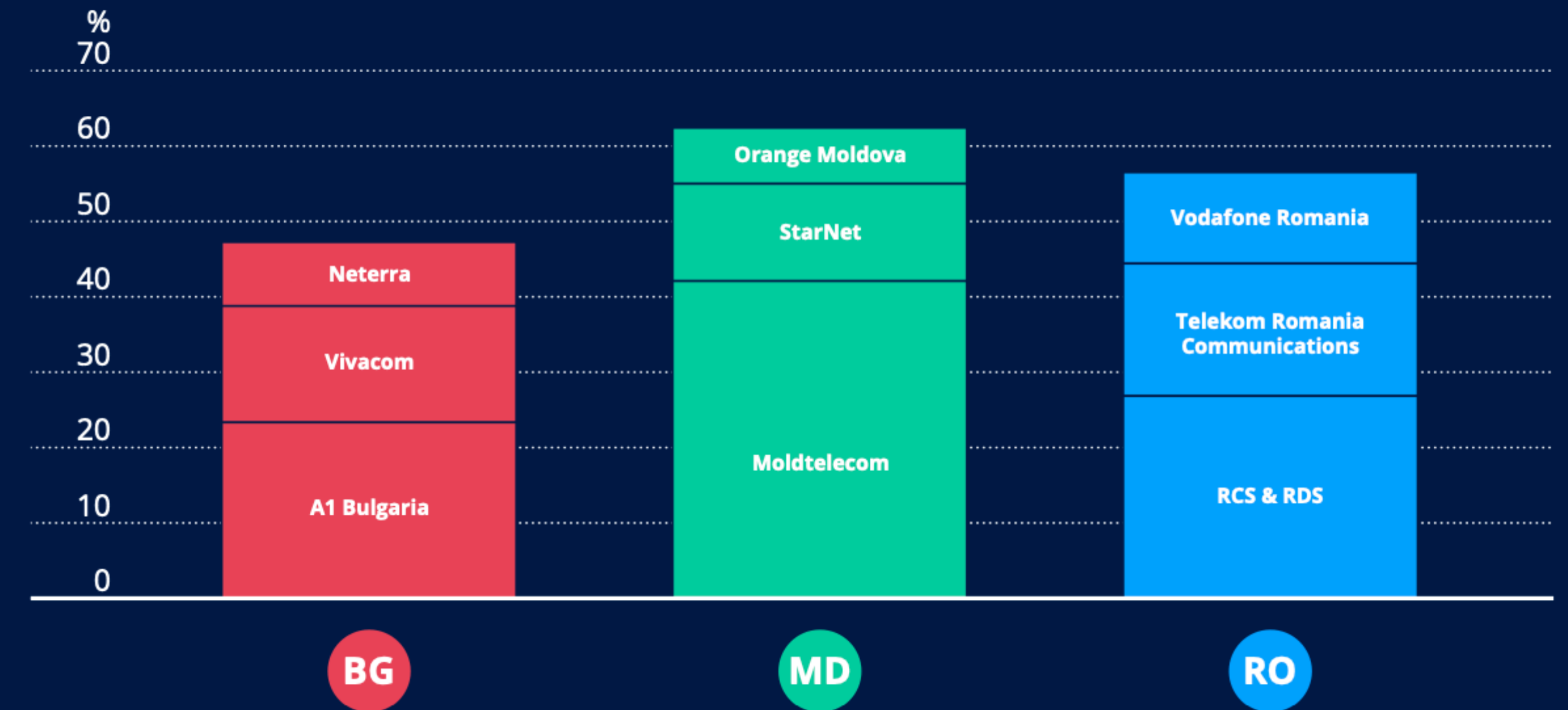


Figure 4:
Top 3 IPv4 holders



- Correspond to population
- Fair bit of consolidation

Figure 5:
IPv4 transfers within, into and out of Bulgaria, Moldova and Romania between October 2012 and March 2022

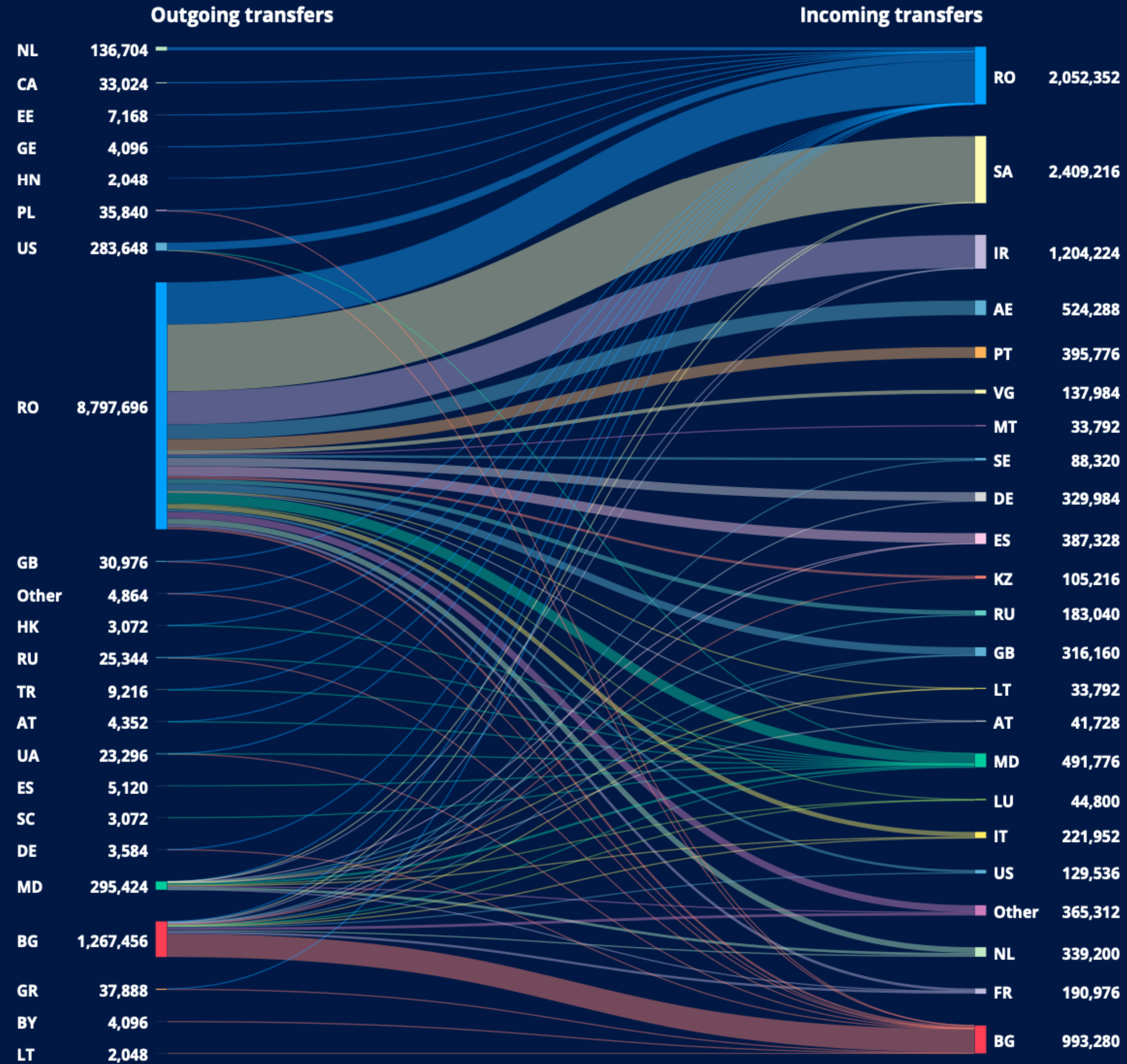
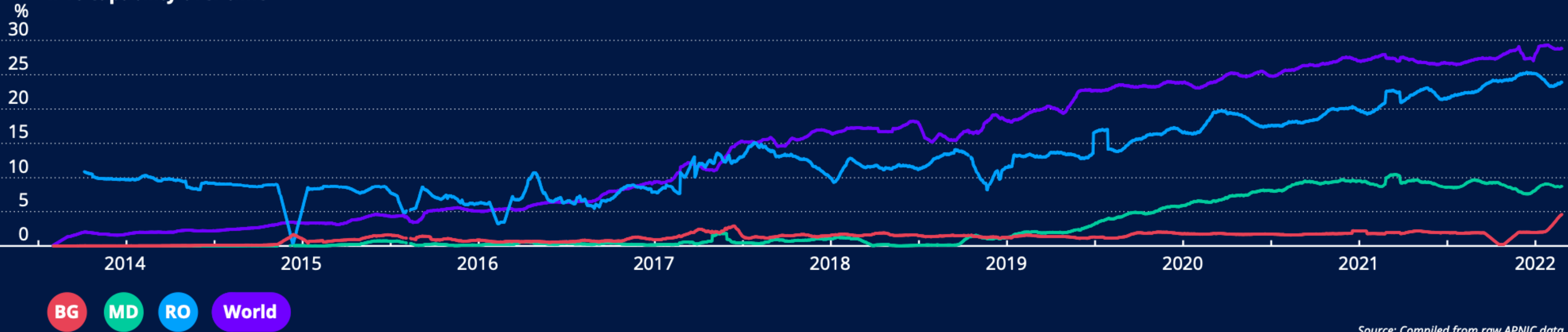


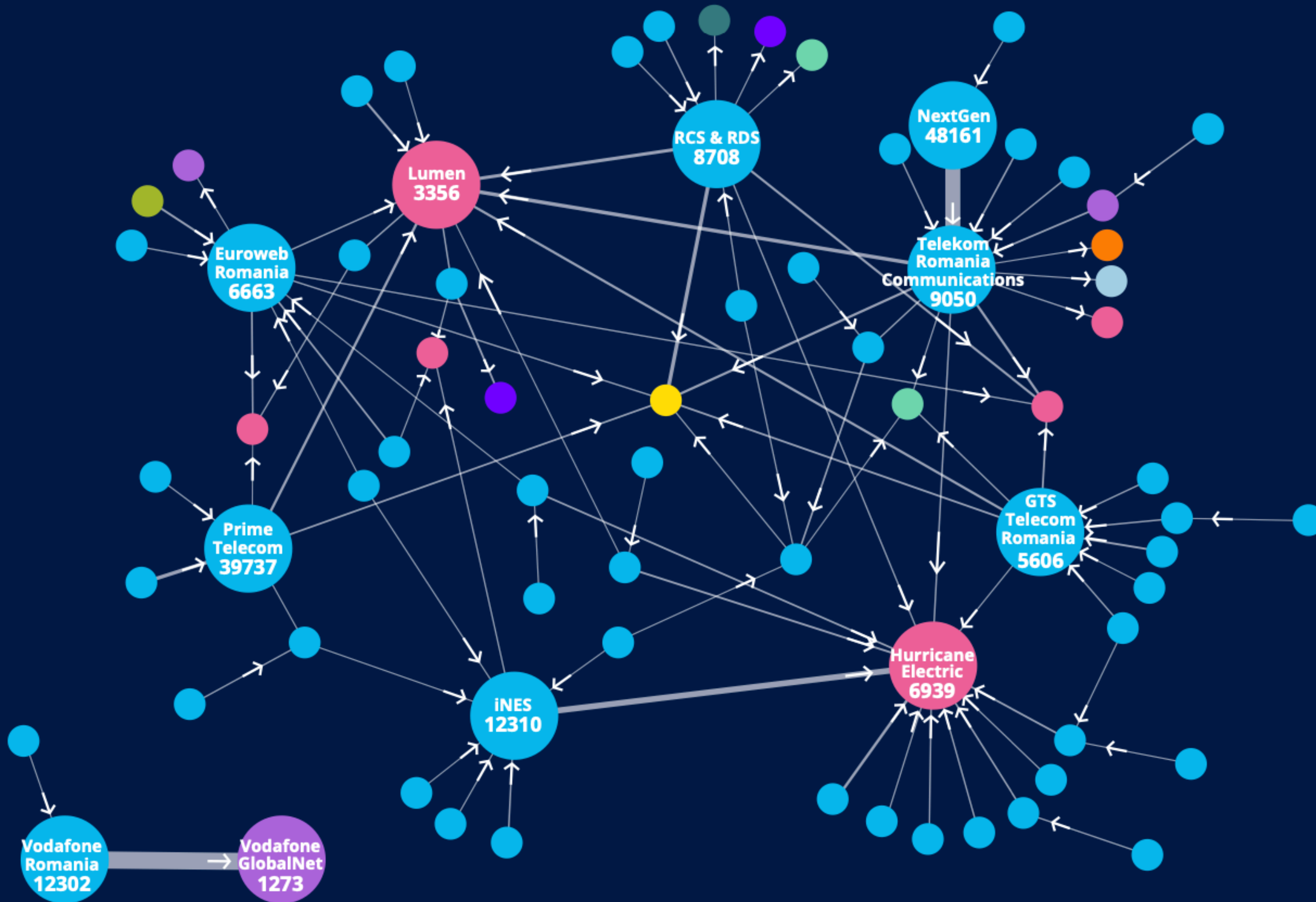
Figure 9:
IPv6 capability over time



Source: Compiled from raw APNIC data

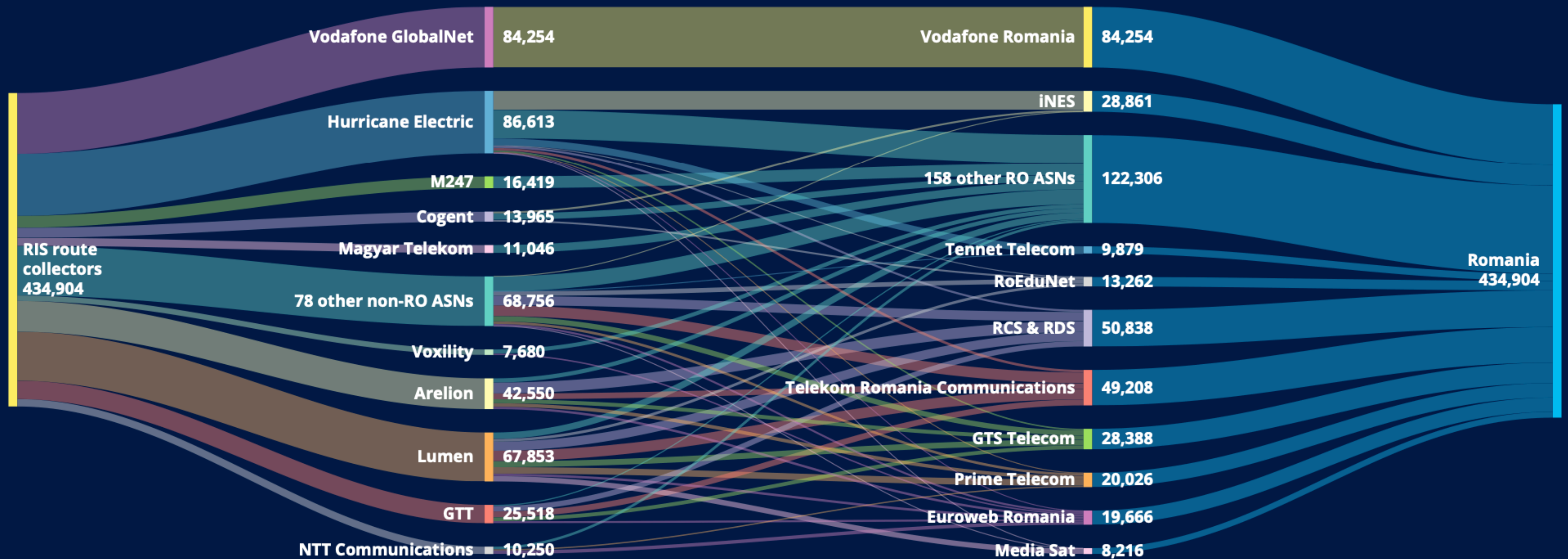
- Just because organisations have it, doesn't mean they use it
- RO & BG route 44% of their IPv6 blocks
- Very little market consolidation in IPv6
- RO was previously world leader, now lags behind world average

Figure 12:
Connectivity between networks in Romania



- Used Routing Information Service (RIS)
- In RO less prominent clustering of local networks around the larger providers compared to BG & MD
- More networks with a direct connection to a major international provider

Figure 15:
Romania's international connectivity



- Variety of upstream providers for the local ISPs
- Vodafone Romania relies exclusively on its parent company
- High number of different available paths



Figure 16:
K-root locations reached from requests originating in Bulgaria, Moldova and Romania over time (IPv4)

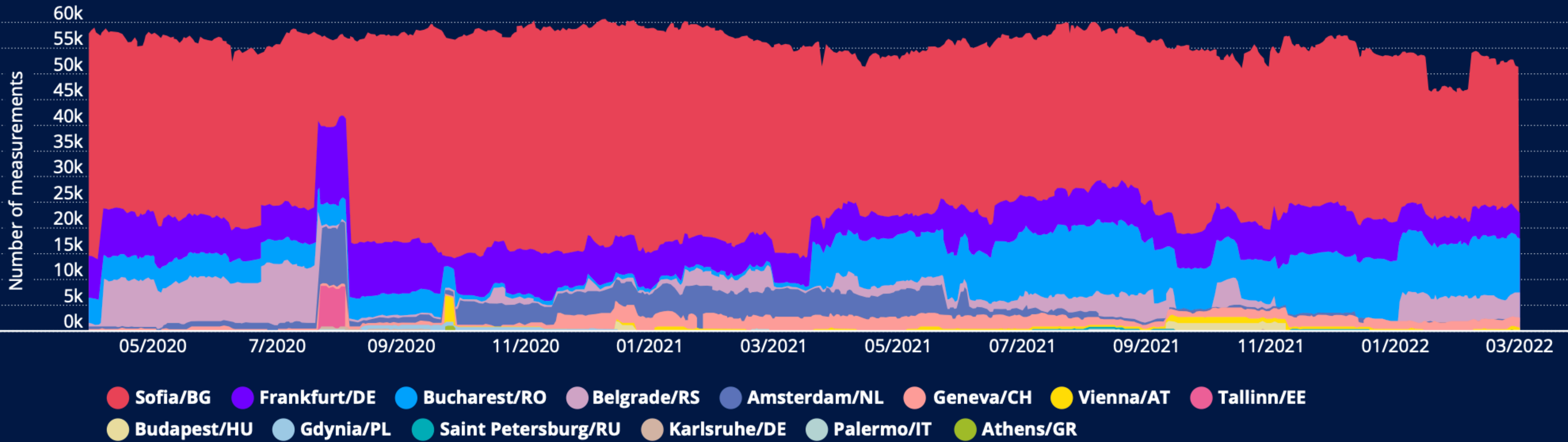


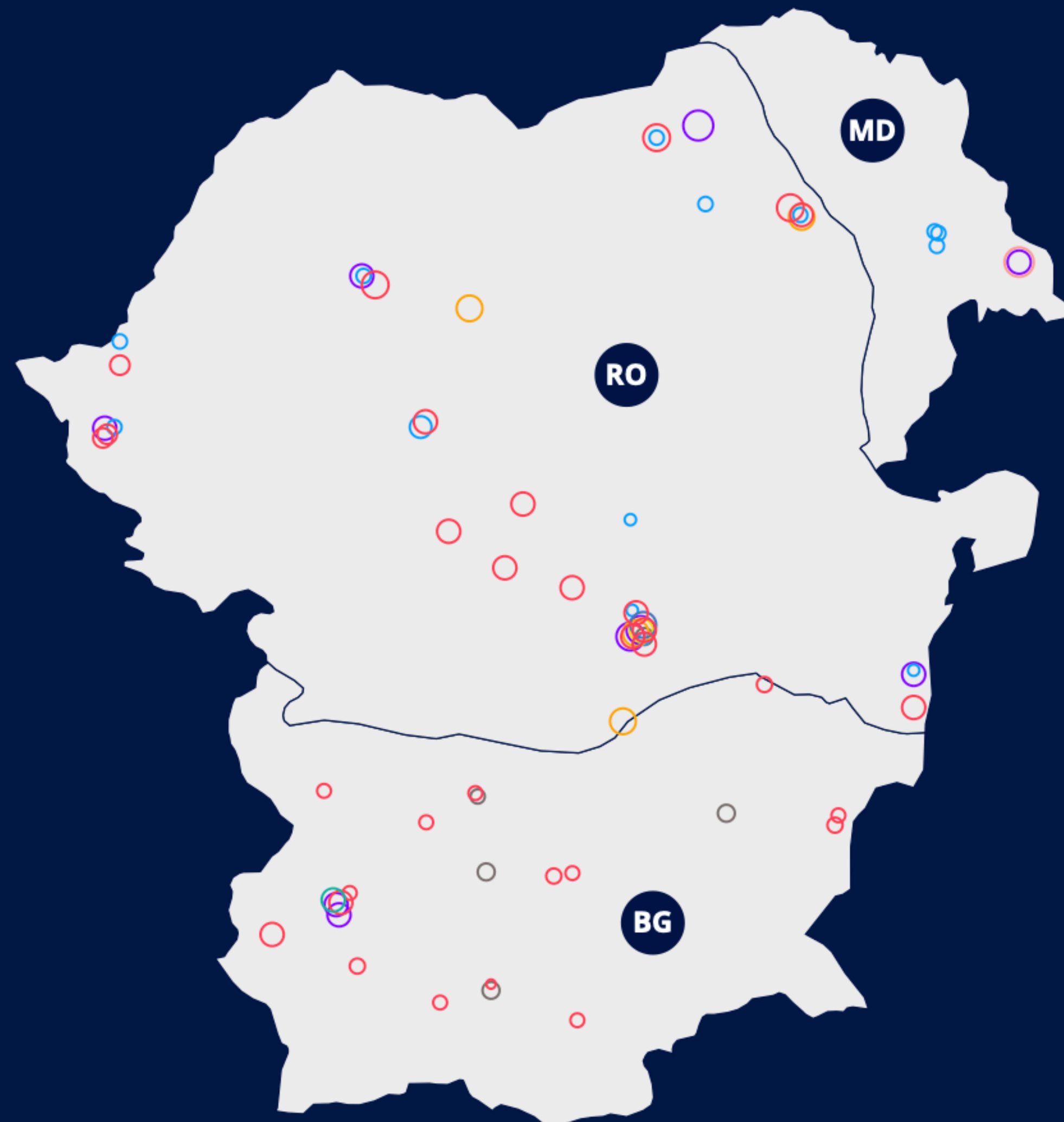
Figure 17:
K-root locations reached from vantage points in Bulgaria, Moldova and Romania



- Sofia/BG
- Bucharest/RO
- Frankfurt/DE
- Belgrade/RS
- Geneva/CH
- Amsterdam/NL
- Milan/IT
- Saint Petersburg/RU
- Vienna/AT

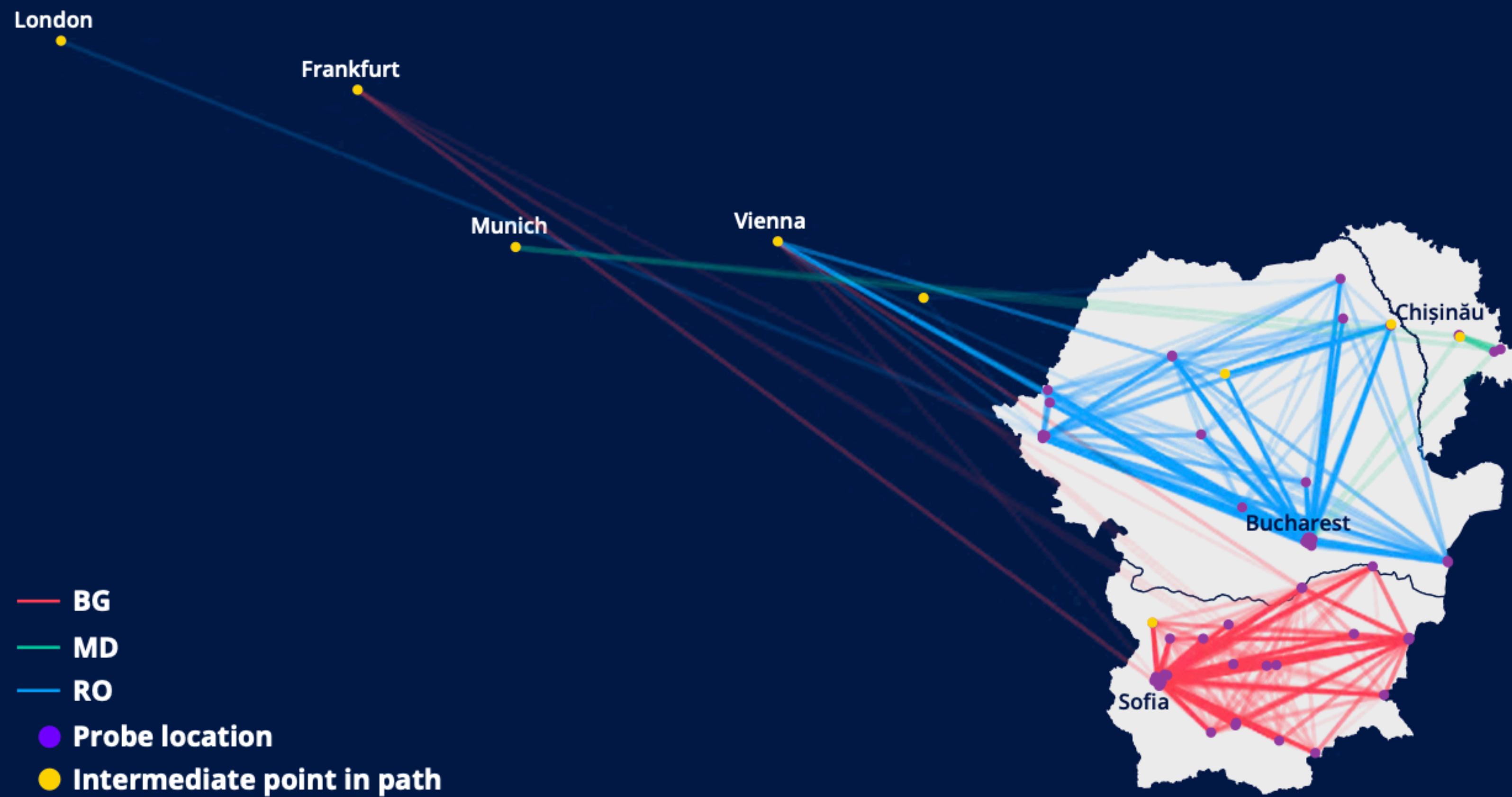
Minimum round-trip
time (ms)

- 10
- 20
- 30
- 40
- 50



- Some probes in RO reach the K-root instance in Sofia
- Probably not following the shortest path, but are instead being routed via an exchange point abroad before reaching Sofia

Figure 19:
Paths between origin and destination in the same country for Bulgaria, Moldova and Romania (IPv4)



- Most domestic traffic stays inside each country



Figure 21:
IPv4 address space covered by RPKI over time

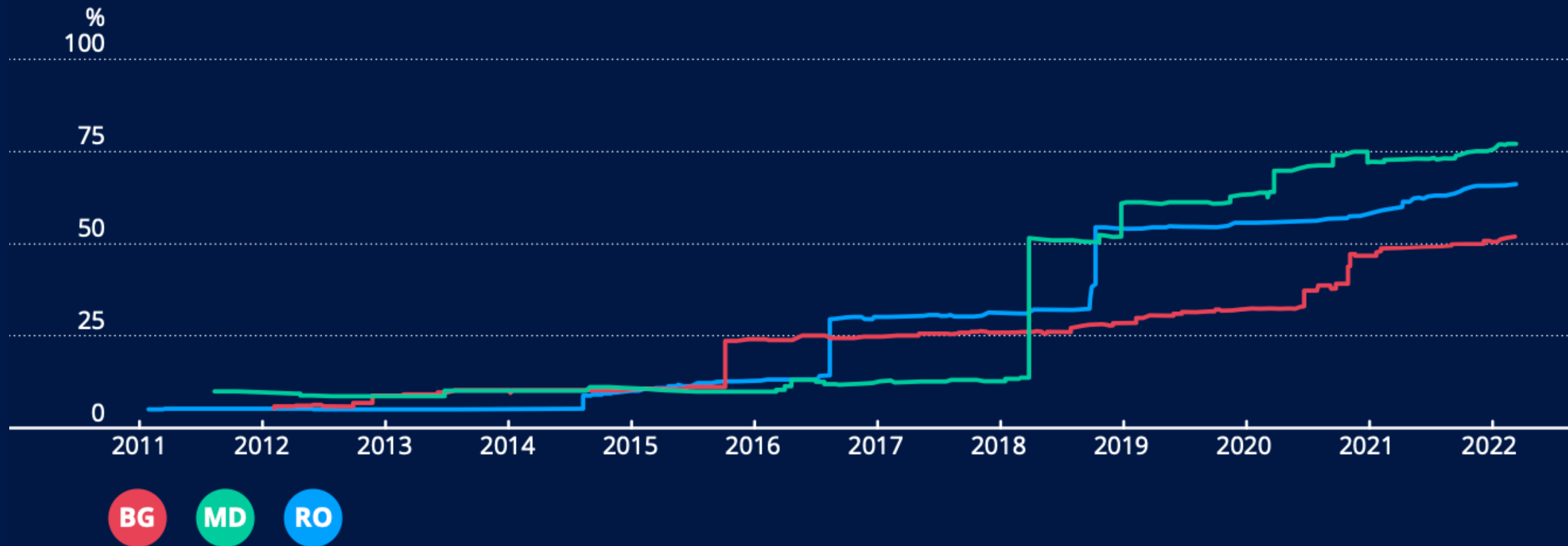


Figure 22:
IPv6 address space covered by RPKI over time



- RPKI uses digital certificates called ROAs (Route Origin Authorisations) to prove a resource holder's right to announce IP prefixes

Conclusion



- Healthy market competition
 - Some of the lowest access prices and fastest speeds in Europe
- Biggest exporter of IPv4 addresses in the RIPE NCC service region
- Further IPv6 deployment to accommodate future growth
- Routing is generally optimised
- Diversity in international connectivity

See you at RIPE 85!



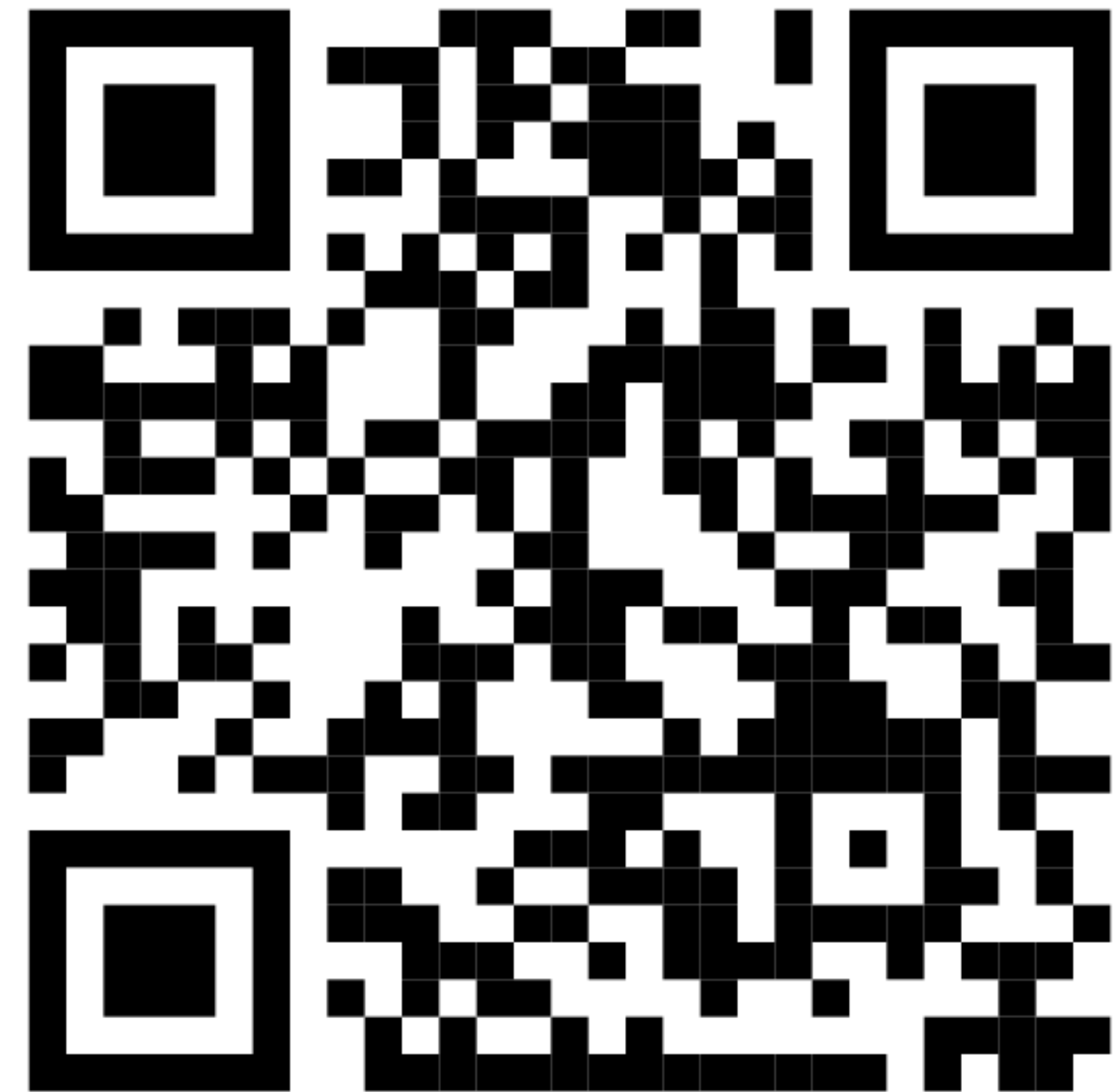
- RIPE 85 will be a hybrid meeting in Belgrade from 24-28 October
<https://ripe85.ripe.net/>
- Remote attendance is free and you don't have to attend the entire week



NOGs Participants Survey



- Takes 5-7 mins!
- Your views on:
 - Channels to stay connected
 - Important topics for NOGs to discuss
 - Challenges that prevent you from attending NOGs



<https://ripe-ncc.typeform.com/to/SjgKEKSx>



Questions



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