



RIPE NCC
RIPE NETWORK COORDINATION CENTRE

Wanna SEE if your local traffic stays local?

A RIPE Atlas measurement study
with focus on Montenegro

Keeping Local Traffic Local

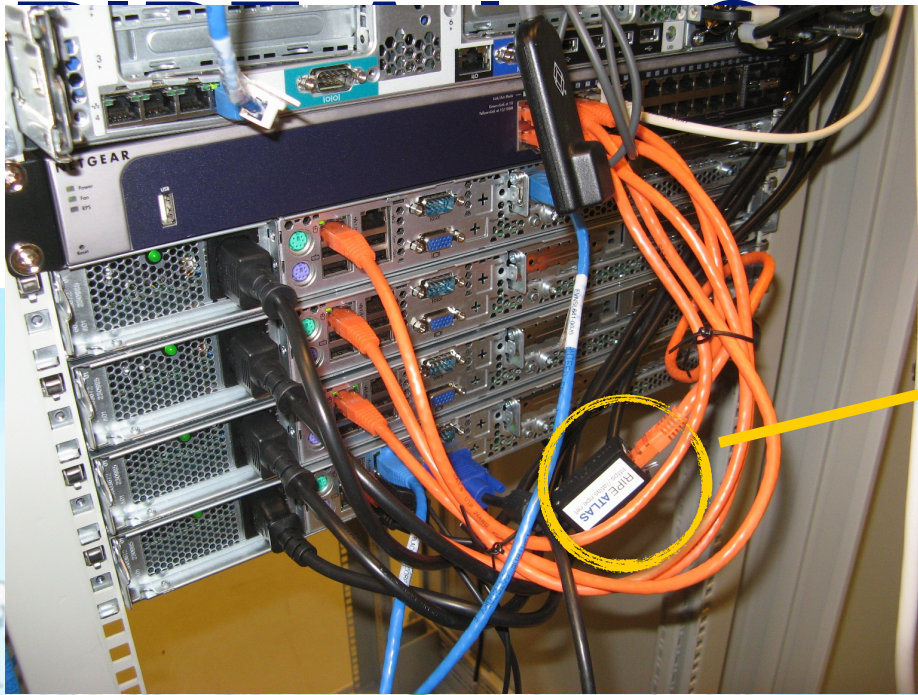


- Why?
 - Cost
 - Service quality: Happy users!
 - Security





erage - World



Leaflet | Tiles © Esri — Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community



RIPE Atlas Infrastructure

- Measurement points
 - Probes: 9767
 - RIPE Atlas Anchors: 270
- Coverage:
 - 179 countries (91%)
 - Networks (ASNs):
 - IPv4: 3,436 (6.0%)
 - IPv6: 1,260 (9.4%)



“Keep local traffic local”+RIPE Atlas



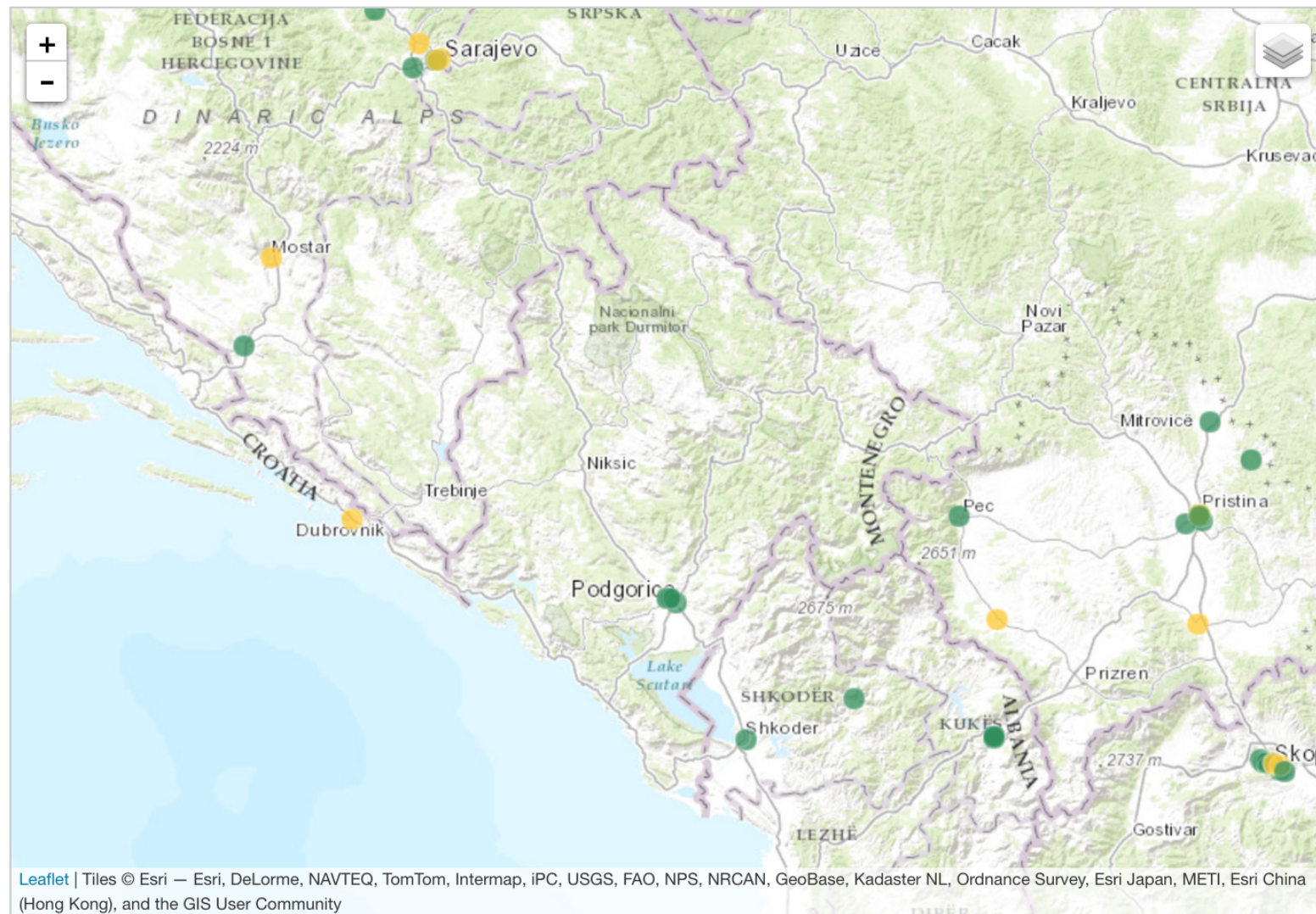
- Can we measure keeping local traffic local with RIPE Atlas?
 - Yes, and we are actually doing this!
 - Many challenges left that we are exploring
 - @@img?



Measure a Country?

- IXP-Country-Jedi
 - Are the paths between ASes staying in the country?
 - What is the difference between IPv6 & IPv4?
 - How many paths go via a local IXP?
 - Which peer could you add to improve reachability?
- Experimental tool
 - Depends on probe distribution in a country
 - Feature requests welcome!

RIPE Atlas Coverage - Montenegro



- All in Podgorica!

- What about:

- Nikšić
- Budva
- Rural areas?

RIPE Atlas Coverage - Montenegro



- End-user networks covered:

ASN	Name	Estimated Population %	IPv4 Public Probes	IPv4 Private Probes	IPv4 Total Probes	IPv6 Public Probes	IPv6 Private Probes	IPv6 Total Probes	More
8585	INTERNET-CG	61.51	0	0	0	0	0	0	View
43940	MTEL-AS	22.33	0	0	0	0	0	0	View
31042	SERBIA-BROADBAND-AS	9.19	0	0	0	0	0	0	View
15397	TELENORMONTENEGRO	4.18	0	0	0	0	0	0	View

http://sg-pub.ripe.net/petros/population_coverage/country.html?name=ME

https://labs.ripe.net/Members/petros_gigis/ripe-atlas-coverage-in-eyeball-networks

IXP Country Jedi



- Tool & concept:
 - <https://github.com/emileaben/ixp-country-jedi>
 - <https://labs.ripe.net/Members/emileaben/measuring-ixps-with-ripe-atlas>



IXP Country Jedi



- Traceroute mesh between RIPE Atlas probes
 - Identify ASNs in the country
 - Identify IXPs & IXP LANs using PeeringDB
 - Mesh: from a set of probes in a country to each other
 - Max two probes per ASN
 - Only “public” probes with “good” geolocation
 - Hops geolocated using “OpenIPMap” database
- Visualised as map, matrix, graph



Benefits (1)

- Country: regulators, politicians, cyber-security
 - How many paths stay in the country? Where do they go?
- Operators
 - Routing and traffic optimisation
- IPv6 advocates
 - Comparing IPv4 and IPv6 paths



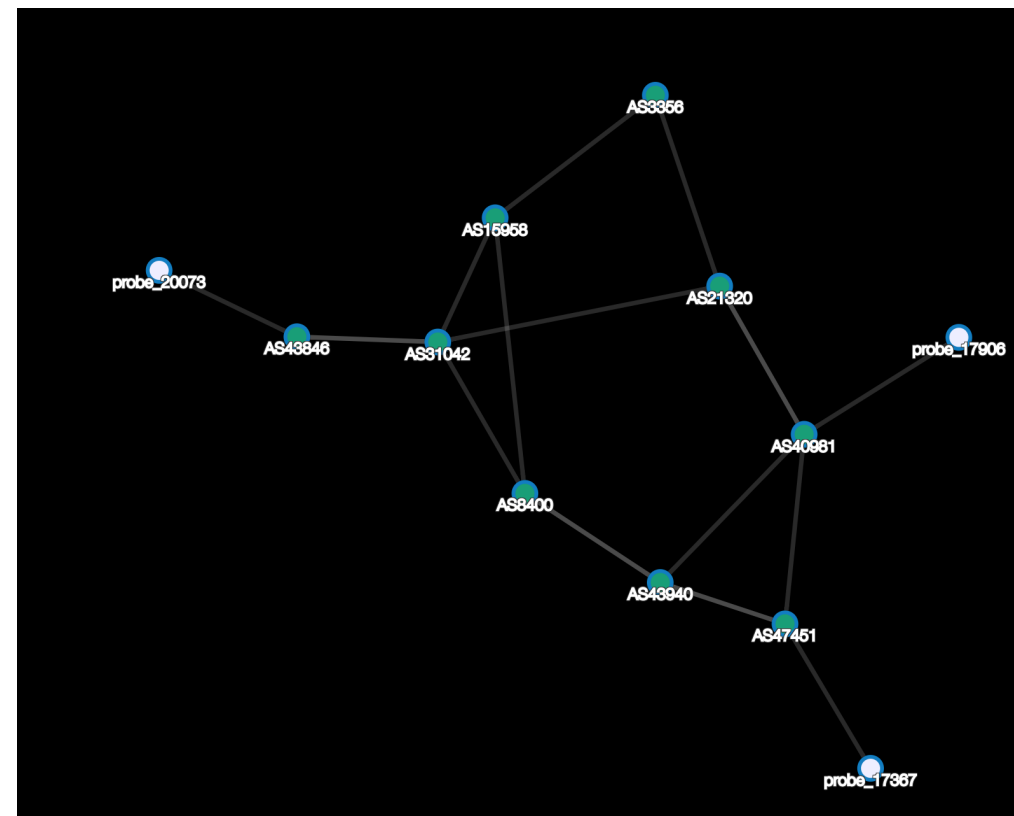
Benefits (2)

- IXP operators
 - Shows how IXPs help to keep traffic local and regional
- RIPE Atlas community
 - More probes in more networks and ASes = higher quality measurement data
- Geolocation data community
 - Use case for improving the data quality



Example: Montenegro

- We do monthly runs for countries with enough probes
 - replace ME with your country code in link below!



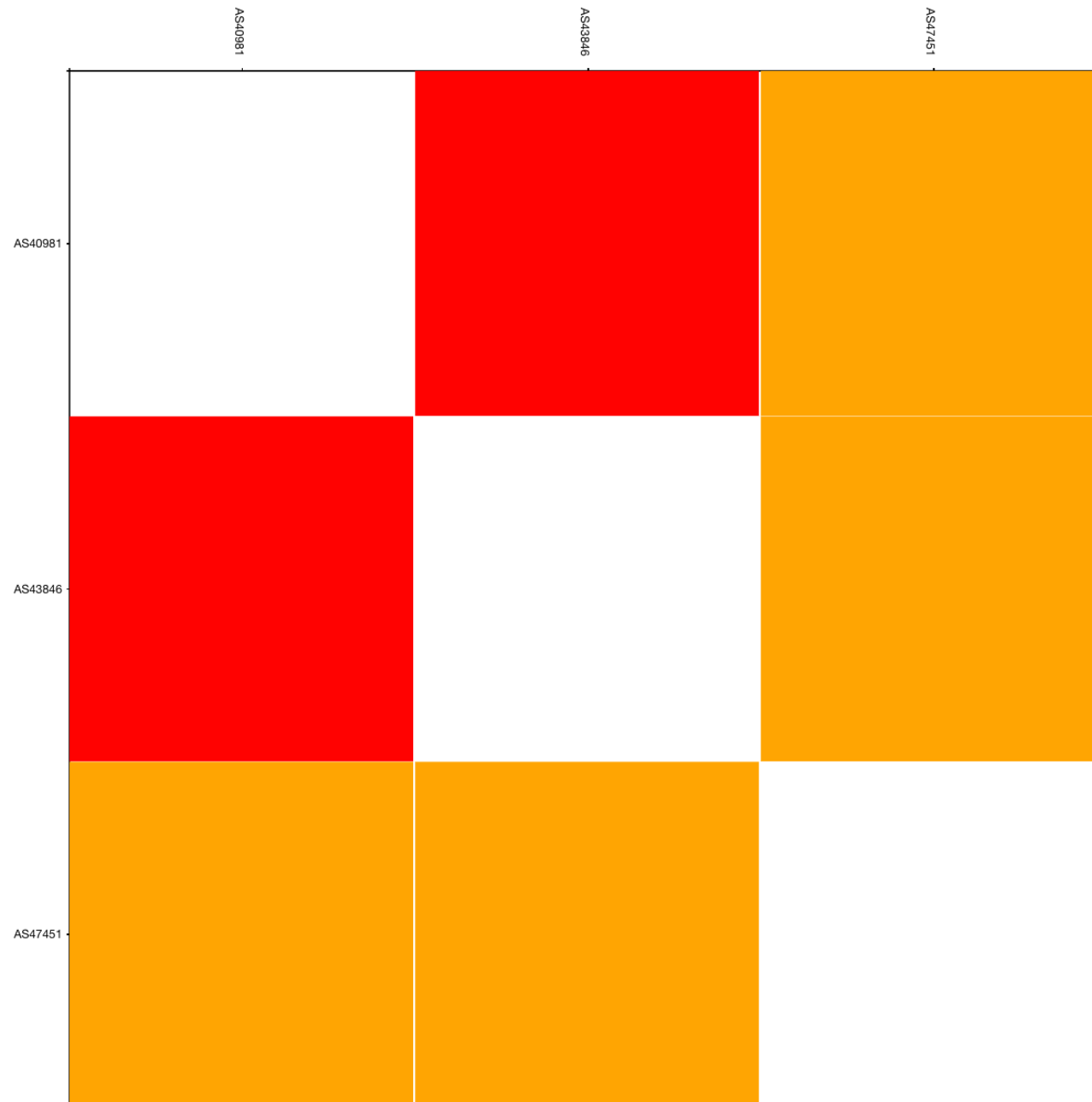
<http://sg-pub.ripe.net/emile/ixp-country-jedi/latest/ME/>

Example: Montenegro



■ IXP IPs: NO, out-of-country IPs: NO
■ IXP IPs: YES, out-of-country IPs: YES

■ IXP IPs: YES, out-of-country IPs: NO
■ IXP IPs: NO, out-of-country IPs: YES



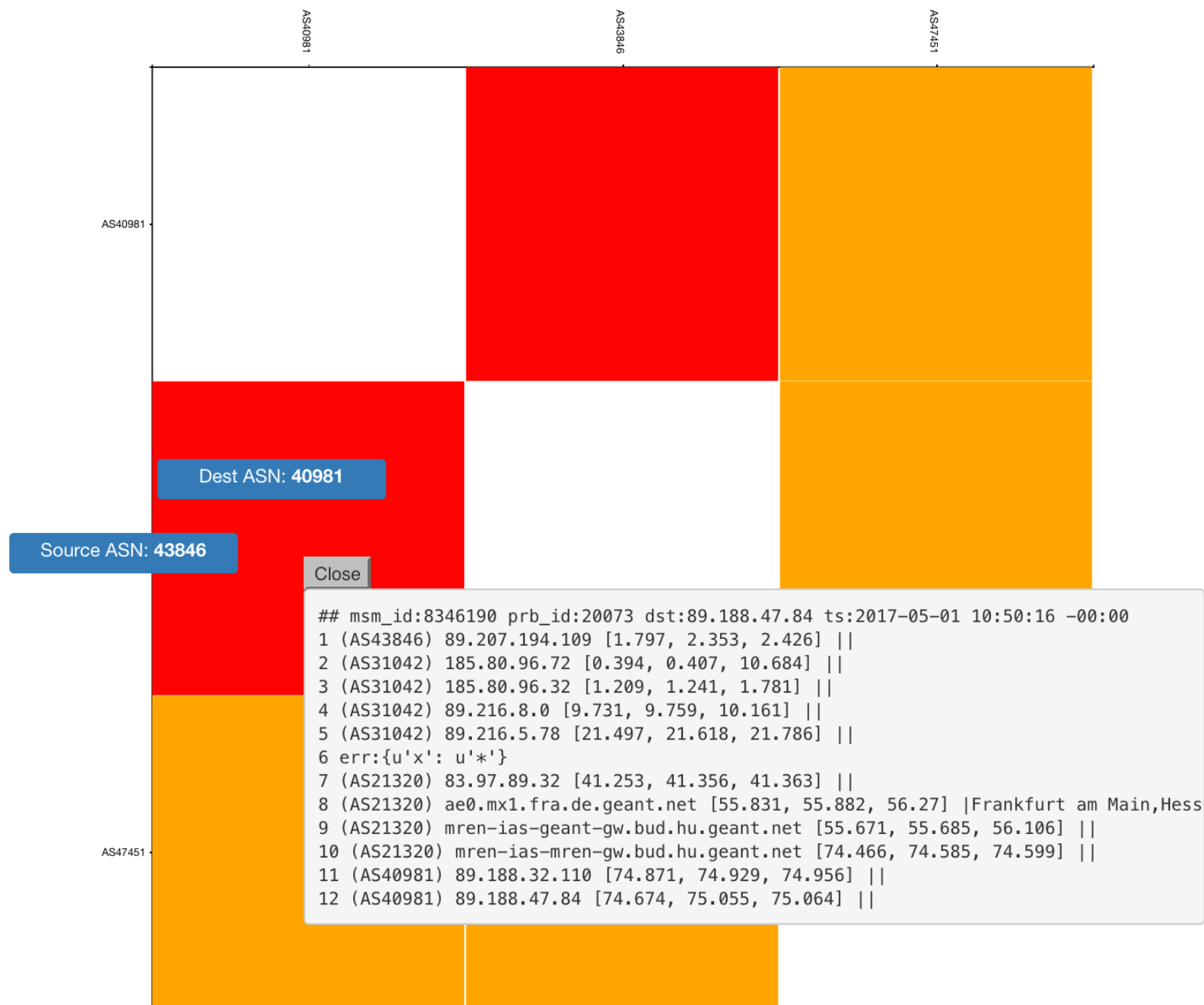
- row: source
- column: dest
- cell: path

Example: Montenegro



■ IXP IPs: NO, out-of-country IPs: NO
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■ IXP IPs: NO, out-of-country IPs: YES



Montenegro: Geographical view



- “red cells”
- paths via:
 - Amsterdam, NL
 - Frankfurt, DE
 - Budapest, HU
 - Belgrade, RS



Measuring Country Pairs

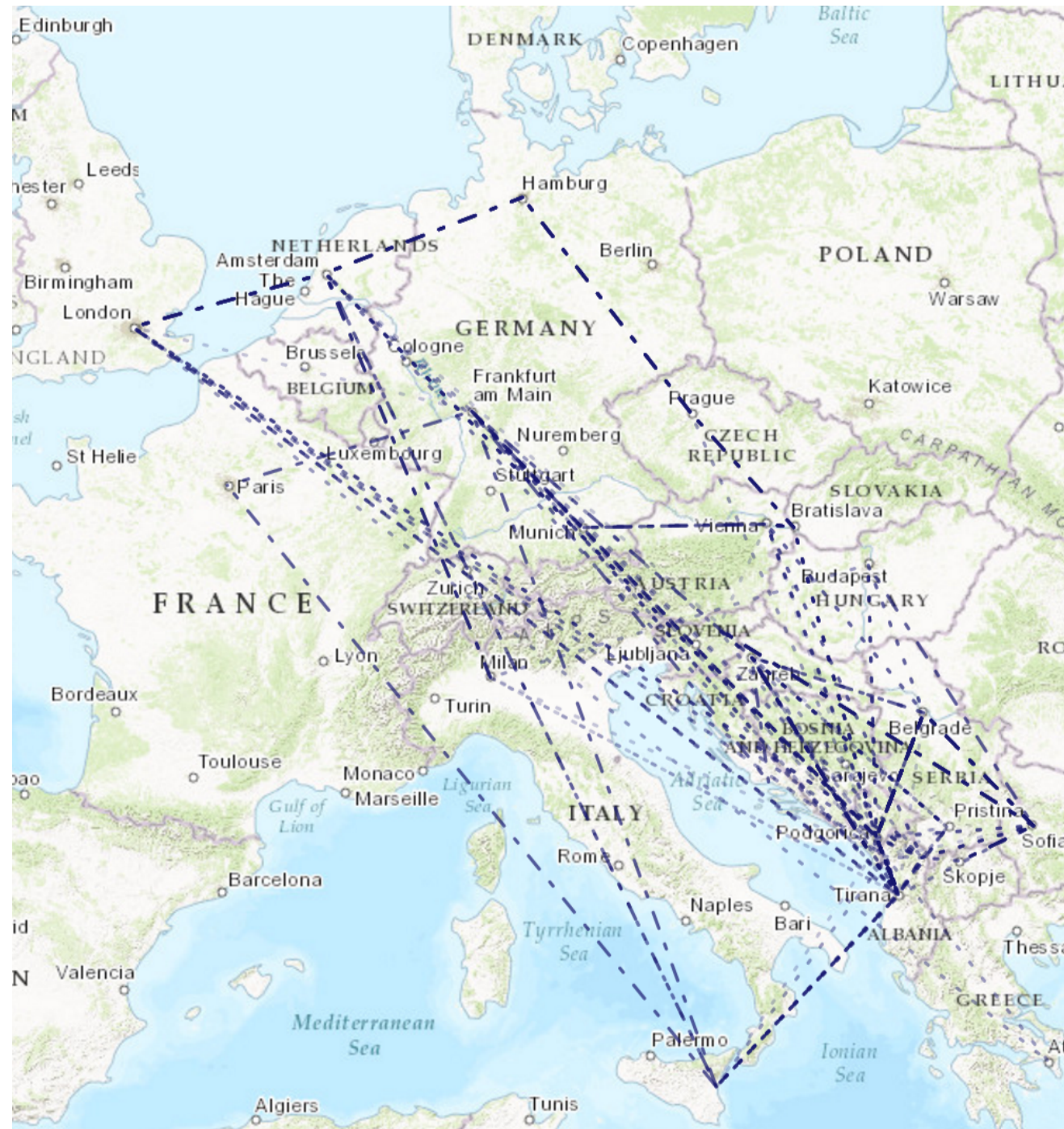


Montenegro-neighbour pairs

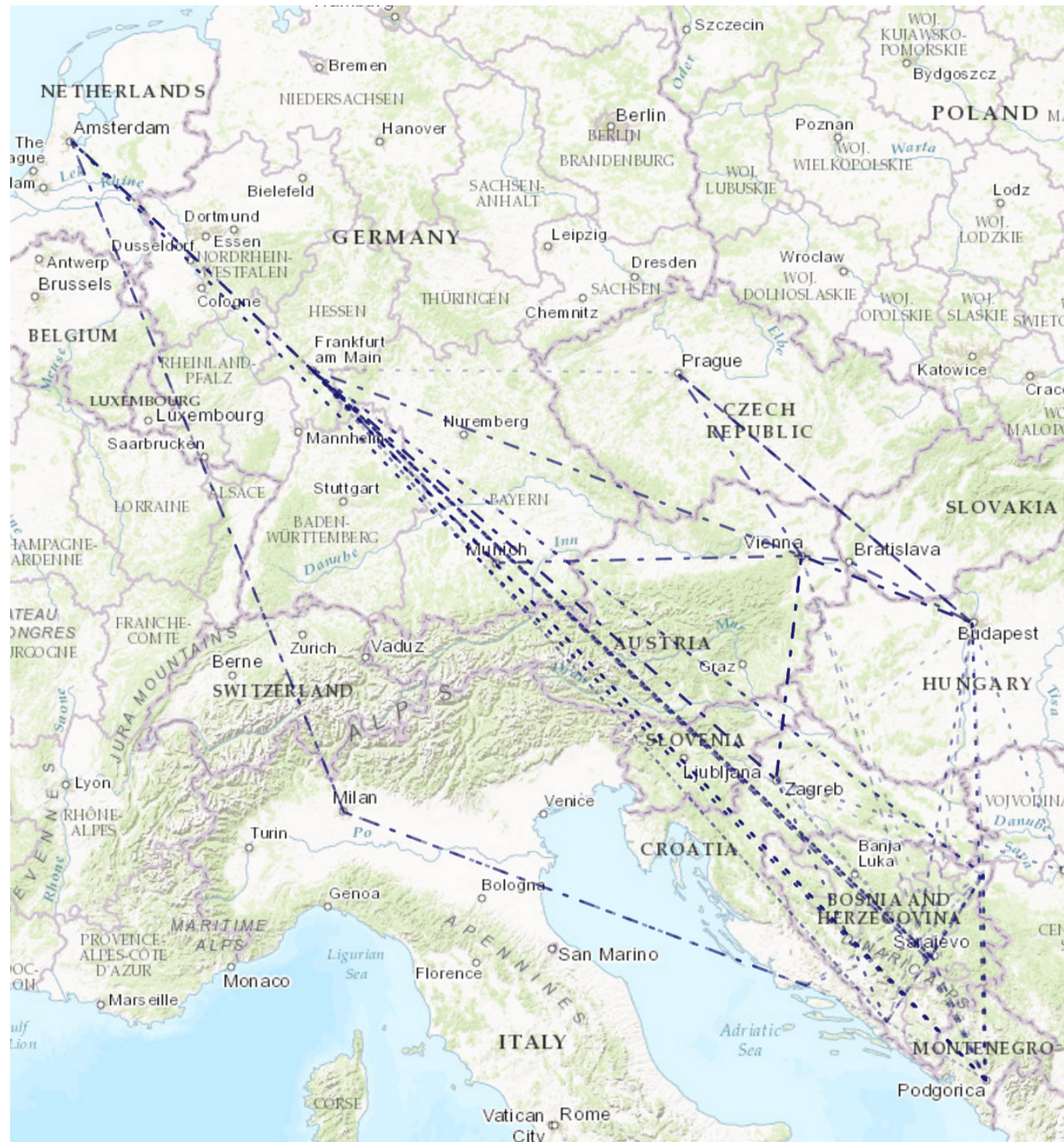
- Tool can also do sets of countries
- Montenegro and neighbours snapshot available at:

<http://sg-pub.ripe.net/emile/ixp-country-jedi/country-pairs/history/2017-05-29/>

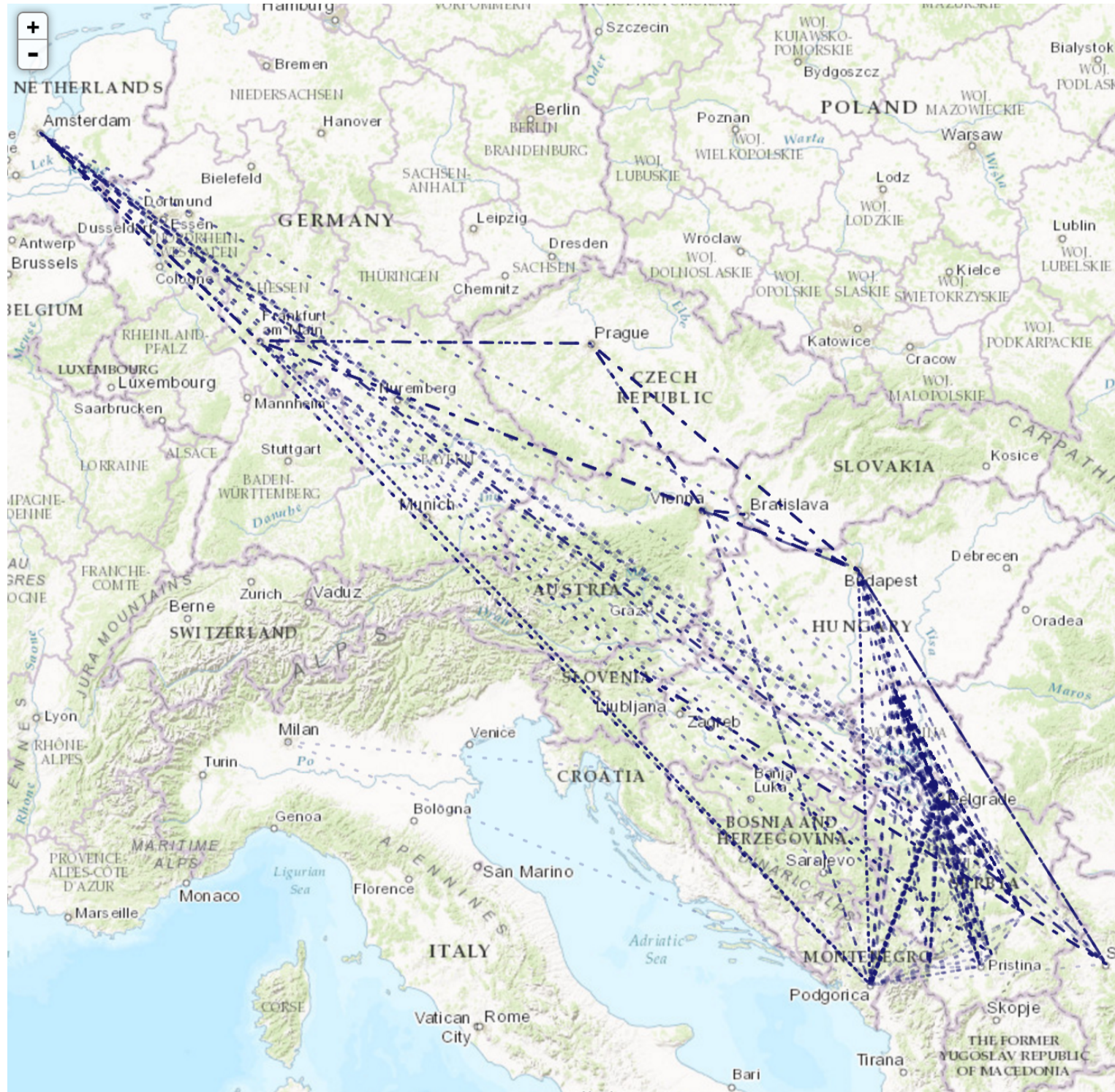
Montenegro - Albania paths



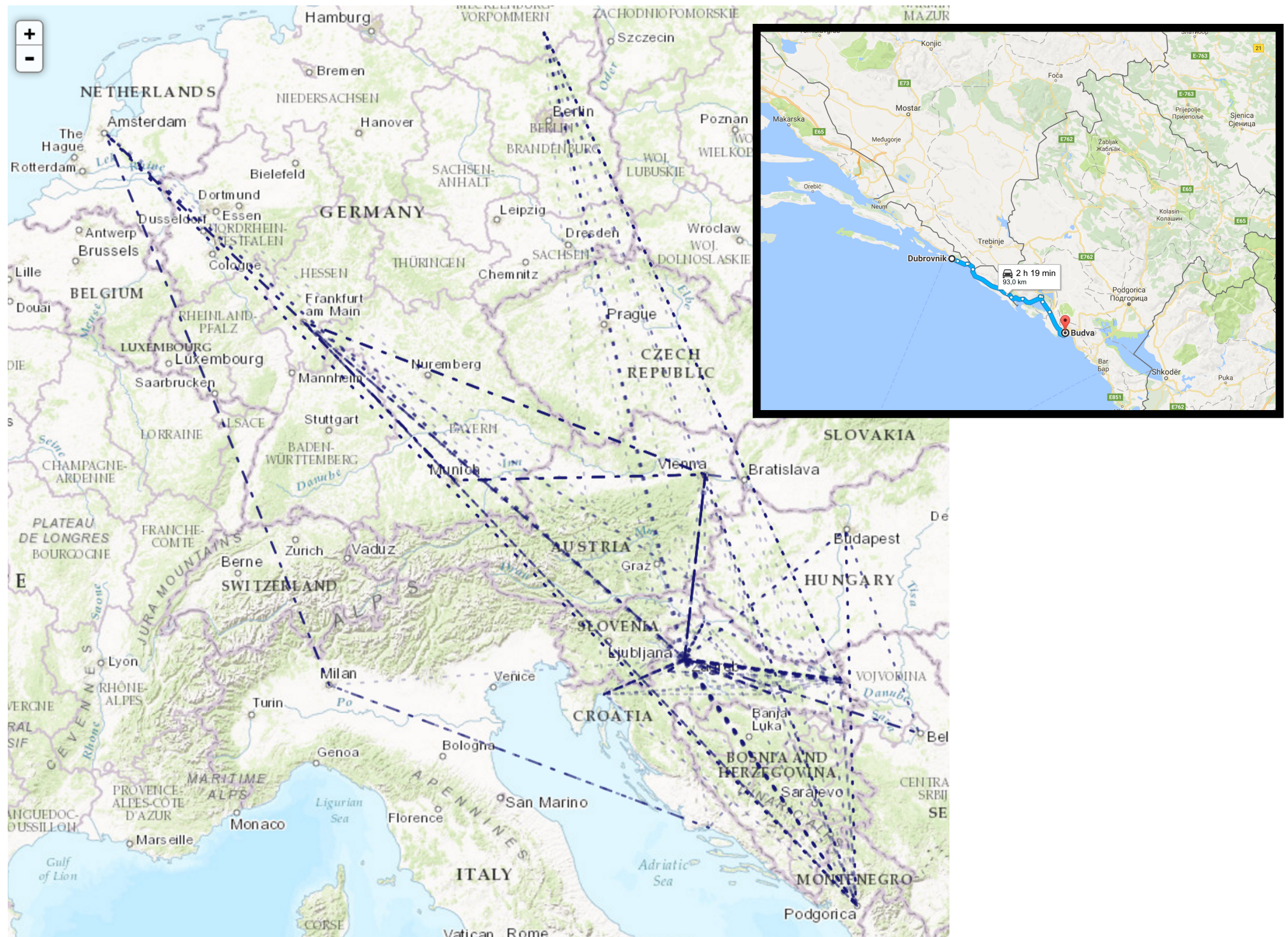
Montenegro - Bosnia Herzegovina



Montenegro - Serbia



Montenegro - Croatia



Why do these paths look like that?



- Internet routing != vehicle routing
- BGP optimisation mostly based on high-cost (~high volume) traffic flows?
 - Network operators typically optimise the largest flow networks first (Google, Facebook, Amazon, Apple, Microsoft ... [1])
 - Easy to forget low-volume, high-value (to users) traffic
 - Latency/locality is hardly accounted for in BGP
 - You'll have to peer with local players (at IXP and/or PNI)

[1] list from <http://www.potaroo.net/ispcol/2017-03/gilding.html>



Actions (1)

- Use this tool to find possible suboptimal routing
 - Find your ASN in the mesh, find the person from another ASN, have tea together :)
- To improve accuracy of this diagnostic tool
 - If your ASN is not on the graph, apply for a RIPE Atlas probe
 - If you move, remember to update your probe's geolocation



Actions (2)

- Re-use & re-write the code: it is free & open-source software
- Improve infrastructure geolocation: contribute data to OpenIPMap!



Questions



emile.aben@ripe.net

@meileaben



Not a typo!



Appendix 1: Challenges

- Correct probe geolocation (user provided)
- Results are per-probe, to what extent can we generalise to all of an ASes address space?
- Geolocation of IPs in traceroute path (OpenIPmap is crowd-sourced)
- IXP detection
- ...