RIPE NCC
RIPE NETWORK COORDINATION CENTRE

How Do Users Interconnect?

Visualising Internet Traffic Paths

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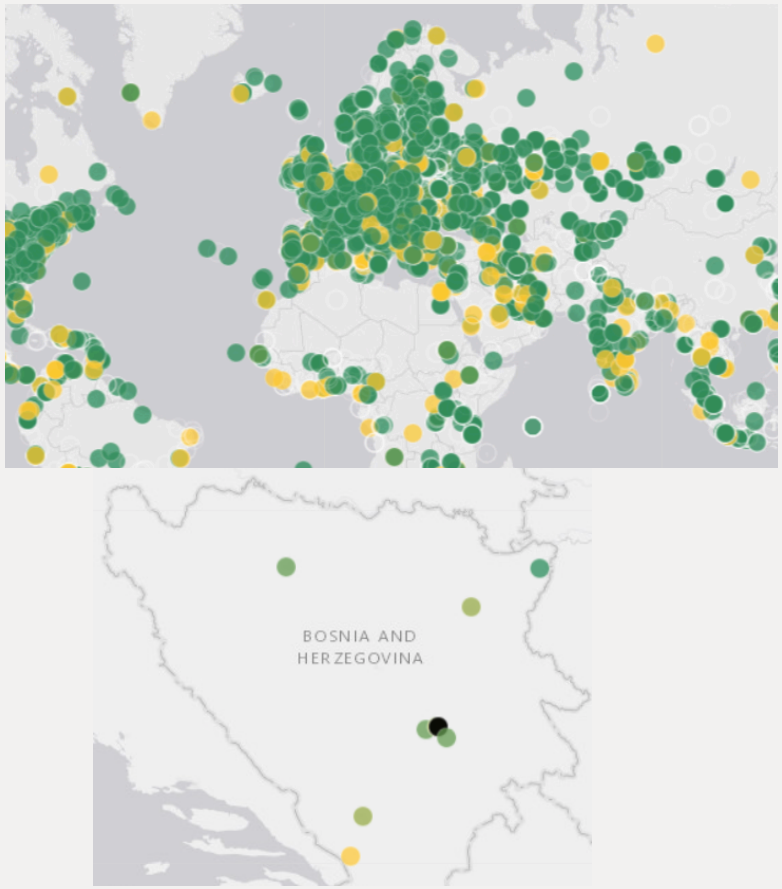
BECHA@ripe.net

View your network from the outside

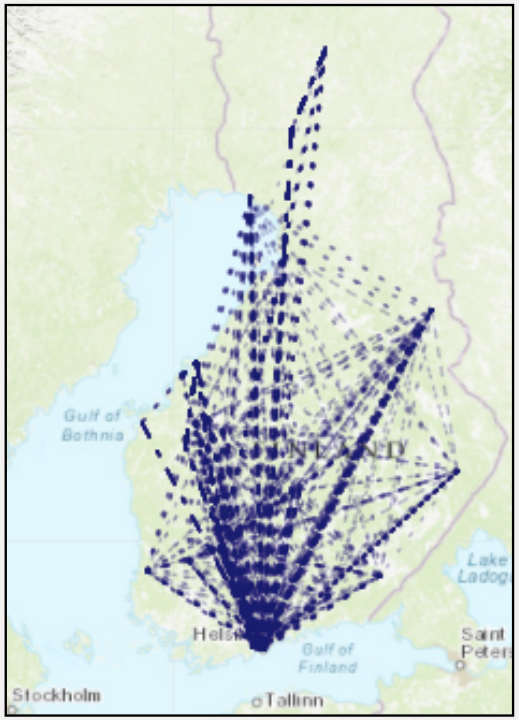


- **RIPE Atlas is a global, open, distributed Internet measurement platform, operated by the RIPE NCC**
  - Consisting of thousands of devices (“probes”, “anchors”, VM)
  - **Actively** measuring Internet connectivity in real time
  - Open data available to the operators & research community
  - Ping, traceroute, DNS, TLS, NTP; IPv4 and IPv6 supported

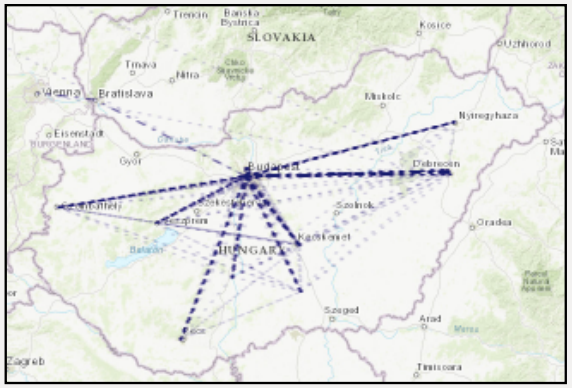
Viewing a Country's Internet Traffic Paths

Bosnia and Herzegovina: IPv4 paths

Finland



Hungary



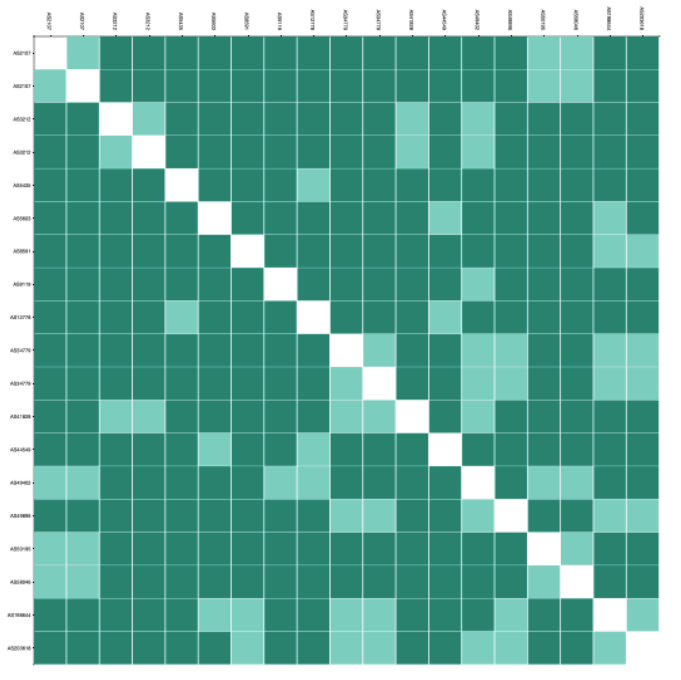
Tool: IXP Country Jedi (Emile Aben)

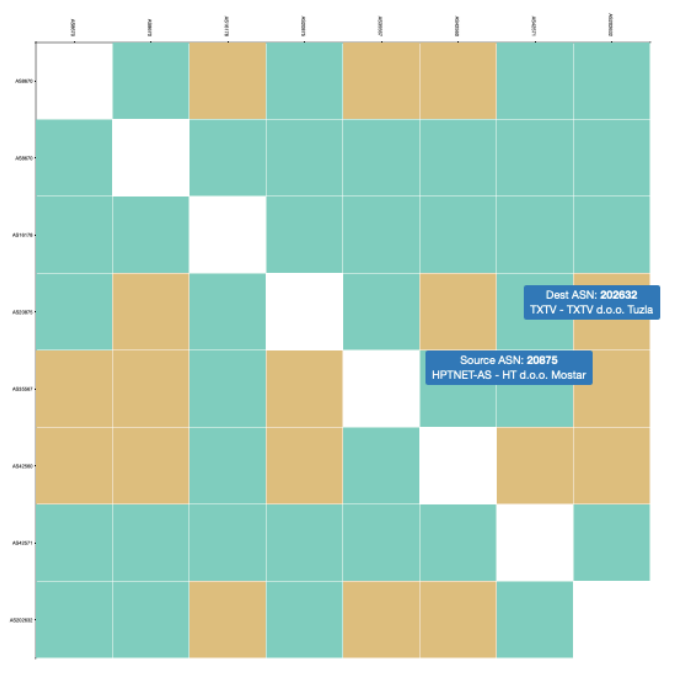
- **Measuring whether local Internet traffic paths stay local**
  - Visualisations of traceroutes between RIPE Atlas probes
  - Do the paths take out-of-country detours?
  - Do we see IXPs in the paths?

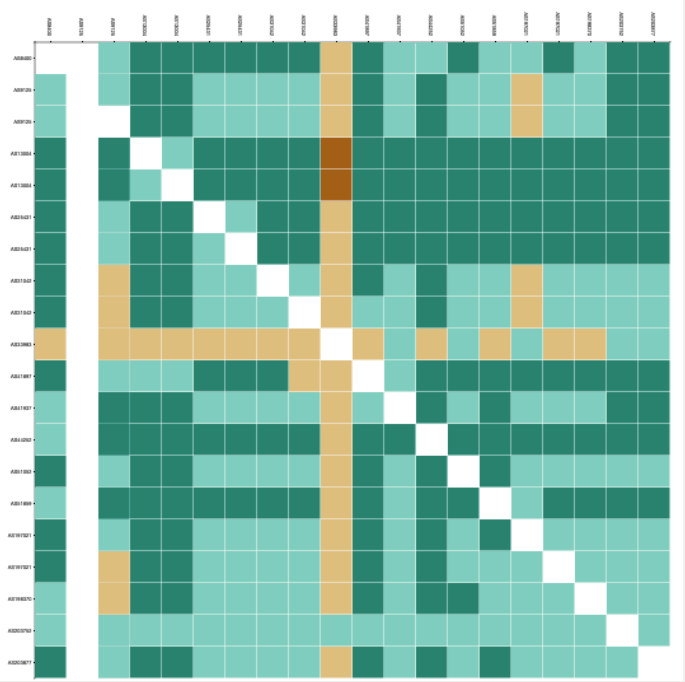
- **Interactive tool!**
- http://ripe.net/ixp-country-jedi

Examples: Slovenia, Bosnia, Serbia

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







Our Suggestions

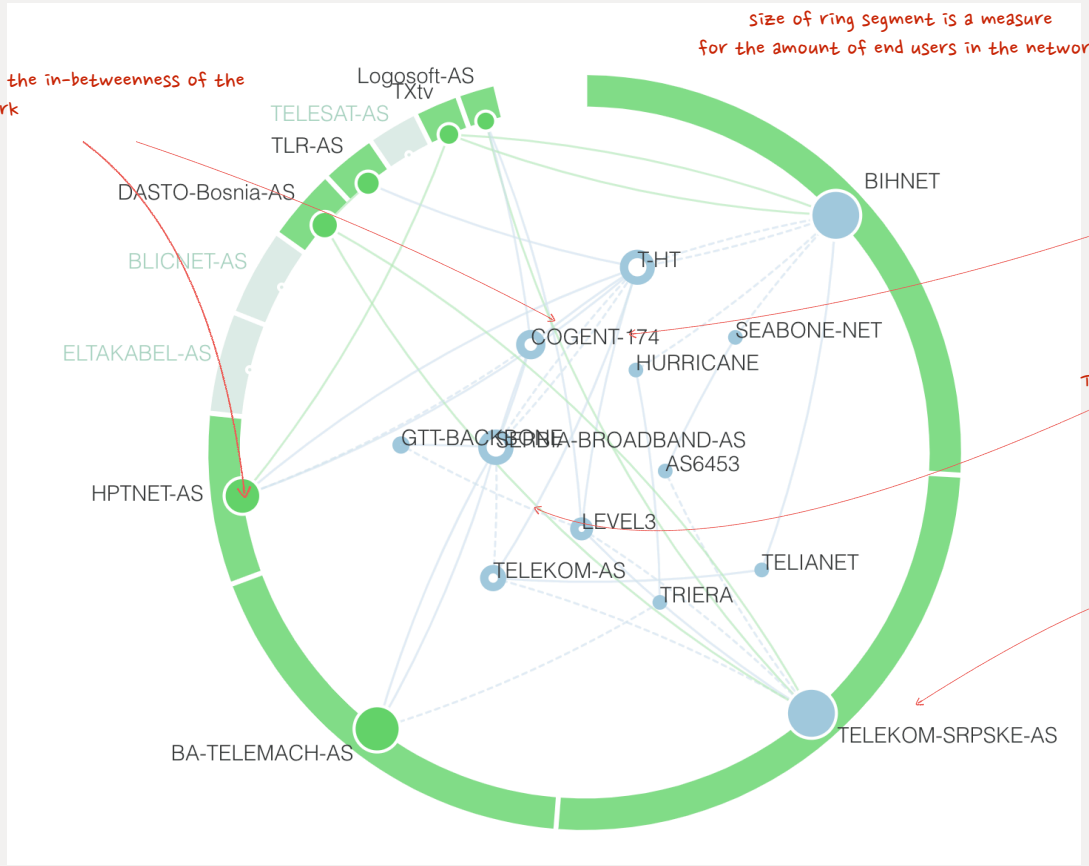
- **Use this tool to optimize your routing!**
  - … select the path that is going out of country
    - Talk to your upstream(s)
  - … select the path that is not going via a local IXP
    - Make a new peering agreement

- **Contribute to the FLOSS code on GitHub**

- **If your ASN is *not* on the graph, apply for a RIPE Atlas probe**

User-to-User Fabric of a Country

Bosnia and Herzegovina



A network that serves end-users

A network that serves end-users and provides transit to other end-user net works within the country

A transit network or an IXP external to this country

An IXP that is identified with this country

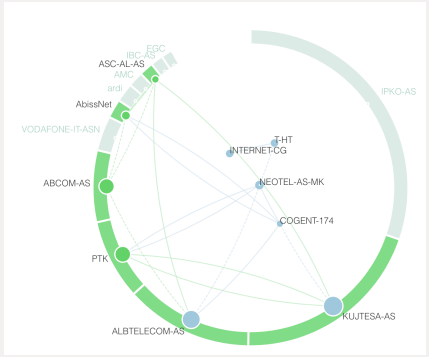
A sizable end-user network for which we have data

A sizable end-user network for which we have no data

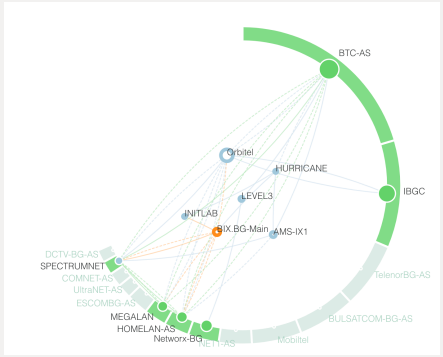
Tool: User-to-User (Jasper den Hertog)

- **Sketches of interconnection between users**
  - focus is on ISPs with the most users in a country
  - **not** the connections to content providers
- **Based on RIPE Atlas probes traceroutes**
- **This does not represent traffic volume!**
  - traceroutes represent traffic paths
- **Hint about health of local interconnect market**
- **Interactive tool**
  - https://sg-pub.ripe.net/ixp-country-jedi/ba/2019/04/01

Country Overviews

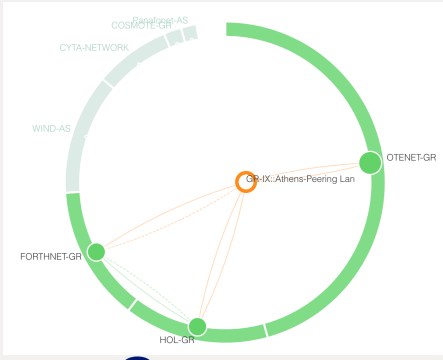


Albania

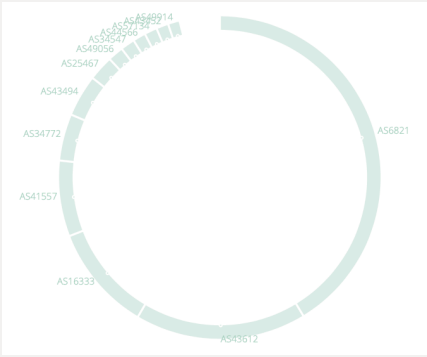


Bulgaria

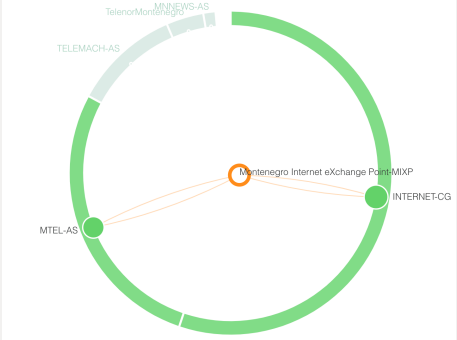
Croatia



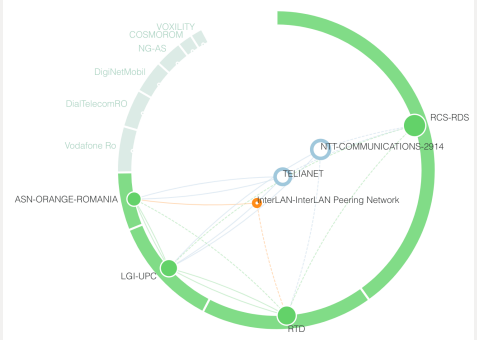
Greece



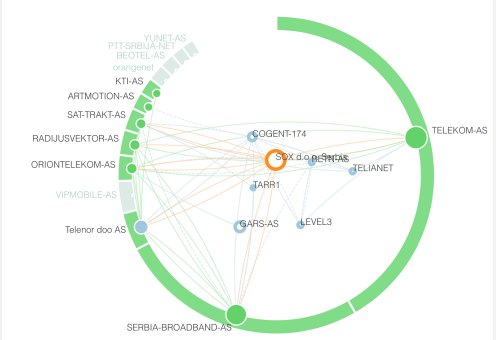
Macedonia



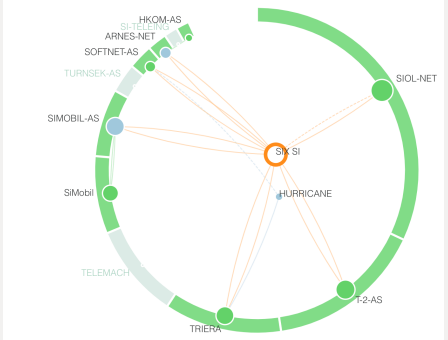
Montenegro



Romania



Serbia



Slovenia

Conclusions and questions

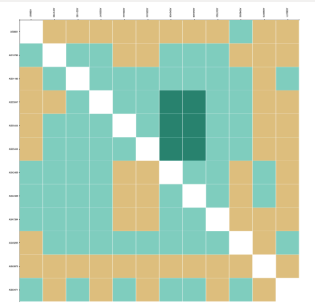
- **This is how un-optimized traffic paths look like**
- **Does it match your expectations?**
  - Let us know - let's have a dialogue!
  - Compare with the other countries in the region!
- **The goal is to have healthy interconnections**
  - Empower innovation & cooperation
  - Give better user experience
- **More RIPE Atlas probes give better "resolution"**
  - Deploy more probes, please

Additional Slides

IXP Country

A matrix view of all probe-to-probe measurements between ASNs

Country Overviews



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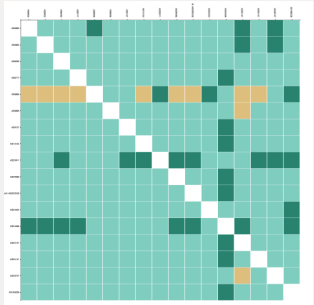
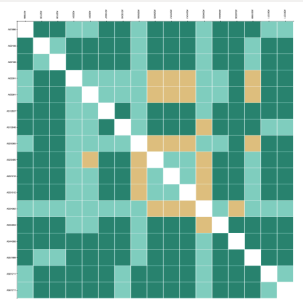
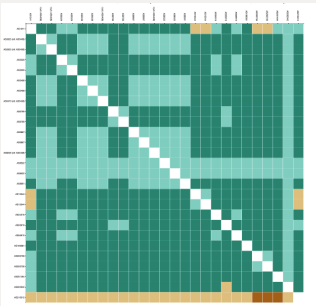


Bulgaria



Croatia



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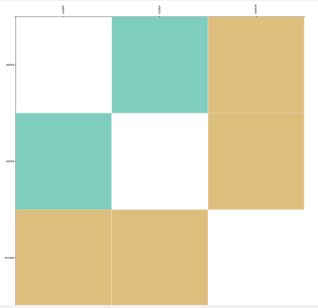

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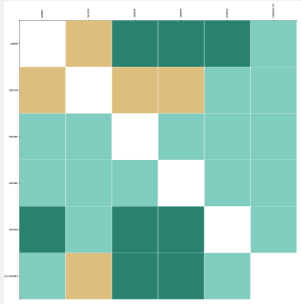

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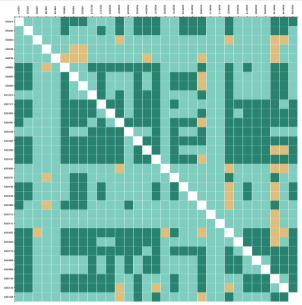

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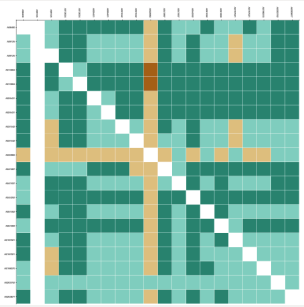

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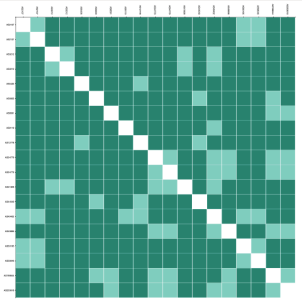
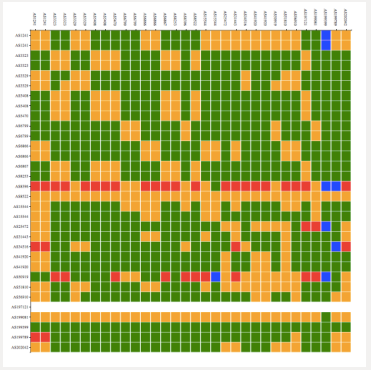
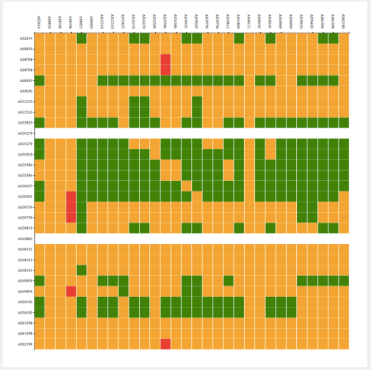
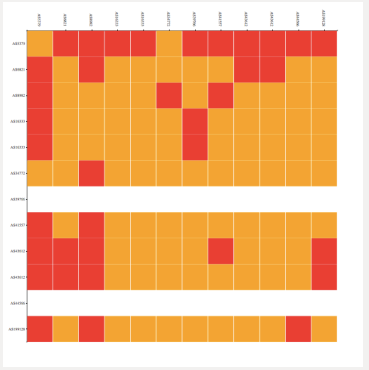


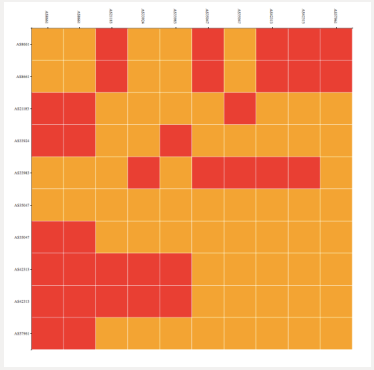
Slovenia

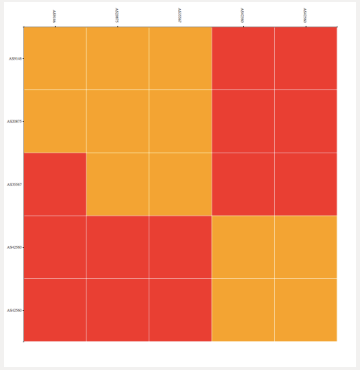
SEE 4, 2015

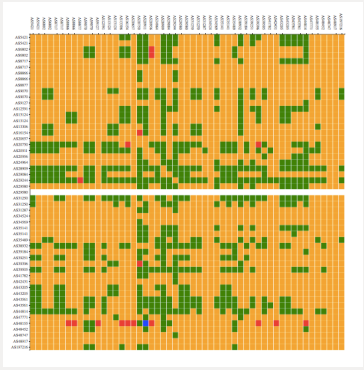




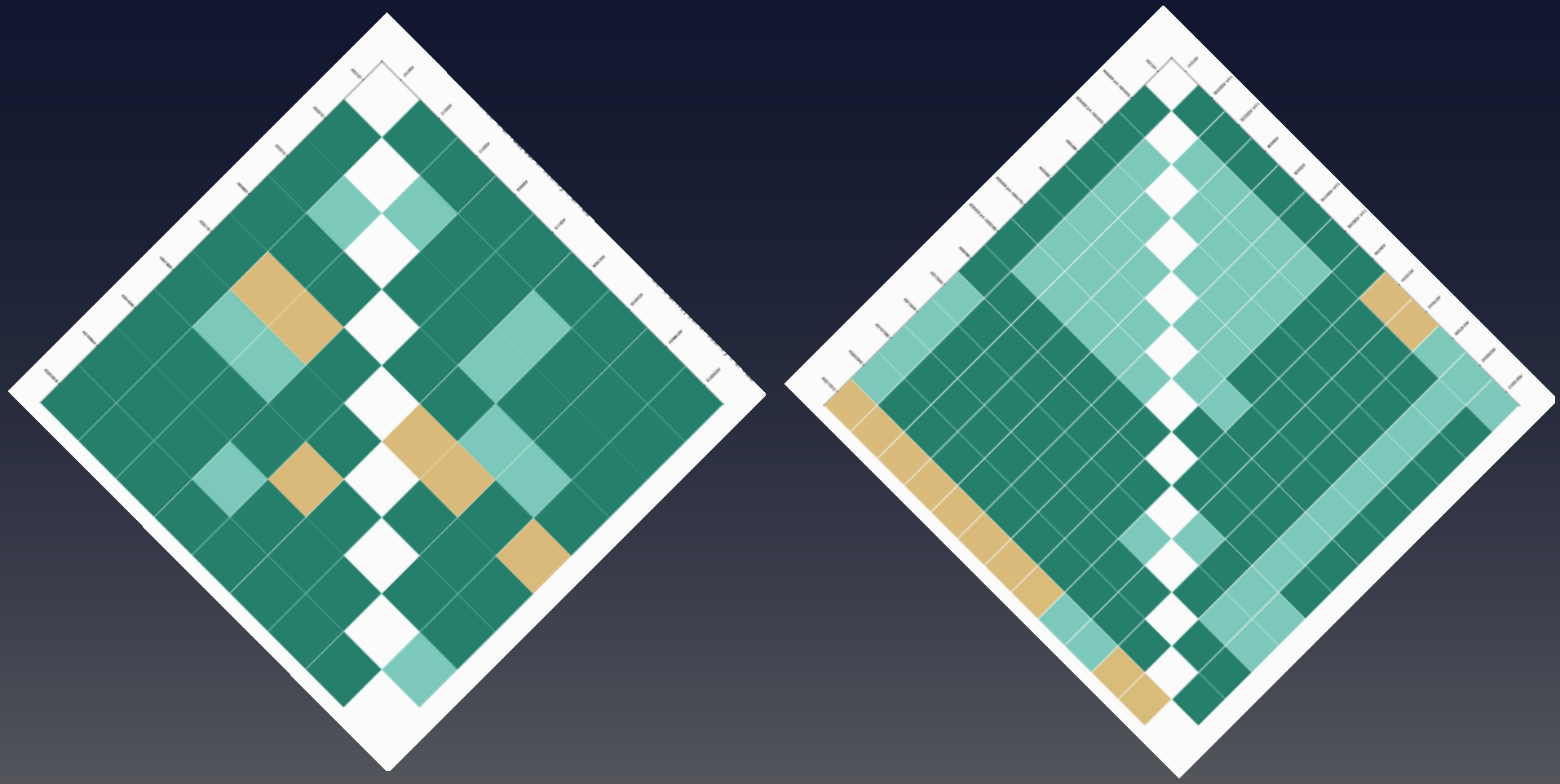




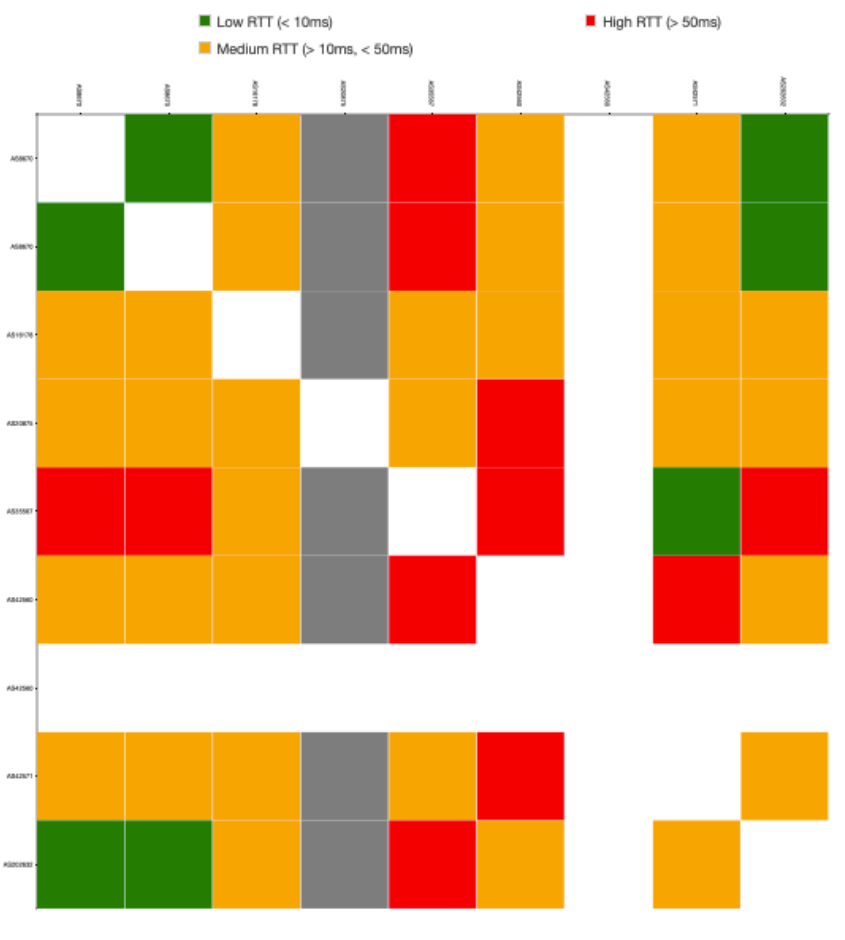




IPv6 Mesh: Greece and Slovenia



RTT (latency) mesh: Bosnia and Herzegovina

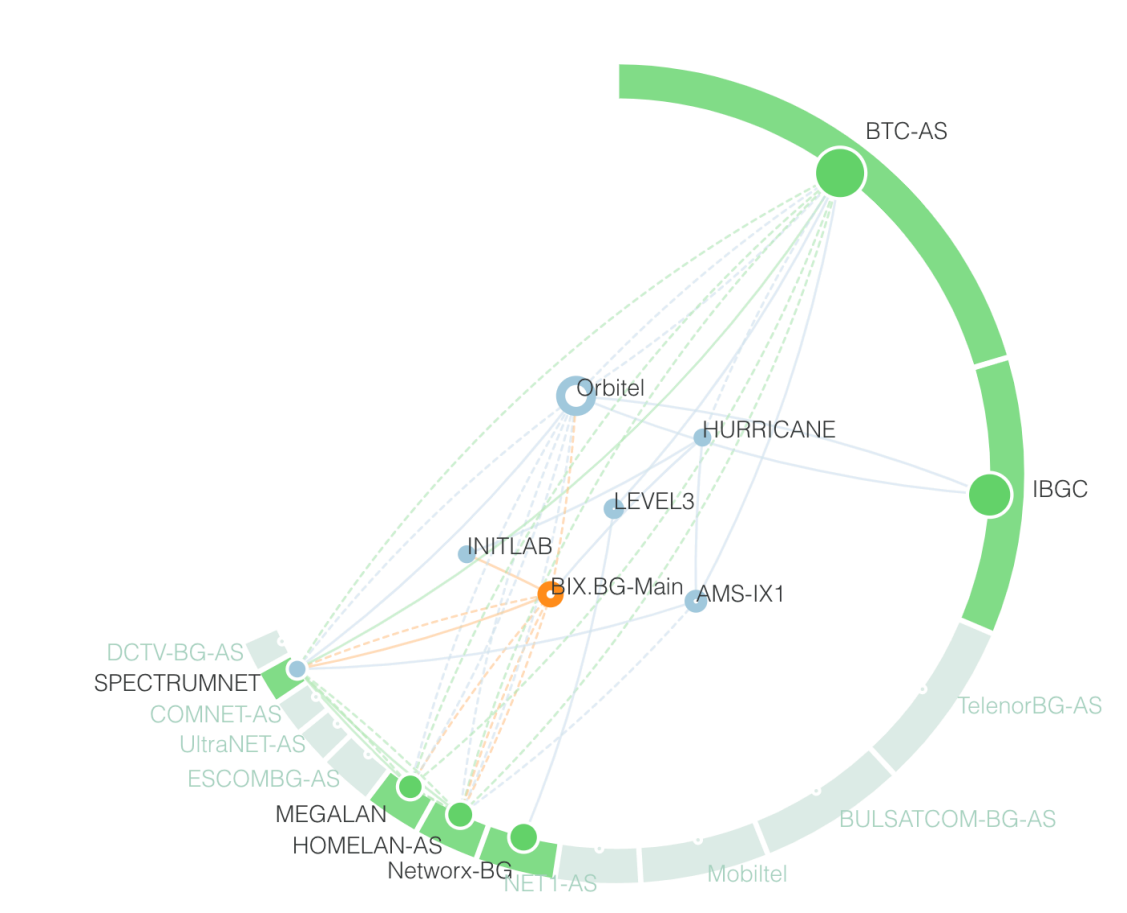


User-to-User Fabric of a Country

“User to User Fabric” Data Sources

- RIPE Atlas
- Datasets from RIPEstat
- AS-to-ORG datasets from CAIDA
- Dataset from APNIC that estimates the percentage of end-users in each network
- https://labs.ripe.net/Members/emileaben/sketching-connectivity-between-users

Bulgaria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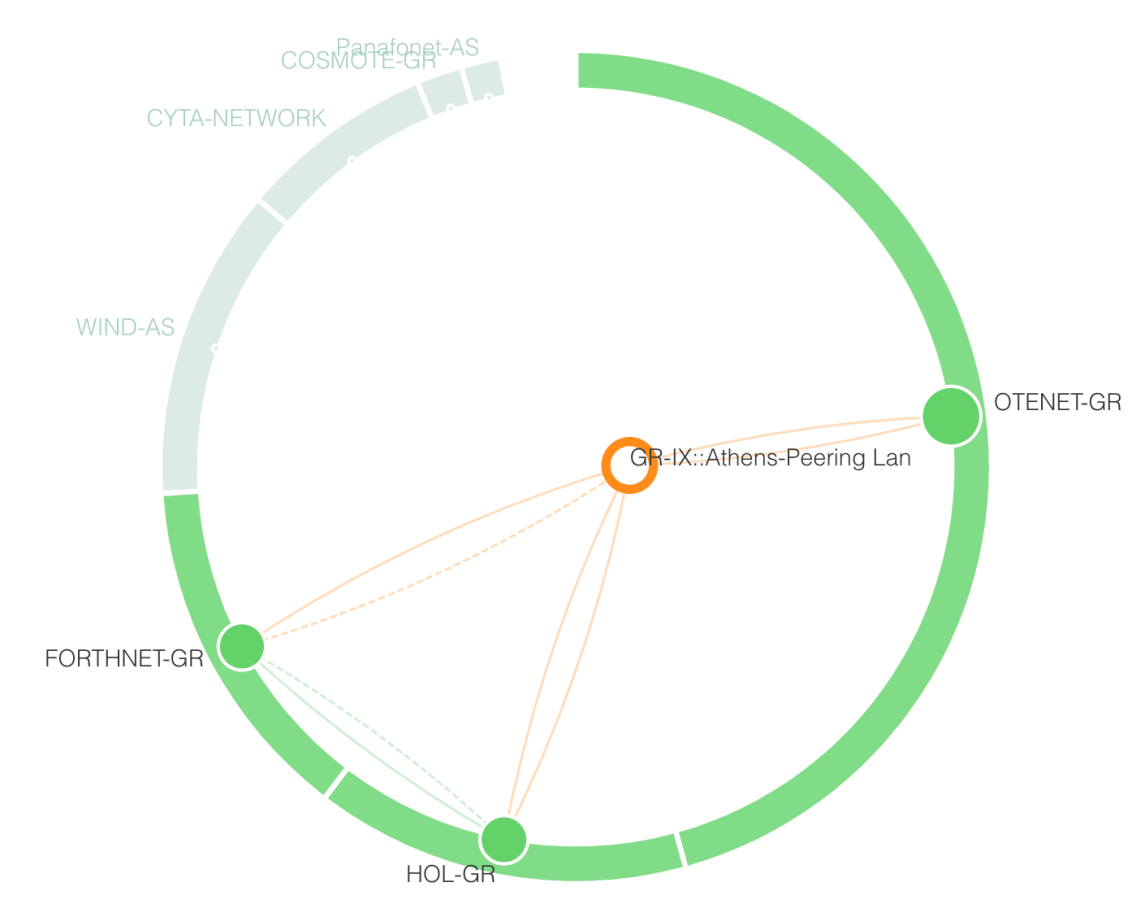
Greece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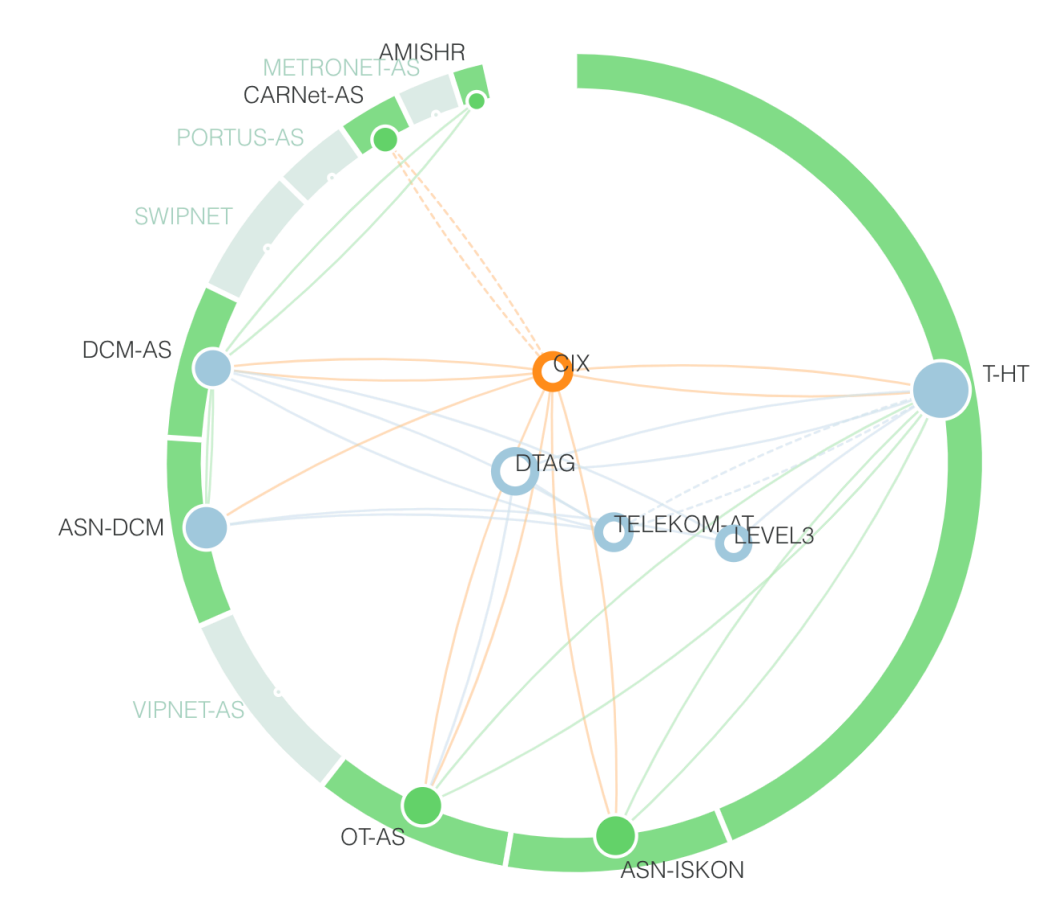
Croatia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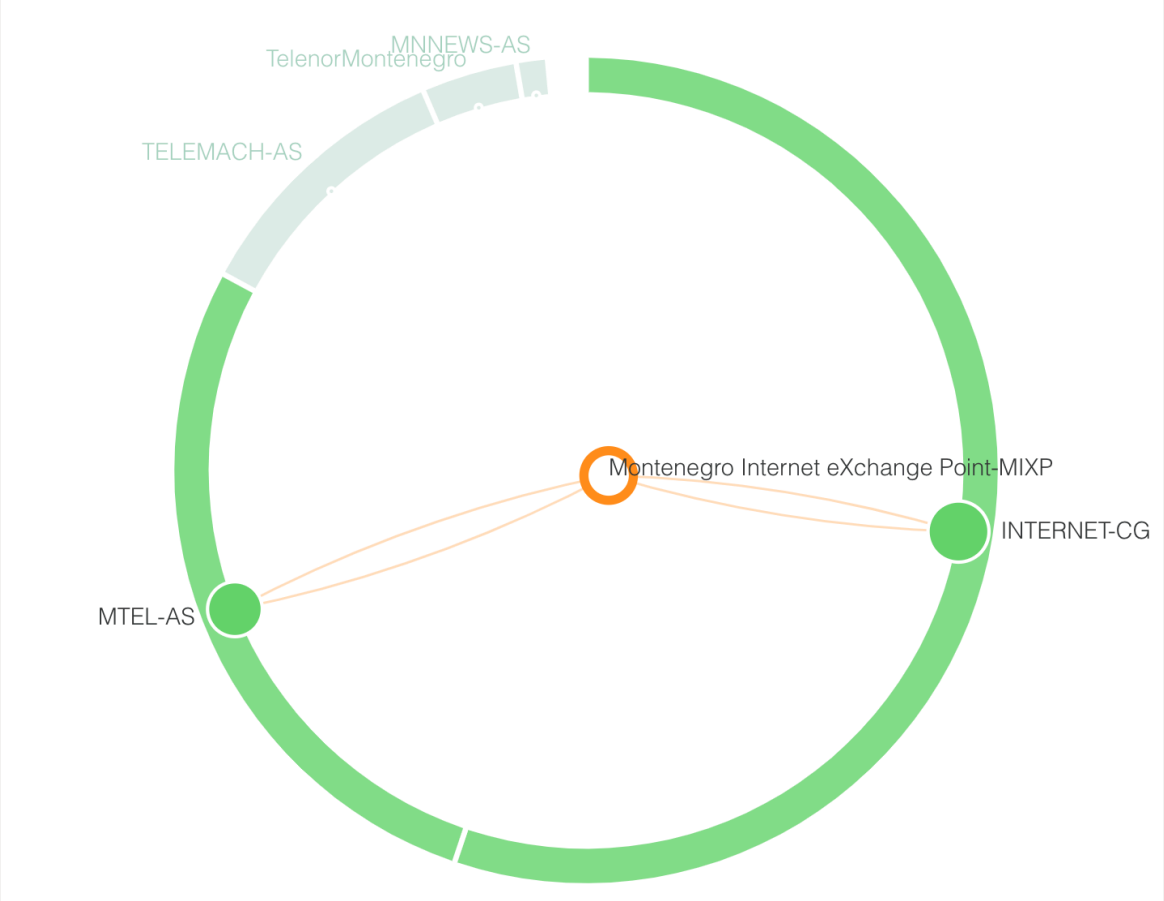
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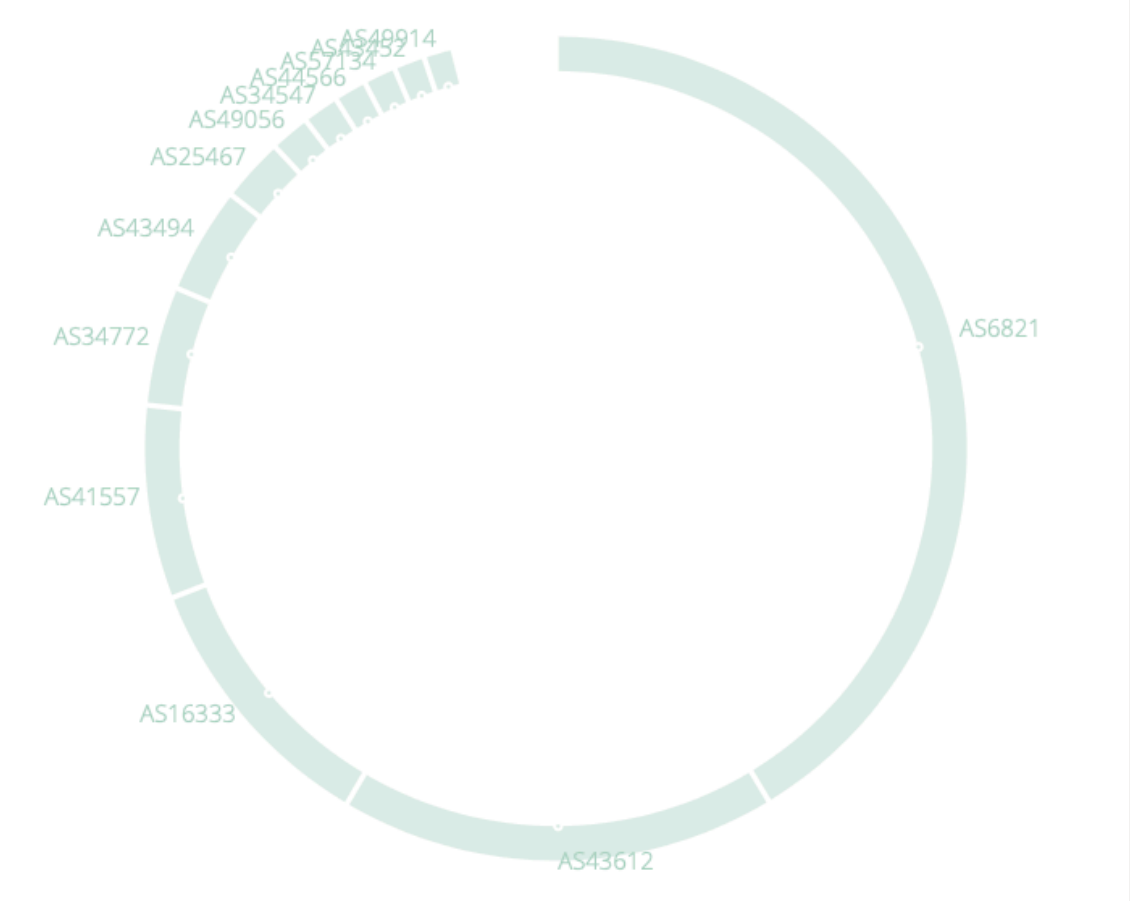
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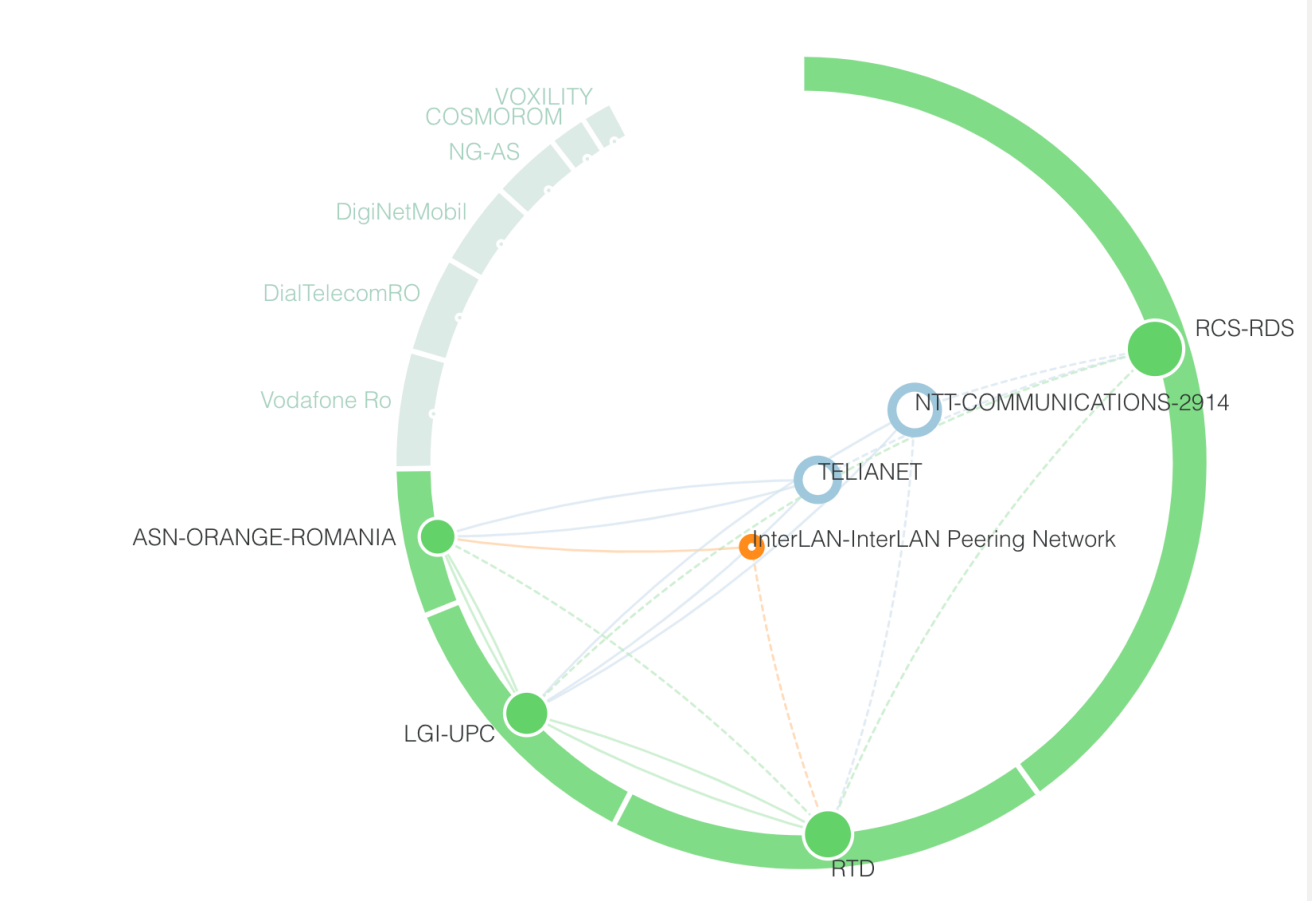
Romania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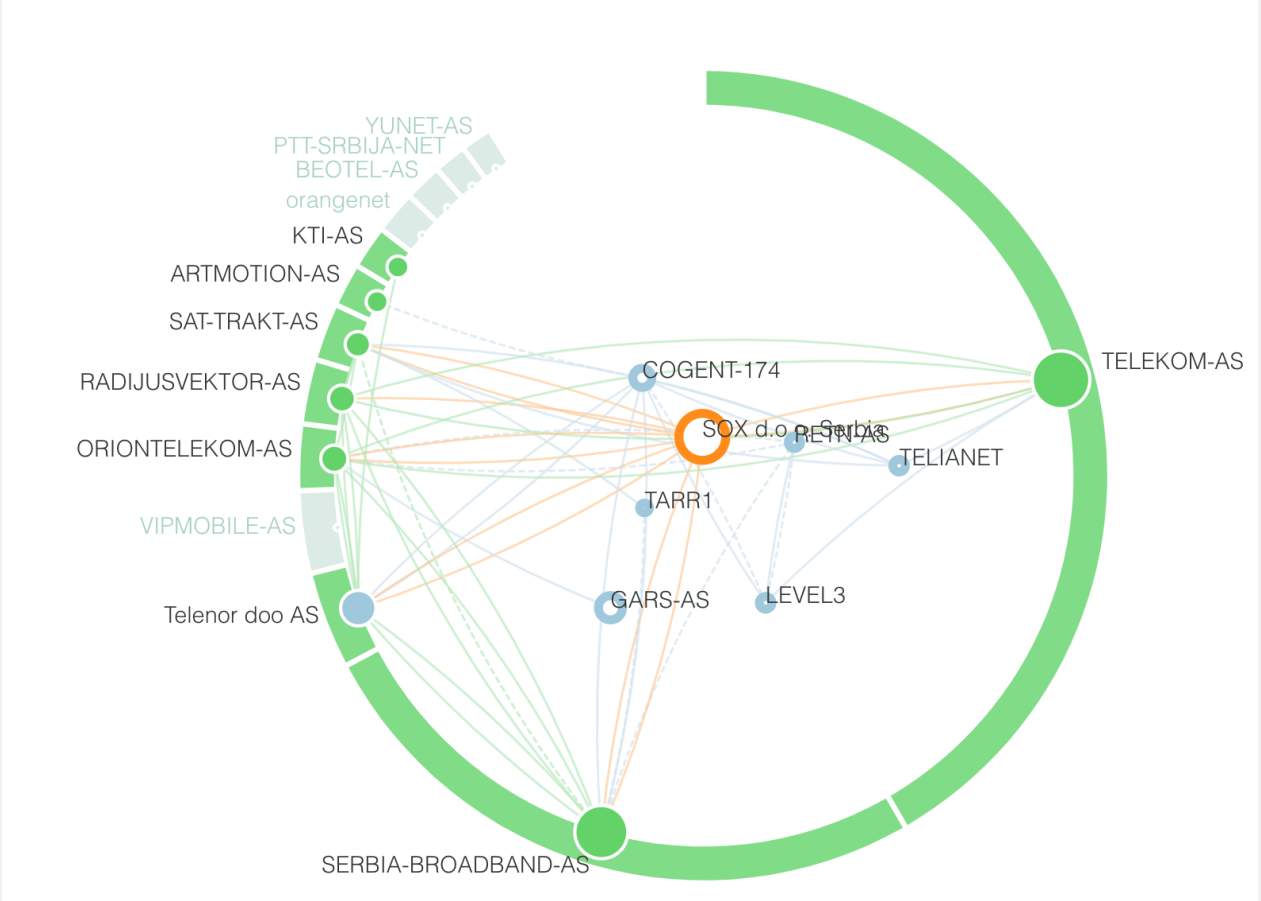
InterLAN-InterLAN Peering Network
LGI-UPC
RTD

Serbia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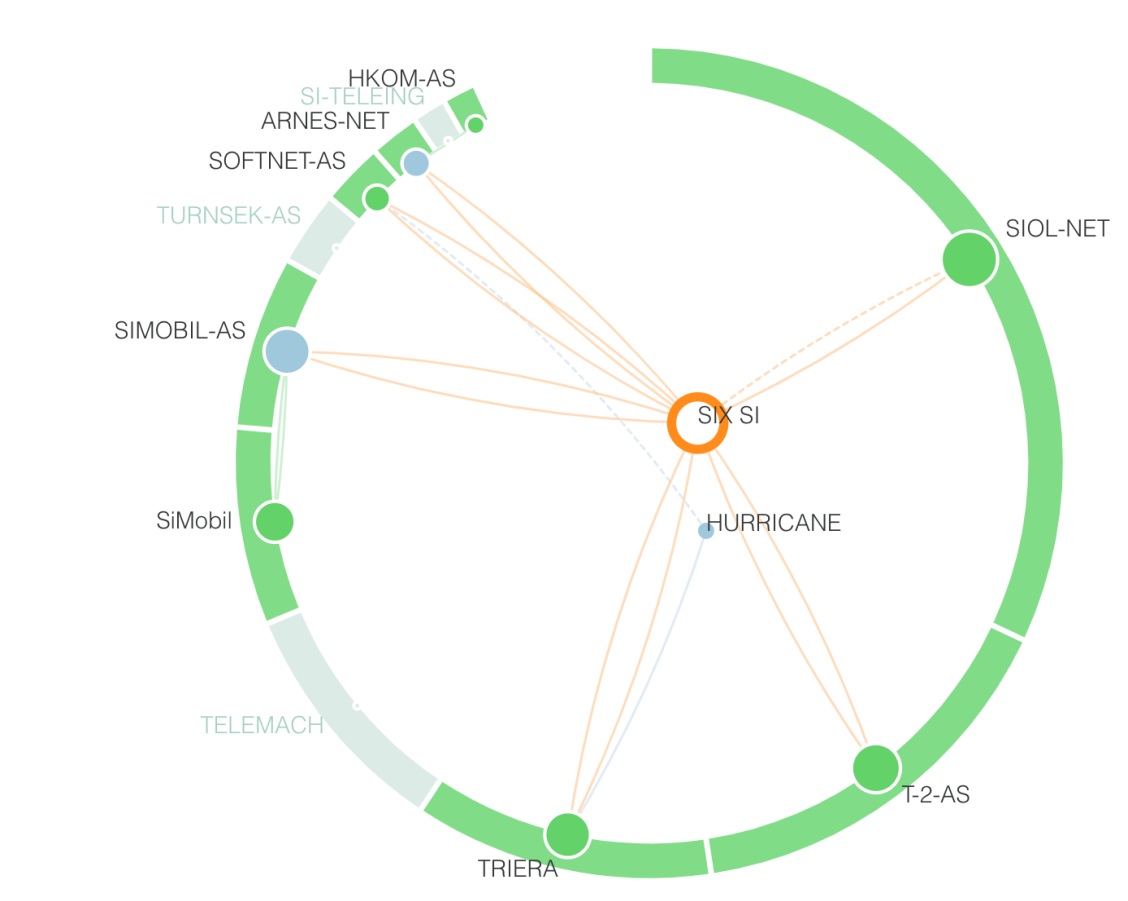
TARR1
GARS-AS
LEVEL3
TELEKOM-AS

Slovenia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