RIPE NCC
RIPE NETWORK COORDINATION CENTER

Connectivity in Baltic Countries

RIPE RIS and RIPE Atlas perspective

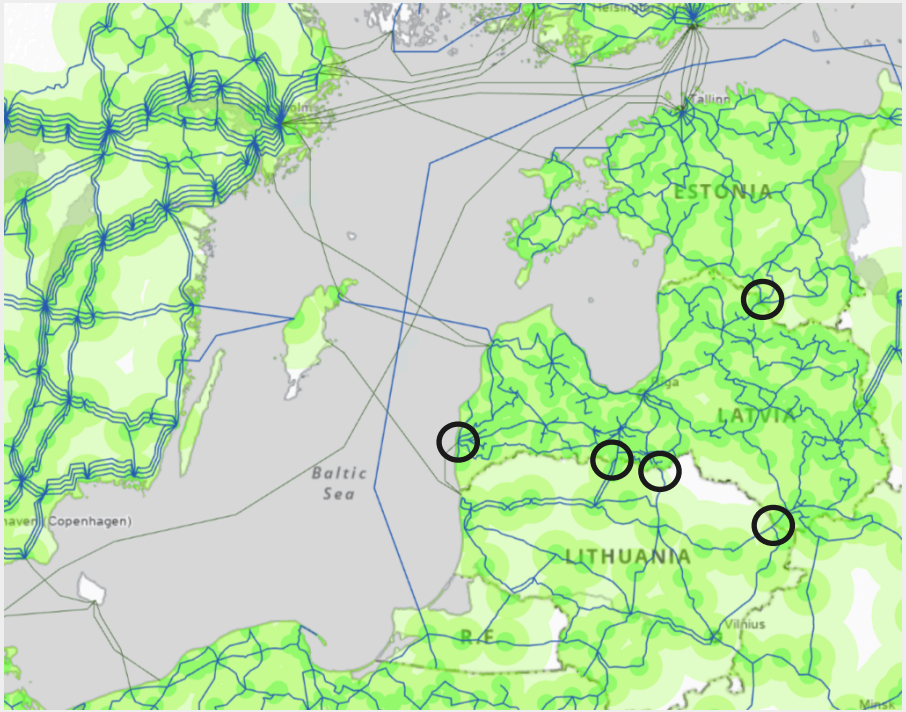
Alex Semenyaka | April 2026 | SEE 14

Overview of the Baltic Region

Cable maps in the region

ITU data

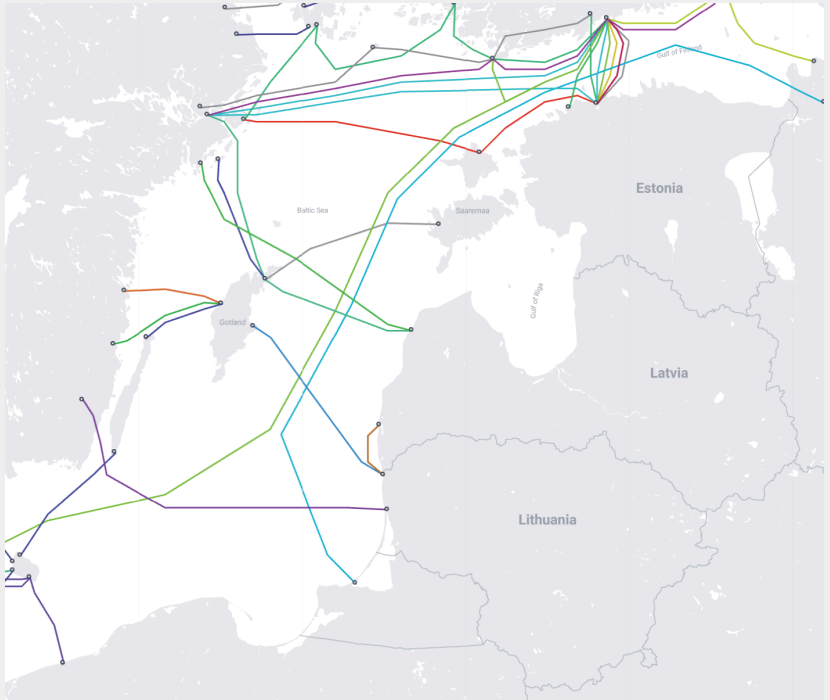
- The density of fiber-optic cable coverage in the Baltic states is on par with that of other Northern European countries
- Interconnectivity is quite limited
  - Just five border crossings: one EE-LV, four LV-LT
- (attn, ITU data are known to be potentially incomplete)



Cable maps in the region

Submarine cables, TeleGeography data

- Data from TeleGeography shows that the Baltic states have well-developed undersea connections with other countries in Northern Europe
- There are almost no undersea cables between the Baltic states
  - One short LV-LT
- The region *should not* be too vulnerable to undersea infrastructure failures



BGP Control Plane

- The number of players with external connections in each country in the region is enormous
- We are forced to filter the data, showing only the largest players in the charts
- Upstreams are most often large operators, and the ASN geotag only indicates the country where the autonomous system is registered
- In any case, this is just the “first hop out”
  - From here on, things can get pretty complicated

RIS Results for the region

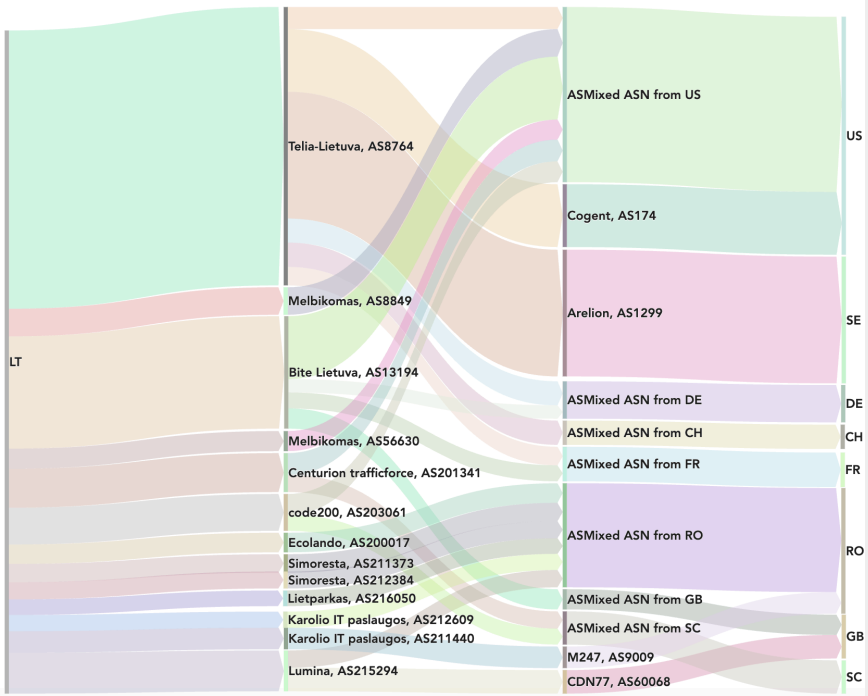
Visualisation principles

- **The complete graphs contain a way too many nodes and paths**

- **Paths with low weight were not considered**
  - **Maximum weight: 324,722 (Telia-Lietuva)**
  - **Cutoff at 15,000**
  - **Upstreams with weights between 15,000 and 25,000 are grouped into “Mixed from <CC>” nodes**

Lithuania connectivity: RIS perspective

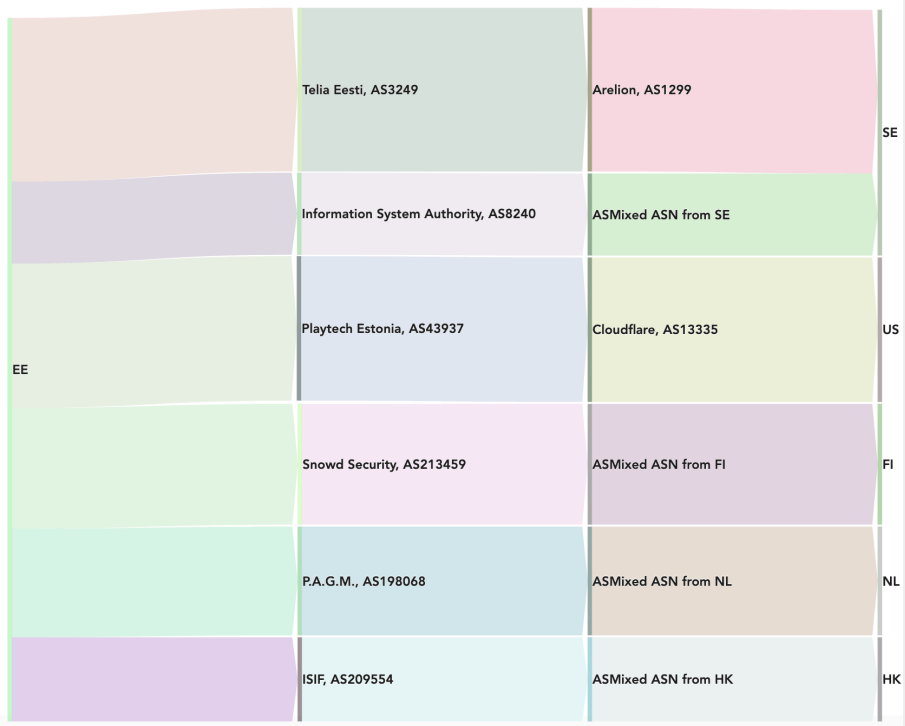
Long-shot



- **Lithuania has the highest degree of diversification in its external connections**
- **The weight of the uplinks is distributed evenly and decreases quite gradually**
- **There are no uplinks from Latvia or Estonia**

Estonia connectivity: RIS perspective

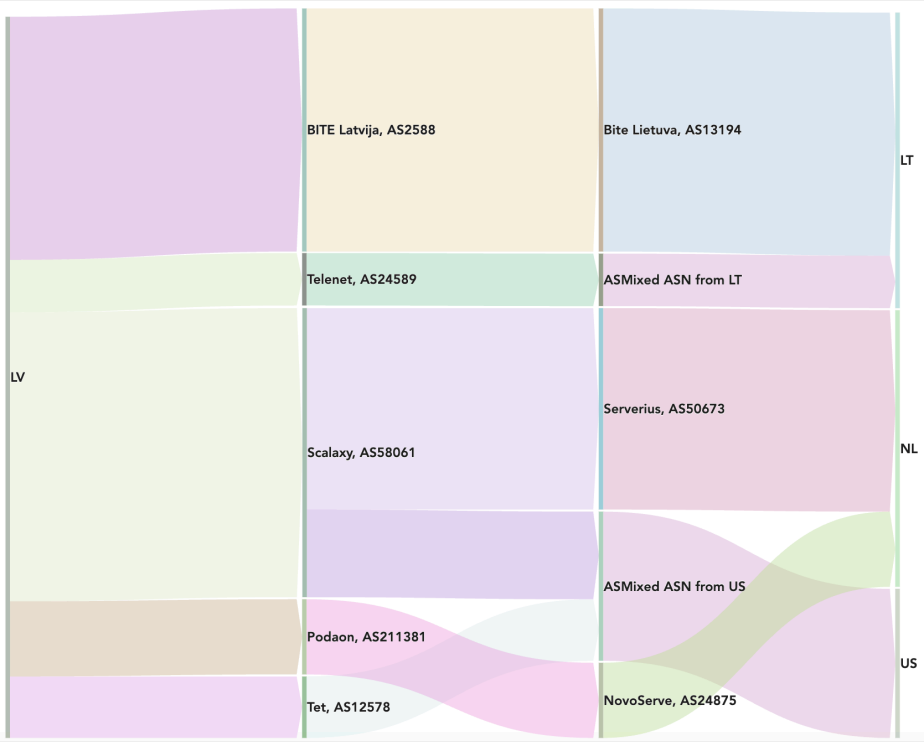
Long-shot



- Less diversification
- The weights of the upstreams are fairly similar
- There are no upstreams from Latvia or Lithuania

Latvia connectivity: RIS perspective

Long-shot



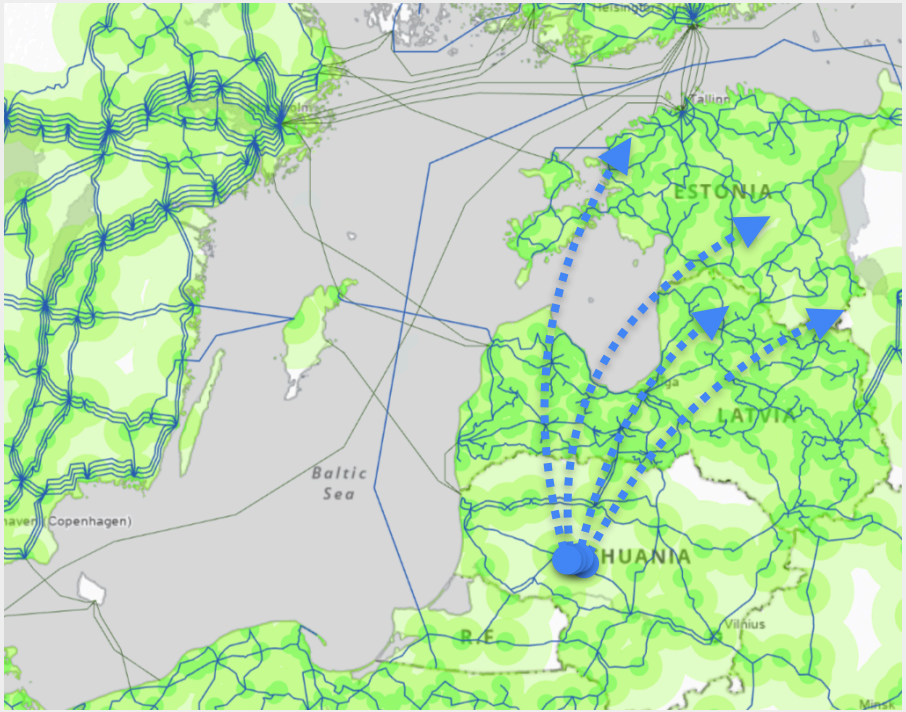
- **Diversification at the Estonian level**
- **The sizes of upstream providers vary significantly**
- **One of the main upstream providers is a Lithuanian operator**
  - **Bite Group**

Methodology

RIPE Atlas

IP addresses + geo data

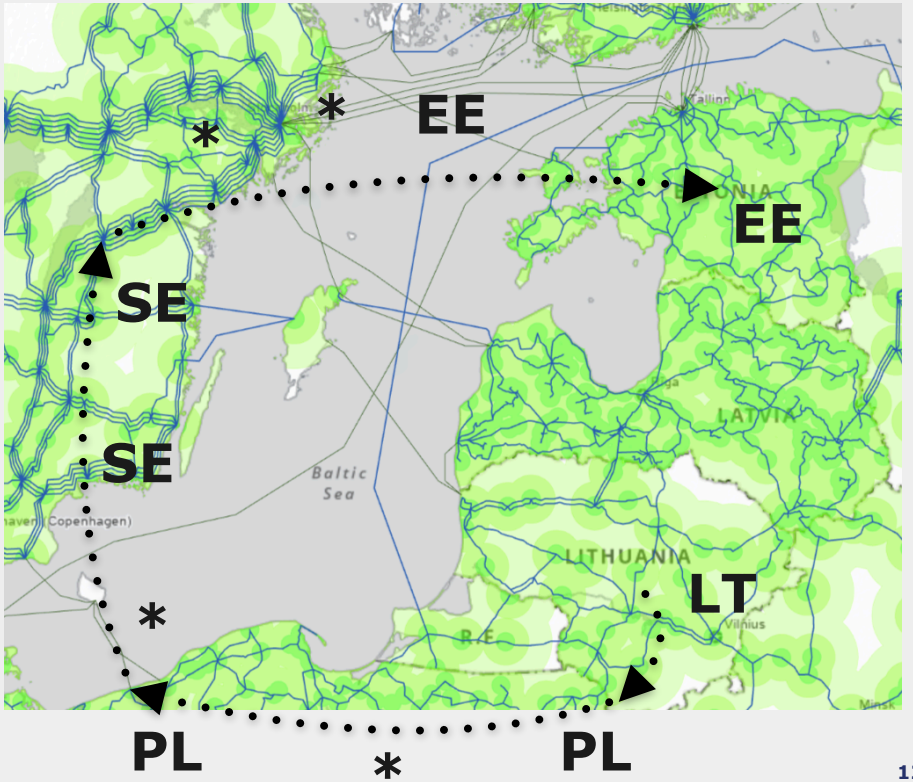
- We use the fact that RIPE Atlas probes are geolocated
- We run traceroutes from each probe in a country to all probes in the other two countries
- For all intermediate nodes, we determine the country where they are located
  - Manual analysis
  - “Asterisks” and private networks are converted to “??"



Getting results

Scrubbing and summarizing

- The results are analyzed for consistency
  - Results from questionable probes are removed
- Sequences of the same country are collapsed
  - The asterisk between two identical countries is removed: PL-*-PL ➤ PL
- The resulting country sequences are compiled into Sankey diagrams



RTT Analysis

Traceroute is also like ping on steroids

- When the traceroute reaches its destination, we have the round-trip time (RTT)
- We can collect this data and check if it meets usual rules of thumb

<20 ms	high quality
<50 ms	good quality
<100 ms	acceptable quality
100-200 ms	quality degradation is noticeable to all users
200+ ms	low quality

Relative RTT Analysis

With the speed of light

- Signal propagation in optical fiber occurs at a finite speed
- Given that the speed of light in glass is one-third slower than in a vacuum, every 100 kilometers of cable adds 1 ms to the RTT
- The ratio

$$rRTT = 100 * RTT/distance$$

indicates how many times worse the actual route is compared to an ideal one

Biases

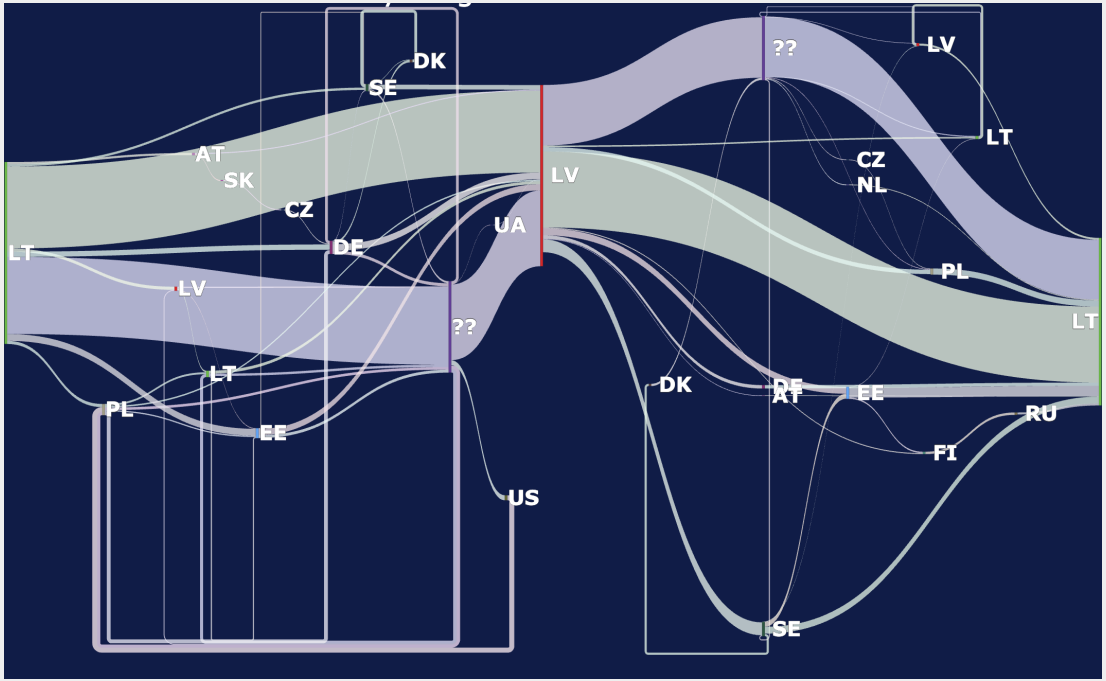
- L1/L2 topology is still hidden
- Not every prefix or even ASN has an Atlas probe installed
- Amount of potential paths is not always correlated with the amount of traffic
- Some hops cannot be geolocated (asterisks, private addresses)
- Routes can change a minute after the measurements are done

Latvia-Lithuania

Lithuania-Latvia-Lithuania: all routes

A web of routes

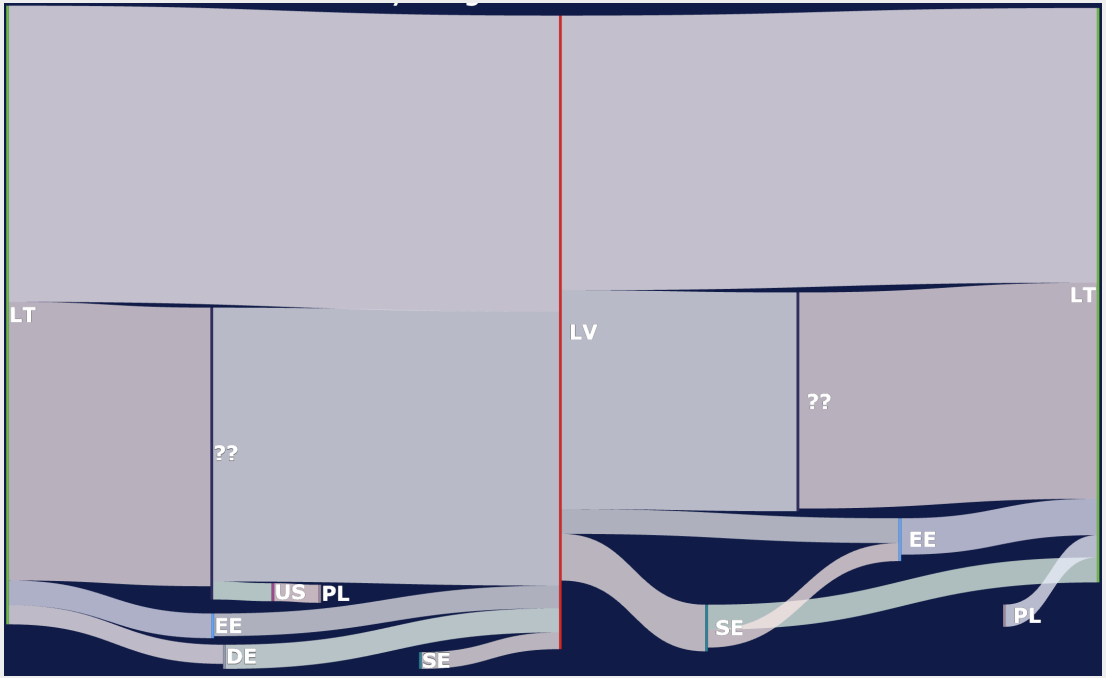
- There are small but alarming paths
- There are paths that go through Russia
- There are paths that go through Ukraine
  - Welcome, but we are a country at war
- There are many paths through Central Europe



Lithuania-Latvia-Lithuania: main routes

Steady flows

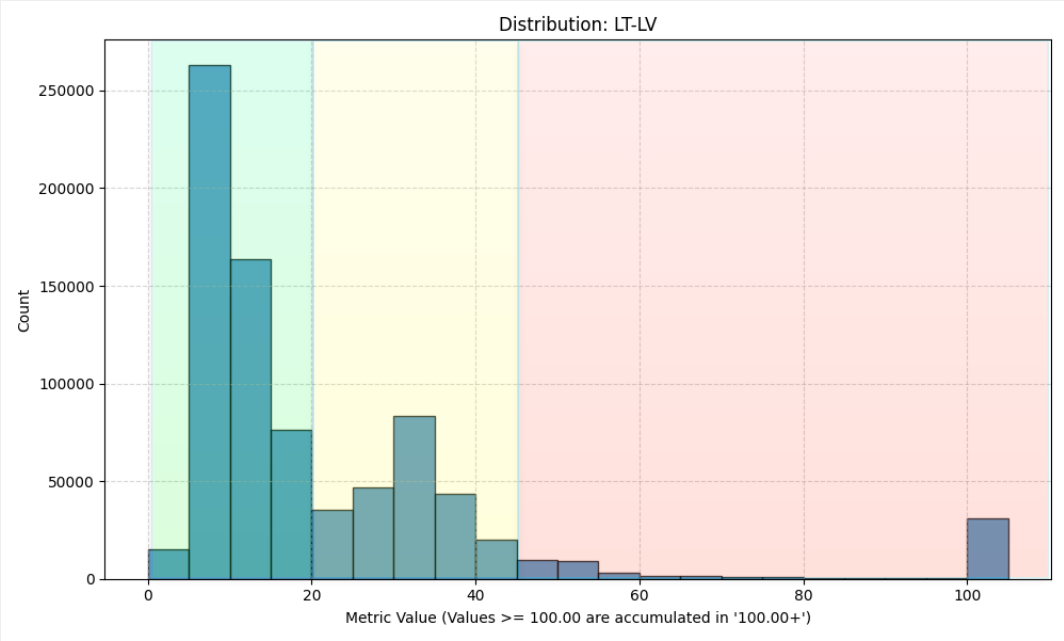
- Most of the paths are direct
- Most likely, the asterisks in the traceroute results are also mostly direct paths
- USA = Starlink
  - However, it is unclear why an American ground station would be used



Latvia-Lithuania: RTT

Not that bad

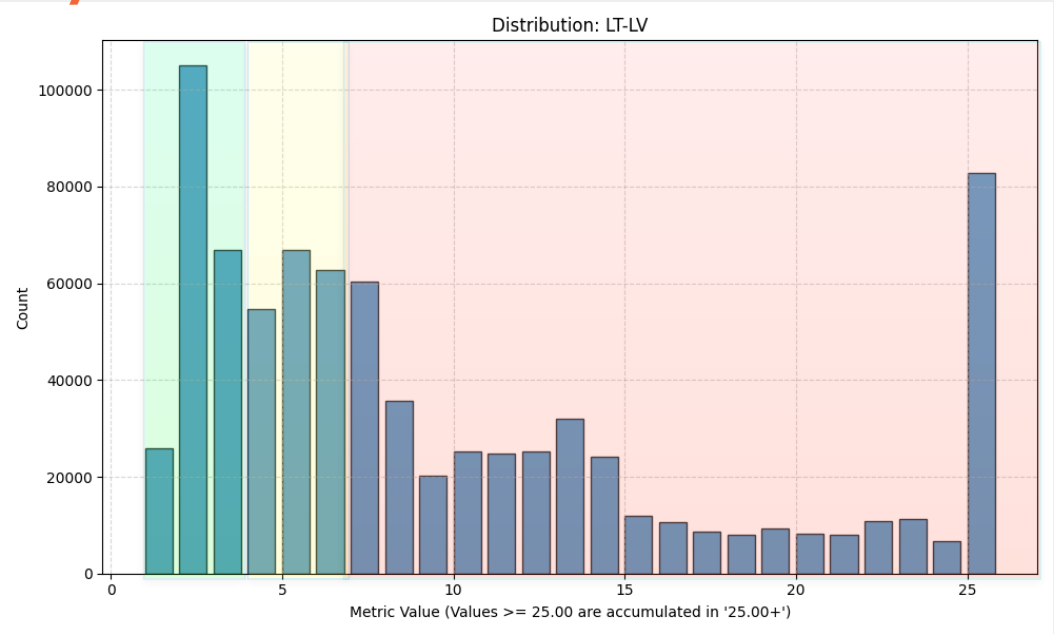
- Most of the RTT is in the green zone
- But the 20+ ms I mentioned, due to travel to Central Europe, are clearly visible



Latvia-Lithuania: rRTT

One doesn't look for the easy way out

- **Most of the traffic flows along routes that are an order of magnitude longer than the ideal length**
- **For short distances within the region, this may not be a serious issue**
  - **But this fact does deserve some attention**

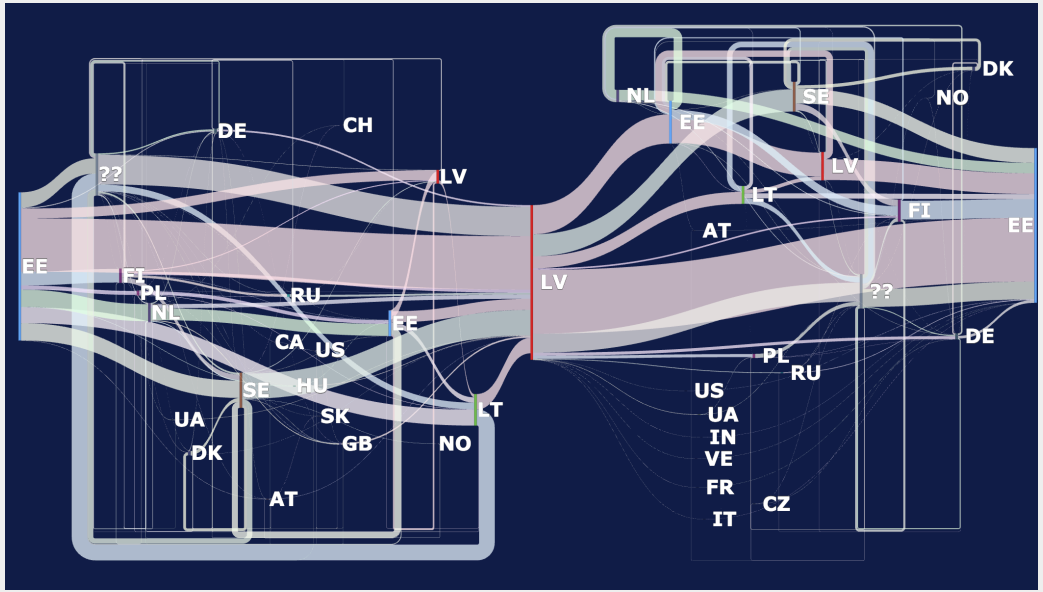


Latvia-Estonia

Estonia-Latvia-Estonia: all routes

Quite a messy web

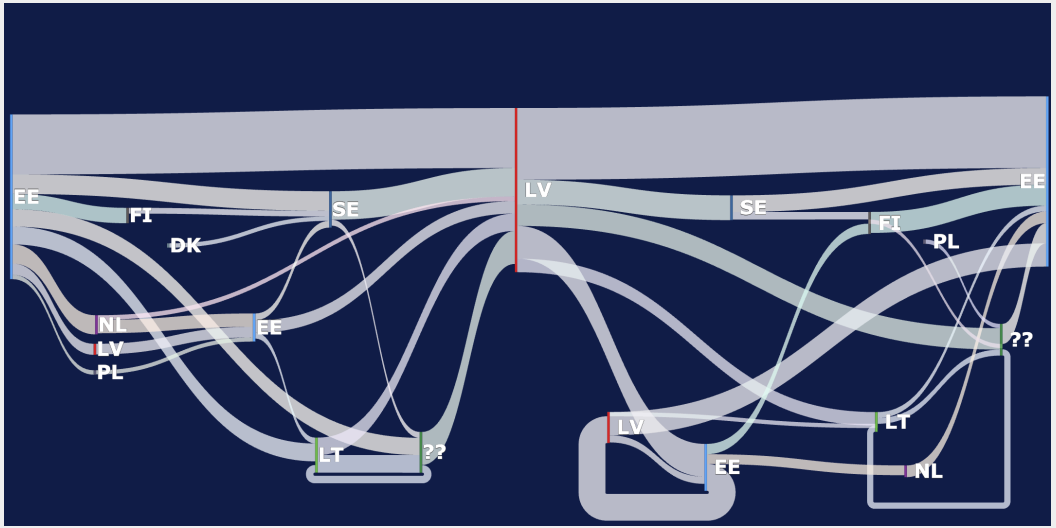
- Abnormally high levels of traffic tromboning
- Even more alarming paths
  - Russia's participation here is already quite noticeable
  - There are some truly abnormal paths through Venezuela or India



Estonia-Latvia-Estonia: main routes

Traveling abroad

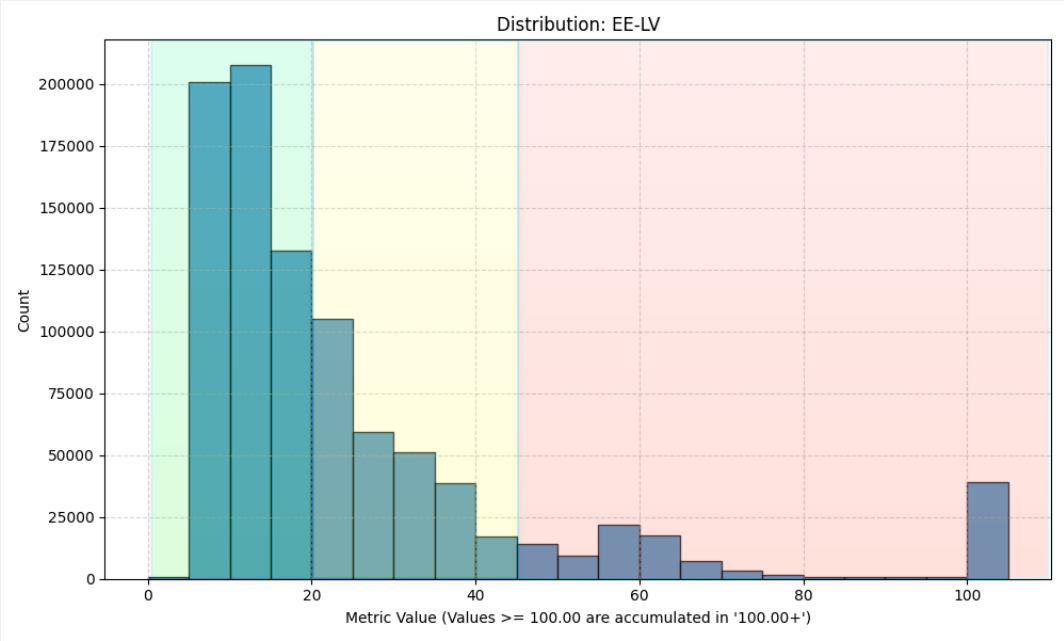
- Traffic from Sweden is most likely routed via undersea cables
- Tromboning through Lithuania, Poland, or the Netherlands is too noticeable



Latvia-Estonia: RTT

More consistent, but not that better

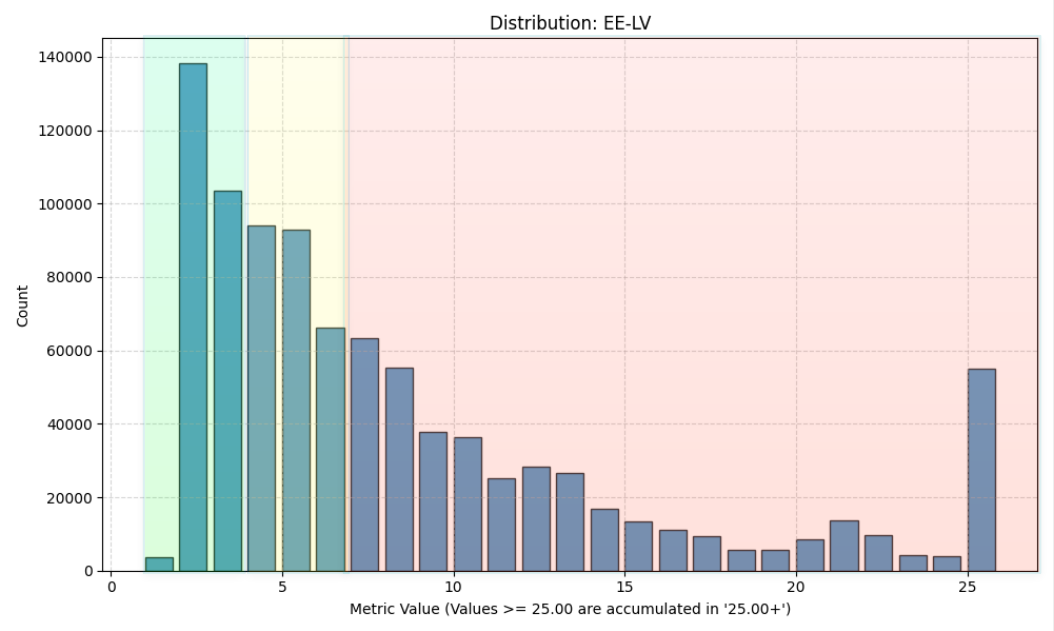
- Most of the RTT is in the green zone
- Less Central European gravitation
- However, a noticeable amount of pathological RTTs (>100 ms)
  - Expectable from paths seen



Latvia-Estonia: rRTT

Shortcuts aren't for us

- **Still most of the traffic flows along routes that are an order of magnitude longer than the ideal length**
- **An even higher peak in pathological rRTT**

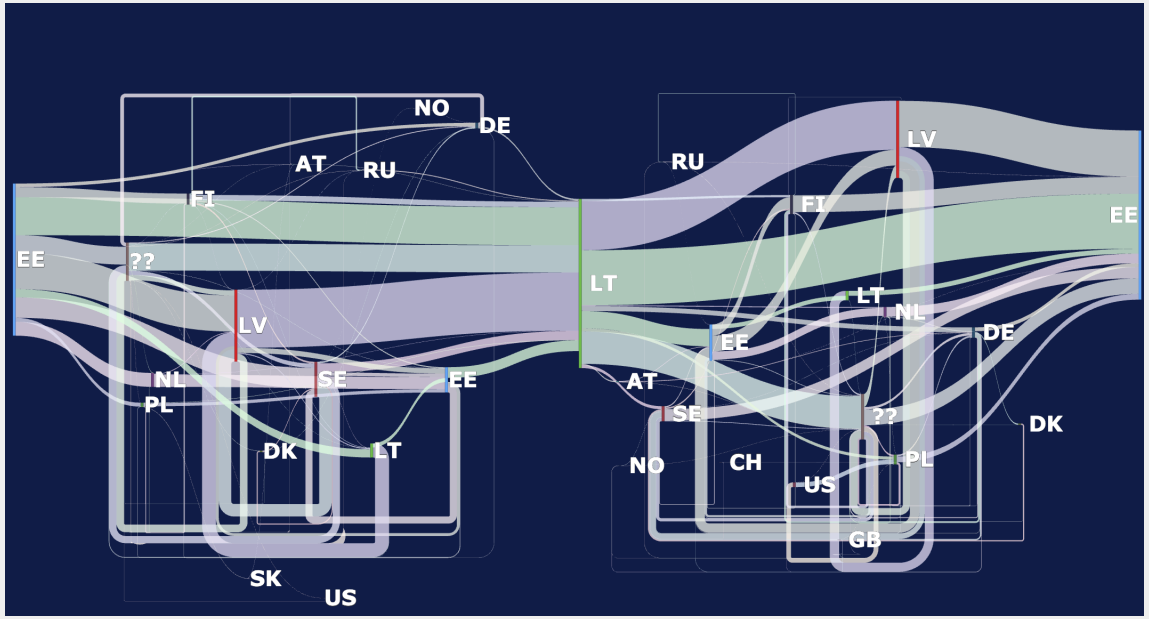


Estonia-Lithuania

Estonia-Lithuania-Estonia: all routes

And even more messy

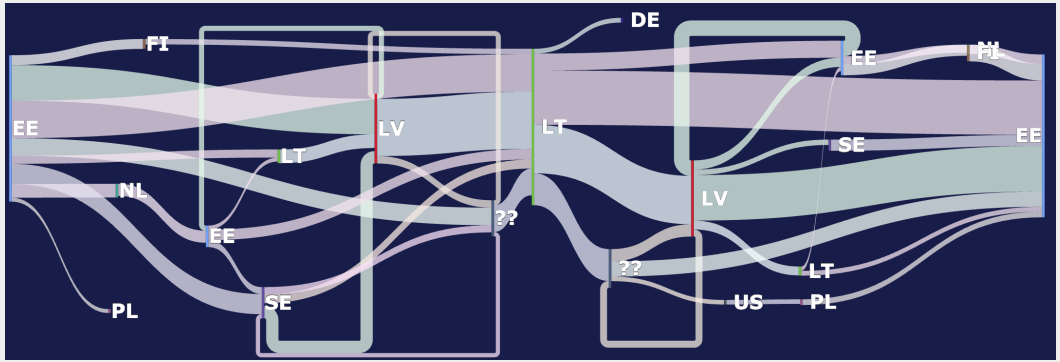
- It’s no surprise that the situation is complicated, since Lithuania and Estonia do not share a border



Estonia-Lithuania-Estonia: main routes

The Garden of Forking Paths

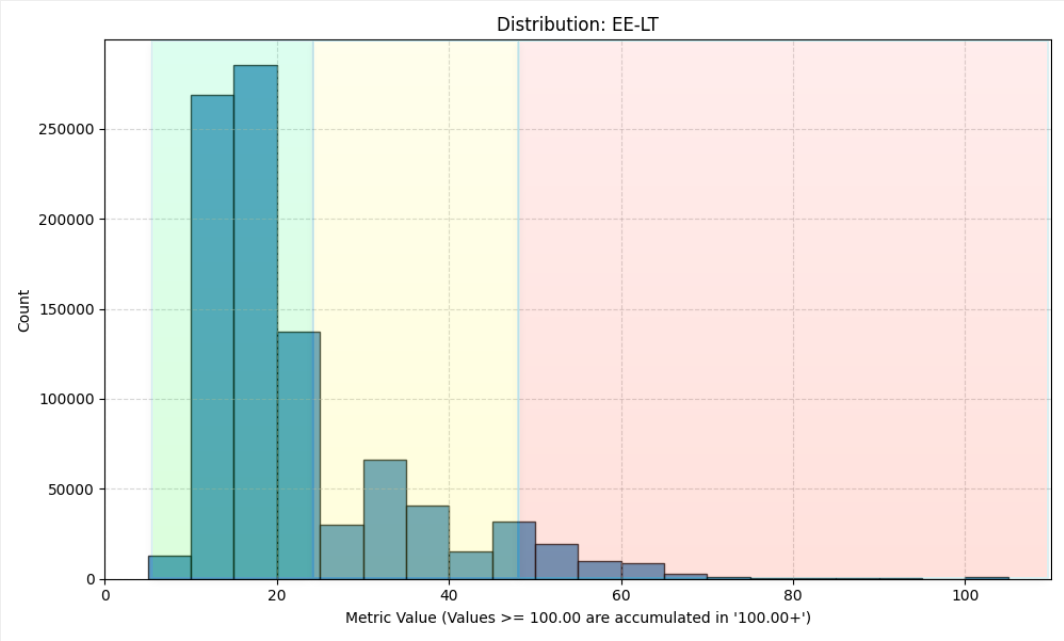
- One might expect the bulk of the traffic to be EE-LT or EE-LV-LT
  - Not the case
- Even after filtering out minor routes, the diversity is enormous
  - Diversifying by cable and operator is an excellent approach
  - Diversifying by transit countries within the region isn't so great



Lithuania-Estonia: RTT

Steady flows

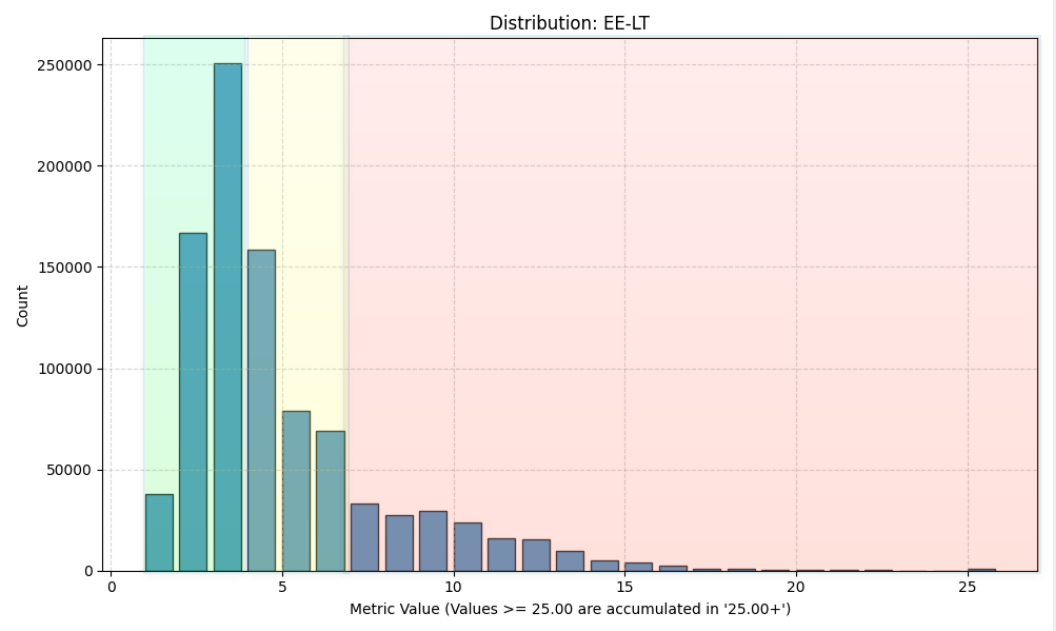
- It may come as a surprise, but the RTT distribution looks best here
- There are very few pathological RTTs



Lithuania-Estonia: rRTT

Steady flows

- **Relative RTT shows a similar situation**
- **Although “cable optimality” is still rather mediocre**



Digging deeper

USA and Canada in the path

Starlink

- There are almost no land routes through other continents
  - Two rare exception: traffic flows thought India and though Venezuela
- Routes through the U.S. (and sometimes onward through Canada) rely on Starlink
- Starlink appears in Atlas measurements as an access-side phenomenon rather than as a visible upstream for regional operators.
  - I.e., in individual use only

Russia in the path

Large players' games

- There are paths with routers in the Russia between every two countries, in both directions.

- AS1299, Arelion (EE ➤ FI ➤ RU and RU ➤ EE)
  - ➤ AS207083, HOSTSLIM
- AS8764, Telia Lietuva (LT ➤ RU)
- AS6939, Hurricane Electric (LV ➤ RU and RU ➤ EE)
- AS9002, RETN (RU ➤ LV)
  - ➤ AS12993, Delska DC
  - ➤ AS199103, Maklaut
  - ➤ AS39900, GOOD

Observations and Conclusions

Observation one

Typical but still not proper

- **Local traffic is often handled by global players**
- **Global players are never interested in localizing traffic: they are interested in optimizing its throughput**
  - **Traffic may pass non-transparently through unexpected geographic regions (like Russia)**
  - **The situation is better than in the South Caucasus or Central Asia, but it is still fairly far from optimal**

Observation two

Money rules

- The high latency in Germany and the Netherlands makes sense from a commercial standpoint
- However, for intra-regional traffic, it adds 20 ms out of nowhere
- This kind of tromboning makes the infrastructure:
  - more fragile
  - more vulnerable due to the increased attack surface

Observation three

Once a friend, forever a friend

- The close partnership with the countries of Northern Europe (Finland, Sweden, Denmark, Norway) is clearly evident
- This is entirely justified and sensible when it comes to outbound traffic
- For intra-regional traffic, this can be risky, because a significant portion of it travels via highly vulnerable undersea cables

Observation four

Asymmetry is the rhythmic expression of functional design

- **Cross-border interactions are largely asymmetrical**
  - This is typical of the modern Internet
  - But it can be corrected in a natural way through traffic localization
- **Latvia could serve as a natural regional hub**
  - But in reality, it has not yet become one

Conclusions

- **Internet connectivity within the region is well developed**
  - **Much has been accomplished at a high level**
- **And this is quite sufficient for normal times**
  - **It is resilient to isolated outages**
- **Given the growing risks, additional efforts are needed to localize traffic**
  - **Hybrid hostile actions can be a challenge**
- **Operators pay international transit providers for the degradation of the quality of their interactions with each other**
- **Good latency does not imply locally resilient routing: performance optimisation can hide jurisdictional and dependency risks**

My recommendations

Come together

- **It is necessary to:**
  - **Strengthen the role of local IXPs in the region**
  - **Ensure that critical network infrastructure components have direct peering connections**

- **It makes sense to organize continuous connectivity monitoring (RIPE RIS, RIPE Atlas)**
  - **Including the installation of new RIPE Atlas probes and the establishment of sessions with RIPE RIS where needed**

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Questions? Comments? Applauses?

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