RIPE NCC
RIPE NETWORK COORDINATION CENTRE

RIPE Atlas Measurements: Interconnection in Central Asia

Alex Semenyaka | November 2022 | CAPIF 1

RIPE Atlas

What is RIPE Atlas?

RIPE Atlas is the RIPE NCC's main Internet data collection system. It is a global network of devices, called probes and anchors, that actively measure Internet connectivity. Anyone can access this data via Internet traffic maps, streaming data visualisations, and an API. RIPE Atlas users can also perform customised measurements to gain valuable data about their own networks.

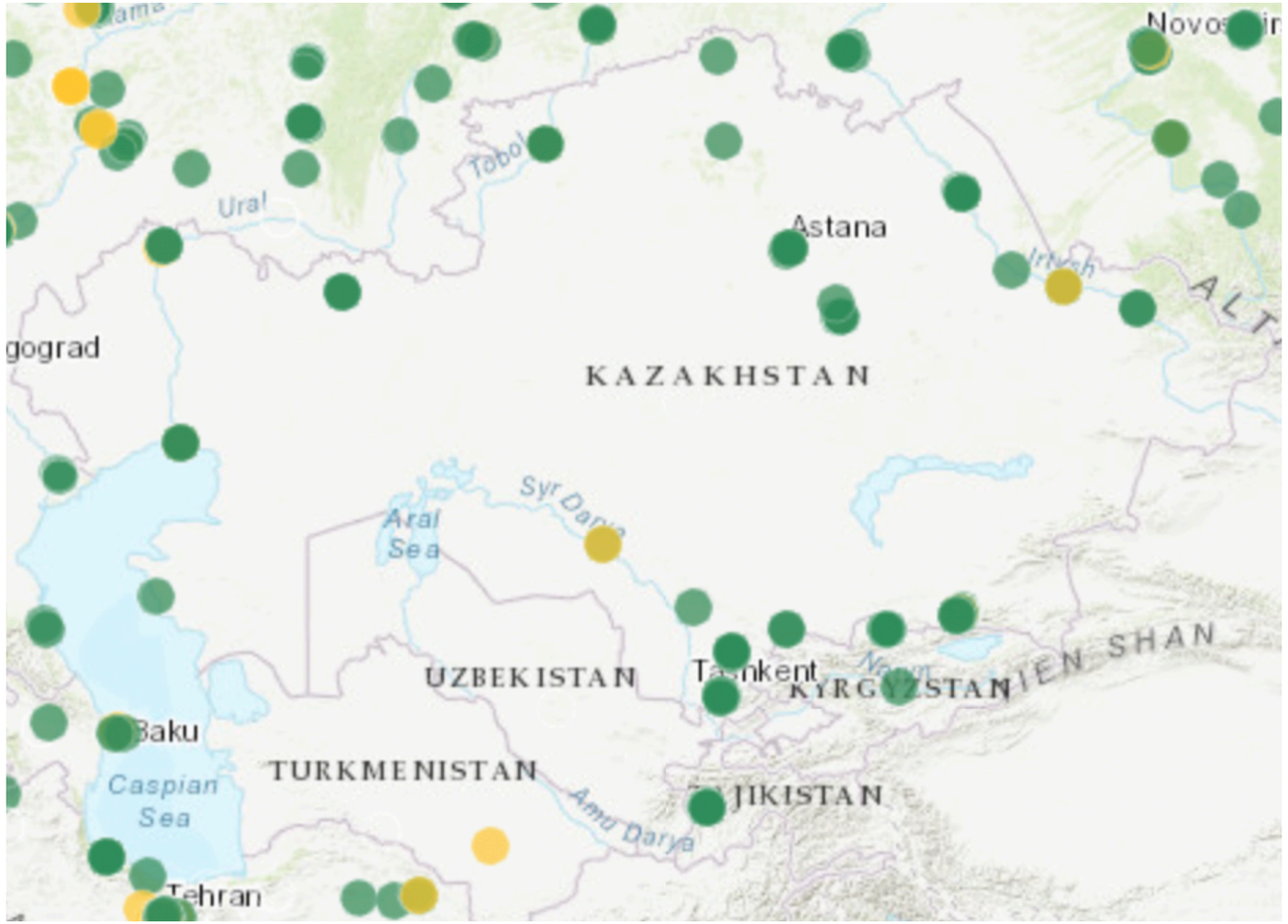
atlas.ripe.net

Traceroute

- Traceroute:
  - Sends packets with increasing time-to-live/hop limit
  - Analyses responses received from intermediate routers
  - Returns their addresses and the time interval between sending the original packet and receiving the response
- RIPE Atlas traceroute
  - One of the basic measurement options in the RIPE Atlas system
  - Has a “Paris” modification
  - Originates UDP, TCP, ICMP packets on choice

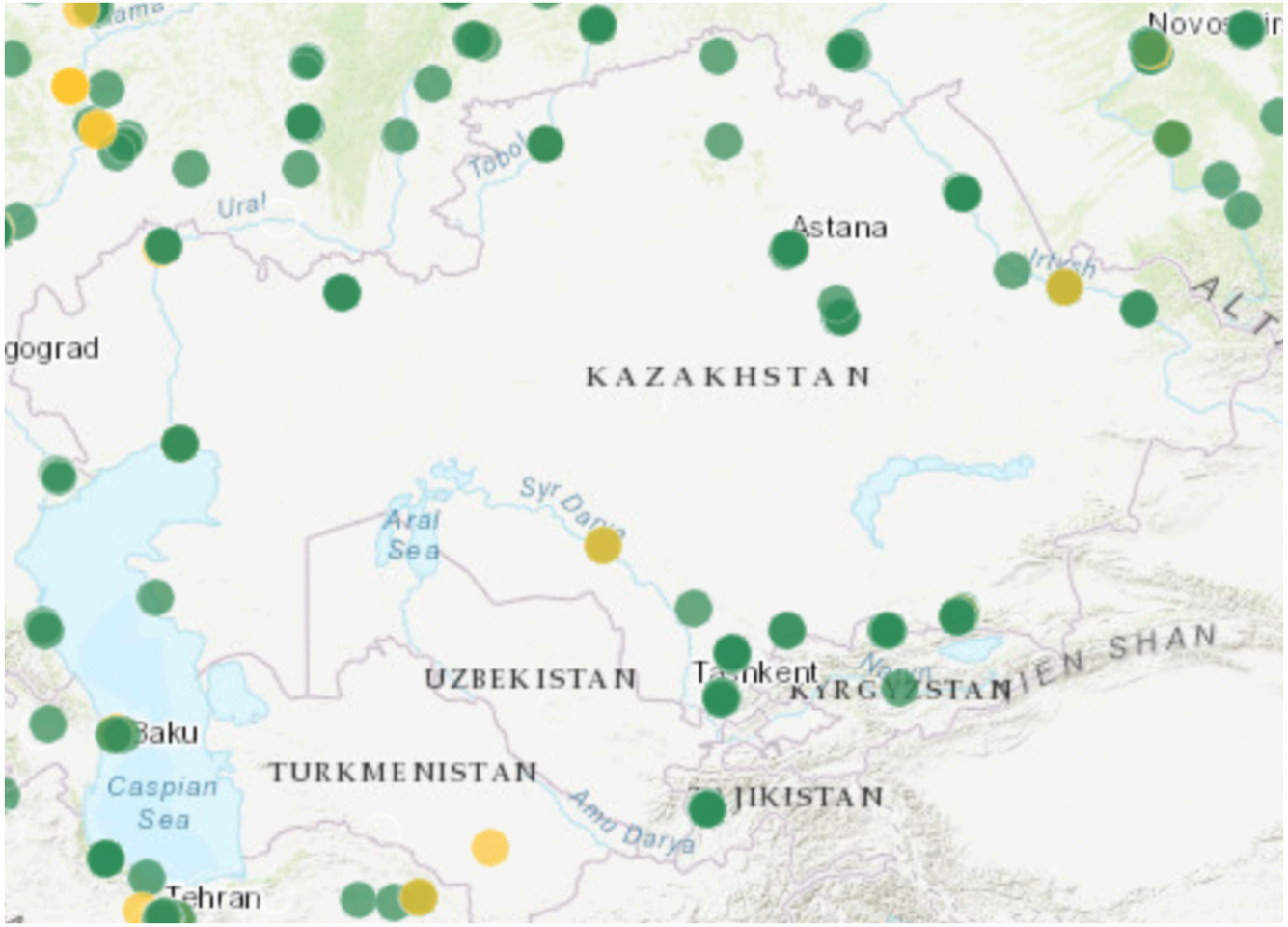
RIPE Atlas probes in Central Asia

- We have probes in four countries
  - Kazakhstan: 63
  - Kyrgyzstan: 6
  - Tajikistan: 9
  - Uzbekistan: 13
- We can augment this set with some hosts from Turkmenistan
  - And get some results for this country too



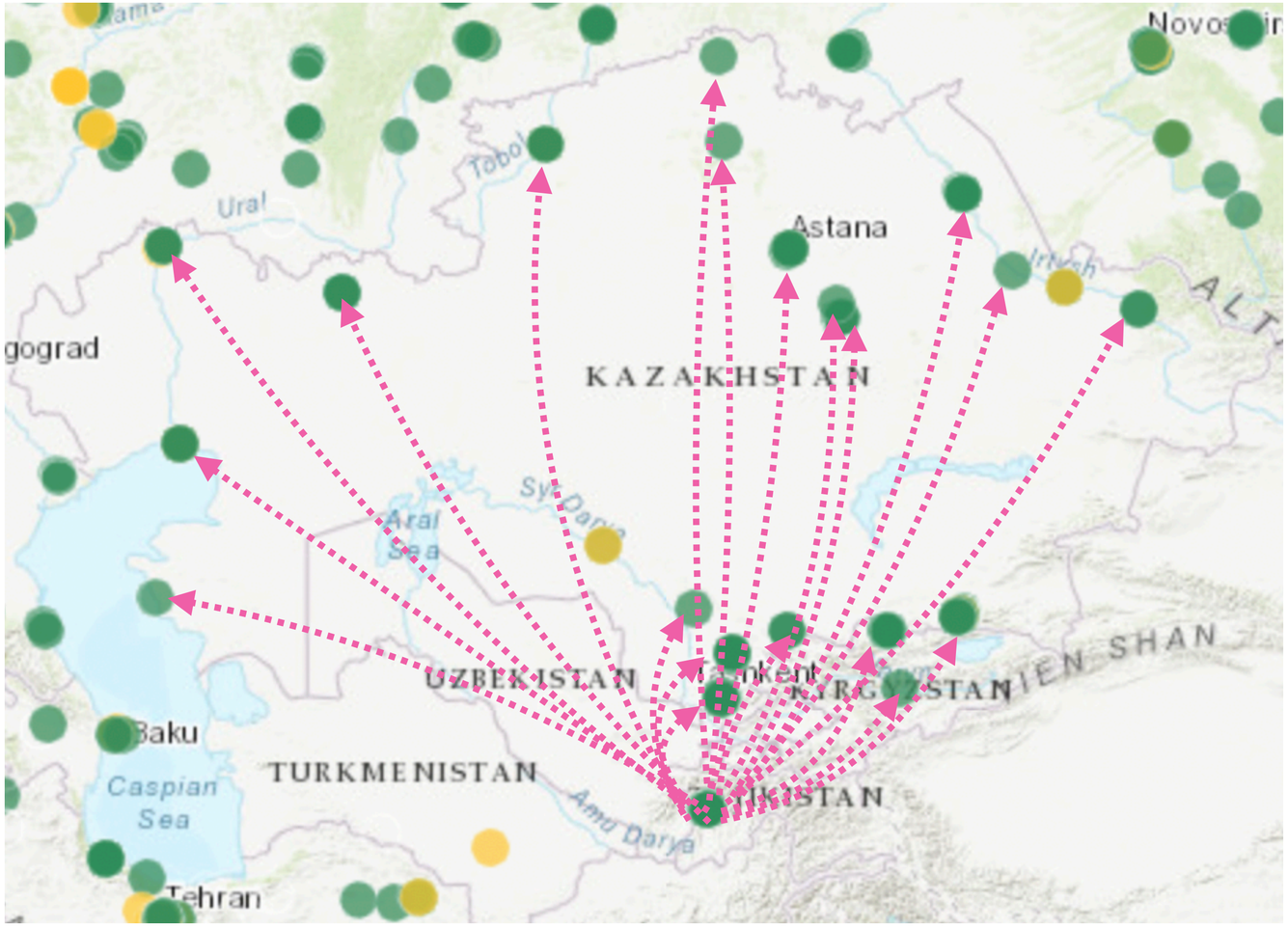
Methodology

What we do



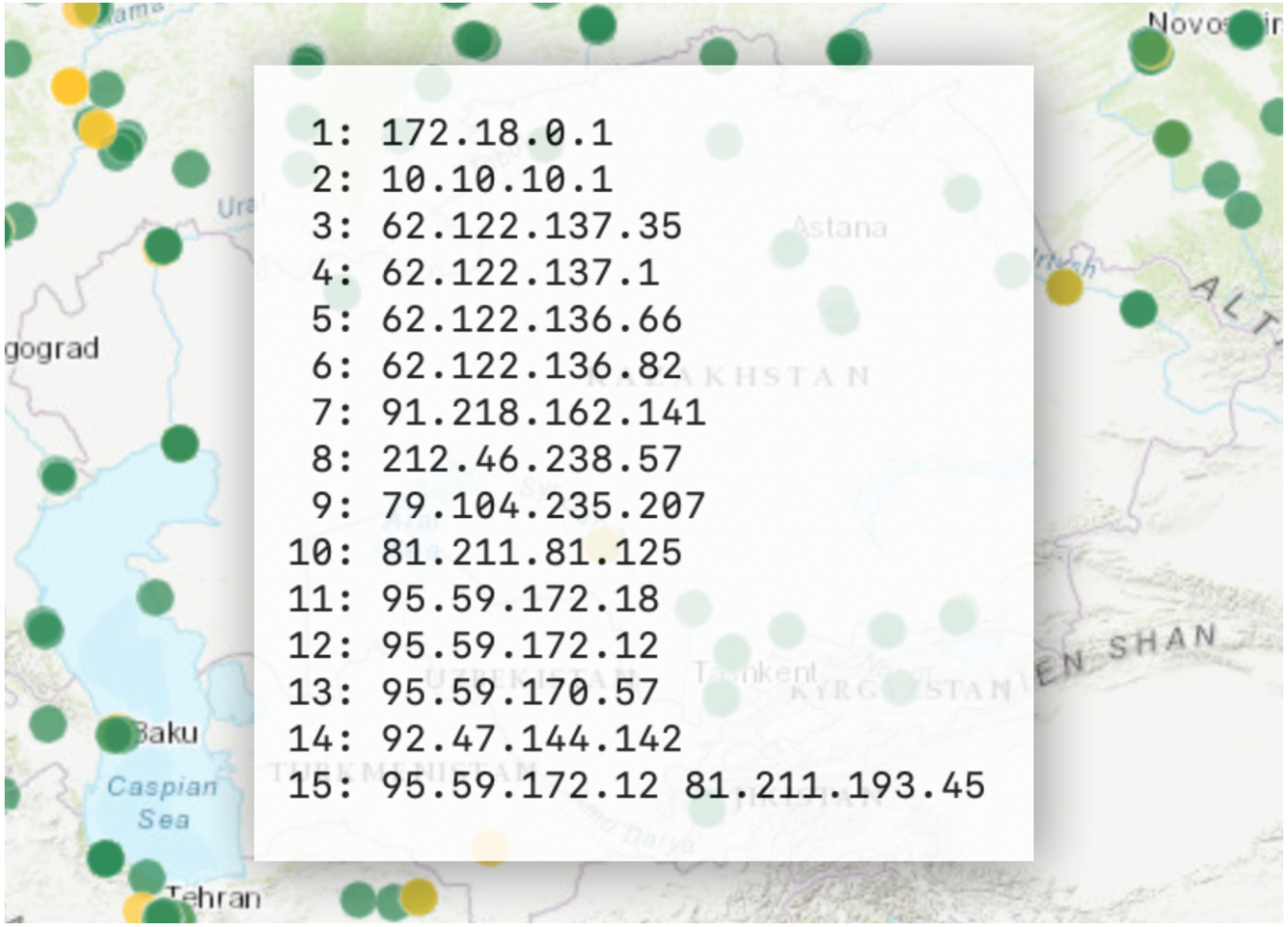
- Sources: all RIPE Atlas probes in a country

What we do



- Sources: All RIPE Atlas probes in a country
- Destination points: RIPE Atlas probes in other countries
  - Plus some additional hosts in Turkmenistan

What we do

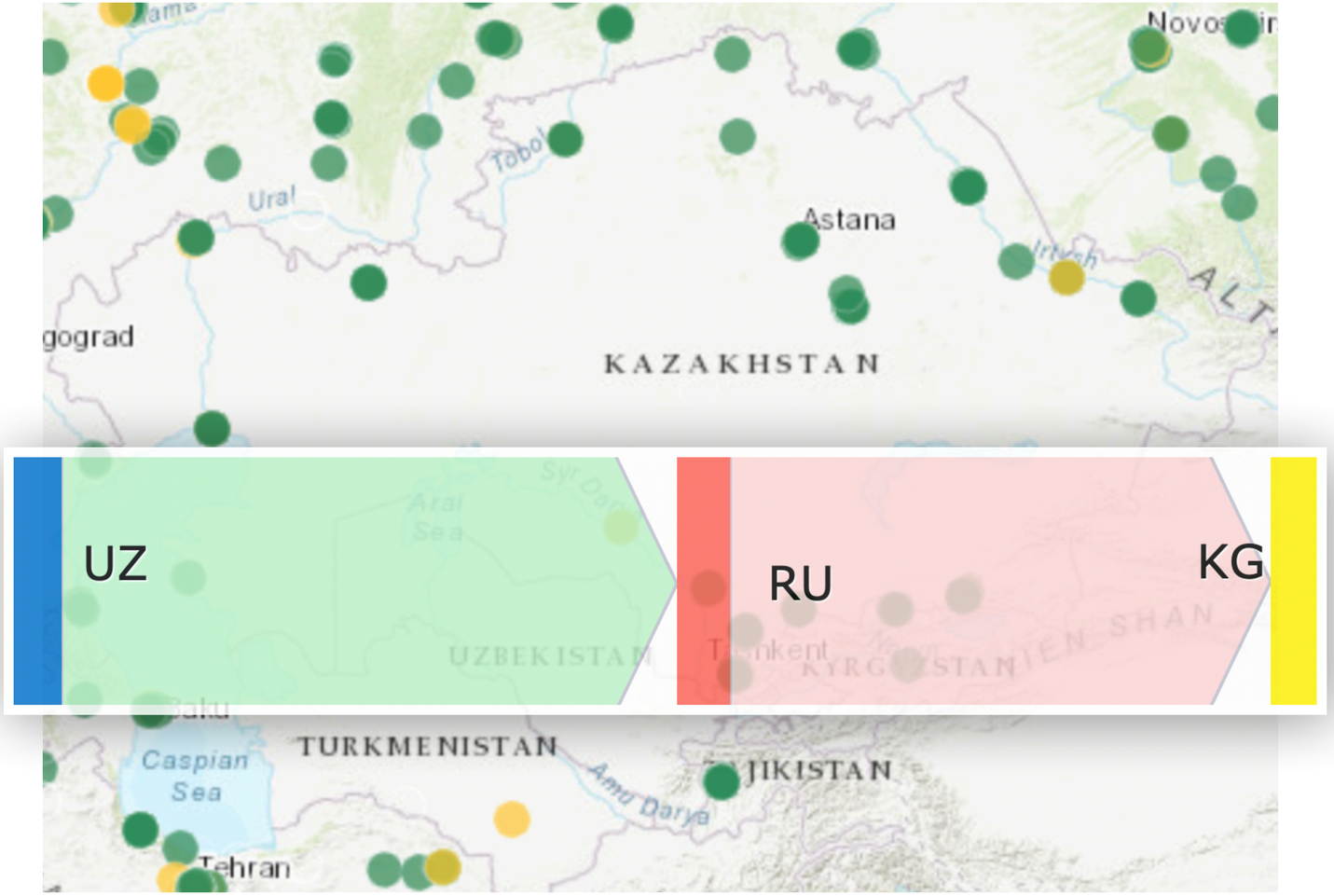


- Sources: All RIPE Atlas probes in a country
- Destination points: RIPE Atlas probes in other countries plus some additional hosts
- We do traceroute and get a sequence of the hops
  - For each source and destination we use all options: UDP, TCP, ICMP over both IPv4 and IPv6

What we do

- Sources: All RIPE Atlas probes in a country
- Destination points: RIPE Atlas probes in other countries plus some additional hosts
- We do a traceroute and get a sequence of the hops
- By associating each hop with a country we get a chain of countries

What we do



- Sources: All RIPE Atlas probes in a country
- Destination points: Atlas probes in other countries plus some additional hosts
- We do traceroute and get a sequence of the hops
- We get a chain of countries
- Results are aggregated by source and destination countries

Some biases to be aware of

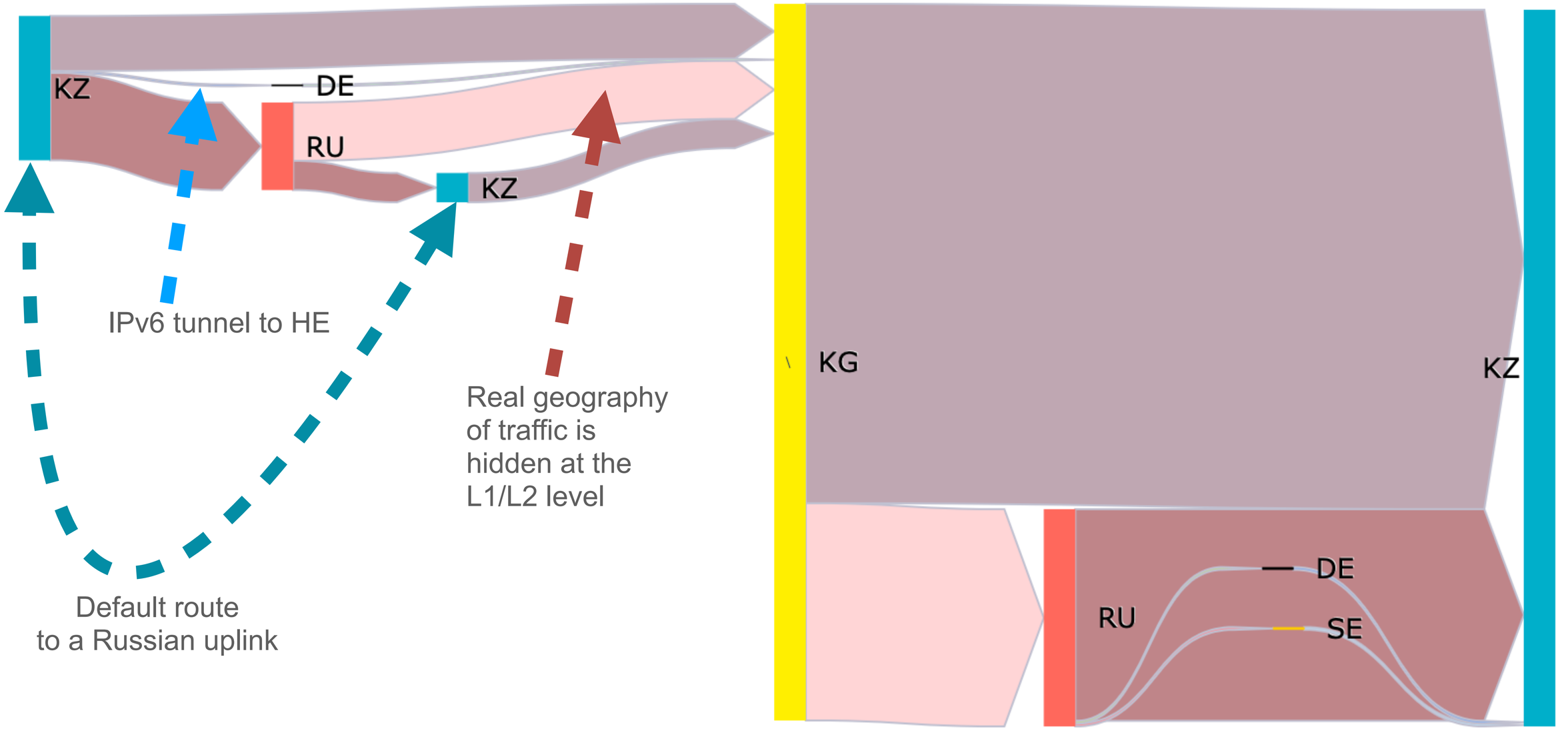
- Not every network prefix has a RIPE Atlas probe
- The real weight of each route is unknown
- Traceroute works at the IP level: L1 and L2 geography is left out
  - Especially for multinational operators
  - And there can also be IP tunnels
- The geographic location of intermediate routers is always questionable
  - They may not be known at all ("stars" in traceroute output)
  - They may have private addresses
- ECMP may still be displayed incorrectly (even with Paris traceroute)
- Some router addresses might belong not to the owner
- Routes tend to change over time

Eh… So can we believe the results?

- An external observer **cannot be 100% accurate** in such a measurement
- The results give a **qualitative picture**, not a quantitative one
- **Data refinement** at each step significantly increases the validity of the results
- Thus they **can provide a basic understanding** of interconnectivity in the region

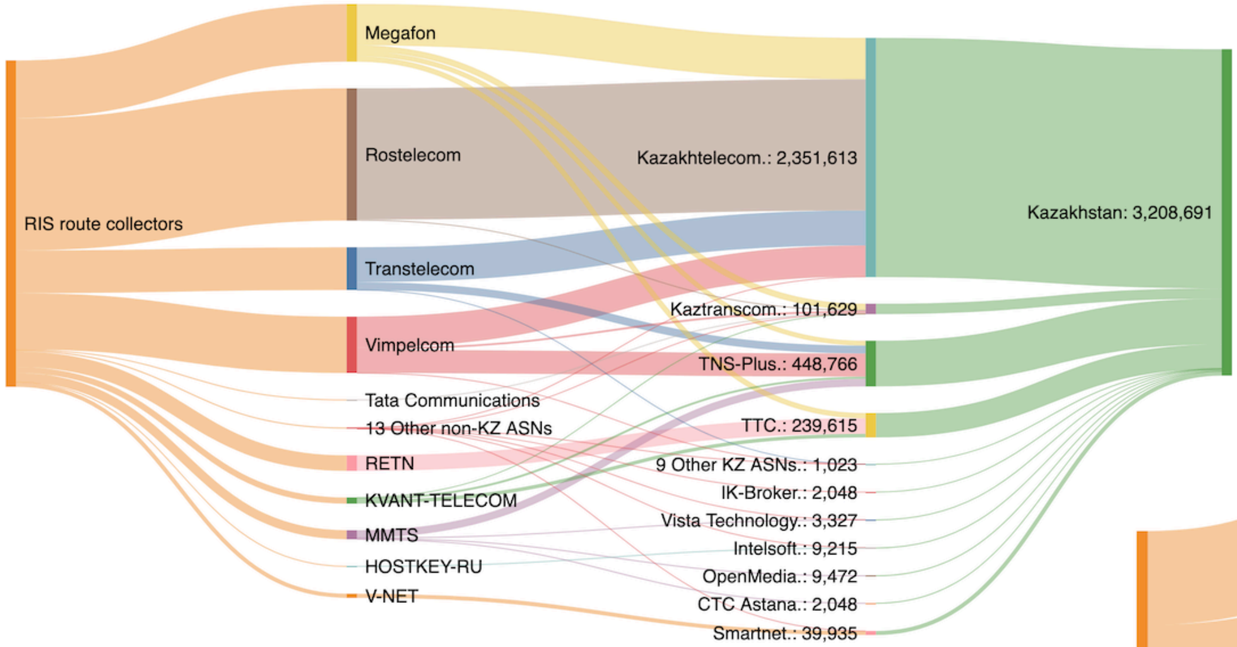
Results

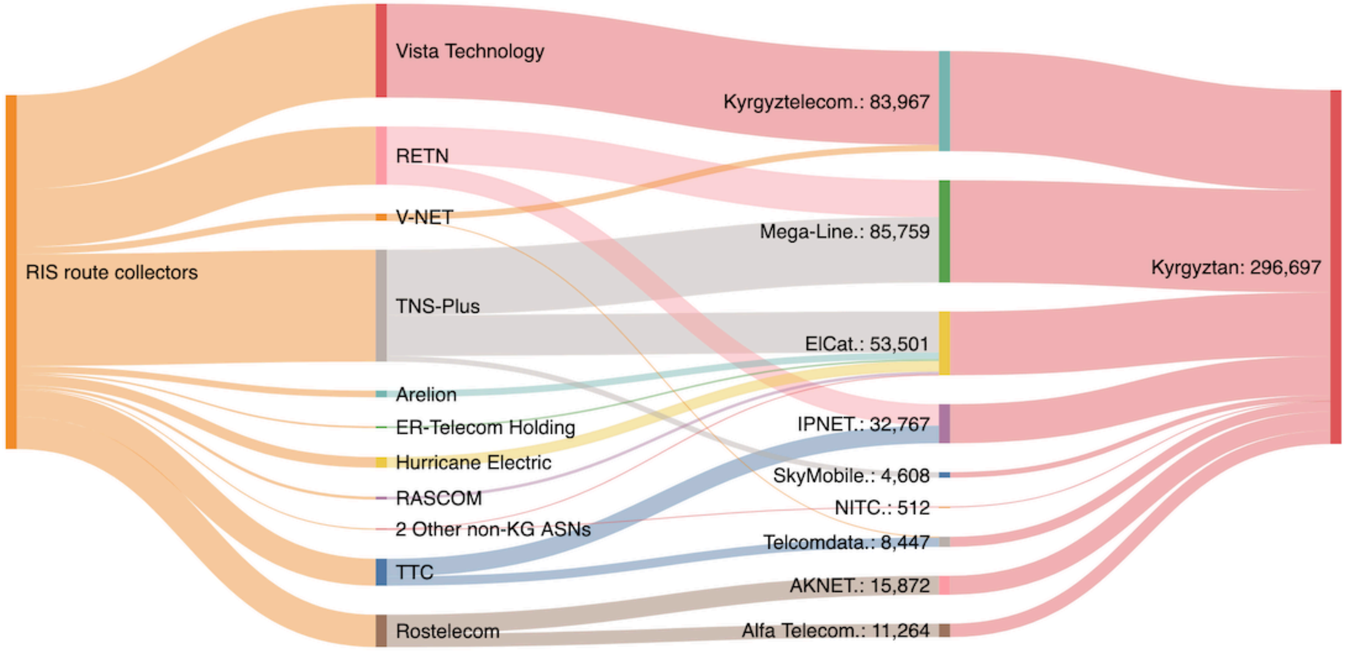
Kazakhstan ⇿ Kyrgyzstan



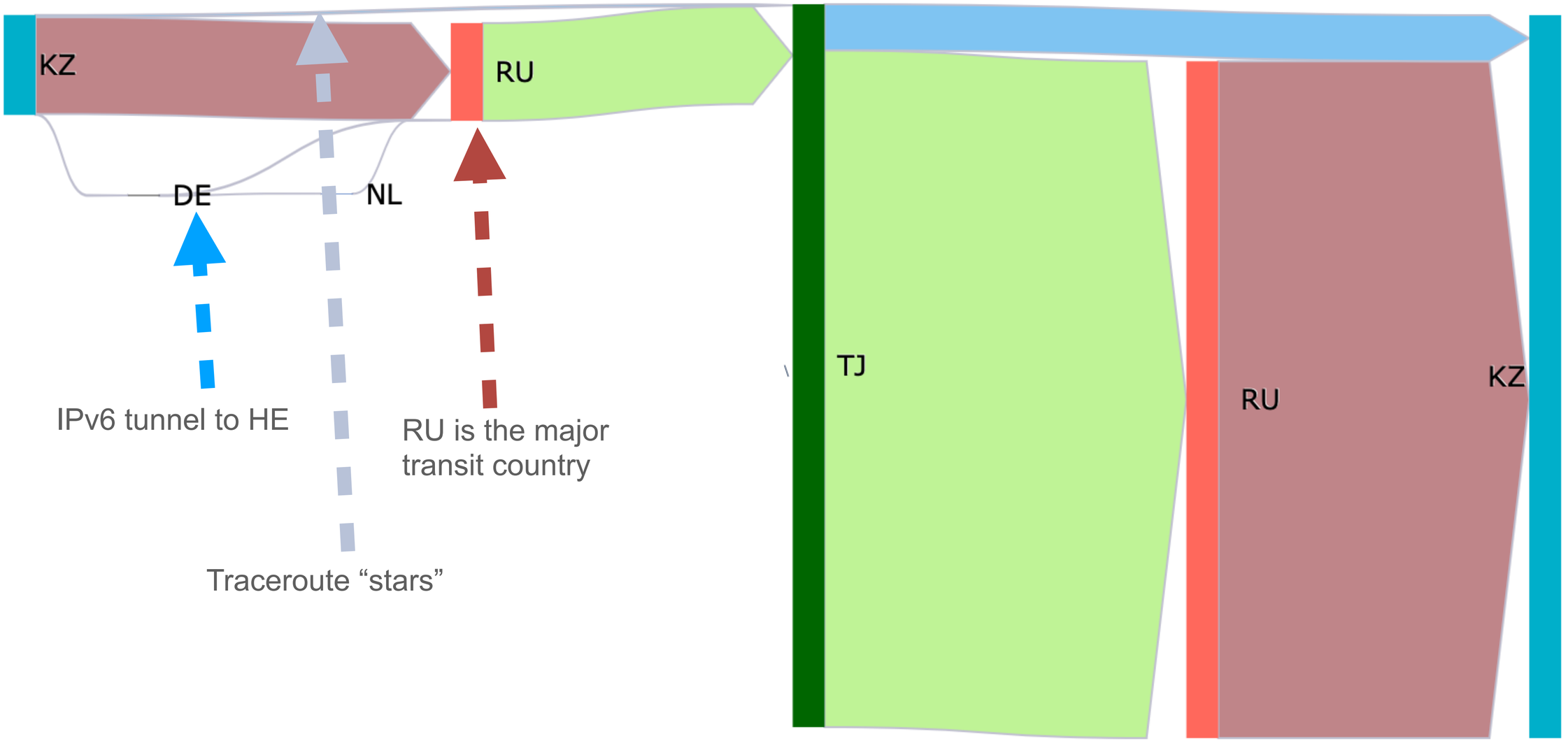
Kazakhstan and Kyrgyzstan BGP uplinks

These measurements and diagrams are made by Rene Wilhelm, RIPE NCC



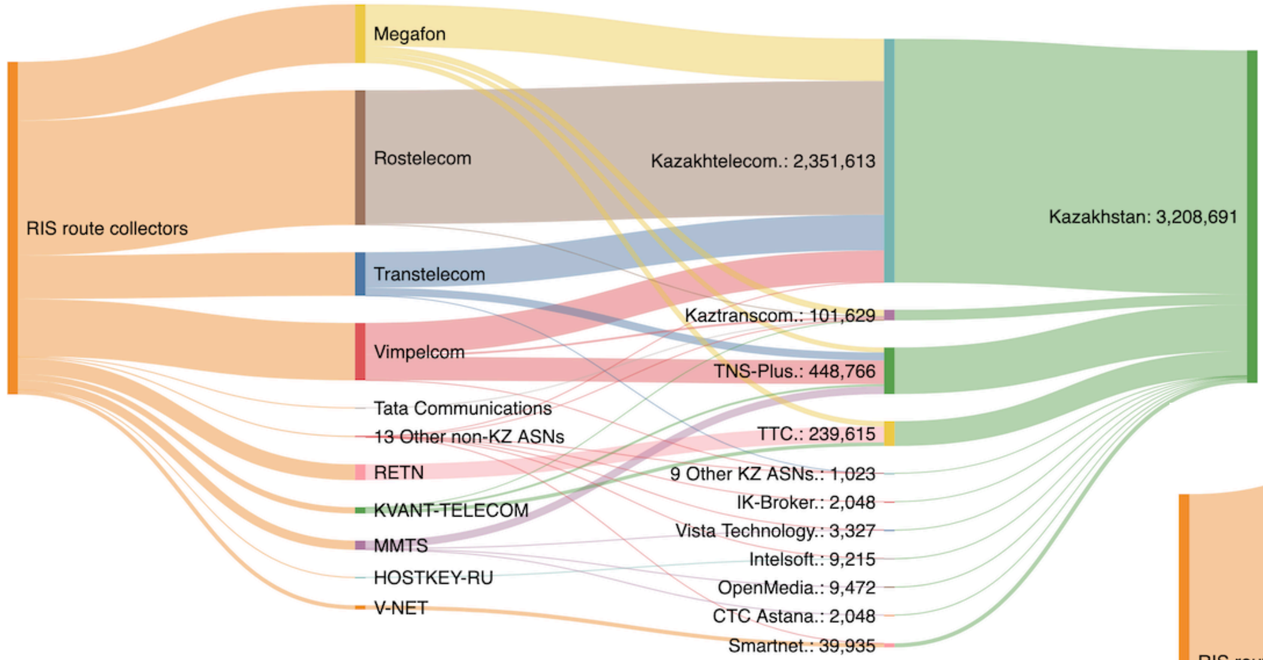


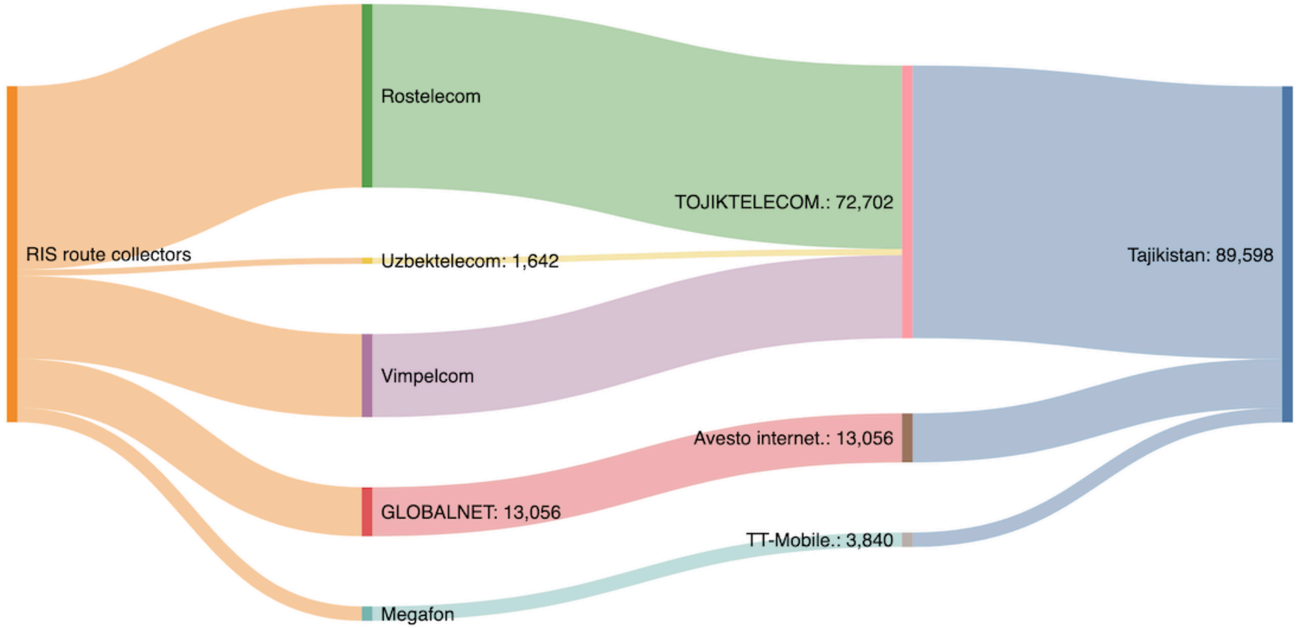
Kazakhstan ⇿ Tajikistan



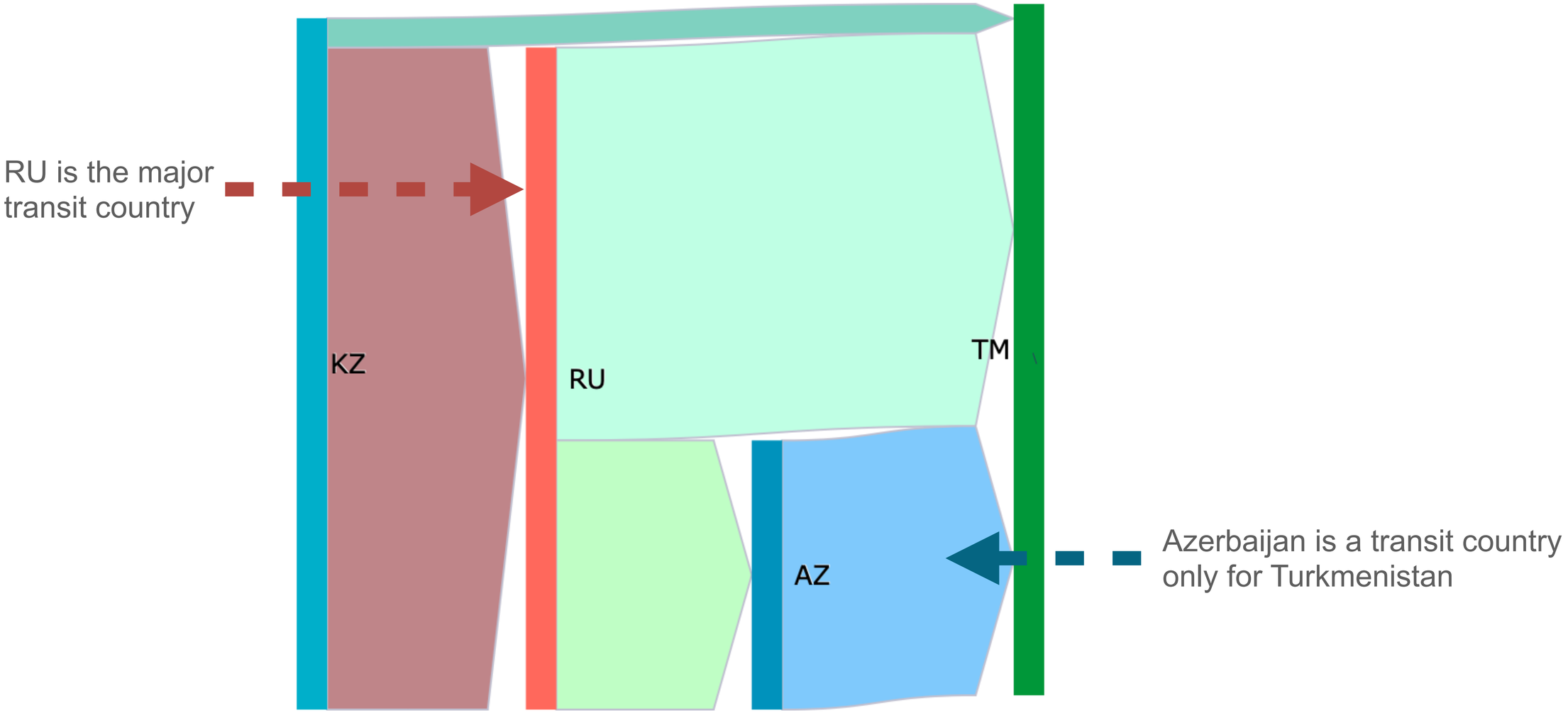
Kazakhstan and Tajikistan BGP uplinks

These measurements and diagrams are made by Rene Wilhelm, RIPE NCC



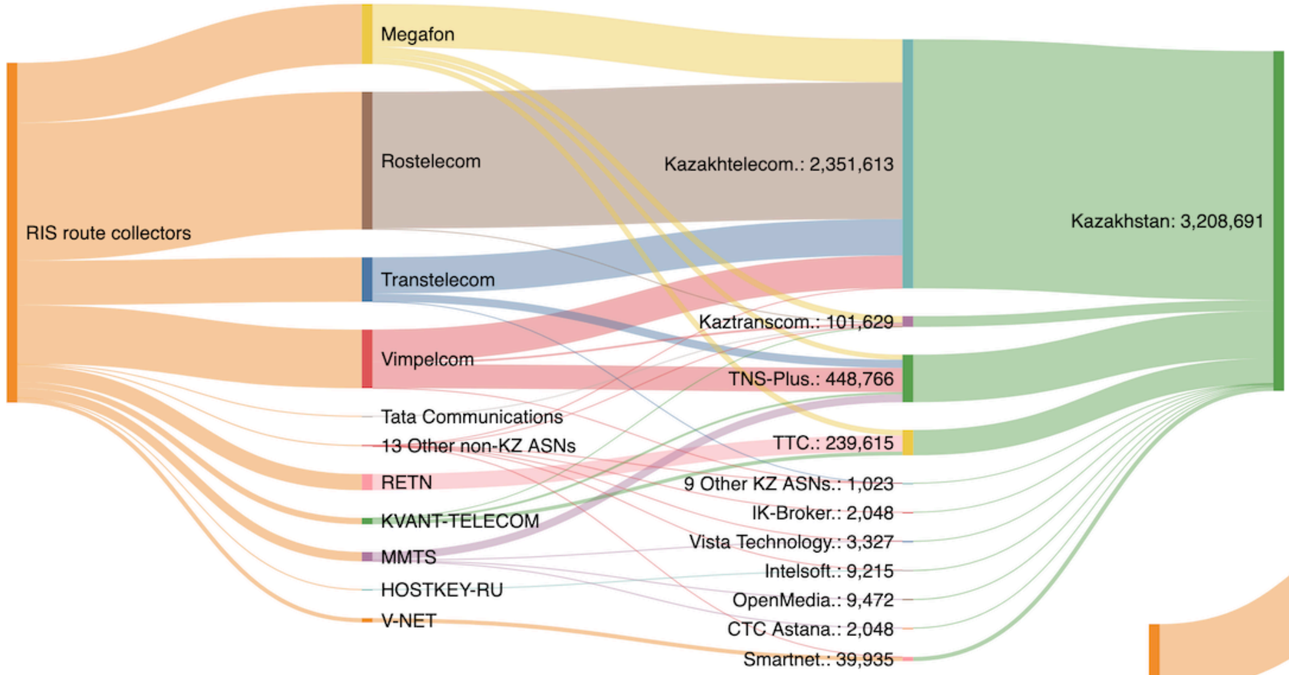


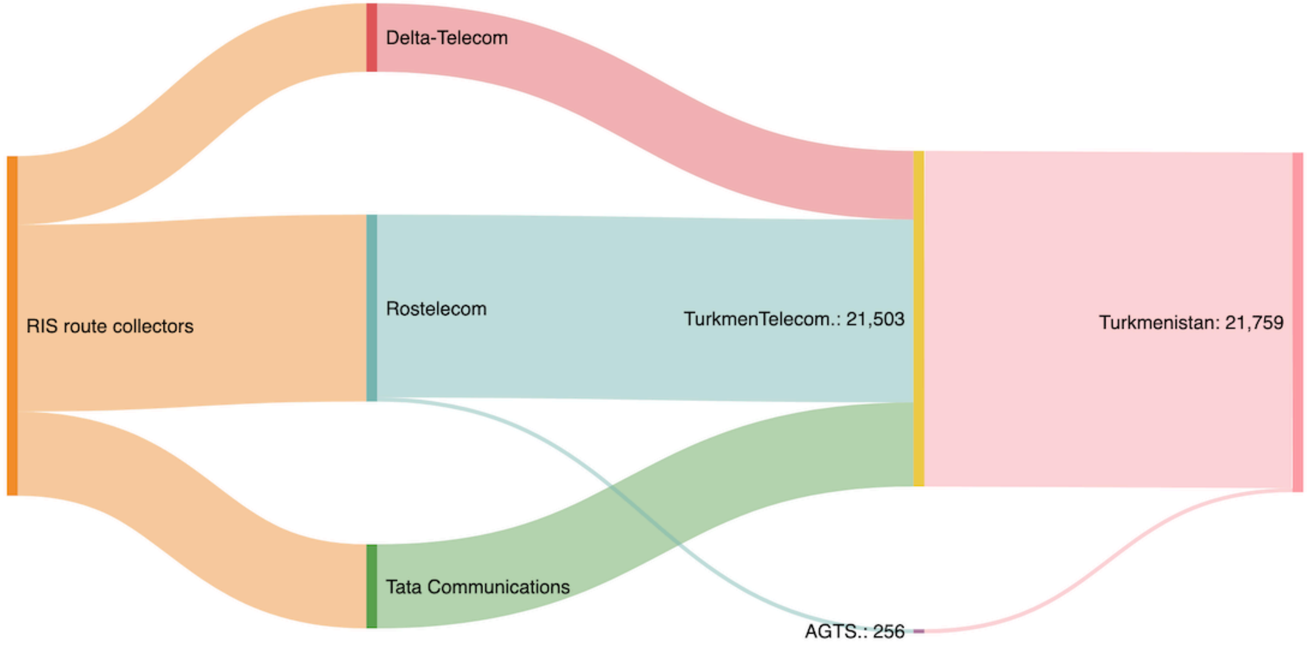
Kazakhstan → Turkmenistan



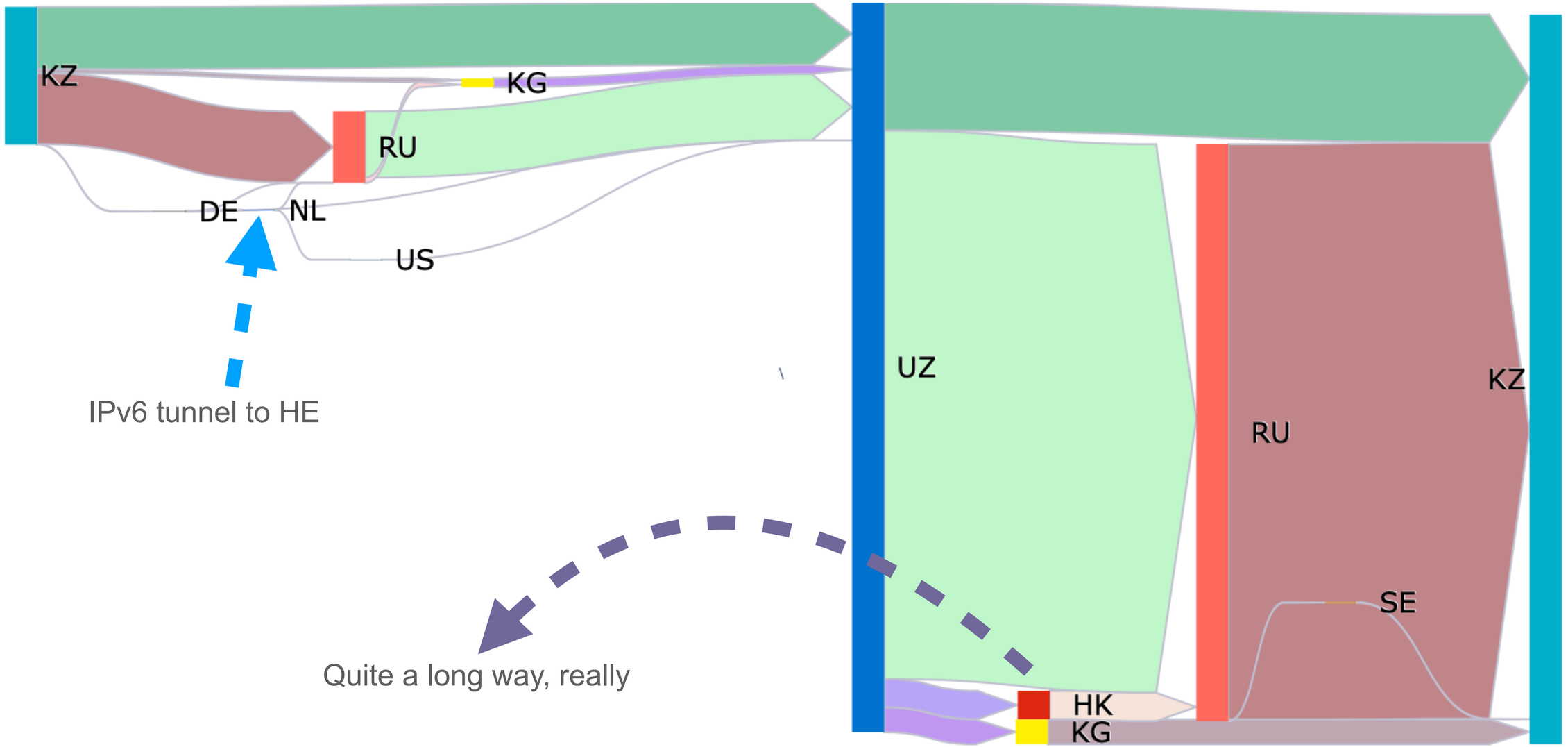
Kazakhstan and Turkmenistan BGP uplinks

These measurements and diagrams are made by Rene Wilhelm, RIPE NCC



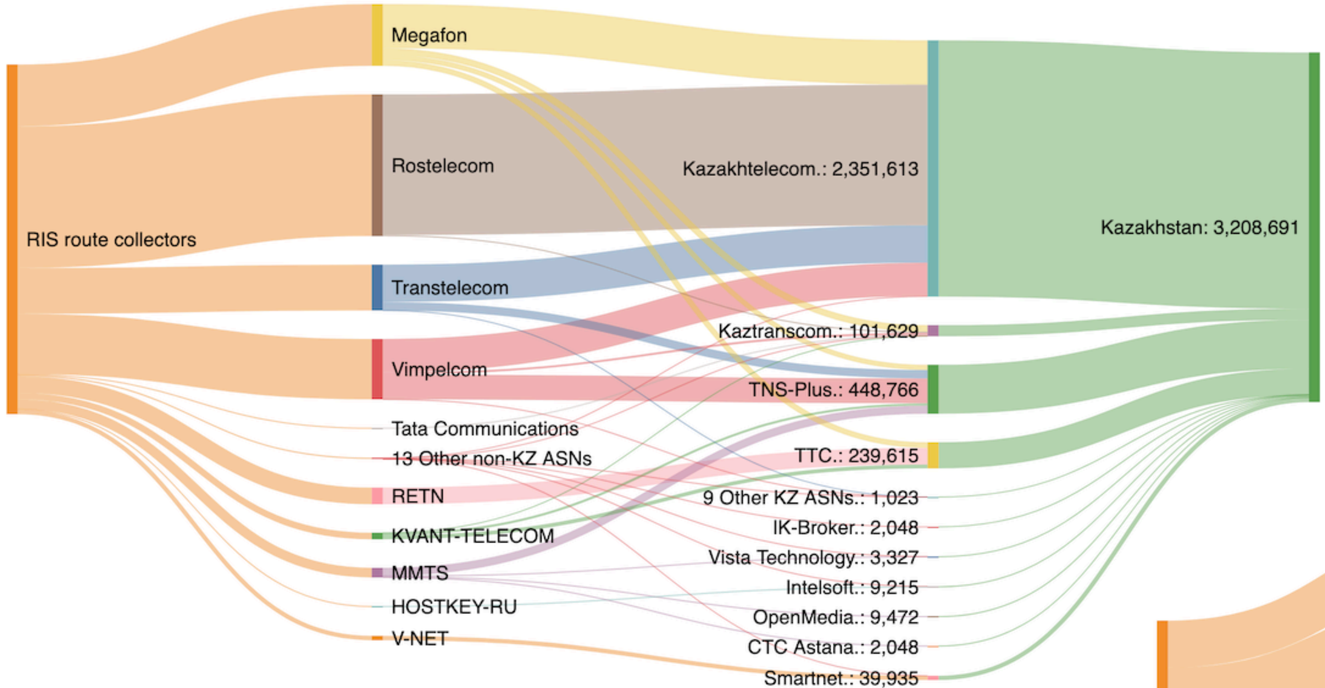


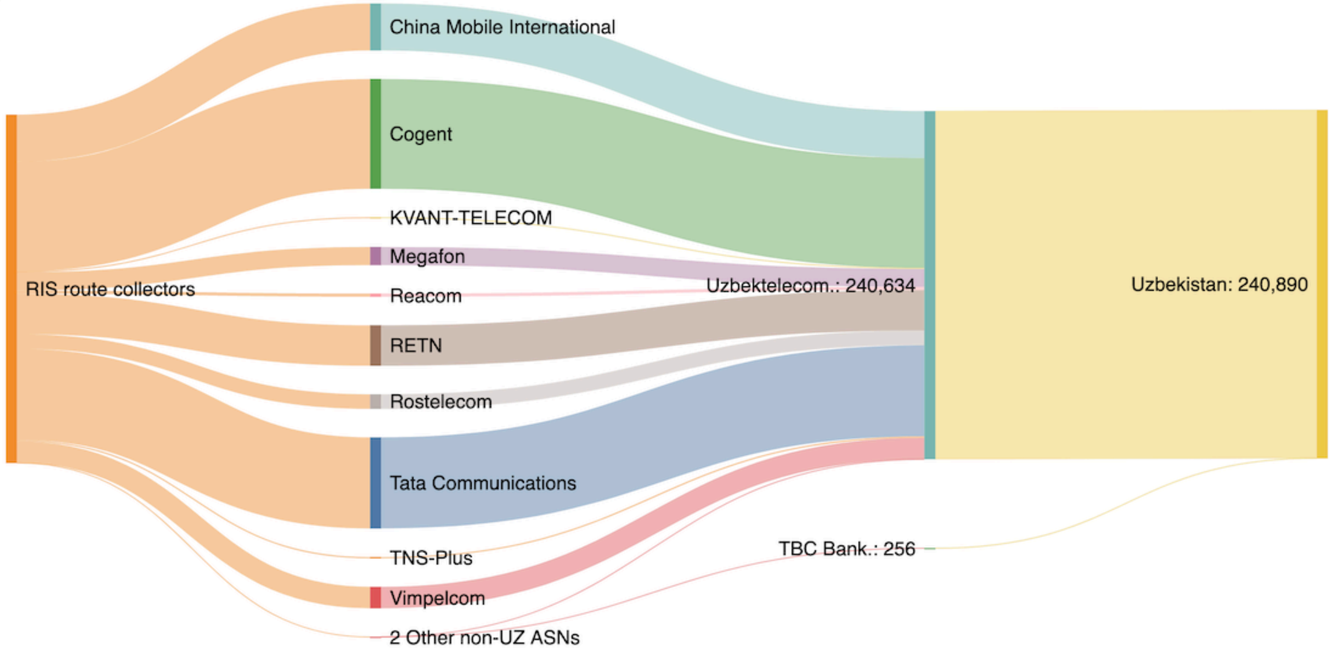
Kazakhstan ⇿ Uzbekistan



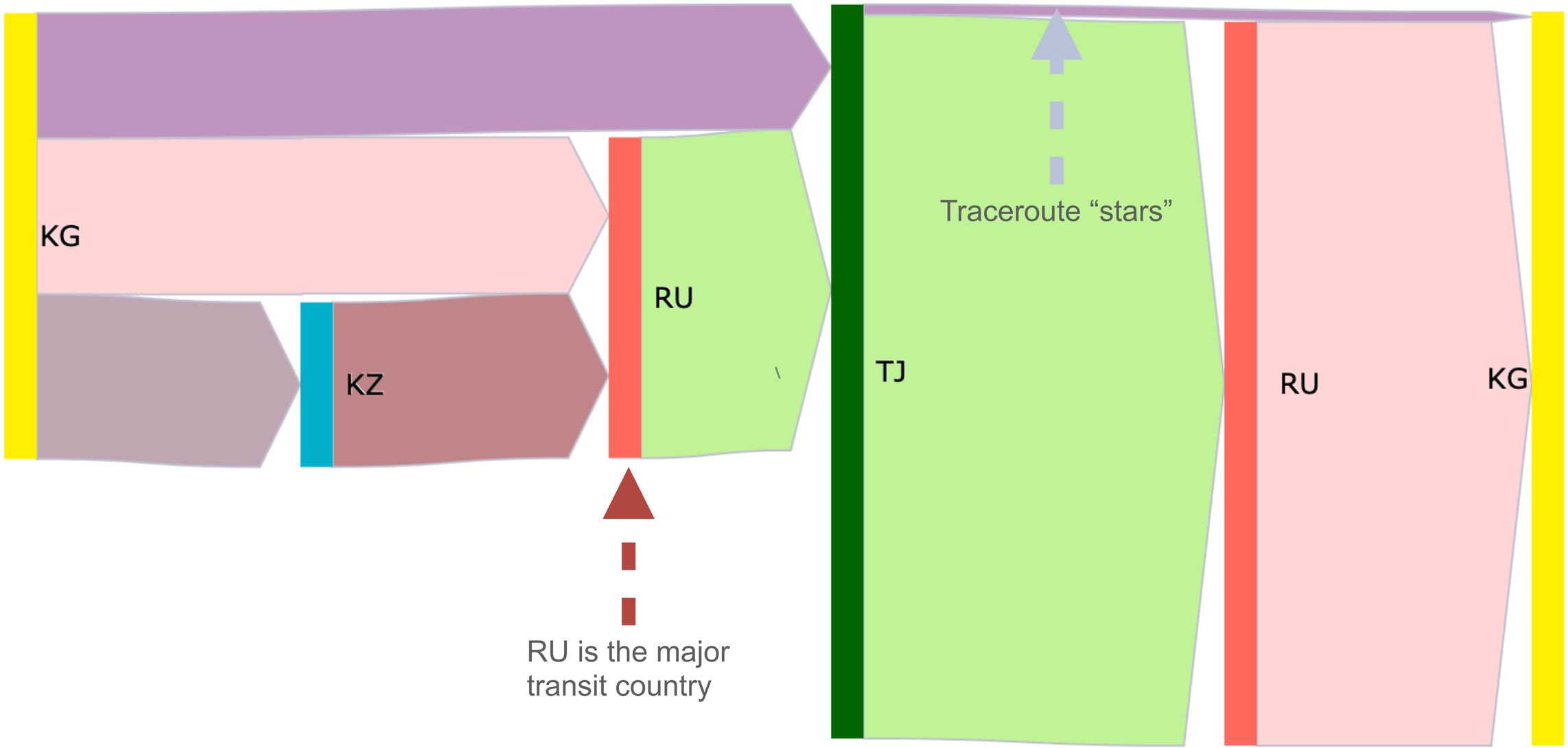
Kazakhstan and Uzbekistan BGP uplinks

These measurements and diagrams are made by Rene Wilhelm, RIPE NCC

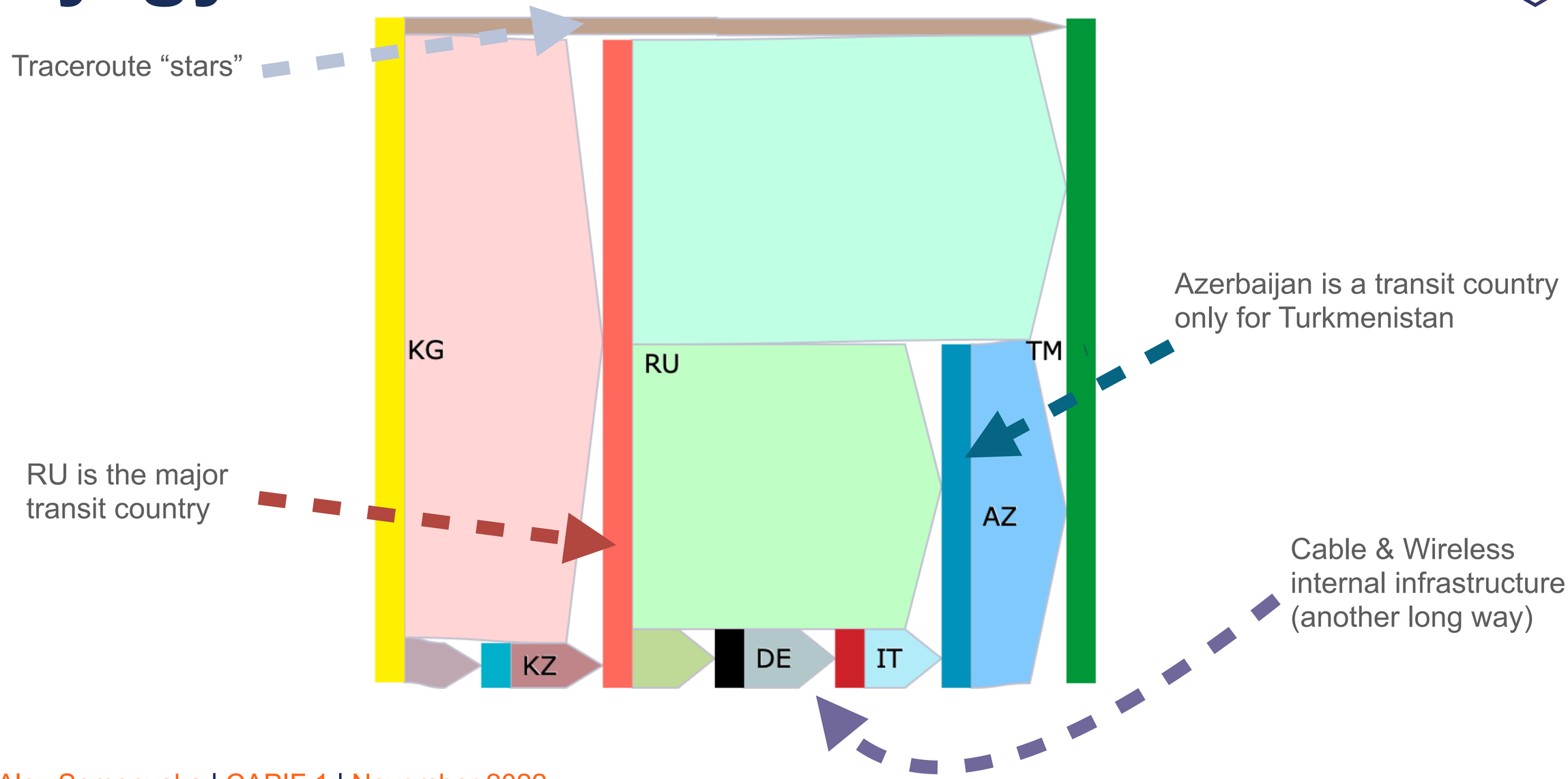




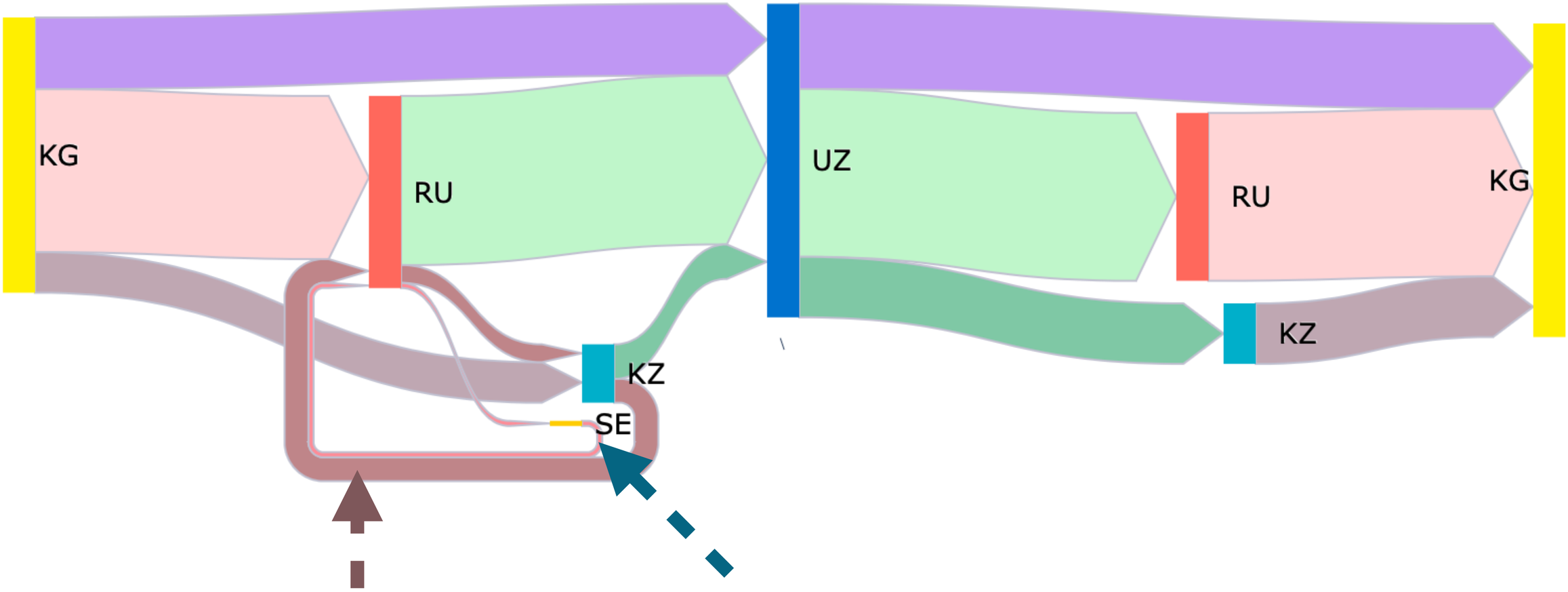
Kyrgyzstan ⇿ Tajikistan



Kyrgyzstan → Turkmenistan



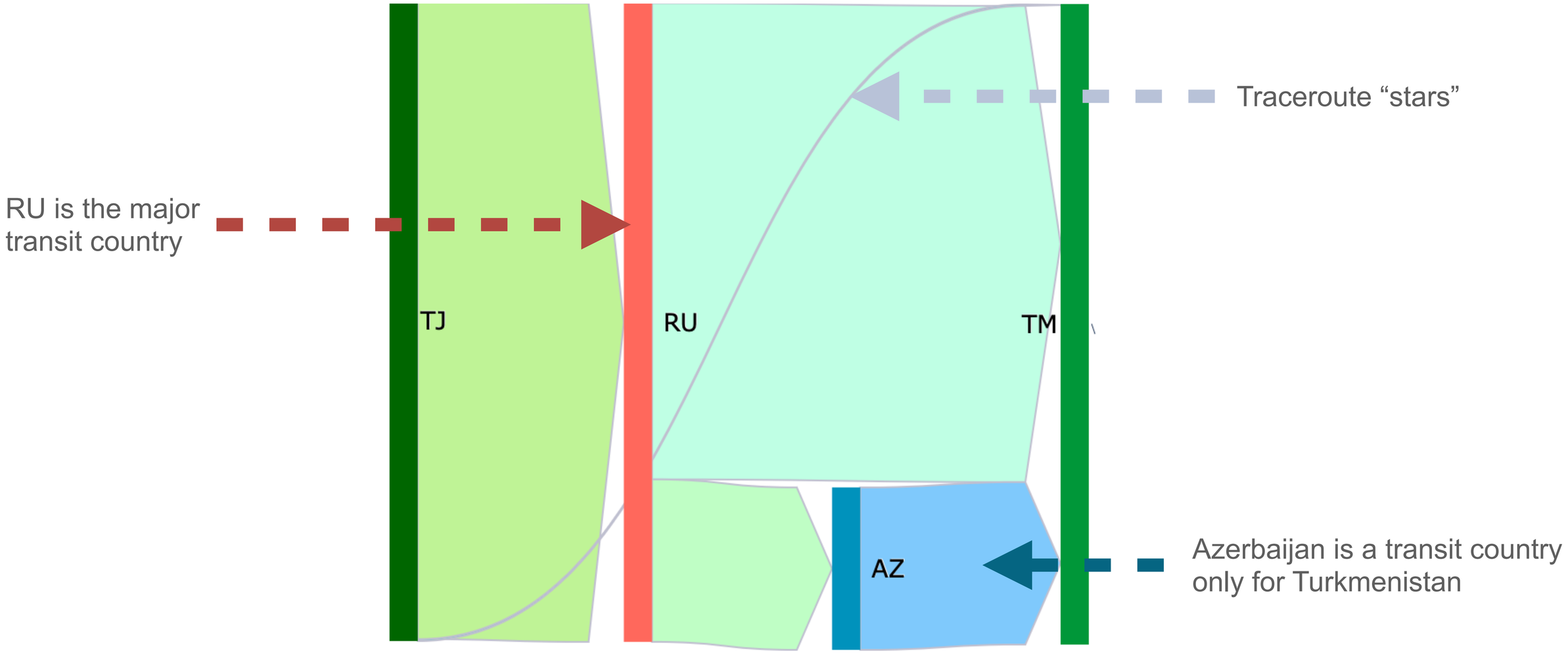
Kyrgyzstan ⇿ Uzbekistan



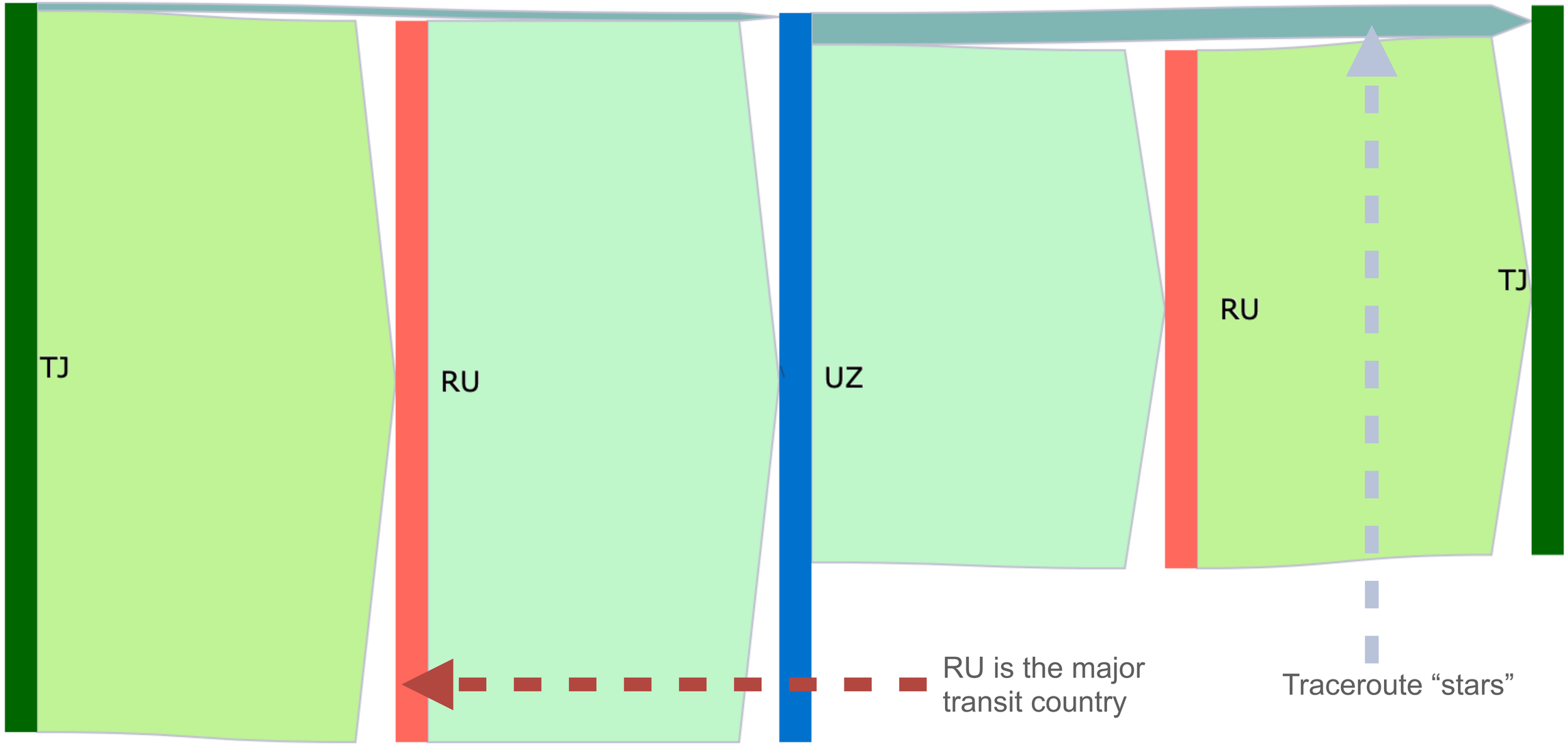
Same ‘KZ-RU-KZ’ ping-pong
that we saw before

Routing wars: two Russian operators
docking in Stockholm
(yet another long way)

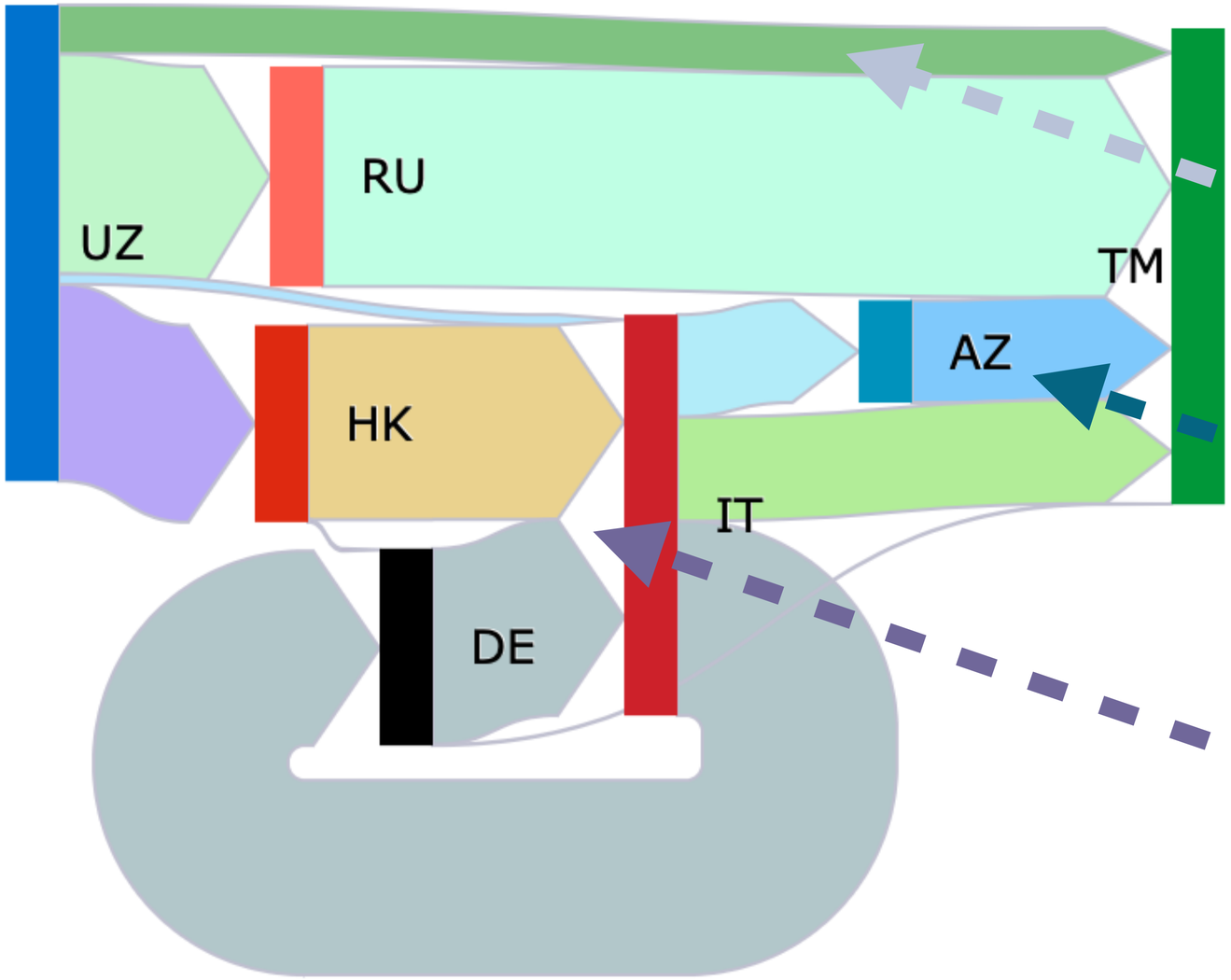
Tajikistan → Turkmenistan



Tajikistan ⇿ Uzbekistan



Uzbekistan → Turkmenistan



Traceroute “stars”

Azerbaijan is a transit country only for Turkmenistan

Cable & Wireless internal infrastructure

Some observations and conclusions

Some odd things seen… (1)

- Measurement 46361250, probe#51648 (KG → TM)

```
1: 212.42.102.193      KG
2: 94.143.195.158      KG
3: 209.85.148.59       US, Google???
4: 195.208.208.223     RU
5: 81.27.252.219       RU
6: 10.50.10.202
```

- Google's address provided to the peering partner

Some odd things seen… (2)

- Measurement 46355164, probe#1003358 (KZ → KG)

```
 1: 192.168.60.1       KZ-TRANSTELECOM
 2: 10.40.255.119
 3: 195.208.209.72     RU
 4: 5.188.237.27       RU
 5: 10.17.17.1
 6: 141.101.186.14     RU
 7: 85.29.131.214      KZ, ORBITA-PLUS LLP, Astana
 8: 85.29.131.215      KZ, ORBITA-PLUS LLP, Astana
 9: 89.38.164.178      KZ
10: 212.112.96.105     KG
11: 213.109.66.53      KG
```

- KZ-Transtelecom sends everything to Russia by default?

Some odd things seen… (3)

- Measurement 46355164, probe#60085 (KZ → KG)

```
14: 141.101.186.14 RU, MMTS-net
15: 85.29.131.214  KZ, ORBITA-PLUS LLP, Astana
16: 85.29.131.215  KZ, ORBITA-PLUS LLP, Astana
17: 188.254.54.2   RU, Rostelecom
```

- Measurement 46355164, probe#50105 (TJ → KG)

```
9: 178.210.33.45   RU, KVANT-TELECOM-Voronezh
10: 85.29.131.214  KZ, ORBITA-PLUS LLP, Astana
11: *
12: 188.254.54.2   RU, Rostelecom
```

- Hops 85.29.131.214 and 85.29.131.215 look illogical. Address lease not registered in the RIPE Database? Route leak? Tell me if you know…

Some odd things seen… (4)

- Measurement 46361336, probe#51648 (KG → UZ)

```
4: 188.43.12.249  RU, Transtelecom
5: 188.43.12.250  RU, Transtelecom
6: 87.245.249.47  SE, RETN
7: 87.245.249.46  SE, RETN
8: 87.245.234.151 RU, RETN
9: 87.245.238.57  RU, RETN
```

- One can see no particular reason for one Russian operator to send another Russian operator traffic from Central Asia to Central Asia though Stockholm, other than "peering wars"

Some odd things seen… (5)

- Measurement 46361275, probe#54726 (UZ → TM)

```
 7: 195.69.189.47   UZ, Intal Telecom JV
 8: 223.119.80.73   HK, China Mobile
 9: 223.120.2.53    HK, China Mobile
10: 223.120.2.46    HK, China Mobile
11: 223.121.2.62    HK, China Mobile
12: 195.2.2.57      IT, Cable & Wireless Austria
13: 195.2.25.190    DE, Cable & Wireless Austria
14: 217.161.78.174  IT, Cable&Wireless Worldwide
15: *
16: 85.132.90.254   AZ, Delta Telecom
```

- Global operators' traffic management can cause very long packet trips (geographically)

Observations and issues

- More probes in the region will provide higher accuracy, better view
- Major transit country of the region: Russia
  - Not really geographically justified
- Kazakhstan is in second place
  - Much more understandable
- The number of suboptimal traffic transit routes is too high
  - And some of them are far too suboptimal
  - Countries are hurt by the decisions of global operators and peering wars of other parties
- Diversification of routes by countries is very low
  - It makes the industry too reliant on local and international geopolitics.
- Traffic asymmetry is very high

Conclusions

- There is tremendous room for improvement
- Our Central Asia Peeing and Interconnection Forum today is a great opportunity to agree on such improvements

Questions

asemenyaka@ripe.net