RIPE NCC
RIPE NETWORK COORDINATION CENTRE

IPv6 Routing in Slovenia

As seen from the world

Given by my colleague from R&D, Christian Teuschel

Nathalie Trenaman| 23 May 2017 | SINOG 4.0

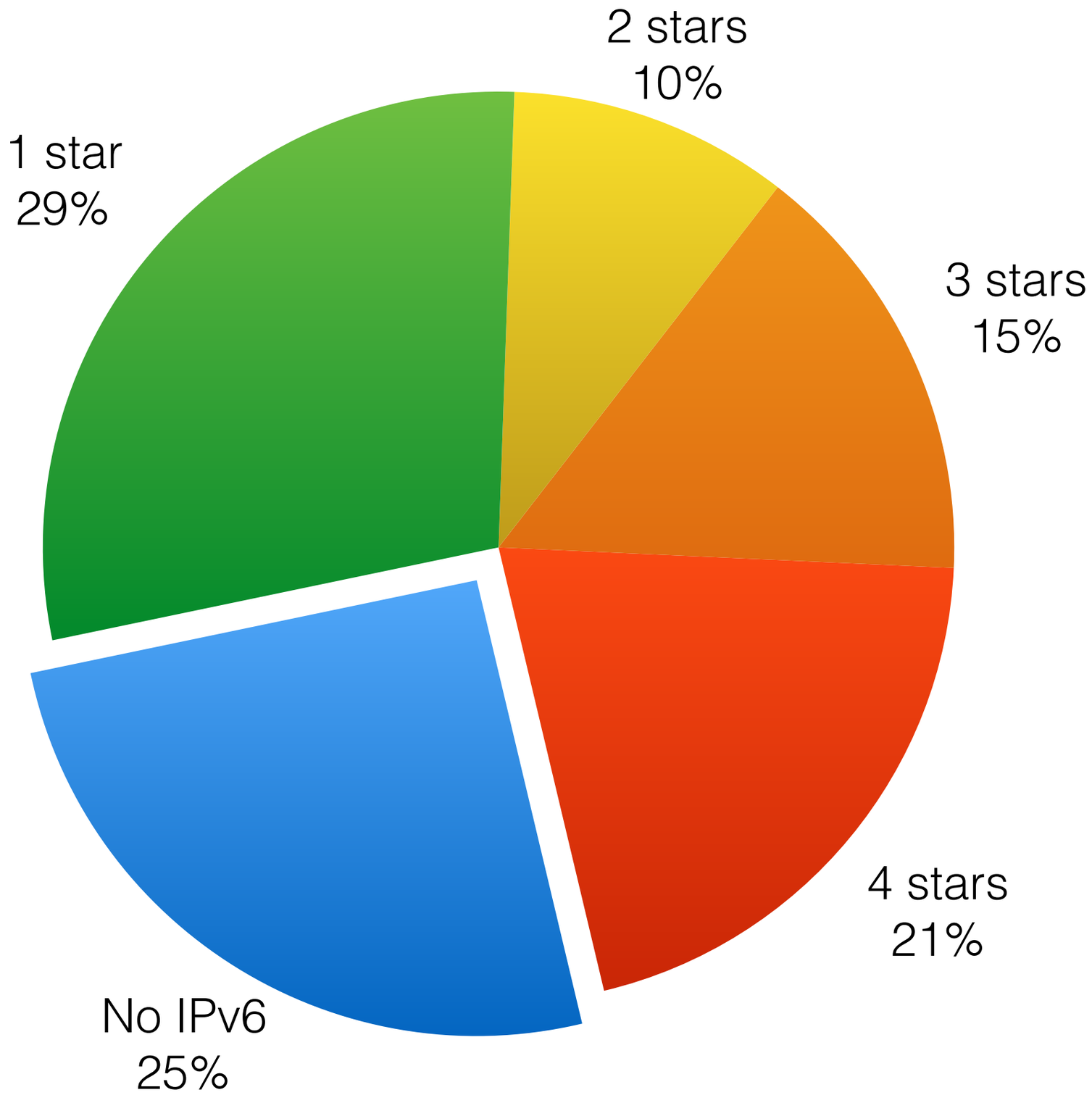
Regional Measurements

- RIPE NCC measures many different things:
  - IPv6 RIPEness
  - Atlas
  - RIS
  - Member Demographics
  - RIPE Database
  - etc…

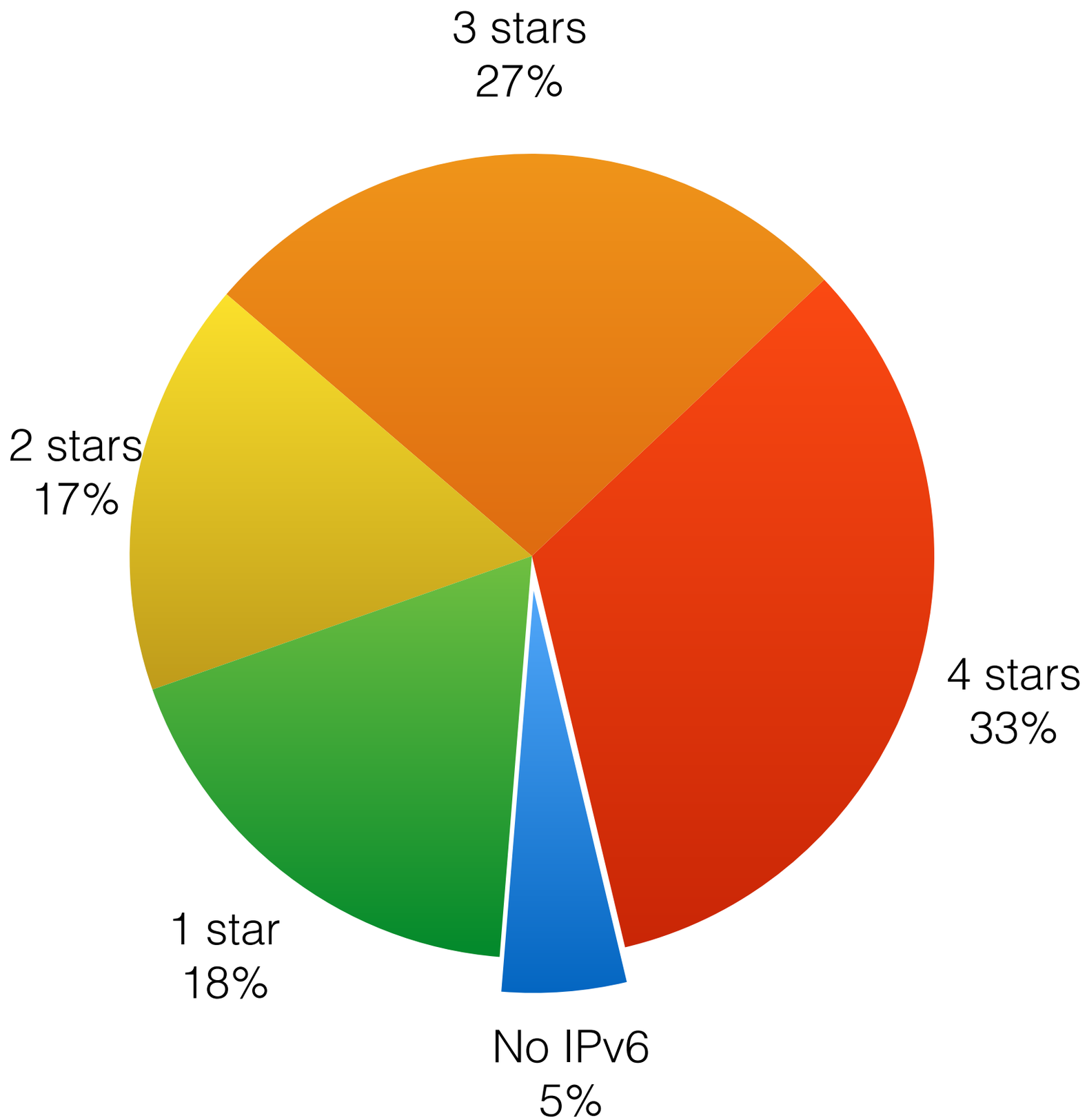
IPv6 Ripeness

- Rating system:
  - One star if the LIR has an IPv6 allocation
  - Additional stars if:
    - IPv6 Prefix is announced on router
    - A route6 object is in the RIPE Database
    - Reverse DNS is set up
- A list of 4 star LIRs:
  - http://ripeness.ripe.net

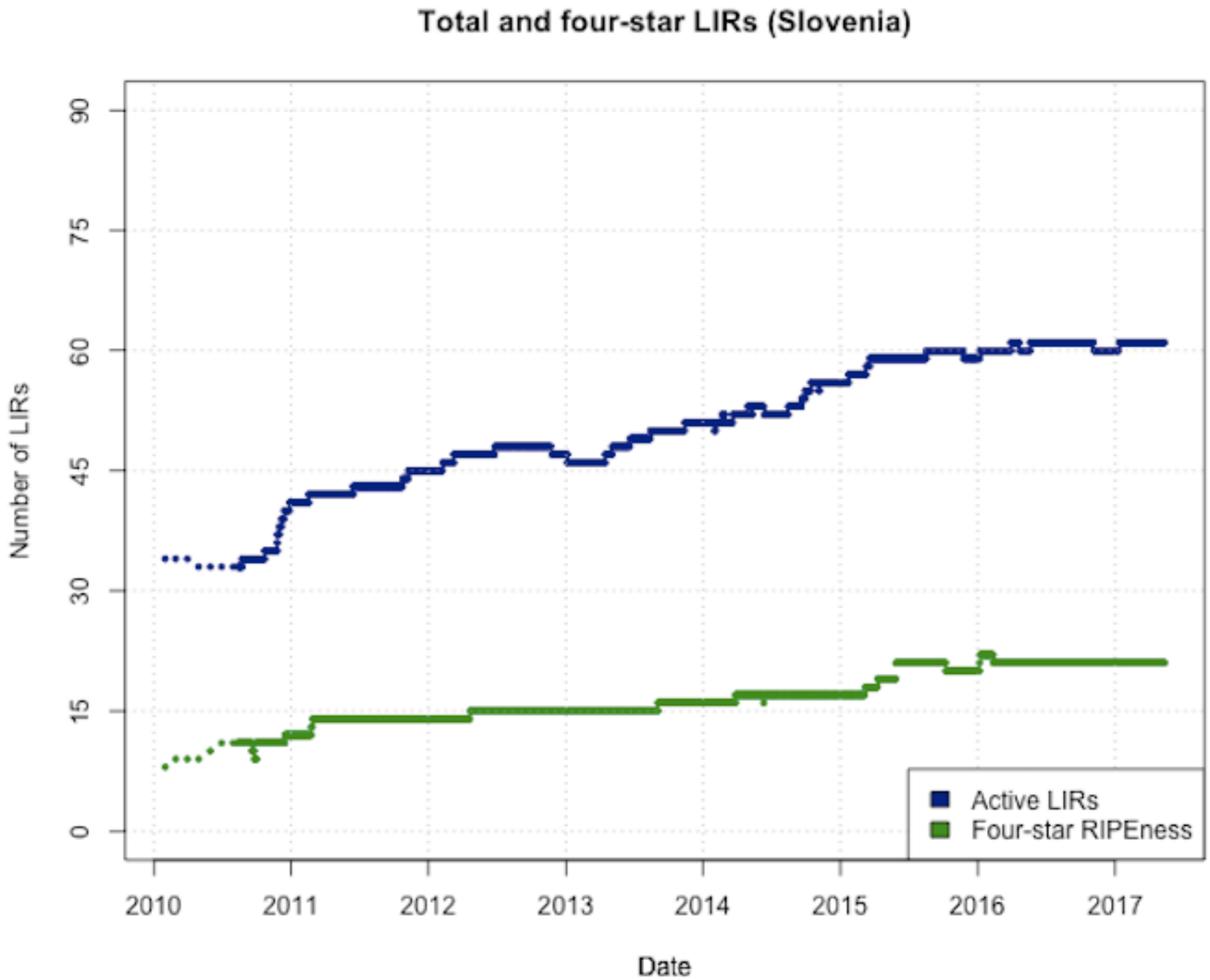
IPv6 RIPEness: 15932 LIRs



IPv6 RIPEness Slovenia: 60 LIRs

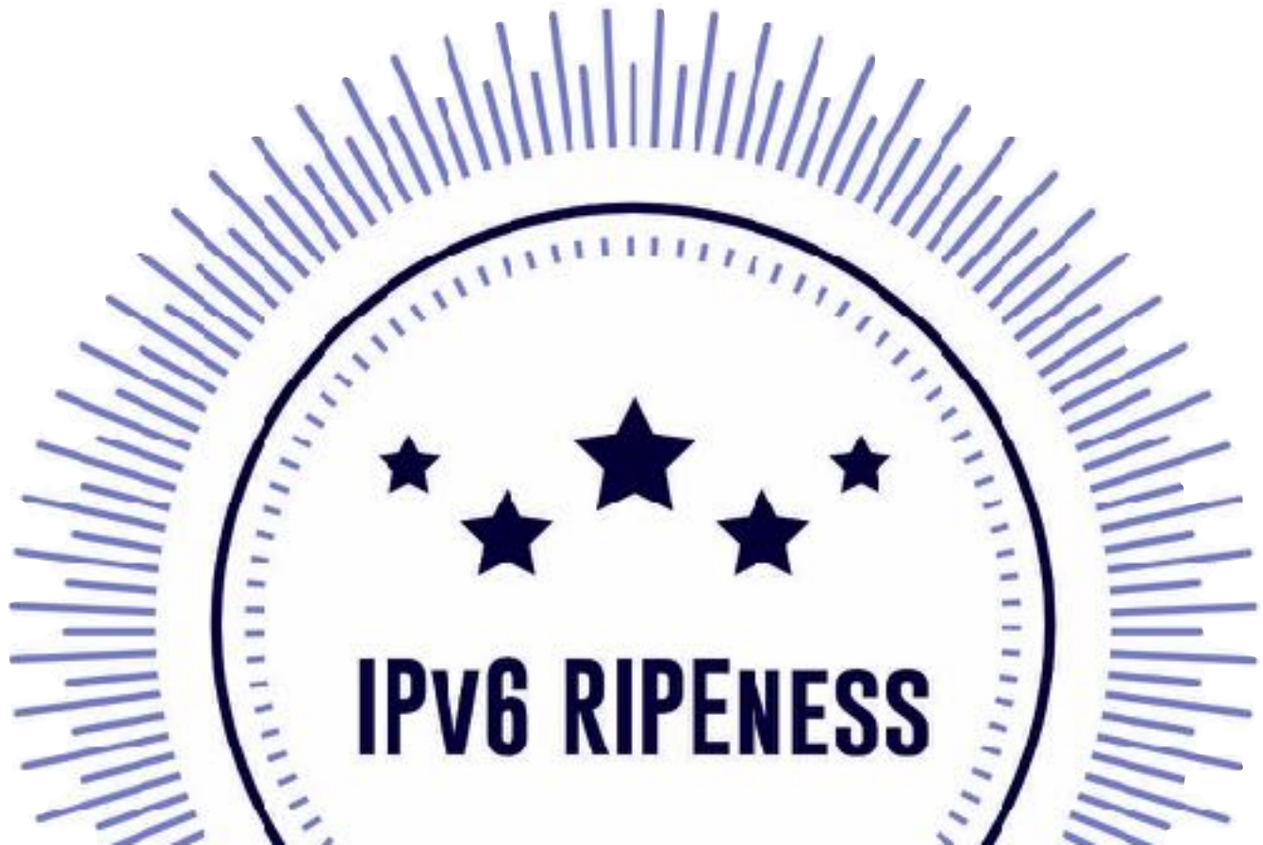


4 Stars over Time



IPv6 RIPEness: the 5th star

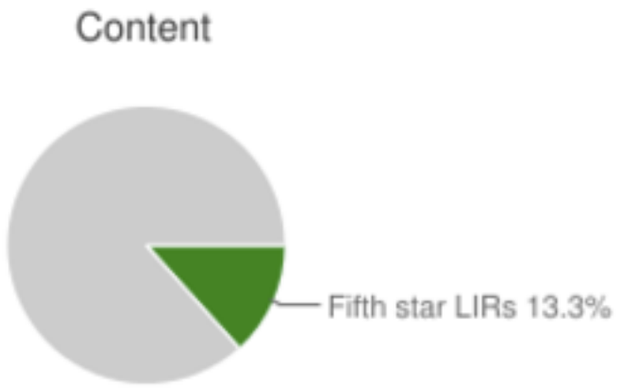
- You already earned 4 stars…
- Actual IPv6 deployment is the 5th star!
- Two ways to get it:
  - Provide content over IPv6
  - Provide IPv6 access to users
- New t-shirt!!!

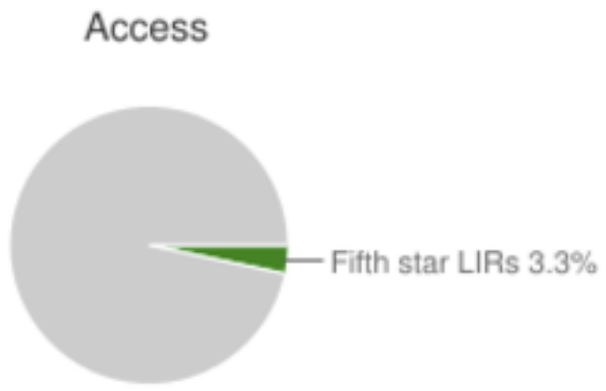


5th Star in Slovenia

Total number of LIRs registered to **Slovenia: 60**

LIRs qualifying for the fifth star

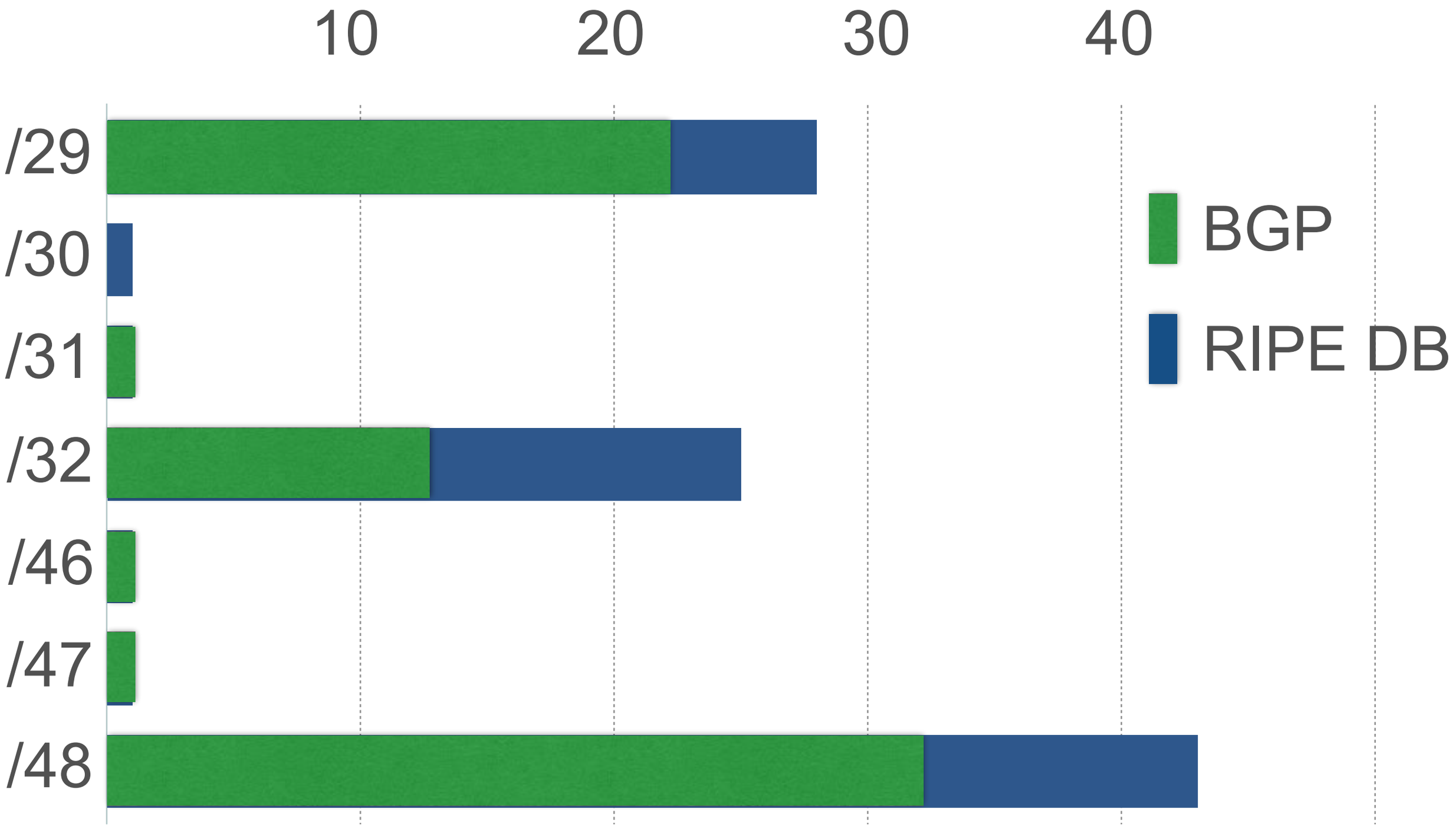




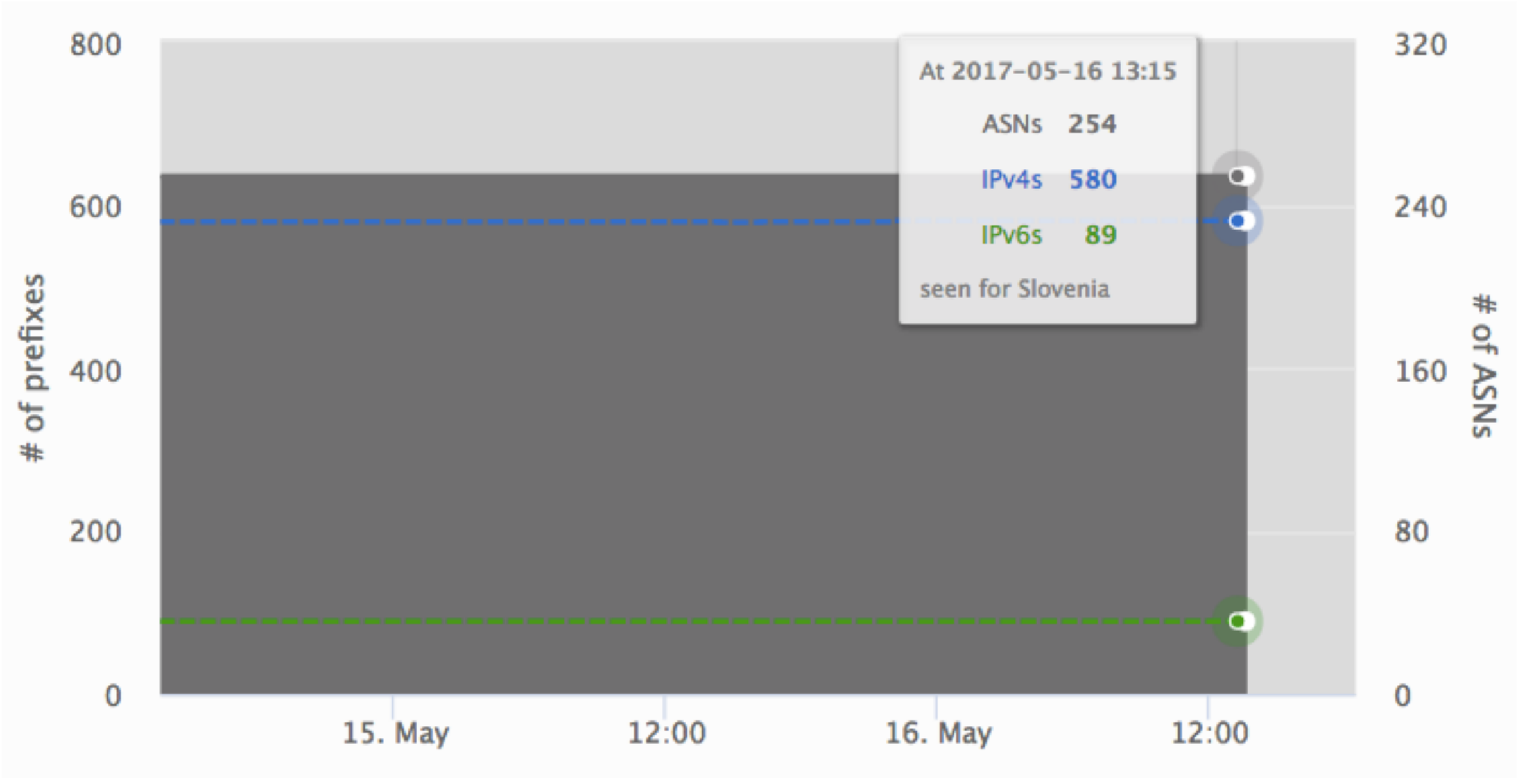
Listing of LIRs qualifying for *all* five stars

Access (last 6 months)	Access (last month)	Content	LIR
		60.4 %	ARNES
37.5 %			Ixtlan Team d.o.o.
		100.0 %	RTV Slovenija
		42.9 %	SGN d.o.o.
		45.2 %	Telekom Slovenije d.d.
		100.0 %	Telekom Slovenije, d.d.
100.0 %	100.0 %	100.0 %	Univerza v Mariboru

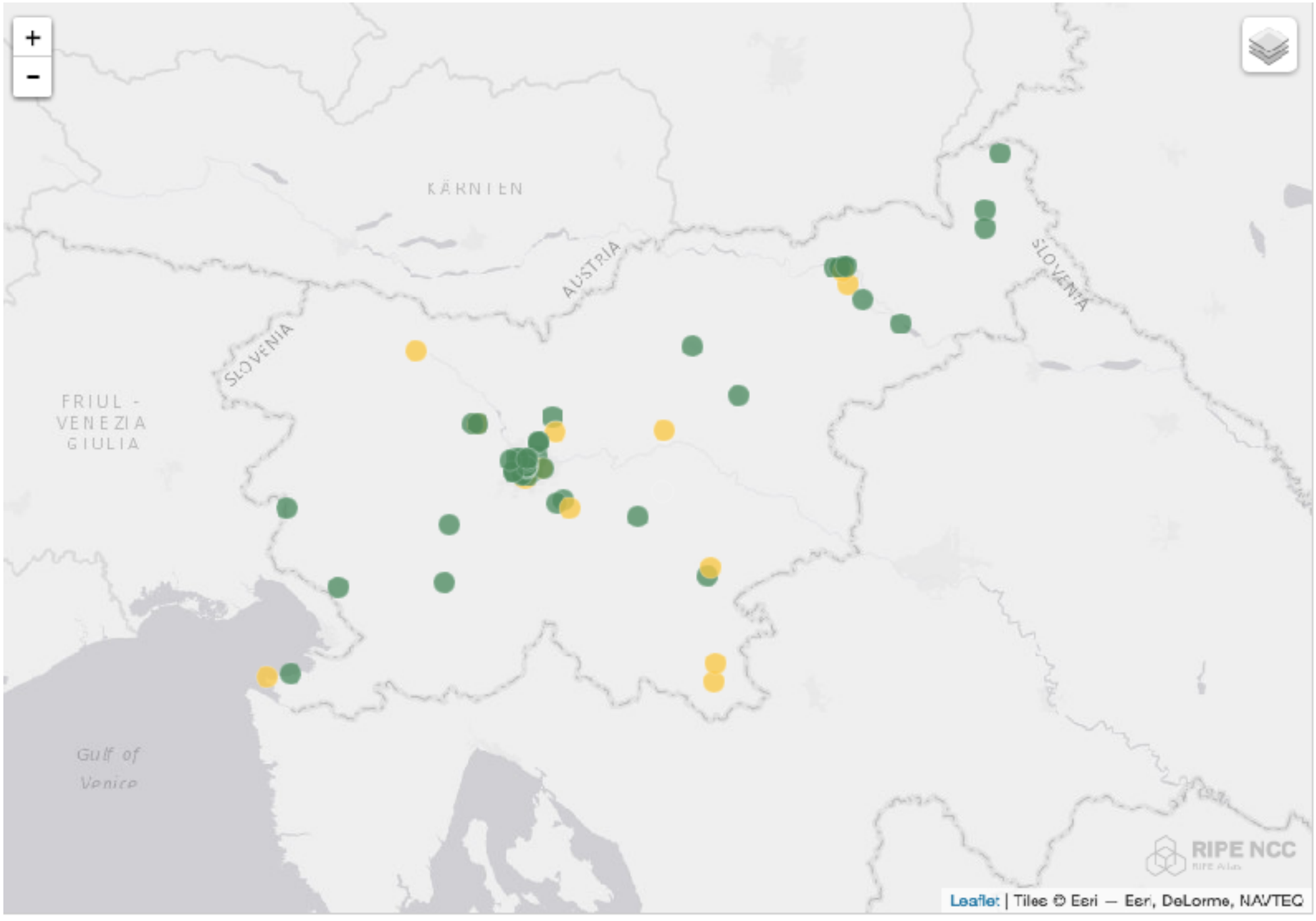
IPv6 Prefixes: RIPE DB vs BGP



IPv6 Prefixes Seen in BGP



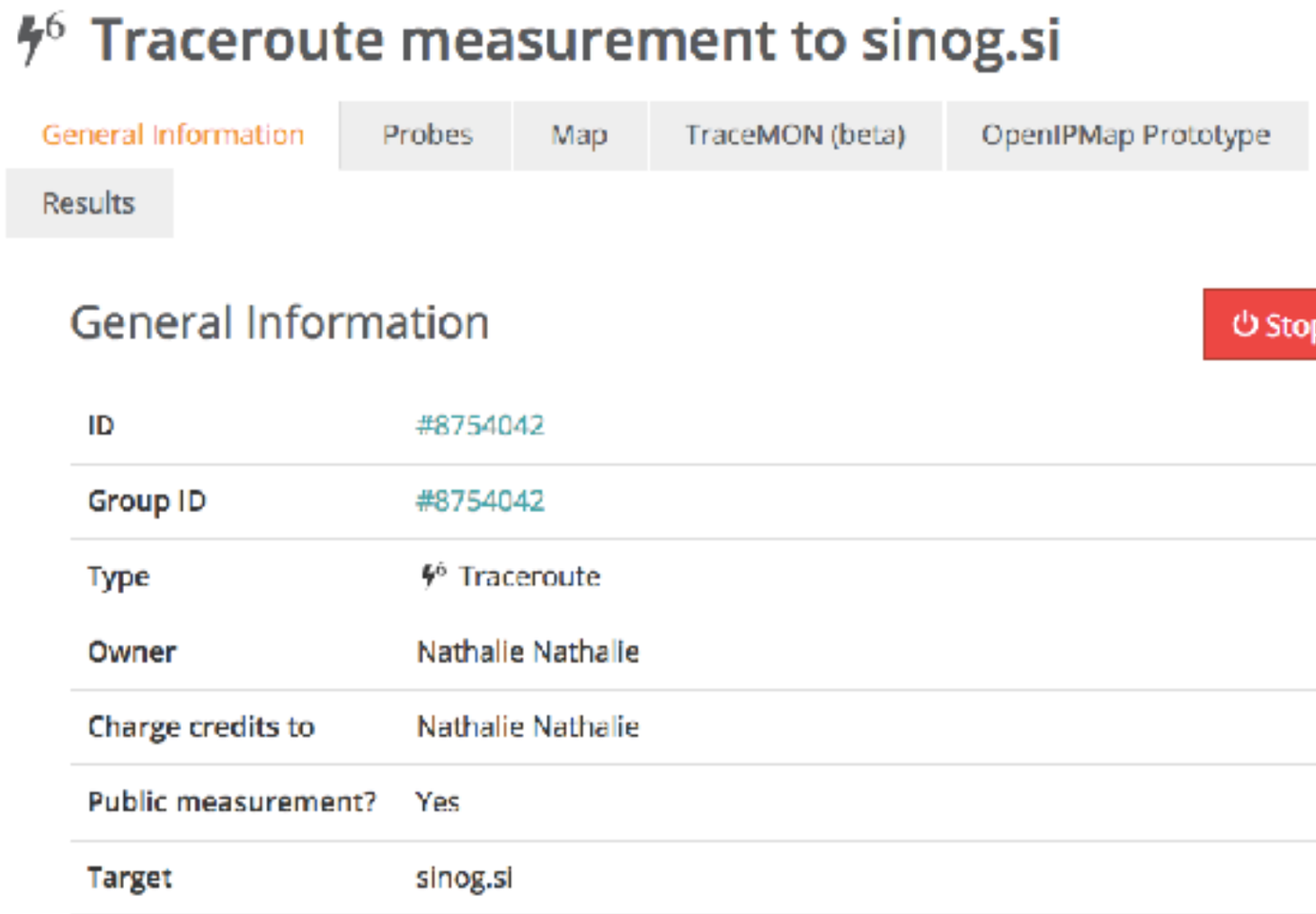
Atlas Probes in Slovenia



Connected: 49 Disconnected: 14 Abandoned: 20

Lets have some fun

- There are 28 active, IPv6 capable probes in SI
- Make a traceroute to sinog.si
  - has working IPv6



Interesting fact (1)

- Slovenia is invading Austria?

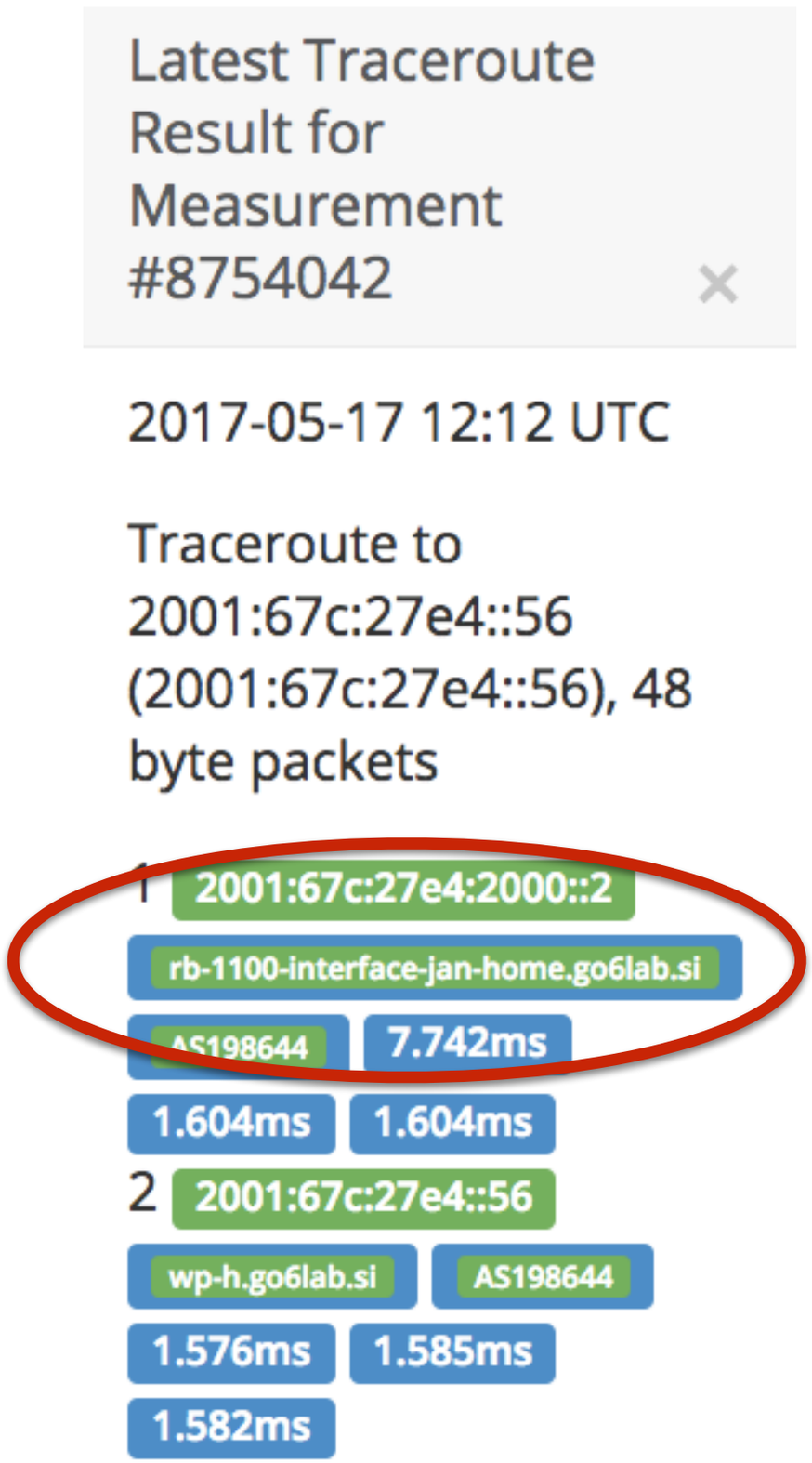
ID	#2067
Country	SI
Current Status	Connected (2017-05-12T01:45:53+02:00)
IPV4 ASN	5603
IPV6 ASN	5603
Time	2017-05-17T14:36:22+02:00
Latest Result	2017-05-17 12:12 UTC

Staying Local

Probe	ASN (IPv4)	ASN (IPv6)		Time (UTC)	RTT		Hops	Success
4029	34779	34779		2017-05-17 12:12	1510.711		1	✖
2695	198644	198644		2017-05-17 12:12	1.582		2	✔
18946	34779	34779		2017-05-17 12:12	2024.905		2	✖

Staying Local

It’s Jan’s home..



Is that….

28473	2107	2107		2017-05-17 12:12	1.984		7	✔
30012	12644			2017-05-17 12:12	43.728		7	✔
31055	199971	199971		2017-05-17 12:12	0.441		7	✖

….6to4?

2002::/16

Latest Traceroute Result for Measurement #8754042

2017-05-17 12:12 UTC

Traceroute to 2001:67c:27e4::56 (2001:67c:27e4::56), 48 byte packets

1 2002:d58f:4fe2:1:eade:27ff:fe6b:1db1 AS1103 5.639ms 0.505ms 0.468ms

2 * * *

3 * * *

4 * * *

5 * * *

6 * * *

255 2001:67c:27e4::56 wp-h.go6lab.si AS198644 43.077ms 43.728ms 43.903ms

A Comparison To IPv4

- Same measurement but with IPv4

	IPv4	IPv6
# of probes	44	28
Average hops	7,6	6,9
Average RTT	5,3	9,9

RTT in IPv6

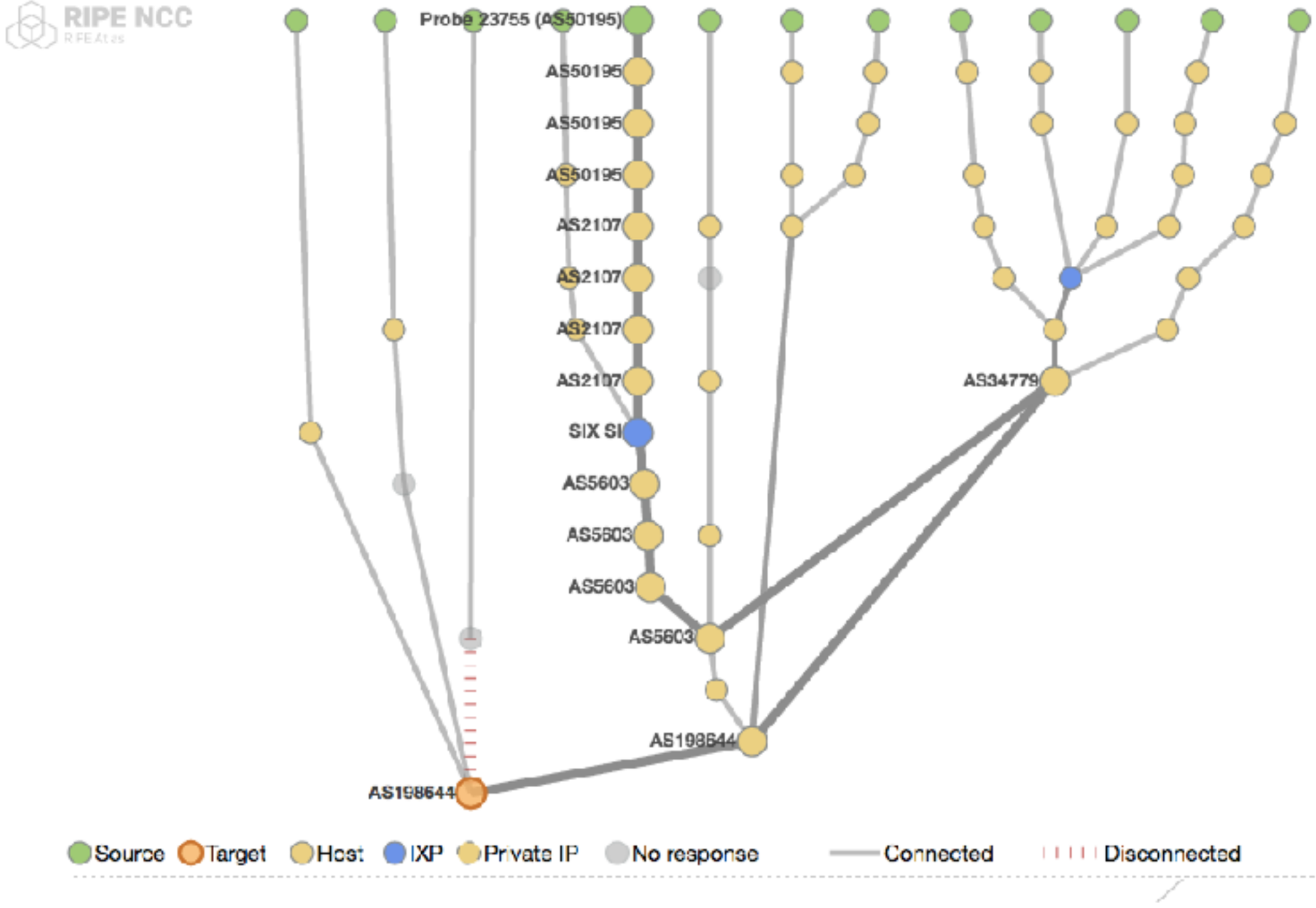
- There are 4 probes with relatively high RTT

10124	5603	5603		2017-05-17 12:12	13.307	8	✔
2067	5603	5603		2017-05-17 12:12	22.604	8	✔
25436	8591	8591		2017-05-17 12:12	27.153	8	✔
30012	12644			2017-05-17 12:12	43.728	7	✔

- 2 in the same ASN
- In the first 3, the problem is in the first hop
- The last one….well…6to4 ;)

Interesting fact (2)

- 2 probes do something funky…



RIPE Atlas IXP Country Jedi

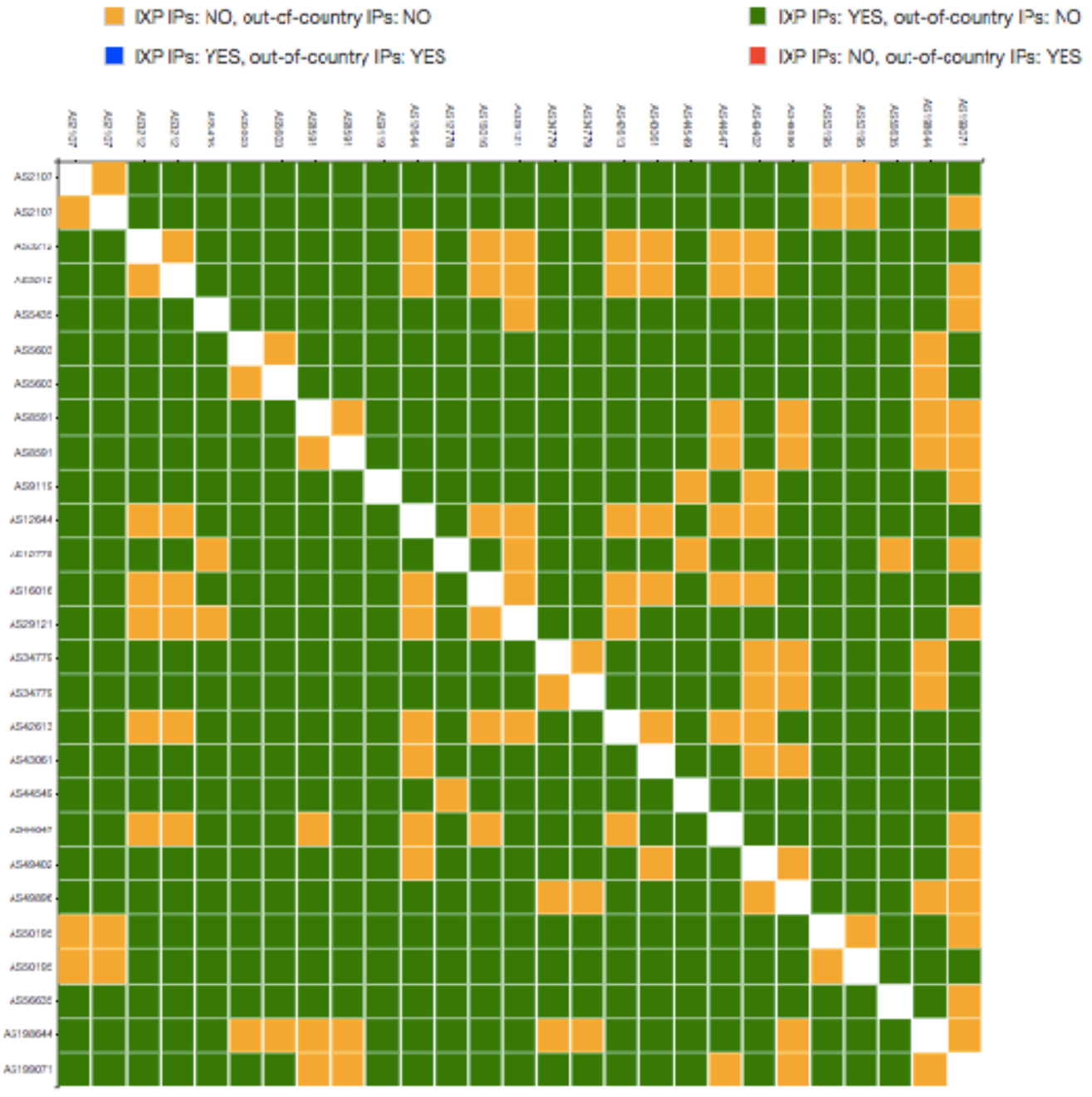
- Are paths between ASes staying in country?
- Any difference between IPv4 and IPv6?
- How many paths go via local IXP?
- Could adding peers improve reachability?

- Experimental tool
  - Feature requests welcome!
  - Depends on probe distribution in country

Methodology

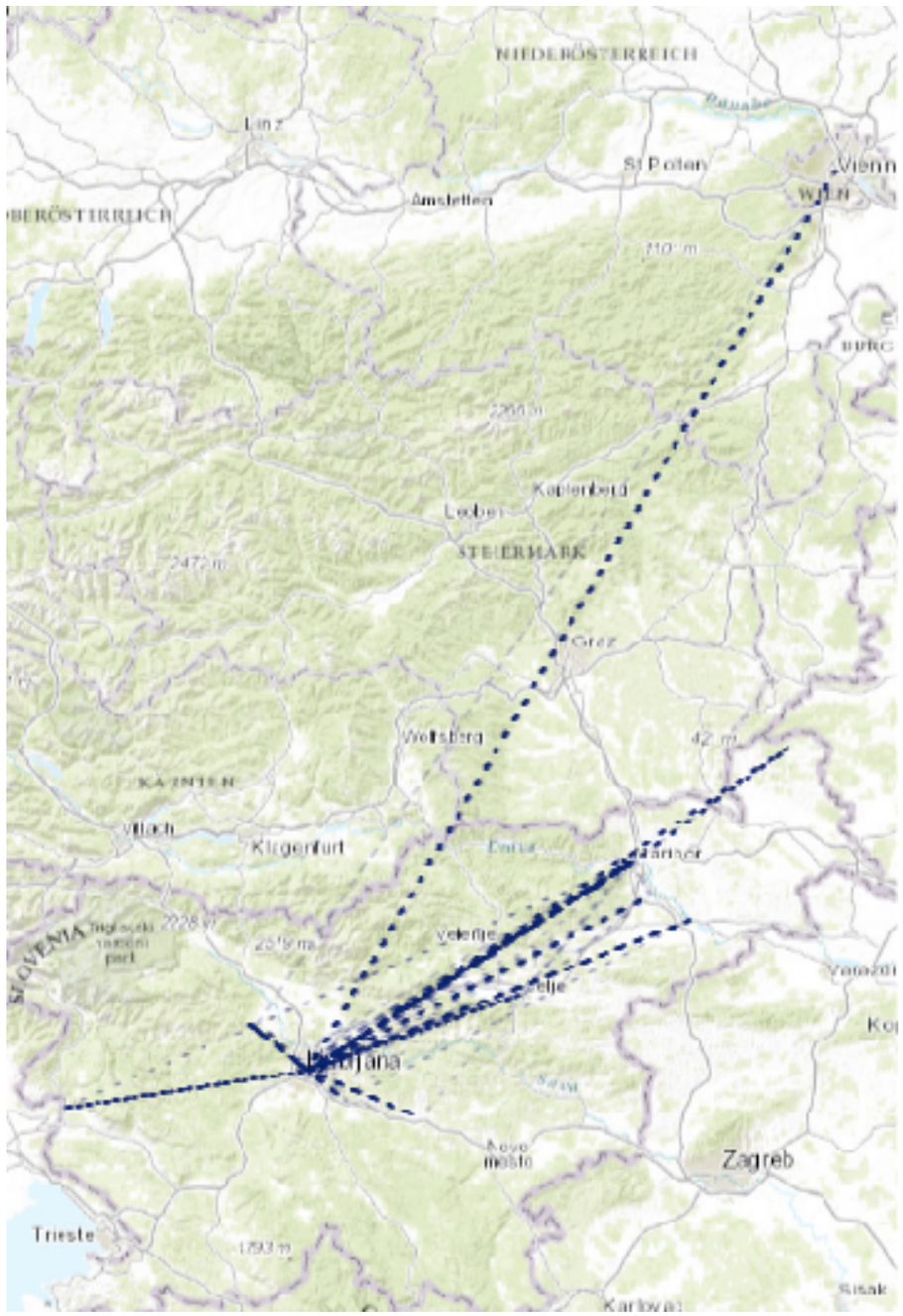
- Trace route mesh between RIPE Atlas probes
- Identifying ASNs in country using RIPEstat
  - Using a maximum of two probes per AS
- Identifying IXP and IXP LANs in PeeringDB

Output for SI (v4)



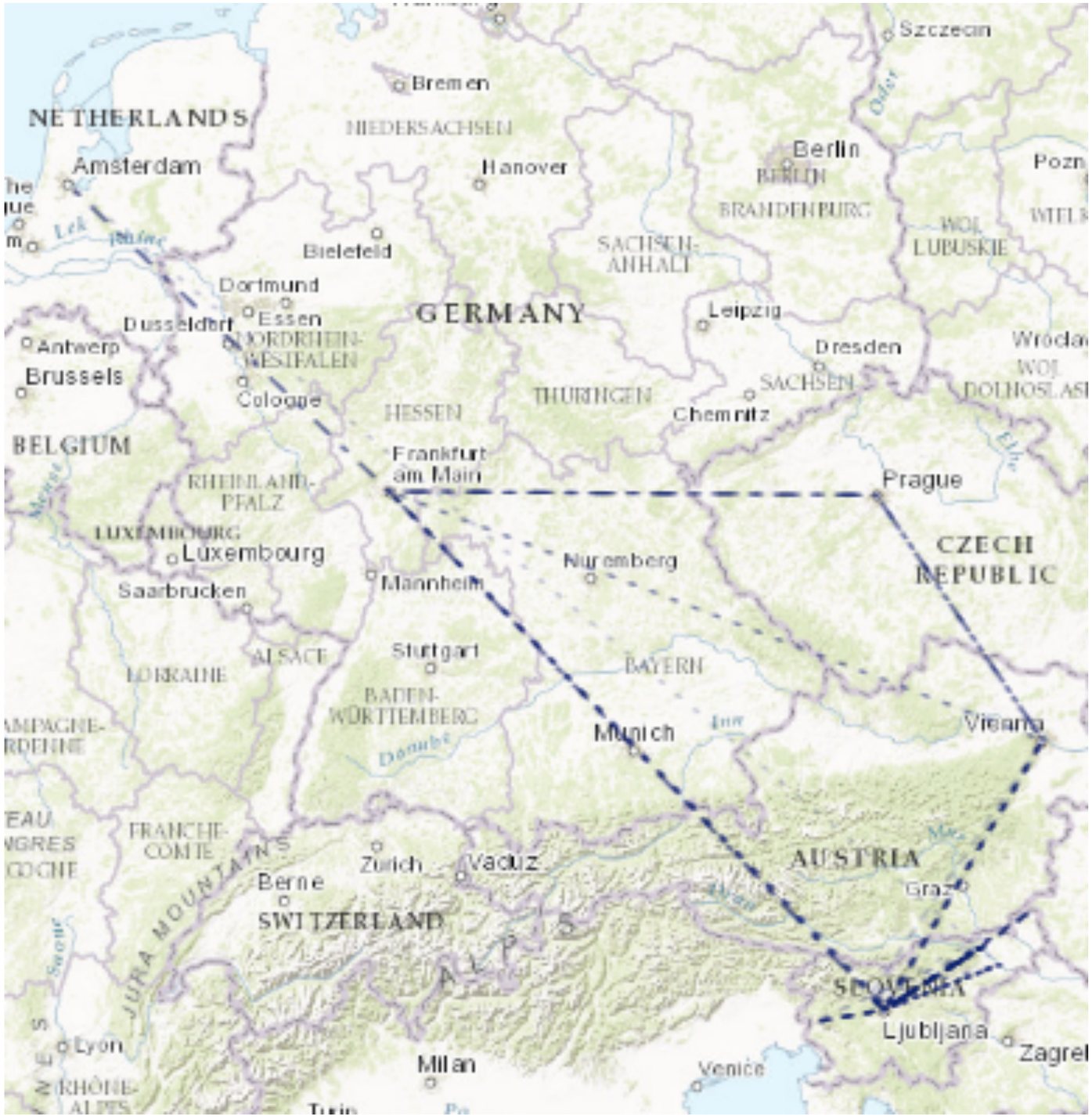
http://sg-pub.ripe.net/emile/ixp-country-jedi/latest/SI/ixpcountry/index.html

IXP Country Jedi (v4)



http://sg-pub.ripe.net/emile/ixp-country-jedi/latest/SI/geopath/index.html

IXP Country Jedi (v6)



A Comparison

- There are 11 probes that have both IPv4 and IPv6 and have the same origin AS for IPv4 and IPv6
- IPv4: 172 unique AS paths
  - 153 via SIX-SI (89%)
- IPv6: 80 unique AS paths
  - 63 via SIX-SI (79%)
  - 2 unique paths via Hurricane Electric (2,5%)
  - 3 unique paths via DE-CIX (3,75%)

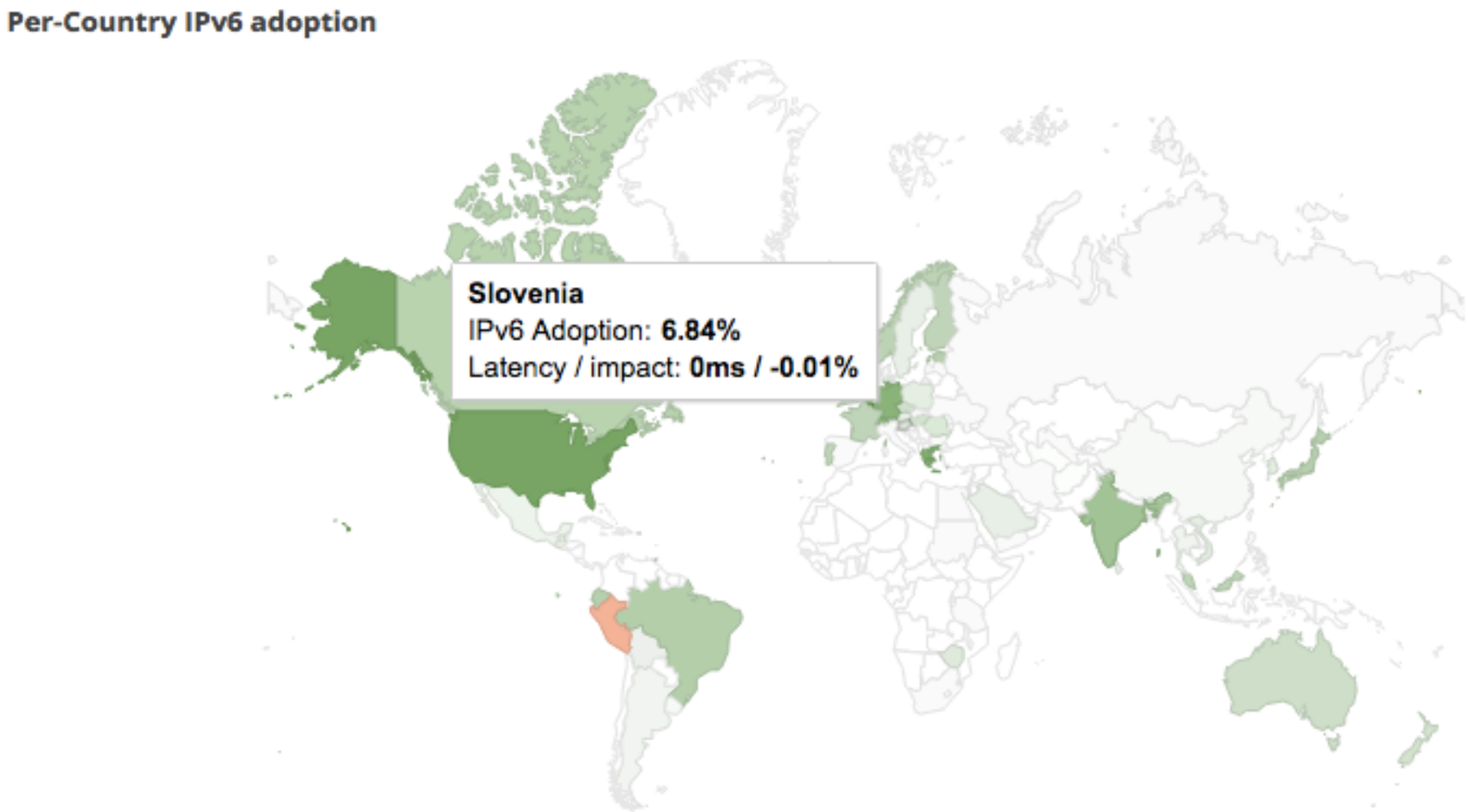
Out-of-Country Traffic

- The paths to HE and DE-CIX come from AS199071 (Prunk)
- All other local traffic stays local, both for IPv4 and IPv6

Conclusions

- 95% of our Slovenian members have IPv6 allocations
- Most local IPv6 traffic stays local
- A few Atlas Probes have broken IPv6 on the router
- A 6to4 tunnel causes slower RTT
- Next step: IPv6 content and users!
  - And if your LIR has 5 stars, get the T-shirt

IPv6 Adoption Seen By Google



Questions

nathalie@ripe.net

christian.teuschel@ripe.net / @cteuschel