



RIPE NCC
RIPE NETWORK COORDINATION CENTRE

IXP-Country-Jedi & OpenIPmap New tools built on top of RIPE Atlas

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Research and Development
RIPE NCC

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IXP-Country-Jedi

Peer-to-Peer Fabric

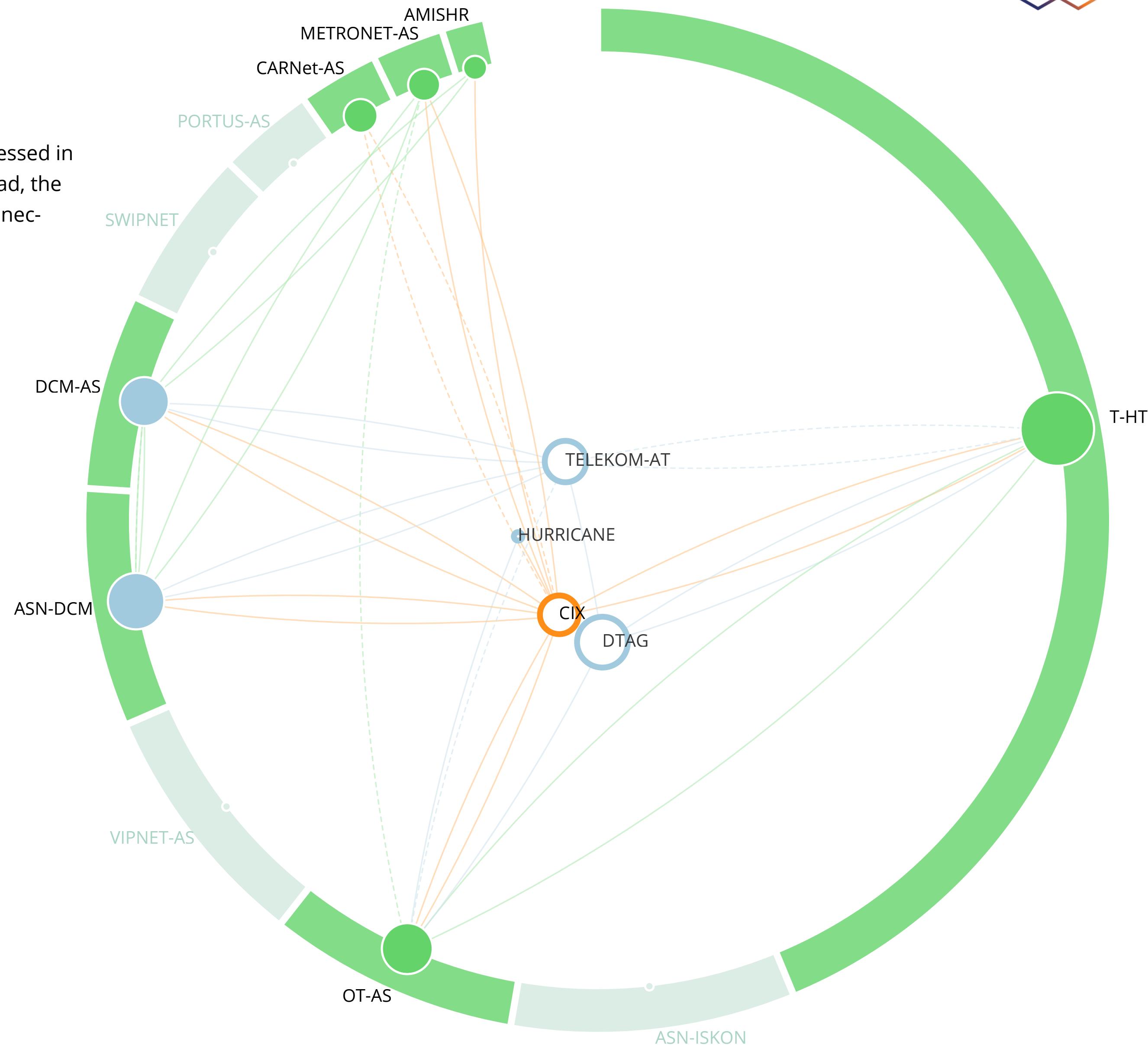
Sketches of the Peer-to-Peer Fabric of a Country



The quality of end-user connections are often expressed in download speeds towards content providers. Instead, the sketches presented here focus on peer-to-peer connections in a country.

The sketches explore the different ways in which end-users are interconnected within the same country: the peer-to-peer fabric. Each sketch represents a snapshot of this fabric at a single given point in time. They try to put a number on the amount of different ways the networks interconnect their users.

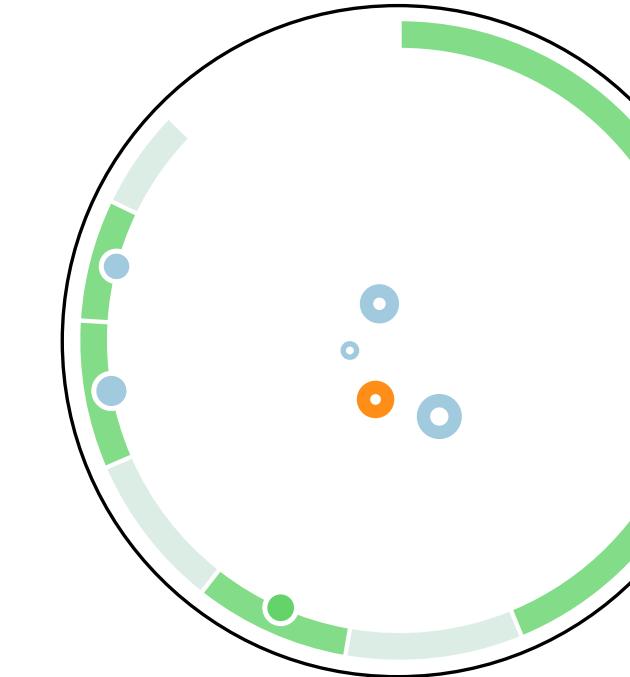
These sketches are created with active measurements from the RIPE Atlas measurement platform, datasets from RIPEstat, AS-to-ORG datasets from CAIDA and a dataset from APNIC that estimates the percentage of end-users in each network.



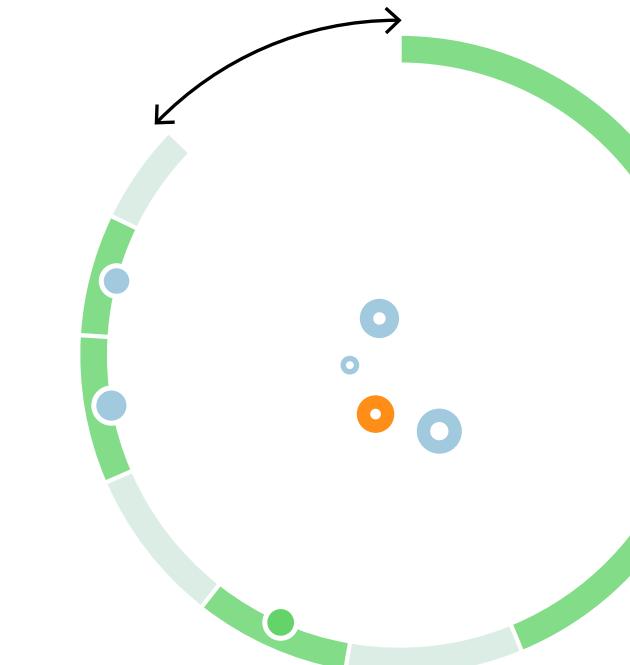
Sketches of the Peer-to-Peer Fabric of a Country



The full circle represents 100% of the end-users in a country.



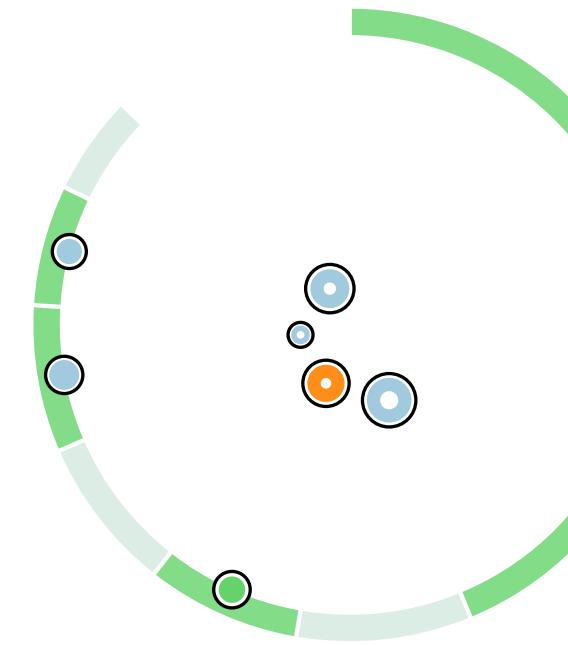
The open part of the circle represents the sum of all ASes that provide connectivity to less than 1% of the end-users in a country.



Each network that provides connectivity to more than 1% of the end-users is represented by a colored circle segment. The length of the arc of the segment represents the percentage of the end-users in a country.

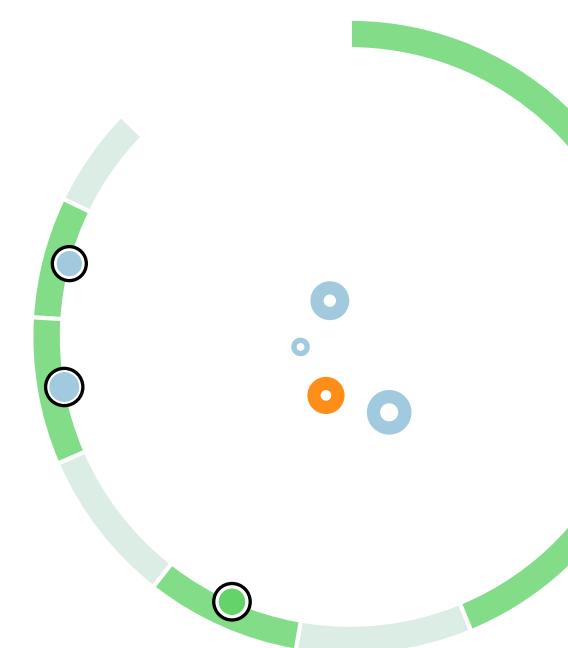
The darker green denotes a network for which we have peer-to-peer data. The lighter green color denotes networks for which we don't have peer-to-peer data.

Sketches of the Peer-to-Peer Fabric of a Country



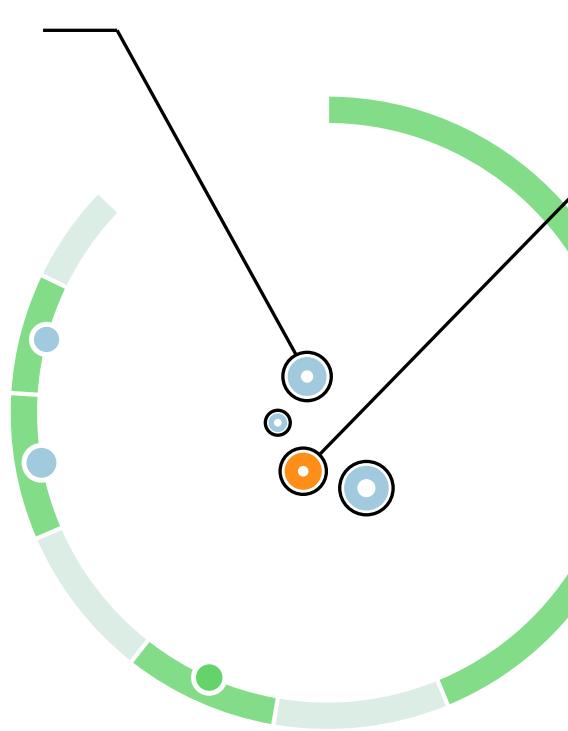
Each ring or circle represents the percentage of the peer-to-peer fabric in a country that passes through this point.

The color of the circle or ring denotes the type of location.



A blue circle on the outer ring represents a network that both serves end-users and provides transit to other end-user networks within the country.

A green circle on the outer ring represents a network that (mainly) serves end-users.



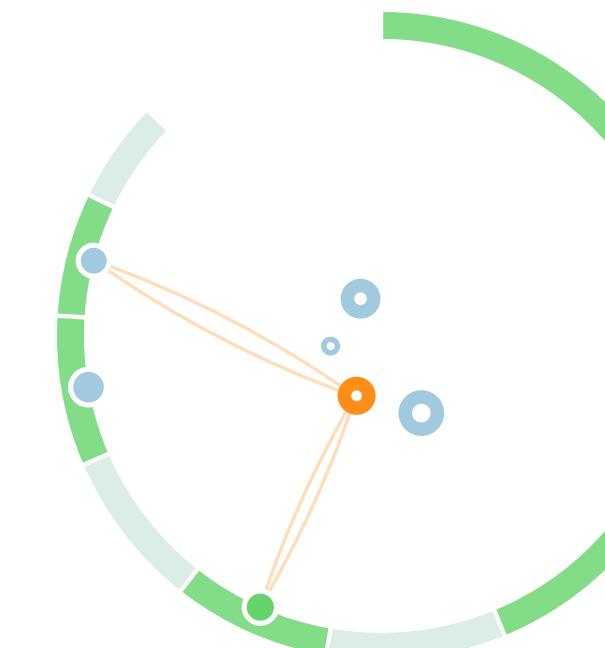
A blue circle in the interior indicates a transit network or an IXP that is external to this country.

An orange circle in the interior indicates an IXP identified with this country.

Sketches of the Peer-to-Peer Fabric of a Country



Orange lines indicate that two end-user networks are connected through an IXP.



Blue lines indicate two end-user networks are connected through a transit network.



Green lines indicate that two end-user networks are directly connected.



Dotted lines of any color indicate that we cannot fully map this path.

Peer-to-Peer Fabric

country

France

snapshot date

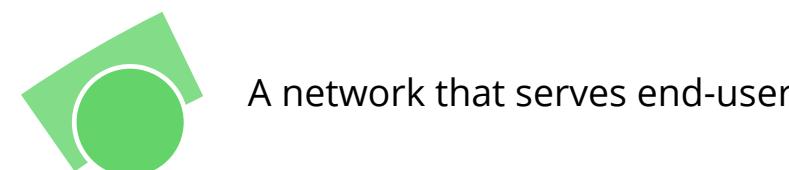
1 March 2018

github

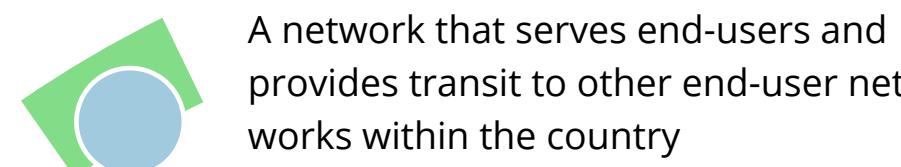
<https://github.com/emileaben/ixp-country-jedi/>

url

<http://sg-pub.ripe.net/ixp-country-jedi/fr/2018/03/01>



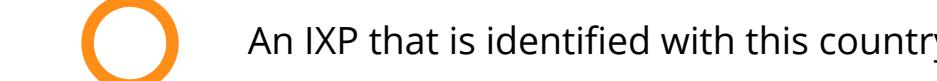
A network that serves end-users



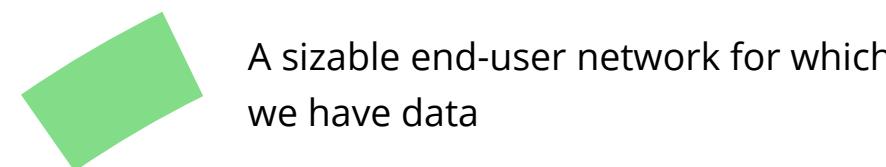
A network that serves end-users and provides transit to other end-user networks within the country



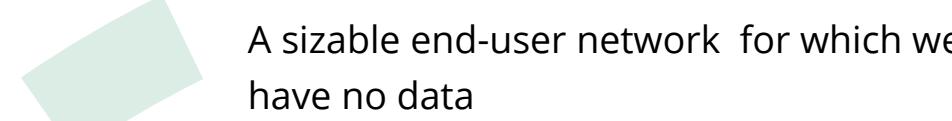
A transit network or an IXP external to this country



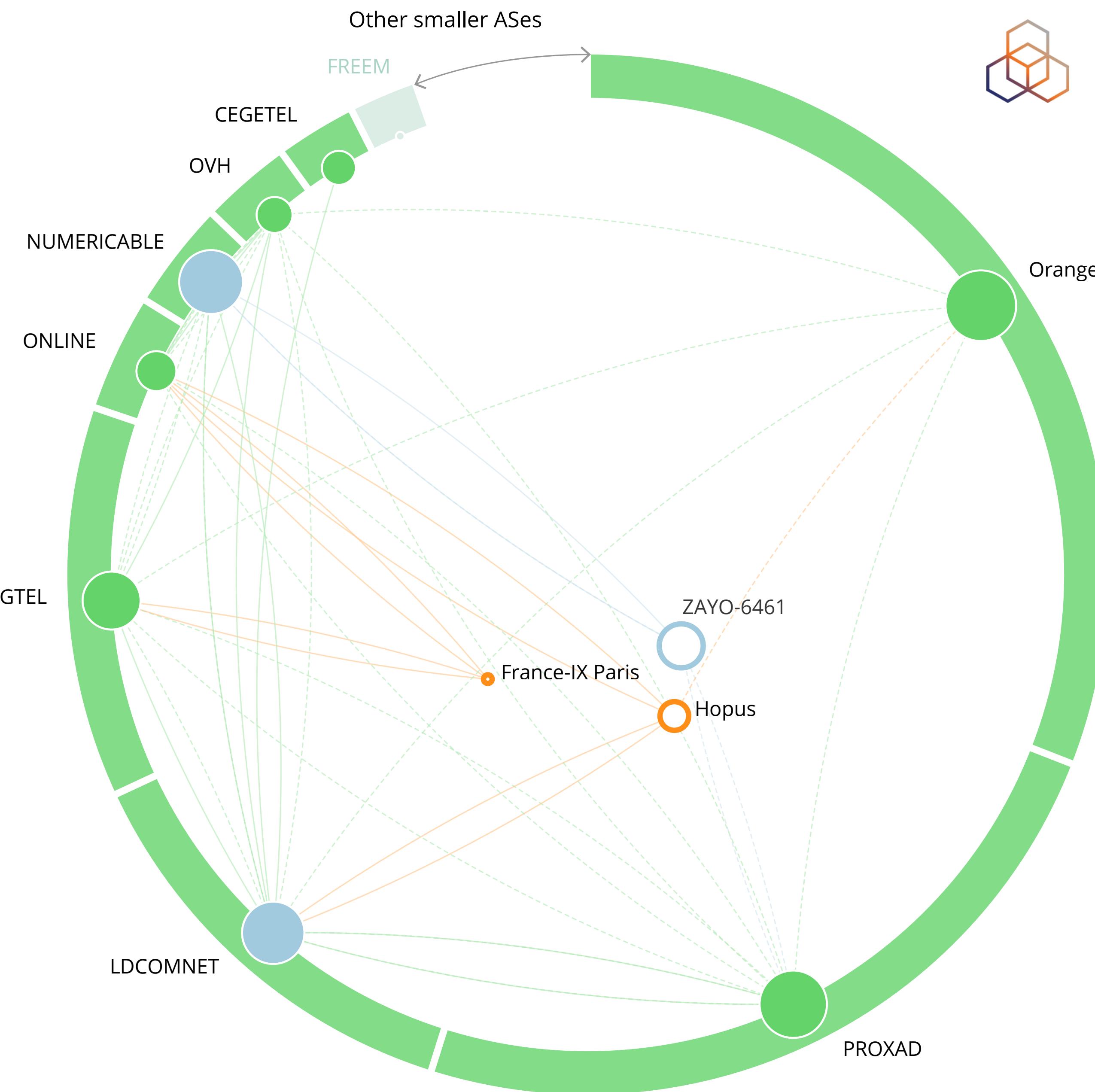
An IXP that is identified with this country



A sizable end-user network for which we have data



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



Peer-to-Peer Fabric



country

Southern Korea

snapshot date

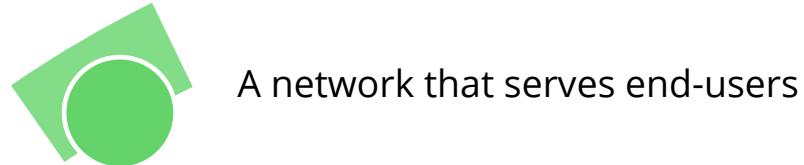
1 March 2018

github

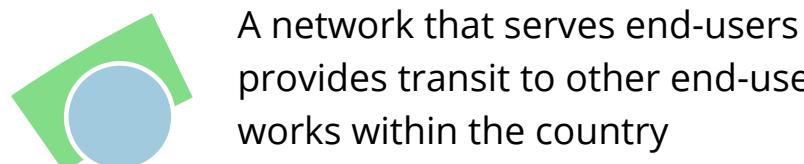
<https://github.com/emileaben/ixp-country-jedi/>

url

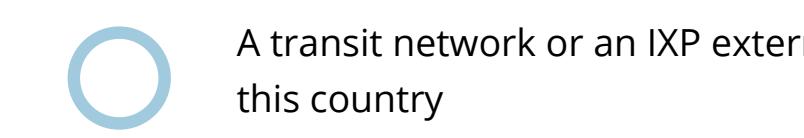
<http://sg-pub.ripe.net/ixp-country-jedi/dk/2018/03/01>



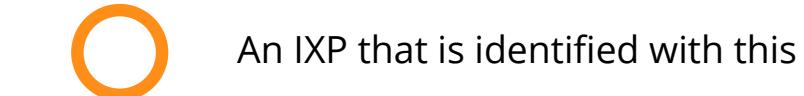
A network that serves end-users



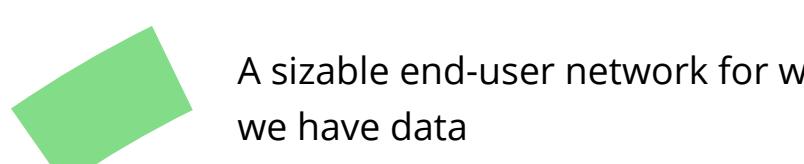
A network that serves end-users and provides transit to other end-user networks within the country



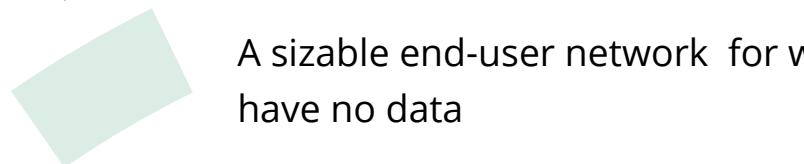
A transit network or an IXP external to this country



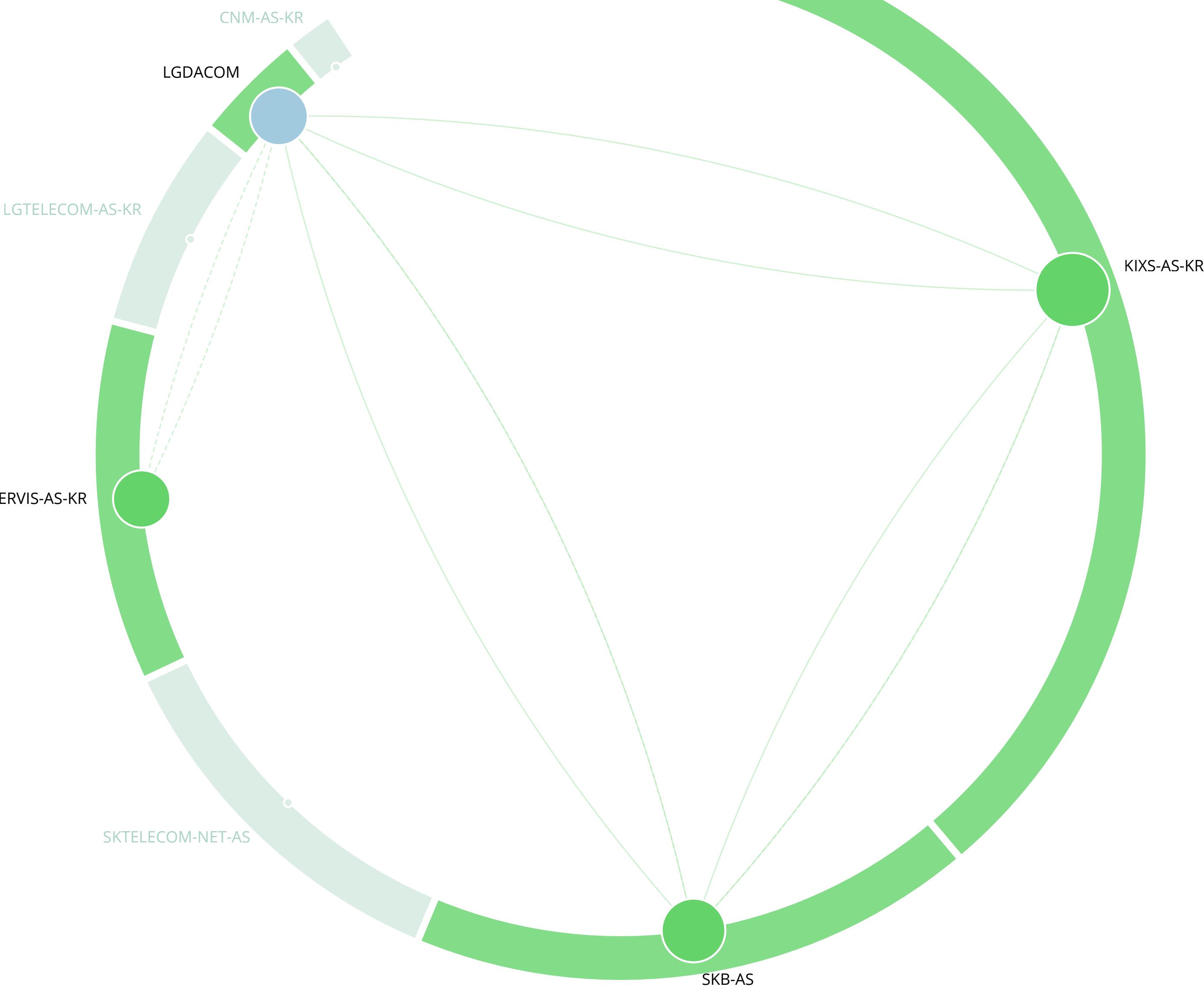
An IXP that is identified with this country



A sizable end-user network for which we have data



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



Peer-to-Peer Fabric



country

Ireland

snapshot date

1 March 2018

github

<https://github.com/emileaben/ixp-country-jedi/>

url

<http://sg-pub.ripe.net/ixp-country-jedi/dk/2018/03/01>



A network that serves end-users



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



A transit network or an IXP external to this country



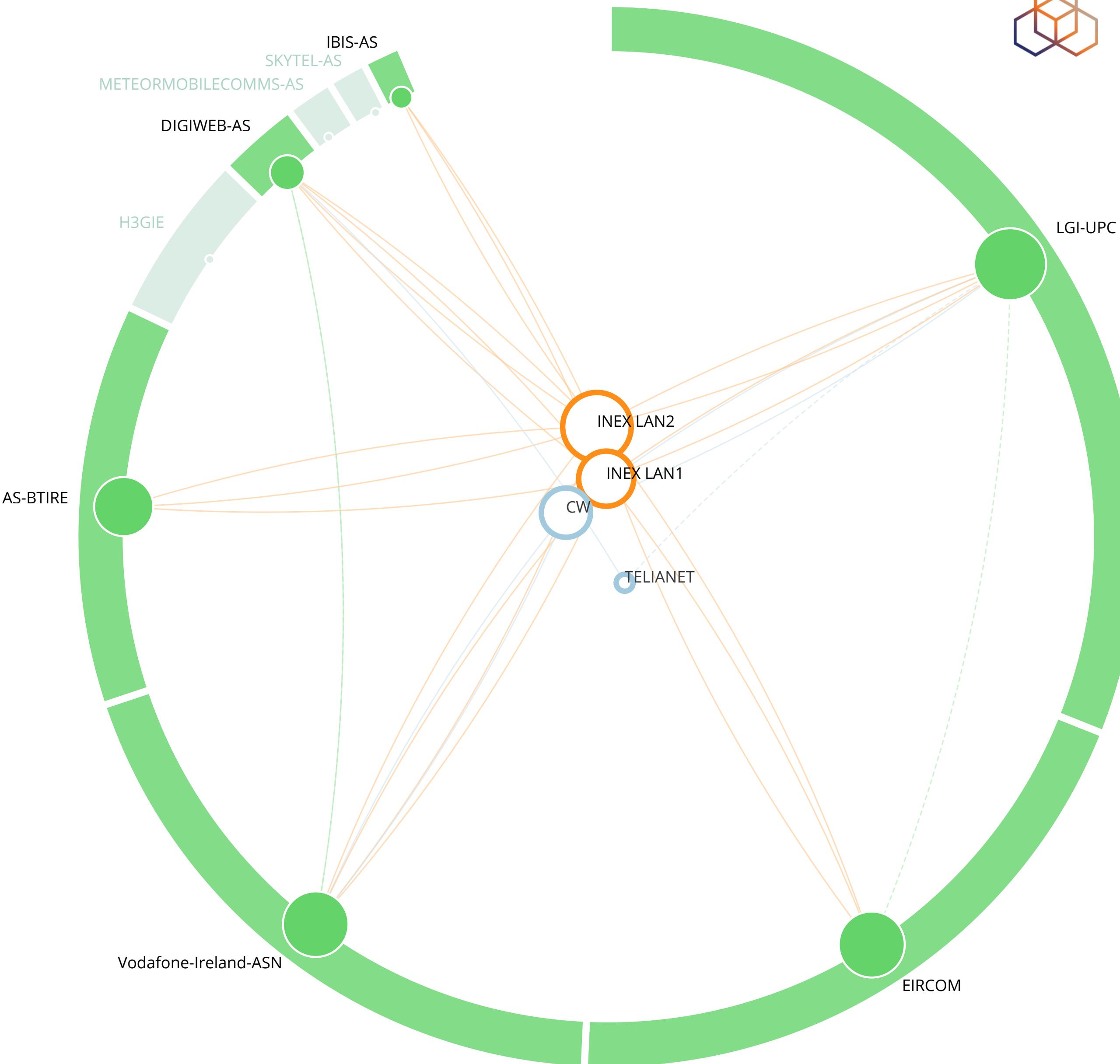
An IXP that is identified with this country



A sizable end-user network for which we have data



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



Peer-to-Peer Fabric



country

USA

snapshot date

1 March 2018

github

<https://github.com/emileaben/ixp-country-jedi>

url

<http://sg-pub.ripe.net/ixp-country-jedi/dk/2018/03/0>



A network that serves end-users



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



A transit network or an IXP external to
this country

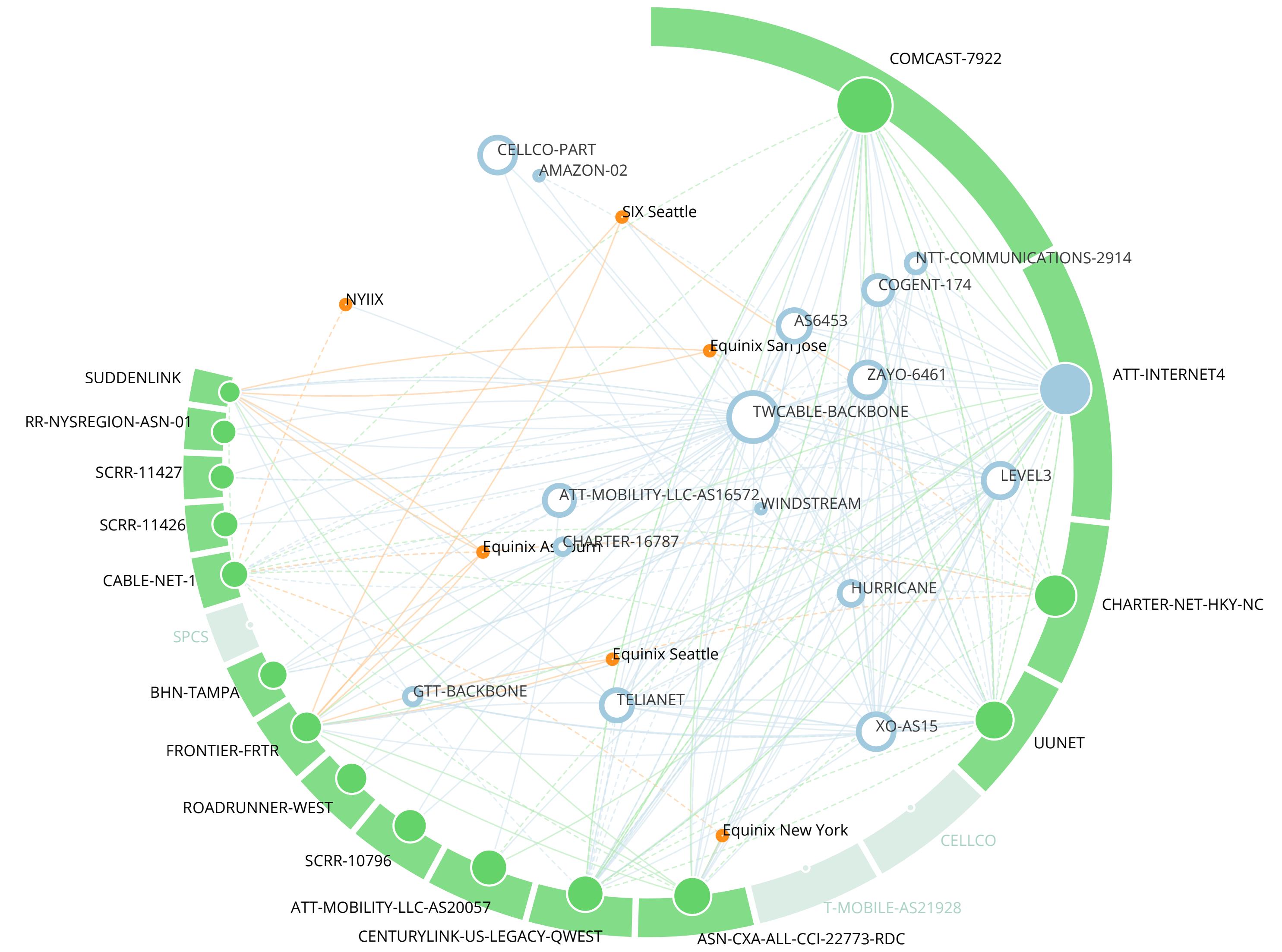


An IXP that is identified with this country



A sizable end-user network for which we have data

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





OpenIPmap

geolocating core internet infrastructure



Why Geolocation of infra-structure?

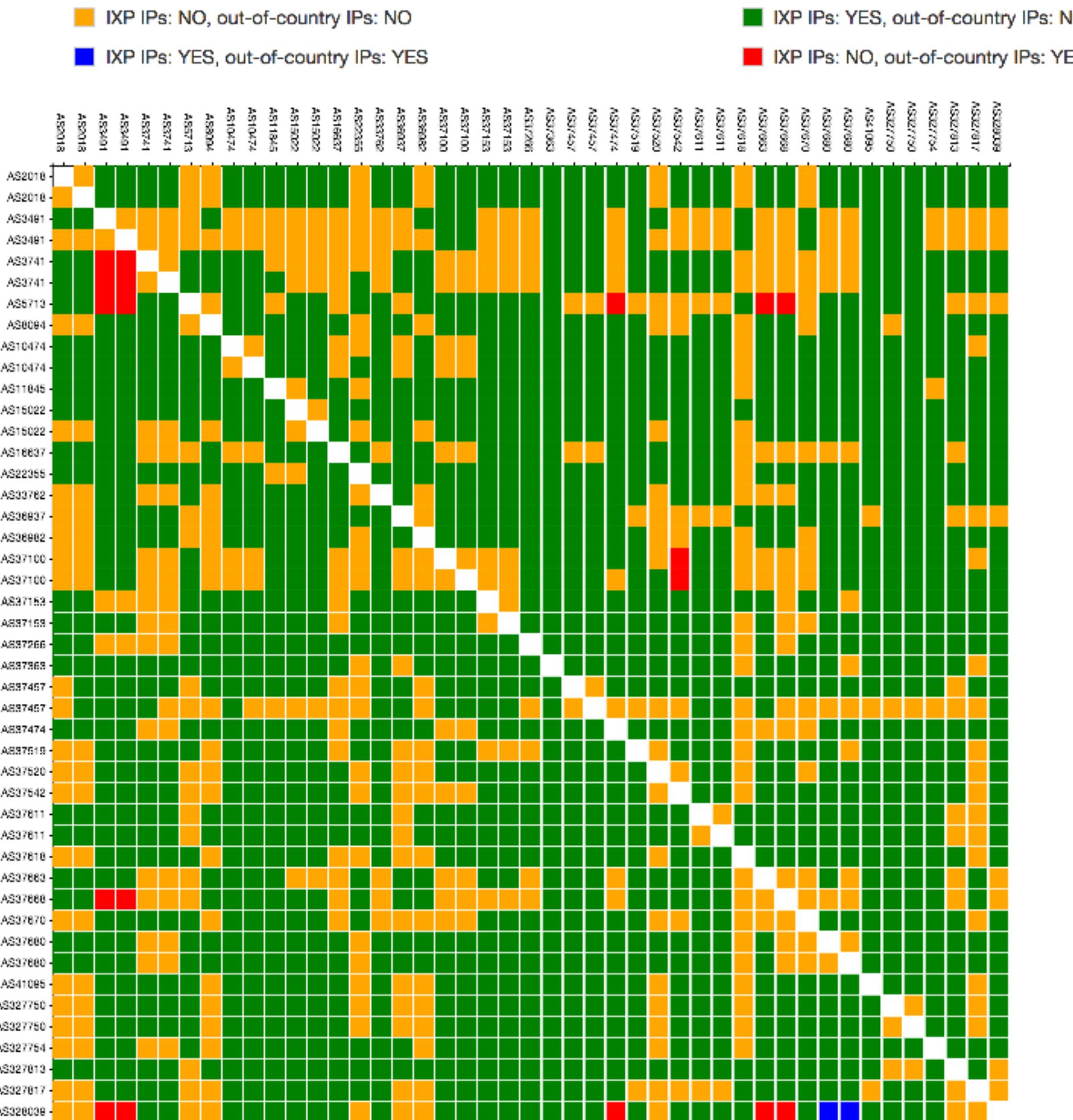
Why?



Analyse & Optimise Paths



Analyse Paths



Why?



Coherence of Geo Information

Geolocation in the RIPE Database



“Please be aware that this information may not be picked up by geolocation providers.”

...

“Please be aware that geolocation information is added by the resource holders in the RIPE Database and the RIPE NCC does not verify this information.”



The problem of Geolocation



Geolocation is hard

Different Research Approaches



- Triangulation a.k.a. trilateration
- Reverse DNS based location inference
- ‘Administrative’ analyses
- Verification/falsification procedures

Commercial Offerings



- Tend to concentrate on end user IP Addresses
- Opaque Methodology
- IPv6 address space largely ignored



Our Integration Attempt

inference engines and crowdsourcing



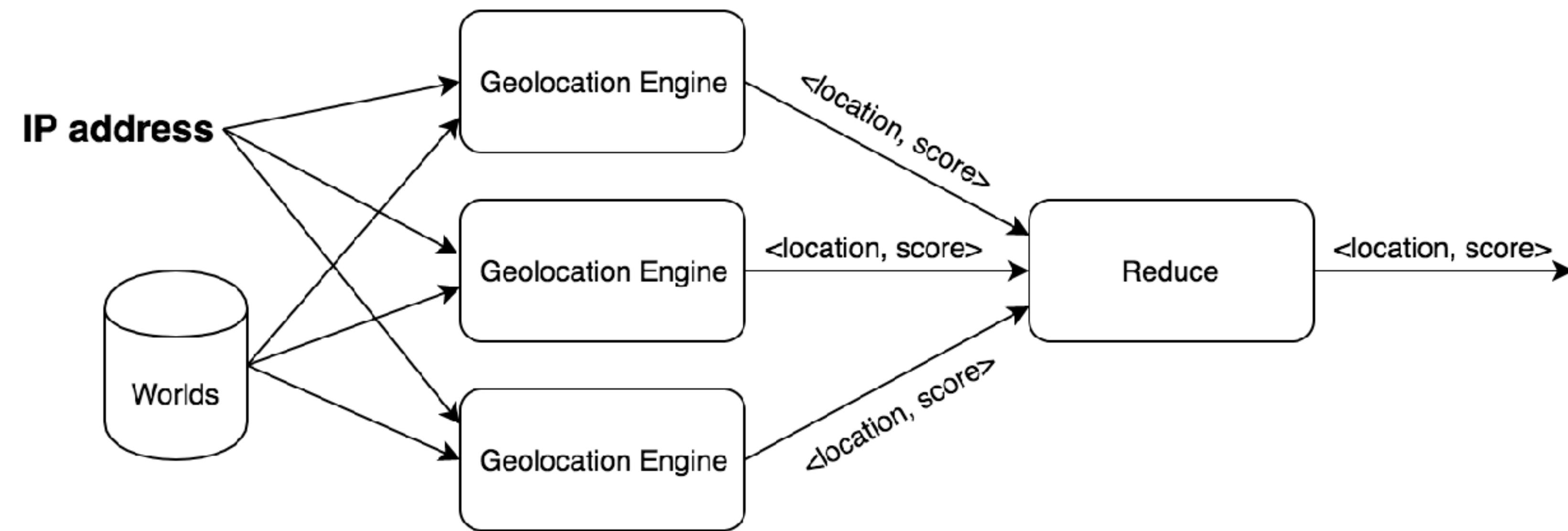
Accumulate Research Efforts as Inference Engines

Inference Engines



- Each of them is applicable only in some cases
- Each of them has a score factor
- Complete transparency about the inference methodology

Inference Engines





geolocation API

<https://openipmap.ripe.net>

```
[{"url": "/locate", "description": "Geolocation service. It provides geolocation according to a set of passive and active geolocation approaches"}, {"url": "/worlds", "description": "Worlds dataset, providing standard geolocation format to all other services"}, {"url": "/crowdsource", "description": "Geolocation service based on crowdsourced information."}, {"url": "/peeringdb", "description": "PeeringDB interface for geolocation purposes."}, {"url": "/triangulation", "description": "Active geolocation service based on latency triangulation."}, {"url": "/anycast", "description": "Anycast geolocation service based on active measurements"}]
```



openipmap.ripe.net/api/locate/ 83.163.50.165/best

```
▼ {
  ▼ "location": {
    "score": 145,
    "countryCodeAlpha3": "NLD",
    "countryCodeAlpha2": "NL",
    "cityPopulation": 147590,
    "stateAnsiCode": "07",
    "pointGeometry": "0101000020E61000005C72DC291D8C12401B81785DBF304A40",
    "cityNameAscii": "Haarlem",
    "stateIsoCode": "NL-07",
    "countryName": "Netherlands",
    "stateName": "North Holland",
    "longitude": 4.63683,
    "geonameId": 2755003,
    "latitude": 52.38084,
    "cityName": "Haarlem",
    "type": "city",
    "id": "HAARLEM-NL-07-U173CX8KTBR196ECJF92"
  },
  ▼ "meta": {
    ▼ "distribution": {
      "version": "17.9.18.1"
    },
    ▼ "service": {
      "version": "0.0.1"
    },
    ▼ "request": {
      ▼ "params": {
        "ip": "83.163.50.165"
      },
      "query": {}
    }
  }
}
```

openipmap.ripe.net/api/locate/ 83.163.50.165/partials



```
▼ {
  ▼ "partials": [
    ▼ {
      "engine": "probeslocation",
      "description": "Probes location suggestor - based on user setting",
      "scoreFactor": 10,
      ▶ "locations": [ ... ] // 1 item
    },
    ▼ {
      "engine": "anycastparistech",
      "description": "Anycast engine - Paristech dataset",
      "scoreFactor": 10,
      "locations": []
    },
    ▼ {
      "engine": "crowdsourced",
      "description": "Crowdsourced engine",
      "scoreFactor": 9,
      "locations": []
    },
    ▼ {
      "engine": "triangulation",
      "description": "Triangulation engine (if empty try in 3 minutes, triangulation requires time)",
      "scoreFactor": 5,
      ▶ "locations": [ ... ] // 20 items
    }
  ],
  "meta": {
    ▼ "distribution": {
      "version": "17.9.18.1"
    },
    ▼ "service": {
      "version": "0.0.1"
    }
  }
}
```

/locate - Active geolocation



If the IP has not been measured yet, a new Ping measurement starts

- Peering DB data and BGP data are used to reduce the locations probed
- Score based on RTT, only RTT <10ms are considered
- PeeringDB facilities and population boost the score
- A list of possible locations will be returned
- We are working on it! (Contributions are welcome!)

let's geolocate 2001:1b48:2::b2



First step: get a set of ASes that are related to this IP address

AS8218

Prefix Overview (2001:1b48:2::b2)

Is visible in RIS

This prefix is part of 2001:1b48::/32 announced by

AS8218
NEO-ASN - Zayo France SAS

Resource	RIR	Country
2001:1b48::/29	RIPE NCC	FR

Show IANA Registry Information

Showing results for 2001:1b48::/32 as of 2018-03-15 08:00:00 UTC

Given resource is not announced but result has been aligned to first-level less-specific (2001:1b48::/32).

[source data](#) [embed code](#) [permalink](#) [info](#)

AS559, AS1126, ...

ASN Neighbours (AS8218)

- Left #: 49
- Right #: 1303
- Unique #: 1583
- Uncertain #: 1533

Show 10 entries Search:

ASN	Name	Type	Path Count	IP Version
AS559	-	right	1	v6 only
AS1126	-	right	1	v6 only
AS1248	-	uncertain	1	v6 only
AS1836	-	uncertain	61	v6 only
AS1836	-	uncertain	3	v6 only
AS2602	-	uncertain	1	v6 only
AS2613	-	right	1	v6 only
AS2613	-	uncertain	25	v6 only
AS2613	-	uncertain	1	v6 only
AS2854	-	right	5	v6 only

Showing 1 to 10 of 2,948 entries

Loading ASN names failed!

Showing results for AS8218 from 2018-03-15 00:00:00 UTC

Query time has been set to the latest available time (2018-03-15 00:00 UTC)

[source data](#) [embed code](#) [permalink](#) [info](#)

let's geolocate 2001:1b48:2::b2



Second step: get a set of geographic locations related with these ASes

AS8218

Public Peering Exchange Points			
Exchange ▾	ASN	IPv4	Speed
		IPv6	RS Peer
AMS-IX	8218	90.249.209.53	20G
		2001:7fb:1:a600:8218:2	
BNIX	8218	194.53.172.79	10G
		2001:7fb:26:a600:8218:1	
DE-CIX Frankfurt	8218	80.81.192.13	10G
		2001:7fb:201e:0:1	
DE-CIX Frankfurt	8218	80.81.193.13	10G
		2001:7fb:201e:0:2	
ESANIX Madrid Lower LAN	8218	193.149.1.110	10G
		2001:7fb:f:66	
Equinix Paris	Equinix IX - PA Metro	195.42.144.7	10G
		2001:7fb:43:8218:1	
France-IX Marseille	8218	37.49.232.7	10G
		2001:7fb:54:6:27	
France-IX Paris	8218	37.49.236.1	20G
		2001:7fb:54:c:1	
LONAP London	8218	5.67.80.210	10G
		2001:7fb:7:201d:1	
Lilix	8218	193.34.197.141	1G
		2001:7fb:17:14:1	
Lyonix	8218	77.95.71.60	10G
		2001:7fb:47:47:30	
NIX.CZ Public Peering VIAN	8218	91.210.16.227	1G
		2001:7fb:44:6:91	
NL-ix	8218	183.239.118.173	10G
		2001:7fb:13:a600:8218:1	
SwissIX Peering	8218	91.206.52.116	2G
		2001:7fb:24:7:4	
VIX	8218	183.239.1.46	10G

Private Peering Facilities		
Facility ▾	ASN	Country
		City
BCE Colocation Luxembourg	8218	Luxembourg
		Luxembourg
DATA4 Paris Maraussis	8218	France
		Maraussis
Equinix Paris Concorde (PA6) (formerly	8218	France

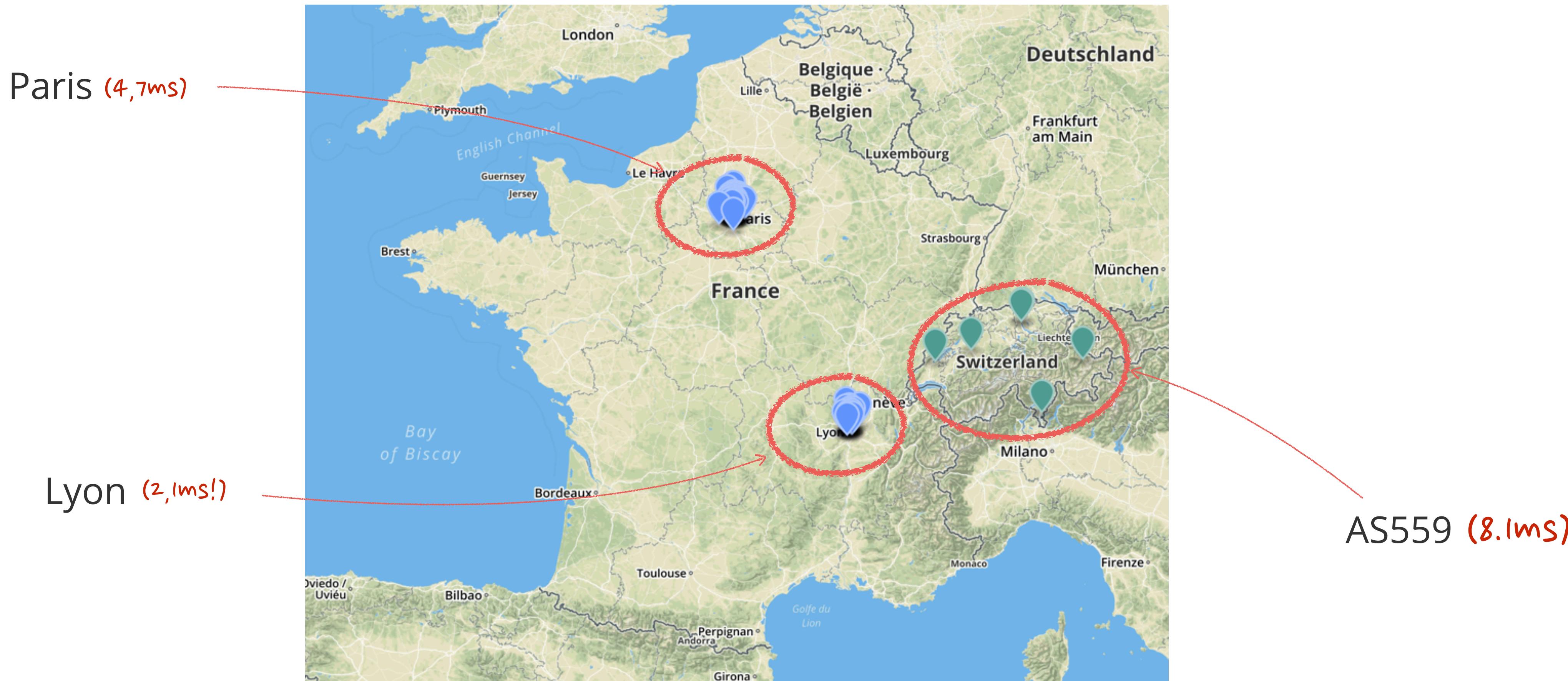
AS559, ...

Private Peering Facilities		
Facility ▾	ASN	Country
		City
CERN Geneva	559	Switzerland
		Geneva
Equinix Zurich (ZH1)	559	Switzerland
		Zurich
IWB Basel	559	Switzerland
		Basel

let's geolocate 2001:1b48:2::b2



Third step: run ping measurements on RIPE Atlas probes within these ASes and these locations.



let's geolocate 2001:1b48:2:3::b2



The screenshot shows the RIPE NCC OpenIPmap interface. At the top, there is a navigation bar with links for "Manage IPs and ASNs", "Analyse" (which is currently selected), "Participate", "Get Support", "Publications", and "About Us". A search bar at the top right contains the text "Search IP Address or ASN" and a magnifying glass icon. Below the navigation bar, the RIPE NCC logo is displayed. The main content area features a map of Europe with a red dot indicating the location of the IP address. A callout box on the left side of the map provides detailed information about the IP address:

- IP: 2001:1b48:2:3::b2
- Location: Lyon, FR-84 France
- IP LOCATION: 2001:1b48:2:3::b2
- City: Lyon, FR-84

At the bottom of the page, there is a dark footer bar with social media icons for Facebook, Twitter, LinkedIn, and YouTube, along with links to "Home", "Sitemap", "Contact Us", "Service Announcements", "Privacy Statement", "Legal", "Cookies", "Copyright Statement", and "Terms of Service".



Crowdsourcing with OpenIPmap

Web UI: put stuff on a map

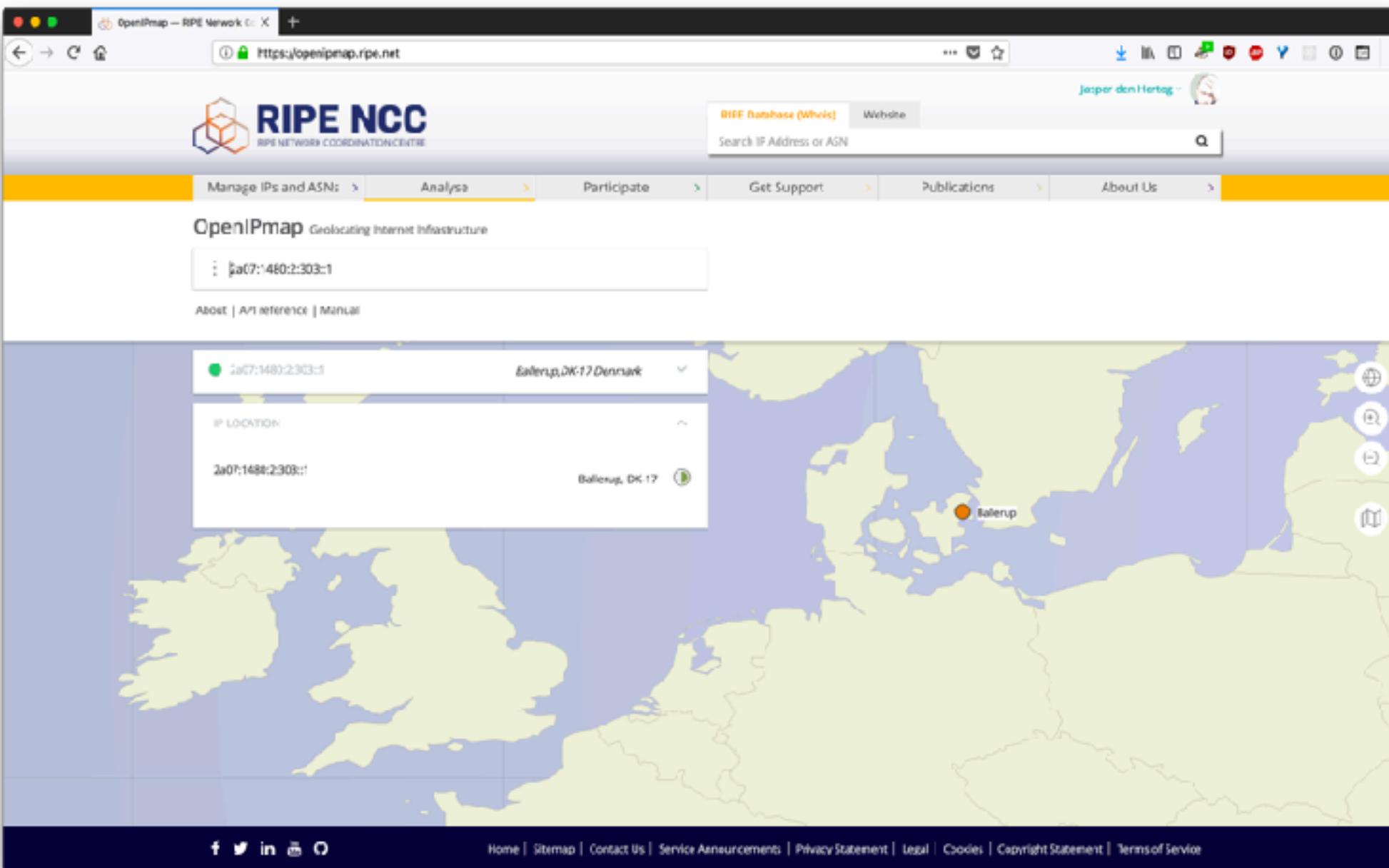


- Make sense of RTTs in one glimpse
- Understand network relationships among countries
- Verify geographical optimisation policies
- Crowdsource IP addresses to geolocation

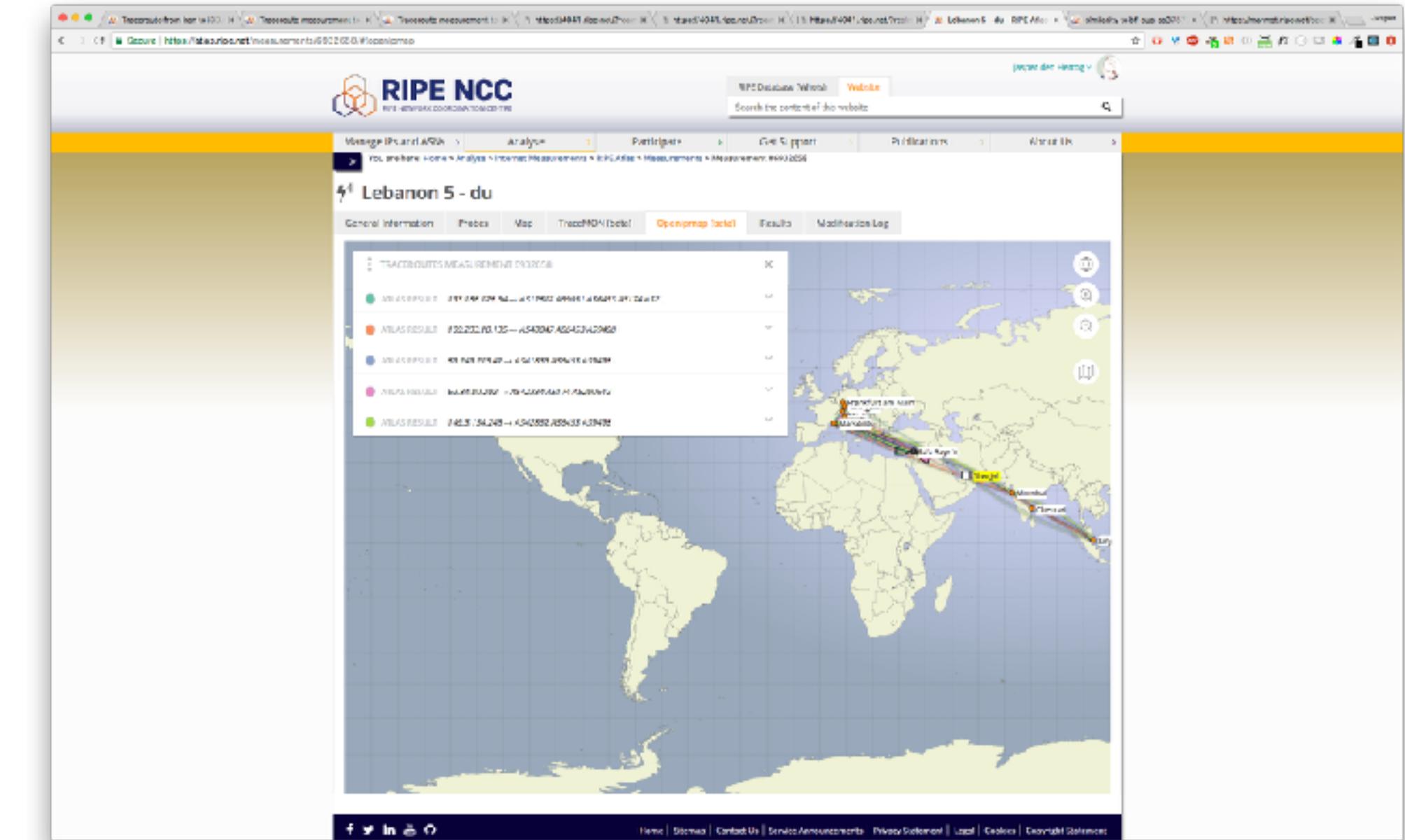
...actually we have two interfaces



<https://openipmap.ripe.net>



<https://atlas.ripe.net/measurements/<TRACEROUTEMSM>>



The first one we already saw...

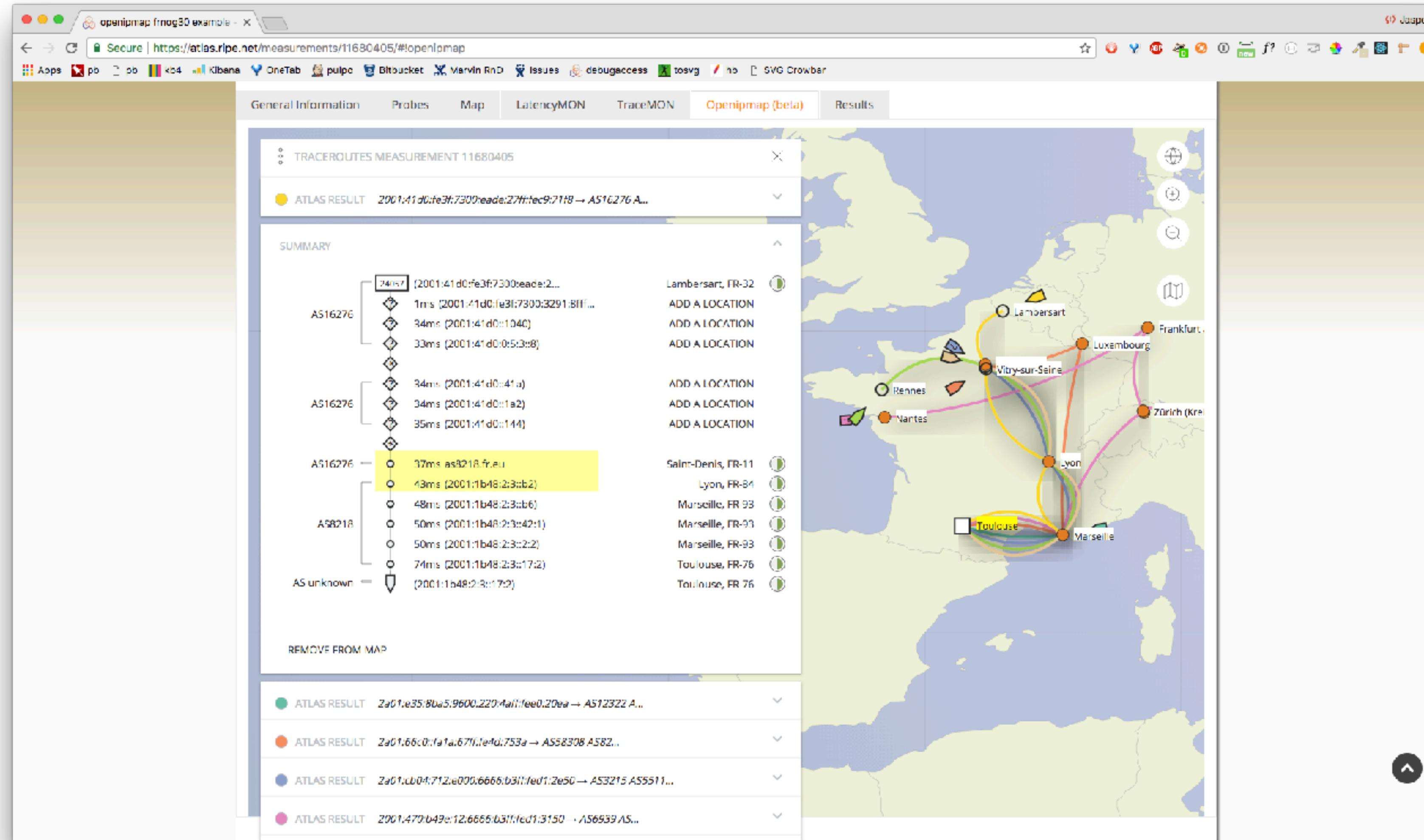


A screenshot of a web browser displaying the RIPE NCC OpenIPmap service. The URL in the address bar is <https://openipmap.ripe.net>. The page header includes the RIPE NCC logo and navigation links for RIPE Database (Whois), Website, Search IP Address or ASN, Manage IPs and ASNs, Analyse, Participate, Get Support, Publications, and About Us. The main content area is titled "OpenIPmap A Collaborative Approach to Mapping Internet Infrastructure" and shows the IP address "2001:1b48:23::b2" with its location "Lyon, FR-84 France". A map of Europe highlights Lyon, FR-84. A sidebar provides more details about the IP location. The footer contains social media links (Facebook, Twitter, LinkedIn) and legal links: Home, Sitemap, Contact Us, Service Announcements, Privacy Statement, Legal, Cookies, Copyright Statement, and Terms of Service.



The second shows traceroutes

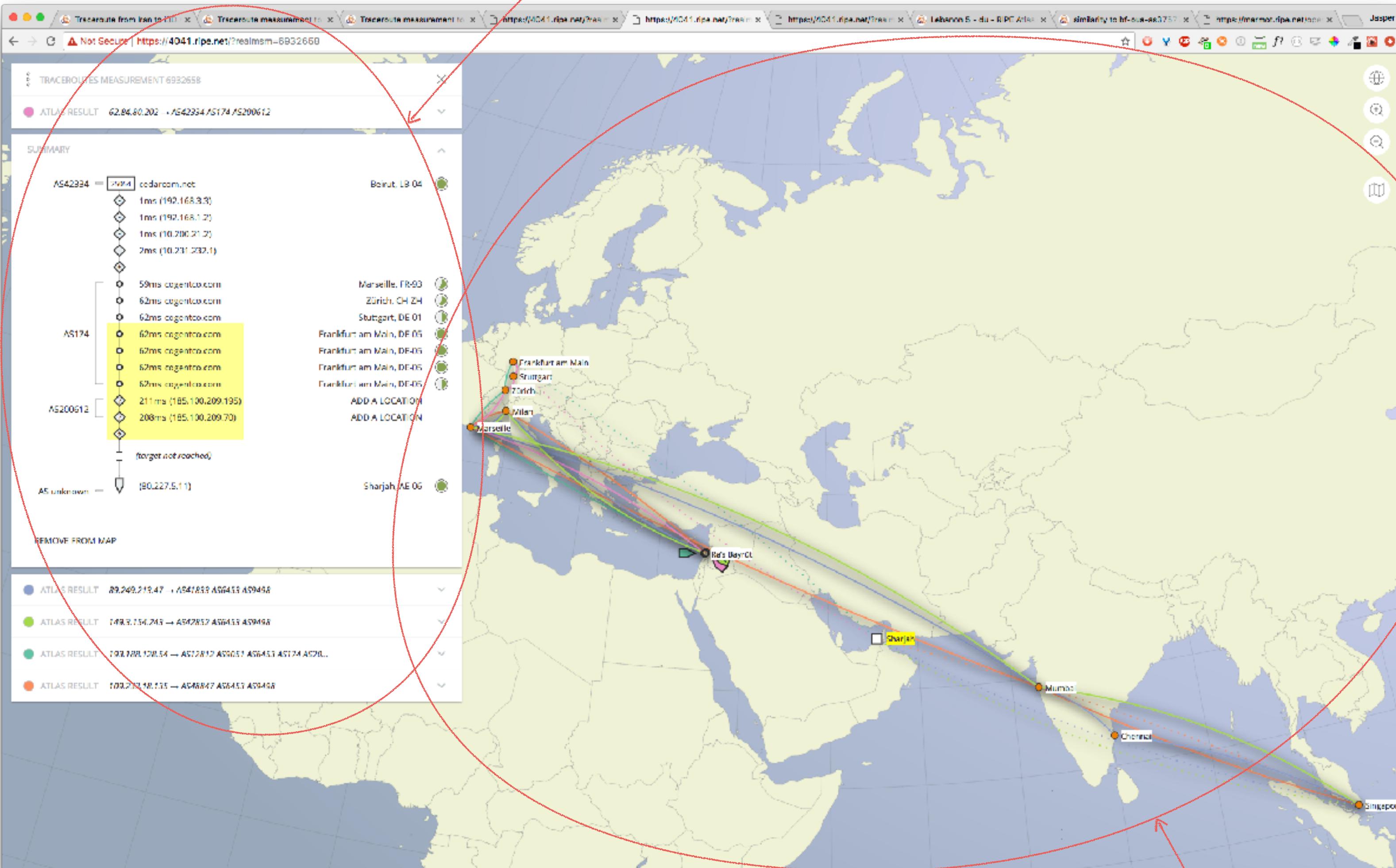
<https://atlas.ripe.net/measurements/11680405/#!openipmap>





elements

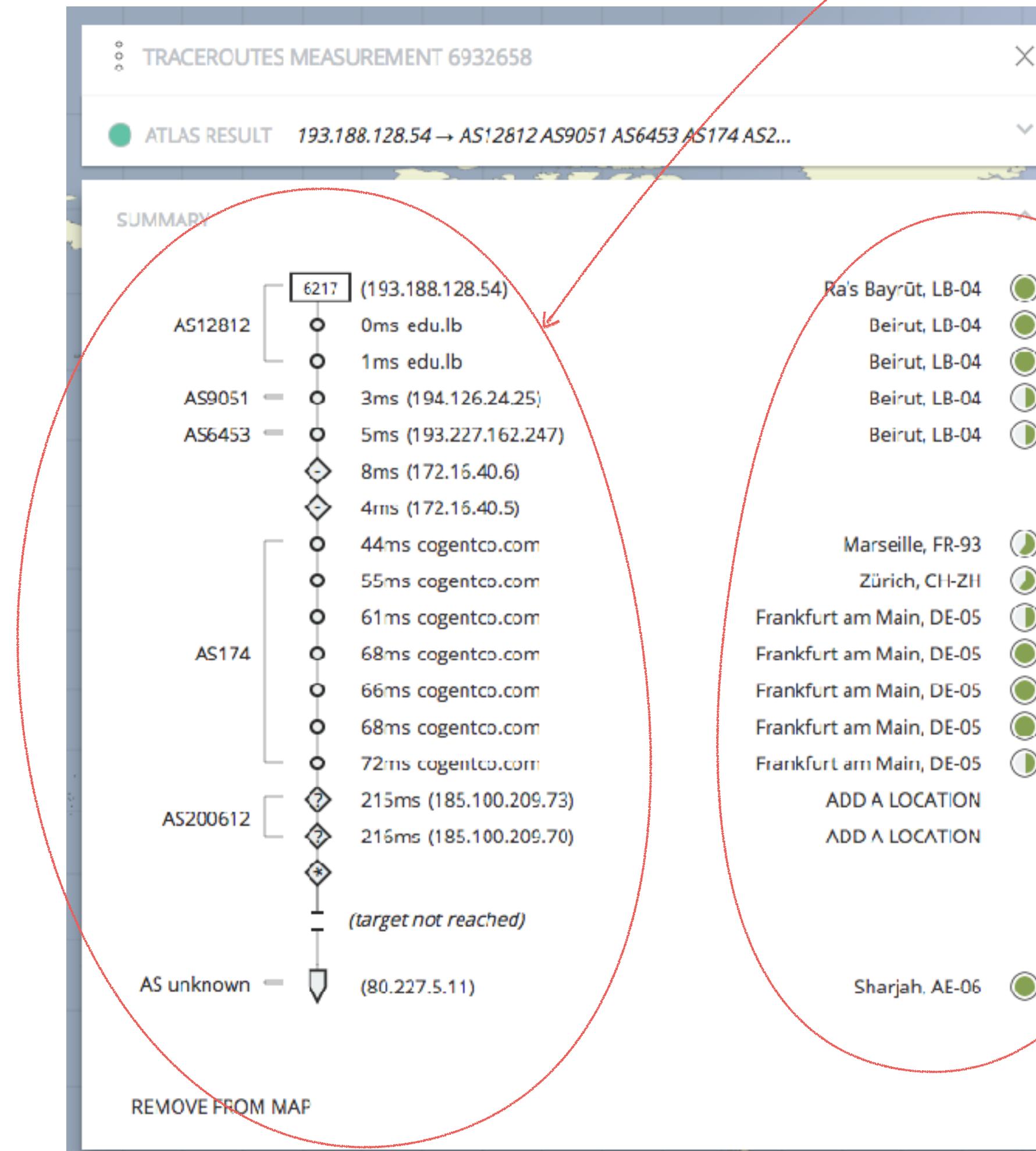
sidebar



map

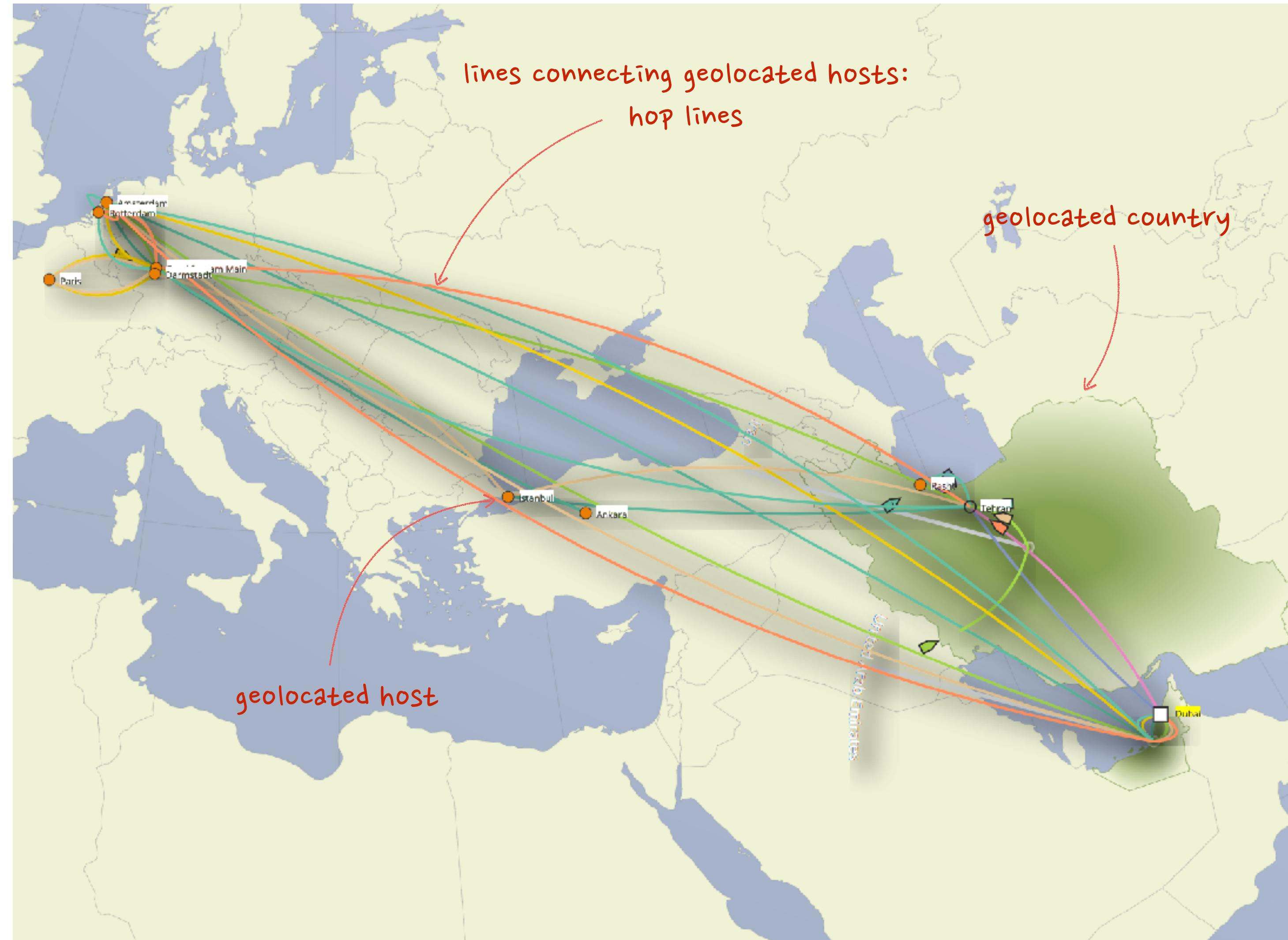
sidebar

hops with enriched info



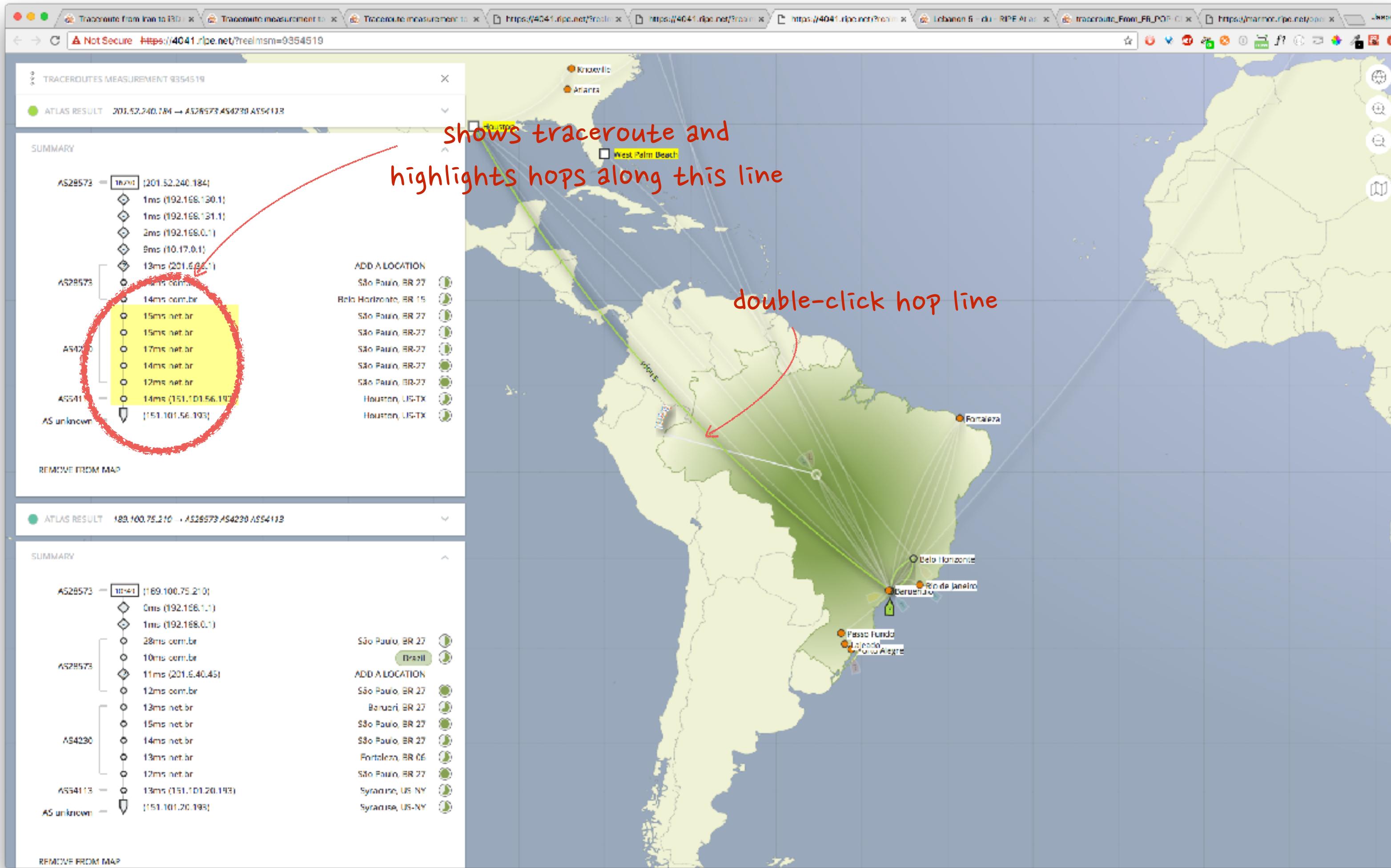
Geographical
information

map





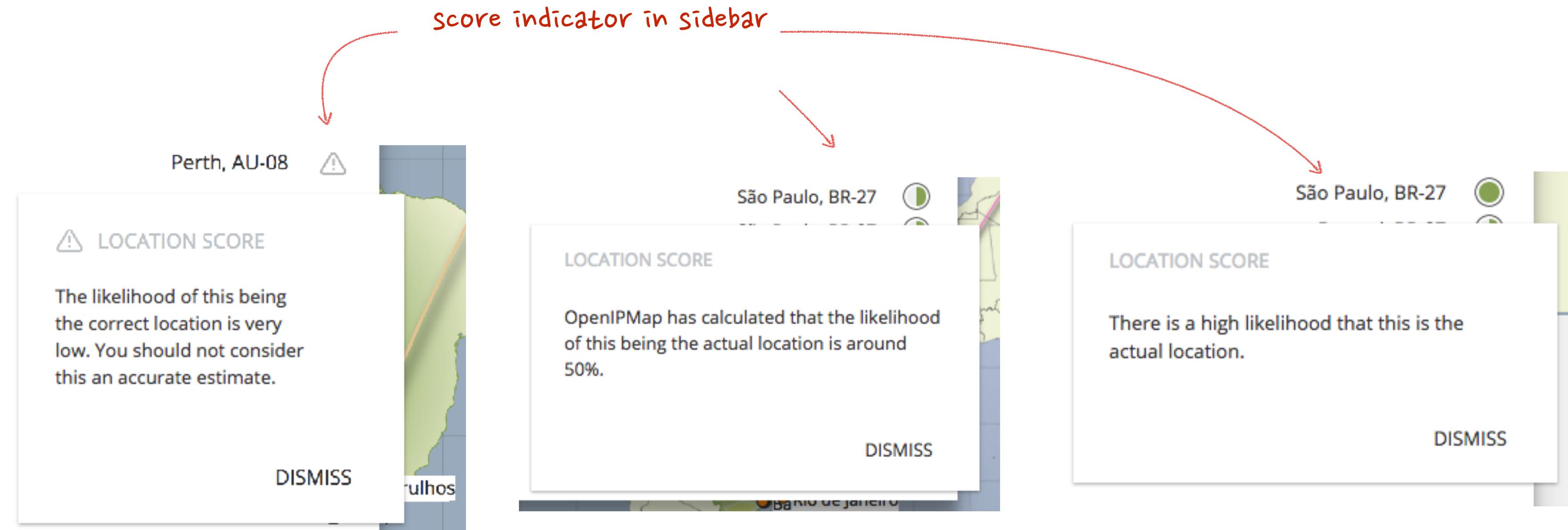
interaction sidebar and map



to each traceroute its own line



data doubt: scores for locations



crowdsouce: add locations



SUMMARY

- AS28573 — 14635 (189.63.153.221)
 - 1ms (192.168.1.1)
 - 11ms (10.35.128.1)
- AS28573
 - 9ms com.br
 - 13ms com.br
 - 11ms com.br
- AS4230
 - 20ms (200.167.43.9)
 - 32ms (200.244.214.13)
- AS54113
 - 36ms net.br
 - 34ms net.br
 - 35ms net.br
- AS unknown — (151.101.56.193)

REMOVE FROM MAP

- ATLAS RESULT 177.32.129.64 → AS28573 AS4230 AS54113
- ATLAS RESULT 189.33.89.42 → AS28573 AS4230 AS54113
- ATLAS RESULT 201.52.240.184 → AS28573 AS4230 AS54113
- ATLAS RESULT 191.180.97.223 → AS28573 AS4230 AS54113
- ATLAS RESULT 189.101.11.138 → AS28573 AS4230 AS3356 AS2914 AS54113
- ATLAS RESULT 187.180.71.87 → AS28573 AS4230 AS54113

click here and...

Porto Alegre, BR-23
Lajeado, BR-23
Passo Fundo, BR-23

ADD A LOCATION

EDIT HOST LOCATION

HOST
200.244.214.13
REVERSE DNS NOT AVAILABLE

CURRENT LOCATION

City

Country

CANCEL CONFIRM

start typing a city or...

a country



confirm and boost location score

The screenshot shows a network path summary on the left and a location scoring dialog on the right.

Network Path Summary:

- AS28573 → 14635 (189.63.153.221)
 - 1ms (192.168.1.1)
 - 11ms (*0.35.128.1)
 - 9ms com.br
 - 13ms com.br
 - 11ms com.br
- AS28573 → AS4230
 - 20ms (200.167.43.9)
 - 32ms (200.244.214.13)
 - 36ms net.br
 - 34ms net.br
 - 35ms net.br
- AS4230 → AS54113
 - 32ms (*51.101.56.193)
- AS54113 → AS unknown
 - (151.101.56.193)

Location Scoring Dialog (EDIT HOST LOCATION):

HOST: 200.230.252.110
ebt B1421 tcore01.spopn.embratel.net.br

CURRENT LOCATION:

City: São Paulo
Country: Brazil

ATLAS RESULTS:

- ATLAS RESULT: 177.32.129.64 → AS28573 AS4230 AS54113
- ATLAS RESULT: 169.33.89.42 → AS28573 AS4230 AS54113
- ATLAS RESULT: 201.52.240.184 → AS28573 AS4230 AS54113
- ATLAS RESULT: 191.180.97.223 → AS28573 AS4230 AS54113
- ATLAS RESULT: 189.101.11.138 → AS28573 AS4230 AS3356 AS2914 AS54113
- ATLAS RESULT: 187.180.71.87 → AS28573 AS4230 AS54113

Boost Score Action:

A red annotation points to the "CONFIRM" button in the dialog, which is highlighted with a red oval. The text "boost the score for this location" is written in red above the dialog.

Change and improve locations



Start typing and...

...choose a new or more specific location and...

now you can submit!

São Paulo, BR-27

EDIT HOST LOCATION

HOST
201.635.193
c90623c1.virtua.com.br

CURRENT LOCATION

City
sao pa

Country
Brazil

cities that match your input

São Paulo, Brazil BR-27

CANCEL CONFIRM

São Paulo, BR-27

EDIT HOST LOCATION

HOST
201.635.193
c90623c1.virtua.com.br

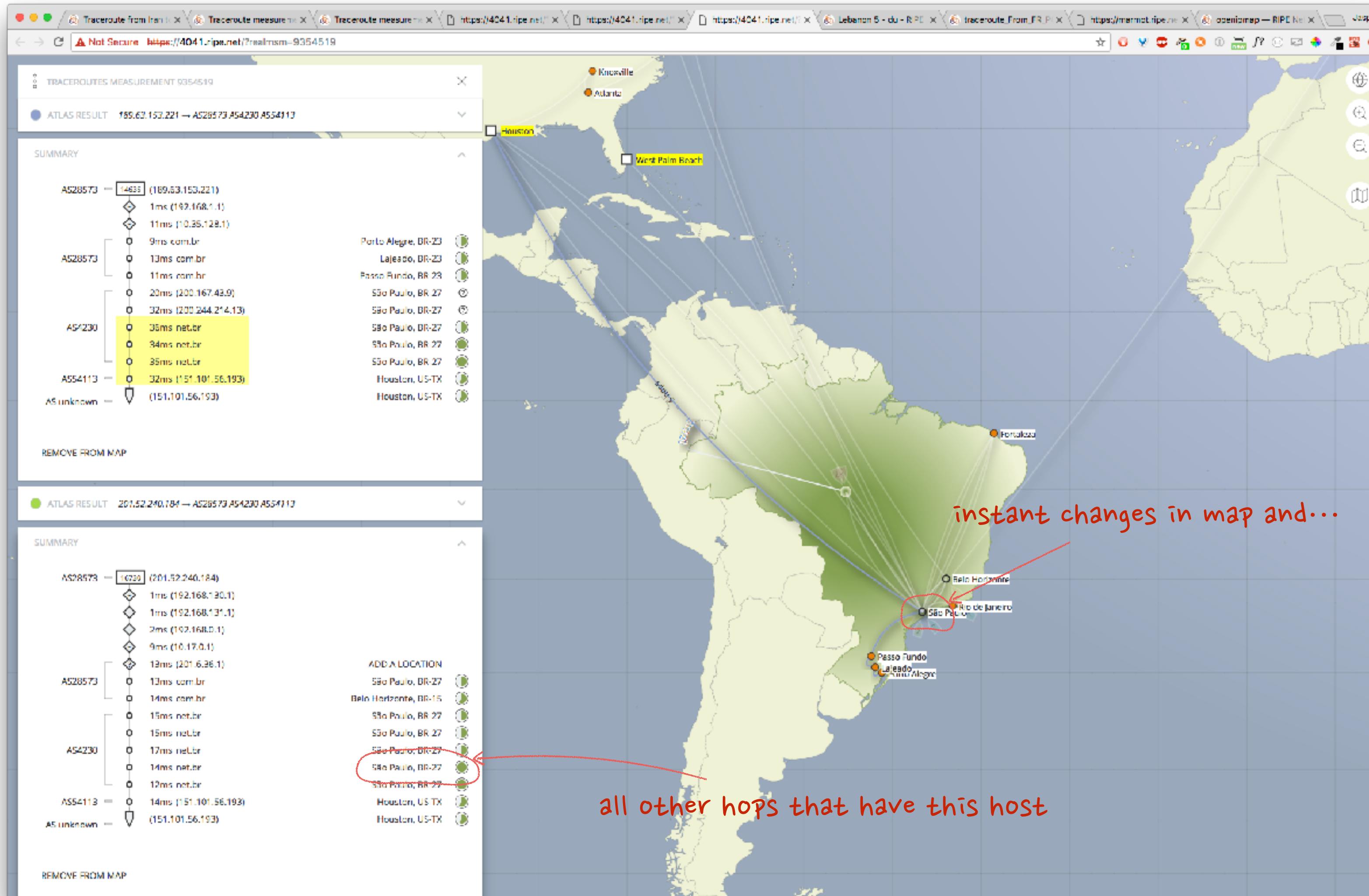
CURRENT LOCATION

City
São Paulo

Country
Brazil

CANCEL SUBMIT

Change and improve



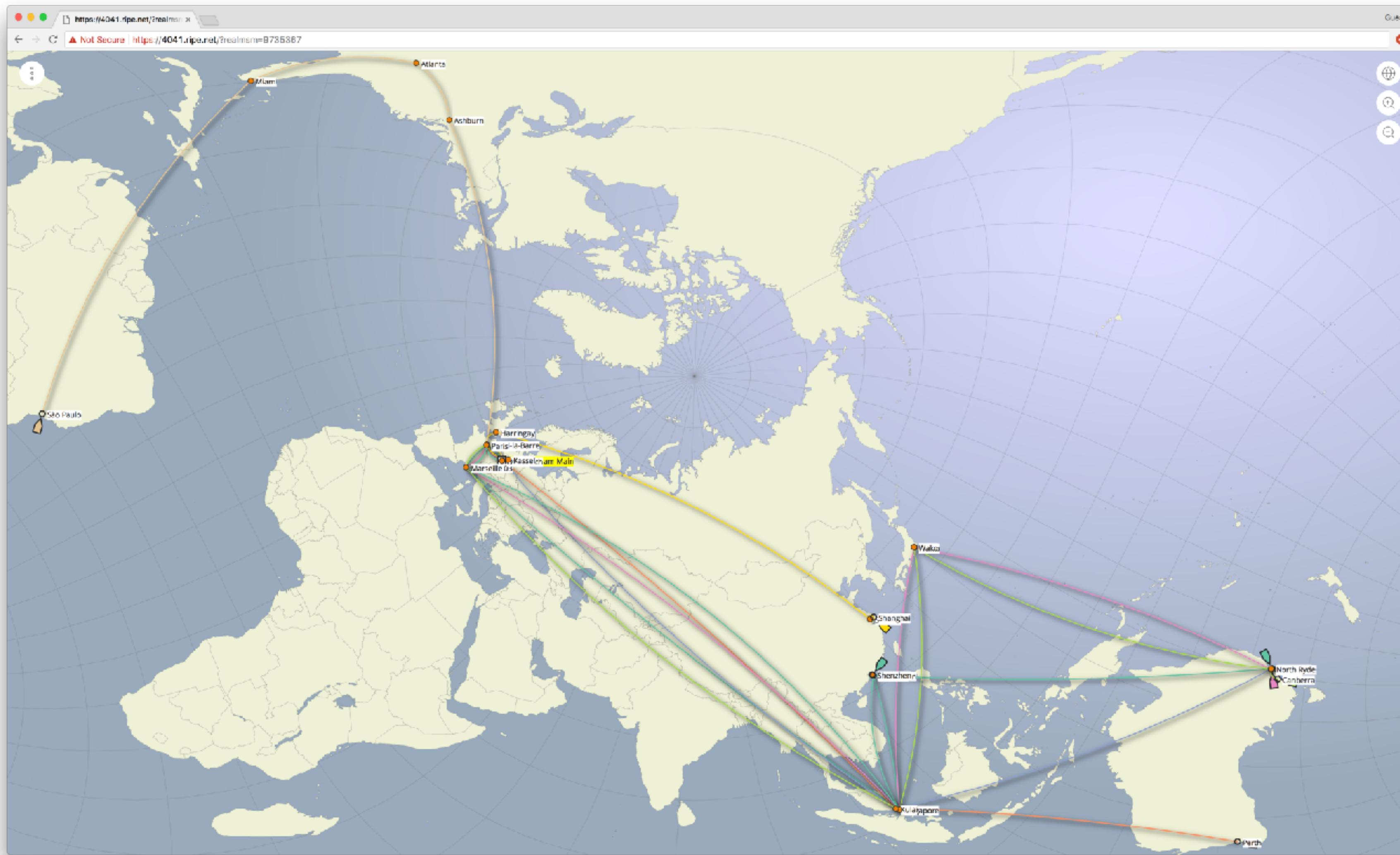
Future Work



New Inference Engines

- Increase research collaborations
- Integrate RIR data
- Reverse DNS engine
- Attempt to separate infra-structure IP addresses from end-user IP addresses
- Automated IP address discovery (IPv6!)

<https://openipmap.ripe.net>





RIPE NCC
RIPE NETWORK COORDINATION CENTRE

RIPE76 a Marseille

Jasper den Hertog | 16 March 2018 | FRNOG30

Pourquoi se rendre à RIPE 76?



- 600+ participants d'organisations internationales
- Opportunités de rencontres d'affaires sectorielles
- Séances plénières, forums, groupes de travail, tutoriels, événements sociaux
- Discussion sur les policies
- Possible de participer à distance (webcast, chat, etc)

RIPE 76 a Marseille!



- 14-18 Mai 2018, Palais du Pharo
- Le programme :
 - Pénurie d'IPv4 et déploiement d'IPv6
 - transactions commerciales d'adresses IPv4
 - Technologies des centres de données
 - L'operation des réseaux IP, DNS et Points d'échanges Internet
 - La gouvernance d'Internet et les pratiques réglementaires
 - Sécurité des réseaux IP et des protocoles de routage
 - CDN
 - Points d'échanges Internet (IXP) et l'échange des information des données mobiles
 - L'internet des objets (IoT)
- Nous desirons impliquer le plus d'acteurs locaux de l'Internet ! Vous pouvez encore envoyer vos presentations. Visit ripe76.net

Diversité et inscription

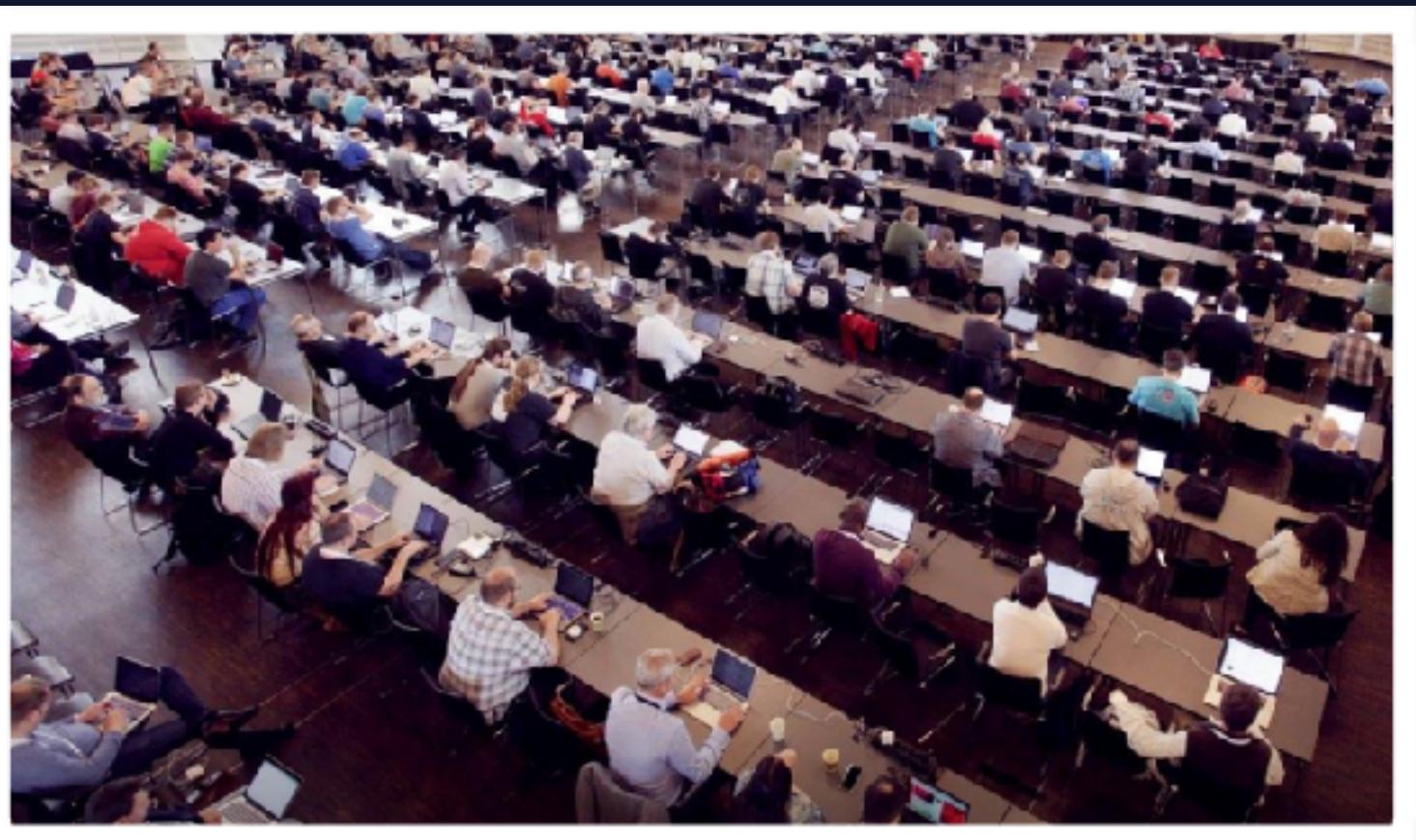


- Programmes pour financer les participants
 - La demande de *bourse RIPE* (www.ripe.net/fellowship, date butoir 6 Avril)
 - ticket pour RIPE76 , transport et logement subventionnés
- Le déjeuner Tech des femmes
- Etes vous une femme de l'internet ? venez échanger vos expériences à labs@ripe.net
- Nouveau! Pendant RIPE76 une crèche pour les enfants <https://ripe76.ripe.net/on-site/on-site-childcare/>



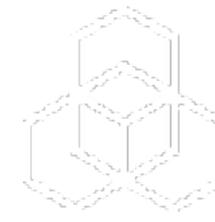
Couts

- €350 pour la semaine
 - Déjeuner, collation, boissons chaudes et les événements sont incluses
 - Le Dîner du RIPE (EUR 50)
- **Les nouveaux Membres du RIPE NCC ont 2 tickets gratuits**
- €125 pour la journée
- €50 pour les étudiants (toute la semaine)



ripe76.ripe.net





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