RIPE NCC
RIPE NETWORK COORDINATION CENTRE

RIPE IPmap
Geolocating Internet Infra-Structure with Inference Engines and Crowdsourcing

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But now for something completely different first

User to User Still Important

- The quality of end-user connections are often expressed and optimised in download speeds towards content providers.

- Instead, these sketches focus on peer-to-peer connections with in a country.

- Fabric snapshots at points in time

- Trying to estimate an amount of ways the networks interconnect their users

  - Any "single point of failure"?

  - How much IXPs and Transit Providers are involved?

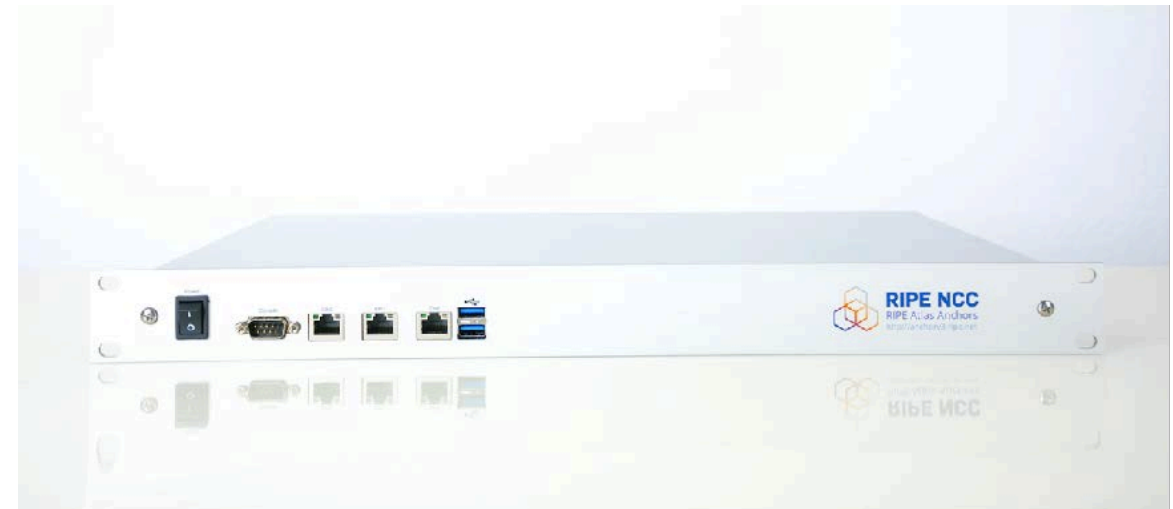We call it sketches since it uses rough estimates data from many source

Data Sources: RIPE Atlas

- Measure the Internet!

  - By community, for community

- Wikipedia: https://en.wikipedia.org/wiki/RIPE_Atlas

Data Sources: RIPE Atlas

10,500+ probes connected (310+ Anchors)

6000 results collected per second

40,000+ user-defined measurements weekly

Five types of user-defined measurements available to probe hosts and RIPE NCC members: ping, traceroute, DNS, SSL, NTP, HTTP, WiFi

Data sources

- APNIC end-users per network estimation

  - https://stats.labs.apnic.net/aspop/

- IXP-country-jedi

  - https://www.ripe.net/ixp-country-jedi/

  - mesh traceroutes between RIPE Atlas probes in a country

    - measures and analyses (using IPMap)

Data sources

- CAIDA AS-to-ORG

  - https://www.caida.org/data/as-organizations/

- PeeringDB

  - https://www.peeringdb.com/

- RIPE IPmap

  - https://ipmap.ripe.net/

- RIPEStat
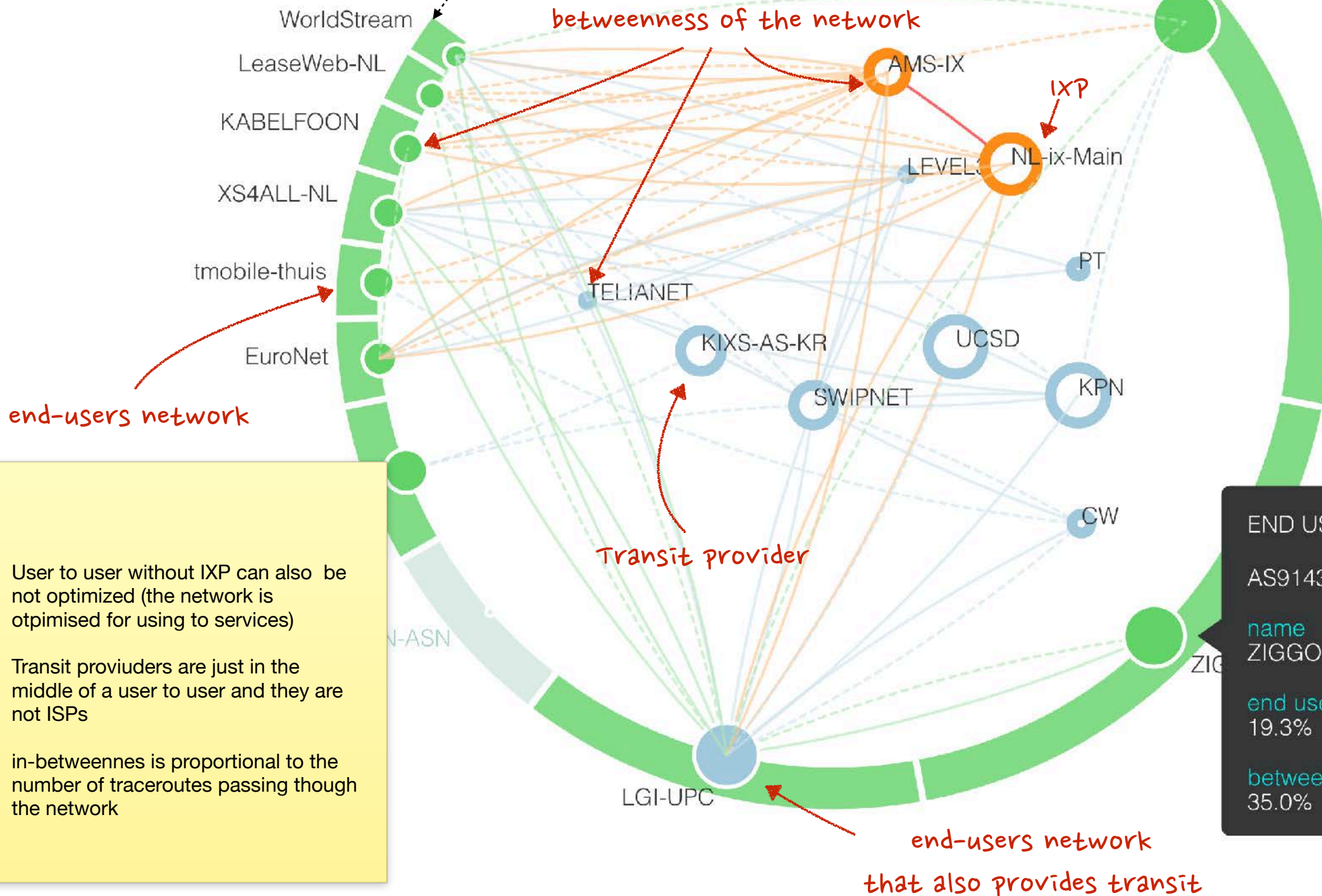
  - https://stat.ripe.net/

Show me the Sketch!

The Netherlands

Empty segment represents ASes providing connectivity to < 1% users

the size of the circle indicates the in-betweenness of the network

Size of a segment is proportional to amount of end-users in the network

IXP

end-users network

Transit provider

User to user without IXP can also be not optimized (the network is otpimised for using to services)

Transit proviuders are just in the middle of a user to user and they are not ISPs

in-betweennes is proportional to the number of traceroutes passing though the network

end-users network that also provides transit

WorldStream
LeaseWeb-NL
KABELFOON
XS4ALL-NL
tmobile-thuis
EuroNet
N-ASN
LGI-UPC

KPN
AMS-IX
NL-ix-Main
LEVEL3
PT
KIXS-AS-KR
UCSD
SWIPNET
KPN
CW
TELIANET
ZIGGO

END USER NETWORK

AS9143

name
ZIGGO

end users
19.3%

betweenness
35.0%

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Russian Federation

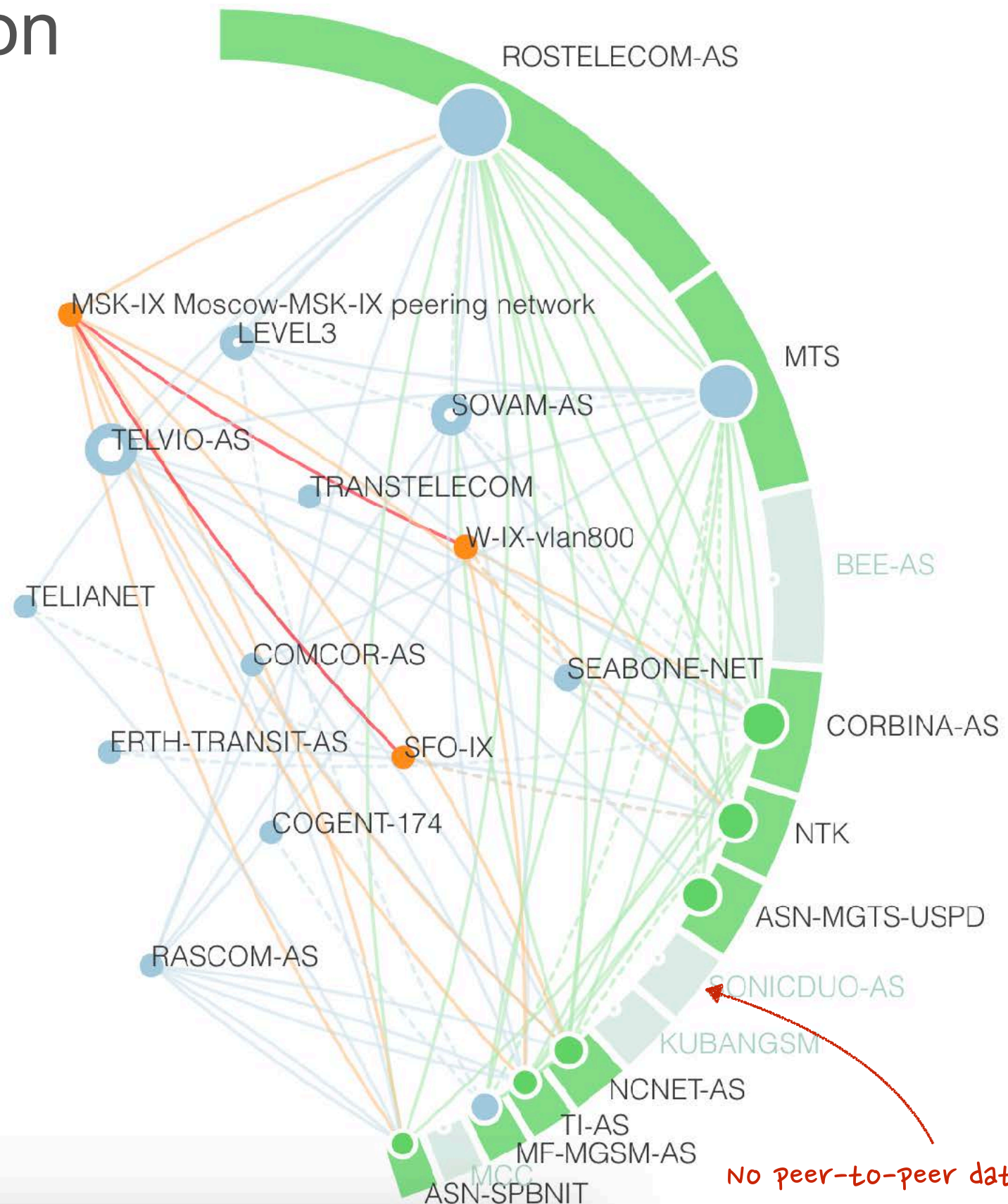Orange lines – end-users networks connected through an IXP

green lines – directly connected

blue lines – through a transit network

dashed lines – we cannot fully map this path

dashed lines - where dns lookup is wrong or have stars in the trace route outputs

red lines show paths between IXPs

No peer-to-peer data in the AS no probes present?

ROSTELECOM-AS
MSK-IX Moscow-MSK-IX peering network
LEVEL3
MTS
SOVAM-AS
TELVIO-AS
TRANSTELECOM
W-IX-vlan800
BEE-AS
TELIANET
COMCOR-AS
SEABONE-NET
CORBINA-AS
ERTH-TRANSIT-AS
SFO-IX
NTK
COGENT-174
ASN-MGTS-USPD
SONICDUO-AS
RASCOM-AS
KUBANGSM
NCNET-AS
TI-AS
MF-MGSM-AS
MGG
ASN-SPBNIT

Why Geolocation of infra-structure?

Reasons

- Increased interest in IP geolocation

  - Content providers

  - From operators and researchers

  - The "geoloc" attribute is not a solution

- A unified geographical data format is needed

- IP geolocation is extremely difficult

  - Various approaches, some of them cannot be used singularly

  - Academia is working on it! Let's work together

  - A validation/feedback loop is needed

  - A unified geographical data format is needed

FOCUS ON Infrastructure

Different Research Approaches

- Triangulation a.k.a. trilateration

  - Paristech anycast

  - RIPE Atlas

- Reverse DNS based location inference

  - CAIDA DNS decoding database - DDec

- 'Administrative' analyses

  - PeeringDB

  - RIPE Database

- Verification/falsification procedures

Commercial Offerings

- Tend to concentrate on the end-user IP addresses

- Opaque methodology

- IPv6 address space largely ignored

Our Integration attempt

- Accumulate research efforts as Inference Engines

- Each engine is applicable only in some cases

- Each engine has a score factor

- Complete transparency in inference methodology

Inference Engines
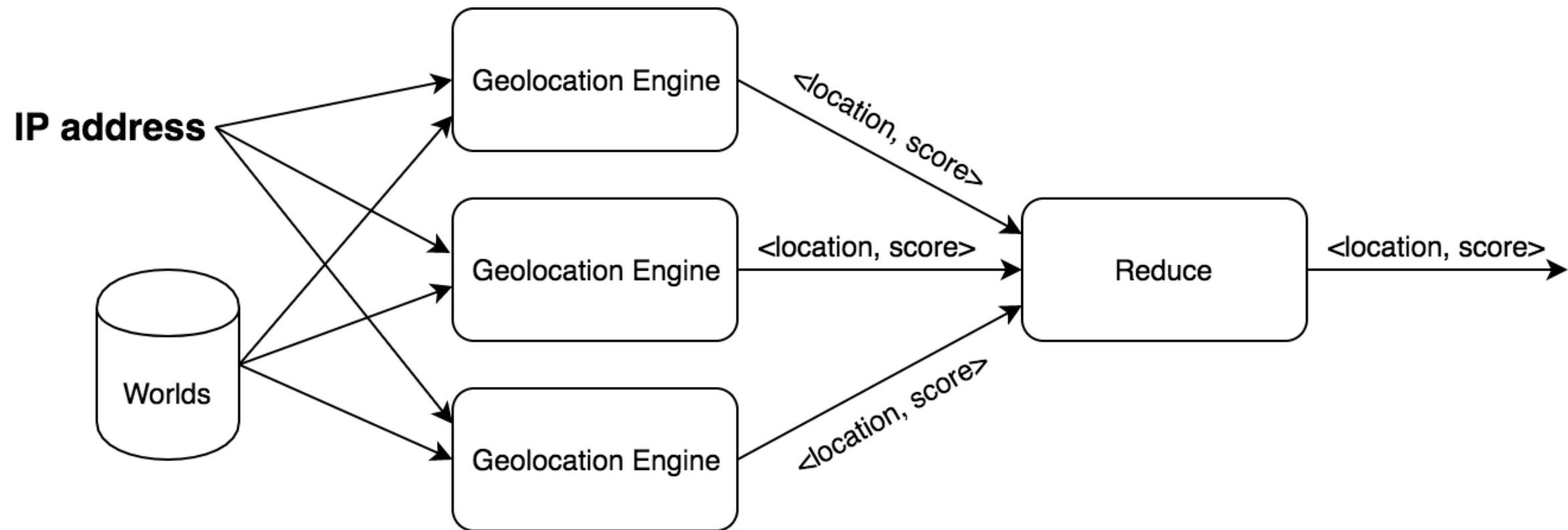
What is ipmap.ripe.net

- A web application where you can query/ correct the geolocation of an IP address

- An API where you can query for multiple IP addresses in bulk

- An API where you can correct/provide yourself the geolocation of an IP address

- A web application to visualize traceroutes geolocated on a map

Where is RIPE IPmap?

Where is RIPE IPmap?

IPmap Demo

IPmap Demo

Traceroute measurement to wikipedia.org

IPmap Demo

Geolocation API

https://ipmap.ripe.net/api/v1

/locate

https://openipmap.ripe.net/api/v1/locate/83.163.50.165/best
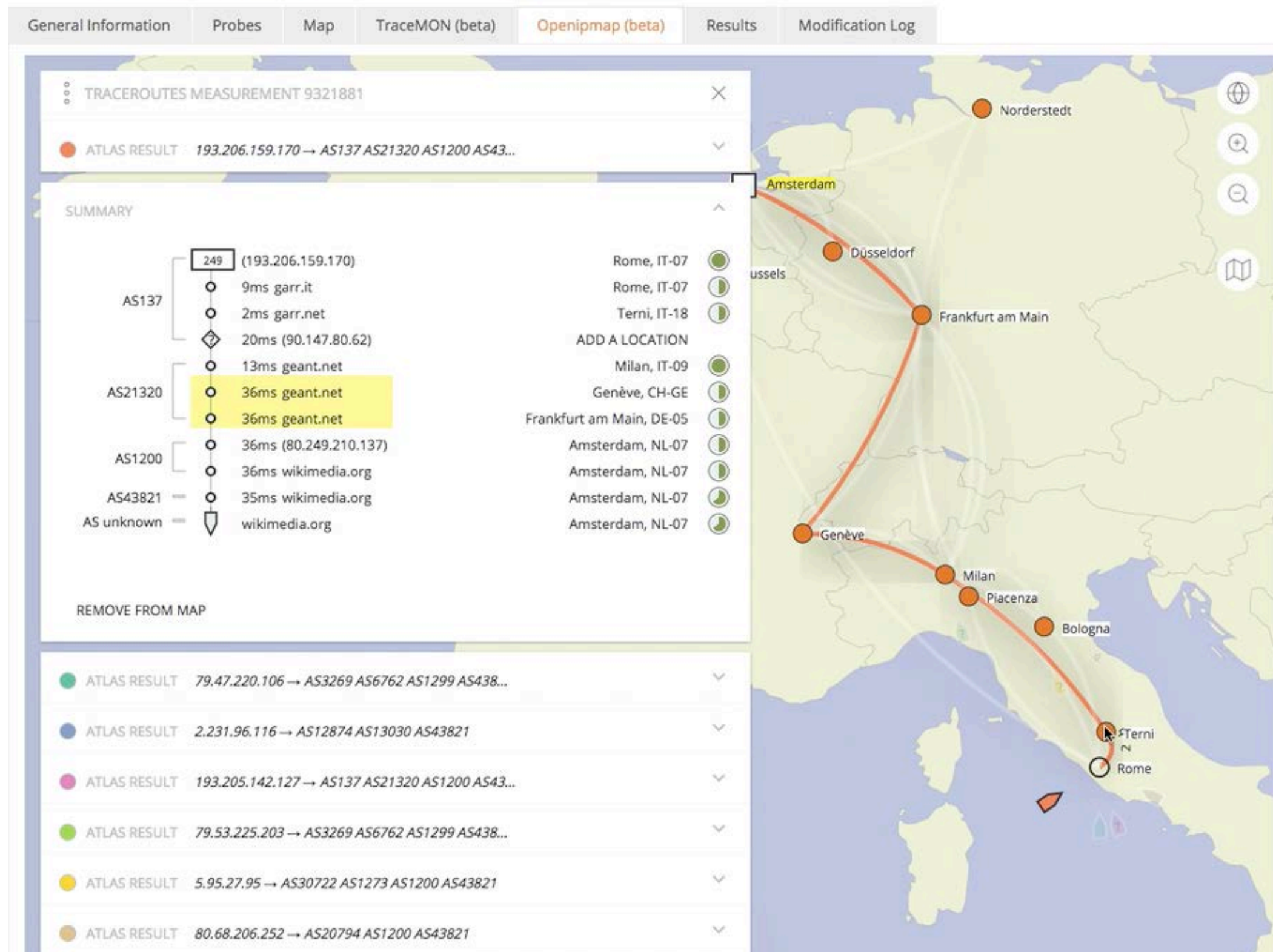
```json
{
  "location": {
    "score": 145,
    "countryCodeAlpha3": "NLD",
    "countryCodeAlpha2": "NL",
    "cityPopulation": 147590,
    "stateAnsiCode": "07",
    "pointGeometry": "0101000020E61000005C72DC291D8C12401B81785DBF304A40",
    "cityNameAscii": "Haarlem",
    "stateIsoCode": "NL-07",
    "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": {}
    }
  }
}
```

*queries can be bundled with:

https://ipmap.ripe.net/api/v1/locate/all?resources=ip1,ip2,ip3..

/locate

https://openipmap.ripe.net/api/v1/locate/83.163.50.165/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"
  },
  "request": {
    "params": {
        "ip": "83.163.50.165"
    },
    "query": {}
  }
}
}
```

/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 bust the score

- A list of possible locations is returned

- We are working on it! (Contributions are welcome!)

That's why you need…

RIPE Atlas coverage!

What's new?

Short RIPE Atlas update

Some New Features and Other Info

- Measurement tagging/labeling

- Result archives

- RIPE Atlas (storage) timestamps

- DNS-over-TLS support (API only yet)

- Scaling up our central infrastructure

 - Working on introducing ElasticSearch

Anchor VMs

- An anchor is a probe and a willing target
  - Automatically measured and generates more credits

- Anchor as a Virtual Machine: almost the same
  - They can be installed where physical machines are a no-go
  - Can be "in the cloud" as well

- <u>We're in the pilot phase as of now</u>
  - Five VMs are up and running
  - With help from members of the community

- We'll report on this activity around end of Q2

Probes

- We stopped preparing new v3 probes

  - Remaining stock is being distributed

- We're testing v4 (NanoPi based)

  - Have a few to give out for field testing

  - Working on logistics and proper casing

- Still (always?) on the lookout for new devices
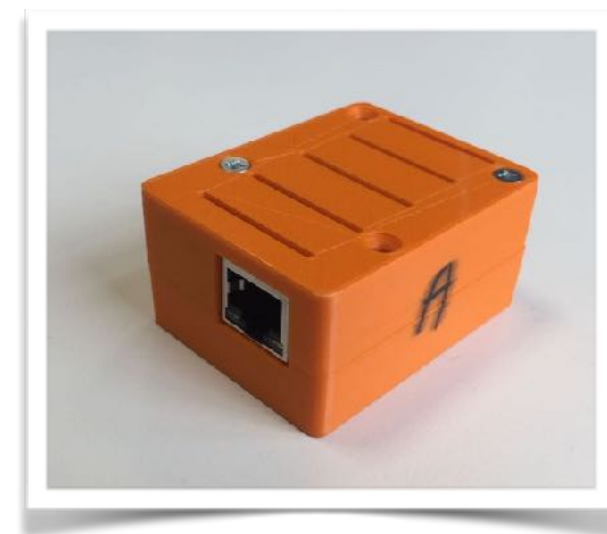
Measurement Tagging

- It allows you to:

  - Group together any number of your measurements

  - Aggregate results from multiple targets and time periods

  - Easily stop all of a campaign's ongoing measurements

  - Choice between collaboration (tags) and full control (labels)

  - Upcoming: support in various RIPE Atlas visualisations

- For more info:

  - https://labs.ripe.net/Members/chris_amin/ripe-atlas-measurement-tagging

References & Feedback

- RIPE Atlas

  - https://atlas.ripe.net

- Peer-to-peer sketches

  - http://sg-pub.ripe.net/ixp-country-jedi/

- RIPE IPmap

  - https://ipmap.ripe.net/

- RIPE Labs

  - https://labs.ripe.net

Questions