



**RIPE NCC**

RIPE NETWORK COORDINATION CENTRE

# RIPE Atlas

Global Measurement Network

Christian Teuschel | October 2019 | ESNOG 24

# RIPE Atlas



- ....is a global, open, distributed Internet measurement platform, consisting of thousands of measurement devices that measure Internet connectivity in real time

# Global active measurements platform



- Goal: View Internet reachability
- Probes hosted by volunteers
- Measurements towards root name servers
  - Visualised as Internet traffic maps
- Users can also run customised measurements
  - ping, traceroute, DNS & SSL/TLS, NTP and HTTP\*
- Data publicly available

# RIPE Atlas measurements



- **Built-in** global measurements towards root nameservers
  - Visualised as Internet traffic maps
- **Built-in** regional measurements towards “anchors”
- **Users** can run customised measurements
  - ping, traceroute, DNS, SSL/TLS, NTP and HTTP

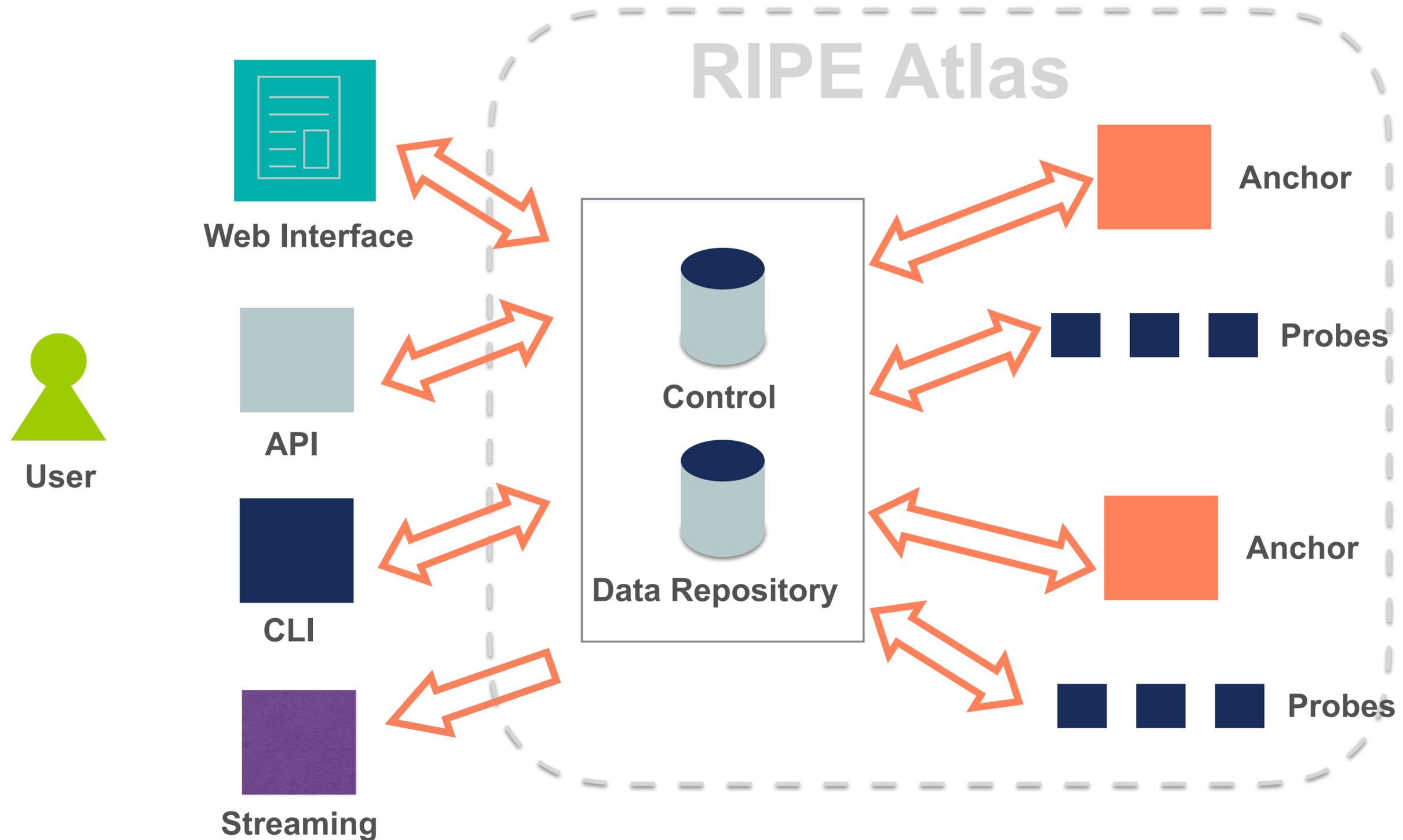


# Probes and Anchors

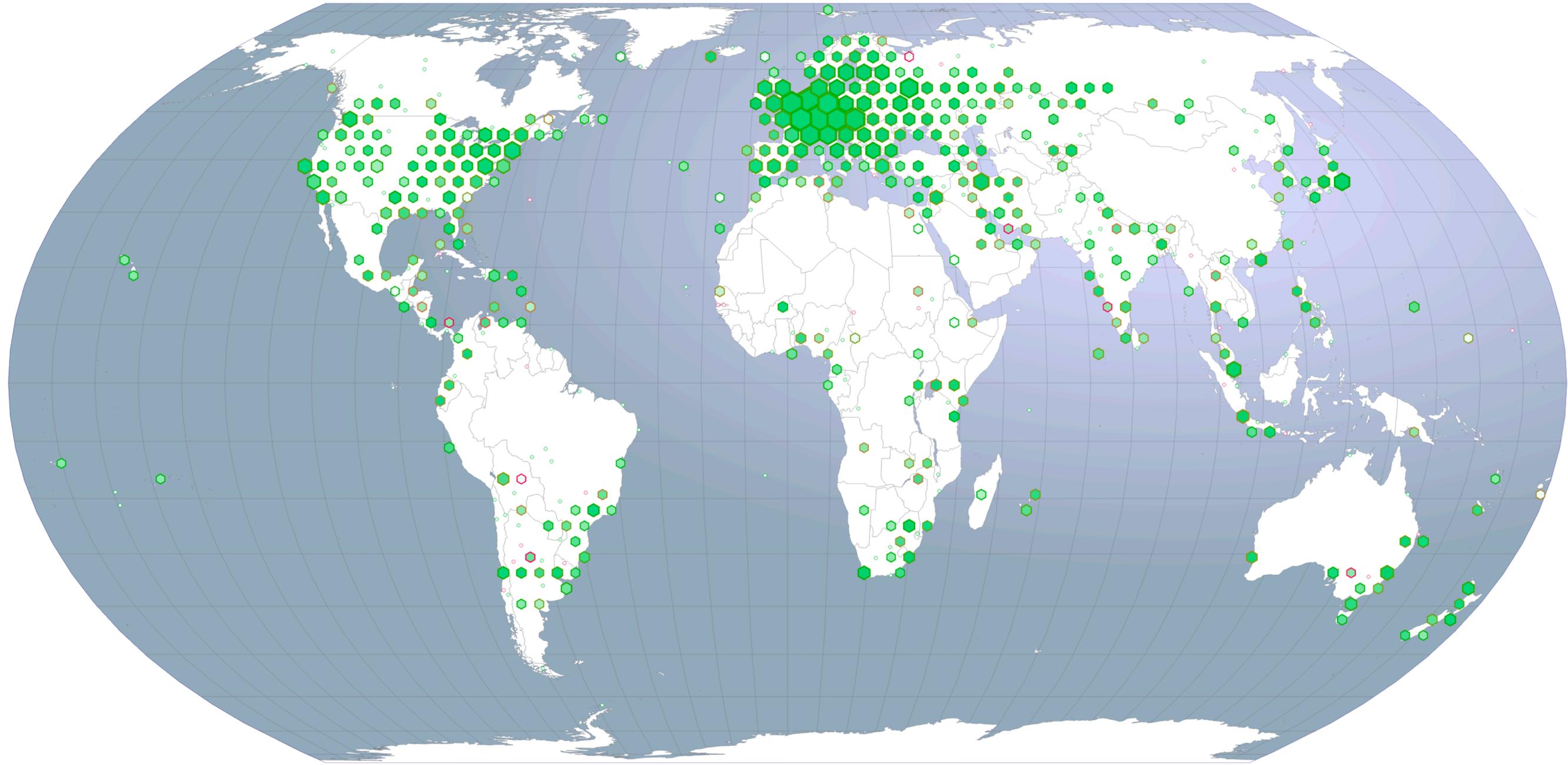
- 10,000+ probes connected (almost 500 Anchors)
- 7,500+ results collected per second
- 21,000+ measurements currently running



# RIPE Atlas Overview



# RIPE Atlas Global Coverage



# Most Popular Features



- Six types of measurements: ping, traceroute, DNS, SSL/TLS, NTP and HTTP (to anchors)
- APIs and CLI tools to start measurements and get results
- Streaming data for real-time results
- Status checks



# Using RIPE Atlas As a Visitor

# Internet Traffic Maps



RIPE Atlas <<  
About RIPE Atlas >  
Get Involved >  
Probes and Anchors >  
**Measurements, Maps and Tools** v  
Measurements  
Internet Maps  
Tools

Resources >  
RIPE NCC Members  
My Atlas >  
Staff Pages >

## Internet Maps

### DNS Root Instances



Shows, for each probe, which root DNS server instance the probe ends up querying, when they ask a particular root server. In other words, it shows the "gravitational radius" for root DNS server instances.

### Comparative DNS Root RTT



Shows a comparison of response time for DNS SOA queries to all the root DNS servers. For each probe, a marker shows the "best" root server with colour identifying the related minimum response time.

### Root Server Performance



This map shows the reply time to the SOA query of a particular root DNS server, over the selected transport protocol (UDP, TCP or comparison of the two) for each probe.

### RTT to Fixed Destinations



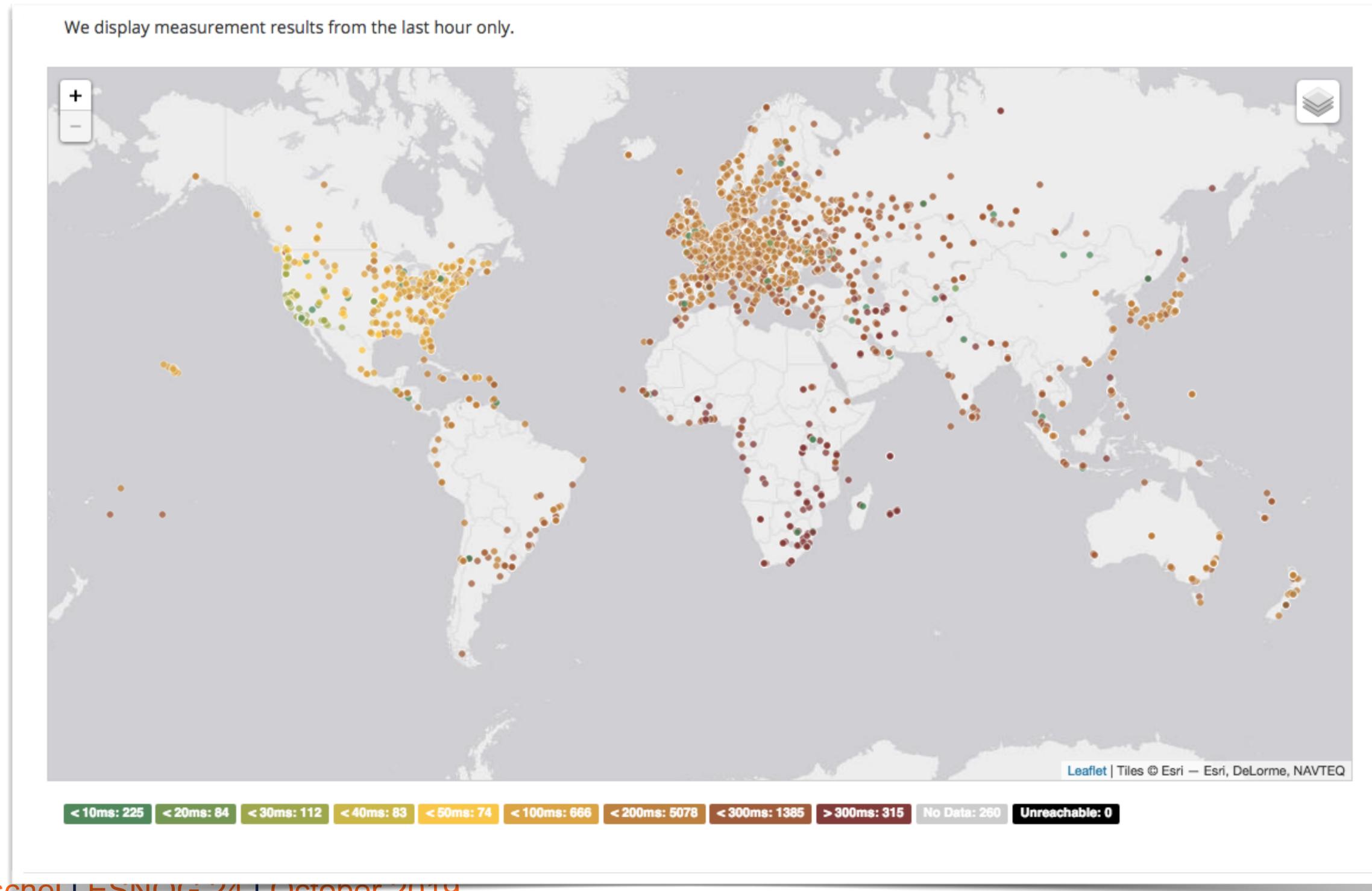
Shows the colour coding for the RTT value for the particular destination for each probe. The minimum / average / maximum values are based on standard "ping" measurements.

### Reachability of Fixed Destinations

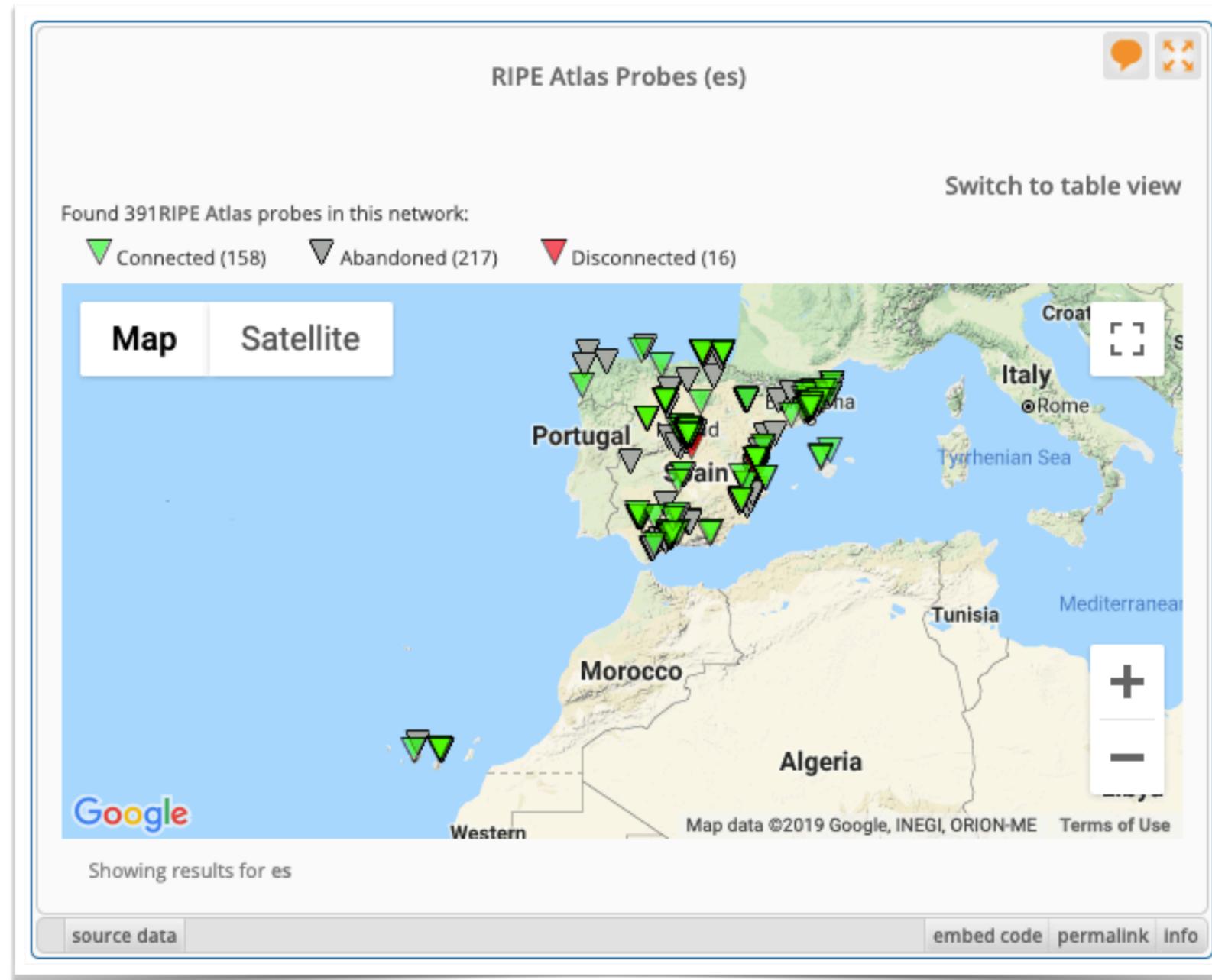


Shows if the particular fixed destination is reachable or not from each probe. Red markers indicate that the specific destination for these probes are unreachable and green reachable.

# Where is B-root?

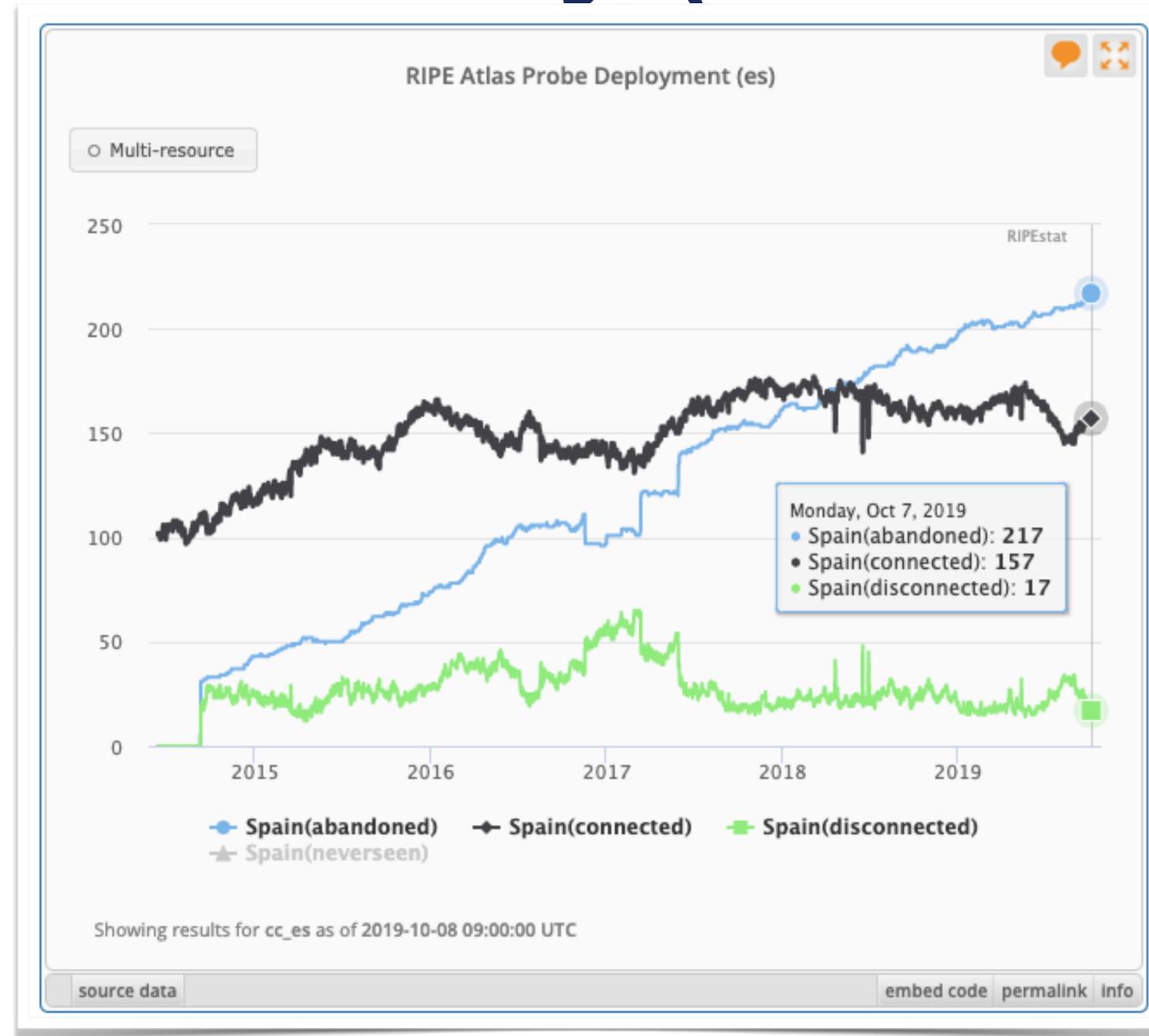


# Probes per country (in RIPEstat)



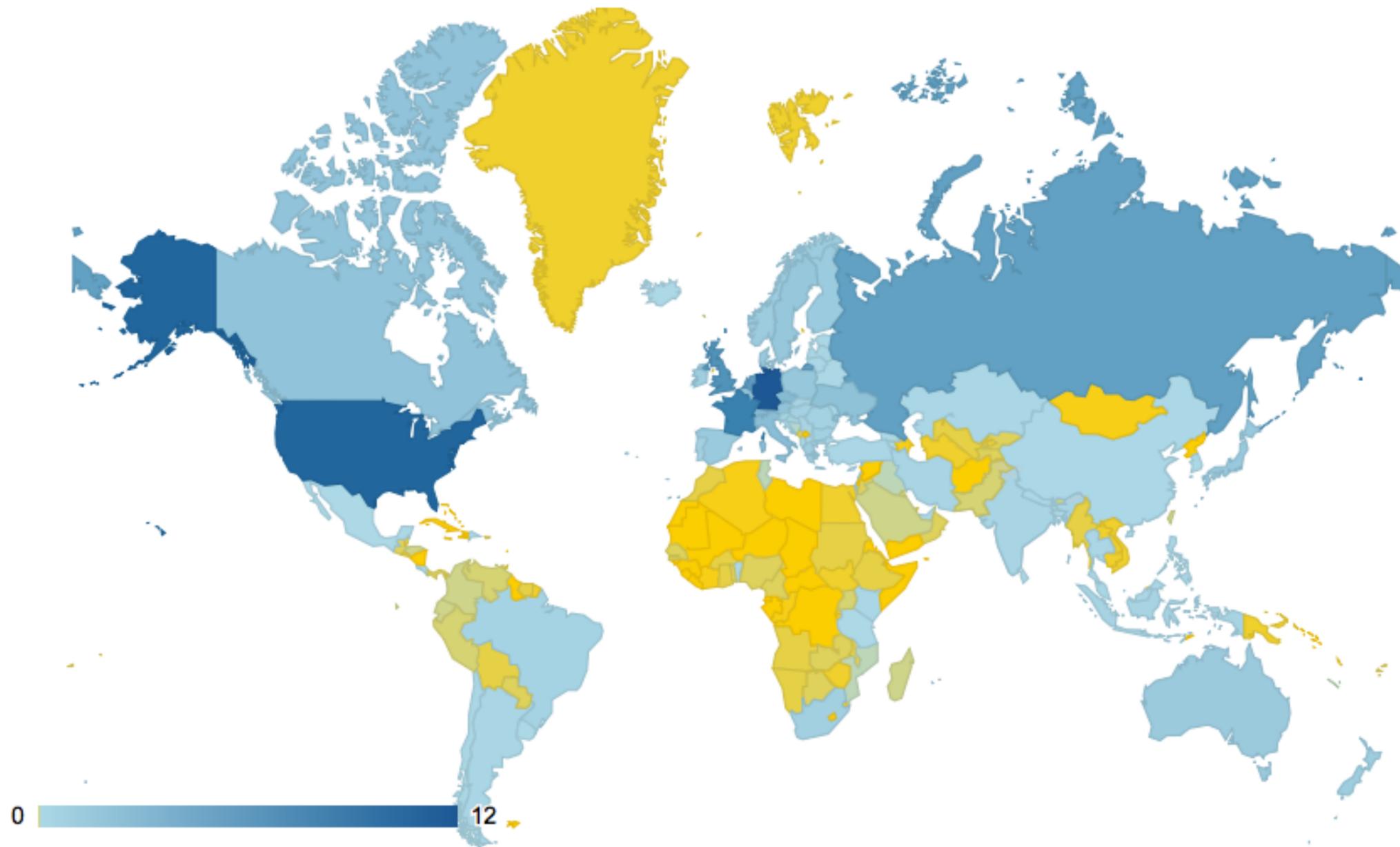
<https://stat.ripe.net/es#tabId=activity>

# Probes per country (in RIPEstat)



<https://stat.ripe.net/es#tabId=activity>

# Where we want to place probes





# Looking Up Public Probes

# Searching for Probes



The screenshot shows the RIPE NCC website interface for the Probes page. At the top, there is a search bar for IP addresses or ASNs. Below the navigation menu, a breadcrumb trail indicates the current location: Home > Analyse > Internet Measurements > RIPE Atlas > Probes. The main heading is "Probes", followed by a brief description and three links: "Learn more about probes", "See the probes map", and "Apply for your own probe". A filter bar allows users to filter by "id/asn/country/description", "Any Status", "IPv4/v6", and "Any Country". Below the filter bar, there are tabs for "Public" and "Login to see more". The main content is a table of probes with columns for Id, ASN v4, ASN v6, Country, Description, and Connection Status. The table lists ten probes, each with its respective details and a "4 weeks" connection status.

Id	ASN v4	ASN v6	Country	Description	Connection Status
6175	1103	1103	NL	SURFnet bv	4 weeks
6146	60781	60781	NL	Leaseweb Network B.V.	4 weeks
6152	28753	28753	DE	Leaseweb Network B.V.	4 weeks
6137	3333	3333	NL	nl-ams-as3333-preprod	4 weeks
6147	33280	33280	US	Afilias	4 weeks
6112	197216	197216	BG	Delta Softmedia Ltd	4 weeks
6161	27843	27843	IS	Optical Technologies	4 weeks
6142	63403	63403	US	Afilias	4 weeks
6008	2607	2607	SK	AA sk-bts-as2607	4 weeks
6001	3333	3333	NL	AA nl-ams-as3333	4 weeks

Filter based on ASN, country, location...

<https://atlas.ripe.net/probes/>

# Probe Page



>> You are here: [Home](#) > [Analyse](#) > [Internet Measurements](#) > [RIPE Atlas](#) > [Probes](#) > [Probe #10010](#)

## Probe #10010 [\(Register\)](#)

General **Network** Built-in Measurements User-defined Measurements

### General Information [Edit](#)

Id	10010
MAC Address	F8:D1:11:A9:F3:2C
Architecture	tl-mr3020
Firmware Version	4680 (1070)
Router Type	
Bandwidth Limit	Not set
DNS Entry	Off
Shared Publicly	Yes

User Tags: [NAT](#) [Chello 200MB](#)

System Tags: [V3](#) [Resolves A Correctly](#) [Resolves AAAA Correctly](#) [IPv4 Works](#) [Auto GEOIP city](#) [IPv4 Capable](#) [IPv4 RFC1918](#)

### Connection & Traffic [↗](#)

5 k  
2.5 k  
0

08:00 12:00

Bits/s  Packets/s

### Connected Time [↗](#) 3 days, 9 hours

April May

[Update Location](#)

[Edit](#)

### Management Sharing [Edit](#)

Only the probe host is permitted to administer this probe.

3 days, 9 hours

Firmware #10010  
4680

Architecture  
tl-mr3020

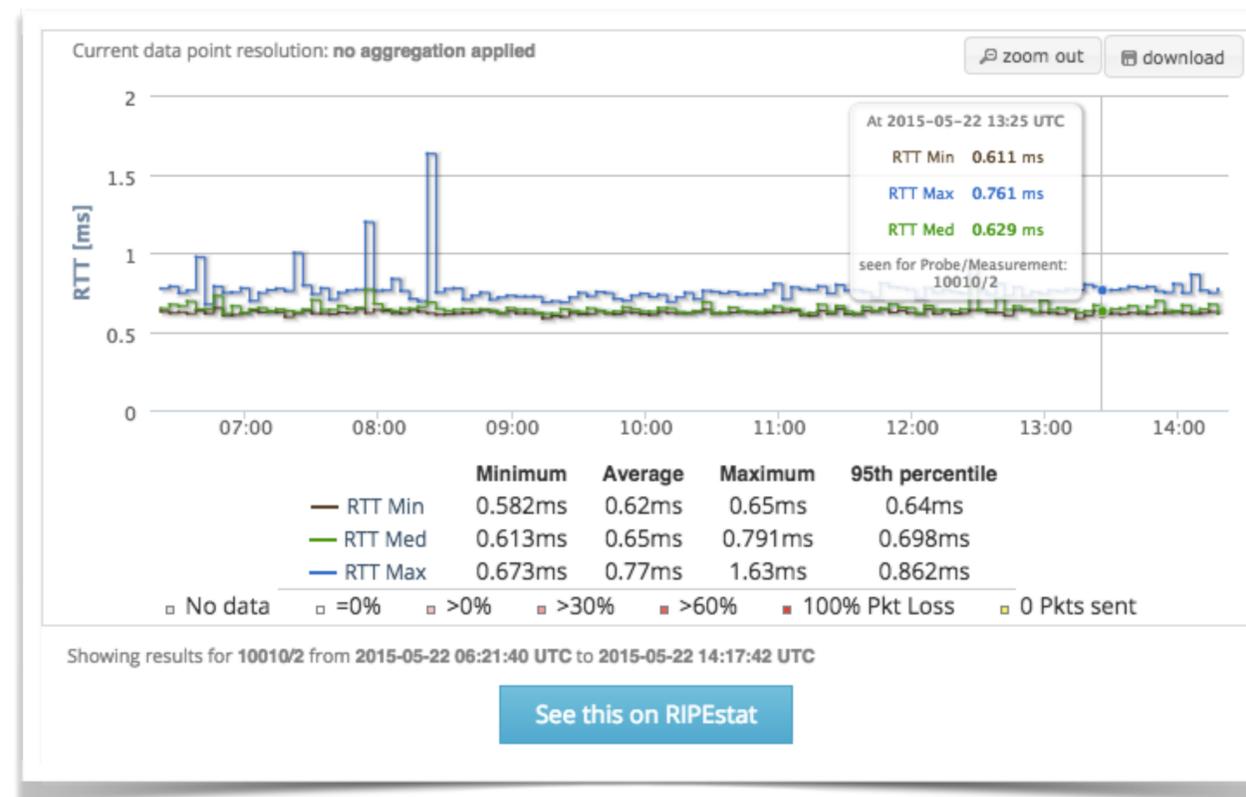
MAC Address  
F8:D1:11:A9:F3:2C

The displayed location is an automatic best guess of the city based on IP address. By manually setting a more accurate location you can help to improve the usefulness and correctness of RIPE Atlas.

# Zoomable Ping Graph



- Replace multiple RRD graphs: zoom in/out in time, in the same graph
- Easier visualisation of an event's details
- Selection of RTT class (max, min, average)

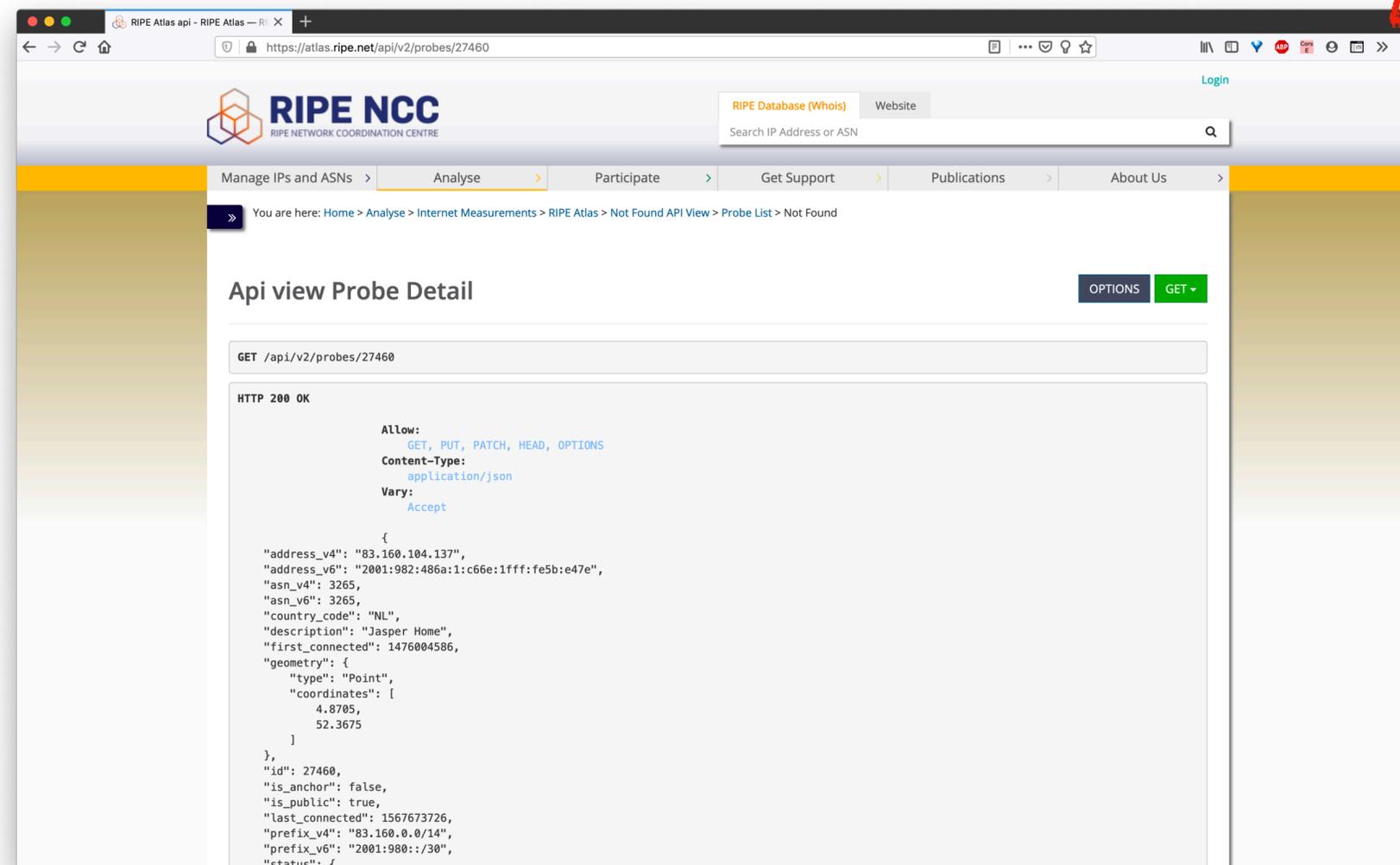


# Searching probes with the API



- endpoint `https://atlas.ripe.net/api/v2/probes/`
- different formats, e.g. geojson

also works in a browser!





# **Finding Results of Public Measurements**

# Looking up Measurements Results



Manage IPs and ASNs > **Analyse** > Participate > Get Support > Publications > About Us >

>> You are here: Home > Analyse > Internet Measurements > RIPE Atlas > Measurements

## Measurements

Search by target Search... Any Status IPv4/v6 All types Of all time

Ping Traceroute DNS HTTP SSL NTP WiFi Built-in Anchoring

ID	Type	Target	Description	Probes	Interval	Time (UTC)	Status
9278562	Ping	www.ripe.net	Ping measurement to www.ripe.net	8	one-off	08-09-2017 14:02 Never	○
9278557	Ping	185.15.245.163	From script for latency checks for Monitoring	35	one-off	08-09-2017 13:58 Never	○
9278556	Ping	123.126.20.54	check unicom	10	one-off	08-09-2017 13:51 08-09-2017 14:00	■
9278555	Ping	r1.d1.de.recast-it.net	From script for latency checks for Monitoring	35	one-off	08-09-2017 13:50 08-09-2017 14:00	■
9278554	Ping	r1.a1.nl.recast-it.net	From script for latency checks for Monitoring	35	one-off	08-09-2017 13:50 08-09-2017 14:00	■
9278553	Ping	2001:6a8:28c0:2017::00:00:FF	Ping 6 BLUE measurement to 2001:6a8:28c0:2017::00:00:FF	956	one-off	08-09-2017 13:49 08-09-2017 13:55	■
9278550	Ping	2001:6a8:28c0:2017::00:00:FF	Ping6 measurement to 2001:6a8:28c0:2017::00:00:FF	484	one-off	08-09-2017 13:42 08-09-2017 13:50	■

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

# Available visualisations: ping



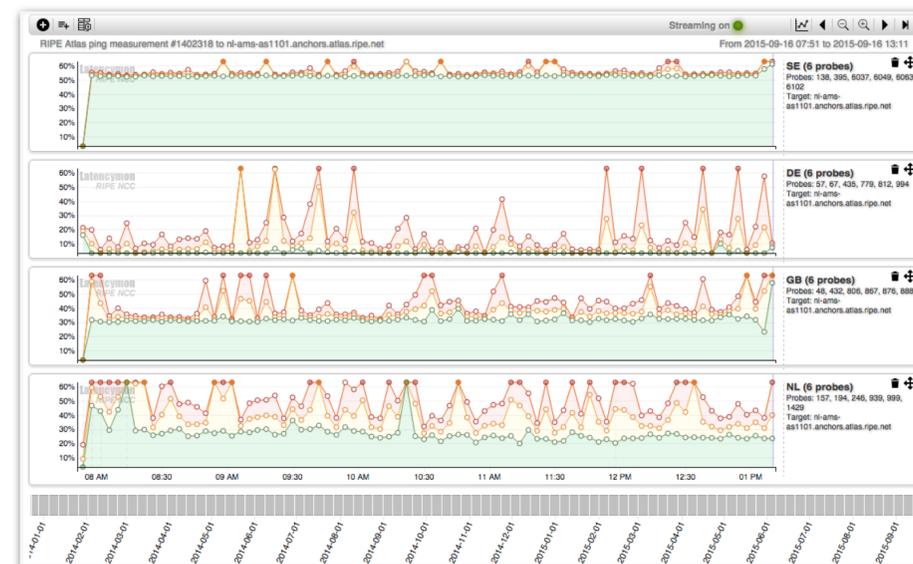
- List of probes: sortable by RTT

Probe	ASN (v4)	ASN (v6)		Time	RTT
6019	3333	3333		2015-05-19 09:23	1.157
6069	59469	59469		2015-05-19 09:23	15.253
6111	198068	198068		2015-05-19 09:23	37.760
6112	197216	197216		2015-05-19 09:23	35.494
10008	3851			2015-05-19 09:23	24.664
10218	6876			2015-05-19 09:23	37.952
10246	39608			2015-05-19 09:23	36.313
10252	50288			2015-05-19 09:23	62.441
10267	12322			2015-05-19 09:23	31.498
10296	51214			2015-05-19 09:23	✘ Unreachable

- Map: colour-coded by RTT



- LatencyMON: compare multiple latency trends





# Available visualisations: traceroute



- List of probes, colour-coded number of hops

www.seil.jp

General Information Probes Map OpenIPMap Prototype Download Results

Probe	ASN (v4)	ASN (v6)	Time	RTT	Hops
2043	3313		2014-08-25 07:44	308.018	21
3246	41135		2014-08-25 07:41	259.912	12
3389	3302		2014-08-25 07:43	285.608	17
4092	37497		2014-08-25 07:40	452.889	19
4228	3269		2014-08-25 07:41	329.862	20
10024	42353		2014-08-25 07:44	×	1

# Available visualisations: DNS



- Map, colour-coded response time or diversity
- List of probes, sortable by response time



### DNS measurement to ns1.opteamax.de

Probe	ASN (v4)	ASN (v6)	Time	Name	Response Time
17840	6327		2015-05-19 09:38	null	362.009
18035	43030		2015-05-19 09:50	null	347.39
18129	327805		2015-05-19 09:49	null	207.743
15844	32098		2015-05-19 09:48	null	184.237
17857	852		2015-05-19 09:37	null	177.694
19894	6327		2015-05-19 09:36	null	168.689
19204	21513		2015-05-19 09:50	null	141.199
15922	30036		2015-05-19 09:47	null	133.309

# Downloading Measurements Results



- Click on “Results”, then “Download”
- Or URL
- Or API
- Results in JSON
- Libraries for parsing

⚡<sup>6</sup> Calibration for anchoring measurement: IPv6 Traceroute for ke-nbo-as37578.anchors.atlas.ripe.net

General Information Probes Map OpenIPMap Prototype **Results**

Download the raw measurement result data here.

You can use this form to download the data through your browser, or use the preview on the right to help you query the REST API directly.

Select Your Timeframe

Start Date\*: 2017-09-13 (start time of this measuremer) All dates are start-of-day

Stop Date\*: 2017-09-13 (start time of this measuremer) All dates are end-of-day

Format: JSON

URL Preview

```
https://atlas.ripe.net/api/v2/measurements/9304064/results/?start=1505260800&stop=1505347199&format=json
```

Download

# Looking at the Result



Destination (IP  
& name)

```
[{"af":6,"avg":61.32,  
"dst_addr":"2a00:1450:4004:802::1014","dst_name":"www.google.com",  
"dup":0,  
"from":"2001:8a0:7f00:b201:220:4aff:fec5:5b5b",  
"fw":4660,"lts":411,  
"max":62.148,"min":60.372,  
"msm_id":1004005,"msm_name":"Ping",  
"prb_id":722,"proto":"ICMP","rcvd":10,  
"result":[{"rtt":62.148}, {"rtt":61.437}, {"rtt":61.444}, {"rtt":61.448}, {"rtt":61.477}, {"rtt":60.372}, {"rtt":60.373}, {"rtt":61.384}, {"rtt":61.267}],  
"sent":10,"size":64,  
"src_addr":"2001:8a0:7f00:b201:220:4aff:fec5:5b5b",  
"step":240,"timestamp":1410220847,"ttl":54,"type":"ping"},
```

Source (probe  
public IP address)

Reference  
(msm ID)

Packet loss:  
difference  
between sent &  
received!

# Search for Measurements by Target in RIPEstat



RIPEstat — Internet Measurements and Analysis

https://stat.ripe.net/widget/atlas-targets#w.resource=8.8.8.8

You are here: Home > Data & Tools > RIPEstat > atlas-targets

**RIPE Atlas Measurement Targets (8.8.8.8)**

8.8.8.8

Show 10 targets/page Search:

Measurement ID	Stopped	Type	Target IP	Target Hostname
1040720	ongoing	ping	8.8.8.8	google-public-dns-a.google.com
1006491	ongoing	traceroute	8.8.8.8	not specified
1006192	ongoing	ping	8.8.8.8	not specified
1004827	ongoing	traceroute	8.8.8.8	not specified
1002630	ongoing	ping	8.8.8.8	not specified
1478085	2014-02-24 13:41 UTC	dns	8.8.8.5	not specified

Go to "RIPEstat > RIPE Atlas Activity"

# Finding one specific measurement



- If you know the measurement ID:
  - <https://atlas.ripe.net/measurements/ID>
  - <https://atlas.ripe.net/measurements/2340408/>

# Use Existing Measurements



- Many measurements already running!
- Search for existing public measurements first...
- Only then schedule your own measurement



# Creating a Measurement

# Benefits of your own measurements



- Customer problem: cannot reach your server
  - Schedule measurements (pings or traceroutes) from up to 1,000 RIPE Atlas probes worldwide to check where the problem is
- Measuring packet loss on suspected “bad” link
- Testing anycast deployment

# Logging In



- Log in to [atlas.ripe.net](https://atlas.ripe.net)
  - Use your RIPE NCC Access account
  - Same account for LIR Portal, RIPE Atlas, RIPEstat, RIPE Labs...
  - Create an account if you don't already have one

The screenshot shows the RIPE Atlas website. The header includes the RIPE NCC logo and a search bar. The main content area features a 'Welcome to RIPE Atlas!' message, a 'Log In' button, and a 'Use Cases' section. A sidebar on the left contains navigation links for 'RIPE Atlas', 'About RIPE Atlas', 'Get Involved', 'Probes and Anchors', 'Measurements, Maps and Tools', 'Resources', and 'RIPE NCC Members'. A 'Statistics' section on the right displays: Probes connected to RIPE Atlas: 9397, Measurements currently running: 11986, and Results collected per second: 3737. Below this is a 'Current Sponsors' section featuring the ICANN logo and a 'Become a Sponsor' link.

The screenshot shows the login page on the RIPE Atlas website. The header includes the RIPE NCC logo and a search bar. The main content area features a 'Sign in using your RIPE NCC Access account' heading, a message stating 'If you don't have a RIPE NCC Access account, click here to create one.', and a 'Sign in' button. To the right of the sign-in button is a 'Forgot your password?' link. Below the sign-in button is a yellow box with the text 'New: Two-step verification. Learn more...'. The page also includes a navigation menu with links for 'Manage IPs and ASNs', 'Analyse', 'Participate', 'Get Support', and 'Publications'.

# Credits system



- Measurements cost credits
  - ping = 10 credits, traceroute = 20, etc.
- Why? Fairness and to avoid overload
- Spending limit and max number of measurements

# Credits overview



**RIPE NCC**  
RIPE NETWORK COORDINATION CENTRE

RIPE Database (Whois) Website

Search the content of this website

Manage IPs and ASNs > **Analyse** > Participate > Get Support > Publications > About Us

You are here: Home > Analyse > Internet Measurements > RIPE Atlas > My Atlas > My Credits

**Credits**

Here you can see the history of your credit use and current consumption, transfer credits to someone else, and redeem a voucher for credits if you have one.

**153,033,561**  
*9,000.00 credits / hour*

History Charts & Archives Transfer Standing Order Redeem voucher

Page 1 of 26

Comm	Change	Balance
Prob	+ 108,000	153,033,561
Probe ID	+ 108,000	152,925,561
Probe ID:6019 Anchor uptime 5x extra credit	+ 108,000	152,817,561
Probe ID:6019 Anchor host 5x extra credit	+ 108,000	152,709,561
2016-02-02 01:02 UTC Probe ID:6019 Anchor uptime 5x extra credit	+ 108,000	152,601,561
2016-02-02 01:02 UTC Probe ID:6019 Anchor host 5x extra credit	+ 108,000	152,493,561
2016-02-01 01:02 UTC Probe ID:6019 Anchor uptime 5x extra credit	+ 108,000	152,385,561
2016-02-01 01:02 UTC Probe ID:6019 Anchor host 5x extra credit	+ 108,000	152,277,561

**My Atlas > Credits**

**Give credits to someone**

# Scheduling a measurement with the web interface



- Log in to atlas.ripe.net
- Navigate to Measurements, Maps and Tools -> Measurements in the left hand sidebar
- Click the green 'Create a Measurement' on the right side of the page

# Scheduling a measurement (2)



**1**

## Create a New Measurement

**Step 1 Definitions**

**2**

▼ Ping measurement to bbc.co.uk

**Target:**  
bbc.co.uk  
An IP address or hostname

**Description:**  
Ping measurement to bbc.co.uk

**Address Family\*:**  
IPv4

**Interval:**  
240  
How often this should be done (seconds between samples). Note that this value is ignored for one-off measurements.

**Packets:**  
3

**Size:**  
48

**Resolve on Probe:**   
Force the probe to do DNS resolution

[Advanced Options](#)

+ Ping + Traceroute + DNS + SSL + HTTP + NTP

**Step 2 Probe Selection**

Worldwide 10

+ New Set - wizard + New Set - manual + IDs List + Reuse a set from a measurement

**Step 3 Timing**

This is a One-off:

**Start time (UTC):** As soon as possible

**Stop time (UTC):** Never

> Measurement API Compatible Specification

**3** Create My Measurement(s)

**Costs summary**

Daily cost: 10800 credits

You will run out of credits in about 124 days

Users who will supply credits for this measurement:  
ferenc@ripe.net



# Scheduling a measurement (3)

- Recurring measurement: mostly used for a periodic, long-term measurement, or..
- One-off measurement: one run on all selected probes.
- Choose type, target, frequency, start/end time, # of probes, region...
- Each measurement will have **unique ID**
- “**API Compatible Specification**” is generated too

# Selecting probes with new-set-wizard



The screenshot displays a web-based interface for selecting probes. On the left, a search bar allows filtering by place, IP, prefix, probe IDs, or AS number. The main area is a map of the Netherlands with numerous probe locations marked by numbered grey boxes. On the right, a panel titled 'Selected Probes (12)' lists the following probe IDs with their corresponding country flags (NL) and status icons:

- Probe ID: 28476
- Probe ID: 26404
- Probe ID: 25022
- Probe ID: 23271
- Probe ID: 22962
- Probe ID: 22896
- Probe ID: 22839
- Probe ID: 21824
- Probe ID: 21819
- Probe ID: 15153
- Probe ID: 4823
- Probe ID: 4783

An 'Ok' button is located at the bottom of the selected probes list.



# Use Cases

# Use cases (1)



## Using RIPE Atlas to Validate International Routing Detours

[Anant Shah](#) — 30 Jan 2017

## A Quick Look at the Attack on Dyn

[Massimo Candela](#)  — 24 Oct 2016

Contributors: [Emile Aben](#)

## Using RIPE Atlas to Monitor Game Service Connectivity

[Annika Wickert](#) — 14 Sep 2016

## Using RIPE Atlas to Measure Cloud Connectivity

[Jason Read](#) — 06 Sep 2016

## Using RIPE Atlas to Debug Network Connectivity Problems

[Stéphane Bortzmeyer](#) — 10 May 2016

# RIPE Atlas IXP Country Jedi (1)



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

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

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

# RIPE Atlas IXP Country Jedi (2)



- Methodology
  - Trace route mesh between RIPE Atlas probes
  - Identifying ASNs in country using RIPEstat
  - Identifying IXP and IXP LANs in PeeringDB

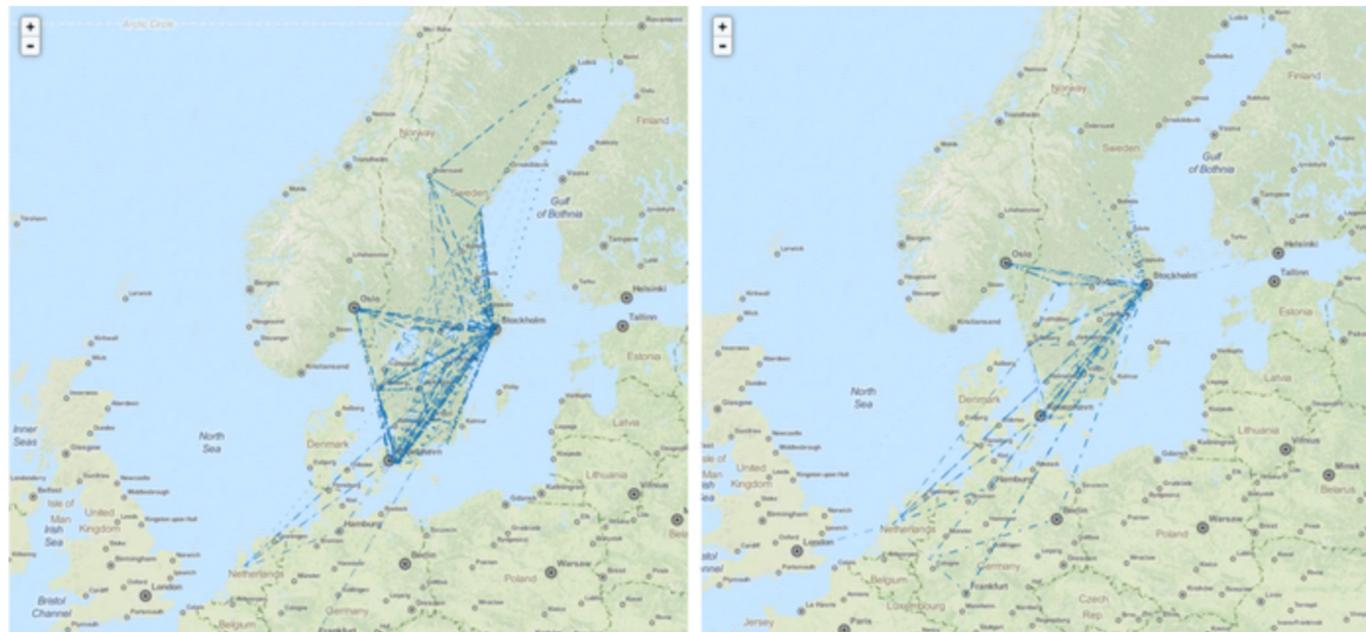
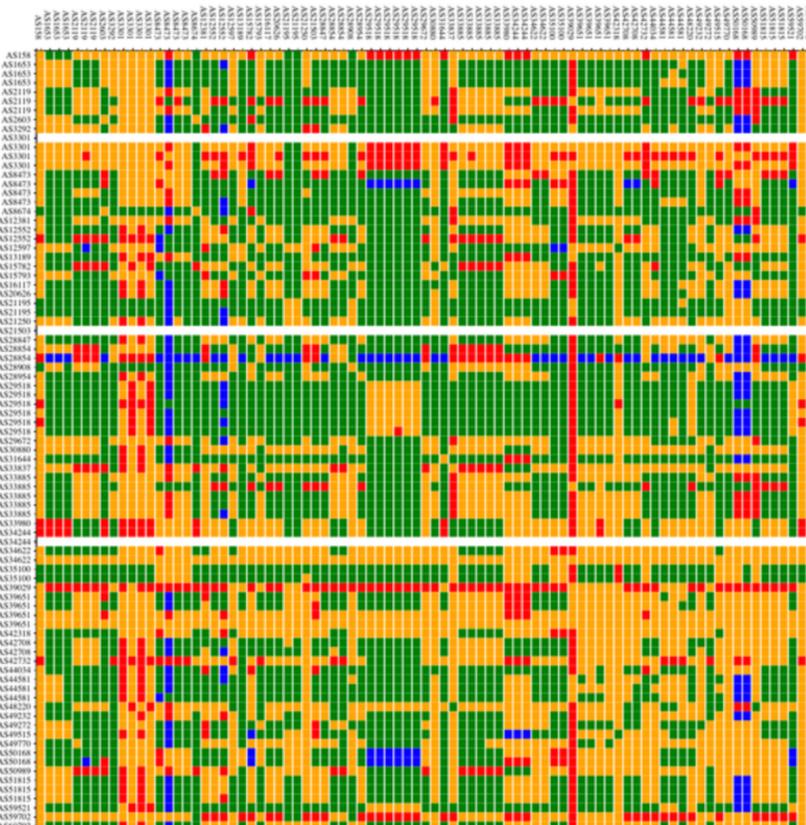


Figure 1: Visual representation of IPv4 paths (left) and IPv6 paths (right) between selected RIPE Atlas probes in Sweden

■ IXP IPs: YES, out-of-country IPs: NO  
■ IXP IPs: NO, out-of-country IPs: NO  
■ IXP IPs: YES, out-of-country IPs: YES  
■ IXP IPs: NO, out-of-country IPs: YES



# Use Cases (2)



- DDoS Attack on Dyn DNS Servers (Oct. 2016)
  - 10s millions devices - Mirai botnet
  - Legitimate requests



# Use Cases (3)



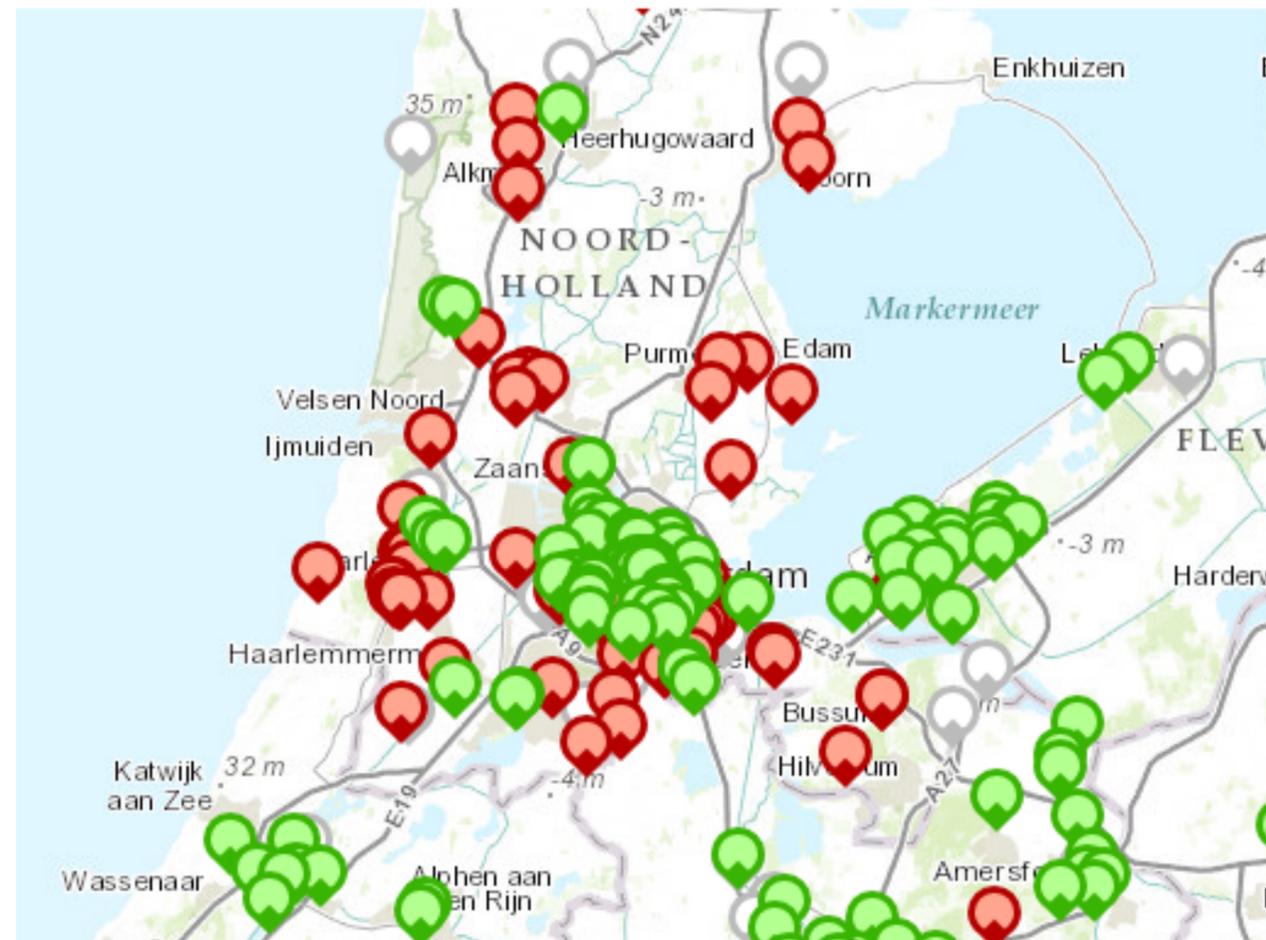
- Monitor Game Service Connectivity (Sept. 2016)
- Requirements:
  - Check General Reachability, Latency, Historical data
  - Supported by an active and helpful community
  - Integrate with their existing logging system
- Track down an outage in one upstream
- Became sponsors



# Use Cases (4)



- Amsterdam Power Outage (March 2015)
- When and where the outage was happening





**Take Part in the  
RIPE Atlas Community**

# RIPE Atlas community (part 1)



- Volunteers host probes in homes or offices
- Organisations host RIPE Atlas anchors
- Sponsor organisations give financial support or host multiple probes in their own networks

# RIPE Atlas community (part 2)



- Ambassadors help distribute probes at conferences, give presentations, etc.
- Developers contribute free and open software
- Network operators create measurements to monitor and troubleshoot
- Researchers and students write papers



# Hosting a probe

- Create a RIPE NCC Access account
- Go to <https://atlas.ripe.net/apply>
- You will receive a probe by post
- Register your probe
- Plug in your probe
- If you receive a probe from an ambassador (trainer, sponsor, someone at a conference), just register it and plug it in!



# Questions



christian.teuschel@ripe.net  
@christian\_toysh