RIPE NCC
RIPE NETWORK COORDINATION CENTRE

RIPE Atlas and RIPEstat

Tutorial

Training Services | ENOG 13| 23-24 May

Introduction to RIPEstat

What is RIPEstat?

One interface for Internet data and statistics

“One-stop shop”

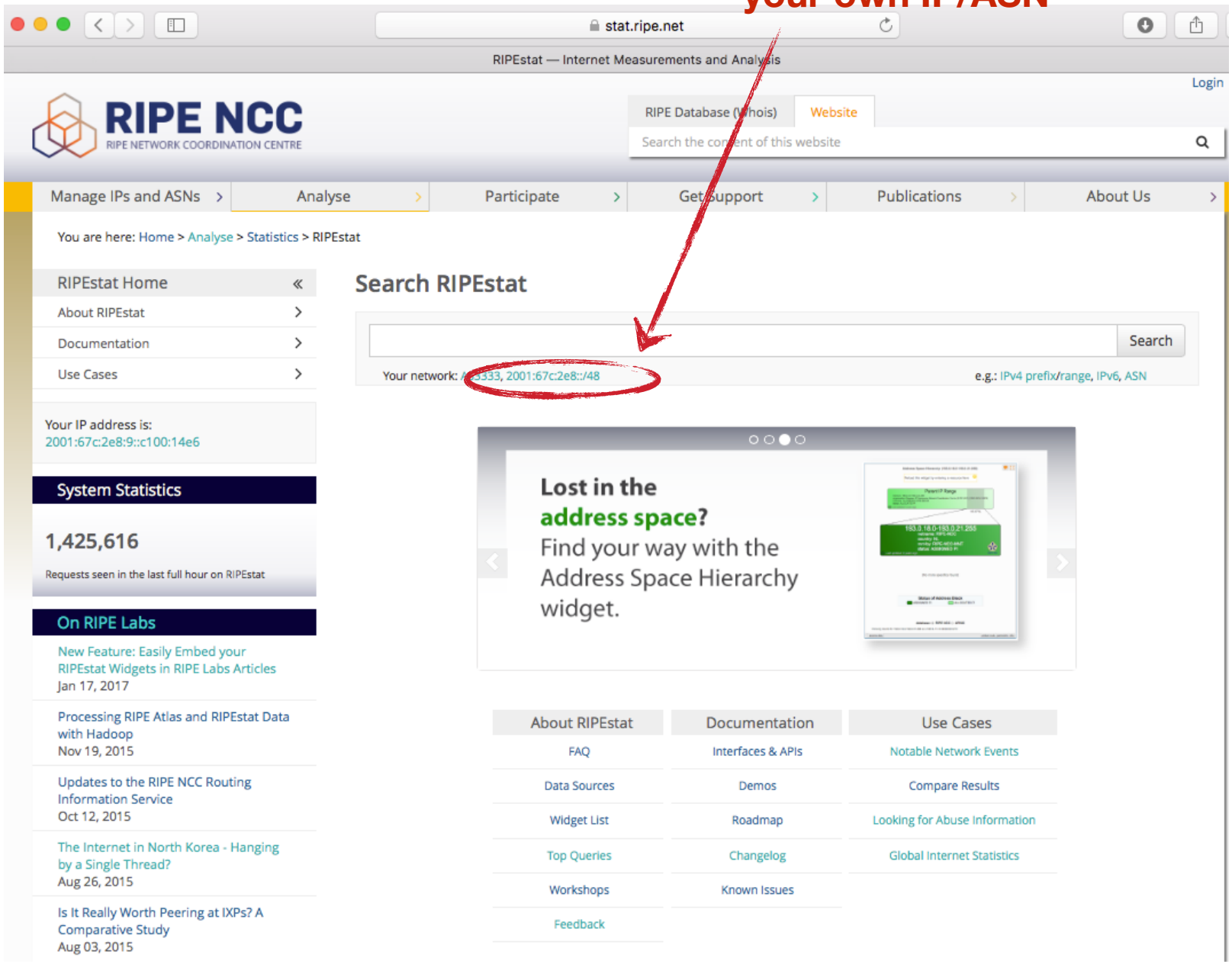
RIPE NCC
RIPEstat

What data? What sources?

- RIPE Database
- Other RIR data
- BGP routing data (RIS)
- Active measurements (RIPE Atlas, DNSMON)
- Geolocation (third party)
- Blacklist data (third party)
- More…

Landing page

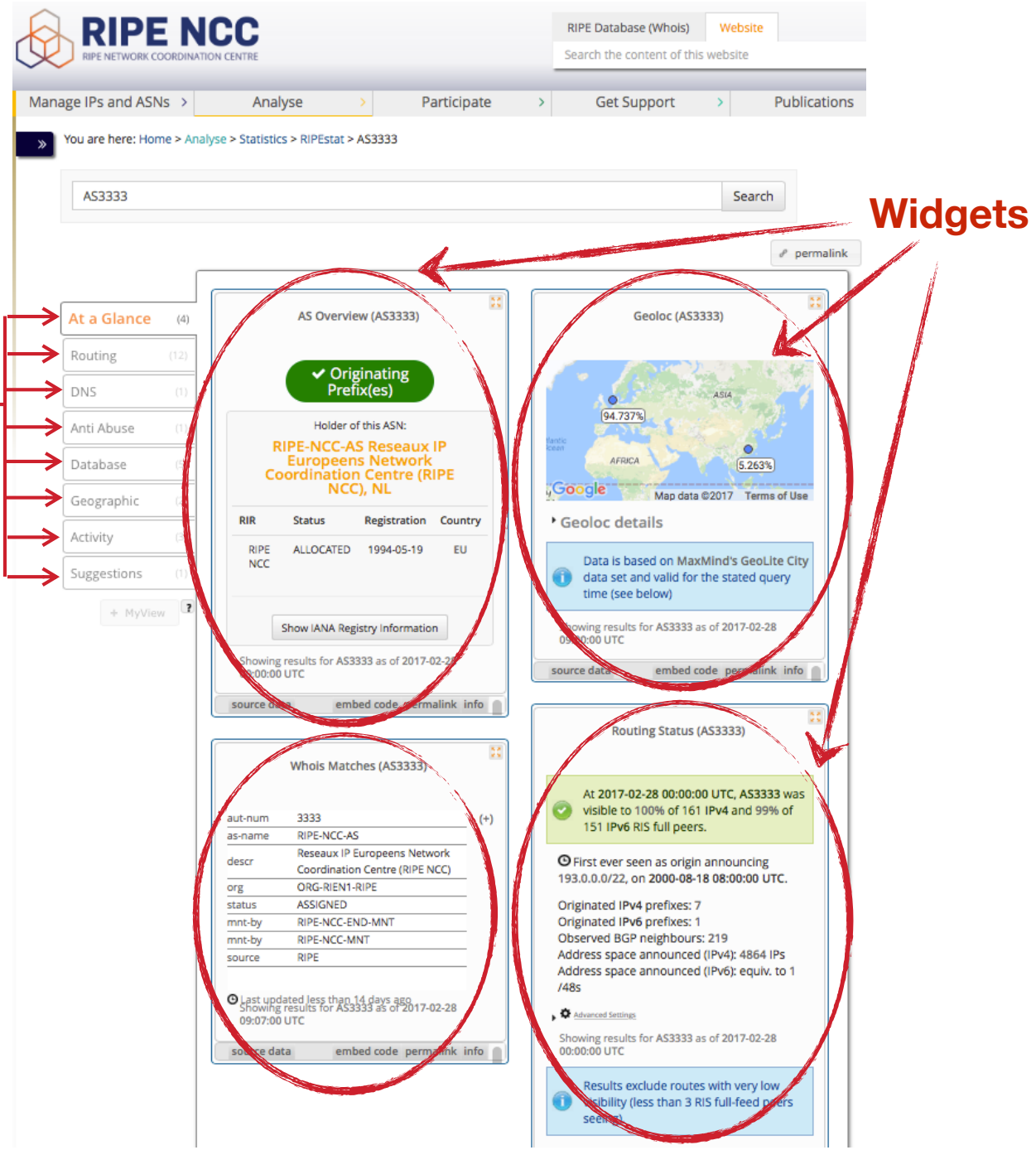
RIPEstat shows your own IP/ASN



Query Types

- IPv6 address/prefix
- IPv4 address/prefix
- ASN
- Hostname
- Country code

Results page



Why use RIPEstat?

- For your own network:
  - Is someone else announcing my prefix?
  - How visible is my new IPv6 network?
  - Is my BGP routing consistent with the Routing Registry?
  - Are my DNS and reverse DNS consistent?
  - Location of my customers' prefixes
  - Was my prefix visible yesterday in Tokyo?

Why use RIPEstat?

- For viewing other networks:
  - How many IPv6 prefixes are announced in my country?
  - IPv6 in my country compared to neighbours
  - Who has more peers, AS1 or AS2?
  - How does the upstream outage look?
  - Is the prefix/ASN that I want already announced?
  - Which ASN announces an IP?
  - Where can I report abuse from an IP?

RIPEstat Interfaces

- Web interface

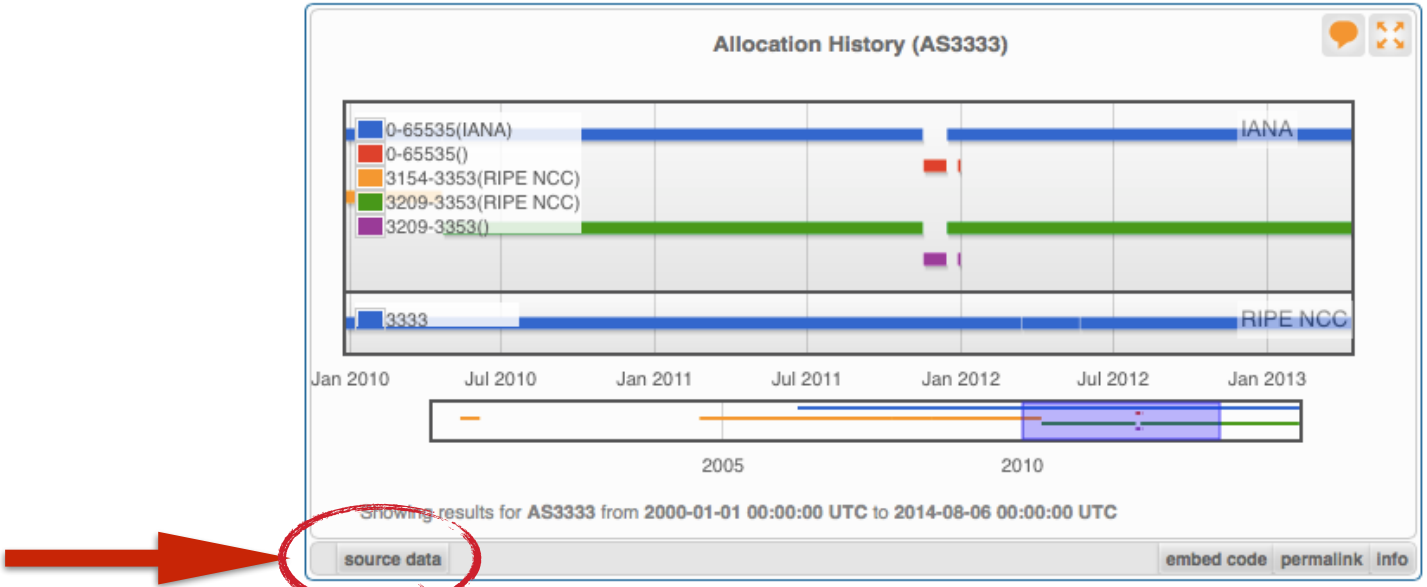
  https://stat.ripe.net

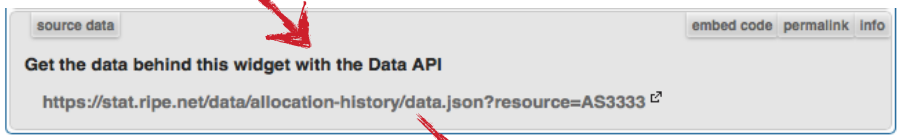
- RIPEstat widget API

- RIPEstat data API

More About Widgets

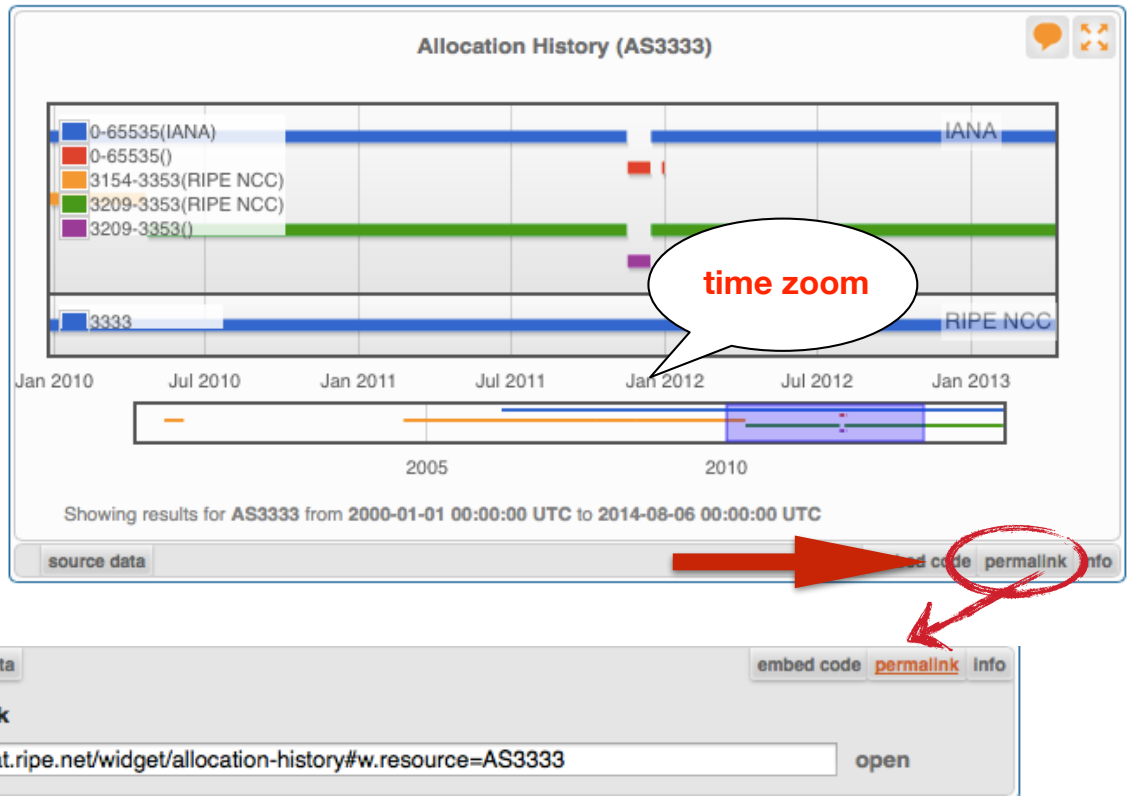
Get the data behind the widget!





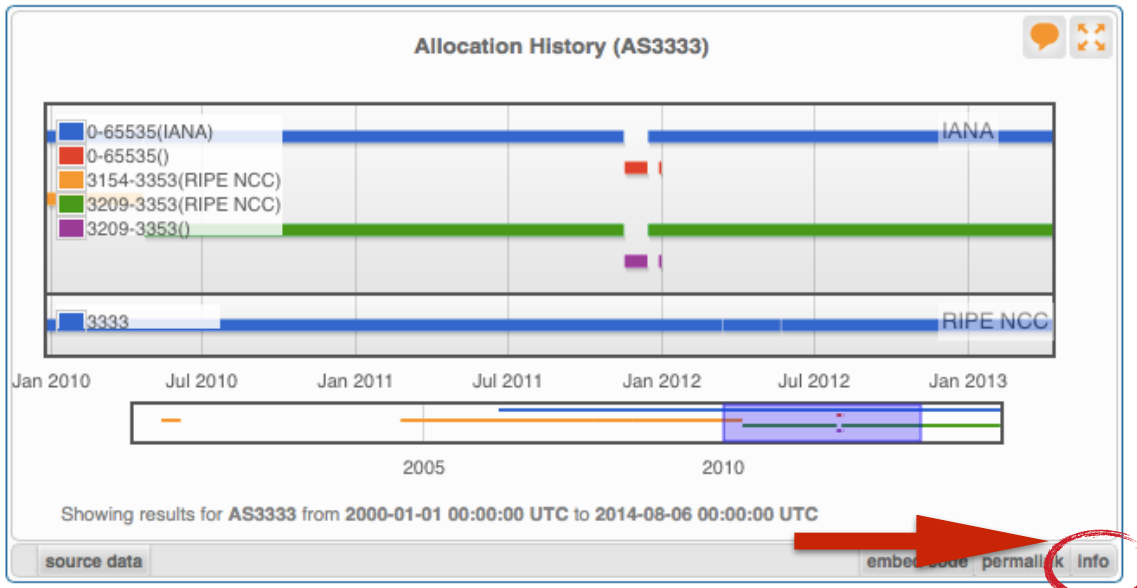

```
{
    "cached": true,
    "data": {
        "query_endtime": "2014-08-06T00:00:00",
        "query_starttime": "2000-01-01T00:00:00",
        "resource": "3333",
        "results": {
            "IANA": [
                {
                    "resource": "0-65535",
                    "status": "IANA",
                    "timelines": [
                        {
                            "endtime": "2007-10-11T00:00:00",
                            "starttime": "2007-10-11T00:00:00"
                        },
                        {
                            "endtime": "2008-11-03T00:00:00",
                            "starttime": "2007-10-27T00:00:00"
                        },
```

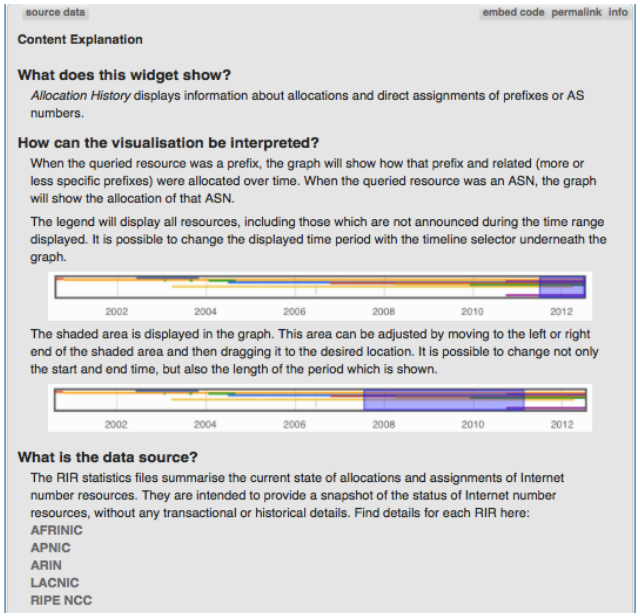
Shareable results URL



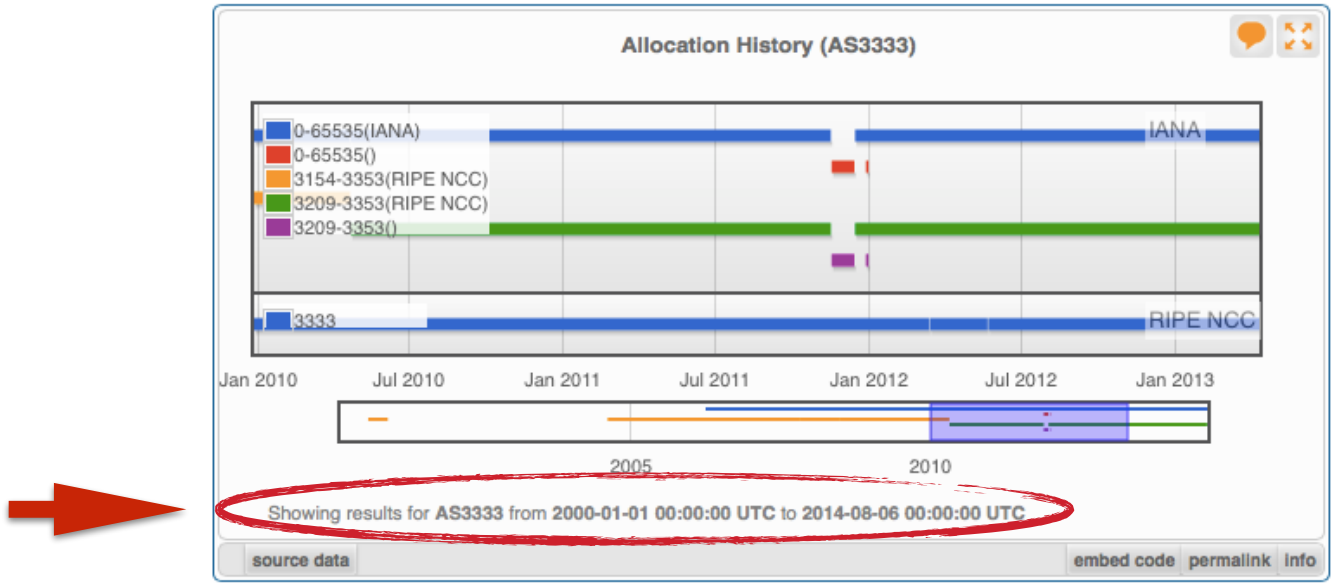
- Immutable shareable URL for each result!
- URL includes:
  - **widget** + queried **resource**
  - for some widgets: **settings**, **zoom**, **time period**

Where’s the data from?



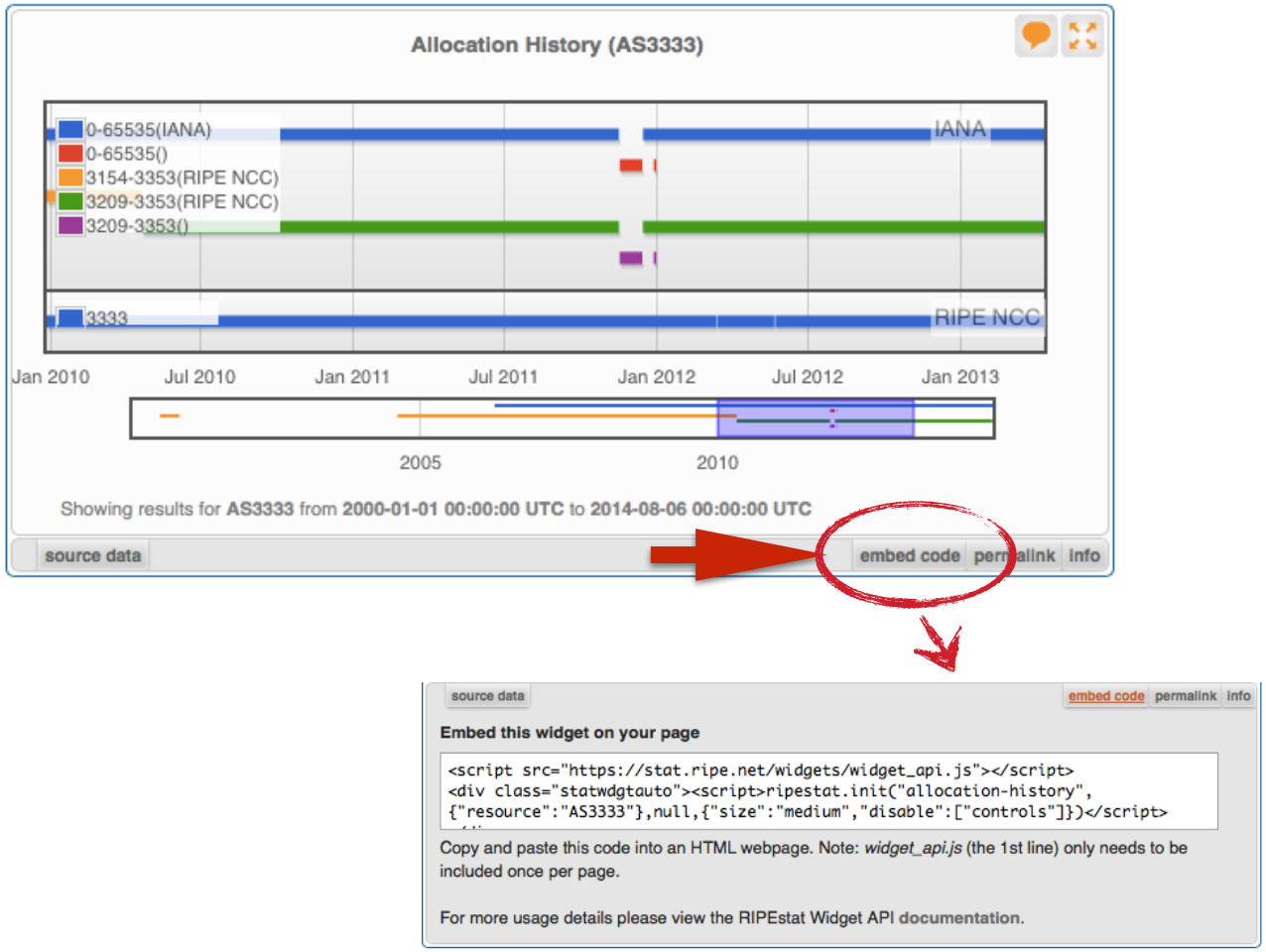


Freshness and timescale of the data



- Timestamp and time period
- Different widgets = different update frequency
- Adjustable usually
  - Limits: different maximum granularities

Embed the widget!

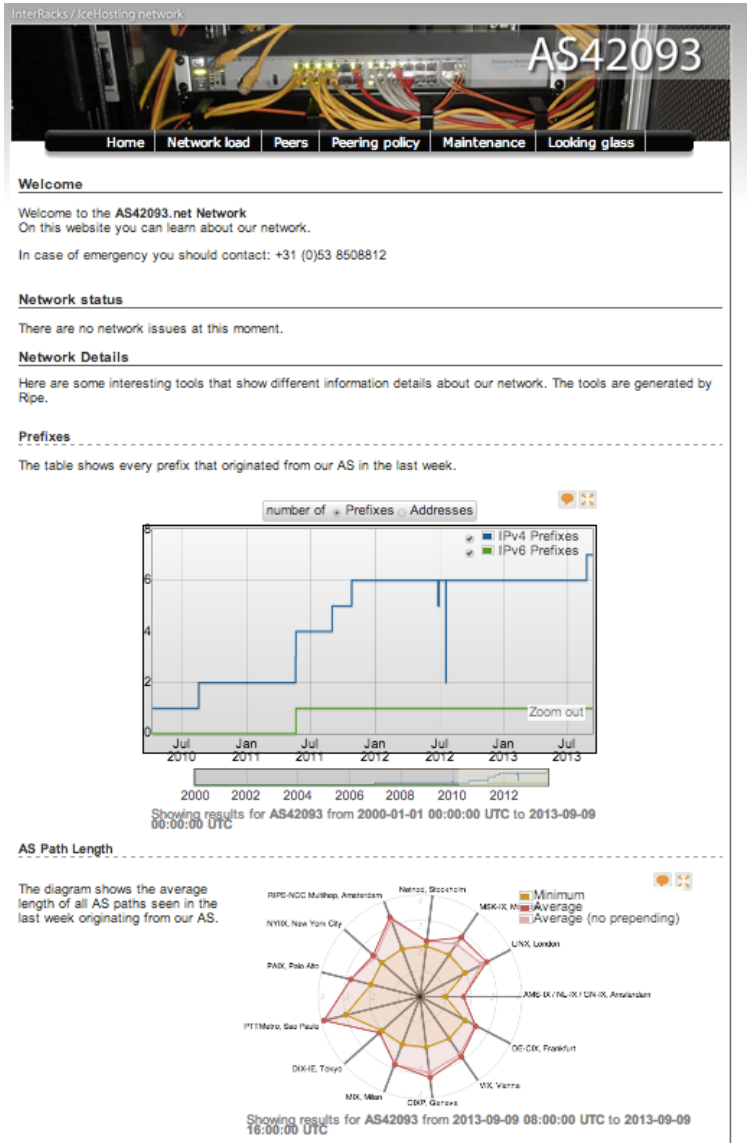


Embedding widgets on your site

- ISP embedded widgets on its page

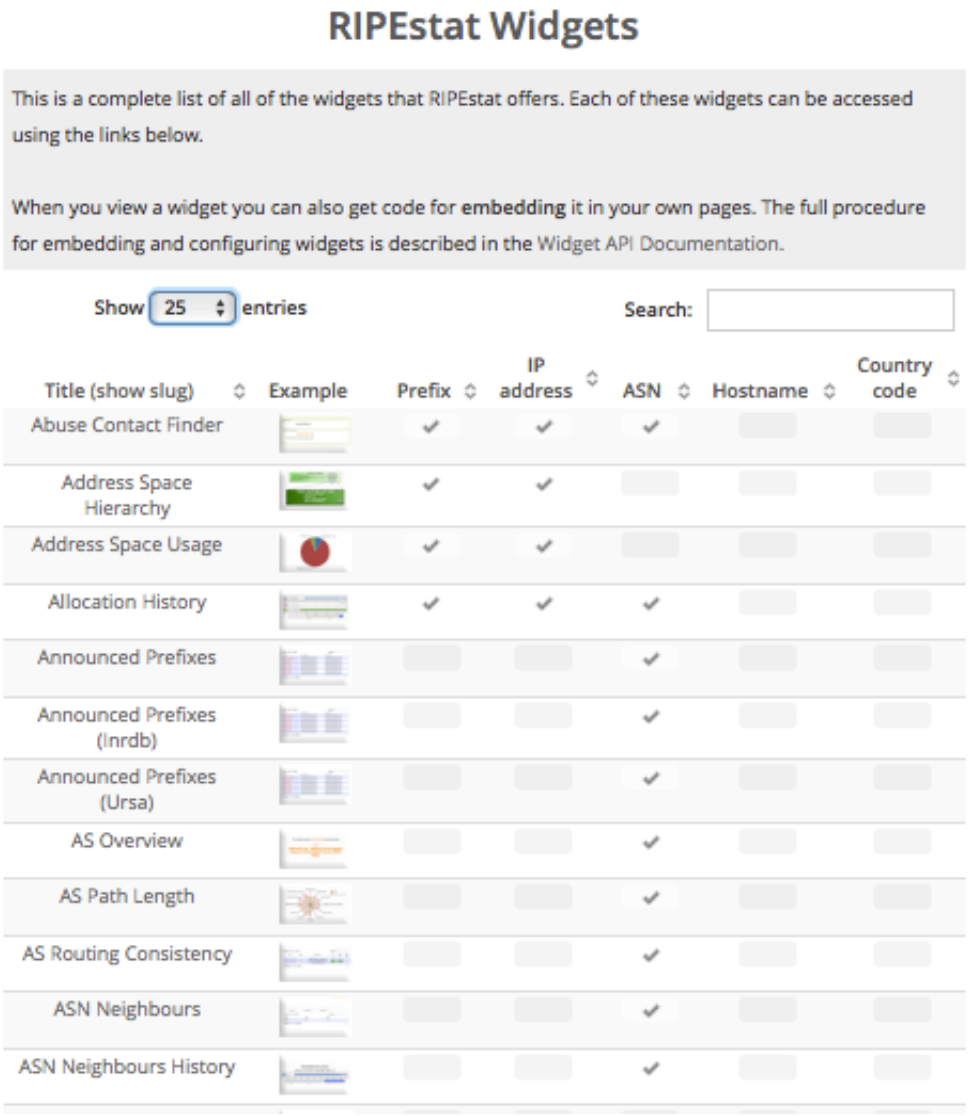
Prefix Count widget

AS Path Length widget



Widgets List

https://stat.ripe.net/widget/list



RIPEstat Widgets

This is a complete list of all of the widgets that RIPEstat offers. Each of these widgets can be accessed using the links below.

When you view a widget you can also get code for **embedding** it in your own pages. The full procedure for embedding and configuring widgets is described in the Widget API Documentation.

Show 25 entries Search:

Title (show slug)	Example	Prefix	IP address	ASN	Hostname	Country code
Abuse Contact Finder		✓	✓	✓		
Address Space Hierarchy		✓	✓			
Address Space Usage		✓	✓			
Allocation History		✓	✓	✓		
Announced Prefixes				✓		
Announced Prefixes (lnrdb)				✓		
Announced Prefixes (Ursa)				✓		
AS Overview				✓		
AS Path Length				✓		
AS Routing Consistency				✓		
ASN Neighbours				✓		
ASN Neighbours History				✓		

Visualising BGP Routing Information

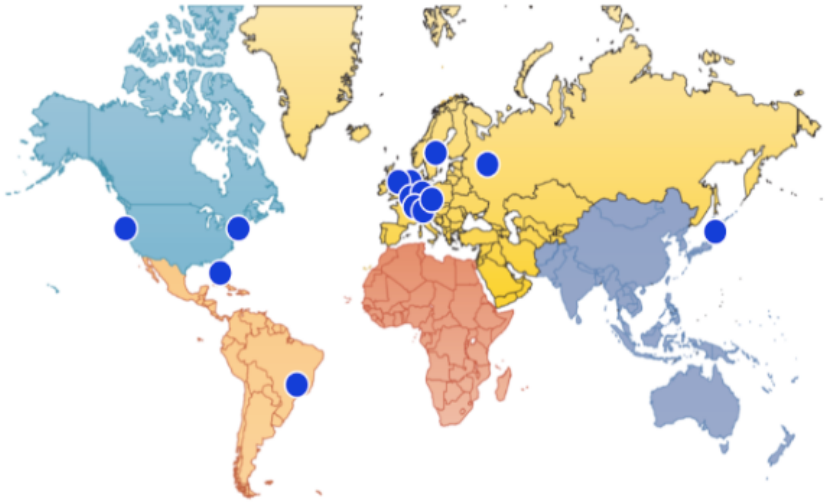
Querying

- IP or ASN queried?
  - You get different widgets!

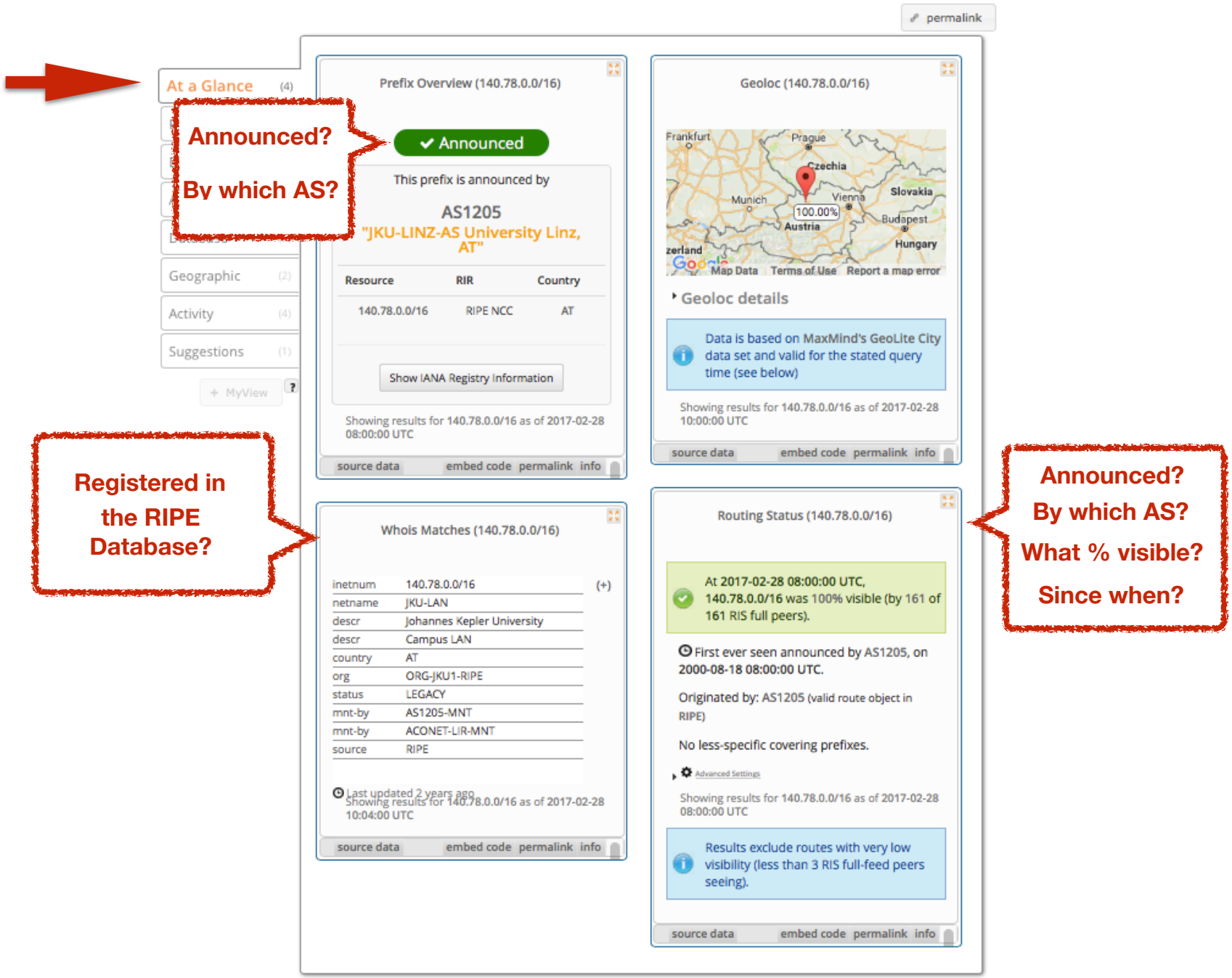
- ASN often visualised based on the prefixes it announces

RIS - Routing Information Service

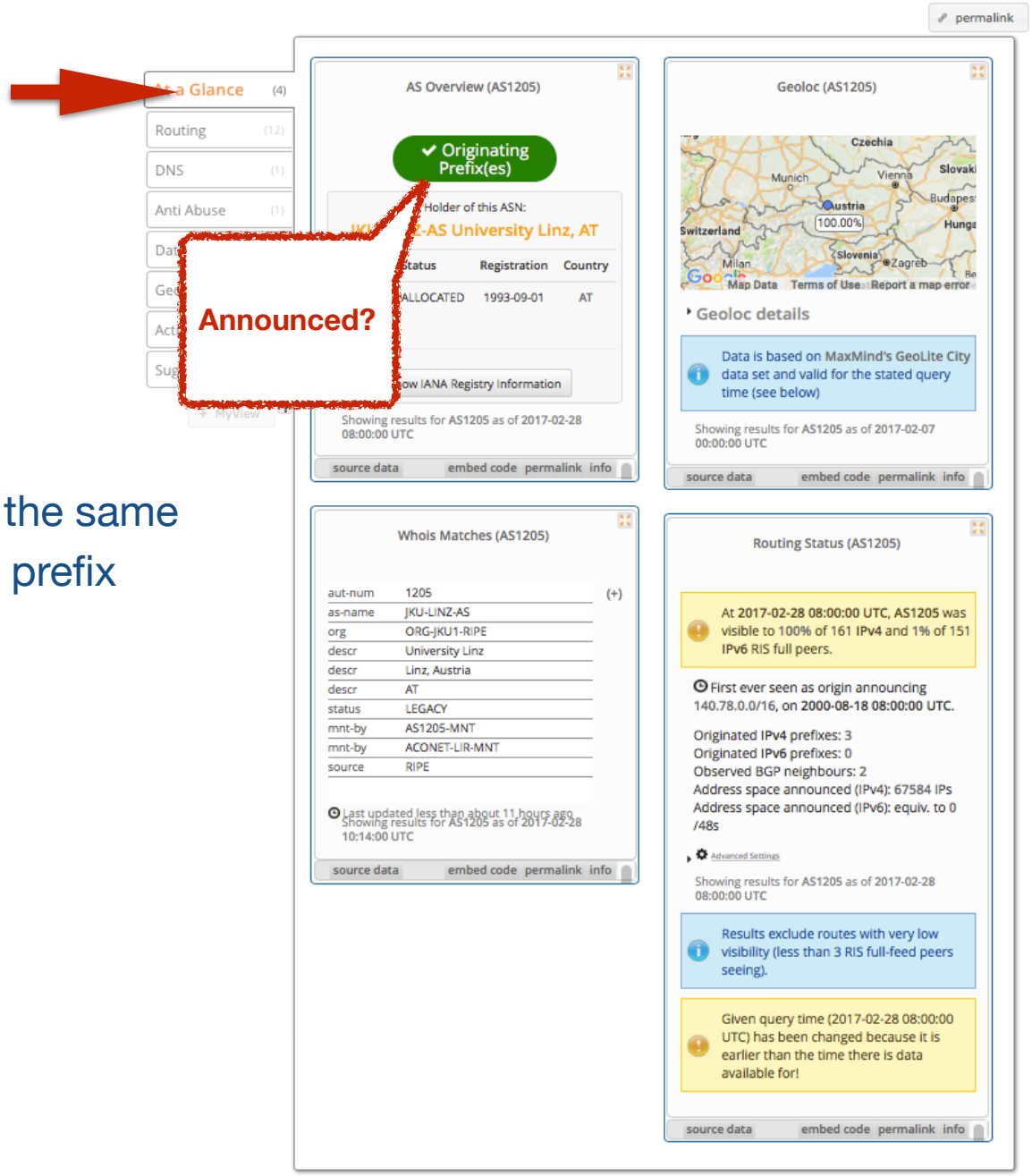
- RIPE NCC collecting BGP information since 1999
  - Raw data: ris.ripe.net
- 22 route collectors 600+ peers
- RIPEstat visualises RIS data



At-a-glance view: Prefix queried



At-a-glance view: ASN queried



The rest is the same as for a prefix

BGPlay

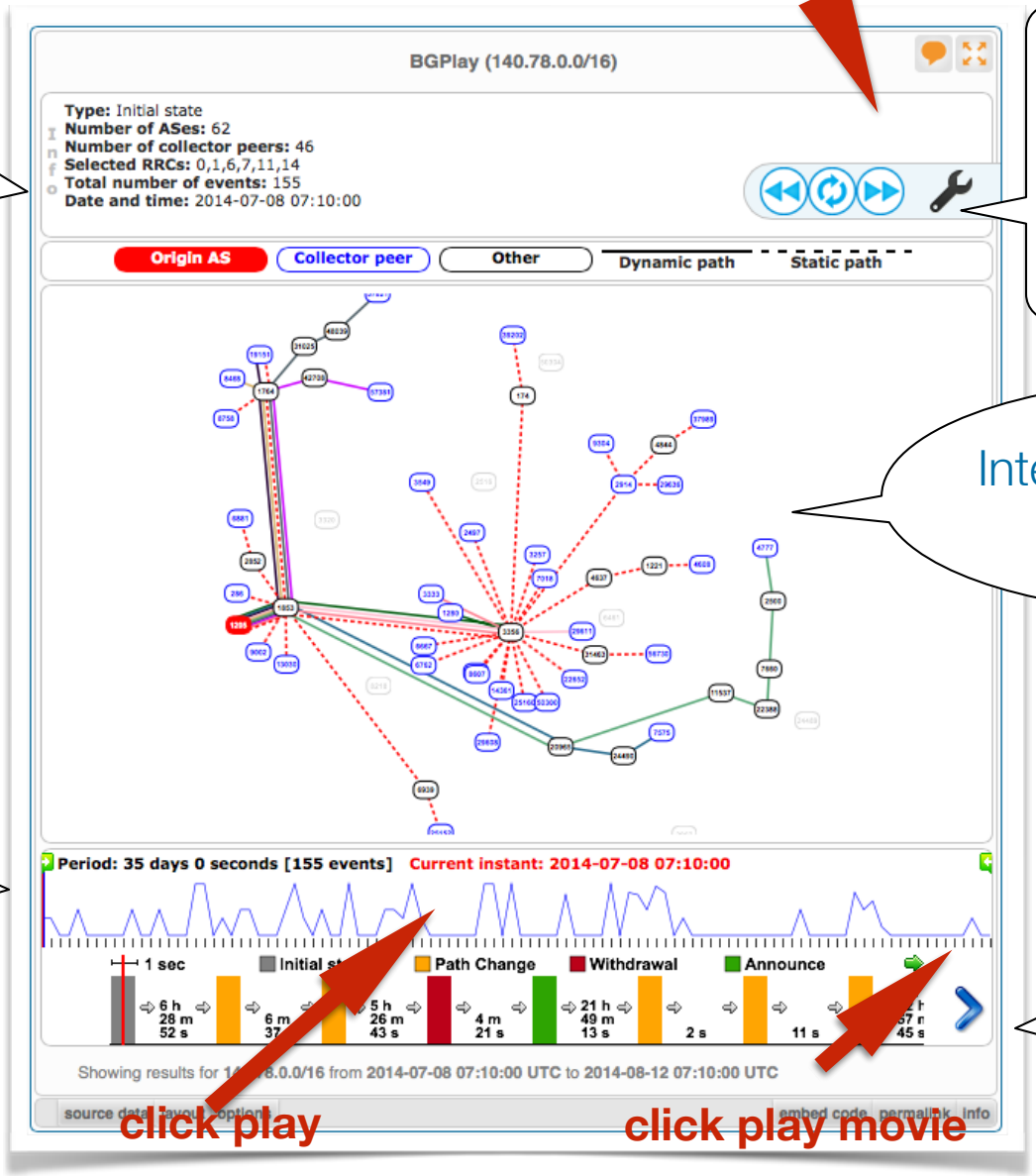
- See how your network is routed
  - Announcements
  - Withdrawals
  - Path changes
- Shows routing history
  - Animated graphic
  - Highly interactive

https://stat.ripe.net/widget/bgplay

BGPlay

BGP event, ASN or ASN path details

click play



Control panel:

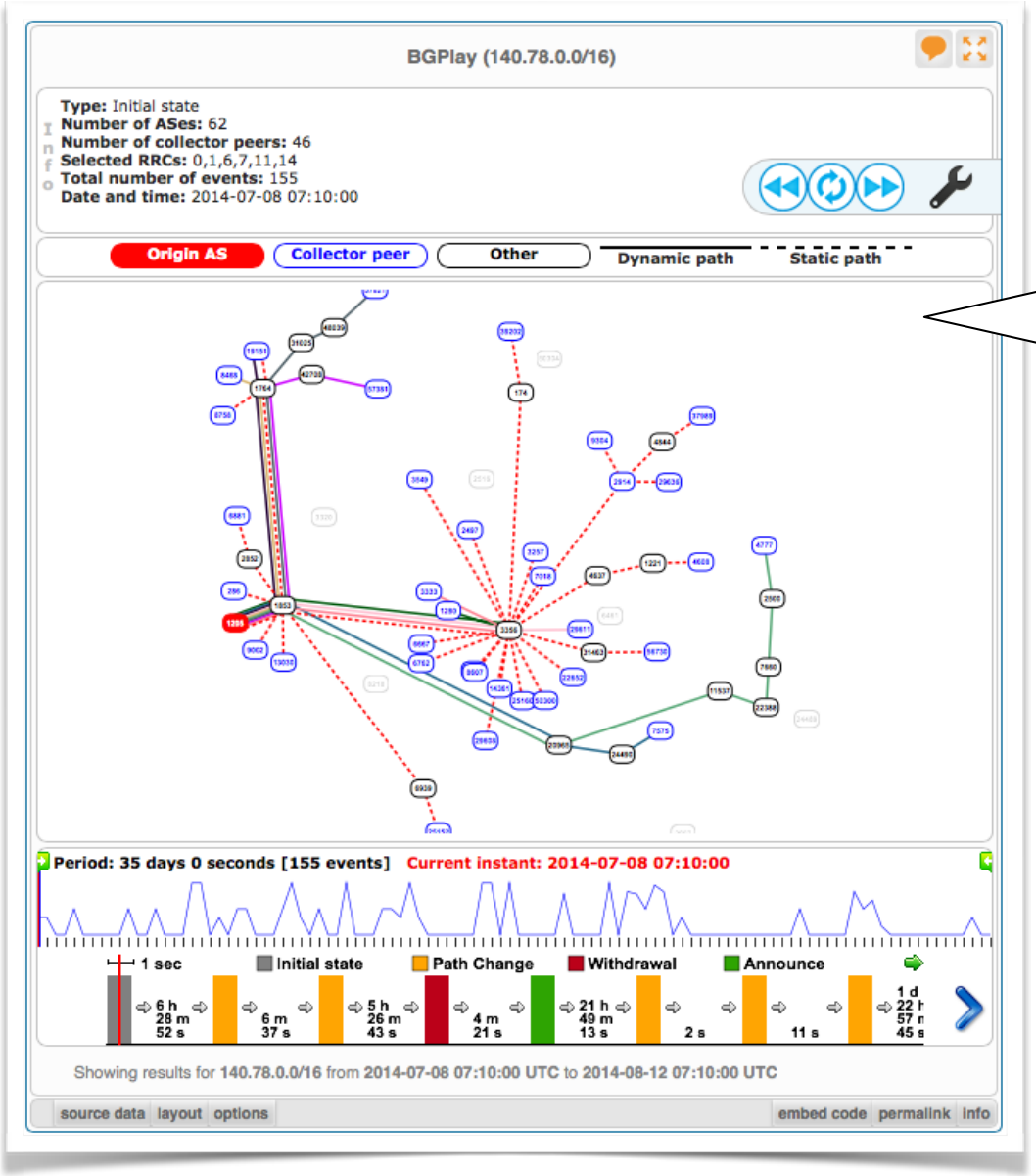
- Covered time period
- RRC selection

Interactive animated graph

Control timeline

Detailed timeline with events

BGPlay



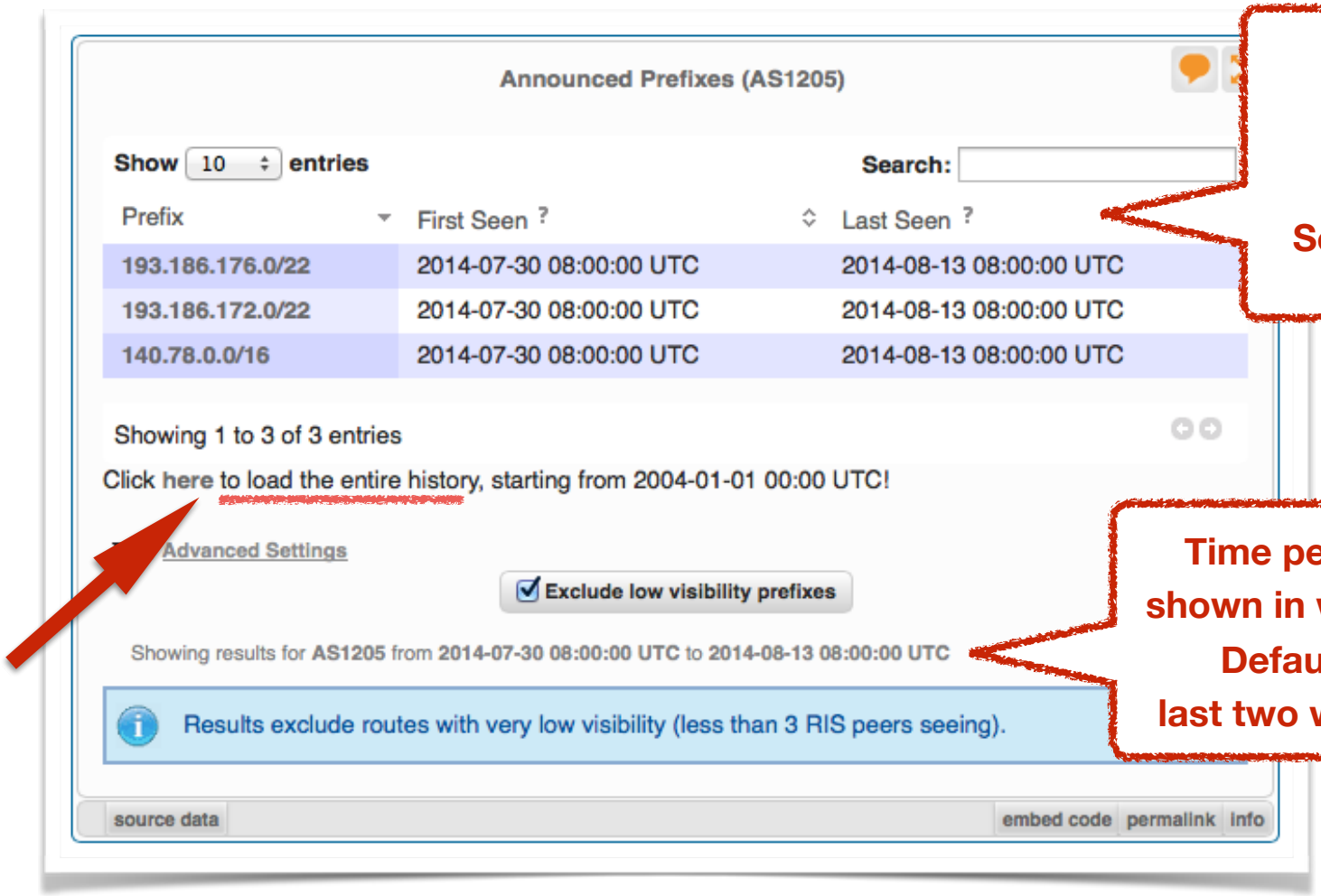
Examples: (2013/8/28-30)

- Prefix with announcements & withdrawals: 84.205.64.0/24
- Check IPv6 connectivity: 2001:67c:2e8::/48
- Multi-homed prefix: 199.7.80.0/24
- BGP hijacking
  2008-02-28: 208.65.153.0/24
  Youtube traffic by Pakistan Telecom AS17557
- Blackholing: 193.33.96.64

Tasks

- Find the up-stream provider for AS1205
- Is 69.36.157.0/24 originated by only one or more ASNs?
- Check the IPv6 connectivity of your own network

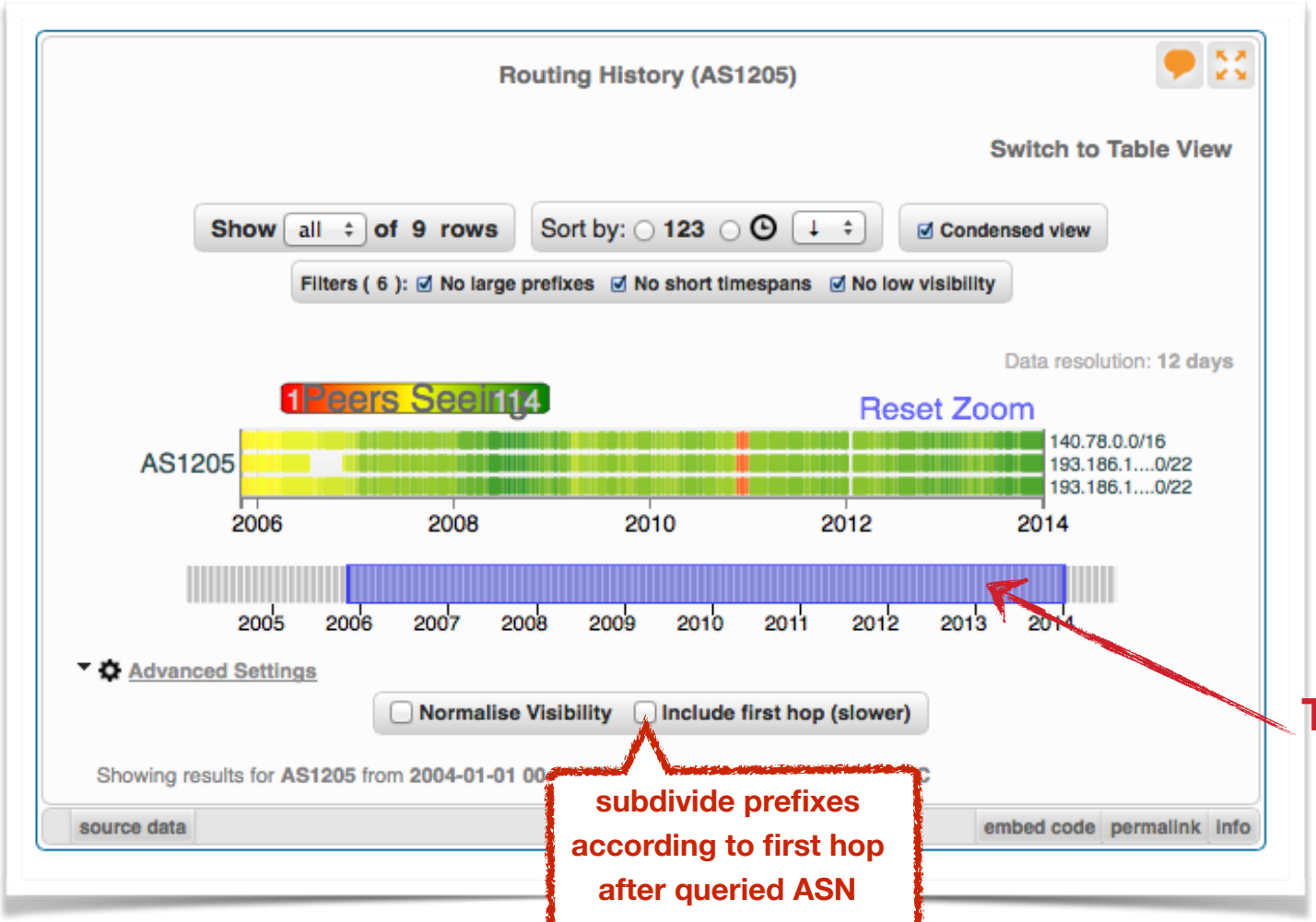
Prefixes visible for this ASN



IPv4 vs IPv6?
Sort by prefix
or
Search "." vs "::"

Time period
shown in widget
Default:
last two weeks

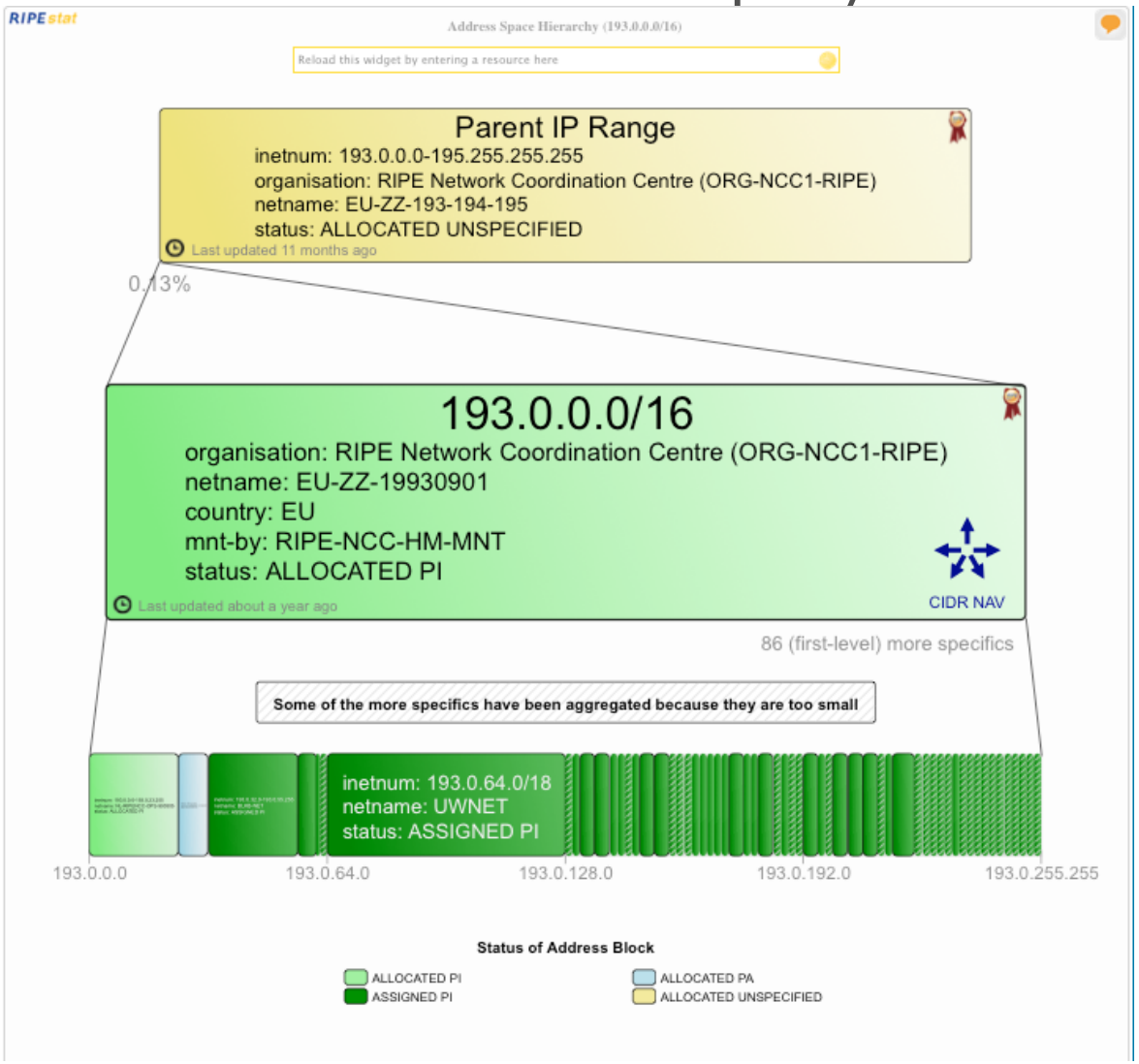
History of Prefixes Announced by ASN



Visualising RIPE Database Data

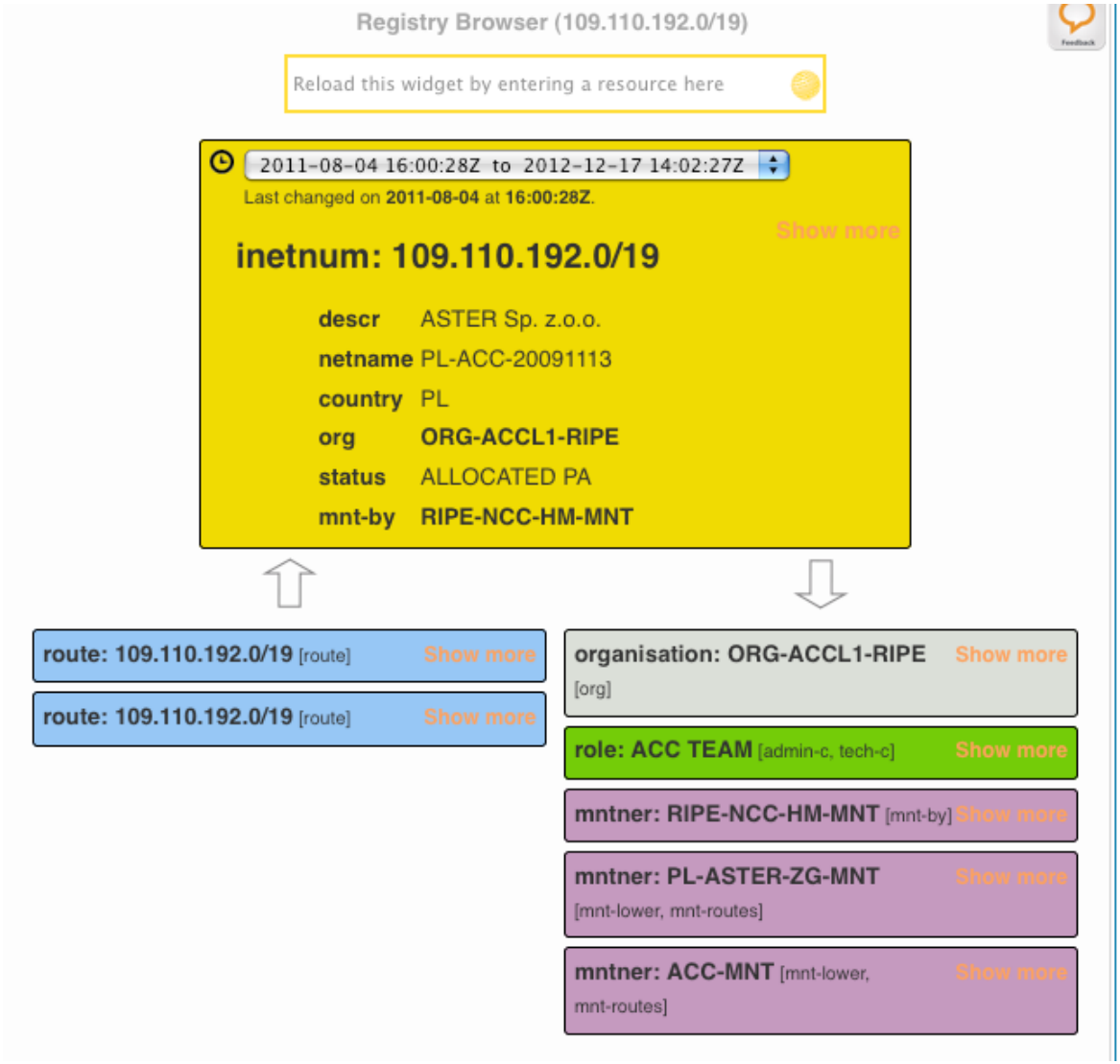
Address Space Hierarchy Widget

- click above or below to refocus query

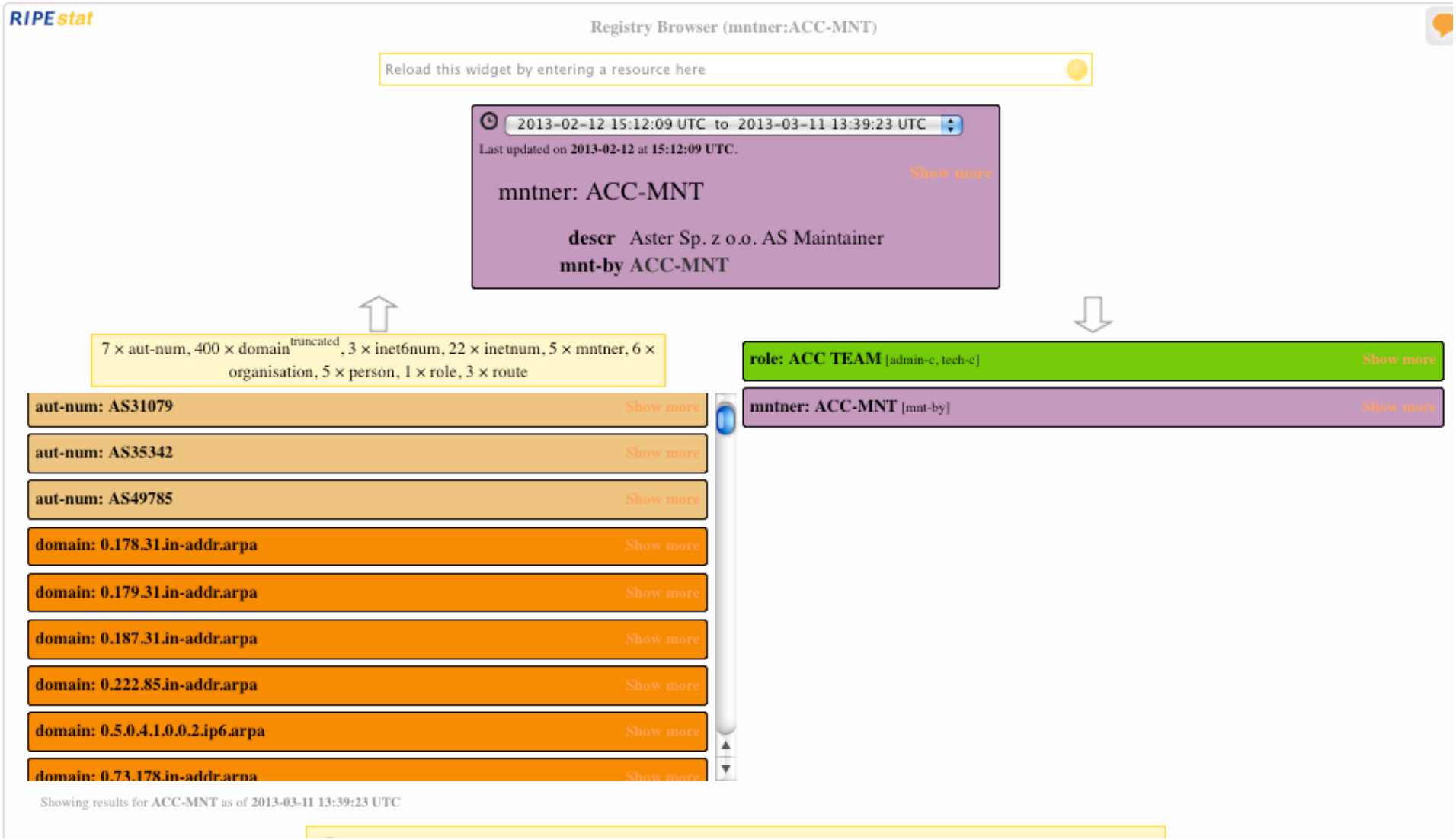


Registry Browser Widget

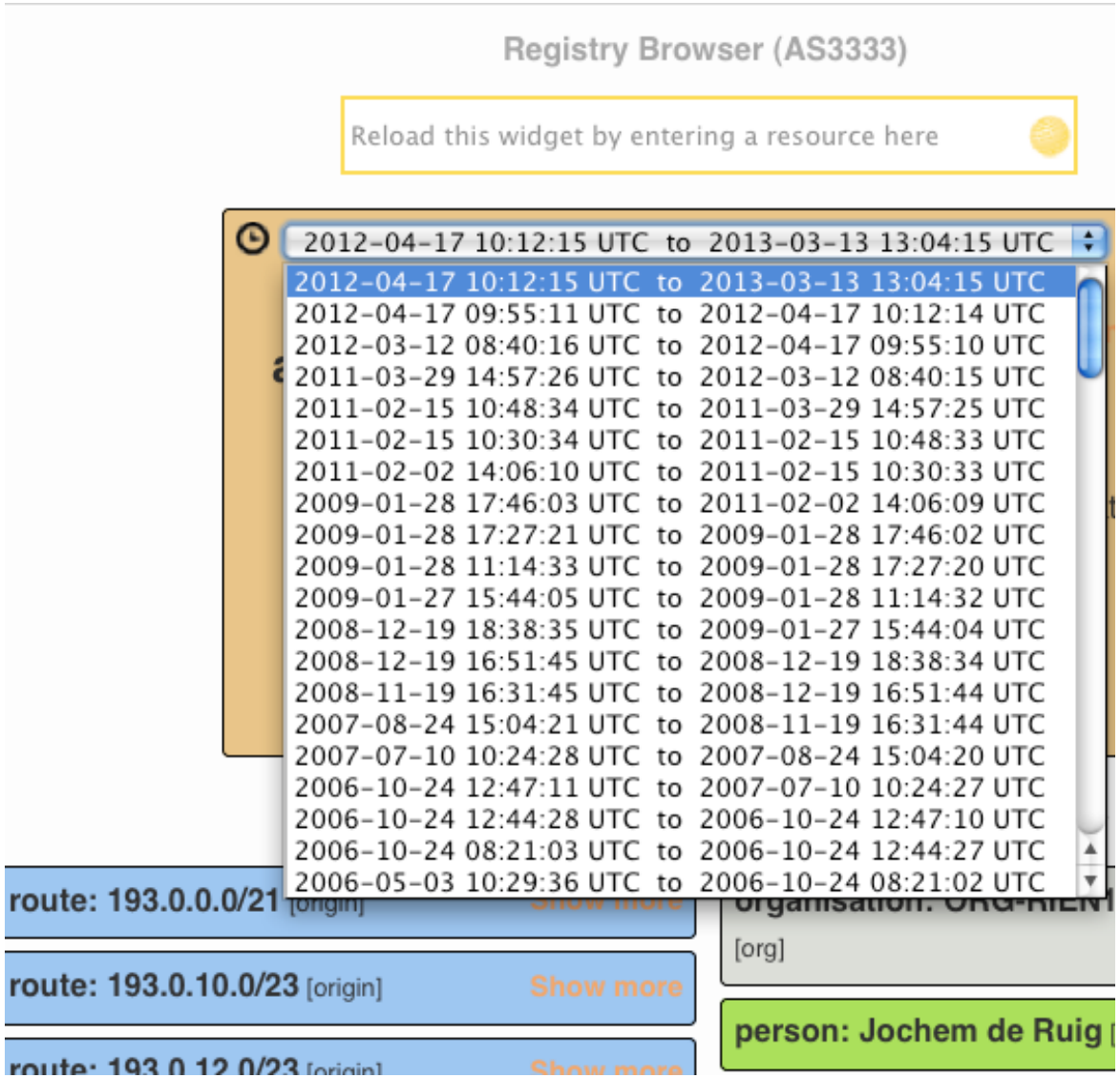
- click on another object to refocus query



Registry Browser Widget

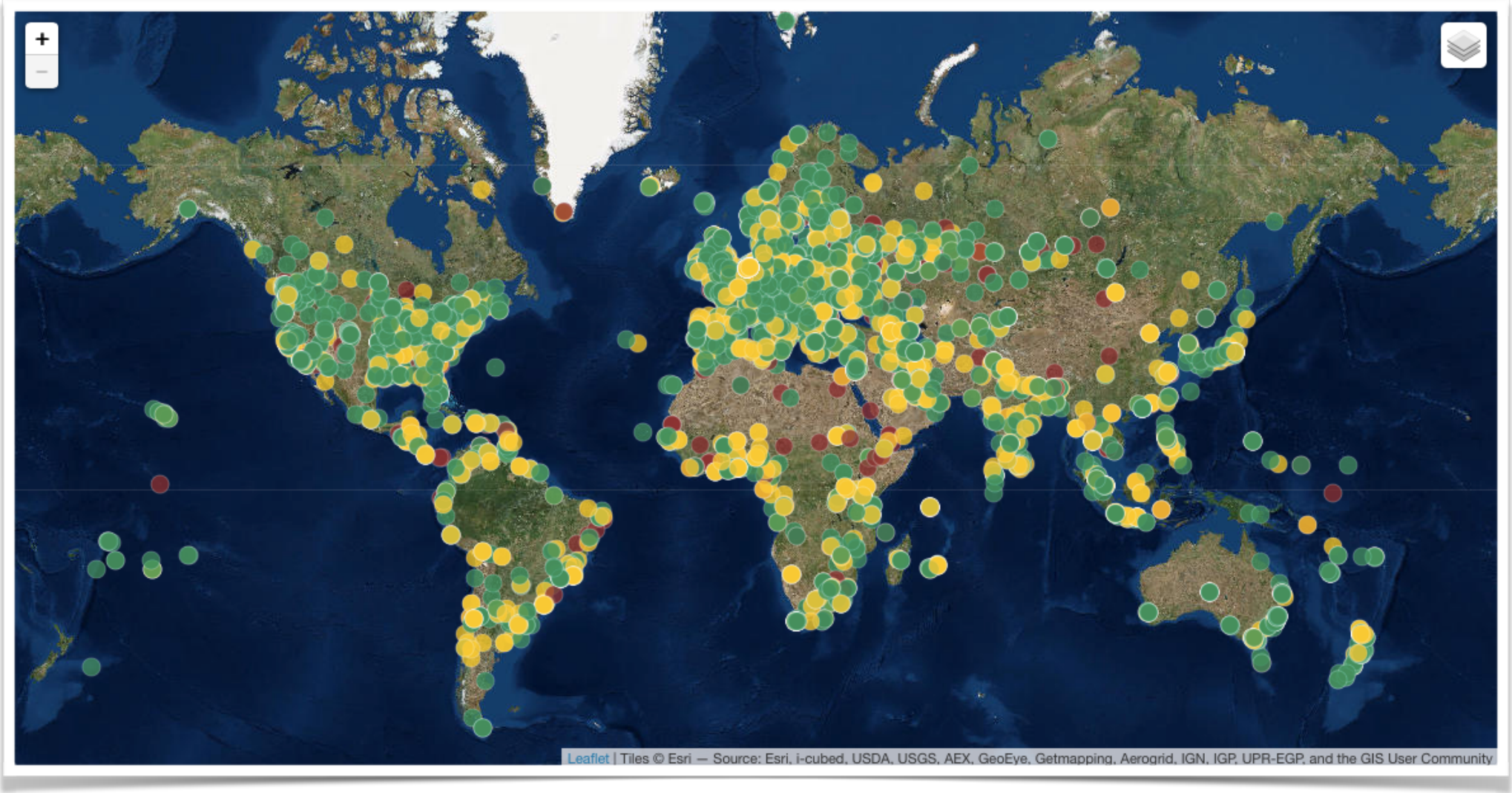


Travel Back in Time: For RIPE NCC Members



RIPE Atlas

RIPE Atlas Global Coverage



Why RIPE Atlas?

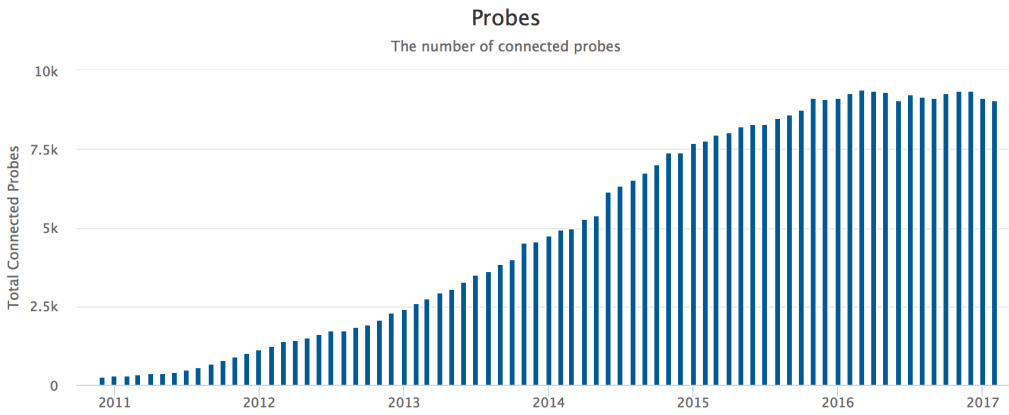
- Internet wide measurement system
  - Internet infrastructure, not all applications
- Goal: view Internet reachability
- Real time & historical info
- Probes hosted by volunteers
- Data publicly available
- Open and free

atlas.ripe.net

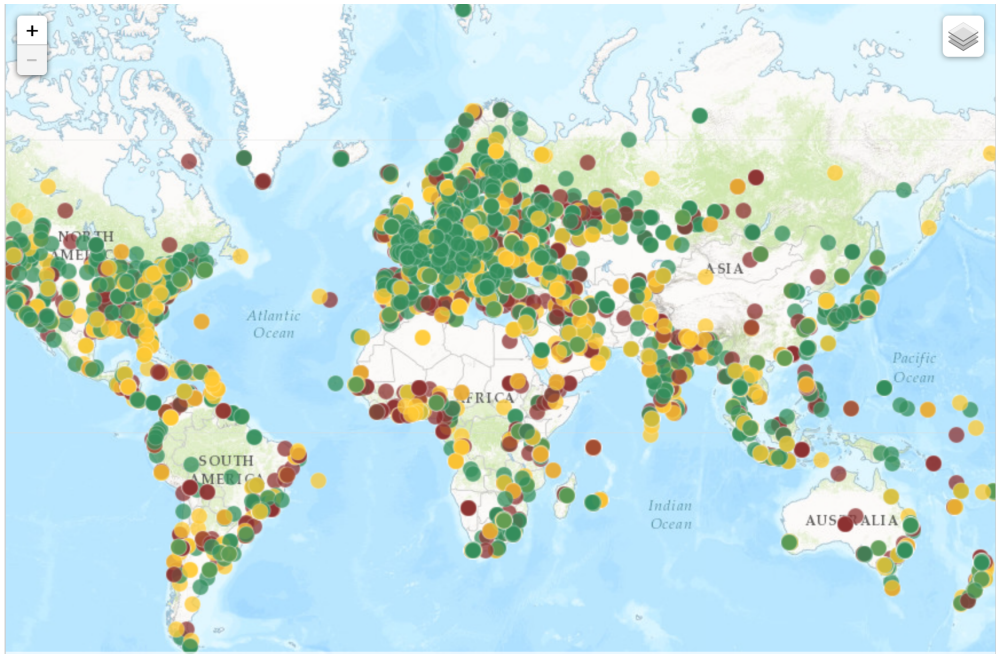
What is RIPE Atlas (1)

Composed of: **Probes**

- 9750+



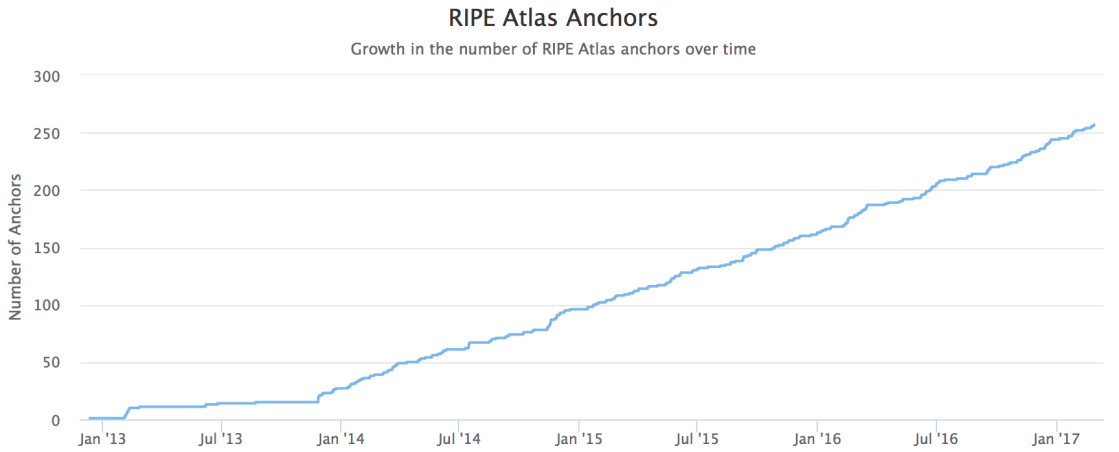
- Around the world



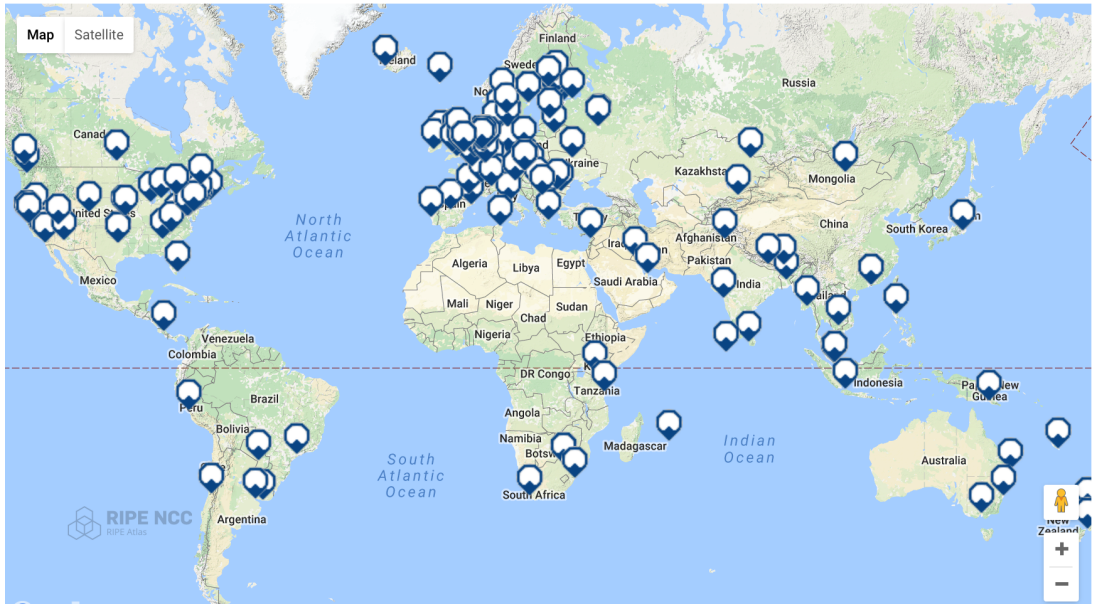
What is RIPE Atlas (2)

Composed by: **Anchors**

- 250+

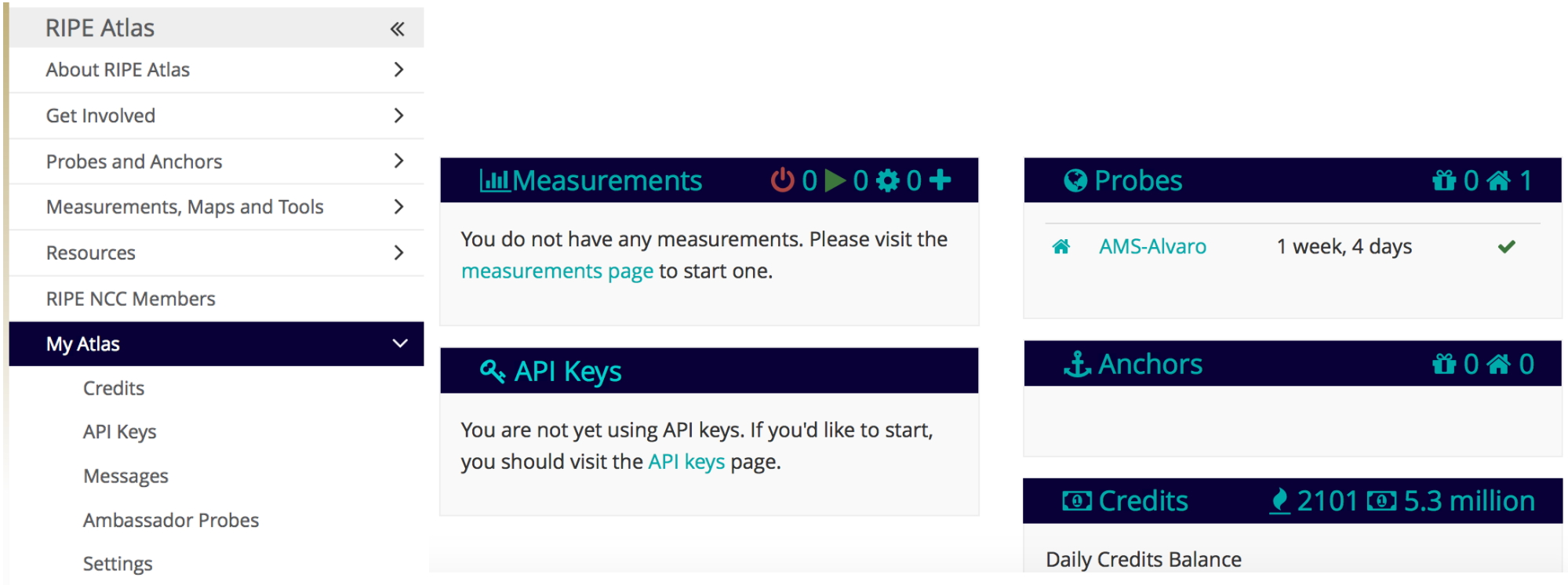


- Around the world



What is RIPE Atlas (3)

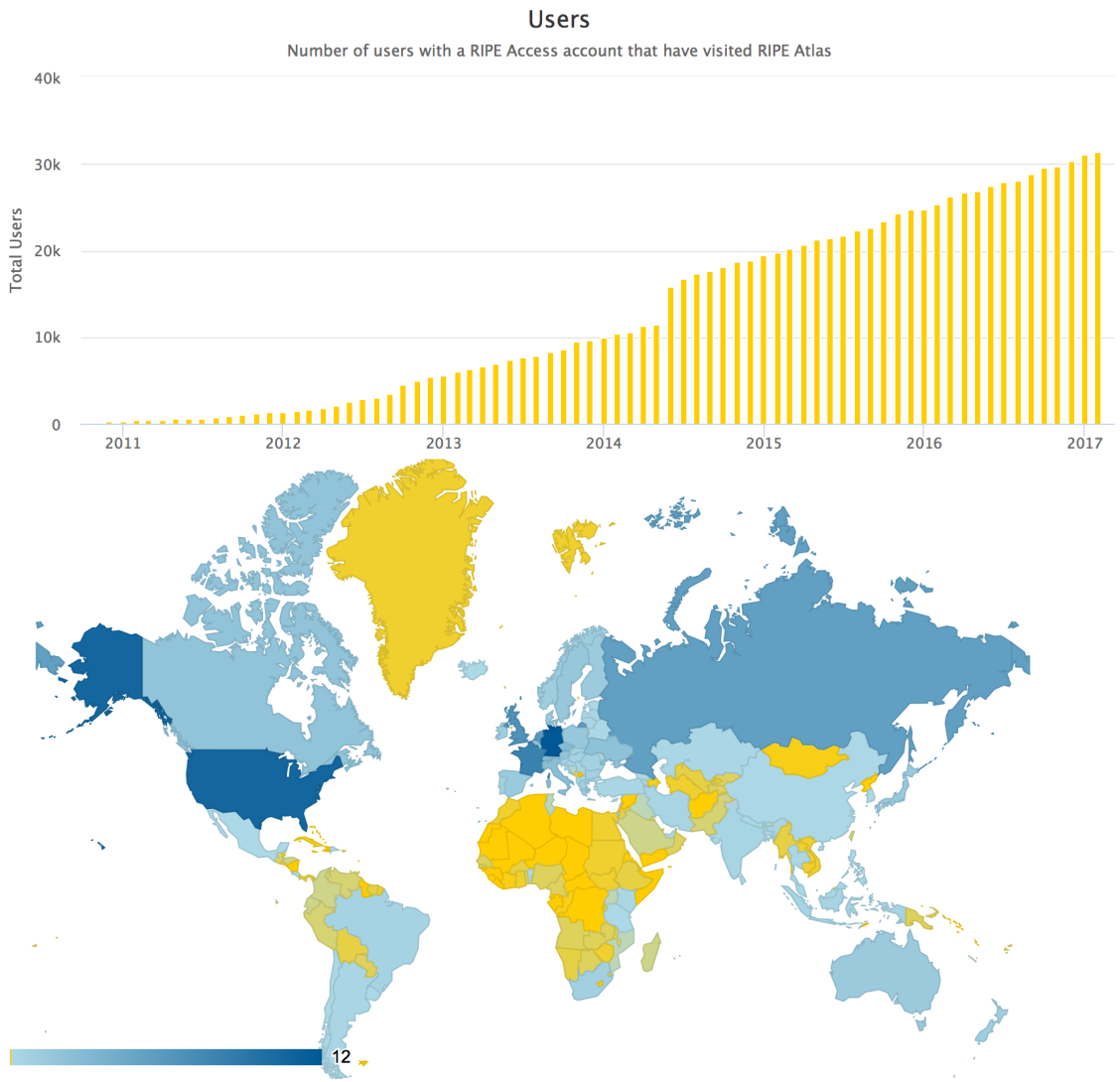
Composed by: **Web interface / API / CLI**



What is RIPE Atlas (4)

Composed by: **RIPE Atlas Community**

- Users
- Hosts
  - Probes
  - Anchors
- Sponsors
- Ambassadors



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

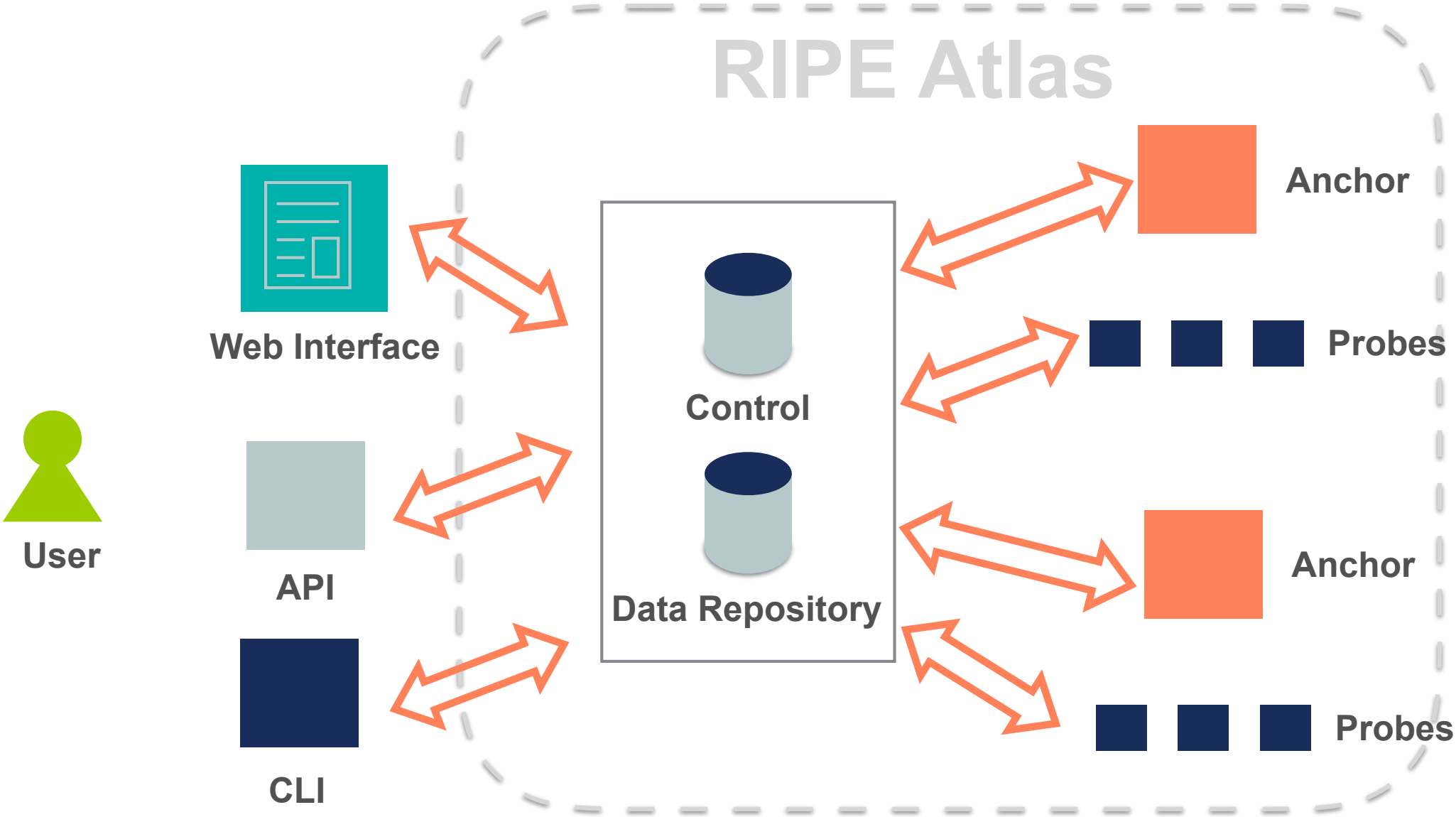
What is RIPE Atlas (5)

Composed by: **Measurements**

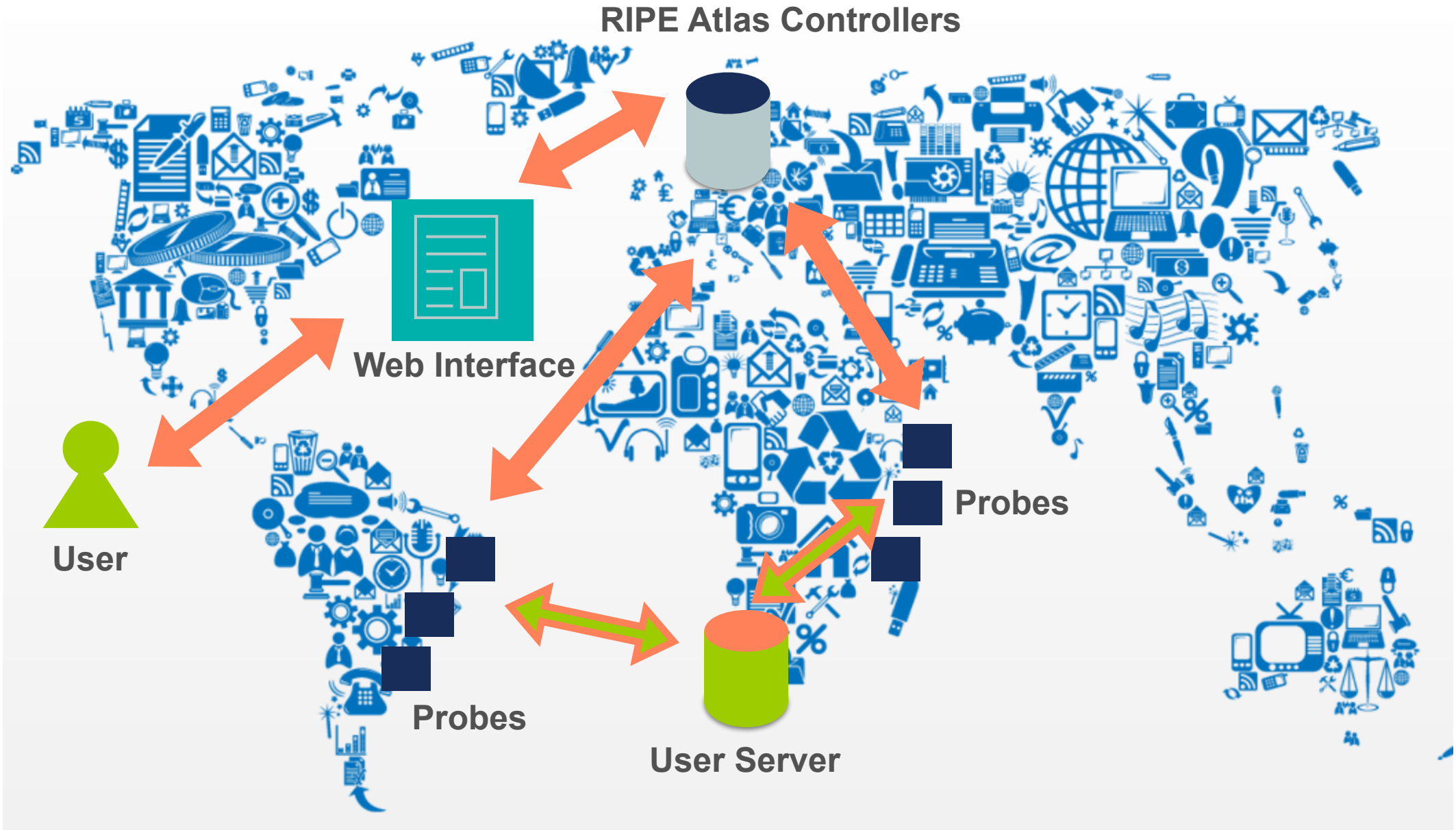
Measurements currently running

	Built-in	User-defined			
		Total UDM	Anchoring	DNSMON	Other
Ping	41	4363	505	0	3858
Traceroute	45	3303	507	817	1979
DNS	158	4869	0	3268	1601
SSL/TLS Certificate	4	225	0	0	225
NTP	0	44	0	0	44
HTTP	4	540	506	0	34

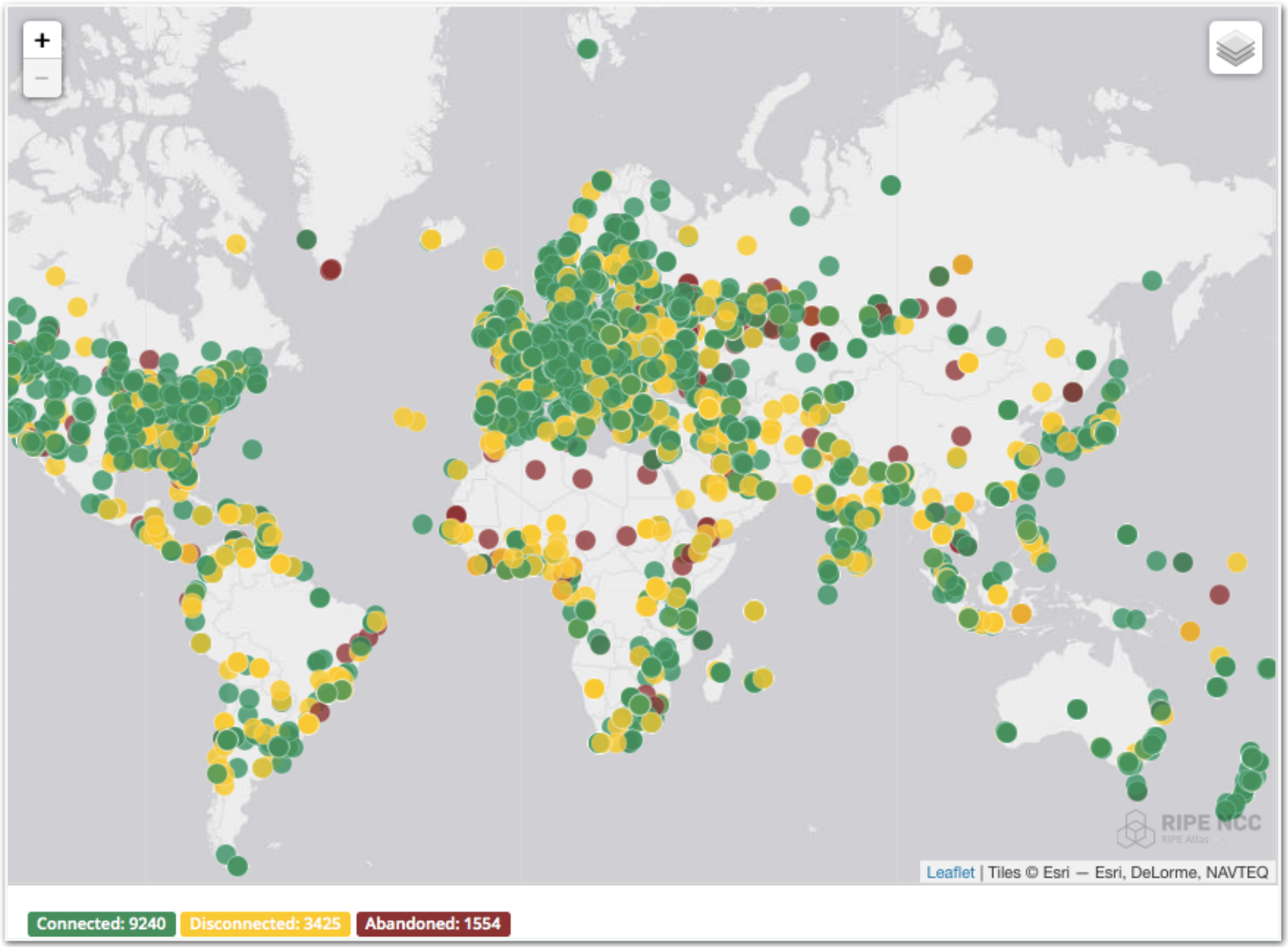
RIPE Atlas Overview (1)



RIPE Atlas Overview (2)



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
- New: “Time Travel”, LatencyMON, DomainMON
- Status checks (Icinga & Nagios)

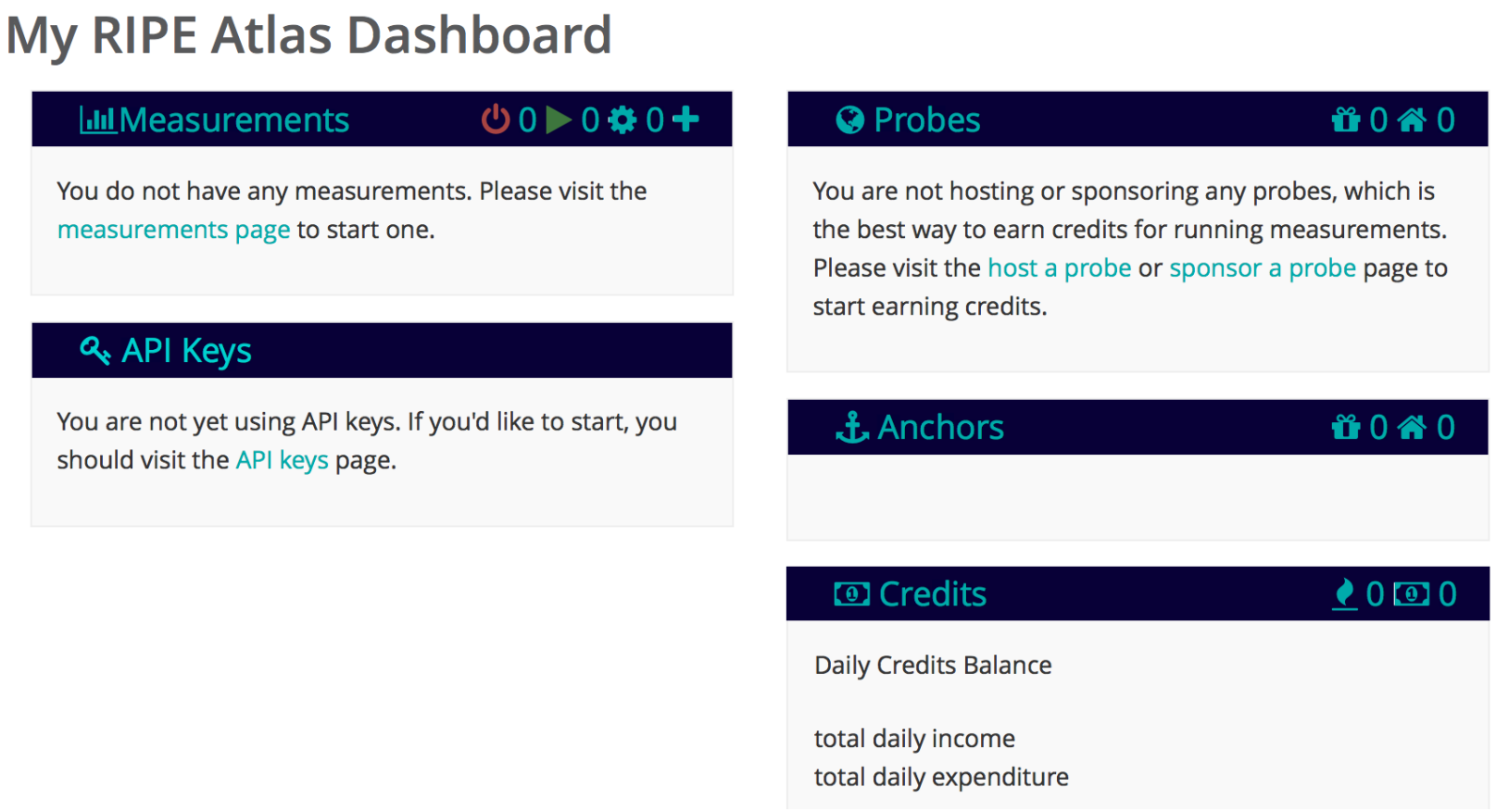
Using RIPE Atlas

How to use RIPE Atlas

- User friendly web interface, API or CLI
- System based on credits
- Create measurements (ping, trace route, etc.)
- Access (historical) data

How to Access RIPE Atlas

- RIPE NCC Access account (http://access.ripe.net)
- RIPE Atlas -> My Atlas (http://atlas.ripe.net)



Credits

- Every measurement has a cost in credits
- Why? Fairness and avoid overload
- How to earn credits?
  1. Hosting a probe / anchor
  2. Being an RIPE NCC member (LIR)
  3. Being RIPE Atlas sponsor
  4. Transfer
  5. Voucher…

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

Highlights

- 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 (Icinga & Nagios)
- New: “Time Travel”, LatencyMON, DomainMON

Security Aspects

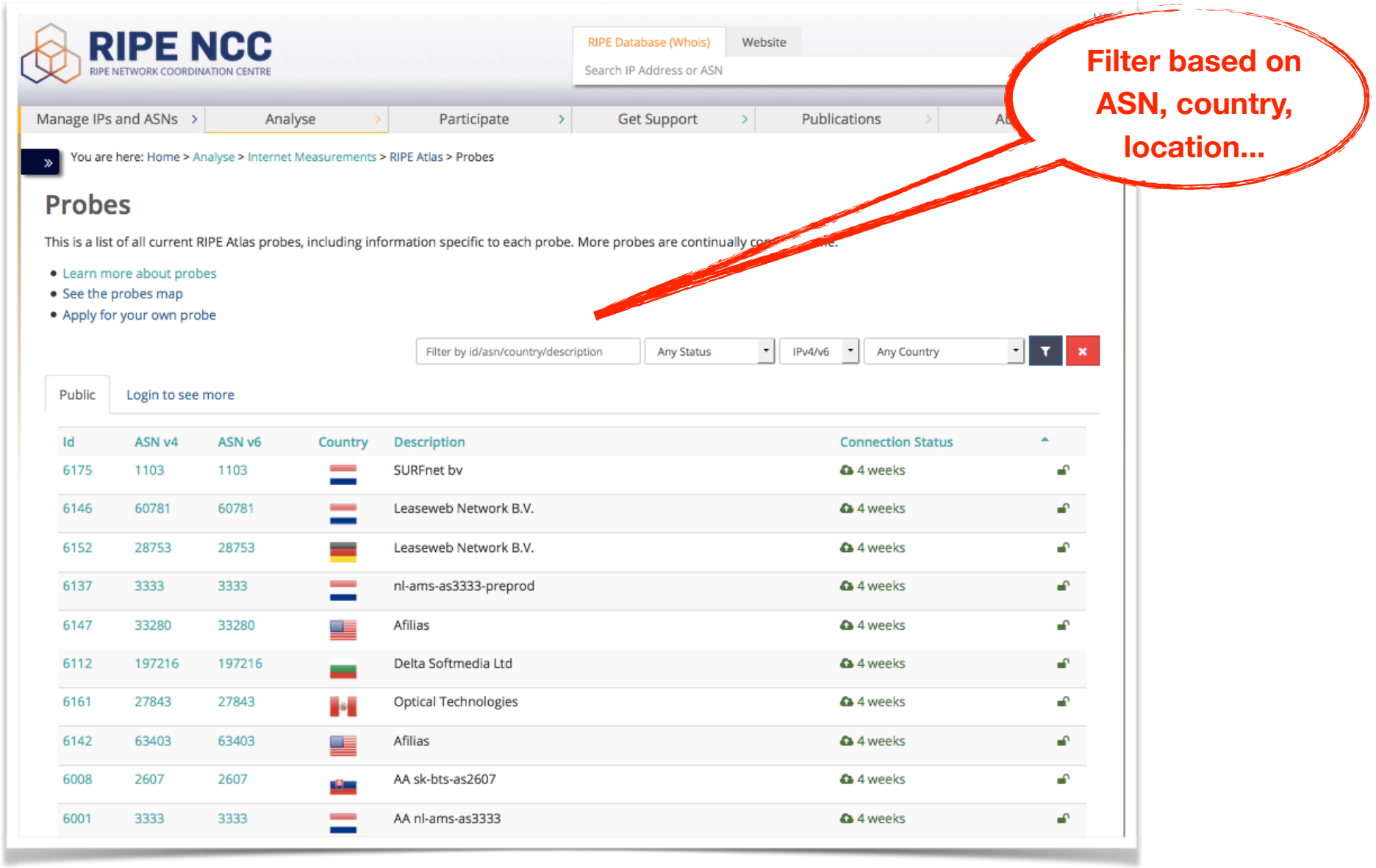
- Probes:
  - Hardware trust material (regular server address, keys)
  - No open ports; initiate connection; NAT is okay
  - Don’t listen to local traffic
  - No passive measurements
  - Automatic FW updates
- Measurements triggered by “command servers”
  - Inverse ssh tunnels
- Source code published

Ethical Considerations

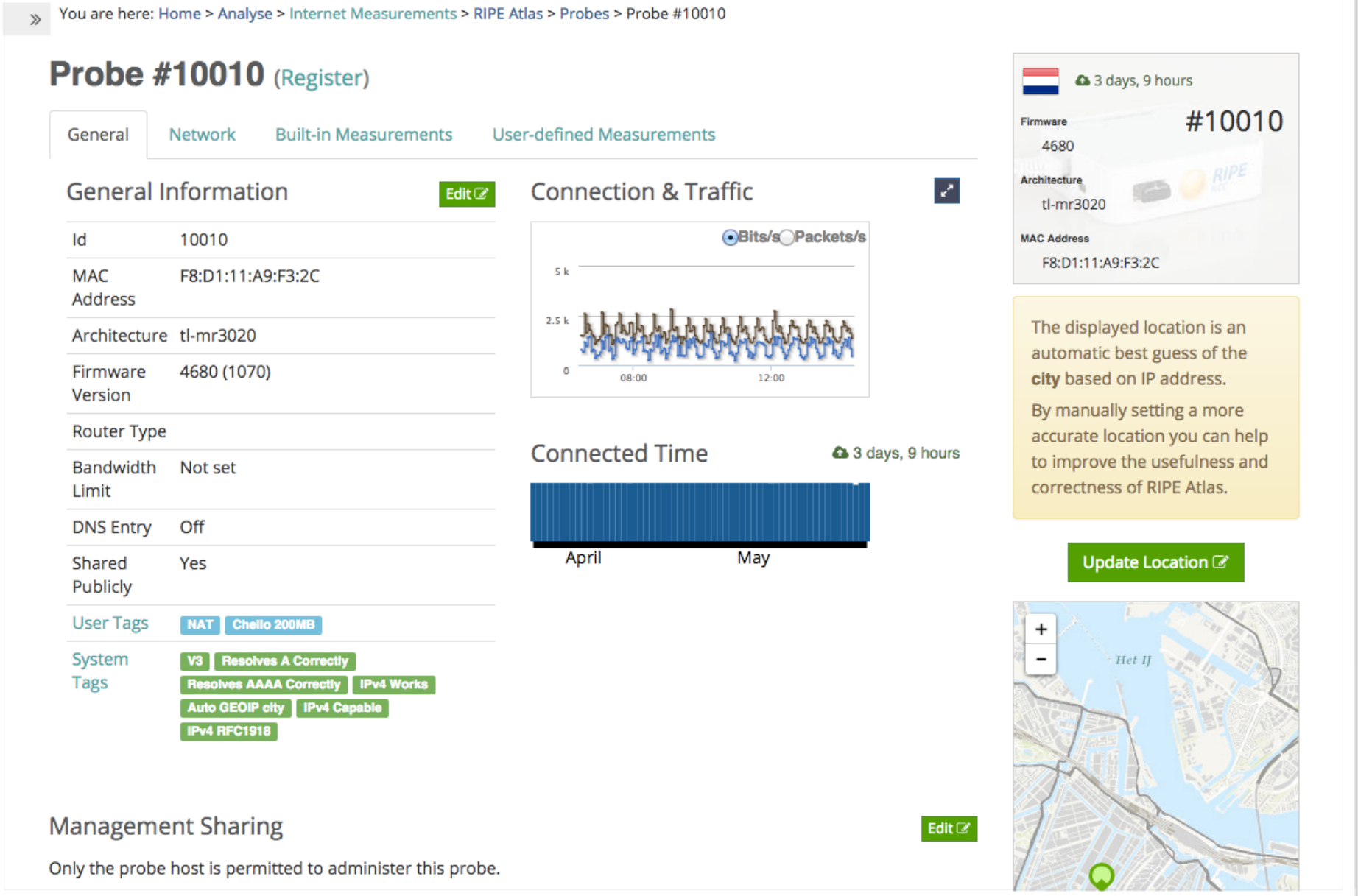
- No passive measurements (no user traffic)
- Set of measurements is limited
- HTTP measurements only to Anchors
- All data is open and available to anyone
- Barrier to entry is low/cheap
- Open API’s
- Open source code on GitHub

Looking Up Public Probes

Searching for 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
Bits/s Packets/s
5 k
2.5 k
0
08:00
12:00
Connected Time
3 days, 9 hours
April
May
Management Sharing
Edit
Only the probe host is permitted to administer this probe.
3 days, 9 hours
Firmware
4680
#10010
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.
Update Location
Het IJ

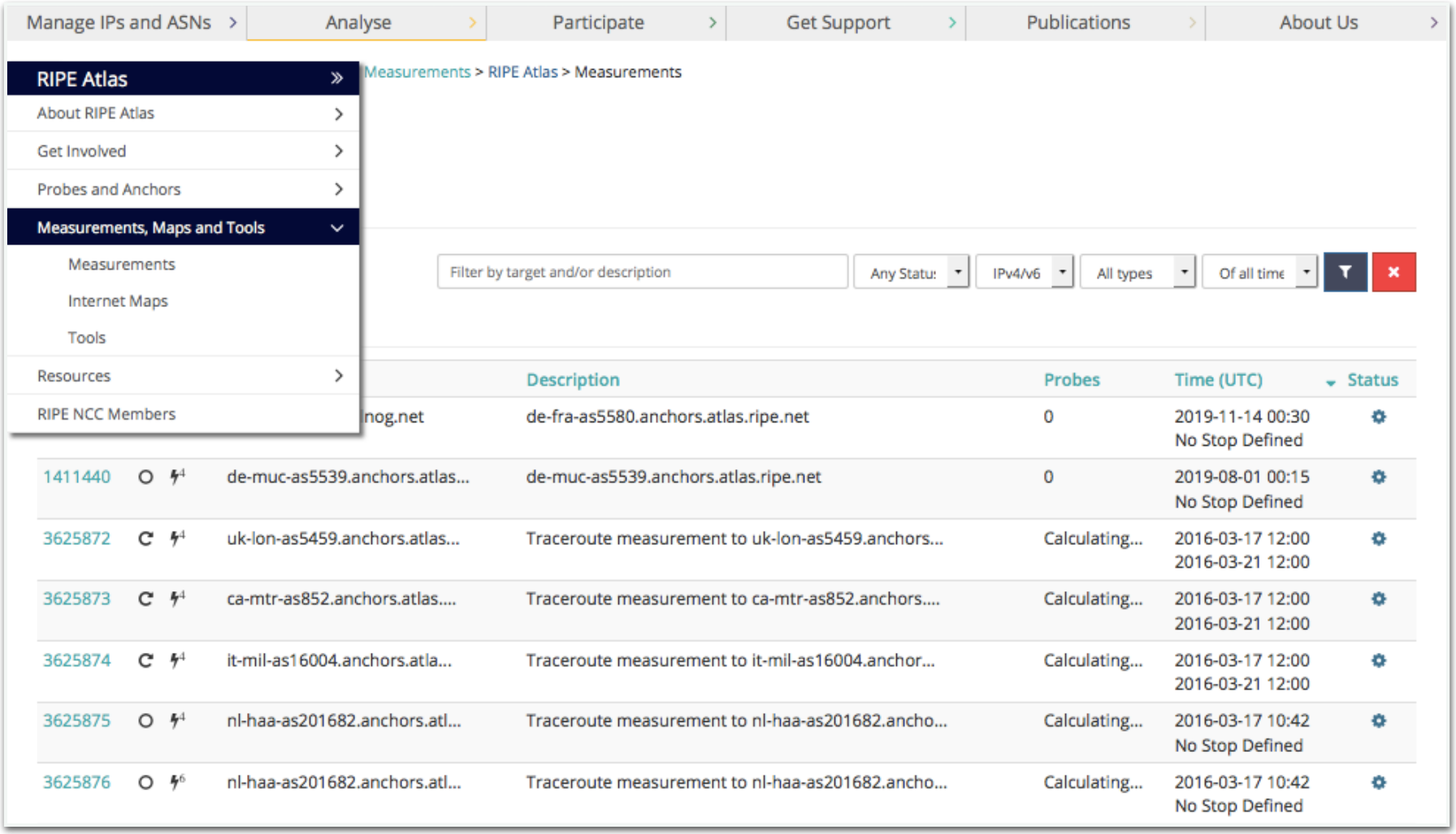
Finding one specific probe

- If you know the probe ID:
  - https://atlas.ripe.net/probes/ID
  - https://atlas.ripe.net/probes/10010/

Finding Results of Public Measurements

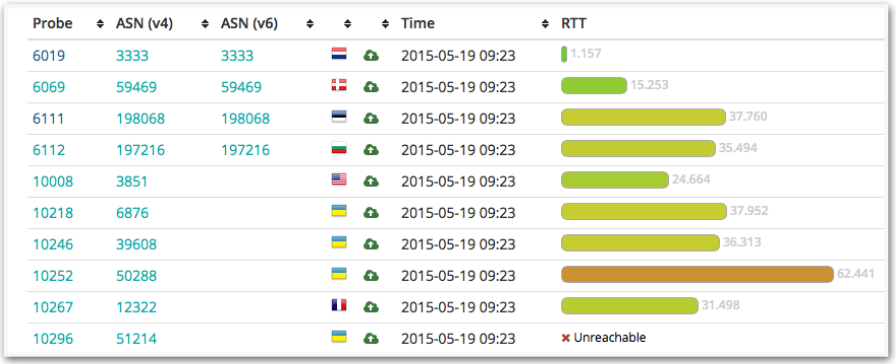
Looking up Measurements Results

- https://atlas.ripe.net/measurements/

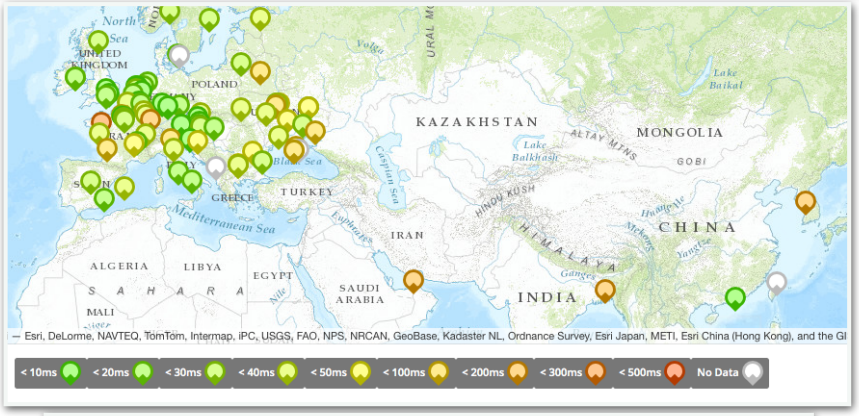


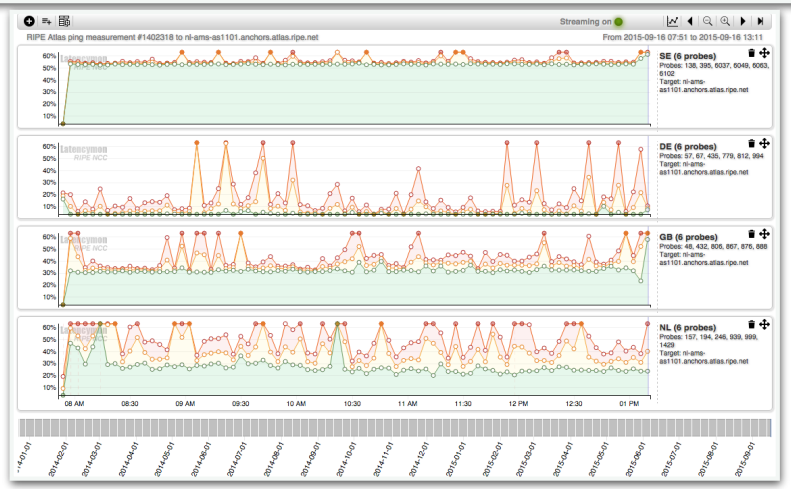
Available visualisations: ping

- List of probes: sortable by RTT
- Map: colour-coded by RTT
- LatencyMON: compare multiple latency trends



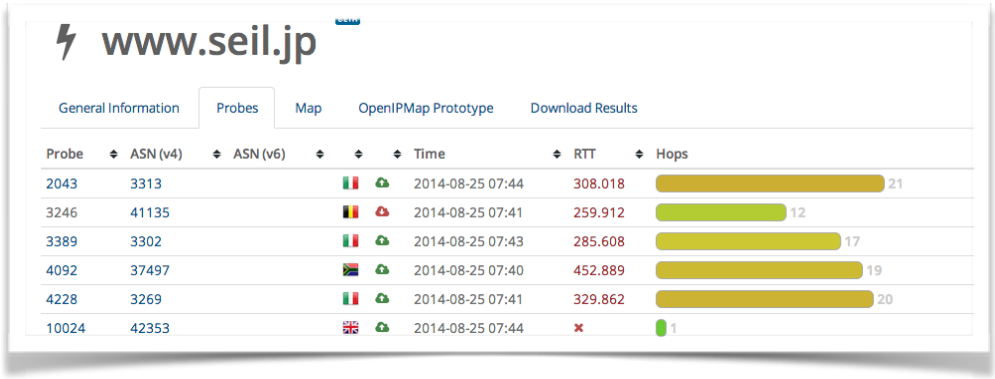
Probe	ASN (v4)	ASN (v6)	Time	RTT
6019	3333	3333	2015-05-19 09:23	1.157
6069	59469	59469	2015-05-19 09:23	15.253
6111	198068	198068	2015-05-19 09:23	37.760
6112	197216	197216	2015-05-19 09:23	35.494
10008	3851		2015-05-19 09:23	24.664
10218	6876		2015-05-19 09:23	37.952
10246	39608		2015-05-19 09:23	36.313
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



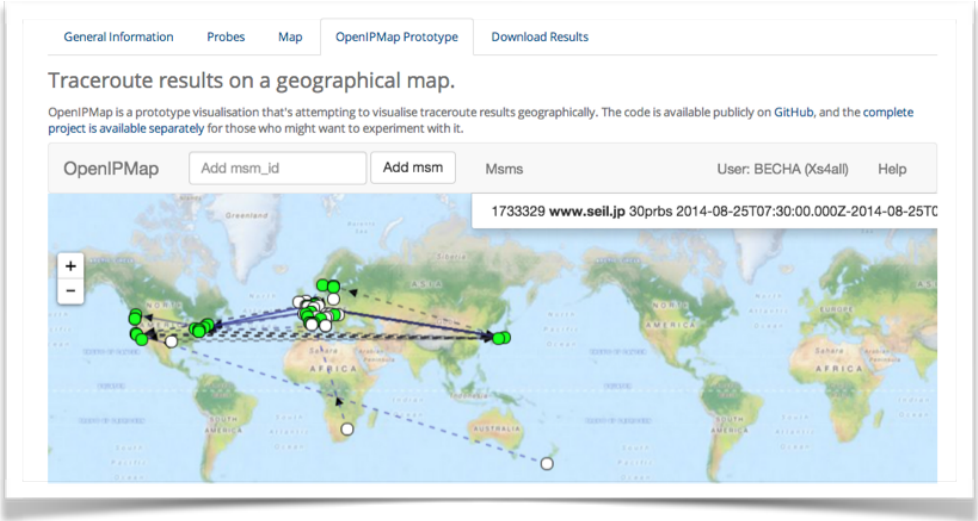


Available visualisations: traceroute

- List of probes, colour-coded number of hops



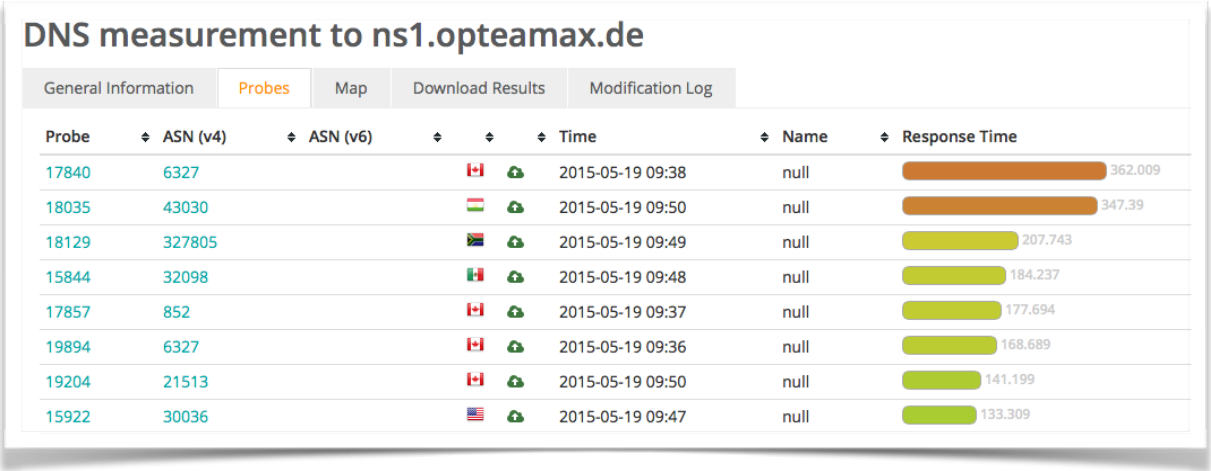
- Traceroute paths map, geolocation using OpenIPMap: github.com/RIPE-Atlas-Community/openipmap



Available visualisations: DNS

- Map, colour-coded response time or diversity

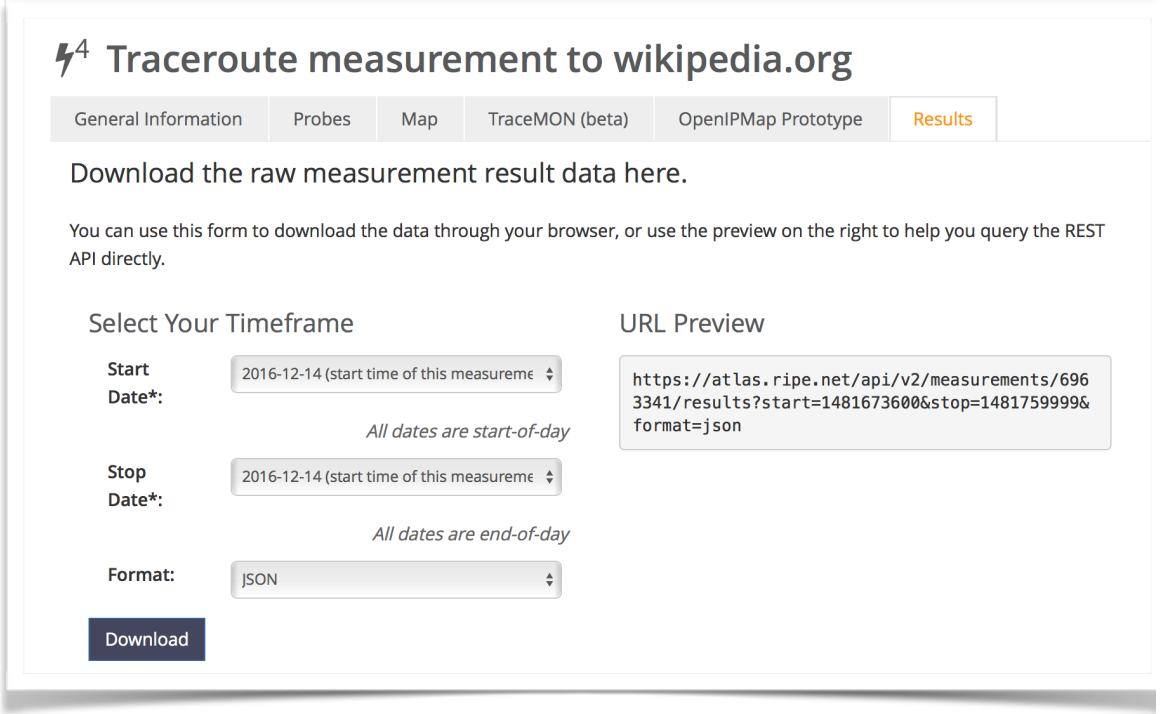
- List of probes, sortable by response time



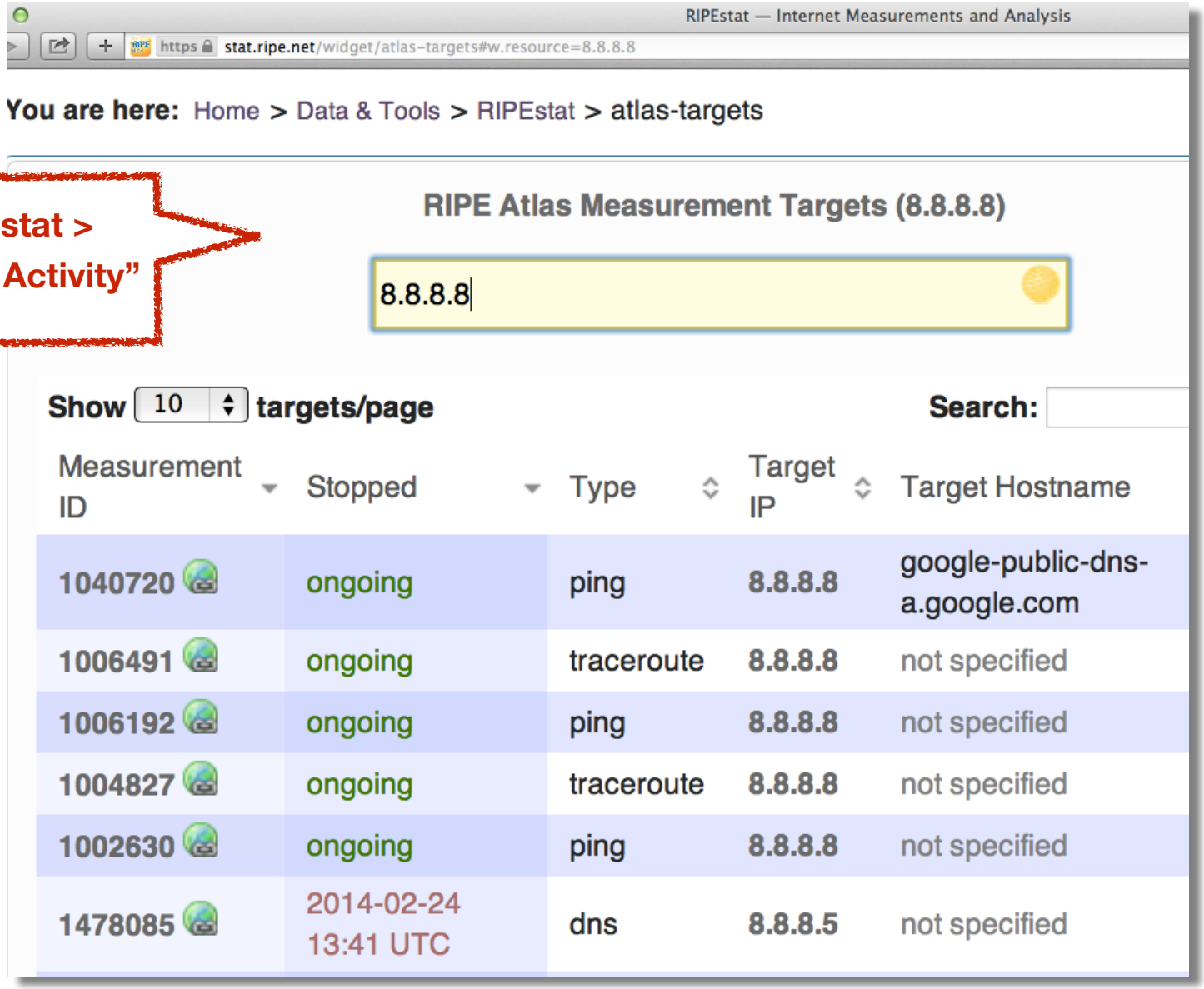
Probe	ASN (v4)	ASN (v6)	Time	Name	Response Time
17840	6327		2015-05-19 09:38	null	362.009
18035	43030		2015-05-19 09:50	null	347.39
18129	327805		2015-05-19 09:49	null	207.743
15844	32098		2015-05-19 09:48	null	184.237
17857	852		2015-05-19 09:37	null	177.694
19894	6327		2015-05-19 09:36	null	168.689
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 msm, then “Results”
- Or URL
- Or API
- Results in JSON
- Libraries for parsing on GitHub



Search for Measurements by Target in RIPEstat



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

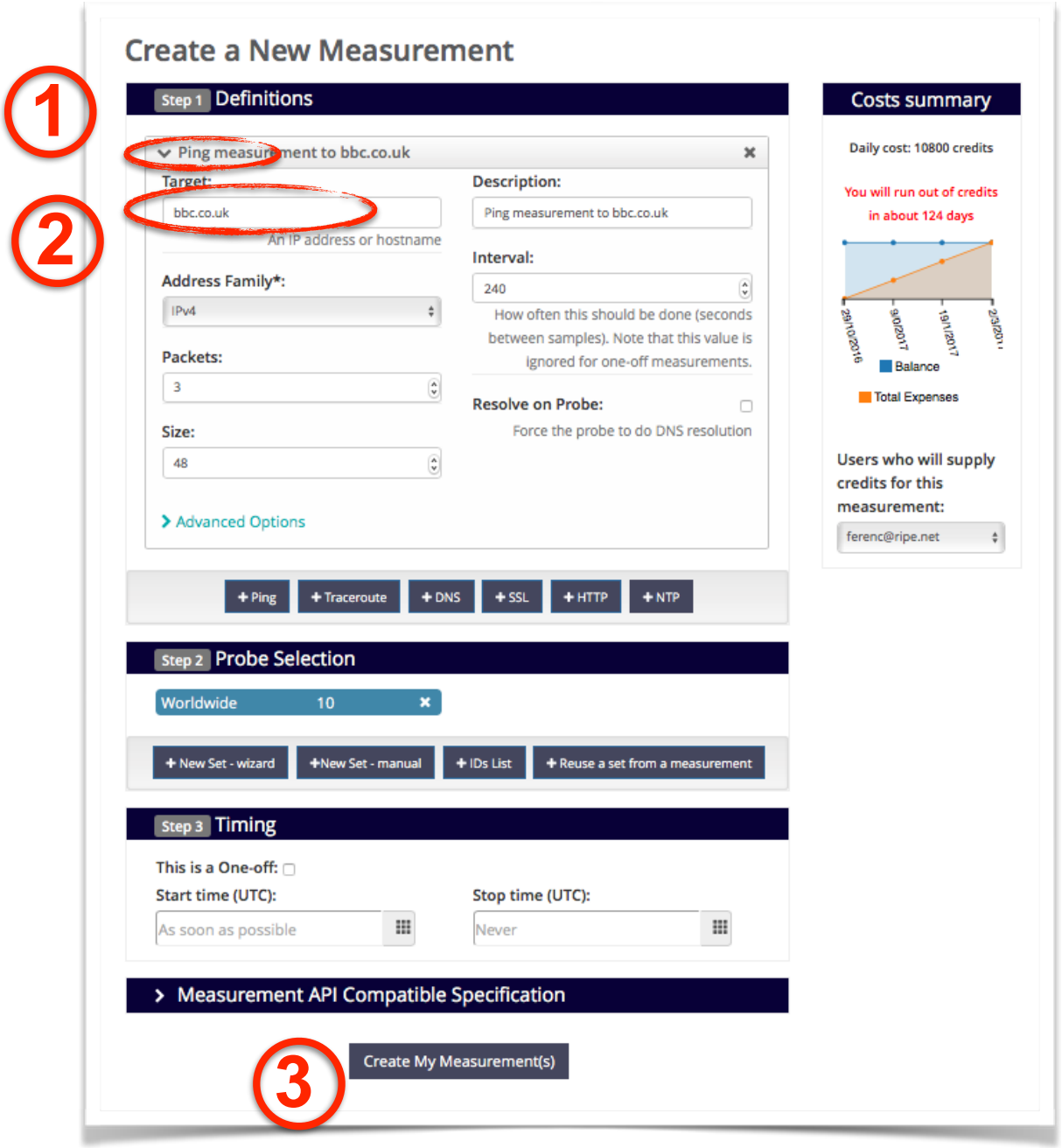
Get Started

- You can start playing right now!
- **Login** using your RIPE access account
- Go to RIPE Atlas (atlas.ripe.net)
  - My Atlas (left menu)
  - Credits 

  - Redeem voucher 

Voucher name: **ENOG13**

Create a measurement: Quick and easy

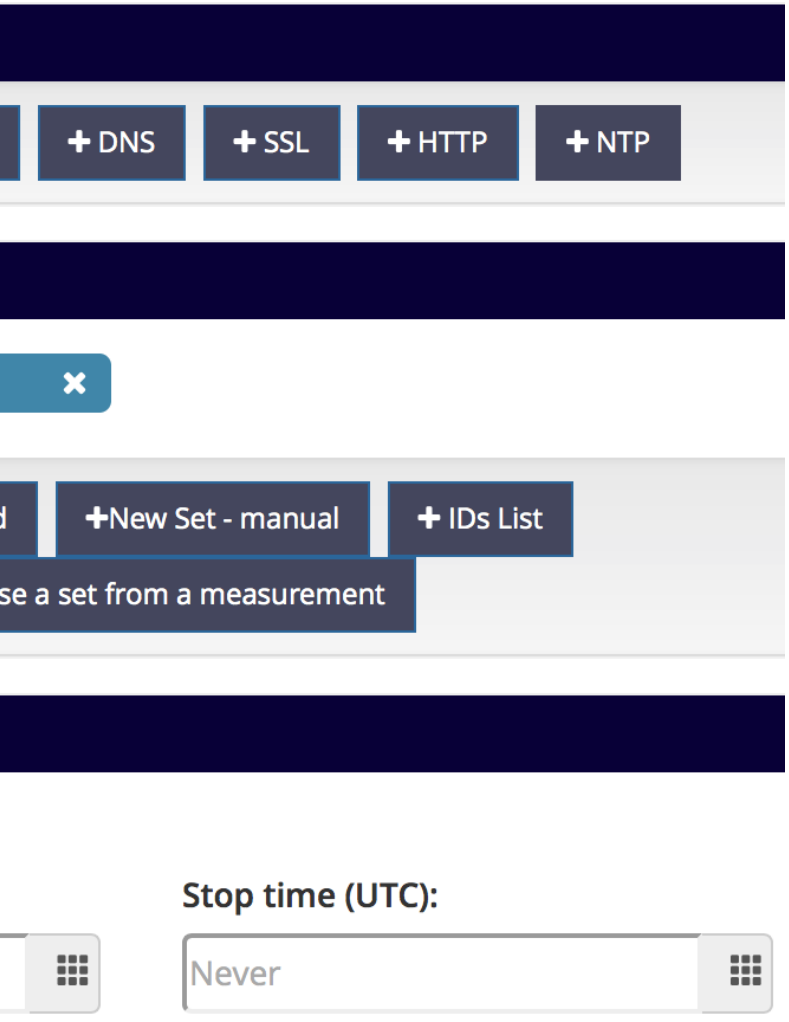


Scheduling a measurement

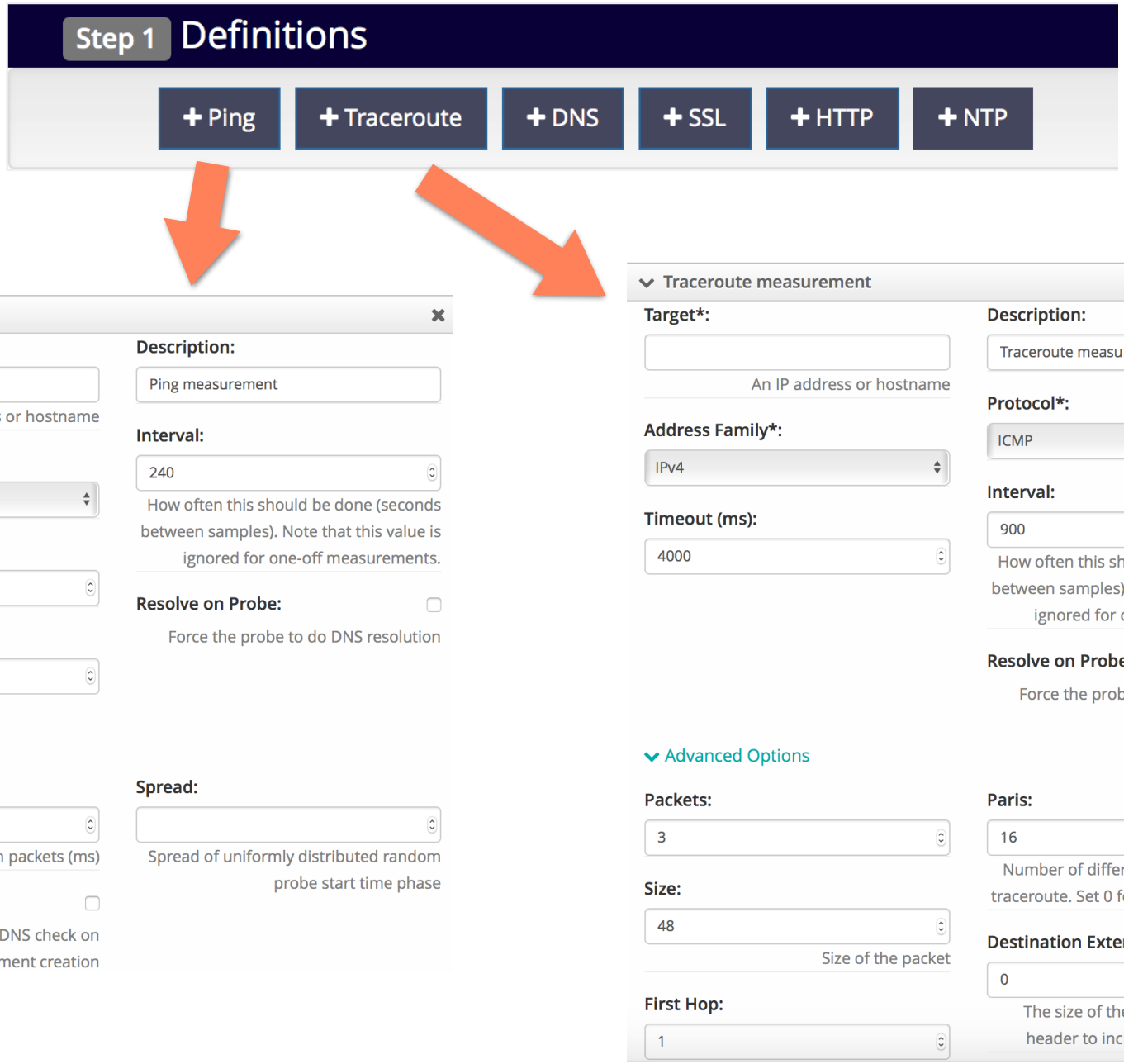
- Log in to atlas.ripe.net
- Four methods:

1. **Quick and easy**
2. **Advanced GUI usage**
3. **API (curl and JSON code)**
4. CLI

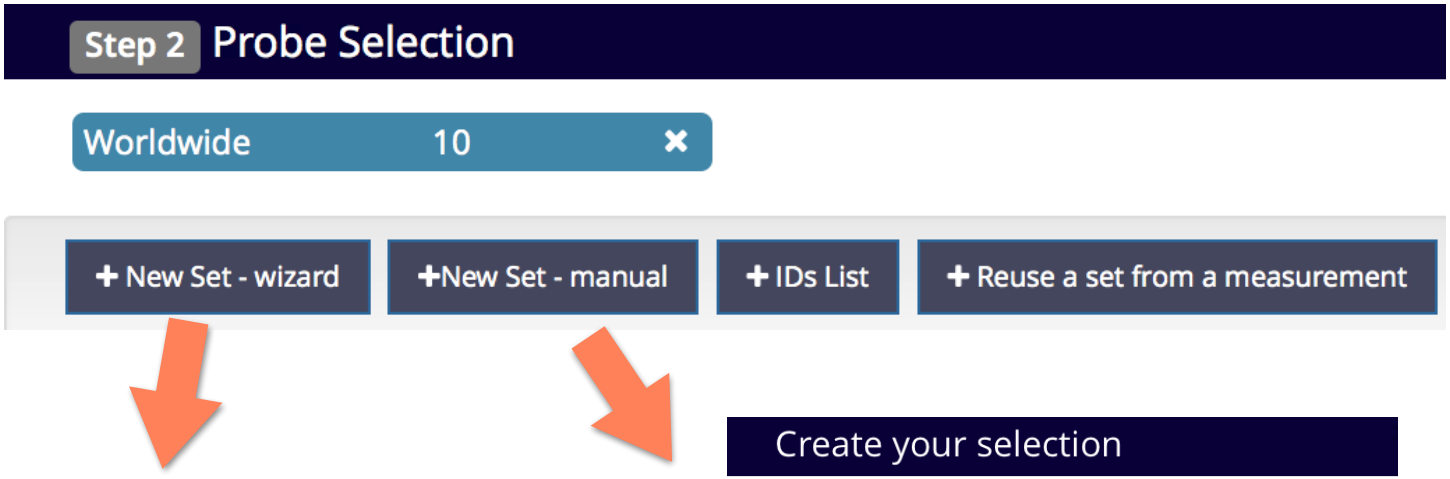
Creating Measurements (1)

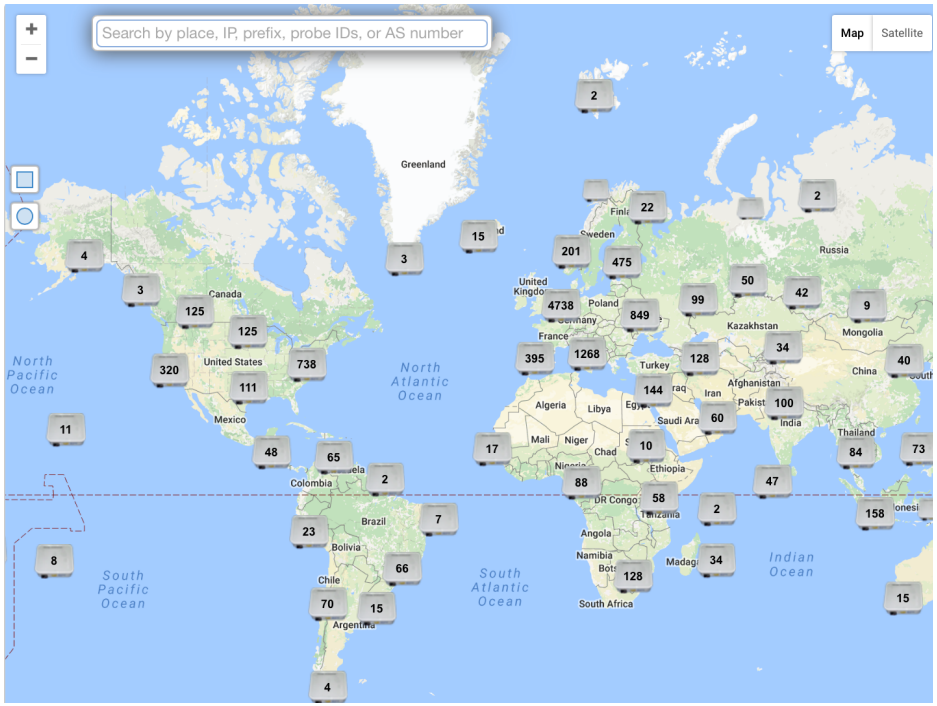


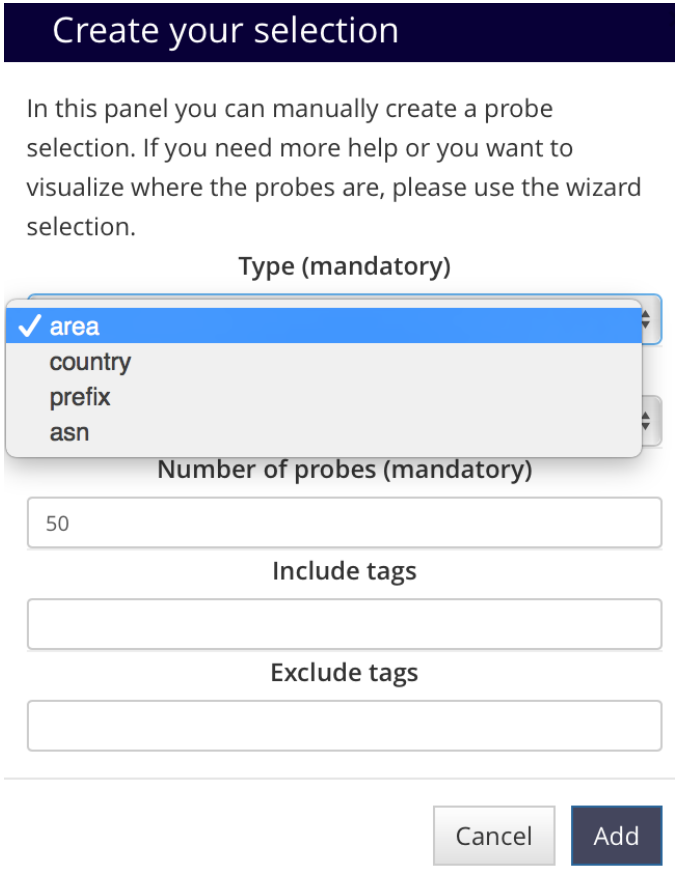
Creating Measurements (2)



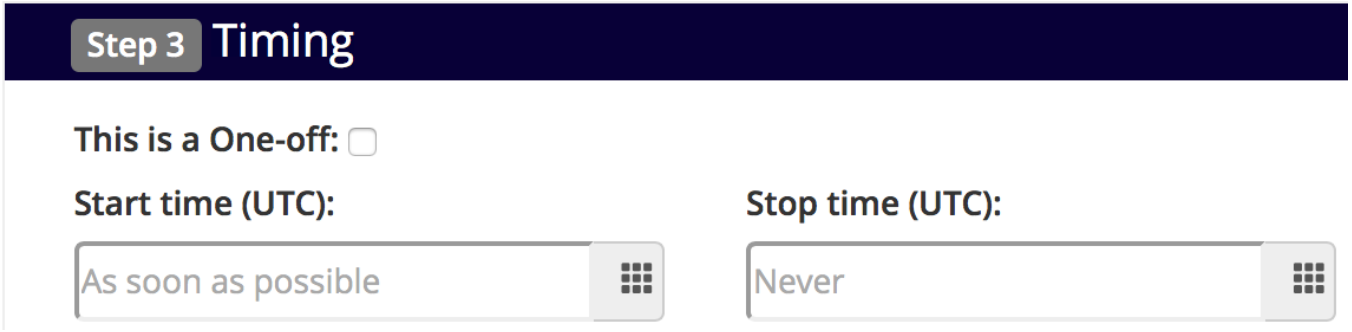
Creating Measurements (3)



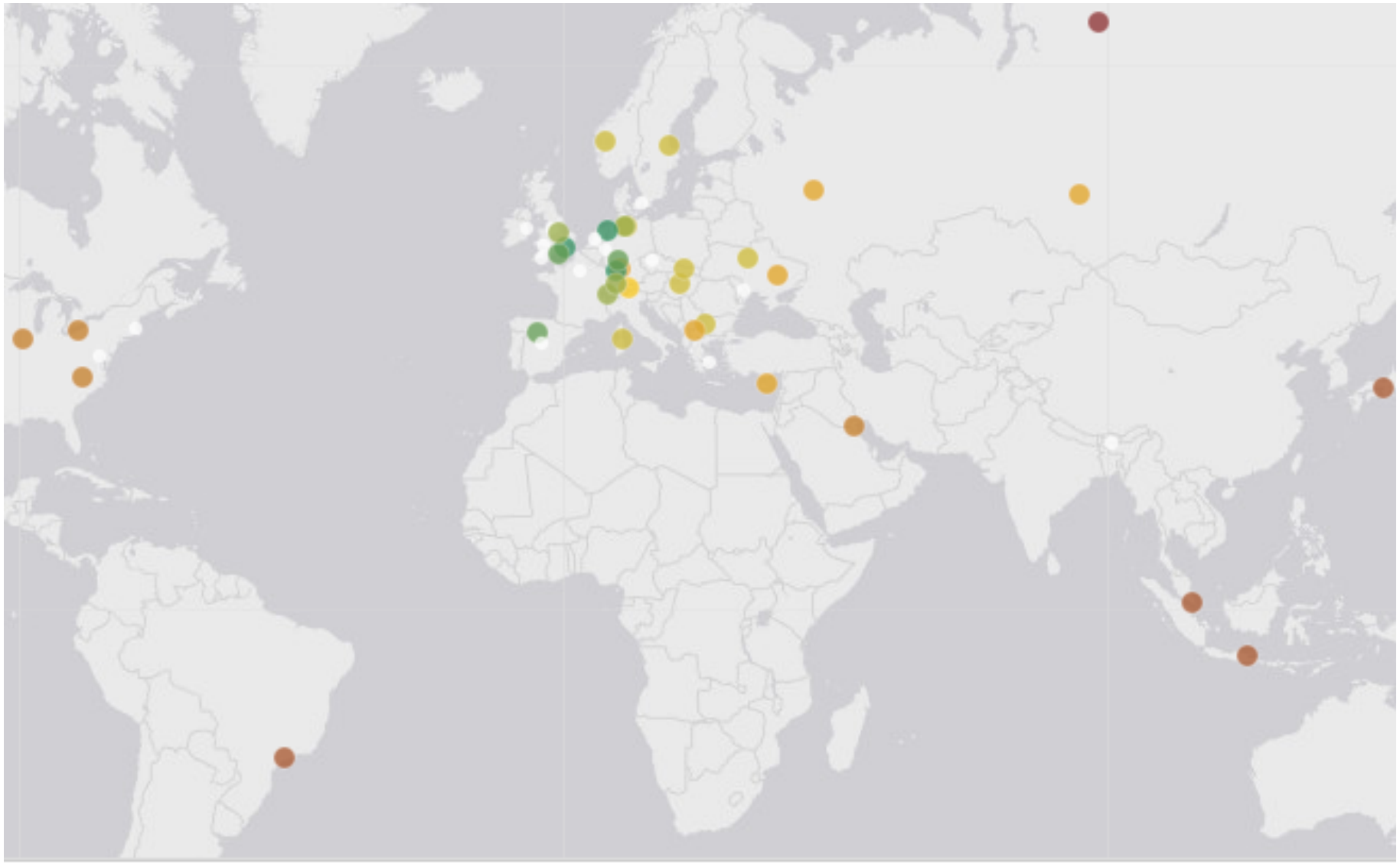




Creating Measurements (4)



Globe reachability check: traceroute

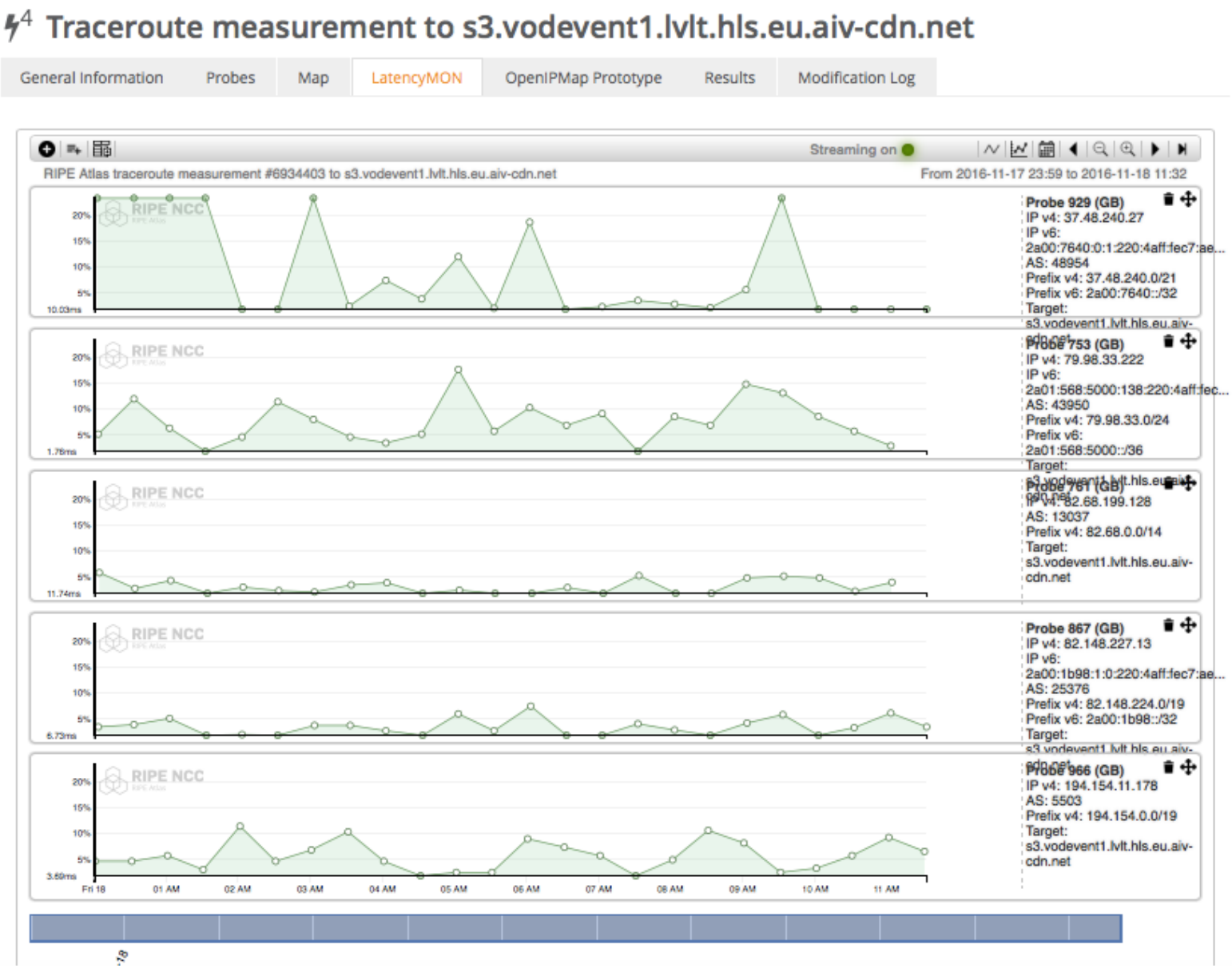


Traceroute view: list

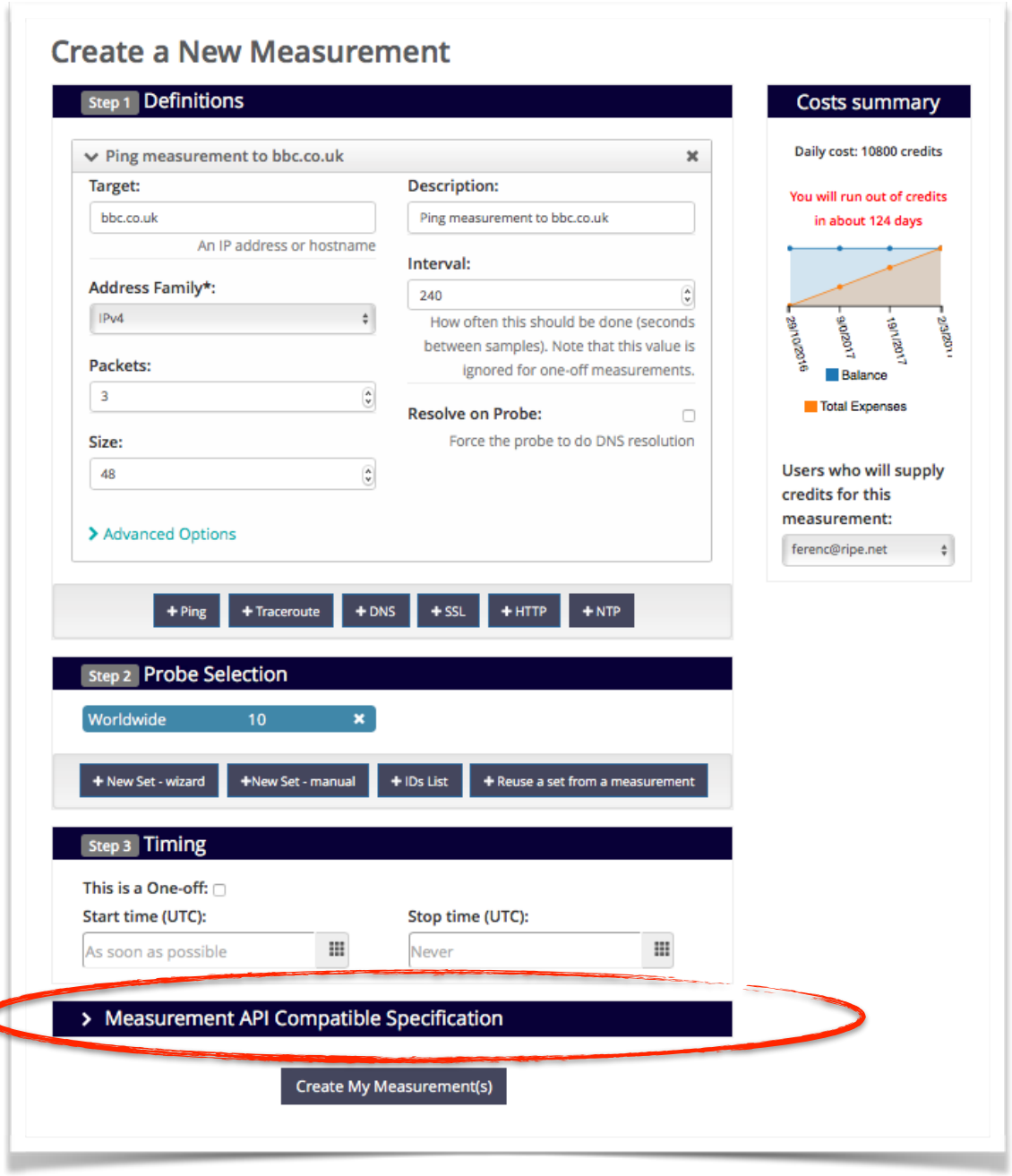
General Information | Probes | Map | LatencyMON | OpenIPMap Prototype | Results | Modification

Probe	ASN (IPv4)	ASN (IPv6)	Time (UTC)	RTT	Hops
2713	60706	60706	2016-11-18 10:52	33.192	14
2941	25394		2016-11-18 10:51	50.783	20
3055	6412		2016-11-18 10:53	150.683	15
3222	6829		2016-11-18 10:49	36.686	24
4166	50581		2016-11-18 10:52	39.533	16
4554	6703		2016-11-18 10:51	82.704	19
4952	3244		2016-11-18 10:51	35.700	19
6078	202040	202040	2016-11-18 10:47	9.279	14
6091	5459	5459	2016-11-18 10:50	9.719	14
6112	197216	197216	2016-11-18 10:52	33.767	11
6139	18106	18106	2016-11-18 10:47	216.946	19
10166	5379		2016-11-18 10:49	60.850	19
10282	49009	49009	2016-11-18 10:47	32.699	11
10312	11426		2016-11-18 10:49	116.443	29

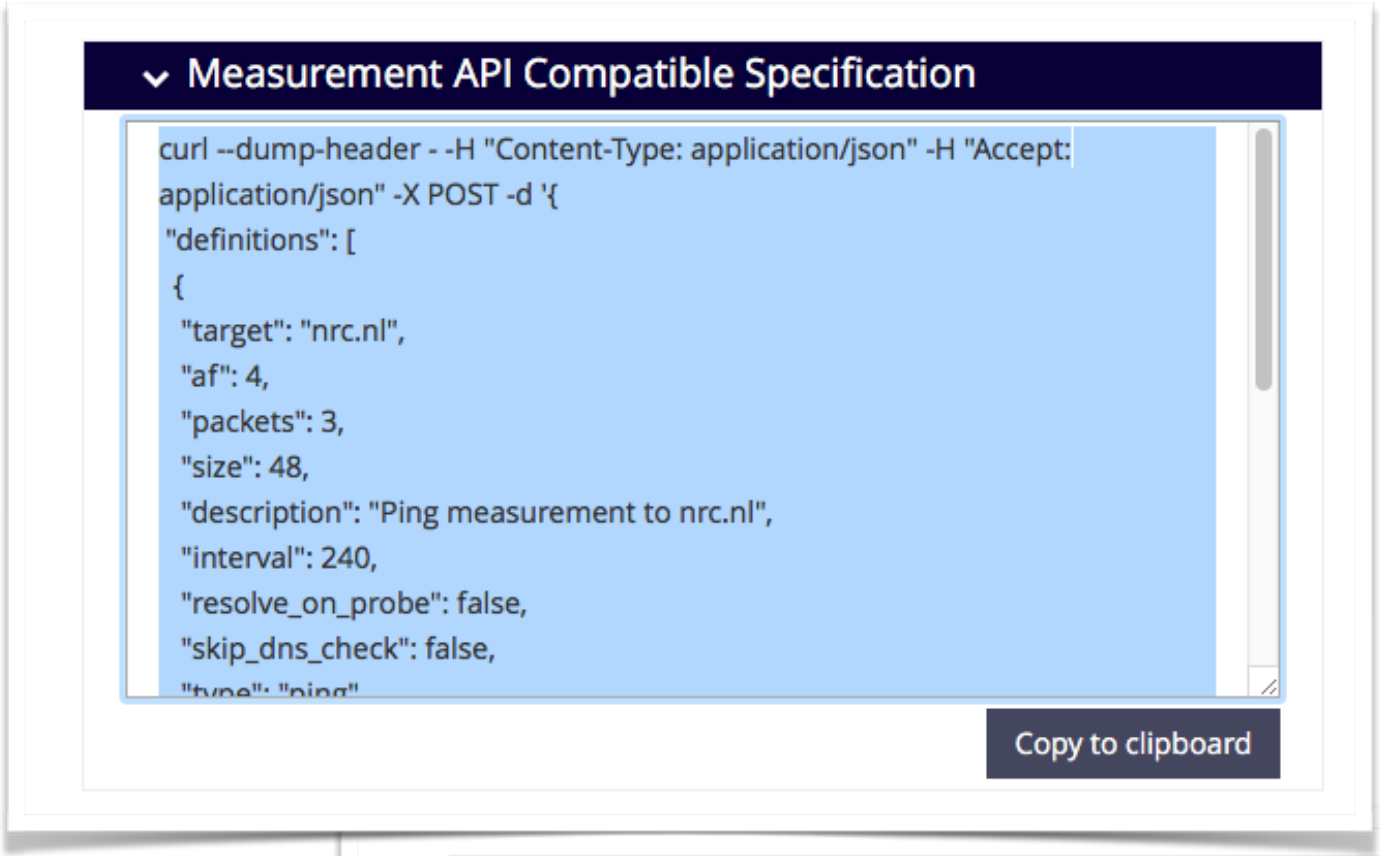
Traceroute view: LatencyMon

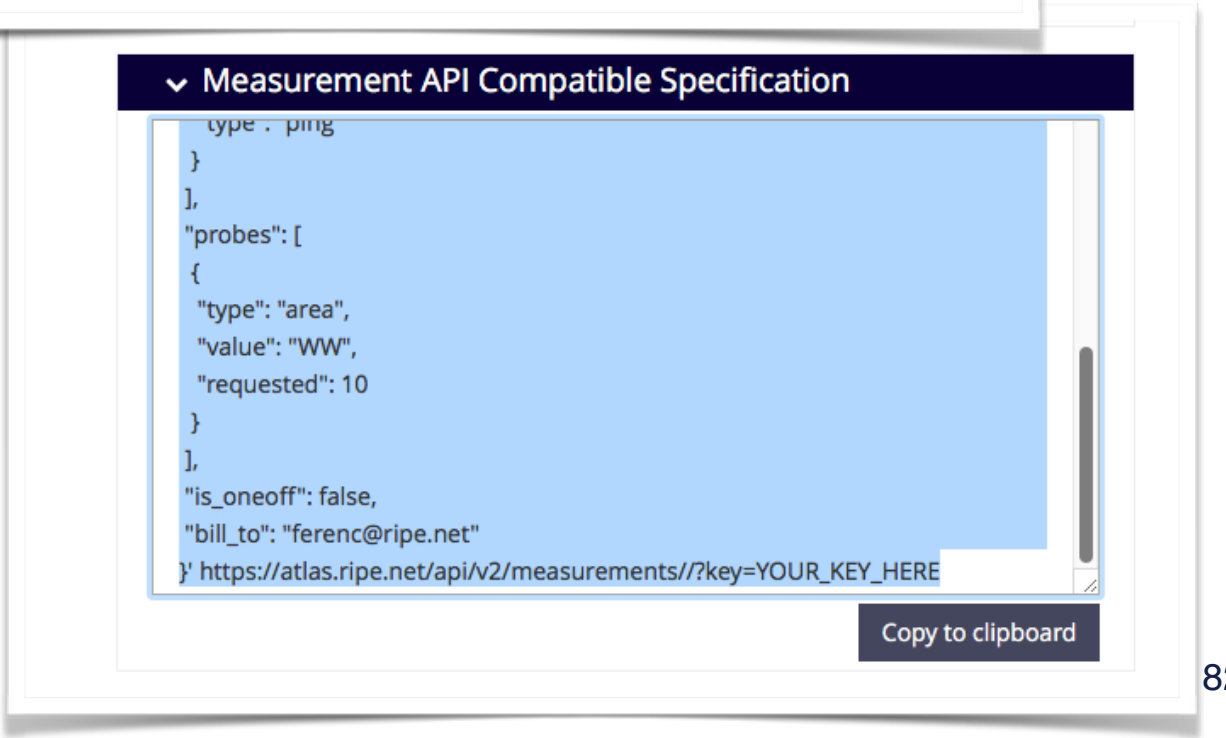


Create measurement : API Compatible



Copy


Measurement API Compatible Specification
curl --dump-header - -H "Content-Type: application/json" -H "Accept: application/json" -X POST -d '{
"definitions": [
{
"target": "nrc.nl",
"af": 4,
"packets": 3,
"size": 48,
"description": "Ping measurement to nrc.nl",
"interval": 240,
"resolve_on_probe": false,
"skip_dns_check": false,
Copy to clipboard


Measurement API Compatible Specification
}
],
"probes": [
{
"type": "area",
"value": "WW",
"requested": 10
}
],
"is_oneoff": false,
"bill_to": "ferenc@ripe.net"
}' https://atlas.ripe.net/api/v2/measurements//?key=YOUR_KEY_HERE
Copy to clipboard

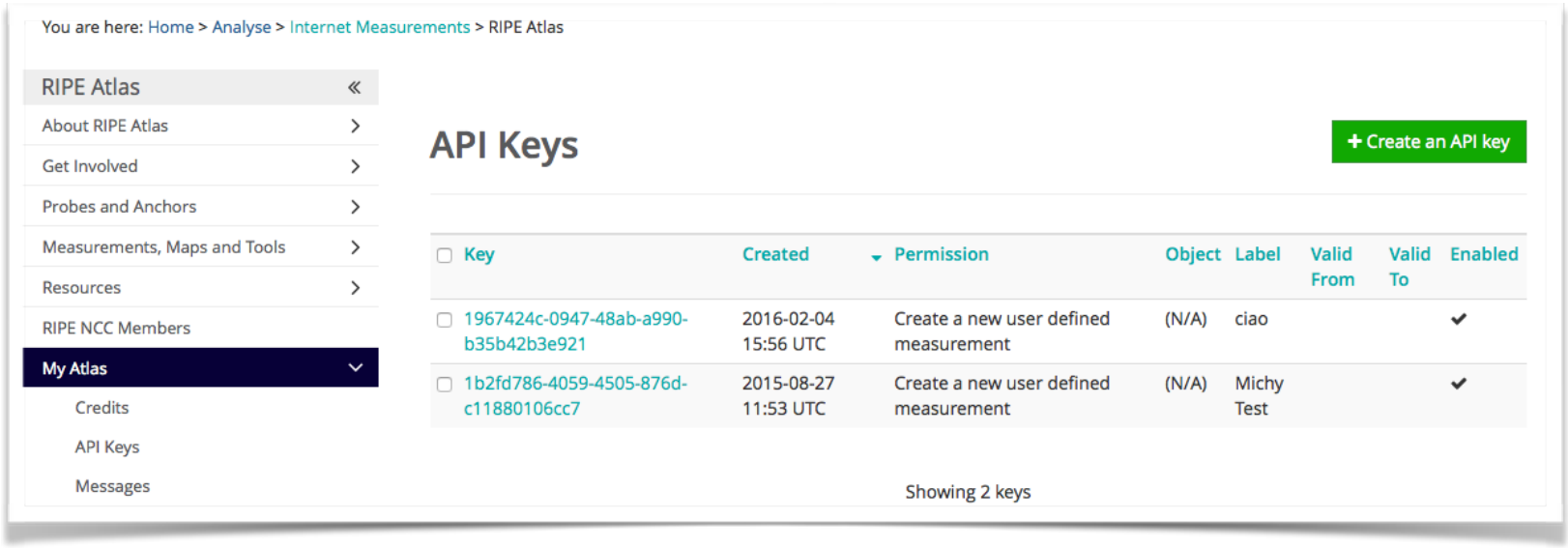
Use API

- Schedule a measurement using API
  - Use the “key” you just generated
  - Hint: copy and past API call syntax from the measurement generated by the GUI
- Example:

```
curl -H "Content-Type: application/json" -H "Accept: application/json" -X
POST -d '{ "definitions": [ { "target": "ping.xs4all.nl", "description":
"My First API Measurement", "type": "ping", "af": 4 } ], "probes":
[ { "requested": 10, "type": "country", "value": "RS" } ] }' https://
atlas.ripe.net/api/v1/measurement/?key=YOUR_API_KEY
```

Create API key

1. Click on “Create an API Key”
2. Permission: “schedule a new measurement”
3. “Target” is not applicable (N/A) for this type



Create API key

1. Give it a label
2. Give it a duration of validity (leave empty for defaults)
3. “Key” value to be passed on to the API call (next step)

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?

- 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

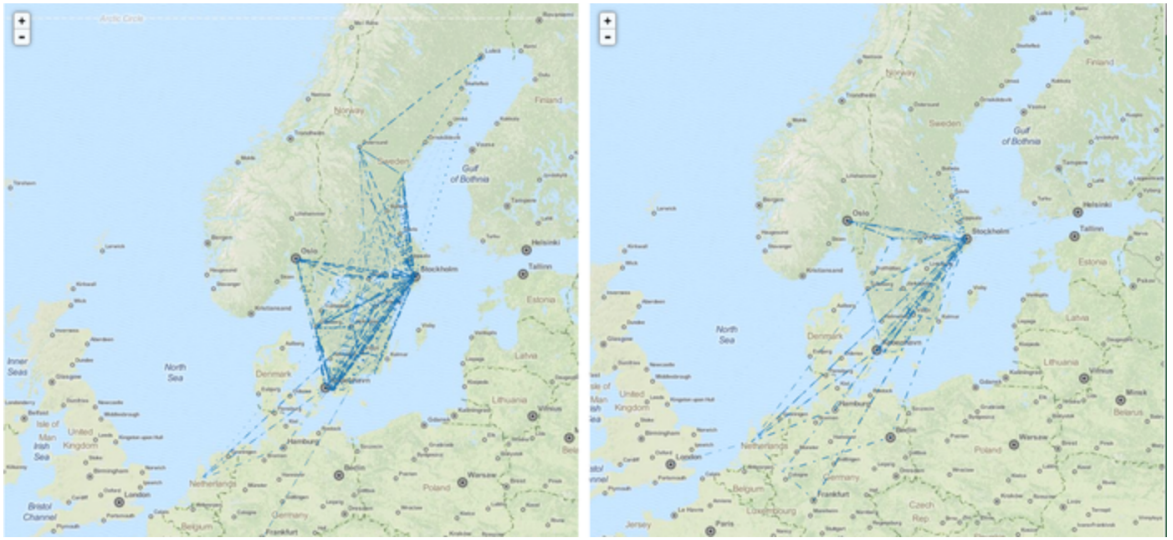
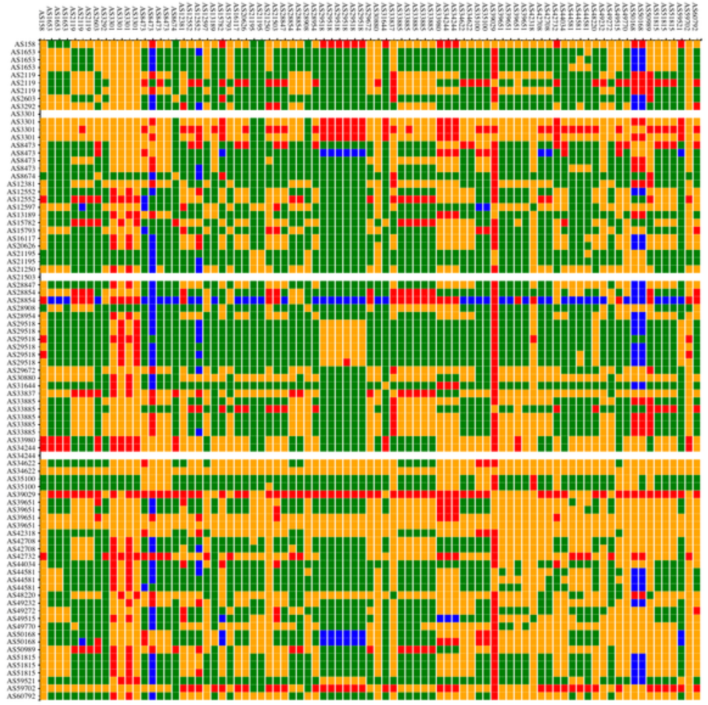


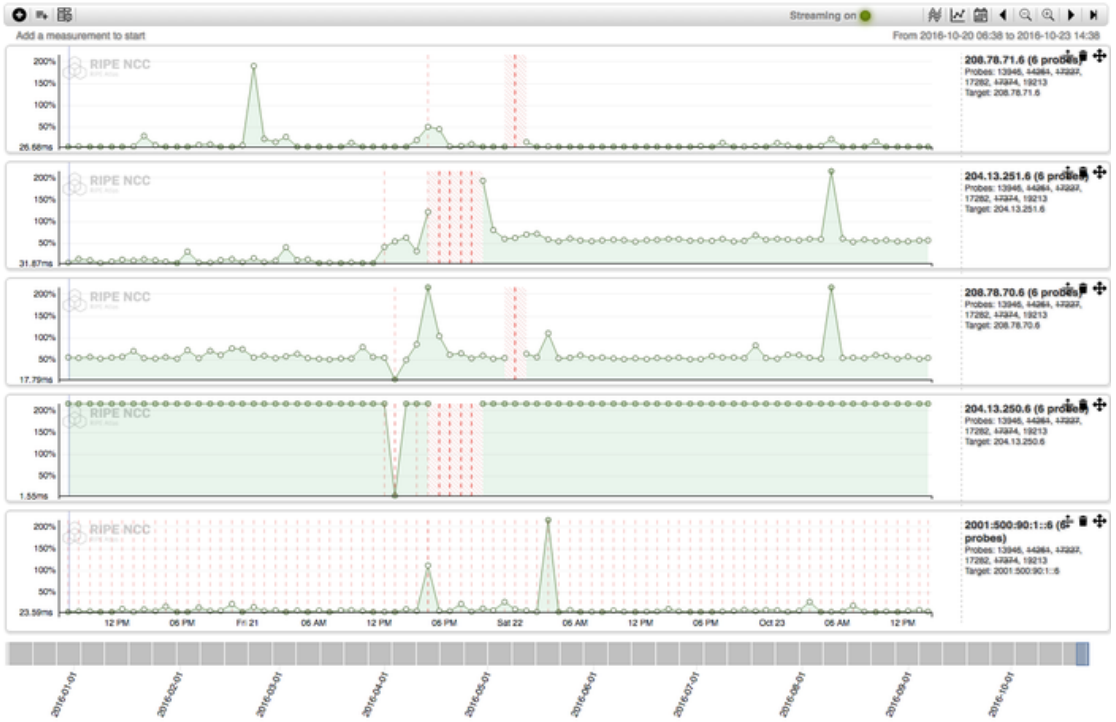
Figure 1: Visual representation of IPv4 paths (left) and IPv6 paths (right) between selected RIPE Atlas probes in Sweden



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

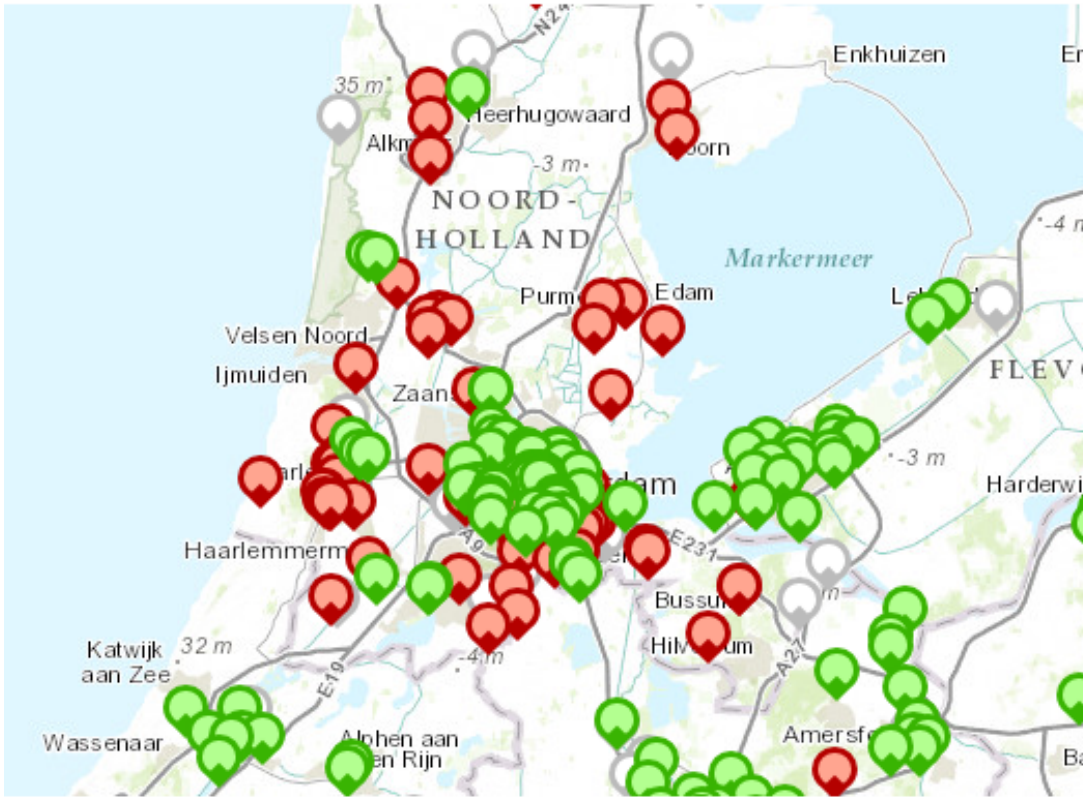


Use Cases (3)

- 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 were the outage was happening



Training

- Webinar
- Training Course

- All material available at RIPE web site

  https://www.ripe.net

RIPE Atlas Contact Info

- https://atlas.ripe.net
- http://roadmap.ripe.net/ripe-atlas/

- Users' mailing list: ripe-atlas@ripe.net
- Articles and updates: https://labs.ripe.net/atlas
- Questions and bugs: atlas@ripe.net
- Twitter: @RIPE_Atlas and #RIPEAtlas

Questions