RIPE NCC
RIPE NETWORK COORDINATION CENTRE

RIPE NCC Operations and Analysis Tools

Emile Aben | 27 November 2017 | SIG-NOC

My Goals

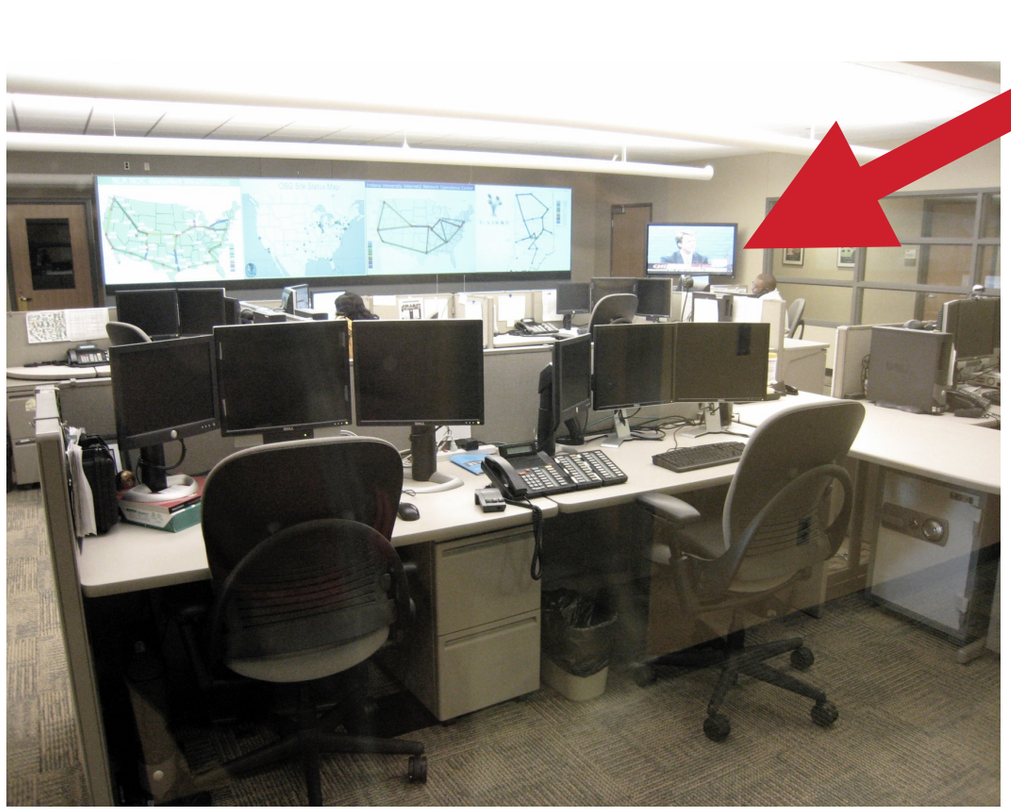
- Show you tools and data available from RIPE NCC

- Do these meet your NOC needs?

- How can we make things better?

Confession

- I don’t have a NOC background
- My assumptions about a NOC
  - Has a very good view of their own network
  - Affected by things happening outside of their own network



By Alan Levine from United States - Network Operations Center, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=2487597

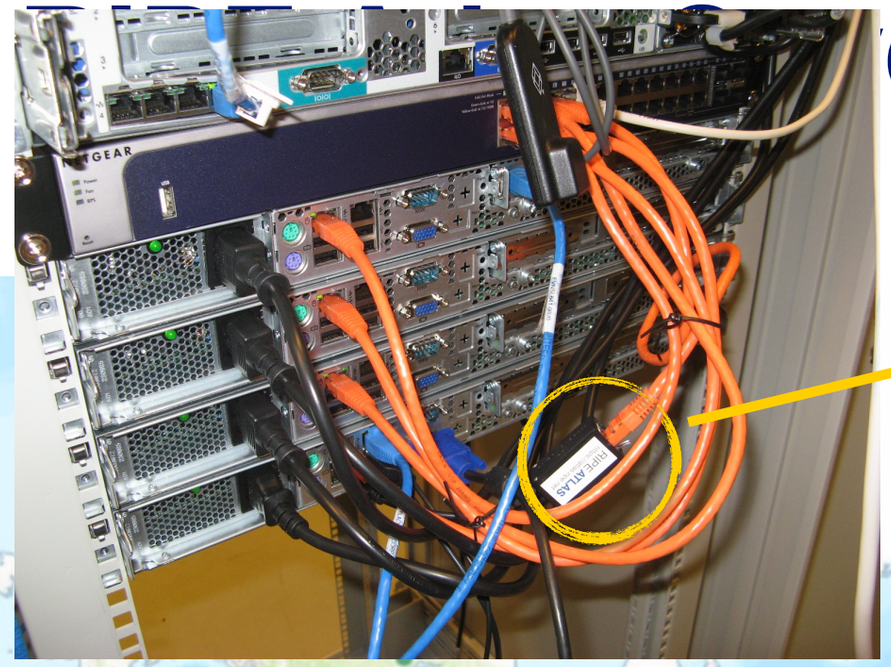
RIPE Atlas

RIPE Atlas

From Wikipedia, the free encyclopedia

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

erage - World

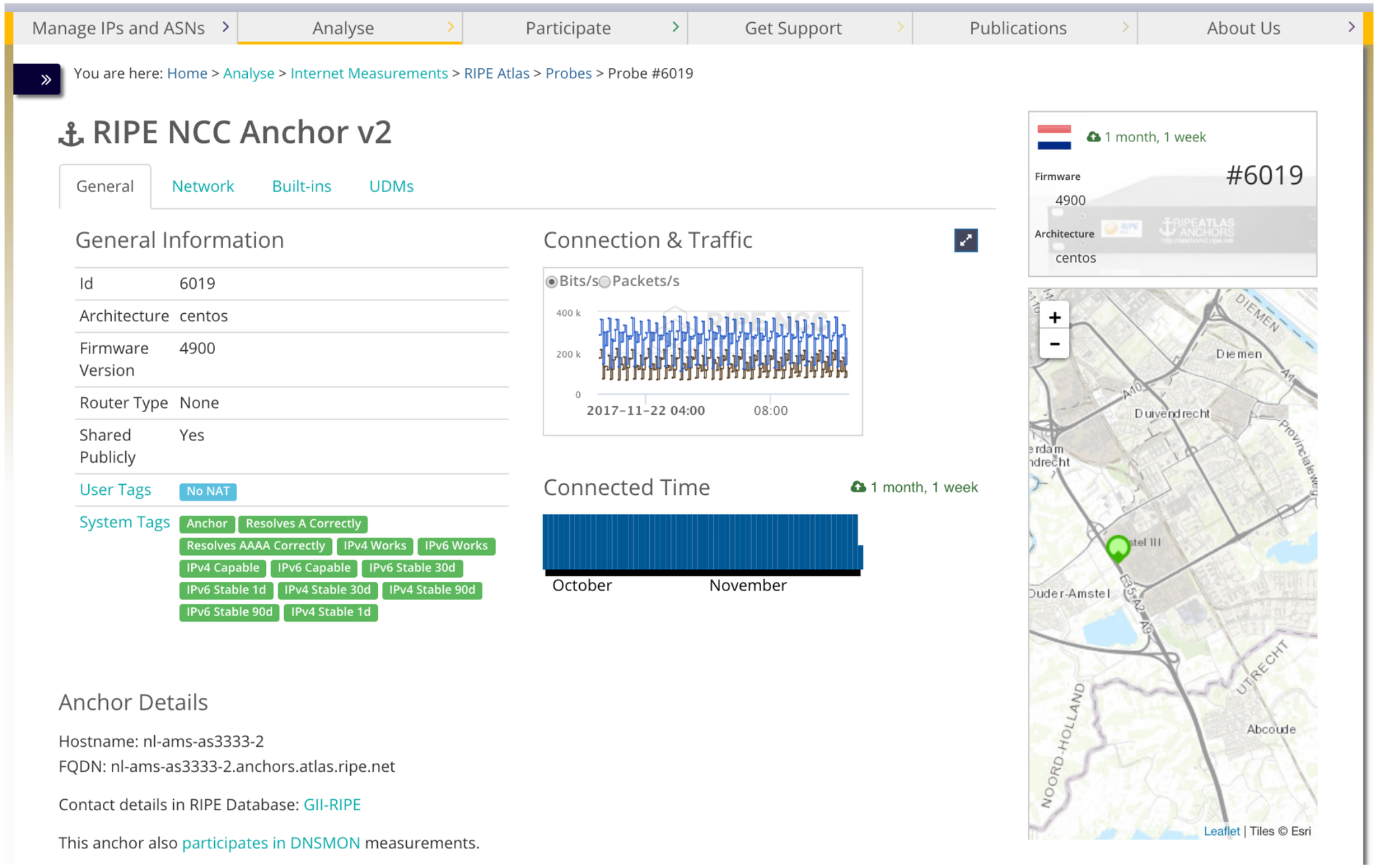

NETGEAR
ELFE ATLAS


NORTH AMERICA
SOUTH AMERICA
EUROPE
ASIA
AFRICA
AUSTRALIA
Atlantic Ocean
Pacific Ocean
Pacific Ocean
Indian Ocean
Leaflet | Tiles © Esri — Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

RIPE Atlas Infrastructure

- Measurement points
  - Probes: 10.3k
  - RIPE Atlas Anchors: 293
- Coverage:
  - 183 countries (93%)
  - Networks (ASNs):
  - IPv4: 3,613 (6.1%)
  - IPv6: 1,369 (9.6%)

Probe/Anchor view



RIPE Atlas: Coverage by tag

10214	system-ipv4-capable
7738	system-ipv4-rfc1918
731	datacentre
213	academic
82	noc
1	datacenter

https://gist.github.com/emileaben/cfa43dd68193407911ef6f7daa866bc1

https://sg-pub.ripe.net/emile/tmp/tags.2017-11-22.txt

RIPE Atlas near Internet users?

- http://sg-pub.ripe.net/petros/population_coverage/table.html

Details for : **Armenia (AM)** | **View Armenia on RIPEstat**

82.19

Internet Users covered : **1241884** Total Internet Users: **1510906**

Internet users coverage is estimated using percentage of IPv4 Public probes.

IPv4 Public Probes >= 3 3 > IPv4 Public Probes > 1

Search:

ASN	Name	Estimated Population % ▼	IPv4 Public Probes	IPv4 Private Probes	IPv4 Total Probes	IPv6 Public Probes	IPv6 Private Probes	IPv6 Total Probes	More
44395	ORG-UL31-RIPE	39.99	7	0	7	2	0	2	View
12297	ARMENTEL	26.5	1	0	1	0	0	0	View
49800	GNC-ALFA	13.84	3	1	4	0	1	1	View
43733	K-TELECOM	5.98	0	2	2	0	1	1	Apply for a probe
47975	KT-AS-47975	2.88	0	0	0	0	0	0	Apply for a probe
197834	INTERACTIVE	1.51	1	0	1	0	0	0	View

Most Popular Features

- Six types of measurements: ping, traceroute, DNS, SSL/TLS, NTP and HTTP (to anchors)
- APIs to start measurements and get results
- Powerful and informative visualisations
- CLI tools
- Streaming data for real-time results
- “Time Travel”, LatencyMON

NOC perspective?

- 10k RIPE Atlas probes =
  - 10k remote Looking Glasses for some standard network debugging tools: ping, traceroute
  - Ability to look at your network outside-in

- Does this satisfy NOC needs?
- How can we make things better?

Traceroute for Checking Reachability

- To start traceroute: GUI, API & CLI
- Results available as
  - visualised on the map, as a list of details, LatencyMon
  - download via API
    - Real-time data streaming
- Many visualisations available
  - List of probes: sortable by RTT
  - Map: colour-coded by RTT
  - LatencyMON: compare multiple latency trends

RIPE Atlas CLI ToolSet

- Network troubleshooting from command line
- Familiar output (ping, dig, traceroute)
- Installation for Linux/OSX & Windows [experimental]
- Included in many BSD and Linux distros
- Documentation
- Source code available, contributions welcome!

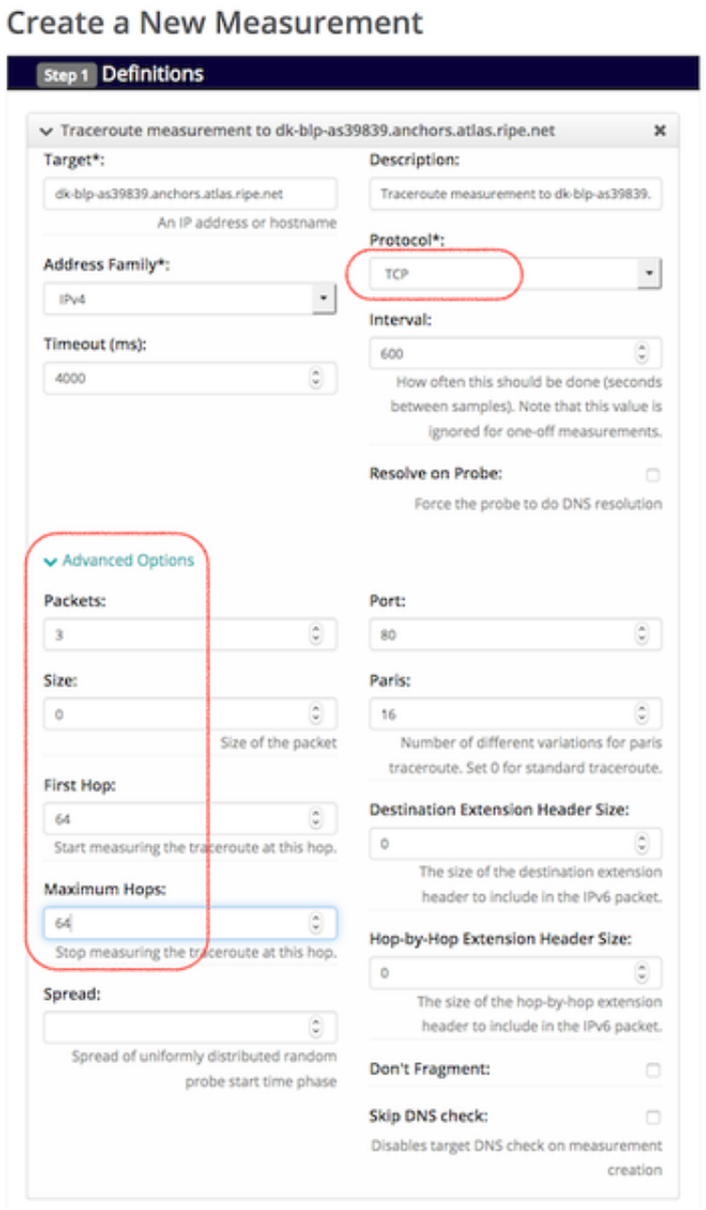
“Users from India have issues reaching us”!

```
e1000$ ripe-atlas measure traceroute --from-country IN --target surfnet.nl

Looking good!  Your measurement was created and details about it can be found here:

  https://atlas.ripe.net/measurements/10276342/


Connecting to stream...


Probe #32886

  1 192.168.1.1                                0.696 ms     0.423 ms     0.391 ms
  2 171.76.72.1                                2.962 ms     2.965 ms      2.64 ms
  3 125.21.0.189                               2.278 ms     2.826 ms     2.503 ms
  4 182.79.187.18                            149.874 ms   149.552 ms   149.478 ms
  5 195.66.225.24                            149.507 ms   149.388 ms   149.556 ms
  6 109.105.98.110                           186.926 ms   155.355 ms   154.874 ms
  7 145.145.17.14                            161.267 ms   157.917 ms   157.124 ms
  8 192.87.108.15                            157.075 ms   156.767 ms   157.877 ms

Probe #32958

  1 192.168.0.1                                1.617 ms     0.743 ms     0.718 ms
  2 202.83.20.205                              2.334 ms     2.022 ms     3.129 ms
  3 202.83.26.1                                2.369 ms      2.41 ms     2.269 ms
  4 14.141.145.197                             3.483 ms     3.445 ms     3.308 ms
  5 172.31.47.5                               23.575 ms    23.723 ms    23.403 ms
  6 180.87.39.25                              23.491 ms    22.502 ms    22.554 ms
  7 180.87.38.1                               128.36 ms   127.767 ms    127.58 ms
  8 180.87.38.126                             126.672 ms   125.524 ms   126.017 ms
  9 80.231.217.6                              127.204 ms   124.816 ms   125.074 ms
 10 80.231.153.49                             126.176 ms   126.155 ms   126.064 ms
 11 80.231.153.202                            128.463 ms   128.374 ms   128.215 ms
 12 141.136.105.89                            135.736 ms   135.672 ms   136.018 ms
 13 77.67.72.110                              137.012 ms   140.409 ms   136.684 ms
```

Complex Example: “HTTP ping”

- HTTP fetch only possible towards Anchors
- “HTTP ping” to check reachability

```
# ripe-atlas measure
traceroute --target
82.94.235.165 --protocol
TCP --size 1  --first-hop
64 --max-hops 64 --port 80
```



Measurement results

Traceroute measurement to surfnet.nl

General Information | Probes | Map | TraceMON (beta) | Openipmap (beta) | Results

Probe	ASN (IPv4)	ASN (IPv6)	Time (UTC)	RTT	Hops	Success
25164	24560					No recent report available
33546	24560					No recent report available
25387	132933		2017-11-21 10:21	126.822	15	✔
28878	17439		2017-11-21 10:21	127.944	15	✔
24887	24309		2017-11-21 10:21	129.588	15	✔
33575	24309		2017-11-21 10:21	131.924	15	✔
32167	24309		2017-11-21 10:21	135.219	16	✔
32958	24309		2017-11-21 10:21	136.520	15	✔
25373	132933		2017-11-21 10:21	136.711	14	✔
28502	18196		2017-11-21 10:21	138.149	8	✔
32923	24309		2017-11-21 10:21	139.512	16	✔
23697	17625		2017-11-21 10:21	141.129	15	✔
32932	56209		2017-11-21 10:21	149.828	6	✔
31242	134053	134053	2017-11-21 10:21	150.312	8	✔
32954	17813		2017-11-21 10:21	153.087	10	✔
29959	9430		2017-11-21 10:21	153.754	17	✔
29939	135036		2017-11-21 10:21	154.320	11	✔
25261	55862		2017-11-21 10:21	155.279	10	✔
32886	24560		2017-11-21 10:21	157.075	8	✔
32001	23860		2017-11-21 10:21	158.148	16	✔
17011	132933	58901	2017-11-21 10:21	158.796	14	✔
30669	55824		2017-11-21 10:21	159.807	12	✔
29983	58405		2017-11-21 10:21	161.715	10	✔
32903	18101		2017-11-21 10:21	162.541	7	✔

Measurement Results

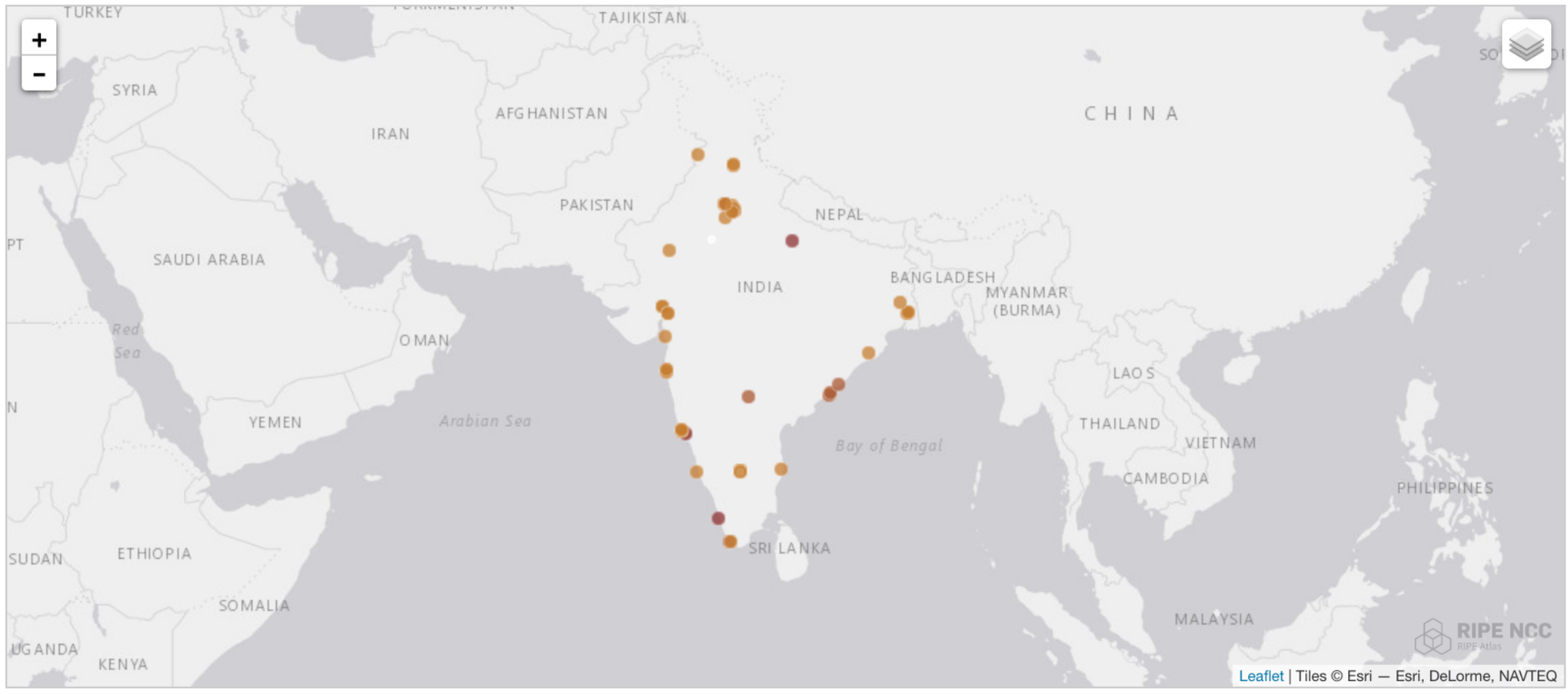
Traceroute measurement to surfnet.nl

General Information | Probes | Map | TraceMON (beta) | Openipmap (beta) | Results

The probes involved in this measurement, plotted geographically.

Filter by ASN, prefix, or country:

Just start typing



< 10 ms: 0 | < 20 ms: 0 | < 30 ms: 0 | < 40 ms: 0 | < 50 ms: 0 | < 100 ms: 0 | < 200 ms: 38 | < 300 ms: 7 | > 300 ms: 3 | No Data: 0

Measurement Results

Traceroute measurement to surfnet.nl

General Information | Probes | Map | TraceMON (beta) | Openipmap (beta) | Results

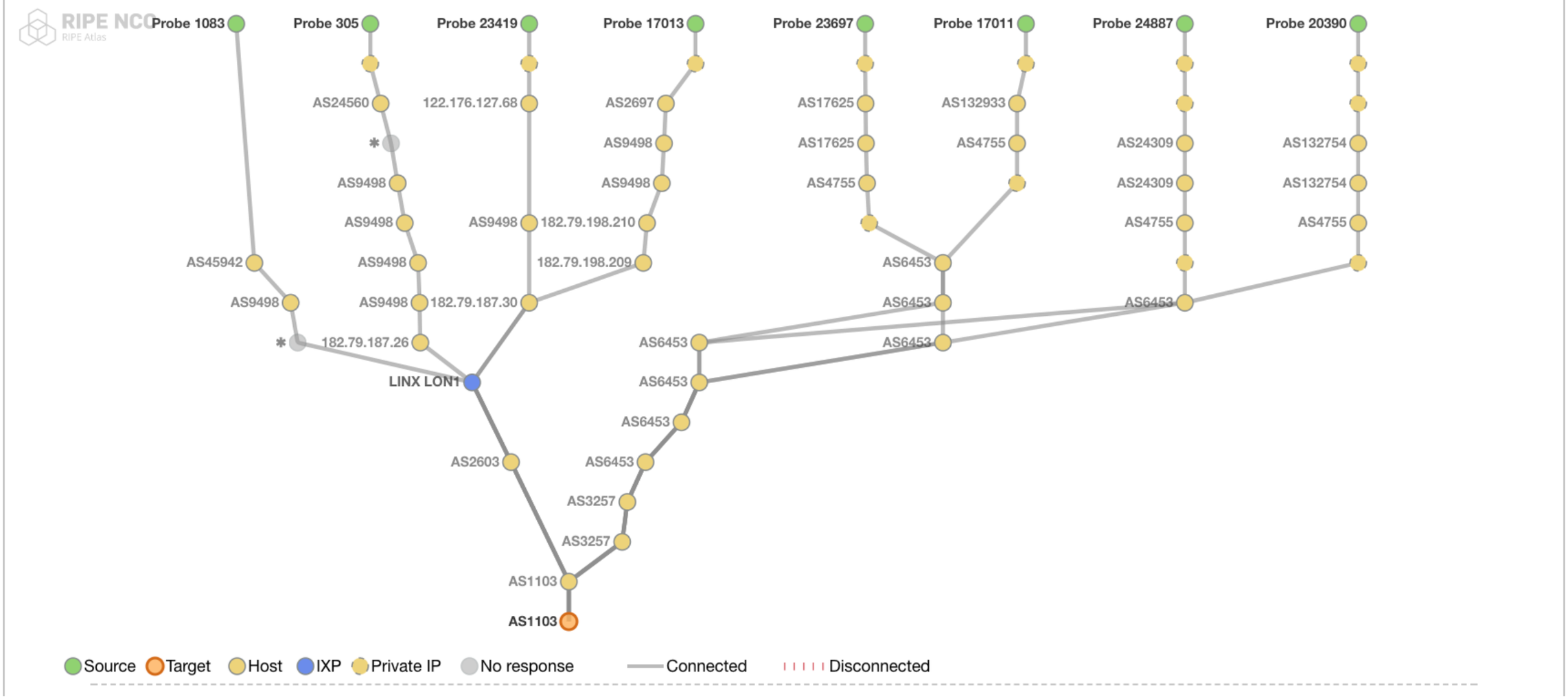
Traceroute Visualisation

speed:

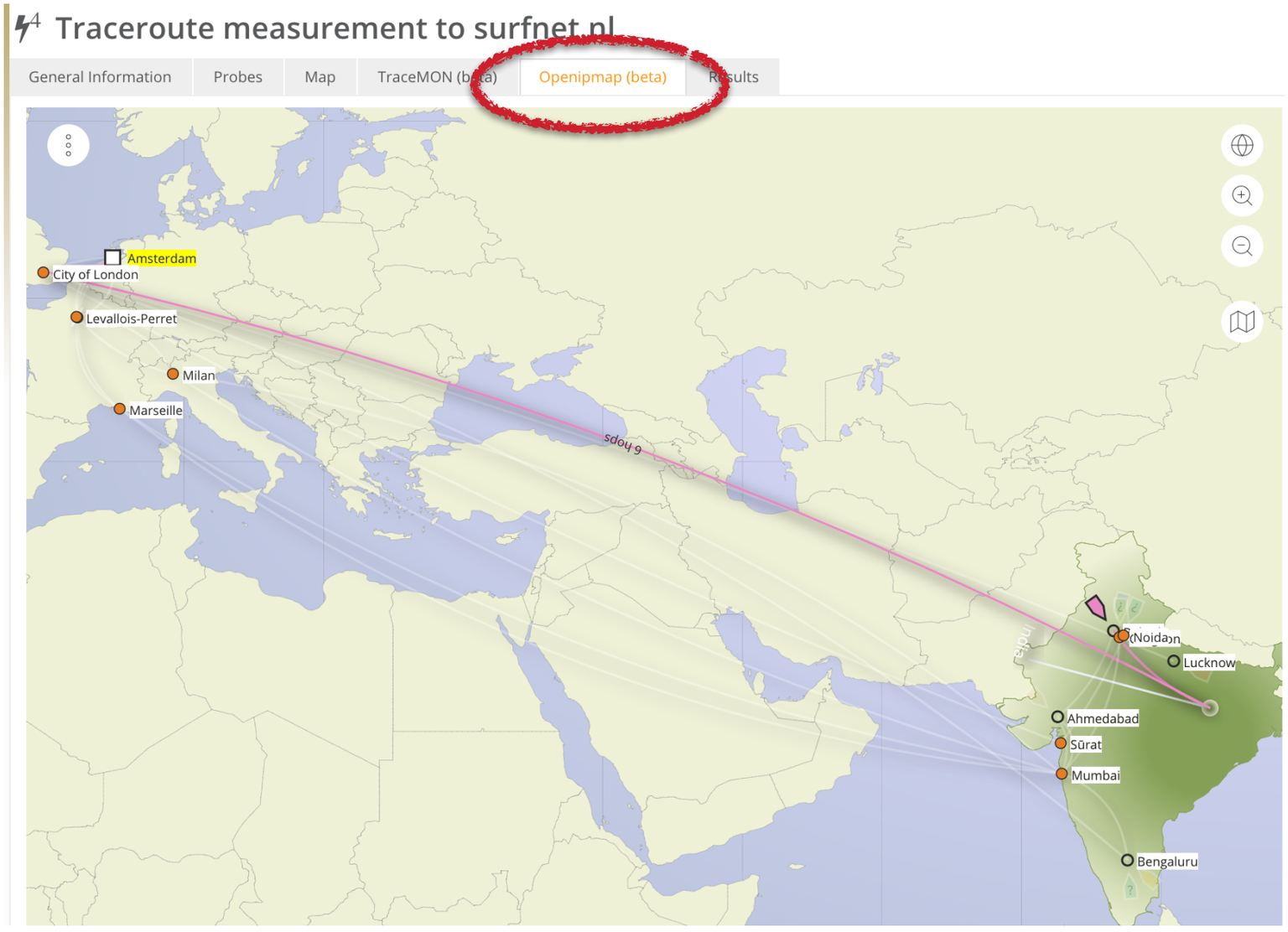
Focus on

Traceroutes to **192.87.108.15** from 8 of 50 probes [select] at **November 21st 2017, 10:25:05 UTC**

Nodes label: Auto | Reverse lookup | Country code



Measurement Results



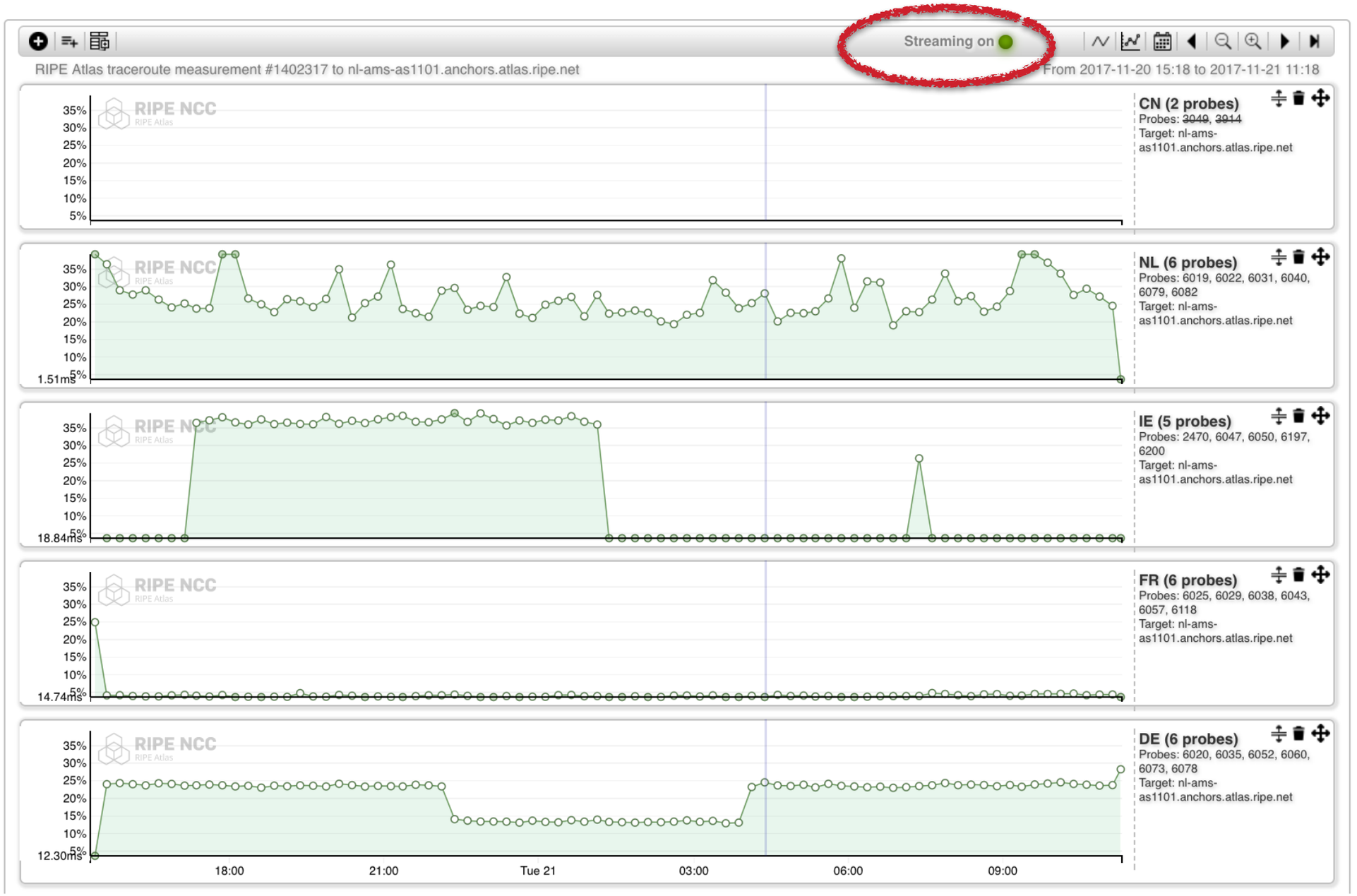
https://ripe75.ripe.net/archives/video/121/

https://ripe75.ripe.net/archives/video/203/

Traceroute View: LatencyMon

Anchoring Mesh Measurement: Traceroute IPv4 for anchor nl-ams-as1101.anchors.atlas.ripe.net

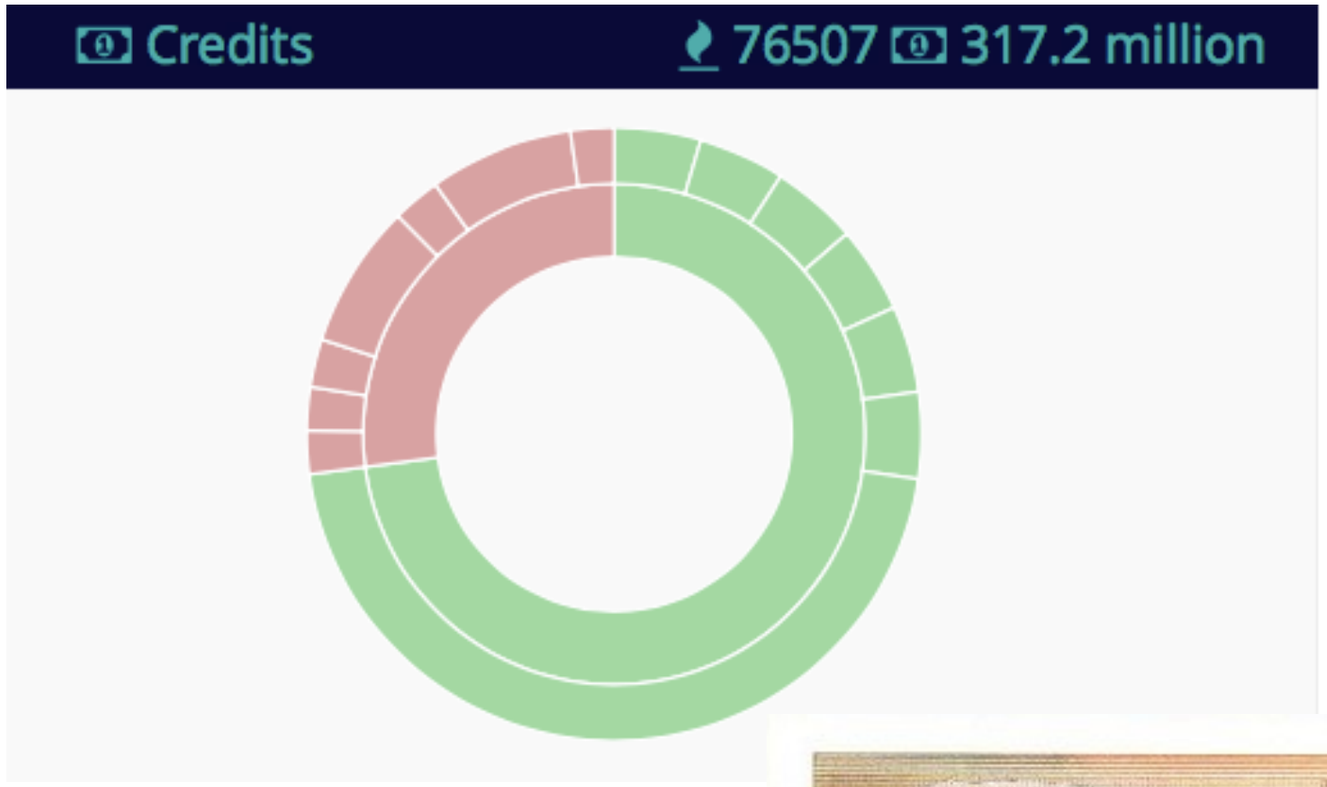
General Information | Probes | Map | LatencyMON | TraceMON (beta) | Openipmap (beta) | Results



“Paying” for your measurements

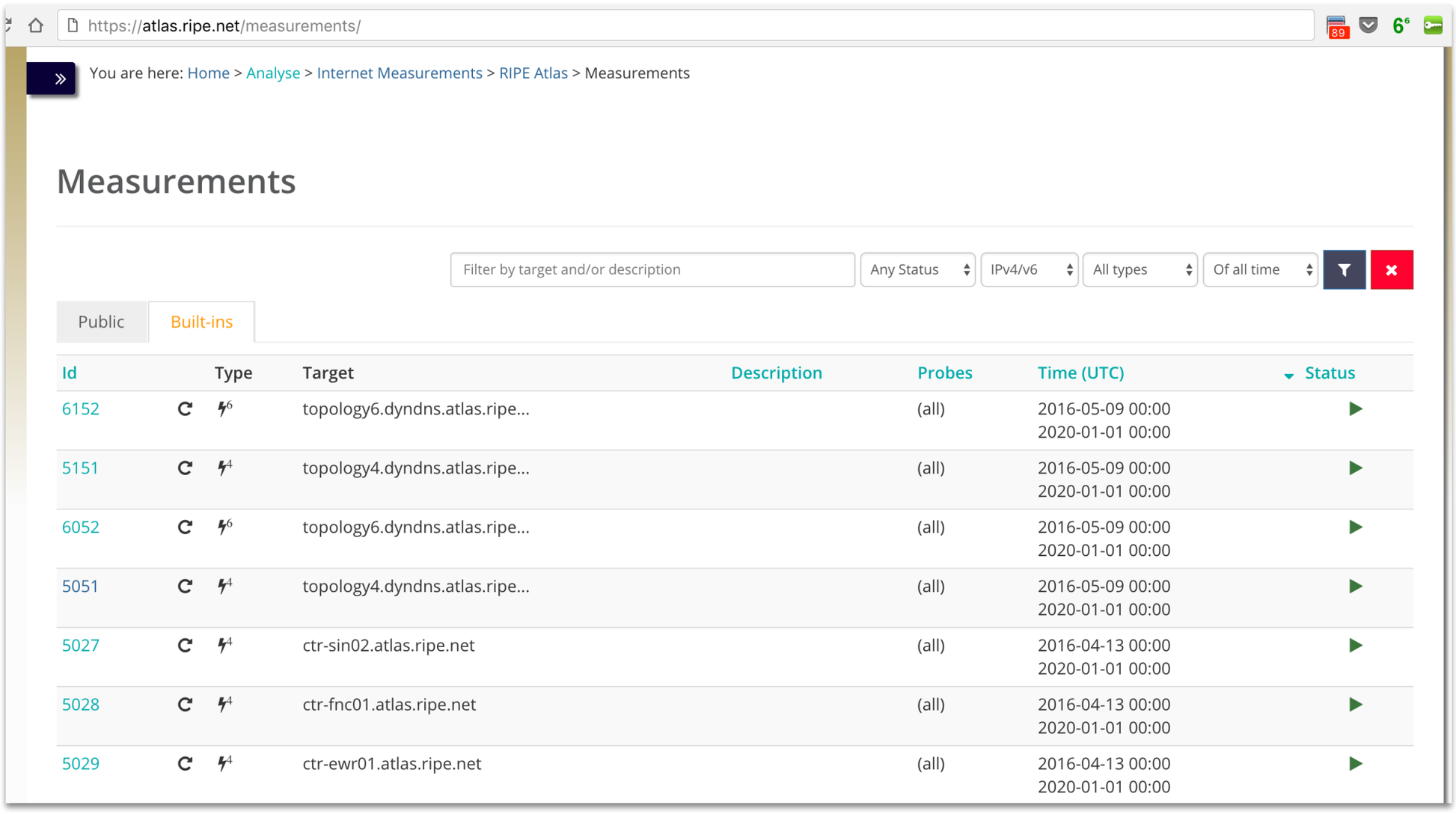
- Running your own measurements cost credits
  - Ping = 10 credits, traceroute = 20, etc.
- Why? Fairness and to avoid overload
- Limited by daily spending limit and measurement results limits
- Hosting a RIPE Atlas probe earns credits
- Earn extra credits by being RIPE NCC members, hosting an anchor or sponsoring

Who Wants to be a Millionaire?



Data, Data, Data

- Don’t spend credits - Use Existing Data!
  - For instance: DNS,ping,traceroute to DNS root-servers



Status Checks

- Status checks work on ping measurements
- You define alert parameters, for example:
  - Threshold for percentage of probes that successfully received a reply
  - How many of the most recent measurements to base it on
  - Maximum packet loss acceptable

https://atlas.ripe.net/api/v2/measurements/10275975/status-check/?lookback=10&median_rtt_threshold=20&show_all=1&permitted_total_alerts=11&max_packet_loss=50

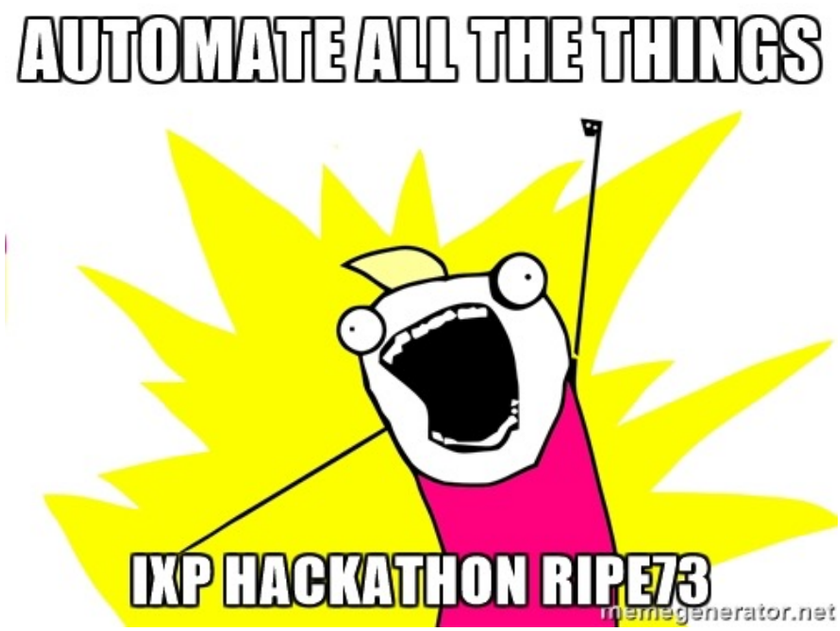
- Documentation:
  - https://atlas.ripe.net/docs/api/v2/manual/measurements/status-checks.html

Icinga Integration

- Community of operators contributed configuration code!
  - Making use of the built-in “check_http” plugin
- GitHub examples:
  - https://github.com/RIPE-Atlas-Community/ripe-atlas-community-contrib/blob/master/scripts_for_nagios_icinga_alerts
- Post on Icinga blog:
  - https://www.icinga.org/2014/03/05/monitoring-ripe-atlas-status-with-icinga-2/

Community

- Many community-contributed pieces of code
  - https://github.com/RIPE-Atlas-Community/ripe-atlas-community-contrib
  - Example: https://github.com/pierky/ripe-atlas-monitor
- RIPE Labs
  - https://labs.ripe.net
- Hackathons



Challenges In Using RIPE Atlas

- Select the right vantage points
  - Already possible: By ASN, country, tag, probe_id, geoloc
  - As dissimilar as possible?
  - Where eyeballs are?
  - By AS-SET?
- Select the right destinations
- Timeliness of data

```
e1000$ time ripe-atlas measure traceroute --from-probes 6042 --timeout 500 --packets 1 --target 8.8.8.8 --renderer raw

real    0m4.651s
user    0m0.245s
sys     0m0.068s
```

Routing Information Service (RIS)

Routing Data (RIS)

- 18 BGP collectors and growing
- 600+ peers
- 150+ full-feed peers

Raw BGP data!

- 15+ years of raw data (5.8 TB) available to download and analyse yourself :)
  - https://www.ripe.net/analyse/internet-measurements/routing-information-service-ris/ris-raw-data
- Readable using BGPdump utility
  - open source, maintained by RIPE NCC
  - https://bitbucket.org/ripencc/bgpdump
- …and by other tools
  - CAIDA BGPStream: http://bgpstream.caida.org/

Live stream demo

- Prototype!!
- Let’s see if it works
- http://stream-dev.ris.ripe.net/demo

- Live stream enables new applications
  - BGP hijack detection
  - Real time anomaly analysis
  - Live monitoring of your routes

NOC perspective?

- Big Looking Glass
- Useful for post-mortems?
- Monitoring around changes?
- Event signaling?

- THE INTERNET IS ON FIRE
- Something is happening near you

RIPEstat

RIPEstat

- Access to these datasets:
  - RIPE Database (INR, IRR) and other RIRs
  - BGP routing data (RIS)
  - RIPE Atlas, M-Lab, Speedchecker, etc.
  - Geolocation
  - Blacklist
- New datasets are constantly added!

MLAB

BROADBAND speedchecker

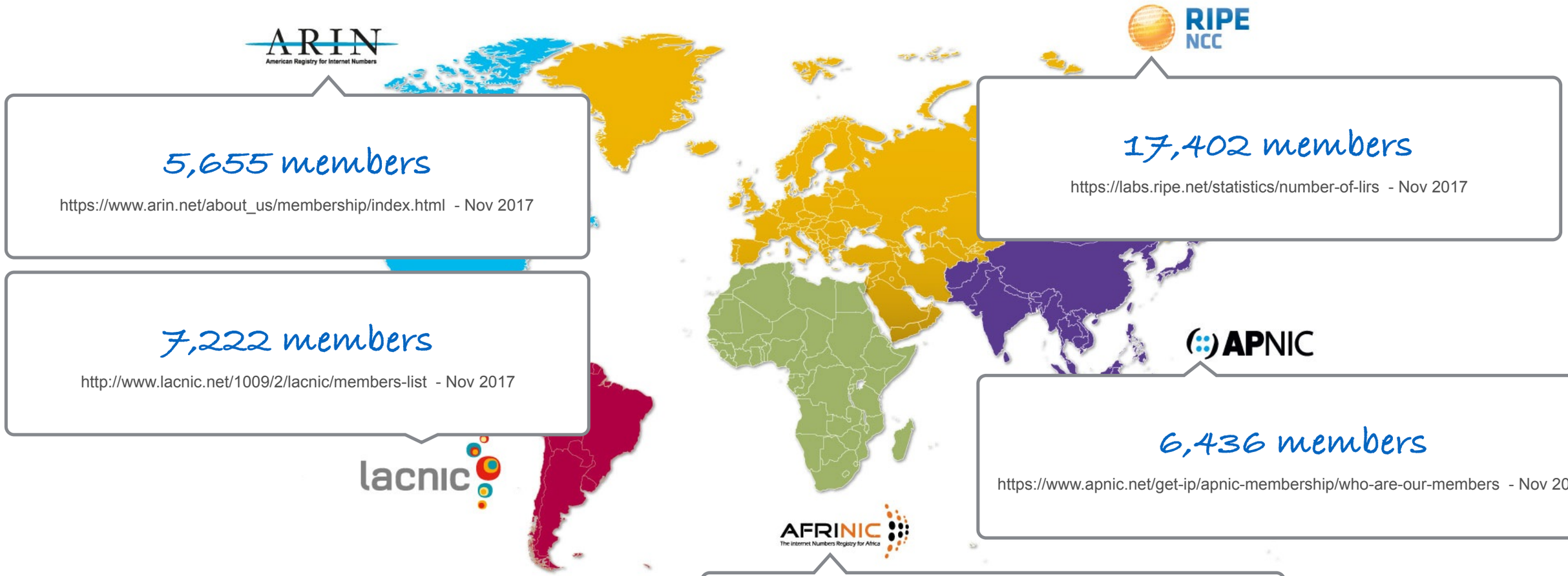
MAXMIND

SPAMHAUS

• • •

Registry Data

- Registry of Internet number resources (INR)
- Five Regional Internet Registries



5,655 members

https://www.arin.net/about_us/membership/index.html - Nov 2017

17,402 members

https://labs.ripe.net/statistics/number-of-lirs - Nov 2017

7,222 members

http://www.lacnic.net/1009/2/lacnic/members-list - Nov 2017

6,436 members

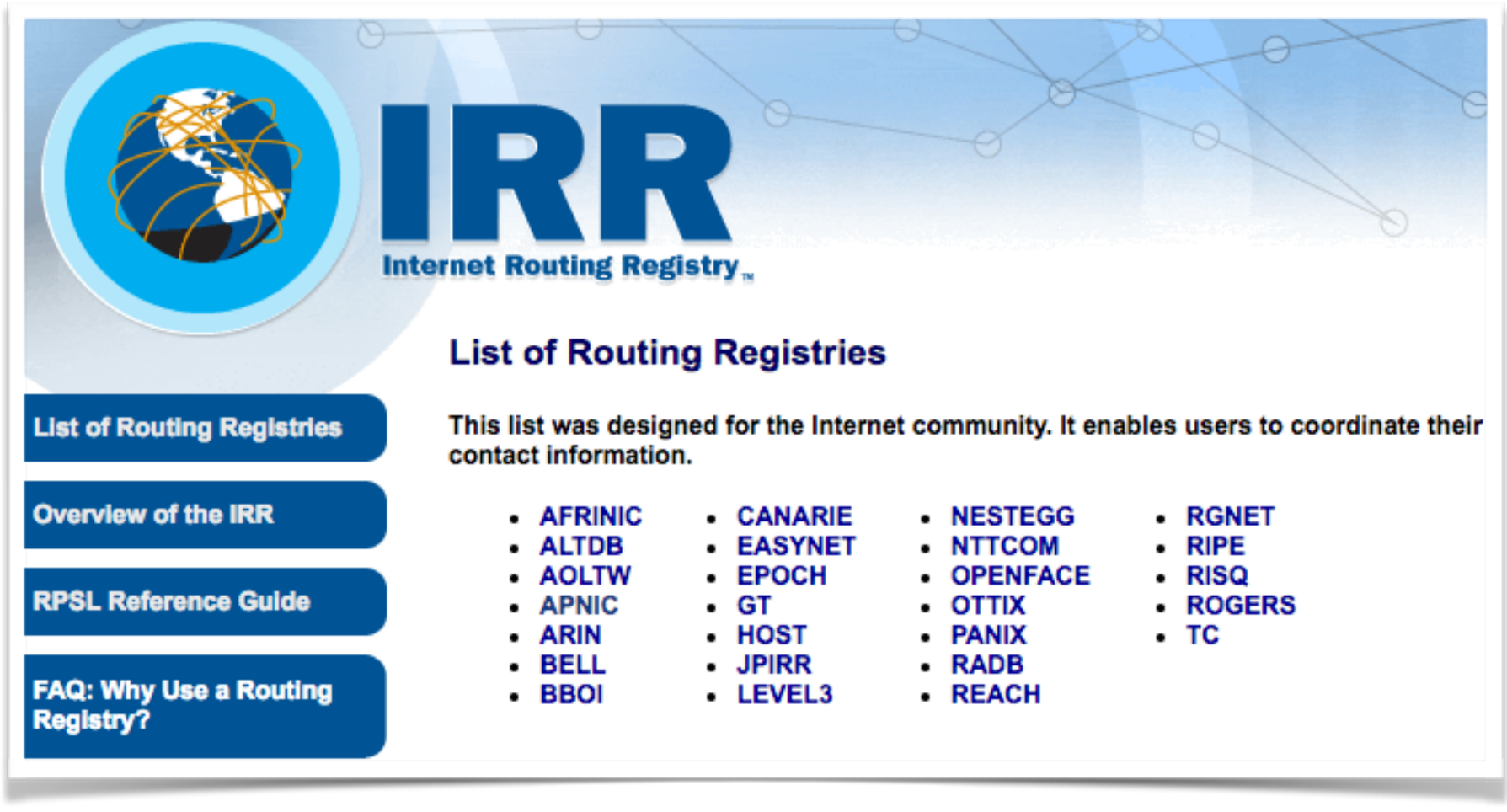
https://www.apnic.net/get-ip/apnic-membership/who-are-our-members - Nov 2017

1,540 members

http://www.afrinic.net/en/about/our-members - Nov 2017

Registry Data

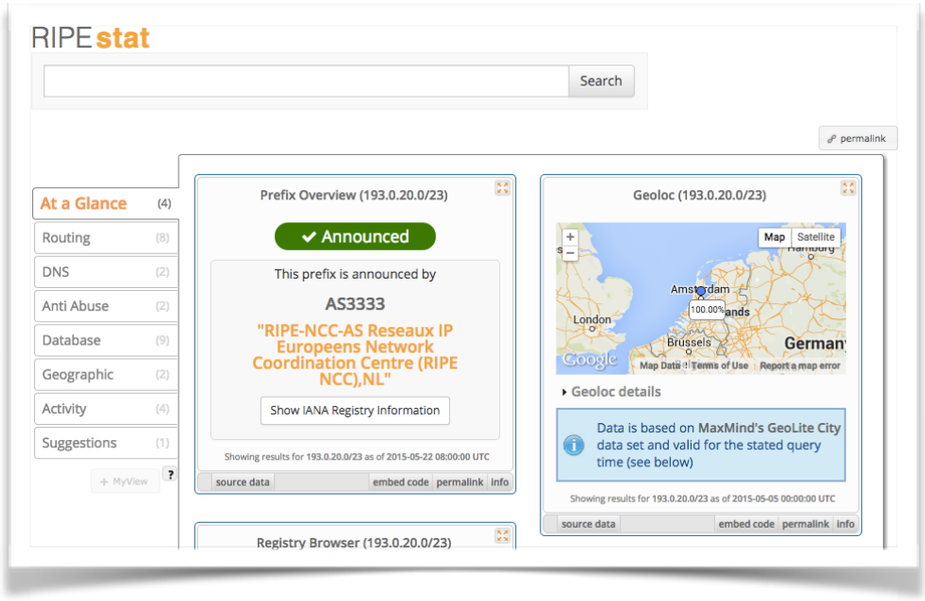
- Internet Routing Registry (IRR)
- Purpose to facilitate routing (RPSL)



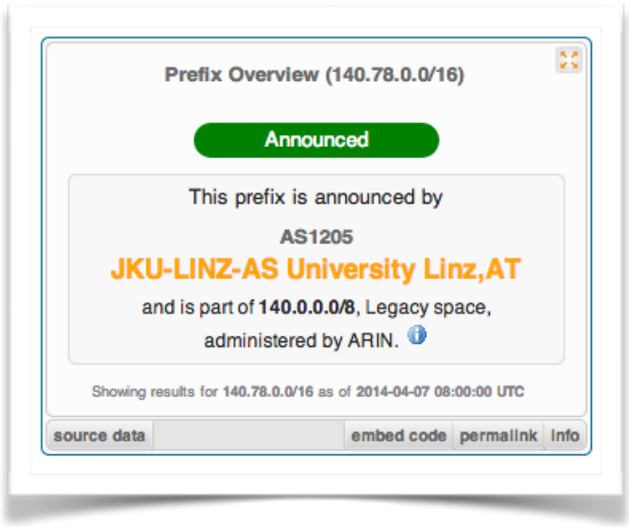
http://www.irr.net/docs/list.html

RIPEstat

- https://stat.ripe.net



- RIPEstat widget API



- RIPEstat data API
  - https://stat.ripe.net/data/routing-status/data.json?resource=…

RIPEstat

Supported resources:

* IP address/prefix (V4/V6)
* ASN
* Domain names
* Country

RIPE NCC
RIPE NETWORK COORDINATION CENTRE

Login

Manage IPs and ASNs › | Analyse | bout Us ›

You are here: Home > Analyse > Statistics > RIPE

RIPEstat Home «

About RIPEstat ›

Documentation ›

Use Cases ›

Your IP address is:
2001:67c:2e8:9::c100:14e6

Search

Your network: AS3333, 2001:67c:2e8::/48 e.g.: IPv4 prefix/range, IPv6, ASN

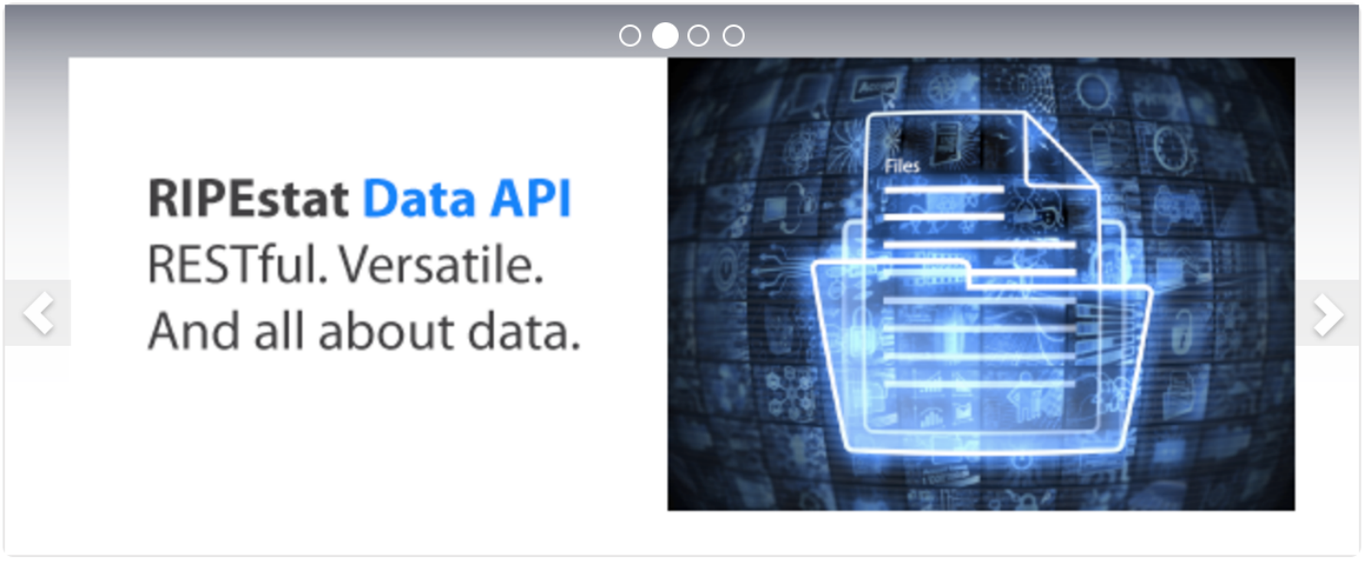
System Statistics

1,429,622

Requests seen in the last full hour on RIPEstat

On RIPE Labs

New Feature: Easily Embed your RIPEstat Widgets in RIPE Labs Articles



RIPEstat - Data API

- More than 50 data calls
- Documentation: https://stat.ripe.net/docs/data_api
- Building blocks
- Integration in open tools

Rosiak commented on 2 Oct 2015 — Contributor

- Whois
- Abuse Finder
- Geolocate
- Looking Glass

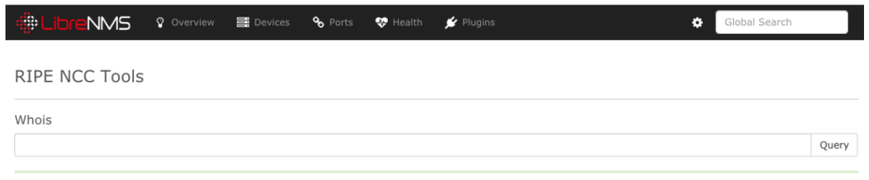
etc.

https://stat.ripe.net/docs/data_api

Rosiak added the **Feature-Request** label on 2 Oct 2015

Rosiak commented on 3 Oct 2015 — Contributor

Quick example, thoughts?:

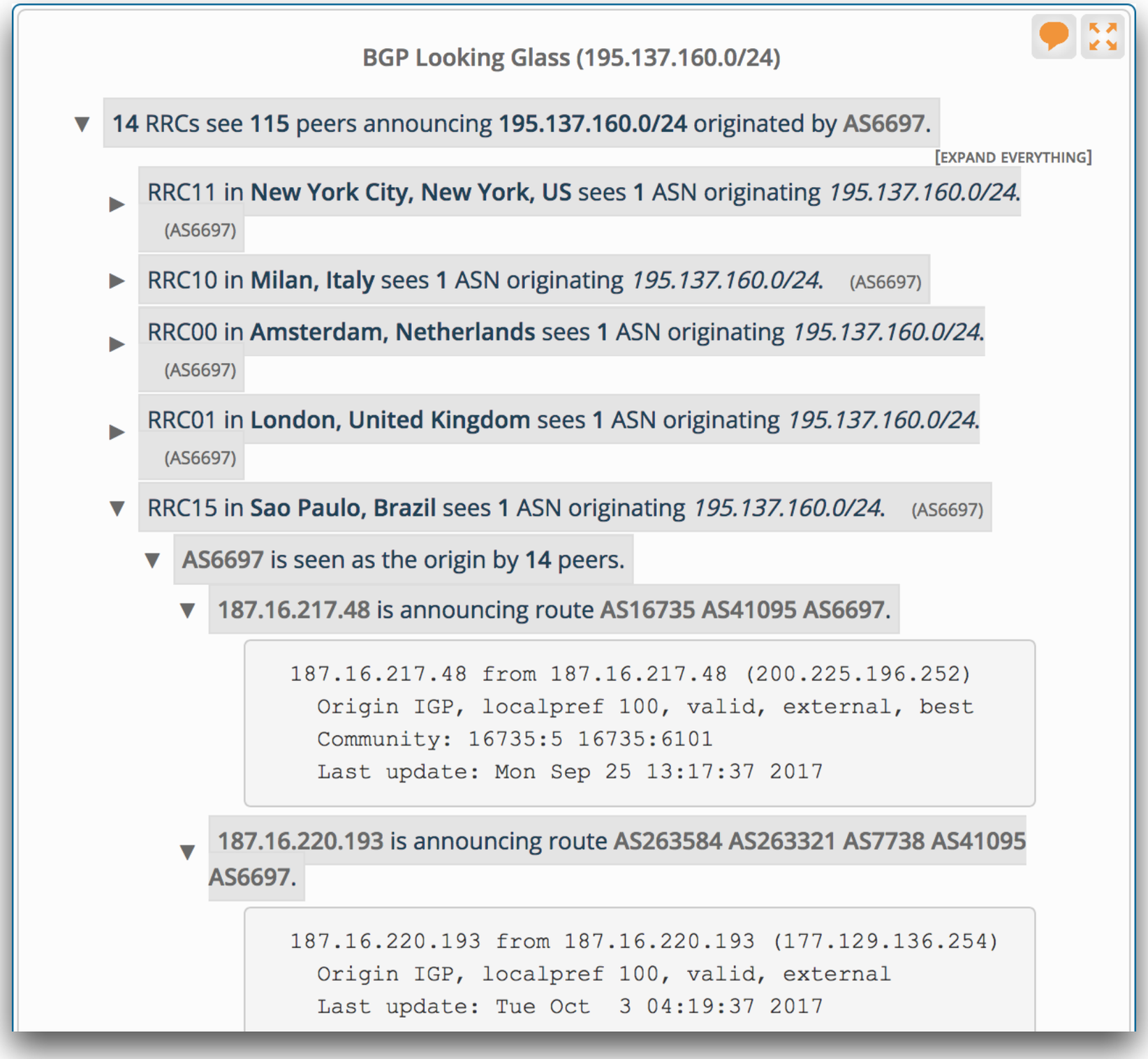


Overview
Data Calls
Abuse Contact Finder
Address Space Hierarchy
Address Space Usage
Allocation History
Announced Prefixes
AS Overview
AS Path Length
AS Routing Consistency
ASN Neighbours
ASN Neighbours History
Atlas Probe Deployment
Atlas Probes
Atlas Targets
BGPlay
BGP State
BGP Updates
BGP Update Activity
Blacklist
Country ASNs
Country Resource Stats
Country Resource List
DNS Chain
Example Resources
Geolocation
Geolocation History
IANA Registry Info
Looking Glass
M-lab Activity Count
M-lab Bandwidth
M-lab Clients
Network Info
Prefix Count
Prefix Overview
Prefix Routing Consistenc...
Prefix Size Distribution
Registry Browser
RIR
RIR Prefix Size Distribut...
RIS Asns
RIS First-Last-Seen
RIS Prefixes
RIS Peerings
RIS Peer Count
Related Prefixes
Reverse DNS
Reverse DNS IP
Reverse DNS Consistency
Routing History
Routing Status
Searchcomplete
Speedchecker Bandwidth Me...
Visibility
Whats My Ip
Whois
Whois Object Last Updated

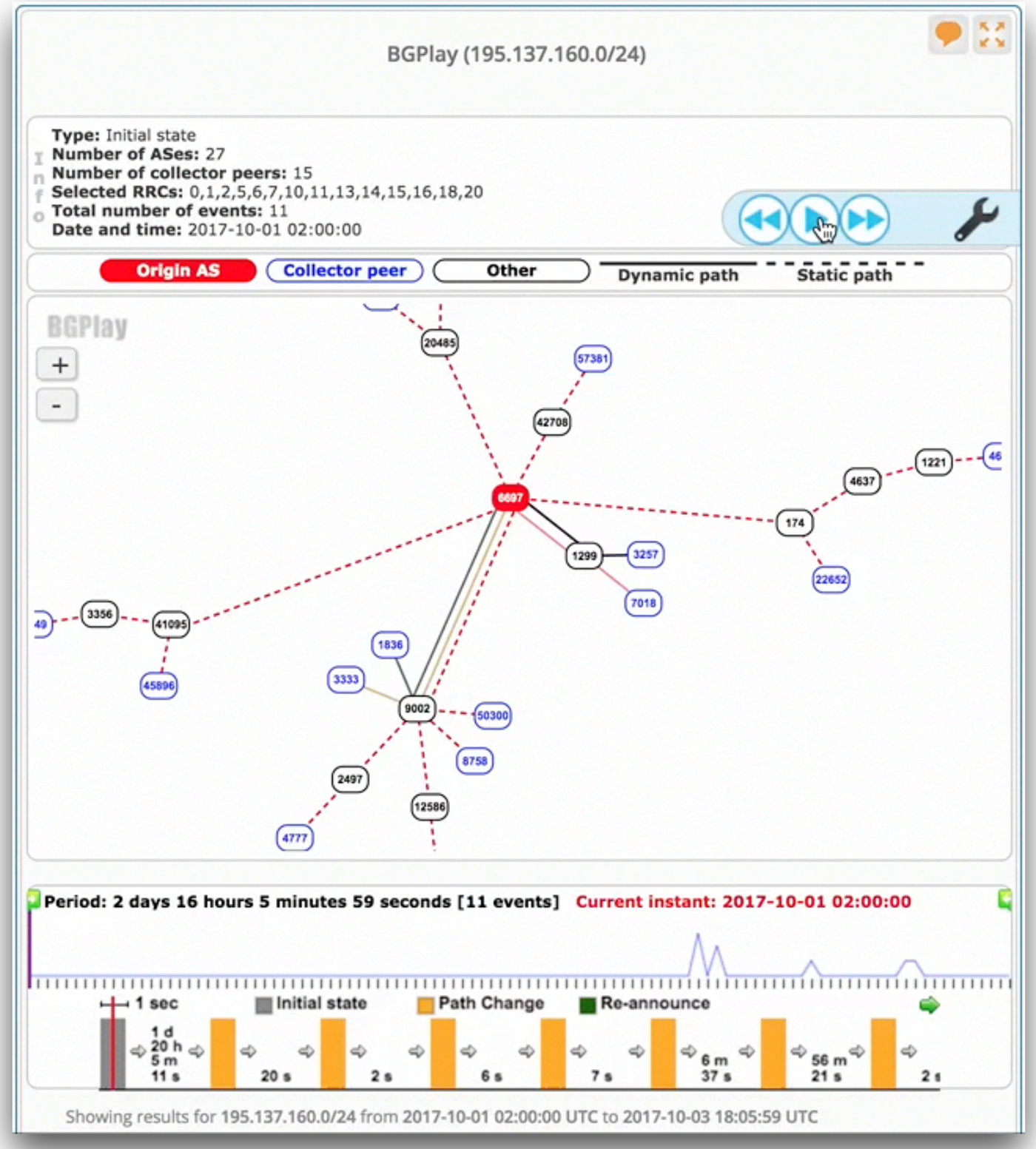
RIPEstat - Widget API

- HTML5/CSS/JS applications
- Standard Javascript
  - JQuery
  - Require.js
- More than 50 widgets
- Documentation
  - https://stat.ripe.net/docs/widget_api
- Embed into NOC dashboards?

RIPEstat Examples



RIPEstat Examples



RIPEstat Examples

Visibility (195.137.160.0/24)

195.137.160.0/24 is visible by **100%** of 158 **IPv4** RIS full peers.

Visibility Location Details of 195.137.160.0/24

RRC	IXP Location	Location	IPv4 peers seeing	IPv4 Visibility
RRC00	RIPE-NCC Multihop	Amsterdam, Netherlands	15 of 15	100%
RRC01	LINX	London, United Kingdom	7 of 7	100%
RRC03	AMS-IX / NL-IX	Amsterdam, Netherlands	7 of 7	100%
RRC04	CIXP	Geneva, Switzerland	8 of 8	100%
RRC05	VIX	Vienna, Austria	3 of 3	100%
RRC06	DIX-IE	Tokyo, Japan	2 of 2	100%
RRC07	Netnod	Stockholm, Sweden	5 of 5	100%
RRC10	MIX	Milan, Italy	9 of 9	100%
RRC11	NYIIX	New York City, US	9 of 9	100%
RRC12	DE-CIX	Frankfurt, Germany	12 of 12	100%
RRC13	MSK-IX	Moscow, Russian Federation	11 of 11	100%
RRC14	PAIX	Palo Alto, US	7 of 7	100%
RRC15	PTTMetro	Sao Paulo, Brazil	14 of 14	100%

What Next?

Internet Events

- Something is happening on the Internet!
  - Global impact
  - Local impact
    - Your topological neighbors
    - Your geographical area
- What events do you want to be signalled on?
- How? Email, Social media (Twitter), App …

An Internal Alerting System

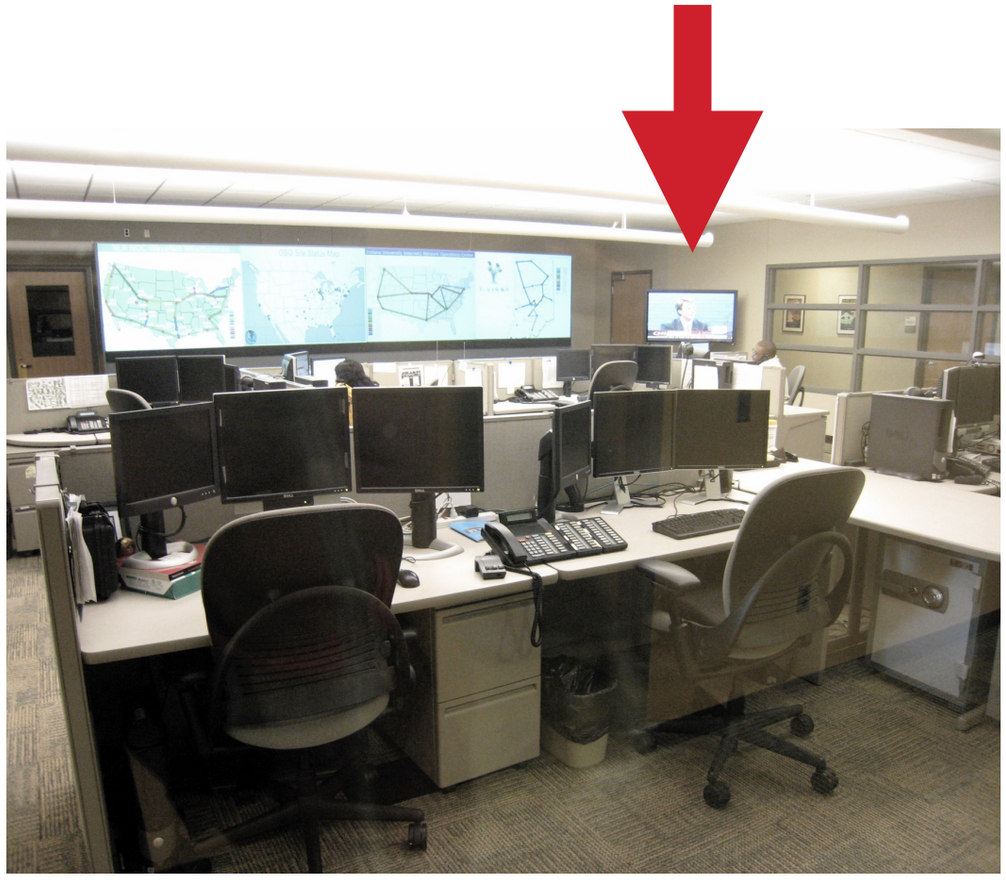
- We have internal alerts on BGP weirdness
  - A country drops >10% ASNs
  - An ASN adds 200+ prefixes
  - Total pfx count changes >500
- It's noisy and messy
- 5 minutes delay is a life-time when turds-hit-the-fan

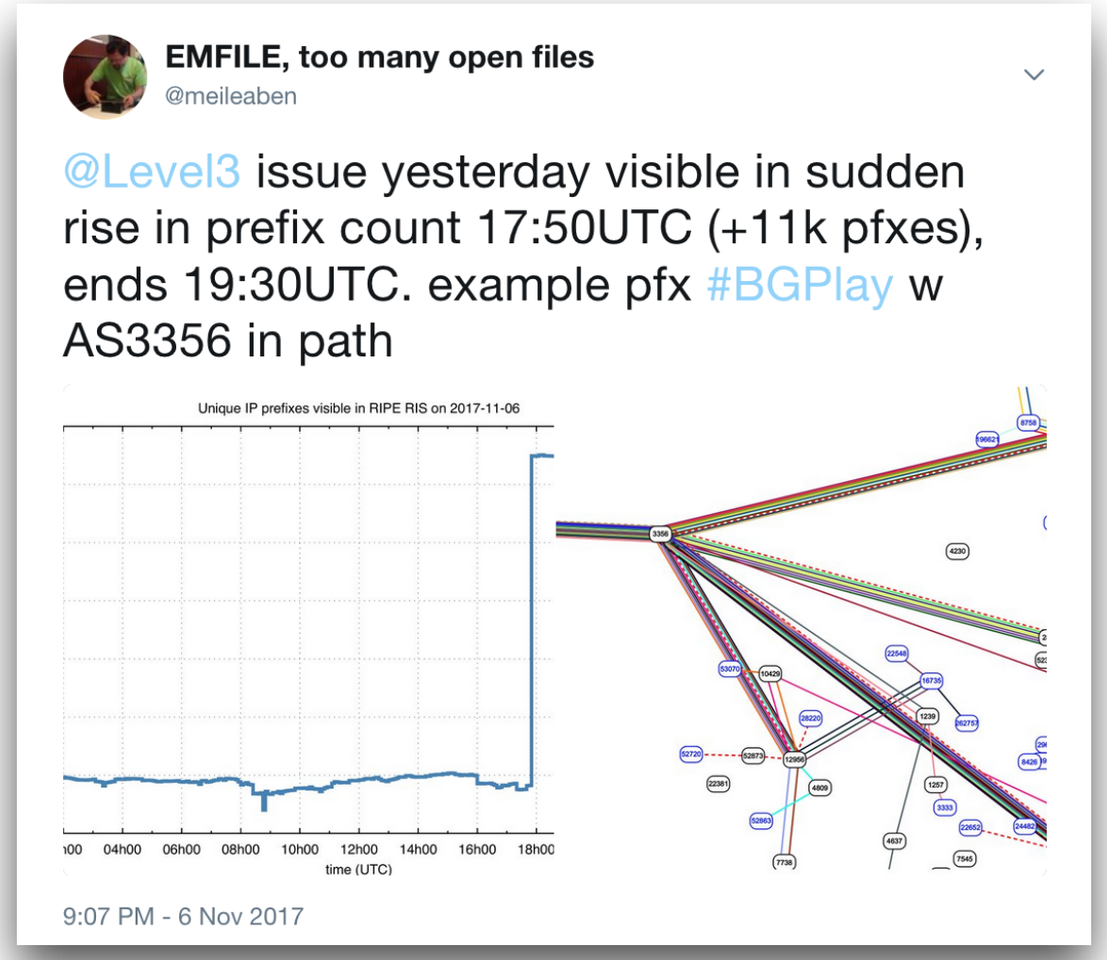
at 17:54Z:

```
Time: 2017-11-06T17:50:00Z
mis-origination? AS10481 (pfxcount: 381->742)
mis-origination? AS13367 (pfxcount: 10->270)
mis-origination? AS20214 (pfxcount: 6->379)
mis-origination? AS22909 (pfxcount: 8->261)
mis-origination? AS33287 (pfxcount: 31->460)
mis-origination? AS33491 (pfxcount: 36->647)
mis-origination? AS33650 (pfxcount: 12->232)
mis-origination? AS33651 (pfxcount: 40->353)
mis-origination? AS33657 (pfxcount: 26->297)
mis-origination? AS33659 (pfxcount: 15->320)
mis-origination? AS33667 (pfxcount: 17->313)
mis-origination? AS33668 (pfxcount: 21->400)
mis-origination? AS39651 (pfxcount: 8->403)
mis-origination? AS5410 (pfxcount: 24->594)
mis-origination? AS577 (pfxcount: 385->4417)
mis-origination? AS7015 (pfxcount: 68->713)
mis-origination? AS7016 (pfxcount: 28->521)
mis-origination? AS7725 (pfxcount: 18->329)
```

Example: Level3 - 2017-11-06

- Did it affect you?
- What actionable signals do you want?





By Alan Levine from United States - Network Operations Center, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=2487597

Research Collaborations

- Goal: Make research more useful to Internet operations
- How?
  - Actively collaborate with external researchers
  - Internships
  - Draw researchers attention to operational needs we hear from RIPE community
  - Make operations aware of useful research
  - Focus on code and tools
  - Your idea here!

Interesting NOC Data for Research

- Correlate RIPE Atlas, RIS and other data to NOC data
  - “Did something happen near AS23456 5 mins ago?”
  - “Did something happen near Hamburg in the last hour?”
  - “We changed our network at 13:55, did something change near us?”
  - Receiving these questions from NOCs might be interesting data in itself!
- Structural data on events in your networks
  - Maintenance windows? DDoS events?

Questions

emile.aben@ripe.net

@meileaben

Not a typo!