

Using the RIPE Atlas API for measuring IPv6 Reachability

FOSDEM 2014

Vesna Manojlovic

Community Builder for Measurements Tools

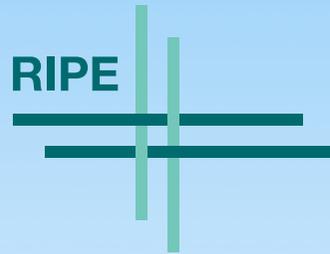
BECHA@ripe.net / @Ms_Multicolor



Overview

- Short intro to RIPE, RIPE NCC
- Getting IPv6
- What is RIPE Atlas
- How to use measurements
- IPv6-related RIPE Atlas use cases
- How to take part in the RIPE Atlas community
- Appendix 1: IPv6 documents
- Appendix 2: RIPEstat

RIPE and RIPE NCC



- Réseaux IP Européens
- Started in 1989
- Not a legal entity
- An open community
- No official membership
- Makes policies
- Meets twice a year
- Work is done in Working Groups on mailing lists

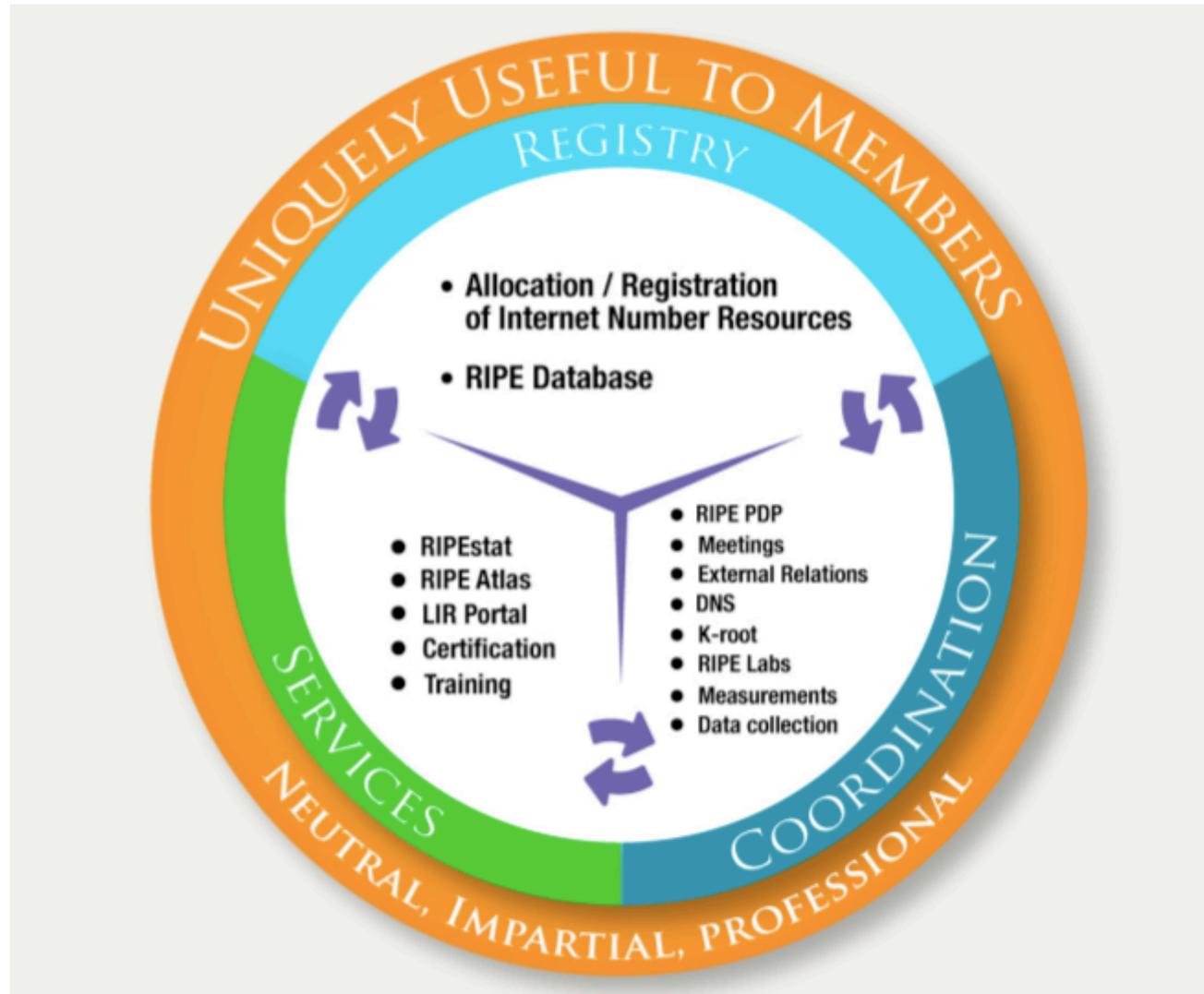


- RIPE Network Coordination Centre
- Started in 1992
- Not-for-profit organisation
- Located in Amsterdam
- Has members called Local Internet Registries (LIRs)
- Implements policies
- Facilitates two RIPE Meetings each year
- Provides services to both members and non-members
- Governed by an Executive Board elected by membership
- Neutral, Impartial, Open, Transparent

The Five RIRs



Not Only an RIR: RIPE NCC Services



Increasing Involvement of Students: RACI



The RIPE Academic Cooperation Initiative (RACI)

RACI (the RIPE Academic Cooperation Initiative [↗](#)) will provide up to five students and researchers with complimentary tickets and transport to RIPE 68, and accommodation for the duration of the meeting.

RIPE 68 will take place from 12-16 May 2014 at the Sofitel Warsaw Victoria Hotel in Poland.

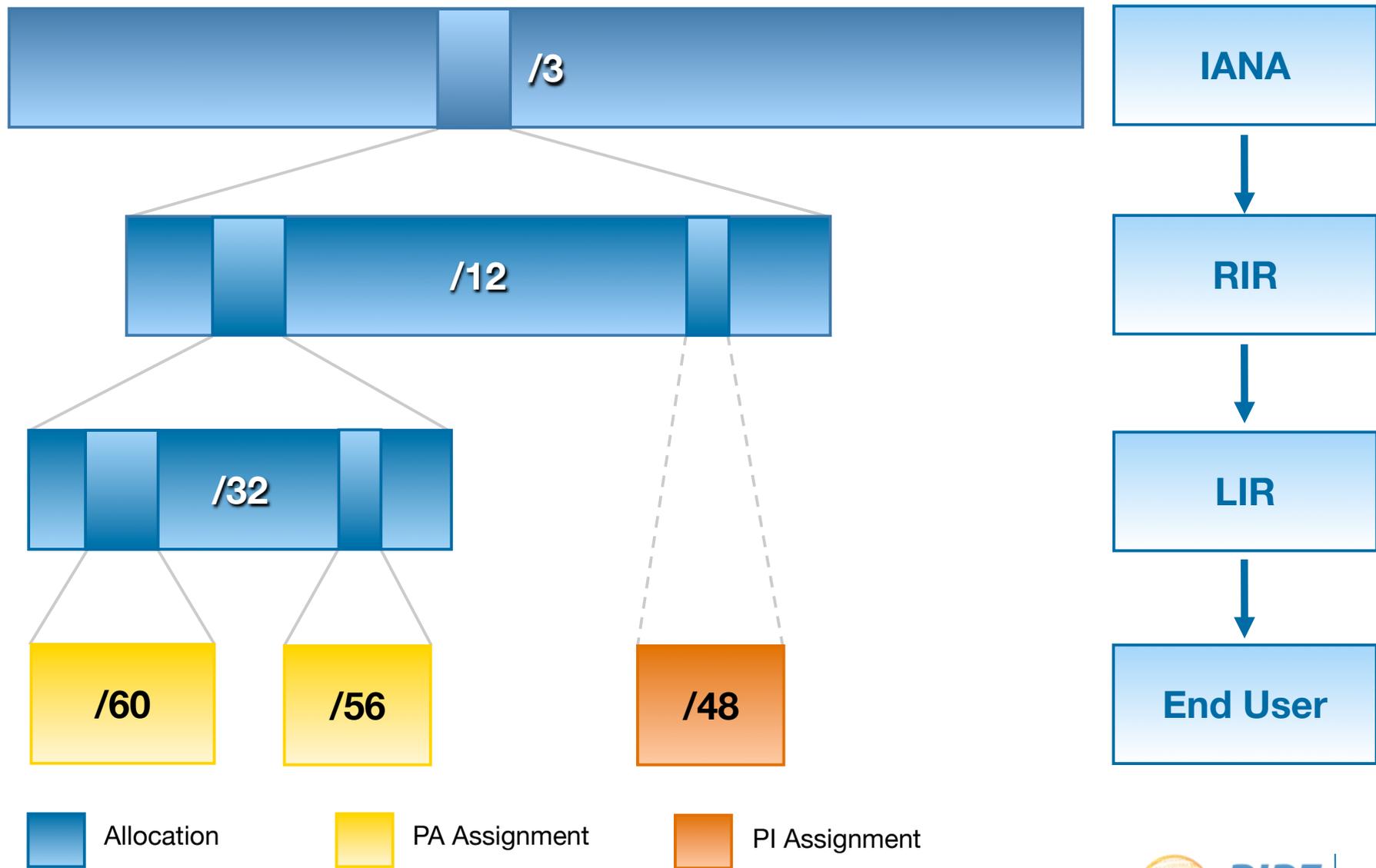
RACI applications are now open!

- <https://ripe68.ripe.net/programme/raci/>
- <https://labs.ripe.net/Members/fergalc/raci-2013-from-dublin-to-athens>

Getting IPv6



IPv6 Address Space Distribution



IPv4 and IPv6 Status in RIPE Database

IPv4	IPv6
ALLOCATED PA	ALLOCATED-BY-RIR
ASSIGNED PA	ASSIGNED
ASSIGNED PA	AGGREGATED-BY-LIR
SUB-ALLOCATED PA	ALLOCATED-BY-LIR
ASSIGNED PI	ASSIGNED PI

Getting IPv6 from the RIPE NCC

- To qualify for an **allocation** an organisation must:
 - Be an LIR
 - Have a plan for making assignments within two years
 - Minimum allocation size is /32
- To qualify for a **PI assignment** an organisation must:
 - Meet the contractual requirements for PI resources
 - LIRs must demonstrate special routing requirements
 - PI space cannot be used for sub-assignments
 - Minimum assignment size is /48

Getting IPv6 Otherwise

- For local network, use “private” IPv6 space
 - FC00::/8 and FD00::/8
 - <http://tools.ietf.org/html/rfc4193>, <http://tools.ietf.org/html/rfc5375>
- For learning, use tunnel providers
 - SixXS: <https://www.sixxs.net/>
 - Hurricane Electric <https://www.tunnelbroker.net/>
- For small SOHO, ask your upstream ISP
 - No, you are not the first one to ask...
 - Ask for a sub-allocation if you are a business
 - Ask for /48 if you are a home user

IPv6 Subnetting

IPv6 Subnetting

2001:0DB8:0000:0000:0000:0000:0000:0000

64 bits interface ID

$/64$
 $/60 = 16 /64$
 $/56 = 256 /64$
 $/52 = 4096 /64$
 $/48 = 65536 /64$
 $/32 = 65536 /48$



RIPE
NCC

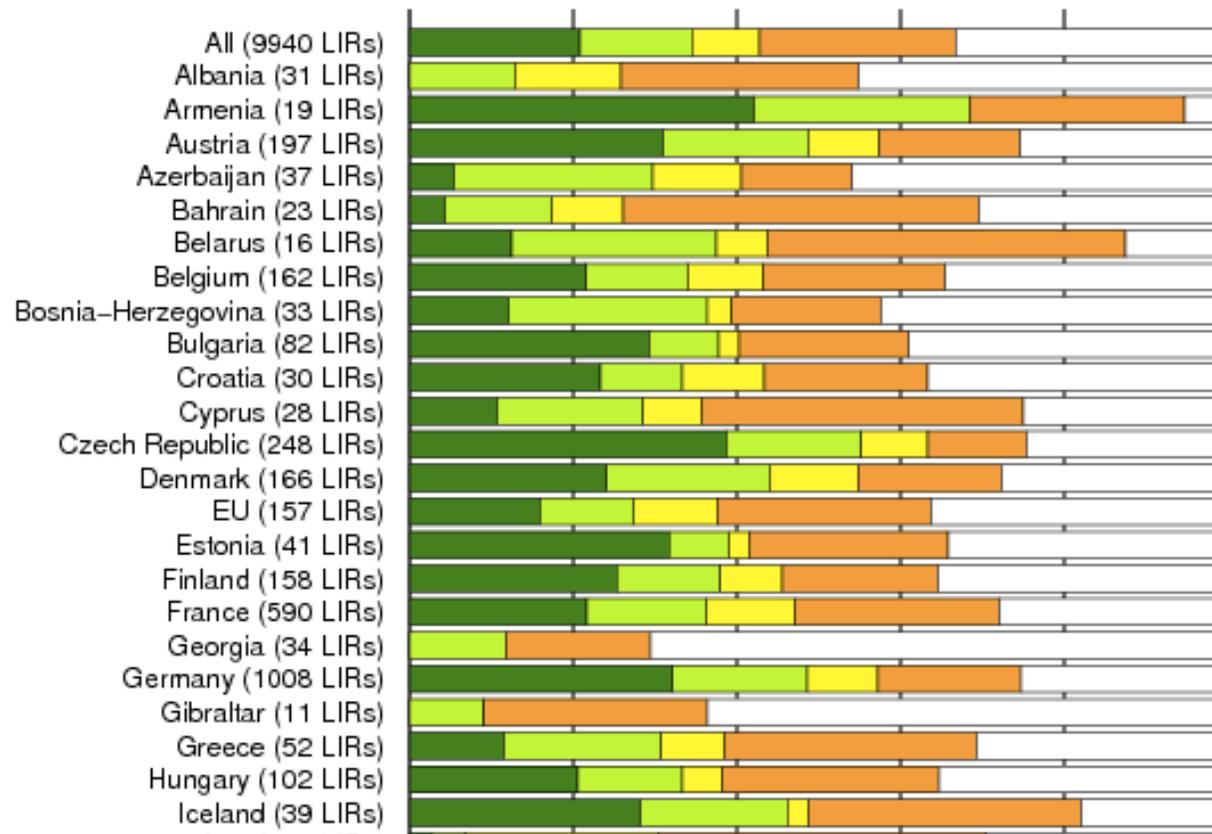
Contact Training Services: ts@ripe.net
Follow us on Twitter: www.twitter.com/TrainingRIPENCC
www.ripe.net

IPv6 Security Considerations

- Everybody can claim to be a router
 - Use RA Guard to filter unauthorised RAs (RFC 6105)
- SEcure Neighbor Discovery (SEND) - RFC3971
 - Neighbor solicitation/advertisement spoofing
 - DoS attack
 - Router solicitation and advertisement attacks
 - No implementations (yet)

IPv6 RIPEness

IPv6 'ripeness' –rating of LIRs per country (2014-01-23)



- <http://ipv6ripeness.ripe.net>



RIPE Atlas



RIPE Atlas Deployment



Vesna Manojlovic, FOSDEM 2014



RIPE
NCC

| 16

RIPE Atlas: January 2014

- 4,700+ active probes
 - 2,050+ probes do IPv6
- 9,500+ registered users
- Four types of customised measurements available to **probe hosts**: ping, traceroute, DNS, SSL
 - And of course, ping6 and traceroute6 :-)

RIPE Atlas Participation and Benefits

- Anyone can become a RIPE Atlas probe host
- Major personal and operational benefit:
See your network from the outside!
 - Have at your fingertips ~5,000 external vantage points to do customised measurements towards the destination of your choice
- Data of built-in measurements available to **everyone**
 - Maps, data from public probes, API to download raw data



Measurement Devices

- v1 & v2: Lantronix XPort Pro
- v3: TP-Link TL-MR3020 powered from USB port
 - Does not work as a wireless router!
 - **Same functionality as the old probe!**
- RIPE Atlas anchor: Soekris net6501-70



RIPE Atlas Anchors

- Anchors: well-known targets and powerful probes
 - Regional baseline & “future history”
- 36 anchors installed
- Anchoring measurements
 - Measurements between anchors
 - 200 probes targeting each anchor with measurements
 - Each probe measures 4-5 anchors
- Apply: <https://atlas.ripe.net/about/anchors/>



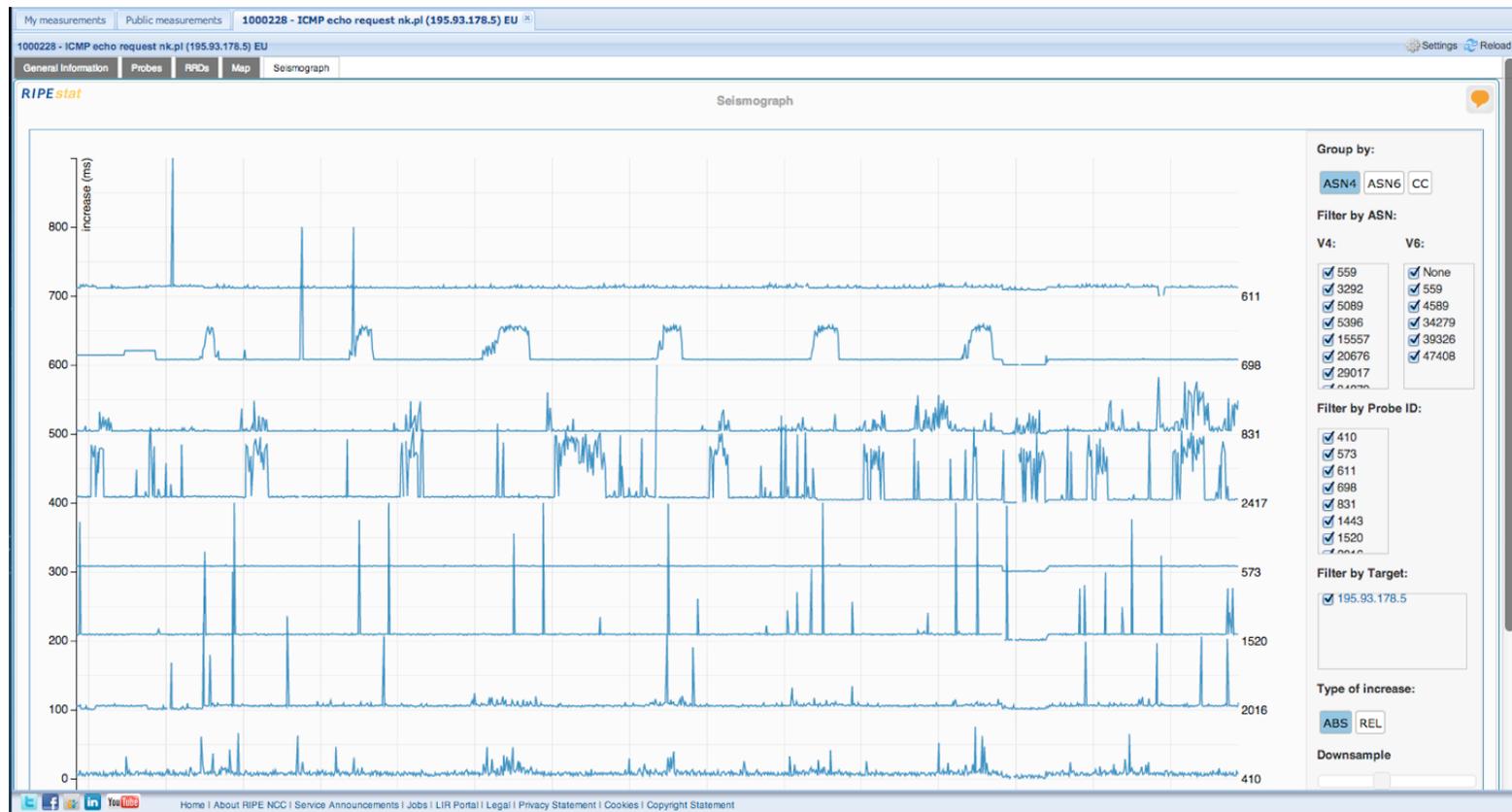
RIPE Atlas Anchor Hosts in 2013



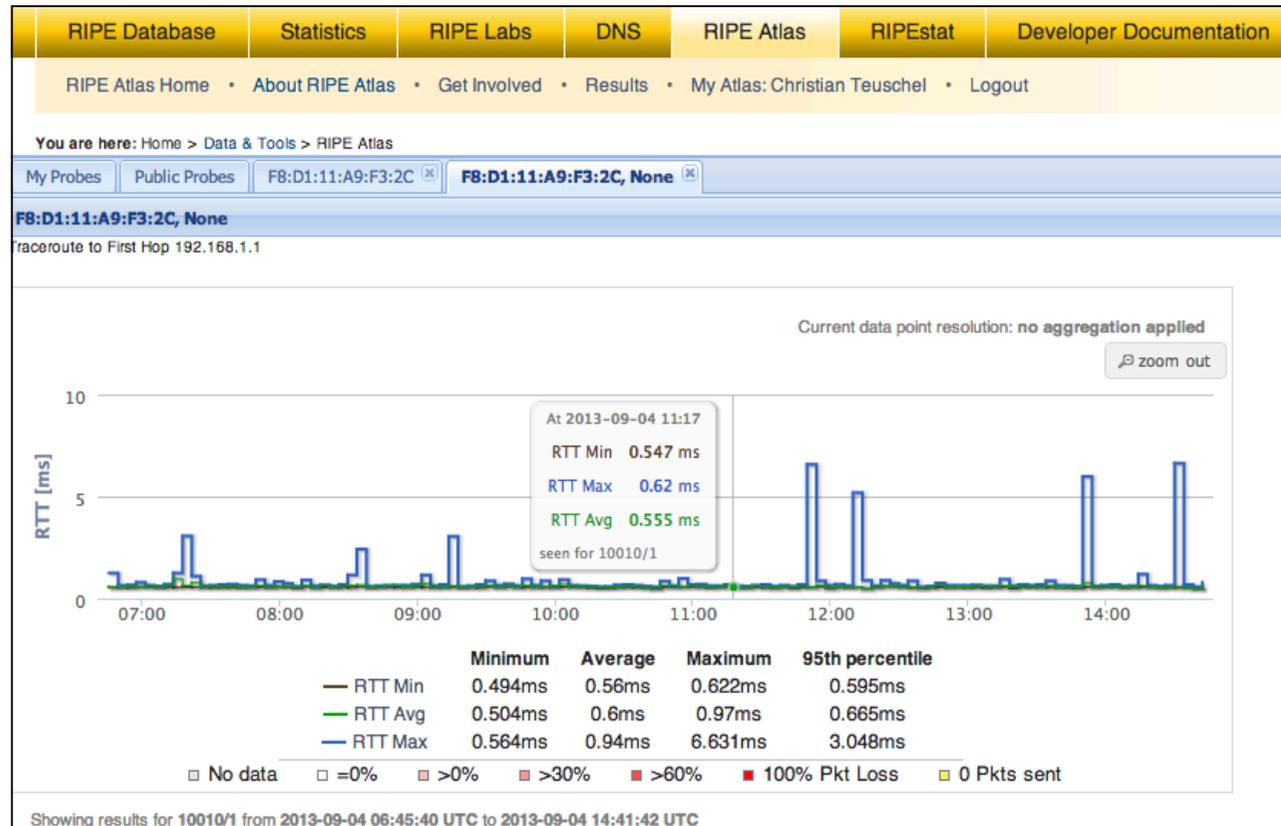
RIPE Atlas Features

- Seismograph
 - Multiple ping measurements in one view
 - Stacked chart and interactive control panel
 - Based on RIPEstat widget framework
- Zoomable ping graph
 - Replacing multiple RRDs graphs: zoom in/out in time, in the same graph, without loss of detail
 - Easier visualisation of an event's details
 - Selection of RTT class (max, min, average)

Seismograph

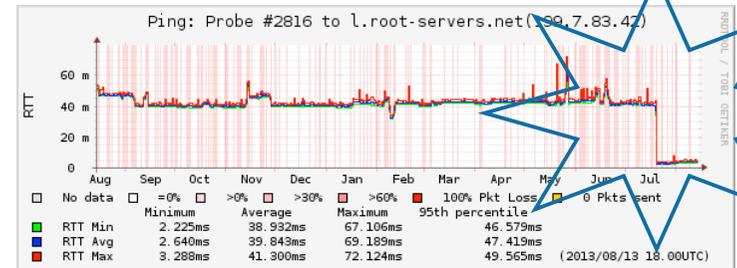


Zoomable Ping Graph



RIPE Atlas Success Stories

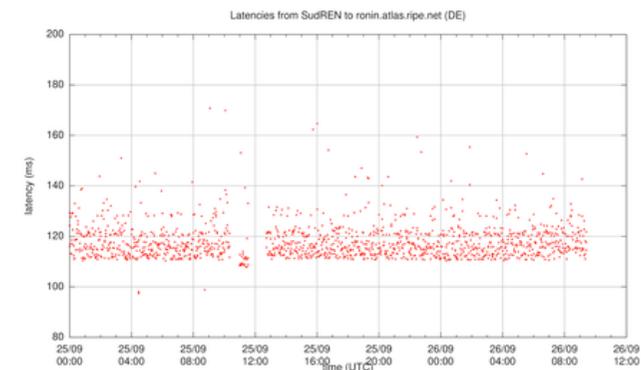
- IXP: Measuring the effect of installing L-root in Belgrade / SOX



- DNS: Looking for most popular instances of .FR anycast servers

Name server instance	Nr. of probes connecting to instance	Percentage
dns.th2.nic.fr	173	36%
dns.fra.nic.fr	173	36%
dns.lon.nic.fr	47	10%
dns.lyn2.nic.fr	29	6%
dns.lyn1.nic.fr	25	5%
dns.bru.nic.fr	19	4%
dns.ix1.nic.fr	18	4%

- Events: Measuring Internet outage in Sudan



Security Aspects

- Probes have hardwired trust material (registration server addresses / keys)
- The probes don't have any open ports; they only initiate connections - this works fine with NATs, too
- Measurements are scheduled by centralised “command servers” via reverse ssh tunnels
- Probes don't listen to local traffic; there are no passive measurements running
- Measurement source code published
- Reported vulnerabilities: <https://atlas.ripe.net/docs/security/>

Hackerspaces

Communication

Active hackerspaces

ALL hackerspaces

> add a hackerspace

List of events

> add an event

List of projects

> add a project

Job Listings

> add a job offer

Recent changes

What links here

Related changes

Special pages

Printable version

Permanent link

Browse properties

RIPE Atlas

29 Hackerspaces with a [RIPE Atlas Probe](#)

To ask for a probe: atlas.ripe.net/apply

To add a probe to your hackerspace: edit the page of your hackerspace on this wiki; at the bottom add "equipment" -> choose "RIPE Probe". The map will be automatically generated to place your hackerspace on this map!

For more info, see [Project description "RIPE Atlas probes at hackerspaces"](#) and [the workshop at 29c3](#)



RIPE Atlas Plans for the Future

- Integrating DNSMON into RIPE Atlas and RIPEstat
- Tagging probes and measurements as “My Favourites” for easy viewing
- Improving traceroute visualisation: T-play
- Increasing probe distribution via RIR cooperation
- Tell us your feature requests:
 - <http://roadmap.ripe.net/ripe-atlas/>

How to Use Measurements

User-Defined Measurements

- Probe hosts and RIPE NCC members perform customised measurements using the targets and frequency of their choice
- API available for creating measurements
 - <https://atlas.ripe.net/docs/measurement-creation-api/>
- REST APIs for analysing measurements, too
 - <https://labs.ripe.net/Members/wilhelm/ripe-atlas-code-for-analysis-and-statistics-reporting>

Web UI: How to Schedule a Measurement

- Log in to atlas.ripe.net
- Go to “My Atlas” → “My Measurements”
- Choose “New Measurement” or “One-off”
 - Most measurements are periodic & last a long time
 - Choose type, target, frequency, # of probes, region...
 - You will spend credits (next slides)
- To see results: “My Measurements”
- More details: <https://atlas.ripe.net/doc/udm>

Credit System

- By hosting a probe, you earn credits as a reward for making your probe available to others
 - Hosts earn 21,600 credits per day, as long as the probe is connected
- To perform customised measurements, you spend credits
 - Use them to perform measurements from your probe towards any target
 - Ping costs 10 credits, traceroute costs 20, etc.
 - Daily limit applies

...continued

- Credit system introduced to ensure fairness and protect system from overload
- To use the API, you need keys that identify users:
 - <https://atlas.ripe.net/atlas/keys>
- Extra credits can be earned by:
 - Being a RIPE NCC member
 - Hosting a RIPE Atlas anchor
 - Sponsoring multiple probes
- More details: <https://atlas.ripe.net/doc/credits>

Status Checks: Creating Alerts in “Icinga”

- Steps:
 1. Create a RIPE Atlas **ping** measurement
 - You can use up to 1,024 probes
 2. URL: https://atlas.ripe.net/api/v1/status-checks/MEAUSRMENT_ID/
 3. Come back later to see whether anything has changed
 4. Define your alerts accordingly
- Icinga:
 - Make use of the built-in check_http plugin
- Documentation and examples:
 - <https://atlas.ripe.net/docs/status-checks/>

Hands-on Tutorials by the Community

- Nikolay Melnikov, Hands-on: RIPE Atlas, AIMS 2013
 - <http://cnds.eecs.jacobs-university.de/users/nmelnikov/aims2013-ripe-atlas.html>
- Stéphane Bortzmeyer, Creating and Analysing RIPE Atlas Measurements, RIPE67
 - <https://ripe67.ripe.net/presentations/153-ripe-atlas-udm-api-1.pdf>

IPv6 Use Cases

IPv6 & RIPE Atlas: Filtering

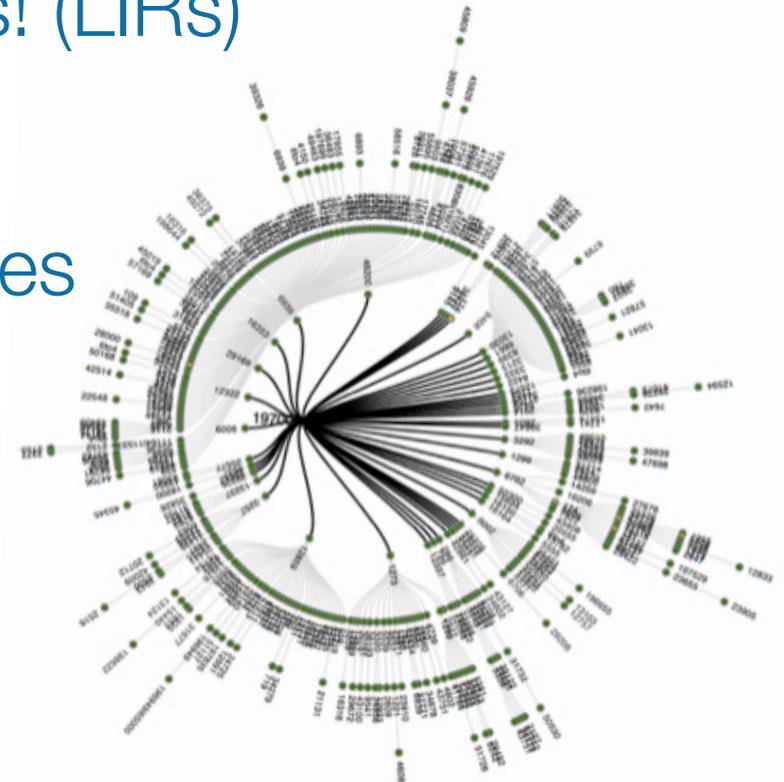
- Is there BGP route filtering based on prefix size in IPv6?
 - We saw roughly 1% out of ~500 RIPE Atlas probes that can't reach a destination in an IPv6 /48 prefix (without a covering shorter prefix) out of IPv6 PA space
 - Likely due to filtering
 - <https://labs.ripe.net/Members/emileaben/ripe-atlas-a-case-study-of-ipv6-48-filtering>
- Is the DNS filtering of AAAA causing unexpected problems?
 - <https://labs.ripe.net/Members/emileaben/ripe-atlas-case-study-of-aaaa-filtering>

IPv6 & RIPE Atlas: Reachability Testing

- Using RIPE Atlas to perform worldwide traces to measure round-trip times and other route measurements
 - We identified routes that can be optimised and sent to other POPs with much better response times
 - We also identified routes that can be optimised by changing the transit provider for the same POP
 - <https://labs.ripe.net/Members/becha/world-ipv6-launch-ripe-atlas-use-cases>
- The success rate with IPv6-only domain names is much lower (~60%) than with "mixed" (both IPv4 and IPv6) domain names (~96%)
 - https://labs.ripe.net/Members/stephane_bortzmeyer/how-many-ripe-atlas-probes-can-resolve-ipv6-only-domain-names

RIPE Atlas IPv6 traceroute Visualisation

- Only for RIPE NCC members! (LIRs)
- Via the LIR Portal
- Using 1,000 RIPE Atlas probes
- Visualising:
 - Completed paths
 - Unsuccessful paths
 - Clickable hops (ASNs)
- <https://labs.ripe.net/Members/becha/test-your-ipv6-reachability-using-ripe-atlas>
- <https://labs.ripe.net/Members/emileaben/visualise-your-ipv6-connectivity-using-ripe-atlas>



IPv6 & RIPE Atlas: Packet Size & PMTU

- What happens when users try to send large packets over the Internet? Above a certain size, these packets will have to be fragmented, which might cause problems
- 9% of RIPE Atlas probes have problems with fragmentation in IPv4, and 10% of probes have fragmentation problems in IPv6
- <https://labs.ripe.net/Members/emileaben/ripe-atlas-packet-size-matters>
- <http://www.nlnetlabs.nl/downloads/publications/pmtu-black-holes-msc-thesis.pdf>

IPv6 & RIPE Atlas: Troubleshooting (1)

- Performing traceroute6 to DNS name that does not have IPv6 helped troubleshoot IPv6 at Vienna University!
 - Most probes reported “name resolution failed”
 - “One probe, 13255 resolved wsww2.cc.univie.ac.at to 2001:6f8:114e:3::c099:aec4, which is interesting because c099:aec4 is exactly equal to the IPv4 address of wsww2.cc.univie.ac.at. So I suspect that this probe is behind a resolver that does DNS64.” (allowing this user-defined measurement was a RIPE Atlas bug ;-)

IPv6 & RIPE Atlas: Troubleshooting (2)

- “It is quite common in the IPv6 world to have devices that believe they are connected to the IPv6 Internet while they are not”
 - “When you use RIPE Atlas to measure the connectivity of an IPv6 device, 90% success is the maximal reachability you'll get.”
 - https://labs.ripe.net/Members/stephane_bortzmeyer/how-many-atlas-probes-believe-they-have-ipv6-but-are-wrong

Tips for Writing IPv6-capable Applications

- Application Aspects of IPv6 Transition: <http://tools.ietf.org/html/rfc4038>
- Porting applications to IPv6:
 - <http://gsync.escet.urjc.es/~eva/IPv6-web/ipv6.html>
 - http://www.euchinagrid.org/IPv6/IPv6_presentation/Introduction_to_IPv6_programming.pdf
- Ecdysis: open-source implementation of a NAT64 gateway:
 - <http://ecdysis.viagenie.ca/>
- Information for application developers:
 - <http://icons.apnic.net/display/IPv6/Information+for+Application+Developers>
- **A Recommendation for IPv6 Address Text Representation:**
 - <http://tools.ietf.org/html/draft-ietf-6man-text-addr-representation-03>
- IETF WGs - Behave: Standardising NATs and protocol translators
 - <https://www.ietf.org/dyn/wg/charter/behave-charter.htm>

How to Take Part in the RIPE Atlas Community



Contribute to the Community GitHub

PUBLIC  RIPE-Atlas-Community / [ripe-atlas-community-contrib](#)

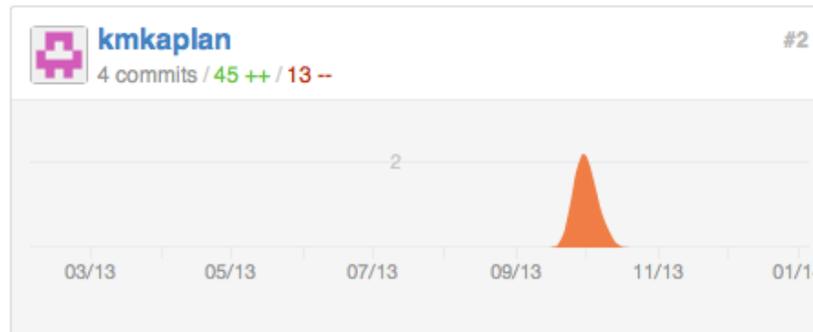
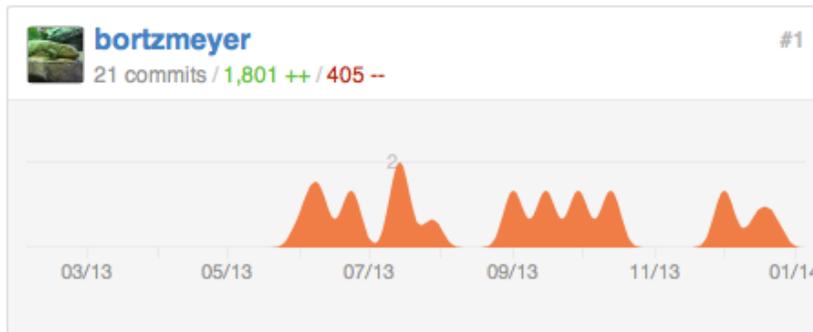
 Unwatch 21  Star 19  Fork 5

Contributors Commits Code Frequency Punchcard

February 3rd 2013 - January 5th 2014

Commits to master, excluding merge commits

Contribution Type: **Commits**



Also on GitHub

- Measurements source code
 - https://labs.ripe.net/Members/philip_homburg/ripe-atlas-measurements-source-code
 - <https://github.com/RIPE-Atlas-Community/RIPE-Atlas-probe-fw-code-4520>
- <https://github.com/RIPE-Atlas-Community/RIPE-Atlas-data-analysis>

Become a RIPE Atlas Ambassador

- If you want to...
 - Help distribute probes
 - Give workshops, tutorials, and promote RIPE Atlas
- To become an ambassador:
 - Get in touch; we'll ship you some probes
 - Join the mailing list:
 - <https://www.ripe.net/mailman/listinfo/ripe-atlas-ambassadors>
- Or become a sponsor:
 - <https://atlas.ripe.net/get-involved/community/#!tab-sponsors>

RIPE Atlas 2013 Sponsors



Questions to the Community

- HTTP measurements: limitations and guidelines?
- System Checks: what level of ease or sophistication?
- IPv6: Only for researchers? Operators' needs?
- Open publication of measurement data
 - To have private measurements or not?
- Testing BCP38 compliance
- Most interesting use cases?
- More success stories? Share them!

RIPE Atlas Contact

<https://atlas.ripe.net>

- Get a probe: **<https://atlas.ripe.net/apply>**
- Mailing list for active users: **ripe-atlas@ripe.net**
- Articles & updates on RIPE Labs:
<https://labs.ripe.net/atlas>
- Questions: **atlas@ripe.net**
- Twitter: **[@RIPE_Atlas](https://twitter.com/RIPE_Atlas)** and **[#RIPEAtlas](https://twitter.com/RIPE_Atlas)**

Questions?



Appendix 1: IPv6 Documents

RIPE NCC IPv6 Training Courses

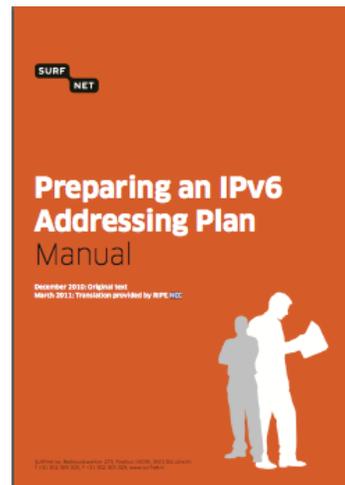
- <http://www.ripe.net/training/ipv6/>
- <http://www.ripe.net/lir-services/training/material/ripe-ncc-training-material#IPV6>
- <http://www.ripe.net/lir-services/resource-management/allocations-and-assignments/request-ipv6/ipv6-subnetting-card>

RIPE-554 Document

- “Requirements for IPv6 in ICT Equipment”
 - <http://www.ripe.net/ripe/docs/ripe-554.html>
- Best Current Practice describing what to ask for when requesting IPv6 support
- Useful for tenders and RFPs
- Originated by the Slovenian government
 - Adopted by various others (Germany, Sweden)

What to do with a /48?

- Organisations have no idea how to handle 65,536 subnets!
- Manual for preparing an IPv6 addressing plan
 - https://www.ripe.net/lir-services/training/material/IPv6-for-LIRs-Training-Course/IPv6_addr_plan4.pdf



Moar Links

Websites

- <http://www.getipv6.info/>
- <http://www.ipv6actnow.org>
- <http://datatracker.ietf.org/wg/v6ops/>
- <http://www.ripe.net/ripe/docs/ripe-554.html>

Mailing lists

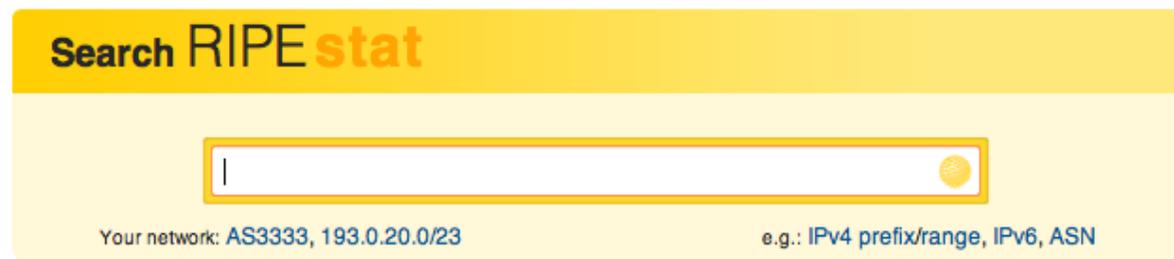
- <http://lists.cluenet.de/mailman/listinfo/ipv6-ops>
- <http://www.ripe.net/mailman/listinfo/ipv6-wg>

Appendix 2: RIPEstat



RIPEstat Introduction

- RIPEstat is a “one-stop shop” for information about Internet number resources
 - RIPE NCC: registration data and RIPE Database, routing (RIS), reverse DNS, RIPE Atlas measurements
 - External sources: IRR, RIRs, geolocation, blacklists, M-Lab network activity



Search RIPEstat

Your network: AS33333, 193.0.20.0/23 e.g.: IPv4 prefix/range, IPv6, ASN

Web Interface: Query Results Page

Search box

Widgets

Widgets grouped into thematic tabs

RIPEstat Data and Interfaces

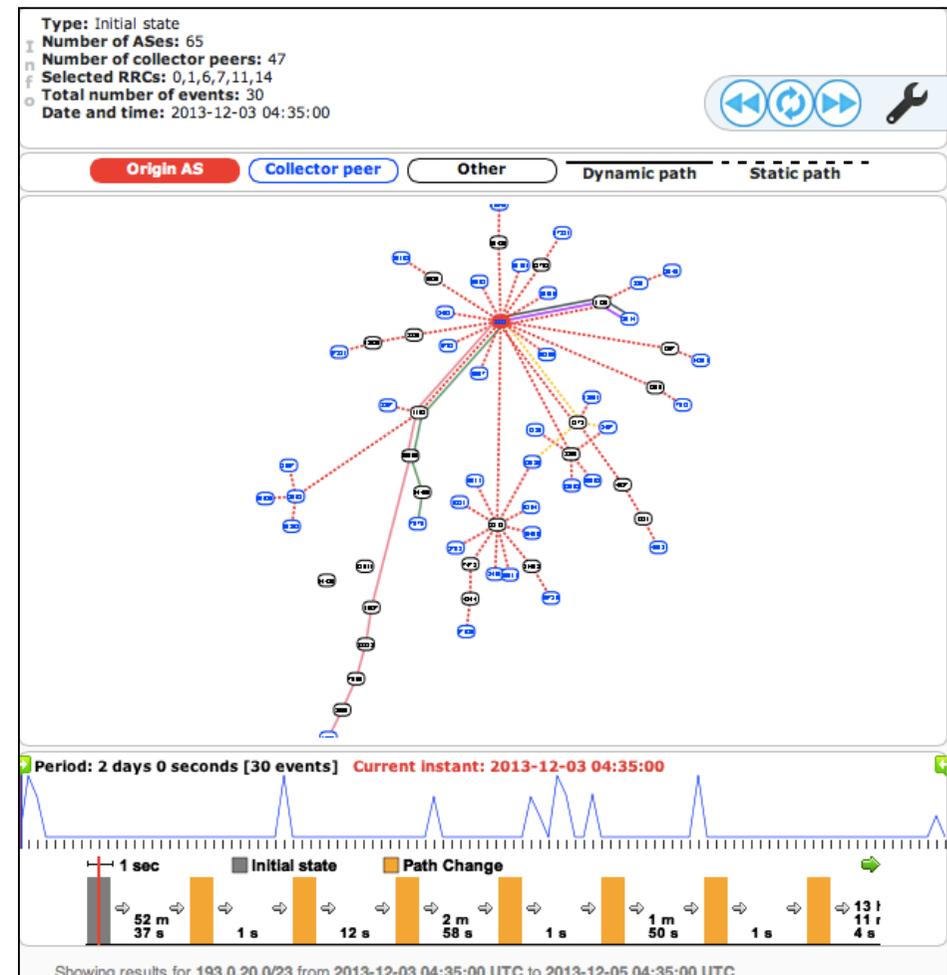
- Search by: IPv4, IPv6 address/prefix; AS Number; hostname; country; keywords (**new**)
- Web, widgets, data API, text service, mobile app
- Other features:
 - BGPlay2
 - Abuse Finder
 - Customisable “My Views”
 - History view for RIPE NCC members / LIRs
 - Embed widgets on your site

BGPlay is back!

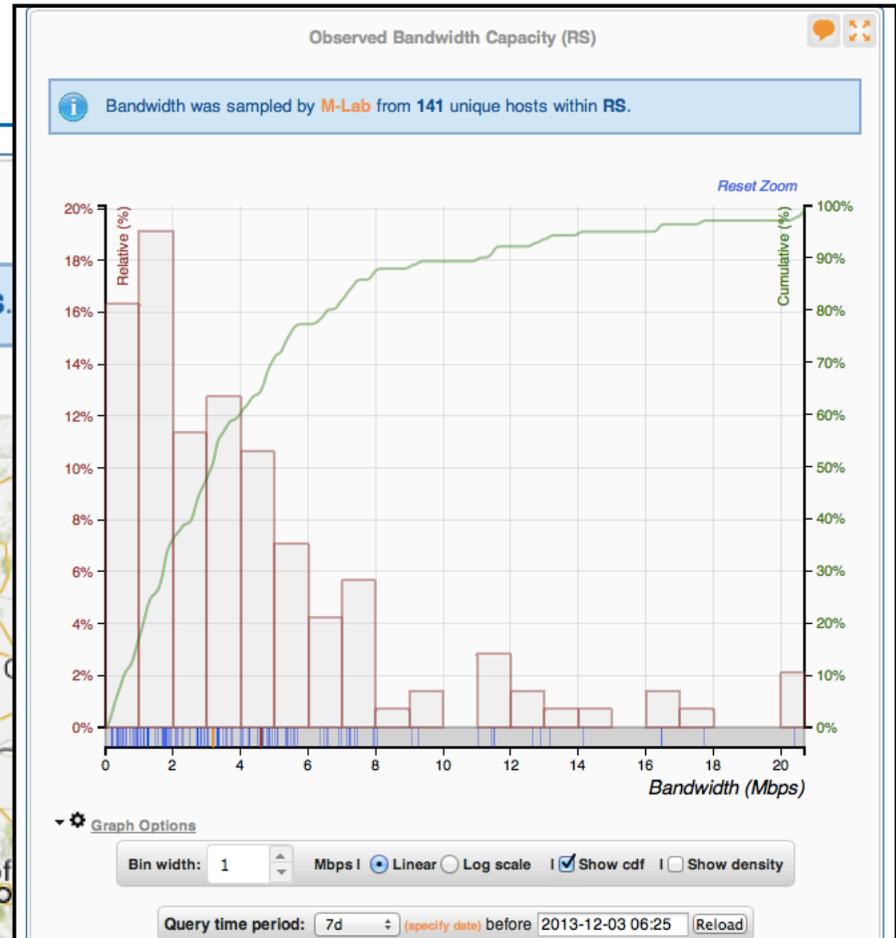
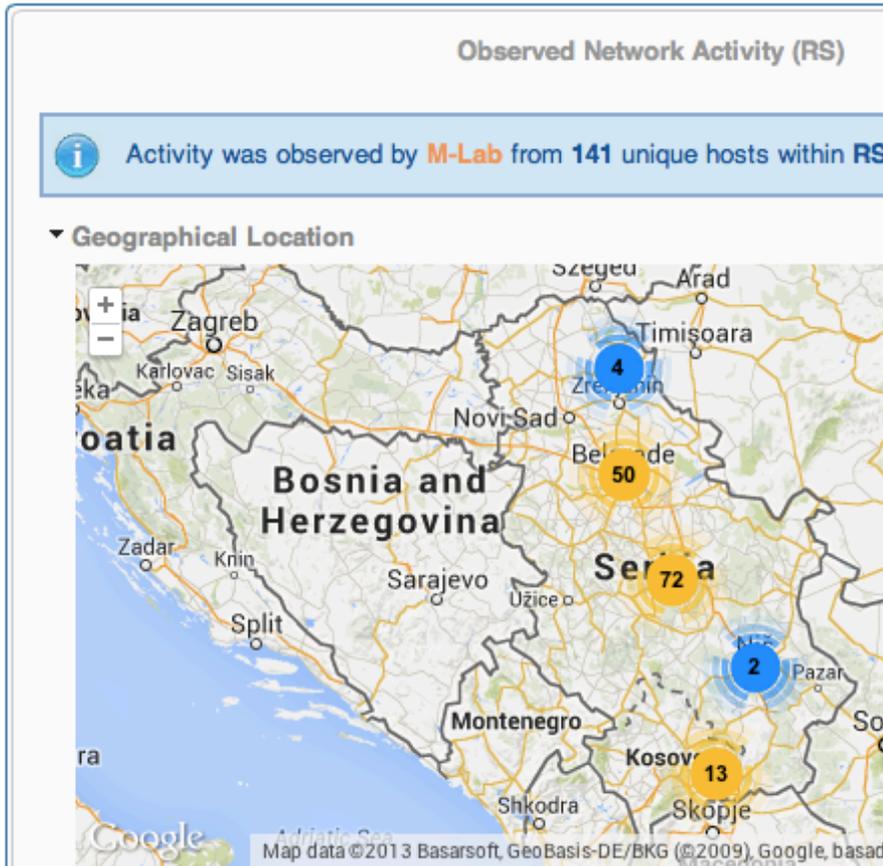
The popular routing visualisation tool has been revamped and implemented in a state-of-the-art web interface.



- The most famous incident: YouTube hijacked by Pakistan Telecom
- <https://www.ripe.net/internet-coordination/news/industry-developments/youtube-hijacking-a-ripe-ncc-ris-case-study>
- Video: <http://www.youtube.com/watch?v=IzLPKuAOe50>



M-Labs Data for Serbia



Address Space Distribution

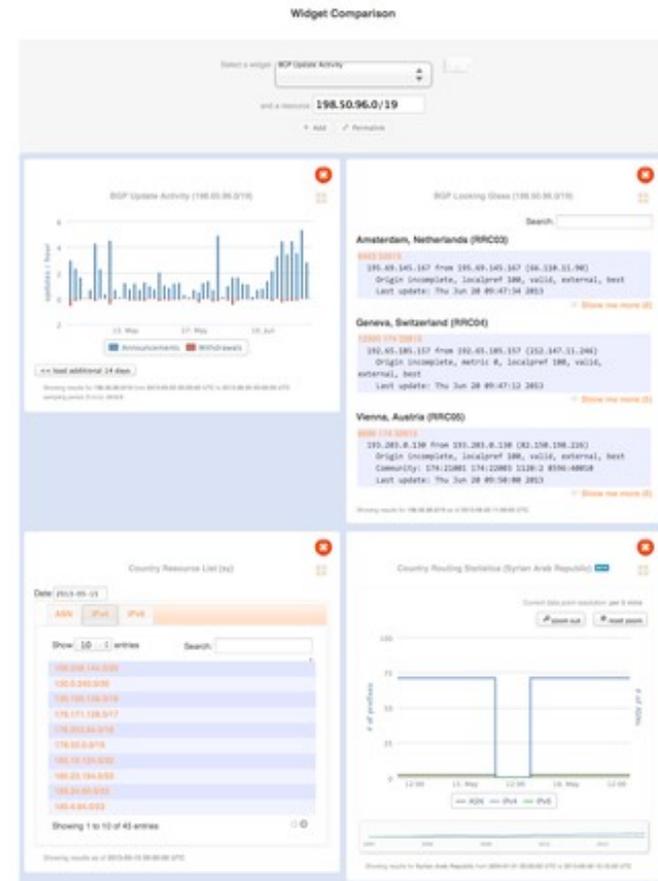
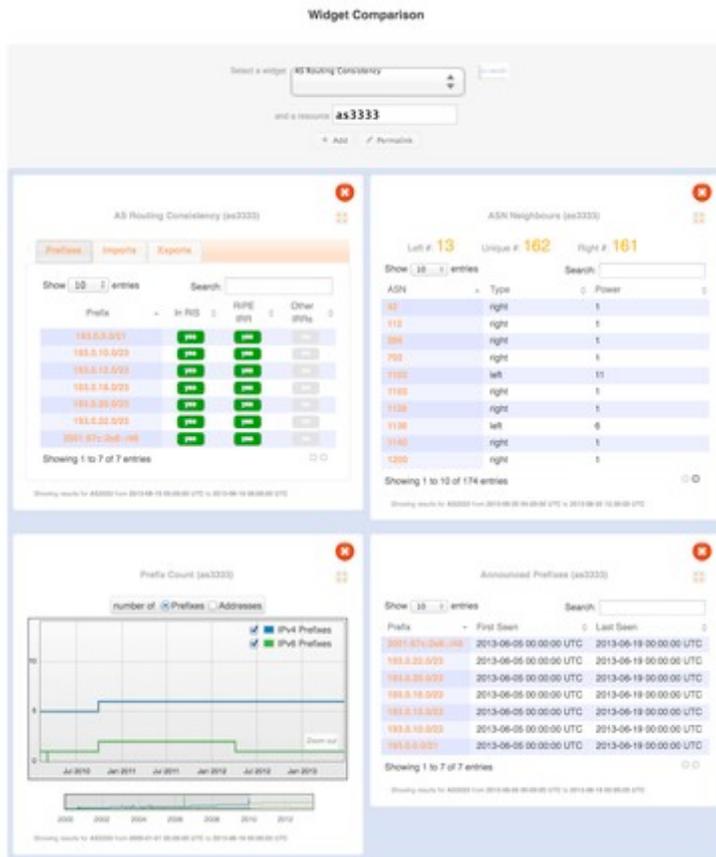


New Features

- Multiple widget and resource comparison
- In-widget comparison and monitoring
- Visualising bandwidth capacity and network activity using M-Lab data
- Old RIS interfaces integrated into RIPEstat
- Tighter integration with RIPE Atlas
 - Zoomable ping graph, Seismograph

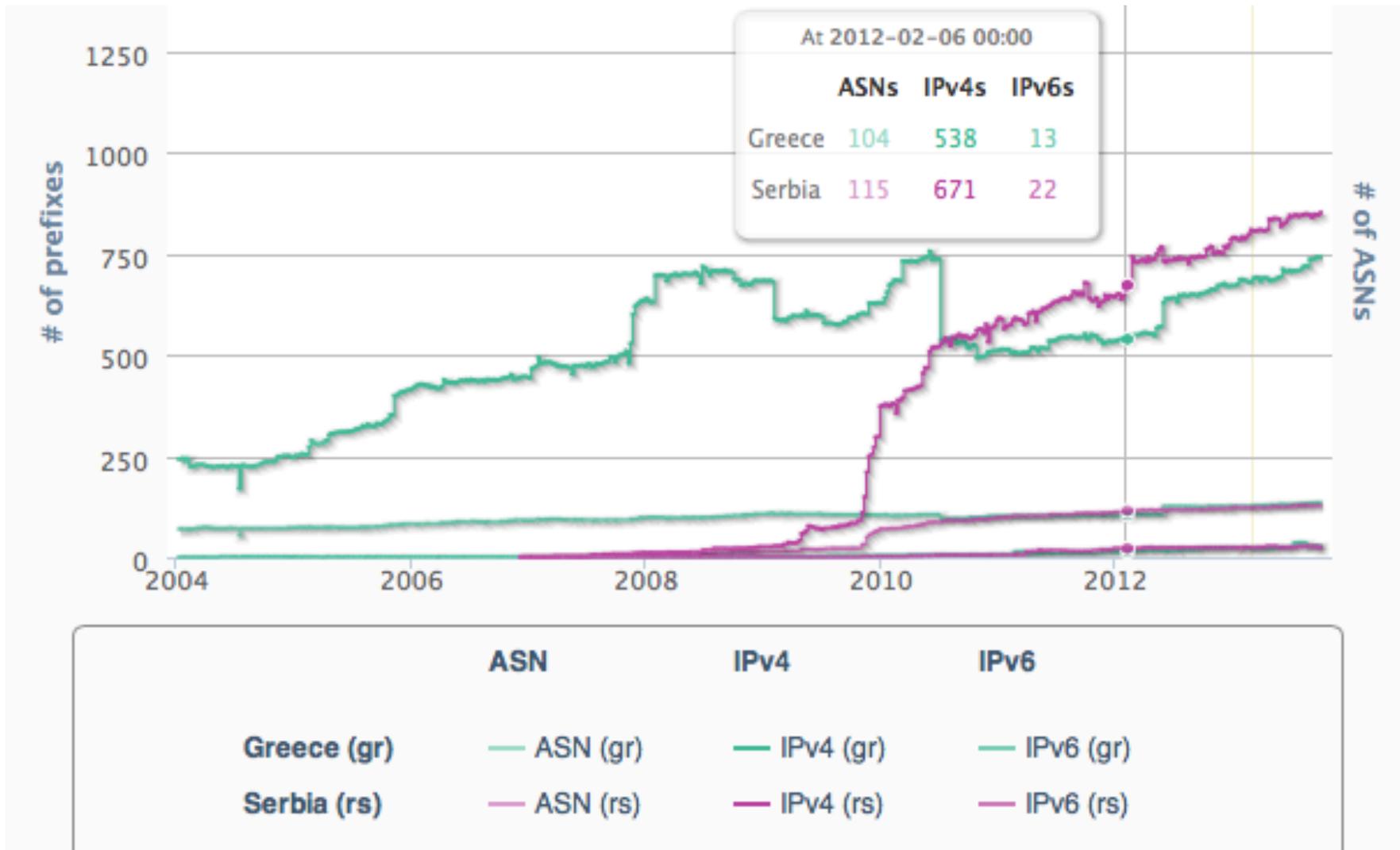
Use Cases for Comparing Multiple Widgets

- Making peering decisions
- Country outage

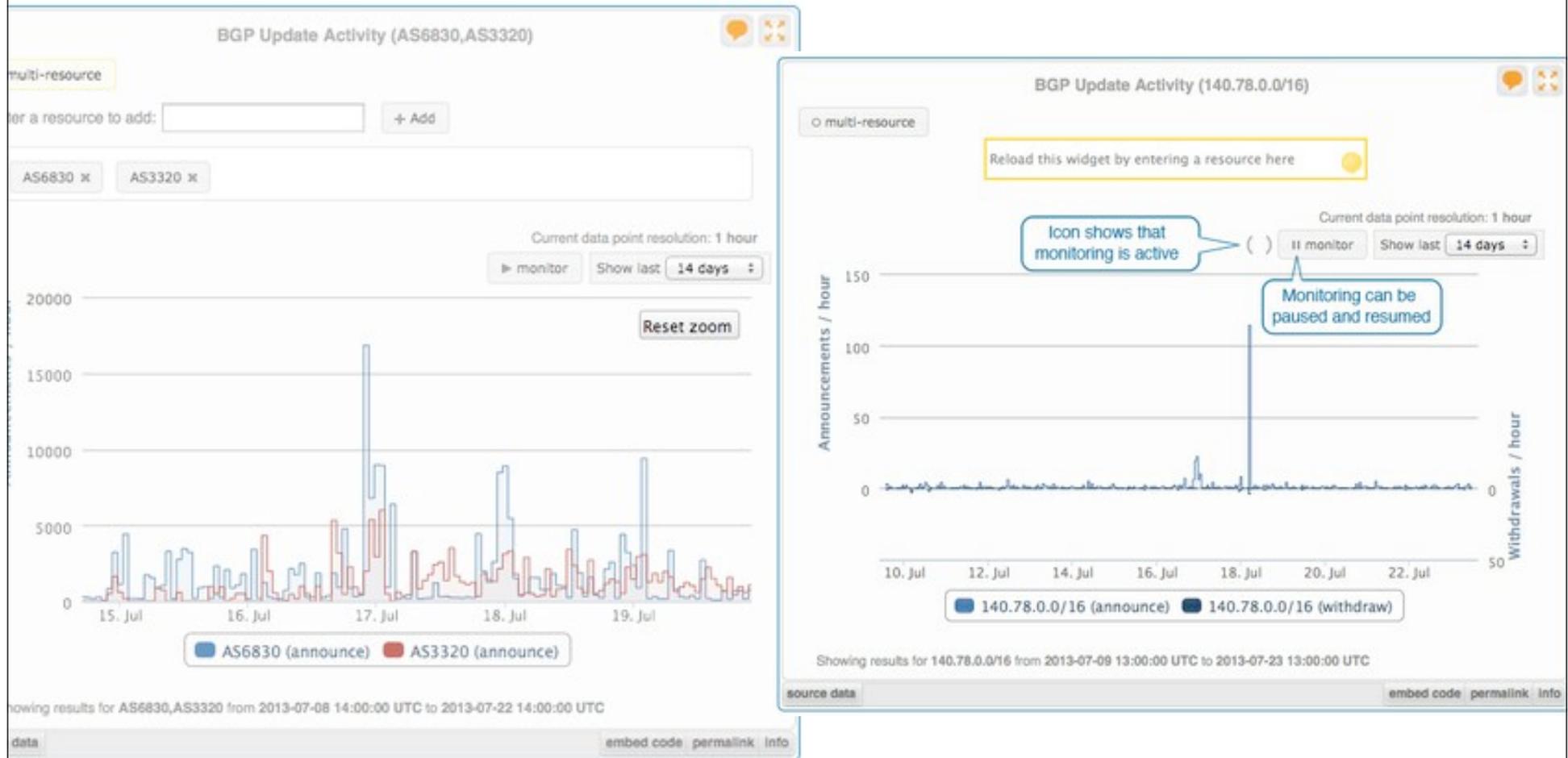


https://labs.ripe.net/Members/suzanne_taylor_muzzin/ripestats-multiple-widget-and-resource-comparison

In-widget Comparison: Serbia & Greece



BGP Comparison and Monitoring



RIPEstat Plans for the Future

- Integrate DNSMON into RIPEstat and RIPE Atlas
- Migrate RIS Dashboard features into RIPEstat
- Add notable events to BGPlay2
- Improve back-end stability to enable resilience of current services and scale for future growth
- Increase data quality and consistency
- Tell us your feature requests:
 - <http://roadmap.ripe.net/ripe-stat/>