



Internet Measurements with RIPE NCC Tools @ MCH2022

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Menu



- Introduction to RIPE & RIPE NCC
 - Community Participation
- *Basics Training Course: "Measurements & Tools"*
- Measuring Websites with RIPE Atlas
 - Ethical Dilemmas
- CLI Tools
- DNS Measurements
- *Use Cases*
- Intro to RIS
- "ObservableHQ" Demo



Documentation & Links

Links 1/n



- Anomaly Alerting for RIPE Atlas, Hoge School Utrecht
 - <https://ripe84.ripe.net/presentations/86-RIPE-Alerts-idea-1.pdf>
- The RIPE Atlas Population Coverage
 - https://sg-pub.ripe.net/petros/population_coverage/
- ObservableHQ prototypes
 - <https://observablehq.com/@ripencc/internet-outages-as-seen-by-ripe-atlas>
- RIPE Atlas probes deployment stats for large cities
 - <https://observablehq.com/@emileaben/ripe-atlas-probes-deployment-stats-for-large-cities>

Links 2/n: Articles



- • "The Resilience of the Internet in Ukraine" (2022-03-10)
 - <https://labs.ripe.net/author/emileaben/the-resilience-of-the-internet-in-ukraine/>
- • "The Ukrainian Internet" (2022-02-28)
 - <https://labs.ripe.net/author/emileaben/the-ukrainian-internet/>
- • "The Kazakhstan Outage - As Seen from RIPE Atlas" (2022-01-07)
 - <https://labs.ripe.net/author/emileaben/the-kazakhstan-outage-as-seen-from-ripe-atlas/>
- • "You are Not Alone: RIPE Community Resilience" (2021)
 - <https://labs.ripe.net/author/becha/you-are-not-alone-ripe-community-resilience/>
- • "Our First Glance at the Uganda Internet Shutdown" (2021-01-14), Vesna Manojlovic
 - <https://labs.ripe.net/author/becha/our-first-glance-at-the-uganda-internet-shutdown/>
- • "Data Feminism: From Data Ethics to Data Justice"
 - <https://labs.ripe.net/author/becha/data-feminism-from-data-ethics-to-data-justice/>
- • "Report from the RIPE Atlas Software Probes Deployathon" (2020-12-11)
 - <https://labs.ripe.net/author/becha/report-from-the-ripe-atlas-software-probes-deployathon/>
- • "After the Quake in Croatia" (2020-03-27), Vesna Manojlovic
 - <https://labs.ripe.net/author/becha/after-the-quake-in-croatia/>
- • "Measuring your Web Server Reachability with TCP Ping" (2017-09-27)
 - <https://labs.ripe.net/author/wilhelm/measuring-your-web-server-reachability-with-tcp-ping/>

Links 3/n: Presentations



- Emile Aben - Resiliency of the Internet in Ukraine , May 2022, RIPE84:
 - <https://ripe84.ripe.net/archives/video/738/>
- Wolfram Friele - Anomaly Alerting for RIPE Atlas, May 2022, RIPE84:
 - <https://ripe84.ripe.net/archives/video/798/>
- Ethics in Technology: Internet Measurements' Ethical Dilemmas and RIPE Atlas - SHA2017, Vesna Manojlovic
<https://www.ripe.net/about-us/press-centre/publications/presentations/2017/ethics-in-technology-internet-measurements-ethical-dilemmas-and-ripe-atlas-sha2017>
- Technical Communities Resilience During COVID-19 Pandemic - NLUUG 2021 , Vesna Manojlovic, November 2021 (video: <https://youtu.be/2HstogAFn9g> ,
 - slides: <https://www.ripe.net/about-us/press-centre/publications/presentations/2021/technical-communities-resilience-during-covid-19-pandemic-nluug-day-2021>
- RIPE Internet Measurements - Internet Freedom Festival, Presentation given by Vesna Manojlovic & Emile Aben at the Internet Freedom Festival on 17 June 2020; [link](#)
- "State of the Internet in Ukraine", RIPE NCC Days in Kyiv | 2019-09-25 | Alex Semenyaka

Links 4/n: Training Slides & Events



- Course Materials
 - <https://www.ripe.net/support/training/material/measurements-and-tools-training-course>
- Webinars: <https://www.ripe.net/support/training/webinars/tools-webinars>
- Promotional video about RIPE Atlas <https://www.youtube.com/watch?v=Z3SW2vO8qW0>
- Wikipedia article: https://en.wikipedia.org/wiki/RIPE_Atlas
- Routing Information Service: ripe.net/ris
- All RIPE Labs articles tagged "atlas": <https://labs.ripe.net/search/tag/atlas/>
- RIPE Community: ripe.net/ripe
- RIPE NCC Hackathons <https://labs.ripe.net/hackathons>
- [RIPE85.ripe.net](https://ripe85.ripe.net)



Intro to RIPE & RIPE NCC

RIPE and the RIPE NCC



The RIPE NCC



- Independent, not-for-profit, membership organisation
 - Funded by membership fees
- Distributing Internet resources as a Regional Internet Registry (RIR)
 - Policies decided by regional community
 - Through a neutral, impartial, open and transparent process
- Supporting the Internet through technical coordination

Regional Internet Registries (RIRs)



RIPE Database



- The RIPE Database contains registration information for networks in the RIPE NCC service region and related contact details.
- Some uses of the RIPE Database and its contents:
 - Providing accurate registration information of Internet number resources
 - Publishing routing policies by network operators
 - Facilitating coordination between network operators
- Uses the “whois” protocol, data is open

Get Involved



- RIPE meetings attendance support:
 - [RACI programme](#), [RIPE Fellowship](#), Diversity Task Force
- Other events organised by the RIPE NCC
 - Regional meetings, training courses, hackathons
- RIPE NCC's Community support
 - NOG support, Community Projects Fund
- [RIPE Labs](#)

RIPE Community



- Started in 1989 by researchers in Europe
- Technical coordination of IP network
- Volunteers, no legal structure
- Open to everybody
 - Meetings
 - Working Groups
 - Mailing lists
- Collaboration and coordination
- **MAT-WG (Measurements, Analysis & Tools Working Group)**



RIPE Working Groups



- Anyone can join the discussion
 - On mailing lists
 - At RIPE meetings (in-person and online)
 - Remote participation
- Read and/or subscribe
 - ripe.net/participate/ripe/wg
- Learning opportunities
- Please contribute!

Address Policy Working Group
Anti-Abuse Working Group
Connect Working Group
Cooperation Working Group
Database Working Group
DNS Working Group
Internet of Things Working Group
IPv6 Working Group
MAT Working Group
Open Source Working Group
RIPE NCC Services Working Group
Routing Working Group

Vesna Manojlovic and Emile Aben | 17 June 2020 | IMV 2020

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Community Participation

with RIPE Atlas

RIPE Atlas Community



- ~30,000 **probes** given to volunteers
 - ~11.000 active at any moment
- 700 **anchors** (physical & virtual) hosted by operators
- ~42 **sponsors** over last 10 years
- 500+ **ambassadors**, at many conferences

RIPE Atlas - Wikipedia, the free encyclopedia

Becha Talk Sandbox Preferences Beta Watchlist Contributions Log out

Article Talk Read Edit source Edit More Search

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.

Contents [hide]

- 1 History
- 2 Technical details
- 3 Community
- 4 Research papers
- 5 Similar projects
- 6 References
- 7 External links
- 8 Categories

GitHub



- **Software Probe**
 - <https://github.com/RIPE-NCC/ripe-atlas-software-probe>
- **Multilingual documentatation**
 - <https://github.com/RIPE-NCC/ripe-atlas-probe-doc/tree/master/manuals>
- **CLI tools for querying RIPE Atlas data & creating measurements**
 - <https://github.com/RIPE-NCC/ripe-atlas-tools>
- **Tools contributed by the community**
 - <https://github.com/RIPE-Atlas-Community/ripe-atlas-community-contrib>
- **Measurement Source Code for Physical Probe**
 - <https://github.com/RIPE-NCC/ripe-atlas-probe-busybox>

Hackathons & Deployathons



- - RIPE Atlas DataViz (March 2015, Amsterdam)
- - RIPE Atlas Tools for Operators (October 2015, Bucharest)
- - RIPE Atlas Interfaces (April 2016, Copenhagen)
- - IXP Tools (October 2016, Madrid)
- - DNS Measurements (April 2017, Amsterdam)
- - Version6 (November 2017, Copenhagen)
- - Network Operators Tools (June 2018, Dublin)
- - IoT Hackathon (November 2019, Rotterdam)
- - RIPE Atlas Deployathon (November 2020, virtual)



Get Involved



- Use RIPE Atlas and RIS for your purposes: data analysis, network troubleshooting, investigative journalism
- Do scientific research and add your paper to the Wikipedia page
- Contribute to the code and community tools
- Add multi-lingual content / documentation on GitHub
- Co-organise / sponsor / participate in a hackathon!
- Host a RIPE Atlas (virtual) anchor or a (SW) probe
- Write a [RIPE Labs](#) article

Feedback Appreciated



- What would you want to do with this data & tools?
- What is missing?
- What could be easier?



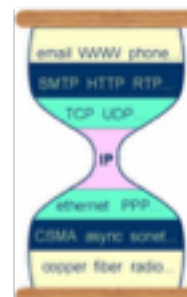
Measuring Websites

with RIPE Atlas

The Most Wanted Feature...



- By design, RIPE Atlas does not measure “application layer”
 - Operators are happy with transport/network layer
 - Ping, traceroute, DNS, TLS/SSL, NTP
- Users have been asking for HTTP measurements
- Due to ethical reasons, we decided:
 - to not target arbitrary websites with probes
 - that “standard” HTTP measurements are ONLY possible towards RIPE Atlas anchors



Ethical Reason: Protecting Hosts



Ethics in Tech



- Ethics in Network Measurements (RIPE Labs)
- Ethics in Technology (RloT Summit, SHA2017)



Workaround: Using a TCP Ping



- Traceroute (TCP) to the targeted web server
 - Towards IP address: port 80
 - 3 packets; a packet size of zero
 - "maximum hops" = 64, initial time-to-live (TTL) = 64
 - Long enough for the first traceroute attempt to immediately reach the destination address
- Mimics the behaviour of the TCP handshake
 - That takes place when setting up an HTTP connection
- This measures the same network delays!
 - RTT turns out to be equivalent to HTTP connect times

(Getting Started)



- Read the Docs
 - <https://beta-docs.atlas.ripe.net/getting-started/>
- Watch video :)
 - <https://www.youtube.com/watch?v=Z3SW2vO8qW0&t=1s>
- First Steps
 - Create an account
 - Log in
 - Look around
 - Get "credits"

Credit System



- Running your own measurements cost credits
 - Ping = 10 credits, traceroute = 20, etc.
- Why? Fairness and to avoid overload
- Limits: daily spending and # of measurement results
- How to get credits?
 - Generated by hosting a probe / anchor
 - Transferred from another user
 - Reclaiming a gift voucher



How to: Web UI

- Go to Measurements
- Click on New msm
- Advanced options
- Add up to 1000 probes
- Choose one off
 - Or continuous / repeated
- Done!
 - You need to have credits



How to: Command Line (CLI)

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

- "—size" should actually be 0 (will be fixed soon)
 - Please help us by fixing it yourself, make a pull request!
- CLI tools:
 - Source: github.com/RIPE-NCC/ripe-atlas-tools/
 - Documentation: ripe-atlas-tools.readthedocs.org
 - Included in many Linux/BSD distributions

Results



- Reachability Map
- Colour-coded for latency
- List of probes and latencies
- Download as JSON

3rd TCP Ping measurement to 82.94.235.165 (unciv.nl)

Probe	AS1 (IPV4)	AS2 (IPV4)	Time (RTT)	RTT	Map
10152	AS100	AS100	2017-10-08 11:01	25,827	1
10152	AS100	AS100	2017-10-08 11:01	18,800	1
10152	AS100	AS100	2017-10-08 11:01	18,800	1
10152	AS100	AS100	2017-10-08 11:01	17,368	1
10152	AS100	AS100	2017-10-08 11:01	16,900	1
10174	AS100	AS100	2017-10-08 11:01	14,702	1



Detailed Technical Information



- For 68% of the probe/destination pairs, median values differ by less than 1ms
- Interdecile ranges differ by less than 6ms
- When compared to RTT of 100 milliseconds, a difference in spread of 5-15ms may still be acceptable to assess network performance
- <https://labs.ripe.net/Members/wilhelm/measuring-your-web-server-reachability-with-tcp-ping>



Command-line Interface (CLI) Toolset

CLI Toolset: Benefits



- Access RIPE Atlas from the terminal / shell console
- Quick and dirty shortcuts for network troubleshooting
- FLOSS (open-source) tools
 - Written and maintained by RIPE NCC
 - Open to community contributions
- Before you can use the toolset:
 - Download the tools
 - Install
 - Configure



CLI Toolset: Links

- Source:
 - <https://github.com/RIPE-NCC/ripe-atlas-tools/>
- Documentation:
 - <https://ripe-atlas-tools.readthedocs.org/>
- Included in the Linux / BSD distributions:
 - OpenBSD, FreeBSD, Gentoo, Arch, Debian & Ubuntu
 - (in progress: Fedora, Windows)



Create a ping measurement

- Simplest: one-off, using default values (50 probes to "target")
- \$ `ripe-atlas measure ping --target wikipedia.org`

```
Looking good! Your measurement was created and details about it can be found here:
https://atlas.ripe.net/measurements/3499736/

Connecting to stream...

40 bytes from probe #18433 94.112.176.45: 90.198.174.182 (90.198.174.182): 11558: conn=41.979, 41.492, 48.789,
40 bytes from probe #29111 37.251.238.289: 90.198.174.182 (90.198.174.182): 11557: conn=288.511, 188.138, 288.325,
40 bytes from probe #25883 176.193.48.211: 90.198.174.182 (90.198.174.182): 11558: conn=47.987, 47.476, 47.483,
40 bytes from probe #29313 5.199.166.9: 90.198.174.182 (90.198.174.182): 11558: conn=36.281, 36.245, 36.293,
40 bytes from probe #23273 89.176.43.44: 90.198.174.182 (90.198.174.182): 11552: conn=28.747, 27.712, 28.448,
40 bytes from probe #19413 89.71.47.56: 90.198.174.182 (90.198.174.182): 11552: conn=49.489, 49.779, 50.277,
40 bytes from probe #18635 78.52.132.137: 90.198.174.182 (90.198.174.182): 11557: conn=37.462, 38.895, 37.73,
40 bytes from probe #23223 82.65.126.46: 90.198.174.182 (90.198.174.182): 11553: conn=23.189, 23.412, 23.867,
40 bytes from probe #17111 87.81.148.2: 90.198.174.182 (90.198.174.182): 11558: conn=13.281, 12.885, 13.499,
40 bytes from probe #12884 46.175.22.262: 90.198.174.182 (90.198.174.182): 11558: conn=38.873, 38.788, 38.883,

40 bytes from probe #18368 188.75.141.6: 90.198.174.182 (90.198.174.182): 11555: conn=23.983, 23.833, 23.85,
40 bytes from probe #28236 94.112.19.136: 90.198.174.182 (90.198.174.182): 11552: conn=33.343, 31.888, 31.873,
40 bytes from probe #18838 43.42.38.244: 90.198.174.182 (90.198.174.182): 11558: conn=58.484, 58.875, 58.246,
40 bytes from probe #18856 176.158.241.173: 90.198.174.182 (90.198.174.182): 11558: conn=32.781, 31.818, 32.734,
40 bytes from probe #18948 47.233.176.217: 90.198.174.182 (90.198.174.182): 11558: conn=131.735, 118.481, 142.888,
40 bytes from probe #27414 178.118.78.253: 90.198.174.182 (90.198.174.182): 11548: conn=198.444, 285.459, 773.989,
40 bytes from probe #18887 188.75.138.145: 90.198.174.182 (90.198.174.182): 11547: conn=41.673, 31.35, 28.11,
40 bytes from probe #18246 194.33.189.128: 90.198.174.182 (90.198.174.182): 11548: conn=35.729, 35.538, 35.617,
40 bytes from probe #14724 194.231.27.133: 90.198.174.182 (90.198.174.182): 11558: conn=22.485, 21.181, 23.242,
40 bytes from probe #12882 81.188.153.142: 90.198.174.182 (90.198.174.182): 11553: conn=15.432, 13.848, 13.99,
40 bytes from probe #18486 83.148.83.21: 90.198.174.182 (90.198.174.182): 11558: conn=79.37, 78.975, 78.883,

Disconnecting from stream

You can find details about this measurement here:
https://atlas.ripe.net/measurements/3499736/
```



Other examples of ping

- Geo-specific using 20 probes from Canada:
 - \$ ripe-atlas measure ping --target example.com --probes 20 --from-country ca
- 20 Canadian probes that support IPv6:
 - \$ ripe-atlas measure ping --target example.com --probes 20 --from-country ca --include-tag system-ipv6-works
- Create a recurring measurement:
 - \$ ripe-atlas measure ping --target example.com --interval 3600

Traceroute



```
$ ripe-atlas measure traceroute google.ca
```

```

Waiting until your measurement is created and details about it can be found here:
https://atlas.ripe.net/measurements/3499302/

Connecting to stream...

Probe #6837
1 192.168.0.254 2.748 ms 3.855 ms 3.982 ms
2 17.12.193.254 3.285 ms 3.491 ms 3.676 ms
3 171.27.175.175 4.411 ms 4.775 ms 4.898 ms
4 171.27.175.128 3.48 ms 3.853 ms 4.12 ms
5 12.14.209.82 4.37 ms 4.232 ms 4.383 ms
6 204.85.249.249 47.499 ms 46.745 ms 41.552 ms
7 204.85.249.182 23.287 ms 23.092 ms 22.893 ms
8 204.85.249.59 48.585 ms 48.454 ms 48.884 ms
9 204.85.254.249 62.337 ms 65.281 ms 64.785 ms
10 174.129.45.28 44.999 ms 44.887 ms 44.987 ms
11 *
12 174.129.45.94 77.313 ms 82.476 ms 83.383 ms

Probe #6838
1 192.168.0.254 4.562 ms 4.483 ms 4.423 ms
2 198.134.255.225 4.79 ms 4.683 ms 4.694 ms
3 84.16.183.226 3.13 ms 3.189 ms 3.124 ms
4 84.16.255.193 3.589 ms 3.715 ms 3.629 ms
5 91.208.16.213 3.719 ms 3.387 ms 3.279 ms
6 174.129.16.188 15.419 ms 15.358 ms 15.242 ms
7 174.129.17.188 15.311 ms 15.28 ms 15.285 ms
8 204.85.253.238 17.812 ms 17.491 ms 16.925 ms
9 12.14.209.128 21.411 ms 21.472 ms 21.528 ms
10 174.129.51.18 25.435 ms 24.437 ms 24.773 ms
11 174.129.56.183 24.687 ms 24.354 ms 24.35 ms
12 *
13 174.129.63.94 25.36 ms 25.894 ms 24.296 ms

Reconnecting from stream
You can find details about this measurement here:
https://atlas.ripe.net/measurements/3499302/

```



Search for existing measurements

```
$ ripe-atlas measurements --af 6 --status ongoing --limit 15 --search google
```

```
Filters:
Search: google
Af: 6
Status inc: (2,)
```

Id	Type	Description	Status
1884885	ping	google - v6	Ongoing
1884732	traceroute	google v6 traceroute	Ongoing
1887128	dns	Google.fi AAAA reply	Ongoing
1812449	sslcert	www.google.com	Ongoing
1824911	ping	IPv6 Google DNS	Ongoing
1484388	ping	IPv6 Ping to Google	Ongoing
1663737	ping	google.com - 2484:6800:4003:c00::71	Ongoing
1796268	ping	Ping measurement to www.google.com	Ongoing
1889888	traceroute	Traceroute measurement to ipv6.google.com	Ongoing
2882542	traceroute	Traceroute measurement to ipv6.google.com	Ongoing
2882543	ping	Ping measurement to ipv6.google.com	Ongoing
2143865	ping	Ping measurement to ipv6.google.com	Ongoing
2488682	traceroute	IPv6 Traceroute measurement to snapchat.com	Ongoing
2488628	ping	Google IPv6	Ongoing
2929551	ping	campaign:th-mon-run2 type:ping host:plus.goog	Ongoing

Showing 15 of 18 total measurements



Search for very specific probes

```
$ ripe-atlas probes --asn 3333 --field id --field asn_v6 --field country --field is_public --field description --field status
```

```
Filters:
ASN: 3333
```

ID	Asn_v6	Country	Public	Description	Status
9	3333	nl	✓	SG office 1	Connected
14	3333	nl	✓	vty probe	Connected
15	3333	nl	✓	SG office 2	Connected
111	3333	br	✗	NCC.br	Abandoned
237	3333	nl	✓	The Traveling Probe	Connected
1188	3333	us	✓	probe 1	Abandoned
2889	3333	nl	✓	NCC Office 2889	Connected
3497	3333	nl	✗		Abandoned
4848	3333	nl	✗		Abandoned
6881	3333	nl	✓	AA nl-ams-as3333	Connected
6812	3333	nl	✗	AA pre-production	Connected
6818	3333	nl	✗		Abandoned
6819	3333	nl	✓	RDPE NCC Anchor v2	Connected
6137	3333	nl	✓	nl-ams-as3333-preprod	Connected
18884	3333	nl	✓	RDPE NCC N&D Office	Abandoned
18185	3333	nl	✗		Abandoned
18186	3333	nl	✗		Abandoned
18888	3333	nl	✓	Ridderkerk - UPC 128/18Pbits	Abandoned
11187	3333	nl	✗	DUPPROBE	Disconnected
11283	3333	gb	✗	DUPPROBE	Disconnected
32888	3333	de	✓	TeraStream Test Lab	Abandoned
13343	3333	ch	✓	PS2T AG - CH-010881 - out of 8	Abandoned
14884	3333	nl	✗		Abandoned
14813	3333	nl	✗		Abandoned
14838	3333	nl	✗		Abandoned

Showing 25 of 39 total probes



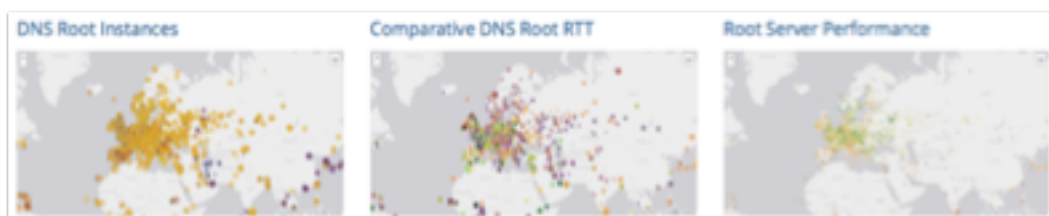
DNS Related Measurements

by RIPE Atlas

Maps Based on DNS Measurements



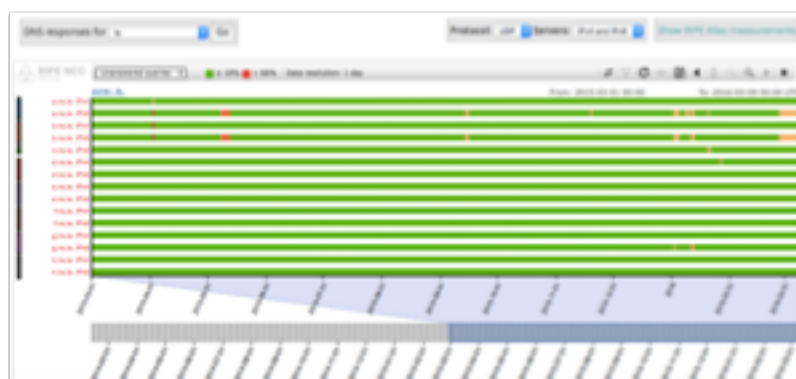
- DNS Root Instances
- Comparative DNS Root RTT
- Root Server Performance





DNSMON

- From anchors to ccTLDs
- An Updated DNS Monitoring Service



DomainMon

- Like "DNSMON", but
 - From probes
 - To second-level domains
- RIPE Atlas: DomainMON is Here



User Measurements Visualisations



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



DNS measurement to 195.253.65.6 (c.flexireg)

Probe	ASN (IPV4)	ASN (IPV6)	Time (RTT)	Answer	Response Size
1000	AS1712	AS1712	2017-06-08-00:00	NOERROR	1000
1001	AS1712	AS1712	2017-06-08-00:00	NOERROR	1000
1002	AS1712	AS1712	2017-06-08-00:00	NOERROR	1000
1003	AS1712	AS1712	2017-06-08-00:00	NOERROR	1000



Additional System and Global DNS Measurements



- Measuring random domains
- Measuring popular domains
 - New RIPE Atlas Root Zone DNS Measurements
- Instead of setting-up your own measurements, use the existing data!

DNS Measurements Analysis



- DNS Censorship (DNS Lies) As Seen By RIPE Atlas (Stéphane Bortzmeyer)
- Orange Blacklisting: A Case for Measuring Censorship (Stéphane Bortzmeyer, Oct 2016)
- Operator Level DNS Hijacking (Babak Farrokhi, Jul 2016)
- Dissecting DNS Defenses During DDoS Attacks (Giovane Moura, May 2018)

DNS Measurements Hackathon, April 2017



- Results of the DNS Measurements Hackathon
- DNS resolver hijack tester
 - Out of 6,700 probes, 113 were "suspicious" or "being weird",
- DNS Fingerprinting to identify hijacked resolvers
 - Top-5 countries were: VN, MG, IQ, ID and KR
- Data sets for researchers, Dec 2018



Stay in touch!

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