



**RIPE NCC**  
RIPE NETWORK COORDINATION CENTRE

# New Developments in Address Policy and Community Tools

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Vesna Manojlovic

Darmstadt | November 2016 | DENOG8



... also known as ...

**EVERYTHING  
YOU ALWAYS  
WANTED TO KNOW  
ABOUT\***



# ... actually

- Help community to shape RIPE policies
- Use RIS for your BGP monitoring
- Measure your reachability with RIPE Atlas



# How to Shape RIPE Policies

# The Internet Registry System



*iana*

**ARIN**  
American Registry for Internet Numbers



**RIPE NCC**  
RIPE NETWORK COORDINATION CENTRE

(: APNIC

**AFRINIC**  
The Internet Numbers Registry for Africa

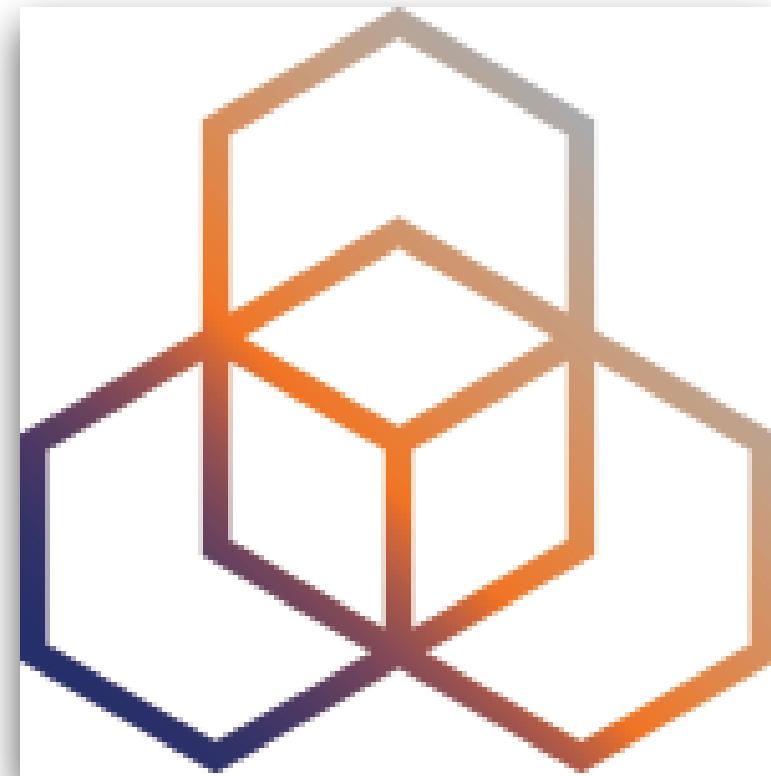
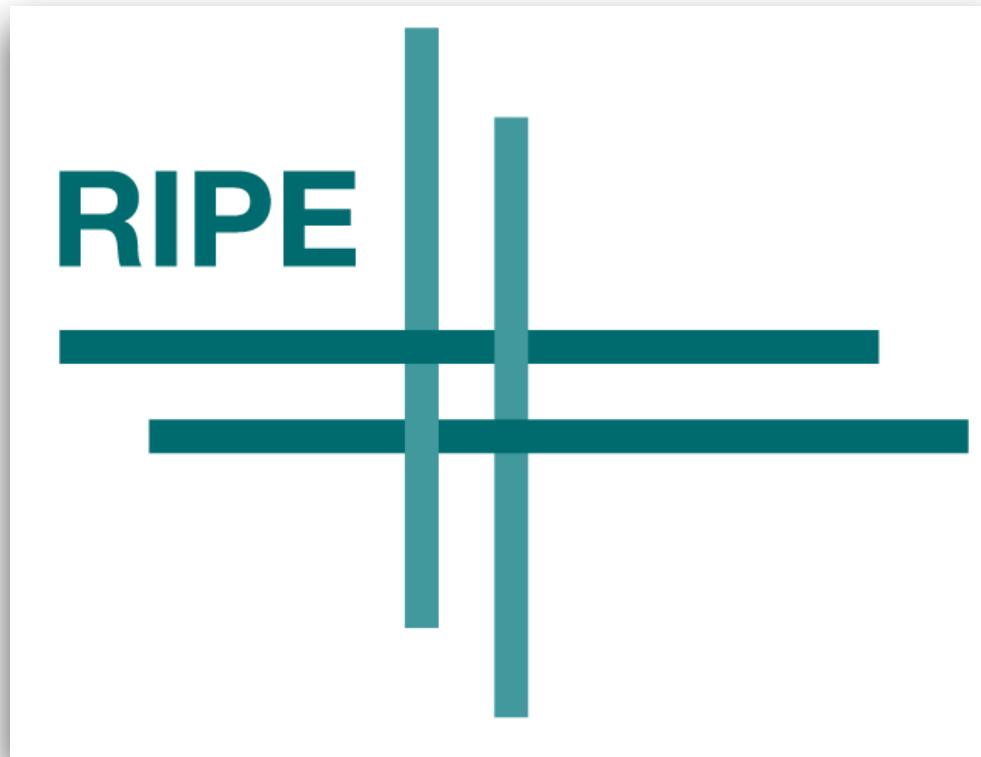


# Regional Internet Registries

- Five RIRs worldwide
  - Not-for-profit organisations
  - Funded by membership fees
  - Distributing Internet resources & coordinating related activities
  - Policies decided by regional communities
  - Neutral, Impartial, Open, Transparent



# RIPE != RIPE NCC





# Who Does What ?

- **The RIPE community**

- Creates & discusses policy proposals
- Seeks consensus and decides on policies
- Has two RIPE meetings per year

- **The RIPE NCC**

- Acts as the secretariat to support the policy process
- Implements the policies & distributes resources
- Helps organise RIPE meetings
- ... and many other activities: training, measurements, gathers statistics, takes part in Internet Governance...

# RIPE Consists of Working Groups



e.g. <https://www.secret-wg.org>



# RIPE Working Groups

- Address Policy
- Routing
- Database
- Anti-abuse
- Cooperation
- IPv6
- RIPE NCC Services
- Connect
- Open Source
- Measurement,  
Analysis and Tools



# RIPE Forum

Beta RIPE Forum v1.2b

## RIPE Forum

### Available Lists

- [RIPE Forum Test mailing list >](#)
- [ACM Task Force >](#)
- [Address Policy Working Group >](#)
- [Anti-Abuse Working Group >](#)
- [Best Current Operational Practices \(BCOP\) Task Force >](#)
- [Connect Working Group >](#)
- [Cooperation Working Group >](#)
- [Database Working Group >](#)
- [DNS Working Group >](#)

### Recent Posts

- [\[db-wg\] Faked entries in the RIPE db](#)  
Last updated by Ian Dickinson at 2016-05-31 12:44:24
- [\[ipv6-wg\] New on RIPE Labs: How are you Deploying IPv6? Take this Survey](#)  
Last updated by Mirjam Kühne at 2016-05-31 11:40:50
- [\[dns-wg\] New on RIPE Labs: Anycast vs. DDoS - Evaluating the November 2015 Root DNS Event](#)  
Last updated by Mirjam Kühne at 2016-05-31 10:01:52

The RIPE Forum is an additional way to participate in RIPE community mailing list discussions using a web-based interface rather than an email client. Everything you post here goes to the mailing list and everything posted to the mailing list is visible here.

# RIPE Forum

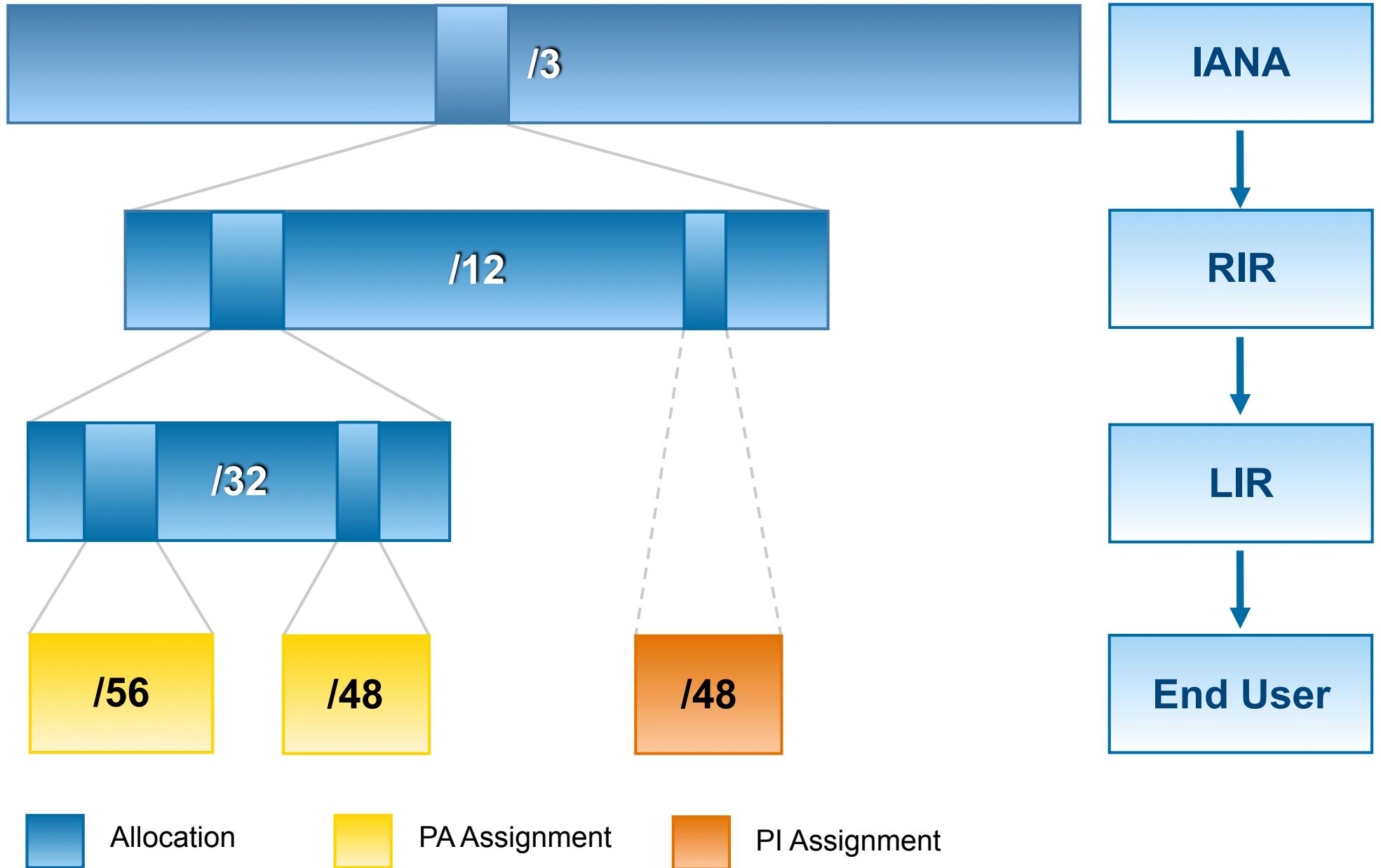


- Alternative way to participate in discussions
- One place to access all RIPE mailing lists
- Completely web-based; no emails in inbox
- Interacts with existing mailing lists
- Contains threaded view, search function and options to share

**<https://www.ripe.net/participate/mail/forum/>**

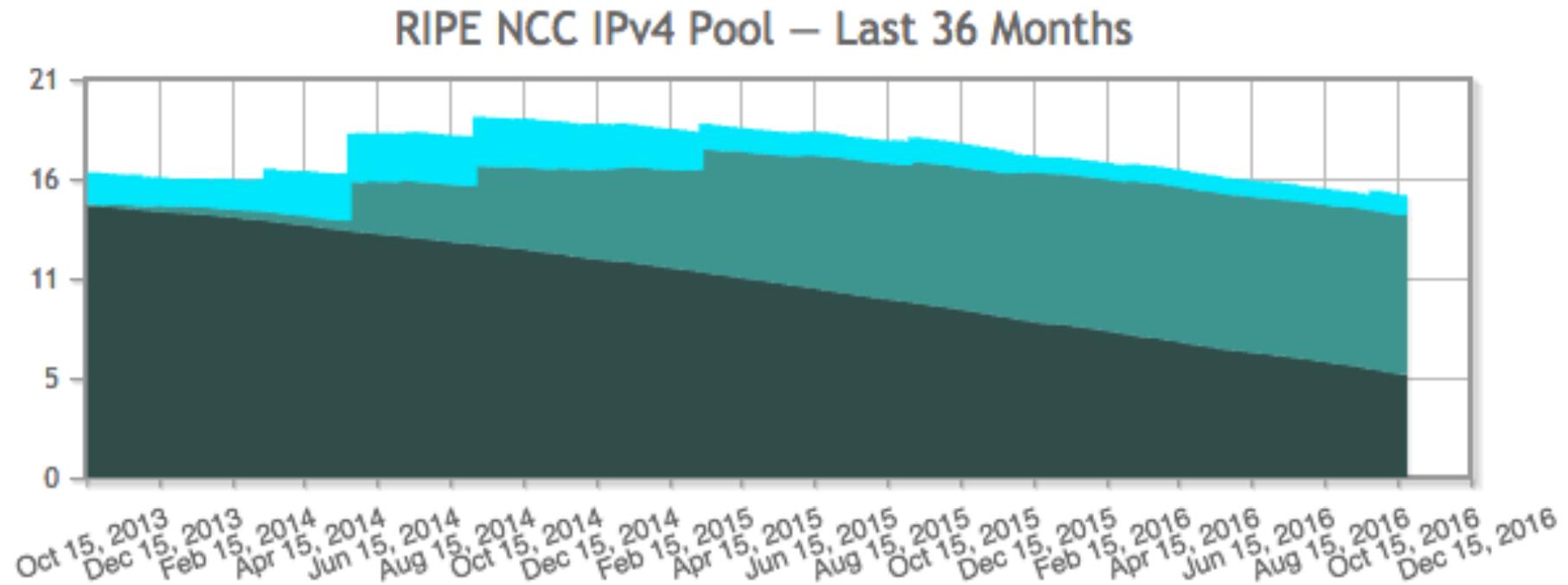


# IPv6 Addresses Distribution





# IPv4 Available Pool





# Types of Transfers

**PA allocations**  
*between RIPE NCC members*

**Merger or Acquisition**

**PI assignments**  
*between End Users*

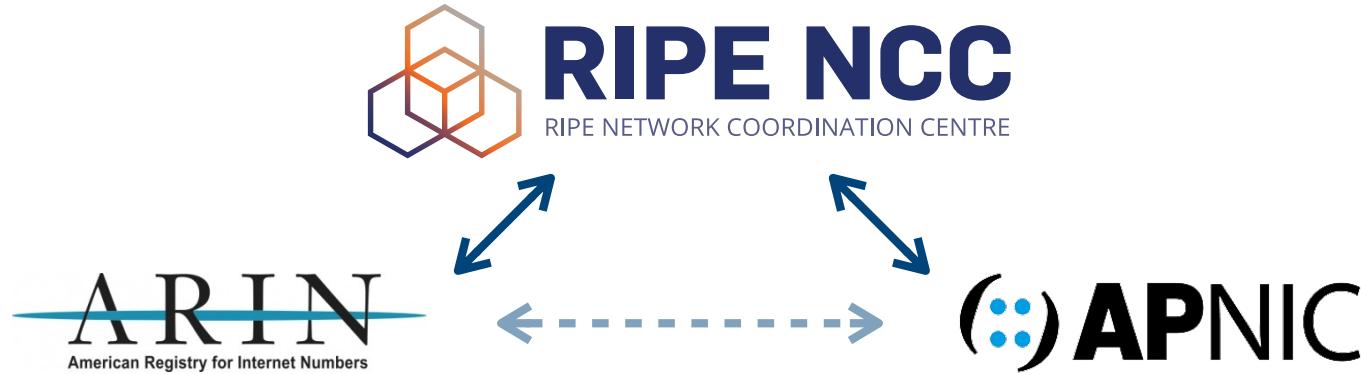
**From Legacy Space**

**AS numbers**  
*between End Users*

**Inter-RIR**



# Inter-RIR Transfers



- Between RIRs with compatible policies
- ARIN: IPv4 addresses (including legacy space)
- APNIC: IPv4 addresses and AS Numbers (including legacy)
- Send your request to [inter-rir@ripe.net](mailto:inter-rir@ripe.net)



# Transfers: How to Request

- IPv4 Listing Service, in LIR Portal account
- Use the “Request Transfer” wizard
- Include the following information & documents:
  - IPv4 / IPv6 / ASN being transferred
  - company names and contact details
  - company registration papers
  - Transfer Agreement
- For PI transfers, sponsoring LIR agreement is needed too



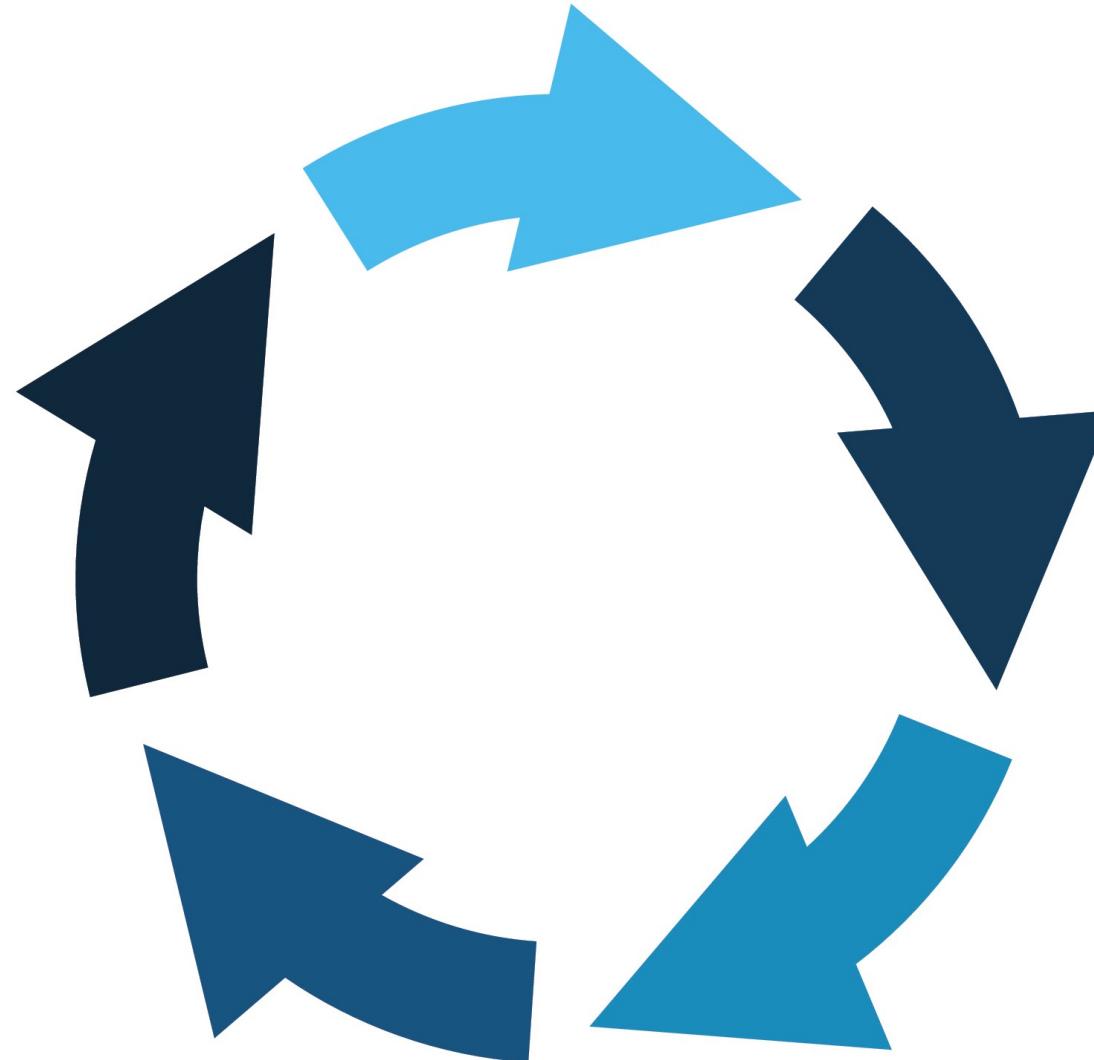
# Protect Your Resources

- Maintain your contact info in the RIPE database
- Keep your LIR contacts in the LIR Portal up to date
- Know the policies and procedures
- In case of questions, contact Registration Services

[lir-help@ripe.net](mailto:lir-help@ripe.net)



# Policy Development Process





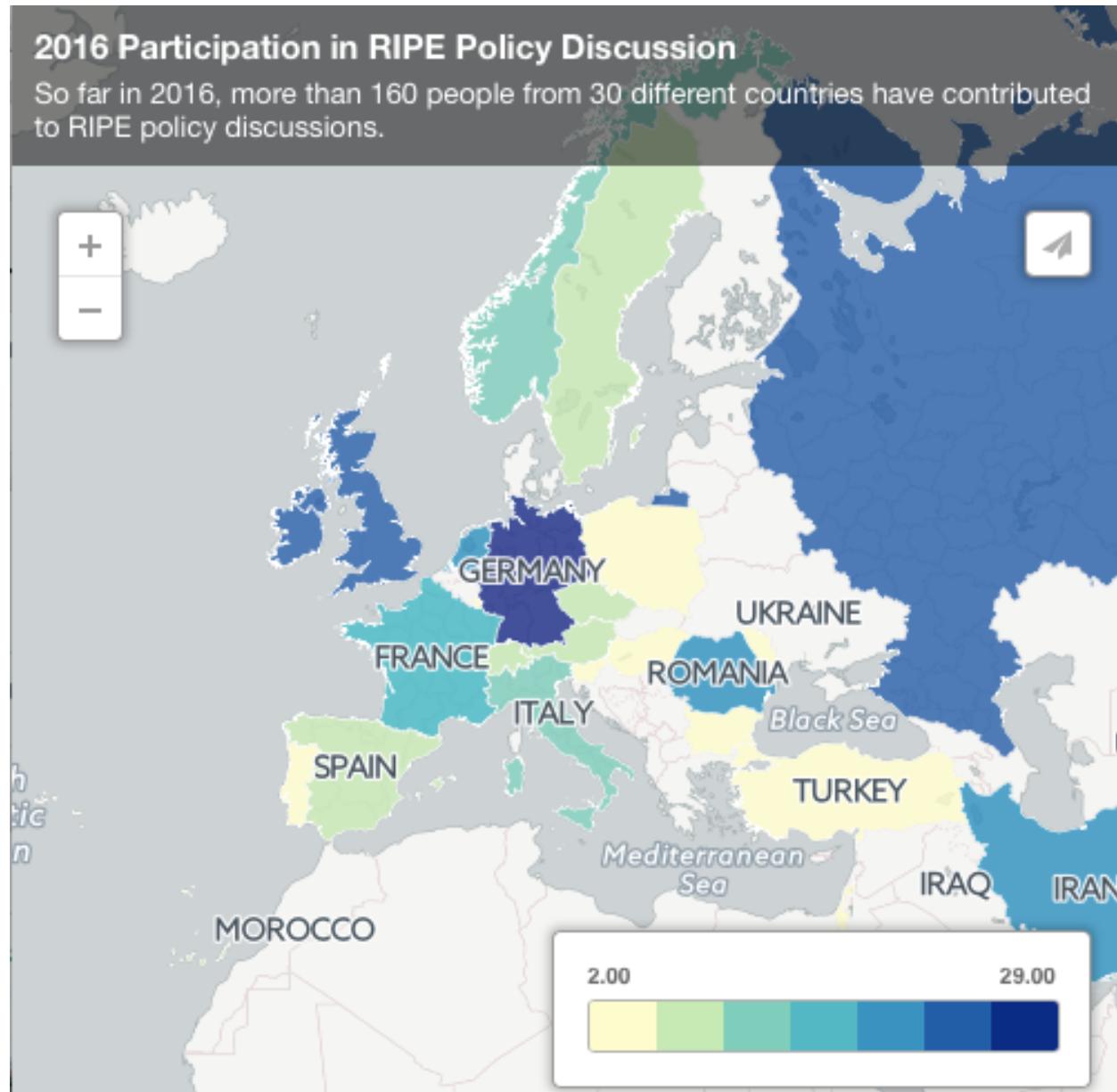
# Current Policy Discussions

- 2015-04, “RIPE Resource Transfer Policies”
  - Aims to create a single transfer policy with all relevant information on the transfer of Internet number resources, replacing text in several RIPE Policies.
- 2016-04, “IPv6 PI Sub-assignment Clarification”
  - Aims to define sub-assignments in IPv6 PI assignments as subnets of /64 and shorter.
- Upcoming: Assessment criteria for IPv6 additional allocations
  - Aims to align allocation criteria for IPv6 additional allocations to initial allocation (segmentation, security, longevity)

<https://www.ripe.net/participate/policies/current-proposals/current-policy-proposals>



# Everyone is RIPE Community





# Using RIS for Your BGP Monitoring



# Routing Information Service (RIS)

- Worldwide network of BGP collectors
- Deployed at Internet Exchange Points
- Collects raw BGP data from peers
  - 669 peers at 18 locations
  - 157 IPv4 full tables
  - 147 IPv6 full tables
- 15+ years of history



# Collector Locations





# Collector History

Collector	Location	IXP	Deployed	Removed
RRC00	Amsterdam	Multi-hop	1999	-
RRC01	London	LINX	2000	-
RRC02	Paris	SFINX	2001	2008
RRC03	Amsterdam	AMS-IX	2001	-
RRC04	Geneva	CIXP	2001	-
RRC05	Vienna	VIX	2001	-
RRC06	Tokyo	DIX-IE	2001	-
RRC07	Stockholm	Netnod	2002	-
RRC08	San Jose	MAE-West	2002	2004
RRC09	Zurich	TIX	2003	2004
RRC10	Milan	MIX	2003	-
RRC11	New York	NYIIX	2004	-
RRC12	Frankfurt	DE-CIX	2004	-
RRC13	Moscow	MSK-IX	2005	-
RRC14	Palo Alto	PAIX	2005	-
RRC15	Sao Paulo	PTT-Metro SP	2006	-
RRC16	Miami	NOTA	2008	-
RRC18	Barcelona	CATNIX	2015	-
RRC19	Johannesburg	NAPAfrica JB	2016	-
RRC20	Zurich	SwissIX	2015	-
RRC21	Paris	FrancelIX	2015	-



# RIS Data

- RAW data
  - <http://data.ris.ripe.net/>
- Shiny web interface: RIPEstat
  - <https://stat.ripe.net/>
- We provide APIs to query all the data
  - [https://stat.ripe.net/docs/data\\_api](https://stat.ripe.net/docs/data_api)



# RIPE Stat - Routing Overview

Routing Status (AS8365)

At 2016-11-18 08:00:00 UTC, AS8365 was visible to 100% of 158 IPv4 and 99% of 146 IPv6 RIS full peers.

⌚ First ever seen as origin announcing 193.23.248.0/24, on 2000-08-18 08:00:00 UTC.

Originated IPv4 prefixes: 6  
Originated IPv6 prefixes: 2  
Observed BGP neighbours: 290  
Address space announced (IPv4): 140800 IPs  
Address space announced (IPv6): equiv. to 65537 /48s

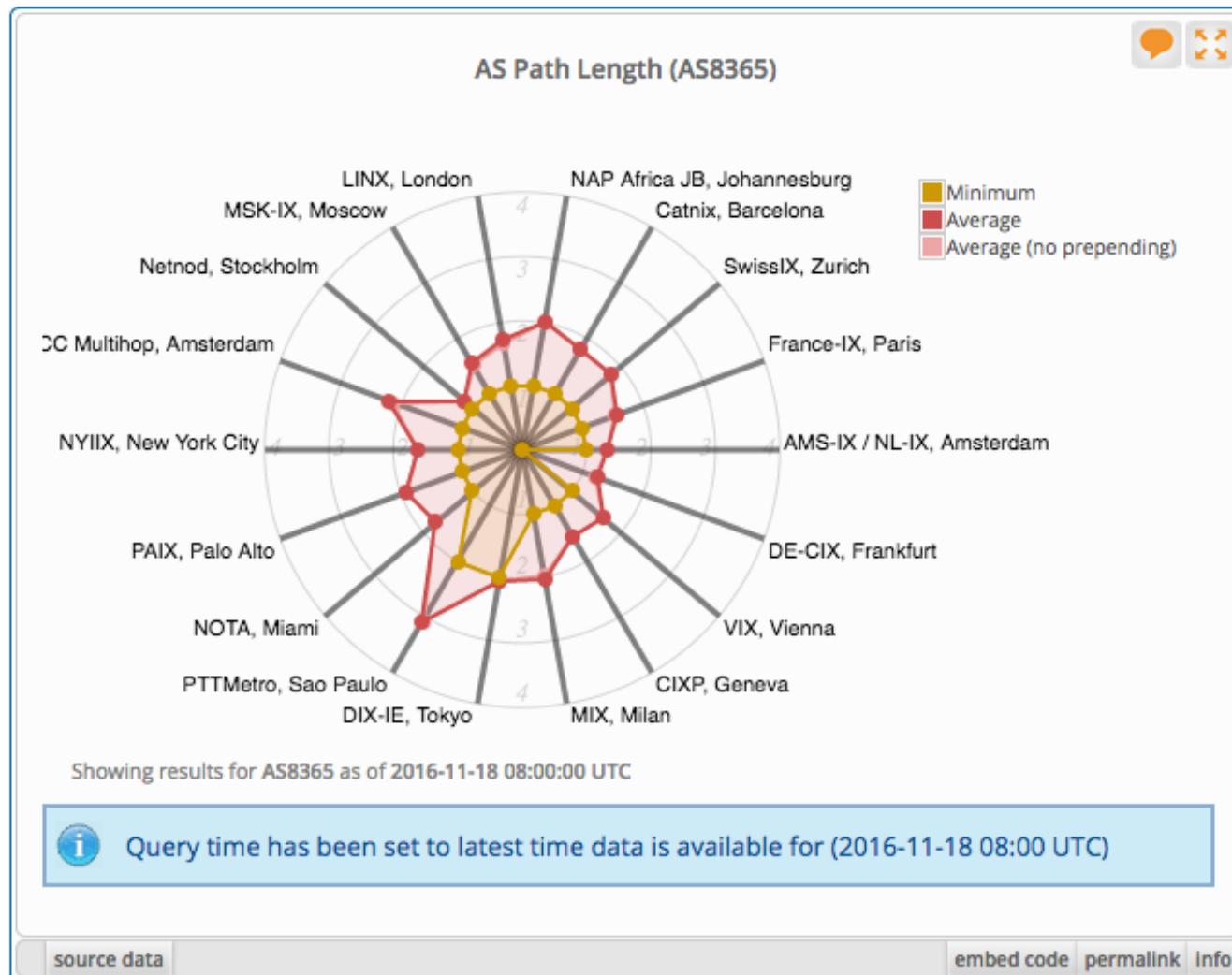
▶ [⚙ Advanced Settings](#)

Showing results for AS8365 as of 2016-11-18 08:00:00 UTC

[source data](#) [embed code](#) [permalink](#) [Info](#)



# RIPE Stat - AS Path Length





# RIPE Stat - Visibility

RIPE NCC  
RIPEstat

Visibility (AS8365)

**AS8365** is visible by **100%** of 158 **IPv4** and **99%** of 146 **IPv6** RIS full peers.

Visibility Location Details of AS8365							
RRC	IXP Location	Location	IPv4 peers seeing	IPv6 peers seeing	IPv4 Visibility	IPv6 Visibility	
RR00	RIPE-NCC Multihop	Amsterdam, Netherlands	14 of 14	9 of 9	<b>100%</b>	<b>100%</b>	
RR01	LINX	London, United Kingdom	7 of 7	10 of 10	<b>100%</b>	<b>100%</b>	
RR03	AMS-IX / NL-IX	Amsterdam, Netherlands	7 of 7	12 of 12	<b>100%</b>	<b>100%</b>	
RR04	CIXP	Geneva, Switzerland	8 of 8	5 of 5	<b>100%</b>	<b>100%</b>	
RR05	VIX	Vienna, Austria	4 of 4	6 of 6	<b>100%</b>	<b>100%</b>	
RR06	DIX-IE	Tokyo, Japan	2 of 2	2 of 2	<b>100%</b>	<b>100%</b>	
RR07	Netnod	Stockholm, Sweden	5 of 5	6 of 6	<b>100%</b>	<b>100%</b>	
RR10	MIX	Milan, Italy	10 of 10	6 of 7	<b>100%</b>	<b>86%</b>	
RR11	NYIIX	New York City, US	9 of 9	9 of 9	<b>100%</b>	<b>100%</b>	
RR12	DE-CIX	Frankfurt, Germany	13 of 13	17 of 17	<b>100%</b>	<b>100%</b>	
RR13	MSK-IX	Moscow, Russian Federation	11 of 11	4 of 4	<b>100%</b>	<b>100%</b>	
RR14	PAIX	Palo Alto, US	7 of 7	8 of 8	<b>100%</b>	<b>100%</b>	
RR15	PTTMetro	Sao Paulo, Brazil	14 of 14	11 of 11	<b>100%</b>	<b>100%</b>	
RR16	NOTA	Miami, US	3 of 3	3 of 3	<b>100%</b>	<b>100%</b>	
RR18	Catnix	Barcelona, Spain	2 of 2	1 of 1	<b>100%</b>	<b>100%</b>	
RR19	NAP Africa JB	Johannesburg, South Africa	6 of 6	4 of 4	<b>100%</b>	<b>100%</b>	
RR20	SwissIX	Zurich, Switzerland	17 of 17	17 of 17	<b>100%</b>	<b>100%</b>	
RR21	France-IX	Paris, France	19 of 19	14 of 15	<b>100%</b>	<b>93%</b>	

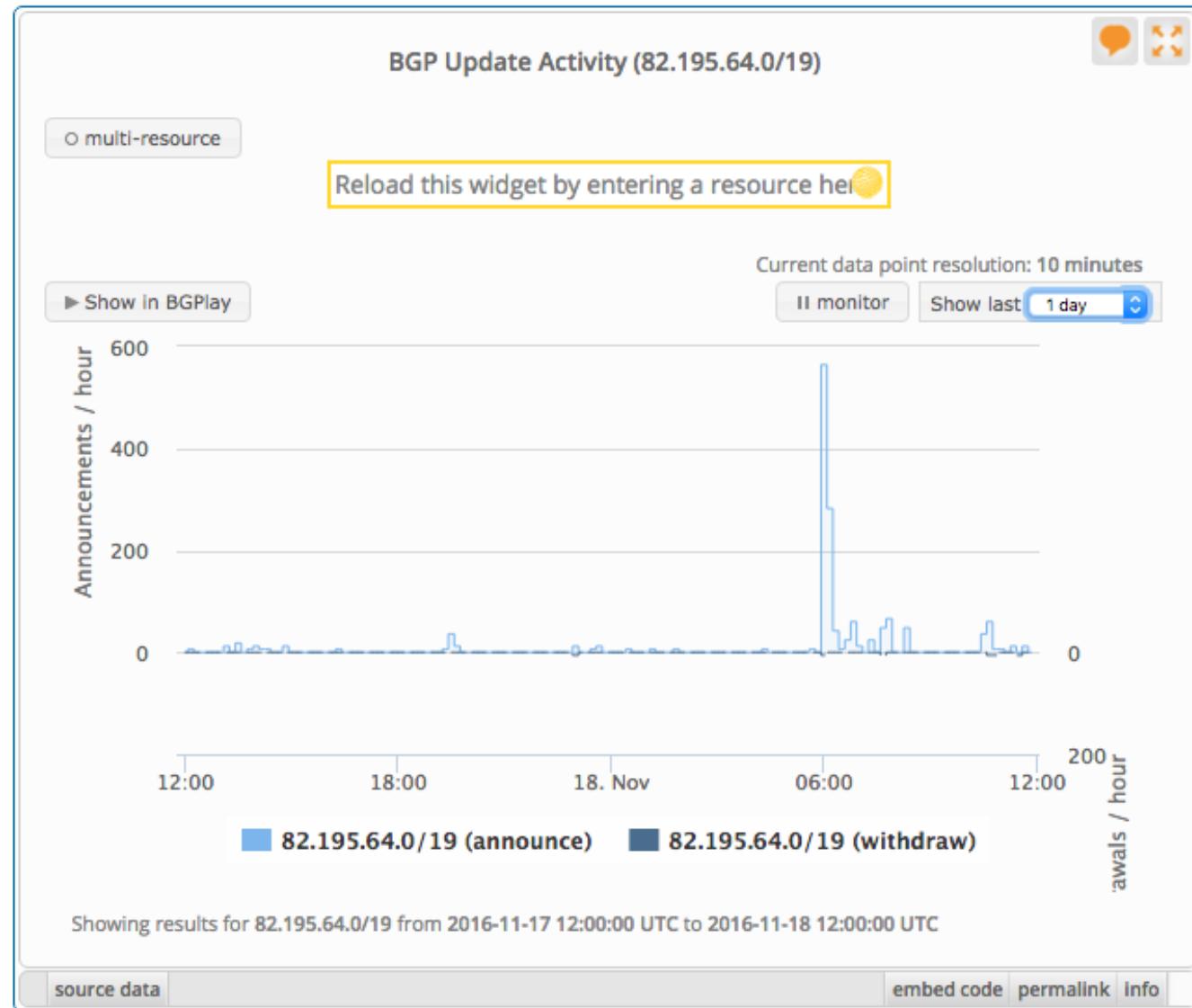
Show Peer Details

Showing results for **AS8365** as of **2016-11-18 08:00:00 UTC**

[source data](#) [info](#)



# RIPE Stat - Monitor Updates





# Real-time Streaming of BGP data

- Public beta available
- Data from newest 4 RRCs only (RRC18-21)
- Client specifies filtering options, streaming service sends BGP
- Messages as they become available
- <http://stream-dev.ris.ripe.net/demo>



# Real-time Streaming

Host:	rrc21
Peer:	
Prefix:	
Originating ASN:	
Type:	
More specific:	
Less specific:	false
selector	message
rate limit /s	1000
<input type="button" value="Update Params"/> <input type="button" value="Play/Pause"/>	

[14:10:45] connection alive

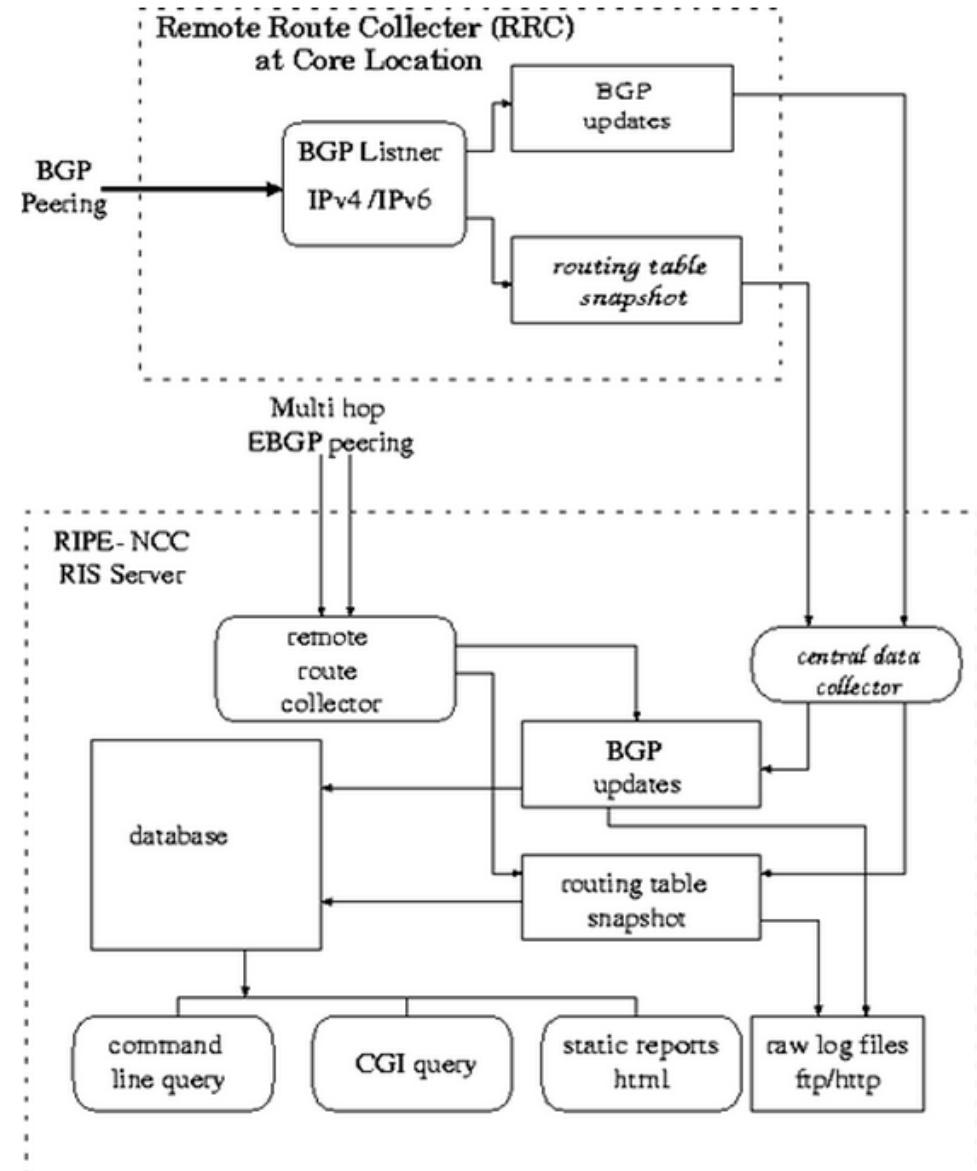
0 messages dropped

RRC time	Delay (s)	JSON message
14:10:45	0.11	{"timestamp":1479474645.54,"prefix":"14.140.190.0/23","community":[[8218,103],[8218,20000],[8218,20110]],"host":"rrc21","next_hop":"37.49.236.1","peer":"37.49.236.1","path":[8218,6461,6453,4755],"type":"A"} {"timestamp":1479474645.54,"prefix":"205.70.128.0/19","community":[[8218,103],[8218,20000],[8218,20110]],"host":"rrc21","next_hop":"37.49.236.1","peer":"37.49.236.1","path":[8218,6461,209,3910,721,27065,5839],"type":"A"} {"timestamp":1479474645.54,"prefix":"177.8.247.0/24","community":[[8218,103],[8218,20000],[8218,20110]],"host":"rrc21","next_hop":"37.49.236.1","peer":"37.49.236.1","path":[8218,6461,3356,3549,28642,263030],"type":"A"} {"timestamp":1479474645.54,"prefix":"205.70.128.0/19","community":[[8218,103],[8218,20000],[8218,20210]],"host":"rrc21","next_hop":"37.49.236.1","peer":"37.49.236.1","path":[8218,6461,209,3910,721,27065,5839],"type":"A"} {"timestamp":1479474645.54,"prefix":"177.8.247.0/24","community":[[8218,103],[8218,20000],[8218,20220]],"host":"rrc21","next_hop":"37.49.236.1","peer":"37.49.236.1","path":[8218,6461,3356,3549,28642,263030],"type":"A"} {"timestamp":1479474645.54,"prefix":"205.70.128.0/19","community":[[8218,103],[8218,20000],[8218,20220]],"host":"rrc21","next_hop":"37.49.236.1","peer":"37.49.236.1","path":[8218,6461,209,3910,721,27065,5839],"type":"A"} {"timestamp":1479474645.51,"prefix":"185.26.155.0/24","community":[[34019,5001],[34019,5104],[34019,65000],[34019,65020],[34019,65021],[65512,2003]],"host":"rrc21","next_hop":"37.49.236.71","peer":"37.49.236.71","path":[34019,6939,4826,60725],"type":"A"} {"peer":"37.49.236.1","timestamp":1479474644.84,"host":"rrc21","type":"W","prefix":"103.30.79.0/24"} {"peer":"37.49.236.1","timestamp":1479474644.84,"host":"rrc21","type":"W","prefix":"103.228.111.0/24"} {"peer":"37.49.236.1","timestamp":1479474644.84,"host":"rrc21","type":"W","prefix":"103.195.107.0/24"} {"peer":"37.49.236.1","timestamp":1479474644.84,"host":"rrc21","type":"W","prefix":"103.24.219.0/24"} {"peer":"37.49.236.1","timestamp":1479474644.84,"host":"rrc21","type":"W","prefix":"103.195.105.0/24"} {"peer":"37.49.236.1","timestamp":1479474644.84,"host":"rrc21","type":"W","prefix":"43.254.164.0/24"} {"timestamp":1479474645.39,"prefix":"14.140.190.0/23","community":[[6453,50],[6453,2000],[6453,2100],[6453,2104],[6453,10002],[24482,1],[24482,12010],[24482,12011],[24482,21200],[24482,64601]],"host":"rrc21","next_hop":"37.49.236.228","peer":"37.49.236.228","path":[24482,6453,4755],"type":"A"}
14:10:45	0.12	



# Original Architecture (1999)

- Diagram from RIPE-200 (original concept)
- Note ‘RIS Server’
  - singular!
- Also, the ‘database’
  - this becomes the hardest part!!



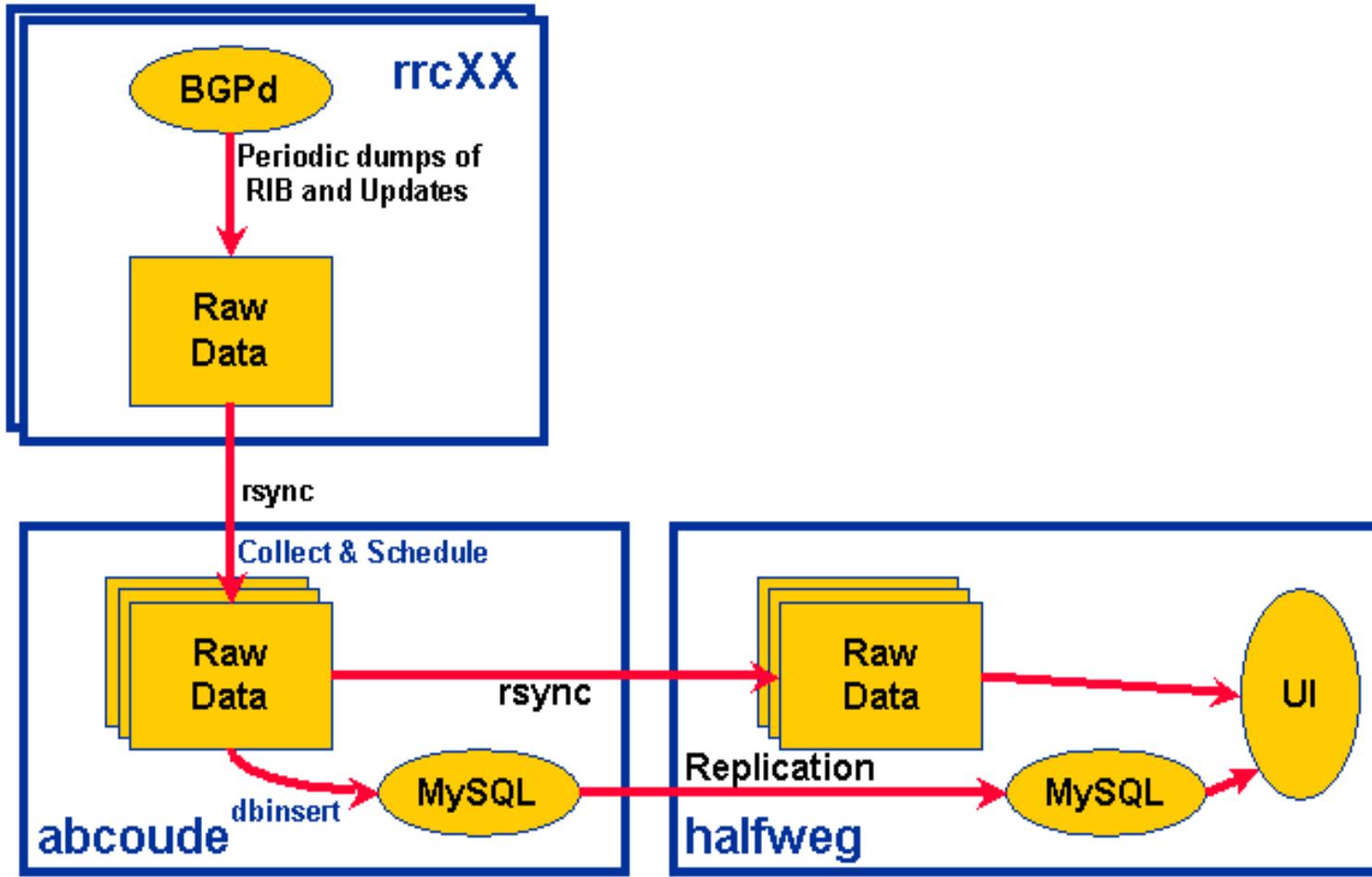
Original RIS design (RIPE-200)  
circa 1999



# Classic Architecture (~2003)



## “RIS Classic” - Overview



3

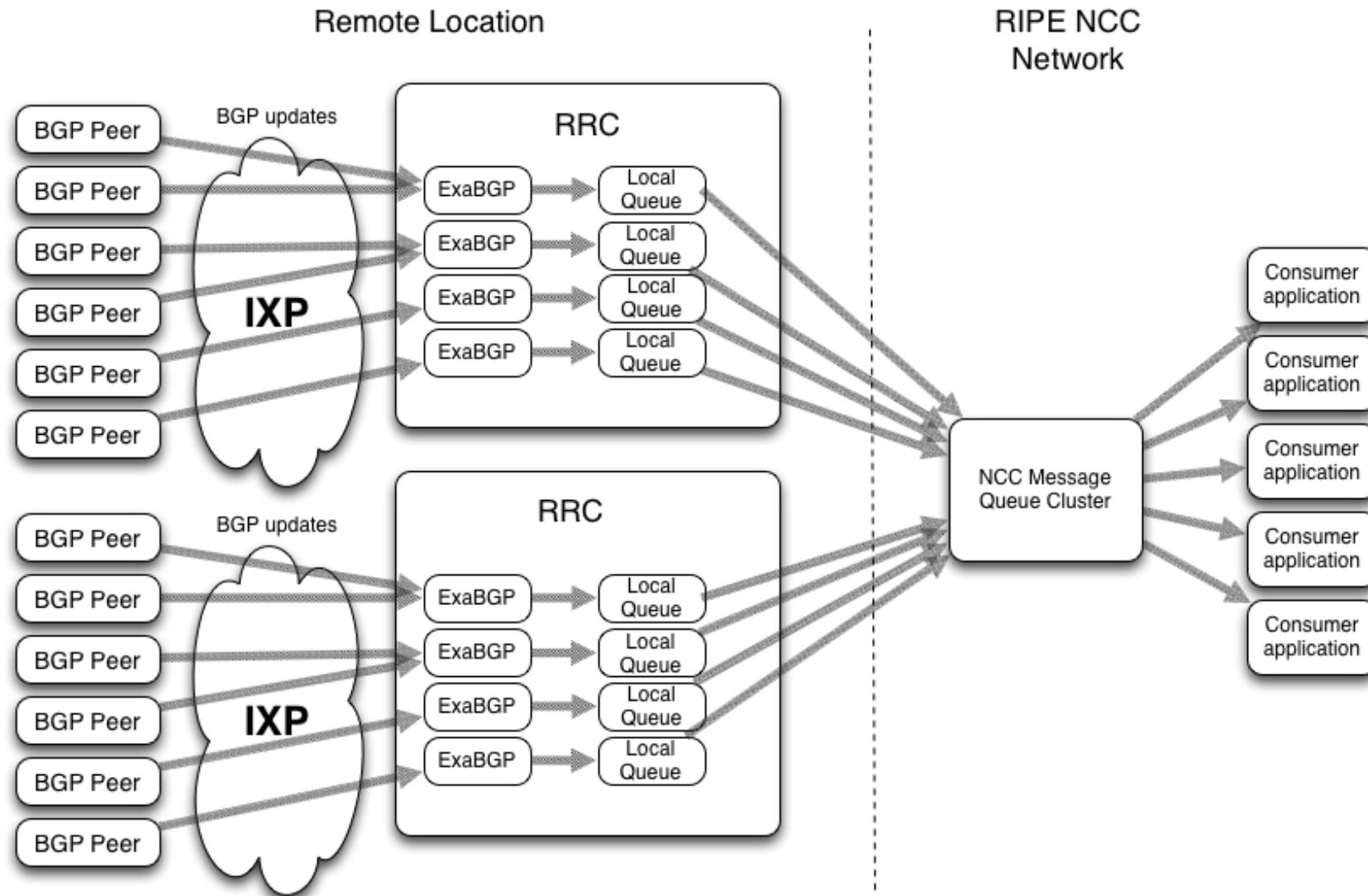
James Aldridge

RIPE 44 , January 2003, Amsterdam

<http://www.ripe.net/ris>

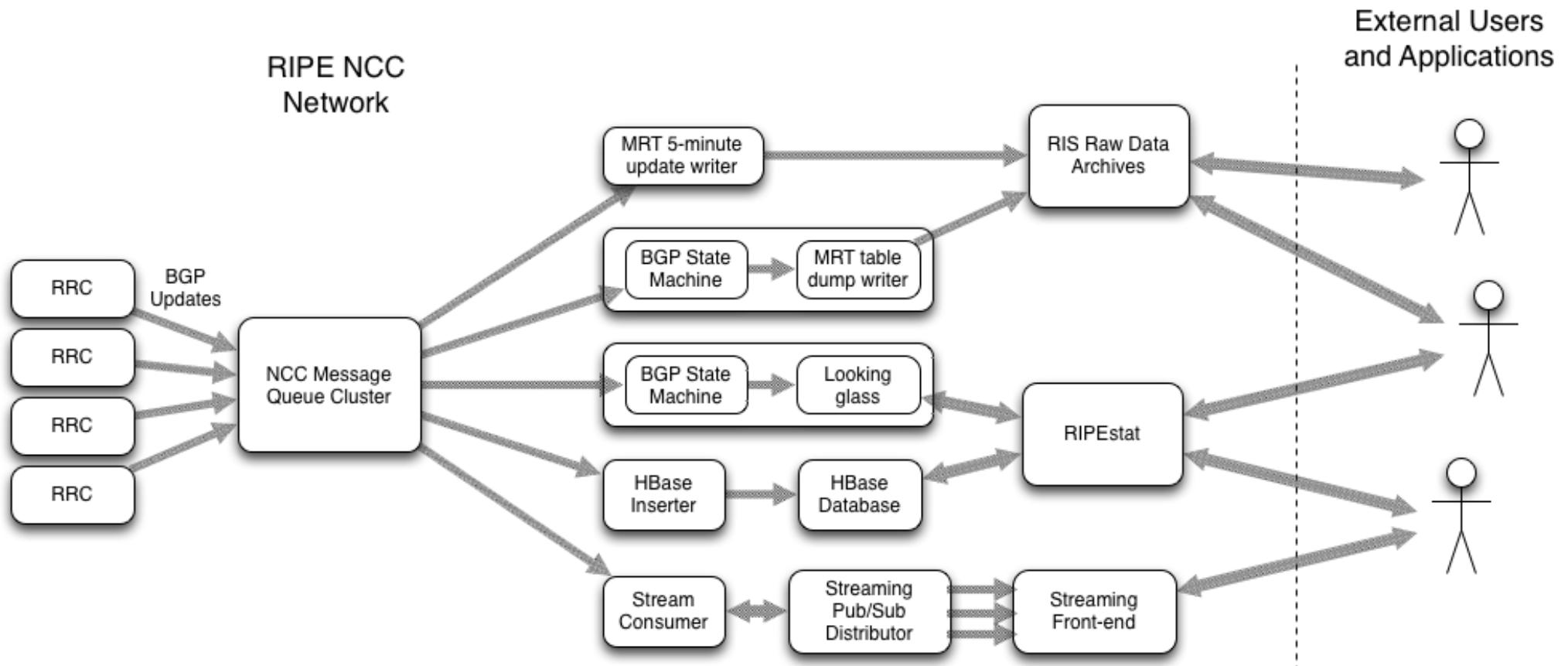


# Current Design - Data Collection





# Current Design - Back-end





# Scaling the Collectors

- Quagga used as BGP collector
- Single-threaded
  - Not as scalable on modern multi-core CPUs
- Locks updates during table-dump process
  - Requires that dump completes before the hold timer expires, or BGP session will drop
- Some data consistency issues
  - Sometimes updates are missing from the update dumps at the time of a table dump
  - This makes it difficult to accurately rebuild BGP state at an intermediate time, if updates are not reliable in-between



# Scaling the Collectors Cont'd

- New RRCs use ExaBGP
- Still single threaded
- But doesn't block & 1 (or n) instances per CPU
- Much simpler job
  - keep BGP session alive
  - write one line of JSON to STDOUT per BGP message
- Python 4 liner stores it in DirQ
  - if process dies takes ExaBGP instance with it



# Scaling the Collectors Cont'd

- BGP message is safely stored on disk
- Or we tore session down
- → BGP state is consistent
  
- 2nd process drains DirQ
- Stores messages in Message Queue Cluster  
in Amsterdam (~~RabbitMQ / Kafka~~)



# Data Processing

- Apache Hadoop
  - An open-source software framework for distributed storage and distributed processing of very large data sets on computer clusters built from commodity hardware.
- “Big Data” storage and analytics
- Allows us to build a scalable storage and processing cluster
- Currently over 150 servers in the cluster!
  - Although the cluster is not only used for RIS!
  - Also used by RIPE Atlas and other projects



# Data Processing - Components

- HDFS
  - distributed, replicated, cluster filesystem
- YARN
  - compute resource manager and application scheduler
- Map/Reduce
  - massive batch job processing
- HBase
  - non-relational distributed database
  - large tables - billions of rows X millions of columns



# Data Processing - Components

- Spark
  - Cluster computing used for data stream processing
  - i.e. non-batch computing
- Azkaban
  - Batch workflow job scheduler, dependency tracking, etc.
- Kafka
  - BGP event messaging bus



# Data Processing

- Raw data inputs:
  - BGP updates events - everything must start from a BGP message!
  - BGP table dumps (which can also be derived from updates)
- Derived datasets
  - update-counts, first-last-seen, prefixes-transited-by-asn, peers-list, asn-stats, asn-adjacencies
  - country-code mapping
  - aggregated counts for historical overviews
  - distributed looking-glass processing



**Measure your  
Reachability  
with RIPE Atlas**



# RIPE Atlas

From Wikipedia, the free encyclopedia

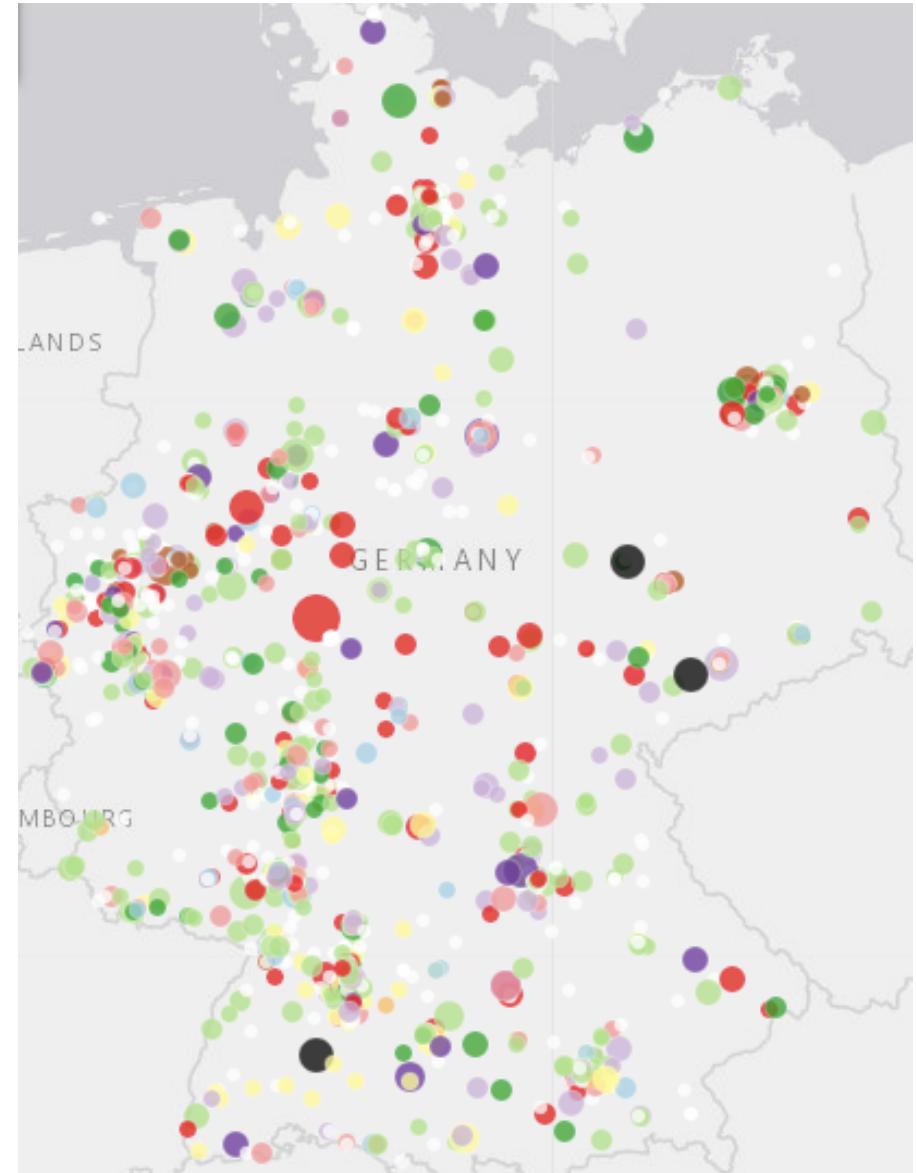
**RIPE Atlas** [↗](#) is a global, open, distributed Internet measurement platform, consisting of thousands of measurement devices that measure Internet connectivity in real time.



# RIPE Atlas Coverage in Germany



Country	Probes
Germany	1189
United States of America	1039
France	748
United Kingdom	593
Netherlands	506
Russia	498
Switzerland	283
Czech Republic	255
Italy	236
Ukraine	206

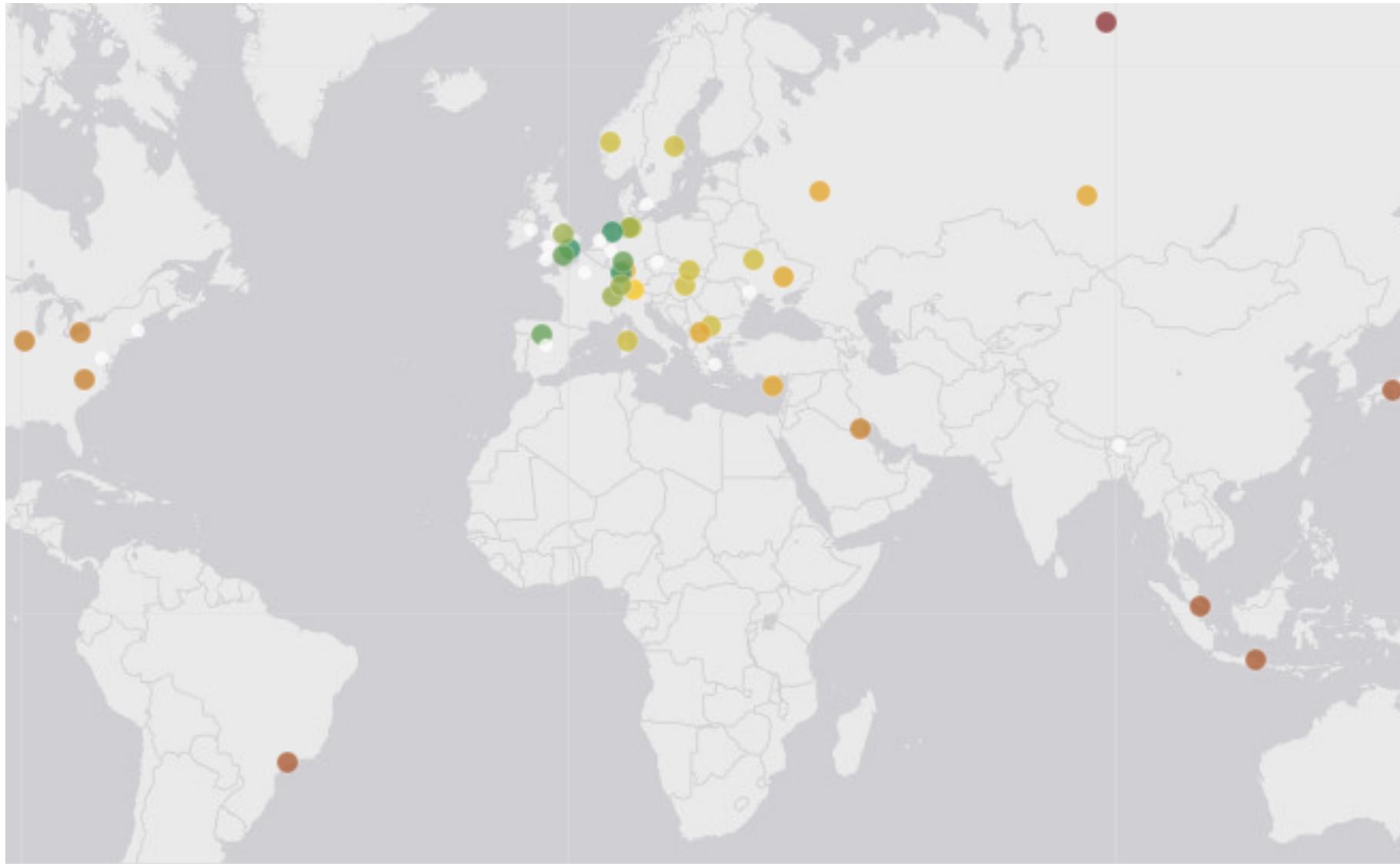




# Most Popular Features

- 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
- New: “Time Travel”, LatencyMON, DomainMON
- Roadmap shows what’s completed and coming

# Global Reachability Check: Traceroute



< 10 ms: 3   < 20 ms: 3   < 30 ms: 4   < 40 ms: 8   < 50 ms: 1   < 100 ms: 6   < 200 ms: 5   < 300 ms: 4   > 300 ms: 1



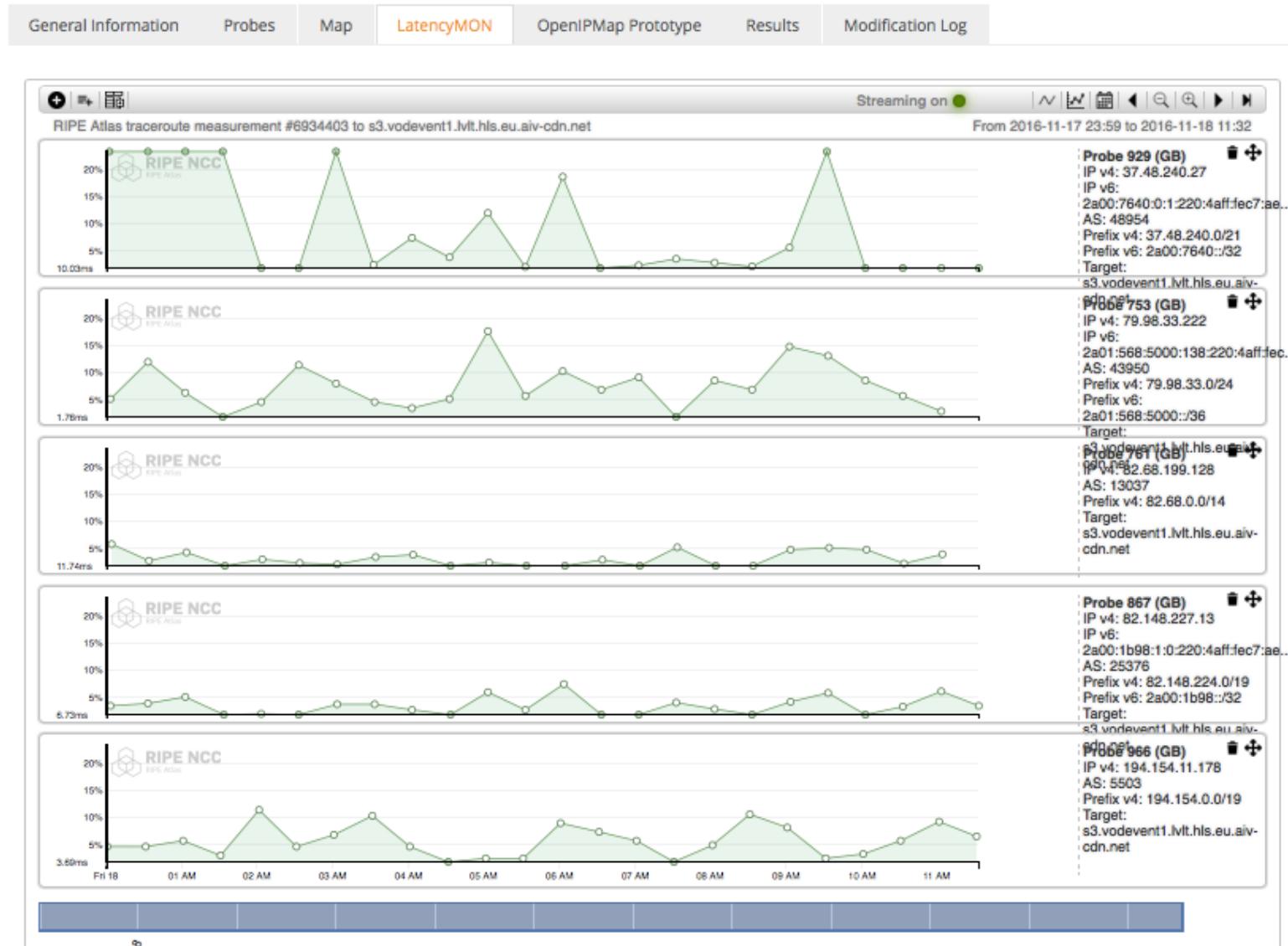
# Traceroute View: List

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	<div style="width: 33.192%; background-color: #90EE90;"></div>	14
2941	25394		🇩🇪	2016-11-18 10:51	50.783	<div style="width: 50.783%; background-color: #E6C931;"></div>	20
3055	6412		🇶🇦	2016-11-18 10:53	150.683	<div style="width: 150.683%; background-color: #90EE90;"></div>	15
3222	6829		🇳🇴	2016-11-18 10:49	36.686	<div style="width: 36.686%; background-color: #E69138;"></div>	24
4166	50581		🇺🇦	2016-11-18 10:52	39.533	<div style="width: 39.533%; background-color: #90EE90;"></div>	16
4554	6703		🇺🇦	2016-11-18 10:51	82.704	<div style="width: 82.704%; background-color: #E6C931;"></div>	19
4952	3244		🇮🇷	2016-11-18 10:51	35.700	<div style="width: 35.700%; background-color: #E6C931;"></div>	19
6078	202040	202040	🇩🇪	2016-11-18 10:47	9.279	<div style="width: 9.279%; background-color: #90EE90;"></div>	14
6091	5459	5459	🇬🇧	2016-11-18 10:50	9.719	<div style="width: 9.719%; background-color: #90EE90;"></div>	14
6112	197216	197216	🇱🇻	2016-11-18 10:52	33.767	<div style="width: 33.767%; background-color: #90EE90;"></div>	11
6139	18106	18106	🇵🇱	2016-11-18 10:47	216.946	<div style="width: 216.946%; background-color: #E6C931;"></div>	19
10166	5379		🇲🇰	2016-11-18 10:49	60.850	<div style="width: 60.850%; background-color: #E6C931;"></div>	19
10282	49009	49009	🇩🇪	2016-11-18 10:47	32.699	<div style="width: 32.699%; background-color: #90EE90;"></div>	11
10312	11426		🇺🇸	2016-11-18 10:49	116.443	<div style="width: 116.443%; background-color: #E69138;"></div>	29



# Traceroute View: LatencyMon

⚡<sup>4</sup> Traceroute measurement to s3.vodevent1.lvt.hls.eu.aiv-cdn.net



# 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 measure traceroute --probes 2 --target google.ca
```



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

<https://atlas.ripe.net/measurements/3499936/>

Connecting to stream...

#### Probe #3837

1	192.168.8.254	2.748 ms	1.931 ms	1.982 ms
2	77.51.191.254	3.286 ms	3.051 ms	3.076 ms
3	172.27.8.174	4.421 ms	4.775 ms	4.694 ms
4	77.37.254.129	5.48 ms	5.363 ms	6.52 ms
5	72.14.209.81	4.37 ms	4.232 ms	4.183 ms
6	209.85.240.209	47.099 ms	46.705 ms	41.563 ms
7	209.85.240.102	23.207 ms	23.001 ms	22.993 ms
8	209.85.249.59	40.565 ms	40.454 ms	40.004 ms
9	209.85.254.198	62.337 ms	45.201 ms	44.595 ms
10	216.239.49.28	44.999 ms	44.887 ms	44.907 ms
11	*	*	*	*
12	173.194.65.94	77.313 ms	82.476 ms	83.303 ms

#### Probe #16731

1	192.168.80.254	0.582 ms	0.483 ms	0.413 ms
2	188.134.205.225	0.79 ms	0.683 ms	0.684 ms
3	84.16.101.226	1.13 ms	1.169 ms	1.114 ms
4	86.61.255.241	5.503 ms	5.711 ms	5.629 ms
5	91.210.16.211	5.753 ms	5.307 ms	5.579 ms
6	216.239.56.169	13.419 ms	13.358 ms	13.243 ms
7	209.85.249.59	17.211 ms	17.261 ms	17.227 ms

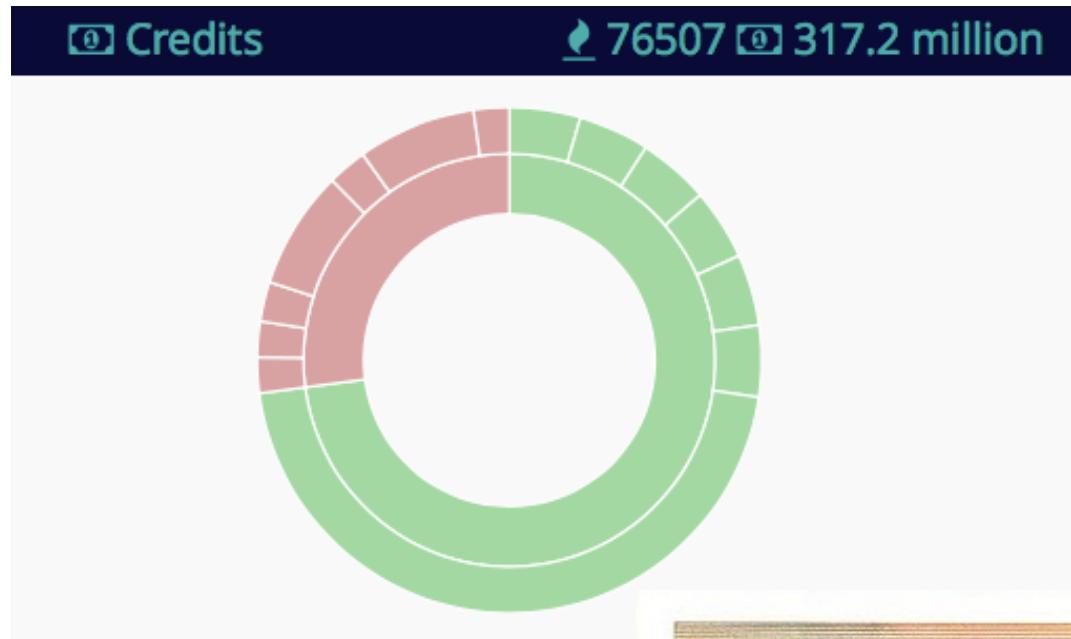


# RIPE Atlas CLI ToolSet

- Network troubleshooting from command line
- Familiar output (ping, dig, traceroute)
- Installation for Linux/OSX & Windows  
[experimental]
- Included in OpenBSD, FreeBSD, Gentoo, Arch, Debian, Ubuntu, Fedora
- Documentation
- Source code available, contributions welcome!



# Who Wants to be a Millionaire?





# “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
- **Or: don't spend credits - use existing data!**

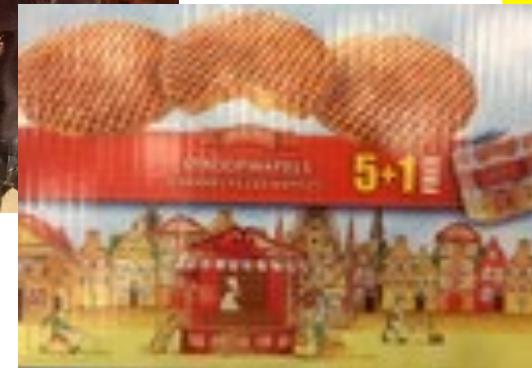
# Take Part in Hackathons



RIPE ATLAS HACKATHON:



AUTOMATE ALL THE THINGS





# Any Questions on How to... ?

- Help community to shape RIPE policies
- Use RIS for your BGP monitoring
- Measure your reachability with RIPE Atlas





# Extra Material



# Monitoring Using RIPE Atlas

- Integrate “status checks” with existing monitoring tools (such as Icinga)
- Using real-time data streaming
  - Server monitoring
  - Detecting and visualising outages
- Developed by community: “RIPE Atlas Monitor”



# RACI

RIPE Academic Cooperation Initiative

- Students and researchers:
  - Present your Internet-related research at RIPE Meetings
  - Complimentary tickets, travel and accommodation
  - Topics: network measurement and analysis, security, IPv6 deployment, BGP routing, Internet governance, peering and interconnectivity
- [ripe.net/raci](http://ripe.net/raci)



- Publish your research or use case
- Reach out to RIPE Community
- Read about latest analysis or conferences
- [labs.ripe.net](http://labs.ripe.net)