RIPE NCC
RIPE NETWORK COORDINATION CENTRE

RIPE Atlas for Network Researchers

emile.aben@ripe.net | TMA Phd School | June 2017

NORTH
AMERICA
SOUTH
AMERICA
EUROPE
ASIA
AFRICA
AUSTRALIA
Atlantic
Ocean
Pacific
Ocean
Pacific
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Ocean
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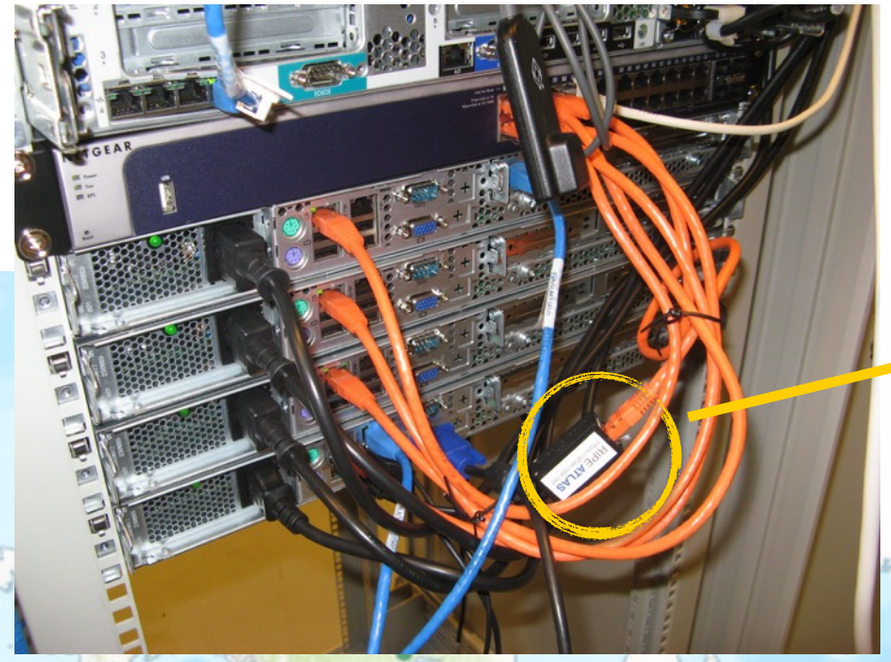
GEAR
RIPE ATLAS

NORTH AMERICA
SOUTH AMERICA
AFRICA
ASIA
AUSTRALIA
Atlantic Ocean
Pacific Ocean
Pacific Ocean
Indian Ocean
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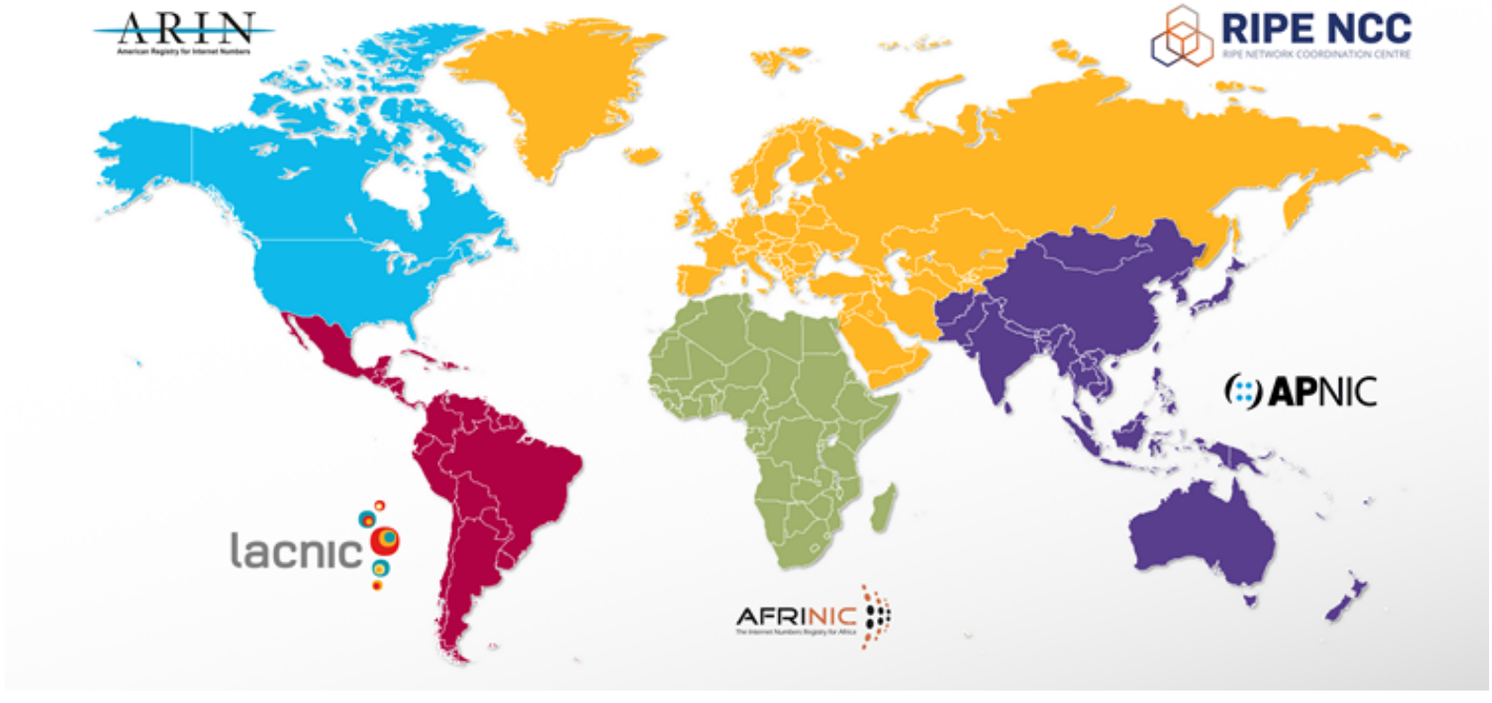
Before We Start

- You need a RIPE NCC Access account:
  - access.ripe.net
- Measurement credits voucher: DATAHUNGRY
  - https://atlas.ripe.net/user/credits/#!redeem
  - https://atlas.ripe.net/user/credits/

… While You Create Your Account

- What is RIPE NCC?
- What does it have to do with research?



Introduction to RIPE Atlas

RIPE Atlas

RIPE Atlas – Wikipedia, the free encyclopedia

https en.wikipedia.org/wiki/RIPE_Atlas

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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

What is RIPE Atlas?

- Goal: Improve Internet through measurements

- Probes hosted by volunteers

  “For the community, by the community”

- Data publicly available

What is RIPE Atlas?

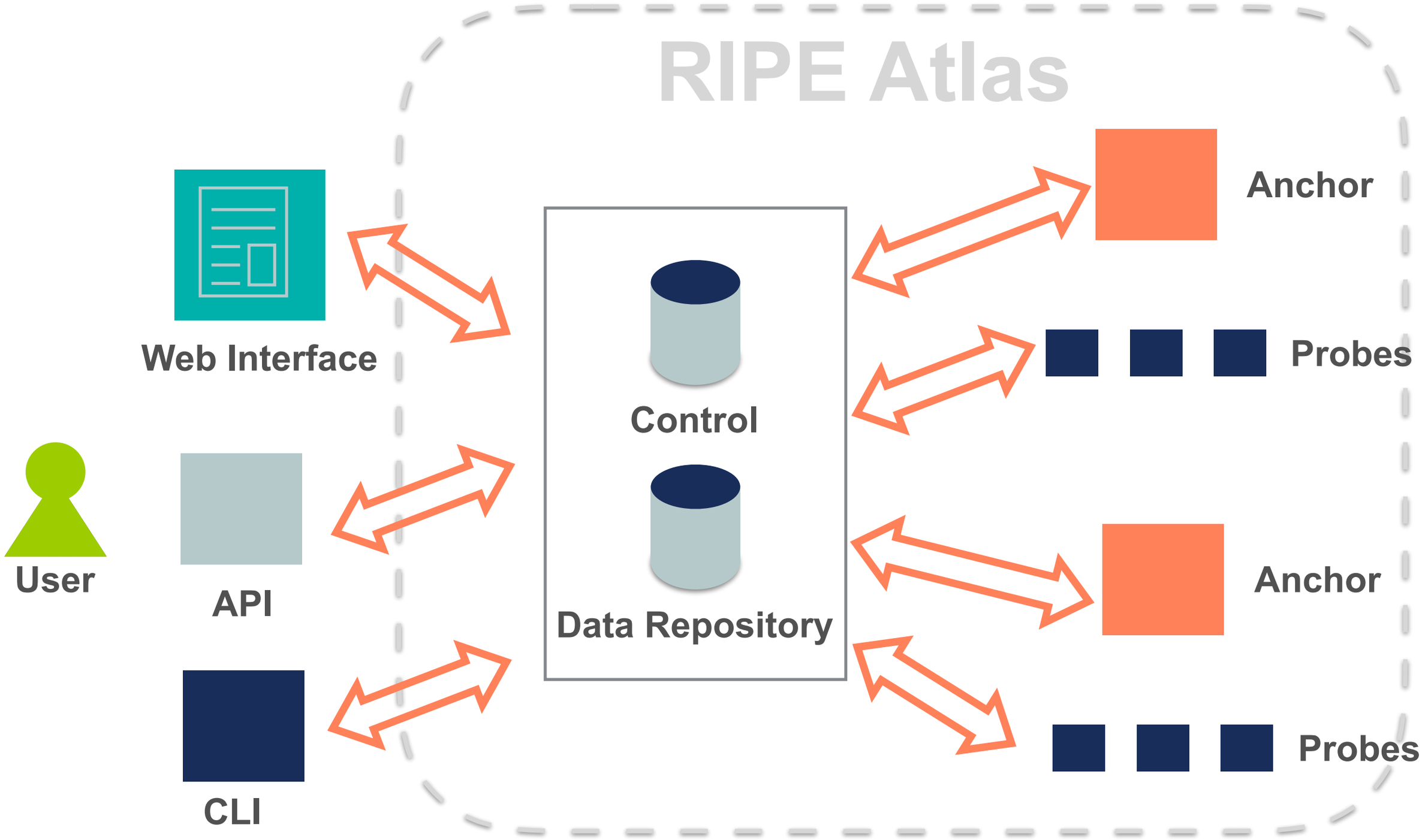
RIPE Atlas Probes

- Regular probes (version 1,2,3)
  - Small form factor boxes

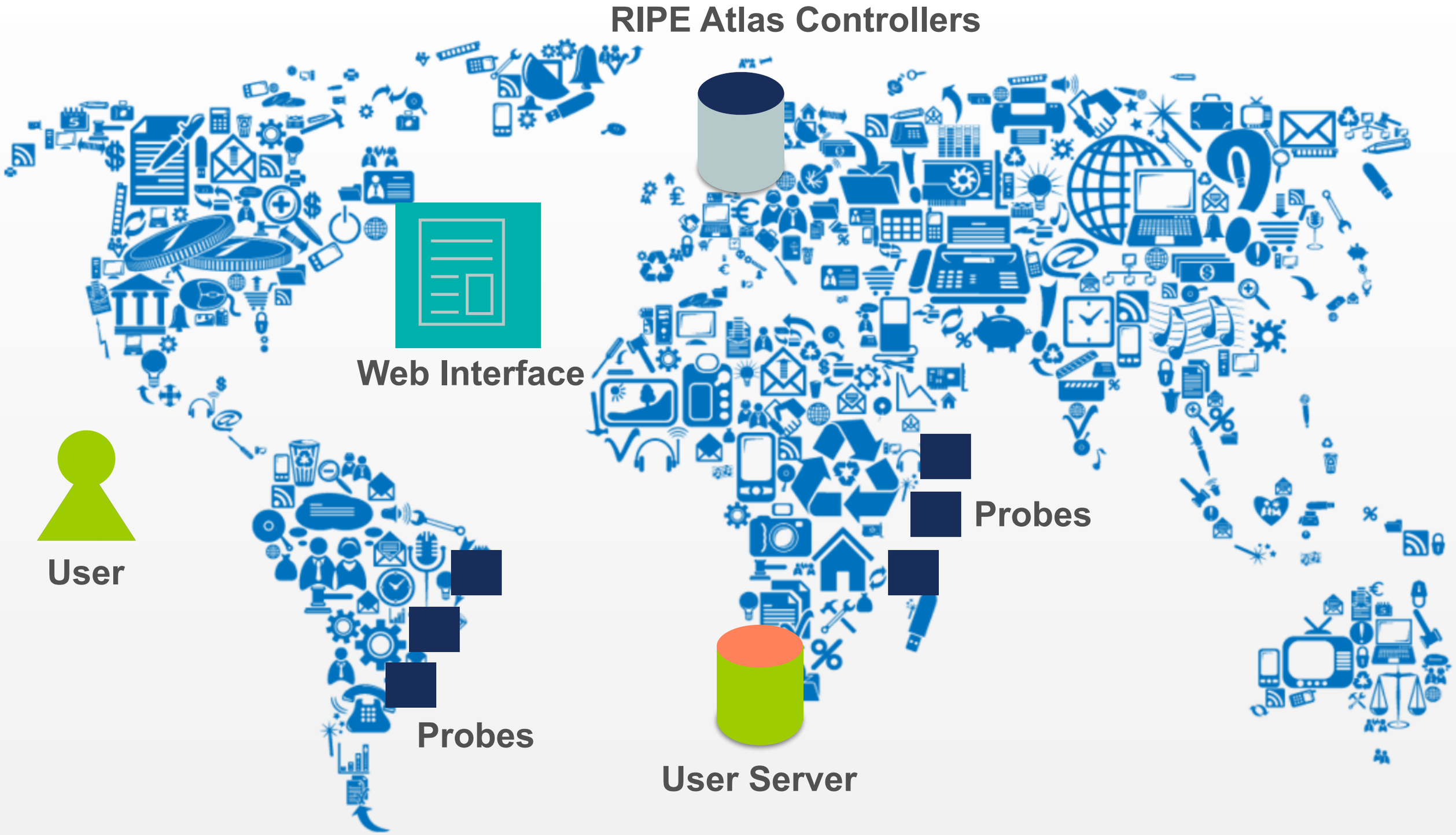
- RIPE Atlas anchors
  - 1U servers (Soekris)

- Future: virtual machine probes?
  - Interested?

RIPE Atlas Overview (1)



RIPE Atlas Overview (2)



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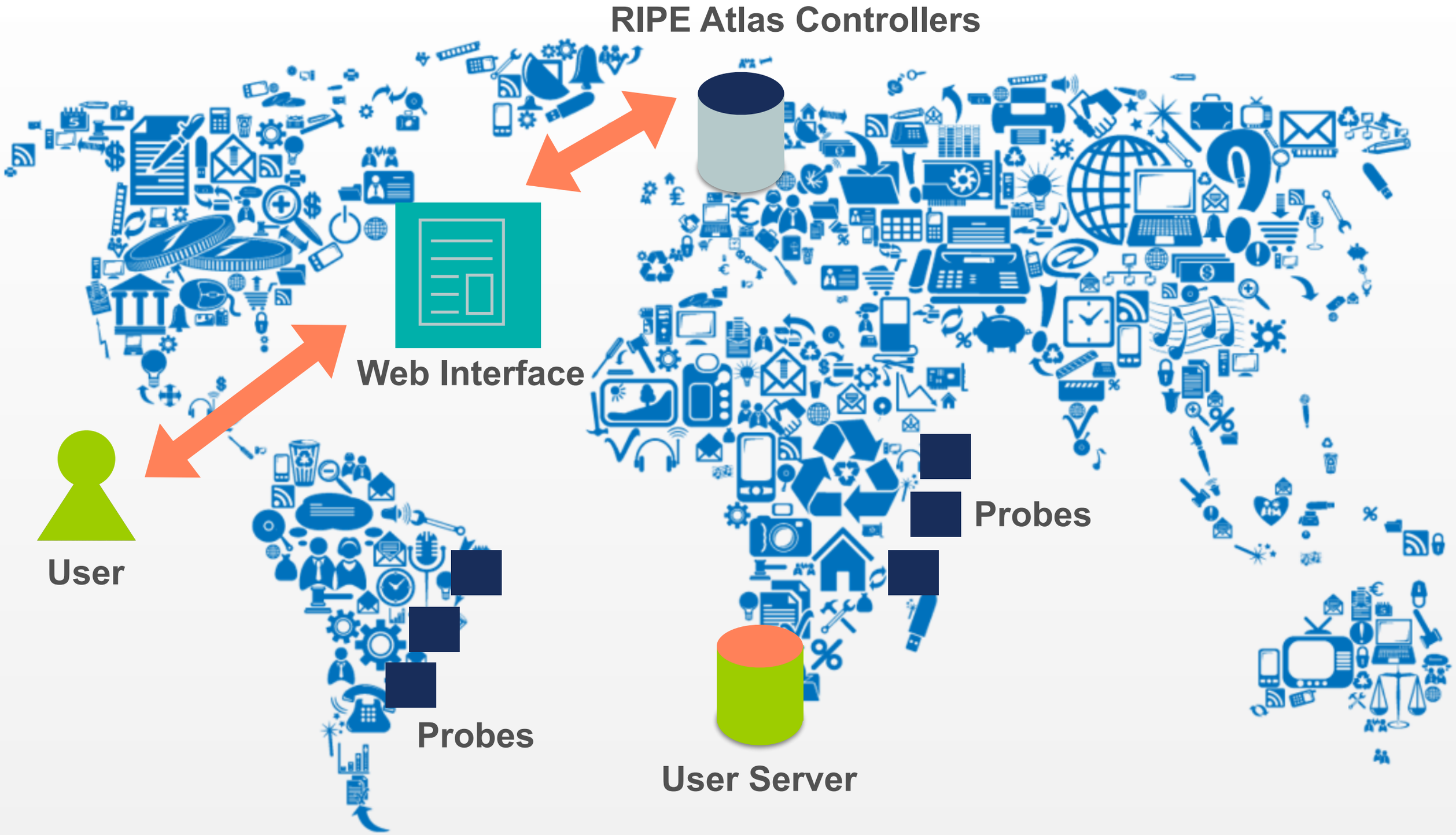

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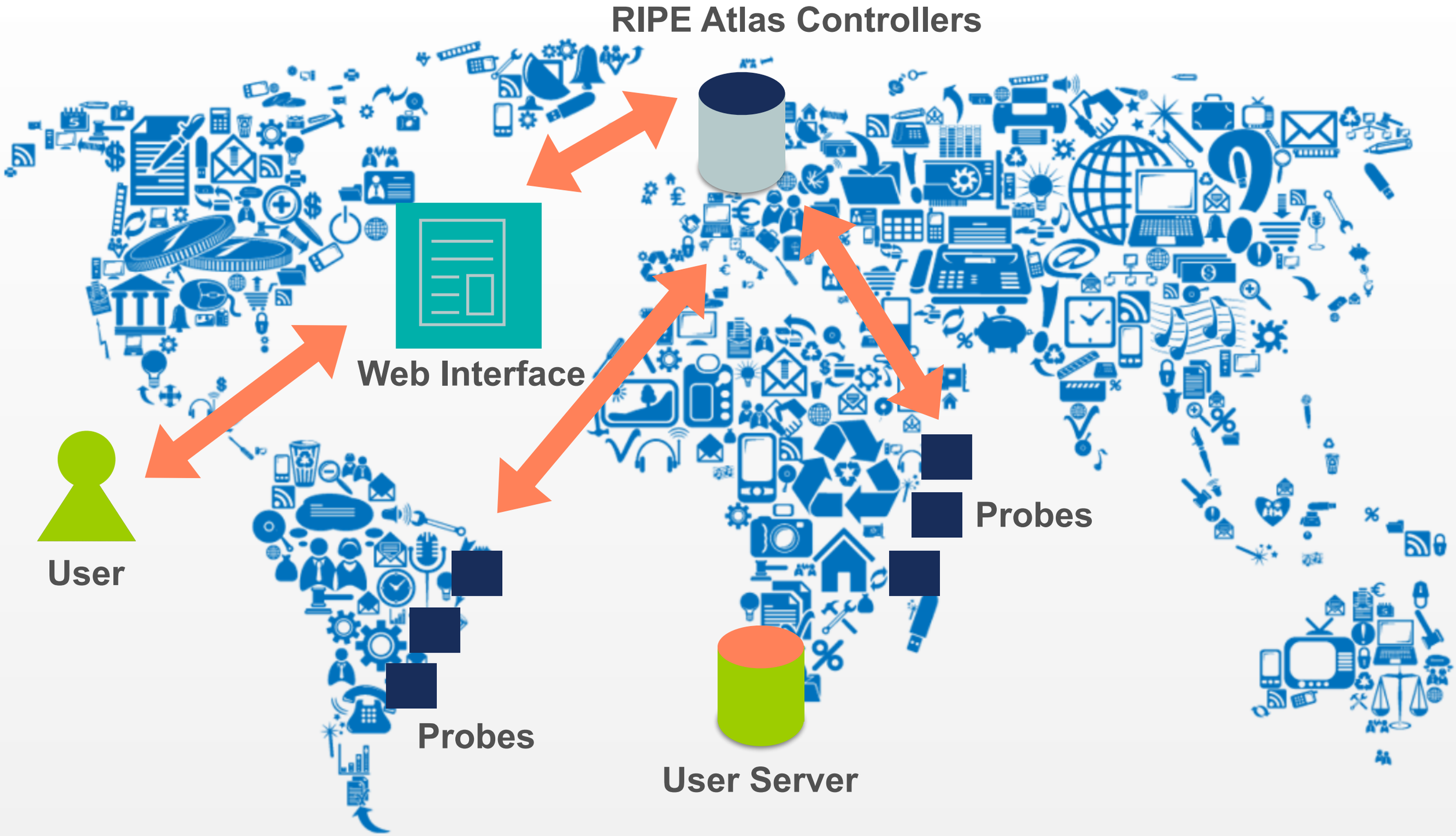

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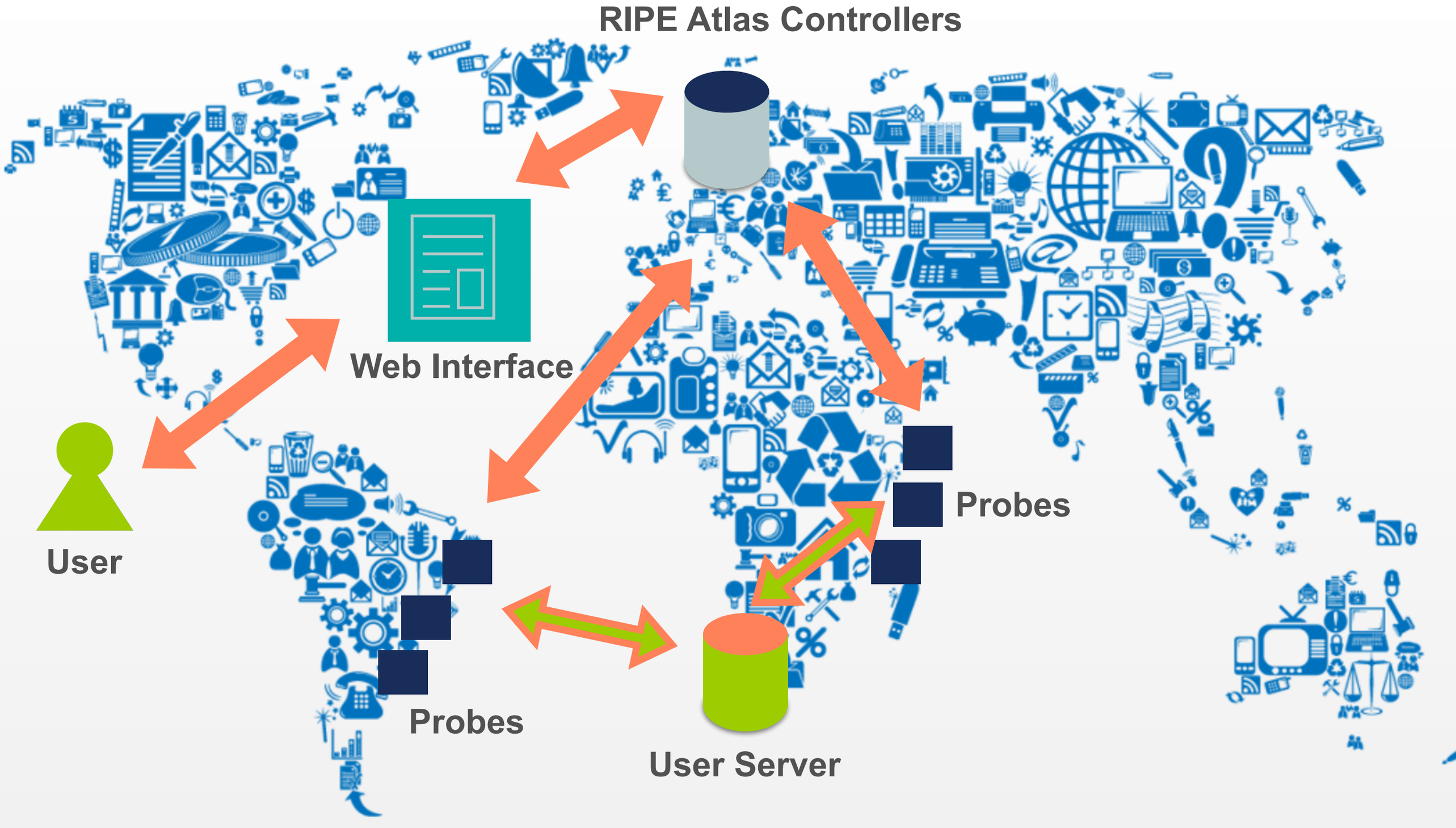
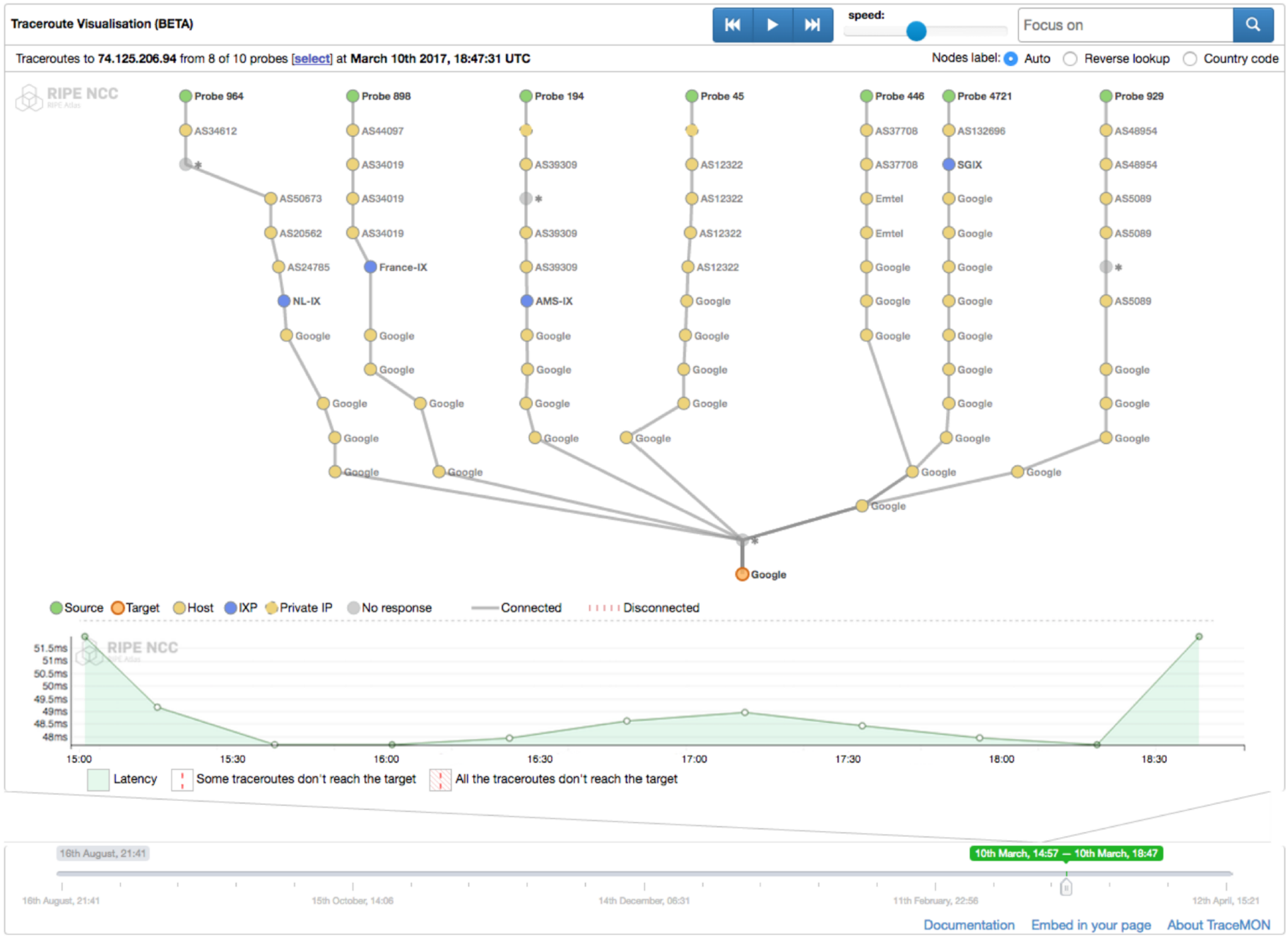


Most Popular Features

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

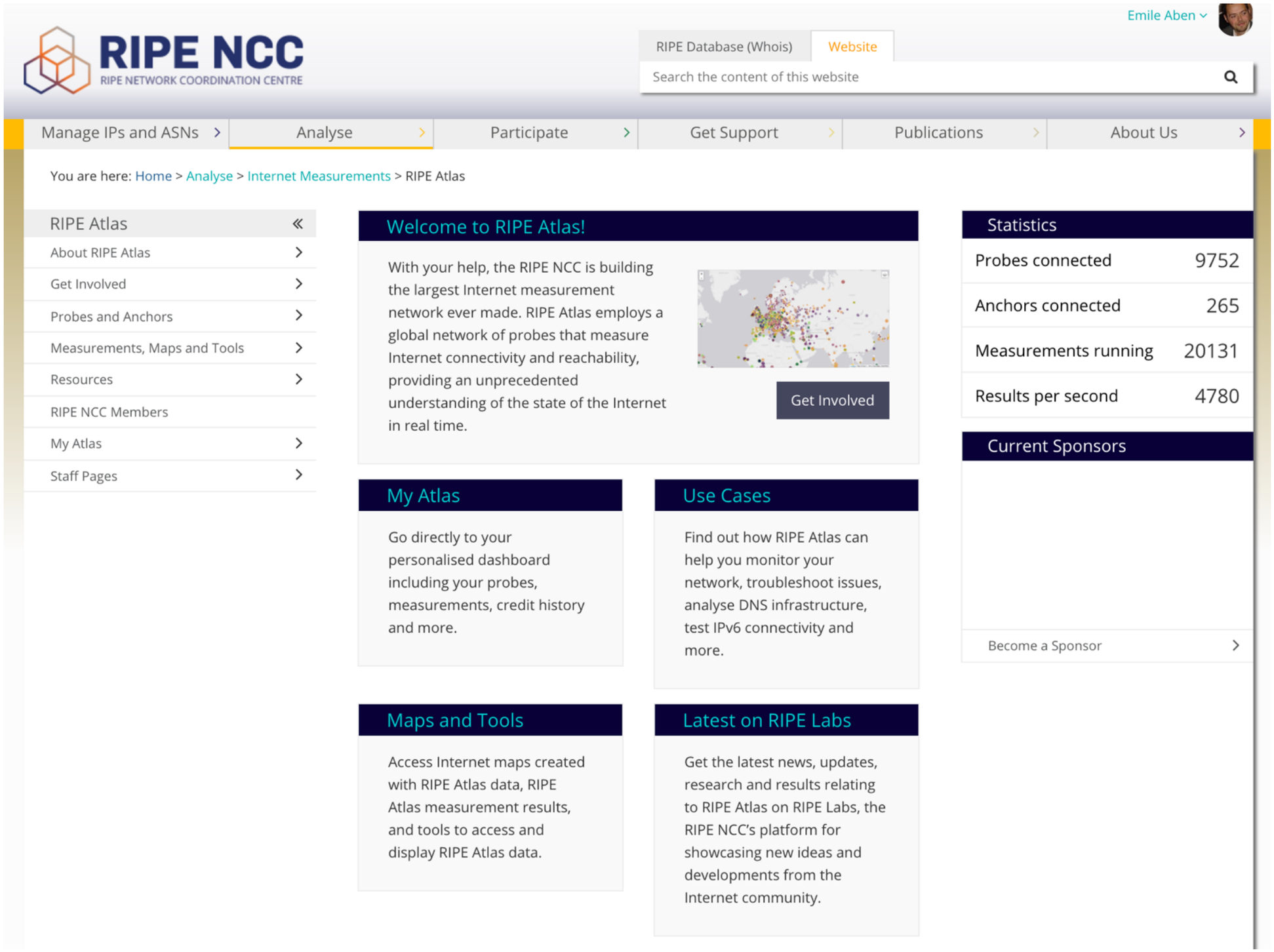
Tracemon


Traceroute Visualisation (BETA)
speed:
Focus on
Traceroutes to 74.125.206.94 from 8 of 10 probes [select] at March 10th 2017, 18:47:31 UTC
Nodes label: Auto Reverse lookup Country code
RIPE NCC
Probe 964
AS34612
AS50673
AS20562
AS24785
NL-IX
Google
Probe 898
AS44097
AS34019
AS34019
AS34019
France-IX
Google
Probe 194
AS39309
AS39309
AS39309
AMS-IX
Google
Probe 45
AS12322
AS12322
AS12322
AS12322
Google
Probe 446
AS37708
AS37708
Emtel
Emtel
Google
Probe 4721
AS132696
SGIX
Google
Probe 929
AS48954
AS48954
AS5089
AS5089
AS5089
Source Target Host IXP Private IP No response Connected Disconnected
51.5ms
51ms
50.5ms
50ms
49.5ms
49ms
48.5ms
48ms
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
Latency
Some traceroutes don't reach the target
All the traceroutes don't reach the target
16th August, 21:41
10th March, 14:57 — 10th March, 18:47
16th August, 21:41
15th October, 14:06
14th December, 06:31
11th February, 22:56
12th April, 15:21
Documentation
Embed in your page
About TraceMON

Interfaces

- Web UI
  - https://atlas.ripe.net/
  - https://atlas.ripe.net/docs/
- API
  - https://atlas.ripe.net/api/v2/root/
  - https://atlas.ripe.net/docs/api/v2/reference/
  - https://atlas.ripe.net/docs/api/v2/manual/
- Command Line Interface
  - https://github.com/RIPE-NCC/ripe-atlas-tools

Interface: https://atlas.ripe.net/



Programming Interfaces

- Python
  - ripe.atlas.cousteau : Interfacing with RIPE Atlas APIs
  - ripe.atlas.sagan : Interfacing with RIPE Atlas results
- Community contributions:
  - https://github.com/RIPE-Atlas-Community/

RIPE Atlas Probes

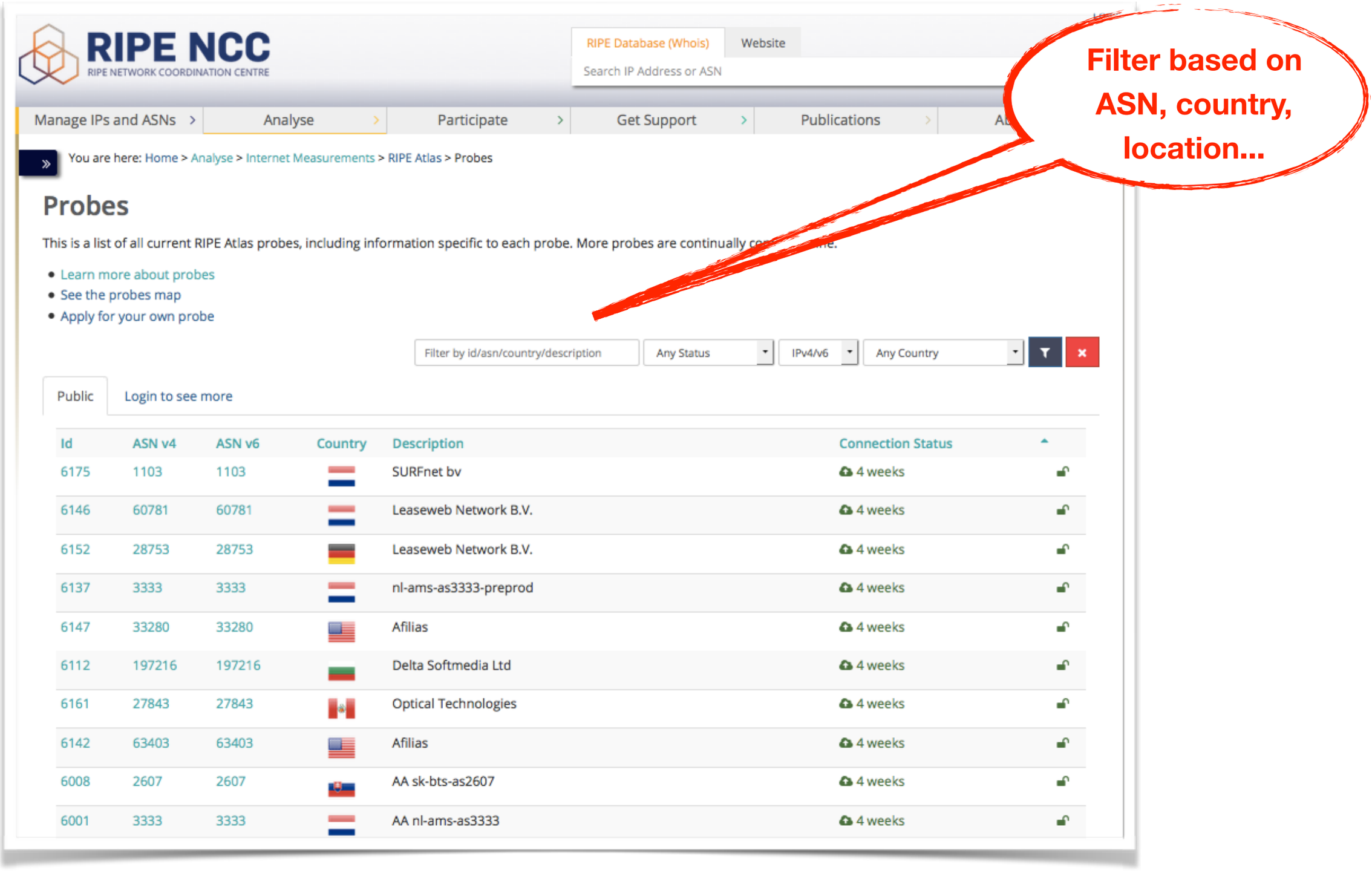
Technical Specifications

- v1 and 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

Searching for Probes



Filter based on ASN, country, location...

Searching For Probes (API)

- https://atlas.ripe.net/docs/api/v2/reference/#!/probes

Parameters

Parameter	Value	Description	Parameter Type	Data Type
optional_fields		Include additional fields named in comma-separated values in response.	form	enum
country_code	IE		query	string
id__lt		filter on id being less than value.	query	integer
id__lte		filter on id being less than or equal to value.	query	integer
id__gte		filter on id being greater than or equal to value.	query	integer
id__gt		filter on id being greater than value.	query	integer
id__in		filter on id being one of comma-separated values.	query	string
latitude		filter on the latitude equaling the exact supplied float value.	query	string
latitude__lt		filter on the latitude being less than values (south to).	query	string
latitude__lte		filter on the latitude being less than or equal to value (south of).	query	string
latitude__gte		filter on the latitude being greater than or equal to value (north of).	query	string
latitude__gt		filter on the latitude being greater than value.	query	string
longitude		filter on the longitude equaling the exact supplied float value.	query	string
longitude__lt		filter on the longitude being less than the value.	query	string
longitude__lte		filter on the longitude being less than or equal to value (to the west of).	query	string
longitude__gte		filter on the longitude being greater than or equal to value (to the east of).	query	string
longitude__gt		filter on the longitude being greater than to value (to the east of).	query	string
asn		filter on probes announced by the autonomous system with the name of value. This field is useful for filtering when you don't care about IP version.	query	string
asn_v4		filter on probes with an IPv4 address announced by an autonomous system with a particular number.	query	string
asn_v4__in		filter on probes with an IPv4 address announced by one of the autonomous systems in a comma-separated list.	query	string

Probe Page

Probe Page

Probe #10010 (Register)

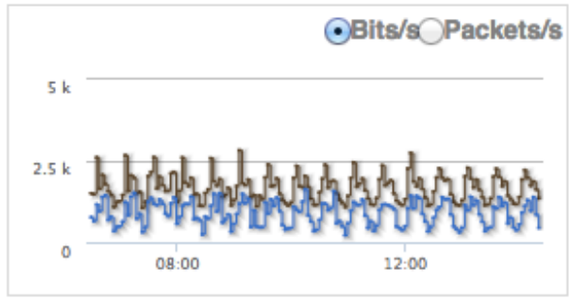
General | Network | Built-in Measurements | User-defined Measurements

General Information

Edit

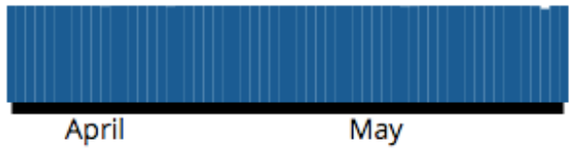
Id	10010
MAC Address	F8:D1:11:A9:F3:2C
Architecture	tl-mr3020
Firmware Version	4680 (1070)
Router Type	
Bandwidth Limit	Not set
DNS Entry	Off
Shared Publicly	Yes
User Tags	NAT, Chello 200MB
System Tags	V3, Resolves A Correctly, Resolves AAAA Correctly, IPv4 Works, Auto GEOIP city, IPv4 Capable, IPv4 RFC1918

Connection & Traffic



Connected Time

3 days, 9 hours



Management Sharing

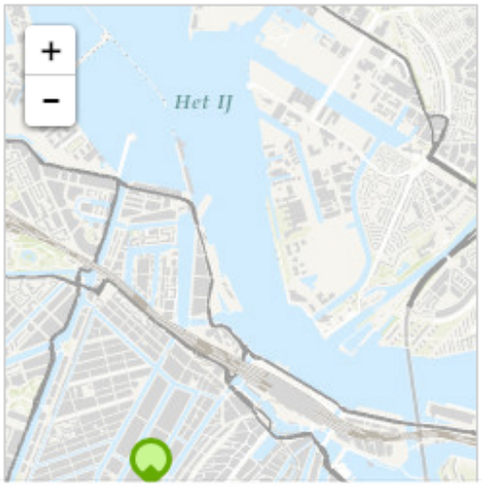
Edit

Only the probe host is permitted to administer this probe.

The displayed location is an automatic best guess of the **city** based on IP address.

By manually setting a more accurate location you can help to improve the usefulness and correctness of RIPE Atlas.

Update Location



Probe Page

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Architecture	tl-mr3020
Firmware Version	4680 (1070)
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Bandwidth Limit	Not set
DNS Entry	Off
Shared Publicly	Yes
User Tags	NAT, Chello 200MB
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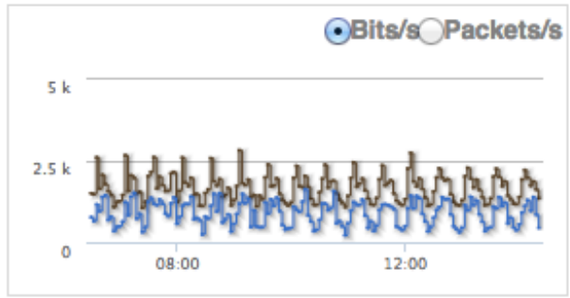
Connection & Traffic



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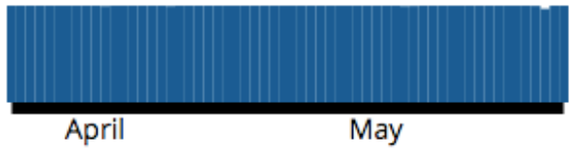

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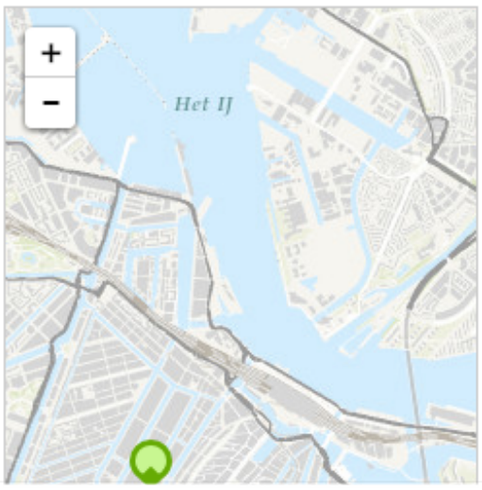

set by probe host

Management Sharing

Edit

Only the probe host is permitted to administer this probe.

Probe Page

Probe #10010 (Register)

General | Network | Built-in Measurements | User-defined Measurements

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Edit

Id	10010
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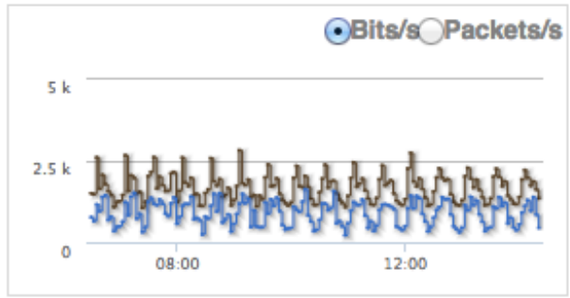
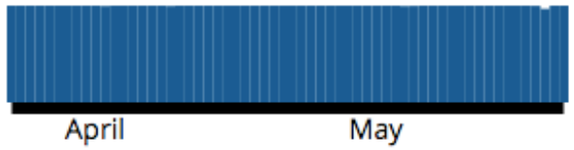
Connection & Traffic



Connected Time

3 days, 9 hours



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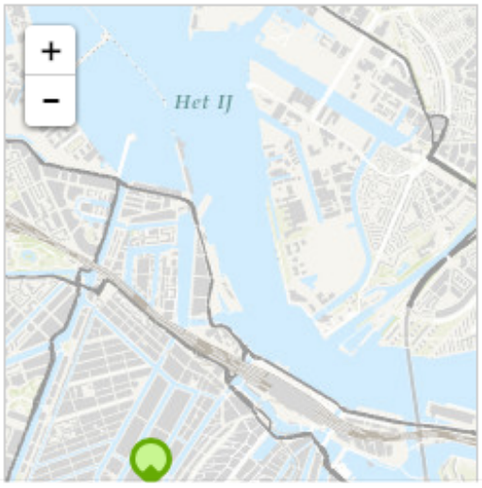


set by probe host

set by system

Management Sharing

Edit

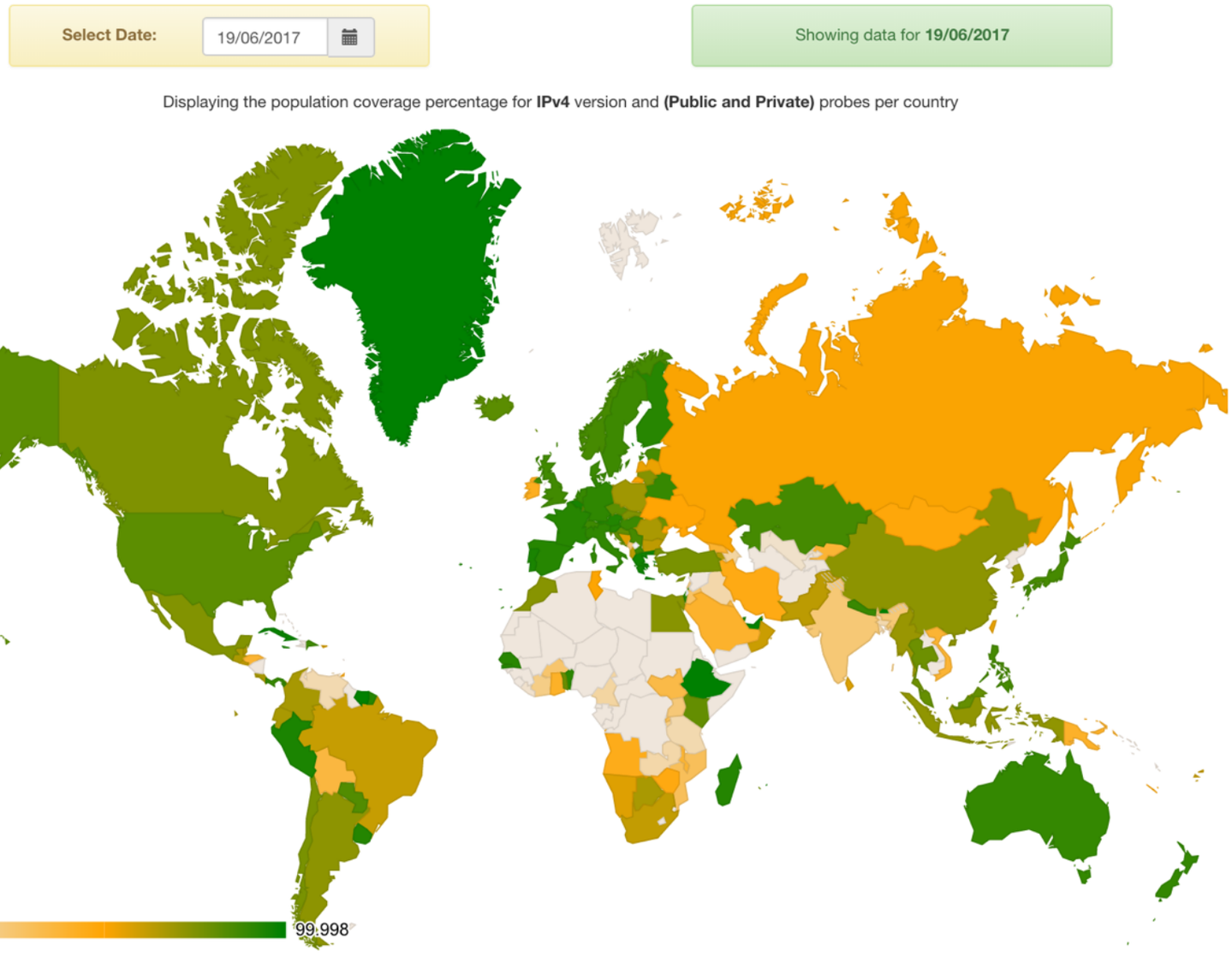
Only the probe host is permitted to administer this probe.

Probe IDs

- Example for probeID ***4***
  - UI: https://atlas.ripe.net/probes/4
  - API: https://atlas.ripe.net/api/v2/probes/4
  - CLI: ripe-atlas probe-info 4
- Probe type embedded in ID:
  - < 6000 : Probe v1,v2
  - 6000-10000 : Anchors
  - > 10000 : Probes v3

Probes - Where users are?

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



RIPE Atlas Measurements

RIPE Atlas Measurements

- **Built-in** global measurements towards root nameservers
  - Visualised as Internet traffic maps
- **Built-in** regional measurements towards “anchors”
- **Users** can run customised measurements
  - ping, traceroute, DNS, SSL/TLS, NTP and HTTP

“Measurements”

- Beware: “measurement” is ambiguous!
- Could be a
  - Measurement specification
  - Measurement result

Measurement Specification

- A RIPE Atlas “measurement specification” is:
  - A number of sources (1-all probes)
  - A single destination (by hostname or IP)
  - For a given IP protocol (IPv4/IPv6)
  - For a given measurement type (ping, traceroute, DNS…)
  - At a given interval (or as a one-off)

RIPE Atlas Measurement IDs

- UI
  - https://atlas.ripe.net/measurements/
  - https://atlas.ripe.net/measurements/<msm_id>
- API
  - https://atlas.ripe.net/api/v2/measurements/<msm_id>/
  - https://atlas.ripe.net/api/v2/measurements/<msm_id/results
- CLI
  - ripe-atlas measurement-info <msm_id>
  - ripe-atlas report <msm_id>

UI

Traceroute measurement to hu-bud-as12303.anchors.atlas.ripe.net

General Information | Probes | Map | TraceMON (beta) | OpenIPMap Prototype | Results | Modification Log

General Information

ID	#8754060
Group ID	#8754060
Type	Traceroute
Owner	Emile Aben
Charge credits to	Emile Aben
Public measurement?	Yes
Target	hu-bud-as12303.anchors.atlas.ripe.net
Resolve on Probe	No
This is a one-off measurement	
Timing	2017-05-17 12:52 - 2017-05-17 13:00
Costs	60 per result, 60 per day
Response timeout	4000
Protocol	TCP
Paris	16
Packets	3
Firsthop	255
Maxhops	255
Port	80
Size	0
Probe Fulfilment	Responsive **Total responsive:** 1 **Total allocated:** 1 **Total requested:** 1
Costs	Others

Anchoring Measurements

- From-To:
  - 100s of probes towards each RIPE Atlas anchor
  - All anchors in a mesh
- Types: ping, traceroute, HTTP

Anchoring Measurements

- UI
  - https://atlas.ripe.net/anchors/list/
  - https://atlas.ripe.net/anchors/map/
- API
  - https://atlas.ripe.net/api/v2/anchor-measurements/
  - https://atlas.ripe.net/api/v2/anchors/

Use Existing Measurements

- Many measurements already running!
- Search for existing public measurements first…
- Only then schedule your own measurement

RIPE Atlas Measurement Creation

Measurements Cost Credits

- Running measurements costs credits
  - ping = 3 credits, traceroute = 30, etc.
  - Why? Fairness and to avoid overload
  - Daily spending limit & max measurements user can create
  - Hosting a RIPE Atlas probe earns credits
- Get extra credits by:
  - Being a RIPE NCC member
  - Hosting an anchor
  - Sponsoring probes

How to Create a Measurement?

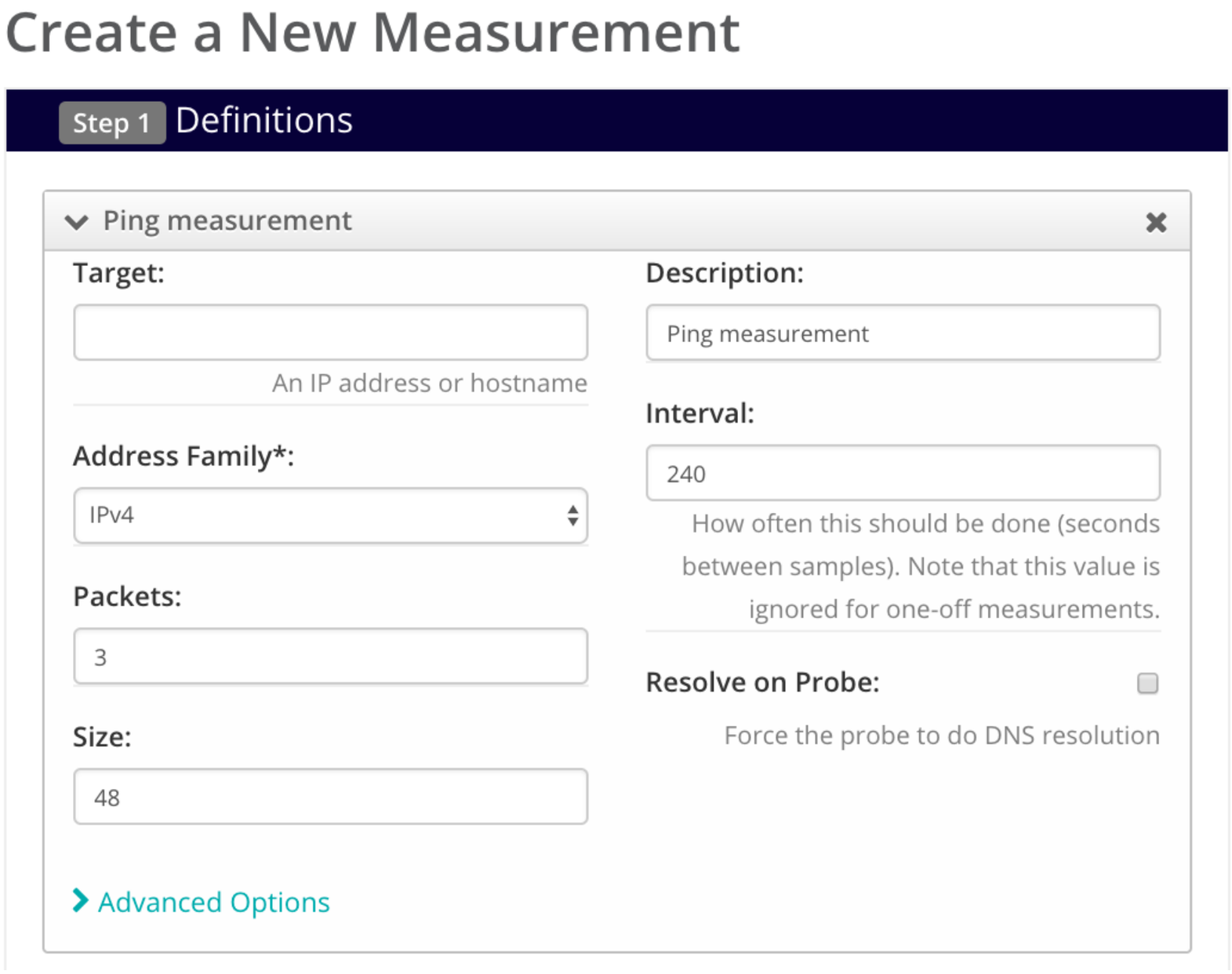
- UI or API

- Many options per measurement type!!

- Upon creation you'll get an ID back by which you can track the status and download the data

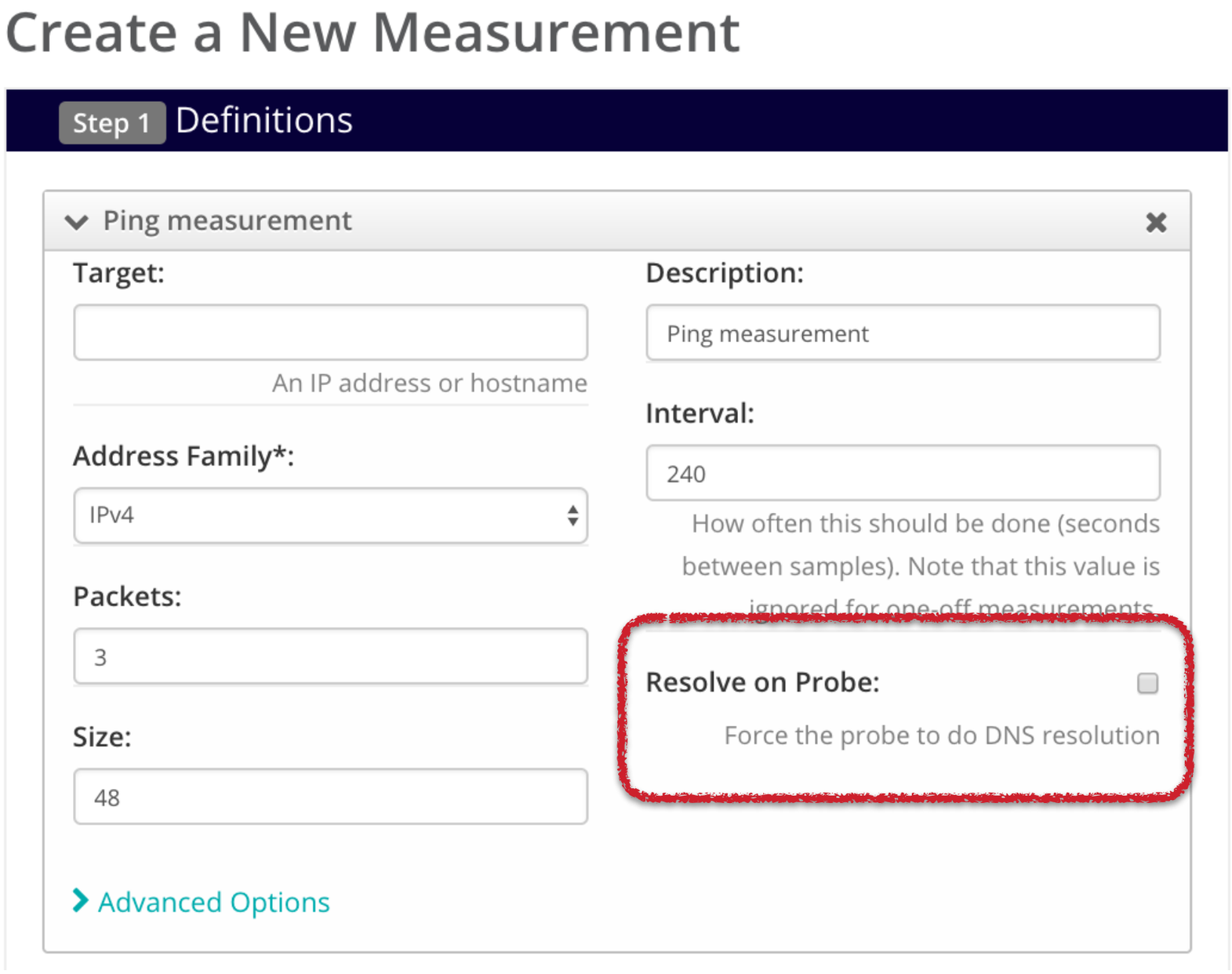
UI

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

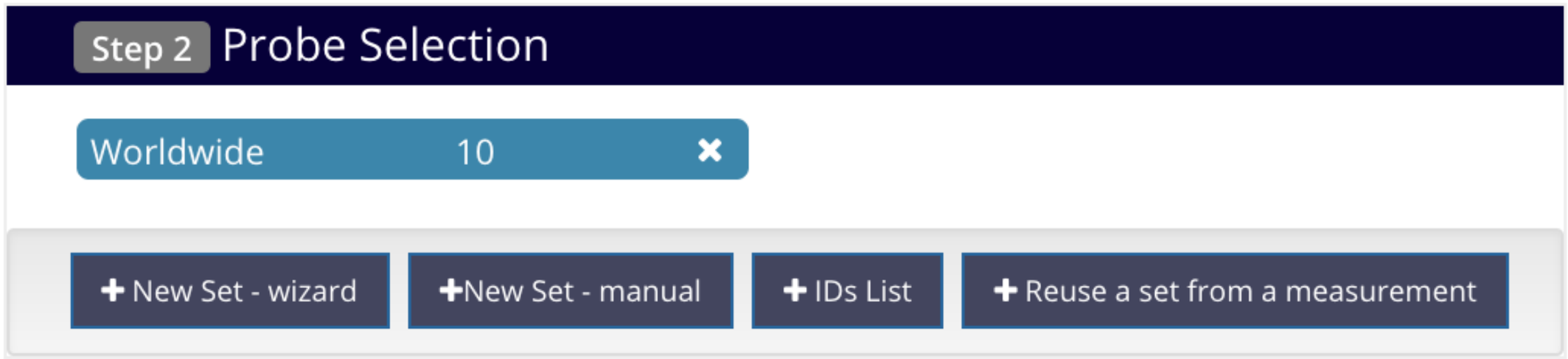


UI

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



UI (Probe Selection and Timing)



UI (Spec)

Measurement API Compatible Specification

```
curl --dump-header - -H "Content-Type: application/json" -H "Accept:
application/json" -X POST -d '{
 "definitions": [
  {
   "af": 4,
   "packets": 3,
   "size": 48,
   "description": "Ping measurement",
   "interval": 240,
   "resolve_on_probe": false,
   "skip_dns_check": false,
   "type": "ping"
```

Copy to clipboard

Create My Measurement(s)

API

- You'll need an API key
  - https://atlas.ripe.net/keys/
- POST a JSON measurement specification to
  - https://atlas.ripe.net/api/v2/measurements/?key=YOUR_KEY_HERE
- Probably easier: via Python library ripe.atlas.cousteau
  - https://ripe-atlas-cousteau.readthedocs.io/en/latest/use.html

API Example (with Cousteau)

```
from datetime import datetime
from ripe.atlas.cousteau import (
  Ping,
  Traceroute,
  AtlasSource,
  AtlasCreateRequest
)

ATLAS_API_KEY = ""

ping = Ping(af=4, target="www.google.gr", description="testing new wrapper")

traceroute = Traceroute(
    af=4,
    target="www.ripe.net",
    description="testing",
    protocol="ICMP",
)

source = AtlasSource(
    type="area",
    value="WW",
    requested=5,
    tags={"include":["system-ipv4-works"]}
)
source1 = AtlasSource(
    type="country",
    value="NL",
    requested=50,
    tags={"exclude": ["system-anchor"]}
)


atlas_request = AtlasCreateRequest(
    start_time=datetime.utcnow(),
    key=ATLAS_API_KEY,
    measurements=[ping, traceroute],
    sources=[source, source1],
    is_oneoff=True
)

(is_success, response) = atlas_request.create()
```

RIPE Atlas Measurement Results

Retrieving Measurement Results

- By Measurement ID

- Streaming

- Daily dumps (bulk downloads) ⟵ new!

By Measurement ID

- UI
  - https://atlas.ripe.net/measurements/<msm_id>/#!download
  - other tabs have visualisation of results
- API
  - https://atlas.ripe.net/api/v2/measurements/<msm_id>/results
- CLI
  - ripe-atlas report <msm_id>

RIPE Atlas Streaming

- **RIPE Atlas streaming** is an architecture that allows users to receive the measurement results as soon as they are sent by the probes - **in real time**
  - Publish/subscribe through web sockets (RFC 6455)

- There are two types of data:
  - Measurement results
  - Probe connection status events

Streaming Features

- Advanced filtering examples:
  - All data between 2017-01-01 and 2017-01-03
  - All measurements of a single type (“gimme all teh pings”)
  - All measurements towards an IP prefix

- Documented at:
  - https://atlas.ripe.net/docs/result-streaming/

Daily Dumps

- ftp://ftp.ripe.net/ripe/atlas/data
- https://labs.ripe.net/Members/petros_gigis/daily-atlas-results-dumps

Other Bulk Downloads

- Probe archive:
  - ftp://ftp.ripe.net/ripe/atlas/probes/archive/

- Measurement archive (specifications!):
  - ftp://ftp.ripe.net/ripe/atlas/measurements/

RIPE Atlas Community

Community

- **Ambassadors** help distribute probes at conferences, give presentations, etc.
- **Developers** contribute free and open software
- **Network operators** create measurements to monitor and troubleshoot
- **Researchers**/students use it to better understand the Internet

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← You!

How to Participate

- Use RIPE Atlas (and give us feedback)
- Talk with us about your (crazy?) ideas
- Share your research on RIPE Labs:
  - https://labs.ripe.net/
- Come to our meetings (RACI):
  - https://www.ripe.net/participate/ripe/raci
- Participate in a hackathon
- Collaborations? Internships?

Questions

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@meileaben

Not a typo!

For The Lab

- You need a RIPE NCC Access account:
  - access.ripe.net
- Measurement credits voucher: DATAHUNGRY
  - https://atlas.ripe.net/user/credits/#!redeem
  - https://atlas.ripe.net/user/credits/
- Think of a country!

Bonus Talking Points

- Demo!!
- OpenIPMap
- IXP-Country-Jedi