



**RIPE NCC**  
RIPE NETWORK COORDINATION CENTRE

# RIPE NCC Internet Measurement Tools

For the Good of the Internet

Adonis Stergiopoulos | GRNOG 15 | 25 October 2023

# RIPE NCC Strategy 2021–2026



- “Be a **centre of excellence for data, measurements and tools** that provide insight on the Internet and its operations”
- RIPE NCC Internet measurement tools and services:
  - RIPE Routing Information Service (RIPE RIS)
  - RIPEstat
  - RIPE Atlas



**RIPE RIS**

# RIPE Routing Information Service (RIPE RIS)



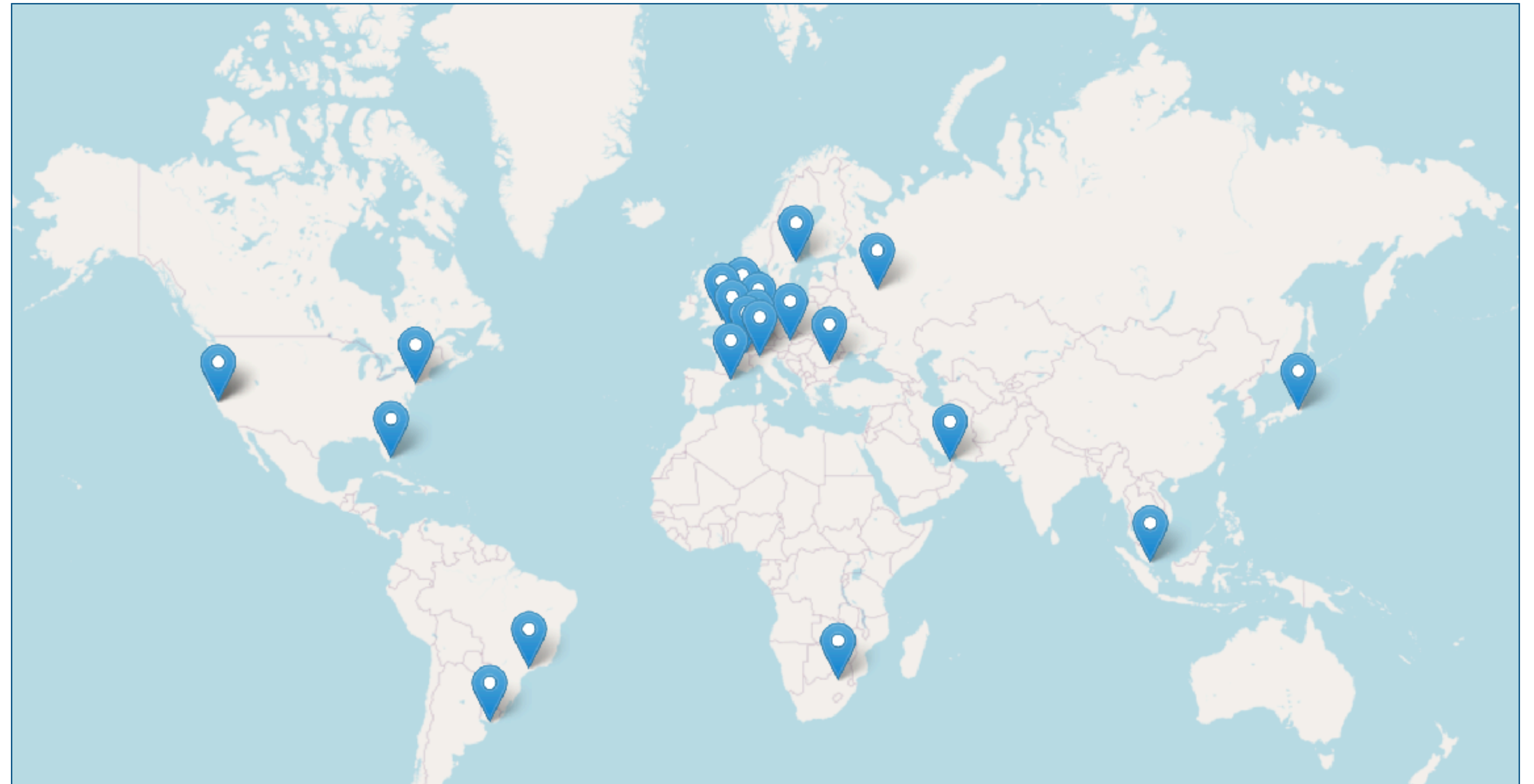
- RIPE RIS is a routing data collection platform
  - It collects raw BGP data from peers
  - and stores BGP messages and routing table dumps
- Historical and live data
  - Historical data since 1999
  - All (historical) data is publicly available



# Remote Route Collectors (RRCs)



- 23 Route collectors deployed at IXPs
  - 1500+ peering sessions
  - 600+ peer ASes
- They collect raw BGP data from peers



# Routing Information Service (RIS)



- Domestic and international connectivity through RIS

Figure 15:  
Connectivity between networks in Greece

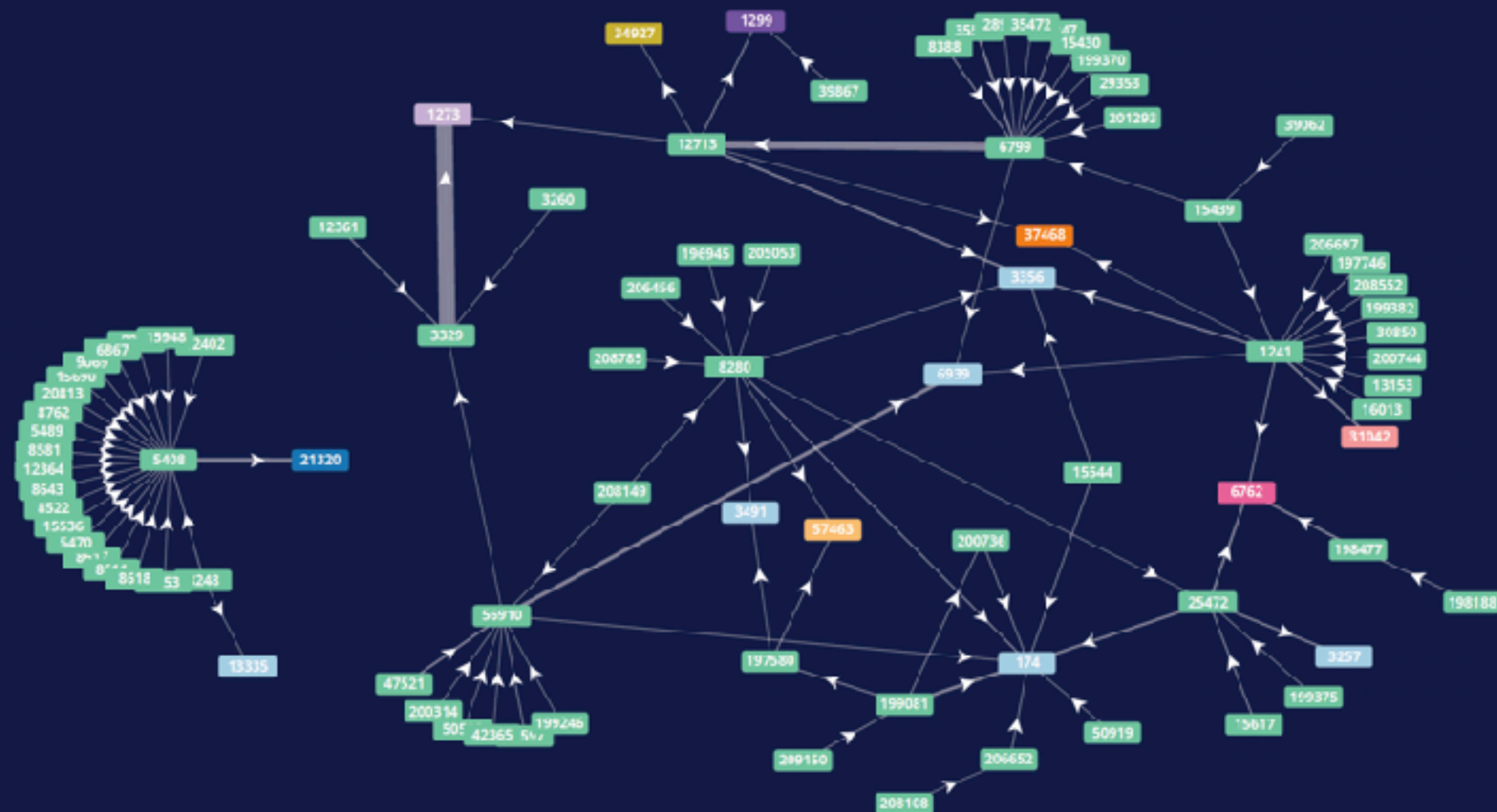
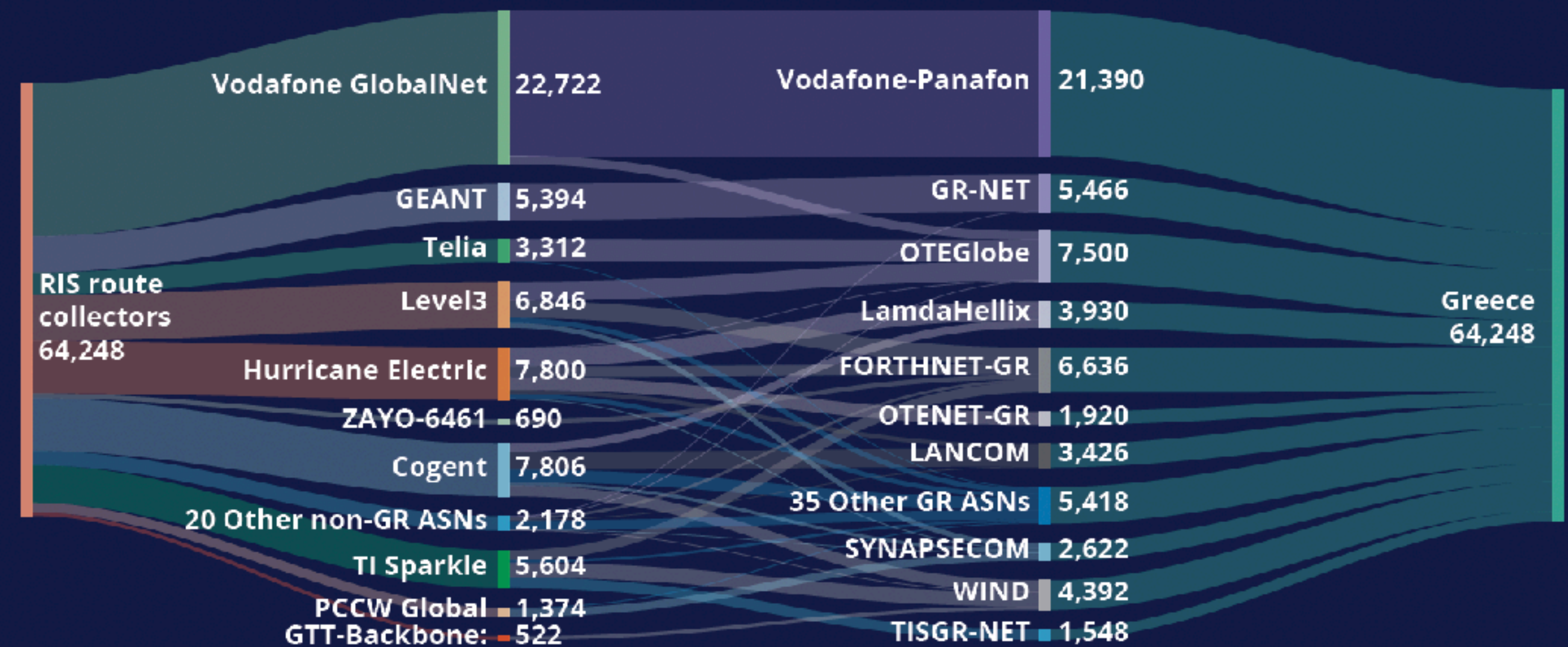


Figure 21:  
Greece's international connectivity



# Actual Routing Data



- RIS shows you what is really happening on the Internet
  - which AS is announcing which address block
  - and where it is visible
  - right now or in the past
- As opposed to information in the RIPE Database and other Routing registries:
  - Route object in the RIPE Database may be out of date
  - RIS includes real routing information
  - “Routing consistency check” tool can help with this

# Why Collect BGP Data?



- BGP doesn't have in-built security mechanisms and routing incidents are common
- Troubleshooting is difficult
  - Routing problems and Looking glasses are temporary
- BGP history is recorded to track what has happened
  - It allows operators to identify and address security risks
  - Better visibility → Greater security → Lower risk of a BGP attacks



# Who is RIS for?



- Network operators
  - To monitor Internet routing and to troubleshoot accidents
  - Build open source tools based on RIS Data
- Researchers
  - To investigate notable routing incidents (i.e. network disruptions in specific countries, service outages, etc.)
- Policy makers
  - To develop future plans based on routing trends

# How Can You Use RIS?



- Raw data - archived MRT files
- RIS Live - Live stream
- RISwhois - Whois query interface
- RIPEstat - Routing check, BGPlay visualisations
- Find more at ris.ripe.net



### Routing Information Service Live (RIS Live)

RIS Live is a feed that offers BGP messages in real-time. It collects information from the RIS Route Collectors (RRCs) and uses a WebSocket JSON API to monitor and detect routing events around the world. A non-interactive full stream ("firehose") is also available.

RIS Live is one way of accessing RIS, together with RIPEstat and the RIS Raw Data dumps. Any bug reports or queries should be sent to [rislive@ripe.net](mailto:rislive@ripe.net).

RIS Live has been used by some organisations for academic and research purposes. In 2017, [INSPIRE group](#) and [CAIDA](#) used RIS Live to develop [ARTEMIS](#), a real-time BGP hijack detection tool. It is also a backend for [BGPalerter](#), a real-time BGP monitoring tool, pre-configured for visibility loss and hijacks detection.

[Get started using the RIS Live Manual](#)

#### Demo

Subscriptions to the stream are sent as a JSON object containing various filter parameters. You can adjust the parameters below and see the messages that are streamed on the right.

```
{
  "prefix": null,
  "path": null,
  "type": null,
  "require": null,
  "moreSpecific": true,
  "lessSpecific": false,
  "host": "rrc05.ripe.net",
  "peer": null,
  "socketOptions": {
    "includeRaw": false,
    "acknowledge": true
  }
}
```

#### Live RIS BGP messages

Connected 294 matching messages ~176 kbit/s

```
// Received at 20:35:09 (2.87 second delay)
{
  "timestamp": 1697909706.7,
  "peer": "2001:7f8:30:0:2:1:3:4288",
  "peer_asn": "34288",
  "id": "2001:7f8:30:0:2:1:3:4288-018b534e0fcc0000",
  "host": "rrc05.ripe.net",
  "type": "KEEPALIVE"
}
```

```
// Received at 20:35:09 (2.87 second delay)
{
  "timestamp": 1697909706.7,
  "peer": "193.203.0.136",
  "peer_asn": "21385",
  "id": "193.203.0.136-018b534e0fcc0001",
  "host": "rrc05.ripe.net",
  "type": "KEEPALIVE"
}
```

```
// Received at 20:35:09 (2.87 second delay)
{
  "timestamp": 1697909706.7,
  "peer": "193.203.0.105",
  "peer_asn": "21385",
  "id": "193.203.0.105-018b534e0fcc0002",
  "host": "rrc05.ripe.net",
  "type": "KEEPALIVE"
}
```

#### Code examples

Below are simple examples of using the RIS Live WebSocket interface. For a full guide, see the [RIS Live manual](#).

Javascript Python

# Other Tools That Use RIS



- Hurricane Electric BGP Toolkit
  - Provides a **dashboard** to locate Internet number resources and access network data
- BGPalerter
  - This software **monitors** RIS data in near real-time to detect route hijacks and other incidents
- Internet Health Report, Georgia Tech/IODA
  - These research projects use RIS data to build experimental views using Internet routing data

# RIS Future Plans



- Improvements to RIS data through peering coordination
  - We aim to add at least one peer per country in our service region that is not yet covered in RIS
  - Working on our new peering strategy
- Define a process to get access to kafka directly
- Open-source RIS Live
- [View our quarterly planning for RIPE RIS](#)

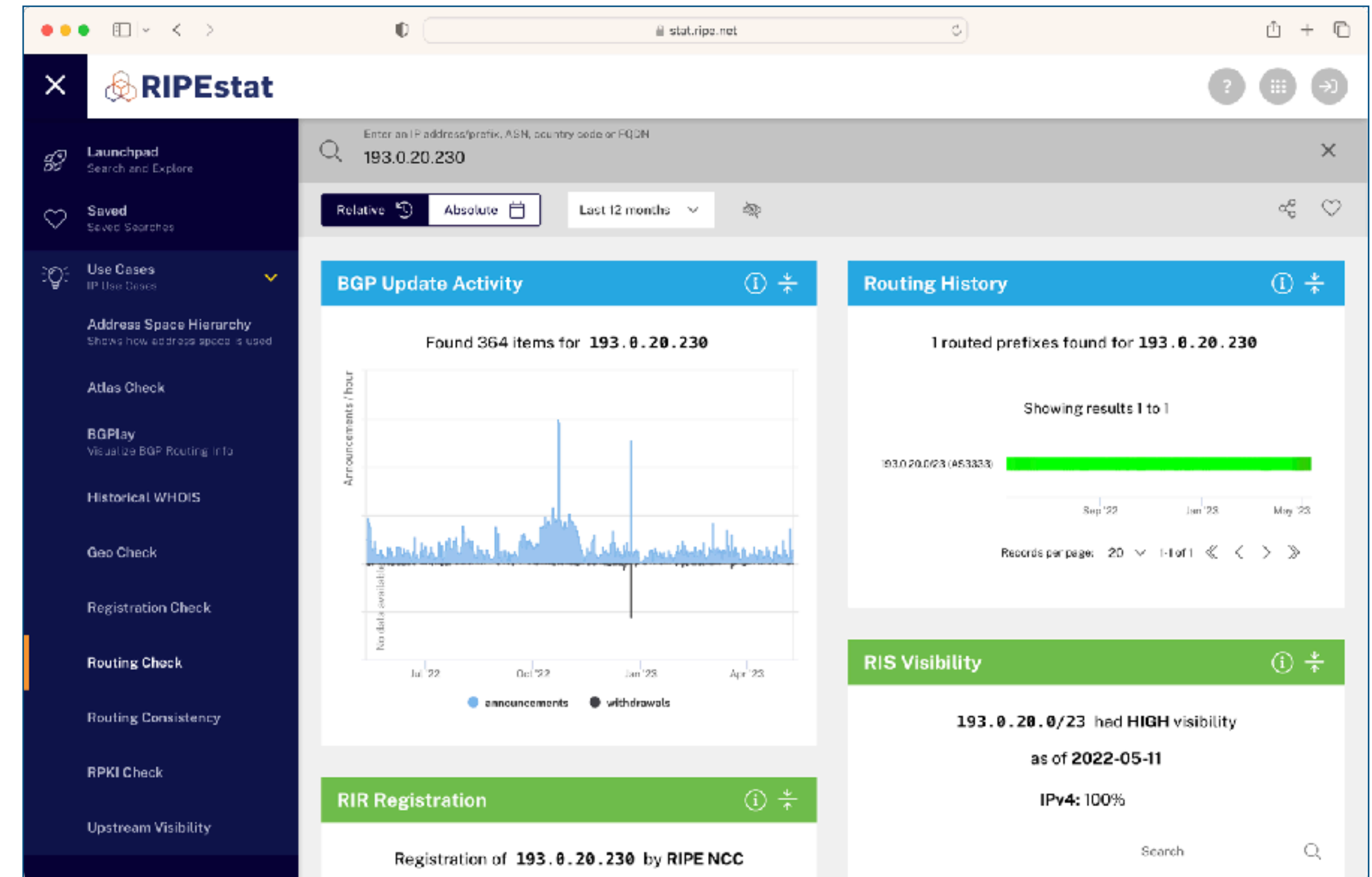


**RIPEstat**

# What is RIPEstat?



- Information service for Internet-related data
- RIPEstat provides:
  - information on IP address space and Autonomous System Numbers (ASNs)
  - statistics on specific hostnames and countries
  - visualisations of Internet routing



# RIPEstat Data Sources



- More than 35 different datasets
  - RIPE Database and the registry data from other RIRs
  - BGP routing data (RIS)
  - RIPE Atlas
  - Geolocation
  - RPKI
  - M-Lab, Speedchecker, etc.
  - More details at <https://stat.ripe.net/data-sources>
- New datasets are constantly added!
  - E.g. new feature to check multiple DNS-based blocklists in real-time

# Quick Intro (1)



- Search by IP address/prefix (IPv4, IPv6), ASN, country code or fully qualified domain name (FQDN)
- Launchpad suggestions are pulled from your network or are random suggestions





# Quick Intro (2)



- Use cases are based on the resource type/search:
  - IP address/prefix (IPv4, IPv6),
  - ASN,
  - country code,
  - fully qualified domain name (FQDN)
- You can play with the timeframe:
  - Relative
  - Absolute
- Expand for more info

The screenshot displays the RIPEstat web application interface. The search bar at the top contains the value '6799'. The left sidebar lists various navigation options: Launchpad, Saved, Use Cases, Atlas Check, Historical WHOIS, Geo Check, Registration Check, Reverse DNS Consistency, Routing Check, Routing Consistency, and RPKI Check. The main content area is divided into several panels:

- Abuse Contact:** abuse@ote.gr
- Announced Prefixes:** AS6799 has 111 prefixes
- AS Neighbours:** Unique ASNs: 39  
IPv4: 1 left 34 right 2 uncertain  
IPv6: 1 left 6 right 3 uncertain
- AS Prefix Count:** Found 520 items for AS6799
- Allocation History:** Records were found in IANA, RIPE NCC
- AS Name:** AS6799  
OTENET-GR - Ote SA (Hellenic Telecommunications Organisation)
- AS Path Length:** AS6799 has a median average path length of 3.81
- BGP Update Activity:** Found 520 items for AS6799

# Use Cases: Country Stats – GR



The screenshot displays the RIPEstat interface for the country Greece (GR). The search bar at the top contains 'GRE'. The main content area is divided into several panels:

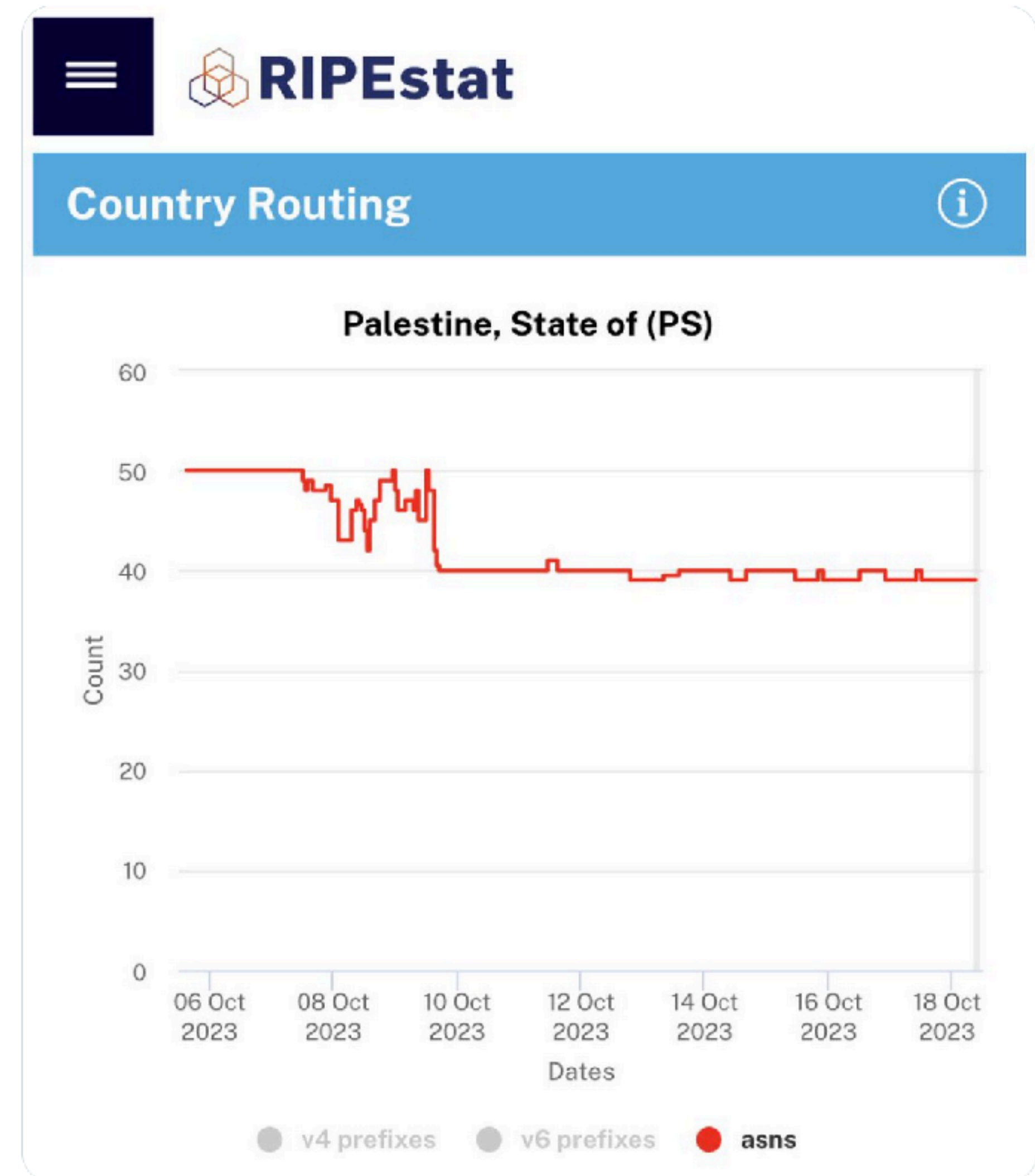
- Country ASNs:** 73% of ASNs were routed in Greece as of 2018-12-21 (see Data Messages).
- Country Resource List:** Resources for Greece (GR) as of 2013-10-18: asn 184, ipv4 300, ipv6 41.
- Country Routing:** A line chart titled 'Greece (GR)' showing the count of v4 prefixes (black), v6 prefixes (yellow), and asns (red) from 2014 to 2022. The y-axis is labeled 'Count' and ranges from 0 to 1500. The x-axis is labeled 'Dates' and ranges from 2014 to 2022. A legend at the bottom identifies the lines: v4 prefixes (black), v6 prefixes (yellow), and asns (red).
- RIPE Atlas Probe Deployment:** A line chart titled 'Greece (GR)' showing the count of probes in different states (Never Seen, Connected, Disconnected, Abandoned) from 2014 to 2022. The y-axis is labeled 'Count' and ranges from 0 to 200. The x-axis is labeled 'Dates' and ranges from 2014 to 2022. A legend at the bottom identifies the lines: Never Seen (black), Connected (green), Disconnected (orange), and Abandoned (grey).
- RPKI History:** A line chart showing the number of VRPs containing IPv4 prefixes from 2014 to 2022. The y-axis is labeled 'VRPs containing IPv4 prefixes' and ranges from 0 to 1500. The x-axis is labeled 'Dates' and ranges from 2014 to 2022. A legend at the top indicates 'IPV4' and 'IPV6' tabs, and 'TOTAL' and 'PERCENT' sub-tabs.

The left sidebar contains navigation options: Launchpad (Search and Explore), Saved (Saved Searches), Use Cases (Country Use Cases), Country Stats, Documentation, Preferences (Settings and Prefs), and Feedback & Support.

# Use Cases: Country Stats – Palestine



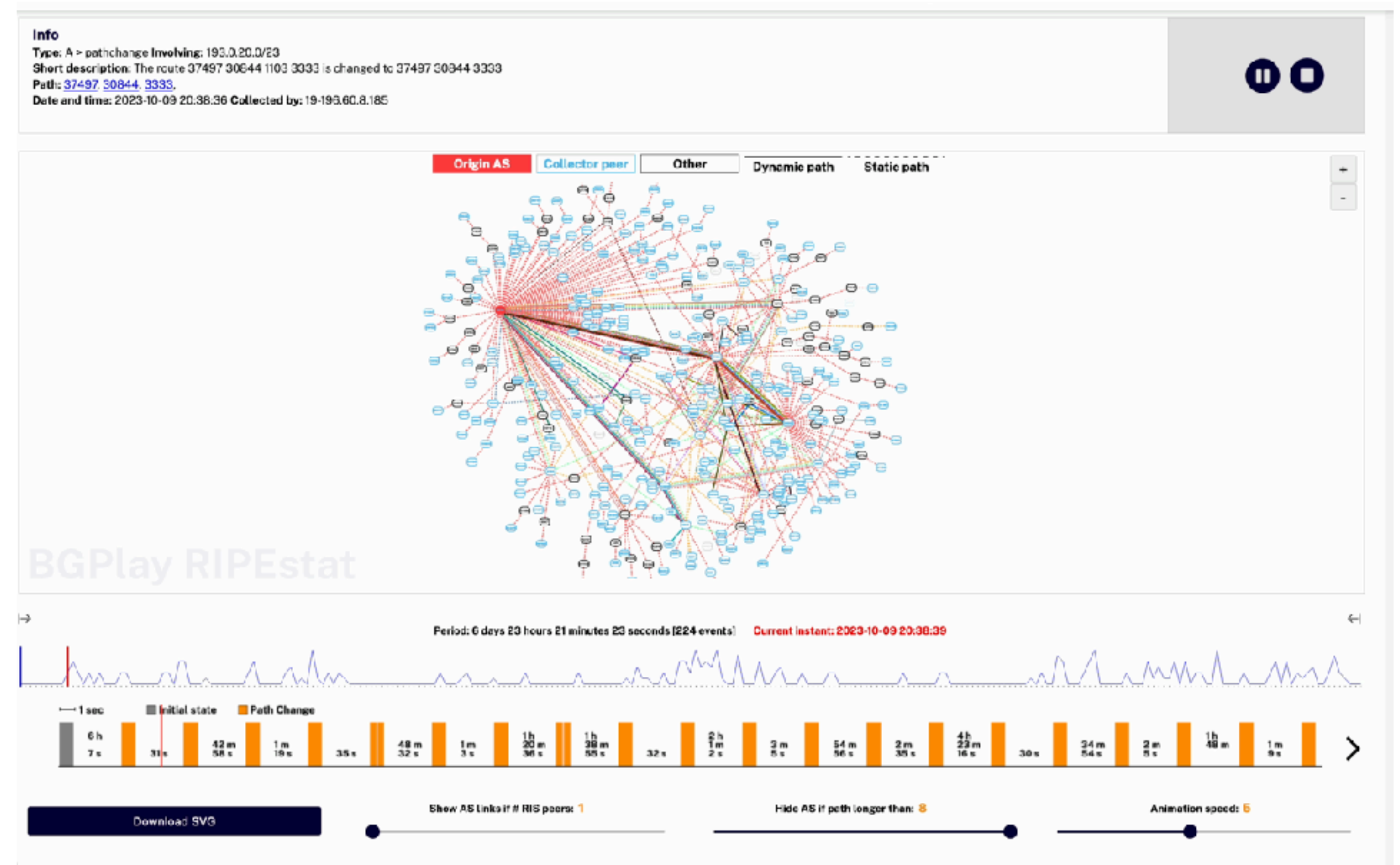
- View of RIPEstat on 18 October
- 1/5 of networks is down since the outbreak of hostilities on 7 October



# Use Cases: BGPlay



- BGPlay shows the routing history related to a specific set of resources (prefixes, Autonomous Systems, IPs)
- BGPlay visualises changes in BGP announcements for a specific destination over time
- As seen by RIS



# Use Cases: Routing Consistency



- Routing Consistency compares:
  - objects in Routing Registries with observed real-world routing (seen by RIS)
  - RPKI validation status where applicable

The screenshot shows the RIPEstat website interface. The search bar contains the IP address 193.0.20.230. The main content area displays the 'Routing Consistency' tool results for this IP. A table shows one record found for the prefix 193.0.20.0/23, with columns for Prefix, Origin, in BGP (RIS), IRRs, RPKI ROV, and VRPs. The RPKI ROV column shows a green smiley face icon, indicating a valid RPKI signature.

Prefix ↑	Origin	in BGP (RIS)	IRRs	RPKI ROV	VRPs
193.0.20.0/23	3333	✓	0/0	😊	✓ maxLength: 23

# Use Cases: Routing Check (1)



- Routing Status of your prefix
- Announced routes to a prefix via RIS Looking Glass
- RPKI Origin Validation

The screenshot shows the RIPEstat website interface. The search bar contains the IP address 193.0.20.230. The main content area is divided into three sections:

- Prefix Status:** Shows that 193.0.20.0/23 is announced by AS3333. Below this, it states that 193.0.20.230 is covered by the prefix above. A table shows the originator: AS3333 (RIPE-NCC-AS - Reseaux IP Europeens Network Coordination Centre (RIPE NCC)).
- RPKI Origin Validation:** Shows that AS3333 is a VALID origin for 193.0.20.0/23. A table below shows the validation details:

STATUS	(valid)
VRP	
ORIGIN	3333
PREFIX	193.0.20.0/23
MAX_LENGTH	23

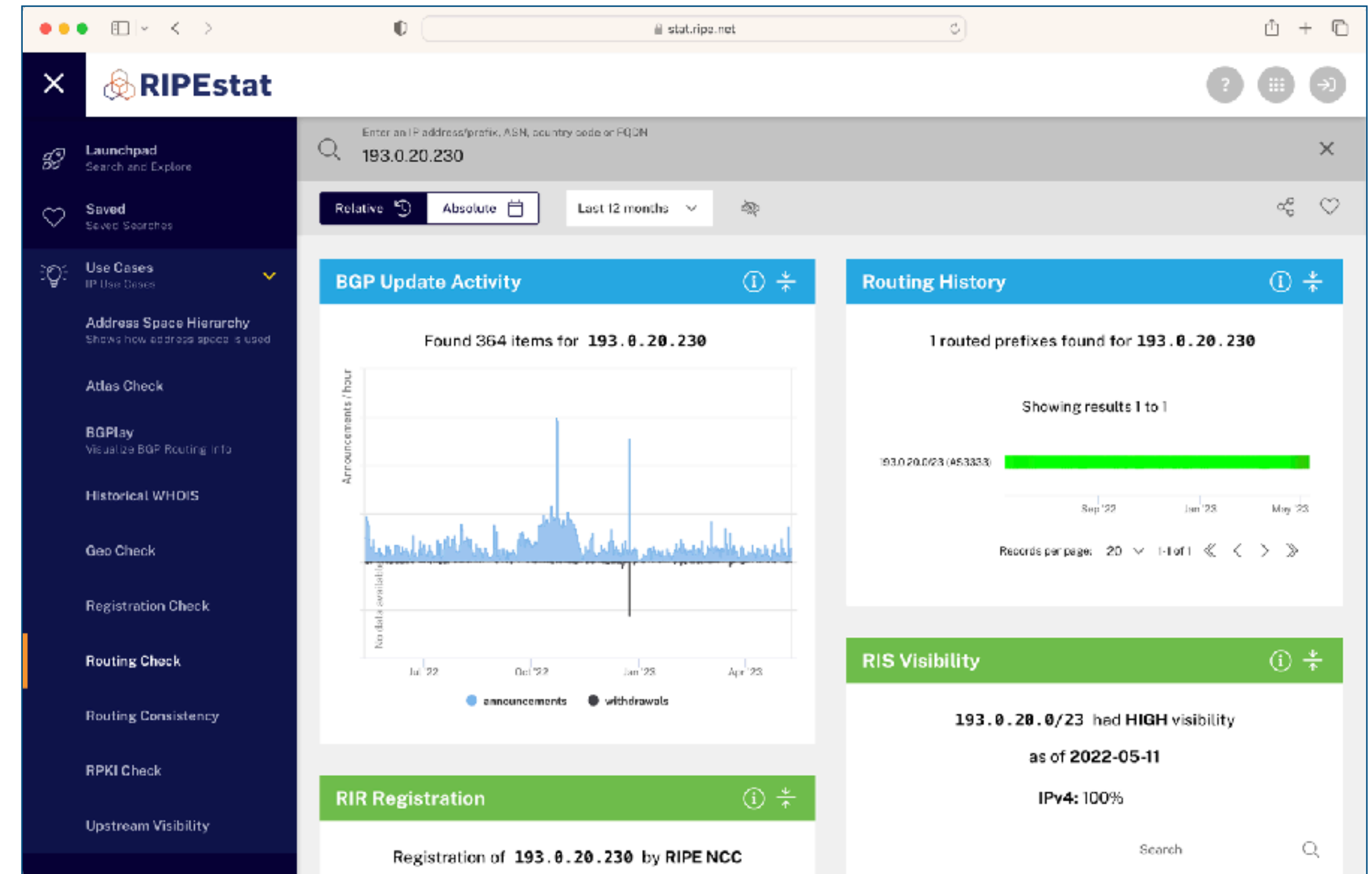
- RIS Looking Glass:** Shows 407 records found for 193.0.20.230. It lists the location as RRC00 Amsterdam, Netherlands and states that AS3333 is origin for 48 peers. A table below shows the AS Path history:

Last Updated	AS Path
2023-05-03	34854 3333
2023-05-05	59919 12779 3333
2023-03-29	202385 1103 3333
2023-05-04	49134 53356 6839 3333
2023-03-29	50304 1103 3333

# Use Cases: Routing Check (2)



- BGP Update Activity
- RIR Registration
- Routing History
- RIS Visibility
- RIPEstat Data API



# RIPEstat Future Plans



- Open-source the RIPEstat widgets
- Working on improving the service quality
- Improvements to the UI
- [View our quarterly planning for RIPEstat](#)





**RIPE Atlas**

# RIPE Atlas



- RIPE Atlas is the RIPE NCC's **Internet measurement platform**
- It is a global network of devices that actively measure Internet connectivity, reachability and performance
- Anyone can access this data
  - via Internet traffic maps, streaming data visualisations, and an API
- RIPE Atlas users can also perform **customised measurements** to gain information about their own networks

# How we Collect Data?



- 12,000+ RIPE Atlas probes connected in 169 countries
- 785 RIPE Atlas Anchors
- 15,000+ results collected per second
- 32,000+ measurements currently running
- More information at: [atlas.ripe.net](https://atlas.ripe.net)



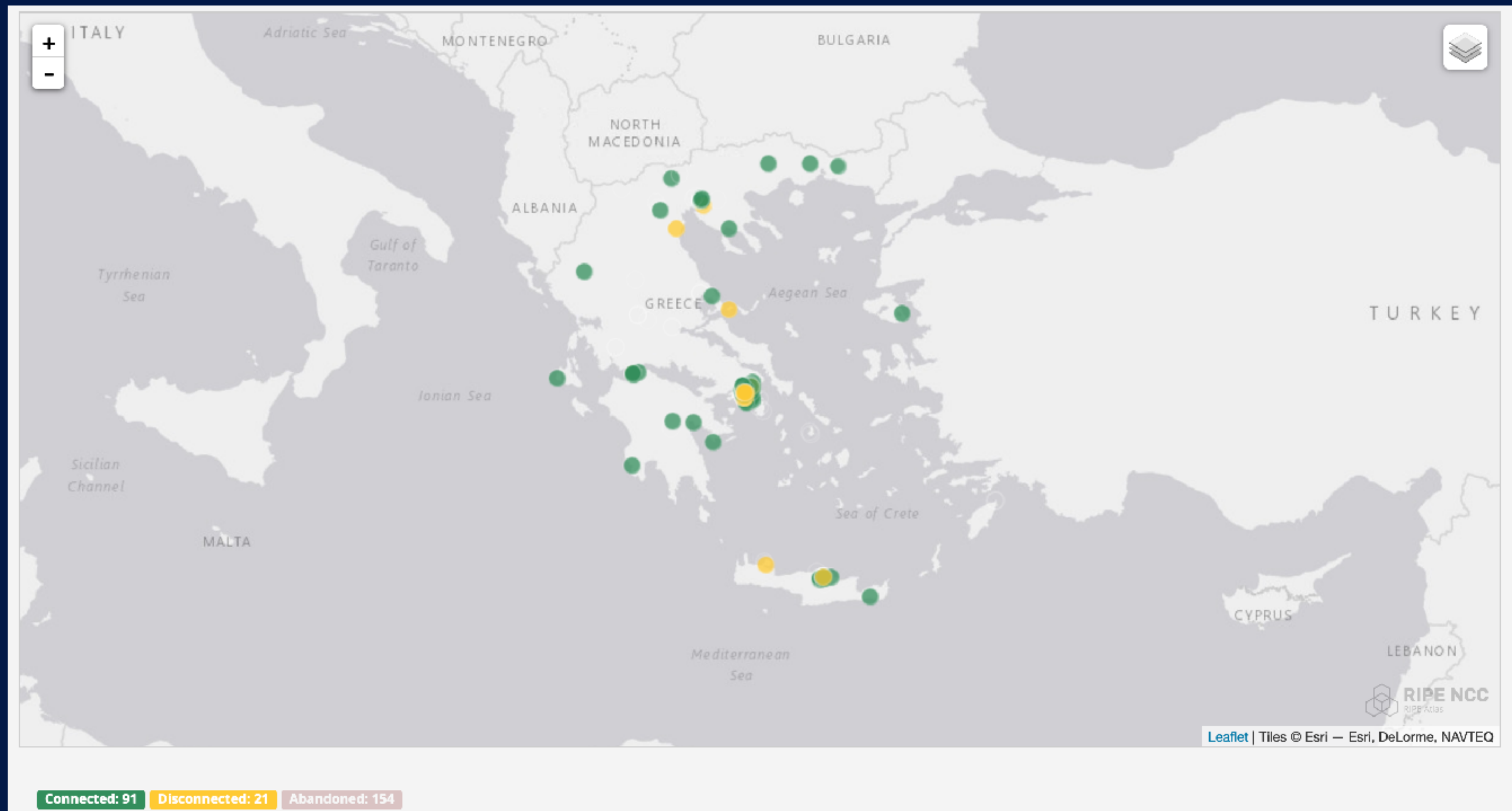
# RIPE Atlas Anchors



- More robust probes mostly for data centres
- Either physical hardware or a virtual machine
- Generally more reliable and better connected than probes
- Have all features of probes plus extra server features
  - DNS server
  - HTTP(S) server
- Full mesh of ping and traceroute measurements is scheduled between all anchors



# RIPE Atlas in Greece – Geographical Distribution



# Networks Coverage in Greece



Network (ASN)	Network Name	Estimated User Population %	IPv4 Public Probes	IPv4 Private Probes	IPv4 Total Probes	IPv6 Public Probes	IPv6 Private Probes	IPv6 Total Probes	More
6799	OTENET-GR	42.29	29	6	35	19	5	24	<a href="#">View</a>
3329	HOL-GR	19.62	10	1	11	4	1	5	<a href="#">View</a>
25472	WIND-AS	14.14	0	1	1	0	0	0	<a href="#">Apply for a probe</a>
29247	COSMOTE-GR	12.89	1	0	1	1	0	1	<a href="#">View</a>
1241	FORTHNET-GR	9	8	1	9	4	1	5	<a href="#">View</a>
12361	Panafonet-AS	0.23	0	0	0	0	0	0	<a href="#">Apply for a probe</a>
200736	INALAN	0.22	2	0	2	0	0	0	<a href="#">View</a>
35506	SYZEFXIS	0.18	0	0	0	0	0	0	<a href="#">Apply for a probe</a>
14593	SPACEX-STARLINK	0.17	0	0	0	0	0	0	<a href="#">Apply for a probe</a>
5408	GR-NET	0.13	2	0	2	3	0	3	<a href="#">View</a>
208149	SKYTelecom-AS	0.11	0	0	0	0	0	0	<a href="#">Apply for a probe</a>
57794	HCN-01	0.11	0	0	0	0	0	0	<a href="#">Apply for a probe</a>

# RIPE Atlas Measurements



- **Built-in global** measurements towards root nameservers
  - Visualised as Internet traffic maps
- **Built-in regional** measurements towards “anchors”
- **Customised** measurements run by users

# Customised Measurements (1)



- Customised measurements allow:
  - Monitor network reachability from thousands of vantage points worldwide
  - Measure packet loss on suspected bad link
  - Test anycast deployment
  - Check the responsiveness of DNS infrastructure, such as root name servers
  - Test IPv6 connectivity
- A complete collection of use cases, published research and analyses based on RIPE Atlas is published on [RIPE Labs](#)



# Customised Measurements (2)



- RIPE Atlas customised measurements are available to:
  - RIPE Atlas probe hosts
  - anchor hosts
  - sponsors
  - RIPE NCC members
- How it works?
  - earn credits by hosting or sponsoring one or more probes
  - pick your destination and customise your measurements

# RIPE Atlas Future Plans



- Make improvements to our UI
- Renew the big data back-end, possibly migrating it to a cloud-based solution
- [View our quarterly planning for RIPE Atlas](#)

# Want to Learn More?



- Check our webinars:
  - [Using RIPE Atlas](#)
  - [RIPEstat](#)
- [Greek country stats from RIPEstat](#)
- [RIPE Atlas use cases](#)
- [RIPE Atlas probes coverage in Greece](#)
- [Our quarterly plans for our services/tools](#)



**One Last Thing**

A photograph of the Colosseum in Rome, Italy, taken during sunset. The sun is low on the left side of the frame, creating a bright orange glow and lens flare. The Colosseum's iconic tiered arches are visible, with the right side showing more significant damage and missing sections. A semi-transparent orange rectangular box is overlaid in the center of the image, containing white text.

Join us at

**RIPE 87**  
Rome, Italy  
27 Nov - 1 Dec 2023



# SOUTH EAST EUROPE (SEE) 12

## RIPE NCC Regional Meeting



Athens, Greece | 22-23 April 2024

# SEE Regional Meeting



- A regional meeting takes place in South East Europe each year
- Two-day event, approximately 200 participants
- We would like the Greek community get more involved
- [More information about the SEE Regional Meetings](#)





# Questions



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