The RouteViews Project: Update

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NgNOG 2025, Abuja
Oct 16 2025

UNIVERSITY OF OREGON

Last updated 19th May 2025

Background

- **RouteViews was first started in 1995**
- Now a growing network of 40+ collectors positioned strategically at Internet Exchange Points around the world
- RouteViews collaborates with the Center for Applied Internet Data Analysis (CAIDA) working with NSF grants that support Designing a Global Measurement Infrastructure to Improve Internet Security, GMI3S (OAC-2131987), and an Integrated Library for Advancing Network Data Science, ILANDS (CNS-2120399).
- RouteViews is supported with financial and in-kind donations by multiple organizations

- **RouteViews is based at the University of Oregon and operated by NSRC**
- NSRC supports the growth of global Internet infrastructure by providing engineering assistance, collaborative technical workshops, training, and other resources to university, research & education networks worldwide.
- NSRC is partially funded by the IRNC program of the NSF (OAC-2029309) and Google with other contributions from public and private organizations.
- The University of Oregon is a public research institution in Eugene, Oregon, USA founded in 1876.

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NSRC Network Startup Resource Center

RouteViews Team Members

Hans Kuhn
Nina Bargisen
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Philip Smith
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What is RouteViews

- A tool that allows Internet network operators to look at the BGP table from different backbones and locations around the world to troubleshoot and to assess:
  - Reachability, hijacks, bugs, peer visibility, mass withdrawals, RPKI status,…
- Operators who find it a valuable tool also peer to contribute to the value
- RouteViews operates collectors strategically positioned at IXPs around the world.
  - It also hosts a few multi-hop collectors at UO for those operators who are not present at IXPs.

What is RouteViews

- Many free and commercial tools used by network engineers every day include data from RouteViews
  - CAIDA ASRANK
  - CAIDA BGP Reader
  - HE BGP Tools
  - Kentik Market Intelligence
  - Kentik BGP monitoring
  - Catchpoint
  - BGPMon
  - And many more

Make life easier for your NOC

upstream

```
route-views3.routeviews.org# sh ip bg 220.239.64.0
BGP routing table entry for 220.239.64.0/20, version 10370995
Paths: (1 available, best #1, table default)
  Not advertised to any peer
  38001 7473 4804 4804
    202.150.221.33 from 202.150.221.33 (10.11.33.29)
      Origin IGP, valid, external, best (First path received), rpki validation-state: invalid
      Community: 38001:100 38001:3003 38001:8003
      Last update: Sun Nov 10 14:28:09 2024
route-views3.routeviews.org#
```

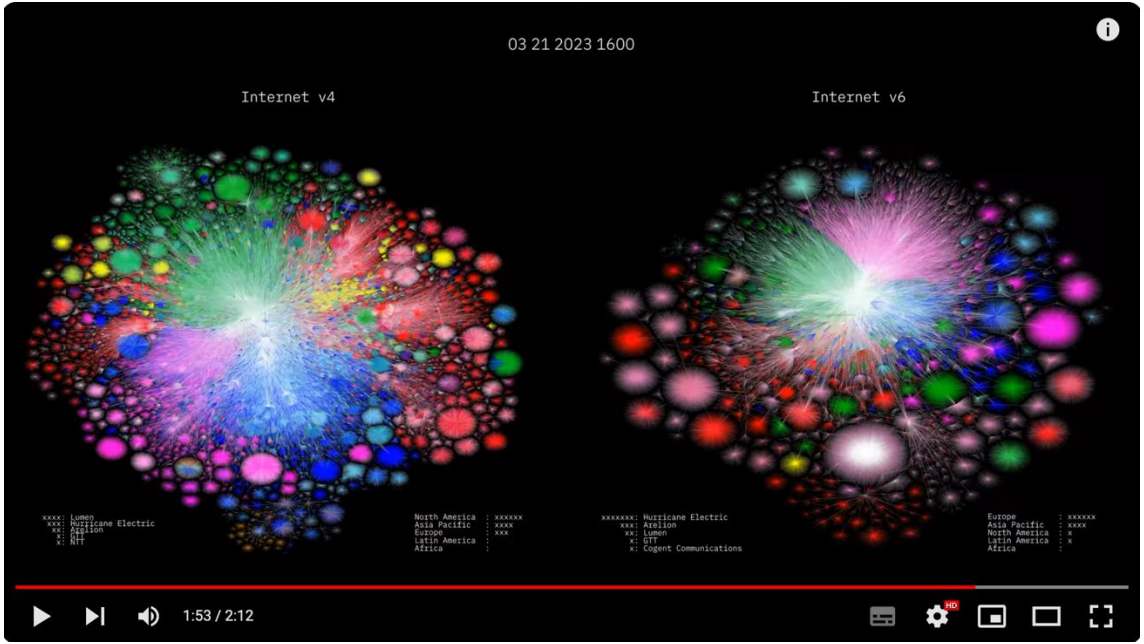
RPKI state

Make life easier for your NOC

upstream

```
route-views3.routeviews.org# sh ip bg 220.239.64.0/19
BGP routing table entry for 220.239.64.0/19, version 9454097
Paths: (25 available, best #24, table default)
  Not advertised to any peer
    9268 4764 1221 7474 4804, (aggregated by 4804 198.142.65.160)
    203.62.187.103 from 203.62.187.103 (203.62.187.103)
      Origin IGP, valid, external, atomic-aggregate, rpki validation-state: valid
      Community: 0:2011 9268:2124
      Last update: Mon Nov  4 04:04:03 2024
    9268 4764 1221 7474 4804, (aggregated by 4804 198.142.65.160)
    203.62.187.102 from 203.62.187.102 (203.62.187.102)
      Origin IGP, valid, external, atomic-aggregate, rpki validation-state: valid
      Community: 0:2011 9268:2124
      Last update: Mon Nov  4 02:34:28 2024
route-views3.routeviews.org#
```

RouteViews Impact



Barrett Lyon: https://www.youtube.com/watch?v=vo5gIK9czIE

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What's happening at RouteViews

ROUTEVIEWS NEWS

RouteViews News

- Collectors:
  - All software collectors use FRR[1] (version 10.2)
  - One Cisco ASR1004 (as a tribute to the original!)
  - Moving collectors from metal to VMs (easier deployment & management)
- Location update:
  - Most recent additions include GetaFIX (Philippines), KINX (Seol, Korea) and Namex (Italy)
  - Soon to go live: HKIX (Hong Kong), Netnod (Sweden)

[1]FRRouting Project: https://frrouting.org/

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[1]FRRouting Project: https://frrouting.org/

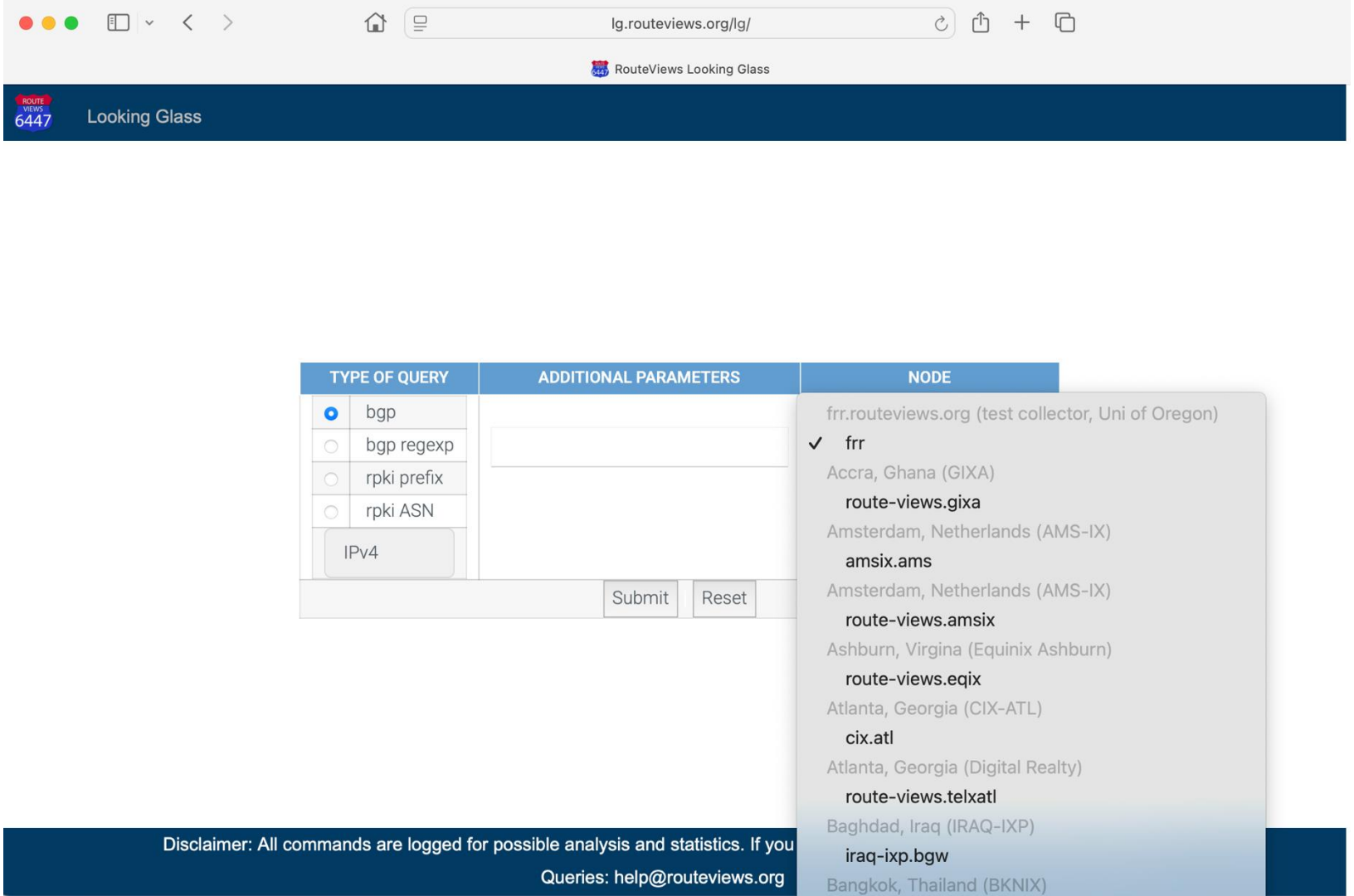
RouteViews Development Projects: API

- API allows programmatic access to live RouteViews data
  - (our collectors currently allow telnet access, which 1000s of automated scripts hammer daily)
- Two access levels:
  - Unauthenticated for casual (infrequent queries)
  - Authenticated access (using verified PeeringDB users) for more serious research
- API currently supports ten collectors
  - More will be added as resources become available
- Please consult the docs on how to use the API
  - https://api.routeviews.org/docs/

Exchange	collector
AMS-IX Amsterdam, Netherlands	route-views.amsix.routeviews.org
LINX, London, United Kingdom	route-views.linx.routeviews.org
NAPAfrica, Johannesburg, South Africa	route-views.napafrica.routeviews.org
Equinix SG1, Singapore, Singapore	route-views.sg.routeviews.org
Equinix SYD1, Sydney, Australia	route-views.sydney.routeviews.org
SAOPAULO (PTT Metro, NIC.br), Sao Paulo, Brazil	route-views2.saopaulo.routeviews.org
Multi-hop at U of Oregon	route-views3.routeviews.org
Multi-hop at U of Oregon	route-views4.routeviews.org
Multi-hop at U of Oregon	route-views5.routeviews.org
Multi-hop at U of Oregon	route-views6.routeviews.org

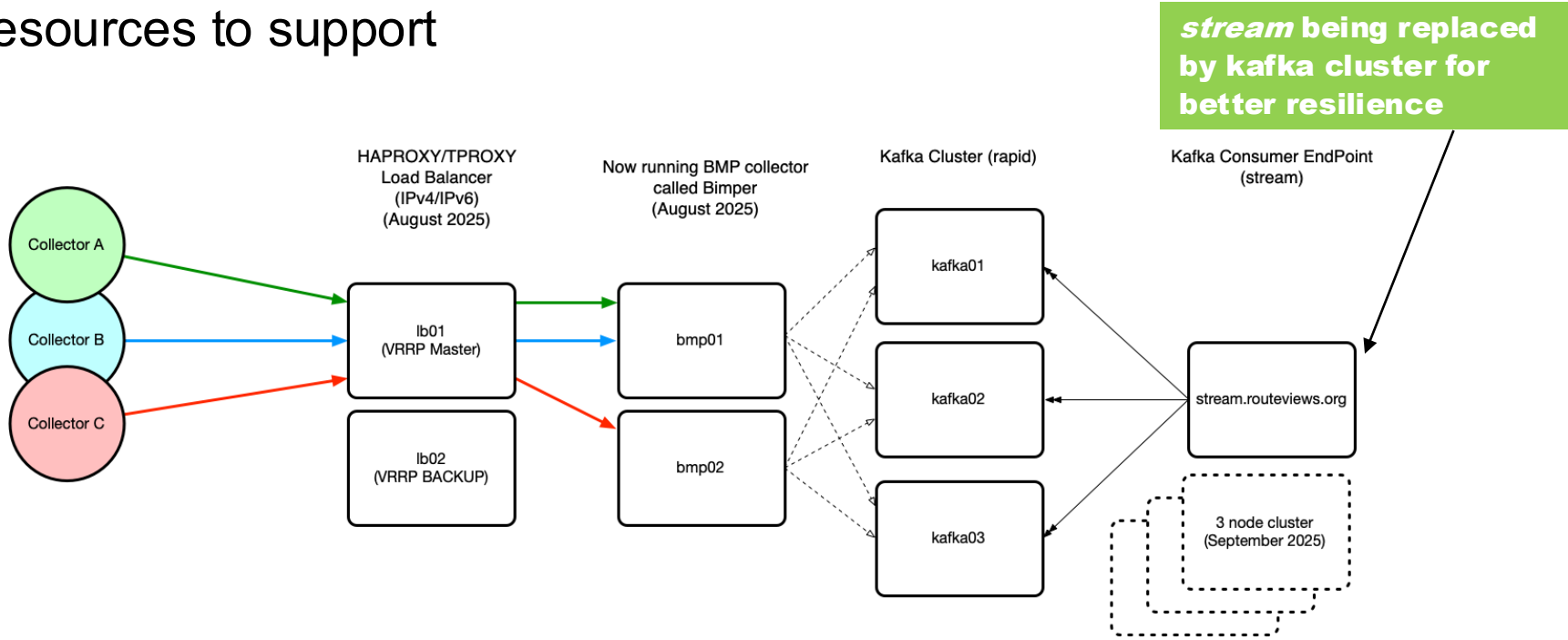
RouteViews Development Projects: LG

- telnet access is unsustainable
  - Gives open access to the collector command line interface to run “show” commands
- Looking Glass will soon become the default access for each collector
  - Permits the most commonly used BGP diagnostic commands
  - telnet remains available on route-views.routeviews.org (the Cisco ASR1004) for legacy access
- Looking Glass has completed internal testing and is now available for general use
  - telnet access will be removed after due notice to the community


lg.routeviews.org/lg/
RouteViews Looking Glass
ROUTE VIEWS 6447
Looking Glass
TYPE OF QUERY
ADDITIONAL PARAMETERS
NODE
bgp
bgp regexp
rpki prefix
rpki ASN
IPv4
Submit
Reset
frr.routeviews.org (test collector, Uni of Oregon)
frr
Accra, Ghana (GIXA)
route-views.gixa
Amsterdam, Netherlands (AMS-IX)
amsix.ams
Amsterdam, Netherlands (AMS-IX)
route-views.amsix
Ashburn, Virgina (Equinix Ashburn)
route-views.eqix
Atlanta, Georgia (CIX-ATL)
cix.atl
Atlanta, Georgia (Digital Realty)
route-views.telxatl
Baghdad, Iraq (IRAQ-IXP)
iraq-ixp.bgw
Bangkok, Thailand (BKNIX)
Disclaimer: All commands are logged for possible analysis and statistics. If you
Queries: help@routeviews.org

RouteViews Development Projects: BMP

- Live feed from collectors for BGP data consumers
- Challenge is to make this scale and provide the infrastructure resources to support



RouteViews Development Projects: Bimper

Bimper is a specialised high-performance BGP Monitoring Protocol (BMP) message processor that receives BGP routing data from network routers and forwards it to Kafka for downstream analysis and storage. It provides real-time monitoring of BGP routing events with Prometheus metrics integration for operational visibility.

The system includes bimperctl, a control utility for managing and monitoring bimper instances, allowing administrators to interact with the service and view connection status information, and manage router connections

Bimper replaces OpenBMP and bimber messages are compatible with OpenBMP's raw bmp

RouteViews Behind the Scenes Projects

- Upgrading archive infrastructure and storage
  - RouteViews stores BGP data from 1997 – around 50 TBytes (compressed)
- Tooling
  - Automation tools for managing the whole infrastructure and deploying new peers
- Collector OS (from CentOS to Ubuntu)
  - CentOS end-of-life – half the collectors still running CentOS
- FRR performance
  - Tuning Linux TCP parameters to improve BGP peer performance
    - https://fasterdata.es.net/host-tuning/linux/
  - “Badly behaving peers” (*aka* slow and/or noisy peers)

RouteViews Future Planning

- Collectors & hosts in new locations outside North America
  - Large IXPs with dense interconnection
  - Unique or specialist environments (e.g. R&E exchanges)
- Scalable and diverse archiving
- Improved community support
  - Running this infrastructure costs money!
  - We hugely appreciate our generous supporters
    - https://www.routeviews.org/routeviews/index.php/supporters/
- Your recommendations are welcome! 🙏

Consumers of RouteViews data

If you use RouteViews data for your products or services:

- Please acknowledge the source!
  - Your product or service likely would not work without our data!
- Please do *NOT* send your customers of your products or services to us for technical support:
  - We simply collect what is seen in the global routing table
  - We cannot fix mistakes made by network operators
  - We cannot fix bugs in BGP implementations
  - We cannot remove BGP announcements we receive
  - We cannot change what is seen in the global routing table

For Peering Coordinators

PEERING WITH ROUTEVIEWS

Peering with RouteViews

- RouteViews has a Selective peering policy
  - PeeringDB: https://www.peeringdb.com/asn/6447
- We require all peers to have a PeeringDB entry
  - Our tools build peering options (for IXP based collectors) and configurations from PeeringDB
- Peering:
  - Over IPv4 (for IPv4 prefixes) and IPv6 (for IPv6 prefixes)
  - We want to receive the entire BGP table (if operationally possible)
  - We do not send you any prefixes (please don't ask)

Peering with RouteViews

- contact us by writing to noc@routeviews.org

RouteViews Peering Policy

General requirements:

- Peer must operate stable equipment - RouteViews will shutdown BGP sessions that disturb the stability of the RouteViews platform
- Peer must have a routable ASN
- Peer must not be a hobby network
- Peer's full view of the global routing table is preferred
- Routes should be aggregated as much as possible (no longer than /24 for IPv4 and /48 for IPv6)
- Peer must be present with up-to-date information in PeeringDB - including the NOC email address
- Peer must filter RFC6890 space
- RouteViews does not accept addpath-RX or TX
- Peers must not send default routes

IXP peering:

- We happily accept everyone's routes from the route servers.
- We will set up bilateral sessions with anyone who meets the general requirements and will send us their full table.
- We will peer at all mutual exchanges if requested.

Multihop peering:

- We will accept multihop peers who are not on any mutual IXPs.
- Peers must provide their full view of the Internet as they see it.
- We accept two sessions for redundancy; more than two sessions can be set up if the feeds are sufficiently different.

Why a Selective Peering policy?

- Balancing operational overhead, scale and information from the data
- Hobby Networks
- Full View of the Internet
- What makes a peering interesting?
  - Networks in regions where we have limited visibility
  - Networks demonstrating new interconnection patterns
  - Networks using innovative routing practices
  - Networks that help us understand emerging market dynamics
  - Or maybe something we haven't thought about yet

For potential hosts of collectors

HOSTING ROUTEVIEWS

Hosting RouteViews

- RouteViews is interested in new locations
  - Especially in regions or economies we have no collector
  - Where there are IXPs with large numbers of peers (>100)
- Hosting a RouteViews collector
  - Hosts can be IXPs themselves
  - Hosts can be members of IXPs
  - Hosts sponsor the IXP port and the (~10Mbps) transit required
  - Hosts sponsor the VM needed for the collector
    - Physical hardware is less preferred due to being harder to manage
    - VMs sometimes may not be possible due to operational requirements

Collector Specifications

- Virtual Machine:
  - 16GB RAM min (prefer 32GB)
  - 100GB disk
  - 4 vCPUs
  - 1 transit interface (management and public CLI access, low traffic)
  - 1 peering interface on the IX
- Physical Hardware:
  - 32GB – 64GB RAM
  - 400GB – 1TB SSD
  - 4+ CPUs
  - Ethernet port for transit interface (1Gbps is enough)
  - Ethernet port for IX peering (10Gbps is the standard now)

Collector Software

- Ubuntu 24.04 is RouteViews standard OS
  - We require a minimal Ubuntu Server install
  - Our deployment scripts do the rest

- Routing daemon we install is FRR
  - MRT[1] used for BGP RIBs (archived every 2 hours) and BGP updates (archived every 15 minutes)

[1] Multi-Threaded Routing Toolkit: https://datatracker.ietf.org/doc/html/rfc6396

Collector Host

- Acknowledged on RouteViews website as a sponsor
- Contact details kept up to date with RouteViews team
  - An up-to-date PeeringDB entry helps 😀

How you can help

SUPPORTING ROUTEVIEWS

Supporting RouteViews

- The project was started in 1995 because network operators wished to see what their BGP announcements looked like from an external viewpoint
  - Thousands of network operators & researchers all around the world now rely on RouteViews
  - Many everyday tools we all rely on use RouteViews data
  - Many commercial products and services rely on RouteViews data

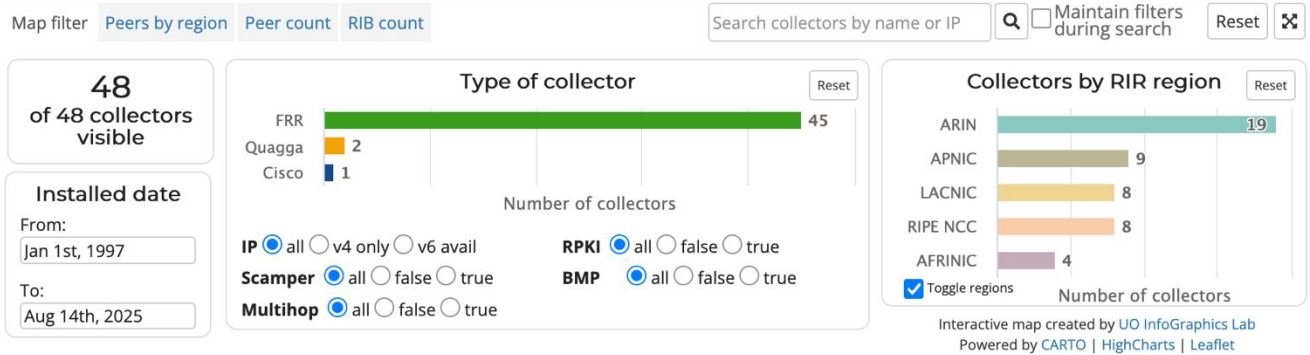
Supporting RouteViews

Please consider supporting RouteViews:

- By peering with one of our collectors
- By publicly acknowledging the value of the information we have collected
  - For citations, our DOI is *10.7264/1y7v-2d90*
- If your product or service is commercially successful, we look forward to receiving your support to keep your product or service that way!
- In any other way that helps keep this community service going

RouteViews Collector Map

https://www.routeviews.org/routeviews/map/



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Thank you!