# The RouteViews Project: Update

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# 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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# RouteViews Team Members

| |
|---|
| Hans Kuhn |
| Nina Bargisen |
| Owen Conway |
| Philip Smith |
| Philip Paeps |
| Anton Berezin |






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# What is RouteViews

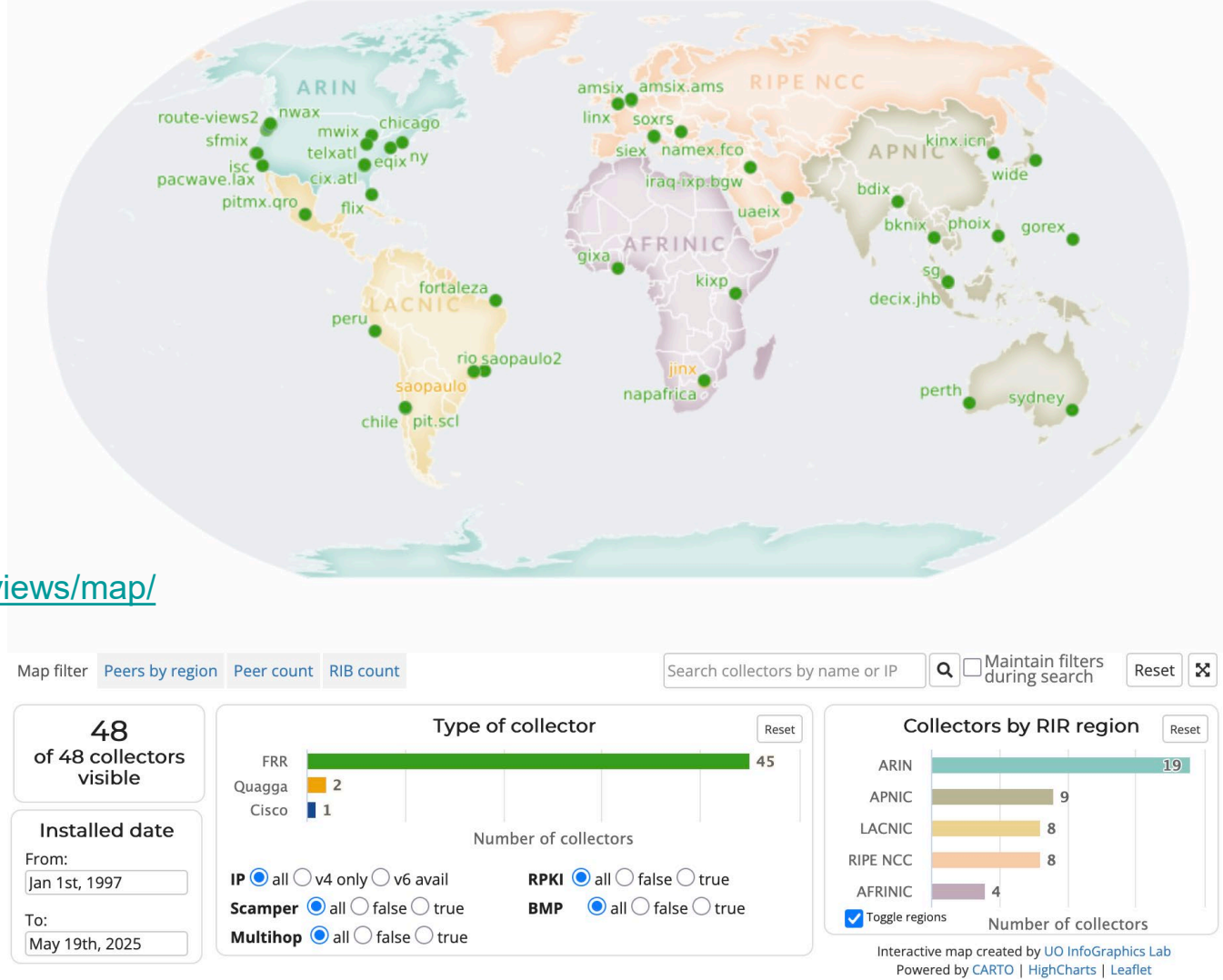
- A tool that allows Internet network operators to look at the BGP table from different backbones and locations around the world to troubleshoot and to assess:
  - Reachability, hijacks, bugs, peer visibility, mass withdrawals, RPKI status,…
- Operators who find it a valuable tool also peer to contribute 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

# RouteViews Collector Map

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



What's happening at RouteViews

# ROUTEVIEWS NEWS



# RouteViews News

- Collectors:
  - All software collectors use FRR[1] (version 10.5.1 where possible)
  - One Cisco ASR1004 (as a tribute to the original!)
  - Moving collectors from metal to VMs (easier deployment & management)
- Location update:
  - Most recent additions include Jakarta (IIX Jakarta), Puerto Rico (CRIX) and Lagos (IXPN), DE-CIX Frankfurt (soon!)

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

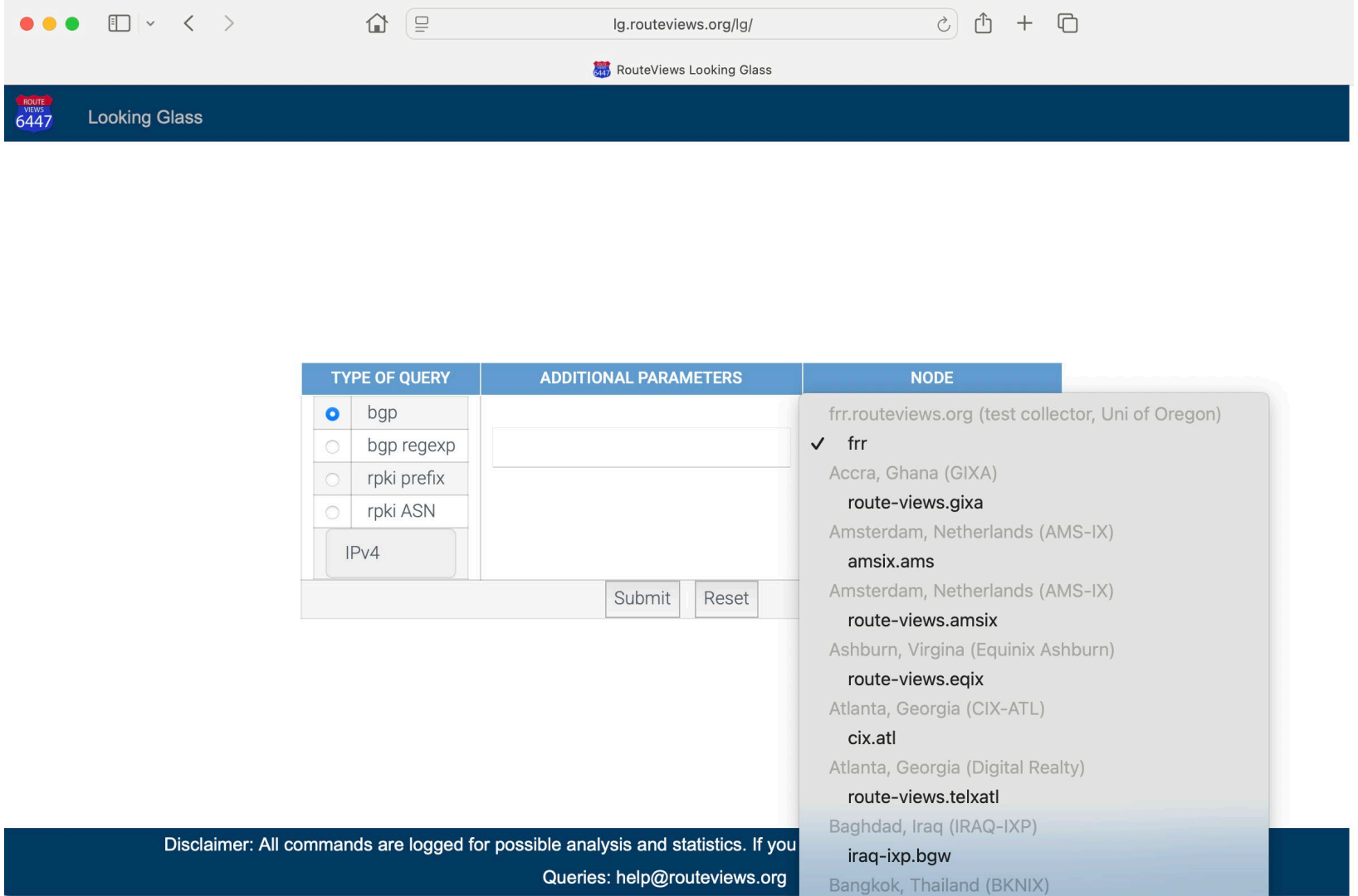
# RouteViews Development Projects: API

- 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 can be found on https://lg.routeviews.org/lg/
  - telnet access will be removed after due notice to the community


lg.routeviews.org/lg/
RouteViews Looking Glass
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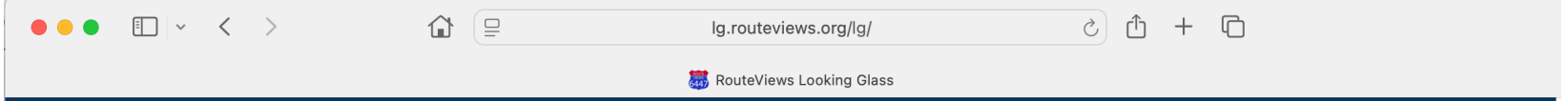
Looking Glass
TYPE OF QUERY
ADDITIONAL PARAMETERS
NODE
bgp
bgp regexp
rpki prefix
rpki ASN
IPv4
Submit
Reset
frr.routeviews.org (test collector, Uni of Oregon)
frr
Accra, Ghana (GIXA)
route-views.gixa
Amsterdam, Netherlands (AMS-IX)
amsix.ams
Amsterdam, Netherlands (AMS-IX)
route-views.amsix
Ashburn, 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

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**Router:** frr

**Command:** show bgp ipv4 unicast 23.56.154.116

```
frr.routeviews.org> show bgp ipv4 unicast 23.56.154.116
BGP routing table entry for 23.56.144.0/20, version 50831
Paths: (2 available, best #1, table default)
  Not advertised to any peer
  3582 3701 6939 4651 20940 16625
    128.223.253.10 from 128.223.253.10 (128.223.253.10)
      Origin IGP, valid, external, multipath, best (Older Path), rpki validation-state: valid
      Community: 3701:10200 3701:10204 3701:30003
      Last update: Tue May  6 21:45:58 2025
  3582 3701 6939 4651 20940 16625
    128.223.253.9 from 128.223.253.9 (128.223.253.9)
      Origin IGP, valid, external, multipath, rpki validation-state: valid
      Community: 3701:10200 3701:10204 3701:30003
      Last update: Tue May  6 21:45:58 2025
```

ROUTE VIEWS 6447 Looking Glass

**Router:** frr

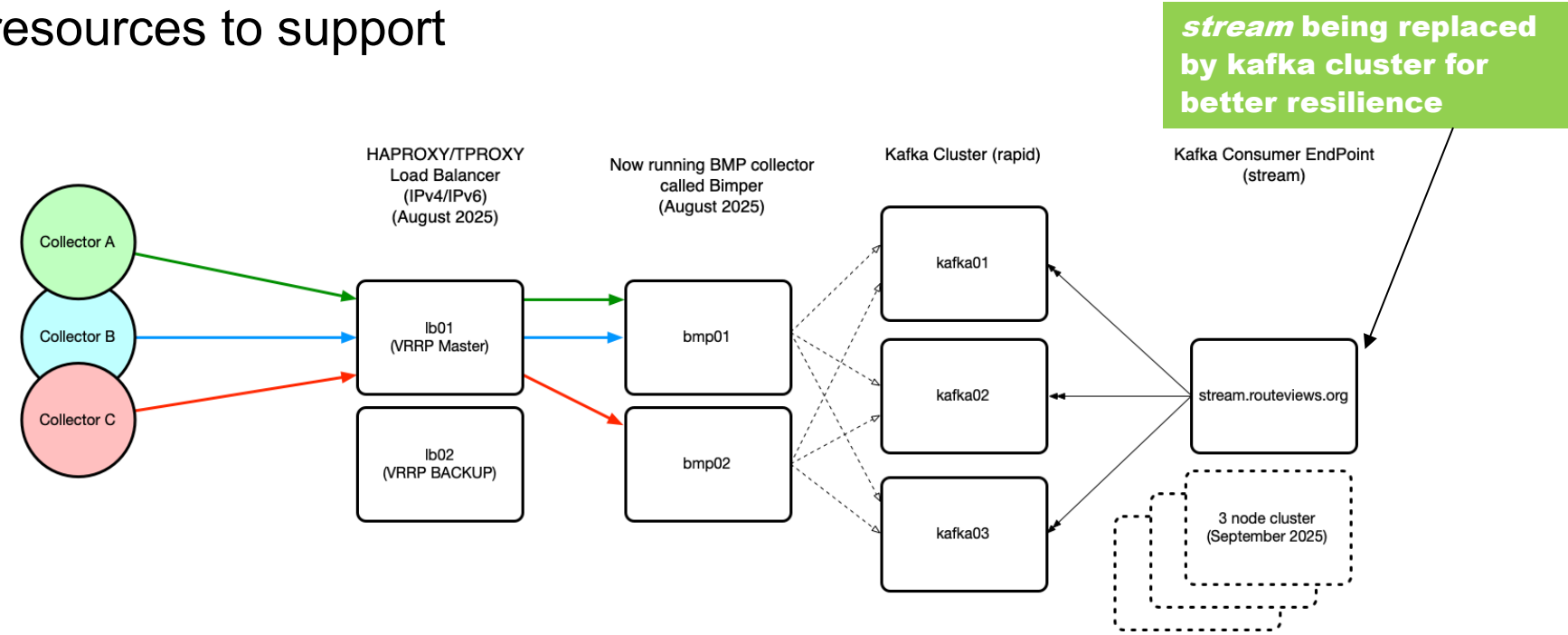
**Command:** show bgp ipv4 unicast 23.56.0.0/16 longer-prefixes

```
frr.routeviews.org> show bgp ipv4 unicast 23.56.0.0/16 longer-prefixes
BGP table version is 21483649, local router ID is 128.223.51.23, vrf id 0
Default local pref 100, local AS 65123
Status codes:  s suppressed, d damped, h history, u unsorted, * valid, > best, = multipath,
               i internal, r RIB-failure, S Stale, R Removed
Nexthop codes: @NNN nexthop's vrf id, < announce-nh-self
Origin codes:  i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

     Network          Next Hop            Metric LocPrf Weight Path
V*>  23.56.0.0/24     128.223.253.10                         0 3582 3701 2152 2516 20940 20940 i
V*=                   128.223.253.9                          0 3582 3701 2152 2516 20940 20940 i
V*>  23.56.1.0/24     128.223.253.10                         0 3582 3701 11164 20940 i
V*=                   128.223.253.9                          0 3582 3701 11164 20940 i
V*>  23.56.2.0/24     128.223.253.10                         0 3582 3701 2152 3356 20940 i
V*=                   128.223.253.9                          0 3582 3701 2152 3356 20940 i
V*>  23.56.3.0/24     128.223.253.10                         0 3582 3701 11164 20940 i
V*=                   128.223.253.9                          0 3582 3701 11164 20940 i
V*>  23.56.4.0/24     128.223.253.10                         0 3582 3701 11164 20940 i
V*=                   128.223.253.9                          0 3582 3701 11164 20940 i
V*>  23.56.5.0/24     128.223.253.10                         0 3582 3701 2152 3356 20940 i
V*=                   128.223.253.9                          0 3582 3701 2152 3356 20940 i
```

# 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 Bimper 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)

# Slow and noisy peers

- Bimper enables us to monitor bgp and bmp more closely
- Much time was spent chasing stalled bgp and bmp sessions
- upgrade to FRR 10.5.1 greatly improve queing and processing of updates  and means the live stream platform is much more stable now

# 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
- RouteViews Peering Portal
- 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! 🙏

For network operators & researchers

# USING ROUTEVIEWS



# Using RouteViews

- Network Operators use the live data to analyse how their routes appear on the Global Routing System
- Researchers use the 27-year-old data archive to study trends, route hijacks, and changes such as:
  - Origin change
  - Next-hop change
  - New prefix / more specifics
  - New neighbours
  - Operator ASN appearing in a new transit path
  - Bogons

# 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 Researchers

# REFERENCING ROUTEVIEWS



# We have a DOI

# 10.7264/1y7v-2d90

https://doi.datacite.org/dois/10.7264%2F1y7v-2d90

Please feel free to use this in your papers if you use our data

For Researchers

# ACCESSING ROUTEVIEWS DATA



# OSDF Cache Locations serving /routeviews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# Using Pelican to access to OSDF caches

- https://docs.pelicanplatform.org/getting-started
- https://docs.pelicanplatform.org/getting-started/accessing-data

For anyone still awake

# PUBLIC ROUTEVIEWS DASHBOARDS



# We want to start trialling public Dashboards

We have a couple available to anyone interested at

https://graphs.routeviews.org/grafana/

(login: rviews/rviews)

Please feel free to look around. Dashboard suggestions can be made to anyone here from RouteViews. Please email help@routeviews.org also.

We'll be adding more over time. We need to also add documentation

For anyone who needs to sleep

# NOISY PEER ANALYSIS

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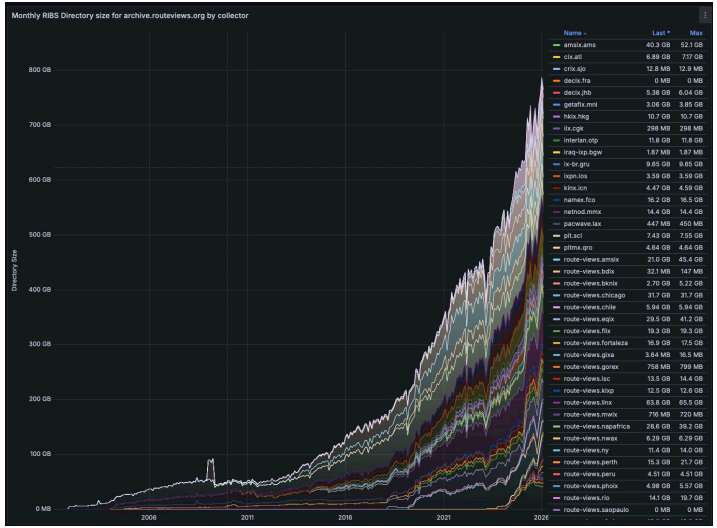
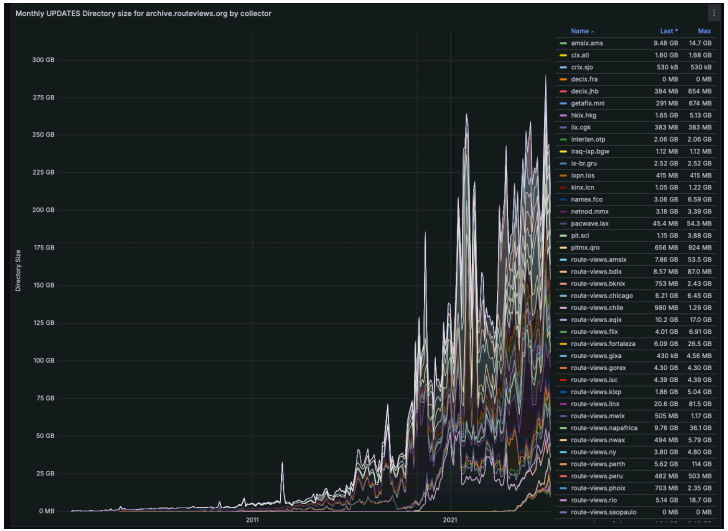
# Noisy Peer Identification

We've been slowly getting better at Noisy Peer Identification, which helps reduce the noise in our archive

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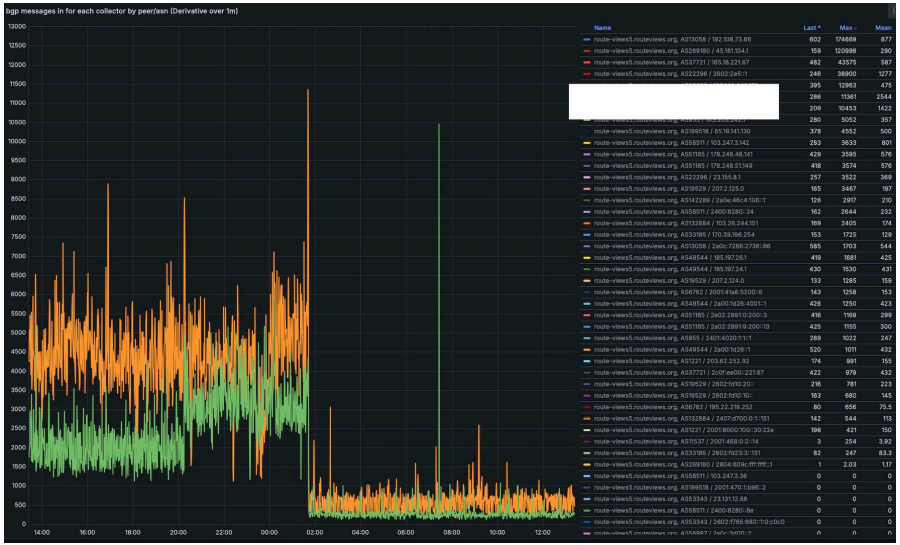
# Noisy Peer Identification

- We've built a relatively simple system which is currently called 'Stampede'
- Utilizes our live streaming service (Kafka RAW BMP)
- Does minute by minute analysis of 40 of our collectors
- Finds Noisiest (per minute):
  - Collectors
  - Peers
  - Prefixes (Announcements / Withdrawals)
  - Single ASN in any ASPATH
  - ASPATH ngrams
  - Communities

# Noisy Peer Identification

This and our existing monitoring helps us find noisy peers and work with them to understand what is happening and in some cases we've seen real reductions

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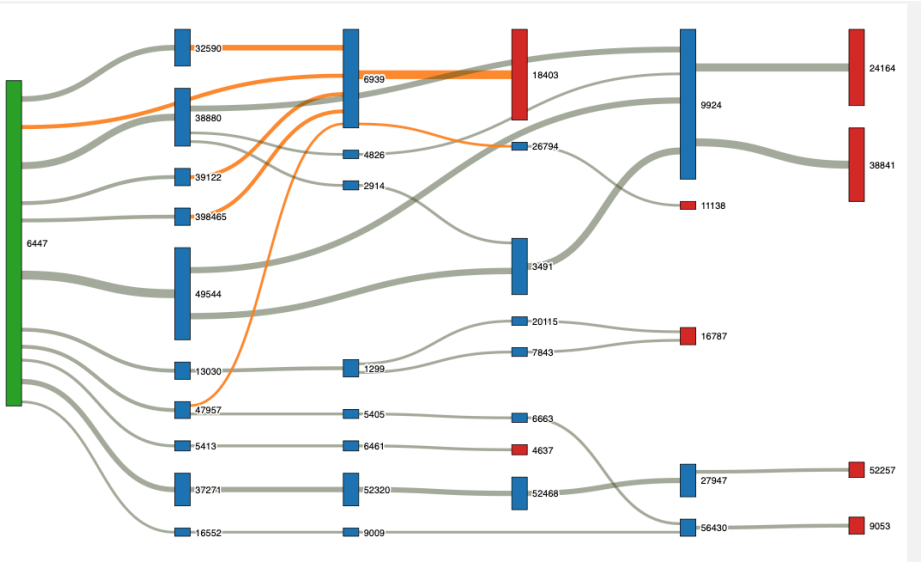
# Noisy Peer Identification

We've also started using the minute by minute data for some Sankey Visualization to identify noise that originates downstream of us in order to assist peers in tracking down potential noise



# Thank you!