

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.



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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



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RouteViews Collector Map



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

Note: Outdated map – modernised version will be released soon

Currently 55 collectors

Map doesn't show locix.fra, crix.sjo, decix.fra, getafix.mnl, netnod.mmx, interlan.otp, hkix.hkg, iix.cgk, ixpn.los

Map filter: [Peers by region](#) [Peer count](#) [RIB count](#) Search collectors by name or IP Maintain filters during search

48
of 48 collectors visible

Type of collector

FRR	<div style="width: 100%; height: 10px; background-color: #4CAF50;"></div>	45
Quagga	<div style="width: 20%; height: 10px; background-color: #FF9800;"></div>	2
Cisco	<div style="width: 10%; height: 10px; background-color: #00008B;"></div>	1

Number of collectors

IP all v4 only v6 avail RPKI all false true

Scamper all false true BMP all false true

Multihop all false true

Collectors by RIR region

ARIN	<div style="width: 100%; height: 10px; background-color: #4DB6AC;"></div>	19
APNIC	<div style="width: 80%; height: 10px; background-color: #8D6E63;"></div>	9
LACNIC	<div style="width: 75%; height: 10px; background-color: #FFC107;"></div>	8
RIPE NCC	<div style="width: 75%; height: 10px; background-color: #FF9800;"></div>	8
AFRINIC	<div style="width: 40%; height: 10px; background-color: #9C27B0;"></div>	4

Number of collectors

Toggle regions

Interactive map created by [UO InfoGraphics Lab](#)
Powered by [CARTO](#) | [HighCharts](#) | [Leaflet](#)

What's happening at RouteViews

ROUTEVIEWS NEWS



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RouteViews News

- Collectors:
 - All software collectors use FRR¹ (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), San Jose (CRIX), Lagos (IXPN), Hong Kong (HKIX) and Frankfurt (DE-CIX & LOCIX)

¹FRRouting Project: <https://frrouting.org/>



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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.napafrika.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



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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



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DEMO

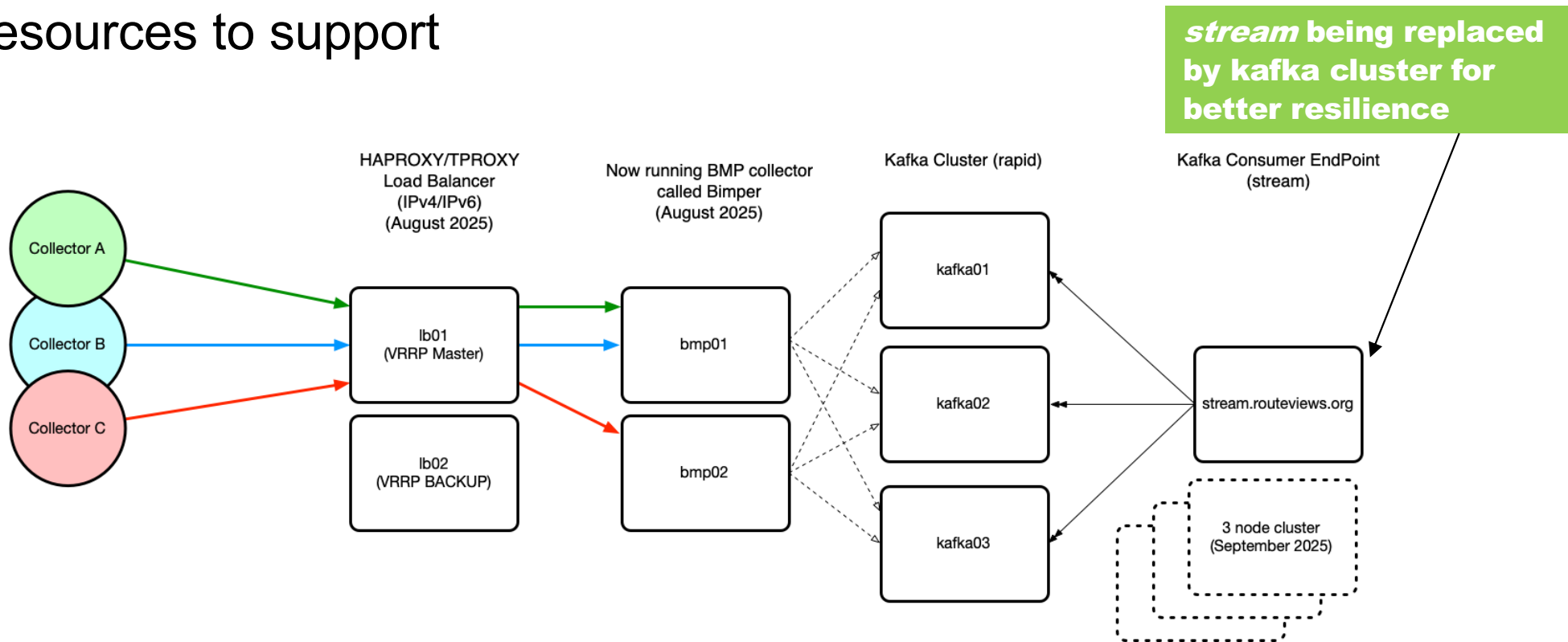
TYPE OF QUERY		ADDITIONAL PARAMETERS
<input checked="" type="radio"/>	bgp	<input type="text"/>
<input type="radio"/>	bgp regexp	
<input type="radio"/>	rpki prefix	
<input type="radio"/>	rpki ASN	
<input type="text" value="IPv4"/>		
		<input type="button" value="Submit"/> <input type="button" value="Reset"/>

Questions? See our [blog post](#) for some Looking Glass use examples

- Ashburn, Virginia (Equinix Ashburn)
route-views.eqix
- Atlanta, Georgia (CIX-ATL)
cix.atl
- San José, Costa Rica (CRIX)
crix.sjo
- Frankfurt, Germany (DE-CIX Frankfurt)
decix.fra
- Manila, Philippines (GetaFIX)
getafix.mnl
- Atlanta, Georgia (Digital Realty)
route-views.telxatl
- Baghdad, Iraq (IRAQ-IXP)
iraq-ixp.bgw
- Malmö, Sweden (Netnod Stockholm/Copenhagen)
netnod.mmx
- Bangkok, Thailand (BKNIX)
route-views.bknix
- Belgrade, Serbia (SOX Serbia)
route-views.soxrs
- Bucharest, Romania (InterLAN-IX)
interlan.otp
- Chicago, Illinois (Equinix CH1)
route-views.chicago
- Dhaka, Bangladesh (BDIX)
route-views.bdix
- Dubai, United Arab Emirates (UAE-IX)
route-views.uaeix
- Fortaleza, Brazil (IX.br (PTT.br) Fortaleza)
route-views.fortaleza
- Guam, US Territories (GOREX)
route-views.gorex
- Indianapolis, Indiana (FD-IX)
route-views.mwix

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 Behind the Scenes Projects

- Upgrading archive infrastructure and storage
 - RouteViews stores BGP data from 1997 – around 50 TBytes (compressed)
 - <https://archive.routeviews.org/> and <https://archive2.routeviews.org/>
- Tooling
 - Automation tools for managing the whole infrastructure and deploying new peers
- Collector OS (from CentOS to Ubuntu)
 - CentOS end-of-life – a few 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)



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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! 🙏



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For network operators & researchers

USING ROUTEVIEWS



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Using RouteViews

- Network Operators use the live data to analyse how their routes appear on the Global Routing System
- Researchers use the 29-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



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RouteViews Use Cases: Peering Negotiation

- Understanding your prospects connectivity can be key to a good negotiation
 - Who are the upstreams?
 - Who are the peers?
 - Who are the customers?



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For Peering Coordinators

PEERING WITH ROUTEVIEWS



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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)



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Peering with RouteViews: General Requirements

- Peer must operate stable equipment
 - RouteViews will shutdown BGP sessions that impact the stability of the RouteViews platform
- Peer must have a public 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 have up-to-date information in PeeringDB, including the NOC email address
- Peer must filter RFC6890 space and must not send default routes
- RouteViews does not accept addpath-RX or TX



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Peering with RouteViews: IXP & Multihop

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.



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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



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R&E Routes

- Dedicated R&E collector hosted by NSRC to support REN BGP statistics (managed by Philip Smith)
- Daily or weekly REN routing table reports
- See <https://bgp.nsrc.org/REN/>
- Please send us your R&E routes!



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How you can help

SUPPORTING ROUTEVIEWS



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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



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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



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Consumers of RouteViews data

If you use RouteViews data for your products or services:

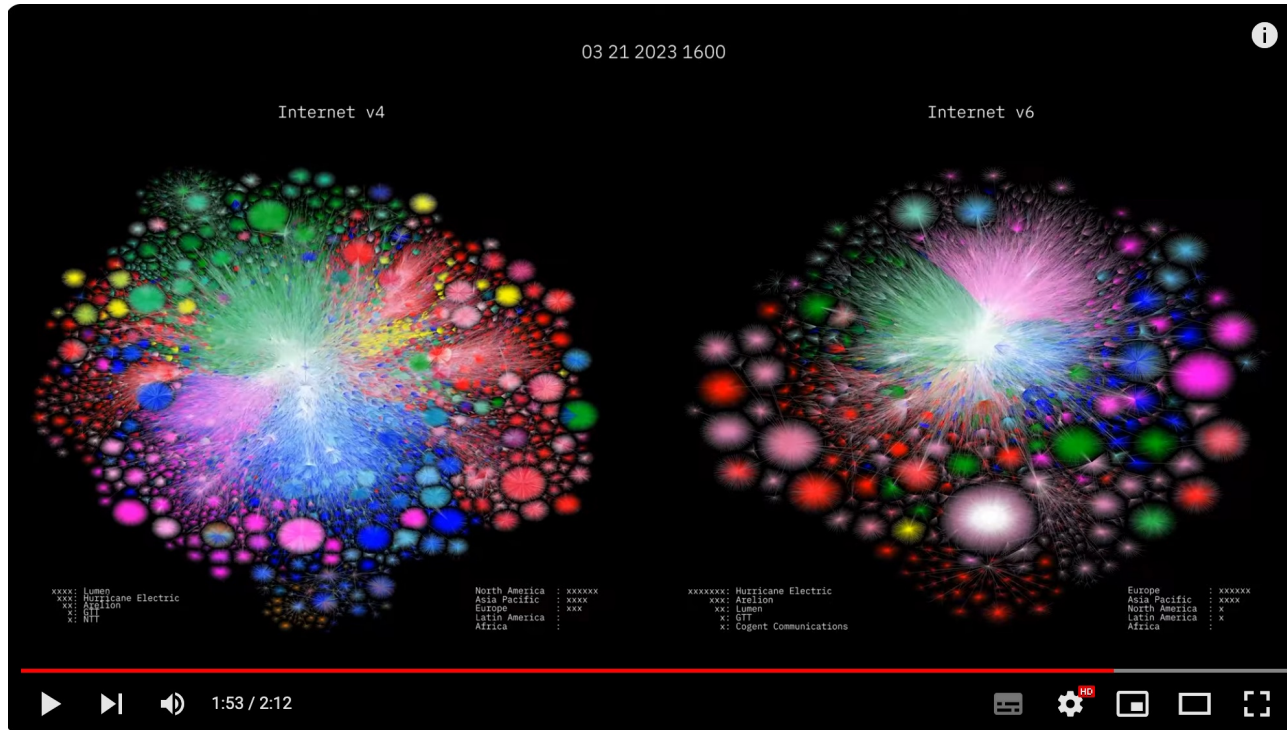
- Please acknowledge the source!
 - Your product or service likely would not work without our data!
- Please do *NOT* send your customers of your products or services to us for technical support:
 - We simply collect what is seen in the global routing table
 - We cannot fix mistakes made by network operators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



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RouteViews Impact



Barrett Lyon:

<https://www.youtube.com/watch?v=vo5gIK9czIE>



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Thank you!

