



RIPE NCC

RIPE NETWORK COORDINATION CENTRE

RIPE NCC Routing Information Service (RIS)

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What is RIS?



- Worldwide network of BGP collectors
- 23 years of history
- Deployed at Internet Exchange Points
- Collects raw BGP data from peers
- Stores BGP messages and routing table dumps
- Used by Network Operators and researchers every day
- Is a source of data for many other services

Why RIS?



- Original project defined in RIPE-200 in 1999:
 - “In other words, it can be regarded as one integrated Looking-Glass for the entire Internet that includes history information”
- Looking glasses and routing problems are temporary
- BGP history is recorded to track what is happening and what has happened
- It provides statistics and reporting on routing table metrics

Collector Locations



- 23 route collectors
- 1,490 peers
- 579 peer ASes



RIS Collectors



Collector	Location	IXP	Deployed	Removed	Collector	Location	IXP	Deployed	
RRC00	Amsterdam	Multi-hop	1999		RRC13	Moscow	MSK-IX	2005	
RRC01	London	LINX	2000		RRC14	Palo Alto	PAIX	2005	
RRC02	2008	2008	2008	2008	RRC15	Sao Paulo	PTT-Metro SP	2006	
RRC03	Amsterdam	AMS-IX	2001		RRC16	Miami	NOTA	2008	
RRC04	Geneva	CIXP	2001		RRC18	Barcelona	CATNIX	2015	
RRC05	Vienna	VIX	2001		RRC19	Johannesburg	NAPAfrica JB	2016	
RRC06	Tokyo	DIX-IE	2001		RRC20	Zurich	SwissIX	2015	
RRC07	Stockholm	Netnod	2002		RRC21	Paris	FranceIX	2015	
RRC08	San Jose	MAE-West	2002	2004	RRC22	Bucharest	InterLAN	2017	
RRC09	Zurich	TIX	2003	2004	RRC23	Singapore	Equinix SG	2017	
RRC10	Milan	MIX	2003		RRC24	Montevideo	LACNIC multi-hop	2019	
RRC11	New York	NYIIX	2004		RRC25	Amsterdam	Multi-hop	2021	
RRC12	Frankfurt	DE-CIX	2004		RRC26	Dubai	UAE-IX	2021	

Raw Data



- 23 years of raw data (34 TB) available for download and analysis:
 - https://ris.ripe.net/docs/20_raw_data_mrt.html
 - https://ris.ripe.net/docs/40_Prototypes/15_per_rrc_dumps.html
- Data is stored in MRT format (RFC 6396)
- Readable using BGPdump utility
 - Open source, maintained by the RIPE NCC
 - <https://bitbucket.org/ripenncc/bgpdump>
- Other tools and libraries

What Does it Look Like?



- Machine-readable format:

```
$ bgpdump -vm /mnt/ris/rrc25/2022.09/updates.20220918.0000.gz
BGP4MP|1663459200|A|165.140.142.121|50058|64.68.236.0/22|50058 174 3356 13904|IGP|165.140.142.121|0|0|174:21000 174:22013 5
BGP4MP|1663459200|A|2001:4da8:f000::25|28824|2a10:cc40:111::/48|28824 6939 211459 139989|IGP|2001:4da8:f000::25|0|0|28824:1
BGP4MP|1663459200|A|2001:4da8:f000::25|28824|2a10:cc40:111::/48|28824 50304 6939 211459 139989|IGP|2001:4da8:f000::25|0|0|2
BGP4MP|1663459200|A|2602:fc23:18::7|50058|2001:7f9::/48|50058 6939 2914 20473 211655|IGP|2602:fc23:18::7|0|0|50058:10|NAG|
BGP4MP|1663459200|A|2602:fc23:18::7|50058|2606:2800:e004::/48|50058 1299 3356 14210|IGP|2602:fc23:18::7|0|0|1299:25000 5005
BGP4MP|1663459200|A|2a0f:5707:ab80:633::1|210633|2a0e:97c0:371::/48|210633 6939 211459 139989|IGP|2a0f:5707:ab80:633::1|0|0
```

- Human-readable format:

```
$ bgpdump -v /mnt/ris/rrc25/2022.09/updates.20220918.0000.gz
TIME: 09/18/22 00:00:00
TYPE: BGP4MP/MESSAGE/Update
FROM: 165.140.142.121 AS50058
TO: 193.0.4.29 AS12654
ORIGIN: IGP
ASPATH: 50058 174 3356 13904
NEXT_HOP: 165.140.142.121
COMMUNITY: 174:21000 174:22013 50058:10
ANNOUNCE
64.68.236.0/22
```

RIS Live (1)



- WebSocket interface which sends messages in real-time
- Messages are in JSON format
- You could receive full feed, or filter by:
 - Collector
 - Peer
 - Message type
 - AS path
 - Prefix (exact or more/less specific)
- Visit ris-live.ripe.net

RIS Live (2)



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": "rrc21",
  "peer": null,
  "socketOptions": {
    "includeRaw": false,
    "acknowledge": true
  }
}
```

Code examples

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

Javascript

Python

```
/*
Subscribe to a RIS Live stream and output every message
to the javascript console.
*/
```

The exact same code will work in Node.js after running 'npm install ws' and including the following line:

```
const WebSocket = require('ws');
```

Live RIS BGP messages



Connected

7398 matching messages ~799 kbit/s

```
// Received at 23:34:16 (1.95 second delay)
{
  "timestamp": 1663536854.98,
  "peer": "2001:7f8:54::228",
  "peer_asn": "24482",
  "id": "21-3513-245721908",
  "host": "rrc21",
  "type": "UPDATE",
  "path": [24482, 174, 2914, 20473],
  "community": [[174, 21000], [174, 22013], [24482, 1], [24482, 13020], [24482, 13021], [24482, 20300], [24482, 64605]],
  "origin": "igp",
  "med": 80020,
  "announcements": [
    {
      "next_hop": "2001:7f8:54::228",
      "prefixes": [
        "2a0e:97c6:4c14::/48"
      ]
    },
    {
      "next_hop": "fe80::c203:8007:966e:500e",
      "prefixes": [
        "2a0e:97c6:4c14::/48"
      ]
    }
  ]
}
```

```
// Received at 23:34:16 (1.95 second delay)
{
  "timestamp": 1663536854.98,
  "peer": "2001:7f8:54::228",
```

BGPalerter (1)

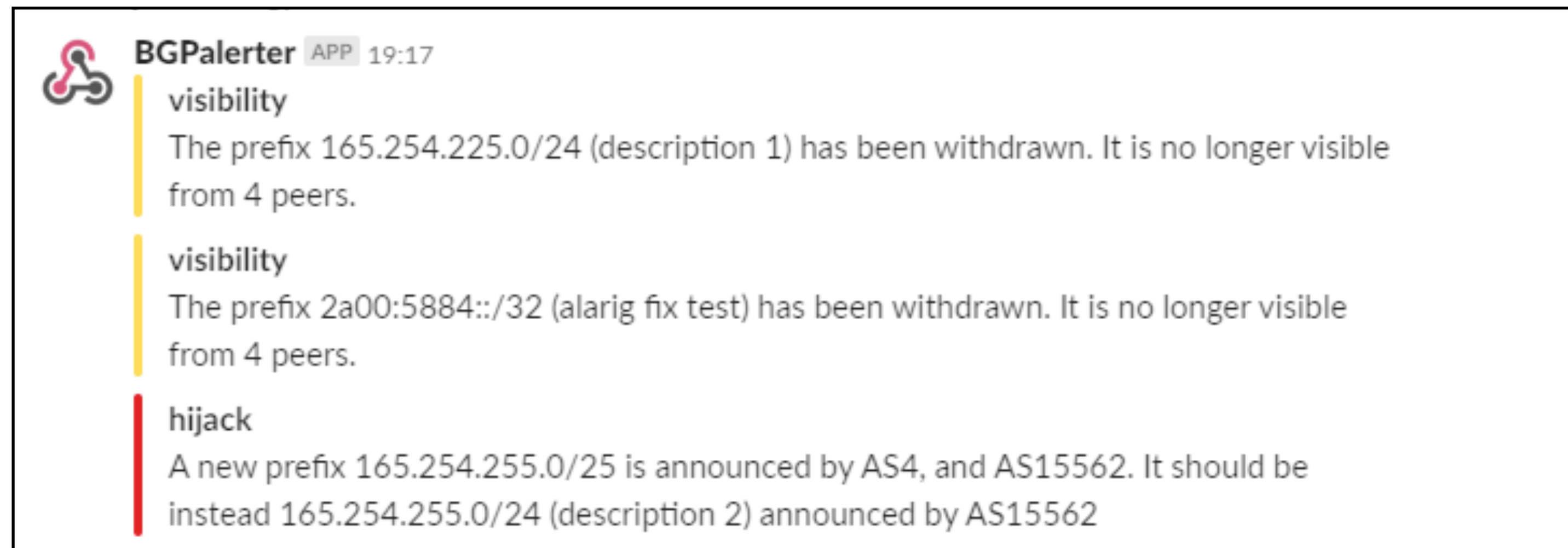


- Self-configuring BGP real-time monitoring tool which allows you to monitor if:
 - Any of your prefixes lose visibility or are hijacked
 - Your AS is announcing RPKI invalid prefixes (e.g. not matching prefix length)
 - Your AS is announcing prefixes not covered by ROAs
 - ROAs covering your prefixes are no longer reachable or are expiring
 - A ROA involving any of your prefixes or ASes was deleted/added/edited
 - Your AS is announcing a new prefix that has never been announced before
 - An unexpected upstream or downstream AS appears in an AS path
 - One of the AS paths used to reach your prefix matches a specific condition

BGPalerter (2)



- It can deliver alerts through files, email, Kafka, Slack, and more



- Find the BGPalerter at <https://github.com/nttgin/BGPalerter>
- More information on [RIPE Labs](#)

RIPEstat



- Of course, if all we did was store the raw data, we would just need hard disks and an FTP server
 - But you would like to query all of our lovely datasets!
- RIPEstat
 - <https://stat.ripe.net/>
 - Our portal for everything you ever wanted to know!
- RIPEstat API
 - <https://stat.ripe.net/data>
 - Data for widgets and so much more

RIPEstat Examples (1)



BGP Looking Glass (2001:798::/32)

Advanced Settings

- 19 RRCs see 234 peers announcing 2001:798::/32 originated by 2 ASNs. [EXPAND EVERYTHING]
 - RRC11 in New York City, New York, US sees 1 ASN originating 2001:798::/32. (AS21320)
 - RRC03 in Amsterdam, Netherlands sees 2 ASNs originating 2001:798::/32. ()
 - AS21320 is seen as the origin by 19 peers.
 - AS20965 is seen as the origin by 1 peer. (2001:7f8:1::a500:1103:2)
 - 2001:7f8:1::a500:1103:2 is announcing route AS1103 AS20965.


```
Origin: IGP
Next Hop: 2001:7f8:1::a500:1103:2
Peer: 2001:7f8:1::a500:1103:2
Community: 20965:155 20965:65532 20965:65533
64700:65532 64700:65533 64700:65534
AS Path: 1103 20965
Last Updated: 2019-03-26T05:26:36
```
 - RRC00 in Amsterdam, Netherlands sees 1 ASN originating 2001:798::/32. (AS21320)
 - RRC01 in London, United Kingdom sees 1 ASN originating 2001:798::/32. (AS21320)
 - RRC06 in Tokyo, Japan sees 2 ASNs originating 2001:798::/32. ()
 - RRC07 in Stockholm, Sweden sees 1 ASN originating 2001:798::/32. (AS21320)
 - RRC04 in Geneva, Switzerland sees 2 ASNs originating 2001:798::/32. ()

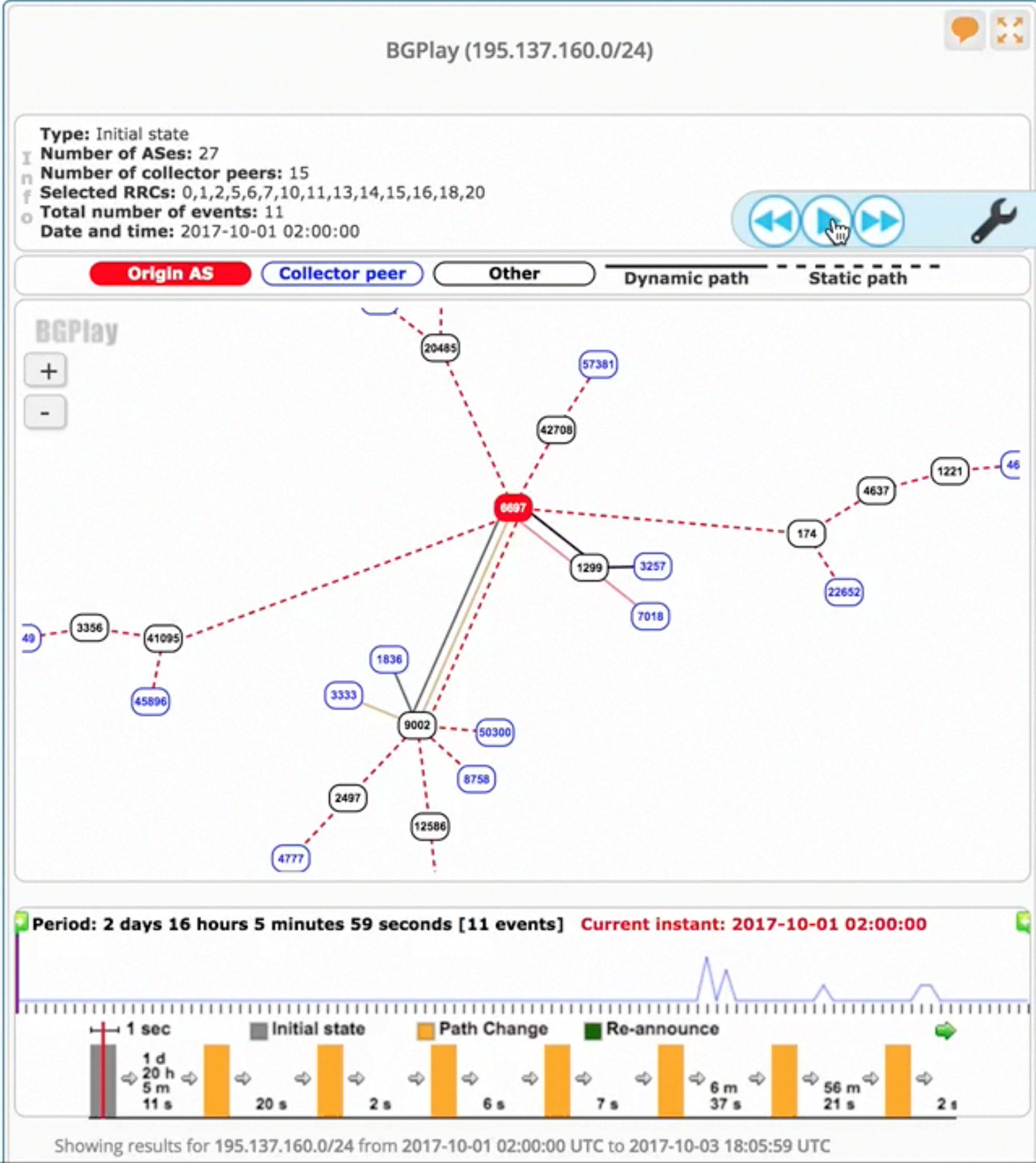
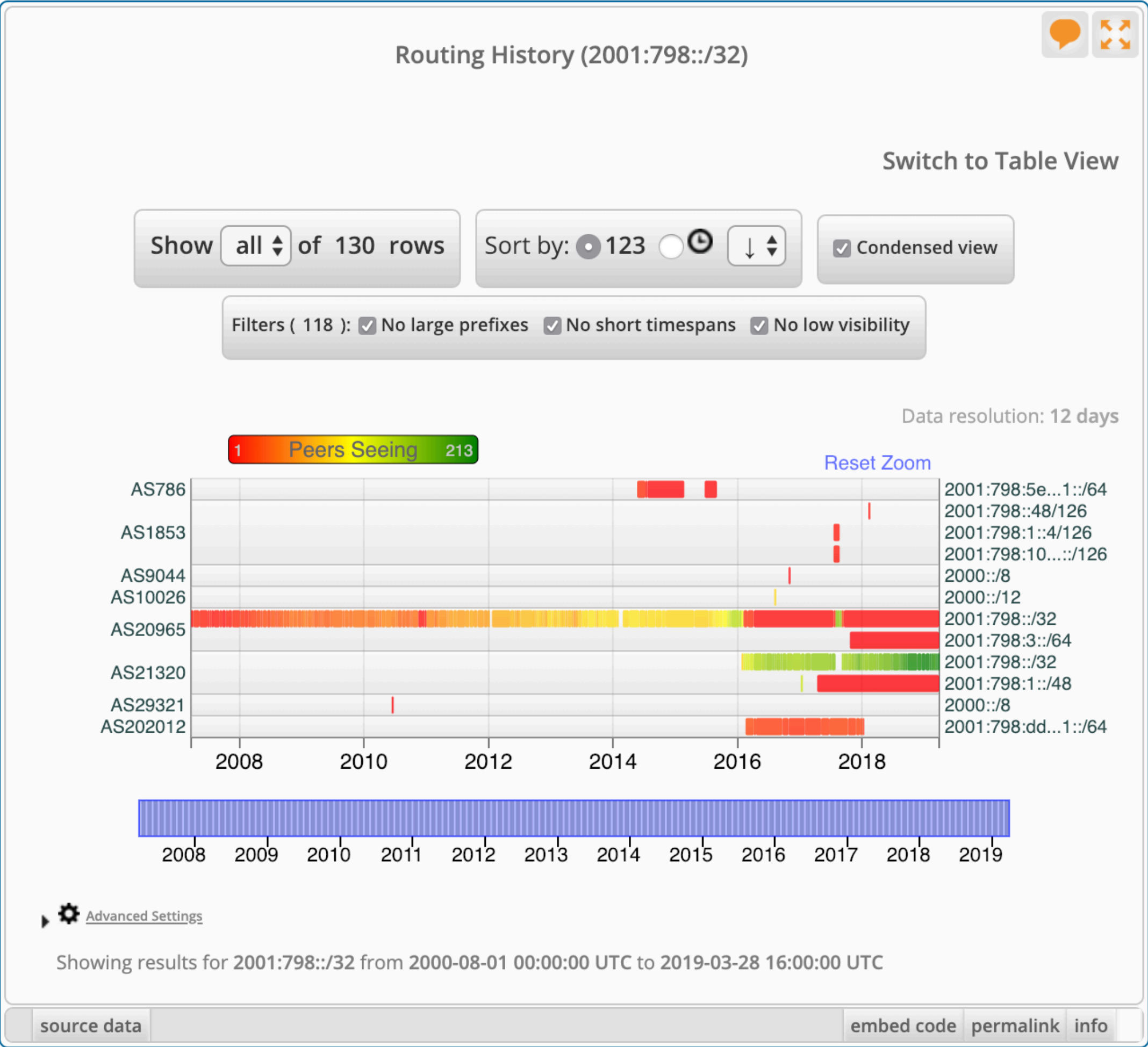
Visibility (2001:798::/32)

2001:798::/32 is visible by 100% of 226 IPv6 RIS full peers.

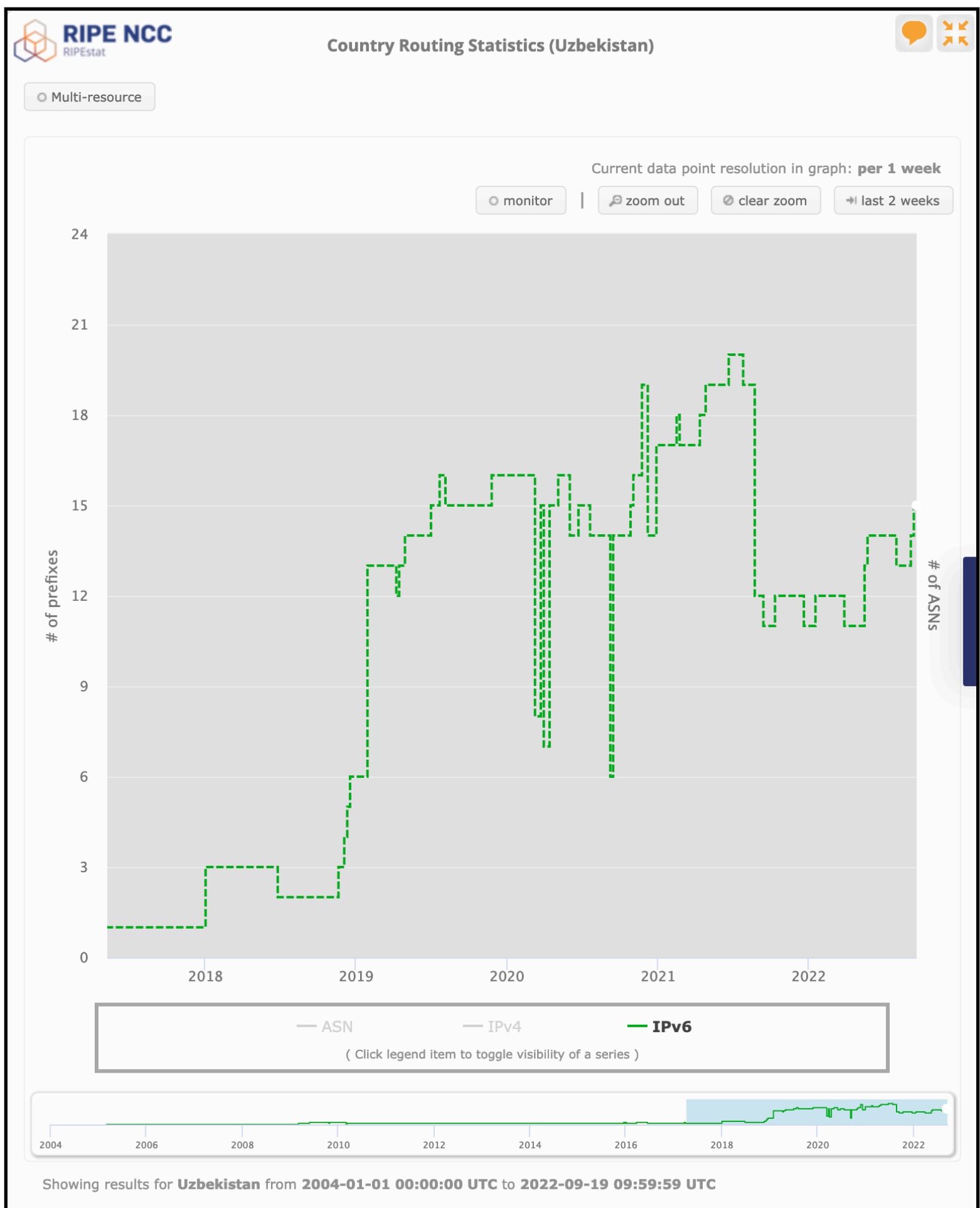
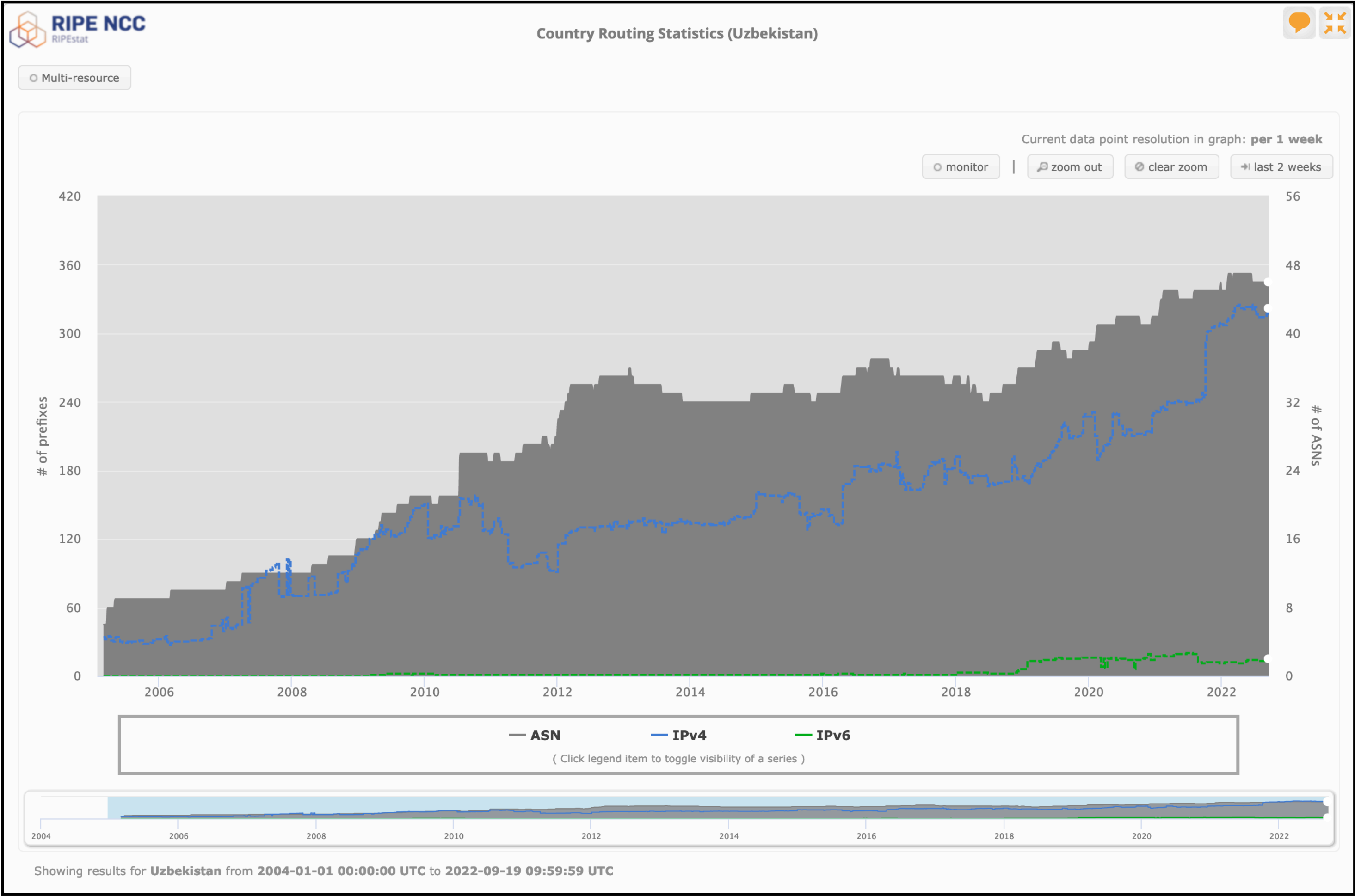
Visibility Location Details of 2001:798::/32

RRC	IXP Location	Location	IPv6 peers seeing	IPv6 Visibility
RRC00	RIPE-NCC Multihop	Amsterdam, Netherlands	27 of 27	100%
RRC01	LINX / LONAP	London, United Kingdom	23 of 23	100%
RRC03	AMS-IX / NL-IX	Amsterdam, Netherlands	19 of 19	100%
RRC04	CIXP	Geneva, Switzerland	4 of 4	100%
RRC05	VIX	Vienna, Austria	6 of 6	100%
RRC06	DIX-IE	Tokyo, Japan	3 of 3	100%
RRC07	Netnod	Stockholm, Sweden	7 of 7	100%
RRC10	MIX	Milan, Italy	13 of 13	100%
RRC11	NYIIX	New York City, US	11 of 11	100%
RRC12	DE-CIX	Frankfurt, Germany	21 of 21	100%
RRC13	MSK-IX	Moscow, Russian Federation	6 of 6	100%
RRC14	PAIX	Palo Alto, US	8 of 8	100%
RRC15	PTTMetro	Sao Paulo, Brazil	19 of 20	95%

RIPEstat Examples (2)



RIPEstat Examples (3)





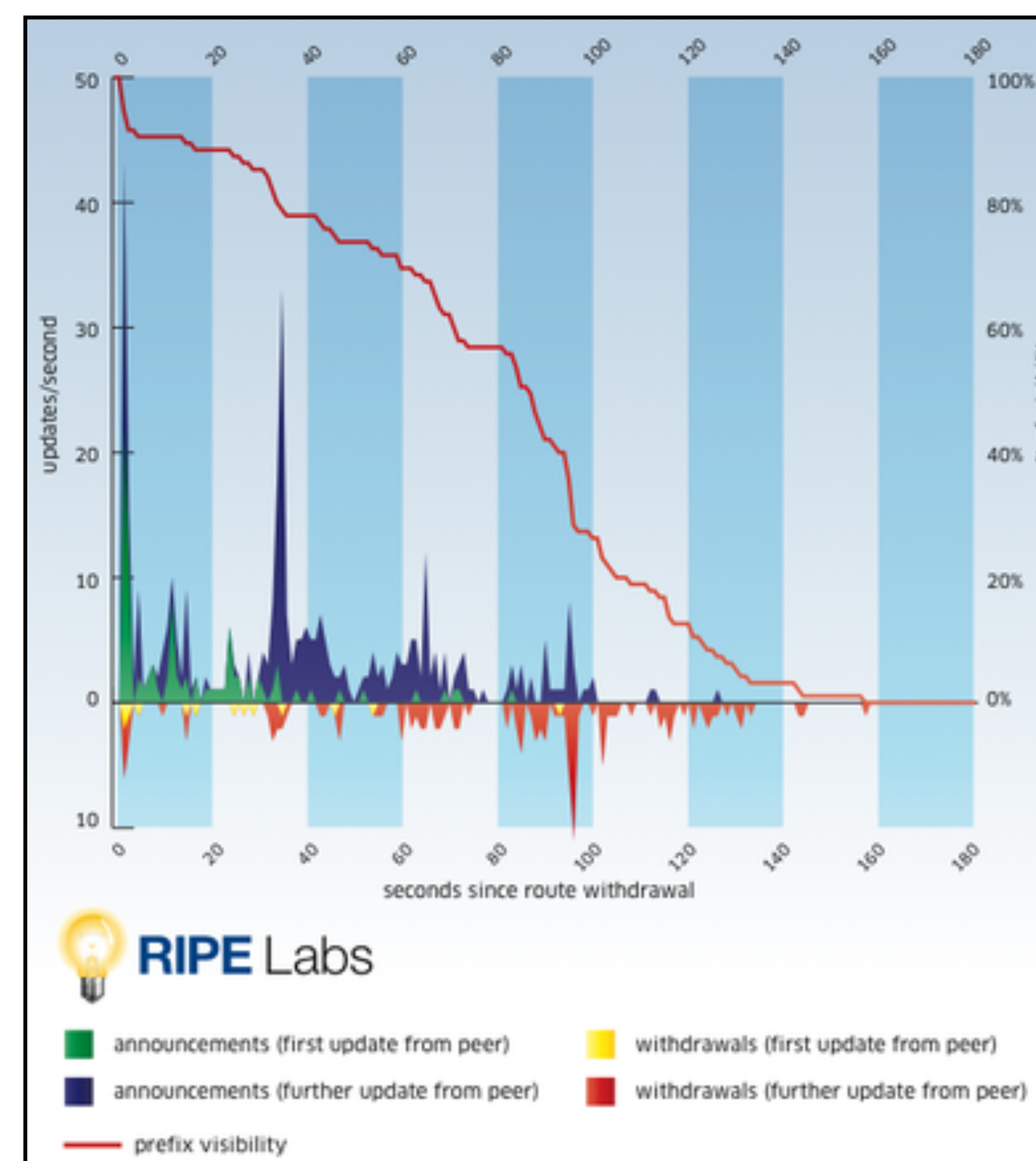
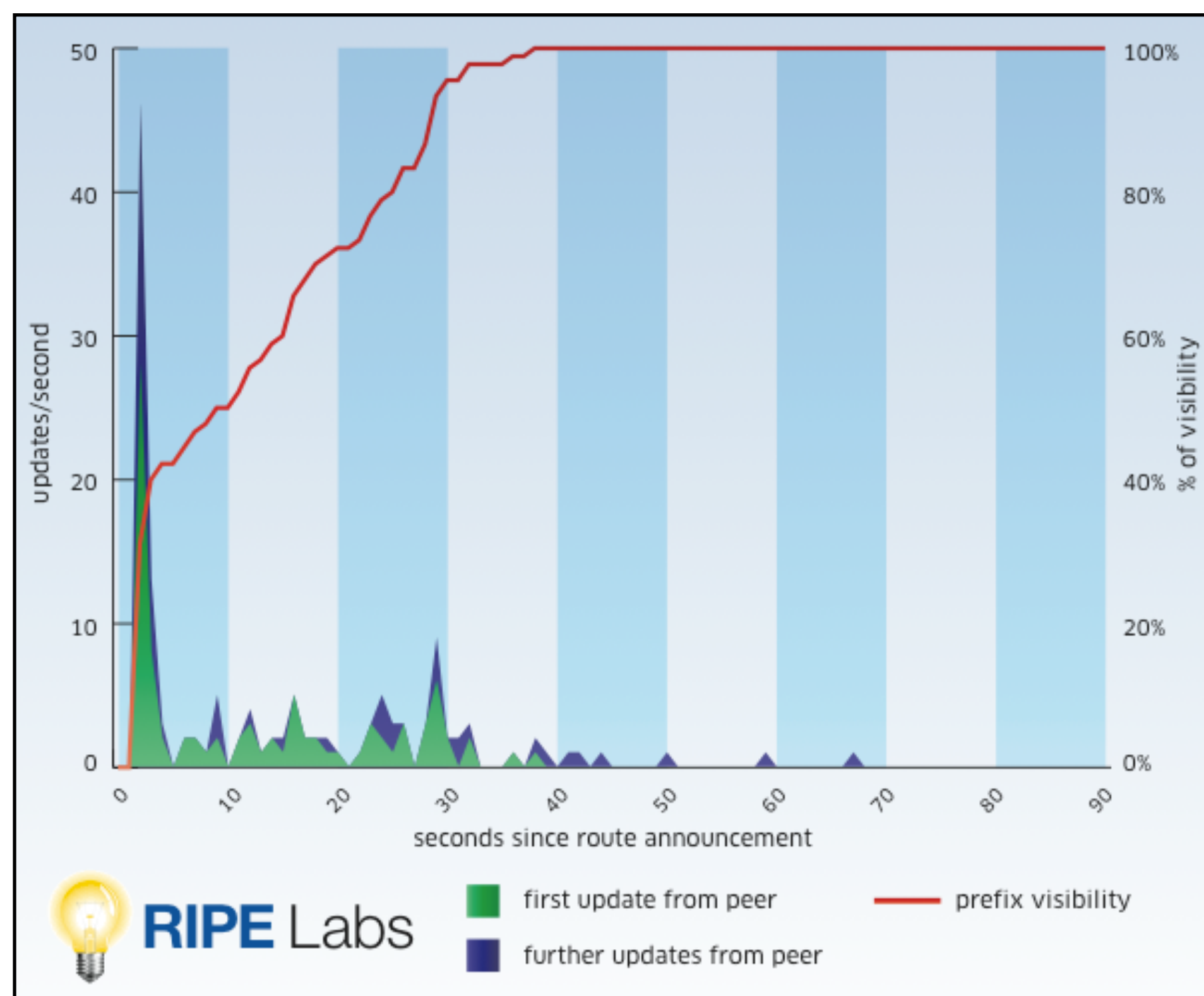
This Data Allows for So Much Analysis

What else can you do?

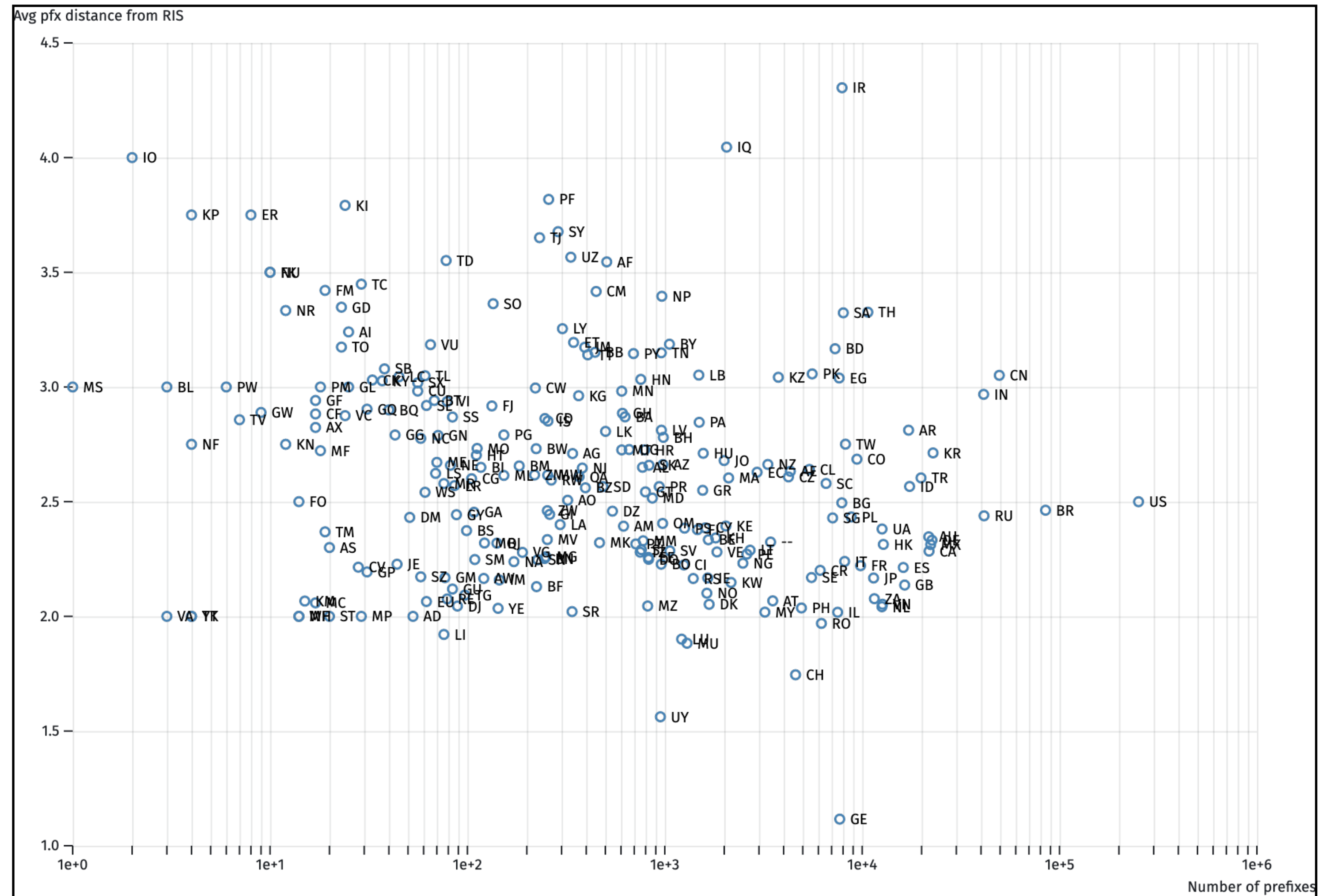
BGP Update Propagation



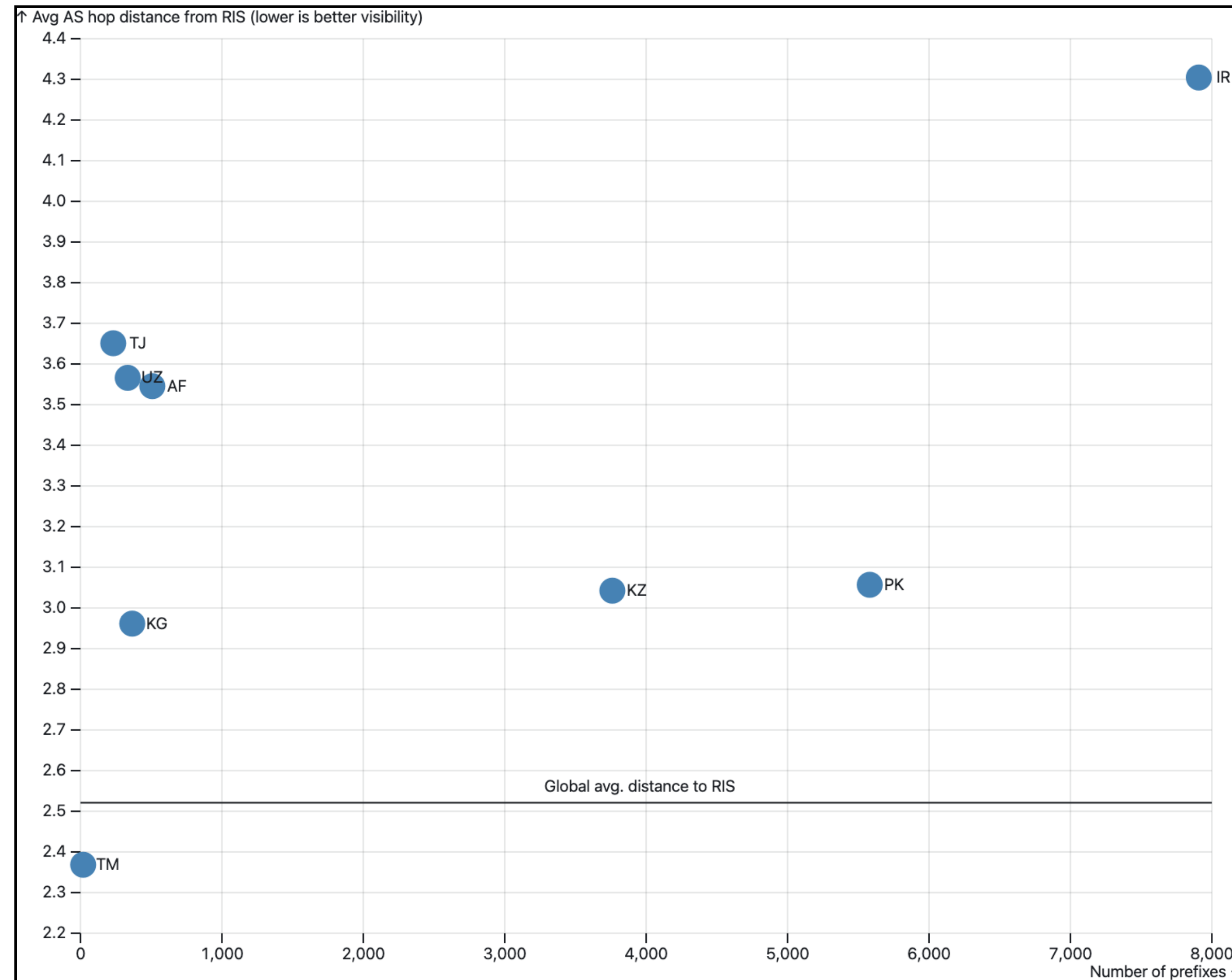
- The Shape of a BGP Update:
 - <https://labs.ripe.net/Members/vastur/the-shape-of-a-bgp-update>



Distance to Country in RIS



Distance to Countries in Central Asia





Questions



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<https://ris.ripe.net>