Expanding Internet Routing Visibility with BMP

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University of Strasbourg

NLNOG Day
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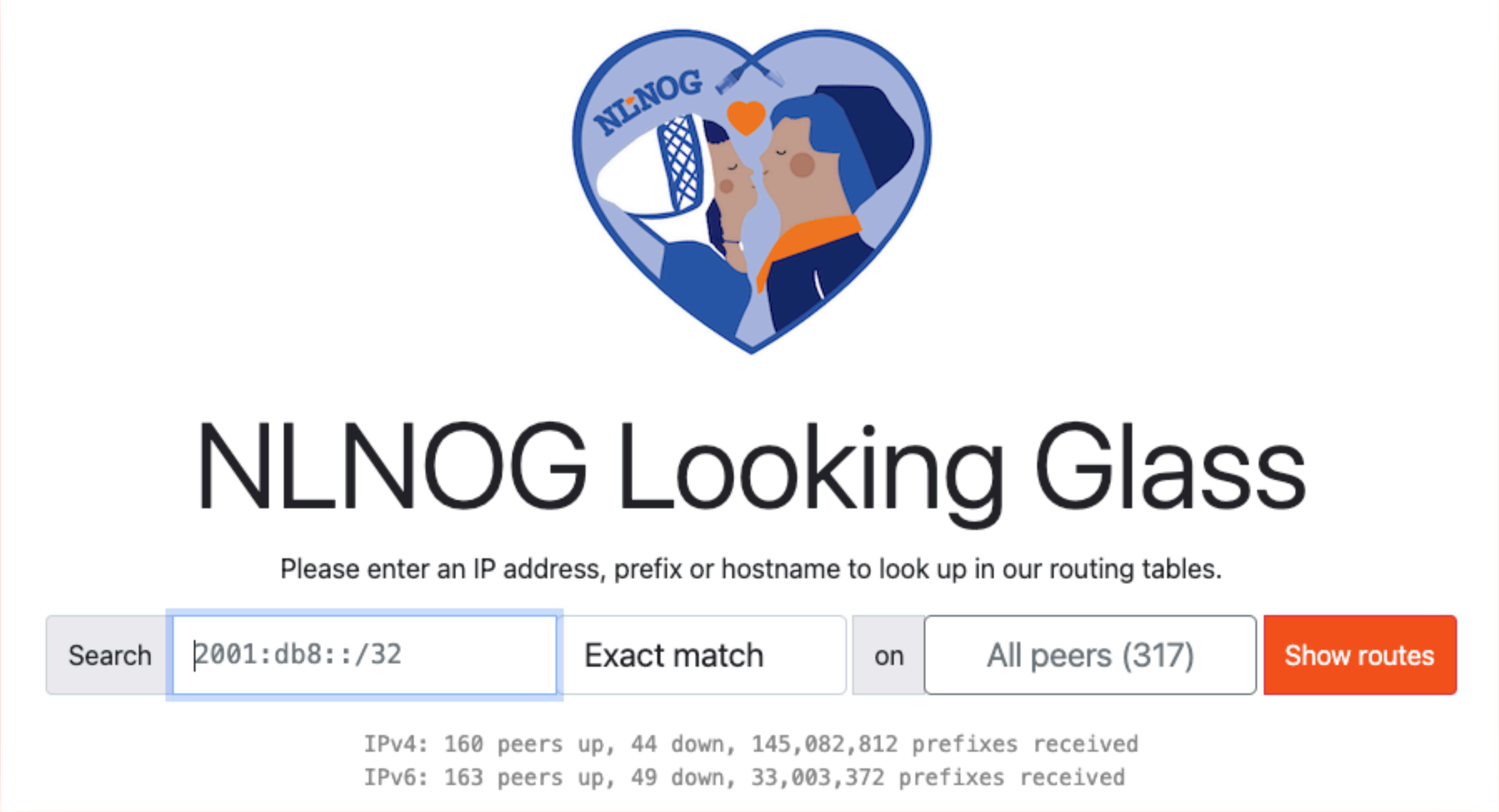
Amsterdam

Joint work with:
Thomas Alfroy
Cristel Pelsser

The BGP data collected from operational BGP routers is essential for understanding and monitoring Internet routing

One example:



NLNOG Looking Glass

Please enter an IP address, prefix or hostname to look up in our routing tables.

NLNOG
Search
2001:db8::/32
Exact match
on
All peers (317)
Show routes

```
IPv4: 160 peers up, 44 down, 145,082,812 prefixes received
IPv6: 163 peers up, 49 down, 33,003,372 prefixes received
```

▶ Used by operators to e.g., verify routes to their prefixes

The two longstanding platforms that collect, archive, and publicly share BGP data are RIPE RIS and RouteViews

▶ They both collect and store data
from ~1500 BGP routers (*a.k.a. "vantage points”*)

bgproutes.io

Our new next-gen BGP route collection platform

https://bgproutes.io

You can peer with us!

bgproutes.io

Our new next-gen BGP route collection platform

We launched our website
a few months ago!

https://bgproutes.io
You can peer with us!

bgproutes.io prioritises **coverage** (i.e., *percentage of ASes sharing data*) whereas RIS and RouteViews prioritises historical depth

	Open peering policy	Perpetual data retention
bgproutes.io	✓	✗
RIPE RIS RouteViews	✗	✓

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For more details:
see our NANOG'94 presentation

https://bgproutes.io

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Outline

1. Increasing coverage is **hard**
2. **BMP** to the rescue
3. How to **connect**
4. How to **monitor**
5. How to **use** the data

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1. Increasing coverage is **hard**
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Challenge #1: It is difficult to motivate operators to share data because there is no direct incentives

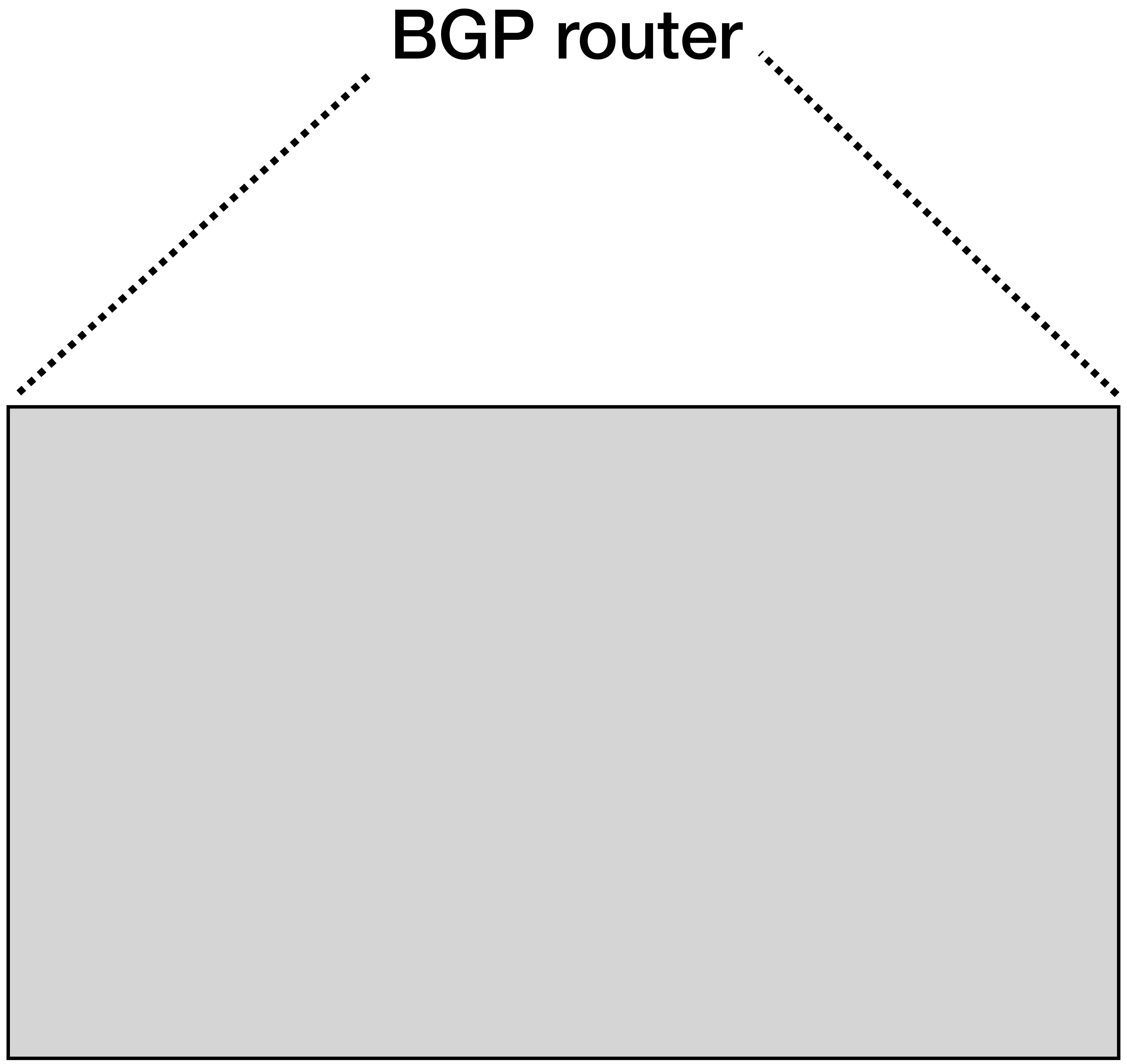
RIS and RouteViews coverage remains steady

Only 1.2% of the ASes share their data

In ~1 year, we managed to get ~40 peers

We need more

Challenge #2: Even when an operator agrees to share data, only a small fraction of its routes are visible due to BGP route hiding



BGP router

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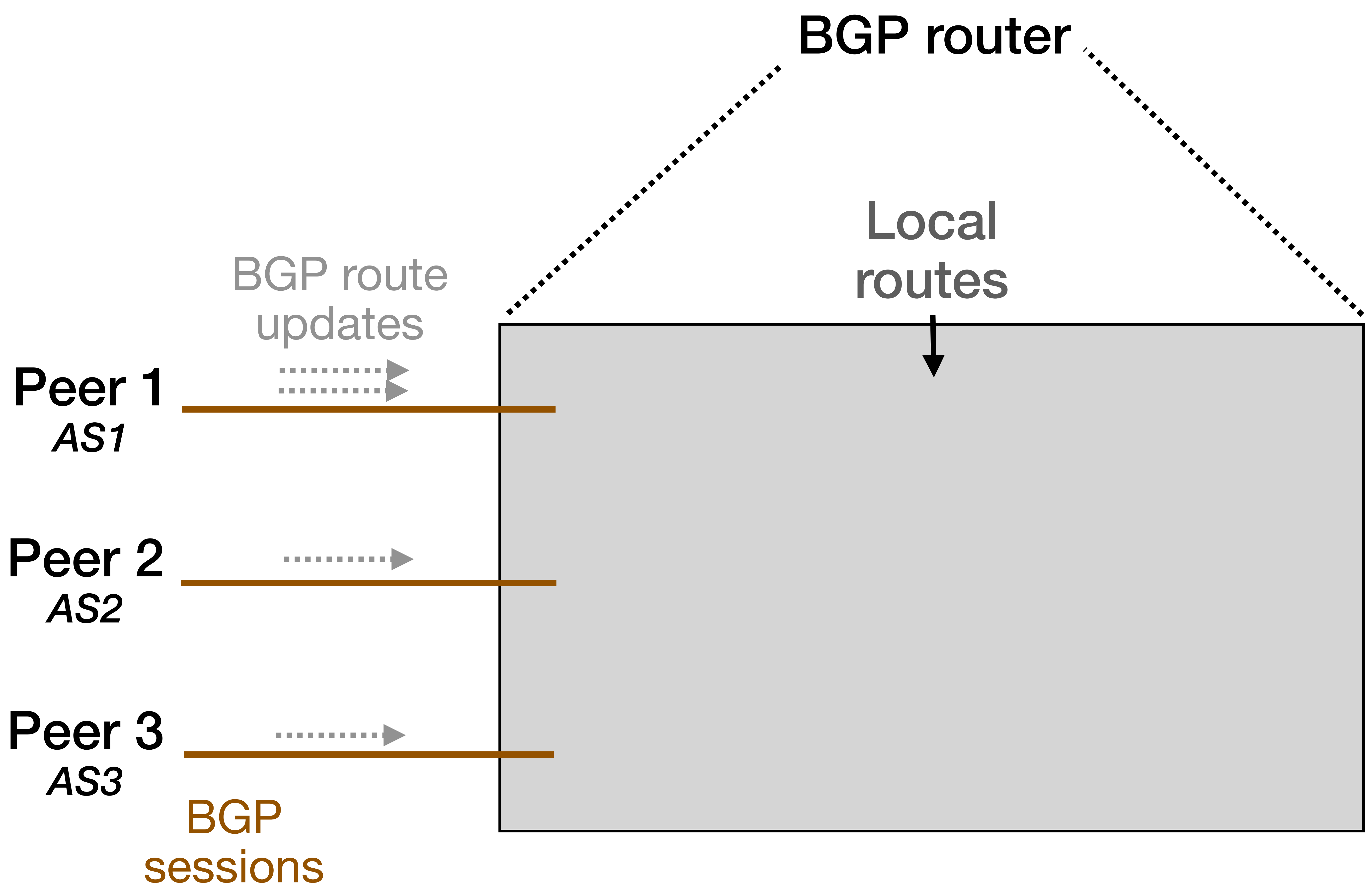
BGP router
Local routes
BGP route updates
Peer 1
AS1
Peer 2
AS2
Peer 3
AS3
BGP sessions

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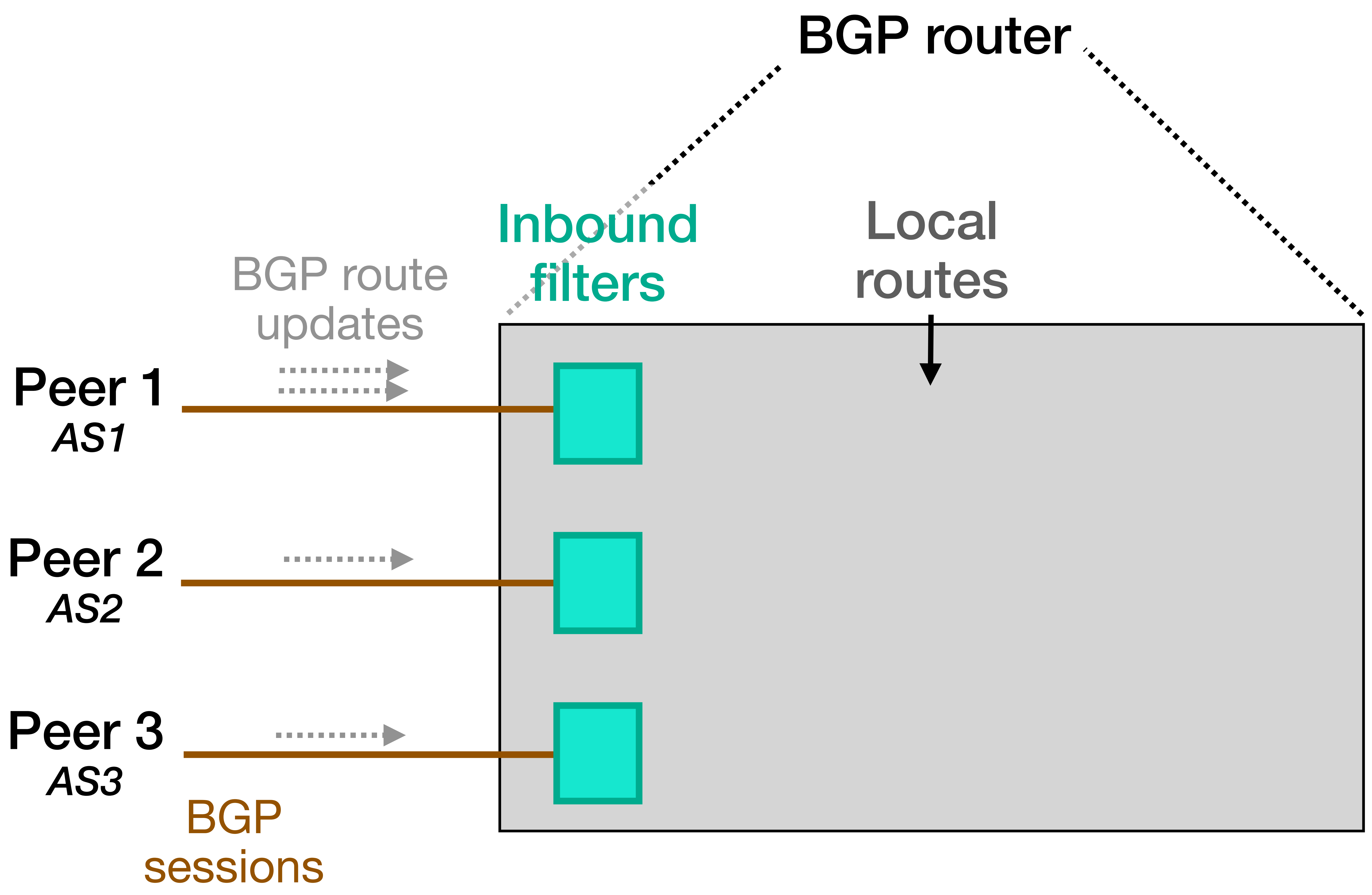
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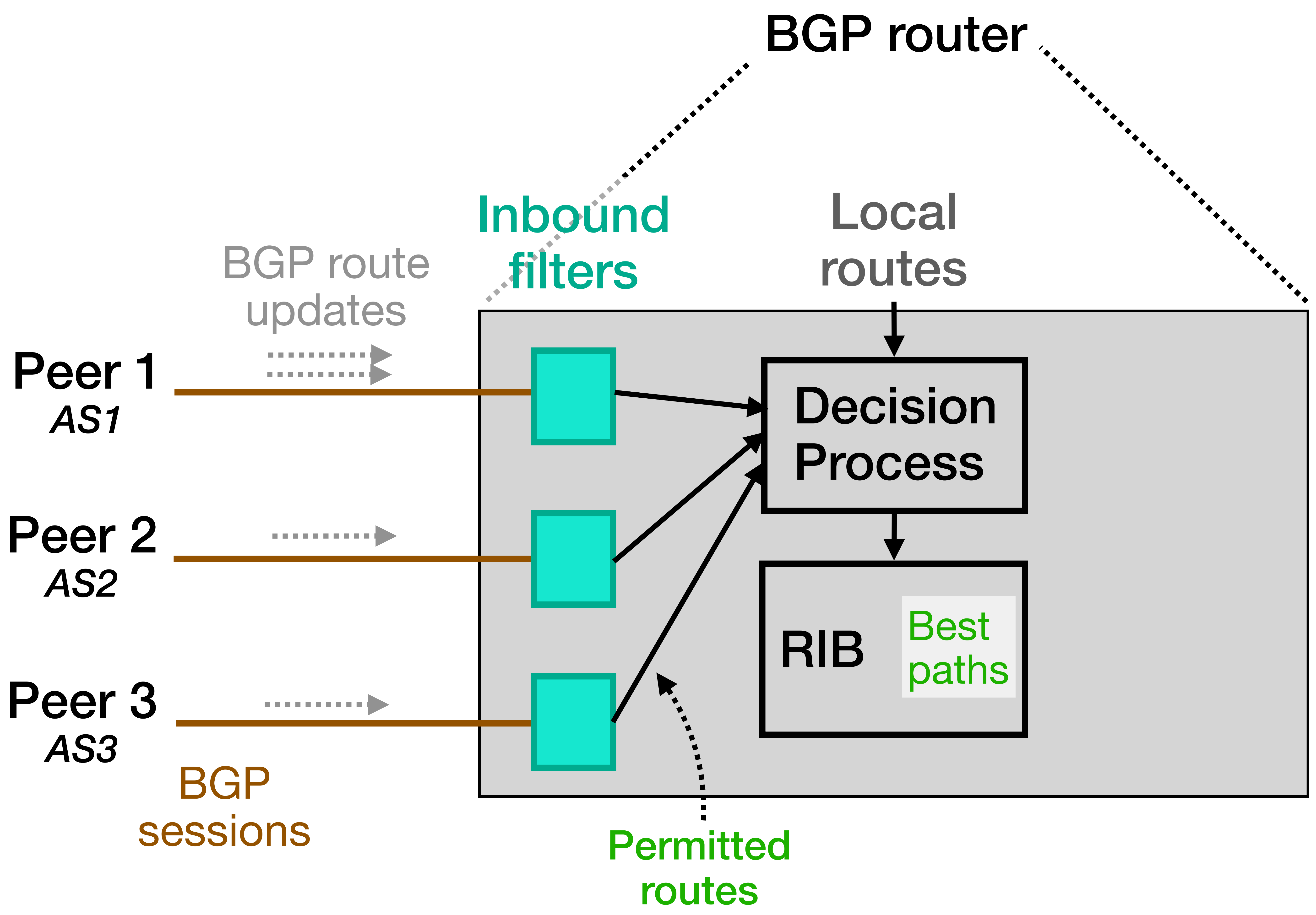
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Decision Process
Peer 2
AS2
RIB
Best paths
Peer 3
AS3
BGP sessions
Permitted routes

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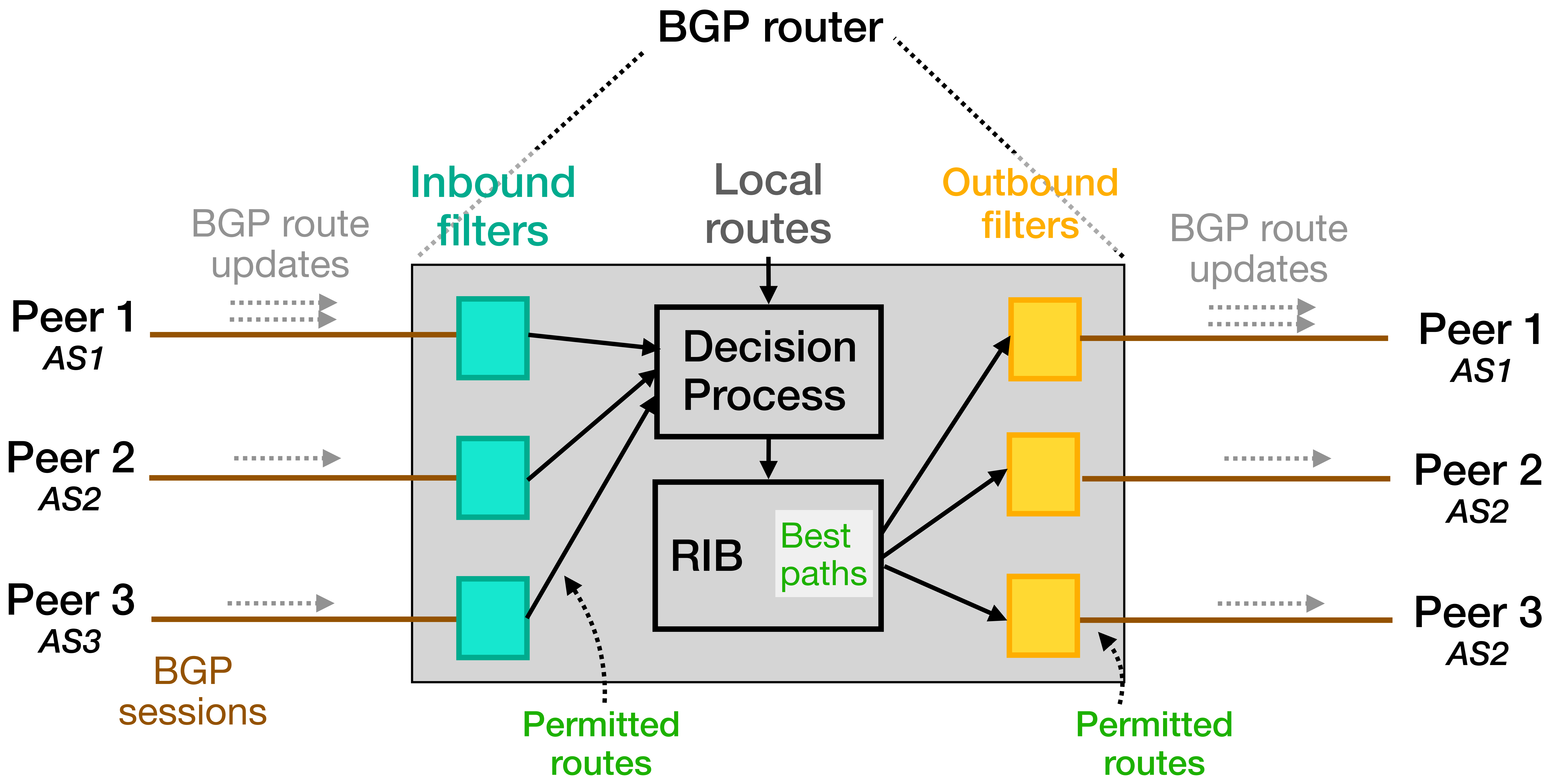
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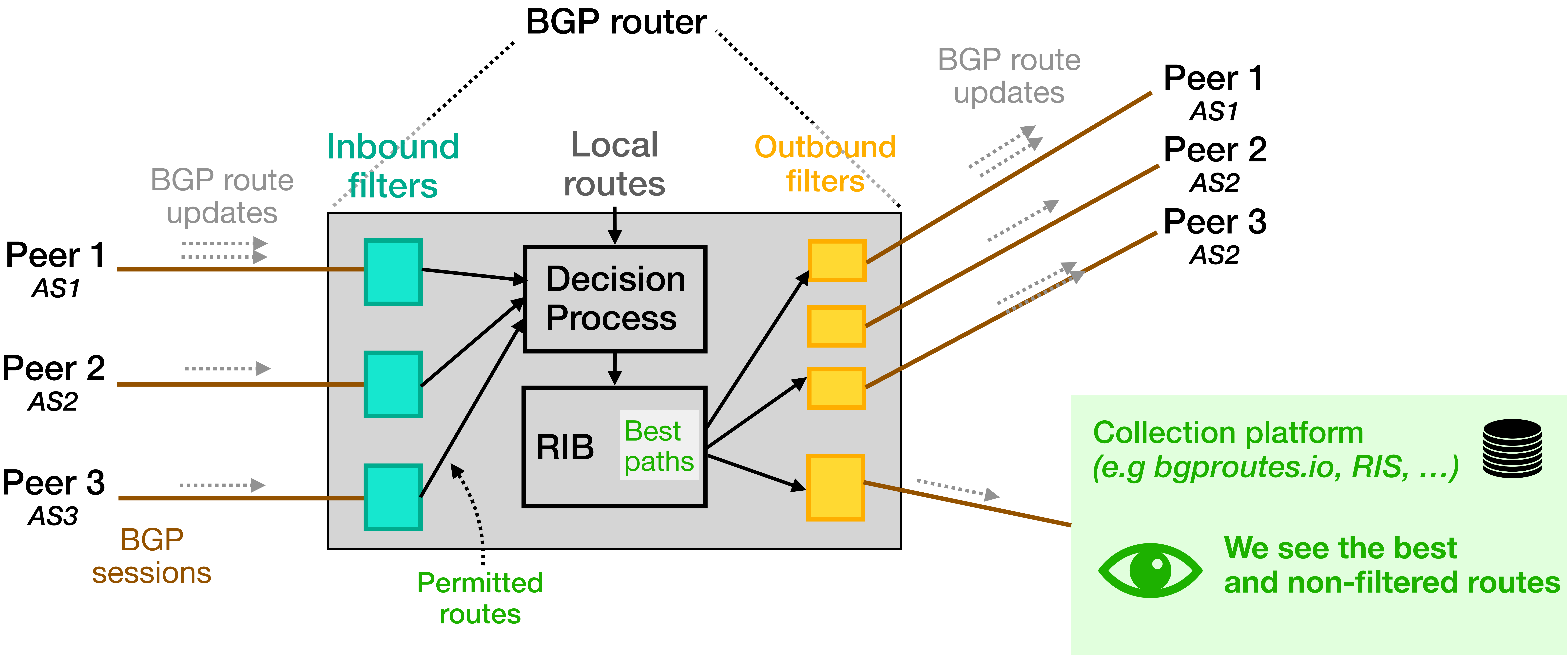
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Collection platform
(e.g bgproutes.io, RIS, …)

We see the best and non-filtered routes

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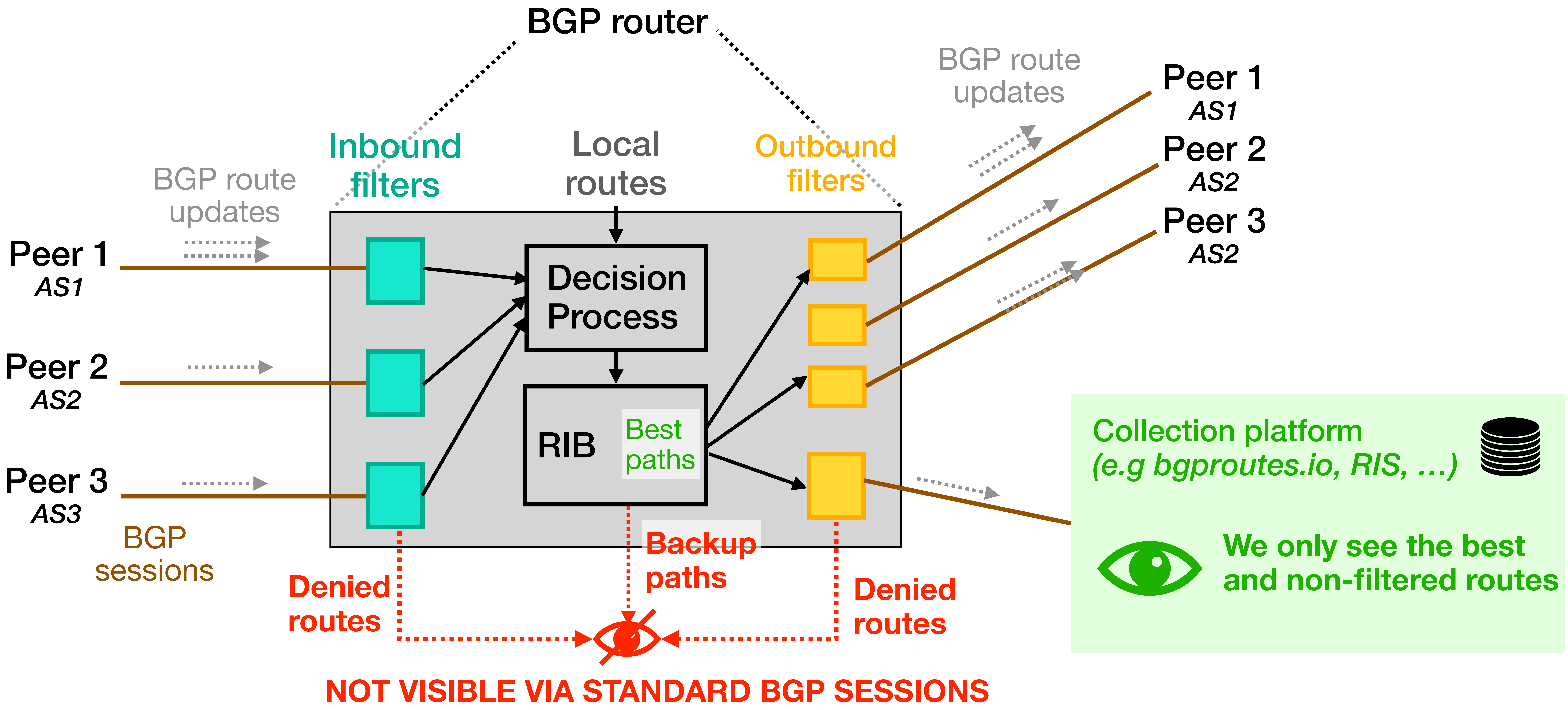
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RIB
Best paths
BGP sessions
Denied routes
Backup paths
Denied routes
Collection platform
(e.g bgproutes.io, RIS, …)
We only see the best and non-filtered routes
NOT VISIBLE VIA STANDARD BGP SESSIONS

Challenge #2: BGP Add-path allows the export of backup routes but that does not resolve the underlying lack of visibility

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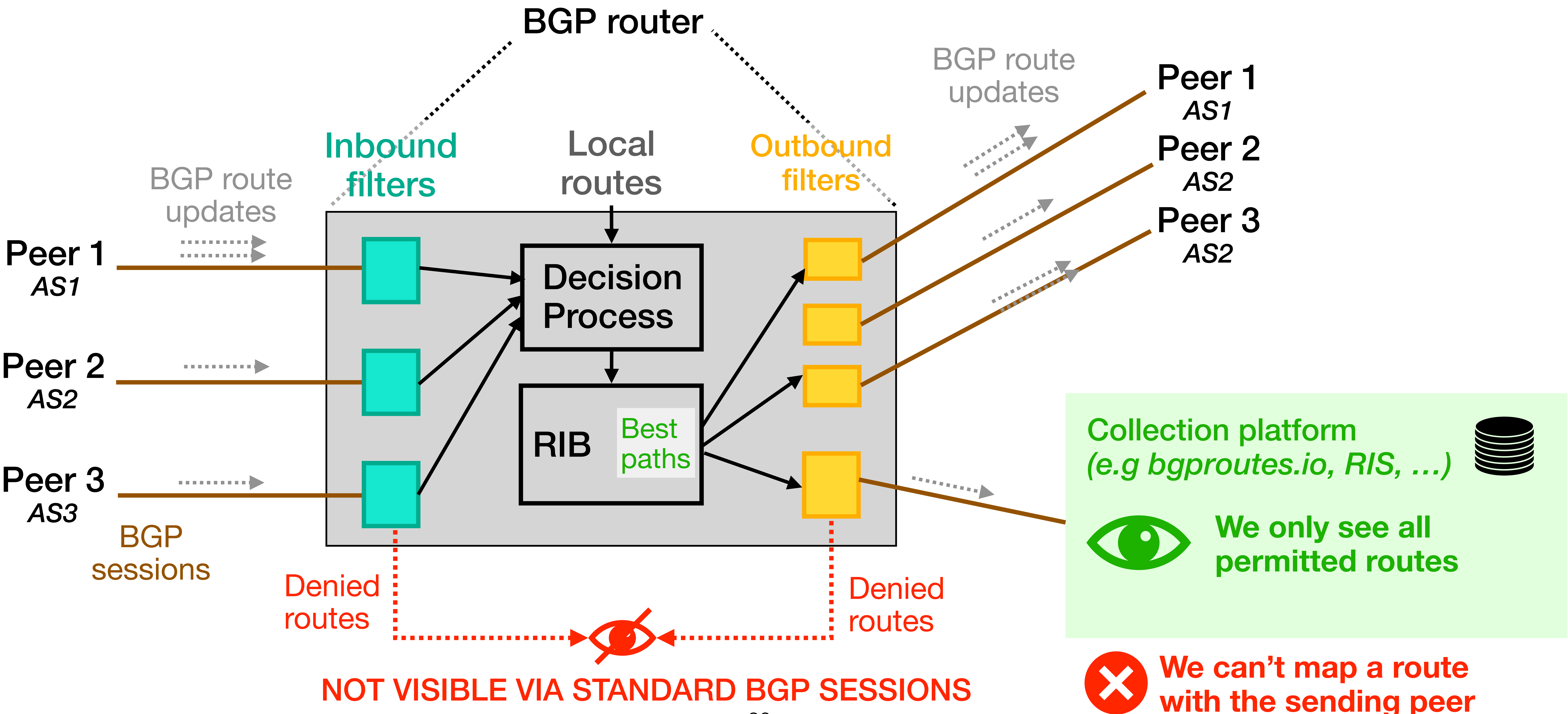
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Decision Process
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Best paths
Peer 1
AS1
Peer 2
AS2
Peer 3
AS2
BGP sessions
Denied routes
Denied routes
Collection platform
(e.g bgproutes.io, RIS, …)
We only see all permitted routes

NOT VISIBLE VIA STANDARD BGP SESSIONS

We can't map a route with the sending peer

Outline

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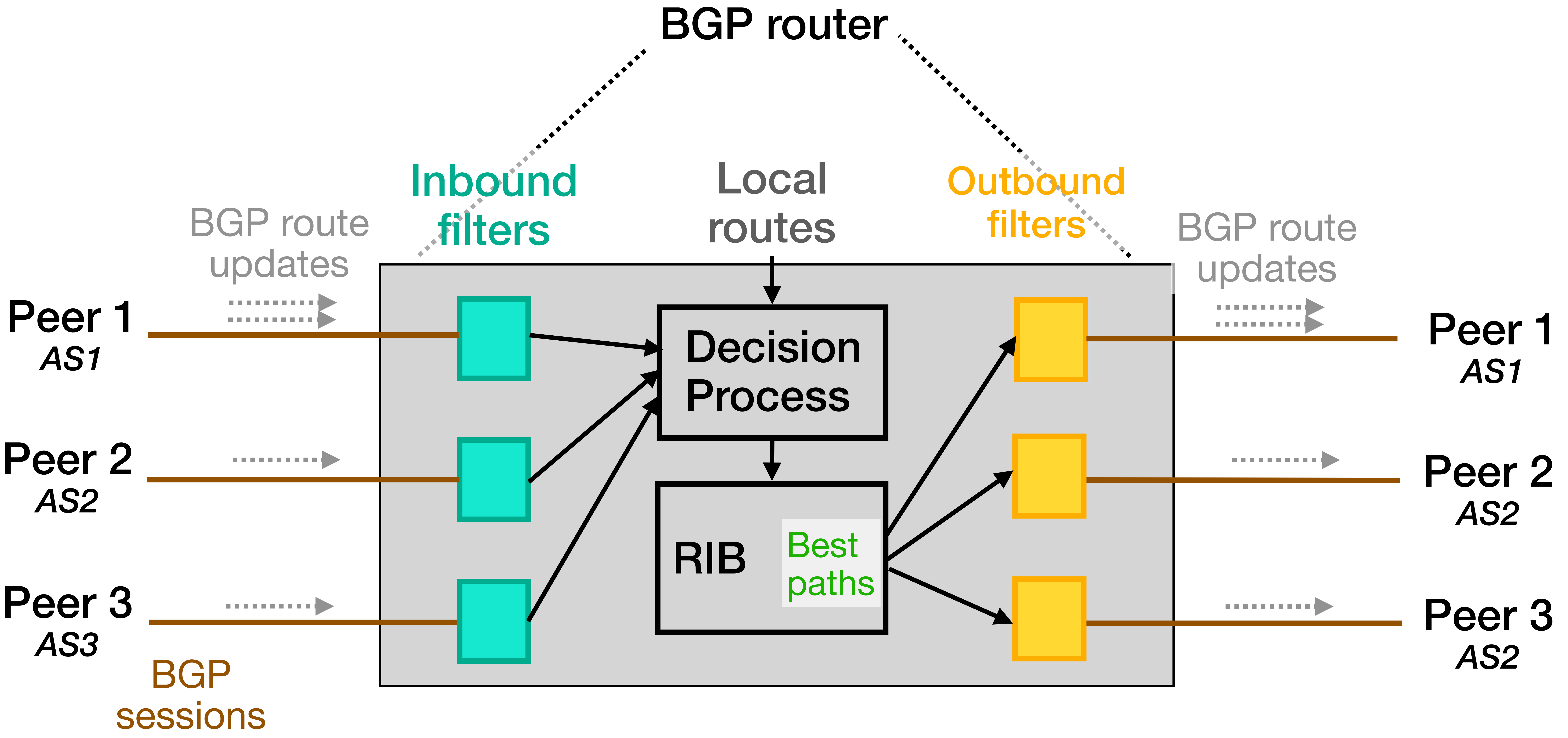
The BGP Monitoring Protocol (BMP) has two main advantages over standard BGP sessions when used for monitoring

✓ It provides all route updates on a per-peer basis

✓ It provides route updates at all stages of the BGP processing pipeline

➜ It's also simple to configure

BMP allows to collect routes at every stage of the BGP router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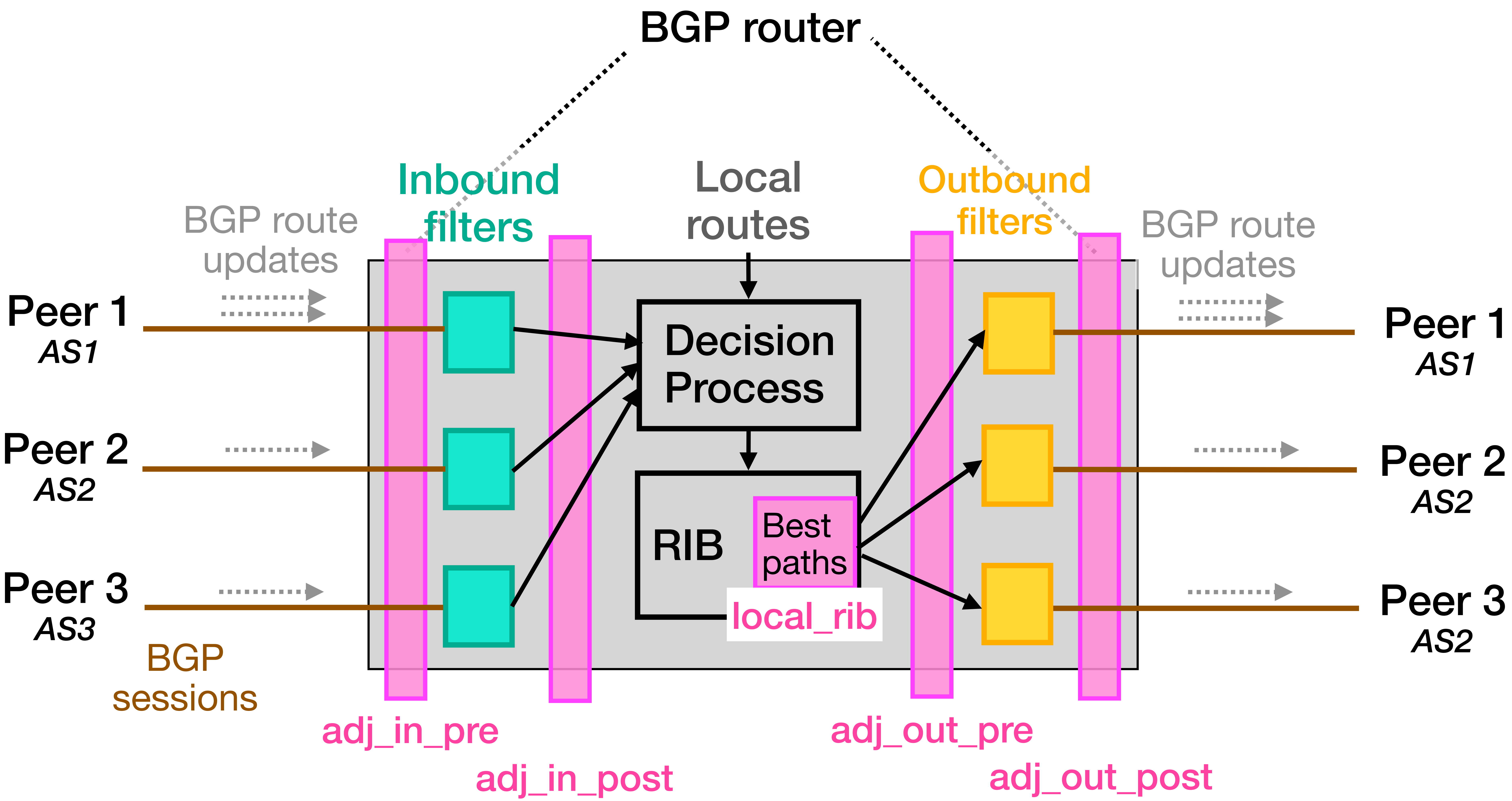
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Outbound filters
BGP route updates
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Peer 1
AS1
Peer 2
AS2
Peer 3
AS3
Decision Process
RIB
Best paths
local_rib
Peer 1
AS1
Peer 2
AS2
Peer 3
AS2
BGP sessions
adj_in_pre
adj_in_post
adj_out_pre
adj_out_post

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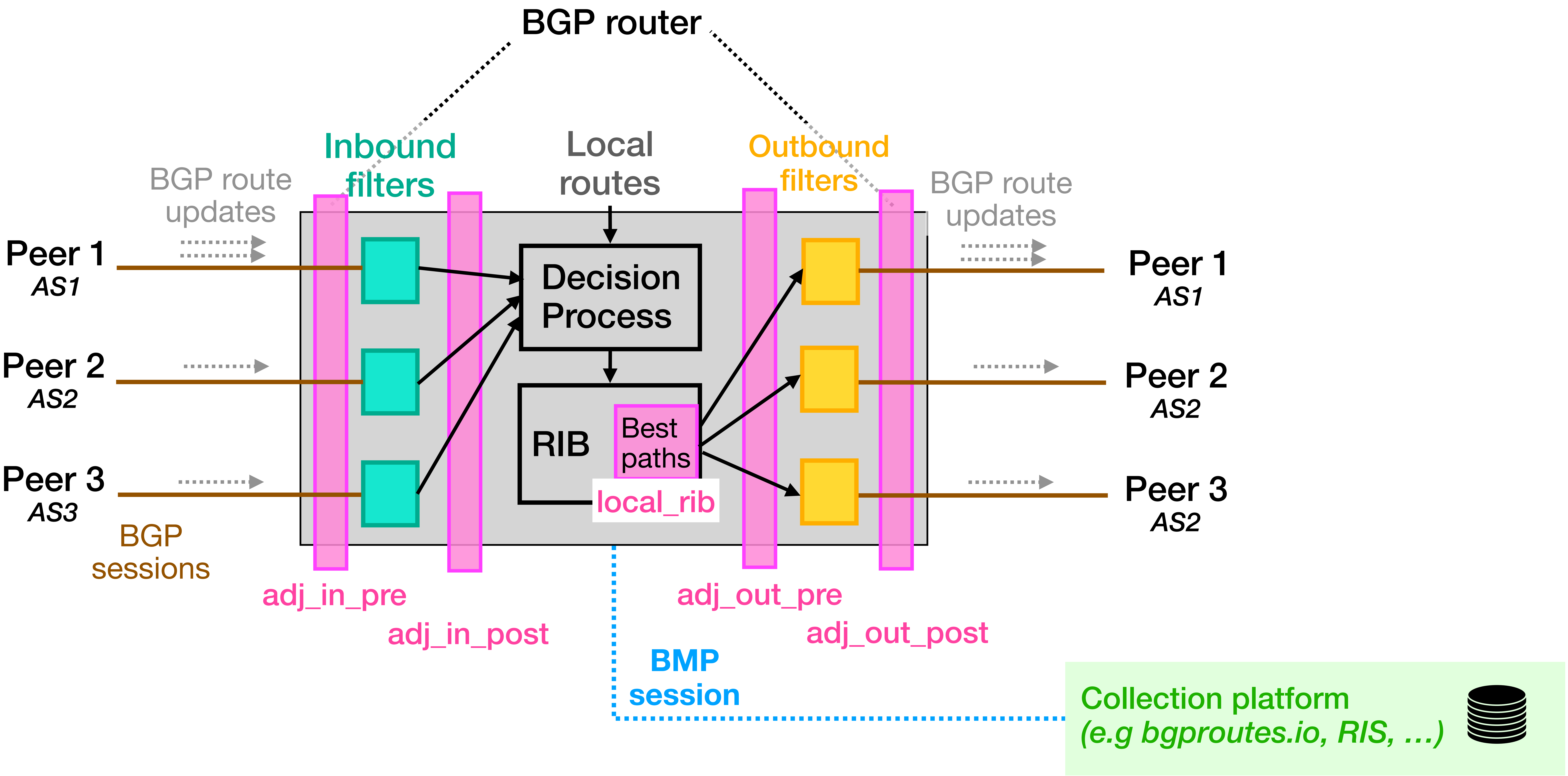
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BGP route updates
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Peer 1
AS1
Peer 2
AS2
Peer 3
AS3
Decision Process
RIB
Best paths
local_rib
Peer 1
AS1
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AS2
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AS2
BGP sessions
adj_in_pre
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BMP session
Collection platform
(e.g bgproutes.io, RIS, …)

We recommend exporting data for the **adj_in_pre** only

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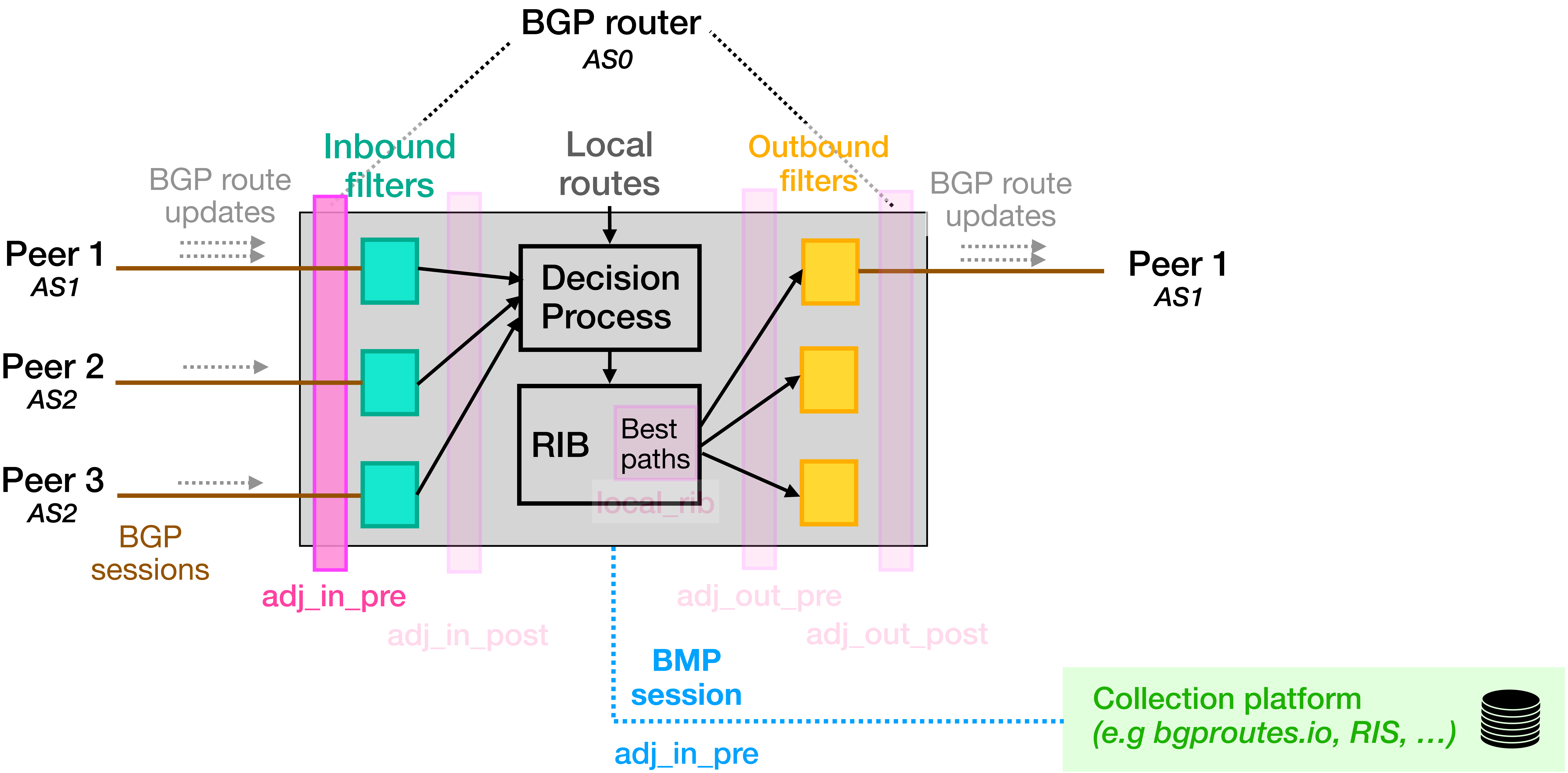
BGP router
AS0
BGP route updates
Inbound filters
Local routes
Outbound filters
BGP route updates
Peer 1
AS1
Peer 2
AS2
Peer 3
AS2
Decision Process
RIB
Best paths
local_rib
Peer 1
AS1
BGP sessions
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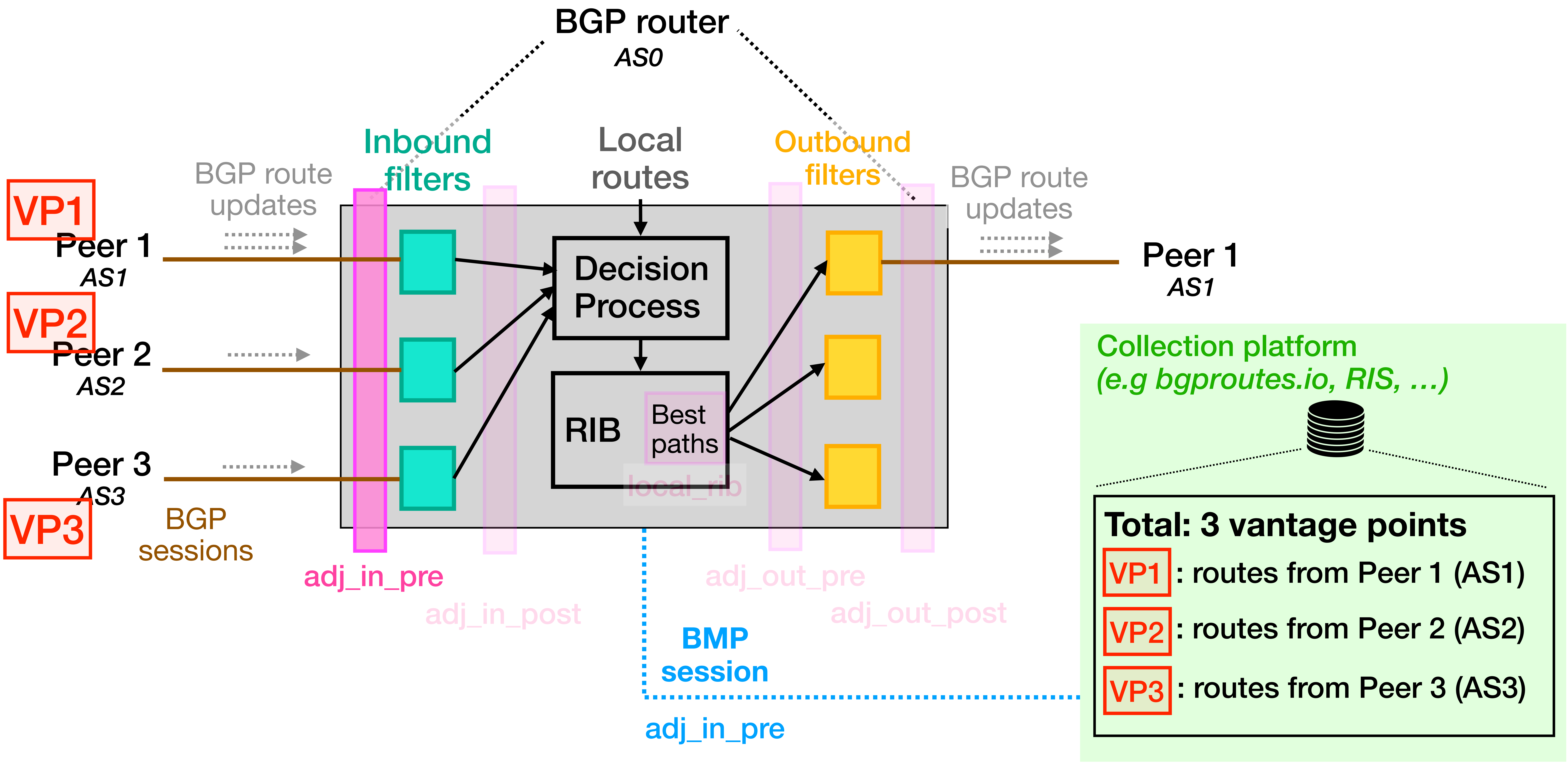
BGP router
AS0
Inbound filters
Local routes
Outbound filters
BGP route updates
BGP route updates
VP1
Peer 1
AS1
VP2
Peer 2
AS2
Peer 3
AS3
VP3
BGP sessions
Decision Process
RIB
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local_rib
Peer 1
AS1
adj_in_pre
adj_in_post
adj_out_pre
adj_out_post
BMP session
adj_in_pre
Collection platform
(e.g bgproutes.io, RIS, …)

Total: 3 vantage points

- VP1 : routes from Peer 1 (AS1)
- VP2 : routes from Peer 2 (AS2)
- VP3 : routes from Peer 3 (AS3)

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Connecting to bgproutes.io with BMP is fully automated and requires minimal efforts

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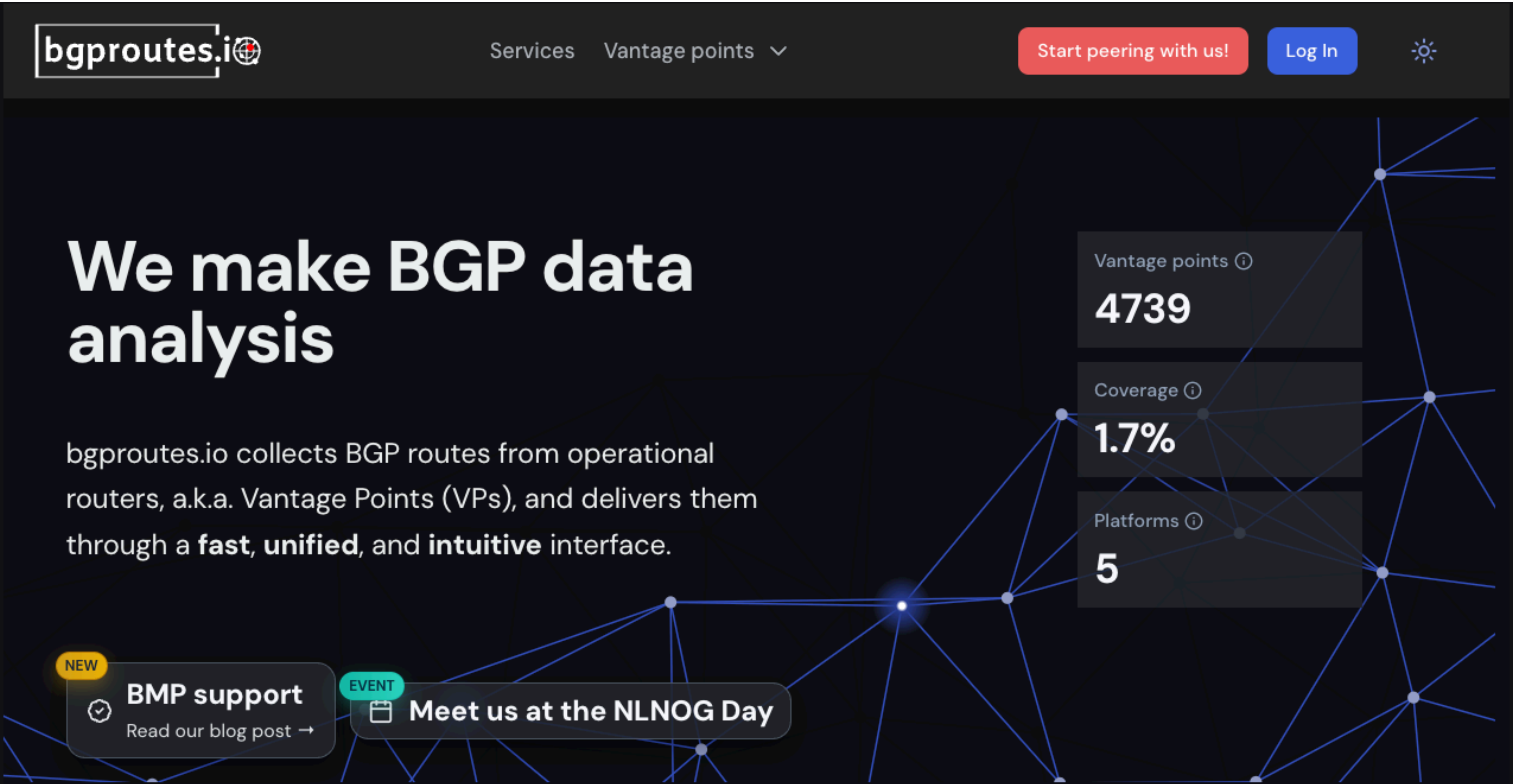


bgproutes.io
Services
Vantage points
Start peering with us!
Log In

We make BGP data analysis

bgproutes.io collects BGP routes from operational routers, a.k.a. Vantage Points (VPs), and delivers them through a **fast**, **unified**, and **intuitive** interface.

Vantage points 4739

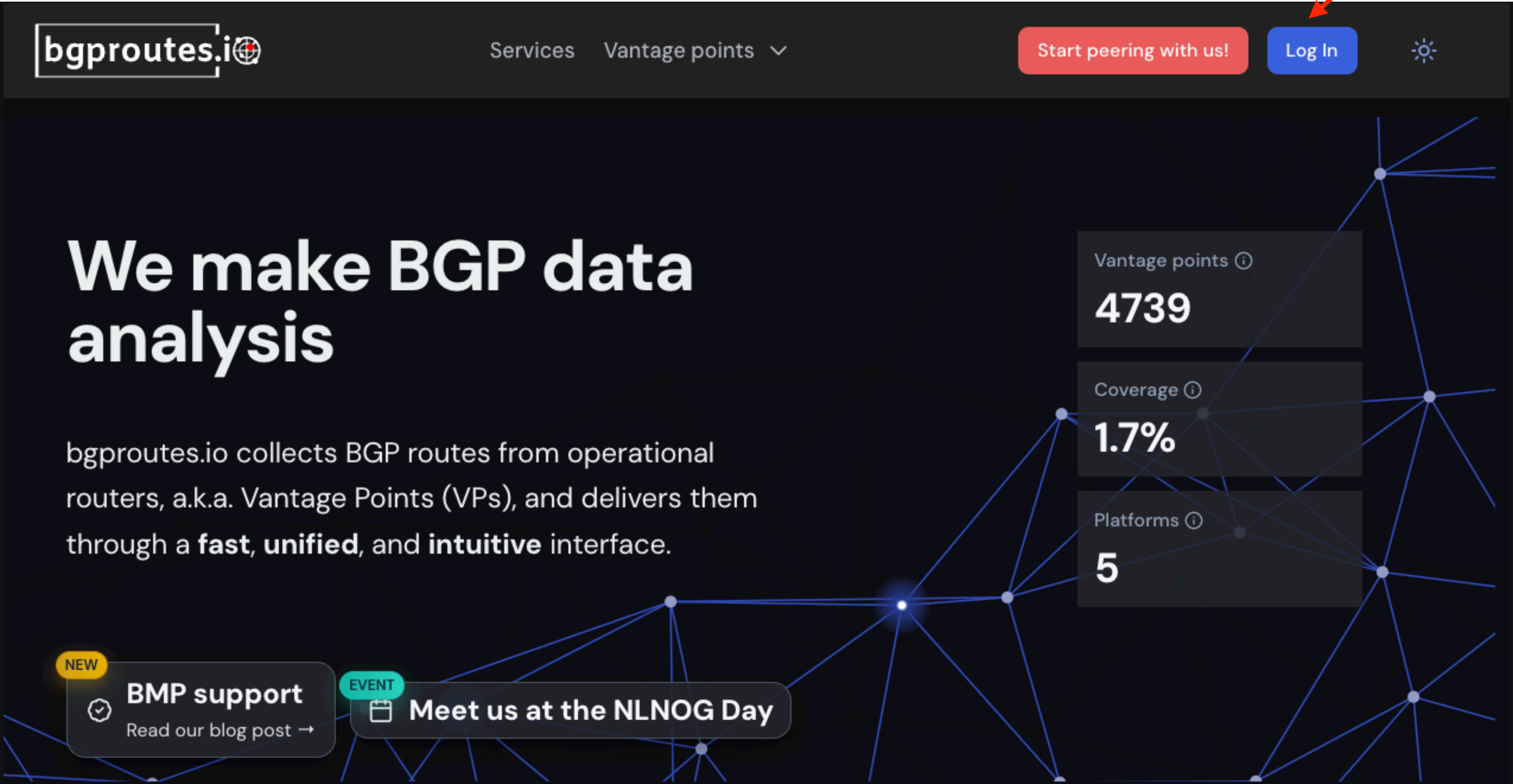
Coverage 1.7%

Platforms 5

NEW
BMP support
Read our blog post →
EVENT
Meet us at the NLNOG Day

Connecting to bgproutes.io with BMP is fully automated and requires minimal efforts

1. Log in with your PeeringDB account



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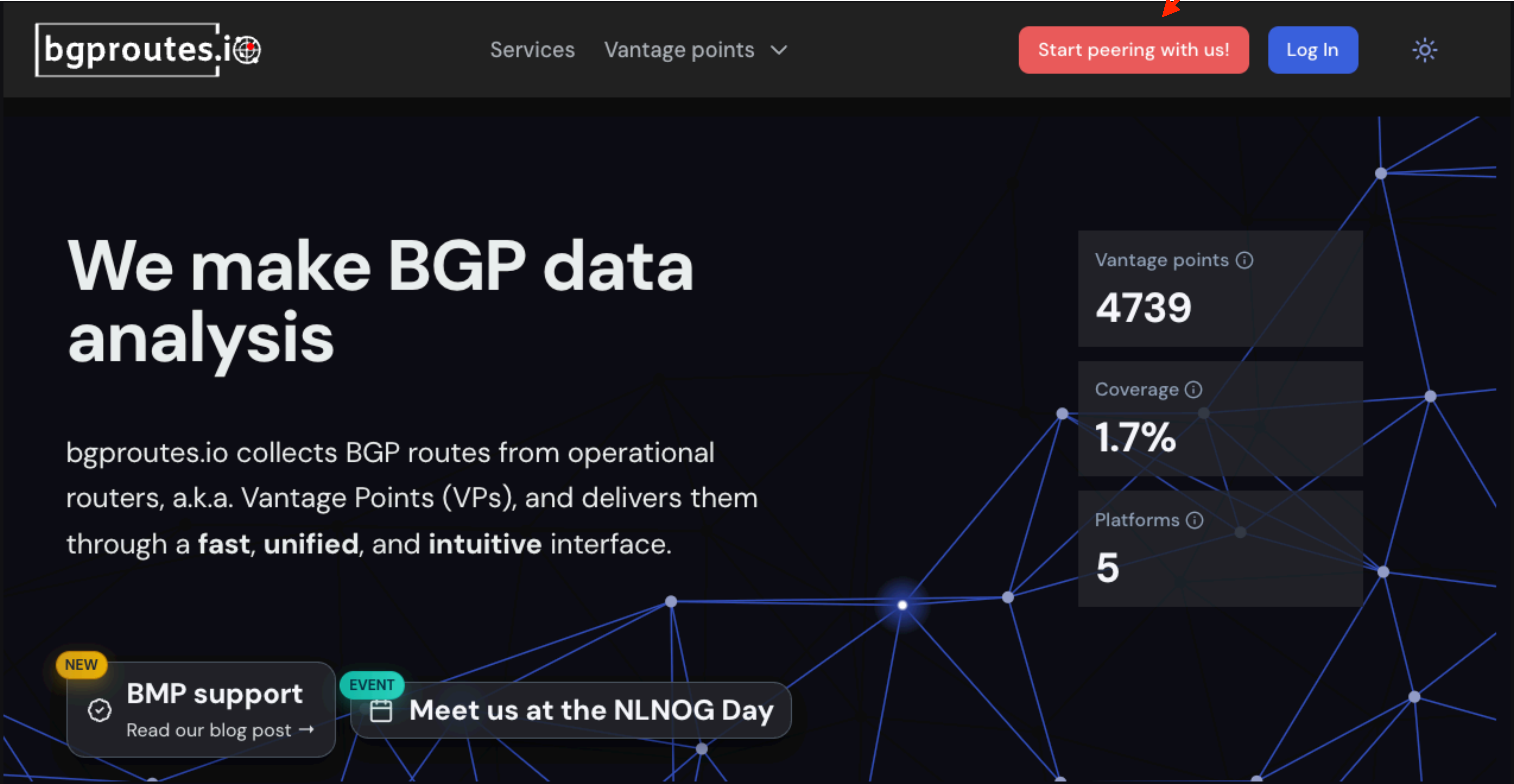
2. Click on the red "*start peering with us*" button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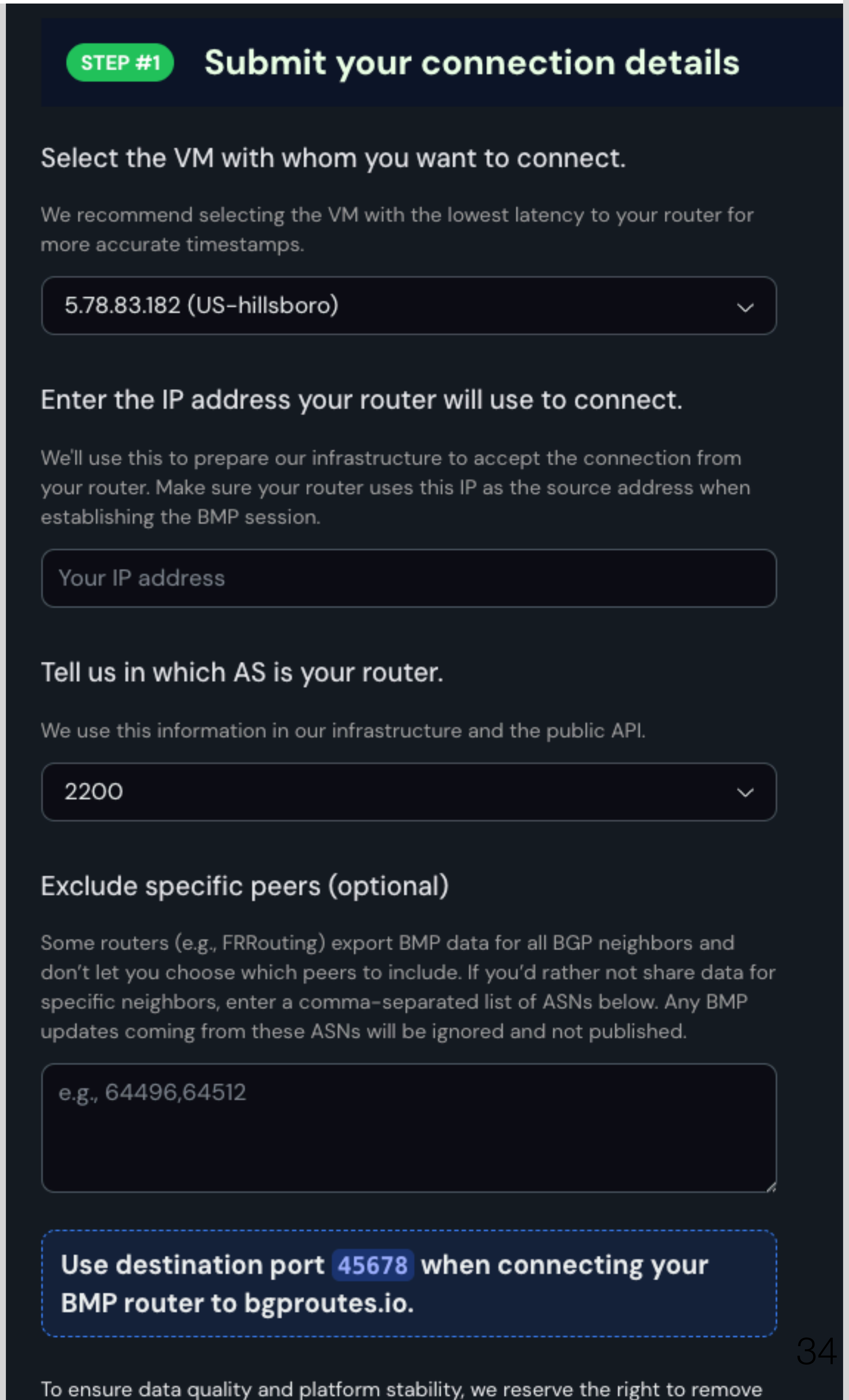

Submit your connection details

Select the VM with whom you want to connect.

We recommend selecting the VM with the lowest latency to your router for more accurate timestamps.

5.78.83.182 (US-hillsboro)

Enter the IP address your router will use to connect.

We'll use this to prepare our infrastructure to accept the connection from your router. Make sure your router uses this IP as the source address when establishing the BMP session.

Your IP address

Tell us in which AS is your router.

We use this information in our infrastructure and the public API.

2200

Exclude specific peers (optional)

Some routers (e.g., FRRouting) export BMP data for all BGP neighbors and don't let you choose which peers to include. If you'd rather not share data for specific neighbors, enter a comma-separated list of ASNs below. Any BMP updates coming from these ASNs will be ignored and not published.

e.g., 64496,64512

Use destination port 45678 when connecting your BMP router to bgproutes.io.

To ensure data quality and platform stability, we reserve the right to remove

3. Complete and submit the form so our infrastructure is ready to accept your BMP session

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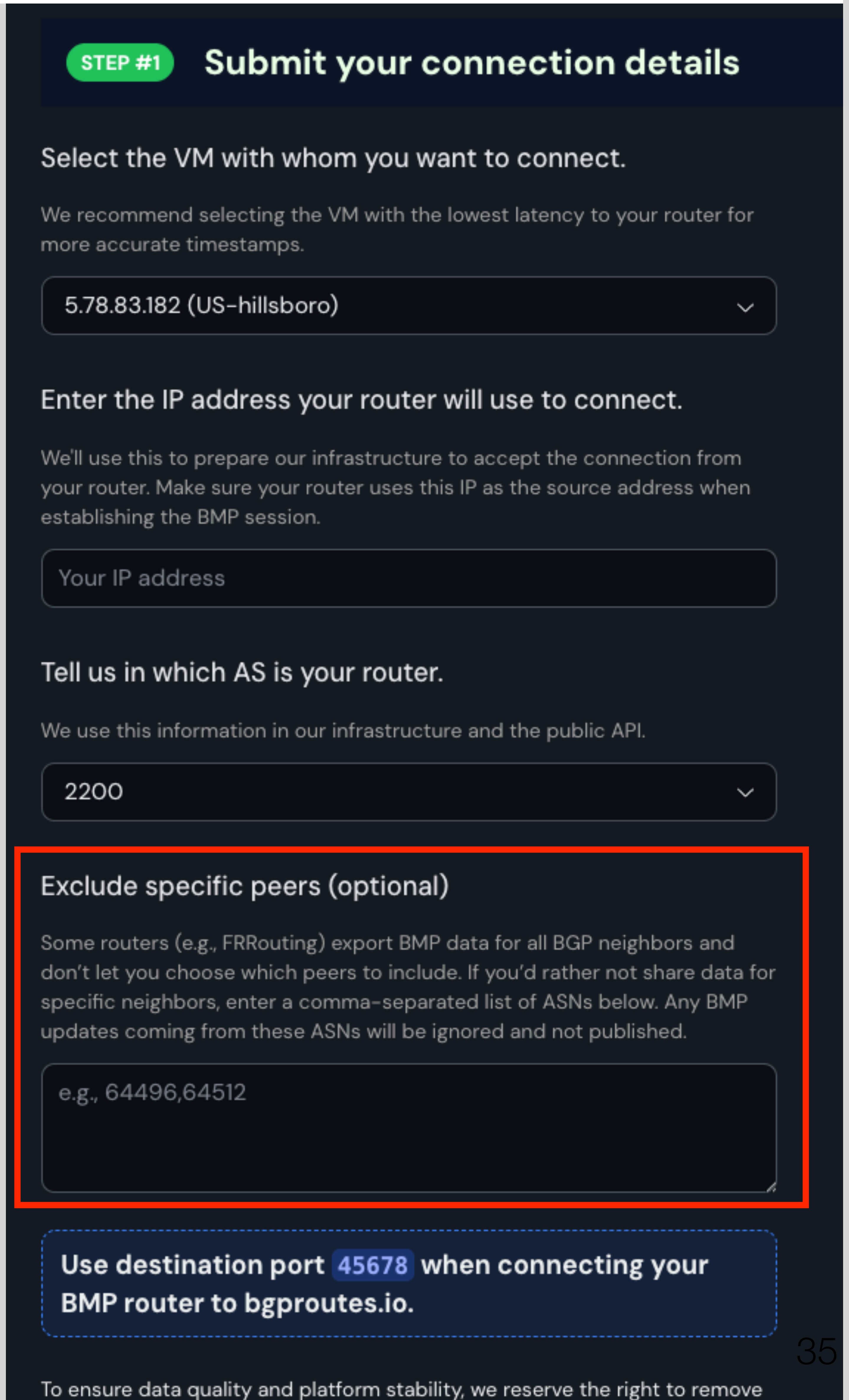

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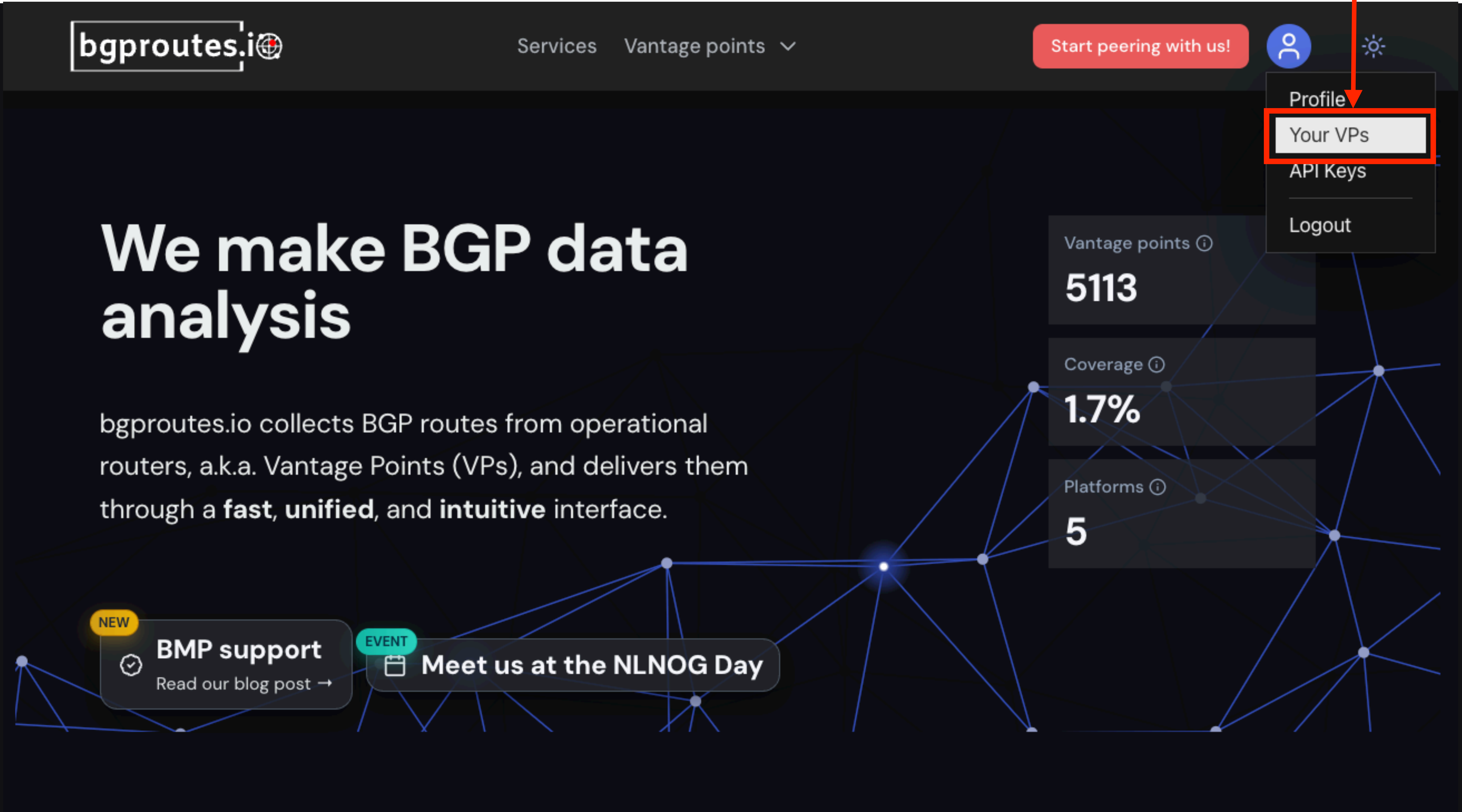
We provide a user-friendly interface to monitor your BGP/BMP sessions

1. Click on the "*Your VPs*" button



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Vantage points	5113
Coverage	1.7%
Platforms	5

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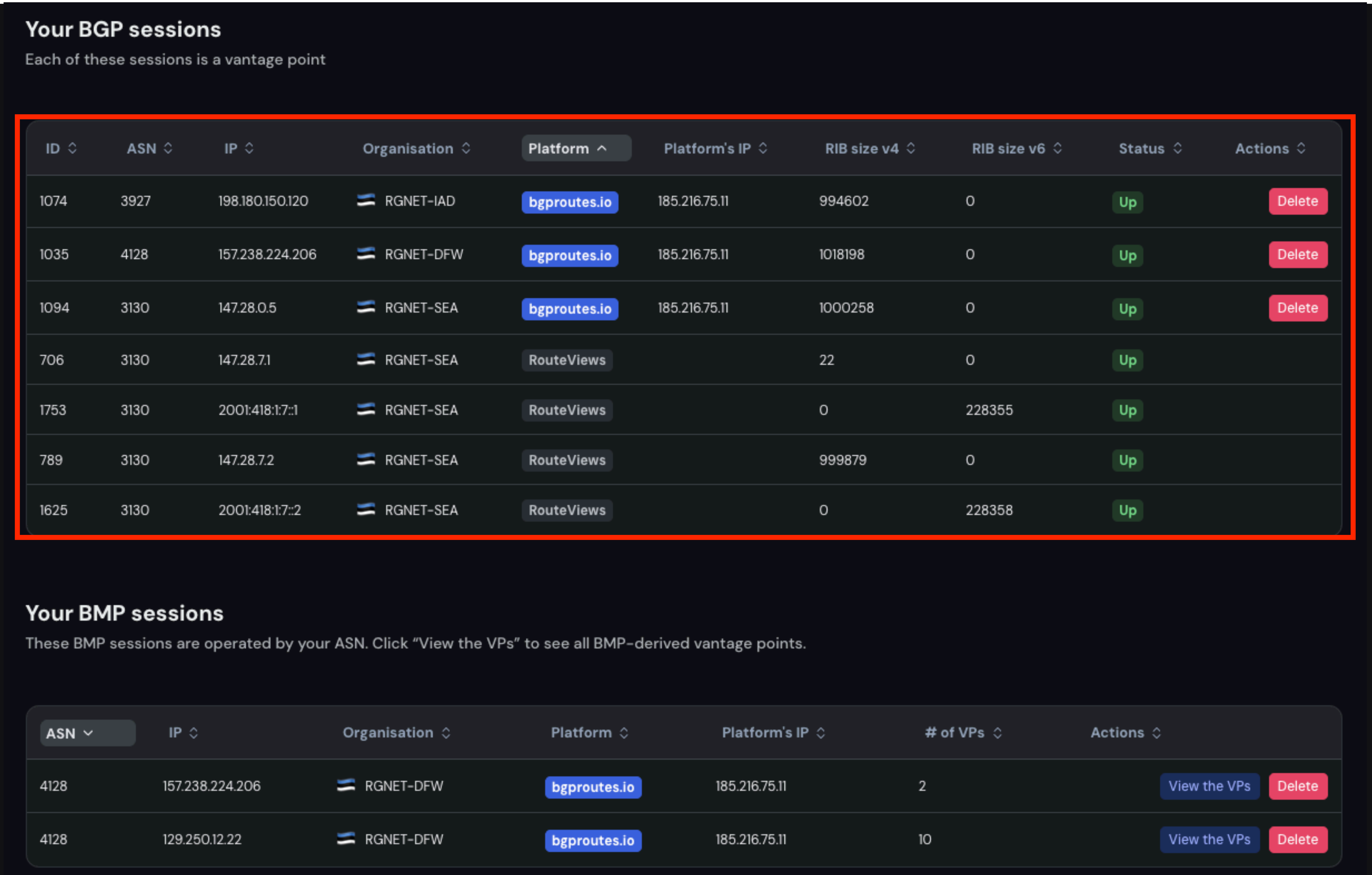
Example for RGNET (AS3927, AS4128, AS3130)



Your BGP sessions

Each of these sessions is a vantage point

ID	ASN	IP	Organisation	Platform	Platform's IP	RIB size v4	RIB size v6	Status	Actions
1074	3927	198.180.150.120	RGNET-IAD	bgproutes.io	185.216.75.11	994602	0	Up	Delete
1035	4128	157.238.224.206	RGNET-DFW	bgproutes.io	185.216.75.11	1018198	0	Up	Delete
1094	3130	147.28.0.5	RGNET-SEA	bgproutes.io	185.216.75.11	1000258	0	Up	Delete
706	3130	147.28.7.1	RGNET-SEA	RouteViews		22	0	Up	
1753	3130	2001:418:1:7::1	RGNET-SEA	RouteViews		0	228355	Up	
789	3130	147.28.7.2	RGNET-SEA	RouteViews		999879	0	Up	
1625	3130	2001:418:1:7::2	RGNET-SEA	RouteViews		0	228358	Up	

Seven BGP sessions

Your BMP sessions

These BMP sessions are operated by your ASN. Click "View the VPs" to see all BMP-derived vantage points.

ASN	IP	Organisation	Platform	Platform's IP	# of VPs	Actions
4128	157.238.224.206	RGNET-DFW	bgproutes.io	185.216.75.11	2	View the VPs Delete
4128	129.250.12.22	RGNET-DFW	bgproutes.io	185.216.75.11	10	View the VPs Delete

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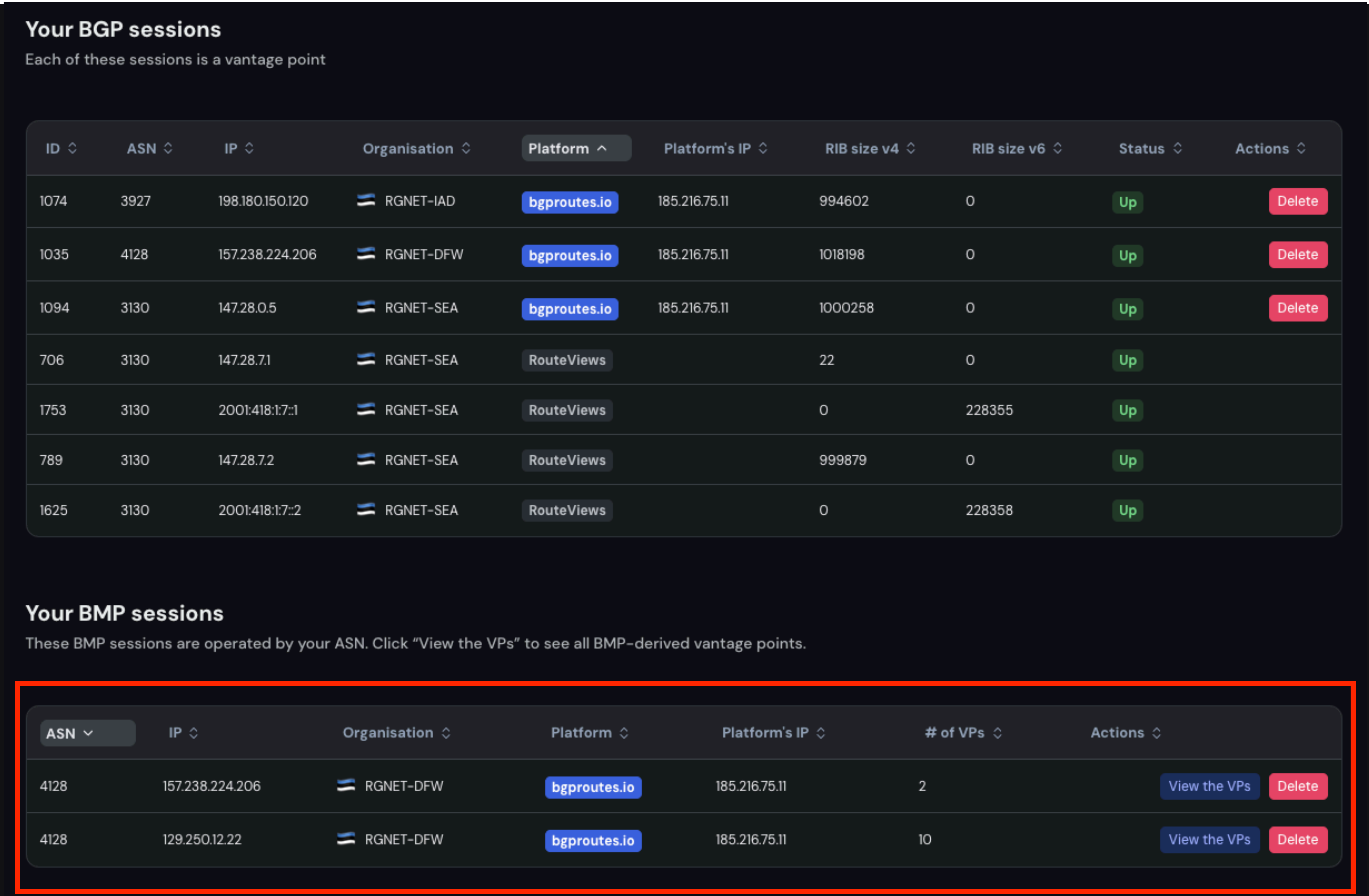
Example for RGNET (AS3927, AS4128, AS3130)



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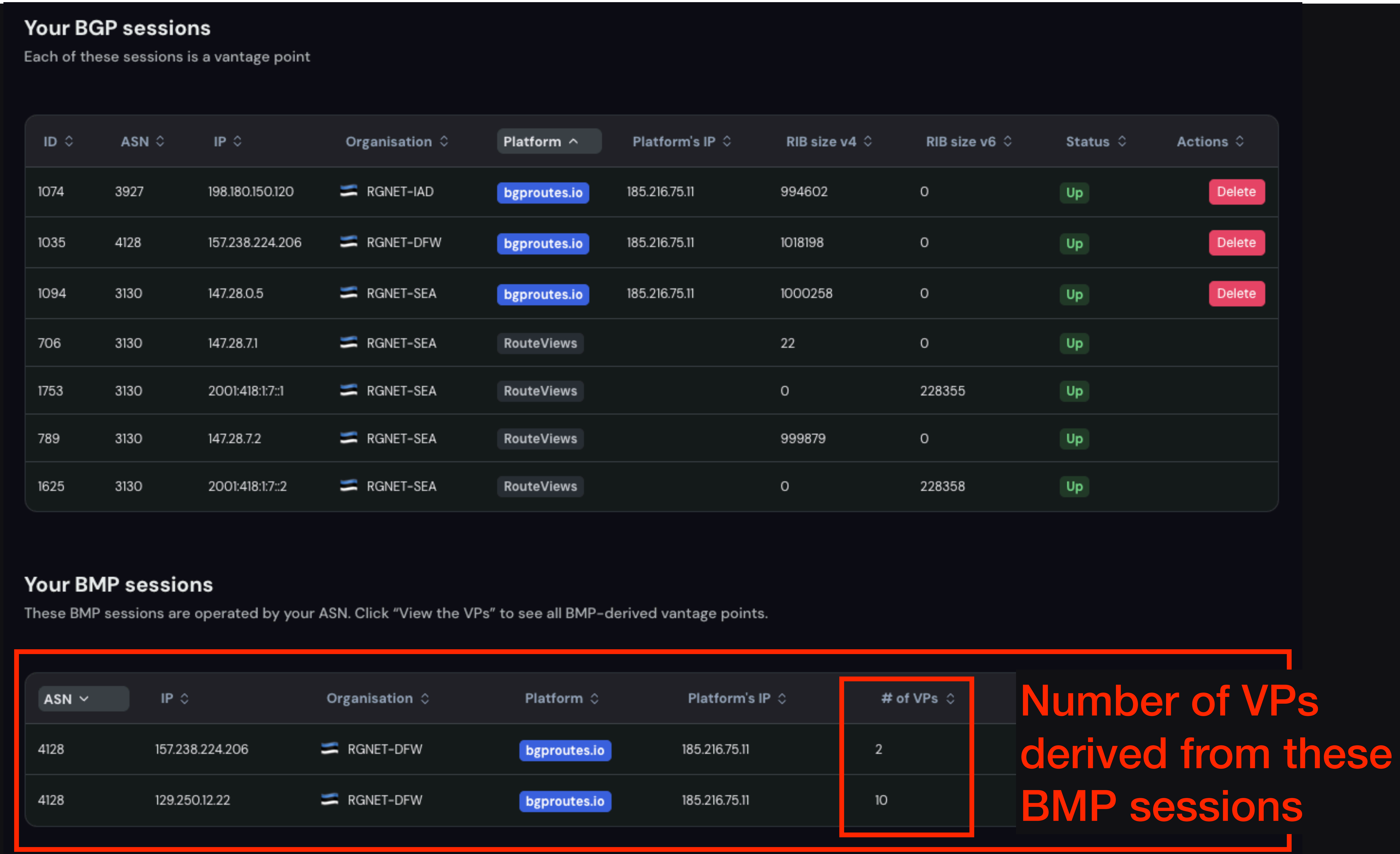
Two BMP sessions

A single BMP session with RGNET exports data for ten VPs

Example for RGNET (AS3927, AS4128, AS3130)



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Number of VPs derived from these BMP sessions

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Three methods to access data:

MRT Archive

To access bulk data

historical data

API

To quickly retrieve specific slices of the data

near realtime

Websocket stream

For realtime applications

realtime

All the data bgproutes.io collects is **publicly** available, and our goal is to power the next-gen of BGP monitoring tools

Three methods to access data:

MRT Archive

To access bulk data

historical data

pybgproutesmrt

API

To quickly retrieve specific slices of the data

near realtime

pybgproutesapi

Websocket stream

For realtime applications

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pybgproutesive

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The API offers four endpoints:

vantage_points

updates

rib

topology

Example: Building a looking glass

```
# Let’s use our Python client to retrieve the data
from pybgproutesapi import vantage_points, rib

# Let’s retrieve some vantage points (BGP and BMP)
vps = vantage_points(source=[‘bgproutes.io', ‘ris’, ‘pch’])
```

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from pybgproutesapi import vantage_points, rib

# Let’s retrieve some vantage points (BGP and BMP)
vps = vantage_points(source=[‘bgproutes.io', ‘ris’, ‘pch’])

# Finally, we retrieve the rib for some prefixes and print them for every VP
response = rib(
   vps,
   date=“2025-09-30T15:00:00”,
   prefix_exact_match=['65.169.6.0/23', '91.106.223.0/24', ‘105.77.0.0/16']
   )

print (response)
```

If preferred, users can work just with the BMP-derived vantage points

```
# Let’s use our Python client to retrieve the data
from pybgproutesapi import vantage_points, rib


# Let’s retrieve some vantage points (BGP and BMP)
vps = vantage_points(source=[‘bgproutes.io', ‘ris’, ‘pch’], peering_protocol=‘BMP’)

# Finally, we retrieve the rib for some prefixes and print them for every VP
response = rib(
  vps,
  date=“2025-09-30T15:00:00”,
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  )

print (response)
```

Expanding Internet Routing Visibility with BMP

BMP		BGP	
◆	Supported by most routers, but not all (e.g., MikroTik)	✓	Supported by all routers
✓	Simple to configure a session	✓	Very simple to configure a session
✓	One session can provide data for dozens of VPs	👎	One session provides data for only one VP (Add-path can help)
✓	Provide all routes, including filtered or non-preferred ones	👎	Only provide the non-filtered best routes

https://bgproutes.io

You can peer with us!