Why ROV?

RPKI Deployment Status in Japan

JANOG 55

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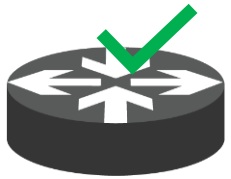
What is RPKI?

RPKI
robust security framework for verifying the association between resource holders and their Internet number resources

Phase 1: ROA (Signing origin)
Resource holders must create their ROA objects, which gets published to the RPKI repo



Phase 2: ROV (Validating origin)
Routers are validating route entries against the RPKI cache

ROA is just the beginning. ROAs only serve their purpose if routes are validating.

Route Origin Authorization (ROA)

What is contained in a ROA?

- ✓ The AS number you have authorized
- ✓ The prefix that is being originated from it
- ✓ The most specific prefix (maximum length) that the AS may announce

For example:

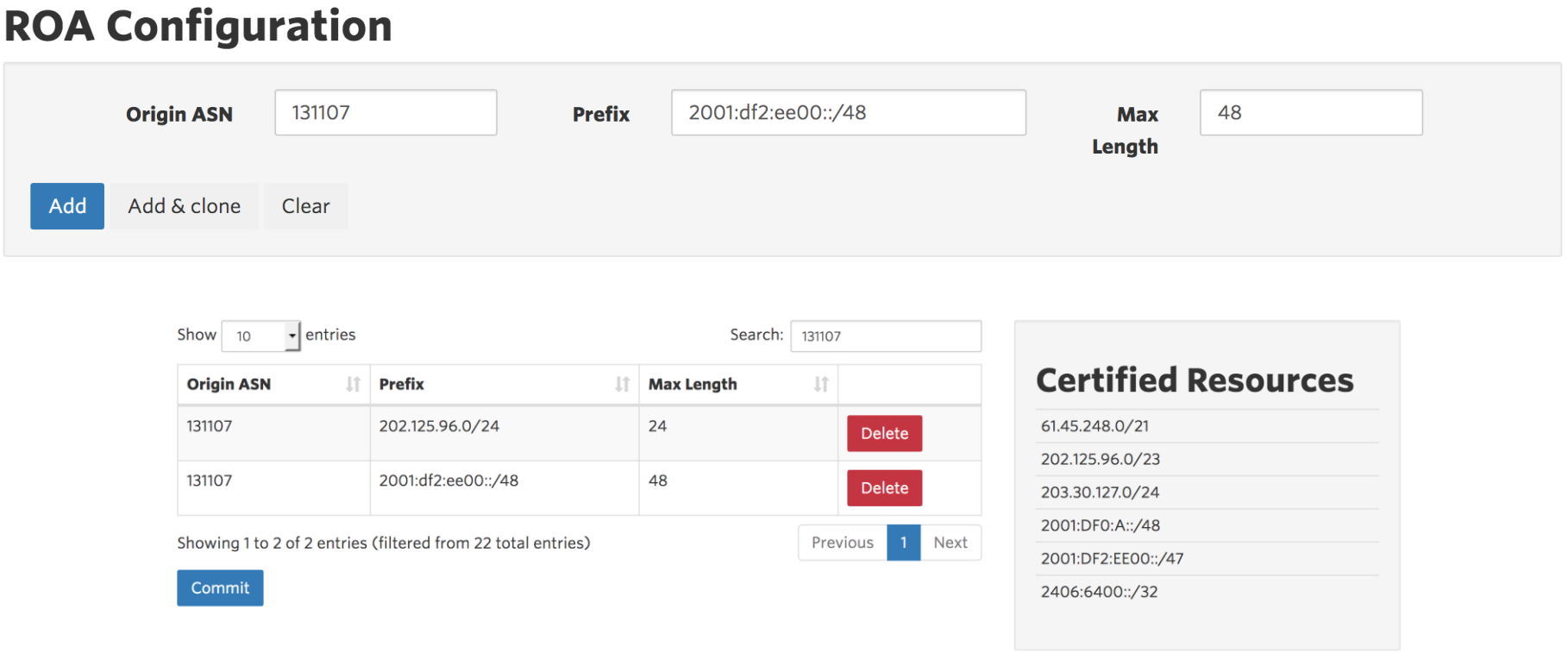
"ISP A permits AS65551 to originate a route for the prefix 198.51.100.0/24"

Who should create a ROA?

- ❑ Resource holders

Phase 1 – Create ROAs

From APNIC (or NIR) portal:



If you are a resource holder of an IP address block, create your ROAs now!

Phase 2 – Implement ROV

Configure router to get validated routes from an RPKI cache (RTR session)

- ✓ Router fetches ROA information from the validated RPKI cache (*Crypto stripped by the validator)*
- ✓ BGP checks each BGP update received against the ROA information and labels them accordingly

Router Sessions

This table shows all routers connected to this RPKI Validator. Requests and responses are described in RFC 6810. For debugging, please refer to rtr.log.

Remote Address	Connection Time	Last Request Time	Last Request	Last Reply
202.125.96.253:51107	2018-11-12T12:58:34+10:00	2018-11-12T13:55:24+10:00	ResetQuery	EndOfDataPdu

Setup your own RPKI validator

RPKI-aware router connects to the validator to fetch validated routes

RPKI Validators

- Many options to choose from:
  - Routinator
  - Rpki-client
  - Fort
  - OctoRPKI/GoRTR
- More mature – easier to install, better documentation
- Considerations:
  - Which validator to use?
  - Do I need multiple validators?
  - What happens when RTR session fails?

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Route Origin Validation (ROV)

There are 3 validation states:

Valid

The prefix (prefix length) and AS pair found in the database

Invalid

Prefix is found, but origin-AS is wrong,
OR
The prefix length is longer than the maximum length

Not Found / Unknown

Neither valid nor invalid (perhaps not created)

Ex: This ROA is created

ASN	Prefix	Max Length
17862	203.176.189.0/22	23

With Origin Validation, these BGP routes will have an RPKI state as follows:

ASN	Prefix	RPKI State
17862	203.176.189.0/22	VALID
17862	203.176.189.0/23	VALID
17862	203.176.189.0/24	INVALID
17861	203.176.189.0/22	INVALID
17862	203.176.189.0/21	NOT FOUND

AS0 ROAs

- ROA with origin **AS0** instead of a real ASN
  - Routes will be RPKI-invalid when they would otherwise be RPKI-unknown.
- Why use it?
  - Prevent unused delegations from being hijacked
  - Mitigate leakage of private-use public address space
- AS0 will never appear as a functional origin in a ROA (see RFC7607)

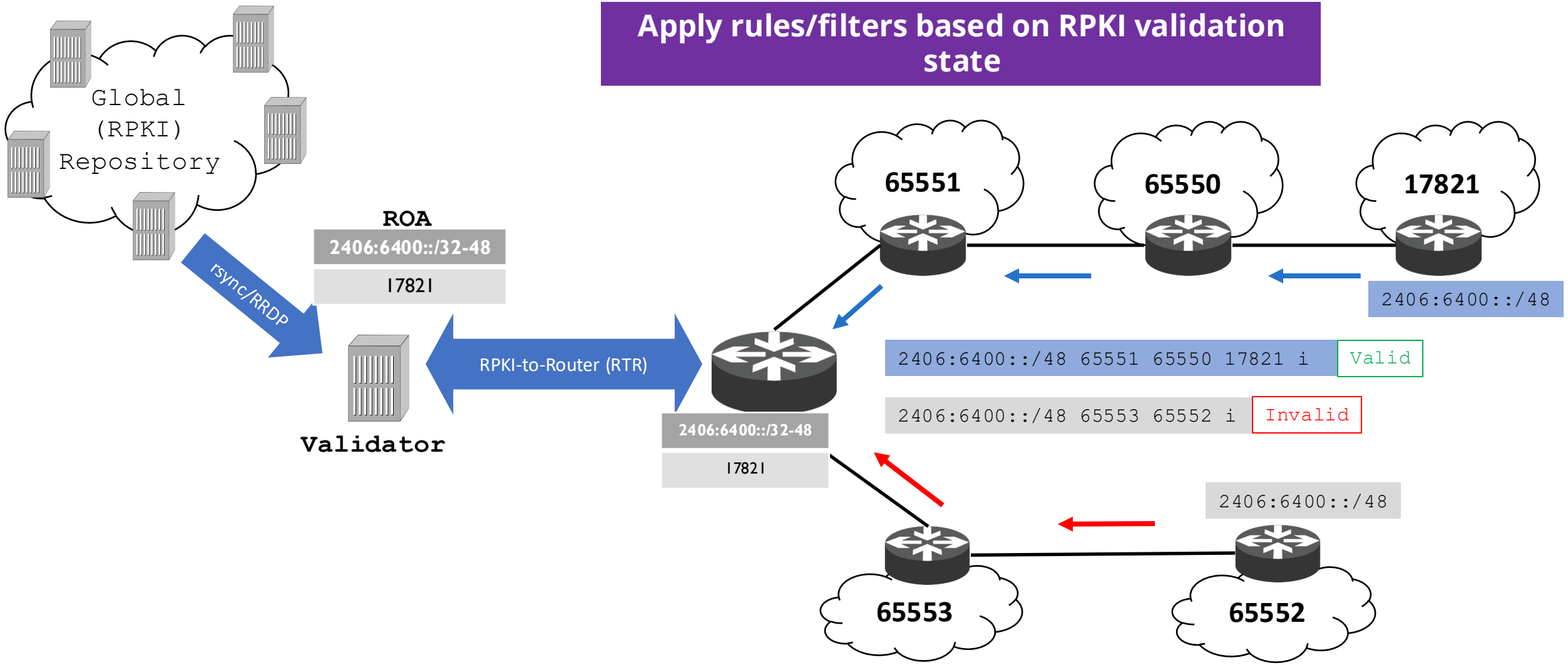
Ex: For the following VRPs

VRPs
2.0.0.0/16-16, AS0
3.0.0.0/22-24, AS0
4.0.0.0/24-24, AS0
4.0.0.0/24-24, AS1234

With Origin Validation, these BGP routes will have an RPKI state as follows:

ASN	Prefix	RPKI State
1234	1.0.0.0/24	NOT FOUND
1234	2.0.0.0/16	INVALID
1234	2.0.0.0/24	INVALID
1234	3.0.0.0/16	NOT FOUND
1234	4.0.0.0/24	VALID

Route Origin Validation (ROV)



Phase 2 – ROV Filtering

Tag

If you have downstream customers or run a route server (IXP)

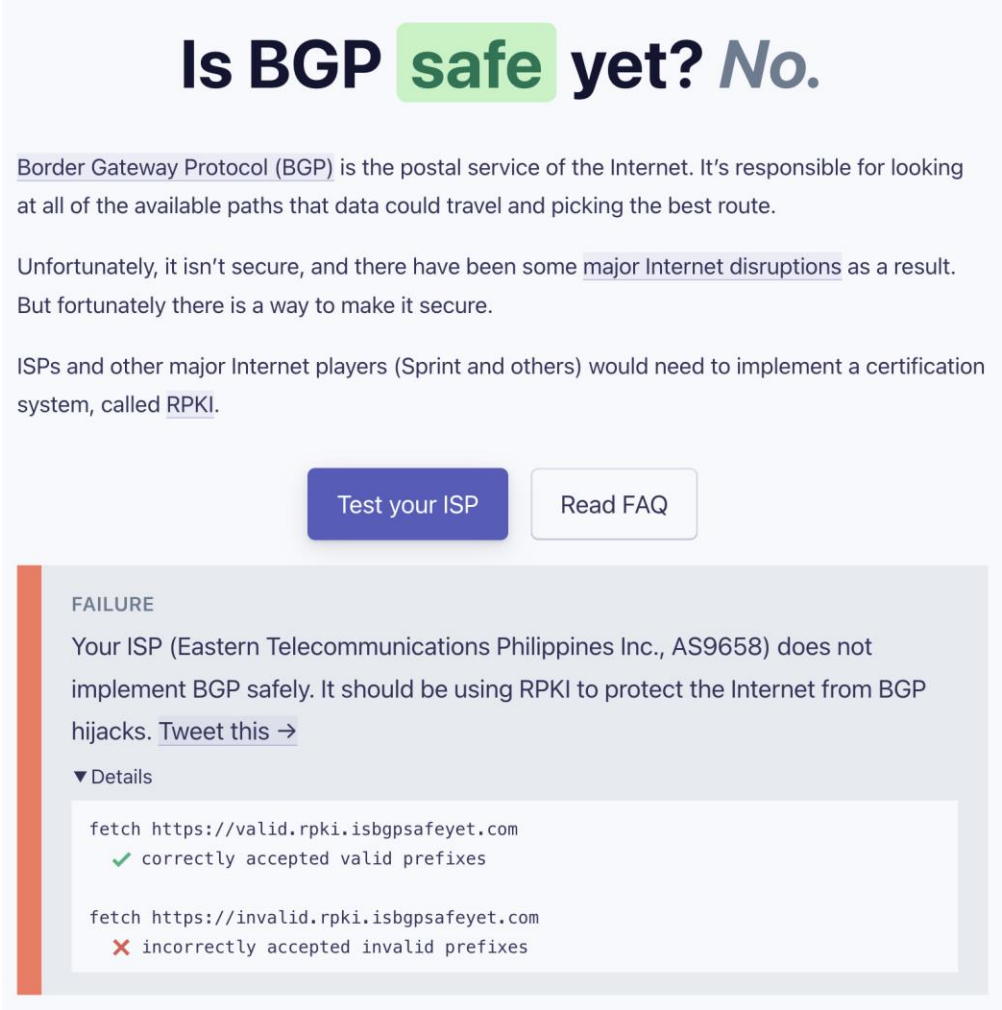
```
[Valid (ASN:65XX0),
Not Found (ASN:65XX1),
Invalid (ASN:65XX2)]
```

Modify preference values – RFC7115

```
[Valid > Not Found > Invalid]
```

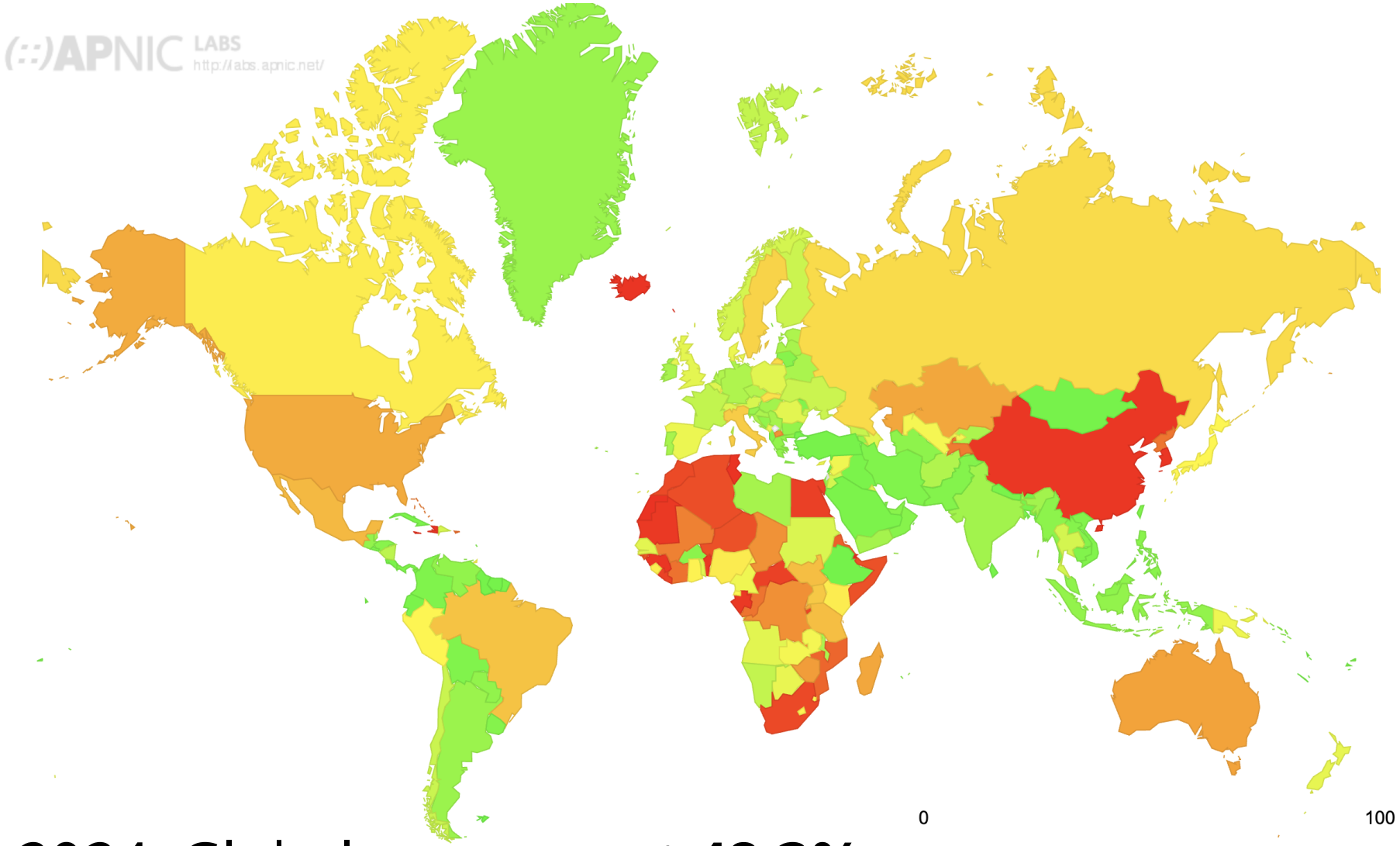
Drop Invalids

Many providers are already dropping invalid routes.



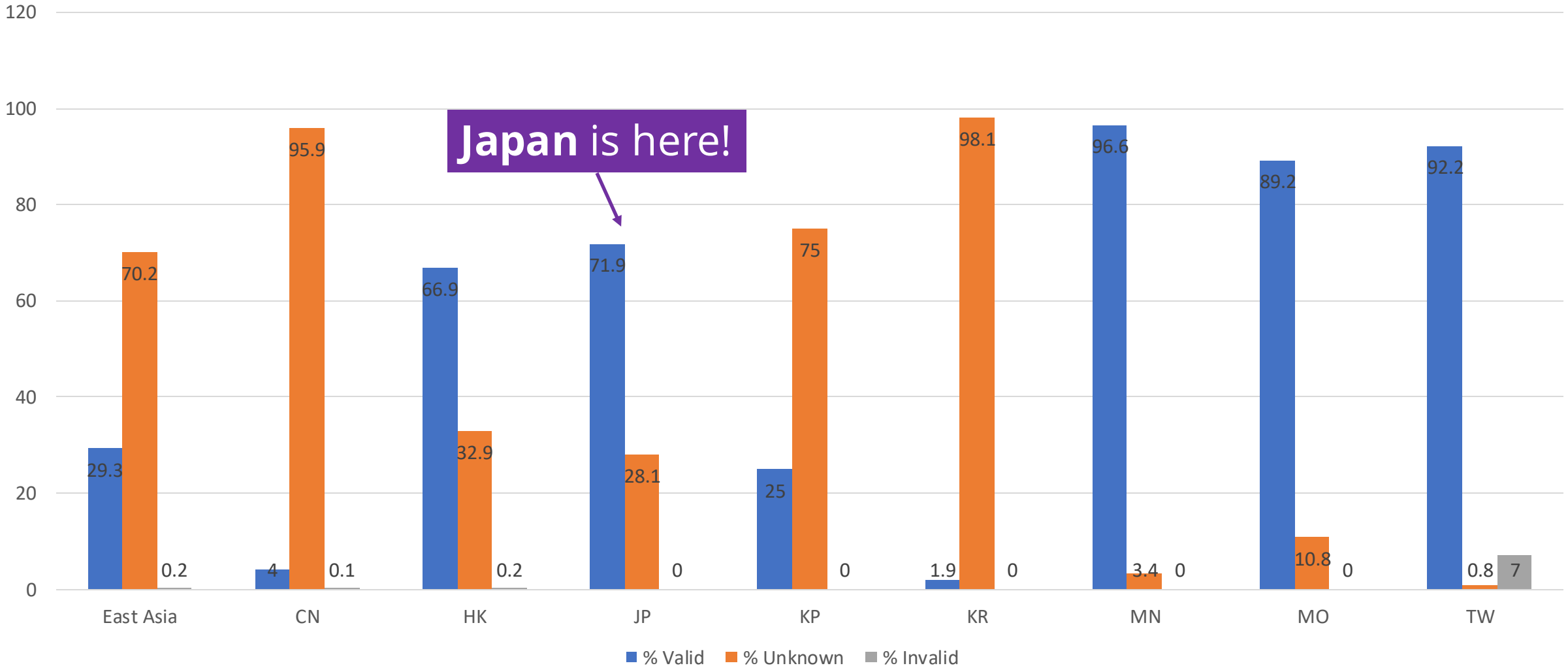
https://isbgpsafeyet.com/

RPKI Adoption Trends – ROA Coverage



06 Dec 2024: Global coverage at **48.3%**

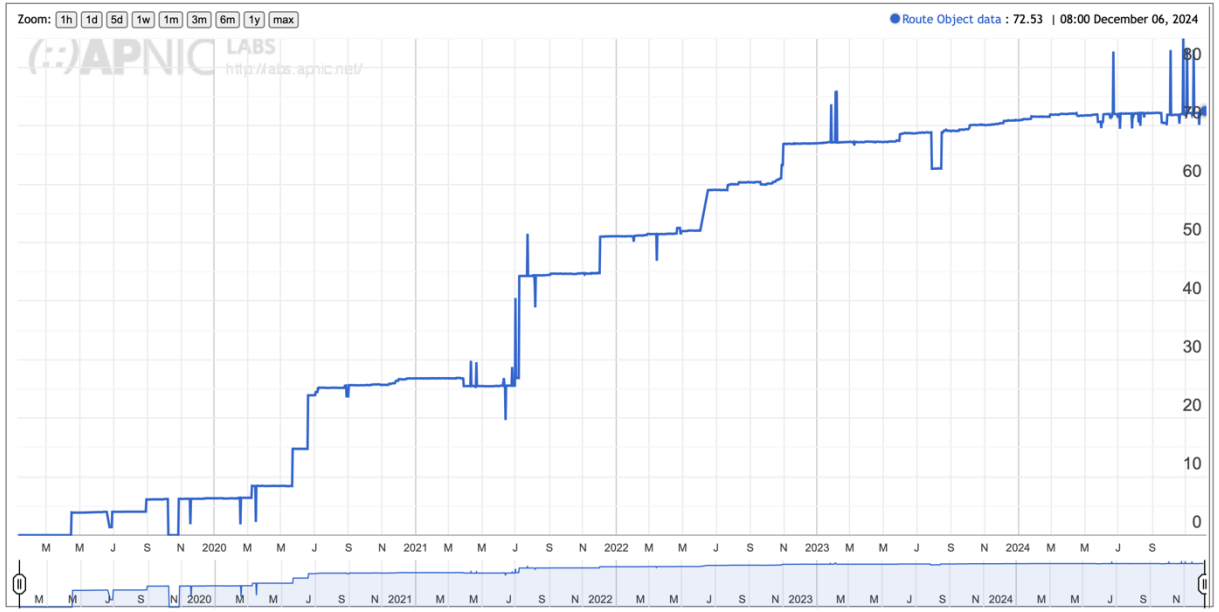
RPKI East Asia Leaderboard – ROA Coverage



ROA Coverage – Japan Focus

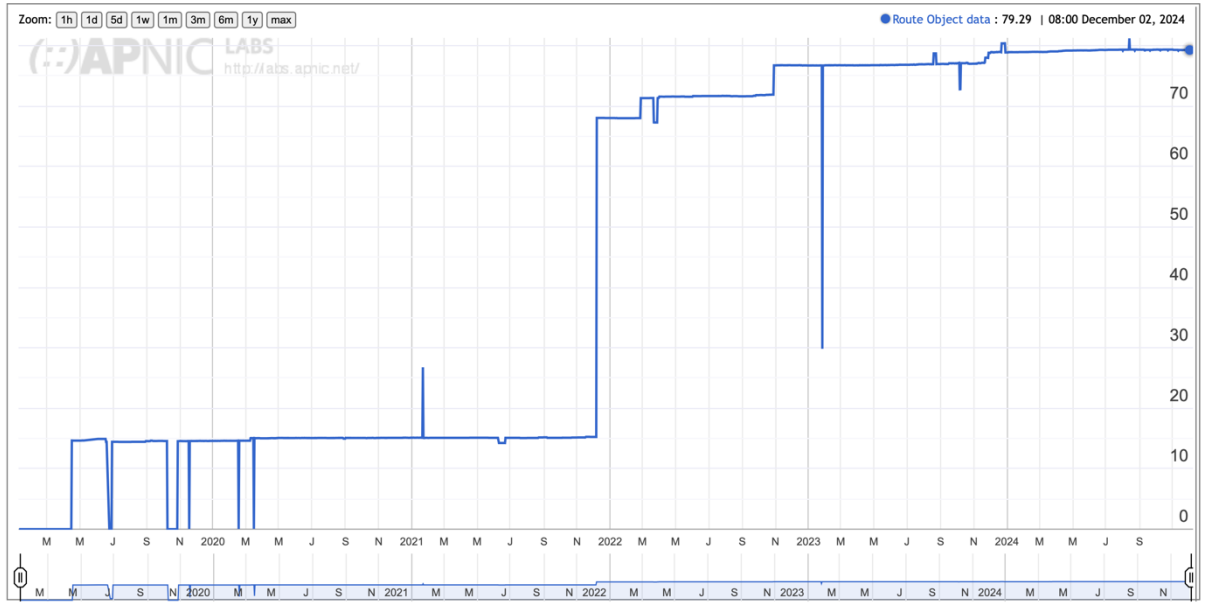
Good overall ROA coverage for both IPv4 and IPv6 ~**75.9%** total

Display: **Addresses** (Advertised ROA-Valid Advertised Addresses), **IPv4**, **Percent** (of Total)



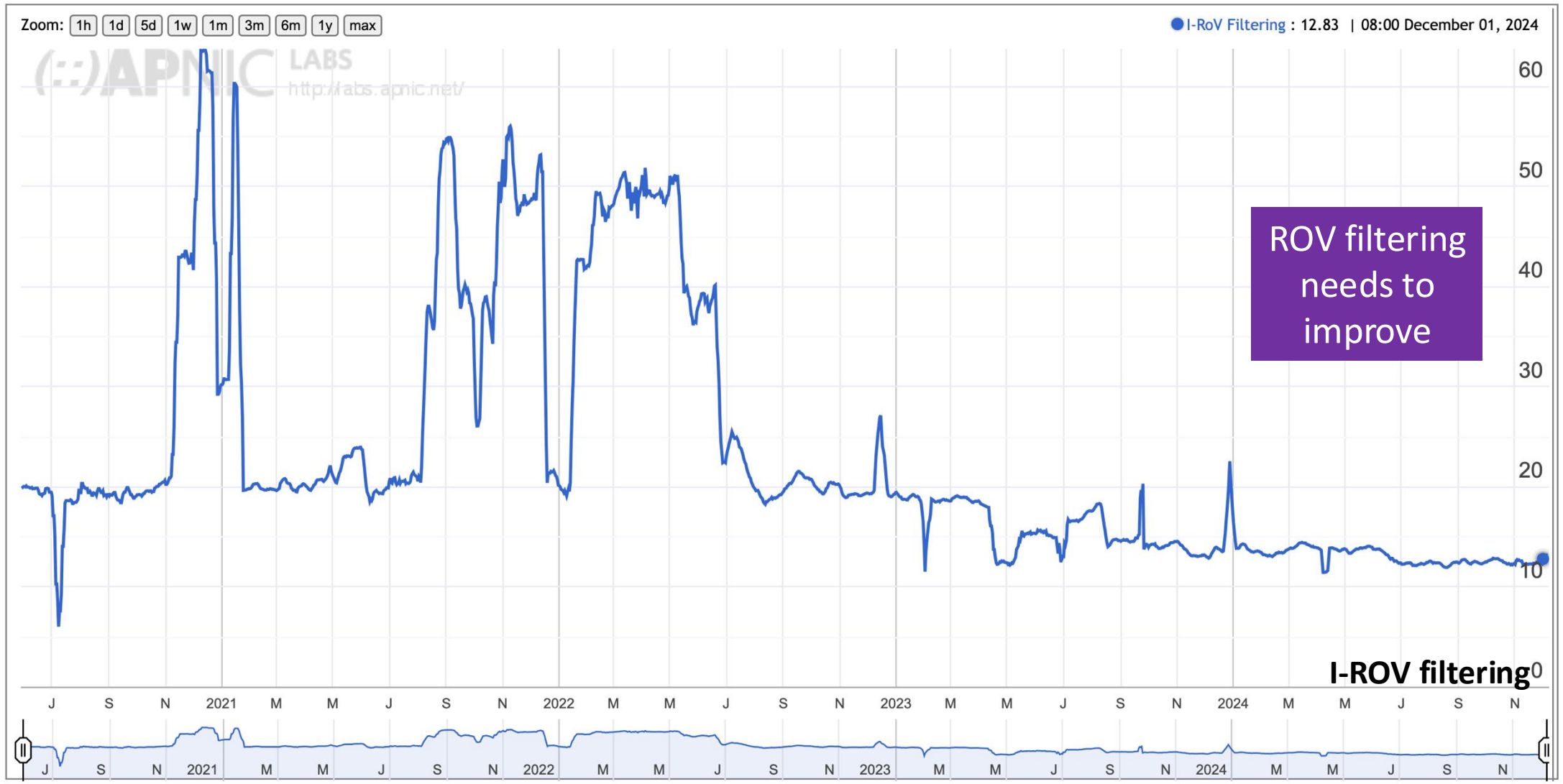
72.53% ROA coverage for IPv4

Display: **Addresses** (Advertised ROA-Valid Advertised Addresses), **IPv6**, **Percent** (of Total)



79.29% ROA coverage for IPv6

ROA and ROV – APNIC Stats



ROV – Top ASNs

ASN	AS Name	RPKI Validates	Samples
AS17676	GIGAINFRA SoftBank Corp.	0.08%	344,457
AS2516	KDDI KDDI CORPORATION	0.29%	325,533
AS4713	OCN NTT Communications Corporation	98.34%	174,446
AS9605	DOCOMO NTT DOCOMO, INC.	5.40%	131,826
AS9824	JTCL-JP-AS JCOM Co., Ltd.	0.09%	69,995
AS2527	SO-NET Sony Network Communications Inc.	0.19%	56,491
AS2518	BIGLOBE BIGLOBE Inc.	0.86%	55,306
AS17511	OPTAGE OPTAGE Inc.	0.77%	54,153
AS138384	RMNI-AS-AP Rakuten Mobile Network, Inc.	0.11%	24,645
AS9617	ZAQ JCOM Co., Ltd.	0.04%	23,945
AS2519	VECTANT ARTERIA Networks Corporation	6.26%	22,699
AS18126	CTCX Chubu Telecommunications Company, Inc.	2.08%	21,304
AS4685	ASAHI-NET Asahi Net	0.46%	20,626
AS10010	TOKAI TOKAI Communications Corporation	9.48%	19,497
AS17506	UCOM ARTERIA Networks Corporation	10.96%	16,408
AS7679	QTNET QTnet,Inc.	0.79%	16,280
AS2497	IIJ Internet Initiative Japan Inc.	99.16%	10,106
AS4721	JCN JCOM Co., Ltd.	0.05%	9,536
AS7684	SAKURA-A SAKURA Internet Inc.	0.06%	8,933
AS2514	INFOSPHERE NTT PC Communications, Inc.	0.58%	8,890

Implemented by two major operators ☺

https://stats.labs.apnic.net/rpki/KR

Thank You!


Questions