



# Measuring Adoption of RPKI Route Origin Validation and Filtering



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Joint work with Randy Bush,  
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Thomas C. Schmidt, and Matthias Wählisch

**Are there any AS out there actually dropping invalid routes?**

# Recap

→ At RIPE 74 in Budapest:

1. We analysed existing work and showed the need for **controlled, active experiments**.
2. Presented our rigorous methodology

→ More details

- Paper: [ACM CCR 48\(1\), January 2018](#)
- Presentation: [Slides](#)

# Now, one year later @ RIPE 76

- New results
- Some observations
- Monitoring portal for the community!

## Results: Who drops invalid routes?

- One year ago, we reported 3 AS that were dropping invalid routes. Now it's over 40 AS. This is a lower bound.

**What happened?**

## Results: Who drops invalid routes?

- One year ago, we reported 3 AS that were dropping invalid routes. Now it's over 40 AS. This is a lower bound.

### What happened?

- IXP Route Servers. Several IXPs have switched to an 'opt-out' filtering policy.
- While Route Server (RS) peers don't technically perform ROV, it looks the same from the outside since RS is transparent.

# Observations

- Some vendor ROV Implementations are faulty
  - Re-validation on ROA changes does not occur
  - Validation can yield wrong results (wow)
- BGP data from route collectors is useful, but strange...
  - Vantage points disappear for hours/days/-ever
- ROV filtering is in flux: AS have started filtering, stopped...
  - Longitudinal monitoring is necessary

# ROV Deployment Monitor: [rov.rpki.net](http://rov.rpki.net)

## What?

- Website shows results of our daily ROV measurements
  - Static BGP announcements for two prefixes
  - Our ROA Beacons change origin AS daily
    - 04:00-12:00 (UTC): BGP announcement invalid
    - 12:01-03:59 (UTC): BGP announcement valid
  - Additional experiments planned in the future

## Why?

- Allows you to better assess the state of deployment
- Might give incentive to deploy ROV



# ROV Deployment Monitor

ROV Deployment Monitor



Feedback

Last measurement was on

Show  entries

Search:

Details	ASN	AS Name	Confidence	Notes	Feedback
	38880	M21-AS-AP Micron21 Datacentre Pty Ltd, AU	1		
	10026	PACNET Pacnet Global Ltd, JP	0.957747		
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# ROV Deployment Monitor: AS Details

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	10026	PACNET Pacnet Global Ltd, JP	0.957747			
Vantage Point IP	Days Measured 	Days Filtering 	Confidence 	Last Measured	Last Marked	Details
202.147.61.12	71	68	0.957747	2018-05-01	2018-04-30	<a href="#">Details</a>
45.127.172.44	71	68	0.957747	2018-05-01	2018-04-30	<a href="#">Details</a>







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# ROV Deployment Monitor: Route Details

## Details for vantage point 202.147.61.12 in AS10026

Show  entries

Search:


Routes	Day	Anchor Prefix	Experiment Prefix
	2018-04-30	147.28.243.0/24	147.28.245.0/24
Timestamp	AS Path for Anchor Prefix	AS Path for Experiment Prefix	
1525053600	10026 47065	10026 47065	
1525060800	10026 47065	10026 47065	
1525068000	10026 47065	undefined	
1525082400	10026 47065	undefined	
1525089600	10026 47065	undefined	
1525096800	10026 47065	10026 47065	
1525111200	10026 47065	10026 47065	
1525118400	10026 47065	10026 47065	
1525125600	10026 47065	10026 47065	

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Show 10 entries

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# ROV Deployment Monitor - Feedback?

Try it our yourself at:

**<https://rov.rpki.net>**

- Is your AS filtering, but not on the list?
- Is your AS not filtering, but is on the list?

Let us know, either using the  button on [rov.rpki.net](https://rov.rpki.net), or come talk to us offline!

# Backup



# Enter RPKI

Prefix hijacking prevention using Resource Public Key Infrastructure

# Enter RPKI

Prefix hijacking prevention using Resource Public Key Infrastructure

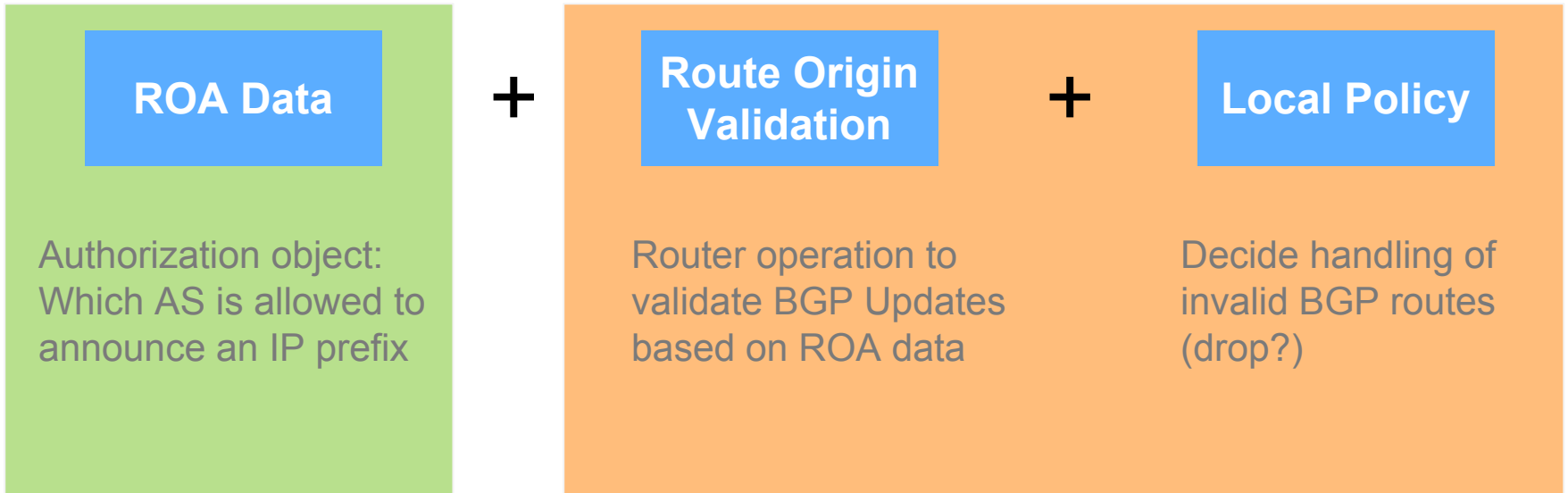


**ROA Data**

Authorization object:  
Which AS is allowed to  
announce an IP prefix

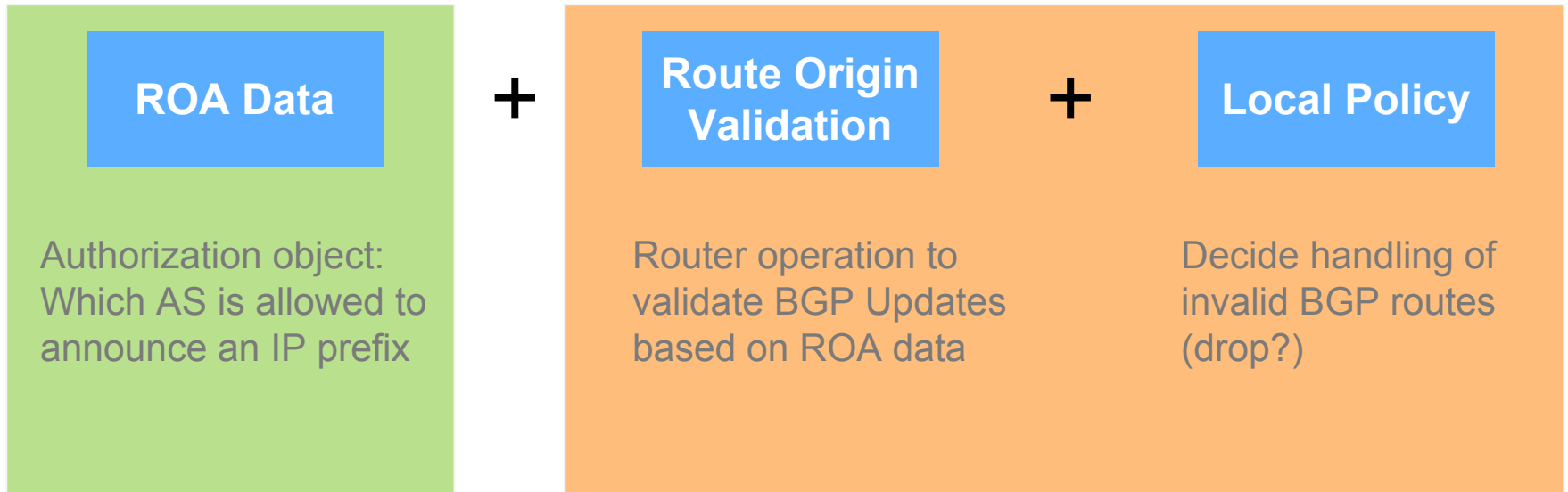
# Enter RPKI

Prefix hijacking prevention using Resource Public Key Infrastructure



# Enter RPKI

Prefix hijacking prevention using Resource Public Key Infrastructure



ROA: 10.20.0.0/16-24 AS100

BGP: 10.20.0.0/16 AS100 ✓

BGP: 10.20.0.0/16 AS666 ✗

Accept

Reject

# RIPE74: Measuring Adoption of RPKI Route Validation and Filtering

- We analysed existing work and showed the need for controlled, active experiments.
- Presented our own methodology: Change validity state of BGP routes, observe route selection of vantage points using route collectors.

# ROV Deployment Monitor

- **Idea:** Give the community a way to assess adoption of Origin Validation.
- Which AS are filtering invalid routes?
- Which AS are using filtering provided by a route server?  
(@ AMSIX , France IX)
- **Incentive for operators to deploy ROV**

Results are published daily based on longitudinal, on-going experiments.

## Background: RPKI and ROV

- The Resource Public Key Infrastructure (RPKI) is part of an effort to secure BGP
- Within the RPKI, network operators can authorize specific AS to originate their prefixes using Route Origin Authorizations (ROAs)
- BGP routers can use the ROA information to perform Route Origin Validation (ROV). Result will either be *valid*, *invalid*, or *not found*.

**Are there any AS out there actually dropping invalid routes?**

# Try it! At [rov.rpki.net](http://rov.rpki.net)

ROV Deployment Monitor Paper Code About

## Measuring RPKI Route Origin Validation Deployment

Which Autonomous Systems (AS) deploy route origin validation, based on attestation objects of the Resource Public Key Infrastructure (RPKI)? See below, or [read more](#) about our methodology.

Feedback

Last measurement was on 2018-02-26

Show 50 entries

Search:

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	38880	M21-AS-AP Micron21 Datacentre Pty Ltd, AU	1		
	50300	CUSTDC, GB	1		
	23106	Cemig Telecomunicações SA, BR	0.947368		
	37468	ANGOLA-CABLES, AO	0.947368		
	25091	IP-MAX, CH	0.9		
	25220	GLOBALNOC-AS equada network GmbH, DE	0.9		
	36236	NETACTUATE - NetActuate, Inc, US	0.9		
	6939	HURRICANE - Hurricane Electric, Inc., US	0.9		
	20764	RASCOM-AS CJSC RASCOM ISP, RU	0.9		
	45352	IPSERVERONE-AS-AP IP ServerOne Solutions Sdn Bhd, MY	0.9		
	10026	PACNET Pacnet Global Ltd, JP	0.9		
	8492	OBIT-AS `OBIT` Ltd., RU	0.9		
	42541	FIBERBY, DK	0.9		
	3252	FBRX-AS, GB	0.9		
	13237	LAMBDANET-AS European Backbone of AS13237, DE	0.9		
	15547	NETPLUS, CH	0.9		
	31424	NEXELLENT-AS AS31424 is operated by:, CH	0.9		
	3267	RUNNET, RU	0.9		



# ROV Deployment Monitor - Thoughts?

- You can provide feedback at [rov.rpki.net](http://rov.rpki.net)
- Are you filtering, but your AS is not on the list?
  - ◆ You might not be in reach of our experiments.

**Please consider peering with route collectors and the PEERING\* testbed!**

# ROV Deployment Monitor

ROV Deployment Monitor



Feedback

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Show  entries

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# ROV Deployment Monitor: Feedback

## Feedback Form ✕

**Email address**

**Reason**

My AS filters, but isn't in the list.

My AS doesn't filter, but is in the list.

Other

**AS Number**

**Subject**

**Message**