Measuring the Adoption of BGP Route Origin Validation

X-CHECK

Andreas Reuter[1], Matthias Wählisch[1]

Randy Bush[2], Ethan Katz-Basset[3], Italo Cunha[4], Thomas Schmidt[5]

andreas.reuter@fu-berlin.de, m.waehlisch@fu-berlin.de

FU Berlin[1], IIJ[2], USC/Columbia University[3], UFMG[4], HAW Hamburg[5]

Freie Universität Berlin

Introduction

- The RPKI enables resource owners to authorize AS to originate their IP prefixes using Route Origin Authorizations (ROAs)
- BGP routers perform Route Origin Validation (ROV), evaluating a route to be *valid*, *invalid*, or *unknown*
- Research Objective: Measure which AS are using ROV in their routing policies to filter *invalid* routes?

Resource Public Key Infrastructure (RPKI)

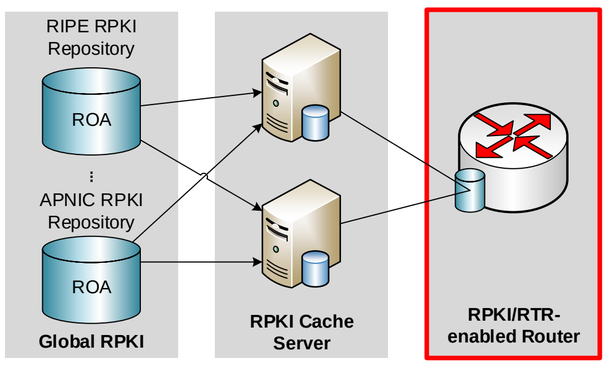
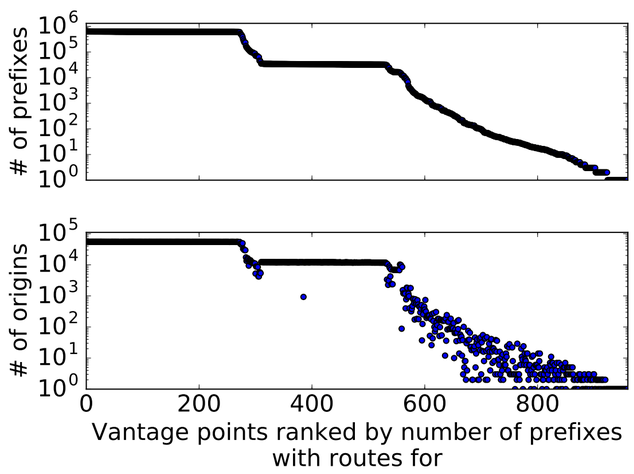


Fig. 1: ROAs can be used by BGP routers to perform Route Origin Validation (ROV)

Challenges

Limited Visibility



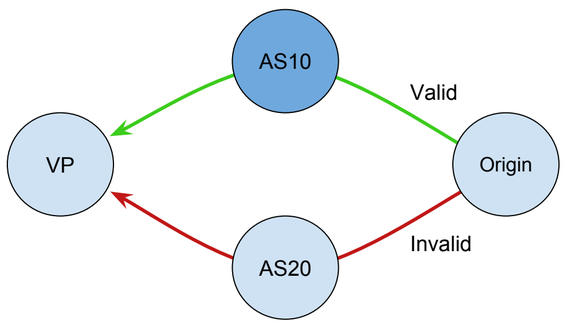


Fig. 3: Does AS10 drop the invalid announcement?

- Divergence of *invalid* and *valid* routes might indicate ROV-based filtering

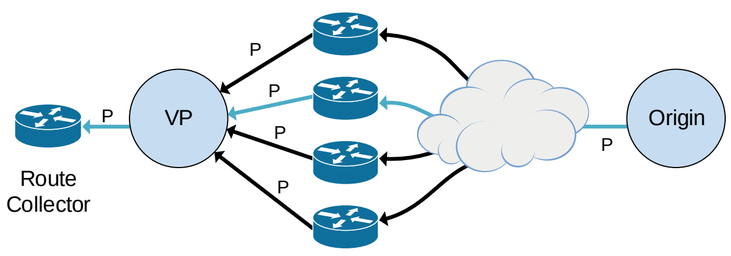


Fig. 2: A vantage point sends only its selected best route for prefix P to a route collector

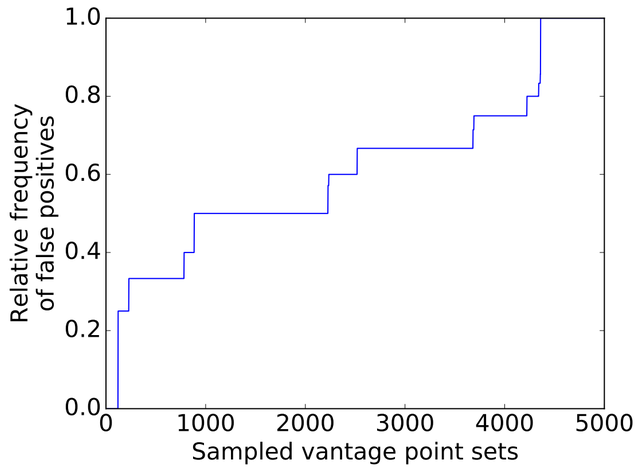


Fig. 4: Classification based on uncontrolled experiments can lead to false positives

Limited Control

- Vantage points only export selected best routes, not all available routes
- Need to distinguish between policies based on ROV and policies based on other routing attributes

State of the Art: Uncontrolled Experiments

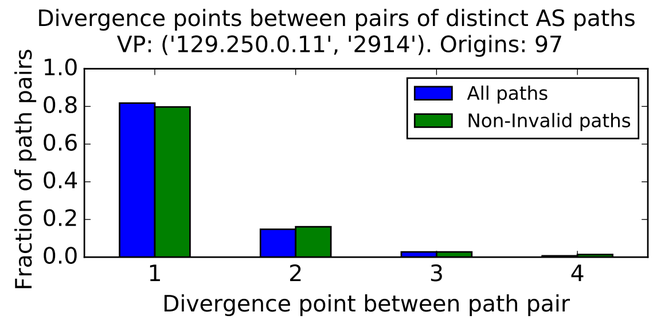


Fig. 5: Divergence between pairs of AS paths, as observed by one vantage point

- Divergence at first hop points towards traffic engineering rather than ROV based filtering

Our Approach: Controlled Experiments

- Announce prefixes P_R, P_E from the same origin AS via the same peers using the PEERING testbed
- Issue ROAs for P_R and P_E, authorizing origin AS to announce both, making the announcements *valid*
- After convergence, change ROA of prefix P_E to make its announcement *invalid*
- Analyse resulting BGP data gathered from vantage points, look for route changes

⇒ A vantage point choosing a different route for P_E, but not for P_R must be filtering based on ROV

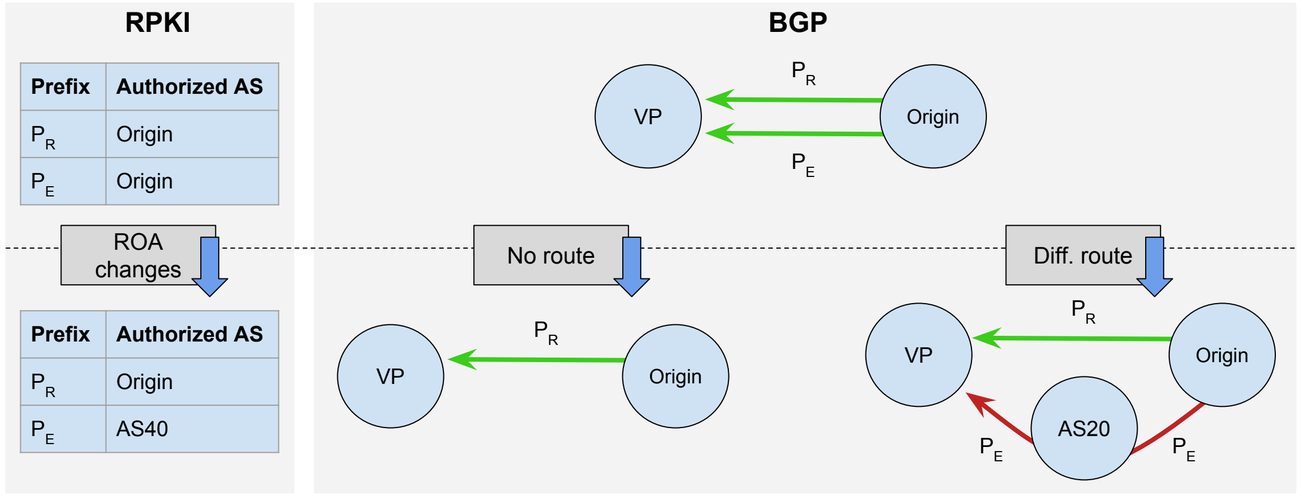


Fig. 6: Once the ROA has changed, both route changes of the VP indicate that it is using ROV to filter

Results

AS50300, AS8283, and AS59715 were found to be filtering invalid routes. Results of existing work using uncontrolled experiments could not be replicated.