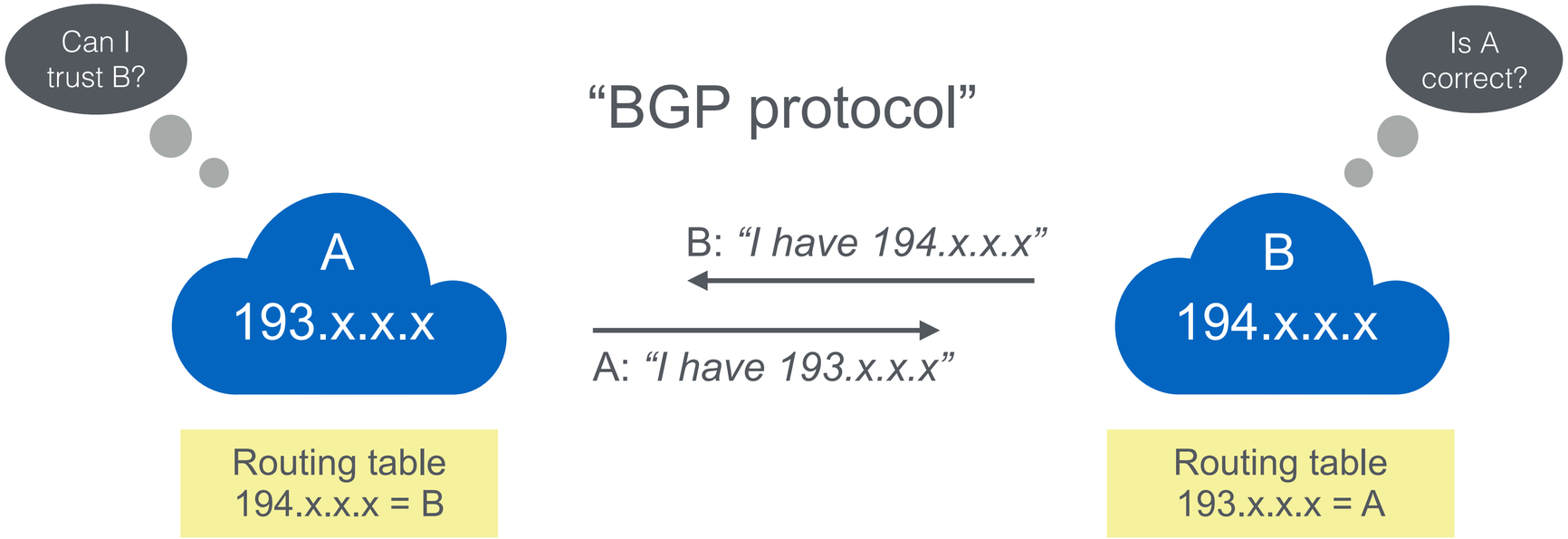
RIPE NCC
RIPE NETWORK COORDINATION CENTRE

RPKI

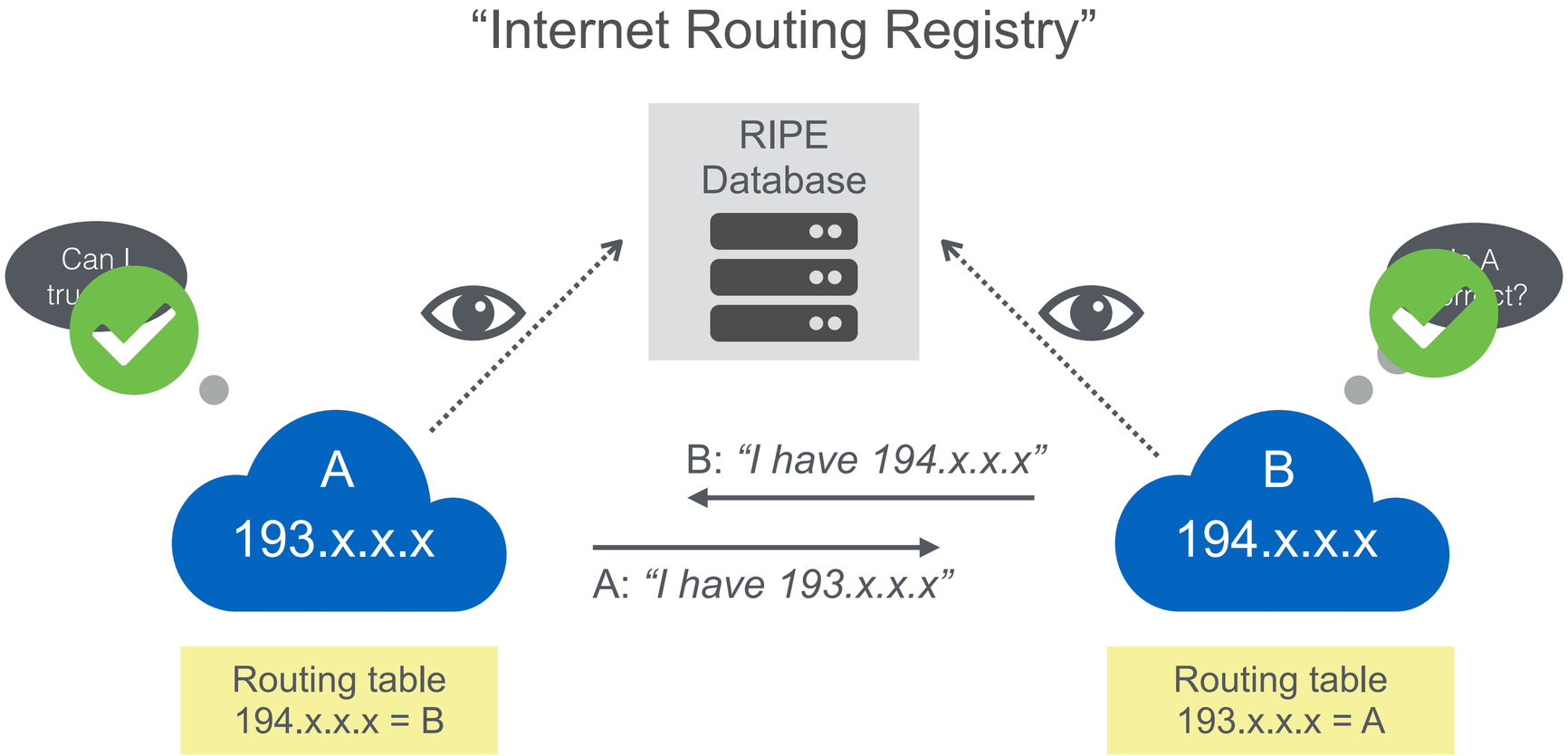
Status Q3 2022

Nathalie Trenaman | 13 September 2022 | Internet Measurement Day Serbia

Routing on the Internet



Routing on the Internet



Accidents Happen

- Fat Fingers
  - 2 and 3 are really close on our keyboards….
- Policy Violations (leaks)
  - Oops, we did not want this to go on the public Internet
  - Incidents gain media attention

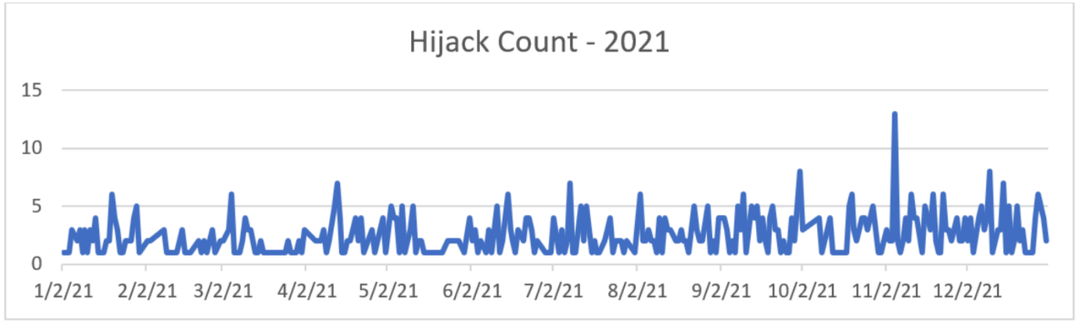
First Line of Defence

- Filtering is essential!
  - Do not accept anything that **doesn’t** belong in BGP
  - Do not accept anything that is **not** from your customer
  - Do not announce anything that **doesn’t** belong in BGP
  - Do not announce anything that is **not** from your customer

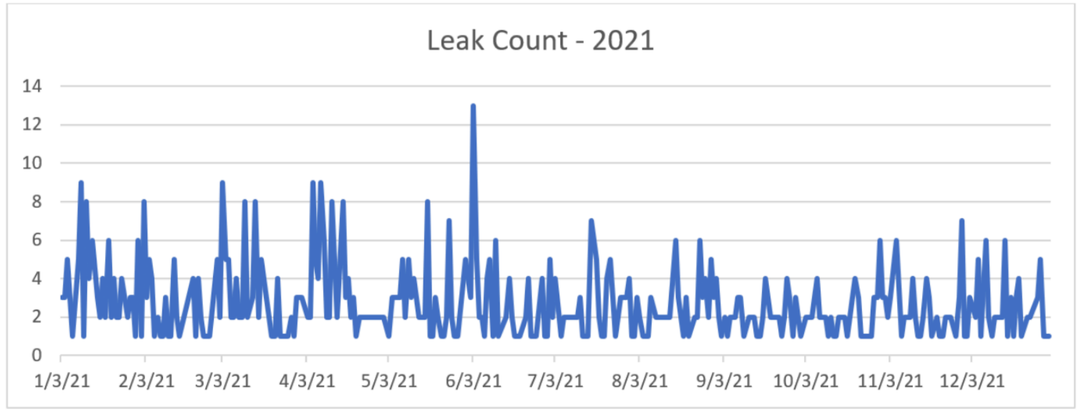
  - https://bgpfilterguide.nlnog.net/

Incidents Are Common

- 2021 Routing Security Review
  - 775 BGP hijack events



  - 830 Route Leaks



Source: https://www.manrs.org/2022/02/bgp-security-in-2021/

Internet Routing Registry

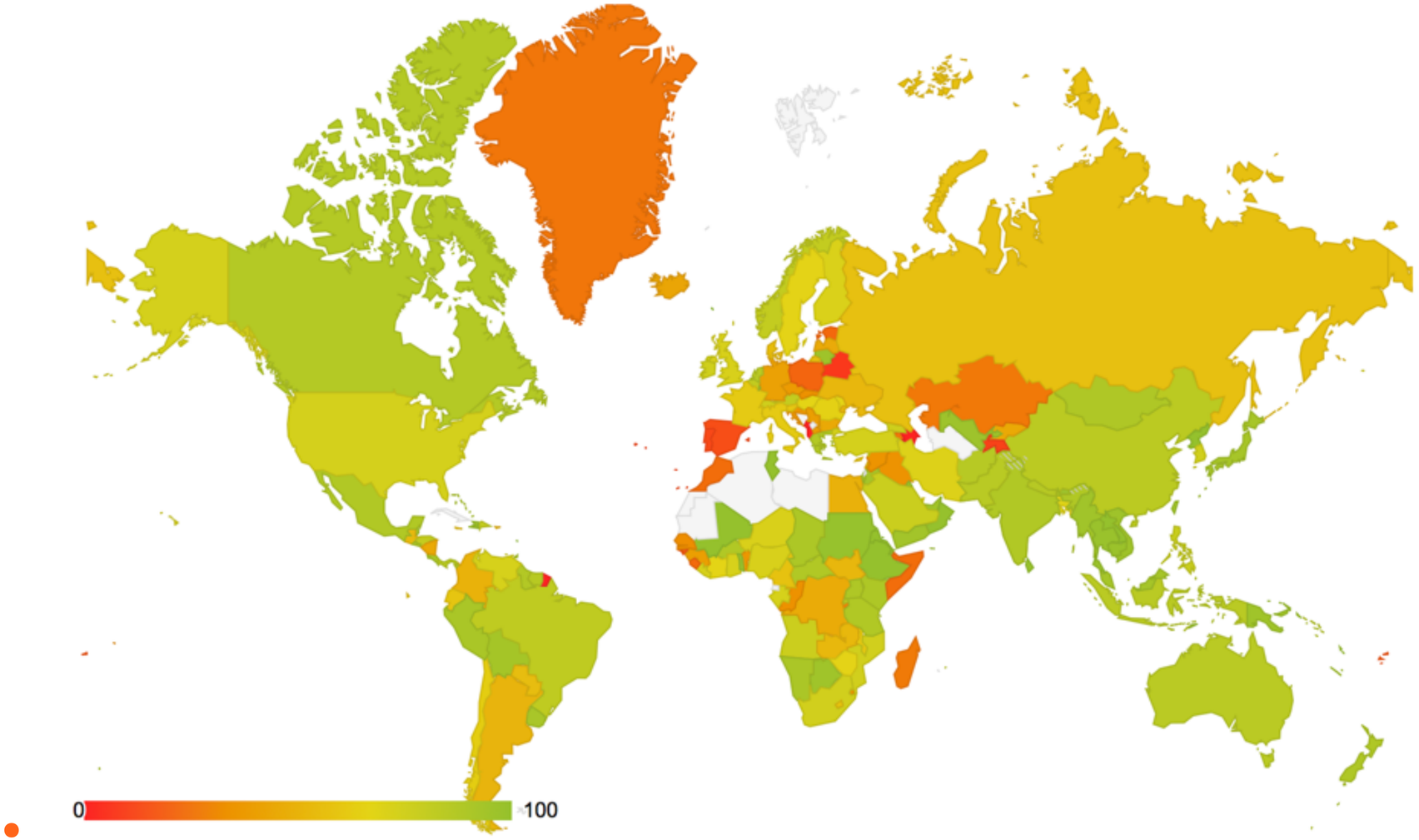
- Many exist, most widely used
  - RIPE Database
  - RADB
- Verification of holdership over resources
  - RIPE Database for RIPE Region resources only
  - RADB allows paying customers to create any object
  - Lots of the other IRRs do not formally verify holdership

Problem Statement

- Some IRR data cannot be fully trusted
  - Accuracy
  - Incomplete data
  - Lack of maintenance

- Not every RIR has/had an IRR
  - Third party databases need to be used (RADB, Operators)
  - No verification of who holds IPs/ASNs

Problem Statement

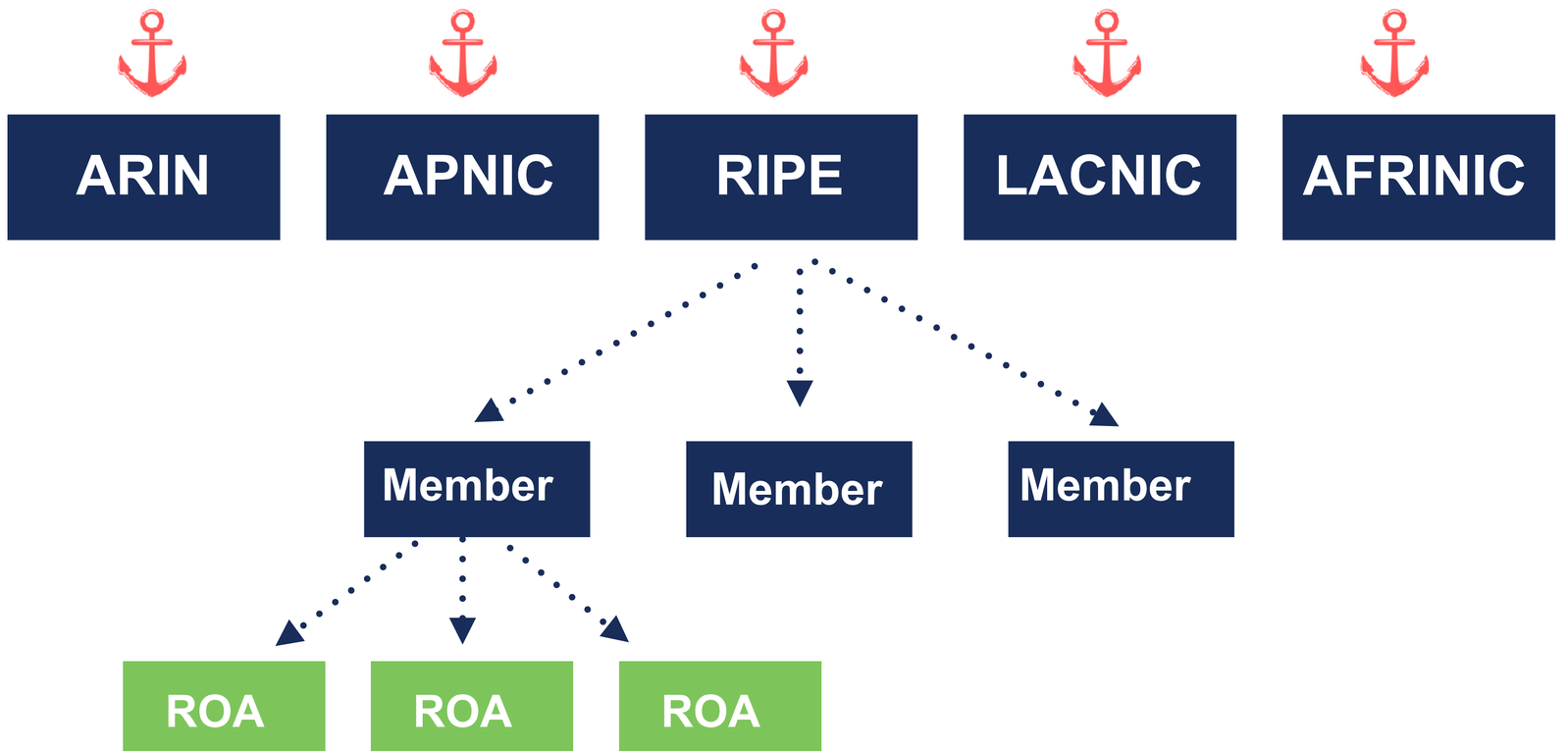


Resource Public Key Infrastructure

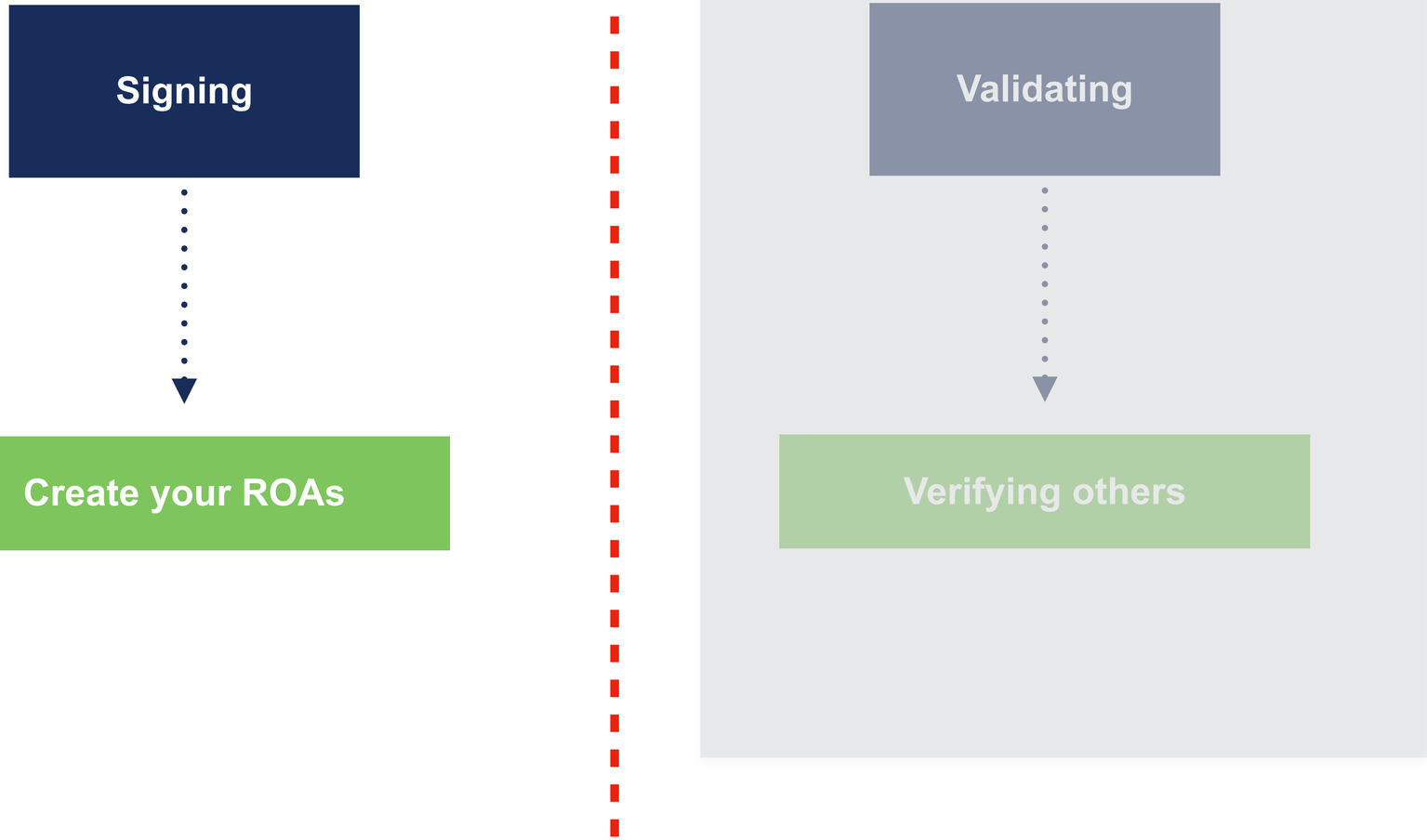
- Ties IP addresses and ASNs to public keys
- Follows the hierarchy of the registries
- Authorised statements from resource holders
  - “ASN X is authorised to announce my Prefix Y”
  - Signed, holder of Y

RPKI Certificate Structure

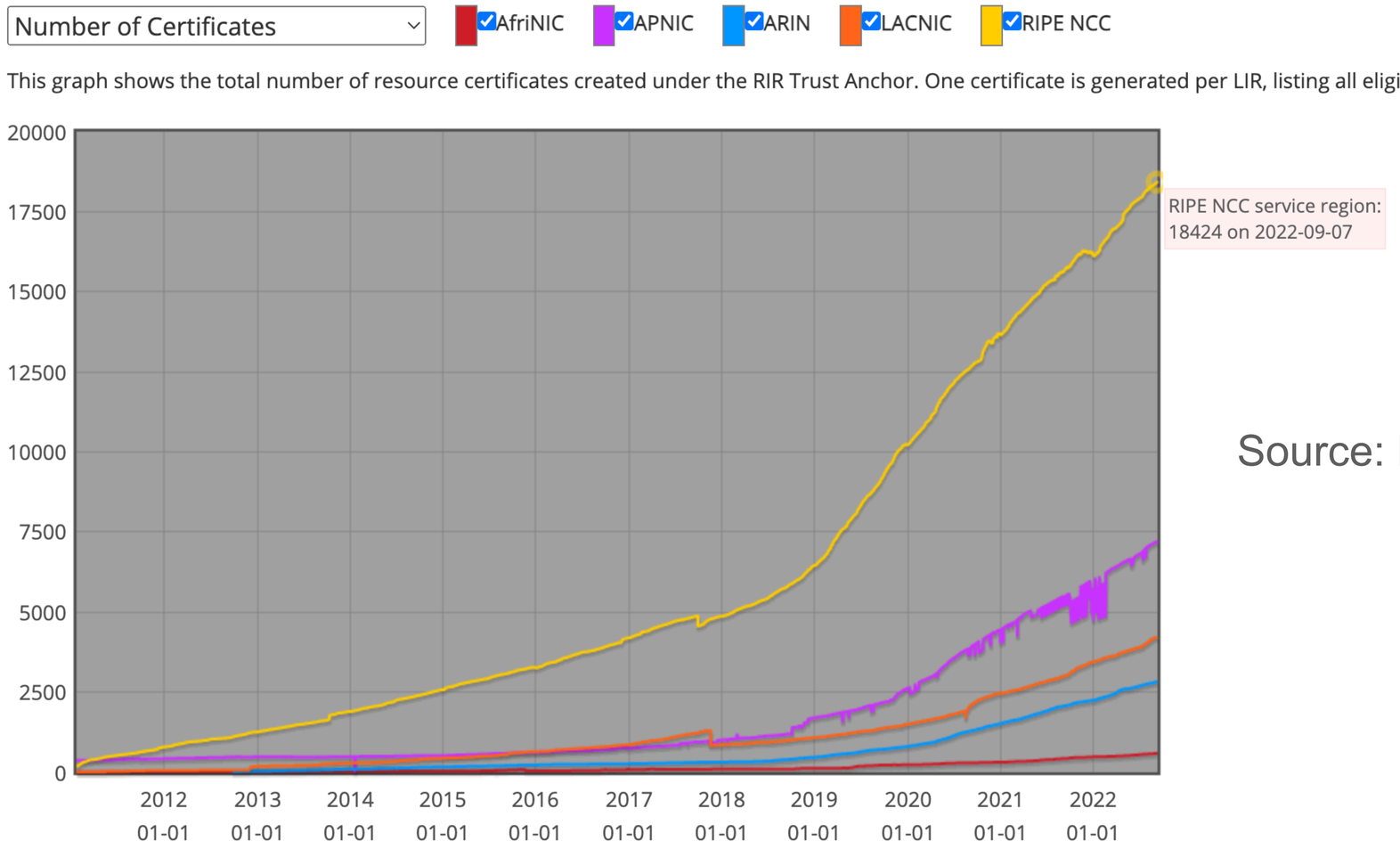
Certificate hierarchy follows allocation hierarchy



Two Elements of RPKI

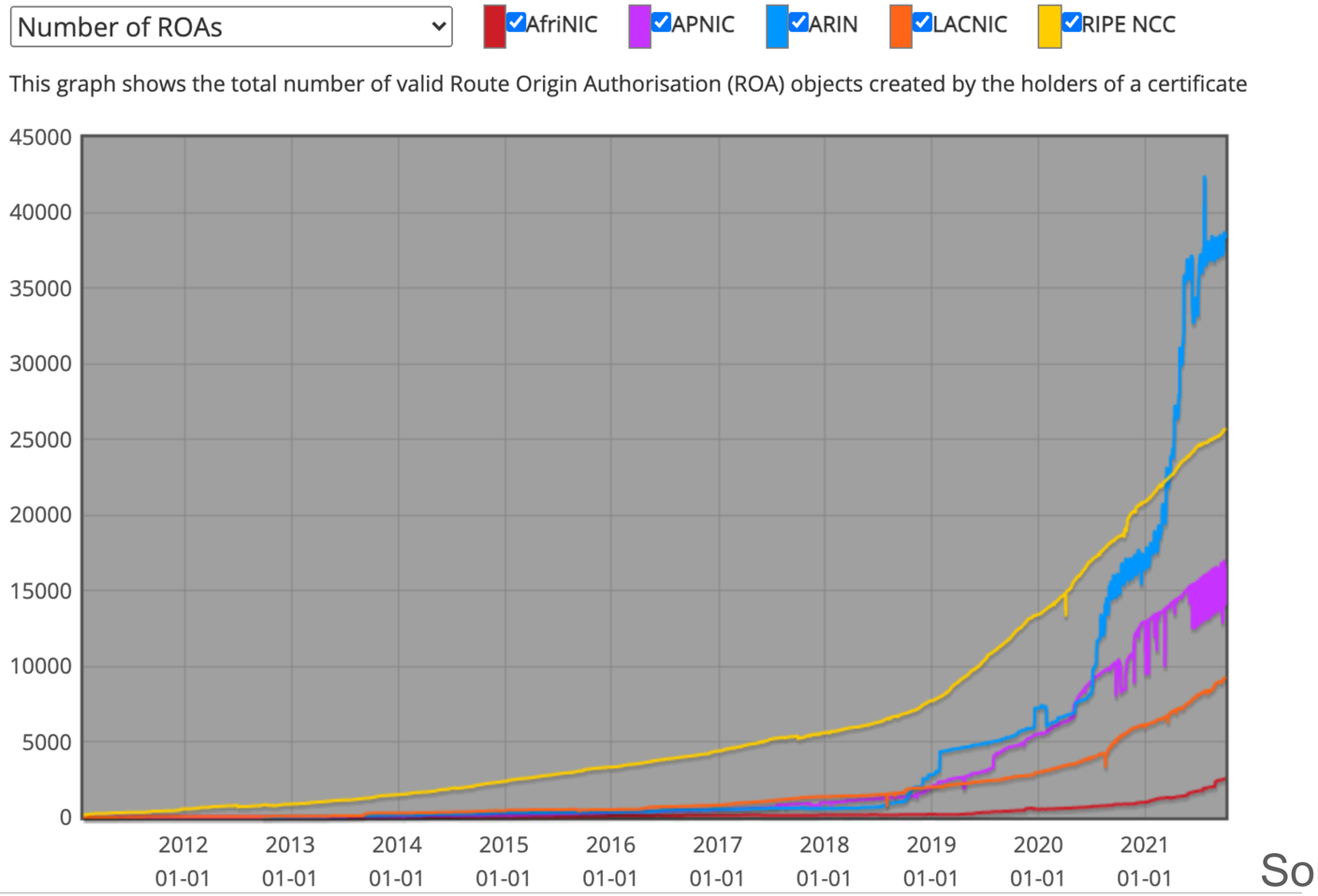


RPKI Certificates



Source: https://certification-stats.ripe.net/

Measuring Signed Objects is Harder…



Source: https://certification-stats.ripe.net/

ROAs versus VRPs…

- ROA - Route Origin Authorisation
- VRP - Verified ROA Payload

ARIN

ROAs

Valid	Invalid
54,880	5

VRPs

Total	Unsafe	Duplicate	Final
66,906	0	4,569	62,337

RIPE

ROAs

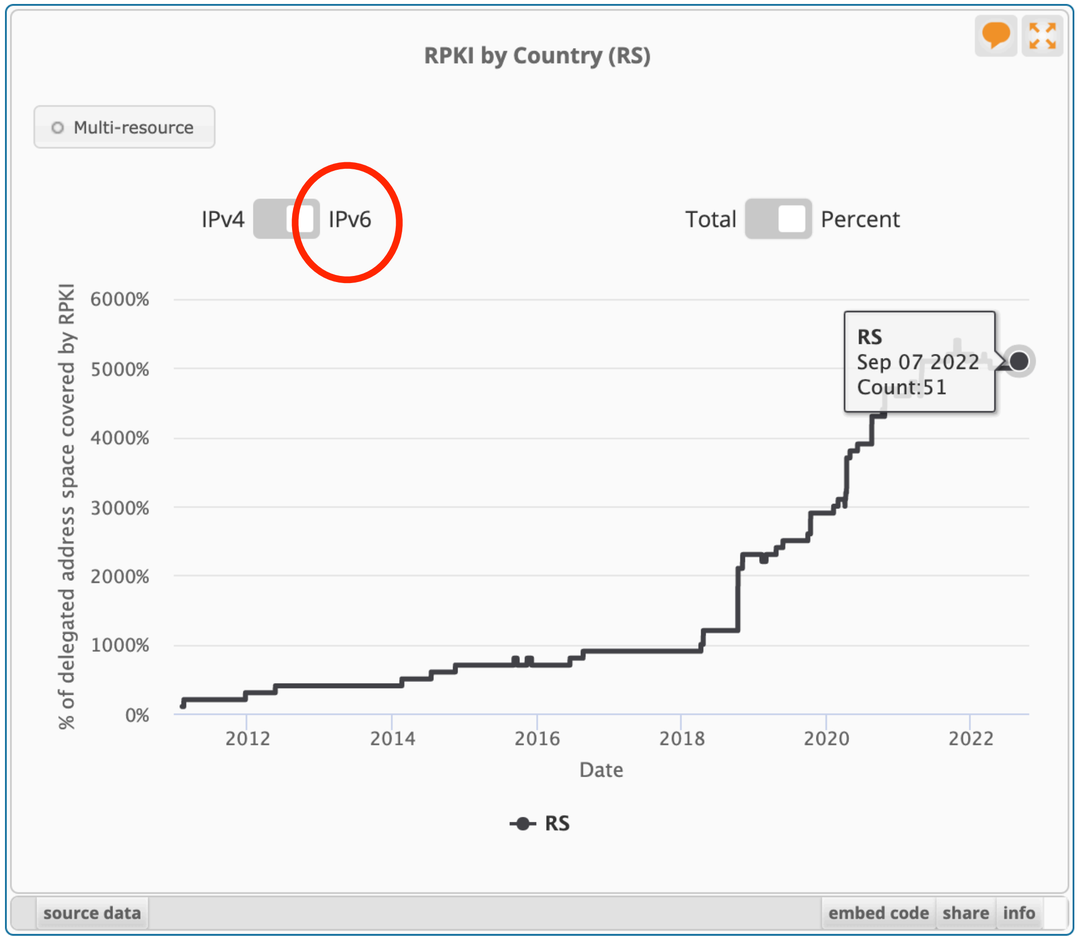
Valid	Invalid
32,705	0

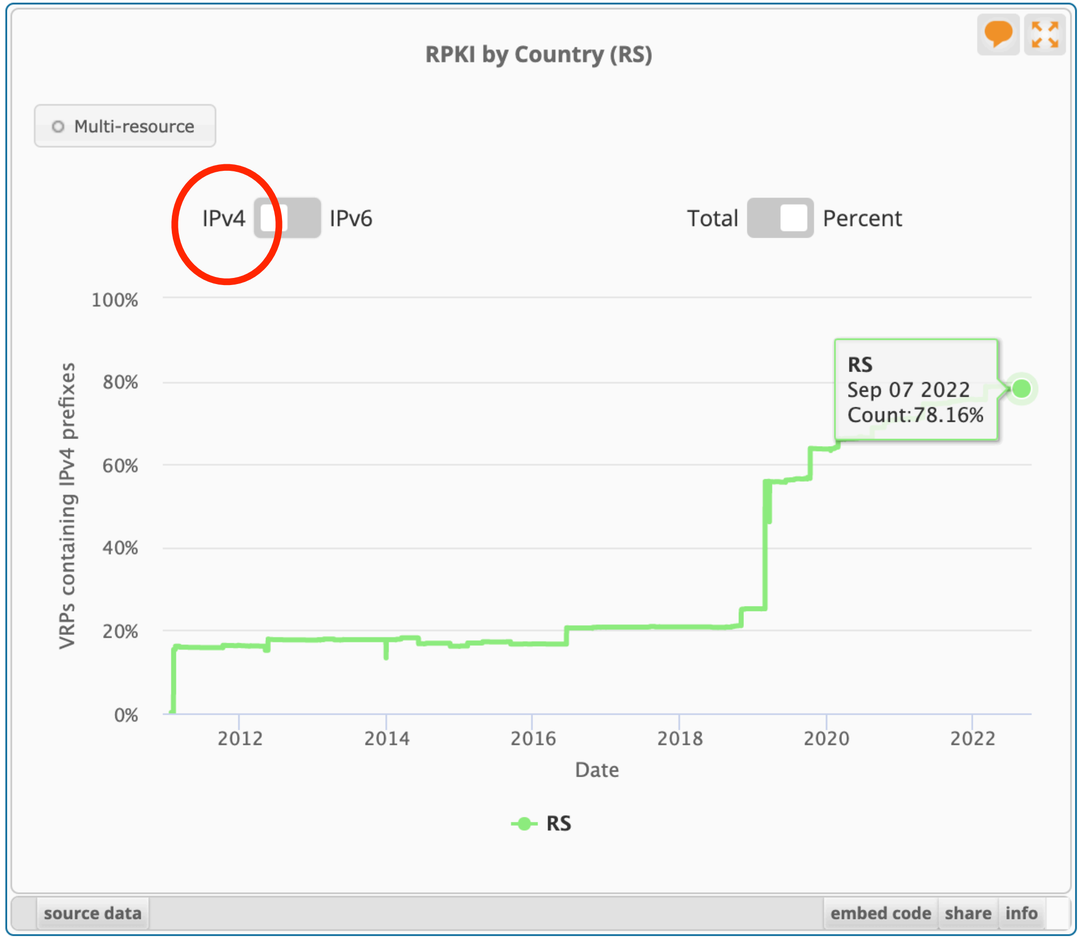
VRPs

Total	Unsafe	Duplicate	Final
176,0912		1	176,090

Source: https://rpki-validator.ripe.net/ui/metrics

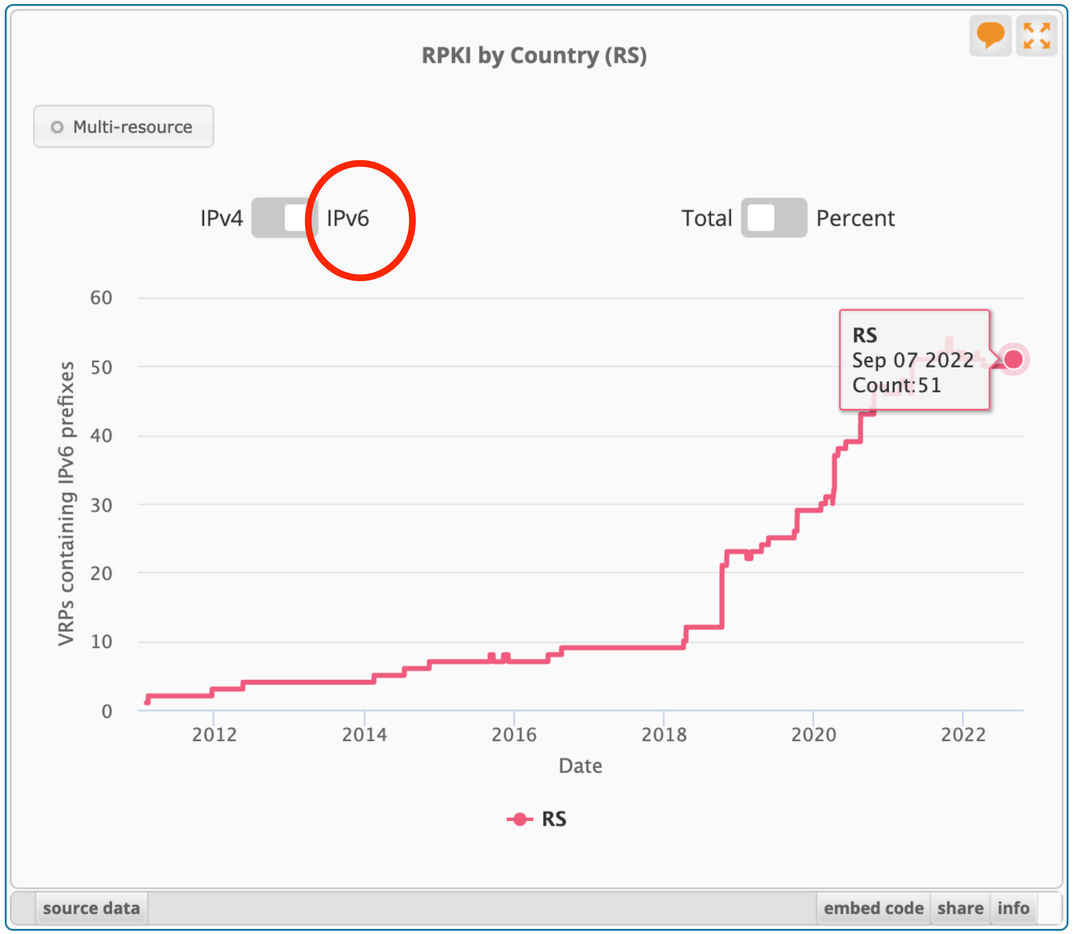
Current Status in RS

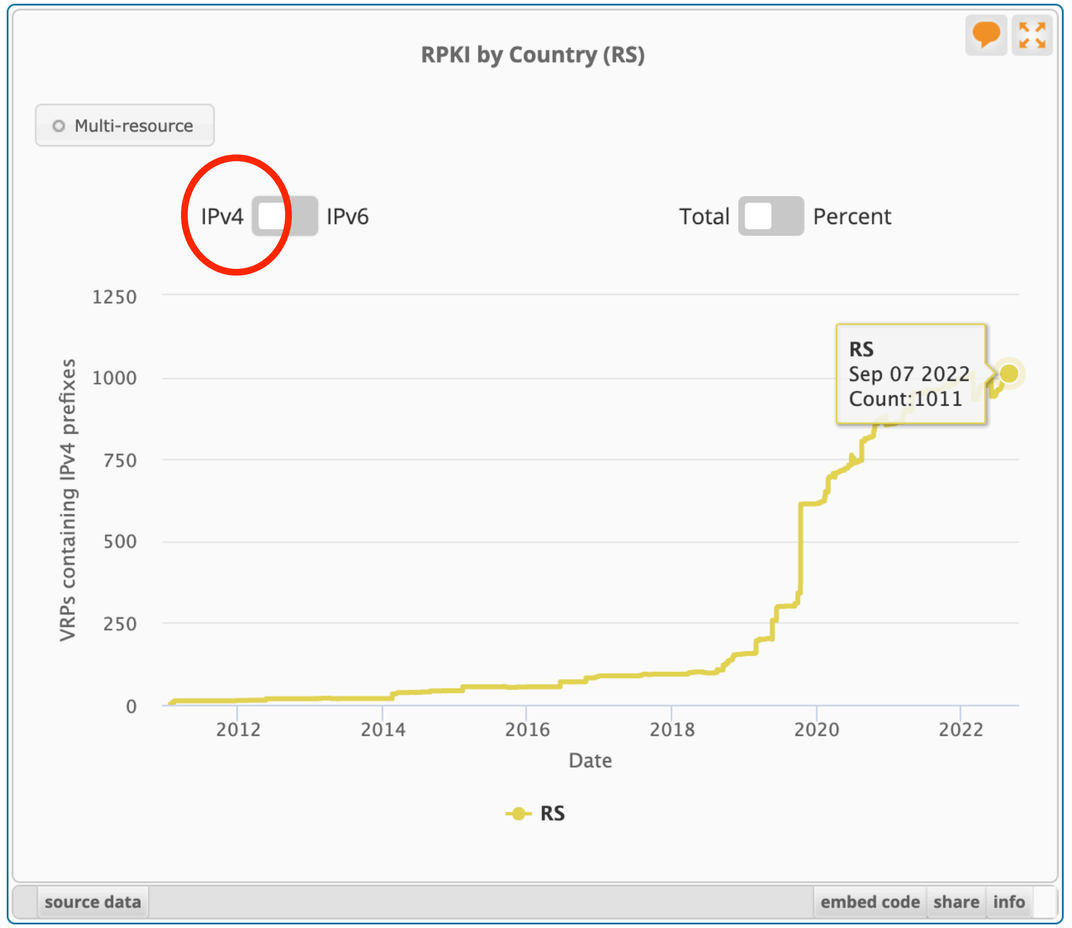




Source: https://stat.ripe.net/ui2013/RS#tabId=routing

Current Status in RS





Source: https://stat.ripe.net/ui2013/RS#tabId=routing

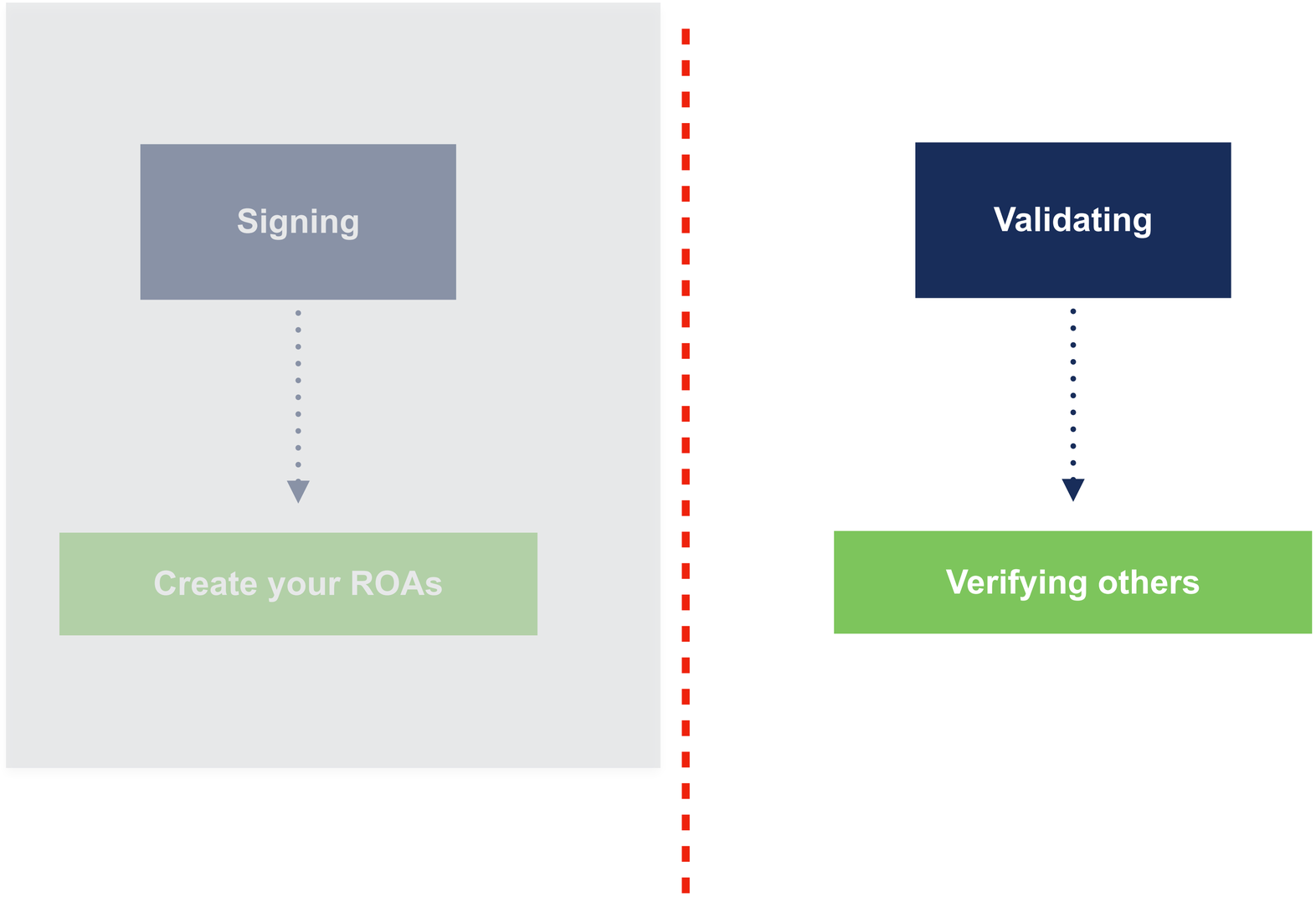
A Quick Comparison

Country	%Prefixes	%Addresses	Accuracy
RS	65.6%	80.0%	100%
BA	75.1%	71.2%	99.78%
ME	62.3%	87.0%	100%
RO	58.6%	84.1%	99.69%
HU	62.6%	80.5%	99.29%

Source: https://lirportal.ripe.net/certification/content/static/statistics/world-roas.html

Route Origin Validation

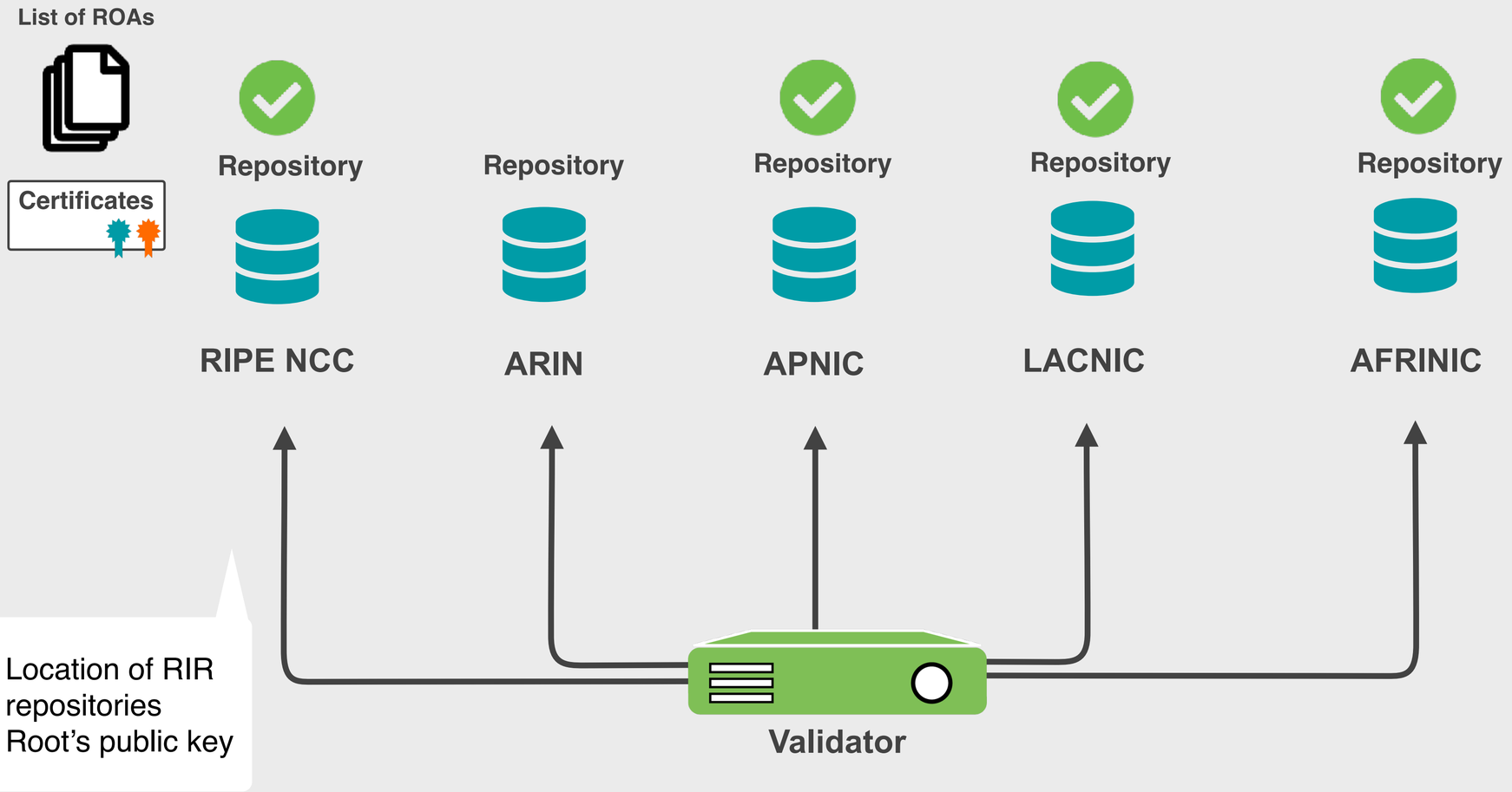
Two elements of RPKI



The Goal

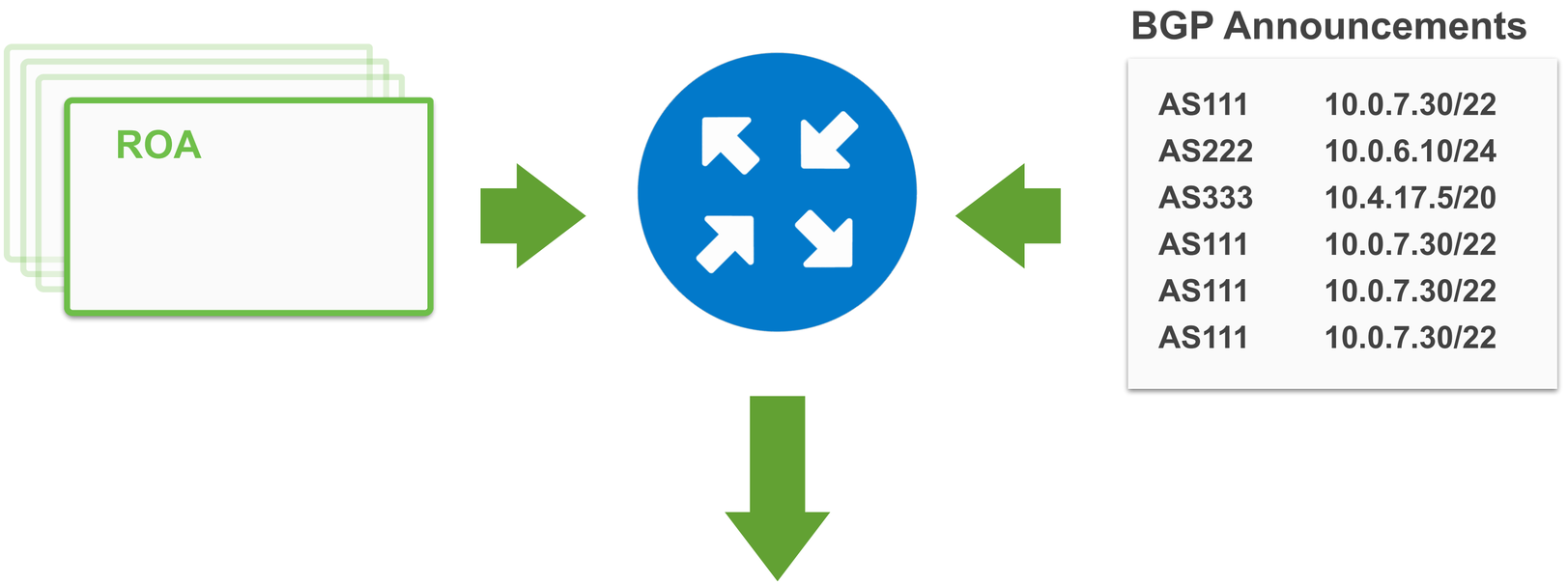
- Verifying the information provided by the others
- Goal is to validate the **“origin of BGP announcements”**
- Known as
  - BGP Origin Validation (BGP OV) or
  - Route Origin Validation (ROV)

How It Works



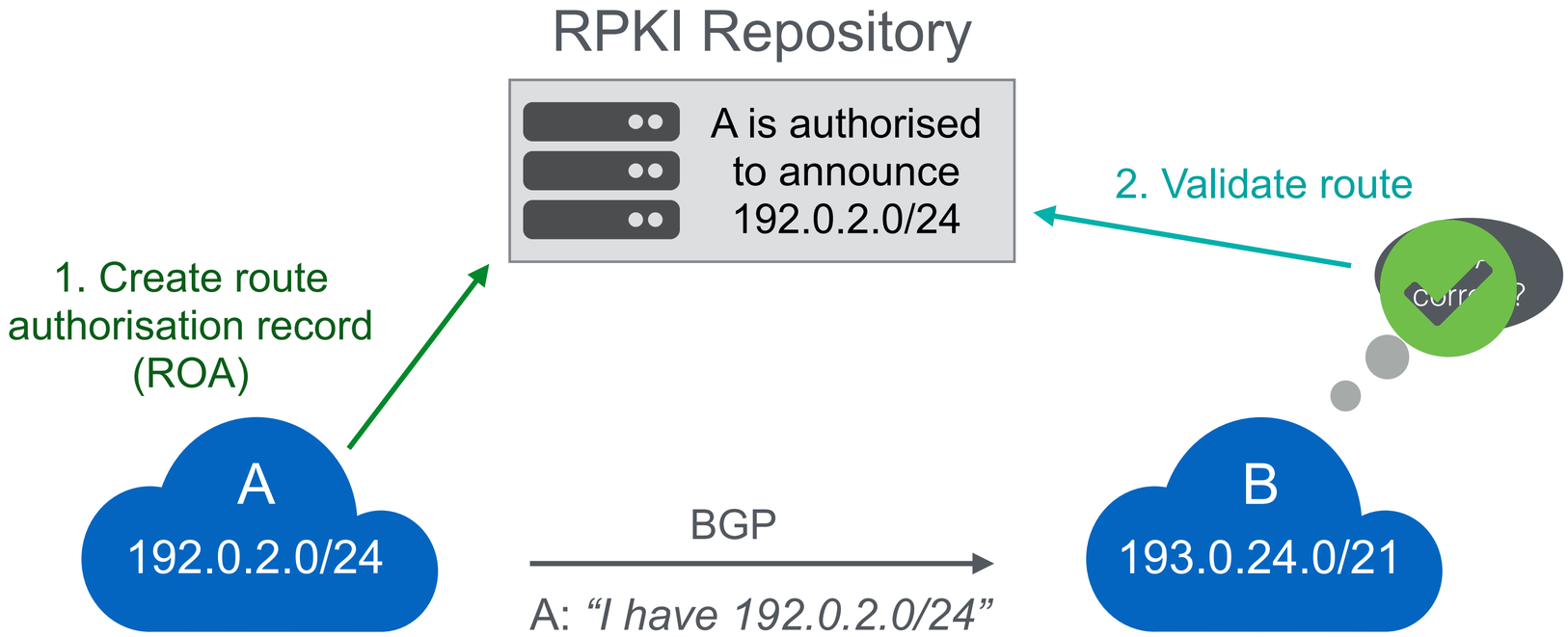
- Location of RIR repositories
- Root's public key

Relying Party



BETTER ROUTING DECISIONS

Routing on the Internet



How To Get Started?

- Read up! This is a great starting point:
  - https://rpki.readthedocs.io/en/latest/
- Create your ROAs
  - In my.ripe.net
- Share your experience or ask for advice
  - https://www.ripe.net/mailman/listinfo/routing-wg/
  - https://discord.gg/TkJpweMB

Questions

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