RIPE NCC
RIPE NETWORK COORDINATION CENTRE

Developments in Routing Security

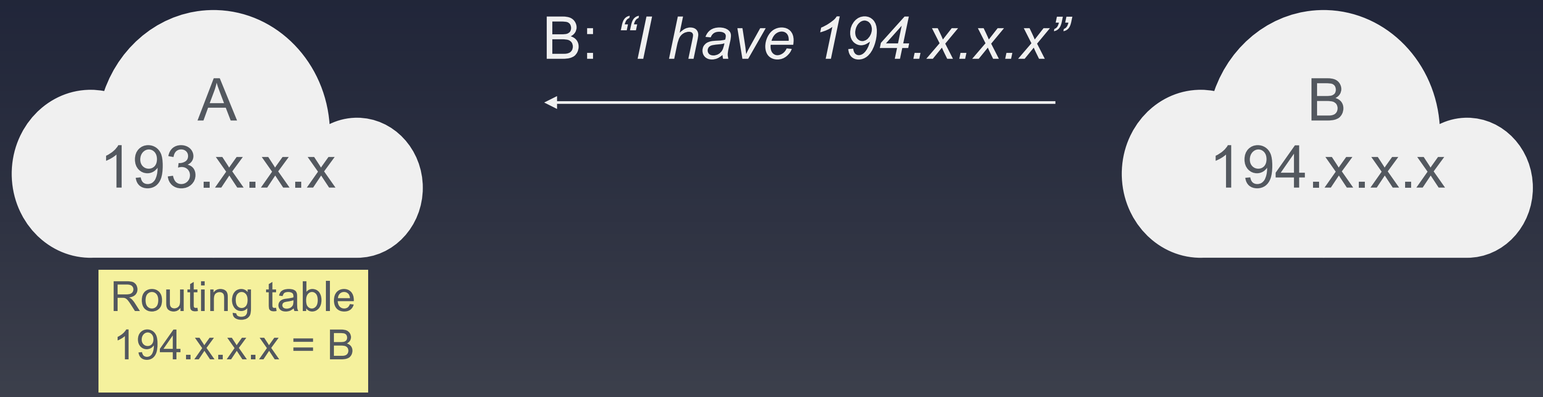
Massimiliano Stucchi | May 2019 | SWINOG

Routing Security is in Our DNA

- In 1994, RIPE-181 was the first document published that used a common language to describe routing policies
- We co-developed standards for IRR and RPKI
- We are one of the five RPKI Trust Anchors
- Our Validator tool was, until recently, the only production-grade tool to do Origin Validation

Routing on the Internet

Routing on the Internet



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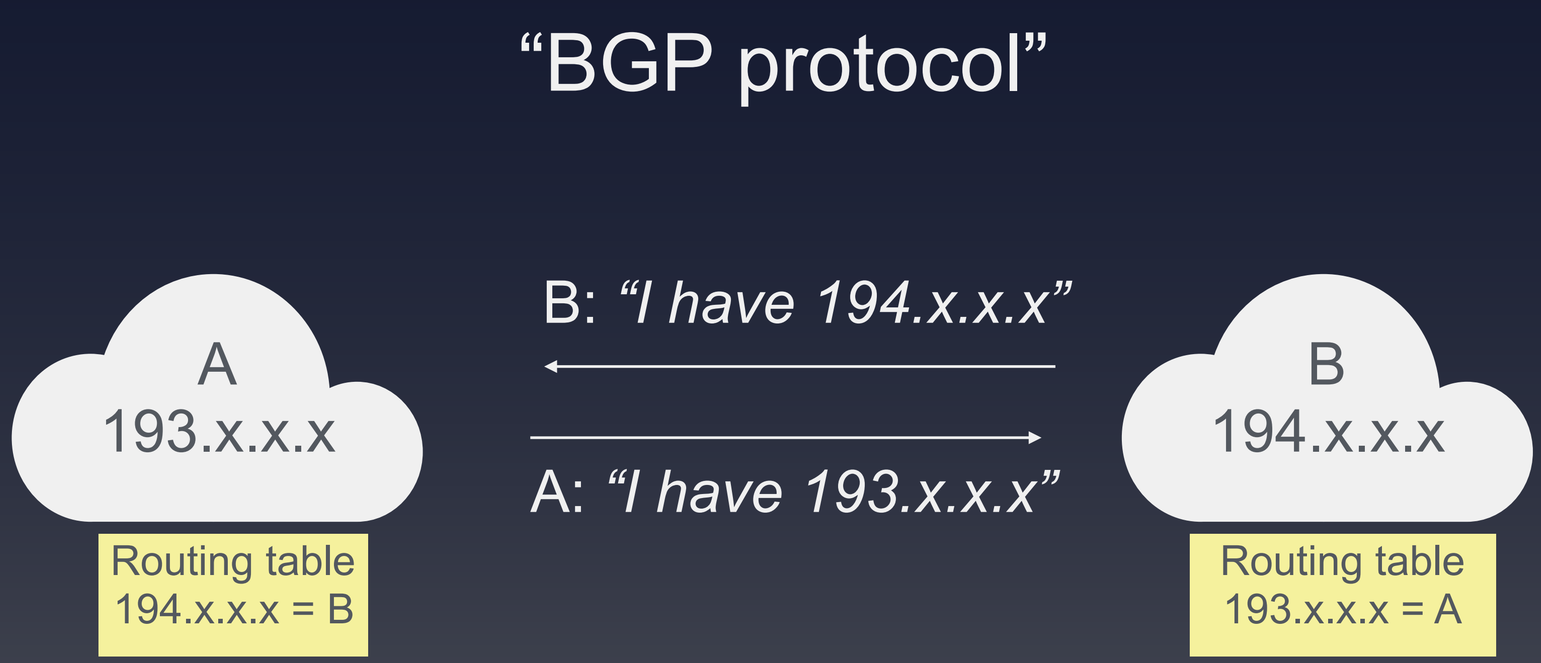

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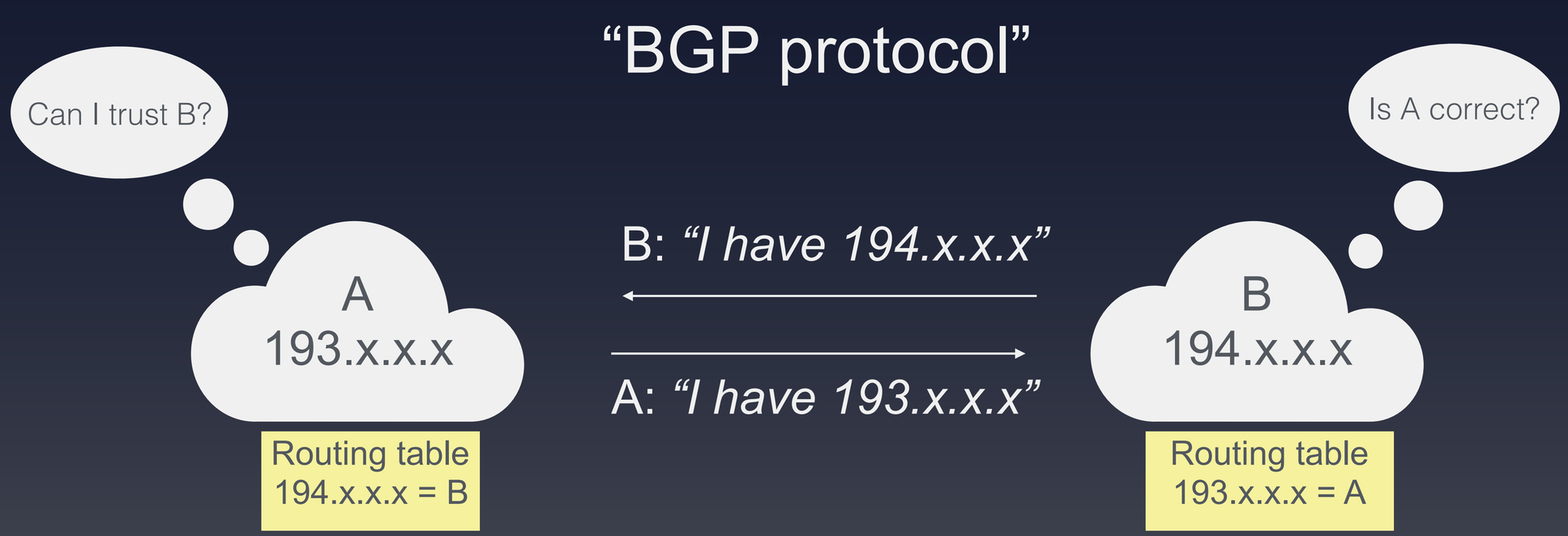

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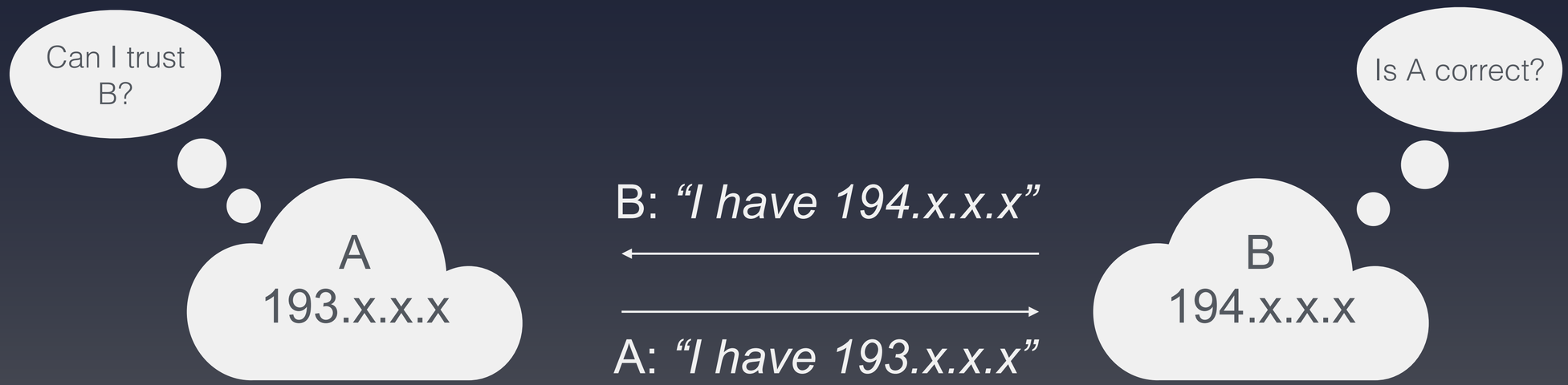

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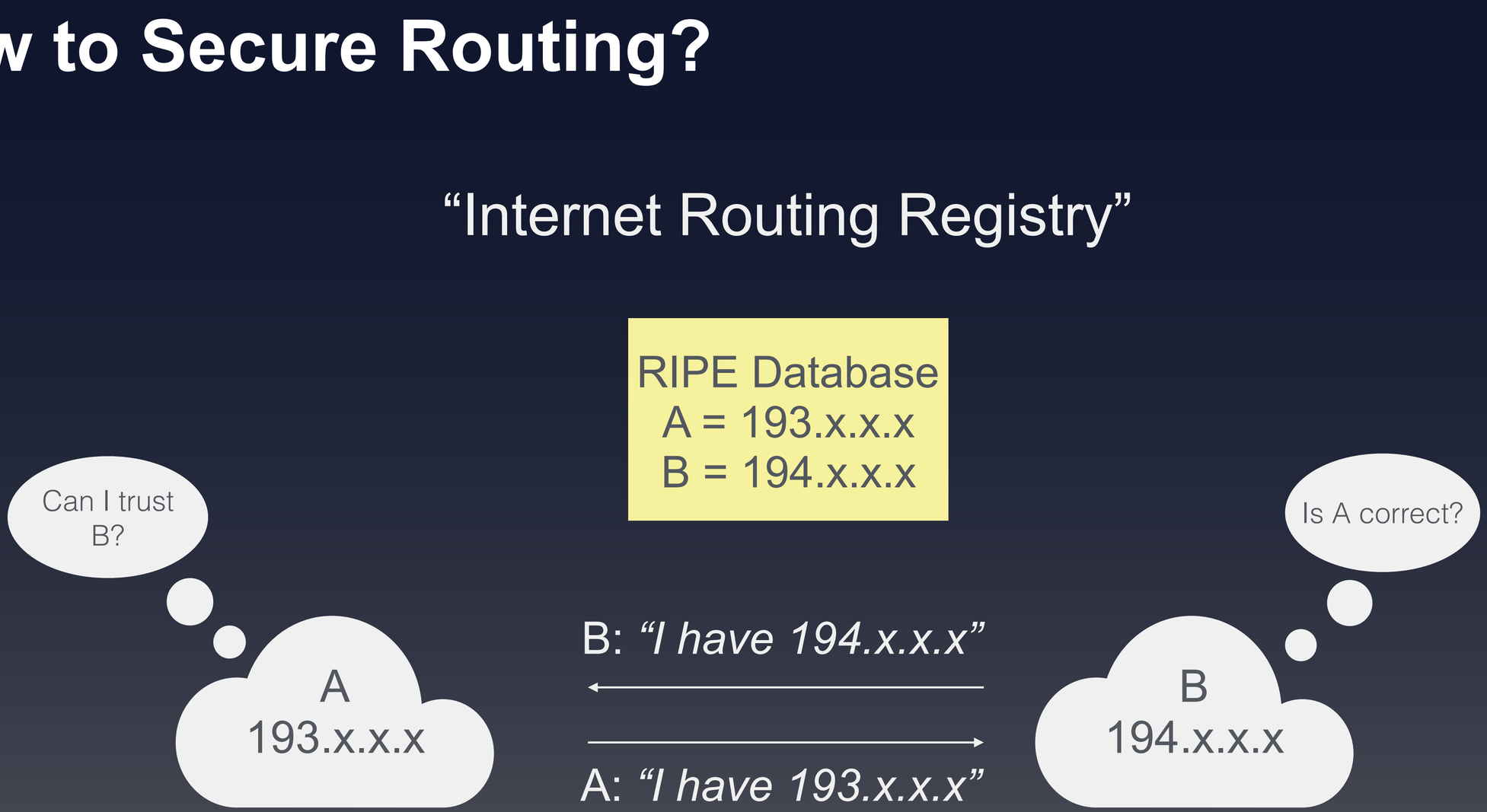

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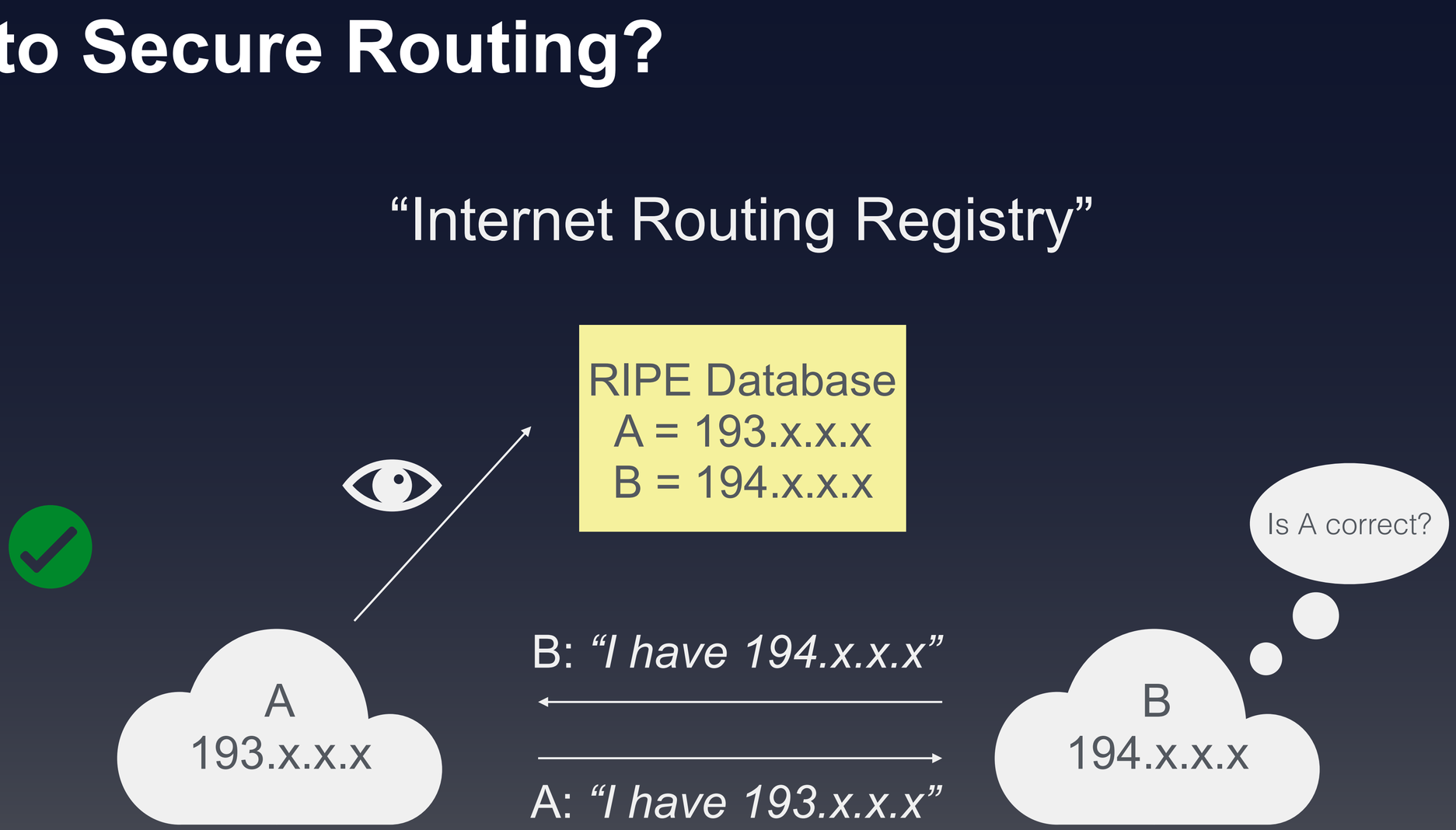

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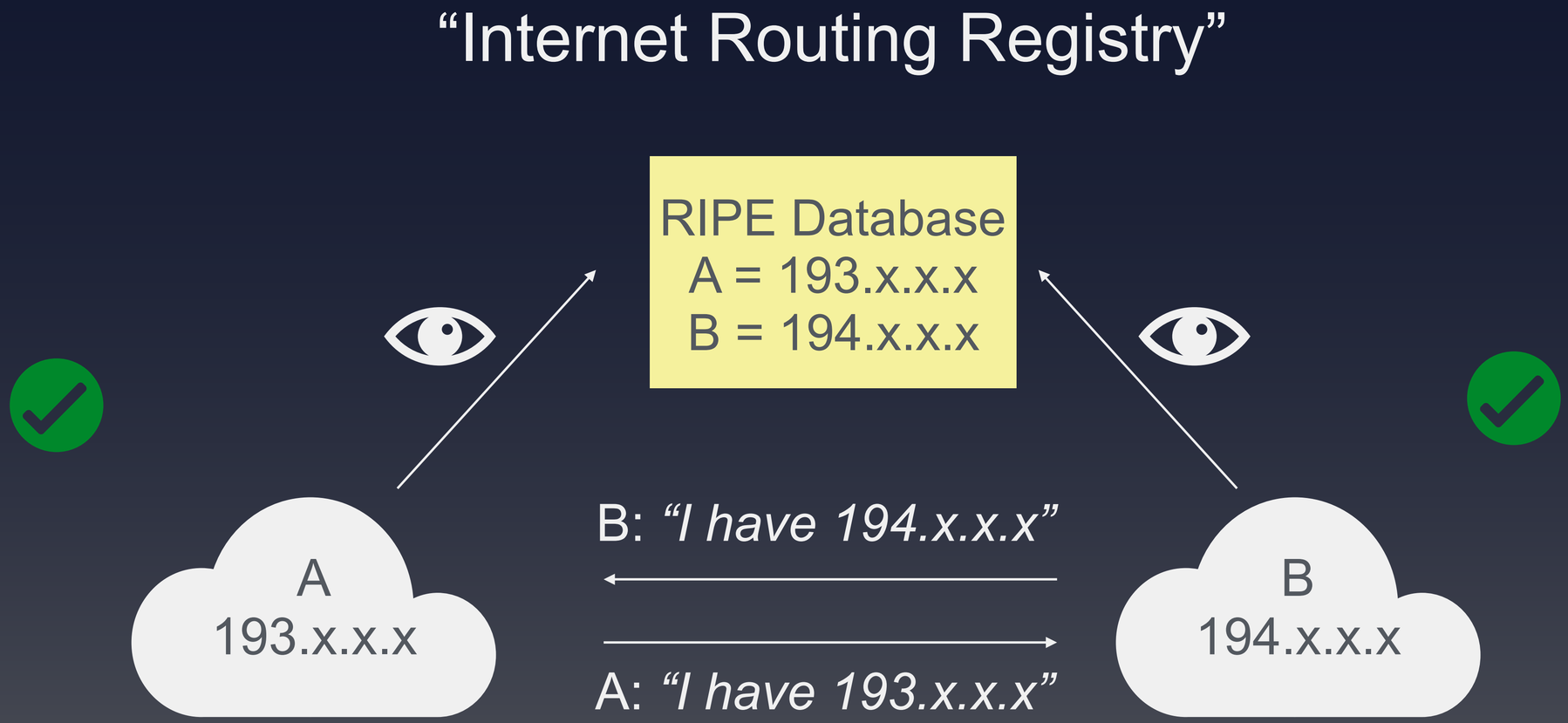


Accidents Happen

- Fat Fingers
  - 2 and 3 are really close on our keyboards…
- Policy violations (leaks)
  - Oops, we did not want this to go to the public Internet
  - Infamous incident with Pakistan Telecom and YouTube

Or Worse…

- **April 2018**
  - BGP and DNS hijack
  - Targeting MyEtherWallet
  - Unnoticed for 2 hours

Incidents Are Common

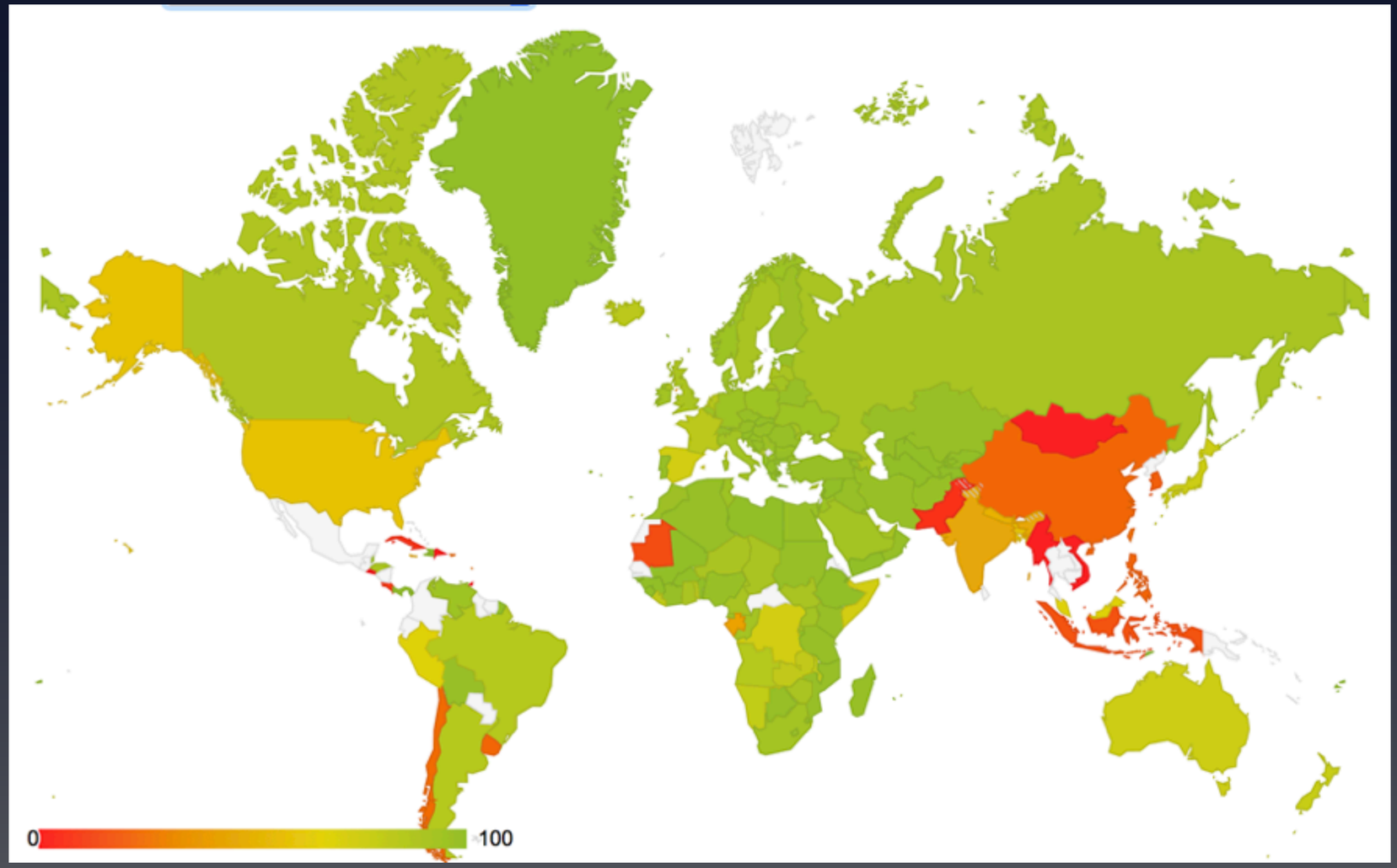
- **2018 Routing Security Review**
  - 12.6k incidents
  - 4.4% of all ASNs affected
  - 3k ASNs victims of at least one incident
  - 1.3k ASNs caused at least one incident

source: https://www.bgpstream.com/

Internet Routing Registry

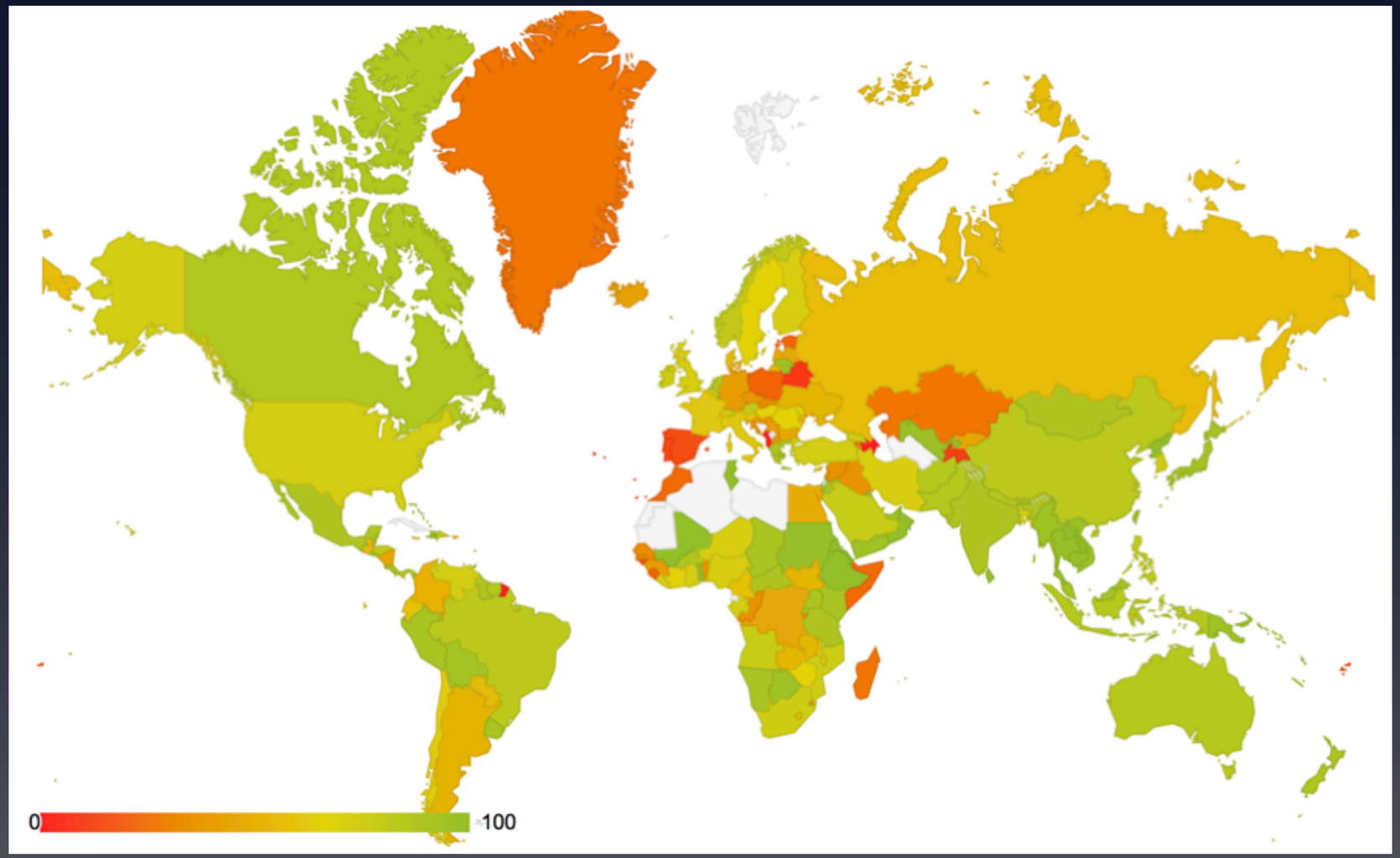
- Many exist, most widely used
  - RIPE Database
  - RADB
- Verification of holdership over resources
  - RIPE Database for RIPE region resources only
  - RADB allows paying customers to create any object
  - Lots of the other IRRs do not formally verify holdership

Accuracy - RIPE IRR



Accuracy - Valid announcements / covered announcements

Accuracy - RADB IRR



Accuracy - Valid announcements / covered announcements

Resource Public Key Infrastructure

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

Resource Public Key Infrastructure

- Operated since 2008 by all RIRs
  - Community-driven standardisation (IETF)
  - IRR was not sufficient (incomplete, incorrect)
- Adds crypto-security to Internet Number Resources

Elements of RPKI

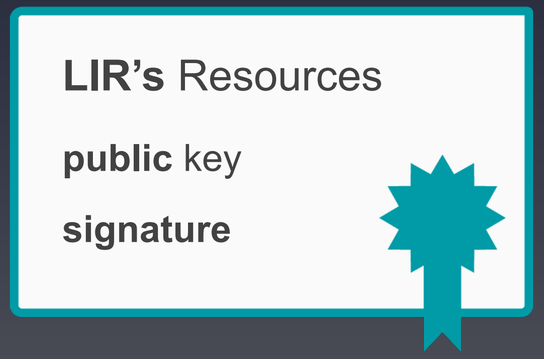
Signing

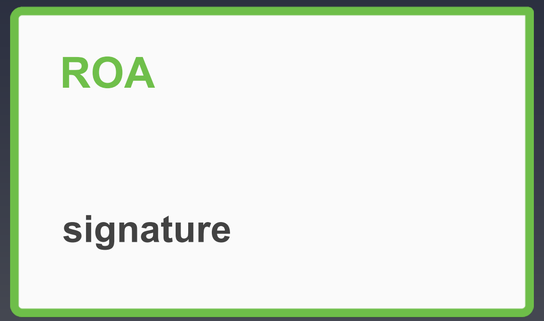
Create your ROAs

Validating

Verifying others

RPKI Chain of Trust





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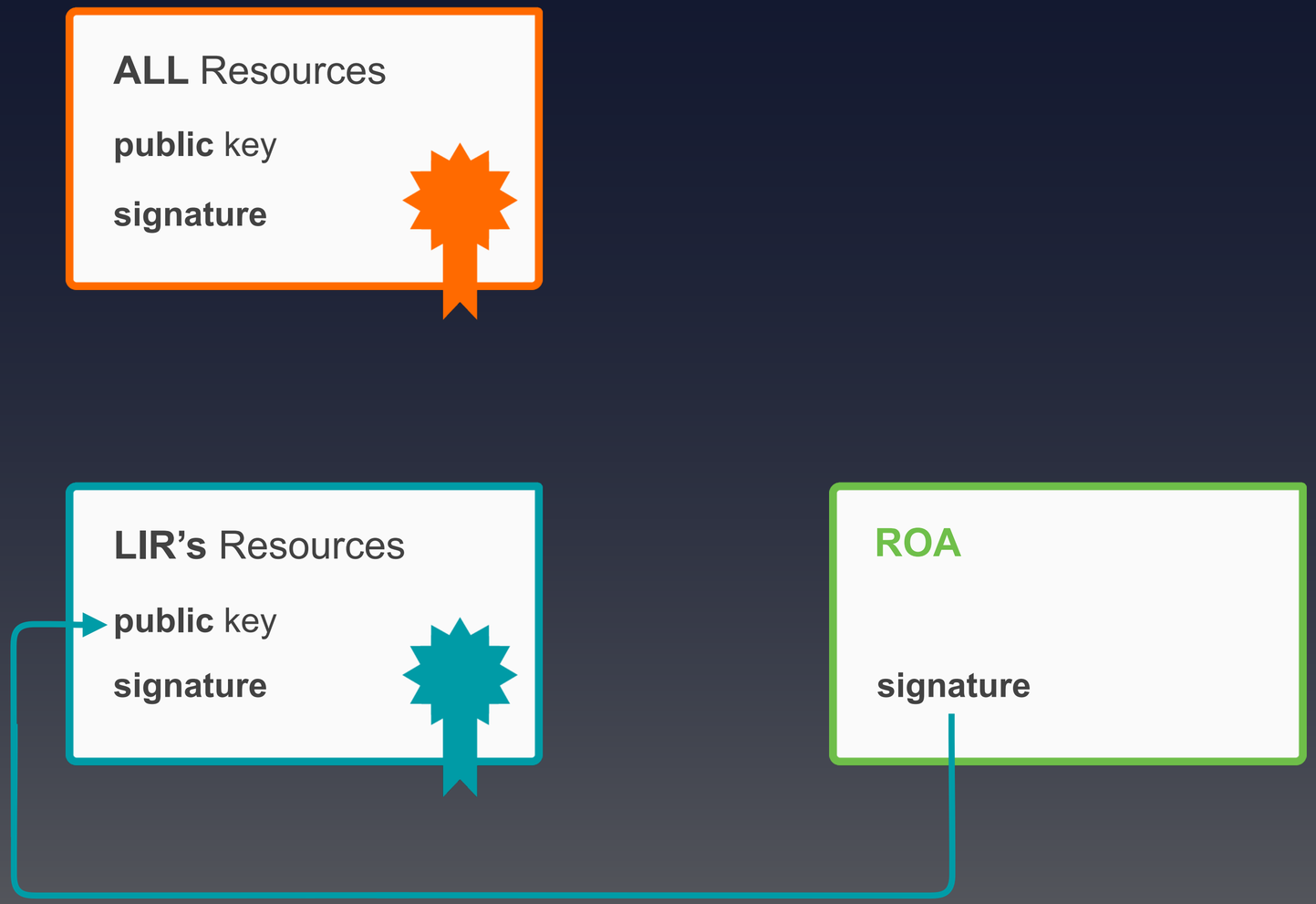

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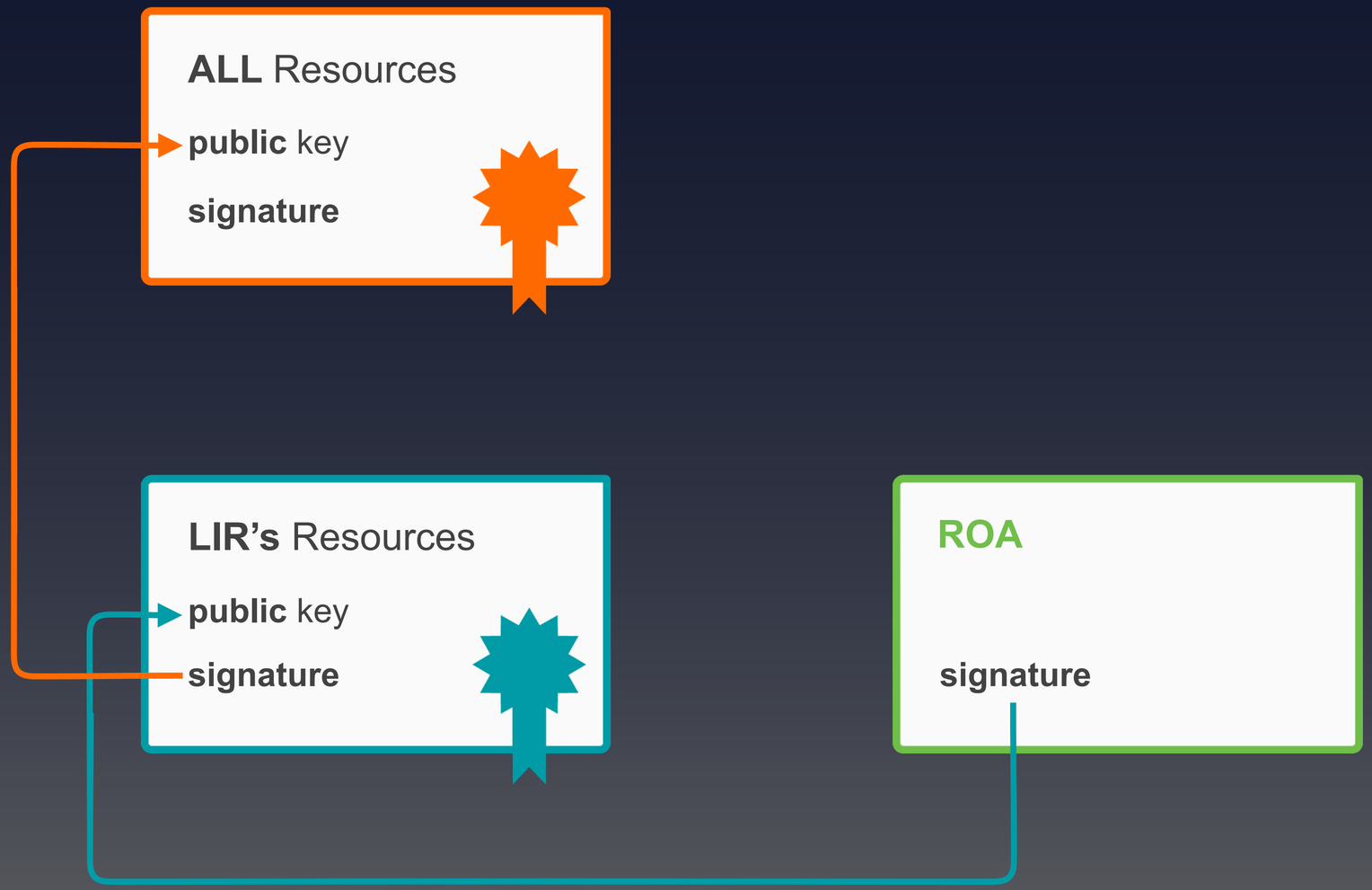


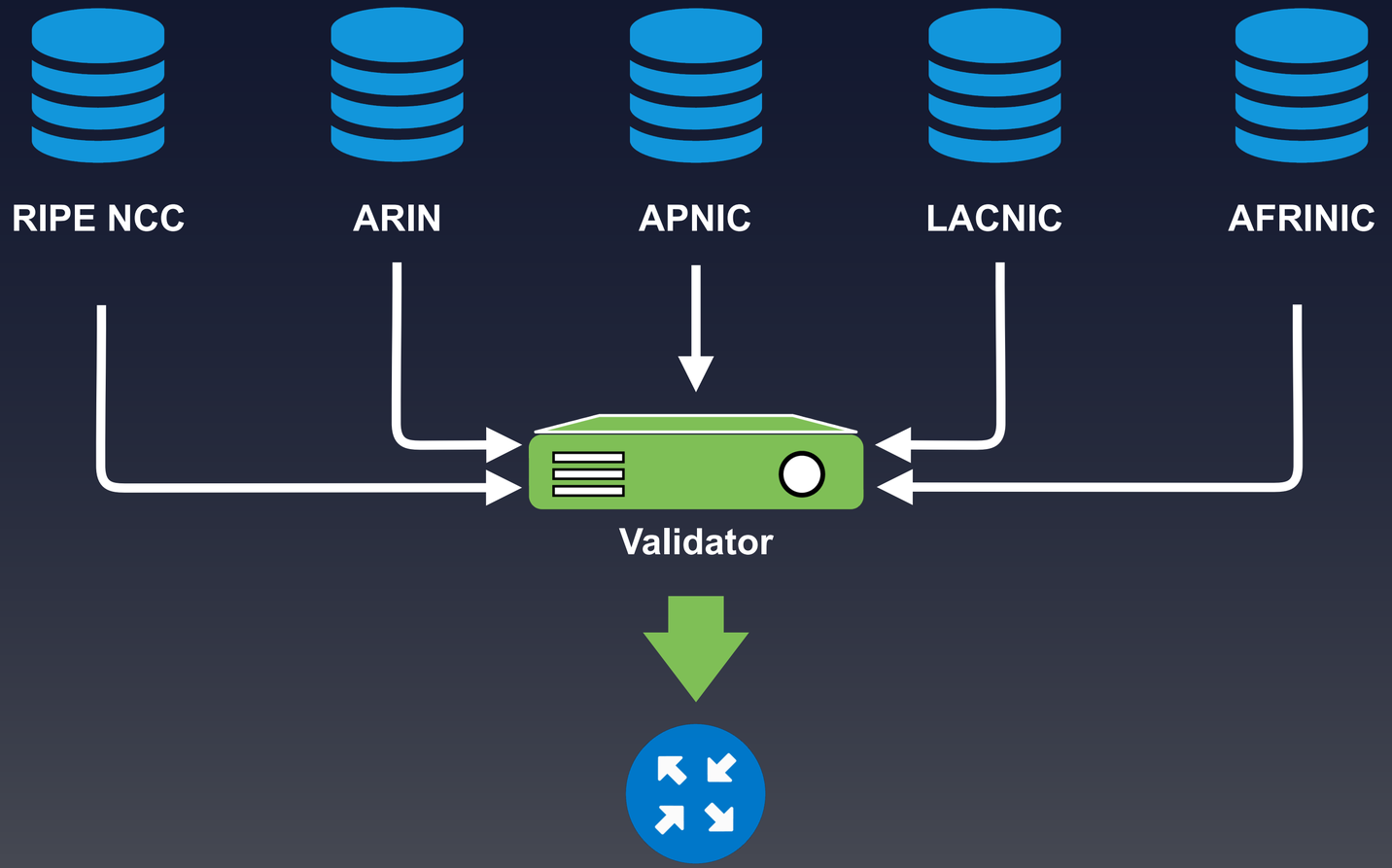
What's in a ROA

Prefix → The network for which you are creating the ROA

Origin ASN → The ASN supposed to be originating the BGP Announcement

Max Length → The Maximum prefix length accepted for this ROA

Route Origin Validation



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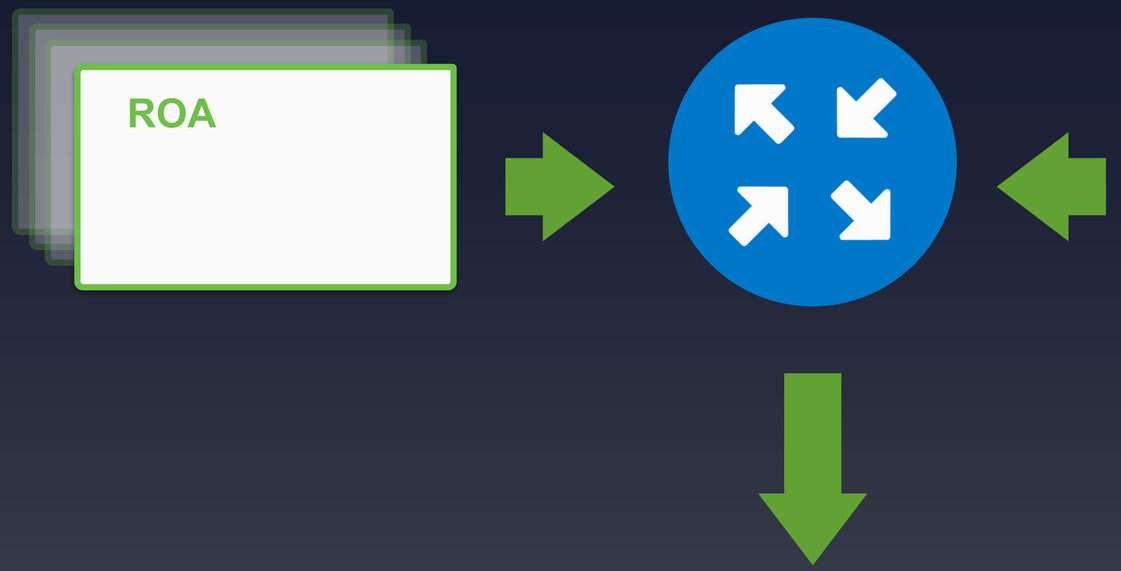

BGP Announcements

AS111	10.0.7.30/22
AS222	10.0.6.10/24
AS333	10.4.17.5/20
AS111	10.0.7.30/22
AS111	10.0.7.30/22
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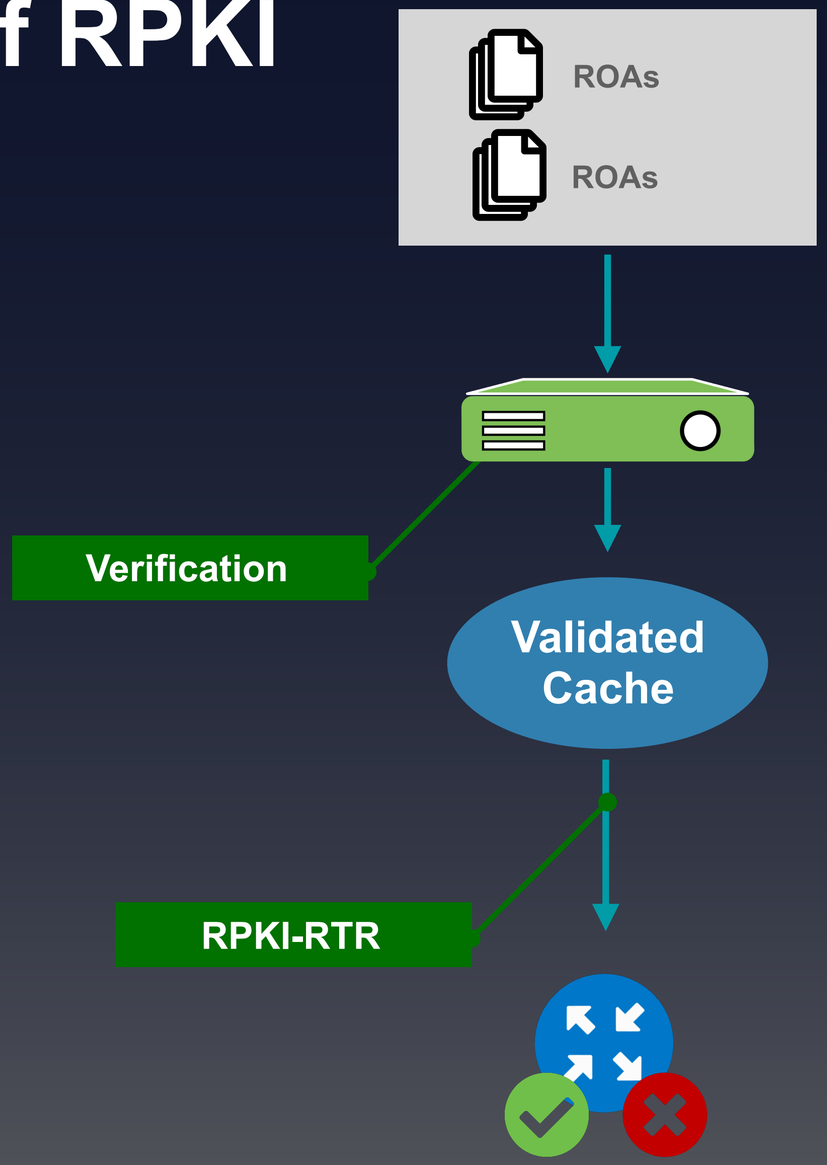
BETTER ROUTING DECISIONS

Elements of RPKI

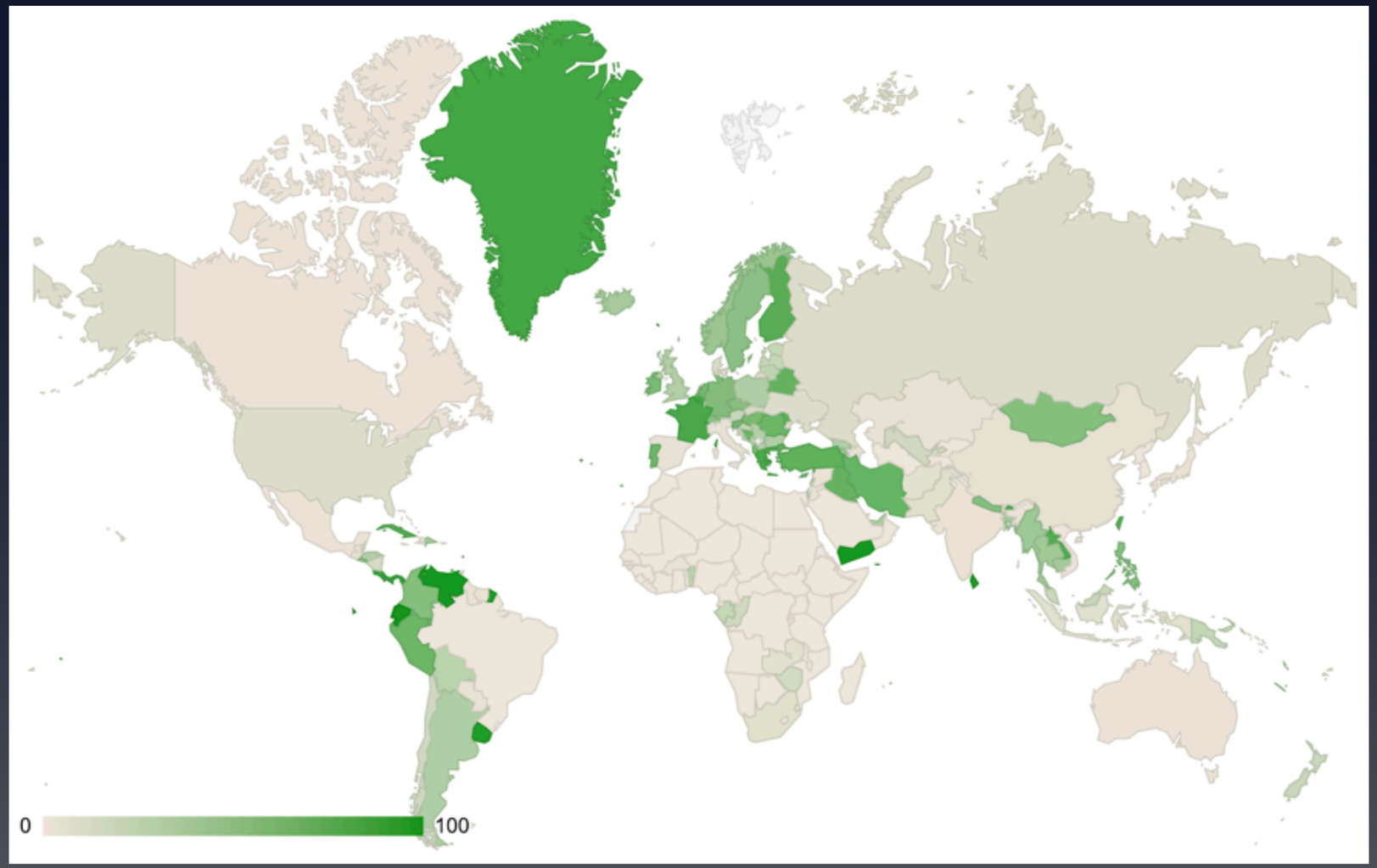


RIR REPOSITORIES

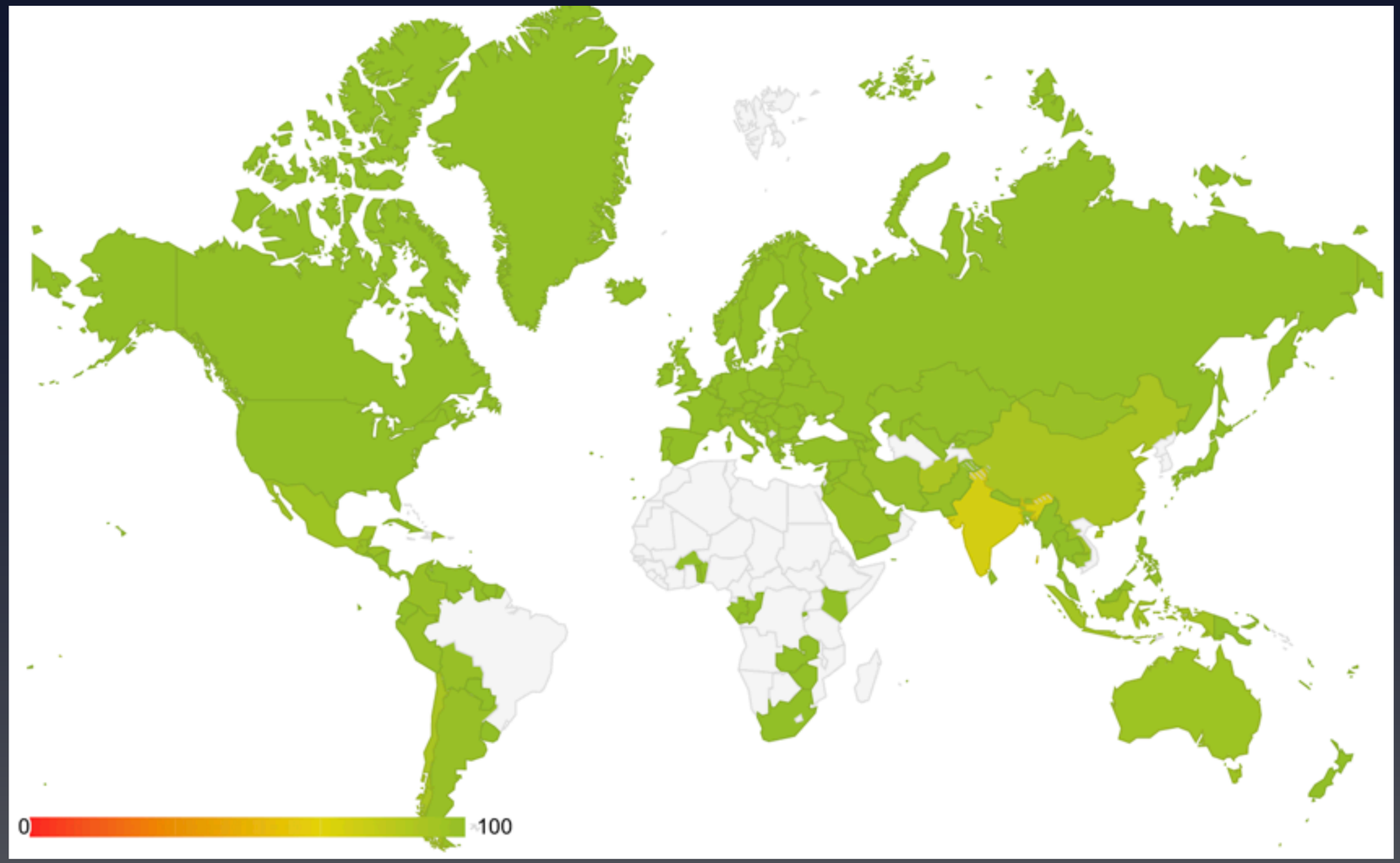
VALIDATOR SOFTWARE

ROUTERS

Coverage - RPKI (all RIRs)



Accuracy - RPKI (all RIRs)



IPv4 addresses in valid announcements / covered announcements

Recommendations to Get Started

- Create your ROAs in the LIR Portal
- Pay attention to the Max Length attribute
- Download and run a Validator
- Check validation status manually, which routes are invalid?
- Set up monitoring, for example pmacct
- (https://github.com/pmacct/)

Invalid == Reject

- **What breaks if you reject invalid BGP announcements?**
  - “Not all vendors have full RPKI support, or bugs have been reported”
  - “Mostly nothing” -AT&T
  - “5 customer calls in 6 months, all resolved quickly” -Dutch medium ISP
  - “Customers appreciate a provider who takes security seriously” -Dutch medium ISP
  - “There are many invalids, but very little traffic is impacted” -very large cloud provider

Making the Difference

- Is routing security on your agenda?
- Initiate the conversation with providers and colleagues

Are you leading by example ?

Questions

rpki@ripe.net