

NEW ADVENTURES IN RPKI

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ROUTING SECURITY



RPKI QUICK START

- Resource Public Key Infrastructure
- Standardised in RFC 6480 - 6493
- Aimed at making Internet routing more secure
 - Provide Route Origin Validation (ROV) now
 - Stepping stone to Path Validation

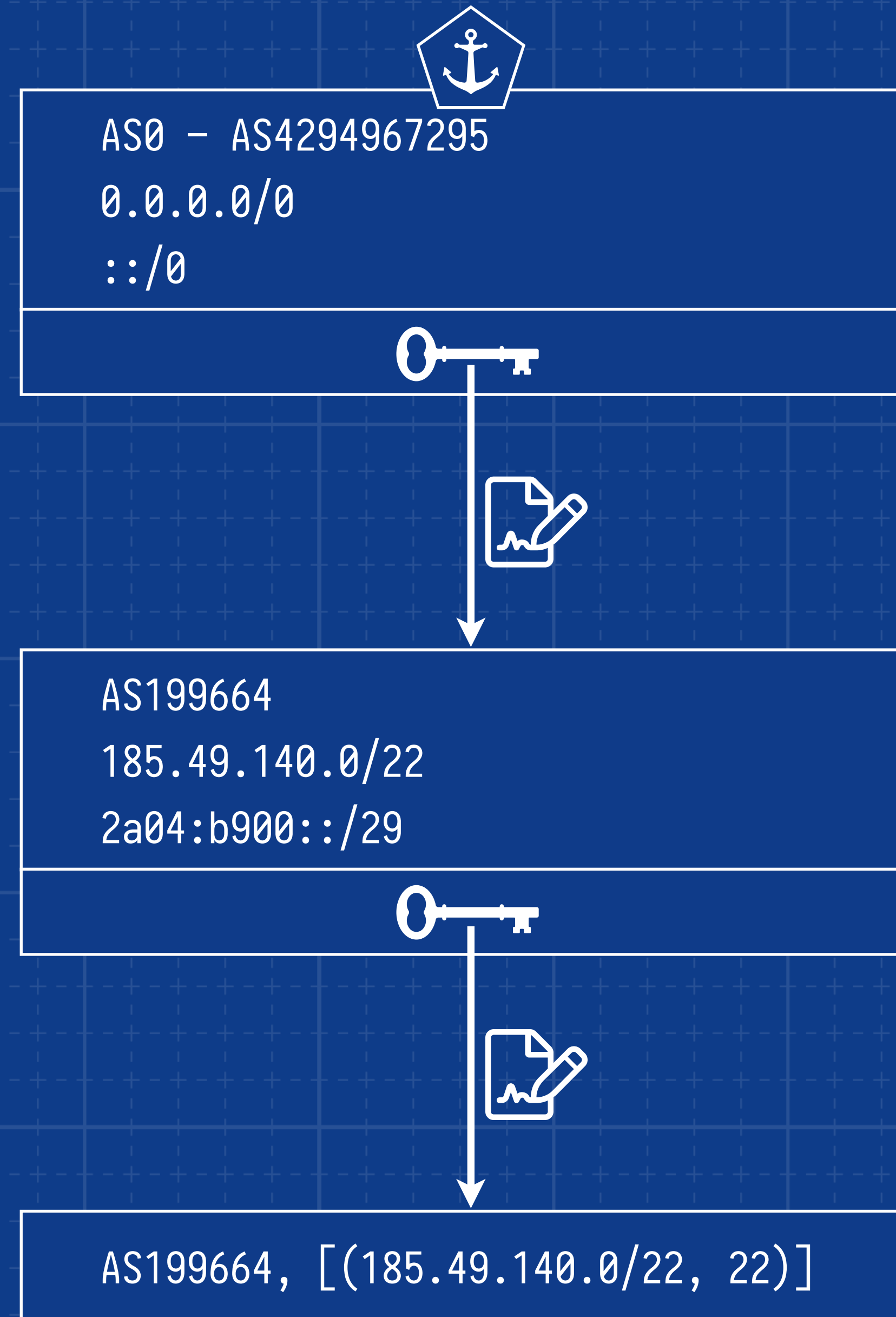
ROUTE ORIGIN VALIDATION

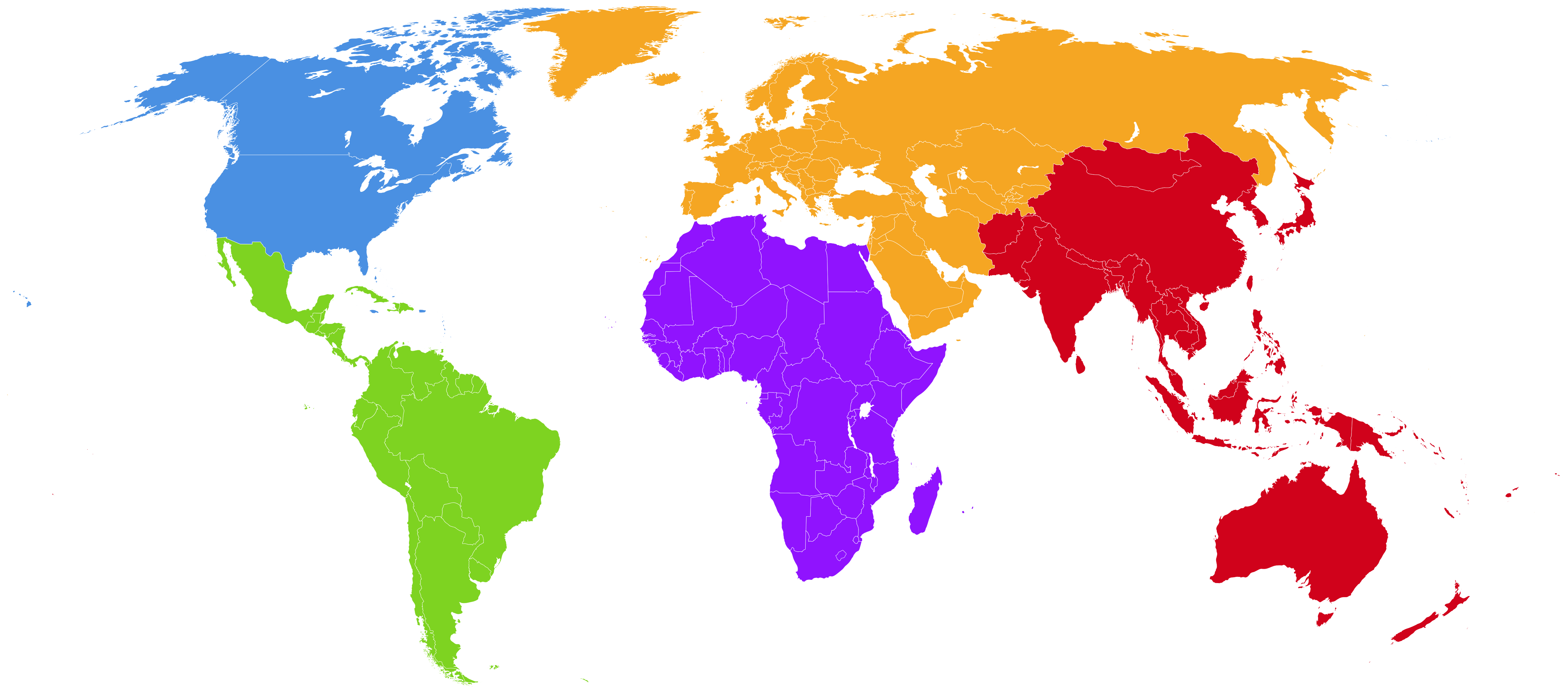
- Organisation holds certificate containing all Internet Resources
- Uses it to make authoritative statements about intended BGP routing
 - Signed objects called Route Origin Attestation (ROAs)
- Other operators – “Relying Parties” – download and verify ROAs
 - Make routing decisions based on the outcome;
 - *Valid, Invalid or NotFound*

*“Is this BGP route origination authorised
by the legitimate holder of the IP space?”*



```
route: 185.49.140.0/22
origin: AS199664
more:  stuff
```





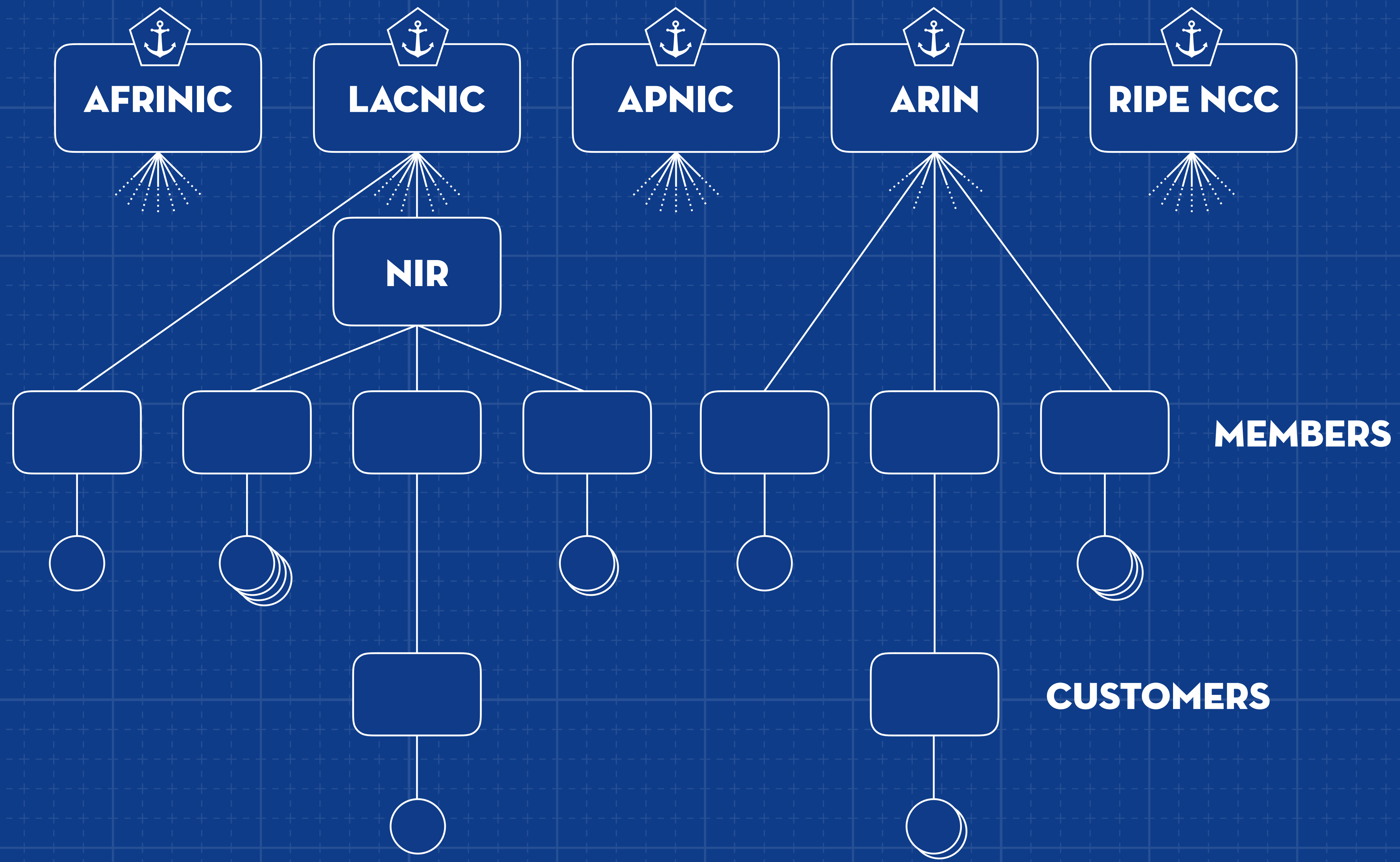
ARIN

LACNIC

AFRINIC

RIPE NCC

APNIC



HOSTED VS. DELEGATED RPKI

- **Hosted RPKI**

- The resource issuer – RIR, NIR, LIR – offers RPKI as a service
- Certificates, keys, and signed products are all kept and published in their infrastructure

- **Delegated RPKI**

- Run your own Certificate Authority, generate your own signed products and publish them yourself

HOSTED RPKI

- All five RIR have been offering Hosted RPKI since 2011
- Easy to get started and use
- Great to gain operational experience with the technology
- No cost of hardware, operations, key storage, publication, etc.
- No worries about uptime or availability (at least not first hand)



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RPKI Dashboard

2 CERTIFIED RESOURCES

ALERTS ARE SENT TO 1 ADDRESS

 **2 BGP Announcements**

 2 Valid  0 Invalid  0 Unknown

 **2 ROAs**

 2 OK  0 Causing problems

BGP Announcements

Route Origin Authorisations (ROAs)

History

Search...

 Discard Changes

 Delete ROAs

 Causing Problems

Not Causing Problems

[+ New ROA](#)

<input type="checkbox"/>	AS number	Prefix	Most specific length allowed	Affects	
	<input type="text" value="AS Number"/>	<input type="text" value="Prefix"/>	<input type="text" value="Max length"/>		 
<input type="checkbox"/>	AS199664	2a04:b900::/29	29	1	 
<input type="checkbox"/>	AS199664	185.49.140.0/22	22	1	 

Show of 2 items

HOSTED RPKI – RIR DIFFERENCES

- Different user interfaces with varying functionality and guidance
- Possibilities for batch processing and auto-renewing ROAs
- Multi-user support, access control, two-factor authentication
- ROA publication interval (varies between minutes to several hours)
- Application Programming Interface
- Support level (24/7)

DELEGATED RPKI

- Run Certificate Authority (CA) as a child of the RIR/NIR/LIR
- Install and maintain software yourself
- Generate your own certificate, have it signed by the parent CA
- Publish signed objects yourself, or ask a third party to do it for you

DELEGATED RPKI

- You can be operationally independent from the parent RIR
- Allows better integration and automation with your own systems
- If you run a global network, you can operate a single system rather than maintain ROAs in up to five web interfaces
- You are in control of the ROA publication interval
- You can delegate or offer RPKI as a service to your customers

WHAT IF IT BREAKS?

- No DNSSEC horror story; e.g. unavailable zone due to signing mishap
- RPKI provides a positive statement on routing intent
- Lose your keys? Hardware failure?
Publication server being DDOSed?

All routes will eventually fall back to the “NotFound” state, as if RPKI were never used

FUNDING?

nic.br

 **DigitalOcean**

JUNIPER
NETWORKS

 **RIPE NCC**
Community Projects Fund

**CISCO**

moz://a



Nationaal Cyber Security Centrum
Ministerie van Veiligheid en Justitie

NOKIA



KRILL ROADMAP

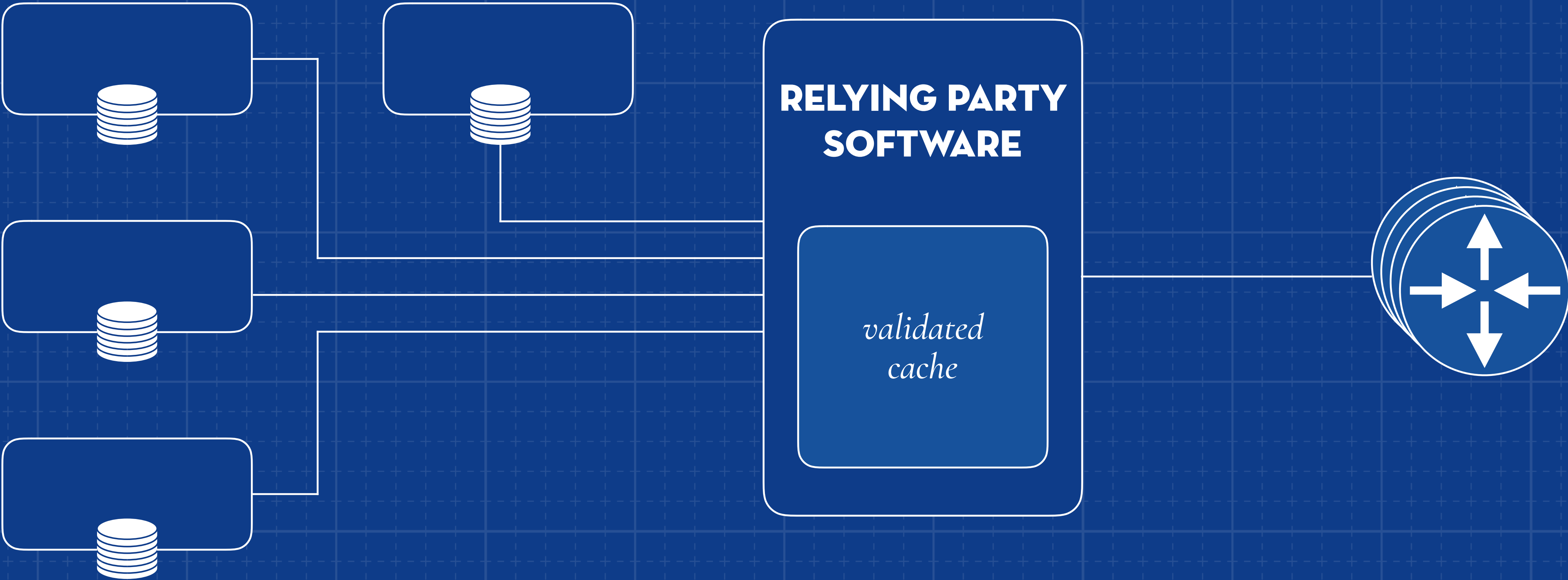
- ✓ Event sourcing architecture with API, CLI and UI
- ✓ Creation of RPKI objects
- ✓ RFC compliant publication server
- ✓ Embedded Trust Anchor for testing
 - Operate under remote parent
 - ROA suggestions, Multi-master support, HSM support (if desired)

*Krill will launch in production
at NIC.br in December 2019*

ROUTINATOR



Likely more to come ...



RPKI DEPLOYMENT

- Healthy ecosystem with seven different RPKI Validator implementations
- NIC.br will launch with Krill in production in December 2019
- Strict validation happening on all Cloudflare PoPs
- AT&T, Nordunet, KPN and Telia reject invalids on all EBGP sessions
- Route server filtering at YYCIX, INEX, AMS-IX, DE-CIX, France-IX, Netnod

RPKI DOCUMENTATION AND FAQ

rpki.readthedocs.io

 nlnetlabs.nl/rpki

 rpki.readthedocs.io

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