# SHOULD I RUN MY OWN RPKI CERTIFICATE AUTHORITY?

ALEX BAND

NLNETLABS

RIPE 78 EDITION

# NLNET LABS?

Purveyors of fine
open source software
since 1999

NSD

unbound

OPENDNSSEC

STUBBY

NSD

GETDNS

DNSSEC TRIGGER

LDNS

unbound

NET::DNS

DNSTHOUGHT

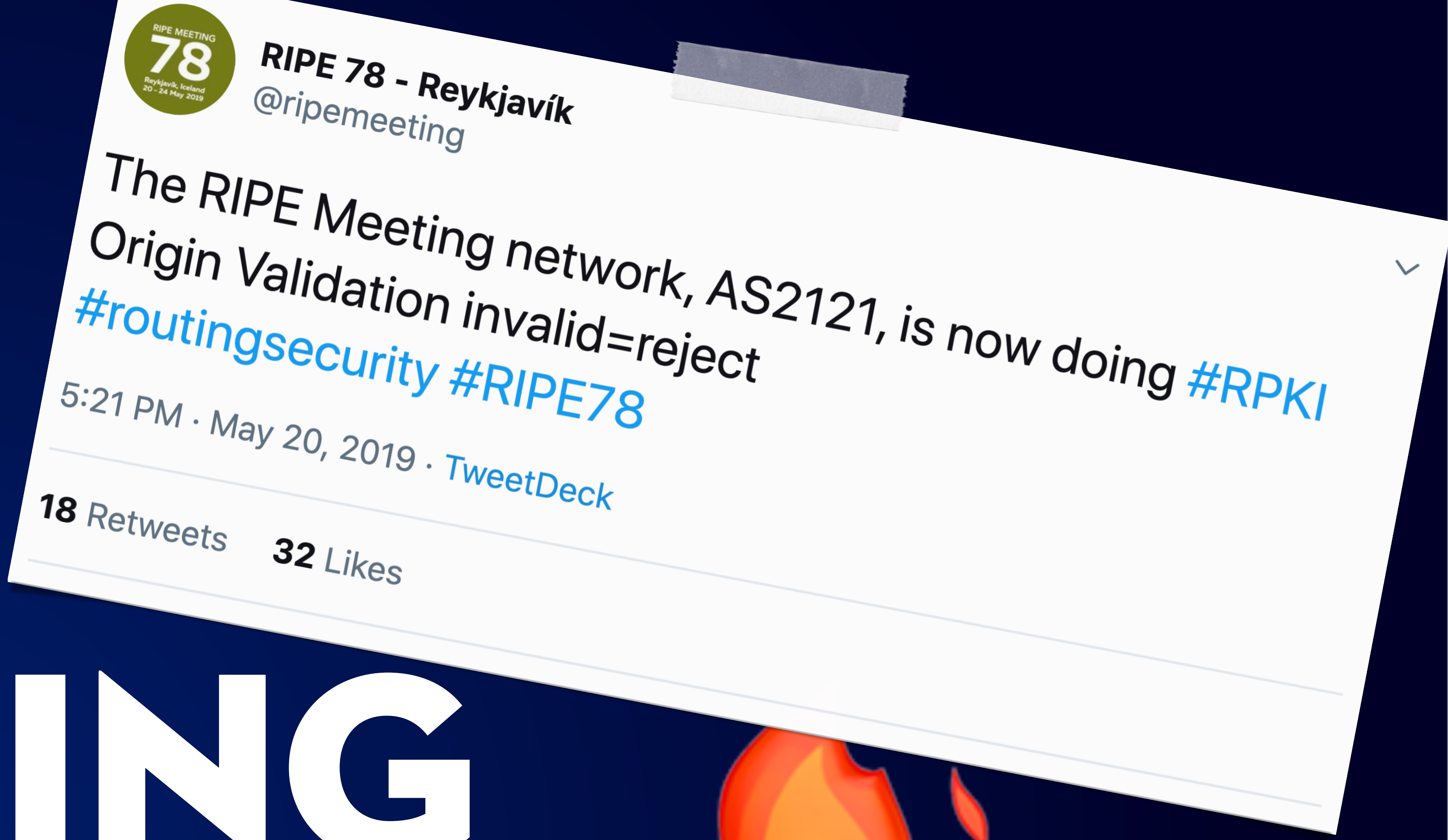
TONY'S CHOCOLONELY
CHOCOLADELETTERREEP
32% melk
puur 51%
NLNETLABS

DNS

# BGP?

# RPKI!

# 🔥 ROUTING SECURITY 🔥



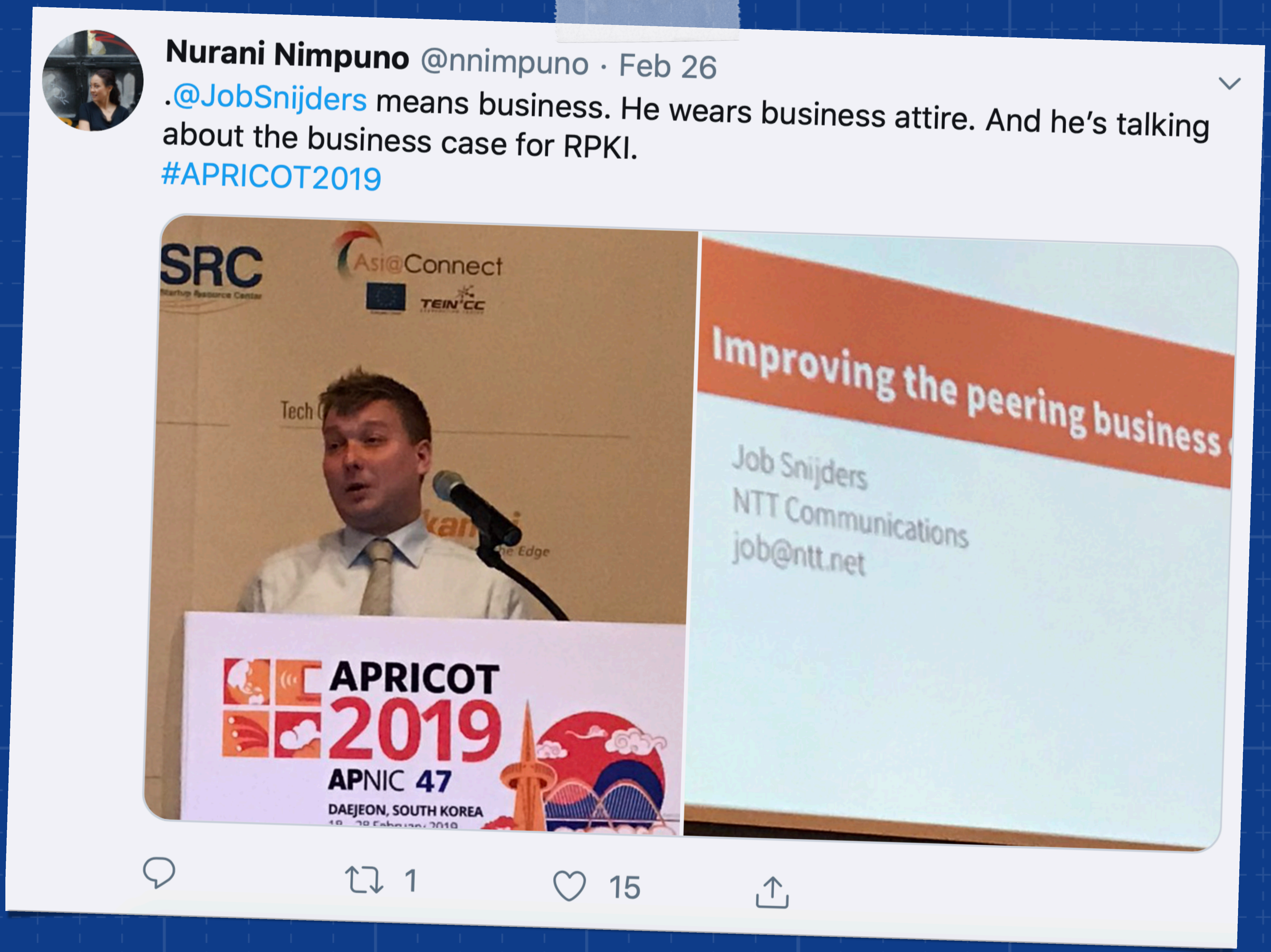
RIPE 78 - Reykjavík
@ripemeeting

The RIPE Meeting network, AS2121, is now doing #RPKI Origin Validation invalid=reject #routingsecurity #RIPE78

5:21 PM · May 20, 2019 · TweetDeck

18 Retweets 32 Likes

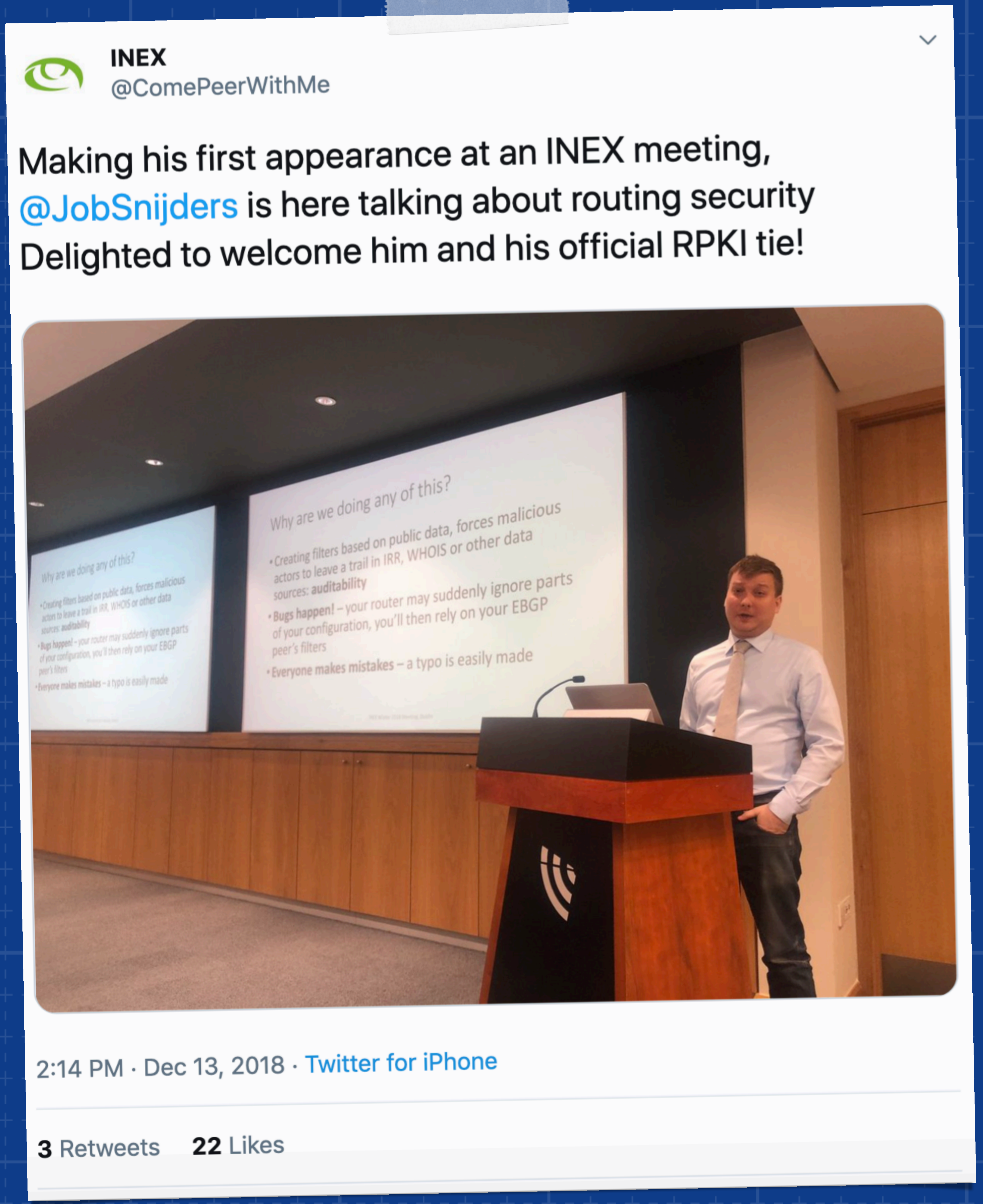
# 🔥 ROUTING SECURITY 🔥



Nurani Nimpuno @nnimpuno · Feb 26

.@JobSnijders means business. He wears business attire. And he's talking about the business case for RPKI. #APRICOT2019

1 15



INEX
@ComePeerWithMe

Making his first appearance at an INEX meeting, @JobSnijders is here talking about routing security Delighted to welcome him and his official RPKI tie!

Why are we doing any of this?
• Creating filters based on public data, forces malicious actors to leave a trail in IRR, WHOIS or other data sources: auditability
• Bugs happen! – your router may suddenly ignore parts of your configuration, you'll then rely on your EBGP peer's filters
• Everyone makes mistakes – a typo is easily made

2:14 PM · Dec 13, 2018 · Twitter for iPhone

3 Retweets 22 Likes

Routing Working Group

Thursday, 23 May 11:00 - 12:30

*Wait, how did we get here?*

# RPKI QUICK START

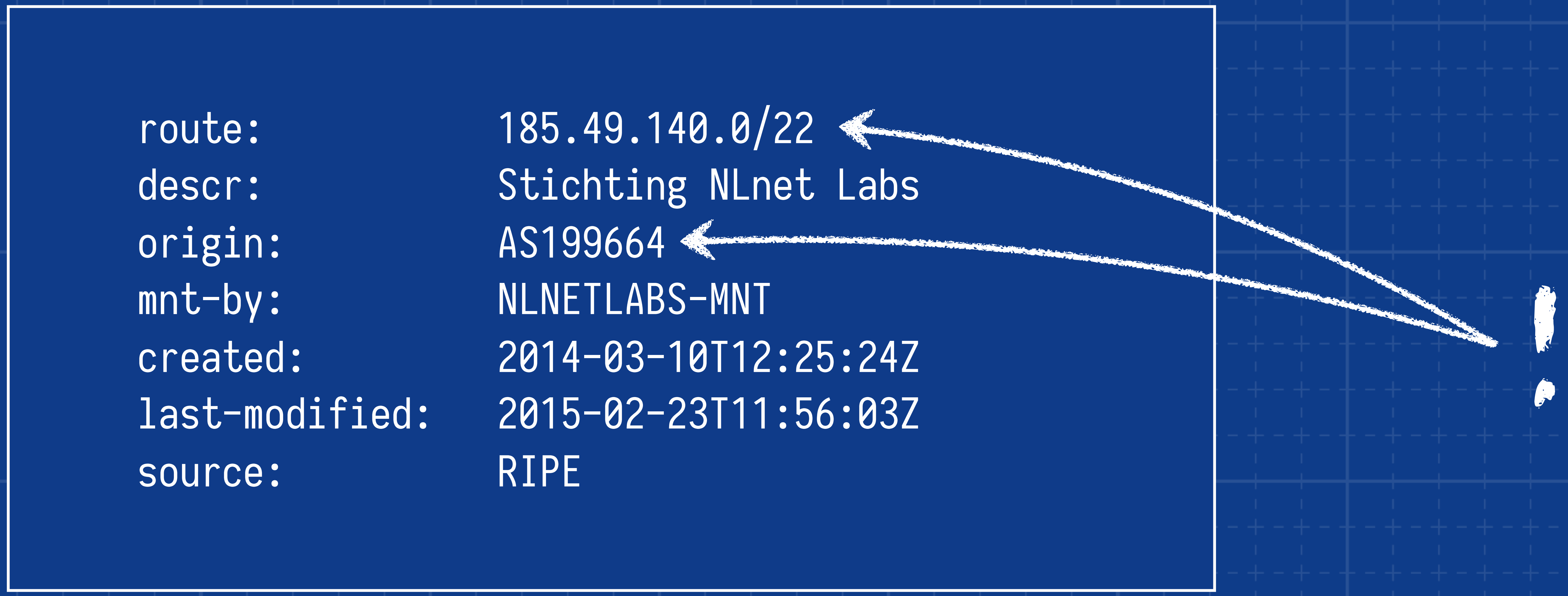
- Resource Public Key Infrastructure
- Standardised in RFC 6480 - 6493
- Aimed at making Internet routing more secure
    - Provide Route Origin Validation (ROV) now
    - Stepping stone to Path Validation

# 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?”*

# INTERNET ROUTING REGISTRY



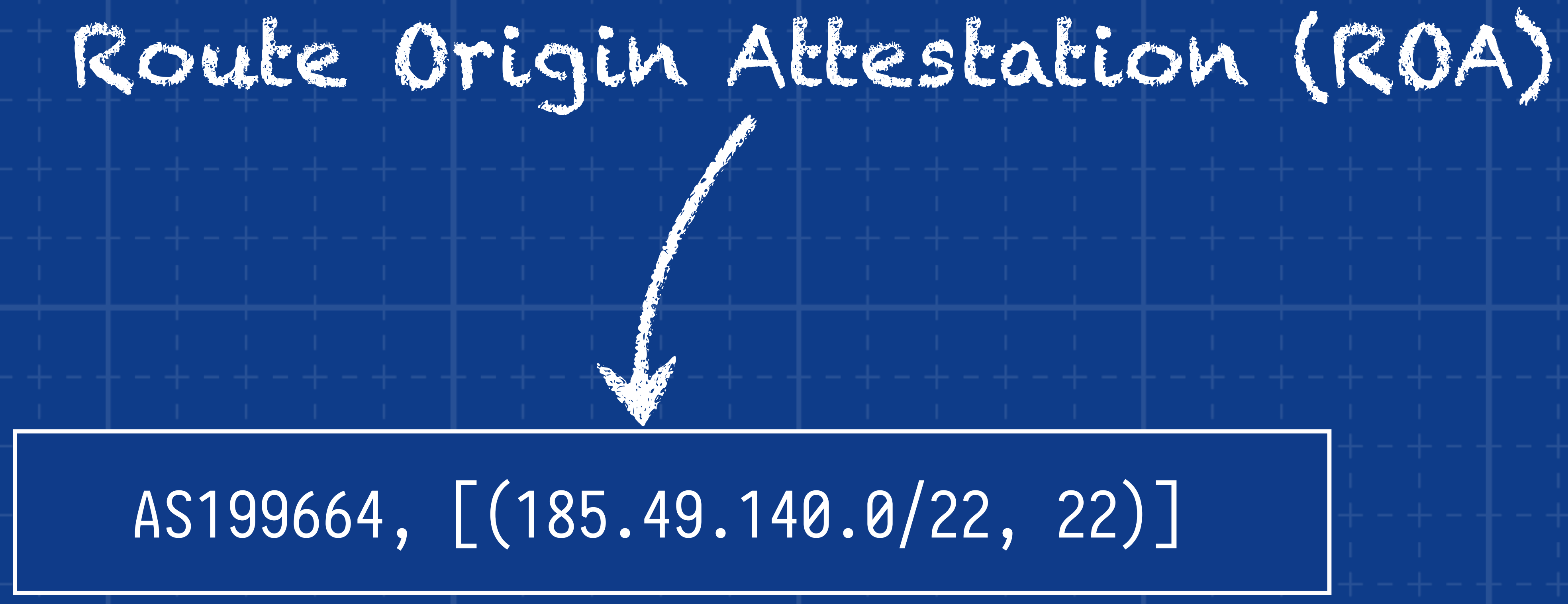
```
route:          185.49.140.0/22
descr:          Stichting NLnet Labs
origin:         AS199664
mnt-by:         NLNETLABS-MNT
created:        2014-03-10T12:25:24Z
last-modified:  2015-02-23T11:56:03Z
source:         RIPE
```

AFRINIC, ALTDB, AOLTW, APNIC, ARIN, BELL, BBOI, CANARIE, EASYNET, EPOCH, HOST, JPIRR, LEVEL3, NESTEGG, NTTCOM, OPENFACE, OTTIX, PANIX, RADB, REACH, RGNET, RIPE, RISQ, ROGERS, TC

irr.net/docs/list.html

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

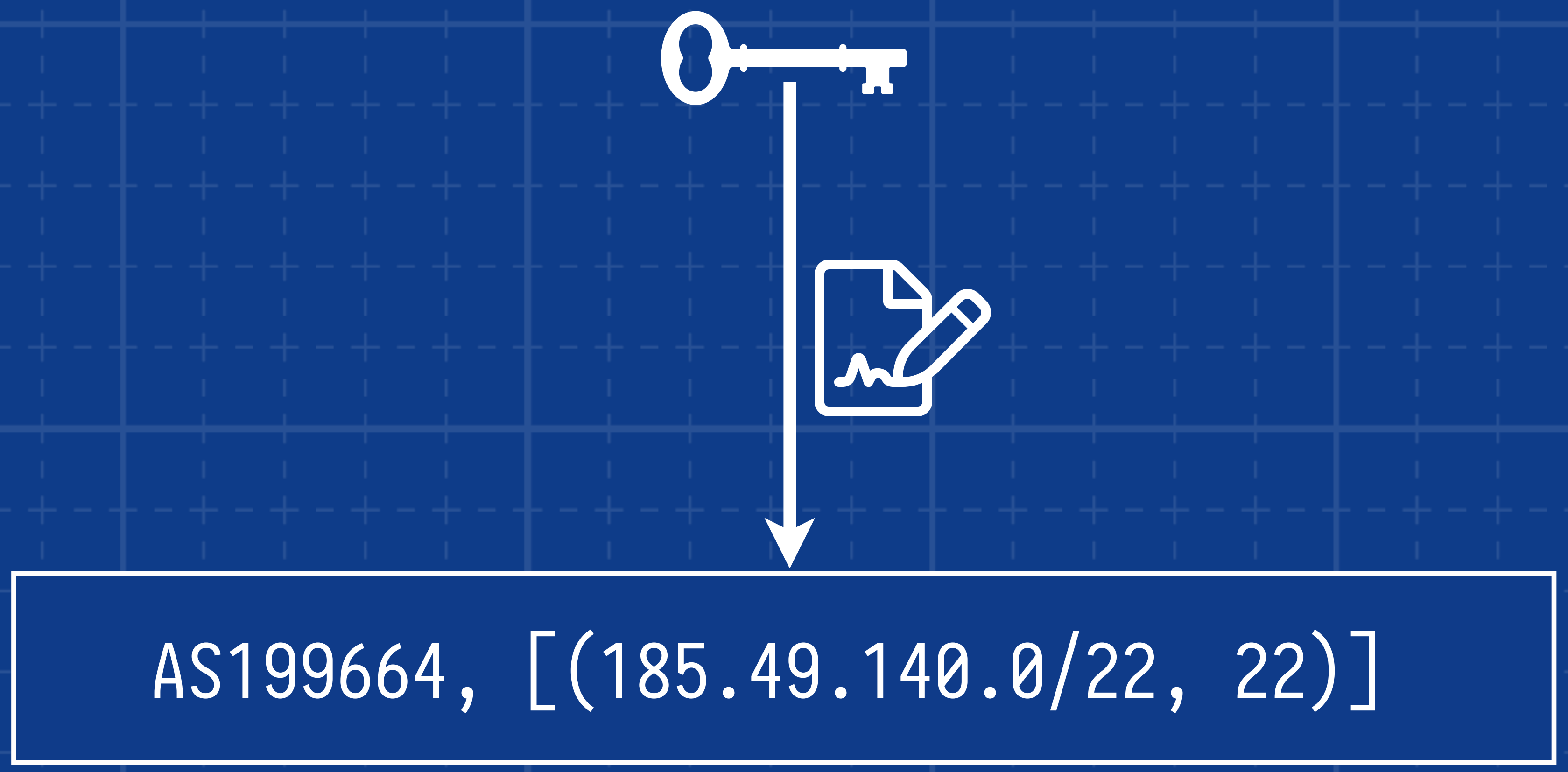
```
route:    185.49.140.0/22
origin:   AS199664
more:     stuff
```



Route Origin Attestation (ROA)

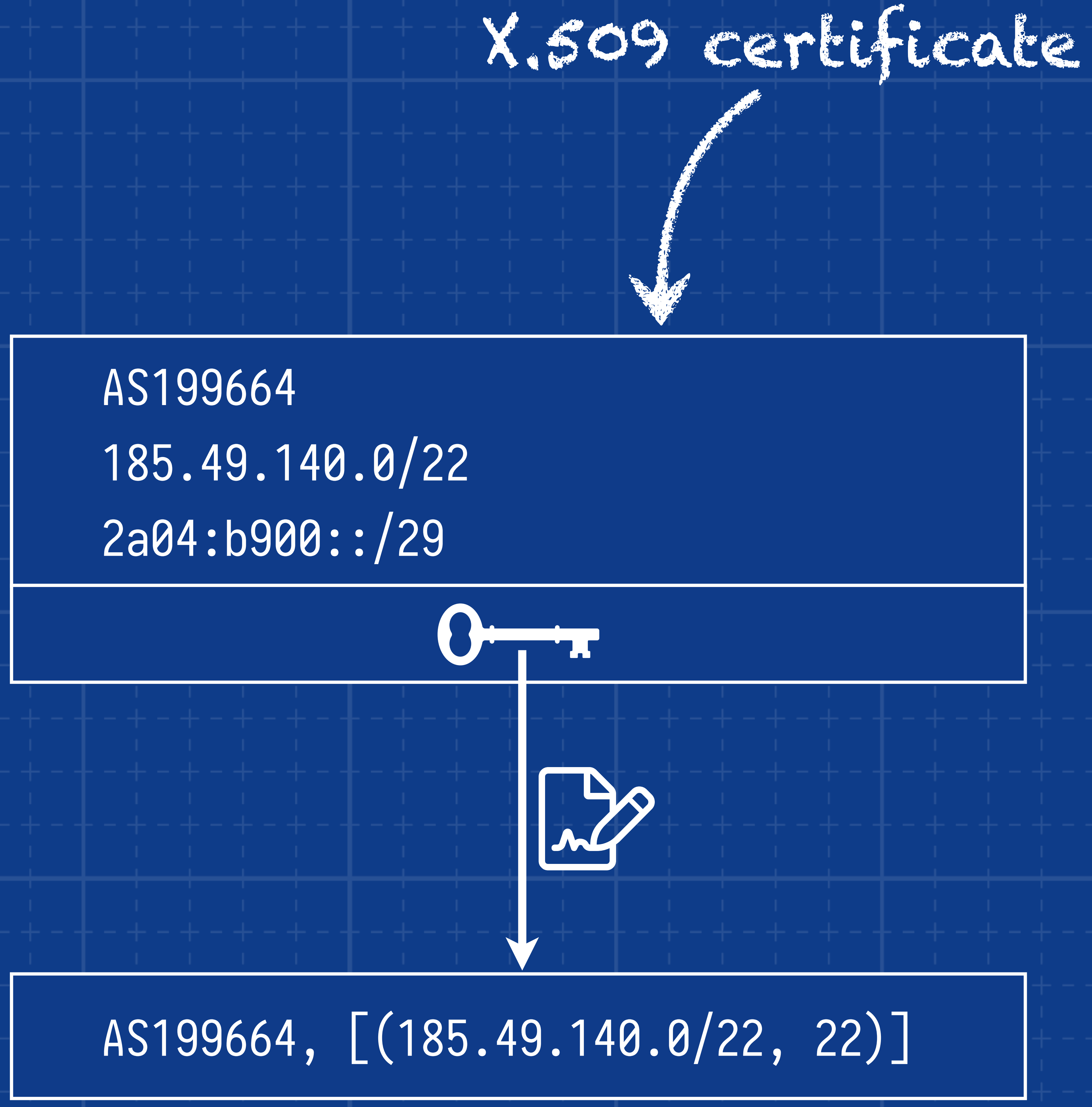
```
AS199664, [(185.49.140.0/22, 22)]
```

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



AS199664, [(185.49.140.0/22, 22)]

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



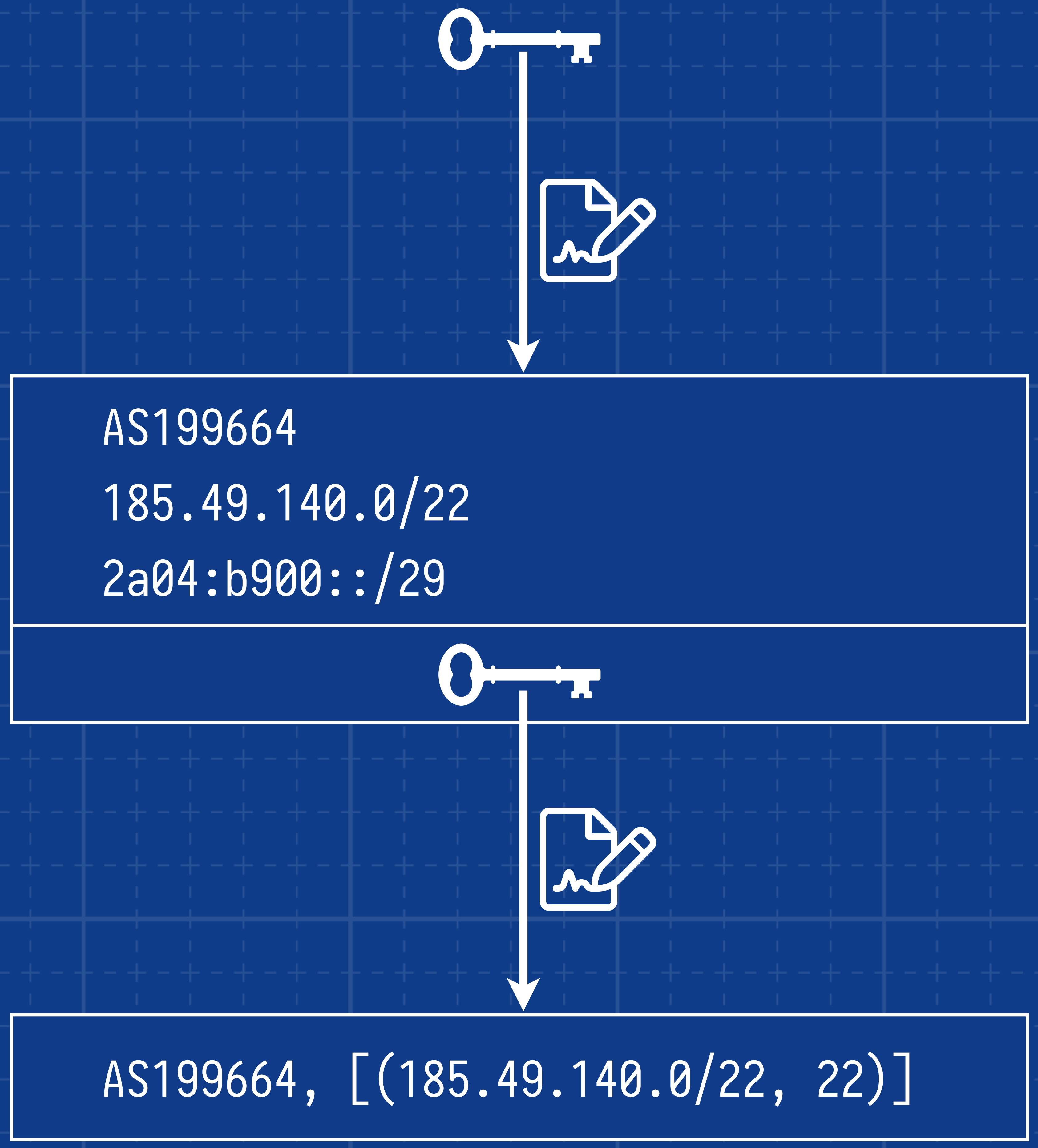
X.509 certificate

AS199664
185.49.140.0/22
2a04:b900::/29

AS199664, [(185.49.140.0/22, 22)]

NLNETLABS

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



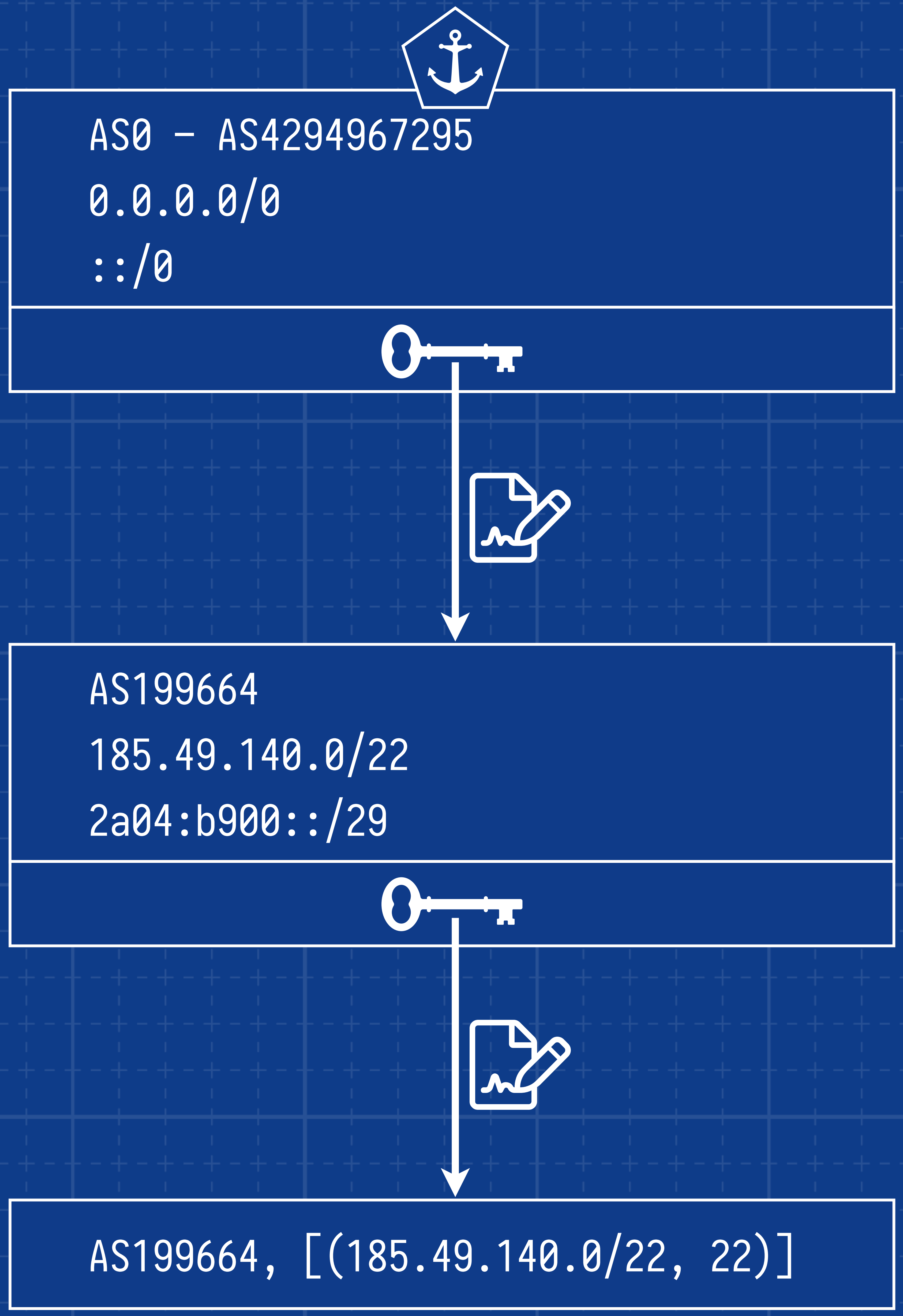
AS199664
185.49.140.0/22
2a04:b900::/29

AS199664, [(185.49.140.0/22, 22)]

RIPE NCC
RIPE NETWORK COORDINATION CENTRE

NLNETLABS

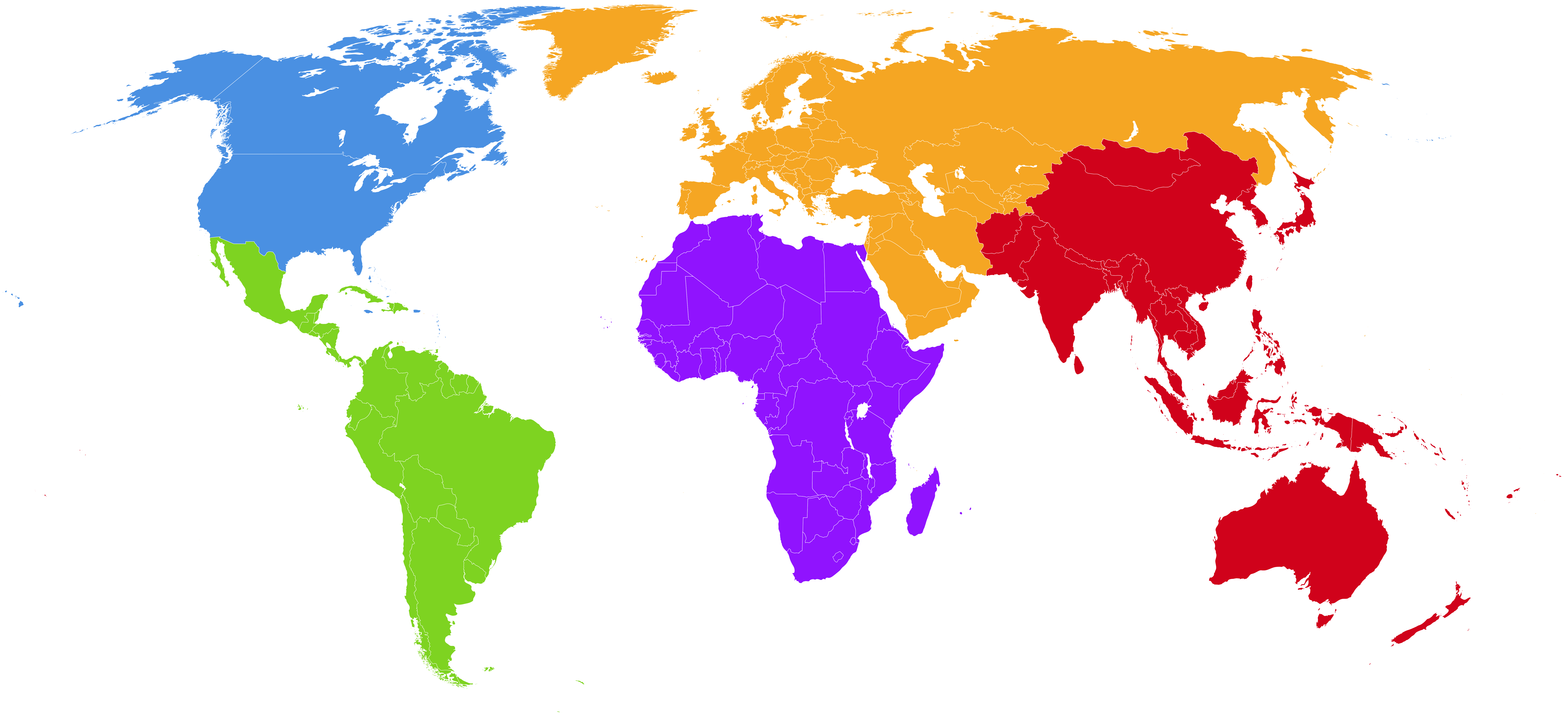
```
route:    185.49.140.0/22
origin:   AS199664
more:     stuff
```



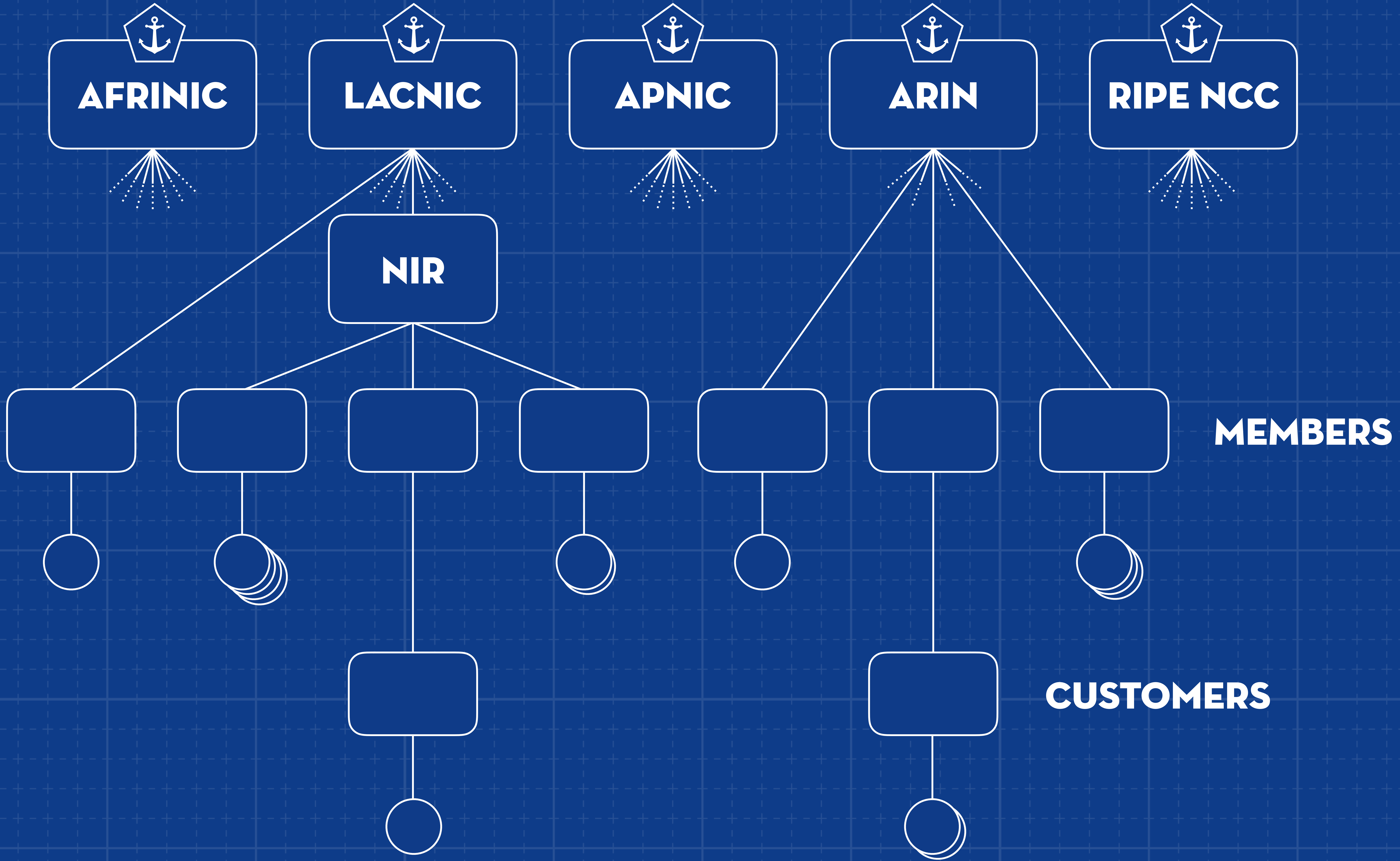
AS0 - AS4294967295
0.0.0.0/0
::/0

AS199664
185.49.140.0/22
2a04:b900::/29

AS199664, [(185.49.140.0/22, 22)]



ARIN LACNIC AFRINIC RIPE NCC APNIC

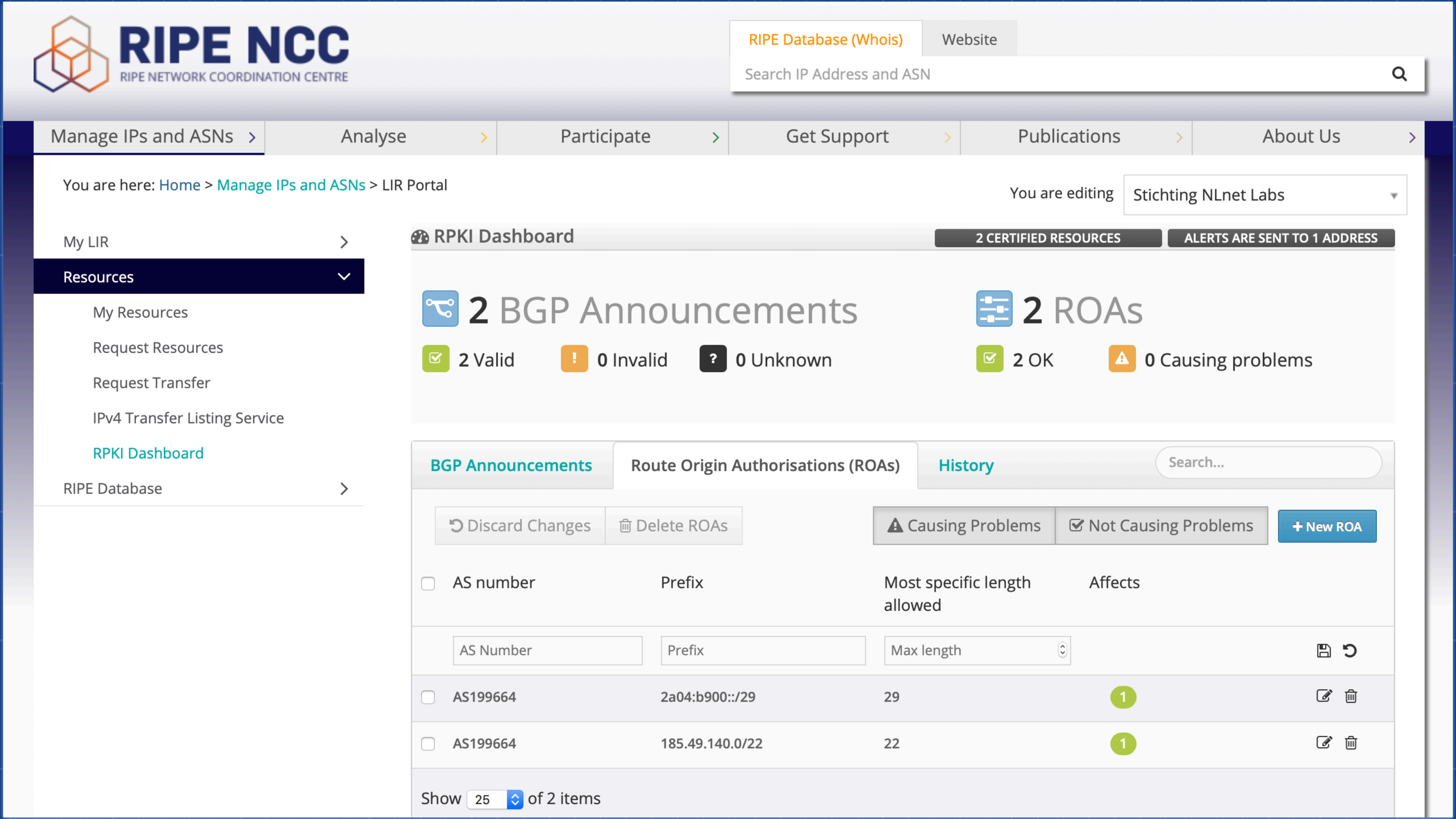

AFRINIC
LACNIC
APNIC
ARIN
RIPE NCC
NIR
MEMBERS
CUSTOMERS

# 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)



You are here: Home > Manage IPs and ASNs > LIR Portal

You are editing: Stichting NLnet Labs

## 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

| | AS number | Prefix | Most specific length allowed | Affects |
|---|---|---|---|---|
| □ | AS Number | Prefix | Max length | |
| □ | AS199664 | 2a04:b900::/29 | 29 | 1 |
| □ | AS199664 | 185.49.140.0/22 | 22 | 1 |

Show 25 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

# RPKI CA SOFTWARE

- rpkid, by Dragon Research Labs

# DIVERSITY

# FUNDING?

DigitalOcean

nic.br

JUNIPER
NETWORKS

RIPE NCC
Community Projects Fund

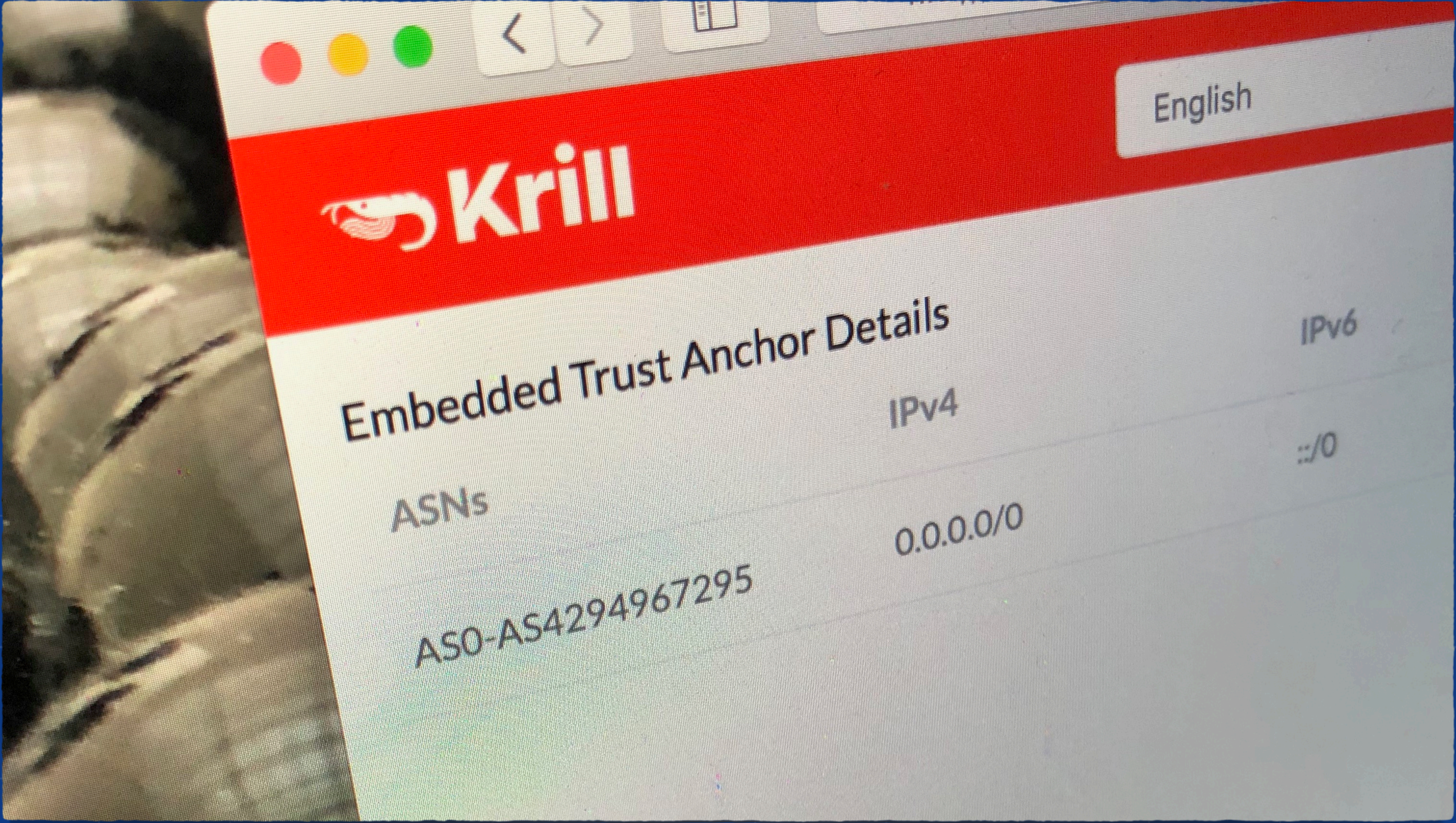
cisco

moz://a

Nationaal Cyber Security Centrum
*Ministerie van Veiligheid en Justitie*

NOKIA

# Krill



## Embedded Trust Anchor Details

| ASNs | IPv4 | IPv6 |
|---|---|---|
| AS0-AS4294967295 | 0.0.0.0/0 | ::/0 |

# 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)

# ROUTINATOR

# MADE WITH

❤

Rust

*“What kind of setup will I need,
in terms of software, hardware
and services?”*

# HARDWARE & CONNECTIVITY

- Certificate Authority
  - Modest hardware is fine for most use cases
  - No HSM needed; keys on disk are fine, really
- Publication Server
  - Internet-facing, with all related consequences
  - Run it yourself, or outsource it – the hybrid option

# PUBLICATION INFRASTRUCTURE

- RPKI relies on rsync for distribution for now
- RPKI Repository Delta Protocol (RRDP), using HTTPS, is its replacement
  - Deployed by RIPE NCC and APNIC
  - ARIN has it on their suggested work items for 2019
  - Ideally suited for CDN participation in publication
- *Note*: CA doesn’t need uptime, your publication server does!

# 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*

# WHY RUN YOUR OWN RPKI CA

- Delegate ROA management to different business units or customers
- Offer Hosted RPKI to downstream customers
- Tight integration with your routing provisioning (API)
- Manage ROAs seamlessly and transparently across multiple RIRs
- Fine-grained access control
- Control over ROA publication interval

nlnetlabs.nl/rpki

rpki.readthedocs.io

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