PacNOG

Beyond your network, why Routing Security requires global collaborative effort

MANRS

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MANRS ROUTINATOR RPKI tfl

Acknowledgement

- This paper is made taking notes, diagram, configurations from MANRS, APNIC training materials, NLnet Labs & Dr. Philip Smith along with the operational experience of the author.

MANRS

- Mutually Agreed Norms for Routing Security (MANRS) is a global initiative, supported by the Internet Society, that provides crucial fixes to reduce the most common routing threats.

MANRS

- MANRS outlines four simple but concrete actions that network operators should take:
    - Filtering
    - Anti-spoofing
    - Coordination
    - Global Validation

Global Validation

- Publish your data, so others can validate routing information on a global scale
- Automated information validation needs arrangements
- Securing global routing information is done by RPKI

Resource Public Key Infrastructure (RPKI)

- RPKI allows holders of Internet number resources to make verifiable statements about how they intend to use their resources.

- RPKI is a way to define data in an out-of-band system such that the information that are exchanged by BGP can be validated to be correct.

- RPKI is used to make Internet routing more secure.

Importance of RPKI

- Secured Routing Table
- Dynamic LOA checking
- Maintaining a Dynamic Chain of Trust
- Digitally Signed Resources Certificate (X.509 Certificates-RFC5280)
- Helps to Stop Route Hijack

Route Origin Authorizations (ROA)

- Using the RPKI system, the legitimate holder of a block of IP addresses can use their resource certificate to make an authoritative, signed statement about which autonomous system is authorized to originate their prefix in BGP.

- These statements are called Route Origin Authorizations (ROAs).

Route Origin Validation (ROV)

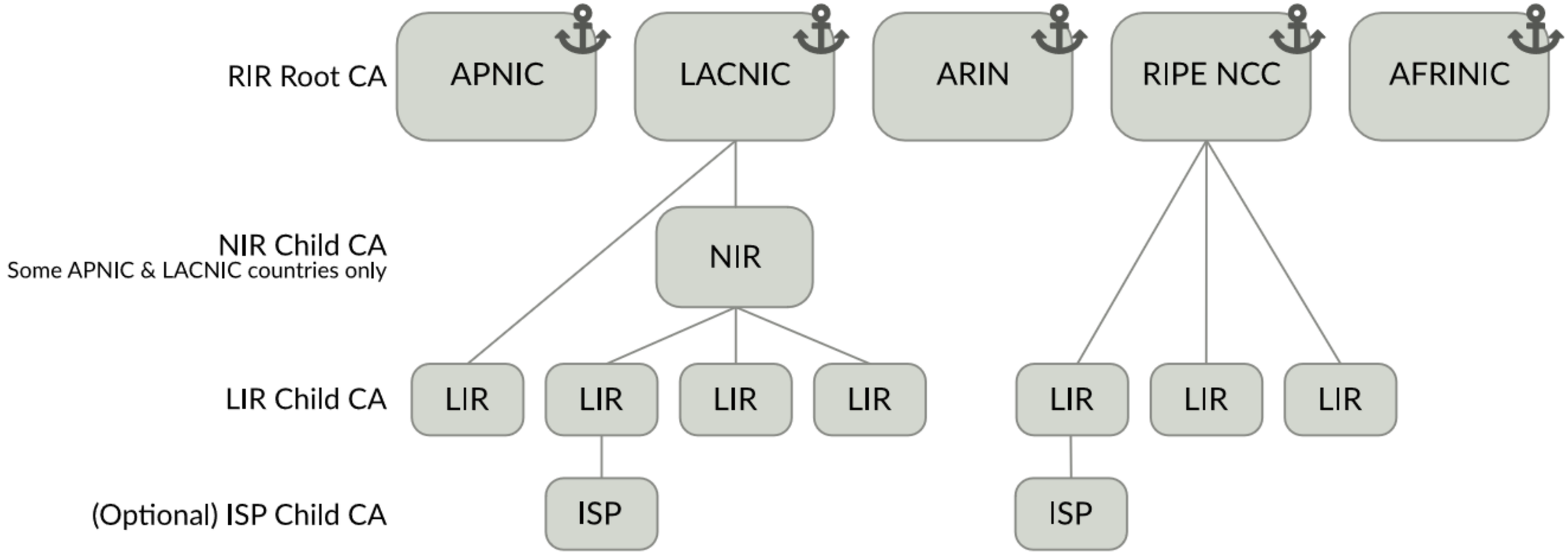
- RPKI system tries to closely mimic what route objects in the IRR intend to do, but then in a more trustworthy manner.

- This process is called route origin validation (ROV)

Validity

- Valid - Resources found in database which is called Validated ROA Payload (VRP).
- Invalid – Resources found but partial/whole information doesn’t match with database.
- Not Found - The prefix in this announcement is not covered by a VRP.

RPKI - Chain Of Trust

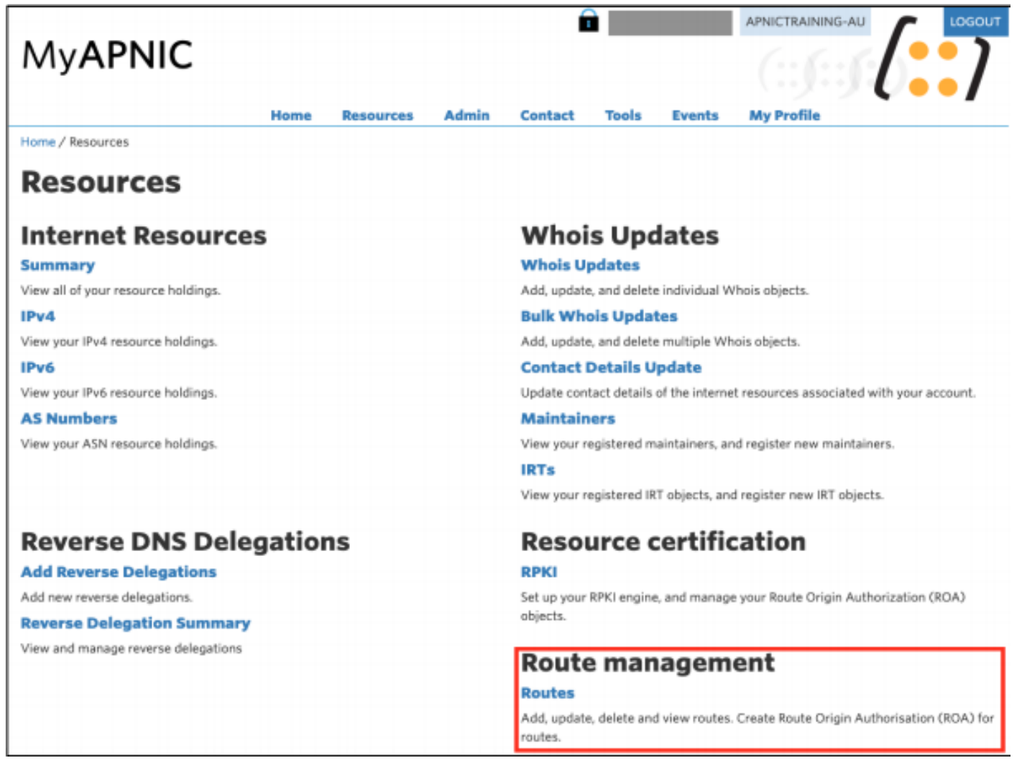


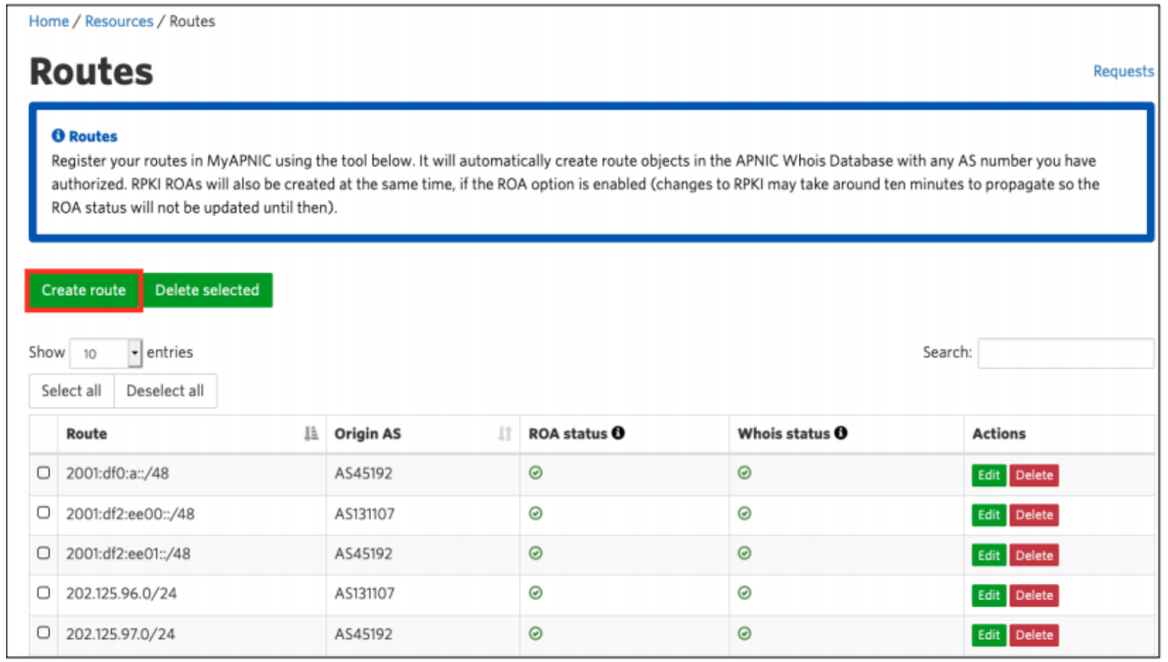
Working Steps

- Creating ROA for owned resources for RPKI
- Implementing Validator relying software for ROV
- Enforcing policies for based on Validation

Creating ROA

- Go to Resources > Route Management and select Create route



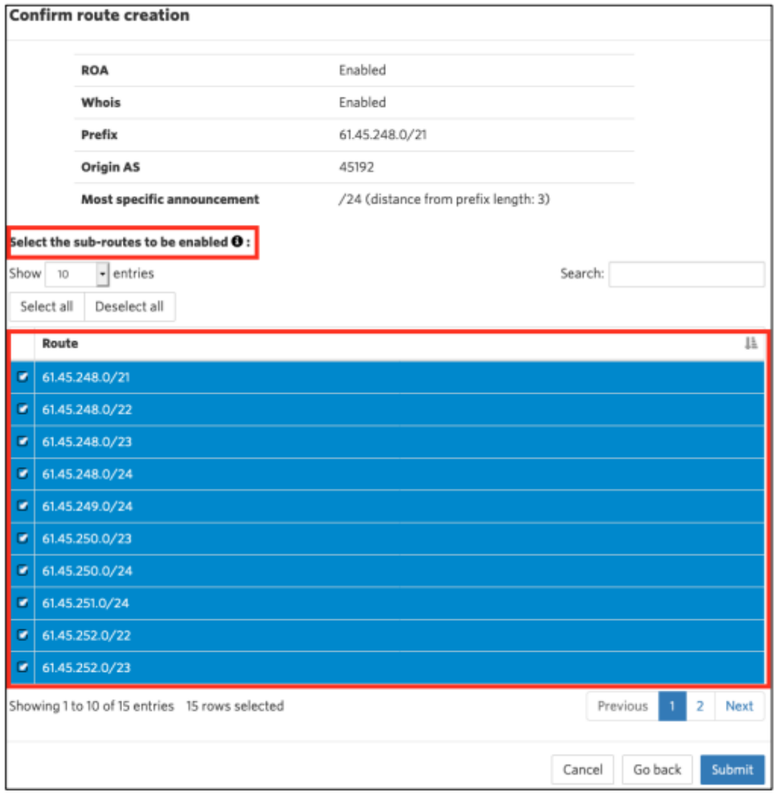


https://www.apnic.net/wp-content/uploads/2017/12/ROUTE_MANAGEMENT_GUIDE.pdf

Creating ROA

- Mention your prefix with ASN & desired subnet & Submit

Example for **IPv4**



https://www.apnic.net/wp-content/uploads/2017/12/ROUTE_MANAGEMENT_GUIDE.pdf

Relying Party Software

- NLnet Labs Routinator
  - https://www.nlnetlabs.nl/projects/rpki/routinator/
  - https://github.com/NLnetLabs/routinator
- Dragon Research validator
  - https://rpki.net
  - https://github.com/dragonresearch/rpki.net/
- RIPE NCC validator
  - https://github.com/RIPE-NCC/rpki-validator-3/wiki
- LACNIC/NIC Mexico validator (FORT)
  - https://github.com/NICMx/FORT-validator
- Cloudflare validator (OctoRPKI)
  - https://github.com/cloudflare/cfrpki

Routinator

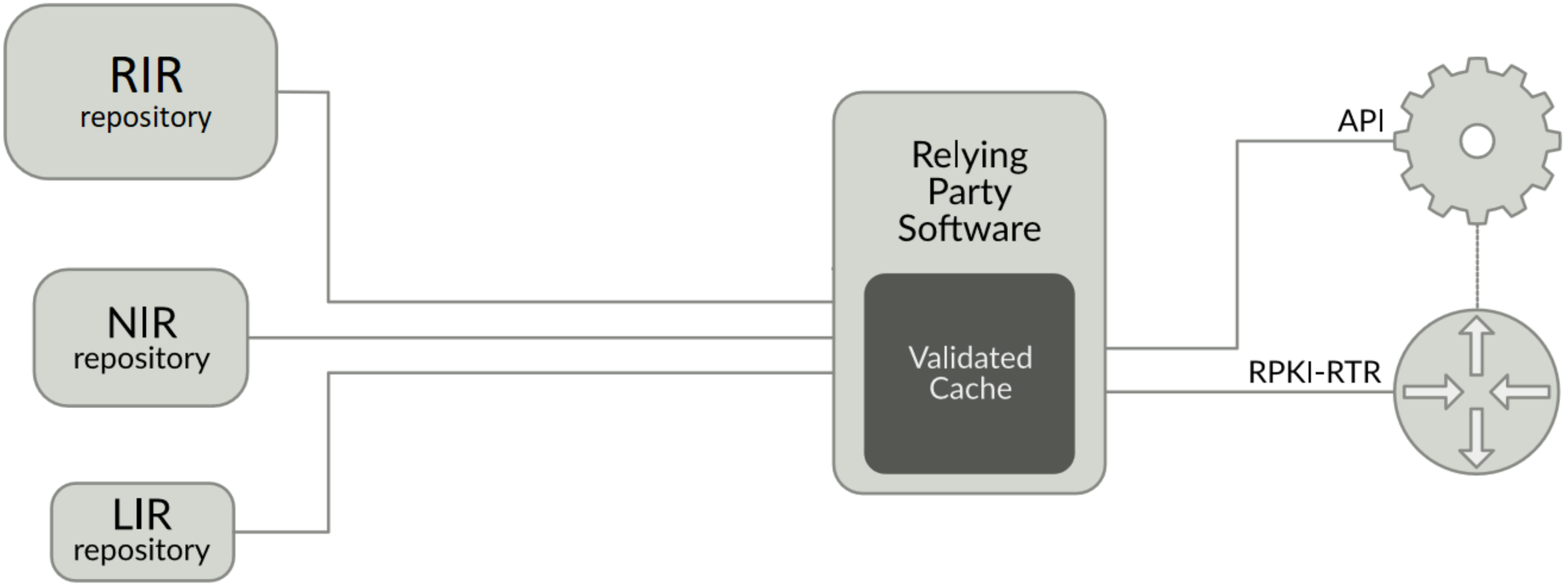
- Routinator is free, open source RPKI Relying Party software written by NLnet Labs in the Rust programming language.

- Routinator connects to the Trust Anchors of the five Regional Internet Registries (RIRs) — APNIC, AFRINIC, ARIN, LACNIC and RIPE NCC — downloads all of the certificates and ROAs in the various repositories, verifies the signatures and makes the result available for use in the BGP workflow.

- The validated cache can be fed directly into RPKI-capable routers via the RPKI to Router Protocol (RPKI-RTR), described in RFC 8210.

https://rpki.readthedocs.io/en/latest/routinator/index.html

Ecosystem


RIR
repository
NIR
repository
LIR
repository
Relying
Party
Software
Validated
Cache
API
RPKI-RTR

Why Routinator?

- Designed to have a small footprint and great portability
- Can run on any Unix-like operating system, but also works on Microsoft Windows via API
- Have a mailing list for general discussion and exchanging operational experiences (https://nlnetlabs.nl/mailman/listinfo/rpki)
- Problem report & feature request is possible (https://github.com/NLnetLabs/routinator/issues)
- Used in production by AT&T, NTT, AMS-IX, DECIX and many more

https://rpki.readthedocs.io/en/latest/routinator/index.html

Installation

- curl https://sh.rustup.rs -sSf | sh
- sudo apt install cargo
- source ~/.cargo/env
- cargo install routinator
- routinator init --accept-arin-rpa
- routinator server --rtr [SERVER IP]:3323 --http [SERVER IP]:9556 –d
- routinator -v vrps

https://rpki.readthedocs.io/en/latest/routinator/installation.html

Adding Into Crontab

- nano /etc/rovscript.sh

#!/bin/bash

/home/[USER]/.cargo/bin/routinator init -f --accept-arin-rpa &

/home/[USER]/.cargo/bin/routinator server --rtr [SERVER IP]:3323 --http [SERVER IP]:9556 -d &

- sudo chmod +x rovscript.sh

- crontab -e

@reboot /etc/rovscript.sh

5 13 * * * /home/nano/.cargo/bin/routinator -v vrps &

5 0 * * * /home/nano/.cargo/bin/routinator -v vrps &

Allow In Iptables

- -A INPUT -i ens18 -p tcp -m tcp --dport 873 -m state --state NEW,ESTABLISHED -j ACCEPT
- -A INPUT -i ens18 -p tcp -m tcp --sport 873 -m state --state NEW,ESTABLISHED -j ACCEPT
- -A INPUT -i ens18 -p tcp -m tcp --dport 9556 -m state --state NEW,ESTABLISHED -j ACCEPT
- -A INPUT -i ens18 -p tcp -m tcp --sport 9556 -m state --state NEW,ESTABLISHED -j ACCEPT
- -A INPUT -i ens18 -p tcp -m tcp --dport 3323 -m state --state NEW,ESTABLISHED -j ACCEPT
- -A INPUT -i ens18 -p tcp -m tcp --sport 3323 -m state --state NEW,ESTABLISHED -j ACCEPT

- -A INPUT -i ens18 -p tcp -m tcp --dport 9100 -m state --state NEW,ESTABLISHED -j ACCEPT
- -A INPUT -i ens18 -p tcp -m tcp --sport 9100 -m state --state NEW,ESTABLISHED -j ACCEPT
- -A INPUT -i ens18 -p tcp -m tcp --dport 9090 -m state --state NEW,ESTABLISHED -j ACCEPT
- -A INPUT -i ens18 -p tcp -m tcp --sport 9090 -m state --state NEW,ESTABLISHED -j ACCEPT

Router Configuration

```
router bgp [ASN]
 rpki server [SERVER IP]
  transport tcp port 3323
  refresh-time 120
```

```
address-family ipv4 unicast
 bgp origin-as validation signal ibgp

address-family ipv6 unicast
 bgp origin-as validation signal ibgp
```

Configuration of IOS-XR

Router Configuration

- routing-options {
  autonomous-system [ASN];
  validation {
  group rpki-validator {
  Session [Server IP] {
  refresh-time 120;
  Port 3323;
  local-address X.X.X.253;
  }
  }
  }
  }

Checking

- ps ax| grep routinator

1369 ? Sl 124:05 /home/[USER]/.cargo/bin/routinator server --rtr [SERVER IP]:3323 --http [SERVER IP]:9556 -d

7487 pts/0 S+ 0:00 grep --color=auto routinator

- sh bgp rpki server summary

Sun Nov 3 12:27:37.333 UTC

Hostname/Address	Transport	State	Time	ROAs (IPv4/IPv6)
[SERVER IP]	TCP:3323	ESTAB	6d19h	97473/16440

Decision

- Since now the validation states are visible to you, you can decide what to do with invalids

- You can –
  - Use them with low preference
  - Or drop them

Policy

```
route-policy RPKI
  if validation-state is invalid then
    set local-preference 50
  else
    if validation-state is valid then
      set local-preference 200
    else
      pass
    endif
  endif
end-policy
```

```
route-policy RPKI
  if validation-state is invalid then
    drop
  else
    if validation-state is valid then
      set local-preference 200
    else
      pass
    endif
  endif
end-policy
```

Configuration of IOS-XR

Closure

- https://sg-pub.ripe.net/jasper/rpki-web-test/

Reference

- https://www.manrs.org/about/
- https://blog.apnic.net/2019/10/28/how-to-installing-an-rpki-validator/
- http://www.bgp4all.com.au/pfs/training/apnic48/agenda
- https://www.nlnetlabs.nl/projects/rpki/routinator/
- https://www.ripe.net/manage-ips-and-asns/resource-management/certification/tools-and-resources
- https://github.com/cloudflare/cfrpki#octorpki
- RPKI Validator - Quick Overview of BGP Origin Validation (apnic.net)

Query !!

Thanks …