RPKI on IXP Route Servers

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Barry O'Donovan
INEX Operations Team & IXP Manager Developer

Based on Nick Hilliard's presentation at RIPE 77.

RPKI at IXPs

RPKI in ~~Three~~ Two Slides

```
route6:          2001:db8::/32
descr:           Example IPv6 route object
origin:          AS65500
created:         2006-07-12T16:11:58Z
last-modified:   2011-02-22T15:58:03Z
source:          SOME-IRRDB
```

```
route:           192.0.2.0/24
descr:           Example IPv4 route object
origin:          AS65500
created:         2004-12-06T11:43:57Z
last-modified:   2016-11-16T22:19:51Z
source:          SOME-IRRDB
```

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IRRDB Filtering in IXP Manager

- Local database storage of members' IRRDB entries (via bgpq3)
- Flexible configuration of IRRDB source database(s) on a per member basis
- Support for both AS sets and *just* ASNs
- Updating IRRDB database is an asynchronous operation to generating route server configuration
- But: IRRDB is not secure

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RPKI at I

IRRDI

- Loca
- Flexi
- Supp
- Upda server confi
- But:

```
$ bgpq3 -j -S RIPE AS-IMAGINE
{ "NN": [
    { "prefix": "78.135.128.0\/17", "exact": true },
    { "prefix": "87.232.0.0\/19", "exact": true },
    { "prefix": "87.232.136.0\/21", "exact": true },
    { "prefix": "87.232.144.0\/20", "exact": true },
    { "prefix": "87.232.160.0\/19", "exact": true },
    { "prefix": "87.232.192.0\/24", "exact": true },
    { "prefix": "87.232.194.0\/23", "exact": true },
    { "prefix": "87.232.196.0\/22", "exact": true },
    { "prefix": "87.232.200.0\/21", "exact": true },
    { "prefix": "87.232.208.0\/20", "exact": true },
    { "prefix": "87.232.225.0\/24", "exact": true },
    { "prefix": "87.232.226.0\/23", "exact": true },
    { "prefix": "87.232.228.0\/22", "exact": true },
    { "prefix": "87.232.232.0\/21", "exact": true },
    { "prefix": "87.232.240.0\/21", "exact": true },
    { "prefix": "87.232.248.0\/23", "exact": true }
] }
```

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ROAs - Route Origin Authorisations

- A cryptographically secure replacement for route[6] objects
- Adds maximum prefix length
- Yields route origin triplets that have been validated

```
( Origin AS, Prefix        ,  Max Length )
( AS65500,   2001:db8::/32,  /48          )
```

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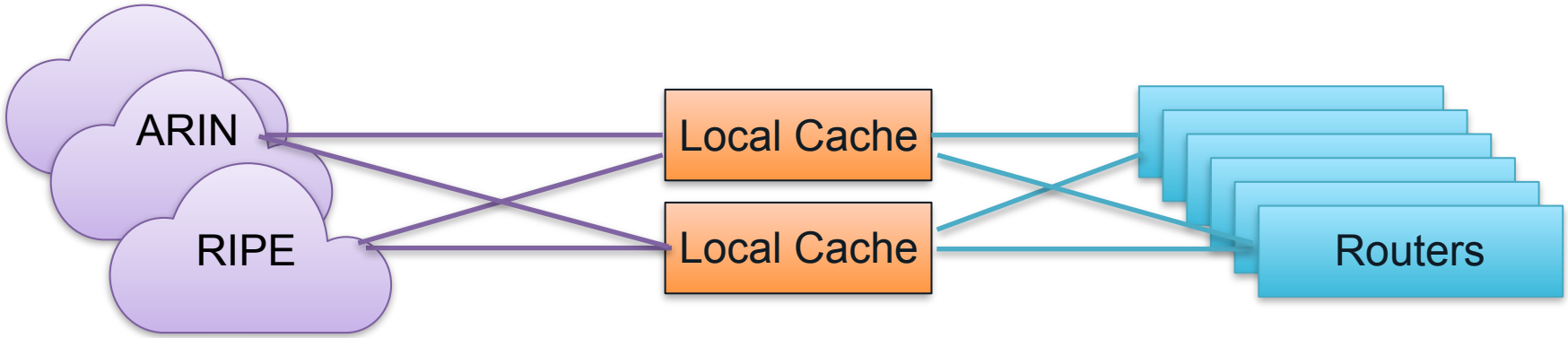
Validating BGP Routing with RPKI-RTR

- A cache server *(validator)* does the cryptographic heavy lifting
- Routers receive and maintain the set of ROAs via RPKI-RTR from the cache
- RPKI gives three validation results: VALID, INVALID, UNKNOWN



RPKI at IXPs

Route Server Software

1. BIRD 1.x: supports ROA tables
2. BIRD 2.x: supports RTR protocol
3. GoBGP: full support
4. Quagga: RPKI patches never reached mainline
5. FRR: supports RTR
6. IOS-XE: RTR support available
7. JUNOS: recent RS implementation
8. Majority of IXPs use BIRD 1.x
9. Many RPKI implementations do not support revalidation

[1] [2] [3] [5] [6] [7]

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Validator Software

- RIPE NCC RPKI Validator 3 released in 2018
  - https://github.com/RIPE-NCC/rpki-validator-3
- Dramatically reduces installation complexity
- Modest VM requirements, runs on standard OS distributions
- Requirement to download ARIN TAL separately

```
$ wget https://ftp.ripe.net/tools/rpki/validator3/rc/generic/rpki-validator-3.0-x-dist.tar.gz
$ tar zxf rpki-validator-3.0-x-dist.tar.gz
$ ./rpki-validator-3.0-x/rpki-validator-3.sh
$ open http://localhost:8080
```

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Creating ROAs

- RIPE NCC: Log in to RIPE Portal Account, click OK a couple of times
- ARIN: open ticket
- Legacy Resources require engagement with RIR
  - RIPE NCC: available if there is any relationship in place
  - ARIN: Requirement to sign LRSA

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AS Paths

- No ability to validate AS paths in RPKI
- No ability to create AS sets in RPKI
  - draft-ietf-grow-rpki-as-cones will resolve this
- These are regressions over static IRRDB filtering
  - path validation is hard
  - AS Set / AS Cone support is critical

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Implementation Considerations

- Needs to co-exist with current filtering mechanisms
- Temptation to create policy filtering which is too complicated
  - Consistency and simplicity is usually better
- Drop invalid / tag invalid?
- Implementation Requirements
  - Revalidation
  - AS Path filtering support
  - Consistent approach for handling RPKI Invalid
  - What to do with RPKI Unknown

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Thoughts on Evaluation Policy

1. Allow RPKI to be enabled on a per-client basis
2. Compare against AS Path filtering from IRR. Drop if origin AS is not in accepted list.
3. RPKI Evaluation
    1. If RPKI valid, then accept
    2. If RPKI invalid, then drop
4. Continue with existing static IRR route / route6 prefix filters

RPKI at IXPs

IXP Manager Development Plan (draft)

1. Support Bird v2
2. RPKI support
3. Looking glass updates (prefix analysis)
4. Support OpenBGPd
5. Support GoBGP

THANK YOU

Any Questions?