Routing Security Roadmap

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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

Average view on routing security

Perception: it is hopeless, too many holes


TOP 10 VIDEO GAMES FINAL BOSSES
OF ALL TIME

Exhaustive list of issues in the current ecosystem

- IRRdb / database inaccuracy (stale, autopiloted, non-validated)
- IXPs not filtering
- Lack of Path Validation
- Lack of sufficient and good enough software

IRR – what is broken what can be fixed?

- Some IRRdbs do not perform validation
  - Meaning that virtually anyone can create virtually any route/route6 object and sneak those into the prefix-filters

- Eleven relevant IRRs not validating: RIPE, NTTCOM, RADB, ALTDB, ARIN IRR, BBOI, BELL, LEVEL3, RGNET, TC, CANARIE

- Two solutions:
  - Lock the database down (RIPE / RIPE-NONAUTH)
  - Filter on the mirror level

RIPE NWI-5 proposal & implementation

- RIPE NCC's IRR previously allowed anyone to register any non-RIPE-managed space if it had not yet been registered. *DANGER*
- The "RPSL" password & maintainer was used for this

Three steps were taken:

- Cannot register non-RIPE-managed space any more
- All non-RIPE space moved to separate "RIPE-NONAUTH" database
- Route/route6 ASN authorization rules have been improved

More info: https://www.ripe.net/manage-ips-and-asns/db/impact-analysis-for-nwi-5-implementation

OK – so current status

- Ten relevant IRRs not validating: NTTCOM, RADB, ALTDB, ARIN IRR, BBOI, BELL, LEVEL3, RGNET, TC, CANARIE
- Done: ~~RIPE~~

ARIN community also recognized this is an issue

- Consultation at NANOG and through ARIN-Consult mailing list
- https://www.arin.net/vault/resources/routing/2018_roadmap.html
- https://teamarin.net/2018/07/12/the-path-forward/

“Improve, or kill it”

OK – so current status

- Nine relevant IRRs not validating: NTTCOM, RADB, ALTDB, BBOI, BELL, LEVEL3, RGNET, TC, CANARIE
- Done: ~~RIPE, ARIN IRR~~

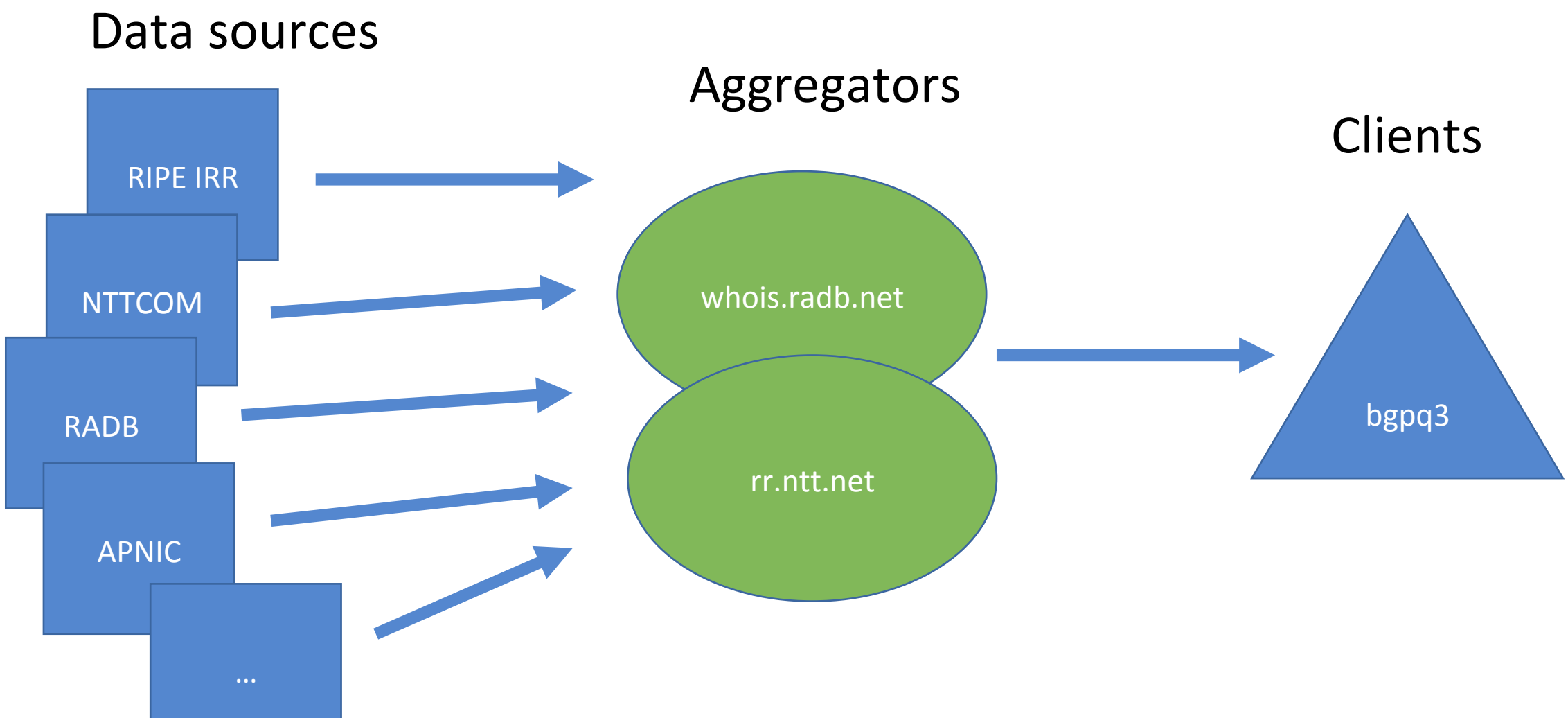
- How to deal with the remaining nine …. ?
- Not all of these are so easily communicated with, not all are really actively managed

The “IRR” system access

- The IRR is access through predominantly two “gateways”
  - **`whois.radb.net`** (the bgpq3 and peval default)
  - **`rr.ntt.net`**
- All mirroring is essentially done with one software: IRRd

Solution: Let’s use the hegemonic duopoly for good!

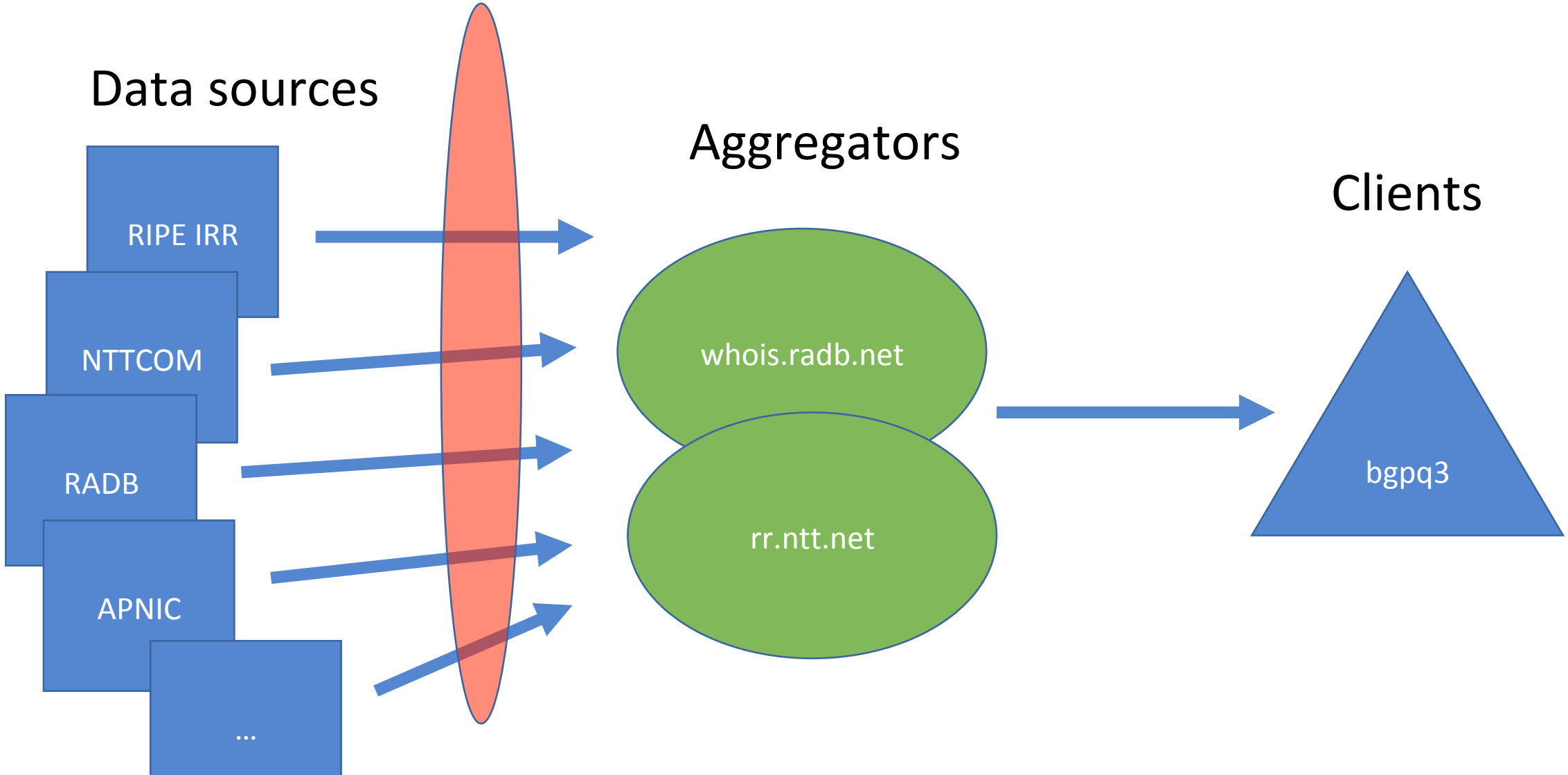
Improving security at the ”aggregator”?



Proposal: Let RPKI “drown out” conflicting IRR

- RPKI can be used for *BGP Origin Validation* – but also for other things!
- A RPKI ROA is sort of a route-object
  - It has a “prefix”, “origin” and “source” (the root)
  - We can use RPKI ROAs for provisioning BGP prefix-filters
- Extend IRRd so that when IRR information is in direct conflict with a RPKI ROA – the conflicting information is suppressed (Github)

RPKI filter at the aggregators



RPKI suppressing conflicting IRR advantages

- Industry-wide common method to get rid of stale proxy route objects – by creating a ROA you hide old garbage in IRRs
- By creating a ROA – you will significantly decrease the chances of people being able to use IRR to hijack your resource

OK – so current status

- IRRs not validating: no longer relevant

- Done: ~~RIPE, ARIN IRR, NTTCOM, RADB, ALTDB, BBOI, BELL, LEVEL3, RGNET, TC, CANARIE~~

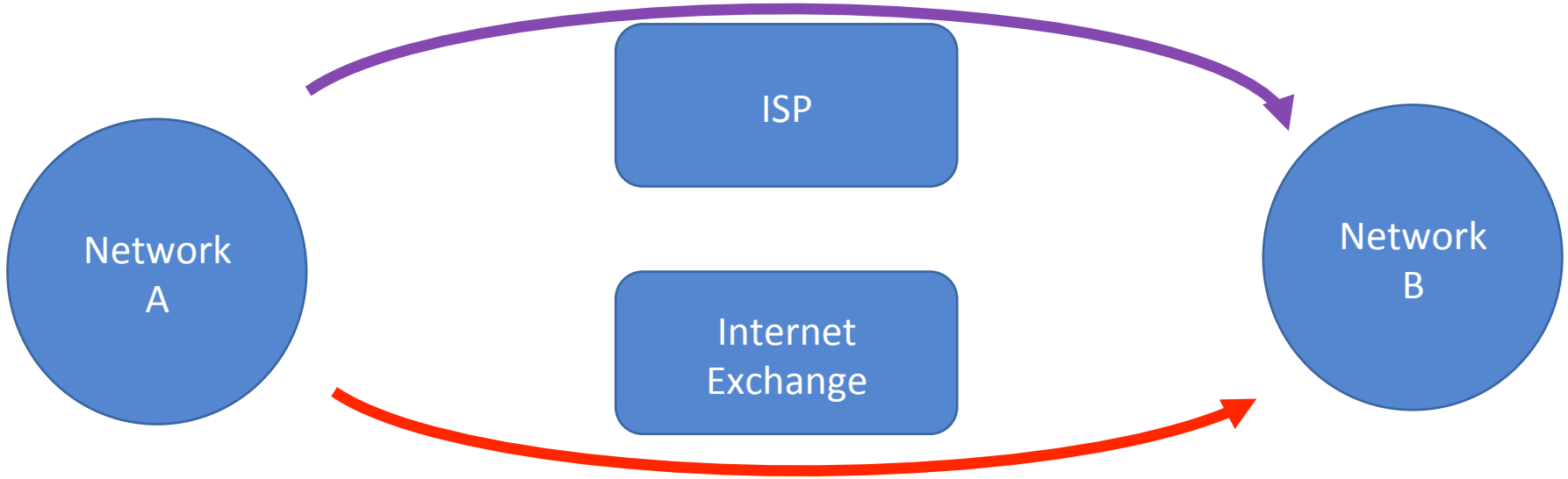
NTT & Dashcare have started a full rewrite of IRRd to make this possible: https://github.com/irrdnet/irrd4

”Filtering at IXPs is hard”

- Many IXPs have come to realize their responsibilities to the Internet ecosystem and the commercial benefits of a more secure product.
- http://peering.exposed/
  - 9 out of top 10 IXPs are filtering, tenth will later this year. **IX.br** making good progtress
- IXP filtering has become much easier, there are multiple fully featured configuration generators:
  - https://www.ixpmanager.org/
  - http://arouteserver.readthedocs.io/
- BIRD’s hegemony in the route server software is being challenged: OpenBGPD is funded to be able to compete

Route servers must begin dropping RPKI Invalids

- Route servers *by definition* provide partial Internet tables
- No guarantees whatsoever that a given route will be available via RS
- When a route server drops a prefix, **worst case scenario is rerouting** – not an outage.



Not everyone needs to do RPKI

- Because of the centralization of the web, if a select few companies deploy RPKI Origin Validation – millions of people benefit
- (google, cloudflare, amazon, pch/quad9, facebook, akamai, fastly, liberty global, comcast, etc…)
- I think only 20 companies or so need to do Origin Validation for there to be big benefits…
- https://dyn.com/blog/bgp-dns-hijacks-target-payment-systems/

“RPKI Origin Validation is useless without Path Validation aka BGPSEC”

- The lack of path validation can be resolved through two methods:
  - Densely peer with each other (Example: Google & Akamai have 126+ facilities in common with each other)
  - An AS_PATH blocking mechanisms like “peerlock”
- Both effectively are “path validation for 1 hop”
- Perhaps “1 hop” already is good enough ☺

“There is no healthy software ecosystem”

- RIPE NCC Validator v3 is works and actively maintained
- NLNetlabs is writing a RPKI Cache Validator (Routinator 3000)
- A company I can’t name is secretly writing one too

- Almost all serious routing vendors have RPKI support (Cisco, Juniper, BIRD, Nokia, FRR – and more are on the way)

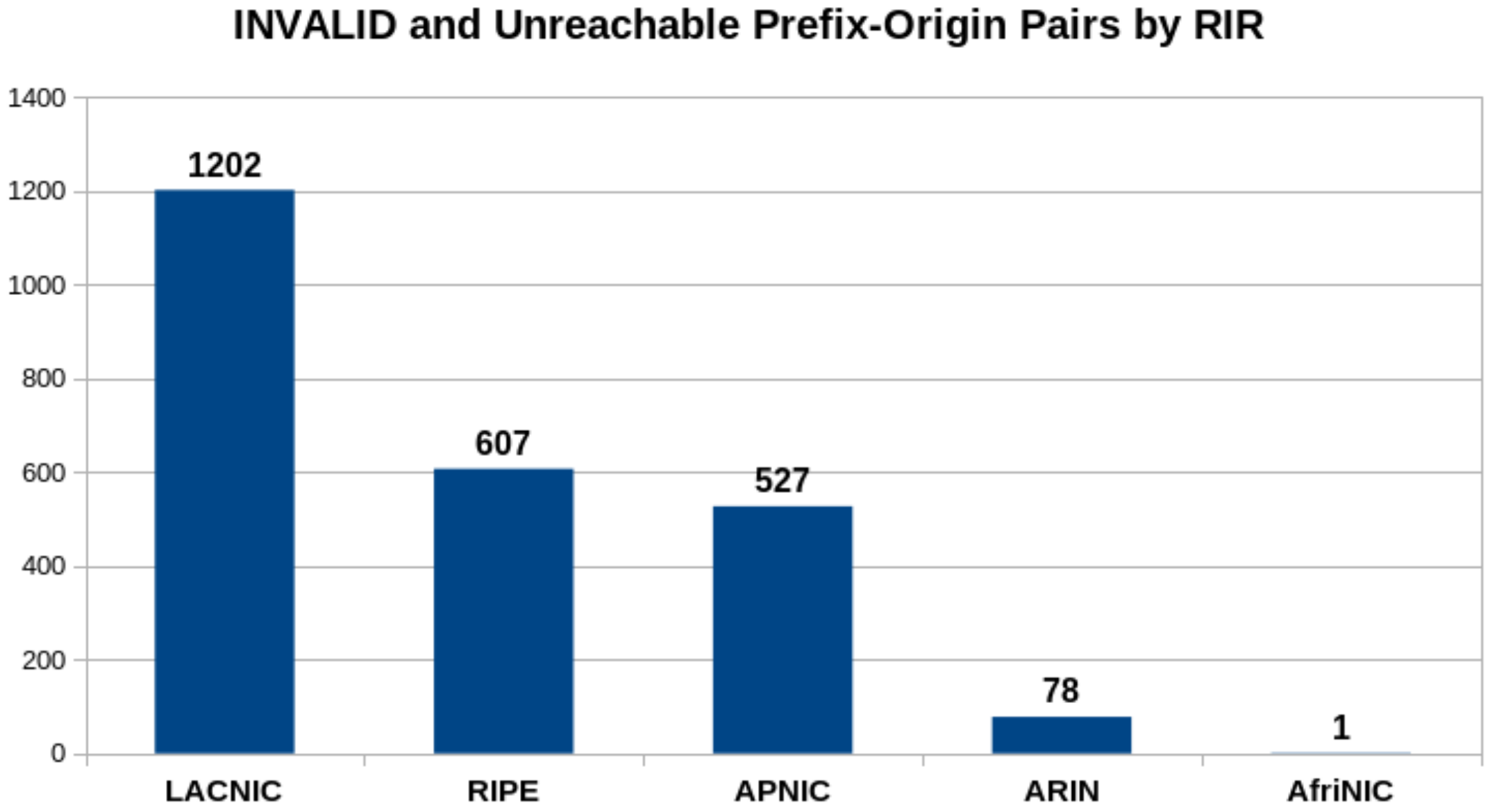
- Solution: more users results in better software, start using!

Timeline

- IXPs – start doing RPKI Origin Validation on your route servers **now**
- ISPs / CDNs
  - if you are pointing default somewhere, do it **now**
  - If you are transit-free, wait a bit

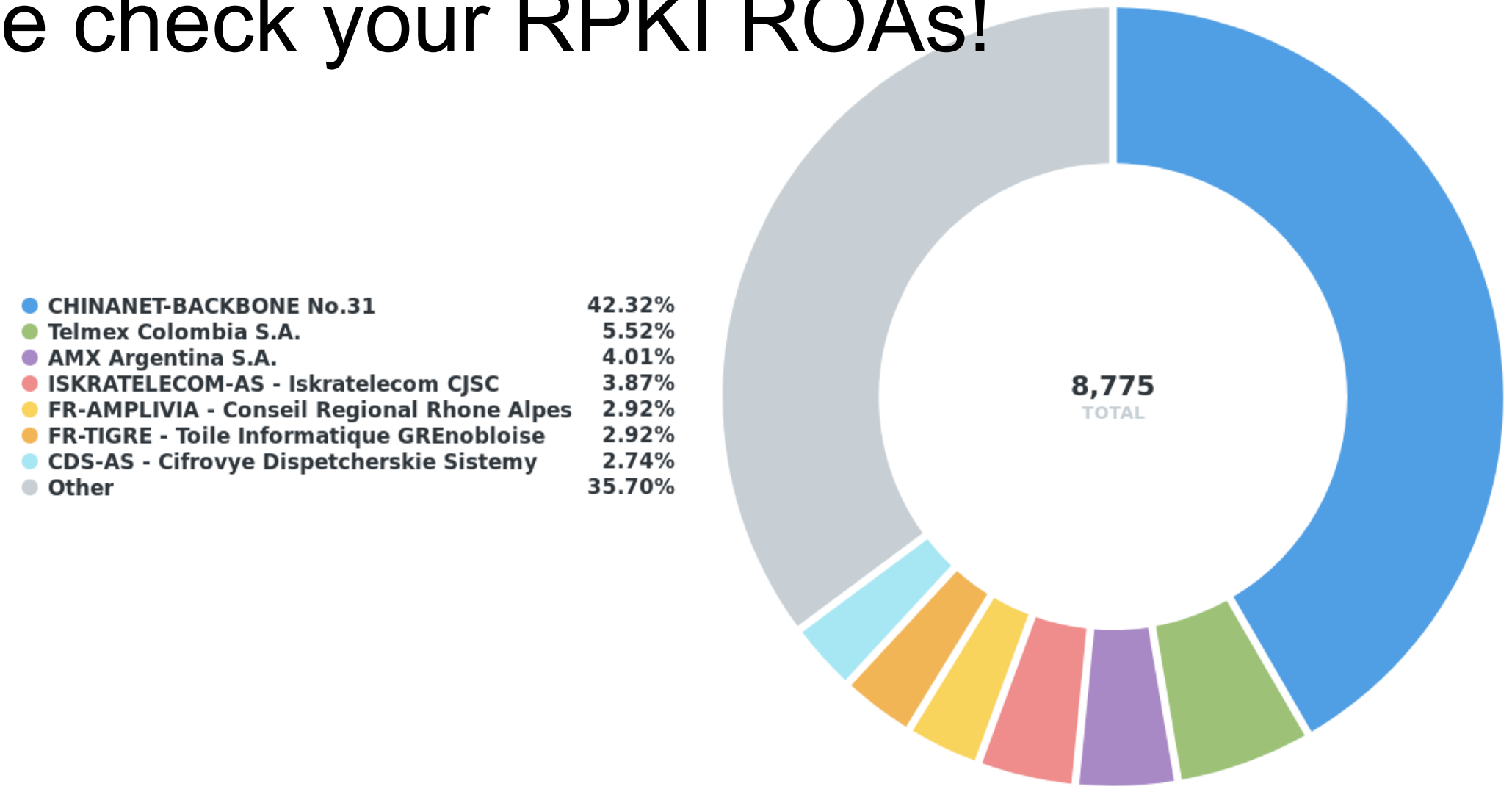
We aren’t done yet - Future work

- Use the RPKI to publish “peerlock” rules about who are authorized upstreams and who aren’t
  - https://tools.ietf.org/html/draft-azimov-sidrops-aspa-verification
  - https://tools.ietf.org/html/draft-azimov-sidrops-aspa-profile
- Extend the RPKI to replace IRR AS-SETs (IRR / RPKI feature parity)
  - https://tools.ietf.org/html/draft-ss-grow-rpki-as-cones
- ARIN TAL issue needs addressing



Source: https://medium.com/@nusenu/towards-cleaning-up-rpki-invalids-d69b03ab8a8c

Double check your RPKI ROAs!



Source: https://medium.com/@nusenu/where-are-rpki-unreachable-networks-located-65c7a0bae0f8

Conclusion


QUESTION
THE
ANSWERS