RPKISpider

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Getting from A to B: Who is allowed to do what?

- BGP runs by rumor
  - Participants assert reachability and ``gossip'' about what they've heard from each other

- We've lacked a rigorous way to automatically learn:
  - Who is the rightful holder of a resource?
  - Who is allowed to assert reachability for resources?
  - What's a ``resource!?!?''

- We've always needed *number resource certification*
  - A stepping stone towards answering: ``who is allowed to do what?''

Resource Certification

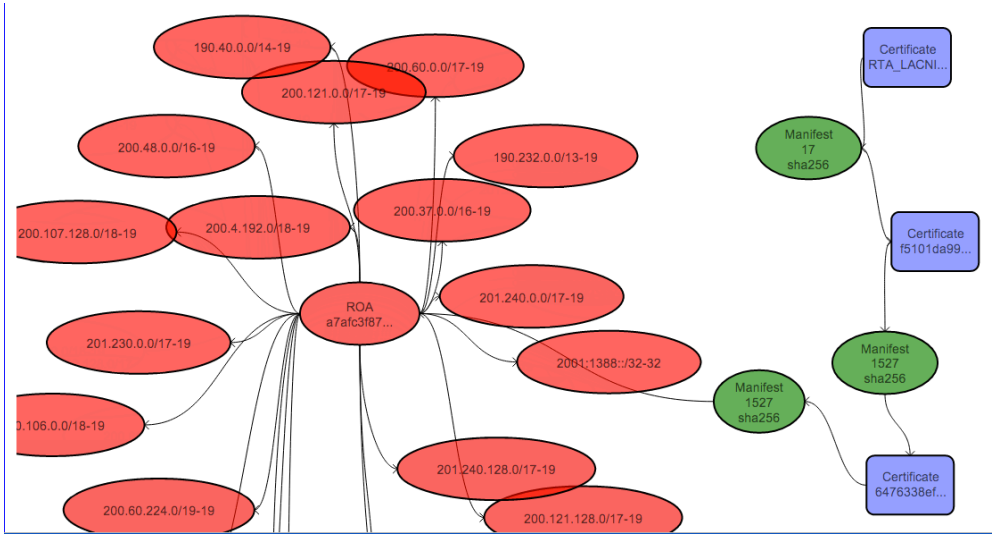
- Being able to verify the authorized resource holders
  - IP addresses are allocated hierarchically
  - Announcements and routing are authorized by resource holders (bilaterally)

- The Resource Public Key Infrastructure (RPKI) is one incarnation of number resource certification
  - It largely focuses on "routed resources" (i.e., ROAs)

- The envisioned usage for RPKI has morphed from just Internet number resource titleship to routed resource certification
  - That is, BGPSEC uses RPKI to sign and verify BGP updates and a new BGP path attribute

RPKI

- IP addresses are allocated hierarchically
  - So, represent that w/ crypto objects



- RPKI envisions an IANA trust anchor that delegates resource allocations to RIRs
  - RIRs then sign objects for *their* allocations
  - But… We don't have a global root today, so we have added complexity

- So… A prefix may have been allocated from IANA to ARIN to Level(3) to a customer…

http://rpkispider.verisignlabs.com/

Deployments have started…

- Can we operationalize RPKI (repositories and RPs)?
- We should be measuring!
- Designs should accommodate fully deployed system (i.e., at least operate at scale of today's Internet **routing** system)
- Discussions about scaling have already begun
  - "Sizing Estimates for a Fully Deployed RPKI" Verisign Labs tech report #1120005 v2

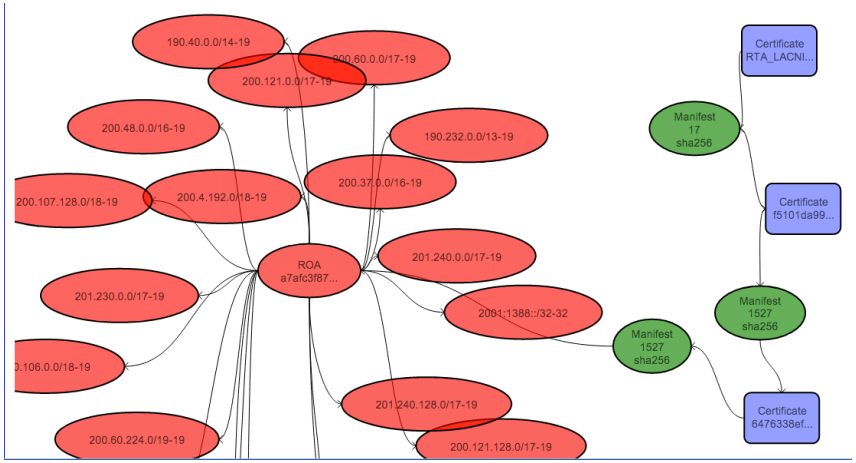
    http://techreports.verisignlabs.com/tr-lookup.cgi?trid=1120005&rev=2
  - Some other work has verified these results

Outline

- How does RPKI work?
- How has RPKI been working?

How does RPKI work?

- Caches try to get info from authorities, and keep it near RPs
  - Chains start from Trust Anchors
  - Trust Anchors are certificates
  - Certs point to manifests



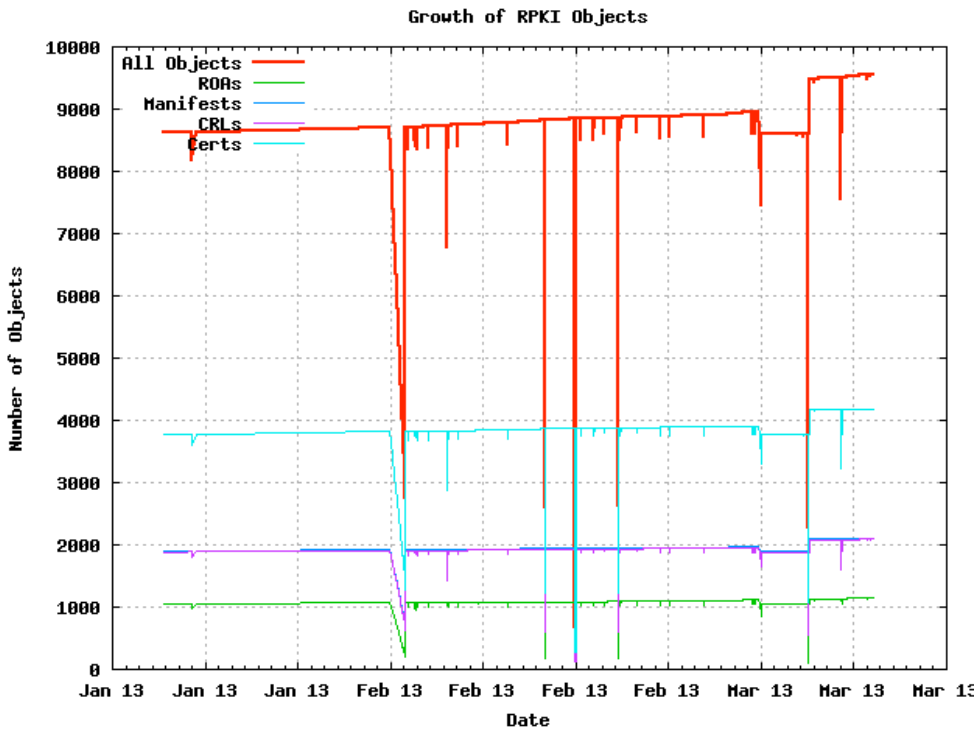
- Basically, one big crypto certified DB: lot's of referential integrity needed

- Chains of objects point at each other, and they use opaque hash values as names
  - If something gets borked, or a directory is misnamed, it is not human readable, so not easy to detect…

RPKISpider

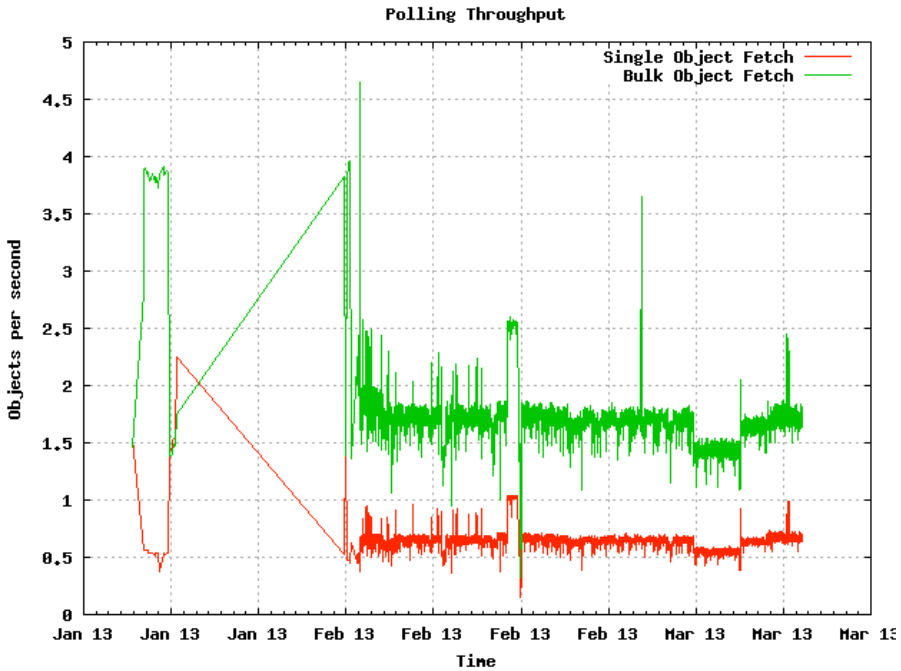
- Backend is parallelized RP cache gathering (spidering) system
  - Ground up implementation
- RPKISpider has been running for a few months
  - http://rpkispider.verisignlabs.com/
  - Follow us on Twitter! @RPKIUpdateBot
- What we track
  - Transaction success rates, throughput, etc.
  - Delegation structure
  - Object count, distribution of object types, etc.
  - Portion of covered *routed* space

What we've seen…



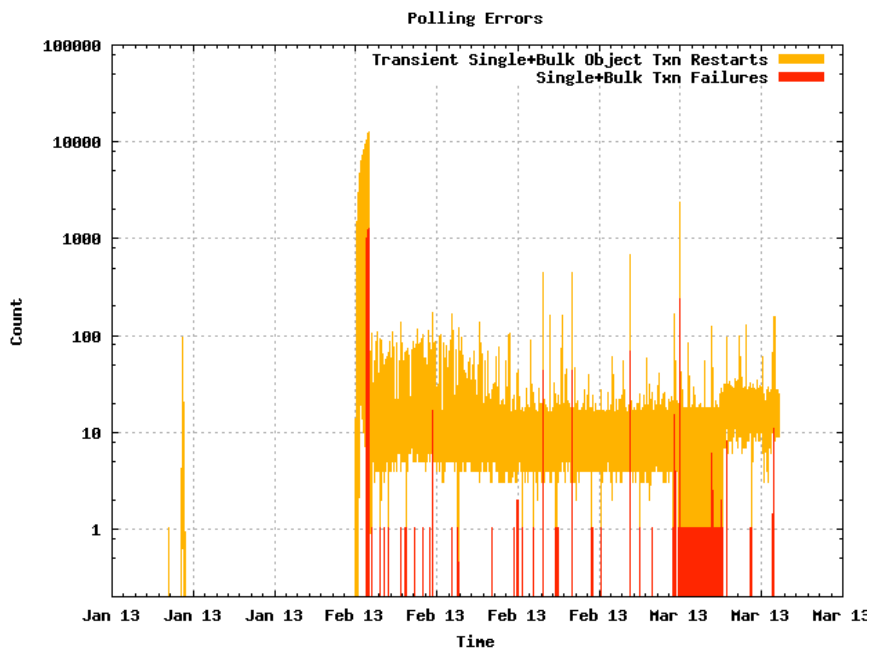
- Growth: up and to the right
  - Overhead: roughly 10k objects for just 1,200 ROAs
  - These dips are qualitative views of outages

Throughput



- Throughput matches previous estimations in "Sizing Estimates for a Fully Deployed RPKI"

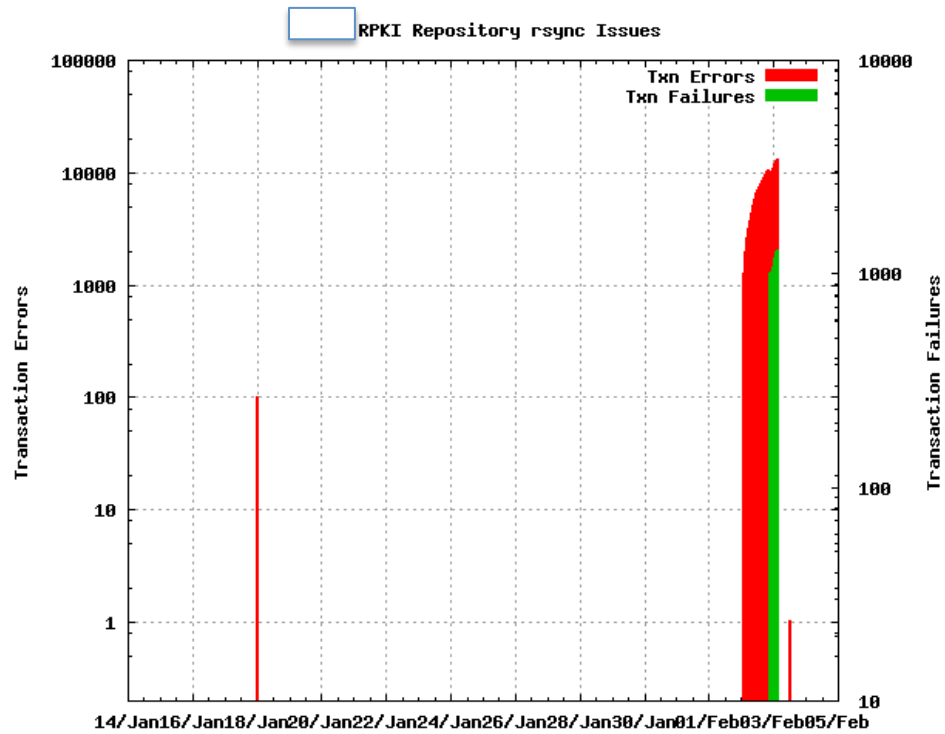
How reliable are the RPKI txns?



- Lots of transient connection errors
- Outages show up as hard failures
  - Descriptions: http://rpkispider.verisignlabs.com/docs.html#intermittent

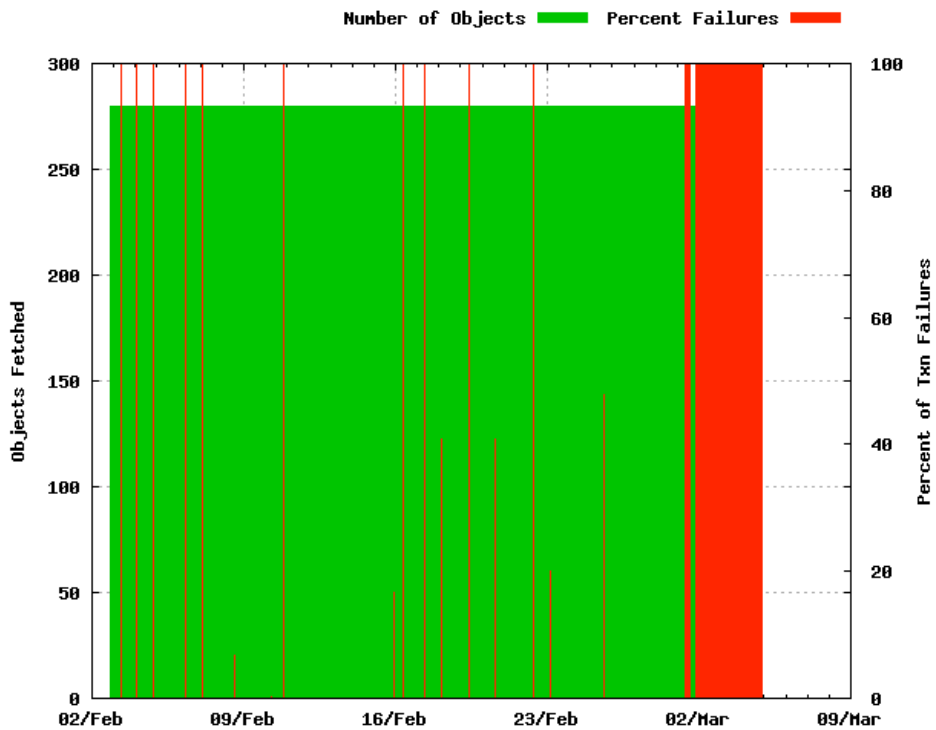
Outages

- Reasons can vary
  - Referential integrity
  - TA rollover
  - PoOO (Plain old Operational Outages)



- Referential integrity failure took one of the 5 repos completely offline
  - Notice was sent to the community after RPKISpider alerted about the problem

Outages (2)

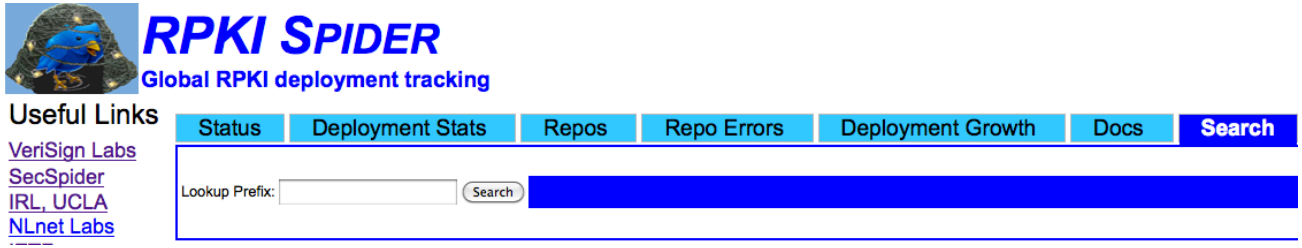


- TA rollovers are an issue that needs attention
  - How can a repo operator *know* when RPs are ready for a rollover
- If a rollover happens before RPs are ready, there is an outage
- One possible direction being investigated: "CoTs and Off-Axis Corroboration:"
  - http://techreports.verisignlabs.com/tr-lookup.cgi?trid=1110001&rev=1
- Envisioned interactions with "tightly coupled" BGPSEC could make this **very** problematic

Going forward

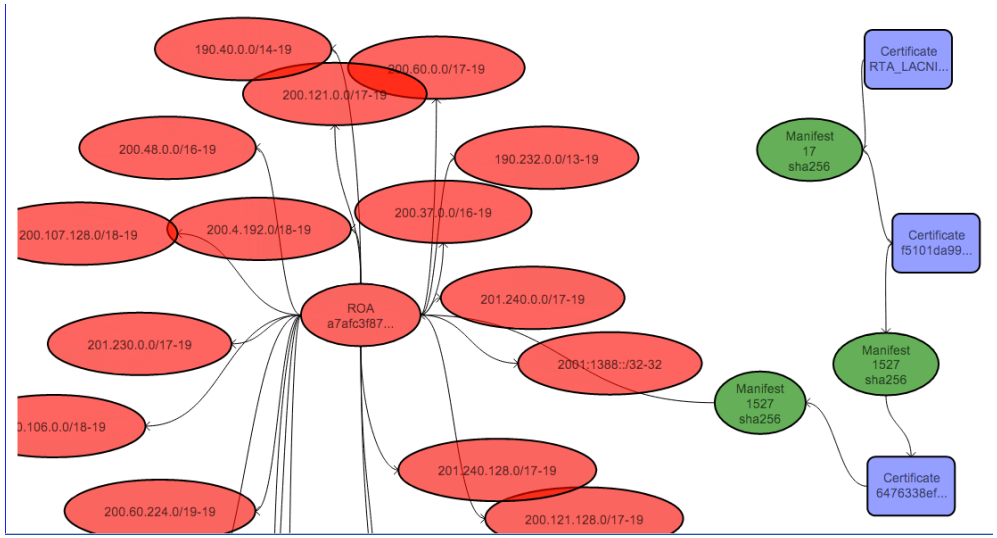
- We've started using our measurements to codify the global system's status in a set of metrics
- Sadly, I ran out of time before this preso, or they would be on our page
- The goal is to use the inherent usage model of RPKI to quantify its operational status so alerting, detection, remediation, etc are possible

RPKISpider Usage



- Feel free to lookup prefixes

http://rpkispider.verisignlabs.com/search.html



Thanks